

TENPIX

TenPix Cloth

Artist Manual

GPU cloth simulation for Autodesk® 3ds Max®

Version	1.0544
For	3ds Max 2024, 2025, 2026 and 2027 (64-bit)
Graphics	NVIDIA RTX graphics card
Companion	TenPix Cloth MAXScript Guide

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Getting Started

1.1 About TenPix Cloth

TenPix Cloth is a GPU cloth simulation system for Autodesk 3ds Max. It works as a set of modifiers: you add them to a mesh the way you would add Bend or Skin, play the timeline, and the cloth is simulated on your NVIDIA graphics card.

It is built for garment and fabric work in production: dressing characters, draping props, flags, curtains and layered outfits, anywhere cloth has to collide properly, stack in layers, hold its seams, tear when it must and react to the scene around it.

Features

- **GPU solver.** The whole solve runs on the graphics card, so dense garments stay interactive.
- **True-geometry collision.** The default collision system uses the collider's actual triangles, so cloth rests on the shape you modelled. Every collider has its own thickness, friction and grip.
- **Self collision and layers.** Folds do not pass through themselves, and the garments of an outfit collide with each other; layer ordering decides which garment gives way.
- **Fabric materials.** Tnpix Material Standard offers twelve stock fabrics and the everyday dials; Tnpix Material Advanced exposes the full fabric model. Both save and load your own presets.
- **Painted channels.** Named weight maps say where a material, a pin, a seam, a tear or a rigid piece applies, so one garment can carry several fabrics.
- **Pins, seams and tearing.** Pin cloth to animated objects, stitch garments together or to themselves, and tear along painted regions, by stretch or by pressure — including a freehand tear brush.
- **Preserve.** Tnpix Preserve makes a painted region follow the character's own animation — a Skin, a Skin Wrap, any deformer below the Solver — instead of simulating it, with a soft edge into the simulated cloth.
- **Threads.** Tnpix Threads grows warp and weft threads out of every tear, some still spanning the crack, and a fringe along painted hems. Each thread hangs, swings, collides and snaps on its own, and renders as a tube.
- **Volume, pressure and rigid pieces.** Closed shells keep or change their volume and can float, and a painted region of a body keeps its own; buttons, buckles and plates can be solid pieces inside the cloth.
- **Soft bodies (experimental).** Tnpix Soft Body turns a closed object into soft flesh, such as fat, jelly or rubber, in the same simulation as the cloth, with entry-level muscle simulation: fibres along a line that contract when activated, tendons at both ends and a tension point that moves the bulge.
- **Scene forces.** Standard 3ds Max space warps, such as Wind, drive the cloth with their own dials and animation.
- **The TenPix Graph.** One window shows every Solver group of the scene and edits it there: every setting of every TenPix modifier, the modifiers each object carries and the objects a Solver group holds. Add any TenPix modifier from a right-click, drag a modifier to reorder a stack, and take any step back with 3ds Max's own undo.
- **Caching and finishing.** Record the simulation to a TenPix cache or to Alembic, retime and posterize it, smooth it with Delta Mush, render it with motion blur, and drive a high-resolution mesh from the simulated

one with Tnpix Wrap, which also closes the cuts of a torn shell.

- **Render farms.** Ready-made Deadline scripts record the caches on the farm, one task per Solver group, with each recorded frame shown as the task's progress.
- **Repeatable results.** The same scene with the same settings produces the same simulation every time, so what you approve is what renders.
- **Scripting.** Every panel can be driven from MAXScript; see the *TenPix Cloth MAXScript Guide*.

About this manual

This manual describes TenPix Cloth version 1.0544 for 3ds Max 2024, 2025, 2026 and 2027. The four builds are compiled from one source and behave the same in every version.

- Chapter 2 explains how the modifiers work together. Read it before you build your first outfit.
- Chapter 3 is the reference for every modifier and every control on its panel.
- Chapter 4 describes the TenPix toolbar and its tools.
- Chapter 5 gives step-by-step procedures for common tasks.
- Chapter 6 lists known limits and what to do when a result looks wrong.

Conventions. Control names are printed as they appear on the panel, for example **Reset Simulation**. A value shown as Default 4 is the value of a newly added modifier. Menu paths are written with ►, for example *Modify panel ► Modifier List ► Tnpix Solver*. Lengths are in the scene's system units unless stated otherwise (see *Units and scale* in Chapter 2).

1.2 System Requirements

Component	Requirement
3ds Max	3ds Max 2024, 2025, 2026 or 2027 (64-bit). Each version has its own build of the plug-in.
Operating system	Windows 10 or Windows 11, 64-bit.
Graphics card	An NVIDIA RTX graphics card (RTX 20-series to RTX 50-series).
Graphics driver	A recent NVIDIA driver (Game Ready or Studio). If TenPix Cloth reports a driver problem, update the driver.
Video memory	No fixed minimum. Memory use grows with the vertex count and the number of garments; use the Tnpix Garment modifier to simulate at the density the shot needs.
Internet access	Only to activate a licence and for its periodic check. The plug-in keeps working when the licence server cannot be reached.
Other software	None. Everything the plug-in needs is inside it.

1.3 Installation

TenPix Cloth comes as one installer, a single .exe file. It installs the plug-in file, Tnpix.dlm, which is built for each 3ds Max version, together with the TenPix tools, toolbar and icons. Each run installs for one 3ds Max version; run the installer again for another version.

IMPORTANT

Close 3ds Max before you install or update the plug-in. A plug-in that 3ds Max has loaded cannot be replaced while it is running.

To install TenPix Cloth:

1. Run the installer and choose the **3ds Max version**. Check its installation folder, or point Setup to another one with **Browse folder** or **Select 3dsmax.exe**. Setup checks the version of that `3dsmax.exe` and installs the matching `Tnpix.dlm`.
2. Choose the plug-in folder. The default is the `plugins` folder of that 3ds Max installation; `Tnpix.dlm` is copied directly into the folder you choose.
3. Choose the script folder for the TenPix tools, toolbar and icons, by default `scripts\TenPixCloth` in the 3ds Max folder. Setup creates its `scripts`, `macroscripts` and `icons` subfolders and registers them with 3ds Max.
4. Optionally, install the TenPix Deadline workflow for a render farm (see *Rendering on a Farm* in Chapter 5), then finish the installation.

Installing another build, such as the licensed build over the demo, replaces the TenPix build already installed for that 3ds Max version. After installation the twenty TenPix modifiers appear in the Modifier List (their names begin with *Tnpix*), the Tnpix Threads Object appears under *Create panel* ▶ *Geometry* ▶ *Tnpix*, and the toolbar actions appear in the **TenPix Cloth** action category.

Checking your version

Select an object with a Tnpix Solver modifier and click **About** on the Solver panel. The About window shows the version and a build number. The build number is computed from the plug-in file that 3ds Max actually loaded, so it identifies the build you are running. The About window also opens the licence window and the third-party notices.

1.4 Licensing

Without an activated licence, TenPix Cloth runs as a demo. On a workstation the demo simulates up to **25,000 vertices** in the scene at once, for the first **100 frames** of the animation range (at frame rates below 24 frames per second, about the first four seconds: 50 frames at 12 frames per second). After them the cloth holds its pose. A scene that simulates more vertices is not simulated at all, and the licence line on the Solver panel says so with the count.

- In the demo, Save cache writes TenPix caches (*.tnc*); Alembic (*.abc*) needs a licence. A saved cache of either kind plays and renders.
- On a render farm or in batch mode the demo simulates nothing and saves no cache; cached garments still play and render. Farm machines need an activated licence.
- Everything else works as in the licensed product. Some builds are free builds that need no licence; their About window and licence line say so.

To activate TenPix Cloth on this computer:

1. Select a cloth object and open its Tnpix Solver panel.
2. In the **Licence** group, click **Licence....** (The About window has the same button.)

3. Type or paste the licence key from your purchase receipt into the **Key** field. The key has the form `XXXXXXX-XXXXXXX-XXXXXXX`; spaces and letter case do not matter. **Paste** pastes the clipboard.
4. Click **Activate this machine**. The key is checked once with the store, which needs an internet connection, and then held on this computer.

Once activated, every garment simulates at full size and the plug-in works offline. The licence is re-checked quietly every 14 days; a computer that cannot reach the store keeps working. Reinstalling the plug-in or installing a newer build does not use another seat of your licence.

Licence window

Key

Your licence key from the purchase receipt.

Activate this machine

Checks the key with the store once and holds it on this computer. Counts one of the key's seats.

Check now

Checks the key with the store now instead of waiting for the 14-day check. A refunded purchase returns the computer to the demo.

Deactivate this machine

Removes the licence from this computer; it returns to the demo. Activating the same key on this computer again does not count a second seat.

The demo build

TenPix Cloth also comes as a **demo build**, made for trying the plug-in: its About window reads *rc-demo* after the version number. It is the same plug-in with the demo's limits built in - up to 25,000 vertices in the scene, the first 100 frames, simulation on a workstation only, caches saved as *.tnc* - and nothing lifts them. It needs no licence and takes no key, so it cannot be activated: its **Licence...** buttons show a note instead of the licence window, and the Solver's licence line begins with *Demo build*.

To work without the limits, install the licensed build and activate it with your key. A garment played from a TenPix cache plays and renders in every build, so caches saved with the demo build can be used in the licensed one.

1.5 Quick Start

This procedure drapes a sheet of cloth over a sphere. It takes about two minutes and touches the modifiers you will use most.

To drape a cloth over a sphere:

1. Create a **Sphere** with a radius of 25 at the origin.
2. Create a **Plane** with a length and width of 100, one length segment and one width segment, and move it 50 units above the sphere.
3. With the plane selected, go to the Modify panel and add **Tnpix Garment**. Set **Edge length** to 2.0. The plane is rebuilt into small, even triangles.
4. Add **Tnpix Gravity**. A new Gravity modifier pulls down with Earth gravity in your scene's units.
5. Add **Tnpix Collision**. Click **Pick Object** and click the sphere. The header reads *1 enabled / 1 objects*.
6. Add **Tnpix Material Standard** and choose **Cotton (approx)** from the **preset** list.

7. Add **Tnpix Solver** at the top of the stack.

8. Go to the first frame of the animation range and click **Play**. The cloth falls and drapes over the sphere.

Now try the things that make TenPix Cloth predictable:

- Turn off Tnpix Gravity with its **Enabled** check box and play again: the cloth stays in the air. A simulation without a Gravity modifier has no gravity.
- Remove the sphere from the Collision list and play again: the cloth falls through it. An object only collides once it is in a Collision list.
- Change any Tnpix value and play from the start: the simulation is computed again with the new value.

TIP

When a shot is approved, add a Tnpix Cache above the Solver and save the simulation to a file. The cloth then plays from disk: fast, identical every time, and independent of changes further down the stack.

Concepts

2.1 The TenPix Modifiers

TenPix Cloth adds twenty modifiers to the Modifier List. One of them, Tnpix Solver, runs the simulation. The others describe the cloth, the scene around it and what happens to the result.

Modifier	What it does	Where it goes
Tnpix Solver	Runs the simulation for every object that carries it; sets quality and collision system.	Top of the stack (recommended)
Tnpix Garment	Rebuilds the mesh into even triangles, or re-surfaces it from a volume.	Bottom of the stack
Tnpix Gravity	Gravity for the simulation.	Anywhere; share one instance
Tnpix Forces	Drives the cloth with 3ds Max space warps such as Wind.	Anywhere; one instance shared, or one per garment
Tnpix Collision	The list of objects the cloth collides with, each with its own settings.	Anywhere; share one instance
Tnpix Self Collision	Cloth against itself and against the other garments of the simulation; layers.	Anywhere; share one instance
Tnpix Material Standard	The fabric: everyday dials and twelve stock fabrics.	Anywhere; one per fabric
Tnpix Material Advanced	The fabric: the full fabric model.	Anywhere; one per fabric
Tnpix Channel	Painted, named weight maps; the tear brush.	Above Tnpix Garment
Tnpix Pin	Holds a painted region in place or makes it follow an object.	Anywhere
Tnpix Preserve	Makes a painted region follow the animation below the Solver (a Skin, any deformer) instead of simulating it.	Anywhere
Tnpix Stitch	Sews painted points to another garment or to the cloth's own folded parts.	Anywhere
Tnpix Tear	Lets the cloth tear by painted region, by stretch or by pressure.	Anywhere
Tnpix Volume	Gives a closed shell, or a painted region of a body, an inside: keeps its volume, inflates it or floats it.	Anywhere
Tnpix Rigid	Makes painted regions or mesh elements solid pieces inside the cloth.	Anywhere
Tnpix Soft Body	Turns a closed object into soft flesh: fat, jelly, rubber, or a muscle with fibres (experimental).	Below the Solver

Modifier	What it does	Where it goes
Tnpix Cache	Saves the simulation to a file and plays it back, with retime and posterize.	Above the Solver
Tnpix Post Process	Smooths the simulated surface (Delta Mush) and pushes crossing cloth apart.	Above the Solver
Tnpix Threads	Warp and weft threads where the cloth tears and along painted hems, simulated after each cloth frame.	Directly above the Solver
Tnpix Wrap	Makes a high-resolution mesh follow simulated low-resolution proxies.	On the high-resolution object

2.2 How a Simulation Is Assembled

Tnpix Solver is the only modifier that simulates. Every other Tnpix modifier contributes to it: Gravity contributes a direction and a strength, a material contributes fabric behaviour, Collision contributes the objects to hit, Channel contributes painted regions, and so on. When the Solver evaluates, it reads every enabled Tnpix modifier on the stack and runs one simulation with all of them applied.

- **Turning a modifier off removes its contribution.** A disabled modifier behaves exactly as if it had never been added, which makes it the clean way to compare a result with and without one effect.
- **You only need the modifiers you use.** A cloth with no Pin modifier simply has no pins; a cloth with no Gravity modifier has no gravity. Nothing acts on the cloth that you did not add.

2.3 The Solver Group

A single Tnpix Solver can sit on several objects at once, the ordinary 3ds Max way: add the modifier to a selection of objects, or instance it from one stack to another. Every object that carries the same Solver instance is simulated together, as one **Solver group**. Garments in one Solver group collide with each other, stack in layers and can be stitched together. Two garments with two separate Solvers are two separate simulations and never touch.

Group-wide and per-garment settings

Some settings describe the whole Solver group and have one value for it; others belong to each garment.

Group-wide	Per garment
Gravity; the collider list; the Self Collision settings; the Material Standard's whole-garment values; the Tear's trigger (Tear by), Ends and weakness range.	Painted channels and everything bound to them (a material bound to a channel, pins, a Preserve, stitches, the Tear's marked region, numbers and weakness paint); a Material Advanced without a channel, which covers its own garment; Tnpix Forces (each garment is pushed by its own list, Strength, Channel and Active Zone); Tnpix Volume; Tnpix Rigid; Tnpix Soft Body; Tnpix Garment; Tnpix Threads.

Colliders picked on any member of the Solver group are merged into one list. Where two members carry different group-wide values, the member created first wins, whichever object happens to evaluate first. The Tear's settings are the exception: they are taken from all the Solver group's Tears (see *Several Tears on one cloth* under Tnpix Tear).

The garments of a Solver group take their places in the order 3ds Max first evaluates them after the scene opens. That order gives every garment its default self-collision layer; the garment list of Tnpix Self Collision shows it, and Reset Simulation and a Save on a render farm keep it.

TIP

Share the group-wide modifiers as instances across the Solver group: one Gravity, one Collision and one Self Collision on every garment of an outfit. One Forces instance shared the same way pushes every garment alike. That is the intended setup, and it keeps every garment's panel showing the values the Solver group actually uses.

A change on any member of a Solver group re-solves the whole Solver group. Channels are merged by name across the Solver group, so give each garment's channels their own names (see *Several Fabrics on One Garment* in Chapter 5).

Cloth, soft bodies, pins and a Tnpix Preserve work in a Solver group as they do on a Solver of their own, with every collision: the colliders, the ground and the garments against each other.

A hidden garment

3ds Max does not evaluate a hidden object. A garment hidden while the scene plays stays in the simulation with the shape it had, and the shown garments go on simulating together, frame by frame; shown again, it rejoins them. A garment that has been hidden since the scene was opened, or since **Reset Simulation**, and never shown is still waited for: until it is shown, every garment of the Solver group simulates alone, without the stitches between them. Show it and play from the first frame to bring the garments together.

2.4 The TenPix Graph

The TenPix Graph shows every Solver group of the scene in one window and edits it there: every setting of every TenPix modifier, the modifiers each object carries and the objects a Solver group holds. It reads the modifier stacks as they are and writes into them; it keeps nothing of its own, so the stacks remain the scene and the graph adds nothing to the saved file.

Location: Select a cloth object ► Modify panel ► Tnpix Solver ► Graph

The graph opens on the Solver group of the Solver it was opened from; the other Solver groups stay closed. It opens in a window of its own, in the middle of 3ds Max: drag any edge or corner of the window to size it, up to the whole screen, and the graph fills it at every size. On 3ds Max 2025, 2026 and 2027 the window can also be docked: drag it by its title bar onto a side of the 3ds Max main window, like other docked panels, and drag it out again to float it. On 3ds Max 2024 it stays a window of its own.

Reading the graph

- Each Solver group is a box headed by its Solver and its first object, with the number of objects simulated together. Its + / – button opens and closes it; **Open all** and **Close all** at the top do the same for every Solver group.
- Inside an open Solver group each object is a column. The modifiers only that object carries sit under it; a modifier some objects share spans their columns (*shared by 2*), and one the whole Solver group shares is a bar across the group (*shared by all 4*). Below them comes the Tnpix Solver, then what sits above it in the stack, such as Tnpix Post Process.

- Objects are teal, TenPix modifiers purple and other 3ds Max modifiers grey. A modifier switched off in its stack is drawn dashed.
- Objects that carry TenPix modifiers but no Tnpix Solver are drawn last, under *Outside any Solver group*.
- The window follows the scene: a modifier added or deleted in the Modify panel, a renamed object, an undo or a redo shows in it within a moment. **Refresh** on the top bar draws it again at once.

Moving around the graph

Zoom

The mouse wheel zooms in and out at the pointer, from 25% to 200%. **Fit** on the top bar, or the Z key, zooms so that the open Solver groups fit the window, at 100% at most; the percentage button beside it returns to 100%.

Scroll

Drag on an empty part of the graph, or drag with the middle mouse button, to move the view. The mouse wheel with Shift, or a sideways wheel, scrolls sideways. Over the settings on the right, the wheel scrolls the settings.

Editing settings

Click a modifier's box. The right side lists every setting of its panel, with the panel's own names, groups, ranges and units, and greys a setting where the panel greys it; each group opens and closes with its + / -. A change made there shows on the Modify panel at once, and a change made on the panel shows in the graph. A value the panel would refuse is refused here too, and the window says why.

Numbers

Click the value to type a new one; Enter or Tab keeps it, Esc cancels. Drag the arrows beside it up or down to change it continuously: hold Ctrl for ten times the step, Alt for a tenth. A click on an arrow moves one step, the step the panel's own spinner takes. A right-click on the arrows sets the value to 0, or to its lowest value where 0 is out of its range, as on a 3ds Max spinner.

Check boxes

A click switches the box.

Lists and channels

A click opens the choices. A channel list offers the channels on the object's stack, as the panel does.

Buttons

The Solver's settings carry **Reset Simulation**, as its panel does: it clears the stored frames, and the frame on screen is simulated again at once.

An object

Pick, then click the object in a viewport. **Clear** empties the slot.

Object lists

Collision's colliders, Forces' space warps, Stitch's targets, Wrap's proxies and the Active Zone helpers: + **Pick object**, then click objects in a viewport one after another; right-click or Esc stops. X removes a row, and a Forces row carries its on / off tick. Click a row to edit that entry's own settings, such as a collider's thickness and friction.

Garments

Self Collision's garments are the objects that carry it. Click one to edit its layer, friction and thickness; an emptied friction or thickness inherits again. The arrows of an inherited value step from the value it inherits.

File names

... opens the file dialog.

A shared modifier is one modifier: a change reaches every object that shares it, as on the panel. The settings of 3ds Max's own modifiers stay in the Modify panel, and a channel is painted on the Tnpix Channel panel.

Adding and removing

Add a modifier

Click an object's box. Under *Add a modifier* choose the type, tick any other objects of the Solver group that should share it, and press **Add**. Every TenPix modifier is offered. The new modifier is one modifier shared by those objects, placed where the stack takes it: just below the Tnpix Solver; just above it for Post Process, Cache, Threads and Wrap; a Garment below every TenPix modifier; a Solver below the modifiers that work on a Solver's result. An object carries one Solver, so the Solver is not offered for an object that already has one.

The right-click menu

Right-click in the graph. The menu names the Solver group under the pointer and offers **Add to all N objects**, **Add to the object** under the pointer and, with objects of the Solver group selected in a viewport, **Add to the N selected objects**; each opens the list of TenPix modifiers. The modifier is added once, shared by the objects it goes on, in the place **Add** puts it. The menu also carries + **Add the objects selected in the viewport** (see *Add object* below).

Remove

Right-click a modifier's box, or the Solver's, and choose to remove it from the object under the pointer or from all the objects that share it. Or click the box and press Delete: a modifier on one object is removed at once, and for a shared one a menu asks for the object, or all of them. **Remove...** in the modifier's settings does the same.

Make unique

On a shared modifier, **Make unique...** gives the chosen object its own copy, with the same values; the others go on sharing theirs.

Add object

Select objects in a viewport, then press + **Add object** on the Solver group's header (or + **Add the objects selected in the viewport** on the Solver's box or in the right-click menu). Each object takes the Solver group's shared modifiers and its Solver, and joins the Solver group. The button is unavailable while no selected object can join: one already in this Solver group, one in another, or one the Solver cannot simulate.

Moving a modifier

Drag a modifier's box up or down to move it in the stack. While you drag, a line shows where it will land and a note under the pointer says where, or why it cannot land there; release the mouse button to move it, or press Esc or right-click to leave it where it was. A moved modifier keeps everything it holds, such as a Tnpix Channel's painted weights, as it does when you drag it in the Modify panel.

- A modifier moves within the stacks of the objects that carry it. A shared modifier moves in every one of them and lands next to boxes that the same objects share. Dropping it on another object's column would add it to that object: use **Add** for that.
- The graph draws each stack from the bottom up. A TenPix modifier that feeds the Solver stays above the Solver in the graph; Post Process, Cache, Threads and Wrap, which work on the Solver's result, stay below it. Other 3ds Max modifiers can go anywhere in their column.
- The Solver and the objects do not move.

Undo and Redo

Every change made in the graph is one entry in 3ds Max's own undo list, the list the viewport and the Modify panel use: *Edit* ▶ *Undo*, the toolbar's undo arrows and Ctrl+Z / Ctrl+Y take it back and forth, and Ctrl+Z / Ctrl+Y also work while the graph has the keyboard. Dragging a value is one entry however far it moves; typing the value a setting already holds adds none. Adding, removing, moving and making a modifier unique, and adding objects to a Solver group, are one entry each.

While the graph has the keyboard, 3ds Max's own keyboard shortcuts wait, so that the graph's keys reach it: Ctrl+Z and Ctrl+Y, Z for Fit, Delete for the picked modifier, and Esc to stop picking or to cancel a drag. They work again as soon as the keyboard goes elsewhere, for example after a click in a viewport.

2.5 Modifier Stack Order

The Solver collects its contributors from the whole stack, above and below itself, so for most modifiers the order does not change the result: Gravity above a material behaves exactly like the material above Gravity. A few positions do matter:

- **Tnpix Garment goes at the bottom.** It changes the vertex count, and every modifier above it must see the converted mesh.
- **Tnpix Channel goes above Tnpix Garment.** Paint is stored per vertex, so it must be painted on the mesh the simulation uses. A channel whose vertex count no longer matches the mesh is left untouched and reported.
- **Tnpix Solver can sit anywhere; the top is recommended.** The stack then reads bottom to top in the order things happen, the 3ds Max convention.
- **Tnpix Cache and Tnpix Post Process go above the Solver.** They work on the simulated result. When both are present, put Post Process above the Cache: its smoothing over time reads the neighbouring frames from the Cache file or the Solver's memory below it.
- **Tnpix Threads goes directly above the Solver.** It reads the cloth from the Solver's frames, not from the modifiers in between, and a cloth playing from a Tnpix Cache file below it grows no threads. Send the tubes to their own object when the modifiers above should work on the cloth alone, and cache that object to keep the threads.
- **A painted Tnpix Soft Body or Tnpix Volume above a Tnpix Pin or Tnpix Preserve wins its area.** Placed above the Pin or the Preserve on the same stack, a Soft Body or a Volume with a Channel lets go of the points it paints: they move with the flesh, or with the Volume, while the rest of the held region stays held, and a soft edge in its paint fades the hold out. Below the Pin or the Preserve it lets nothing go, and a Soft Body or Volume with no Channel lets nothing go wherever it is. On a Solver shared by several objects each object's paint lets go of its own points only.
- **Render modifiers go above the simulation.** TurboSmooth, Shell and similar modifiers smooth or thicken the simulated result and never feed back into it.

A typical garment stack, top to bottom

TurboSmooth (render only) > Tnpix Post Process > Tnpix Cache > Tnpix Solver > Tnpix Self Collision > Tnpix Collision > Tnpix Gravity > Tnpix Pin > Tnpix Material Standard > Tnpix Channel > Tnpix Garment > Editable Poly

2.6 Playback, Memory and Reset

The simulation starts at the first frame of the animation range and is computed frame by frame. Every simulated frame is held in memory: scrubbing back reads the stored frames, and playing past the last stored frame simulates the missing ones. Rendering does the same: a render of a frame that is not stored simulates up to it, and a render that asks for a time between two frames, for motion blur, simulates the next frame when it is missing, up to the end of the animation range.

- **Changes re-simulate.** When you change a simulation setting on any Tnpix modifier, the next evaluation simulates again from the first frame with the new value. On a shared Solver the whole Solver group is re-solved.
- **An edited shape restarts the cloth.** Change the cloth's own shape below the Solver, a collider's shape or the shape of an object a pin follows, and the simulation starts again from the first frame, as Reset Simulation does.
- **Reset Simulation** on the Solver panel, or in the Solver's settings in the TenPix Graph, clears the stored frames by hand.
- **Show End Result.** Opening a Tnpix panel turns on 3ds Max's Show End Result button. With it off, selecting a modifier below the Solver shows the mesh as it is below the Solver, unsimulated, and the cloth looks frozen. If you turn the button off it stays off until you next open a Tnpix panel.
- **Panels report in words.** Status lines on the panels say what each modifier is doing: how many colliders are enabled, how many points are stitched, what was torn, which build you run. The MAXScript Listener stays quiet during normal work.

TIP

For a final result, save the simulation with Tnpix Cache. Playing from a cache is fast, identical every time and unaffected by later changes below it.

2.7 Units and Scale

TenPix Cloth works in your scene's system unit (*Customize ▸ Units Setup ▸ System Unit Setup*). Every length you type is in system units: collider thickness, self-collision thickness, contact give, stitch search distance and offset, pin reach, volume pressure, wrap distance, and the threads' spacing, length, bending length and thickness. Gravity is in system units per second squared. The conversion happens where values enter and leave the solver, so you never convert by hand.

A new modifier expresses its length defaults in the scene's unit. A new Tnpix Gravity pulls with Earth gravity: **–386.22** in an inch scene, **–981** in a centimetre scene, **–9.81** in a metre scene. The default collider thickness, self-collision thickness and stitch search distance are converted the same way. A saved scene keeps the values it was saved with.

- **The Tear threshold is not a length.** It is a strength that you set by reading the Tear status line.
- **The Garment edge length and the Post Process thickness** are measured on the mesh itself, in the mesh's own units.

NOTE

A few labels and tooltips name inches, such as (*in*) or (*in/s2*). They describe an inch scene; in a scene with another system unit, read them in that unit.

Model garments at real-world size. The stock fabrics describe real cloth, and a garment modelled ten times too large behaves like a much larger, heavier piece of cloth.

2.8 Simulation Quality

Five controls on the Solver panel set the quality of the solve. The first two are the ones to understand.

- **Substeps** divide each frame into shorter slices of time. Everything, including collision, is evaluated again in every slice. Substeps fix a garment that moves too fast for the solver to keep up with: fast body motion, whipping hems, anything that travels a long way in one frame.
- **Iterations** solve the constraints again inside the slice that is already running. Time does not advance and collision is not evaluated again. Iterations tighten a solve that is nearly right.

Raise **Substeps** first: it is the more effective of the two for almost every problem an artist meets. The two multiply: the solver does $\text{substeps} \times \text{iterations}$ constraint passes per frame, and that product is the first number to look at when a scene is slow.

- **Contact passes** is the collision quality. Raise it together with Iterations and Stretch quality: raising those two while Contact passes stays at 1 costs more time and can give more penetration, not less.
- **Stretch quality** adds passes for the stretch constraints only. Raise it when a material's stretch status line says the stretch is still converging.
- **Smoothing iterations** evens out the fine zigzag a dense mesh can show, without adding or removing motion.

Quality steps

The Quality tool on the TenPix toolbar applies these steps to one Solver or many. Normal is the default of a new Solver.

Step	Substeps	Iterations	Contact passes	Stretch quality	Smoothing iterations
Draft	1	1	1	1	5
Normal	4	2	1	2	10
High	8	4	4	4	10
Ultra	16	8	7	8	12

Rule of thumb from the same tool: Iterations or Stretch quality of 4 or more want at least 4 contact passes; 8 or more want at least 7.

2.9 Painted Channels

A **channel** is a named weight map painted on the cloth with the Tnpix Channel modifier: every vertex carries a weight from 0 (outside) to 1 (fully inside). Other modifiers read channels by name to decide where they act:

Modifier	What the channel says
Tnpix Material Standard / Advanced	Which region of the garment this fabric covers.
Tnpix Pin	Which points are held.

Modifier	What the channel says
Tnpix Preserve	Which points follow the animation below the Solver, and how closely.
Tnpix Stitch	Where a seam may form.
Tnpix Tear	Where the cloth may tear, and where it is weaker.
Tnpix Volume	Which region keeps its volume, and how firmly; above a Pin or a Preserve, which of their points it lets go.
Tnpix Rigid	Which regions are solid pieces.
Tnpix Soft Body	Where its material is, in the object's flesh; above a Pin or a Preserve, which of their points it lets go.
Tnpix Post Process	Where the smoothing and the detangle may work.
Tnpix Wrap	How strongly each point follows the proxies.
Tnpix Threads	Which hems carry a fringe.

Because the binding is by name, renaming a channel re-points everything that used the old name, and reordering the channel list breaks nothing. A channel that nothing reads changes nothing. Paint once and bind by name from whichever modifier needs it. A channel painted on one side of a garment can be copied to the other side with the Channel's **Mirror**.

2.10 Repeatable Results

TenPix Cloth is deterministic: the same scene with the same settings produces the same simulation on every run. What you approve in the viewport is what the render farm computes, and a scene that shows a problem shows it again when it is opened later.

Modifier Reference

This chapter describes every TenPix modifier and every control on its panel, in the order the panel shows them. Values marked **Default** are those of a newly added modifier. Every control also carries a tooltip in 3ds Max; hover over it for a short description.

3.1 Tnpix Solver

The Tnpix Solver modifier runs the simulation. Every object that carries the same instance of the modifier is simulated together, as one Solver group. The Solver sets the quality of the solve, the collision system and the viewport diagnostics; the fabric itself is described by the material modifiers.

Location: Select the cloth object ► Modify panel ► Modifier List ► Tnpix Solver

Interface

Tnpix Solver rollout

Solve group

Substeps **Default 4**

The main quality control: how finely each frame is solved. Higher values give more accurate motion and collision and cost proportionally more time. There is no upper limit. The TenPix Graph and MAXScript use the same number. See *Simulation Quality* in Chapter 2.

Iterations **Default 2**

How many times the constraints are solved inside each substep.

Contact passes **Default 1**

How many times contacts are resolved per step, from 1 to 16. Raise it when cloth is pushed through a collider under sustained pressure, and raise it together with Iterations and Stretch quality.

Smoothing iterations **Default 10**

Smooths the cloth surface once per substep, after the constraints are solved. On a dense mesh the solve can print a fine woven zigzag into the surface; this averages it away without adding or removing motion. 0 turns it off; 2 removes most of the zigzag. Range 0 to 16.

Timeline FPS

The frame rate the solver reads from the scene, shown so you can confirm that the solver agrees with your timeline.

Reset Simulation

Clears the stored frames. The next evaluation simulates again from the first frame. Use it after any change that should invalidate what you have already seen.

Graph

Opens the TenPix Graph: every Solver group of the scene with its objects and modifiers, and every TenPix setting editable there. See *The TenPix Graph* in Chapter 2.

About

Opens the About window: the version, the build number, the third-party notices and the licence window.

Stretch quality / contact give group

Stretch quality Default 2

Extra passes for the stretch constraints only (the edge net and the membrane), per substep, from 1 to 32. Raise it when a material's stretch status line says the stretch is still converging.

Contact give (breathing) Default 0

A small slide, in scene units, that contact allows before friction grips. It lets a fitted garment move on the body instead of being held in place by friction. It acts in the contact stage and is not a stretch control. Range 0 to 100.

Collision System / Contact group

Collision system Default Surface (True Geometry)

Chooses how the cloth collides with the objects in its Collision list. Hover over the list for a description of each option.

Option	Behaviour
Volume Only	The cloth is pushed out of a voxel distance field built around each collider. Features smaller than a voxel are invisible to it. The cheapest and least accurate option.
Volume + Proxy	The voxel field plus a point-to-triangle pass that catches what the field misses.
Surface + Volume	The collider's surface has the final say, with the volume field in support. Penetration is equal to or lower than Volume + Proxy, at about 1.8 times the contact cost. It does not reduce jitter.
Surface (True Geometry)	Contact uses the collider's actual triangles; no voxel field is built, so it works at any scale and on small features. The deep-penetration recovery of the three volume options is not part of it, so start the cloth clear of the body.

Mesh contact softness Default 0

How forgiving contact with a body is, from 0 to 1. 0 is hard contact; higher values let the cloth press in slightly, which can hide small pokes on dense meshes.

Mesh contact smoothing Default 0

Blends contact across neighbouring points so that a body's facets do not print through the cloth, from 0 to 1. Raise it when you can see the collider's polygons in the drape.

Unlimited ground (Z = 0) Default off

An endless floor at $Z = 0$, the plane of the home grid: the cloth lands on it anywhere and cannot fall through it, with no ground object and no collider. It holds the cloth 0.1 inch above the floor, in the scene's unit, as a new collider row does, and grips it with a new row's friction (0.35). It applies to every garment of the Solver group, and Tnpix Threads land on it too.

Solver internals group

Friction in-loop Default on

Applies friction while the cloth is being solved rather than afterwards. Steadier for sliding contact; off is slightly faster.

Body stabilization Default on

Damps the jolt when a body starts moving under the cloth. Leave it on unless the cloth should react instantly.

Gamma decouple (body) Default on

Keeps a body's push, which moves the cloth out of the body, from being treated as fabric motion, so cloth resting on a collider is not damped as if it were stretching.

Body strain comp Default 0.25

Lets the fabric give a little exactly where it presses against a body, so contact does not fight the stretch limit. Mesh contact only. Range 0 to 10.

Display group

Stress / contact heatmap Default off

Colours the cloth by how hard it is stretched or pressed, on every garment of the Solver group. Diagnostic only; it changes nothing in the solve.

Particle bonds (debug) Default off

Draws the internal connections between cloth points. The check boxes below choose which kinds, all off by default: **Distance**, **Weld (held only)** for the welds still holding on that frame, **Bend (hinge edge)** and **Triangle strain**. The bonds are drawn in the viewport on every garment of the Solver group, whichever object is selected, on frames that have been simulated. Diagnostic only.

Licence group

Status line

The licence state of this computer, or in the demo, what the demo simulates and which garment, if any, is too large for it. In the demo build it begins with *Demo build*.

Licence...

Opens the licence window, where you activate this computer with your key, check the licence or deactivate it. In the demo build it shows a note instead: the demo build takes no key. See *Licensing* in Chapter 1.

NOTE

The fabric's stretch limit is set on the material, not on the Solver: see **max strain** on Tnpix Material Standard and the **Stretch** rollout of Tnpix Material Advanced.

3.2 Tnpix Garment

The Tnpix Garment modifier rebuilds the incoming mesh into cloth the solver can work with: an even triangle mesh at the edge length you choose, or a new surface re-made from a volume. It changes the vertex count, so it goes at the bottom of the stack, below every other Tnpix modifier.

Location: Modify panel ► Modifier List ► Tnpix Garment

Interface

Tnpix Garment rollout

Enabled Default on

Turns the conversion off without removing the modifier, so you can compare with the original mesh. The conversion is suspended, not lost.

Garment (remesh) Default

Rebuilds the surface as an even triangle mesh at the edge length below. Use it when the incoming garment has uneven or badly shaped polygons.

OpenVDB (volume)

Rebuilds the surface from a volume instead: closes gaps, thickens thin shells and re-surfaces geometry the solver cannot use as it stands. Its settings are on the OpenVDB rollout.

Edge length Default 5.0

The target triangle size of the remesh, measured on the mesh in its own units. Smaller values give more detail and a slower solve; larger values are coarser and faster.

Keep UVs Default on

Carries the original texture coordinates through the remesh. Leave it on unless the UVs are what you are rebuilding.

Status line

Reports the result of the conversion.

OpenVDB rollout

Used when the mode is **OpenVDB (volume)**.

Voxel Size Default 5.0

The size of the volume's voxels. Smaller voxels keep finer detail and cost more.

Half Width Default 3.0

The half width of the band around the surface that the volume stores, in voxels, from 1 to 100.

Adaptivity Default 0

0 re-surfaces with uniform triangles; higher values, up to 1, let flat areas use fewer, larger triangles.

Cap Open Borders Default off

Closes the open borders of the mesh before it is turned into a volume.

Shell Open VDB Default on

Treats an open mesh as a thin shell so that it can be turned into a volume.

Smooth Default off / Smooth Width Default 1.0

Smooths the volume before it is re-surfaced, over the given width.

Flip Normals Default off

Reverses the normals of the result.

Dilate / Erode Default 0

Grows or shrinks the volume before it is re-surfaced.

TIP

Simulate at the density the shot needs and add detail for the render above the Solver, with TurboSmooth or with Tnpix Wrap on a high-resolution copy.

3.3 Tnpix Gravity

The Tnpix Gravity modifier sets the gravity of the simulation. Without a Gravity modifier the Solver group has no gravity and the garments float; nothing pulls on the cloth that you did not add. Add one per Solver group and share it as an instance.

Location: Modify panel ► Modifier List ► Tnpix Gravity

Interface

Tnpix Gravity rollout

Enabled Default on

Turns gravity off without removing the modifier, so you can compare with no gravity at all.

Magnitude Default Earth gravity

The strength of gravity, in system units per second squared, applied along **Direction**. A new modifier starts at Earth gravity in the scene's unit: -386.22 in an inch scene, -981 in a centimetre scene. A negative value pulls against the direction; a positive value pulls along it, which lifts the garment with the default direction and is a legitimate choice. Animatable.

Direction Default 0, 0, 1

The axis gravity acts along. Tilt it for a sideways, wind-like pull. Animatable.

TIP

For a reduced-gravity, slow-motion look, lower the magnitude. For a steady sideways pull, tilt the direction.

3.4 Tnpix Forces

The Tnpix Forces modifier drives the cloth with 3ds Max's own space warps. Add a warp to the list and it acts during the simulation. The warp keeps its own settings and its own animation, so a keyframed Wind strength rises and falls in the cloth exactly as it does on the warp. Each cloth is pushed by its own Tnpix Forces, also when several cloths share one Tnpix Solver.

Location: Create the space warp (*Create panel ► Space Warps ► Forces*), then Modify panel ► Modifier List ► Tnpix Forces

Interface

Tnpix Forces rollout

Enabled Default on

Turns every force in the list off at once, without removing any.

Strength Default 1.0

Scales every force in the list together. 1.0 applies each warp at its own strength; 2.0 doubles them; 0 silences them. Range –1000 to 1000.

List

The space warps that drive this cloth. Each row has a check box: clear it to mute that warp. A muted row contributes nothing, the same as removing it, and can be turned back on.

Add

Pick a space warp in the viewport (Wind, Gravity, Drag, Vortex, Motor, Push, PBomb or another) to add it to the list.

Remove

Takes the selected warp out of the list. The warp itself stays in the scene.

Status line

Reports what the list contributes.

Channel group

Limits every force in the list to a painted channel of this cloth (Tnpix Channel), such as a sleeve or a hem.

Channel Default <none - the whole cloth>

The channel the forces act through. Each point is pushed by its usual amount times its painted weight there: fully where the weight is 1, not at all where it is 0, in proportion between. **<none - the whole cloth>**: every point is pushed fully. A cloth that has no channel of this name is not pushed; the list then shows the name followed by **[MISSING from this stack]**.

Refresh

Reads the channel list again, after a channel is added or renamed on the Tnpix Channel modifier.

Status line

After a simulation: how many points of the cloth the channel reaches, or that the cloth has no channel of that name and is not pushed.

With the Active Zone on as well, each point is pushed by its channel weight times the zone's value there.

Active Zone group

Limits every force in the list to a region of the scene, the zone.

Active Zone Default off

Each point of the cloth is pushed by its usual amount times the zone's value there: full inside Near, fading to nothing at Far, nothing outside. Off: the forces act everywhere.

Invert Default off

Turns the zone round: the forces push where the zone does NOT reach - fully outside Far, fading out towards Near, nothing inside Near. With several helpers, everywhere none of them reaches (the Invert on an Influence Helper turns round that one helper only). With no helper picked, every point is pushed. It works inside the zone's time, below.

List / Pick / Remove

The Influence Helpers that make the zone. **Pick** adds helpers from the viewport, several in a row; right-click, or press it again, to stop. **Remove** takes the selected helper out of the list; the helper stays in the scene. Each row shows the helper's Near, Far and Falloff.

Active only between frames / From / To Default off, 0 to 100

The zone works only from the From frame to the To frame, as the timeline shows them; outside that range it reaches nothing, so these forces push nothing. Off: the zone works the whole time.

Status line

After a simulation: how many points of the cloth the zone reached on the last simulated frame.

The zone is made of 3ds Max's own **Influence Helpers** (*Create panel ▶ Helpers ▶ Standard ▶ Influence*): full inside a helper's **Near** radius, fading along its **Falloff** (Linear, Smooth or Smoother) to nothing at its **Far** radius. **Invert** makes the zone everywhere except around the helper; a helper that is not **On** covers nothing. With several helpers, the largest value at a point counts. The zone follows the helper: move it, change Near, Far or Falloff, or animate any of them, and the zone follows frame by frame; changing it makes the cloth simulate again. The helper's Bias settings are not used.

Working with Wind

- **Strength 1 is about one g.** A Wind at Strength 1.0 pushes about as hard as Earth gravity pulls, and the response is linear from there. Scenes that needed a very high Wind strength to be felt should be turned back down.
- **Frequency needs Turbulence.** In 3ds Max's Wind, Frequency acts only when Turbulence is above zero.
- **Wind from MAXScript.** A Wind created from the interface starts with Decay, Turbulence and Frequency at 0; created from MAXScript they start at 1.0. With Decay at 1.0 the wind dies off within a few units of the warp, so set Decay yourself when you create a Wind by script.
- **Velocity.** Each warp is evaluated at every cloth point with that point's own velocity, as 3ds Max particle systems do, so a velocity-dependent warp such as Drag acts as damping on the moving cloth.

TIP

The Forces tool on the TenPix toolbar lists every Tnpix Forces modifier in the scene with the dials of its warps in one window. See Chapter 4.

3.5 Tnpix Collision

The Tnpix Collision modifier lists the objects the cloth collides with. It sits on the cloth's stack, and each row of its list has its own settings, so a body can be slippery while a belt grips, and a hero prop can use its full mesh while a background collider is simplified. The list is group-wide: rows picked on any member of a Solver group are merged and duplicates are dropped. A Tnpix Soft Body collides with the objects of its own Collision modifier the same way, on a Solver of soft bodies only as well as beside cloth.

Location: Select the cloth object ▶ Modify panel ▶ Modifier List ▶ Tnpix Collision

To make the cloth collide with an object:

1. Select the cloth and add Tnpix Collision (or select the instance your Solver group already shares).
2. Click **Pick Object** and click the object in a viewport, or click **From List** to pick it by name.
3. With the row selected, set its **Thickness**, **Friction** and other settings in the Selected Object and Surface Response groups.

Interface

Tnpix Collision rollout

Collision Objects group

Active Default on

Turns every collider in the list off at once, without removing any.

Header

Shows how many colliders are enabled and how many are listed, for example *2 enabled / 3 objects*.

List

Everything this cloth may collide with. An object only pushes the cloth once it is in this list; being nearby in the scene is not enough. Select a row to edit its settings below.

Pick Object / From List

Add a collider by clicking it in a viewport, or by name. While **Pick Object** is active the button stays highlighted; click it again or right-click in a viewport to stop. A collider must be geometry that converts to a mesh; an object already in the list is not added twice. The cloth that carries this Collision modifier (every object it is instanced on) cannot be its own collider: Pick Object does not accept it and From List leaves it out.

Remove

Takes the selected collider out of the list. The object stays in the scene.

Clear

Empties the list. The objects stay in the scene.

Selected Object group

Enabled Default on

Turns this one collider off, leaving the rest of the list alone.

Two-sided mesh

Contact on both sides of this collider's surface, for thin sheets and single-sided props.

Open mesh Default on

For an open mesh that still has an inside, such as a character with holes. The outward side is kept, and cloth that got through is pushed back out. Holes stay open. A new row starts with it on; a row saved in a scene keeps its own setting.

Voxel (0=auto) Default 0

The resolution of this collider's volume field, used by the volume-based collision systems. 0 chooses it automatically and is right almost always.

SDF voxel grid (debug)

Draws this collider's volume grid in the viewport. Diagnostic only.

Surface Response group

Override material Default Off

Decides whether this row's friction and grip or the cloth's materials apply where they touch.

Off	A material that sets friction and grip uses its own values; where no material sets them, this row's values apply.
Unpainted cloth only	This row's values apply to cloth that no material covers; a material wins where it is painted.
Everything	This row's values apply wherever it touches and the materials are ignored, for example for an ice floor.

Thickness Default 0.1 in

How far the cloth is held off this surface, in scene units (a new row takes 0.1 inch in the scene's unit). The most common first fix for poke-through: raise it before changing anything else.

Friction Default 0.35

How much the cloth grips this surface rather than sliding.

Proxy (0=unlim) Default 0

Decimates this collider to a simpler shape for speed. 0 means unlimited: the true mesh, not decimated. The proxy setting is taken from the first enabled row. Greyed on the panel and in the TenPix Graph while every Tnpix Solver this Collision feeds is in Surface (True Geometry): that mode always collides with the true mesh, and only the voxel field of Volume Only, Volume + Proxy and Surface + Volume uses a decimated collider. The number is kept and acts again when the Solver goes back to one of those three. A Collision shared by Solvers in different modes stays live while any one of them is in a voxel mode; on an object with no Solver it stays live.

Grip Default 3.0

An extra holding force for surfaces the garment should stay put on. Grip is a multiplier, not a 0 to 1 value: the hold against a body is $\text{grip} \times \text{friction}$.

Mesh Smooth Default 0

0 uses the faceted true mesh; 1 blends the surface smoothly (Phong). Raise it when the facets of a low-polygon collider print through into the cloth.

NOTE

Where the cloth is pushed off a collider's own triangles, a collider with hard edges, such as a box or a table, pushes it straight out of the face it touches. Where a corner of the touched triangle leans more than 30 degrees away from that face — the corners along a hard edge — the face's own direction is used, so cloth or a soft body that lands anywhere on a big flat face stays where it lands instead of sliding toward the edge. On a smooth body the corners lean less, and the push is blended across the triangle as before.

NOTE

To make two garments collide with each other, put them in one Solver group and add Tnpix Self Collision. A garment can also be listed as a collider of another garment; its own simulation is then evaluated for the other's solve, which makes the first frame take longer.

3.6 Tnpix Self Collision

The Tnpix Self Collision modifier stops cloth passing through itself and makes the garments of one Solver group collide with each other. It also orders layered garments, so that an inner garment holds its shape while an outer one moves around it. A new Self Collision modifier starts switched on; one saved in a scene keeps its own setting.

Location: Modify panel ► Modifier List ► Tnpix Self Collision

Self collision is the heaviest part of the solve. Add it once the rest of the garment behaves, and switch it off when you want to know what a scene costs without it.

Interface

Tnpix Self Collision rollout

Self Collision group

Enable self collision Default on

Stops the cloth passing through itself. Turning it on also turns on **Edge-edge**.

Edge-edge Default on

Catches the cases where two edges cross without either one poking through a face, typically thin folds and creases. It costs a little more; leave it on unless you are comparing. Under the Optimized and Advanced modes it is always on and the check box is unavailable.

Mode Default Optimized

Which self-collision engine runs.

Basic	Measures the gaps between cloth surfaces once at the start of each step and works from that picture.
Optimized	Basic plus recovery: where the cloth has already cut through itself, it remembers which side it came from and pushes it back there. Always uses Edge-edge.
Advanced	Optimized working in smaller steps: self collision runs several times per substep, each time on the next part of the motion, so two layers are caught while they approach instead of after one has passed through the other. Set by Collision substeps in the Advanced group; at 1 it is exactly Optimized. Slower; it helps most in fast folds and twists. Always uses Edge-edge.

Layer ordering works under every mode.

Cloth group

Thickness Default 0.15 in

How thick the cloth is when it touches itself, in scene units (a new modifier takes 0.15 inch in the scene's unit). This is a radius: two layers settle about twice this far apart. Larger values keep layers cleanly separated and are more stable; too large and the cloth looks inflated and loses fine folds. Try 0.05 to 0.30 inch.

Friction (mu) Default 0

How much the cloth grips itself where it touches, from 0 (no grip) to 1. The grip never exceeds what the contact is pressed with, so in a fast crush it holds less than you might expect; that is correct behaviour.

Quality group

Relaxation passes Default 10

How many times per step the solver works on the self-contacts, from 1 to 50. More passes separate layers more thoroughly and cost more time. The main cost versus quality control of this modifier.

Query diameter (x sep) Default 2.0

How far the solver looks around each point for contacts, as a multiple of the thickness, from 1 to 4. Larger values find contacts earlier and cost more. It does not go below 1.

Exclusion Default Mesh ring

Which parts of the same piece of cloth are its own neighbourhood and ignore each other.

Rest distance	Points closer than Same-piece exclusion in the rest shape ignore each other, so folds tighter than that radius can pass through themselves.
Mesh ring	Only points one mesh edge apart ignore each other, so creases and hems folding onto the cloth beside them are seen. Where a garment is thinner at rest than two layers settle apart (about twice the thickness), such as the two sides of a thin jacket, its two layers are held at a share of the gap they have at rest: they cannot close up and pass through each other, and nothing is pushed apart at rest. Basic holds the whole gap, Optimized and Advanced half of it. Inside Advanced's collision substeps only pairs whose gap at rest runs across the cloth, from one layer to the other, are held; two points of one sheet that are close only because the mesh is fine there ignore each other. Layers lying on each other at rest (closer than a tenth of that distance) ignore each other too.

Same-piece exclusion (x) Default 2.5

Used with Exclusion = Rest distance: the radius, as a multiple of the point spacing, inside which parts of the same piece ignore each other, from 0.5 to 4. Unavailable under Mesh ring.

Advanced group

Collision substeps Default 4

Used with Mode = Advanced; unavailable under the other modes. Self collision runs this many times per substep, each time on the next part of the substep's motion: it finds contacts and repairs crossings on a pose that has moved only a fraction as far, so two layers are caught while they approach instead of after one has passed through the other. The cloth's material is not solved again, so the cloth is exactly as stiff or soft as before. From 1 to 16; 1 is exactly Optimized. Each step up runs self collision once more per substep, so it costs time. Relaxation passes count for each of these runs, so with more collision substeps fewer passes are often enough.

Layers group

Layer ordering Default off

Decides what happens when two garments on different layers press on each other: the lower layer holds its shape and the upper one gives way. Layers count outward from the body: a shirt on layer 0 under a coat on layer 1 keeps its shape while the coat moves around it. The friction felt between two layers is the top garment's; garments on the same layer average theirs.

hold strength Default 4.0

How firmly the lower layer holds, from 1 to 32. At 1 both garments give way equally, as with layer ordering off; at 4 a coat slides over a shirt that barely notices.

Contact group

Override material friction Default off

Off, each garment uses the friction its material sets, and this panel's Friction covers the garments whose material sets none. On, this panel's Friction applies to every garment and the materials' values are ignored; use it to test one friction across a scene.

Inelastic contact Default on

Cloth that presses on cloth stops instead of bouncing off it: the push that keeps two layers apart moves their positions and is kept out of their velocity. Piles settle and pressed folds stay put. Off, the push becomes velocity.

Garments this solver owns group

A list of every object this modifier is on, with its **name**, **layer**, **friction**, **thickness** and **verts** (vertex count). This is the set the solver simulates together. There is no Add button: to add a garment, add the modifier to that object.

- Double-click (or click) a **layer**, **friction** or **thick** cell to give that garment its own value; clear the cell to inherit again. An inherited cell opens empty, and leaving it unchanged writes nothing.
- The **layer** column shows the layer each garment is simulated at. A garment you have not given a layer takes its place in the Solver group's order (see below) and the list shows that number; a layer you type wins over the order.
- A value in brackets, such as *(0.30)*, is an inherited friction: the value the garment actually uses, taken from its material or from the dials above. An inherited thickness shows -.
- *(mixed)* means the garment carries several materials that ask for different frictions; each region uses its own.
- Drag the bar under the list to make it taller or shorter; double-click the bar to show every garment, or to go back to four rows. The height is kept while 3ds Max is open; it is not saved in the scene.
- The list keeps its scroll position and the selected garment when it refreshes, so you can edit one garment after another. The verts count is read when the panel opens: a garment re-meshed while the panel stays open shows its new count the next time the panel opens.

The Solver group's order. The garments of a Solver group take their places in the order 3ds Max first evaluates them after the scene opens, not the order they were created in; on your workstation the viewport sets it as it draws the scene. A garment's default layer is its place in that order, counting from 0 (before the first simulation, its row in the list). Reset Simulation keeps the order, and a Save on a farm machine forms it the way a viewport would, so the default layers are the same everywhere. To fix a garment's layer whatever the order, type it in the list.

IMPORTANT

Self collision prevents; it does not prove. It pushes cloth apart where it finds it too close, but it cannot guarantee that no fold ever passes through another. Chapter 6 lists what helps when it happens.

3.7 Tnpix Material Standard

The Tnpix Material Standard modifier describes the fabric with the everyday dials and twelve stock fabrics. Start here, and move to Tnpix Material Advanced when a particular fabric needs the full model. A stack can carry several Standard materials, each bound to a painted channel, so one garment can be several fabrics.

Location: Modify panel ► Modifier List ► Tnpix Material Standard

The modifier has three rollouts: **Presets** (your own saved presets), **Material Parameters** and **Advanced Parameters**.

Interface

Presets rollout

Saves every dial of the material to a preset file and loads it back, on this material or any other of the same kind. The rollout is the same on Tnpix Material Advanced.

Folder / ...

The folder where presets are saved and read. One folder serves both materials and is remembered on this computer. The first time, it is `Documents\TenPix Cloth\Material Presets`.

Preset

The presets in that folder that belong to this kind of material (Standard presets on a Standard material, Advanced presets on an Advanced material).

Load

Puts every dial and every check box back exactly as saved. A preset is a complete description: every value the preset does not mention returns to its default. `Ctrl + Z` undoes the load.

Save...

Saves every dial, its value and whether it is ticked, under a name you type. The name becomes the file name in the folder.

Delete

Deletes the chosen preset. The file goes to the Windows Recycle Bin.

NOTE

A preset stores the fabric, not its place on the garment: the channel binding is not saved and is not changed by Load. Standard presets are `.tpstd` files; Advanced presets are `.tpadv` files.

Material Parameters rollout

preset

Applies one of twelve stock fabrics: Cotton (approx), Silk (approx), Denim (approx), Leather (approx), Wool, Linen, Chiffon (approx), Satin, Spandex, Polyester, Canvas and Velvet. A stock fabric writes only the values it carries; every other dial keeps your number, so a stock fabric layers onto your work instead of replacing it. Fabrics marked (*approx*) are starter values: adjust them to your shot.

channel Default <none - whole garment>

Binds this material to a painted channel, so that it covers only the region painted in that channel. Left at *none*, the material covers the whole garment; that is a real choice, not a placeholder.

K bend Default 50

How strongly the fabric resists folding. Acts on this material's own region: two materials give two bend behaviours. Like the other large-range dials of this panel it has three controls: the list snaps the value to a power of ten, the slider moves across the whole range (10^{-10} to 10^{10}) on a logarithmic scale, and the field sets an exact value.

bend damp (material, stateless) Default off

Tick to damp folds; the **damp bend** dial appears, starting at 0.01. It sets how quickly a fold settles once it forms. Clearing the tick turns bend damping off.

damping ratio (XPBD-class: stretch + bend) Default on, 0.05 / 0.05

How quickly an oscillation settles, as a fraction of critical damping, for stretch (**ratio stretch**) and bend (**ratio bend**). The working range is about 0.001 to 0.25; 1 is critical damping. Applies to the whole garment. Ticking the box arms both ratios at 0.01; clearing it turns them off.

Relative Damp Default on, 0.01

Damps each point's movement relative to its whole cloth piece, rather than against the world (**k relative**). It takes the shimmer out of a jittery surface without deadening the garment's overall motion. Guide values: leather about 0.2, cotton about 0.08, silk about 0.02. Applies to the whole garment. Clearing the tick turns it off completely.

exponential membrane (K stretch / K shear) Default on, 400,000 / 40,000

The membrane model: **K stretch** is the stiffness along and across the weave, and **K shear** how hard the fabric resists being pushed out of square. Clearing the tick turns the membrane off; ticking it again arms 400,000 and 40,000. Both act on this material's region; regions no channel covers use the whole-garment value.

max strain Default 0.05

The stretch ceiling of this fabric, as a fraction of the rest length: 0.05 lets an edge stretch 5 percent. Acts on this material's region.

"the sanctioned dials" group

Motion Damping Default 0

Resistance across the surface: the weight in the movement, per frame. Raise it to settle a jittery garment; too high looks syrupy. 0 is off. Acts on this material's region.

velocity damping (global) Default 0.02

Velocity damping for this fabric. Keep it at a small floor, about 0.02 to 0.05; it is not the tool to settle motion (use the damping ratios). Acts on this material's region.

weight (density) Default 1.0

Fabric mass per unit area. It drives how the garment hangs under gravity. Acts on this material's region.

Contact group

friction (sliding resistance) Default on, 0.35

How much this fabric grips a collider. Ticked, this fabric's value counts; clearing the tick keeps your number, so ticking again brings it back. A ticked friction takes over from a collider row's own value unless that row's **Override material** is set.

grip (x multiplier, not 0-1) Default on, 3.0

An extra holding force for this fabric against a collider. It multiplies: the hold against a body is $\text{grip} \times \text{friction}$, so 0.3 is a large reduction, not a small one. The tick behaves like the friction tick.

NOTE

A new material starts with the membrane, friction and grip ticked. These are the defaults of a material you add; a saved scene opens with the values it was saved with. Because friction and grip are ticked, a new material's 0.35 and 3.0 are used on the colliders it touches in place of a collider row's own friction and grip; they are the numbers a new collider row has too. To make a row's own values count, set **Override material** on that row.

Stretch limit group

limit stretch (hold this fabric's ceiling)

On, this fabric holds its own stretch ceiling, the **max strain** value above. Off, it follows the Solver's own stretch limit.

limit where it touches the body Default off

Off, an edge whose two ends both touch the body is free of the ceiling, so a fitted garment stays as modelled. On, the ceiling holds there too; use it where a dense garment shows small pits on the body.

strain-rate limit (/s) Default off, 25

Caps how fast a taut edge may lengthen, in rest lengths per second; only impacts reach 25. 0 turns it off for this fabric. Unticked, the fabric follows the Solver's own strain-rate limit and your number is kept.

Advanced Parameters rollout

material group

compress stiffness Default 0.5

How hard the fabric resists being squashed along its own surface, as opposed to being stretched. Low values let it buckle into wrinkles naturally.

warp / weft Default 0 / 0

Directional stiffness along the warp and across the weft. Equal warp and weft give cloth that behaves the same in every direction.

shear Default 0.5

How hard the fabric resists being pushed out of square.

bend anisotropy (per material) group

warp bend / weft bend Default 1.0 / 1.0

Let the fabric fold more easily in one direction than the other, as a real weave does. Equal values favour no direction.

Fold Body group

fold body k_b Default 0, range 0 to 100

Bend stiffness of the fabric's own fold term, applied per region by the paint. Low values fold loosely and crumple; higher values hold broader, rounder folds. 0 turns it off. Above about 100 the fold term no longer changes the cloth visibly, so the field stops there.

Stretch limits group

max strain

The same stretch ceiling as on the Material Parameters rollout.

per-triangle limiter (principal strain) Default off

Limits stretch across the whole triangle rather than only along its edges.

Accurate strain limit (iterations) Default 0

Extra passes of the accurate stretch limit. It holds the fabric's length more tightly than the ordinary limit, most noticeably on dense cloth, and costs more time. 0 turns it off.

Solve steps per iteration Default 12

Solver steps inside each accurate stretch pass. Raise it if the fabric still creeps longer than asked; it costs time rather than changing the look.

multi-res levels (MRS) Default 0

Multi-resolution levels for this fabric: the setting that makes high-resolution cloth behave. On a dense shirt it more than halves the stretch left in the cloth at the same cost. 0 turns it off.

energy dials group

collision damping (gk) Default 0

A global stiffness scale for this fabric.

velocity damping (global)

The same velocity damping as on the Material Parameters rollout.

weight & contact group

bend enable Default on

Clear it to turn bending off over this material's region.

fabric weight (density)

The same fabric weight as on the Material Parameters rollout.

Which values act per region

When a garment carries several Standard materials, each bound to its own channel, these values act on each material's own region: **weight**, **velocity damping**, **Motion Damping**, **max strain**, **K bend**, **K stretch** and **K shear**. **Relative Damp** and the **damping ratios** act on the whole garment. Regions that no channel covers use the whole-garment values.

TIP

If a stock fabric feels too stiff and lifeless, check **compress stiffness**: cloth has to buckle to wrinkle, and a fabric that resists compression as hard as tension cannot fold.

3.8 Tnpix Material Advanced

The Tnpix Material Advanced modifier exposes the full fabric model: mass, air drag, stretch, bend, plasticity, grain and the stretch limit, each with its own rollout. Its default bend, Shape Memory, keeps the shape the garment was modelled in: every fold returns to the angle it has in the modelled mesh (see **Bend Type**). A new Advanced material starts as the Medium Fabric preset with the stretch limit on at 5 percent, so every row shows a value that is in force.

Location: Modify panel ► Modifier List ► Tnpix Material Advanced

The rollouts are **Presets** (see Tnpix Material Standard), **Channel (Tnpix)**, **Material**, **Geometry / Physical**, **Drag**, **Stretch**, **Bend** and **Advanced**. Channel (Tnpix) sits directly under Presets and opens expanded, so the channel binding is the first setting you see. Controls that the chosen mode does not use are shown unavailable.

Ticks: "I chose this value"

Several rows carry a check box beside the value (Relative Damp, Fold Body, the grain ratios, Friction and Grip). The tick is the statement *I chose this value*. Unticked means nobody has chosen, and the fabric follows the whole-garment behaviour; ticked means you chose the value, even when it happens to be the neutral one. Clearing a tick keeps your number: the field is unavailable, the value stays, and ticking again brings it straight back.

A new Advanced material starts with **Relative Damp** (0.01), **Friction** (0.35) and **Grip** (3.0) ticked, the same values as Tnpix Material Standard. A saved scene opens with the ticks it was saved with.

Interface

Channel (Tnpix) rollout

Enabled Default on

Turns the material off without removing it. While off it contributes nothing, and the garment behaves as though the modifier were not there.

Channel / Refresh Default <none - default material>

Binds this material to a painted channel, so one garment can carry several fabrics. Left at *none*, the material is the default of its own garment: it covers every vertex of that garment that no material bound to a channel claims. **Refresh** reads the channel list from the stack again. The line below reports the binding.

An Advanced material whose channel is *none* covers the vertices of its own garment that no painted material claims; a painted channel keeps every vertex it reaches, soft edges included. On a shared Solver an instanced no-channel material covers each garment it is on, and the no-channel materials of two garments never merge. Give a garment one Advanced material without a channel: with two, only the one created last acts.

Material rollout

Preset Default Medium Fabric

Ultra Light Fabric, Light Fabric, Medium Fabric, Heavy Fabric or Leather (Debug). A preset here is an override: it clears every dial and every tick and then writes its own values, so picking Light gives exactly Light with nothing left over. Relative Damp, Friction and Grip are cleared too; tick them again after picking a preset if you want them. The Stretch Type you chose stays: a material on Fabric Curve keeps it, with the curve rows back at their defaults. When you edit a value afterwards, the list reads Custom.

Preset	Stretch stiffness	Bend stiffness	Shear	Edge	Damping	Mass (kg/m ²)
Ultra Light Fabric	4 × 10 000	5 × 10	2,000	1e+6	0.010	0.06
Light Fabric	6 × 10 000	1.5 × 100	4,000	1e+6	0.010	0.12
Medium Fabric	1 × 100 000	1 × 1 000	10,000	1e+6	0.020	0.25
Heavy Fabric	2 × 100 000	4 × 1 000	30,000	1e+7	0.030	0.50
Leather (Debug)	5 × 100 000	1.2 × 10 000	80,000	1e+9	0.050	0.90

Stiffness is written as coefficient × multiplier, as on the Stretch and Bend rollouts.

Geometry / Physical rollout

Mass Mode Default Override

Unchanged keeps the mass the fabric already has; *Override* replaces it with the value below.

Mass (kg/m2) Default 0.25

Fabric mass per unit area. It drives how the garment hangs under gravity.

Drag rollout

Normal Drag Default 0

The flat-on push of air: what a sheet feels when it is waved broadside. It is strong, so useful values are small. Range 0 to 1.

Tangent Drag Default 0

The along-the-surface part of air resistance, felt when cloth slides edge-first. Range 0 to 1. Leaving it untouched is not the same as typing 0.

Relative Damp (Tnpix) / k relative Default on, 0.01

Damps each point's movement relative to its whole cloth piece, rather than against the world. It takes the shimmer out of a jittery surface without deadening the garment's overall motion.

Stretch rollout

Stretch Type Default Standard

How the fabric resists being stretched.

Standard	The edge net and the triangle pass together, at the stiffness set below. The default.
Fabric Curve	Both passes, but the stiffness follows the curve real woven fabric has: soft for the first few percent of stretch, then locking. Stretch Stiffness becomes the fabric's stiffness once locked. The curve is set in the <i>Fabric Curve (Tnpix)</i> group below.

Stretch Stiffness Default 1.0 × Multiplier Default 100 000

Membrane stiffness: how hard the fabric resists being pulled. The stiffness is the coefficient times the multiplier, which lets you cover ten orders of magnitude without typing zeros; *No Scaling* uses the number as written. The product can go from $1e-10$ to $1e+10$. A change that takes it outside is refused: the box keeps what it had and the line under the Stretch rows says why, for example *REFUSED: $1000 \times 1e+09 = 1e+12$, over $1e+10$* . To go higher, lower the Stiffness first. Acts on this material's region; regions no channel covers use the whole-garment value.

Damping Ratio Default 0

How quickly a stretch oscillation settles. Applies to the whole garment.

Rest Length Scale Default 1.0

Makes the fabric sit tighter (below 1) or looser (above 1) than the shape it was modelled at, without editing the mesh.

Compression Stiffness Default 0

How much the fabric resists being squashed, as opposed to stretched. Low values let it buckle into wrinkles naturally.

Stiffness Dropoff Default 0

Makes the garment firm at the top and progressively softer towards the bottom, for example a skirt stiff at the waist and loose at the hem, without painting. The top is the highest point of the garment's rest pose, so it follows the garment, not the world. Range 0 to 1.

Enable Plasticity Default off

Cloth that stays stretched: pulled past a point, it keeps some of the extra length. The amounts are on the Advanced rollout.

Stretch limit (Tnpix)

Strain limit Default on

The stretch ceiling of this fabric. On, edges may not lengthen past Max stretch; off, only the stiffness resists.

Max stretch (%) Default 5

How far the fabric may stretch beyond its rest length before the ceiling holds it: 5 is denim-tight, 15 is a knit, 100 is no ceiling at all.

Hardness Default 1

How firmly the ceiling holds. 1 is a wall; lower values let the ceiling give under a heavy load instead of snapping.

Sweeps Default 8

How completely the ceiling is reached in each substep. 8 is one pass and the minimum; above 8 the pass repeats and fewer edges are left over the ceiling. When several fabrics share a Solver, the largest count applies.

Limit where it touches the body Default off

Off, an edge whose two ends both touch the body is free of the ceiling, so a fitted garment stays as modelled. On, the ceiling holds there too.

Strain-rate limit (/s) Default 25

Caps how fast a taut edge may lengthen, in rest lengths per second; only impacts reach 25. 0 turns it off for this fabric.

Status line

The last solved frame, measured: the largest and mean stretch, the edges held at the ceiling, the edges freed on the body, and whether one more pass would still lower the maximum. When it says the stretch is still converging, raise **Stretch quality** on the Solver.

Fabric Curve (Tnpix)

Real woven fabric gives easily for its first few percent of stretch, while its yarns straighten, and then locks once they pull taut. With Stretch Type set to *Fabric Curve* this fabric does the same: below its lock point it is soft, the Stretch Stiffness divided by **Lock stiffness**; past the lock point it rises smoothly to the Stretch Stiffness itself, the firmness you set. The rows are unavailable under the other Stretch Type and keep their numbers. Each direction has its own lock point: the warp and weft from the rows below, the bias from the angle at which the weave jams, and every edge in between mixes them by its angle to the grain. The grain is the one the Bend rollout's Grain group uses: the garment's grain axis, turned by Grain Angle. The curve shapes stretch and shear only; bending is unchanged. It reads the Grain group only to know which way the warp runs, so turning Grain Angle turns the curve's warp and weft with it.

Warp soft until (%) Default 2

How far the fabric stretches easily along the warp before it locks, in percent of the rest length. Woven cottons lock early (1 to 3); knits much later (10 to 30). Range 0.1 to 100.

Weft soft until (%) Default 4

The same across the weave. Real weft usually gives more than warp.

Bias lock (deg) Default 30

The shear angle at which the weave jams: the lock point of the bias, at 45 degrees to the grain. Woven fabric is soft on the bias, so its lock point is late. Range 1 to 80.

Lock stiffness (x) Default 500

How many times stiffer the fabric is once locked than in its soft range. 1 means no curve: the fabric keeps its Stretch Stiffness throughout and runs exactly as Standard. A stiff fabric needs a large number to show a soft range at all: on the stock fabric, 20 changes almost nothing and 500 lets it give its first percent or two. Range 1 to 100,000.

Lock smoothness Default 0.5

How gradually the fabric locks, so it never snaps: 0 is a sharp corner at the lock point, 1 locks over a stretch range as wide as the soft range. Range 0 to 2.

Status line

Whether the curve is acting on this fabric, and its warp and weft lock points.

The curve acts on this material's region only, like the rest of the Stretch rollout. The Strain limit above still holds as a ceiling past the lock point.

Bend rollout

Bend Type Default Shape Memory

The bend model the solver runs.

Basic	A spring across every fold keeps the distance between the outer corners of its two triangles as it is at rest: it holds how deep a fold is, not which way it turns. It is the bend of Tnpix Material Standard. Fold Body acts under this type only.
Shape Memory	Keeps the angle of every fold, and the side it turns to, as it is in the garment's rest shape. The fabric remembers the shape it was modelled in: a rolled collar, a shaped brim or a sculpted fold comes back after it is pushed, instead of relaxing flat.
Shape Memory (Even)	Shape Memory, with each fold weighted by the shape of its two triangles at rest, so the fabric bends by its material rather than by how the mesh happens to be triangulated. On an even mesh it is exactly Shape Memory.

The rest shape is the garment as it stands on the first frame of the simulation, normally the shape you modelled. Rest Angle Scale and Plasticity act under Shape Memory and Shape Memory (Even), and are unavailable under Basic.

Bend Stiffness Default 1.0 × Multiplier Default 1 000

How strongly the fabric resists folding, as coefficient times multiplier. Acts on this material's region: two materials give two bend behaviours.

Damping Ratio Default 0

How quickly a fold settles once it forms.

Rest Angle Scale Default 1.0

Scales the fold angles the fabric remembers from its rest shape: 1 keeps them as modelled, 0 makes the fabric want to lie flat, above 1 deepens every fold.

Stiffness Dropoff Default 0

The top-to-bottom softening of Stretch, applied to bending.

Enable Plasticity Default off

Creases that stay: a fold held past the threshold on the Advanced rollout sets into the rest shape instead of relaxing out.

Fold Body (Tnpix) / k_b Default off, range 0 to 100

How much the cloth resists folding as a sheet rather than hinge by hinge. Low values fold loosely and crumple; higher values hold broader, rounder folds. Per material, so two regions of one garment can differ. Above about 100 it no longer changes the cloth visibly, so the field stops there. Used by Basic only; it works toward an unbent sheet, not toward the modelled shape.

Grain (Warp / Weft / Angle) (Tnpix)

Real fabric is not equally stiff in every direction: threads run lengthwise (the warp) and crosswise (the weft), and cloth bends differently along each. These rows act under every bend type.

Warp Ratio / along

How much of the bend stiffness runs along the grain. A ratio, not a stiffness: warp 2.0 with weft 1.0 is twice as stiff along the grain as across it. Range 0.1 to 10.

Weft Ratio / across

The same ratio across the grain. Warp and weft both at 1.0 means no grain.

Grain Angle / deg

Turns the grain direction: the bias cut. A panel cut at 45 degrees drapes quite differently from one cut on the straight grain. Measured in the garment's own frame, so rotating the garment rotates the grain with it. Range -180 to 180.

Advanced rollout

Global Damping Default 0.02

Velocity damping. Raise it to settle a jittery garment; too high looks syrupy. Acts on this material's region.

Shear Stiffness Default 10,000

How hard the fabric resists being pushed out of square.

Edge Stiffness Default 1e+6

The stiffness of the edge net on its own. Cloth is held by the springs along its edges and by its triangle faces; this sets the first, so you can hold the lengths hard and still let the surface give. Acts on this material's region.

Stretch XX (warp) / Stretch YY (weft) Default 100,000

Directional stiffness along the warp and across the weft. Equal values give cloth that behaves the same in every direction.

Stretch Plastic Threshold / Rate / Max Change Default 0.1 / 0.1 / 0.5

How far the fabric must stretch before any of it stays stretched, how quickly stretch past that point stops coming back, and a ceiling on how much it may permanently give.

Bend Plastic Threshold (rad) / Rate / Max Change (rad) Default 0.2 / 0.1 / 0.5

How far a fold must go, in radians, before it starts to set into a crease, how quickly it sets, and a ceiling on how much permanent crease may build up.

Scale Multiplier Default 1.0

Moves every stiffness of the fabric together by the same factor, so the fabric keeps its character and only becomes softer or stiffer as a whole.

Authored (Tnpix) Default on

Off, the material ignores every value you set and runs pure defaults: a way to compare with "no material" without losing your work. Nothing is destroyed; turning it on brings everything back.

Authored state (Tnpix) / Clear all

Shows which stiffness values are set. **Clear all** withdraws the set stretch, bend and shear stiffness together so the solver falls back to its defaults; the numbers stay in the fields.

Friction (Tnpix) Default on, 0.35

How much this fabric grips a collider. A ticked friction takes over from the collider row's own value unless that row's Override material is set.

Grip (Tnpix) Default on, 3.0

An extra holding force against a collider. It multiplies: the hold is grip × friction, so 0.3 is a large reduction. If cloth suddenly slides off a body, check the grip as well as the friction.

Per region. Stretch Stiffness acts per painted region under both stretch types; Edge Stiffness acts per region the same way; Shear Stiffness acts per region under Standard.

3.9 Tnpix Channel

The Tnpix Channel modifier is where you paint. A channel is a named weight map from 0 to 1 over the vertices of the cloth. Materials, pins, a Preserve, stitches, tears, rigid pieces, Post Process and Wrap read channels by name. The modifier also carries the Tear brush, which cuts a freehand line into the cloth.

Location: Modify panel ► Modifier List ► Tnpix Channel (above Tnpix Garment)

To create and paint a channel:

1. Add Tnpix Channel above Tnpix Garment. Make sure the object shows its mesh in the viewport (scrub a frame if needed), so the modifier has a mesh to paint.
2. Type a name in the **Name** field, for example *collar*, and click **Add**.
3. With the channel selected in the list, set **Mode** to Add and **Value** to 1, click **Paint** and paint the region in the viewport. Click **Paint** again to stop.
4. Turn on **Show Weights** to see what you painted.
5. On the modifier that should use the region (a material, a Pin, a Stitch...), choose the channel by name.

Sub-object levels

Channel Vertices and **Channel Edges** select components to weight; they never move them. Click, drag or use the selection buttons, then **Apply to Selection** writes the **Value** into the selected channel (an edge selection means the vertices it joins) and **Remove Selection** sets them back to 0.

A new channel from a selection. **Add** creates the channel carrying the current selection, if there is one: the Channel's own Vertices or Edges selection when you are in that level; otherwise a selection made *below* the Channel at a sub-object level - for example vertices, edges or polygons selected in an Edit Poly that is still in that level. Vertices left selected inside an object that is at its top level are not a selection and are not used, as for any 3ds Max modifier. With nothing selected, **Add** creates an empty channel to paint into.

Undo and redo. Every change of the Channel Vertices or Channel Edges selection — a click or a drag in the viewport, All, None, Invert, Shrink, Grow, Ring, Loop — and every channel edit — **Add**, **Delete**, **Rename**, **Active**, **Live from stack**, **Apply to Selection**, **Remove Selection**, **Clear Channel**, **Mirror** — is one step of 3ds Max's own undo (Ctrl+Z, Ctrl+Y, *Edit ▸ Undo*), named for the press. A press that changes nothing files no step. Undoing a channel's **Delete** brings back its tear-brush lines with it.

A Channel shared by several objects. All, None, Invert, Shrink, Grow, Ring and Loop act on every object's own selection. **Mirror**, **Apply to Selection** and painting refuse, with the reason: the weights belong to the modifier and are shared by every object it sits on.

Interface

Tnpix Channel rollout

Channels group

List

Every channel on this modifier. Select one to paint it, rename it or check its state.

Name / Add / Delete / Rename

Type a name and click **Add** to create a channel. **Delete** removes the selected channel, its weights and the tear-brush lines drawn into it. **Rename** gives it a new name; everything bound to the old name follows.

Active

Shows whether the selected channel is on; clear it to turn that channel off without deleting it. A binding to an inactive channel does nothing, rather than falling back to something else.

Show Weights

Draws the selected channel's weights in the viewport, from dark blue (0) through yellow (0.5) to red (1). The weights are also drawn while you paint. They use their own map channel, never the object's vertex colours: an object with Vertex Paint keeps its colours, and they show again, exactly as before, when the weights go off.

Live from stack Default off

Reads the channel list from the modifiers below again, so channels added further down the stack appear here.

Status line

What the selected channel holds and what is bound to it. A channel that nothing binds changes nothing, and the line says so.

Paint group

Mode

How the brush changes the weights it touches: *Add*, *Subtract*, *Replace* or *Smooth*.

Strength

How strongly one stroke moves the weight towards the value.

Value

The weight a stroke paints towards: 1 is fully in the channel, 0 fully out.

Brush Options...

Opens the 3ds Max brush options: size, strength and falloff. With **Mirror** ticked there, a stroke on one side paints its mirror image too, across the axis and offset chosen in the brush options.

Paint

Starts painting on the selected channel. Click again to stop.

Apply to Selection

Writes the value into every selected vertex. If it cannot, it says why.

All / None / Invert

Select every vertex, no vertex, or swap the selection.

Shrink / Grow / Ring / Loop

Edit Poly's selection tools, in Channel Vertices and Channel Edges (unavailable at the top level).

Shrink	Deselects the outer layer of the selection.
Grow	Adds the neighbours of the selection along the mesh's edges.
Ring	Adds the parallel edges across each quad, until a border or a face that is not a quad.
Loop	Extends the selection along its edge loop: at a vertex with four edges it goes straight on; it stops at a border, a pole or a triangle area.

Loop and Ring follow the edges you see: a quad split by a hidden diagonal counts as the quad. On a triangle mesh, such as a Tnpix Garment remesh, there is no quad to follow, so Loop and Ring stop and the line under the buttons says why. In Channel Vertices, Loop and Ring need two neighbouring selected vertices to give the direction. The line under the buttons reports each press. Like All / None / Invert, a press changes the selection only; each one is a step of 3ds Max's undo.

Remove Selection

Sets every selected vertex back to 0 in this channel: the way out of a mistaken selection.

Clear Channel

Sets the whole channel back to 0. The selection is not changed.

Mirror / side / Tolerance Default +X to -X, 0.1 in

Copies the selected channel's weights from one side of the object to the other. The list says which side gives its weights: +X to -X, -X to +X, +Y to -Y, -Y to +Y, +Z to -Z or -Z to +Z. The plane runs through the middle of the object (the middle of its bounding box on that axis), in the object's own axes; each vertex on the giving side hands its weight to its twin — the vertex nearest its mirror image, if it is closer than **Tolerance** (a new modifier takes 0.1 inch in the scene's unit). A vertex with no twin keeps its weight, and the line under the buttons says how many there were. Mirror reads the positions of the frame on the timeline, after the tear-brush cuts. One undo step.

Tear brush group

Tear brush

Draw a line on the cloth. When you release, the mesh is cut along the line, and the vertices on the line receive the **Value** in the selected channel, so a Tnpix Tear bound to that channel opens exactly the line you drew. Draw again to add more lines; click the button again to stop. The line is shown while you drag, and a right-click cancels the stroke. A stroke that starts or ends off the cloth is cut out to the border on that side.

Spacing

The least distance between two cut points along the stroke, in scene units; it thins a dense stroke. 0 cuts at every mouse sample. On the first use it fills itself with the mesh's average edge length; type over it to change it.

Remove last cut

Removes the last line and its marks; the cloth is cut again with the lines that remain. Undoable.

Remove all cuts

Removes every line of this modifier and its marks; the original vertices keep the weights they had before. Undoable.

Status line

What the last stroke did, or why it was refused.

NOTE

The cut lives in the modifier. It is made on the mesh that reaches the Channel modifier, whatever it is (a Plane with a Tnpix Garment below, an Editable Mesh, an Editable Poly), and the base object is never changed or converted. The lines are saved with the scene. The Tear brush refuses, with the reason, when no channel is selected, when the modifier is instanced on more than one object, or when no mesh has reached it yet.

TIP

Bindings are by name, never by position. Two materials cannot share one channel: point the second at a different one. If two Channel modifiers on the same stack carry the same channel name, the first wins and the panel warns you.

3.10 Tnpix Pin

The Tnpix Pin modifier holds part of the cloth in place or makes it follow an object: a collar on a neck, a waistband on a hip, a flag's edge on its pole. The pinned region is a painted channel, so the pin survives edits to the mesh. A stack can carry several Pin modifiers, each with its own channel and object.

Location: Modify panel ► Modifier List ► Tnpix Pin

To pin a region to an animated object:

1. Paint the region in a Tnpix Channel, for example a channel named *waist*.
2. Add Tnpix Pin and choose *waist* in **Channel**.
3. Click **Select Object** and click the object the region should follow.
4. Play. The painted points follow the object, including its animation; the rest of the cloth hangs from them.

Interface

Tnpix Pin rollout

Pin group

Enabled ☐ Default on

Turns this pin off without removing it.

Channel / Refresh

The painted channel that defines the pinned region. *<none>* means this pin holds nothing. **Refresh** reads the channel list from the stack again.

Object: Select Object / Clear

The object the pinned region follows. **Clear** unbinds it; the region then holds in place.

Weight Default 1.0

How much of the object's motion the pinned region follows, from 0 to 1; each point's share is its painted value times this Weight. At 1.0 the region follows 100 percent. Below 1 the pin is soft and the Weight is the share it follows: 0.5 follows half of the object's motion and sags behind it, 0.75 three quarters, the same on a coarse or a fine garment and on a garment that shares its Solver. Each point is drawn toward the object by a damped spring, so it follows smoothly and does not swing past it, while the cloth, a Tnpix Volume and collisions still act on it. Animatable.

Dynamic Default off

On, the pinned points keep their mass and the pin pulls them to the object, so gravity, damping and collision keep acting on them, and a point that is let go keeps its own velocity; the pull is damped as a soft pin's is. Off, the object moves the points directly, which is exact and cheap: use it for cloth pinned to a body.

Reach Default 0

How far from the object a painted point may be when the pin takes hold, in scene units. Farther points are left as free cloth. 0 means any distance. Use it when the cloth has torn or fallen away before the pin starts, so the pin does not pull back pieces that are no longer at the object.

Min piece Default 1.0

A torn piece smaller than this share of the cloth, in percent of its faces, lets go of the pin, keeps the motion the pin gave it and falls. The main piece never lets go. 0 means every pinned piece stays pinned.

Active time group

Active only between frames Default off

Limits the pin to a frame range. Off, the pin holds for the whole animation. On, before **From** and after **To** the painted points are free cloth: at **From** the pin takes them where they are, and after **To** it lets go and they keep the motion the pin gave them.

From Default 0 / To Default 100

The first and last frames the pin holds, counted as the timeline counts frames. Because the pin takes the points where they are at **From**, there is no jump. If **To** is before **From**, the pin never activates.

Status line

What the pin is bound to and what it holds.

Active Zone group

Lets the pin hold a painted point only where a zone reaches it. A point the zone reaches is taken where it is, with no jump, as at the Active time's **From** frame; a point the zone leaves is let go and keeps the motion the pin gave it, as after **To**. The zone works inside the Active time above: with Active only between frames on, it works only from **From** to **To**.

Active Zone Default off

The pin holds a painted point only while the zone reaches it, with its Weight times the zone's value there: the full Weight inside a helper's Near radius, fading to nothing at its Far radius. A point the zone reaches again is taken again where it is, unless it is then farther than **Reach** from the object. Off: the pin holds every painted point.

Invert Default off

Turns the zone round: the pin holds every painted point except where the zone reaches - nothing inside Near, fading in to the full Weight at Far. A point the turned-round zone reaches is taken where it is. With no helper picked, the pin holds every painted point.

List / Pick / Remove

The Influence Helpers that make the zone, as on Tnpix Forces.

Stays held once touched Default off

Off: the zone is a window - the pin holds only the points inside it now. On: the zone is a brush - every point it has reached stays held until the Active time ends. With Invert on, the box reads **Stays free once touched**: it still remembers what the helper touched, and a point the helper has touched stays let go - the helper is an eraser.

Status line

After a simulation: on the last simulated frame, how many of the painted points the zone holds.

TIP

Paint at full weight, with Weight 1, for a hard pin. Below that the pin follows its share: painted 1 with Weight 0.5, or painted 0.5 with Weight 1, follows half of the object's motion. For a region that should hold almost firm, use a Weight near 1: 0.9 follows about 93 percent of the motion, 0.95 about 98 percent and 0.99 nearly all of it.

TIP

To make a region follow the character's own animation — a Skin, a Skin Wrap or any deformer below the Solver — rather than another object, use Tnpix Preserve (below). The Pin binds each painted point once, at the first frame, to the nearest triangle of the object it follows, so with an arm close to the body at that frame a sleeve's armpit binds to the body; a Preserve searches for nothing.

NOTE

A Tnpix Soft Body or a Tnpix Volume with a Channel placed above this Pin on the stack lets go of the points its channel paints, as far as it paints them: they move with the flesh or the Volume while the rest of the pin holds. Placed below the Pin, it lets nothing go: the Pin holds them. On a Solver shared by several objects each object's paint lets go of its own points only.

NOTE

Keep pinned points out of colliders. A pinned point inside a body is held there by the pin and pushed out by the collision on every step, which shows as jitter near the pinned region, most visibly in slow motion.

3.11 Tnpix Preserve

The Tnpix Preserve modifier makes a painted region follow the animation of the mesh below the Tnpix Solver — a Skin, a Skin Wrap, a Tnpix Wrap, a Morpher, a Point Cache, anything that moves the mesh —

instead of being simulated. A collar, a cuff, the top of a sleeve or a waistband rides the character exactly, and a soft edge blends it into the simulated cloth.

Location: Modify panel ▶ Modifier List ▶ Tnpix Preserve

To make a region follow the character's animation:

1. Make sure the animation reaches the cloth below the Tnpix Solver: the cloth is skinned, wrapped or otherwise deformed by modifiers under the Solver.
2. Paint the region in a Tnpix Channel, for example a channel named *cuffs*: 1 where the cloth must sit on the animation, falling to 0 over a few rows where it should blend into the simulated cloth.
3. Add Tnpix Preserve and choose *cuffs* in **Channel**.
4. Play from the first frame. The points painted 1 sit on the animation, the soft edge follows it part of the way, and the rest of the cloth is simulated.

What the paint means

Painted	The point
1	Sits on the animation exactly, on every frame, the first frame included. Nothing moves it: it is ignored by every collision — the colliders, the ground, self collision and the other garments — and it pushes nothing.
Between 0 and 1	Is pulled toward the animation by the Pin's Weight rule: 0.5 follows half of it, 0.75 three quarters. It is still simulated, so it still collides.
0	Is simulated, as without a Preserve.

Its place in the stack does not change what it follows: the mesh as it arrives at the Tnpix Solver, so every deformer below the Solver counts. A Tnpix Soft Body or a Tnpix Volume with a Channel above the Preserve lets go of the points it paints, as it does over a Tnpix Pin. Over a Tnpix Pin on the same point the Preserve wins; with two Preserves on one object each names its own channel, and where they overlap the larger paint counts. On a Tnpix Soft Body the preserved surface points hold and the flesh between them moves. A Tnpix Cache records the preserved points like every other point. A Preserve works the same on a Solver shared by several garments.

How it reads the animation

Each frame of the animation is taken when 3ds Max hands that frame to the Solver. Played in order from the first frame (with Real Time off), or recorded into a Tnpix Cache as the farm scripts do, every frame is exact. A frame 3ds Max never showed — after a jump ahead on the timeline — has no animation to read: the preserved points take the animation blended between the nearest frames that were shown, and the status line names those frames. Played from the first frame afterwards, they are simulated again on their own animation.

An edit to the animation below the Solver — a changed Skin, a moved key — is seen on the next play: the cloth simulates again on the edited animation.

Interface

Tnpix Preserve rollout

Enabled Default on

Switches this Preserve off without removing it. Off, the painted points are simulated like the rest of the cloth.

Channel / Refresh

Which painted channel follows the animation below the Solver. *<none>* means this Preserve holds nothing. A channel that is no longer on the stack is shown as missing: pick it again or restore the channel. **Refresh** reads the channel list from the stack again.

Status line

What the Preserve holds: how many points it preserves, how many of them sit on the animation and how many form the soft edge; and the frames whose animation was blended because 3ds Max never showed them.

The TenPix Graph shows a Preserve node with the same Enabled and Channel.

NOTE

Self collision leaves out every triangle and edge that touches a point painted 1, so the ring of triangles around a preserved region lets other cloth through. Keep the hard edge of the paint where no other cloth has to rest on it.

NOTE

A render farm job that simulates while it renders, instead of recording a Tnpix Cache first, reaches each task's first frame by a jump, and those frames are blended. Record the caches on the farm, as the TenPix farm scripts do (see *Rendering on a Farm* in Chapter 5).

3.12 Tnpix Stitch

The Tnpix Stitch modifier sews cloth to cloth. A Pin holds cloth to an object outside the simulation; a Stitch holds the painted points of one garment to another garment in the same Solver group, or to the garment's own folded-over parts, such as a rolled cuff or a tucked flap. It sews a Tnpix Soft Body the same way: a strap to a soft body, or a fat layer to a muscle, sliding over it if you let it (see the Sliding group).

Location: Modify panel ► Modifier List ► Tnpix Stitch

Stitches form when the simulation starts: every painted point within the search distance binds to the nearest surface point of a listed garment, and the pair holds for the run. A stitched pair is left alone by self collision, so the two never fight. Chapter 5 walks through a complete seam.

Interface

Tnpix Stitch rollout

Enabled ☒ Default on

Turns this stitch off without removing it.

Stitch to group

List / Add / Remove

The garments this cloth stitches to. They must be on the same Solver as this cloth; a garment on another Solver is marked in the list and refused when the simulation starts. **Add** picks a garment in the viewport (right-click to stop picking); **Remove** takes the selected garment out of the list without deleting it.

Stitch to self Default off

Stitches the cloth to its own folded-over parts. Only parts folded close through space can stitch; neighbours along the cloth never do.

Binding group

Search distance Default 0.5 in

How far a painted point looks for a surface to stitch to, in scene units (a new modifier takes 0.5 inch in the scene's unit). A starting point: tune it per scene. At 0 nothing is found, and the panel says so.

Tightness Default 1.0

1.0 pulls the pair together like a sewn seam, and the seam stays shut, also where three panels meet: the Solver's smoothing leaves every stitched point where the seam put it. 0 is a rigid tack: the pair keeps its starting gap exactly. Values in between close the gap proportionally.

Offset Default 0

A gap the seam keeps between the two cloths, in scene units, added to what Tightness leaves: at Tightness 1 the pair holds exactly this far apart. This cloth keeps the gap; the cloth it is stitched to is never pushed away by it.

Strength Default 1.0

How rigid the hold is, from soft basting at 0 to a hard seam at 1: around 0.5 the seam holds, from about 0.8 it is sewn shut.

Seam passes Default 1

How many solver passes the seam gets each step, from 1 to 10. 1 is the normal solve; raise it if a sewn seam sags while the cloth is falling.

Sliding group

Slide along the surface Default off

The stitched points stay on the surface they are sewn to, at the stitch's gap, but can slide along it: a fat layer over a muscle, a skin over the fat. Off, every point is sewn in place.

Friction Default 0.3

How hard the sliding is: 0 slides freely, 1 does not slide, as a plain stitch. Range 0 to 1. Unavailable while Slide along the surface is off, on the panel and in the TenPix Graph.

Where (painted channel) group

Channel / Refresh

The painted channel that says where stitching is allowed. Only painted points stitch: paint the seam and leave the rest free.

Threshold Default 0.5

Painted points at or above this weight stitch; below it they stay free. It trims the edge of the painted area.

Active time group

Active only between frames Default off

Limits the stitch to a frame range. On, before **From** and after **To** the painted points are free cloth: at **From** the stitch finds its pairs where the cloths are and starts to pull, and after **To** it lets go and the points keep the motion the seam gave them.

From Default 0 / To Default 100

The first and last frames the stitch holds. If To is before From, the stitch never activates.

Active Zone group

Lets a stitch pull only where a zone reaches its seam, the point halfway between its two ends. The stitches are found as before, by the painted channel and the search distance; the zone decides which of them pull. A stitch the zone reaches starts to pull from where the cloths are. The zone works inside the Active time above.

Active Zone Default off

A stitch pulls only while the zone reaches its seam, with its Strength times the zone's value there: the full Strength inside a helper's Near radius, fading to nothing at its Far radius. Off: every stitch pulls.

Invert Default off

Turns the zone round: every stitch pulls except where the zone reaches its seam - nothing inside Near, fading in to the full Strength at Far. With no helper picked, every stitch pulls.

List / Pick / Remove

The Influence Helpers that make the zone, as on Tnpix Forces.

Stays sewn once touched Default on

On: a stitch the zone has reached keeps pulling after the zone moves on - sweep the helper along the seam and it closes behind it like a zipper. Off: only the stitches inside the zone pull, and the seam lets go again behind it. With Invert on, the box reads **Stays open once touched**: a stitch the helper has touched lets go for good - sweep the helper along a sewn seam and it opens behind it.

Status line

After a simulation: on the last simulated frame, how many stitches are pulling.

Display group

Show stitches while this panel is open Default on

Draws one line per stitch while the panel is open. Nothing is drawn until the simulation has been built.

Status line

Says what will happen before you play, for example *22 painted points are stitched to 1 garment(s)*, or that no painted point is within the search distance of a surface, or that there is nothing to stitch to yet, with what to do about it.

3.13 Tnpix Tear

The Tnpix Tear modifier lets the cloth come apart under load. The mesh is split where the fabric is pulled past its limit, so a caught hem rips instead of stretching forever. The cloth can tear inside a painted region, anywhere an edge stretches too far, or where a closed shell bursts under pressure.

Location: Modify panel ► Modifier List ► Tnpix Tear

Interface

Tnpix Tear rollout

Tear group

Enabled Default on

Turns tearing off without removing the modifier; the cloth simulates whole.

Tear by Default Map

Map	Tears only inside the painted channel, where the pull in the cloth exceeds the Threshold .
Stretch	Tears anywhere an edge gets longer than the Stretch ratio allows. No paint is needed; a channel only grades the weakness, and Marked above is not used.
Pressure	Bursts the painted region when the air pressure held by a Tnpix Volume on the same stack exceeds the Threshold.

Region group

Channel / Refresh

The painted channel that marks where the cloth may tear. Map and Pressure need one; until it is chosen the status line reads that no region is bound.

Marked above Default 0.5

A point painted at or above this weight may tear; below it the cloth stays whole.

Ends Default Both marked

Both marked: both points of an edge must be painted for it to open. *Either:* one painted point is enough, so the cloth tears more readily.

Grow paint Default 0

Every point within this many edges of a painted point counts as painted, from 0 to 8 rings. 1 matches the faces the paint colours in the viewport; 0 uses the painted points alone.

Strength group

Threshold Default 10.0

How strong a seam is, for Map and Pressure. Map: the pull an edge can take before it opens. Pressure: the air pressure at which the painted region bursts. Higher is stronger; lower tears sooner. The status line shows the strongest pull reached: type a number just below it to tear there. Not used by Stretch.

Stretch ratio Default 0.1

For Stretch: how much longer an edge may get before it tears, as a part of its own length. 0.1 tears at 10 percent longer, 0.5 at one and a half times its length, 1 at twice its length. Smaller tears sooner and more. The status line shows how much the most stretched edge grew: type a number below it to tear there.

Weakness min / Weakness max Default 1.0 / 1.0

Multiply the pull (Map) or the stretch (Stretch) of each marked point. Every point has its own weakness between the two: its paint sets how far towards Weakness max it may reach (the lightest marked paint stays at Weakness min, full paint may reach Weakness max), and a fixed share of its own spreads the points over that span, so a painted region tears point by point instead of all at once. The spread is the same on every play and every machine. Above 1 the region tears sooner, below 1 later; both at 1.0 means the paint only marks the region. Under Stretch, the channel's weight grades the weakness and unpainted points take Weakness min. Range 0.01 to 10.

Status line

Before you play: how many points are marked and how many welds can tear, and the Substeps and Iterations the Threshold was typed at. After: how much tore, and the strongest pull (or pressure, or stretch) reached against the limit.

NOTE

The Threshold is compared with a force in the solve, and that force depends on the Solver's Substeps and Iterations. The panel remembers the pair the Threshold was typed at and tells you when the Solver runs at another pair; set the Threshold again at the new pair.

Active Zone group

Lets the cloth tear only where a zone reaches. Set the Threshold or the Stretch ratio low enough to tear the cloth at once: nothing tears until the zone arrives, and then it tears only where the zone is. The tear settings above are used as they are.

Active Zone Default off

A point may tear only where the zone reaches it: anywhere inside a helper's Far radius. Off: the cloth tears wherever it is marked.

Invert Default off

Turns the zone round: a point may tear where the zone does NOT reach - anywhere beyond a helper's Near radius, since the Tear tears wherever its zone reaches at all (give the helper the same Near and Far for a sharp edge). With no helper picked, every marked point may tear. Outside the zone's time nothing tears.

List / Pick / Remove

The Influence Helpers that make the zone, as on Tnpix Forces.

Stays active once touched Default on

On: a point the zone has reached stays able to tear for the rest of the simulation, after the zone has moved on. Off: only the points inside the zone at that frame can tear. With Invert on, the box reads **Stays protected once touched**: a point the helper has covered (inside Near) never tears again - the helper is a shield.

Active only between frames / From / To Default off, 0 to 100

The zone works only in that frame range; outside it, it reaches no new point. Points it has already reached stay able to tear while Stays active once touched is on.

Status line

After a simulation: on the last simulated frame, how many marked points could tear, and how many seams have torn.

The zone is made of 3ds Max's own **Influence Helpers** (*Create panel ▶ Helpers ▶ Standard ▶ Influence*): full inside a helper's **Near** radius, fading along its **Falloff** (Linear, Smooth or Smoother) to nothing at its **Far** radius. **Invert** makes the zone everywhere except around the helper; a helper that is not **On** covers nothing. With several

helpers, the largest value at a point counts. The zone follows the helper: move it, change Near, Far or Falloff, or animate any of them, and the zone follows frame by frame; changing it makes the cloth simulate again. The helper's Bias settings are not used.

Several Tears on one cloth

A cloth can carry more than one Tnpix Tear, for example a Map Tear for a seam and a Stretch Tear for the rest. Where they mark the same point, the stack order makes no difference:

- **A Stretch Tear and a Map or Pressure Tear** both test the point, each with its own numbers and weakness; whichever reaches its limit first tears it.
- **Two Tears of the same kind:** the one that tears the point first sets it, that is the lower Threshold or Stretch ratio, each divided by the point's weakness under that Tear (a Pressure Tear reads no weakness). A Map Tear and a Pressure Tear on the same point share one test, the Map Tear's.
- **Active Zone:** a point marked by both kinds uses the Map or Pressure Tear's zone when it has one, otherwise the Stretch Tear's.

Tearing is per object: each garment on a shared Solver carries its own regions and weakness paint, its Tears act on its own points only, and each marked point keeps the numbers of its own Tear. A Tnpix Soft Body in the Solver group keeps its flesh while a garment tears; one whose own mesh its Tear splits simulates as cloth (see Tnpix Soft Body). A few rules have one setting for the cloth, or for the whole Solver group on a shared Solver, taken from one Tear (a Map Tear before a Pressure Tear before a Stretch Tear, then the lowest Threshold): **Tear by**, which decides the rules a crack follows, Ends, and the Substeps and Iterations the Threshold was typed at. The weakness range runs from the lowest Weakness min to the highest Weakness max of the Tears. Draw the line a rip should follow with the Tear brush of Tnpix Channel: a stretch along its strokes is measured over at least a quarter of the cloth's own edge length there, so the very short edges the brush makes do not tear as dots.

TIP

Tnpix Threads grows warp and weft threads out of the tears; see Tnpix Threads in this chapter.

3.14 Tnpix Volume

The Tnpix Volume modifier gives a closed shell an inside. Without it a closed mesh is still just a surface and collapses like cloth; with it the enclosed volume is kept, so a ball stays a ball, a sleeve keeps its round and an inflatable inflates. On a whole object it needs a closed mesh; on a painted region of a body (a belly, a cheek, the top of a cushion) it holds the volume of that region alone, measured against a centre.

Location: Modify panel ► Modifier List ► Tnpix Volume

Volume is per object: on a shared Solver each garment follows the target of its own Volume modifier, and an object without one has no volume, even when it is stitched to a garment that has one. Several regions are several Tnpix Volume modifiers on one object, each with its own channel, centre and settings; a point painted in two channels belongs to both.

Interface

Tnpix Volume rollout

Volume group

Enabled Default on

Turns the volume off without removing the modifier.

Mode Default Keep volume

Keep volume holds the air inside at Volume ratio times the rest volume, every frame. *Pressure* pushes the shell outward with a constant pressure instead, and the fabric decides where it settles (see How a Volume reaches its size).

Region group

Channel / Refresh Default <none - the whole object>

The painted channel this Volume holds. *<none - the whole object>* holds the whole closed shell. A channel makes this Volume hold only the painted area, and the paint says how firmly each point keeps the volume: painted 1 keeps it fully, 0 is free, so a soft-edged region blends into the rest of the cloth with no crease at its border. The region does not have to be closed. **Refresh** reads the channel list from the stack again.

Centre Default Its own middle

A painted patch is open, so its volume is measured against a centre: everything between the painted skin and that point. *Its own middle* is the middle of the painted points, carried with them; there is nothing to pick, but a nearly flat region holds little against it. *Object* with **Pick** uses an object inside the region, such as a bone or a helper that follows the animation: the region keeps its volume around it and is carried with it. The cloth itself cannot be its own centre.

Keep volume group

Volume ratio Default 1.0

The target as a fraction of the rest volume: 1.0 holds the rest volume, 1.3 inflates by 30 percent, 0.8 lets 20 percent of the air out. Range 0.05 to 10. Animatable.

Softness Default 0

0 holds the volume exactly every frame. Higher values let contact squash the shape, which then recovers over time: the higher the value, the more it gives and the slower it comes back. Range 0 to 1.

Pressure group

Pressure Default 0

A constant push outward, in scene units per solver step; negative values pull inward. Keep it under a quarter of the mesh's edge length. Range -10 to 10. Used in Pressure mode. Animatable.

Rest volume from (check box) Default on

On, the shell keeps the volume it had at the frame beside it, times the Volume ratio. Off, there is no rest frame: the shell's volume follows the shape below the Solver on every frame, times the Volume ratio, so a body that grows or shrinks during the shot takes the shell with it. The shape below is read through a Tnpix Wrap below the Solver, on a cloth with a Solver of its own; TenPix modifiers that move nothing below the Solver, such as a Tnpix Soft Body or a Tnpix Preserve, may sit there too. Where the shell cannot follow, it keeps its first frame's volume and the status line says why. Keep volume mode only. The frame is unavailable while the box is off, on the panel and in the TenPix Graph.

Rest volume from (frame) Default frame 0

The frame whose shape counts as the rest volume. 0 means the first simulated frame, wherever the timeline starts: on a timeline from -10 the volume is held from frame -10. Any other number is that frame: until then the Volume leaves the shape alone.

Buoyancy group

Buoyancy Default off

Lifts the closed shape as if it were lighter than the air around it. Buoyancy and Lift belong to a whole object and are not used while a Channel is set. Animatable.

Lift Default 1.0

1.0 makes the shape hover, weightless. Below 1 it still falls, more slowly; above 1 it rises; 2.0 rises as hard as it would fall. Range 0 to 3. Animatable.

Status line

Reports what the modifier is doing on this object. For a region: its channel, its centre and how many points it holds, then its volume on the last simulated frame against its rest.

How a Volume reaches its size

A Volume pushes like the air in a balloon: the shell inflates until its fabric holds it. A fabric can stretch only so far, and a Volume that asks for more holds the fabric at its stretch limit: the default fabric, which stretches at most 5 percent, encloses about 1.15 times its volume there. For a shell that inflates further, give it a fabric that stretches further. A keyed Volume ratio or Pressure inflates and deflates the shell with the keys.

On a body that nothing pins, free or resting on the ground, a region changes shape without pushing the body away. On a pinned body the pins take the region's push. A region measured against a picked object moves with that object: a bone carries its region.

A region placed above a Tnpix Pin or a Tnpix Preserve on the stack lets go of the points it paints: they keep the region's volume while the rest of the pinned body stays held. Placed below the Pin, the region works on the points the Pin leaves free. A ball hung by a Pin on its pole, with a region over its top half that covers the pole, drops when the Volume is above the Pin: put the Pin above the Volume, or paint the region off the pinned points, to keep it hanging.

TIP

Keyed values drive one continuous simulation: animate Volume ratio or Pressure to inflate or deflate a shape during the shot. Keys are read on their own frame on any timeline, in any scene unit.

3.15 Tnpix Rigid

The Tnpix Rigid modifier makes parts of a garment solid: buttons, buckles, a stiffened collar, an armour plate. Each piece keeps its modelled shape, moves as one body and has weight, while the cloth around it stays cloth. Pieces keep their collisions, self collisions and pins.

Location: Modify panel ► Modifier List ► Tnpix Rigid

Interface

Tnpix Rigid rollout

Pieces group

Enabled Default on

Turns the rigid hold off without removing the modifier; the cloth simulates as if it were not there.

Pieces from Default Tnpix channel

Tnpix channel takes the pieces from a painted channel. *Mesh elements* makes every separate element of the mesh a piece, except the largest (the cloth itself) and any element with more than a quarter of the points: the quick route when the hard parts are already modelled as separate elements.

Channel / Refresh

The painted channel that marks the rigid regions. Paint 1 where the cloth is rigid and leave the rest free.

Threshold Default 0.5

A point is rigid where the channel's paint is at or above this value.

Each painted region is its own piece Default on

On, every connected painted region is its own piece: a buckle and two straps are three pieces. Off, everything painted is one piece.

Status line

The pieces the paint makes on this mesh, counted while you paint. A piece needs at least three points.

Rigidity group

Rigidity Default 1.0

How firmly each piece holds its rest shape: 1 keeps it exactly; lower values let it yield a little, like a stiff leather patch rather than a steel plate; 0 is off. The result does not change with Substeps. Animatable.

Mass x Default 1.0

The pieces' points weigh this many times the fabric around them, so a buckle swings like a buckle. 1 is the fabric's own weight. Range 0.01 to 1000.

Contact group

Bounce Default 0.5

How much of its speed a piece keeps when it hits a collider, from 0 to 1. 0 lands dead; 0.5 bounces back to about a quarter of the drop; 1 to the full height.

Friction Default 0.3

How much a piece grips what it presses on. 0 is ice; higher values stop sliding, so a ball rolls and a box tips instead of skating. It is the pieces' own friction in object and self collision; a friction override on Tnpix Collision or Tnpix Self Collision still wins. Range 0 to 10.

Damping group

Air resistance Default 0

Slows a piece's motion: 0 is off, 1 lets its speed fall to about a third each second, 5 stops it within a second. It slows a fall too. Range 0 to 100.

Spin resistance Default 0

Slows a piece's spin the same way; use it to stop a ball rolling on after it lands. Range 0 to 100.

Status line

What the Solver received for this garment when the simulation started: pieces and points.

NOTE

Bounce 0.5 and Friction 0.3 match the defaults of 3ds Max MassFX, so rigid pieces behave like the rigid bodies you already know.

3.16 Tnpix Soft Body

The Tnpix Soft Body modifier turns a closed object into soft flesh: fat, jelly, rubber or muscle that wobbles, keeps its volume, has the weight of its material and collides with cloth, colliders and the ground. With fibres it is a simple muscle that contracts and bulges.

Location: Modify panel ► Modifier List ► Tnpix Soft Body

IMPORTANT

Experimental. Tnpix Soft Body is experimental in this release, and its behaviour may change in later versions. Its muscle simulation is entry level: fibres along a line that contract when activated, tendons at both ends, and a tension point that moves the bulge along the muscle. It is not a full anatomical muscle system.

The object's own points become the corners of a volume of small tetrahedra, the **flesh**, filled inside with more corners at the Resolution's spacing. The flesh is solved inside the Solver's own steps, so the Solver's pins, stitches, colliders, ground and self collision act on it as they act on cloth, and the object's surface keeps every cloth setting that reaches it. Put Tnpix Soft Body below the Tnpix Solver, like the other modifiers that describe the object.

- **It needs a closed mesh.** An open mesh, or one with holes, gets no flesh and simulates as cloth; the status line says why.
- **Twice the steps.** A Solver that holds a closed soft body runs twice its Substeps, and the flesh takes half its passes in each step: a muscle squeezed hard jumps far less from one folded shape to another. The simulation takes longer. A soft body whose own object carries an enabled Tnpix Tear does not count; a Tear on another garment of the Solver group does not change the steps.
- **Several Soft Bodies on one object** are several materials in one flesh: each covers its own painted channel, an upper modifier over a lower one as its paint says, and points that no channel reaches take the lowest one's material.
- **Colliders.** A soft body collides with the objects of its own Tnpix Collision modifier, on a Solver that holds only soft bodies as well as beside cloth, and on a Solver shared by several objects.
- **With a Tnpix Tear.** A Tear on another garment of the Solver group leaves a soft body's flesh alone: the soft body keeps it while the garment tears. A soft body whose own mesh its Tear splits has no flesh — a Tnpix Soft Body does not tear, as a Tnpix Rigid does not — and simulates as cloth; its status line says the Tear has split this object's mesh.
- **Above a Tnpix Pin or a Tnpix Preserve.** A Soft Body with a Channel placed above a Pin or a Preserve on the stack lets go of the points its channel paints: they move with the flesh while the rest stays held. A Soft Body with no Channel lets nothing go, and a Pin above the Soft Body holds its points. With Keep volume on, a small area let go on a body whose other skin is held moves little: the flesh behind it keeps its volume and has almost nowhere to go. Let go a larger area, or turn Keep volume off, for a looser one.

- **With a Tnpix Preserve** on the same object, the surface points painted 1 in the Preserve's channel ride the animation below the Solver and the flesh between them moves: paint the parts that must follow the character and let the Soft Body's region jiggle on top of it. Placed above the Preserve, the Soft Body's channel may overlap the Preserve's: where it paints, the flesh wins.

Interface

Presets rollout

Saves every setting of the Soft Body to a preset file and loads it back, as on the materials (see Tnpix Material Standard). The list shows the Soft Body presets of the folder.

Tnpix Soft Body rollout

Soft Body group

Enabled Default on

Turns the soft body off without removing the modifier: the object simulates as cloth.

Material Default Jelly

Fat, Jelly, Muscle or Rubber sets every material and fibre setting at once; change one and the list reads Custom.

Material	Stiffness	Density	Damping	Fibres
Fat	1.5 kPa	0.92 g/cm ³	0.30	off
Jelly	5 kPa	1.02 g/cm ³	0.08	off
Muscle	10 kPa	1.06 g/cm ³	0.15	on
Rubber	500 kPa	1.10 g/cm ³	0.05	off

Stiffness Default 5 kPa

How firm it is, in kPa as for real materials: fat 1.5, jelly 5, relaxed muscle 10, rubber 500. Range 0.01 to 100,000.

Density Default 1.02 g/cm³

How heavy it is for its size; water is 1. With the Stiffness it sets the weight and the speed of the wobble at the object's real size. Range 0.01 to 20.

Damping Default 0.08

How fast its wobble dies: 0 wobbles on and on, 0.1 is jelly, 0.3 is fat, 1 settles without a wobble. Range 0 to 1.

Keep volume Default on

It keeps its volume as it wobbles: squashed in one place, it bulges next to it. Off, it squashes like a sponge.

Resolution Default 40 tets across

How many tetrahedra fit across the object's longest side. More is finer flesh and slower. Range 8 to 200. With several Soft Bodies on one object, the finest wins.

Region group

Channel / Refresh Default <none - the whole object>

The painted channel this Soft Body's material covers. *<none - the whole object>* covers the whole object. The flesh is always the whole object's; the channel says where this material is, and how fully: painted 1 is this material, 0 is the Soft Body's below it. On an object with one Soft Body the whole flesh is its material. **Refresh** reads the channel list from the stack again.

Status line

What the last simulation made: the flesh, its tetrahedra and their size, and on the last simulated frame its volume against its rest and, with fibres, the activation. Or why there is no flesh, and that the object simulates as cloth.

Soft Body Fibres rollout

Fibres Default off (on for Muscle)

Gives the soft body fibres along the fibre line: they pull when it is activated, and its volume bulges it across.

Fibre line Start / End Default none

The objects at the fibres' start and end: the fibre line runs from Start to End and moves with them, such as two bones or helpers linked to them. Neither picked, it runs along the object's own length. Pick both or neither. The soft body itself cannot be picked.

Strength Default 300 kPa

How hard the fibres pull at full activation. Living muscle is about 300 kPa. Range 0 to 100,000.

Max contraction Default 45 %

How short the fibres can get at full activation, as a share of their length. Range 0 to 90.

Tendons Default 10 % each end

How much of each end is tendon: it does not contract and is much stiffer. Range 0 to 45.

Tendon stiffness Default 30 x body

How much stiffer the tendons are than the body between them. Range 1 to 1000.

Activation Default 0

How hard the fibres work, from 0 to 1. Animate it to flex the muscle. Animatable.

Auto tension / Tone Default on, 5 %

The fibres tense by themselves as Start and End come closer, and keep a little tone so the body stays taut. Tone is how much tension it keeps, from 0 to 50 percent.

Tension point Default 0.5 of length

Where along the fibre line it tenses most, and bulges: 0 at Start, 0.5 in the middle, 1 at End. Animate it to move the bulge along the muscle. Animatable.

Tension spread Default 0.2 of length

How wide the tense area is, as a share of the fibre line. 0 tenses the whole body evenly. Range 0 to 1.

Tension Point sub-object level

Open the modifier's **Tension Point** level in the stack to see the fibre line and the yellow marker on it. With Move on, drag the marker along the line to set the Tension point.

Limits

- A soft body squeezed hard against itself with Self Collision on can jump and leave a few tetrahedra inside out.
- A soft body that only lies on a pinned cloth can sink through it. Sew it to the cloth with a Tnpix Stitch instead.
- A layer that slides at Friction 0 can buzz; keep a little friction (0.3 is the Stitch's default).

3.17 Tnpix Cache

The Tnpix Cache modifier saves the finished simulation to a file and plays it back. Once a shot is approved, the cache is what you render from: the cloth is read from disk instead of simulated, so it is fast, identical every time and unaffected by changes further down the stack. The cache can also be retimed and posterized.

Location: Modify panel ► Modifier List ► Tnpix Cache (above the Solver)

To save a simulation and play it from the cache:

1. Add Tnpix Cache above the Tnpix Solver.
2. Click ... and choose a file name. Choose *Tnpix cache (*.tnc)* for TenPix's own format or *Alembic (*.abc)* for use in another application.
3. Leave **Specific range** off to save the whole animation range, or turn it on and set **Start** and **End**.
4. Click **Save cache**. The recording starts at the first frame of the range wherever the time slider is. Frames already simulated are saved as they are; missing frames are simulated first.
5. Make sure **Play from cache** is on. The cloth now plays from the file.

Interface

Tnpix Cache rollout

Cache file group

Path / ...

The file this garment plays from and saves to. The file type you choose in the file dialog, *.tnc* or *.abc*, is the format **Save cache** writes. The line below says whether the file was found. Each garment's file is listed in *File ► Reference ► Asset Tracking*, in the Resource Collector and in a farm's asset gathering (*Scene_<garment>.tnc* when one Cache serves several garments). Set Path in Asset Tracking moves the Cache to the folder given, and every garment's file is read from there; a bare or relative name is found the way 3ds Max finds any input file. A Cache that does not play is never reported as a missing file.

Save cache

Writes the frame range to the file, from its first frame, wherever the time slider is; the slider is put back afterwards. Frames already simulated are saved as they are; missing frames are simulated first. If the simulation in memory began on another frame, the Save starts the simulation again from the first frame. A progress bar shows the frames recorded; **Esc** or **Cancel** stops it, and the frames written so far are kept. Playing the timeline never records. In the demo, Save cache writes *.tnc* only.

Load

Opens the cache file and starts playing from it. A *.tnc* file whose recording was cut short, for example a farm task that was stopped, plays every frame it finished, and the status says that the recording stopped early and which frames were kept.

Clear

Stops using the file. Nothing is deleted from disk.

Write velocities (Alembic only) Default on

Adds per-point velocities to an Alembic file, so a renderer can compute motion blur from a single sample.

Frame range group

Specific range Default off

Off, the scene's whole animation range is saved. On, only the frames from Start to End.

Start Default 0 / End Default 100

The first and last frames to save when Specific range is on.

Playback group

Play from cache Default off

Serves the mesh from the file. While it is on, the Solver below is not evaluated and its stored frames are released. A successful save turns it on.

Frame offset Default 0

Shifts the cached frames on the timeline, in frames, for example to reuse a recorded action later in the shot.

Retime Default 1.0

Playback speed: 1.0 plays as cached, 0.5 at half speed, 2.0 at double speed. Between cached frames the pose is interpolated. Animatable: key it for a speed ramp or a freeze (0). Every moment plays at the speed keyed there, so a key never makes the cloth jump. Range 0 to 1000.

Posterize step Default 0

Every this many frames the pose is stamped and held: the stepped look of animation on twos or threes, without simulating again. 0 is off. Animatable.

Hold Default 0

How many frames each stamped pose is held; the rest of the step plays as animated. Hold equal to Step is fully stepped. Animatable.

Outside the recorded range the cache holds its first or last frame.

Rendering from the cache

- **Motion blur.** Turn on the renderer's motion blur; the Tnpix Cache serves the times between frames. Where the vertex count changes between two frames, as on a torn cloth or on the tubes of a threads object, the two frames are matched point by point, so the cloth and the threads blur across the cut too. Write velocities adds velocities to an Alembic file for renderers that blur from a single sample.
- **Saving on a render farm.** The garments of a shared Solver take their places in the Solver group, and so their default self-collision layers, in the order 3ds Max first evaluates them; on your workstation the viewport does that. On a farm machine, where nothing has drawn the scene, a Save that finds its Solver group not yet formed first evaluates the scene once at its first frame, as a viewport would, so the Solver group is formed as on your workstation.

- **Farm progress.** With the Deadline scripts, every frame a Save records is shown as the task's progress in the Deadline Monitor. See *Rendering on a Farm* in Chapter 5.

TIP

The Cache Manager on the TenPix toolbar loads, saves and clears the caches of many garments at once. A garment on a shared Solver is saved together with its whole Solver group. See Chapter 4.

3.18 Tnpix Post Process

The Tnpix Post Process modifier tidies the simulated surface without changing the simulation: a Delta Mush smooths the cloth and puts the modelled detail back, and a detangle pushes crossing cloth apart. It goes above the Solver (and above the Cache when there is one).

Location: Modify panel ► Modifier List ► Tnpix Post Process

Interface

Tnpix Post Process rollout

Delta Mush group

Delta mush Default on

Smooths the simulated surface and puts the modelled detail back through the rest deltas.

Iterations Default 10

Smoothing rounds per frame. More rounds smooth larger features; the modelled detail comes back through the deltas either way. Range 0 to 500. Animatable.

Strength Default 1.0

0 leaves the simulation as it is, 1 applies the full mush; values in between blend. Animatable.

Pin boundary points Default on

Open edges keep the simulated position.

Weight from Default None (whole cloth) / **Invert** / **Channel**

Where the mush may work: the whole cloth, the vertex colour (red), or a Tnpix channel chosen by name. **Invert** flips the weight.

Advanced

Method Default Shrink-free (Taubin)

Uniform (Max) is 3ds Max's own Delta Mush rule exactly: a plain average every round, with the tangential, crease and limit settings unavailable. *Cotangent* stops the drift on uneven triangles. *Shrink-free (Taubin)* keeps the size and the broad shape over any number of rounds.

Step Default 0.5

How far each round moves a point towards its neighbours. Range 0.01 to 1. Animatable.

Tangential only Default off

Relaxes along the surface only: the spacing evens out while the silhouette and every bump stay, so a pinch along the normal is not cleaned.

Keep creases Default 60°

An edge folded sharper than this angle is not smoothed across, so a hem or a pleat stays crisp. The angle is read on the rest pose, once for each rest: the rest and every frame are smoothed by the same rule, so a fold that only appears in the pose is smoothed like any other, and the mesh holds together at any number of iterations. 0 is off. Animatable.

Inward limit Default 0 / Outward Default 1.0

How much of the move along the normal into the cloth, and out of it, is allowed. An inward limit of 0 never moves a point towards the body. Animatable.

Detail Default 1.0

A multiplier on the rest deltas: 1 puts the modelled detail back exactly, 0 leaves the smoothed base, above 1 exaggerates it. Range 0 to 5. Animatable.

Smooth over time Default off / Window Default 2 / Filter Default Gaussian

Averages each point with itself in the neighbouring frames, **Window** frames on each side. It needs frames on both sides, from a Tnpix Cache file or the Solver's memory below. *Gaussian* softens over the window; *Median* removes a single-frame hop without softening the motion.

Rest from Default Range start / frame / Capture rest

Where the rest pose is taken: the input at the start of the animation range, or at the frame you type (*This frame*). **Capture rest** takes the rest pose now by evaluating the stack at the rest frame; it is needed only when nothing below (a Cache or the Solver) can provide it. The Rest line says where the rest came from. The rest is saved with the scene and read back whatever frame the file opens on, and the Rest line then says *read back from the scene file*; a rest that came from a Tnpix Cache or the Solver's memory is asked of them again first, and the file's copy is used when they cannot hand it over. A rest taken by Capture rest is kept until Capture rest is pressed again, whatever the timeline does and whatever the rest frame is set to (the Rest line says when the rest frame no longer matches it); the press marks the scene as changed, so 3ds Max asks to save it. A copy of the object keeps the rest of the one it was copied from.

Detangle group

Detangle Default on

After the mush: cloth that went through other cloth is brought back to its own side, then points closer than the thickness are pushed apart. No step leaves a new crossing.

Passes Default 3

Push-apart rounds per frame, from 1 to 50, after the cloth that went through is brought back. The status line says how many crossings were undone and how many are left, how many pairs were pushed and how many are still close. Animatable.

Thickness Default From Self Collision

The separation the detangle restores: the garment's own Self Collision thickness, or *This value*, typed in scene units (default 0.15).

Self collisions Default on

Cloth against itself: what went through is brought back, then layers closer than the thickness are pushed apart.

Body colliders Default off

Cloth against the colliders listed in the Tnpix Collision below the Post Process, each at its own row's thickness: points inside a collider, or closer than its thickness, are moved out, before and after the cloth-against-cloth steps. An open collider keeps the side its **Open mesh** setting gives it. With no Tnpix Collision below, the status line says so.

Weight from / Channel

Which points the detangle may move: the whole cloth, the vertex colour, or a Tnpix channel. Weight 0 is held in place.

NOTE

Where two open edges cross each other, like two hems crossing as scissors do, no closed piece of cloth went through and nothing is moved: the status line counts those crossings as left where two open edges cross.

This frame group

The order of work (Delta mush, then Detangle) and what each did on the current frame.

NOTE

The rest pose follows the mesh. When the mesh below changes its topology, for example a TurboSmooth added below or a segment count edited, a rest taken from the rest frame is taken again by the same rules, and the Rest line says so. A rest taken by Capture rest is held instead, not applied: the Post smooths without it, as with no rest, the Rest line says so, and the rest applies again when the mesh it was taken on comes back; press Capture rest to take the new mesh's. A tear only adds vertices, so the rest is kept through a tear and the torn edges are smoothed.

NOTE

The file grows by 12 bytes per point of each object with a Post Process (about 1.2 MB for 100,000 points).

IMPORTANT

Post Process is a finishing tool, not a fix for a wrong simulation. If the cloth passes through the body, raise the collider's Thickness and the Solver's Substeps first: smoothing a wrong surface gives a smooth wrong surface.

3.19 Tnpix Threads

The Tnpix Threads modifier adds the threads of the weave. Where the cloth tears, warp and weft threads stick out of the crack and some still span it; along painted hems a fringe can hang. Every thread is a thin tube, built into the cloth mesh or into an object of its own, and in Dynamic each one hangs, swings, collides and snaps by itself after every cloth frame.

Location: Modify panel ► Modifier List ► Tnpix Threads (directly above the Tnpix Solver)

Tnpix Threads reads the cloth from the Tnpix Solver below it, frame by frame, and needs one on the same stack. It never changes the simulation: the cloth is exactly the same with the threads on or off. Threads at a tear need a Tnpix Tear on the cloth; a fringe along painted edges needs none. On a shared Solver each cloth grows its own threads from its own part of the Solver group.

To add threads to a tearing cloth:

1. Set up a cloth that tears (see *Tearing* in Chapter 5).
2. Add Tnpix Threads directly above the Tnpix Solver. **Where it tears** is on.
3. Set **Warp every** and **Weft every** to the spacing of the threads and **Thread length** to how far a loose thread reaches, in scene units.

4. Play from the first frame. The threads appear on the frame a seam tears and grow as the crack opens.
5. In the Tear and Motion rollout, choose the **Material** of the thread and **Dynamic** or **Follow the cloth**.
6. To give the tubes their own material, or to keep them out of the modifiers above, click **Make the threads object** in the Output rollout.

To fringe a hem:

1. Paint the hem at 0.5 or more in a Tnpix Channel.
2. Add Tnpix Threads, turn on **Along painted edges** and choose the channel. With *<none - every open border>*, every open border of the cloth is fringed.
3. Turn off **Where it tears** if the cloth should have only the fringe.

Interface

A new Tnpix Threads takes its lengths in the scene's unit; the defaults below show the inch values.

Tnpix Threads rollout

Enabled Default on

Off, the cloth leaves this modifier exactly as it came in.

Where the threads grow group

Where it tears Default on

Threads are born on the frame a seam tears, at the seams the Solver reports torn. Before the first tear there is nothing to see. Needs a Tnpix Tear on the cloth.

Along painted edges Default off

A fringe on the cloth's open borders inside the channel below: hems, holes and garment edges, never a crack. The fringe is there at full length from the first frame.

Channel / Refresh

The channel that marks the borders to fringe: an edge whose two points are both painted at 0.5 or more. *<none - every open border>* fringes every open border. Available while Along painted edges is on. A channel that is no longer on the stack is listed as *[MISSING from this stack]* and no fringe is made.

The weave group

Grain from Default Auto: UVs, else combed

Which way the threads run. *Auto*: the UVs of map channel 1 on every face whose UVs are sound; a face with no UVs or broken ones takes the direction of the sound faces around it, or the comb where there are none. *UVs only*: each pattern piece's own grain from map channel 1; a face without UVs grows no threads. *Combed only*: one direction laid over the whole garment and smoothed; it needs no UVs and never jumps at a seam.

Comb along Default Up (world Z)

The axis the combed grain follows: *Up (world Z)*, *World X* or *World Y*. Up suits a garment on a standing figure. Unavailable with UVs only.

Grain angle Default 0

Turns the grain around each face, in degrees, from -180 to 180. 45 is a bias cut.

Warp every / Weft every Default 0.25 in

The spacing between the threads that run along the grain (warp) and across it (weft). A smaller spacing makes more threads; see Thread cap.

Thread length Default 0.75 in

How far a loose thread reaches out of the cloth.

Random length Default 40%

Each thread's length varies by up to this share, longer or shorter. Range 0 to 100.

Strays Default 3% / **x length** Default 6

This share of the threads is much longer than the rest; the second value says how many times longer, from 1 to 100.

Seed Default 1

Another arrangement of the same settings: which threads are long, clumped or holding, and which short edges carry a thread.

The look group

Clump Default 0.3

How strongly neighbouring threads bunch into strands: 0 keeps every thread apart, 1 makes a strand's tips meet.

Clump size Default 6

How many threads make one strand, from 2 to 100.

Frizz Default 0.2

How far a thread wanders off straight, as a share of its length, from 0 to 2. It rides on top of the motion, so a swinging thread keeps its frizz.

Frizz frequency Default 3

How many kinks a thread has along its length, from 0 to 50.

Tear and Motion rollout

At a tear group

Threads that still hold across the crack Default on

Some threads span the crack from lip to lip. Off, every torn seam leaves loose ends only.

Warp holds / Weft holds Default 12%

The share of the crack's warp or weft threads that still span it. One family at 0 gives the look of ripped denim. Unavailable while holding is off.

A holding thread snaps at Default 3 x length

As the lips part, a taut holding thread first pulls more length out of the weave, up to this many times its own length; past that it stretches, and it snaps at **Breaks at**. Range 1 to 100.

Loose ends on both lips Default on

A torn seam without a holding thread leaves a loose thread on each side.

Lean toward the cut Default 0

0: every thread sticks out along its own grain, as torn cloth does. 1: every thread points straight out of the cut, like a brushed trim. In between, a blend.

Motion group

Dynamic / Follow the cloth Default Dynamic

Dynamic: each thread is simulated after each cloth frame; it hangs by its own weight, swings, collides and slides. *Follow the cloth*: each frame every thread takes the shape it would rest in on the cloth there, with the same material, without swinging. Either way the cloth itself is untouched.

Material Default Cotton

Starting values for Bending length, Damping, Friction and Breaks at, from five kinds of thread (see the table below). Change any of the four and the list reads *Custom*; choosing Custom changes nothing.

Bending length Default 0.35 in

How stiff the thread is, as a length: a thread shorter than this stands out of the cloth, a longer one droops; a thread twice this long droops about 41 degrees. So long strays hang while short fringe stands, from one number.

Damping Default 0.08

The share of a thread's swing lost each frame, at 30 frames per second (the loss per second is kept at other frame rates and at any substep count). Range 0 to 1. Dynamic only.

Friction Default 0.4

How much a thread grips what it lies on: its own cloth, a collider, another object. 0 slides off; 1 stays where it lands. Range 0 to 2. Dynamic only.

Breaks at Default 7% stretch

How far a thread stretches before it snaps, as a share of its length. A holding thread pulled taut by the widening crack gives this much past its Snaps at length, then breaks, and its halves whip back to their lips. A loose thread caught between two surfaces as the cloth moves away gives this much, then its outer piece breaks off, falls free and lands. Range 0 to 1000.

Points per thread Default 13

How many simulated points carry each thread, from 3 to 64. More points bend more smoothly and cost more.

Forces from this cloth's Tnpix Forces Default on

The wind and other forces on the cloth act on its threads too, where each thread grows. Gravity is always the Solver's. Dynamic only.

Collide with: this cloth / its colliders / the other objects in its Solver Default on

The threads stay off the cloth they grow from, except right around a thread's own root, which it grows out of; off the objects in the cloth's Tnpix Collision list, with their thickness; and off every other object simulated in the same Solver, where each stands within the frame. With the Solver's **Unlimited ground (Z = 0)** on, the threads land on that floor too, with their own Friction. Half the Thread thickness is kept off every surface, and no thread passes through its own cloth. Threads do not collide with each other.

Material	Bending length	Damping	Friction	Breaks at
Cotton	0.35 in	0.08	0.40	7%
Wool	0.25 in	0.15	0.60	30%
Silk	0.12 in	0.05	0.20	20%
Linen	0.60 in	0.10	0.45	3%
Synthetic	1.00 in	0.04	0.25	25%

The Bending length of a material is converted to the scene's unit when you choose it. The values are starting points taken from textile references.

Output rollout

Tubes go to Default this cloth

this cloth: the tubes are part of the cloth mesh and wear its material. *their own object*: the cloth leaves this modifier exactly as the Solver made it, so a Tnpix Wrap, or any modifier above, sees the cloth alone; the tubes appear in the threads object.

Make the threads object / Select it

Make the threads object creates a Tnpix Threads Object named after the cloth, for example *TornSheet_Threads*: a child of the cloth with its move, rotate and scale locked, the cloth's material and wire colour, showing this modifier's tubes. It also sets Tubes go to *their own object*; one undo step. **Select it** selects that object. Each Tnpix Threads on a cloth makes its own object.

Thread thickness Default 0.02 in

Each thread's thickness. The tubes are built at it and taper to half at the tip, and collision keeps half of it off every surface.

Tube sides Default 3

How many sides each tube has, from 3 to 16.

Warp material ID / Weft material ID Default 0

The material ID the warp or weft tubes take. 0 is the ID of the face the thread grows from.

Texture Default along the thread

along the thread: each tube has its own UVs in map channel 1, around it and from root to tip, so a thread texture runs along every thread. *from its root*: each thread takes the cloth's texture where it grows; every map channel the cloth carries, its UVs and its vertex colours, is read at the thread's root and given to the whole thread, so a textured cloth sends each thread out in the colour of its spot. A cloth without UVs keeps the threads' own, and the status says so. In both, the third coordinate (W) of map channel 1 numbers the thread.

Thread cap Default 500,000

The most threads this Tnpix Threads makes, from 1 to 2,000,000. When the cracks would need more, every crack gets the same thinner density instead of the first cracks taking them all: none is left bare, and the same threads are made on every play. While you play forward the density follows what has torn so far (a first play can make up to four times the cap); going back a frame, or starting a render, evens it out over every crack. Snapped halves and broken-off pieces do not use it up. The status line says when it thins.

Viewport % Default 10

The share of the threads the viewport shows, from 0.1 to 100. Always the same threads, spread evenly over every crack and edge, so the look does not flicker from frame to frame. Every thread is still simulated, and a render (Render, Render Setup, a batch or network render) makes all of them, whatever this says. 100 shows all of them in the viewport too.

Status

What the threads did on this frame, one line each: the cracks, threads and holding threads; the painted edges; where the grain came from (UVs, filled or combed faces); the motion and the tube faces of every thread; the cap and the viewport share while they thin; and, with their own object, where the tubes are.

The threads object

A **Tnpix Threads Object** shows the tubes of a cloth's Tnpix Threads when Tubes go to is set to *their own object*. **Make the threads object** creates and connects one; you can also create one from *Create panel* ▶ *Geometry* ▶ *Tnpix* ▶ *Tnpix Threads Object* and pick the cloth. The object draws the tubes where they are in the world, wherever its own node stands, so a separate material, a separate render setting or a Tnpix Cache can be given to the threads alone.

Tnpix Threads Object rollout

Threads from

The cloth whose Tnpix Threads this object shows. Pick another cloth to show its threads instead; only an object that carries a Tnpix Threads can be picked.

Status

Which cloth and Threads it shows and how many tubes and faces it has on this frame, or why it shows nothing: no cloth picked, the cloth carries no Tnpix Threads (or no longer carries the one this object was made from), or that Threads puts its tubes in the cloth.

If the threads object is deleted, **Make the threads object** becomes available again and the status of Tnpix Threads says that no object shows the tubes: until you make another, they appear nowhere.

Working with threads

- **What re-runs.** A change to how the threads grow or move, to Points per thread, Thread thickness, the cap or the channel, or a new simulation, runs the threads again from the first frame. Clump, Frizz, Tube sides, the material IDs, Tubes go to, Texture and Viewport % only redraw.
- **Memory and cost.** Every frame's threads are kept in memory. At the defaults each thread is a tube of 144 triangles; dense spacing on a long tear makes millions, which is what Viewport % and Thread cap are for.
- **A Tnpix Cache below.** The threads read the Solver's frames, and a cloth that plays from a Tnpix Cache file has none: no threads are made. To keep the threads of a saved simulation, cache the threads object itself: add a Tnpix Cache to it and save, as for any mesh.
- **Tnpix Wrap.** With Tubes go to *this cloth*, a Tnpix Wrap that uses the cloth as a proxy reads the cloth without its tubes. Put the threads in their own object when other modifiers above should work on the cloth alone.
- **Motion blur.** Between two frames, a threads mesh that is alive in both moves from one to the other; a thread born, snapped or broken in between changes at the frame. A threads object played from a Tnpix Cache blurs the same way.
- **After the last simulated frame** the threads of the last frame are shown.

3.20 Tnpix Wrap

The Tnpix Wrap modifier makes a high-resolution mesh follow one or more low-resolution proxies. Simulate a light proxy, then let Wrap carry the detailed garment along with it: every point of the high-resolution mesh remembers its place on the nearest proxy and follows it, including across tears, and a shell's cuts are closed so a tear shows the cloth's edge.

Location: Select the high-resolution mesh ▶ Modify panel ▶ Modifier List ▶ Tnpix Wrap

To drive a detailed garment with a simulated proxy:

1. Simulate a low-resolution version of the garment (the proxy), and save it to a Tnpix Cache for speed.
2. Place the high-resolution garment so that it lines up with the proxy at one frame, usually the first.
3. Select the high-resolution garment and add Tnpix Wrap.
4. Click **Add** and pick the proxy. Add more proxies if the garment is made of several.
5. Set **Bind at** to the frame where the meshes line up and click **Bind**.
6. Play. The detailed garment follows the proxy.

Interface

Tnpix Wrap rollout

Wrap group

Enabled Default on

Off, this mesh is left as it comes up the stack.

Proxies / Add / Remove

The low-resolution meshes that drive this one: a Tnpix cloth, a cache, or any deforming mesh whose faces stay the same. Each point follows the closest proxy. **Add** picks a proxy in the viewport; **Remove** takes the selected one off the list, and its points bind to the remaining proxies at the next Bind.

Bind at Default frame 0 / **Bind**

The frame where this mesh and the proxies line up; every point remembers its place on a proxy from that frame. **Bind** binds again; use it after editing this mesh or a proxy's rest shape.

Smoothing Default 1.0

How far around its face a point blends the neighbouring proxy faces, in proxy edge lengths, from 0 to 4. 0 rides one face and is stiff; 1 to 2 smooths over the proxy's facets. It never blends across a tear.

Falloff Default 1.0

How fast a neighbouring face's influence fades with distance. 1 fades evenly to the edge of the Smoothing reach; higher values hold tighter to the nearest face. Range 0.1 to 10.

Offset Default 1.0

How much of its height above the proxy a point keeps: 1 all of it, 0 pressed onto the proxy surface. Animatable.

Strength group

Strength Default 1.0

How far each point moves from where it came up the stack to where the wrap puts it: 1 fully, 0 not at all. Animatable.

From Default Everywhere

Where the per-point strength comes from: one value everywhere, the vertex colour (red), or a Tnpix channel painted below this modifier. In a channel, white is full strength and black is not moved.

Distance group

Only within Default off, 1.0

Points farther than this from every proxy at the Bind frame are left alone. The distance is in scene units, measured at the Bind frame; the status line shows the farthest bound point.

Tearing group

Cut along proxy tears Default on

When a proxy tears, this mesh is cut along its own edges nearest the tear. Off, it stays whole and stretches across the gap.

Close the cuts Default on

Where this mesh is a shell, two layers with the cloth's thickness between them, each cut along a proxy tear is closed: a strip of faces joins a layer's cut edge to its twin on the other layer, so the tear shows the cloth's edge instead of the hollow between the layers. Both layers are cut alike, and the inner layer rides the same torn piece as the outer one. A mesh of one layer has nothing to join and stays as it is. Works with Cut along proxy tears on.

Rim material ID Default 0

The material ID of the faces that close the cuts. 0 takes the ID of the outer face beside each one. The closing faces also take that face's smoothing group and the UVs of the points they join.

Remember proxies (frames) Default on

Keeps each proxy's shape per frame in memory the first time the frame is seen, so playing or scrubbing it again costs only the wrap. The memory has no limit: it keeps every frame it has seen until the scene closes, about 12 bytes per proxy point per frame (a 400,000-point proxy uses 4.8 MB a frame, 1.7 GB over 360 frames) - allow for it on a render node that renders a long sequence in one session. The memory is cleared when a proxy or its animation changes, or when you clear the check box.

Fill now

Evaluates every frame of the animation range into the proxy memory now, so the first play is already from memory. **Esc** stops it; what was filled stays. A proxy that is a live Tnpix simulation is refused: save it to a Tnpix Cache first.

Status line

What is bound and how far the farthest bound point is; after a tear, how many proxy edges tore, how many points of this mesh were split, and how many faces close the cuts, or that the mesh is one layer and there is nothing to close.

A shell is recognised on its own at the Bind: Close the cuts looks for faces that have a twin facing the other way one thickness behind them, as a Shell modifier makes. Borders that were open at rest stay open, and so does an edge whose twin did not open; on a rim with several segments, small holes beside the strip are filled.

- **Motion blur.** Between two frames the Wrap keeps one cut, the one its proxies' tears give, so a torn mesh has the same points through the shutter and blurs.
- **A proxy with thread tubes.** When a proxy carries Tnpix Threads whose tubes go to the cloth, the Wrap reads the cloth without the tubes and follows it as usual.

The TenPix Toolbar

The TenPix toolbar gathers seven tools that build, check and manage cloth and soft body set-ups. Each tool opens a small window, works on ordinary TenPix modifiers and leaves nothing behind that you could not have made by hand.

The toolbar is a docking toolbar named **TenPix Cloth**. Its seven buttons, and an action that shows or hides the toolbar, are also 3ds Max actions in the **TenPix Cloth** category, so you can put them on a hotkey, a menu or a quad menu.

Tool	What it does
Quick Cloth	Makes the selected meshes simulation-ready cloth in one click.
Cache Manager	Adds, loads, saves and clears the caches of many garments at once.
Quality	Sets the Solver quality of one cloth or many, by hand or with a quality step.
Cloth Doctor	Scans the scene for set-ups that will not do what you expect, and fixes the safe ones.
Tearing Sample	Builds a ready-made tearing scene: a grid pulled apart by two boxes along a painted band.
Forces	Lists the Tnpix Forces modifiers in the scene and the dials of their space warps.
Quick Soft Body	Makes the selected closed meshes simulation-ready muscles or fats in one click.

4.1 Quick Cloth

Turns the selected meshes into cloth with your preferred settings. It adds the modifiers in the right order: Tnpix Garment at the bottom and Tnpix Solver on top.

Triangle size Default 2.0

The Edge length of the Tnpix Garment that rebuilds the mesh.

Rebuild the mesh (Tnpix Garment) Default on

Adds Tnpix Garment. Turn it off for a mesh that is already clean, even triangles.

Quality Default Preview

Draft (Substeps 2, Iterations 2), Preview (Substeps 4, Iterations 3) or Final (Substeps 9, Iterations 4), in the numbers the Solver panel shows.

Smoothing iterations Default 5

The Solver's Smoothing iterations. 0 is off; 2 removes most of the zigzag of a dense mesh.

Add gravity Default on

Adds Tnpix Gravity.

Add Standard material, hold ceiling on body Default on

Adds Tnpix Material Standard with **limit where it touches the body** turned on.

Pick collider (optional) / Clear collider

A body to add to a Tnpix Collision list for the new cloth.

Make Selected Cloth

Builds the stack on every selected mesh.

4.2 Cache Manager

Every garment's cache in one window: see which garments have a cache, and load, save or clear them one by one or many at once.

Selected objects / All cloth in the scene

The list follows your selection while the window is open, or shows every object that has a Tnpix Solver or a Tnpix Cache.

Add / Load / Save / Clear / Select

Act on the highlighted rows (**Ctrl** or **Shift** to pick several). **Add** gives each highlighted garment its own Tnpix Cache, with no file and nothing recorded - the stacks made ready. **Load** plays each garment from its file; a row without a file asks for one, and several rows without a file ask for one folder in which each garment takes the file with its own name. **Save** records each garment over the range, into its own file or into the folder as *<object name>.tnc* or *.abc*, and then plays from it. A garment on a shared Solver is saved with its whole Solver group by one press. **Clear** stops playing and forgets the file; nothing is deleted. **Select** selects the objects.

Each garment's own file / This folder, Folder...

Where Save writes.

.tnc (TenPix) / .abc (Alembic), Velocities (.abc)

The format of new files, and per-point velocities for motion blur in Alembic files.

Specific range, Start, End

Off saves the whole timeline; on saves the frames from Start to End.

4.3 Quality

Lists every Tnpix Solver in the scene and writes the quality settings into the ones you pick. A Solver shared by several objects is one row, because its settings are one set for all of them.

List / All / From selection

Pick one or several Solvers in the list, all of them, or the ones on the selected objects.

Draft / Normal / High / Ultra

Fill the dials with a quality step (see *Simulation Quality* in Chapter 2). Normal is the default of a new Solver.

Substeps, Iterations, Contact passes, Stretch quality, Smoothing iterations

The values to apply, in the numbers the Solver panel shows.

Contact passes rise with Iterations / Stretch quality Default on

Taking Iterations or Stretch quality to 4 or more lifts Contact passes to at least 4; to 8 or more, to at least 7. It never lowers Contact passes.

Apply to the picked cloths

Writes the values into the picked Solvers. One Undo reverts the apply.

4.4 Cloth Doctor

A cloth set-up can be wrong without anything going red: the scene opens, the modifiers are there, nothing reports an error, and the cloth floats, falls through the body or ignores the value you just changed. Cloth Doctor looks for those silent set-ups and fixes the safe ones on request. Nothing changes until you tick a finding and click Fix.

Only the selected objects / Scan the scene

Scans the whole scene or the selection and lists what it finds.

Fix the ticked findings

Fixes the findings you ticked. Anything not ticked is left alone.

Select the objects in the ticked findings

Selects the objects concerned, so you can inspect them.

It looks for:

- a garment with no Tnpix Gravity, which will hang in the air;
- Tnpix Garment above the Solver, where it rebuilds the mesh after the simulation has read it;
- a Tnpix Collision modifier with no collider in its list;
- a substeps value below the product's minimum, which the Solver panel cannot display;
- a Tnpix Self Collision modifier that is present but switched off;
- contact passes below the quality steps' rule (4 for Iterations or Stretch quality of 4 or more, 7 for 8 or more);
- a Tnpix Cache still playing from disk, which makes every change below it do nothing;
- garments on separate Solvers, which will never collide with each other.

4.5 Tearing Sample

Builds a complete tearing scene from ordinary objects and modifiers: a grid whose left and right edges are pinned to two boxes, a tear band painted down its middle, and the boxes keyed to move apart. Click Play and the cloth rips along the band.

Width / Height / Segments across / Segments down Default 100 / 60 / 60 / 36

The grid's size in scene units and its segments. More segments give finer tear edges and a slower solve.

They pull apart by Default 40 / **From frame** Default 10 / **To frame** Default 60

How far apart the two boxes move in total (each moves half), and when.

Band width (down the middle) Default 4

How wide the painted tear band is. The cloth can rip only inside it.

Tear threshold Default 20

How strong a seam is: lower tears sooner and more. On the default grid, 10 rips under the grid's own weight before the boxes move; 20 rips during the pull.

Build the sample

Creates the grid *TearSample* with Tnpix Channel (maps *pinL*, *pinR* and *tear*), two Tnpix Pin modifiers following *BoxLeft* and *BoxRight*, Tnpix Tear by Map on the *tear* map, Tnpix Gravity and Tnpix Solver. Every part is yours to change afterwards.

4.6 Forces

TenPix has no wind of its own: Tnpix Forces holds ordinary 3ds Max space warps. This window lists every Tnpix Forces modifier in the scene (one shared by several cloths is one row) with its Enabled box and Strength, the warps each one holds, and the dials of the picked warp: the same numbers its own panel shows.

Enabled / Strength (x every warp)

The modifier's own switch and its strength, which multiplies every warp in its list.

Its warps / Acting (clear = muted)

The warps in the picked modifier's list; clear Acting to mute one.

Warp dials

The picked warp's shape and dials: Wind (strength, decay, turbulence, frequency, scale, planar or spherical), Gravity (strength, decay, planar or spherical), Drag (linear, spherical or cylindrical, with the dampings of that shape and time on and off), Vortex (orbital speed, radial pull, axial drop, taper length, taper curve, direction), Motor (torque, time on and off), Push (force, time on and off) and PBomb (strength, range, chaos). Any other warp can be muted here; its dials are on its own panel. An animated dial is changed at the current frame, as on its own panel.

Select the warp / Select the cloth

Selects the picked warp, or the cloth objects that carry the picked modifier.

4.7 Quick Soft Body

Quick Cloth's twin for soft bodies, which are experimental (see Tnpix Soft Body in the reference): select one or more closed meshes and click one button. It paints for you what a soft body needs held or sewn, and adds the modifiers in the right order.

Pick start bone / Pick end bone Optional

The bones, or helpers linked to them, that the muscle's two ends follow. Pick both or neither; right-click a button to clear it.

Held ends (% of length) Default 5

How much of the muscle's length, at each end, is held: the tip of each tendon.

Auto tension (the bones drive it) Default on

The Soft Body's Auto tension: the fibres tense by themselves as the bones close in. Off, animate Activation on the Soft Body panel.

Make Selected Muscle

Gives each selected closed mesh, from the bottom up: Tnpix Channel with two maps painted for you, *start* and *end* (the points within the Held ends share of its length at each end); Tnpix Soft Body, Material Muscle, its fibre line from the start bone to the end bone, or along the mesh's own length when no bone is picked; a Tnpix Pin on *start* following the start bone and one on *end* following the end bone (with no bones, both hold their points where they are); Tnpix Gravity; Tnpix Solver.

Pick muscle to slide on Optional

A muscle that already has its Tnpix Solver, for example one made with Make Selected Muscle.

Friction Default 0.3

How hard the fat slides over the muscle: 0 slides freely, 1 does not slide. A layer at 0 can buzz.

Make Selected Fat

Gives each selected closed mesh a Tnpix Soft Body, Material Fat. With a muscle picked, the side of the fat that faces the muscle is painted for you into a map, *on_muscle*, and sewn to the muscle by a Tnpix Stitch with Slide along the surface on, and the fat shares the muscle's Tnpix Solver and Tnpix Gravity, so the two simulate together. With no muscle it gets Tnpix Gravity and a Solver of its own: a loose soft object.

Resolution (tets across) / **Keep volume**

The Soft Body's own Resolution and Keep volume.

Add gravity

Adds Tnpix Gravity; a fat on a muscle shares the muscle's.

Pick collider (optional) / Clear

An object to add to a Tnpix Collision list on every object a click makes.

The status line under the buttons says what each click made and how many points each painted map holds. A mesh that is not closed is skipped, with its open edges counted, and so is a mesh that already has a Tnpix Solver or a Tnpix Soft Body. One Undo takes a whole click back. A new Solver has no ground: pick a collider, or turn on the Solver's Unlimited ground, for the soft body to land on.

Workflows

The procedures in this chapter combine the modifiers for common production tasks. Each assumes the basic set-up from *Quick Start*: a Tnpix Garment at the bottom, Gravity, Collision, a material and the Solver on top.

5.1 Dressing a Character

To simulate a garment on an animated character:

1. Model or place the garment clear of the body at the first frame of the animation range. Cloth that starts inside a collider is thrown out on the first frames.
2. Add Tnpix Garment and set **Edge length** to the density the shot needs.
3. Add Tnpix Collision and pick the character's body. Leave the Solver's **Collision system** on Surface (True Geometry), which follows small features such as fingers and straps.
4. Set the collider row's **Thickness**. If the cloth pokes through, raise the Thickness first, then the Solver's Substeps.
5. If the garment should stay put at the waist or shoulders, paint that region in a Tnpix Channel and add a Tnpix Pin that follows the body, or rely on friction and grip.
6. Add a material, the Solver on top, and play from the first frame.

To make cuffs, a collar or a sleeve's top ride a skinned garment:

1. Skin the garment to the character's skeleton (or wrap it to the body) below the Tnpix Solver, so it moves with the character when the Solver is off.
2. In a Tnpix Channel, paint the regions that must follow exactly: 1 at the cuff or collar, falling to 0 over two or three rows into the sleeve.
3. Add Tnpix Preserve and choose that channel. Play from the first frame: the painted rows ride the skin, the soft edge blends into the simulated cloth, and the rest of the garment is simulated.

A Preserve follows the cloth's own animation, so an arm that starts close to the body does not drag the armpit along with the body, as a Pin bound at the first frame can.

TIP

For a fast move, raise **Substeps** before anything else. Iterations do not help with fast motion, because they do not evaluate collision again.

5.2 Setting Up a Solver Group in the Graph

The TenPix Graph (see *The TenPix Graph* in Chapter 2) puts every garment of a Solver group and all their settings in one place. A typical outfit:

1. Select the garments and add one Tnpix Solver to the selection in the Modify panel. It is one modifier the garments share, so together they form a Solver group.

2. On the Solver panel press **Graph**. The Solver group opens with each garment as a column.
3. Right-click in the graph and choose **Add to all N objects** ▶ Gravity, then Collision and Self Collision the same way. Each is one modifier all the garments share, drawn as a bar across the Solver group.
4. Click the Collision bar, press + **Pick object** in its list and click the body in a viewport; right-click to stop. Click the body's row to set its thickness and friction.
5. Click a garment's box, choose Material Standard under *Add a modifier*, tick the garments of the same fabric and press **Add**. Click the new box and set its fabric.
6. Add a Tnpix Channel, Pin, Stitch or Tear the same way, or from the right-click menu, where a garment needs one, and paint its channels on the Tnpix Channel panel as usual. Drag a box up or down to change its place in the stack.
7. Where one garment should differ, click the shared modifier and use **Make unique...** for it.
8. To bring another garment into the Solver group, select it in a viewport and press + **Add object**.
9. Play. Any step can be taken back with Ctrl+Z.

5.3 Several Fabrics on One Garment

A jacket has a heavy shell, a light lining and a stiff collar; a dress has a bodice and a skirt that should not hang the same way. Give each region its own material, bound to a painted channel.

To give one garment several fabrics:

1. Add a Tnpix Channel above Tnpix Garment. Create a channel for each region, for example *collar* and *skirt*, and paint each one at 1.0.
2. Add one material per region and choose its channel by name. Two materials cannot share a channel.
3. Leave the channel at *none* on one material, Standard or Advanced, to make it the material for everything that is not painted.

On a Standard material, weight, velocity damping, Motion Damping, max strain, K bend, K stretch and K shear act per region, so a heavy collar on a light shirt, a damped skirt under a lively bodice and a hem that may stretch further than the body all work. Relative Damp and the damping ratios act on the whole garment. On an Advanced material, Stretch Stiffness, Edge Stiffness and Shear Stiffness act per region.

TIP

An Advanced material left at *none* covers every vertex of its garment that no painted material claims. Give a garment only one such material.

Several garments, several fabrics, one Solver

A Solver group merges channels by name across its garments. To give two garments on one Solver two different fabrics, bind each garment's material to a channel painted at 1.0 over that garment, and give the two channels different names. Two garments whose channels share a name share one fabric, and an edit on either material moves both. With the channels left at *none*, each garment's Advanced material covers that garment alone, while Standard materials give the Solver group one set of whole-garment values, those of the garment created first.

5.4 Layered Outfits

To simulate an outfit of layered garments:

1. Select every garment of the outfit and add one Tnpix Solver to the selection, so they share one instance and form one Solver group. Do the same with Gravity, Collision and Self Collision.
 2. On the Self Collision panel, check that **Enable self collision** is on; a new Self Collision starts with it on. Every garment appears in the **Garments this solver owns** list.
 3. Turn on **Layer ordering** and give the inner garment a lower layer number than the outer one: shirt 0, jacket 1, coat 2.
 4. Play. The lower layer holds its shape and the upper one moves around it. Raise **hold strength** if the order does not hold.
- The friction between two layers is the top garment's; garments on the same layer average theirs. Give a garment its own friction or thickness in its cell of the list.
 - Two garments on the same layer are treated equally; neither dominates.
 - Layer ordering works under every Self Collision mode.

5.5 Sewing a Seam

To stitch one garment to another:

1. Make sure both garments carry the same Solver instance. This is the one hard requirement.
2. On the garment that carries the seam, add Tnpix Channel, create a channel (for example *seam*) and paint the points along the seam line. Only painted points stitch.
3. Add Tnpix Stitch. Choose the channel, click **Add** and pick the garment to stitch to, or turn on **Stitch to self** for a rolled cuff or a tucked flap.
4. Read the status line. If it says the points are out of reach, raise **Search distance** or move the pieces closer in the modelled pose. If it says how many points are stitched, you are set.
5. Set **Tightness** 1.0 to sew the seam shut, or 0 to keep the modelled gap as a rigid tack; **Strength** around 0.5 holds, 0.8 and above is rigid.
6. Play. With the Stitch panel open, the stitch lines are drawn once the simulation has been built.

Gaps between stitch points where the paint is sparse are a paint question: paint more of the seam and they close. To keep a small gap between the two cloths, for example for a piping, set **Offset**.

5.6 Pinning and Letting Go

A pin can hold for the whole shot or only for part of it. With **Active only between frames** the painted points are free cloth before **From**; at **From** the pin takes them where they are, with no jump; after **To** it lets go and they keep the motion the pin gave them.

To drop a cape at a chosen frame:

1. Paint the cape's shoulder line in a channel and add a Tnpix Pin that follows the character.
2. Turn on **Active only between frames**, leave **From** at the first frame and set **To** to the last frame the cape should hold.

3. Turn on **Dynamic** if the released points should carry their own velocity and keep reacting to gravity and collision while held.

For a soft follow, set the Pin's **Weight** below 1: each painted point is drawn toward the object it follows by a damped spring, so it follows the animation smoothly while the cloth, a Tnpix Volume and collisions still act on it. A fleshy body pinned to its skinned character this way rides the animation, still jiggles and keeps its volume. The Weight is the share of the motion it follows: 0.5 follows half and sags behind, 0.9 about 93 percent; for a region that should hold almost firm, use a Weight near 1.

When the region should follow the character's own animation rather than another object — a cuff on a skinned arm, a collar on a skinned neck — use a Tnpix Preserve instead of a Pin: its painted points sit on the animation below the Solver, whatever was near them at the first frame (see Tnpix Preserve in Chapter 3).

When pinned cloth can tear, **Min piece** lets small torn pieces fall from the pin, and **Reach** stops a pin that starts late from pulling back pieces that have already fallen away.

To let a pin go point by point rather than all at once, give it an **Active Zone**: an Influence Helper over the pinned region, animated to slide off it. Each point is let go as the zone leaves it - a cape peels off the shoulders from one side to the other. With **Stays held once touched** on, the zone works the other way round: a helper swept over the cloth picks up every point it passes, as a hand gathering cloth would. On a Tnpix Stitch the same zone closes a seam like a zipper: sweep the helper along the seam and it closes behind it.

Tick **Invert** in the Active Zone group to turn the zone round: the modifier then acts everywhere the zone does not reach. A Pin with Invert and **Stays free once touched** lets go of every point the helper passes - sweep it along the pinned edge and the cloth peels off behind it. A Stitch with Invert and **Stays open once touched** unzips a sewn seam the same way, and a Tear with Invert and **Stays protected once touched** never tears where the helper has been. On Tnpix Forces, Invert keeps the wind out of the zone.

5.7 Tearing

Tearing along a painted region

1. Paint the region that may tear in a Tnpix Channel, or draw the exact line with the channel's **Tear brush**.
2. Add Tnpix Tear, set **Tear by** to Map and choose the channel.
3. Play and read the status line: it shows the strongest pull reached. Set **Threshold** just below that value to tear there. Lower tears sooner and more; higher holds longer.

Tearing by stretch

Set **Tear by** to Stretch to let the cloth tear anywhere an edge grows beyond the **Stretch ratio**: 0.1 tears at 10 percent longer. No paint is needed; a painted channel with **Weakness max** above 1 makes its region tear sooner, point by point, with each painted point's own weakness between Weakness min and Weakness max.

A seam that rips first

Combine two Tears: a Stretch Tear for the whole cloth and a Map Tear with a low Threshold on the painted seam. A point both mark keeps both tests and tears at whichever limit it reaches first, wherever the two sit in the stack.

Bursting under pressure

Add Tnpix Volume in Pressure mode to a closed shell, paint the region that should burst, and add Tnpix Tear with **Tear by Pressure**. The region bursts when the pressure passes the Threshold.

Threads at the tear

1. Add Tnpix Threads directly above the Tnpix Solver of the tearing cloth.
2. Set **Warp every**, **Weft every** and **Thread length** for the weave you want, and play from the first frame: the threads grow out of each crack as it opens.
3. Choose the thread's **Material**; raise **Warp holds** and **Weft holds** for more threads spanning the crack, or set one family to 0 for ripped denim.
4. For dense threads, keep **Viewport %** low while you work: the render makes every thread.
5. Click **Make the threads object** to give the threads their own material, and cache that object when the shot is approved.

TIP

The Tearing Sample on the TenPix toolbar builds a complete tearing scene to start from.

5.8 Inflatables and Closed Shells

- **Keep a shape.** Add Tnpix Volume with Mode Keep volume and Volume ratio 1.0: a ball stays a ball, a pillow keeps its fill. Raise **Softness** to let contact squash it and recover over time.
- **Inflate or deflate.** Animate **Volume ratio** (1.3 inflates by 30 percent) or use Pressure mode and animate **Pressure**.
- **Float.** Turn on **Buoyancy**; **Lift** 1.0 hovers, above 1 rises.
- **Keep a region.** Paint the area in a Tnpix Channel, such as a character's belly, and set it as the Volume's **Channel**. Pick a bone inside it as the **Centre** so the region keeps its volume around the bone as the body moves; paint a soft edge so it blends into the rest of the skin. Add one Tnpix Volume per region.

A whole object's mesh must be closed; a painted region need not be. Each object needs its own Volume modifier; on a shared Solver each garment keeps its own volume.

5.9 Rigid Attachments

To add solid buttons or buckles to a garment:

1. Paint the hard parts at 1.0 in a Tnpix Channel, or model them as separate mesh elements.
2. Add Tnpix Rigid. Choose **Pieces from** Tnpix channel and the channel, or Mesh elements.
3. Leave **Each painted region is its own piece** on so every button moves on its own.
4. Raise **Mass x** so a heavy buckle drags the strap it is on. Check the pieces status line: it counts the pieces while you paint.

5.10 Soft Bodies and Muscles

Tnpix Soft Body is experimental, and its muscle simulation is entry level (see Tnpix Soft Body in the reference).

To make a soft object, such as a jelly or a rubber toy:

1. Start from a closed mesh: every edge shared by two faces, the caps of a cylinder on.
2. Add Tnpix Soft Body and choose a **Material**. Add Tnpix Gravity and a Tnpix Solver above it, with Tnpix Collision for what it lands on.
3. Play. The status line says how many tetrahedra the flesh has; raise **Resolution** for finer flesh.

To set up a muscle with fibres between two bones:

1. Model the muscle as a closed mesh between the two bones, for example a Cylinder with its caps on.
2. In a Tnpix Channel paint each tendon end into a channel of its own, for example *upper* and *lower*.
3. Add Tnpix Soft Body and choose Material **Muscle**: Fibres turns on.
4. In the Soft Body Fibres rollout pick the two bones, or helpers linked to them, as **Start** and **End**.
5. Add a Tnpix Pin for each end: channel *upper* following the upper bone, channel *lower* following the lower bone.
6. Add Tnpix Gravity and a Tnpix Solver.
7. Animate the bones. With **Auto tension** on, the muscle tenses as the bones close in and bulges; or animate **Activation** yourself.
8. Set or animate the **Tension point**, or drag the yellow marker at the modifier's Tension Point level, to move the bulge along the muscle.

To slide a fat layer over the muscle:

1. Model the fat as a closed shell around the muscle, for example a Tube.
2. Paint the fat's inside surface into a channel in a Tnpix Channel.
3. Add Tnpix Soft Body with Material **Fat**, and a Tnpix Stitch: that channel, Stitch to the muscle, a Search distance that reaches the muscle's surface.
4. Turn on **Slide along the surface** and keep a little **Friction** (0.3).
5. Put the muscle and the fat on one Tnpix Solver.

TIP

Quick Soft Body on the TenPix toolbar makes a selected closed mesh a muscle between two bones, or a fat that slides over a muscle, in one click: it paints the held ends and the fat's inner side for you.

To let only part of a skinned character jiggle:

1. Give the character's closed mesh its Skin below the Tnpix Solver.
2. In a Tnpix Channel, paint two channels: *skin* where the character must follow the animation exactly (head, arms, hands, legs and feet), and *belly* where the flesh should move.
3. Add Tnpix Preserve bound to *skin* and, above it, Tnpix Soft Body bound to *belly*. Above the Preserve the Soft Body's paint wins its area, so *skin* may cover the belly too.
4. Add the Solver on top and play from the first frame. The preserved parts ride the Skin; the belly jiggles on top of it, and a soft edge in the paint blends the two.

TIP

With Keep volume on, a small belly on a body that is otherwise held moves little: its flesh keeps its volume and has almost nowhere to go. Paint a larger belly, or turn Keep volume off, for looser flesh.

5.11 Wind and Other Forces

To blow the cloth with a Wind:

1. Create a Wind space warp and aim it at the cloth. Strength 1.0 pushes about as hard as gravity pulls.
2. Add Tnpix Forces to the cloth (share one instance across a Solver group, or give each garment its own), click **Add** and pick the Wind.
3. Play. Animate the Wind's Strength for gusts; raise Turbulence (and then Frequency) for flutter.

Clear a warp's check box in the list to mute it without removing it, and use the modifier's **Strength** to scale every warp together.

To push only part of a garment, a sleeve or a hem, paint a channel over it with Tnpix Channel and pick that channel in the Forces' **Channel** list: each point is pushed by its painted weight, and the rest of the garment follows through the cloth.

5.12 Caching, Retiming and Rendering

1. **Cache the approved simulation.** Add Tnpix Cache above the Solver and click **Save cache**. Use *.tnc* inside 3ds Max, or *.abc* with **Write velocities** for another application. A threads object gets a Tnpix Cache of its own.
2. **Retime.** Key **Retime** for a speed ramp or a freeze (0) without simulating again; use **Posterize step** and **Hold** for animation on twos.
3. **Finish the surface.** Add Tnpix Post Process above the Cache to smooth the cloth with Delta Mush and to push crossing layers apart.
4. **Add render detail.** Add TurboSmooth or Shell on top, or drive a separate high-resolution garment with Tnpix Wrap bound to the cached proxy.
5. **Render with motion blur.** Turn on the renderer's motion blur. A cached cloth, a torn one included, and a cached threads object blur between frames; an uncached cloth is simulated as far as each render needs.

TIP

The Cache Manager on the TenPix toolbar saves or loads the caches of every garment in one step; a garment on a shared Solver is saved together with its whole Solver group.

5.13 Rendering on a Farm

TenPix Cloth records its caches on a Thinkbox Deadline 10 farm through two scripts that come with the plug-in: a workflow for *Submit Max To Deadline* (SMTD) and the job each farm machine runs. Each Solver group is one task and is recorded from start to end on one machine, since every frame needs the one before it. Once the files are written, render the shot from the caches as usual.

To install the farm scripts (once):

1. Run the TenPix Cloth installer on a computer that can reach the Deadline repository. On its **Deadline integration** page, check **Install the TenPix Deadline workflow** and choose the repository's root folder: for a network repository a path such as `\\server\DeadlineRepository`; if a mapped drive is missing, use its network path. Setup puts `SMTDWorkflow_TenPixCache.ms` and `MAXScriptJob_TenPixCache.ms` into the repository's `submission\3dsmax\Main\Workflows` folder, next to SMTD's other workflows. Nothing of Deadline's own changes; deleting the two files removes them, and uninstalling TenPix Cloth from a computer leaves them in place.
2. On every farm machine, install the same TenPix Cloth version for the scene's 3ds Max year. The machines need an NVIDIA graphics card and a licence: in the demo a farm machine simulates nothing.

To record the caches on the farm:

1. Give every garment's Tnpix Cache a file in a network folder the farm machines can write: a drive letter the machines map too, or a `\\server\share` path. The Cache's frame range is the range recorded.
 2. In 3ds Max, choose *Deadline ▶ Submit Max To Deadline* and pick the workflow **Submit TENPIX CLOTH CACHES To Deadline** at the top of the dialog.
 3. On the **TenPix Job** tab, check the Solver groups to record. Pool, group, priority, job name and limits work as for any job. Use **Cache Output Directory Override** writes every file into one network folder instead; the scene keeps its own paths unless **Make Directory Override Changes Permanent** is checked.
 4. Click **Submit**. The job has one task per Solver group. Submit refuses, with the reason on its tooltip, when no Solver group is checked, a Cache has no file, a file is on a local drive or the override folder is missing.
 5. Follow the tasks in the Deadline Monitor. Each task's progress rises with the frames recorded, its status reads, for example, *TenPix Cloth: 82 of 221 frames recorded (Solver group 1 of 1)*, and its log has a line every 10 frames.
 6. When the job is done, open the scene and click **Load** on the Caches, or tick **Play from cache**.
- **A Solver group** is every object that carries the pressed Tnpix Cache together with every garment of their Tnpix Solver; objects that share a Cache or a Solver are one Solver group, so no two tasks write the same file.
 - **A task fails**, with the reason in its log, when TenPix Cloth is not installed on the machine, a garment or its cache file is missing, the cache folder cannot be reached from the machine (checked before anything is simulated), or a Save wrote nothing or stopped before the end of its range.
 - **The machine list**. The workflow treats SMTD's Machine List as a deny list even when the dialog says Allow. To keep a job on chosen machines, deny the others, or use a group.
 - **Without Deadline**, `3dsmaxbatch.exe MAXScriptJob_TenPixCache.ms -sceneFile <scene.max>` records every Solver group of a scene in one run. The environment variable `TENPIX_CACHE_DIR` sends every file to one folder, and a report is written beside them.

TIP

The farm forms each Solver group the way your workstation does, so the garments keep their places and their default layers, and a Save records from the first frame of its range whatever frame the farm starts on. A farm script of your own can show the same frame-by-frame progress; see the *TenPix Cloth MAXScript Guide*.

Troubleshooting

Every cloth solver has limits. This chapter lists the ones you are likely to meet, each with the remedy that works, and then goes from the symptom you see to the setting to check.

6.1 Known Limits and What Helps

Collision

Limit	What helps
Volume collision on small characters and thin parts	Volume Only and Volume + Proxy resolve the collider on a voxel grid. On a small character, or on thin parts such as fingers, straps and belt edges, the grid is coarse compared with the detail, and the cloth rests on a blurred version of the shape. Use Surface (True Geometry), the default. If you need a volume system for speed, lower the row's Voxel from automatic until the grid is fine enough for the smallest feature that matters.
Proxy decimation	A Proxy value decimates the collider: detail is traded for speed, and a decimated hand loses its fingers. Keep Proxy at 0 on hero colliders; decimate only background colliders. In Surface (True Geometry) the value is greyed: that mode always collides with the true mesh.
Open and single-sided colliders	Tick Two-sided mesh or Open mesh on the row, then use the two levers that work: more Thickness on the row and more Substeps on the Solver.
Fast body motion (cloth passing through)	The same two levers: the row's Thickness and the Solver's Substeps. Iterations do not help, because they do not evaluate collision again.
A low-polygon collider prints its facets into the cloth	Raise Mesh contact smoothing on the Solver or Mesh Smooth on the row before adding polygons to the collider.
Cloth that starts inside a body	Surface (True Geometry) does not include the deep-penetration recovery of the volume systems. Model the garment clear of the body at the first frame.
Colliders must be meshes	An object that cannot be converted to a mesh is not added. Convert splines and surfaces to a mesh first.

Self collision and layers

Limit	What helps
Cloth cutting through itself in hard folds	Self collision prevents; it does not prove. In this order: make sure Edge-edge is on; use Exclusion Mesh ring, so hems and creases folding onto the cloth beside them are seen; raise Query diameter so contacts are found earlier; raise Relaxation passes. If it still shows, set Mode to Advanced and raise Collision substeps (4, then 8): fast folds and twists are where it helps most.

Limit	What helps
The two sides of a thin garment pass through each other	Use Exclusion Mesh ring. Under it, where a garment is thinner at rest than about twice the thickness, its two layers are held at a share of their gap at rest; under Rest distance they ignore each other. Layers modelled lying on each other (closer than a tenth of that distance) are not held: leave a small gap between them in the model.
Heavy crush of many layers	When a whole outfit is compressed (a character sitting, a fall), every layer touches every other. Raise Relaxation passes and turn on Layer ordering so the inner layers hold and the outer ones give way.
Layer ordering does nothing	The check box is off, or every garment is on the same layer. Give the inner garment a lower layer number in the garment list, and raise hold strength if the order does not hold.
The garment looks inflated	Self Collision Thickness or Query diameter is too large. Thickness is a radius: layers settle about twice that distance apart.
Self friction holds less than expected in a fast crush	Grip never exceeds what the contact is pressed with. That is correct; raise hold strength if layers must stay put.

Seams and pins

Limit	What helps
A stitch target on another Solver	Stitches work only inside one Solver group. Instance one Solver across both garments, or use a Pin to follow a garment that has its own Solver.
A seam opens between stitch points	Sparse paint. Paint more of the seam line; the solver holds exactly the points you painted.
Stitch lines are not visible	They are drawn only while the Stitch panel is open, and only after the simulation has been built.
A pin or stitch channel is on another object	The painted channel must be on the same stack as the modifier that reads it.
Jitter near a pinned region, worst in slow motion	Pinned points inside a collider are held by the pin and pushed out by the collision on every step. Move the pinned points clear of the surface at the first frame, or paint them lighter so they form a soft pin.
Stitch set-up time on dense garments	Stitches are paired when the simulation is built, by searching every painted point against the target garment. Paint the seam, not the whole garment, and tune before you raise the density.
A Preserve on frames 3ds Max never showed	After a jump ahead on the timeline, a Tnpix Preserve has no animation for the frames in between and blends it from the nearest frames it was shown; its status line names those frames. Play from the first frame (Real Time off), or record a Tnpix Cache, and every frame is exact.
Cloth passes through the edge of a preserved region	Self collision leaves out every triangle and edge touching a point painted 1 on a Tnpix Preserve. Keep the region's hard edge where no other cloth has to rest on it, or give it a soft edge (paint below 1), whose points still collide.
A pinned point moves under a painted Soft Body or Volume	A Tnpix Soft Body or a Tnpix Volume with a Channel above a Tnpix Pin or a Tnpix Preserve lets go of the points it paints. Put the Pin above it, or paint its region off the points that must hold.

Limit	What helps
A garment of a shared Solver is a little stiffer than alone	A Tnpix Solver gives its cloth one unit of mass over all its points, so each of two equal garments in one Solver group weighs half of what it weighs on a Solver of its own, and its fabric acts slightly stiffer (a free fall is the same). Pins and a Preserve follow their Weight on either. Simulate a garment on a Solver of its own when it must match its solo result exactly.

Materials

Limit	What helps
Not every material value acts per region	See <i>Which values act per region</i> under Tnpix Material Standard. Relative Damp and the damping ratios act on the whole garment.
Two Advanced materials without a channel on one garment	Only the one created last acts. Bind the other to a channel, or remove it.
Fabric Curve makes no visible difference	The fabric's soft range is still too stiff to give. Its stiffness is the Stretch Stiffness divided by Lock stiffness, so raise Lock stiffness (500 or more on the stock fabric) or lower the Stretch Stiffness. A fabric that never stretches to its lock point shows only the soft range.
The × Multiplier does not switch to a higher number	Stretch Stiffness times Multiplier would pass 1e+10, so the change is refused and the box keeps its value; the line under the Stretch rows gives the product. Lower the Stiffness first, then pick the higher Multiplier.
Two garments on one Solver share one fabric	Their channels share a name, or their Standard materials have no channel, so the Solver group runs on one set of whole-garment values. Bind each garment's material to its own channel, painted over that garment, each with its own name; an Advanced material without a channel covers only its own garment.

Scene and set-up

Limit	What helps
Violent first frames	A garment that starts intersecting a collider, or far from its rest shape, is thrown on the first frames. Model it clear of the body and let Substeps calm the start.
Very dense meshes	Time grows with the vertex count, the substeps and the iterations; video memory grows with the vertex count and the number of garments. Simulate at the density the shot needs and add render detail above the Solver.
The Tear threshold changes with Substeps	The threshold is compared with a force that depends on Substeps and Iterations. The Tear status line names the pair it was typed at; set it again at the new pair.
Labels that name inches	They describe an inch scene. Values follow the scene's system unit; see <i>Units and Scale</i> in Chapter 2.

Threads

Limit	What helps
Threads do not collide with each other	Each thread collides with its own cloth, the colliders and the other objects of its Solver, never with another thread. Clump bunches them into strands where that matters.
A cloth that plays from a Tnpix Cache file grows no threads	The threads read the Solver's frames. Make the threads object, add a Tnpix Cache to it and save it while the cloth still simulates.
Millions of threads	Dense spacing on a long tear makes millions of tubes. Keep Viewport % low while you work (the render makes all of them), and let Thread cap thin every crack alike.
A modifier between the Solver and the Threads	The threads read the cloth from the Solver, so a modifier in between that moves points does not move them. Put Tnpix Threads directly above the Solver.

Soft bodies (experimental)

Limit	What helps
An open mesh gets no flesh	A soft body needs a closed mesh: every edge shared by two faces. Close the holes (a cylinder's caps on); the status line says why there is no flesh, and the object simulates as cloth.
A Solver with a soft body is slower	A Solver that holds a closed soft body runs twice its Substeps (a soft body whose own object carries an enabled Tear does not count), so a muscle squeezed hard does not jump from one folded shape to another. Lower the Resolution for coarser, faster flesh.
A soft area painted over a Pin does not move	The Soft Body is below the Pin or the Preserve, or has no Channel. Put a Soft Body with a Channel above them: its painted points are let go. With Keep volume on, a small area on a body that is otherwise held still moves little; let go a larger area, or turn Keep volume off.
A soft body that tears has no flesh	A Tnpix Soft Body does not tear: a soft body whose own mesh its Tear splits simulates as cloth, and its status line says so. A Tear on another garment of the Solver group leaves its flesh alone.
A soft body squeezed against itself jumps	With Self Collision on, a soft body pressed hard onto itself can jump and leave a few tetrahedra inside out.
A soft body sinks through a cloth it lies on	A soft body that only lies on a pinned cloth can sink through it. Sew it to the cloth with a Tnpix Stitch.
A sliding layer buzzes	A layer that slides at Friction 0 can buzz. Keep a little Friction on the Stitch (0.3 is its default).
The muscle does not bulge	Fibres is off; or Activation is 0 with Auto tension off; or only one of Start and End is picked, and the status line says so. Pick both, or neither for a line along the object's own length.

6.2 When Something Looks Wrong

Symptom	Where to look
The garment floats	There is no Tnpix Gravity in the Solver group, or it is disabled. Add one.
The cloth falls through a collider	The object is not in the cloth's Collision list, its row is disabled, or the list's Active box is off. The header shows how many colliders are enabled.
Changes have no effect	A Tnpix Cache above the Solver is playing from its file: turn off Play from cache. Cloth Doctor finds this.
The cloth looks frozen in the viewport	Show End Result is off while a modifier below the Solver is selected. Opening a Tnpix panel turns it back on.
A garment is not simulated at all, or stops after frame 100	The demo simulates up to 25,000 vertices in the scene, for the first 100 frames; a larger scene is not simulated and later frames hold the pose. The Solver's licence line says which. Activate a licence, or lower the density. The demo build cannot be activated: install the licensed build.
A farm task saves nothing	Read the task's log. A farm machine in the demo simulates nothing: activate it (a machine running the demo build needs the licensed build). A cache folder the machine cannot reach, or a Cache without a file, fails the task with the reason.
The farm's progress stays at 0% until the Solver group is done	The farm machine runs an older TenPix Cloth. Install the version your workstation runs on every machine.
No threads appear	Read the Tnpix Threads status: there is no Tnpix Solver below it, the Solver holds no frames yet (press Play), the cloth plays from a Tnpix Cache file, the cloth has no Tnpix Tear, or nothing has torn yet: threads appear on the frame a seam tears. For a fringe, the hem must be painted at 0.5 or more in a channel that is on the stack.
Only some of the threads show	Viewport % shows a share in the viewport (10 by default); a render makes every thread. When the status reads <i>Thread cap: N of M threads made</i> , raise Thread cap or widen Warp every and Weft every.
The tubes are gone	Tubes go to is set to their own object and the threads object was deleted: click Make the threads object again, or set Tubes go to this cloth.
A cached threads object renders sharp with motion blur	Its cache was saved by a version that did not number the threads. Save it again.
The TenPix Graph does not dock	It opens as a window of its own. From 3ds Max 2025 on, drag it by its title bar onto a side of the 3ds Max main window to dock it. On 3ds Max 2024 it does not dock.
A setting is greyed in the TenPix Graph	It is greyed on the panel too: the graph follows the panel's own rules. Switch on what the panel asks for first, for example Enable Plasticity before its values.
The TenPix Graph shows no settings for a modifier	It is a 3ds Max modifier, not a TenPix one: its settings are in the Modify panel.
+ Add object is unavailable in the TenPix Graph	No object selected in a viewport can join the Solver group. Select geometry that is not in this Solver group already and carries no other Tnpix Solver.

Symptom	Where to look
A modifier will not move where it is dragged in the TenPix Graph	The note under the pointer says why. A TenPix modifier that feeds the Solver stays above it in the graph; Post Process, Cache, Threads and Wrap stay below it; a modifier stays in the stacks of its own objects. To put it on another object, use Add.
Particle bonds show nothing	Tick the kinds to draw under Particle bonds: they are all off by default. Bonds are drawn on frames that have been simulated; play or scrub to the frame.
The cloth falls through the floor	A floor object only collides once it is in the cloth's Collision list. For an endless floor at $Z = 0$, turn on Unlimited ground ($Z = 0$) on the Solver.
The cloth stretches too much	Raise K stretch on that region's material or lower its max strain; then raise Stretch quality or Substeps on the Solver.
Jitter or shimmer	Raise Relative Damp before Motion Damping: it removes the high-frequency part without deadening the garment. Check that no pinned points sit inside a collider.
The garment is stiff and lifeless	Check compress stiffness (Standard) or Compression Stiffness (Advanced): cloth has to buckle to wrinkle.
A painted region behaves like the rest	Check that the value acts per region, that the material is bound to the region's channel by name, and that <i>exponential membrane</i> is ticked for K stretch and K shear. A material left at <i>none</i> covers only what no painted material claims.
Layers of a costume fight each other	Turn on Layer ordering with the inner garment on a lower layer, and raise hold strength if needed.
Two garments do not interact	They are in two Solver groups. Instance one Solver across both and add Self Collision.
Two garments on one Solver behave like one fabric	Their channels share a name, or their Standard materials have none. Give each garment its own channel name.
A closed shell collapses like cloth	The object has no Tnpix Volume of its own, or the mesh is not closed.
A painted region holds little volume	Its Centre is Its own middle and the region is nearly flat. Pick an object inside the region, such as a bone, as its Centre.
A Volume stops short of its Volume ratio or Pressure	The fabric's stretch limit holds the shell: the default fabric encloses about 1.15 times its rest volume at its limit. Give the shell a fabric that stretches further.
A Volume on a timeline that starts before frame 0 swells from the first frame	Rest volume from 0 is the first simulated frame. To take the rest shape later, set Rest volume from to that frame.
A sleeve's armpit stays on the body when the arm lifts	A Pin binds each point to the nearest triangle at the first frame, so with the arm close to the body the armpit binds to the body. Paint the region in a Tnpix Preserve instead: it follows the cloth's own animation below the Solver.
The cloth stretches but never tears	Under Map, check that a region is bound, then lower the Threshold below the strongest pull the status line reports. Under Stretch, lower the Stretch ratio.
A torn shell under Tnpix Wrap shows the hollow between its layers	Turn on Close the cuts (with Cut along proxy tears). The status line says how many faces close the cuts, or that the mesh is one layer; Bind again after editing the mesh.

Symptom	Where to look
A whole painted region tears on one frame	Spread the weakness: with Weakness min below Weakness max, each painted point takes its own weakness between them and the region tears point by point.
The Tear brush does nothing	A message names the reason: no channel selected, the modifier instanced on more than one object, or no mesh has reached it yet (show the object, or scrub a frame).
A rigid piece behaves like fabric	Rigidity is 0, which means off. Check that Channel and Threshold cover the region you painted; the pieces status line counts what the paint makes.
The wind does nothing, or blows the cloth away	A Wind at Strength 1 is about one g. Check that the row is not muted, that the Forces Strength is 1.0, that a Wind created by script has its Decay set, and that the Forces' Channel is <none> or a channel this cloth has (the status line says when it is not pushed).
Adding one cache to a whole character skips some garments	3ds Max refuses <i>one</i> modifier instanced across objects that depend on each other, so a garment whose Tnpix Pin follows a selected object is skipped - its own Bend is skipped the same way. Use the Cache Manager's Add , which gives each garment its own Tnpix Cache.
The first frame takes much longer than the others	A garment is listed as a collider of another, so its simulation is evaluated for the other's first frame. Later frames are normal.
Post Process breaks the mesh under a TurboSmooth	Read the Rest line: a rest taken from the rest frame is taken again when the mesh below changes. If it says the rest was not taken, click Capture rest.
The Post Process's Rest line says Rest NOT APPLIED	The mesh below has changed since Capture rest was pressed (a TurboSmooth added, a segment count edited): the rest is held, and the Post smooths without it. Press Capture rest to take the new mesh's rest, or bring the old mesh back and the held rest applies again.
The scene is slow	Look at Substeps × Iterations first. Then switch Self Collision off to see what it costs, and lower Relaxation passes before switching it back on; under Mode Advanced, lower Collision substeps first. Run Cloth Doctor.

6.3 Reporting a Problem

When you report a problem, include:

- the build number from the About window, and your 3ds Max version;
- the modifier stack of the cloth, from top to bottom, and whether Self Collision was on;
- the scene file (**.max**) or a link to it. A scene that shows the problem is the fastest route to a fix, because the simulation repeats exactly.

Send the report to ar2sun3d@gmail.com.

Copy the TenPix lines from the MAXScript Listener into the report as well.

The TenPix lines in the Listener

TenPix writes short lines to the MAXScript Listener as it works: a note when a cache is saved or a material is opened on a changed setting, a warning when a demo limit holds the simulation or a collider is gone or changes

its point count, and an error when a cache cannot be saved. Each line starts with `TenPix` and names the garment or the collider it is about.

Glossary

Term	Meaning
Solver group	All objects that carry the same Tnpix Solver instance. They are simulated together and can collide, layer and be stitched to each other.
TenPix Graph	The window opened by Graph on the Tnpix Solver panel: every Solver group of the scene, its objects and modifiers, with every TenPix setting editable there and every change in 3ds Max's undo.
Channel	A named weight map painted with Tnpix Channel, from 0 to 1 per vertex. Other modifiers read it by name.
Substep	A slice of a frame. Everything, collision included, is evaluated in every substep.
Iteration	One more pass over the constraints inside a substep. Time does not advance.
Contact pass	One round of contact resolution in a step.
Stretch ceiling	The largest stretch a fabric allows, set by max strain (Standard) or Max stretch (Advanced).
Hard pin / soft pin	A pin that holds its points completely (full paint, Weight 1), or partly (lighter paint or a lower Weight): a soft pin follows the share of the motion its paint times its Weight gives.
Preserve	A painted region that follows the animation below the Solver instead of being simulated (Tnpix Preserve); a point painted 1 sits on the animation and is ignored by every collision.
Blended frame	A frame 3ds Max never showed (after a jump ahead on the timeline), whose animation a Tnpix Preserve takes as a blend of the nearest frames it was shown; its status line names such frames.
Region (Volume)	A painted channel that a Tnpix Volume holds instead of the whole object, its volume measured against its Centre.
Rigid tack	A stitch at Tightness 0: the pair keeps its starting gap exactly.
Weakness	The Tear's multiplier on the pull or stretch at a marked point, between Weakness min and Weakness max: above 1 the point tears sooner.
Rest pose	The shape a modifier treats as undeformed: the rest length of the cloth, the rest volume of a shell, the rest shape Delta Mush restores.
Proxy	For Tnpix Collision, a decimated stand-in of a collider. For Tnpix Wrap, the low-resolution mesh that drives a detailed one.
Bind frame	The frame at which Tnpix Wrap records where each point sits on its proxy.
Flesh	The volume of small tetrahedra a Tnpix Soft Body makes inside a closed object, its corners the object's own points and more inside.
Fibre line	The line a soft body's fibres run along, from its Start object to its End object, or along the object's own length.

Term	Meaning
Activation	How hard a soft body's fibres work, from 0 to 1: they shorten and the body bulges across.
Tension point	Where along the fibre line a muscle tenses most, and bulges.
Tendon	The end of a muscle that does not contract and is much stiffer than its body.
True Geometry	The collision system that uses the collider's actual triangles, with no voxel field.
Voxel field (SDF)	A grid around a collider that stores the distance to its surface; used by the volume collision systems.
Unlimited ground	The Solver's endless floor at $Z = 0$: the cloth and its threads land on it with no ground object and no collider.
Delta Mush	Smoothing that removes noise from the simulated surface and then adds the modelled detail back.
Detangle	A finishing pass that brings cloth that went through other cloth back to its own side, then pushes layers closer than the thickness apart.
Retime / Posterize	Playing a cache at another speed, or in held steps, without simulating again.
Demo	TenPix Cloth without an activated licence: up to 25,000 vertices in the scene simulate, for the first 100 frames, on a workstation; caches save as .tnc; on a farm nothing simulates.
Demo build	The build of TenPix Cloth made for trying it (its About window reads rc-demo): the demo's limits are built in, it needs no licence and cannot be activated.
Warp / weft	The two families of threads in a woven cloth: warp runs along the grain, weft across it.
Threads object	A Tnpix Threads Object: the object that shows a cloth's thread tubes when Tubes go to is set to their own object.
Thread cap	The most threads one Tnpix Threads makes; past it, every crack is thinned alike.
Build number	The number in the About window that identifies the exact plug-in file 3ds Max loaded.