



EP Software Tools for Irradiation & Test-beam Facilities

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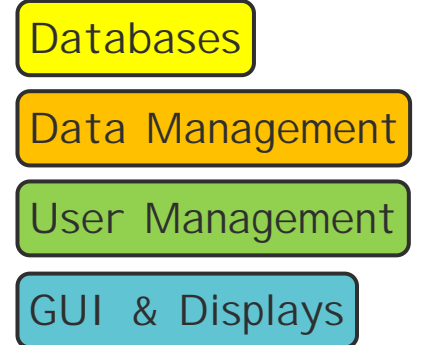
With input from: Pierre PELISSOU (EP-DT), Jaroslaw SZUMEGA (EP-DT)

CERN INDICO [1307835](#)



Outline

- **Introduction**
- **EP Software Tools:**
 - Informative Databases (DB)
 - Facilities Data Management (DM)
 - Users Data Management (UM)
 - Controls, GUIs DAQ and Data Display (OP)
- **Common CERN-IT Software Technologies**
- **Maintenance & Operation (M&O)**
- **Conclusion**



Introduction

- **History:**

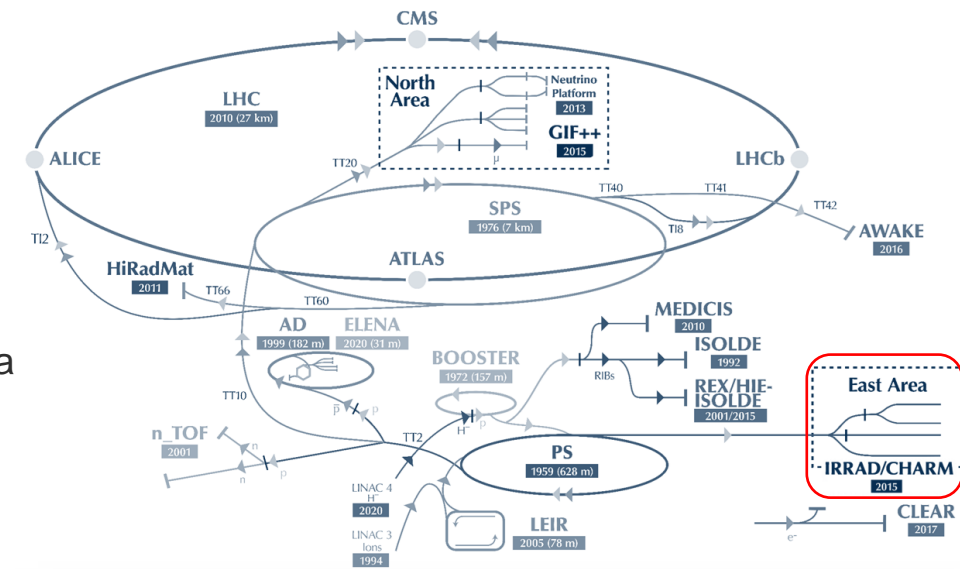
- **1999-2012:** handling information of the IRRAD facility (EA-T7)
 - “samples manager” on local PC (M. Glaser), manual handling of irradiation data
- **2013-2014:** CERN accelerators unavailable (LS1)
 - CERN **web databases idea** (on-line from 2017)
- **2015-2018:** new IRRAD facility, increase in experiments throughput
 - Control of dedicated IRRAD equipment, **information displays**, etc.
 - **IRRAD Data Manager** (<https://www.cern.ch/idm>)

- **Recent times (2019-2023):**

- **Improving features** of existing tools (data exchange with TREC, etc.)
- extension to **external facilities** (ITA @ FNAL, etc.), handling of **EU-projects data** (TA) and **CERN PS & SPS User Schedule Management**, etc.

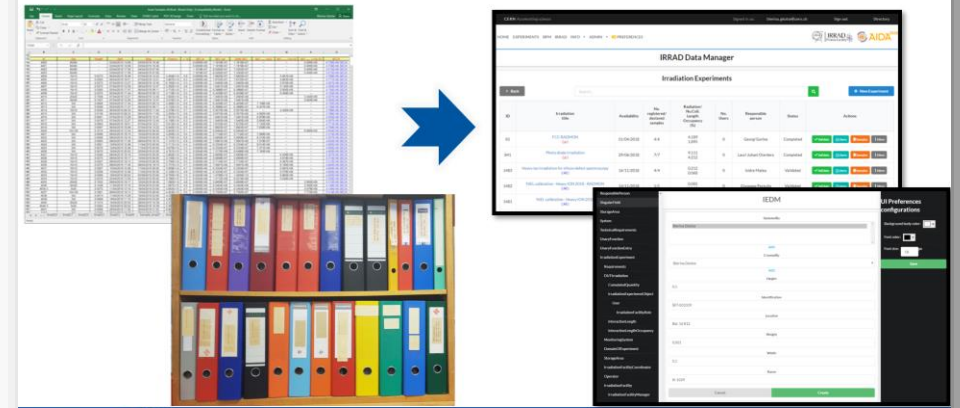
- **Development, M&O based on EU-project funds:**

- **AIDA** / -2020 / innova, **RADNEXT**, **EURO-LABS** (+ CERN contributions)
- **expertise concentrated in EP** (mainly EP-DT-DD)



Bridging the Gap in Data Management

- Knowledge sharing among communities
- Small experiments, no strong IT support
- User Experience
- ✓ Web Semantics
- ✓ Automatic generation of web applications
- ✓ UI personalization



DB: Irradiation Facilities Database

CERN Accelerating science

Directory



HOME DATABASE USER GUIDE COLLABORATIONS TERMS OF USE CONTACT

IRRADIATION FACILITIES DATABASE

Welcome to the Irradiation Facilities Database.
This website hosts information about facilities for radiation testing at CERN, in EU, and worldwide.

This website is of public access and its content has been compiled from a variety of sources.
Data accuracy and completeness relies on the information submitted by the facility coordinators.

CERN FACILITIES

IRRADIATION FACILITIES DATABASE

FACILITIES MAP

A unified entry point for **CERN and worldwide irradiation facilities** with an essential collection of information
<https://www.cern.ch/irradiation-facilities/>

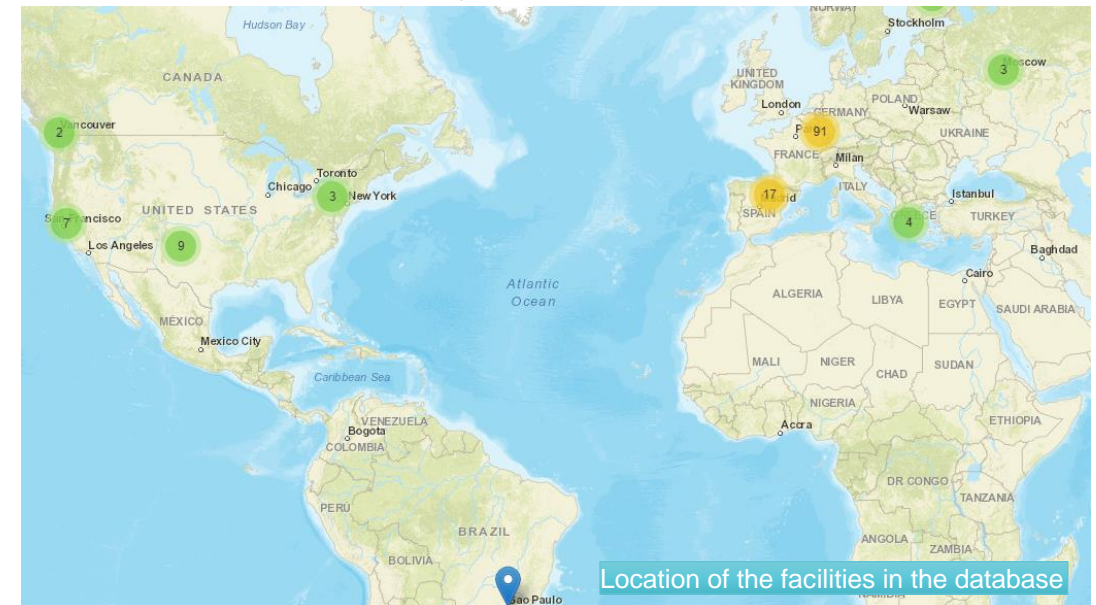
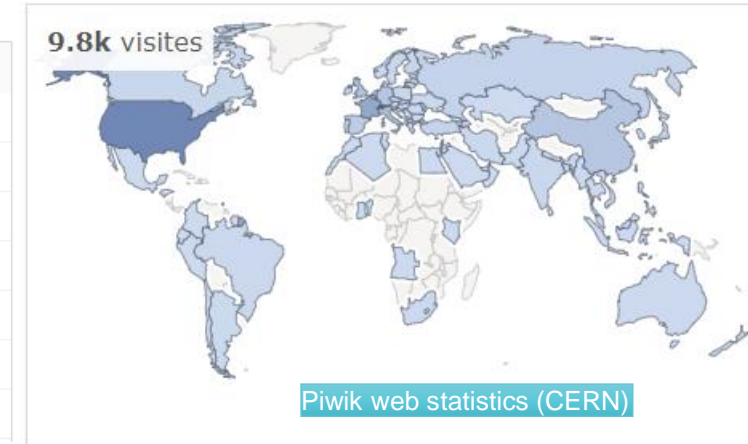
DB: Irradiation Facilities Database

- Platform listing essential information of CERN and worldwide irradiation facilities:

- open source** developed by CERN-EP
 - EU-funded: AIDA-2020, now RADNEXT
- list infrastructures **across application domains**
- information under the **responsibility of facility coordinators**:
 - automatic **annual reminders for updates**
 - information **validated by database admin**
- ~210 entries initially listed (2017) from “paper” data collections, webpages, etc. (often outdated)
- Today:**
 - 234 valid facility entries** (update Nov. 2022)
 - 85% EU, 11% America, 4% Asia/Australia**
 - ~10k visits** since launch

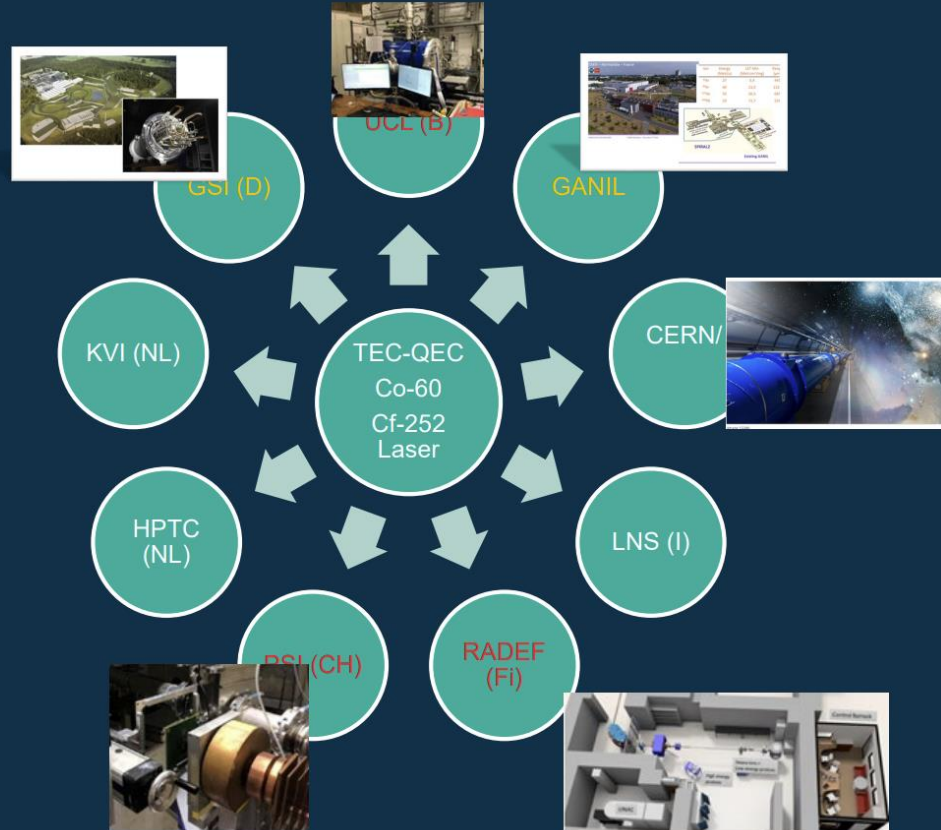
Visitor countries

COUNTRY	VISITS
Switzerland	2,830
United States	1,680
France	1,032
Italy	557
United Kingdom	450
China	387
Germany	380



DB: Irradiation Facilities Database

ESA supported European Irradiation Facilities



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

12



→ THE EUROPEAN SPACE AGENCY

CERN-ESA Collaboration Protocol on Radiations Issues - SC Meeting (<https://indico.cern.ch/event/1099489/>)

DB: Test-beam Facilities Database

- Platform listing essential information of CERN and worldwide test-beam facilities:
 - “Twin” platform with **same functionalities**:
 - requested by the community (BTTB)
 - the **PS/SPS Physics Coordinator** is the responsible for the data review
 - Today:
 - 19 facility entries** (and 37 beamlines)
 - Entries being updated (Jul. 2023)

Experiments and projects

- Experiment, project and collaboration websites*
- CERN experiments (Grey Book)
 - AEGIS
 - ALICE
 - ALPHA
 - AMBER
 - AMS
 - ASACUSA
 - ATLAS
 - AWAKE
 - BASE
 - CAST
 - CERN Neutrino Platform
 - CLIC
 - CLOUD
 - CMS
 - COMPASS
 - DIRAC
 - ELENA
 - FASER
 - FCC
 - GBAR
 - HL-LHC
 - Irradiation Facilities**
 - ISOLDE
 - LHCb
 - LHCF
 - LIU project
 - MoEDAL
 - NA61/SHINE
 - NA62
 - NA64
 - nTOF
 - OSQAR
 - PBC
 - SHIP
 - SND@LHC
 - Test Beam Facilities**
 - TOTEM
 - UA9
 - WLCG

CERN Directory

Test Beamlines Database

This database contains a list of several different Test-Beam Facilities available at CERN, in Europe and Worldwide.

Search by Country: All | Search by Particle Type: All | Show All

Log In to Edit Data

Facility Name↑	Institute Name ^	Beamline Name↑	Country↑	Particle Type↑	Particle Energy↑	Coordinator↑
MAMI	University of Mainz	Beamline	Germany	gammas	< 1.6 GeV/c	fischer@kph.uni-mainz.de
MAMI	University of Mainz	Beamline	Germany	electrons	< 1.6 GeV/c	fischer@kph.uni-mainz.de
ELSA	University of Bonn	Beamline	Germany	electrons	1.2 - 3.2 GeV/c	elsner@physik.uni-bonn.de
Compton Facility	SPRING-8	Beamline	Japan	electrons, positrons	0.4 - 2.9 GeV/c	yosoi@rcnp.osaka-u.ac.jp
Compton Facility	SPRING-8	Beamline	Japan	photons (tagged)	1.3 - 2.9 GeV/c	yosoi@rcnp.osaka-u.ac.jp
SLAC	SLAC	Beamline	USA	electrons (sec.)	1 - 14 GeV/c	hast@slac.stanford.edu
SLAC	SLAC	Beamline	USA	electrons (prim.)	2.5 - 15 GeV/c	hast@slac.stanford.edu
ELPH	Research Center for EElectron PHoton	Beamline	Japan	electrons, positrons (conv.)	0.1-1.0 GeV/c	suda@ins.tohoku.ac.jp

<https://test-beam-facilities.web.cern.ch/>

DB: Databases Software Stack

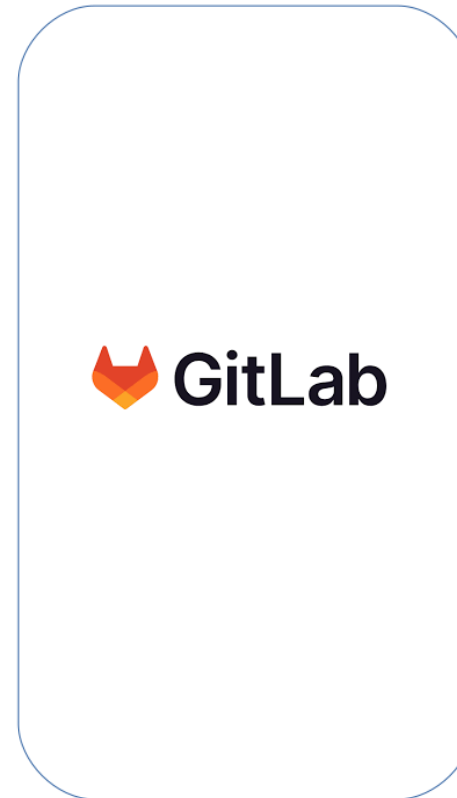
Front end



Back end



Development



Deployment



DM: Irradiation Experiments Workflow

Registration

- Users
- Experiments
- Samples



Planning

- Schedule
- Beam interaction quantities
- Capacity
- Dosimeter/sample assignment



Operation

- Irradiation status
- Control system
- Beam Instrumentation



Dosimetry

- Gamma spectrometry
- Proton fluence calculations



Traceability

- Logistics/Infrastructure
- Transport



History

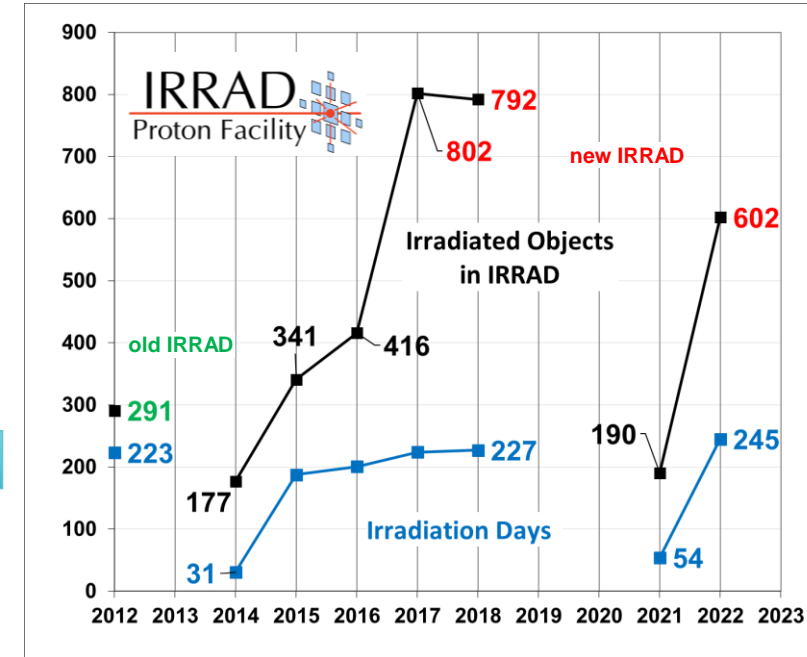
- Reproducibility
- Dissemination
- Reporting



Before

During

After



see B. Gkotse PhD, (2020):
<https://cds.cern.ch/record/2743492>



DM: IRRAD Data Manager (IDM)

A unified data management tool for Irradiation Experiments follow-up

IRRAD Data Manager - Irradiation Experiments

ID	Irradiation title	Availability	No. registered/declared samples	Radiation/NaCl/CuK Length Occupancy (h)	No. Users	Responsible person	Status	Actions
81	FDC RADMON (R)	02/04/2018	4/6	4.139/1.895	0	Georgi Corine	Completed	Visible Edit Delete
842	Photo diode Irradiation (R)	28/06/2018	7/7	9.111/4.232	0	Leuri Aghari-Oliana	Completed	Visible Edit Delete
1483	Heavy Ion Irradiation for silicon defect spectroscopy (M)	16/11/2018	4/4	0.212/0.060	0	Witka Matej	Validated	Visible Edit Delete
1482	NIEL calibration - Heavy ION 2018 - RADMON (M)	14/11/2018	1/1	0.085/0.043	0	Giuseppe Pezzullo	Validated	Visible Edit Delete
1481	NIEL calibration - Heavy ION 2018 (M)	14/11/2018	5/5	3.205/0.995	0	Giuseppe Pezzullo	Validated	Visible Edit Delete

IRRAD Data Manager - Dosimetry results for SET-003252 (ULTEM1000)

Dosimeter	Dimensions (mm ³)	Date In	Date Out	SEC	Accumulated fluence	Error(%)	Comments
DOS-004033	10x10	18/04/2018 20:02	05/09/2018 03:00	1.45e+30	9.79e+16	7	
DOS-004151	10x10	12/09/2018 13:25		0.00e+00		None	

Dosimeter dimensions (mm³): 10x10mm³ Total accumulated fluence: 9.790e+16 Protons/cm²

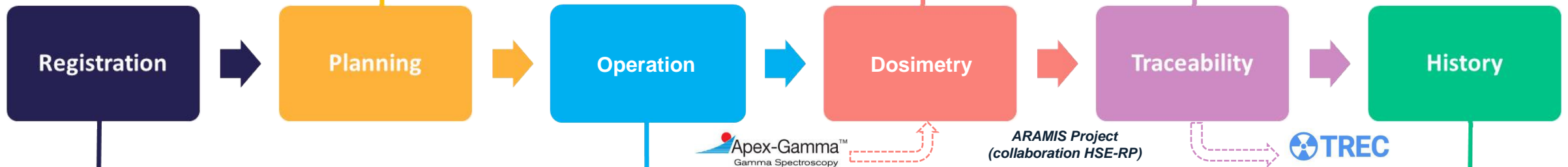
IRRAD Data Manager - TREC Data of Sample SET-003122

Modification:

- Code: F00187001-CR003122
- Serial Number: SET-003122
- Description: Sample Sets
- Current location: 25-2-019
- Value: 1 CHF

Characteristics:

- Length: 1 cm
- Width: 0.5 cm
- Height: 0.002 cm
- Weight: 0.1 kg
- Family:
- Material:



Sample dimensions configuration interface with fields for length, width, height, and material.

IRRAD Data Manager - Irradiation Status

Updated at	Sample	Dosimeter	Date IN - Date OUT	IRRAD table	Table position	Accumulated fluence	SEC	Updated by	Status	In Beam	Actions
15/11/2018	SET-003899	DOS-004211	15/11/2018 16:11 -	IRRAD19	Center		272851	irradiation.facilities@cern.ch	Registered	<input type="checkbox"/>	Visible Edit Delete
15/11/2018	SET-003900	DOS-004211	15/11/2018 16:11 -	IRRAD19	Center		272851	irradiation.facilities@cern.ch	Registered	<input type="checkbox"/>	Visible Edit Delete
15/11/2018	SET-003901	DOS-004211	15/11/2018 16:11 -	IRRAD19	Center		272851	irradiation.facilities@cern.ch	Registered	<input type="checkbox"/>	Visible Edit Delete
15/11/2018	SET-003902	DOS-004211	15/11/2018 16:11 -	IRRAD19	Center		272851	irradiation.facilities@cern.ch	Registered	<input type="checkbox"/>	Visible Edit Delete
15/11/2018	SET-003903	DOS-004211	15/11/2018 16:11 -	IRRAD19	Center		272851	irradiation.facilities@cern.ch	Registered	<input type="checkbox"/>	Visible Edit Delete

IRRAD Data Manager - 3D pixel for ATLAS ITk

Experiment Details:

- Title: 3D pixel for ATLAS ITk
- Description: Study of radiation hardness of 3D silicon pixel sensors for the innermost pixel layer of ATLAS ITk with fluences up to 2e16 protons/cm2. Both FE4 prototypes and modules with the new RD53A readout chip are going to be tested.
- Responsible person: jason.dange@cern.ch
- Innovation type: Prototypes
- Additional comments: Important to characterize the new RD53A readout modules for ATLAS ITk prior before the PS-SPS shutdown in 2019-20.

Sample Details:

- Category: Passive Custom
- Type: Silicon sensor

180 users in IDM so far ...

DM: IDM Software Stack

Front end



Semantic UI



Back end



Development



Selenium

Deployment



Docker



OpenShift

DM: IDM In Other Facilities

- cloning and adapting IDM to other facilities
 - according to identified requirements
- deployment using the OpenShift platform
- development & deployment:
 - GIF++ @ CERN
 - ITA @ FNAL, ENEA-FNG @ LNF (ongoing)



IDM at ITA

ENEA-FNG Signed in as: salvatore.fiore@enea.it Logout

Home Experiments Info Admin Help

FRASCATI NEUTRON GENERATOR AIDA 2020

IRRAD Data Manager

Home / Experiments **IDM Prototype at ENEA-FNG**

Actions Filters

+ Create Validate Users Change Status Update visibility Samples Update Clone Upload Attachment View Details Contact Responsibilities Delete

ID	Experiment title	Availability	No. registered/ declared samples	Radiation/ Nu.Coll. Length Occupancy (%)	No. Users	Responsible person	Visibility	Status
1	test3 (DD - 2.45 MeV)	02/06/2022	2/1	0.318 0.468	1	giovanni.mariano@enea.it	Private	Validated

https://test-gif-idm.web.cern.ch/data_manager/experiments/ GitHub - CMSTrack...

CERN Accelerating science Signed in as bgkotse Directory

Home Experiments Info Help GIF+ AIDA

GIF++ Irradiation Data Manager

Home / Experiments

Actions Filters

+ Create Validate Users Samples Update Change Status Update visibility Contact Responsibilities Clone Upload Attachment View Details Delete

ID	Experiment title	Availability	No. registered/ declared samples	No. Users	Responsible person	Visibility	Status
2	test irr29 (g)	17/11/2022	0/2	0	bgkotse	Public	Validated
1	test irr1 (g)	17/11/2022	0/2	0	bgkotse	Public	Registered

IDM at GIF++

Fermilab

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Register Samples

After a TSW has been approved, all samples being brought to the ITA must be registered in the ITA Data Manager (TODO: Add link to website and instructions). It is suggested that an experiments spokesperson or a designate request an account on the data manager to log information on the samples. This registration process will help us monitor what is coming and associate samples with relevant dosimetry information. **Sample registration must be completed the week before your expected ITA run.**

Until the user interface side of the data manager is up and running the ITA coordinator will enter samples into the database on behalf of the user based on the TSW.



UM: RADNEXT TA Proposals Portal



Home Help Proposals Reviews All Users My Account jaroslaw.szumega@cern.ch Logout

RADNEXT Portal

Welcome to RADNEXT Transnational Access Portal.

Please choose your action.

Submit Proposal

View Proposals

View Reviews

Facilities

<https://radnext-ta-portal.web.cern.ch/>

- **RAD**iation facility **N**etwork for the **EX**ploration of effects for indus**T**ry and research
 - EU-project coordinated by CERN ATS including 30 beneficiaries, 9 partners & **32 facilities** (EU + Canada)
 - >6000 h. of **EU-funded irradiation beam time** made available to the worldwide radiation effects community (mostly electronics) via **Transnational Access (TA)**
 - Portal for TA proposals **submission, evaluation and facilities assignment**

UM: RADNEXT TA Proposals Portal

RADNEXT Portal

Home Help Proposals Reviews All Users My Account blerina.gkotse@cern.ch Logout

Change Status Assign Reviewers View Reviews Final Decision Team Members

Proposal Details

Proposal title (acronym)
TA03-19: 12 - SEE evaluation on RFID tags under fast neutrons (TagSEEn)

Beam Type
Neutrons - (quasi)monoenergetic

Project abstract
Proper management of irradiated samples and systems at facilities is a challenging task, that implies both asset management and post-irradiation activation measurement techniques. Within the AIDAInnova project, a specific activity is carried on to realise a system that integrates both these techniques, by exploiting RFID tags to trace samples and systems during beam test for High Energy Physics experiments. Assessing the radiation hardness of such tags is mandatory in order to guarantee their usability along the irradiated setups. For this reason, within task 4.3 of AIDAInnova a testing campaign is foreseen on RFID tag samples to be used in HEP beam test conditions. We propose to perform a SEE testing campaign on RFID tag samples with high intensity 14 MeV neutrons, testing their memory integrity for induced errors and the functionality of the communication systems embedded in the tags. This would allow to qualify their use under neutron test irradiation, and

Comments

Comment

Comment

TA1 Carlo Cazzaniga 28/02/2022 11:42:41 UTC
72h awarded at FNG. Confirmed by users, dates TBD.

578 users in the portal so far...

RADNEXT Portal

Home Help Proposals Reviews

My Proposals

My Proposals

Title	Beam type	Group	Status	Created
TA03-19: 12 - SEE evaluation on RFID tags under fast neutrons	Neutrons - (quasi)monoenergetic	Fed		
TA03-25: 03 - Integrated Sensor Interface for Harsh Radiation	Heavy ions	Paul Leroux	Performed	14/04/2023 13:32:29
TA03-26: 04 - Statistical approach to defect simulation in complex analog and mixed-signal circuits: application to radiation-induced single-event transients	Heavy ions	Gildas Leger	Performed	14/04/2023 13:32:29

UM: Portals Software Stack

Front end



Semantic UI



Back end



Development



Selenium

Deployment



Docker



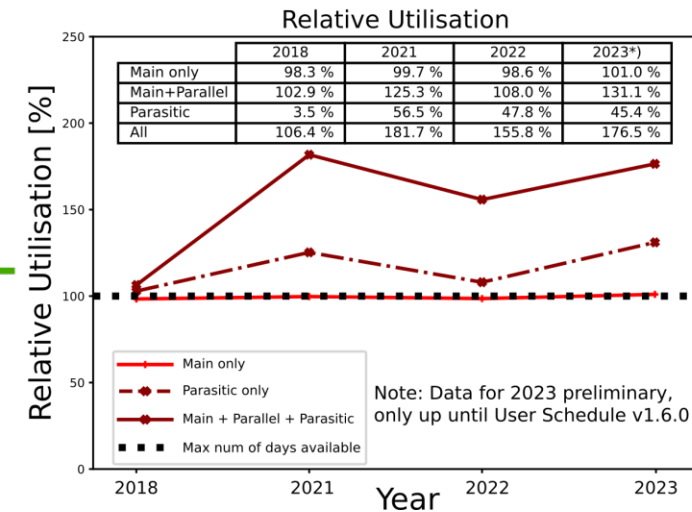
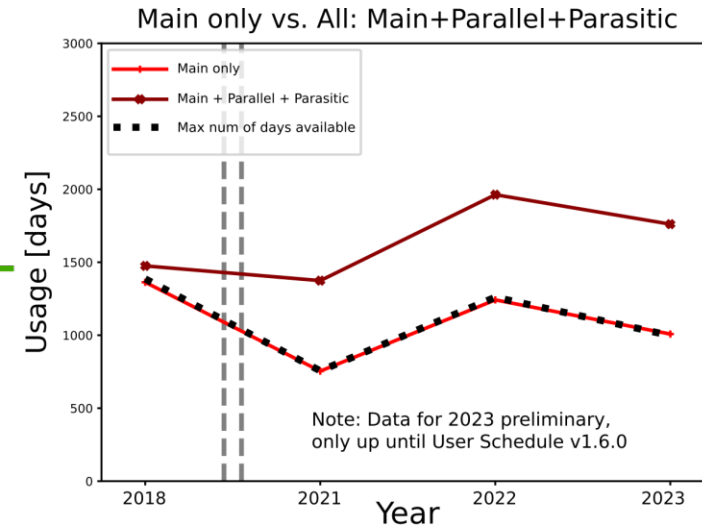
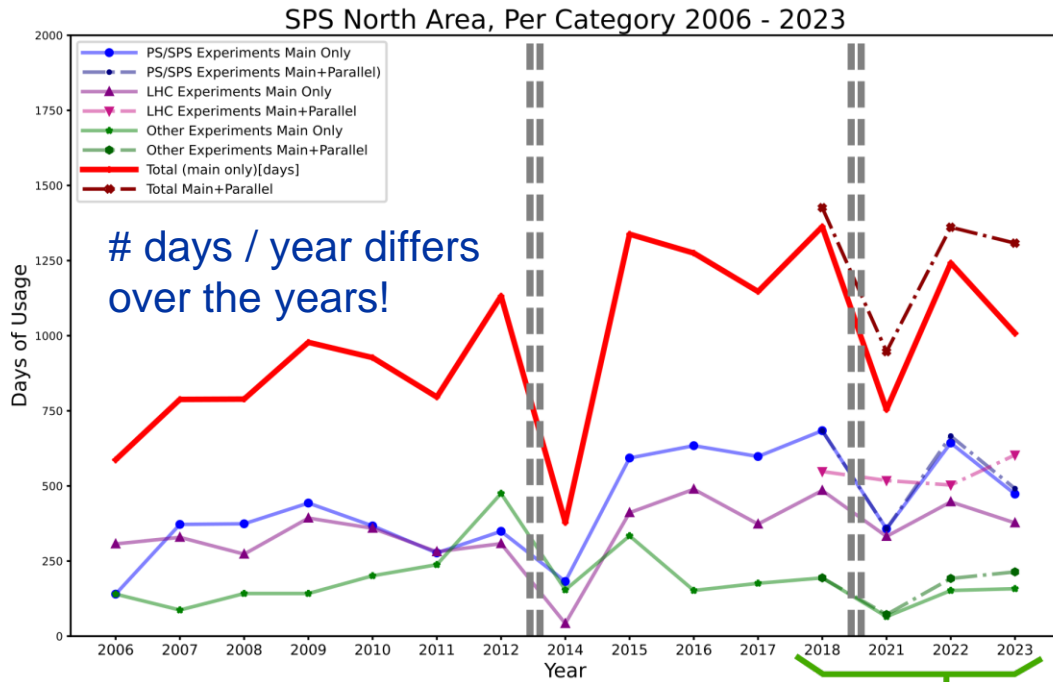
OpenShift

data analysis tools for research activities
(ML, NLP, etc.) performed on text data



J. Szumega PhD project ongoing
(MINES PSL [FR] and CERN-EP)

UM: PS & SPS User Schedule Management Tool



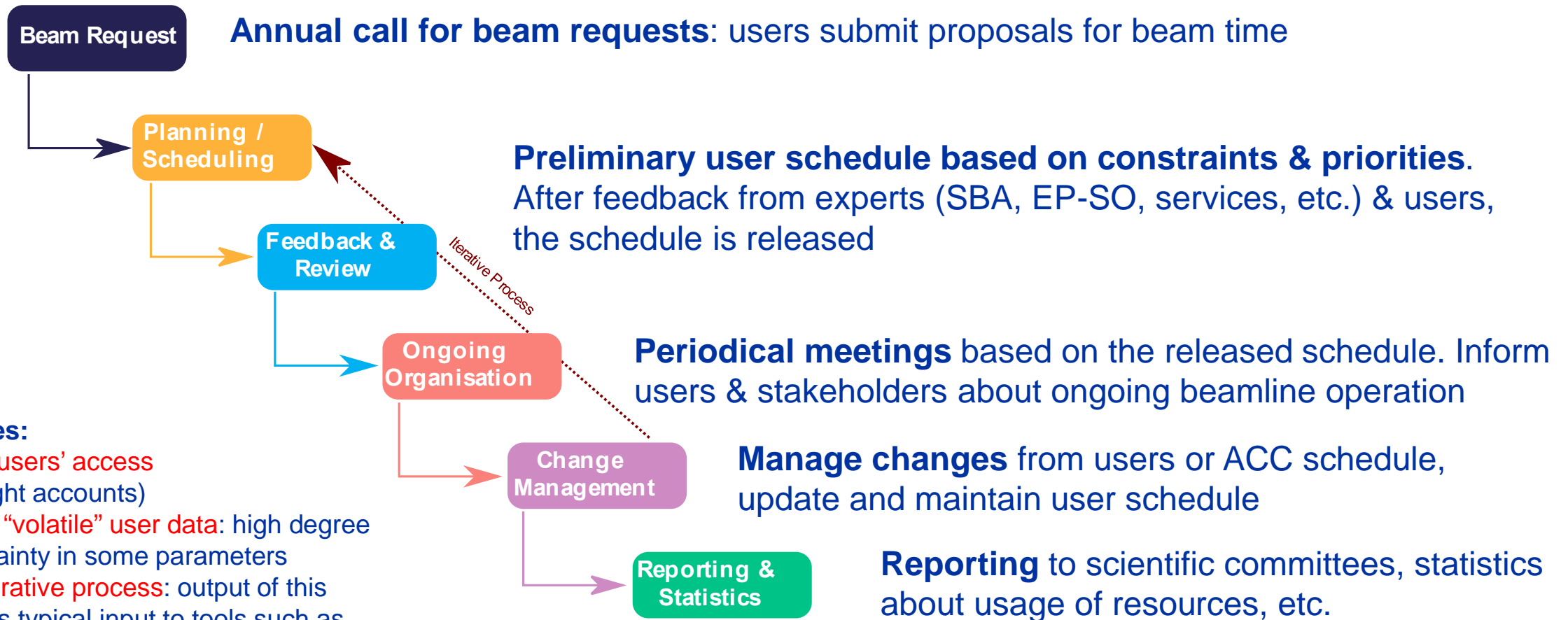
Long term PS East Area data not consistently available, Data from 2022 and 2023 (preliminary) for T8 - T11:

	2022	2023
Main only	731 days	649 days
Main + Parallel	731 days	674 days
Parasitic	70 days	26 days
All	801 days (~82% utilisation)	700 days (~85% utilisation)

Consistently high levels of relative utilisation (**more than 100%**) due to scheduling additional parallel and parasitic users!

UM: PS & SPS User Schedule Management Tool

• Intended Workflow (Simplified)



Main features:

- External users' access (lightweight accounts)
- Handling "volatile" user data: high degree of uncertainty in some parameters
- Highly iterative process: output of this process is typical input to tools such as [ASM](#), etc.

UM: PS & SPS User Schedule Management Tool

- **Challenges:**

- Increasingly **overbooking**, handling acceptance / rejection (parallel running, parasitic usage, etc.)
- Increased **rescheduling** due to delays and cancellations
- Until 2022: user requests, schedules, requirements, etc. **managed “manually”** (set of disconnected scripts, emails, spreadsheets, & ad-hoc solutions)

- **Consequences:**

- Increasing **manual & repetitive work**
→ not scalable, strain on limited resources
- **No coherent long-term picture** of the data
→ difficult to derive *KPIs* & optimize based on data
- **Limited transparency** towards the users

- **Example - Year 2023^(*):**

Very high number of **user-requested changes** to the schedule

- East Area:

Change Category	# Of Activities	# Of Weeks
Change run slot (time location)	12	21
Cancellation / Withdrawn by Users	1	1
Request for Additional Beam Time	6	6

- North Area:

Change Category	# Of Activities	# Of Weeks
Change run slot (time location)	50	65
Cancellation / Withdrawn by Users	9	12
Request for Additional Beam Time	18	34

→ **21 versions of the schedule so far** (9 since the first published version!)

(*) only data until 13/07/2023 and User Schedule v1.6.0

UM: PS & SPS User Schedule Management Tool

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- **Solution:**

Unified data-base driven software solution

- 1) **Improve the service to the users:**

- **Diverse user groups** → adapted data model
- **Include feedback, reviews & comments into data model**
→ increase transparency, traceability & accountability
- **Improved handling of user requirements & constraints**
(beam-lines and user groups schedules are interlinked)
- **Improved management of user roles & succession**
→ targeted communication
- **Quicker turnaround for change management**

- 2) **Keep the UM scalable** (increasing demands & constraints)

- 3) **Improve reporting** (future optimization of resources)

UM: PS & SPS User Schedule Management Tool

<https://ps-sps-users.web.cern.ch>

Create New Beam Request

For Activity "Beamline for Schools" ← BACK

Period: Protons 2023

Select accelerator(s): Directly (please choose all requested areas / accelerator complex(es))

Requested accelerators / complexes:

- PS Complex (East Area)
- PS Complex (JH09)
- SPS Complex (North Area)
- SPS Complex (MMAKE)

Details for selected accelerator(s): We only target the low energy beamlines in the east area with this activity

Import all active roles from the activity: Yes

Create Beam Request

Details Run

Activity: NP04

Beam Request: Beam request in Protons 2023 for "NP04"

Period: Protons 2023

Beam request run: Run no. 0 for Beam request in Protons 2023 for "NP04" (id: 11)

Schedule Information | Requested Beam Properties | Requested Hardware and Setup | **Review** | Comments

Review Comment

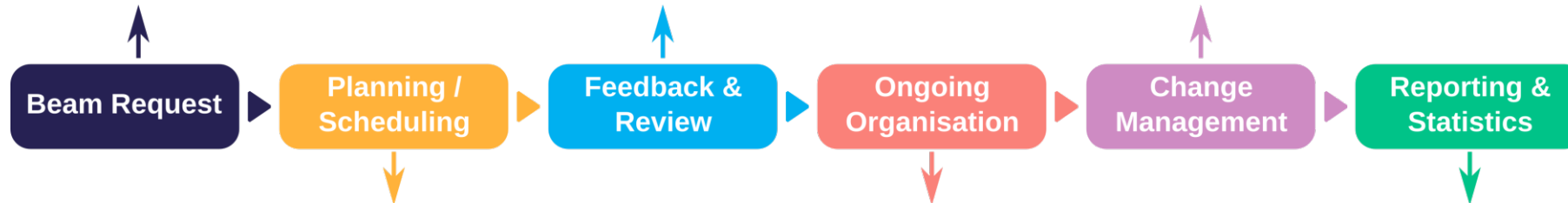
Reviewer: Nikolaos Charitonidis

Posted on: 2023-03-02 at 12:15:17

Review result: Comments only

Message: Review transferred from <https://indico.cern.ch/event/1257930/> by the SPS and PS Physics BE-EA team: Comments: - NP04 is compatible with CMS HGAL. If NP04 needs negative p (e.g. -80 GeV/c secondary to whatever polarity/momentum needed for the tertiary beam) but not the case with positive polarity in the secondary beam (as NA61 always takes posi but not the case with positive polarity in the secondary beam (as NA61 always takes posi be ready or not be scheduled (to be confirmed after the next SPS)). NA65 would have be

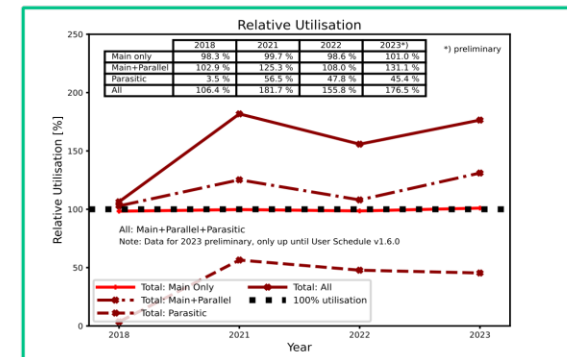
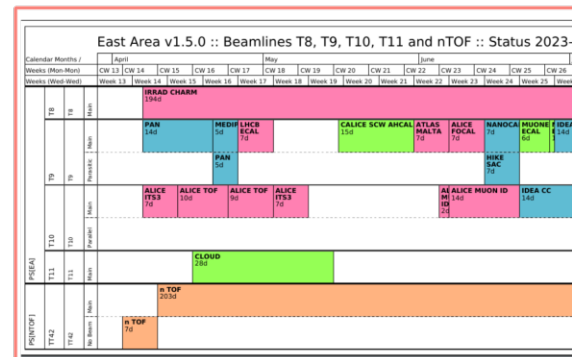
Work In Progress -
Currently
Under Development



Scheduled Runs

Displayed: 279 Runs. [Create XLSX File] [Beamconfig + Influence to XLSX File] [Visualisation]

Actions	Id	Activity	Requ Id	Requ Run	period	Begin Slot	End Slot
<input type="checkbox"/>	1	BL4S	5	9	Protons 2023	Week 29 [Jul. 19 - 26]	Week 29 [Jul. 19 - 26]
<input type="checkbox"/>	2	BL4S	5	36	Protons 2023	Week 37 [Sep. 13 - 20]	Week 38 [Sep. 20 - 27]
<input type="checkbox"/>	3	ALICE_TIMING	9	17	Protons 2023	Week 27 [Jul. 05 - 12]	Week 28 [Jul. 12 - 19]
<input type="checkbox"/>	4	ALICE_TIMING	9	18	Protons 2023	Week 42 [Oct. 18 - 25]	Week 42 [Oct. 18 - 25]
<input type="checkbox"/>	5	ALICE_MUON_ID	11	19	Protons 2023	Week 23 [Jun. 07 - 14]	Week 24 [Jun. 14 - 21]
<input type="checkbox"/>	6	HERD	14	149	Protons 2023	Week 35 [Aug. 30 - Sep. 06]	Week 36 [Sep. 06 - 13]
<input type="checkbox"/>	7	CLOUD	21	23	Protons 2023	Week 15 [Apr. 12 - 19]	Week 19 [May. 10 - 17]
<input type="checkbox"/>	8	CLOUD	21	24	Protons 2023	Week 37 [Sep. 13 - 20]	Week 43 [Oct. 25 - Nov. 01]
<input type="checkbox"/>	9	ALICE_RICH	24	30	Protons 2023	Week 40 [Oct. 04 - 11]	Week 41 [Oct. 11 - 18]
<input type="checkbox"/>	10	REX_GAMMA_MEV	28	37	Protons 2023	Week 36 [Sep. 06 - 13]	Week 36 [Sep. 06 - 13]



UM: PS & SPS User Schedule Management Tool

Activity Management

Handling life-cycle,
Approval / Renewal by
Scientific committees, etc.

User Management

Permissions and Roles,
Allow users to store assets,
etc.

Beam Request

Drafting and editing by users,
Allow re-use and transfer
over years, etc..

User Schedule

Tools for creating and
visualising schedules,
change and requirement
management, etc.

Infrastructure

Information about beamlines,
accelerators, detectors,
magnets, beam
instrumentation, etc.

Funding

Applications for Transnational
Access (TA) in programs
such as **EURO-LABS**,
etc. .

Implementation Detail: Modular Design

- The Tool is composed by **modules**
- Potential for **reuse / shared development** of some components with other software tools
- Some functionality also available in other tools at CERN (i.e., Greybook, ASM, etc.)
- Some modules address **requirements specific** to the PS & SPS User Management
- **Strategy:**
 - Enable interfaces to external services / tools
 - **Leverage modularity once development is mature enough to clearly define interfaces**

UM: PS & SPS User Schedule Management Tool

- **Beam Requests & User Schedules 2023** already handled using the new tool (first version). As of June:
 - Approx **100 beam requests**
 - Approx **200 scheduled runs, 380 Users**
-  **EURO-LABS** first MS due at the end of August 2023:
 - First implementation ready → **achieved 02/2023!**
- **Ongoing Development & Improvements:**
 - Enable users to perform some data maintenance on their own
 - Improve change requests & schedule maintenance
 - Leverage synergies with other EP software tools
→ **spin out modules into reusable components**. Exploratory work started by summer student 2023 (D. Vasquez)
 - statistics and reporting
 - Handling EURO-LABS TA applications & funding
- **Future Development Goals:**
 - Improvements in visualization & archival of schedule iterations
 - Optimization, performance & scalability improvements
 - Update the data model

EURO-LABS Statistics (07/2023)

- 42 projects requested funding in 2023
- for 78 separate visits
- In 2023 (first year of the project):
 - Approximately **x2 the number of access units requested** (planned for the full project in 4Y)
 - Approximately **x3 the budget requested that was planned** for all the 4Y project duration (3Y of CERN test beams), representing a **9-fold overbooking of resources!**
- **More stringent reimbursement rules without reduce the number of projects or visits!**
- **Notes:**
 - **The workload and complexity scales with the number of visits!**
 - There is a close connection between change requests / schedule changes and EURO-LABS TA application management

UM: PS & SPS Management Tool Software Stack

Front end



Back end



PostgreSQL



python™

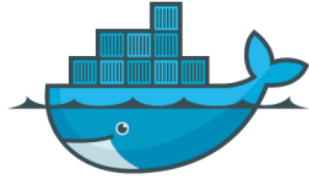


Development



Selenium

Deployment



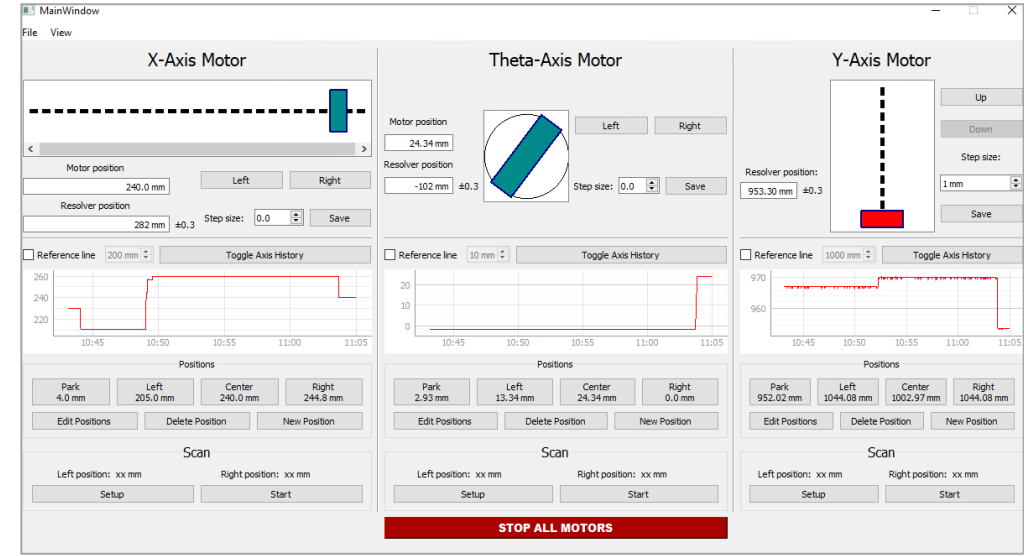
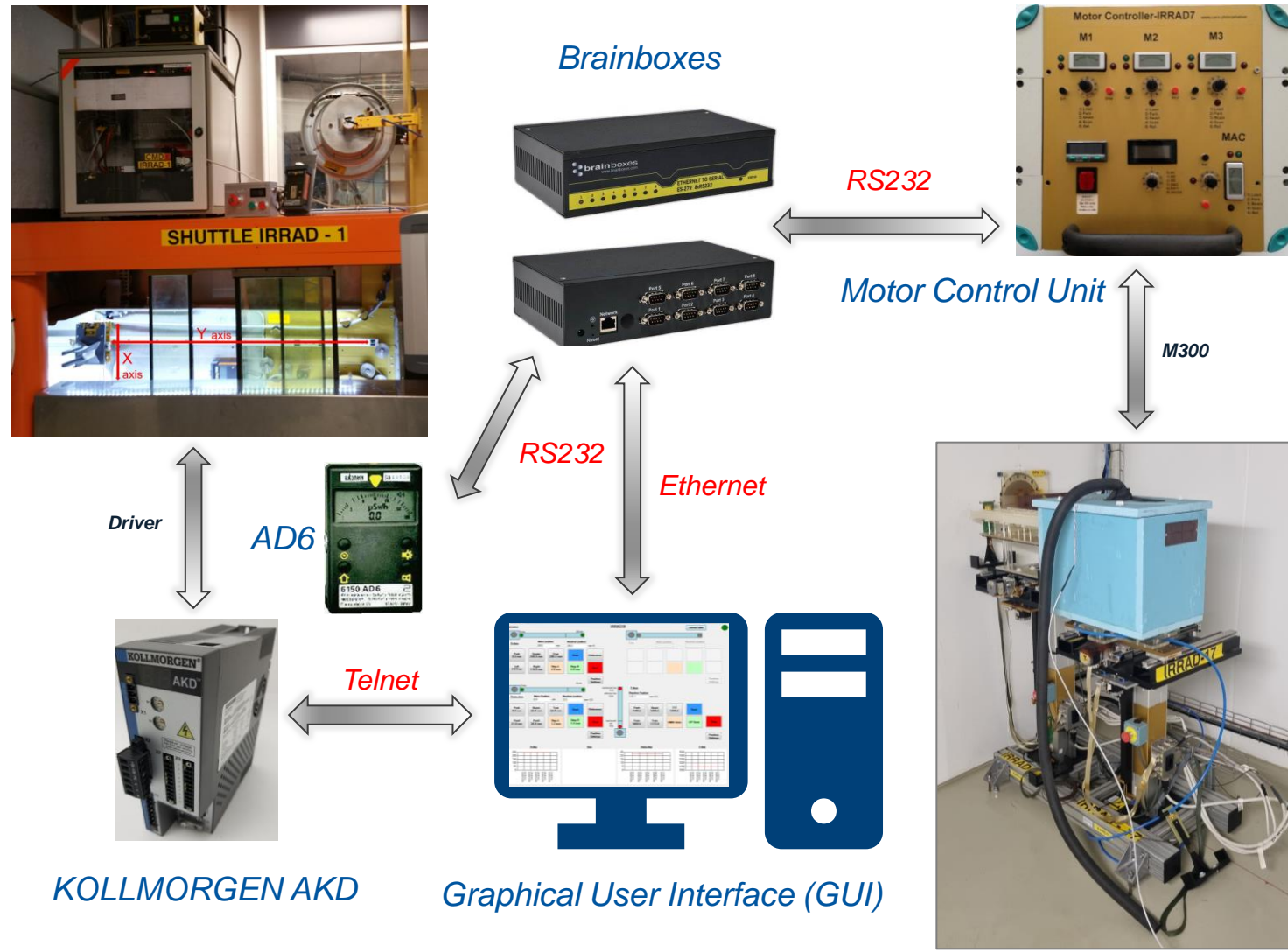
Docker



OpenShift

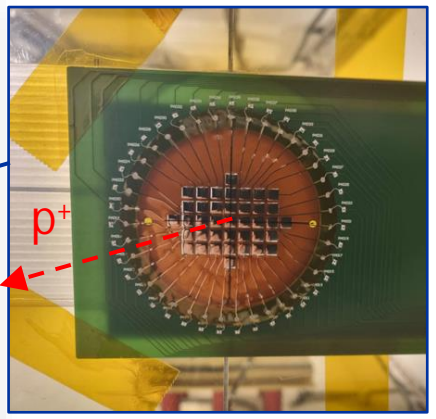
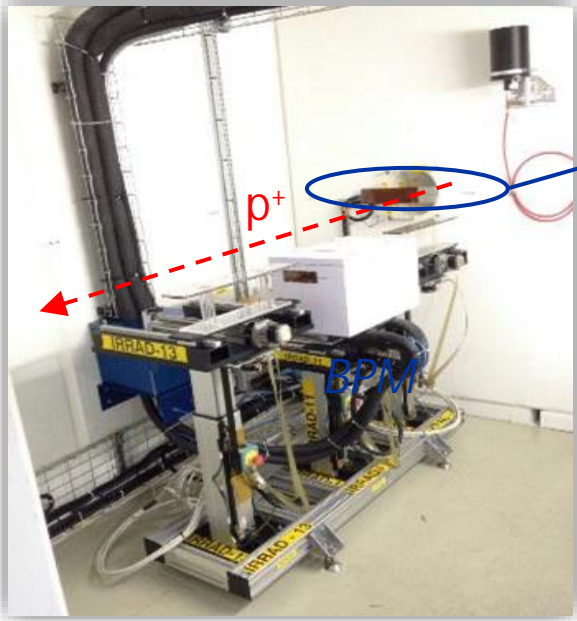
OP: IRRAD Controls, GUIs

New interface with open-source technologies



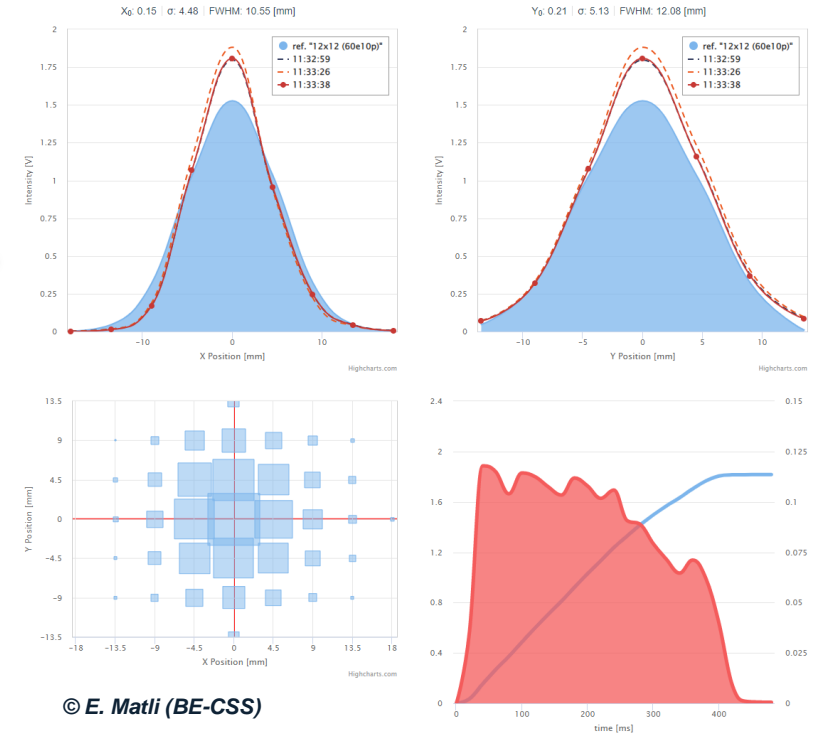
- custom-made IRRAD equipment
 - **movable stages & conveyor** operating in harsh radiation environment:
 - stepper / AC motors, radiation monitors, environmental and position sensors, cooling systems, cryogenics, etc.
 - adapted to **EP users' needs** allowing **flexibility** to perform irradiation experiments
 - **reliability & RP constraints** in radiation environment

OP: DAQ & Beam Display



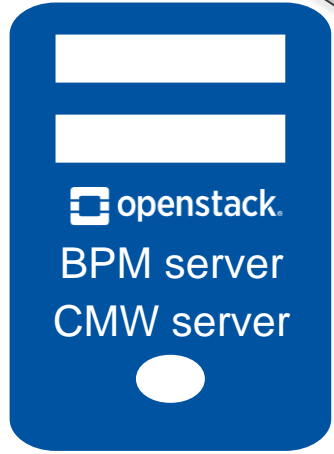
Real-time beam data GUIs (BE-CSS)

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

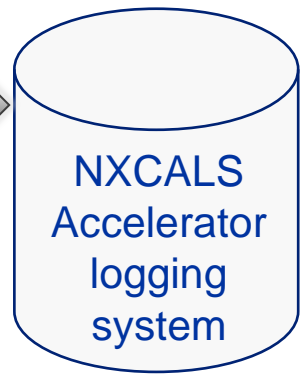


© E. Matli (BE-CSS)

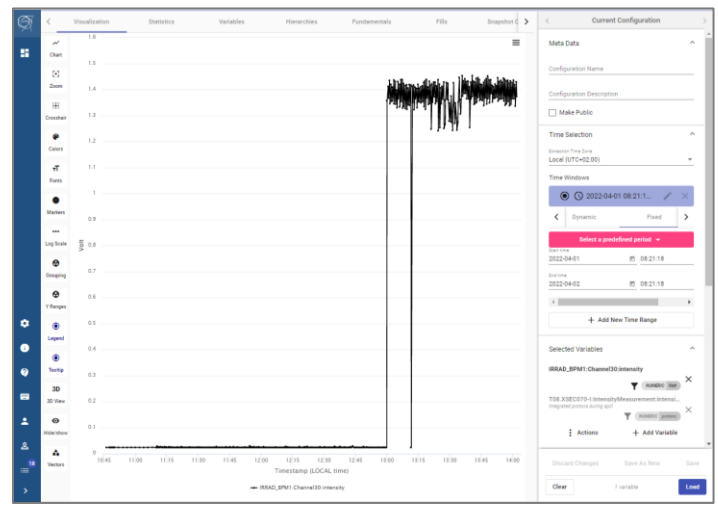
BPM detector
ATTRACT
(data processing software)



2021



Development of back-end software (EP-DT)



BPM DAQ
(firmware for data-taking)

OP: Tools Software Stack

IRRAD Controls



IRRAD BPM Architecture



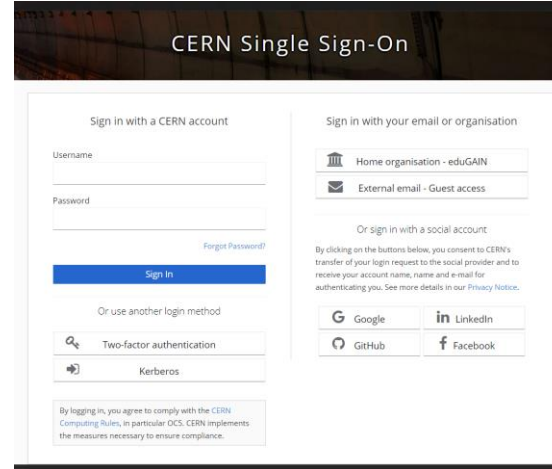
Common CERN-IT Software Technologies

CERN Authentication and Authorization (SSO)

Hosted on GitLab

Deployed on OpenShift or OpenStack

IT



CERN IT Databases:

- Oracle
- Database on Demand (MySQL, PostgreSQL)



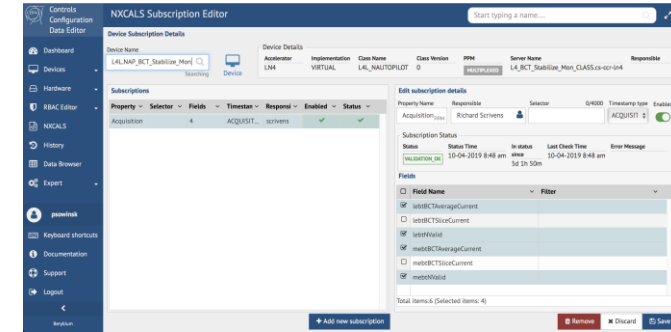
CERN APIs (e.g., InforEAM)

EN

Accelerators' Services:

- NXCALS
- Control Configuration Database (CCDB)
- Timber

BE



SW tools provided by CERN-IT infrastructure "at large" need periodic maintenance (updates, computer security, upgrades, etc.)

Maintenance and Operation

Technology	What's needed ?	Impact	Frequency (*)	% Effort (**)
Libraries and API changes	Code modifications according to the changes. Validation and testing, etc.		few times / year	~10%
CERN IT Database version upgrades and interventions	Adapting outdated code and ensuring software tools operation		few times / year	~5% (max.)
Security changes and updates (GIF++ e-log, APEX-gamma, etc.)	Data back-up, applications updates, etc.	Critical for tools operation and computer security	monthly (regular)	~10%
Authentication (SSO) upgrades	New software configurations and code adaptation		every few years	~20%
IT infrastructure upgrades (e.g., DFS to EOS, VMs, OSs, etc.)	Change of application host and software configurations		every few years	~5%
OpenShift upgrades	Rebuilding and redeploying code with new images, ensuring compatibility, etc.		every few years	~5% (max.)

(*) not considering CERN IT policy changes, outdated software changes or re-deployment
 (**) for one expert on annual basis (best guess based on past operational experience)

Conclusion

- **Ecosystem of IT informative & management tools developed in EP:**
 - Last, but not least, the **PS & SPS User Schedule Management Tool** based on **standard CERN-IT technologies**, on the **previously developed tools** and on the **experience and knowhow** built in EP-DT
- **Tools became essential to manage the increasing:**
 - **number of users / experiments** in the EP facilities (irradiation and test-beam areas)
 - **additional commitments** coming from EU-funded projects (TA applications, etc.)
 - exploited & consulted by **thousands of users** (CERN / external)
- **Tools development, M&O strongly based on external EU-funds:**
 - **resources & manpower fading out** soon
- **How to insure operation & continuity ?**
 - need to define a strategy, support (CERN?), etc.

Tool	2023	2024	2025	2026 (LS3)
DBs	← AIDAInnova funds	← RADNEXT funds		
DM				
UM		← EURO-LABS funds		
IRRAD OP				



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