Welcome to DESY.

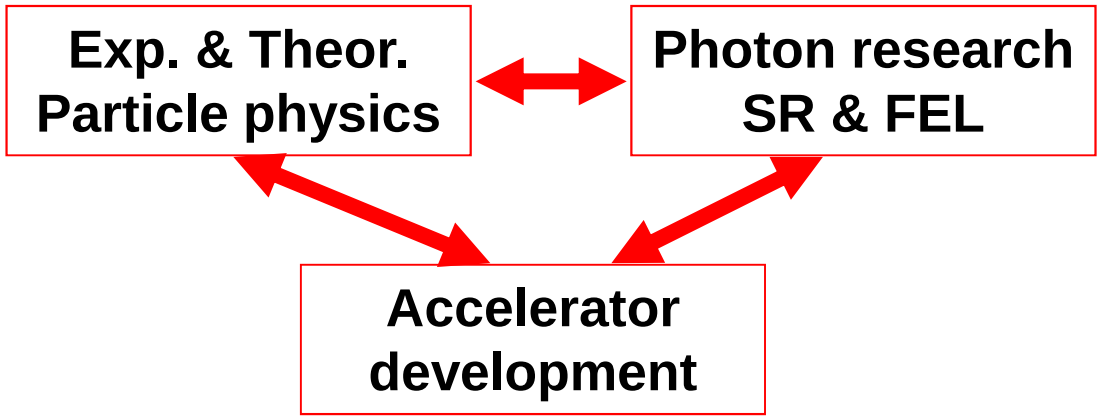
Joachim Mnich
Director for Particle and
Astroparticle Physic

Plenary ECFA
DESY, July 24, 2014

HELMHOLTZ GEMEINSCHAFT

DESY

- **DESY has a long successful history in three areas of basic science and high tech :**
  - **Particle physics,**
  - **Research with X-rays (synchrotron radiation) and**
  - **Accelerator development.**
- **These topics stimulate each other and constitute the basis for the future of the laboratory.**



DESY fact sheet

- **DESY was founded in 1959**
- **Mission:** **development, construction, operation and scientific exploitation of particle accelerators**

  provide access to national and international users
- **Nationally funded research institute, but internationally used**

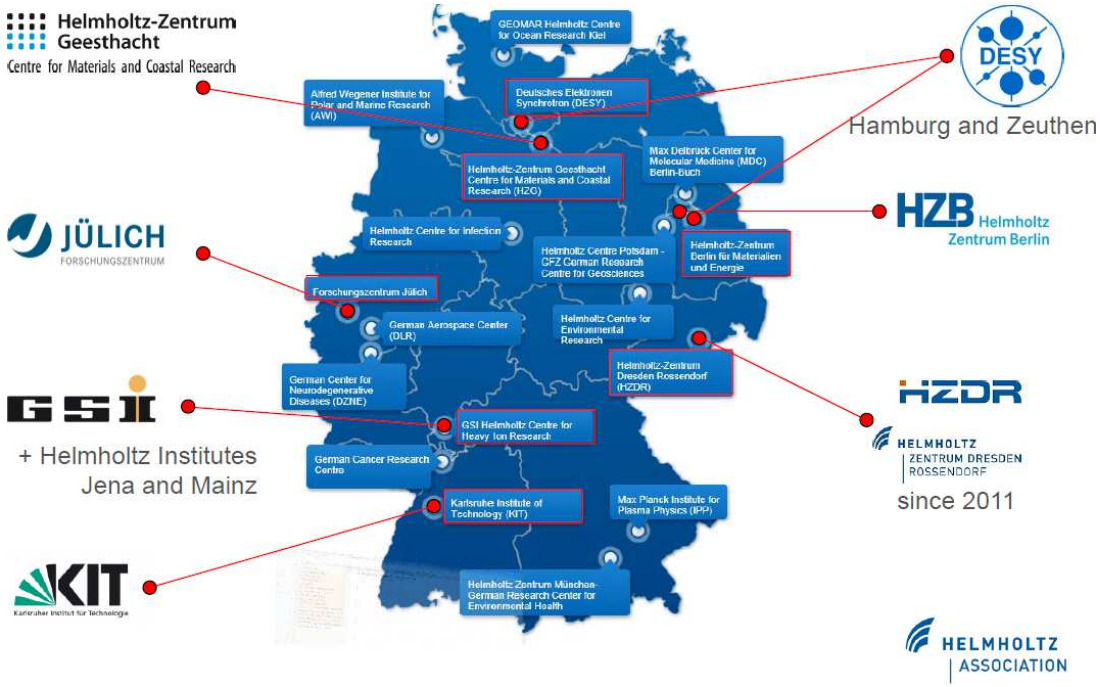
Base-Budget:	≈ 200 MEuro
Staff:	≈ 2000 employees in Hamburg and Zeuthen
Users:	≈ 3000 (1500 from abroad) from 45 nations

DESY sites Hamburg & Zeuthen

Hamburg

Helmholtz Association

- **18 large research centres in Germany**
- **Structured in six research fields**
  - **Aeronautics, Space and Transport**
  - **Earth and Environment**
  - **Energy**
  - **Health**
  - **Key Technologies**
  - **Structure of Matter (→ Matter)**



Budget (2013):

- **2.4 G€ institutional funding (90% federal, 10% local)**
- **1.2 G€ Third-party funding**

Particle Physics in Helmholtz

- 5-years funding cycles
- Restructuring of research field for next funding period (2015 -19)

Structure of Matter
4 programmes:

- Particle Physics
- Astroparticle Physics
- Hadrons and Nuclei
- Photon, Nuclei, Ions

Matter
3 programmes:

- Matter and Universe
- From Matter to Materials and Life
- new Matter and Technology (Accelerator, Detector, Computing)

- Programme evaluation took place in spring 2014
- Positive feedback on DESY science programmes

- Talks:
  - Photon Science: Edgar Weckert
  - XFEL: Winfried Decking
  - ILC: Brian Foster
  - (Astro)-particle physics: JM

DESY Long-term Strategy in Particle Physics

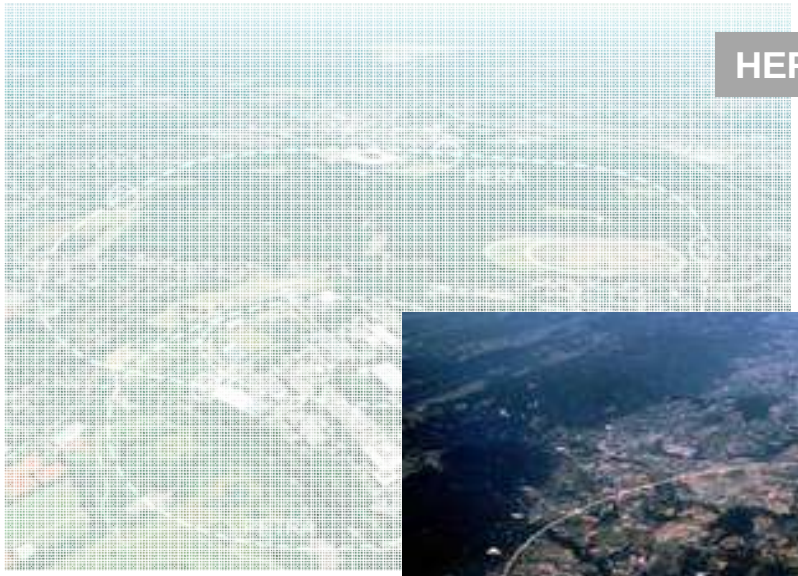
- Accelerators
- Detectors
- Physics

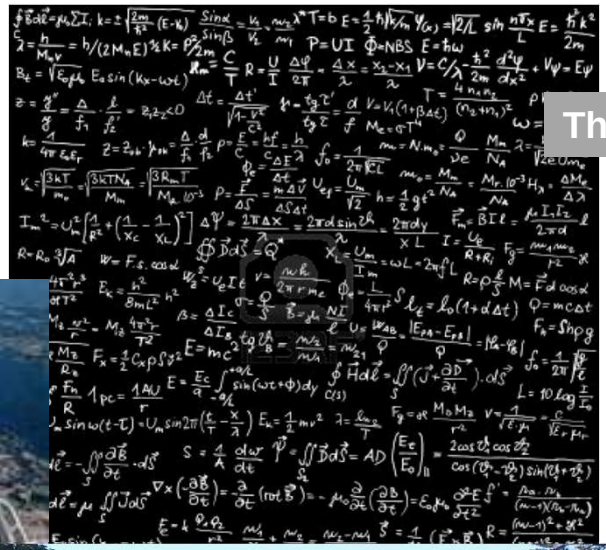
+ support through strong theory group
+ computing infrastructure
+ testbeam & other infrastructures

- **Use of DESY infrastructure for particle physics**
  - **e.g. Tier-2/NAF, testbeam for detector R&D, ALPS II, …**

- **Strategic role of DESY as national laboratory for particle physics**

DESY Particle Physics 2015-19





- LHC (ATLAS & CMS)
- e^+e^- physics: (Belle & ILC)
- Theory

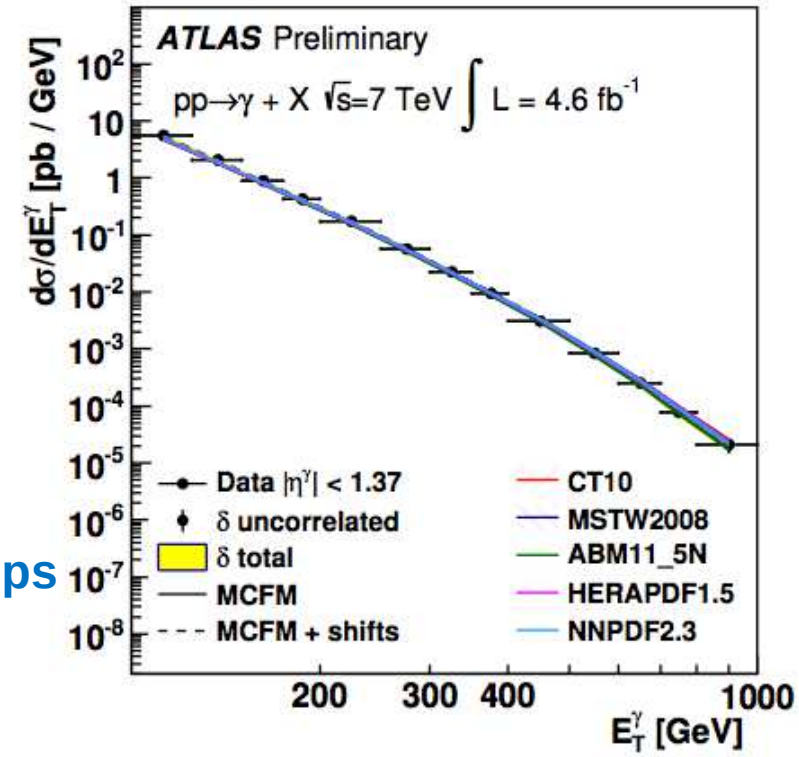
DESY at the LHC

- **Two large groups in ATLAS and CMS**
  - more than 60 scientists per group

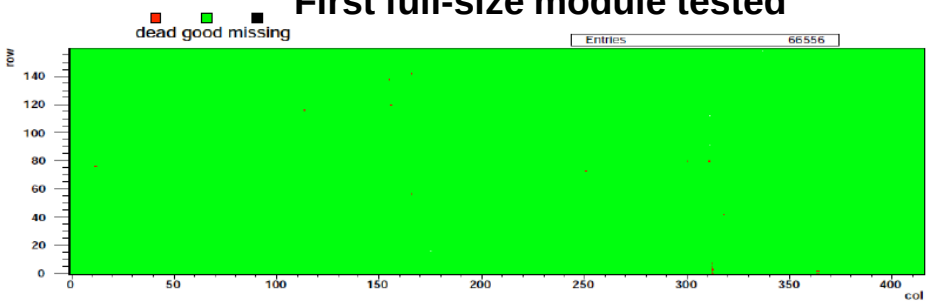
    ~1/3 staff, ~1/3 postdocs,
    ~1/3 students + technical support
- **Building on large experience and expertise from HERA**
  - physics analysis, detector operation, computing, upgrades, management …
- **Example: CMS phase 1 pixel upgrade**
  - 4th layer together with German CMS groups

Example proton structure

- HERAFitter to extract PDFs



First full-size module tested

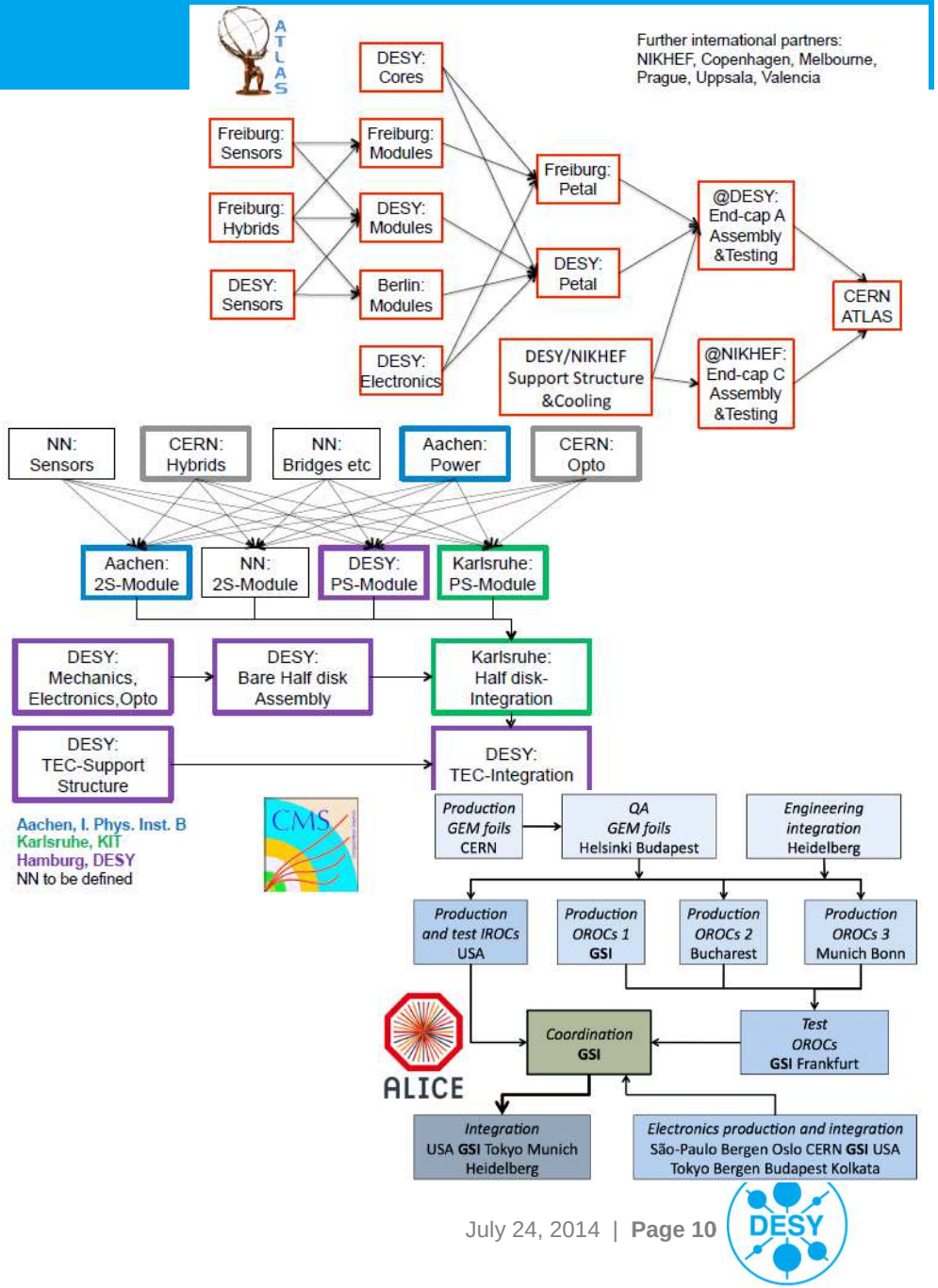


LHC Detector Upgrades

- **Future: Phase 2 upgrades**
- **Proposal for Helmholtz Strategic Large Investments**

  DESY, KIT, GSI: 28 M€

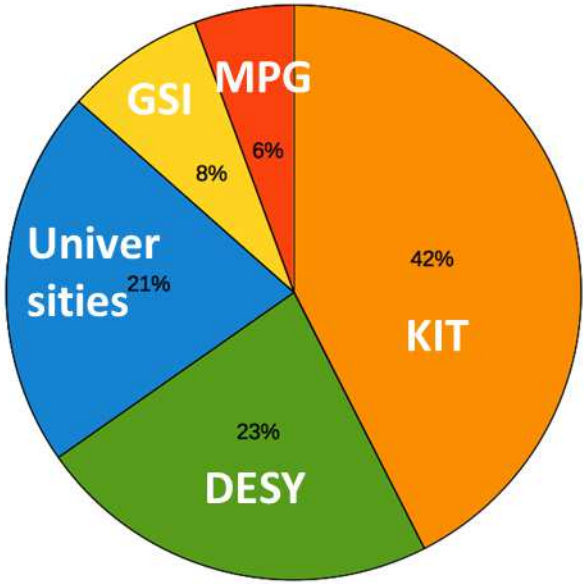
  Helmholtz part for ATLAS & CMS tracker and ALICE TPC (2018)
- **Close collaboration with German & international partners**
  - **part of German concept for LHC upgrade presented to funding agencies**
- **Crucial for future of particle physics in Helmholtz**
- **Proposal submitted in June**
  - **decision by Helmholtz in 2015**

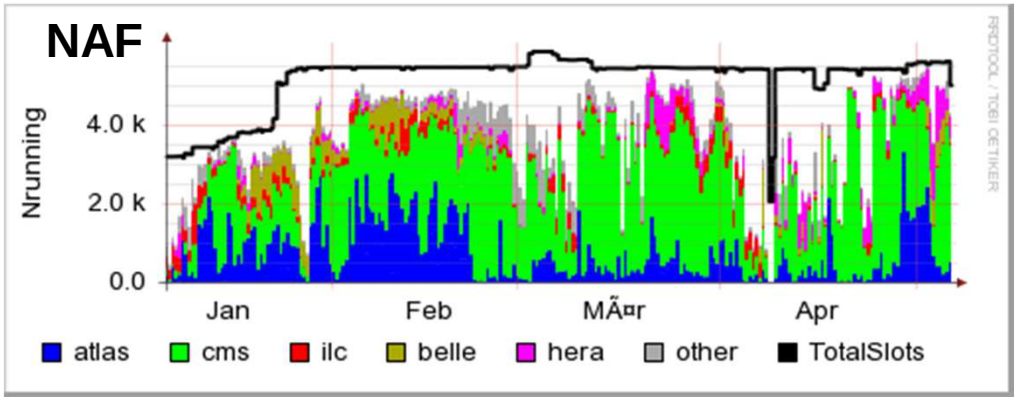


Computing

- **Helmholtz provides large share of LHC computing in Germany**
  - Tier-1 Centre at KIT (GridKa) for all experiments
  - Tier-2 centres at DESY (ATLAS, CMS, LHCb) and GSI (ALICE)
- **National Analysis Facility (NAF) at DESY**
- **Facilities used also for non-LHC experiments**
- **Future:**
  - funding proposal to Helmholtz to secure Tier-1 and Helmholtz part of Tier-2 centres
  - part of upgrade proposal

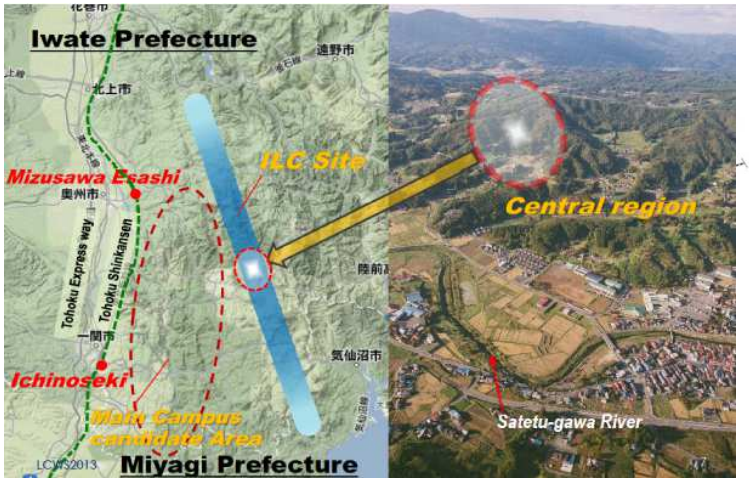
German Tier-1+2 CPU wall-clock time delivered



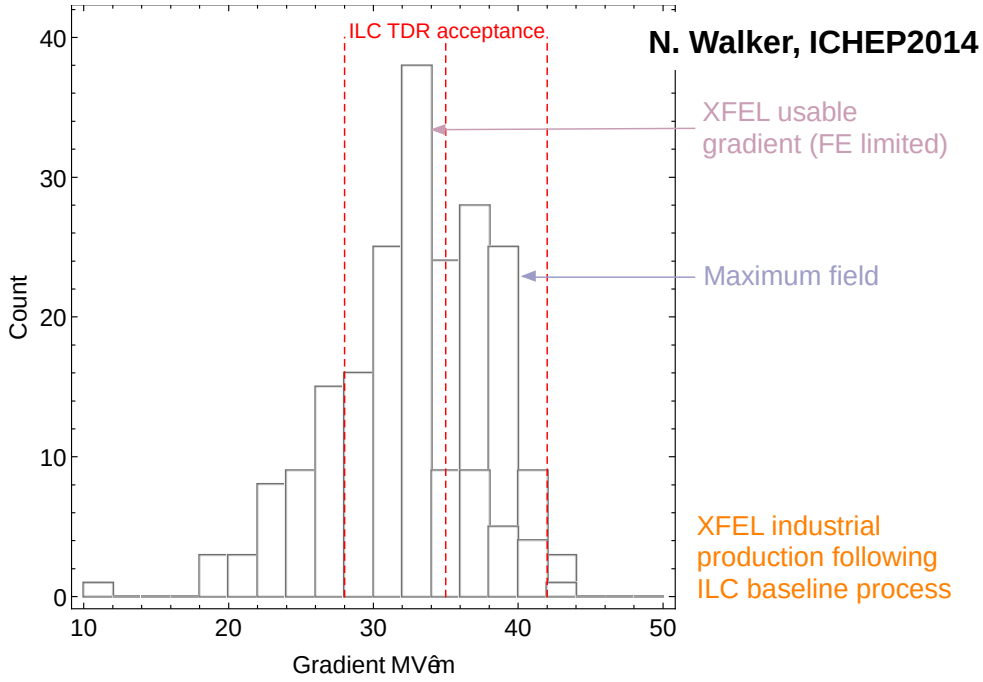


International Linear Collider

- **DESY is key to the development of a superconducting linear collider**
  - **TESLA collaboration since 1990ies**
  - **key contributions to the 2013 ILCTDR**
  - **construction of the European XFEL**

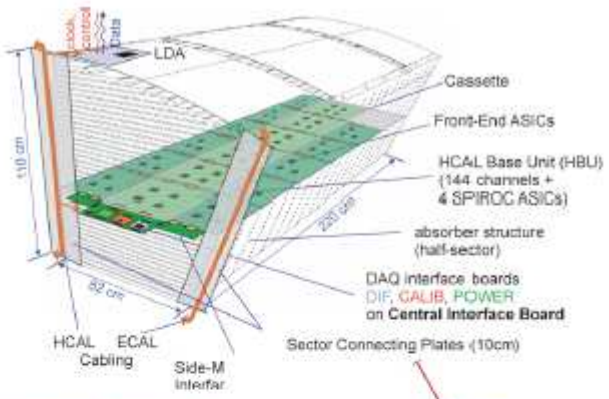


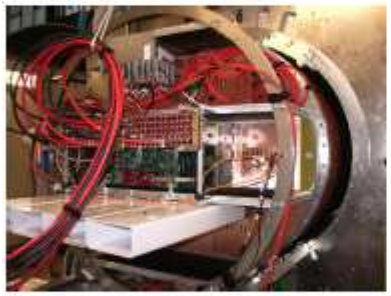
- **Example: industrial cavity production**
  - **exceeds XFEL specs**
  - **average gradient close to ILC needs (31.5 MV/m)**

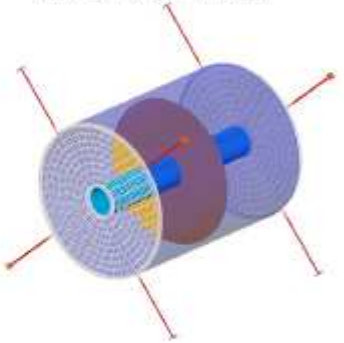


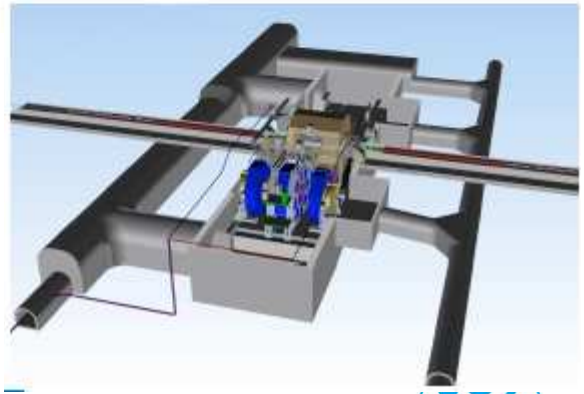
ILC Detector & Physics

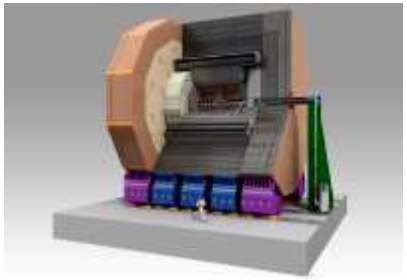
- **ILD and SiD detector concepts**
  - co-spokespersons in both concepts from DESY
- **Hadron calorimeter**
  - CALICE collaboration to advance Particle Flow algorithms
- **TPC development**
- **Integration laboratory for detector**
  - engineering expertise and support
  - EDMS for detector and accelerator





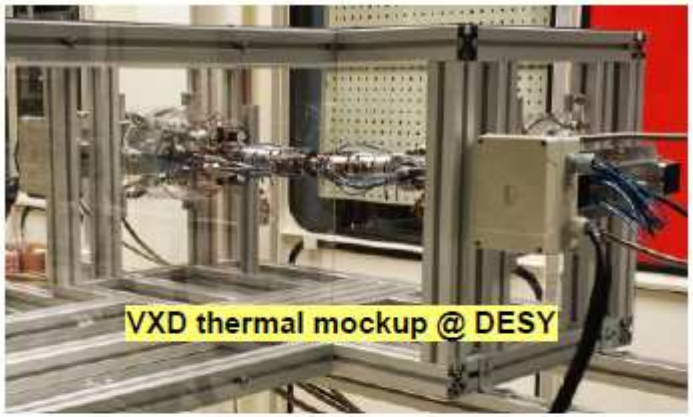






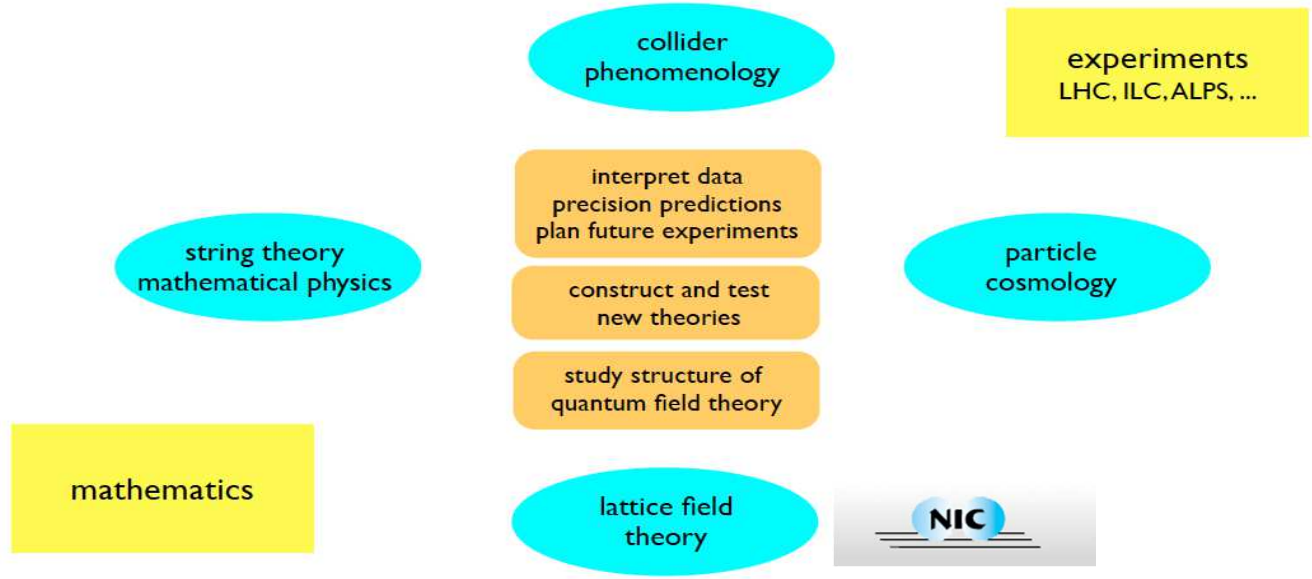
Belle (II)

- **Germany plays major role in Belle II**
  - **10 institutes represent 2nd largest country after Japan**
  - **deliverable is DEPFET vertex detector in 2016**
- **DESY joined Belle II in 2011**
  - **bringing in engineering expertise, e.g.heat management**
  - **and delicate installation into Belle II (remote vacuum connection)**
- **DESY test Beam**
  - **full vertex detector system test in Jan 2014**
- **Computing**
  - **Tier-2 & NAF at DESY**



Particle Physics Theory in Helmholtz

> **Broad spectrum, firmly connected to the experimental programme**



> **Closely integrated with local universities (Hamburg, Berlin, Karlsruhe)**

> **Shapes theoretical particle physics in Germany & beyond**

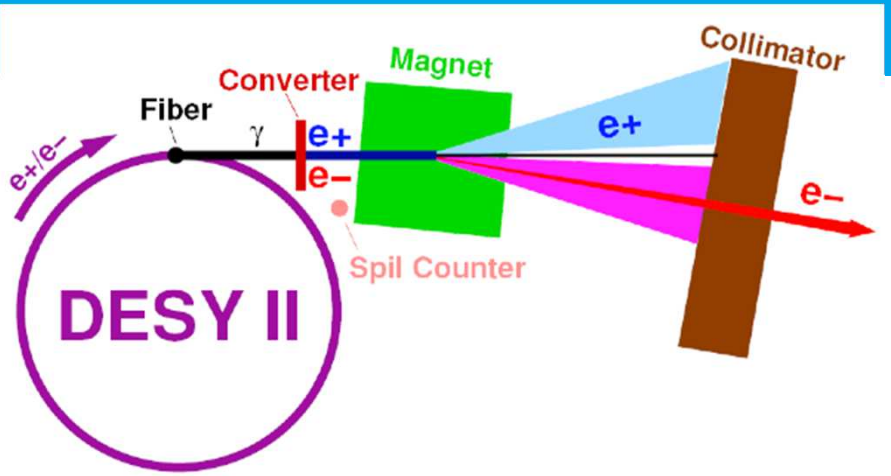
Lectures, schools, conferences, workshops

DESY fellowship programme (each year >300 applications from around the globe)

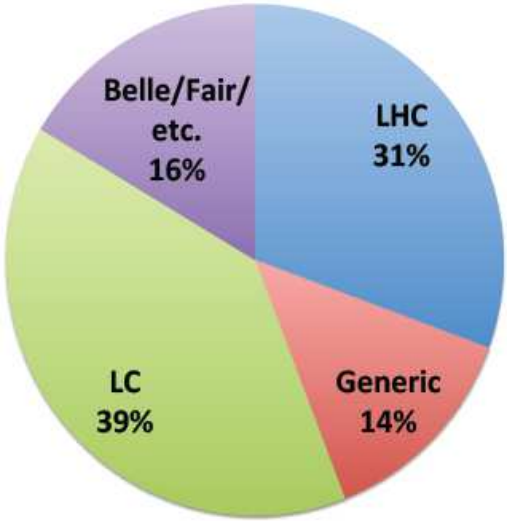
Large fraction of theory staff in Germany have a DESY history

DESY Testbeam

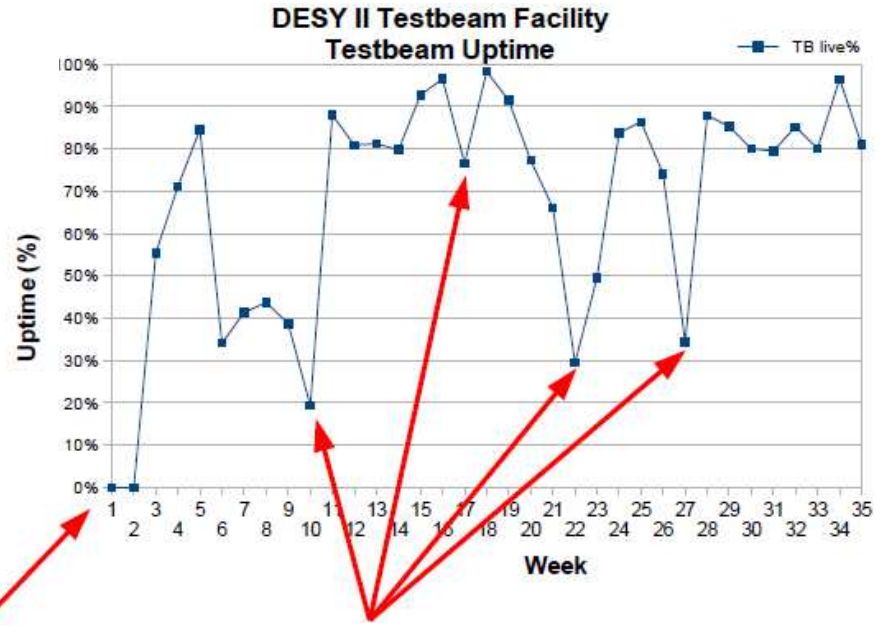
- **Increasingly important facility for detector R&D**
  - **approx. 400 users in 2013**



- German groups : 24.7 %
- European groups : 50.2 %
- Extra-European users : 25.1 %



User groups represent all HEP communities.

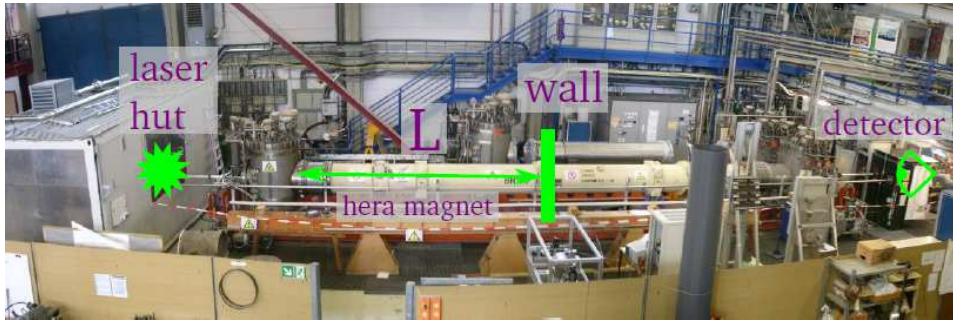


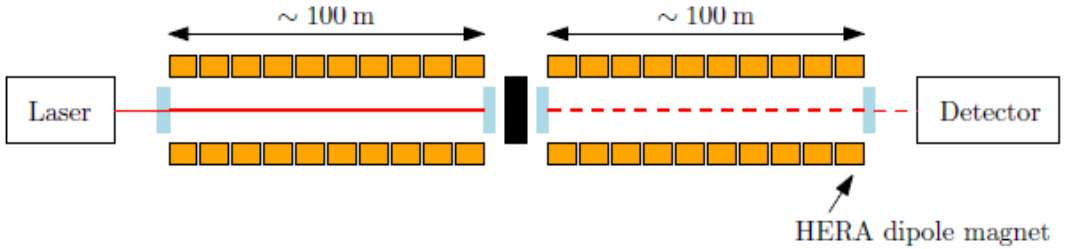
Ramp-Up

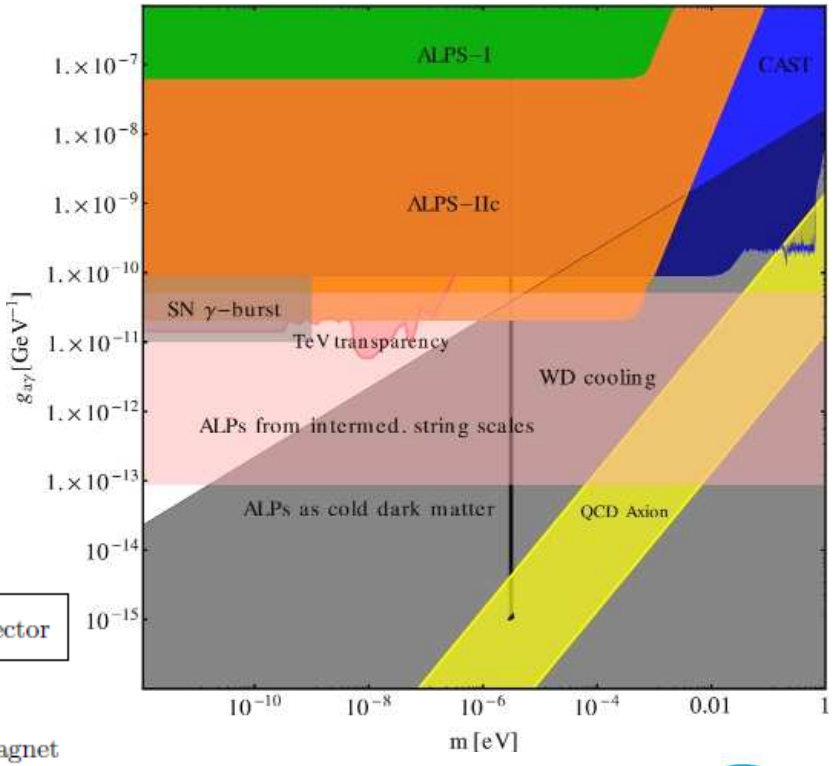
Maintenance weeks

Axion-Like Particle Search

- **ALPS I experiment:**
  - **„light shining through wall“ experiment**
  - **published results early 2010**
  - **to-date still best limit (from this type of experiment)**
- **ALPS II**
  - **regeneration cavity**
  - **transition edge sensor**
  - **2 × 10 straightened (!) HERA dipoles**
  - **data taking expected in 2017**



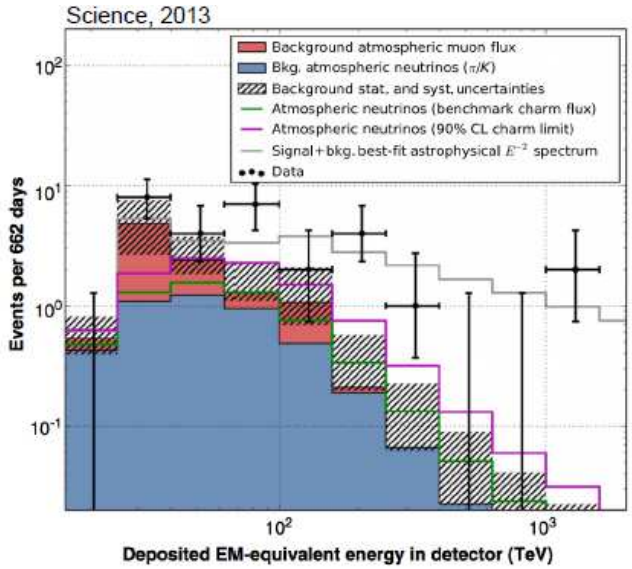




DESY Astroparticle Physics

- **IceCube**
  - DESY is second largest group in the collaboration
  - Tier-1 data centre
- **Upgrade plans for IceCube:**
  - PINGU (neutrino mass hierachy)
  - multi-km3 neutrino telescope, multi-km2 surface detector, …
- **CTA**
  - mid-size telescopes
  - array control
  - MC production
  - …
- **Participation in HESS, MAGIC, Veritas**

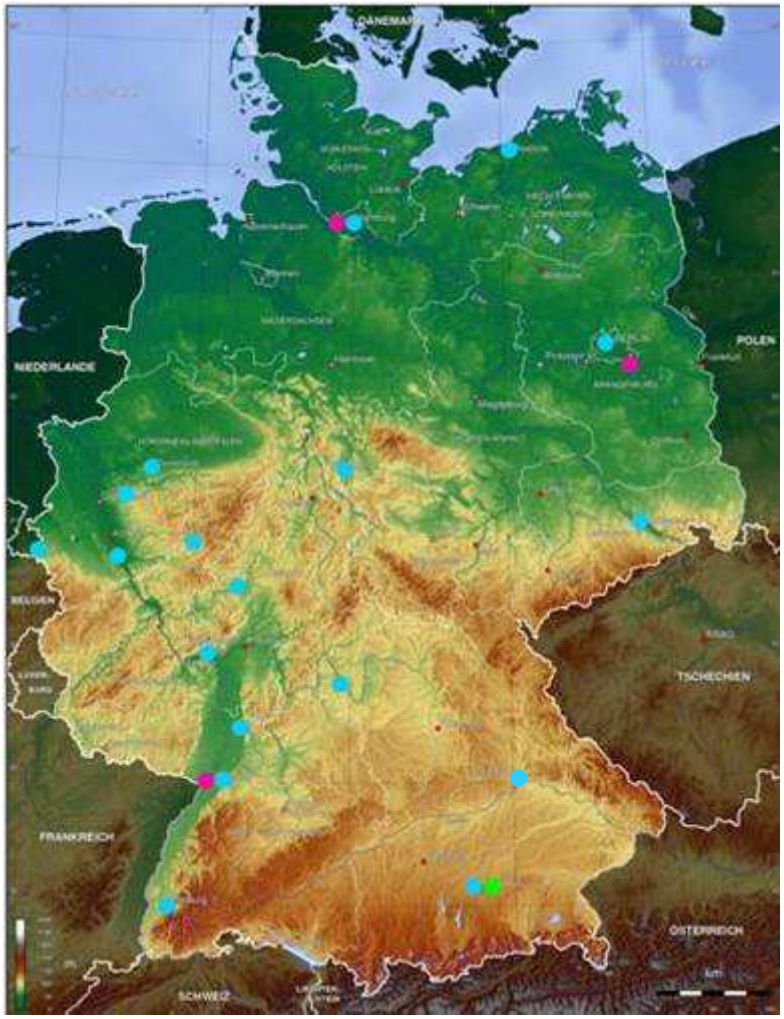
Observation of extraterrestial neutrinos



Telescope prototype close to Zeuthen

Helmholtz Alliance „Physics at the Terascale“

- **Network between Helmholtz centres, universities and Max-Planck institute**
- **Generously funded by Helmholtz**
  - **25 M€ for 2007-12 and 1 M€ for 2013-14**
- **Alliance very successfully contributed to shape German particle physics**
  - **≈1000 people, >150 events**
  - **numerous positions created in the field**
- **Future**
  - **keep structures and main elements schools and workshops**
  - **with support from DESY and Universities**
- **Similar Alliances exist in hadron & nuclei and astroparticle physics**
  - **common events?**



Tour of DESY

- **Tour of DESY**
  - 13:30 - 16:00
- **Three “Attractions”**
  - XFEL Injector + Tunnel
  - AMTF Hall
  - DESY-II Test Beam Facility
- **Tour start/end**
  - lobby of Seminar room 4
- **Note: XFEL is still a construction site**
  - special rules and regulations apply