

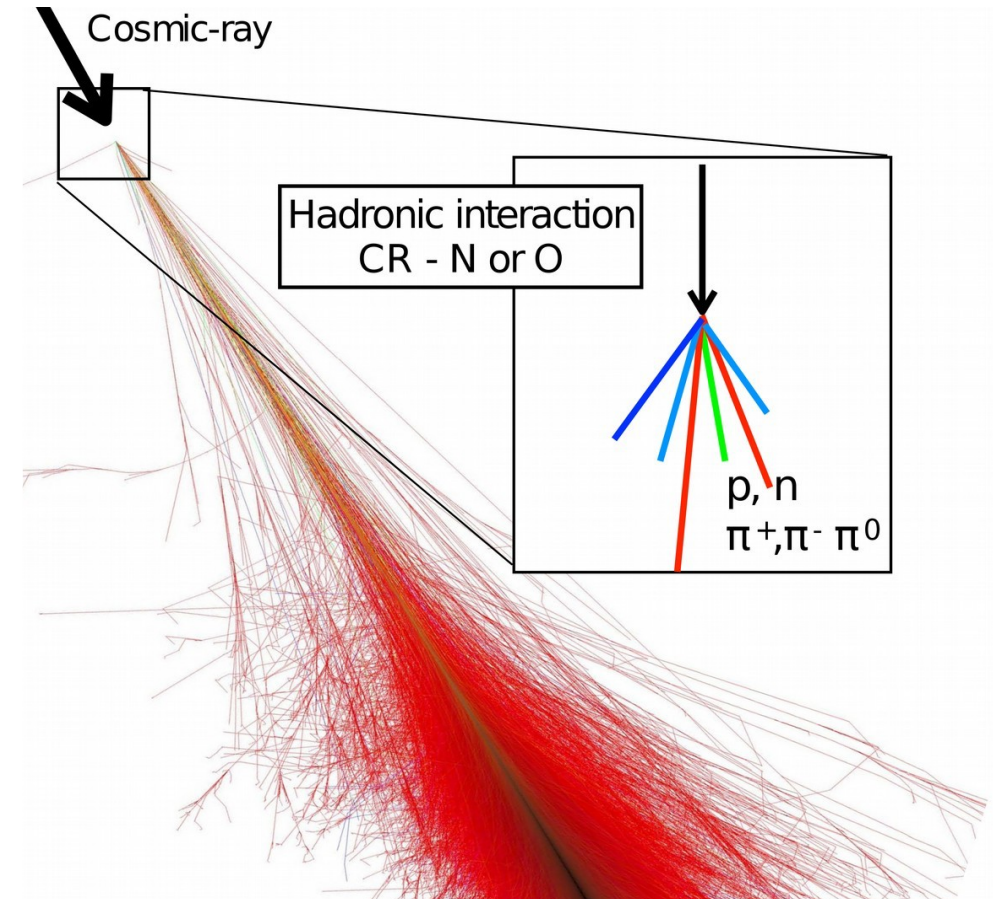
Discussion on forward physics and cosmic rays

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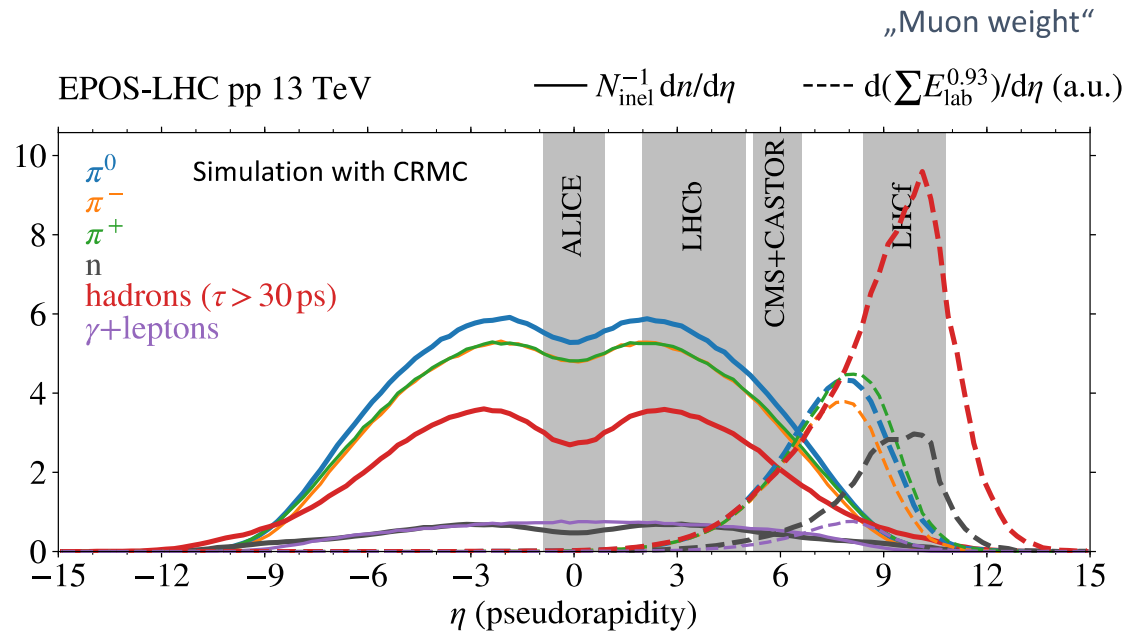
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Motivations for p-O run

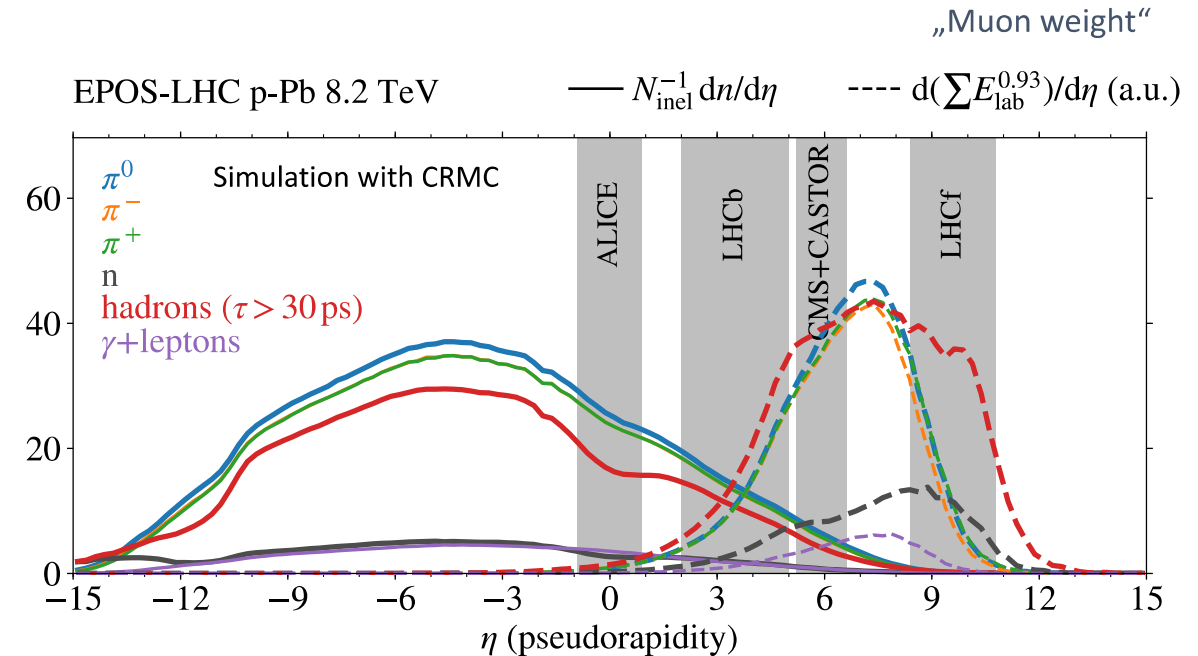
- **Best configuration to test CR-atmosphere interaction** (p-remnant side)
- directly probe the first interaction of a cosmic ray with a light nucleus of the atmosphere (N or O)
 - **forward energy/ P_T spectrum**
 - **inelasticity**
- direct measurement of the **nuclear modification factor** in p-O



Importance of forward acceptance



Importance of forward acceptance



- Unique opportunity to cover very fwd region with LHCf detector
 - No possibility to install at RUN4
- In time with AUGER exp

Some questions (I)

- Which LHCf pp, pPb measurements have been actually implemented into the CR MCs? Which underlying physics mechanisms are most sensitive to LHCf results? Are there versions of the MCs with and without those LHCf effects to see their impact on key UHECR observables?
- Related to the previous question, p-A & AA cross-section, elasticity and multiplicity are all measurable quantities at LHC. How they have been used?
- Are really photonuclear interactions negligible in EAS development (maybe yes for p+air, alpha+air, but also for Fe+air)? Are they implemented into the CR MCs? If so, can we see predictions for key UHECR observables with and without those observables?
- What are the (forward and central) p+O measurements most important to improve CR MCs? Do we actually need LHCf or e.g. running with ZDC, or central detectors, alone would be enough?
- To improve the nuclear-dependent ingredients of the MCs, are O+O collision data needed for CR MCs? or p+Pb, Pb+Pb and p+O results are enough?

Some questions (II)

- I assume that to improve for CR MCs mostly min-bias p+O data is needed, and therefore 1--2 days running is enough? Or you would need to have also some high-pT observables measured?
- For CR MC improvement, is $\sqrt{s_{NN}} = 9.9$ TeV a good c.m. energy to run for p+O or you need also lower $\sqrt{s_N}$ data?
- For CR MC improvement: Do you need p+O and O+p observables or one side is enough?
- Which of the LHCf p+O measurements would be more useful to address the "muon excess puzzle" ?