GEORG-AUGUST-UNIVERSITÄT
GÖTTINGEN

Lightning Talk
Anomaly Detection for the ATLAS Pixel Detector

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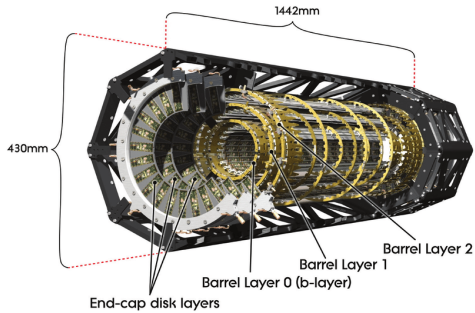
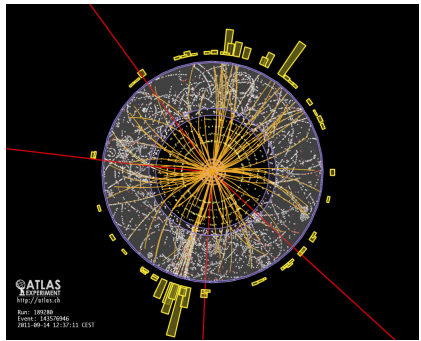
CERN Openlab

FSP ATLAS
Erforschung von
Universum und Materie

Pixel Detector





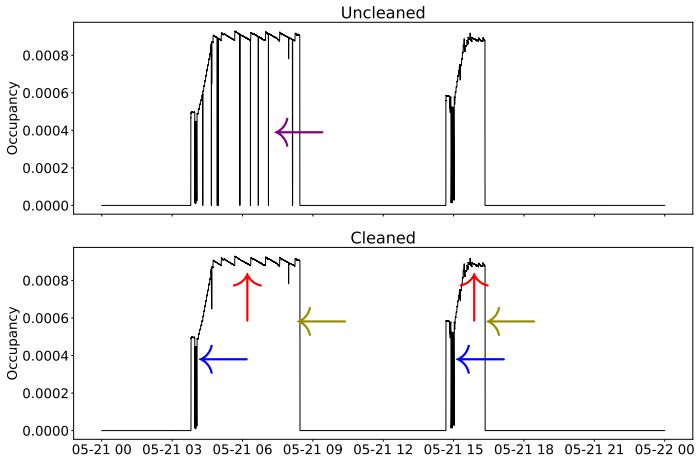
- Innermost layer of the tracking system
- Tracking system information used to reconstruct charged particle tracks
- Most precise part $\rightarrow$ highest spatial resolution

Project

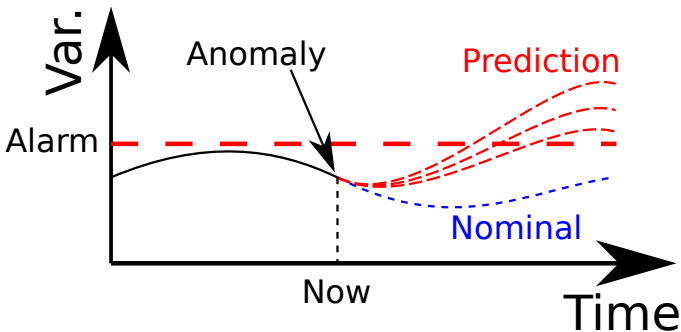
- Data quality only ensured if modules (devices for acquiring data) are fully functioning
- Currently: Many shifters/experts sitting in ATLAS Control room monitoring the condition of detector
  - Check for anomalies in data
- Use machine learning (ML) to detect anomalies automatically
  - → reduce number of shifters and help experts to anticipate/predict future failures

Status

- First focus on occupancy (hits per pixel per event)
- Implement artifacts removal
- ← Beam dump
- ↑ Luminosity leveling
  - Keep luminosity constant
- ← Emmitance scan
  - Check the position of beam



Goal



- Predict module condition in the future → Recurrent Neural Networks?
- If there are anomalies in the data, prediction might deviate from nominal
- If prediction is under a alarming value, then no shifters needed

Challenges and Outlook

- Very large data sets ($14400 \times 280 \approx \mathcal{O}(4 \cdot 10^6)$ datapoints per day)
  - Throw away the zeros in occcupancy?
  - Do not train on all modules?
- Data non stationary
  - When is a trend normal and when not?
  - When are fluctuations okay?
  - Can this be captured through correlations with other variables?
- Development of ML model

Investigated by just testing and trying to understand the data first to find optimal model