Documentation of Wooden Architectural Heritage

Research and Theory of Architecture

Linnanmaa, 2nd October 2017

Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

2006 — First research expedition at the **Kinerma village** (University of Oulu)

2007 — First **International conference about Wooden Architecture in Carelia (Russia)**

2007-'08 — Research expeditions in **Bol'shaya Selga** village and **Panozero village.**

2009 — **Second International conference about Wooden Architecture in Carelia (Russia)**

2009 — Research expedition for the documentation of the landscape and architecture of the northern part of **Kizhi Island**, Carelia, Russia

2010- '11 — Digital survey of the **Pogost Complex** on Kizhi Island, UNESCO Heritage.

2012 — **EUROPEAN PROJECT** Participation as ESR Early Stage Research in the European project (duration 36 months)
"Wooden Architecture. Traditional Karelian Timber Architecture and Landscape"
Coordinators: Prof. S. Bertocci, Prof. S. Parrinello

2013 2014 — **Summer Schools in Carelia**
Documentation of the historical villages in the **geographical area of Vedlozero**
Surveying and documentation of traditional historical villages which **area of Syamozero.**

2015 2016 — *Digital survey for the documentation of **Lamminaho** wooden farm house in Vaala region**, Finland***
As Postdoctoral Fellow at the University of Oulu, Department of «History of architecture and restoration studies»

2017 2018 2019 — EUROPEAN PROJECT Marie S. Curie Individual Fellowship
Title: "Preserving Wooden Heritage. Methods for monitoring wooden structures: 3D laser scanner survey and application of BIM systems on point cloud models".

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Wooden architecture has been recognized as an object of growing interest of scientific research even on international scale, not only from the architectural point of view but also from theoretical approaches. Vitruvius' old theory of the «primitive hut» caused the notion that all architecture and classical compositional models would come from the first «wooden hut» designed by our ancestors.

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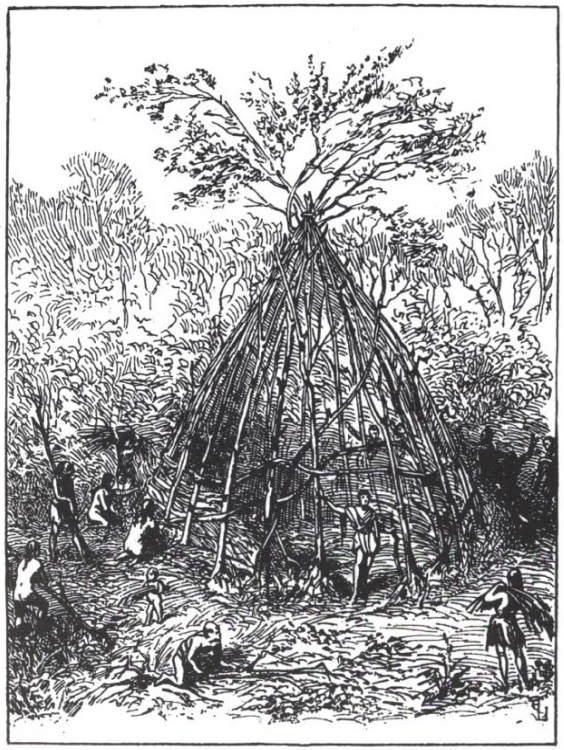
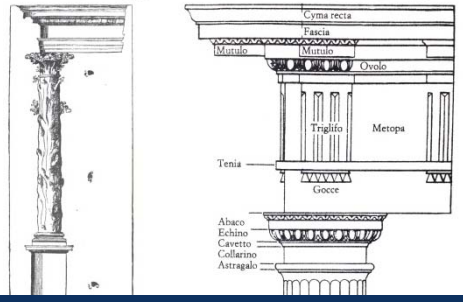
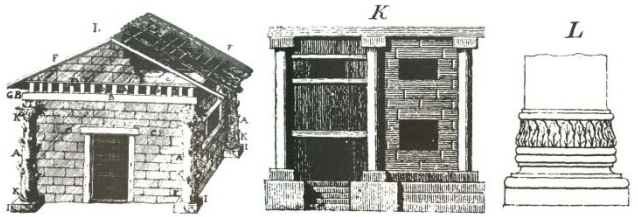
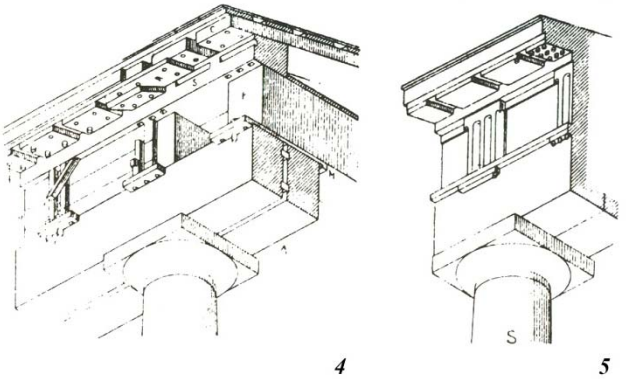


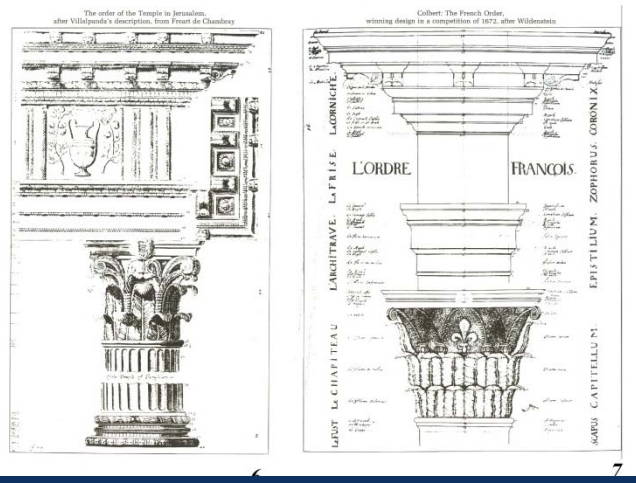
The primitive hut, Histoire de l'Habitation Humaine, 1875. Eugène Viollet-le-Duc. La scoperta del fuoco, da C. Cesariano, De Lucio Vitruvio Pollione De Architectura libri decem, Como, 1521.

The tree-coloumn shape by de l'Orme and the origin of the doric order. Da J. Summerson, "Il linguaggio classico dell'architettura" / "The classical language of Architecture".









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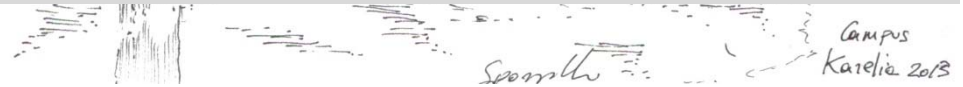
The theme of the «primitive hut» has always existed and the topic of the ancient wooden shelter has included in the wider theme of the relationship between Architecture and Nature, or rather Human Being and Nature.

Eyes can see just what our mind already knows. Johann Wolfgang Goethe

The eyes see only what the mind is prepared to comprehend. Robertson Davies

Culture and Experience are fundamental for the interpretation and evaluation of determinated values.

Several times we see but we do not observe.



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sara.porzilli@oulu.fi

Elements and general characteristics of timber structures

Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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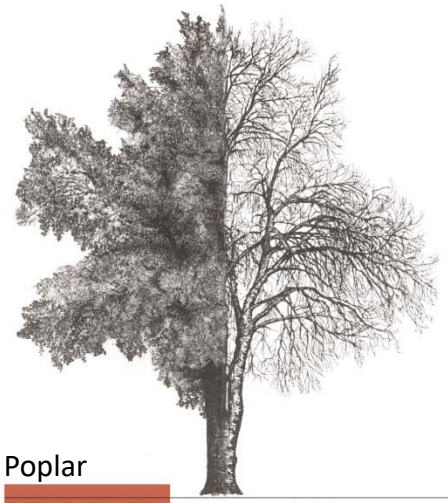


Poplar

PIOPPO TREMULO (*Populus tremula L.*)

Famiglia: Salicaceae

Genere: Populus

Descrizione: sono alberi caratterizzati da radici che si allungano in profondità, per questo motivo sono estremamente resistenti a condizioni climatiche estreme. Hanno una crescita molto veloce, in 20 anni riescono già a raggiungere la loro altezza massima. Il pioppo tremulo è uno dei pioppi più piccoli che arrivano ai 10,50 m di altezza e ai 6 m di larghezza. Ha foglie rotonde molto dentellate. Spuntano a primavera e rimangono sull'albero fino quasi all'inverno successivo, volgendo verso un colore giallo chiaro nel tardo autunno.

Legno: con alburno bianco ben distinto dal durame più scuro, è tenero ed omogeneo, ma di valore mediocre.

Impiego: scandole e decorazioni.

Spruce

ABETE ROSSO (*Picea abies L.*)

Famiglia: Pinaceae

Genere: Abies

Descrizione: è un albero molto longevo, il suo areale di vegetazione naturale è estesissimo e va dalle Alpi, attraversando la Germania, Scandinavia, Polonia, varie zone dei Balcani raggiungendo la Russia di cui copre la metà setentrionale debordando in parte sulla Siberia, sino al limite Nord della vegetazione arborea. Si caratterizza per un tronco diritto e cilindrico, molto resinoso, corona lungamente piramidale e acuta, corteccia rossastra, sfaldata in piccole squame. Questa specie ha rami così fitti da presentare una struttura quasi perfettamente conica arrivano ad un'altezza di oltre 60 m. Gli aghi di abete hanno di solito la punta smussata e il profilo piatto, sono morbidi al tatto. Lunghi da 2,5 a 5 cm, variano di colore dal verde scuro al verde-azzurro sulla pagina superiore, mentre hanno una tinta argentea su quella inferiore.

Legno: di colore bianco-opaco, senza durame apparente e con anelli annuali ben distinti e regolari ed evidenti vasi resiniferi.

Impiego: strutture portanti.

Pine

PINO (*Pinus Sylvestris*)

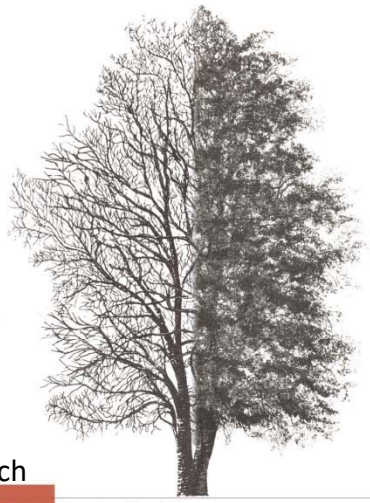
Famiglia: Pinaceae

Genere: Pinus

Descrizione: sono conifere predominanti nelle regioni vicine alla Siberia, ma si incontrano anche nell'Europa Centro Settentrionale. Sopportano sia il terreno umido che quello secco. Ha aghi rigidi verde-azzurri e, sui rami superiori, una corteccia bruno-arancio, che si stacca in falde. Il pino ha un rapido sviluppo quando è giovane raggiungendo in poco tempo l'altezza massima che arriva, a seconda dei casi, a 30- 48 m. E' una pianta molto longeva e resinosa. La forma dei fusti è fortemente influenzata dalle condizioni ambientali. Offrono un gran quantitativo di legname. Hanno forme coniche allargate finché sono giovani, ma con l'età si arrotondano e appiattiscono.

Legno: alburno bianco e durame roccioso, con anelli distinti, è resinoso, tenero e di facile lavorazione.

Impiego: strutture portanti.



Birch

BETULLA (*Betula alba L.*)

Famiglia: Betulaceae

Genere: Betula

Descrizione: raggiunge in età adulta i 20-25 metri di altezza, poco longevo, non supera infatti gli 80 anni. E' un albero a crescita rapida, per raggiungere la sua altezza massima, infatti, impiega circa vent'anni. I rami sono sottili, le foglie piccole, verde chiaro, diventano gialle in autunno; la corteccia, liscia e sottile, con l'età diventa bianca, e sviluppa caratteristiche striature nere nei punti in cui si desquama. I fiori sono dei lunghi amenti marroni-giallastri; i semi compaiono in autunno, sono gialli, contornati da una membrana marrone.

Legno: di colore bianco-giallognolo, sprovvisto di durame, omogeneo, elastico e tenero, poco durevole.

Impiego: finiture e parti decorative. Con la lana di betulla venivano eseguite le "guarnizioni" e imbottiture di tutte quelle parti soggette a ponte termico, ovvero lungo i bordi dei telai delle aperture e fra tronco e tronco nelle pareti esterne, affinché la non perfetta aderenza fra le superfici dei tronchi posti uno sopra l'altro non generasse comunque degli intercapedini causa di dispersioni.

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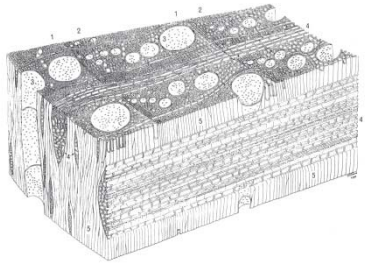
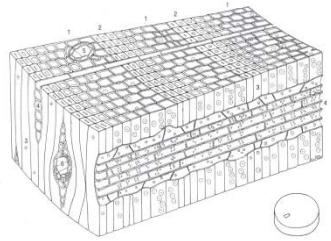
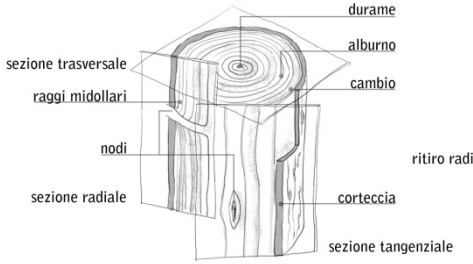
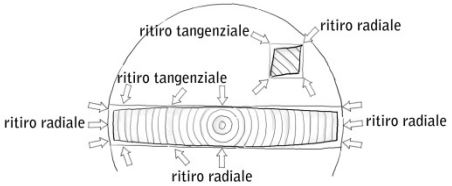
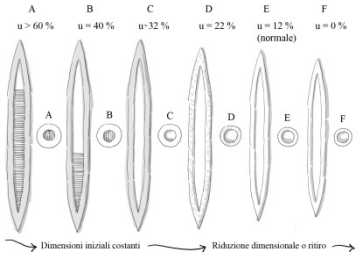


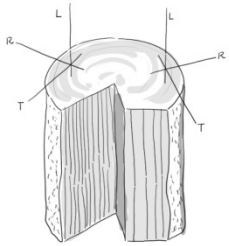


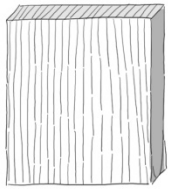
The different microstructure of a hardwood and a softwood.





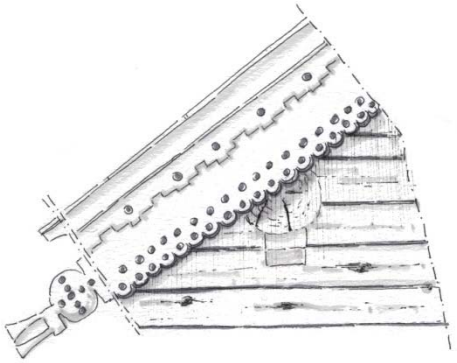


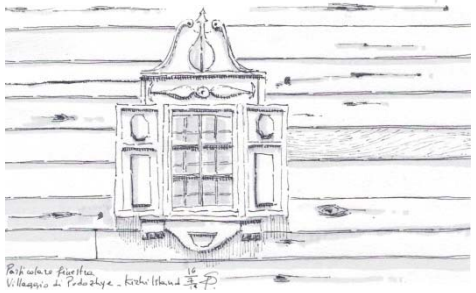


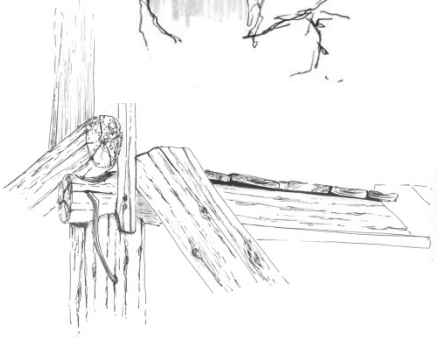


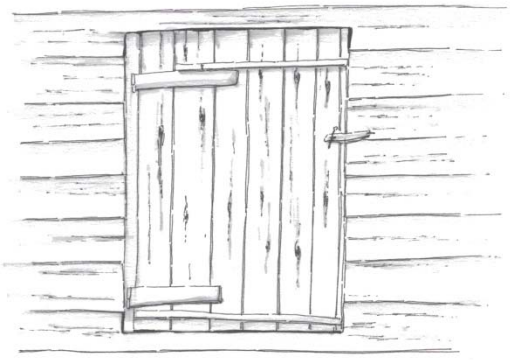
In the analysis of the intrinsic characteristics of a wooden structural element are performed generally with **three zoom levels**:

- **ultrastructural,** which analyzes the cell walls,
- **microscopic level**, for the understanding of the organization of the cells forming the woody tissues
- **macroscopic level,** analysis of veins, anomalous, defects, presence of nodes and what type, presence of deviations of the grain.









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PostDoctoral Fellow
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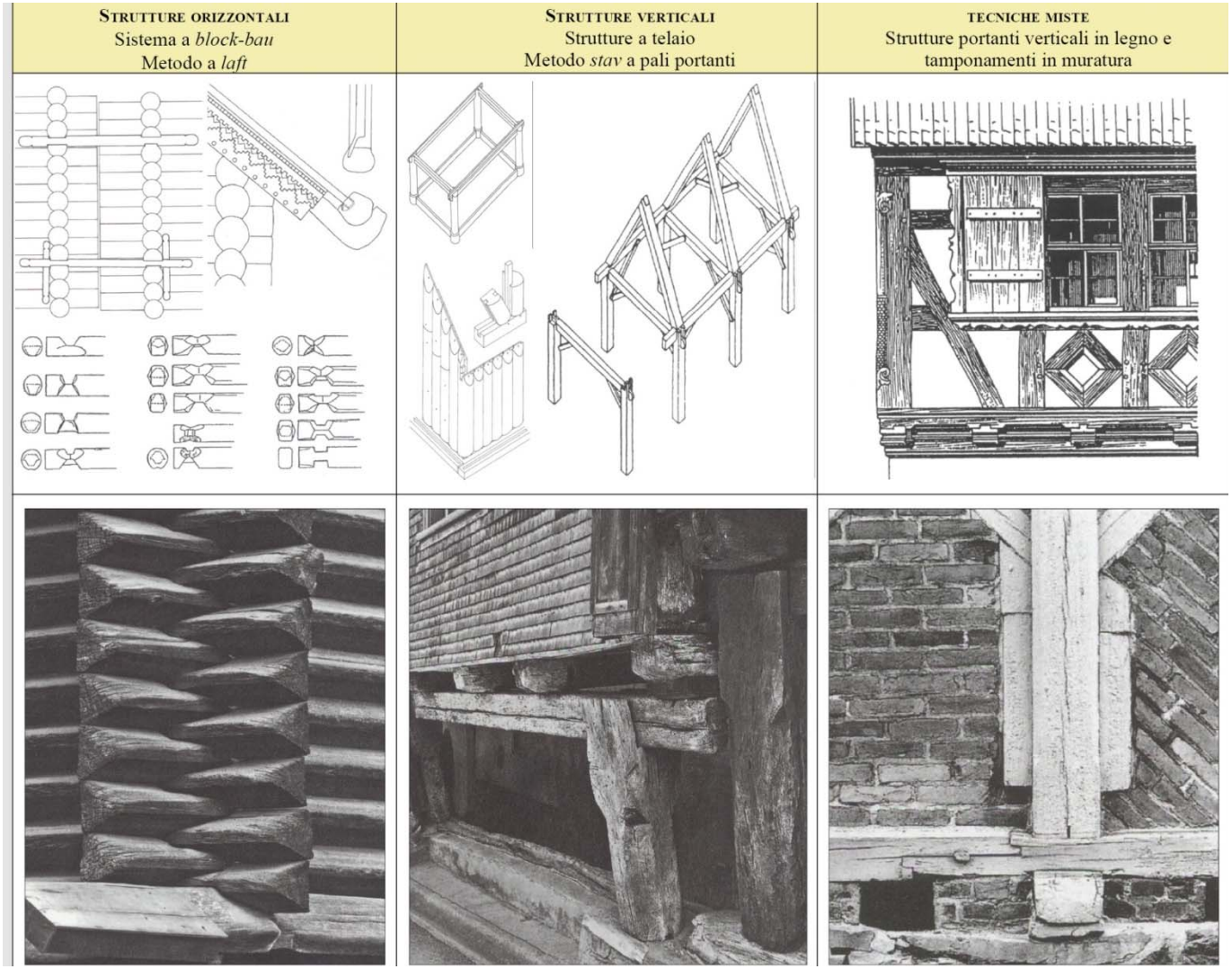

It is known that wooden architecture is one of the oldest building systems adopted by the majority of people belonging to different geographic areas. Over time they have developed **building techniques dictated by local characteristics**, the availability of the raw material on site and the geomorphological and climatic characteristics of the area. . In spite of these facts, it is often possible to discover **strong similarities in different contexts**, especially in planning compositions of villages and in the choices of manufacturing solutions. Research-theory-practice triangle has offered new insights into the world of wooden architecture, different sectors of investigation have found mutual interaction in 2D and 3D new digital representations.

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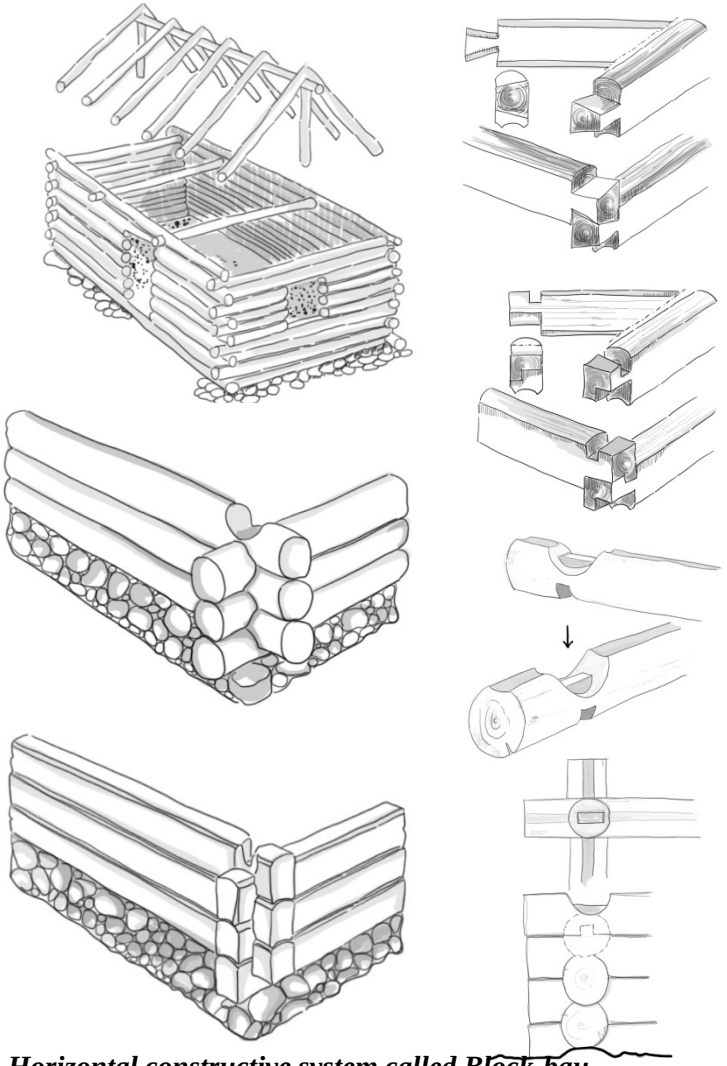

Horizontal constructive system called Block-bau

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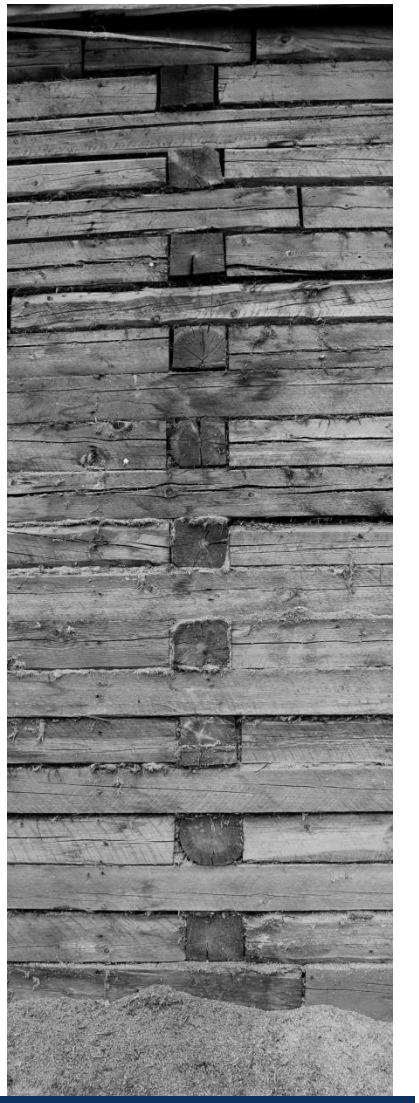

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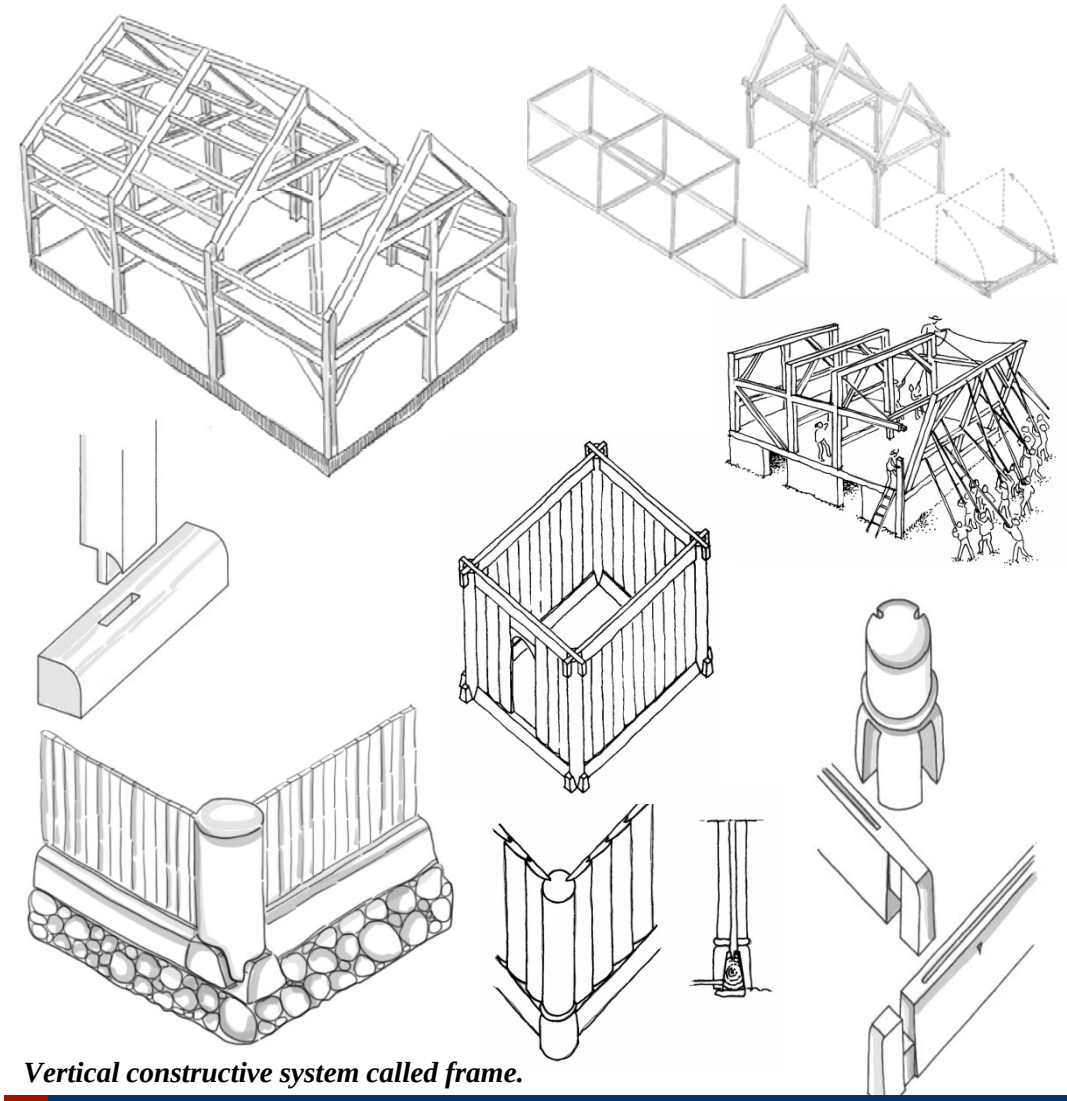
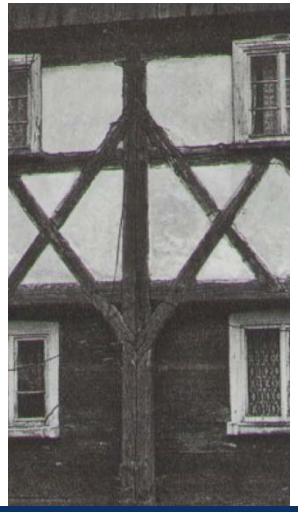


Vertical constructive system called frame.



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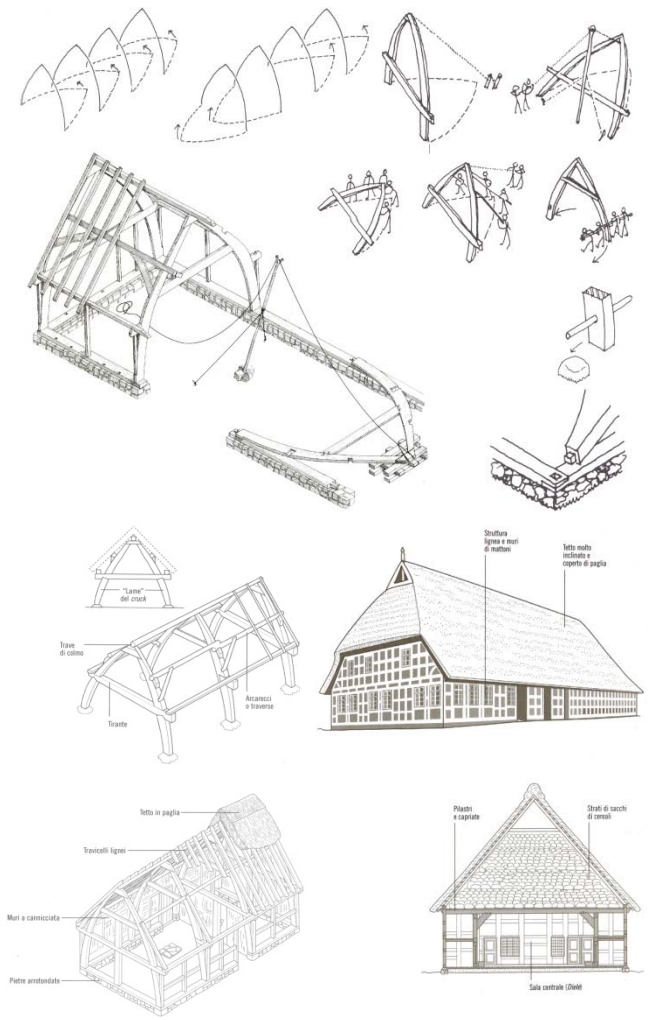
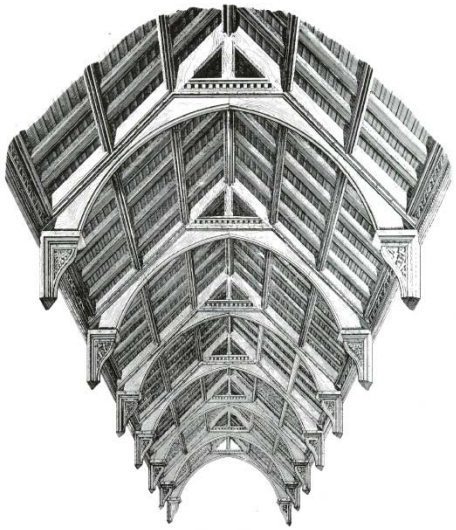
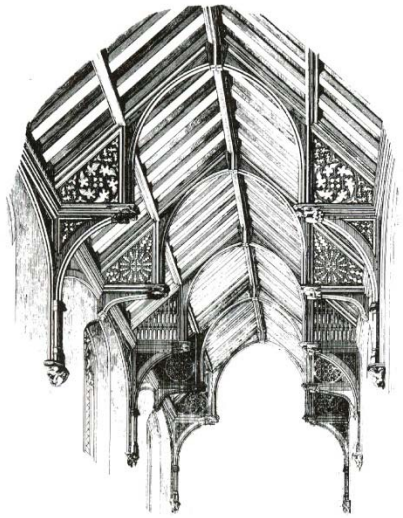
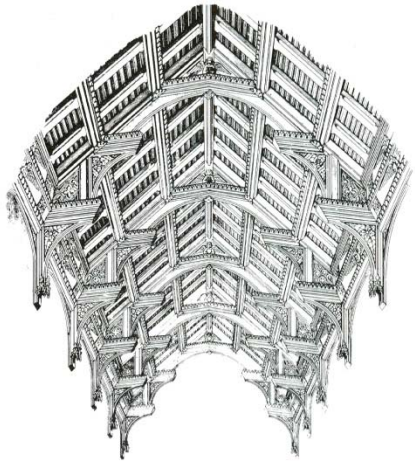
Anglo-Saxon region









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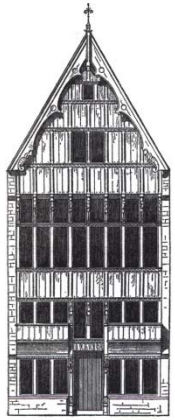

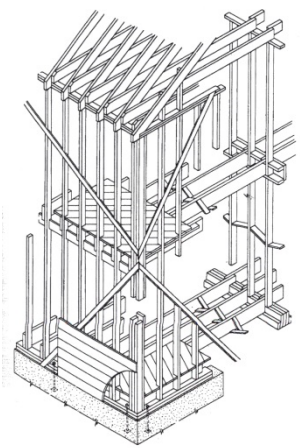

Holland. *The construction systems of* ***Balloon Frame and Platform Frame***

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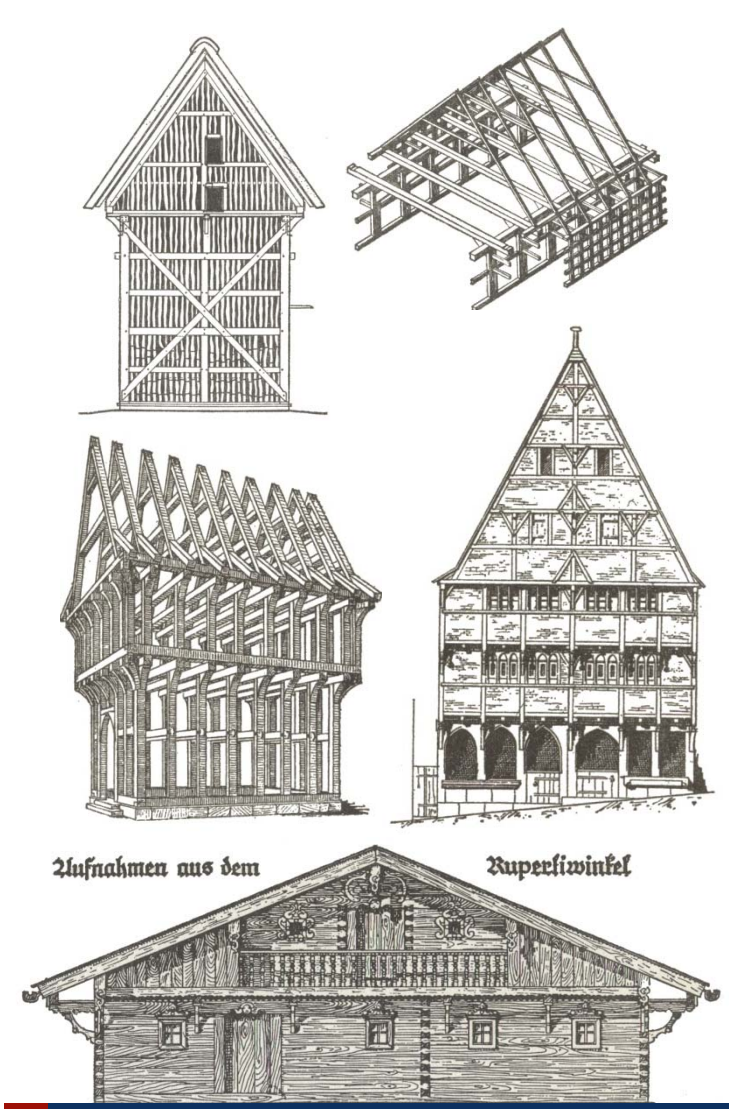

Germany. *The houses of Bavaria and the rural houses dell'Hellenhaus*

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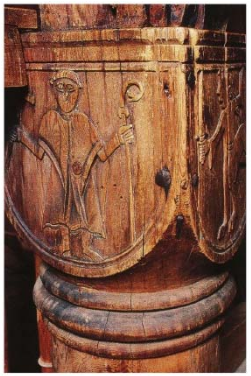

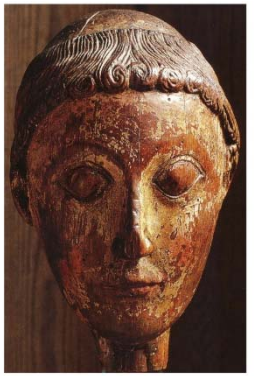

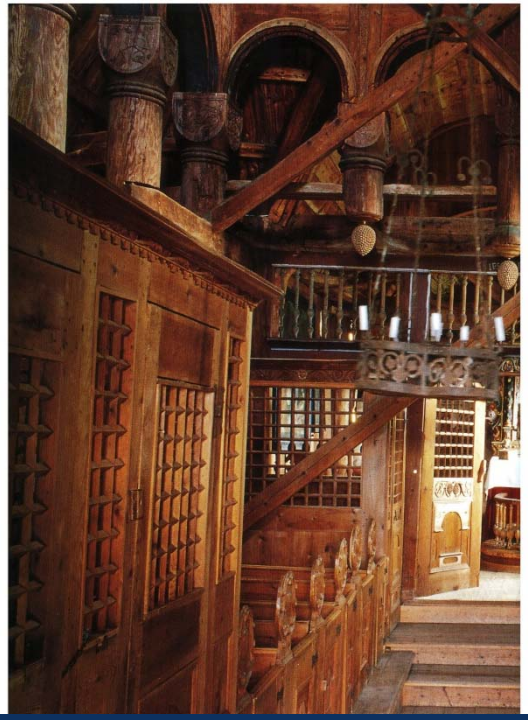

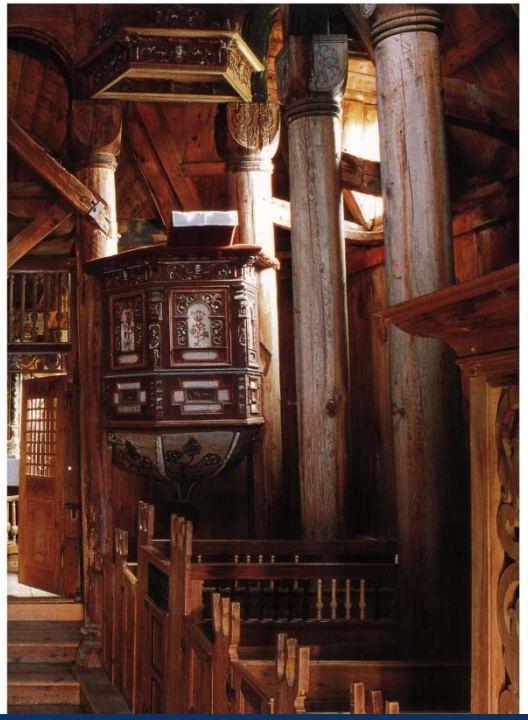

Norway and Sweden. *The church of Urnes*

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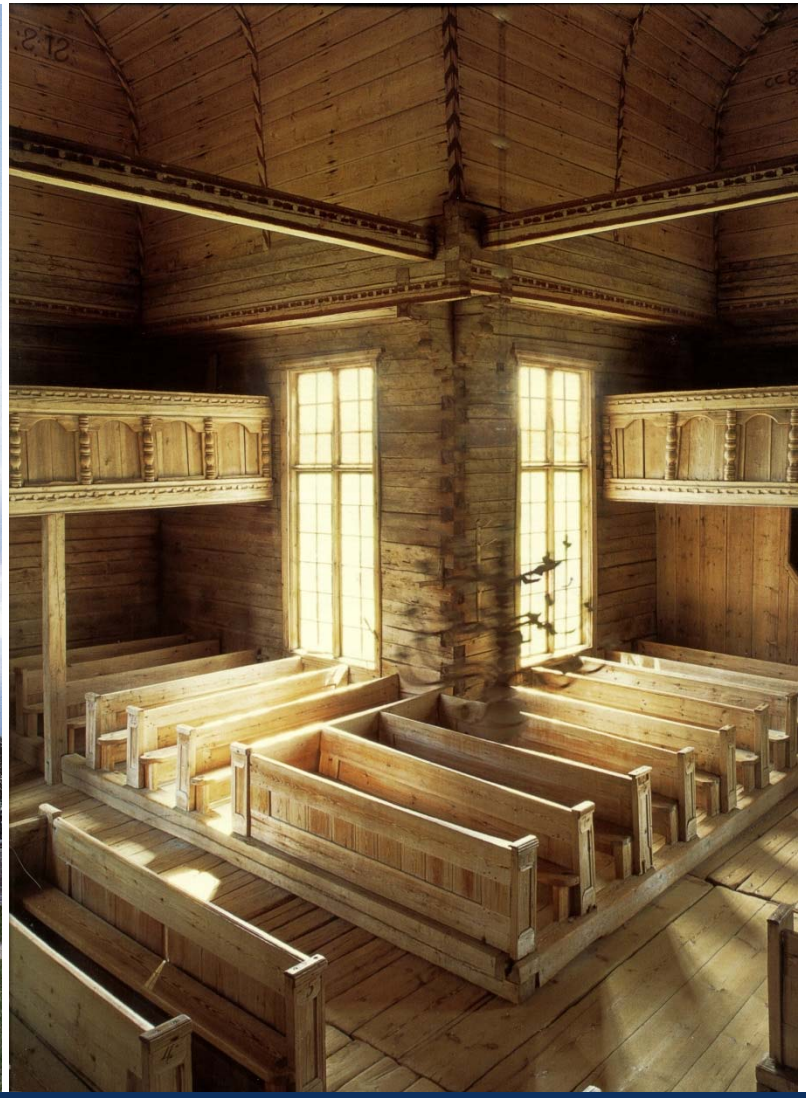

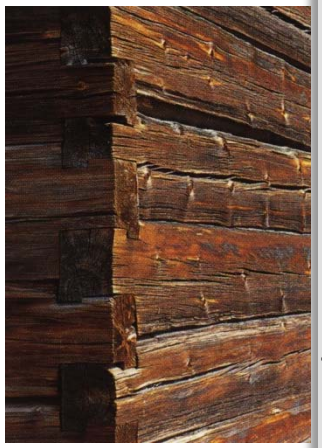

Finland. *The church of Petäjävesi*

Research and Theory of Architecture

Linnanmaa, 2nd October 2017

Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

Documentation of Wooden Architectural Heritage

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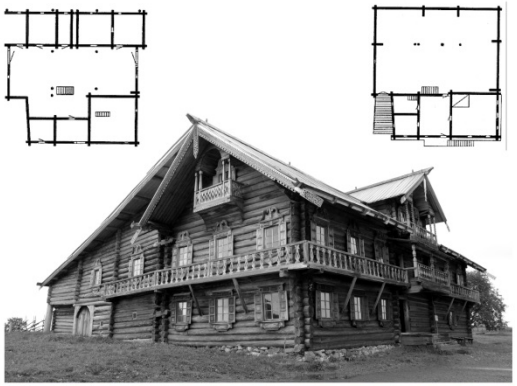

Russia. *The traditional architectonic syte of the country side*

Research and Theory of Architecture

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PostDoctoral Fellow
sara.porzilli@oulu.fi

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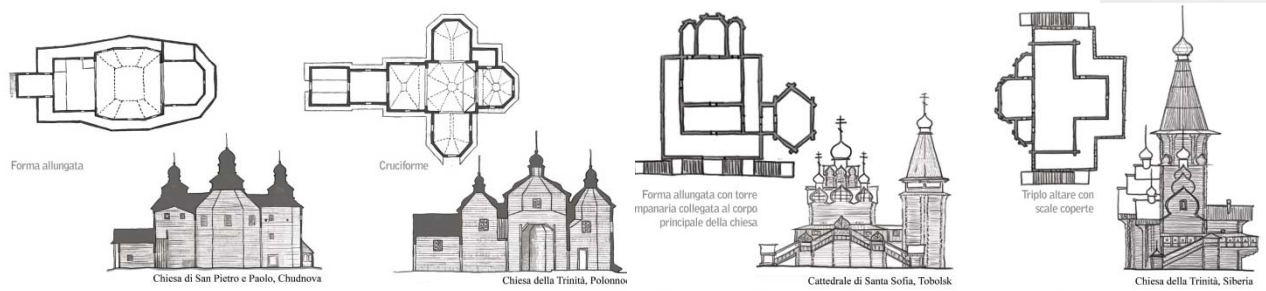

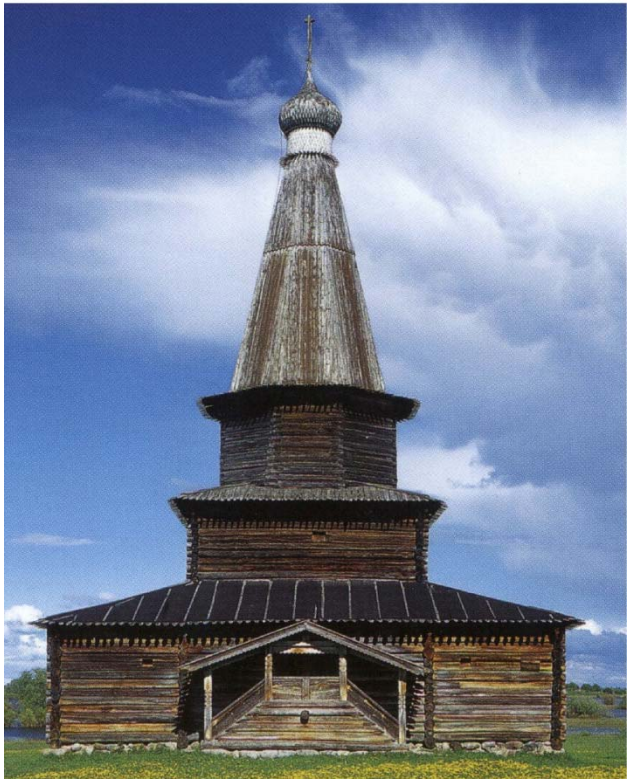

Chiesa della Dormizione di Kuritsko (1595)

Chiesa dell'Assunzione di Kondopoga (1774)

Chiesa della Trasfigurazione di Kizhi (1714)

Russia. *The colossal religious architectures*

Research and Theory of Architecture

Linnanmaa, 2nd October 2017

Sara Porzilli
PostDoctoral Fellow
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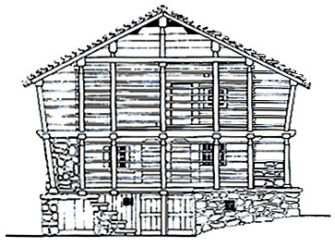
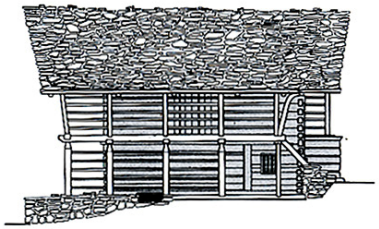
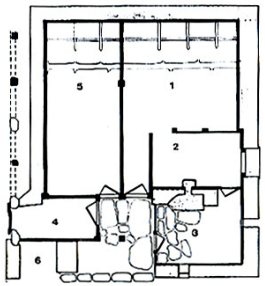
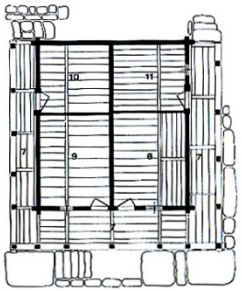
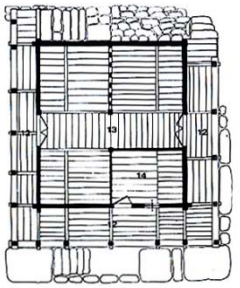
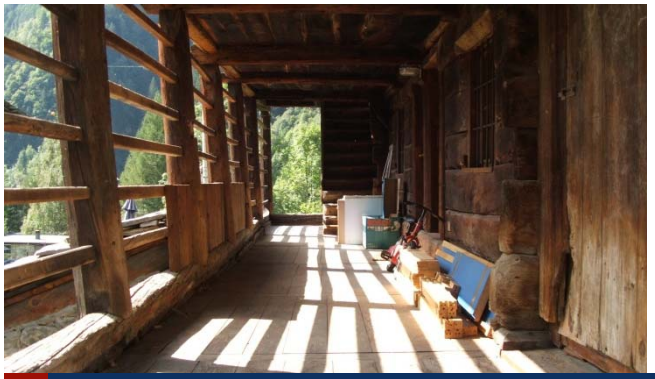






Italy. *The architecture on Alps developed by Walser population*



Research and Theory of Architecture

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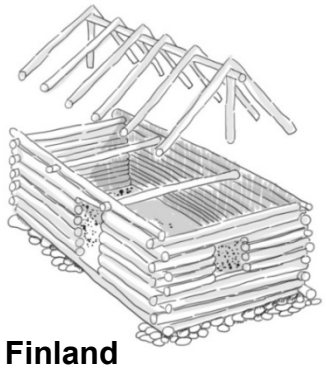
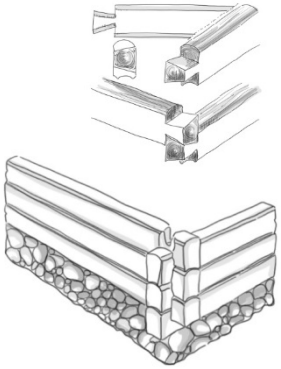
PostDoctoral Fellow
sara.porzilli@oulu.fi

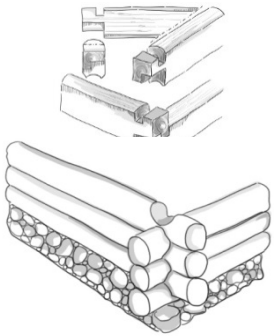
Wooden Architecture represents one of the oldest building systems adopted by the majority of people that developed construction techniques in respect of the local tradition.



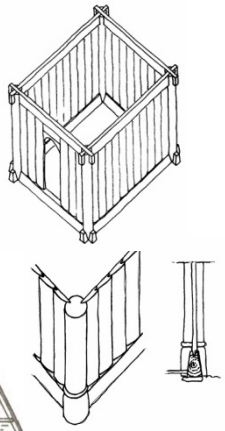
Finland

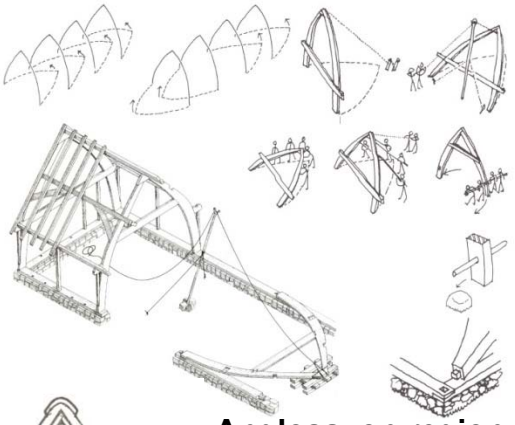


Sweden

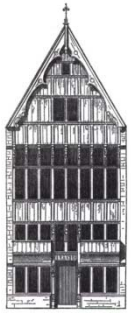


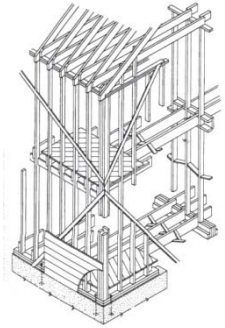
Norway





Anglosaxon region





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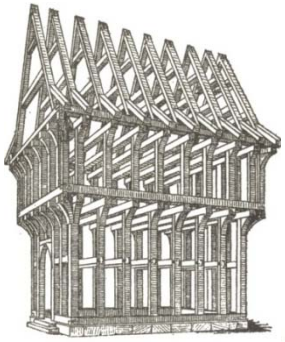
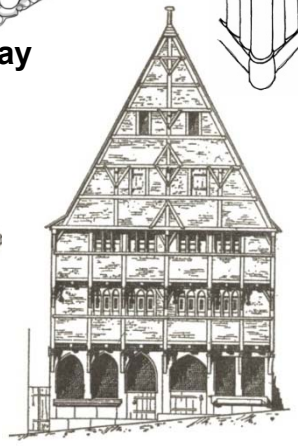
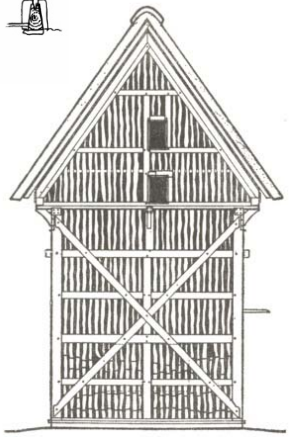
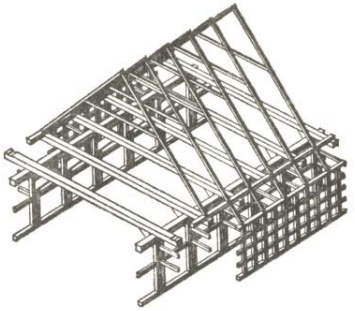
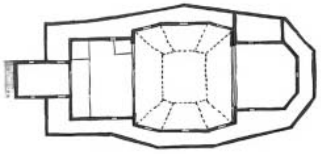




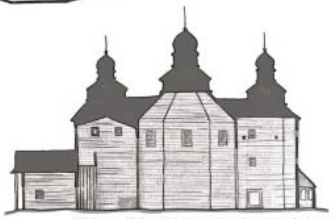




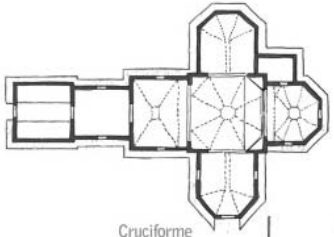
Germany



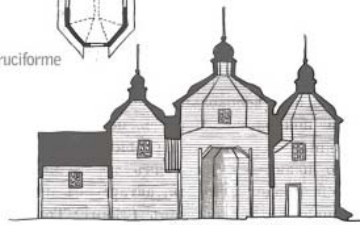
Forma allungata



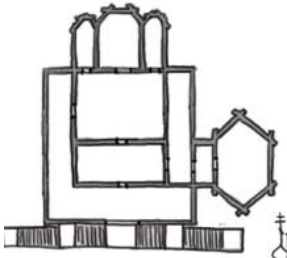
Chiesa di San Pietro e Paolo, Chudnova



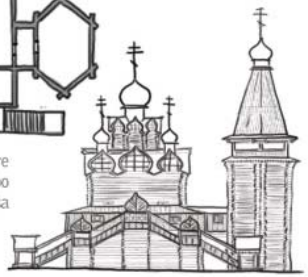
Cruciforme



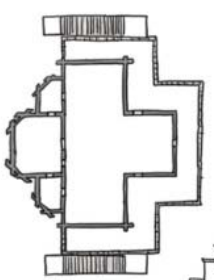
Chiesa della Trinità, Polonnoe



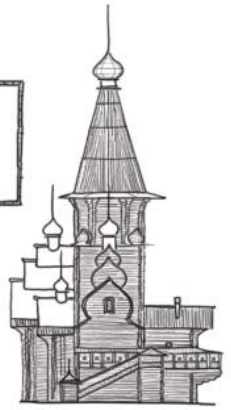
Forma allungata con torre
mpanaria collegata al corpo
principale della chiesa



Cattedrale di Santa Sofia, Tobolsk



Triplo altare con
scale coperte



Chiesa della Trinità, Siberia

Russia

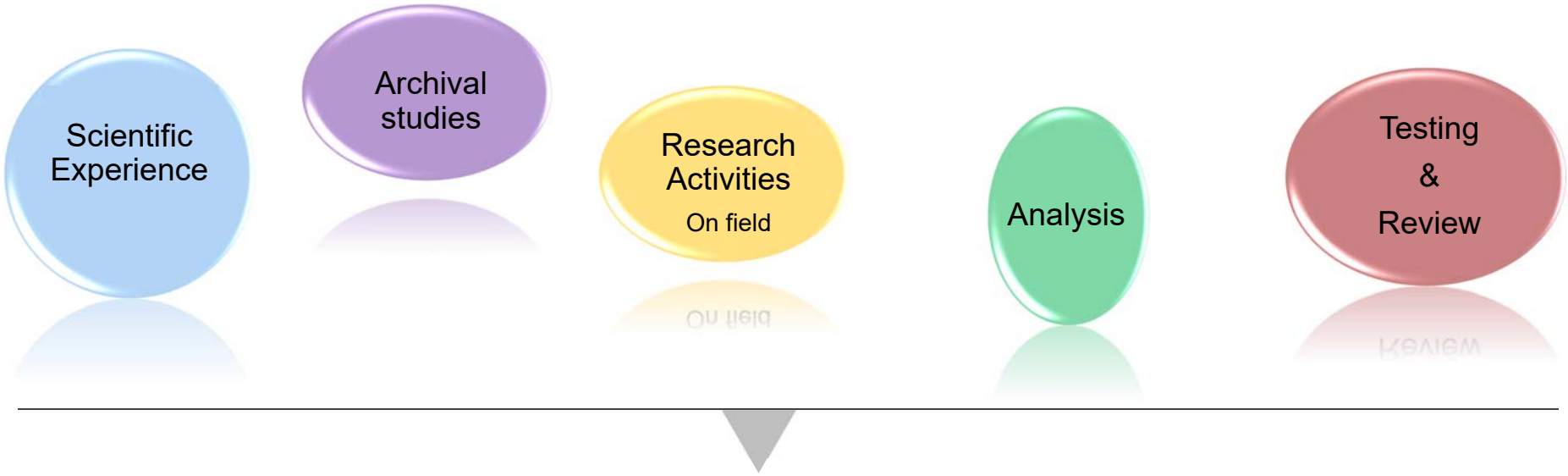
Today this **vast and unique wooden world heritage is strongly needing to be surveyed and cataloged**. Fires and abandonment for negligence are the main factors which are jeopardizing the preservation of this architecture; every year too many wooden buildings still disappear because of these main reasons.

Preserving Wooden Heritage project is born from the **urgent necessity to keep and preserve wooden architecture** by developing systematic specific technical procedures of interventions based on scientific survey, 2D/3D representations for diagnostic analysis and cataloging of the elements with census activities.

Accurate survey operations constitute the fundamental basis for critical analysis on the development of a context, a village, an architecture as well as for planning specific interventions:

- CONSERVATION
- RESTORATION
- RE-USE AND NEW PLANNING

This important challenge has the purpose to obtain new technical methods, procedures and protocols, fundamental for technicians and operators.



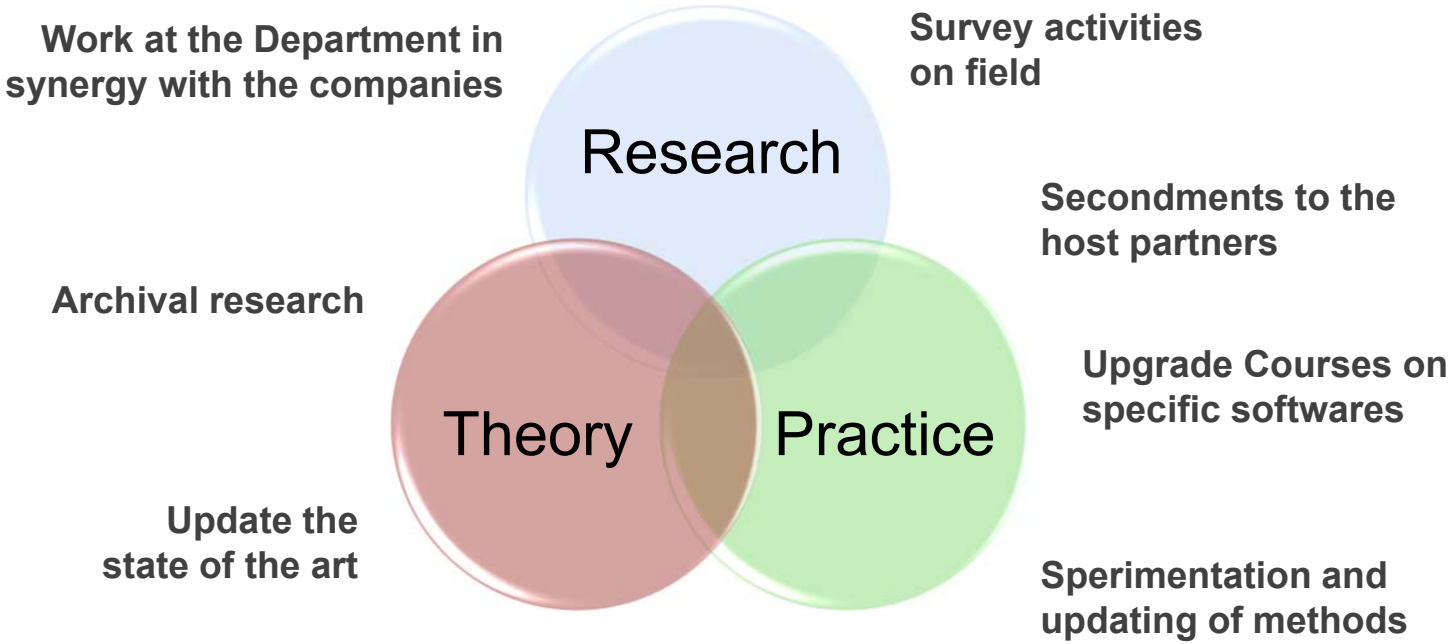
Develop **systematic specific technical procedures** of interventions based on:

- **Digital Survey Activities**
- **2D/3D representations for diagnostic analysis**
- **Cataloging of the elements with census activities**

Obtain a **complete description of a wooden architecture as a sort of echography** by including analysis of practical matters with different techniques.

Define the main tangible and intangible values, fundamental for preserving not only the historical memory of the place but mainly the **authenticity of the architecture** with its intrinsic characteristics.

This project wants to address a new scientific approach of **how-to-do research** on **wooden buildings** for practical interventions with respect to scientific foundations.



In this sense **Research-Theory-Practice triangle** will offer new insights into the world of timber architecture and wooden heritage preservation.
The research approach of this study is based on **cultural ecology where historic preservation and restoration**, both in theory and methods, **are seen as part of a wider process, sustainable development.**

Evolution of technology

Evolution of programmes And software

Development of the laser scanner survey **technology** and **methodologies**

Traditional survey: need to select the information already in the survey phase

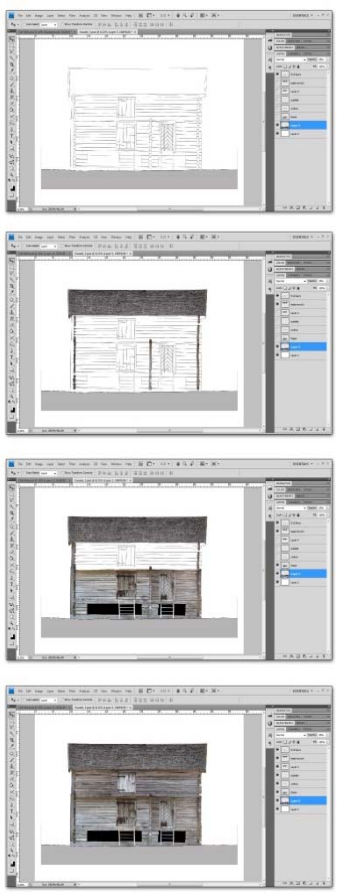
Digital survey: acquisition of a large number of information that the surveyor will have to select in the second phase

---

Accurate surveying operations constitute the fundamental basis for designing any kind of architectural project and critical analysis. Innovative methods for survey and geo-reference data on architecture allow technicians to acquire exact knowledge of the current status of the object studied. **True metrical information and data are fundamental for understanding the formation and development of an architectural entity, village, or city, as well as for planning interventions for conservation and restoration activities.**

Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

Documentation of Wooden Architectural Heritage



Newest technologies still must be based on technical knowledge in architecture and its environment. Cool equipment is not sufficient for producing technical documentation. We **constantly** need to push and improve our knowledge (curiosity?) increasing both our skills and critical point of view. Observe, analyse, sketch for the understanding of reality. If we assume these aspects technology can give us all the best support in our research activities.

Research and Theory of Architecture

Linnanmaa, 2nd October 2017

Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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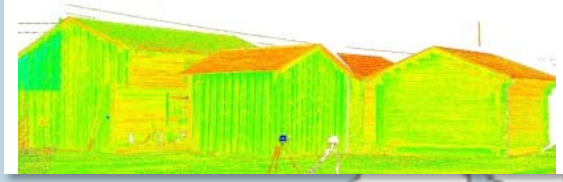
Lamminaho farm house

VAALA - FINLAND



Pogost Complex on Kizhi Island and its rural settlements

REP. OF CARELIA - RUSSIA

Research and Theory of Architecture

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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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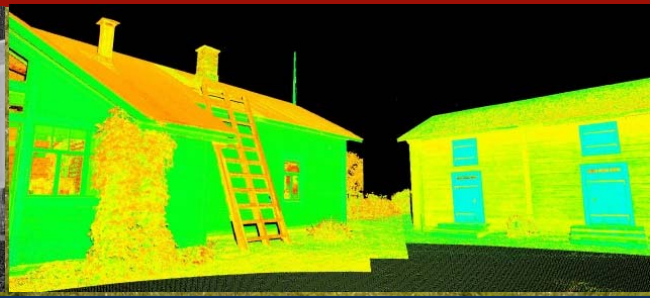
Lamminaho farm house VAALA - FINLAND



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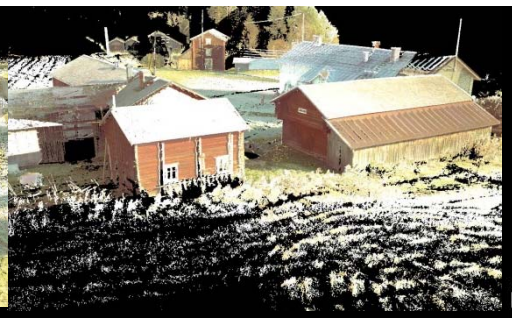
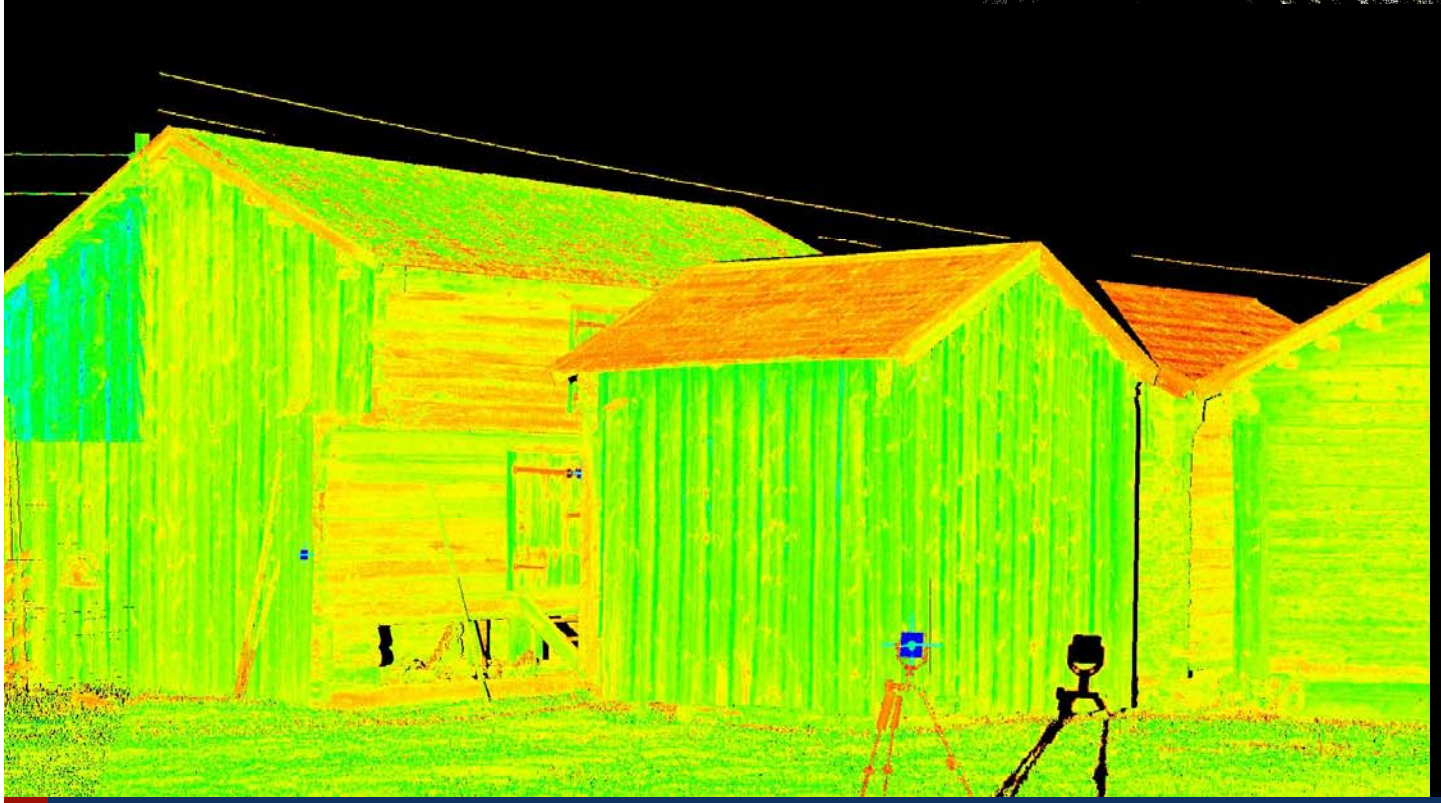
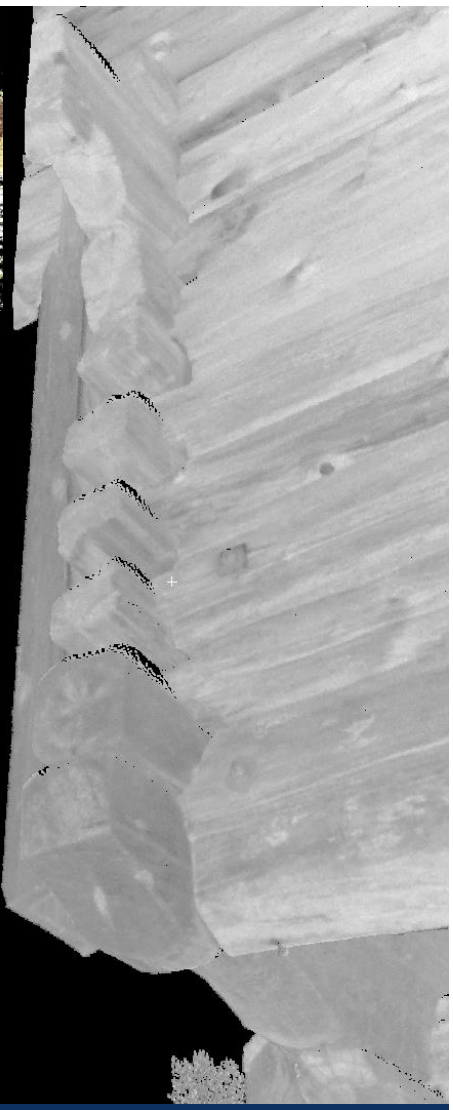

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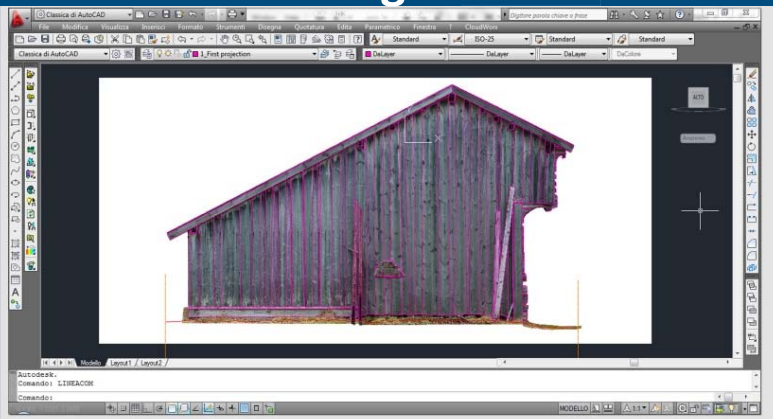
◀••••••••From the point cloud to the photo maps / ortho photos. ••••••••▶



Exmple of the main process used for the elaboration of the data acquired.

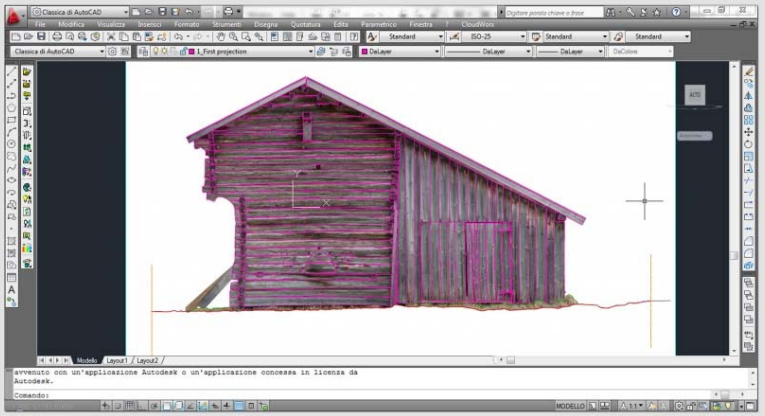
1. Laser scanner survey

2. Orthoimages of the facades from the point cloud obtained;

3. Wireframe drawings on the othoimages imported in CAD softwares

4. Elaboration of the photo maps or ortho photos;

5. Conclusion and re-elaboration of the CAD drawings adding all the missing information of the point cloud visible on the picture.



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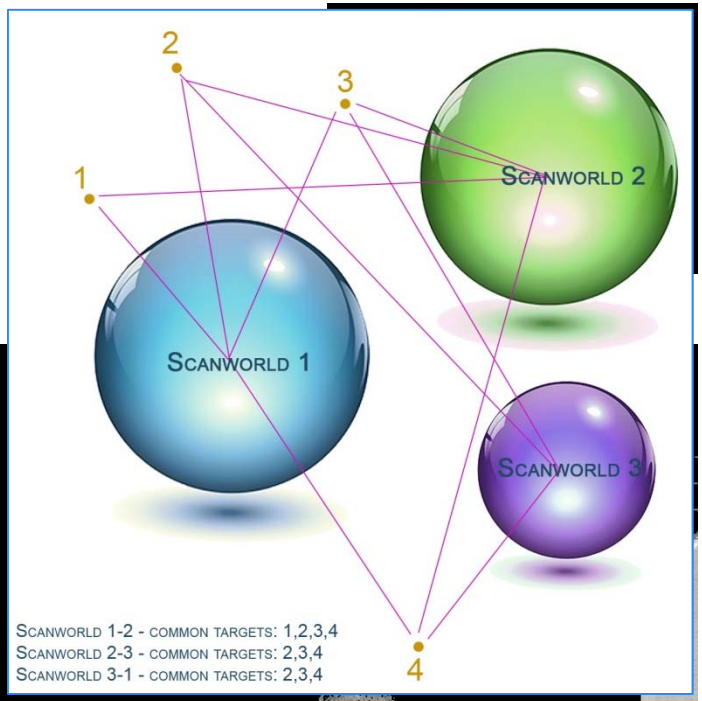

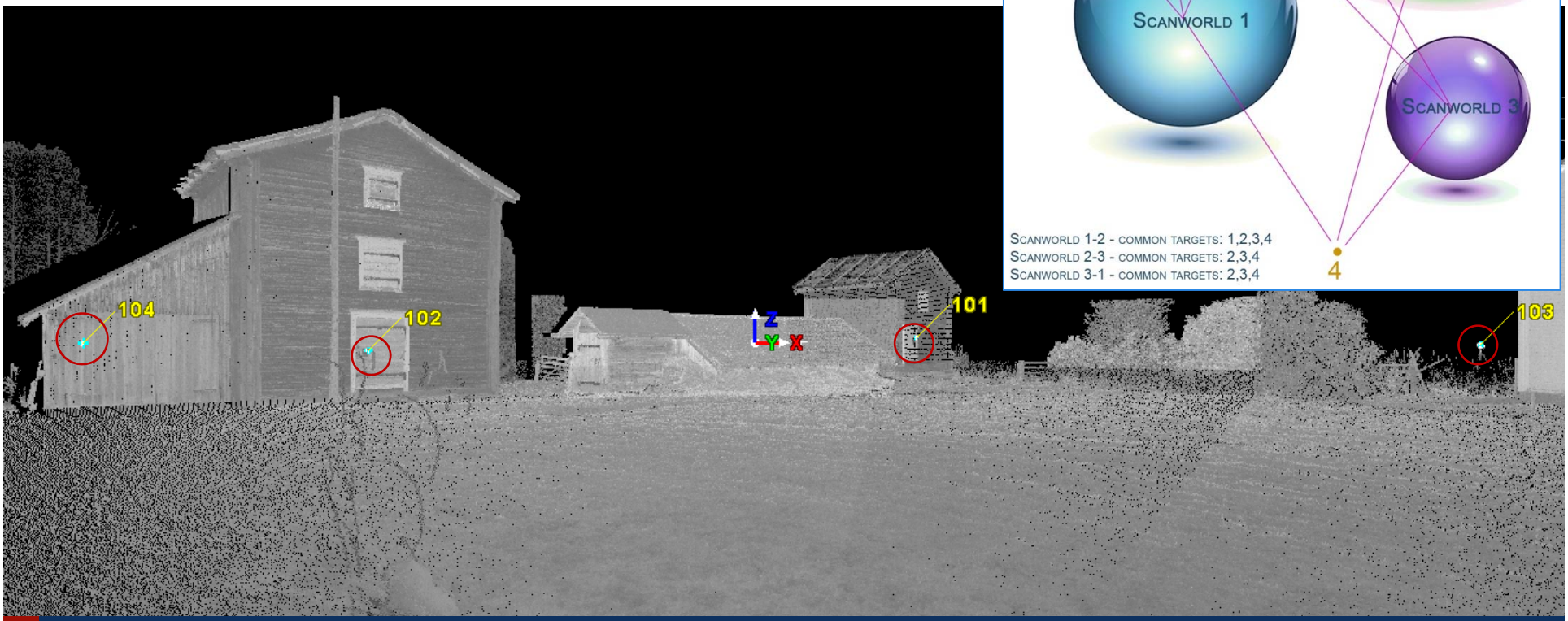

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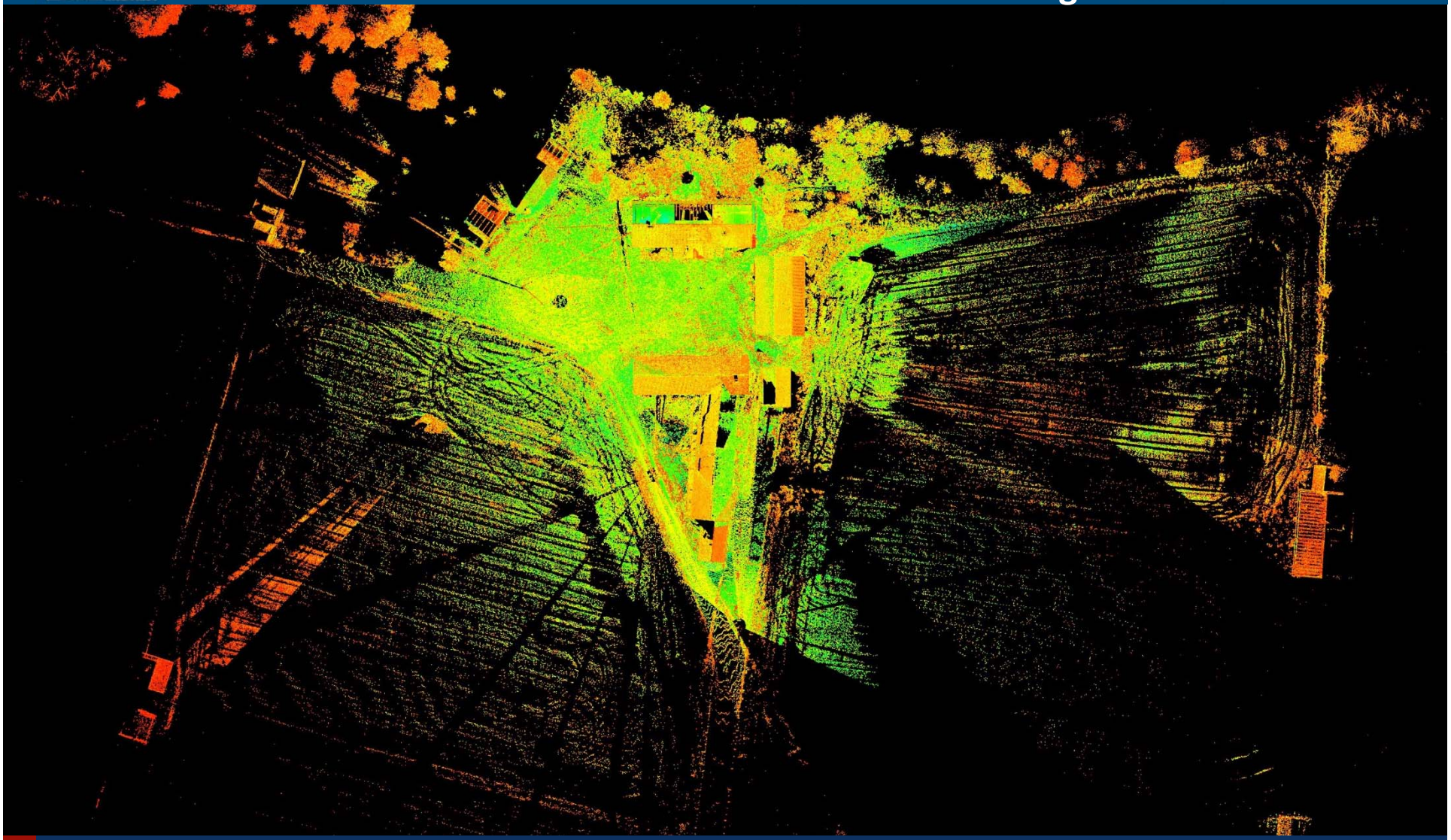

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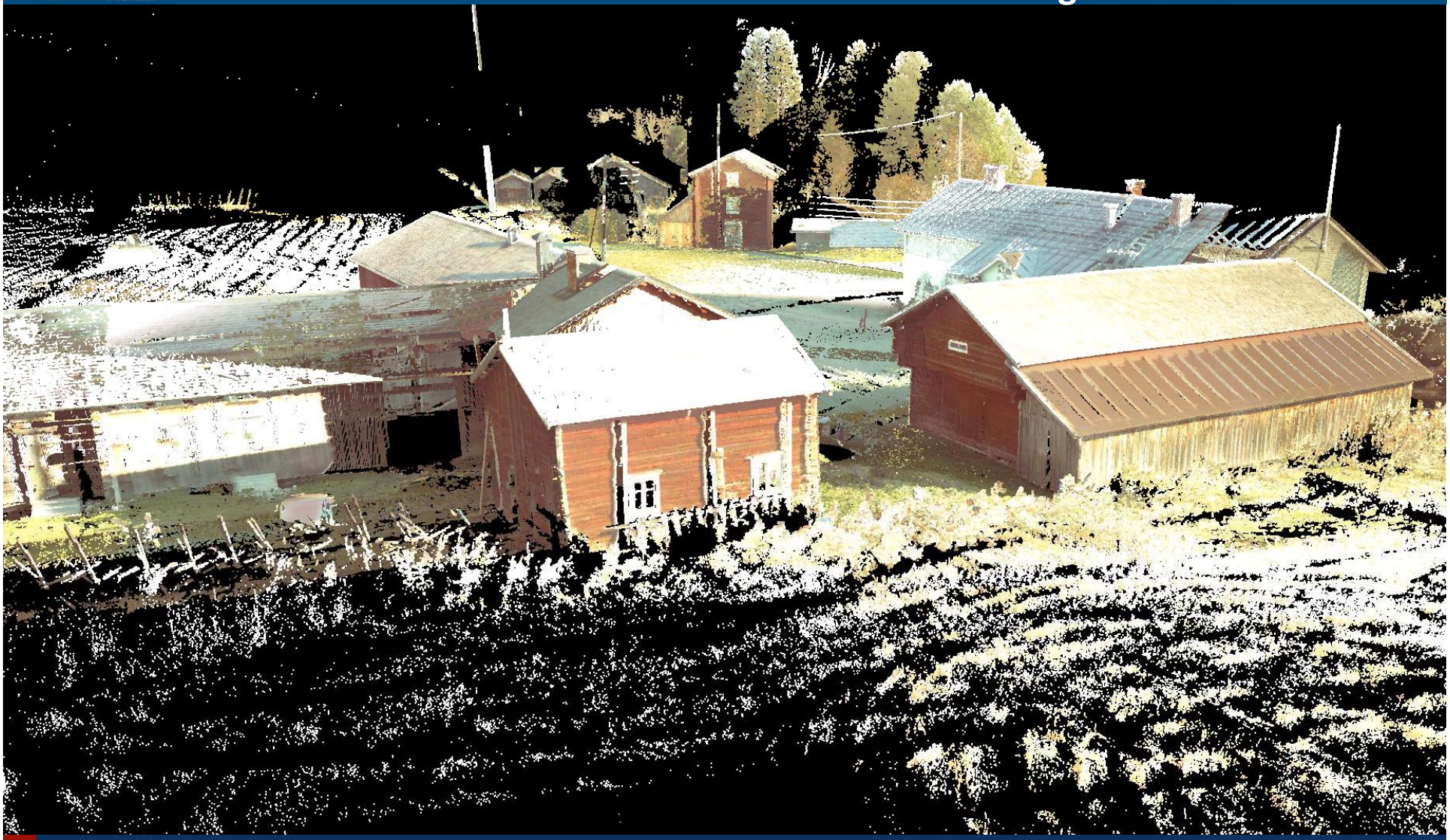

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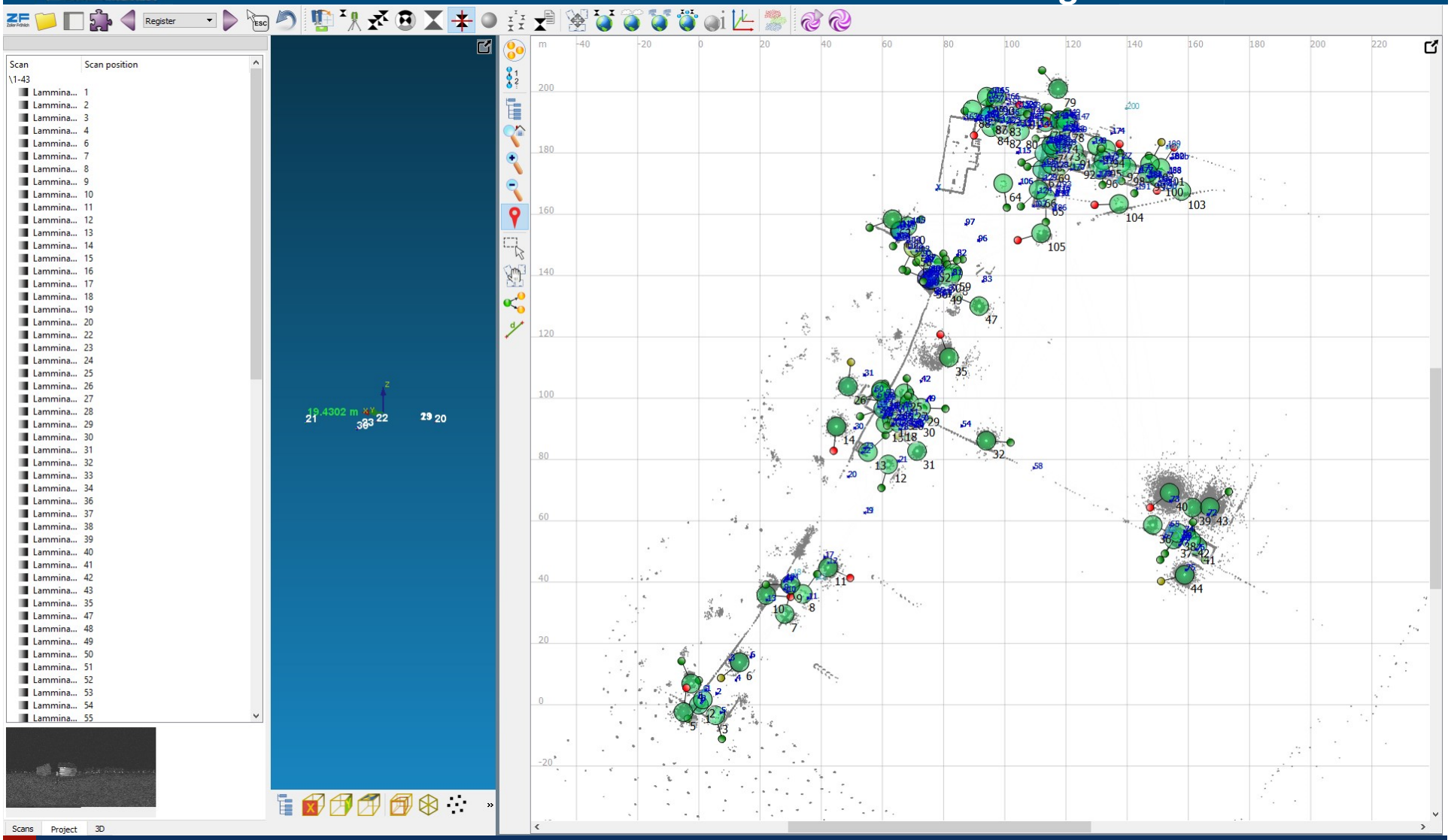

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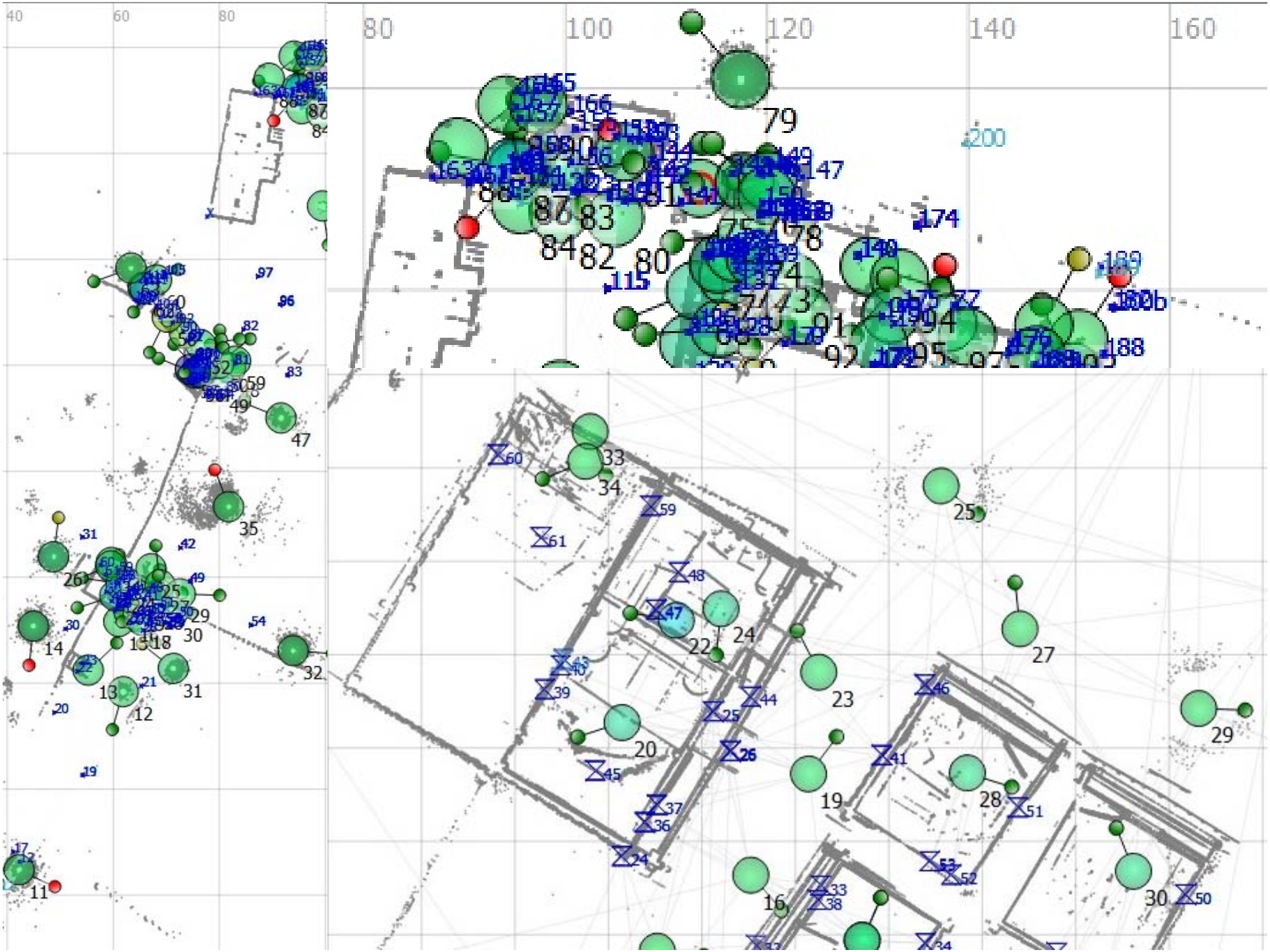

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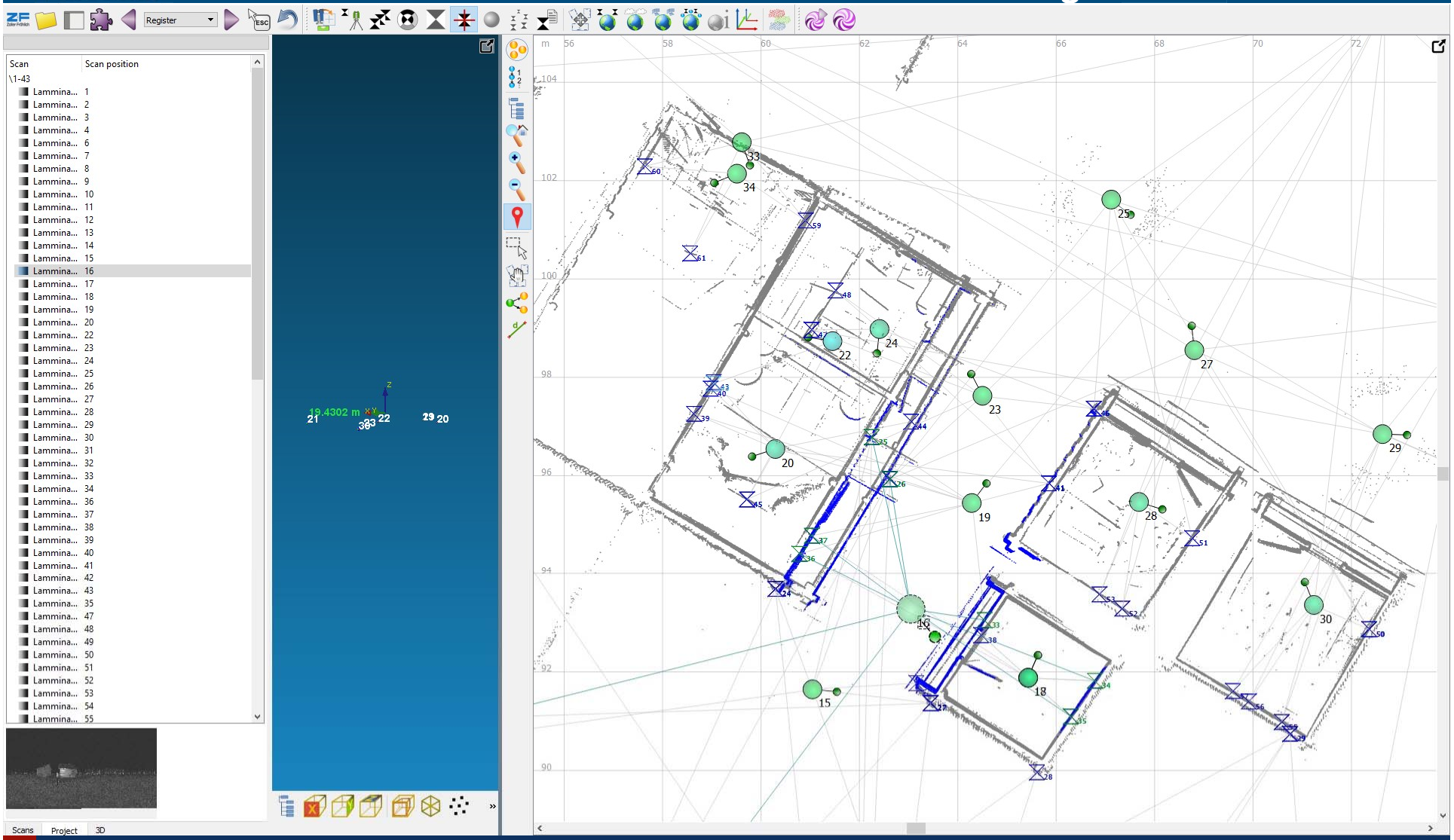

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Linnanmaa, 2nd October 2017

Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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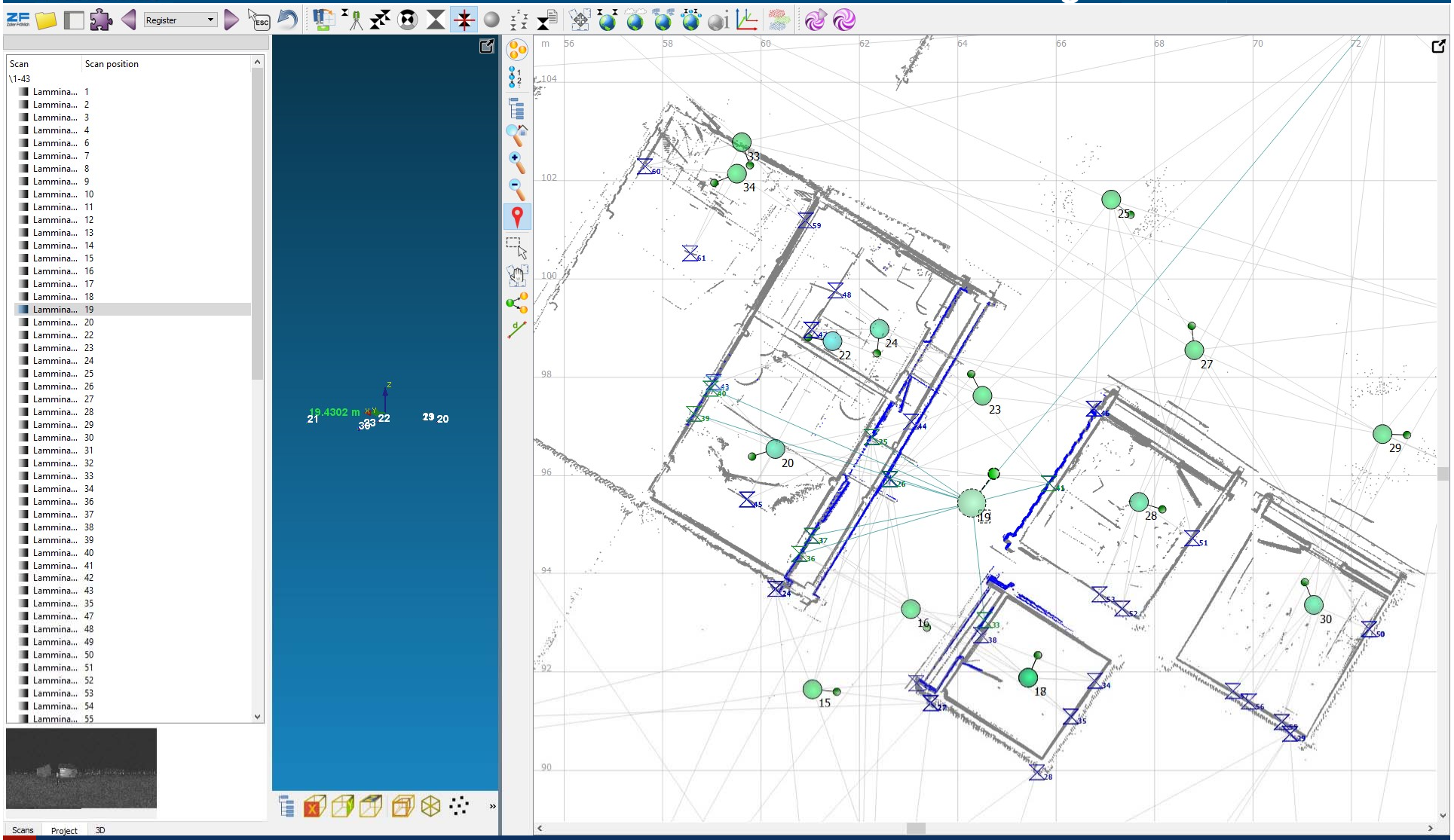

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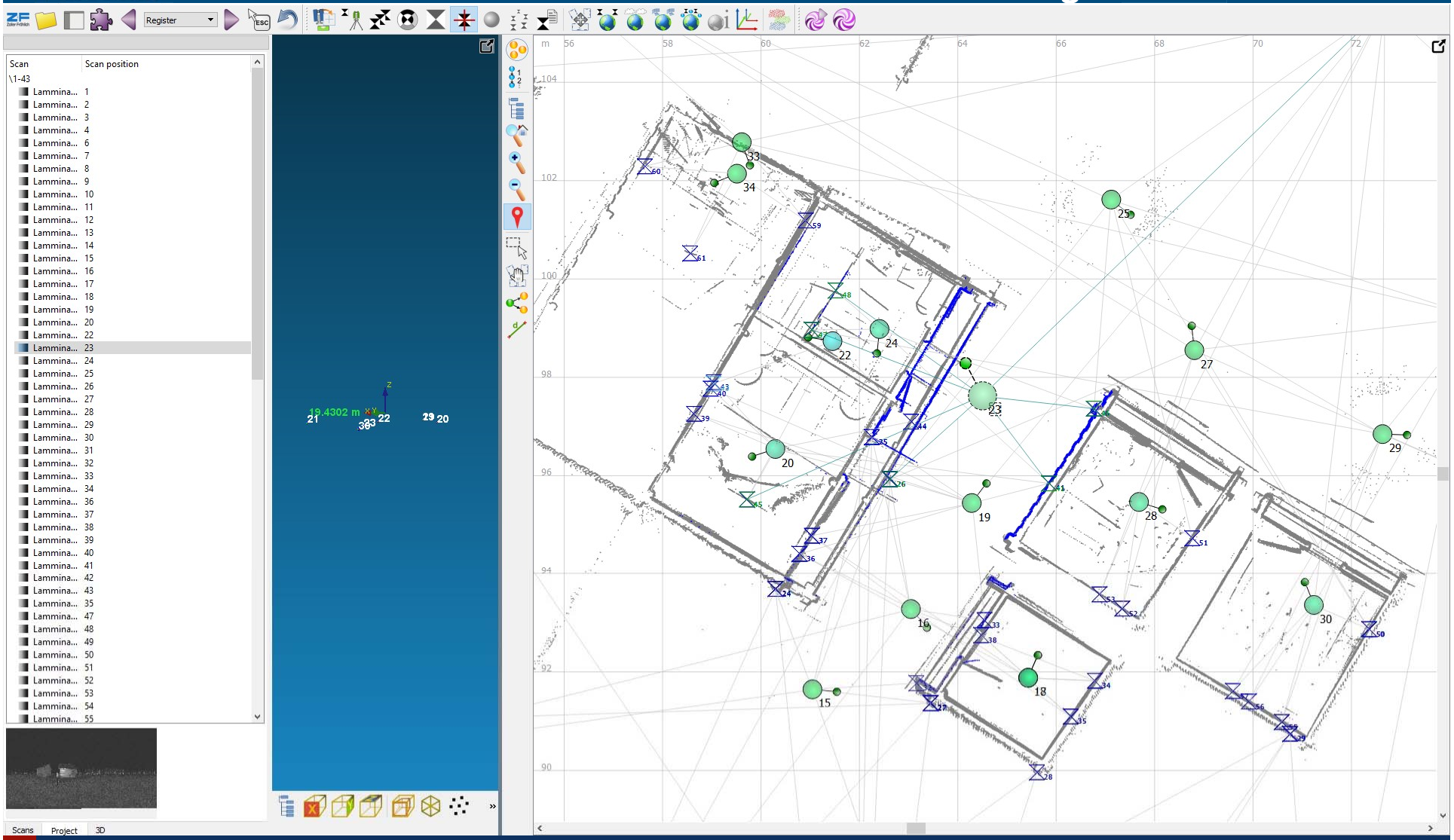

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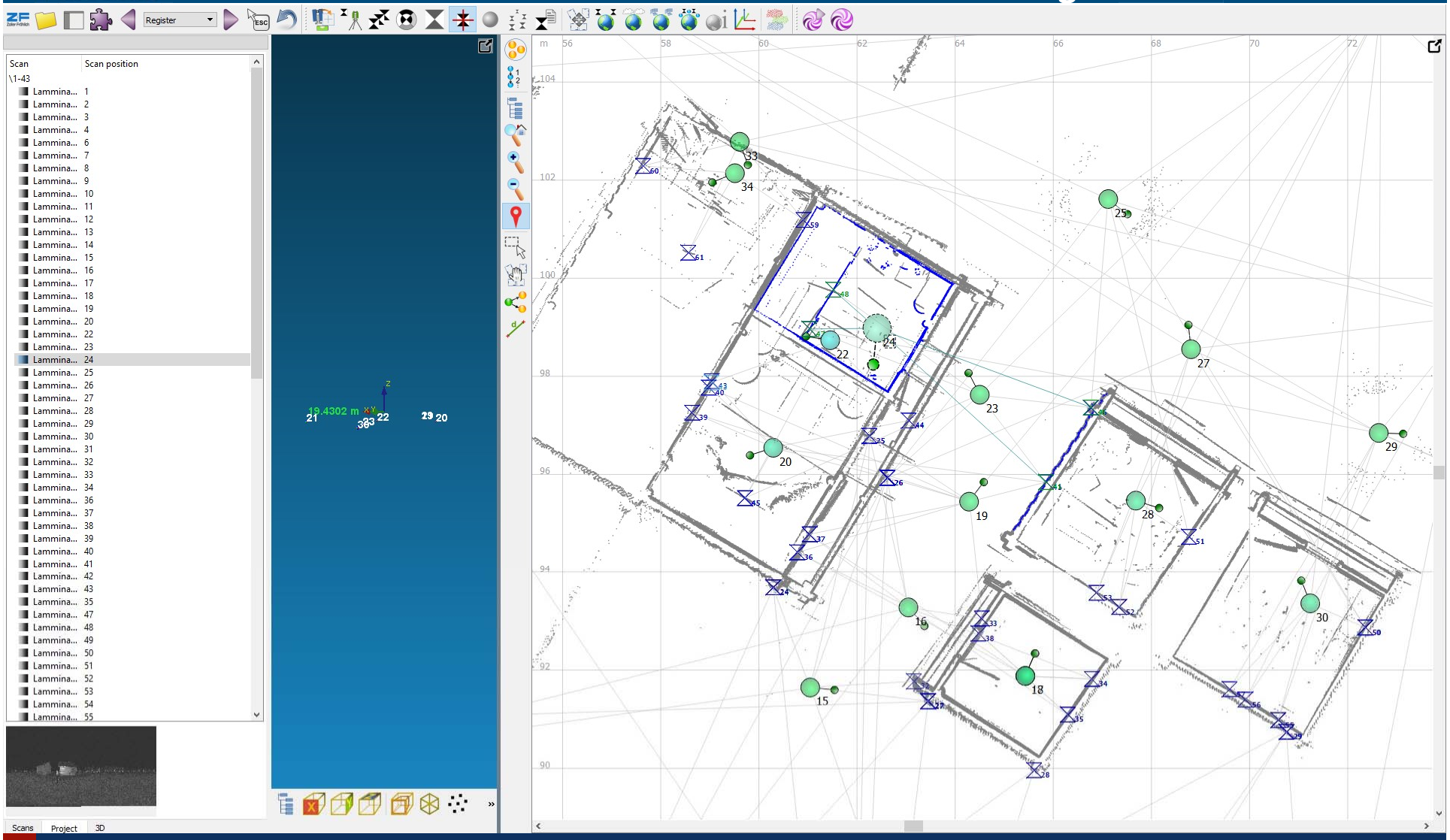

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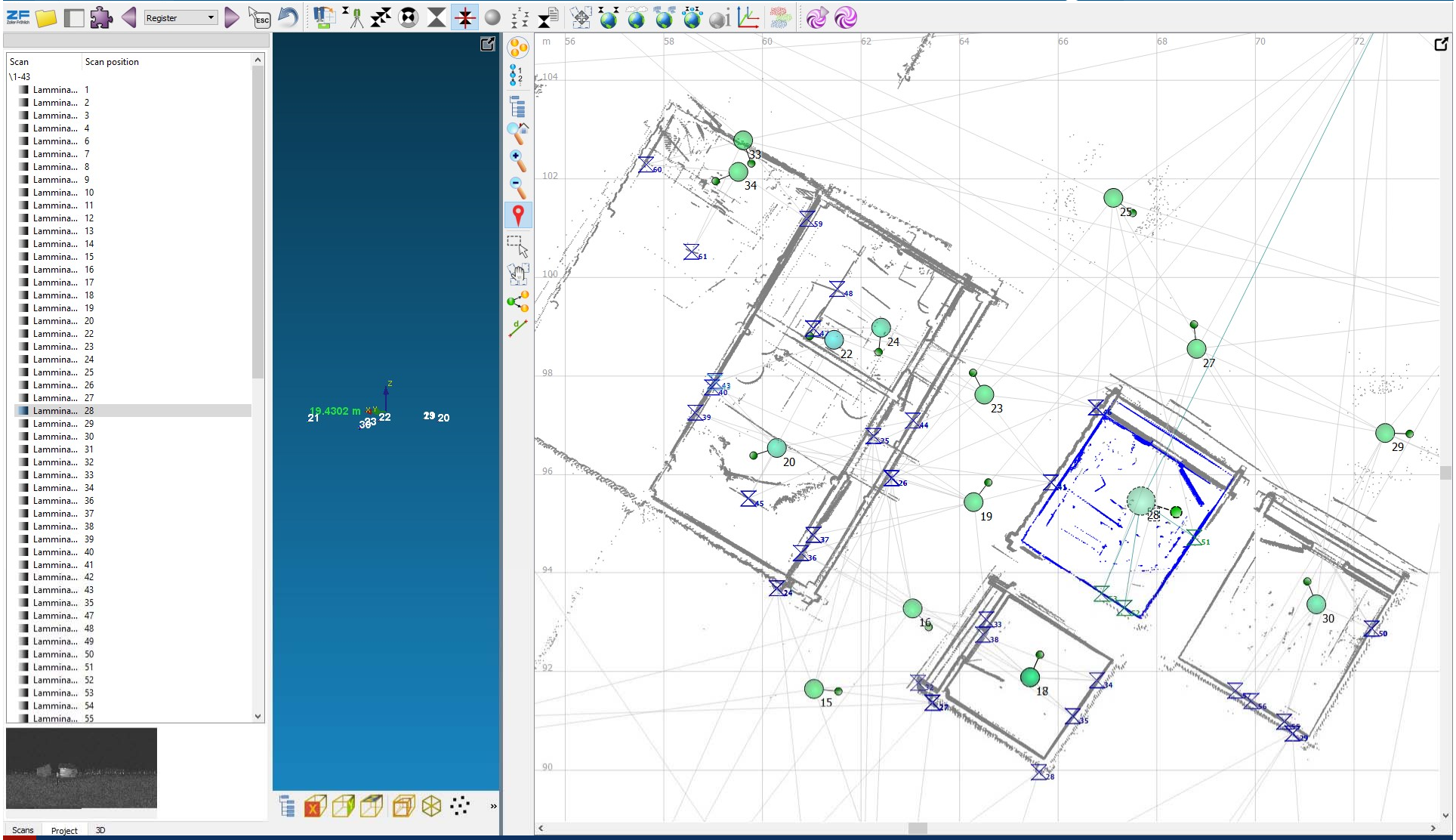

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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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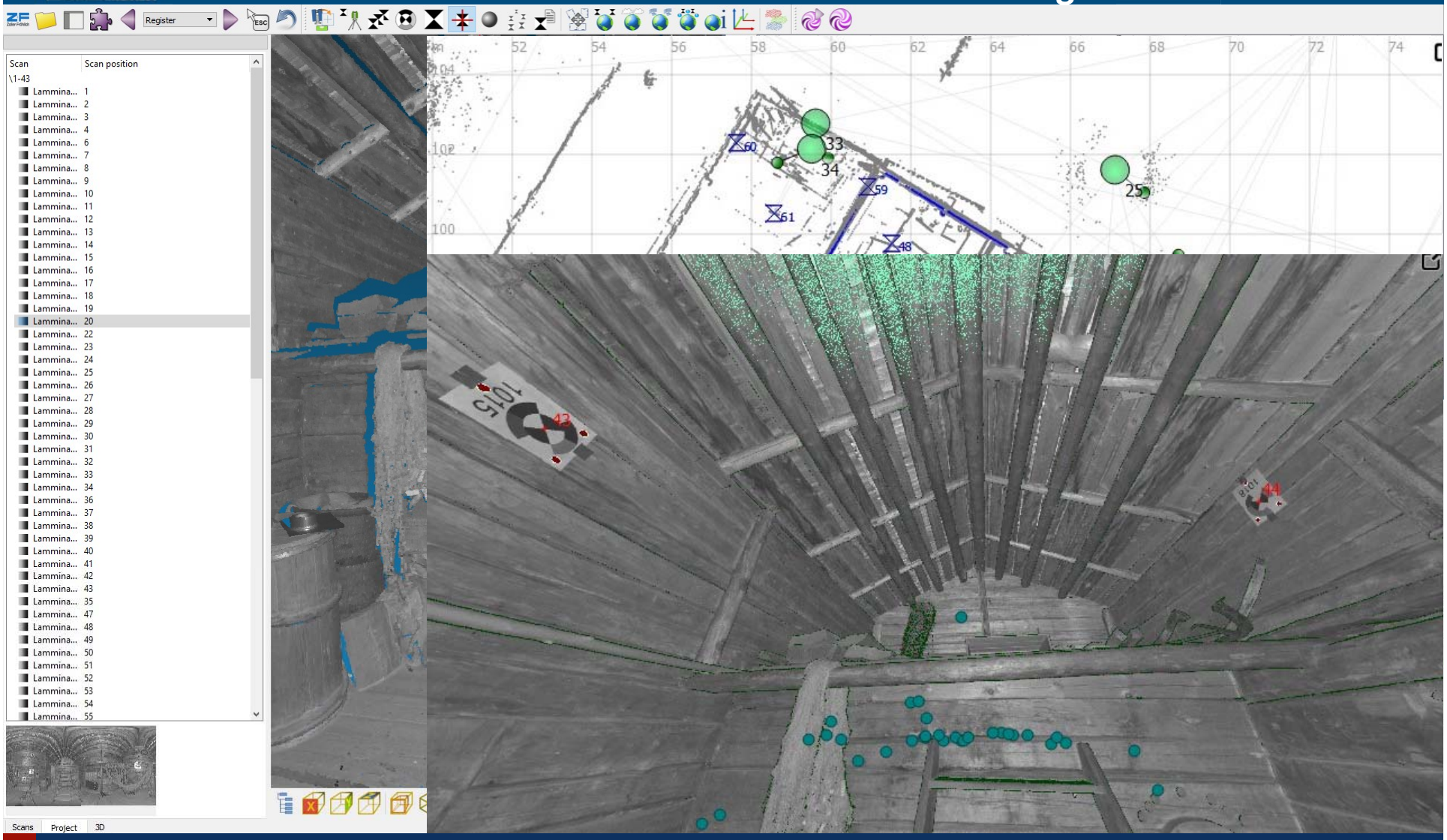
DIDA DIPARTIMENTO DI ARCHITETTURA



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PostDoctoral Fellow
sara.porzilli@oulu.fi

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PostDoctoral Fellow
sara.porzilli@oulu.fi

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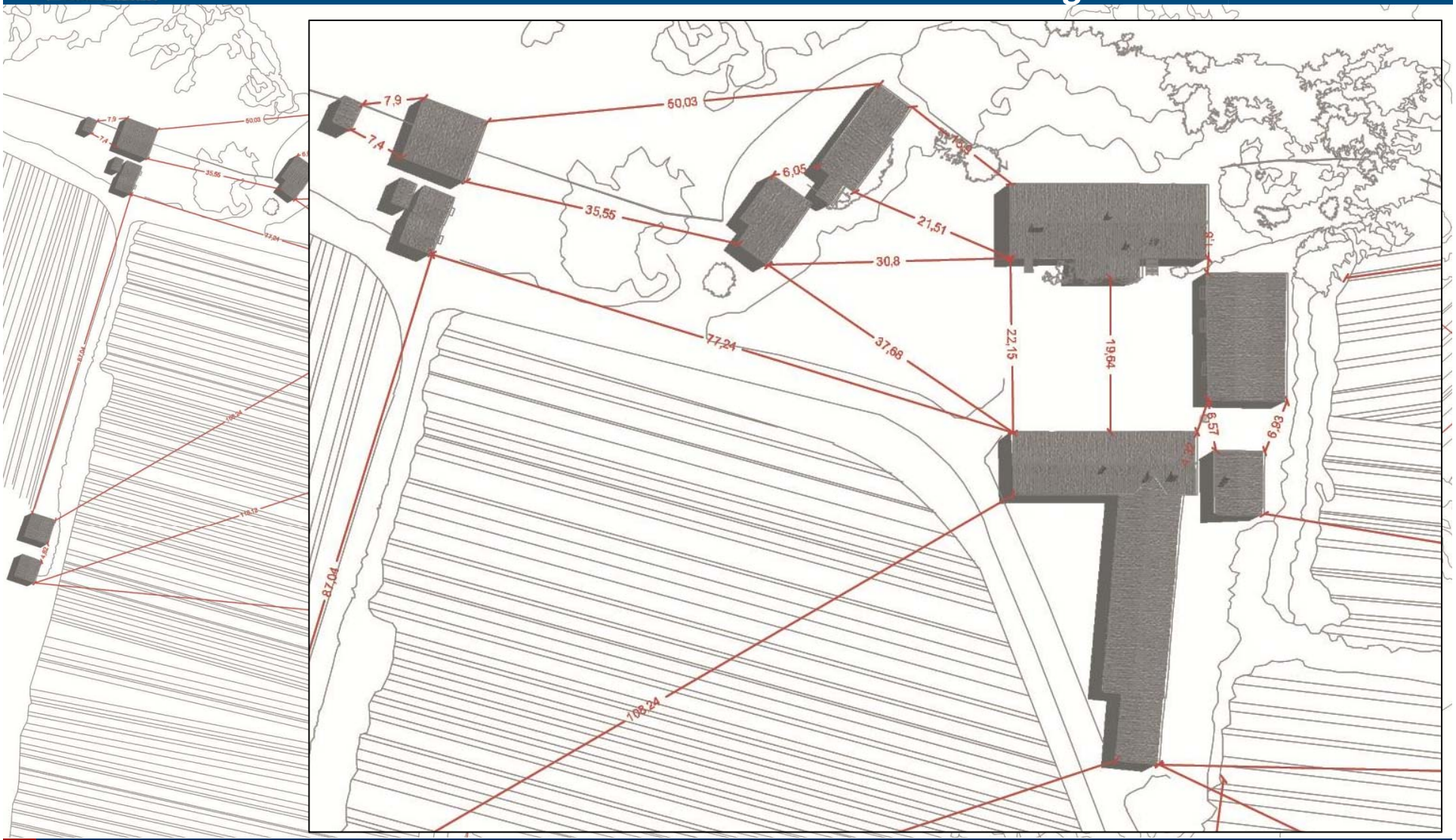

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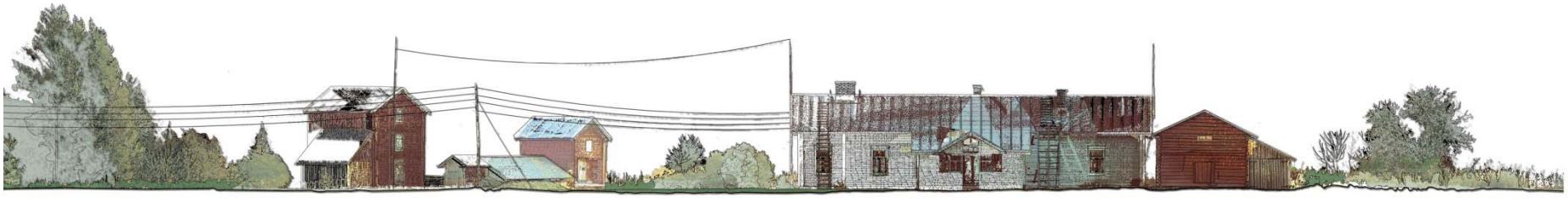
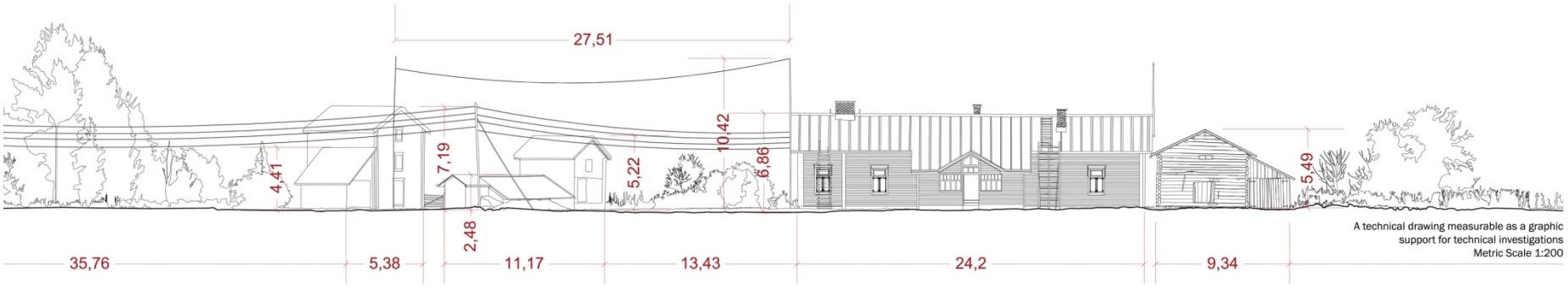
PostDoctoral Fellow
sara.porzilli@oulu.fi

Point cloud and vector redrawing



Point cloud and vector redrawing
Metric Scale 1:200

Vector redrawing with application of colours
Metric Scale 1:200



A technical drawing measurable as a graphic support for technical investigations
Metric Scale 1:200

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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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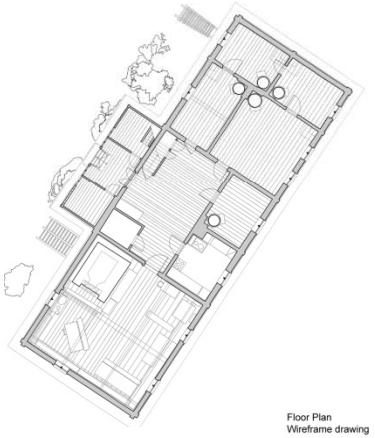
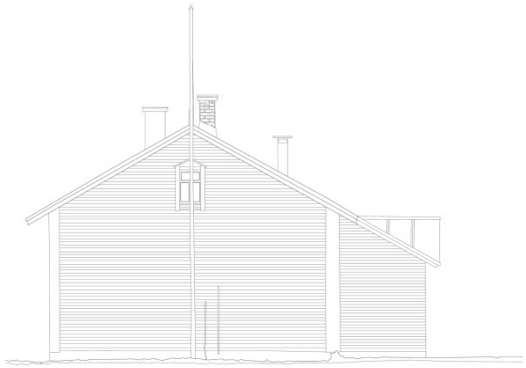
Facade NORTH-WEST
Photomap
Metric Scale 1:50

Facade SOUTH-WEST
Photomap
Metric Scale 1:50



Floor Plan
Wireframe drawing

Facade NORTH-WEST
Wireframe drawing
Metric Scale 1:50



Facade SOUTH-WEST
Wireframe drawing
Metric Scale 1:50

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Sara Porzilli
PostDoctoral Fellow
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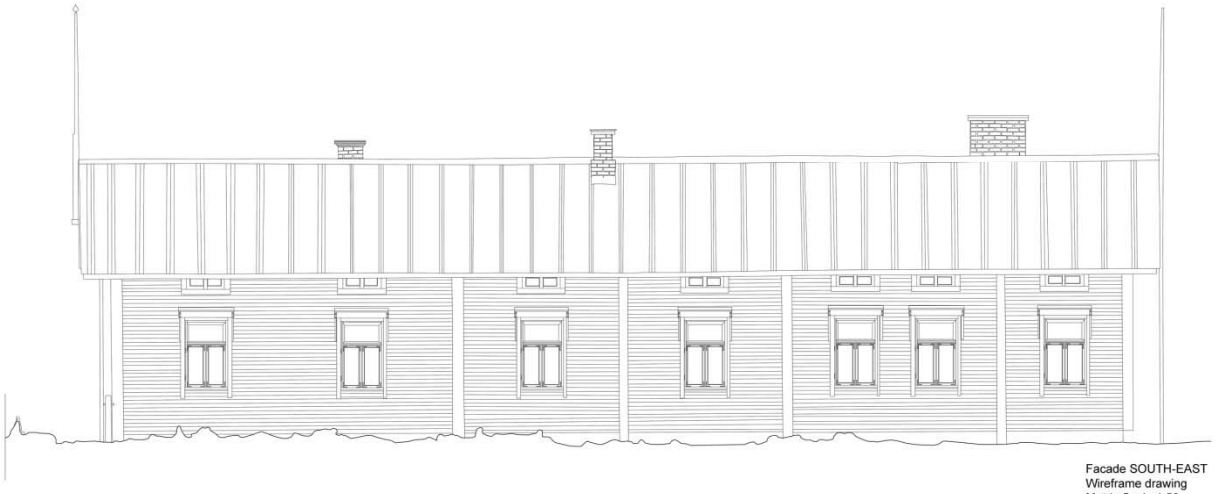
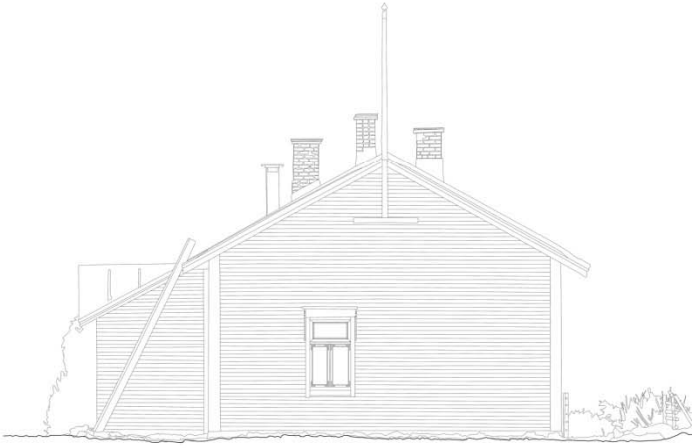
Facade SOUTH-EAST
Photomap
Metric Scale 1:50

Facade SOUTH-WEST
Photomap
Metric Scale 1:50



Facade SOUTH-EAST
Wireframe drawing
Metric Scale 1:50



Facade SOUTH-WEST
Wireframe drawing
Metric Scale 1:50

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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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General views from the point cloud

Facade NORTH
Photomap
Metric Scale 1:25

Facade WEST
Photomap
Metric Scale 1:25

Facade EAST
Photomap
Metric Scale 1:25

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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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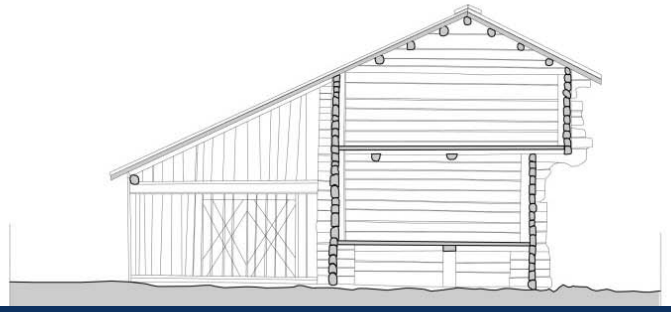
Facade 1

Facade 2

Facade 4



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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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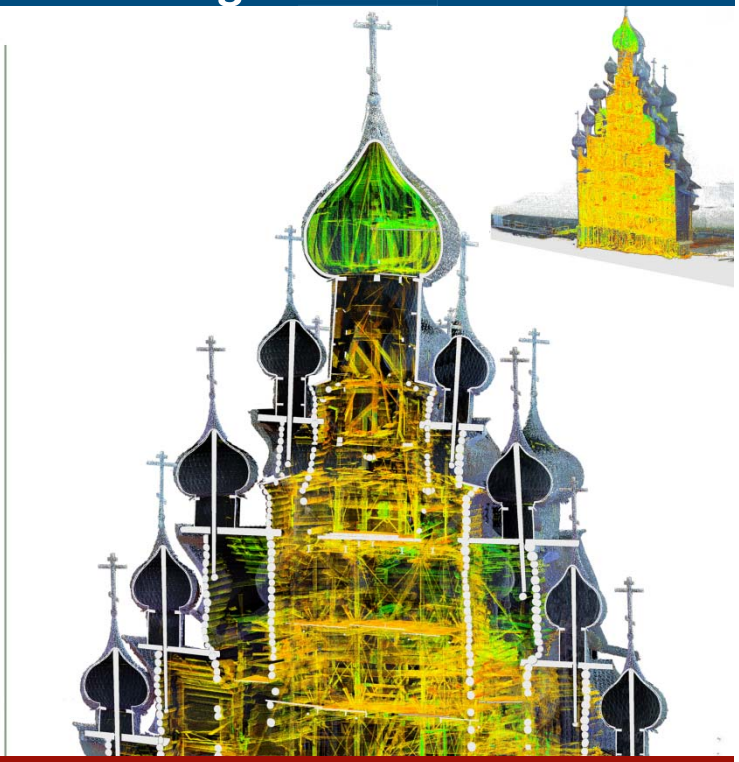

Pogost Complex on Kizhi Island and its rural settlements REP. OF CARELIA - RUSSIA

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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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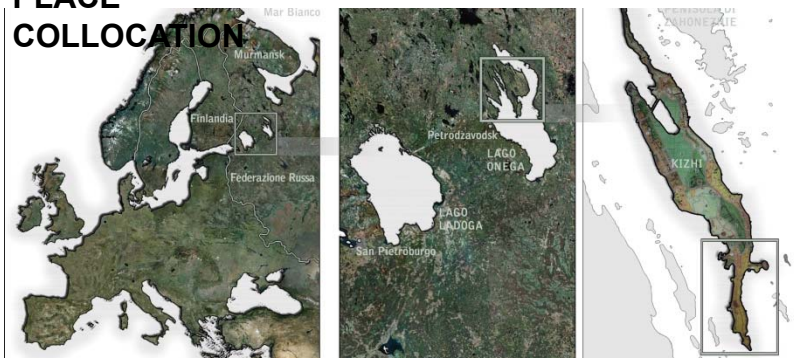
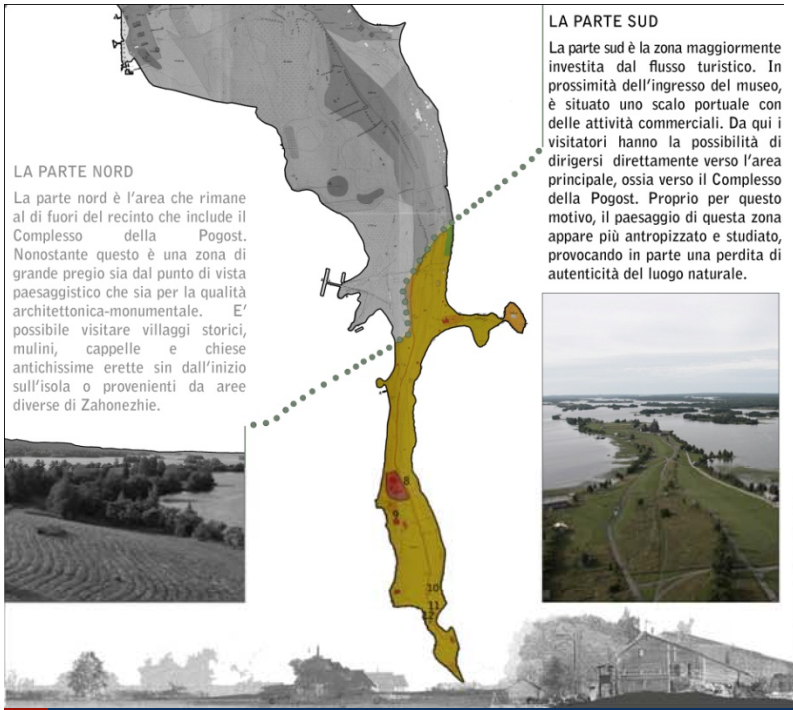
PLACE
COLLOCATION





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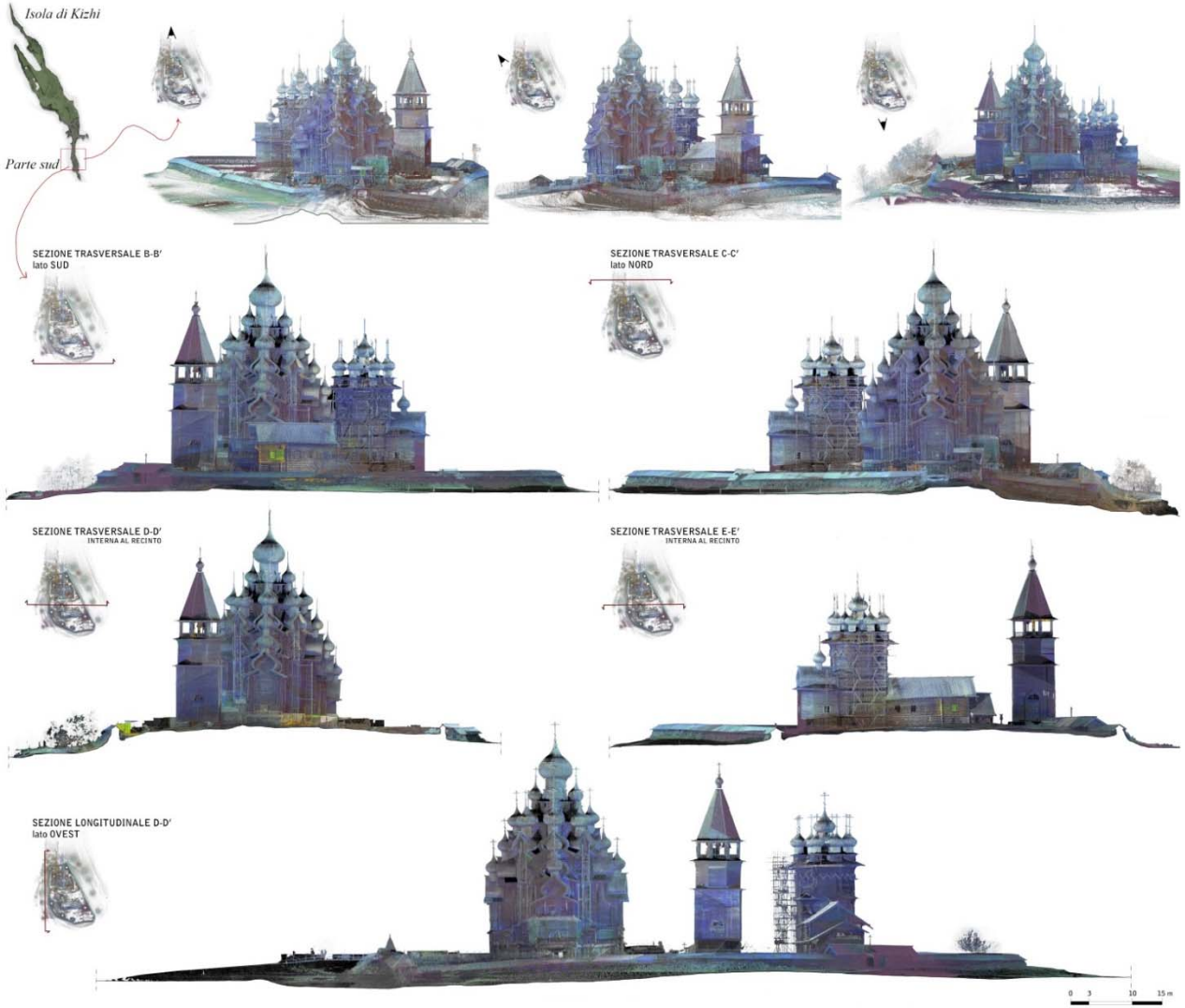

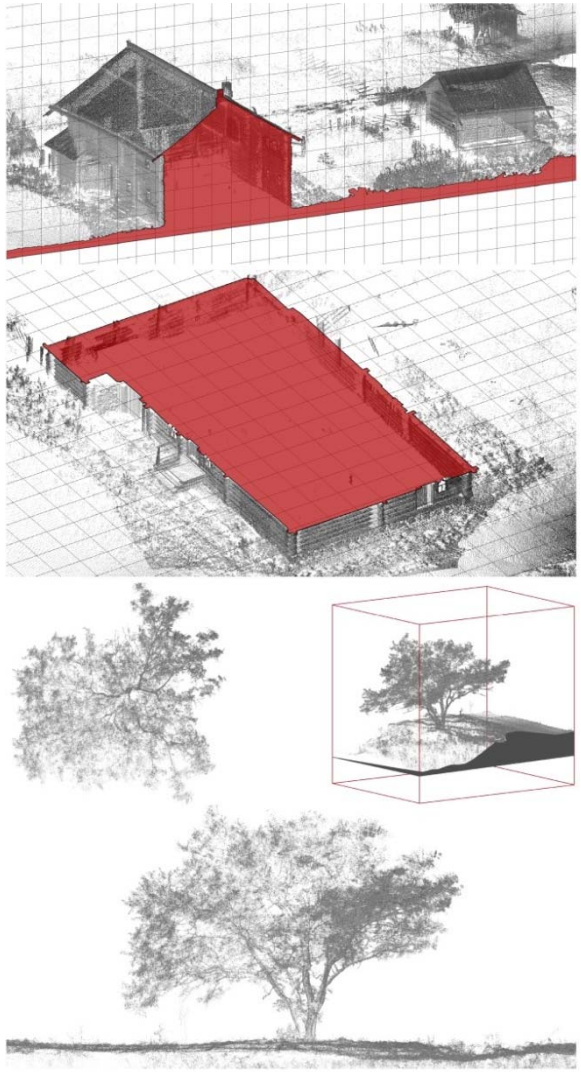

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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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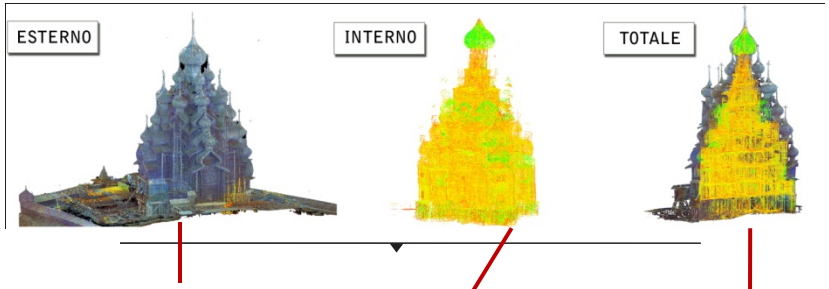
DIDA DIPARTIMENTO DI ARCHITETTURA

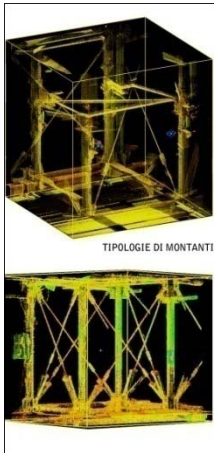
For the complexity of the architectonic structure the work has been planned with three different and separated points clouds: external parts, inside parts, one point cloud with everything.

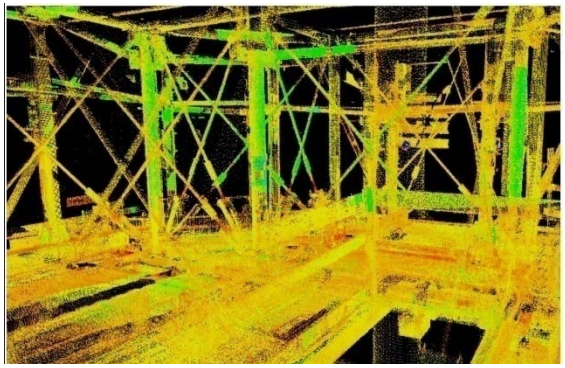


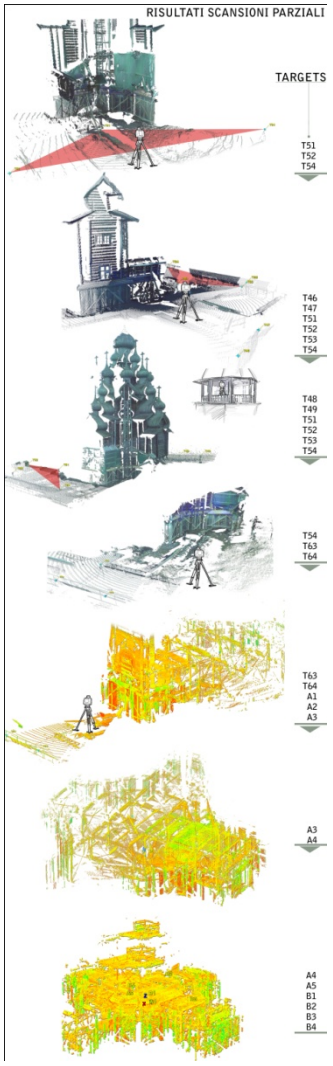
ANALYSIS OF THE WOODEN STRUCTURE

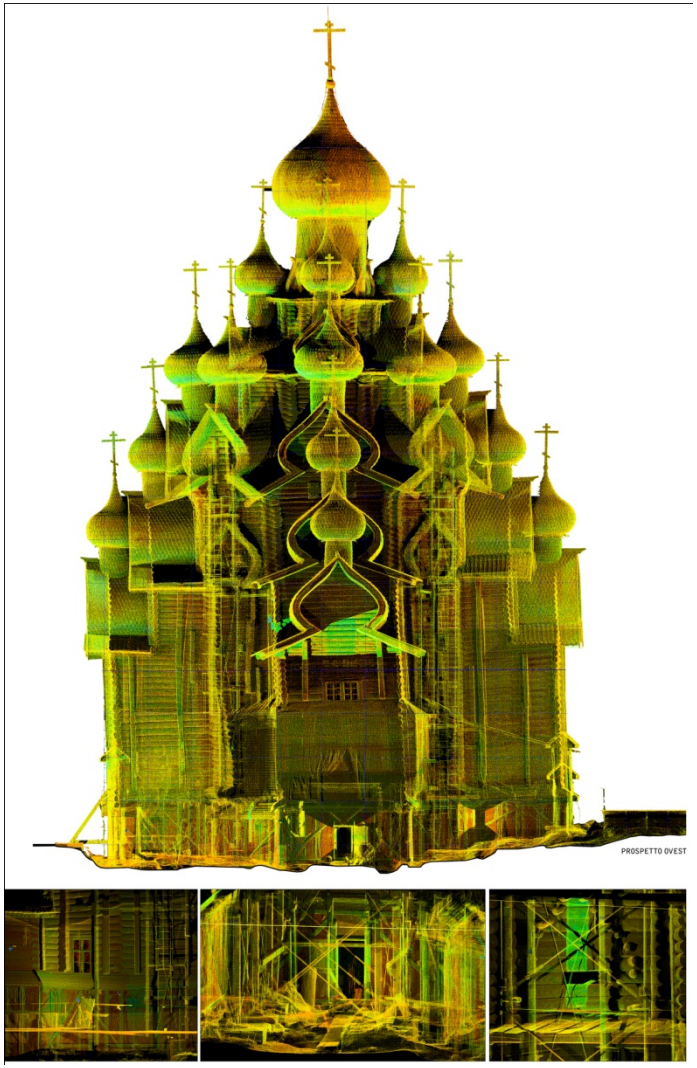
ANALYSIS OF THE METALLIC STRUCTURE

ANALYSIS OF ALL MOVEMENTS IN RELATIONSHIP EACHOTHER









Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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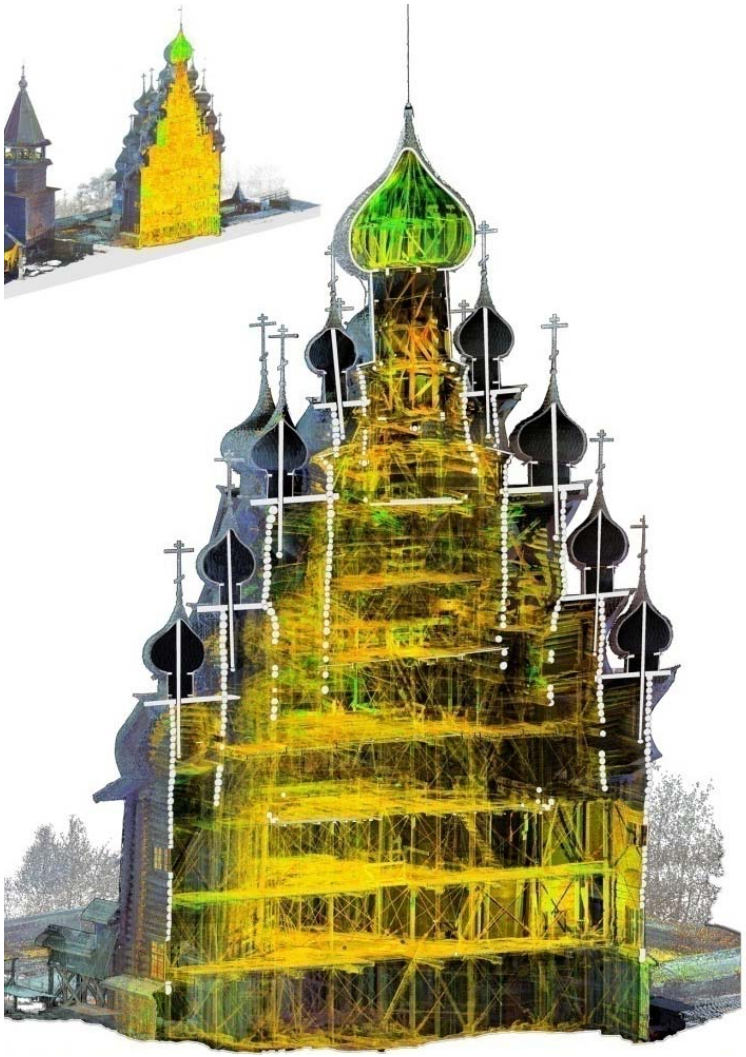

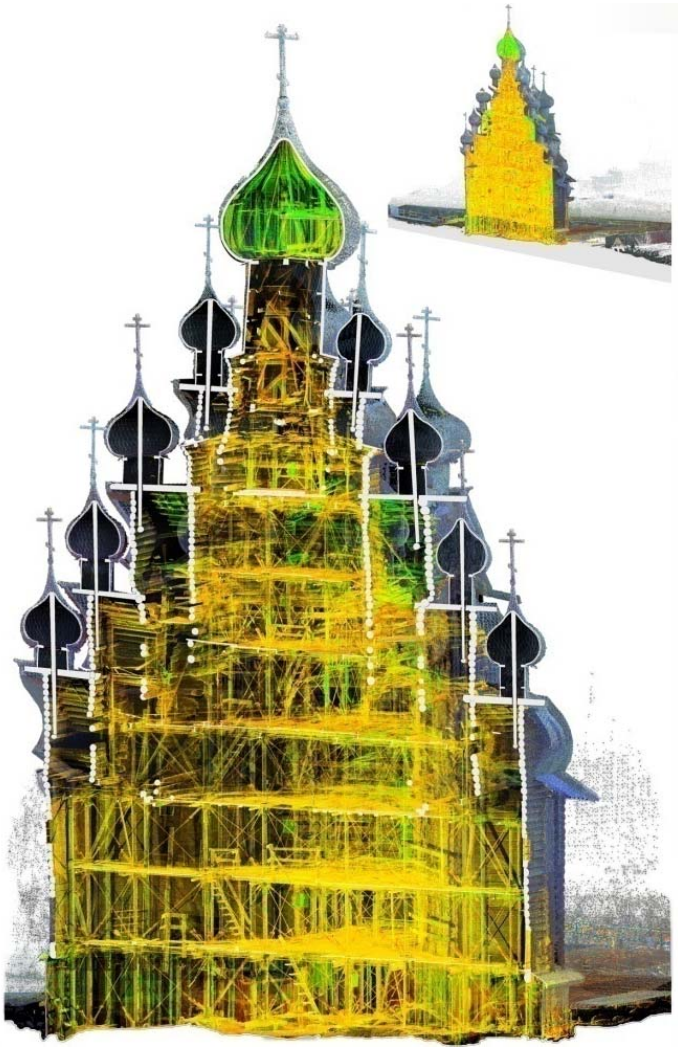

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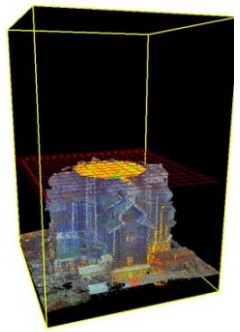
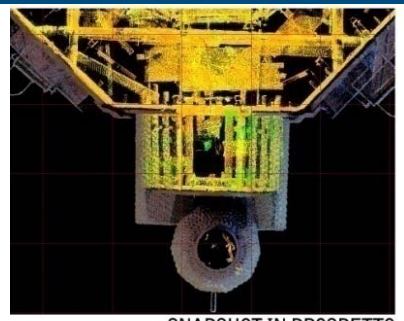
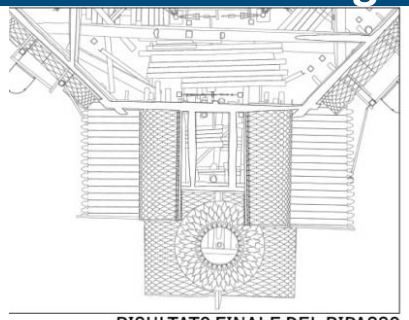
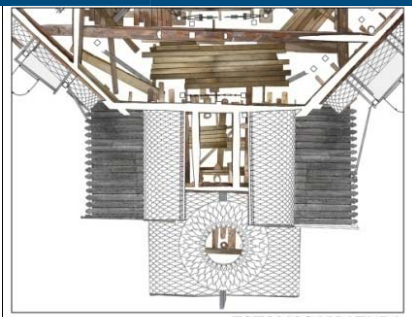




SNAPSHOT IN PROSPETTO



RISULTATO FINALE DEL RIPASSO



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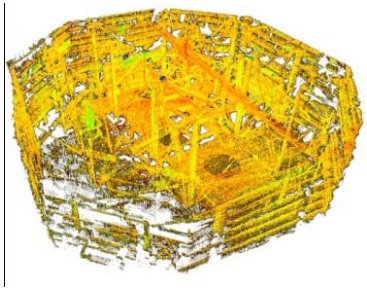
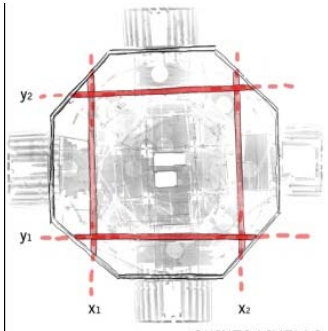
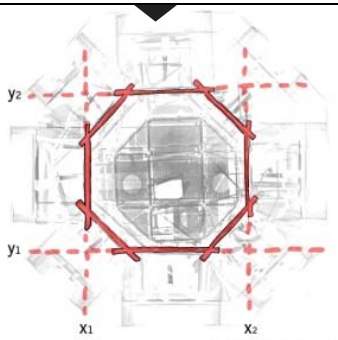
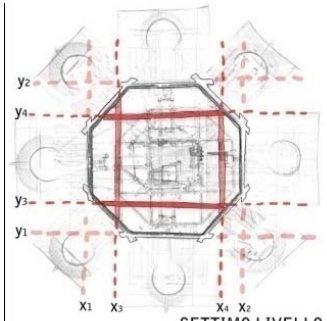




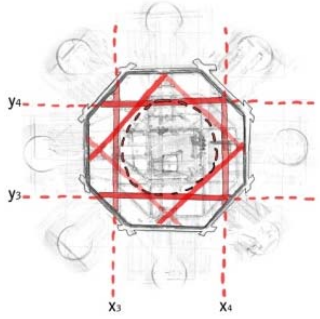
QUINTO LIVELLO



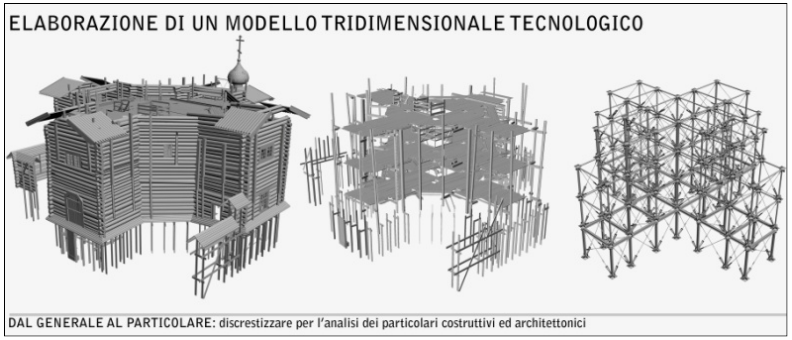
SESTO LIVELLO

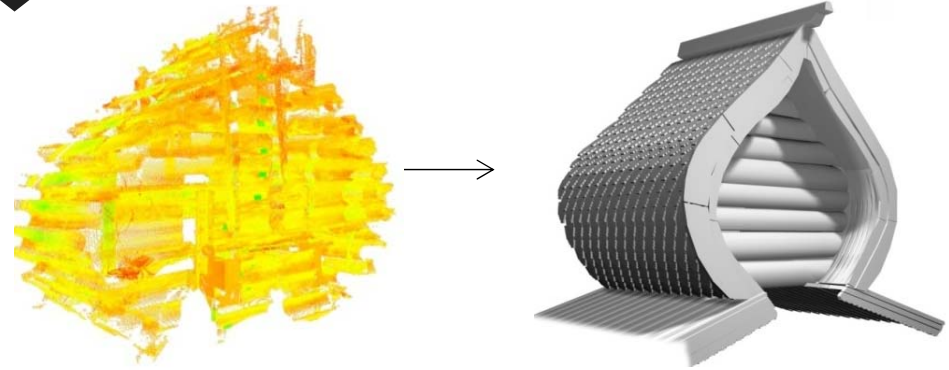


SETTIMO LIVELLO



BASE TAMBURO





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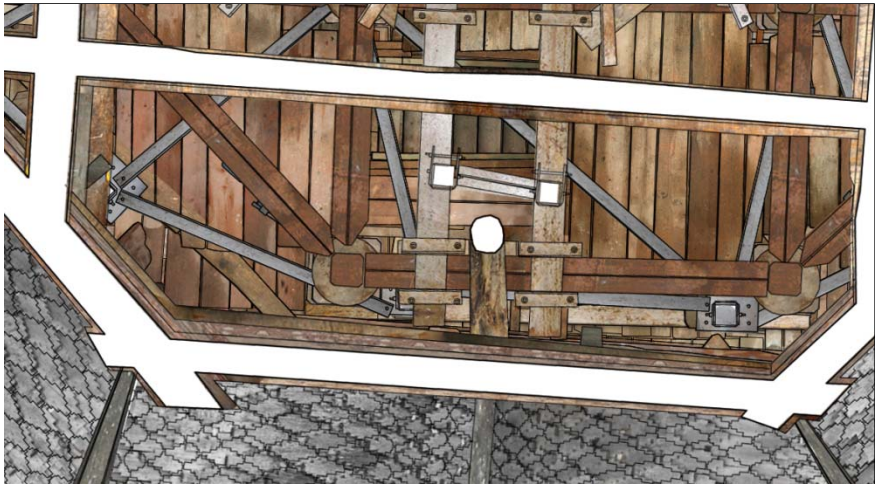
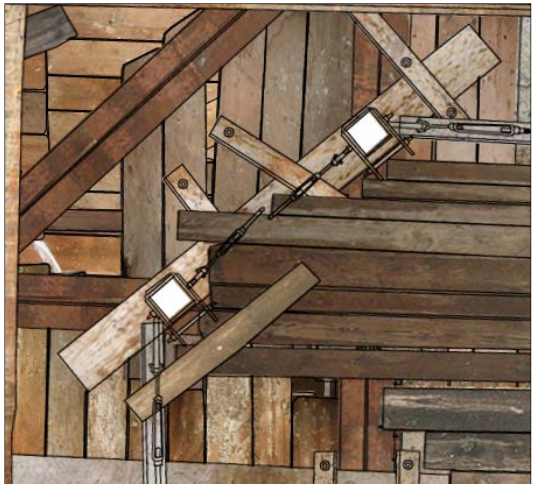
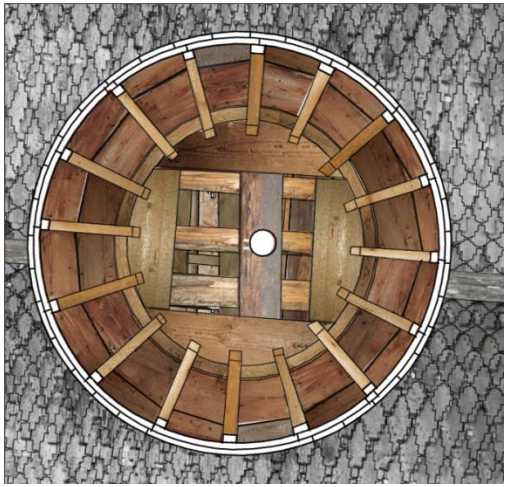
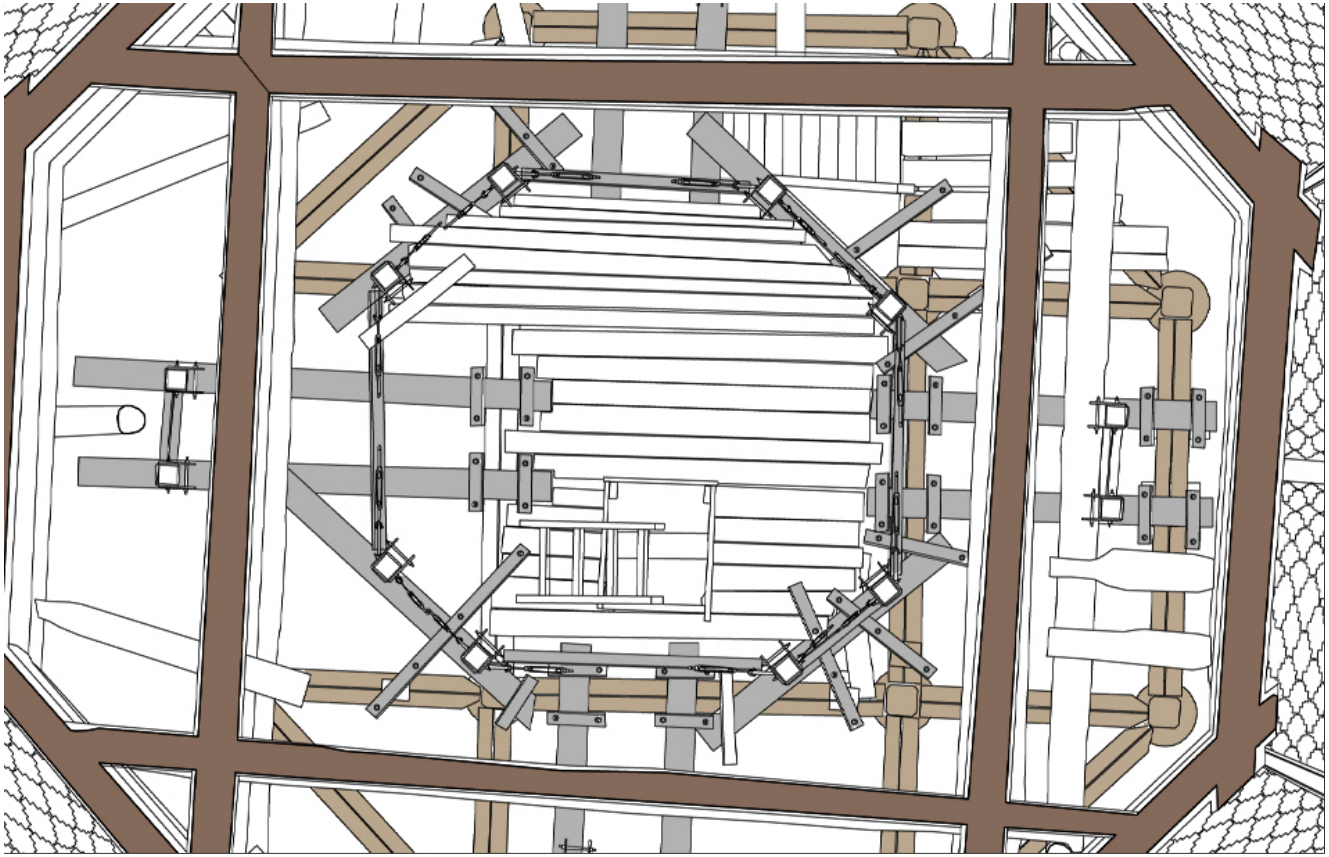
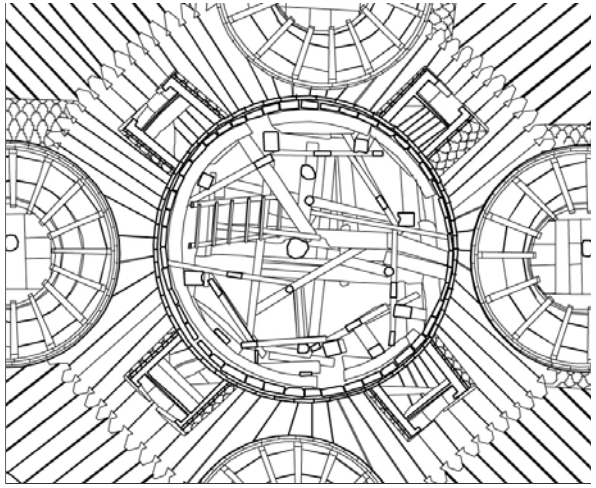
Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

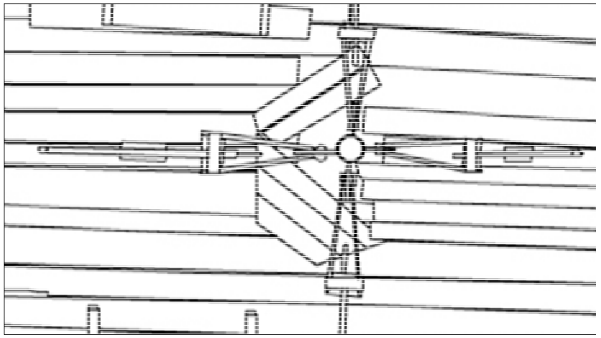


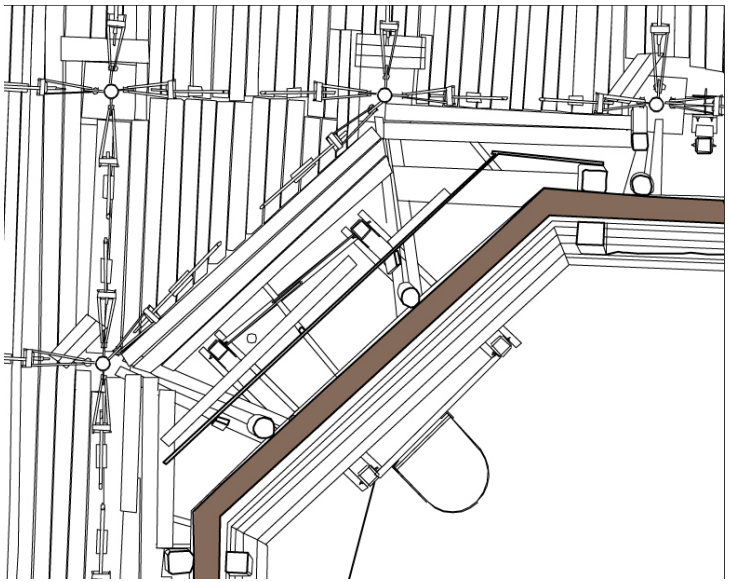


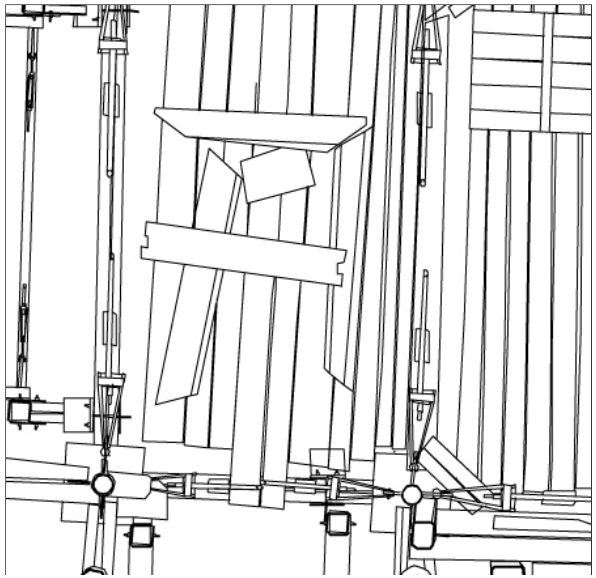


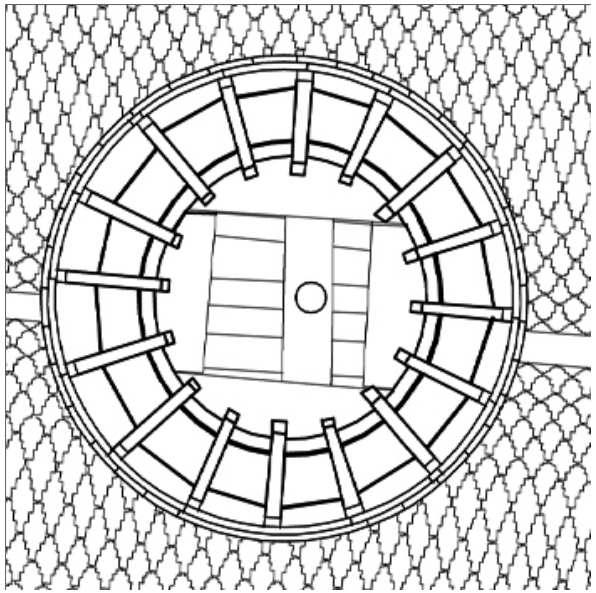












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Madrid,
UPM.

Sesión 2
restaura

The Pogost Complex on Kizhi Island, Karelia:

Laser scanner survey for the analysis of the structural assessment of the Church of Transfiguration

Phd. Stud. Arch. Sara Porzilli

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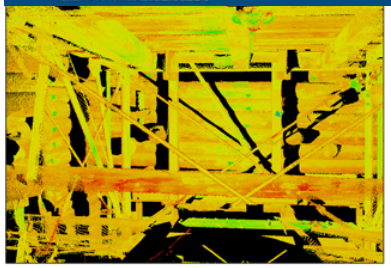

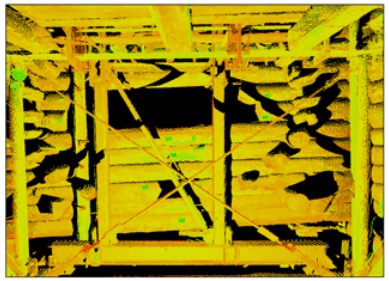

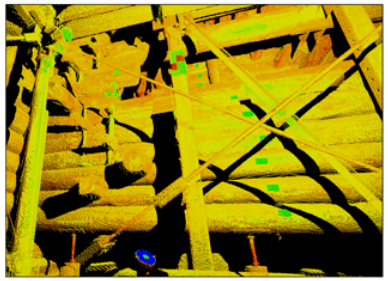

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Linnanmaa, 2nd October 2017

Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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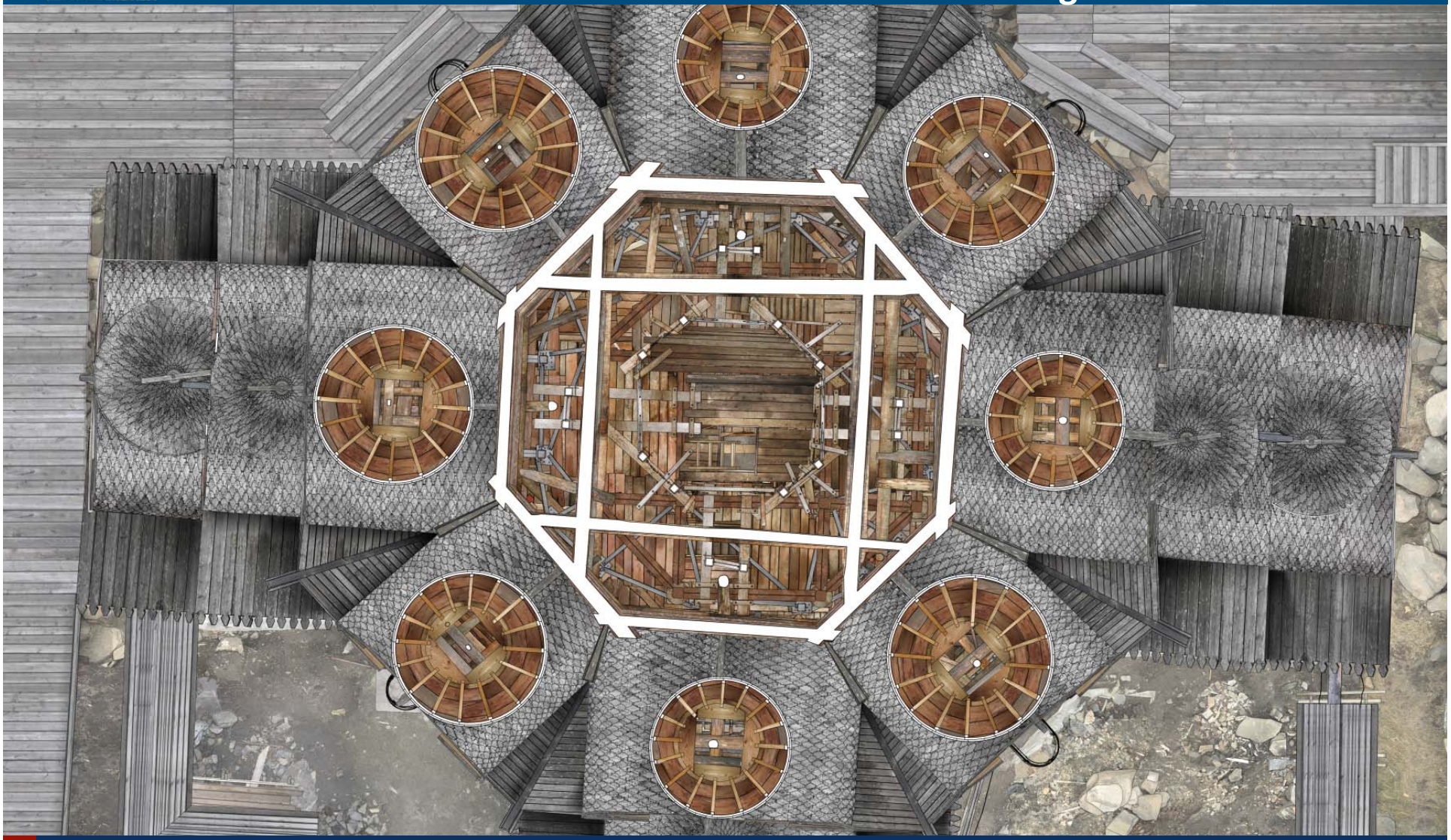

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PostDoctoral Fellow
sara.porzilli@oulu.fi

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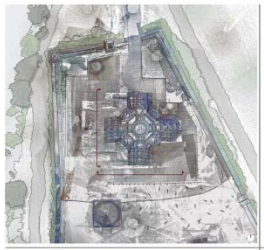

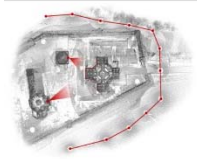

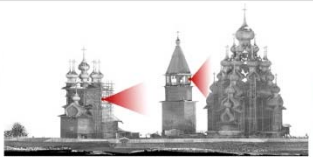

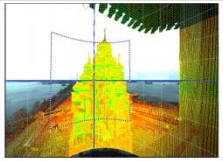

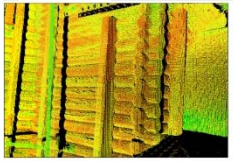

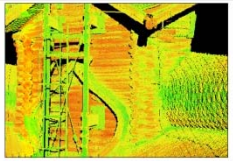

Gli elaborati grafici che riguardano il complesso della Pogost e l'analisi della Chiesa della Trasfigurazione fanno parte della tesi di laurea magistrale in Architettura da me sostenuta insieme a A. Sorini nel 2011.

Titolo della tesi di laurea: "Il Complesso della Pogost dell'Isola di Kizhi. Rilievo laser scanner per l'analisi della struttura architettonica della Chiesa della Trasfigurazione". (Relatore: Prof. Stefano Bertocci, Correlatore: Prof. Sandro Parrinello).

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Linnanmaa, 2nd October 2017

Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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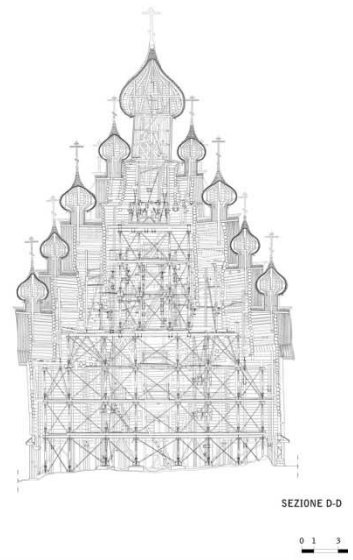

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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi


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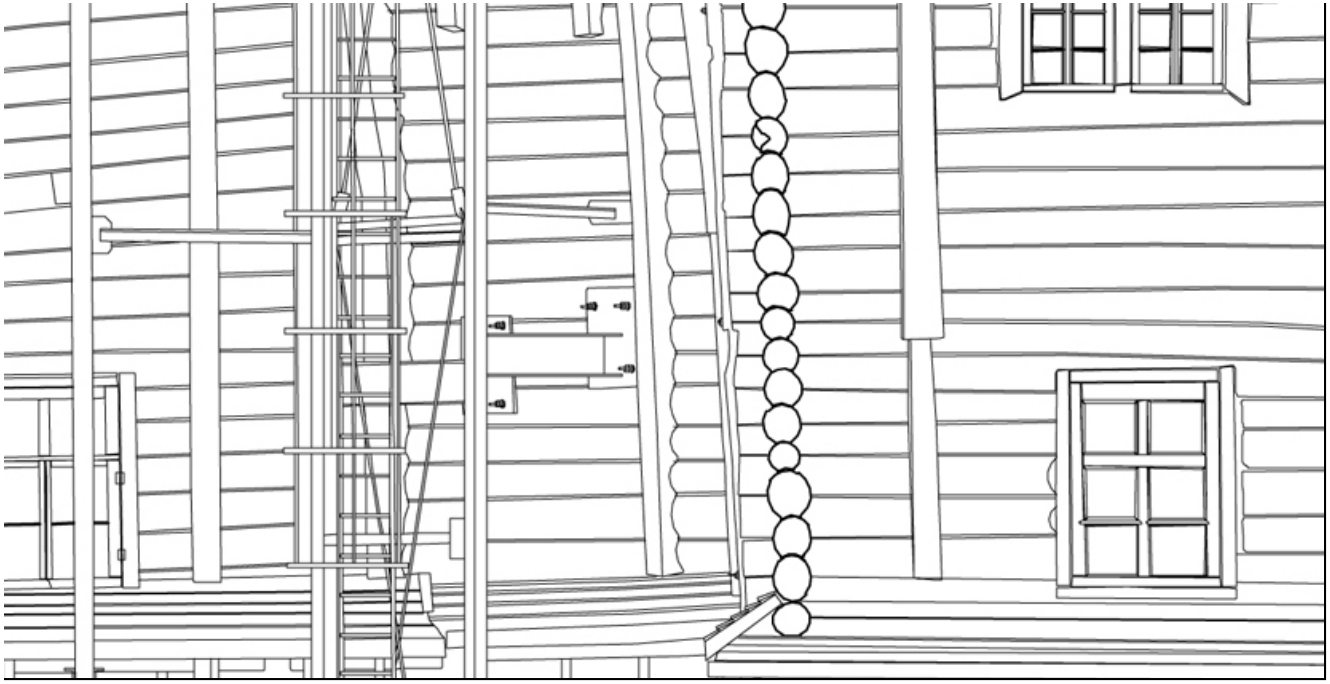

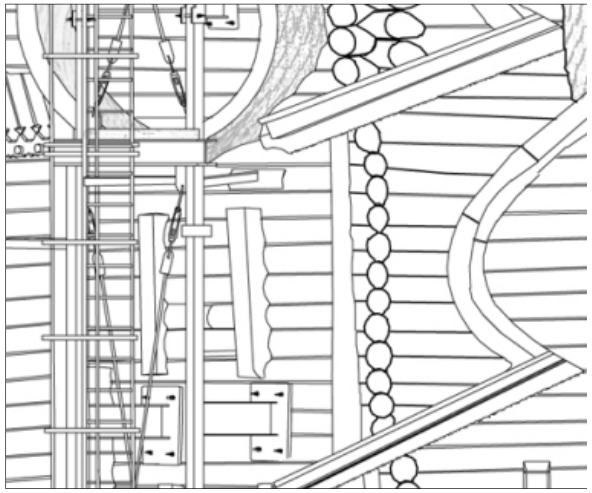

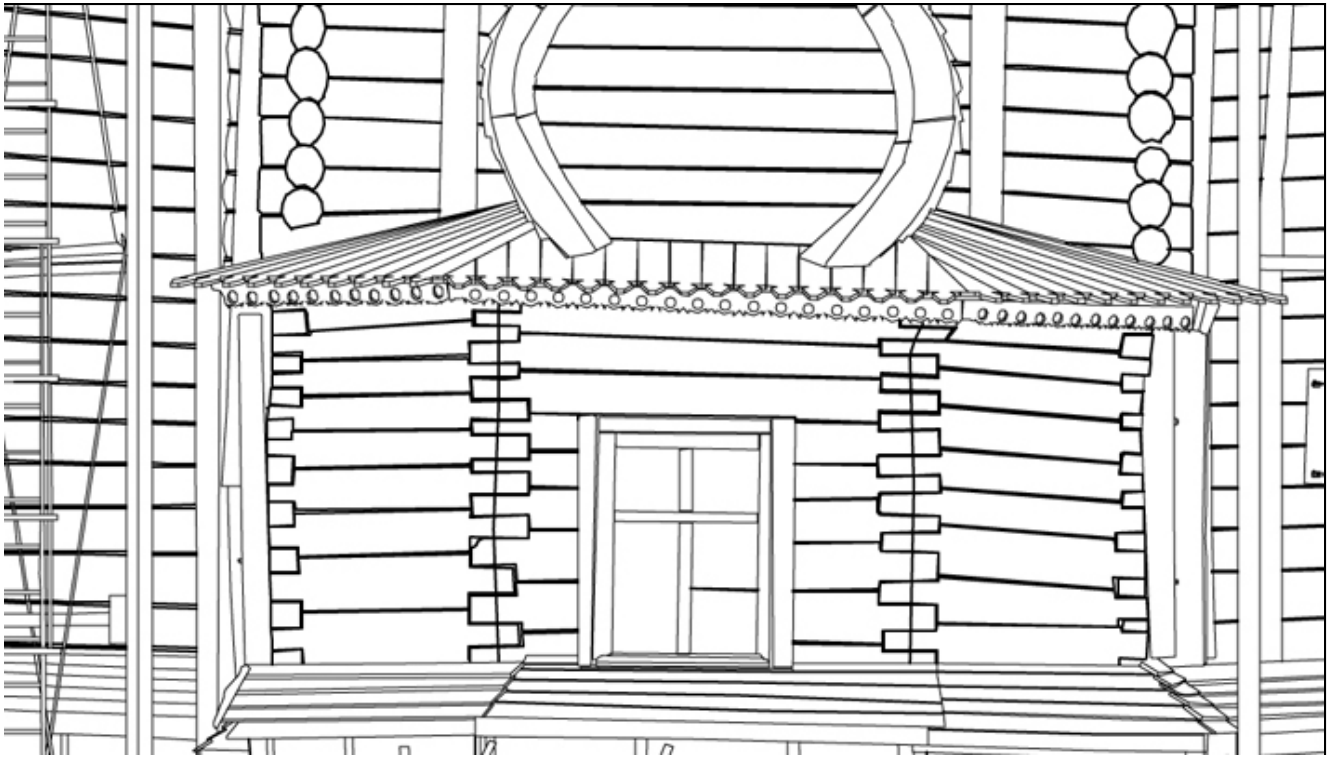

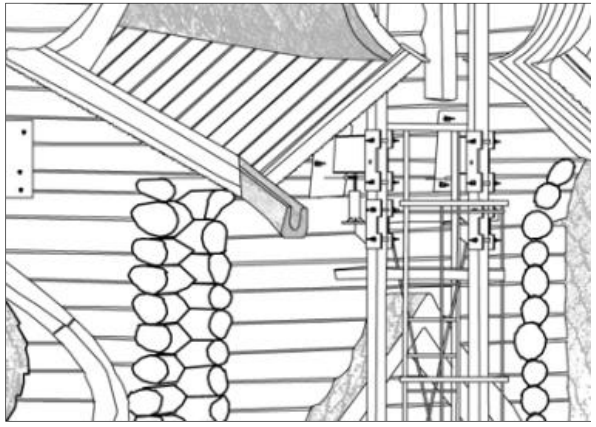

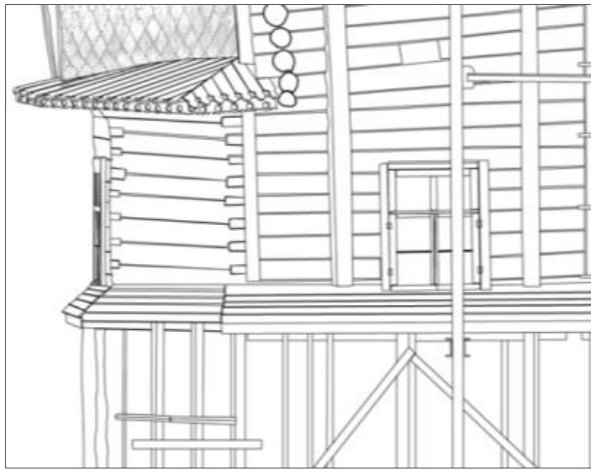

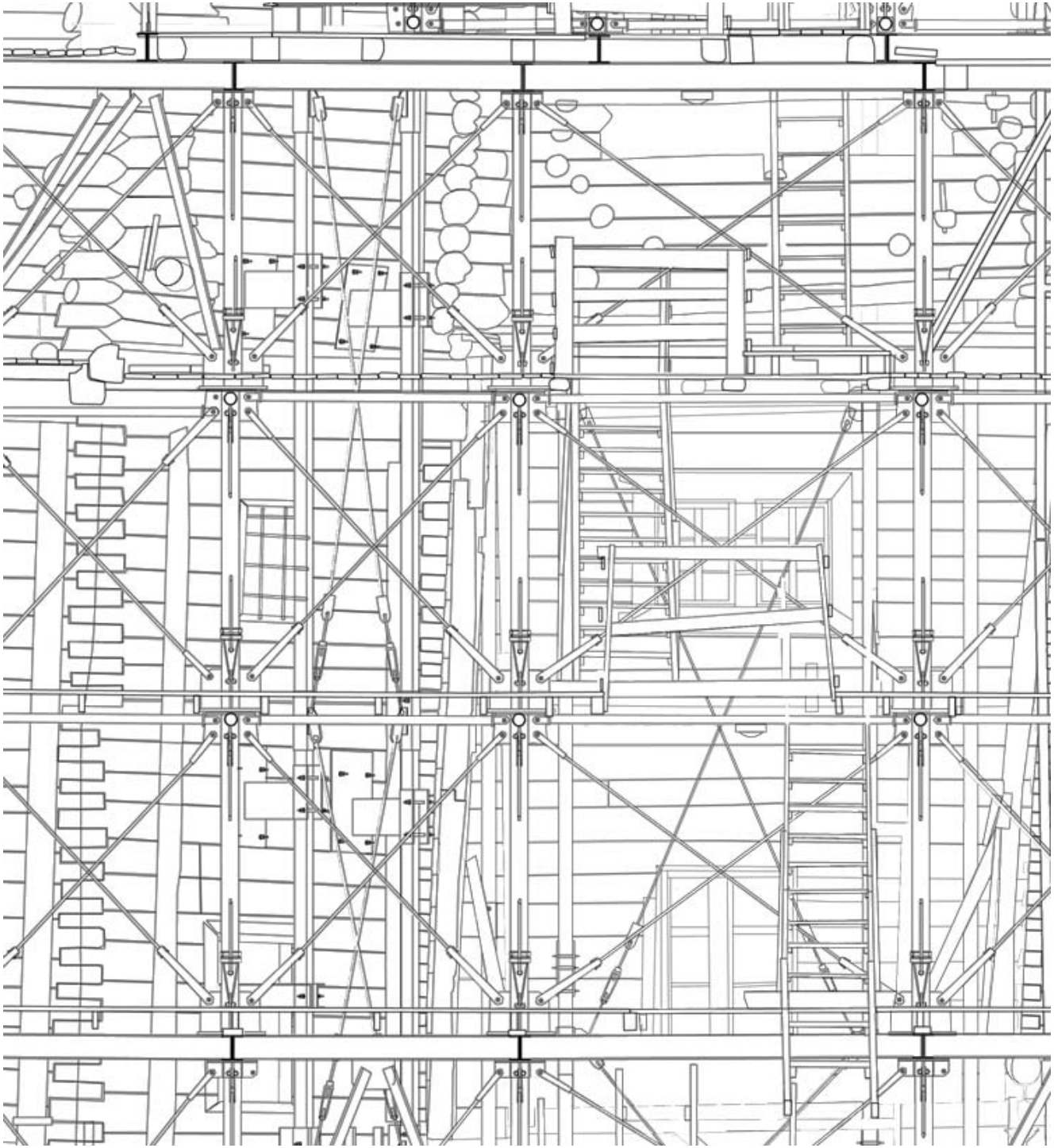

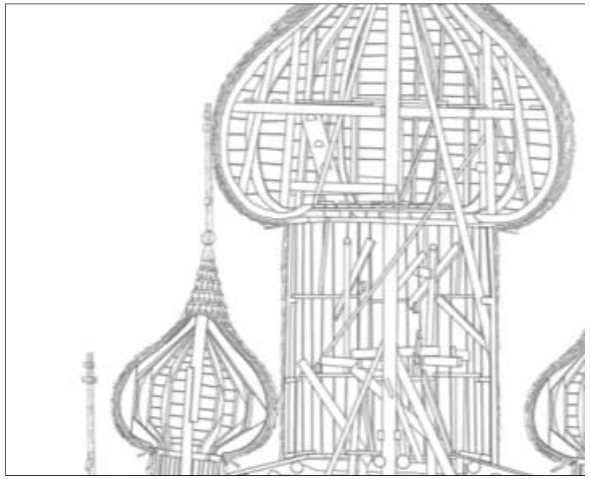

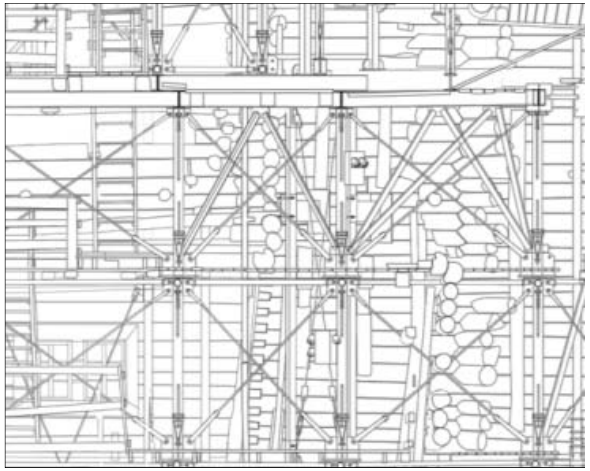

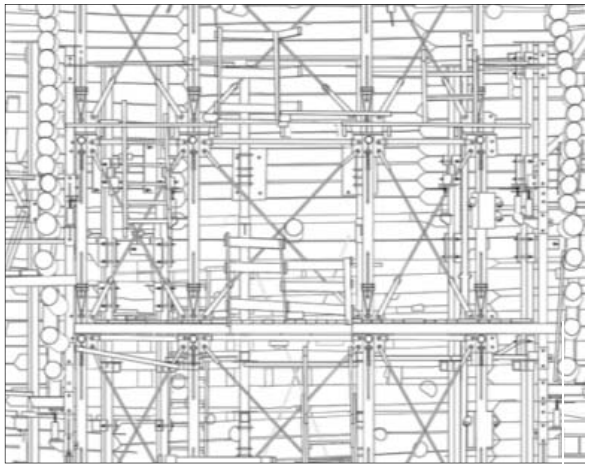

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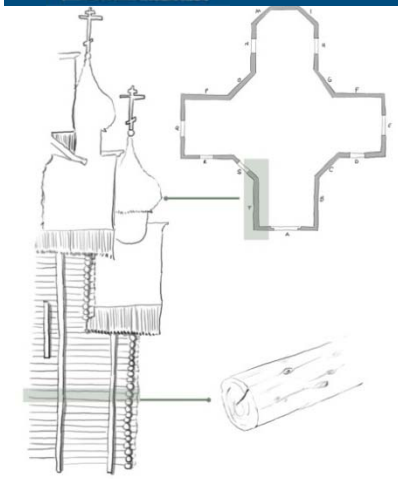

parete — numero tronco

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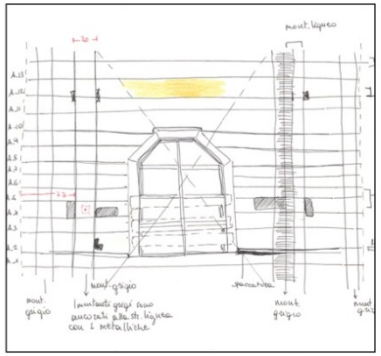
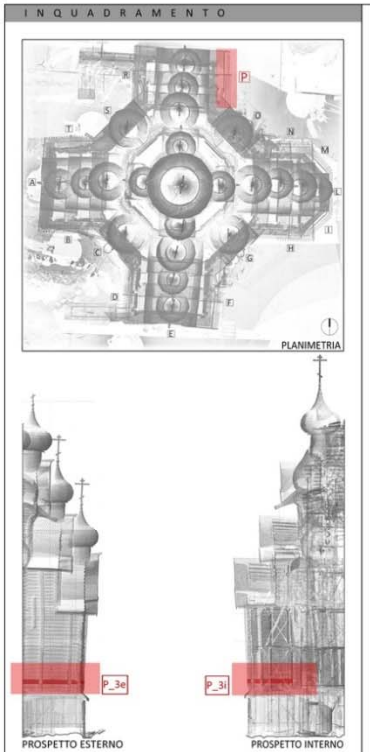
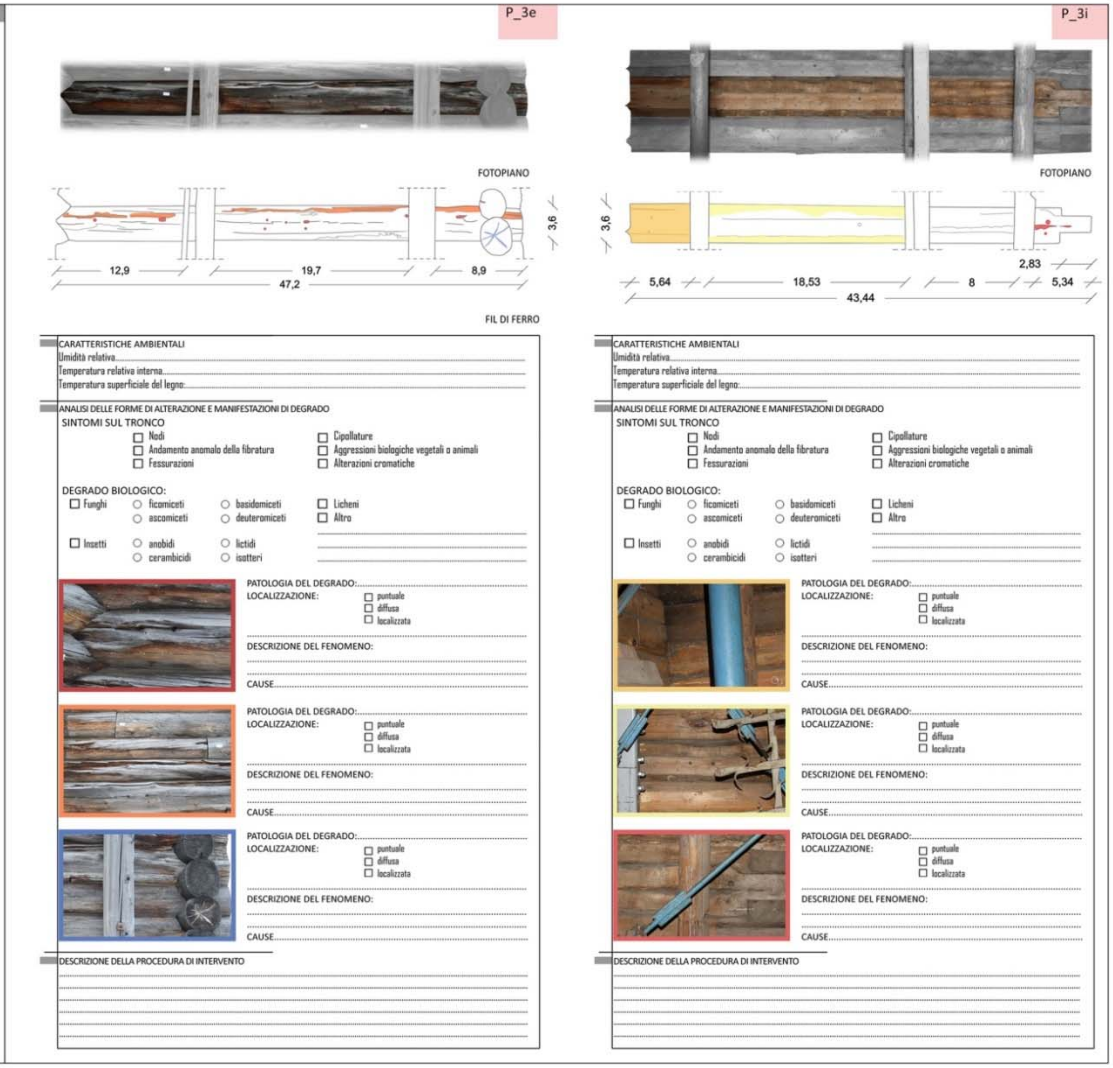
arretramento — lato





SPECIFICITA' DELLE STRUTTURE LIGNEE
Specie lignea
Tipo di lavorazione
Distribuzione durame / alburno
Incidenza difetti

ANALISI PRELIMINARE
Relazione delle condizioni preliminari, ricerca delle cause del degrado, determinazione oggettiva e quantitativa delle caratteristiche strutturali



CARATTERISTICHE AMBIENTALI
Umidità relativa
Temperatura relativa interna
Temperatura superficiale del legno:

ANALISI DELLE FORME DI ALTERAZIONE E MANIFESTAZIONI DI DEGRADO
SINTOMI SUL TRONCO
☐ Nodi ☐ Andamento anomalo della fibratura ☐ Fessurazioni
☐ Cipollature ☐ Aggressioni biologiche vegetali o animali ☐ Alterazioni cromatiche

DEGRADO BIOLOGICO:
☐ Funghi ○ ficomiceti ○ basidiomiceti ○ ascomiceti ○ deuteromiceti ☐ Licheni ☐ Altro
☐ Insetti ○ anobidi ○ lictidi ○ cerambicidi ○ isotteri

PATOLOGIA DEL DEGRADO:
LOCALIZZAZIONE: ☐ puntuale ☐ diffusa ☐ localizzata
DESCRIZIONE DEL FENOMENO:
CAUSE:

DESCRIZIONE DELLA PROCEDURA DI INTERVENTO

Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

Research and Theory of Architecture

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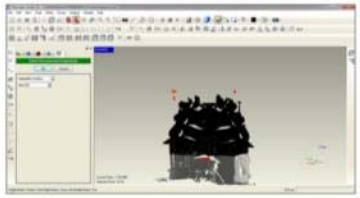
LA MODELLAZIONE 3D

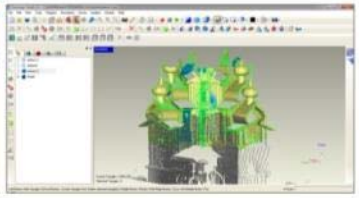
METODOLOGIE A CONFRONTO

Supporto informatico: Geomagic Studio

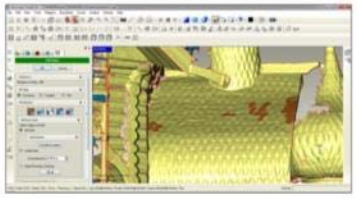
Il primo approccio alla modellazione è stato effettuato con il programma Geomagic Studio. Questo software di reverse enginnering permette di importare porzioni di nuvola provenienti da un progetto di scansioni laser scanner, elaborarle quando sono ancora in formato nuvola di punti quindi trasformarle in una mesh poligonale per elaborare un modello globale dell'oggetto. L'elaborato finale è buono nella sua globalità ma presenta importanti lacune nei dettagli.



Dopo aver importato le porzioni di nuvola si eliminano tutti i punti di disturbo, che potrebbero interferire l'operazione di triangolazione.

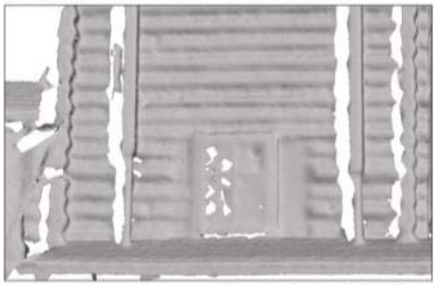


Dopo aver effettuato la trasformazione in mesh, si regolano i parametri che modificano rugosità e levigatezza delle superfici.

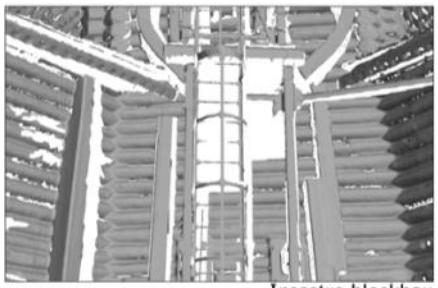


Le parti nelle quali non si ha alcun riempimento vengono ricostruite attraverso la creazione di mesh.

RISULTATI DELL'ELABORAZIONE

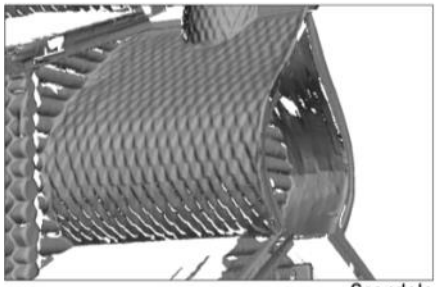


Particolare dell'infisso

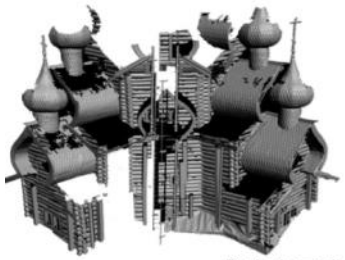


Incastro blockbau

Incastro blockbau



Scandole



Risultati parziali

Prova di modellazione dell'interno

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Linnanmaa, 2nd October 2017

Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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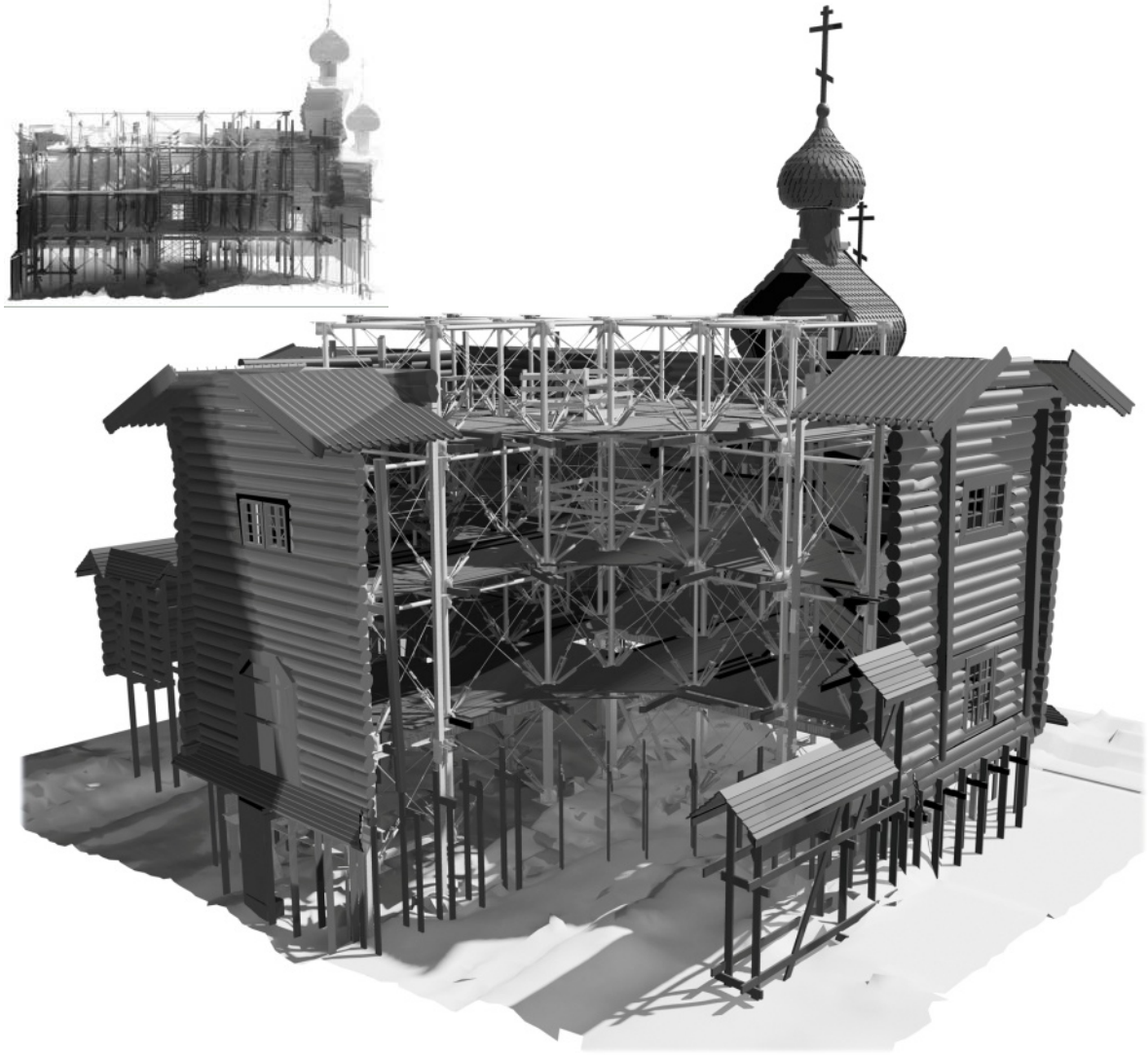

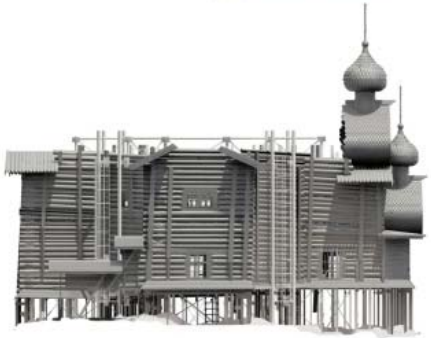

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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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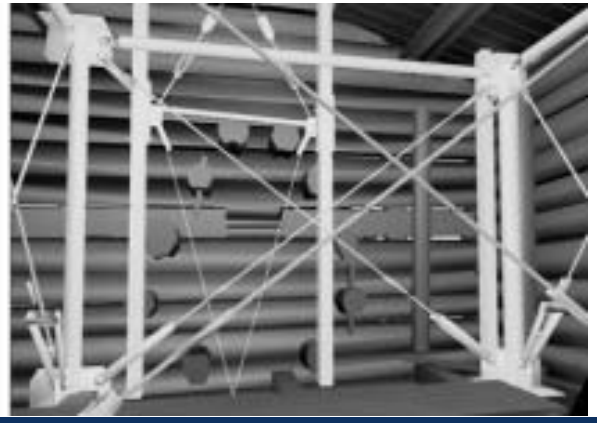

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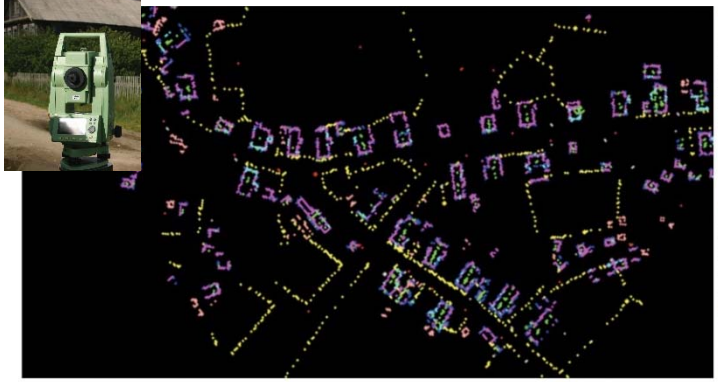
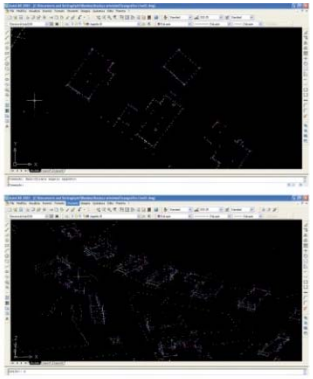
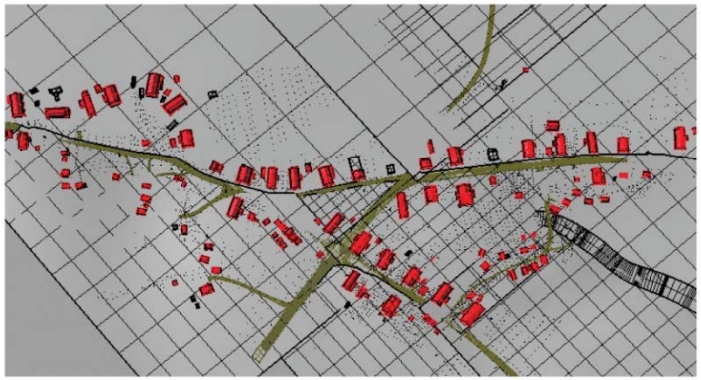
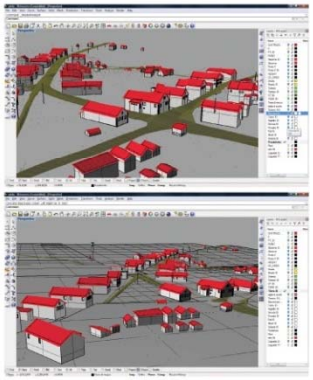
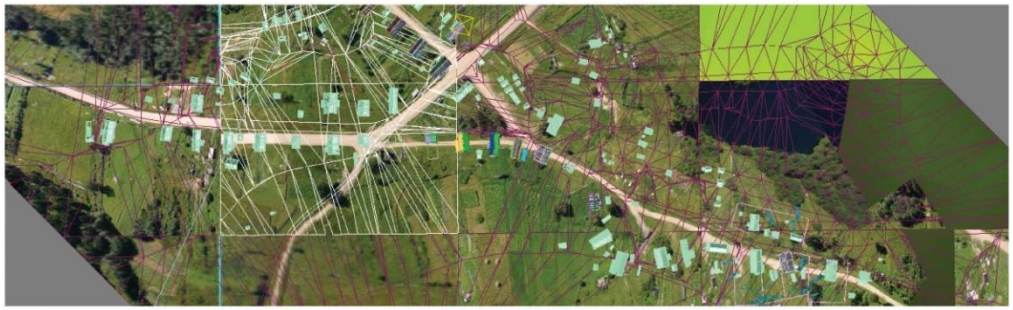
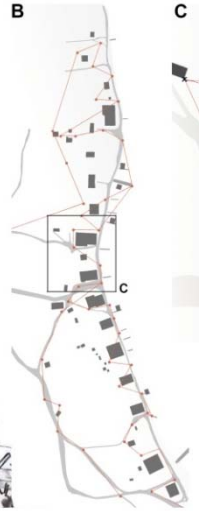


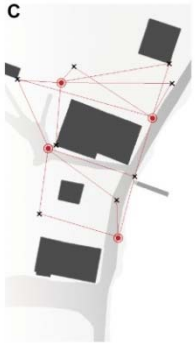






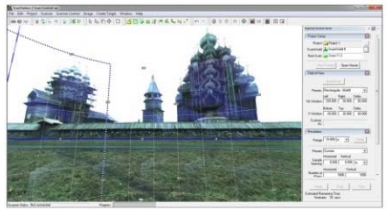


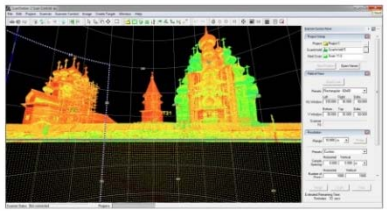




SCANSIONE

Fase nella quale avviene l'acquisizione da parte del laser dell'immagine del luogo e dei punti nello spazio. La scansione deve essere pre-impostata definendo la densità dei punti della nuvola e l'angolo zenitale e azimutale da effettuare rispetto all'orizzonte.





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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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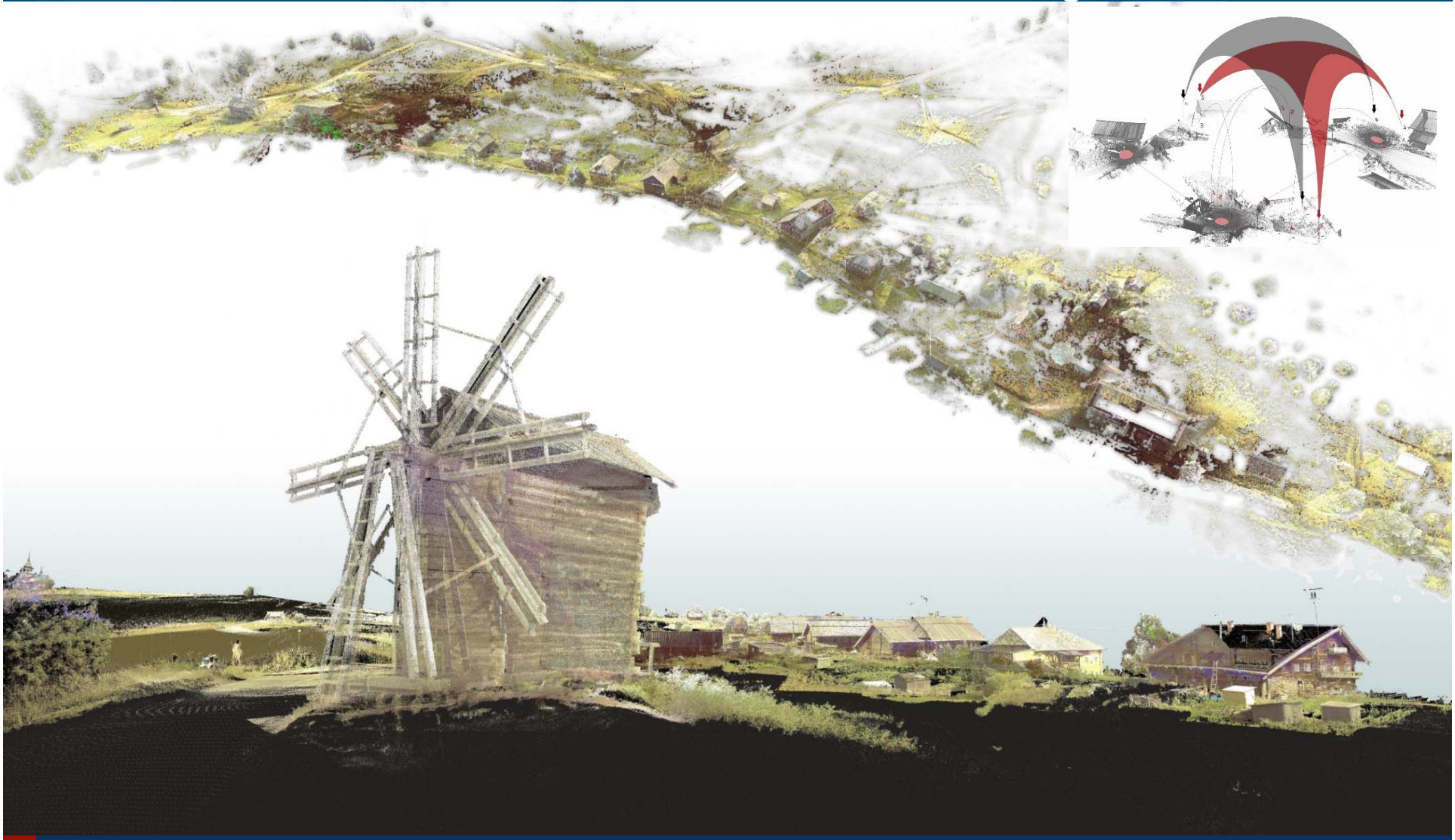

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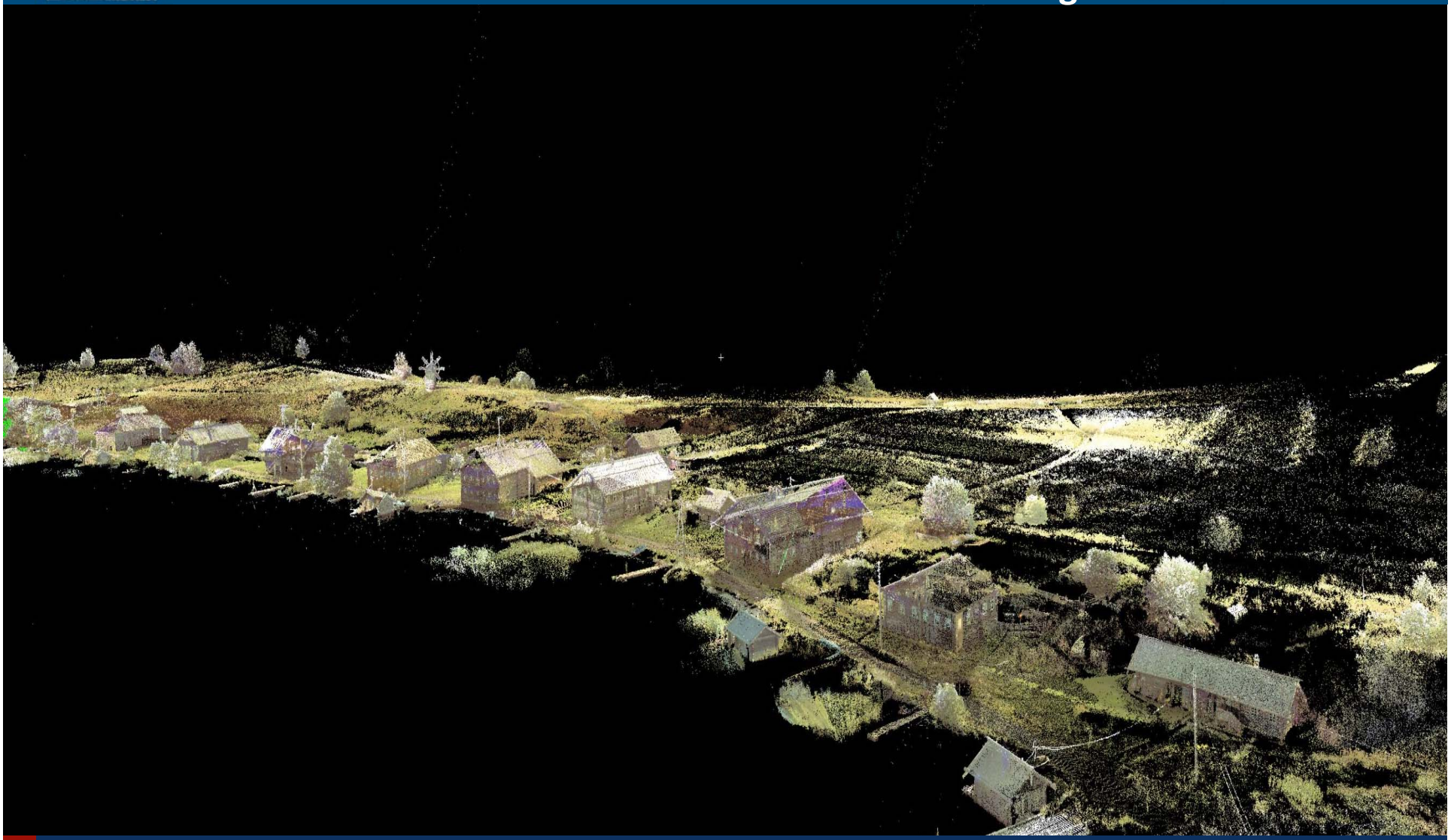

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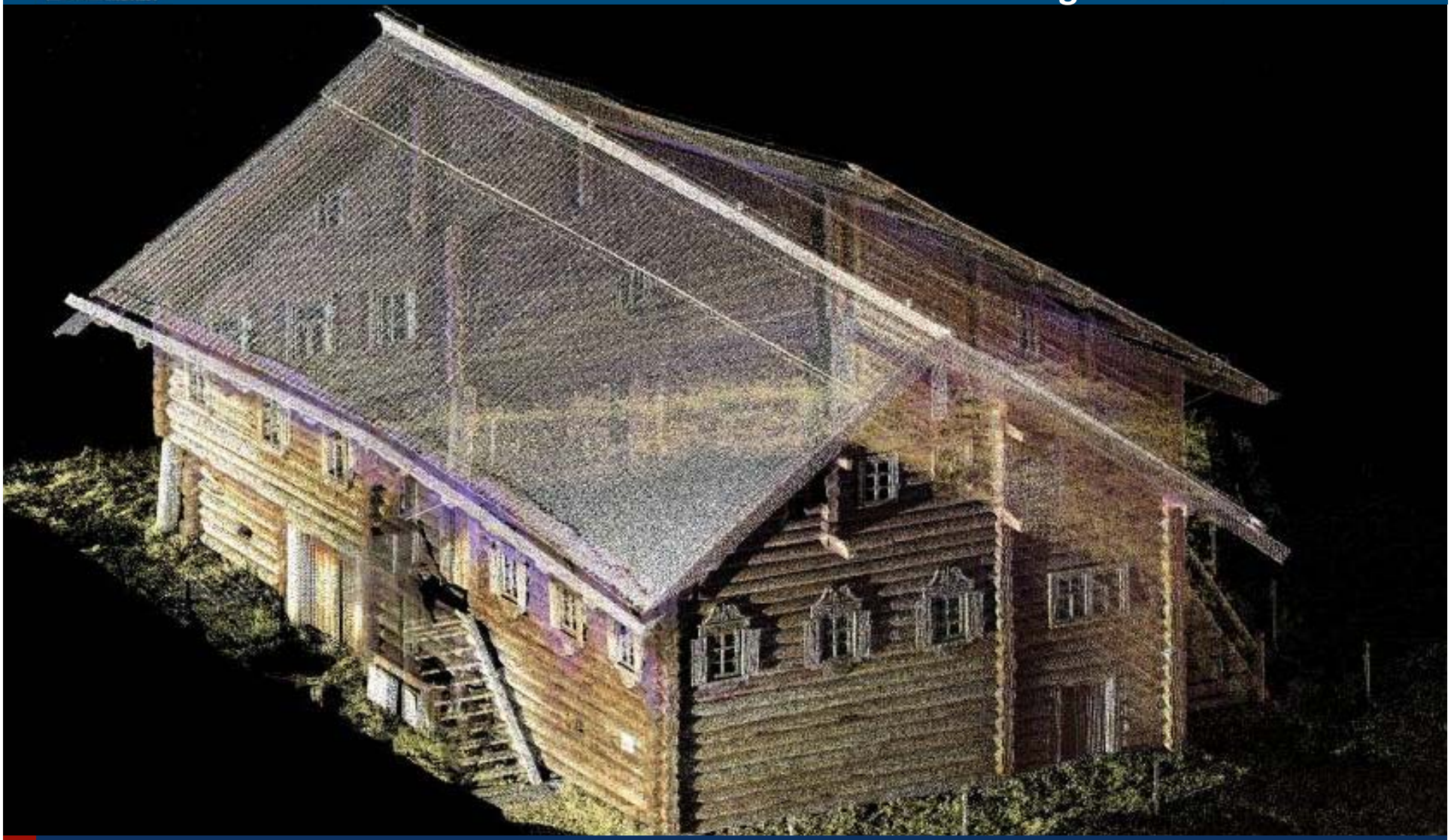

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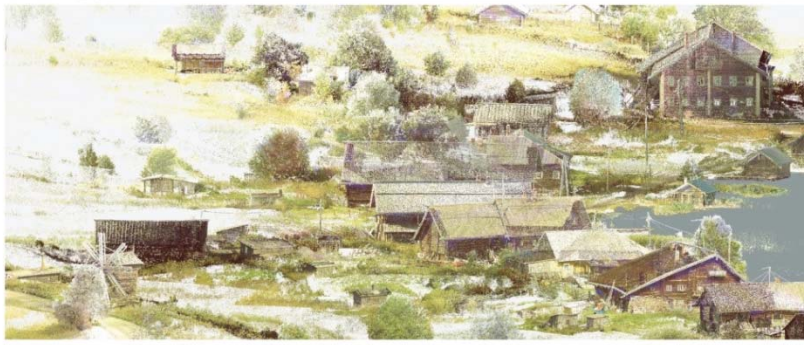

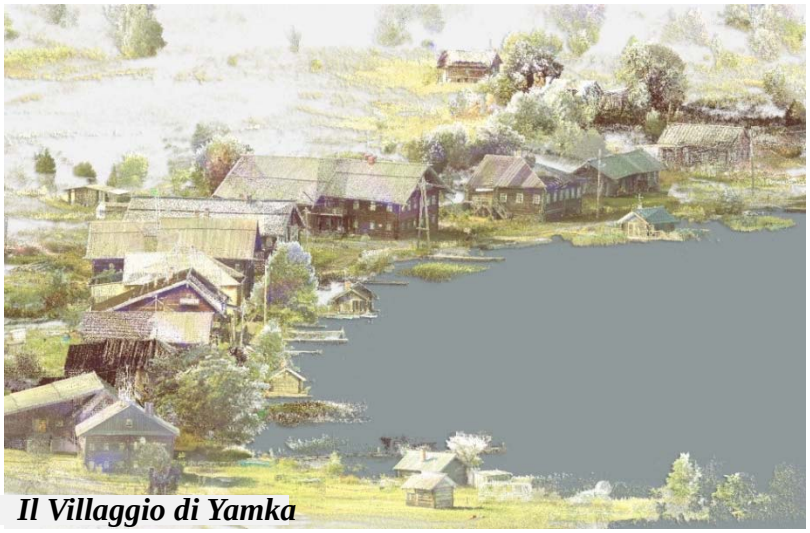

Il Villaggio di Yamka

Research and Theory of Architecture

Linnanmaa, 2nd October 2017

Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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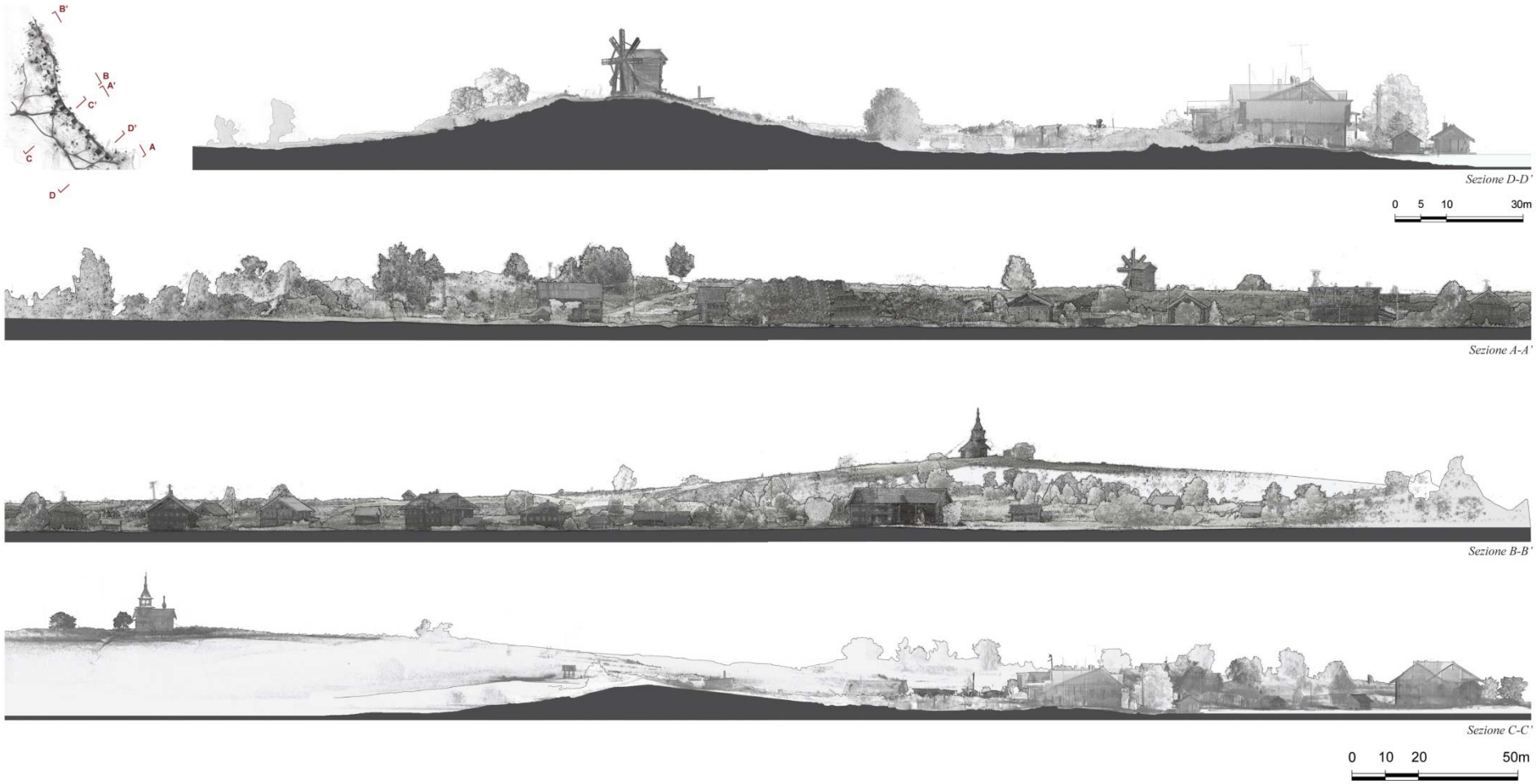

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PostDoctoral Fellow
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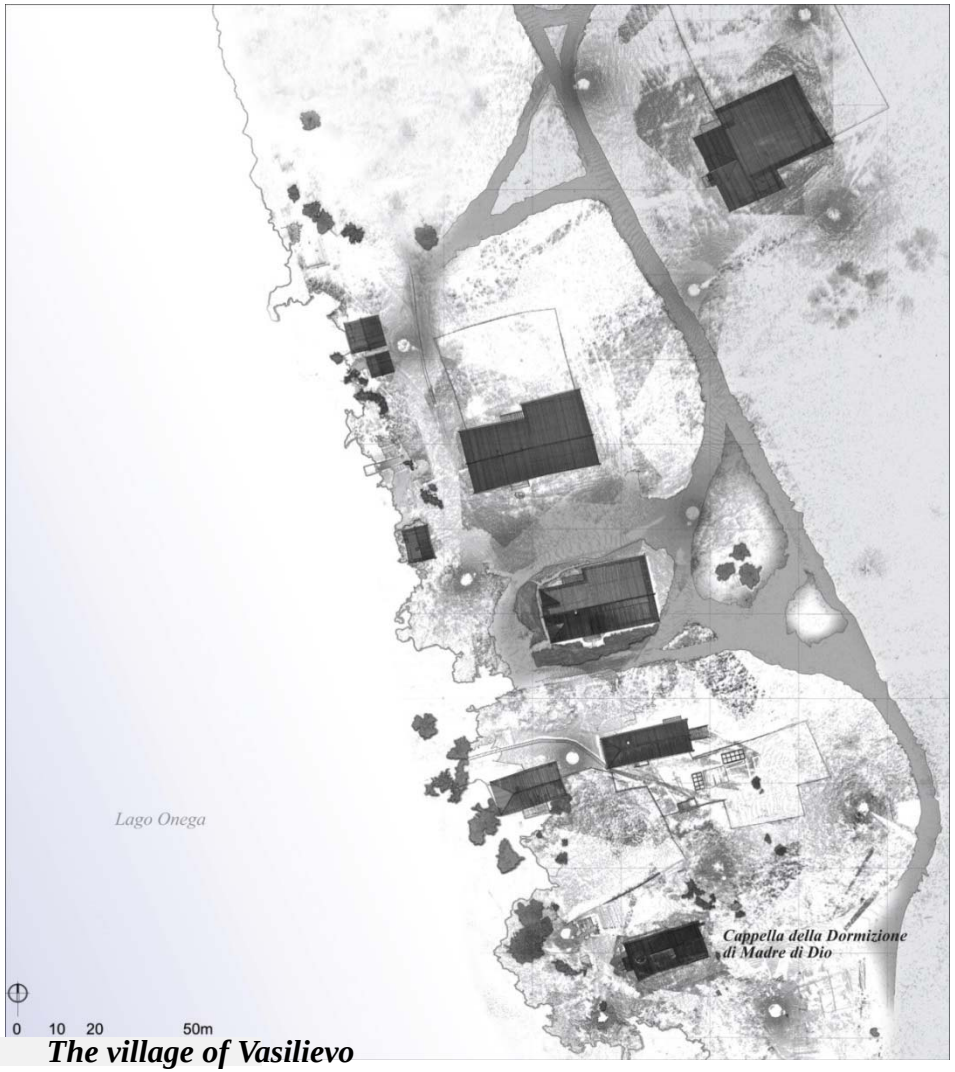
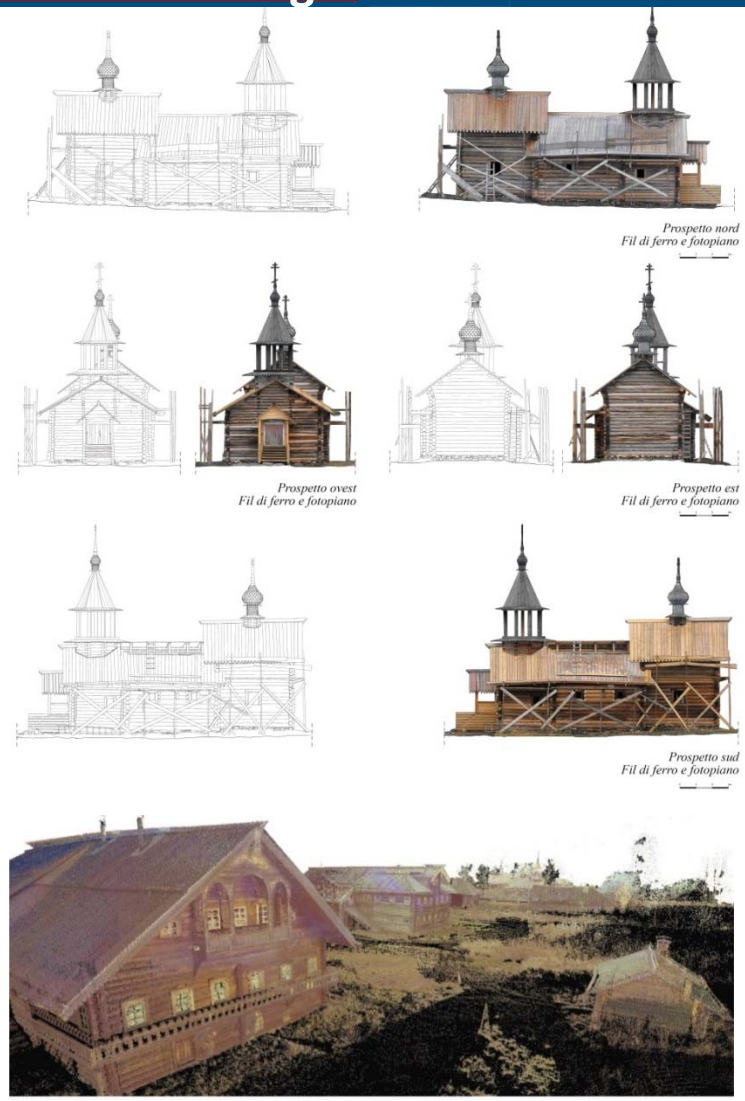


The village of Vasilievo



Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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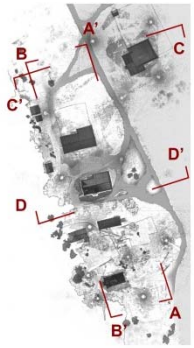

Sezione A-A'

Sezione B-B'

Sezione C-C'

Sezione D-D'

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PostDoctoral Fellow
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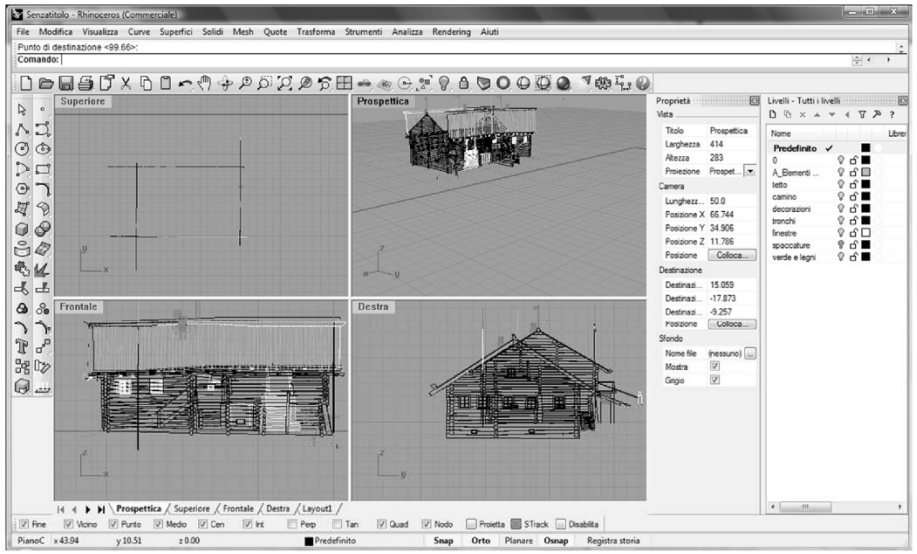

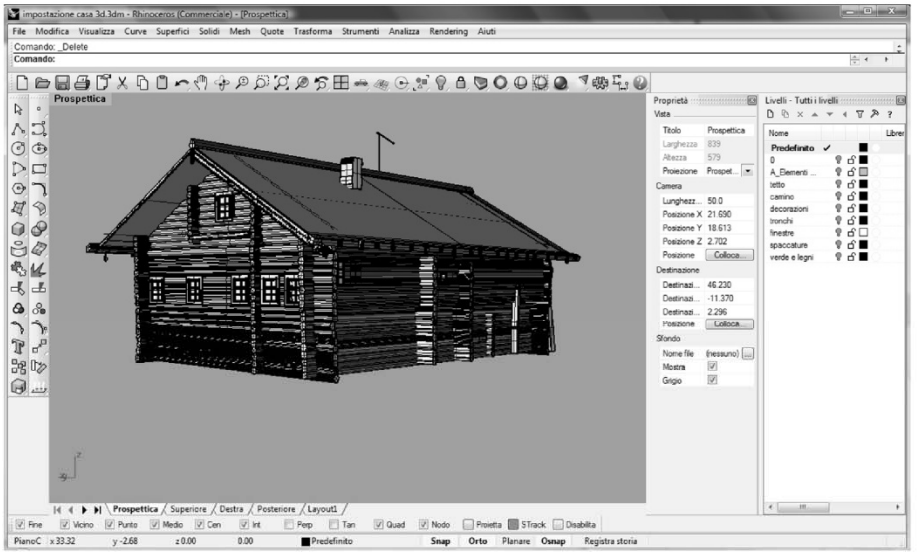

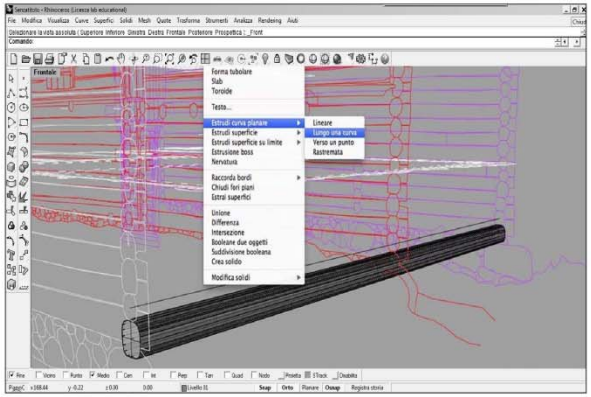

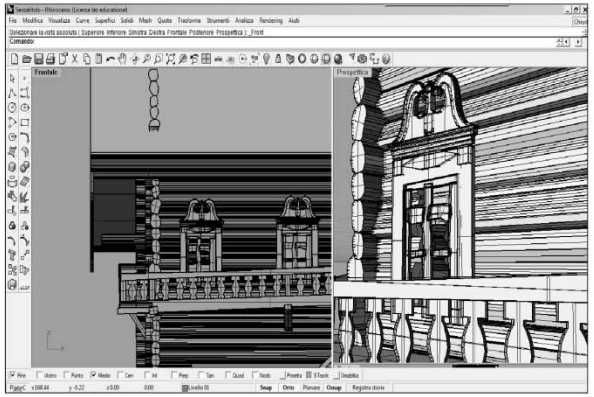

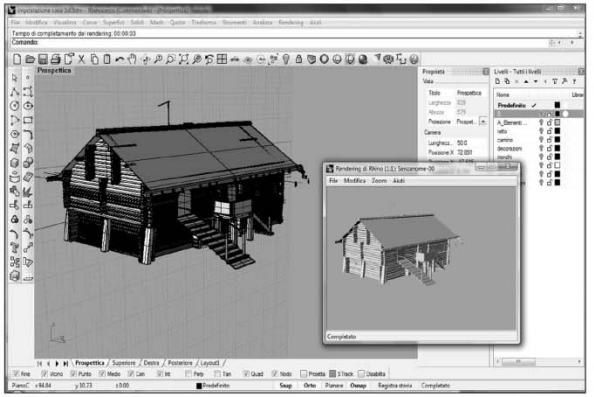

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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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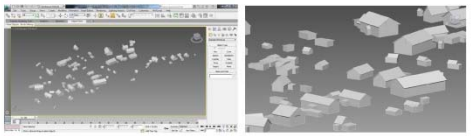
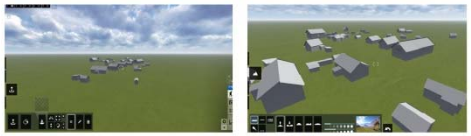
DIDA DIPARTIMENTO DI ARCHITETTURA



1. Il modello 3D viene aperto in ambiente 3ds Max ed esportato in .fbx file.

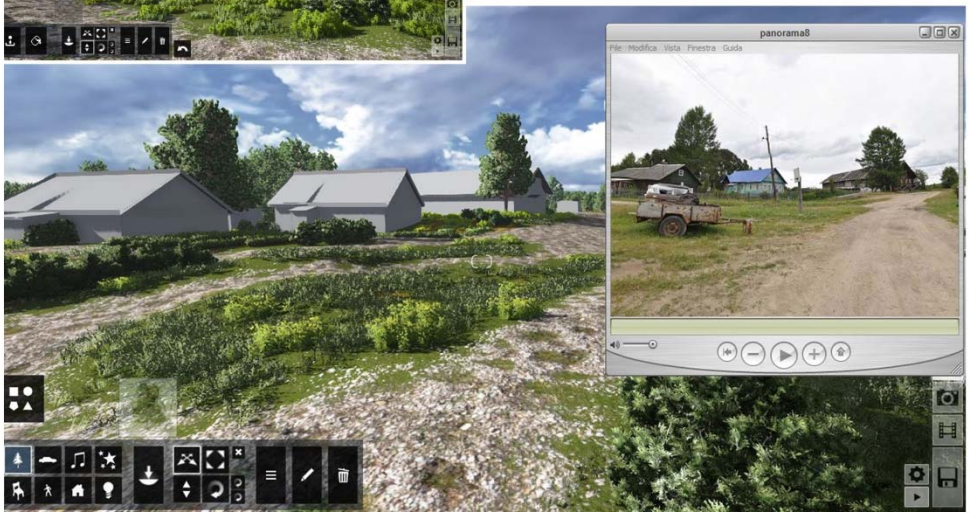


2. Il modello in .fbx viene importato in ambiente Lumion.

3. Creazione del terreno attraverso il confronto con le fotografie panoramiche, generali o di dettaglio del contesto.

4. Attraverso le curve di livello elaborate su Autocad è possibile lavorare con le pendenze del terreno.

I menu a tendina messi a disposizione all'interno del programma Lumion consentono una buona gestione del trattamento del sistema ambientale, delle superfici e dei volumi precedentemente elaborati in ambiente RhinoCeros. Il programma offre inoltre della ampie e utili librerie relative alla vegetazione (dai diversi tipi di alberature, a vegetazione bassa, sino ai diversi manti erbosi o sterrati), alle textures relative a un'ampia gamma di materiali differenti. Fra i cataloghi a disposizione si ha anche la possibilità di gestire gli sfondi del cielo, la posizione del sole e il sistema delle ombre.



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sara.porzilli@oulu.fi

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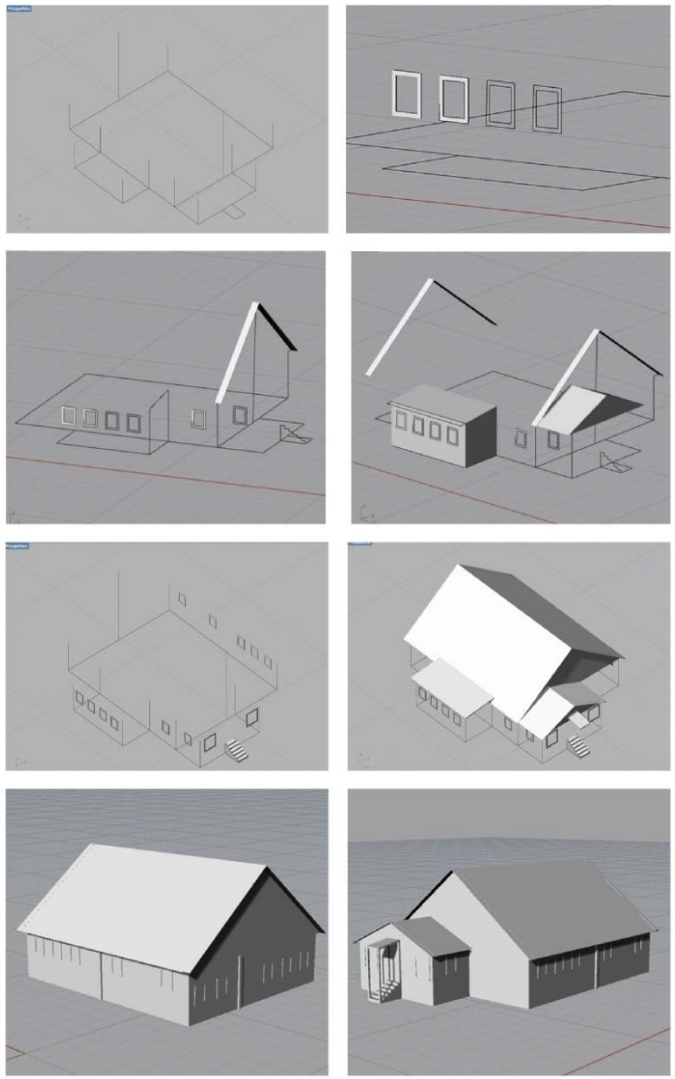

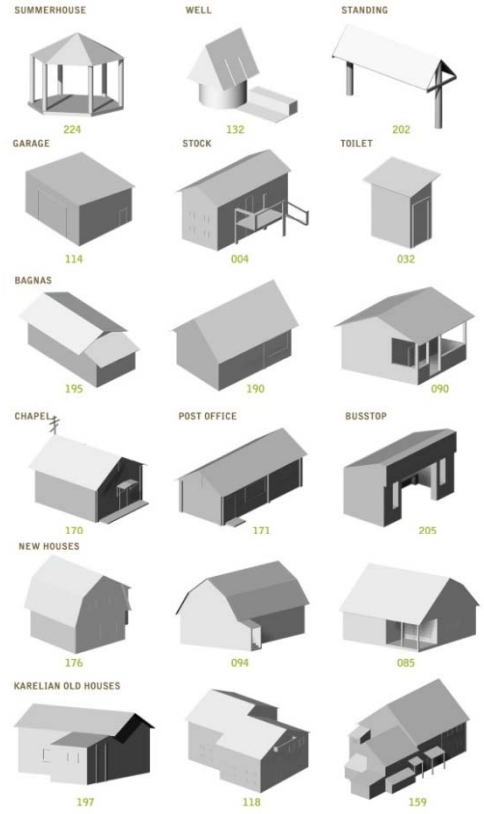

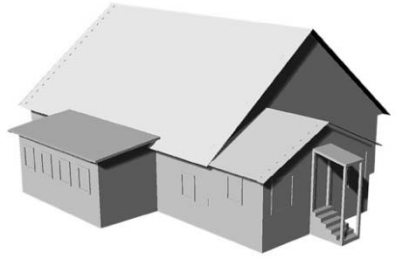

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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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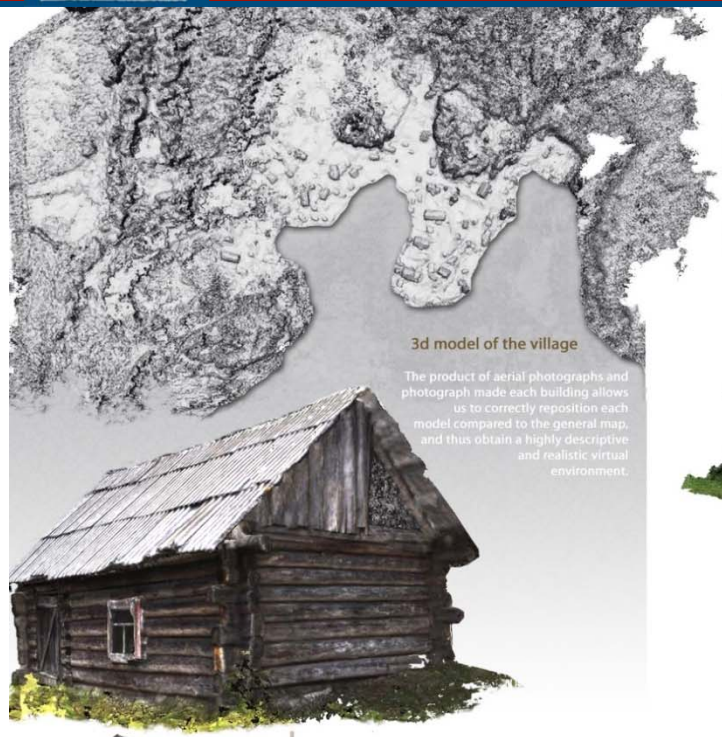


3d model of the village

The product of aerial photographs and photograph made each building allows us to correctly reposition each model compared to the general map, and thus obtain a highly descriptive and realistic virtual environment.

Traditional house # 107

Photographs were taken to al the historic houses, round to 360°, trying to describe all the elements of traditional architecture and dwelling especially on those architectural and decorative details typical of the Karelian wood architecture.

New building # 034

Also the new buildings were photographed in order to develop models that can describe the provision volumetric and the color of surfaces.

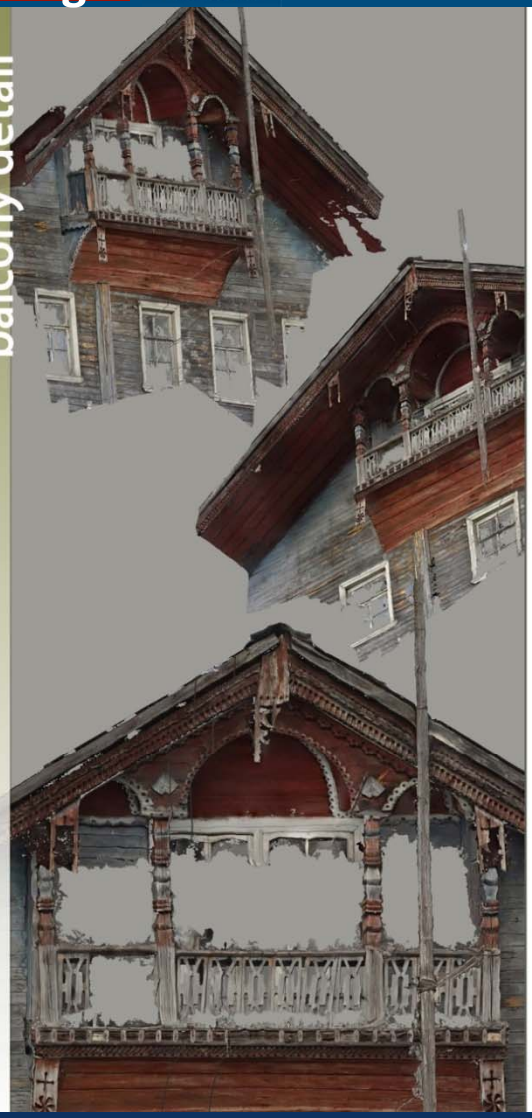
Traditional with new elements building # 013

The historic houses with outbuildings have experienced problems for the methodology of taking photographs, with large volumes with different provisions planimetric have constrained the movement around the houses and the high number of pictures.

monumental building # 002

The monumental buildings such as the historic chapel of the village have called attention to the methodology of shots of the photographs. presents of trees or other obstacles has linked the shooting to more steps and

balcony detail



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PostDoctoral Fellow
sara.porzilli@oulu.fi

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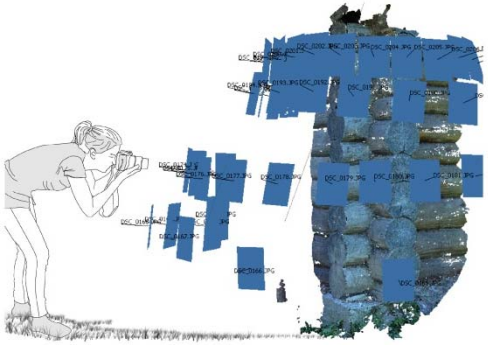
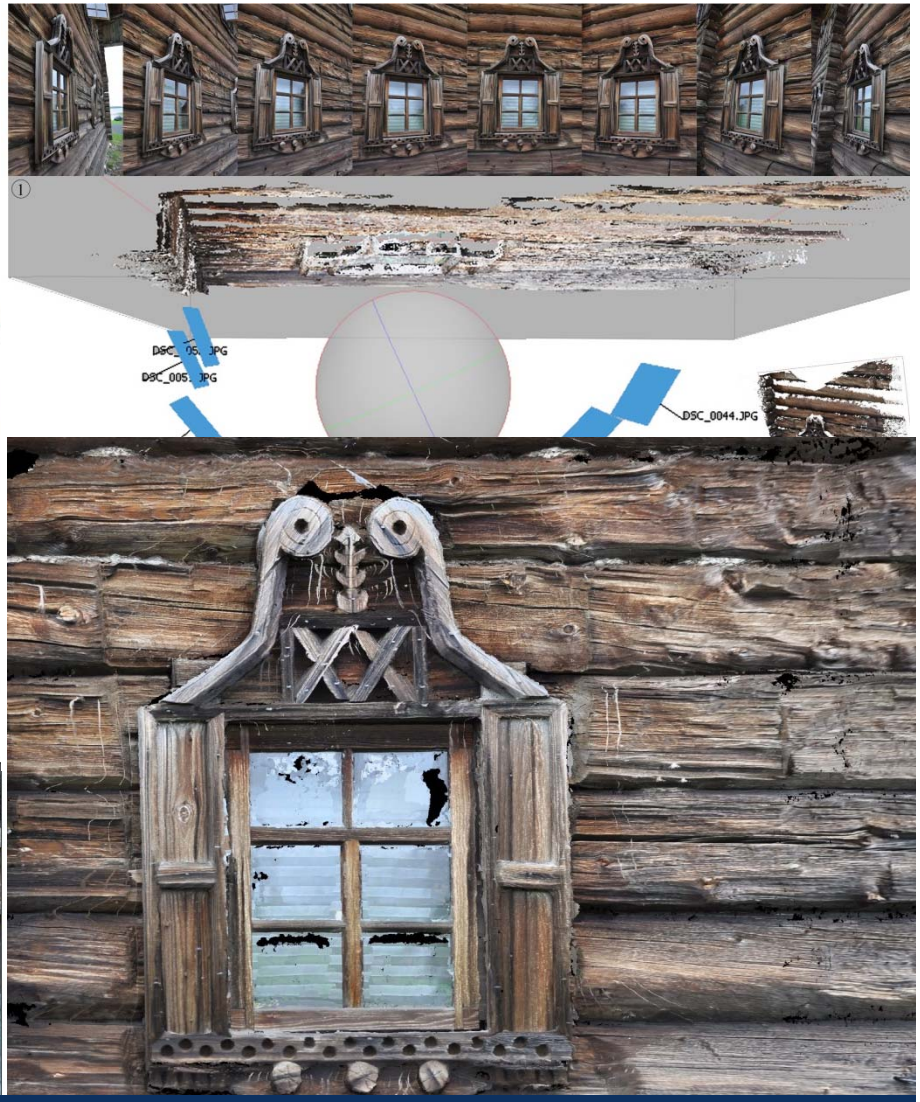


Fase operativa di acquisizione delle foto necessarie per ricostruire tridimensionalmente un modello meshato e texturizzato dei particolari architettonici lignei dell'architettura tradizionale careliana. I semplici modelli 3D possono costituire un'importante base metricamente affidabile e cromaticamente realistica per svolgere analisi specifiche sullo stato di conservazione e comprensione dello stato di degrado del legno.

1. Allineamento delle foto: dopo aver caricato le foto all'interno del progetto di PhotoScan, deve essere eseguito l'allineamento geometrico. In questa prima fase il programma individua la posizione spaziale della telecamera per ciascun fotogramma e genera una nuvola di punti.
2. La ricostruzione tridimensionale è un'operazione computazionalmente intensiva e può richiedere molto tempo, a seconda della quantità di dati da processare e della risoluzione delle foto caricate.
3. L'operazione di texturizzazione colorizzare attraverso le cromie reali tratte direttamente dalle fotografie l'oggetto analizzato. Le proprietà relative all'operazione di mappatura consentono di



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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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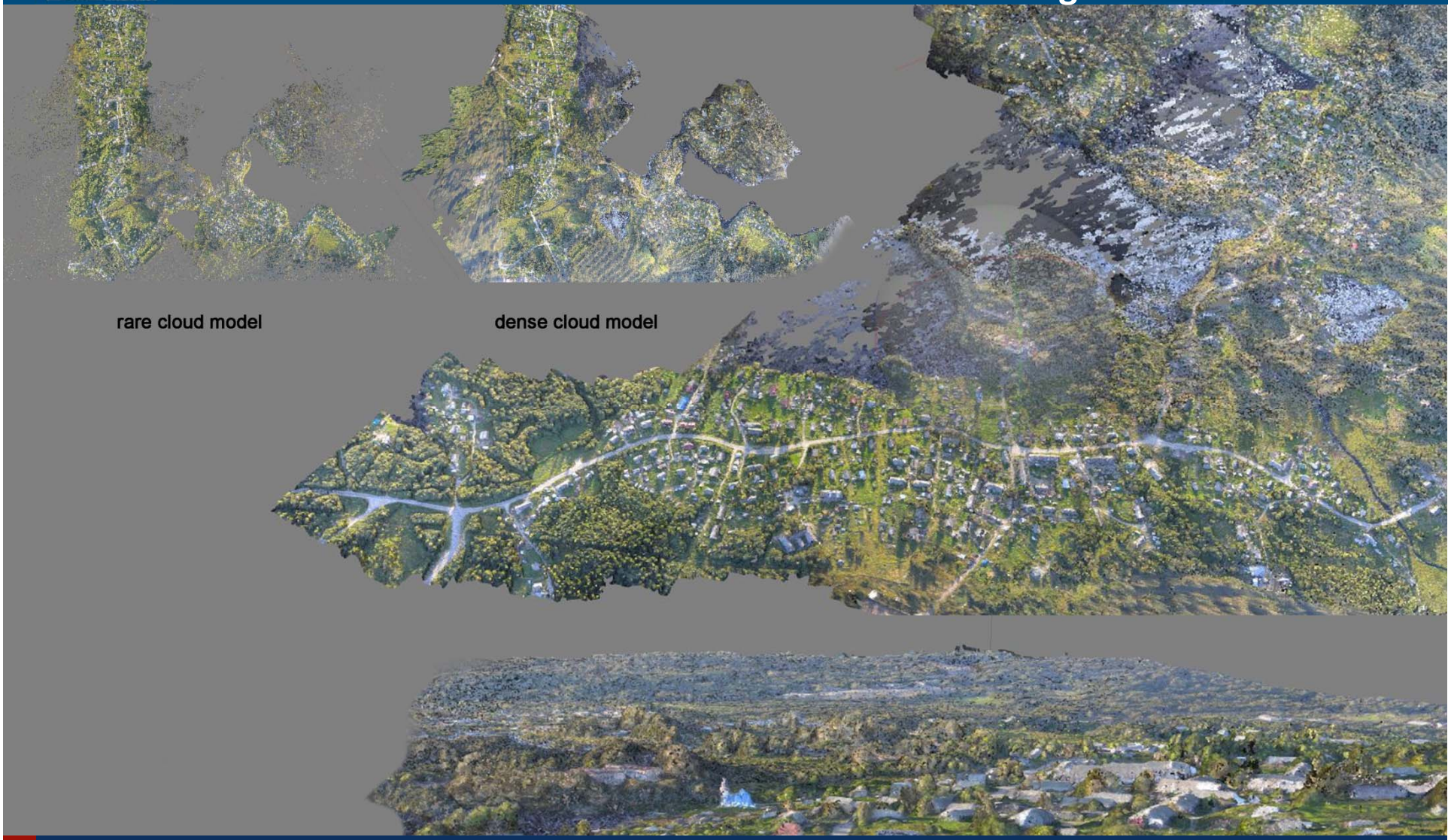

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PostDoctoral Fellow
sara.porzilli@oulu.fi

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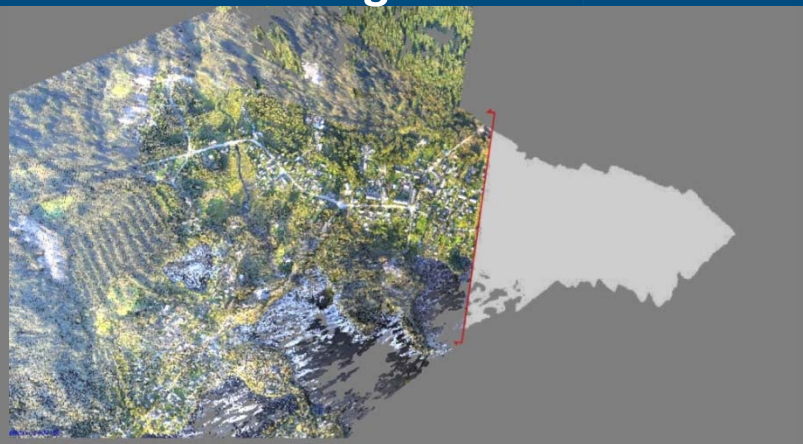
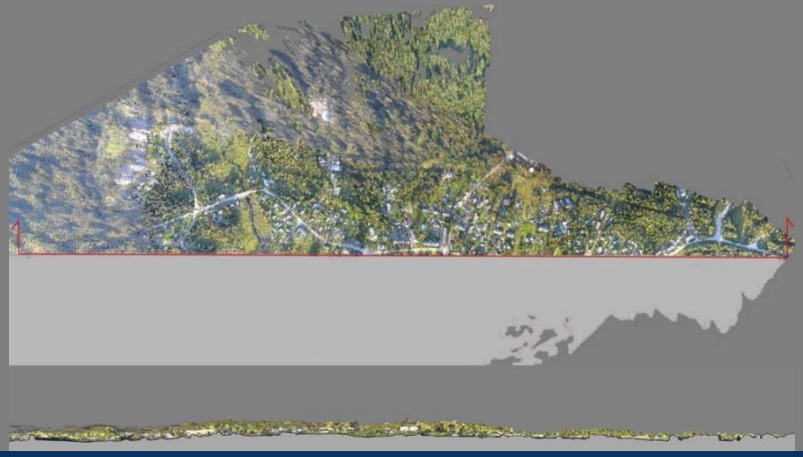


trasversal section of Vedlozero Village



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PostDoctoral Fellow
sara.porzilli@oulu.fi

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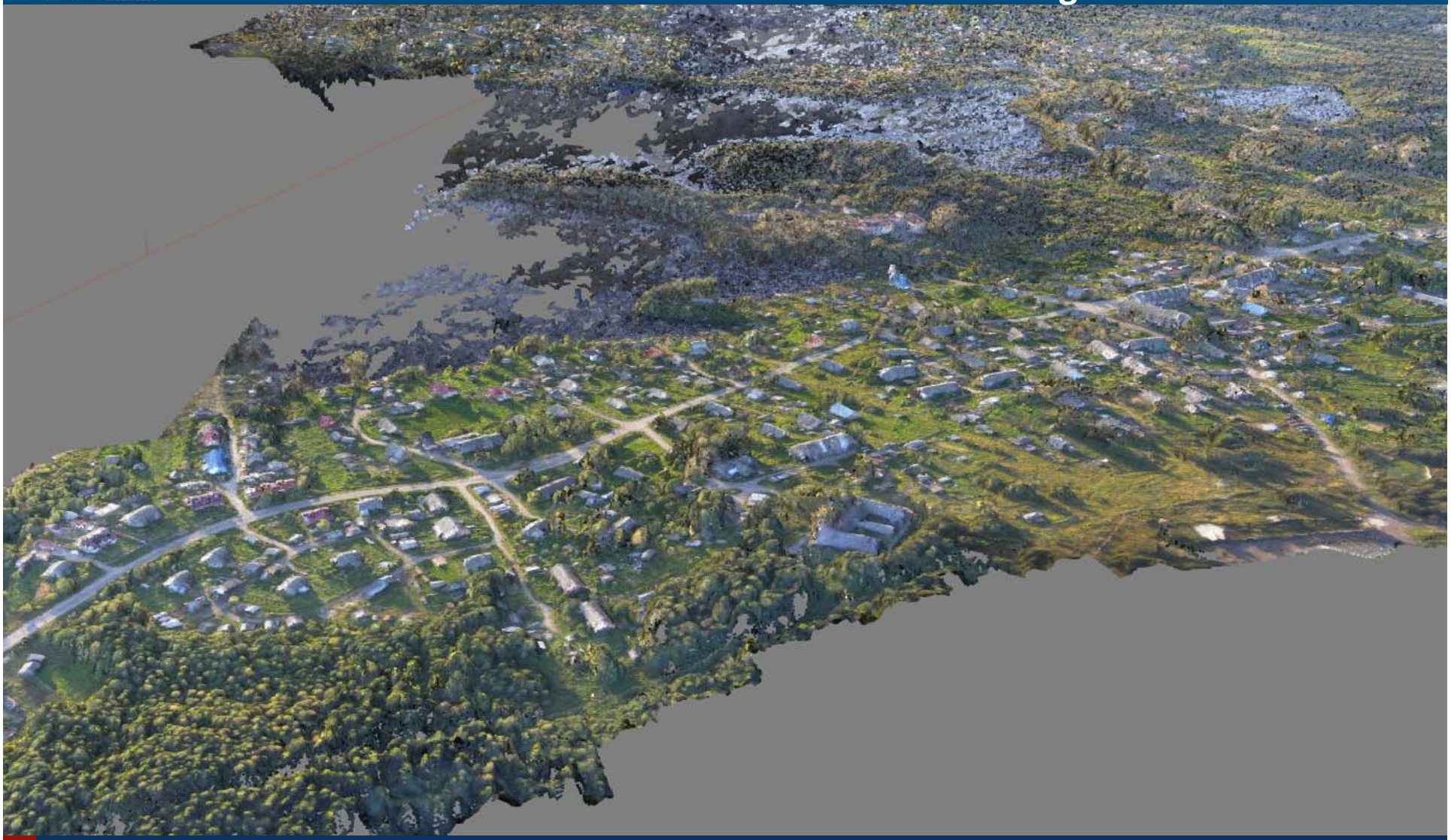

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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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PostDoctoral Fellow
sara.porzilli@oulu.fi

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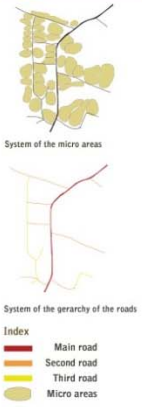
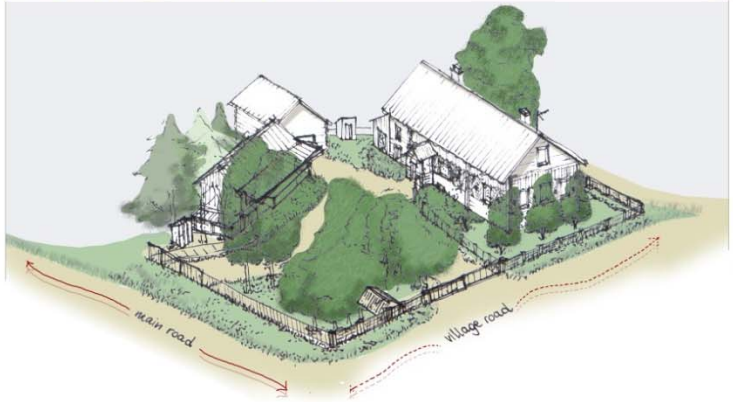
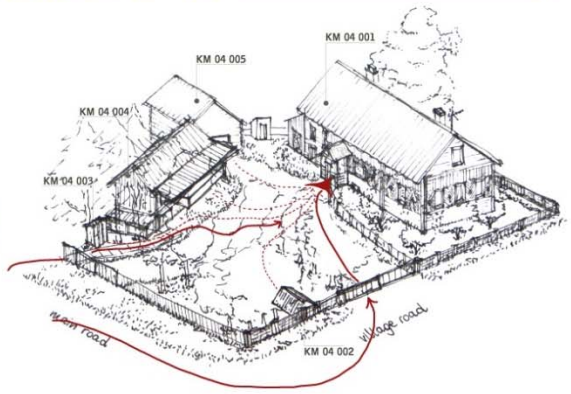
Main level of the entire village → Definition of the micro areas → Architectural unit





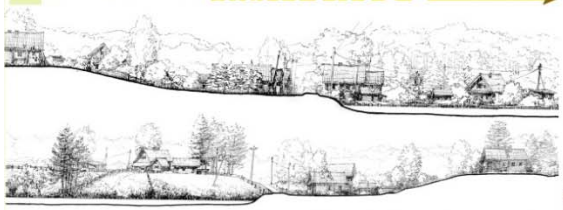


The first step of the analysis has included the study of the rural settlement from the general to the particular for understand the plan and the different types of relations. We underline the relations of the physical structure made by full and empty spaces. Full spaces are represented by the lower level of micro areas (the space related by stocades or administrative limits to the main houses) and the natural green areas; the empty spaces are organised according with the different type of access in the place focused on principal and secondary paths.

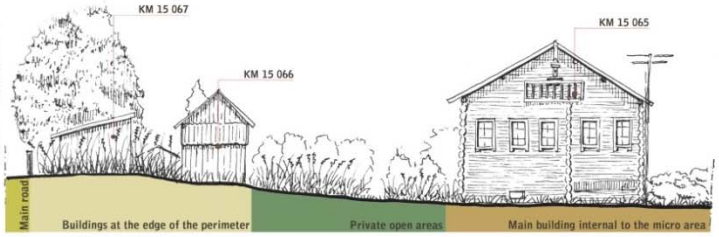
For each micro area the analysis has gone deeper until the understanding of the relations between environmental and rural systems, building-building, empty-full spaces, street system, other elements. The micro areas corrispond at the organization system of the village. During the analysis is important to define the limits and the main aspects an which architctural elements are inside.

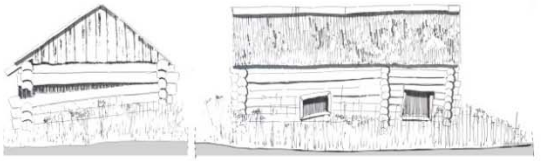
For each micro areas the analysis has included the study of the singular environmental and urban situation inside this real or absent perimeter. : corrisponds to each wilted structure in the village. For each architectural units we define the system of census analysis designing a database schedules containing all the descriptors for describe typology, function and condition state of the building.

GENERAL LEVELS OF REPRESENTATION AND DESCRIPTION OF THE PLACE ACCORDING WITH THE DIFFERENT LEVELS OF ANALYSIS

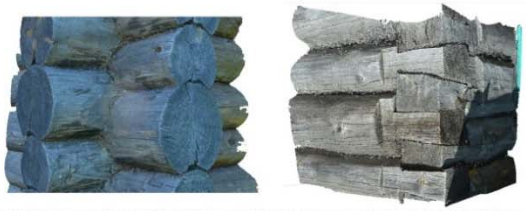


Section of the entire village for the understanding the relations of the different micro areas according with the morpholigical aspects of the environmental system.





Study of each facades for the understanding of the main characteristic of buildings. Thanks to the draw it was possible to realize the first architectonical and structural considerations.



The analysis has gone deeper until the realization of experimentation on the main structural and decorative

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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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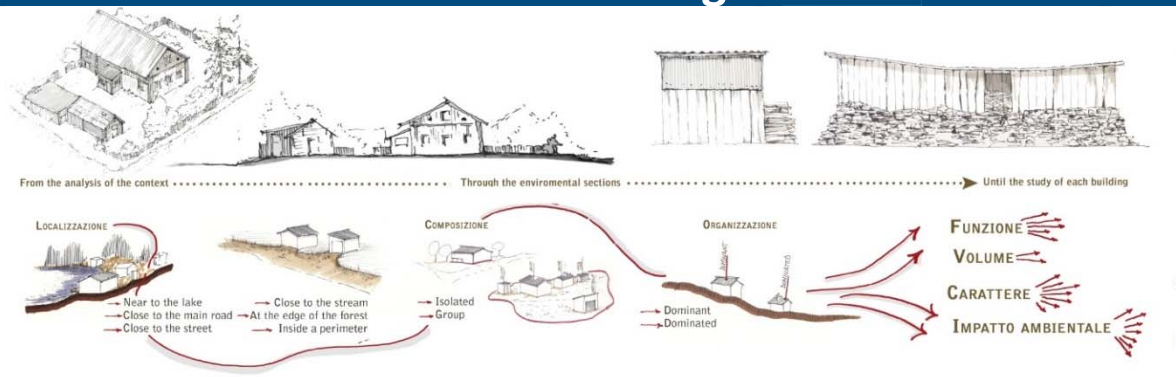
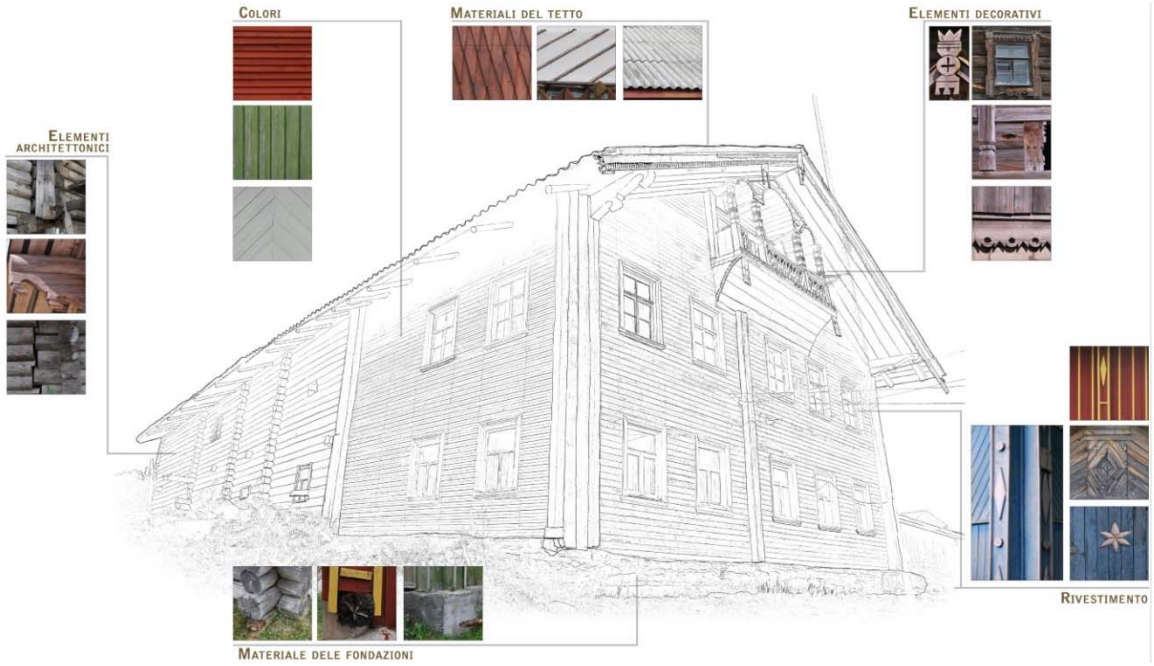


I dati generali individuano quegli elementi descrittivi riferibili al contesto, al tipo di aggregazione e organizzazione, alla volumetria dell'edificio, al carattere intrinseco e all'impatto ambientale che questo ha nei contronti dell'intorno.



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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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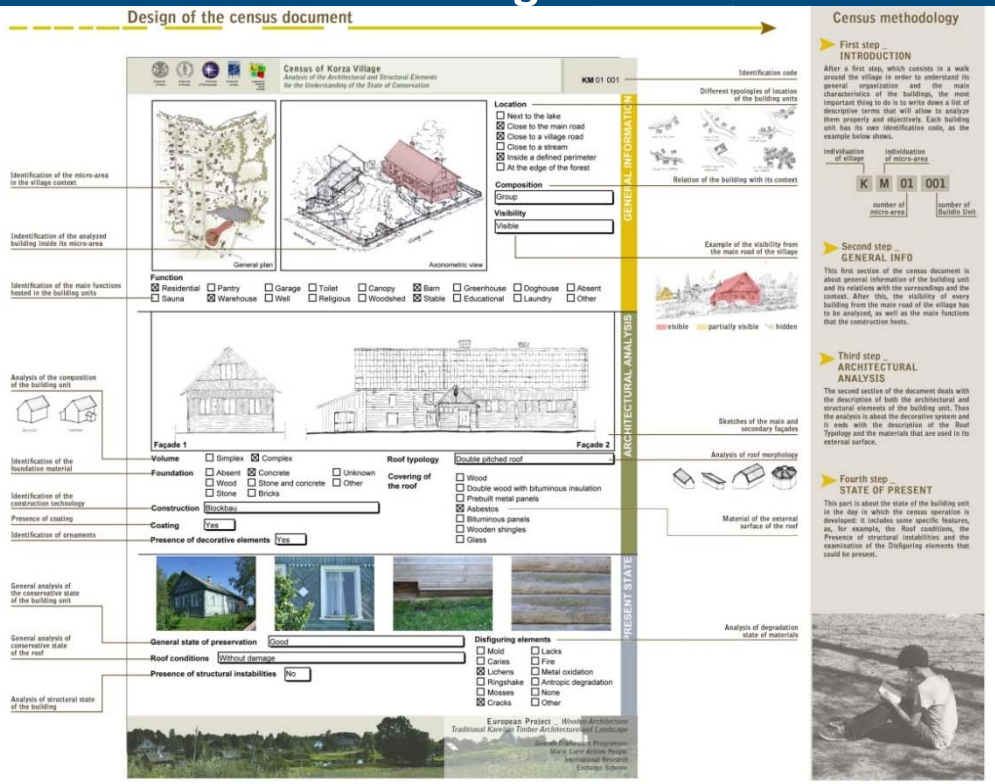

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PostDoctoral Fellow
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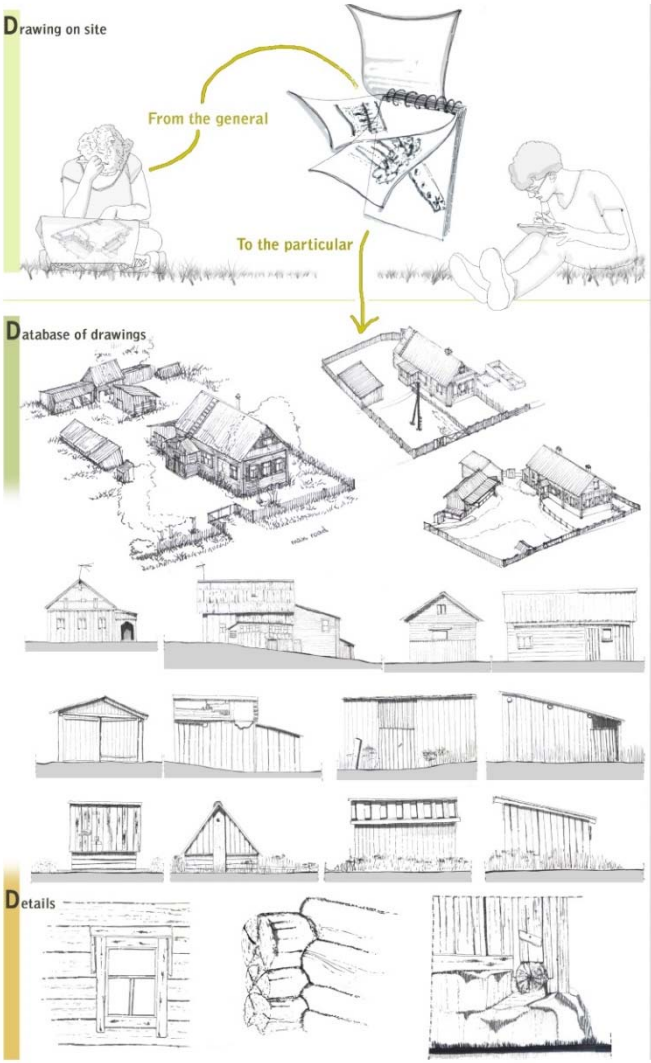
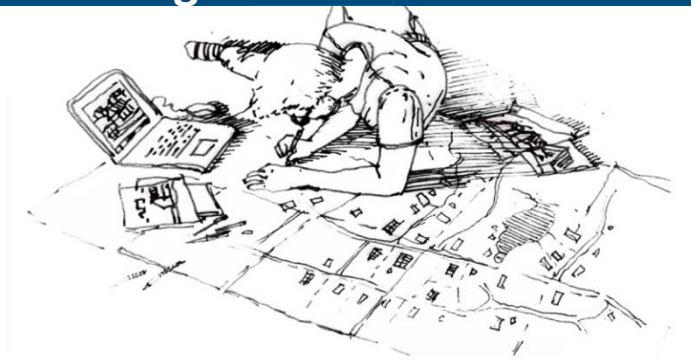
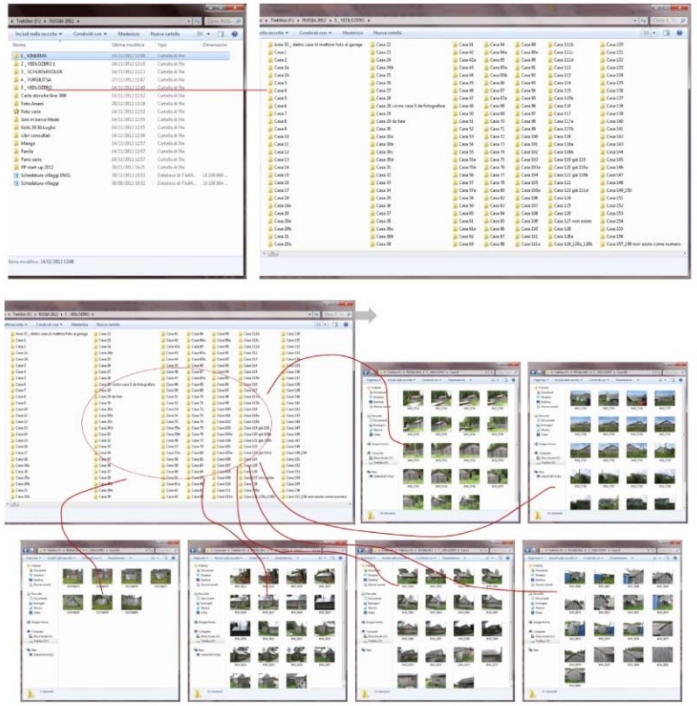


La comprensione del paesaggio attraverso la discretizzazione dei dati acquisiti durante il lavoro sul campo. Il processo di sintesi effettuato sul villaggio di Rubcheyla è avvenuto grazie a due strumenti che hanno permesso di confrontare i dati diversi tra di loro: schedatura e analisi del paesaggio.





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sara.porzilli@oulu.fi

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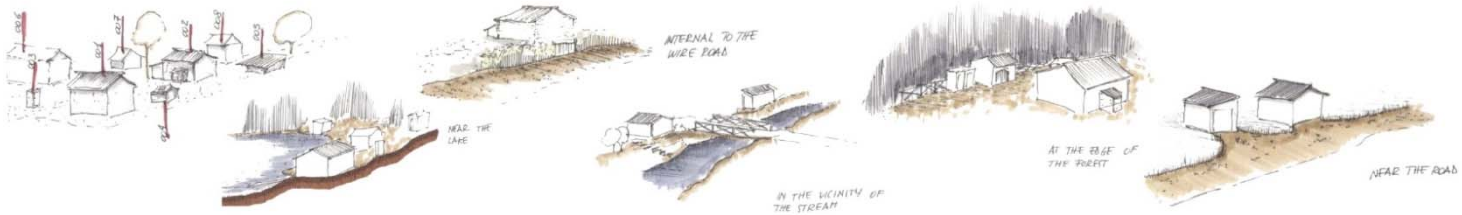
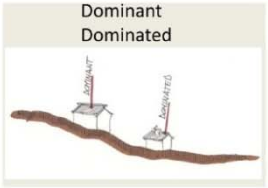
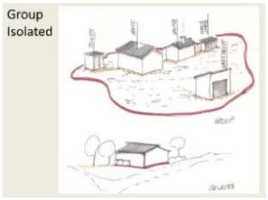
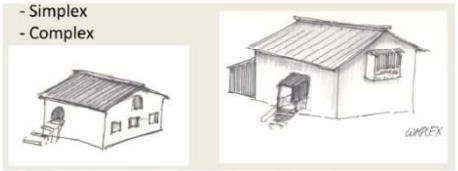
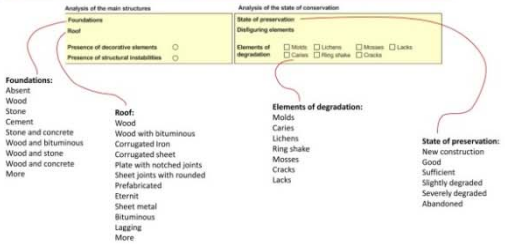
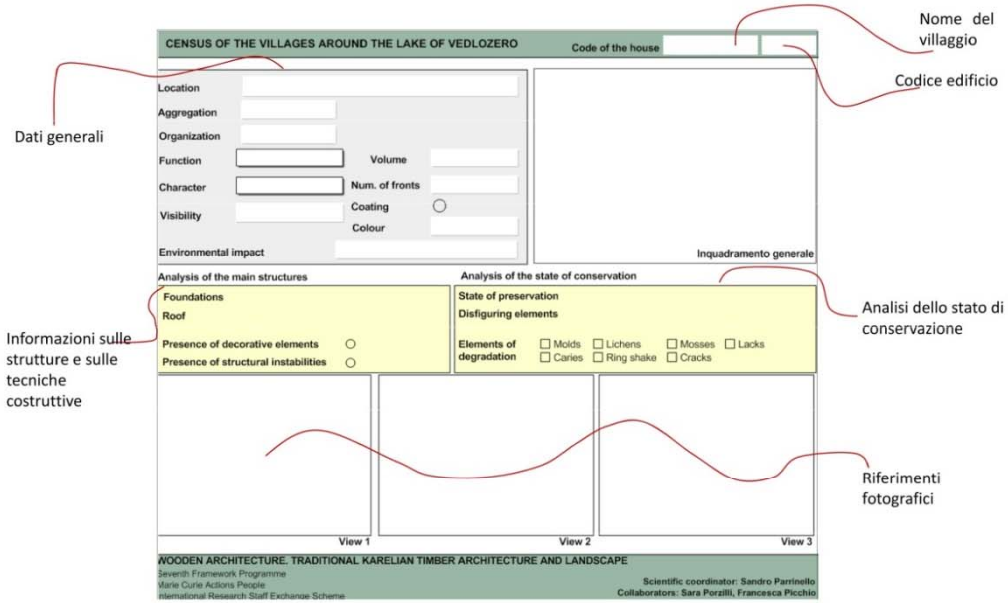










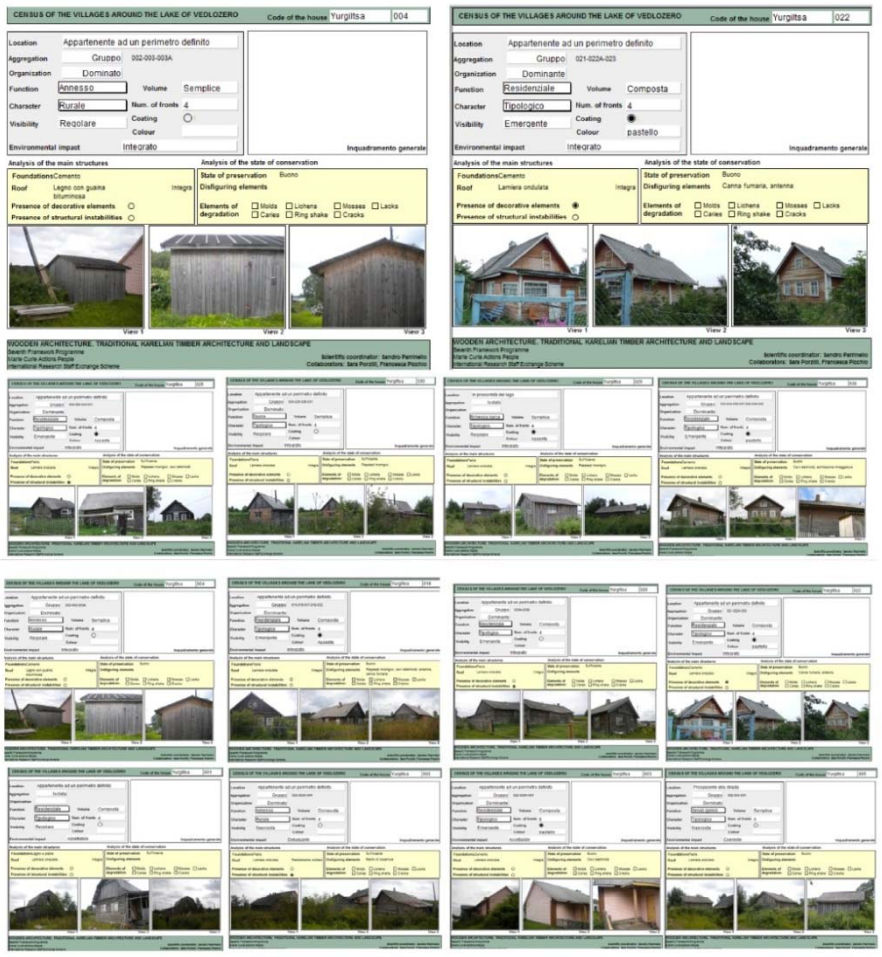


Funzioni individuate

- Residential
- Dependance
- Sauna
- Pantry
- Warehouse
- Luggage wet waste
- Greenhouse
- Well
- Toilet
- Building of Worship
- Commercial
- Outbuilding
- Garage
- Throw boat
- Woodshed
- Barn
- Canopy
- Tourist accommodation
- Industrial
- Educational
- Loggia
- Hospital

Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

Documentation of Wooden Architectural Heritage



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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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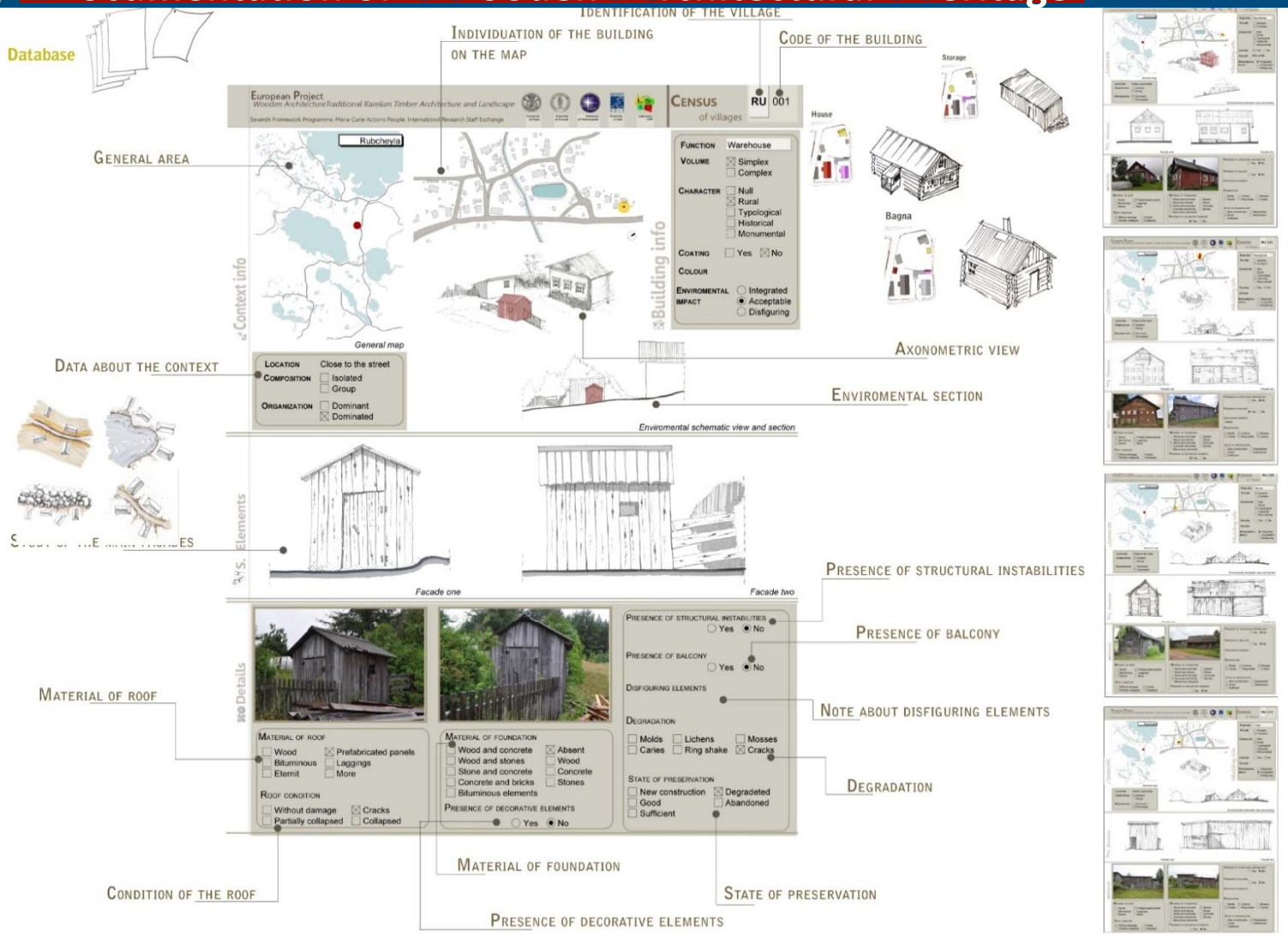

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PostDoctoral Fellow
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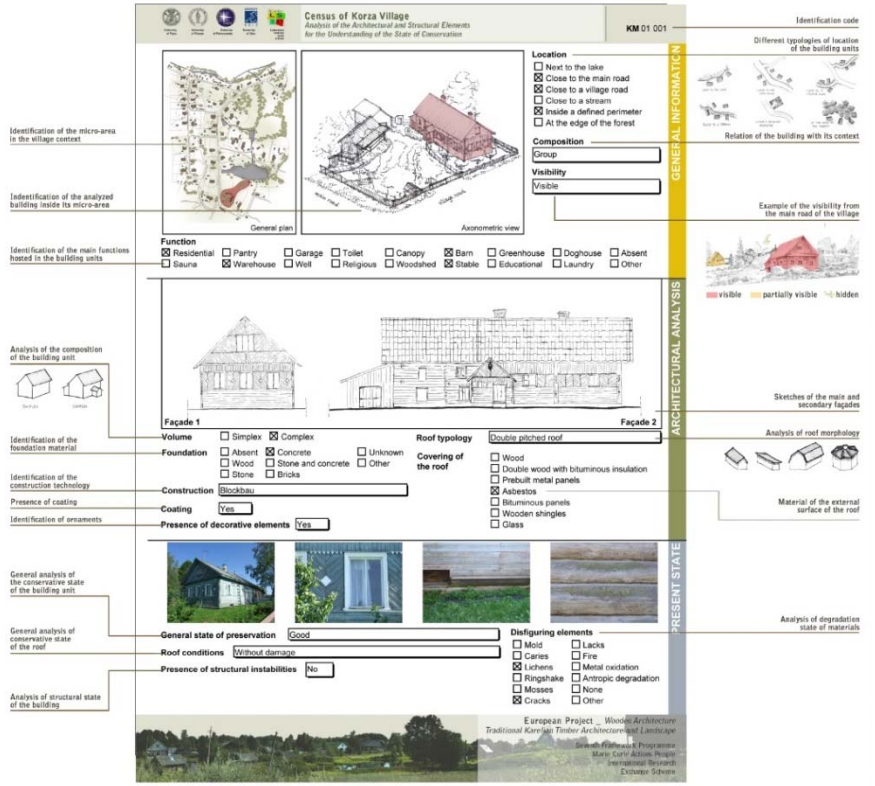

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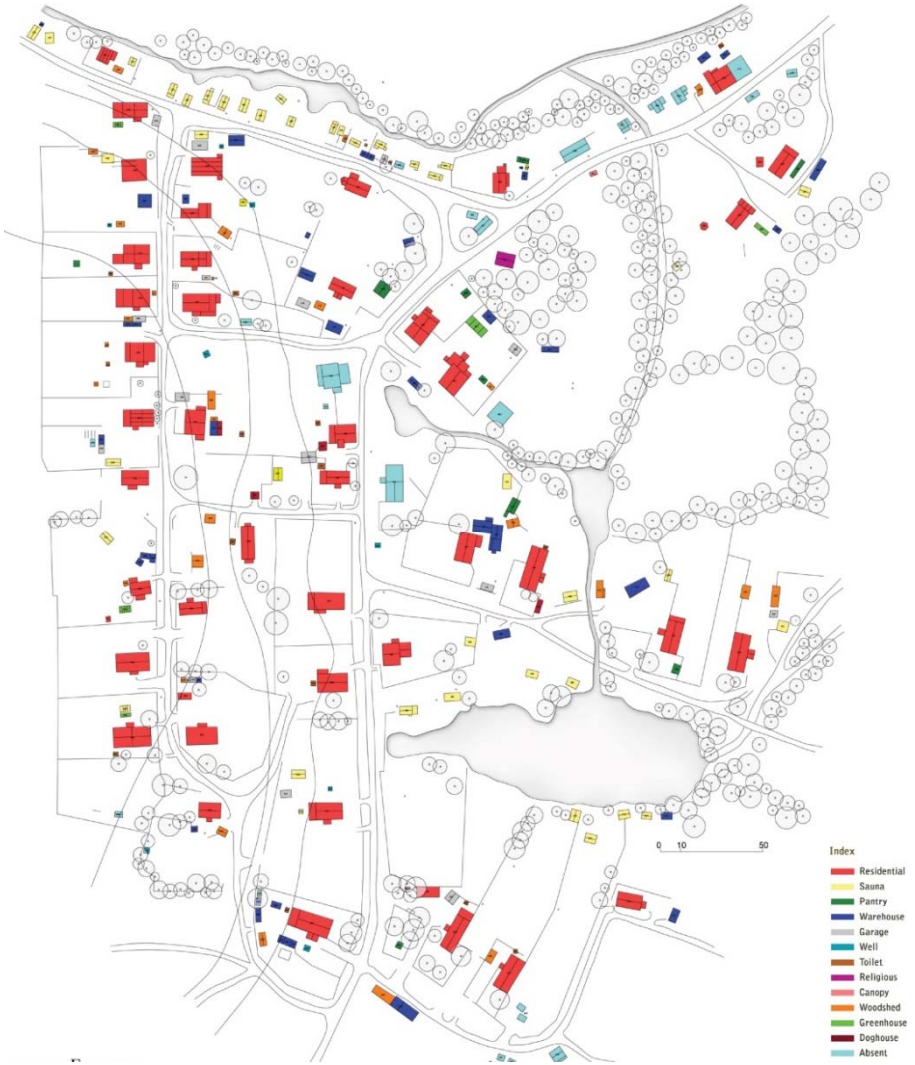
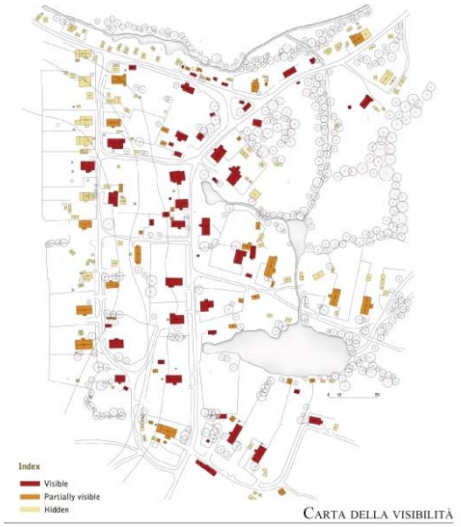
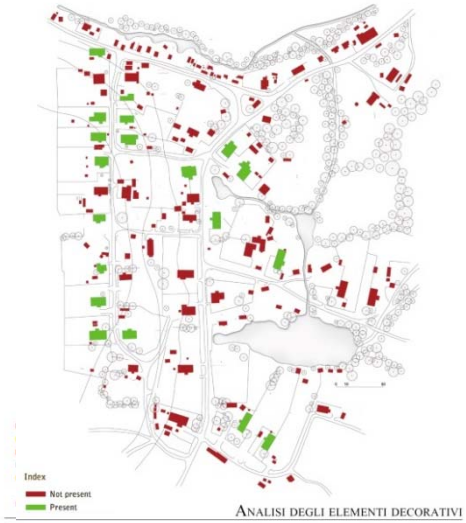


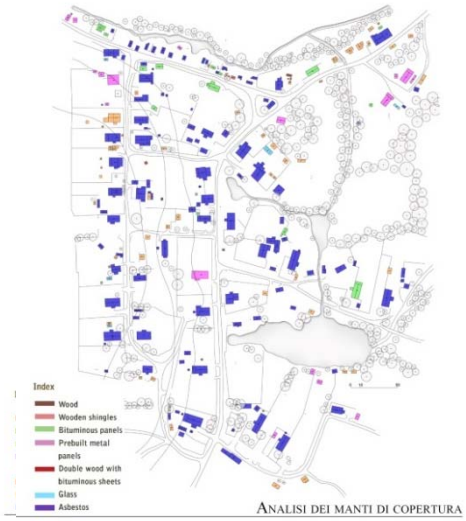


CARTA DELLA VISIBILITÀ



ANALISI DEGLI ELEMENTI DECORATIVI

VALUTAZIONE SULLA PRESENZA DI CRITICITÀ STRUTTURALI



ANALISI DEI MANTI DI COPERTURA

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Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

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Concluding considerations on the results achieved

The results of these research activities have highlighted that the development of strategies of interventions for preservation of cultural heritage MUST today be based on UPDATED DOCUMENTATION.

Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

It is evident that the careful acquisition of the data has a fundamental role in validating each decision. The importance of the documentation becomes even more valuable considering the conservation in its widest sense, thinking about the “physical characteristics” and the “immaterial intrinsic elements”

Urgent needs

The use of cheap and untraditional materials is altering and undermining the structural image of these places.

Pay attention to the repairs that need to be started immediately.

Plan periodical surveys can help a technical and deep understanding of the structures studied in order to check their state of maintenance and operate with fast, safe coherent actions when needed.

The loss of knowledge of this wide wooden heritage, the disappearance of the traditional cultural identity and the memory of these places is compromising the conservation of wooden traditional architecture.

The elaboration of new typologies of analysis on the architectural and landscape heritage has represented a strong, high, urgent necessity.

Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi

Thank you for your attention

Sara Porzilli
Sara.porzilli@oulu.fi

CREDITS:
Research activities and results

Karelia research project has been carried out at the Department of Architecture of Florence DIDA and Department of Civil Engineering and Architecture DICAR of the University of Pavia, Italy. Scientific Responsables: Prof. S. Bertocci, Prof. S. Parrinello. Images and data under copyrights. Sara Porzilli has been Technical Coordinator for project of Laser scanning survey and postproduction of the Pogost Complex on Kizhi Island in Karelia (Russia).

Research activities and results of Lamminaho farm house have been carried out at the School of Architecture at the University of Oulu jointly with Museovirasto ans Senate Properties. Materials are under copy rights. Survey and Postproduction carried out by Sara Porzilli.

Sara Porzilli
PostDoctoral Fellow
sara.porzilli@oulu.fi