

The DESY II Test Beam Facility

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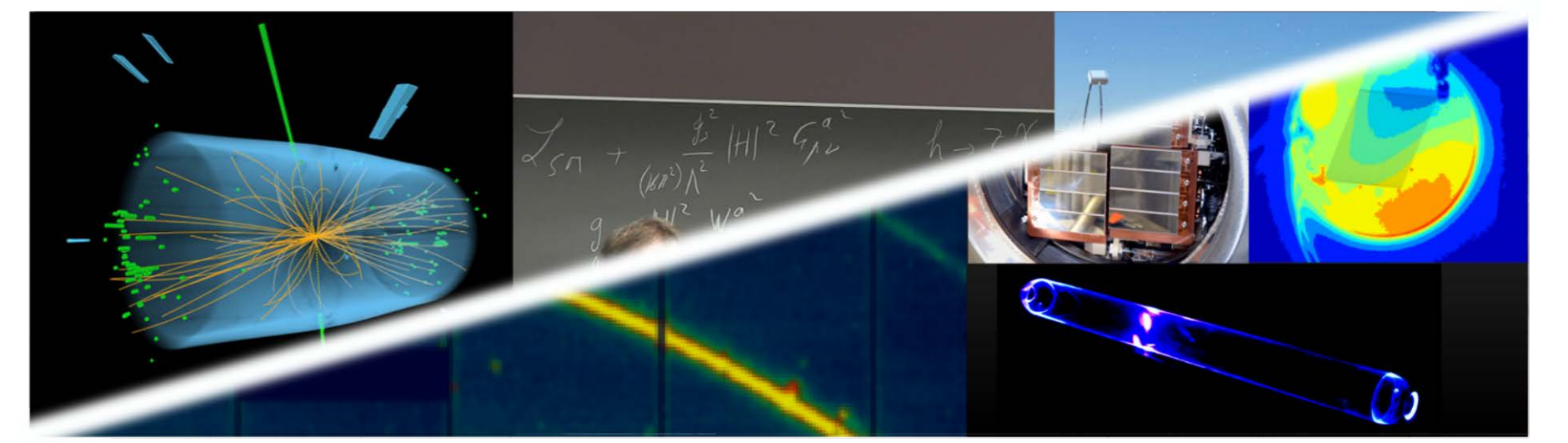


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The DESY II Test Beam Facility.



Jan Dreyling-Eschweiler & Paul Schütze

Matter and the Universe & Matter and Technologies
Experimental Particle Physics & Detector Development

Beam Lines & Infrastructure: Enabling detector research

Purpose & Performance

Three independent electron beam lines are available for the detector research & development community:

- 1 to 6 GeV/c electrons or positrons
- Beam divergence of about 1 mrad
- Quasi-continuous particle flux of $O(1 \text{ kHz/cm}^2)$

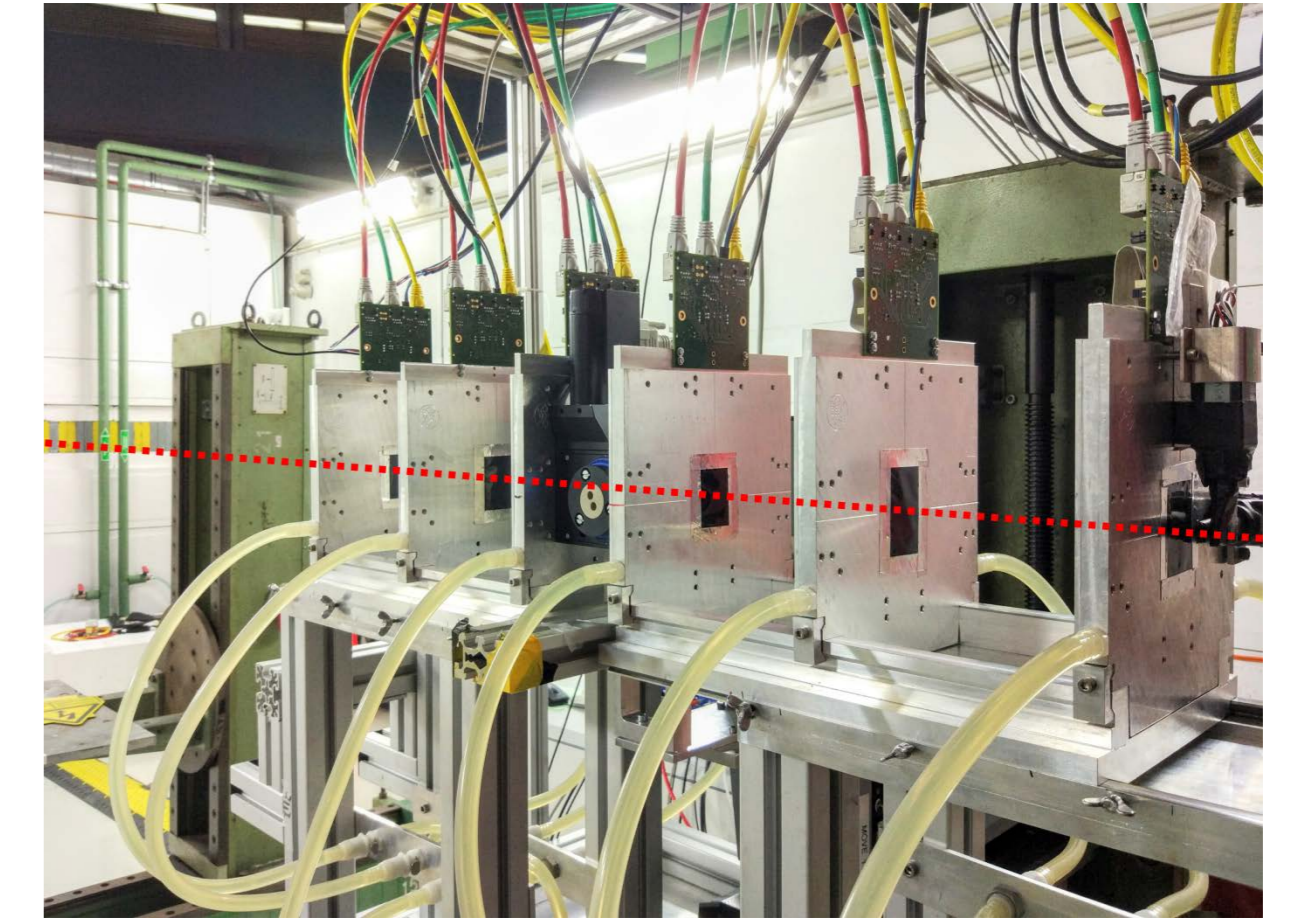
User Operation & Infrastructure

- Open access
- Test Beam areas for experimental setup
- Measurement huts for remote monitoring and control
- Various tools and instruments
- User support

Precise Infrastructure: Pixel Beam Telescopes

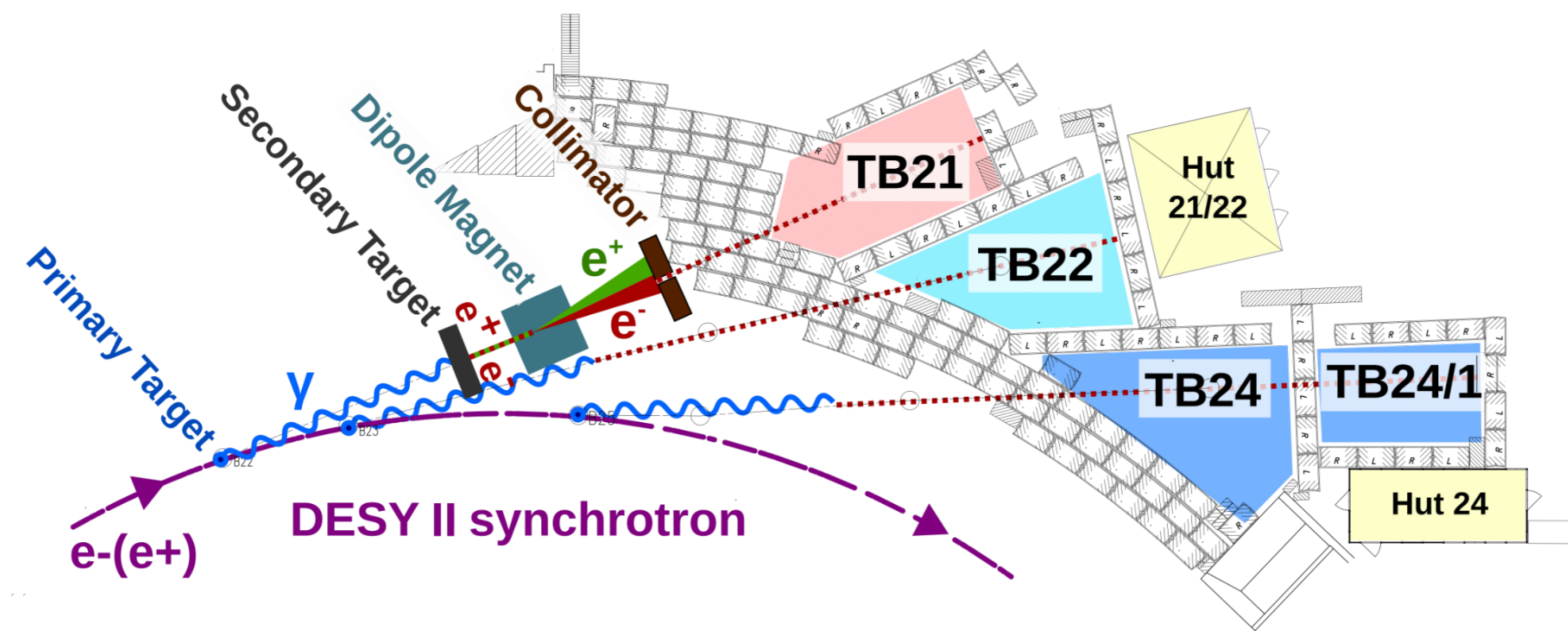
EUDET-type telescopes in TB21 and TB22 as reference tracker:

- Defined hardware and common DAQ interfaces
- $1 \times 2 \text{ cm}^2$ sensitive area
- Up to $2 \mu\text{m}$ pointing resolution
- About 2 kHz trigger rates



Substantial Infrastructure: Large Magnets

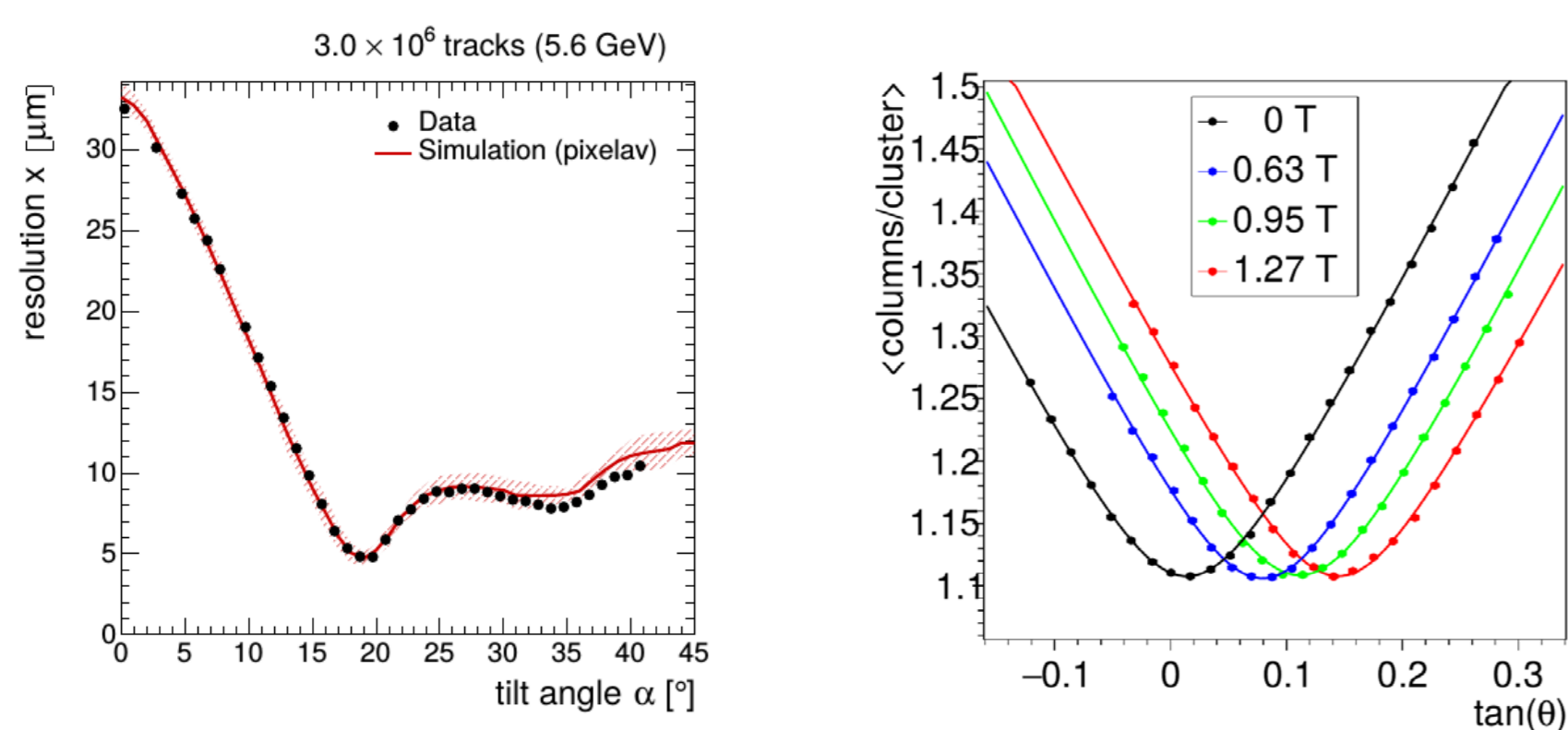
- 1.3 T dipole in TB21
- 1.0 T solenoid in TB24/1



Selected Results & Highlights: From research to production

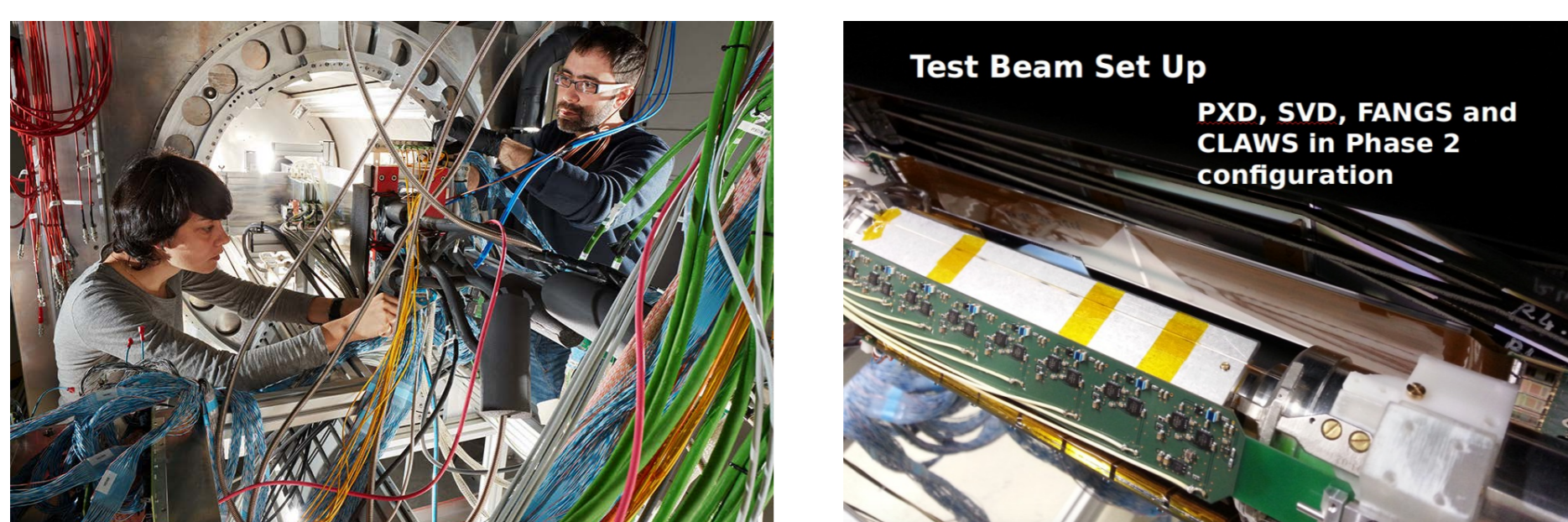
Characterization: Tracking Sensors for LHC

- Prototyping for the CMS Pixel Detector Phase I upgrade
- Resolution & efficiency & irradiation studies
- Lorentz angle measurements (Rotation & B-field)



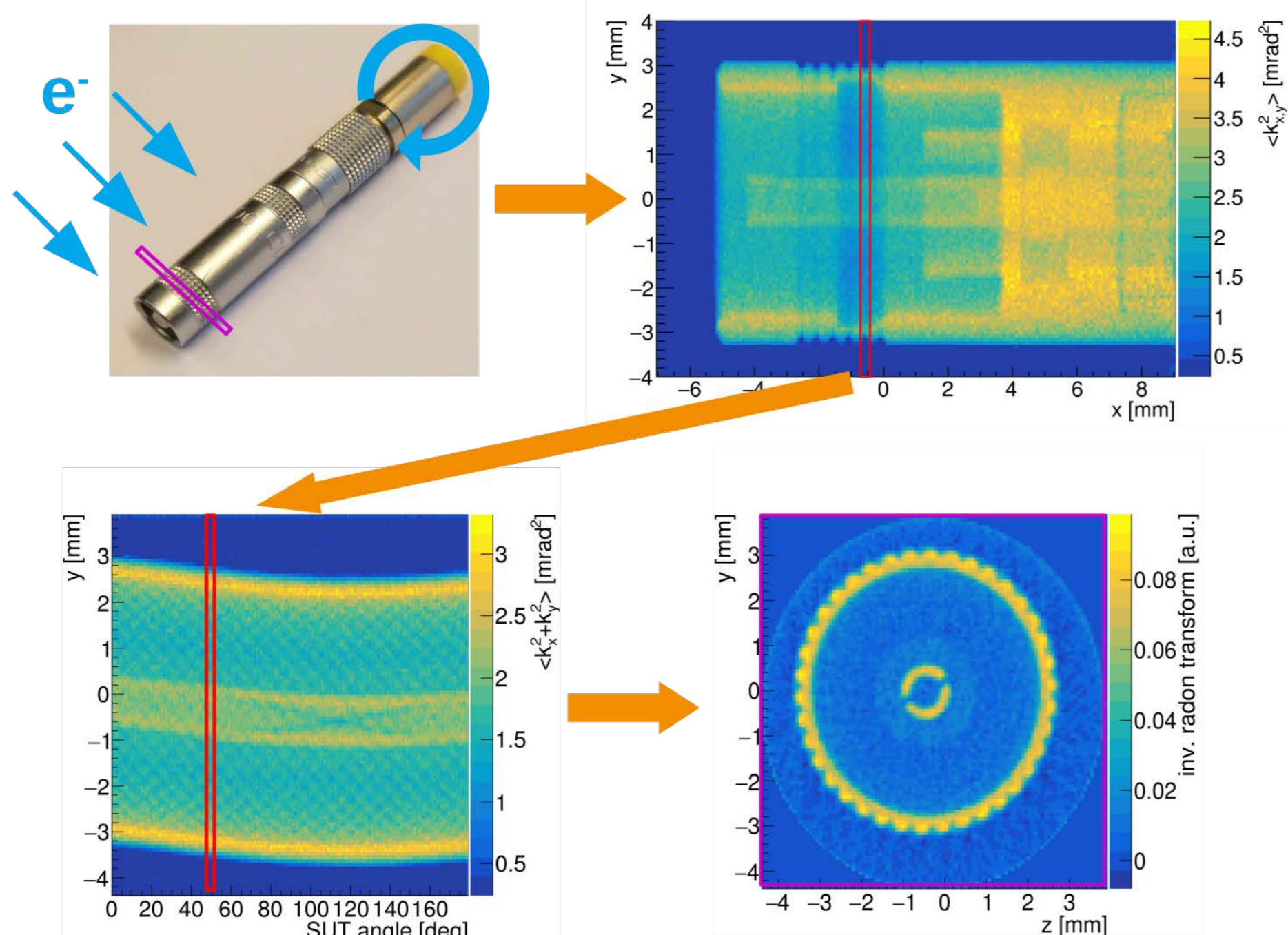
Integration: Belle II Vertex Detector

- 6 weeks of test beam in 2016 and 2017
- Beam telescope and Vertex Detector in 1T solenoid
- Commissioning for Phase 2 at KEK, Japan in fall 2017



Imaging: Material Budget & Tomography

- DESY energies and telescope resolution match the requirements
- Radiation length studies for future detectors
- Tomography (3D imaging)



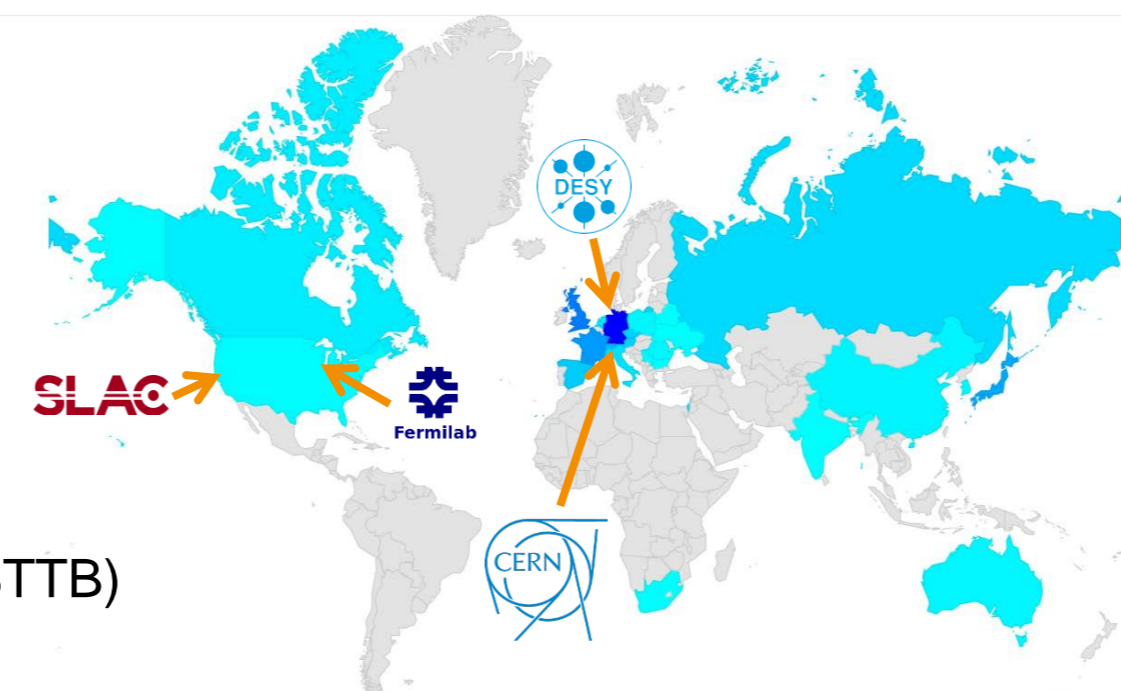
Users & Support: Local experts for the community

Manpower & Funding

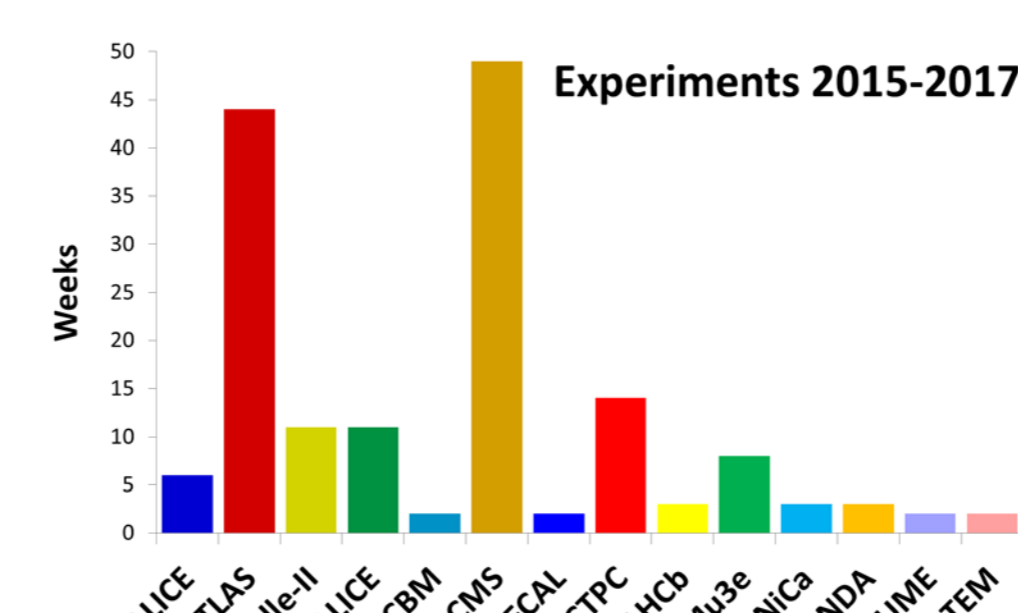
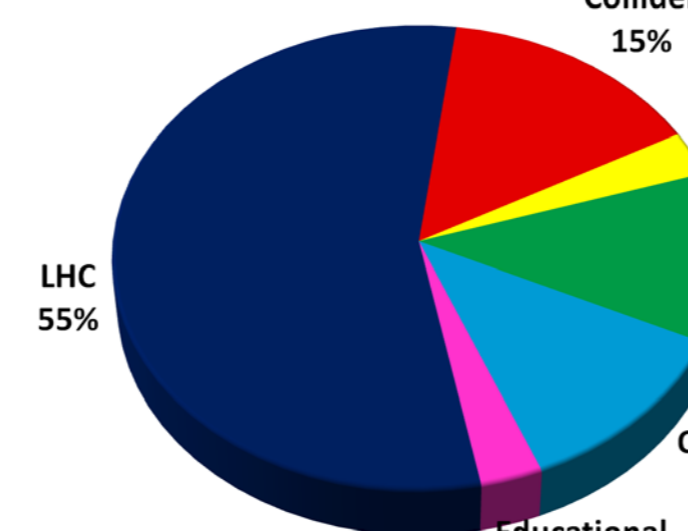
- Since 1988 continuous development of the facility
- Local experience and support from ATLAS, CMS, FLC and M
- Continuous European support (FP6, FP7, H2020)
- Open access for the international R&D community

User & Experiments

- Detector development for particle physics and beyond
- People in 2016: 300 users of 21 countries
- Primary request: 75% telescope usage
- Yearly community workshop (BTTB)



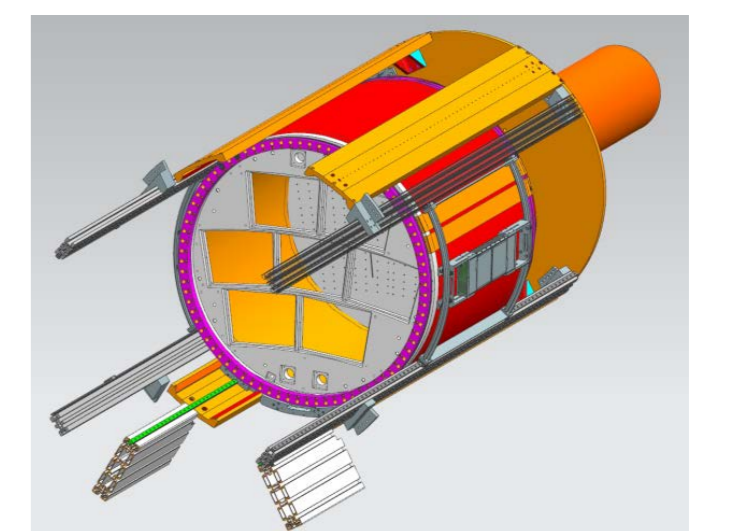
Usage 2015-2017



Improvements & Future: Challenging user needs

Ongoing Improvements

- Maintenance and user support
- General infrastructure and user access
- Development of a permanent Strip Telescope for 1T solenoid in TB24/1



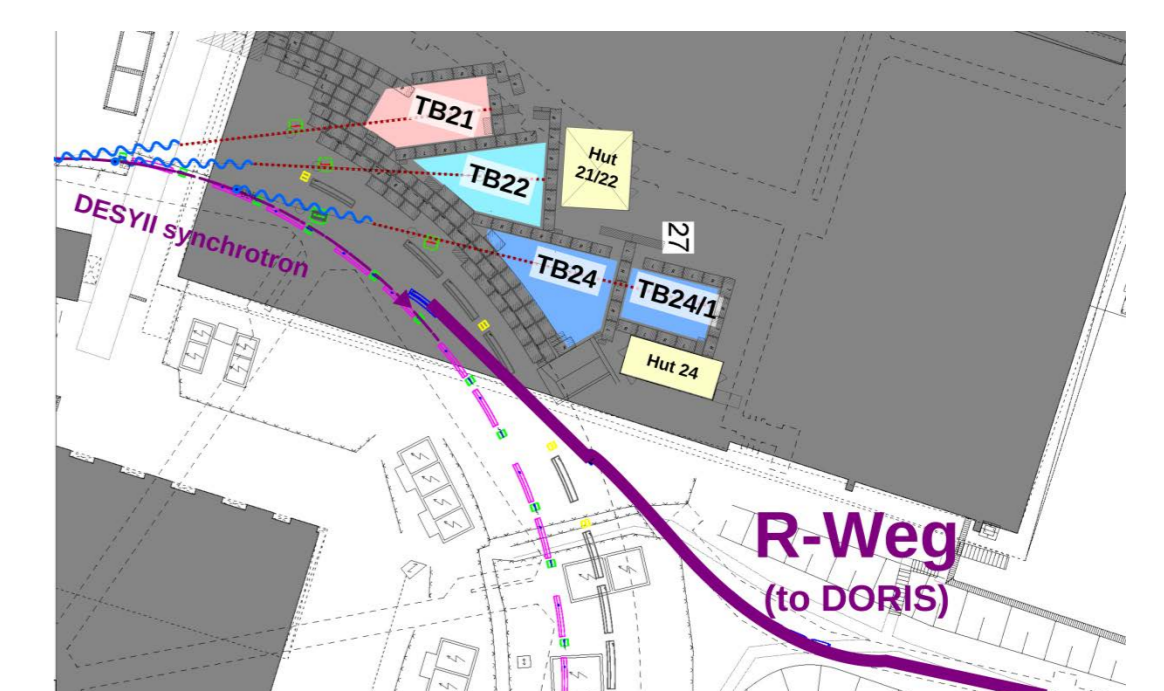
Future Opportunities Workshop

- 5./6. October 2017 at DESY, Hamburg
- Results & needs of 15 experiments
- White Paper as collaborative output



Future plans & possibilities

- Bridge CERN TB shutdown 2019/2020
- Multi-bunch operation for higher rates
- 4th beam line having a direct extraction



Career & Outreach: A hands-on experience

Education & Skills

- Experimental particle and nuclear physics
- Measurement instrumentation
- System integration
- Project management

For young researchers

- Various aspects of detector development
- 2-5 students per year in the DESY Summer Student program
- 1-3 PhD theses per year at the DESY groups



For teachers

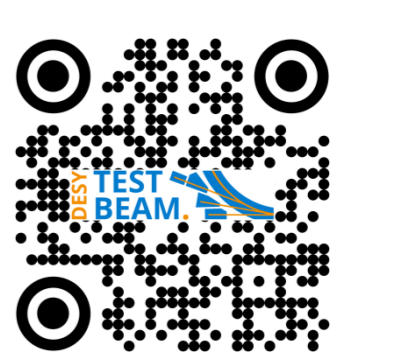
- Unique opportunity for a hands-on in particle physics
- Since 2016: One week of advanced training per year
- Energy measurements using a calorimeter



Contact & References

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