The Years 2022 and 2023 in PS & SPS Physics Coordination and Irradiation Facilities at CERN

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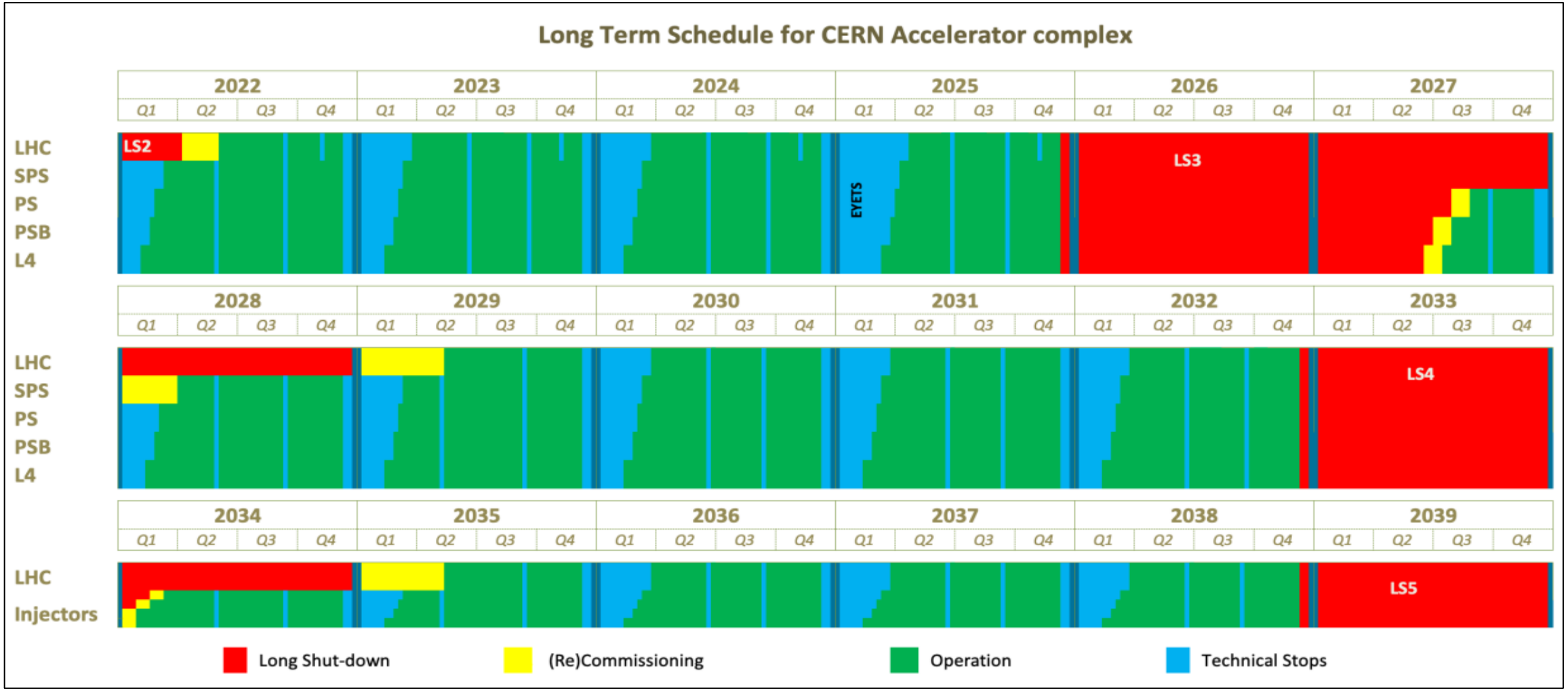
Content

- CERN PS and SPS Accelerator and User Schedules and Beam Availability
- EURO-LABS
- GIF++ and IRRAD/CHARM Facilities

CERN Long Term Accelerator Schedule



Changes to the Run Schedule due to Energy Crisis

- Shortage of Electrical Energy in France at the end of 2022 and strong increase of energy prices → Shortening of the 2022 and 2023 Runs
- 2022 physics period was shortened by two week at the end of the run
  - SPS Physics users: AWAKE shortened by 1 week, NA61 ion run shortened by two weeks
  - PS irradiation programs: CHIMERA Pb ion beam time reduced from 14 to 5 days → first full beam time in 2023
    - **C**HARM **H**igh-energy **I**ons for **M**icro **E**lectronics **R**eliability **A**ssurance (https://indico.cern.ch/event/971222)
    - CERN-ESA collaboration for testing of stat-of-the-art microelectronics with a unique combination of high range and high energy deposition Pb ions (100 MeV/n to 5 GeV/n, 10^2 - 10^5 ions/cm^2/s, up to 20x20 cm^2 beam size)
  - SPS Pb ion test beams were shortened to two weeks → parallel running
- 2023 accelerator and physics schedules reduced by 15% to 25% with respect to 2022
  - Strong over-booking of the SPS test beam lines (booked on average to 180%)
  - Particular problem for high purity electron beam users and for those which cannot share the beam time with other users (e.g. EM calorimeter tests)
- Other user (tracking detectors, timing detectors, …) share the beam with up to 3 or more other users in the SPS

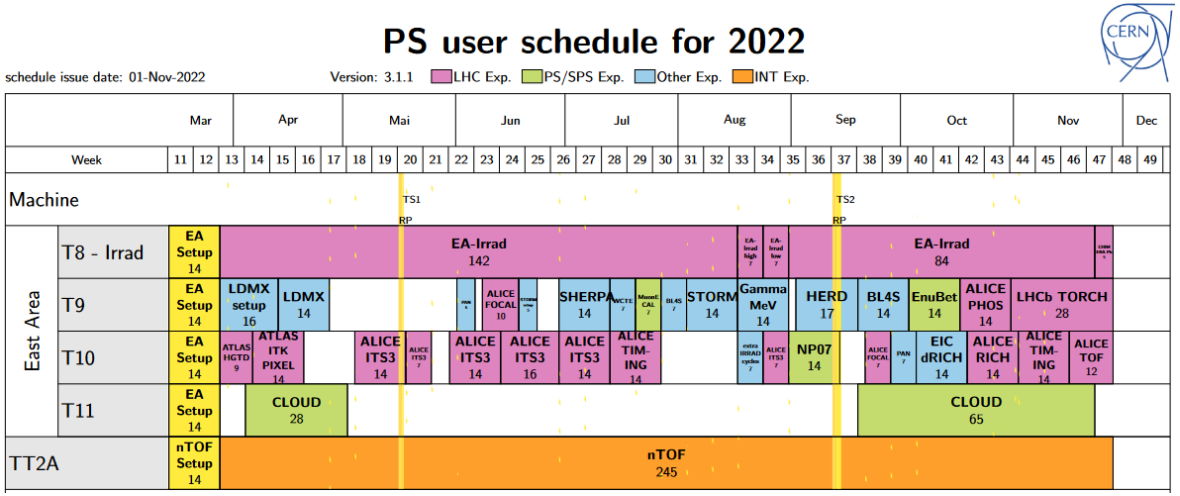
2022 User Beam Schedules

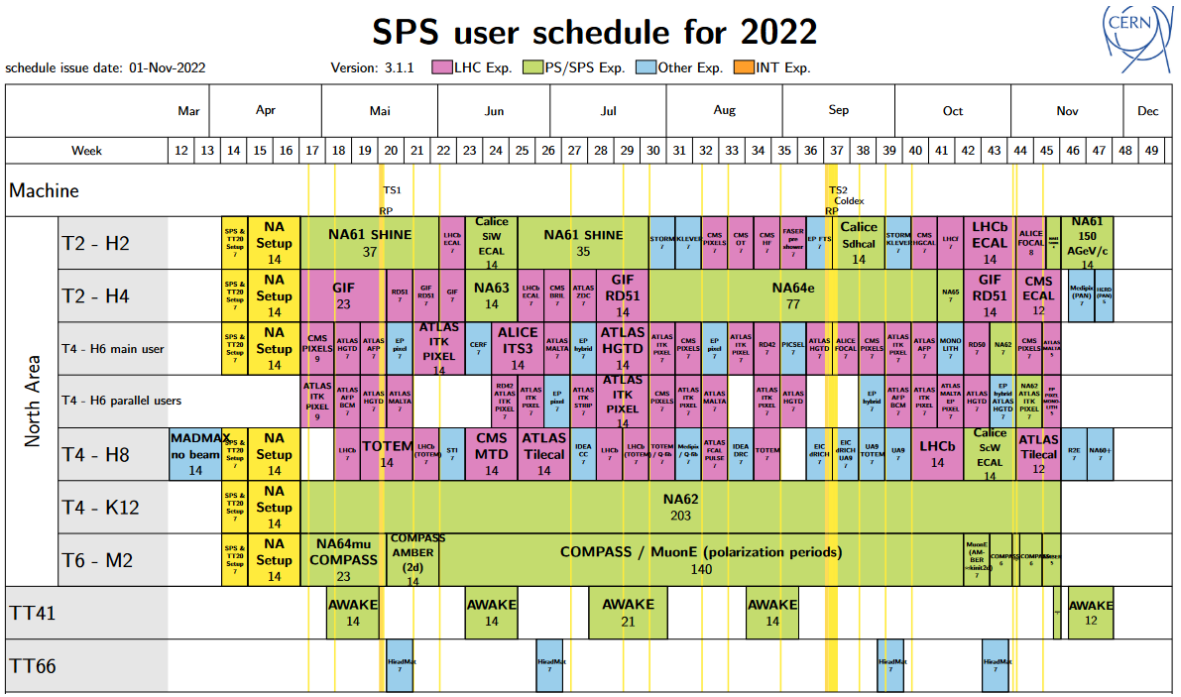
- 2022 User Schedule was updated frequently
- High number of teams that had to canceled their beam time → redistribution to other users
  - 4 PS weeks and 17 SPS weeks
- Additional beam time requests, requests for re-scheduling
- Introducing a semi-formalized way to handle additional, fully parasitic beam time → will be fully integrated in 2023 run.

SPS H6 beam line:

	Sub-zone			a	b	c	d	e	f	g	h	i	j
	Telescope			KARTEL	STRASSBOURG		ACONITE	CHROMIE		MALTA	AIDA		EP PIXEL
Week	Beam												
17	120 GeV/c						ATLAS Itk pixel			MALTA	CMS PIXELS		n.a.
18	120 GeV/c		NA62 CEDAR				ATLAS HGTD			ATLAS BCM	CMS PIXELS	ATLAS AFP	n.a.
19	120 GeV/c		NA62 CEDAR				ATLAS HGTD			MALTA	CMS PIXELS	ATLAS AFP	n.a.
20	high rate						ATLAS ITk pixel (in telescope but without teles			MALTA	CMS PIXELS		EP PIXEL
21	120 GeV/c		~~NA62 CEDAR~~				ATLAS Itk pixel			MALTA	EP hybrid		EP PIXEL
22	120 GeV/c		~~NA62 CEDAR~~				ATLAS Itk pixel			MALTA	EP hybrid		EP PIXEL
23	CERF	CERF	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
24	120 GeV/c			RD42	RD42		ATLAS Itk pixel			MALTA	EP hybrid	ALICE ITS3	n.a.
25	120 GeV/c						ATLAS Itk pixel			MALTA	EP hybrid	ALICE ITS3	n.a.
26	high rate						ATLAS Itk pixel			MALTA		ALICE ITS3	EP PIXEL
27	120 GeV/c						ATLAS Itk strip			MALTA	EP hybrid		EP PIXEL
28	120 GeV/c						ATLAS HGTD			MALTA	ATLAS Itk pixel		EP PIXEL
29	120 GeV/c						ATLAS HGTD			MALTA	ATLAS Itk pixel		n.a.
30	120 GeV/c						ATLAS Itk pixel				CMS PIXELS		n.a.
31	120 GeV/c						ATLAS Itk pixel				CMS PIXELS		EP PIXEL
32	high rate						ATLAS Itk pixel			MALTA			EP PIXEL
33	120 GeV/c						ATLAS Itk pixel			MALTA	EP hybrid		EP PIXEL
34	120 GeV/c			RD42	RD42		ATLAS Itk pixel			MALTA	EP hybrid		EP PIXEL
35	120 GeV/c					PICSEL	ATLAS HGTD			MALTA	EP hybrid		n.a.
36	120 GeV/c					~~CMS OT~~	ATLAS HGTD		ALICE FOCAL		EP hybrid		n.a.
37	ALICE FOCAL		n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	ALICE FOCAL				n.a.
38	120 GeV/c						CMS PIXELS			MALTA	EP hybrid		n.a.
39	120 GeV/c			ATLAS BCM	ATLAS BCM		ATLAS Itk pixel			MALTA	EP hybrid	ATLAS AFP	n.a.
40	120 GeV/c						ATLAS Itk pixel			MALTA	EP hybrid	ATLAS AFP	n.a.
41	high rate		NA62 CEDAR				ATLAS ITk pixel (in telescope		ALICE ITS3	MALTA		MONOLITH	EP PIXEL
42	75 GeV/c		NA62 CEDAR				ATLAS HGTD			MALTA	RD50		EP PIXEL
43	75 GeV/c		NA62 CEDAR				ATLAS HGTD			MALTA	EP hybrid		n.a.
44	75 GeV/c		NA62 CEDAR				ATLAS Itk pixel				CMS PIXELS		n.a.
45	high rate						ATLAS Itk pixel		ALICE ITS3	MALTA		MONOLITH	EP PIXEL

main user
parallel user
parasitic user





2022 Injectors Availabilities

- Extended fault periods for the SPS NA

Facility	Destination	Achieved 2022 Total [%]	Period
LINAC4	-	**97.1**	28.03.2022 – 21.11.2022
PSB	PS	**95.5**	28.03.2022 – 21.11.2022
	ISOLDE	**95.5**	
PS	SPS	**89.6**	28.03.2022 – 21.11.2022
	nTOF	**90.0**	
	AD	**90.6**	
	East Area	**91.6**	
SPS	LHC	**89.9**	25.04.2022 – 21.11.2022
	North Area	**73.2**	
	AWAKE	**92.3**	
	HiRadMat	**93.6**	

SPS North Area Beams on T2 and T4 Targets

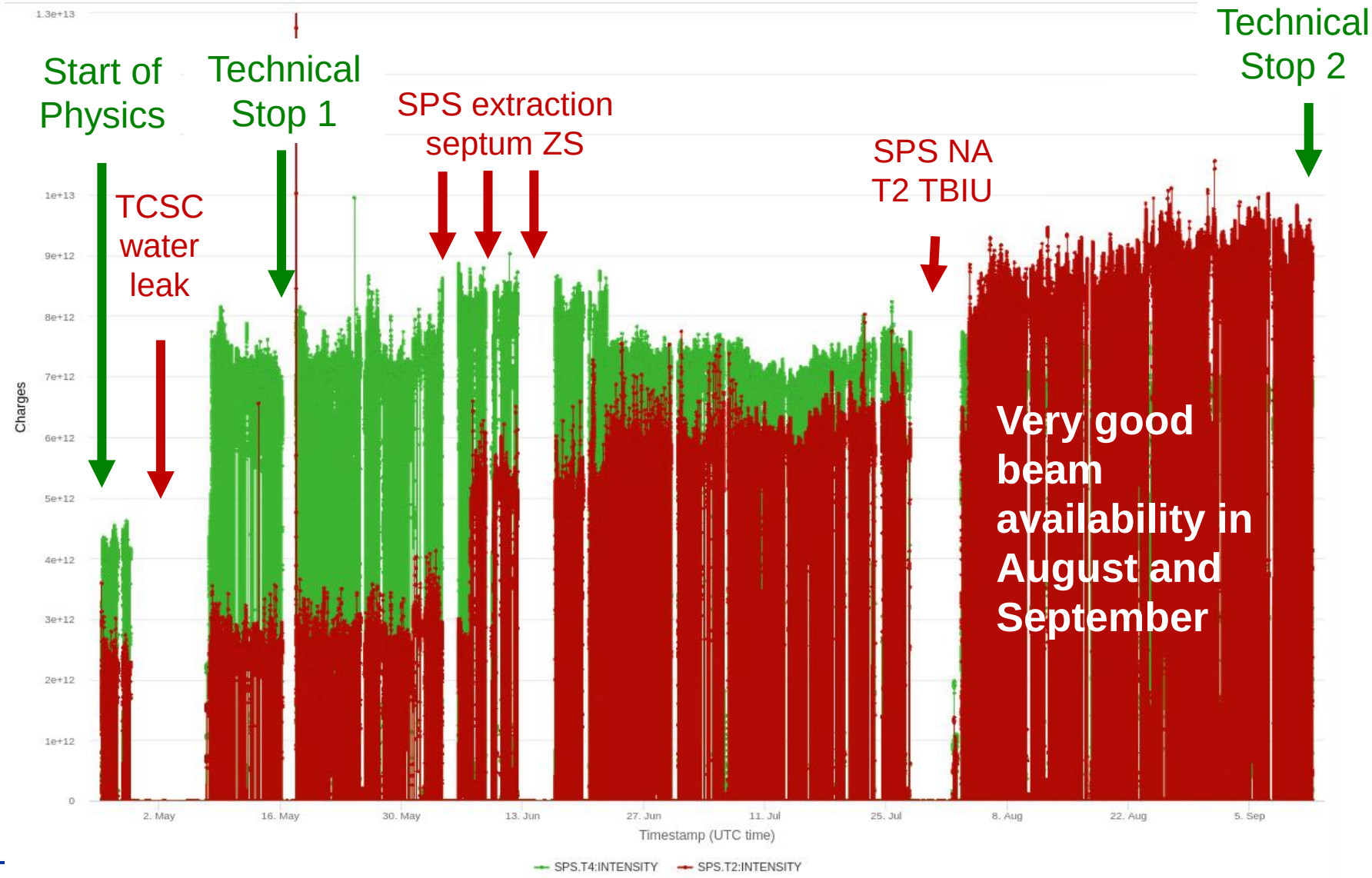
Extended periods of faults in May, June and July 2022

→ Rescheduling of beam time could compensate for almost all of the test beam users

a) TCSC cooling water leak – collimator protecting a splitter magnet (9 days)

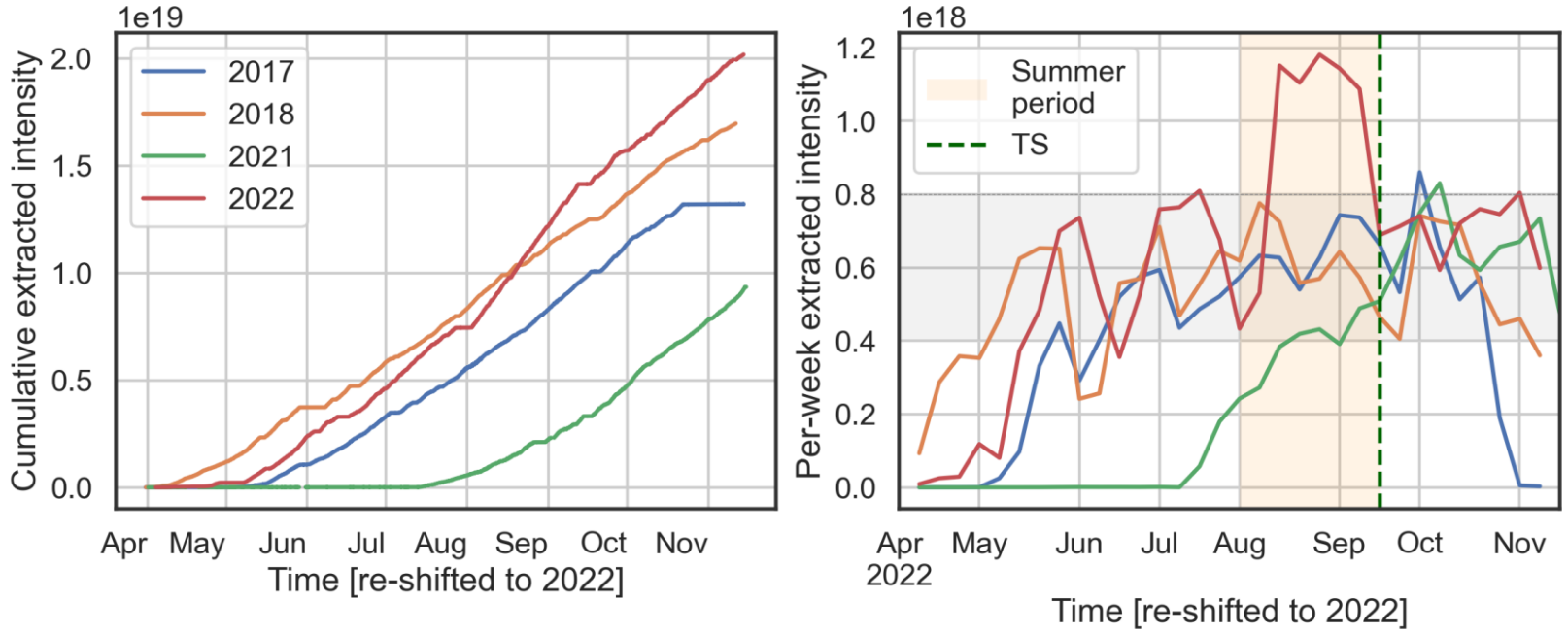
b) Electrostatic septum, ZS, failures – cables exchanged and feed-throughs cleaned (total: 7 days)

c) T2 TBIU replacement – vacuum failure in the upstream beam instrumentation box of the T2 target (6.5 days)



SPS NA physics delivery – intensities

2022 Summer period: high intensity requests from experiments, excellent machine performance and the LHC down → **Unprecedented extraction rate**!



- **Extracted intensities were reviewed**
- **Per-week extracted intensities still need limit to be established → 0.8e18 ppw looks like a reasonable number**
- **Cumulative extracted intensity for a typical year (29 weeks in 2022) not more than 23e18 p+**

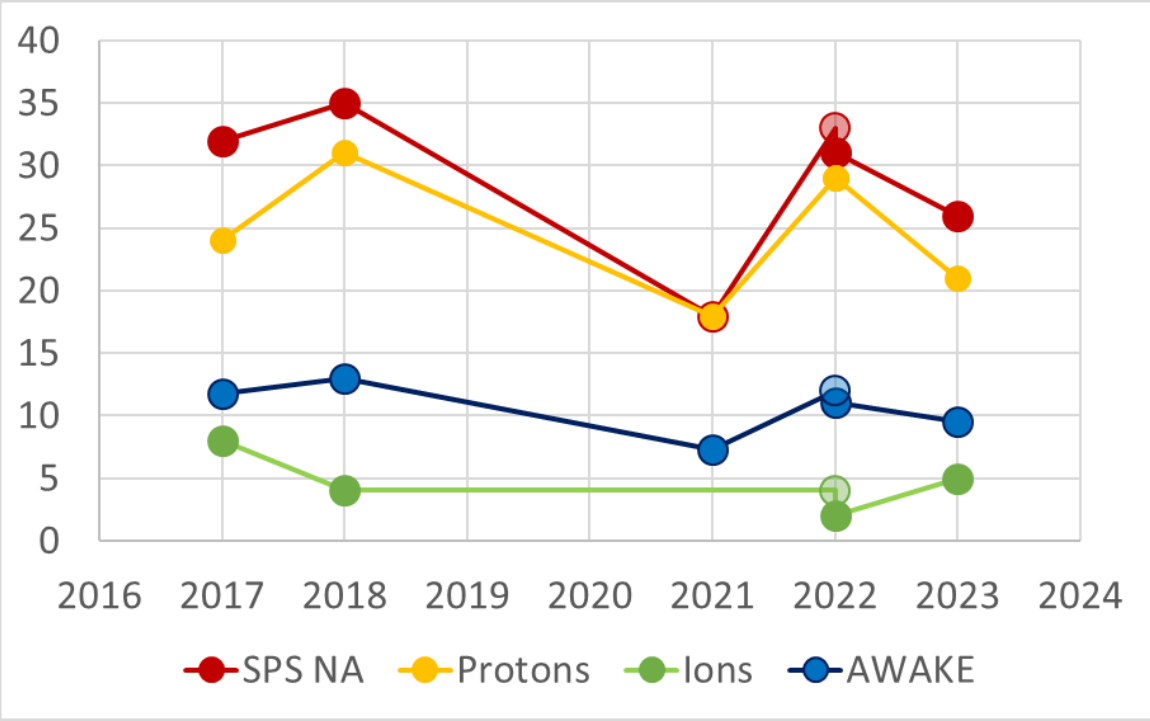
- Very **high intensities requested and reached** during most part of the summer!
- Struggling with stability – running **close to the machine limits** (beam stability, losses,…)
- Still, managed to obtain mostly stable, solid and reliable beam parameters throughout the summer… up to **beyond** the generally accepted limits!

→ **Unprecedented intensities and extraction rates** during summer period in 2022!

SPS North Area Long Term Statistics

- CERN Long Shutdown 3:
  2019, 2020, part of 2021

	SPS NA weeks	Proton weeks	Ion weeks	Ions %	AWAKE weeks	AWAKE %
2017	32	24	8	25	11.8	37
2018	35	31	4	11	13	37
2021	18	18			7.3	41
2022 original	33	29	4	12	12	36
2022 reduced	31	29	2	6	11	35
2023	26/27	21/22	4	15	9.5	37

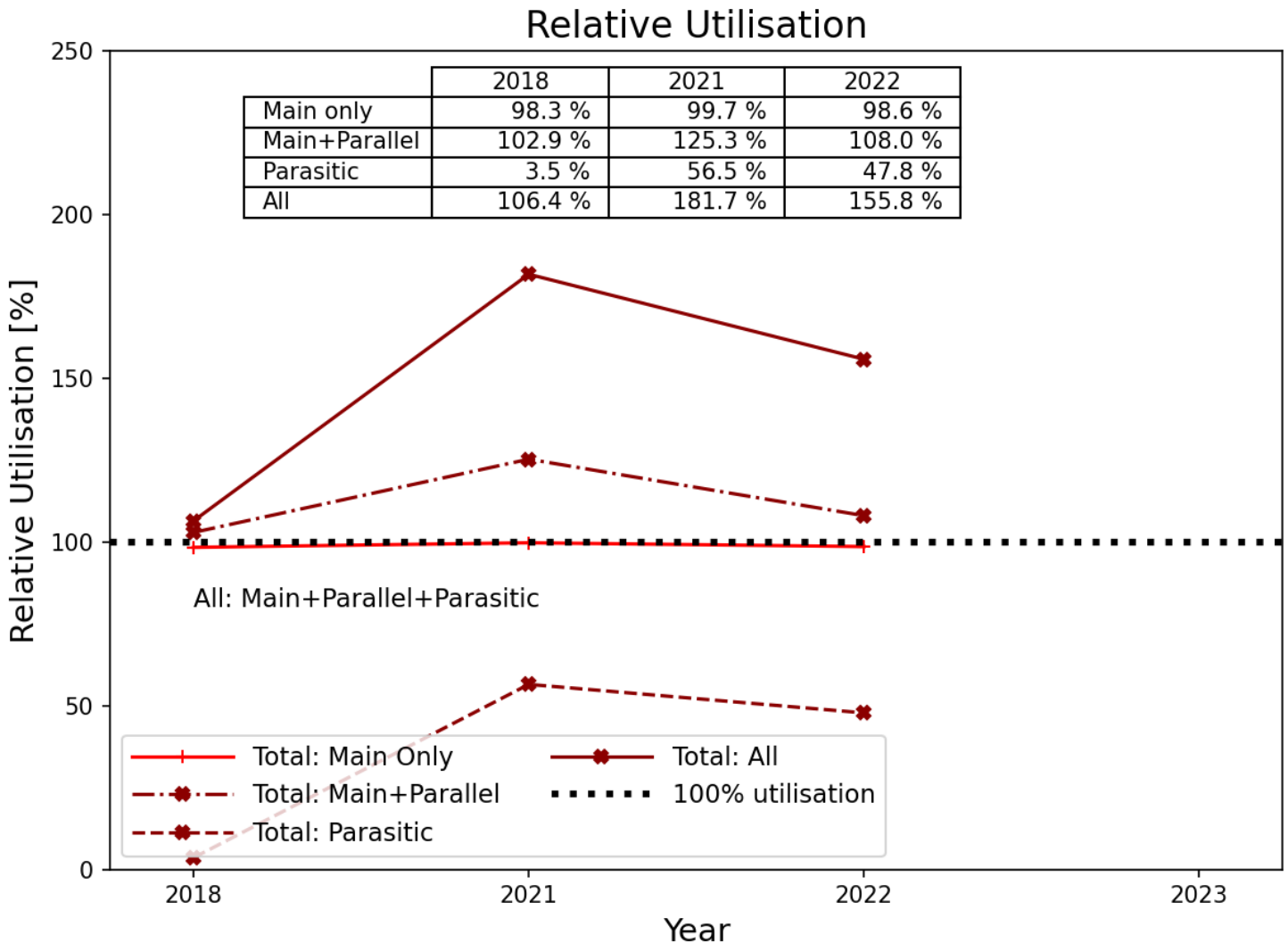


Weeks of SPS North Area Physics and AWAKE

SPS North Area Statistics

- Statistics for EHN1 (4 multi purpose beam lines) plus EHN2 and ECN3 (2 dedicated beam lines for experiments)

- Increasing number of parallel and parasitic running of test beams to cope with the increased number of beam requests and the reduced number of weeks of user beams



- 4 year project started September 2022
- Transnational Access to a range of facilities – emphasis on students and post-docs
- PS & SPS test beam users

  Financial support for coming to CERN for beam times in 2023 to 2025

  Development of a data-base driven software tool for User's request submission, scheduling, statistics, reporting

Participants

- 34 participating Laboratories
- Access to 43 Research Infrastructures (RIs)
- Spread in 12 countries across Europe

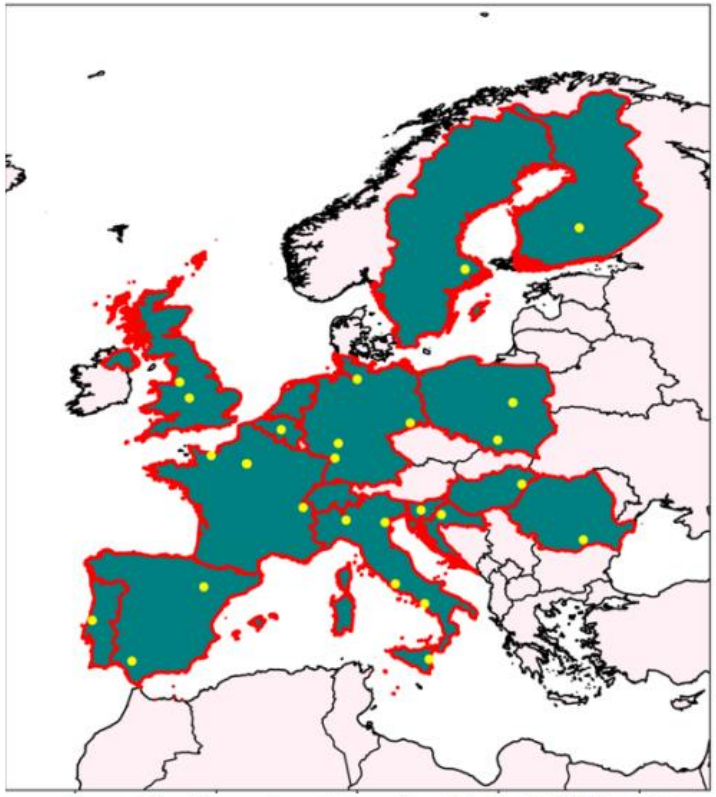


Figure 1 - Map of participating RIs in EURO-LABS

Participant short name	Participant name	Country	Country Code	Role	WP
INFN	**National Institute for Nuclear Physics**	**Italy**	**IT**	**Coordinator**	WP1, WP2, WP3, WP5
GANIL	GRAND ACCELERATEUR NATIONAL D'IONS LOURDS	France	FR	Partner	WP2, WP5
CERN	European Organization for Nuclear Research	Switzerland	CH	Partner	WP1, WP2, WP3, WP4
JSI	INSTITUT JOZEF STEFAN	Slovenia	SI	Partner	WP4
IFJ-PAN	THE HENRYK NIEWODNICZANSKI INSTITUTE OF NUCLEAR PHYSICS, P	Poland	PL	Partner	WP2, WP4
DESY	STIFTUNG DEUTSCHES ELEKTRONEN-SYNCHROTRON DESY	Germany	DE	Partner	WP4
UCLouvain	UNIVERSITE CATHOLIQUE DE LOUVAIN	Belgium	BE	Partner	WP4
RBI	RUDER BOSKOVIC INSTITUTE	Croatia	HR	Partner	WP4
CNRS	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	France	FR	Partner	WP2, WP3, WP5
FBK	FONDAZIONE BRUNO KESSLER	Italy	IT	Partner	WP2
ITAINNOVA	INSTITUTO TECNOLOGICO DE ARAGON	Spain	ES	Partner	WP4
UoB	THE UNIVERSITY OF BIRMINGHAM	UK	UK	Partner	WP4
UNIWARSAW	UNIWERSYTET WARSZAWSKI	Poland	PL	Partner	WP2
GSI	GSI HELMHOLTZZENTRUM FUR SCHWERIONENFORSCHUNG GMBH	Germany	DE	Partner	WP2, WP5
IFIN	INSTITUTUL NATIONAL DE CERCETARE-DEZVOLTARE PENTRU FIZICA	Romania	RO	Partner	WP2, WP5
USE	UNIVERSIDAD DE SEVILLA	Spain	ES	Partner	WP2
IST	INSTITUTO SUPERIOR TECNICO	Portugal	PT	Partner	WP2
ATOMKI	ATOMMAGKUTATO INTEZET	Hungary	HU	Partner	WP2
JYU	JYVASKYLAN YLIOPISTO	Finland	FI	Partner	WP2
UU	UPPSALA UNIVERSITET	Sweden	SE	Partner	WP3
CEA	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERN	France	FR	Partner	WP2, WP3, WP5
KIT	KARLSRUHER INSTITUT FUER TECHNOLOGIE	Germany	DE	Partner	WP3
UKRI	UNITED KINGDOM RESEARCH AND INNOVATION	UK	UK	Partner	WP3
UMCG	ACADEMISCH ZIEKENHUIS GRONINGEN	Netherlands	NL	Partner	WP2
FEP	Fraunhofer Institute for Organic Electronics, Electron Beam and Plasm	Germany	DE	Partner	
INCT	INSTYTUT CHEMII I TECHNIKI JADROWEJ	Poland	PL	Partner	WP3
CSIC	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENT	Spain	ES	Partner	WP5
PSI	*PAUL SCHERRER INSTITUT*	*Switzerland*	*CH*	*Associated*	WP4
JINR	*JOINT INSTITUTE FOR NUCLEAR RESEARCH*	*Russian Federation*	*RU*	*Associated*	
RIKEN	*RIKEN THE INSTITUTE OF PHYSICAL ANDCHEMICAL RESEARCH*	*Japan*	*JP*	*Associated*	
MSU	*MICHIGAN STATE UNIVERSITY*	*USA*	*US*	*Associated*	
TUD	*TECHNISCHE UNIVERSITAET DRESDEN*	*Germany*	*DE*	*Associated*	
UMIL	UNIVERSITA DEGLI STUDI DI MILANO	Italy	IT	Partner	WP2
LIP	*LABORATORIO DE INSTRUMENTACAO E FISICA EXPERIMENTAL DE F*	*Portugal*	*PT*	*Associated*	

CERN User Facilities participating to EURO-LABS

- **PS and SPS test beams**

  The CERN Proton Synchrotron (PS) and Super Proton Synchrotron (SPS) provide highly configurable test beams in the energy range from 1 GeV to 400 GeV. A total of six general purpose test beam lines and their large, well-equipped experimental areas are available for Transnational Access.

- **IRRAD**

  IRRAD is located in the EAST AREA of the CERN PS and allows for the irradiation of materials and devices with protons of 24 GeV/c. Objects up to 10 cm2 can be exposed to up to 10^{15} p/cm2 and smaller objects, for which a beam spot of 5 mm2 FWHM is sufficient, up to 10^{17} p/cm2.

- **GIF++**

  GIF++ is located in the H4 beam line of the CERN SPS North Area. It combines a high energy charged particle beam (mainly muons with up to 100 GeV/c) with a 14 TBq 137Cesium source. The main application is to perform test beam experiments of gas detectors in an intense gamma background field.

- **CLEAR**

  CLEAR is a versatile accelerator installation, including a 200 MeV electron linac followed by an experimental beamline and operated at CERN as a multi-purpose user facility, providing high quality e- beams with high availability and easy access to a broad user community.

- **HiRadMat**

  HiRadMat is a unique test irradiation facility, providing fastly extracted, high brightness, LHC-type beams for allowing validation and R&D on novel materials, target concepts, detectors or accelerator components. It is serving the international community for more than 10 years.

- **ISOLDE**

  Radioactive beam facility where >1200 different isotopes of >74 elements are produced with 1.4-GeV protons on thick targets. Beams are available at low energy or reaccelerated and used in a variety of setups for nuclear physics, fundamental interactions, condensed matter and biochemical research.

- **nTOF**

  Spallation neutron source for time-of-flight experiments. Experimental setups for neutron induced reactions measurements. Activities in the fields of nuclear astrophysics, advanced nuclear technologies and basic nuclear science.

- **XBOX**

  The XBOX at CERN refers to state-of-the art klystron-based X-band (11.994 GHz) test stands dedicated to the development of high-gradient accelerating structures, in the range of 100 MV/m, and very high peak power, above 100 MW, RF devices.

Focus Point: WP 4.1 Development Of A User Schedule Management Tool

Until 2022:

- User requests, schedules, requirements, etc. managed by a set of disconnected scripts, emails, spreadsheets, & ad-hoc solutions

Goals:

- **Data-base driven software solution**
- Adapt data model to the diverse user groups
- Separation of data, processes, and visualization
- Improve management of user requirements and constraints (schedules of different beam lines are highly interlinked)

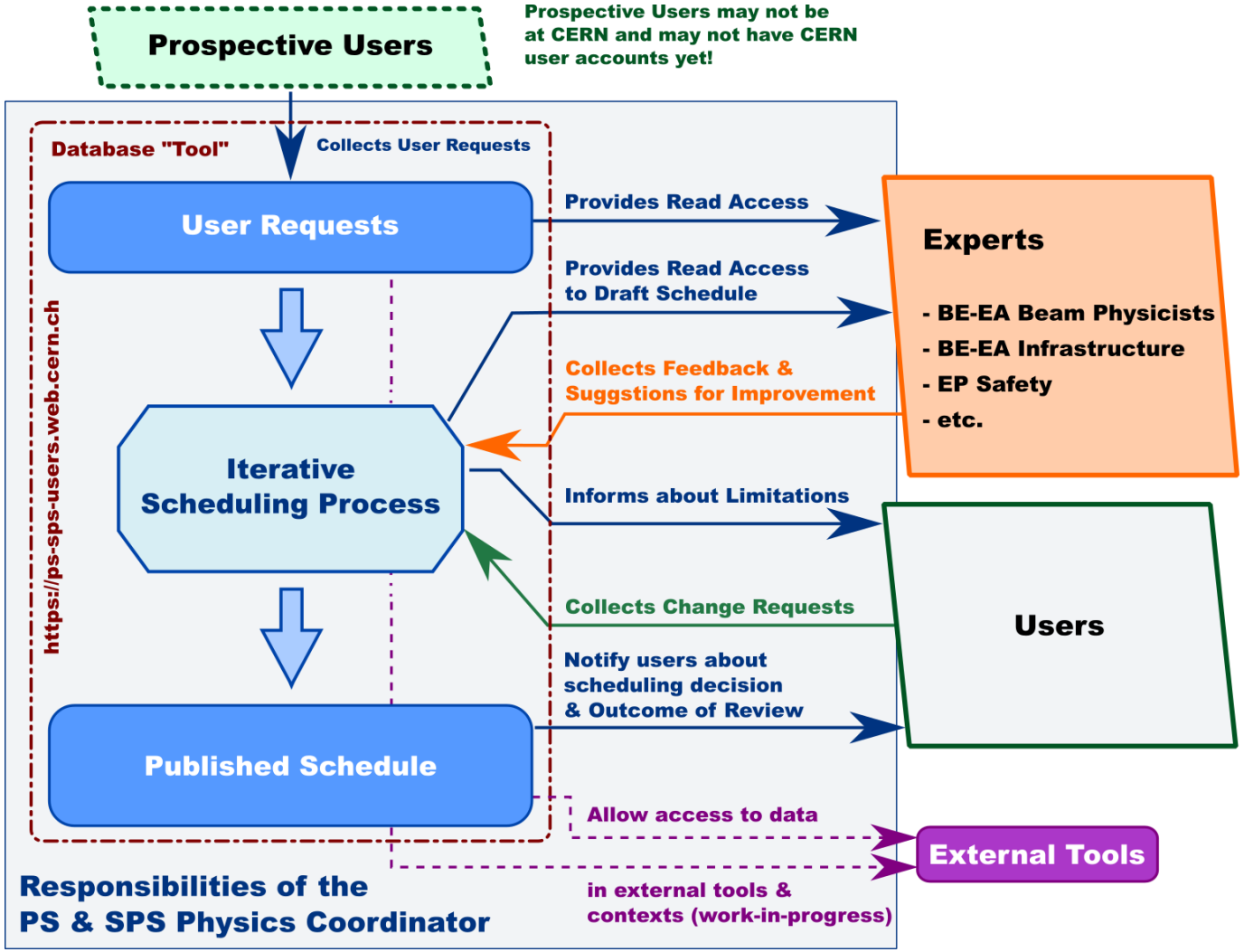
Goals cont.:

- Improve management of roles and successions within user teams
  → targeted communication
- Quicker turn-around for user and change management
- Automatizing repetitive tasks
- Include reviews and comments into the data model for increased transparency, traceability and accountability

Status: first iteration (v0.8.14) in productive use, development in parallel.

Milestone Release: (v1.0) planned for Aug. 2023

First Use Case: Call For Beam Requests & Scheduling in 2023

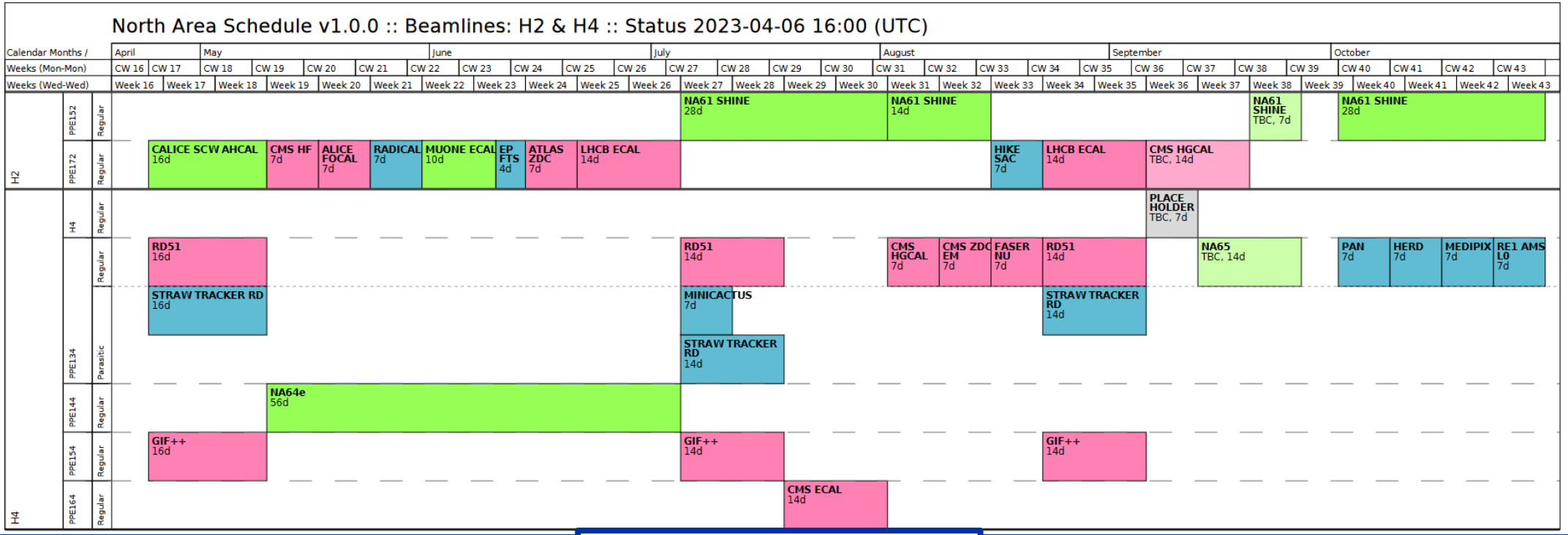


- Dec. 7th 2022 to Jan. 4th 2023
- **96 beam requests** for **183 runs** (main/parallel, parasitic, no beam) 2022: **97 beam requests** => different system, not directly comparable
- Approx **300 users** registered at the system (CERN SSO)
- Resulting in **184 scheduled runs** (no 1:1 correspondence to requested runs: some runs split, some could not be scheduled, additional parasitic and parallel runs added since end of beam request call)
- ➔ Important lessons learned about necessary improvements of data model, user logic and UI / UX elements
- ➔ First successes in improving workflows and data management

Improvements For Users Already Present & Under Development

- Beam requests are stateful => can be edited & reviewed over longer period of time
- Users can export beam requests as PDF (early version)
- Schedules, GANTT diagrams, spreadsheets, etc. are generated dynamically & automatically => fast updates!
- Users can delegate rights on beam requests (coming: also on activities, scheduled runs, hardware setups)
- Generation of meeting agendas, reports, etc. from data (under development)

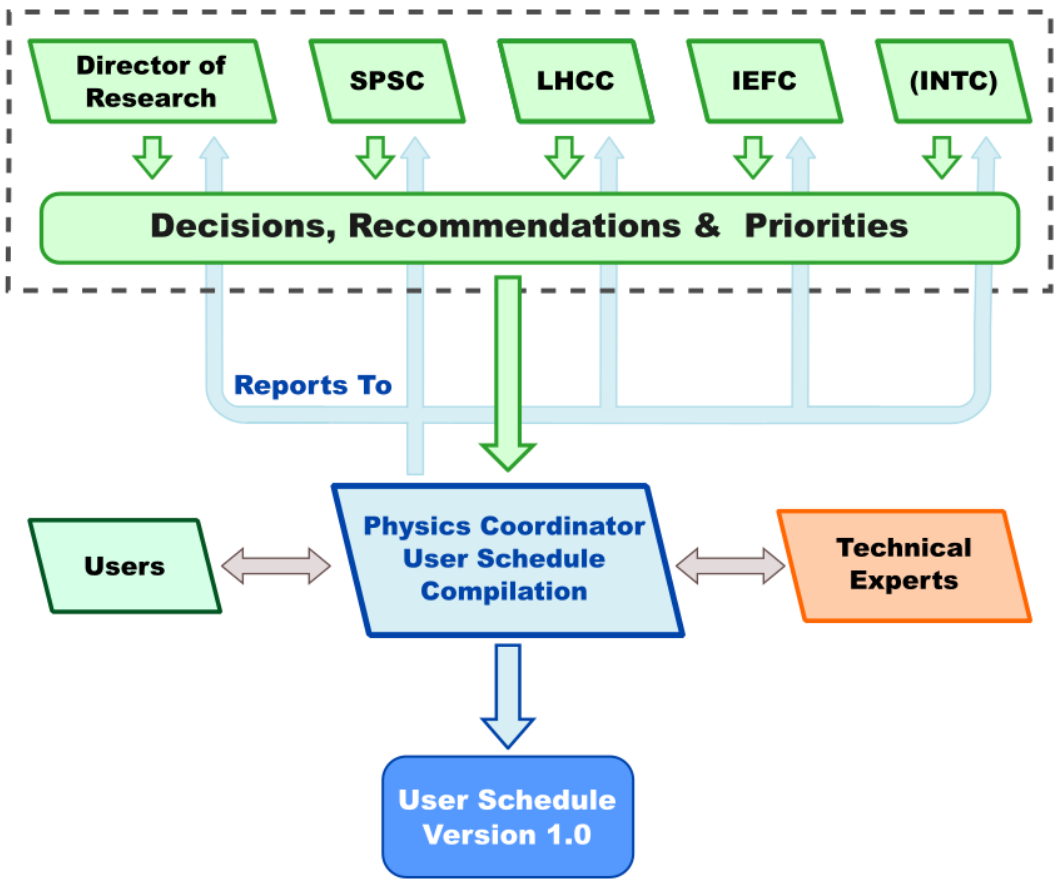
- Scheduling history for each run (coming soon: timeline)
- Comments, reviews & conclusions stored together with the schedule information
- Targeted communication to specific groups of user
- Accessible to users with self-registered accounts (to be released soon)
- …..

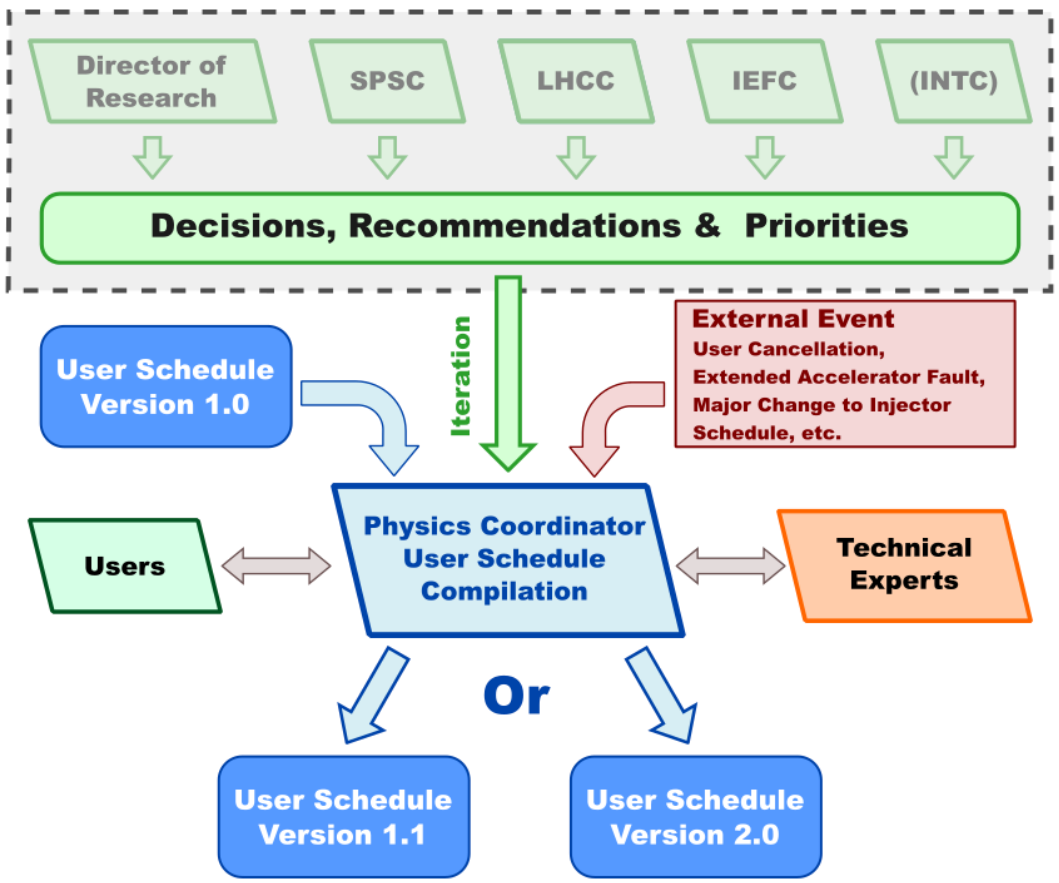


Outlook for 2023: Iterative Change & Request Management

- Currently: Nearing publication of the v1.0 schedule for all beamlines / accelerators
- New tool already allows for more flexible approach (PS: already at v1.1 while H6 & H8 at pre-release)

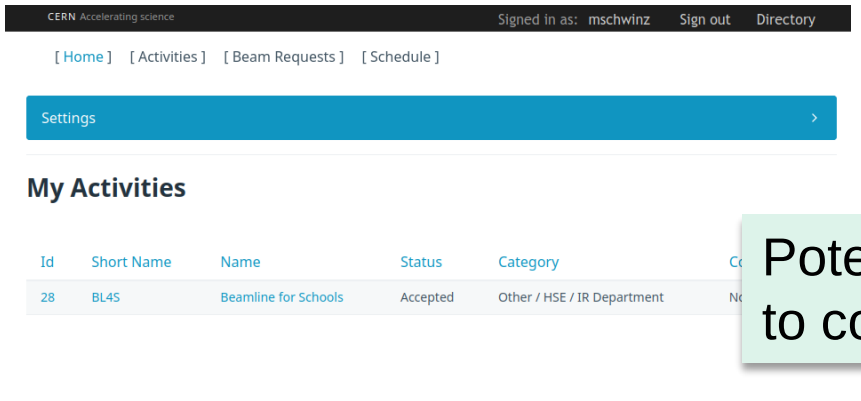
- **Goal for v1.0 release (EURO-LABS wp4 MS 08/2023)**
  - Handle full iterative workflow via tool
  - Seamless tracking of changes to the schedule (including parasitic beam-time & cancellations)
  - Allow generation of reports & statistics on-the-fly

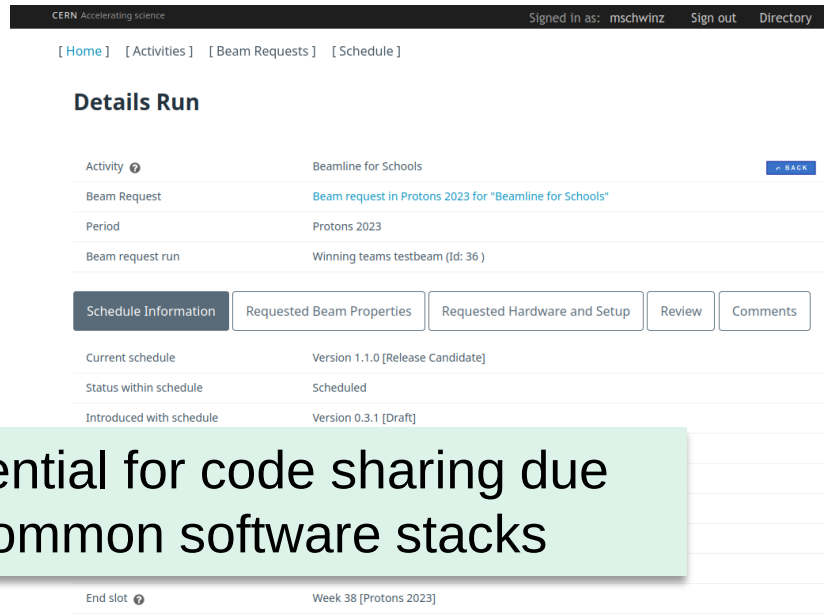




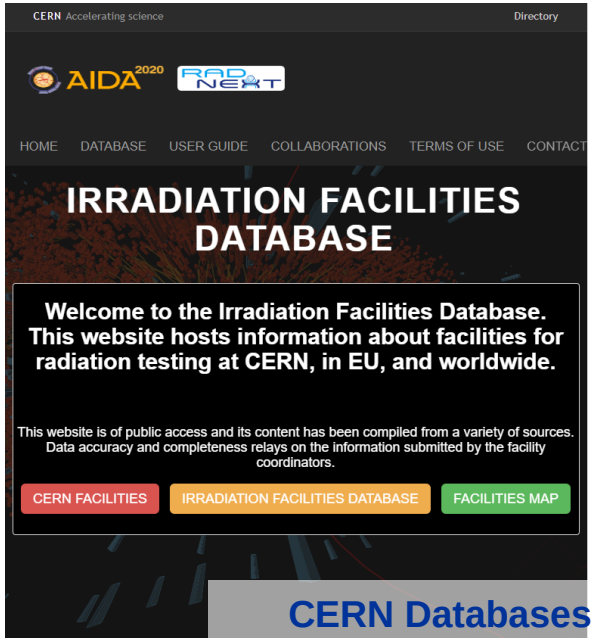
Wider Software Ecosystem at the CERN EP

Beam Request and User Management Tool for PS & SPS Test Beam Users



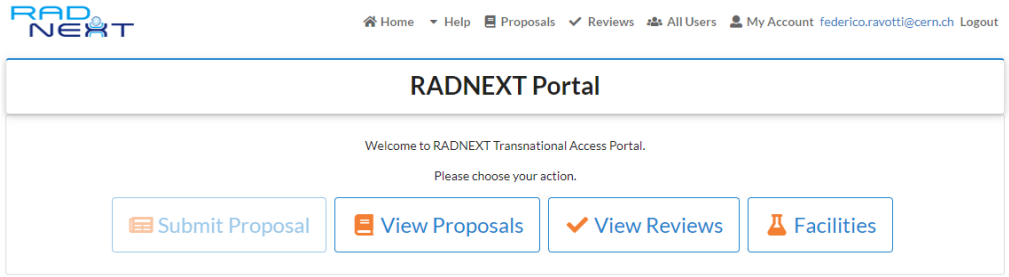


Potential for code sharing due to common software stacks

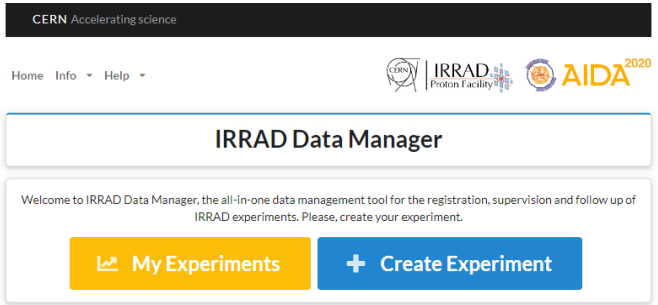


CERN Databases of Worldwide Irradiation and Test-Beam Facilities and Infrastructures

RADNEXT TA Portal: Management of TA Proposals for RADNEXT Project



IRRAD Data Manager (IDM): Management of Proton Irradiation Experiments at CERN

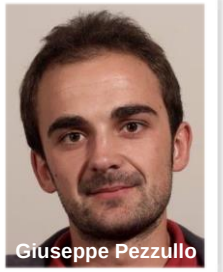


GIF++ and IRRAD

Current EP-DT GIF^{++} Team

- GIF^{++} Physics Coordinator
  (Deputy to SPS Physics Coordinator for the GIF^{++})
- Overall facility responsibility
- Future development of the GIF^{++} facility

- EP-DT Facilities Team Responsible, IRRAD Facility Coordinator
- Irradiation Facilities EXSO

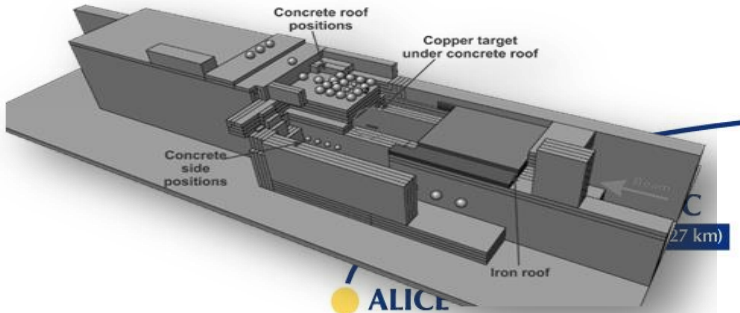


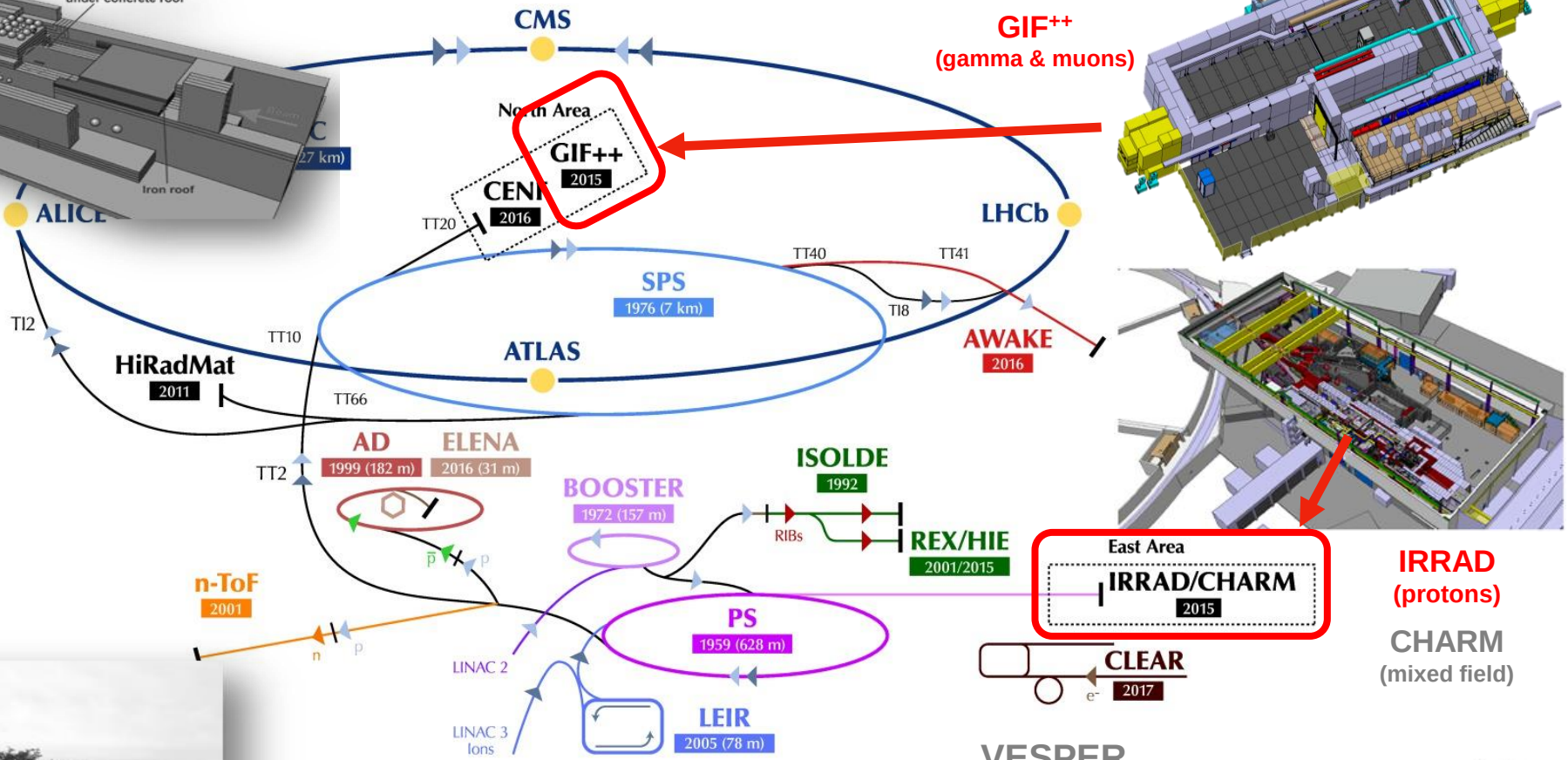
- GIF^{++} & IRRAD: users supervisor, contact to EN services
- General user support
- Gas system first level support,
- Deputy EXSO

- Tasks leader AIDAinnova & RADNEXT EU-projects
- Facilities Computing (Controls, DAQ, Data Management) M&O / R&D

CERN Irradiation Facilities

CERF
(mixed field)





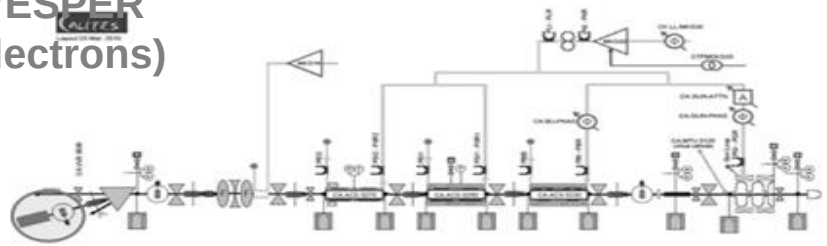
GIF^{++}
(gamma & muons)

IRRAD
(protons)

CHARM
(mixed field)

CALLAB
(irradiation sources)

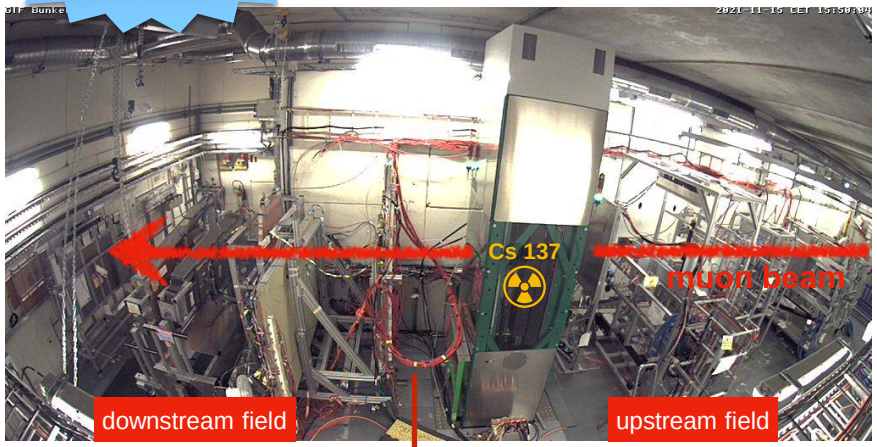
VESPER
(electrons)

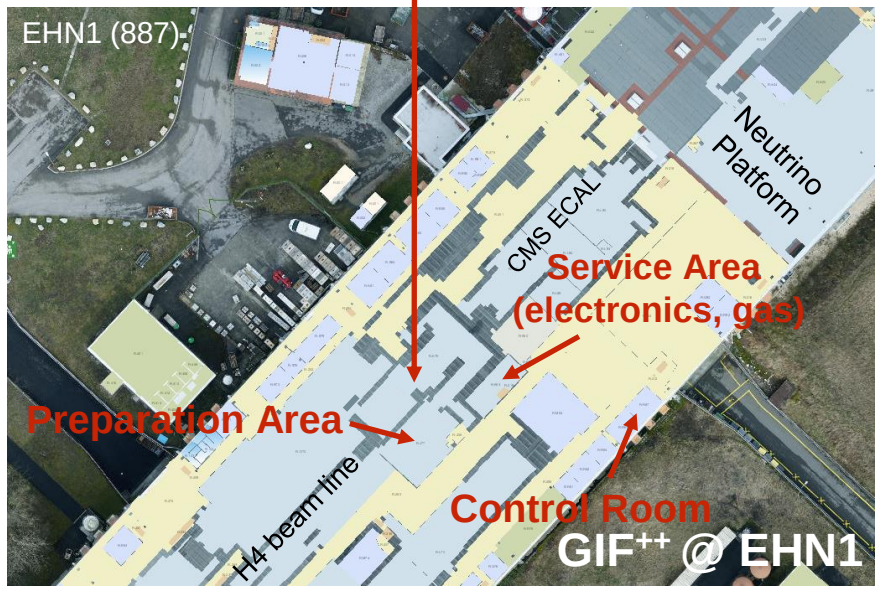


GIF++ @ EHN1

Irradiator operation throughout the whole year

Irradiation Bunker





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

- Joint facility (EP & BE) operated by EP-DT-DD
- Unique place, combining a high energy muon beam with a 14 TBq* ^{137}Cs gamma source
- Designed for testing real size muon gas detectors, of up to several m^2, as well as a broad range of smaller prototype detectors and electronic / optical components
- 160 m^2 irradiation bunker with 2 independent irradiation zones (30 m^2 & 75 m^2), separated attenuation systems
- All year operation from Cs-Irradiator
- Muon beam (H4) for 7-9 weeks per year (on average)
- Central Control System, recording all relevant parameters and provides interlocks
- Wide range of available gases (+ custom gases) in irradiation bunker & preparation zone
- around 15-20 different large setups scheduled during the year (up to 14 participating in muon beam time in parallel)

*) as of 2014

Successful 2022 with extended muon beam operation :

- **Irradiator operation from 14.Jan. to 16. Dec. = 48 weeks of operation !**
  (stop only during CERN Christmas closure and essential maintenance)
- **9 weeks of dedicated muon beam, up from 7 weeks requested**
  (Will be less in 2023 due to shortened beam operation)
  Providing essential muon beam time for critical projects like ECOGAS beyond requests

Set-ups participating

Setup / Week
ATL NSW MM
ATL NSW sTGC
ATL RPC
ATL sMDT
CMS CSC – 1
CMS CSC – 2
CMS CSC – 3
CMS DT
CMS GEM
CMS RPC – 1
CMS RPC - 3
iRPC (inside RPC3)
EP DT2
RPC ECOGAS
ProTov-RPC
RE21/CBM

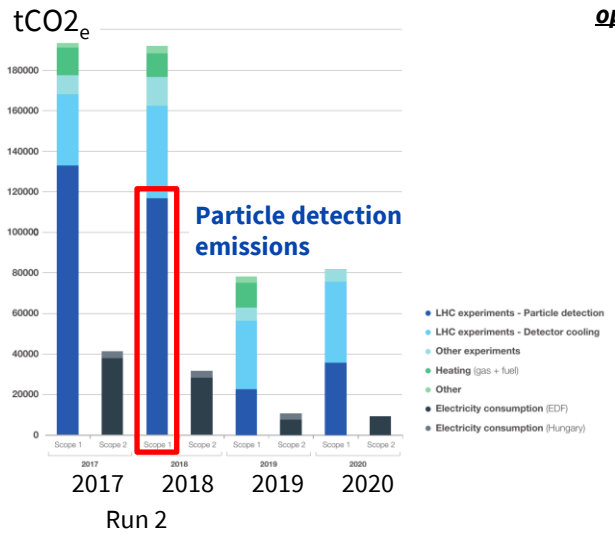
- 2 dedicated weeks for GIF^{++}
- 5 shared weeks with RD51
- 1 parasitic week
- +2 extra weeks due to cancelation of other H4 users

- Up to 15 set-ups scheduled
- **Up to 11 set-up hosted** in parallel during beam weeks

ECOgas

ECOgas - search for environmentally friendly gas mixture with lower Global Warming Potential (GWP) than standard RPC mixture

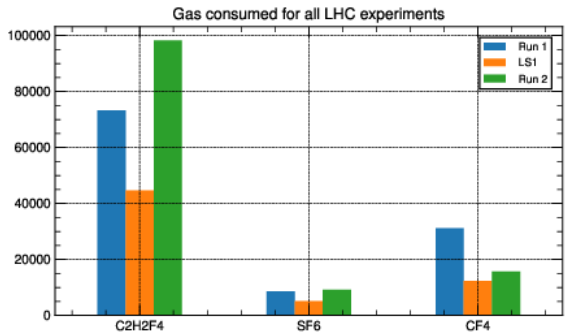
https://hse.cern/environment-report-2019-2020



CERN emissions during 1 year of Run 2 ~ **220 000 tCO2e**

Half of them from particle detectors → mostly due to leaks and operation

- **C2H2F4/R-134a biggest contributor → leaks from RPC detector during operation**
- **CF4 → due to operation of CSC and RICH systems**
- **SF6 → Related to RPCs as R-134a**



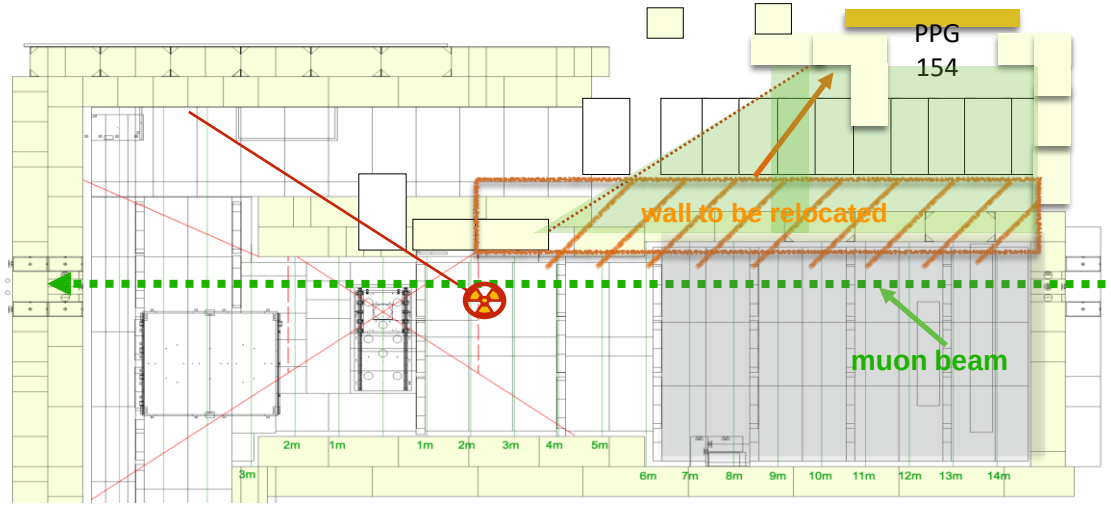
- Test of alternative gas mixtures with reduced GWP (Global Warming Potential)
- Gas recirculation, better flow and pressure regulations
- Monitoring, detection of abnormalities
- Offline analysis, deeper understanding of dynamics
- Some potential candidate mixtures - not a trivial search !

Studies to reduce greenhouse gas emissions from detectors at the LHC / Gianluca Rigoletti (EP-DT-FS)

EP-DT Seminar : https://indico.cern.ch/event/1155238/

Upcoming challenges (LS3 and beyond) : Proposed GIF^{++} Phase II Upgrade Bunker Extension LS3

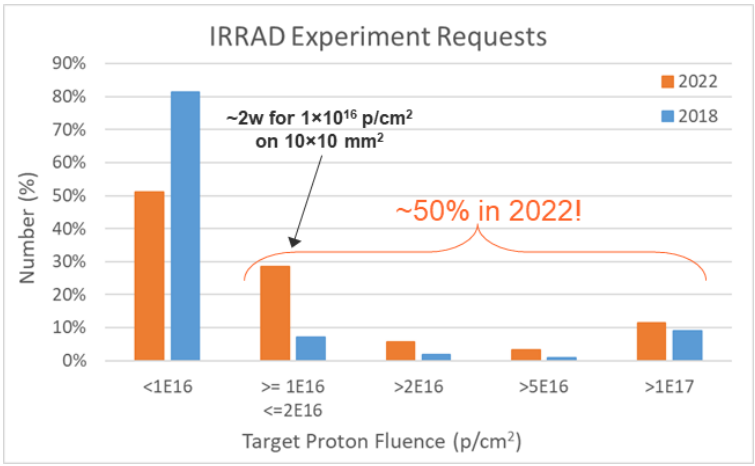
- **While already considered in the 2019 bunker extension, the Saleve wall modifications could not be done in LS2 due to severe manpower shortage, especially with EN-EL**
  - Main electrical cupboard of GIF^{++} would need to be relocated
  - Gas distribution panels need to be relocated….
- **After the strong EP endorsement to operated the facility beyond LS3, we now restart the planning of the Phase II upgrade**
  - Bunker redesign with increased space to allow better distributions of detectors
  - Possibility to place the full width of a detector inside the muon beam

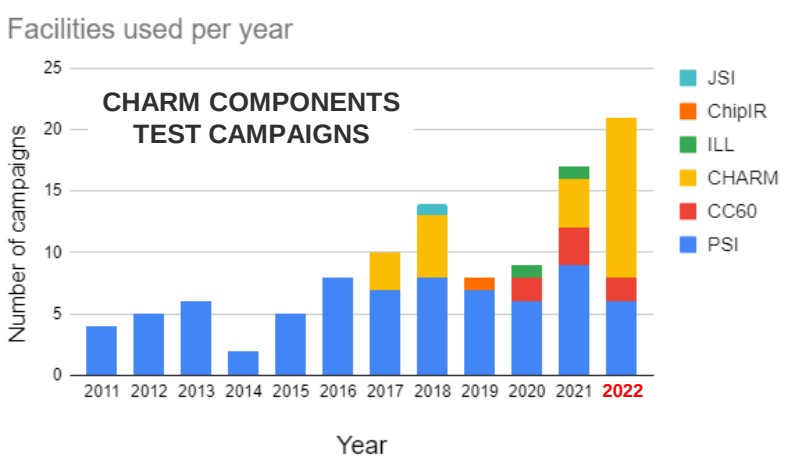


- **Current financial situation (e.g. energy prices, inflation..) makes this proposal more difficult**
- **Requires a strong support from the user side**
- **Significant improvement for “moderate” spending**

Statistics 2022

- **IRRAD:**
  - **54 experiments registered**
  - **>600 samples processed**:
    - **LHC Experiments:** ATLAS, CMS, LHCb Phase II upgrade
    - **R&D & expt. support:** EPRD, RD53, RD50, EP-ESE / DT
    - **CERN ATS Projects:** TE-MSC, EN-EL, R2E
    - **EU- projects & external:** AIDAinnova, CNES (FR)
  - **~50% requests exceeding 10^{16} p/cm^2**
    - cold (-25°C), cryogenic & **large areas** often required
    - **irradiations to 10^{17} p/cm^2 level require ~1 year!**
- **CHARM:**
  - **29 users scheduled**
  - **39 system-level & 13 component tests**:
    - **ATS:** SY-BI / EPC / STI, TE-MPE / VSC, BE-CEM
    - **RCS:** EP-DT, CMS, ATLAS, Caen, Wiener
    - **EU-projects:** RADNEXT (3 users)
  - **increasing number of requests**

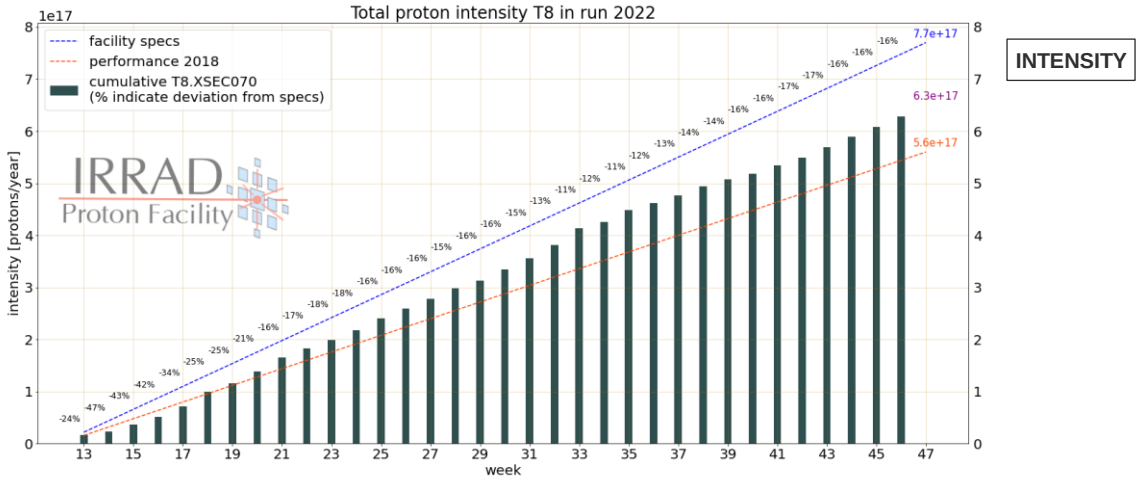




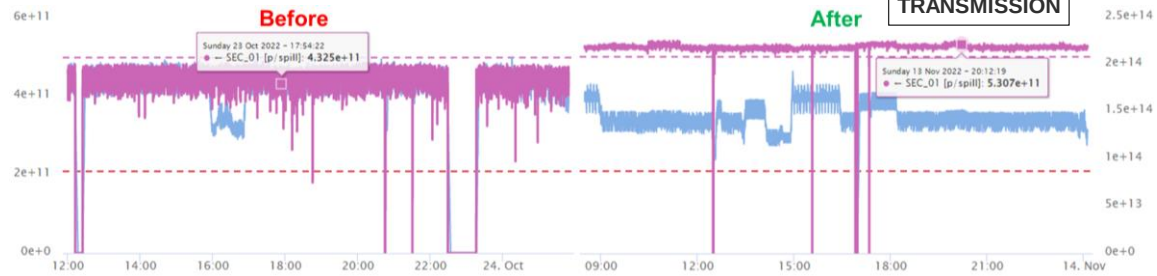
Feedback T08 beam

- **Reporting of Intensity KPI since summer 2022:**
  - **2.2×10^{16} p/w** (facility specification & 2021 beam sharing)
- **Cumulated Intensity on T08 in 2022:**
  - **~1.8×10^{16} p/w** vs. **1.6×10^{16} p/w** (performance 2018)
  - beam **sharing target achieved during ~55% of the weeks** (target 1 EAST_T8 each ~ 10 BP)
- **Beam Transmission:**
  - dedicated Al-foil / BCT calibration of XSEC070 (EDMS 2783968) confirm the **~20% transmission loss** during slow-extraction
  - intensity **variations ~>1×10^{11} p/spill** sometime observed
- **Beam Profile & Alignment**
  - preliminary analysis on BPM2 (center within ± 2mm):
    - **improved beam trajectory** (both axes), but **larger variations**
    - **slow "drift" of the beam center** (x-axis only) along the weeks
  - tail on the horizontal profile (BPM1)
    - **scattering of lower energy particles** when reducing extraction losses ?

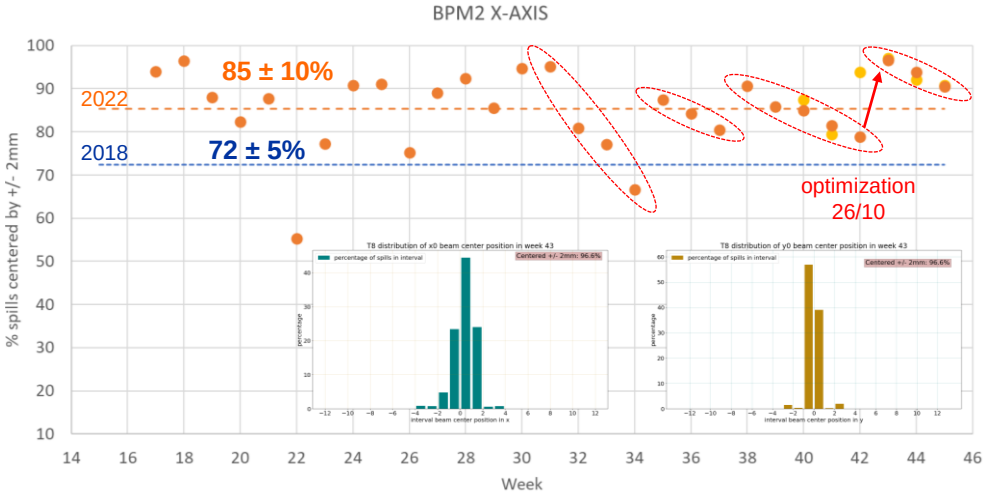
INTENSITY



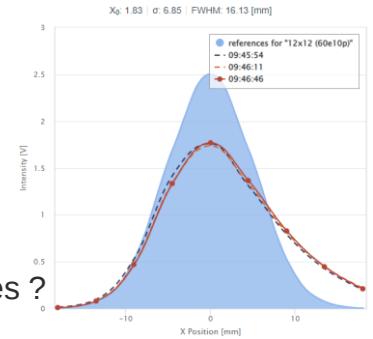
TRANSMISSION



ALIGNEMENT



PROFILE



SUMMARY

Summary

- CERN “Injector Complex” provides
  - On top of a world class and diverse physics program
  - Approximately 30 weeks per year of highly diverse beams for
    - Test beam users
    - Irradiation facilities offering a vide variety of radiation fields
  - User groups from around the world
    - Not necessarily linked to CERN scientific program
    - Possibilities to support users financially
    - From space experiments and radiation testing for ESA to high school student experiments to calibration of dosimeters for CERN and outside users.

Resources for the Users

- Find the test beam or the radiation facility for your application (worldwide):
  - https://test-beam-facilities.web.cern.ch/
  - http://irradiation-facilities.web.cern.ch/
- CERN Experimental Area Physicists can help you to find the most appropriate beamline for your requirements and identify possibilities for non-standard beams: sba-physicists@cern.ch
- Main PS and SPS user page: https://ps-sps-coordination.web.cern.ch/ps-sps-coordination/
- PS and SPS Physics Coordinator: sps.coordinator@cern.ch
- Request for beam time in most years to be submitted Q4 for the following year:
  - For the EP irradiation facilities, beam time requests are collected by the facility coordinators.
  - For the LHC experiments, beam time requests are collected by the experiments' test-beam coordinators.
  - Any other requests are submitted directly to the PS / SPS Physics Coordinator

Come and talk to me about any feed-back, wishes, concerns etc. you might have!

Martin Schwinzerl, responsible for technical implementation of the User Schedule Management Tool and technical user support is present as well!

SPARE SLIDES