

The Leptonpropagator PROPOSAL for CORSIKA

Jan Soedingrekso, Alexander Sandrock

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PRopagator with Optimal Precision and Optimized Speed for All Leptons

History

Optimized for muon propagation for IceCube

- ▶ MMC (Java)

arXiv:hep-ph/0407075 [1]

- ▶ PROPOSAL (C++)

Comput. Phys. Commun. 184 (2013), 2070 [3]

- ▶ Improved PROPOSAL (C++11)

arXiv:1809.07740 [2]

- ▶ Development on GitHub

<https://github.com/tudo-astroparticlephysics/PROPOSAL>

⇒ long developed MC library

Charged Lepton Propagator

- ▶ Propagation till next stochastic loss
- ▶ Split between continuous and stochastic losses
- ▶ Multiple scattering
- ▶ Decay
- ▶ Multiple cross section parametrizations for systematic studies
- ▶ State of the art cross sections
- ▶ Interpolation tables → quick

Possible CORSIKA connection?

Idea

Use PROPOSAL as charged lepton propagator for

- ▶ Muon and Tau Propagation and decay (usecase in IceCube)
- ▶ Electron propagation (some missing effects can be implemented)




Can not propagate Photons.

No complete replacement of EGS4

TODOs

- ▶ Magnetic Field deflection
- ▶ Some effects for Electrons/Positrons (Annihilation of Positrons)
- ▶ Describing the Atmosphere (Interpolation table for each medium)

Currently 2 Masterstudents (advised by Alexander and Jan) further develop PROPOSAL.

-  Dmitry Chirkin and Wolfgang Rhode. *Propagating leptons through matter with Muon Monte Carlo (MMC)*. 2004. arXiv: [hep-ph/0407075](https://arxiv.org/abs/hep-ph/0407075).
-  Mario Dunsch et al. *Recent Improvements for the Lepton Propagator PROPOSAL*. 2018. arXiv: [1809.07740](https://arxiv.org/abs/1809.07740).
-  Jan-Hendrik Koehne et al. “PROPOSAL: A tool for propagation of charged leptons”. In: *Computer Physics Communications* 184 (2013), pp. 2070–2090. DOI: [10.1016/j.cpc.2013.04.001](https://doi.org/10.1016/j.cpc.2013.04.001).