SNRS - Foil Shaping Fit from calibrated LTD datasets

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The SNRS package contains some tools to build a realistic geometry model for a given source strip based on a fit of *laser tracker* data build from the raw LTD dataset (DocDb #5400).

This work applies to strips 3 (LAPP-ITEP-3), 8 (LAPP-ITEP 2), 9 (ITEP-11), 14 (ITEP-10), 15 (ITEP-9), 20 (ITEP-8), 21 (ITEP-7), 22 (ITEP-6), 23 (ITEP-5), 24 (ITEP-4), 25 (ITEP-3), 26 (ITEP-2), 27 (ITEP-1), 28 (LAPP-ITEP-21), 31 (LAPP-ITEP-1), 32 (LAPP-ITEP-5), 33 (LAPP-ITEP-6) and 34 (LAPP-ITEP-4) with meshes of 10x100 tiles.

Strip 2 (LAPP-ITEP 7) has not been processed.

Programs:

- `snrs-build-fsf` :
  - processing of the calibrated LTD datasets,
  - fitting an elliptic model for each ITEP-style strip,
  - post-processing (smoothing) of the fit data,
  - generating 3D-meshes for each source strip and associated surrounding mylar films.
- `build-fsf.bash` : wrapper scripts to automate the launch of the `snrs-build-fsf` executable for a set of selected source strips

Building FSF datasets

1. Preparing the setup:

   Define the path to the working SNRS data base directory from and where high-level data files will be loaded and stored:

   ```
   $ export SNRS_DATA_DIR="/data/SuperNEMO/snrs_data"
   ```

2. Run the FSF algorithm on a selection of source strips:

   ```
   $ ./scripts/build-fsf.bash
   ```

3. Generated FSF datasets are stored in `${SNRS_DATA_DIR}/geometry/source_foils/fsf`:

```
$ cat ${SNRS_DATA_DIR}/geometry/source_foils/fsf/processed-strips.lis
$ find ${SNRS_DATA_DIR}/geometry/source_foils/fsf -maxdepth 1 -name "strip-*" -exec basename \{\} \;
...
strip-34-pad-0-shaping.report
strip-34-pad-0-shaped.dat
strip-34-pad-0-tessellated.dat
```

   Description of the generated files (example for strip 34) :

   - `strip-34-pad-0-shaping.report` is a CSV formatted ASCII file which contains the result of the fit for the strip (for now, only elliptical fit is available)
   - `strip-34-pad-0-shaped.dat` is a ASCII file which contains the data (in a specific format) that describe the geometry of the source pad after fitting
   - `strip-34-pad-0-tessellated.dat` is a ASCII file which contains the data (in a specific format known by Bayeux >=3.5) that describe the tesselated shape of the source pad.

4. Publishing the mesh datasets:

   The SNRS package provides some specific actions to:

   - build the 3D mesh datasets,
   - install them in the source directory for the official release.

```
$ make snrsBuildFsfDataset
```

   - The mesh datasets for selenium source foil and mylar films are stored in: `resources/data/geometry/source_foils/fsf`.
   - The geometry models are defined in: `resources/config/snemo/demonstrator/geometry/GeometryModels/source_module/realistic/strips_itep_like.geom`.

5. Generate documentation:

```
$ make docBuildFsf
```

Datasets per individual source strip

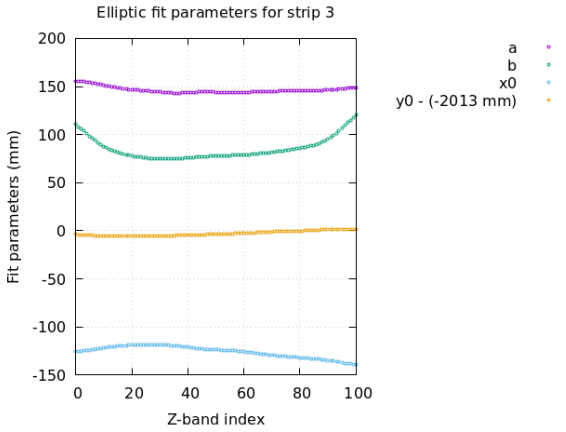
- Plot data (CSV ASCII format) and images files are generated in the `${SNRS_DATA_DIR}/geometry/source_foils/fsf/images/` directory and addressed through a symbolic link.
- Report on elliptic fit :

  The top-left graph shows the evolution of the four parameters *a*, *b*, *x0* and *y0* depending on the Z-band (0 : bottom, 100 : top).

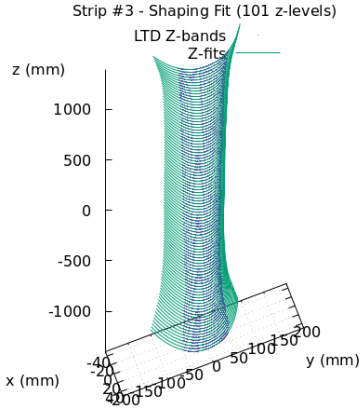
  - the *a* and *x0* parameters are necessarily strongly correlated.
  - the *y0* parameter represents ideally the position of the central vertical axis of the strip at Z coordinate. It is shown here biased by the theoretical position of the vertical axis of the strip. In principle, it should display a horizontal line but the real positions of the strips show some significant vertical shift for most strips.

Strip 3

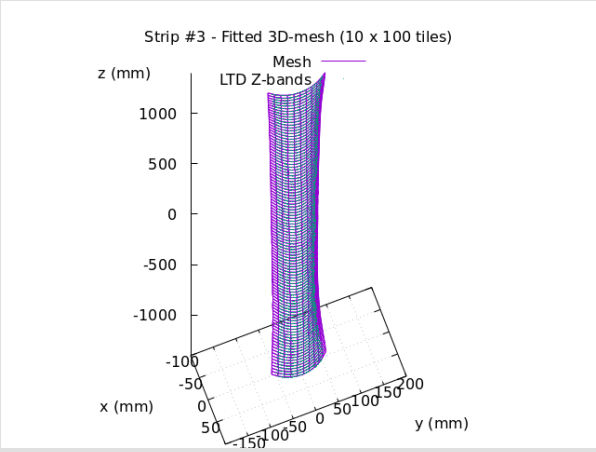
Fit report



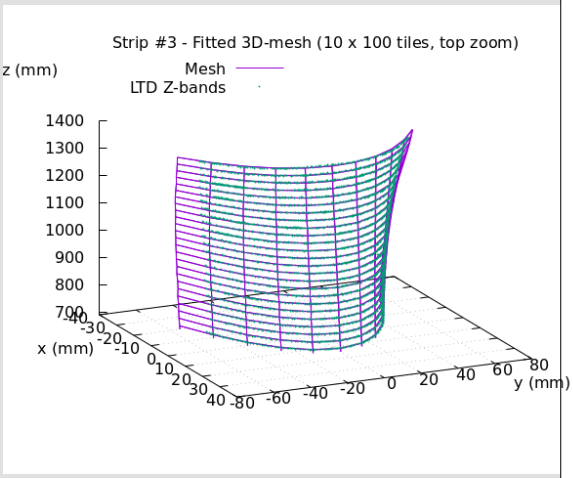
Fitting of Z-bands LTD (3D view)



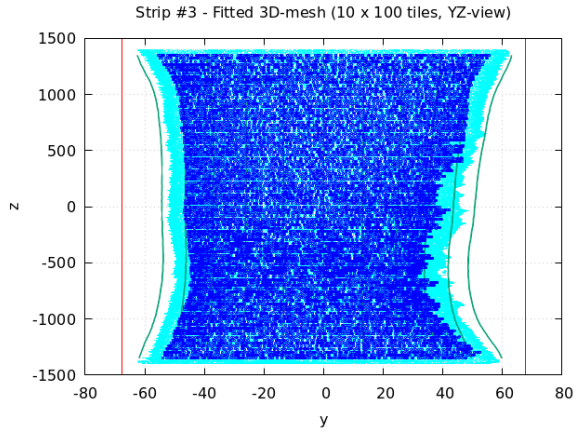
Generated 3D-mesh



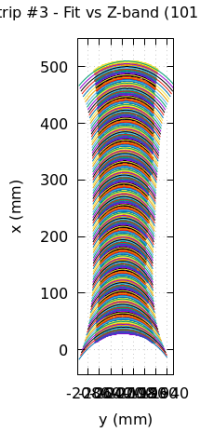
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

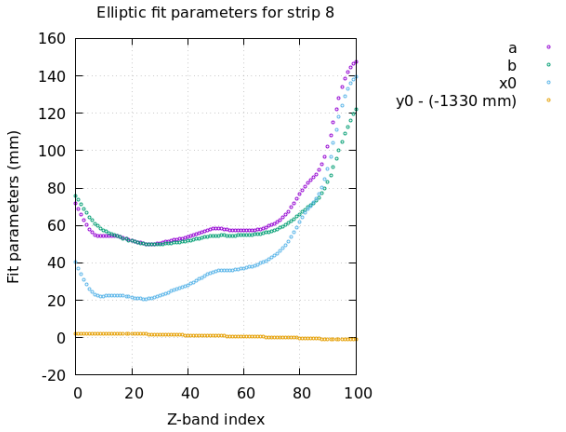


Fitting of Z-bands LTD (YX view)

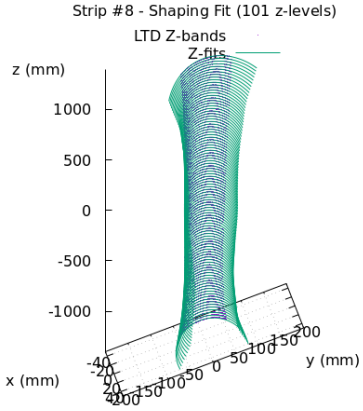


Strip 8

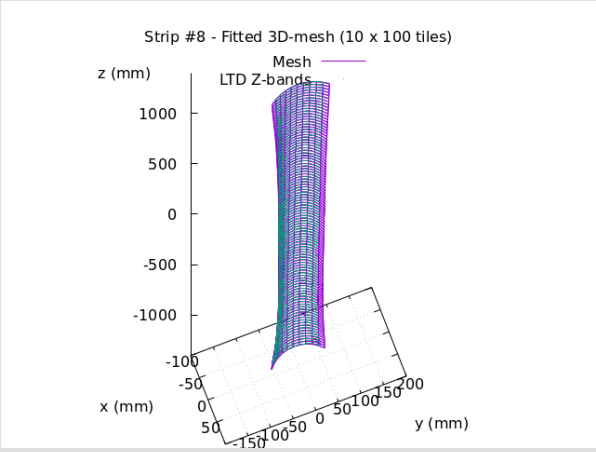
Fit report



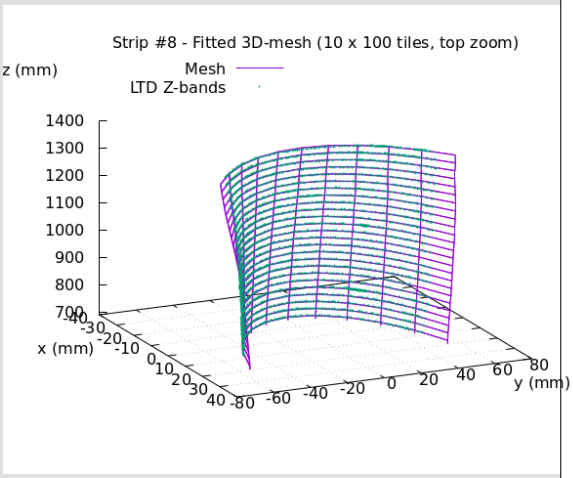
Fitting of Z-bands LTD



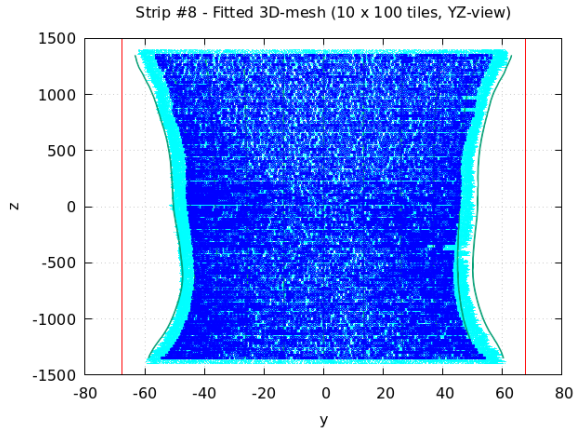
Generated 3D-mesh



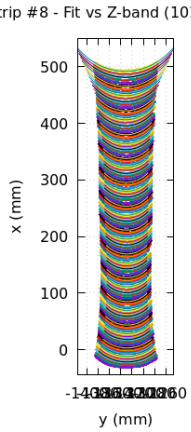
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

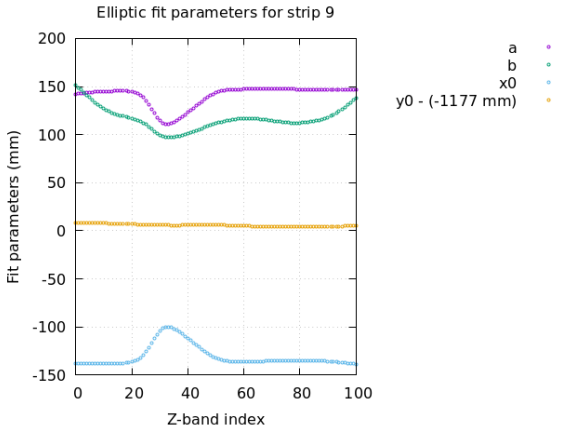


Fitting of Z-bands LTD (YX view)

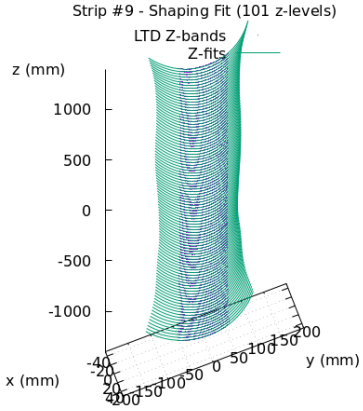


Strip 9

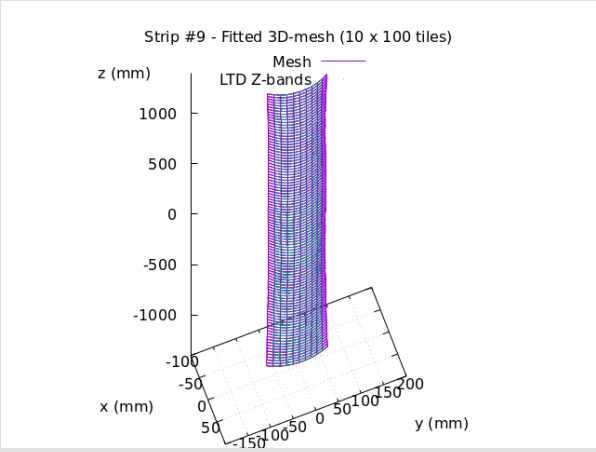
Fit report



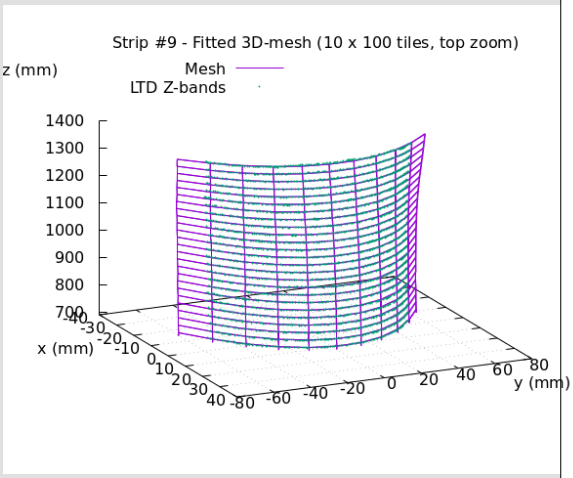
Fitting of Z-bands LTD



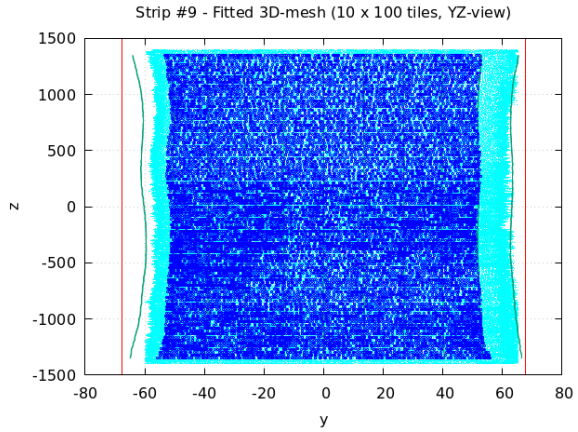
Generated 3D-mesh



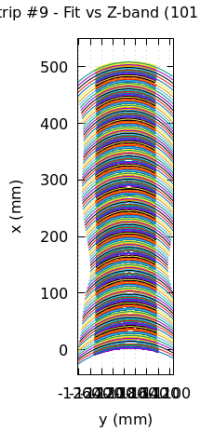
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

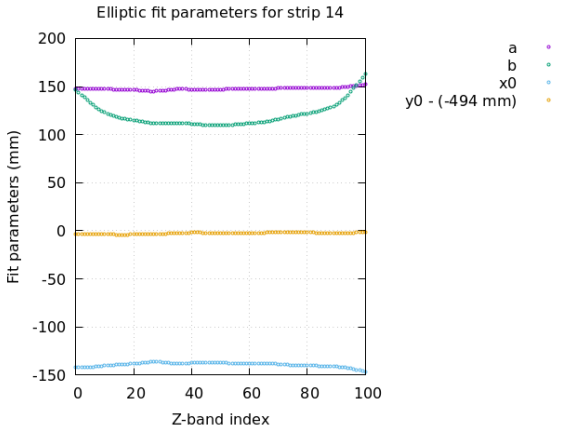


Fitting of Z-bands LTD (YX view)

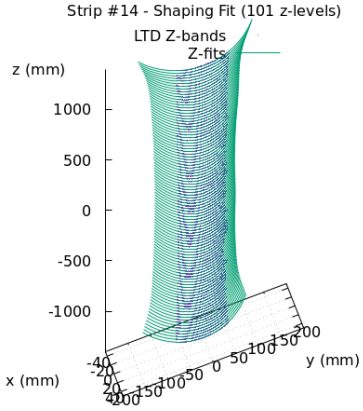


Strip 14

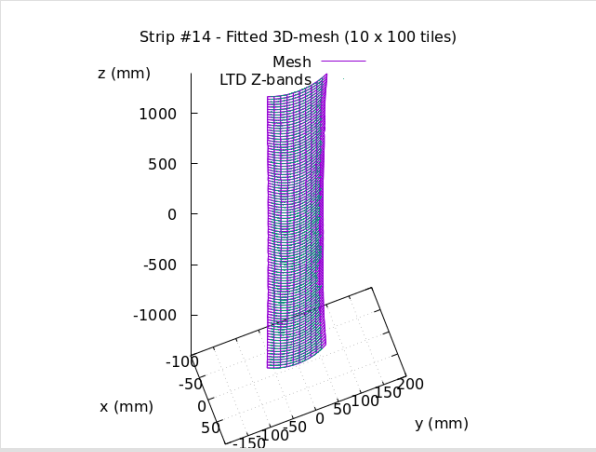
Fit report



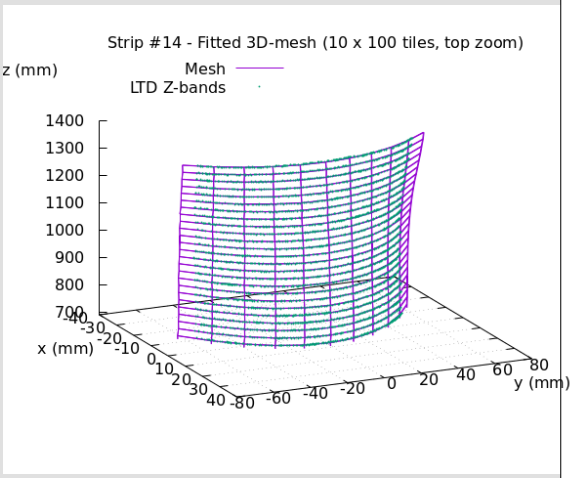
Fitting of Z-bands LTD



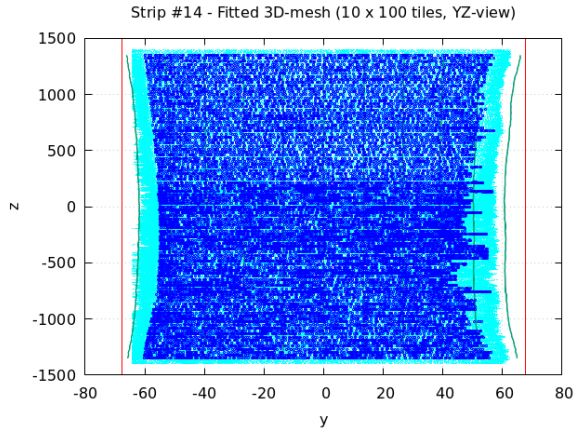
Generated 3D-mesh



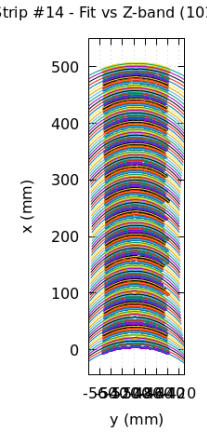
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

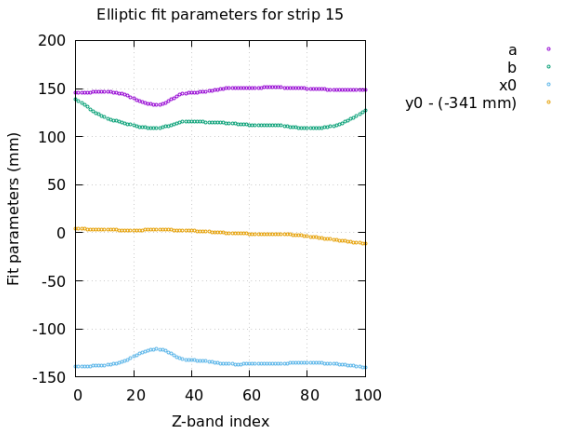


Fitting of Z-bands LTD (YX view)

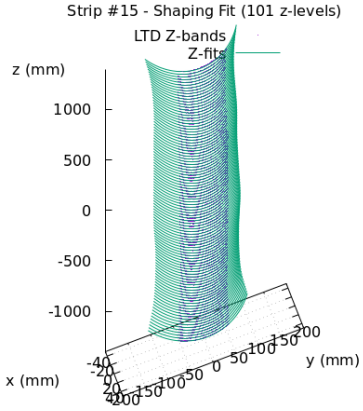


Strip 15

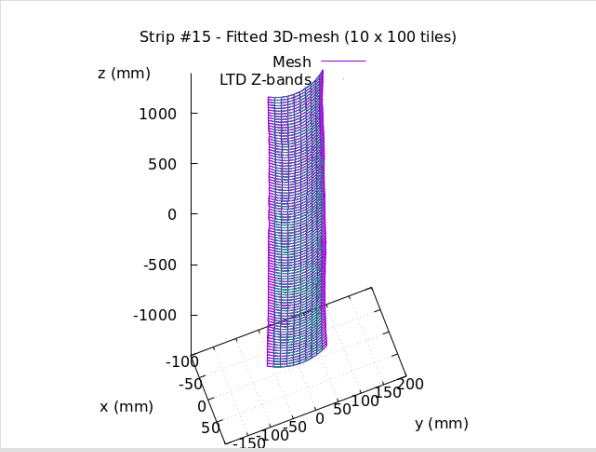
Fit report



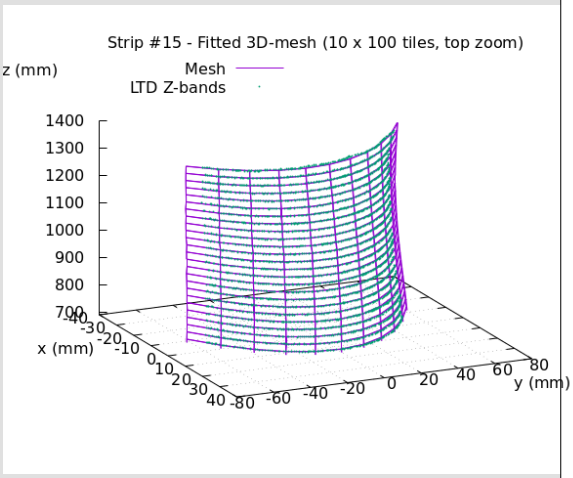
Fitting of Z-bands LTD



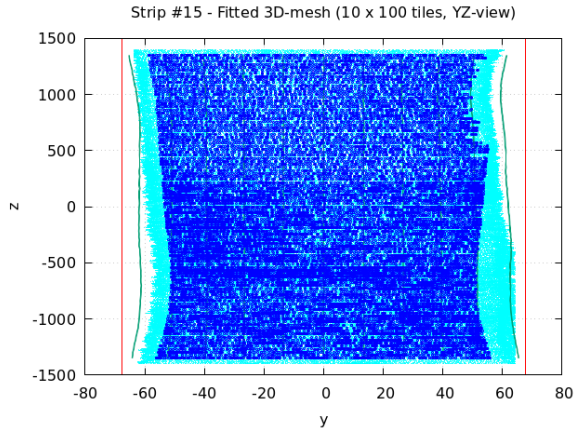
Generated 3D-mesh



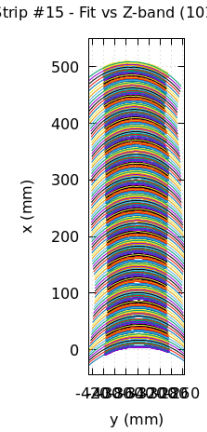
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)



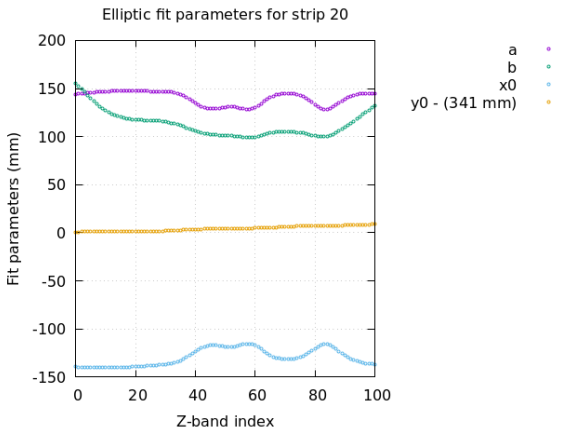
Fitting of Z-bands LTD (YX view)



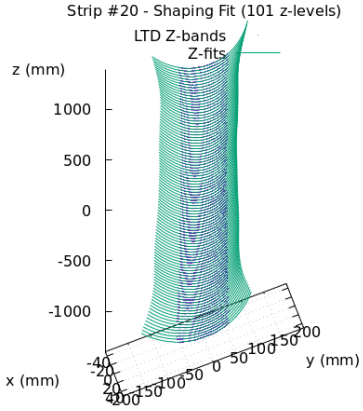
Strip 15 is strongly deformed and has been installed in a special way to avoid contact with the field wires of the first planes of tracker cells on both sides of the source frame. One consequence is a rather large shift of the vertical axis (yellow curve above).

Strip 20

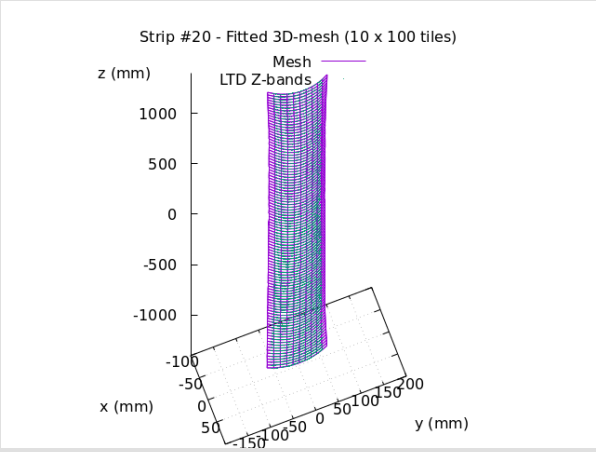
Fit report



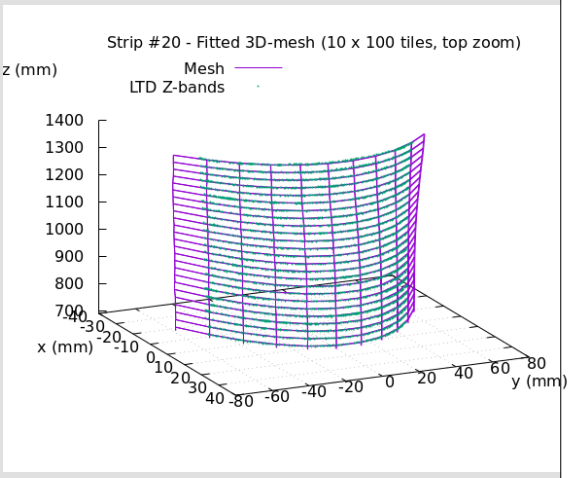
Fitting of Z-bands LTD



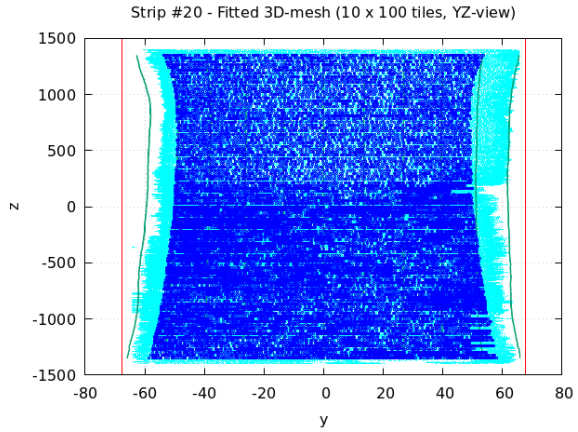
Generated 3D-mesh



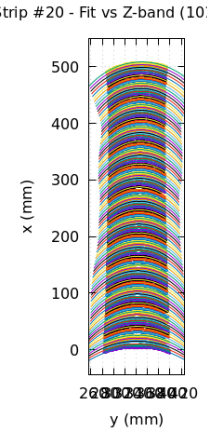
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

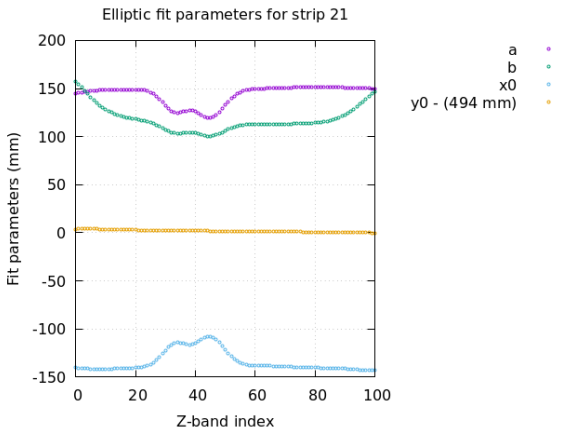


Fitting of Z-bands LTD (YX view)

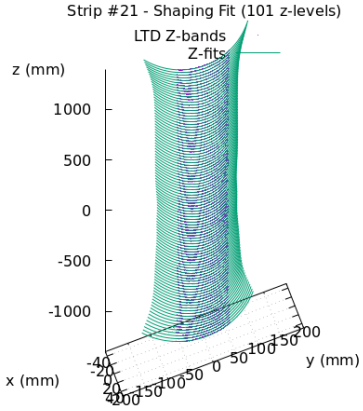


Strip 21

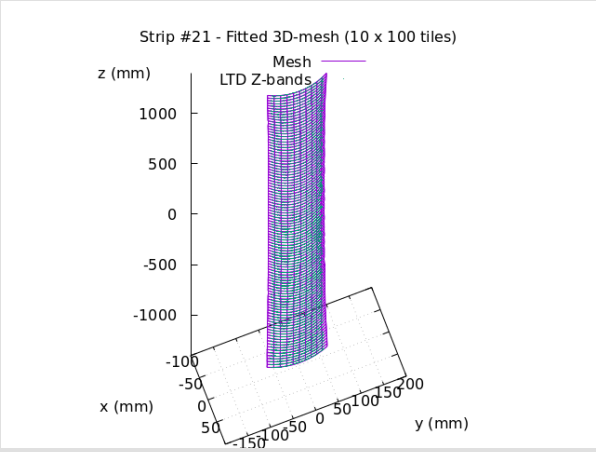
Fit report



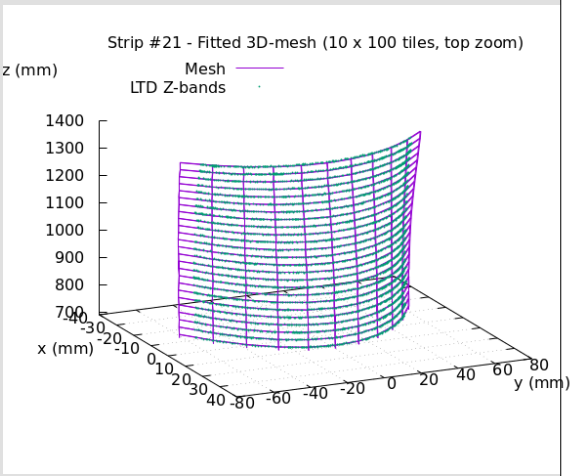
Fitting of Z-bands LTD



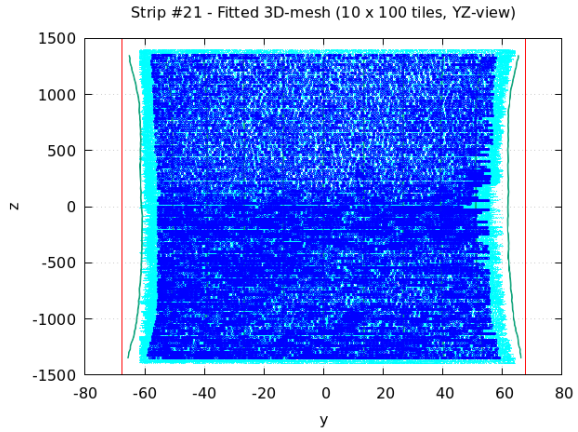
Generated 3D-mesh



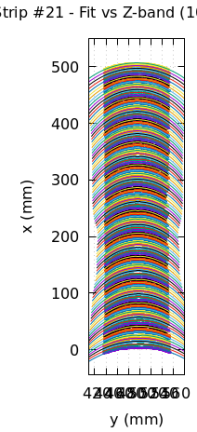
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

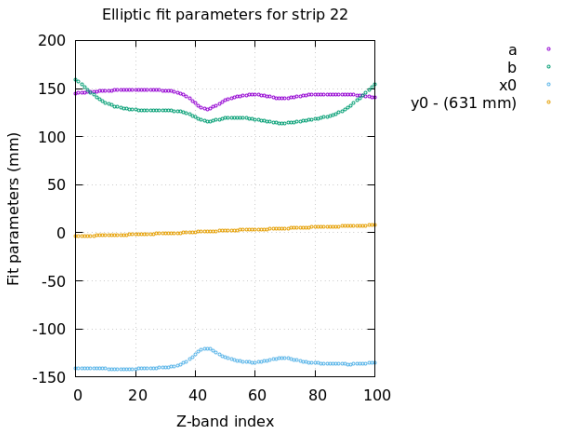


Fitting of Z-bands LTD (YX view)

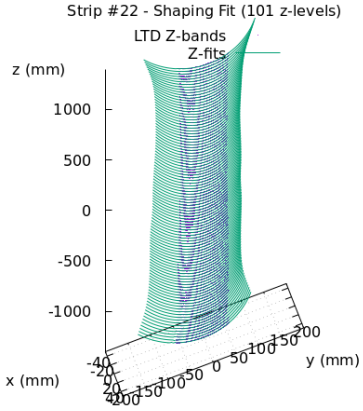


Strip 22

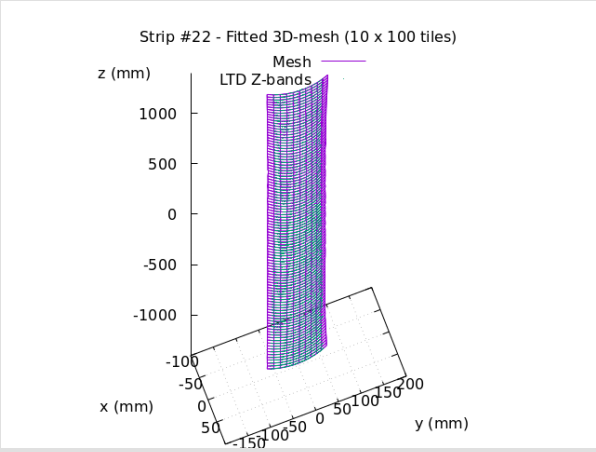
Fit report



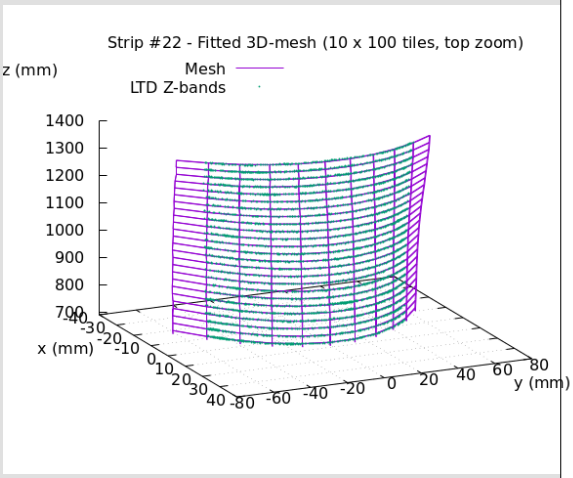
Fitting of Z-bands LTD



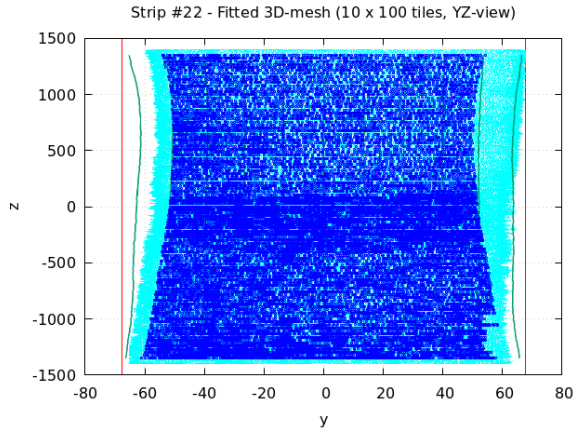
Generated 3D-mesh



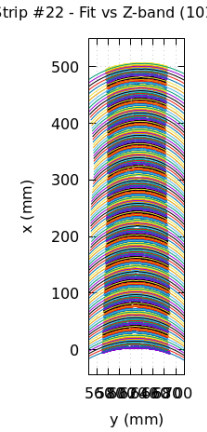
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

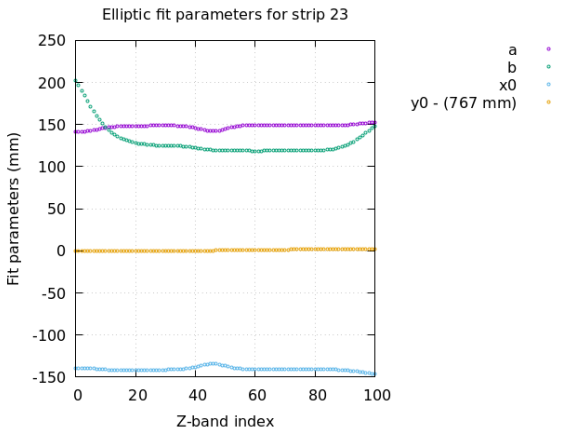


Fitting of Z-bands LTD (YX view)

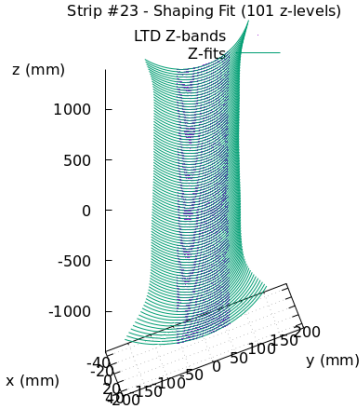


Strip 23

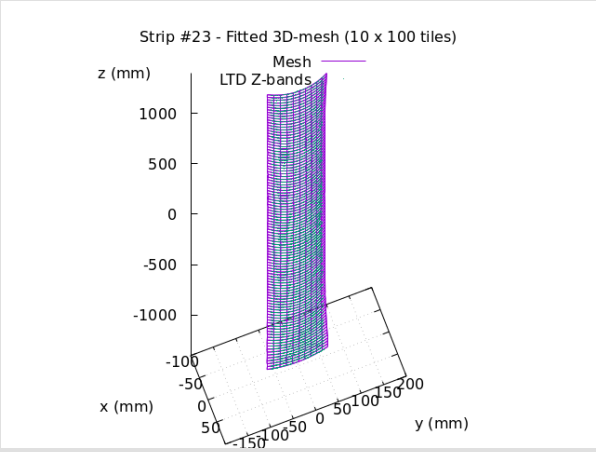
Fit report



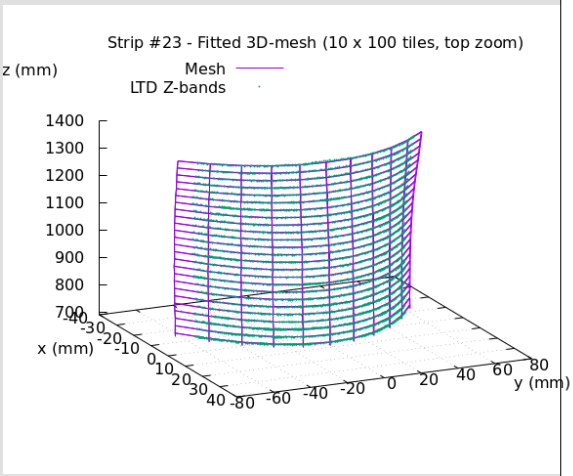
Fitting of Z-bands LTD



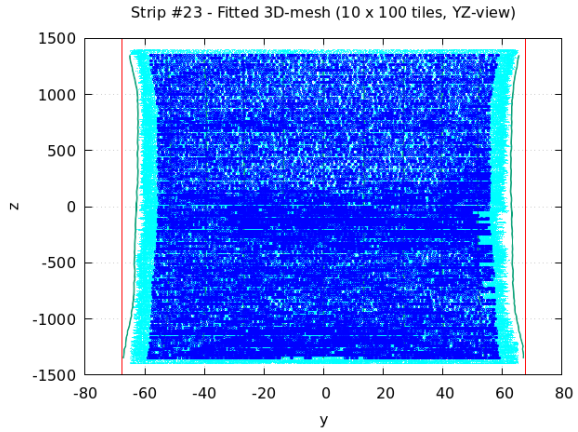
Generated 3D-mesh



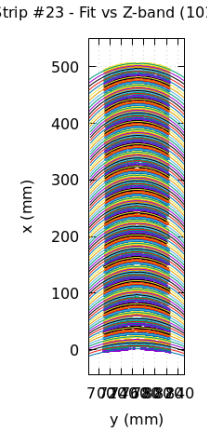
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

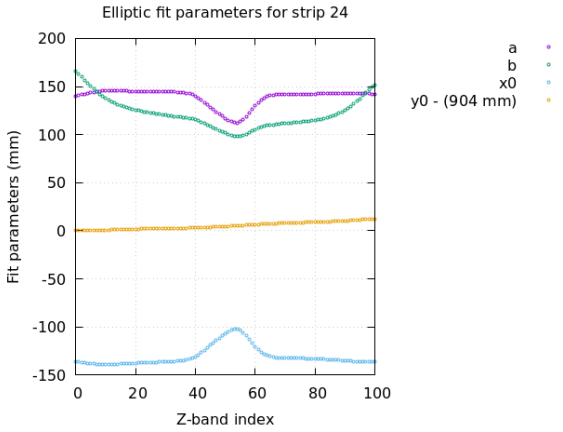


Fitting of Z-bands LTD (YX view)

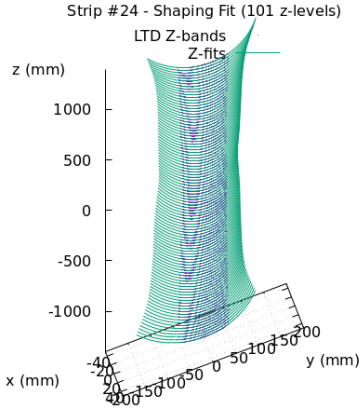


Strip 24

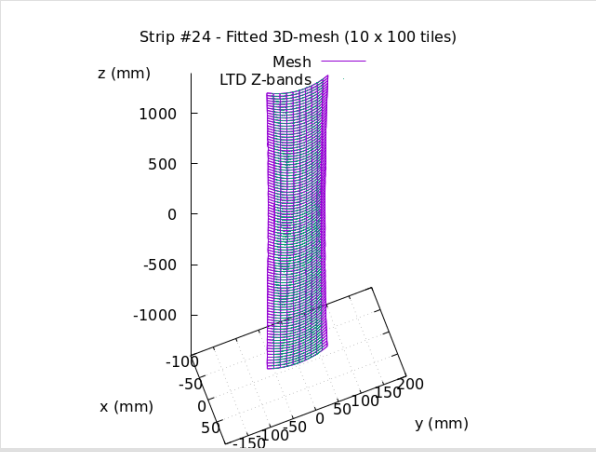
Fit report



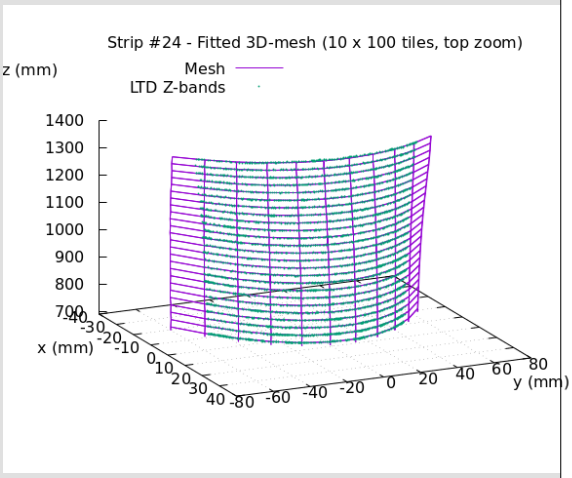
Fitting of Z-bands LTD



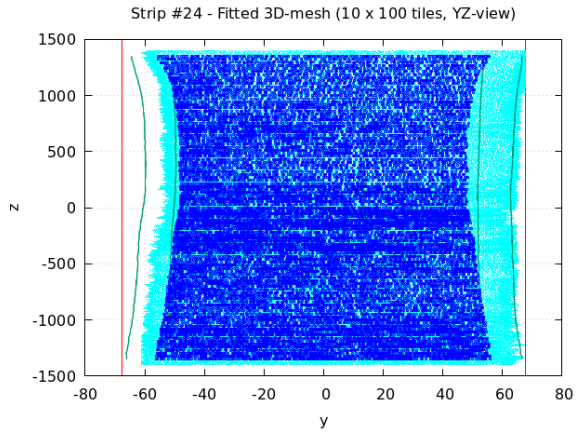
Generated 3D-mesh



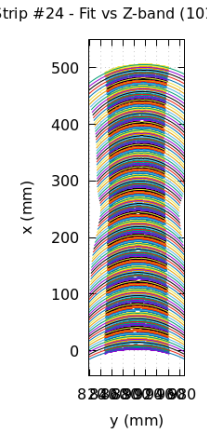
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

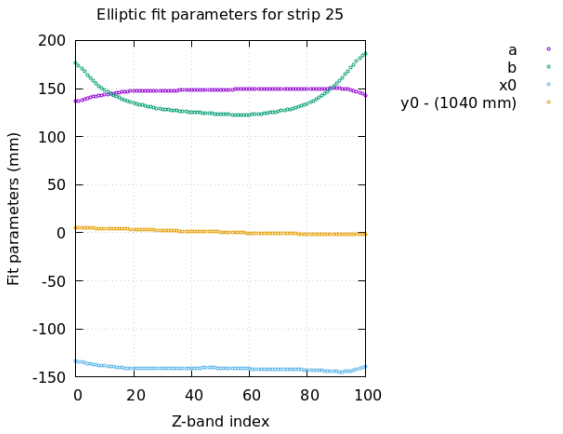


Fitting of Z-bands LTD (YX view)

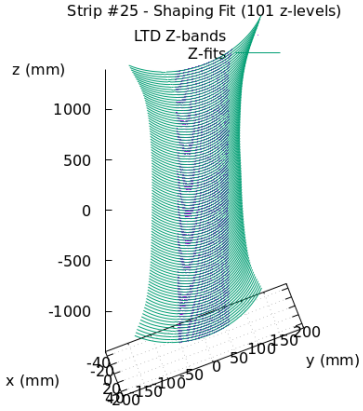


Strip 25

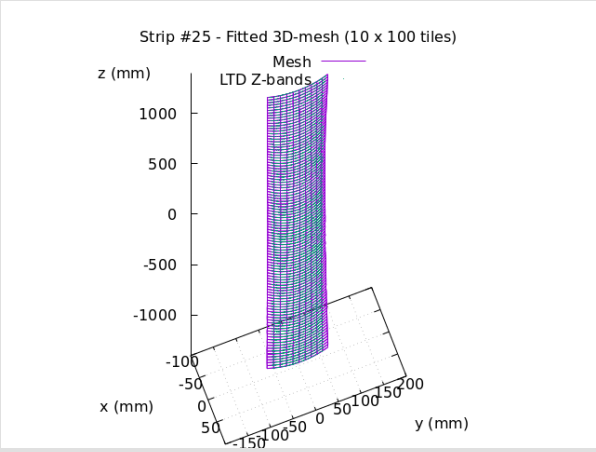
Fit report



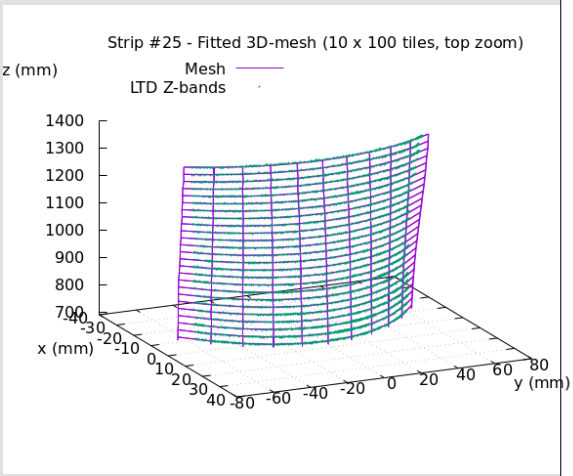
Fitting of Z-bands LTD



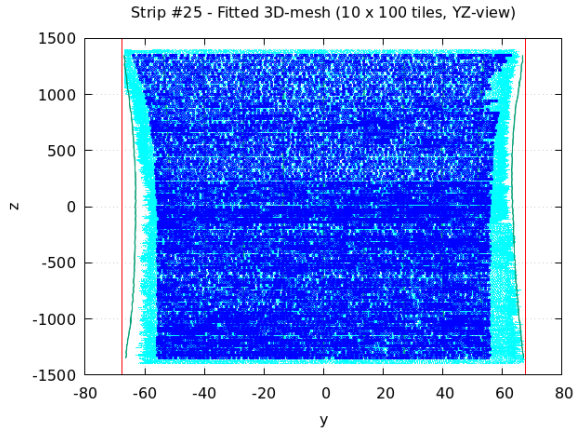
Generated 3D-mesh



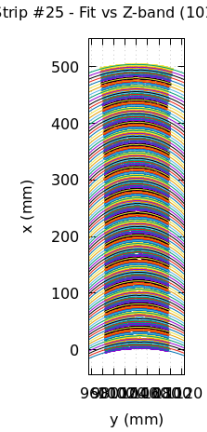
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

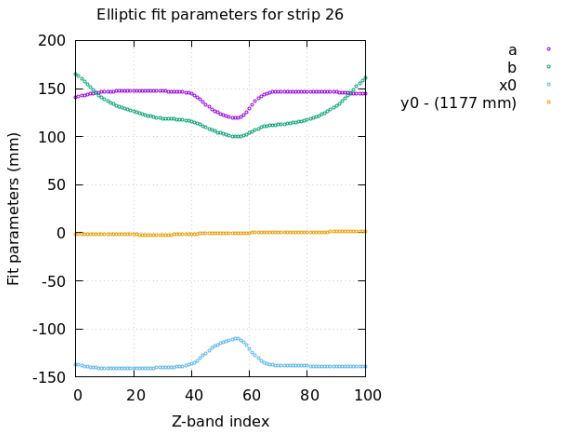


Fitting of Z-bands LTD (YX view)

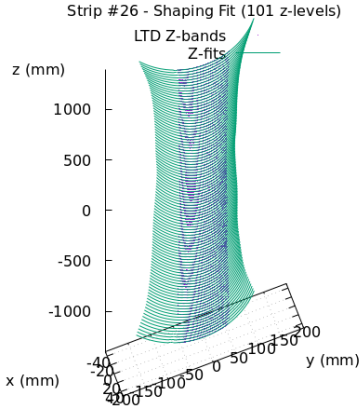


Strip 26

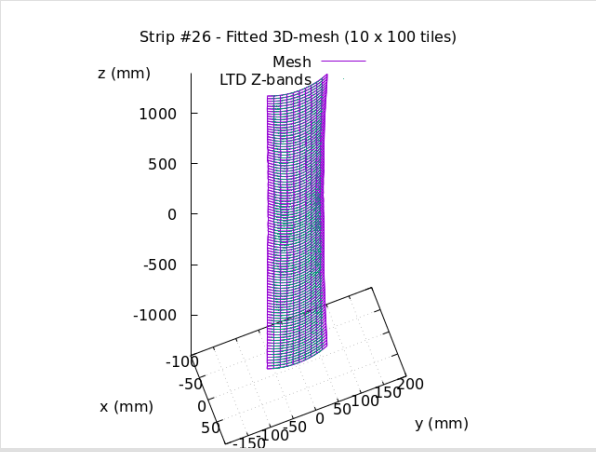
Fit report



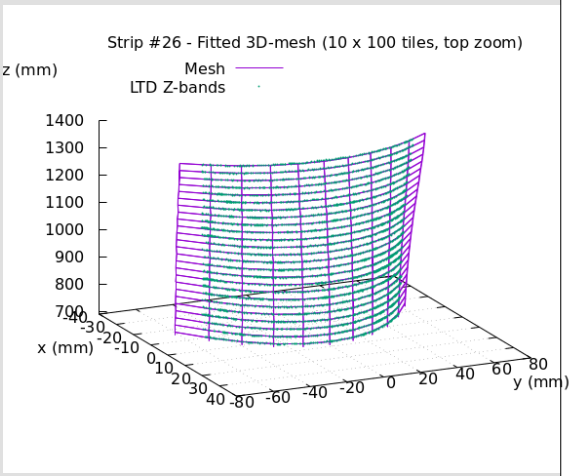
Fitting of Z-bands LTD



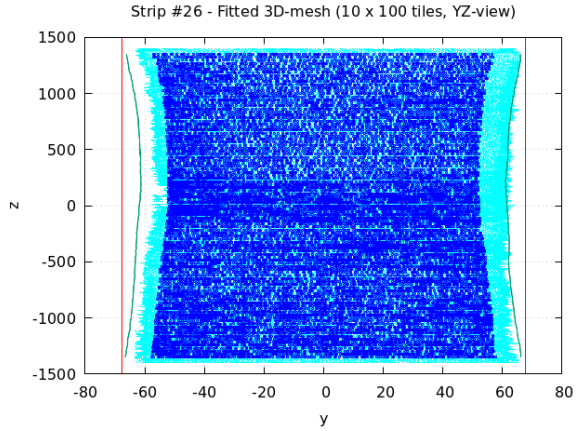
Generated 3D-mesh



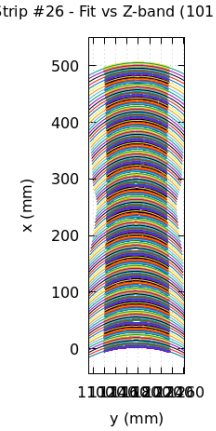
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

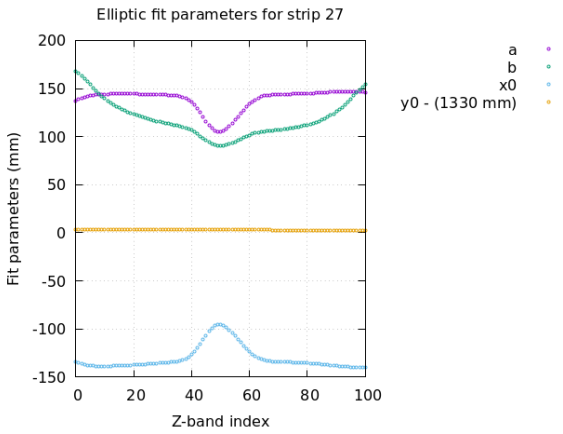


Fitting of Z-bands LTD (YX view)

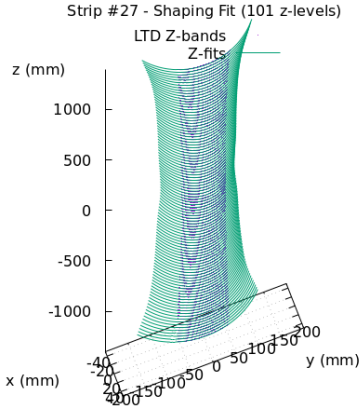


Strip 27

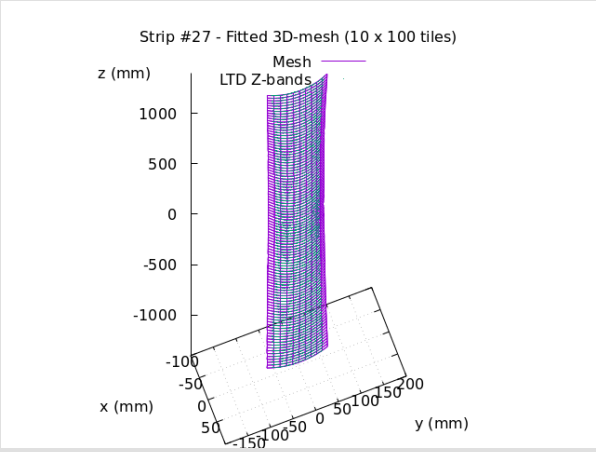
Fit report



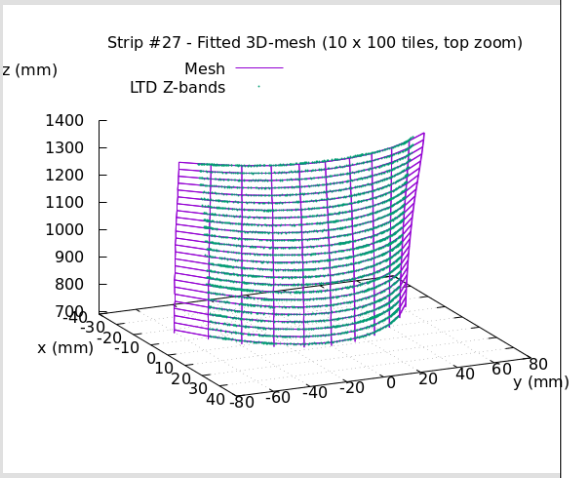
Fitting of Z-bands LTD



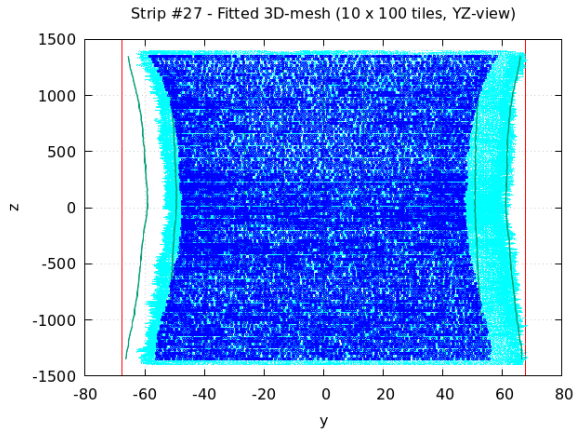
Generated 3D-mesh



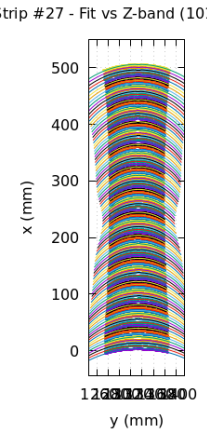
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

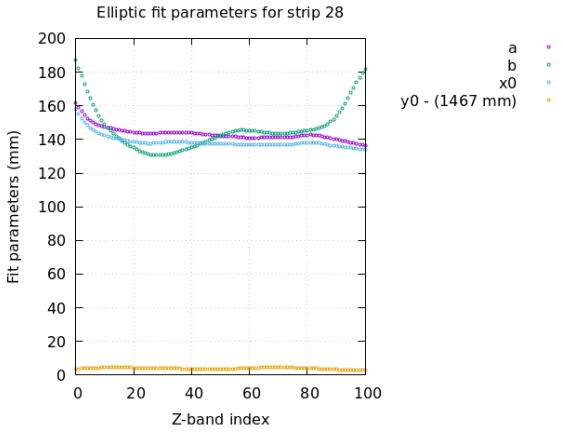


Fitting of Z-bands LTD (YX view)

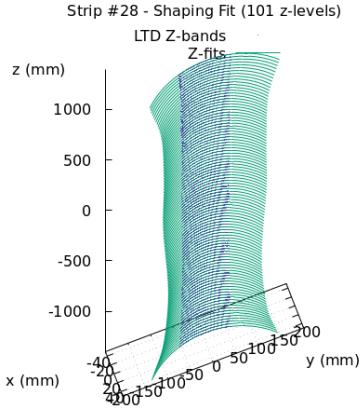


Strip 28

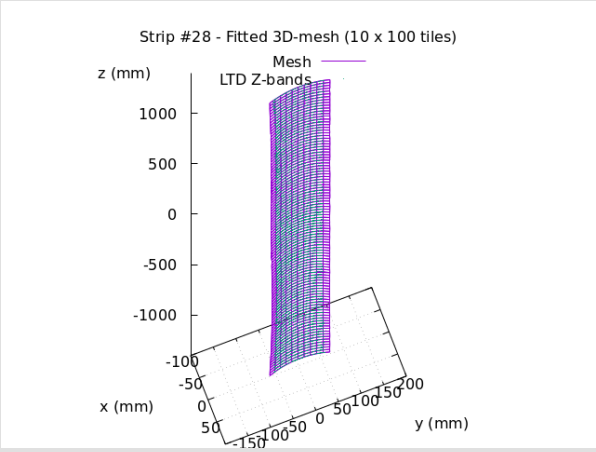
Fit report



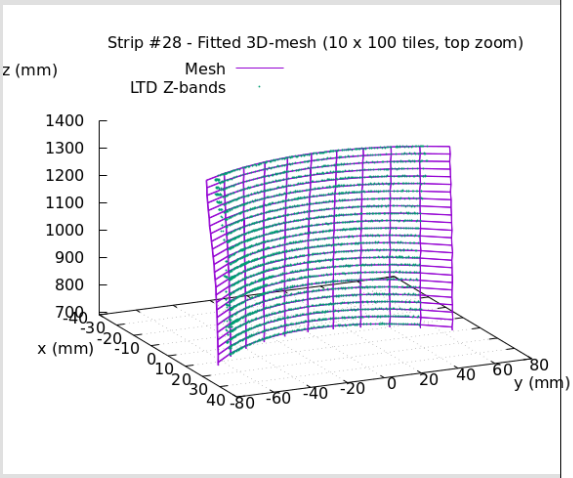
Fitting of Z-bands LTD



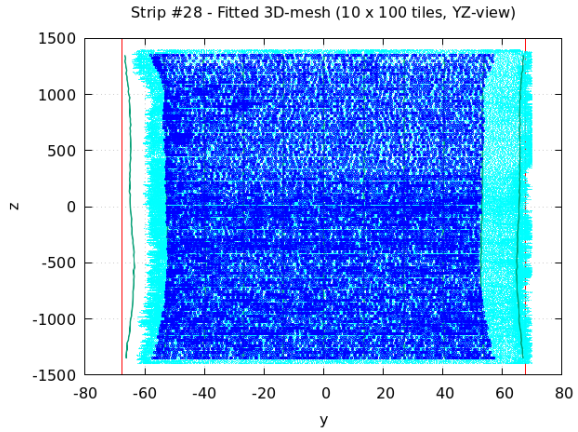
Generated 3D-mesh



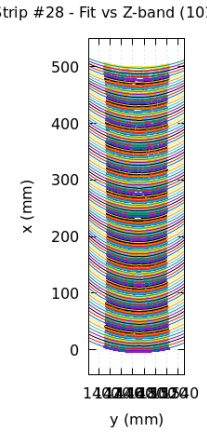
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

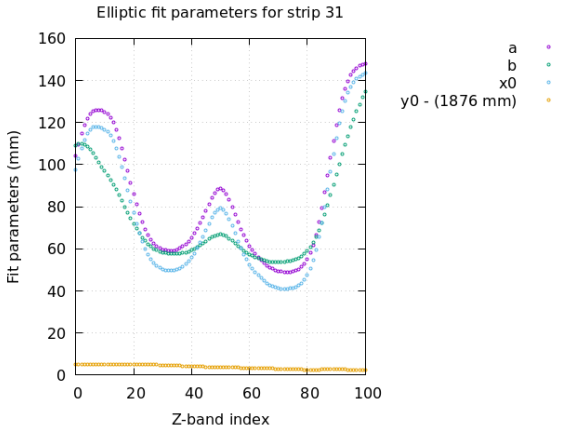


Fitting of Z-bands LTD (YX view)

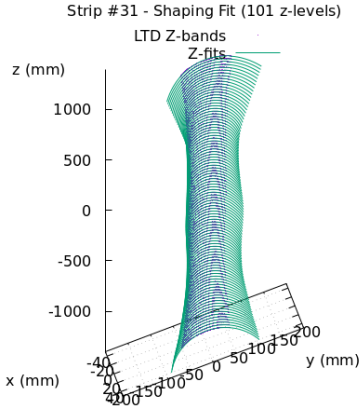


Strip 31

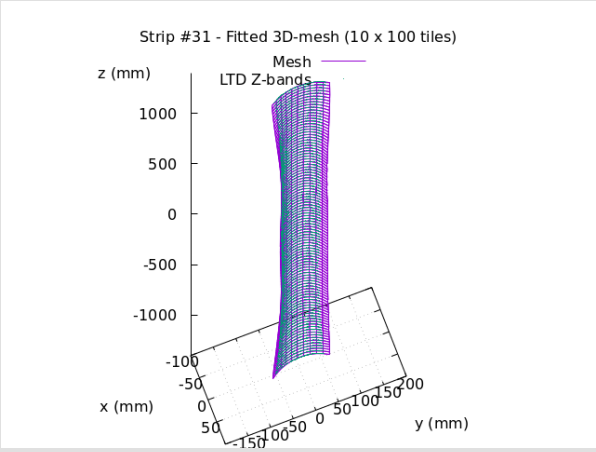
Fit report



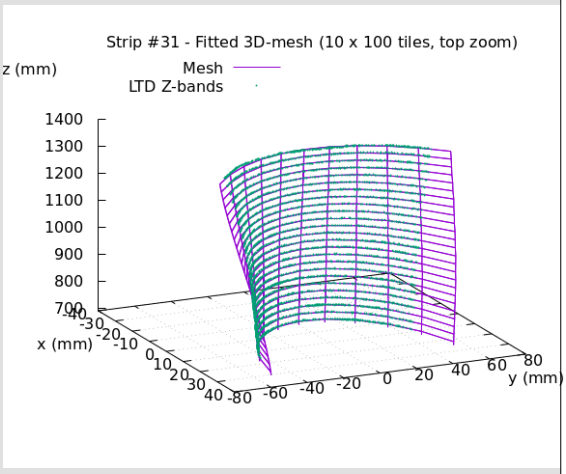
Fitting of Z-bands LTD



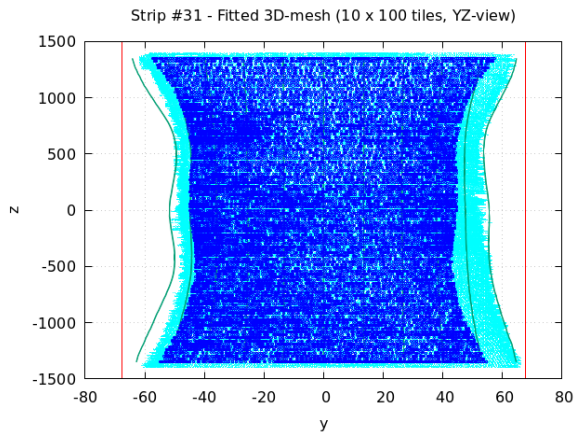
Generated 3D-mesh



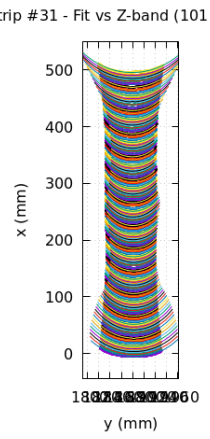
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

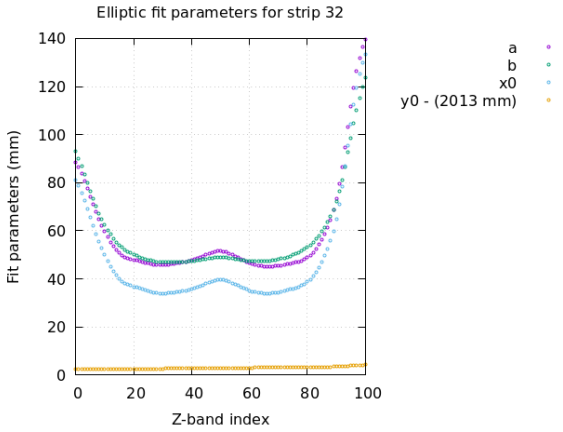


Fitting of Z-bands LTD (YX view)

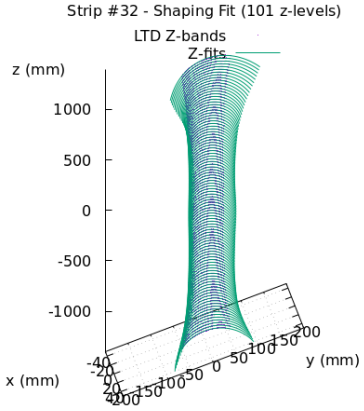


Strip 32

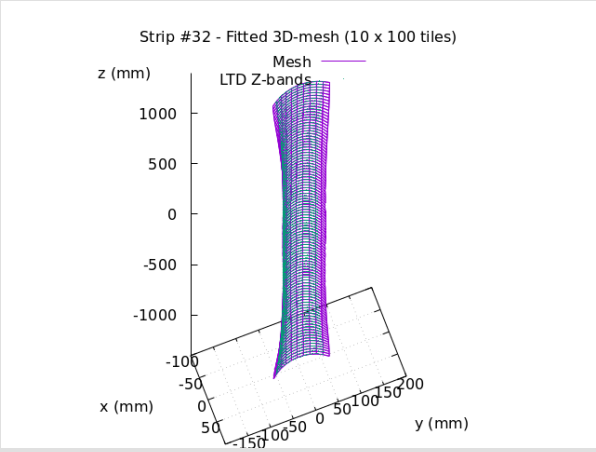
Fit report



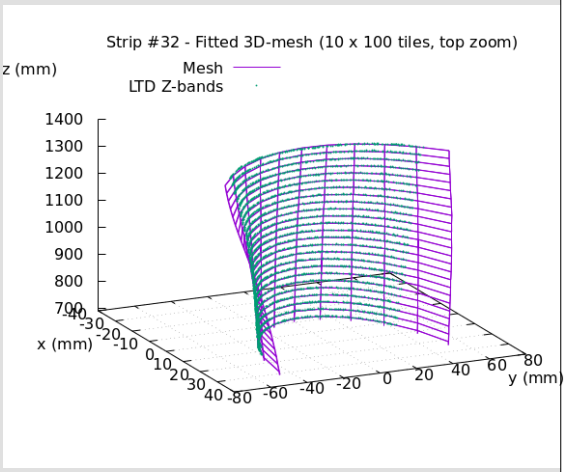
Fitting of Z-bands LTD



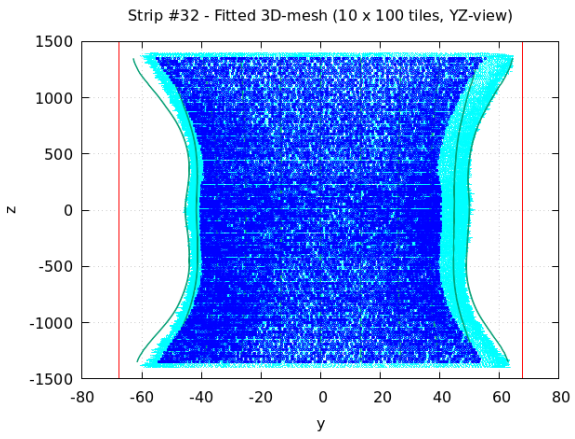
Generated 3D-mesh



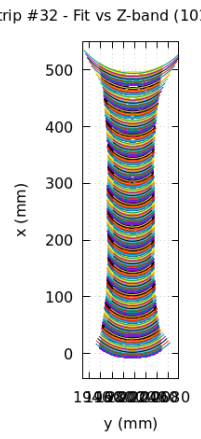
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

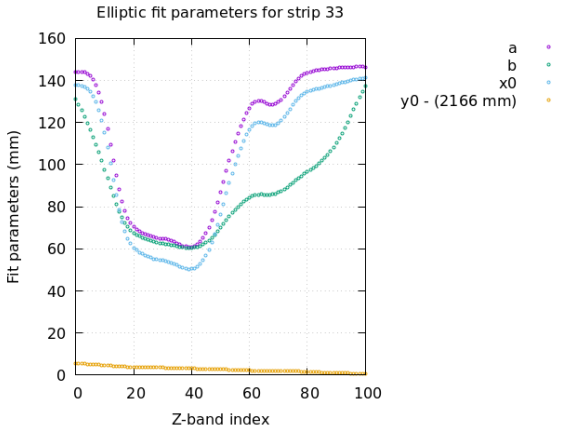


Fitting of Z-bands LTD (YX view)

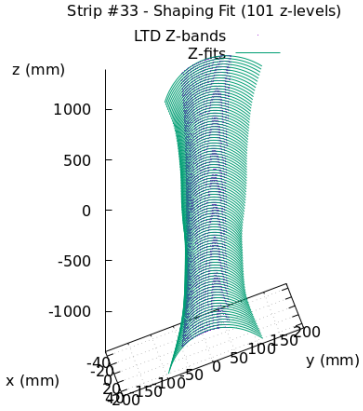


Strip 33

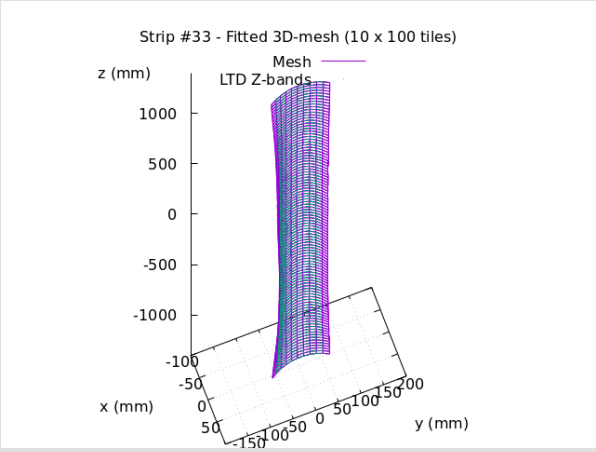
Fit report



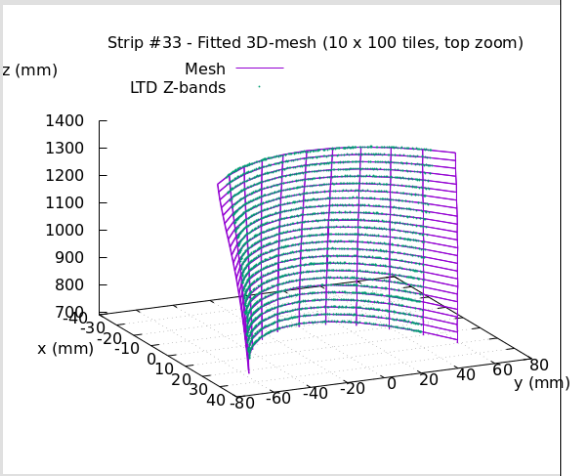
Fitting of Z-bands LTD



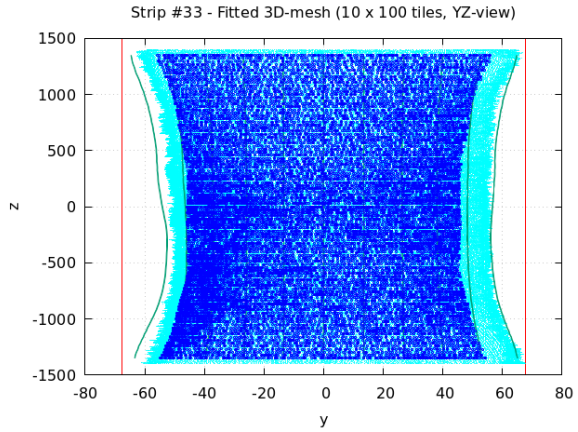
Generated 3D-mesh



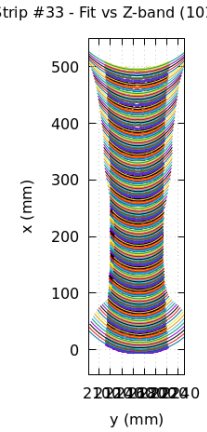
Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)

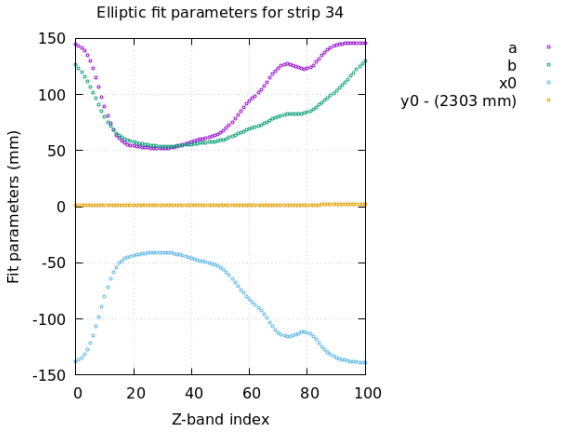


Fitting of Z-bands LTD (YX view)

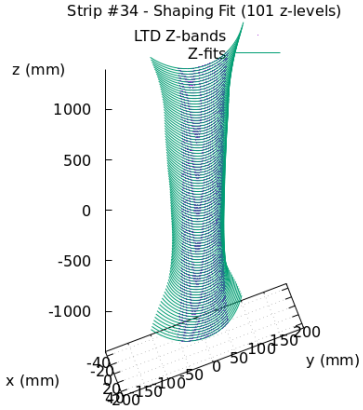


Strip 34

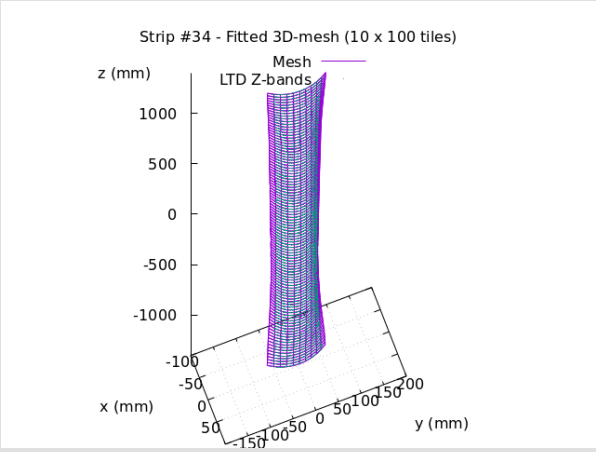
Fit report



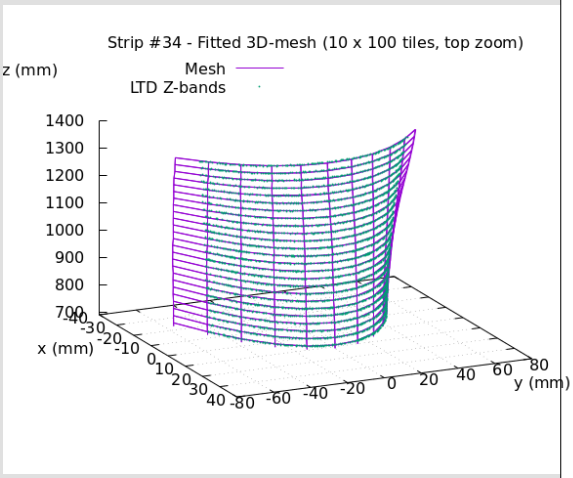
Fitting of Z-bands LTD



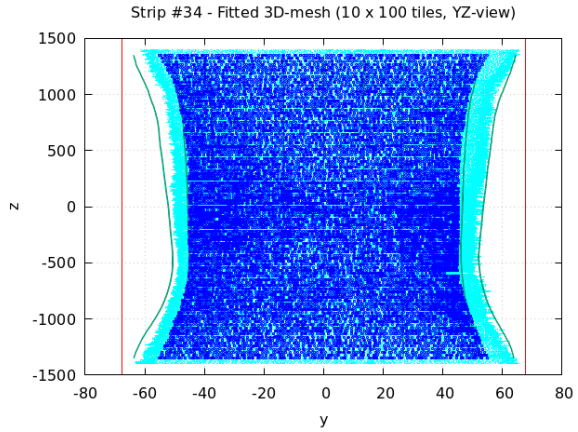
Generated 3D-mesh



Generated 3D-mesh (zoom at the top of the strip)



Generated 3D-mesh (YZ view)



Fitting of Z-bands LTD (YX view)