The Accelerator

- DESY II
  - 6.3 GeV electron storage ring
  - Single bunch operation
  - Continuously ramping energy
  - Energy cycle of 80 ms
  - Injection every 160 ms
- Main purpose:
  Injector for PETRA III
- DESY TB as parasitic user
Beam Generation

- Carbon fiber targets (7 um) insertable at three positions in DESY II
  - Bremsstrahlung, $E < 6.3$ GeV
- Pair conversion at secondary targets (aluminum & copper sheets)
  - Electrons / Positrons, $E < 6.3$ GeV
- Single $e^+ / e^-$ Beam defined by further dipole magnets and collimators
  - Selection of polarity and particle momentum
  - Rate dependent on beamline, momentum and collimation
Beam Parameters

• Energy range: 1 GeV – 6.3 GeV
• Energy spread: ~ 150 MeV
• Beam size: few mm – few cm
  • Collimator sizes selected by users
• Beam divergence: 1 mrad
• Maximum repetition rate: 1 MHz
Infrastructure I

- 30 kg and 1 ton stages, 25 t crane
- Patch panels: Gb-Ethernet, optical fiber, BNC, S-HV
- Movable, high-res IP cameras
- Dry nitrogen, cooling water, gas cabinets
- Beam monitor
- Common slow control system
- Two (three) EUDET-type beam telescopes
Infrastructure II

- Superconducting 1 T solenoid in TB 24/1
  - Usable diameter ~ 75 cm
  - On movable stage
- Dipole magnet in TB 21 (~1.5 T)

- Common slow control system
  - Measure magnetic field, temperature, humidity, pressure, flow, ADC, ...
  - EUDAQ implementation ready
Operation 2019
Users 2019

- Again dominated by LHC based experiments
  - ATLAS, CMS, LHCb, ALICE

- Linear Collider R&D ongoing
  - CLIC, CALICE, ...

- Further detector R&D
  - Mu3e, SHiP, T2K, CBM ...

- Education & Outreach growing:
  - Since 2019: Beamline for Schools
  - Summer Students
  - EDIT2020
  - 2020: Continue teacher’s program
User Statistics 2019

- Total number of users: 702
  - Highest value in history

- Users from 31 countries (institute locations)

- 120 weeks available – 115 weeks allocated
User Statistics 2019

- Total number of users: 702
  - Highest value in history
- Users from 31 countries (institute locations)
- 120 weeks available – 115 weeks allocated
- Doubled the number of users compared to 2018
- High demand due to CERN accelerator shutdown
User Statistics 2019

- Total number of users: 702
- Highest value in history
- Users from 31 countries (institute locations)
- 120 weeks available – 115 weeks allocated
- Doubled the number of users compared to 2018
- High demand due to CERN accelerator shutdown
- Schedule for 2020 is already full
- Parasitic usage on request (when operationally possible)
- Waiting list → Contact us
A Glimpse into the Future
Interlock System

✔ New system in operation since February 2019
  • Replaced 30 years old system
  • New doors, new blinking lamps, new tableaus, new search buttons, new emergency off buttons
  • Similar logic, slightly different routine
  • Hall access also secured via DESY access system
Infrastructure Projects 2020

- Primary Target System
  - Simplify and reduce time for the exchange of broken carbon fibers
    - Currently: Ventilating a full sector of DESY II → 48 hrs swap time
    - Future: Ventilating of a stub → 6 hrs swap time
    - *Installation in 2020*

- Test Beam Hall renovation
  - ✔ Updated power distribution for TB, scheduled for the entire building 2020
    - Window replacement *First half of 2020*

- Beam telescopes
  - EUDET + X *see presentation by L. Huth, Wednesday*
  - LYCORIS *see presentation by U. Krämer, Thursday*
Improving Beam Parameters

- Multi-bunch operation of DESY II
  - Increased particle rate (x2 with four bunches)
  - Tests performed in 2019 – promising results in terms of particle rate
  - But …
    - Potential reduction of target lifetime
    - Activation issues at primary target station T22
    - Reduction of beam lifetime
    - Impact on PETRA III operation must be avoided at all cost
  - Further tests after installation of new primary target system 2020
Towards DESY IV

- PETRA III → PETRA IV (2025 – 2027)
- Newly built pre-accelerator foreseen: DESY IV
- Keeping the DESY Test Beam Facility in operation has an *essential* role during this upgrade
- Options:
  - Usage of DESY IV for test beam production
  - Resonant extraction at DESY IV
  - Maintain the DESY II storage ring and use it mainly for test beams

Test Beams at the PETRA IV Complex
Due to their central role for detector development in particle physics, nuclear physics, photon science and beyond, the availability of electron/positron test beams is essential.

PETRA IV CDR, Nov. 2019
New Beam Line: R-Weg

- Usage of the DESY II beam
- Downstream shift of the beam dump
- Parameters:
  - Intensity: $1 \times 10^8$ – $2 \times 10^{10}$ particles/bunch
  - Repetition rate: 12.5 Hz
  - Extraction energy: 450 MeV – 6.3 GeV
- Status:
  - ✔ Preparations in DESY II tunnel
  - ☐ Preparations in the R-Weg ongoing
    - Installation of further equipment
    - Interlock system installation
- Goal: First beam in Summer 2020
New Beam Line: R-Weg
Conclusions
Conclusions

• DESY II Test Beam Facility
  • Three beam lines with electrons/positrons at up to 6 GeV
  • 2019: 96 % beam line utilization with all-time high of users
  • 2020: Schedule already filled – parasitic use possible on request

• Upgrades:
  • Interlock system, Hall renovation, Target system
  • General infrastructure, Beam reference telescopes
  • 4th Beam line → R-Weg

• PETRA IV upgrade as major game changer
  • Test beam strongly supported @DESY
  • Future realization options under discussion

Acknowledgements
The excellent performance of the DESY II Test Beam Facility would not be possible without the great support from the FH and M divisions and the DESY management

Contact
http://testbeam.desy.de
testbeam-coor@desy.de
Call for your Support

- We have to justify the test beam facility to keep
- Please always include the following acknowledgment sentence in all publications, presentations and posters based on data taken at the DESY II 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)"

- Also, don't forget the AIDA(2020) acknowledgments where appropriate:

  "This project has received funding from the European Union’s Horizon 2020 Research and Innovation programme under Grant Agreement no. 654168."

  or the short version

  “Supported by the H2020 project AIDA-2020, GA no. 654168.”