

# INNO INFRA SHARE

Interreg Europe



European Union  
European Regional  
Development Fund

**SUPER**

**The SUP.ER project: A Regional project for a national federated digital infrastructure integrated in the European e-infrastructure ecosystem**



**Sanzio Bassini**

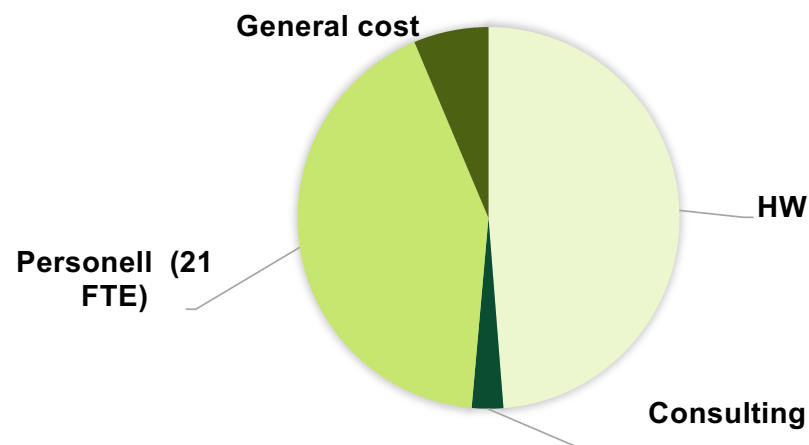
Director CINECA HPC Department

[s.bassini@cenea.it](mailto:s.bassini@cenea.it)

October 6<sup>th</sup>, 2020 □ Inno Infra Share

# **SUPER** Project information

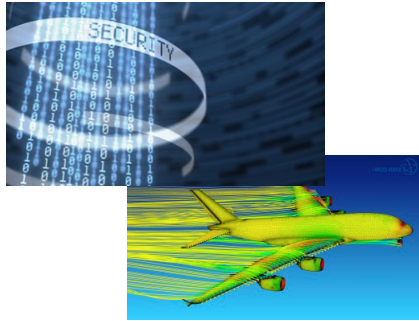
- **SUPER: Supercomputing Unified Platform – Emilia-Romagna**
- **Action 1.5.1 POR-FESR 2014-2020**
- **Participants: 12 (cord. CINECA)**
- **Funds : 3.988.594€ (Budget: 5.823.706€)**



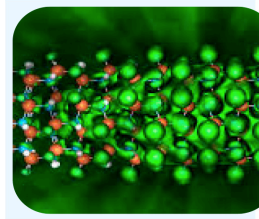
Designing unified infrastructure:

- Realization of the regional digital infrastructure prototype, enhancing and federating the services offered by CINECA and INFN and subsequently extending them to those of ENEA, CMCC and in perspective of INAF and INGV
- Project driven by specific use cases
  - Big Data and Supercomputing
  - Biomedicine (bioinformatics, biobanks, regenerative medicine)
  - Materials (advanced materials and innovative production systems)

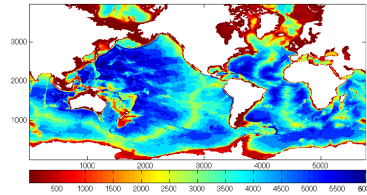
## I4.0, ML, IA



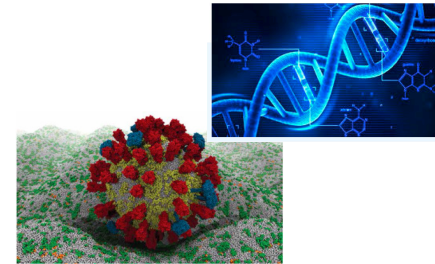
## New material



## Extreme earth

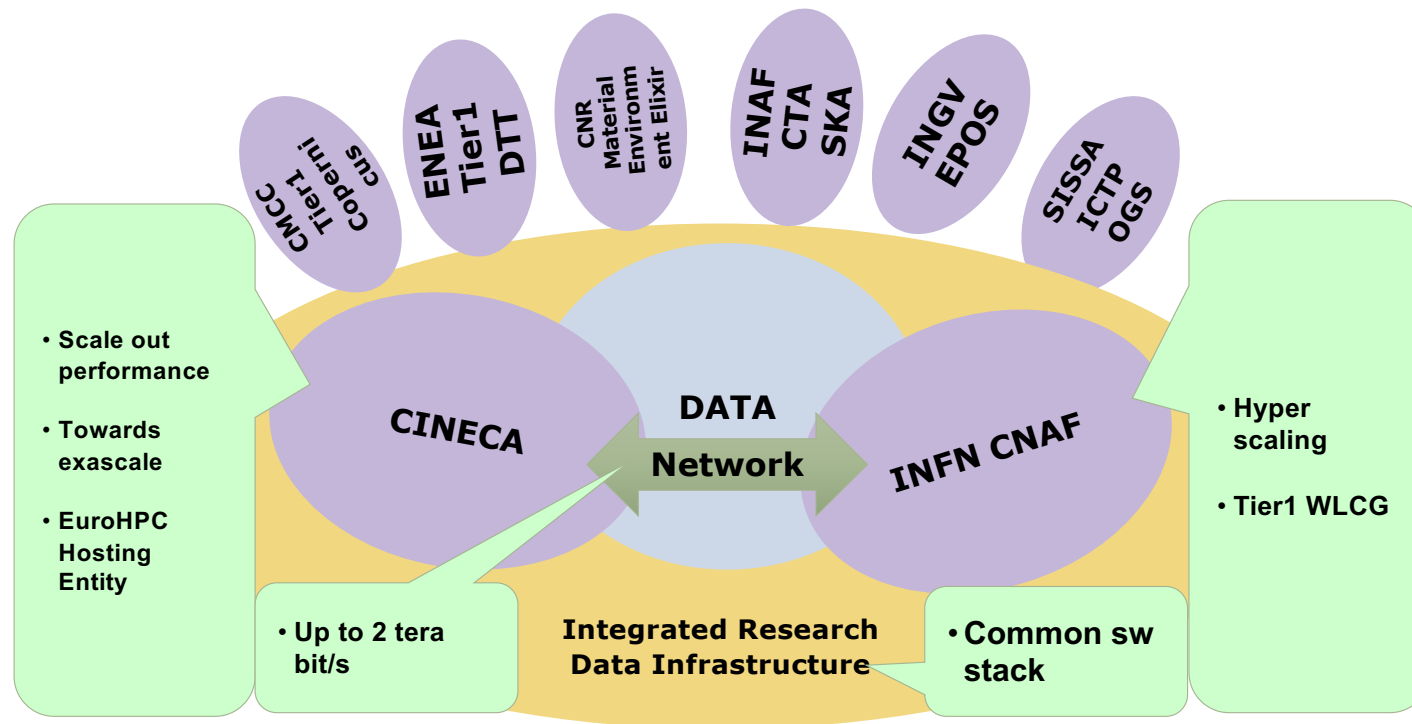


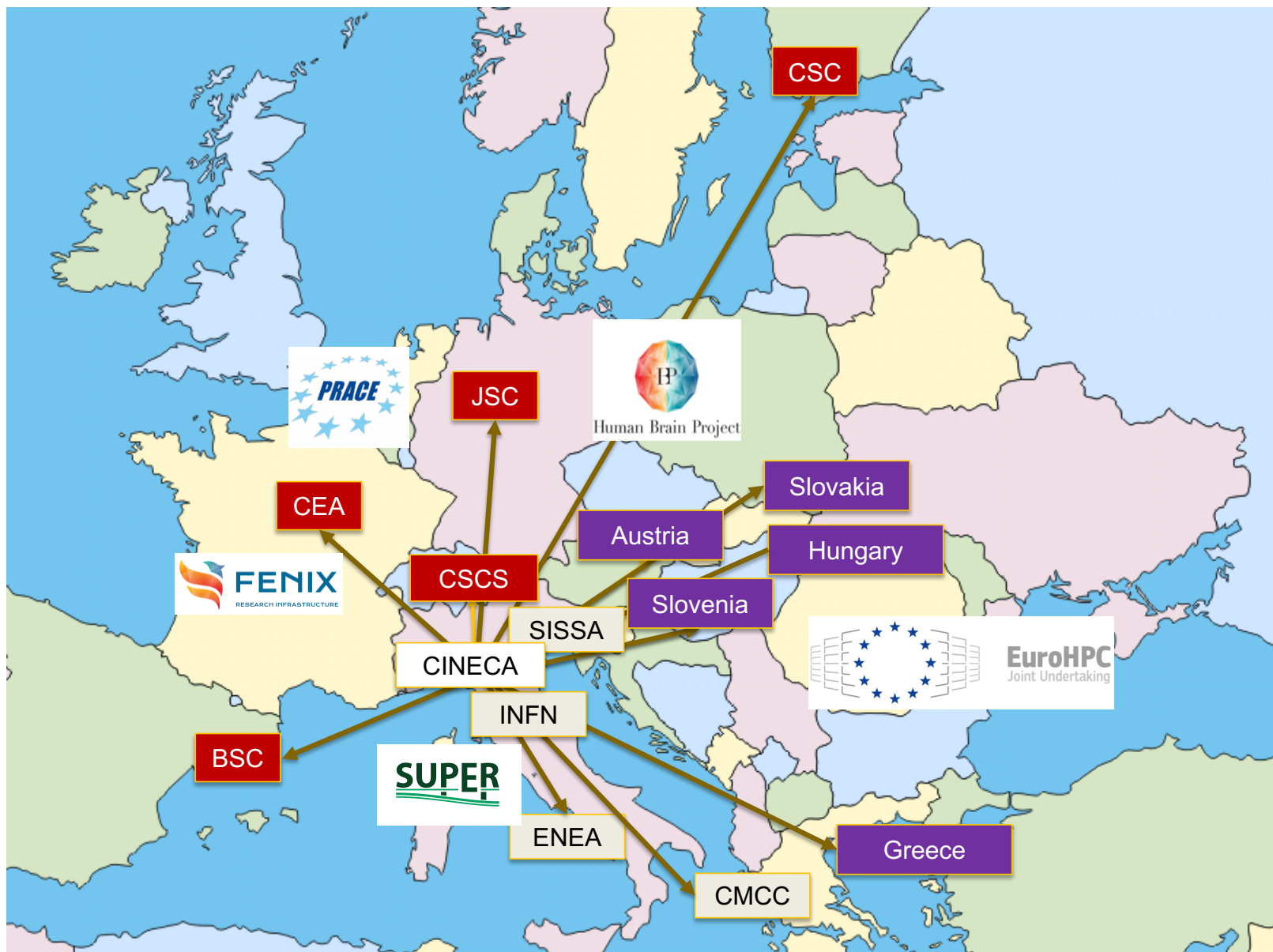
## Life science, genomic, biobanking



## National Ecosystem

- Federated Infrastructure
- Federated National User ID Management
- Federated National Multi Tier storage services
- National infrastructure model for European Open Science Cloud Initiative
- Based on the Fenix – Human Brain Project Infrastructure





**INNO INFRA  
SHARE**  
Interreg Europe



CINECA, BSC, CEA, JUELICH,  
CSCS, CSC...



Human Brain Project



CINECA, BSC, CEA, JUELICH,  
CSCS

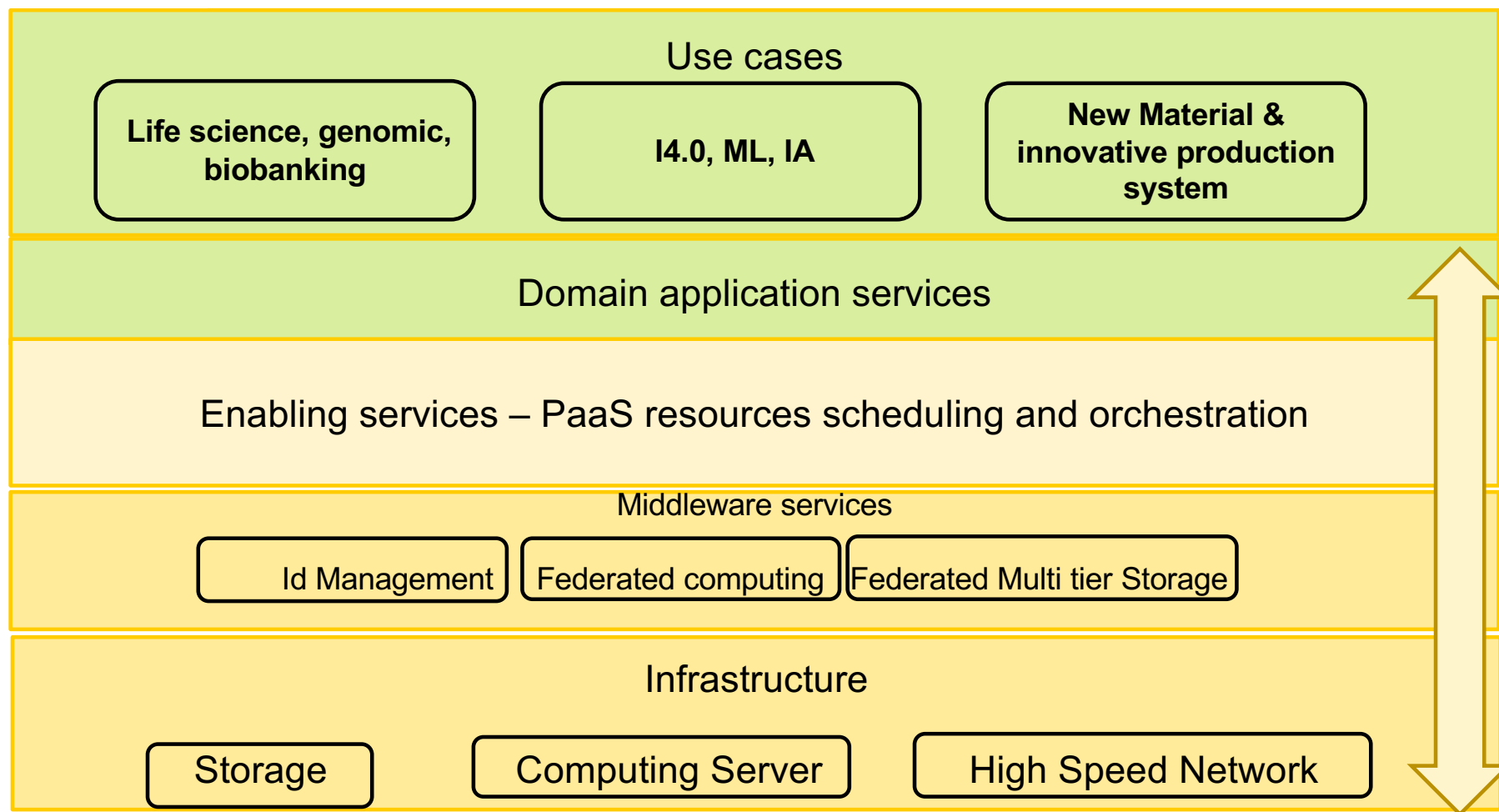


**EuroHPC**  
Joint Undertaking

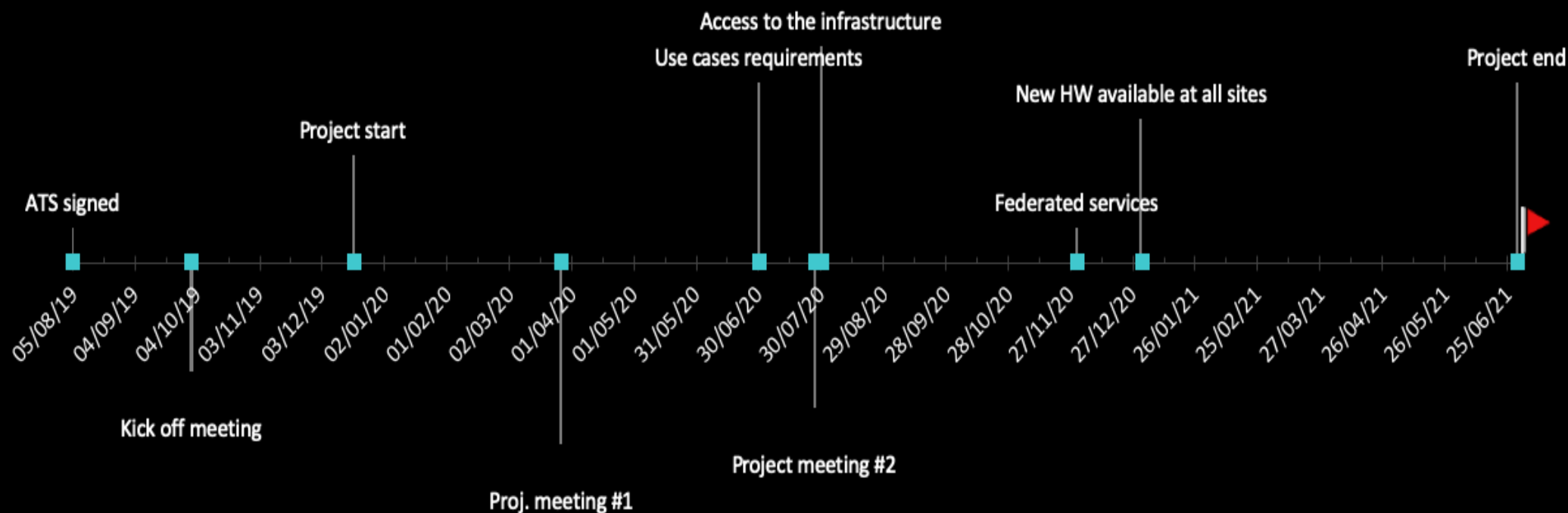
LEONARDO CONSORTIUM:  
ITALY, AUSTRIA, SLOVENIA,  
SLOVAKIA, HUNGARY, GREECE



CINECA, INFN, ENEA, CMCC,  
SISSA



**Project duration: 18 Months**



## Performed activities

### Completed procurement:

- CINECA procured 44 nodes (including computation and storage) on the Marconi100 HPC system - #9 in the June 2020 Top500 - to provide services for workloads for data analytics, AI and numerical simulation applications

### Tender procedures in progress for:

- INFN: approximately 5 PB of storage with different quality of service & 30 servers for HTC computing.
- ENEA: storage server (0.5PB) and virtualizer in HA
- CMCC: 20 bi-processor servers with 128 GB of RAM.

Resources currently accessible from use cases on infrastructures already operational at various entities.

### Next steps:

- Complete all procurement by the end of 2020
- Making the HW available for use cases in 1Q21



## Performed activities:

- **Rare diseases in the orthopedic field (Multiple Exostoses):**
  - Clinical data collected, and exomic data being analyzed.
  - Imaging data collection in progress.
  - Identified the clinical parameters and selected the dataset of the patients to investigate.
  - Preparation of the documentation of the Ethics Committee.
- **Neurological diseases and lesions and biobanks:**
  - sequencing of 50-exomes for rare genetic diseases in the orthopedic field
  - sequencing of 50-genomes in the field of neurodevelopmental diseases, with reference to undiagnosed diseases
  - preparation of the database for the collection of historical data and new data of the animal model of spinal cord injury;
- **Neurodevelopmental diseases:**
  - Genomic sequences of 20 individuals (6 families) in which a syndromic intellectual disability phenotype occurs.
  - Genomes equated to an average depth of 50X, and derived single nucleotide and structural variants now under evaluation.
- **Next steps:**
  - The data is currently stored on site, pending all the necessary authorizations for a centralized repository
  - Completion of patient enrollment and data processing

## Performed activities:

- MaX as a regional infrastructure for HPC applications in materials design
- **Prepared the deployment of the MaX software on the HW infrastructure** (thanks to the MaX development versions of the GPU codes, and access to Cineca's Marconi100 from the pre-production stage)
- **Extensions of the SW to allow the calculation of properties of materials of interest to regional operators**
- **Materials for energy (ENEA):** silicon nanowire model developed; HPC simulations (DFT with QE) launched to study their structural and electronic properties with and without adsorbed hydrogen.
- **2D materials in real devices (UNIMORE, CNR):** methodological and algorithmic development to accelerate the convergence of 2D systems, with implementation in Yambo, first results available, applications on HPC systems in progress.
- **Spectroscopy of magnetic systems (UniPR):** implementation, based on AiiDA, of an automated procedure for the identification and characterization of muon sites has begun. Testing on HPC systems in progress.
- **Poroelastic materials for insulation (UniFE):** preliminary thermo-visco-acoustic simulations on a single 3D foam cell (rigid structure); preliminary thermo-visco-acoustic simulations on 2D fibrous materials. Testing on HPC systems designed but not yet initiated.

## Next goals:

- Software enhancement and interoperability (Jun 2021)
- Full HTC / HPC calculation for real system set and feedback from testing results (Jun 2021)

## Performed activities:

- **Prediction of unscheduled shutdowns in gas turbines:**
  - Machine learning methods studied for the modeling of time series applicable to the analysis of plant malfunctions using datasets available on the network for now.
- **Anomaly detection methodologies for wind farms:**
  - Semi-supervised anomaly detection methodologies applied using available small size datasets.
- **Methods for the prediction of thermal anomalies on HPC systems:**
  - extension of the HPC infrastructure monitoring platform called Examon with inclusion of information on Jobs, Services Status, Nodes, Computing Resources and Infrastructure
- **New artificial intelligence solutions based on deep learning and applied in the Luxury Fashion sector:**
  - architectures for the retrieval of the most similar clothing items have been proposed within the Yoox catalog
- **Next steps:**
  - Acquisition of new datasets
  - Small scale prototyping completion (Jun 2021)



# INNO INFRA SHARE

Interreg Europe



European Union  
European Regional  
Development Fund

## Thank you!

Questions welcome



*Project smedia*

---