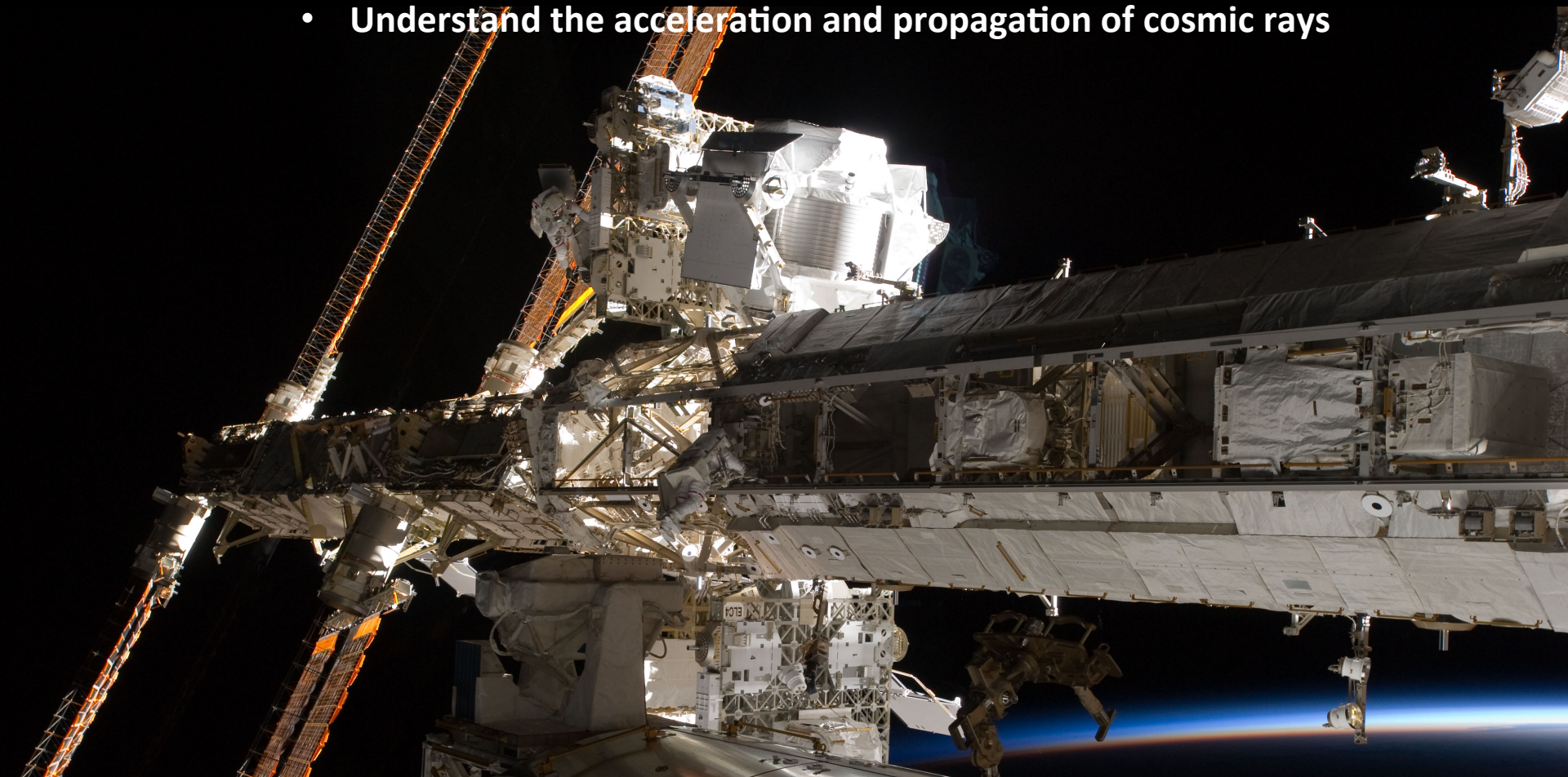
AMS Experiment on the ISS
Prof. Gast and Prof. Schael, I. Physics Institute

AMS is a particle physics detector in space to study the properties of charged cosmic rays and:

- **Search for primordial antimatter**
- **Search for Dark Matter**
- **Search for new particles (Stranglets, magnetic monopoles, ...)**
- **Understand the acceleration and propagation of cosmic rays**

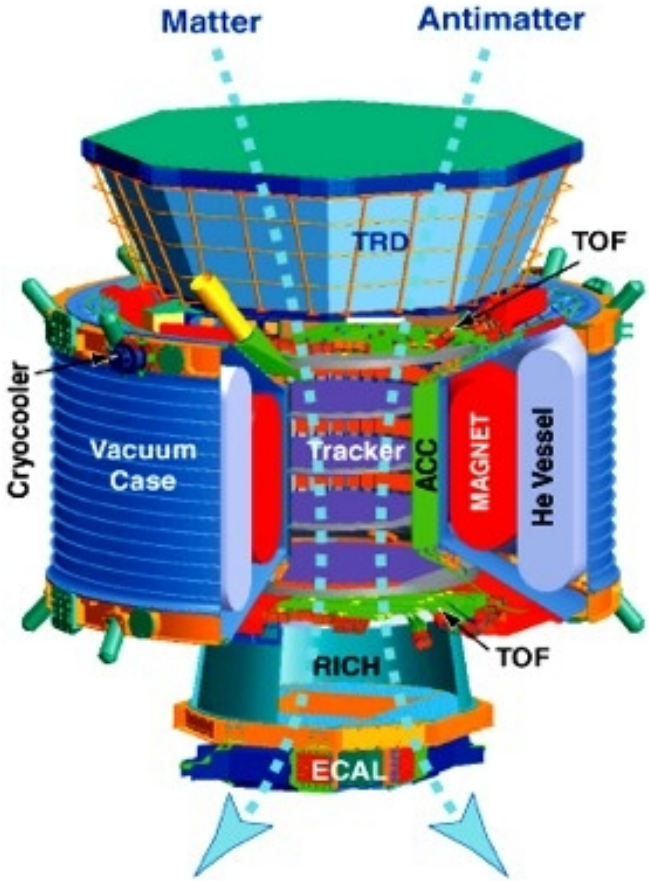


Thesis -
AMS Experiment on the ISS

Prof. Gast, Prof. Schael

The following topics are available:

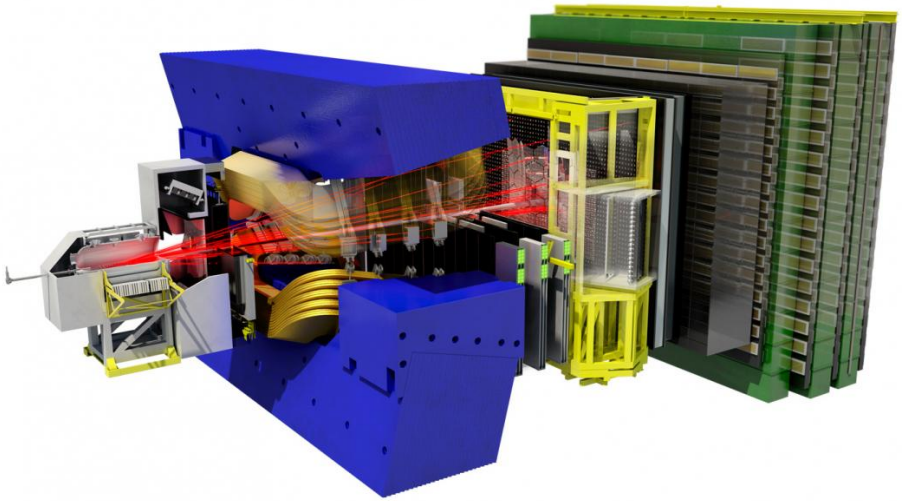
- **Measurement of charged cosmic rays with AMS**
- **Photon Reconstruction with AMS**
- **Calibration of the AMS Detector on the ISS**
- **Search for dark matter with AMS**
- **Investigation of the production and propagation of charged cosmic rays**



Expected skills:

- **Good knowledge in particle- and astroparticle physics**
- **Good knowledge C++ and ROOT**
  for bachelor students we offer special courses in C++ & ROOT

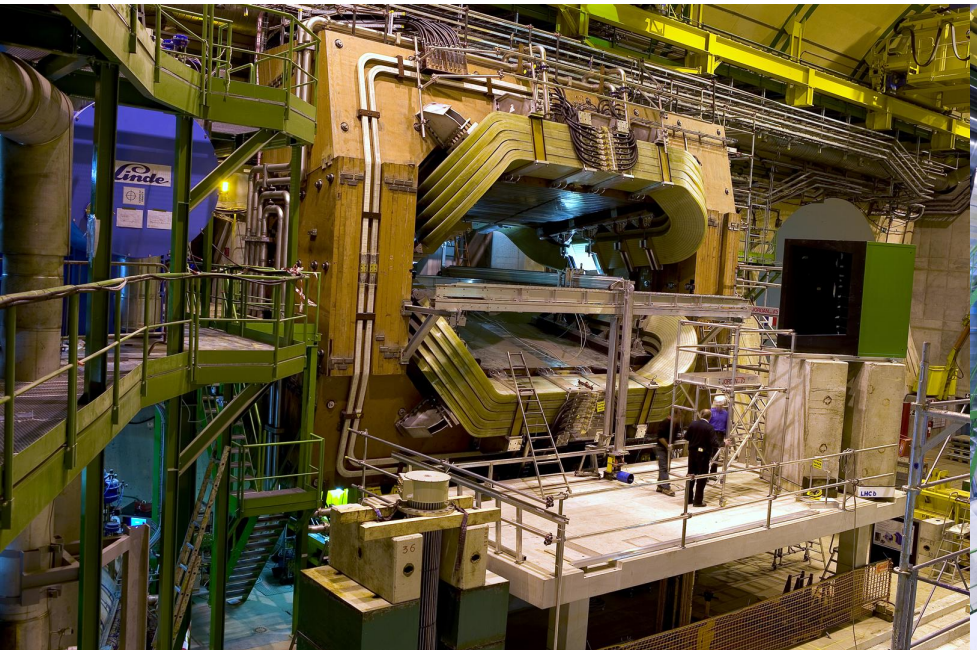
LHCb at CERN
Prof. Schael, I. Phys. Institut

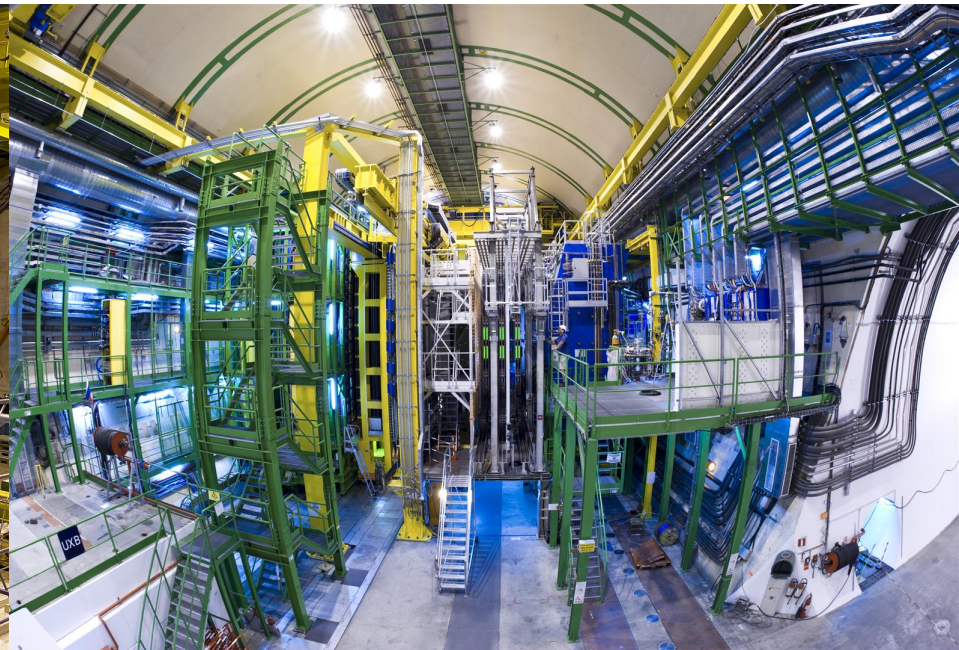


LHCb is a single arm spectrometer covering 2 < eta < 5

Designed to study heavy flavour physics to

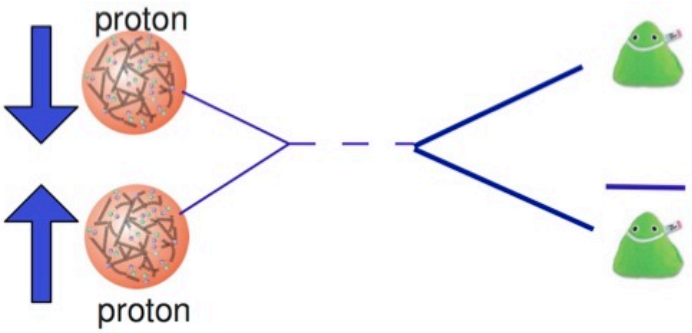
- Understand the Matter-Antimatter Asymmetry in the Universe
  i.e. measure CP-Violation
  using B-Hadrons
- Search for new Physics in
  loop diagrams
  i.e. study rare B-Hadron decays



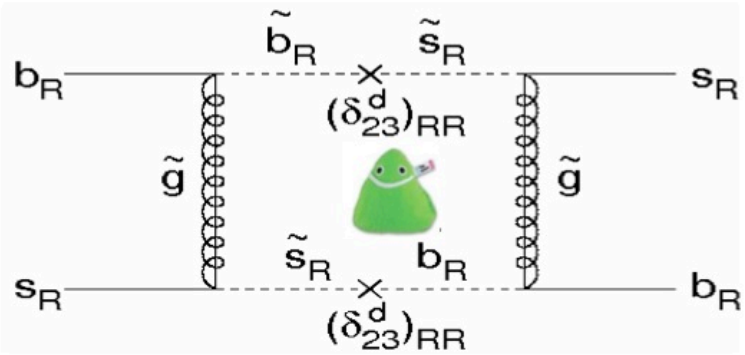


Direct vs indirect observations

The *absolute* energy frontier:



The *virtual* energy frontier:

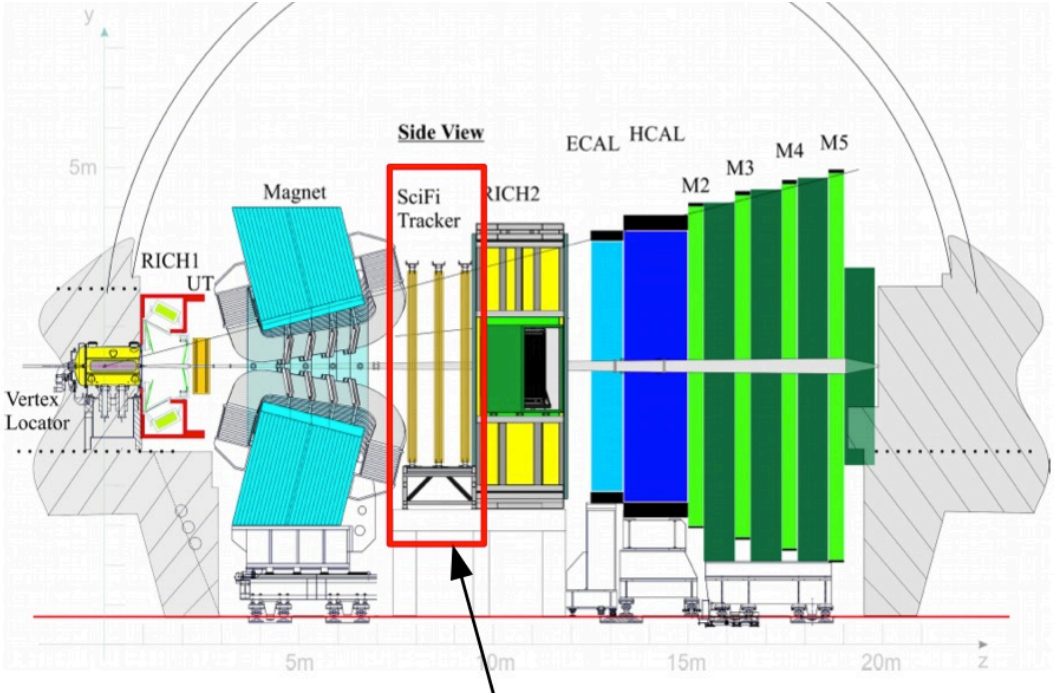


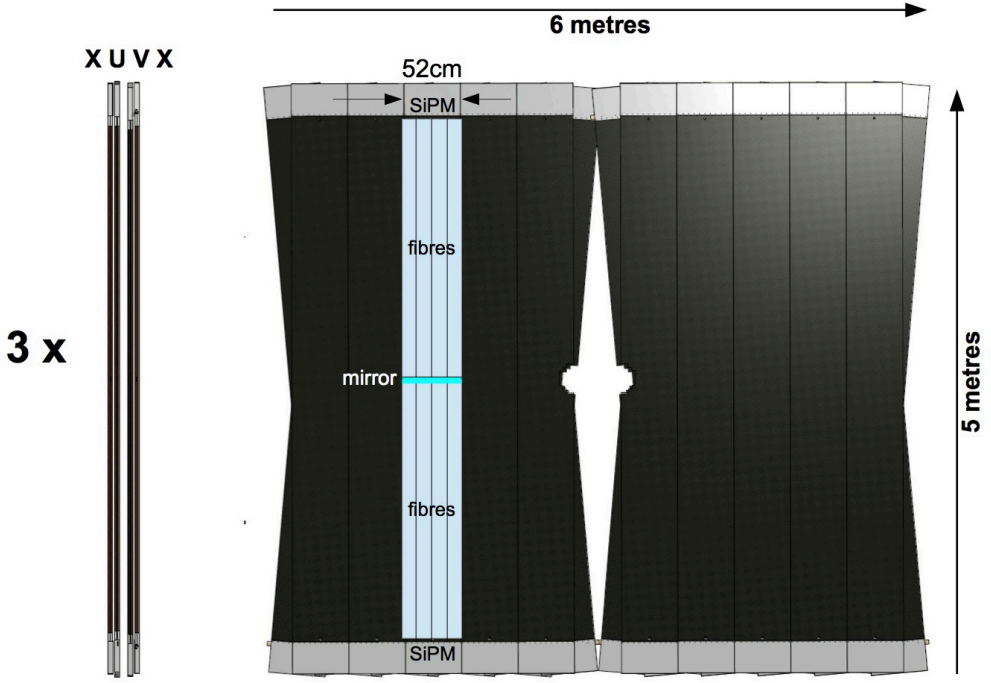
- **Direct observation:**
  - Produce particles on-shell and detect decay properties
  - More intuitive, „really“ produced
  - Limited by collision energy
- **Indirect observation**
  - Less intuitive, quantum level
  - Limited by precision, not by collision energy
  - CP observables sensitive to imaginary couplings

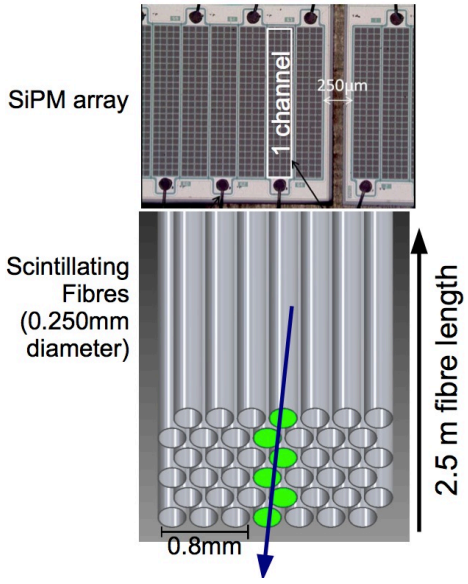
- **Indirect observations in the past:**
  - Kaon decay $K^0 \rightarrow \mu\mu$ hints at c-quark via GIM in 1970 (J/ψ found in 1974)
  - 3rd quark family predicted 1972 to explain CP violation (b found in 1977, t in 1994)
  - Neutral currect observed in neutrino experiment in 1973 (Z-boson found in 1983)
  - 1987 BB mixing hints at large top mass, 1990 LEP predicts top mass (top found in 1994)
  - prediction of Higgs Boson mass ~100 GeV in ~2000 (Higgs found 2012)

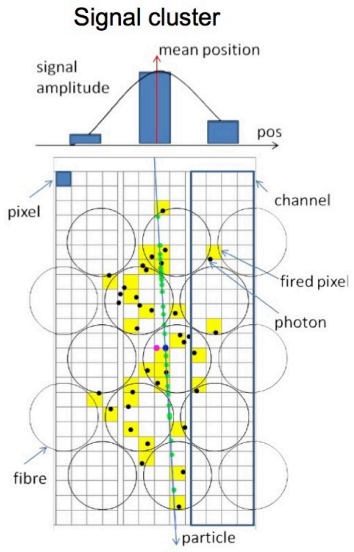
Scintillation Fiber Tracker

- Concept developed at I. Physics Insitute (2005-2011)
- Will be installed 2018-2020
- 2020-2025 increase LHCb data set by a factor of 20









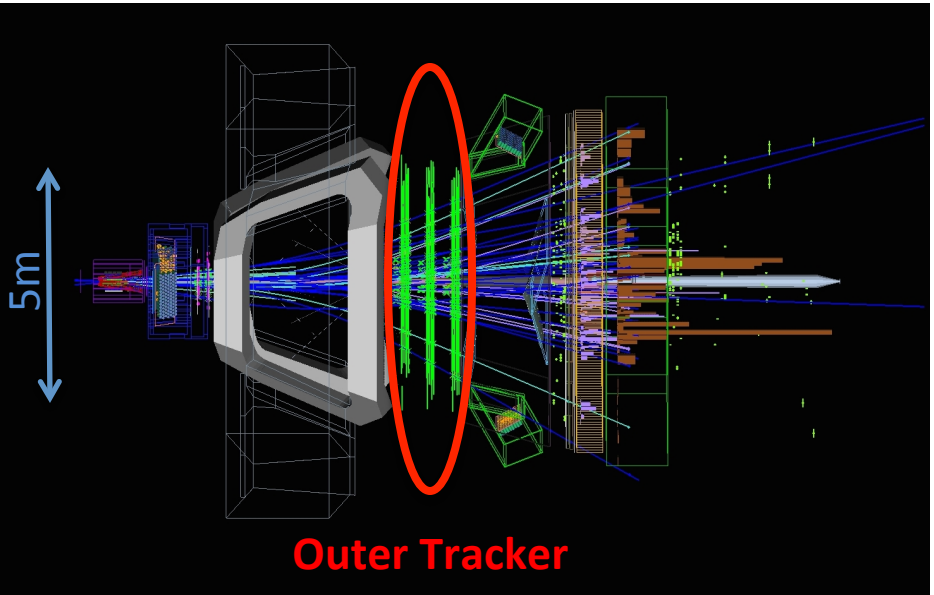
Typically one observes 15-20 photoelectrons for 5 layers of fibre

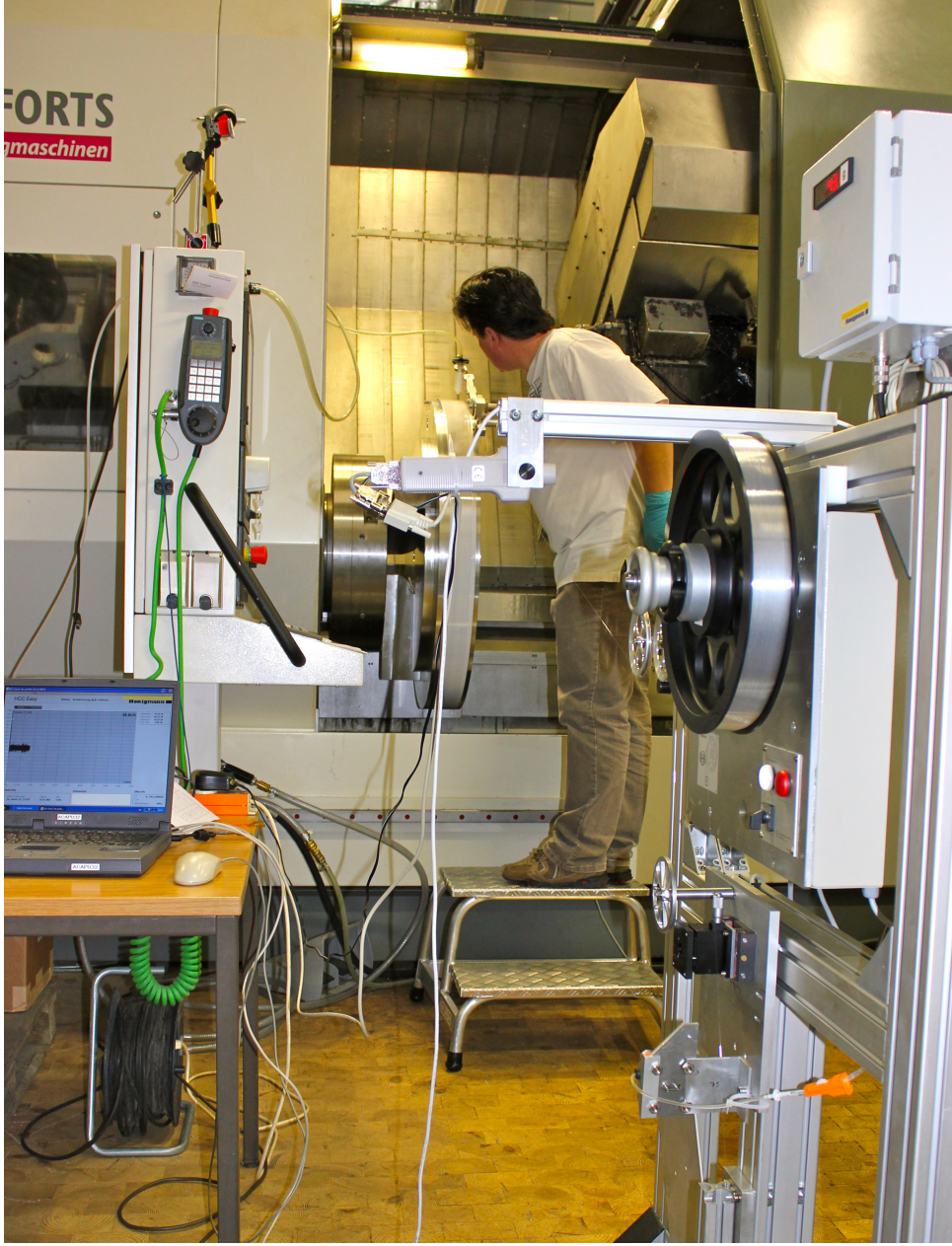
Bachelor-, Master- and PhD Thesis
LHCb Experiment at CERN

Prof. Dr. Stefan Schael

Topics:

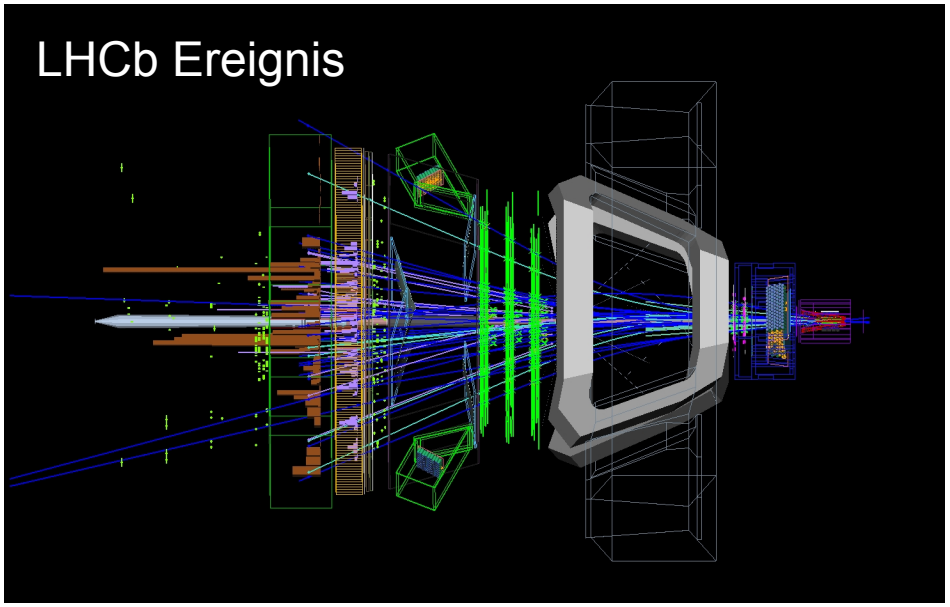
- Construction and Quality Control of 5m long Scintillating Fiber Modules with Silicon-Photomultiplier readout
- Search for Majorana Neutrinos in rare B-Hadron decays
- Search for Matter-Antimatter Asymmetries in B-Hadron Decays
- Search for Excited B_c-States at LHCb

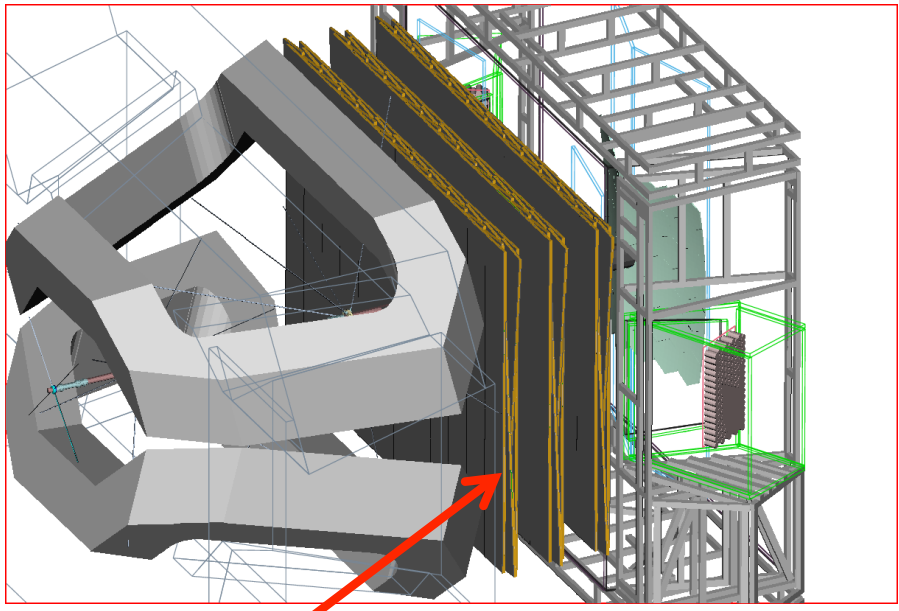




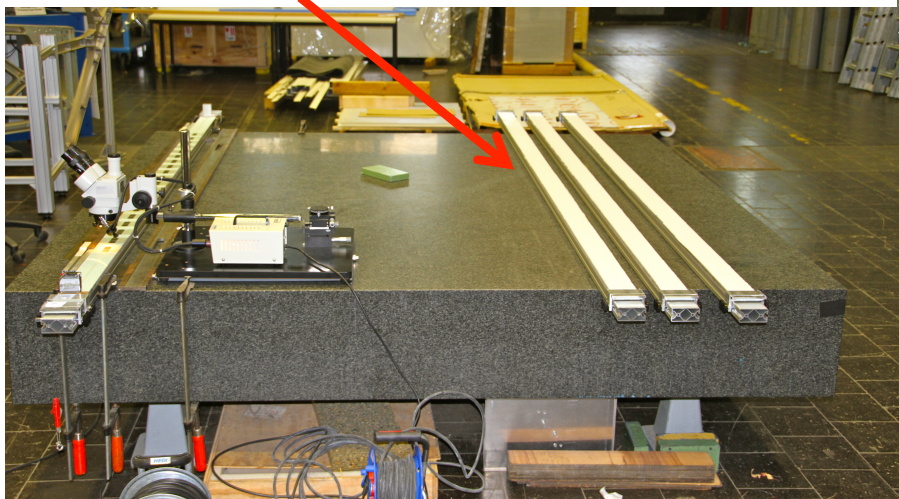
Scintillating Fiber Detector Production at RWTH Aachen

Bachelor/Master 2015
LHCb - Spurdetektor
Prof. Schael



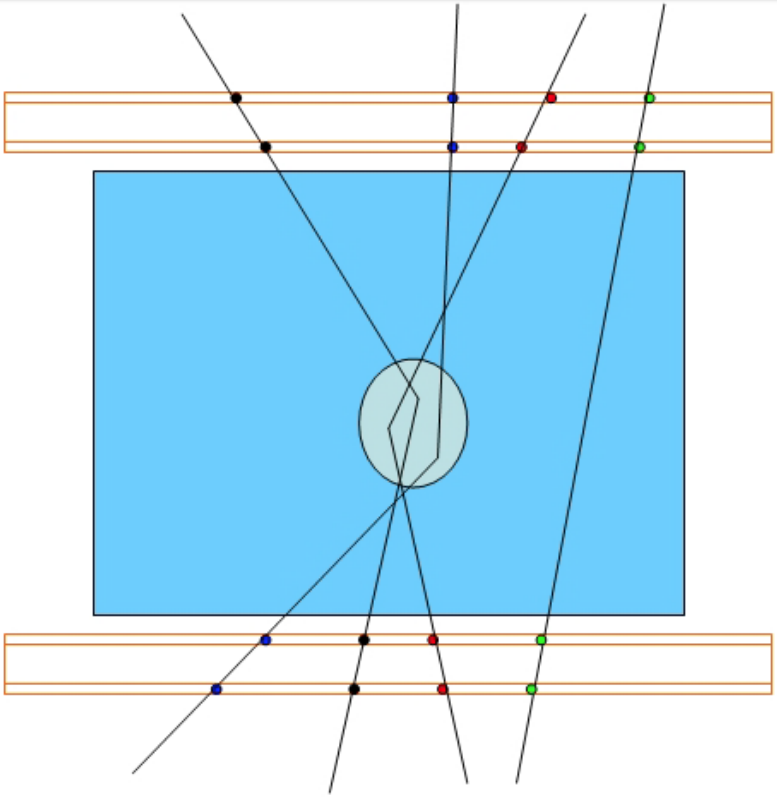


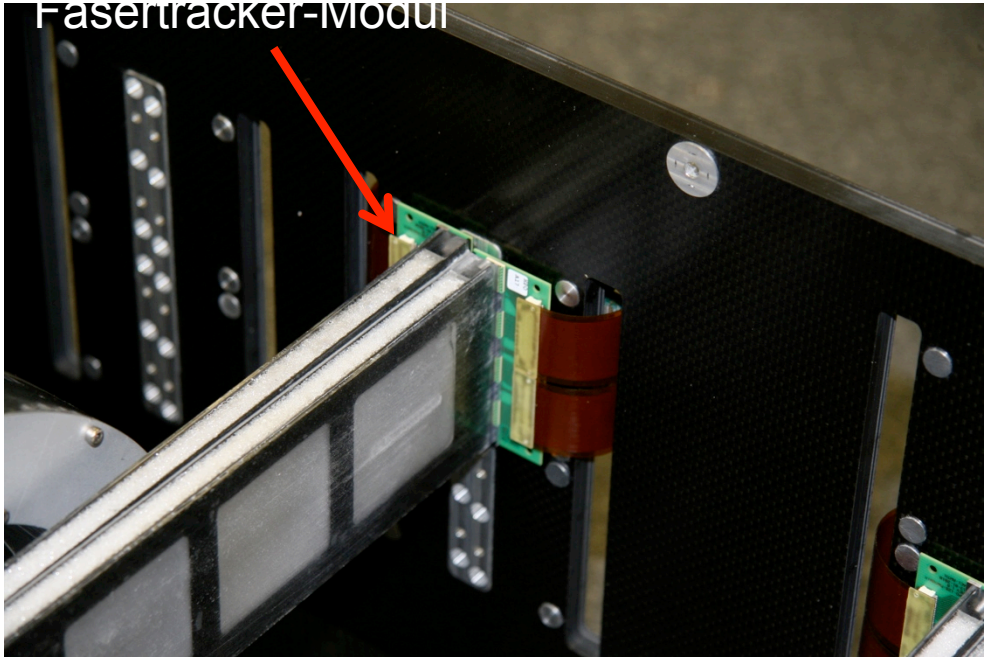
LHCb Spurdetektoren an der RWTH

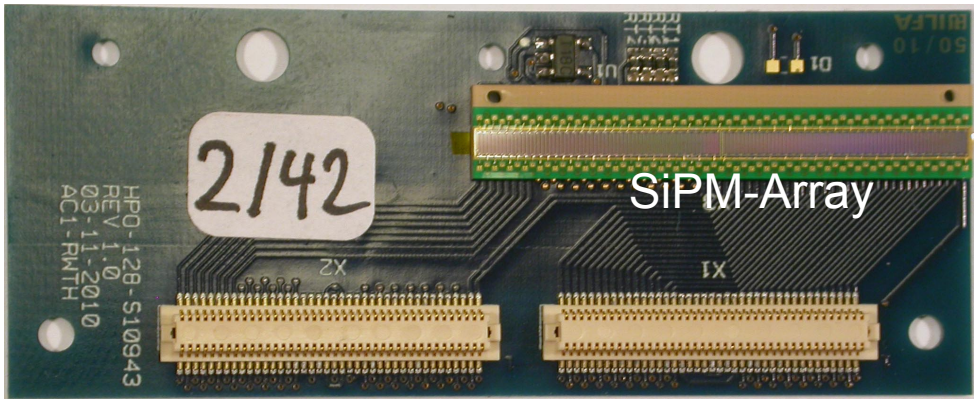


Der von uns neu entwickelte Spurdetektor, der auf dünnen szintillierenden Fasern mit SiPM-Auslese basiert, soll ab 2018 in LHCb eingesetzt werden. Die Arbeiten beschäftigen sich mit Entwicklung und Tests der Detektormodule.

Bachelor/Master 2015
Entwicklung eines Myontomographen
Prof. Schael







Mit Hilfe eines von uns neu entwickelten Spurdetektors, der auf dünnen szintillierenden Fasern mit SiPM-Auslese basiert, soll ein Myon-Tomograph aufgebaut werden, um die Dichteverteilung in unbekannten Materialproben zu bestimmen.