A simulation study for one-pion exchange contribution on very forward neutron productions in ATLAS-LHCf common events

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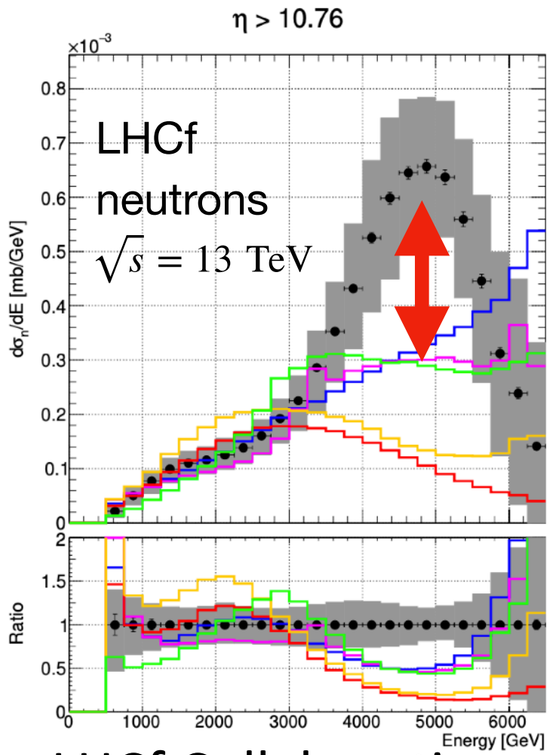
In this contribution, we focus on the validation of hadronic interaction models, which is important to understand the mass-composition of ultra-high energy cosmic ray.

Motivated by the results by the LHCf experiment:



LHCf Collaboration, JHEP 11(2018)073

Differences between data and MC are reported by the LHCf experiment.

If these differences are caused by

diffractive / Non-diffractive

=> affects $\langle X_{\mathrm{max}} \rangle$ and $\langle X^{\mu}_{\mathrm{max}} \rangle$

One-pion exchange

Which connects high-energy pion-proton collisions.

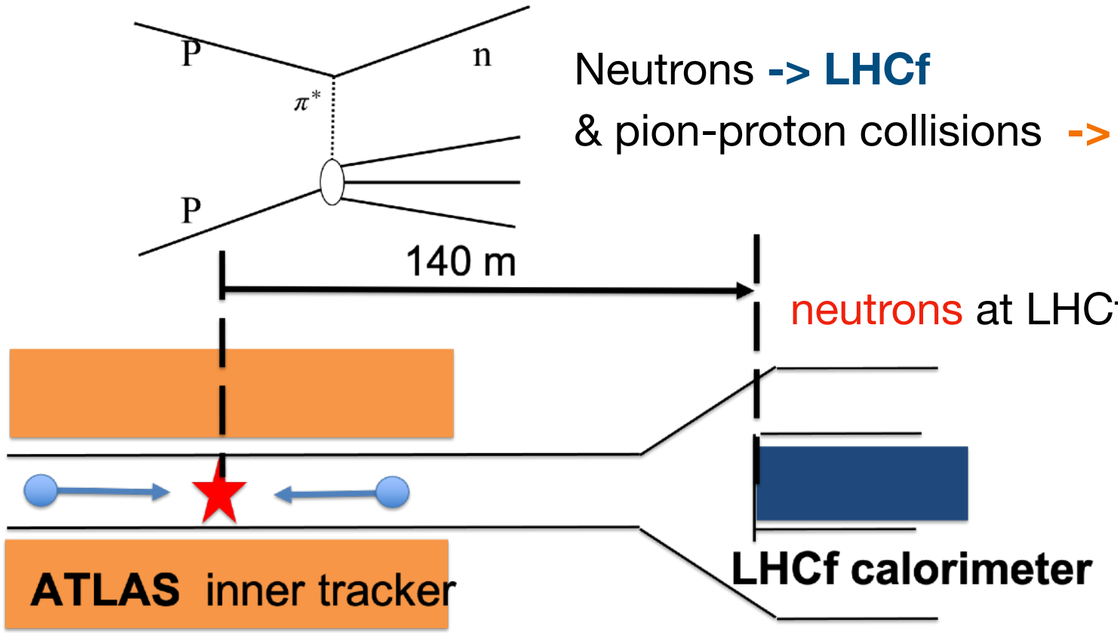
=> **affects muon components in air shower.**

A method for separating one-pion exchange contribution

Target of this work

Develop a method for separating one-pion exchange contribution from diffractive/non-diffractive backgrounds

One pion exchange

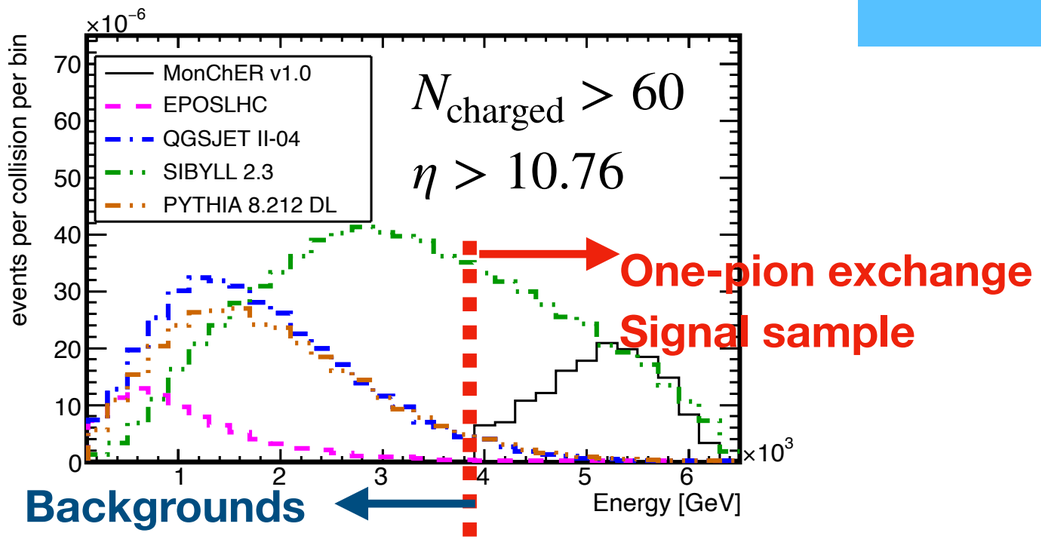


Neutrons **-> LHCf**

& pion-proton collisions **-> ATLAS**

neutrons at LHCf

N_{charged} : number of charged particles in ATLAS inner tracker.



Results

We can **separate signal samples and background samples in event-by-event bias**, except for the cases with very large backgrounds like SIBYLL.

Possibility to measure cross-sections and multiplicity for the one-pion exchange process in LHC-Run3.