

Project 4

Analysis of Cluster Shapes in the ATLAS AFP Detector

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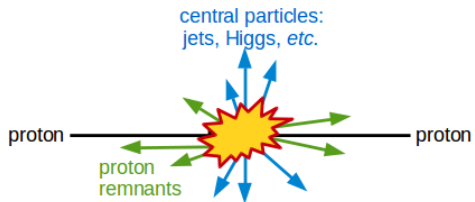
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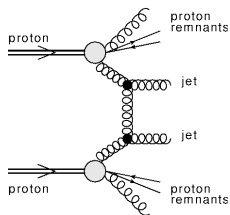
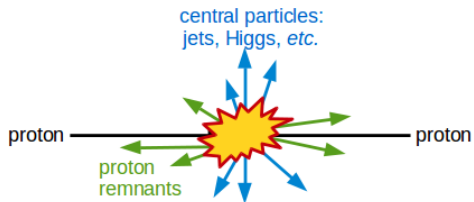
Usual situation at Large Hadron Collider:



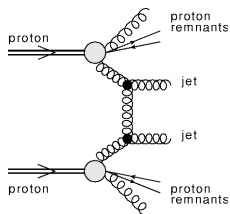
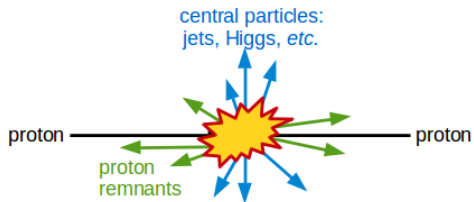
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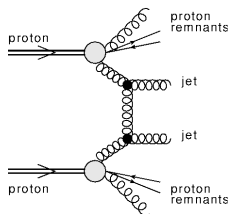
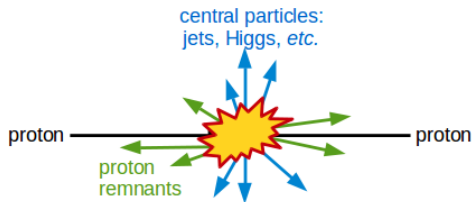


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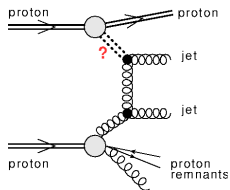
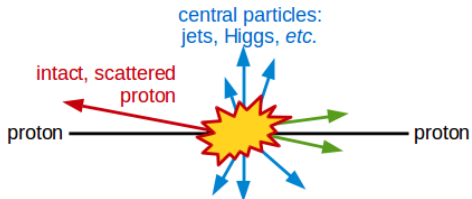


Can proton(s) remain intact?

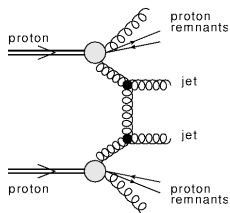
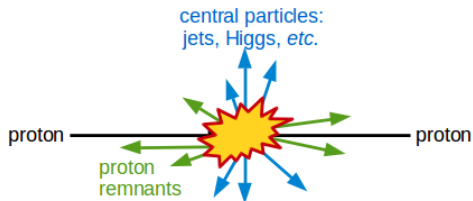
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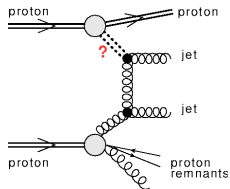
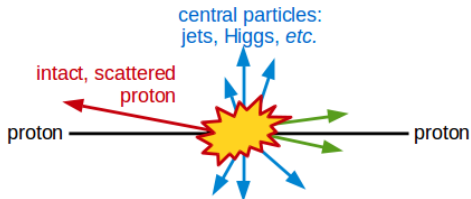
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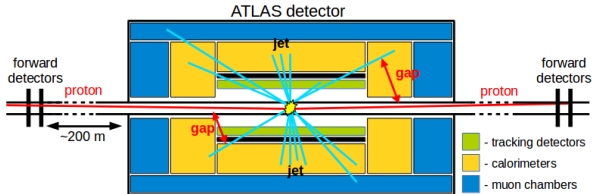


Yes! But exchanged object must not change quantum numbers of proton(s):

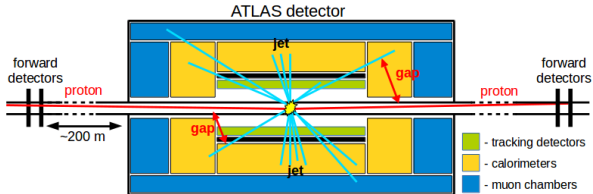
- electromagnetic force: photon,
- strong force: Pomeron (QCD = two gluons + h.o. terms).

Such events are often called diffractive ones.

Typical diffractive topology:
a gap in rapidity is present
between proton(s) and central
system and one or both
interacting proton stay intact.



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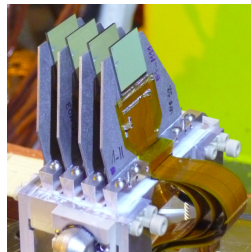
Intact protons are scattered at very small angles,
typically into LHC beampipe.

In order to measure them, special detectors called
Roman pots, must be installed.

ATLAS is equipped with two sets of such detectors
ALFA and AFP.

AFP (ATLAS Forward Proton) detectors are located
about 210 m from ATLAS collision point.

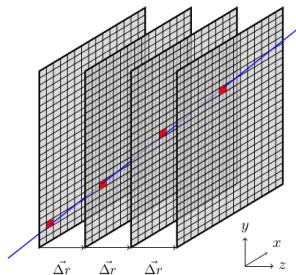
For position measurement 3D-silicon sensors are used.



Each AFP Roman pot contains four layers of silicon sensors.

In the first approximation, each layer can be described as a matrix of 338×80 pixels.

Proton passing through detector induce signals in pixels, forming clusters.



Main task: deepen the knowledge on how protons form cluster hits in AFP silicon detector.

Tools: standalone C++ code for cluster reconstruction, sample with diffractive protons generated by Pythia.

Starting from simple analysis of track properties based on Monte Carlo events generated by Pythia 8, through reconstructing clusters with dedicated standalone-tool, ending on analysis of signals in close-to real LHC conditions, this project would allow for deep understanding of cluster formation in AFP.

