[Магистратура] SimBa/Muography

For a nice introduction to muography we point out the survey byL. Bonechi et al., and further experimental aspects are discussed in the wonderful paper byW. Trzaska et al. Our starting point isPUMASa C99 library for backward Monte-Carlo simulations of muons passing through matter, specifically designed for muography.
Consider the bremsstrahlung, pair production,photonuclear andionisation differential cross-sections from PUMAS v1.0 :

- Re-implement the calculations in python using numba on both CPU and CUDA (we advise you to integrate numba with pytorch, cf. examples).
- In your jupyter notebook, provide the exact formulas for the cross-sections used (you can have a look at MUM for initial reference).
- Compare accuracy and performance across CPU/CUDA (document your results).

We recommend the PENELOPE manual as a good introductory read about Monte-Carlo simulations for the passage of particles through matter. Backward Monte-Carlo technique is well described in the PUMAS paper. Also, you are welcome to have a look and contribute to our prototypes repository.

For research directions in this project have a look at this tutorial on differentiable programming for particle physics simulations.