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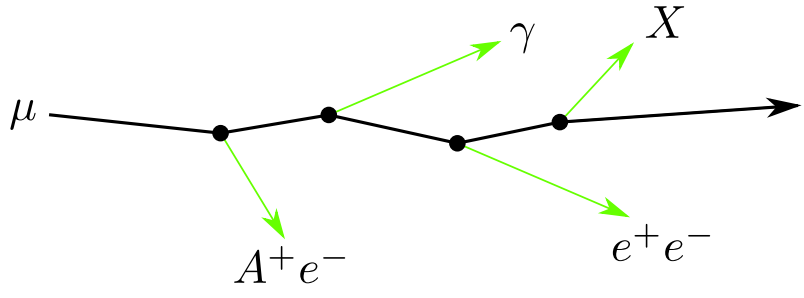

EM Shower Call

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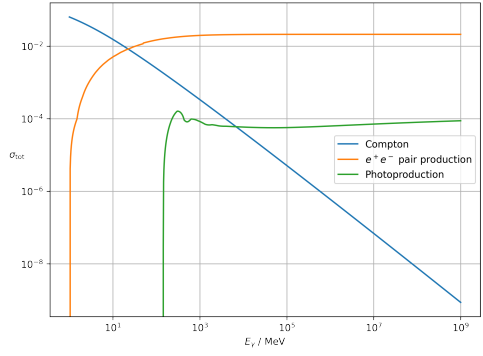
New PROPOSAL release

- PROPOSAL version currently used on C8 master branch: `v7.0.5` (from March 2021!)
  → Newest release of PROPOSAL: `v7.2.1` (February 2022)
- Release notes of intermediate PROPOSAL releases relevant for C8 have already been presented in previous EM Shower calls:
  → `v7.1.0` on 14 Oct meeting
  → `v7.1.1` on 9 Dec meeting
- PR to update PROPOSAL from `v7.0.5` to `v7.2.1` on C8 master is already open: !421

Changes in **v7.2.1** relevant for CORSIKA 8

1. Add Photoproduction as a crosssection to PROPOSAL

- Process $\gamma + Z \rightarrow$ Hadrons
- Relevant for very-high photon energies
- Several parametrizations for this process available
- Hadronic cascades produces inside an EM shower are still being discarded
  - $\rightarrow$ Need to implement the connection to a hadronic event generator!
  - $\rightarrow$ Could have an influence on longitudinal and lateral particle distributions.



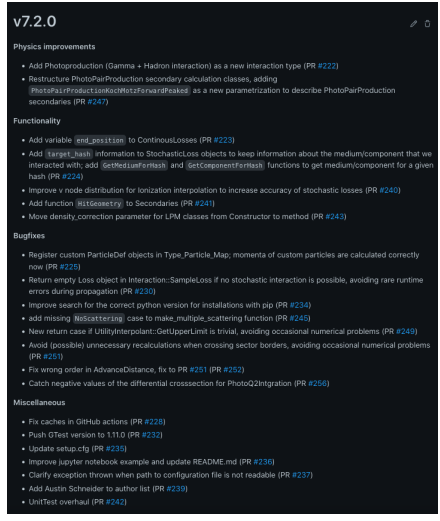
Changes in **v7.2.1** relevant for CORSIKA 8

2. Improve secondary particle calculation in e^+e^- pair production
   - Mean free path length has been calculated using `KochMotz` parametrization
   - Energy asymmetry ρ of secondaries has been calculated using `Tsai` parametrization
     → However, both parametrization assumed a different energy threshold where pairproduction is still possible
   - This unfrequently lead to the error message:
     `Unable to calculate GetUpperLimit since resultis below lower_lim. rnd was 16.838820 with rnd_max 0.000000`

⇒ Fixed in `v7.2.1`, where a consistent treatment of the pairproduction process in used per default

Full release notes

- Numerous PROPOSAL-internal changes and bugfixes that won't have a (significant) impact on CORSIKA 8
  → Full release notes: See here



v7.2.0

Physics improvements

- Add Photoproduction (Gamma + Hadron interaction) as a new interaction type (PR #222)
- Restructure PhotoPairProduction secondary calculation classes, adding `PhotoPairProductionKochMotzForwardPeaked` as a new parametrization to describe PhotoPairProduction secondaries (PR #247)

Functionality

- Add variable `end_position` to ContinousLosses (PR #223)
- Add `target_hash` information to StochasticLoss objects to keep information about the medium/component that we interacted with; add `GetMediumForHash` and `GetComponentForHash` functions to get medium/component for a given hash (PR #224)
- Improve v node distribution for Ionization interpolation to increase accuracy of stochastic losses (PR #240)
- Add function `HitGeometry` to Secondaries (PR #241)
- Move density_correction parameter for LPM classes from Constructor to method (PR #243)

Bugfixes

- Register custom ParticleDef objects in Type_Particle_Map; momenta of custom particles are calculated correctly now (PR #225)
- Return empty Loss object in Interaction::SampleLoss if no stochastic interaction is possible, avoiding rare runtime errors during propagation (PR #230)
- Improve search for the correct python version for installations with pip (PR #234)
- add missing `NoScattering` case to make_multiple_scattering function (PR #245)
- New return case if UtilityInterpolant::GetUpperLimit is trivial, avoiding occasional numerical problems (PR #249)
- Avoid (possible) unnecessary recalculations when crossing sector borders, avoiding occasional numerical problems (PR #251)
- Fix wrong order in AdvanceDistance, fix to PR #251 (PR #252)
- Catch negative values of the differential crosssection for PhotoQ2Intgration (PR #256)

Miscellaneous

- Fix caches in GitHub actions (PR #228)
- Push GTest version to 1.11.0 (PR #232)
- Update setup.cfg (PR #235)
- Improve jupyter notebook example and update README.md (PR #236)
- Clarify exception thrown when path to configuration file is not readable (PR #237)
- Add Austin Schneider to author list (PR #239)
- UnitTest overhaul (PR #242)

Electron/positron interactions

	CORSIKA 7	CORSIKA 8 (ICRC)	CORSIKA 8 (!396)	Today
Bremsstrahlung	✓	(✓)	✓	✓
Bremsstrahlung deflection	✓	✗	✓	✓
Bremsstrahlung LPM	✓	✗	✗	Concept
Ionization	✓	✓	✓	✓
Ionization deflection	✓	✗	✓	✓
Pair production	✗	✓	✓	✓
Pair production deflection	✗	✗[1]	✗[1]	✗[1]
Photonuclear	✗	(✓)	(✓)	(✓)
Photonuclear deflection	✗	✗[1]	✗[1]	✗[1]
Annihilation	✓	✓	✓	✓
Multiple scattering	✓	(✓)	✓	✓

[1] Only for μ

Photon interactions

	CORSIKA 7	CORSIKA 8 (ICRC)	CORSIKA 8 (!396)	Today
e^-e^+ Pair production	✓	(✓)	✓	✓
e^-e^+ Pair production LPM	✓	✗	✗	Concept
$\mu^-\mu^+$ Pair production	✓	✗	✗	Planned
Photohadronic ($\gamma N \to X$)	✓	✗	✗	(✓)
Photoelectric	✓	✗	✗	Concept
Compton scattering	✓	✓	✓	✓
Rayleigh scattering	✓	✗	✗	✗