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

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Physics of Interest
Events in which one or both protons remain intact after interaction.
Colourless exchange: photon or Pomeron.

Hard diffraction
BSM processes

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 µm² (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).

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.

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.