Overview of ATLAS forward proton detectors for LHC Run 3 and plans for the HL-LHC

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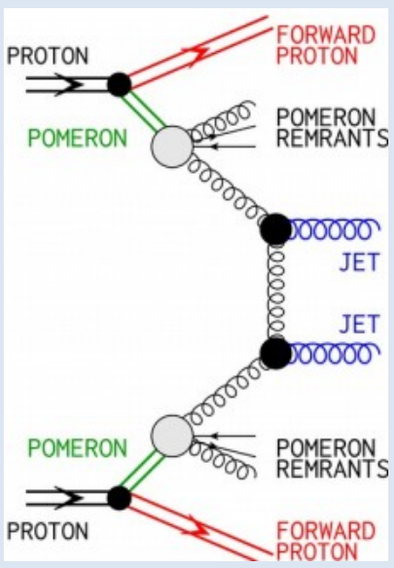
on behalf of ATLAS Forward Detectors

Physics of Interest

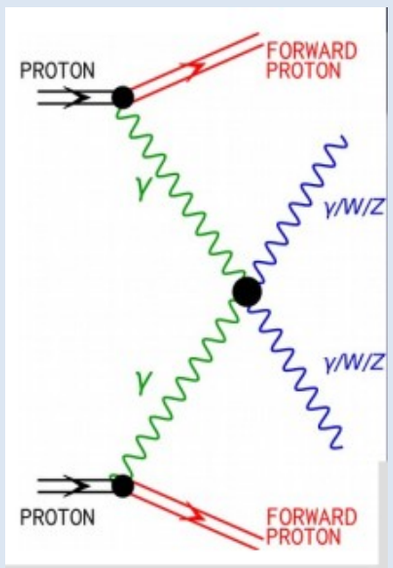
Events in which one or both protons remain intact after interaction.

Colourless exchange: photon or Pomeron.

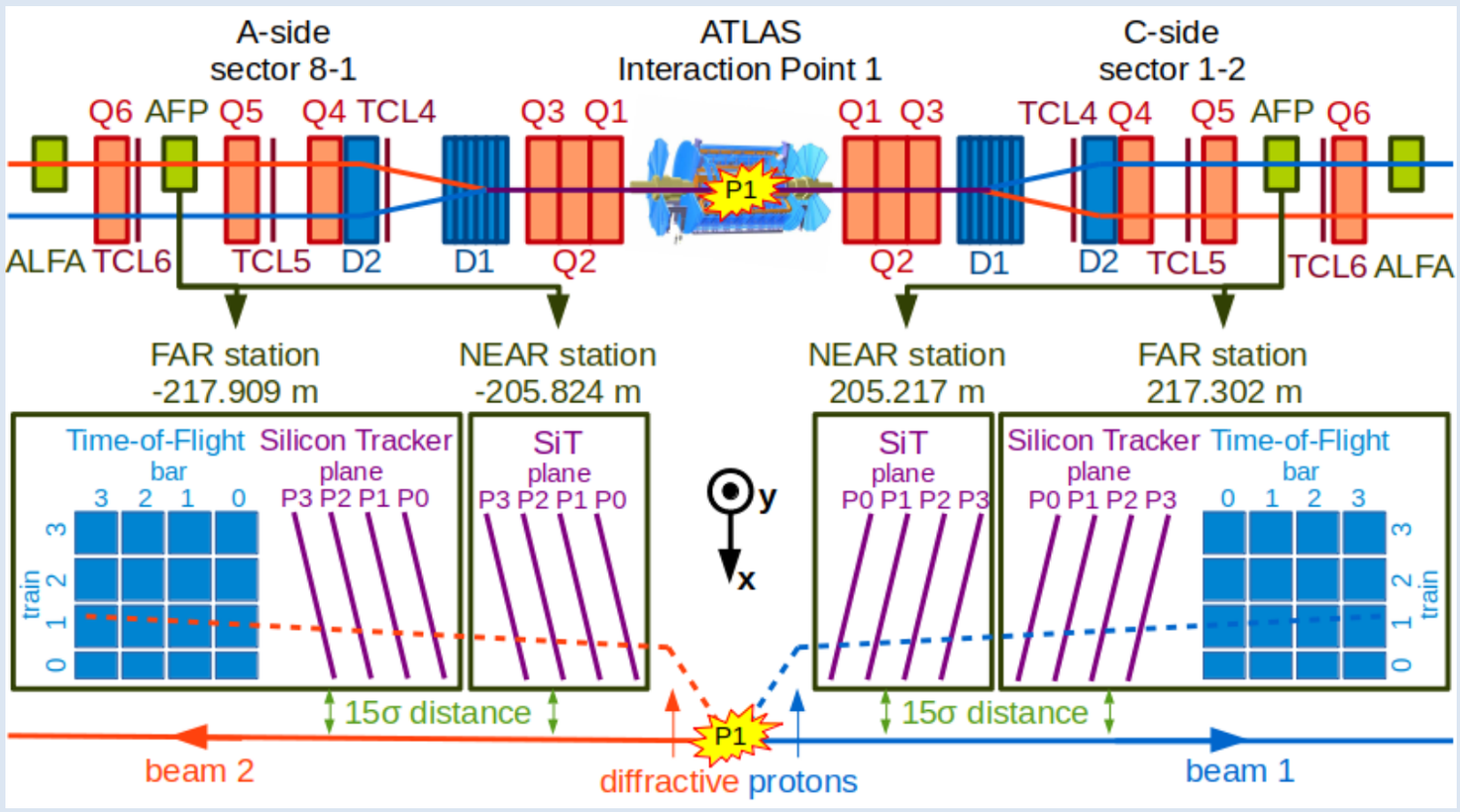
Hard diffraction



BSM processes



ATLAS Forward Proton Detectors

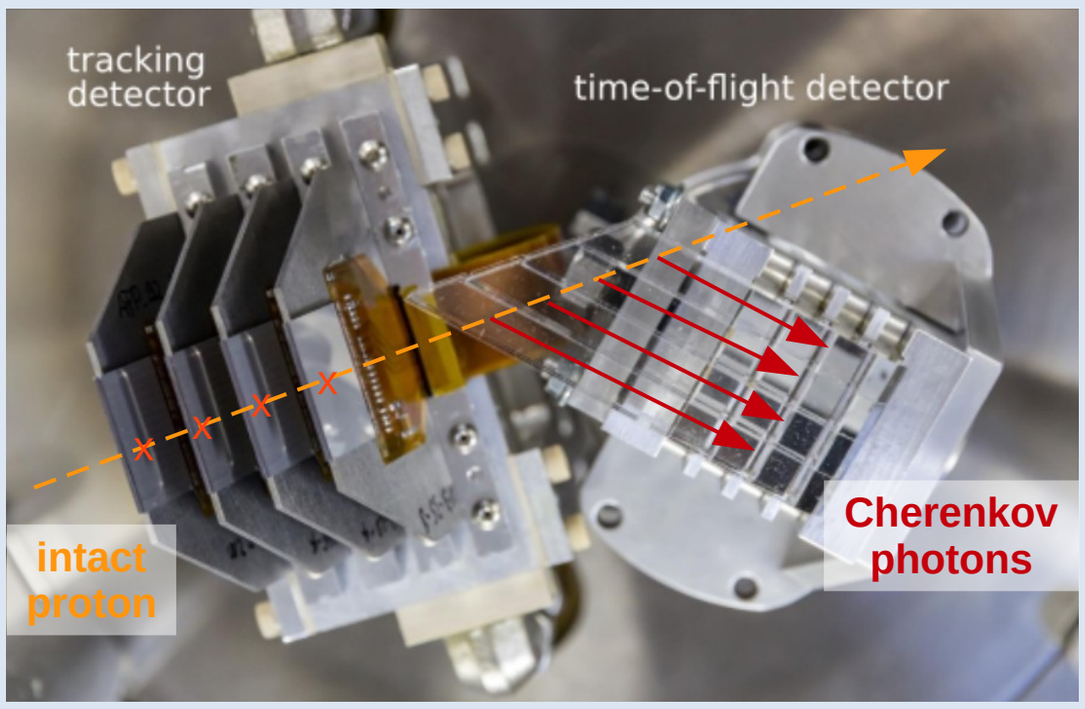


Roman Pot technology to move detectors 2-3 mm to proton beam.

Four Roman Pots, two on each site of ATLAS: Near and Far stations.

All stations host Silicon Tracking (SiT) detectors.

Far stations equipped with Time-of-Flight detectors.



Silicon Tracker

Purpose: precise reconstruction of proton trajectory
6 μm in x, 30 μm in y [JINST 11 (2016) P09005]

4 SiT planes in each station, each consist 336×80 pixels with size of 50×250 μm^2 (230 μm thickness).

Edgeless: dead edge (beam side) of only ~100 μm.

Radiation-hard technology.

Triggering possibilities (~400 ns dead-time).

Time-of-Flight System

Purpose: reduce combinatorial background.

16 L-shaped quartz bars to guide Cherenkov light.

Photons detected by a Micro-Channel Plate Photo Multiplier (MCP-PMT); radiation hard readout.

Timing resolution: aim for 20 ps at Run3. In Run 2: 35 ± 6 ps (side A) and 37 ± 6 ps (side C) per train.

Triggering possibilities (<25 ns dead-time).

AFP @ Run 3

New design of detector flange: Out-of-Vacuum solution for ToF detectors.

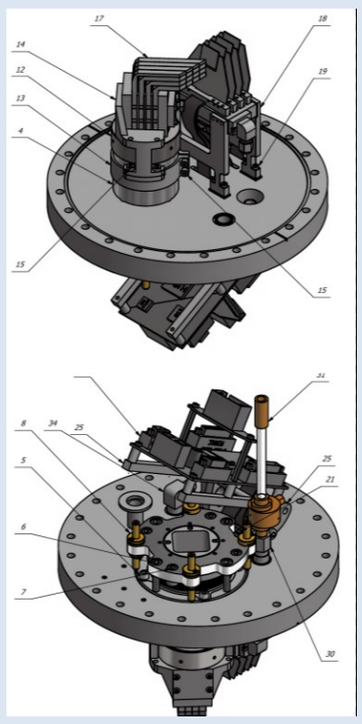
New SiT modules to replace used ones.

Trigger module: possibility to trigger on a single ToF train.

New photo-multipliers: address inefficiency issues from Run2 data-taking.

Successful beams tests and installation in LHC tunnel.

Currently commissioning with first LHC beams → **waiting for Run 3 physics data!**



Data-taking plans:

- participate in all standard, high pile-up (μ) fills,
- take part in dedicated low-μ runs.

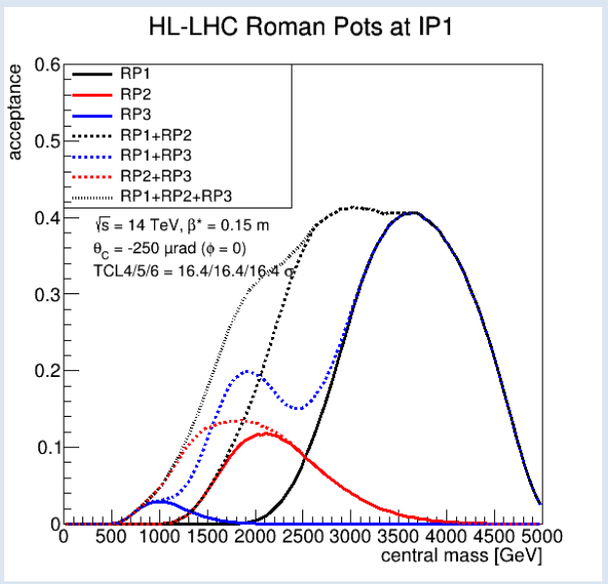
AFP @ Run 4

Motivation: photon induced processes and BSM searches.

Ongoing discussion in ATLAS.

Significant constraints in LHC tunnel wrt. Run3 → only few locations possible for pots.

Location of pots determines accessible mass range.



Having more stations located at various locations would cost more, but would improve overall detector acceptance.

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