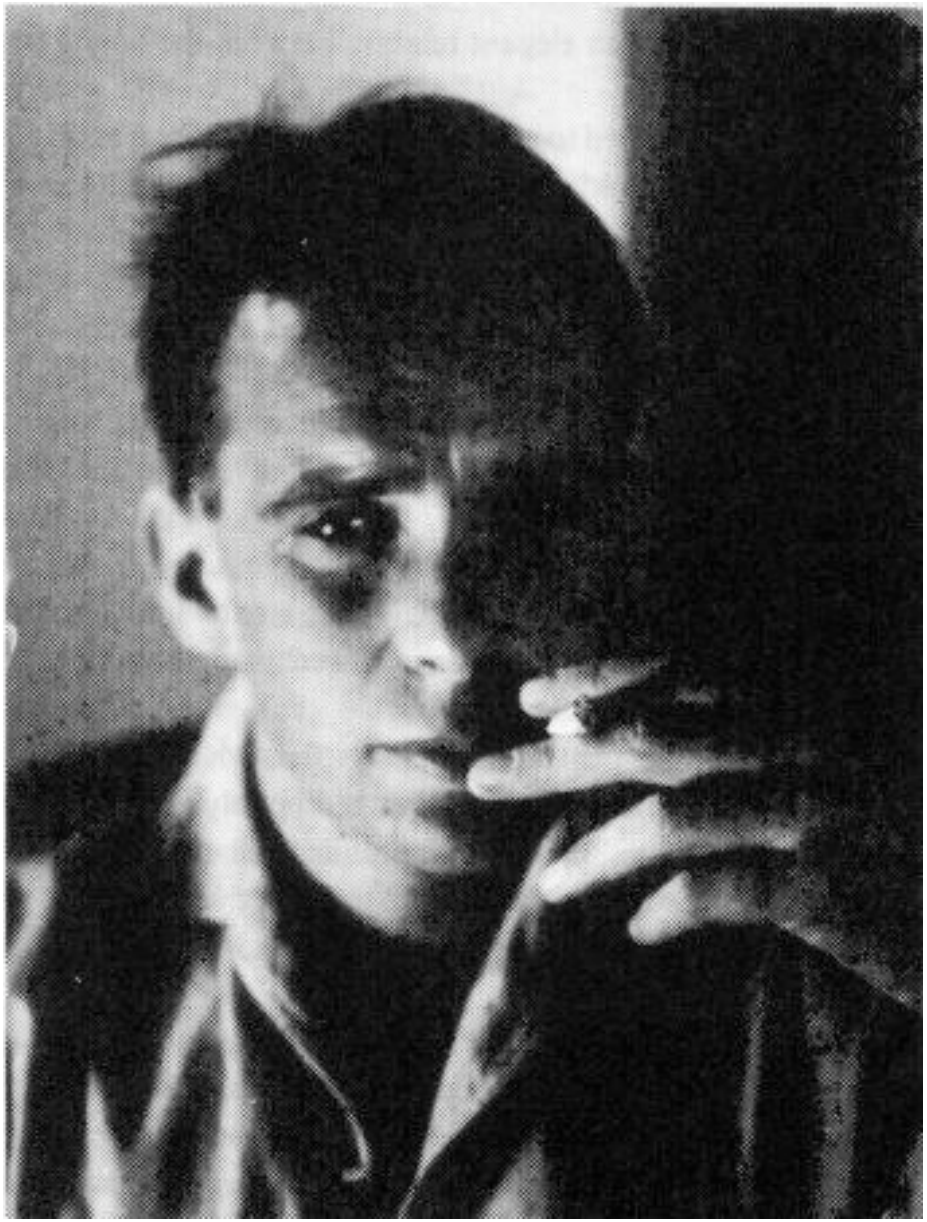
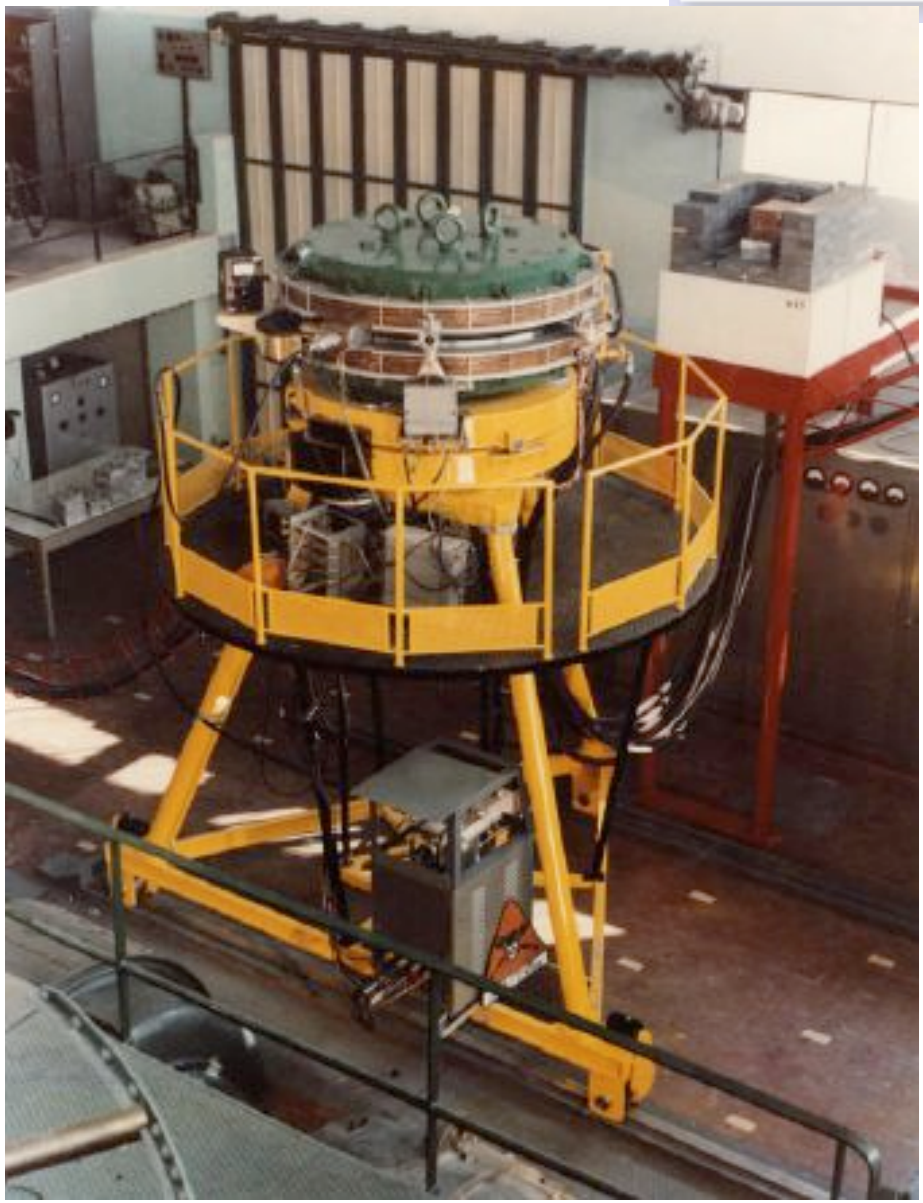
INFN and LNF





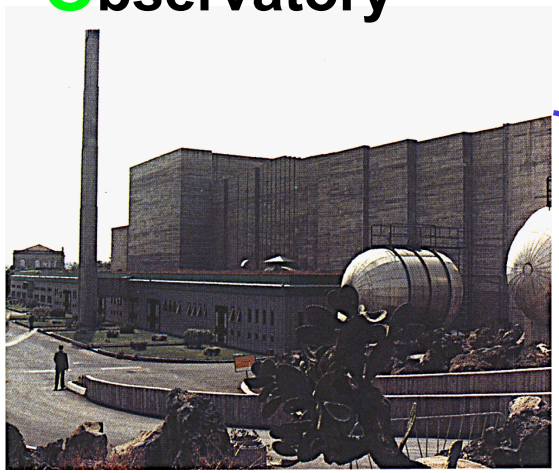
Legnaro

VIRGO-EGO

European

Gravitational

Observatory



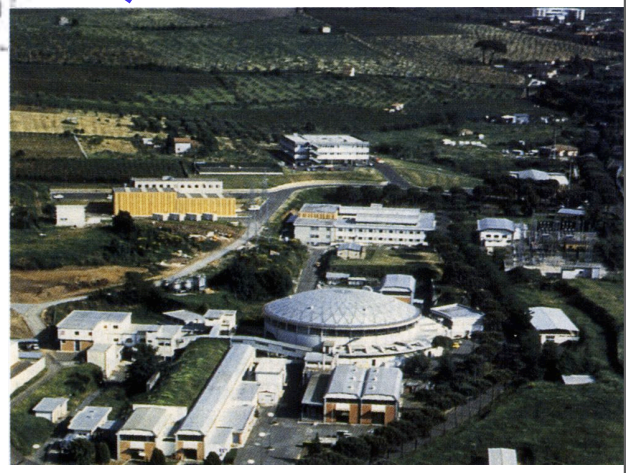
Laboratori del Sud (Catania)

Gran Sasso

19 Sezioni

11 Gruppi collegati

4 Laboratori Nazionali



Astroparticle physics and INFN

(INFN=Istituto Nazionale di Fisica Nuclare)

- INFN was established for **nuclear and particle physics**. Similar situation for other agencies around the world (IN23P, DOE..)
- Cosmic rays physics was considered "**less important**"
- Around 1980 supersimmetry ==> proton decay searches. In Italy **NUSEX** under the Mont Blanc. *Beginning of a new interest for cosmic rays ..also triggered by the CYGNUS X3 claim..*
- Then (1982) the Gran Sasso laboratory : main goals proton decay, monopole search, solar neutrinos... Increase of interest for cosmic rays (**EAS-TOP** first INFN experiment dedicated to cosmic rays)

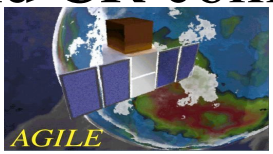
INFN "Space" Experiments

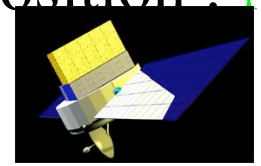
(in collaboration with CNR-INAF-ASI)

- 1990 cosmic rays balloon (WIZARD)

and later :

- antimatter search and CR composition : NINA, PAMELA, AMS (ASI INFN)

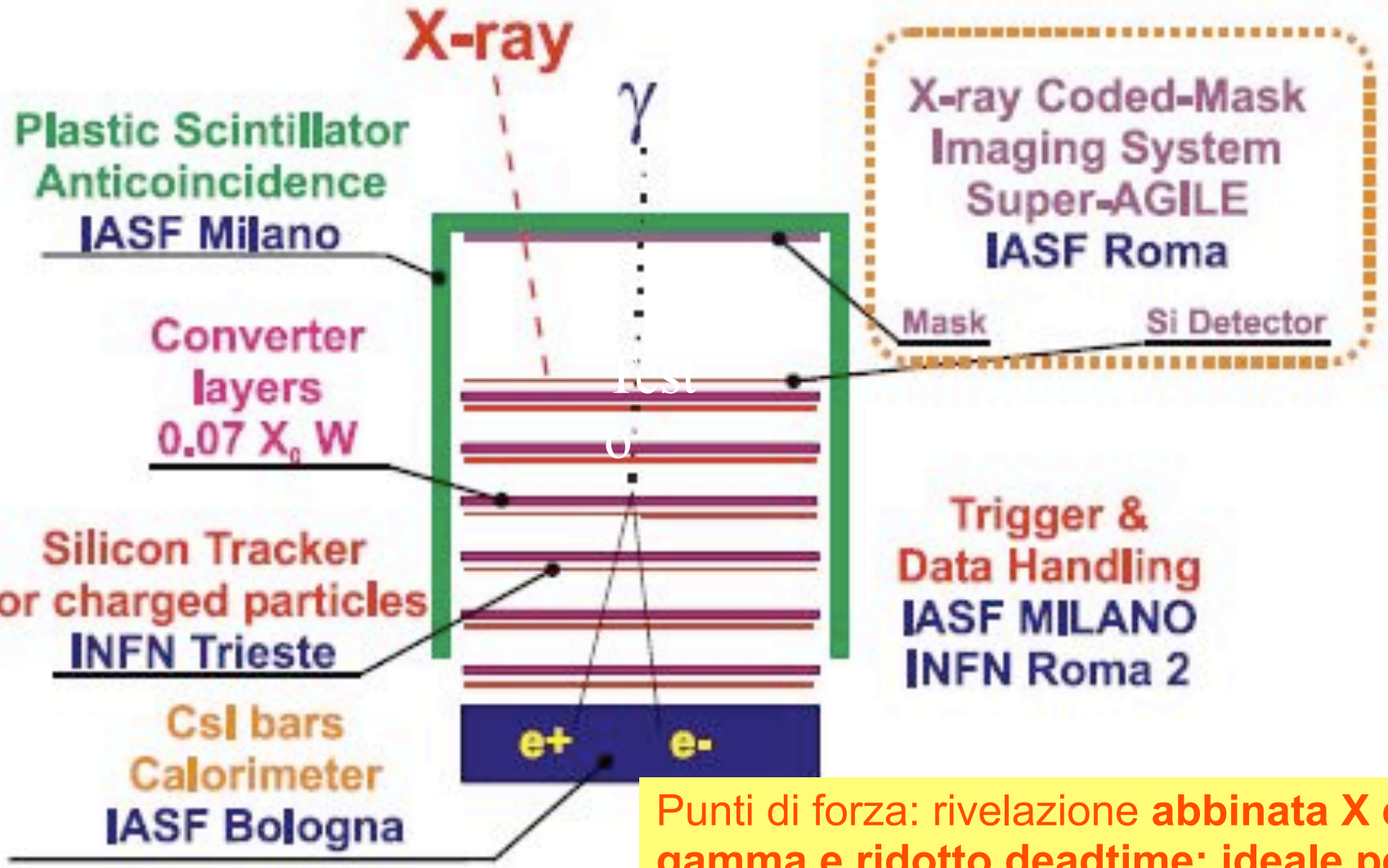




- gamma ray astronomy :AGILE, GLAST (ASI INAF INFN)
- Cosmic ray composition CREAM South Pole balloon experiment
- R/D for X ray detectors
- Medicine SIRAD(Gr5)
- gravition and gravitational waves experiments or R/D (LISA-PF, LARES R/D, GGG R/D,
- ETRUSCO R/D for fundamental physics in space

Example of ASI INAF INFN collaboration

AGILE payload



Punti di forza: rivelazione **abbinata X e gamma e ridotto deadtime: ideale per i GRBs**

PAMELA DETECTOR

Anticoincidence system

Multiple particles rejection

Anticoincidence system

- Defines tracker acceptance
- Plastic scintillator + PMT

Si-W Calorimeter

- Imaging Calorimeter : reconstructs shower profile discriminating e^+/p and p/e^- at level of $10^{-4} \sim 10^{-5}$
- E ution for $e^\pm$ $\Delta E/$ $E^{1/2}$.
- Si i-Y structure

  22 W planes
- 16.3 X_0 / 0.6 I_0

Time-of-flight

- Level 1 trigger
- particle identification (up to 1GeV/c)
- dE/dx
- Plastic scintillator + PMT
- Time Resolution ~ 70 ps

Si Tracker + magnet

- Permanent magnet B=0.4T
- 6 planes double sided Si strips 300 μm thick
- Spatial risolution ~3μm
- Maximum Detectable Rigidity

S4 and Neutron detectors

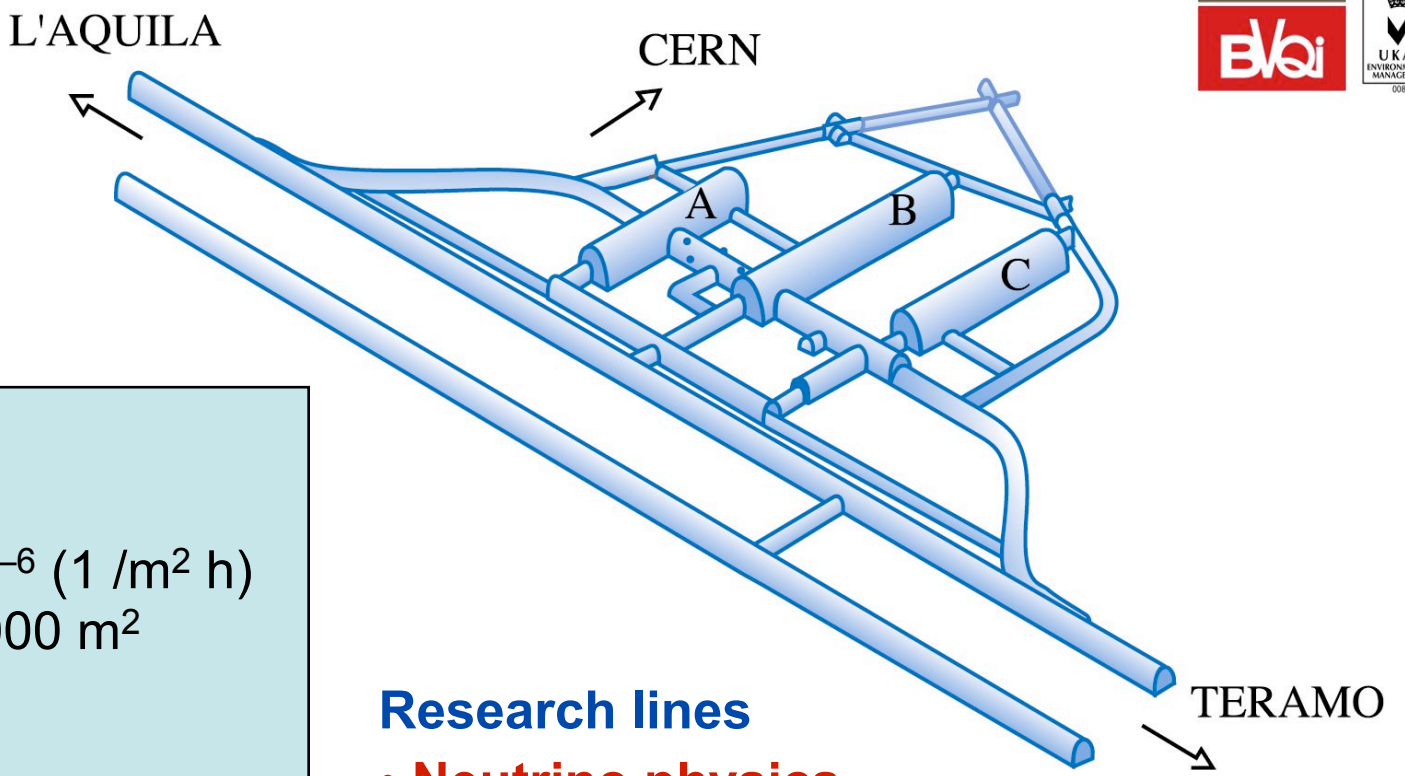
- Extend the energy range for primary protons and electrons up to 10 TeV
- Plastic Scintillator
- 36 ^{3}He counters in a polyetilen moderator

INFN Istituto Nazionale di Fisica Nucleare

Laboratori Nazionali del Gran Sasso

LABORATORI NAZIONALI DEL GRAN SASSO - INFN

Largest underground laboratory for particle and astroparticle physics



1400 m rock coverage
cosmic μ reduction= 10^{-6} (1 /m^2 h)
underground area: 18 000 m^2
external facilities
easy access
756 scientists from 24 countries
Permanent staff = 70 positions

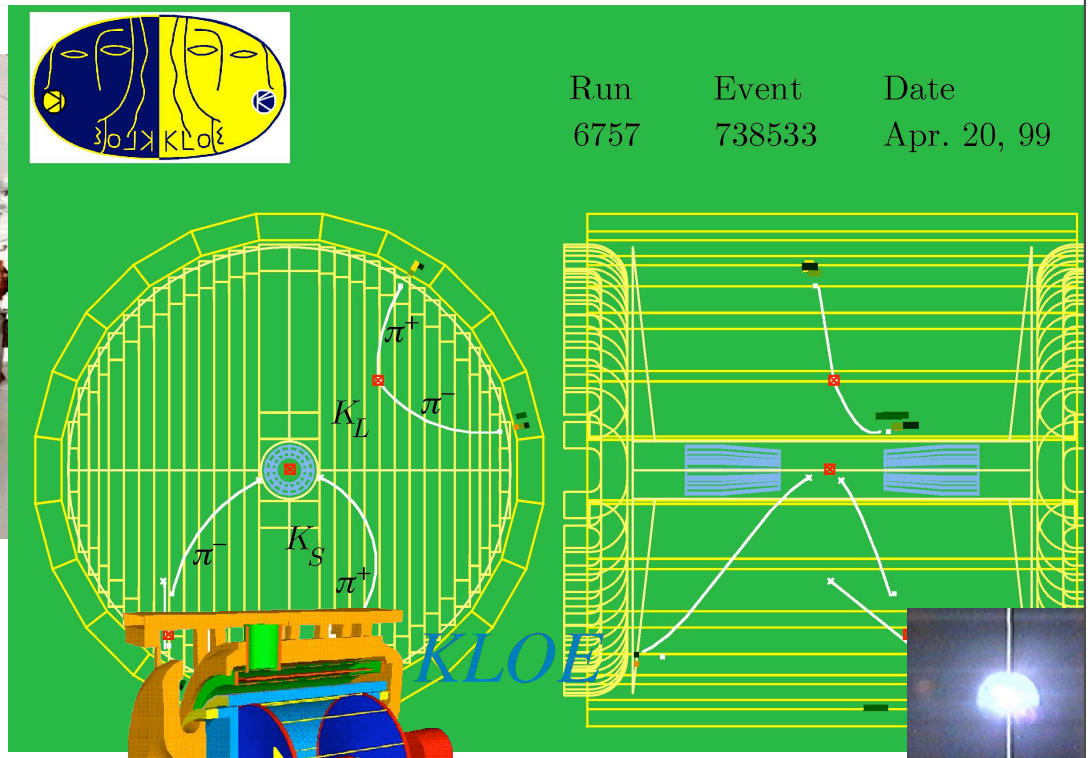
Research lines

- **Neutrino physics**
  (mass, oscillations, stellar physics)
- **Dark matter**
- **Nuclear reactions of astrophysics interest**
- **Gravitational waves**
- **Geophysics**
- **Biology**

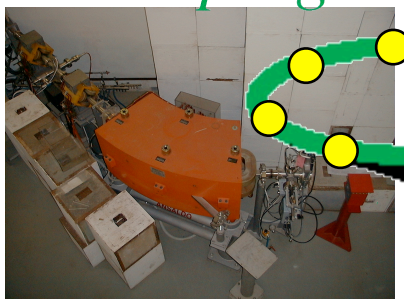
Laboratori Nazionali di Frascati

Data di nascita: 1955

DAΦNE



Damping ring



Test beam

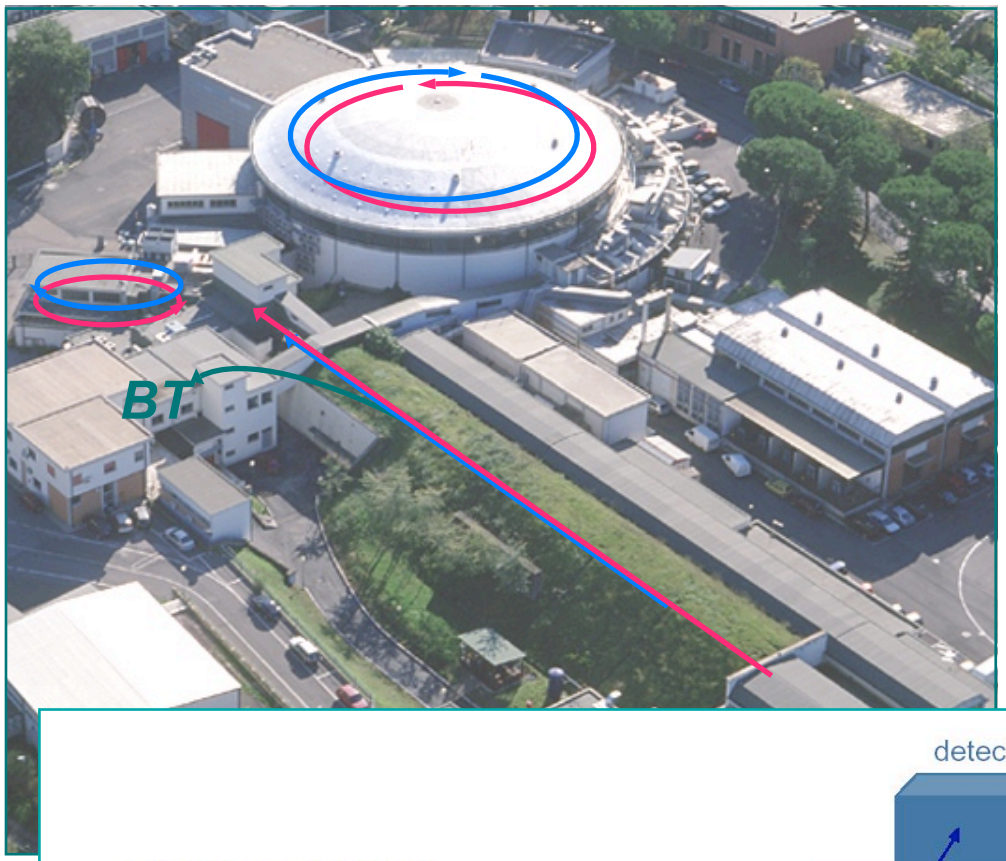
Main rings

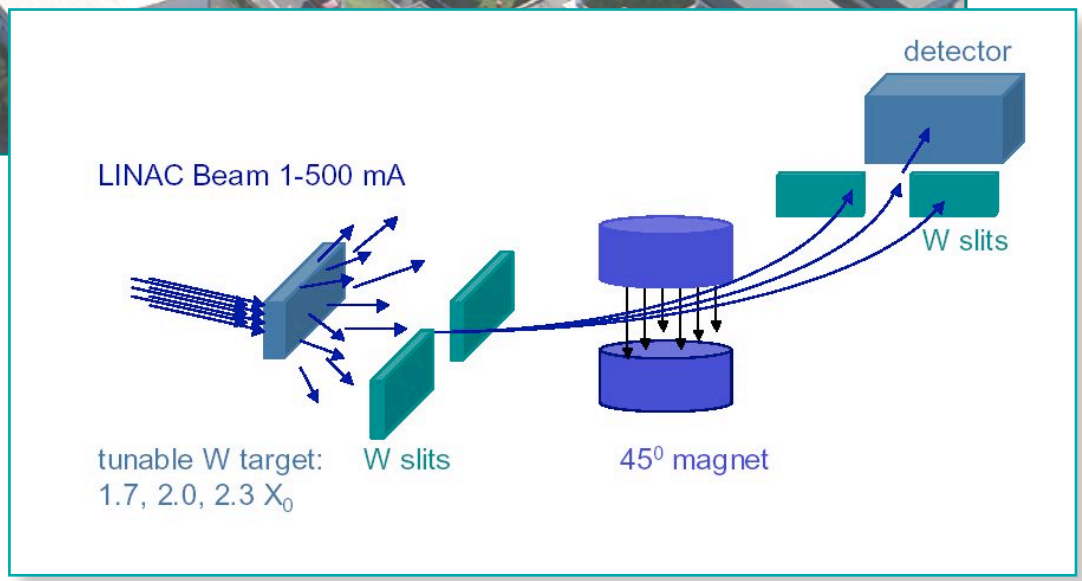
DAFNE-Light

DEAR

Linac

The DAΦNE Beam-Test Facility



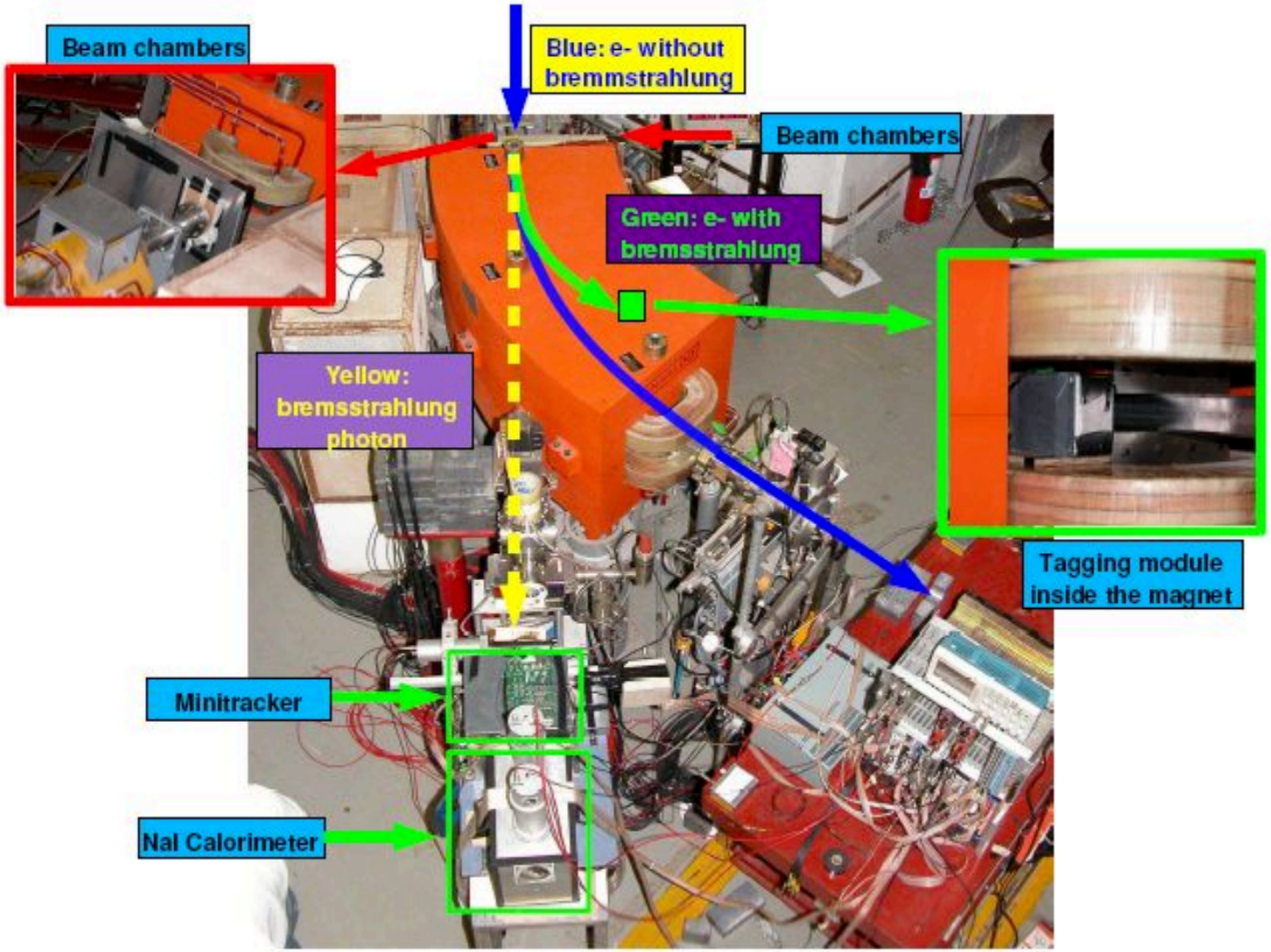


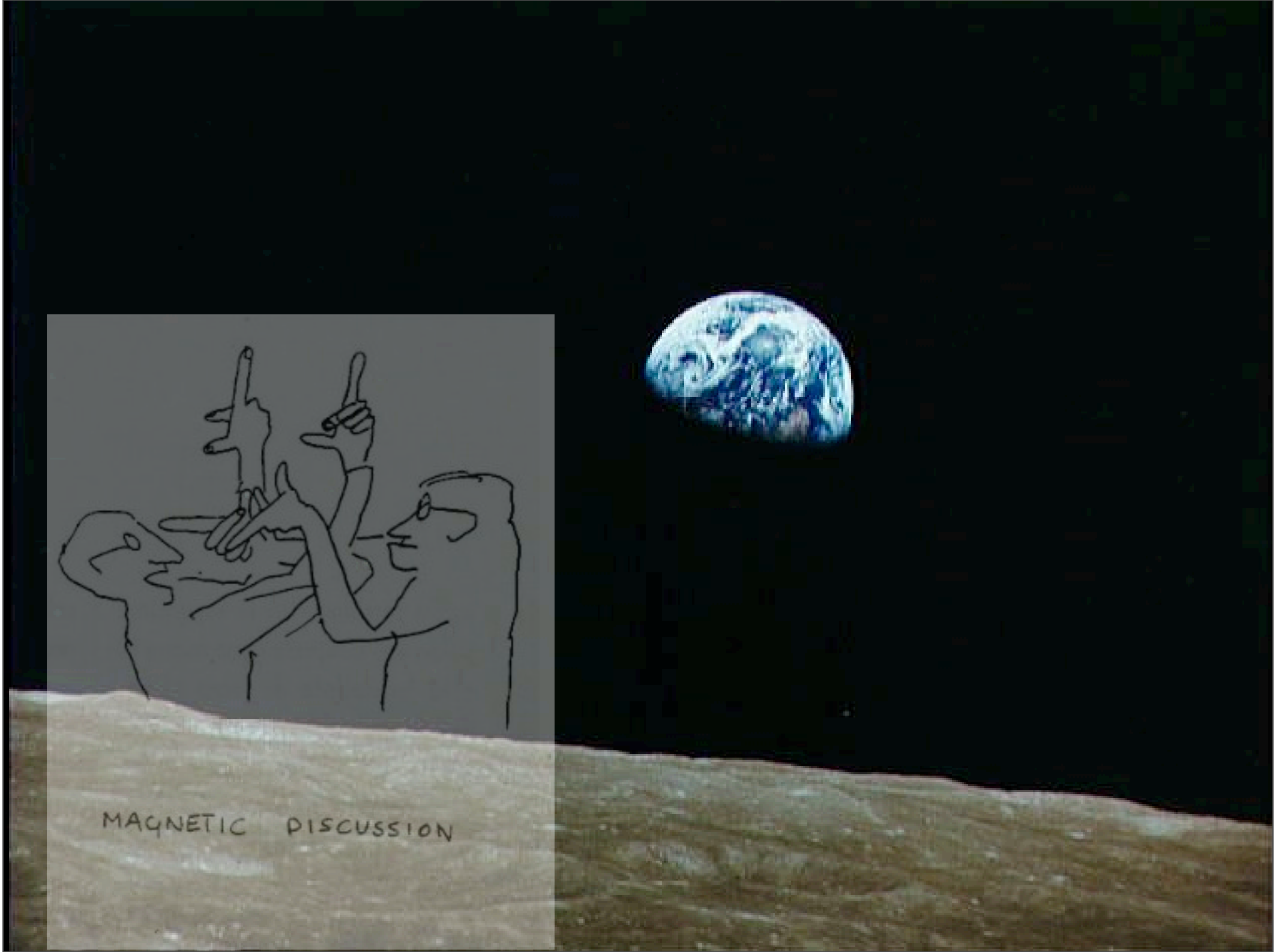
Characteristics	
Energy Range	25-750 MeV e^-/e^+
Max. Repetition Rate	50 Hz
Pulse Duration	1-10 ns
Current/pulse	1 to 10^{10} particles
Allowed Current	10^3 particles/second

e' una linea di test che puo' essere usata per diverse attivita':

- calibrazione e messa a punto di rivelatori;
- diagnostica di fascio;
- studi elettromagnetici a bassa energia

Calibrations




MAGNETIC DISCUSSION