

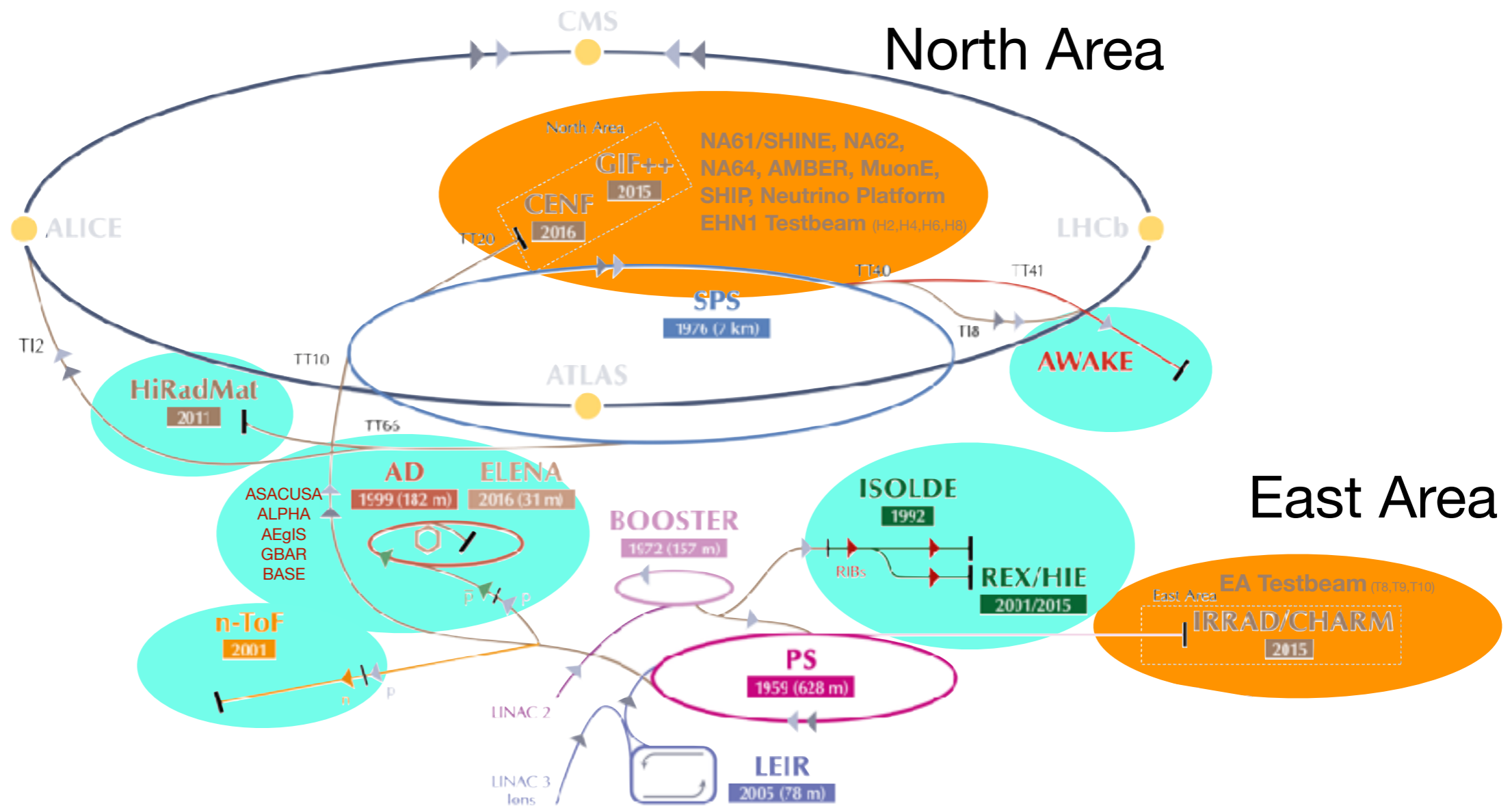


Introduction and Test Beam Availability

DRD6 Collaboration Meeting 2024

Martin R. Jäkel
Deputy PS / SPS Physics Coordinator
CERN

CERN beside the LHC flagship

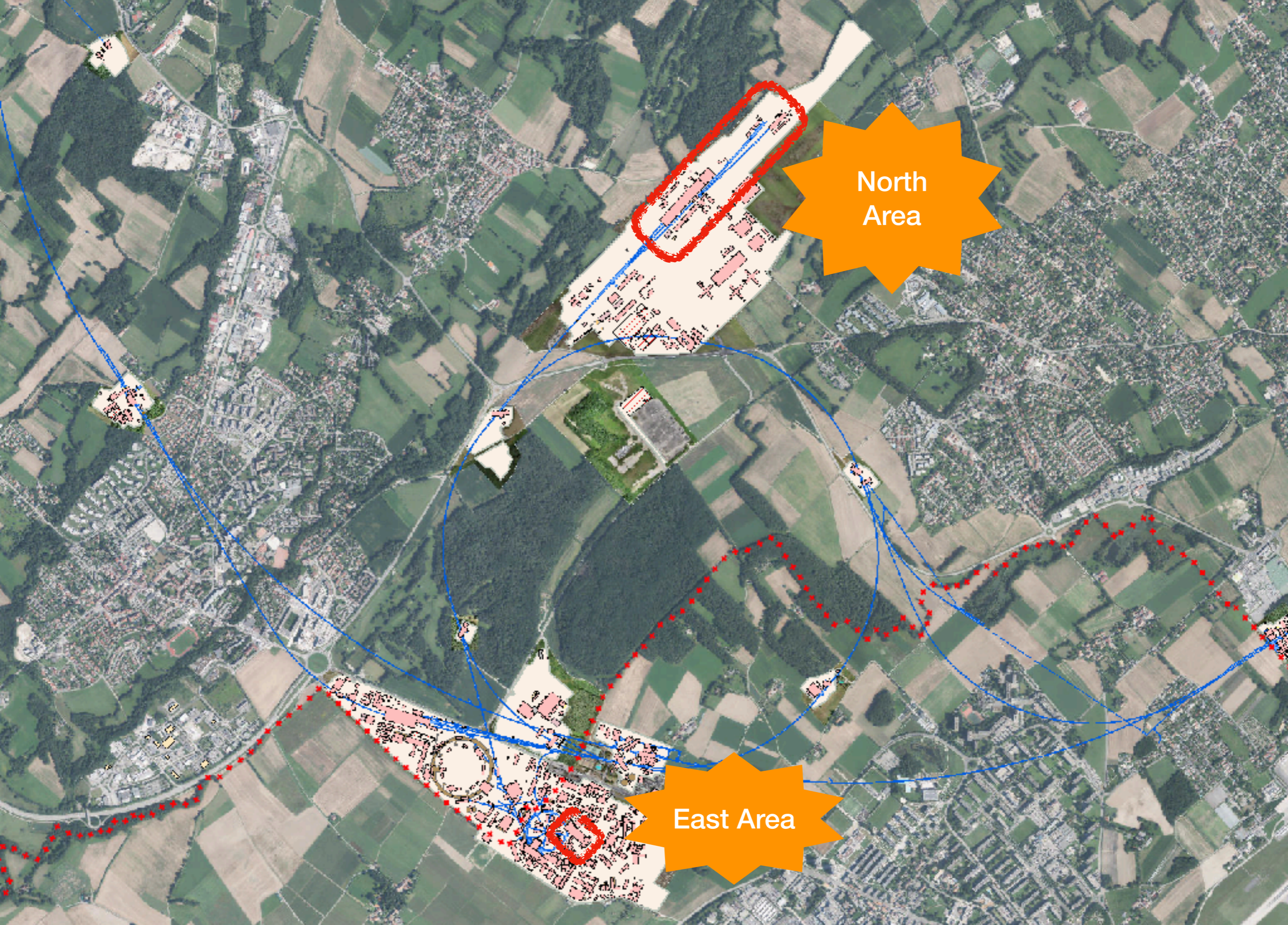


- ASACUSA
- ALPHA
- AEgIS
- GBAR
- BASE
- ELENA
- NA61/SHINE,
- NA62
- NA64
- AMBER
- MuonE
- SHIP
- Neutrino Platform
- n-ToF
- ISOLDE REX/HIE
- AWAKE
- HiRadMat
- GIF++
- IRRAD
- CHARM
- CHIMERA/HEARTS
- CLOUD
- UA9

EHN1 North Area Testbeam (H2,H4,H6,H8)
East Area Testbeam (T8,T9,T10)

VERY impressive range of research !

... and even more non-accelerator based experiments !



North Area

East Area



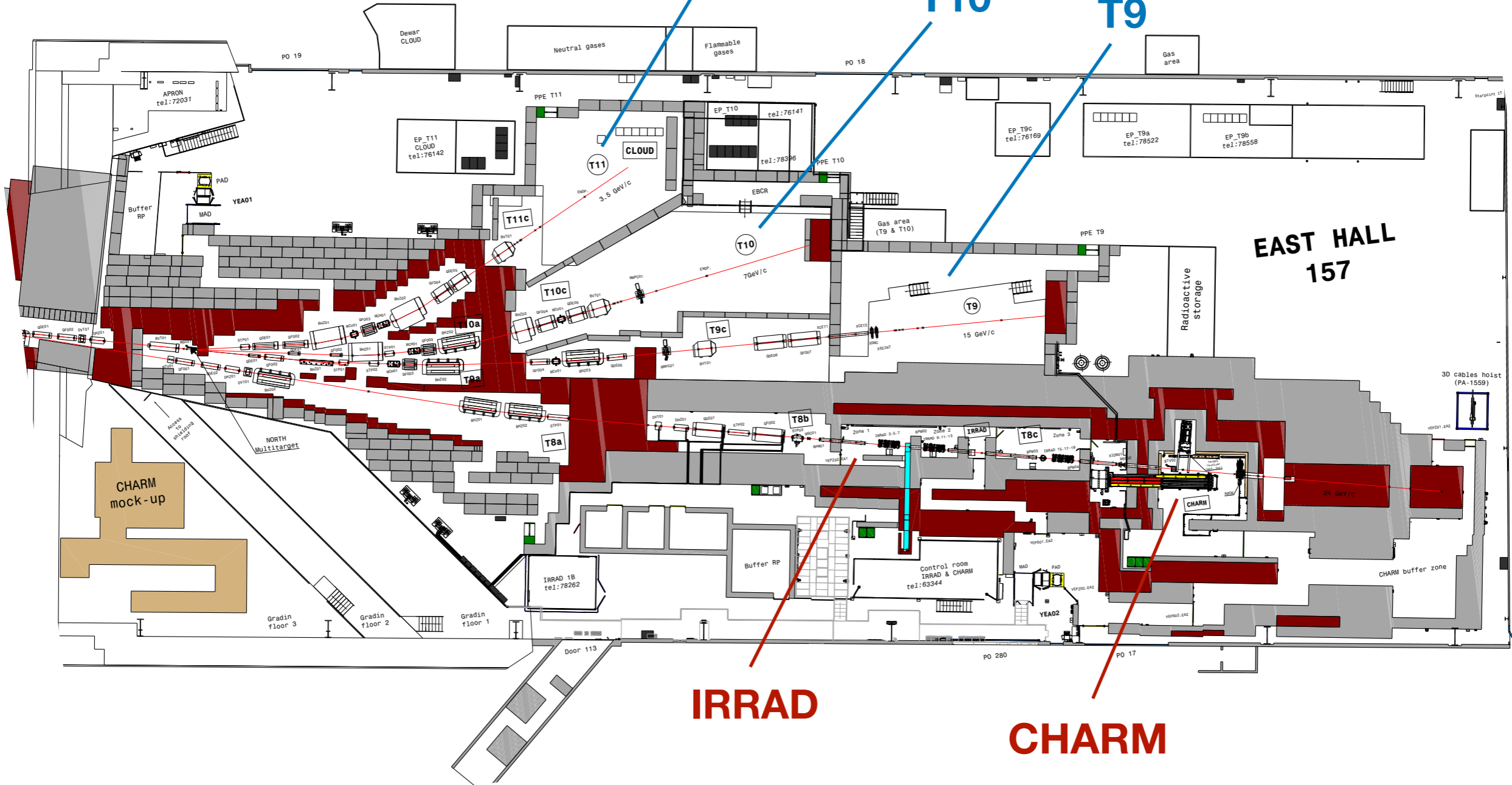
East Area

T11/CLOUD

NORTH

T10

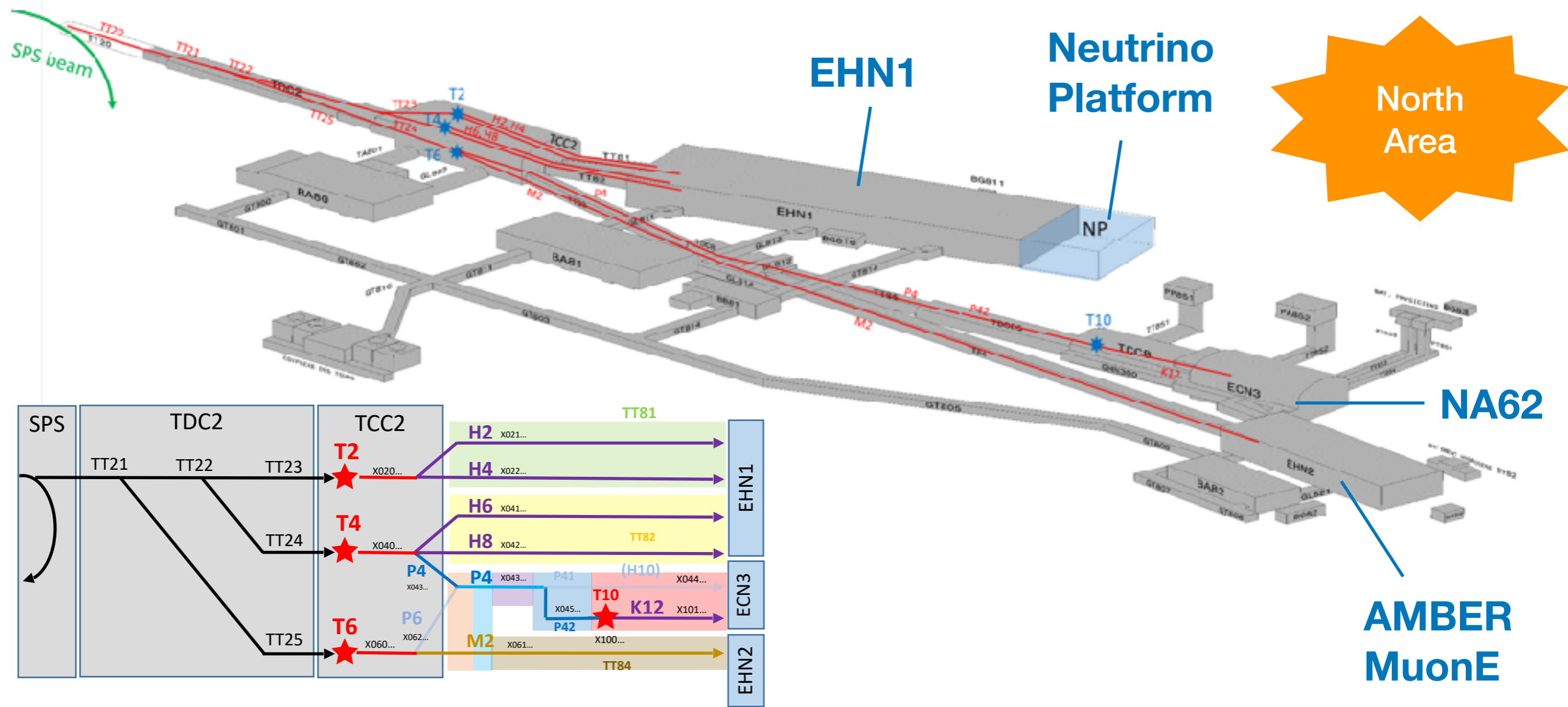
T9



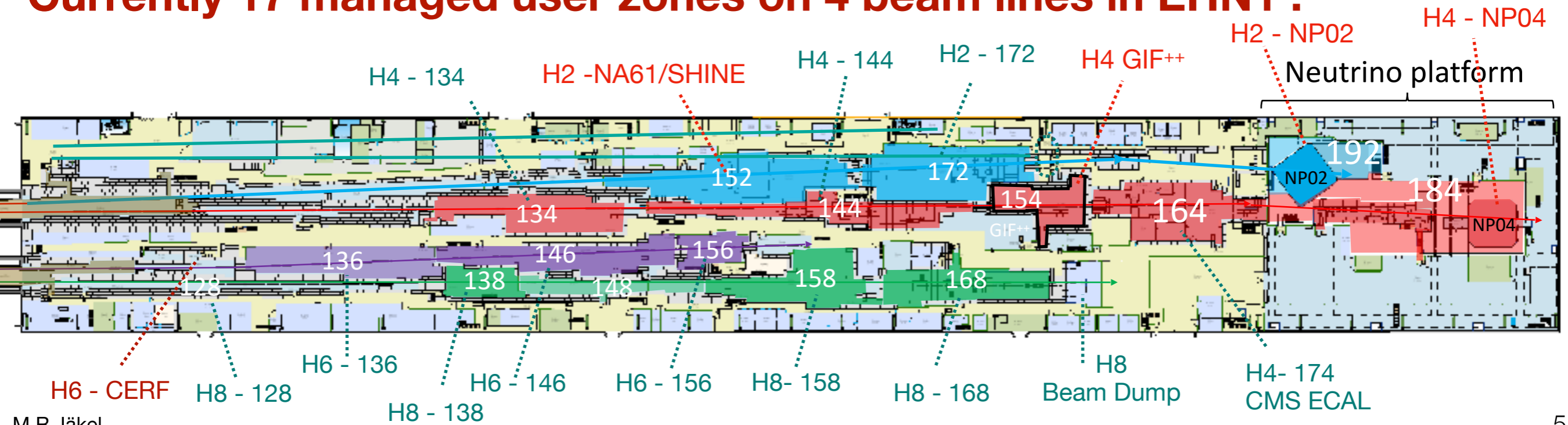
EAST HALL 157

IRRAD

CHARM



Currently 17 managed user zones on 4 beam lines in EHN1 :



CMS HF Wall	EP Fast Timing Scintillators	ATLAS MICROME GAS	ATLAS AFP ToF	Medipix/Timepix beam test
CBM TRD 2024	FASERnu Test Beam for LHC	NP04	ATLAS TRT	International Linear Collider (Dumps)
ATLAS Tile Calorimeter	ALICE3 RICH	EIC ePIC LFHCal	Quartz Fiber Cherenkov Timing Detector	muonID detector for ALICE 3
IDEA Cluster Counting	CMS MTD ETL	GIF++	CMS ECAL Upgrade	NP07 HATPC
MPGD-based transition radiation detector/tracker	RE7 GammaMeV	Cern Gamma Irradiation Facility	NA60+	High Angle TPC Detector
	SHiP Timing Detector		Tests of detectors and beam optics	ALICE FoCal
	CMS HGCal	AWAKE	AIDAINNOVA_WP6`	ATLAS HGTD
CMS Pixel Sensors for HL-LHC	SND@LHC	UA9	Hybrid sensors for 4D tracking	MiniCactus
	MONOLITH ERC Advanced Grant		LHCb	EIC dRICH prototype
CMS MIP Timing Detector (BTL)	PICSEL	CALICE	NP06 ENUBET	MPGD-based Calorimeter
	ScW-ECAL + AHCAL		MUonE	RE44 HERD
P349 Search for polarisation effects in the antiproton production process	ATLAS ITk Strip	NA62	LHCb ECAL	Technology for Crystal Light Sources
		Nucleon	ALICE TOF	Micro-Pattern Gaseous Detectors Technologies
AMBER (NA66)	ATLAS MALTA	ALICE3 Timing	PICSEL	POsitron resonant annihilation into dark matter
	Straw Tracker R&D	STI		CALorimetric Electron Telescope
ATLAS ITK PIXEL	E+BOOST	SHIP		Dual-readout calorimetry for FCC-ee
		N_TOF		ALICE ITS3
ATLAS BCM Prime	NA64mu	Neutron Time-Of-Flight		R2E- Radiatlon To Electronics
				PAN
	NA64e			FASER pre-shower
Water Cherenkov Test Experiment				Radiation Hard Innovative EM Calorimetry
				HIKE Small-Angle Calorimeter
ORiEnted calOrimeter				CMS Precision Proton Spectrometer
				4D Photon
				ALICE PHOS
NanoCal	NA61/SHINE	RE1 AMS Layer0 Upgrade	Super Tau-Charm Facility	ECAL & PID
				CERF
		Medipix/Timepix	Very Large Area gamma-ray Space Telescope	MADMAX
	DRD6 MAXICC			Beam-line for Schools
Maximum Information Crystal Calorimeter	CLOUD			East Area Irradiation Facility - IRRAD / CHARM

This does not include the internal planning from AD, Isolde, n-TOF, Radiation Facilities....

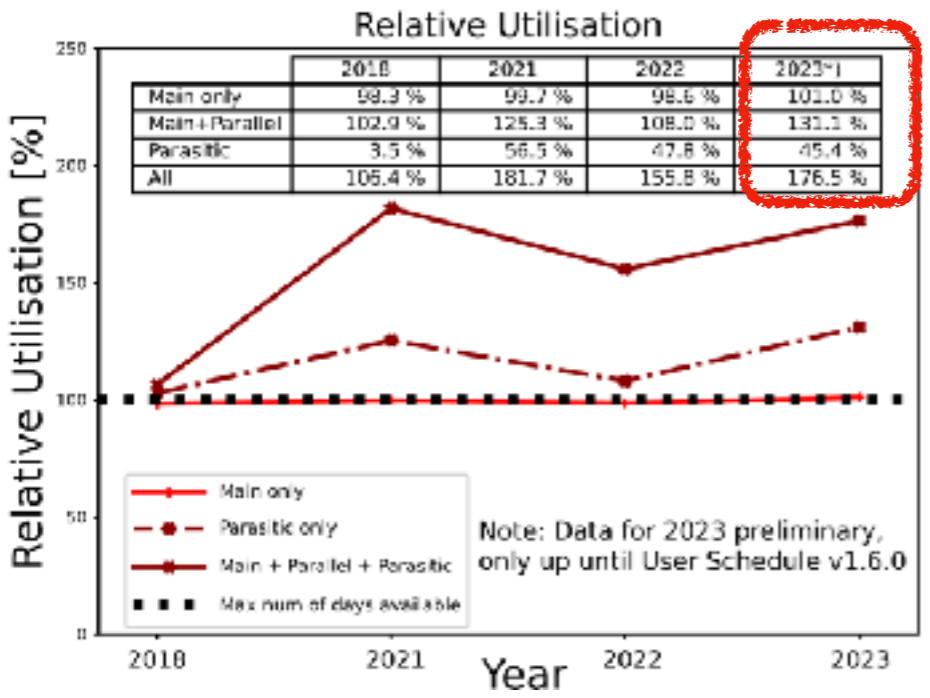
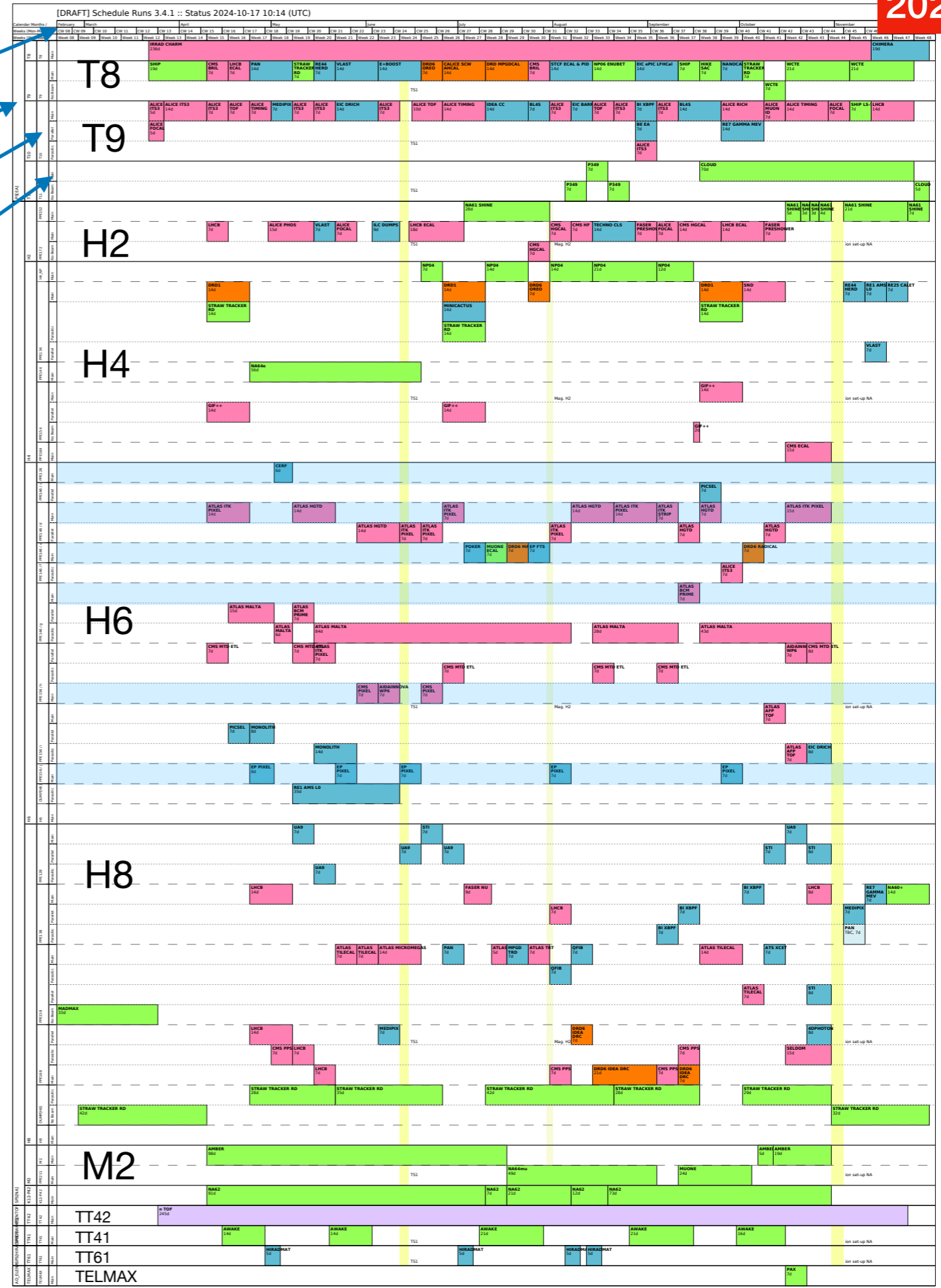
Example of required planning :

For 2024, we received ≈ 100 requests for test beam with often multiple runs, spread over the various areas, with the EHN1 being the most complex to schedule

Some beam lines overbooked (e.g H4 -> 200%)

2023 : High number or change requests by user: time slot (delays), cancelations, request for additional beam time granted

Weeks
Beamline
Zone
User Type
Main/Parallel/Parasitic



Huge effort over the last years to optimise the beam usage and host additional experiments in parallel / parasitic mode
Big thanks to the beam physicist, constantly optimising the delivered beams

Test beam availability

➔ **Test beams slots are normally fully booked shortly after the call for requests**

- Some beam-lines are (over-)booked by 200% (main user requests)
- Beam-lines H2/H4 and H6/H8 are sharing a target, therefore beams delivered to both lines are interlinked - adding to the complexity of scheduling and operation of the beam lines
- We try our best to host as many experiments as feasible, often with users hosted as parallel or parasitic.
- Thanks to the flexibility of most users (e.g. agreeing on common beam conditions) and the skills from our beam physicist, we manage to host the vast majority of user requests.
 - Very good usage of CERN resources
- **Test beam request for 2025 are CLOSED** (some flexibility in justified cases)

➔ **If selected, you will be called for a beam line meeting H2/H4 or H6/H8, or Tx**

- As soon as first draft schedule is available, to check the required infrastructure, beam parameters and compatibility between beam-lines and additional users

➔ **High number of user requests for schedule changes during the year**

- The schedule has to be adapted multiple times during the year
 - If you know you need to cancel a beam slot -> PLEASE TELL US ASAP
Other people are waiting, but need time to prepare the test beam / user shifts
- It is **mandatory** to join the weekly user meeting before*/during/after* the allocated beam time
 - weekly update to be added to the CodiMD page during stay

Test beam practicalities

➔ Practical infos

- EP Coordination page <https://ps-sps-coordination.web.cern.ch/ps-sps-coordination/>
- EP Beam requests <https://ps-sps-users.web.cern.ch/>
- Weekly meeting <https://indico.cern.ch/category/5682/>
- User E-Group : <https://e-groups.cern.ch/e-groups/Egroup.do?egroupId=10092727>

- Experimental Areas (BE-EA) group : <https://be-dep-ea.web.cern.ch/>
- Beam line contacts : <https://be-dep-ea.web.cern.ch/experimental-areas/beamline-contacts>
- Your beam line configuration : <https://asm.web.cern.ch/experimental-area/experiments>
- Test beam user guide : <https://be-dep-ea.web.cern.ch/users-guide>

- EP Safety team : <https://ep-th-safety.web.cern.ch/> (remember to login into Drupal)
 - Safety form (ISIEC) needs to be filled in good time in advance
(\approx 1 month if more complex due to laser, pressure vessels, special gases...)
 - ISIEC valid up to 3 weeks
 - Safety visit mandatory before turning ON your equipment (this is independent of beam)
 - Organise the visit \approx 1 week in advance, to be done at a time your setup is complete

Test beam & Facility Overview



CERN Secondary Beamlines and Test Beams Facility Overview (BTTB 2024 F. Metzger)

https://indico.cern.ch/event/1323113/contributions/5823647/attachments/2837211/4959273/BTTB_CERN_Secondary_Beams_Test_Beams_Metzger.pdf

Characteristics of the beams

Parameter	T2 Target		T4 Target	
	H2	H4	H6	H8
Beamline	H2	H4	H6	H8
p attenuated primary / secondary beam in GeV/c	400/360	400/360	-/205	400/360
Maximum $\Delta p/p$ in %	± 2.0	± 1.4	± 1.5	± 1.5
Maximum intensity/spill (hadrons/electrons)	$10^7/10^6$	$10^7/10^7$	$10^7/10^5$	$10^7/10^5$
Available particle types	Primary protons or pure electrons or pure/mixed hadrons or pure muons			
Ion beam availability	Yes	Yes	No	Yes

- **T6 target** → Serves the **M2** beam that is currently used for the AMBER experiment
 - $< 4.8 \times 10^8$ hadrons/spill with < 280 GeV/c (requires additional shielding around target); increase to 10^9 with improved shielding in future
 - $< 2 \times 10^8$ muons/spill with < 280 GeV/c
 - NA64 μ and MUonE will continue physics and test runs
- **P42** beam also originates from the T4 target and transports the proton beam that has not interacted onto the T10 target to produce typically 75 GeV/c kaon beams guided via **K12** to NA62



15.04.2024

Fabian Metzger | CERN Secondary Beamlines and Test Beams

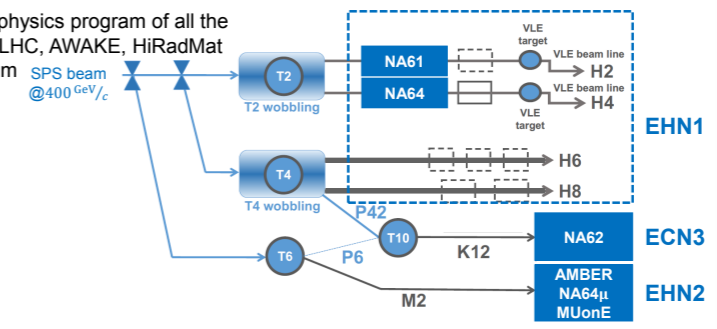
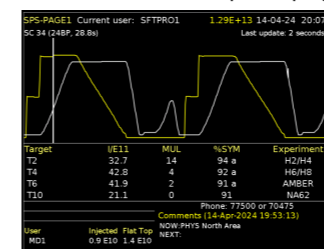
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North Area Secondary Beamlines

Spill duration: 4.8s flat top
Typically : **2 cycles / SPS supercycle** for NA and ~ **3000 spills/day**

The 400 GeV/c primary beam is slowly extracted to three primary targets → T2, T4 and T6

Supercycle structure depends on the physics program of all the facilities served by the SPS including LHC, AWAKE, HiRadMat and the Machine Development program



15.04.2024

Fabian Metzger | CERN Secondary Beamlines and Test Beams

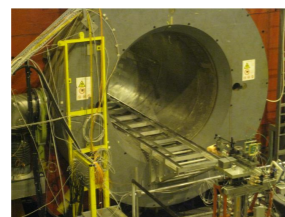
4

Large aperture magnets for tests with beam



GOLIATH

- EHN1, H4 beamline
- Large classical dipole
- $160 \times 240 \times 360$ cm³
- **1.5T** field



Morpurgo

- EHN1, H8 beamline
- Superconducting dipole
- 1.6m diameter, 4m length
- **1.5T** field



CMS M1 magnet

- EHN1, H2 beamline
- Superconducting dipole
- 82cm gap, 1.4m diameter
- **3.0T** field

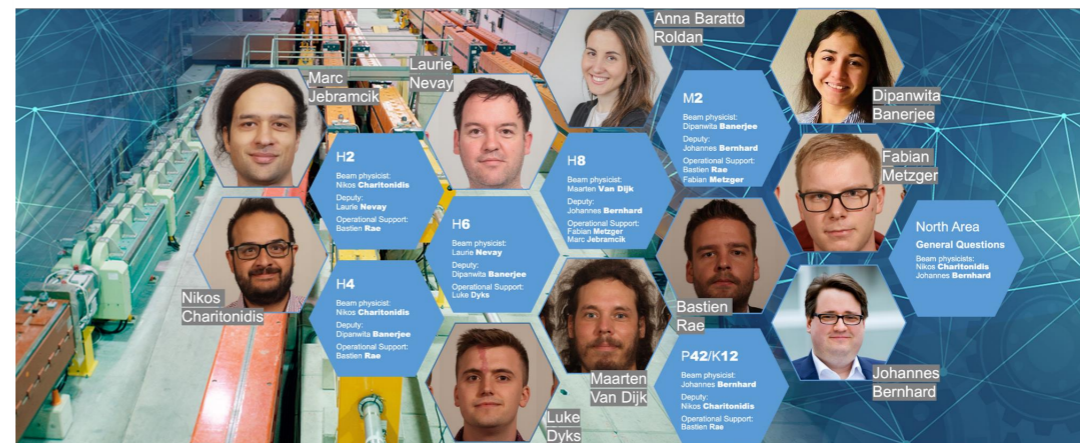


15.04.2024

Fabian Metzger | CERN Secondary Beamlines and Test Beams

8

North Area



15.04.2024

Fabian Metzger | CERN Secondary Beamlines and Test Beams

9

Beam availability 2025

Draft 2025 Injectors Schedule ver. 0.6 in numbers

Experimental facility	Beam to	Start physics	End physics	Duration 2025 Physics DRAFT Version 0.6 [days]*	
ISOLDE	05.03.2025	28.03.2025	08.12.2025	241	
nTOF	17.03.2025	19.03.2025	08.12.2025	264	
PS East Area p ⁺	19.03.2025	02.04.2025	08.12.2025	250	
PS East Area Pb ions	-	17.11.2025	08.12.2025	21	
SPS North Area p ⁺	28.03.2025	14.04.2025	07.07.2025	84	209
	-	18.07.2025	20.11.2025	125	
SPS North Area O ions	07.07.2025	09.07.2025	18.07.2025	9	
SPS North area Pb ions	20.11.2025	23.11.2025	08.12.2025	14	
AD-ELENA	26.03.2025	28.04.2025	08.12.2025	224	
HiRadMat	-	05.05.2025	21.09.2025	20 (+8)	

*TS and MD time etc. not deducted



29.10.2024

R. Steerenberg | Draft 2025 Injectors Schedule Version 0.6 explanations

7

- LHC schedules may change, impacting on this draft injectors schedule
- The proposed Oxygen and Pb ion runs remains to be endorsed by the SPSC.
- Final schedule to be presented at the SPSC of 26 & 27 November and final approval by the RB on 4 December.

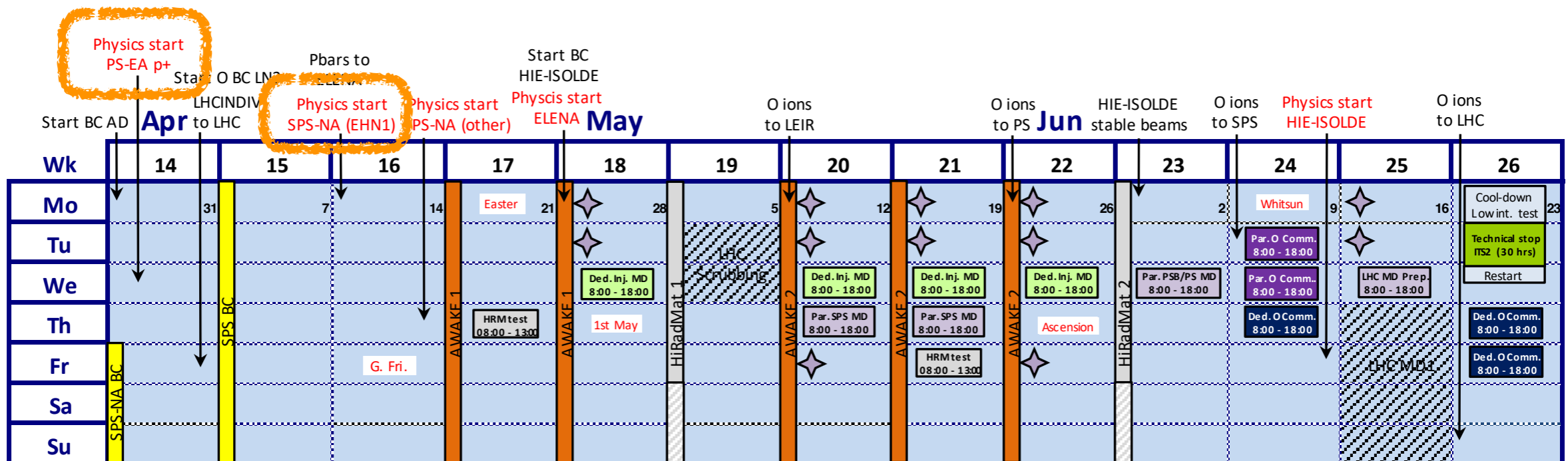
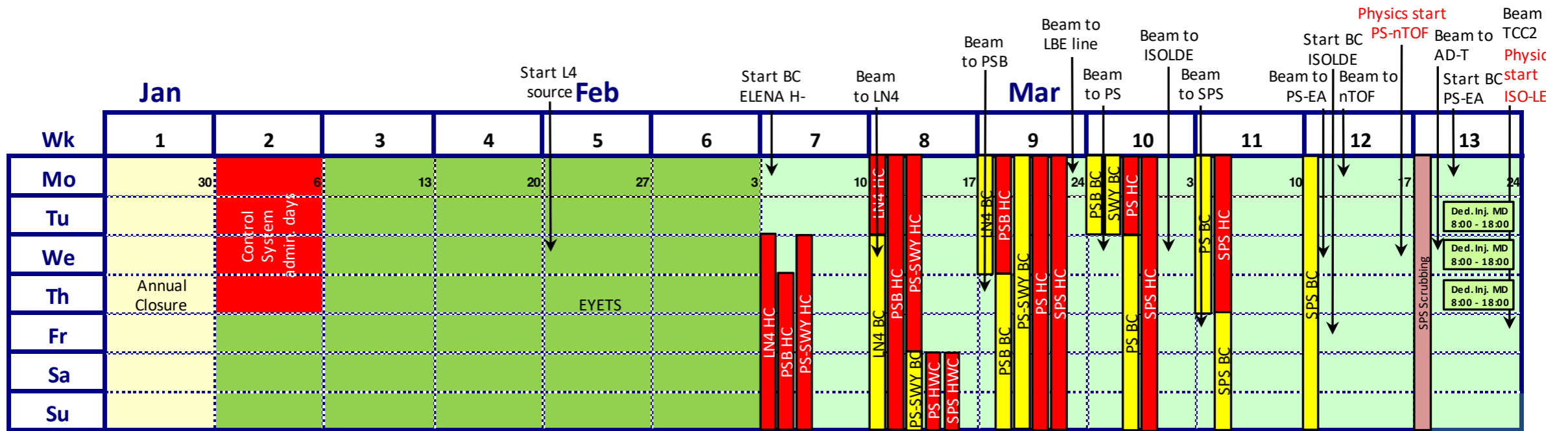
Beam availability 2025 - DRAFT

RS

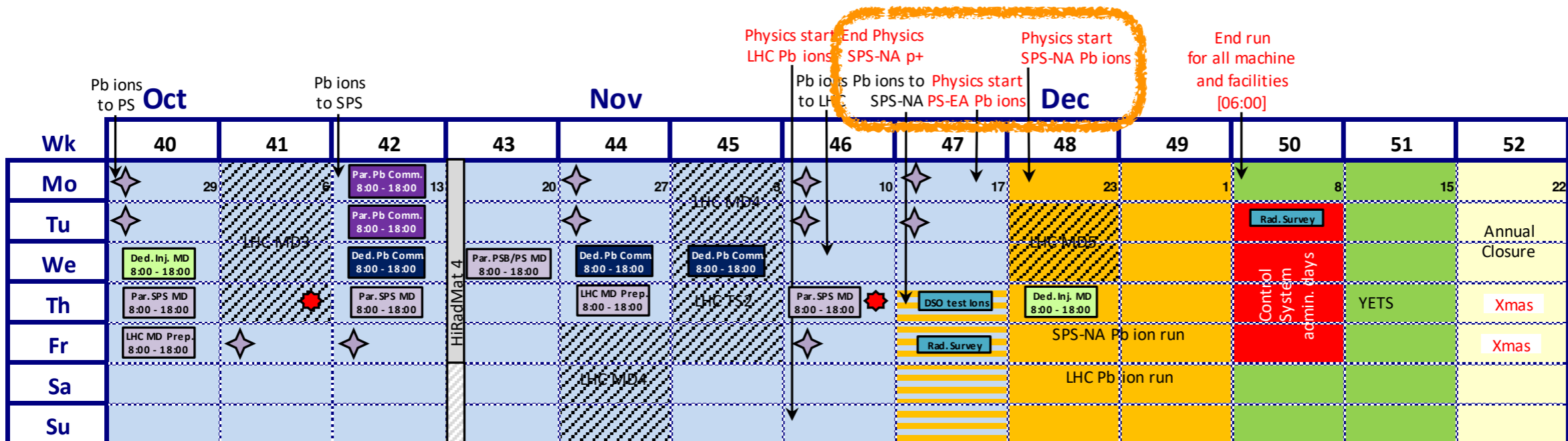
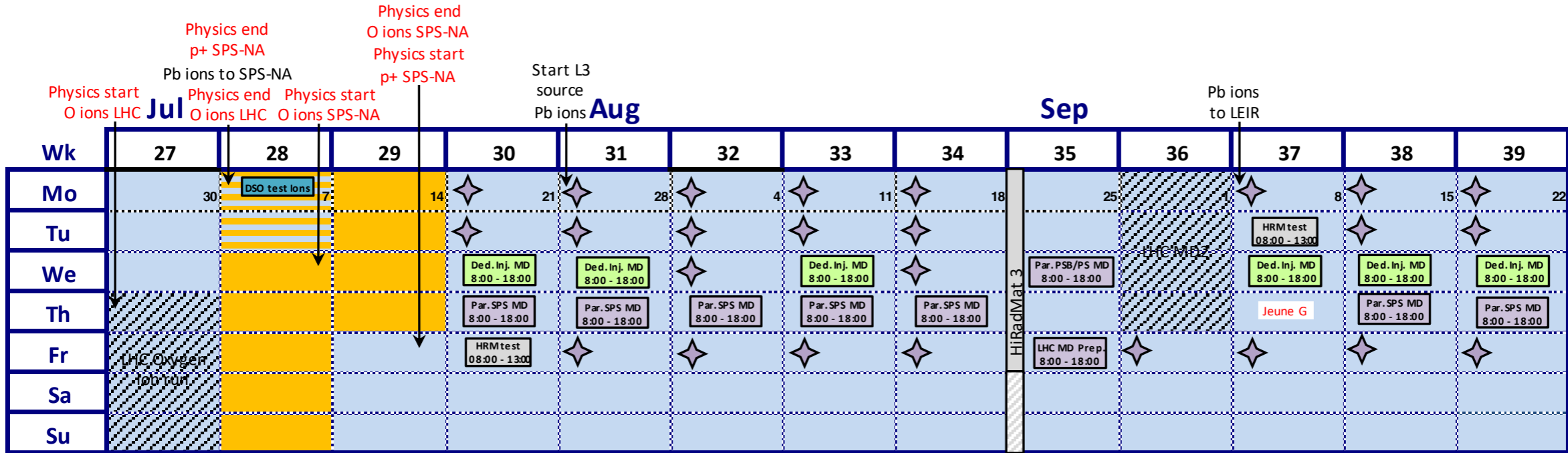
October 28, 2024

ver. 0.6

DRAFT Injector Accelerator Schedule 2025



Beam availability 2025 - DRAFT



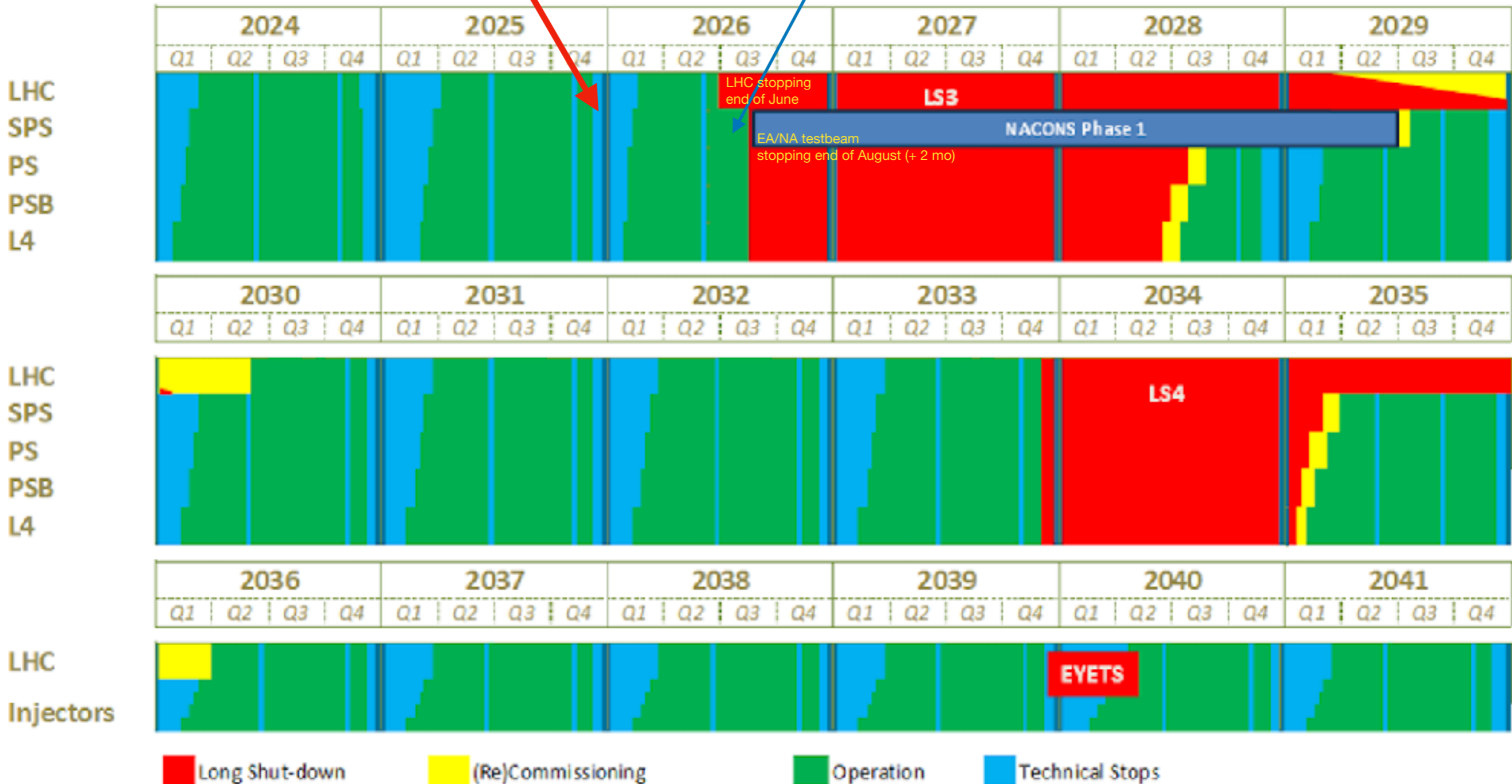
- Proton & Antiproton physics
- Hardware commissioning / Sys. admin days
- Parallel SPS ions beam commissioning
- Pb ions physics
- Beam commissioning
- Dedicated SPS ions beam commissioning
- Parallel Injectors MD block (08:00 - 18:00)
- Scrubbing
- LHC MD block proton period
- Dedicated Injectors MD Block (08:00 - 18:00)
- AWAKE Run (08:00 - 24:00)
- LHC MD blocks ion period
- YETS & Injector chain Technical Stop
- HiRadMat Run & reserve (08:00 - 24:00)
- Special interventions/stops
- SPS ions Hardware commissioning
- SPS short cycle (6-7 bp) parallel MD (08:00-20:00)
- CERN Official Holidays
- Annual closure
- Linac 3 source refill

Long Term Schedule (as of Oct.2024)

Very short YETS 25/26
expect restart \approx 1 month earlier than usual

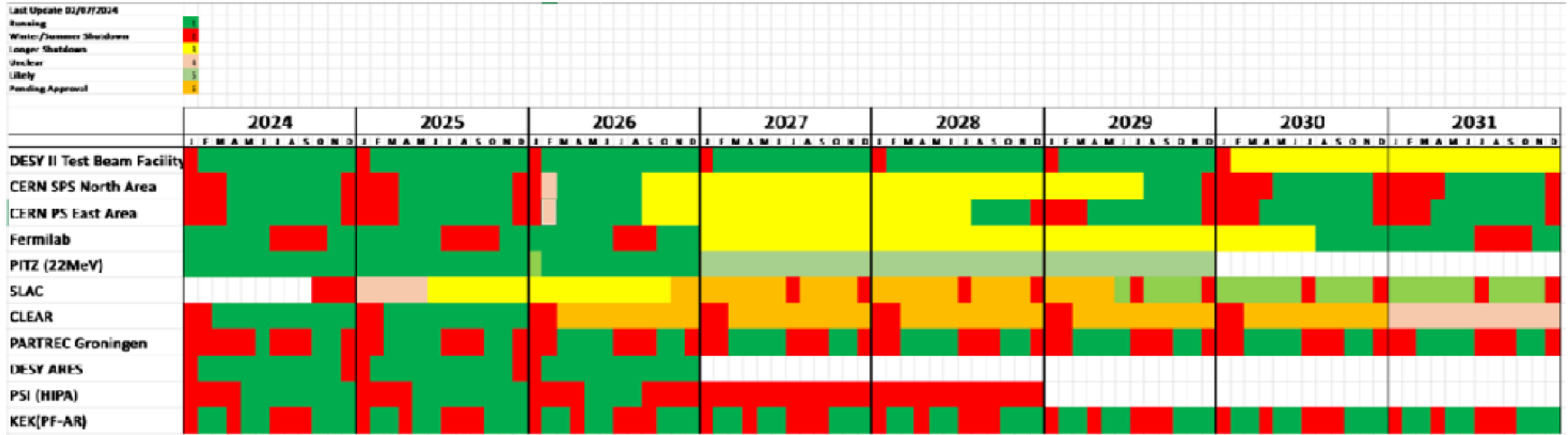
Long Term Schedule for CERN Accelerator complex

Probably ion run



Basically \approx 6 months of EA/NA test beam foreseen in 2026

International Overview



- ▶ CERN dates updated with current schedule
- ▶ Dates for Fermilab currently uncertain, might start shutdown in summer 2025 (same end date)

DRD6 Test Beam Requirements ?

Johannes Bernhard (BE-EA)

➔ **It would be very useful to know the test beam requirements from DRD6 for 2025/2026 (in addition to the beam request with dates, exclusion periods etc..)**

- Beam: Type (hadron/electron/muon/proton/ion/...), charge (+/-/0), momentum (GeV/c), intensity (particles/spill), diameter (mm), divergence (mrad)
- Preferred zones, control room
- Detector/installation: length (m), width (m), height (m), weight (kg), footprint on floor (A x B m²), beam height (cm), movable table (e.g. DESY table), support needed for detector (e.g. concrete block, iron block, frame), ideally also radiation and interaction length for RP assessment, need of engineering assistance (e.g. safety/load calculations), 2D/3D drawings / step files
- Services: gases, power, grounding, network connection, patch panel / cabling, cooling water, cryogenics, beam instrumentation, spectrometer magnets, transport needs, specific infrastructure, vacuum, shielding, short-term storage, scaffolding, assembly space, access for persons with disabilities, link to specific CERN labs and service groups
- Beam telescopes (not under BE-EA responsibility)
- Contact person(s)

➔ **Consider parallel or parasitic user**

➔ **Long term perspective**

- Plans beyond LS3 !

DRD6 Test Beam Request 2025

Requ Id	Activity	Status	Period	Num Runs	Run Ids
145	DRD6 CRILIN	Submitted	Protons 2025	2	248, 249
238	DRD6 HGCCAL	Submitted	Protons 2025	2	455, 456
171	DRD6 IDEA DRC	Submitted	Protons 2025	2	333, 345
189	DRD6 MAXICC	Submitted	Protons 2025	1	305
241	DRD6 MPGD-HCAL	Submitted	Protons 2025	1	440
153	DRD6 OREO	Submitted	Protons 2025	1	259
209	DRD6 RADICAL	Submitted	Protons 2025	1	334

Questions ?