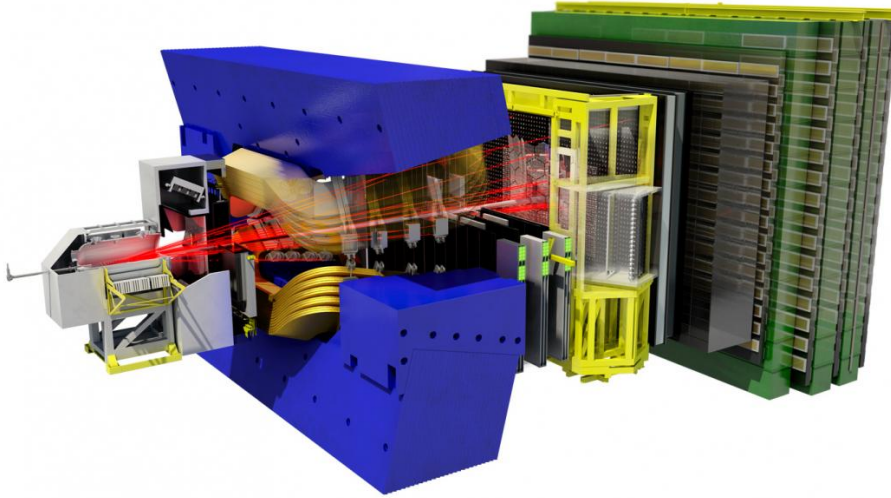


LHCb at CERN

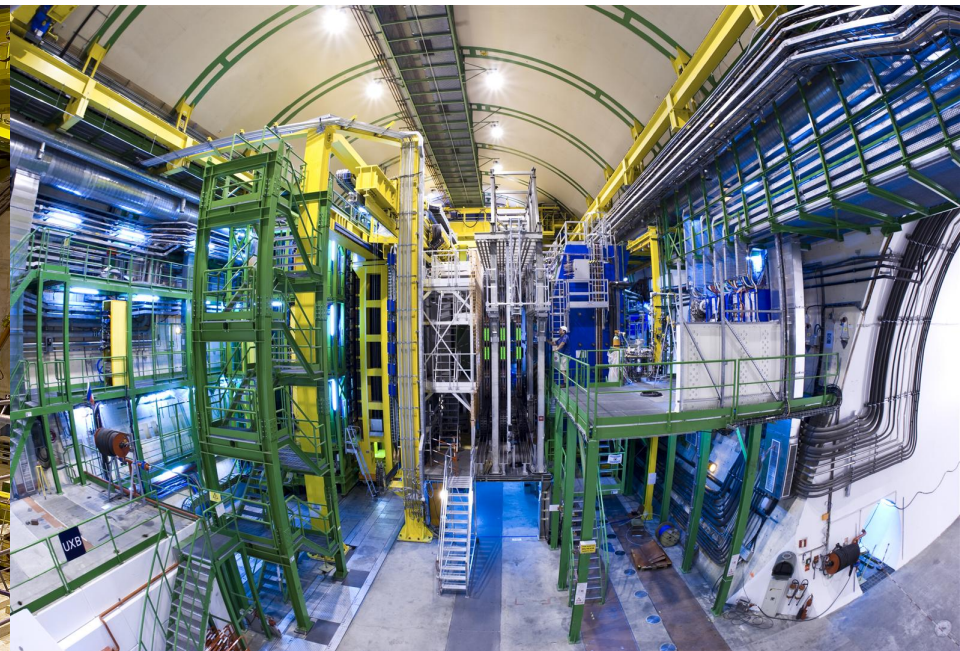
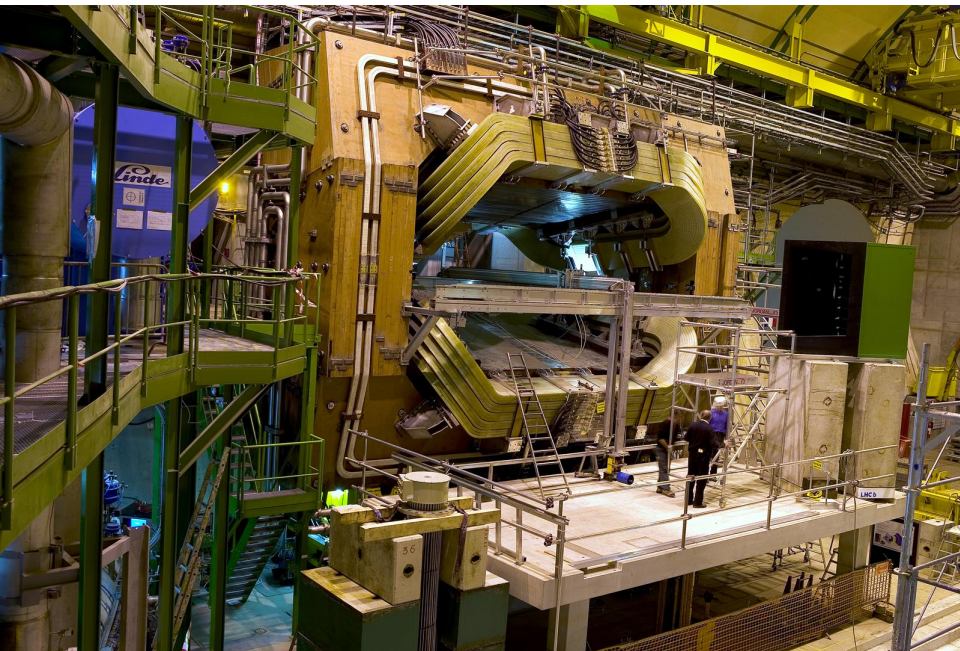
Prof. Schael, I. Phys. Institut



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

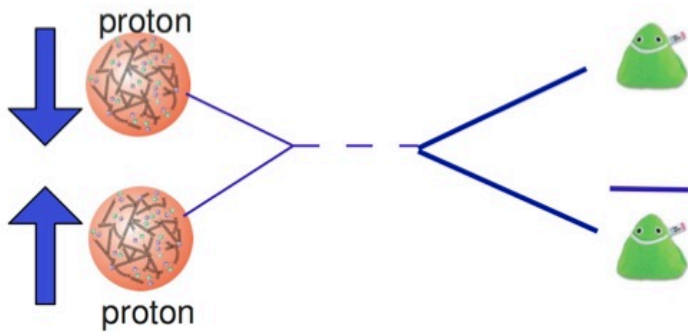
Designed to study heavy flavour physics to

- 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

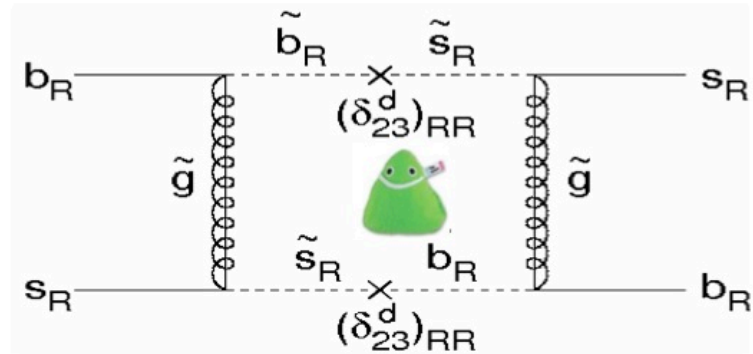


Direct vs indirect observations

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

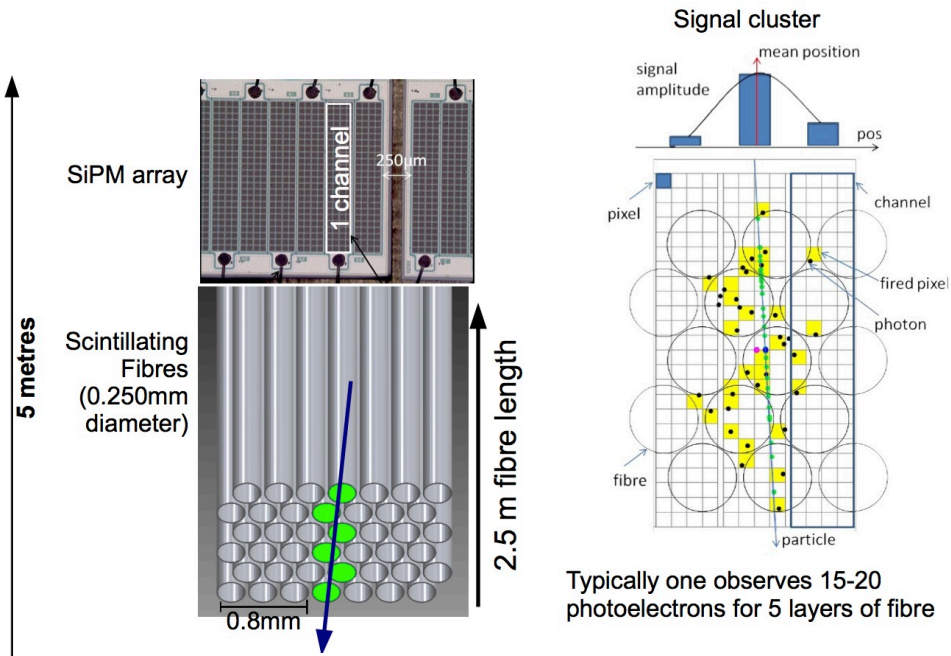
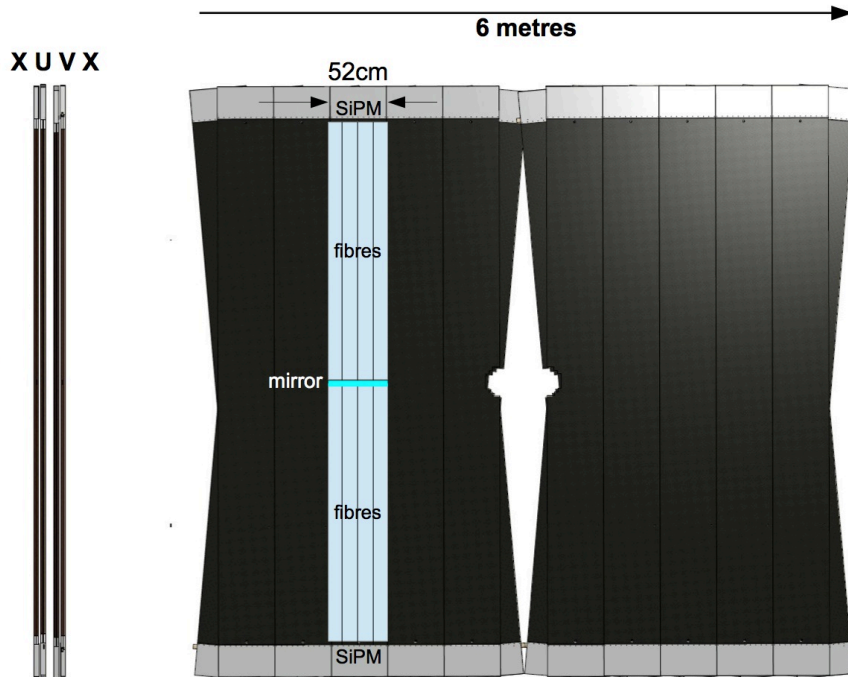
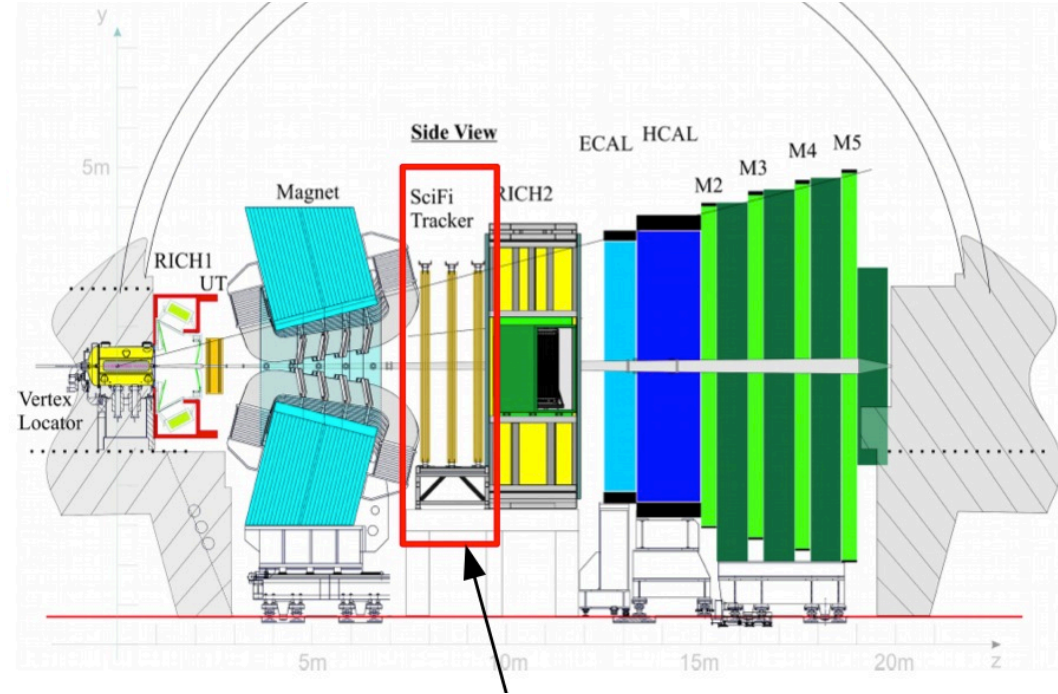
- **Indirect observations in the past:**

- Kaon decay $K^0 \rightarrow \mu\mu$ hints at **c-quark** via GIM in 1970
- **3rd quark family** predicted 1972 to explain CP violation
- **Neutral current** observed in neutrino experiment in 1973
- **1987 BB mixing** hints at large **top** mass, 1990 LEP predicts top mass
- prediction of **Higgs** Boson mass ~ 100 GeV in ~ 2000

- (J/ψ found in 1974)
- (b found in 1977, t in 1994)
- (Z-boson found in 1983)
- (top found in 1994)
- (Higgs found 2012)

Scintillation Fiber Tracker

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

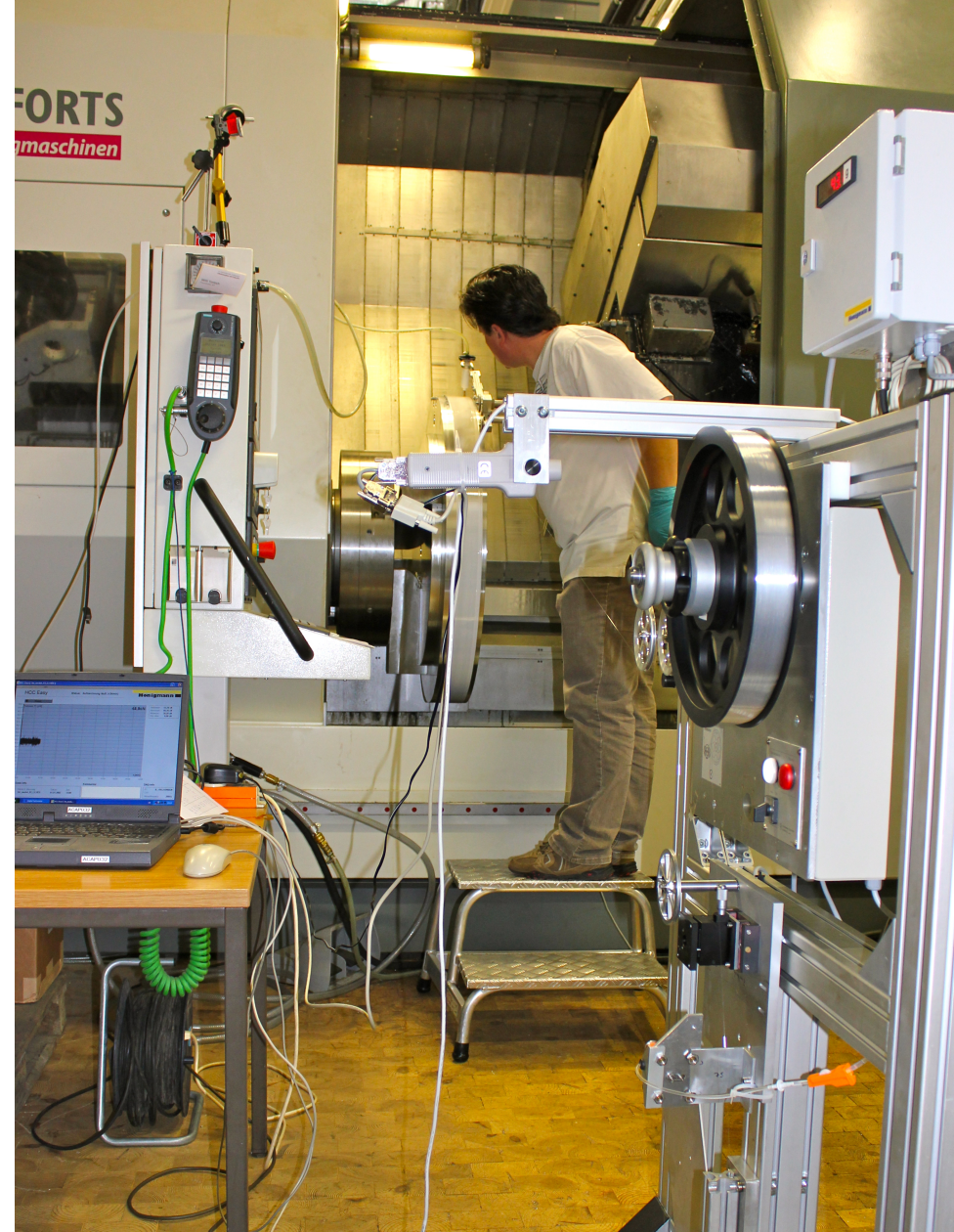
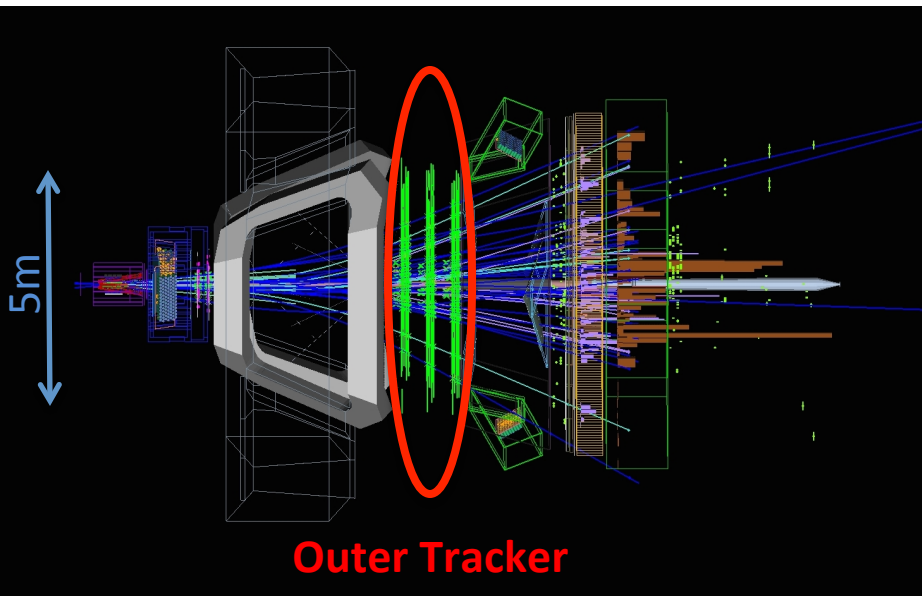


Bachelor-, Master- and PhD Thesis LHCb Experiment at CERN

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