

Servizio progettazione meccanica

INFN Sez. Pisa

Ing. A. Moggi



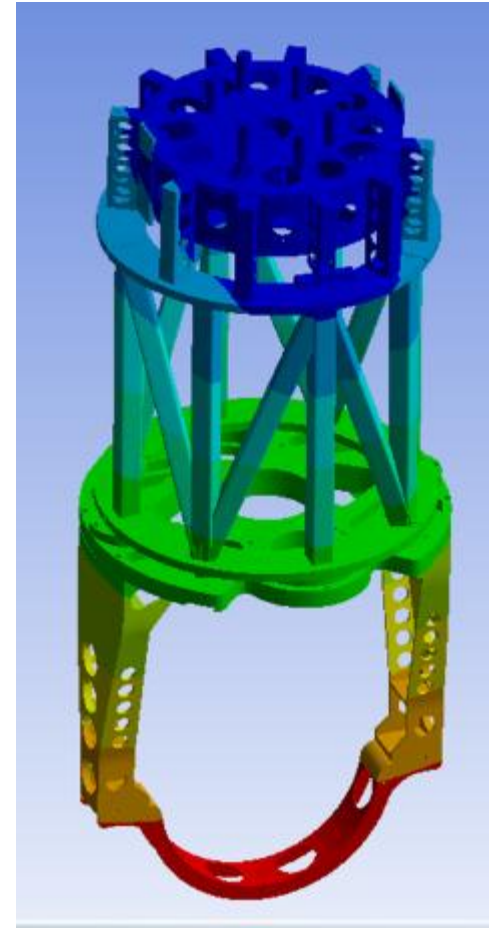
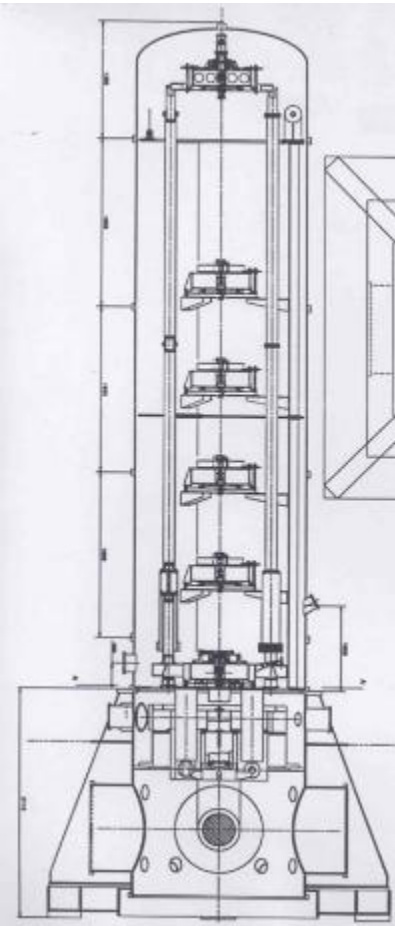
La ricerca in fisica delle Alte Energie richiede strumenti in grado di misurare traiettorie ed energie delle particelle sub atomiche.

Si traduce generalmente nei seguenti requisiti meccanici:

- Trasparenza alle radiazioni,
- Stabilità dimensionale nel tempo,
- Stabilità termica,
- Strutture ad alta efficienza meccanica,
- Integrazione di sistemi di controllo temperatura,
- Isolamento meccanico a basse frequenze,
- Integrazione di sistemi complessi

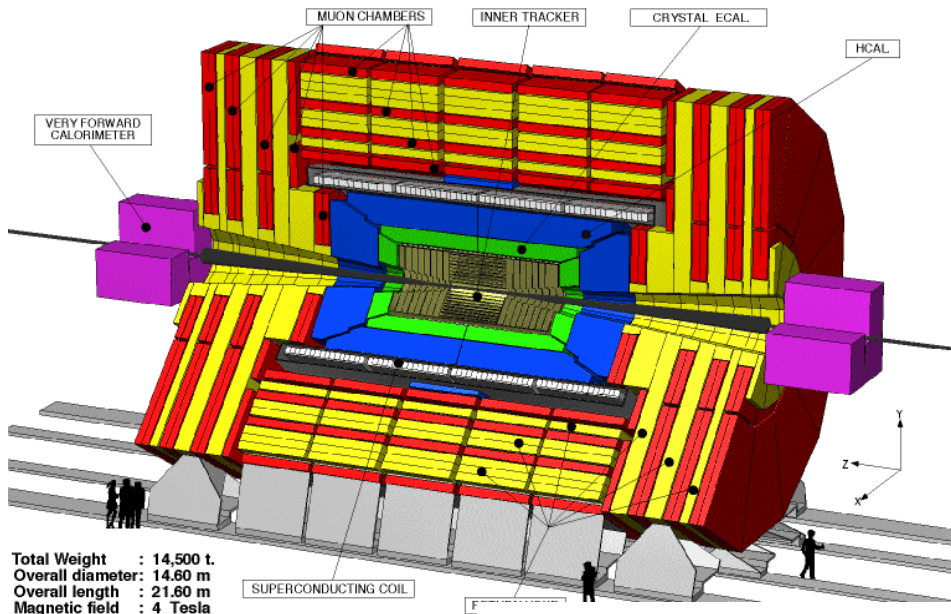
A disposizione per la progettazione e verifica delle strutture
abbiamo i seguenti strumenti:

- Progettazione 3D con la suite Autodesk.
(Inventor, Autocad)
- Analisi FEM con Ansys Multiphysics
- Analisi CFD con Ansys Fluent.
- Fogli di calcolo con Mathcad.
- Caratterizzazione compositi con ESACOMP.



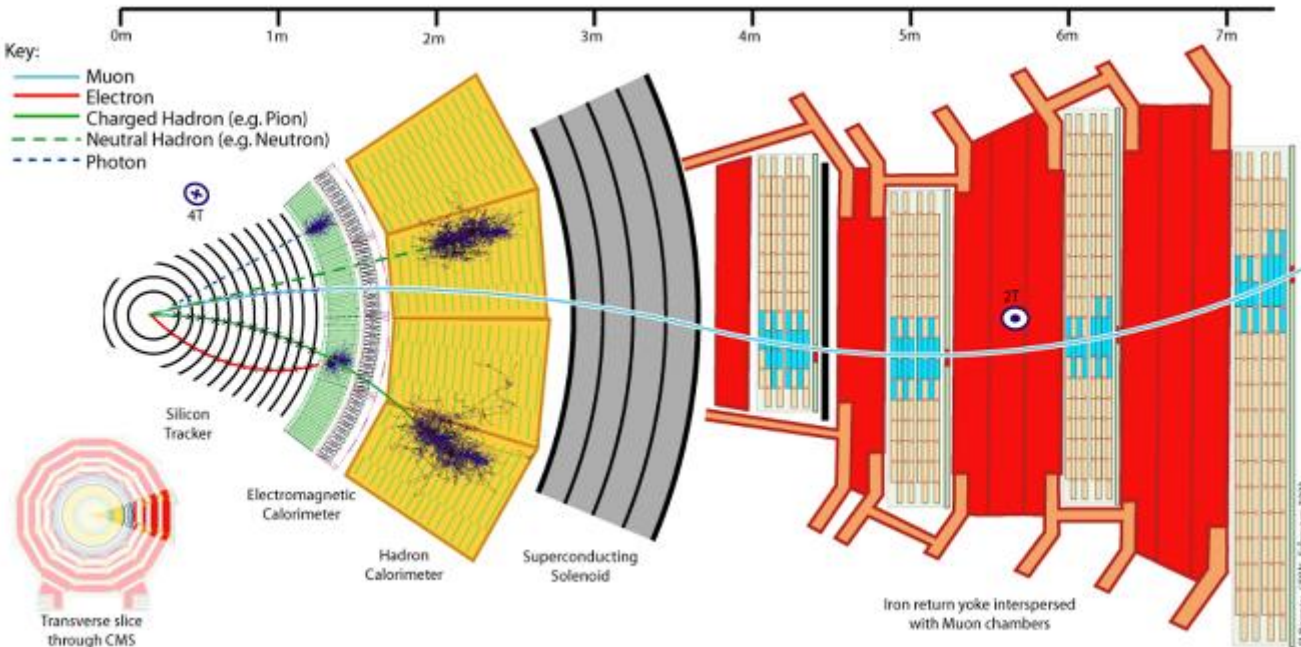
ESEMPI DI PROGETTAZIONE E REALIZZAZIONE

Esperimenti per studio di collisioni di particelle.

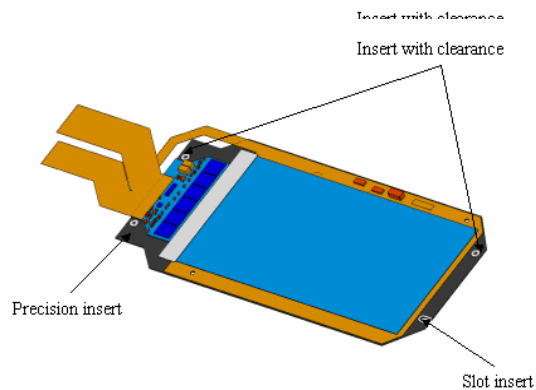
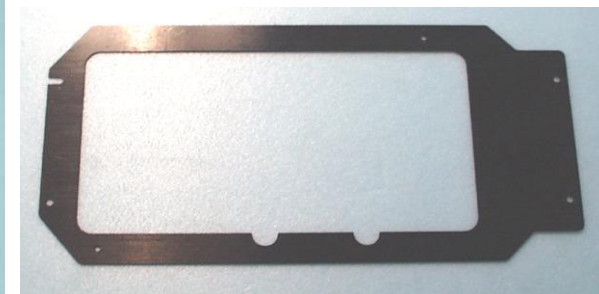
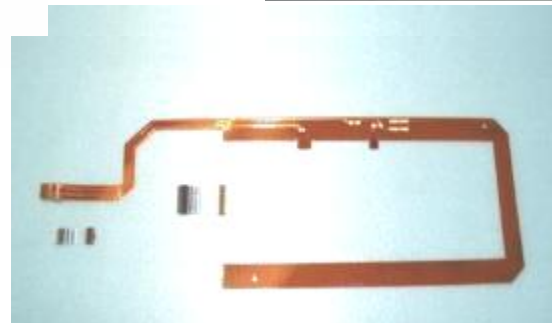
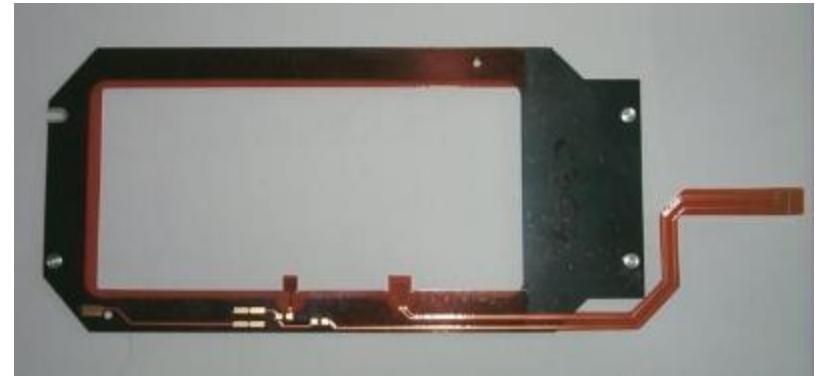
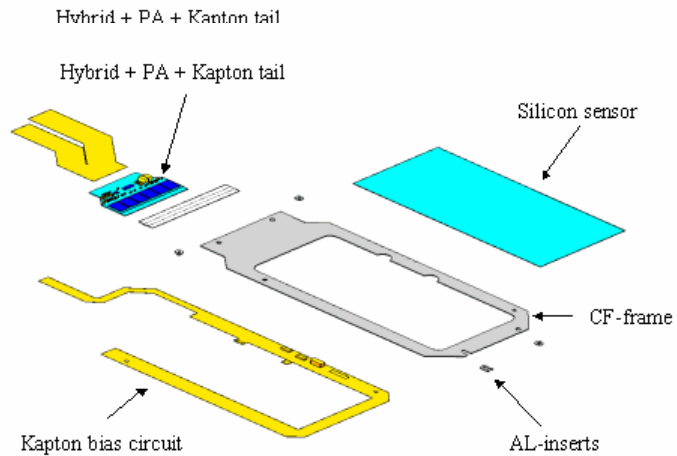


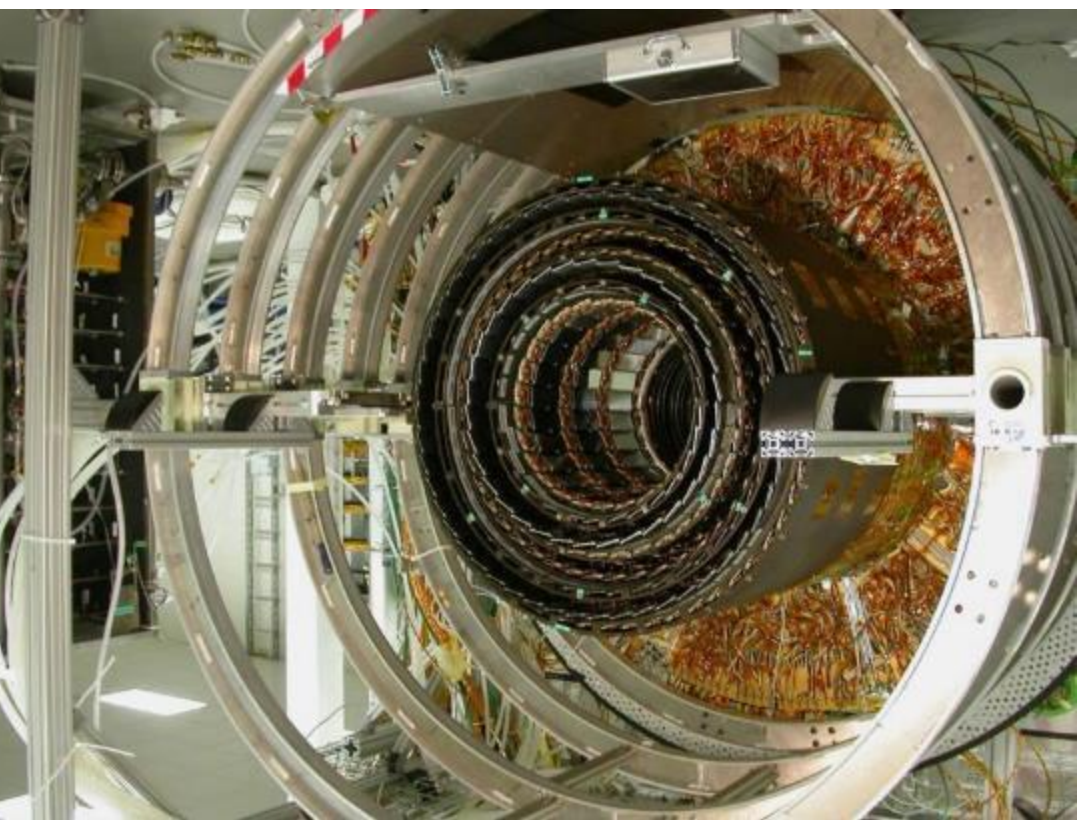
Key:

- Muon
- Electron
- Charged Hadron (e.g. Pion)
- Neutral Hadron (e.g. Neutron)
- - - Photon

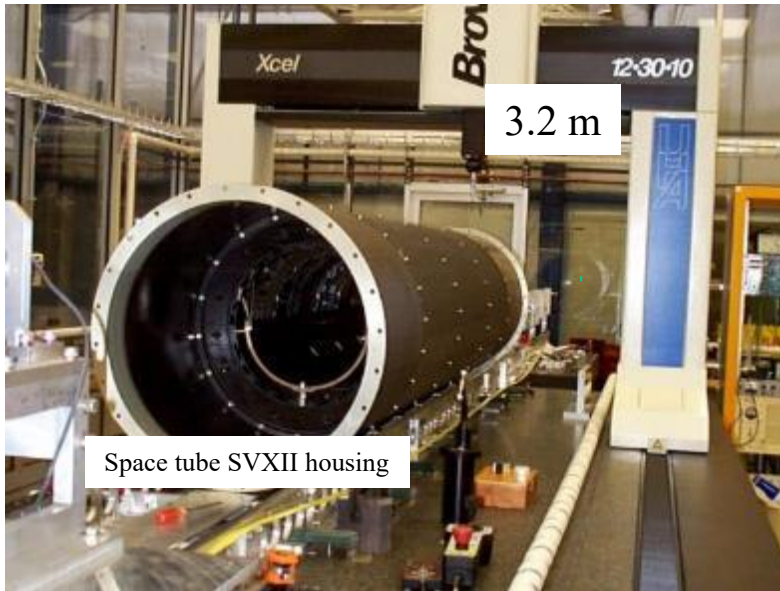


Tipico modulo di rivelazione per tracciatore

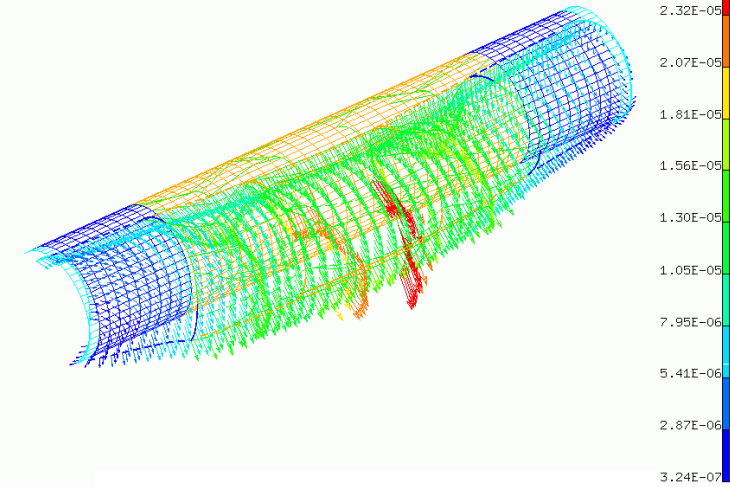
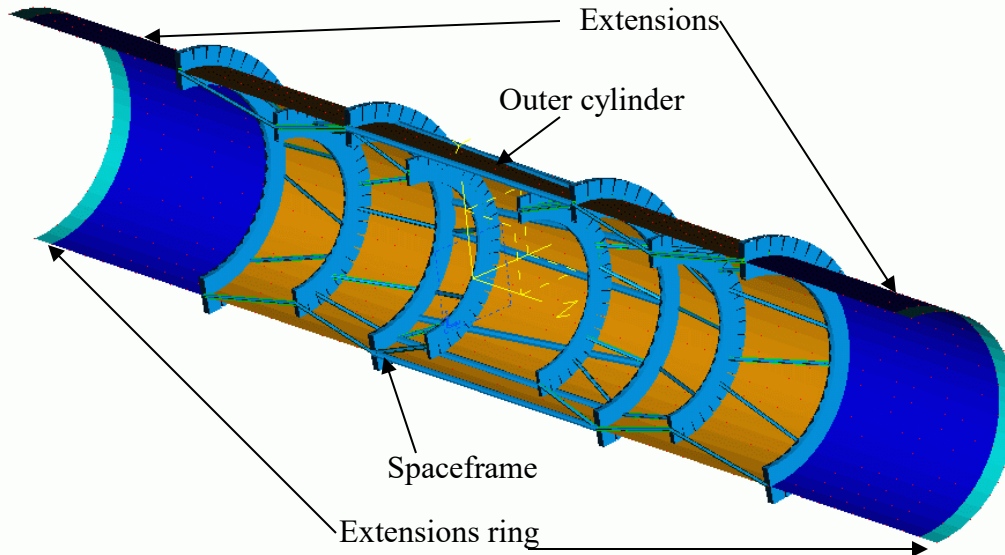
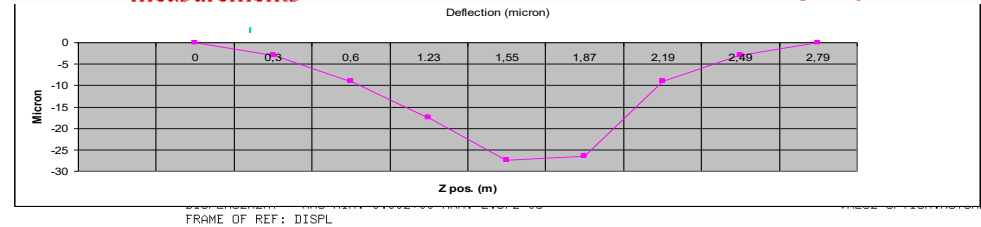
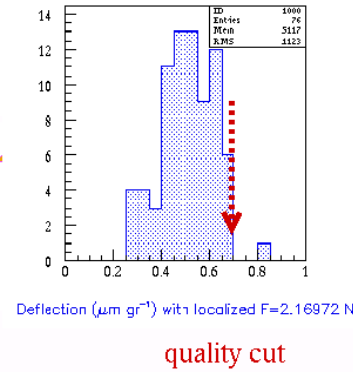
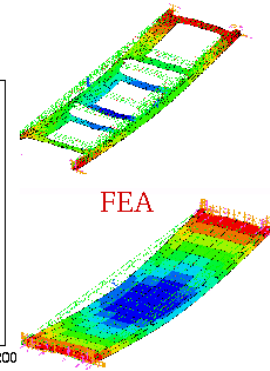
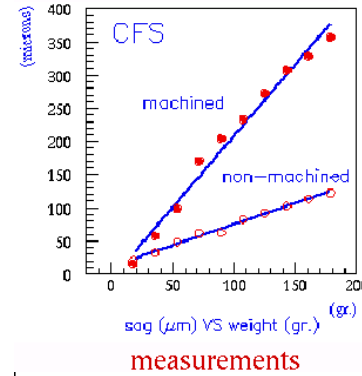




Calcoli e tests meccanici di verifica



Carbon Fibers Support



Deflection test setup

We evaluate the global stiffness with FE analysis and we verify experimentally the calculations (results are in meters).

Comparison between two different hybrid material

Alumina ceramic

and

FR4 composite

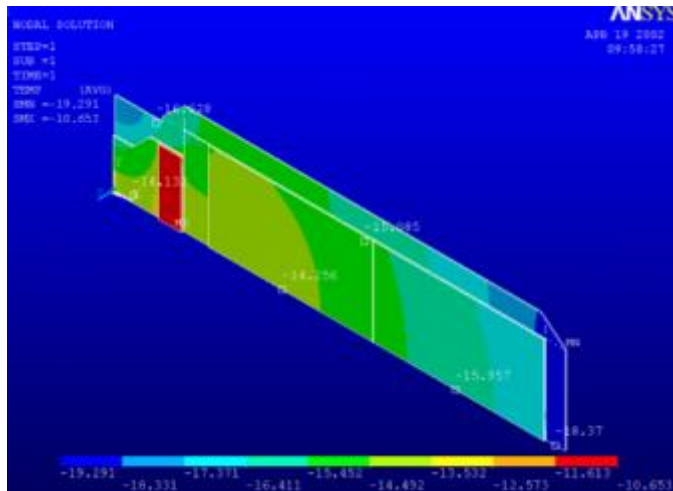
ISOTROPIC MATERIAL

$$K = 34 \text{ W/M} \cdot \text{K}$$

Max temperature on the read-out chips **-10.6°C**

Max temperature on the silicon sensors **-14°C**

(fluid inlet **-25°C**)



AN-ISOTROPIC MATERIAL

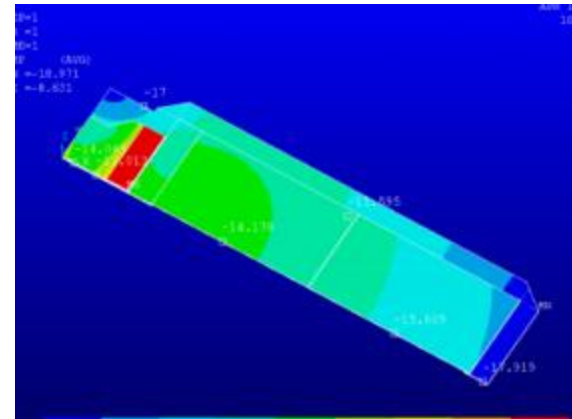
$$K_{\text{IN PLANE}} = 50 \text{ W/M} \cdot \text{K}$$

$$K_{\text{NORMAL}} = 0.34 \text{ W/M} \cdot \text{K}$$

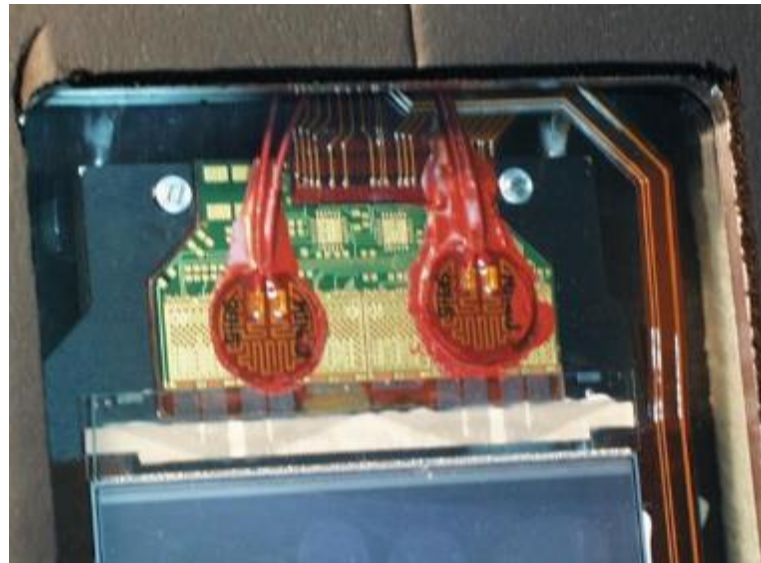
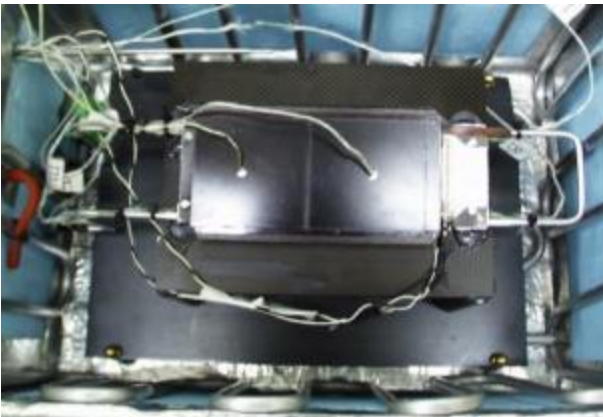
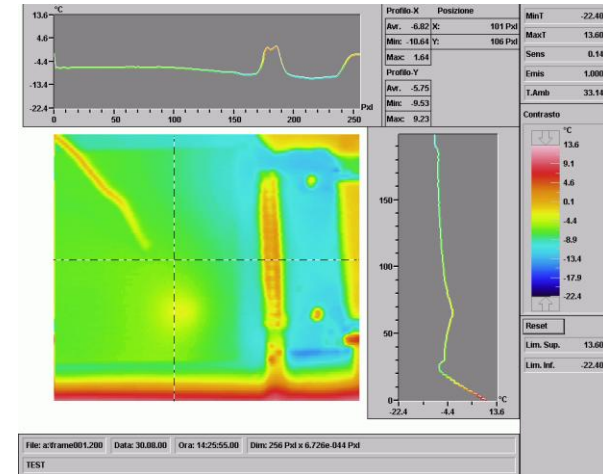
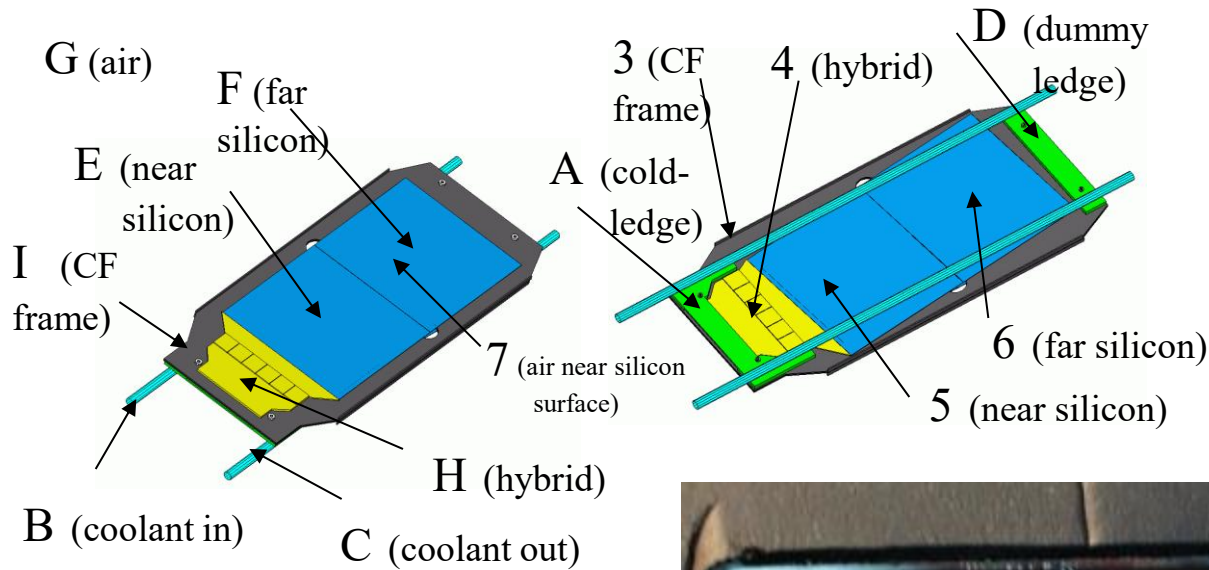
Max temperature on the read-out chips **-8.6°C**

Max temperature on the silicon sensors **-14°C**

(fluid inlet **-25 °C**)



Silicon module experimental cooling setup

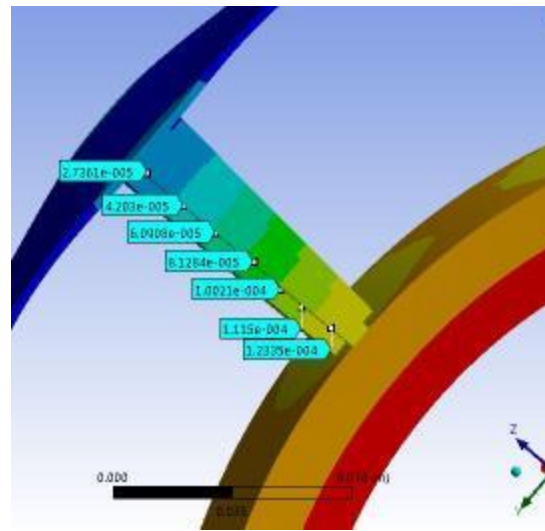


**Thermo-camera
view - 1**

Camera a fili per l'esperimento MEG. Paul Scherrer Institute Svizzera



40 μm diam. Aluminum wires
Total wire load 3500N Max displacement 0.2mm of the end plates.



VIRGO Cascina Pisa Italy

Il progetto Virgo consiste in interferometro laser costituito da due bracci ortogonali lunghi 3 km. Le riflessioni multiple fra gli specchi di estremità estendono la lunghezza ottica effettiva fino a 120 km per braccio. I due bracci sono costituiti da tubi in ultra alto vuoto del diametro di 1,2m e costituiscono uno dei più grandi recipienti in pressione al mondo.

L'obiettivo di questo esperimento è la rilevazione e studio delle onde gravitazionali generate da eventi catastrofici nello spazio profondo.

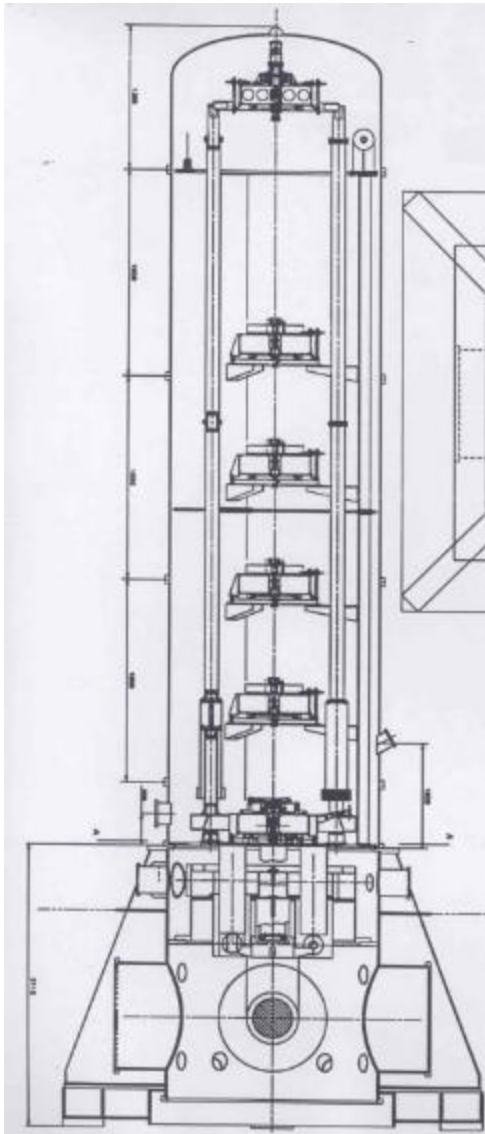
Per effettuare queste misure deve essere garantito un isolamento completo dall'ambiente esterno, Gli specchi di estremità sono isolati meccanicamente per frequenze da pochi a migliaia di Hz.

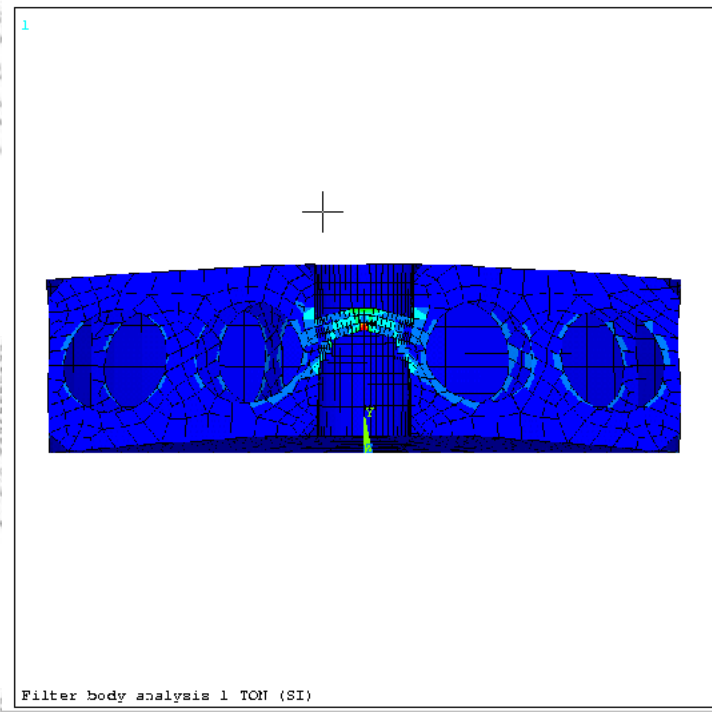


The V.S.A. is a sophisticated 6-Degree isolation system that is capable to adjust its position with respect to the laser using a system of linear motion.

Six filtering units connected by wires are called Super Attenuator Module (S.A.M.).

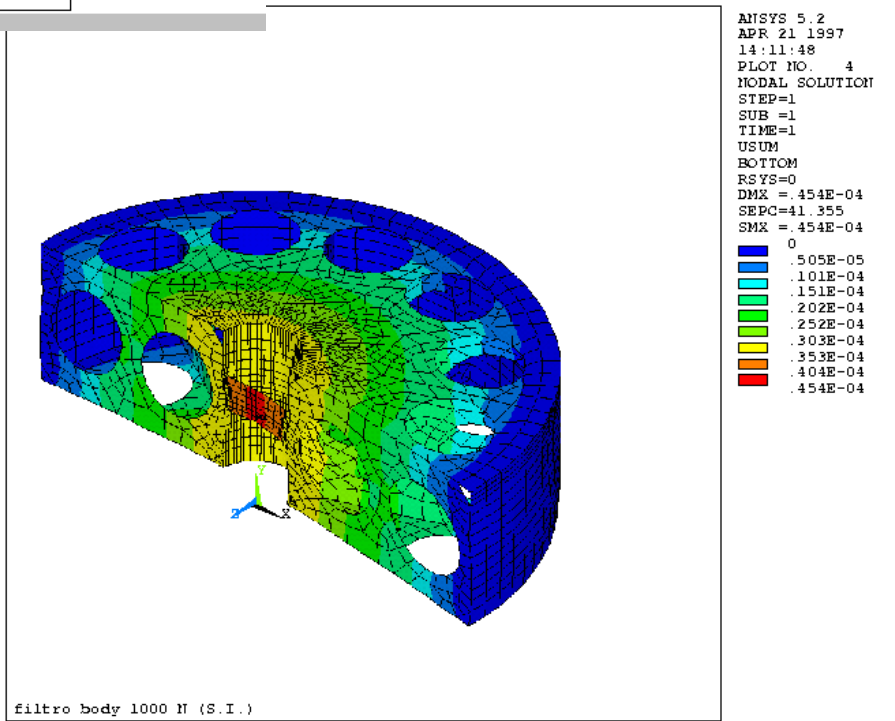
All S.A.M. are contained inside towers, which are twelve meter-tall vertical vacuum vessels. These are connected with the Virgo vacuum system at the base. Inside the tower there is also an inverted pendulum to form the pre-isolator stage that is anchored to the bottom of the tower.





ANSYS 5.2
MAR 14 1997
19:05:12
PLOT NO. 4
ELEMENT SOLUTION
STEP=1
SUB =1
TIME=1
SEQV (NOAVG)
TOP
DMX = .573E-04
SMN =111236
SMNB=-.308E+08
SMX = .910E+08
SMXB=-.130E+09
111236
102E+08
203E+08
304E+08
405E+08
506E+08
607E+08
708E+08
809E+08
910E+08

Molle in acciaio maraging
Tensione di lavoro 900 Mpa
Frequenza fondamentale 1.2 Hz

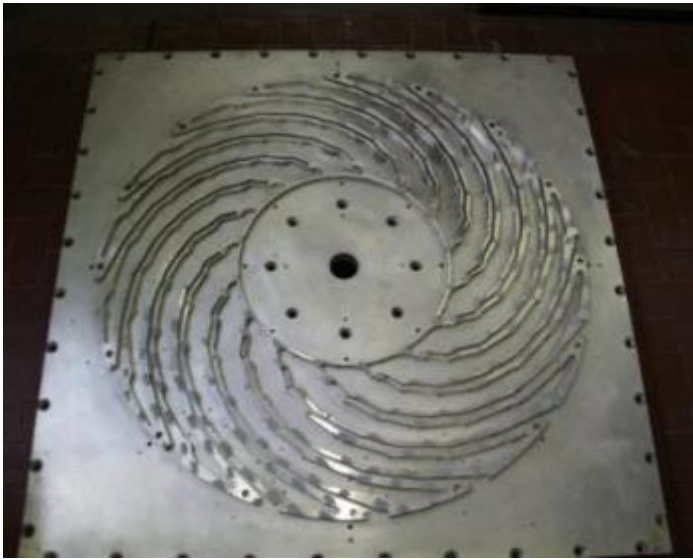


ANSYS 5.2
APR 21 1997
14:11:48
PLOT NO. 4
MODAL SOLUTION
STEP=1
SUB =1
TIME=1
USUM
BOTTOM
RSYS=0
DMX = .454E-04
SEPC=41.355
SMX = .454E-04
0
505E-05
101E-04
151E-04
202E-04
252E-04
303E-04
353E-04
404E-04
454E-04

filtro body 1000 N (S.I.)

PROTOTIPIZZAZIONE

Conclusa la fase di progettazione o in parallelo con essa vengono realizzati prototipi e piccole serie tramite il servizio di **officina meccanica** della sezione o per la verifica della integrazione dei componenti la **stampante 3D**



- Tre estrusori.
- Camera chiusa, piatto riscaldato, Tmax ugelli 400C.
- Materiale filamento: PLA, ABS, HIPS, PC, PC-ABS, PETG, NylonCarbon, TPU.
- Area di stampa = 620 x 355 x 500 mm .
- Qualità di stampa = High 50 – Low 300 microns.
- Precisione di posizionamento = (xyz) 15 microns..



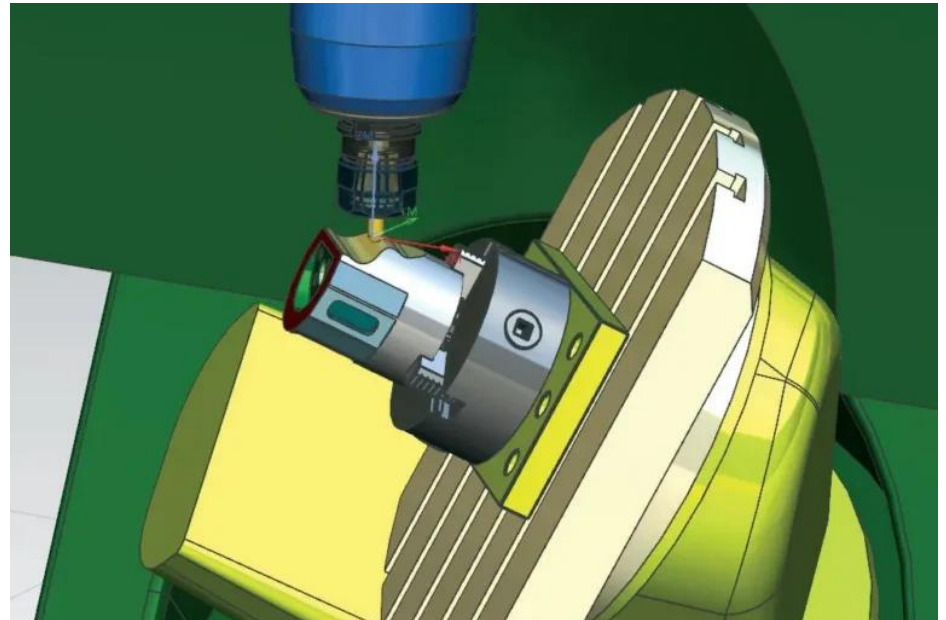
OFFICINA MECCANICA

La totalità dei prototipi e delle attrezzature di montaggio (jigs) vengono realizzate presso la nostra officina.

PERSONALE AFFERENTE

- **Filippo Mariani**
- **Manuel Passeri**
- **Mirco Marinari**

Software CAM: FUSION360 della Autodesk



OFFICINA MECCANICA



Fresa a 5 assi
Corse 500x500x350



Fresa a 4 assi
Corse 1000x1000x450



Tornio CNC
Mandrino 300

OFFICINA MECCANICA



Taglio ad acqua
Corse 750x1000x200

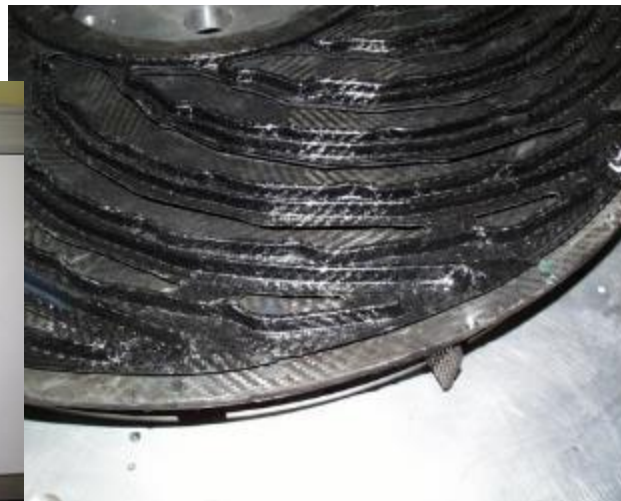
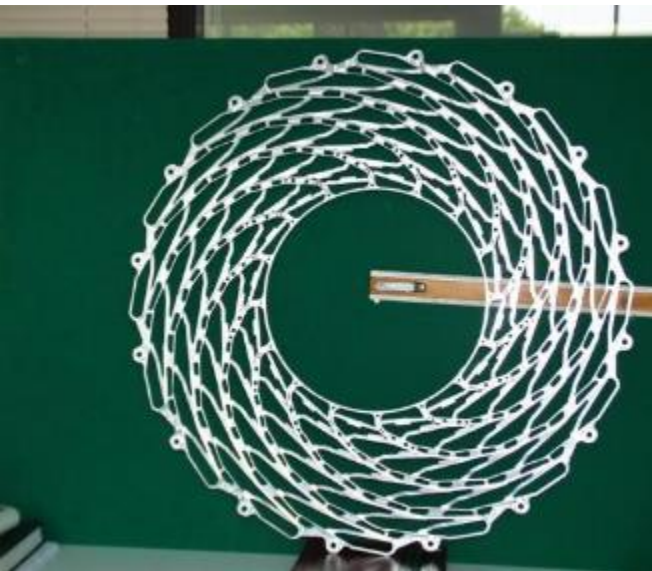


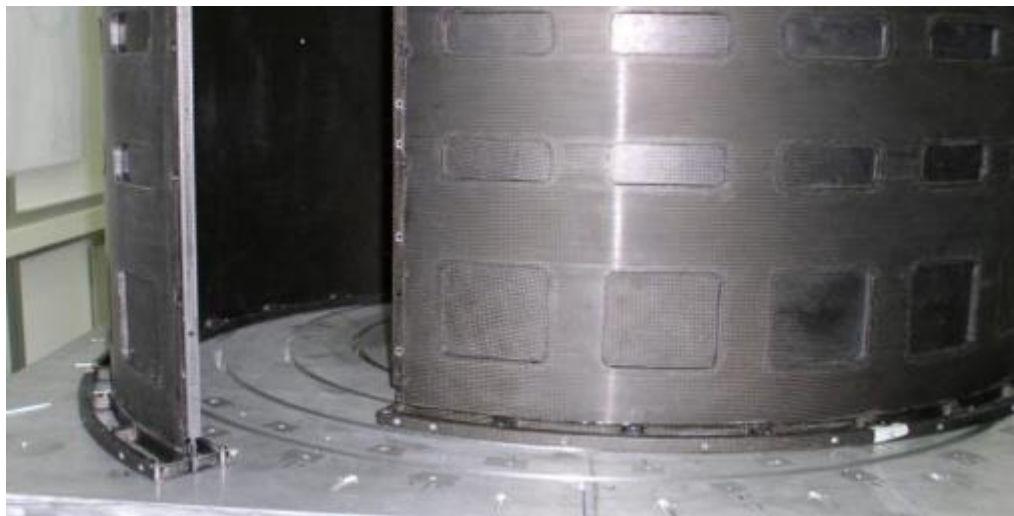
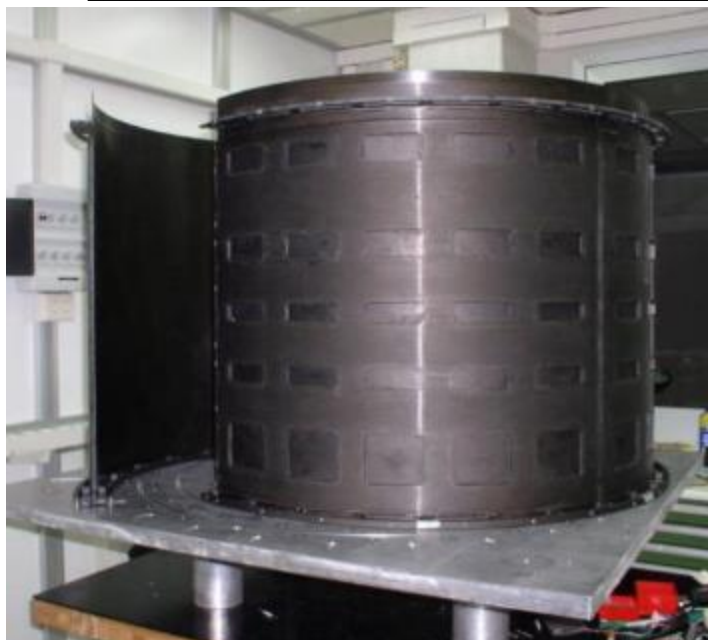
Elettroerosione a filo
Corse 450x450x300



Riserva

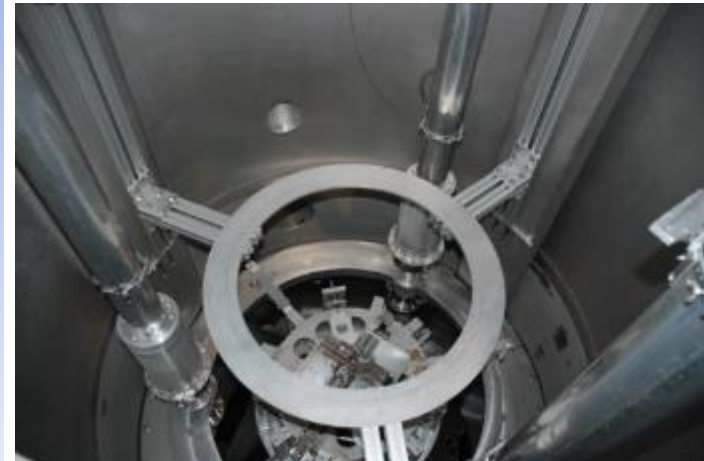
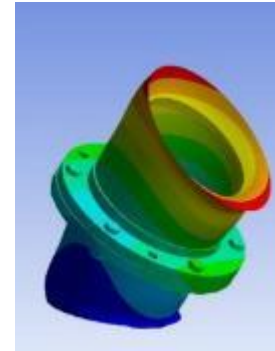
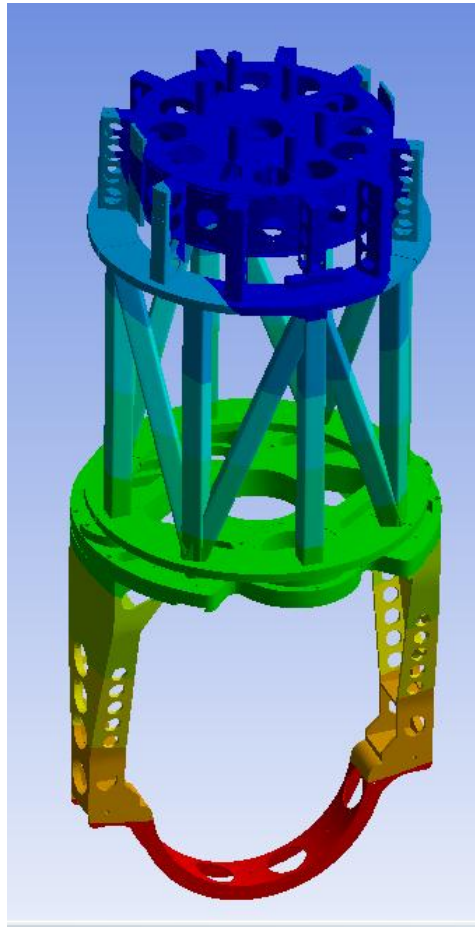
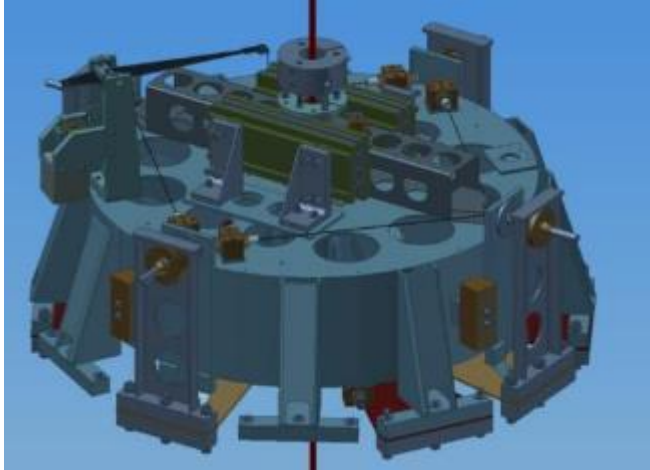
Varie realizzazione in alluminio e fibra di carbonio

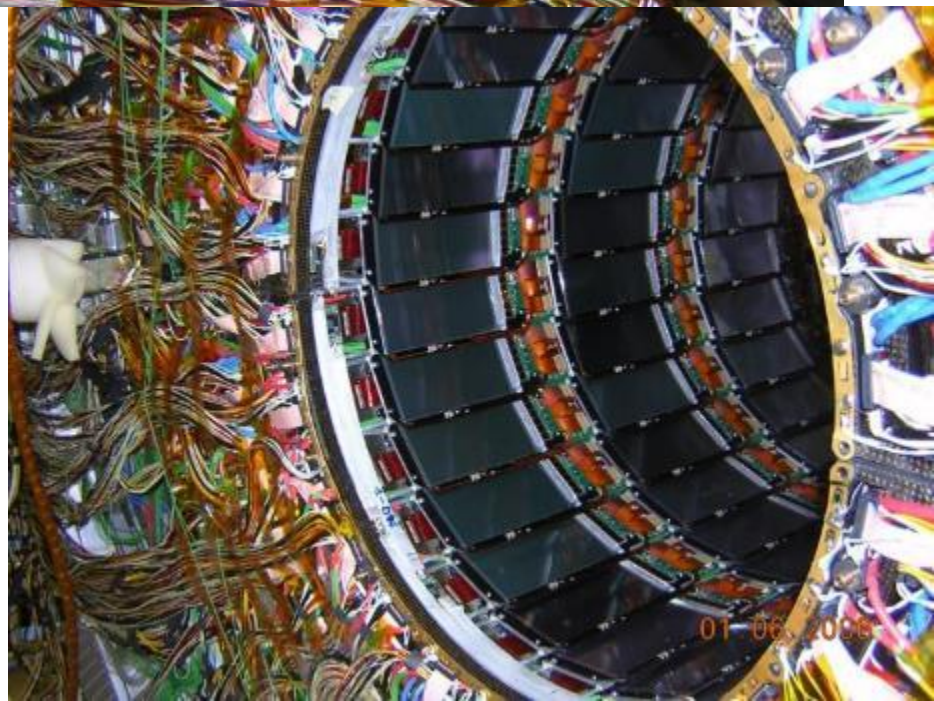
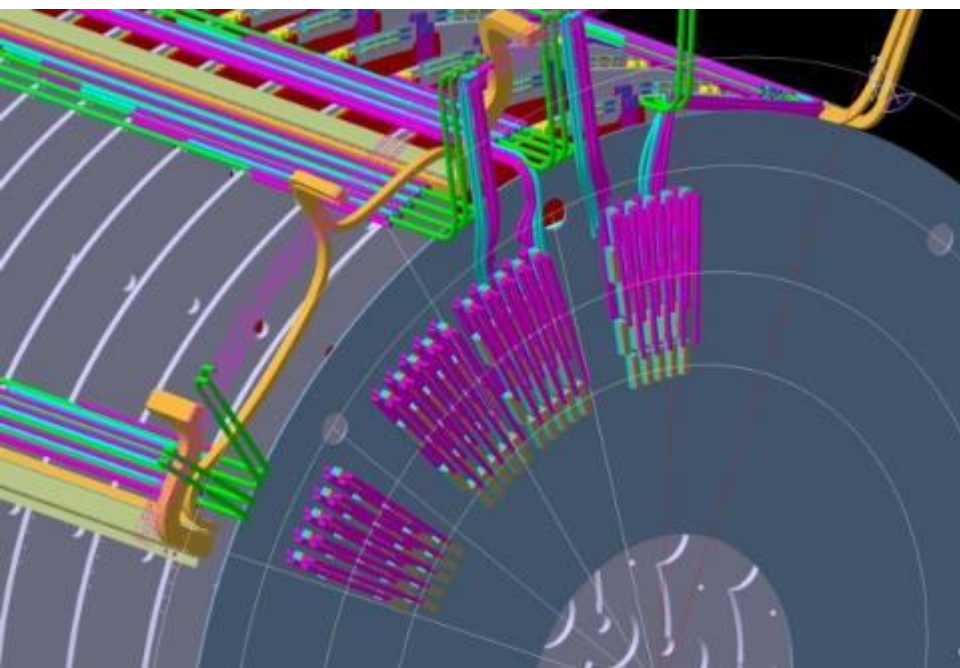
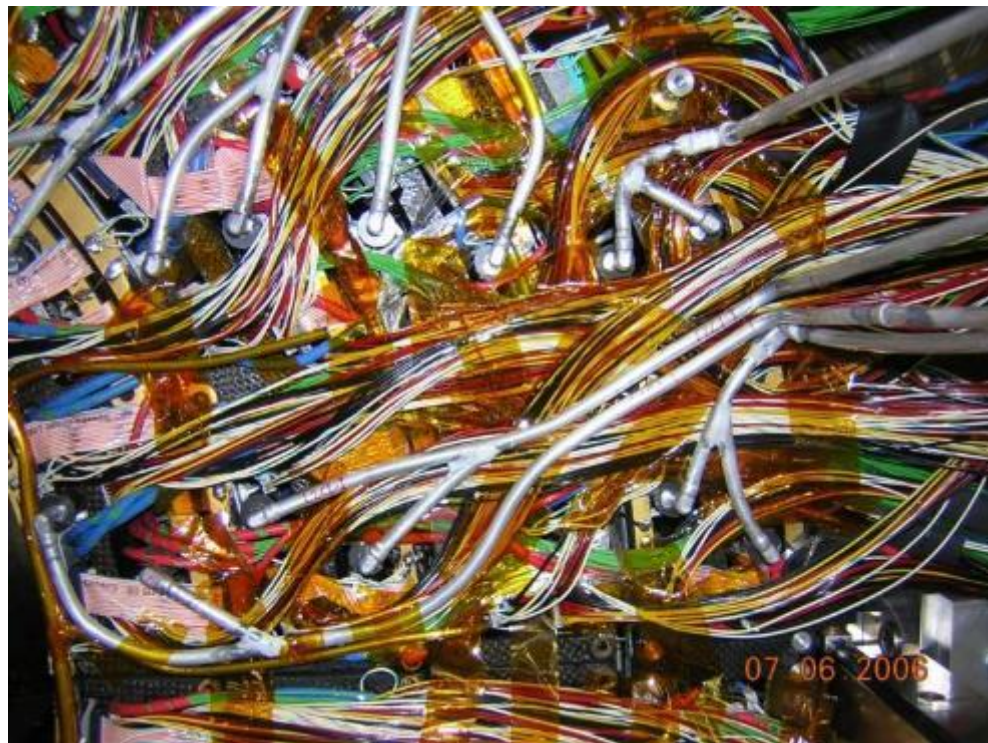




Virgo AdV

Upgrade meccanico apparato di Virgo





Inverted pendulum

External gage





