HiRadMat: A high-energy, pulsed beam, material irradiation facility

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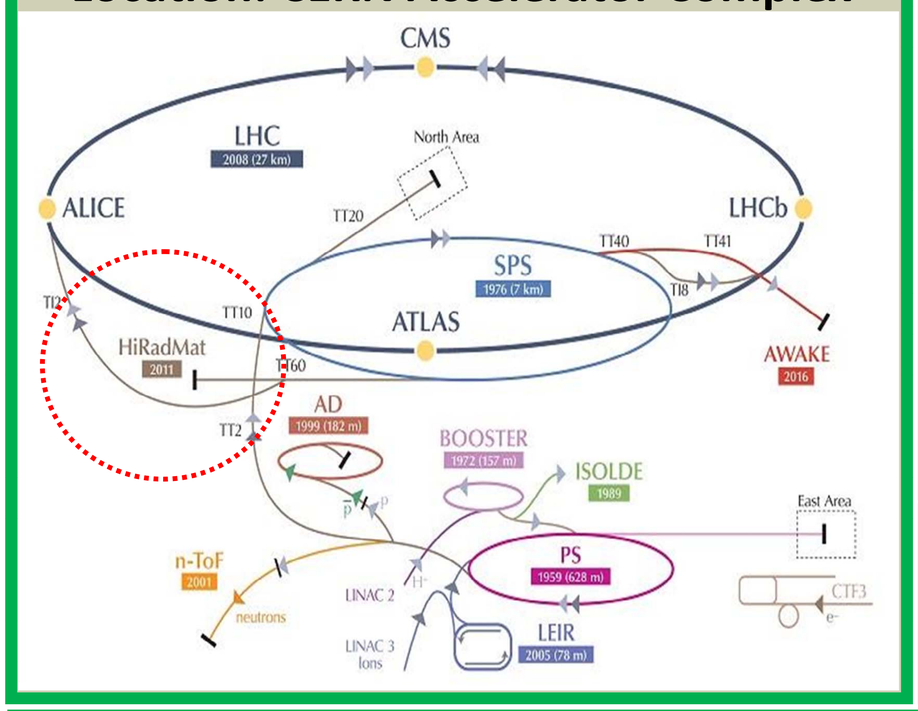
HiRadMat is a facility constructed in 2011, designed to provide high-intensity pulsed beams to an irradiation area where different material samples or accelerator components can be tested. The facility, located at the CERN SPS accelerator complex, uses a 440 GeV proton beam with a pulse length up to 7.2 μs and a maximum intensity up to 10^{13} protons / pulse. The facility, a unique place for performing state-of-the art beam-to-material experiments, operates under transnational access and welcomes and financially supports, under certain conditions, experimental teams to perform their experiments.

PRESENTED AT 6TH HPTW, 11—15 APRIL 2016, OXFORD, U.K

Location: CERN Accelerator Complex



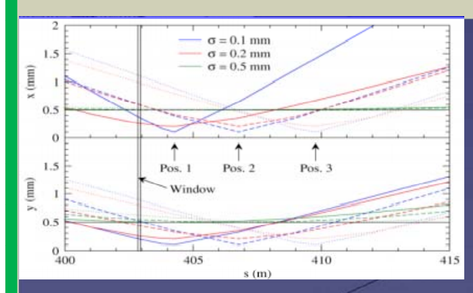
Proton & Ion Beam Parameters

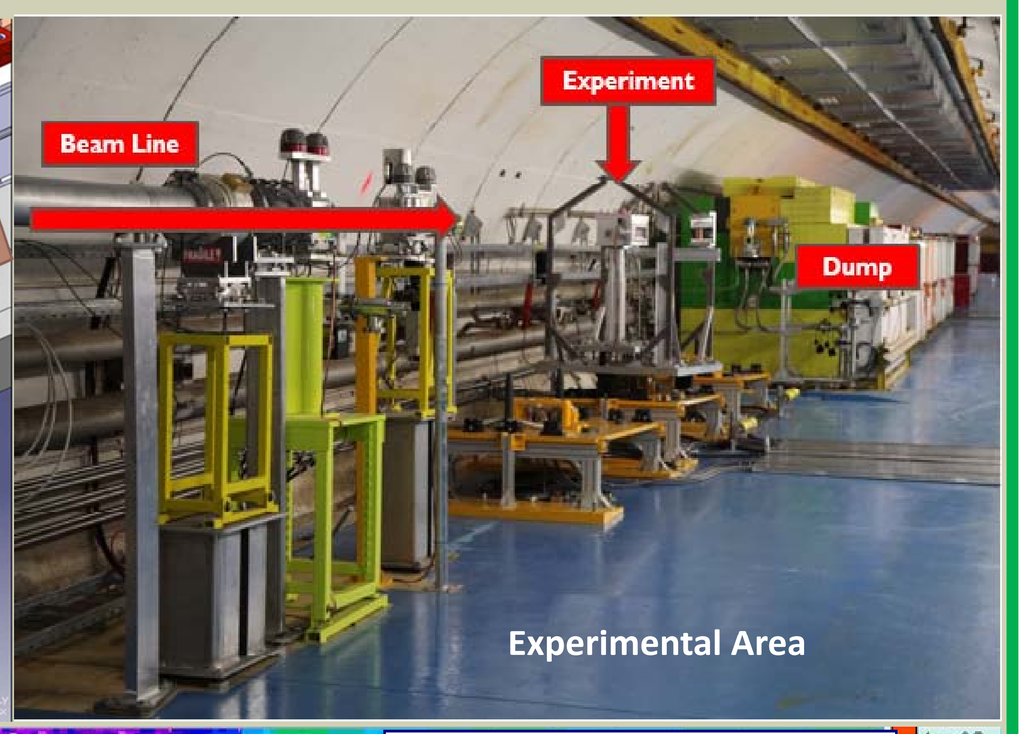
Beam parameter	Protons	Pb^{82+}
Nominal energy	440 GeV	173.5 GeV/nucleon
Pulse Energy	up to 3.4 MJ	up to 21 kJ
Bunch Intensity [protons]	$5.0 \cdot 10^9$ - $1.7 \cdot 10^{11}$	$3 \cdot 10^7$ to $7 \cdot 10^7$
Number of bunches per pulse	1— 288	52
Bunch spacing [ns]	25, 50, 75 or 150	100
Pulse length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

Not an irradiation facility for large doses - Annual proton budget limited to 10^{16} protons

- **To be shared amongst 10 experiments / year approximately**

Experimental Area & Services





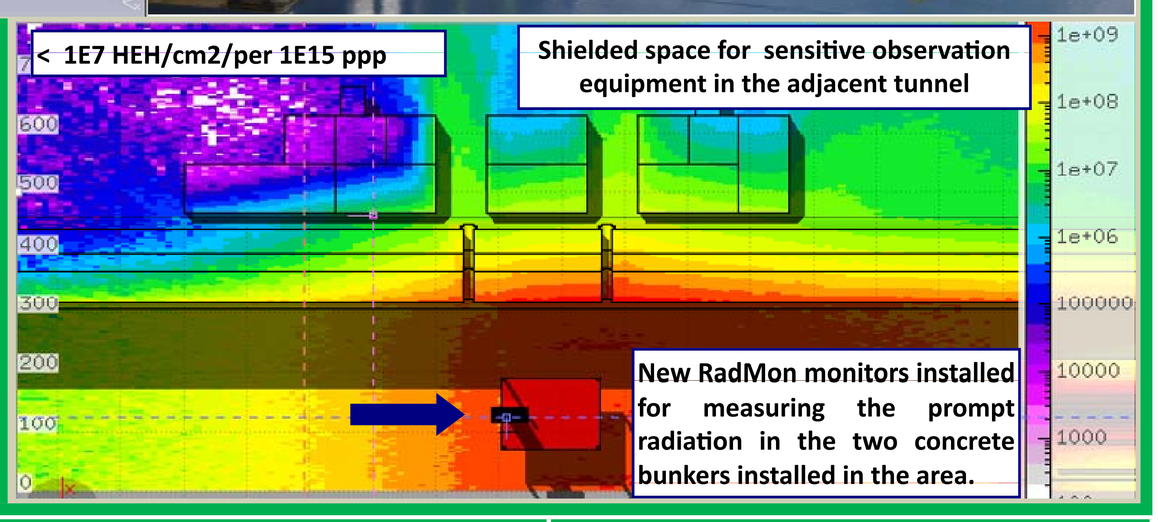
3 stands for experiments, supporting remote installation and transport to a dedicated cool—down zone

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:

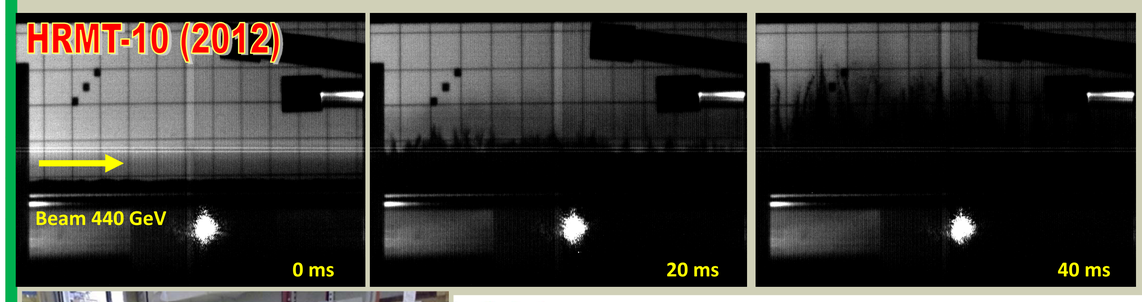
- High Speed Camera, Laser-Doppler Vibrometer, Microphones, Beam Loss Monitors...

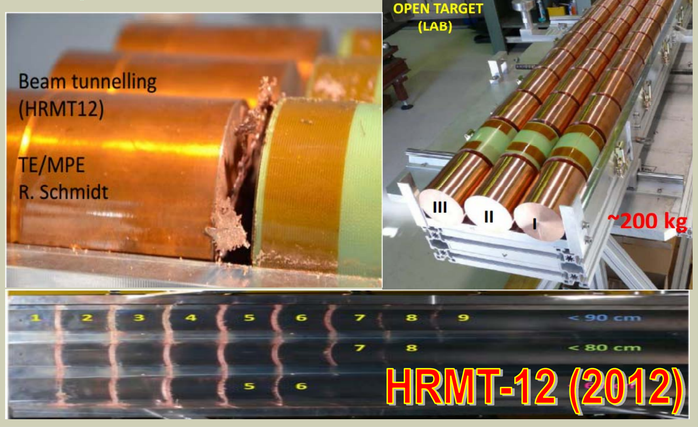


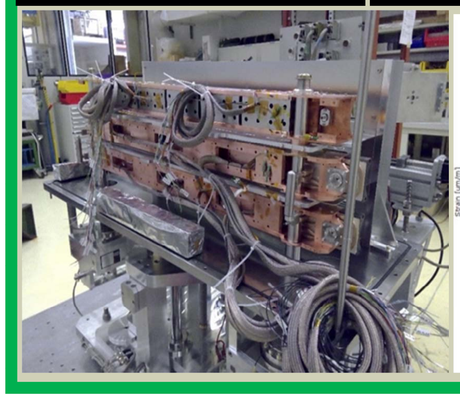
Experiments @ HiRadMat

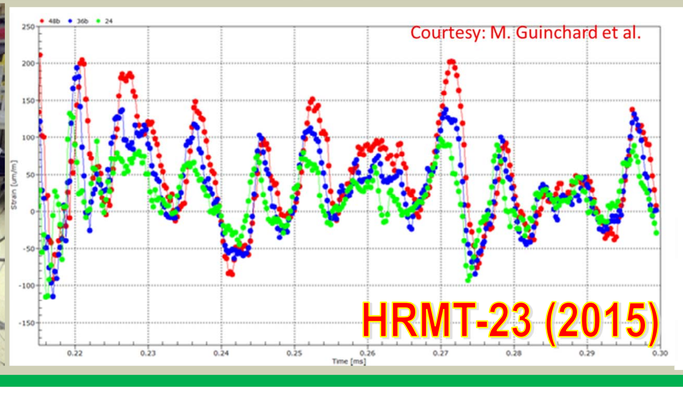
17 experiments completed since 2012

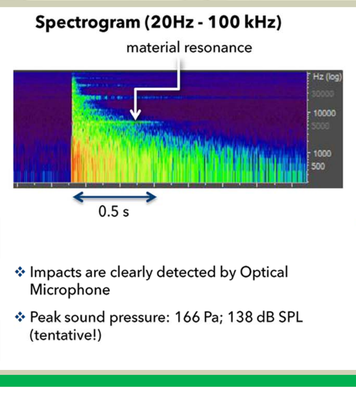
- New high power target concepts for secondary particles production (W-powder)
- Impact of high-intensity beam to LHC collimators
- Optical Microphones to evaluate beam impact on collimators
- Radiation protection instrumentation, test of LHC septum, ...



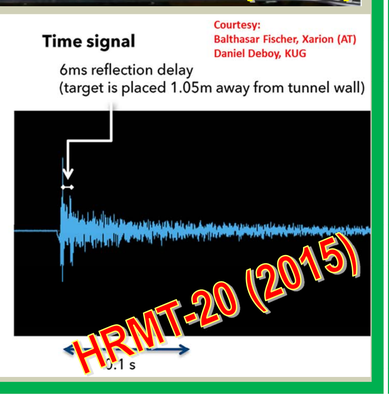








- Impacts are clearly detected by Optical Microphone
- Peak sound pressure: 166 Pa; 138 dB SPL (tentative!)



Experiment approval steps

1. Application for beam time
2. Initial discussion with facility's management
3. Review by Scientific Board
4. Review by Technical Board
   - Safety review, beam availability review, technical review

Positive recommendation from the above boards leads to validation of the beam slot allocation to the schedule

Possible users' financial support by EuCard2—Transnational Access

For more information :
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