



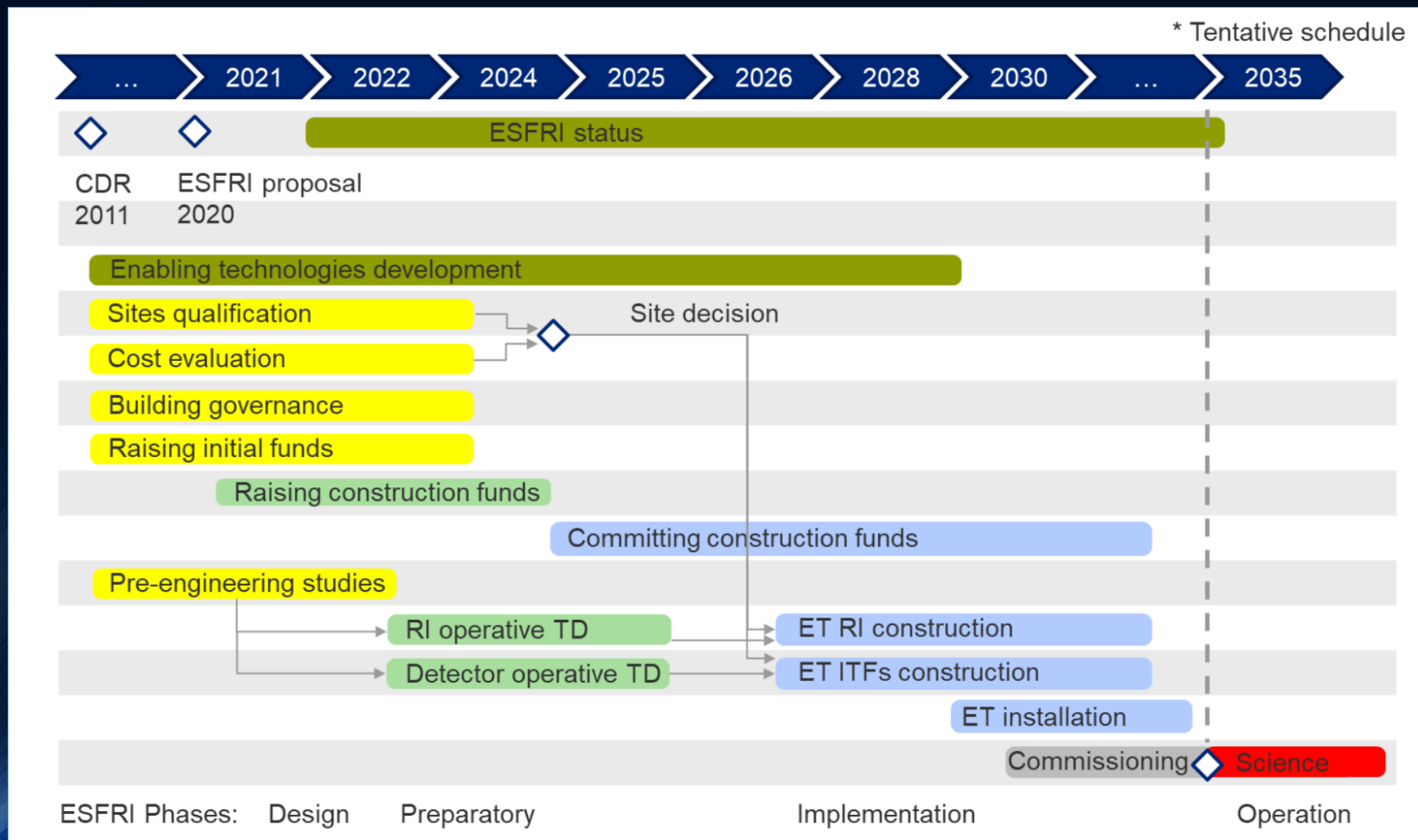
Istituto Nazionale di Fisica Nucleare
SEZIONE DI PISA

ET-Italia Einstein Telescope

PREVENTIVI DI SPESA 2023
PISA, 4 LUGLIO 2022



ET Rodamap



Proto-council

ESFRI Coordinators

Stan Bentvelsen, Antonio Zoccoli

BGR (Board Governm. Represent.)

BSR (Board Scient. Represent.)

Advisory Bodies

Scientific and Technical
Advisory Committee
Program Advisory Board
Finance Board

Project Directorate

Jo v.d. Brand, F. Ferroni

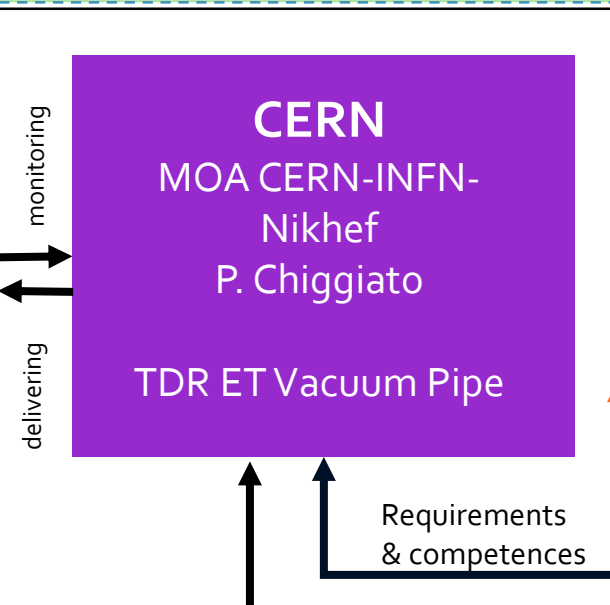
monitoring
reporting

Deliverables:
Beam pipe vacuum
Site Preparation
Civil Infrastructure

INFRA-DEV

M. Martinez

- WP1 Coordination and Management
- WP2 Organization , Governance, Legal
- WP3 Financial Architecture
- WP4 Site Preparation
- WP5 Project Office/Engineering Dept.
- WP6 Technical Design
- WP7 Transfer of Technology
- WP8 Computing and Data Access
- WP9 Sustainable Development Strategy
- WP10 Education, Outreach, Citizen Engagement



Requirements
& competences

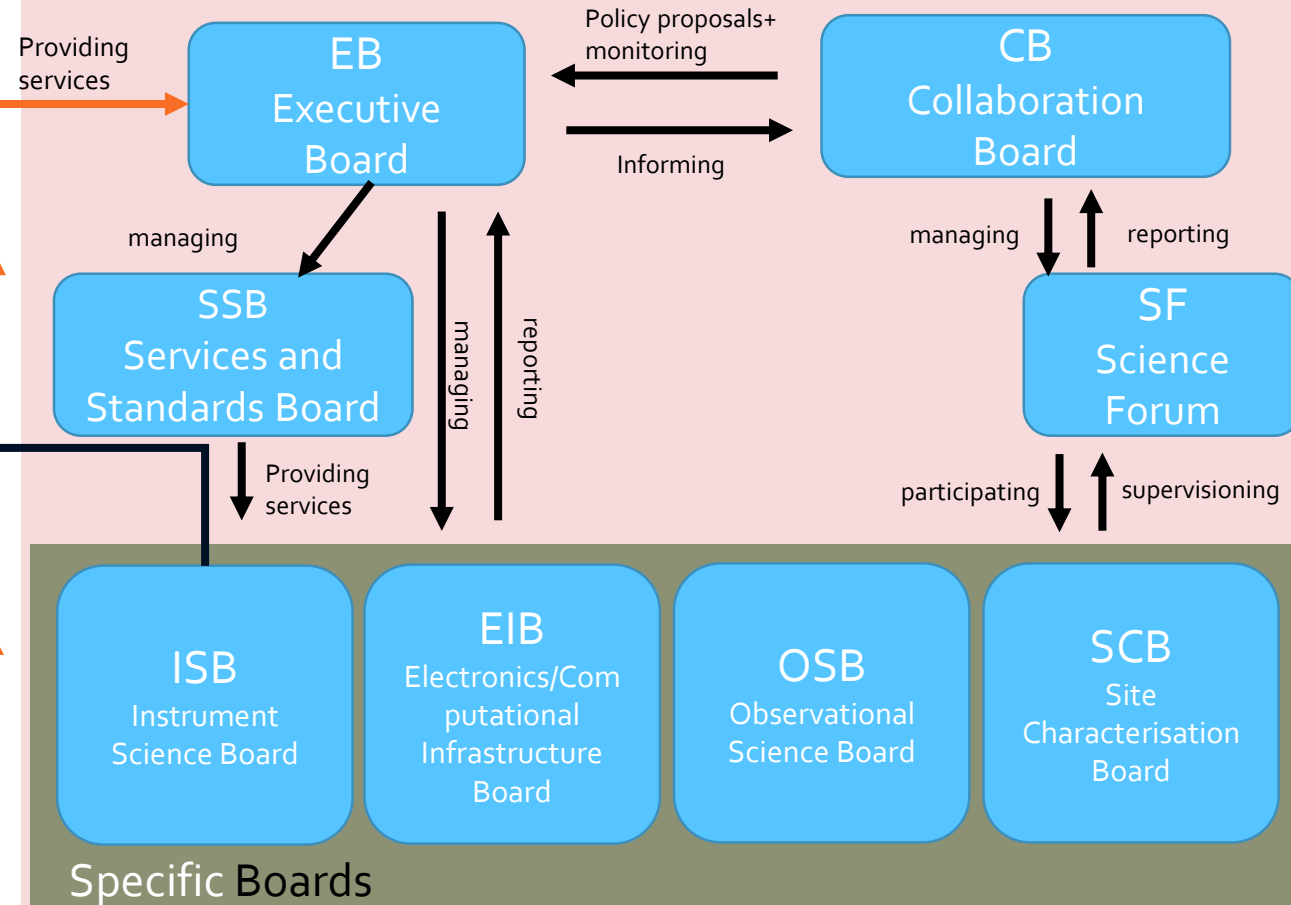
Engineering
Department

Project Office

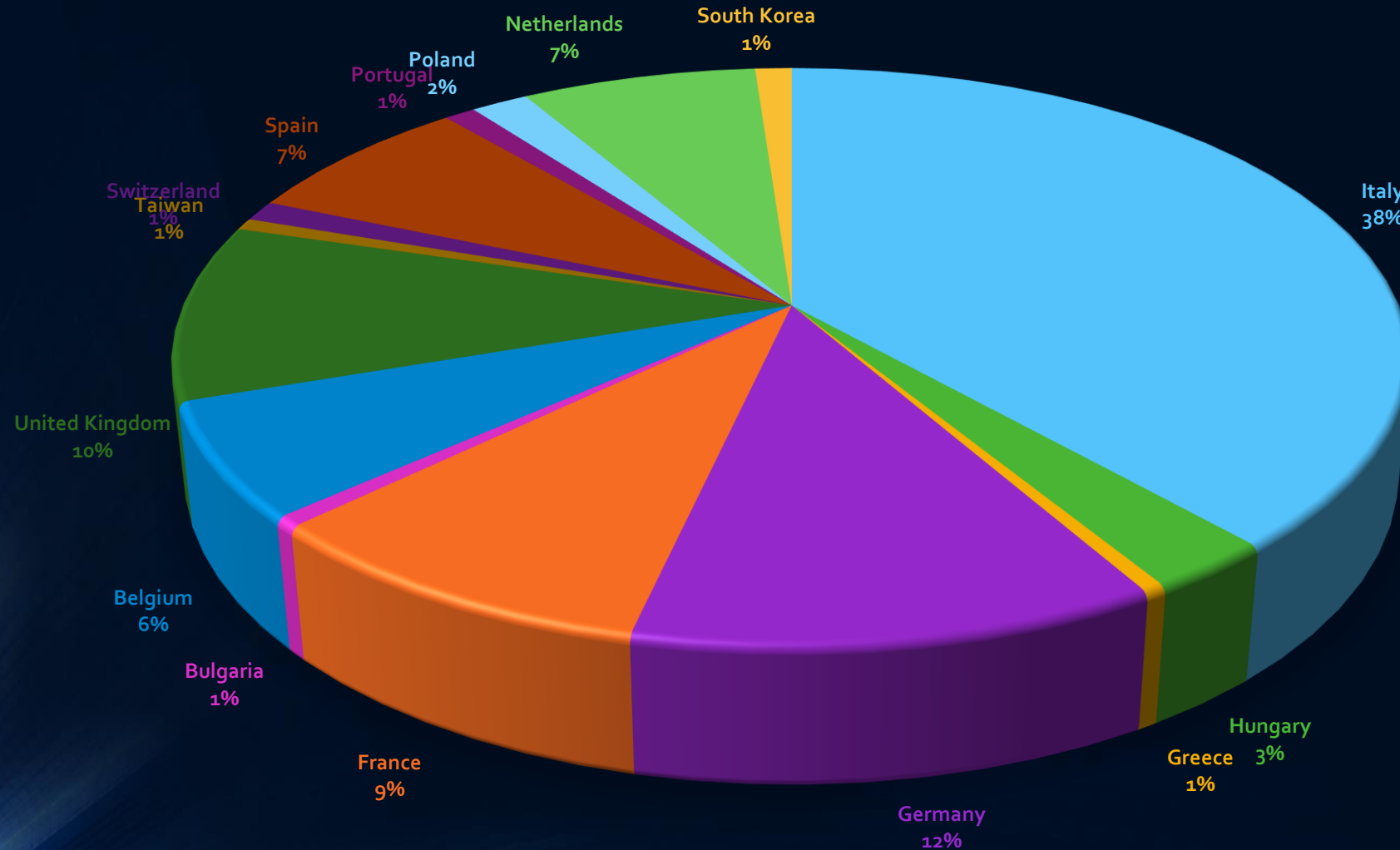
setting

ET Project

ET Collaboration



7 Giugno 2022: XII ET Symposium – ET Collaboration Launch



1240 Members of the ET Collaboration

Pisa Research Unit

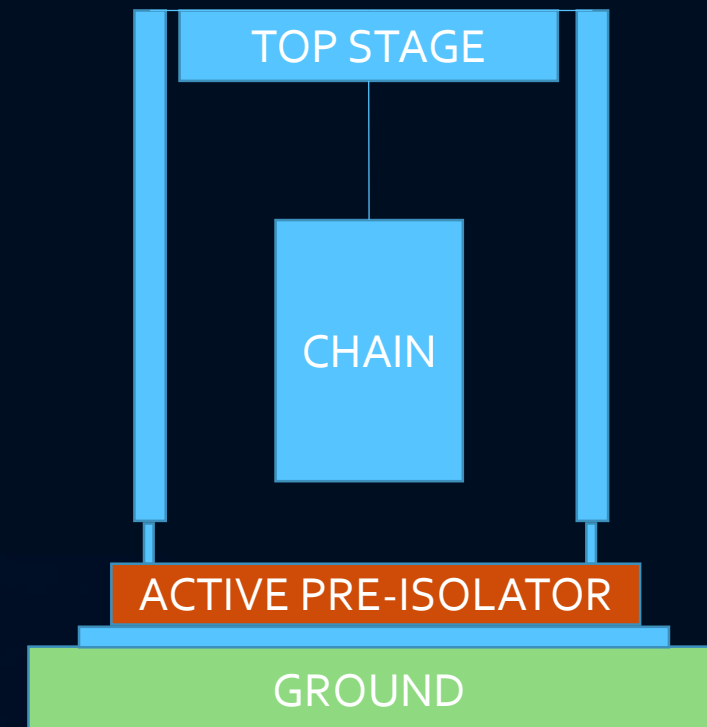
- Numero di membri triplicato nell'ultimo anno



N	Family Name	First Name	Position	Expertise	FRTE [0.1,1]	Affiliation
1	Basti	Andrea	Staff researcher	Mechanical design	0.1	UNIP
2	Bitossi	Massimiliano	Staff researcher	Electronics & Software	0.1	INFN
3	Boschi	Valerio	Staff researcher	Seismic Isolation	0.2	INFN
4	Capaccioli	Simone	Staff researcher	Coating materials	0.2	UNIP
5	Cella	Giancarlo	Staff researcher	Data analysis	0.2	INFN
6	Chessa	Piero	Post-doc	System Modelling	0.1	UNIP
7	Chiofalo	Maria Luisa	Staff researcher	Squeezing	0.1	UNIP
8	Del Pozzo	Walter	Staff researcher	Data analysis	0.1	UNIP
9	Di Renzo	Francesco	Post-doc	Data Analysis, Computing	0.2	UNIP
10	Fidecaro	Francesco	Staff researcher	Seismic Isolation, Management, Coatings	0.4	UNIP
11	Fiori	Alessio	PhD	Astrophysics, Computing, Data Analysis	0.2	UNIP
12	Frasconi	Franco	Staff researcher	System Engineering, Mechanical Design	0.4	INFN
13	Gennai	Alberto	Staff researcher	System Engineering, Control Engineering	0.5	INFN
14	Grigoli	Francesco	Staff researcher	Seismology, Geophysics	0.2	UNIP
15	Gualtieri	Leonardo	Staff researcher	Fundamental Physics	0.2	UNIP
16	Iess	Alberto	Staff researcher	Machine Learning, Data Analysis	0.1	SNS
17	Losurdo	Giovanni	Staff researcher	Seismic Isolation, Management	0.1	INFN
18	Lucchesi	Leonardo	Staff researcher	Mechanical design	0.8	INFN
19	Moggi	Andrea	Staff researcher	Mechanical design	0.1	INFN
20	Paoletti	Federico	Staff researcher	Sensors and Electronics	0.1	INFN
21	Parisi	Alessandro	Staff researcher	Machine Learning, Data Analysis	0.1	SNS
22	Passaquieti	Roberto	Staff researcher	System Engineering, Mechanical Design	0.1	UNIP
23	Passuello	Diego	Staff researcher	Senior Scientist	0.2	INFN
24	Patricelli	Barbara	Staff researcher	Astrophysics, Data analysis	0.1	UNIP
25	Piendibene	Marco	Staff researcher	Electronics & Software	0.1	UNIP
26	Pilo	Federico	Staff researcher	System Engineering, Mechanical Design	0.1	INFN
27	Pisignano	Dario	Staff researcher	Coating materials	0.2	UNIP
28	Poggiani	Rosa	Staff researcher	Astrophysics, Fundamental Physics	0.1	UNIP
29	Puosi	Francesco	Post-doc	Coating materials, molecular dynamics	0.2	INFN
30	Razzano	Massimiliano	Staff researcher	Astrophysics, Computing, Machine Learning	0.3	UNIP
31	Sorrentino	Nunziato	PhD	Astrophysics, Data Analysis	0.2	UNIP
Total					6.1	

Pisa Group Activities

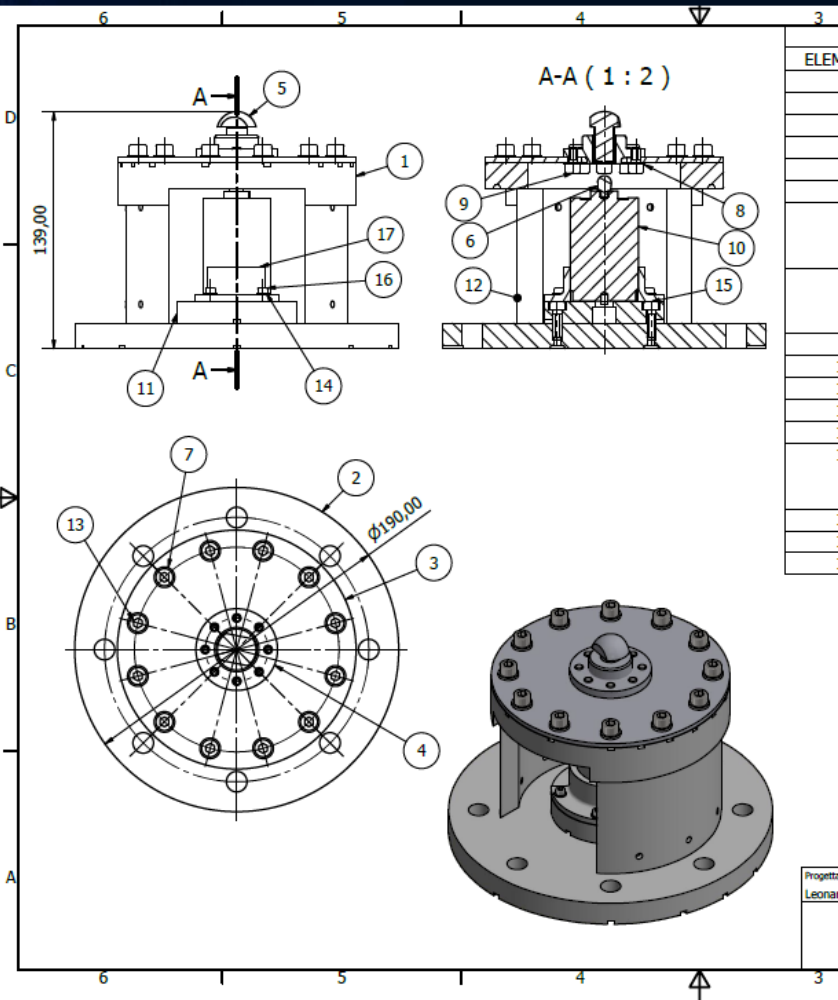
- Sos Enattos – Site Characterization
 - Mainly seismic activity monitoring and study.
- Active Pre-Isolator
 - We are building an active seismic isolation system to be placed between ground and ET seismic attenuators.
- Sensors Test Bench
 - We designed and installed a suspended bench to test inertial sensors.
- Seismic Isolators / Suspensions Control System
 - New architectures for hardware and software are being evaluated. CPU-GPU based systems will allow introducing AI methods.
- Synergistic Activities
 - NCSA Call Gr. 5
 - PRIN
 - VIRGO



VIRGO Lab - Marzotto

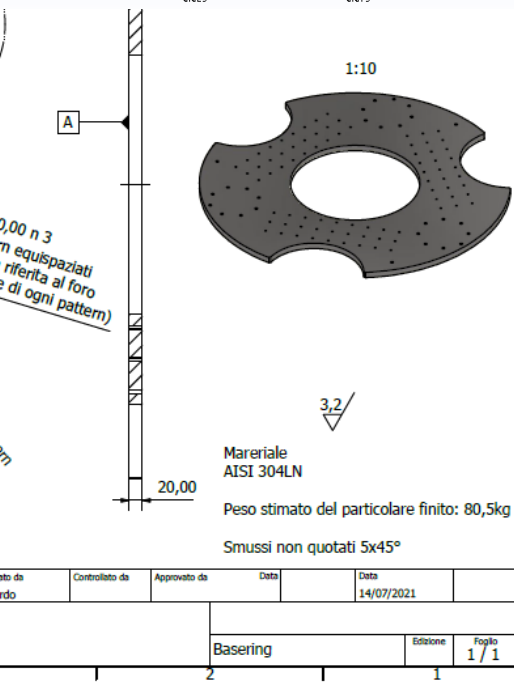
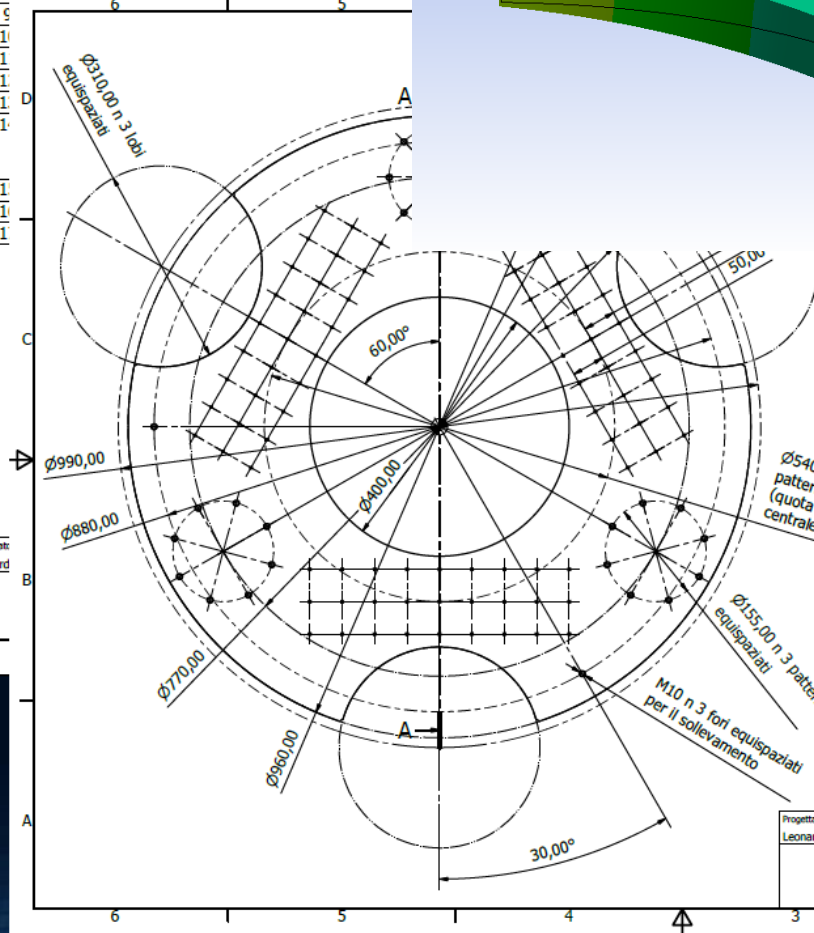


Active Pre-Isolator



ELENCO PARTI			
ELEMENTO	QTÀ	NUMERO PARTE	DE
1	1	2_2	
2	1	Base	
3	1	Dett2_1	
4	1	Dett2_2	
5	1	Dett2_3	
6	1	punta sferica piezo	
7	12	ISO 7091 - 6	Rondelle normale - C
8	8	ISO 7091 - 5	Rondelle normale -

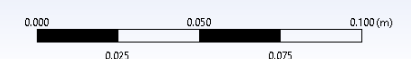
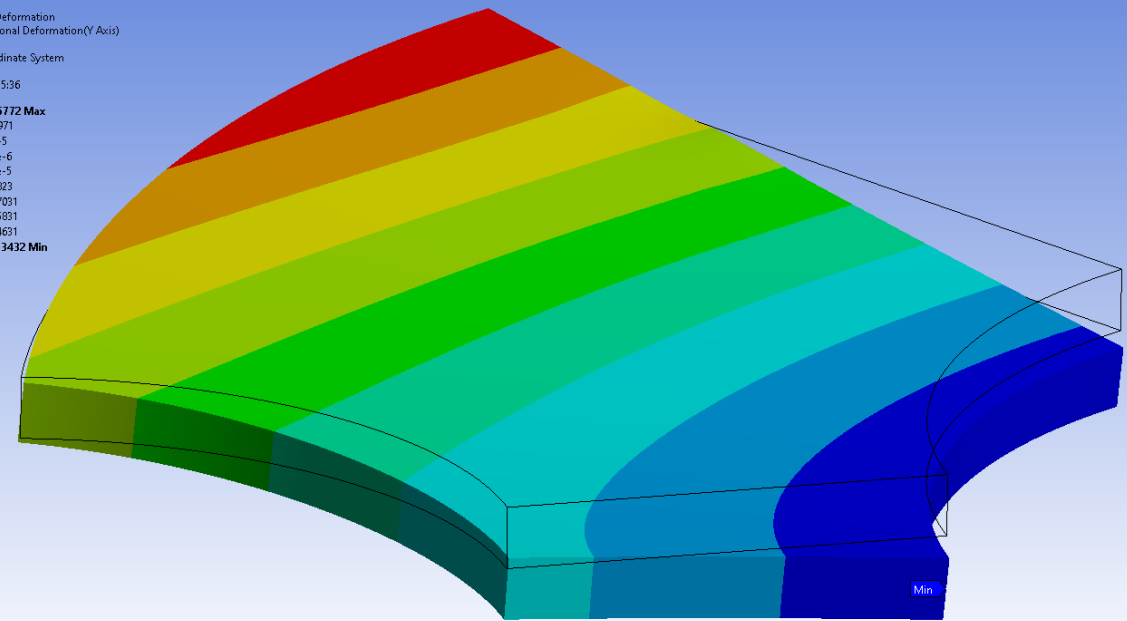
Progettato da
Leonardo



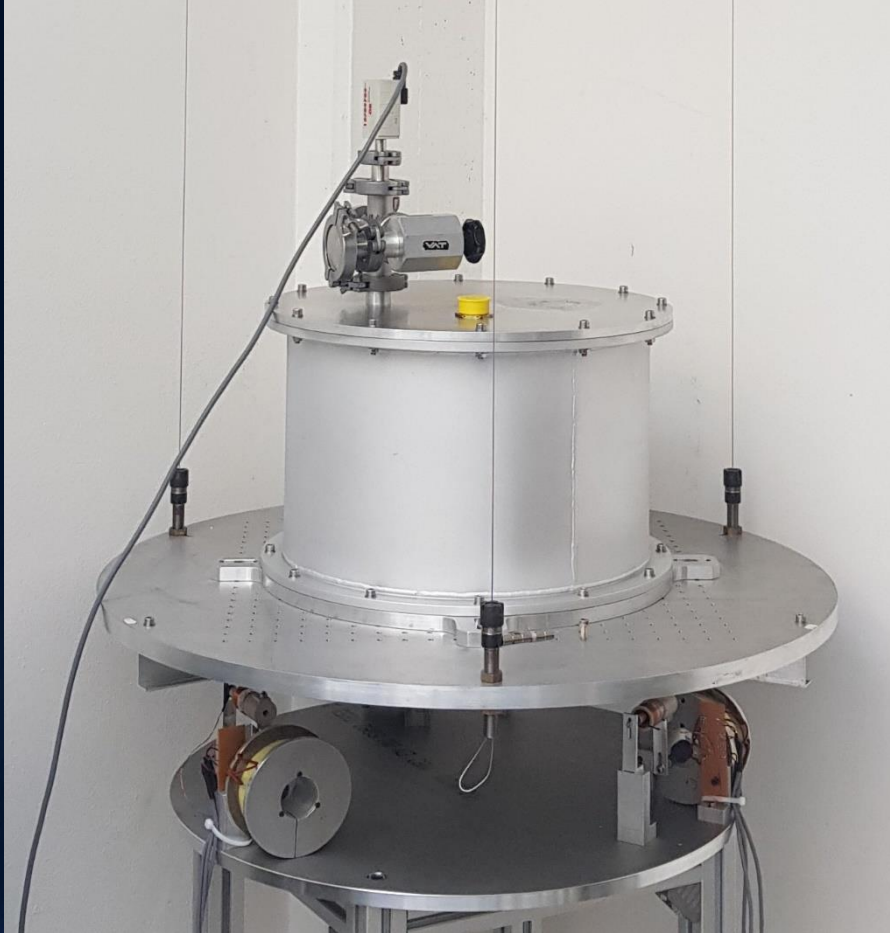
Progettato da Leonardo	Controllato da	Approvato da	Data 14/07/2021	Foglio 1 / 1
Basing		Edizione		

D: 1,2
Directional Deformation
Type: Directional Deformation(Y Axis)
Unit: m
Global Coordinate System
Time: 1
24/10/2021 15:36

0.00025772 Max
0.00016971
8.1709e-5
-6.2949e-6
-9.4298e-5
-0.0001823
-0.00027031
-0.00035831
-0.00044631
-0.00053432 Min

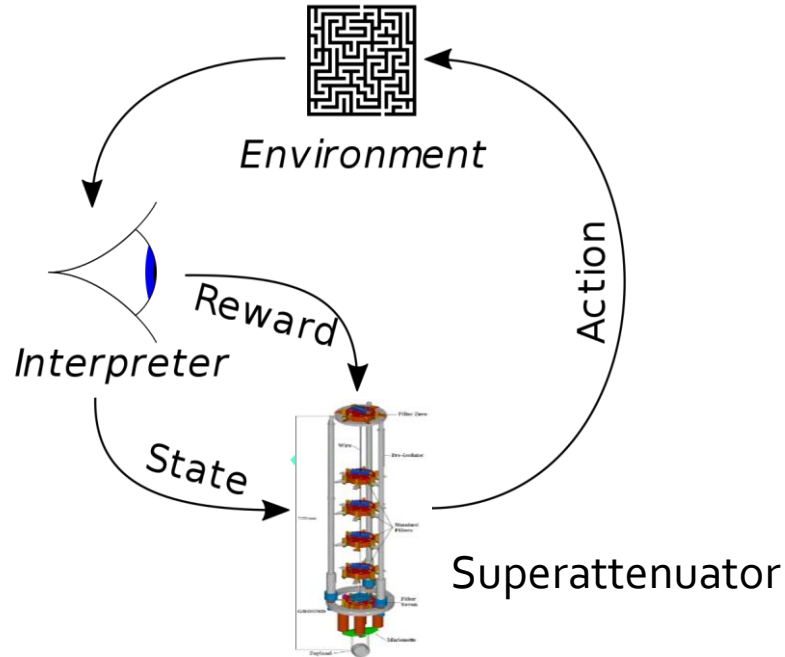
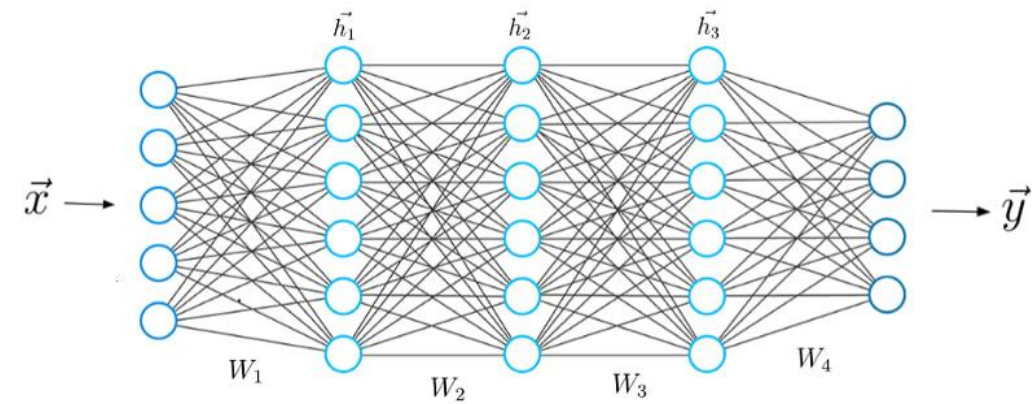


Test Bench for Inertial Sensors



AI Methods for controls of suspensions

- Machine learning emerging as a method to characterize and control complex, MIMO systems in real time
- Allow for dynamic choice of control strategies according to environmental conditions
- Explore and develop control system methods based on machine learning (e.G. Reinforcement learning)



Desiderata

- GPU-based machine for collecting input and perform training
- Lab setup for sensing and controlling using ML-based hardware
- R&D on controls based on GPU portable systems

Richieste 2023

- Tabella con il piano Triennale presentato lo scorso anno e le variazioni che pensiamo di chiedere
- Sismometro: 10k era una richiesta ottimista. Per un Centaur 3 Ch + Trillium Compact Horizon 120s con antenna GPS servono 20k.
- Viaggi: con il lancio della Collaborazione, il Gruppo di Pisa è passato da 10 membri per 1.9 FTE a 31 membri e 6.1 FTE
- Sistema di controllo. Anche in questo caso siamo stati ottimisti. Come architettura stiamo valutando soluzioni alternative (CPU+GPU) a quella basata su DSP in funzione a VIRGO.

Unit	WP	Item	Richieste			Type
			2022	2023	2024	
PI	SUS.SOE	Seismometer		10+10		Instr
PI	SUS.SOE	Travels	10	10+10	10+10	Travel
PI	SUS.PRE	Base	10			Cons
PI	SUS.PRE	Feet	20	10		Cons
PI	SUS.PRE	Piezos	7	10		Instr
PI	SUS.PRE	PC	2			Instr
PI	SUS.MAS	Test Bench	10	15	30	Cons
PI	SUS.SSA	Accelerometers		20	20	Cons
PI	SUS.SCS	Components and prototype circuits		20+20	30	Cons

Risorse in sezione: pochi giorni uomo per piccoli lavori in officina
Laboratorio: spazi ristretti