



RESEARCH CENTRE: DESY

HELMHOLTZ
SPITZENFORSCHUNG FÜR
GROSSE HERAUSFORDERUNGEN

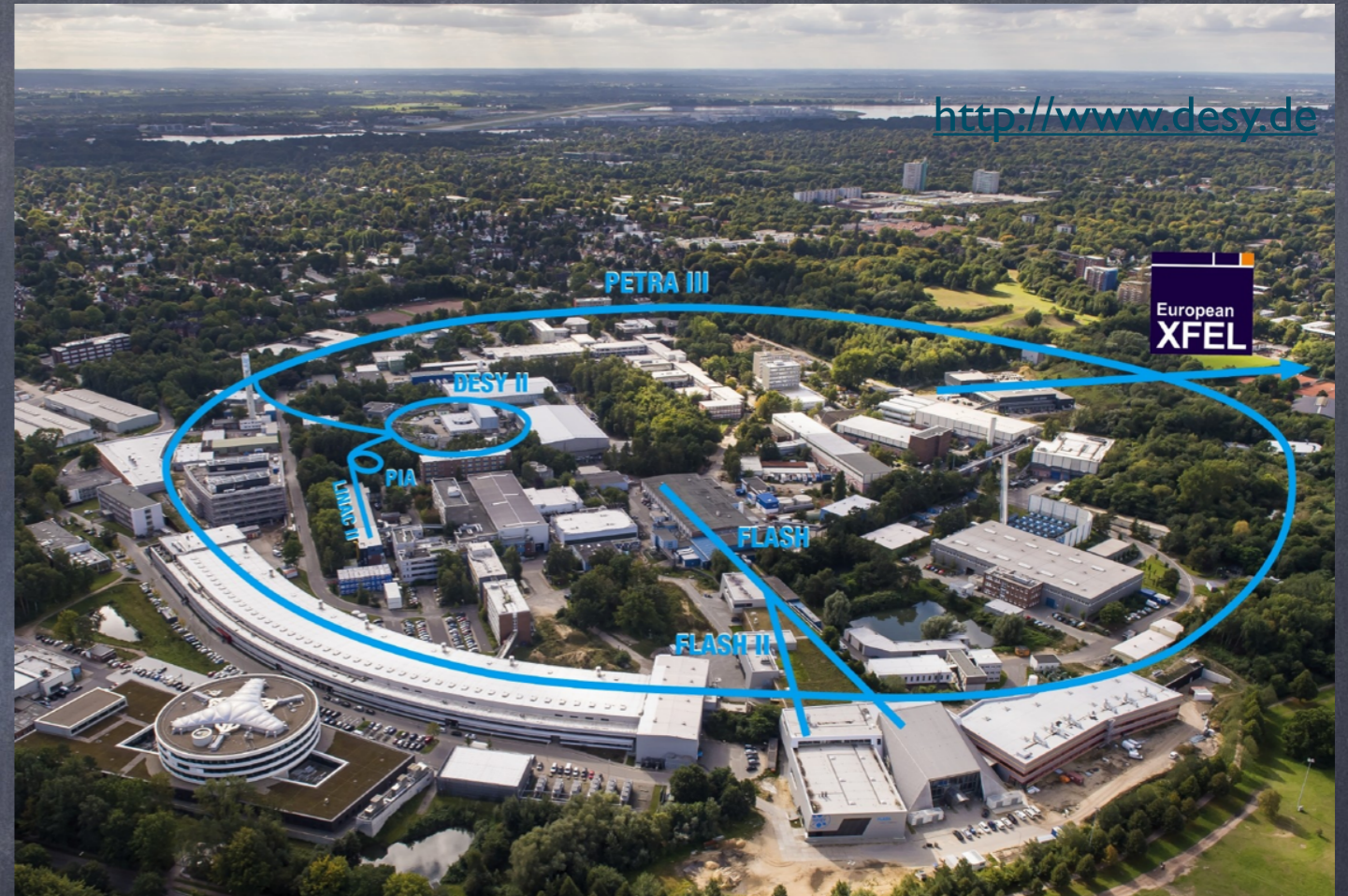
DEUTSCHES ELEKTRONEN SYNCHROTRON: German centre for particle physics

Founded 1959,
located in Hamburg and Zeuthen

650 staff scientists, 700 young scientists
3000 guest scientists from 40 countries

Fundamental & Applied Science:

- **accelerator development & operation**
- **particle and astroparticle physics**
- **photon science**



Research centre of Helmholtz Association

Leading the Helmholtz Research Programs in the Field “Matter”: “*Matter and the Universe*”
and “*Matter and Technology*”



DESY INVOLVEMENT IN THE LHC PHYSICS



Analysis of the LHC data

- **DESY-CMS: top-quark and Higgs physics**
leading role in the CMS TOP group,
focus on measurement of $t\bar{t}$, $t\bar{t}+H$, $t\bar{t}+\text{jets}$,
- **DESY-CMS: properties of jets**
leading CMS analyses of inclusive
jet, jet+V, W+charm, c- b- production

Interpretation: extraction of PDFs, TMDs,
top mass, strong coupling, EFT, new physics

Grid Computing: Tier-2 center

LHC Detector upgrade DESY-CMS provides major contribution in building the new
silicon outer tracker (R&D, maintenance and integration in CMS)

Collider Physics Theory in Hamburg

Scientific exchange programs with phenomenology-groups in USA and Europe



RECENT HIGHLIGHTS (related to topics to be covered)

- First measurement of running of the top quark mass

<https://cms.cern/news/watching-top-quark-mass-run>

For the first time, CMS physicists have investigated an effect called the “running” of the top quark mass, a fundamental quantum effect predicted by the Standard Model.

TODO: go for precision (full RunII), test new physics models, NNLO

CERN COURIER | Reporting on international high-energy physics
11 May 2020

Physics ▾ Technology ▾ Community ▾ In focus Magazine

STRONG INTERACTIONS | NEWS

First sight of the running of the top-quark mass
11 May 2020
A report from the CMS experiment

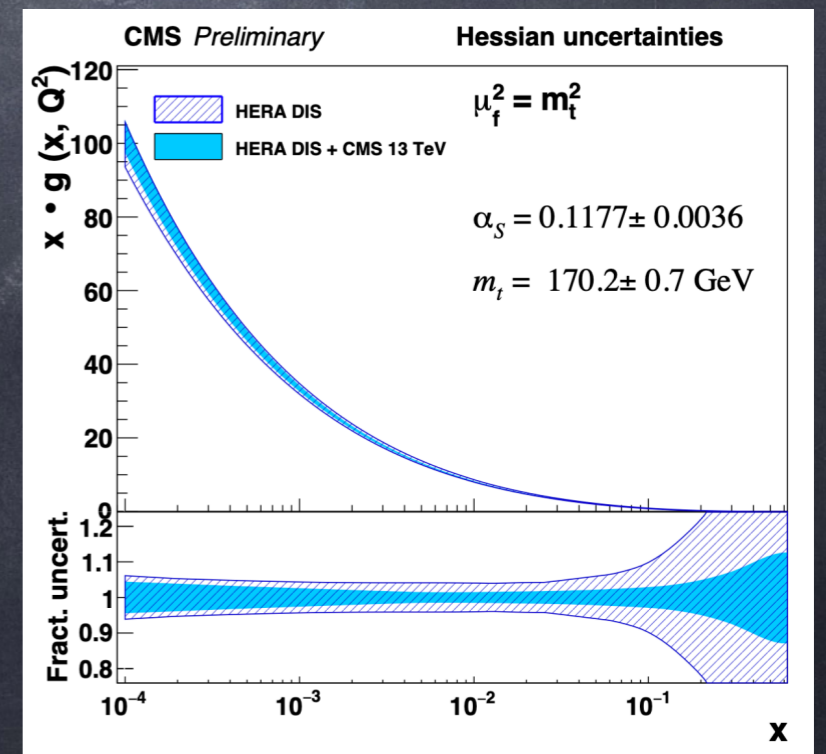
https://cerncourier.com/a/first-sight-of-the-running-of-the-top-quark-mass/

- First unbiased indirect search for New Physics

<https://cms.cern/news/jets-all-trades-constraining-standard-model-and-beyond>

JETS-OF-ALL-TRADES:
CONSTRAINING STANDARD
MODEL AND BEYOND

Parton distributions, $\alpha_S(m_Z)$, m_t and constraints on Contact Interactions extracted all together !





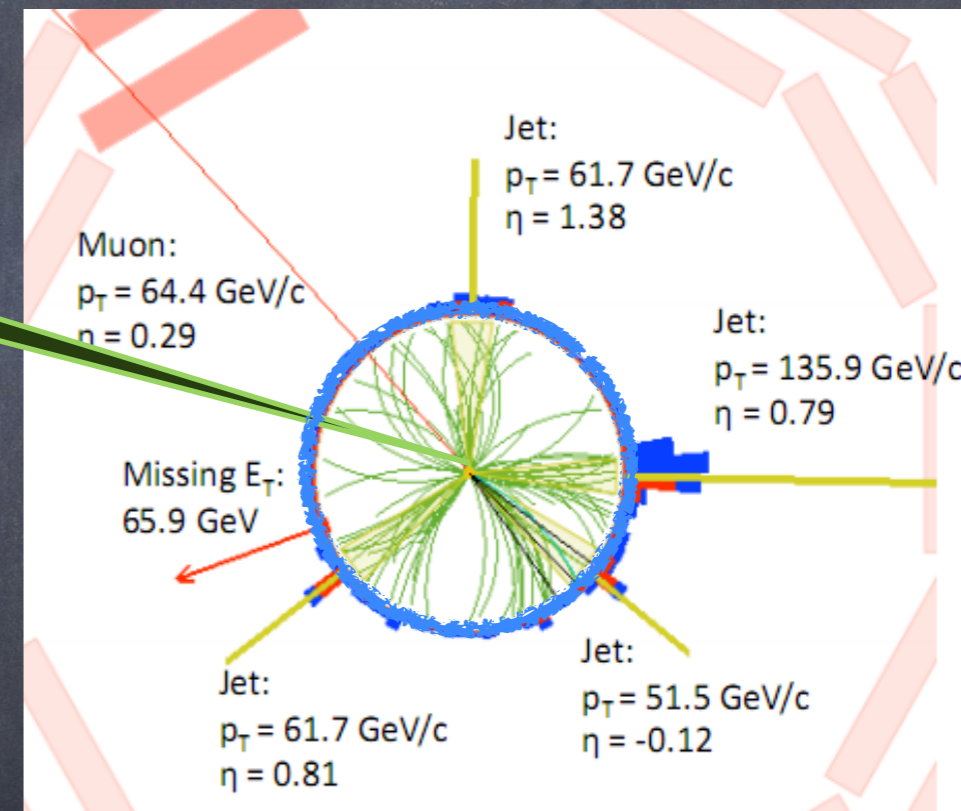
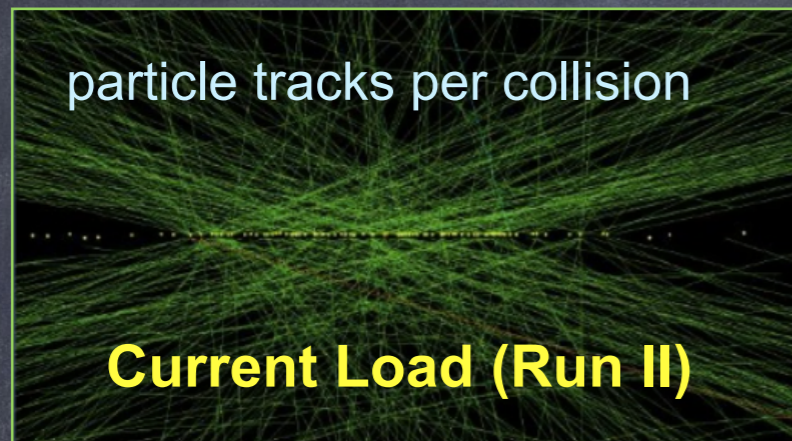
TECHNOLOGY CHALLENGE OF PRECISION

LHC: collider at frontiers of collision energy & rates → the facility for precision

2026 → High-Luminosity LHC: increase of the detector load

~ 7 x higher rates

Technological challenge for the experiment: unprecedented radiation level, extreme hit rates, huge data volumes



DESY-CMS in collaboration with KIT and Aachen builds endcap of outer tracker
~1500 PS modules have to be tested and integrated, thermic tests, cooling, tests of the disc efficiency, preparation of burn-in setup ...



PhD OPPORTUNITY FROM JANUARY 2022

Physics analysis (full RUN II UL data, preparation for RUN III) + upgrade

- inclusive cross section of top quark pair production, extract m_t, α_S
- multi-differential top quark pair cross sections, interpretation in QCD, EFT, SMEFT
- Z+jet probing the gluon in the proton at NNLO
- first measurement of running of $\sin(\theta_W)$ at the LHC
- joined SMEFT interpretation of jet, jet + V and top quark measurements
- outer tracker upgrade

Positions based in Hamburg, hired by DESY, position 66% of regular scientist (public service E13/2).

Duration: 3 years. Enrolment in a german university (Dr. rer. nat.)

Social insurance+unemployment, retirement, health care taken care of by the Lab

Graduate program PIER (language, soft-skills etc.)

Regular schools at DESY in the framework of Terascale Alliance

Stays at CERN possible

Many lively international exchange programs with US and inside Europe

Close collaboration and exchange with world-leading theory groups



CONTACTS

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ADDITIONAL INFORMATION

Further possibilities to join our projects are:

DESY Fellowship (deadline 30. September / 31. May each year)

https://www.desy.de/career/career_programs/fellowships/experimental_particle_physics/index_eng.html

Humboldt Fellowship (contact K. Lipka)

<https://www.research-in-germany.org/en/research-funding/funding-programmes/avh-humboldt-research-fellowship-for-postdoctoral-researchers.html>