

Particle Type Re-ordering in Bertini Cascade

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Recent Changes in Shower Shapes

- Ref-07 shows more visible energy, wider shower shapes
 - due to change in elementary particle collisions in Bertini
- Two-body collisions in Bertini use parameterized phase-shift data to get angular distributions in final state
 - for both elastic and charge exchange
 - for incident pions and nucleons
- Scattered angle should be assigned to incident (or charge-exchanged) particle
 - was not the case in previous releases

Re-ordering

- In hadron-nucleon collisions within the nucleus, final state particles are now listed with the scattered incident particle first
 - allows correct angle to be assigned to it
 - biggest effect for pion scattering

Explanation (1)

- The incident (or charge-exchanged) hadron in most hadron-nucleon two-body final states is forward-peaked
- For pion scattering, if the pion is incorrectly assigned the backward angle it has too little energy after the boost to the nucleus frame
 - nucleon has too much, but compared to pion not that much more
 - lower energy pion → lower multiplicity in cascade → lower multiplicity in shower → less energy deposited
 - using correct ordering → more energy deposited

Explanation (2)

- Also, as multiplicity increases, proportion of pions increases
 - more scattering → wider showers