Quick museum artifacts digitization in 3D-ICONS

G. Guidi[1], S. Gonizzi Barsanti[1], L. Micoli[1], M. Russo[2]

Dept. of Mechanical Engineering, Politecnico di Milano, Milan, Italy

[2] *Dept. Design, Politecnico di Milano, Milan, Italy*

[gabiele.guidi, sara.gonizzi, laura.micoli, michele.russo]@polimi.it

DIGITAL HERITAGE
INTERNATIONAL CONGRESS 2013
28 Oct - 01 Nov. Marseille, France

3DICONS Project

- 3 years EU-ICT pilot project
- Aim: populating Europeana with 3D contents such as:
  - Sites
  - Architectures
  - Monuments
  - Artifacts

  Including UNESCO World Heritage sites

http://3dicons-project.eu/eng

3DICONS Project

For reaching the **goal** of 3D-ICONS

two main actions are needed:

Massive acquisition of shapes and colors of the selected artifacts (**2D/3D data)**

Definition of their associated descriptions (**metadata**)

Our Repository of Archeological Icons

The Archaeological Museum in Milan is settled upon a complex historical stratification of archeological ruins, tangible sign of the ancient role of Milan as Capital of the Western Roman Empire.

The Museum contains a relevant collection of **more than 1000 archaeological** epigraphs, statues, mosaics, furniture and potteries, related to Greek, Etruscan, Roman and Medieval historical periods.

Almost all metadata are already existing!!

Data collection

- Need to produce a huge amount of models in a quite short period
- Decided to use mainly photogrammetry:

- texturized mesh model has been demonstrated to be far more time consuming with active devices rather than with image-based techniques;
- some CH materials resulted less optically cooperative with laser than with digital photography.

- Use of triangulation laser scanner for untexturized small objects
- Use of TOF laser scanner for structures

Metadata collection

Regarding the objects metadata, the POLIMI's research team is using the **SIRBeC** (Information System of Cultural Heritage of the Lombardia Region) data sheets, which permits to export all the information needed in **.xml format**.

First pre-selection [objects value]

Starting from a large set of **SIRBeC records,** 600 artifacts has been chosen considering **the intrinsic and extrinsic value**, in cooperation with the Museum Director.

Second selection [objects survey]

A second selection (472 artifacts) was carried out considering their geometry, the optical surface cooperation and their accessibility.

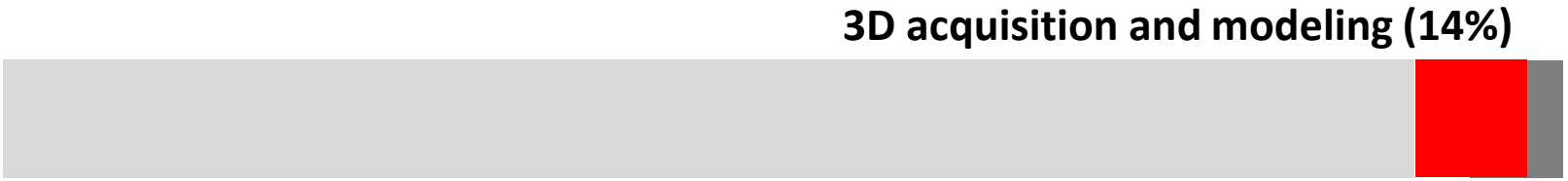
Role of metadata in CH acquisition

- **Skills demand**

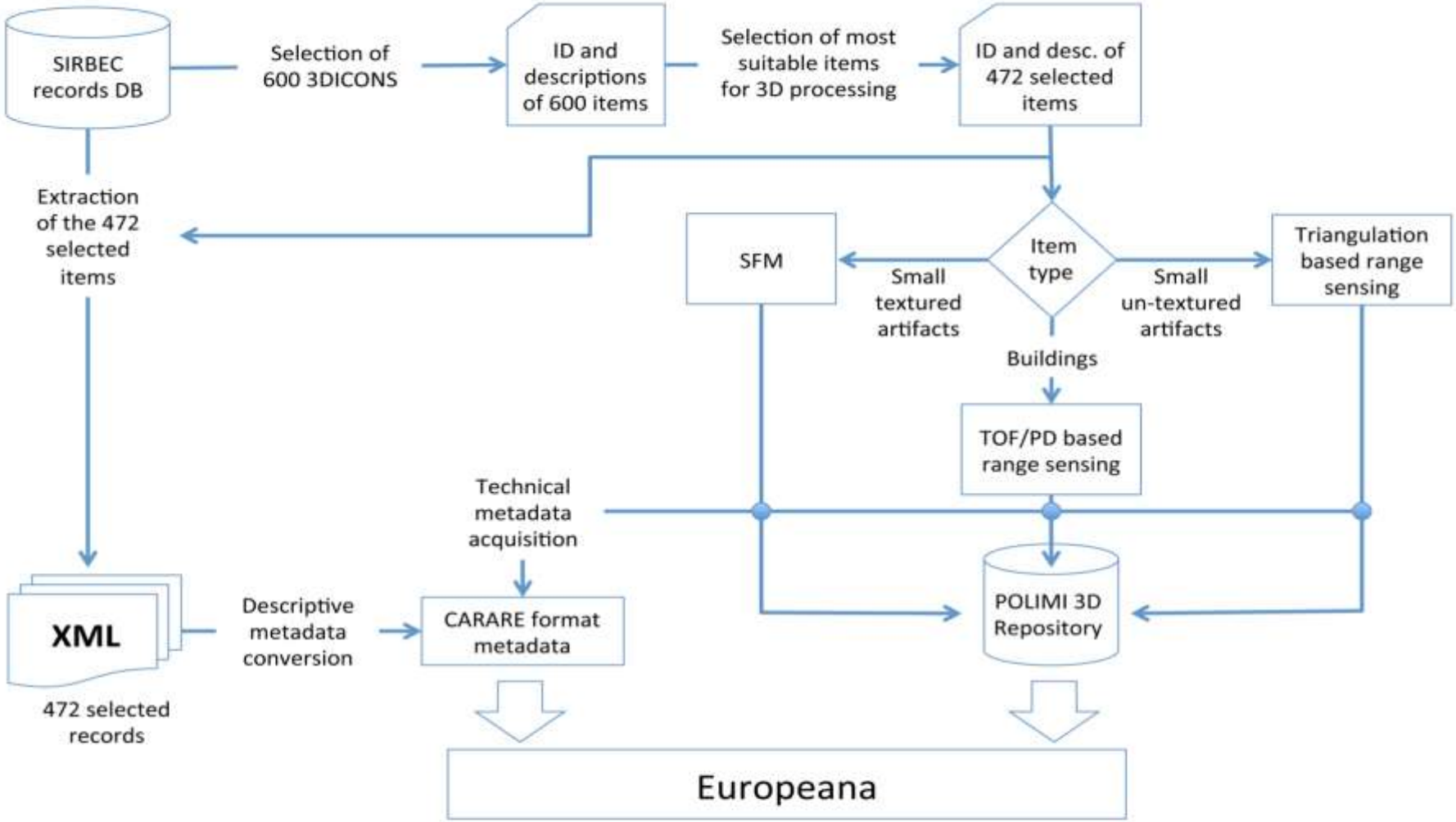
  The complex articulation of data tree in metadata compilation requires a high level of expertise in that field.

- **Time consuming process**

  Timeline of a research group as POLIMI with solid expertise in 3D acquisition but rather less used in cataloguing CH items.



Data collection workflow



3D data collection

Image-based modelling

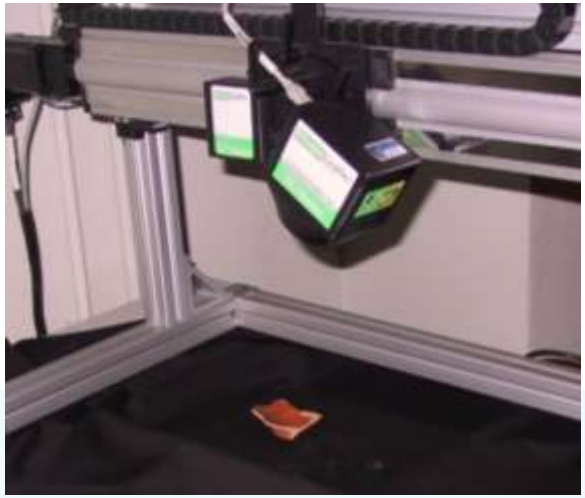
Small texturized objects

(77%)

triangulation-based systems

Small un-texturized objects

(14%)



TOF system

Buildings

(9%)

Data processing

- We decided to use Agisoft Photoscan: at mesh generation stage permits to decide the accuracy and the polygon number of the final 3D model; implements image orientation and mesh generation through SfM and dense multi-view stereo-matching algorithms (Exact, Smooth, Height Field and Fast).
- SfM is nearly a "black box“: output with little of no way of intervention on the final output
- the only input are good quality images

↳ *we need an optimized image acquisition protocol in order to maximize the quality of the 3D output*

Possible imaging problems

- Image blurring due to
  - Movement on shooting
  - Wrong focusing
  - Limited Depth of Field
- Lighting/dynamic range
  - Backlights/mixed color temp.
  - Light spots
  - Highlights
- Confusing scene elements
  - Painted walls/mosaics
  - High contrast elements around the subject

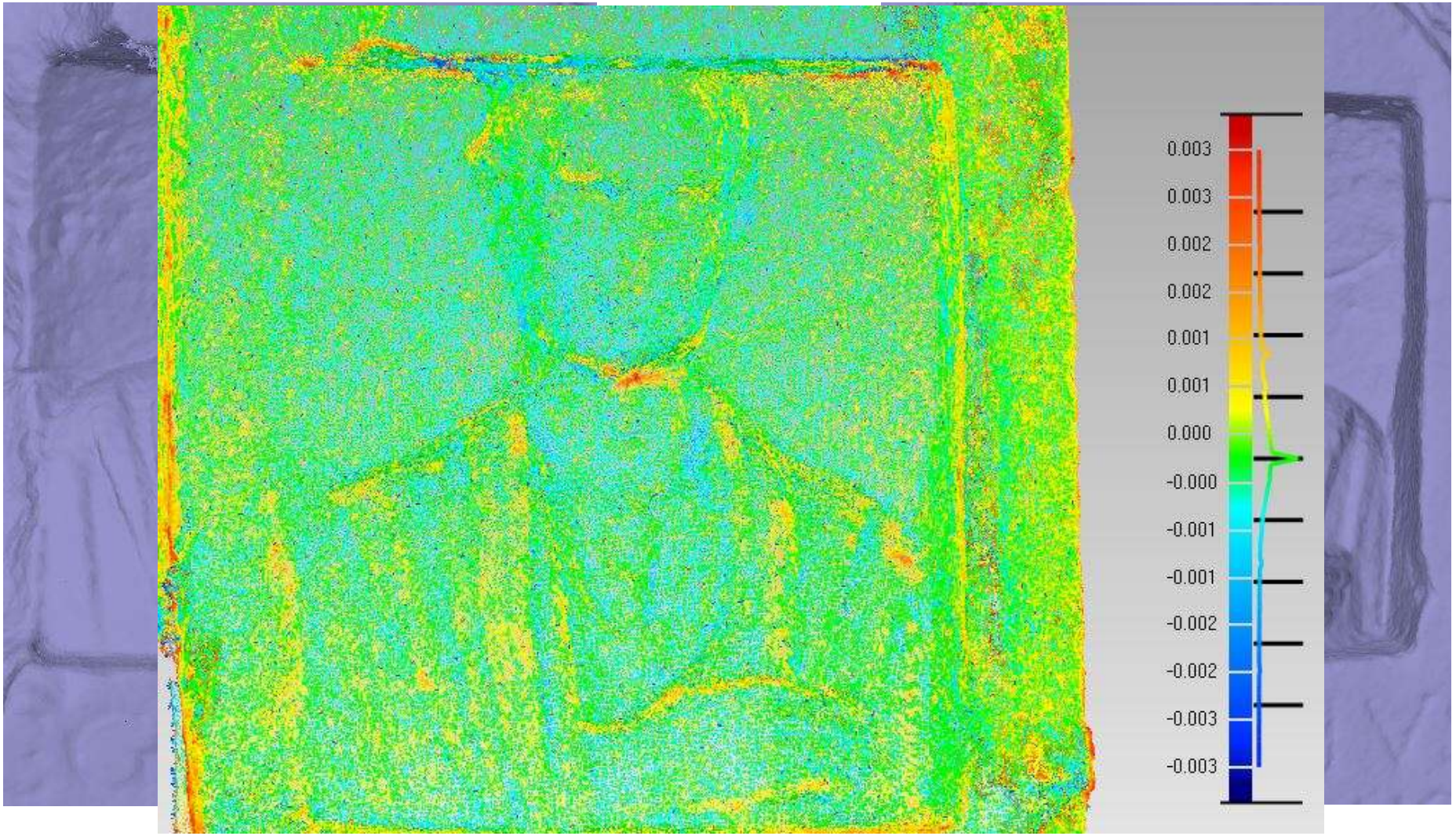
First test

- GSD of 0.3 mm at 2.3 m distance

- "Geometry type" = Sharp,
- "Target quality"= Medium,
- "Face count" = 2 million.

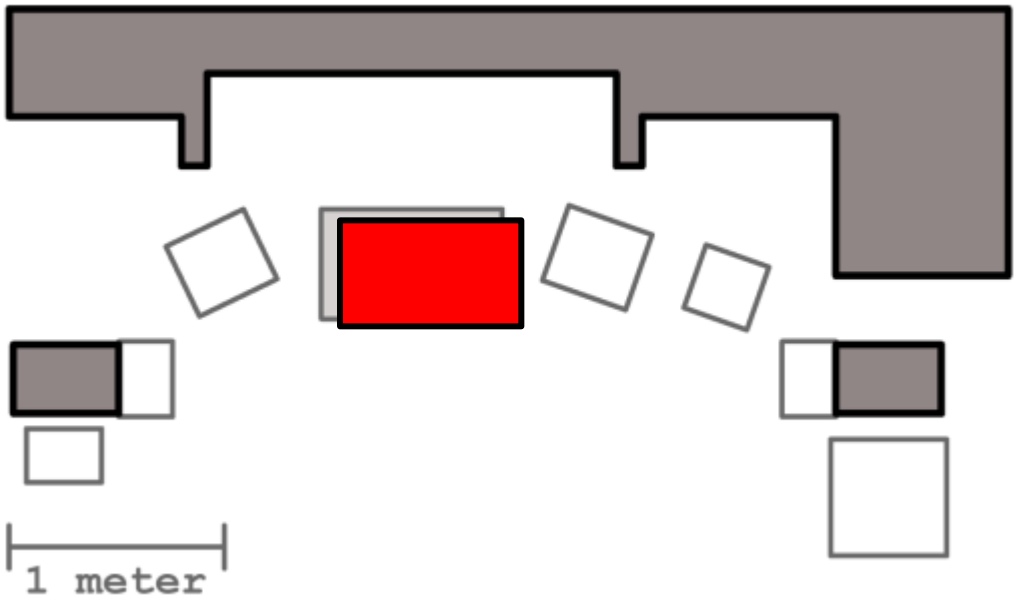
- "Geometry type"= Smooth
- all other parameters unchanged

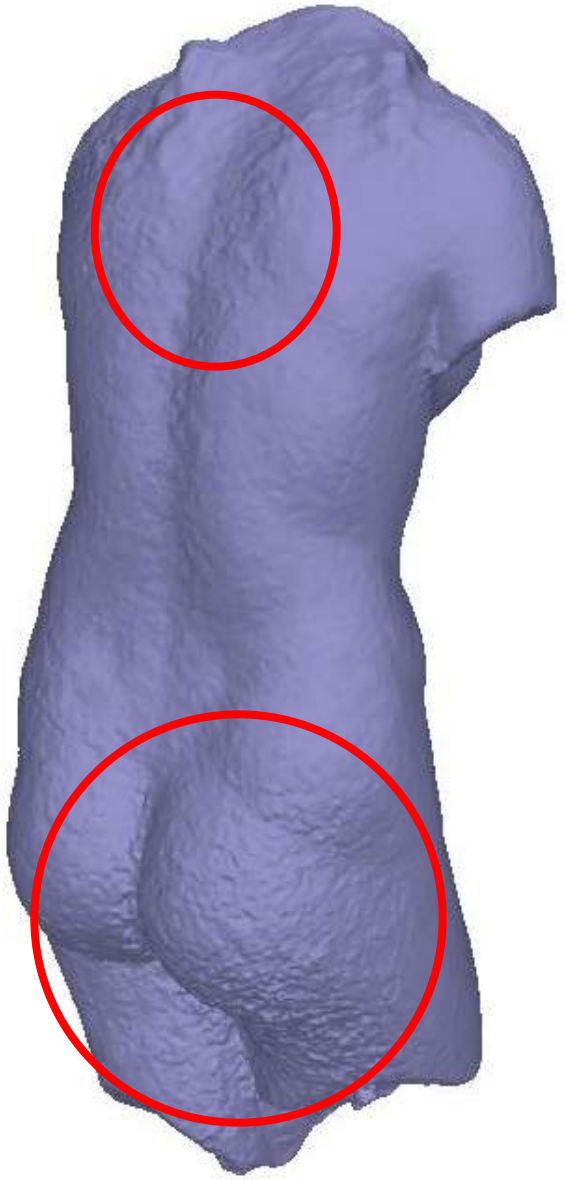
- The sharp geometry type generated a 3D model full of topologic anomalies → long and complex post-processing
- "Geometry type" = Smooth → all these anomalies were reduced.


0.003
0.003
0.002
0.002
0.001
0.001
0.000
-0.000
-0.001
-0.001
-0.002
-0.002
-0.003
-0.003

Second test

- Canon 20D + 20 mm lens (32 mm on a full frame camera)
- framed area at 1 m average distance 70x 46 cm
- GSD of 0.25 mm





Conclusion

A preliminary cataloguing workflow of Cultural Heritage assets was suggested to

i) allow a **selection** and **organization** for 3D acquisition of massive data;

ii) create a **check list** for **monitoring** the digitization progress;

iii) easily **collect** data records as descriptive metadata to be used towards Europeana;

iv) reduce the **operating time** with massive 3D acquisitions, like 3D-ICONS project.

Conclusion-Good practices adopted

Issues

- Image blurring due to
  - Movement on shooting
  - Wrong focusing
  - Limited Depth of Field
- Lighting/dynamic range
  - Backlights/mixed color temp.
  - Light spots
  - Highlights
- Confusing scene elements
  - Painted walls/mosaics
  - High contrast elements around the subject

Shooting/pre-processing solutions

- Tripod
- Manual focusing @ 10x
- Small apertures (16-32)

- Light shielding panels
- Mask post processing

- Black/white background
  - hides confusing elements
  - speeds up masking


INVICT
PATRIO
VIB·GAIANV
PRAEFVEI

THANK YOU!