High Radiation to Materials

A Facility at CERN for Material & Component Testing

HiRadMat@SPS Transnational Access

- **Summary of HiRadMat@SPS TA activities within EUCARD**
- **Highlights of 2012 Experiments and TAs**

http://cern.ch/hiradmat - hiradmat.sps@cern.ch

HiRadMat - Motivation

- Move away from ad-hoc setups, to a facility specially designed to study the impact of **intense pulsed beams** on materials (thanks Ralf !!! :-))
  - Thermal management (heating)
    - material damage even below the melting point
    - material vaporization (extreme conditions)
  - Radiation damage to materials
  - Thermal shock - beam induced pressure waves

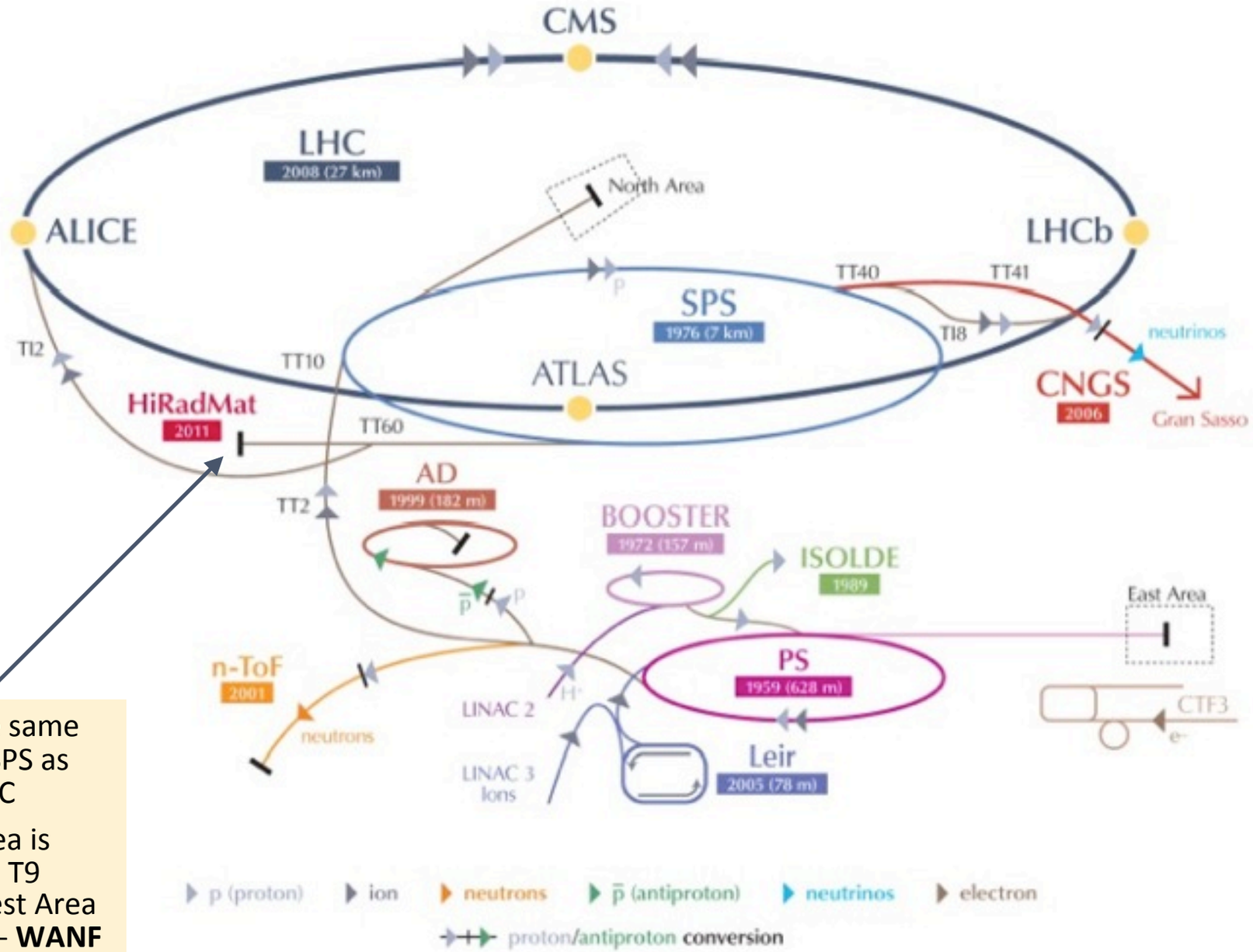
- Search for threshold effects
  - More challenging, but interesting for the understanding of the underlying physics,
  - More interesting for engineering and applications

- Robustness tests of assemblies
  - high-intensity beams, single or multiple pulses

- Test bed, important for the design validation of **LHC near beam components** before installation in the ring

- **Targeted users**: LHC collimators, R&D on materials, high-power targetry, test of vacuum components (beam windows, coating), others?

HiRadMat - Location

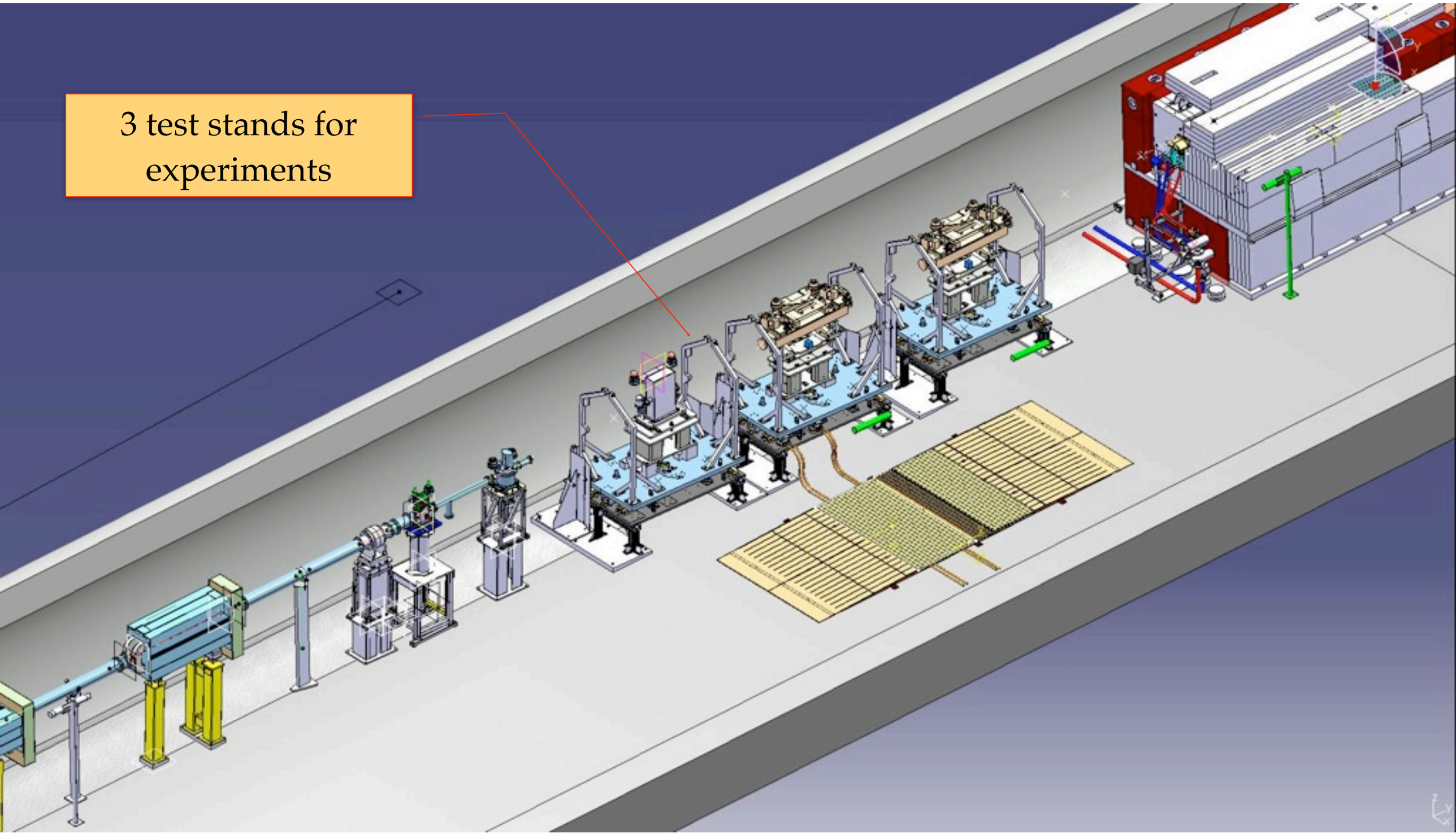


HiRadMat shares the same extraction from SPS as the **TI2** line to LHC

The experimental area is upstream the old T9 target for the West Area Neutrino Facility - **WANF**

Layout Experimental Area

3 test stands for experiments



HiRadMat - Timeline

Sep'09
Project Starts

Jun'11
Phase-I Beam Commissioning (Low-intensity)

Sep'11
Phase-II Beam Commissioning (High-intensity)

May-Dec'12
Experiments - Operations

LS1 shutdown

Oct-Dec'14
Restart - Operations

2009 | 2010 | 2011 | 2012 | 2013 | 2014

Dismantling WANF was a very interesting experience and lots of lessons learnt on what to do (or not to do!) when building ν -beams!

HiRadMat Beam Parameters

- LHC type beam extracted from SPS, protons or ions

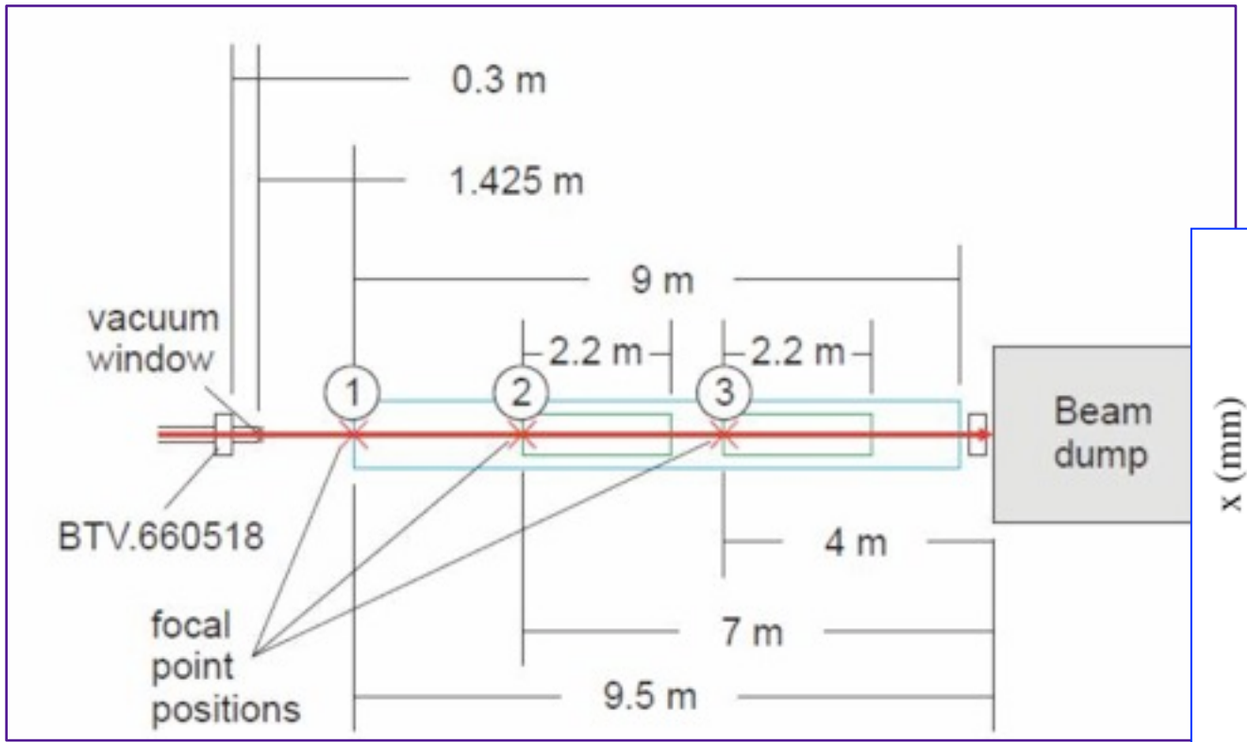
	Protons	Heavy ions ($Pb82^{+}$)
Beam Energy	440 [GeV]	173 [GeV/u], 36.1 [TeV/ions]
Pulse energy	**up to 3.4 [MJ]**	up to 21 [kJ]
Bunch intensity	3×10^{9} to 1.7×10^{11} [protons]	3×10^{7} to 7×10^{7} [ions]
Number of bunches	1 to 288	52
Max intensity	**4.9×10^{13} [protons]**	3.64×10^{9} [protons]
Bunch length	11.24 [cm]	11.24 [cm]
Bunch spacing	25, 50, 75 or 150 [ns]	100 [ns]
Pulse length	7.2 [μs]	5.2 [μs]
Cycle length	18 [s]	13.2 [s]
Beam spot at the experiment	variable around 1 [mm^2]	variable around 1 [mm^2]

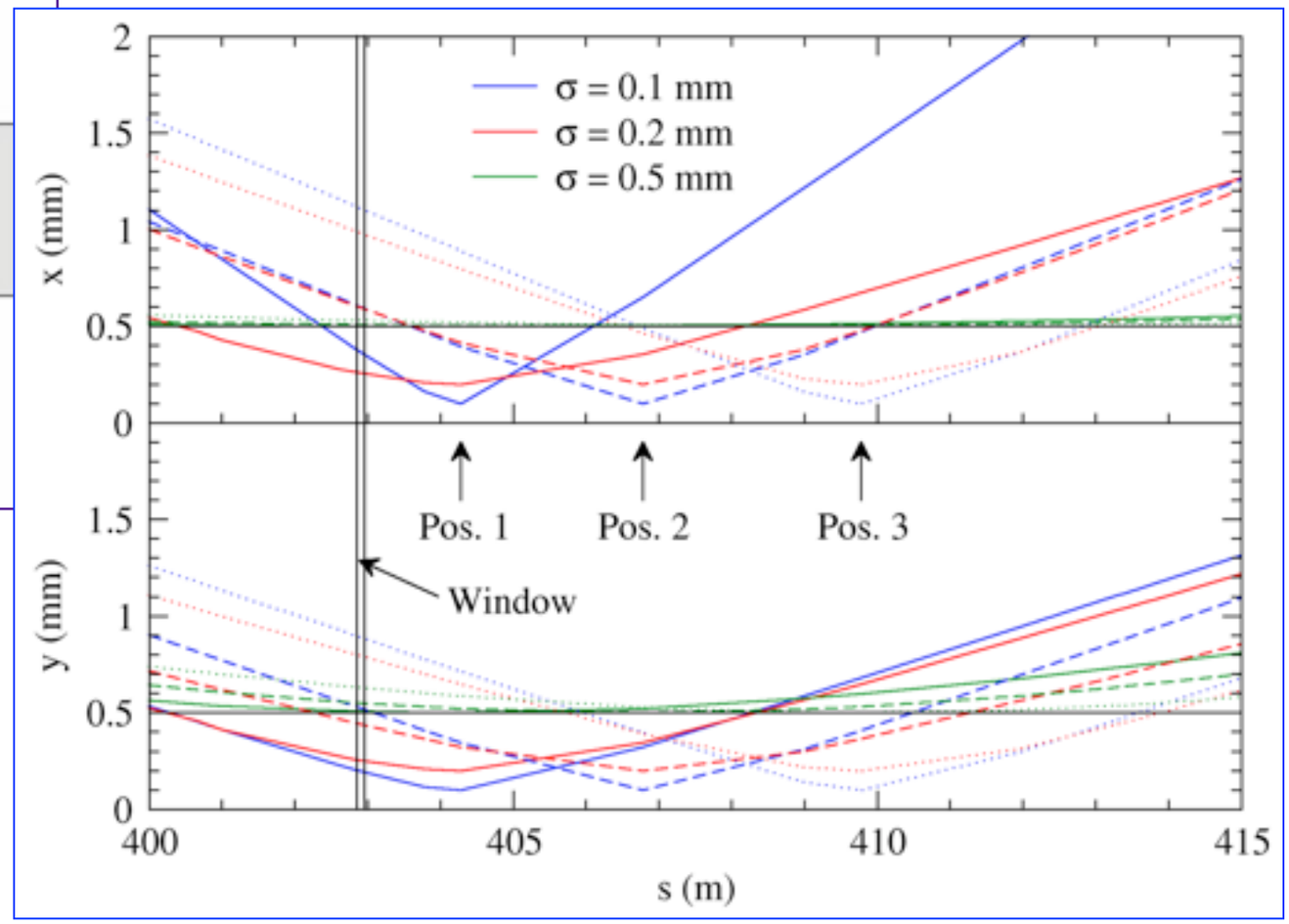
- Intensity:
  - **10^{15} protons/experiment** (max 30 high-intensity pulses)
  - 10 experiments/year - **10^{16} protons in total/year**

Beam Parameters

- Constraint: the beam must be >0.5mm in [x, y] at the last beam window of the line and at the dump

- Larger beam sizes can be achieved, <2mm - **work from M.Meddahi, C.Hessler TE/ABT**





Organization

A & T Sector Mgmt

HiRadMat Facility Project
Project Leader : ***I. Efthymiopoulos***
Deputy PL : ***S. Evrard***

IEFC Committee

Operation

Experiments

Commissioning Coordination
M. Meddahi

HiRadMat Scientific Board
- I. Efthymiopoulos - CERN (secretary)
- S. Evrard - CERN
- Y. Kadi - CERN
- B. Riemer - SNS
- **N. Simos - BNL (chair)**
- S. Sgobba - CERN
- M. Wohlmuther - PSI

HiRadMat Technical Board
- K. Cornelis - SPS Beam
- S. Gilardoni - PS beam
- **I. Efthymiopoulos - HiRadMat (chair)**
- S. Evrard - HiRadMat (secretary)
- M. Meddahi - SPS/HiRadMat beam
- A. Pardons - HiRadMat
- J. Pedersen - EN DSO
- M. Tavlet - BE DSO
- C. Theis - RP

- **Physicist in charge :** I. Efthymiopoulos
- **Engineer in charge :** S. Evrard
- **Beam Operation & Monitoring :** K.Cornelis, V.Kain, CCC(SPS)
- **Area Manager :** D.DePaoli
- **User support team:**
  - **engineering :** A. Pardons
  - **tech. support :** M. Lazzaroni, MEF
- **RP support :** C. Theis, K. Weiss
- **Handling/transport :** Y. Seraphin, J.L. Grenard

- **bi-weekly Users meeting** (during operations)
- **weekly meeting of EAM Team**

Experiments in HiRadMat

- **Approval process for experiments**
  - Submit **application** for HiRadMat beam time (~August)
    - Application = scientific interest (1-2 pages), pulse list, installation sketch, preliminary safety documents
  - Initial discussion with **Facility Management**
    - feasibility of installation, compatibility with existing infrastructure
  - Review by **HiRadMat Scientific Board**
    - evaluate the scientific interest of the experiment, feasibility, online and post-irradiation analysis, obtained results and publications
    - establish experiment list for each running period ---> beam slot in the schedule
  - From beam slot to scheduled beam schedule - **HiRadMat Technical Board**
    - **safety review** : interview with safety officials, safety file (includes dismantling!)
    - **beam review** : interview with beam operations and CCC
    - **technical review** : interview with HiRadMat technical coordination
    - positive recommendation of all above validates the beam slot allocation to the schedule
- **Beam time**
- **Dismantling - analysis of results - feedback on publications to HiRadMat Scientific Board**

Experiments in HiRadMat

Operations

Go to parent category | iCal export | View | Create | **Manage**

September 2012

- 28 Sep HiRadMat Technical & Safety Review (protected by parent category)
- 17 Sep Preparation Meeting for HRMT-06 Technical & Safety Review (protected by parent category)

July 2012

- 27 Jul HiRadMat Technical & Safety Review (protected by parent category)

June 2012

- 15 Jun HRMT12-LPROT Technical & Safety Review (protected by parent category)
- 14 Jun HiRadMat Experiments Meeting (protected by parent category)

April 2012

- 23 Apr HiRadMat Scientific Board Meeting (protected by parent category)

March 2012

- 22 Mar HiRadMat Experiments Meeting (protected)

July 2011

- 14 Jul HiRadMat Users Meeting (protected by parent category)
- 09 Jul User Selection Panel Kick-off Meeting (protected by parent category)

March 2011

- 08 Mar HiRadMat Access Sectorization (protected by parent category)

Hide the events in the past (8)

Documentation in EDMS

HIRADMAT Project

Reset | Set as Top | Search | Re-login *EFTHYMIO*

- HIRADMAT Project
  - Project Leader
    - Presentation/slides
    - Internal notes
    - Budget codes
    - Scientific and Technical Board
  - General planning
  - General description
  - Primary Beam
    - Layout-Drawings-Integration-DB
    - Beam line commissioning
    - Beam Instrumentation
    - Vaccum systems
    - Power convertors
    - Beam interlock system
    - Survey
  - WANF Dismantling
  - Irradiation Area
  - General services
  - Safety
    - General safety
    - Radiation Protection
    - Safety File
  - Operation&Maintenance
    - Operation
      - Project
      - Operations-2011
      - Shutdown-2011_2012
      - Operations-2012
    - Maintenance
  - **HiRadMat Experiments**

Summary | Structure | Documents | Used in | Access Rights | Versions & other info

Actions: New | Attach | Detach | Edit positions | Auto Link | Add all to caddie

Documents in this node: 14

Sort by: Position | Ascending | Display: Default | Obsolete: Hide

1224448 v.3	HiRadMat Experiments Safety file template	Released
Doc. page	Safety_file_for_users_template **docx** (481 Kb) **pdf** (577 Kb)	
1213282 v.1	HiRadMat Beam Request Template	Released
Doc. page	HiRadMat_BeamRequest_Template **docx** (198 Kb) **pdf** (393 Kb) HiRadMat_ExpScientMotivation_Template **docx** (105 Kb) **pdf** (149 Kb)	
1213283 v.2	HiRadMat Beam Pulse List Template	Released
Doc. page	HiRadMat_BeamPulseList_Template **xlsx** (25 Kb) **pdf** (142 Kb)	
1213284 v.1	HRMT01-TISD Experiment	In Work
Doc. page	HiRadMat_BeamRequest_HRMT01-TISD **docx** (223 Kb) **pdf** (417 Kb)	
1213285 v.1	HRMT06-TPSG4 Experiment	In Work
Doc. page	HiRadMat_BeamRequest_HRMT06-TPSG4 **docx** (213 Kb) **pdf** (408 Kb)	
1213286 v.1	HRMT09-LCOL Experiment	In Work
Doc. page	HiRadMat_BeamRequest_HRMT09-LCOL **docx** (676 Kb) **pdf** (868 Kb) HiRadMat_ExpScientMotivation_HRMT09-LCOL **docx** (114 Kb) HiRadMat-tests-TCT-SLAC-2012-specs-v2 **docx** (91 Kb)	
1218683 v.1	HRMT10-WTHIMBLE Experiment	In Work
Doc. page	HRMT10_BeamPulseList **pdf** (142 Kb) HRMT10_Target_FIDUCIALS **pdf** (120 Kb) HRMT10_Activation_studies **pdf** (601 Kb) Safety_file_for_TungstenPowder **pdf** (2 Mb)	
1224528 v.1	HRMT12 - LPROT Experiment	In Work
Doc. page	HRM12_Activation_Studies **pdf** (715 Kb)	
1224692 v.1	HRMT14 - LCMAT	In Work
Doc. page	HRM_Alessandro_2012_FINALsr_nc **pdf** (833 Kb)	
1233522 v.1	HRMT-15 (RPINST)	In Work
Doc. page	HiRadMat_safety_presentation_N_G **pptx** (2 Mb) RPINST_Safety_file_REV **pdf** (184 Kb) Schema_Cables_RPINST **pdf** (36 Kb)	
1245093 v.1	HRMT16-UA9CRY	In Work
Doc. page	HiRadMat_ExpScientMotivation_UA9 **docx** (109 Kb) HiRadMat_BeamRequest_UA9 **docx** (2 Mb)	

Experiment Safety File

CERN
CH-1211 Geneve 23, Switzerland

EDMS No.	Rev	Validity
1224448	3.0	Released

Reference: HRMT-XX – Date

Date: 14/06/12

Safety documentation

HRMT-XXX Experiment

Safety file

Abstract

The safety aspects of the HRMT-XXX experiment are described. This includes safety aspects of the experimental apparatus/equipment to be tested in the HiRadMat facility, as well as installation, operation and post-irradiation activities related to the experiment.

Guideline: each experiment must fill/replace the highlighted text.

Prepared by :	*To be Checked by :*	*To be Approved by :*
Mister Nobody - NOWHERE	*J. Pedersen (EN-HDO)* *M. Tavlet (BE-ASR)* *C. Theis (DGS-RP)*	I. Efthymiopoulos (EN-MEF)

This document is considered as the Safety file of the Experiment. It consists of a set of documents that the Experiment Project Leader provides and maintains during the life cycle of the experiment to demonstrate compliance with the CERN Safety requirements.

TABLE OF CONTENTS

Experiment Pulse List

HiRadMat-Experiment
EDMS No: 1213283
Version 1.0

Beam Pulse List Template

Created:

General	
Experiment Name	
Acronym	
Responsible	
name	
phone	
e-mail	
If not at CERN – contact person at CERN	
name	
phone	
e-mail	
Installation Info	
Short Description	
Test stand	
Windows(1)	Upstream: 6cm diam, Downstream: 6cm diam, Material: TiA14V
Location (2)	Upstream: ????? Downstream: ????
Beam conditions	
Comments from beam experts	

Note:
(1) the aperture of the beam windows
(2) the location of the windows wrt to the last beam window, as defined in the EDMS Doc: 1054880

HiRadMat-Experiment
EDMS No: 1213283
Version 1.0

Beam Pulse List Template

Created:

Beam Pulse List							
No	Intensity			Beam spot *[mm]*		Bunch spacing *[ns]*	Pulse length *[us]*
	# bunches	p/bunch	Total	Sigma_x	Sigma_y		
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

Total 0.00E+00

- The pulse list comes first as request from the experiment, then worked out and "rationalized" by the SPS experts (Karel)
  - Beam intensity, # of bunches and sequence to ease operations
  - Beam optics, focusing conditions spot size, not to damage the beam and experiment windows

Experiment Schedule - 2012

	Technical&Safety Review	Apr w17	w18	May w19	w20	w21	w22	Jun w23	w24	w25	w26	Jul w27	w28	w29	w30	w31
SPS TS																
LHC MD																
HRMT Beam Period																
HRMT10-NTHIMBLE																
installation																
experiment																
dis-cool down																
HRMT12-LPROT																
installation																
experiment																
dis-cool down																
HRMT15-RPINST																
installation																
experiment																
dis-cool down																

		w30	w31	Aug w32	w33	w34	w35	Sep w36	w37	w38	w39	Oct w40	w41	w42
SPS TS														
LHC MD														
HRMT Beam Period														
HRMT09-LCOL(TCTA)														
installation	*27/07 (pre-review for RP issues: 20/07)*													
experiment														
dis-cool down														
HRMT04-BLM														
installation	*27/07 (pre-review for RP issues: 20/07)*													
experiment														
dis-cool down														
HRMT14-LCMAT														
installation	*27/07*													
experiment														
dis-cool down														
HRMT15-RPINST														
installation	*27/07*													
experiment														
dis-cool down														

		Oct w39	w40	w41	w42	w43	w44	Nov w45	w46	w47	w48	Dec w49	w50
SPS TS													
LHC MD													
HRMT Beam Period													
HRMT01-TISD													
installation	*28/09*												
experiment													
dis-cool down													
HRMT06-TPSG4													
installation	*28/09*												
experiment													
dis-cool down													

Modified : September 9, 2012 - ie

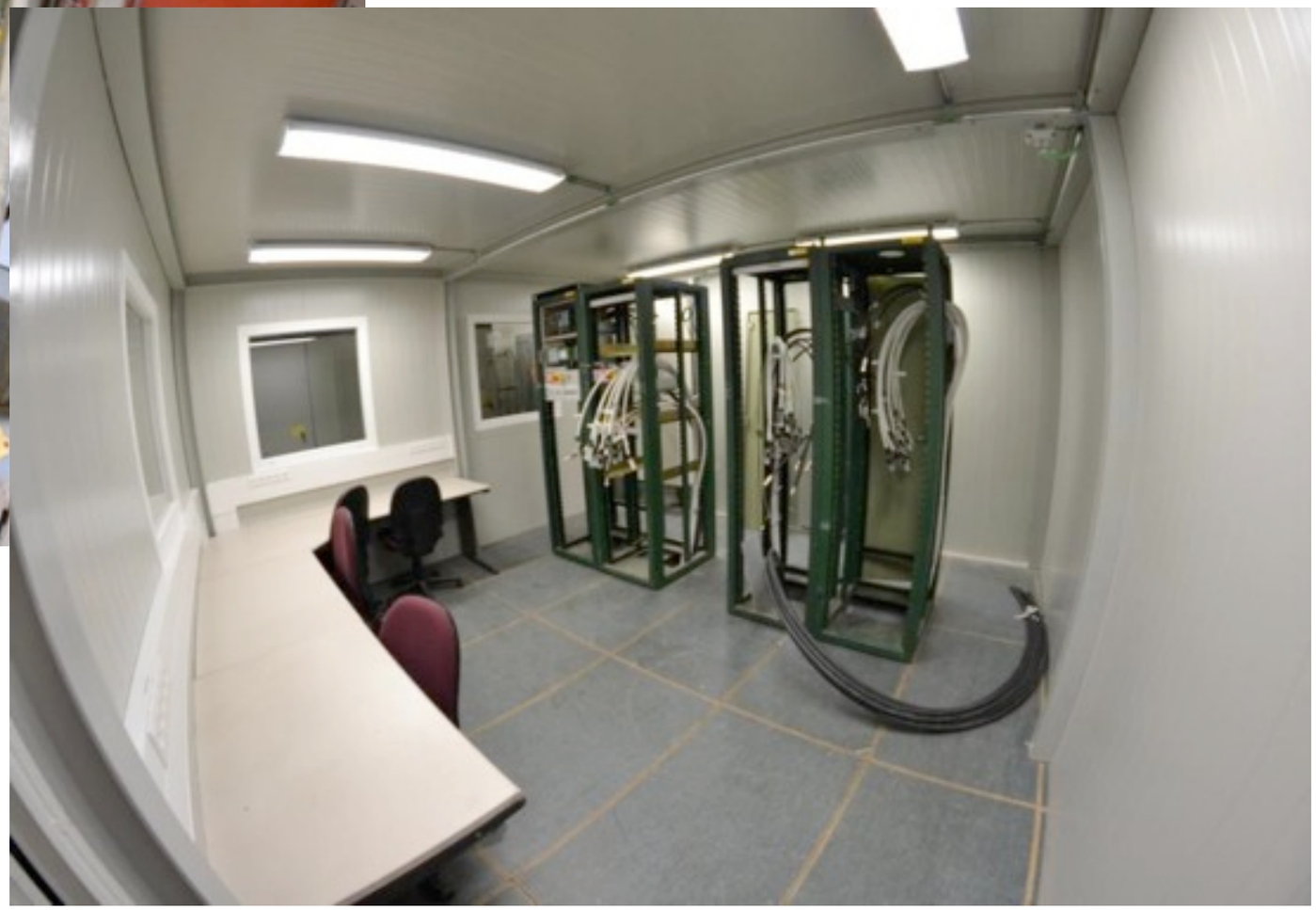
- HiRadMat lives in the shadow of LHC,
  - access in the underground areas is conditioned with injection from SPS to LHC
- Requires lot of flexibility :
  - from the users, good preparation to limit the stay underground
  - from the operations team to provide the beam to the experiments
- Has some impact on the experiment planning and TAs, we'll try to improve it for 2014

Experiment Infrastructure

- **What we provide to the users:**
  - the interface table
  - "standard" cabling from the test area to the surface control room
    - each test stand will be equipped with 5 plug-in connectors
      - signal, power (DC and 220V), HV, cables available
        - others could be added if needed
  - technical support for their installation and operation at CERN
- **Available instrumentation**
  - A camera and lens for high-speed photography
  - An LDV for vibration measurements
  - pCVD diamond detectors and readout for particle flux monitoring and beam positioning
  - Experiments also used:
    - strain gauges, temperature sensor

Surface facilities

- Control room and assembly lab in BA7 outside the access zone



HiRadMat Operations 2012

- **16** experiment requests received
- **9** experiments completed, interesting variety of tests!
- No safety incidents !
  - During installation - operations - and decommissioning/dismantling of the experiments!

Exp-ID	Title	Description	Contact Person	Status	Beam Period	Mobile Table	Storage (temporary)
HRMT-01	TISD	RIB target R&D	T. Stora - CERN	Completed	w44-2012	Table-01	cool-down #4
HRMT-02	RADTOL	Radiation tolerence of electronics	M. Brugger - CERN	Request			
HRMT-03	SLACRC1	LHC rotating collimator	T. Markewicz - LBL	Request			
HRMT-04	BLM	LHC beam loss monitor	B. Dehning - CERN	Completed	w35-2012	-	departed
HRMT-05	VDWBR	Vacuum Be window	R. Veness - CERN	Request			
HRMT-06	TPSG4	LHC transfer line collimator - TPSG	J. Borburgh - C.Baud CERN	Completed	w47-2012	special support	
HRMT-07	TCDQ	LHC transfer line collimator - TCDQ	W. Weterings - CERN	Request			
HRMT-08	TCDS	LHC transfer line collimator - TCDS	W. Weterings - CERN	Request			
HRMT-09	LCOL	LHC collimator tests	A. Rossi - CERN	Completed	w32,2012	Table-04	departed
HRMT-10	WTHIMBLE	High-power W-thimble experiment	C. Densham - RAL, N.Charitonidis - CERN	Completed	w22, 2012	Table-01 (sample holder removed)	
HRMT-11	DYNVAC	Ion disorption and vacuum	E. Mahner - CERN	Request			
HRMT-12	LPROT	LHC machine protection R&D	R. Schmidt - J.Blanco CERN	Completed	w25,2012	Table-03	cool-down #5
HRMT-14	LCMAT	LHC collimator material R&D	A. Bertarelli - CERN	Completed	w39,w40-2012	Table-02	cool-down #7
HRMT-15	RPINST	RP Instrumentation R&D	M. Silari - CERN	Completed	w41,w24-2012	dismantled	departed
HRMT-16	UA9CRY	UA9 Crystal collimation	W.Scandale LAL, S. Montesano - CERN	Completed	w44-2012	Table-01(sample holder removed)	departed

2012 Operations Summary

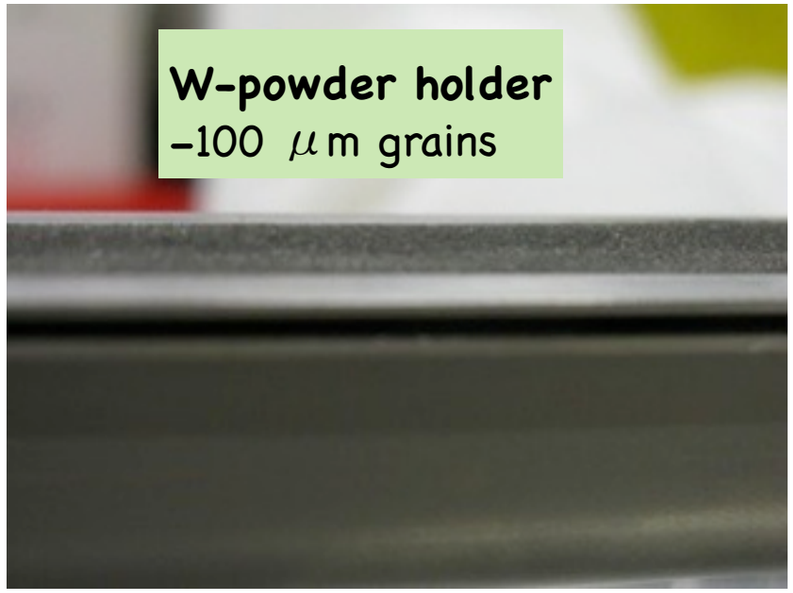
Experiment	Dates	Beam		Trans. Access		Publications
		Time	Intensity	Users	Units	
HRMT10-WTHIMBLE	31/05	8h	7.44E+12	6	50.1	1+Thesis
HRMT12-LPROT	02-27/07	56h	1.53E+14	1	6	4
HRMT09-LCOL	07-12/08	16h	9.19E+13		-	2
HRMT04-BLM	21-31/08	32h	3.74E+14	(*)	-	2
HRMT14-LCMAT	27/09-04/10	40h	4.42E+14	1	6	7
HRMT15-RPINST	10-30/10	24h	3.97E+14	2(**)	13	1
HRMT16-UA9CRY	01/11	8h	1.98E+15	(*)	-	1
HRMT01-TISD	02-03/11	48h	1.03E+16	(*)	-	-
HRMT06-TPSG4	30/11	8h	1.48E+14	-	-	-
			1.39E+16	**10**	**75.1**	

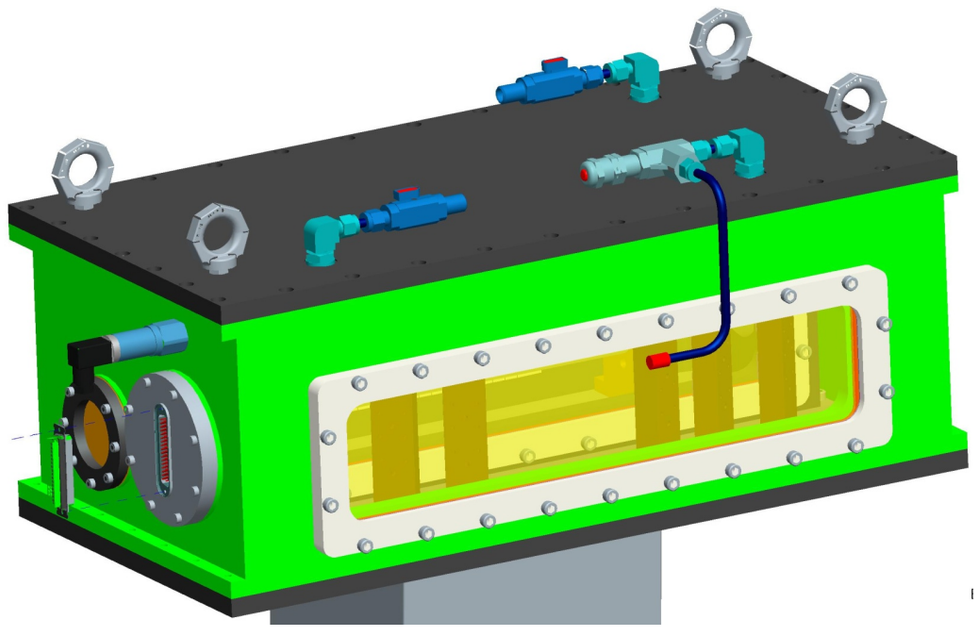
- (*) candidate teams for TAs could have come but didn't work out at the end
- (**) Interest from the RP community but difficult to organize due to variable schedule of the beam
- TA access unit definition changed from **"one beam hour"** to **"one day (8h) presence"** at CERN.

HRMT10-WTHIMBLE

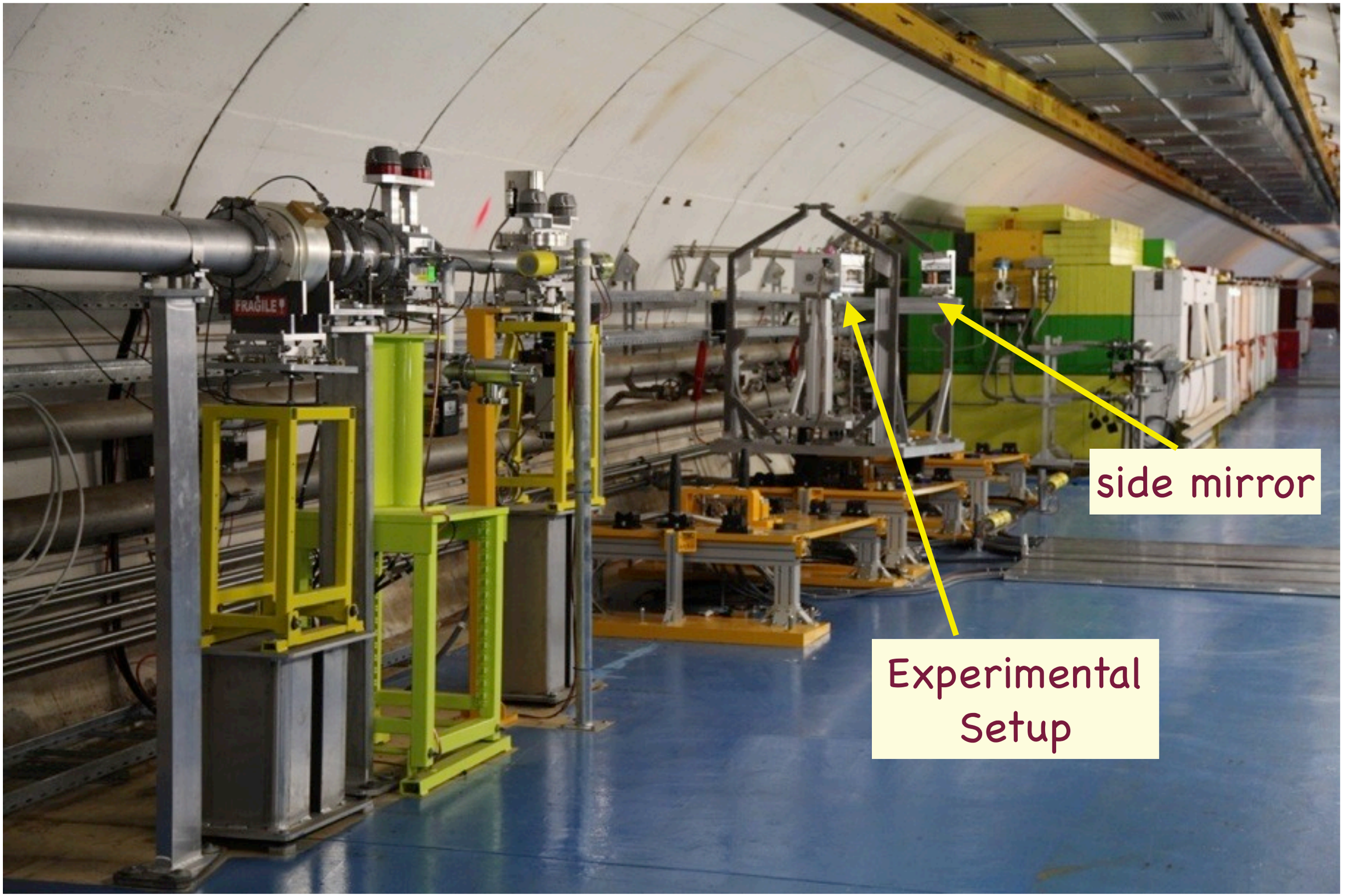
Tungsten Powder Test @ HiRadMat (RAL-CERN Collaboration)

- Proof-of-principle operation of a segmented target as high-power option in future ν-beam facilities (>1 MW range)
- Key questions/observations:
  - would the W-powder splash/erupt?
  - can you propagate a pressure waver through the powder target to its container?



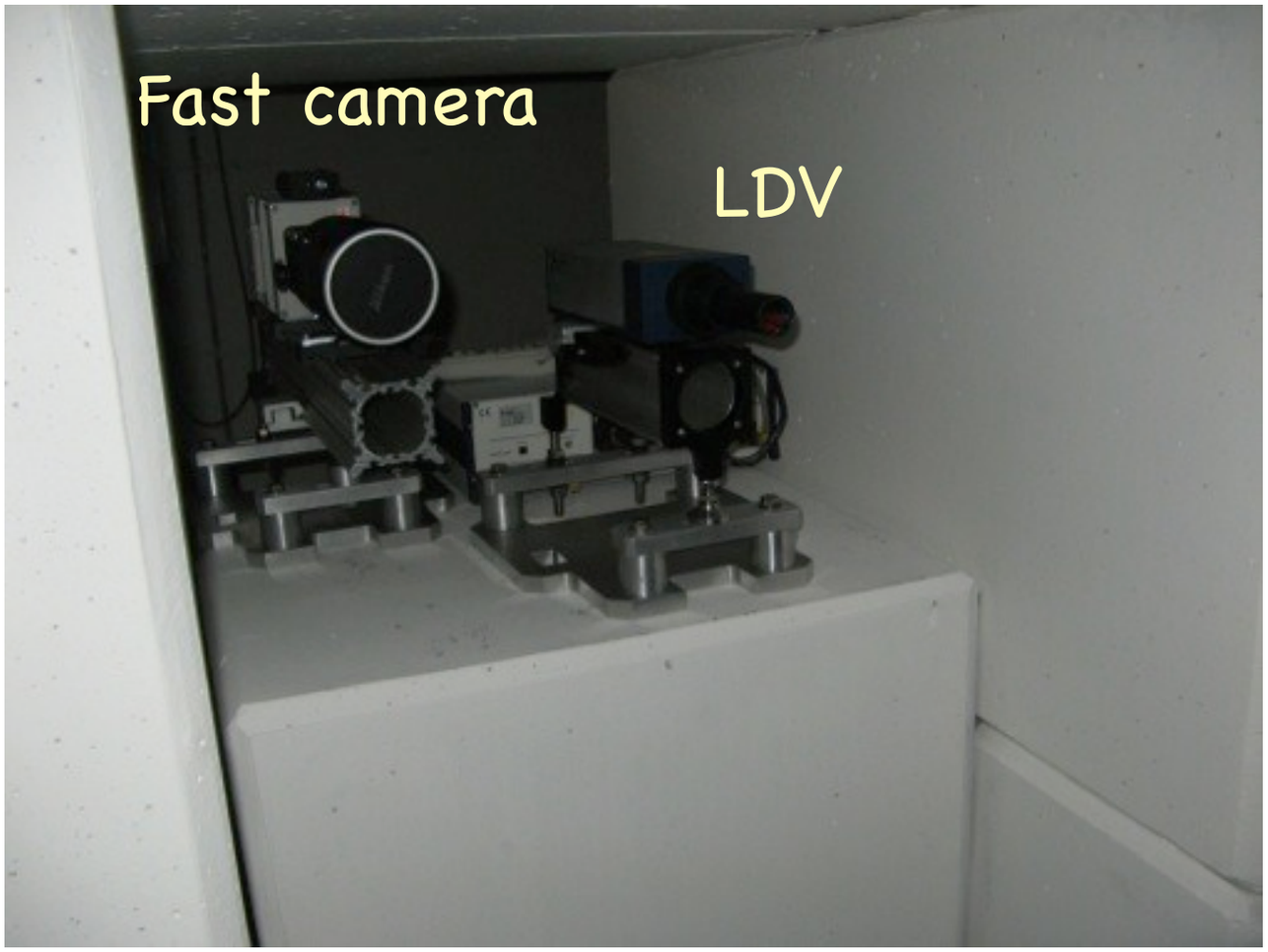


HRMT10-WTHIMBLE

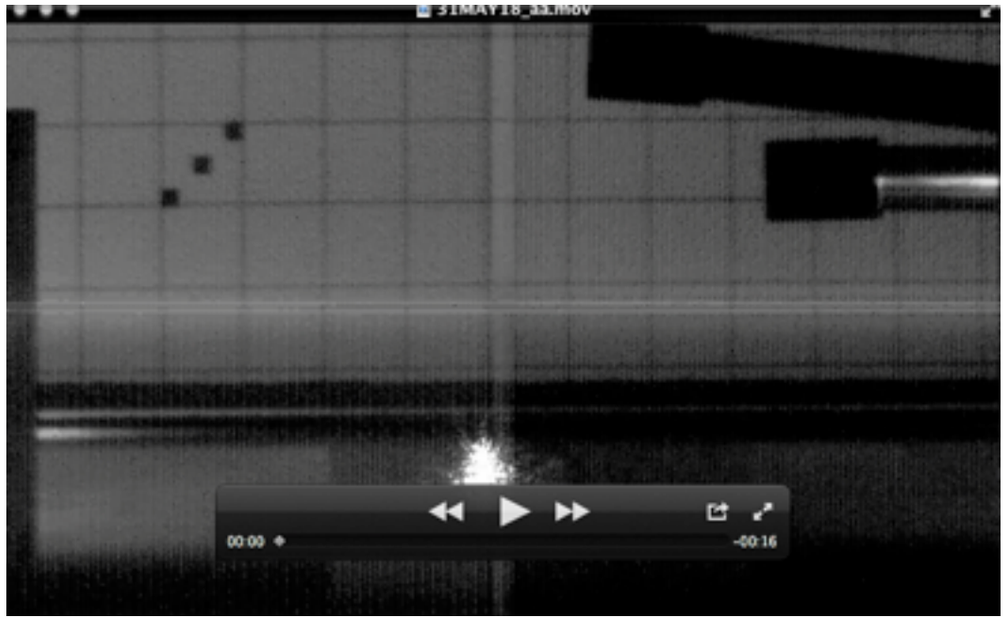


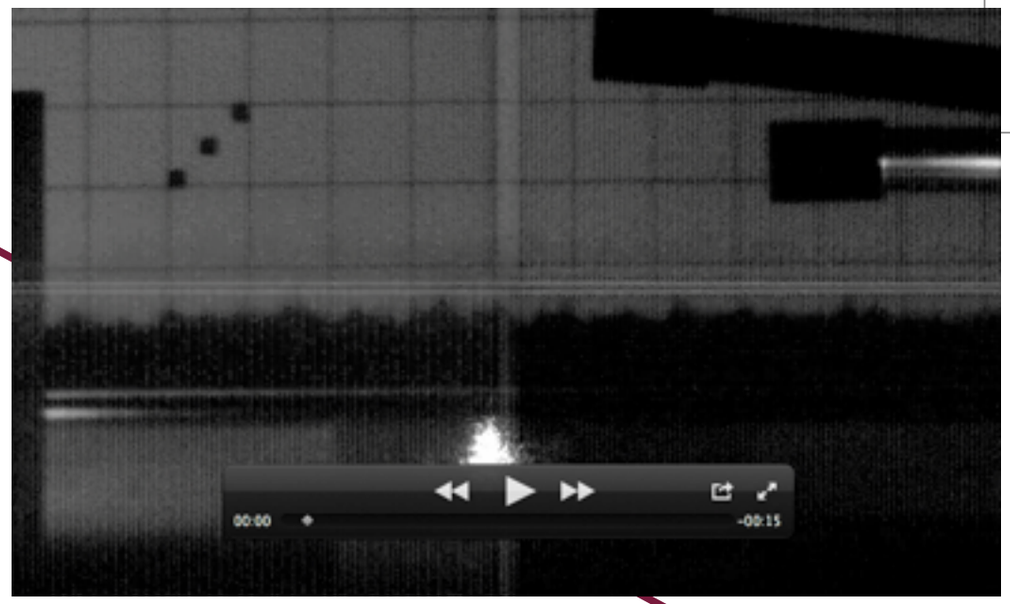
HRMT10-WTHIMBLE

- Experiment instrumentation:
  - LDV for shock wave measurement (borrowed from EN/STI - thanks!)
  - Fast camera (from BE/BI - thanks!) with special lenses and mirrors to take photos at 40m distance!



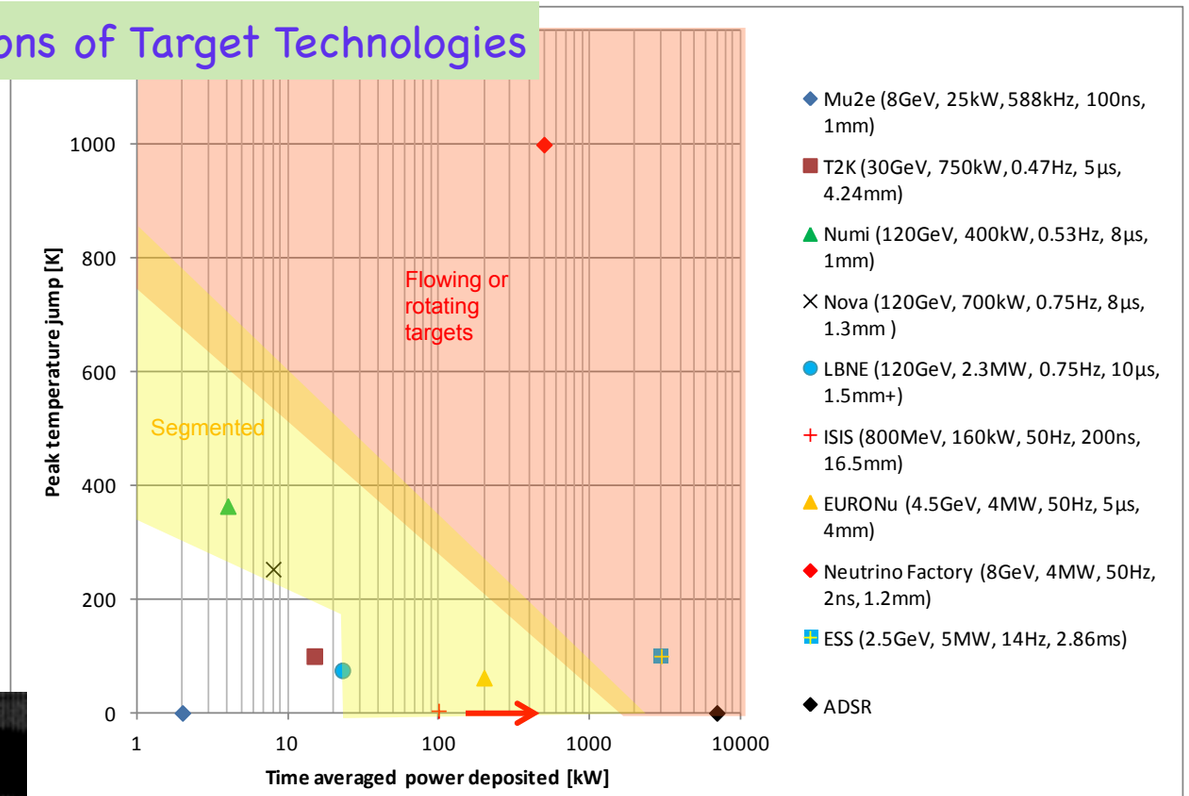
HRMT10-WTHIMBLE Experiment

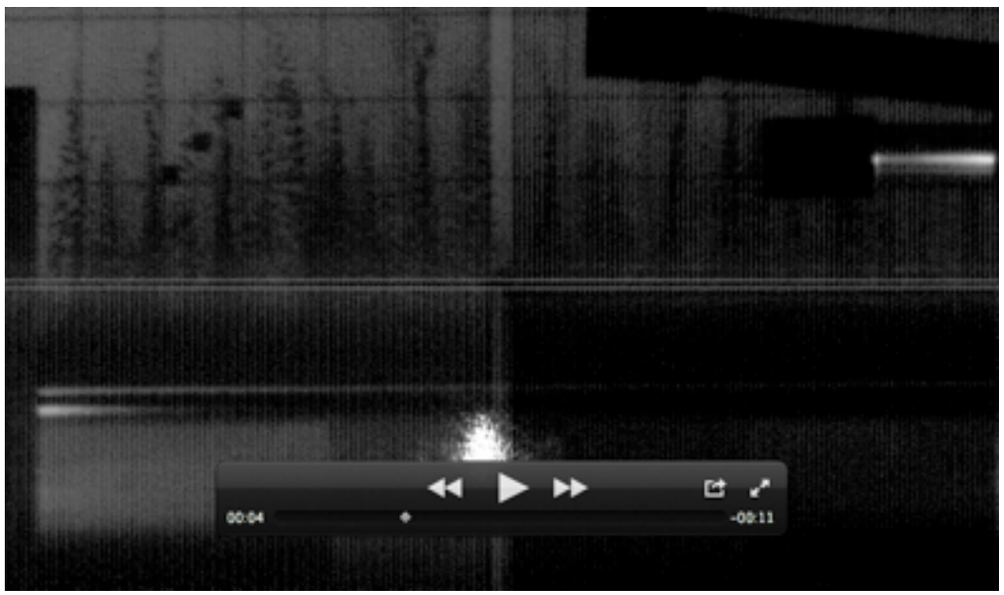




time

Limitations of Target Technologies





Courtesy HRMT10, N. Charitonidis, C. Densham

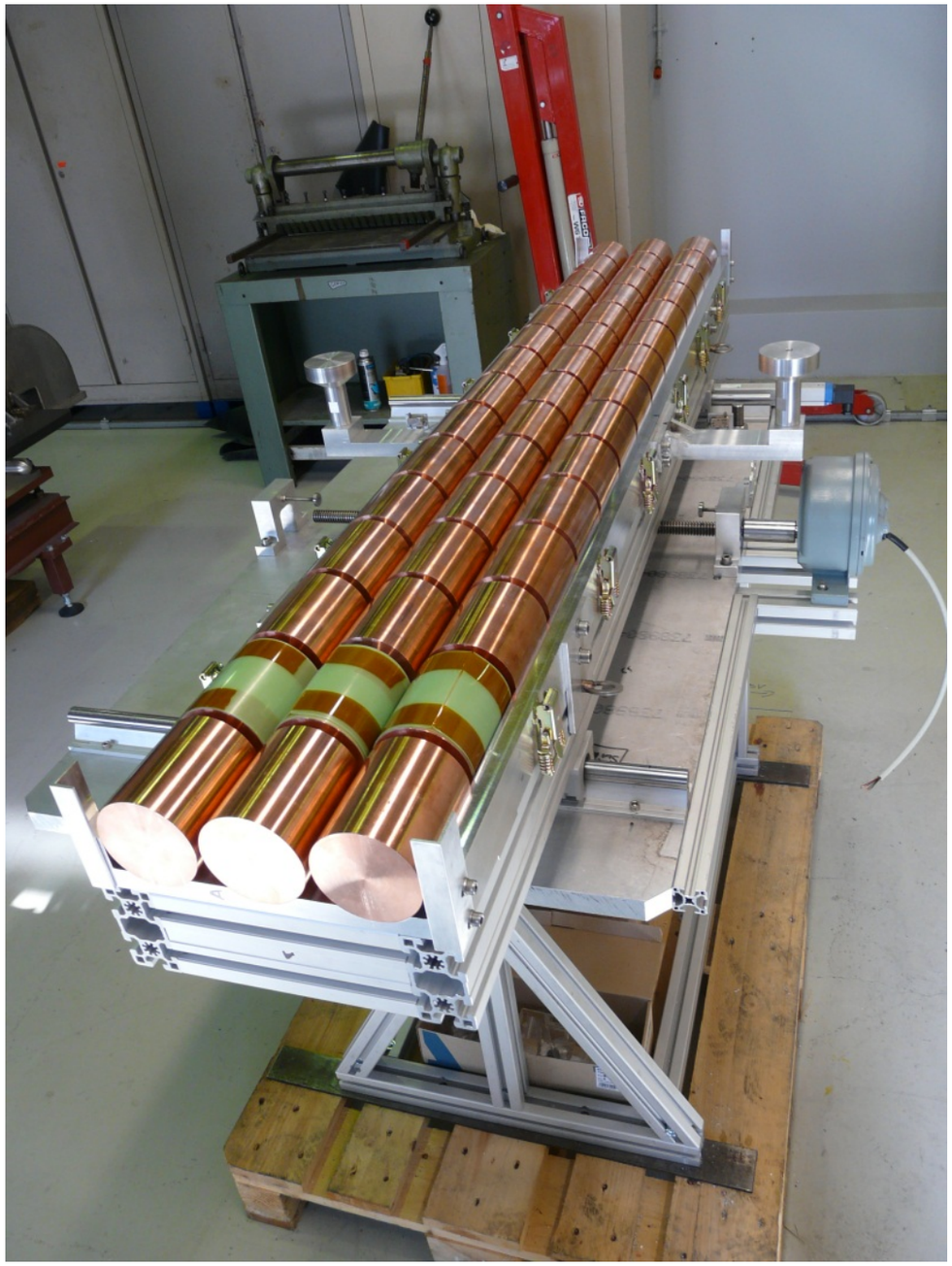
HRMT12-LPROT

- Experiment to study the **beam tunneling in matter**

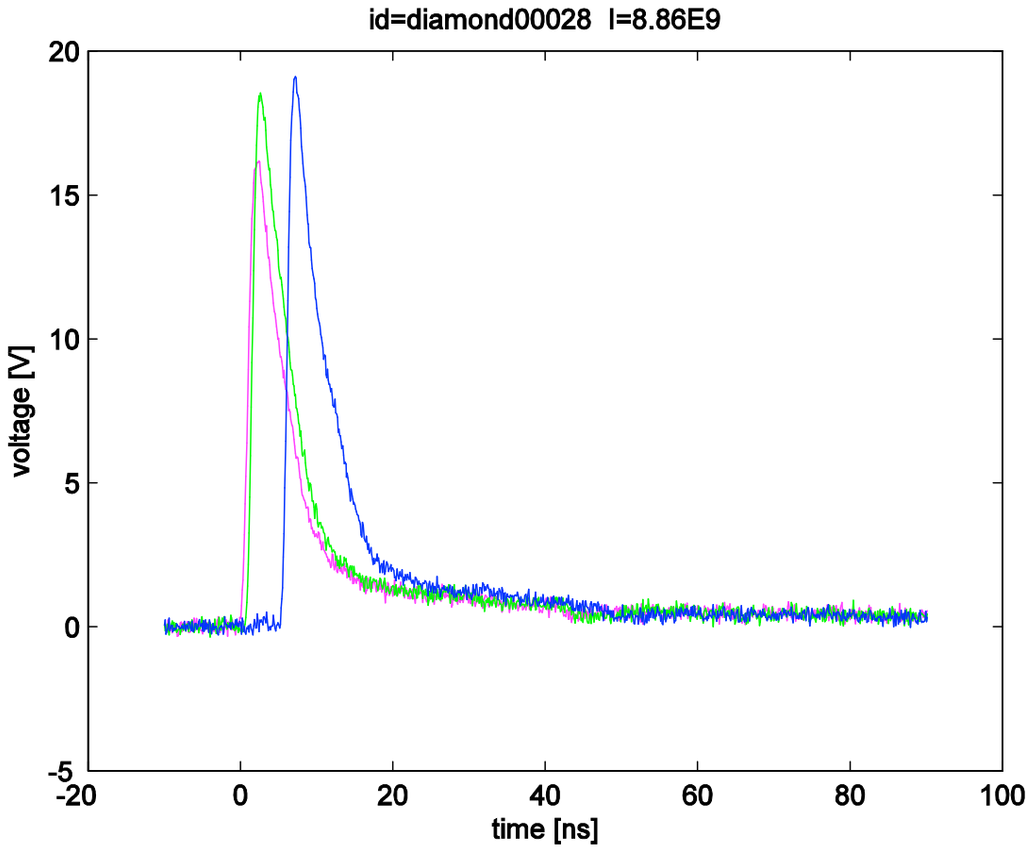
- First "open" experiment - **not to repeat!!!**
- Beam taken:
  - 71 low intensity single bunch shots (2E9 - 1.0E10)
  - 85 high-intensity single bunch shots (1.0E11 - 2.0E11)
  - 8 high-intensity multi-bunch shots (1.5E11 ppb)

target sample - Cu rods:

- 3 Cu rods, 15 cylinders, 8cm diam, 10cm long

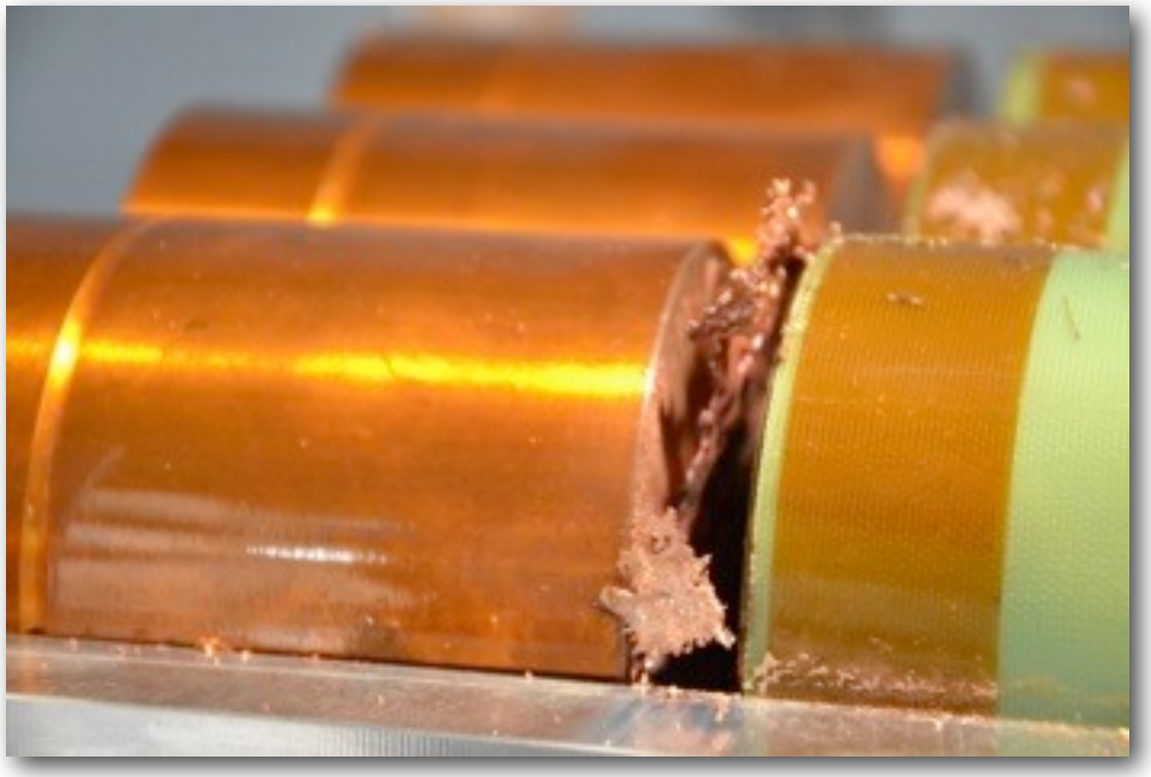


pCVD diamond detectors



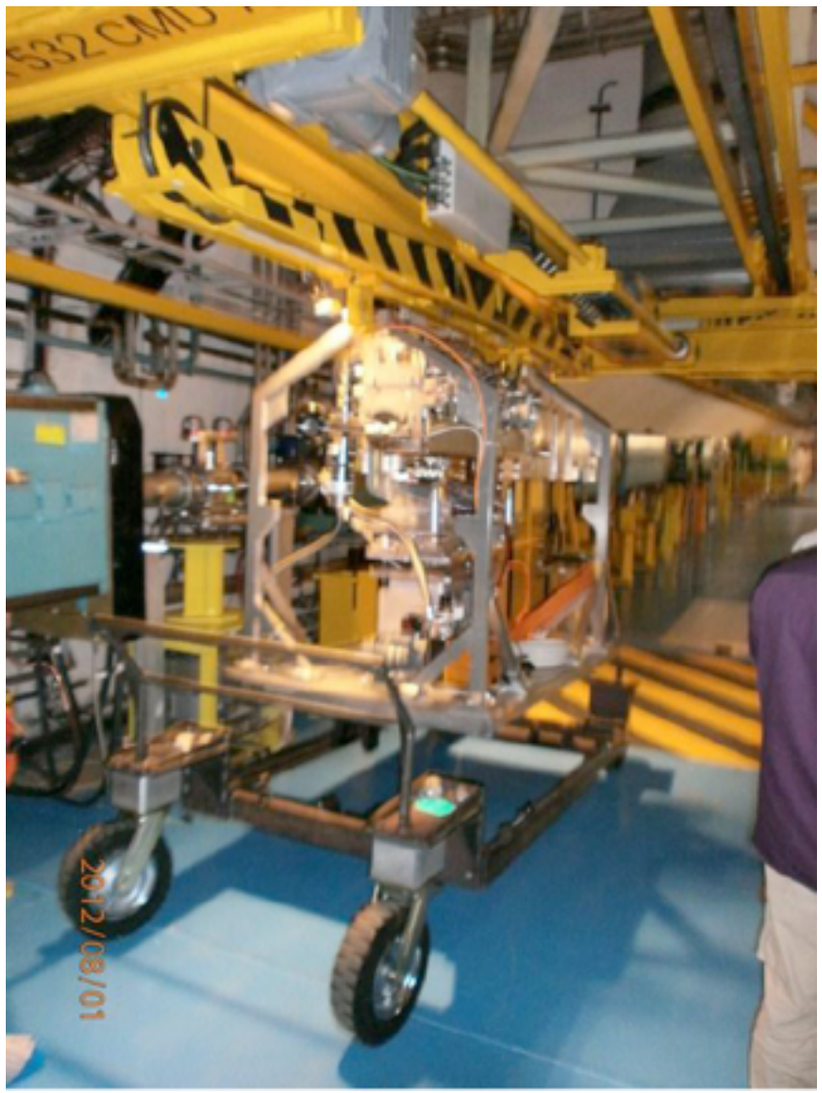
Courtesy HRMT12, D. Wollman, J.Blanco

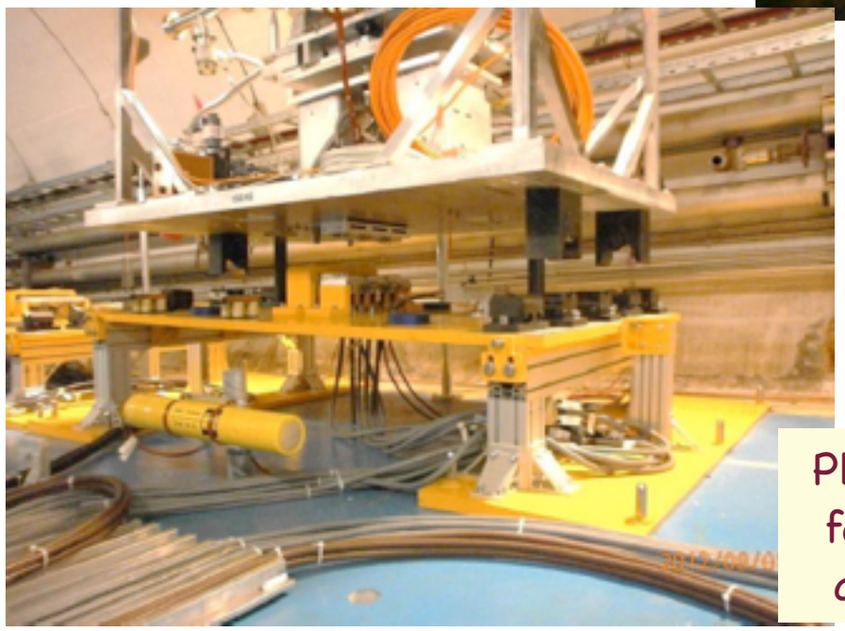
IPAC13 Oral Presentation by J. Blanco



HRMT09-LCOL

- Impact of high-intensity beam to LHC collimator
- Remote handling (almost) for installation and removal

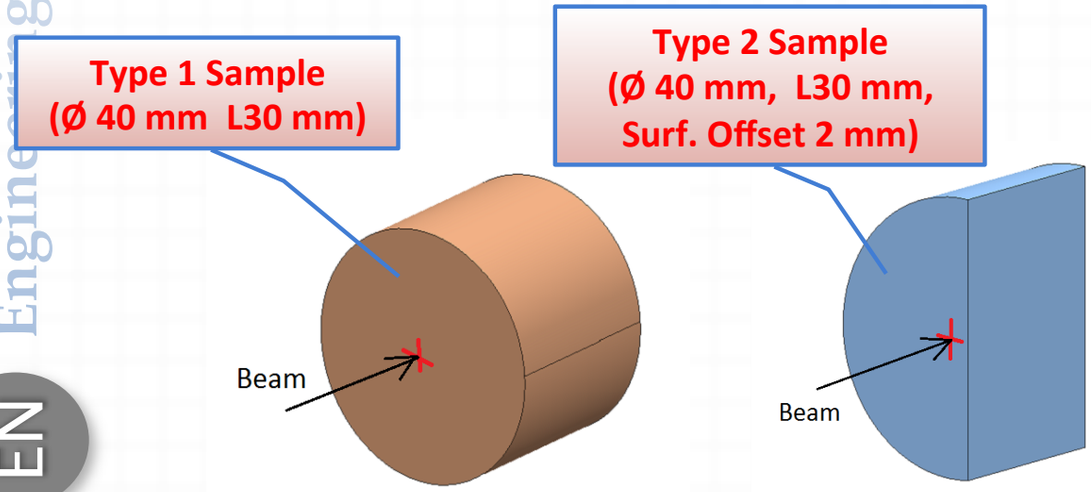




Plug-in system for all cables and services

LCMAT Experiment: Specifications

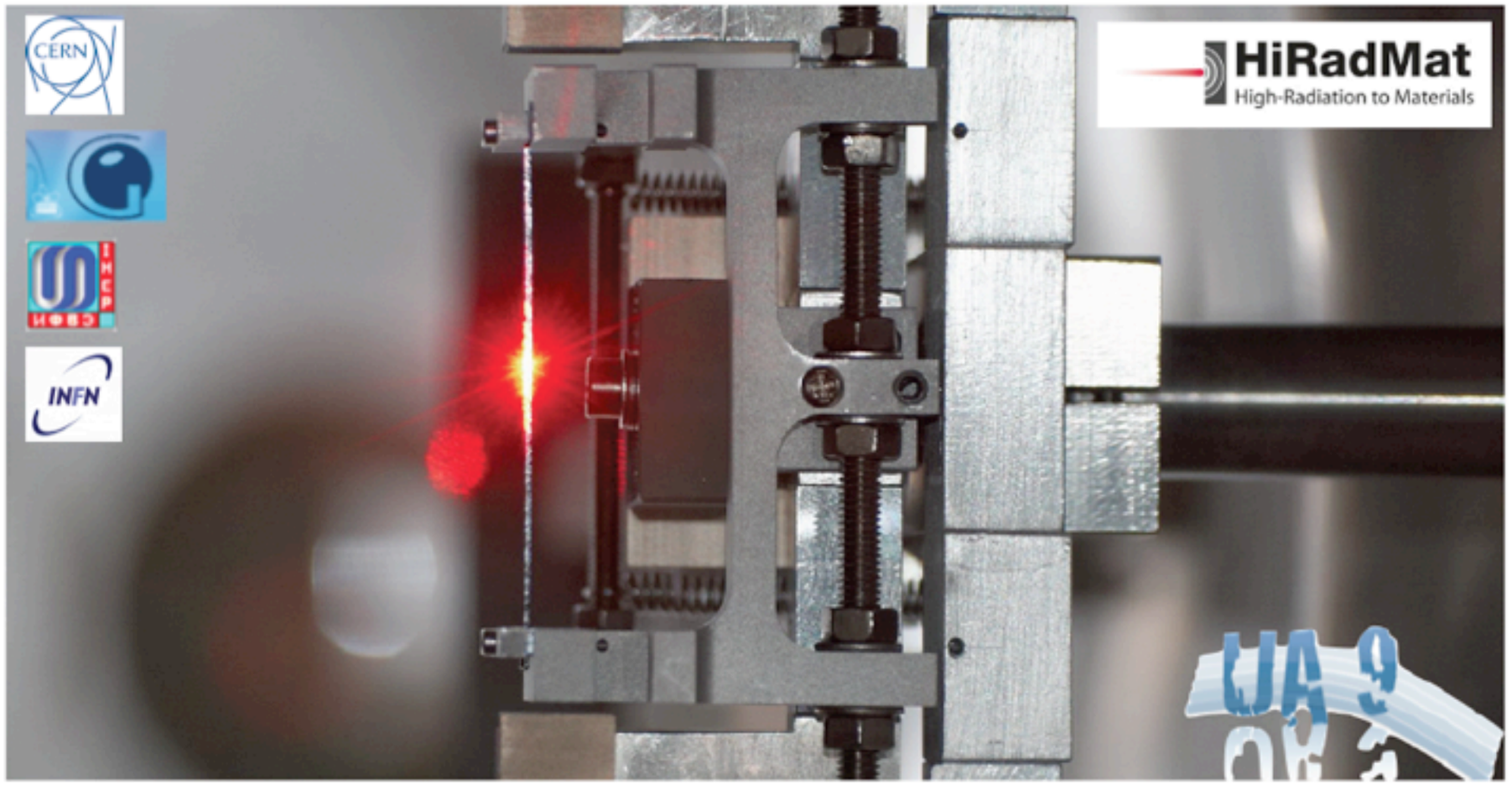
- Characterize **six different materials** (Inermet 180, Glidcop, Molybdenum, Copper-Diamond, Molybdenum-Diamond, Molybdenum-Graphite)
- **Medium intensity** and **High intensity** tests, with different material samples for each material (Type 1, Type2)
- Each sample holder tier can host up to **10 specimens**
- Extensive **real time data acquisition**
- **Post-irradiation** analysis



HRMT15-RPINST

- Test and inter-comparison of RP detectors to neutron and mixed radiation field
- Opens the facility to the RP detector R&D community

HRMT16-UA9CRY



HiRadMat Scientific and Technical board - 18 October 2012

Proposal of the HRMT16-UA9CRY experiment

Simone Montesano (CERN – EN/STI)

Reporting on the work by many people including: A. Lechner, M. Di Castro, C. Maglioni, A. Perillo Marcone, J. Lendaro, F. Loprete, M. Calviani, G. Smirnov, R. Losito and W. Scandale

HRMT01-TISD

Experiment

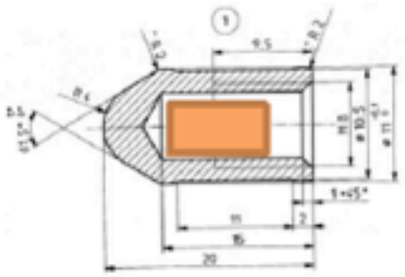
8 samples: (pellets Ø 2 cm x 2 cm) – 4 SiC & 4 Al_2O_3

Previous experience – irradiation of SiC and Al_2O_3 at PSI
TARPIPE exp. (INJECTOR 2) – good agreement with experimental results

Fernandes, S., Thèse 4813 (2010), CERN

ISOLDE

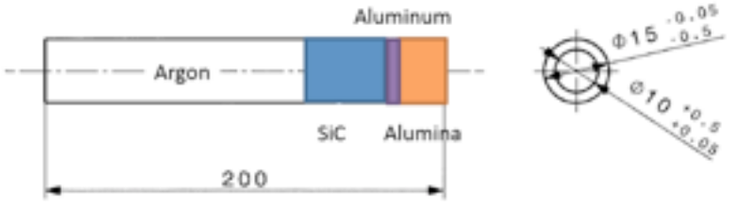
beam: NORMGPS – 1.4 GeV, 3.2x10^{13}/pulse (2.4 μs/1.2s, 3-4 bunches), σ = 2.3
RaBIT setup
(Rapid p-beam Irradiation Transport – a pneaumatic system; shuttles sent in front of HRS front-end)



Cooling down period – 1 year

HiRadMat
High-Radiation to Materials

beam: SPS – 450 GeV, 4.9x10^{13}/pulse (7.2 μs/18s, 1 – 288 bunches), σ = 2.0
Max. cycles = 100 (desirable 10x more)
Setup - 8 samples in a row



HRMT06-TPSG4

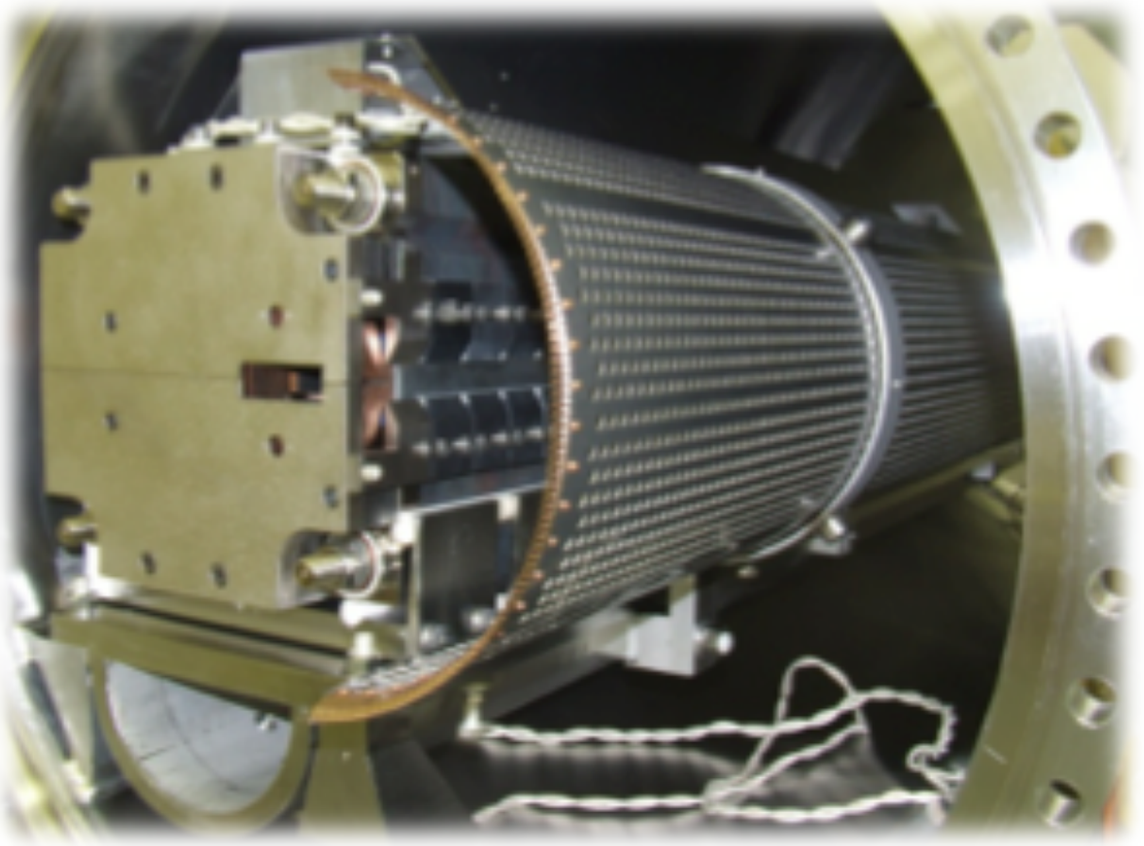
- Robustness test of a beam septum protection collimator
  - Very large installation (~9m setup) in vacuum!

HRMT06-TPSG4

- TPSG: protective device in SPS LSS4 extraction for MSE septum (beam mis-steering, kicker fault)

3100 mm long diluter, with graphite CZ5, CfC, Titanium alloy (TA6V), and a Nickel based alloy (Inconel).

Designed to protect MSE against impact of 450 GeV beam (total intensity: 4.9 10^{13}, time structure: 25ns x 72 x 4)



Courtesy HRMT06, J. Borburgh

Publications & Outreach

BUL-NA-2012-365

CRYSTALS IN THE LHC

Bent crystals can be used to deflect charged particle beams. Their us… high-energy accelerators has been investigated for almost 40 years. Recently, … irradiated for the first time in the … crystals would have to withstand i… confirmed that this technology co… performance in future upgrades of …

UA9 bent crystal tested with a …

BUL-NA-2011-141

HIRADMAT: MATERIALS UNDER SCRUTINY

CERN's new facility, HiRadMat (High Radiation to Materials), wh… materials for the world's future particle accelerators, should be o… its first experiments by the end of the year.

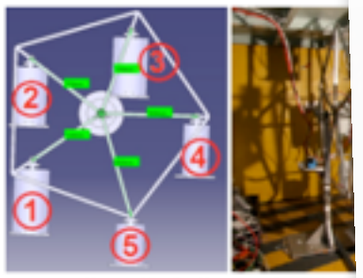
The HiRadMat facility, located in the TNC tunnel.

The materials used in … experiments are expos… particles. The LHC ma… didn't wait for the firs… most powerful accele… through their paces - … validated following a … And these tests will g… the arrival of HiRadMa…

The tunnel that forme… Neutrino Facility (WA… revamped to make way for CERN's latest facility, HiRadMat. Supp… Radioprotection service, a team from the Engineering (EN) Depart… dismantling operations from October 2009 to December 2010. "W… dismantling the old WANF machinery at an average rate of one w… LHC schedule)," explains HiRadMat Deputy Project Leader, Séba… radioactive materials were processed, stored and, where possible, … strict compliance with radiation protection rules." This was the fi… on such a large scale since the dismantling of LEP, and the extract… the WANF took a great deal of organising, using automatic hook … to allow the operators to keep their distance from the radioactive … the work went off very well, giving EN Department engineers soli… handling techniques. As Sébastien underlines, "this will stand us … dismantling jobs."

DETECTORS THAT DON'T FI…

High-intensity pulsed neutron fi… PS and LHC. The efficient detecti… and standard detectors show stro… performed at the HiRadMat facili… neutron detectors exposed to ext…

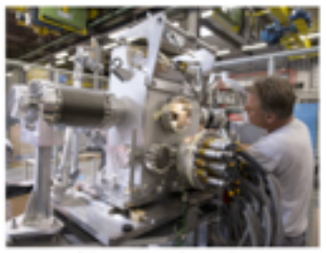


In order to limit the required hum… intervention to the beginning and th… of the test, detectors were mounted on a dedicated wheel that CERN's HiRadMat team built for the HRMT-15 experiment.

of the accelerator, thereby endan… stage collimation systems are th… by CERN, INFN, Imperial Colleg… investigate the advantages of us… hadron colliders," says Walter S… electronics, building det… high-intensity pulsed ne… technical challenge," say… of CERN's Radiation Pro… project leader of the HRMT-15 RPINST experiment. "Most detector… pile-up and the read-out becomes meaningless. In some cases, algo… compensate for losses due to high-intensity pulses but they usually … results."

DELVING INTO THE HEART OF MATERIALS

In the middle of September, the HiRadMat platform w… designed by CERN teams, which should provide a grea… when impacted by high-energy, high-intensity particl…



Section of the new machine where images of the sample fragments being projected upon beam impact are recorded.

The HiRad… facility is d… high-inten… componen… As part of … finances a … one to dev… LHC again… Mechanica… Group, supported by teams from the EN, BE, TE and PH Departments, has designed a machine capable of testing six different materials in a single experiment. In total, twelve rows of up to ten 40-mm-diameter samples can be subjected to a series of high-intensity proton pulses.

"With the power of accelerators increasing, research into the behaviour of materials under extreme conditions of temperature and pressure is becoming more and more urgent," says the experiment coordinator Alessandro Bertarelli, who is also Head of the PE Section in the Engineering Department's Mecha… - simultaneously and in real time - th… about by the impact of the beam and, … fragments being projected upon impa… models and understand the mechani… extreme conditions.

- IPAC13 : oral presentation and publications from all experiments!

Future improvements

- Beam telescope using pCVD diamonds
  - measure the beam position, intensity and profile per shot and bunch
  - improved alignment with the experiment samples
- Fast trigger signal synchronous with the beam using the signal from the BPMs of the line
  - asynchronous signal via ethernet (~1msec precision) also available
- Work on the fast camera imagine system
  - fixed installation with mirror positions and focusing lenses
  - lighting system solution
- Additional signal, HV and AC cables to the test area, possibility for vacuum installation

- HiRadMat has a small yearly budget for operational needs and consumables
- No funds for upgrades or additional instrumentation
  - request rejected
  - **we count on EUCARD2 funds**

The Future

- HiRadMat will be in shutdown mode during the CERN technical stop in 2013-2014

- Restart is expected as of **October 2014**, call for applications in **Summer'13**, user workshop in October'13

- Experiments in the pipeline and what I would like to see in HiRadMat:
  - 2nd generation of **collimator materials**
  - **Beam windows** (Be, Ti?) used in all machines upstream of targets, beam dumps
  - High-power **targetry** R&D for Neutrino Factory and SuperBeams, LAGUNA-LBNO, LBNE (pebble beds, ~2MW beam power, others?)
  - **Quench limit** of superconducting magnets

- **TAs within**

Summary - Outlook

HiRadMat is a unique facility, specially designed to perform experiments on beam-impact on materials

The Facility delivers already interesting results from the first experiments to justify its existence, and I am confident will gain popularity as a unique accelerator R&D facility

Thanks to all user teams for their efforts to prepare the facility and support the first experiments !!

Particular thanks to the HiRadMat EA team and CCC crew for the successful and safe operations and fun we are having !!

More information in our web page and blog

http://cern.ch/hiradmat -> blog