Grafica 3D per i beni culturali: Due esempi

Lezione 10: 13 Aprile 2012

Example 1: Larger than life

Portalada, monastery of Santa Maria De Ripoll, Spain
7 x 11 meters… to be scanned at 1mm resolution

Portalada de Ripoll

Romanic sculptured entrance of the Benedictinian monastery of Ripoll (Spain)
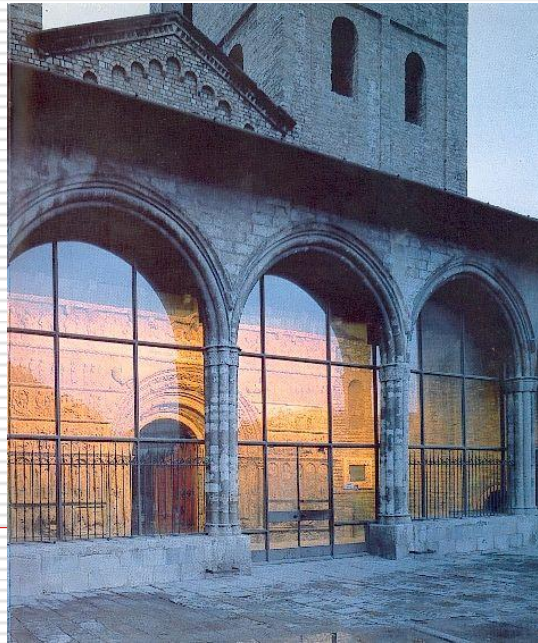Quite a large piece (7mx13m)
The museum needed a **millimetric** resolution for the entire surface

Joint project:
UPC
NMAC
CNR

A rigid substrate

Object is 70 square meters, scans are 30x30 cm
Object has no back-side → highly probable deformation

Solution: have a rigid reference of the entire object

2 scanning devices:
TOF scanning, lower resolution but intrinsically rigid
Triangulation scanning, higher resolution

Triangulation data aligned OVER the TOF model… no deformation and high resolution

MultiScale Acquisition

Triangulation
Minolta V910 (2x)
High resolution, small parcels

Time of Flight
Leica HDS3000
Low resolution, fullsize scans

MultiScale Processing

Range map alignment works well, but is impossible to guarantee a deformation-free result when the range maps are so small with respect to the object size (this is a scale-dependent problem)

Solution: use the precision of the triangulation range maps AND the rigidity of the TOF scan

Alignment between triangulation scans

Alignment towards rigid TOF data
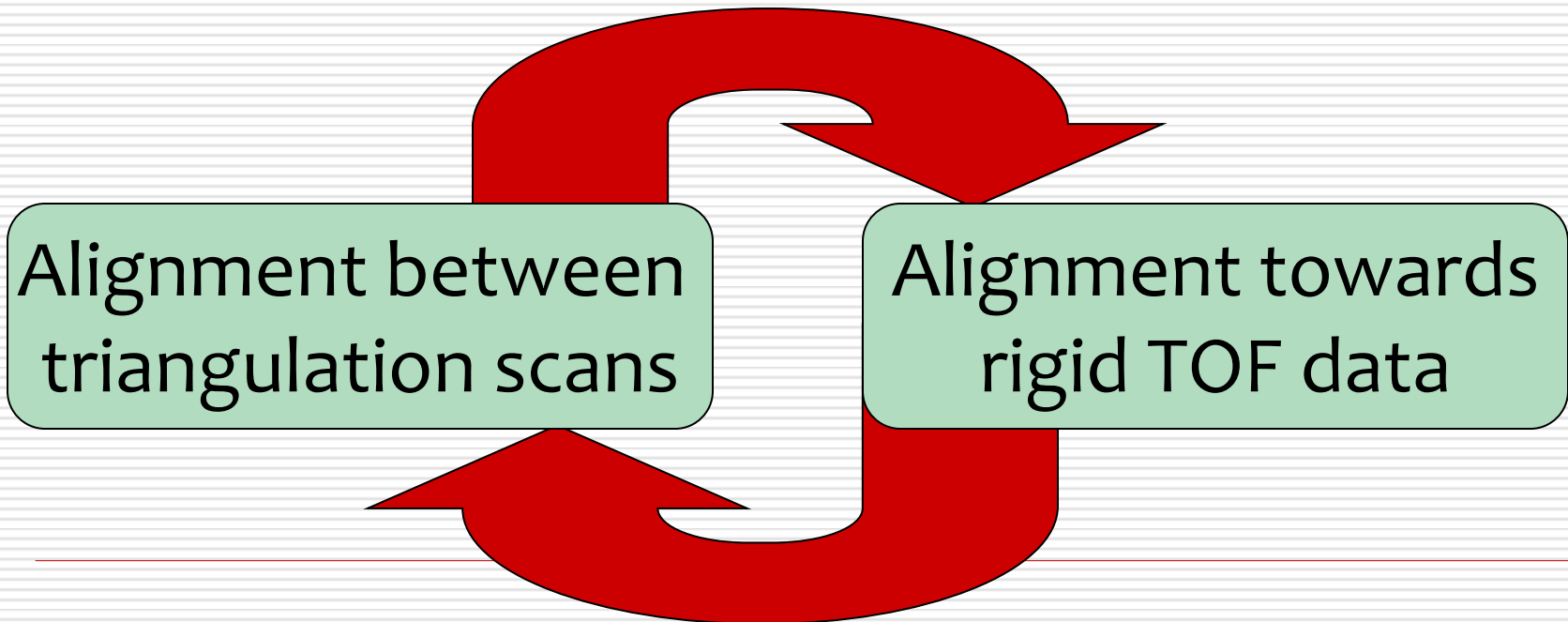
Integration of different data sources

- All sections (colored frames) of Minolta data aligned locally
- Then, each section aligned with the Leica full model

==> medium quality alignment

- Finally, refine global alignment between all Minolta range maps (from intermediate results)
- **Final reconstruction**: 170M tr, 26hours
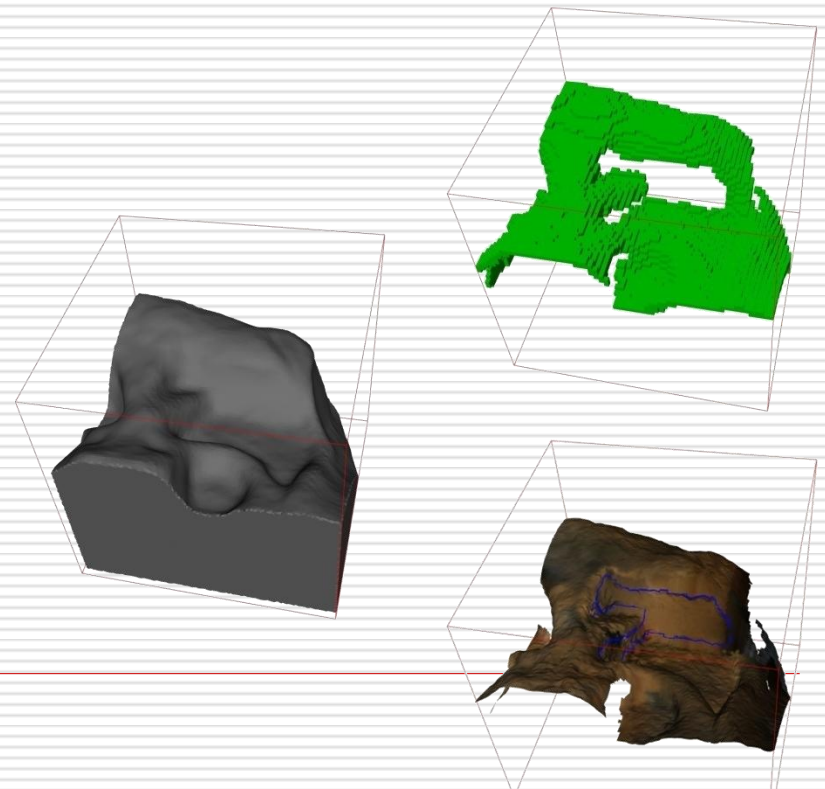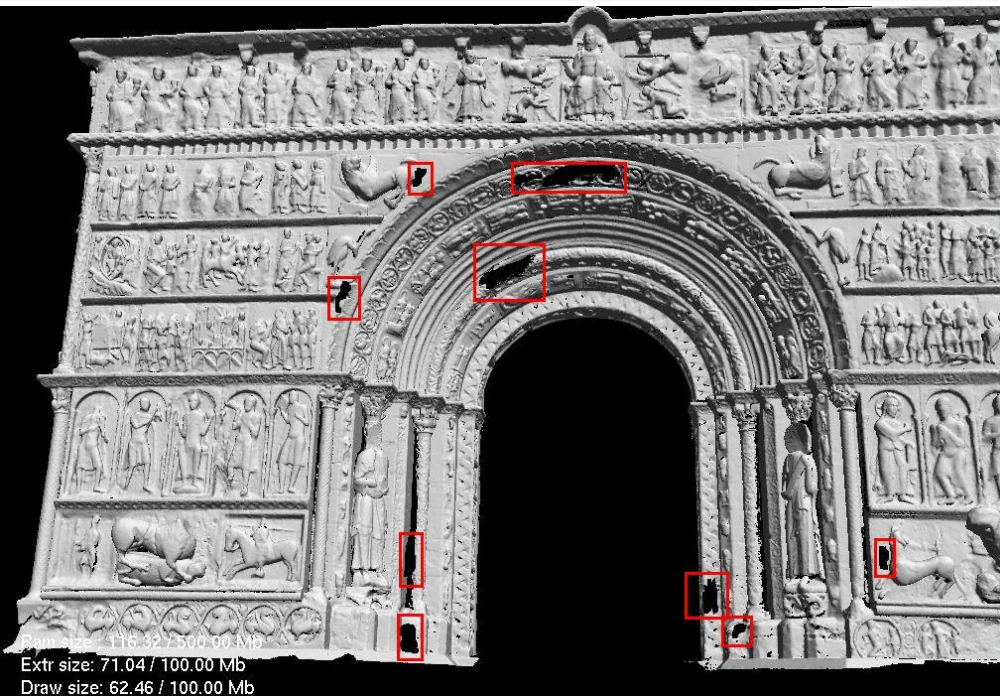
  + Color mapping (200 photos)

MultiScale Completion

TOF data has been used to fill unsampled areas in the triangulation dataset…

Remaining holes have then been filled working at different level of resolution, from low to high…

Results

The interactive kiosk

Results

The final 3D model

Portalada: lesson learned

- With a high quality planning, everything is possible.
- The integration of different technologies (with different accuracy) is possible, but you must be careful in handling data

Example 2: Support to restoration

Madonna of Pietranico, clay statue destroyed (again) by an earthquake.
19 fragments + several very small pieces

The Madonna project

The initial goal of the project was to:

- 3D Scan all the major fragments
- Obtain a virtual reconstruction of the original statue
- Study the original color

Scanning campaign:

- 19 fragments
- 15 to 70 range maps each
- Total N. of range maps: 580
- Voxel side merging: 0.3-0.5 mm
- Photographic campaign: nearly 500 images.

The Madonna project

The first goal was to "virtually reconstruct" the statue.

First idea: use images of the original statue and of the already found fragments combinations, find geometric alignment.

Result: FAILURE, due to difficult alignment and cracks surfaces.

Second idea: use 3D scans of already found fragments combinations, in order to obtain an initial position.
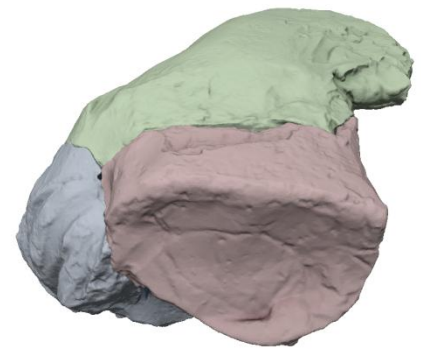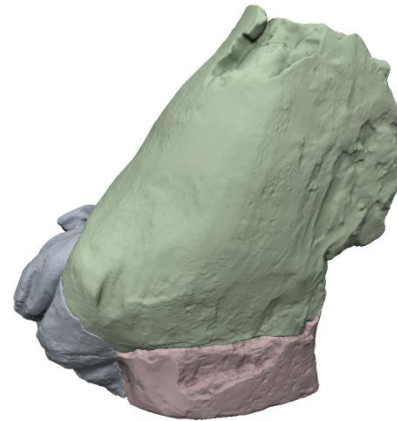
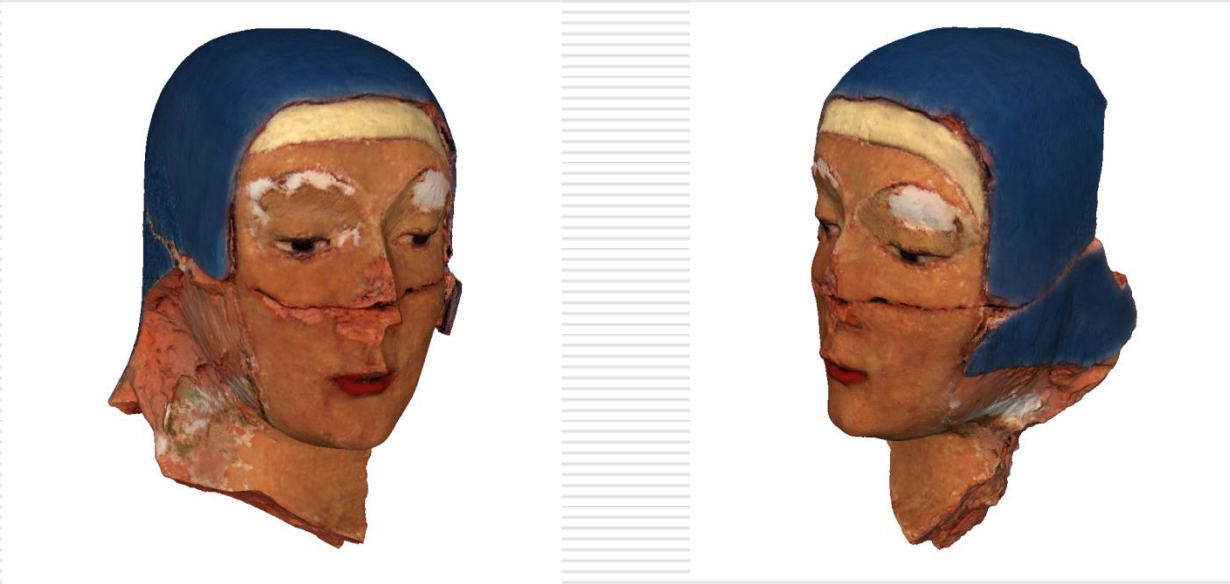Result: OK, and two more combinations found!

The Madonna project

Final result: a virtual reconstruction of the statue.

The Madonna project

The second goal was to work on the original painting of the statue. A first coloring was obtained using MeshLab.

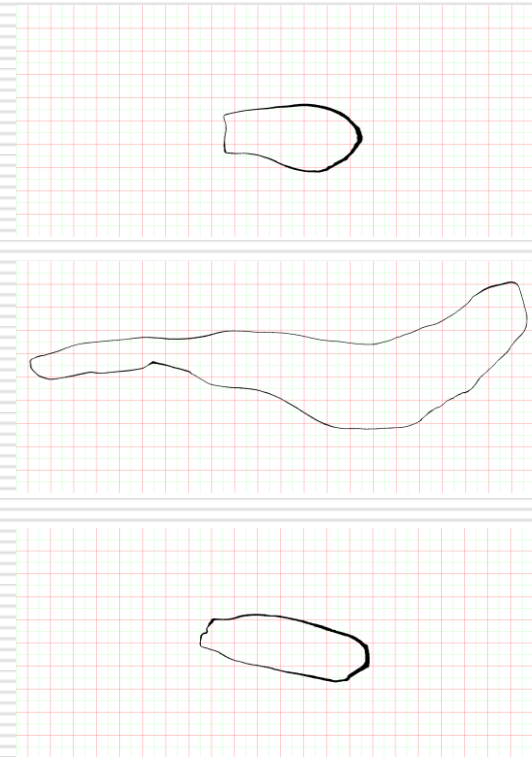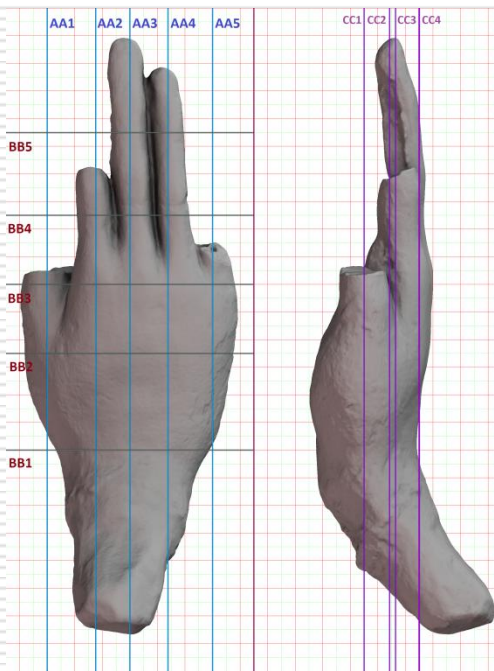Result: people afraid of wrong hypotheses!

The Madonna project

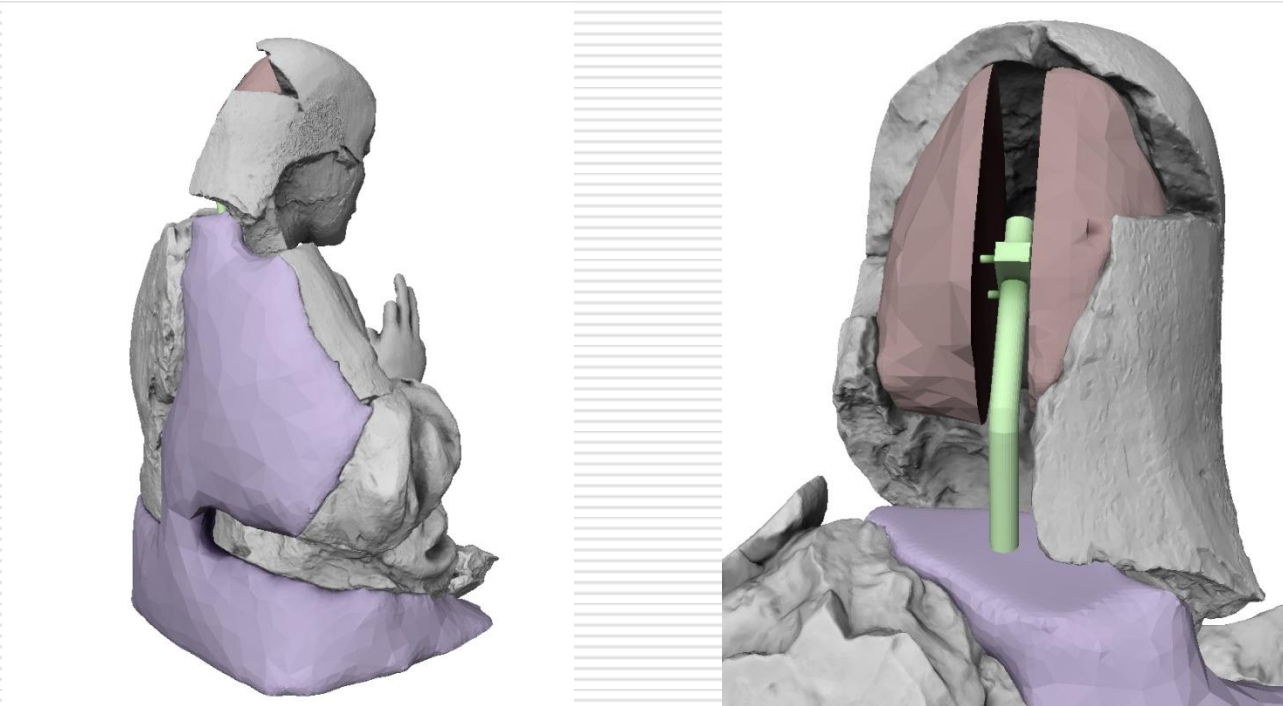But the most interesting stuff was obtained by supporting the work of restorers:

First: sections and ortho-views to reproduce symmetric stuff!

The Madonna project

But the most interesting stuff was obtained by supporting the work of restorers:

Second: designing the supports for physical reconstruction!

The Madonna project

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The Madonna project

But the most interesting stuff was obtained by supporting the work of restorers:

Second: designing the supports for physical reconstruction!

Madonna: lesson learned

- ☐ Also a typical, "boring" scanning campaign can become innovative
- ☐ Rapid prototyping must be part of restoration activity
- ☐ Finding a "common language" is the key

Next in line...

Next lesson:

- Dense Stereo Matching: theory

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