ATLAS-LHCf Update

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DESY APP Meeting, 31.8.2021

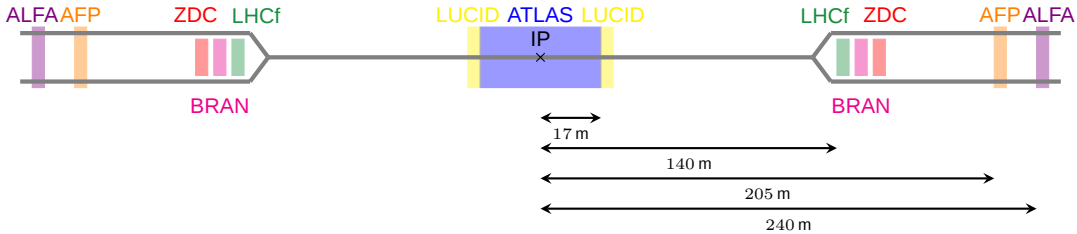
General News from ATLAS-LHCf Meetings

- Meeting on planning joint calibration test of LHCf and ZDC
- LHCf people are busy preparing for the beam test at SPS in September
- There are however hardware related delays in Italy → thinking about postponing it

→ Not much other news because of that and vacation season

New PhD student, Yusuf Can Cekmecelioglu, will join Cigdem's group tomorrow – will also work on forward hadronic interaction studies!

Plans for Run 3



- Good news: p-O (and O-O) collisions are planned for late run 3 for $\sim$ 1 week
  - Especially valuable for air shower modelling!
- There will be a joint operation of LHCf and ZDC (ATLAS) detectors during a $\sim$ 2 days low-μ run in 2022 (p-p collisions)

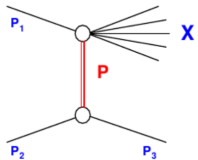
$\rightarrow$ This will improve the neutron energy resolution as compared to just using LHCf

Pion Exchange Simulation

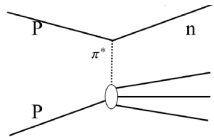
New analysis target for run 3:

> Discriminating pion exchange from pomeron exchange diffractive events

Pomeron exchange:



Pion exchange:



> Impact on meson and therefore also muon production cross section and multiplicity in EAS simulations! (muon puzzle)

→ Need to tag forward proton!

→ **For joint operation with AFP or ALFA we need studies to support this possibility!**

Pion Exchange Simulation

- Problem: There is no ATLAS generator for simulating pion exchange!
- LHCf is using the MonCher generator
  - Challenging: Based on very old versions of software packages (pythia 6.4, cernlib)
- Goal: Produce a private LHE file that can be used as an input for ATLAS production
- Can then be used for feasibility studies

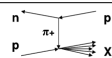
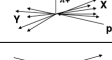
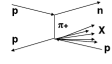
N	Process	Type of $\pi^+ p$ interactions	Picture of the process	The MONCHER parameters
1	$pp \to nX$	minimum bias: $\pi^+ p \to X$		MONPAR(7)=1 MONPAR(8)=0 MSEL=1
2	$pp \to n\pi^+ p$	elastic scattering: $\pi^+ p \to \pi^+ p$		MONPAR(7)=1 MONPAR(8)=0 MSEL=0 MSUB(91)=1
3	$pp \to nXY$	double diffraction: $\pi^+ p \to X + Y$		MONPAR(7)=1 MONPAR(8)=0 MSEL=0 MSUB(94)=1
4	$pp \to nXp$	single diffraction (π^+ dissociation): $\pi^+ p \to X + p$		MONPAR(7)=1 MONPAR(8)=0 MSEL=0 MSUB(92)=1
5	$pp \to nX\pi^+$	single diffraction (p dissociation): $\pi^+ p \to X + \pi^+$		MONPAR(7)=1 MONPAR(8)=0 MSEL=0 MSUB(93)=1

Table 4: Some SπE processes which can be generated with MONCHER.

Pion Exchange Simulation

- MonCher setup including cernlib compiled and working
- Prepared job options for processing LHE files with ATLAS event generation software to get the right file format

→ works!

- So far tested setup with simple MonCher simulation setting for elastic scattering $pp \to n\pi^+ p$ (runs the fastest)
- Issues encountered so far:
  - Had to correct some outputs in MonCher code so the LHEF content is readable
  - Beam information, cross section, process ID were missing or wrongly put in LHE output
  - Still working on output of correct cross section and ID per process

Backup