

The DESY II Test Beam Facility



Present and Future

15 April 2024 – BTTB12, University of Edinburgh

Sven Ackermann, Ralf Diener, Norbert Meyners, Marcel Stanitzki

Facility.

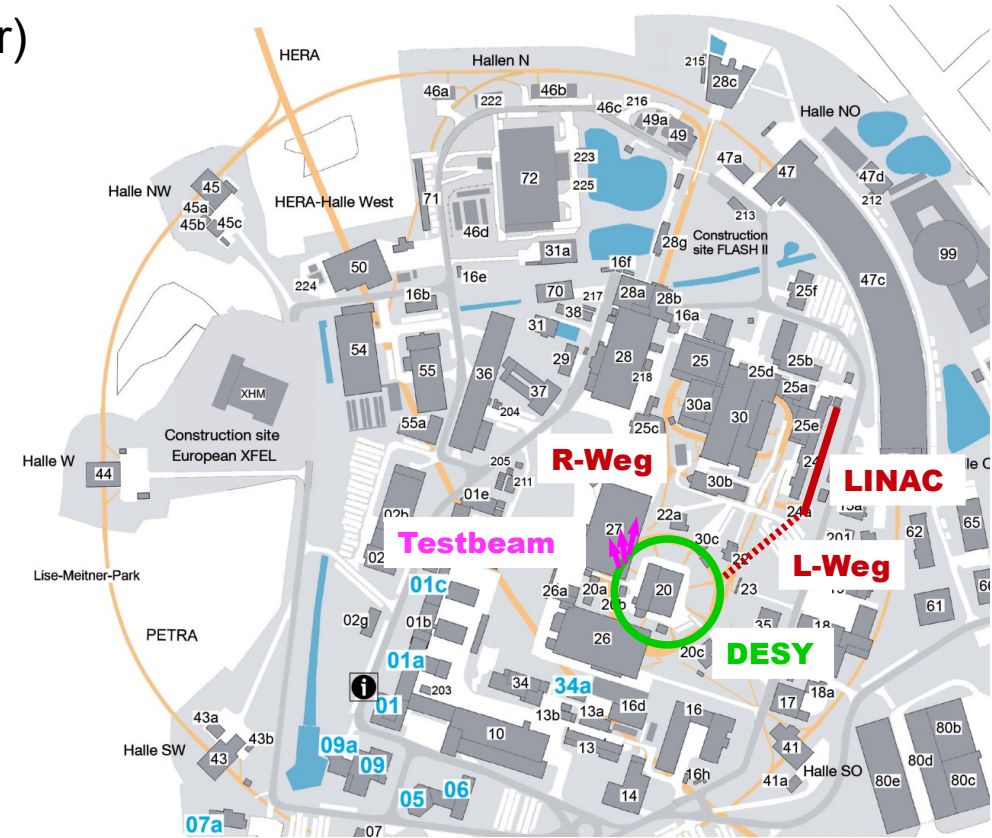
Overview and Beam Generation



Facility

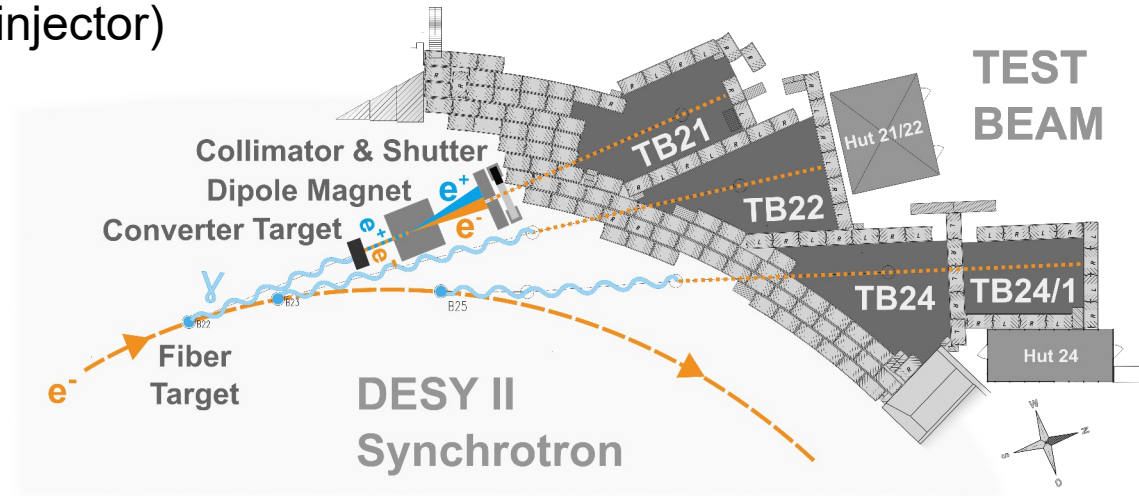
Overview and Beam Generation

- Facility parasitically fed by DESY II synchrotron (PETRA III injector)
 - 1 bunch per fill
 - Energy ramps sinusoidal @ 12.5 Hz between 0.45 and 6.3 GeV
 - Very high availability (~ 99 % uptime)



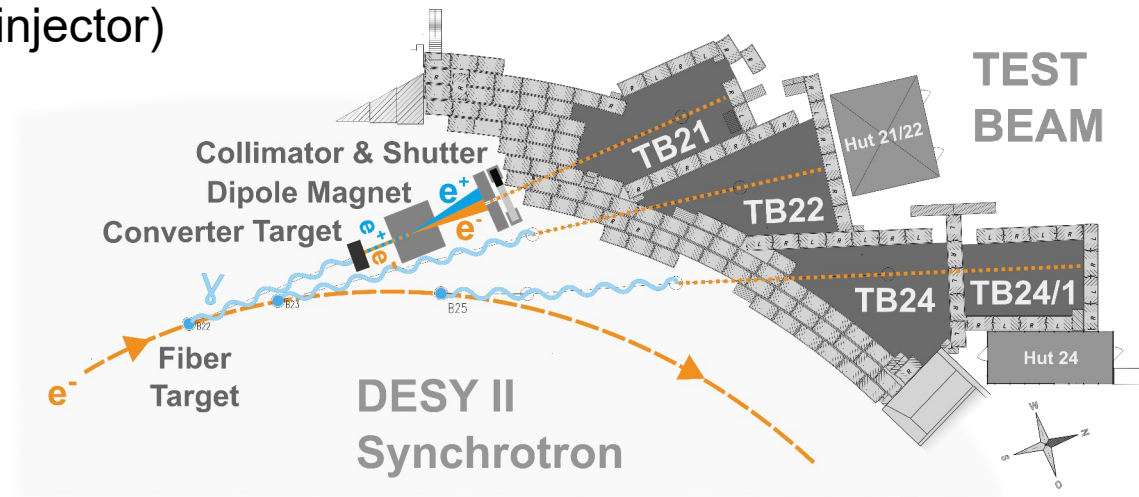
Overview and Beam Generation

- Facility parasitically fed by DESY II synchrotron (PETRA III injector)
 - 1 bunch per fill
 - Energy ramps sinusoidal @ 12.5 Hz between 0.45 and 6.3 GeV
 - Very high availability (~ 99 % uptime)
- Test beam generation:
 - 3 primary carbon fiber targets generate bremsstrahlung photons
 - Conversion at secondary target to e^+/e^- up to 6 GeV
 - Energy selected with dipole / collimator

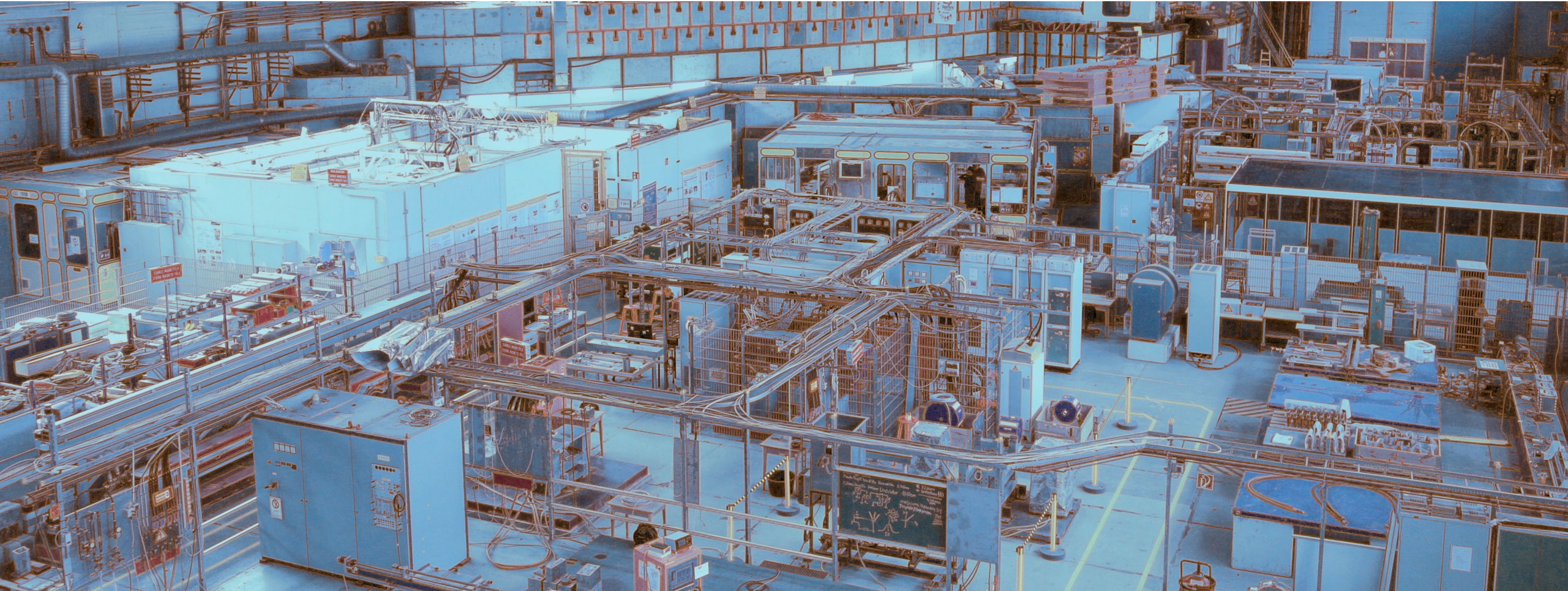


Overview and Beam Generation

- Facility parasitically fed by DESY II synchrotron (PETRA III injector)
 - 1 bunch per fill
 - Energy ramps sinusoidal @ 12.5 Hz between 0.45 and 6.3 GeV
 - Very high availability (~ 99 % uptime)
- Test beam generation:
 - 3 primary carbon fiber targets generate bremsstrahlung photons
 - Conversion at secondary target to e^+/e^- up to 6 GeV
 - Energy selected with dipole / collimator
 - Single electrons, rates $O(10k \text{ particles s}^{-1} \text{ cm}^{-2})$ depending on beam line, energy, converter target, collimation
 - Three individual beam lines, controlled by the user: shutter, area interlock, converter, momentum + collimation



Infrastructure.



Infrastructure

Area and Hall

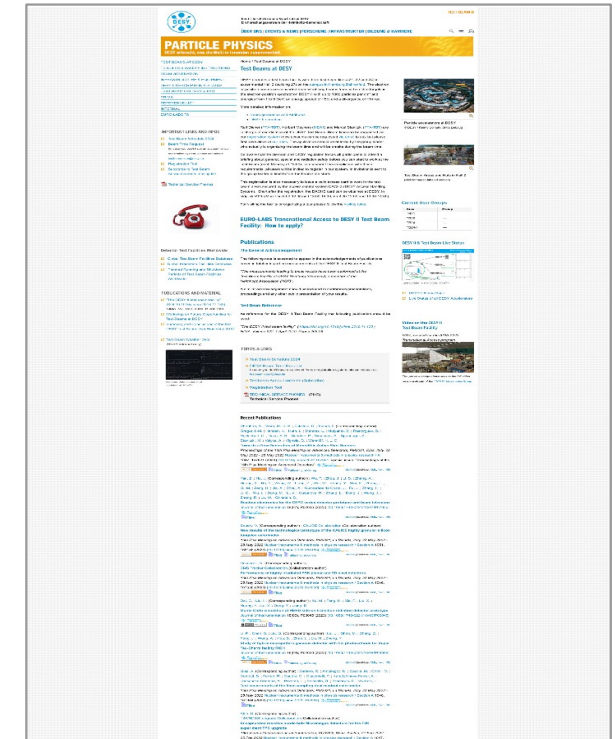
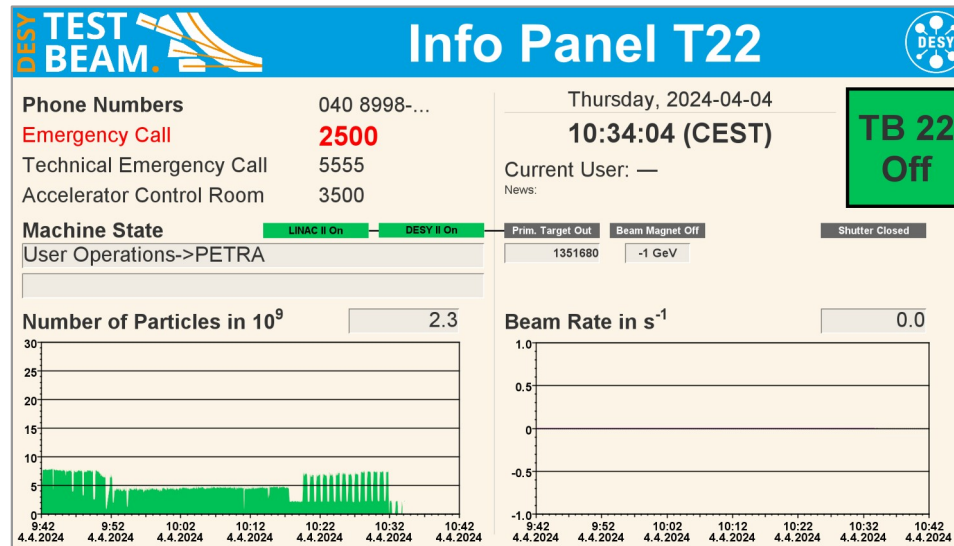
- EUDET-type beam telescope in two areas, ALPIDE based telescope prototype in one (see [presentation by A. Herkert on Wednesday](#))
- Test magnets: SC 1 T solenoid (TB24/1), 1.35 T dipole (TB21)
- And all the other useful things:
 - Remote controlled 1 t and 30 kg stages
 - Hall crane, up to 25 t
 - Remote controlled IP cameras in each area
 - Dry nitrogen, cooling water in each area
 - Gas cabinets in TB22 and TB24, flammable gas mixtures possible
 - Weather stations, slow control system, laser alignment
 - Beam monitors
 - Patch panels: SHV, BNC Coax, Ethernet RJ-45, optical fiber (single and multi-mode)



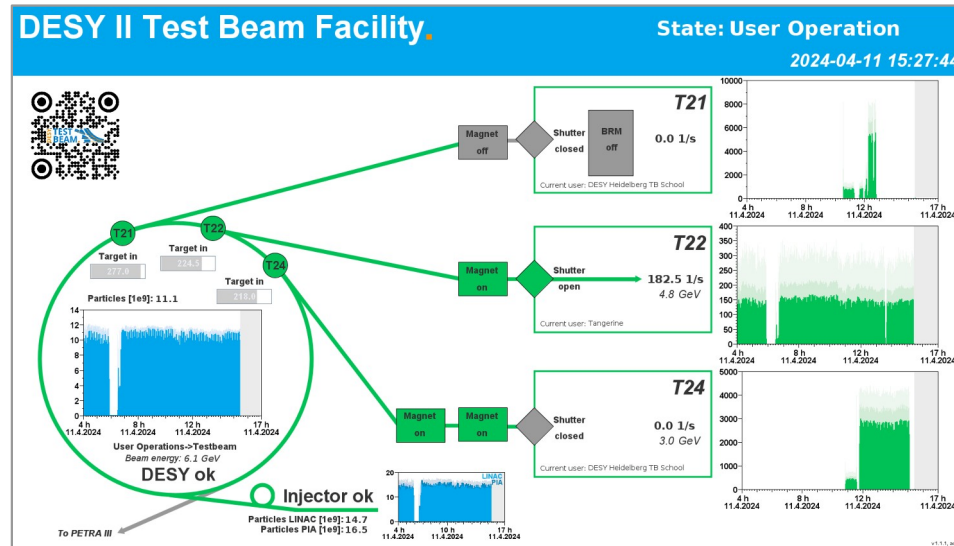
Infrastructure

Info Displays

- In the huts upgraded with beam generation chain



- Facility overview: accessible externally



Registration Application



Beam Time Application

- Move to one single registration tool completed
- Beam time application

DESY 2 Test Beam Controlling

My Beam Time Applications

Applications List

submitted in scheduling scheduled

ID	Status	Area	Telescope	Slot Name	Category	Experiment	Earliest Start	Duration	Latest End	Description	Comments	Hardware	Safety Hazards
4224	Submitted	TB24	-none-	test_exclude	Educat...		2024-03-11	2 weeks	2024-07-21	test 654		AIDA2020 Slow Control System	Use of flammable gases ** Radioactive sources **

1 - 1

DESY 2 Test Beam Controlling

Test Beam Slot Application

Group Leader: Raff Diener | Application Date: 2024-04-04

Group Leader Email: raff.diener@desy.de

Name of the Test Beam Slot (required)

Category (required) | Experiment (optional)

Preferred Test Beam Area (optional) | Telescope (optional)

Possible Period: Earliest Start (required) | Duration (required) | Possible Period: Latest End (required)

Project Description (required)

Hardware (required) *
 CMS-Pixel reference plane
 Rotation stage
 Translation Stages
 AIDA2020 TLU
 AIDA2020 Slow Control System
 PCMAG (Persistent Current, superconducting MAG)
 BRM (big red magnet / MD Dipole)
 TeamViewer
 Gas (aside N2, please specify in project desc.
 Others, please specify in the project description
 --No hardware required--

Safety Hazards (required) *
 Use of flammable gases **
 Lasers brought by user group **
 High voltage
 Magnetic field
 Radioactive sources **
 Hazardous materials will be used **
 Irradiated samples are considered as hazard **
 Others, please specify in project description **
 --No Safety Hazards--

Additional Comments (optional)

Cancel | Send Application | Send Application and Fill Another

Registration Application

Beam Time Scheduling

- Move to one single registration tool completed
- Beam time application
- Scheduling



DESY 2 Test Beam Controlling

Year Select: 2024

Printed best in DIN A3 format

DESY 2 Test Beam Schedule 2024 - Status from 04/APR/2024

DESY 2 Test Beam Coordinators: Ralf Diener, Norbert Meyners, Marcel Stanitzki

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	
04.03.2024	10	ITk Pixel Dortmund	X	ATLAS-ITk-Strips	X			ATLAS HGTD	
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			SHIP-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	
15.04.2024	16	Schwartz-Reisman School		Tangerine	X			ALICE-ITS3	
22.04.2024	17	MDI-2		RD50-MPW4	X			CalVision	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	
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					
17.06.2024	25	CMS ETL ETROC	X	DCRSD	X			CMS ETL	X
24.06.2024	26	CMS Inner Tracker	X	ATLAS-ITk-Strips	X			DDR6-CALICE SIW-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					MIMOSIS	
22.07.2024	30								
29.07.2024	31	BL4S preparation		TelePix	X				
05.08.2024	32	Shutdown		Shutdown		Shutdown		Shutdown	
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								

Registration Application

Beam Time Handling

- Move to one single registration tool completed
 - Beam time application
 - Scheduling
 - User registration
 - Beam time handling
 - Description
 - Hardware requests
 - Safety handling
 - Safety document upload
 - Publication references

Name	Beamline	Start	End	Category	Experiment
FTX-TRK	TB24/1	04-OCT-2021	10-OCT-2021	Linear Collider	LCTPC
FTX-TRK	TB24/1	30-AUG-2021	05-SEP-2021	Linear Collider	LCTPC
Showcase	TB22	30-AUG-2021	05-SEP-2021	Educational	BTTB WS

FH Test Beam Slot

Buttons: Back to the Schedule, Apply Changes, Copy Data from prev. Slot, Invite Group Members

Team Presence: Bar chart showing Total Count and GL On-Site for 7 days.

Form fields:

- Test Beam Line: TB22
- Name of TestBeam Slot: Showcase
- Project Description: This is a slot with dummy information to demonstrate the system.
- Search for Group Leader: Ralf Diener
- From: 30-Aug-2021, To: 05-Sep-2021
- Category: Educational, Experiment: BTTB, Telescope: Lyncris
- Hardware: CMS-Pixel reference plane, Rotation stage, Translation Stages, AIDA2020 TLU, AIDA2020 Slow Control System, PCMAG (Persistent Current, superconducting MAG), BRM (big red magnet / MD Dipole), TeamViewer, Gas (aside N2, please specify in project description), Others, please specify in the project description, --No hardware required--
- Safety/hazard: Use of flammable gases **, Lasers brought by user group **, High voltage, Magnetic field, Radioactive sources **, Hazardous materials will be used **, Irradiated samples are considered as hazard **, Others, please specify in project description **, --No Safety Hazards--

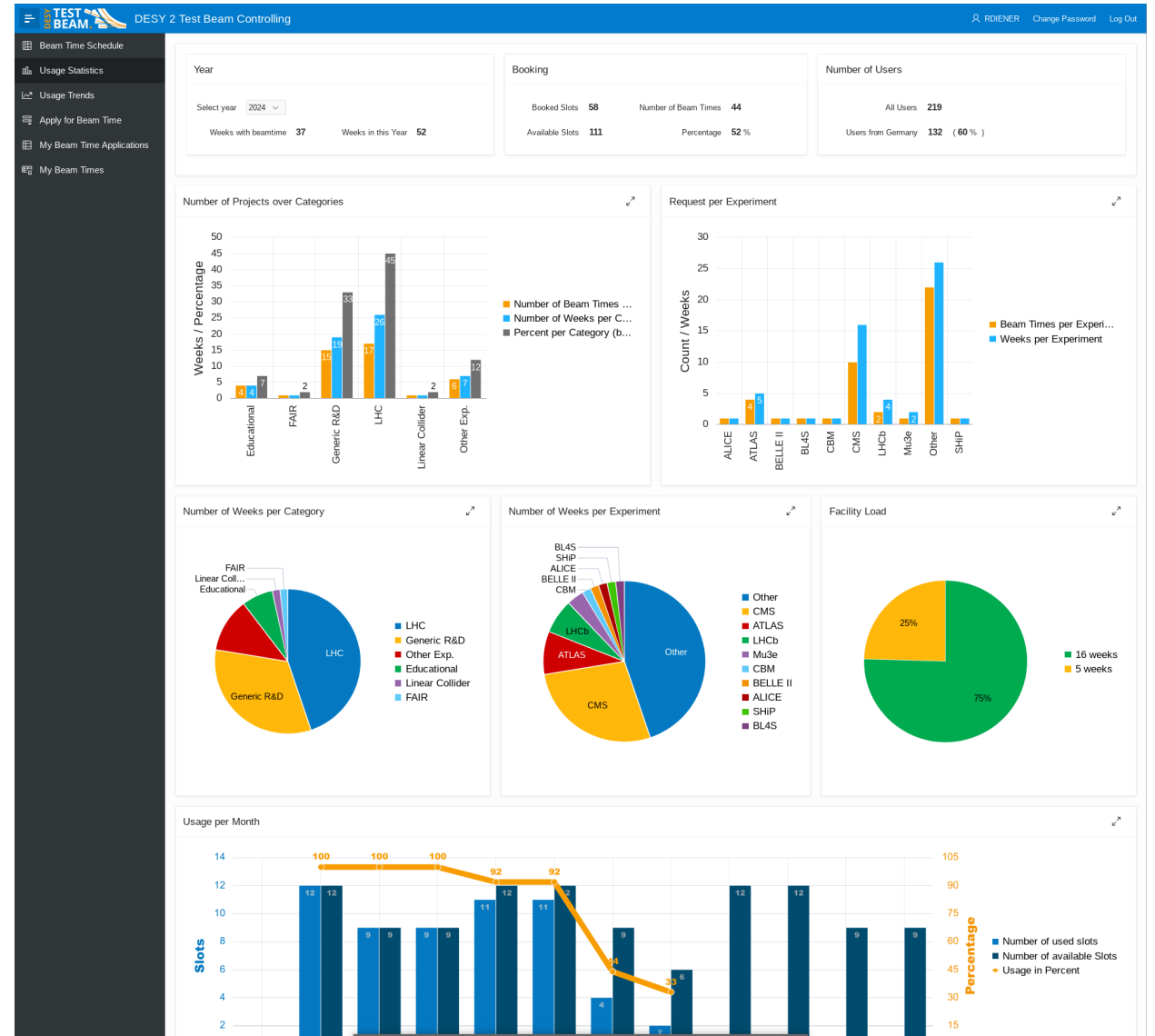
Comments & Attachments: Use this section here only for safety and technical information regarding this test beam slot. This means information and documents like: Dose measurements of irradiated material, information and safety sheets for hazardous and toxic substances (including cooling fluids), technical drawings or photos of the setup/parts, laser properties & safety sheets, risk assessments, etc. All other questions and requests should be sent to the test beam coordinators. This includes visa and invitation letter related information, registration issues, (hardware) requests, shipping labels and tracking information, etc.

Comments/Attachments to this Slot: Reload, Start New Topic, Sample Photo [Ralf Diener]

Registration Application

Statistics

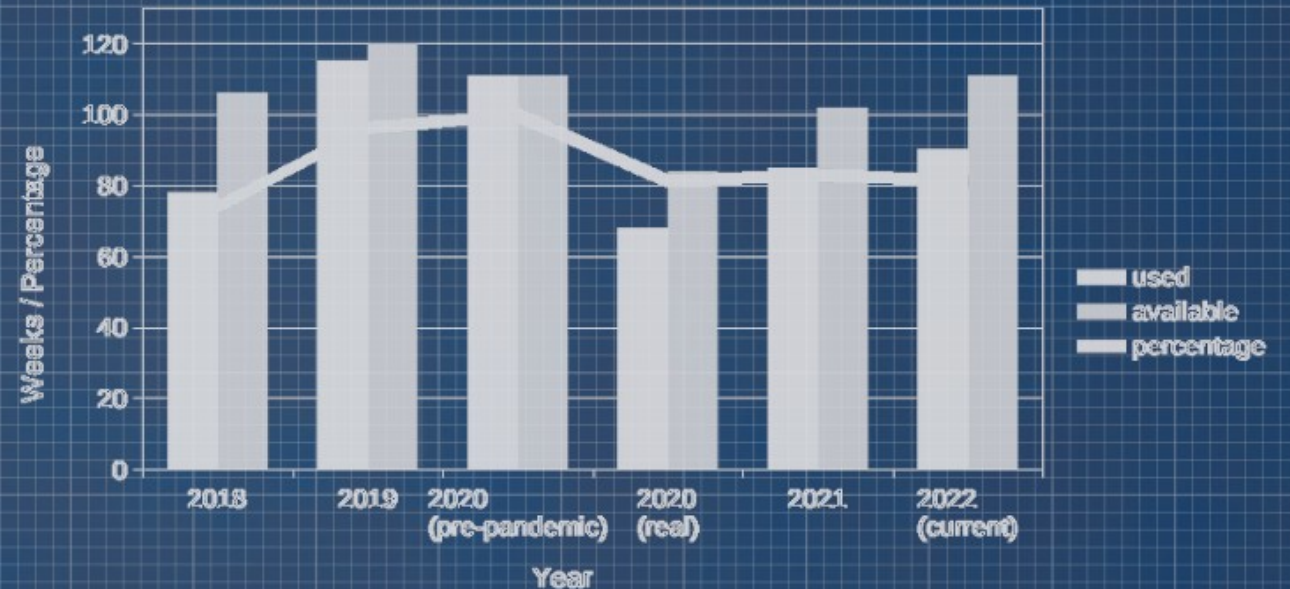
- Move to one single **registration tool** completed
- Beam time application
- Scheduling
- User registration
- Beam time handling
 - Description
 - Hardware requests
 - Safety handling
 - Safety document upload
 - Publication references
- Scientific accounting / key numbers
- Continuously being improved - feedback welcome



Schedule.

Booking, User Statistics, Outreach

The image shows a Gantt chart interface with a grid. It features two main sections: 'Shutdown' at the top and 'Summer Shutdown' at the bottom. Each section contains multiple horizontal bars representing tasks or activities, with various colors and patterns. The bars are organized into columns, likely representing different time periods or projects. The interface includes a vertical axis on the left and a horizontal axis at the bottom.

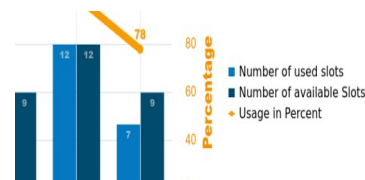


Schedule 2023



Booking/Usage Statistics

- Typical year
 - ... except starting with 3 weeks downtime for energy conservation
- 80 of 102 slots booked (78 %)
- LHC 44 % , generic R&D 40 %
- 400 users, about 30 % first time at the DESY test beam



Startdate	Week	TB21	T	TB22	T	TB241	T	TB24	T
02.01.2023	1	Shutdown		Shutdown		Shutdown		Shutdown	
09.01.2023	2	Shutdown		Shutdown		Shutdown		Shutdown	
16.01.2023	3	Shutdown		Shutdown		Shutdown		Shutdown	
23.01.2023	4	Shutdown		Shutdown		Shutdown		Shutdown	
30.01.2023	5	Shutdown		Shutdown		Shutdown		Shutdown	
06.02.2023	6	Energy Conservation		Energy Conservation		Energy Conservation		Energy Conservation	
13.02.2023	7	Energy Conservation		Energy Conservation		Energy Conservation		Energy Conservation	
20.02.2023	8	Energy Conservation		Energy Conservation		Energy Conservation		Energy Conservation	
27.02.2023	9	Startup		Startup		Startup		Startup	
06.03.2023	10	CMOS Strips Detectors	X	CMS-HGCAL					
13.03.2023	11	DSIPM	X	ATLAS-ITk-Strips	X			Telescope-Dev	X
20.03.2023	12	DSIPM	X	ATLAS-ITk-Strips	X				
27.03.2023	13	MONOPIX2	X	CMS ETL	X			RSD	X
03.04.2023	14	Maintenance		Maintenance		Maintenance		Maintenance	
10.04.2023	15	CEPC Vertex	X	Tangerine	X				
17.04.2023	16	CEPC Vertex	X	BTTB	X			BTTB	X
24.04.2023	17	CMS Inner Tracker	X	TelePix	X				
01.05.2023	18	CMS Inner Tracker	X	TelePix	X				
08.05.2023	19			Tangerine	X			LHCb-ECAL	X
15.05.2023	20	CMS-HGCAL	X	Tangerine	X			LHCb-ECAL	X
22.05.2023	21	Maintenance		Maintenance		Maintenance		Maintenance	
29.05.2023	22								
05.06.2023	23			ATLAS-ITk-Strips	X			LUXE LeadGlass	X
12.06.2023	24	CMS Inner Tracker	X	ATLAS-ITk-Strips	X				
19.06.2023	25								
26.06.2023	26	MONOPIX2	X	Telescope-Dev	X			PSI-MAPS	X
03.07.2023	27	CMS Inner Tracker	X	Belle-II CMOS	X				
10.07.2023	28	CMS Inner Tracker	X	RD50-CMOS	X				
17.07.2023	29	Shutdown		ATLAS-ITk-Strip-DAQ		Shutdown		Shutdown	
24.07.2023	30	Shutdown		Shutdown		Shutdown		Shutdown	
31.07.2023	31	ATLAS-ITk-Strip-Magnet		ATLAS-ITk-Strips		Shutdown		Shutdown	
07.08.2023	32	BL4S	X	Telescope-Dev	X			ATLAS-ITk-SystemTest	
14.08.2023	33								
21.08.2023	34								
28.08.2023	35							CMS-HGCAL	X
04.09.2023	36	BL4S		Tangerine	X			CMS-HGCAL	X
11.09.2023	37	Maintenance		Maintenance		Maintenance		Maintenance	
18.09.2023	38	BL4S	X	ATLAS-ITk-Strips	X			LUXE LeadGlass	X
25.09.2023	39	BL4S	X	ATLAS-ITk-Strips	X			Telescope-Dev	X
02.10.2023	40	TelePix	X	CALICE-Crystal	X			FAST3	X
09.10.2023	41	CMS Inner Tracker	X	CALICE-Crystal	X			ATLAS-HGTD	X
16.10.2023	42	Maintenance		TelePix		Maintenance		Maintenance	
23.10.2023	43	MDI-2		CMOS Strips Detectors	X			MONOPIX2	X
30.10.2023	44	MDI-2		CMOS Strips Detectors	X			MONOPIX2	X
06.11.2023	45	CMS Outer Tracker P5	X	Tangerine	X			ATLAS-HGTD	X
13.11.2023	46	CMS Inner Tracker	X	Tangerine	X			ATLAS-HGTD	X
20.11.2023	47	Maintenance		Maintenance		Maintenance		Maintenance	
27.11.2023	48	CMS Inner Tracker	X	ATLAS-ITk-Strips	X			IPHC-CE65_v2	
04.12.2023	49	CMS ETL ETROC	X	ATLAS-ITk-Strips	X			LHCb-ECAL	
11.12.2023	50	CMS ETL ETROC	X	Tangerine	X			LHCb-ECAL	
18.12.2023	51			Tangerine	X				
25.12.2023	52	Shutdown		Shutdown		Shutdown		Shutdown	

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

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	
04.03.2024	10	ITk Pixel Dortmund	X	ATLAS-ITk-Strips	X			ATLAS HGTD	
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			SHIP-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	
15.04.2024	16	Schwartz-Reisman School		Tangerine	X			ALICE-ITS3	
22.04.2024	17	MDI-2		RD50-MPW4	X			CaIVision	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	
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					
17.06.2024	25	CMS ETL ETROC	X	DCRSD	X			CMS ETL	X
24.06.2024	26	CMS Inner Tracker	X	ATLAS-ITk-Strips	X			DDR6-CALICE SIW-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					MIMOSIS	
22.07.2024	30								
29.07.2024	31	BL4S preparation		TelePix	X			EIC AC-LGAD	
05.08.2024	32	Shutdown		Shutdown		Shutdown		EIC AC-LGAD	
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	

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/



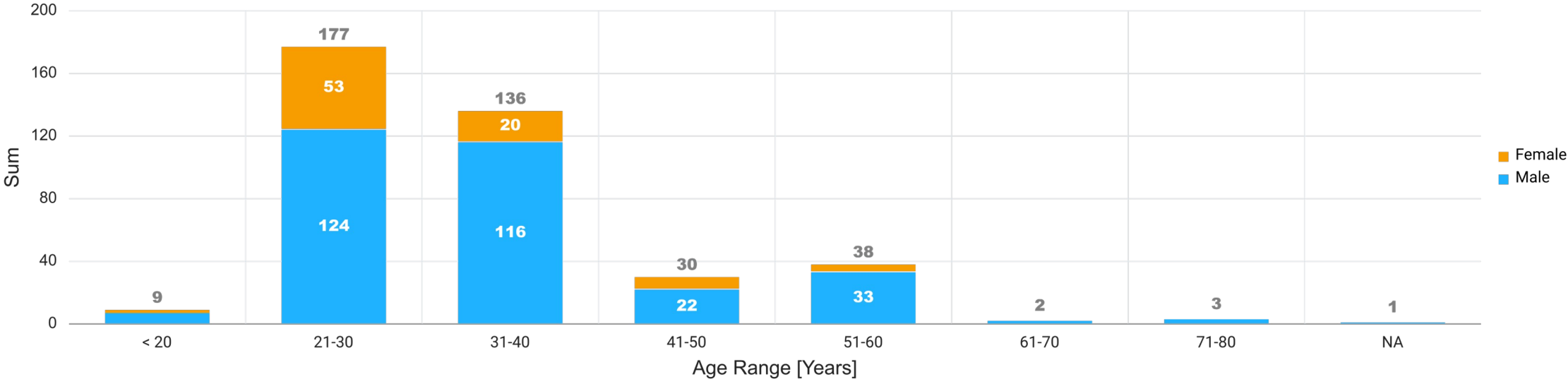
Startdate	Week	TB21	T	TB22	T	TB241	T	TB24	T
01.01.2024	1	Shutdown		Shutdown		Shutdown		Shutdown	
08.01.2024	2	Shutdown		Shutdown		Shutdown		Shutdown	
15.01.2024	3	Shutdown		Shutdown		Shutdown		Shutdown	
22.01.2024	4	Shutdown		Shutdown		Shutdown		Shutdown	
29.01.2024	5	Startup		Startup		Startup		Startup	
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	
04.03.2024	10	ITk Pixel Dortmund	X	ATLAS-ITk-Strips	X			ATLAS HGTD	
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			SHIP-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	
15.04.2024	16	Schwartz-Reisman School		Tangerine	X			ALICE-ITS3	
22.04.2024	17	MDI-2		RD50-MPW4	X			CaIVision	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	
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					
17.06.2024	25	CMS ETL ETROC	X	DCRSD	X			CMS ETL	X
24.06.2024	26	CMS Inner Tracker	X	ATLAS-ITk-Strips	X			DDR6-CALICE SIW-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					MIMOSIS	
22.07.2024	30								
29.07.2024	31	BL4S preparation		TelePix	X			EIC AC-LGAD	
05.08.2024	32	Shutdown		Shutdown		Shutdown		EIC AC-LGAD	
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	

Outreach and Education

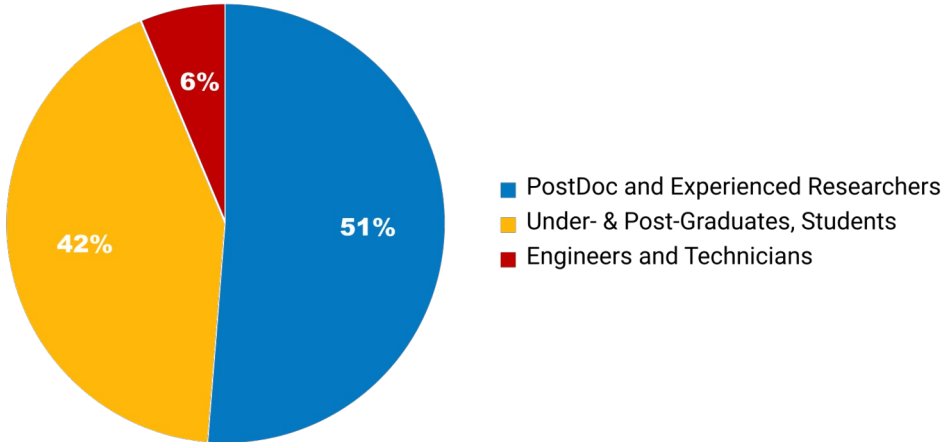


Test Beam Users

- Age distribution: it's a young people's game (close to 50 % 30 years or younger; 70% under 35 years)



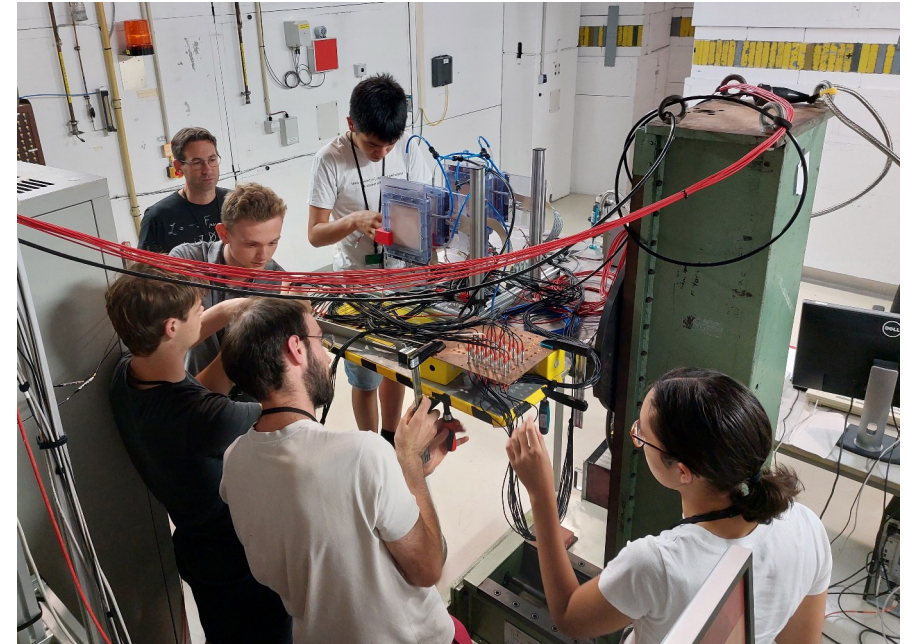
- Most of our users are students or early-career postdocs



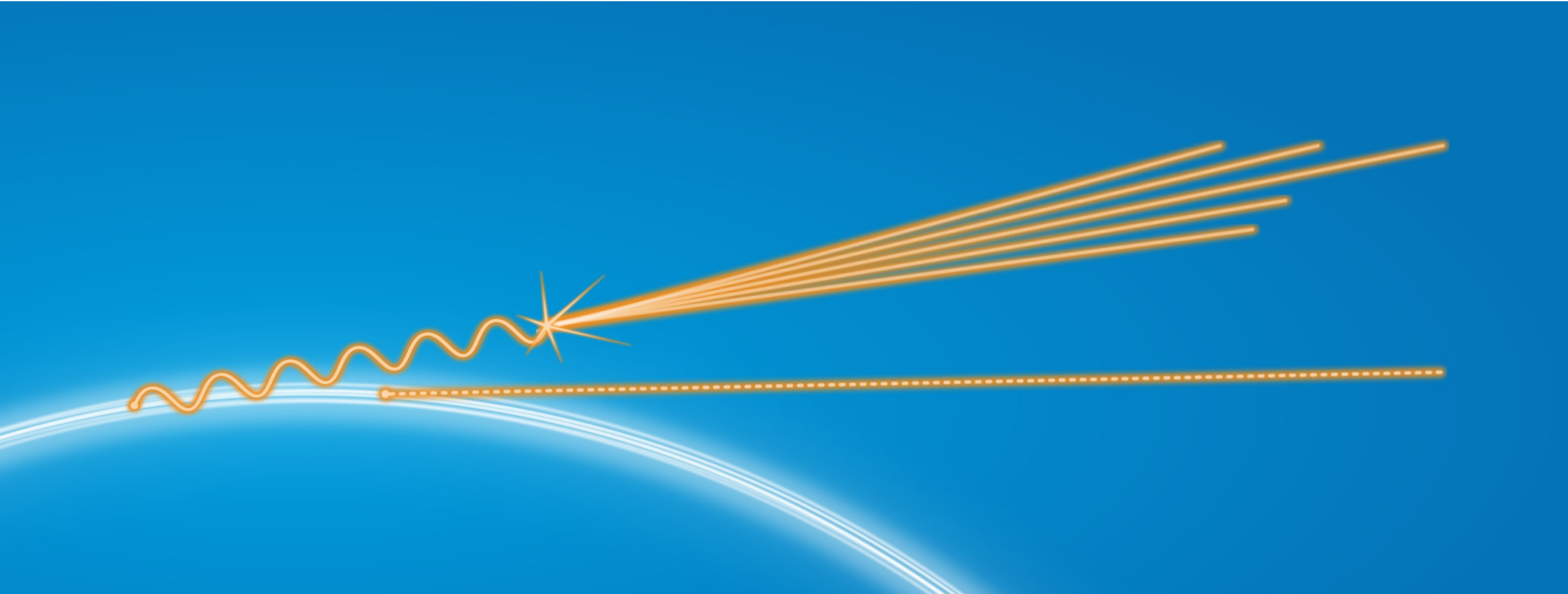
Outreach and Education

On-site Activities

- BTTB 11 in 2023 with hands-on tutorial at 2 beam lines
- [DESY Summer Student Program](#)
 - Undergraduate students join day-to-day work
 - In 2023, TelePix2 studies; foreseen for this year again → see [Poster of A. Wintle on Wednesday](#)
- [Beamline 4 Schools](#)
 - Competition for high school students, parallel at CERN and DESY
 - In 2023, at DESY “Wire Wizards” with self-build wire chambers → see [presentation on Thursday](#)
 - Proposal submission for 2024 ended 10 April
- [HighRR Testbeam School @ DESY](#) – last week
 - Hands-on course at DESY with silicon devices, timing detectors and calorimetry incl. introductory lectures



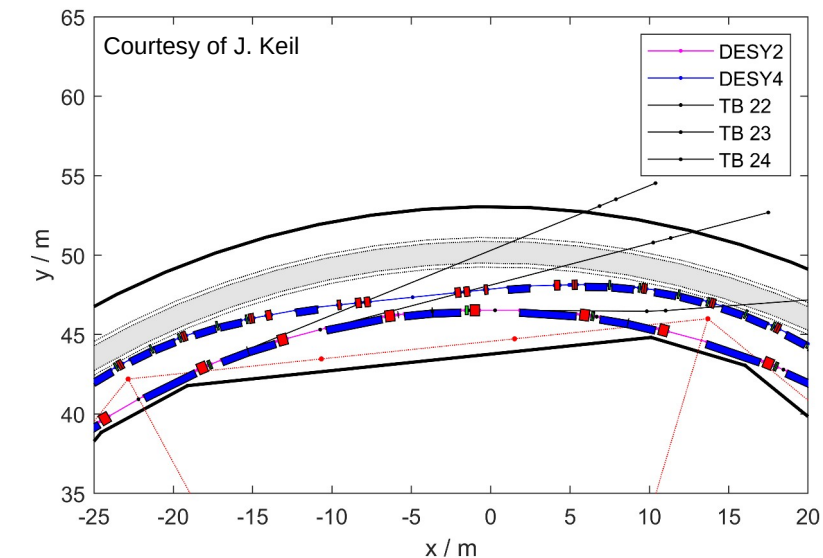
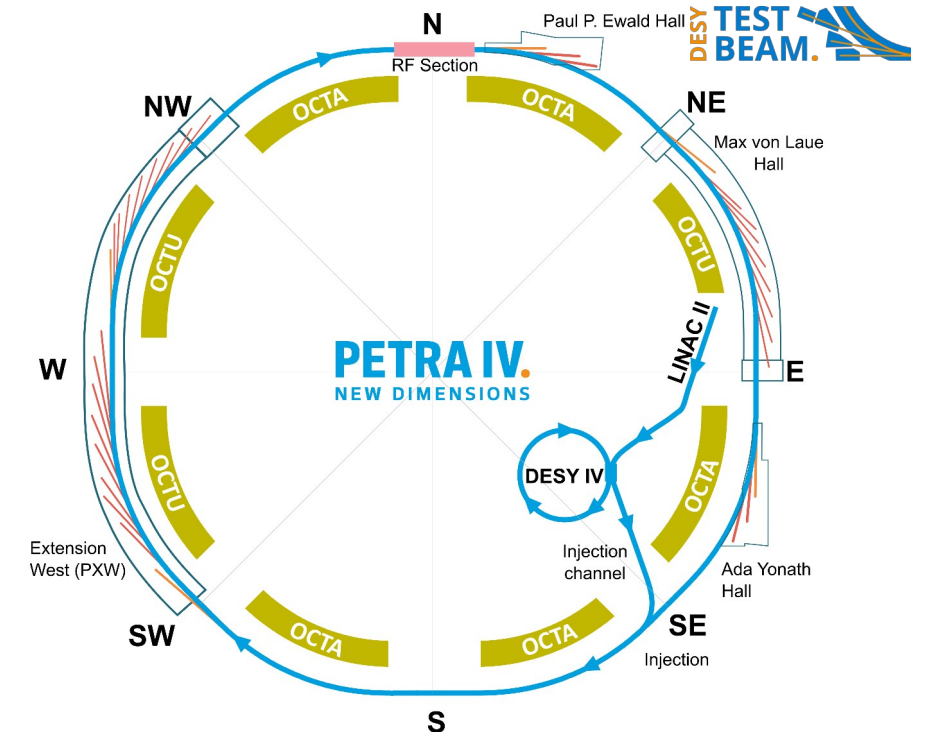
Test Beam Future.



We want to upgrade...

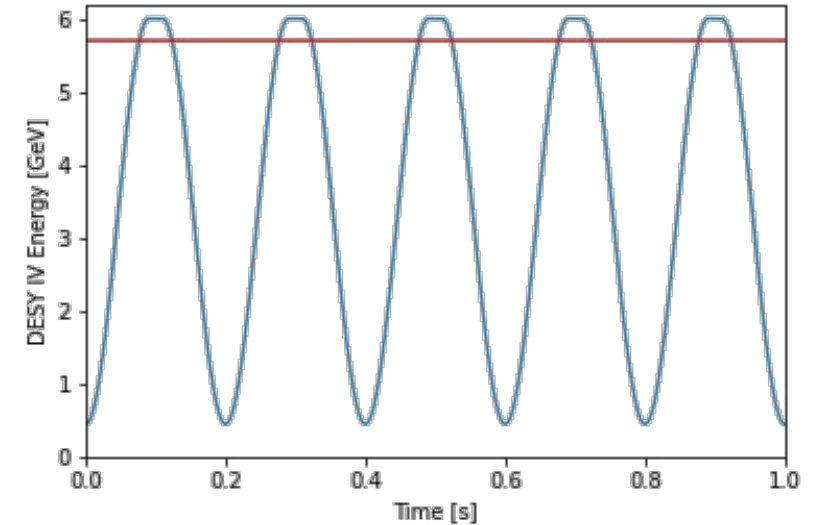
... and might have to

- DESY is planning a new synchrotron light source: PETRA IV
 - DESY II is not optimized to deliver electron bunches with necessary parameters
 - DESY II has been build in 1985 – almost 40 years old
- PETRA IV plans with a new booster synchrotron: DESY IV
 - 5 Hz cycles with a 20 ms flat-top at 6 GeV
 - Smaller emittances (350 nm rad → 19 nm rad)
 - Different magnetic lattice with more than twice the number of magnets
 - Space for targets limited, position changes
- Darktime is planned to start 4 years after political approval

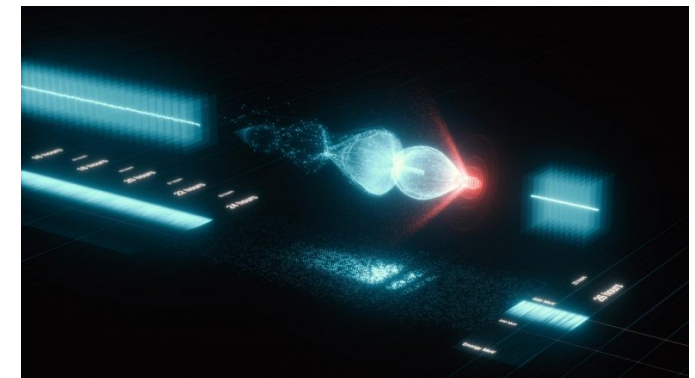


What it is and why we might not get it.

- DESY IV, as in the project proposal, is the baseline
 - 8-fold symmetry with 8 straight sections, each approx. 5 m long:
 - 1 for injection
 - 1 for extraction
 - 5 for accelerating RF structures
 - 1 for Test Beam installations
- A laser-plasma accelerator (LPA) as injector at 6 GeV is in the project proposal
 - A booster is not needed if the LPA works to specification with the given availability (> 99 %)
 - It is not yet clear if the LPA can do this from the start of darktime
- Currently there are studies if DESY II can be used until LPA is at full specs
 - It needs refurbishments
 - The final decision will be on directorate level
 - DESY IV is the baseline



20 ms flat-top at 6 GeV,
90 ms ramp-down to 450 MeV,
90 ms ramp-up

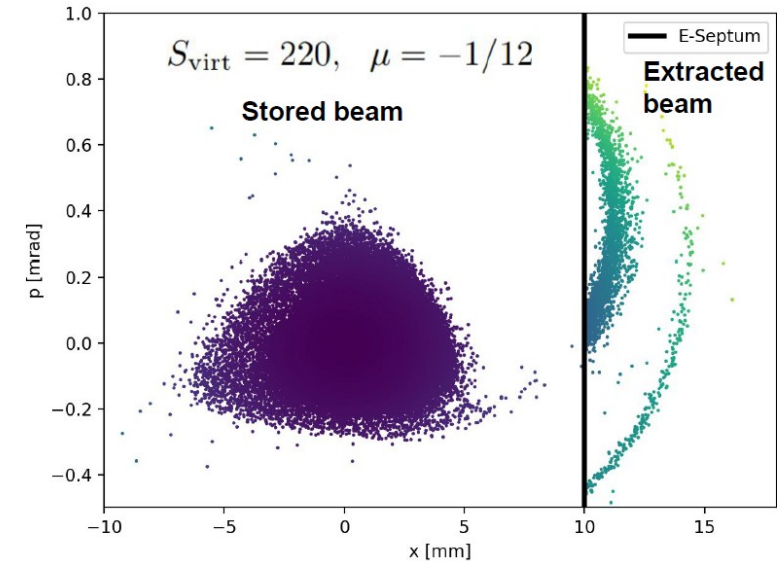


Test beams at DESY IV

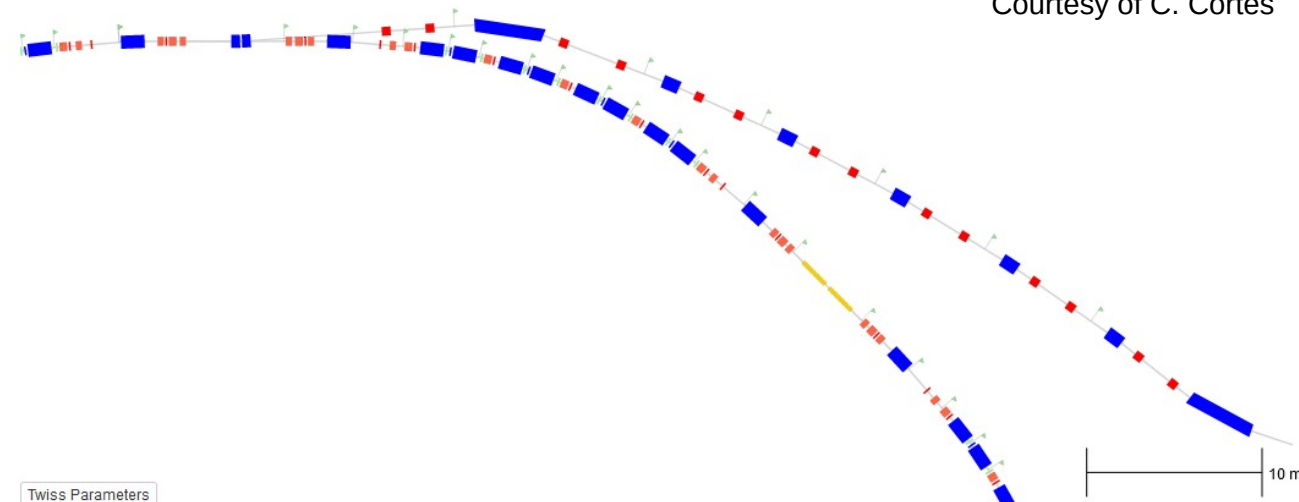
Current idea

- The DESY IV baseline enhances expected particle rates by a factor of 2
- But 5 m space is too short to have 3 targets with angular separation
 - Generate the secondary beam outside the synchrotron
 - Extract to get a portion of the beam, then use targets
- DESY IV was designed to work only 6 min in 1 hour
 - Magnets, cooling, infrastructure have to be able to support permanent operation
 - Still, about 80% of the time the beam energy is insufficient to drive test beams (less than 5.7 GeV)
- Design the magnets for DC operation at 6 GeV
 - Mitigate the detrimental effects, improve efficiency
 - Enhance particle rates by a factor of ~ 10
 - Higher costs (Invest, Power consumption, ...)

DESY4 hor. phase space



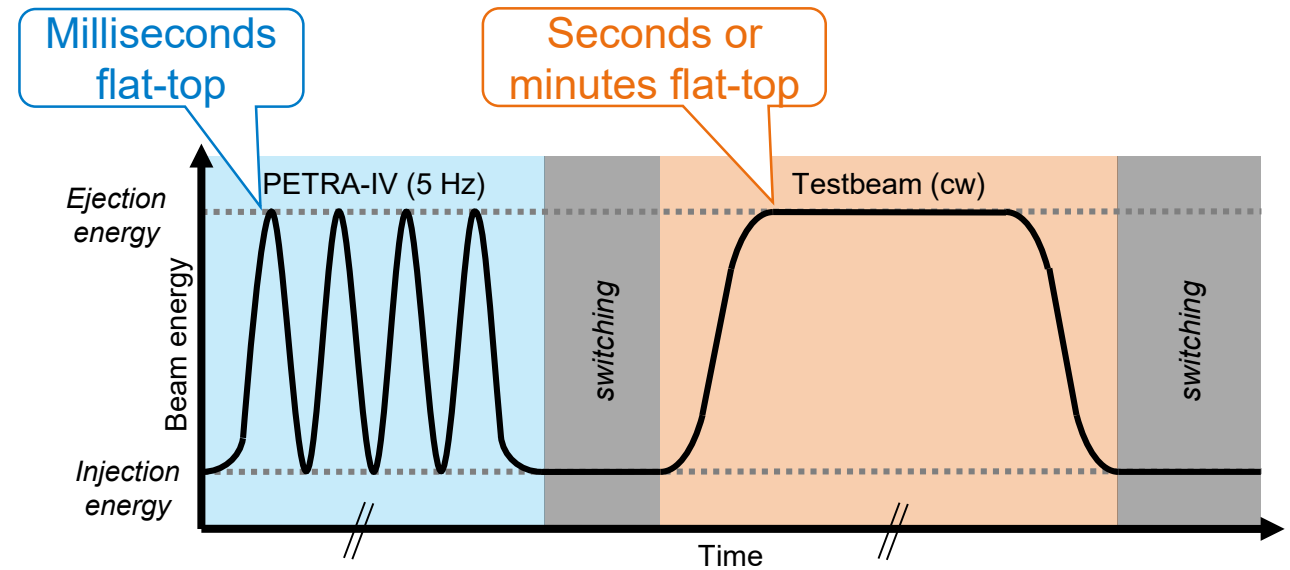
Courtesy of C. Cortés



If tomorrow never comes...

What if DESY IV will not be build?

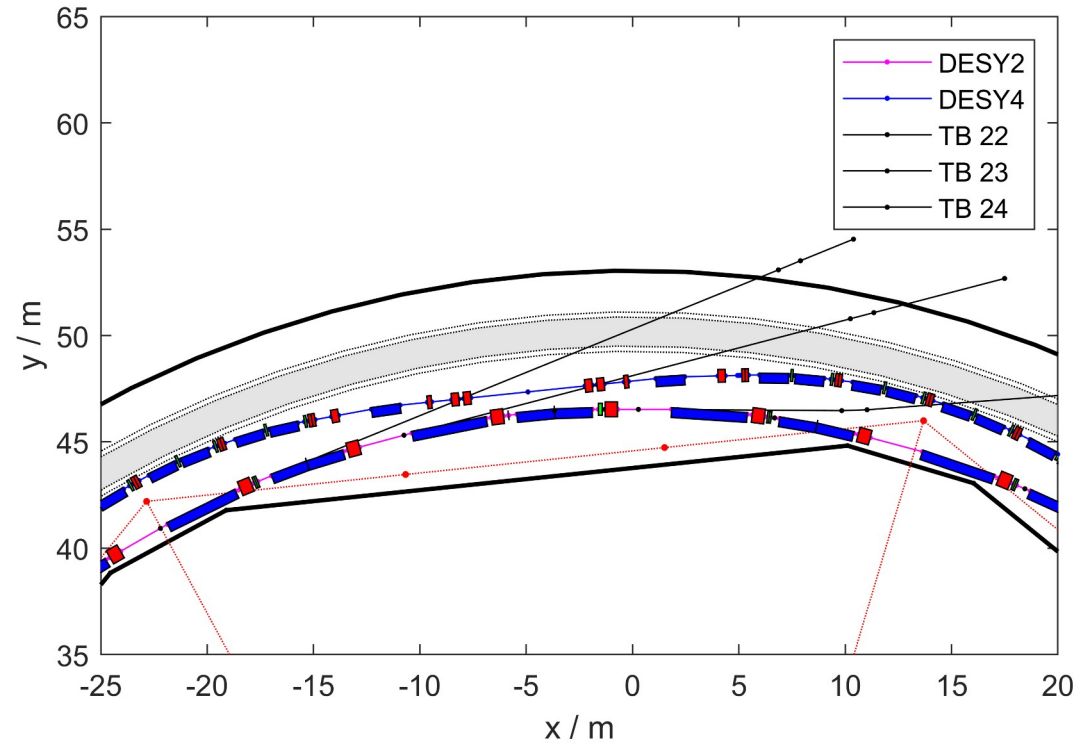
- What will happen if DESY IV is not build?
 - As long as DESY II runs, so does the Test Beam
 - No improvements on the accelerator
 - If LPA proves to be reliable, DESY II will be shut down
- The upgrade plan
 - Refurbish the magnets, targets, cables, ...
 - Prepare DESY II for DC operation at 6 GeV
 - Inject from the LPA also into DESY II
 - Inject multiple bunches
 - Overall rate increase by a factor of 100



DESY II: A new idea

Return of the Test Beam

- DESY IV DC and Resonant extraction
 - Requires an electron beam line
 - Is difficult to set up
 - Uses a lot of electrical energy
- DESY II and DESY IV could coexist in the tunnel
 - DESY II is changed to a storage ring at 6 GeV
 - DESY IV serves PETRA IV, then injects into DESY II, and sleeps for the next 10 minutes
 - Apart from injection → independent machines
- Advantages:
 - DESY II consumes less energy than DESY IV
 - DESY IV is not disturbed, and can be built cheaper (no CW/DC needed)
 - Target based secondary generation possible



Also in the future

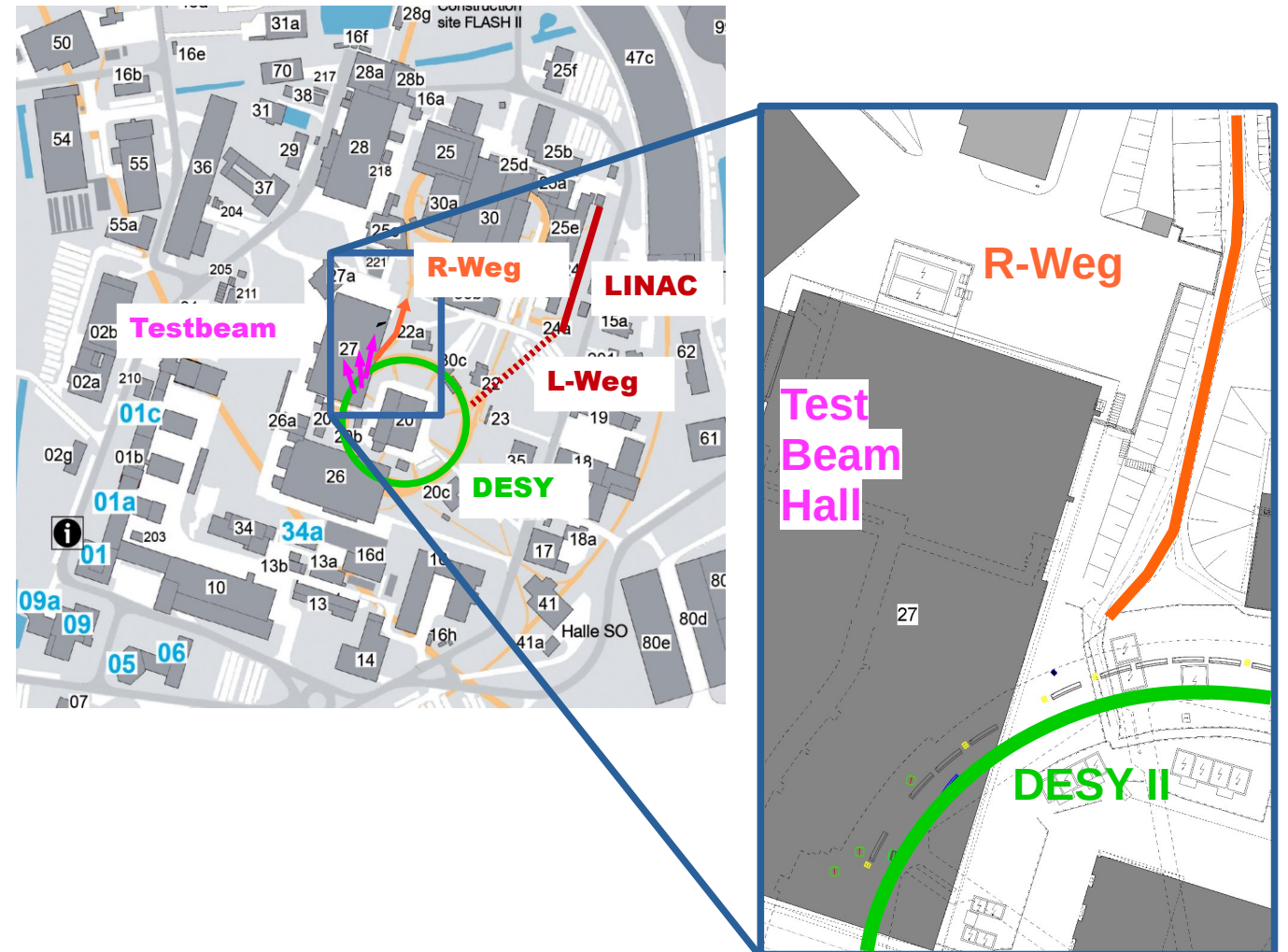
- The impact of the DESY Test Beam User Facility on the international detector community is well understood
 - PETRA IV project group is aware of the importance of the Test Beam
 - The Test Beam Group is always working to improve and adapt the Facility
- Decisions are still awaited
 - From the Federal Ministry of Education and Research on the PETRA IV project funding
 - From the DESY directorate on what will happen with the test beam
- **Take away message: We have a plan for all of the possible scenarios**

We want to thank the members of the PETRA IV project group, and the project leaders R. Bartolini and H. Reichert, for the useful discussions and support

PRIMA / R-Weg

Direct Electron-Beam Line

- PRIMA: **PRIM**ary-beam test **A**rea in the “R-Weg” using the (dumped) direct DESY II electron beam
 - High intensity electron beam
- Study to prove feasibility of the concept
- See [presentation by D. Kim](#) directly after



Closing Remarks

Web, Publication, Acknowledgments, Contact

- More information can be found on our web page: testbeam.desy.de
- And in the reference publication: *"The DESY II test beam facility"* <https://doi.org/10.1016/j.nima.2018.11.133> ,
NIMA, Volume 922, 1.4.2019, Pages 265-286
- Please include this acknowledgment in publications, presentations etc. based on data from DESY test beam:
 - *"The measurements leading to these results have been performed at the Test Beam Facility at DESY Hamburg (Germany), a member of the Helmholtz Association (HGF)."*
 - Please add AIDA and EURO-LABS acknowledgments where applicable:
 - AIDA 2020: *"This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement no. 654168."*
 - AIDA Innova: *"This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under grant agreement No 101004761."*
 - EURO-LABS: *"The research leading to these results has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement no. 101057511."*
- Contact: testbeam-coor@desy.de

