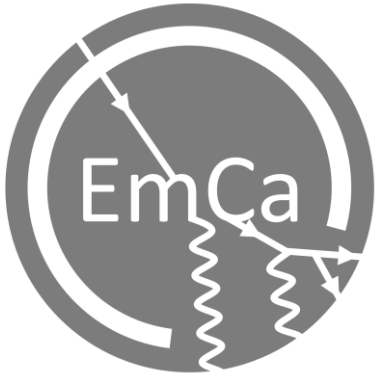
SFB 1258 | Neutrinos Dark Matter Messengers



CORSIKA Focus Week

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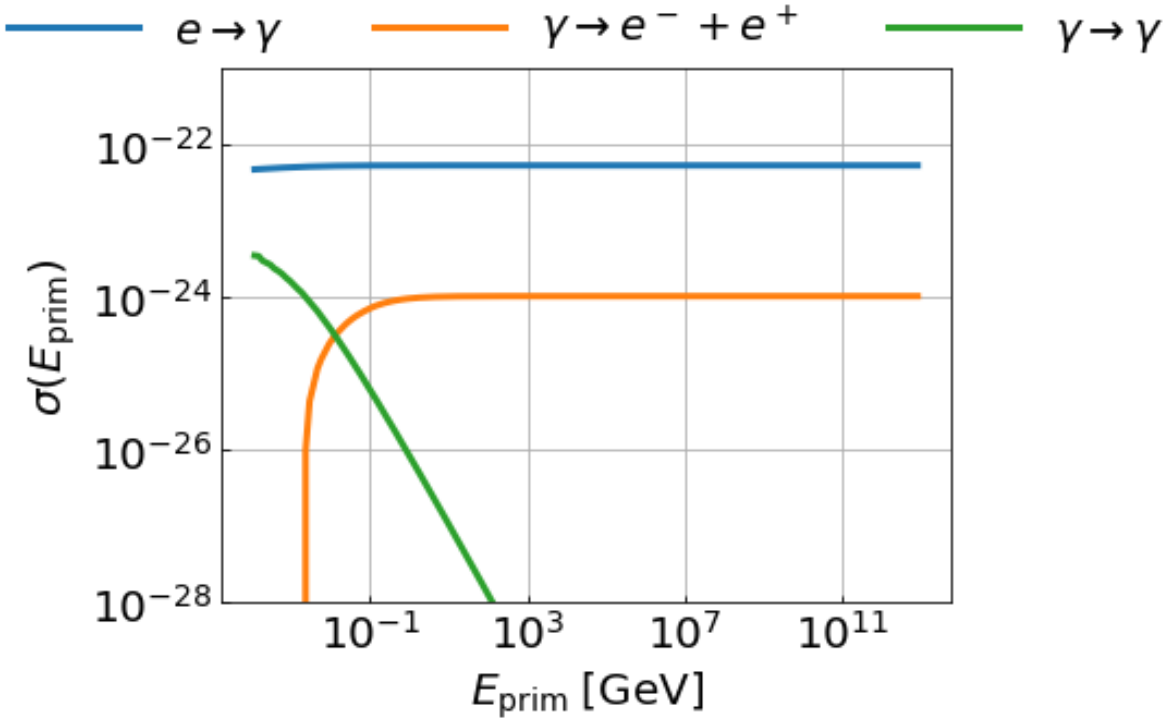
EmCa-Integration

Cross sections – Seem to work

- Implementing Bethe-Heitler cross sections
  - Pair production and Bremsstrahlung
  - With some EmCa trickery
    - Removed the infrared divergence of the bremsstrahlung (dielectric effect)
    - Added rudimentary LPM effect
- Compton Scattering
  - Klein-Nishina
- Multiple scattering
  - Only leading order implemented (infinite scatterings)
    - Single scattering just as relevant
- Muon pair production
  - CORSIKA implementation
- Muon interactions available
  - Tannenbaum (Approximation)
  - Kokulin

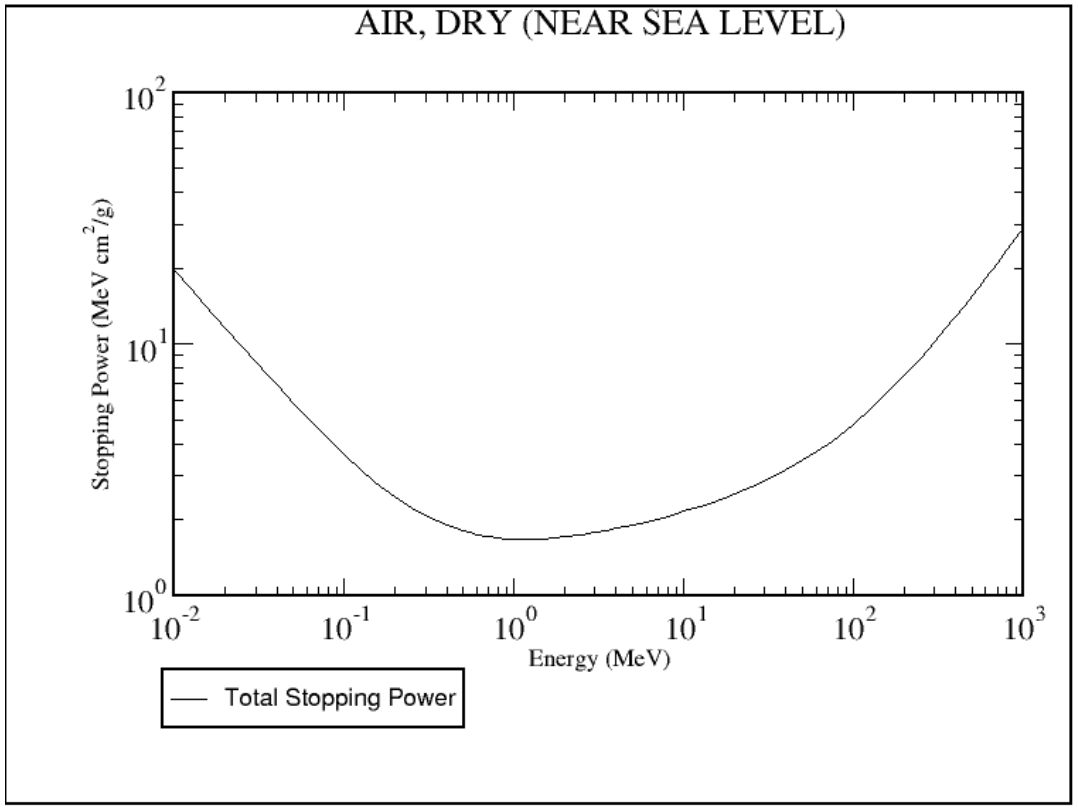


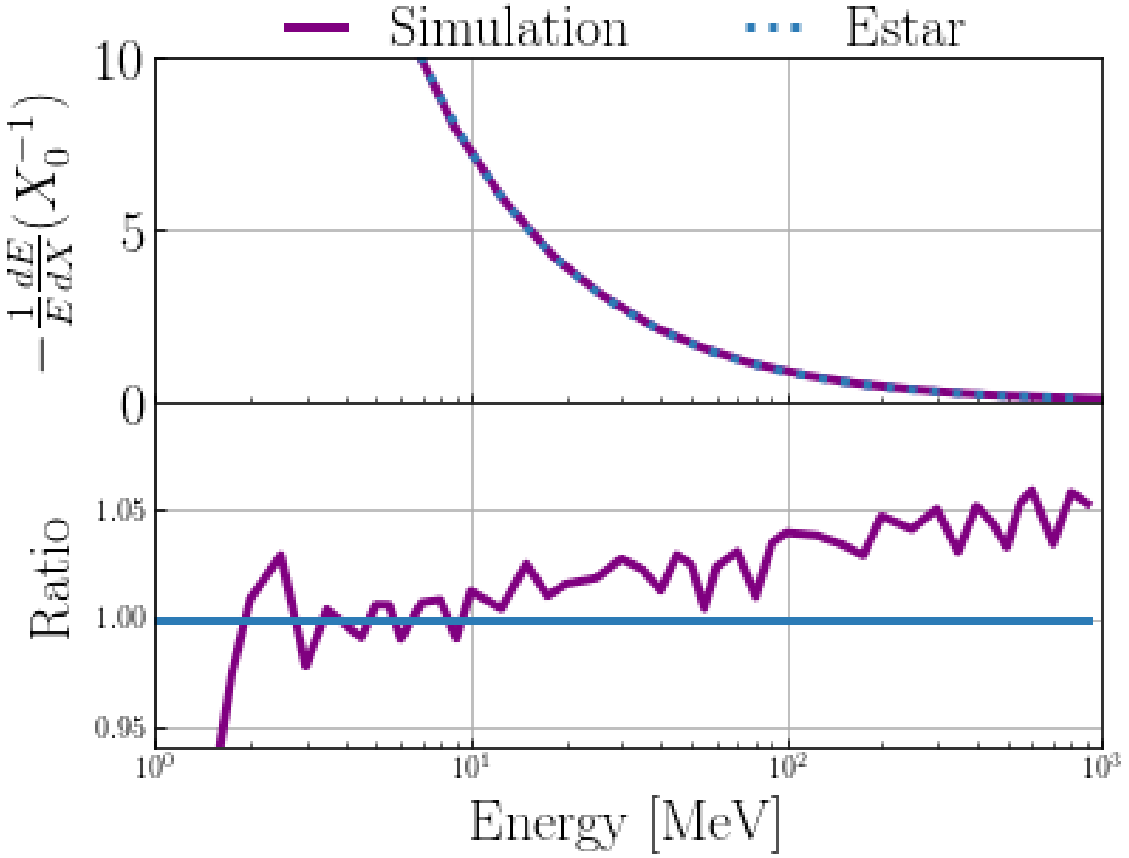
Some details

- Current implementation:
  - No special integrator required
    - This will change with the implementation of more exact cross sections
      - Will have some questions concerning precision as well
  - No density dependence
    - This needs to change
      - LPM effect is implemented as a median
        - Currently a scaled cross section is used
      - Dielectric effect requires density
        - Minimal implementation does kill infrared divergence
        - Suppression starts at r = 1e-10, realistic (standard air) 1e-6

Collision losses

- Collision losses use ESTAR tables





Angle distribution – Approximation

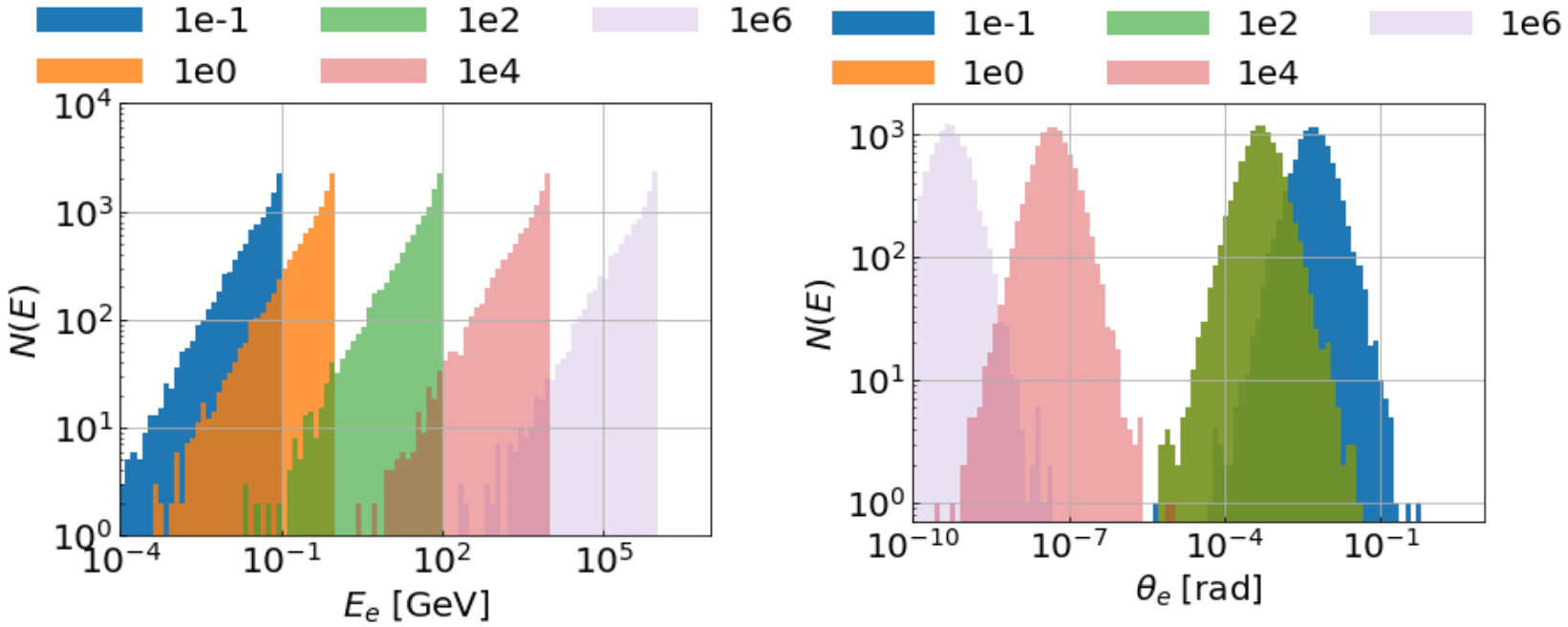
- EmCa uses single differential cross sections
  - Angle distributions require sampling from double differential
    - Still have some stability issues

- Employ some approximations (from EGS4 / 5)
  - Bremsstrahlung:
    - $\theta = m/E$
  - Pair production:
    - Schiff distribution

- Angular distributions will be similar to those from CORSIKA 7
  - With some caveats

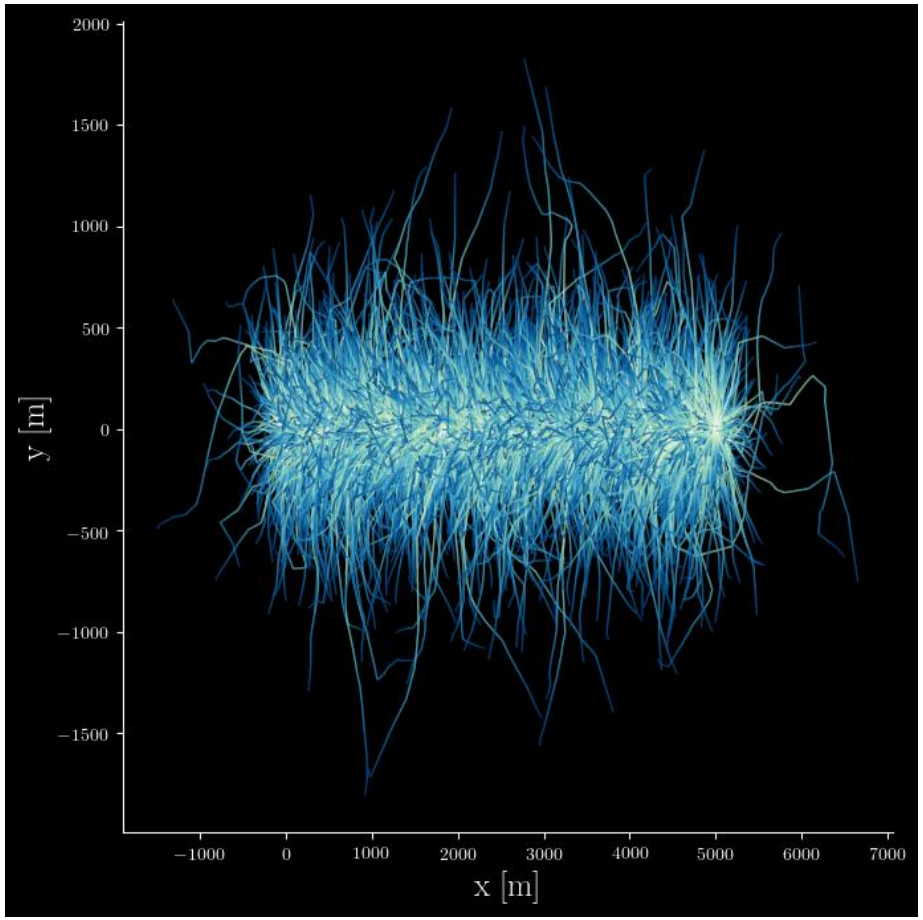
Generator

- Energy and angular sampling
  - Sampling procedure works
    - Still some small problems with momentum conservation



What needs to be done

- Integration into the CORSIKA framework
  - Still some bugs
- Improvements to the model
  - Additional cross sections
  - Density dependence
  - Refined treatment of the LPM effect



Thank you for your attention
Questions?