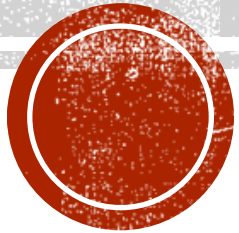
OpticSiren calibration on WCTE cosmics MC data

Ka Ming Tsui

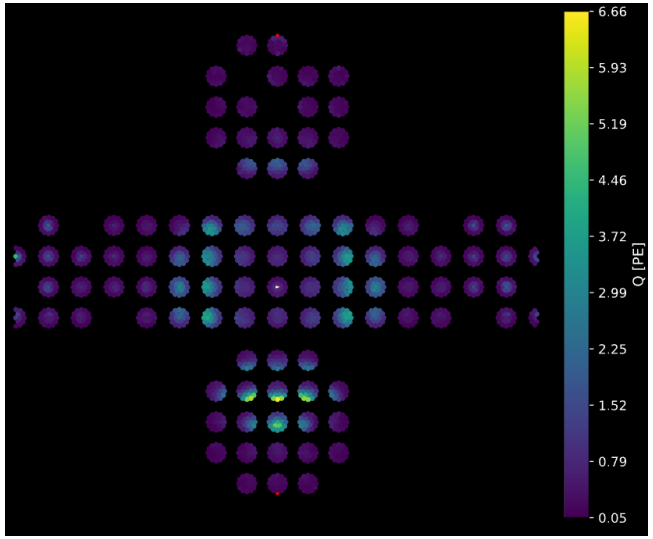
kaming.tsui@ipmu.jp



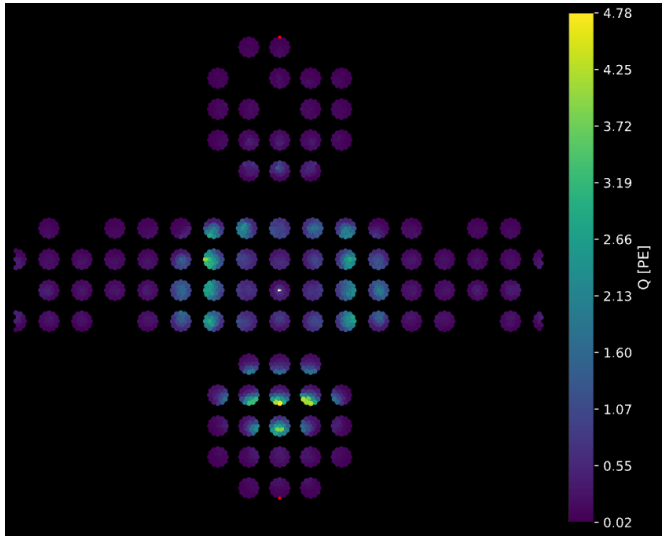
Reminder

- Previous work on top-down through going muons
- Missing upward going photons → visibility tuned down too much in upward dir
  - 300 MeV/c beam muon

Siren, pre-tuned



Siren, after 6 epoch



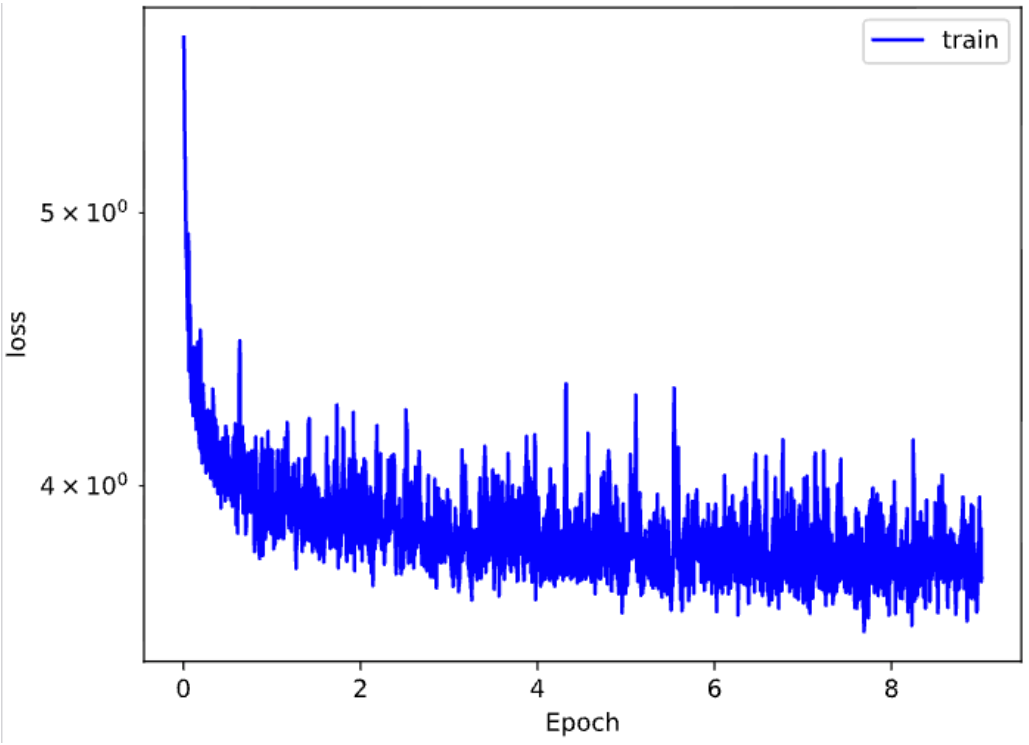
Development

- Update model params every-k iteration
- Reshuffle events every new epoch
- Introduce overall fudge factor as optimizable parameter

- To be done
  - Renormalize charge and improve loss definition
  - Introduce PMT saturation factor (~30 PE)
  - PMT masking

New calibration results

- Use all cosmic muon tracks with track length > 1 m inside detector (~90k evt)
  - Start with truth track parameters (will test reco case later)
- Artificially scale PMT charge by 0.9
- Update model params per 1000 evt
- Around 2.5 h per epoch on Tesla V100
- Loss does not change much after 2 epochs
- fudge factor stays at 1
  - Maybe initialize to 0.9 at beginning?



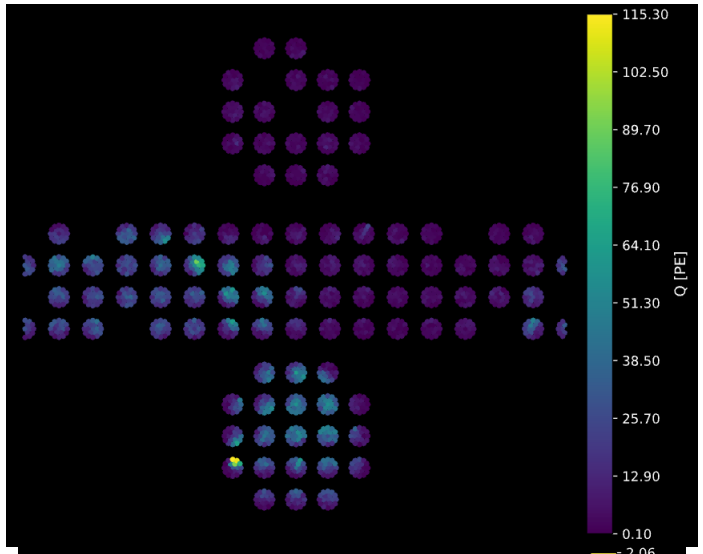
Cosmic track example

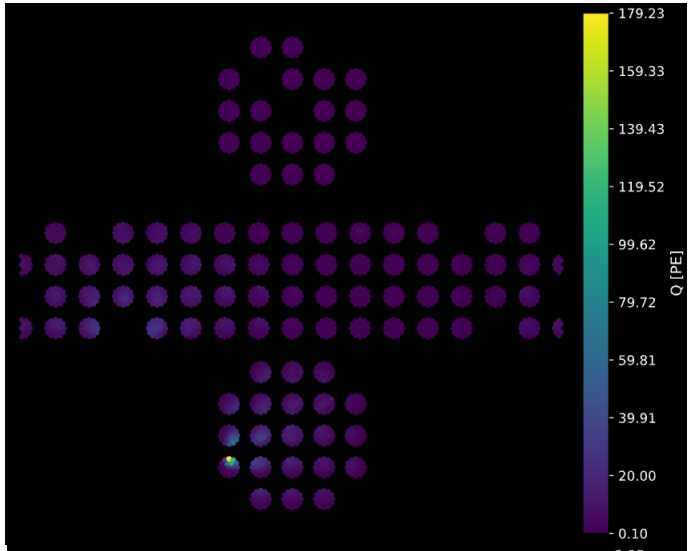
Target

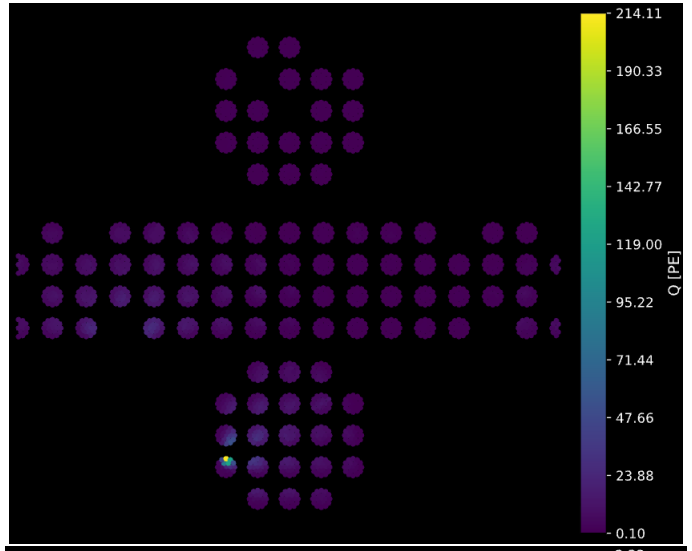
Siren, pre-tuned

Siren, after 8 epoch

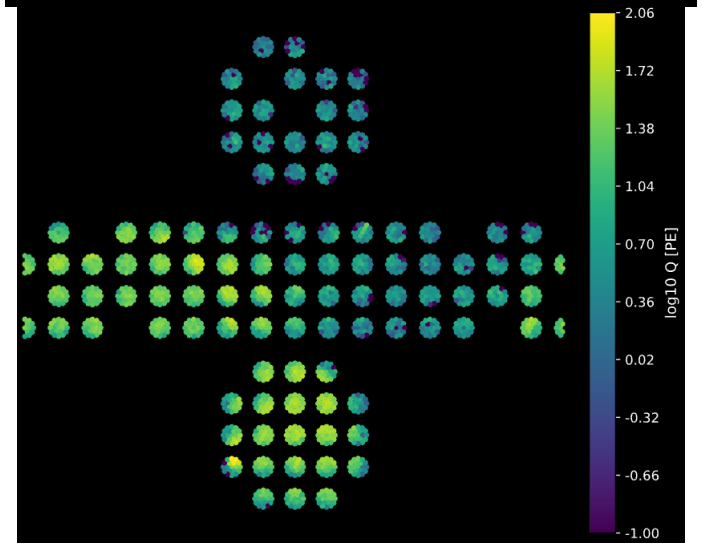
Linear

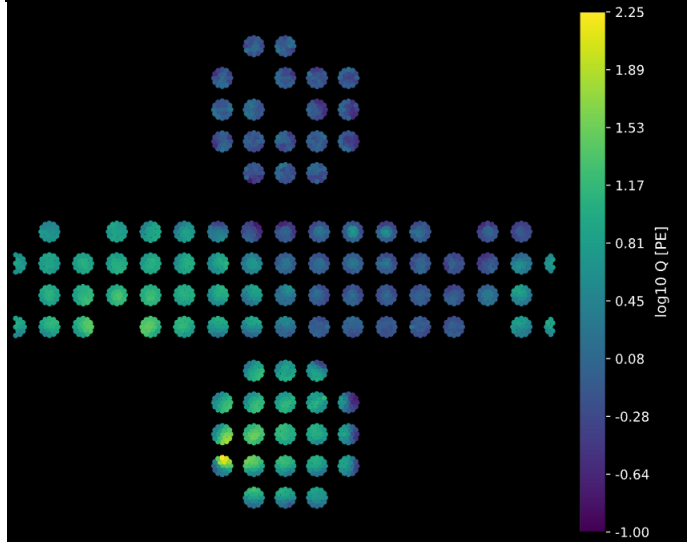


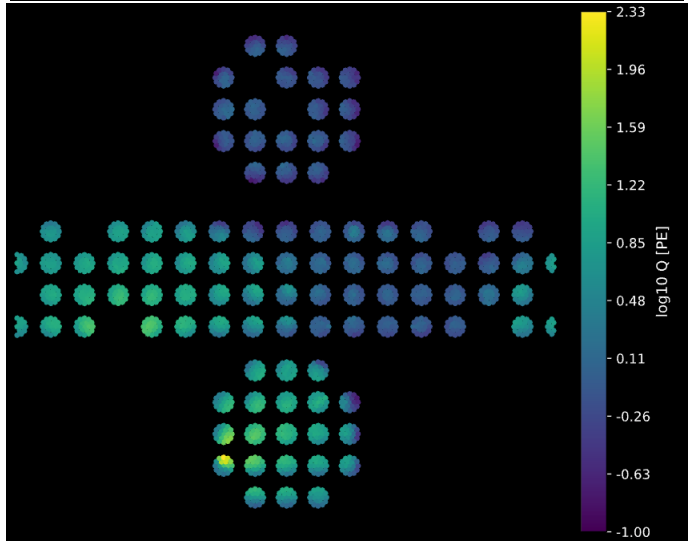


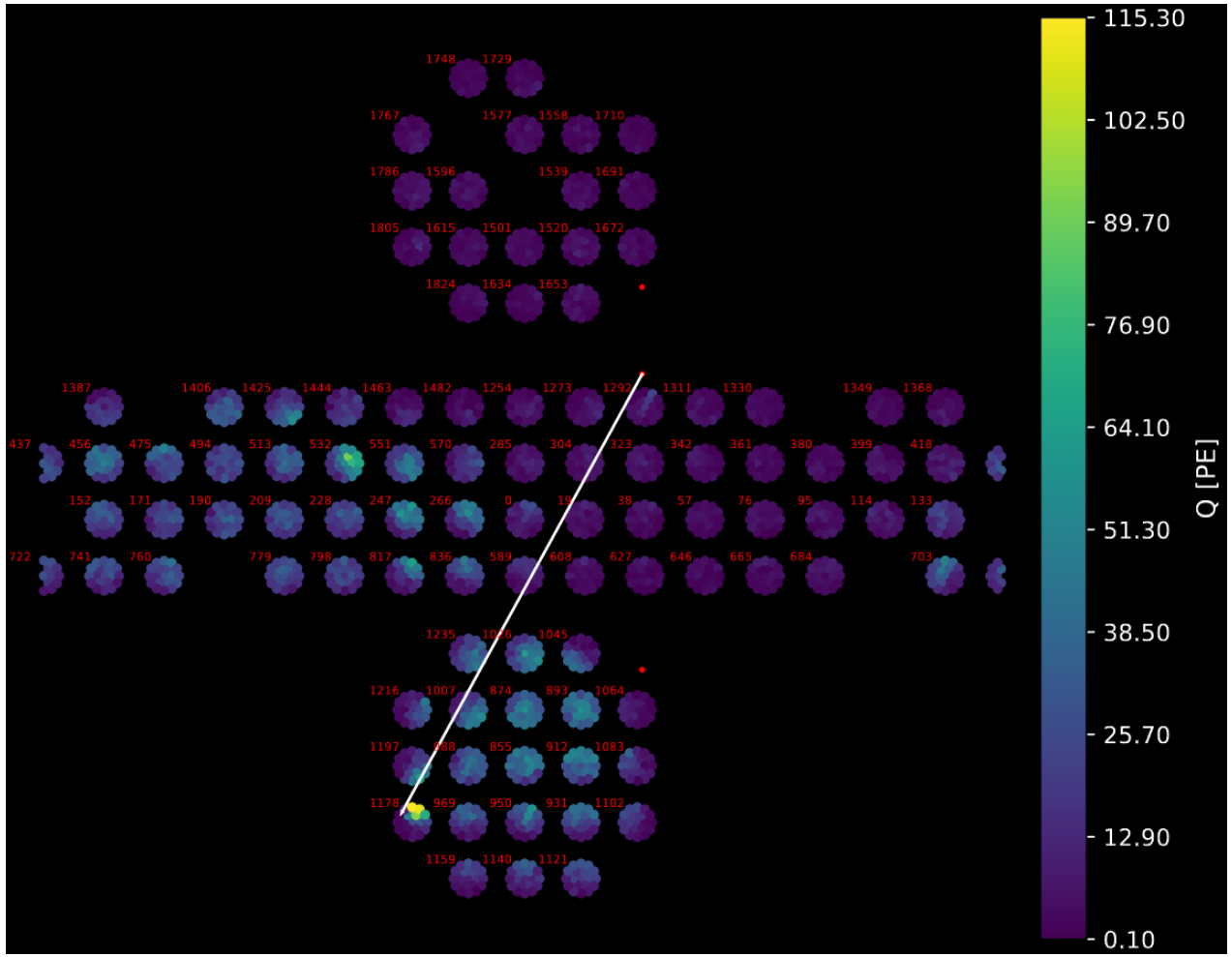


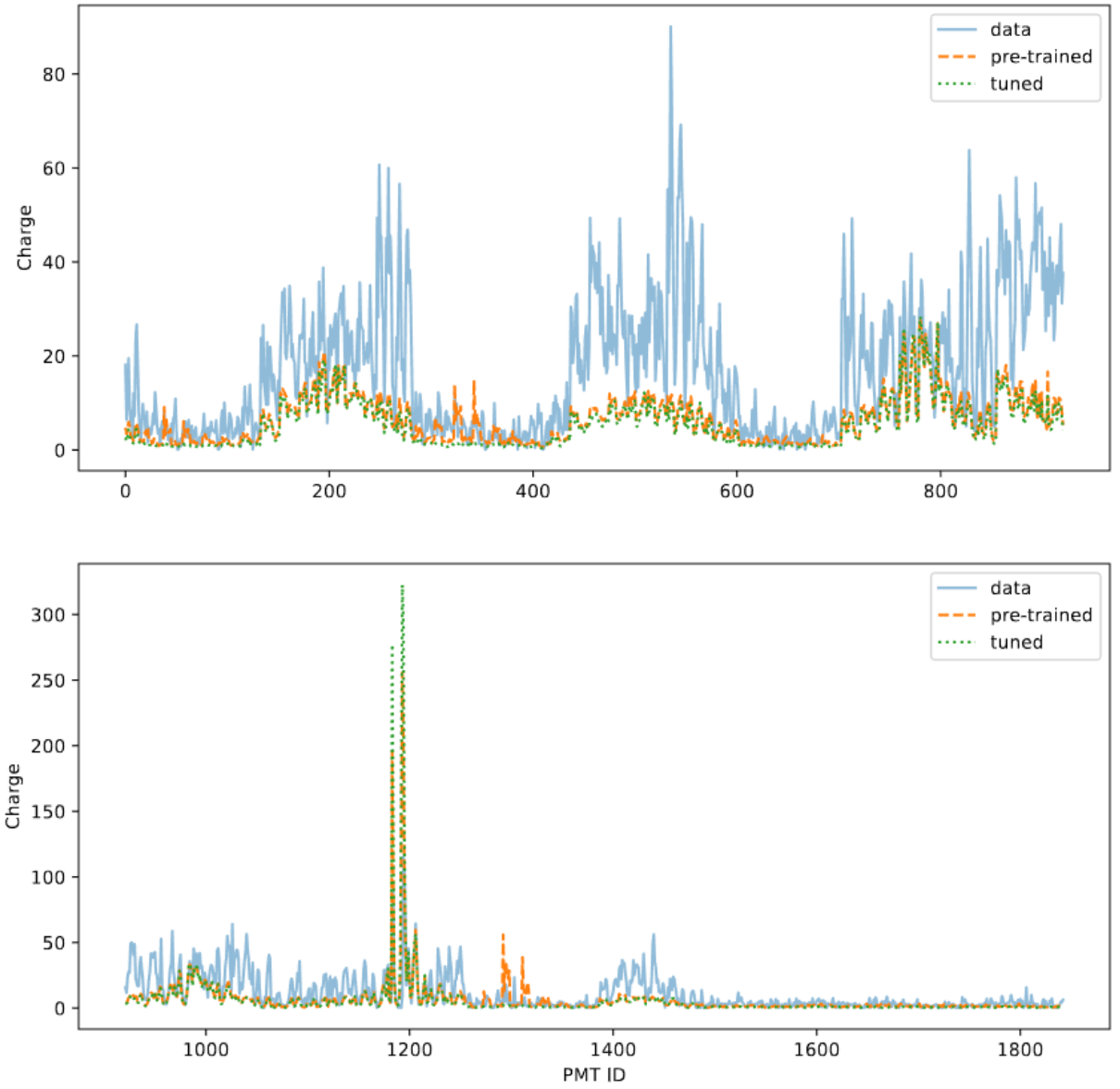
Log



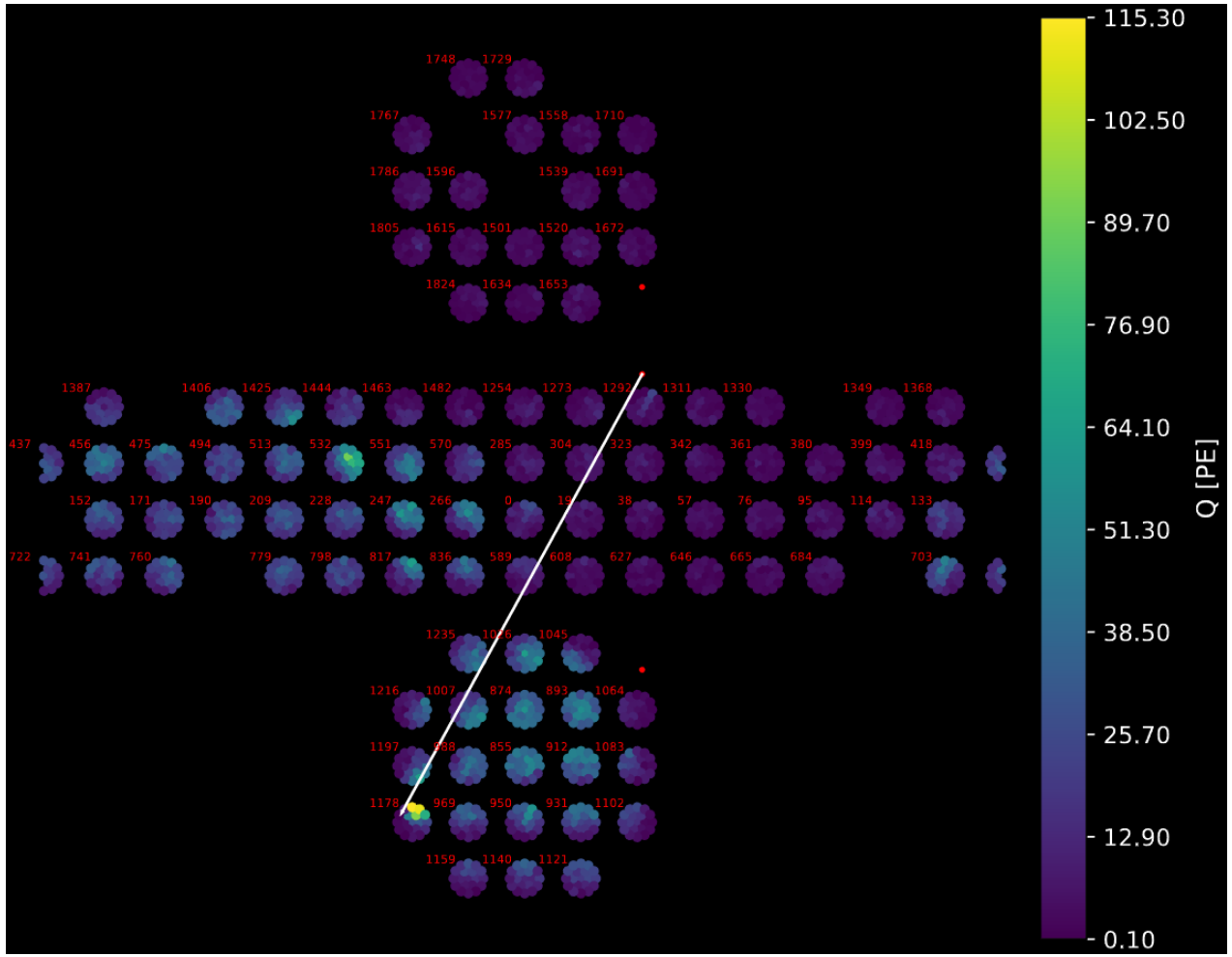


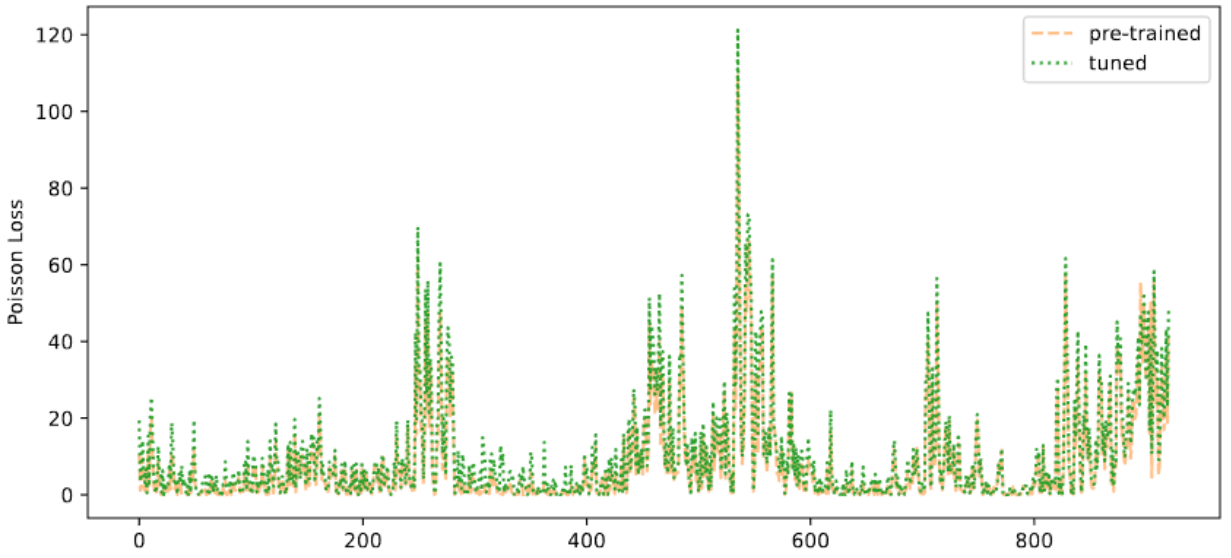


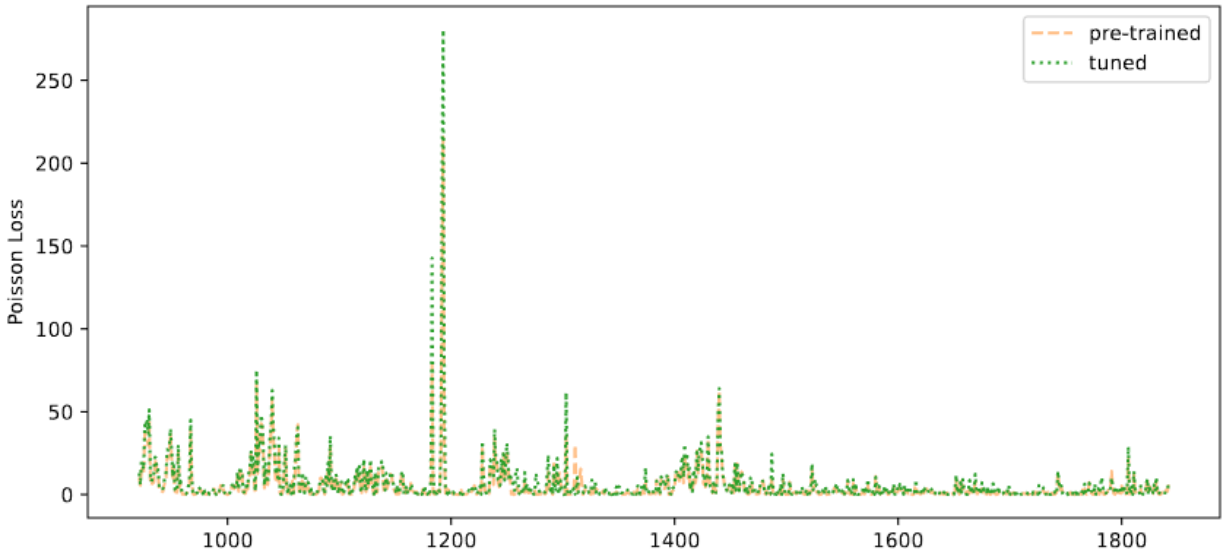




This is probably an unusual example with a bit showering







This is probably an unusual example with a bit showering

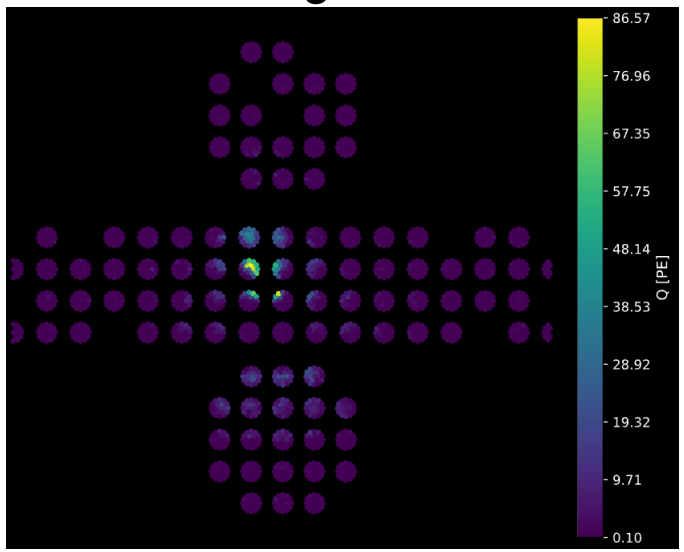
Cosmic track example

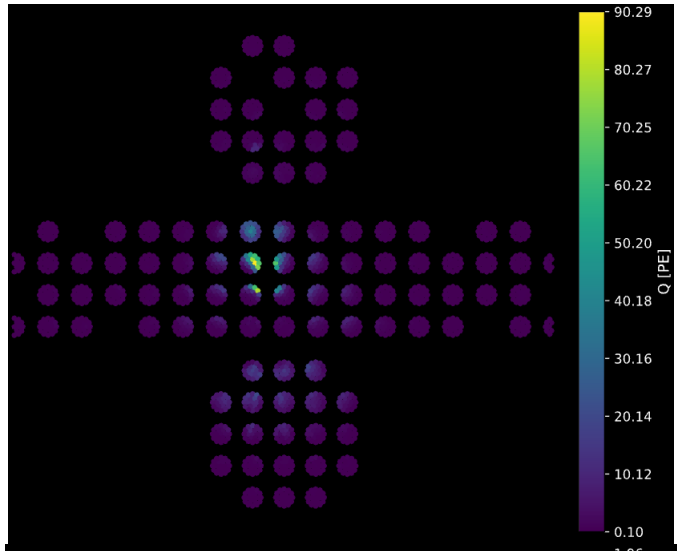
Target

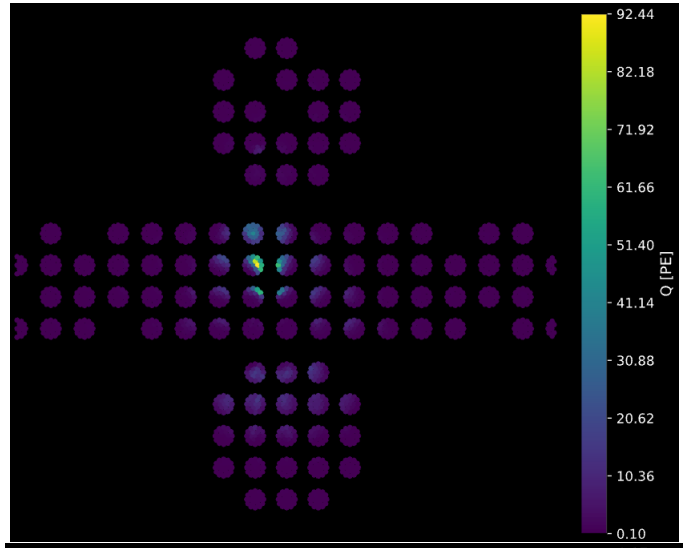
Siren, pre-tuned

Siren, after 8 epoch

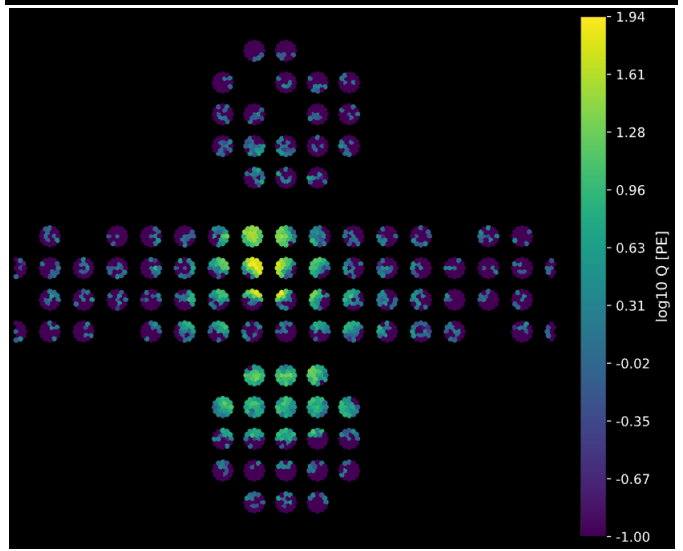
Linear

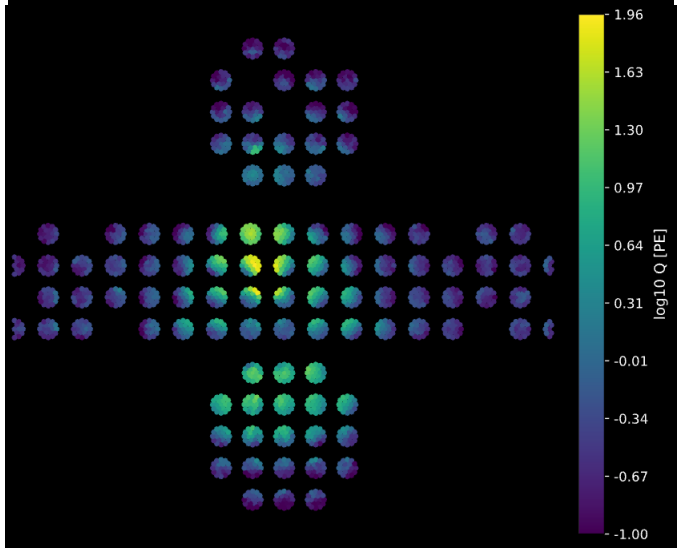


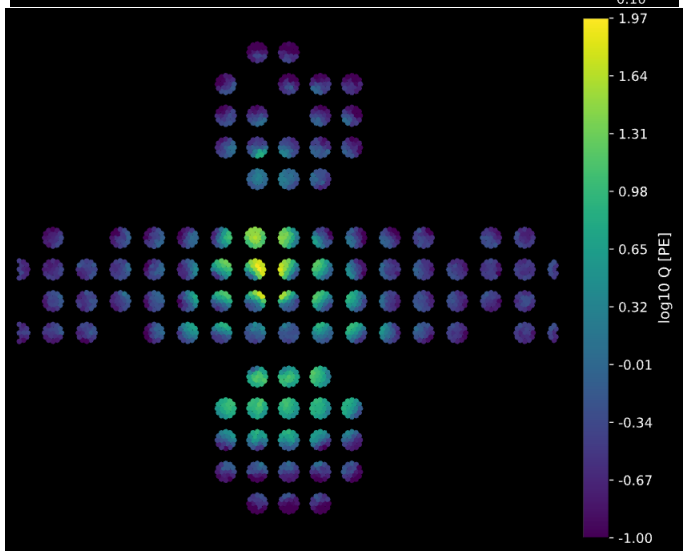


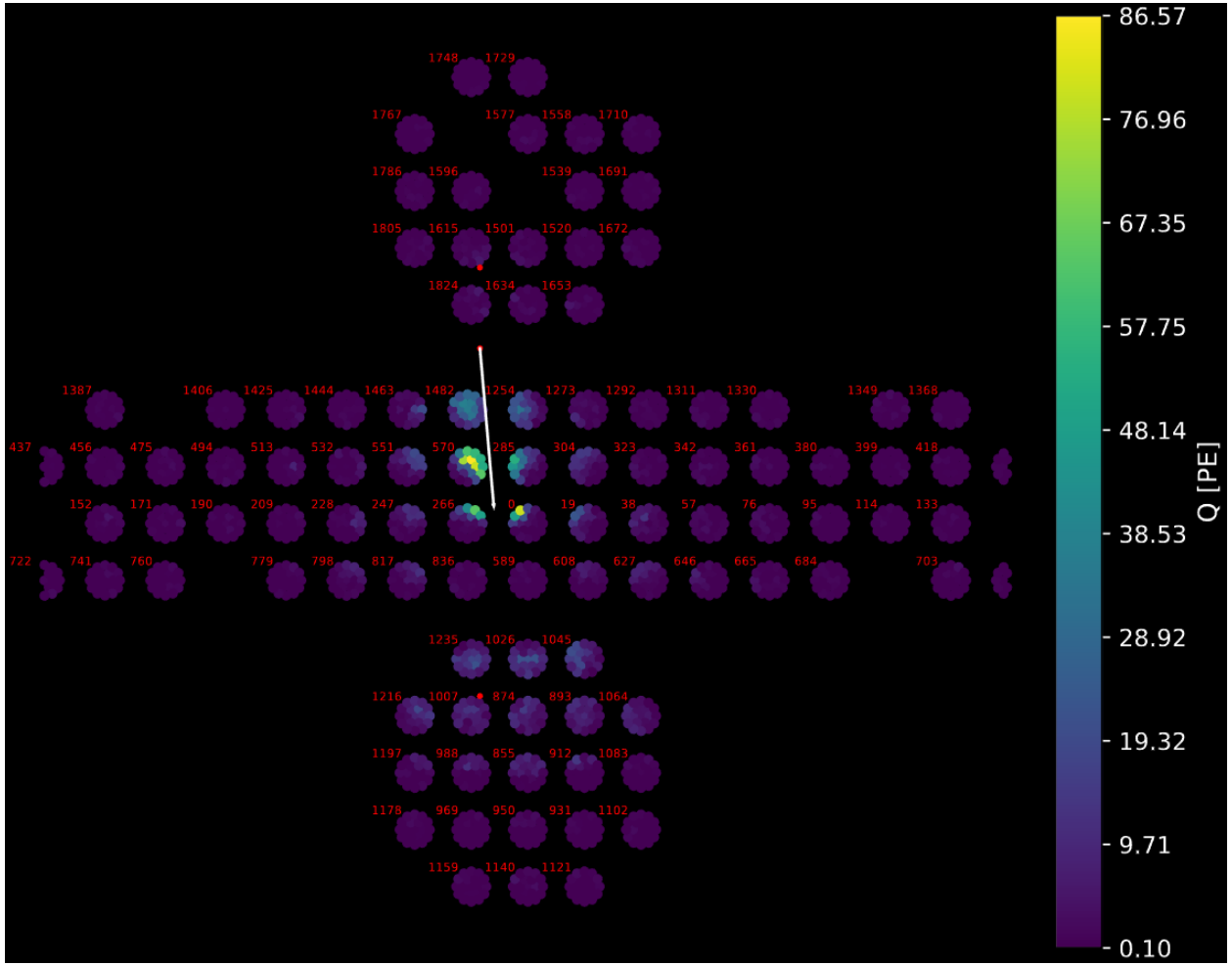


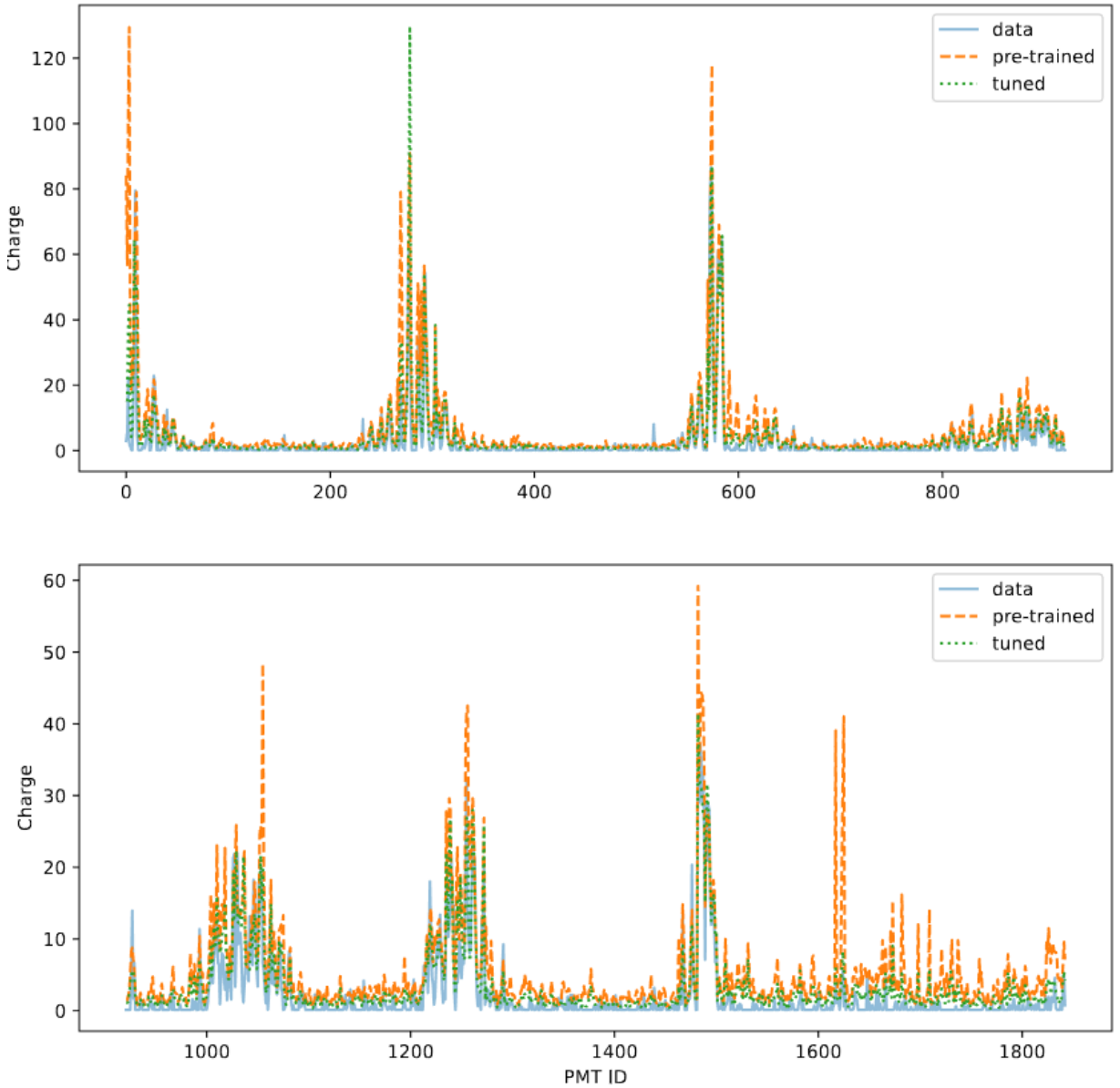
Log



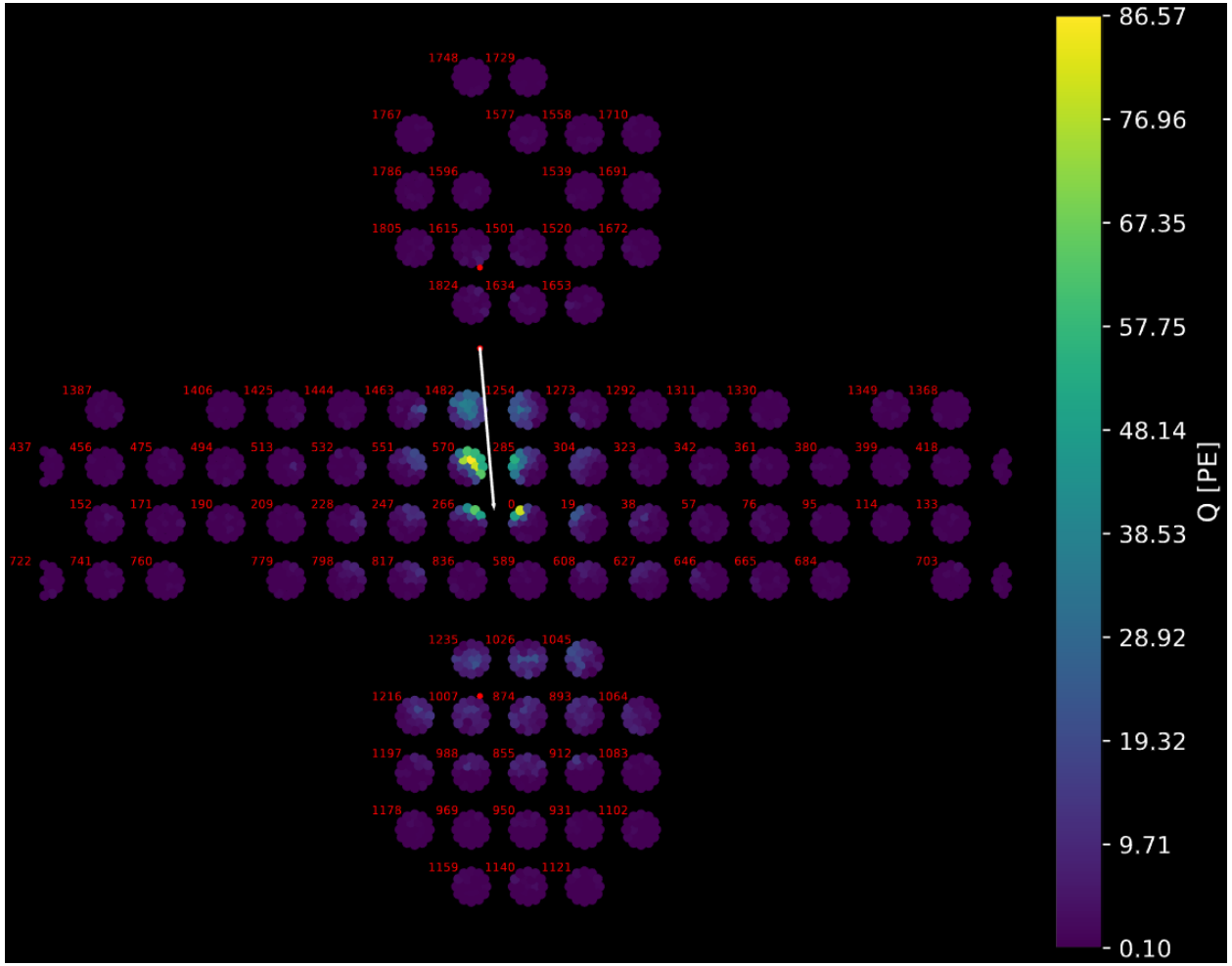


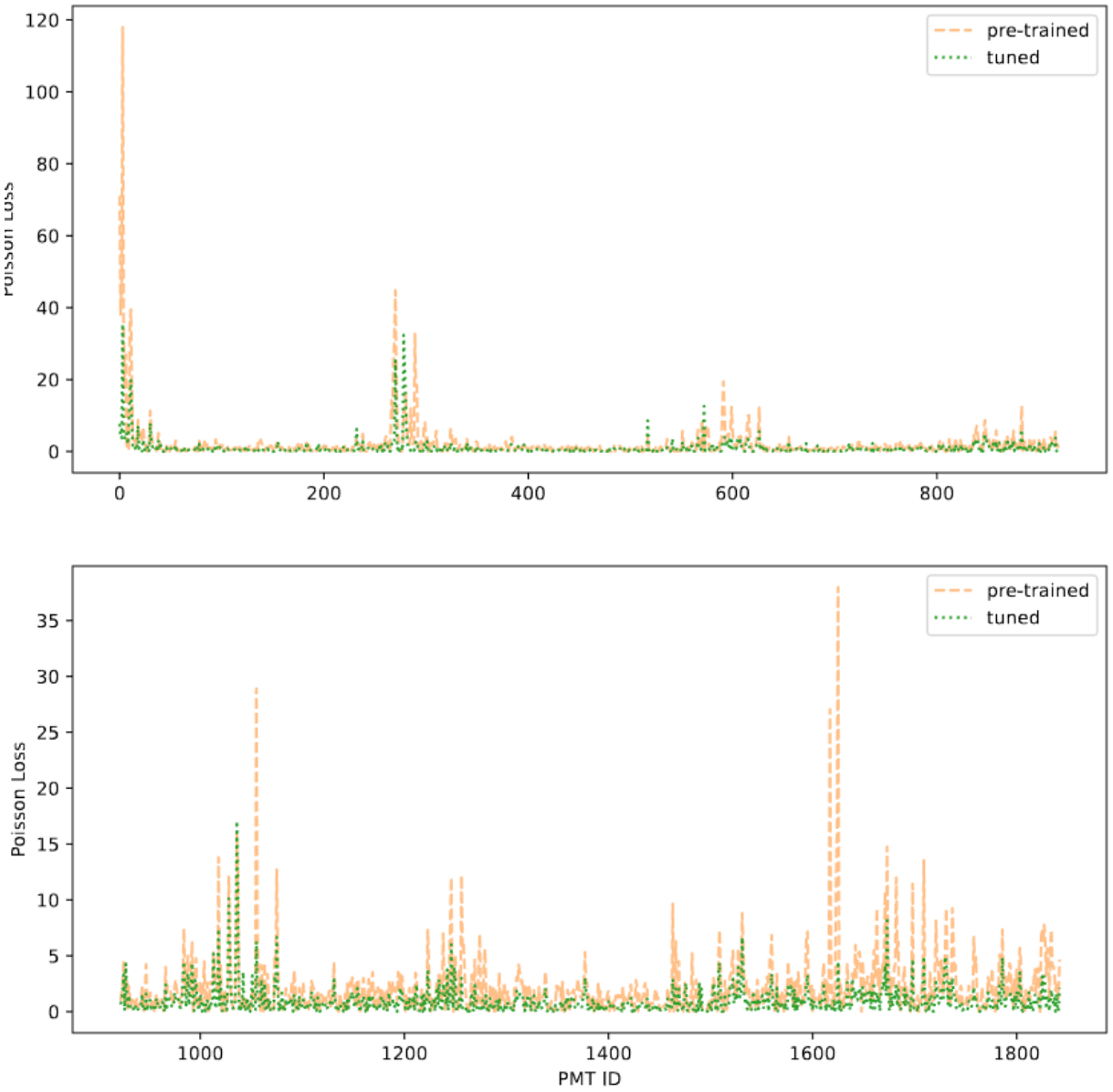




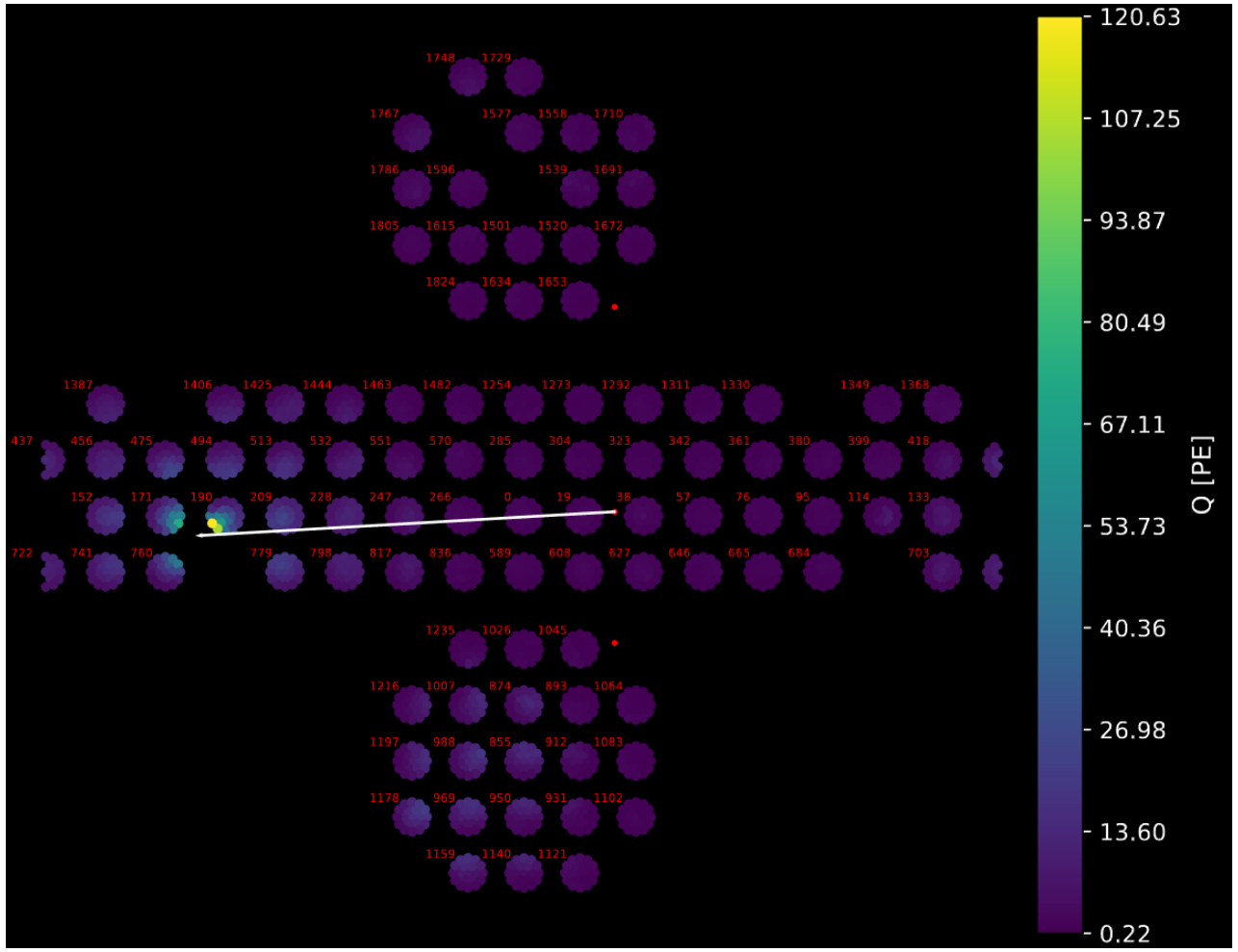


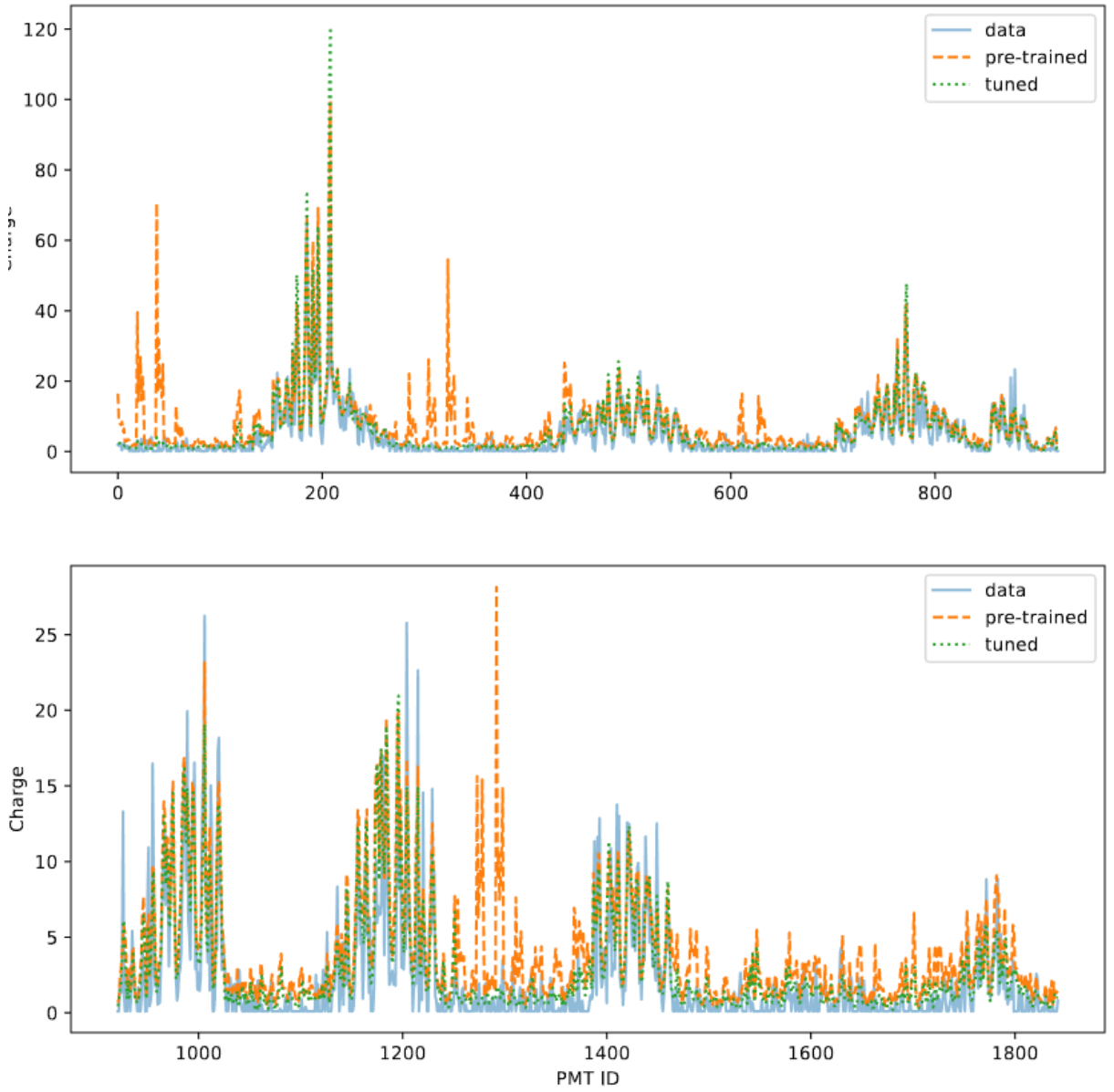
In general better agreement after fine-tuning.
But the model struggles when photons are starting close to the PMTs.



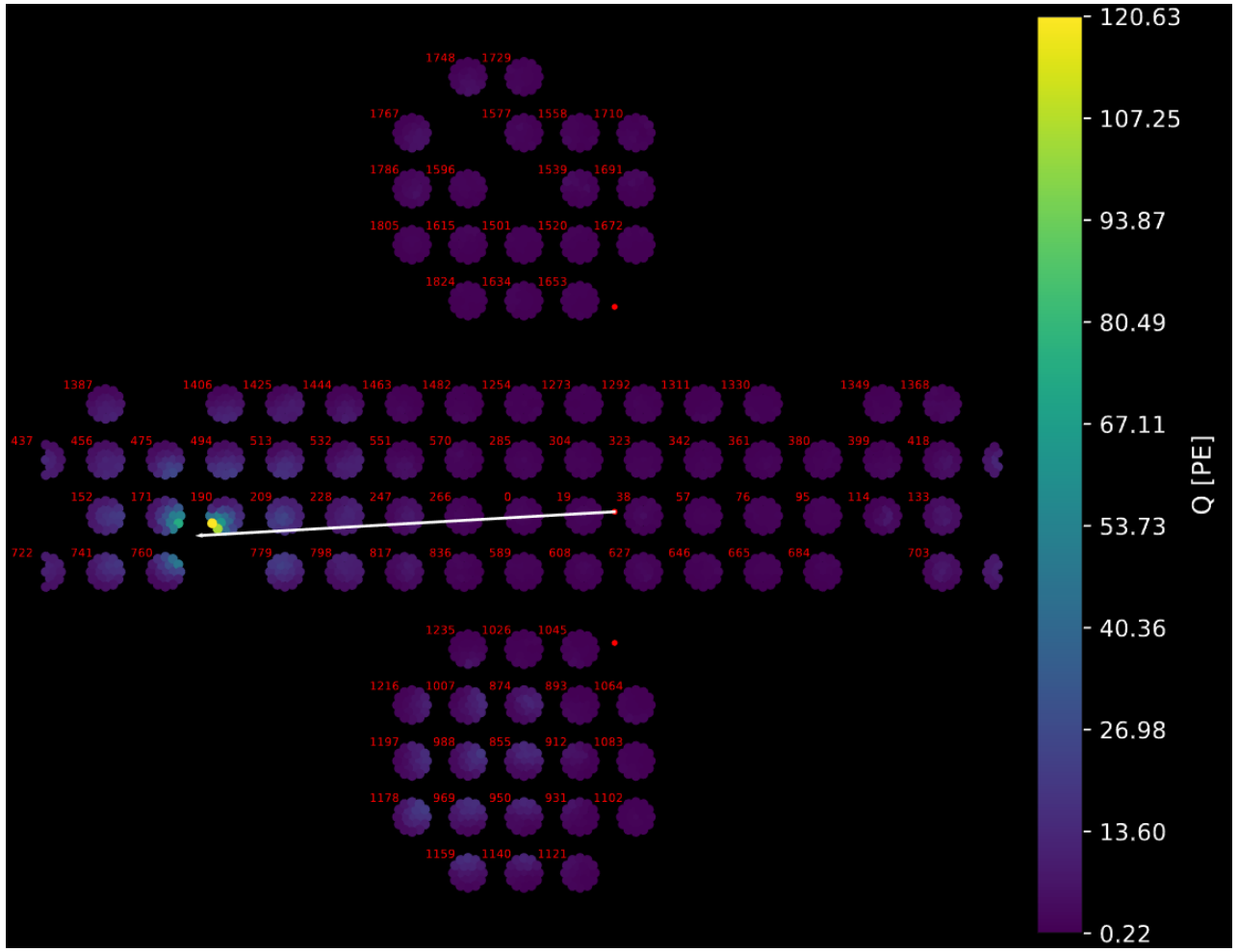


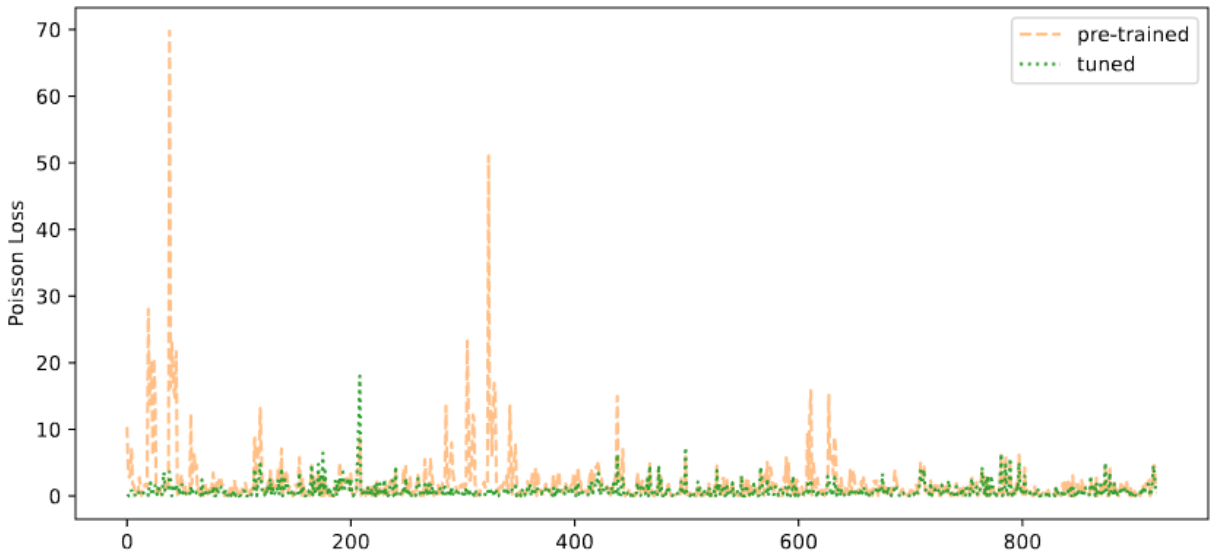
In general better agreement after fine-tuning.
But the model struggles when photons are starting close to the PMTs.

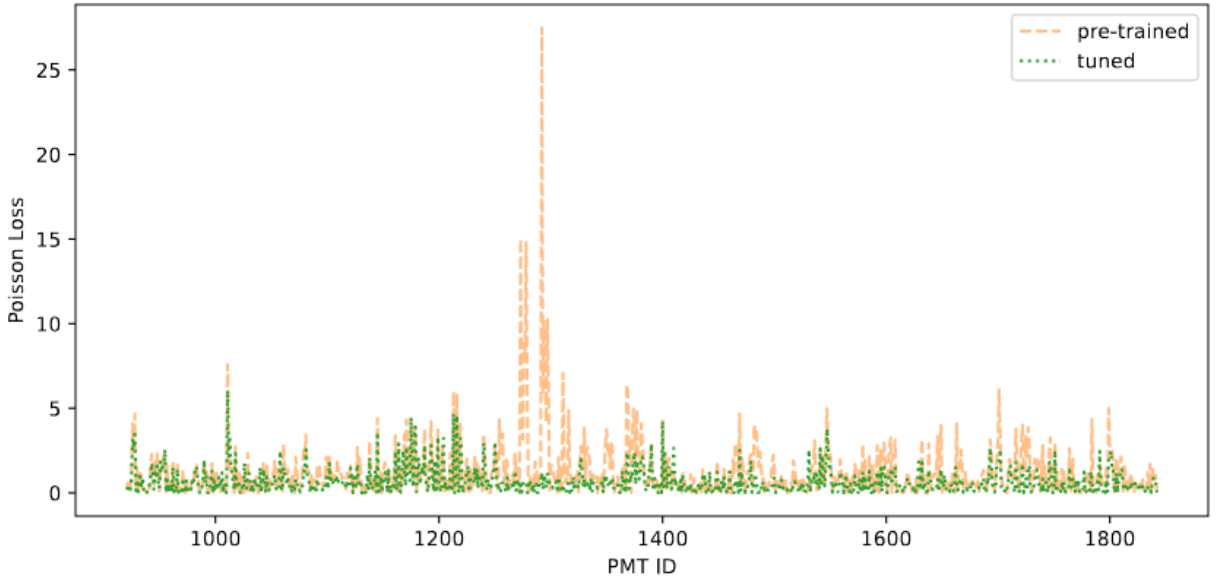




Looks reasonable for more horizontally going muons





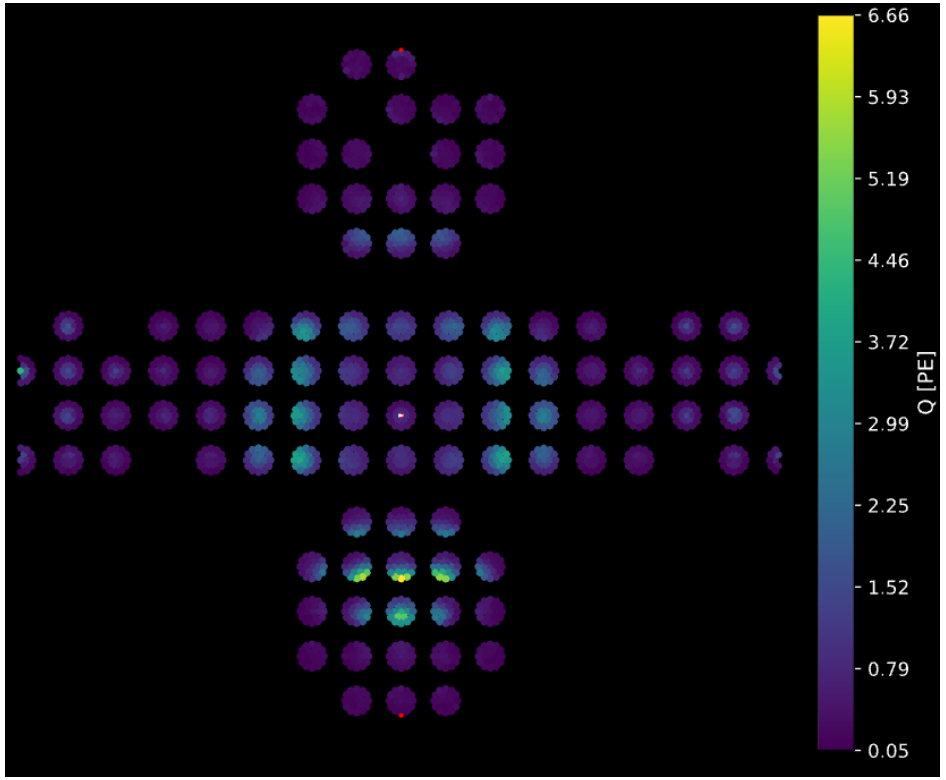


Looks reasonable for more horizontally going muons

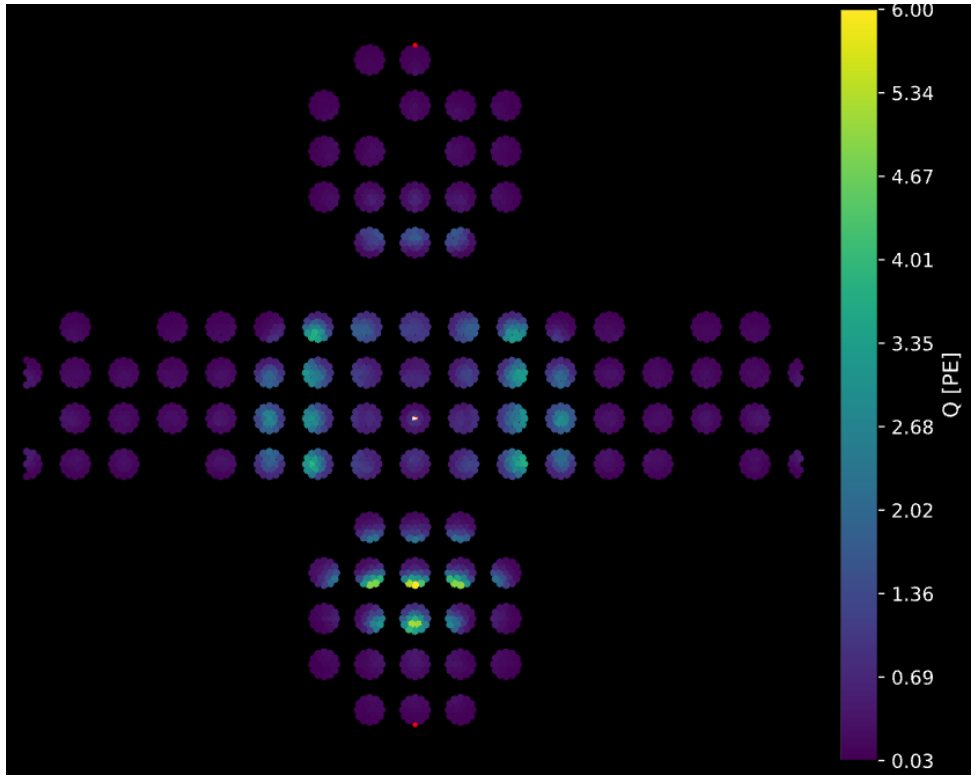
Impact on beam muon

- Horizontally going, momentum = 300 MeV/c
- Shape is quite consistent

Siren, pre-tuned

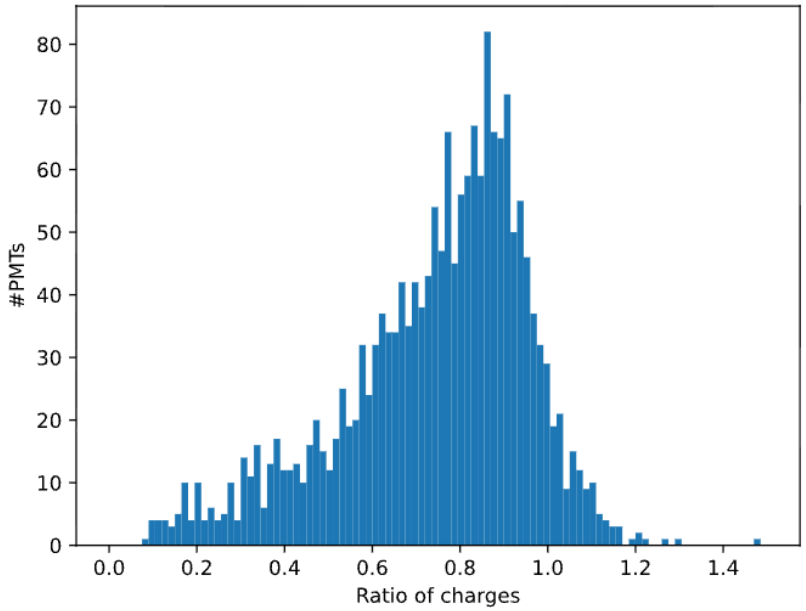


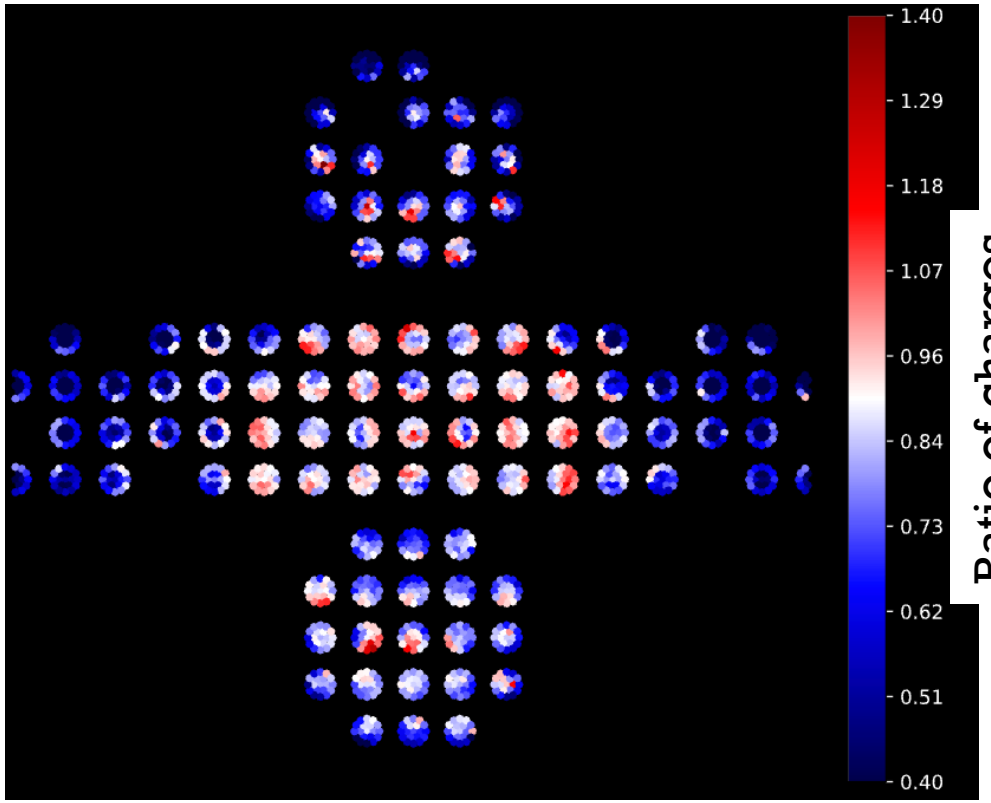
Siren, after 8 epoch



Impact on beam muon

- Horizontally going, momentum = 300 MeV/c
- Shape is quite consistent
- Charge ratio is quite close to truth (0.9) within the Cherenkov ring
- Outside generally drops more
  - Not necessarily bad because visibility is likely to be overestimated for reflection/scattering





Replace truth track parameters by fiTQun

- Significantly worse loss (performance) → need to selection for good reconstruction