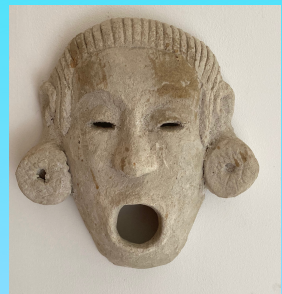
Simulation:
nuSim status and plans



Data sets: data.nustorm.org

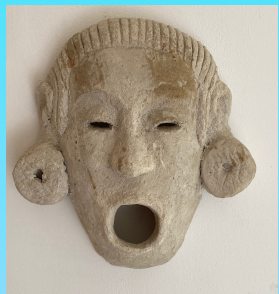
1 Runs

Run	Events	Beam	E GeV	Description
0020	25000	π	7.6	BM1: E_{beam} parabolic $\pm 10\%$, β is π, emittance is 25000 $E_\mu = 6$
0021	25000	π	5.11	BM1: E_{beam} parabolic $\pm 10\%$, β is π, emittance is 25000 $E_\mu = 4$
0022	25000	π	2.53	BM1: E_{beam} parabolic $\pm 10\%$, β is π, emittance is 25000 $E_\mu = 2$
0023	25000	π	6.35	BM1: E_{beam} parabolic $\pm 10\%$, β is π, emittance is 25000 $E_\mu = 5$
0024	25000	π	3.82	BM1: E_{beam} parabolic $\pm 10\%$, β is π, emittance is 25000 $E_\mu = 3$
0025	25000	π	1.27	BM1: E_{beam} parabolic $\pm 10\%$, β is π, emittance is 25000 $E_\mu = 1$
0026	25000	π	0.63	BM1: E_{beam} parabolic $\pm 10\%$, β is π, emittance is 25000 $E_\mu = 0.5$
0027	25000	μ	0.5	BM1: E_{beam} parabolic $\pm 15\%$, β is π, emittance is 25000
0028	25000	μ	1.0	BM1: E_{beam} parabolic $\pm 15\%$, β is π, emittance is 25000
0029	25000	μ	1.5	BM1: E_{beam} parabolic $\pm 15\%$, β is π, emittance is 25000
0030	25000	μ	2.0	BM1: E_{beam} parabolic $\pm 15\%$, β is π, emittance is 25000
0031	25000	μ	2.5	BM1: E_{beam} parabolic $\pm 15\%$, β is π, emittance is 25000
0032	25000	μ	3.0	BM1: E_{beam} parabolic $\pm 15\%$, β is π, emittance is 25000
0033	25000	μ	3.5	BM1: E_{beam} parabolic $\pm 15\%$, β is π, emittance is 25000
0034	25000	μ	4.0	BM1: E_{beam} parabolic $\pm 15\%$, β is π, emittance is 25000
0035	25000	μ	4.5	BM1: E_{beam} parabolic $\pm 15\%$, β is π, emittance is 25000
0036	25000	μ	5.0	BM1: E_{beam} parabolic $\pm 15\%$, β is π, emittance is 25000
0037	25000	μ	5.5	BM1: E_{beam} parabolic $\pm 15\%$, β is π, emittance is 25000
0038	25000	μ	6.0	BM1: E_{beam} parabolic $\pm 15\%$, β is π, emittance is 25000
				Old runs

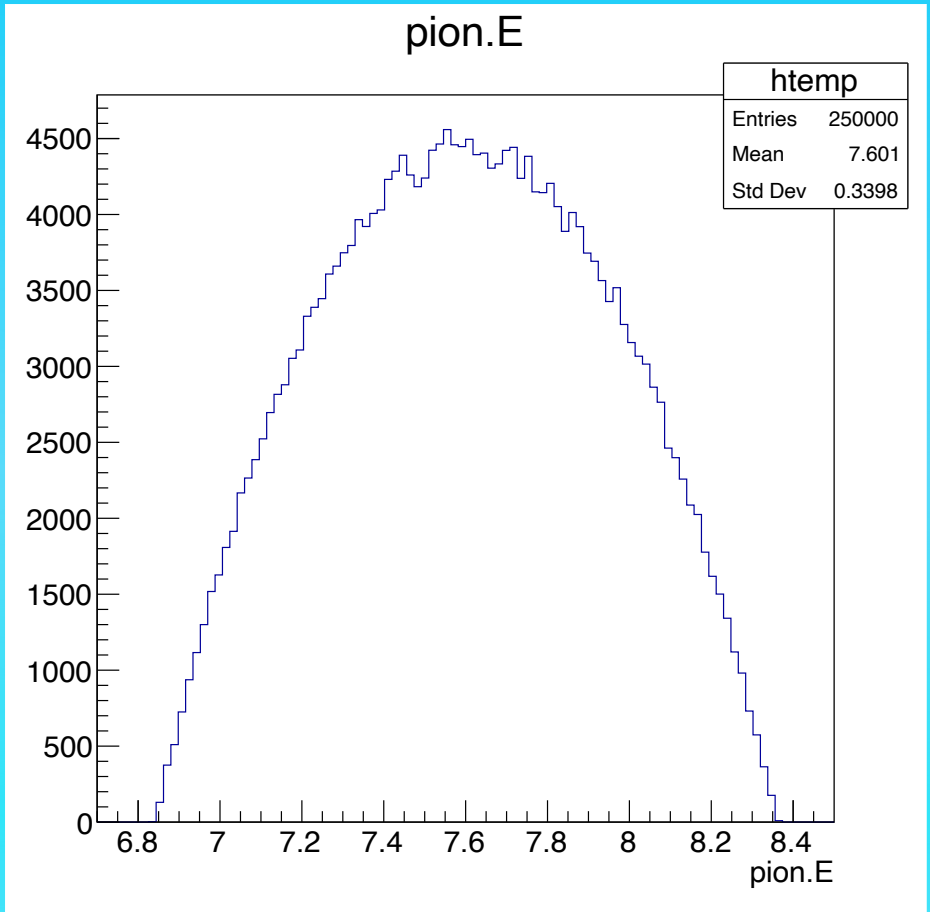
Muons:
0.5 to 6.0 GeV in 0.5 GeV steps

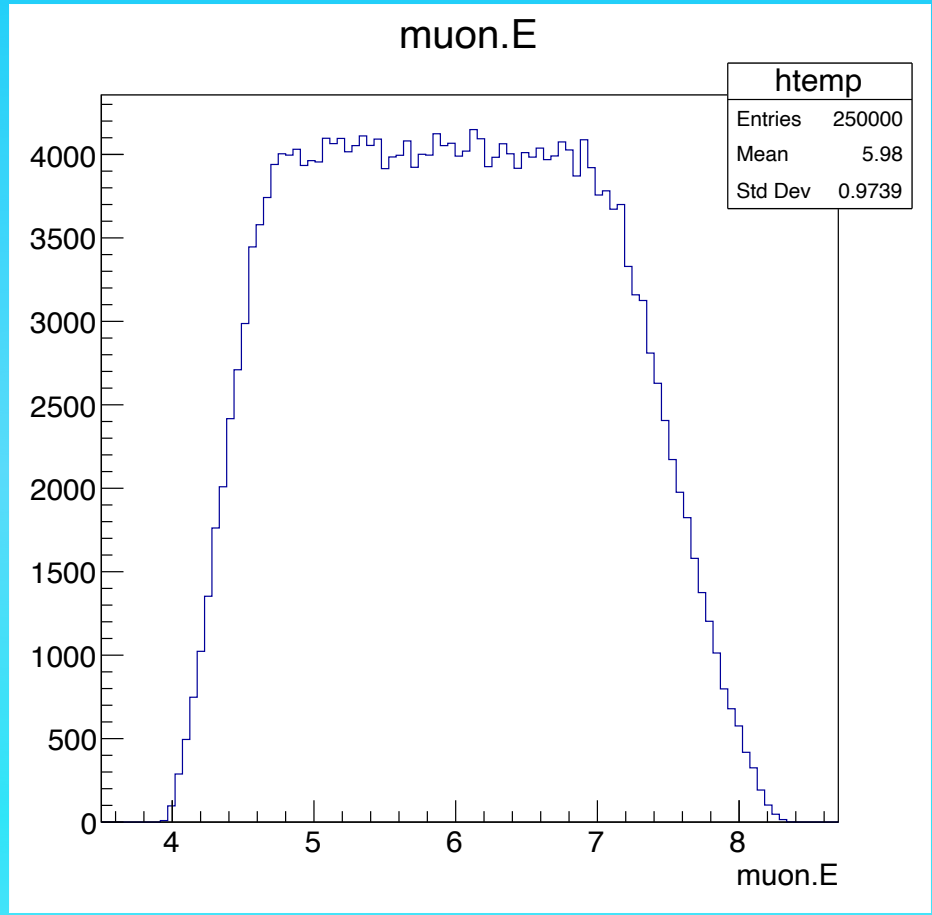
Pions:
to give muon datasets centered on the muon energies 1 to 6 plus at 0.5.

Generation of larger datasets can be done on request.



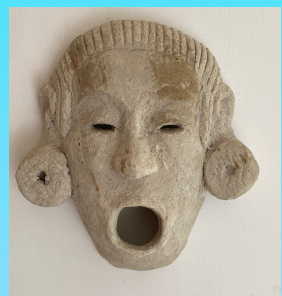
Pion Flash





Pion Flash: E=7.6 +/- 10%
Beta and emittance nominal

Muon spectra:
No cuts on acceptance



Pion Flash

This is just the source spectrum, without any selection, even on muons which will make it as far as the bend.

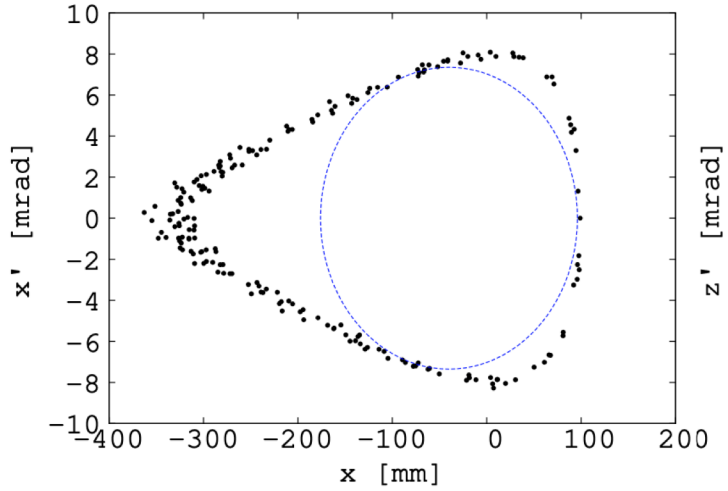


Figure 6: Stable motion in the horizontal Poincare map for maximum initial amplitude over 100 turns for p_0 in JBT. The ellipse shows a 1 mm.rad unnormalized emittance.

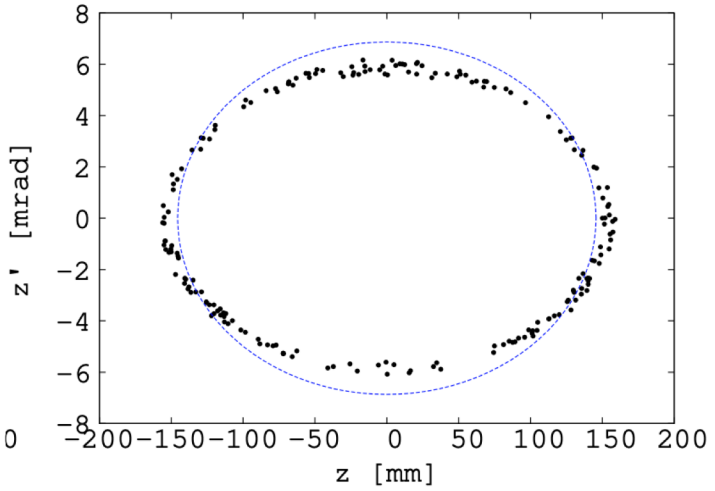
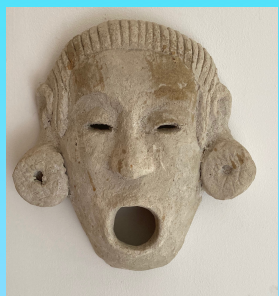


Figure 7: Stable motion in the vertical Poincare map for maximum initial amplitude over 100 turns for p_0 in JBT. The ellipse shows a 1 mm.rad unnormalized emittance.

By parametrizing these results:

- Get a input spectra for the bend
- Improve the matching of pion beam energy with the required muon beam
- Start to calculate our normalisation

Racetrack FFAG muon decay ring for nuSTORM with triplet focusing
J.-B. Lagrange et al



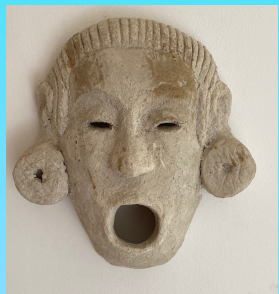
Neutrinos at detector plane

There are a number of beam parameters which affect the (energy dependent) angular distribution at the detector plane (50m beyond the end of the straight)

- Size and shape of the momentum bite
- β and ε of the beam
- Decay point of the muon/pion
- Backgrounds from decays in the arc
- Change of mean momentum with path length (multi-turn)

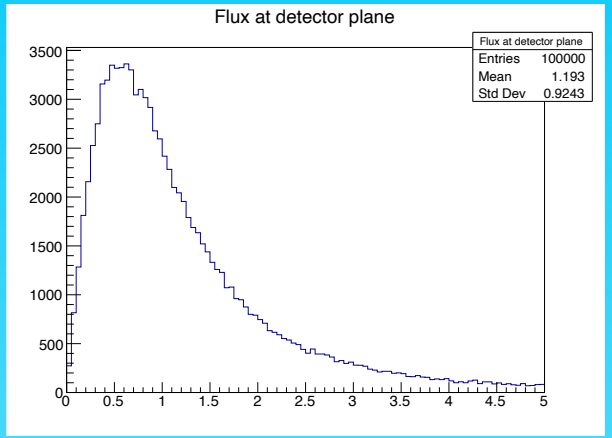
I did not have access to Backgrounds or multi-turn.

Which of the rest is most serious?

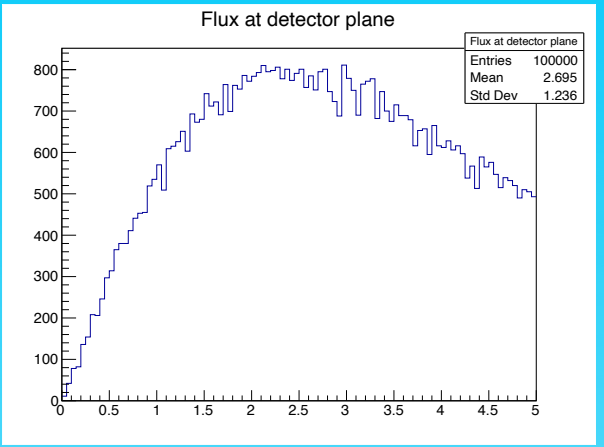


Neutrinos at detector plane

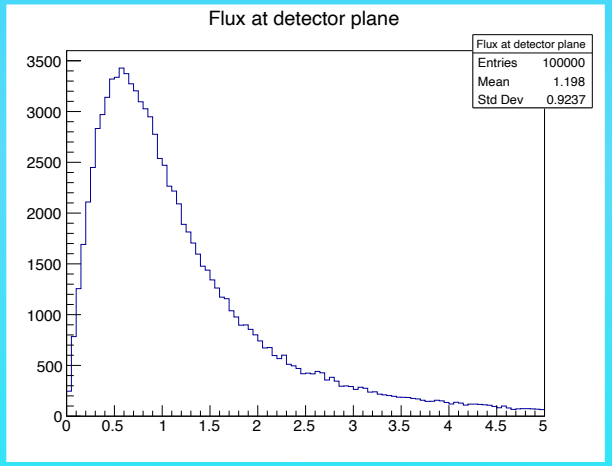
End of straight E=8+/-10%
β and ε nominal



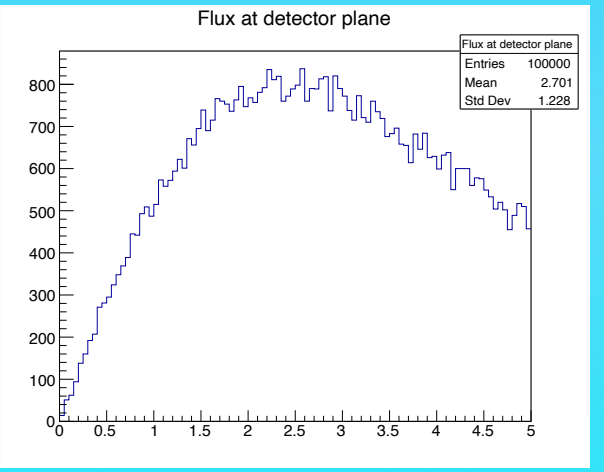
Start of straight



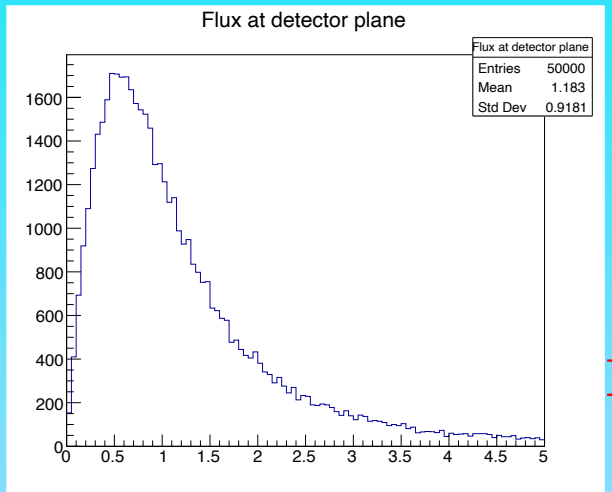
End of straight E=8
β and ε nominal



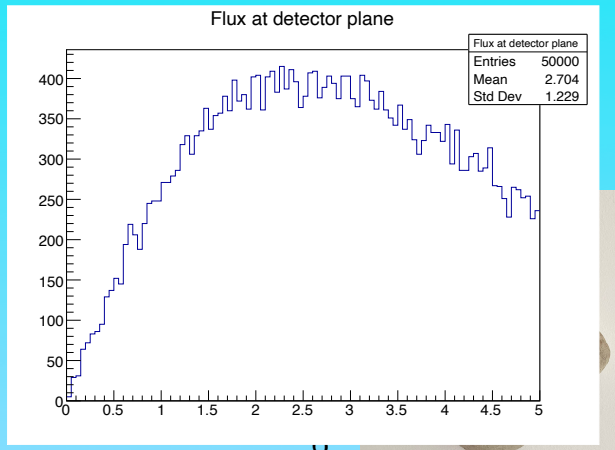
Start of straight



End of straight E=8
β and ε =0



Start of straight



Decay point dominates

νSTORM

Neutrinos at detector plane

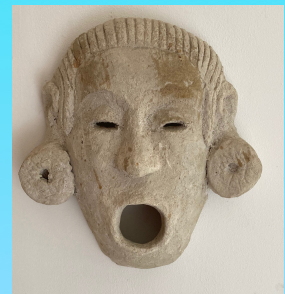
- Size and shape of the momentum bite
- β and ε of the beam
- Decay point of the muon/pion

- Backgrounds from decays away from the straight
- Change of mean momentum with path length

Backgrounds and multi-turns are in development

The decay point depends only on the muon/pion lifetimes, which are well known.

The distributions are good enough to start physics studies



Status

nuSim:

available on GitHub

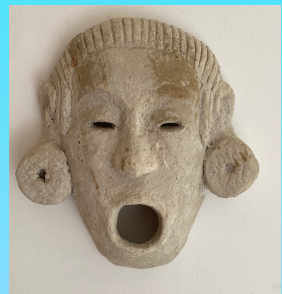
nuSTORM.org as a tarball

manual and installation instructions – these are being checked by Paul Smith

Github test and validation structure

under development – some progress

Slack channel for communication developers and users



Status

nuSim:

Muon momentum bite (+/- 15% parabolic)

Pion momentum bite (+/- 10% parabolic)

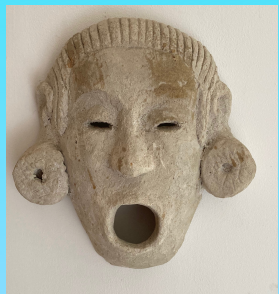
Emittance and beta of beam – same everywhere

Multi-turn under development

Backgrounds from arc under development

muon beam for 6D cooling demo – needs root branch

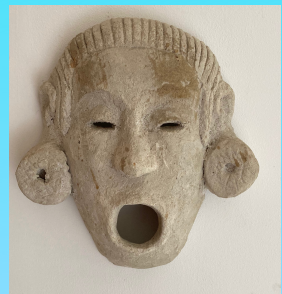
Pion and Muon Flux files on the data repository



Meetings

09 August:

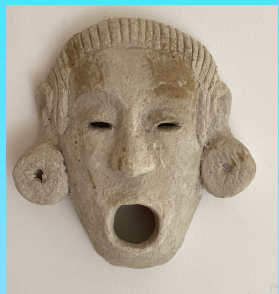
Timing/injection	Parameters for injection scheme Allow modelling and optimisation
Ring	Multiple turns – decay in the arc
Normalisation	Structure integrated into flux production
Genie	Generate a dataset
Geant4	Model of a detector component
Cooling	Data sets in repository



Meetings

20 September:

Normalisation	Neutrino spectrum per protons of target
Genie	Datasets for all muon beam conditions
Geant4	Simple detector … display of tracks
Paper	Define simulation requirements



Future Meetings

Every 6 weeks

<u>01 November:</u>

<u>13 December:</u>