

AIDA 2020

Report on Transnational Access in AIDA2020

WP 10, 11, 12

Marko Mikuž

J. Stefan Inst. & Univ. Ljubljana, Slovenia

for the Transnational Access Team

AIDA2020 2nd Annual Meeting, Paris, April 6, 2017

- WP10: *Beam test facilities* (TA1)
- WP11: *Irradiation test facilities* (TA2)
- WP12: *Detector characterisation facilities* (TA3)

- Aim: Provide support for evaluation of detector technologies in terms of radiation hardness, particle response and electromagnetic interference
 - Resources usage monitored by User Selection Panel
 - Supplemented by WP15: Upgrade of beam and irradiation test infrastructure (JRA3)

TA Tasks - Facilities

- 10.1: CERN PS and SPS Test Beams
- 10.2: DESY-II Test Beam Facility
- 11.1: CERN IRRAD & GIF++
- 11.2: JSI TRIGA Reactor, Slovenia
- 11.3: KIT KAZ, Germany
- 11.4: UCLouvain CRC, Belgium
- 11.5: UoB MC40 Cyclotron, UK
- 12.1: RBI-AF, Croatia
- 12.2: ITAINNOVA – EMClab, Spain

TA in Paris

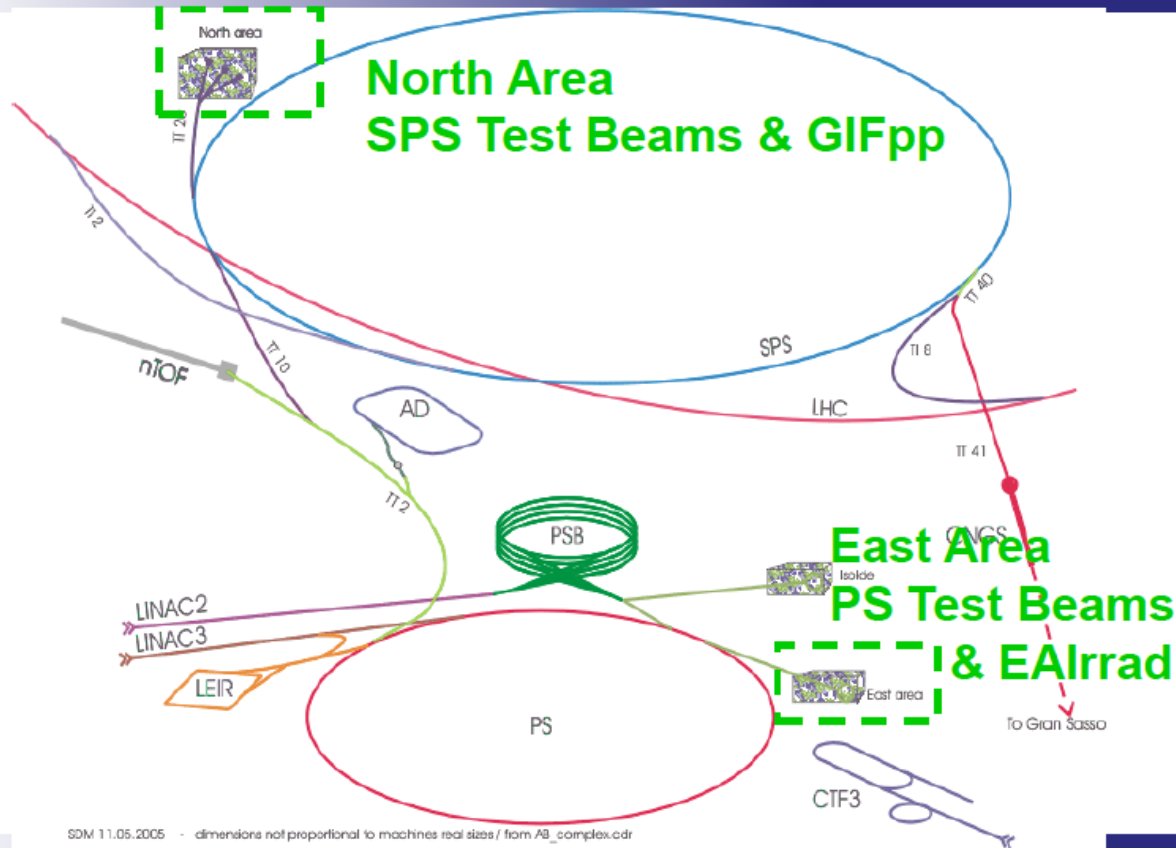
- Full Wed morning dedicated to common meeting of all three TA WP's
 - preceded by WP15 meeting on Tue afternoon
- Meeting with talks from each facility reporting progress and flagging problems
 - well attended, only one remote presentation
 - lively discussion, input from users, management and advisers, mostly on common problems
- A few highlights follow, choice arbitrary, look at talks to get complete picture

10.1: CERN Test Beams



AIDA²⁰²⁰

CERN testbeam facilities



4 April 2017

H. Wilkens (CERN)

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10.1: CERN Test Beams

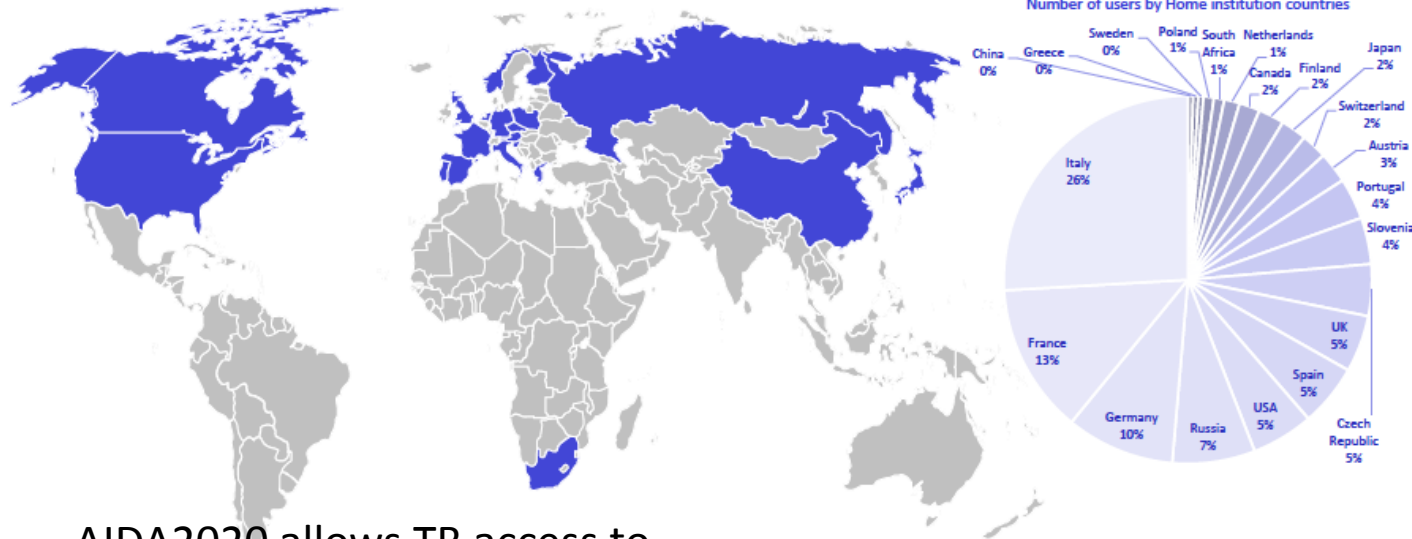


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Countries of recipients home institutes



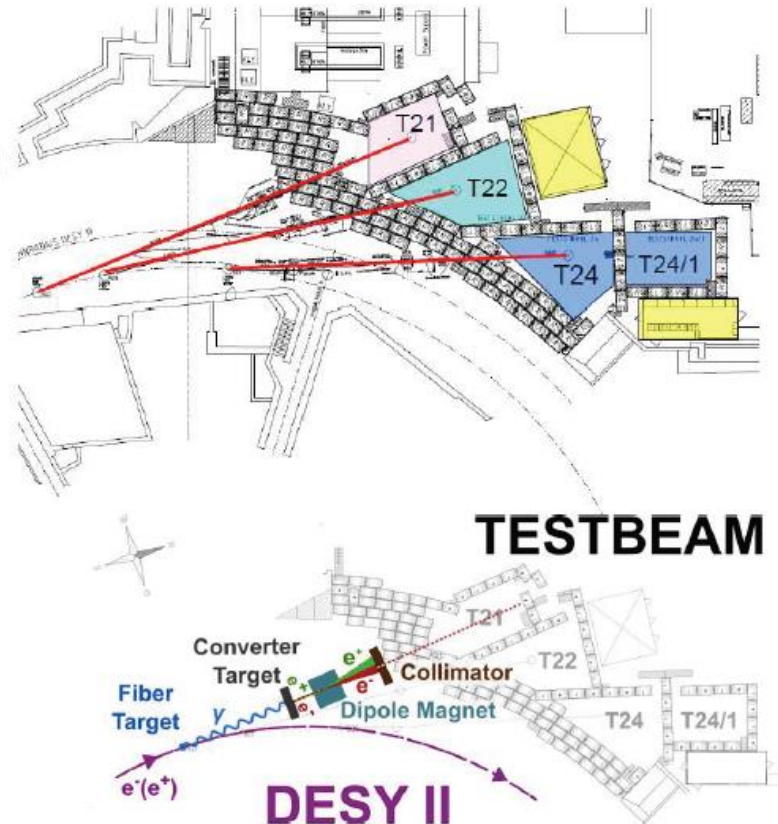
AIDA2020 allows TB access to users outside of CERN community !

In 2015-2016, 21 countries benefited from CERN TA support to their institutes employees coming to CERN test-beam facilities.

10.2: DESY Test Beams

DESY II Test Beam Facility Layout

- ✓ Three test beam lines
- ✓ Electron or positron beam from 1-6 GeV (spread: ~5%)
- ✓ Beam Generation:
 - DESY II beam converted into bremsstrahlung at carbon fiber targets
 - Converter target: e^- / e^+
 - Magnet to select particle type and momentum
 - Rates up to several kHz depends on beam line, energy, target material, collimator setting

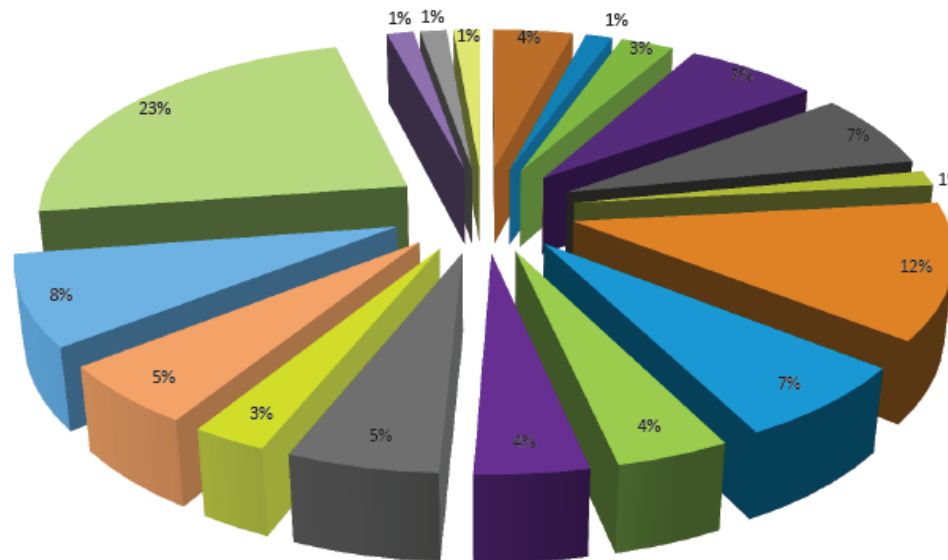


10.2: DESY Test Beams

TA Statistics 2015-2017 by institute country

AIDA-2020 users 2015-2017 by their affiliations country

- | | | | | | |
|-----------|---------------|------------------|------------------|---------------------|----------|
| ■ AUSTRIA | ■ BELARUS | ■ CANADA | ■ CZECH REPUBLIC | ■ GERMANY | ■ INDIA |
| ■ ISRAEL | ■ JAPAN | ■ NETHERLANDS | ■ POLAND | ■ ROMANIA | ■ SERBIA |
| ■ SPAIN | ■ SWITZERLAND | ■ UNITED KINGDOM | ■ UKRAINE | ■ REPUBLIC OF KOREA | ■ ITALY |

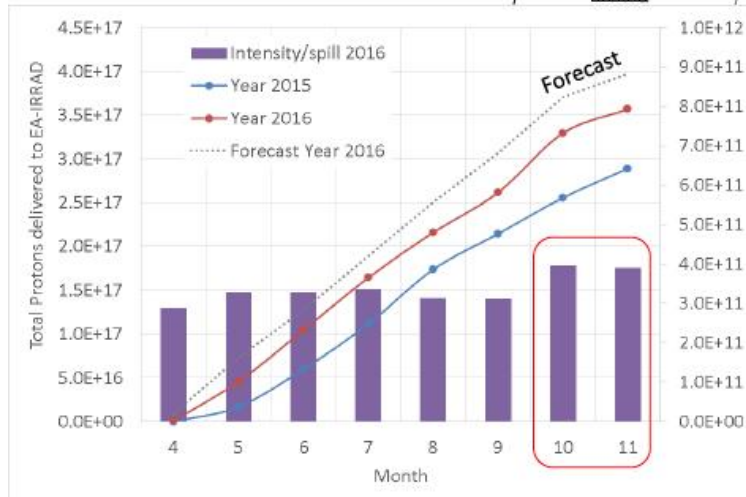
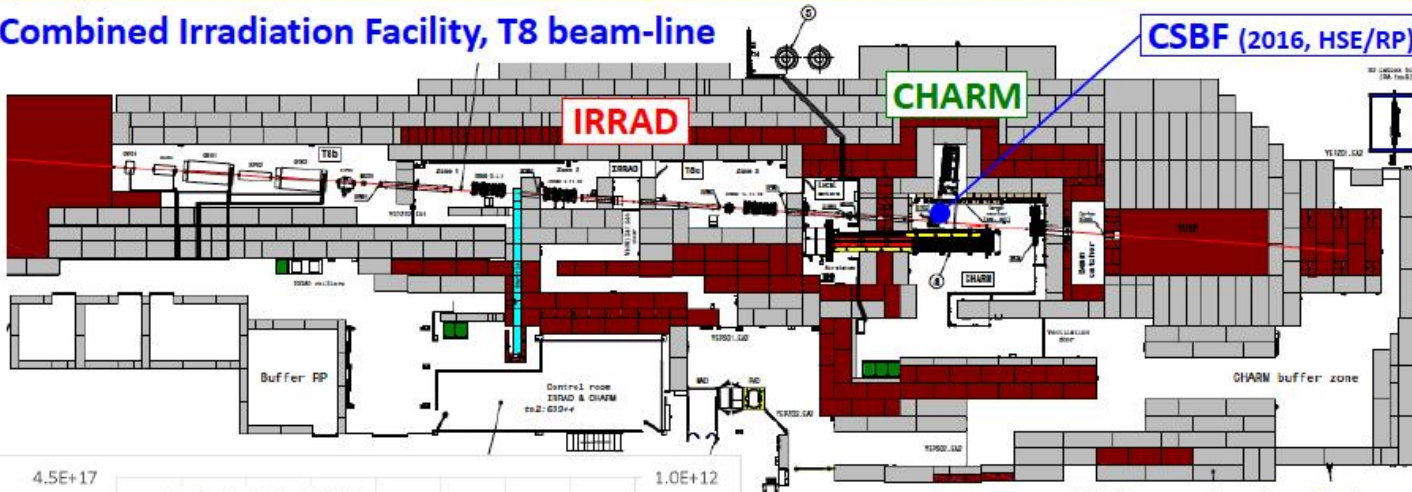


Average: 6,7 Person pro TA-project

11.1: CERN IRRAD & GIF++

East Area Irradiation Facility

Combined Irradiation Facility, T8 beam-line



CERN Shielding Benchmark Facility (CSBF)

- **Cumulated proton intensity year 2016**

**200 days with standard beam:
 5×10^{11} p ejected,
 90% PS efficiency**



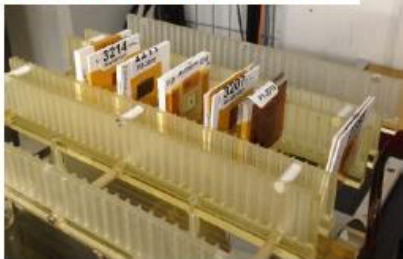
11.1: CERN IRRAD & GIF++

CERN EP-DT Detector Technologies

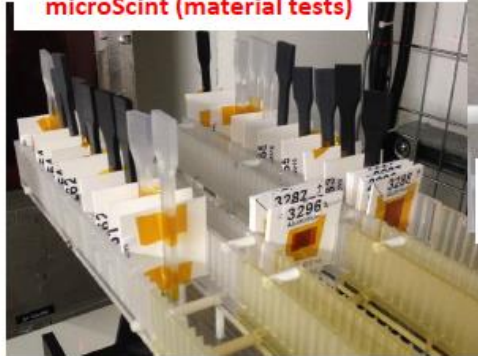
IRRAD Proton Facility

CERN EN ENGINEERING DEPARTMENT

CMS pixel, FCC test structures



microScint (material tests)

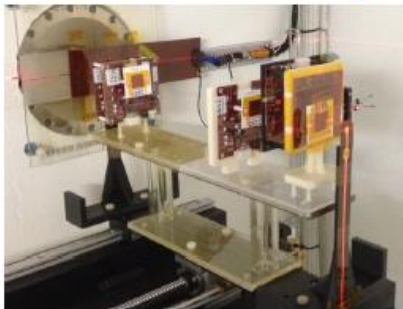


LHCb-SciFi detector prototype



RD18 (crystals)

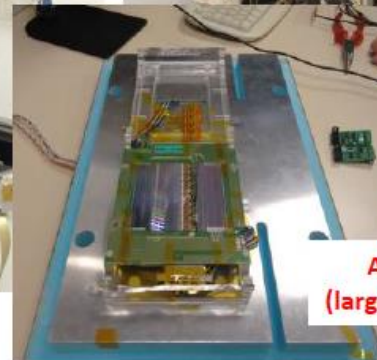
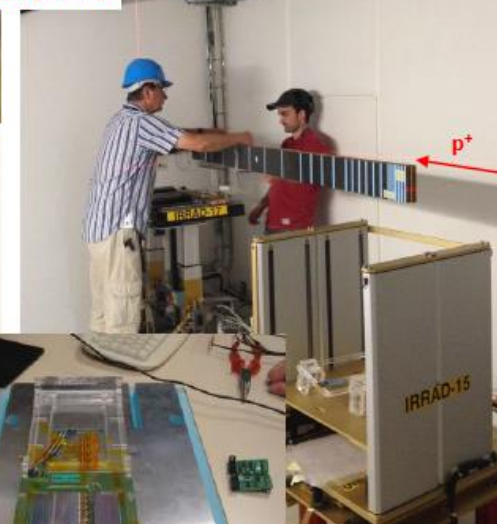
FEI4 with various technologies



RD50 structures, ATLAS CMOS

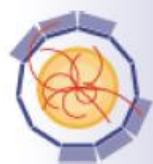


RD53, HVMOS, EP-ESE (SEU/functional testing)



ATLAS ITk Strip (large modules, low T)

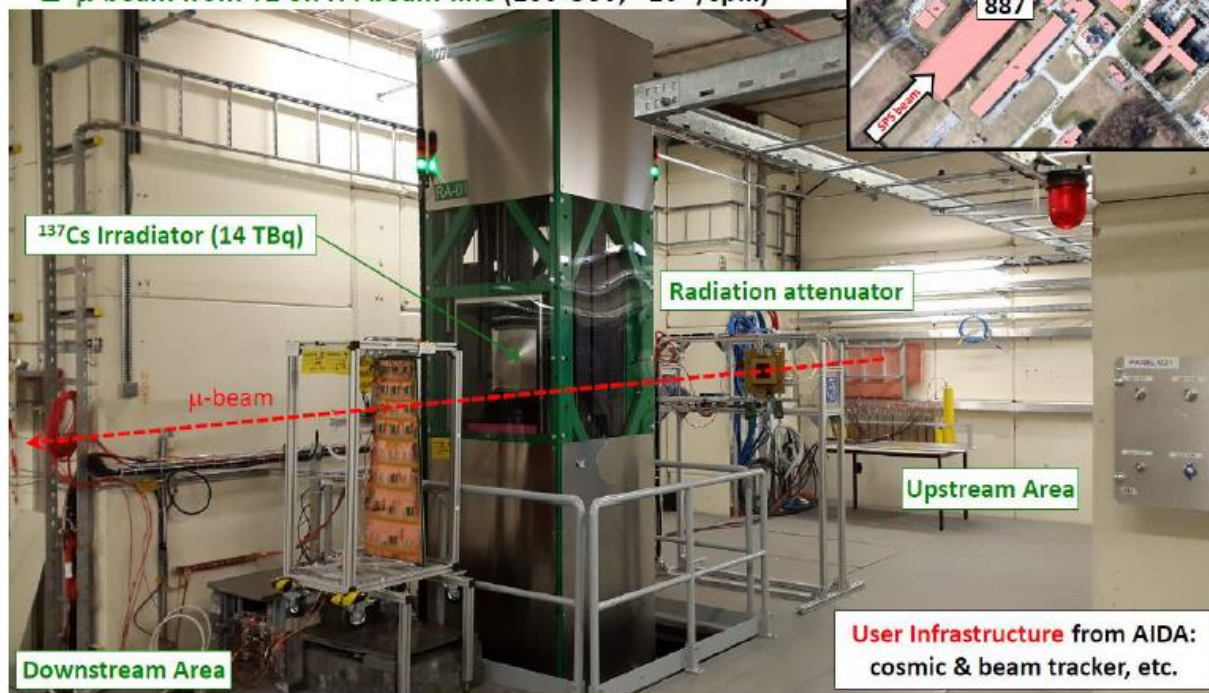
11.1: CERN IRRAD & GIF++ AIDA ²⁰²⁰



AIDA ²⁰²⁰

GIF++ Facility

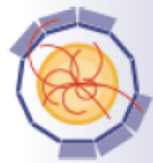
- $E_\gamma = 0.66 \text{ MeV}$; max. dose-rate $\sim 0.5 \text{ Gy/h @ 1m } (\pm 37^\circ \text{ angle})$
- Several attenuation factors available (up to $\sim 50'000$)
- μ -beam from T2 on H4 beam-line (100 GeV; $\sim 10^4$ /spill)



B.Gkotse & M.Moll for IRRAD and GIF++ TA team, AIDA 2020 2nd Annual Meeting, Paris, 4-7.4.2017

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11.1: CERN IRRAD & GIF++

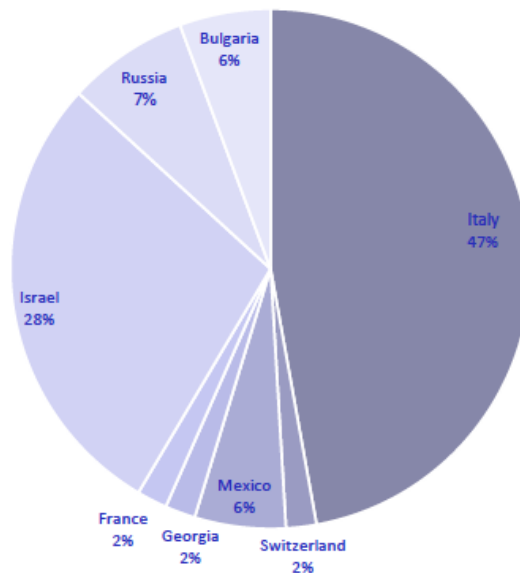


AIDA²⁰²⁰

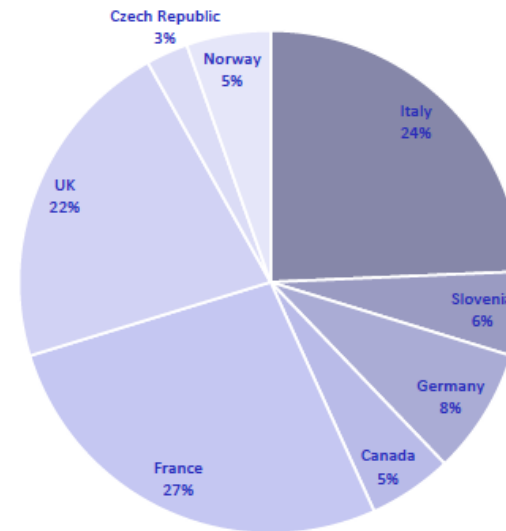
User distribution

- Users split per country of home institution

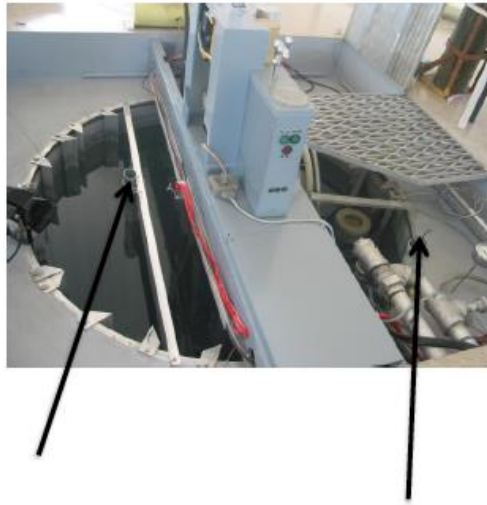
GIF++



IRRAD



11.2: JSI TRIGA Reactor

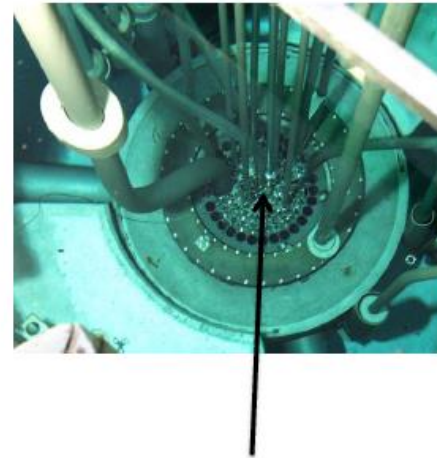


Small tube

$$\Phi_{\max} = 1.54 \cdot 10^{12} n_{\text{eq}} \text{cm}^{-2}$$

$$10^{16} n_{\text{eq}} \text{cm}^{-2} \text{ in } 6500 \text{ s}$$

Accuracy about 10%



Large tube

$$\Phi_{\max} = 3.57 \cdot 10^{12} n_{\text{eq}} \text{cm}^{-2}$$

New:

Central tube

$$\Phi_{\max} = 6 \cdot 10^{12} n_{\text{eq}} \text{cm}^{-2}$$

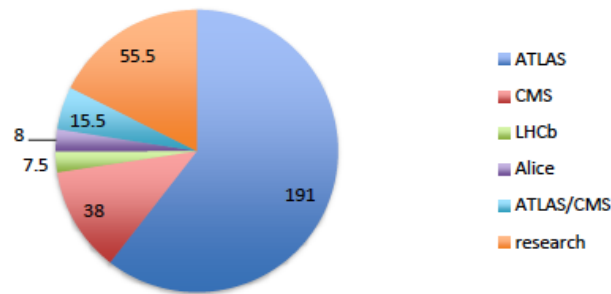
Preliminary....

11.2: JSI TRIGA Reactor

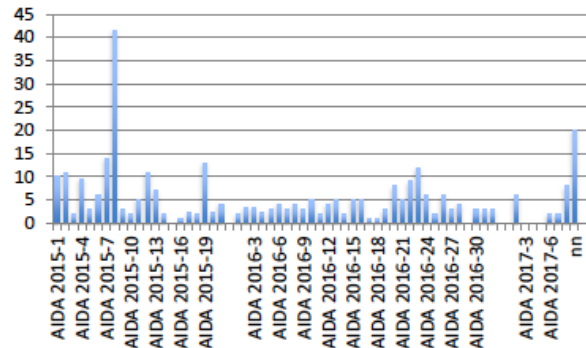
Sharing of units between experiments:

315.5 units delivered in 61 projects
 500 units foreseen in total
 7 publications in P1

UNITS



UNITS



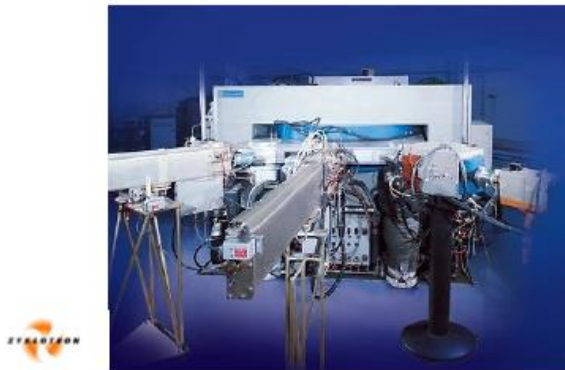
11.3: KIT KAZ



KIT TA Status

Felix Bögelspacher, Bärbel Bräunling, Wim de Boer, Alexander Dierlamm

INSTITUT FÜR EXPERIMENTELLE KERNPHYSIK



KIT – The Research University in the Helmholtz Association

www.kit.edu

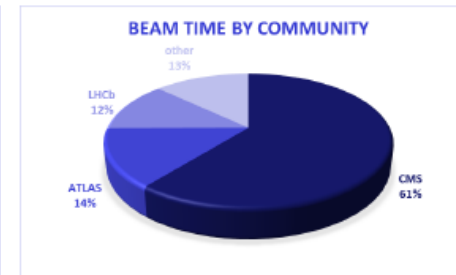
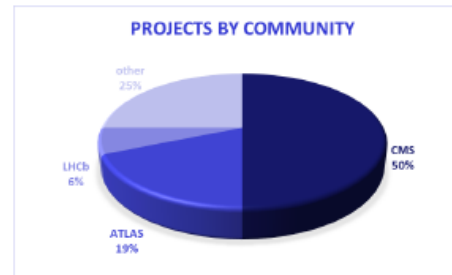
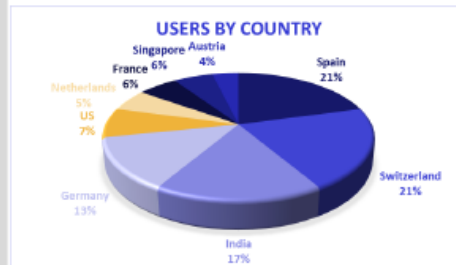
11.3: KIT KAZ

Projects so far



TA Project Acronym	Project Title	Communities involved (CMS, ATLAS, Neutrino...)	Continuation from previous reporting periods		Access Units
			Project completed (yes/no)	Date - when project completed	
AIDA-2020-KIT-2015-01	LHCb VELO upgrade	LHCb	yes	19 August 2015	2.13
AIDA-2020-KIT-2015-02	Irradiation of a LPNHE/FBK active edge pixel module	ATLAS	yes	11 August 2015	0.42
AIDA-2020-KIT-2015-03	Radiation-hard Si sensors development at India for the CMS Experiment	CMS	yes	16 November 2015	2.62
AIDA-2020-KIT-2015-04	Irradiation study of the CMS upgrade pixel detector readout chip	CMS	yes	12 May 2016	5.99
AIDA-2020-KIT-2015-05	Embedded Pitch Adapters		yes	10 December 2015	2.92
AIDA-2020-KIT-2016-01	High voltage sensor contacts in high radiation environment		yes	08 September 2016	1.22
AIDA-2020-KIT-2016-02	CMS tracker upgrade: front-side biasing with IFX sensors	CMS	yes	01 September 2016	5.43
AIDA-2020-KIT-2016-03	Finding a HV insulation for the future ATLAS strip tracker	ATLAS	yes	01 March 2017	1.67
AIDA-2020-KIT-2016-04	Radiation test for domain wall device		yes	08 September 2016	0.17
AIDA-2020-KIT-2016-05	Proton irradiation of a new generation of 3D sensors developed for the HL-LHC	ATLAS	yes	22 September 2016	2.62
AIDA-2020-KIT-2016-06	LHCb VELO upgrade	LHCb	yes	18 November 2016	1.92
AIDA-2020-KIT-2016-07	Investigation of radiation damage in CMS FPix sensors	CMS	yes	29 September 2016	4.08
AIDA-2020-KIT-2016-08	Study of Radiation hardness of small pixel Si sensors for CMS phase 2	CMS	no		
AIDA-2020-KIT-2016-09	Radiation-hard Si sensors development at India for the CMS Experiment	CMS	no		0.08
AIDA-2020-KIT-2016-10	TID dependence study of a readback mechanism calibration of the CMS pixel readout chip	CMS	no		1.73
AIDA-2020-KIT-2017-01	Proton irradiation of AMS H35Demo chips	CMS	no		0.33

Total: 16 projects, 53 users, 33.33h



11.4: UCLouvain CRC

HIF: Heavy Ion Facility

Facility to measure the response of electronic components to single event effects (SEE).



11.4: UCLouvain CRC

Irradiations

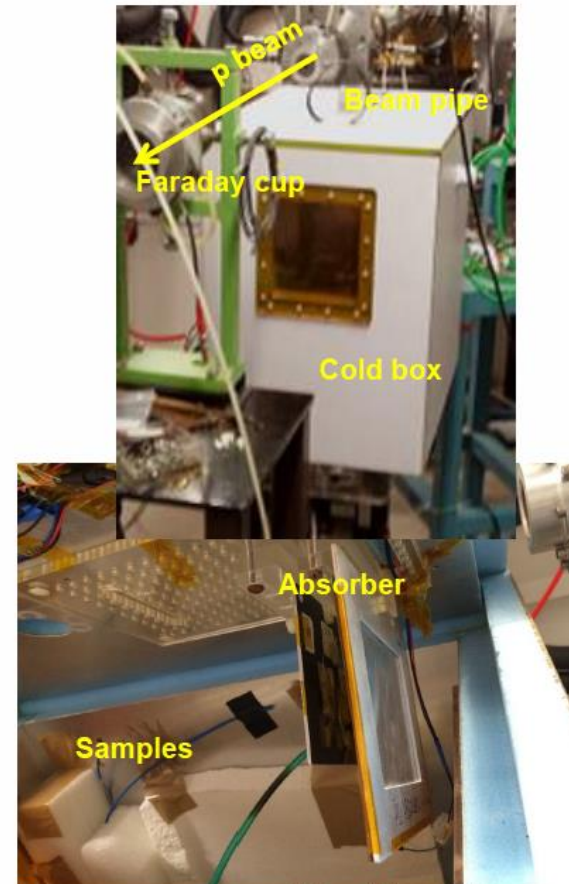
- 5 projects finished

Acronym	Experiment	Users	Irrad	Institute
AIDA-2020-CRC-2015-01	ALICE ITS	2	11.5 h	CERN
AIDA-2020-CRC-2016-01	ATLAS calo ASIC	2	6.5 h	Columbia Univ.
AIDA-2020-CRC-2016-02	LHCB FPGA RICH	5	10.0 h	IFIN-HH
AIDA-2020-CRC-2016-03	LHCb CLARO	3	8.0 h	INFN
AIDA-2020-CRC-2016-04	LHCb calor	6	13.0 h	CNRS/Barcelona
AIDA-2020-CRC-2017-01	CMS tracker	3	12.0 h	Imperial College

- 1 project submitted but not eligible
- 21 users
 - ▶ 19 male 2 female
 - ▶ 8 institutes, 8 nationalities
- 49(61)/80h used

Irradiation setup

- XY-axis scanning system allows areas of 15cm × 15cm (orthogonal) to be uniformly irradiated
- Liquid nitrogen evaporative cooling system ('Norhof LN2'). Typ. **T = -27°C** during irradiation
- Dry N₂ is used to keep low humidity. Typ. **RH = ~10%** during irradiation
- Sealed feed-through allow external read-out and monitoring during irradiation
- Samples are suspended from the lid in the box
- **0.3mm aluminum absorber** in front of samples used to remove low energy components
- **Faraday cup** after samples used to measure beam current



4/5/2017

WP11.5 University of Birmingham

AIDA-2020 Users

Project Code	Project Title	Project Contact	Total access units M1-M24
AIDA-2020-UoB-2015-1	ATLAS CMOS Strips Research and Development	T. Huffman	12.00
AIDA-2020-UoB-2015-2	Silicon sensor study of HPK sensors for ITK ATLAS Upgrade	S. Khuen	39
AIDA-2020-UoB-2016-1		Irradiation of glue foams for the ATLAS ITK	C Lacasta
AIDA-2020-UoB-2016-2	Irradiation of passive CMOS pixel sensors for ATLAS	F. Hugging	7
AIDA-2020-UoB-2016-03	Development of a Detector Control System for ATLAS Itk Pixel	C Zeitnitz	28
AIDA-2020-UoB-2016-04	Thin Planar Sensors for ATLAS ITK	A. Macchiolo	50.5*
AIDA-2020-UoB-2017-01	GanFET Irradiation for Atlas Upgrade	D. Lynn	12.5
AIDA-2020-UoB-2017-02	LHCb VELO Upgrade	P. Collins	2

Total of 8 users
165 total access units M1-M24

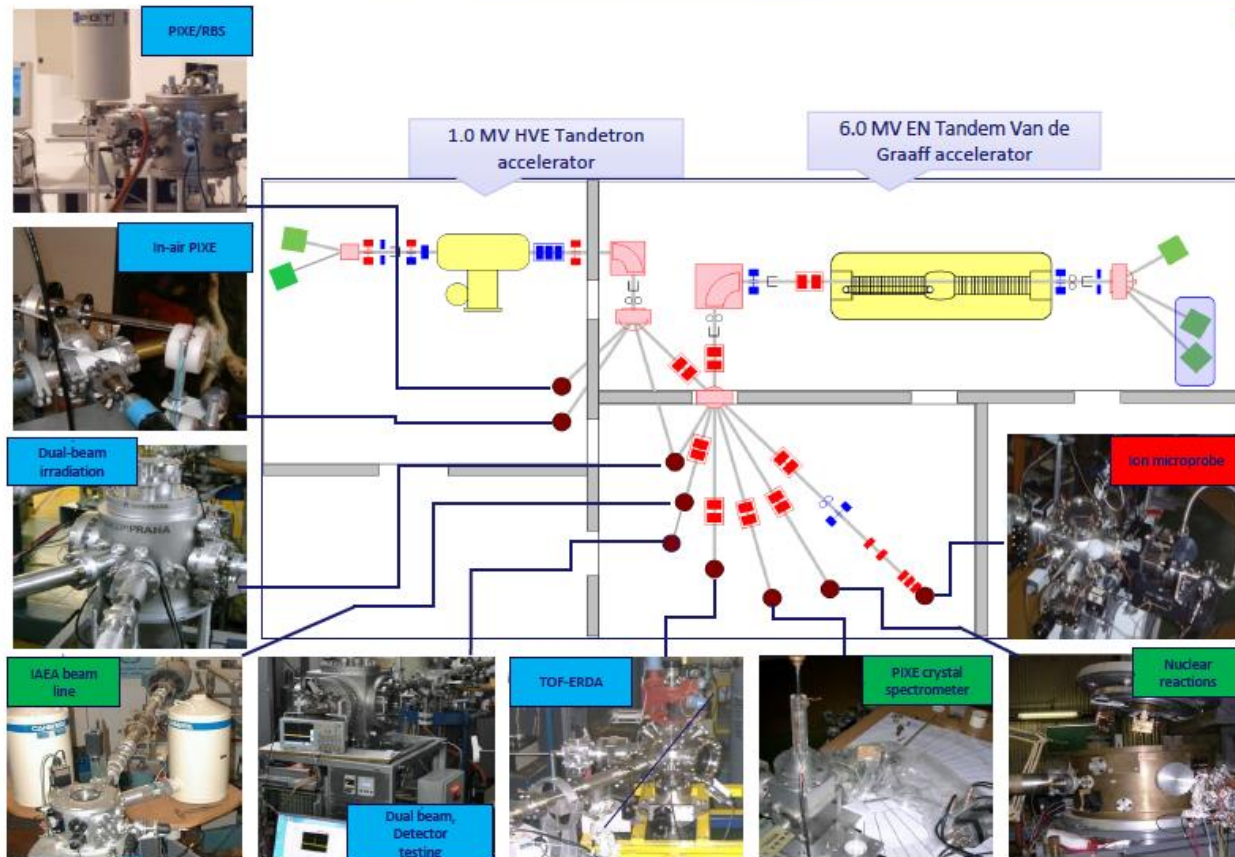
* 14.5 units projected by end of M24

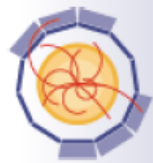
4/5/2017

WP11.5 University of Birmingham

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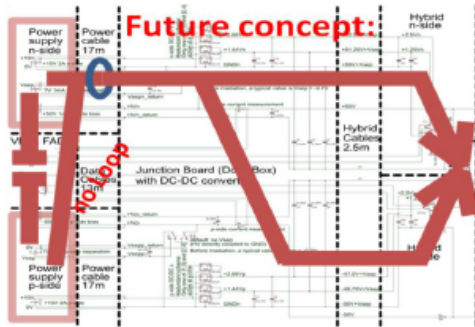
AIDA 2020 WP12 -Detector Characterization Facilities WP12.1. – RBI Accelerator Facility

- **8 TA projects** have been already **approved**
- **7 TA access** have been **completed** by 30th March 2017
(on schedule –completed)
- Users from **6 countries supported**

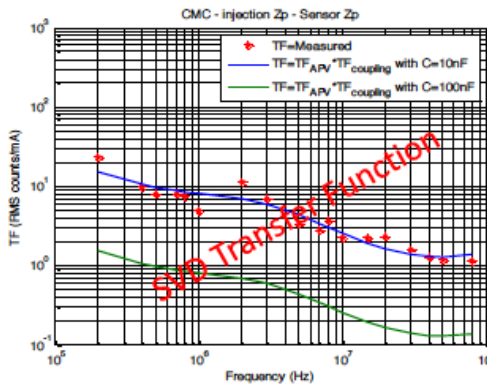
RBI	User Projects		Total users	TA units
	Submissions	Selected		
M1-M22	8	8	17 (11 supported)	280
M1-M48	16		24	640



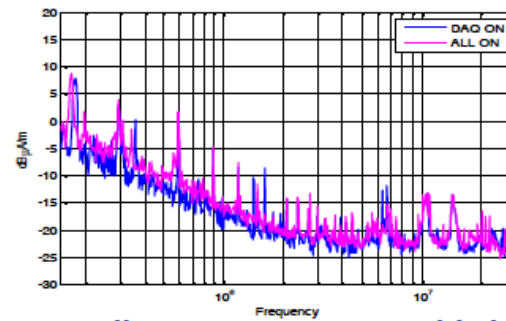
2. TA EMC activity



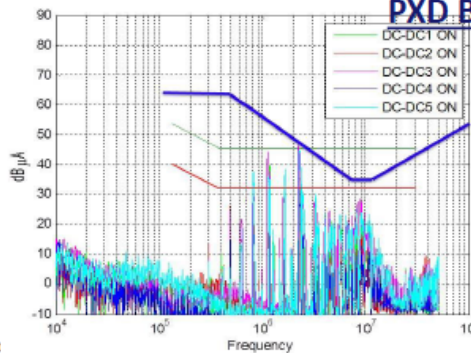
SVD belle II FEE - Redesign



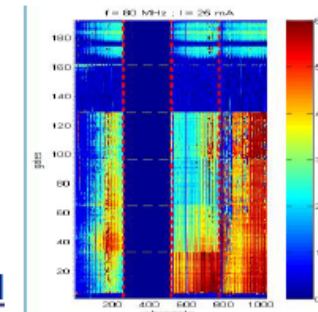
DC-DC converters noise emissions



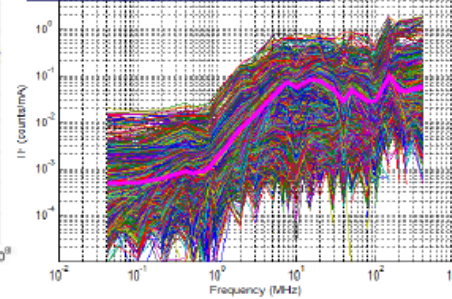
PXD Belle II – Noise compatible level



Belle II Pixel Noise mapping



PXD Belle II – susceptibility level to beam pipe radiation





- **3 TA have been completed (500 hours).**
 - ✓ **AIDA-2020-EMC-2015-01** - EMC Studies with the Belle II SVD Readout System , HEPHY, Austria
 - ✓ EXTENDED ACCESS for EMC characterization of Large system (240 TA units)
 - ✓ 4 users - 3 users have been present at the facility. 1 has been covered by AIDA-2020
 - ✓ **AIDA-2020-EMC-2015-02** – *DC-DC converters noise emissions for Belle II SVD System, HEPHY Austria*
 - ✓ STANDARD ACCESS for EMC component testing (Remote access) 40 TA units
 - ✓ **AIDA-2020-EMC-2016-1** - EMC characterization of Belle II Pixel System, MPI Germany
 - ✓ EXTENDED ACCESS for EMC characterization of Large system (220 TA units)
 - ✓ 3 users have been present at the facility. 1 has been covered by AIDA-2020
- All of them have been focused on Belle II experiment
 - A complementary facility of other TA
- **They have produced very useful and interesting results**

Overall Comments

- Facilities fully complementary
 - test beam, irradiations, characterization
- Test beams
 - DESY available during CERN winter shut-down
- Irradiations
 - charged hadrons: low and high energy
 - neutrons
 - heavy ions: single event effects
 - gammas for large scale objects

Common Problems



- Number of projects and users somewhat on the low side
 - people hate filling forms...
 - ask PI's to check in the complete team of users
 - needed for statistics on gender, countries etc.
- Hard to trace publications
 - our main scientific output !
 - remind PI's of their (signed !) duty 12&24 months after finishing TA access

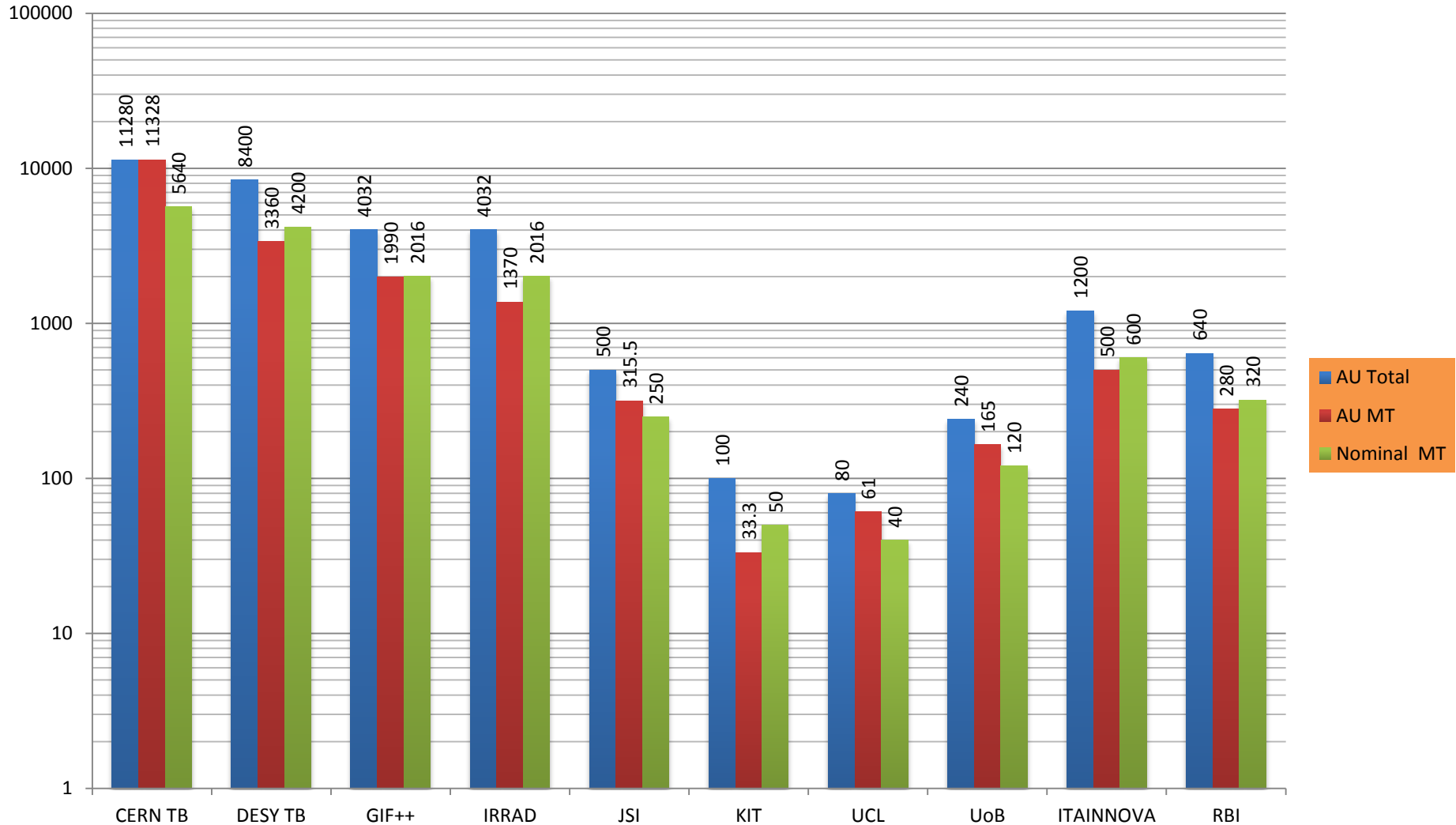
Resources Usage

- The only TA deliverable: Access Units
 - some of them (@CERN&DESY) fully covered by institutes budget
 - some (partially) covered by AIDA
 - large AU cost range (80-850 EUR) due to different cost models and (partial) coverage from other funds
 - AU budgets per facility more balanced: 50-125 kEUR
- Two access modes
 - users on site: visits (partially) supported by AIDA2020
 - test beams, some irradiations (SEE)
 - remote access: facilities receive samples and ship them back to users
 - most irradiations

4y Pledge & MT(M1-24) Usage

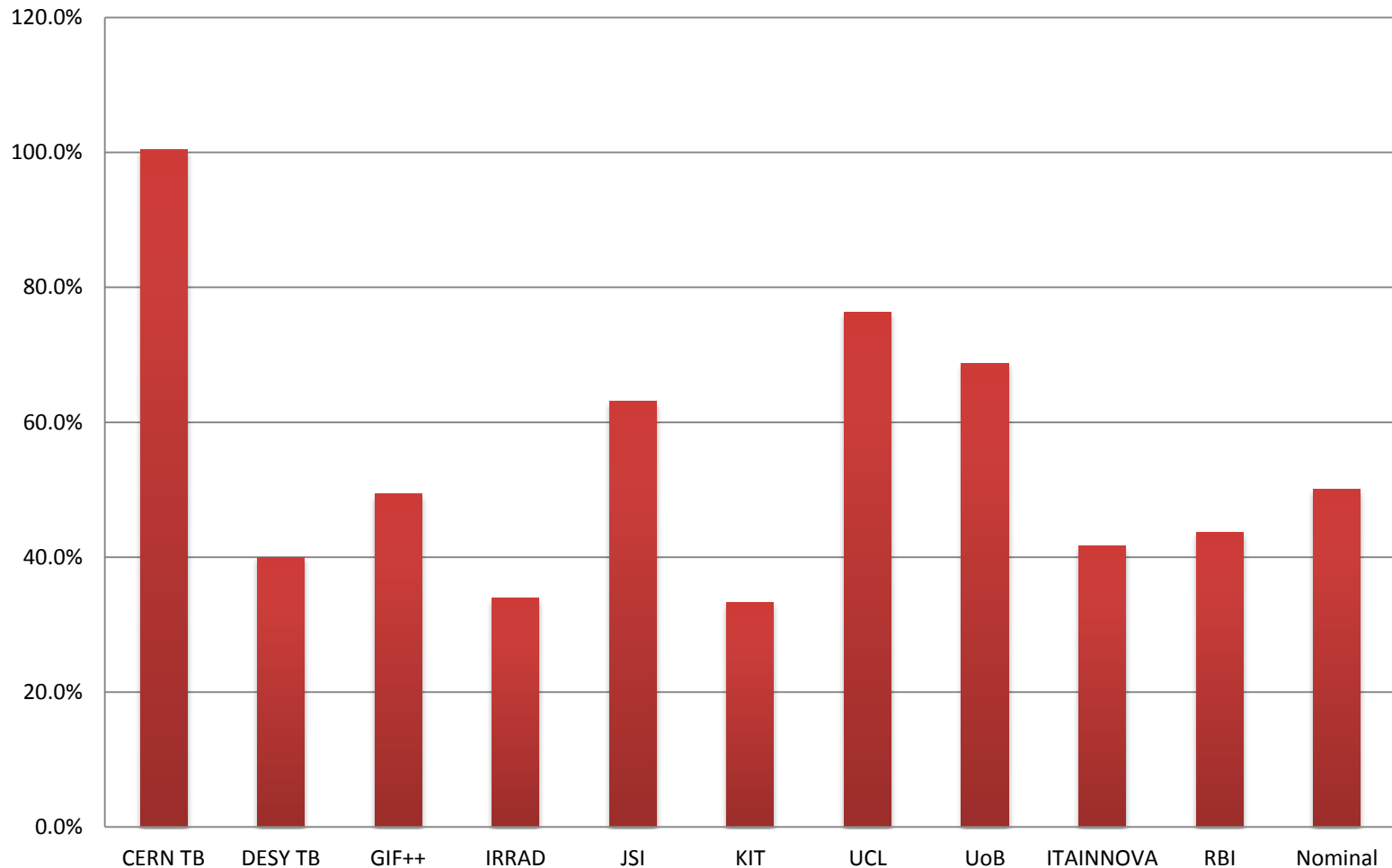
Facility	AU Total	Users Total	Projects Total	Project app. MT	Users MT	AU MT
CERN TB	11280	210	47	39	208	11328
DESY TB	8400	120	30	11	73	3360
Σ(WP10)	19680	330	77	50	281	14688
GIF++	4032	50	20	6	30	1990
IRRAD	4032	60	30	5	18	1370
JSI	500	150	50	61	166	315.5
KIT	100	90	30	16	53	33.3
UCL	80	50	10	6	21	61
UoB	240	180	60	8	25	165
Σ(WP11)	8984	580	200	102	313	3935
ITAINNOVA	12	12	1200	4	11	500
RBI	16	24	640	8	17	280
Σ(WP12)	28	36	1840	12	28	780

Usage of AU at MT



Fraction of MT AU to pledge

AU: % of pledge



Comments

- CERN TB:
 - used all AU and user support funds
 - can/will do more, support for outside users limited to CERN logistics (non-trivial !)
- DESY TB:
 - somewhat behind, expected to catch up
- CERN: GIF++/IRRAD:
 - somewhat behind, predominantly because of beam schedule May-Nov
- JSI:
 - a bit ahead, but within reasonable tolerance
 - tangential channel (additional load) commissioned (D15.9)
 - charge for add-on/large projects if (projected to) run out of AIDA funds
- KIT:
 - somewhat low usage, heavier demand when module QA for HL-LHC trackers
- UCL:
 - fully caught up, most % AU usage of all (small overall allocation)
 - all projects HIF oriented (SEE/SEL), PR seems to have worked !
- UoB:
 - a bit ahead, small allocation
- ITTANOVA, RBI
 - great start-up, nearly on-track

Summary

- TA in AIDA2020 well under way
 - so far, all facilities on track for successful completion of their AU pledge
 - good complementarity
 - no major problems
 - no corrective actions foreseen
- ... a true European success story !