HiRadMat at CERN SPS— A dedicated facility providing high intensity beam pulses to material samples

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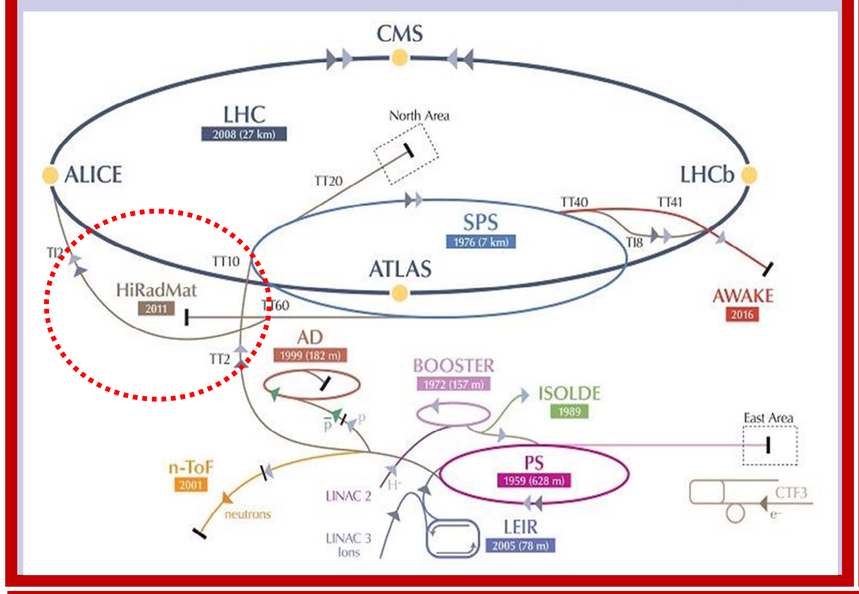
Abstract

HiRadMat (**Hi**gh **Rad**iation to **Mat**erials), constructed in 2011, is a facility at CERN designed to provide high-intensity pulsed beams to an irradiation area where material samples as well as accelerator component assemblies (e.g. vacuum windows, high power beam targets, collimators…) can be tested. The facility uses a 440 GeV proton beam extracted from the CERN SPS with a pulse length of up to 7.2 us, and with a maximum pulse energy of 3.4 MJ ($3x10^{13}$ proton/pulse). In addition to protons, ion beams with energy of 440 GeV/charge and total pulse energy of 21 kJ can be provided. The beam parameters can be tuned to match the needs of each experiment.

HiRadMat is not an irradiation facility where large doses on equipment can be accumulated. It is rather a test area designed to perform single pulse experiments to evaluate the effect of high-intensity pulsed beams on materials or accelerator component assemblies in a controlled environment. The facility is designed for a maximum of 10^{16} protons per year, distributed among 10 experiments, each having a total of 10^{15} protons or about 100 high-intensity pulses. This poster will also demonstrate the possibilities for research using this facility and showing examples of upcoming experiments scheduled for the coming beam period starting in autumn 2014. Beam operation to HiRadMat will resume in autumn 2014, initially with proton beam availability, while in early 2015 Argon ions will also be available.

PRESENTED AT NUMAT14, 24—30 OCTOBER 2014, CLEARWATER, FLORIDA, USA

Location: CERN Accelerator Complex



Proton & Ion Beam Parameters

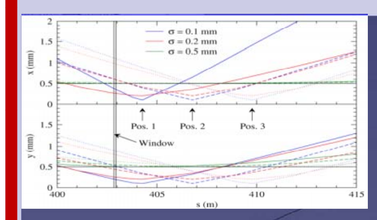
Not an irradiation facility for large doses !

Beam parameter	Protons	Pb^{82+}
Nominal energy	440 GeV	173.5 GeV/nucleon
Pulse Energy	up to 3.4 MJ	up to 21 kJ
Bunch Intensity [protons]	$5.0 \cdot 10^{9}$ - $1.7 \cdot 10^{11}$	$3 \cdot 10^{7}$ to $7 \cdot 10^{7}$
Number of bunches per pulse	1— 288	52
Bunch spacing [ns]	25, 50, 75 or 150	100
Pulse length [μs]	7.2	5.2
Beam size at target	Variable around 1 mm^2	

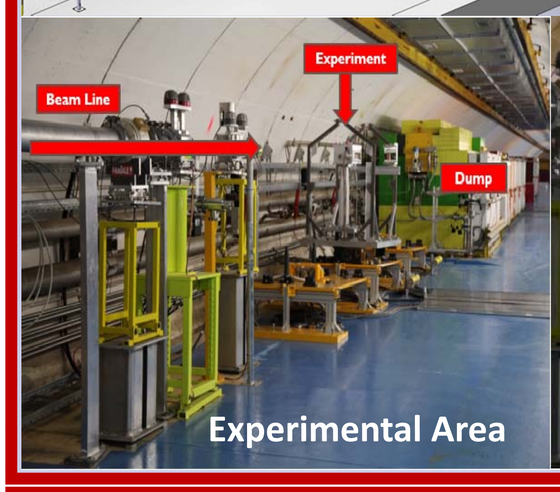
Annual proton budget limited to 10^{16} protons

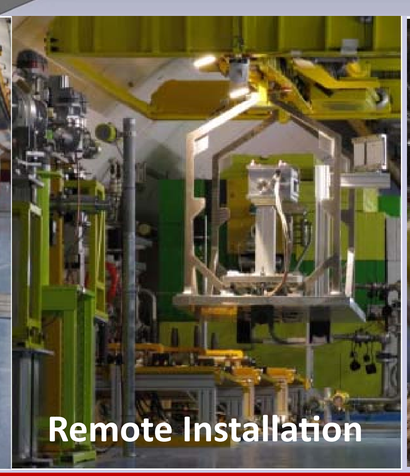
- **To be shared amongst the experiments**

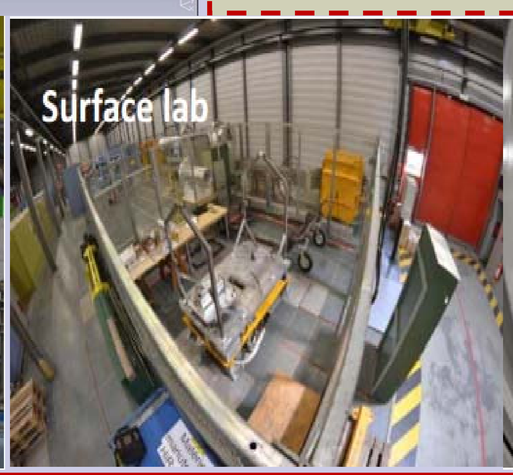
Facility's Layout and Services



- **3 stands for experiments, supporting remote installation and moving to a dedicated cool—down zone**
  - **Equipped with automatic connections for signals, electricity (low and high voltage) and water**
- **Preparation lab (same interface us the underground area) at surface for safe commissioning and installation and pre-flight check of the experiment.**
- **Availability of various experimental instruments:**
  - **High Speed Camera, Laser-Doppler Vibrometer, Microphones, Beam Loss Monitors…**



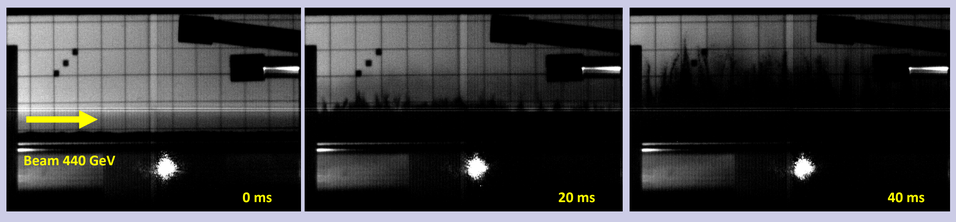




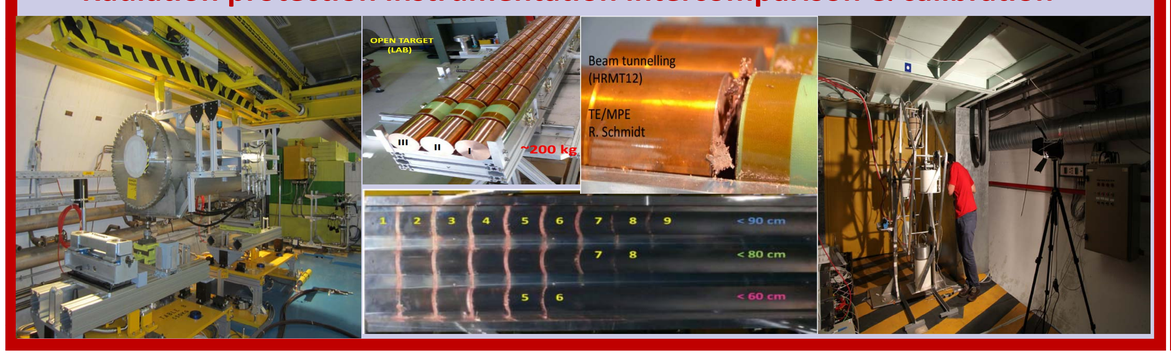
Highlights of experiments in 2012

9 experiments successfully completed

- New high power target concepts for secondary particles production (W-powder)
- Impact of high-intensity beam to LHC collimator
- Characterization of six different materials under the beam impact

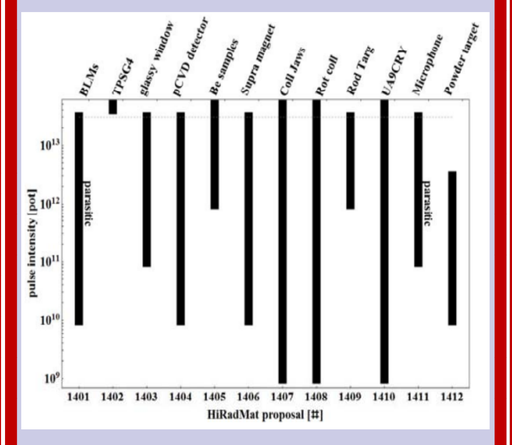


- Robustness test of beam septum collimator (9 m long installation)
- Radiation protection instrumentation intercomparison & calibration



Experiments planned for 2014—2015

12 applications received !



Beam instrumentation, high power targets, microphones, beam windows . . .

Experiment approval process

1. **Submit application for beam time**
   - Scientific interest, pulse list, installation drawing, preliminary safety documentation
2. **Initial discussion with facility management**
3. **Review by HiRadMat Scientific Board**
4. **Review by HiRadMat Technical Board**
   - Safety review, beam availability review, technical review

Positive recommendation from the above boards *validates* the beam slot allocation to the schedule

- Possible users' financial support by EuCard2—Transnational Access

For more information :
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