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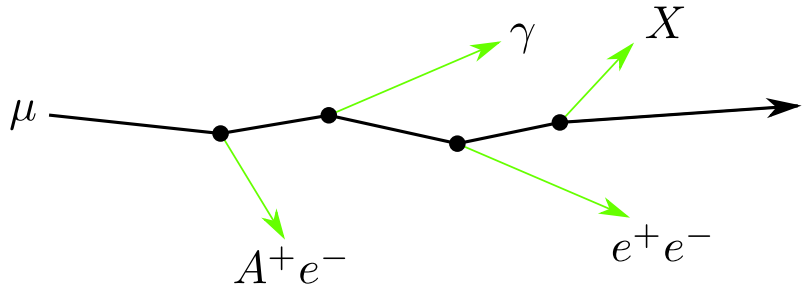
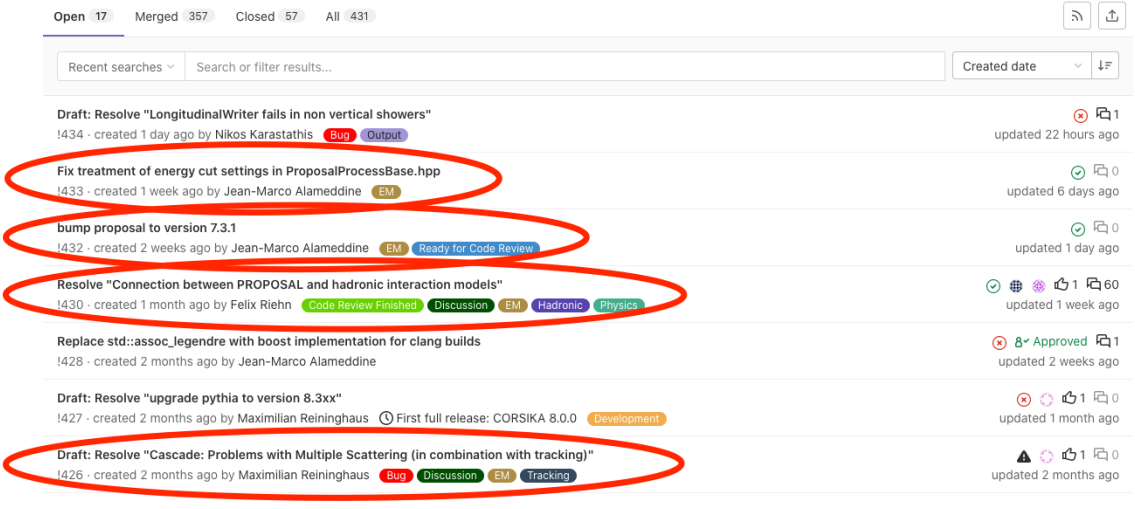


Merge requests important for EM showers

Jean-Marco Alameddine, Alexander Sandrock

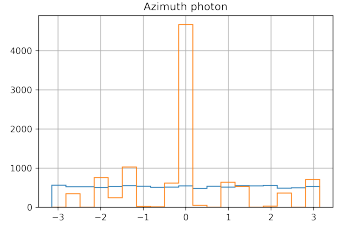
2022-05-12

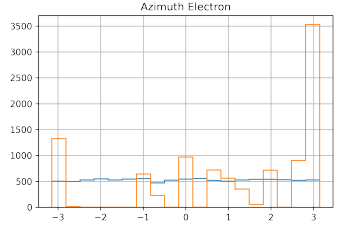
Overview of current PR



PR !432: bump proposal to version 7.3.1

- New patch release of PROPOSAL (27.04.2022)
- Full PROPOSAL release notes: Here
- Release includes some fixes that might improve the stability of PROPOSAL within CORSIKA 8:
  - → Catch negative dNdx values (PR #277)
  - → Catch calculation that can become `nan` in `Highland::CalculateTheta0` (PR #282)
- Fixes bug in sampling the azimuth angle in Compton scattering
  - → Reason: A random number has not been correctly initialized
  - → This lead to unphyical articfacts in the azimuthal distribution
  - → However, a first analysis by Nikos showed that this doesn't change the bipolar structure in the radio pulses





⇒ PR only changes the PROPOSAL version in `conanfile.txt` and is "ready for review"

PR !430: Resolve "Connection between PROPOSAL and hadronic interaction models"

- Felix Riehn wrote an interface between hadronic energy losses in PROPOSAL and a hadronic event generator (currently: SIBYLL)
  - → If a photon or a lepton interacts via a hadronic interaction, a ρ_0 with the corresponding energy is passed to the hadronic interaction model
  - → Particles with an energy below an (adaptable) threshold and particles interacting with Argon are currently discarded (issues #497 & #498)
- The PR adds some basic UnitTests
- There has been some discussion in the PR about diffractive interactions
  - → *"...for now what we have is good enough and short of what is done for SIBYLL the implementation is consistent with corsika7."* - Felix Riehn

⇒ I reviewed the PR positively. Apart from the discussion about the diffractive interactions, this should be ready to be merged. The muon/hadron numbers also show that the interface produces reasonable results.

PR !433: Fix treatment of energy cut settings in ProposalProcessBase.hpp

- In CORSIKA 8, before PR !345 has been merged, there has only been one "energy cut setting"
  - → Particles were removed from the stack if their energy has been below the cut
  - → PROPOSAL produced energy losses that were above 50 % of this cut
- Now, we have two separate settings:
  - → `energy_propagation_threshold`: Particles with an energy below this threshold are removed from the stack
  - → `energy_production_threshold`: PROPOSAL only produces secondary particles with an energy above this threshold
- However, PROPOSAL still uses 50 % of the energy set with `energy_production_threshold` as a threshold
  - → This is basically a bug that is fixed with this PR
  - → The simulation can now be optimized much better

⇒ We might want to improve/rethink the interface of these settings at some point. Still, this PR should be ready for review/discussion.

PR !426: Draft: Resolve "Cascade: Problems with Multiple Scattering (in combination with tracking)"

- Current issues due to the structure of `Cascade.inl`:
  - → Multiple scattering by PROPOSAL is ignored / not correctly calculated
  - → Energies at the beginning and end of steps are inconsistently communicated to PROPOSAL
    - → Crosssections are not (always) evaluated at the correct energies
- The issue is being worked in my Maximilan Reininghaus
  - → New interface for continuous processes
  - → Redistributing the information on track and particle
  - → No (public) commits on GitLab so far