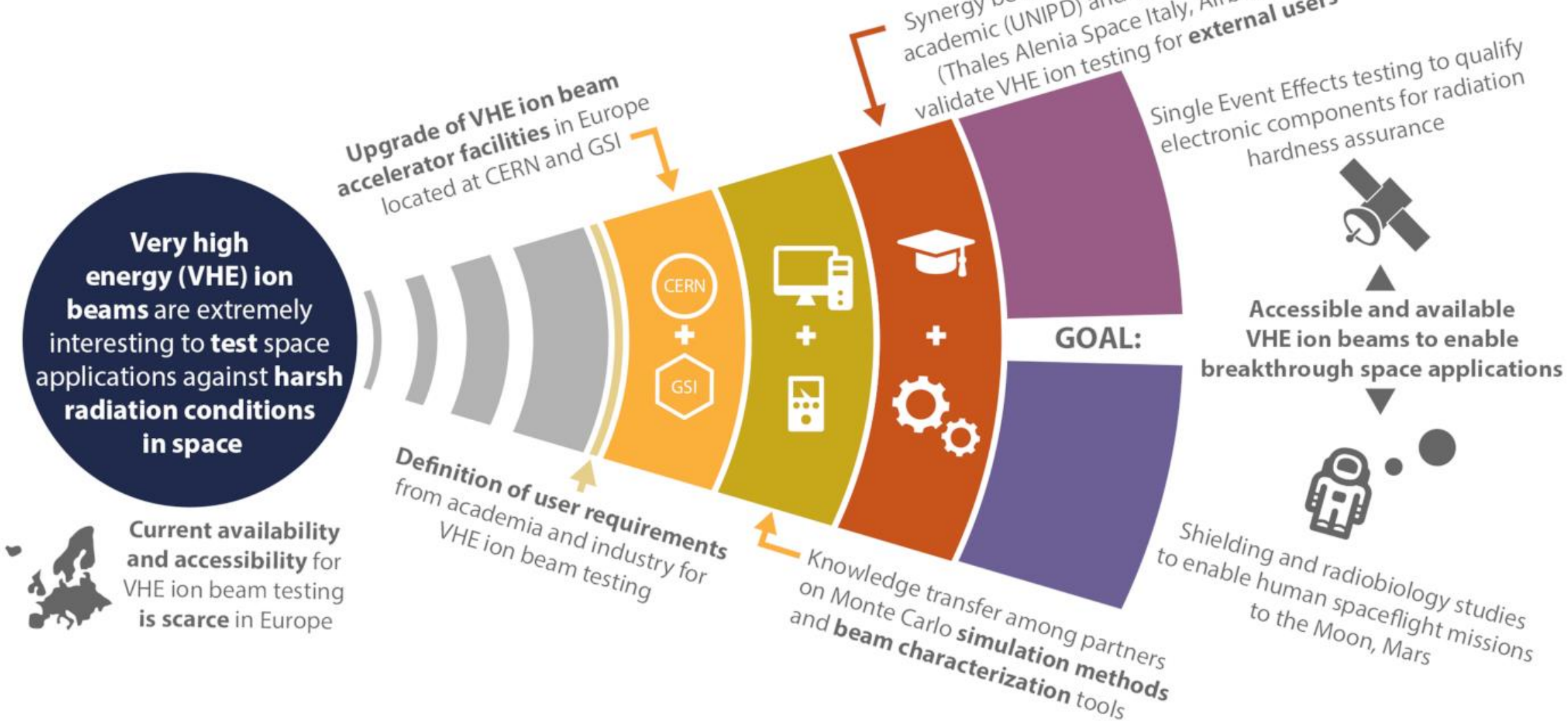
February 6th 2024
HEARTS Annual Meeting @CERN

Markus Brugger

An Amazing Endeavor



Quite A History of European Projects

HORIZON 2020

RADiation and reliability challenges for electronics used in Space, Avionics, on the Ground and at Accelerators

HORIZON 2020

RADiation facility Network for the EXploration of effects for indusTry and research

HORIZON EUROPE

High-Energy Accelerators for Radiation Testing and Shielding

Start date 1 March 2017 — **End date** 28 February 2022

Funded under
EXCELLENT SCIENCE - Marie Skłodowska-Curie Actions

Total cost
€ 3 882 975,78

EU contribution
€ 3 882 975,78

RADSAGA

Coordinated by
ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE
Switzerland

Start date 1 June 2021 — **End date** 31 May 2025

Funded under
EXCELLENT SCIENCE - Research Infrastructures

Total cost
€ 4 999 999,75

EU contribution
€ 4 999 999,75

RADNEXT

Coordinated by
ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE
Switzerland

Start date 1 January 2023 — **End date** 31 December 2026

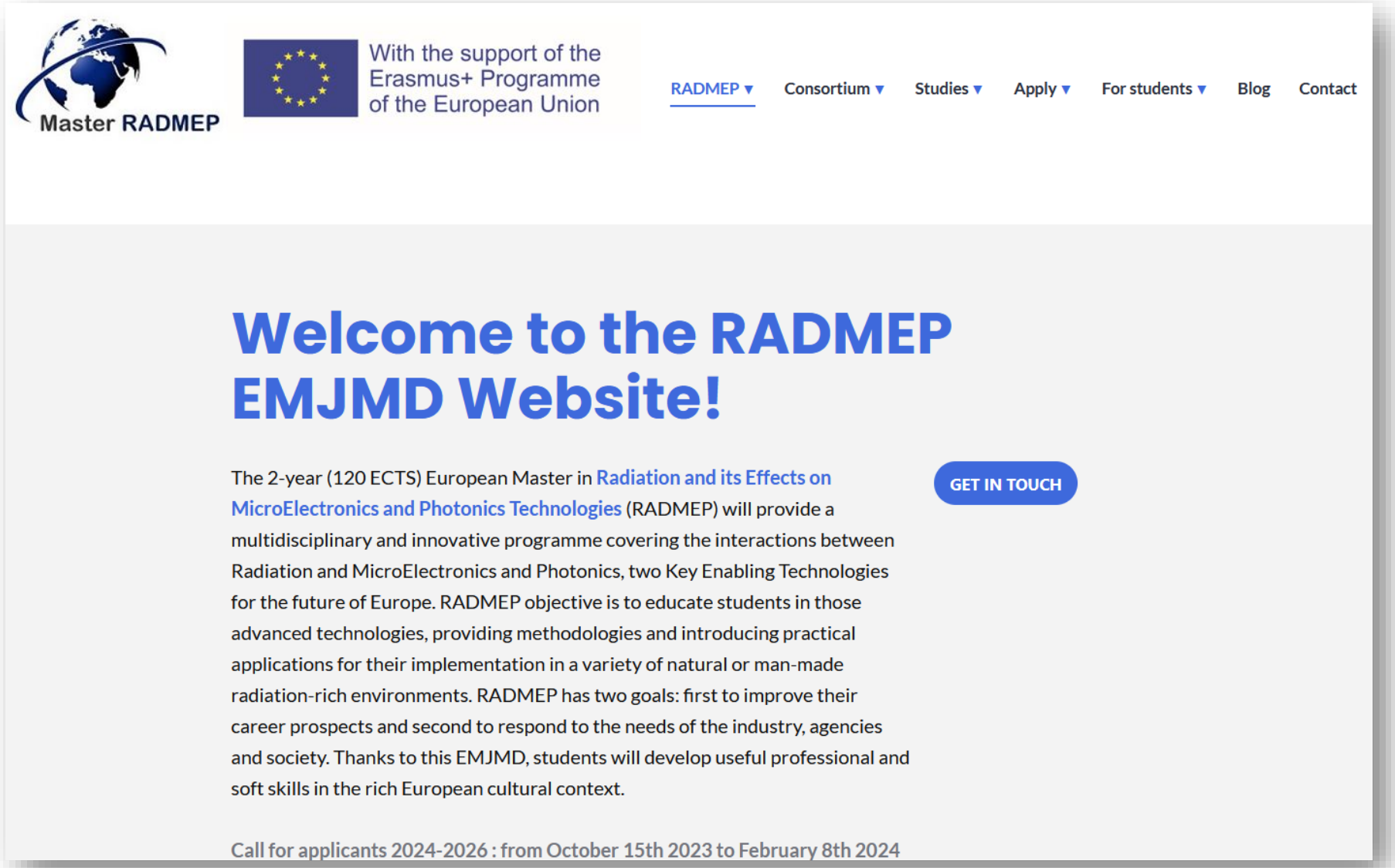
Funded under
Digital, Industry and Space

Total cost
€ 2 999 965,00

EU contribution
€ 2 999 965,00

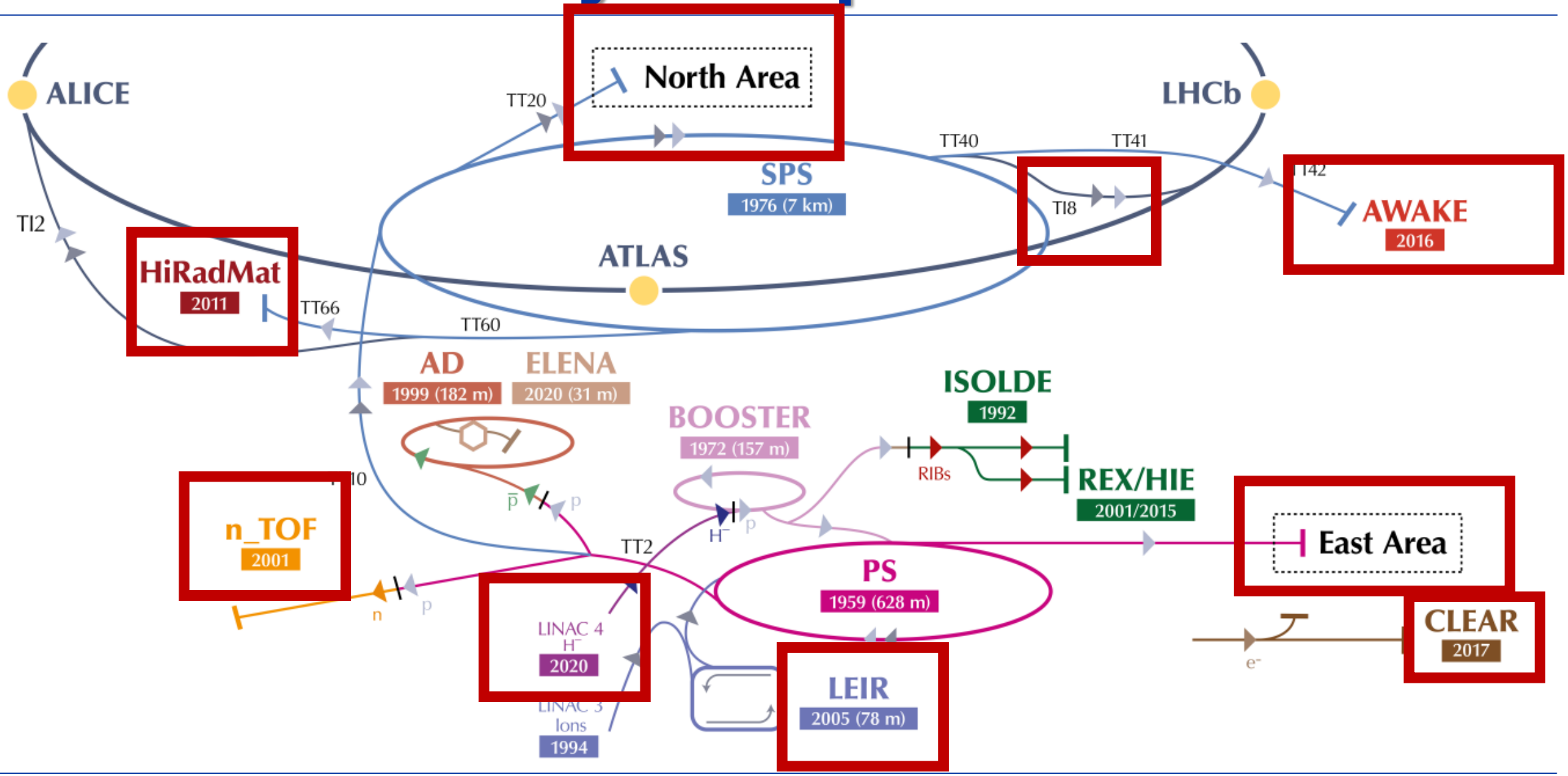
Coordinated by
ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE
Switzerland

RADMEP – a RADSAGA Spin-Off

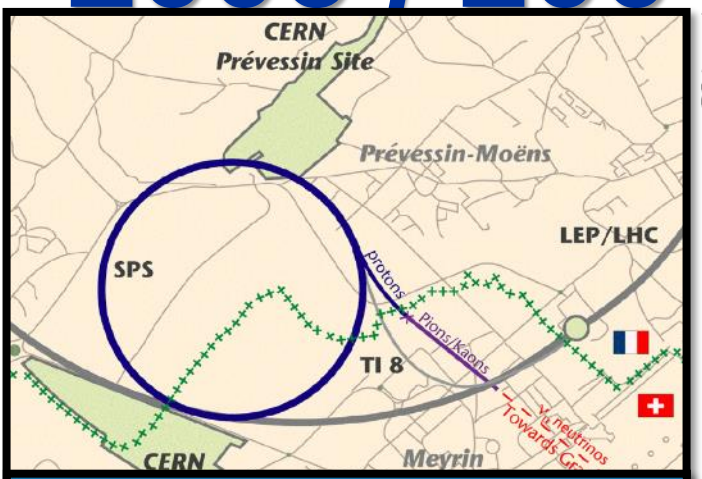


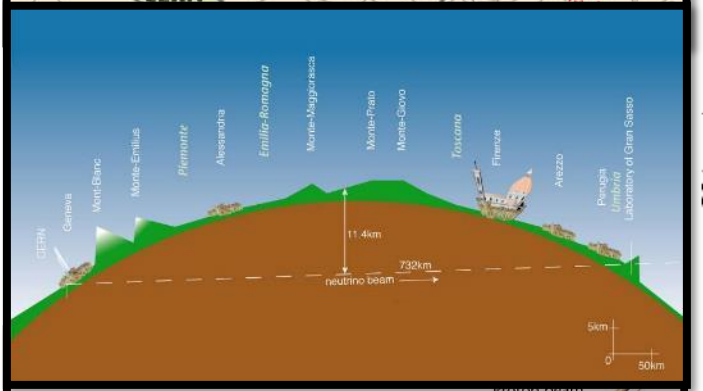
A Brief History of (CERN R2E Facility) Time

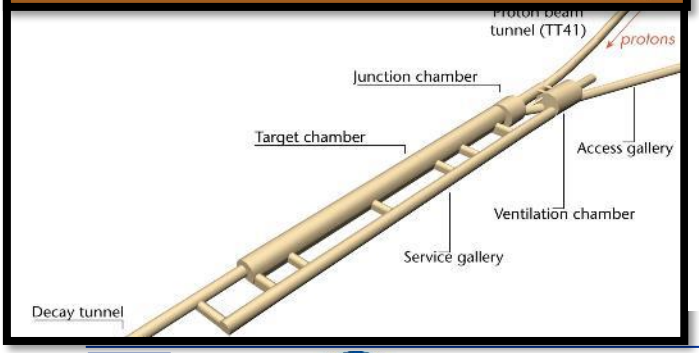
The R2E Facility Footprint over Time

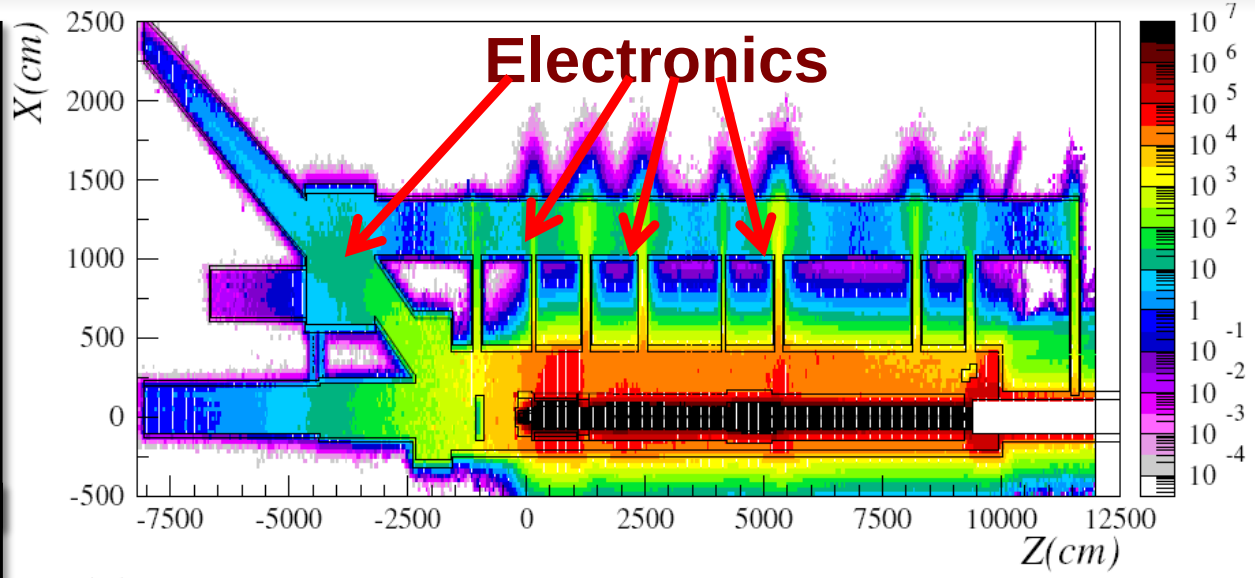


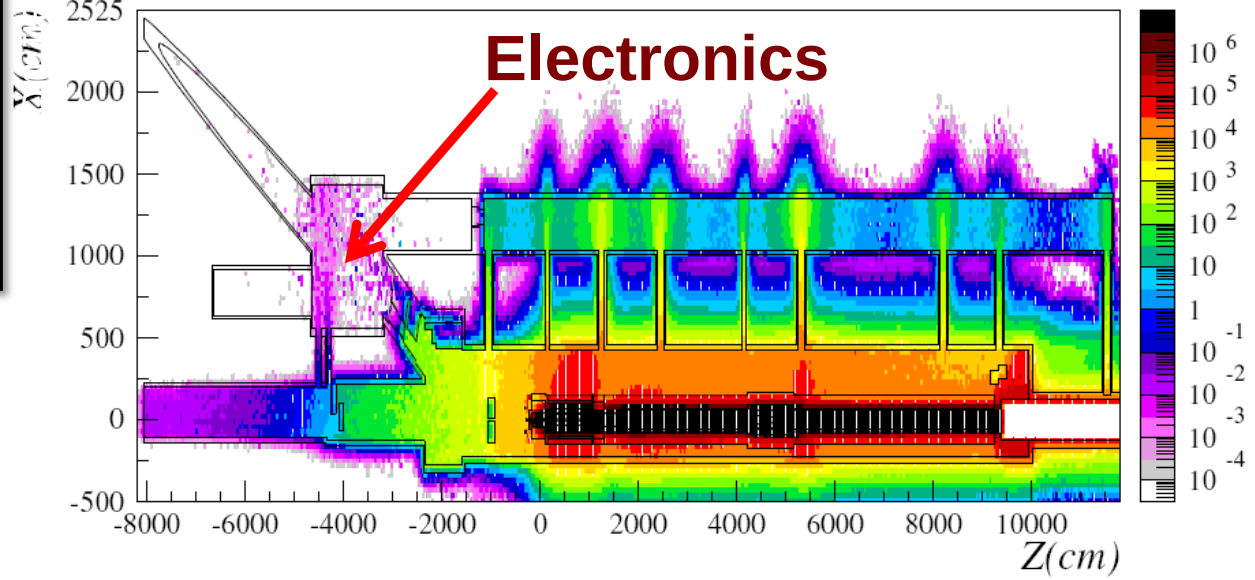
2006 / 2007 - CNGS











- 2006 – 2007 Electronics Failures
- Mitigation by Shielding

2002

TCC2 is Now Qualified to Provide a
Radiation Test Environment
Similar to That of the LHC Tunnel (Arcs)

TCC2 Test Area to be Used for the
Final Qualification of Electronic Equipment

Test Reports Demonstrate that

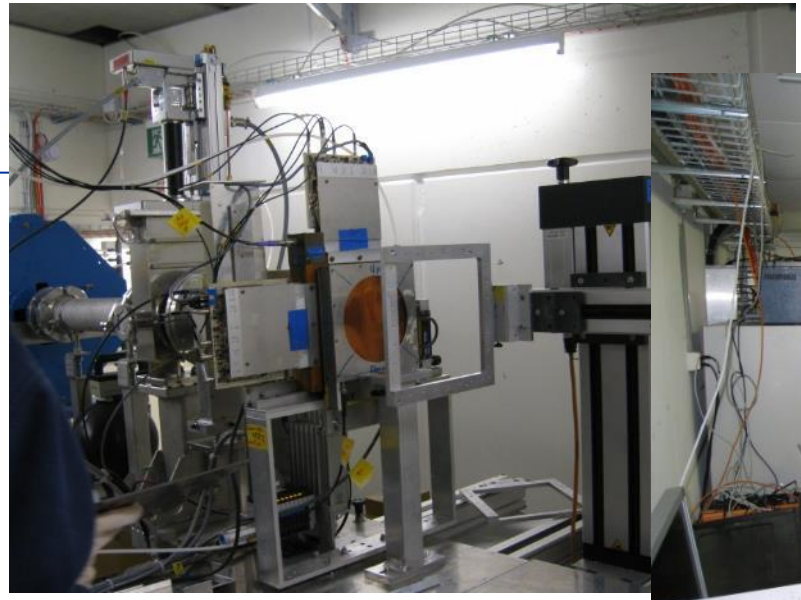
All Electronic Components, Equipment & Systems

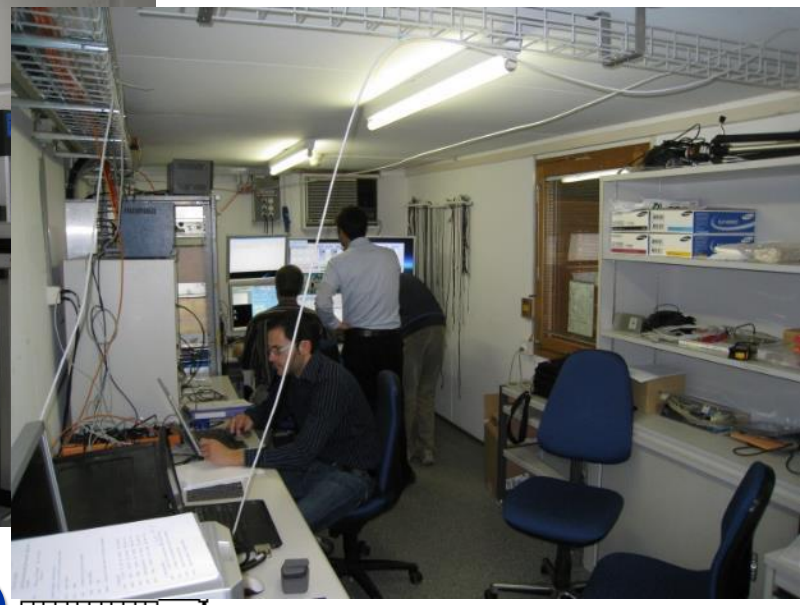
Intended for Installation in the LHC Tunnel

Must be Radiation Qualified.

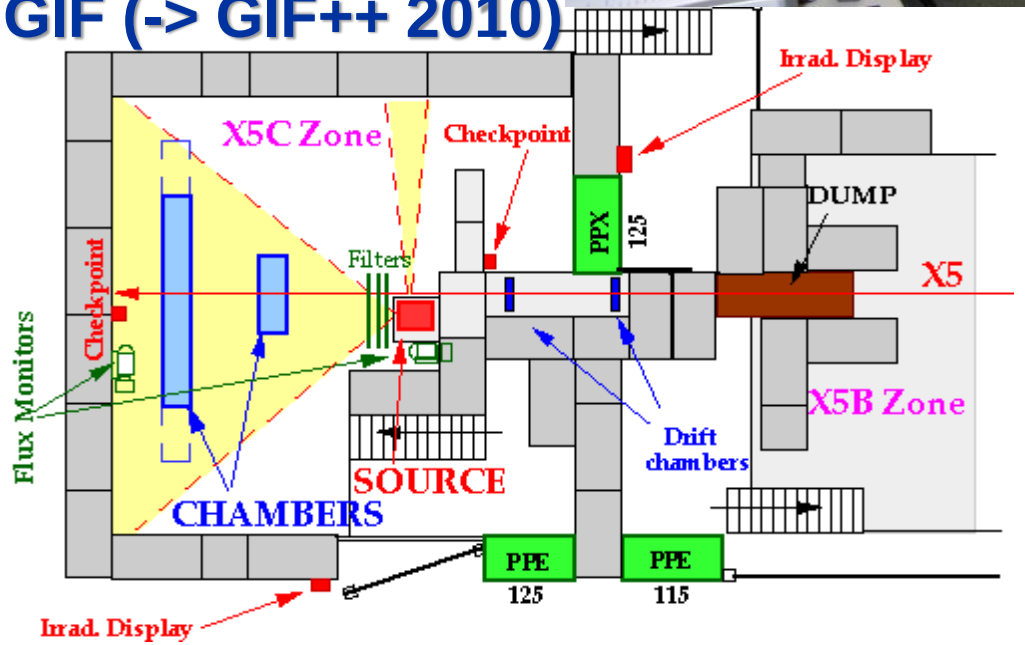
2006 - 2008

- Protons
  - Louvain
  - PSI
- Neutrons
  - CEA Reactor
  - Thermal neutron facilities
- Heavy-Ion Facilities
- @CERN
  - GIF
  - IRRAD
  - xRay
- …



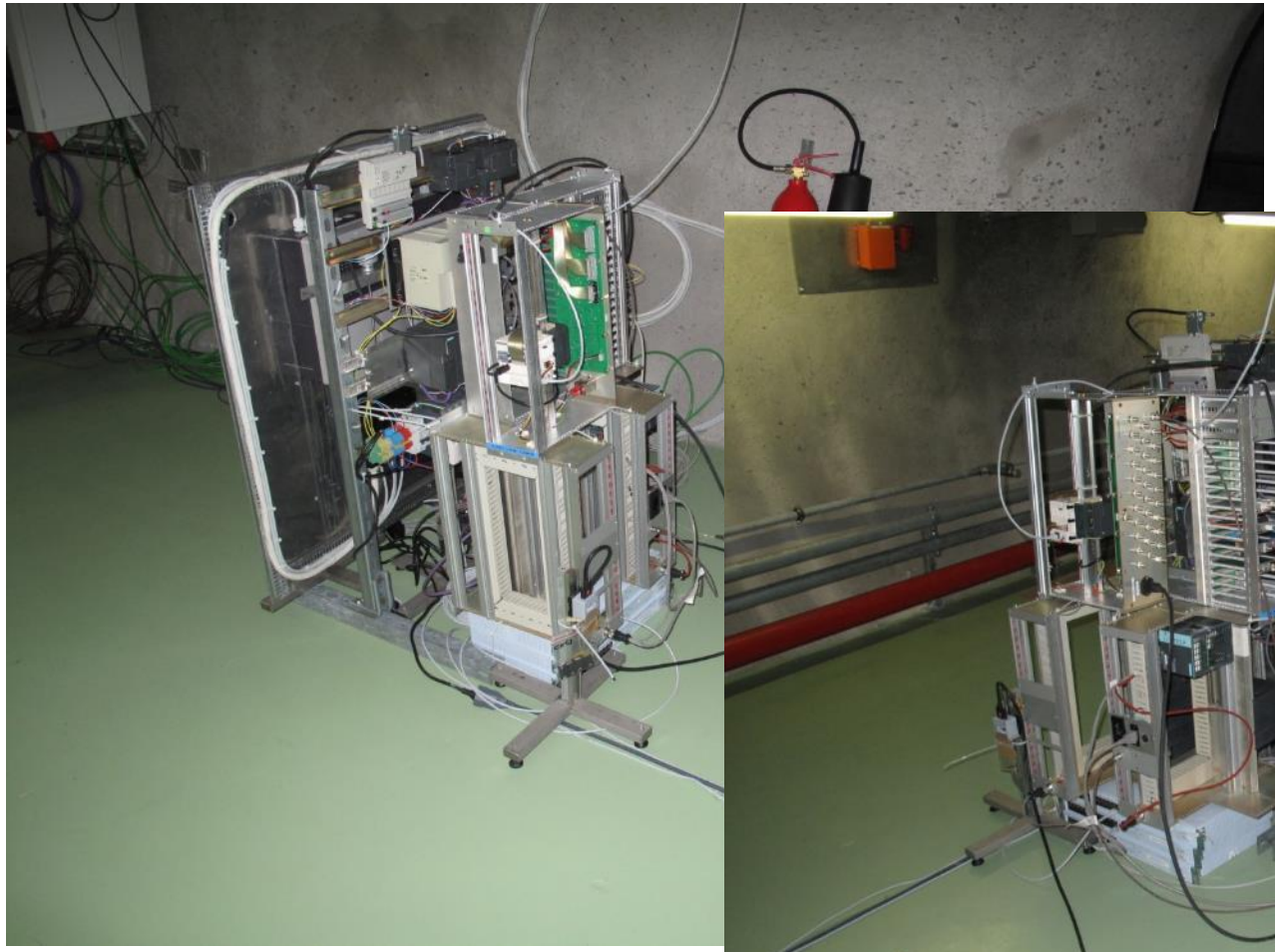


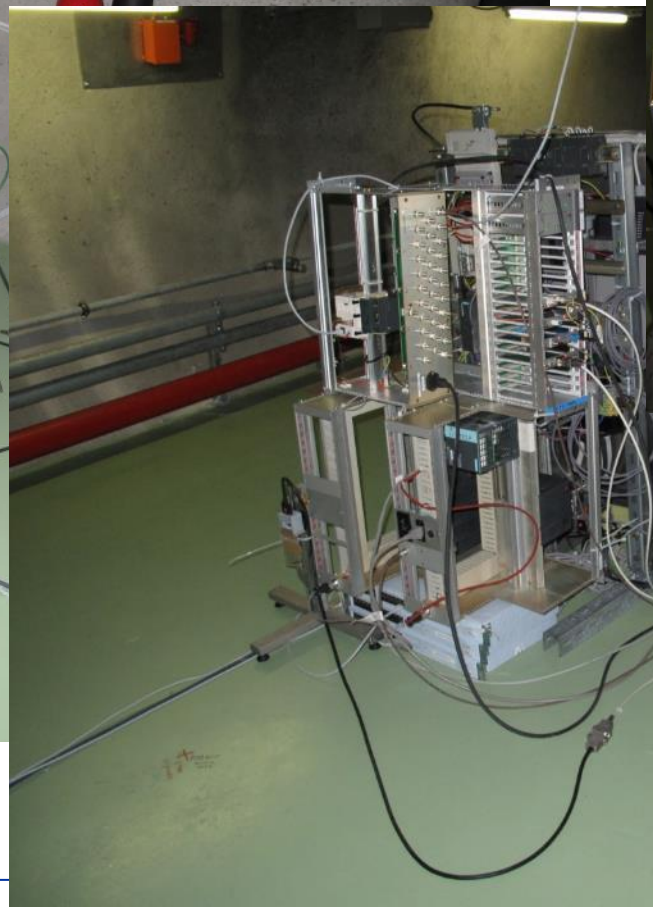
GIF (-> GIF++ 2010)

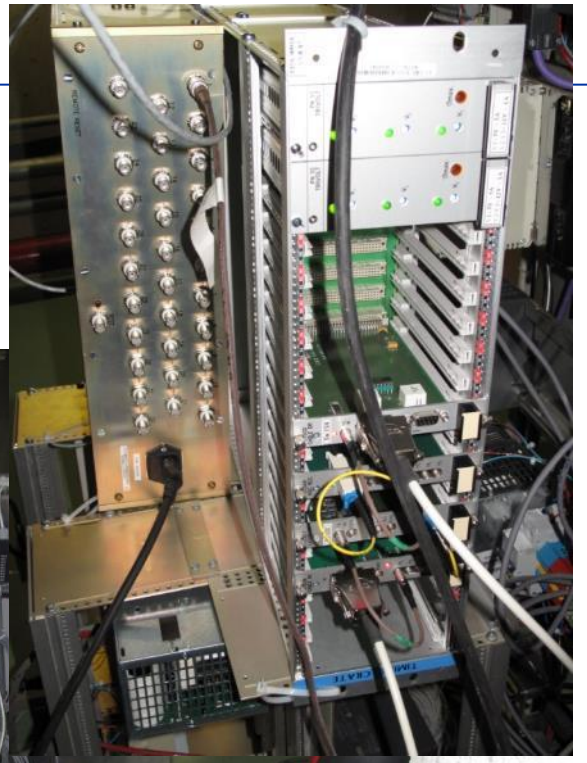


2007/2008 – TI8 Tests (UJ88)

2008 – CNGS -> CNRAD





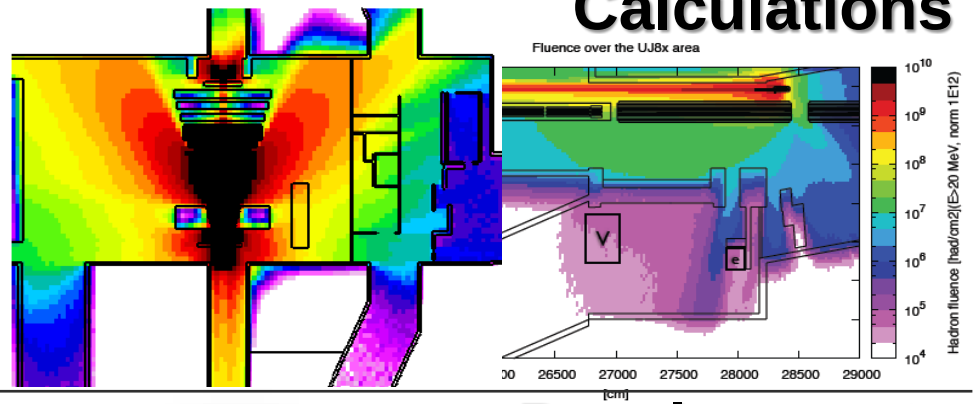


The ‘Tower of Pisa’

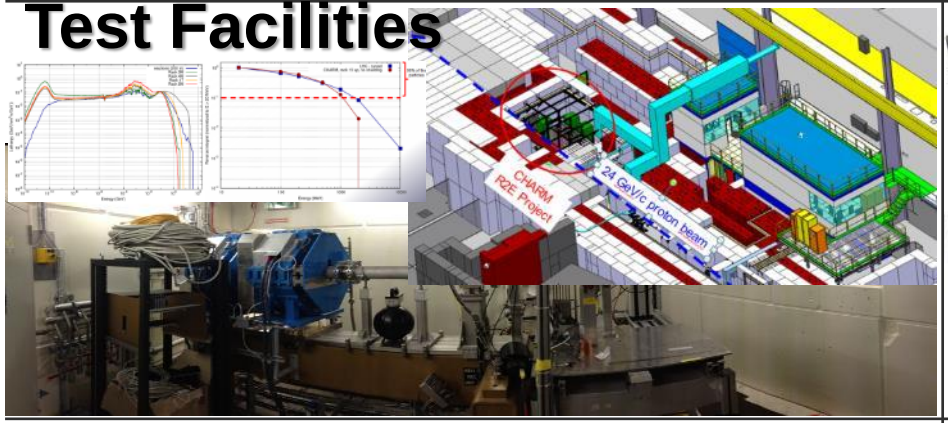
2010 R2E Strategy

Radiation Monitoring

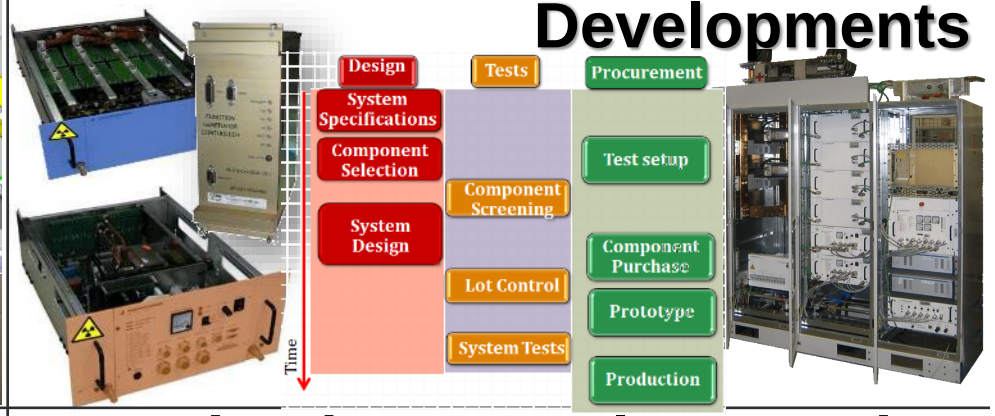
Calculations



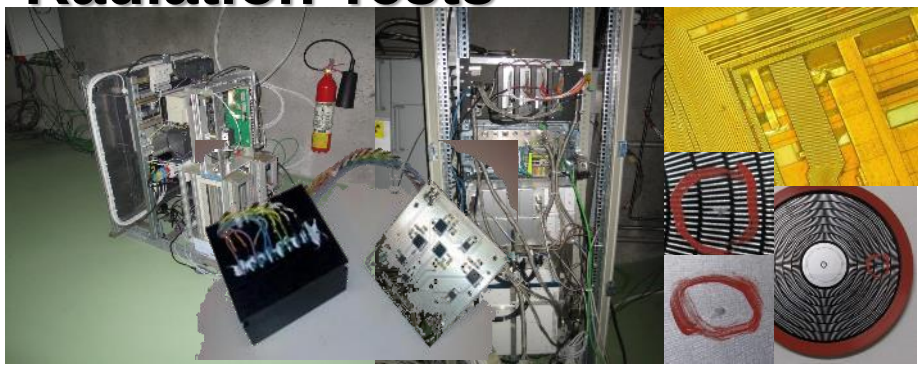
Test Facilities



Developments

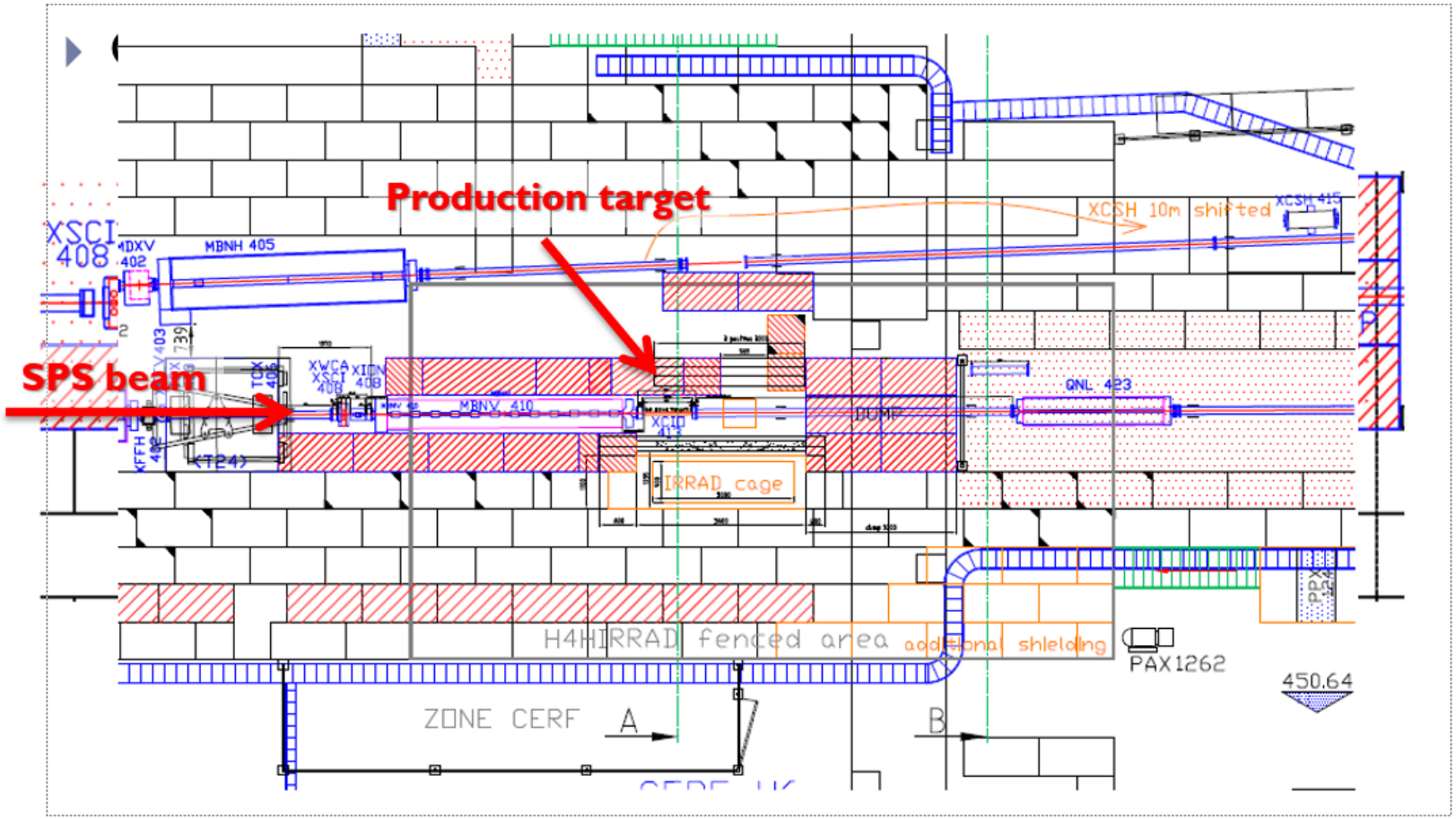


Radiation Tests



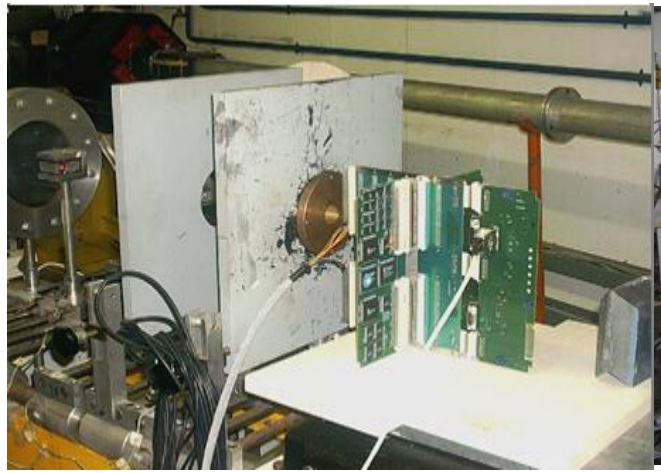
Production & Implementation

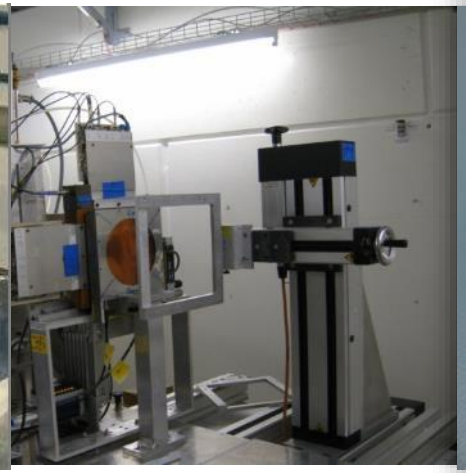
2010 H4IRRAD



2010 H4IRRAD

PSI Component Tests:





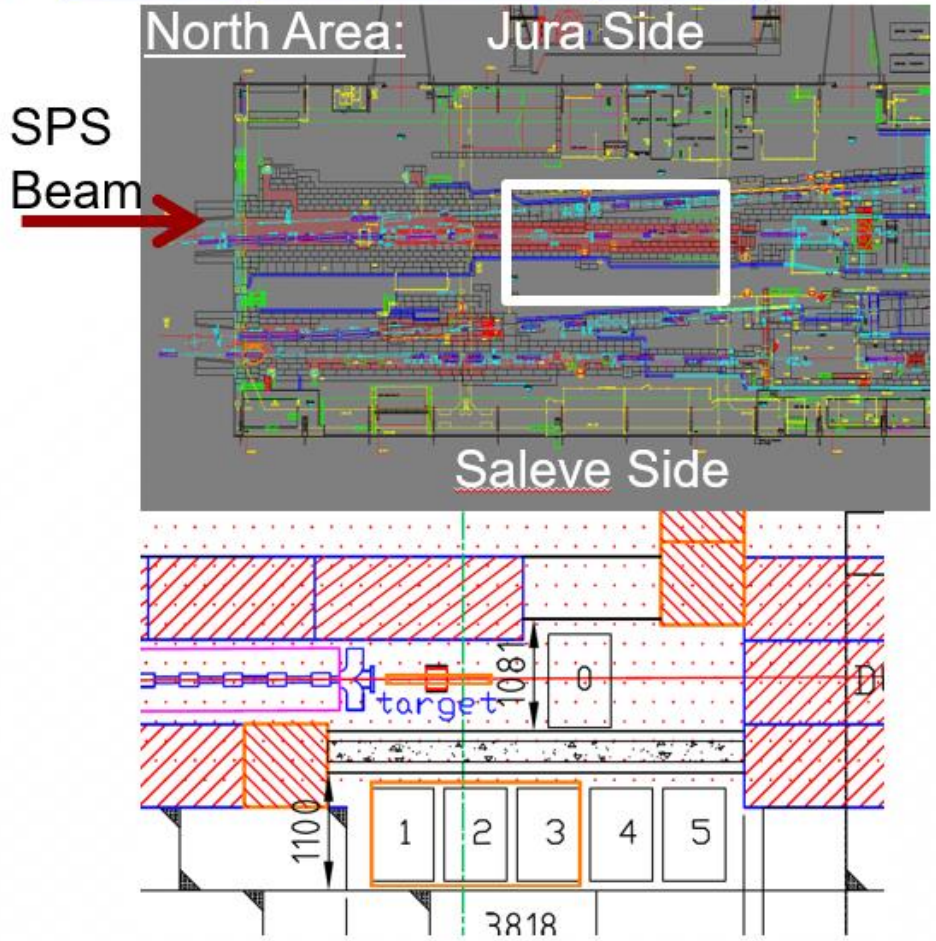
To FULL System Tests:

HERE

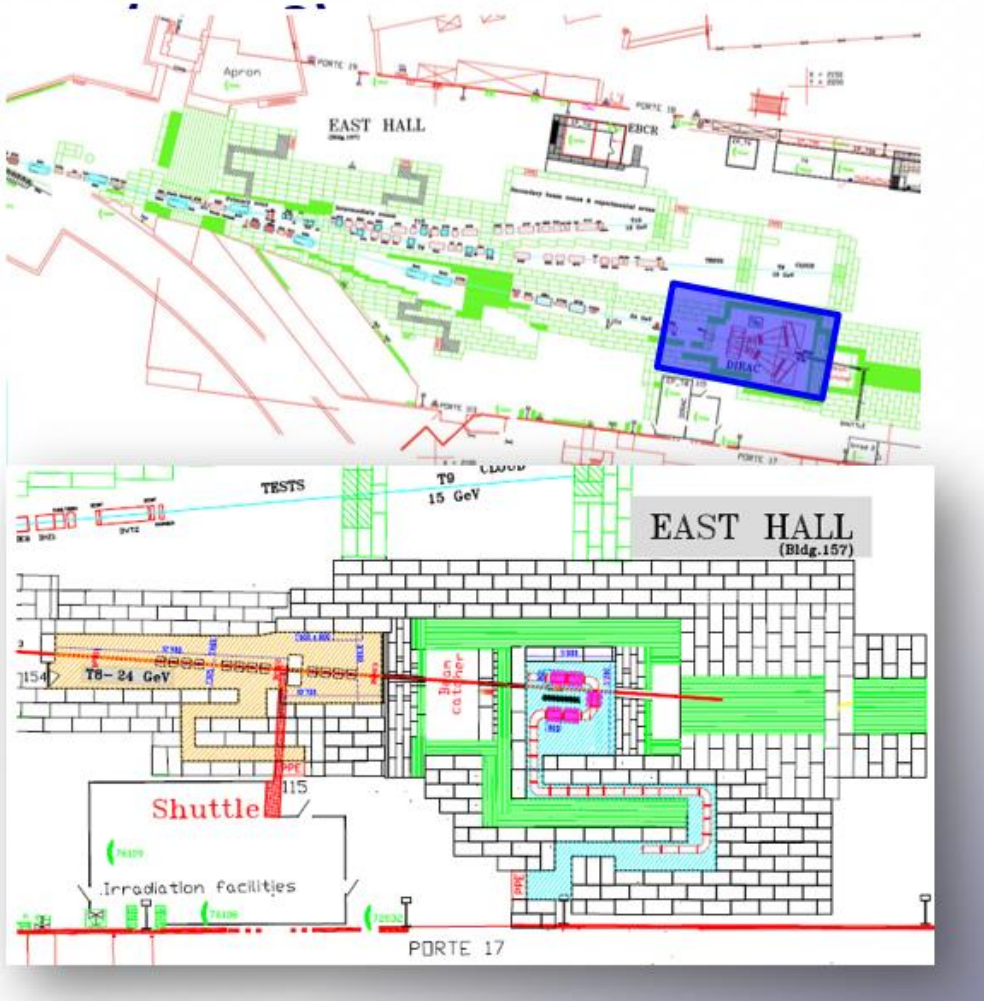
(W)HOW

2012 A New Idea

1st Step: H4IRRAD (2011)



2nd Step: PS-EastArea (2013?)



2012 -> 2013 CHARM

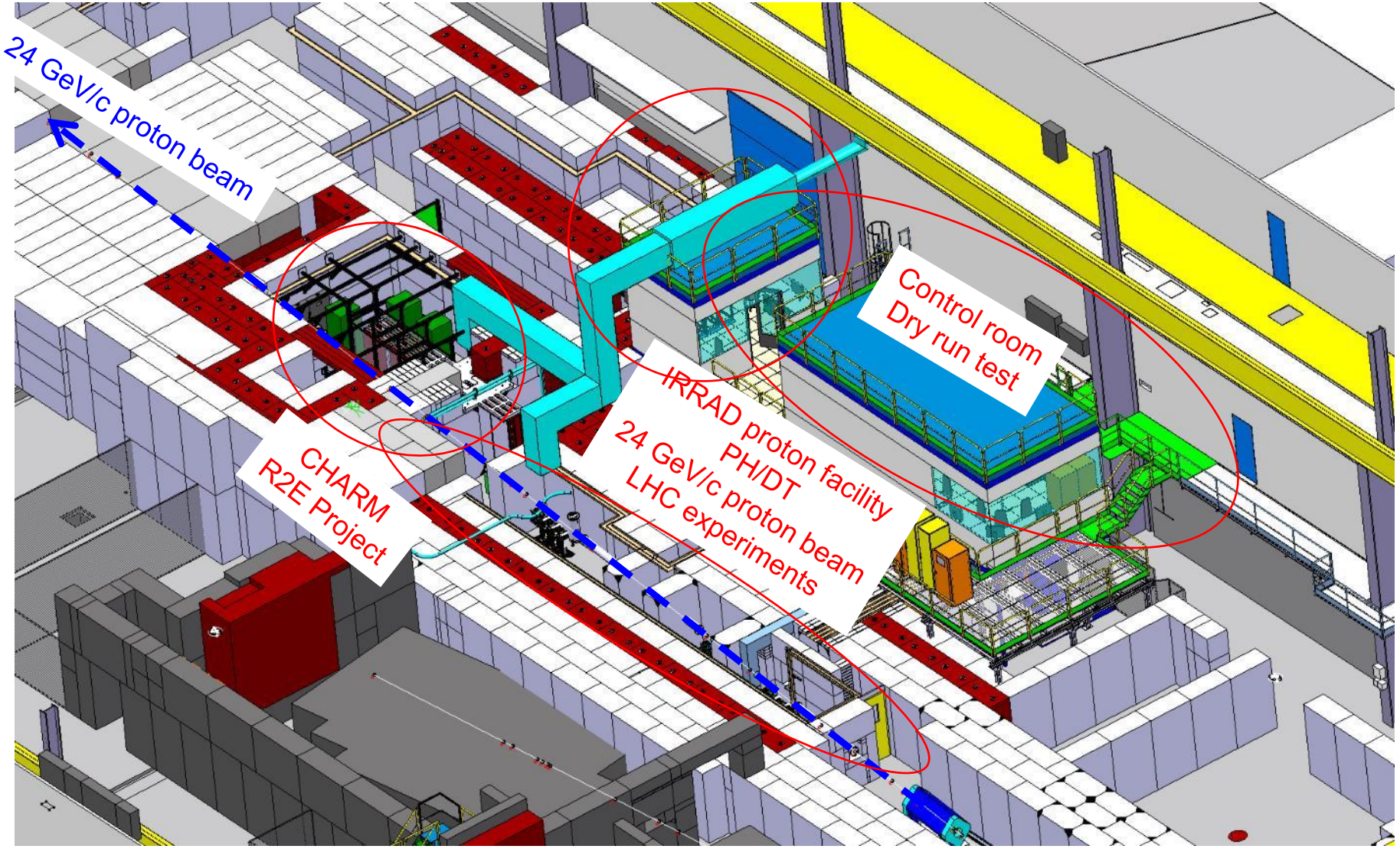
Cern High Energy AcceleRator Mixed Field/Facility

- We'd also Other Good Options,
- (Cern High Energy Radiation Facility)

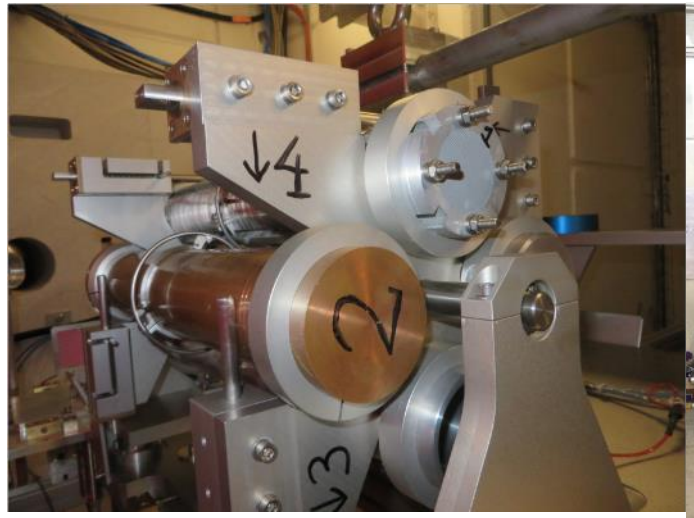
… But

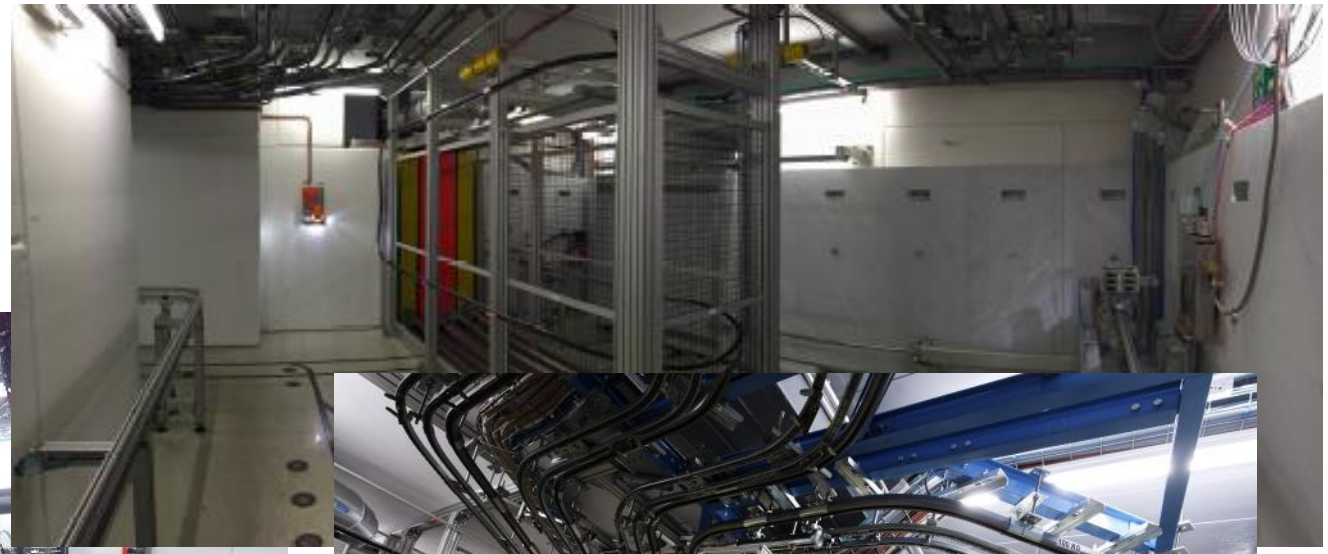
…CHER (French = expensive)

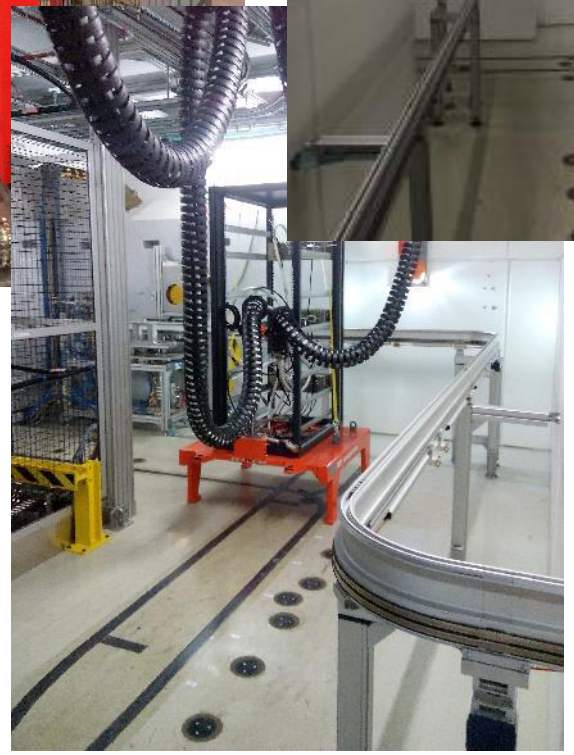
2012 -> 2013 CHARM

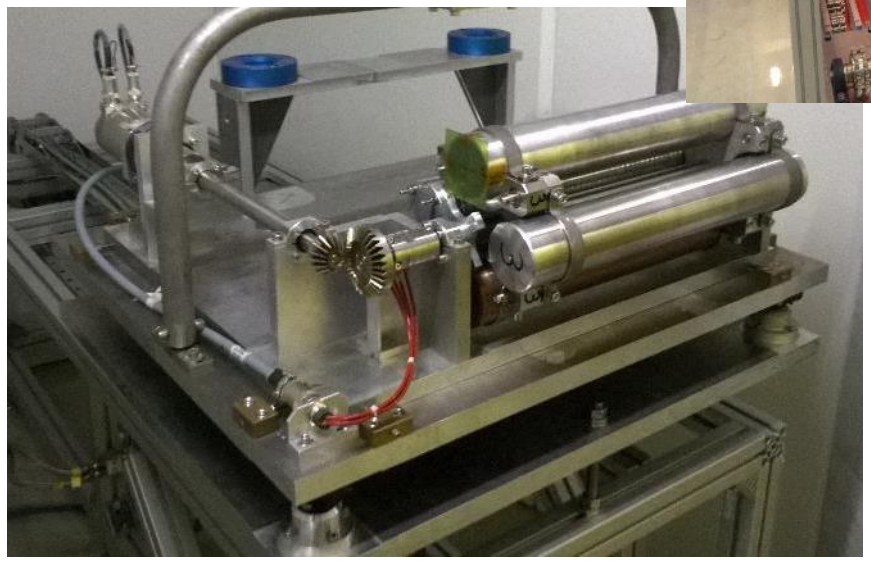


2012 -> 2013 CHARM



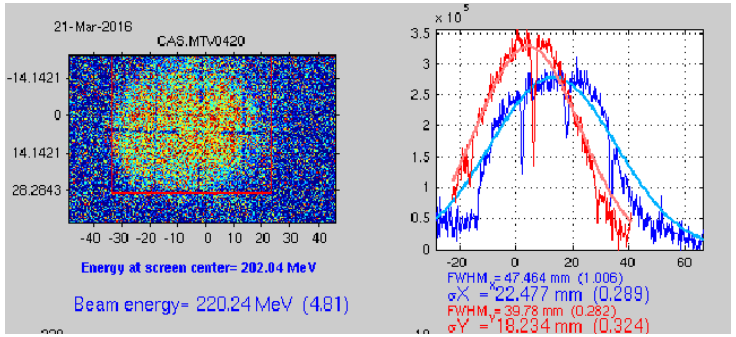




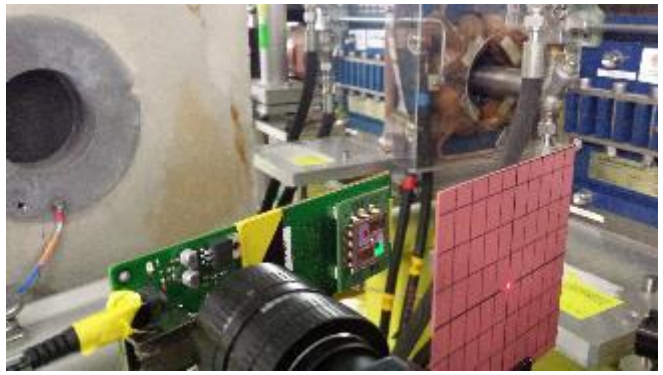


2014 CC60

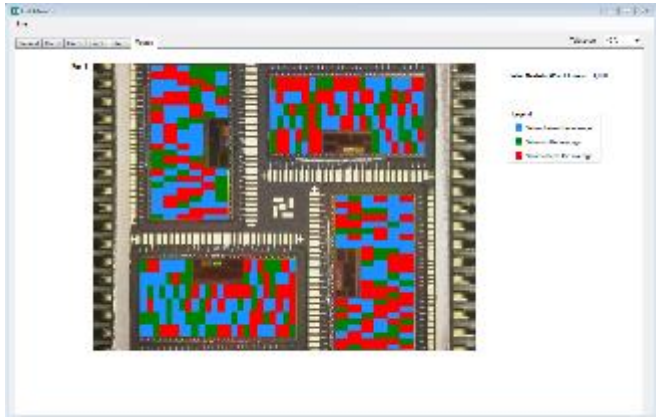
2015 CLEAR -> High-E Electrons



BTV screen for beam profile monitoring



Laser alignment system

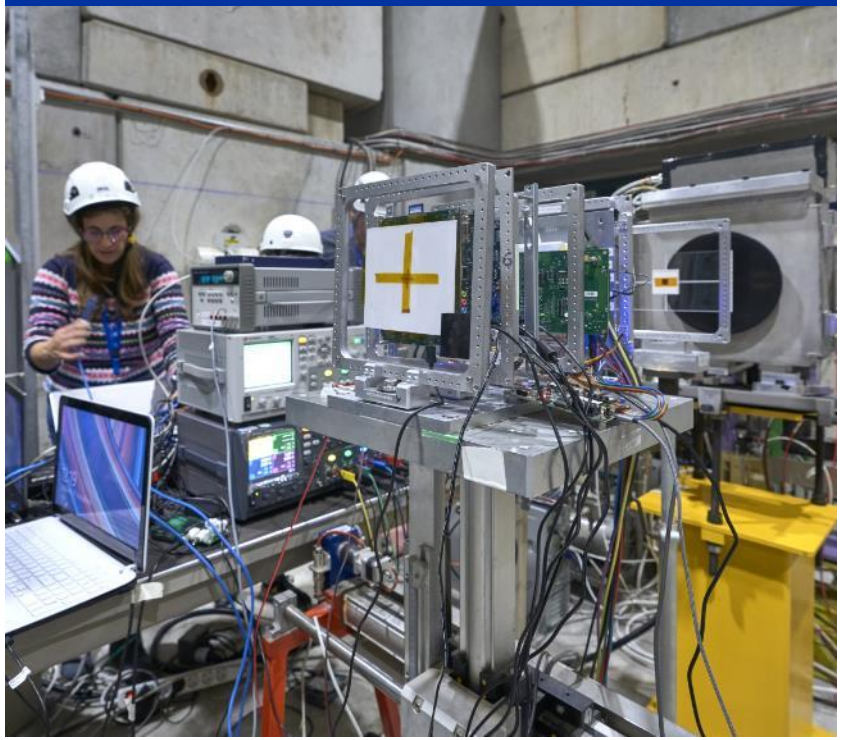


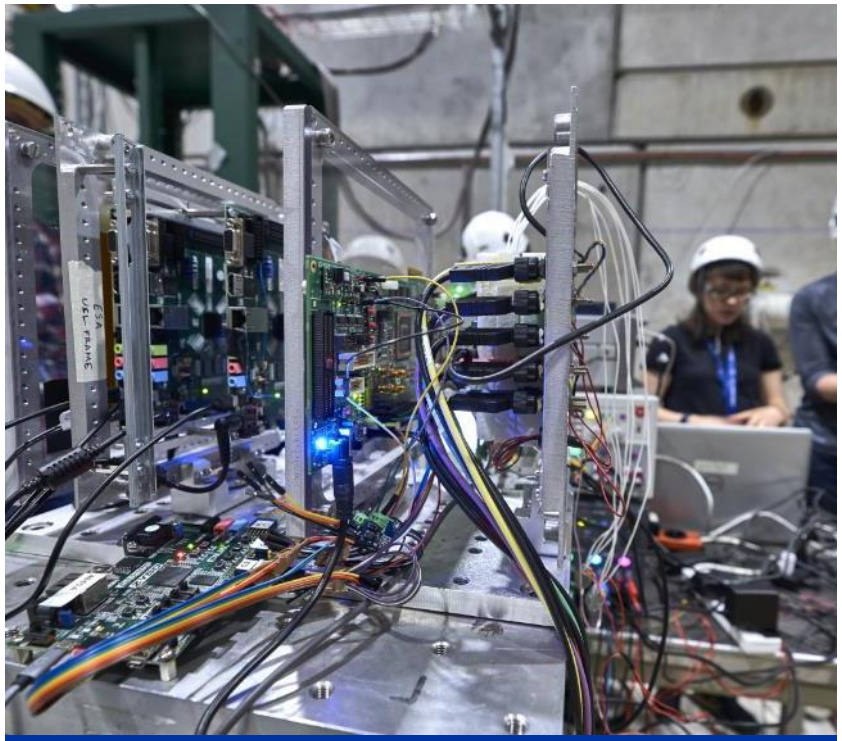
ESA Monitor SEU distribution (20 x 20 mm^2)

2017+ High-E HI @CHARM and @NA

Modified NA User Area

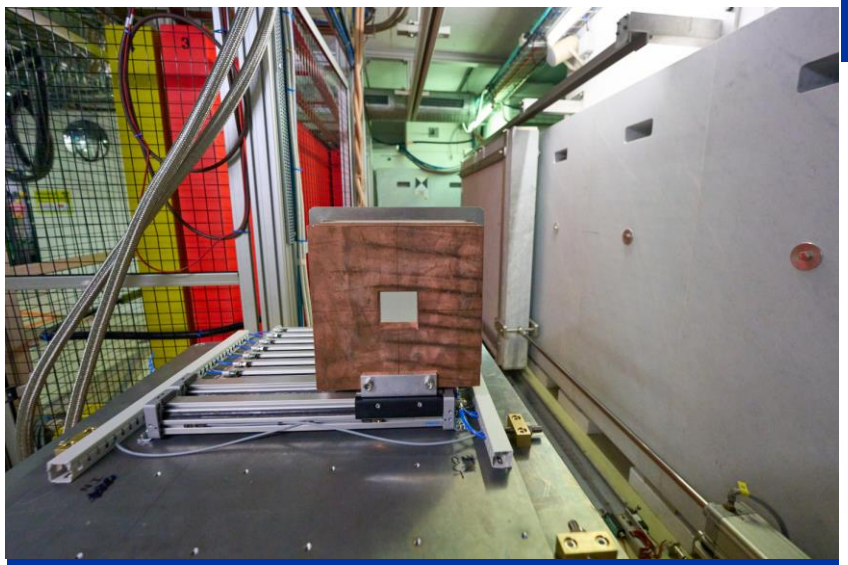
First Test Setups





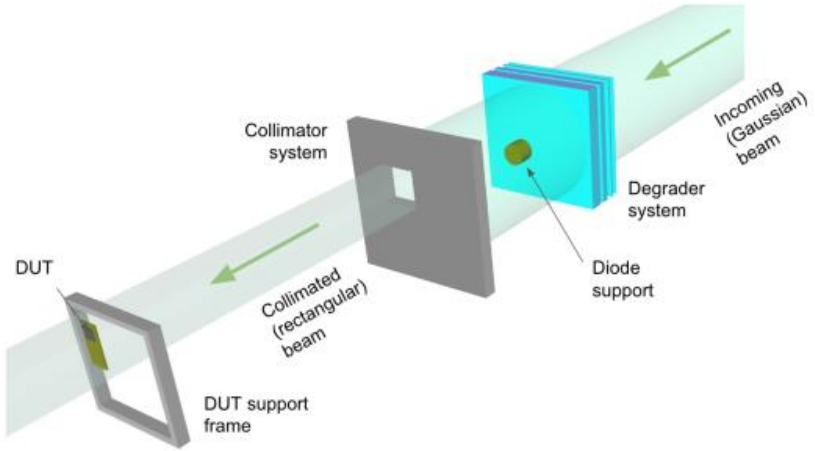
Benchmarking & 1st Tests

2017+ High-E HI @CHARM and @NA



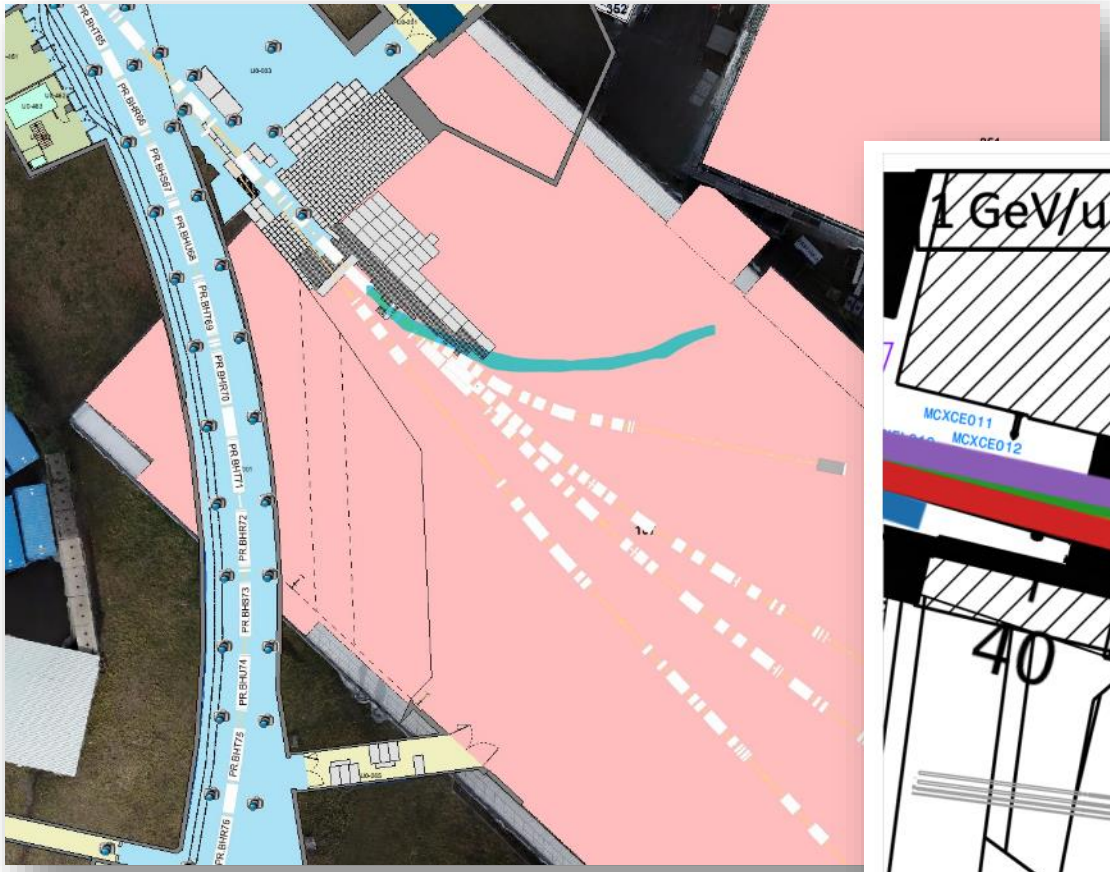
Ions @CHARM

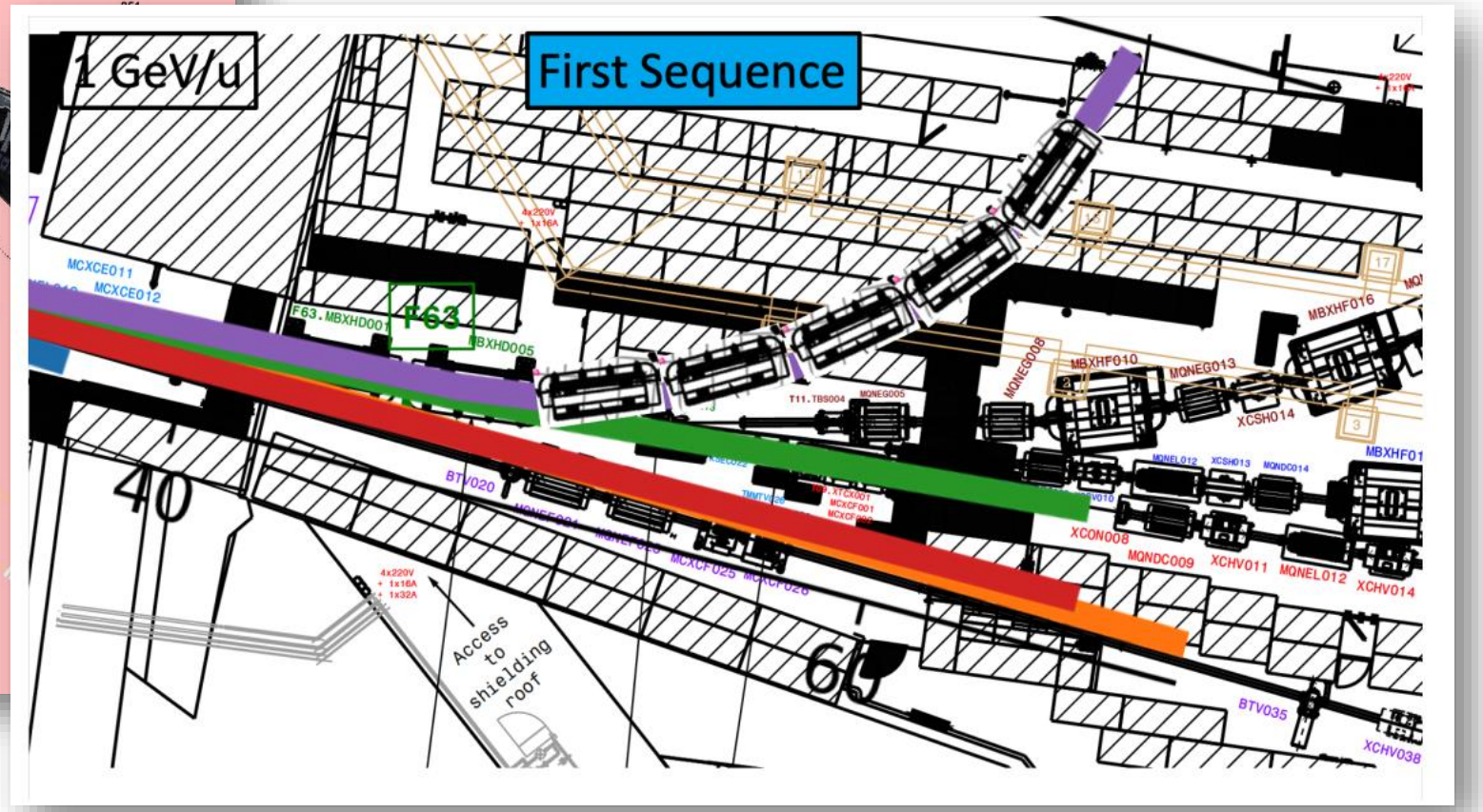
Degrader Design



Installation @ Conveyor

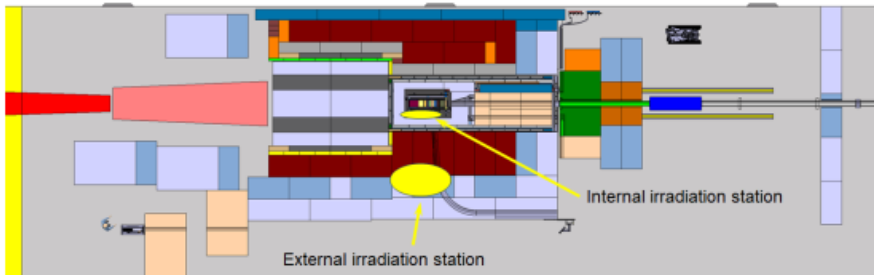
NEW (Challenging) HEARTS IDEAS





And others to consider…

- **Irradiation Stations @SHIP**



- **LEIR**
  - **-> BioLEIR**
  - **-> R2E LEIR ?**

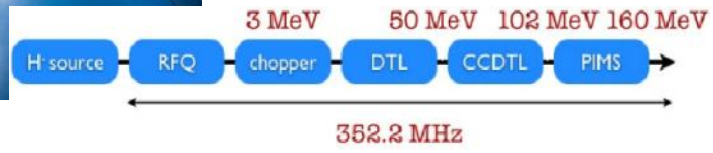
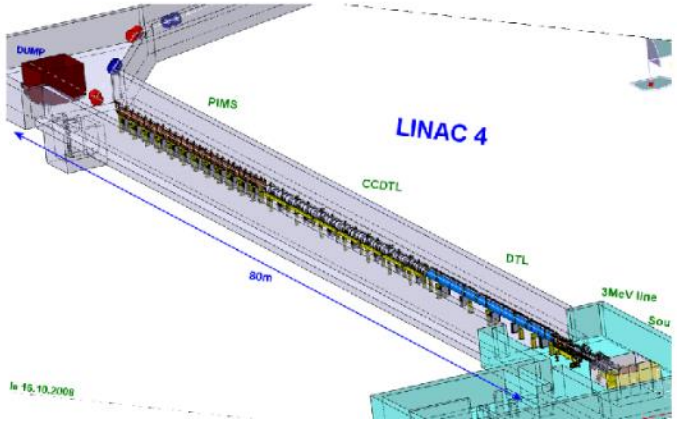
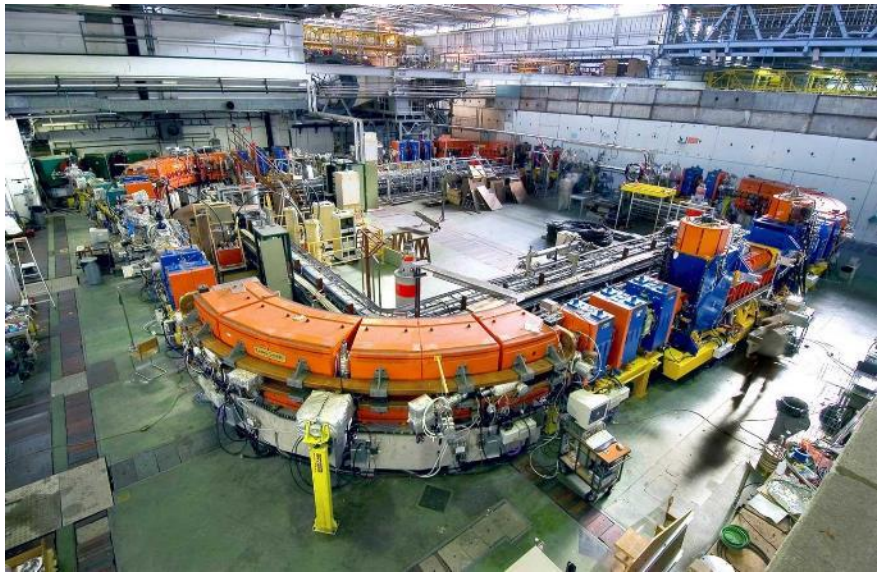


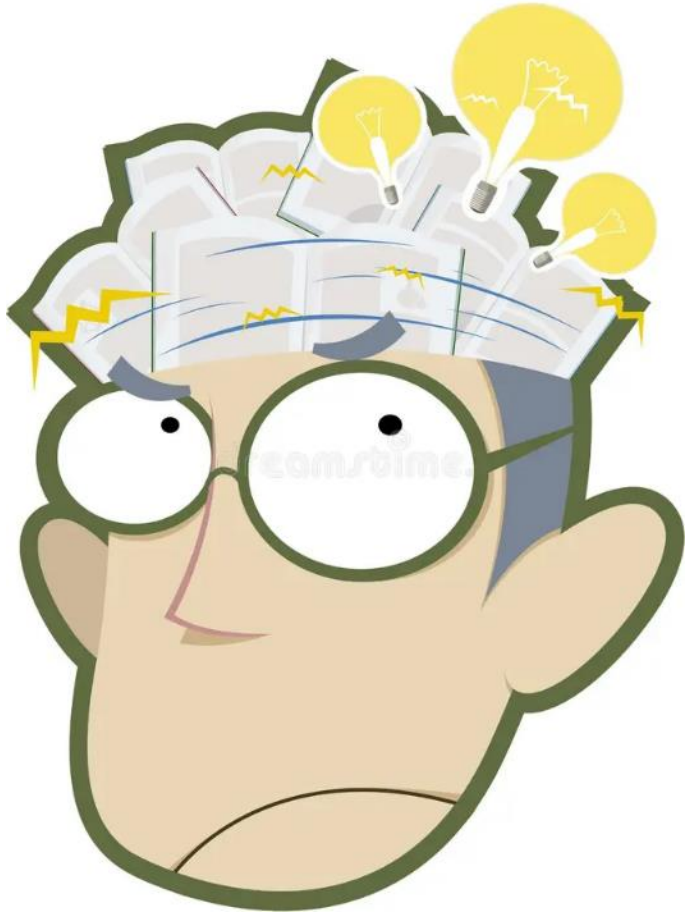
Figure 2: Linac4 layout.

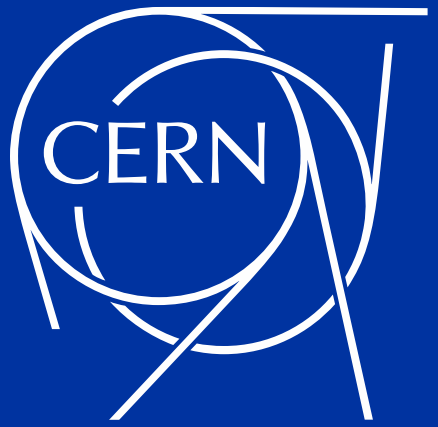
- **LINAC-4 Dump Line**





… Wishing You a GREAT Meeting





!!! WELCOME & ENJOY !!!