

Status Report

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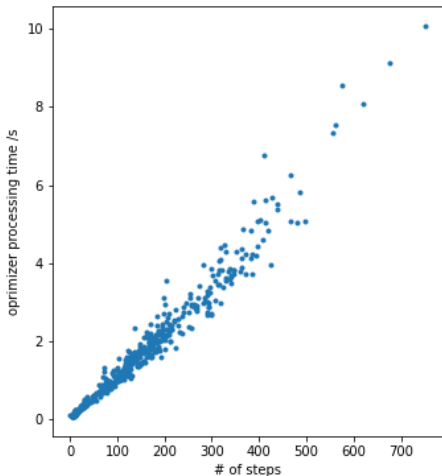
CIDeR-ML meeting

July 19, 2024

Momentum reconstruction: reminder

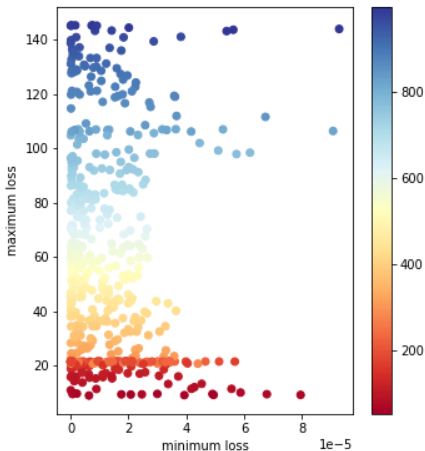
- I develop a algorithm to reconstruct momentum from OptSiren output (number of photon and angle of track segments).
 - Reconstruct by minimizing the loss function (gradient descent method).
- The reconstruction algorithm takes long time 1 sec.

Momentum reconstruction: number of steps v.s. processing time



- Finish iteration if $|\mathcal{L}_i - \mathcal{L}_{i-1}| < 10^{-14}$.
- Reconstruct 500 fake data (randomly selected 50-1000 MeV momentum samples) to evaluate performance.
- Processing time of the optimizer is linear with respect to the number of steps.
 - it is appropriate.

Momentum reconstruction: range of loss

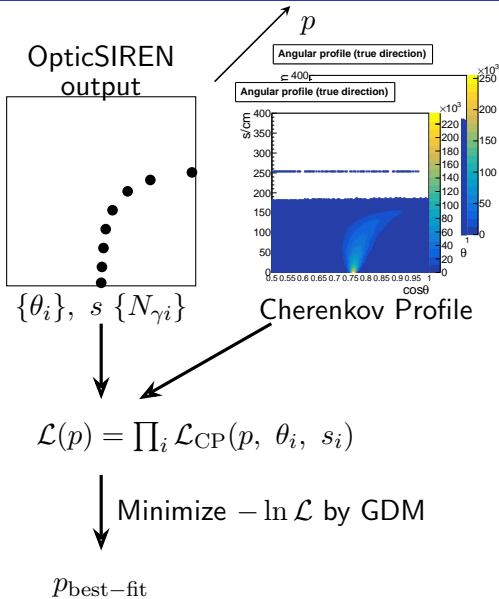


- I checked minimum loss v.s. maximum loss for each fakedata.
- Maximum loss:
 - varied 10-140.
 - large momentum dependence.
- Minimum losses seem to have small momentum dependence.

- Momentum reconstruction:
 - By using toy-model fakedata, evaluate and improve reconstruction algorithm.
 - Use new toy-model fakedata.
 - Add randomness when generating fake data.

appendix

appendix: Reconstruction



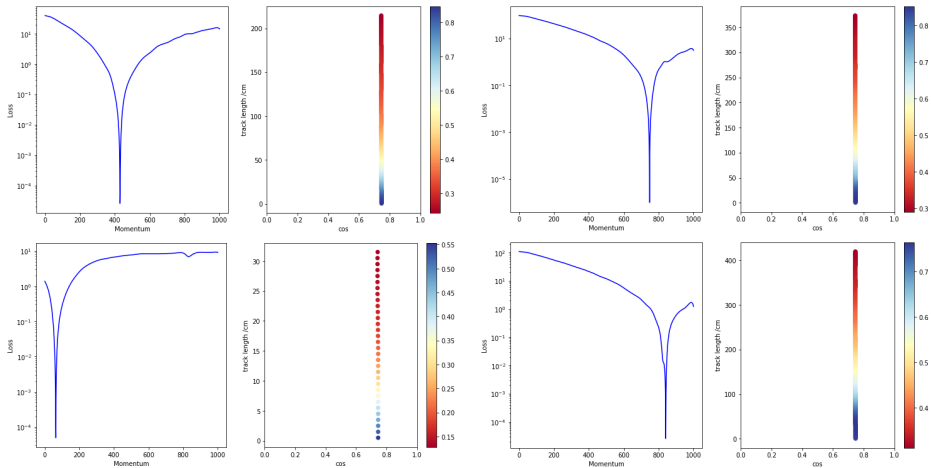
- I used a maximum-likelihood method for the reconstruction.
- Likelihood:

$$\mathcal{L}_i \sim \exp\left(-\frac{(N_{\gamma i} - N_{\text{CP}})^2}{2\sigma^2}\right).$$

$(N_{\text{CP}} = N_{\text{CP}}(\theta_i, s_i, p).)$

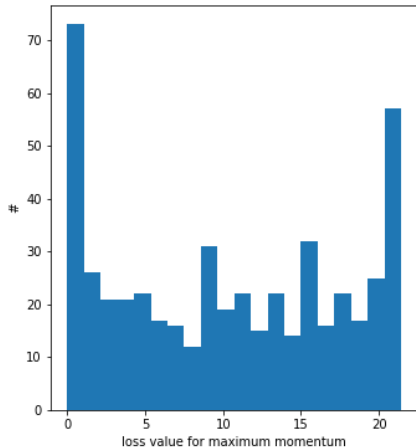
- To decide the initial momentum, scanned all momentum between 50-1000 MeV in 1 MeV steps and take minimum.

appendix: Fake data examples



● color: number of photon.

appendix: loss for maximum momentum (1 GeV)



- I checked loss for 1 GeV.
- I cannot make any meaningful observation.