Close-Out

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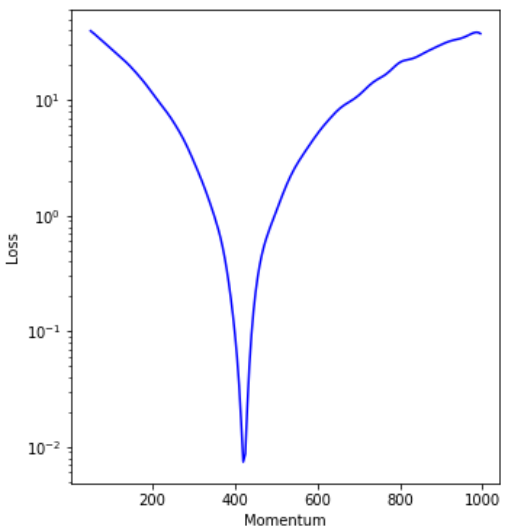
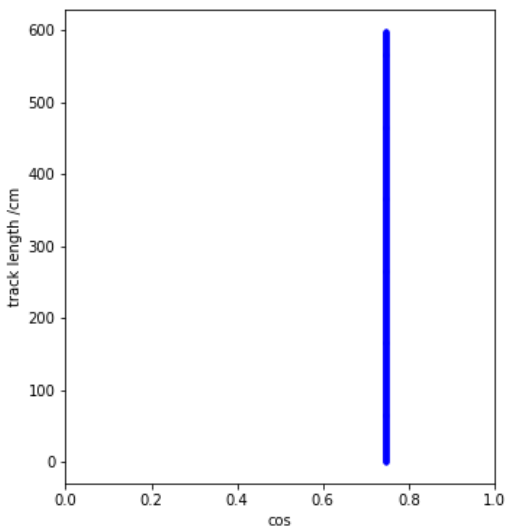
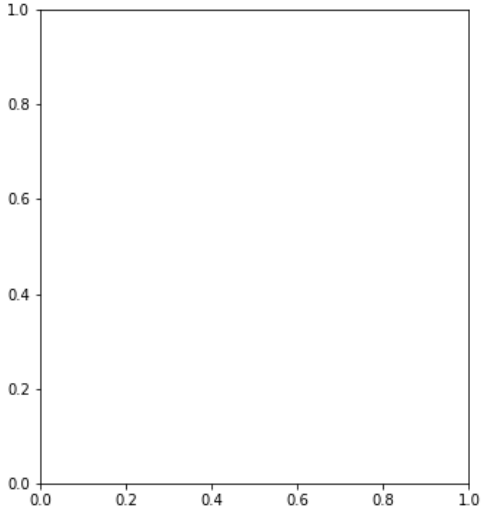
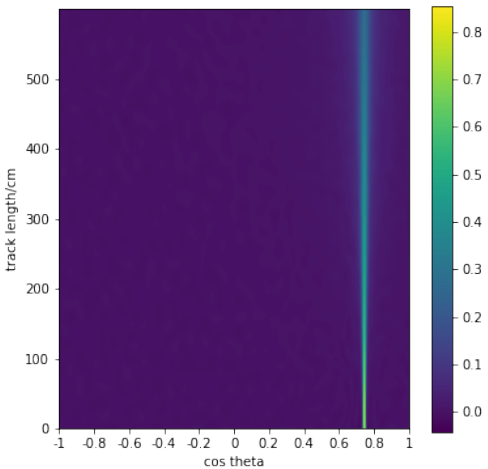
Momentum reconstruction: toy data





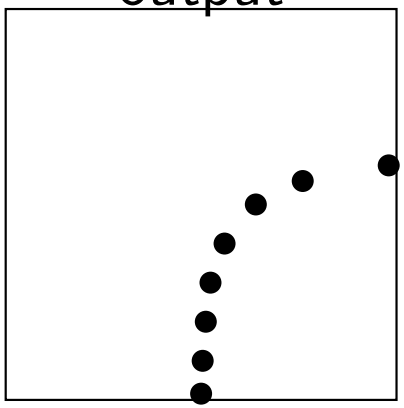




- I was given the toy data and the Cherenkov profile by Matsumoto-san.
- I tried to reconstruct the momentum of this data.

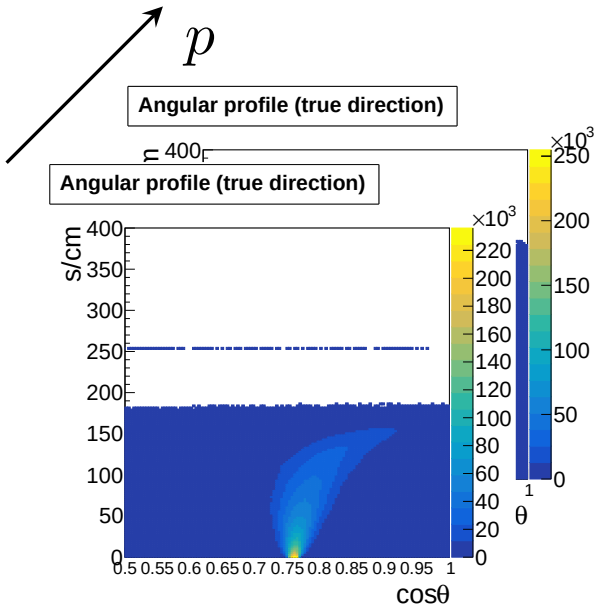
Momentum reconstruction: toy data

OpticSIREN output



$\{\theta_i\},\ s\ \{N_{\gamma i}\}$

p



Cherenkov Profile

$\mathcal{L}(p) = \prod_i \mathcal{L}_{\mathrm{CP}}(p,\ \theta_i,\ s_i)$

Minimize $-\ln \mathcal{L}$ by SGD

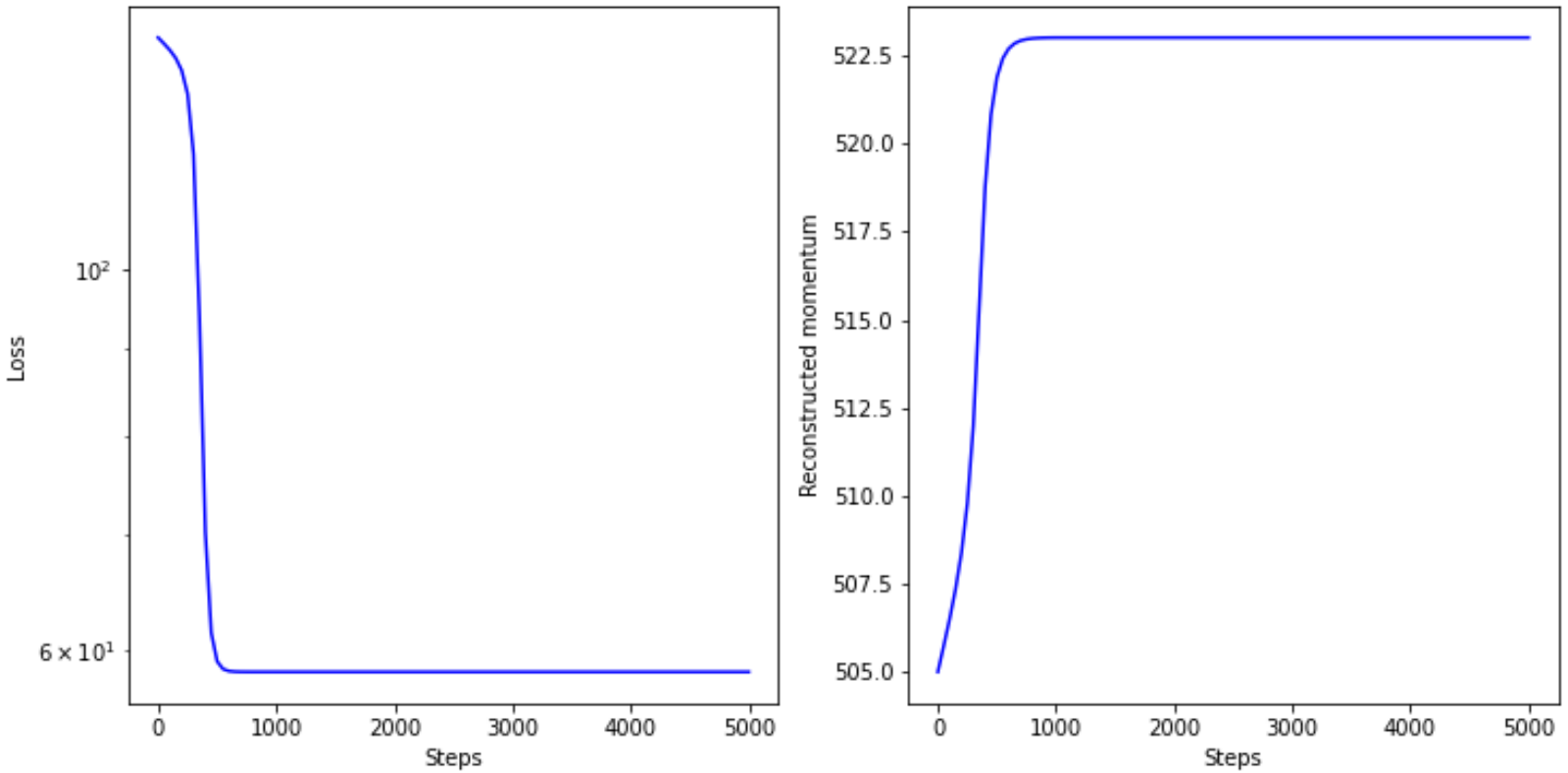
$p_{\mathrm{best-fit}}$

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

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

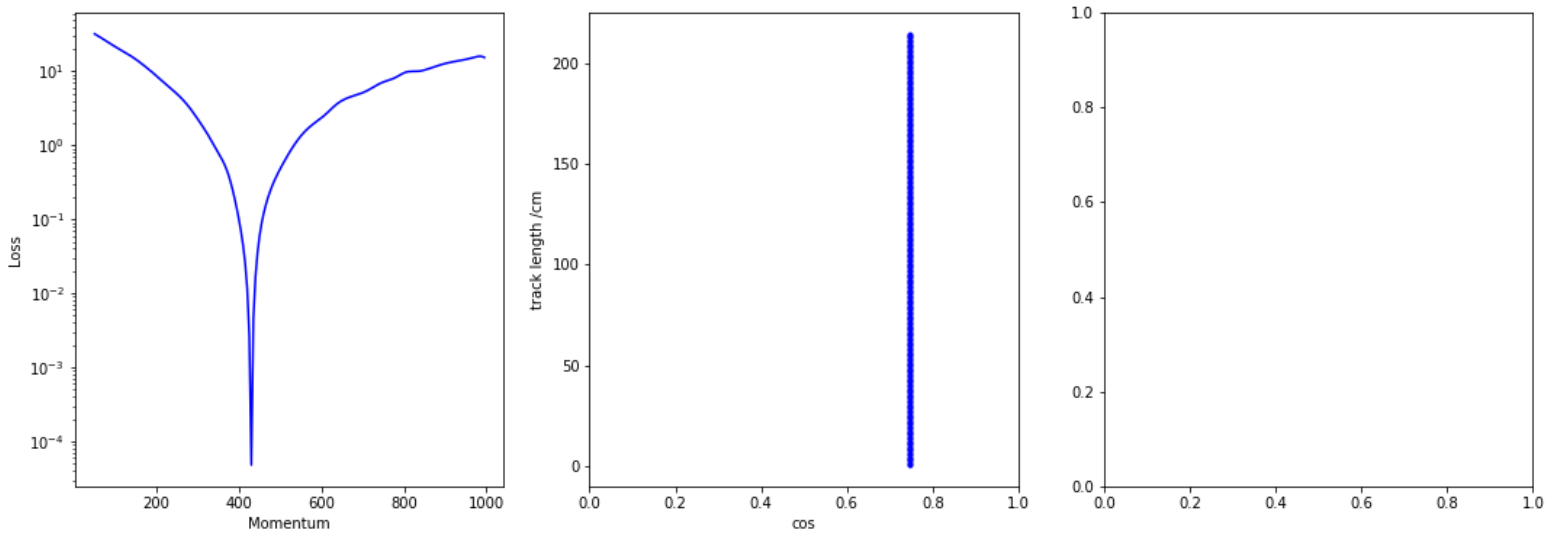
$$(N_{\mathrm{CP}} = N_{\mathrm{CP}}(\theta_i,\ s_i,\ p).)$$

Momentum reconstruction: toy data



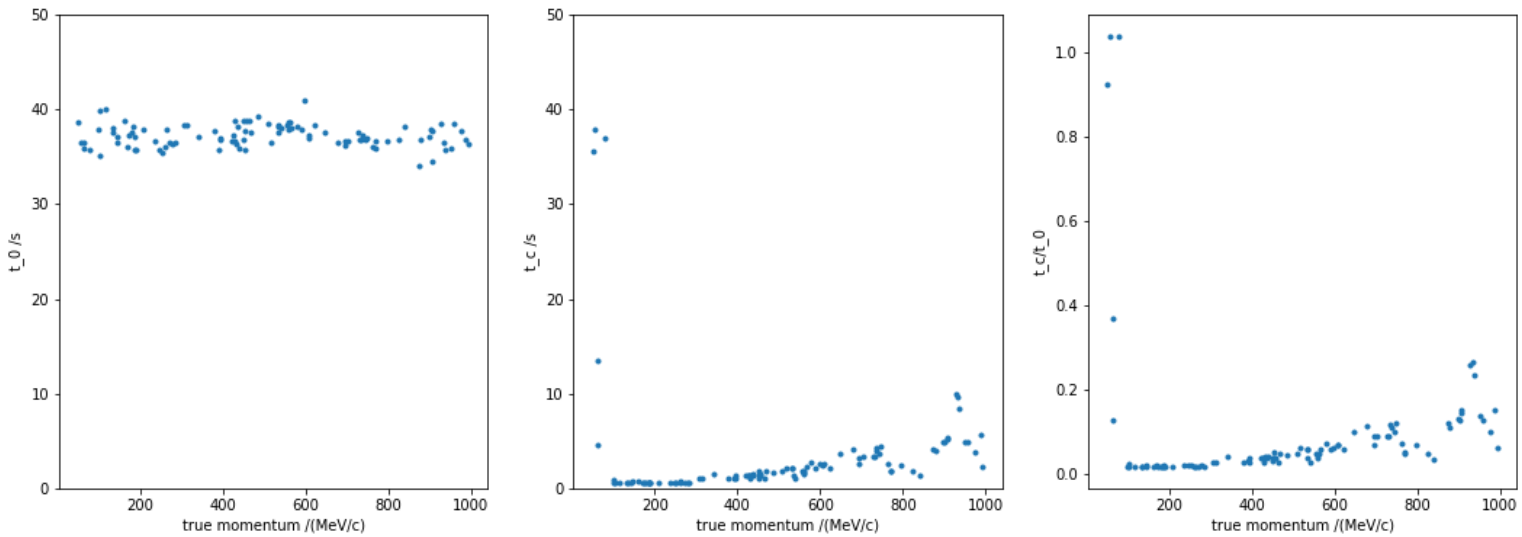
- $p_{\mathrm{reco}} = 523\ \mathrm{MeV/c}$.
- $p_{\mathrm{true}} = 543.75\ \mathrm{MeV/c}$.
  - Slightly different.

Momentum reconstruction: my fake data



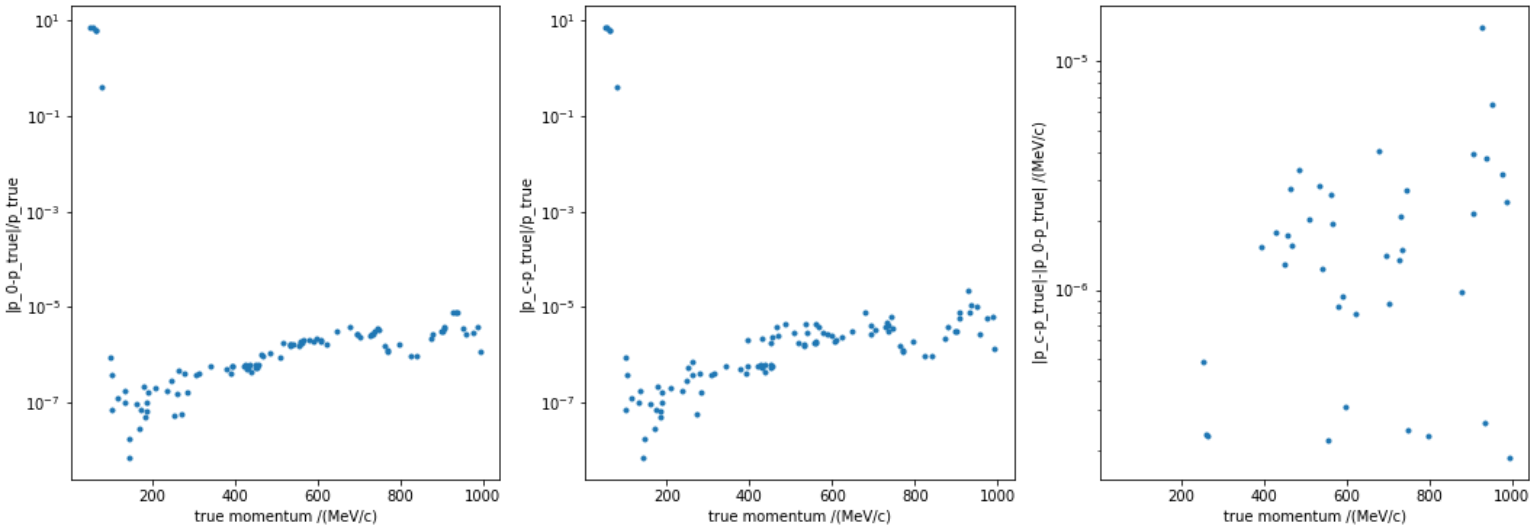
- I generated the fake data samples.
- the way:
  - On fixing the randomly sampled momentum, a graph of $\cos\theta$ and N_γ at each s_i was made, and the $\cos\theta$ and N_γ at the maximum were used as the fake data.
- I tried to reconstruct the 100 samples.
  - When reconstruction, I calcurate the loss at every $5\ \mathrm{MeV}$ and regarded the minimum as the initial momentum.

Momentum reconstruction: my fake data



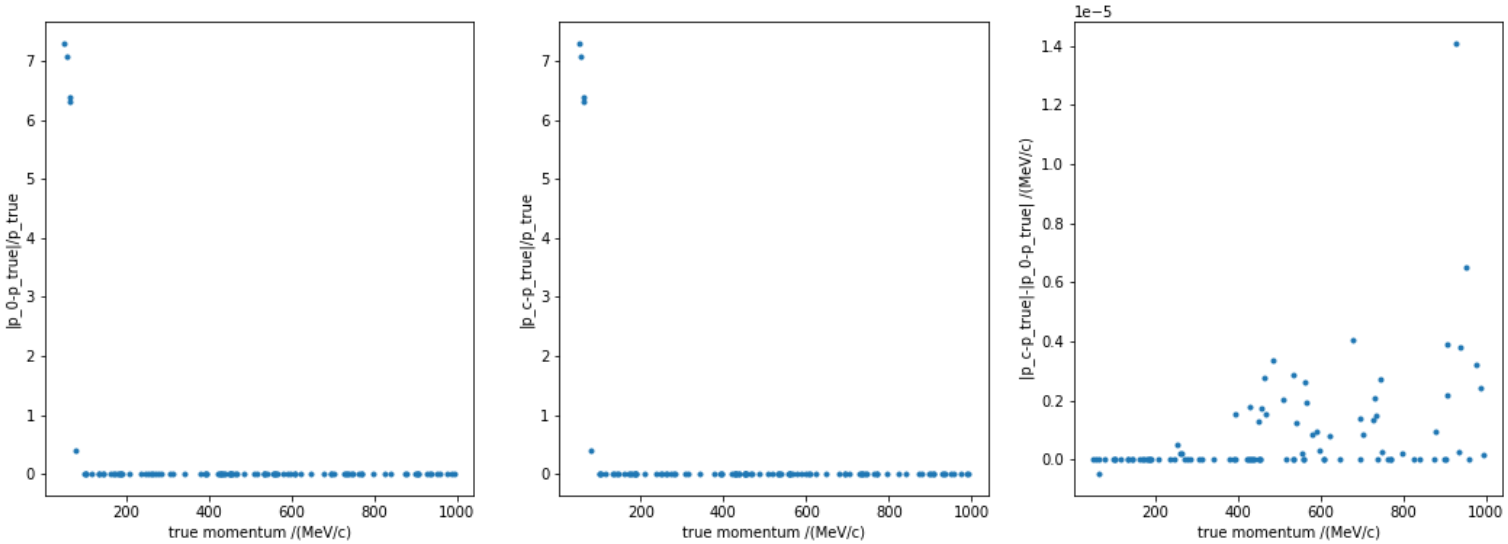
- I compared between the reconstruction speed and quality with and without the condition that the iteration is terminated if $|l\mathrm{loss}_{i+1} - \mathrm{loss}_i| < 10^{-14}$.
- The time required was very reduced.

Momentum reconstruction: my fake data



- I compared between the reconstruction speed and quality with and without the condition that the iteration is terminated if $|l\mathrm{loss}_{i+1} - \mathrm{loss}_i| < 10^{-14}$.
- The differences of the relative error ($|p_{\mathrm{reco}} - p_{\mathrm{true}}|/p_{\mathrm{true}}$) are very small.
- Several samples at small momentum are not reconstructed well.

Momentum reconstruction: my fake data



- I compared between the reconstruction speed and quality with and without the condition that the iteration is terminated if $|l\mathrm{loss}_{i+1} - \mathrm{loss}_i| < 10^{-14}$.
- The differences of the relative error ($|p_{\mathrm{reco}} - p_{\mathrm{true}}|/p_{\mathrm{true}}$) are very small.
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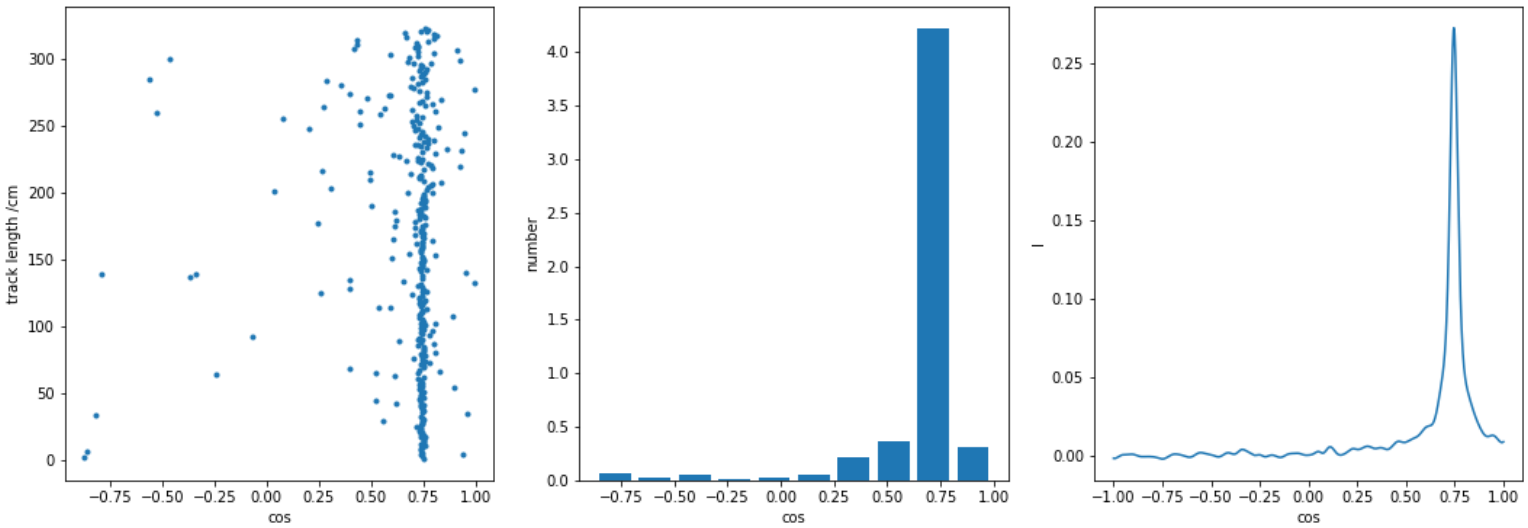
ToDo



- Change the learning rate with some conditions, and evaluate the performance.
- Use the new fake data.
  - treating the graph of $\cos\theta$ and N_γ at each s_i as a probability distribution and sampling $\cos\theta$.