

DIGITAL ENGINEERING

for alignment
optimization

PRESENTATION SUMMARY

DIGITAL ENGINEERING

TUNNEL ALIGNMENT OPTIMIZATION

DEEP TUNNELS

URBAN CONTEXT

SEGMENTAL LINING

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DIGITAL ENGINEERING

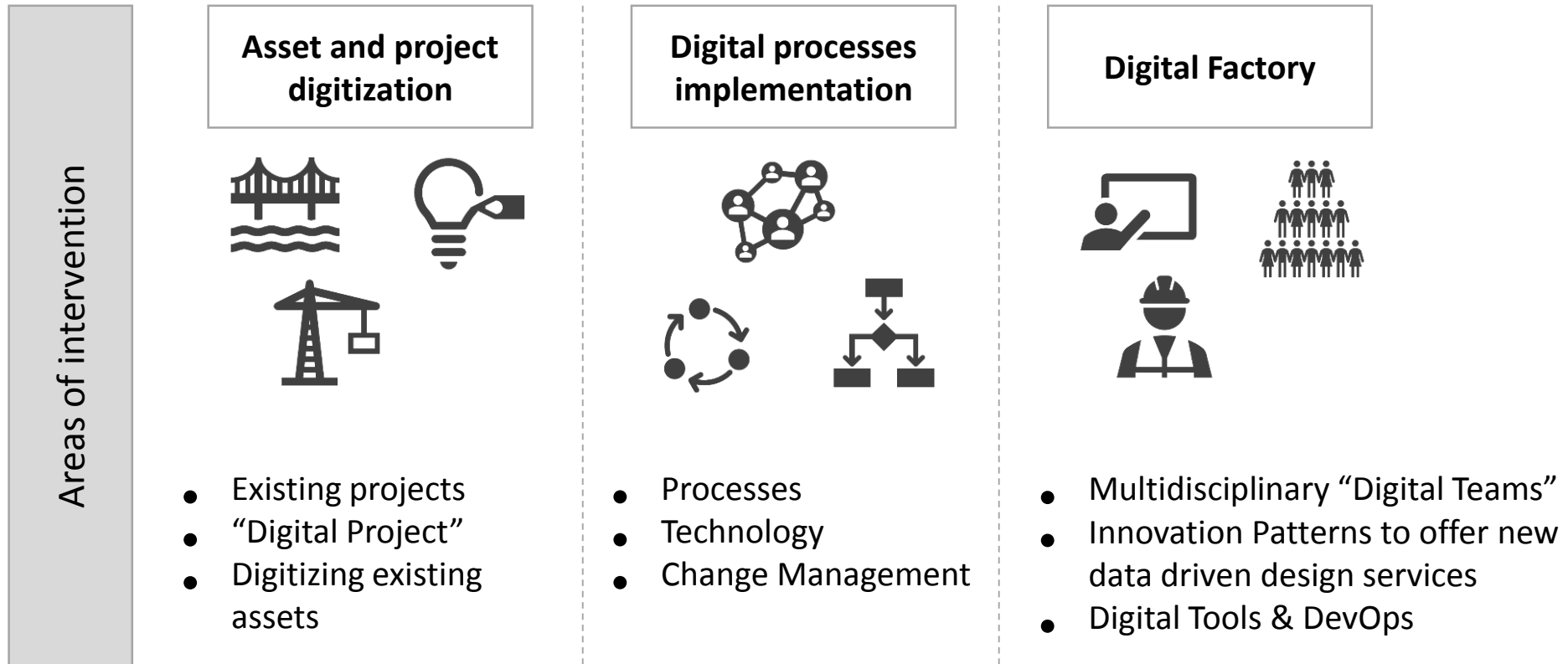
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Digital Engineering Transformation Program



Digital Engineering Innovation Goals

Data management

The creation of a centralised database ensures data are stored in a structured and managed system. Organically grown structures ensure users can utilise and understand data in a logical and accessible way.

Predictive maintenance

Sensors providing real-time data monitoring allow predictive and condition based maintenance procedures to be used.

FM integration

The information model integrates with Facility Management softwares currently available on the market. By associating spatial information with documents and design data, made operations more efficient.

Real-time monitoring

Through advanced communication protocols it is possible to connect sensors positioned on real assets to their digital twins enabling real-time performance monitoring.



Efficiency and cost reduction

Integrated design, automation and digital tools allow an exponential increase in efficiency with a consequent reduction in costs.

Design optimisation

Shared data sources allow natural coordination between all design disciplines and digital development support operatives.

Advanced simulation

The integration of information deriving from the construction phase as well as the implementation of custom algorithms allows the generation of simulations focused on predictive analysis.

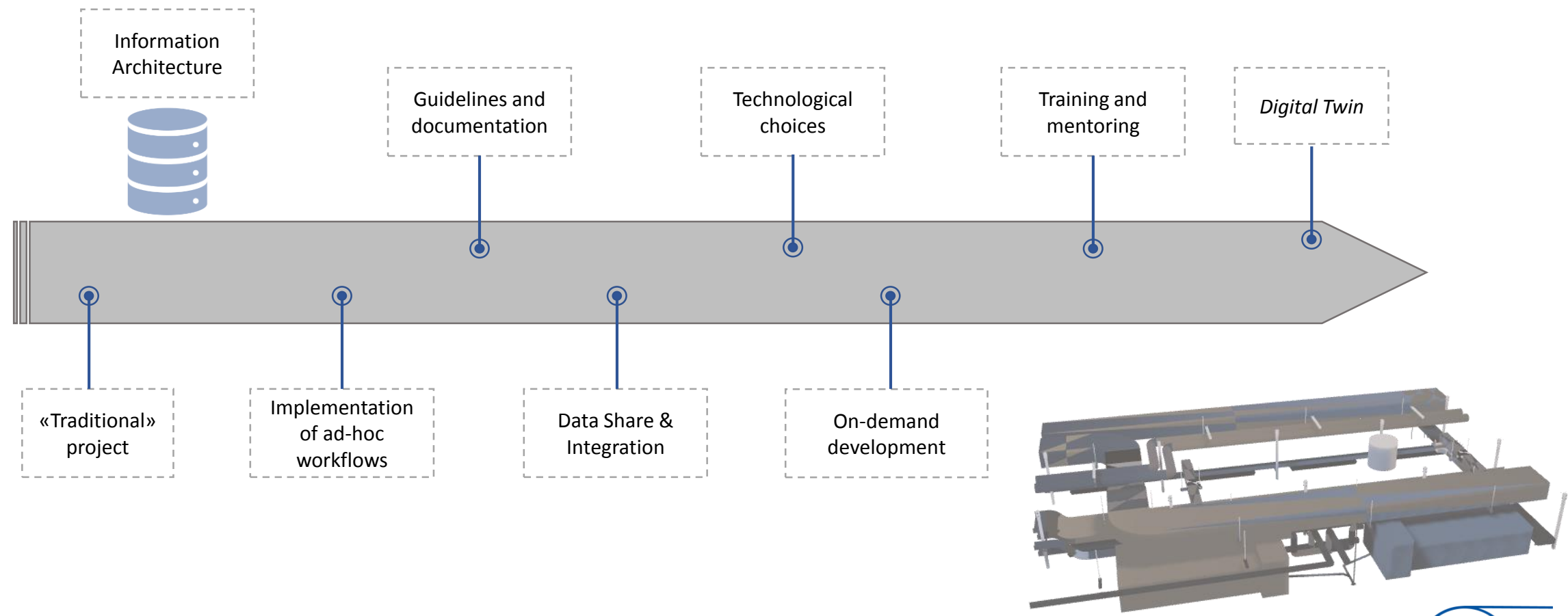
Interoperability

Interoperability is the key word when it comes to digital innovation processes. In house software development enables rapid prototyping and speeds up data collection and data transformation.



Digital Engineering

The digitization process



TUNNEL ALIGNMENT OPTIMIZATION

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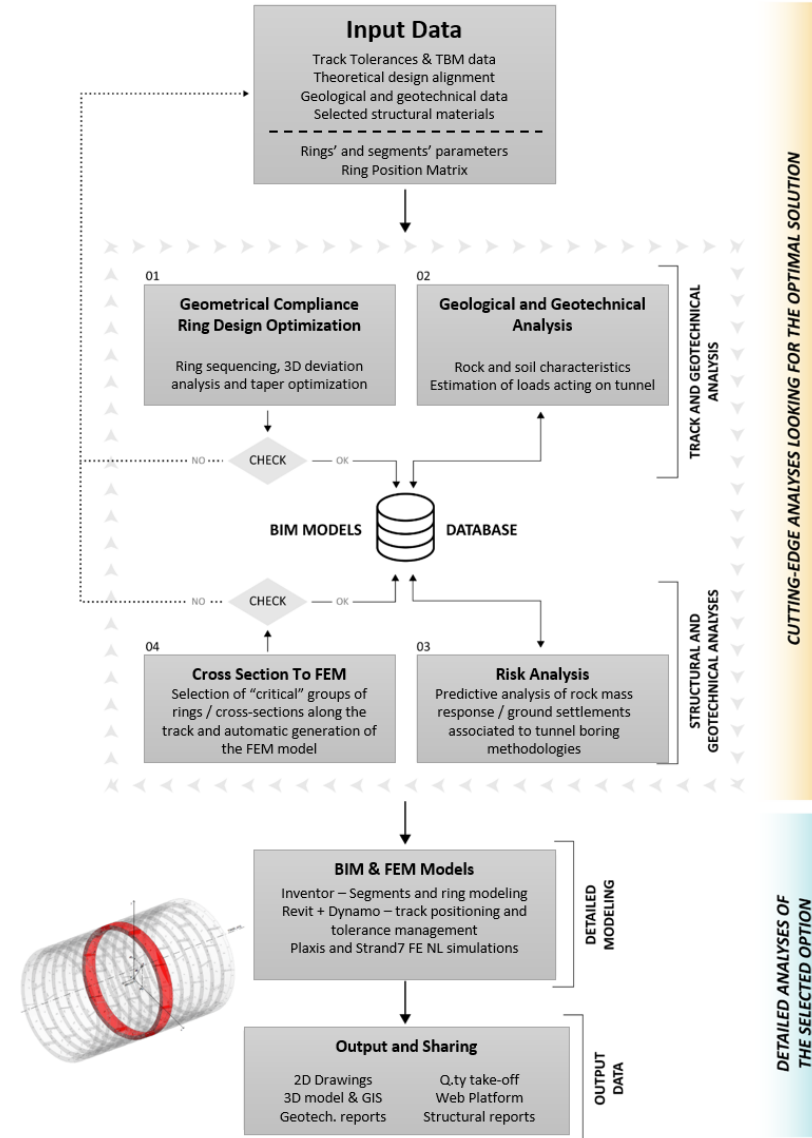
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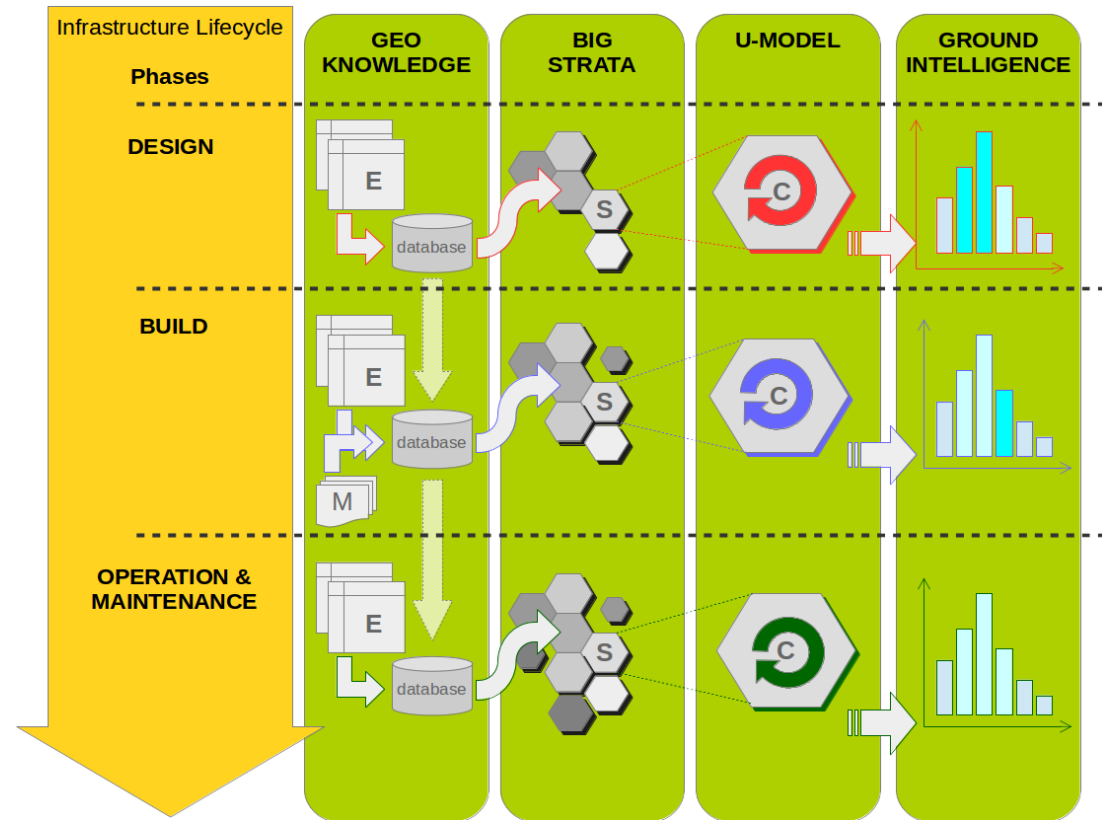
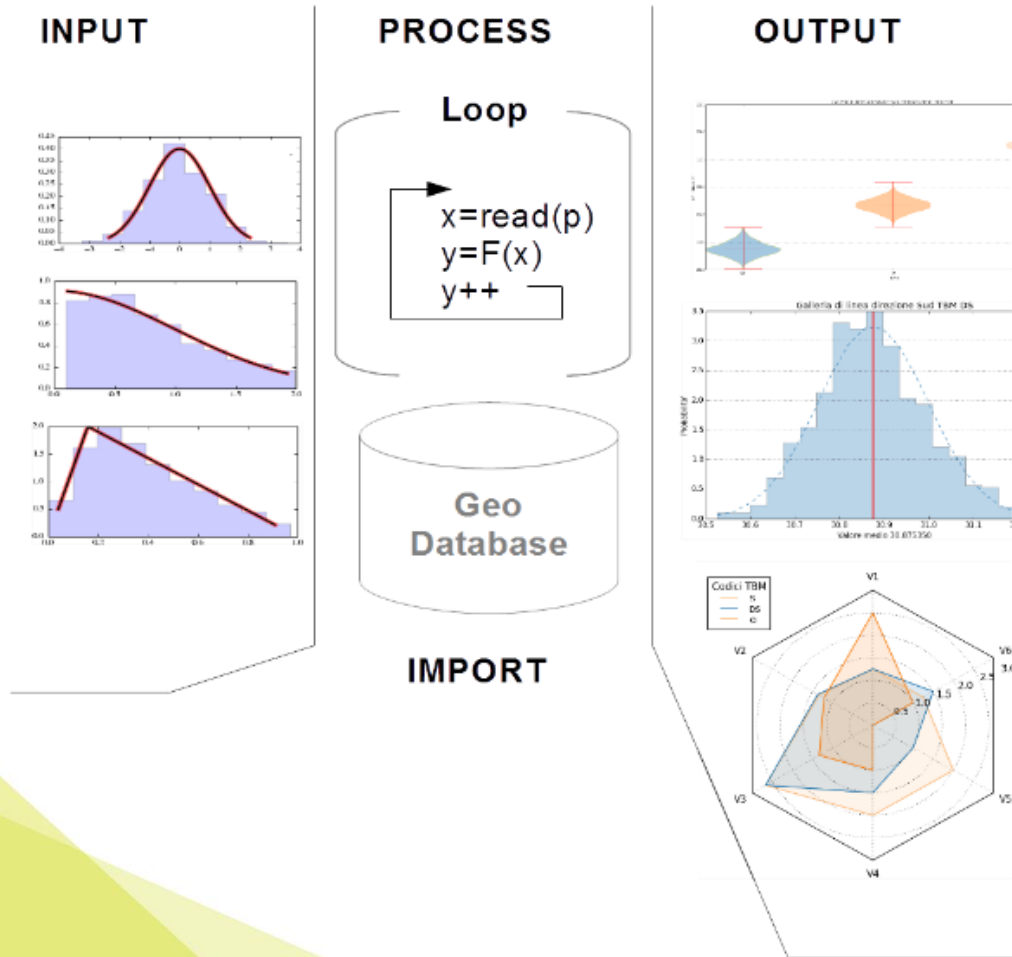
SEGMENTAL LINING

Digital Engineering for Alignment Optimization



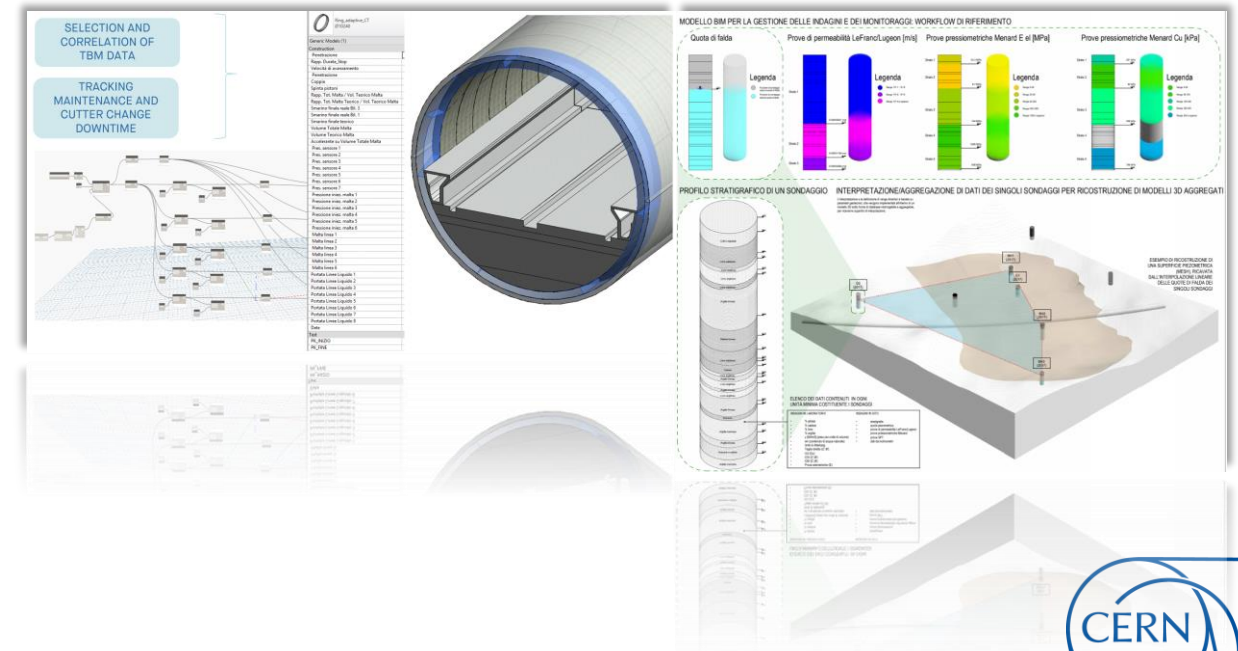
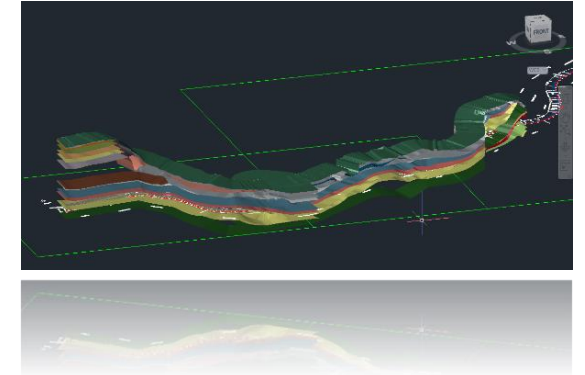
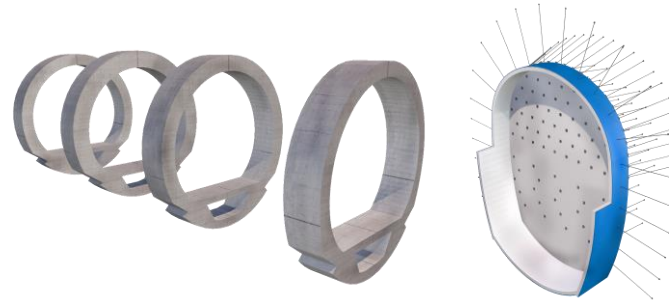
Digital Engineering

The digitization process for Tunnels



Digital Engineering improved Data collection & Analysis

- Design
 - Existing projects
 - Start new project from scratch
- Build
 - Existing “Digital Projects”
 - Traditional Projects
- Operation & Maintenance
 - Digital Tunnel Twin



DEEP TUNNELS OPTIMIZATION

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Digital Engineering deep tunnels (rock)

Input Data Digitalization

G

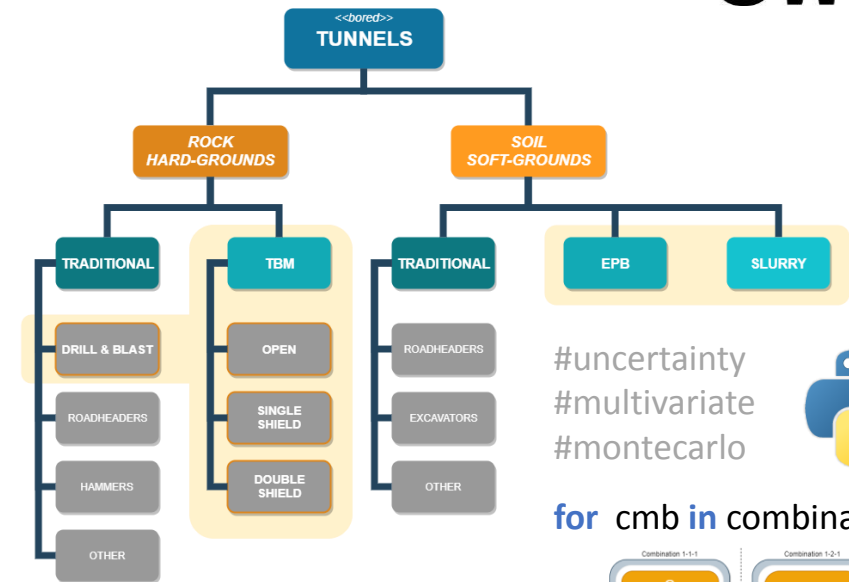
- Alignment & DEM
- Stratigraphy & Geotechnical parameters
- Cross-sections and related geometries
- Tunnelling Method (TBM, D&B, etc.)

P

- Potential Risk Factors
- Performance requirements & constraints
- Historical (TBM) production datasets

V

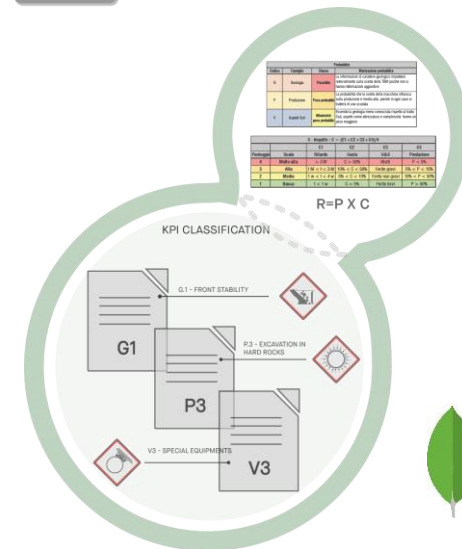
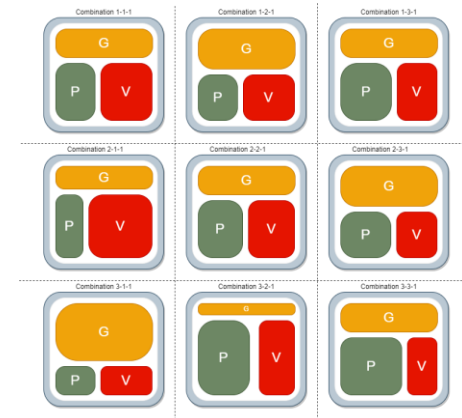
- Stocking/laydown areas
- Schedule of works



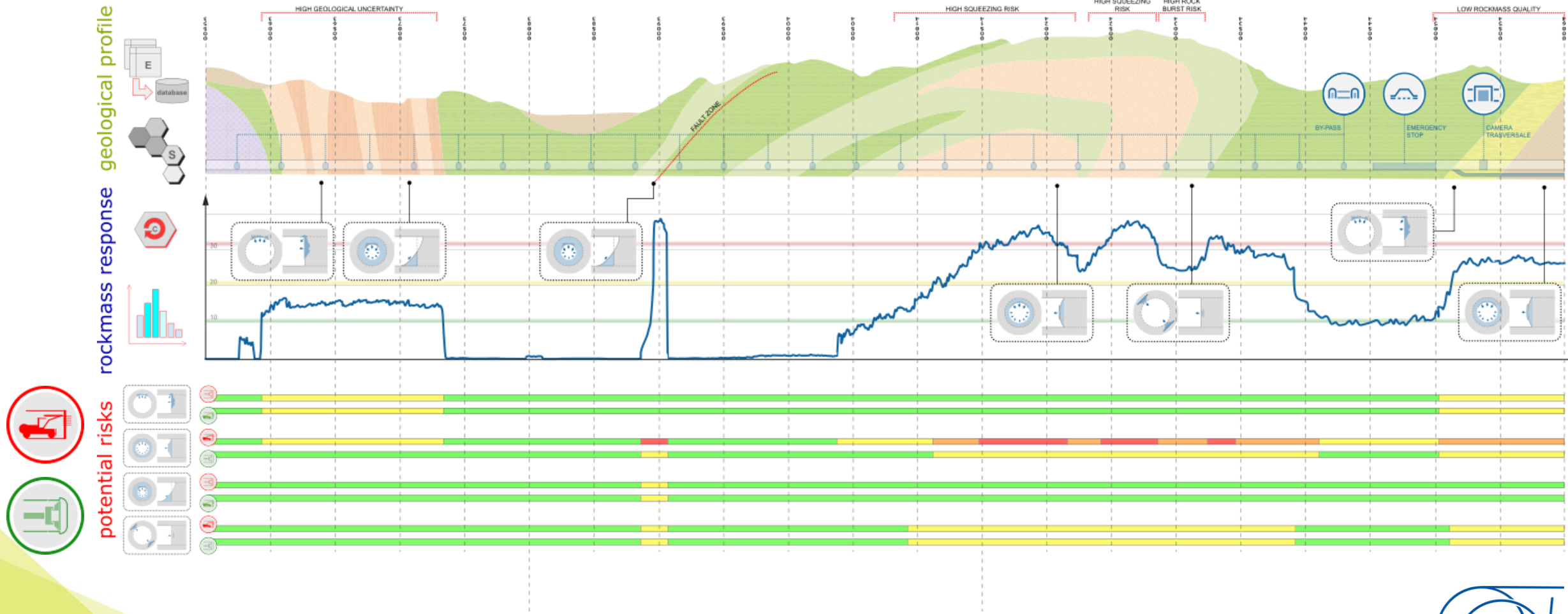
#uncertainty
#multivariate
#montecarlo



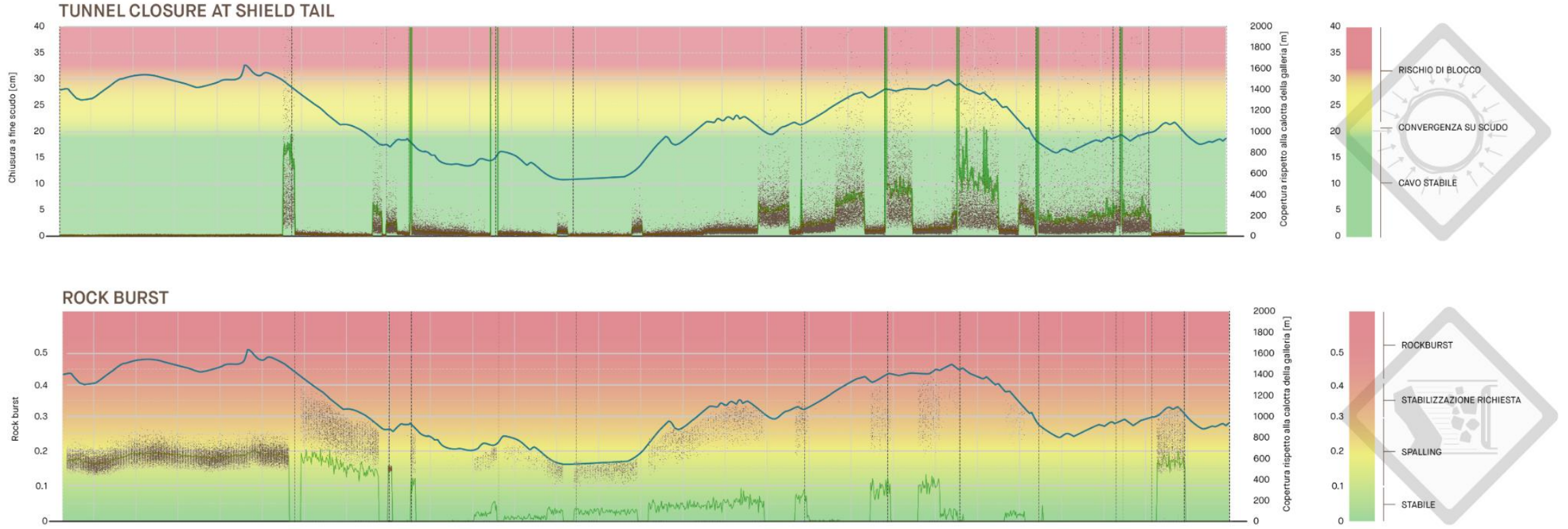
for cmb in combinations:



Digital Engineering deep tunnels (rock)

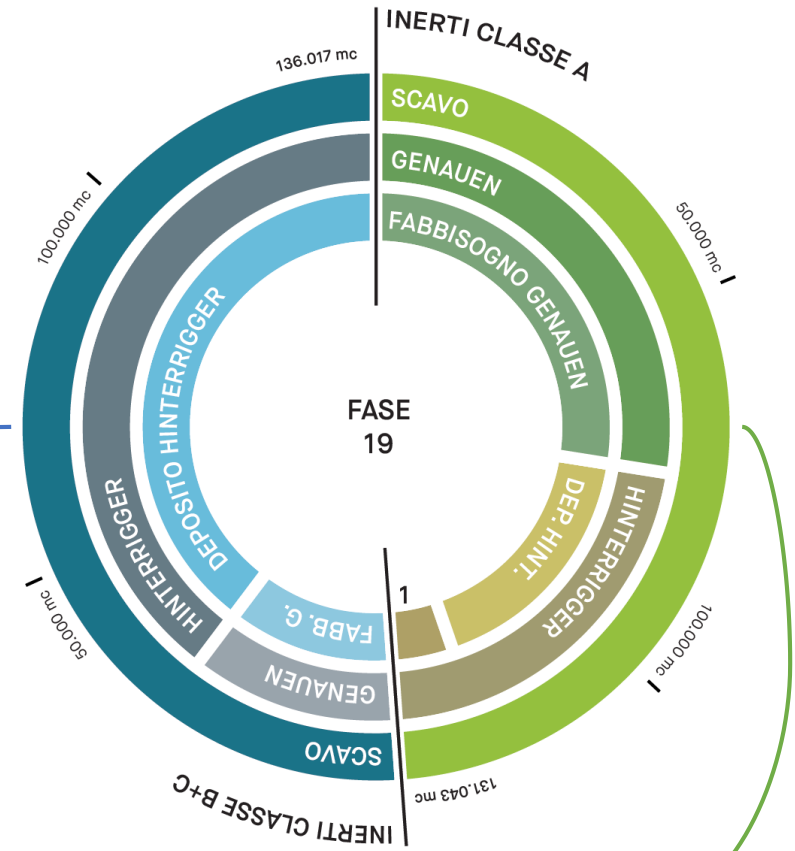
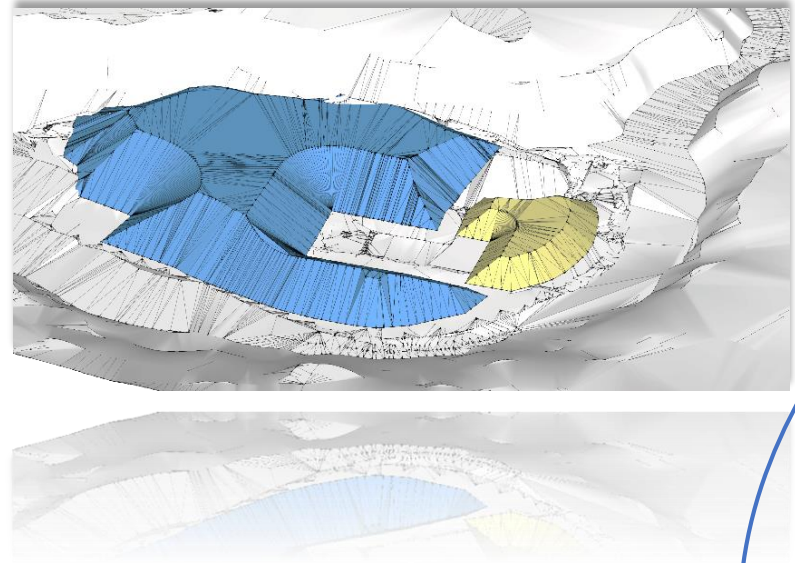


Digital Engineering deep tunnels - **benefits**

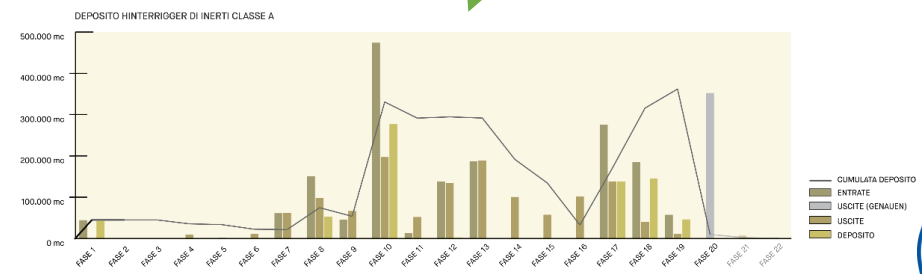
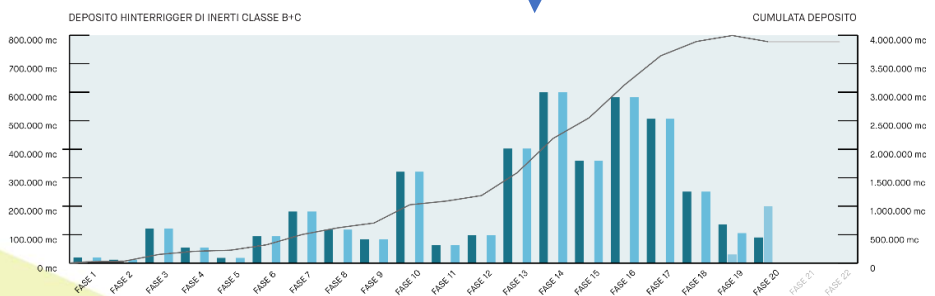


Digital Engineering deep tunnels - benefits

Stocking area planning



Material flow



URBAN CONTEXT OPTIMIZATION

DIGITAL ENGINEERING

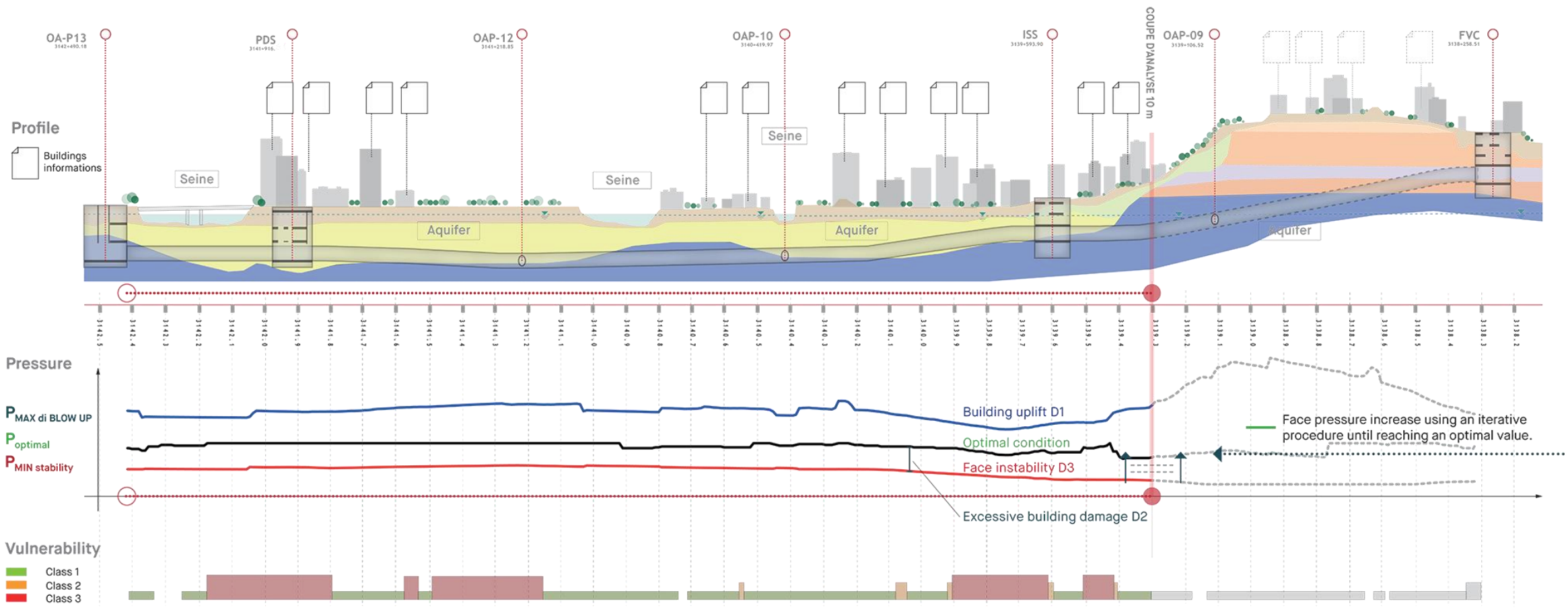
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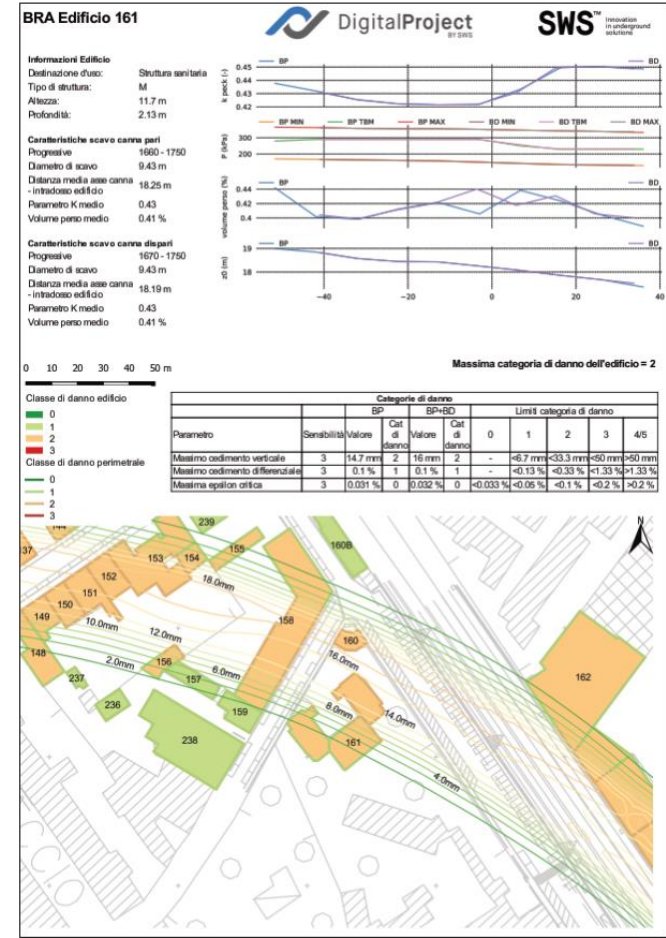
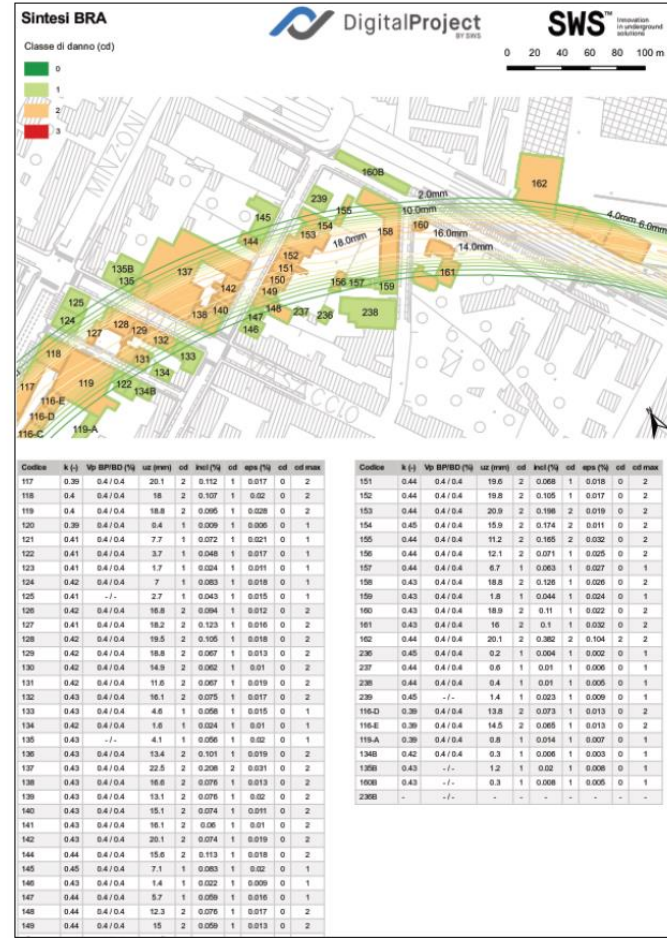
SEGMENTAL LINING

Digital Engineering urban context (soil)



Digital Engineering urban context - benefits

BUILDING DAMAGE ASSESSMENT



SEGMENTAL LINING OPTIMIZATION

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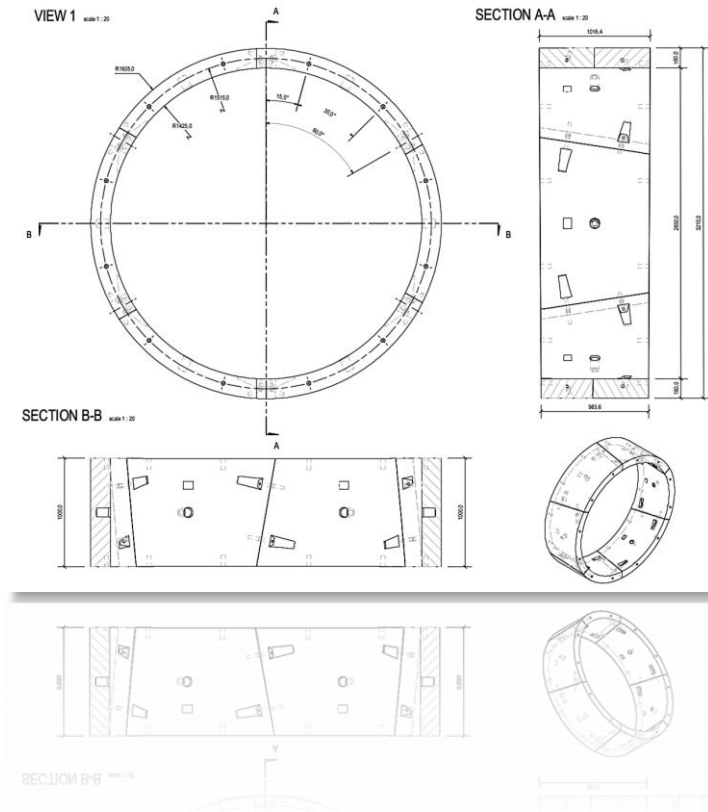
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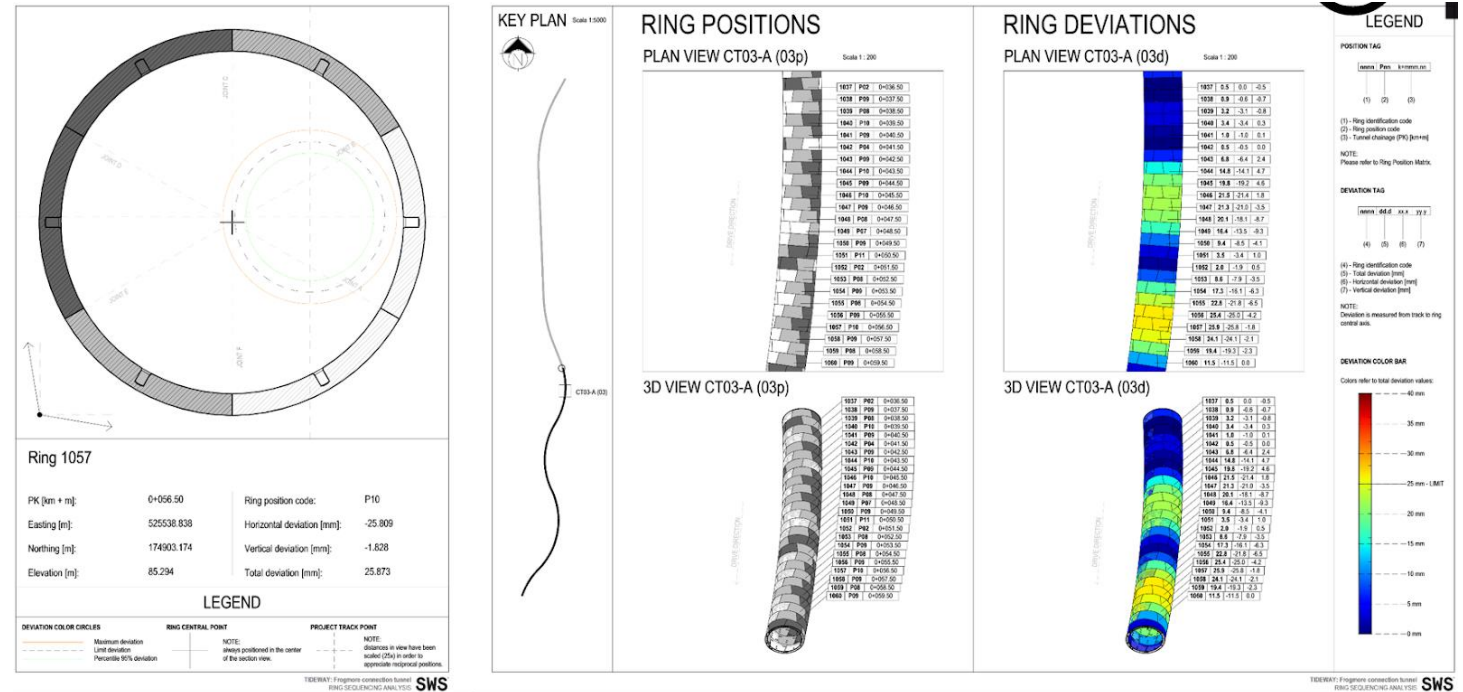
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Digital Engineering Segmental Lining



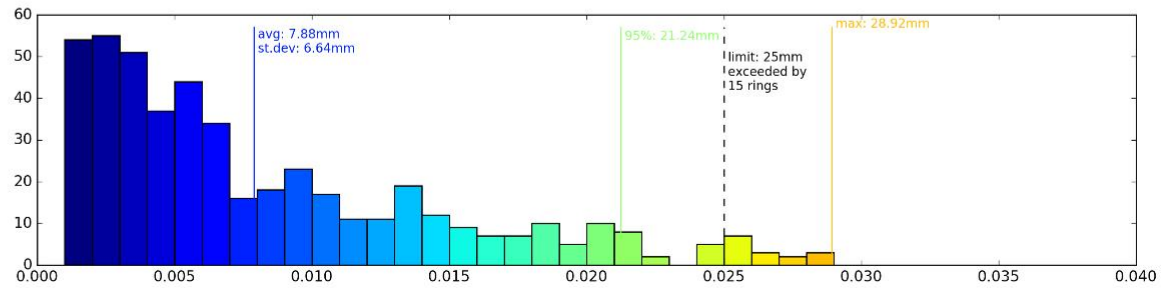
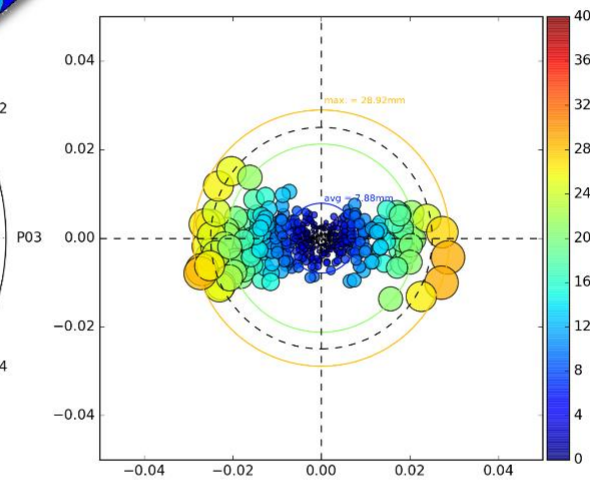
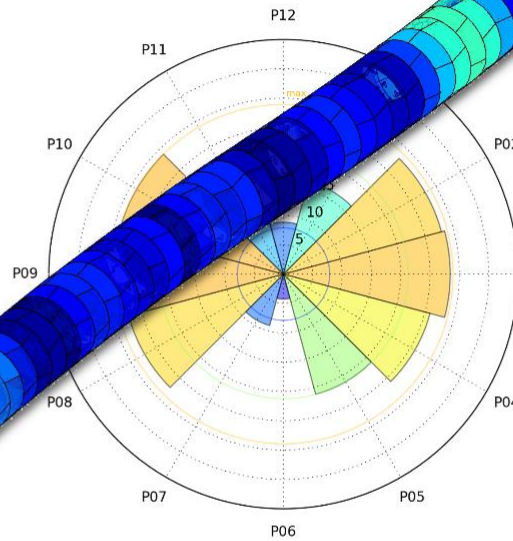
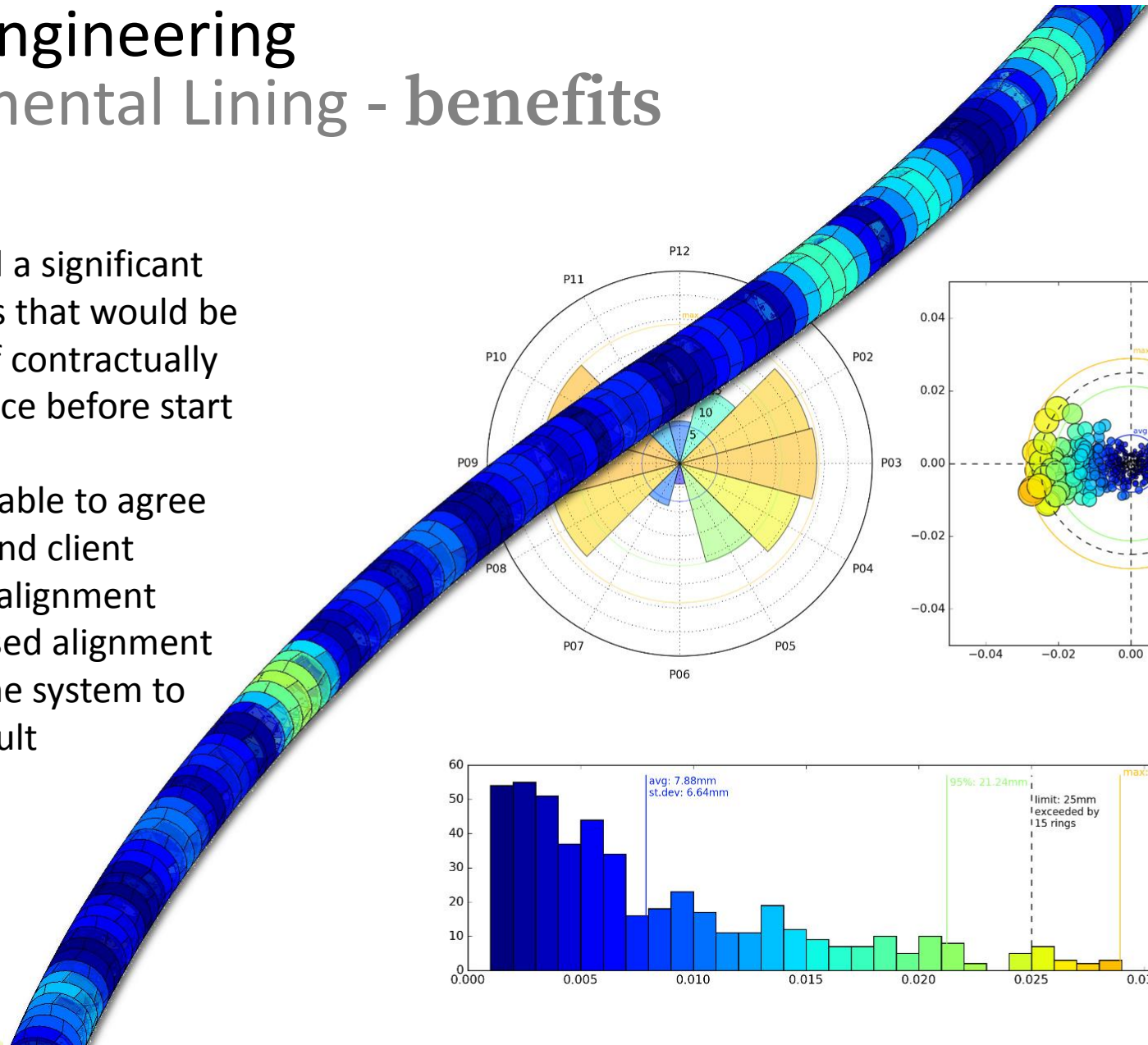
Tideway: a customized digital solution for ring sequencing analysis



Digital Engineering Segmental Lining - benefits

Results

- Study identified a significant number of rings that would be build outside of contractually allowed tolerance before start of construction
- contractor was able to agree with designer and client changes to the alignment
- the new proposed alignment was re-run in the system to confirm the result

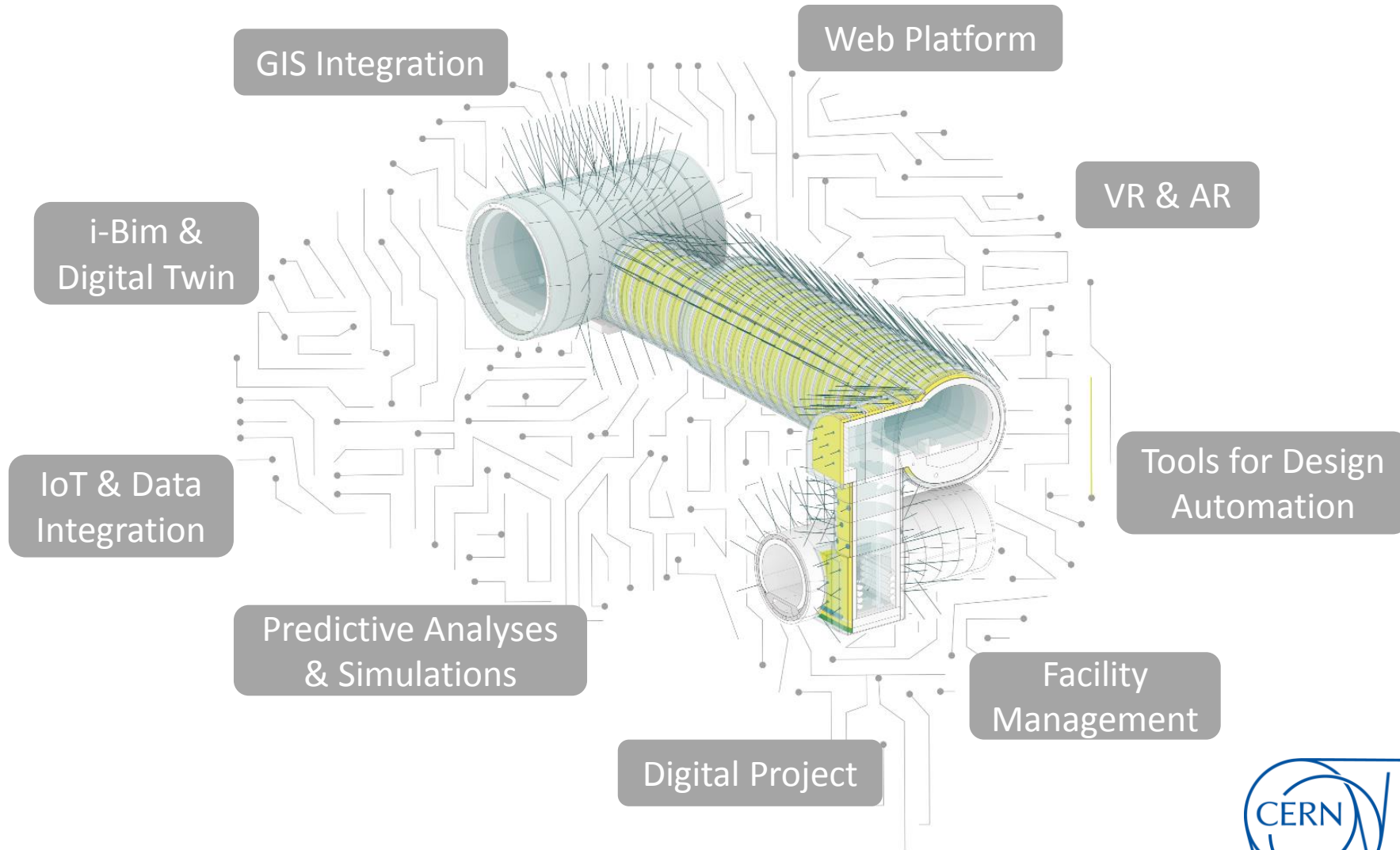


DIGITAL ENGINEERING

BENEFITS & NEXT STEPS

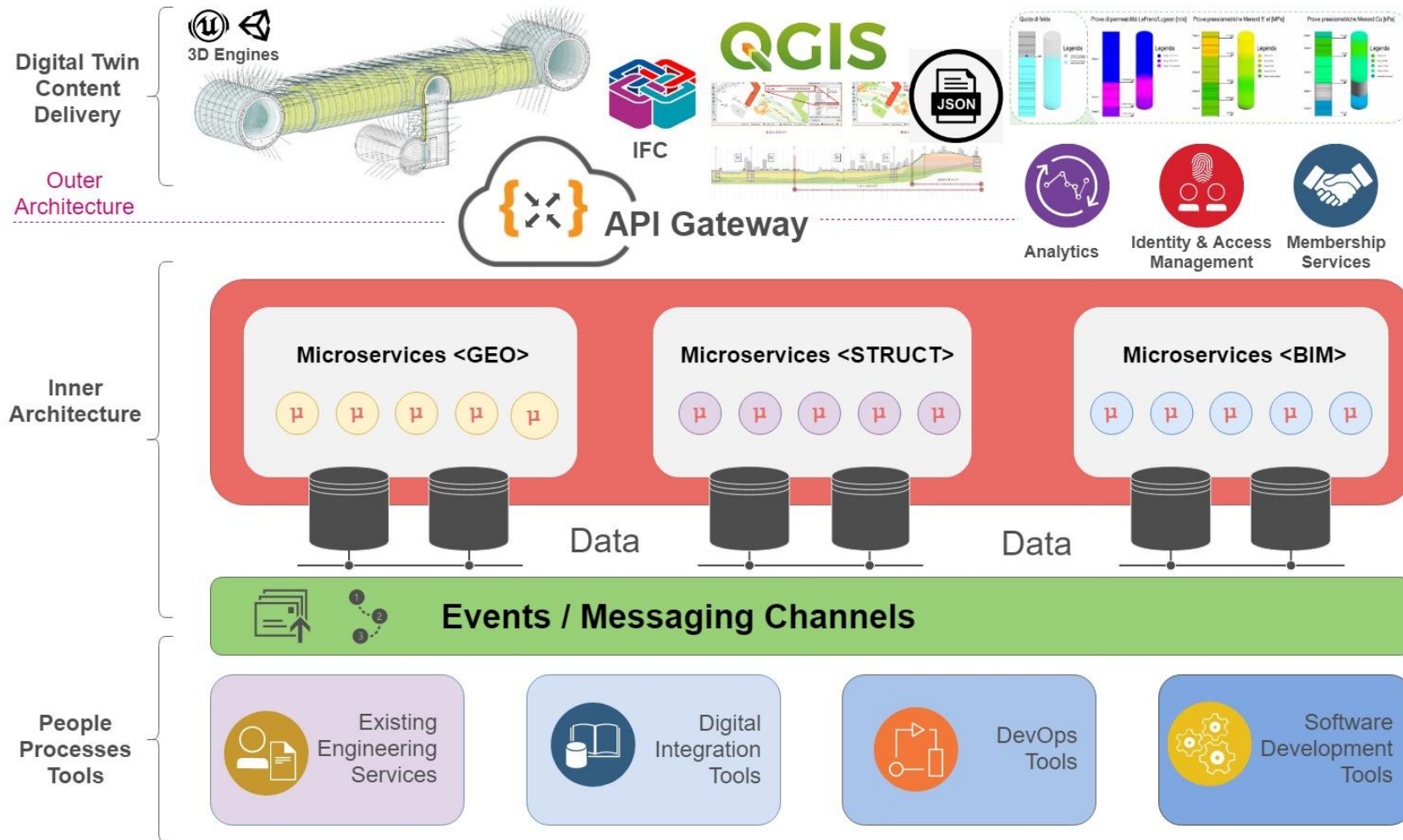
Digital Engineering Benefits

- ✓ On-time interventions
- ✓ Performance control
- ✓ Visualization and immediate data analysis
- ✓ Efficiency improvement in work progress control
- ✓ Elimination of inconsistencies and interferences during the design phase
- ✓ Accessibility of documentation
- ✓ Reduction of time in asset management
- ✓ Complete time and cost control
- ✓ Integrated design



Digital Engineering

Next Step & Future Concepts



THANKS FOR
YOUR TIME



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