



**AIDA** 2020

Advanced European Infrastructures  
for Detectors at Accelerators



AIDA2020, 2<sup>nd</sup> Annual Meeting, LPNHE, Paris, 4-7 April 2017



# WP 11.1 Transnational Access to the GIF++ and IRRAD facilities at CERN

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Livia Elena Lapadatescu, Michael Moll, Martin Jaekel, Federico Ravotti

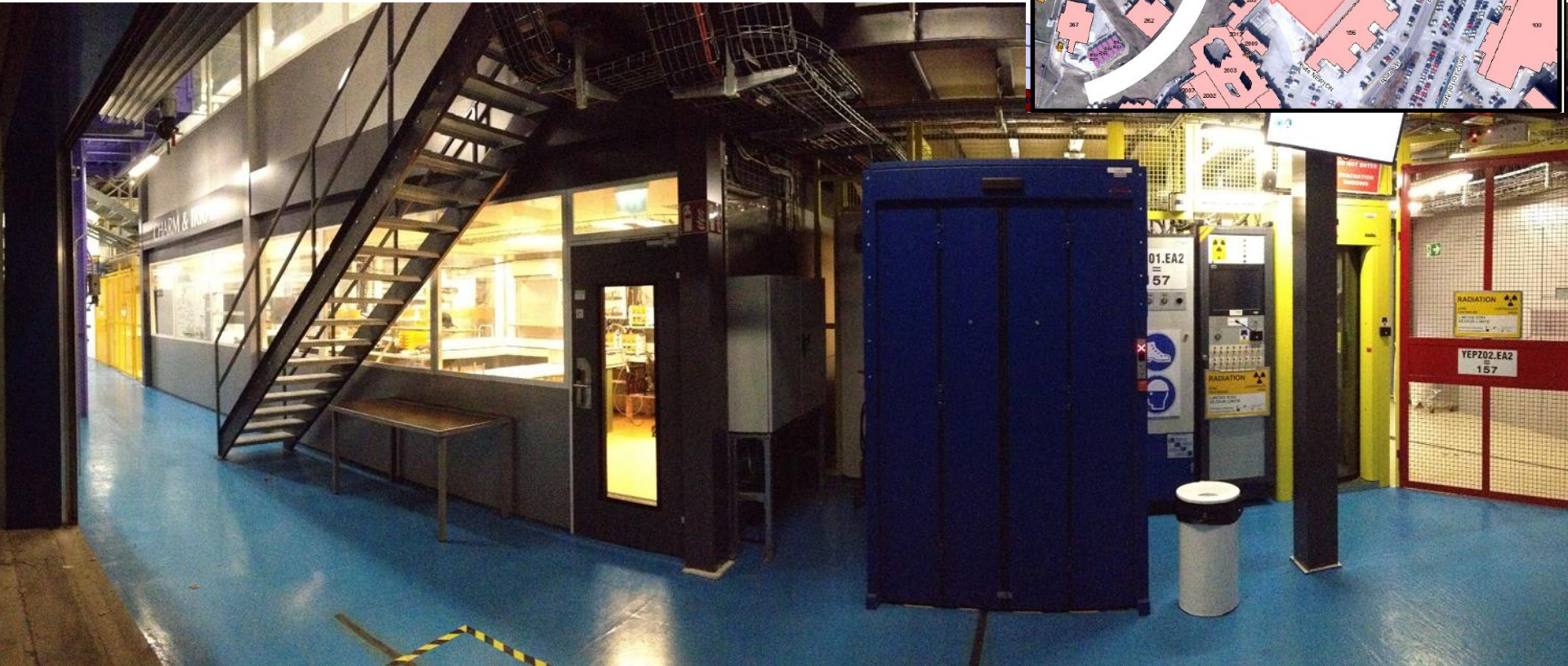
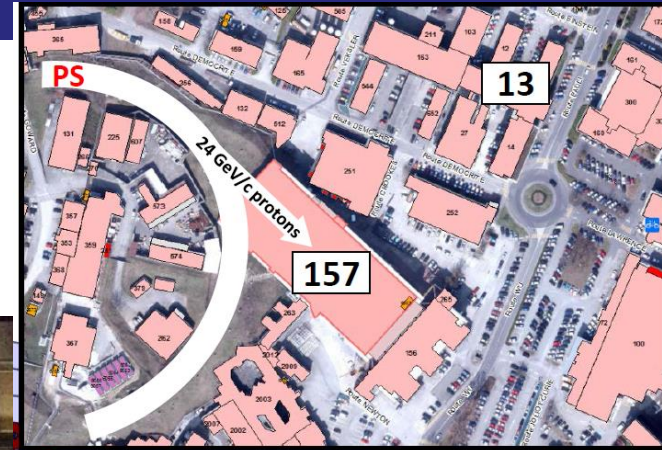
CERN, Geneva, Switzerland



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 654168.



- EA-IRRAD Facility located at the CERN PS
  - 24 GeV/c protons; Proton facility: up to  $10^{16}$  p/cm<sup>2</sup> in 14 days
- Photo: Entry area, Control Room, Access doors
  - Bottom (IRRAD Facility) – Top (CHARM Facility)

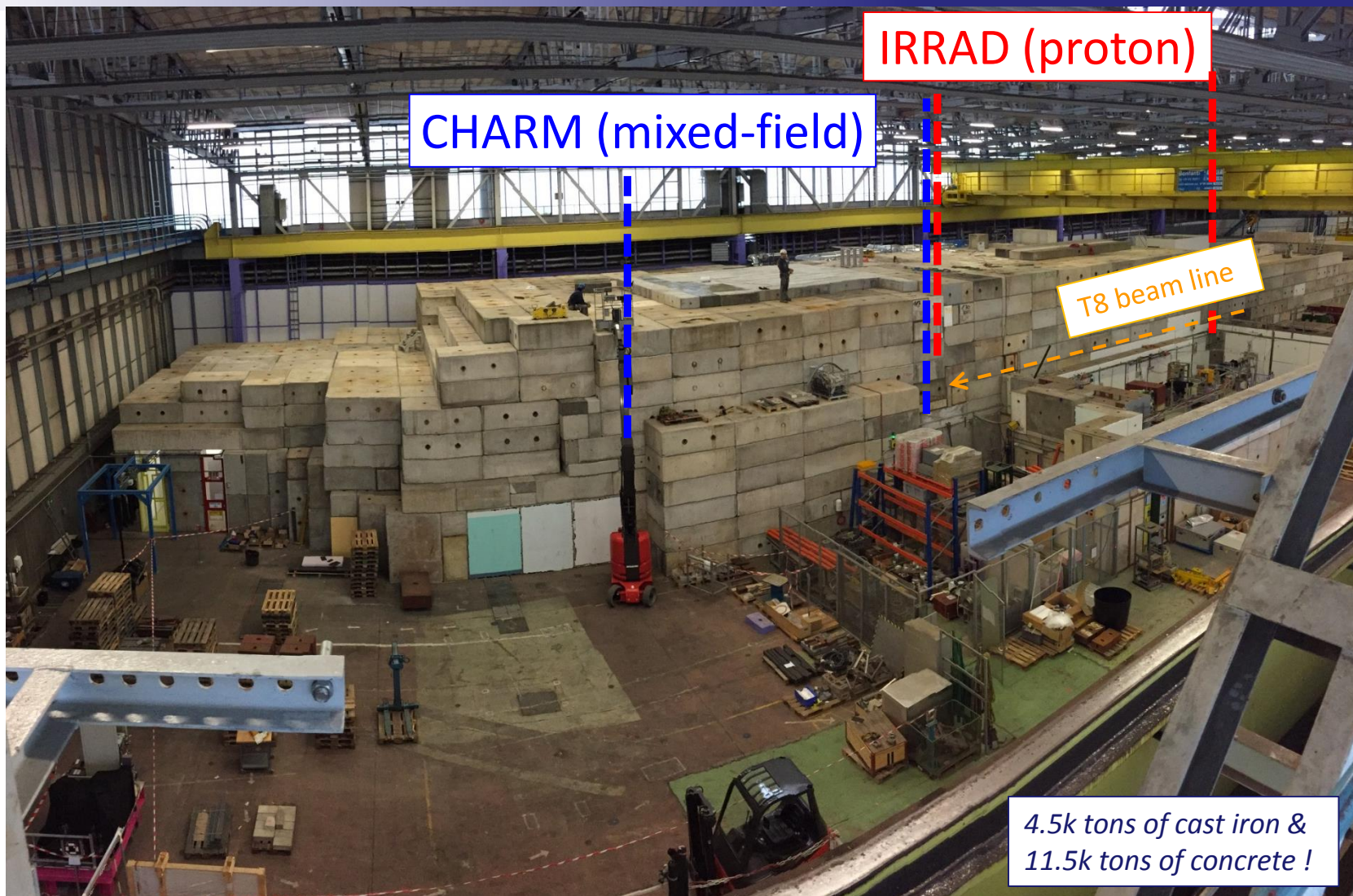






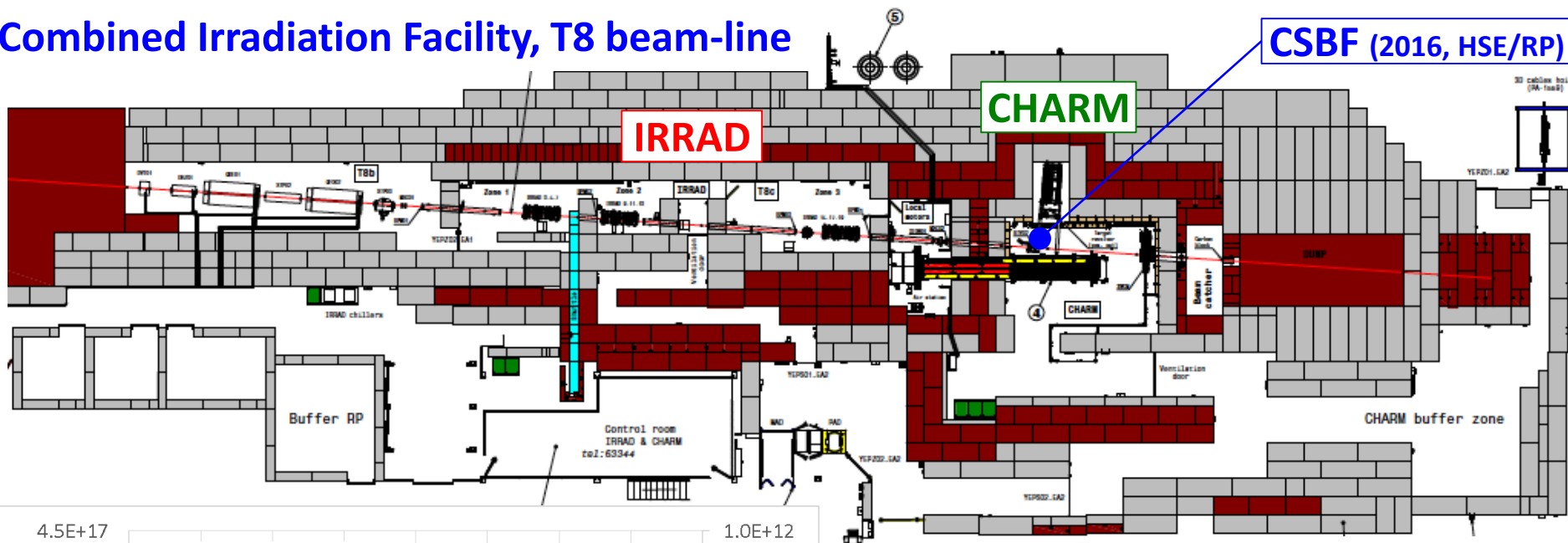
# AIDA 2020

## EA-IRRAD Arial View



## Combined Irradiation Facility, T8 beam-line

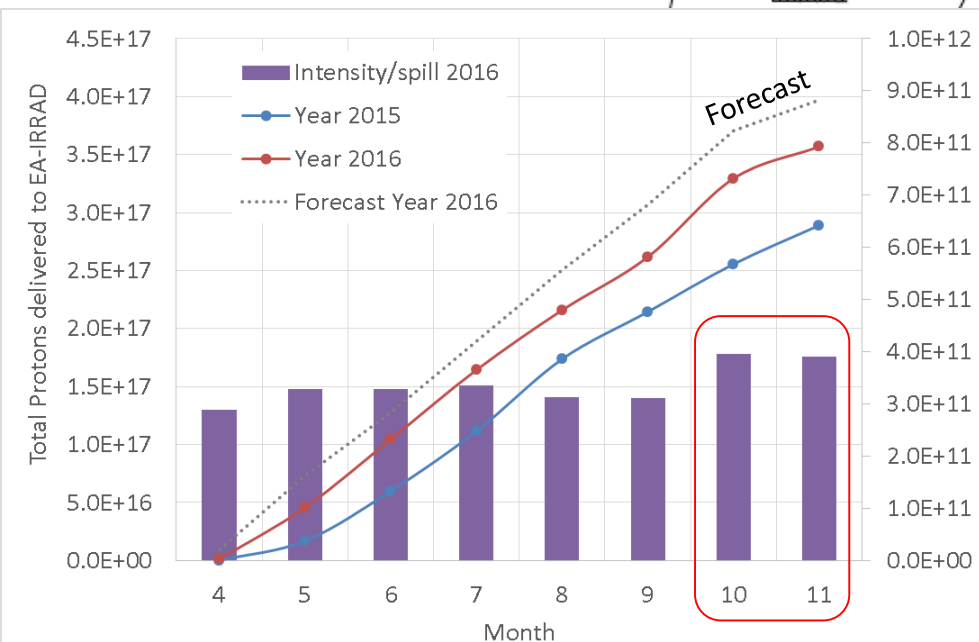
CSBF (2016, HSE/RP)



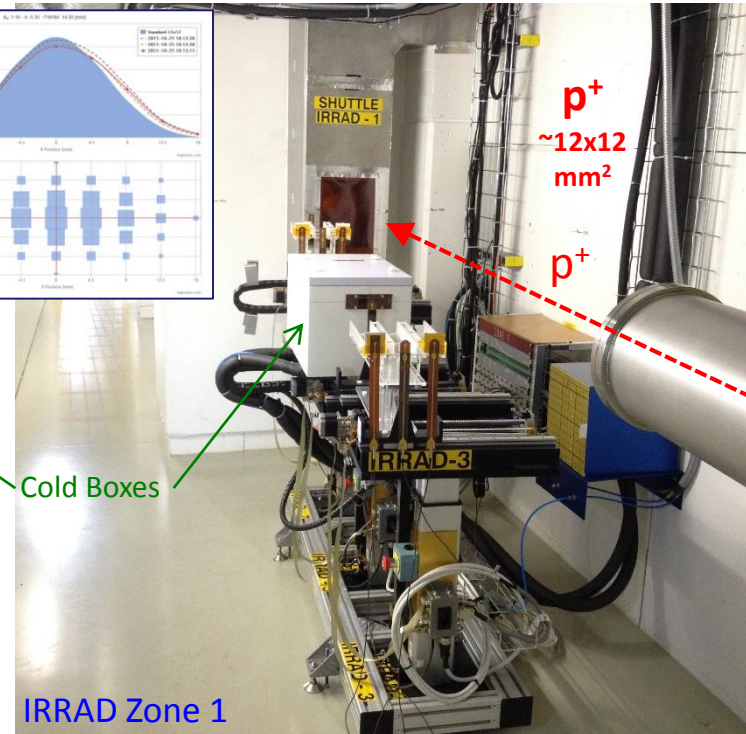
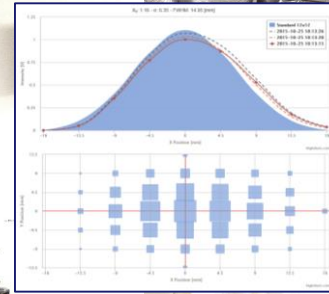
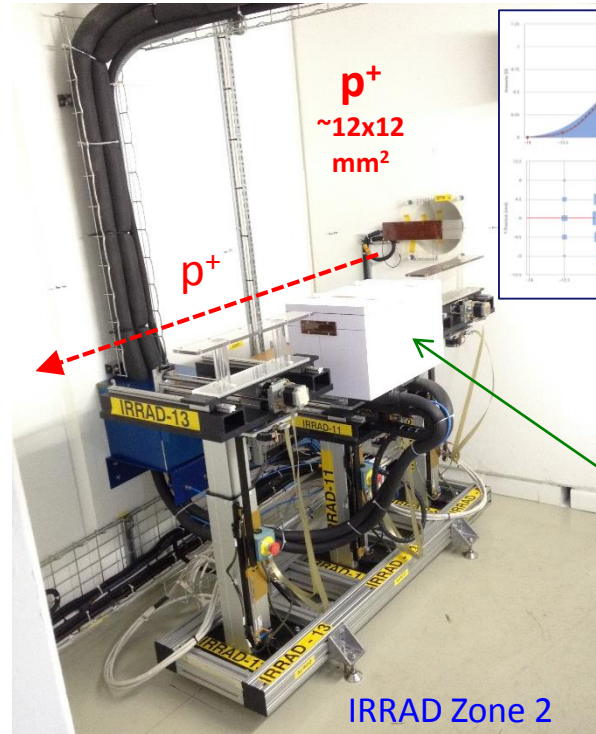
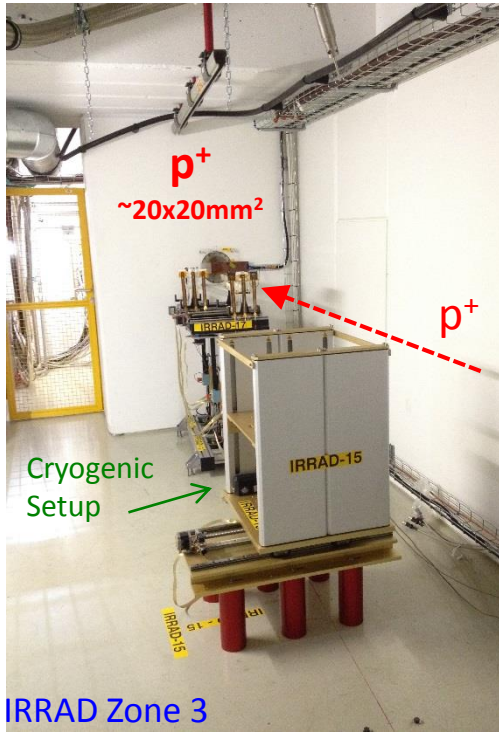
CERN Shielding Benchmark Facility (CSBF)

**Cumulated proton intensity year 2016**

**200 days with standard beam:  
5x10<sup>11</sup> p ejected,  
90% PS efficiency**







- 3 tables per IRRAD zone

- 9 remote-controlled irradiation tables

- 6x RT irradiation (IRRAD 3,7,9,13,17,19)
    - 2x water-cooled cold boxes down to -25°C (IRRAD 5,11)
    - 1x dedicated to the cryogenic setup (IRRAD 15)

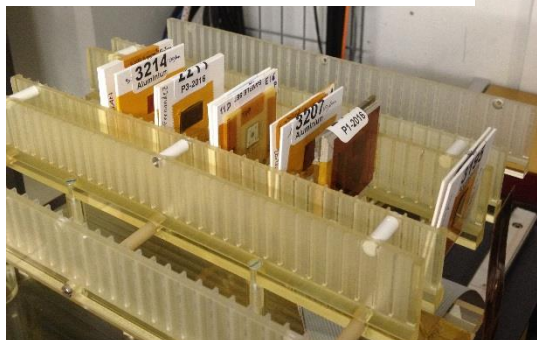
- 1 remote-controlled shuttle system

(IRRAD 1)

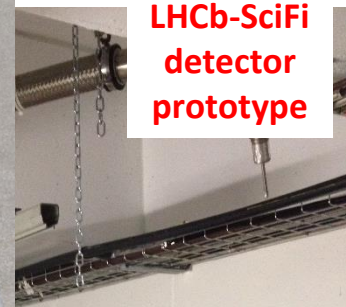
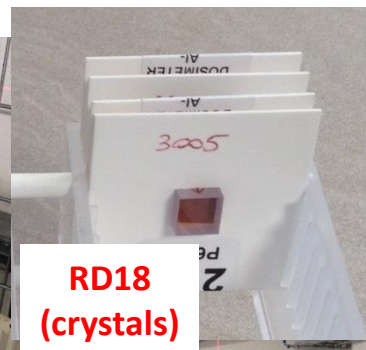
- Pre-installed cabling infrastructure



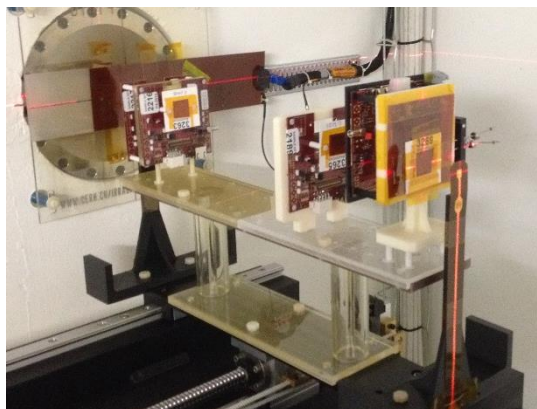
CMS pixel, FCC test structures



microScint (material tests)



FEI4 with various technologies



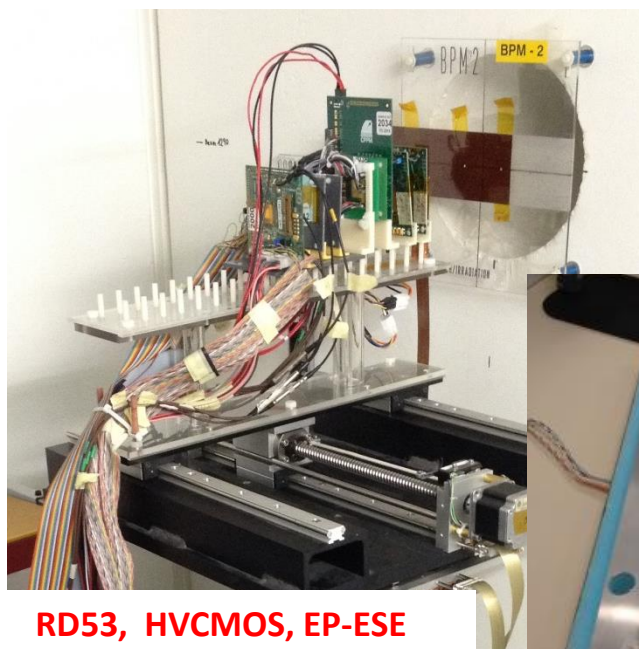
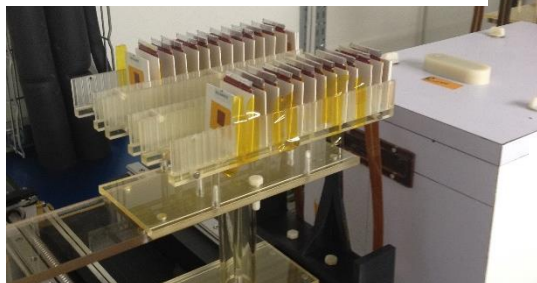
RD18  
(crystals)

LHCb-SciFi  
detector  
prototype

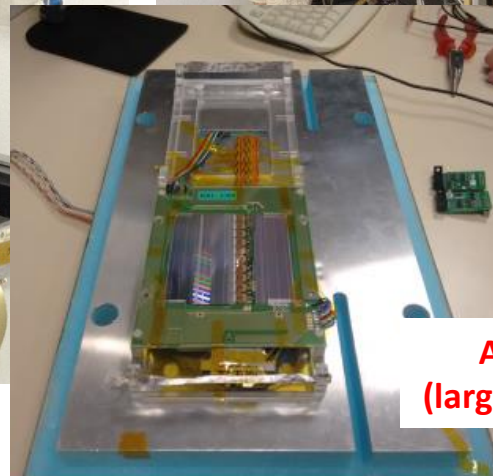
p<sup>+</sup>



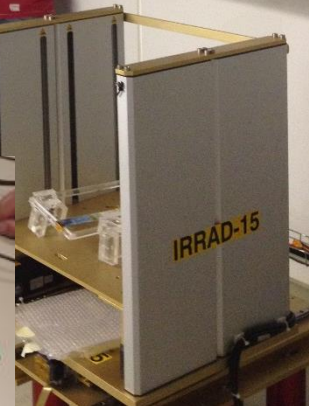
RD50 structures, ATLAS CMOS



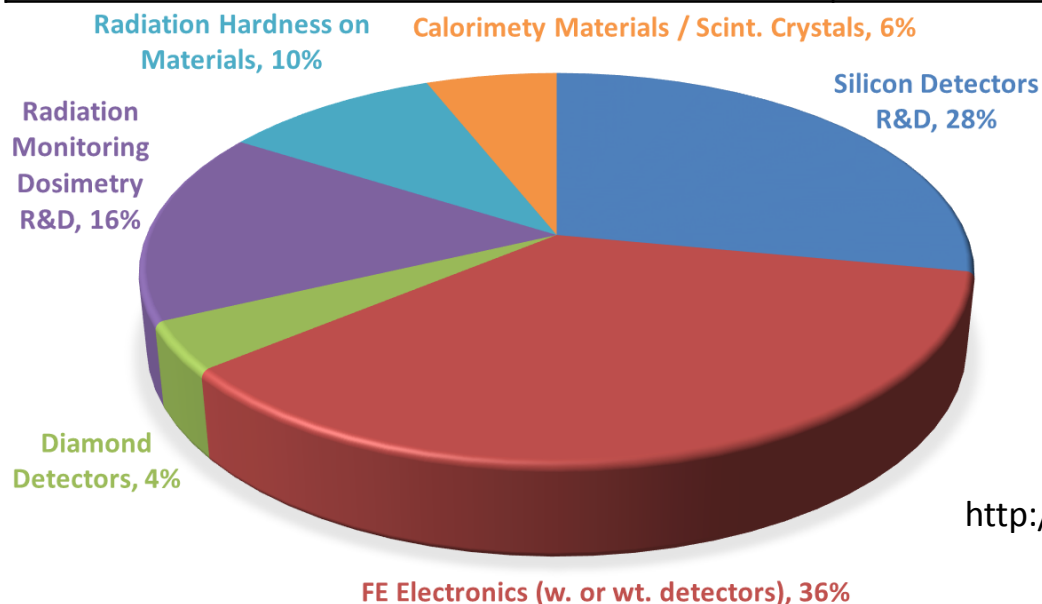
RD53, HVCMOS, EP-ESE  
(SEU/functional testing)



ATLAS ITk Strip  
(large modules, low T)



Registered Experiments (web)	52	49 executed (94%)
Number of user teams	23 + 5 AIDA teams	~70% LHC experiments
<b>Number of samples / irradiated objects</b>	<b>416</b>	246 "SET" numbers
Samples size (MIN/MAX)	2mm × 2mm	250cm × 13cm × 4cm
Target proton fluence (request MAX)	$1 \times 10^{17}$ p/cm <sup>2</sup> (5×5mm <sup>2</sup> FWHM)	~27MGy in Si
Typical irradiation runs (MIN/MAX)	~ $2 \times 10^{11}$ p/cm <sup>2</sup> (1 spill)	~ $4.2 \times 10^{16}$ p/cm <sup>2</sup> (5×5mm <sup>2</sup> FWHM) ~ $1.6 \times 10^{16}$ p/cm <sup>2</sup> (20×20mm <sup>2</sup> FWHM)
Typical irradiation time (MIN/MAX)	400 ms	~50 days ~76 days



- Low T (< -20°C) experiments
- «scanning» experiments
- cryogenic setup not used



**Transnational Access Program**

<http://aida2020.web.cern.ch/content/transnational-access>





## Old system

The old system interface is a desktop-style web application with a blue header and a complex layout. It features a 'Sampel Manager - Samples' title bar with a 'Print labels' button. Below the header, there are navigation tabs for 'Samples' and 'Dosimeters', and a search bar. The main content area displays details for a sample set 'Set-1762-P3-2012'. It includes three storage labels: 'Irradiation label', 'Main label', and 'Description label'. The 'Main label' shows 'SAMPLE SET 1762 P3-2012' and 'OWNER: Paul Dervan'. The 'Description label' shows 'DESCRIPTION: Frame with NTC's and FET's'. Below the labels, there are sections for 'Storage of sample set' and 'Description and comments'. The 'Irradiation status' is set to 'Completed', and the 'Irradiation Facility' is 'IRRAD7'. The interface is cluttered with many small text elements and buttons.

## New system

The new system interface is a modern, responsive web application with a dark blue header and a clean, organized layout. It features a 'Samples Manager' title bar and a navigation menu. The main content area displays a table of samples with columns for 'Samples', 'Experiment', 'Owner', 'Updated by', 'Date of the update', and 'Status'. The table lists various irradiation experiments and their statuses, such as 'Registered', 'Approved', 'Out of beam', and 'Completed'. Below the table, there are three buttons: 'New Irradiation', 'New Samples', and 'New Users'. The interface is user-friendly and easy to navigate.

**Table of Samples:**

Samples	Experiment	Owner	Updated by	Date of the update	Status
SET-2104	Fidlers irradiation	Federico Ravotti	Maurice Glaser	01/02/2017 16:00	Registered
SET-2103	Silicon irradiation	Federico Ravotti	Maurice Glaser	01/02/2017 16:05	Approved
SET-2102	Sensors irradiation	Federico Ravotti	Maurice Glaser	01/02/2017 16:10	Completed
SET-2101	Fidlers irradiation	Federico Ravotti	Maurice Glaser	01/02/2017 16:15	Out of beam
SET-2100	Silicon irradiation	Federico Ravotti	Maurice Glaser	01/02/2017 16:20	Completed
SET-2099	Cold irradiation	Federico Ravotti	Maurice Glaser	01/02/2017 16:00	Registered
SET-2098	Cold irradiation	Federico Ravotti	Maurice Glaser	01/02/2017 16:05	Approved
SET-2097	Sensors irradiation	Federico Ravotti	Maurice Glaser	01/02/2017 16:10	Completed
SET-2096	Fidlers irradiation	Federico Ravotti	Maurice Glaser	01/02/2017 16:15	Out of beam
SET-2095	Silicon irradiation	Federico Ravotti	Maurice Glaser	01/02/2017 16:20	Completed
SET-2094	Cold irradiation	Federico Ravotti	Maurice Glaser	01/02/2017 16:00	Registered
SET-2093	Cold irradiation	Federico Ravotti	Maurice Glaser	01/02/2017 16:05	Approved
SET-2092	Sensors irradiation	Federico Ravotti	Maurice Glaser	01/02/2017 16:10	Completed
SET-2091	Silicon irradiation	Federico Ravotti	Maurice Glaser	01/02/2017 16:15	Out of beam
SET-2090	Fidlers irradiation	Federico Ravotti	Maurice Glaser	01/02/2017 16:20	Completed

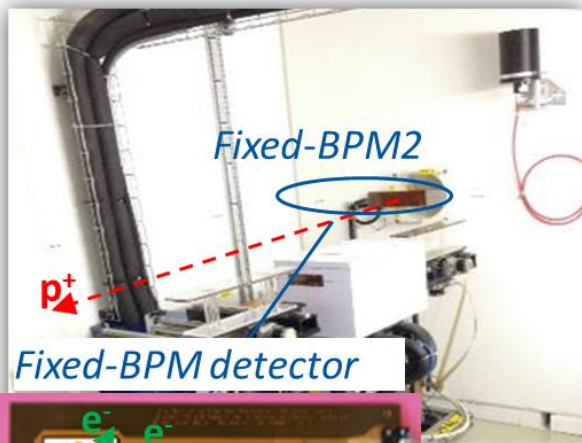
The new system also includes a 'New Irradiation Experiment' form with fields for 'Irradiation title', 'Requested Resource', 'When the sample will be available for irradiation (if any)', 'Deadline for the end of irradiation (if any)', 'Justification for the deadline (if any)', 'Irradiation type', 'Priority', 'Requested sponsor resources', and 'Storage'. It has 'Save' and 'Add Samples' buttons.





## Fixed BPM

For the beam alignment



Fixed-BPM detector

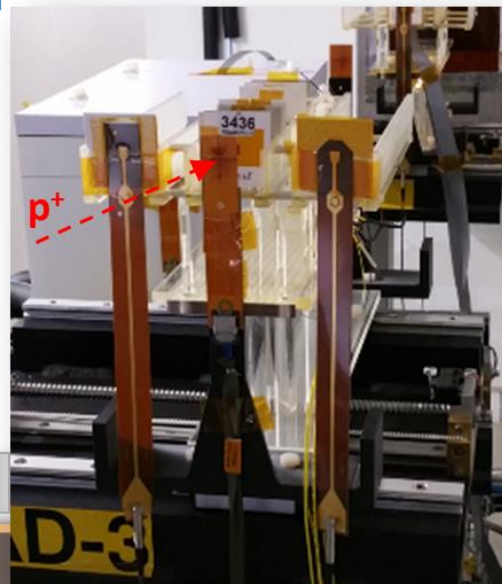


Transversal beam profile



## Mini and single-pad BPMs

IRRAD tables alignment purpose and “in-beam” detection



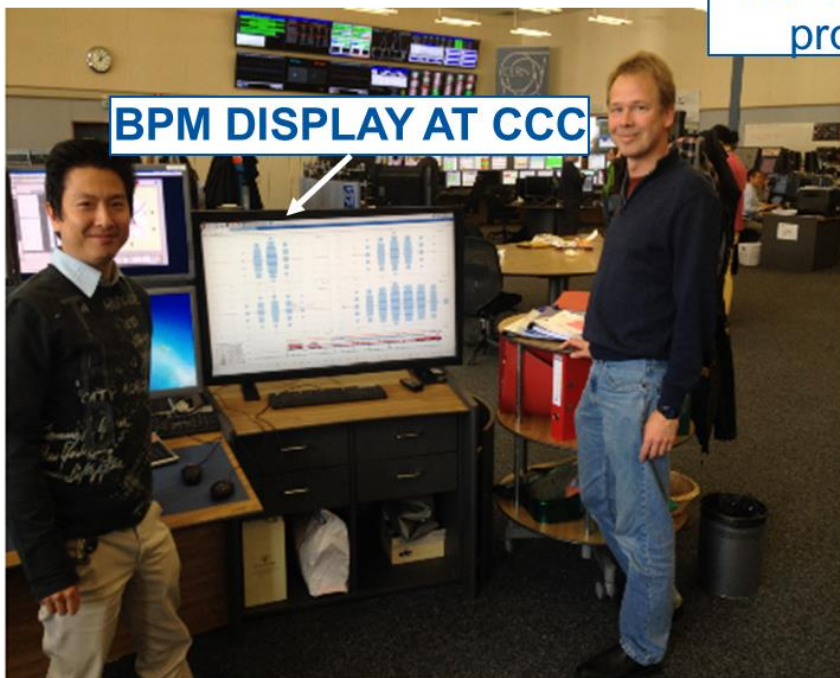
**D15.7:**  
Radiation  
Hard Facility  
Instrumenta  
tion ready &  
installed

**M44**



BPM DAQ unit 25-35m away from fixed-BPM device.

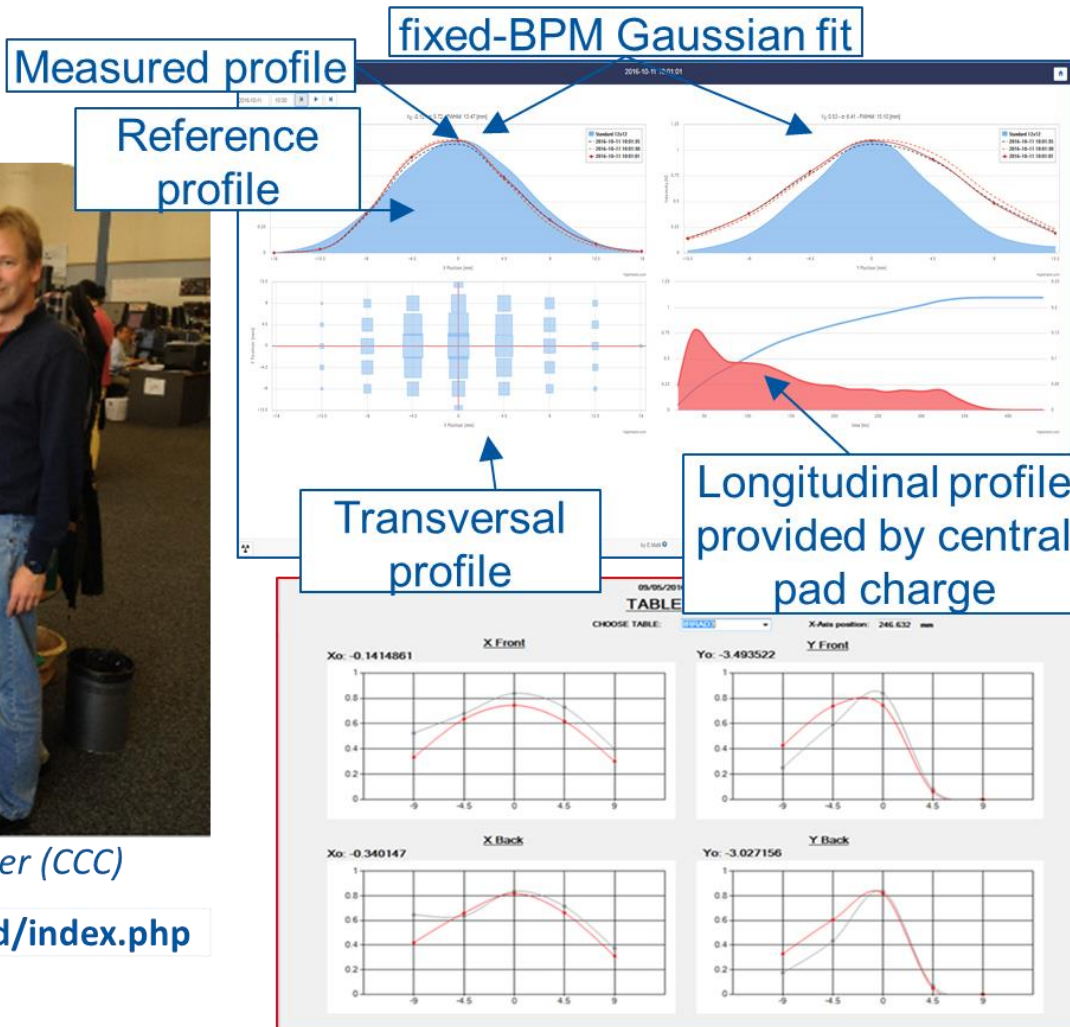




BPM DISPLAY AT CCC

Beam monitoring at CERN Control Center (CCC)

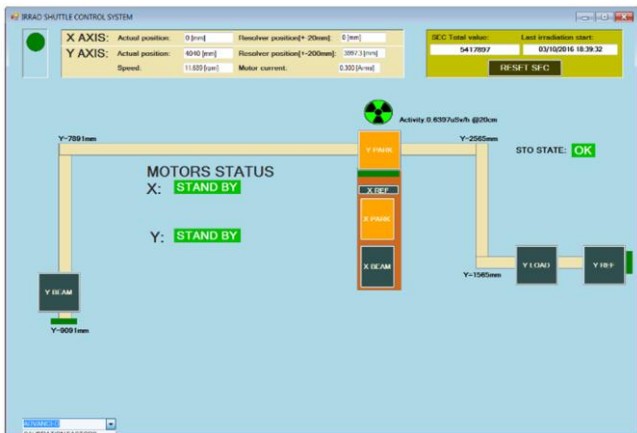
<https://op-webtools.web.cern.ch/irrad/index.php>





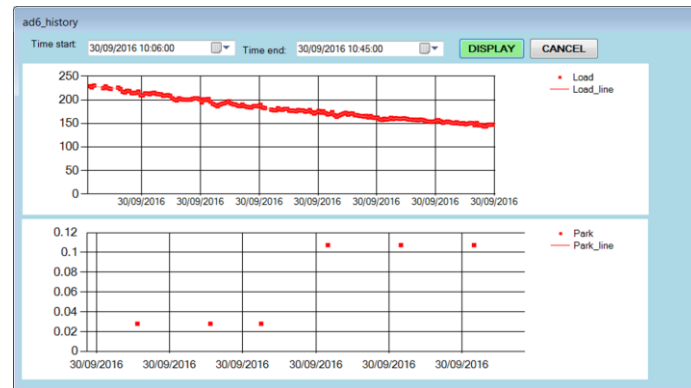


- New software for control and data acquisition (see WP15 report)

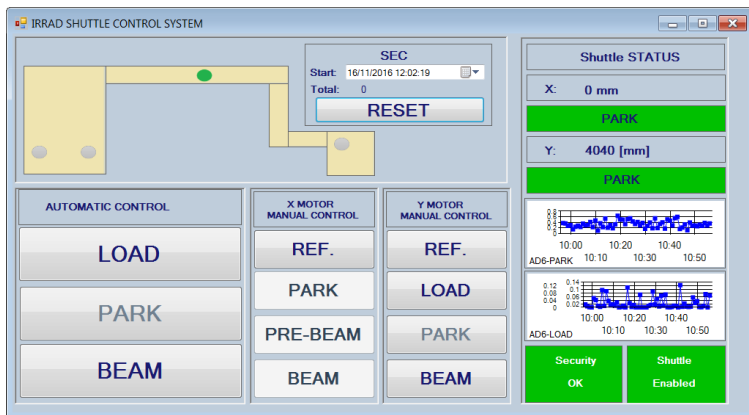


*Shuttle: Administrator interface*

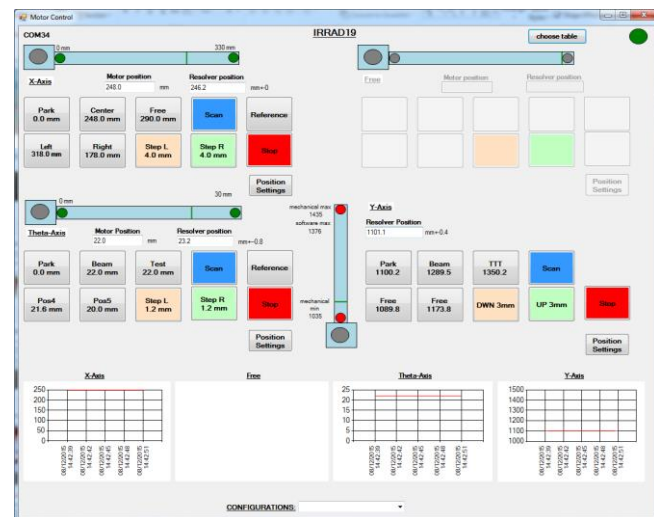
*Dose rate monitoring*



*Tables control interface*



*Shuttle: User interface*





# AIDA 2020

## GIF++ Aerial View

[www.cern.ch/gif-irrad](http://www.cern.ch/gif-irrad)

Irradiation Bunker

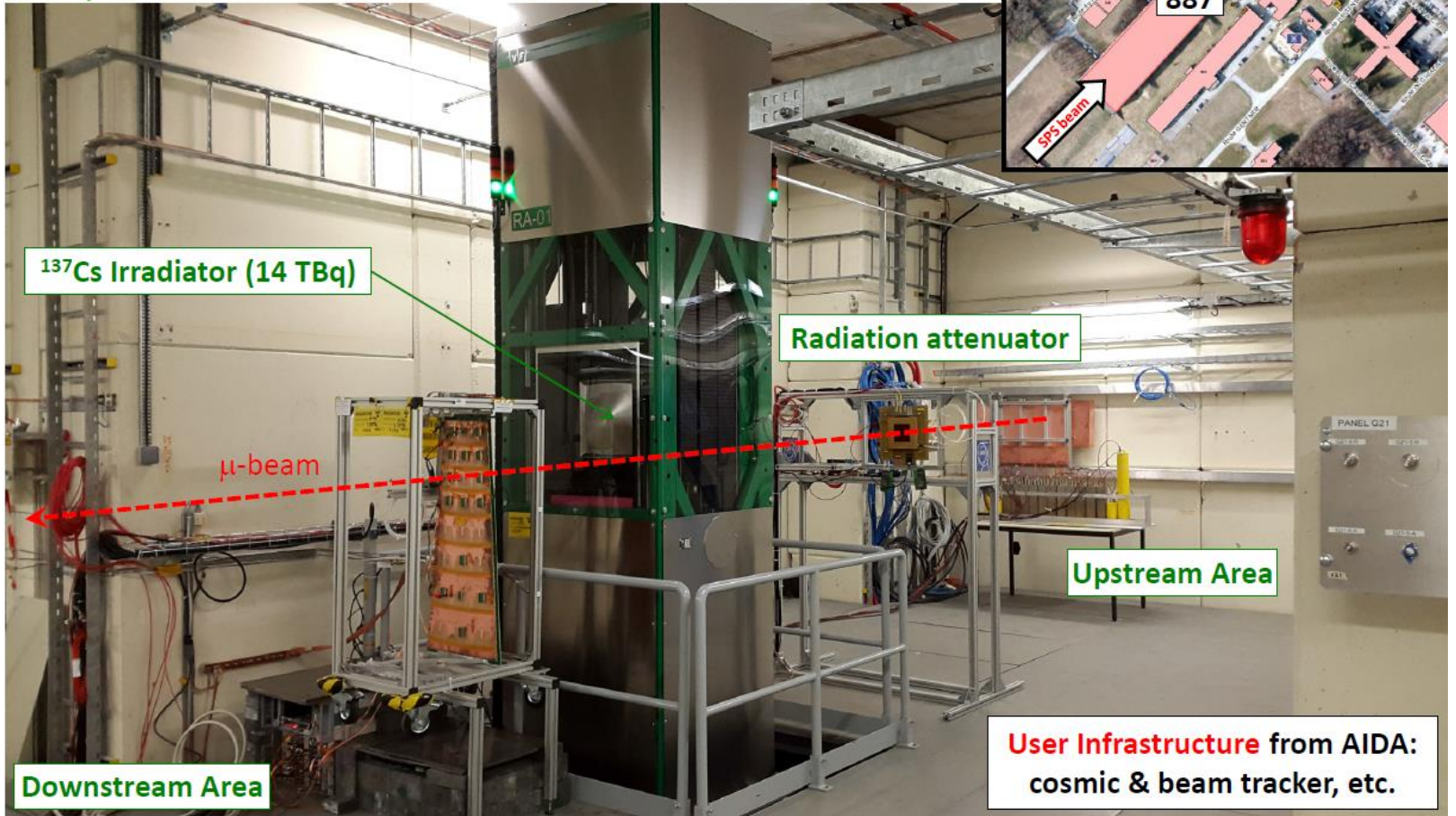
Electronics & Gas Service Areas

Preparation Area





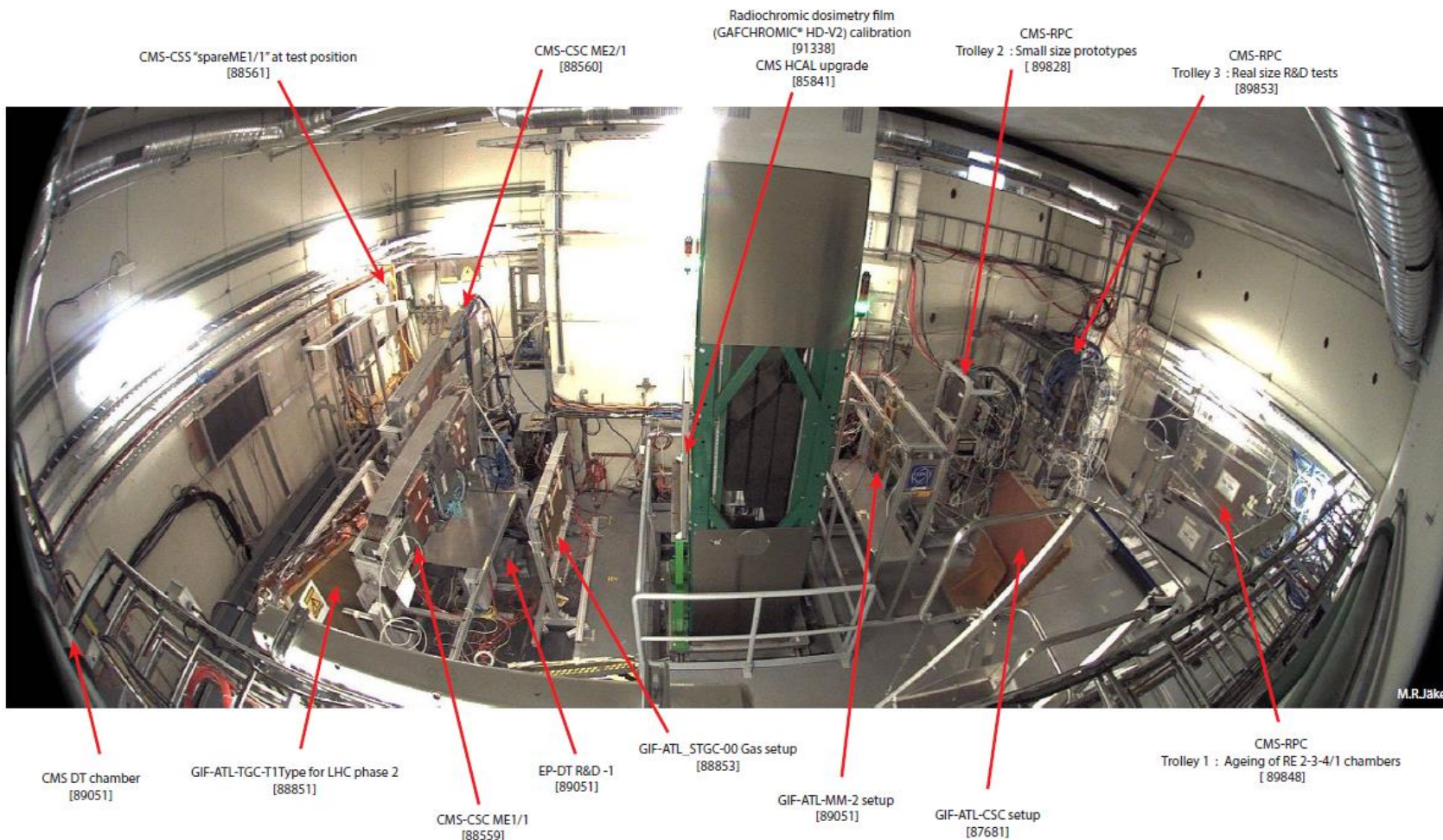
- $E_\gamma = 0.66 \text{ MeV}$ ; max. dose-rate  $\sim 0.5 \text{ Gy/h @ 1m}$  ( $\pm 37^\circ$  angle)
- Several attenuation factors available (up to  $\sim 50'000$ )
- $\mu$ -beam from T2 on H4 beam-line ( $100 \text{ GeV}$ ;  $\sim 10^4$  /spill)







- Present status (more setups arriving in April)







- Intense maintenance period completed in March
- Second cosmic trigger chamber installed
- Improved temperature & humidity control inside bunker + temperature stabilisation for gas system
- Improved central control system, new web page
- Upstream XTDV installed
- Irradiation field markings
- New gas detection system under installation
- Several new setups installed
- Material access door finalised, installation later this year





- <https://gif-irrad.web.cern.ch/gif-irrad/>

The screenshot shows a web browser window displaying the 'Gamma Irradiation Facility - Operation Page'. The page has a blue header with the GIF++ logo and the text 'Gamma Irradiation Facility - Operation Page'. On the left, there is a vertical navigation menu with links to 'Main Page', 'Logbook', 'Meetings', 'Schedule', 'GIF Control System', 'Irradiation Request', 'Contacts', 'User List', 'Documents & Plans', 'Publications', 'RADMON Status', 'Subscribe to e-group GIF-active-users', and 'Secondary Beam & Areas (SBA)'. Below the menu, there is a grid of icons representing various services: 'GIF++ Logbook' (notepad), 'Weekly Meetings' (group of people), 'Schedule & Calendar' (calendar), 'GIF Control System' (computer), 'Irradiation Request' (red square with pencil), 'Contacts & Notifications' (envelope and phone), 'News (Twiki)' (orange starburst with 'NEW!'), '(Gas System)' (empty space), 'User List' (group of people), 'Documentation & Plans' (folder), 'Publications' (quill pen), and 'Procedures Safety & Access' (blue circle with white helmet). At the bottom, there is a section for 'Installation related questions' with links to 'Martin', 'Giuseppe', and 'EP-DT Irradiation Facilities Team', and a note about 'ISIEC/Safety Clearance'.





- Unified entry point for irradiation facilities at **CERN** and **worldwide**
- Essential (but exhaustive) collection of information
- 182 entries so far
- Validation of the data in progress

*Facilities worldwide*

ID	Institute Name	Country	Facility Name	Source Type	Radiation Field/Type	Funding Details	OwnerID	ShowEntry
18	A.R.T.E.	Italy			Heavy ions		info@radarte.it	✖
103	ADVANCED RADIATION RESEARCH INSTITUTE (JAEA)	Japan	PROTON facility TIARA	AVF Cyclotron(K110), 3 MV Tandem accelerator, 3 MV Single-Ended accelerator, and 400 kV Ion Implanter	Proton		kojima.takui@jaea.go.jp	✖
105	ADVANCED RADIATION RESEARCH INSTITUTE (JAEA)	Japan	Electron Beam Irradiation Facility	Cockcroft-walton type	Electrons		kojima.takui@jaea.go.jp	✖
106	ADVANCED RADIATION RESEARCH INSTITUTE (JAEA)	Japan	Gamma-ray Irradiation Facilities	Co - 60	Gamma		kojima.takui@jaea.go.jp	✖
107	ADVANCED RADIATION RESEARCH INSTITUTE (JAEA)	Japan	HEAVY IONS facility TIARA	AVF cyclotron (K110), 3 MV Tandem accelerator, 3 MV Single - Ended accelerator, and 400 kV Ion Implanter	Heavy ions		kojima.takui@jaea.go.jp	✖
64	AEROFLEX RAD	USA	NEUTRON facility - 1		Neutrons		joe.benedetto@aeroflex.com	✖
65	AEROFLEX RAD	USA	ELECTRON facility - 1	Pelletron	Electrons		joe.benedetto@aeroflex.com	✖
66	AEROFLEX RAD	USA	Gamma facility - 1	Co - 60 and Cs - 137	Gamma		joe.benedetto@aeroflex.com	✖
42	ÚJV Řež	Czech Republic	Prague reactor				milan.krivda@ujv.cz	✖

*Homepage*

**IRRADIATION FACILITIES**

**Welcome to the CERN Irradiation Facilities website.**

*The website information are public, however some sections are oriented to the CERN community.*

December 2016: Database filled to the best of our knowledge with existing data compilation from CERN departments and the collection made in RADECS 2011. Validation from facility owners ongoing.

[CERN FACILITIES](#) [IRRADIATION FACILITIES DATABASE](#) [FACILITIES MAP](#)

<http://irradiation-facilities.web.cern.ch/>

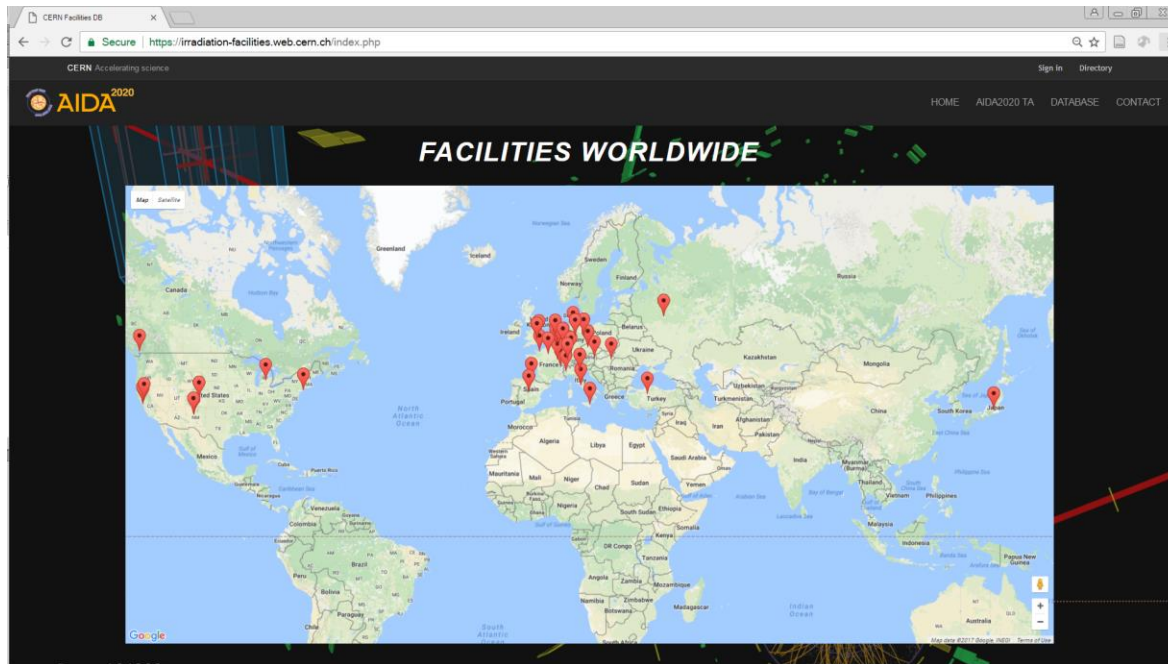
*CERN Facilities*

**CERN FACILITIES**

- EP-DT IRRAD Proton Facility**
- GIF**
- CALLAB & CC60**
- HiRadMat**
- CERF**



- **Open access** data, secured with the CERN authentication system (SSO)
- Search filters by country, source or radiation field
- Irradiation facilities worldwide map
- Possibility to **ADD** a new facility and **EDIT** an existent one by the **facility coordinator**
- **Auto-maintenance** (regular reminders)







- Data given in P1 report [M1 to M18] (....38% of 48 months have passed)

CERN IRRAD	User-projects		Total no. of users benefitting from the TA	Units of access (IRRAD = beam operation hour)
	Eligible submissions	Selected		
Period 1 (M1-M18)	5	5	18 (10 received financial support, 8 remote access)	1,370
Foreseen for project (M1-M48)	30		60	4,032

Achieved:                                  17%                                  30%                                  **34%**

CERN GIF++	User-projects		Total no. of users benefitting from the TA	Units of access (GIF++ = operation hour)
	Eligible submissions	Selected		
Period 1 (M1-M18)	6	6	30 (20 received financial support)	1,990
Foreseen for project (M1-M48)	20		50	4,032

Achieved:                                  30%                                  60%                                  **49%**

- First 18 months within planned spending (except number of IRRAD facility projects)



- Status of AIDA-2020 projects in IRRAD today

- **8 projects** (26% of aim: 30 projects)
- **2080 units** (52% of aim: 4032 units)
- **37 users** (62% of aim: 60 users)

- Spending: **38% of available funds spent**

- Conclusion:

- Number of users and units delivered are in line with proposal
- Number of projects is less than anticipated
- Funds still available for coming years
- Note:
  - 8 AIDA projects for the IRRAD facility, which is very small compared to the overall irradiations performed in this facility

CERN-IRRAD-2015-01	Radiation hardness of 65nm IP blocks and CMOS pixels	Alexandre Rozanov, CPPM, Marseille
CERN-IRRAD-2015-02	Study of acceptor removal in deep diffused silicon samples	Gianluigi Casse, Liverpool University
CERN-IRRAD-2015-03	Proton irradiation of CMS pixel sensors and diodes	Alexandra Junkes, Hamburg University
CERN-IRRAD-2015-04	Irradiation of CHESS-1 and HVSTRIP1 chips	Todd Huffman, University of Oxford
CERN-IRRAD-2015-05	Characterisation of 3D SINTEF silicon sensors	Ole Rohne, University of Oslo
CERN-IRRAD-2016-01	ATLAS Strip module irradiation	Susanne Kuehn, Freiburg University
CERN-IRRAD-2016-02	Radiation hardness of 65nm IP blocks and CMOS pixels under radiation for the ITK project	Marlon Barbero, Aix-Marseille University
CERN-IRRAD-2016-03	Optical fiber-RCF read-out method	Luigi Campajola, University of Naples Federico II and INFN, Italy





- Status of AIDA-2020 projects in GIF++ **today**

- 9 projects approved (aim for 20)
- **2110 units** (52% of aim)
- **9 projects** (45% of aim)
- **53 users** (106% of aim)

- Spending: **52% of available funds spent**

- Conclusion:

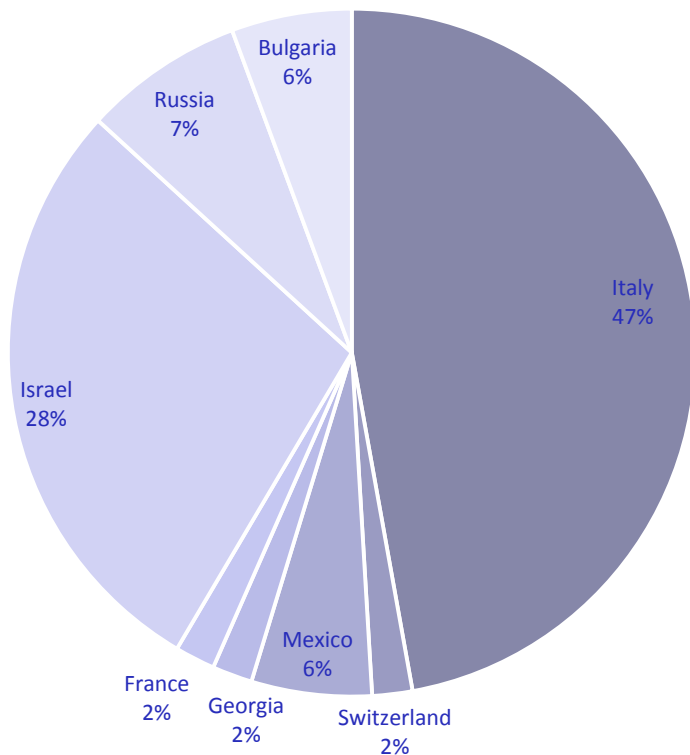
- Number of users ahead w.r.t. proposal
- Number of units/projects in line with proposal time plan
- Note:
  - 9 AIDA projects for the GIF++ facility (could be increased if also those colleagues using the facility without financial support would fill AIDA requests)

CERN-GIF-2015-01	RPC for HL-LHC & Studies on new gases	Giulio Aielli (Uni Roma Tor Vergata)
CERN-GIF-2016-01	CERN MicroMegas at GIF++	Paolo Iengo (CERN)
CERN-GIF-2016-02	Validation of high rate large area RPC for Phase-1 LHC	Giulio Aielli (Uni Roma Tor Vergata)
CERN-GIF-2016-03	CMS RPC irradiation test	Gabriella Publiese (Bari University)
CERN-GIF-2016-04	Small Thin Gap Chamber - GIF++	Yan Benhammou (Tel Aviv University)
CERN-GIF-2016-05	Aging test runs of CMS CSC chambers at GIF++	Gennadii Gavrilov (St. Petersburg Nuclear Physics Institute (PNPI), Russia)
CERN-GIF-2016-06	Fiber optic sensors and dosimeters	Luigi Campajola, Uni Naples
CERN-GIF-2016-07	Online dose rate monitoring system for GIF++	Plamen Iaydjiev, (INRNE, Sofia)
CERN-GIF-2017-01	Performance of ATLAS TGC under high background rates	Shikma Bressler (Weizmann Institute of Science)

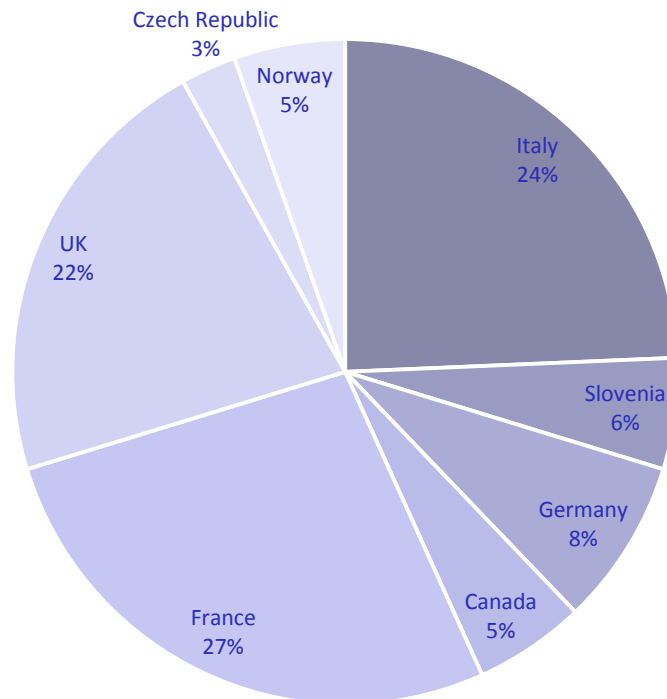


- Users split per country of home institution

### GIF++



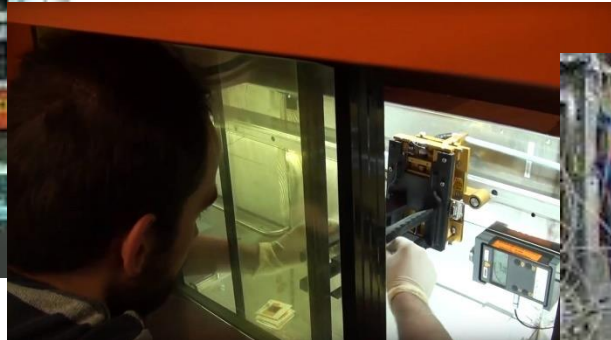
### IRRAD







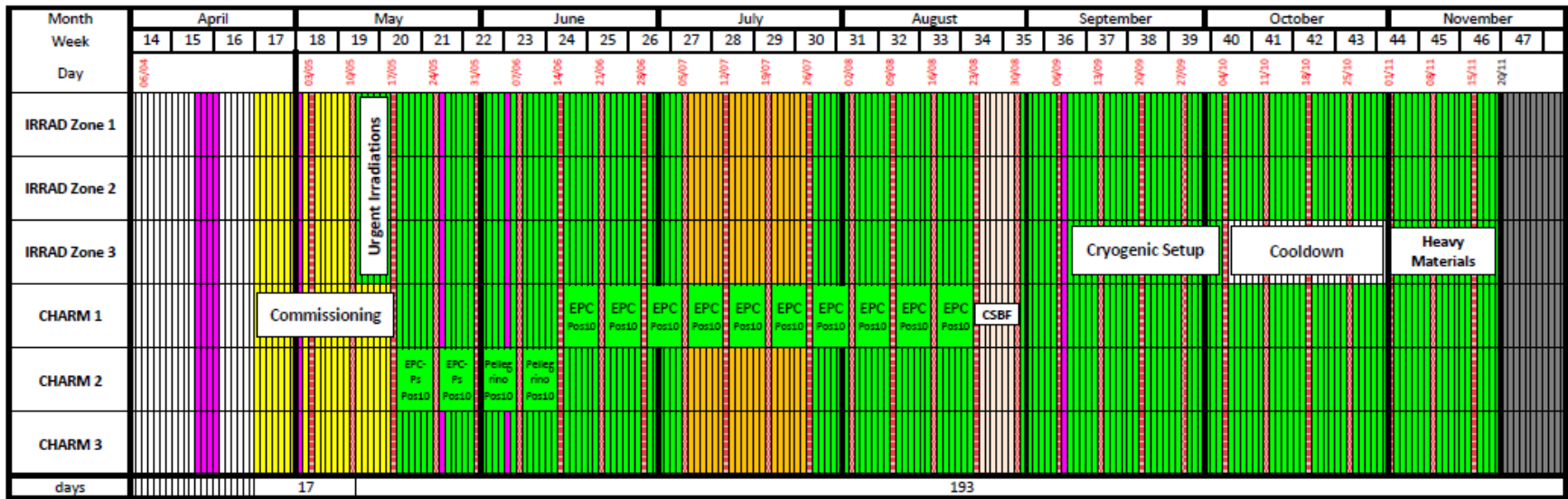
- Database on (World Wide) Irradiation Facilities created. AIDA TA facilities are highlighted in this database.
- AIDA TA program announced in all presentations of the CERN facilities
- CERN Technology Transfer group promoting access to CERN facilities as opportunity
- Videos of IRRAD and GIF++ facilities available on Youtube  
Link: [IRRAD](#) – [GIF++](#)





- Irradiation facility running from mid May to mid November 2017

IRRAD & CHARM Operation Schedule 2017 (Synchronized with Users Schedule v. 1 of January 2017)

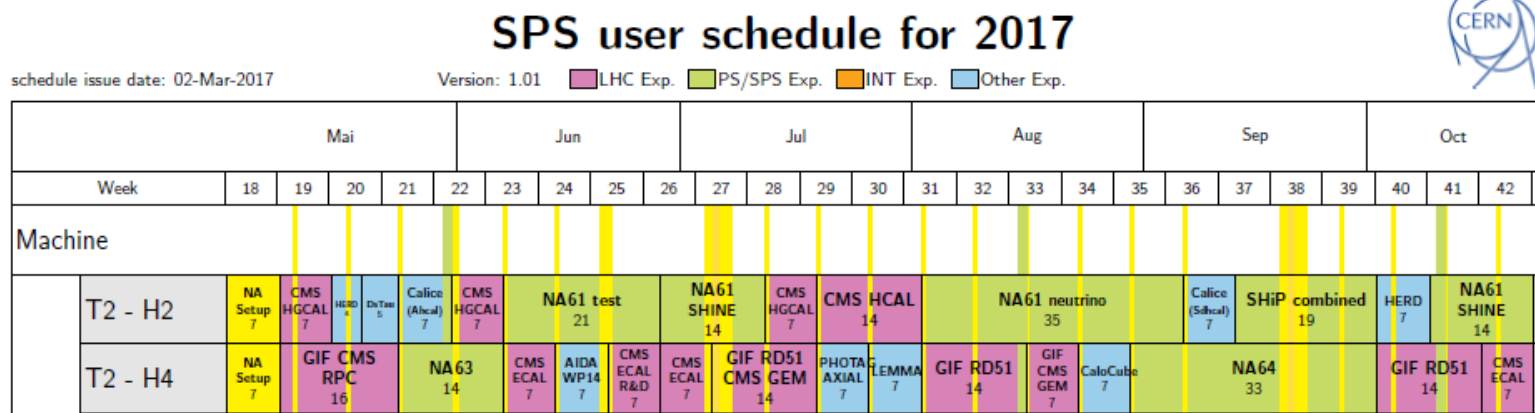


- EA Setup & Beam Commissioning (NO USERS)
- RP Measurements
- Standard Beam (1 spill every 10 BP =  $1.2 \times 10^{14}$  p/h) x 24h (day) x 0.9 (efficiency) /  $2 (10 \times 10 \text{ mm}^2) \sim 1.3 \times 10^{15}$  p/cm<sup>2</sup>/day
- Blown-up Beam
- High-Intensity Beam (up to design max. =  $2.4 \times 10^{14}$  p/h)
- Technical Stop (NO BEAM up to 36h + cooldown)
- on Wednesday: Machine Development (8:00 - 18:00) and Access IRRAD/CHARM (9:00 - 12:00) - Beam OFF at 3:00
- CERN official holidays





- GIF++: Note that source is accessible throughout the year (i.e. without beam)
- GIF++ beam time allocation for 2017



- Shared beam time with RD51 and CMS RPC/GEM
- Up to 15 parallel set-ups in muon beam (difficult access to detectors)
- May beam time practically finalised, July & August looks fine. October still difficult.



- High demand for IRRAD and GIF++ facilities
- Number of supported users and number of delivered units as assumed in proposal. TA program and financing to continue as planned.
- Less project applications for IRRAD and GIF++ than expected.
  - Users are only applying for TA if they need financial support (e.g. in IRRAD only 20% of experiments performed with AIDA-2020 TA application)
  - Less but more complex irradiation experiments have been performed
- IRRAD and GIF++ access via AIDA-2020 is a success