



Trento Institute for
Fundamental Physics
and Applications



Biofisica delle radiazioni presso il centro di protonterapia di Trento

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Congresso SIF 2015, Roma 21-25 Settembre



- 1.4.2015: official start of TIFPA
Director: Prof. Marco Durante

- About TIFPA:
 - Innovative Research Center (synergy of INFN, UNITN, FBK & APSS)
 - Excellence as goal (high quality scientific research)
 - Transational research (impact on territory and technology transfer)

Proton Therapy - APSS

- Official Agreement signed
- Current goal: to setup one of the most advanced laboratories for radiation biophysics research in Proton Therapy
- Planning phase ongoing with IBA and Mantovani

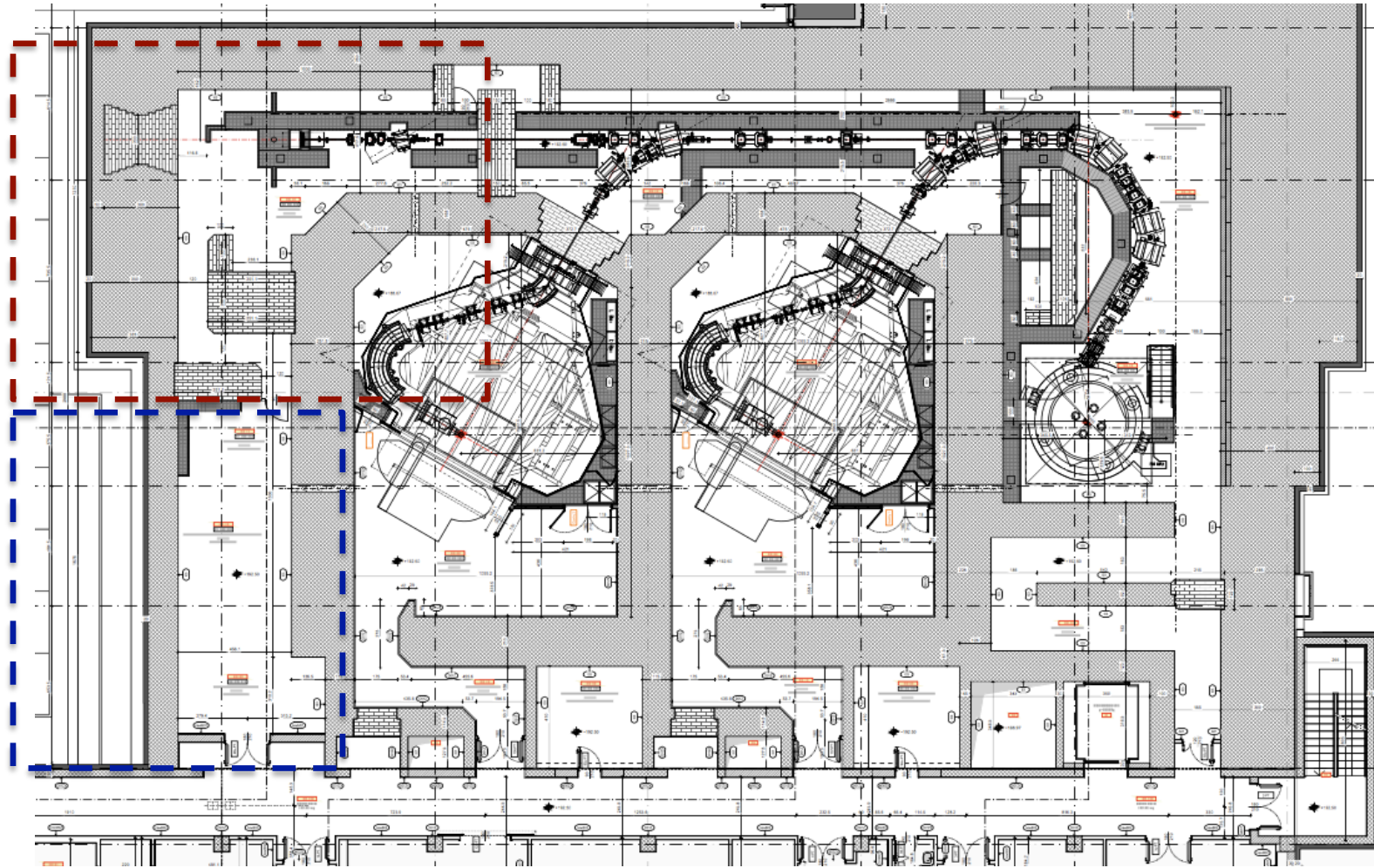
Experimental cave - today

Two
beam lines



**Experimental
Cave**

**Multi-
functional
laboratory**



Construction Plan

- **Phase I:** plan design and basic equipment for beam characterization (3 months, **ongoing!**)
- **Phase II:** installation of equipment for physics and biology experiments (phase I + 6 months)
- **Phase III:** completion of installation experimental equipment, generation of quasi-monoenergetic fast neutrons (unique facility in Europe!) – phase II + 4 months

—————→ **ready in ≈ 1 year**

First experiments in waiting list:

- ROSSINI2 (ESA): material for space shielding
- LIMADOU (ASI): seismo electro-magnetic satellite for earthquake prediction
- PANC (NCI)

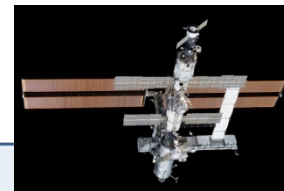
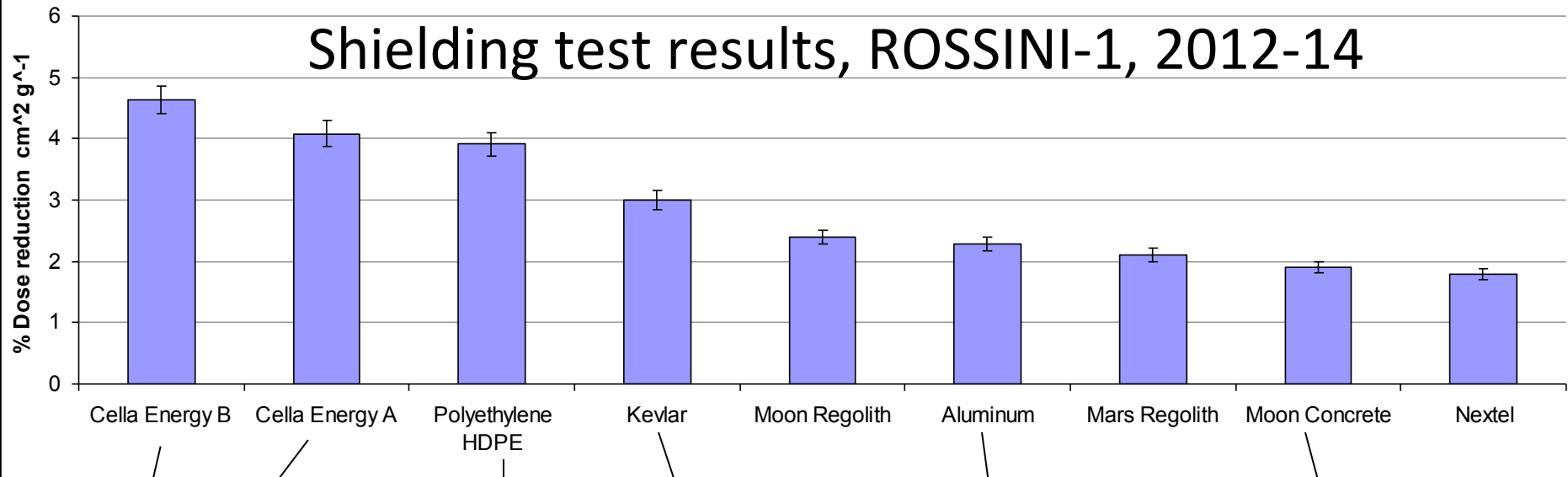
Protection by passive shielding



Percent Dose Reduction per Unit Areal Density for Single Materials



Shielding test results, ROSSINI-1, 2012-14



PANC: an International clinical trial on locally advanced pancreatic cancer and a pre-clinical study of immunotherapy+particle therapy

- **Clinical trial:** IMRT (USA+Europe), CIRT (NIRS, CNAO, HIT), protons (?)
- **Pre-clinical:** combination of high proton doses (hypofractionation) with new triterpenoid CDDO-Me (badoxolone metile), *in vitro + in vivo*
- Pre-clinical grant GSI-UT Southwestern, now at TIFPA



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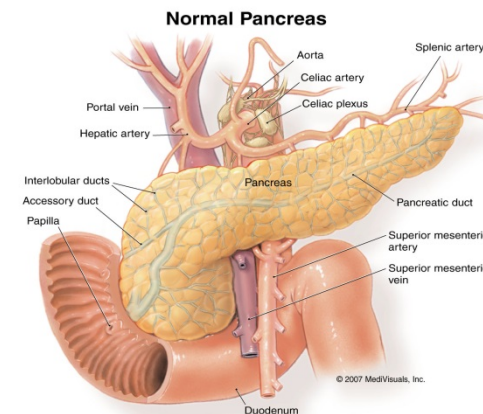
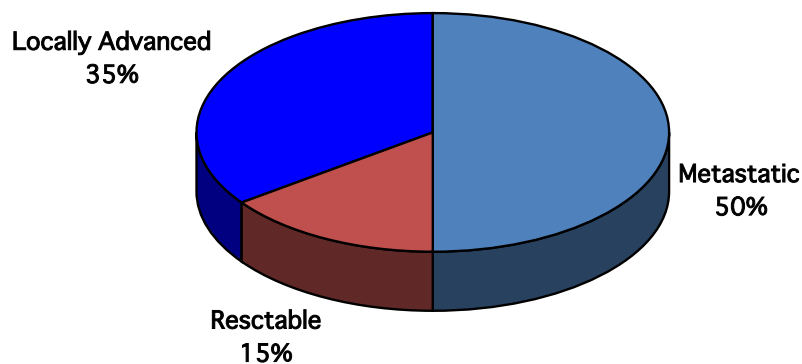
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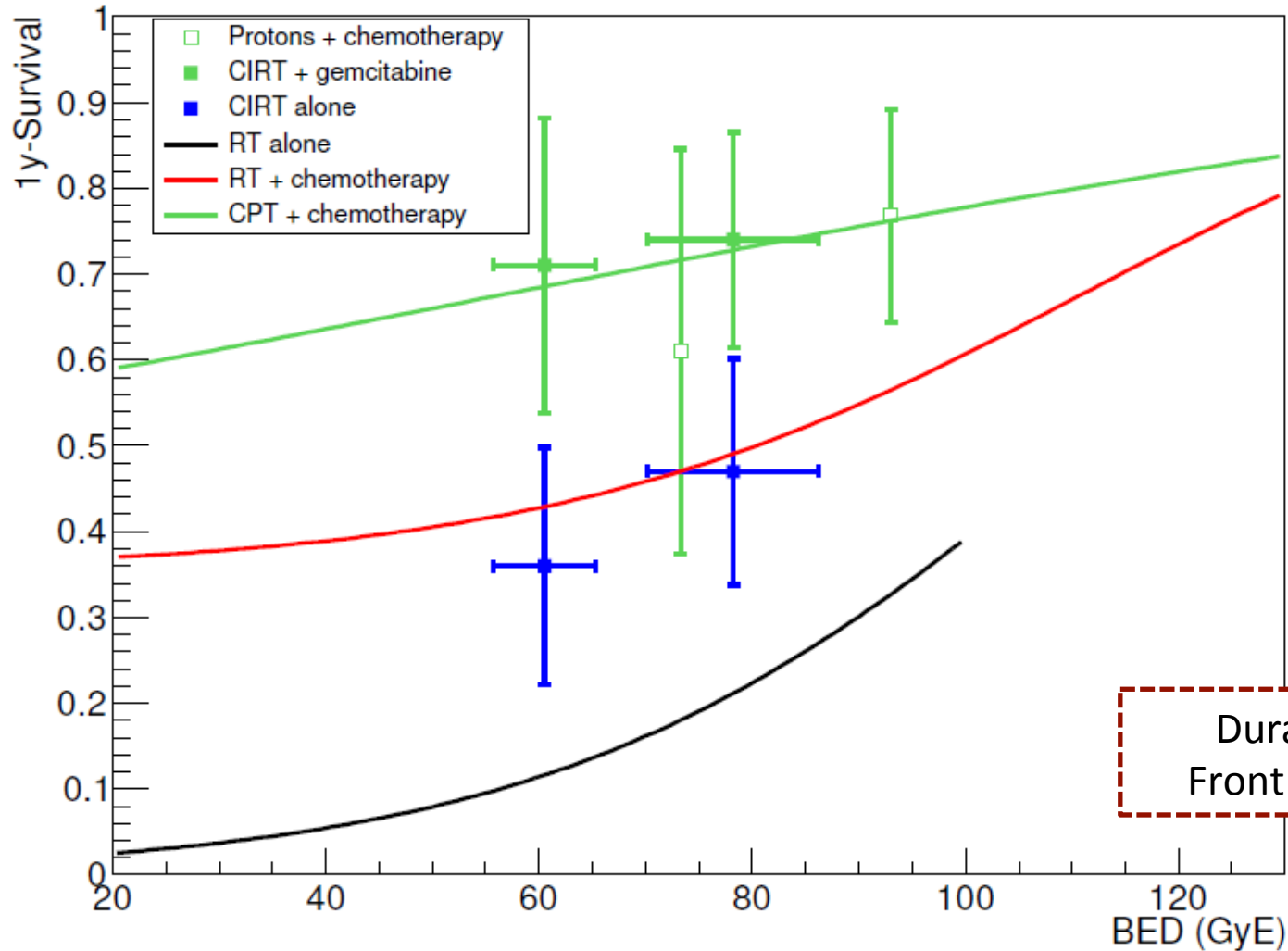


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PANC: combined Proton Therapy and Immunotherapy for pancreatic cancer

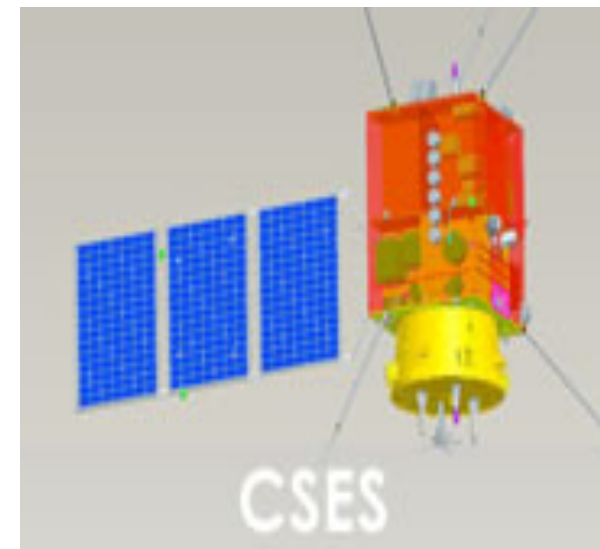
Pancreatic cancer ranks as the 4th leading cause of cancer related death in US (Siegel et al., *CA Cancer J Clin* 2014) and the only cancer where mortality is on the rise in Europe (Malvezzi et al., *Ann Oncol* 2014) Its average survival time after diagnosis is only 9 months.





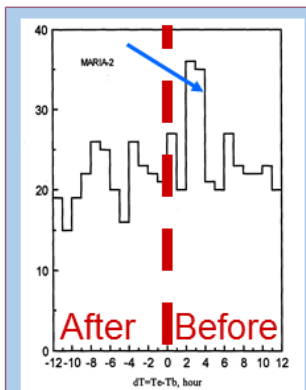
2. LIMADOU-CSES: studiare i terremoti dallo spazio

LIMADOU-CSES: CHINA SEISMO-ELECTROMAGNETIC SATELLITE



Electron bursts in inner belts

Correlations between EQ & ps: ΔT_{EQ-PB} distributions



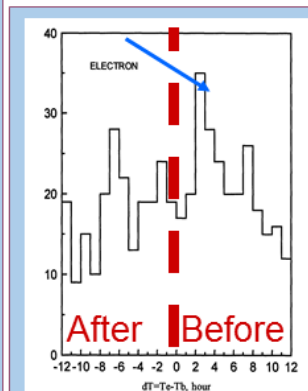
MIRA mission
1985-2000

Altitude: 400 km

Inclination: 51°

E_e : 20 ÷ 200 MeV

E_p : 20 ÷ 200 MeV



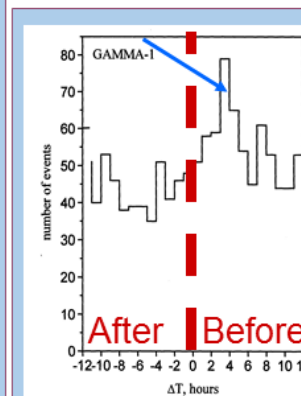
METEOR-3 mission

1985-1986

Altitude: 1250 km

Inclination: 82°

E_e : ≤ 30 MeV



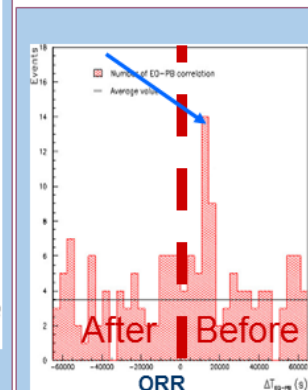
GAMMA-1 mission

1990-1992

Altitude: 350km

Inclination: 51°

E_e : > 50 MeV



ORR
(Orbit Rate Rotation;
July 1992 - May 1994)

SAMPEX/PET
Mission 1992-1999

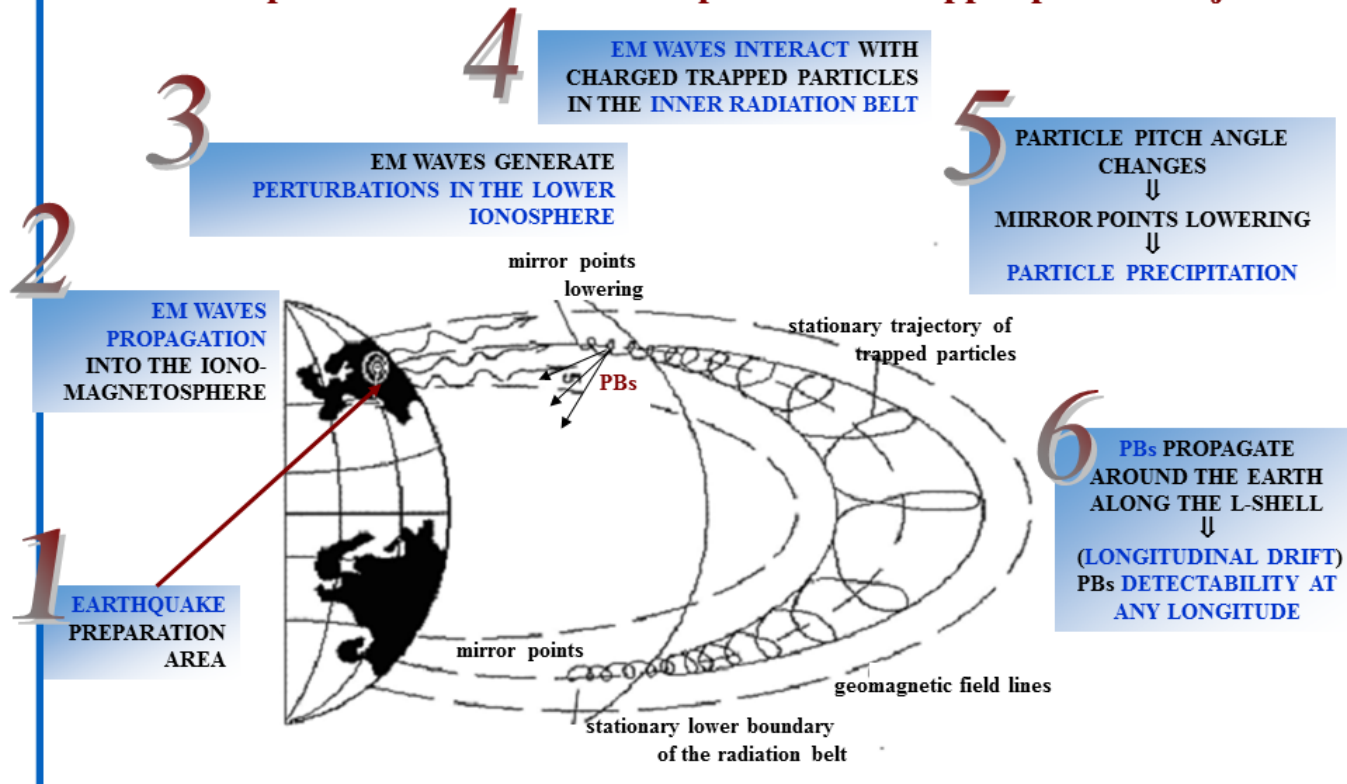
Altitude: 520÷740km

Inclination: 82°

$4 \leq E_e \leq 15$ MeV

Wave – particles interaction mechanism

Schematic representation in a meridian plane of the trapped particle trajectories



Calibrazione del detector con protoni fra 70-200 MeV:

