

# AFP: First Experience with Data and Future Plans

Grzegorz Gach  
*on Behalf of the ATLAS Collaboration*

AGH University of Science and Technology

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Deep-Inelastic Scattering and Related  
Topics*



# ATLAS Forward Detectors

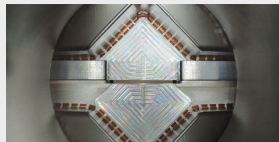
LUCID  
17 m



Zero Degree  
Calorimeter 140 m



Absolute Luminosity  
For ATLAS 240 m

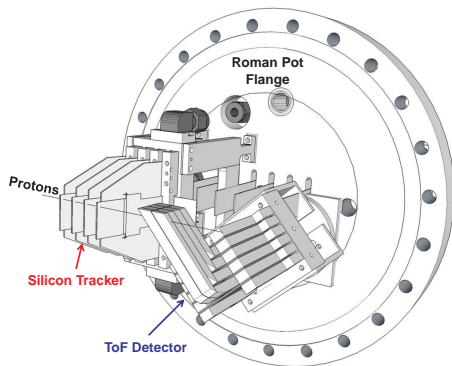


ATLAS Forward Proton  
210 m

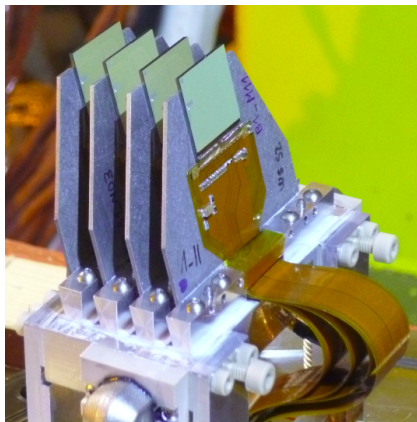


- four horizontal roman pots
- detectors dedicated to the measurement of diffractively scattered protons

- stations placed at 205 m and 217 m away from the nominal interaction point
- acceptance in  $\xi = (E - E')/E \approx (0.025, 0.1)$
- near stations equipped with 3D pixel tracking detectors
- far stations additionally house time-of-flight counters

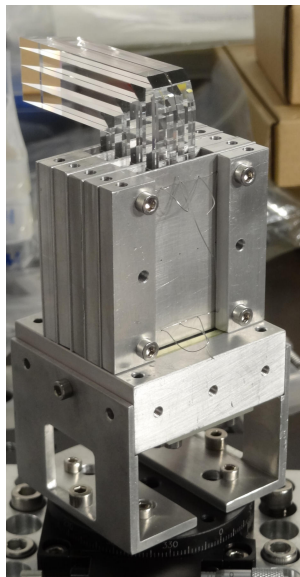


# Tracking Detectors



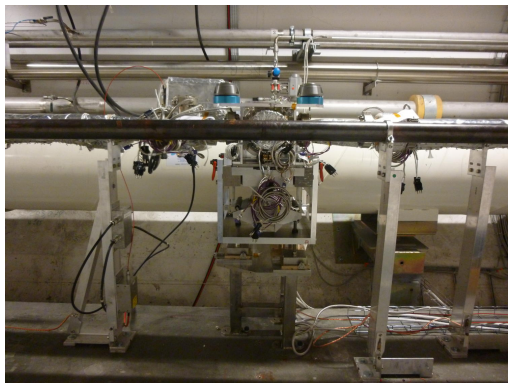
- 4 layers of 3D pixel detectors in each station
- $336 \times 80$  pixels of  $50 \times 250 \mu\text{m}^2$
- pixel modules are similar to the ones used in IBL with proven radiation hardness
- detectors are tilted by  $14^\circ$  with respect to the horizontal direction
- measure the forward proton track needed to reconstruct its kinematics

# Time-of-Flight Counters



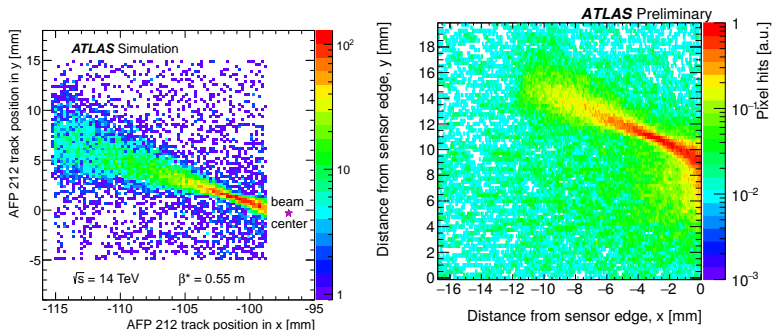
- $4 \times 4$  Quartz LBars
- time resolution aiming at 10 ps
- vertex position resolution of about  $\sigma_z = 2.1$  mm
- design efficiency not smaller than 90 %
- fast enough to provide trigger signal
- pile-up background reduction
- necessary in standard runs with high pile-up

# AFP in 2016 — Installation



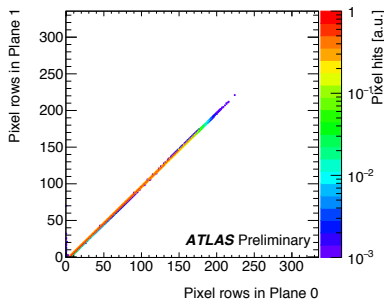
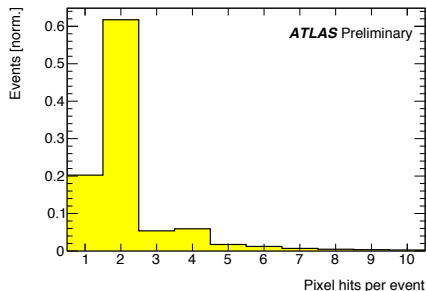
- two stations installed on one side ATLAS
- tracking detectors installed in the stations
- passed LHC qualification
- DAQ system integrated with ATLAS
- trigger system integrated with ATLAS

# AFP in 2016 — Data Taking



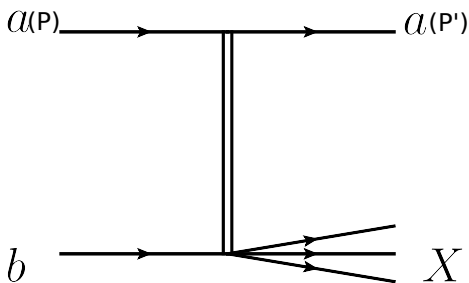
- commissioning runs with various positions of the detectors
- smooth operations
- two dedicated physics runs with low pile-up ( $\mu \approx 0.03$  and  $\mu \approx 0.3$ )
- collected integrated luminosity  $\mathcal{L} \approx 500 \text{ nb}^{-1}$

# 2016 Tracking Detectors Performance



- in most events 2 hits are observed in each plane
- very good correlation of hits between two planes (first and second)

# 2016 Physics Program — Single Diffraction

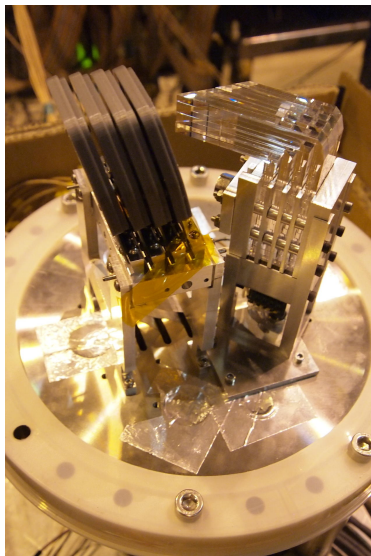


- relatively high cross section
- single proton detectable in AFP
- AFP provides access to so far non-measurable quantities like  
 $\xi = (E - E')/E$  or  
 $t = (\mathbf{P} - \mathbf{P}')^2$

## Presently Studied

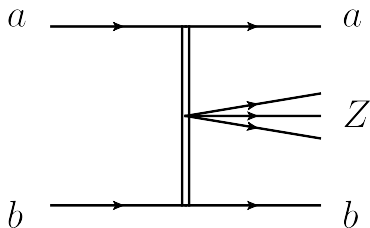
- inclusive single diffractive dissociation
- diffractive dijet production

# AFP in 2017



- two remaining stations installation
- tracking detectors installation
- time-of-flight counters installation in the far stations
- LHC qualification
- timing detectors triggers integration with ATLAS
- data acquisition in special runs
- data acquisition in standard runs

# 2017 Physics Program — Central Diffraction



- low pile-up runs for studies of high cross-section processes
- standard runs for small cross-section processes studies
- double proton tag allows direct observation of central diffraction
- access to full event kinematics

## Considered Analyses

- central diffractive jets production
- exclusive dijet production
- photon induced processes
- single diffractive production of  $W$  or  $Z$

# Summary

## 2016

- successful installation and operation
- collected good data with  $\mathcal{L} \approx 500 \text{ nb}^{-1}$  for studies of single diffraction
- data analyses are already in progress

## 2017

- installation of the remaining two stations and time-of-flight counters
- data acquisition in standard runs with high pile-up as well as in dedicated runs
- studies focused on central diffraction

Thank You for Your Attention!