Data Provenance in Photogrammetry Through Documentation Protocols

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Initial Training Network for Digital Cultural Heritage
ITN DCH
MARIE CURIE ACTIONS
Ministère Culture Communication
UMR 3495
map
cnrs

Diego Bellido

ArcTron 3D
Expertise in Three Dimensions

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FONDAZIONE
BRUNO KESSLER

MARIE CURIE ACTIONS

Data Provenance

"a record that describes entities and processes involved in producing and delivering or otherwise influencing that resource"

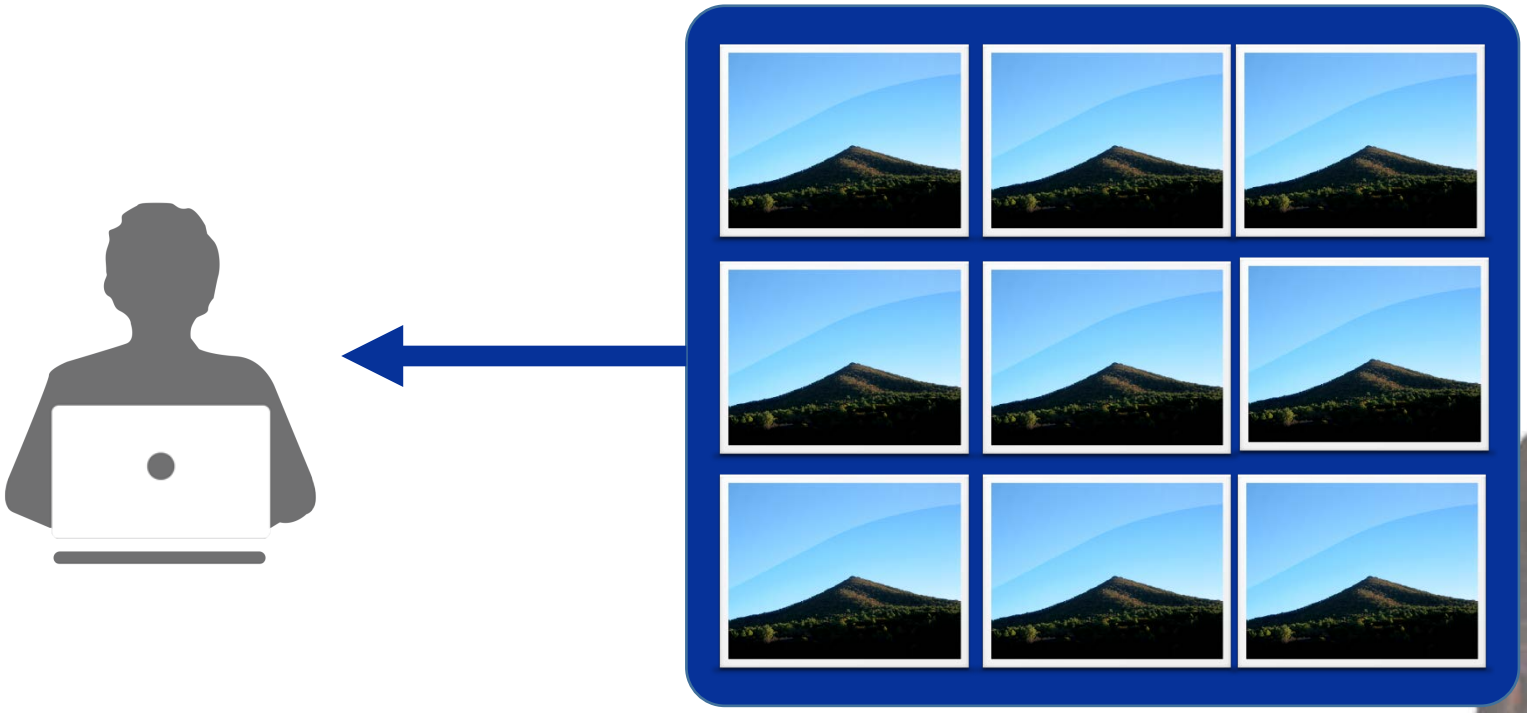
London Charter

"While computer-based visualisation methods are now employed in a wide range of contexts to assist in the research, communication and preservation of cultural heritage, a set of principles is needed that will ensure that digital heritage visualisation is, and is seen to be, at least as intellectually and technically rigorous as longer established cultural heritage research and communication methods."

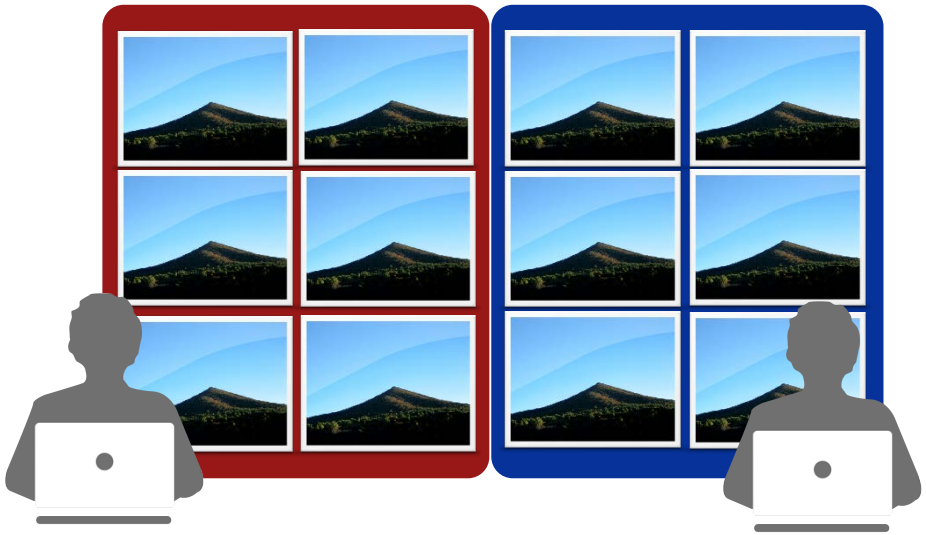
Provenance

- Agent-centered provenance
- Object-centered provenance
- Process-centered provenance

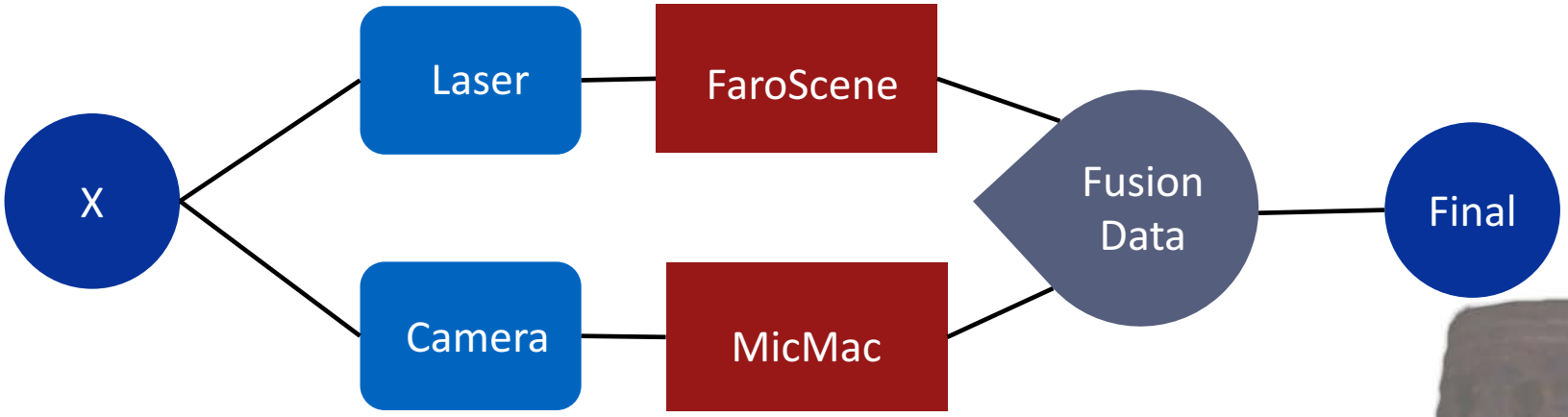
Agent-centered provenance



Object-centered provenance



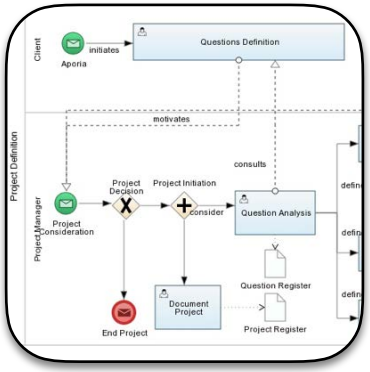
Process-centered provenance

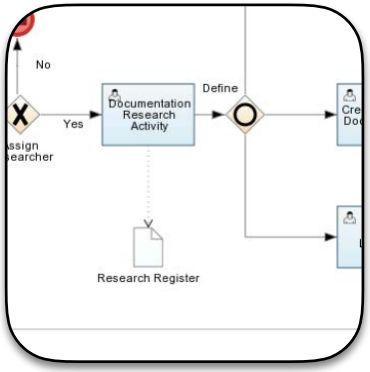


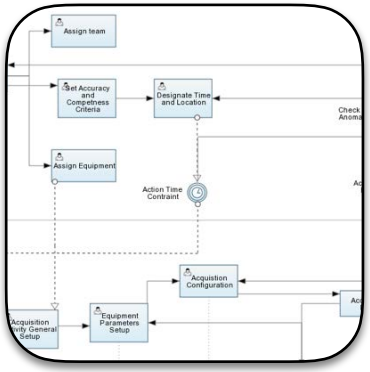
LITERATURE

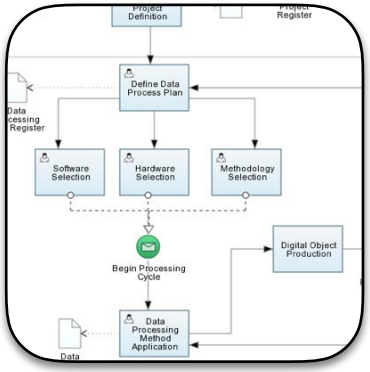
- TAPEnADe (**T**ools and **A**cquisition **P**rotocols for **En**hancing **A**rtifacts **D**ocum**e**ntation)
- CARARE
- STARC Metadata Schema

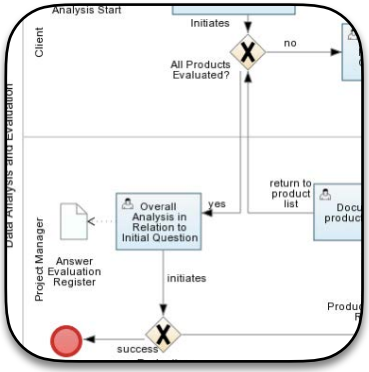
Business Process Modelling Notation

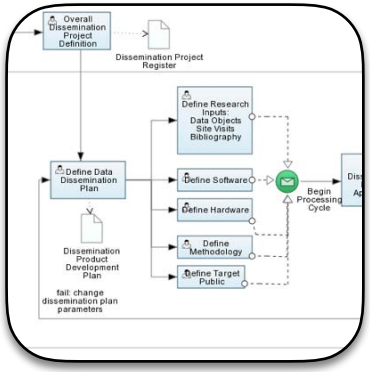


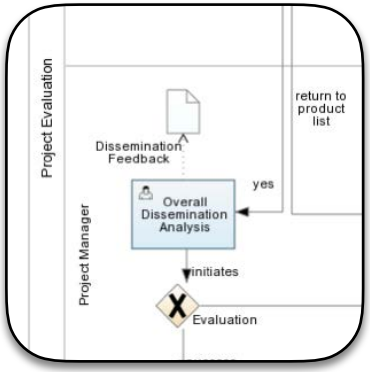




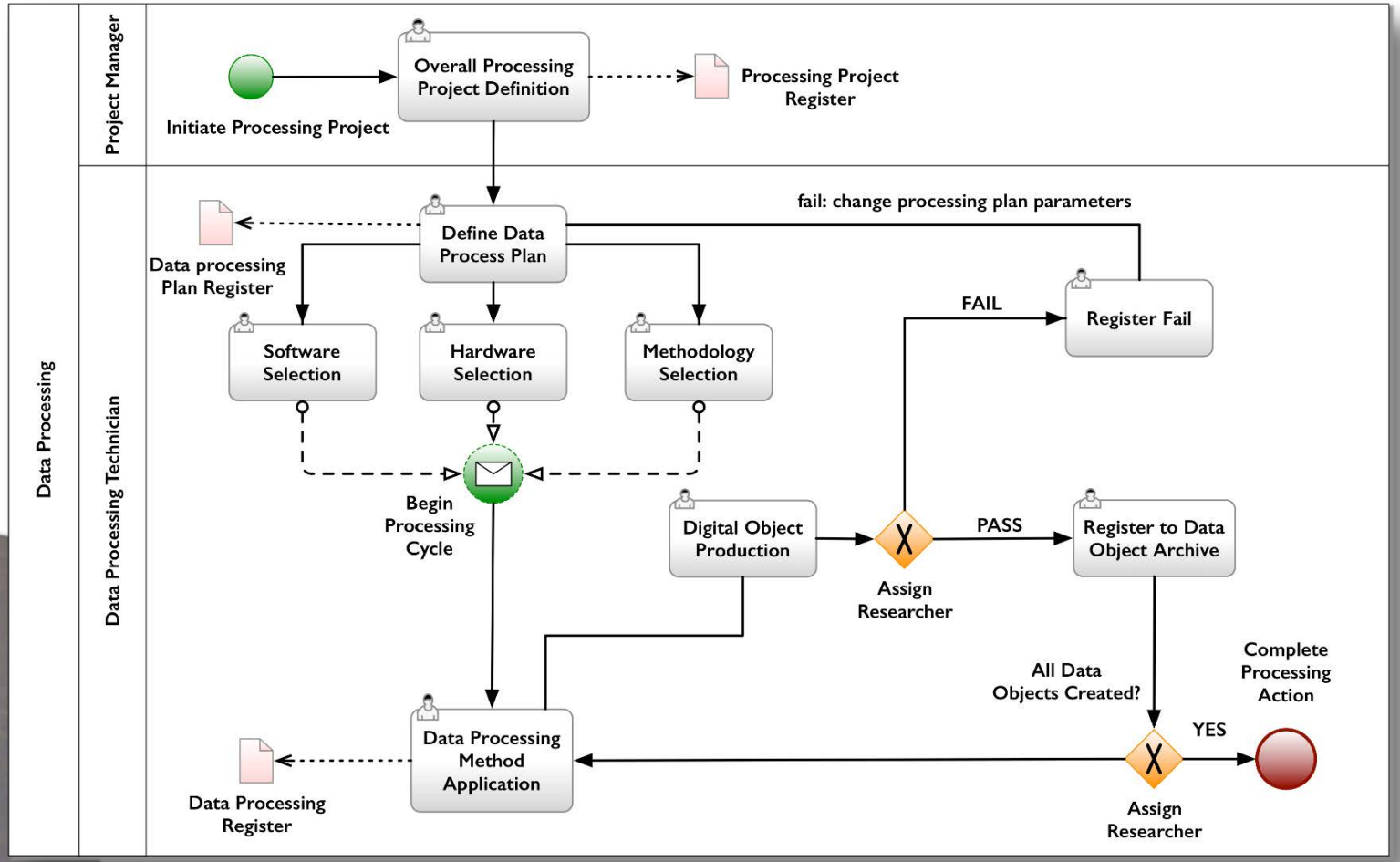








Business Process Modelling Notation

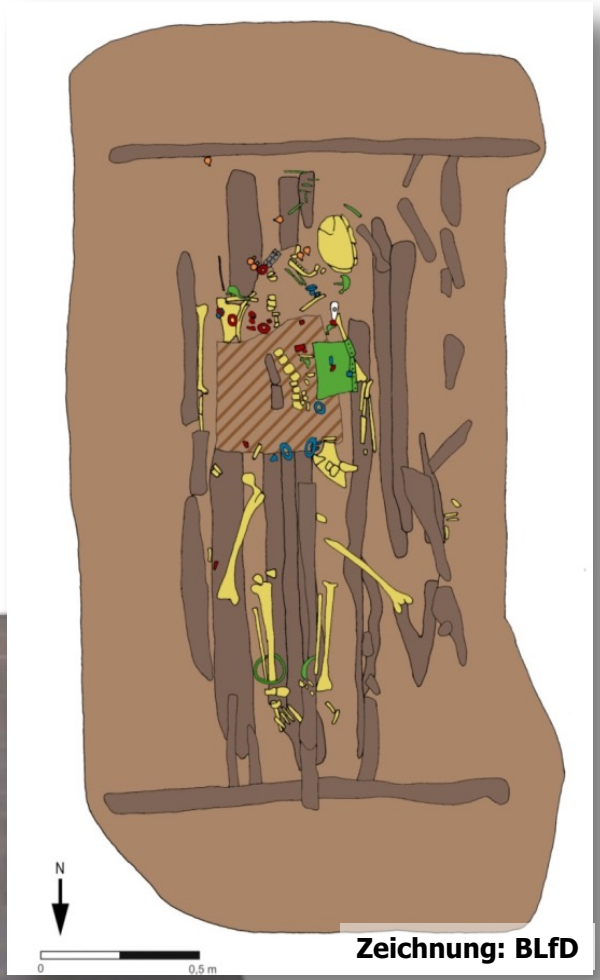


Steps

Step 1: Project Definition	Step 2: Preliminary Studies	Step 3: Data Acquisition	Step 4: Data Processing	Step 5: Analysis	Step 6: Dissemination	Step 7: Delivery
Central Register - Project - Question	Central Register - Research - Site Visit - Bibliography	Central Register - Acquisition Project - Acquisition Activity - Equipment Setup Parameters - Object Acquisition Configuration	Central Register - Processing project - Processing Plan - Data processing	Central Register - Product Evaluation - Answer Evaluation - Evaluation egister	Central Register - Dissemination Project - Product Development plan - Dissemination product development plan	Central Register - Client individual product feedback - Dissemination feedback

Ilmendorf & Buonconsiglio

Ilmendorf

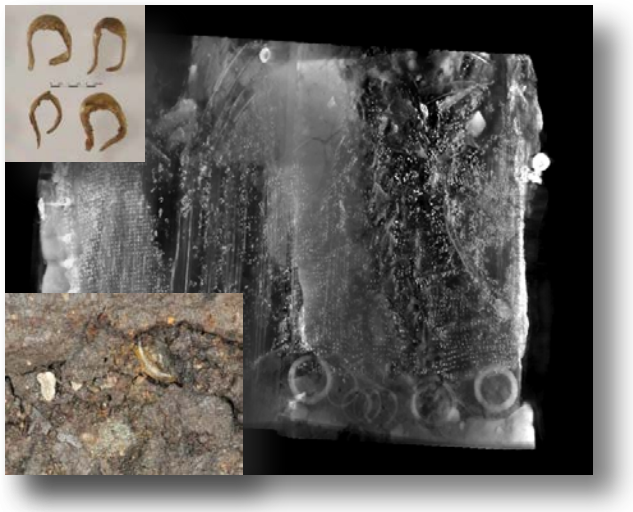


Hallstatt is a pre-Roman period from the 8th to 6th centuries BC during which the Hallstatt culture dominated Central Europe north of the Alps. In Illmendorf, a Bavarian village 80km north of Munich, women tombs has been discovered out of a mine. The excavation was done by the firm KANT, Ingolstadt (Germany). Two blocks has been rescued. The Computed Tomography (CT) analysis done by Britt Nowak-Böck from the Bayerisches Landesamt für Denkmalpflege (BLfD) has shown some exciting elements: bronze belt, bronze pins, glass rings, etc. Since then, the Archäologische Staatssammlung München has been in charge of the uncovering and the conservation of the blocks.

Ilmendorf

- The excavation was done by the firm KANT, Ingolstadt (Germany).
- The Archäologische Staatssammlung München has been in charge of the uncovering and the conservation of the blocks, the conservation of the small findings as well as the complete interpretation and analysis of the archaeological site.

- The small findings were spread through the grave and they form an unique collection of more than 80 small pieces: bronze belt, bronze pins, glass rings, etc.
- The two blocks were excavated in the lab. They were formed mainly for the pelvis and different textile and bronze and gold components around it.



Object FZ_03

Object FZ_03

- Bernstein perle / Amber tower

Central Repository

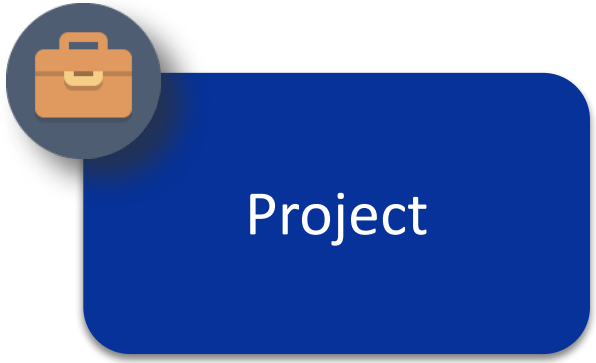
Actor

Object

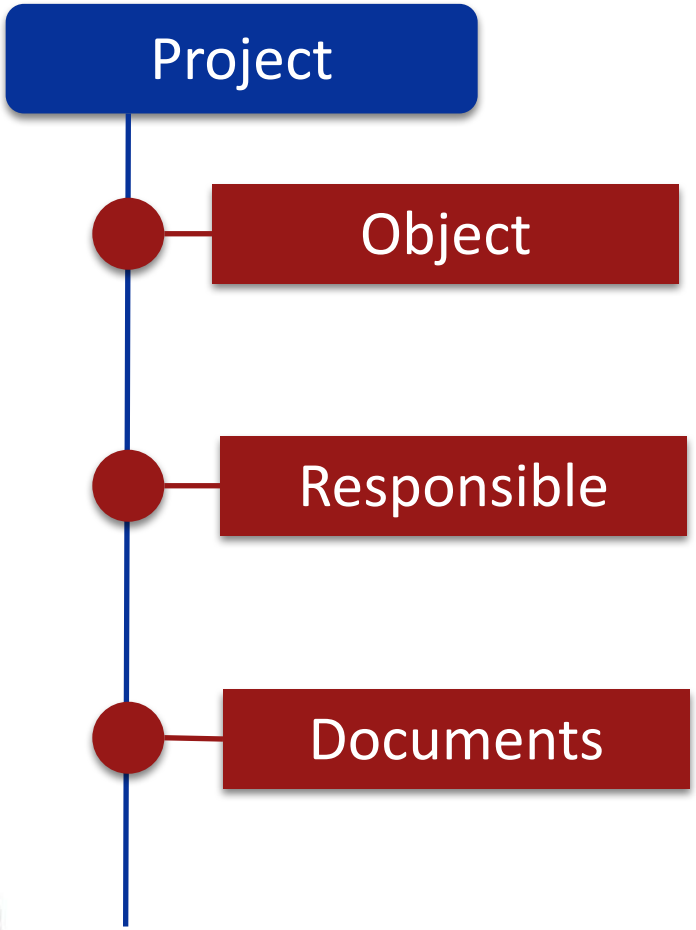
Digital Assets

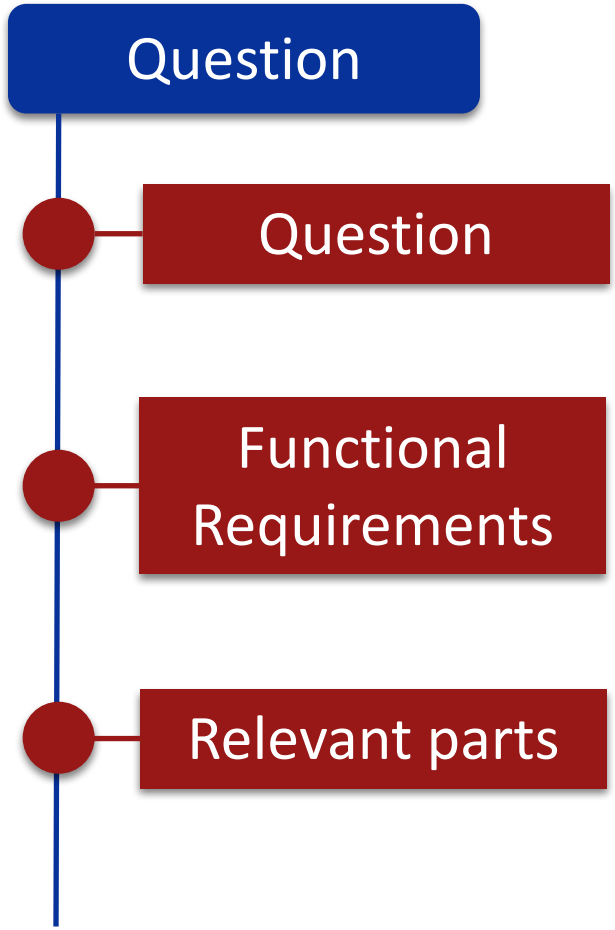
Equipment

Step 1 — Project register

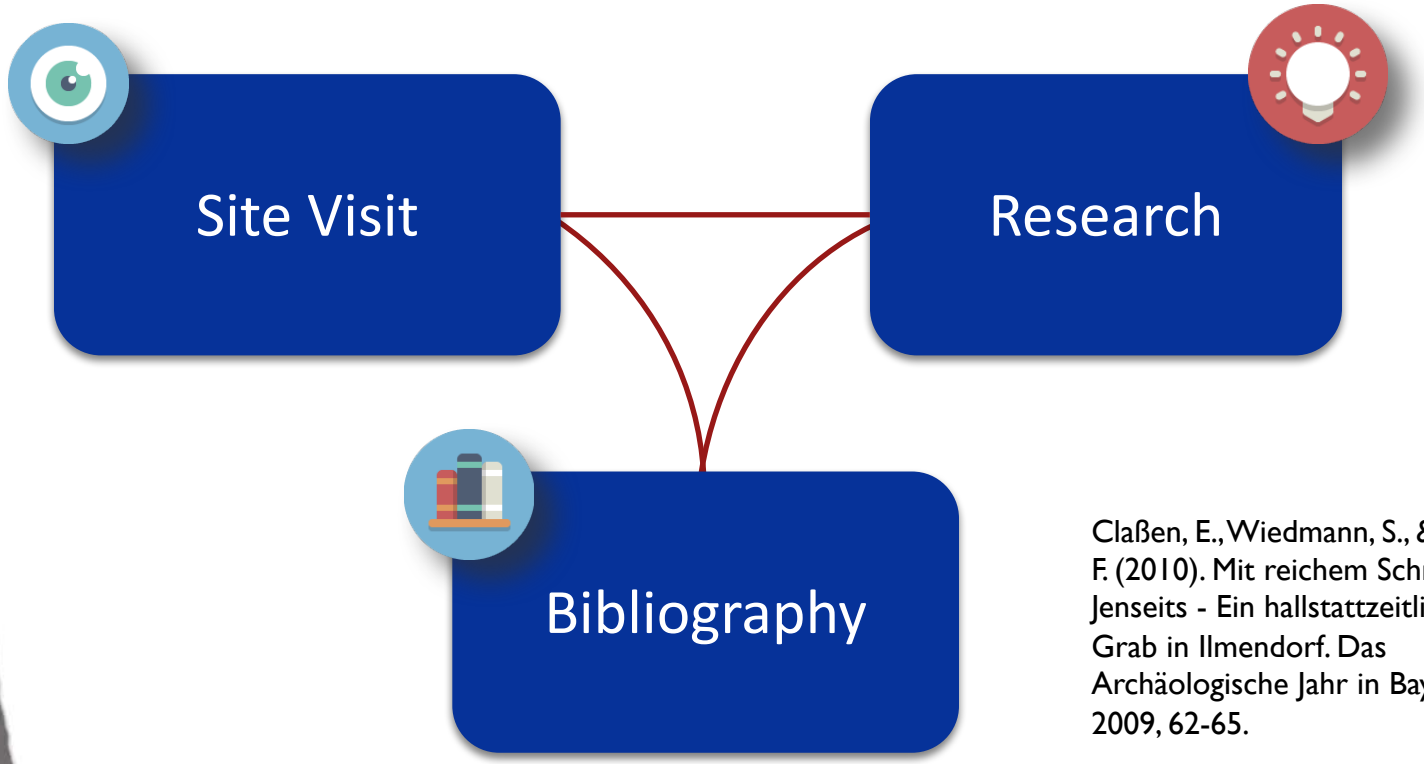


Step 1— Project register



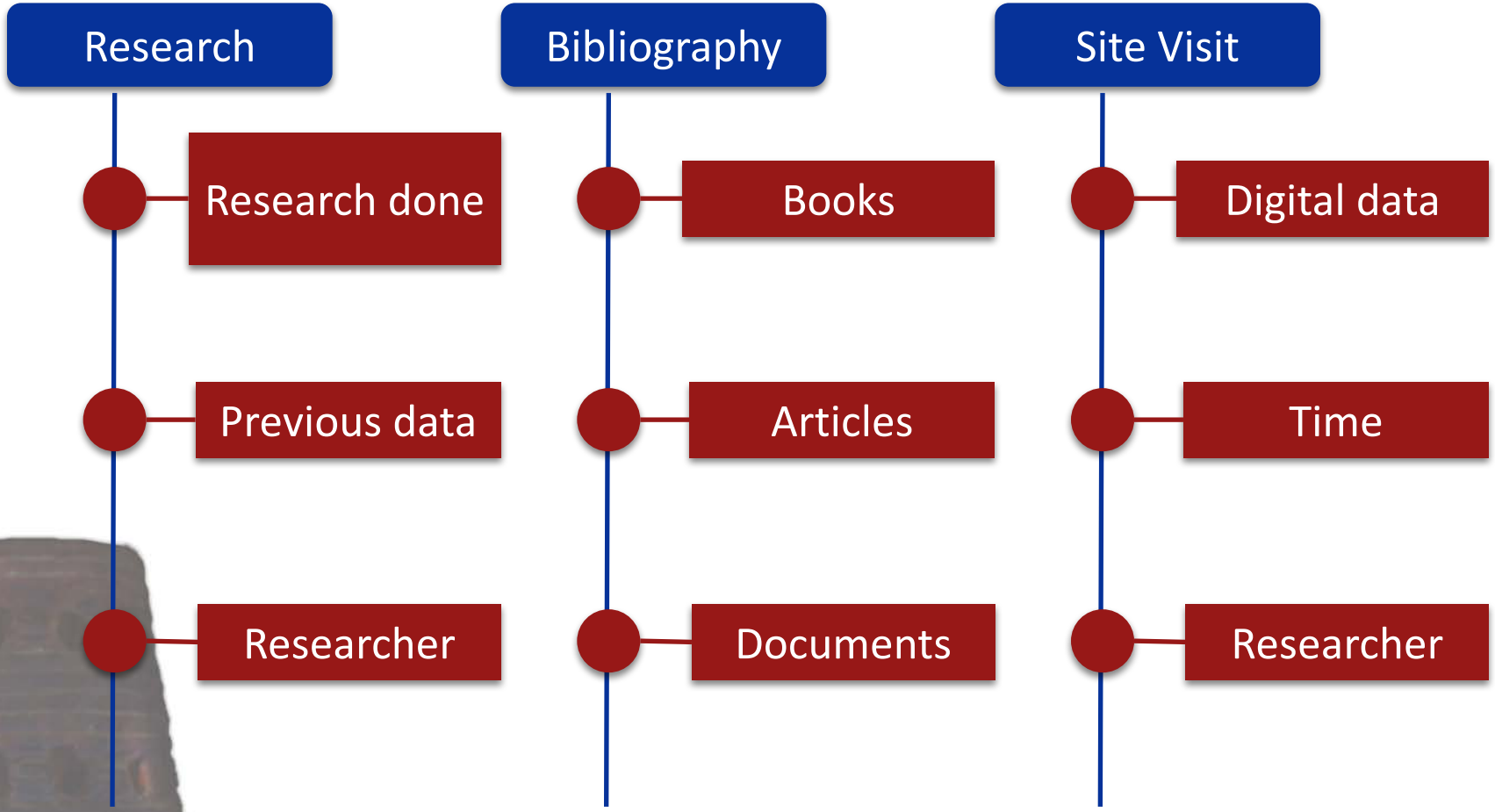


Step 2 — Preliminary Studies



Claßen, E., Wiedmann, S., & Herzig, F. (2010). Mit reichem Schmuck ins Jenseits - Ein hallstattzeitliches Grab in Ilmendorf. Das Archäologische Jahr in Bayern 2009, 62-65.

Step 1 — Project register



Step 3 — Acquisition

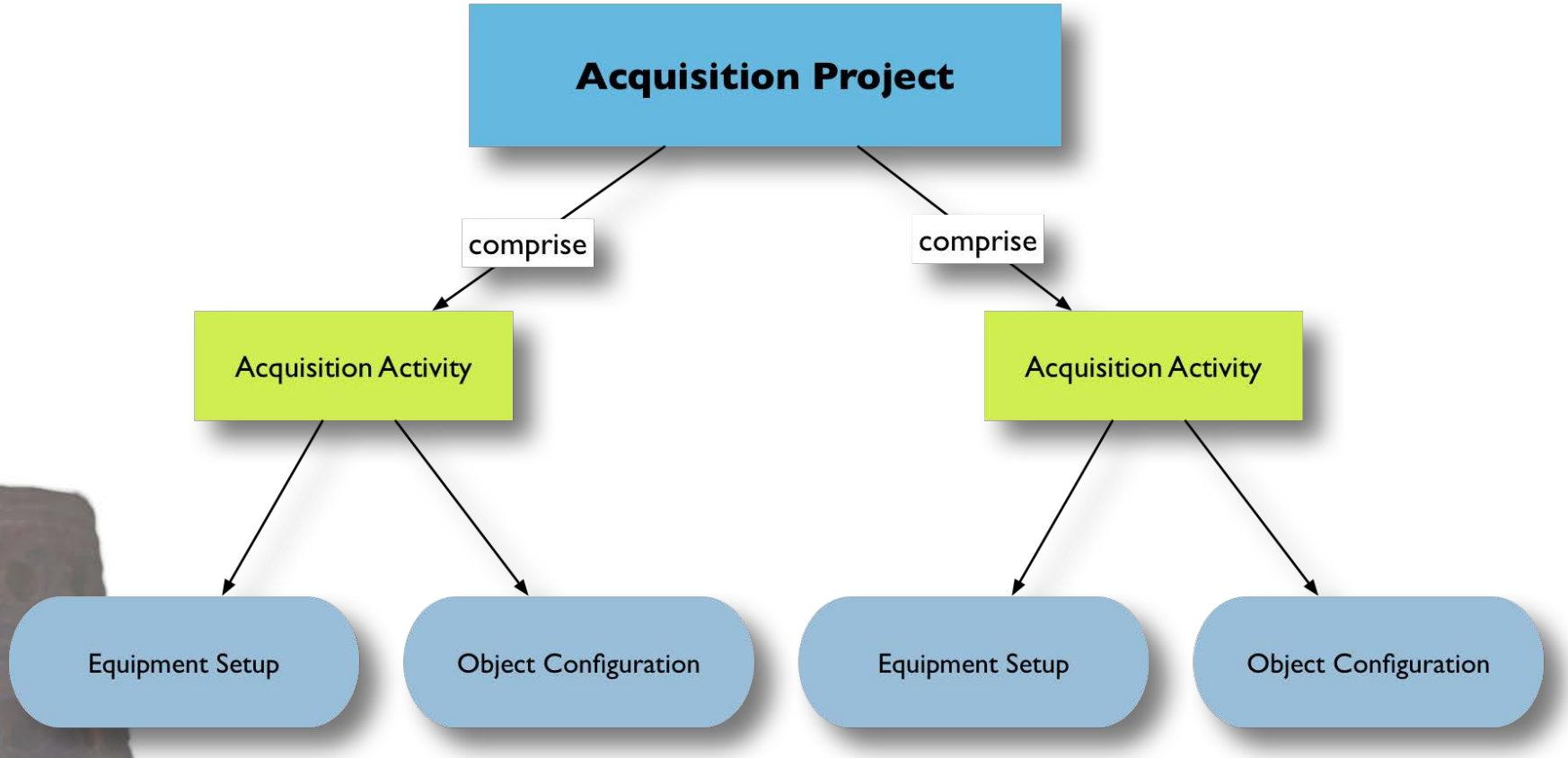
Acquisition Project

Acquisition activity

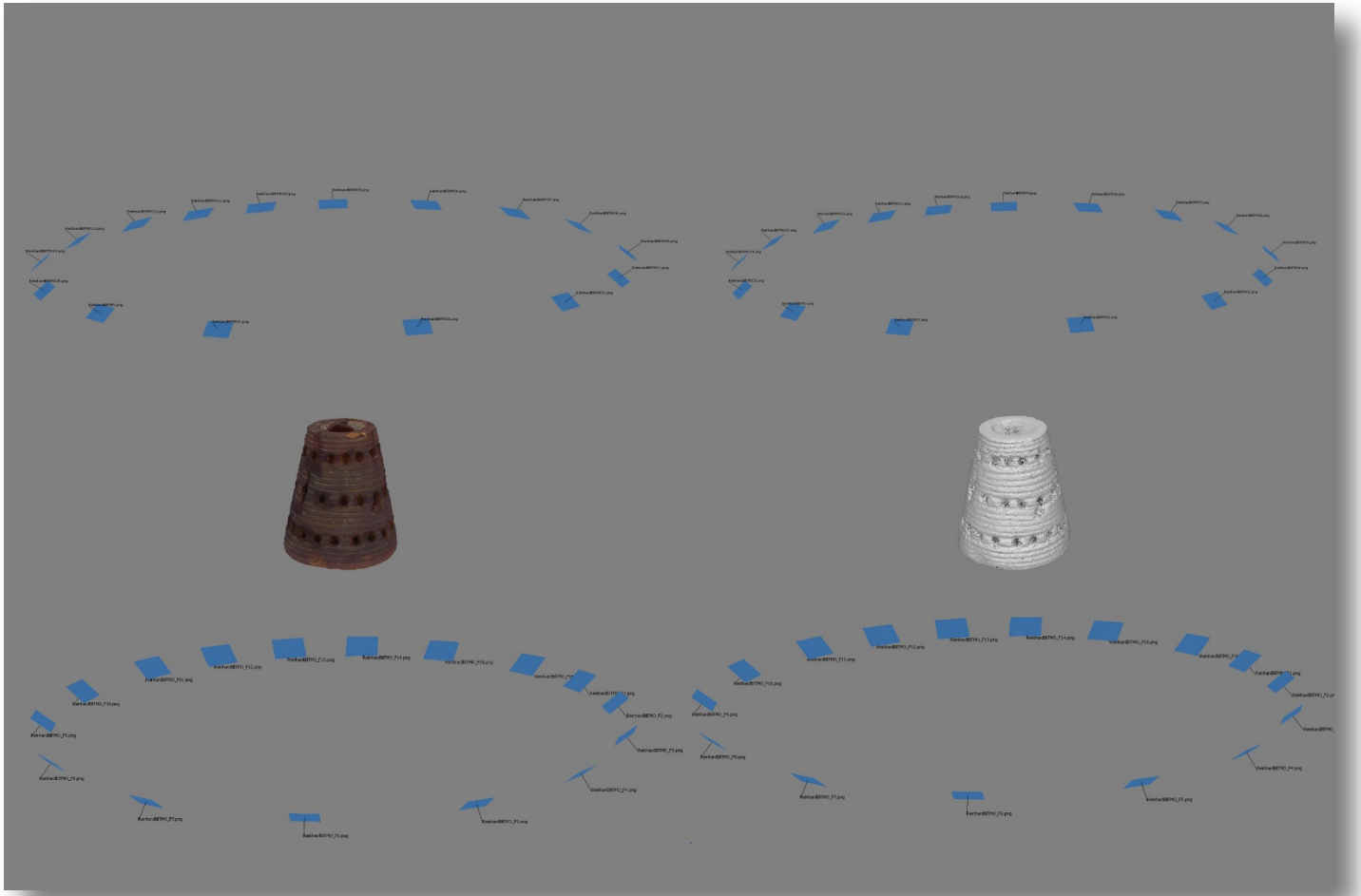
Equipment setup

Object Configuration

Step 3 — Acquisition



Step 3 — Acquisition

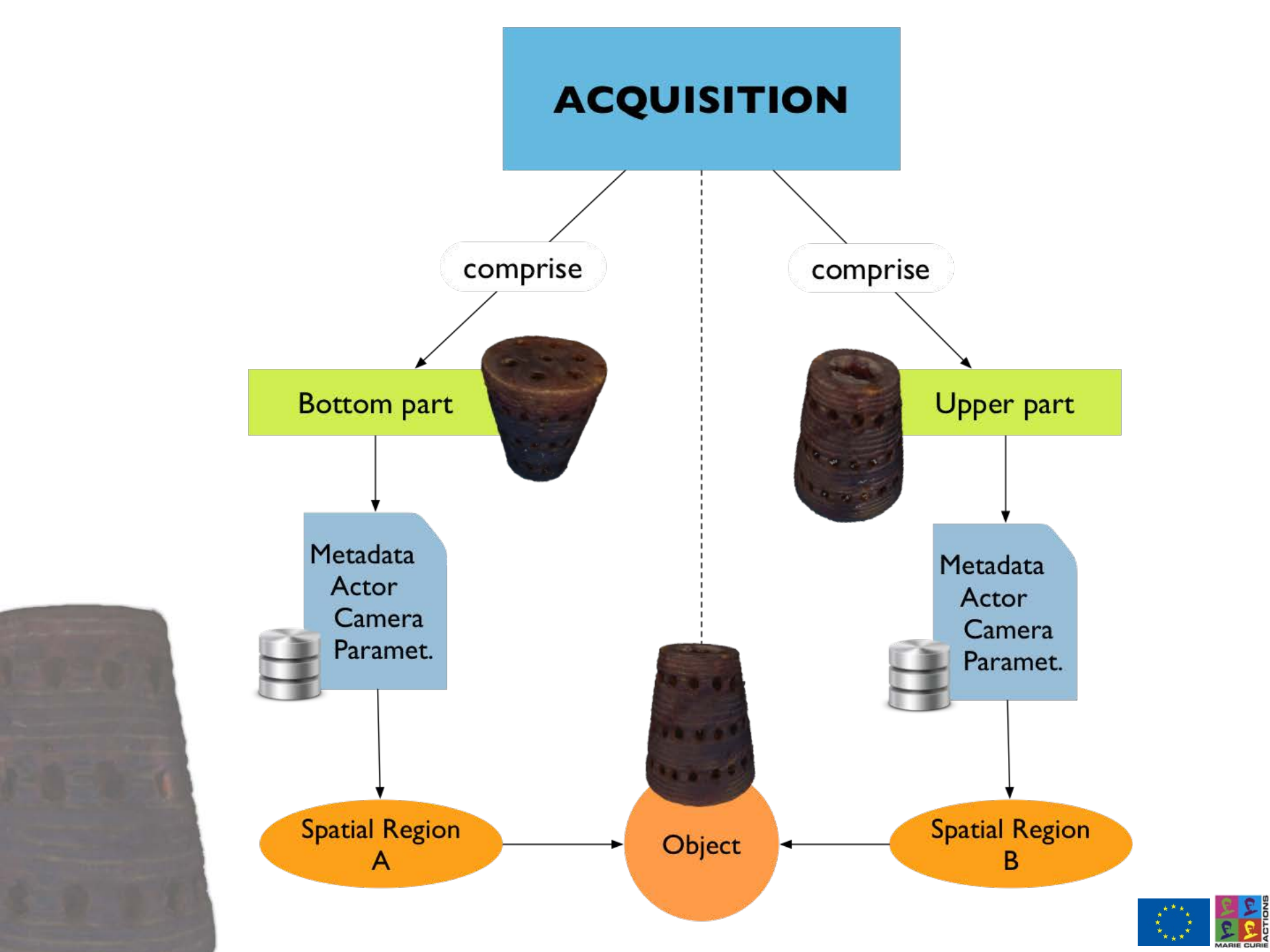


Equipment Setup Parameters

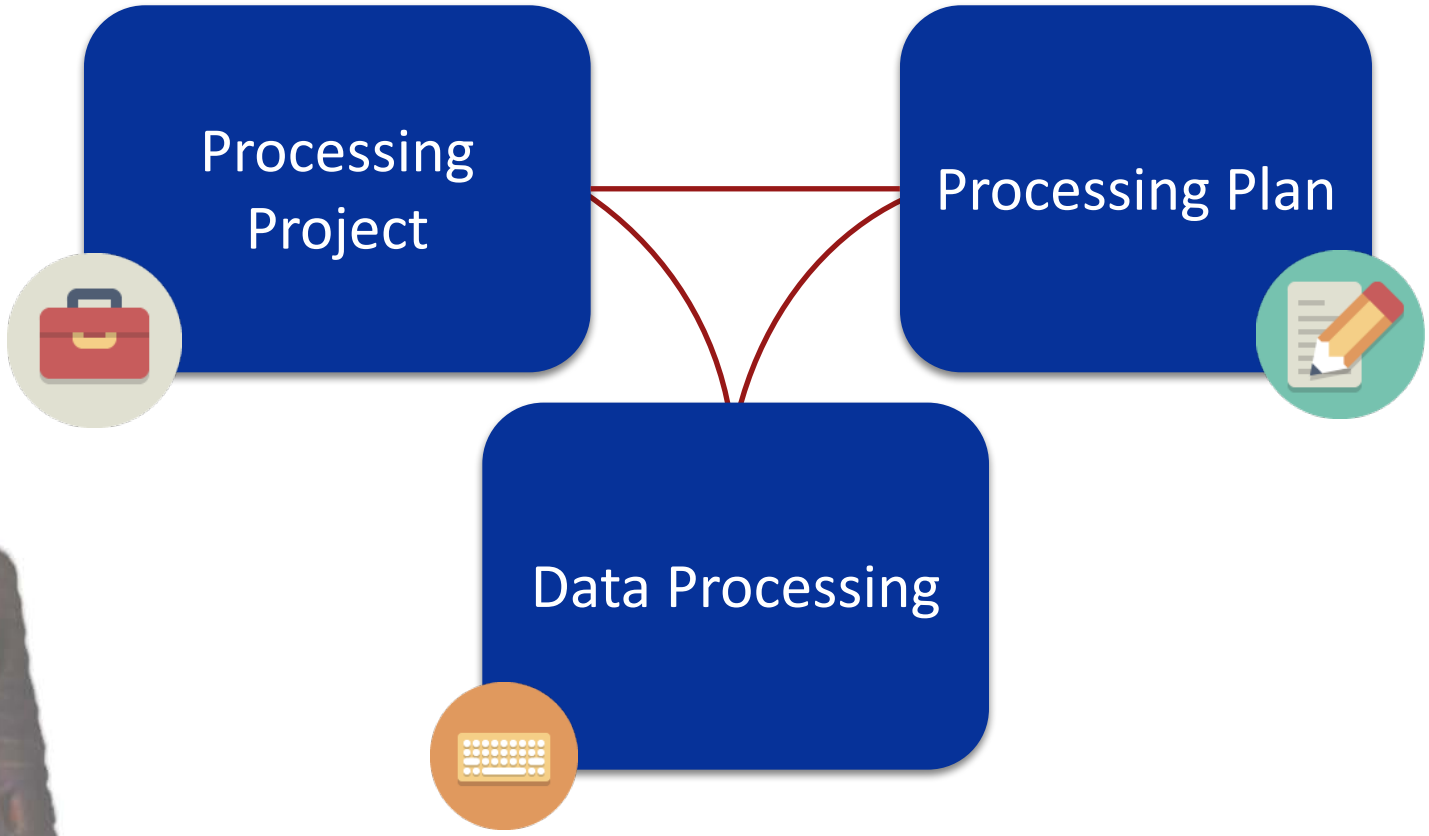
1 Camera	Nikon D800	8 Depth of field	12cm
2 Lens	Nikkor 28	9 Focal Lenght	28mm
3 ISO	100	10 White balance	YES/Grey Card
4 Shutter mode	Manual	11 Lightmeter	NO
5 Shutter speed	1/3	12 Colour calibration	YES
6 Aperture	14	13 HDR technique	Bracketing
7 Platform	Tripod	14 HDR values	-1EV, 0, +1EV

Object Acquisition Configuration

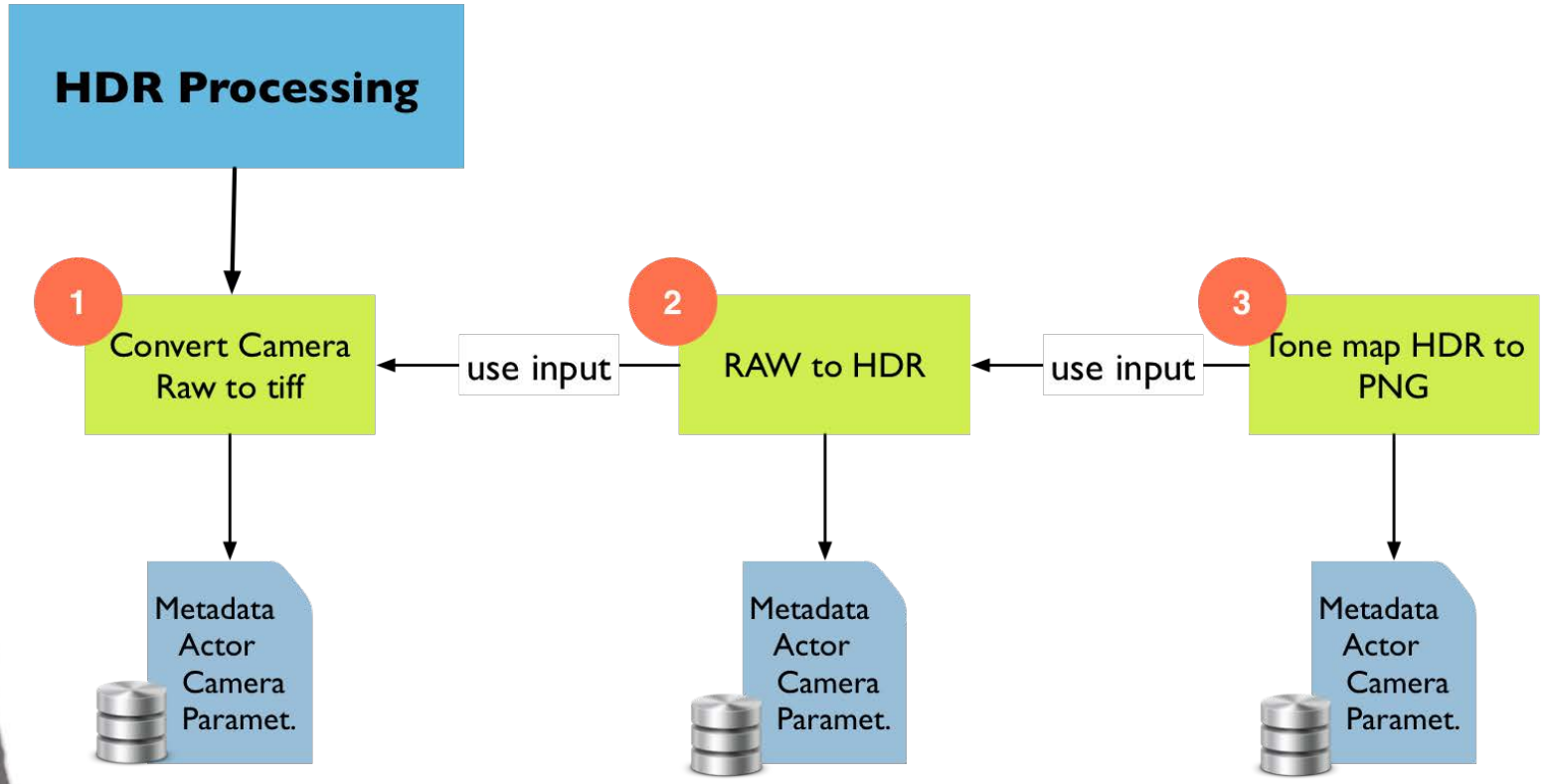
1 Configuration type	Convergent
2 Average GSD	0.06 mm
3 Coverage	80 %
4 Object Distance	33 cm
5 Markers	YES/96
6 Baseline	16 cm


ACQUISITION
comprise
comprise
Bottom part
Upper part
Metadata
Actor
Camera
Paramet.
Metadata
Actor
Camera
Paramet.
Spatial Region
A
Object
Spatial Region
B

Step 4 — Processing

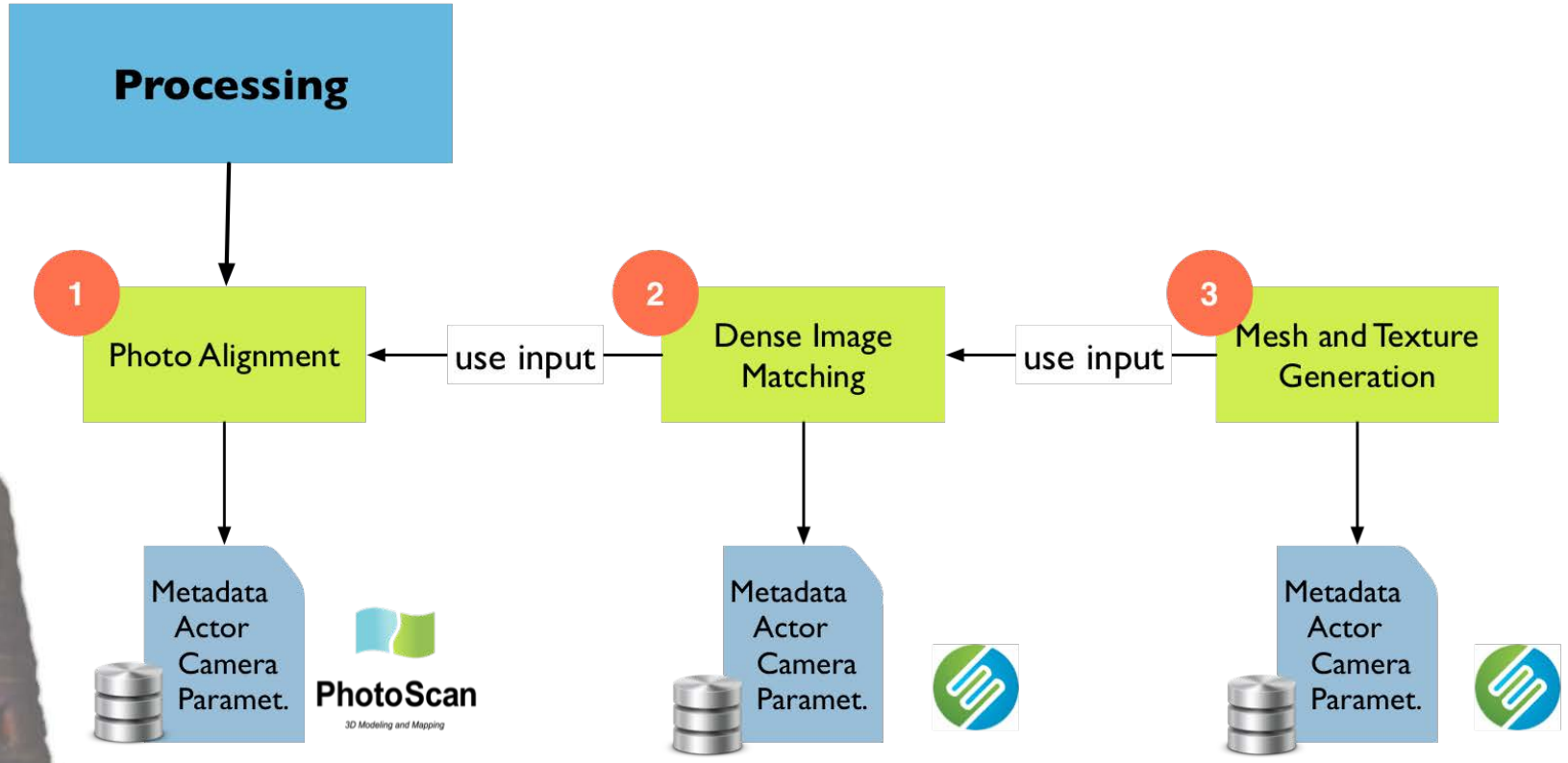


Step 4 — Processing

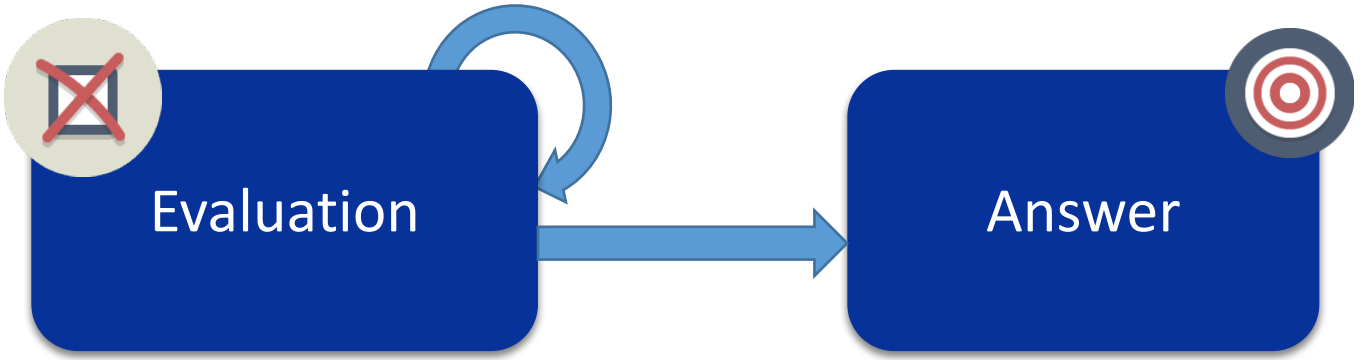


1 Question relation	HDR Tonemmaped vs LDR images
2 Input	TIFF stack
3 Action Date	28/10/15
4 Type	Image manipulation
5 Software used	Matlab (HDR toolbox)
6 Parameters	**lin_type**: the linearization function images are encoded using sRGB **merge_type**:it merges different LDR images in the linear domain using Robertson et al.'s weighting. **weight_type**: Debevec and Malik 97 weight function
7 Technician	Rossella Suma
8 Algorithm Used	BuildHDR Version: 1.0.7
8 Accuracy Value	32 bit single floating point

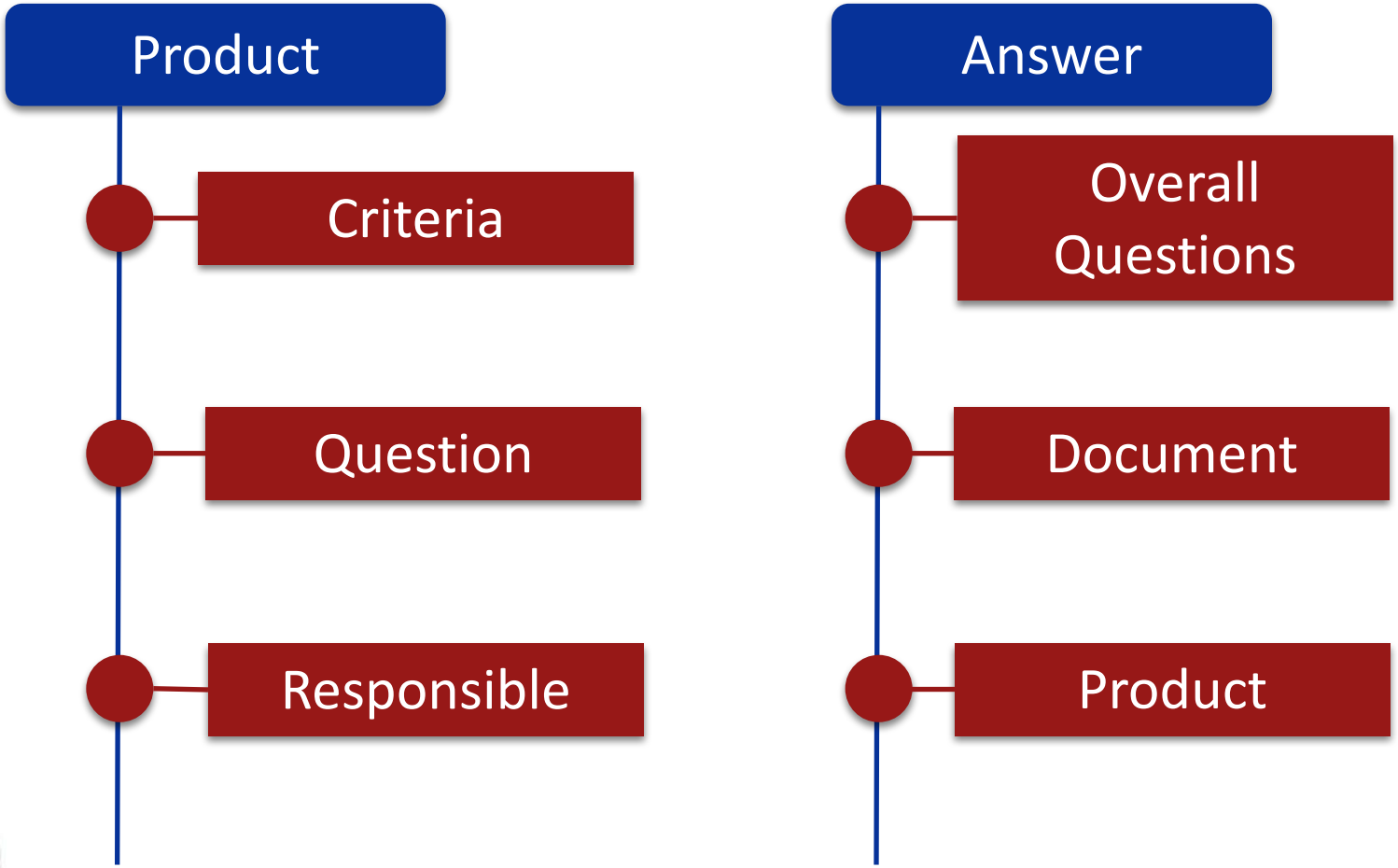
Step 4 — Processing



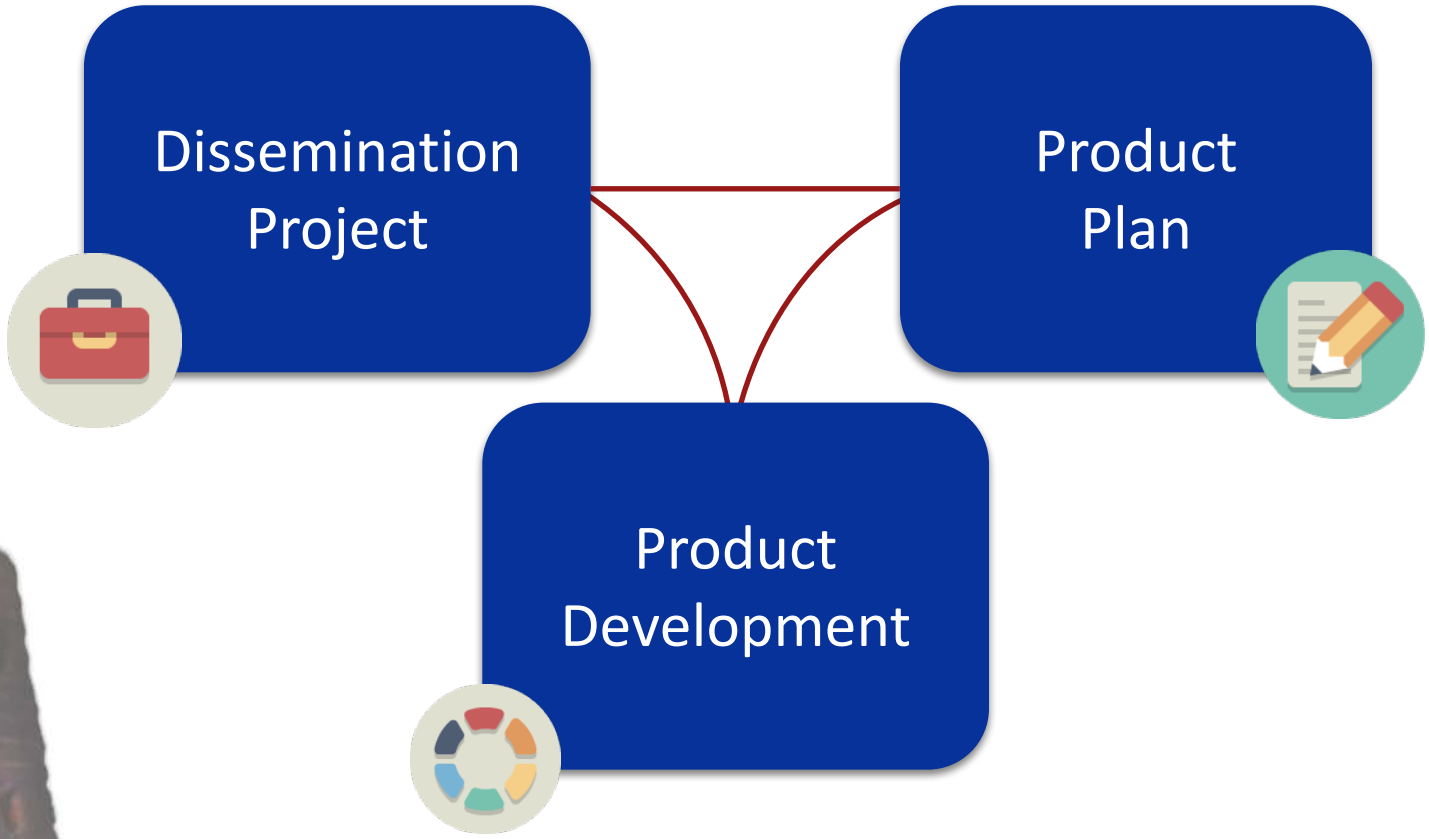
Step 5 — Analysis



Step 5 — Analysis



Step 6 — Dissemination



Texture View | Mesh View | Wireframe View

ITN DCH

Data
Object: FZ03 Amber Spindle

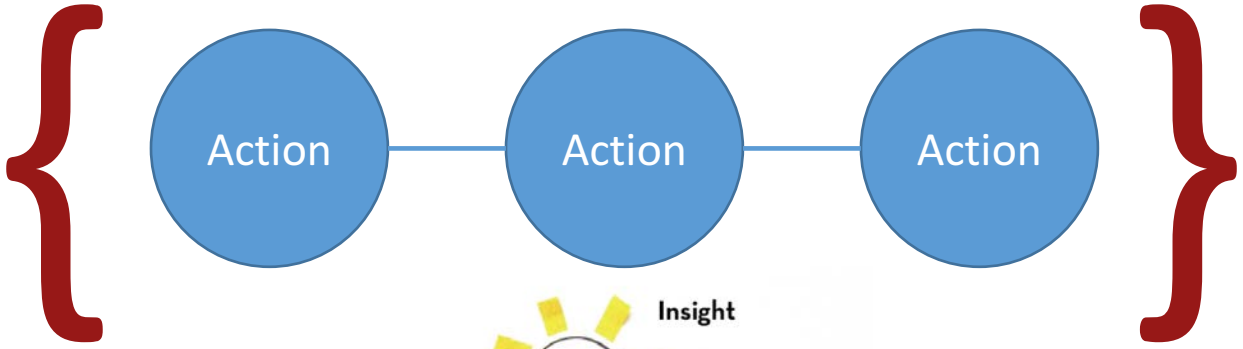
This conical bead is made of amber, with multiple holes drilled through the centre. It was probably part of a string of beads worn on the upper body, perhaps as a necklace. The latter statement has no basis in fact, it is merely being used to illustrate the kind of infor-

Texture View | Mesh View | Wireframe View

ITN DCH

Step 6 — Dissemination

Dissemination Project



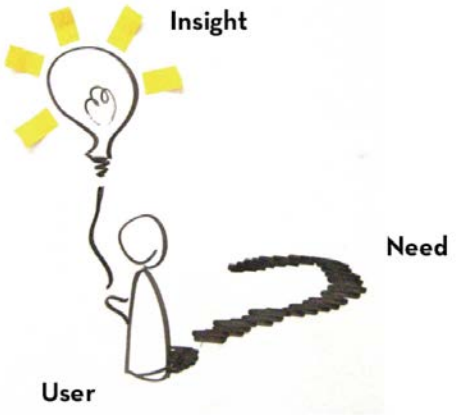
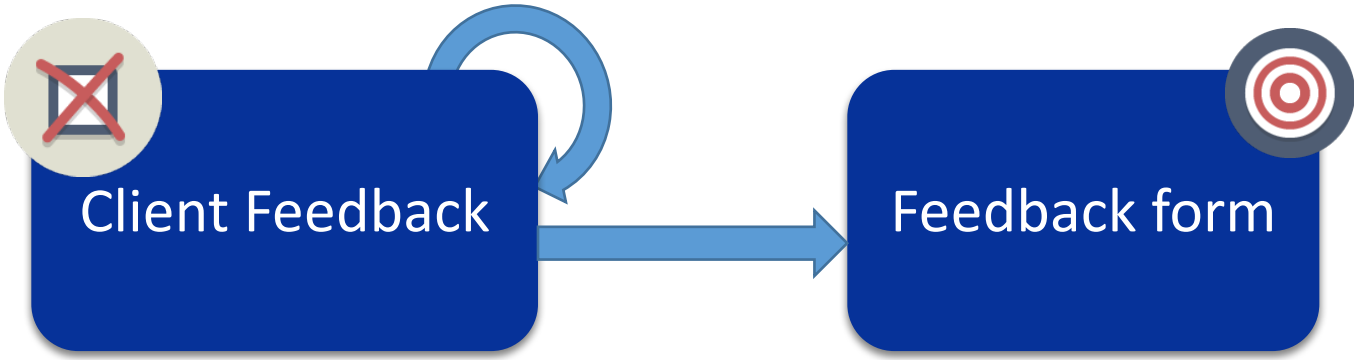
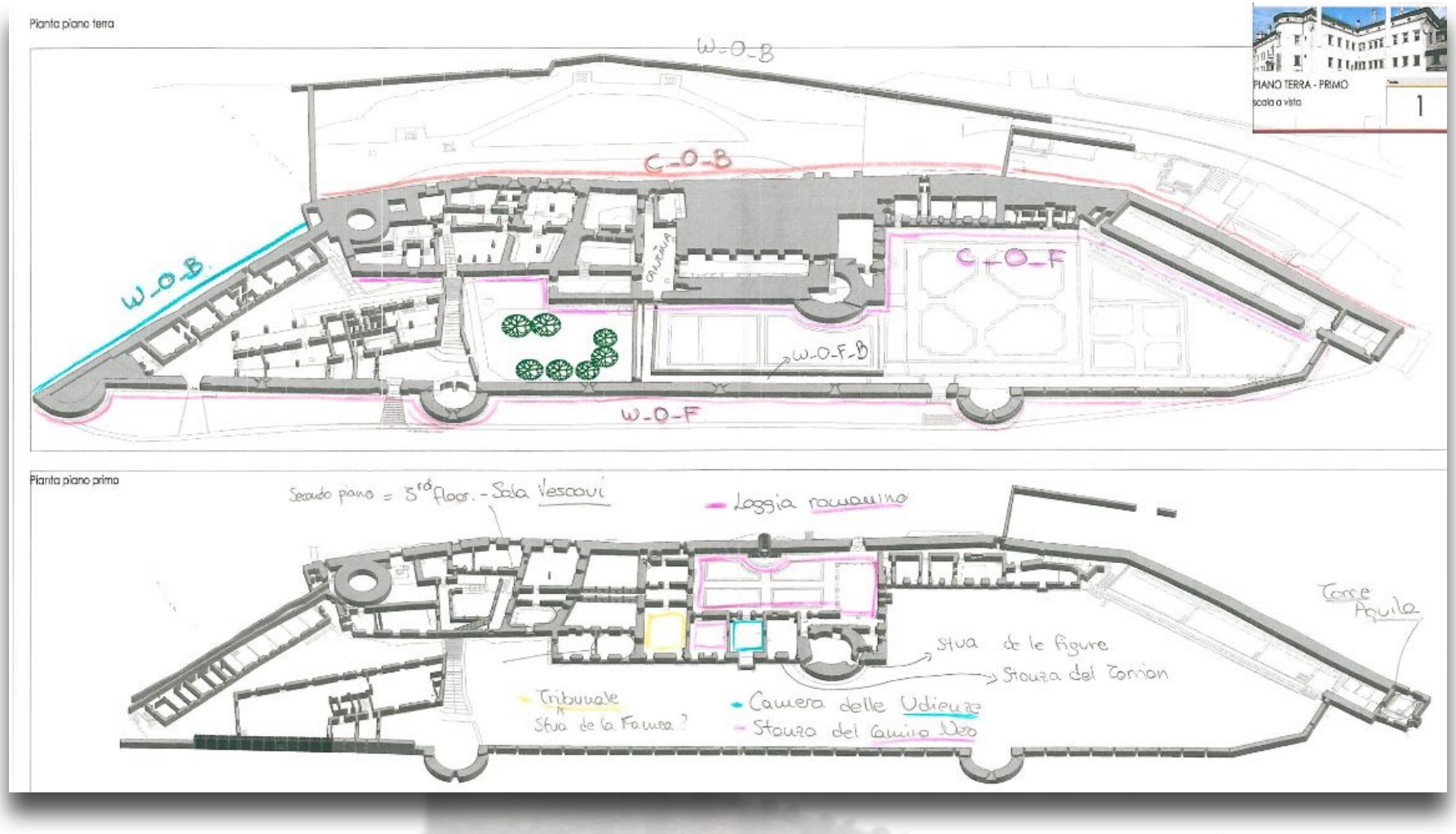


Image credit: http://www.ot-lab.ch/wp-content/uploads/2014/08/User-Need-Insight.jpg

Step 7 — Conclusion



The largest and most important monumental complex of the Trentino - Alto Adige region. It was the residence of the prince-bishops of Trento from the 13th century to the end of the 18th century when it started to be used as a barrack and then as Austrian military headquarter until the end of the First World War. Following its restoration in 1924, it became a National Museum and since 1973 it belongs to the Autonomous Province of Trento. The castle is composed of a series of buildings of different eras, enclosed by walls and positioned slightly higher than the city.



ArcTron 3D
Expertise in Three Dimensions

Fraunhofer IGD

KU LEUVEN

Exterior

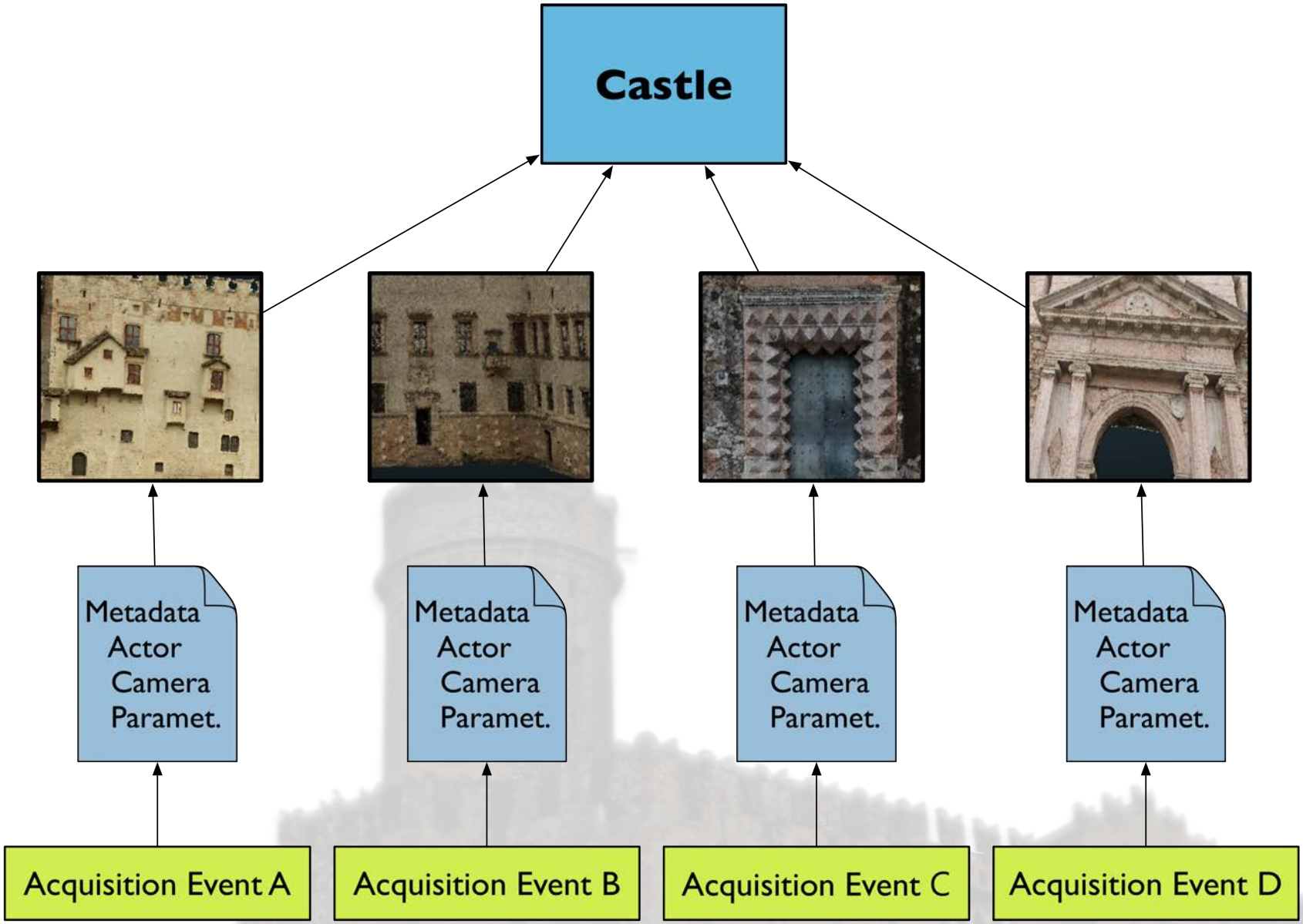
Camera	Type	f	Average distance (m)	Average GSD (mm)
Nikon D750 FX	Full Frame	28	5	1.1
Nikon D3X	Full Frame	28	5	1.1
Nikon D3X	Full Frame	28	20	4.3
Nikon D3X	Full Frame	28	40	**8.5**
Nikon D3X	Full Frame	60	50	5.0
Nikon D3X	Full Frame	24	5	1.2
Nikon D3100	NO Full Frame	18	25	7.0

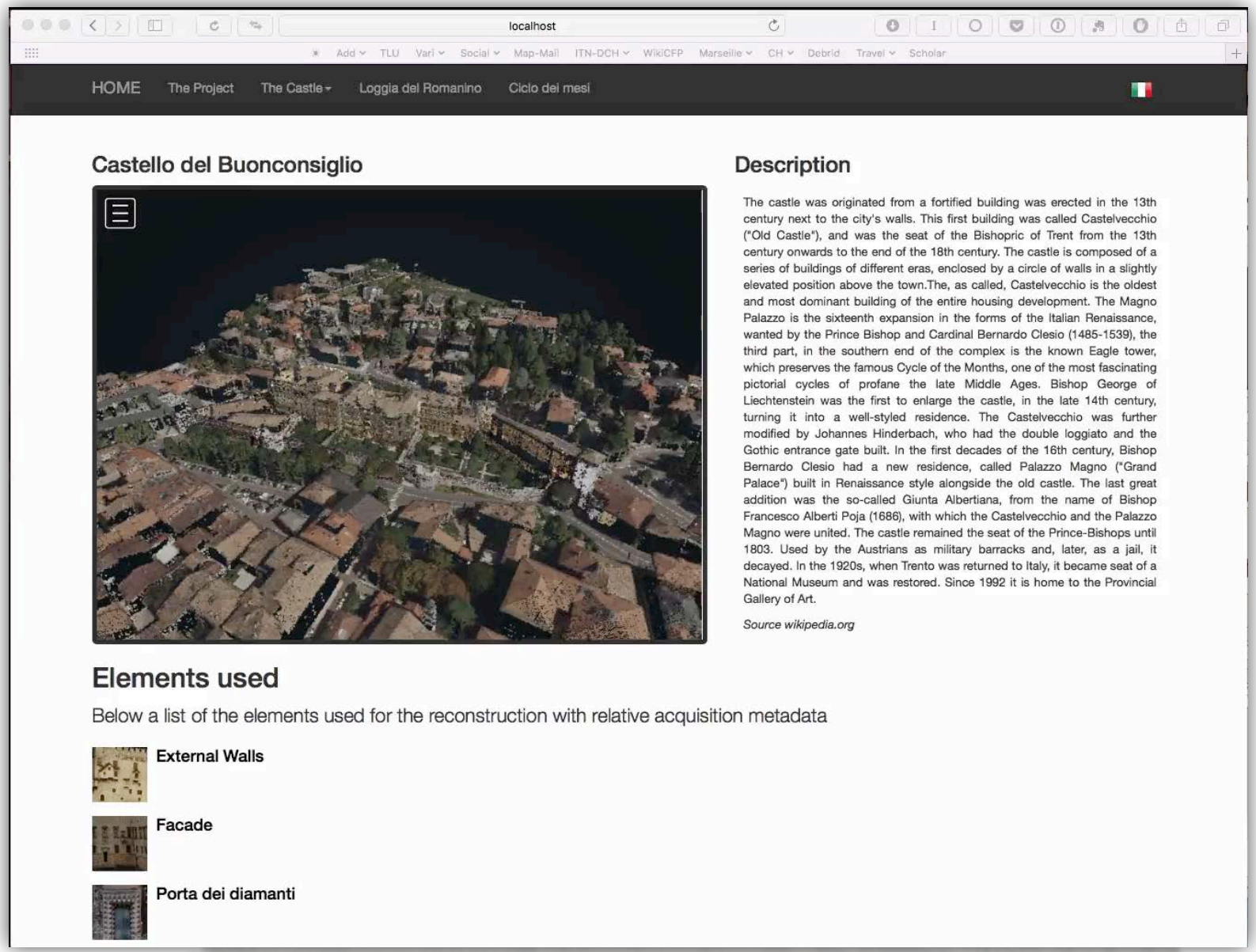
Output GSD: 1cm for the exterior

Interior

Camera	Type	f	Average distance (m)	Average GSD (mm)
Canon EOS 600D	NO Full Frame	18	5	1.2
Canon EOS 1100D	NO Full Frame	18	5	1.4
Canon EOS 1200D	NO Full Frame	18	5	1.2
Nikon D300	NO Full Frame	18	5	**1.5**

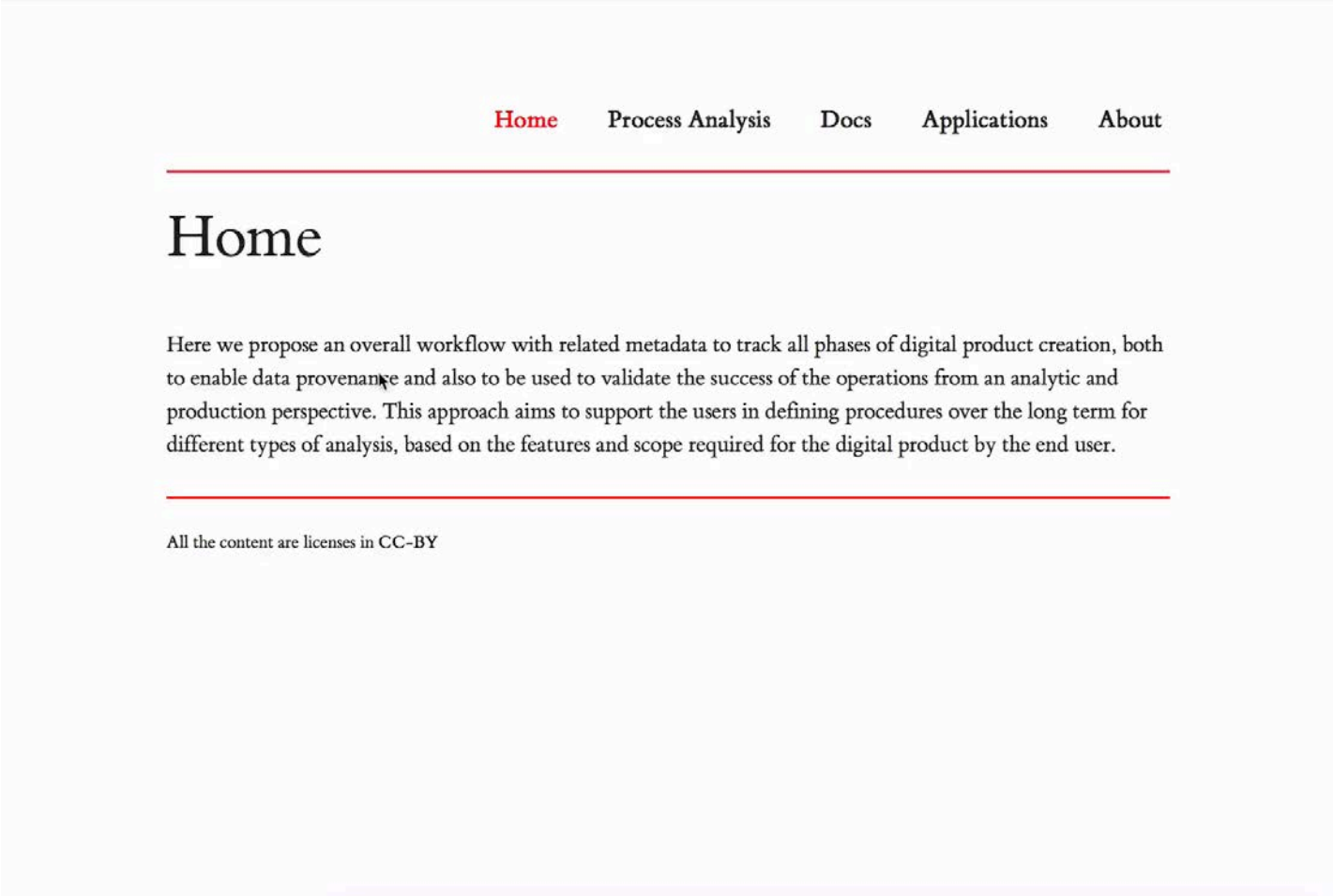
Output GSD: 5mm for the interior rooms


Castle
Metadata
Actor
Camera
Paramet.
Metadata
Actor
Camera
Paramet.
Metadata
Actor
Camera
Paramet.
Metadata
Actor
Camera
Paramet.
Acquisition Event A
Acquisition Event B
Acquisition Event C
Acquisition Event D



http://3dom.fbk.eu/repository/buonconsiglio_castle/index.html

Where?



http://pacs.map.archi.fr

Acknowledgments

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AUTONOMA DI TRENTO

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münchen

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Ramos, M.M., Bellido, D., Carboni, N., Domajnko, M., Stathopoulou, E.K., Stavropoulou, G., Morabito, D., Remondino, F., 2016: Complex 3D heritage architectures accessible on the web. Proc. 8th Arqueologica 2.0, pp. 426-429

THANK YOU

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