



DRD6 Collaboration Meeting Closeout

Roberto Ferrari
CERN, April 11, 2024

Coordinators: Roman Pöschl (IJCLAB), Gabriella Gaudio, R.F. (INFN-Pavia)

Representative from ECFA Detector R&D Roadmap Coordination Team: Felix Sefkow (DESY)

WP 1: Sandwich calorimeters with fully embedded Electronics – Main and forward calorimeters

Conveners: Adrian Irlles (IFIC, adrian.irlles@ific.uv.es), Frank Simon (KIT, frank.simon@kit.edu), Jim Brau (University of Oregon, jimbrau@uoregon.edu), Wataru Ootani (University of Tokyo, wataru@icepp.s.u-tokyo.ac.jp), Imad Laktineh (I2PI, imad.laktineh@in2p3.fr), Lucia Masetti (masetti@physik.uni-mainz.de)

WP 2: Liquified Noble Gas Calorimeters

Conveners: Martin Aleksa (CERN, martin.aleksa@cern.ch), Nicolas Morange (IJCLab, nicolas.morange@ijclab.in2p3.fr), Marc-Andre Pleier (mpleier@bnl.gov)

WP 3: Optical calorimeters: Scintillating based sampling and homogenous calorimeters

Conveners: Etienne Auffray (CERN, etiennette.auffray@cern.ch), Marco Lucchini (University and INFN Milano-Bicocca, marco.toliman.lucchini@cern.ch), Philipp Roloff (CERN, philipp.roloff@cern.ch), Sarah Eno (University of Maryland, eno@umd.edu), Hwidong Yoo (Yonsei University, hdyoo@cern.ch)

WP 4: Electronics and DAQ

Christophe de la Taille (OMEGA, taille@in2p3.fr)

Transversal Activities

Photodetectors: Alberto Gola (FBK, gola@fbk.eu)

- Indico page: <https://indico.cern.ch/event/1368231/>
 - 133 registered participants, 67 on-site partially from far away
- Support by Patricia Mage-Granados and Caroline Cazenoves, Thank you very much!!!!



Everything smooth ...

- 1) All proposals were endorsed → now 133 institutes fully CB members (with right to vote)
 - To be checked → ping all institute contacts and verify
- 2) Nicolas was endorsed as WP2 coordinator: congratulations!
 - Congratulations also to Marc-André, elected IB Chair of WP2
- 3) Next collaboration meeting in 6 month, yet at CERN

but ...

Took quite some time and some effort to reach 50% quorum

About possible countermeasures:

- Considered safer and healthier NOT to touch 50% quorum
- Make all group leaders be conscious of importance of attendance

We (Roman and I) went to Users Office and asked about institute registration

Answer was “YES” → i.e. institutes can start registering already now

Please, look at page:








<https://usersoffice.web.cern.ch/duties-and-obligations-team-leader>

for procedure to get team leader registered

Following team leader registration, each group member can (and must) be registered

Few slides from WG sessions

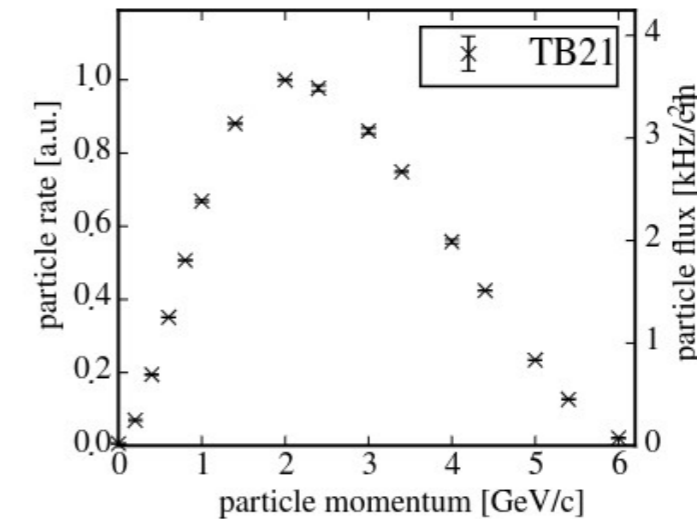
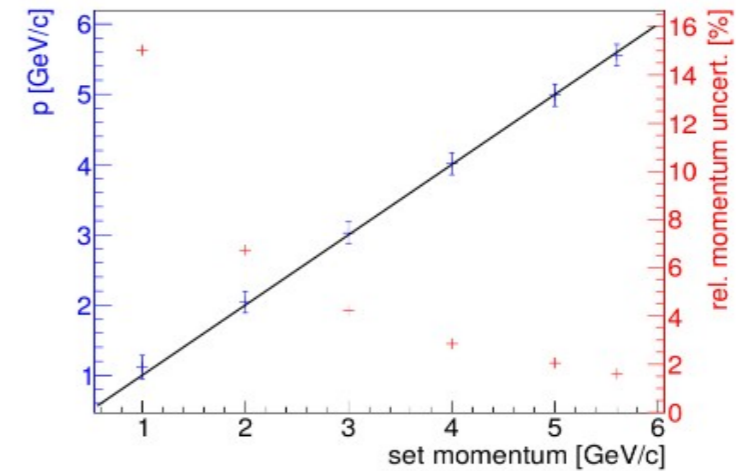
Talks:

14:00 → 16:00	Working Groups: WG Testbeams
14:00	Introduction to Testbeam at DESY Speakers: Marcel Stanitzki (Yale University), Marcel Stanitzki (Deutsches Elektronenlaboratorium)  DesyllTestBeamFac...
14:20	Introduction to Testbeams at CERN Speaker: Henric Wilkens (CERN)  HW20240409-DRD6...  HW20240409-DRD6...
14:40	Introduction to Testbeams at FNAL Speaker: Grace Cummings (Fermi National Accelerator Lab. (US))  GECummings_FTBF...
15:00	Overview on further Testbeam sites Speaker: Roman Poeschl (Université Paris-Saclay (FR))  talk100424.odp  talk100424.pdf  talk100424.pdf
15:20	Discussion on the organisation of DRD Calo beam tests

Some numbers

Beam Properties

- A few measurements to get an idea of the dependencies
 - DESY II synchrotron intensity
 - How well the target is positioned in the beam
+ which beamline + how many targets are in overall
 - Energy dependence
 - Energy precision: Offset very small
 - Absolute spread rather independent of energy
→ relative spread smaller at higher energies
 - Can be influenced by the collimator setting
(but less spread also means less rate,
so you need to decide what's more important)



Schedule 2024

Booking/Usage Statistics

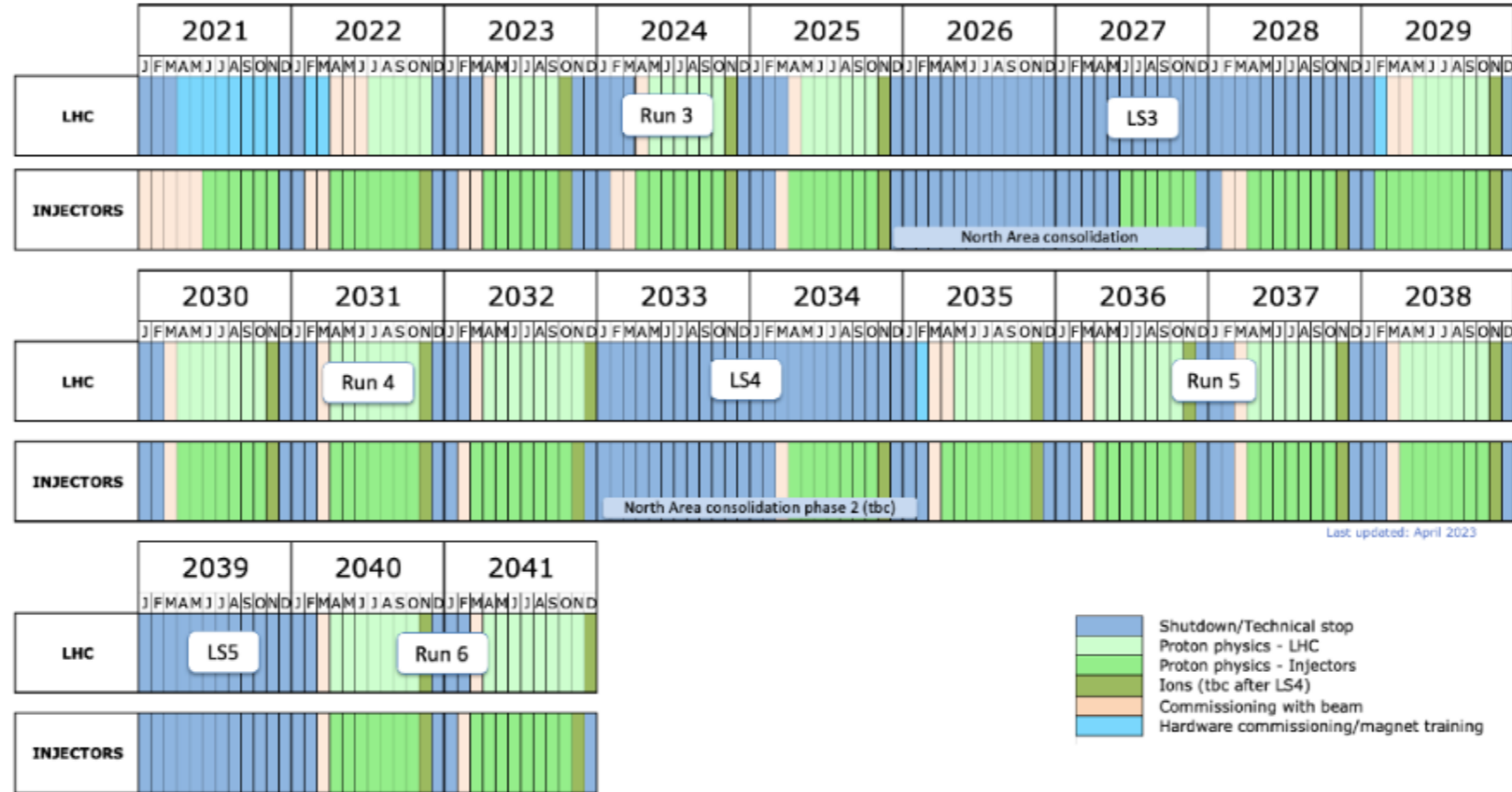


- First half year
 - February to April fully booked
 - Overall 59 of 66 available slots (90 %)
 - Still a few slots before the summer break available on a first-come first-served basis
- Call for the 2nd half year running until May, 3rd 2024
- EURO-LABS Transnational Access
 - financial support for user travels
- User groups can apply, where the team leader and the majority of the members are employed at an institution outside Germany
- More details:
 - https://particle-physics.desy.de/test_beams_at_desy/euro_labs_ta/



Startdate	Week	TB21	T	TB22	T	TB241	T	TB24	T
01.01.2024	1	Shutdown		Shutdown		Shutdown		Shutdown	
08.01.2024	2	Shutdown		Shutdown		Shutdown		Shutdown	
15.01.2024	3	Shutdown		Shutdown		Shutdown		Shutdown	
22.01.2024	4	Shutdown		Shutdown		Shutdown		Shutdown	
29.01.2024	5	Startup		Startup		Startup		Startup	
05.02.2024	6	CMS Outer Tracker	X	dSIPM	X			CMS-HGCAL	X
12.02.2024	7	CMS Outer Tracker	X	Mu3e	X			AidAInnova-WP6	X
19.02.2024	8	CMS ETL ETROC	X	Mu3e	X			AidAInnova-WP6	X
26.02.2024	9	CMS ETL ETROC	X	TelePix	X			ATLAS HGTD	X
04.03.2024	10	ITk Pixel Dortmund	X	ATLAS-ITk-Strips	X			ATLAS HGTD	X
11.03.2024	11	CMS Inner Tracker	X	LHCb-MightyPix	X			CMS ETL	X
18.03.2024	12	CMS Inner Tracker	X	LHCb-MightyPix	X			SHP SHADOWS-ECAL	X
25.03.2024	13	Maintenance		Maintenance		Maintenance		Maintenance	
01.04.2024	14	Maintenance		Maintenance		Maintenance		Maintenance	
08.04.2024	15	DESY Heidelberg TB School	X	Tangerine	X			DESY Heidelberg TB School	X
15.04.2024	16	Schwartz-Reisman School	X	Tangerine	X			ALICE-ITS3	X
22.04.2024	17	MDI-2		RDSO-MPW4	X			CaVision	X
29.04.2024	18	CMS ETL ETROC	X	CMOS Strips Detectors	X			Telescope-Dev	X
06.05.2024	19	CMS ETL ETROC	X	CMOS Strips Detectors	X			IPHC-CE65_v2	X
13.05.2024	20	Maintenance		Maintenance		Maintenance		Maintenance	
20.05.2024	21	MDI-2		dSIPM	X				
27.05.2024	22	ATORCH		Tangerine	X			LHCb-ECAL	X
03.06.2024	23	CMS ETL ETROC	X	Tangerine	X			LHCb-ECAL	X
10.06.2024	24	CMS ETL ETROC	X	Telescope-Dev	X				
17.06.2024	25	CMS ETL ETROC	X	DCRSO	X			CMS ETL	X
24.06.2024	26	CMS Inner Tracker	X	ATLAS-ITk-Strips	X			DDR6-CALICE SW-ECAL	X
01.07.2024	27	Maintenance		Maintenance		Maintenance		Maintenance	
08.07.2024	28	MONOPIX2	X					CMS-HGCAL	X
15.07.2024	29	Belle-II CMOS	X					MMOSIS	X
22.07.2024	30								
29.07.2024	31	BLAS preparation	X	TelePix	X			EIC AC-LGAD	X
05.08.2024	32	Shutdown		Shutdown		Shutdown		EIC AC-LGAD	X
12.08.2024	33	Shutdown		Shutdown		Shutdown		Shutdown	
19.08.2024	34	Shutdown		Shutdown		Shutdown		Shutdown	
26.08.2024	35								
02.09.2024	36								
09.09.2024	37								
16.09.2024	38								
23.09.2024	39								
30.09.2024	40								
07.10.2024	41	Maintenance		Maintenance		Maintenance		Maintenance	
14.10.2024	42								
21.10.2024	43								
28.10.2024	44								
04.11.2024	45								
11.11.2024	46	Maintenance		Maintenance		Maintenance		Maintenance	
18.11.2024	47								
25.11.2024	48								
02.12.2024	49								
09.12.2024	50								
16.12.2024	51								
23.12.2024	52	Shutdown		Shutdown		Shutdown		Shutdown	

Long term injector schedule



- No beams to PS East Area in 2026 and 2033
- No beams to SPS North Area in 2026-mid 2028 and 2033-2034

SPS:

Characteristics of the Beams

Parameter	T2 Target		T4 Target	
	H2	H4	H6	H8
Beam Line				
Attenuated primary proton / Secondary beam	400/360	400/360	-/205	400/360
Maximum $\Delta p/p$ (%)	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 (not in H6) or pure electrons or pure/mixed hadrons or pure muons			
Ion Beam Availability	Yes	Yes	No	Yes

Beam energies in H2 and H4 are coupled, as are the energies in H6 and H8.

Electrons from γ conversions in H2 and H4 (highest purity)

γ can be made available as tertiary beam (needs ad-hoc installation)

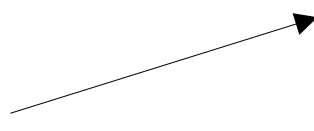
Beam lines are instrumented with profile monitors, intensity counters, Cherenkov detectors (XCET, and CEDAR) and Secondary Emission Monitors at the target.

Multiple Experimental Areas per beam line.

Final remarks and conclusions

- CERN is committed for the long term availability of the test beam facilities (EA-cons, NA-cons)
- In the immediate future, availability of the CERN testbeams will be reduced due to LS3 and NA-cons.
- Subscribe to ps-sps-users e-group to stay informed on the CERN testbeds (call for beam time requests etc).
- Scheduling: 2 weeks in East Area, 1 week at North Area by SPS coordinator, longer requests require approval by CERN scientific committee. Can DRDC help here?

Yes, it already worked this year:

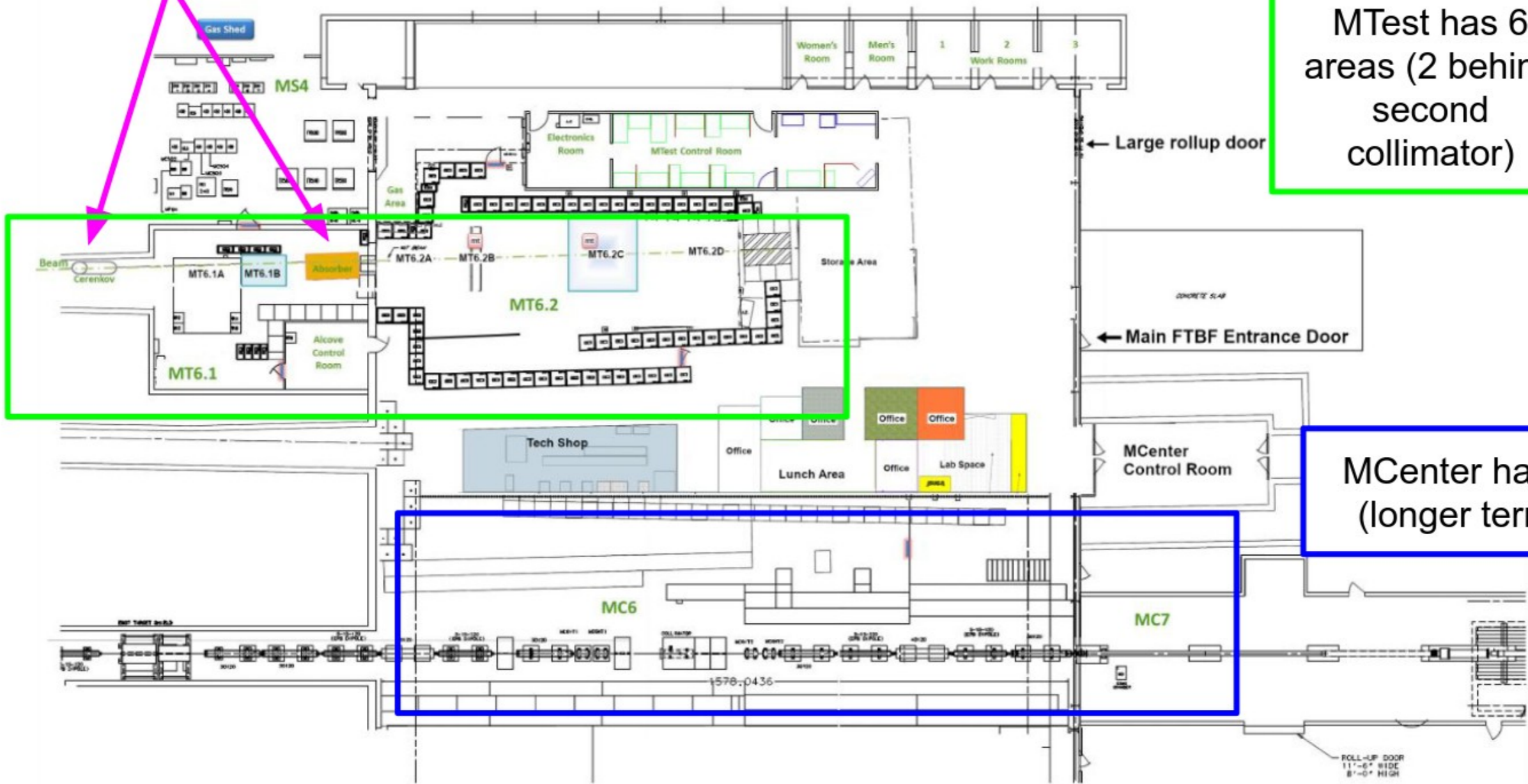


Collimators for secondary beams

MTest has 6 areas (2 behind second collimator)

MCenter has 2 (longer term)

FTBF Layout

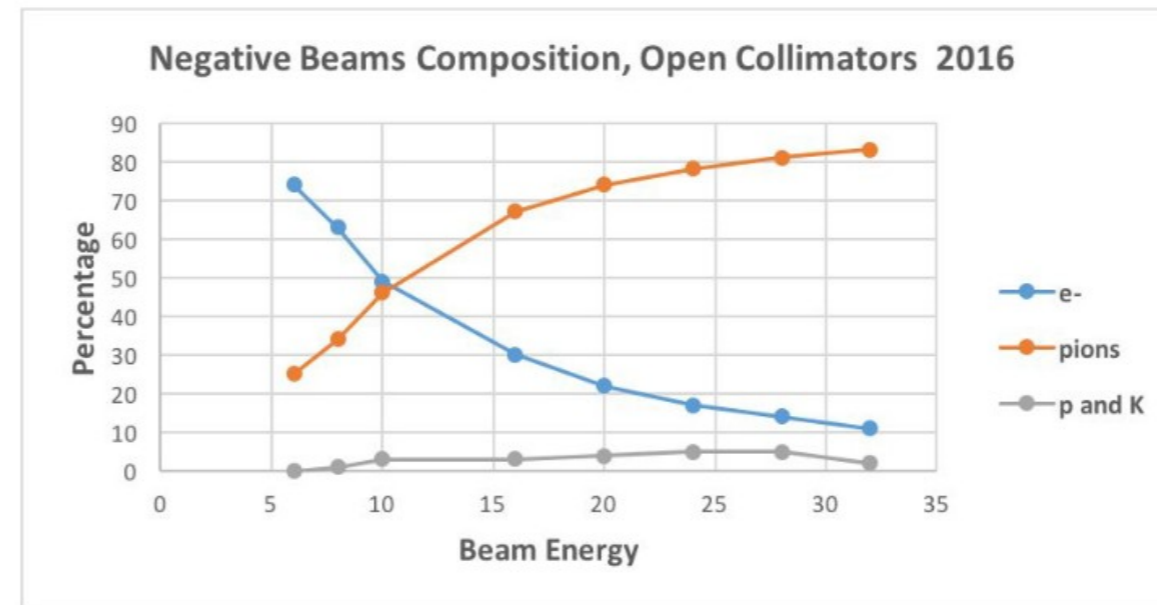
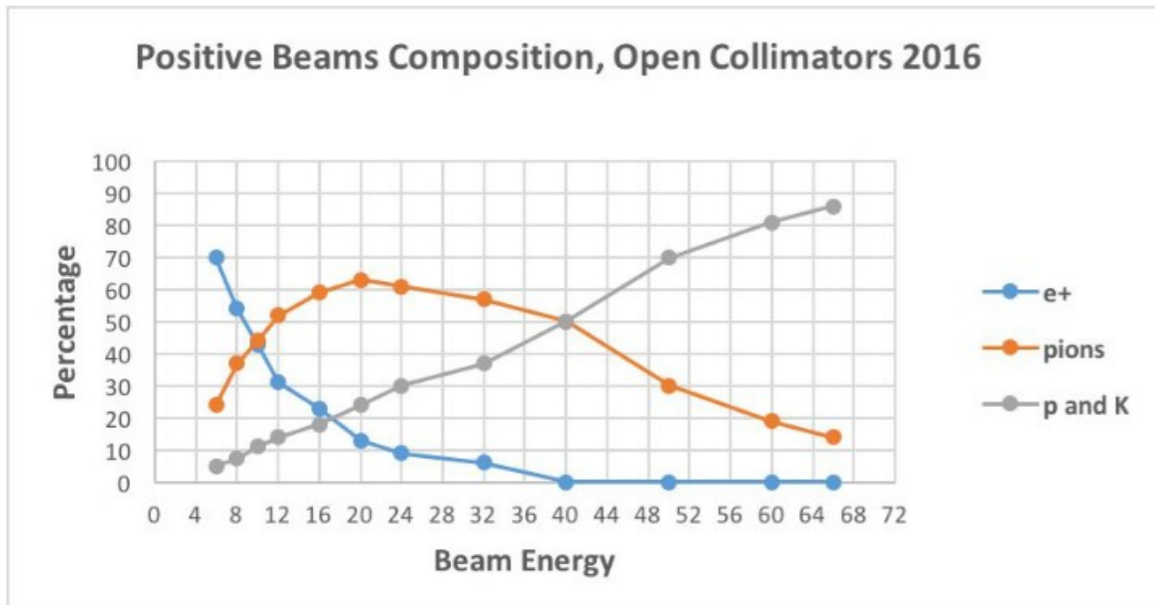


FTBF - MTest Beam Options [\[Link\]](#)

- 120 GeV Protons
- 8 - 60 GeV Pions
- 1-32 GeV Pions, electrons, Kaons, or broadband muons

Purity issue → can be improved w/ Cher. cntrs or other PID det.s

Secondary Beam [Compositions](#)

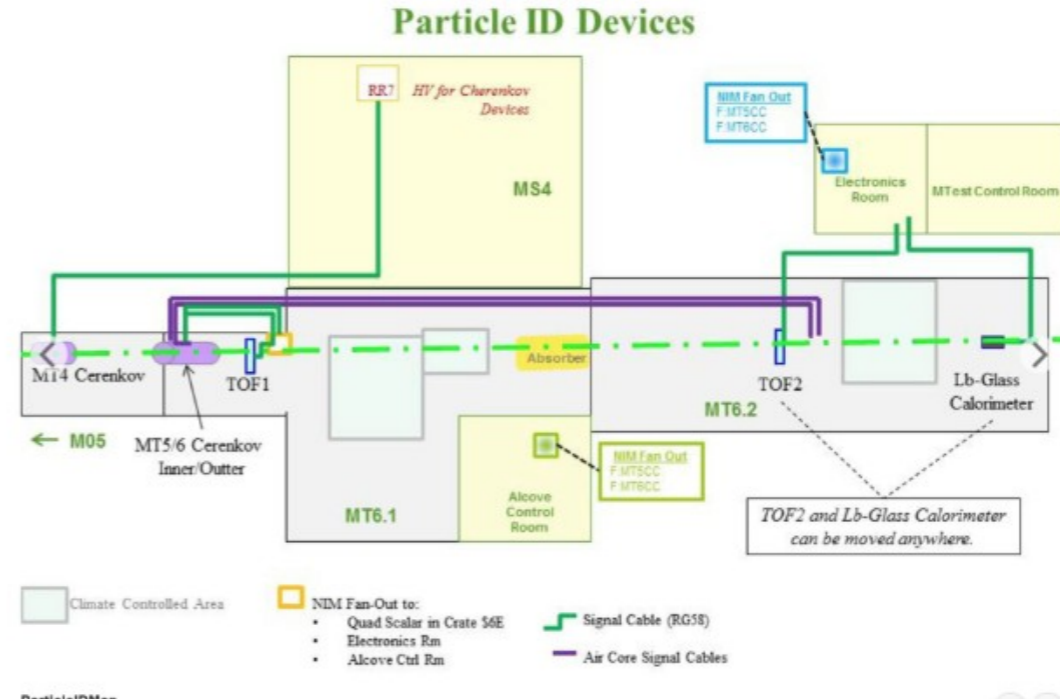


MTest Instrumentation - PID

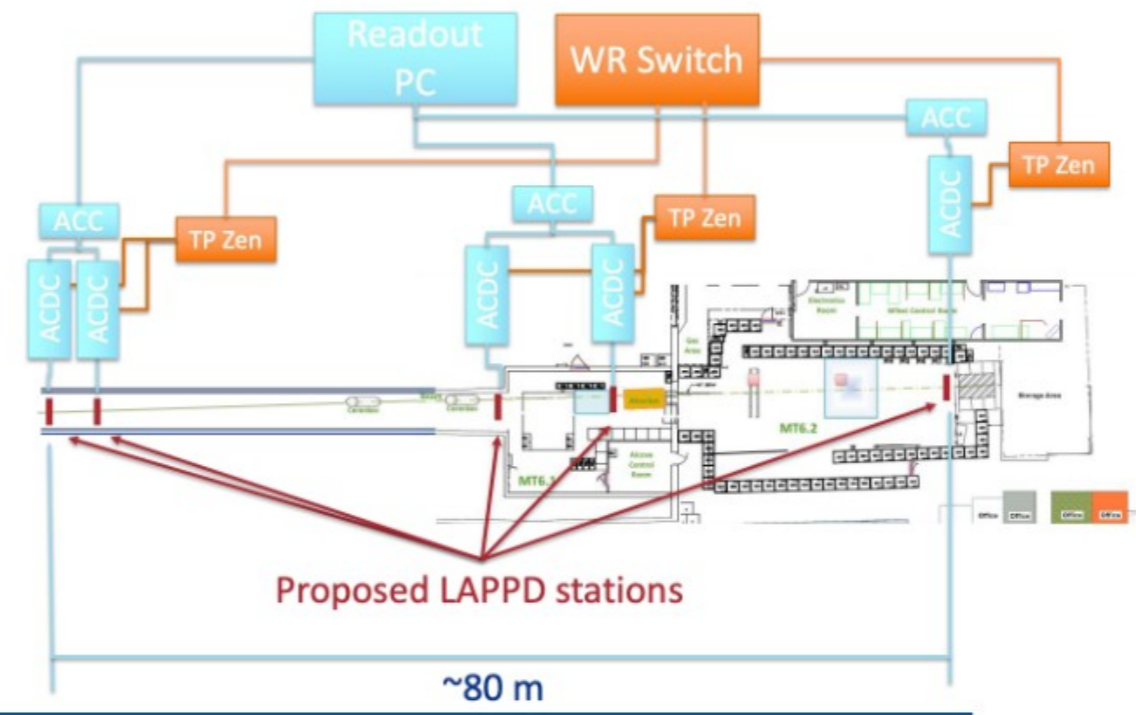
- Current
 - [Cherenkov Detectors](#)
 - limited to threshold counting
 - [TOF System](#)
 - Hard to use
- Being commissioned
 - LAPPD + White Rabbit TOF
 - [See Joe's CPAD Talk](#)

Not covered (but present - [trigger!](#))

Current Setup



Proposed



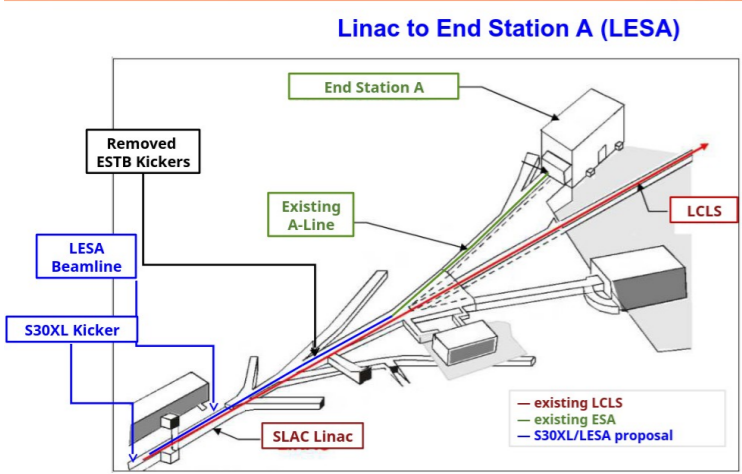
The proposed future of FTBF/ITA

- PIP-II Linac will provide high intensity 800 MeV protons
 - New location will have less beam-line to maintain
 - New ITA to replace old w/ decommissioning of existing linac
- 4-6 new beamlines
 - 120 GeV protons from Main Injector
 - 8 GeV from the booster
 - Additional, clean secondary beams
- Recommended in [P5 Report](#)



ECFA

Testbeam facilities – SLAC



- Beam Energy
 - Pegged to LCLS-II
 - 4 GeV and then 8 GeV with LCLS-II-HE
 - Can tune energy lower in A-Line (when making secondaries: a few to $\ll 1$ e- per pulse)
- Variable Current
 - Up to 25 nA (3000 e-/bunch) with 50% duty cycle (useful for irradiation tests, testing integrating detectors)
 - Down to Poisson average < 1 e- per pulse
- Repetition rate 46MHz@50% duty cycle
- Now beam in S30XL
- Availability > 2026
- If available ~ 250 user days

Citation Carsten: **I Hope We Can Continue Electron Test Beams at SLAC's ESA Soon**

Testbeam facilities – KEK

I. Nakami

PF-AR



- PF-AR (Photon Factory Advanced Ring)
 - Photon Source Facility (High Energy X-ray)
 - former booster (8 GeV) of TRISTAN e^+e^- collider
- Maximum 6.5 GeV, 60 mA, Single Bunch (Run at 6.5 or 5 GeV, 50 mA, Top-up)
- 377m Circumference (1.26 μ s or 795 kHz)
- Four Experimental Halls North/East/West/South

FA

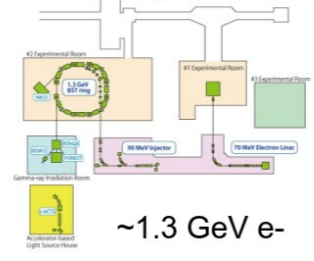
Smaller facilities (Incomplete list)

JGU Mainz



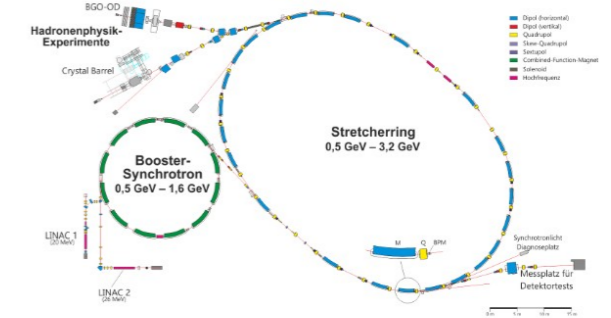
~ 1 GeV e^-

ELPH @ Tohoku U



~ 1.3 GeV e^-

ELSA @ Uni Bonn

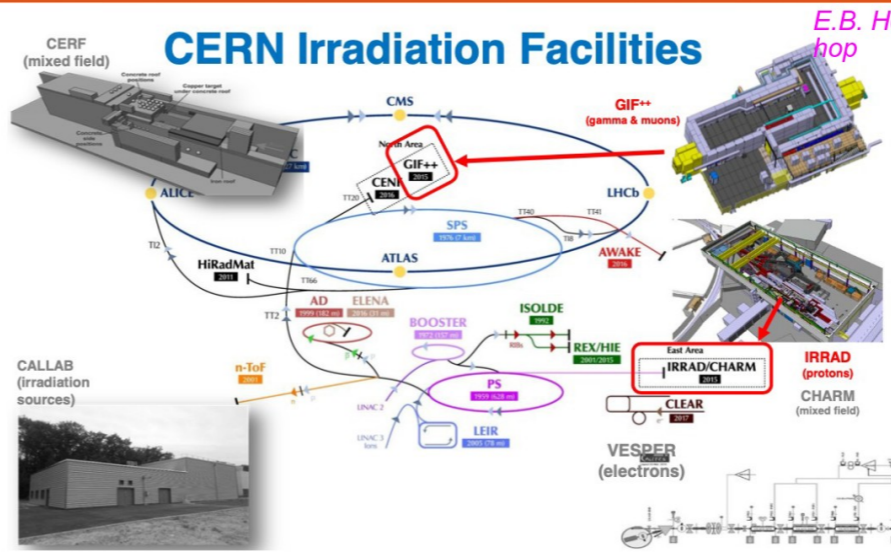


~ 3 GeV e^-

- Apologises to those that are not listed
- Please help us to complete this list

FA

Irradiation facilities – Example CERN



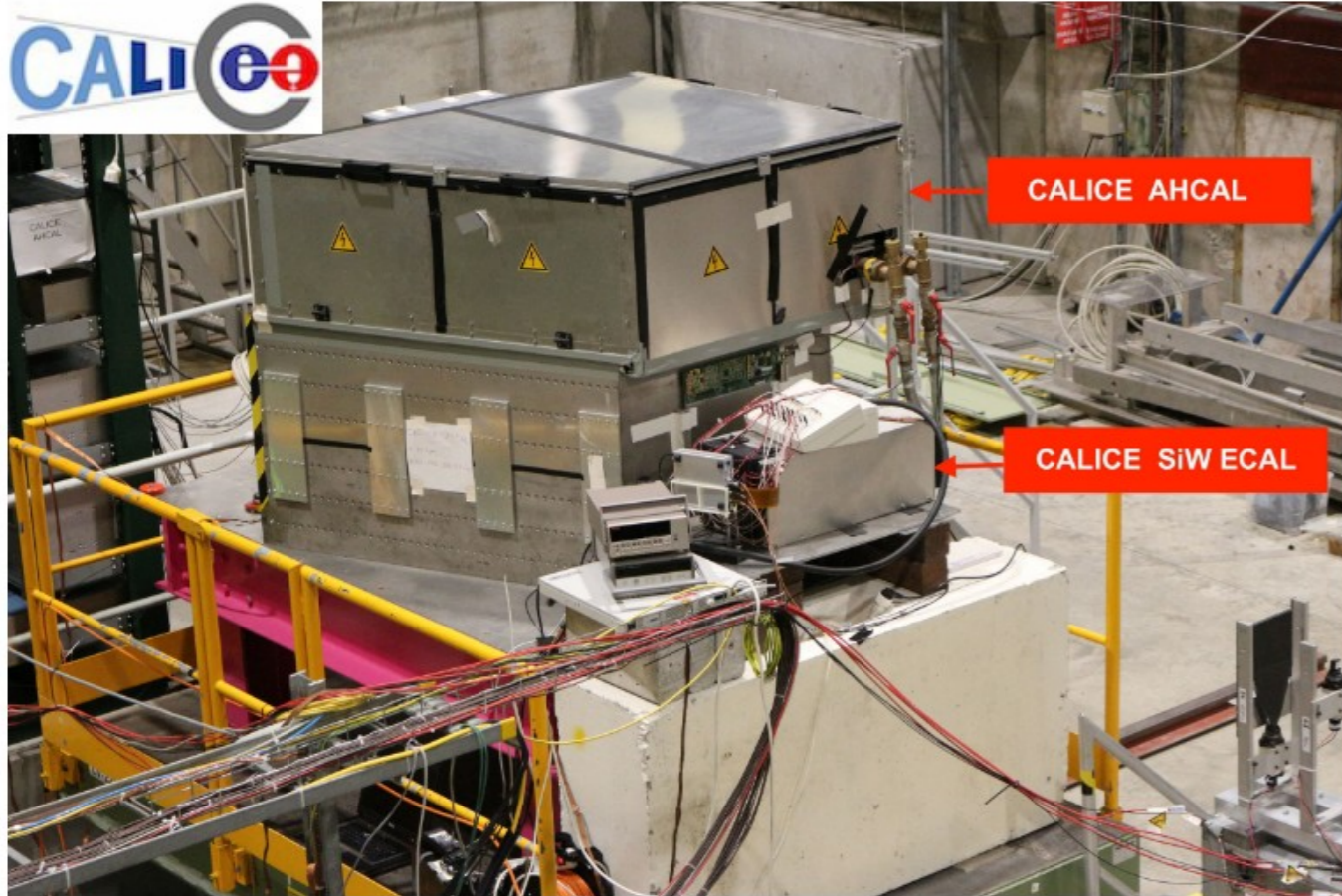
E.B. Holzer, 11th BTTB Works hop

A number: 10^{17} p/cm² take one year at Gif++

I don't forget: JSI Triga, U.o.B Cyclotron, Louvain, ITAINNOVA, Groningen and there are others

Match Irradiation/Beamtest Facilities Detector Needs

	Energy	Irradiation
Higgs Factory CMS energy 90-1 TeV Radiation $\leq 10^{14}$ n_{eq}/cm^2	✓	✓
HL-LHC CMS energy 14 TeV (shared by partons) Radiation $\sim 10^{16} n_{eq}/cm^2$	(✓)	✓
Muon Collider CMS energy 3-10 TeV Radiation \sim HL-LHC	X	✓
Future Hadron Collider CMS energy 100 TeV (shared by partons) Radiation up to $\sim 10^{18}$ n_{eq}/cm^2	X	X



Common setup at CERN June 2022

- Calorimeters are typically large objects
 - A beam test is similar to a small experiment
- Difficult for facility managers to schedule calorimeter beam tests
 - No concurring running with other devices possible
- Takes lots of expertise to carry out a successful beam test campaign
 - Implies use of infrastructure
- A dedicated beam line maybe with dedicated slots during a year may help curing these issues
 - Would need sustained expertise on the beamline

Points for discussion:

- a) How to plan and organise beam test for DRD-Calo?
- b) What does it mean a common beam test area?

General consensus on the need of common efforts and testbeam coordination

Resources (manpower, instrumentation, software) ?

Talks:

14:00 → 16:00 Working Groups: WG Software

 503/1-001 - C

14:00

Lesson from CALICE software

Speaker: Gerald Grenier (IP2I, CNRS, Univ Lyon 1 (FR))

 DRD6_Calice_softw...

14:30

Geant4, geant-val & DRD6

Speaker: Lorenzo Pezzotti (CERN)

 lopezzot_DRD6G4_1...

15:00

Getting more from hadron calorimeters

Speaker: Tommaso Dorigo (Universita e INFN, Padova (IT))

 Getting More From ... Getting More From ...

15:30

Discussion 20240410_SW.pdf

- Very comprehensive overview by Gerald Grenier on CALICE experience
- Presentation on GEANT4 experience in collaboration with calorimeter
- From conclusion slide from Lorenzo:

“Usually, one member of the Geant4 Group at CERN acts as representative for each of the most important Collaborations (ATLAS, CMS, LHCb, ALICE, ...)

We believe it would be mutually beneficial to have a Geant4 representative at the DRD6 Software Working Group as well

Our involvement in DRD6 might go beyond this as we could actively participate in the creation and organization of the DRD6 SW WG”

=> I would say this is a good model to follow; we may have this approach also with other standard software, e.g. EUDAQ, DD4HEP...

- Very interesting and innovative presentation of Tommaso Dorigo on possibility of using AI and ML approaches

Things discussed on which there seems to have been consensus:

1) Identify common tools and common data format

Proposal by software experts:

Survey on the tools used by the community, both to count how many users should port their code and to estimate available expertise

2) Build around those tools "forum" = "WG tasks" ... call whatever we want and create the community

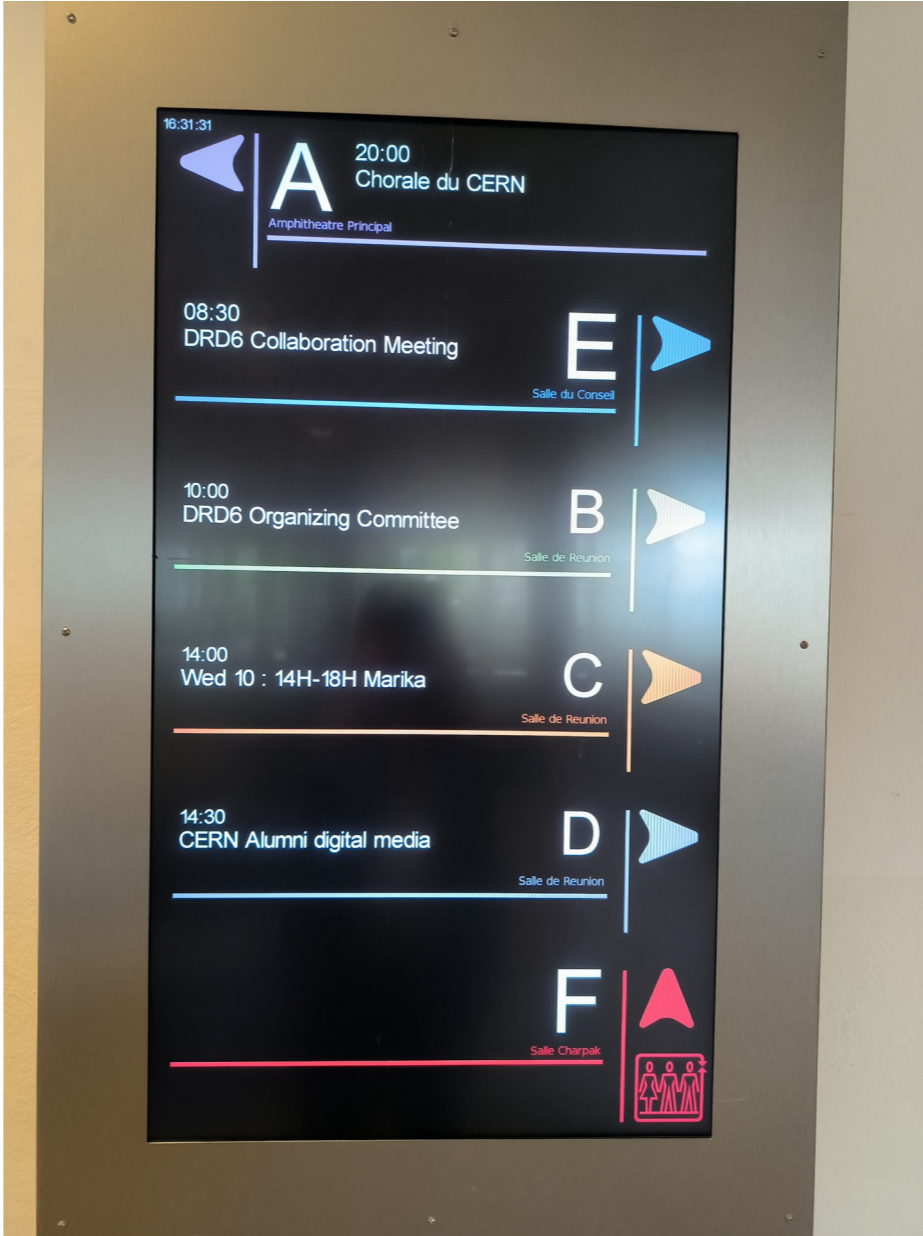
3) Common repository for both "shared software" but also detector-specific stuff (e.g. the same git repository)

Share code among different subtasks as much as possible

Take inspiration from each other

also in the same project, code will remain even if the developer (e.g young post-doc) changes institute,

In general very positive attitude and willingness to share work



DRD Calo – Collaboration Meeting April 2024

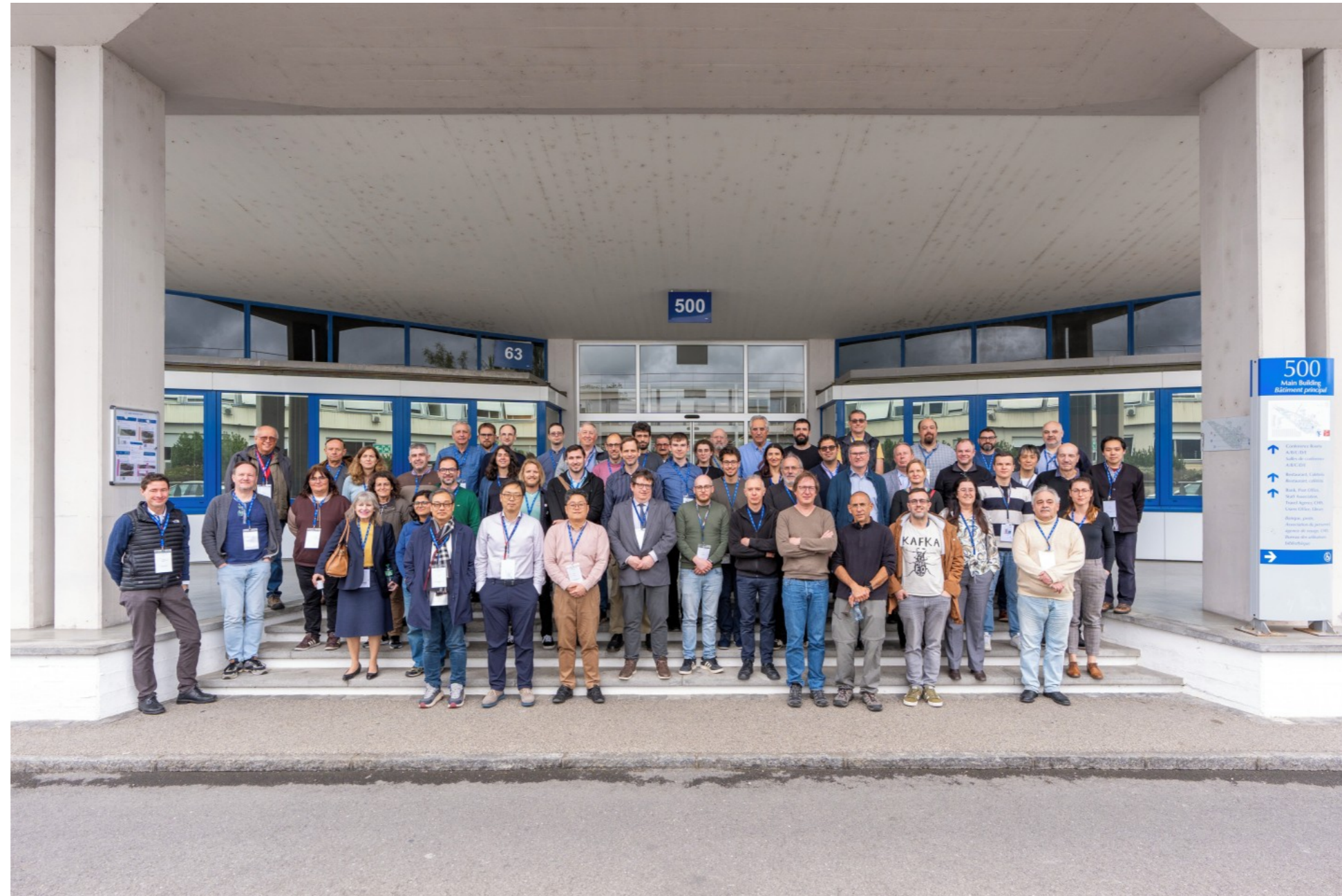


Photo by Maximilien Brice

Have a safe trip home and see you soon!

to Spokesperson election!

Many thanks to everybody for this very interesting and positive start

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As I said yesterday ... by far ...

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As I said yesterday ... by far ...

not my fault!