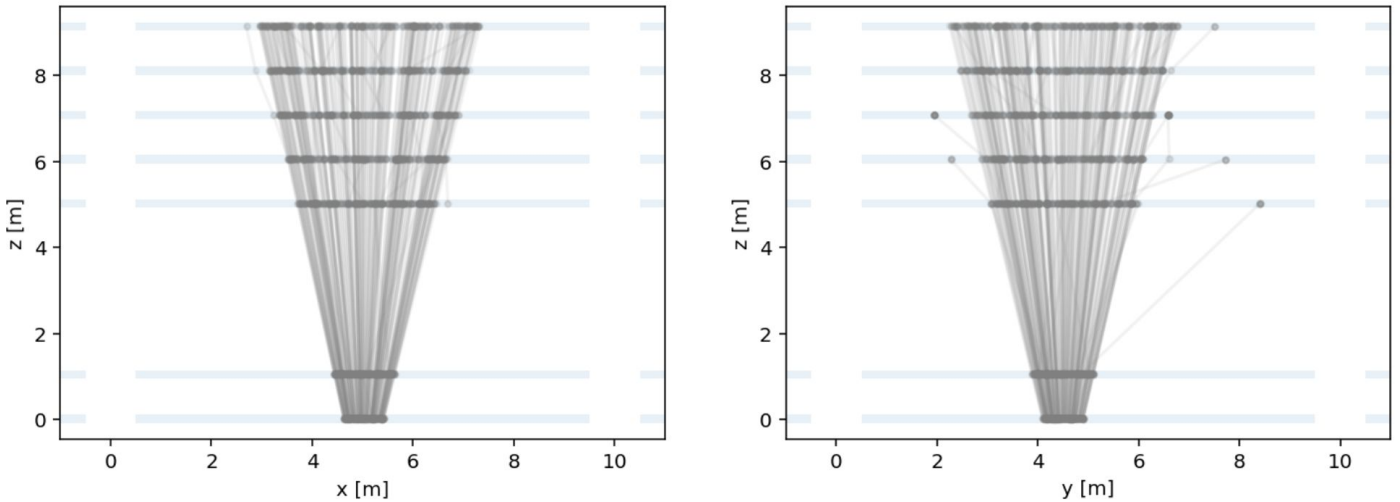
Track efficiency study

1. Simulation: muon gun, located at 2 m below the center of one detector (avoiding gaps and making sure muon hits every layer)

   Energies used: 1, 2, 5, 10, 50, 100, 500 GeV

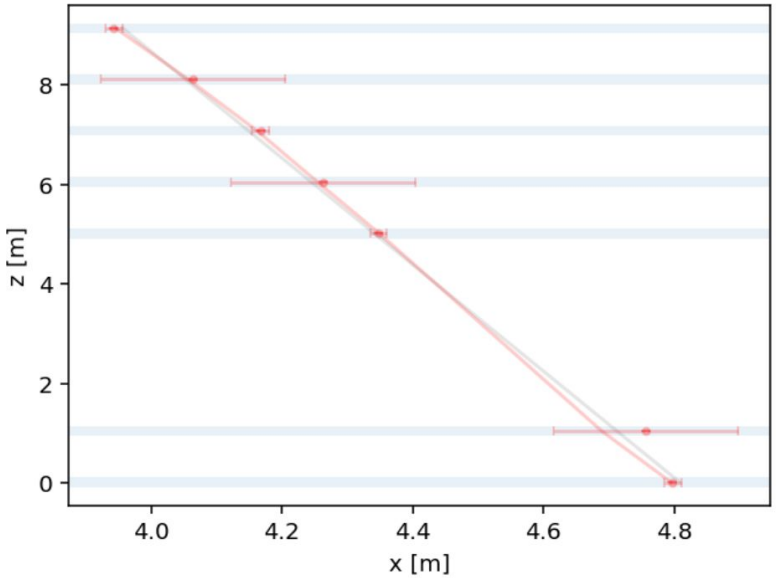
(x→ beam, y→ other, z→up)

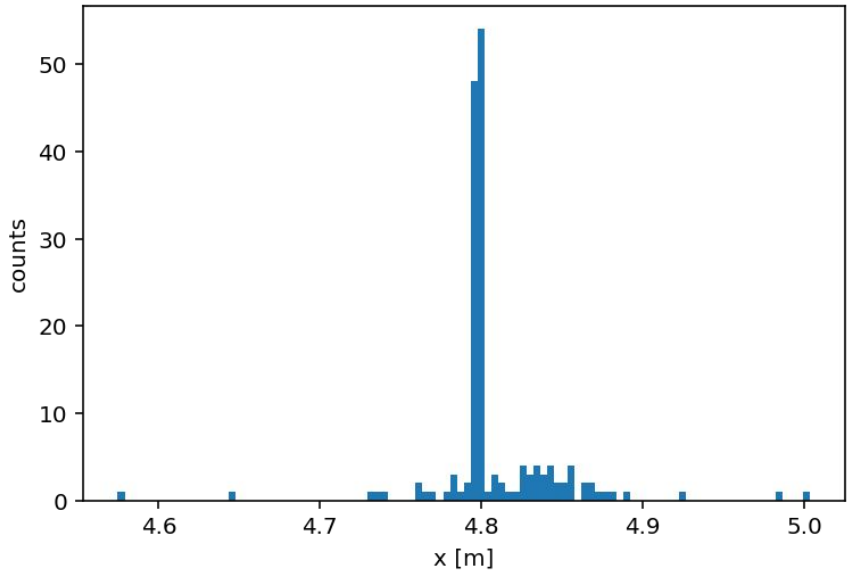


Track efficiency study

2. Tracker: using default setup, beta cut 0.8-1.2

For each event, run tracker (and digitizer) 200 times

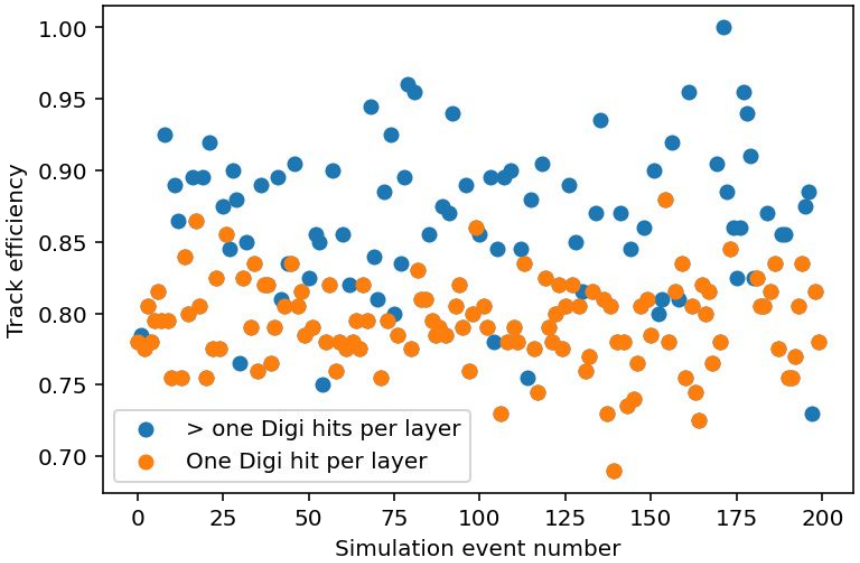


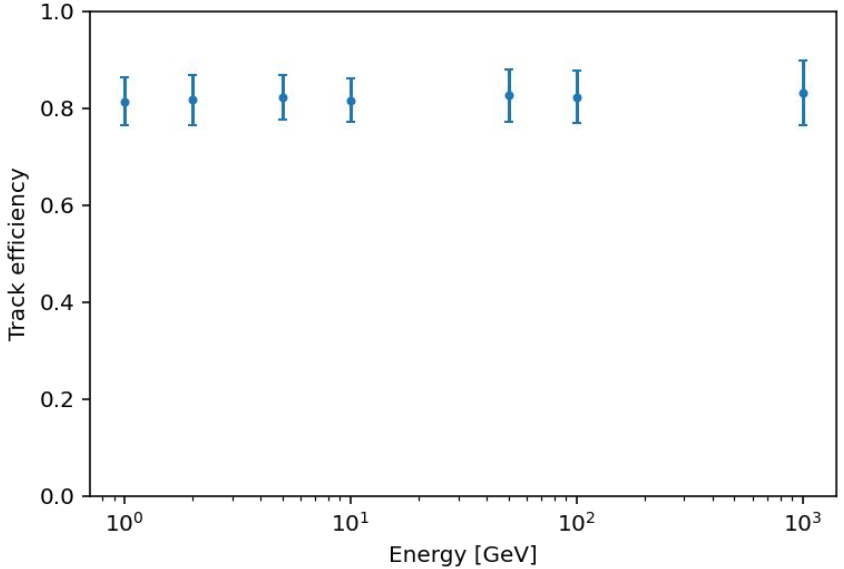


Track efficiency study

For each event, only 82% (+/- 5%) of the runs succeed.

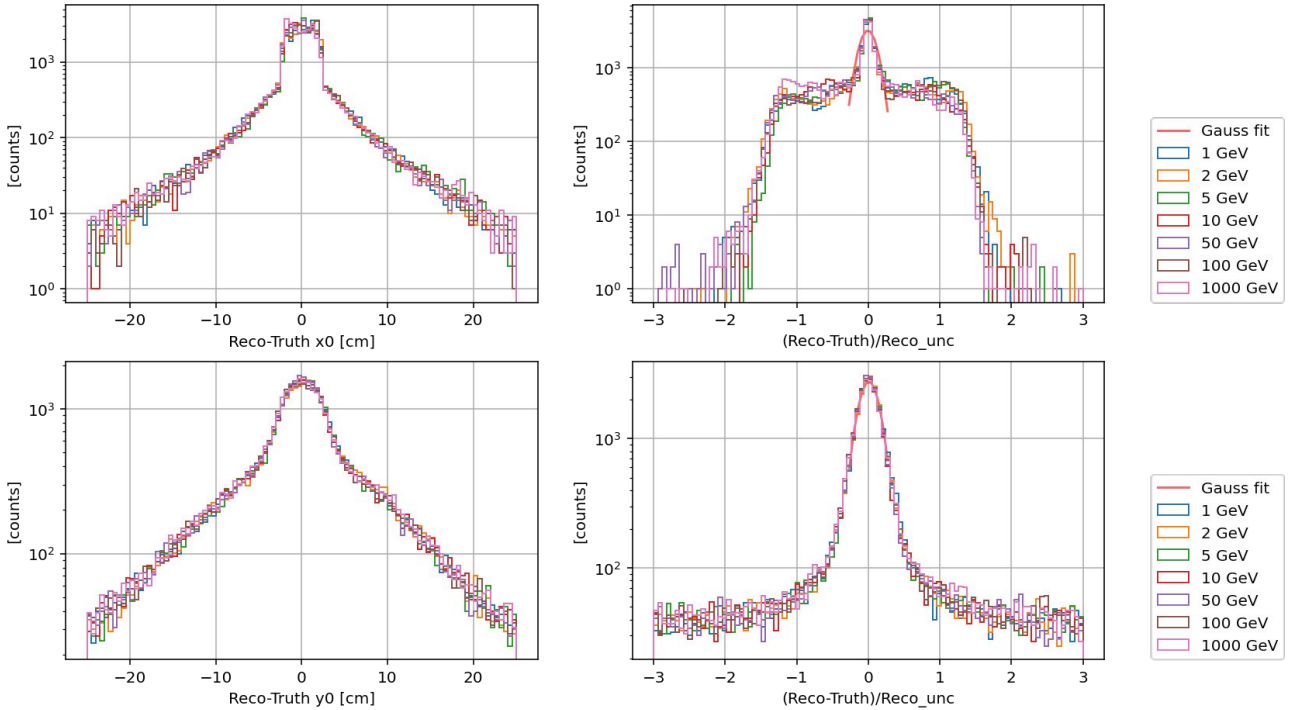
There is no obvious energy dependency of the track efficiency.





Track efficiency study

Error and pull plots



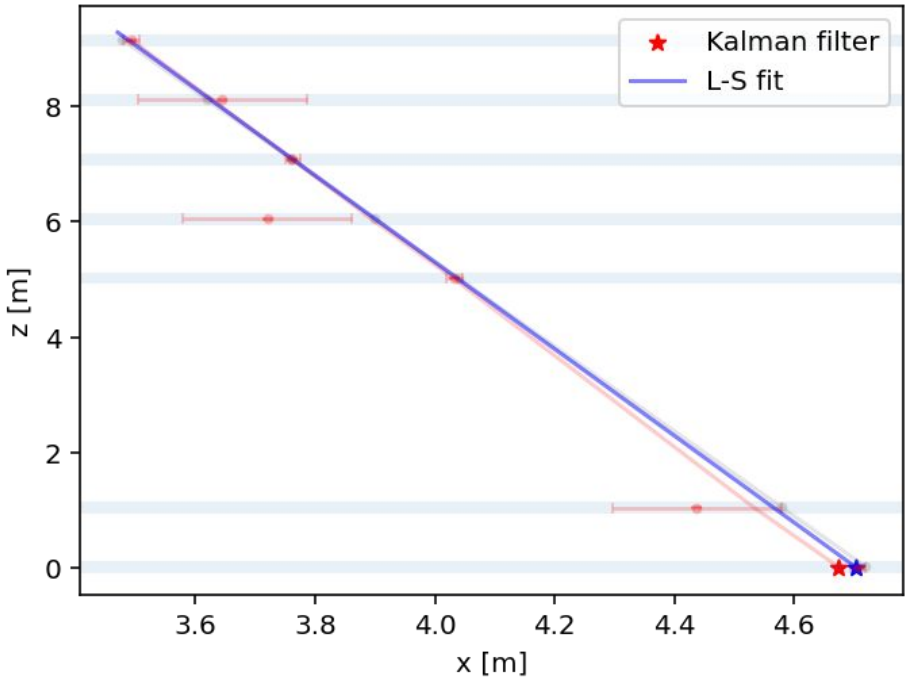
Track efficiency study

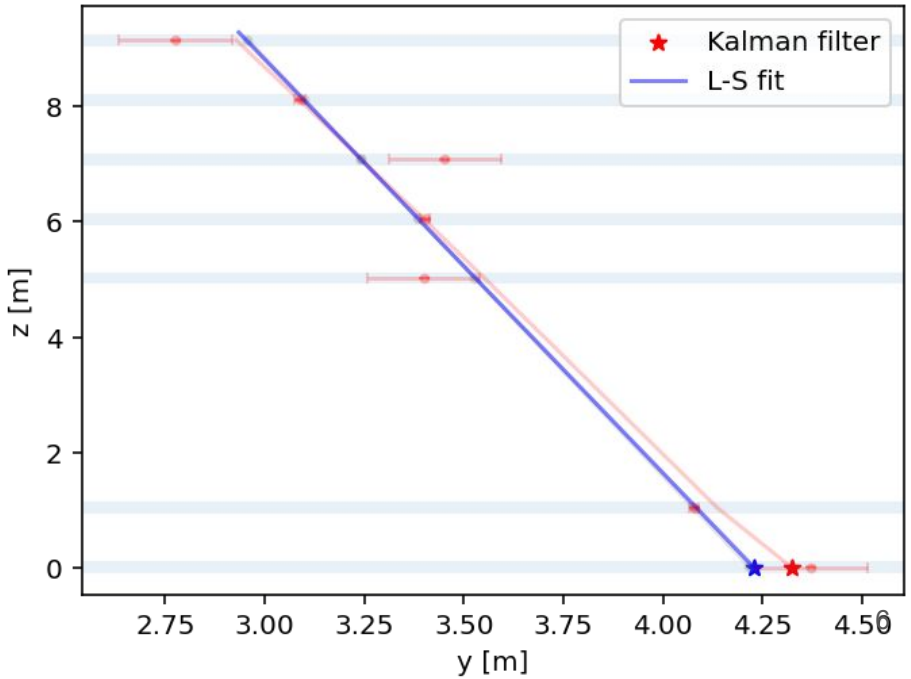
Two problems:

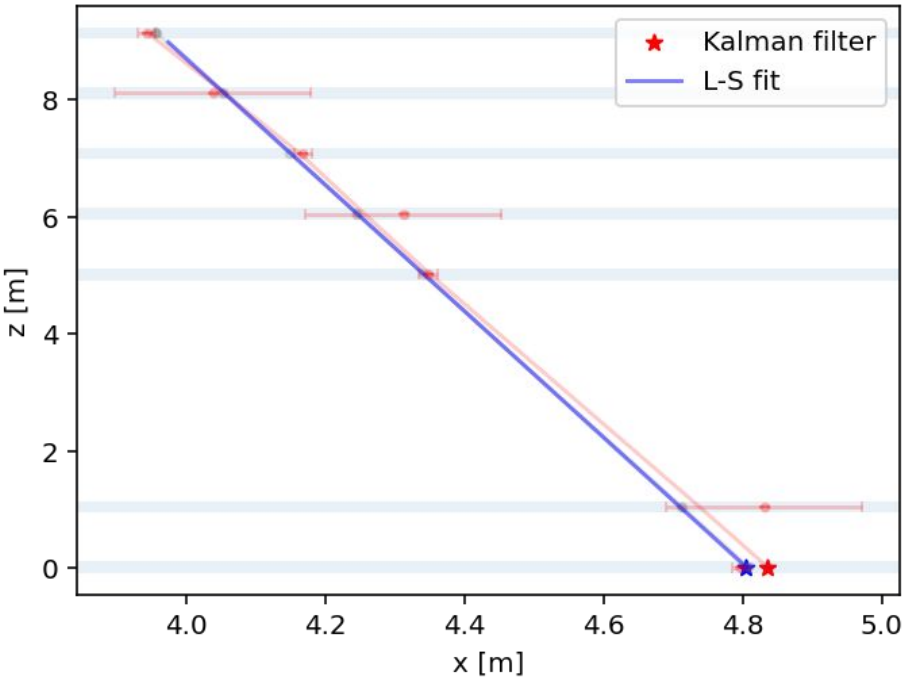
1) Efficiency: kind of low (82%)
2) Accuracy: Large spread beyond the gaussian core

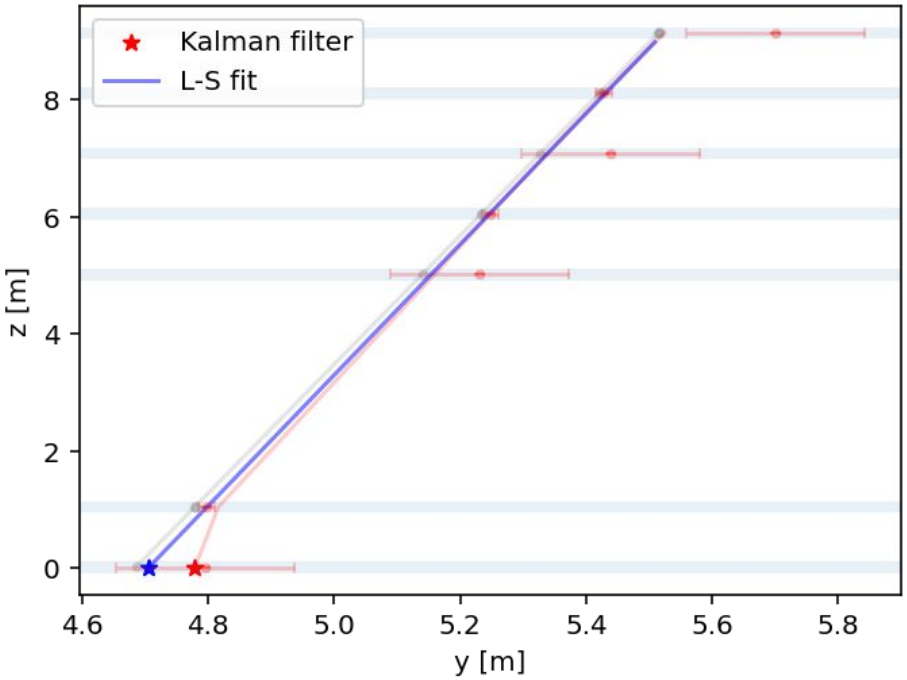
Compared with least square fit

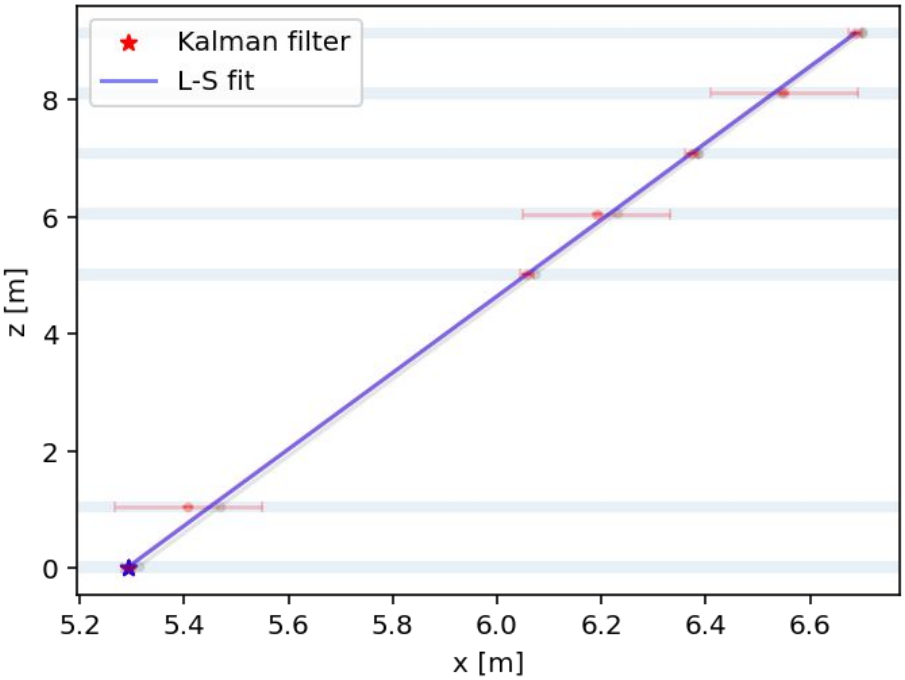
Minimizing $\frac{(x_{model} - x_{mea.})^2}{(x_{unc})^2} + \frac{(y_{model} - y_{mea.})^2}{(y_{unc})^2} + \frac{(t_{model} - t_{mea.})^2}{(t_{unc})^2}$

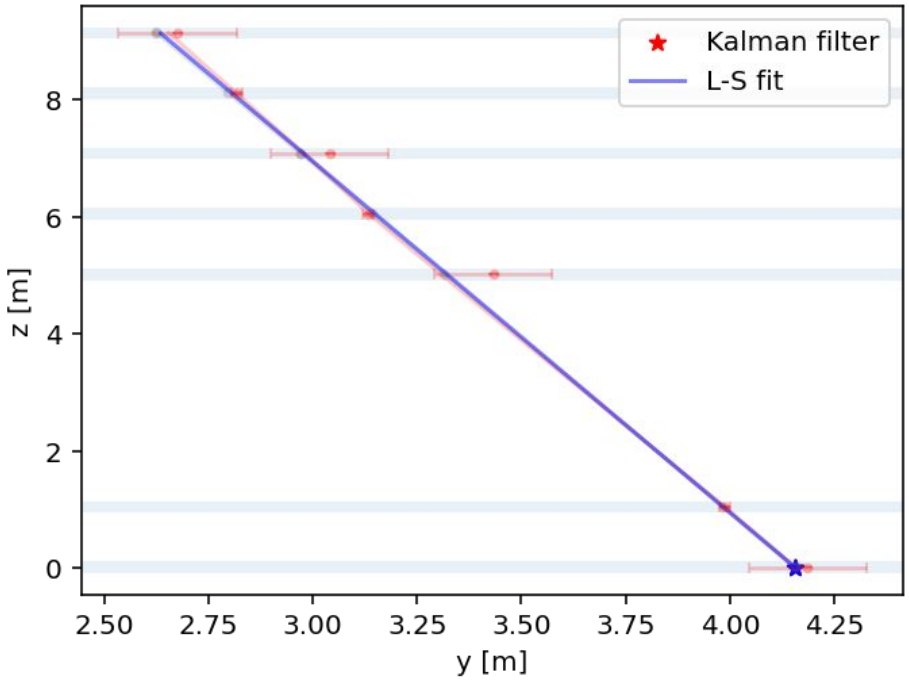




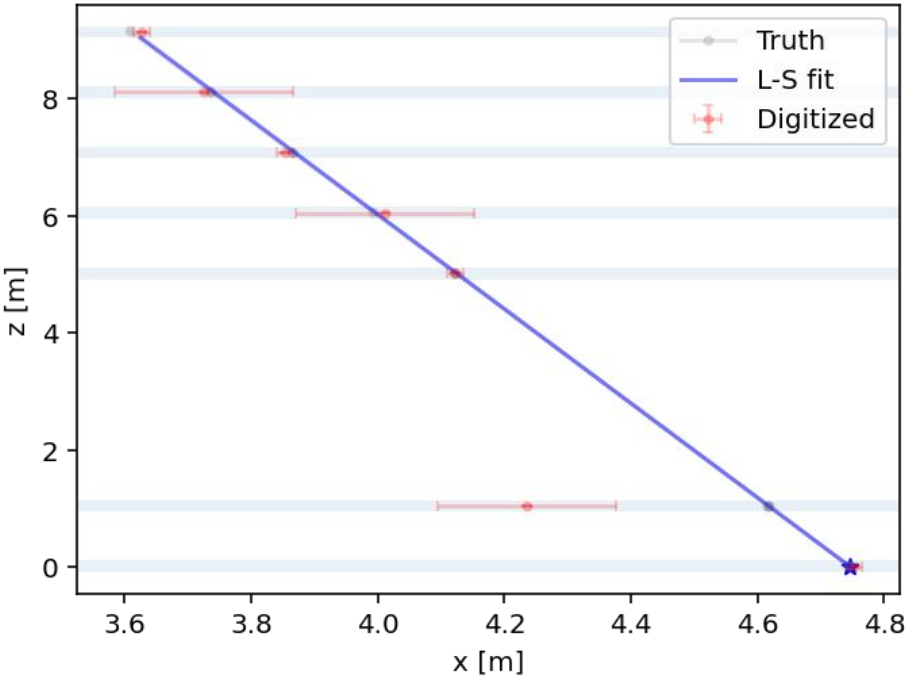

Kalman filter
L-S fit
z [m]
x [m]
0
2
4
6
8
4.0
4.2
4.4
4.6
4.8
5.0

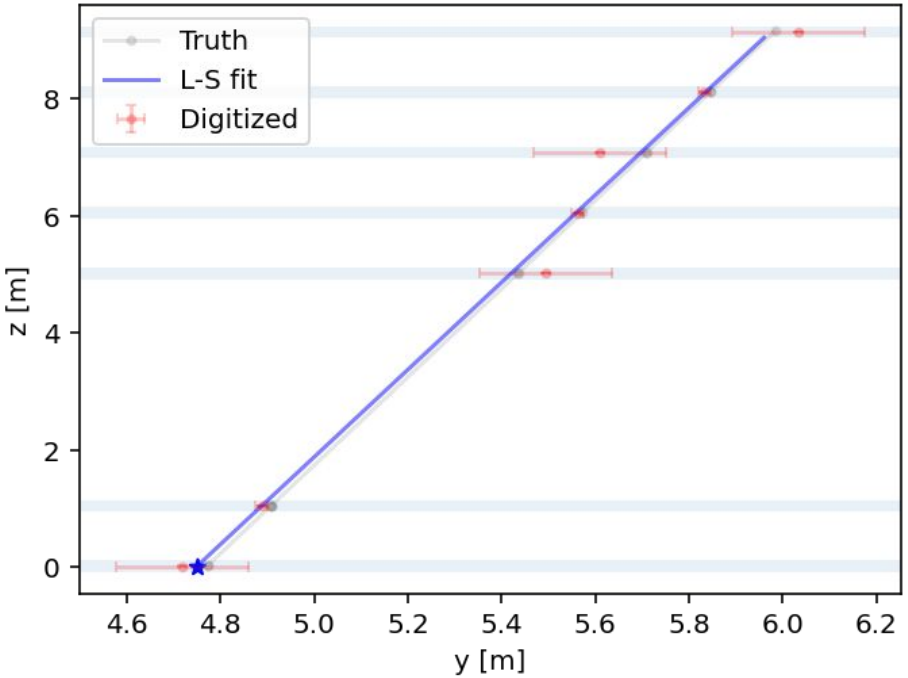

Kalman filter
L-S fit
z [m]
y [m]
0
2
4
6
8
4.6
4.8
5.0
5.2
5.4
5.6
5.8

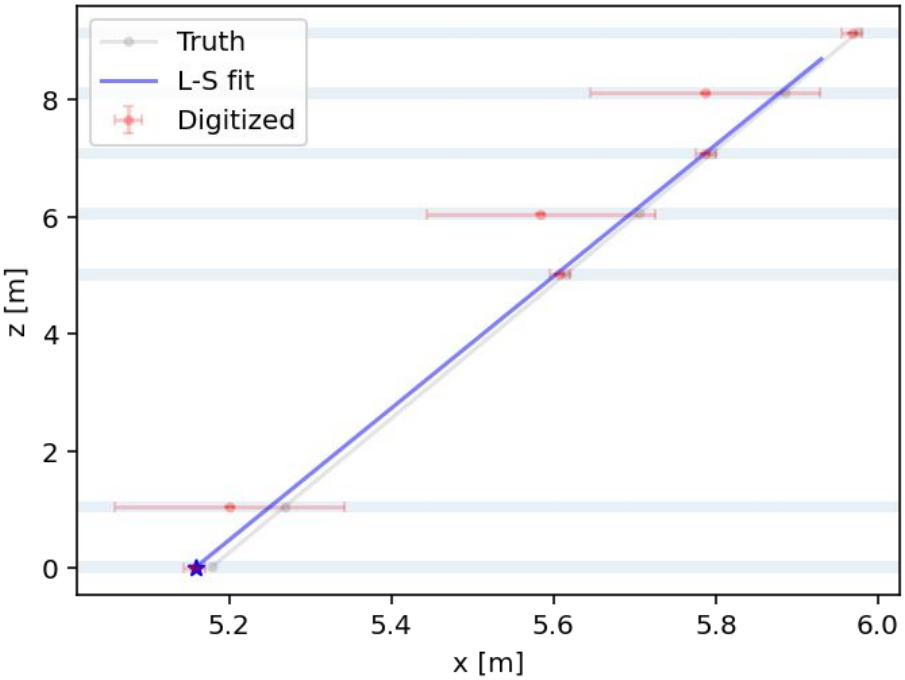

Kalman filter
L-S fit
z [m]
x [m]
0
2
4
6
8
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6

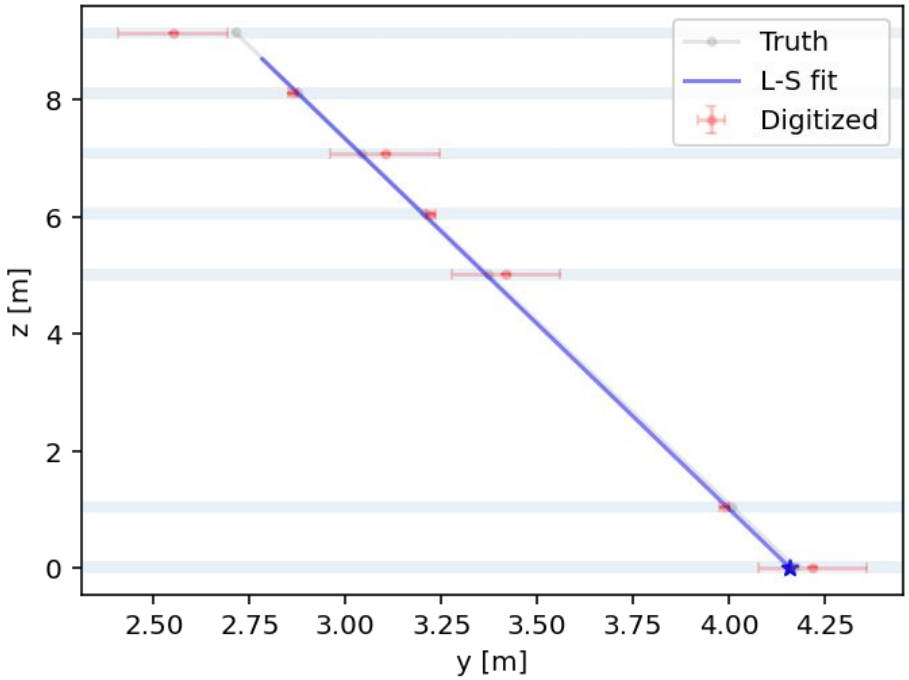

Kalman filter
L-S fit
z [m]
y [m]
0
2
4
6
8
2.50
2.75
3.00
3.25
3.50
3.75
4.00
4.25

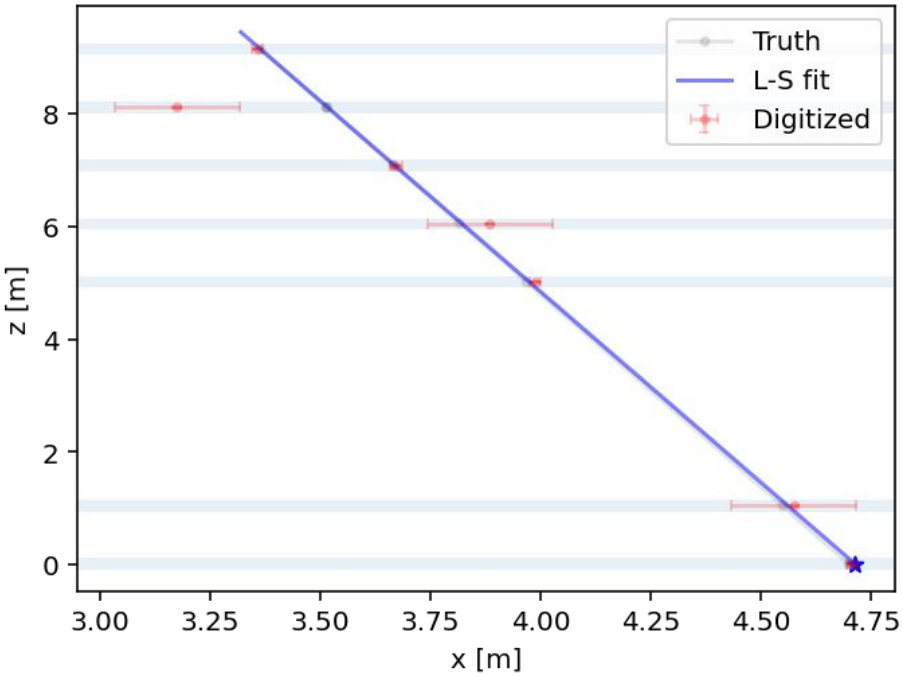
Tracks that failed the Kalman filter

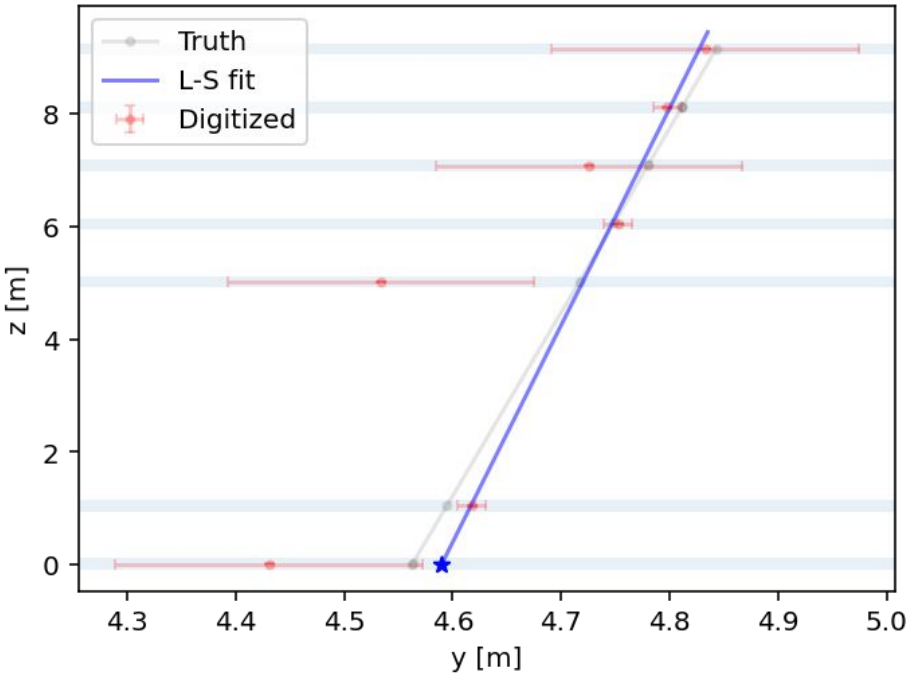


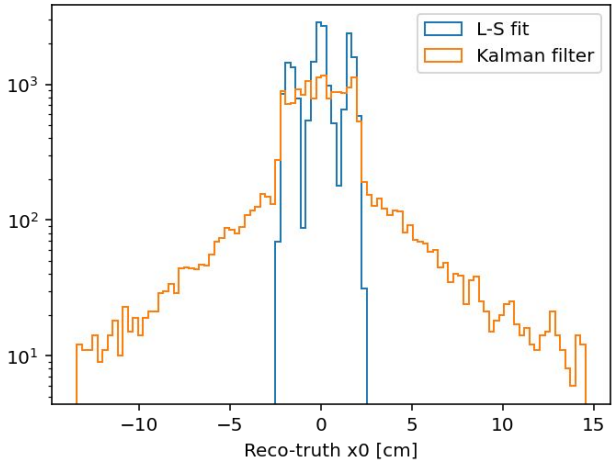


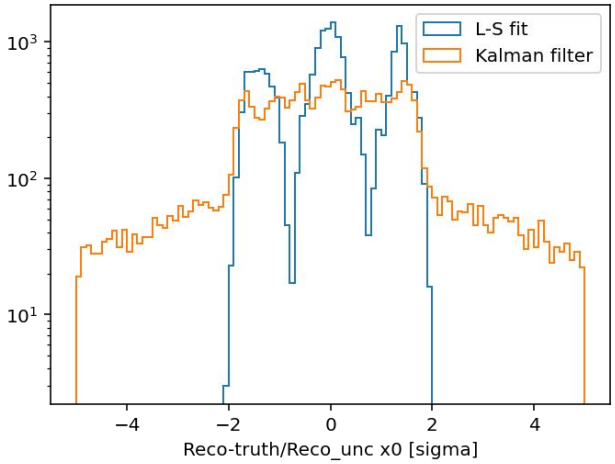

Truth
L-S fit
Digitized
z [m]
x [m]
0
2
4
6
8
5.2
5.4
5.6
5.8
6.0

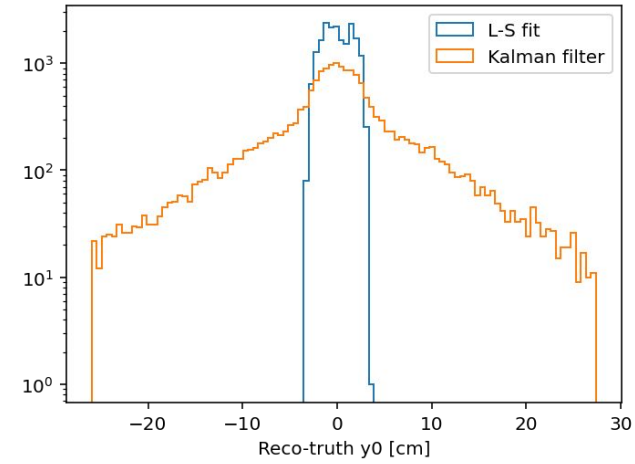

Truth
L-S fit
Digitized
z [m]
y [m]
0
2
4
6
8
2.50
2.75
3.00
3.25
3.50
3.75
4.00
4.25

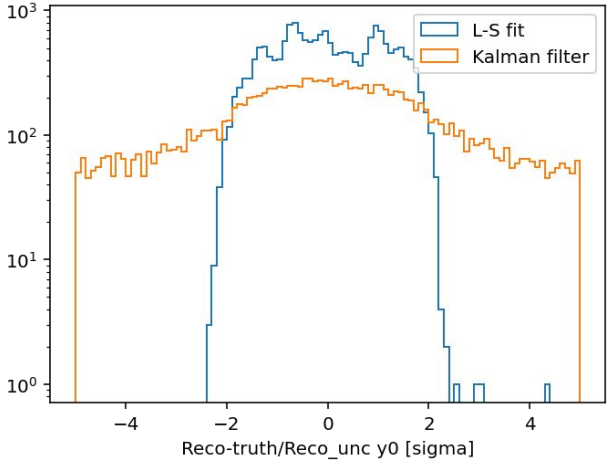

Truth
L-S fit
Digitized
z [m]
x [m]
0
2
4
6
8
3.00
3.25
3.50
3.75
4.00
4.25
4.50
4.75

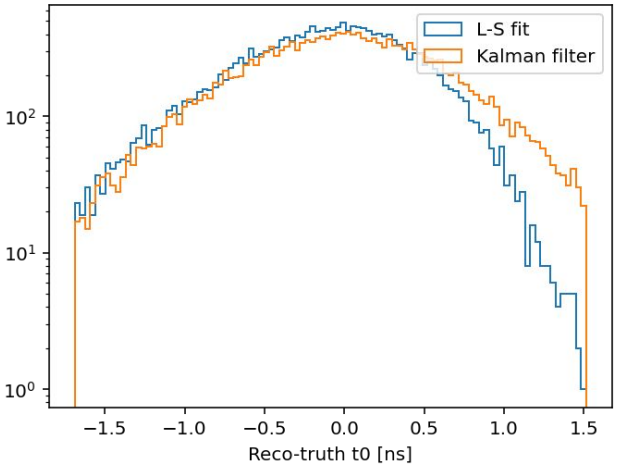

Truth
L-S fit
Digitized
z [m]
y [m]
0
2
4
6
8
4.3
4.4
4.5
4.6
4.7
4.8
4.9
5.0

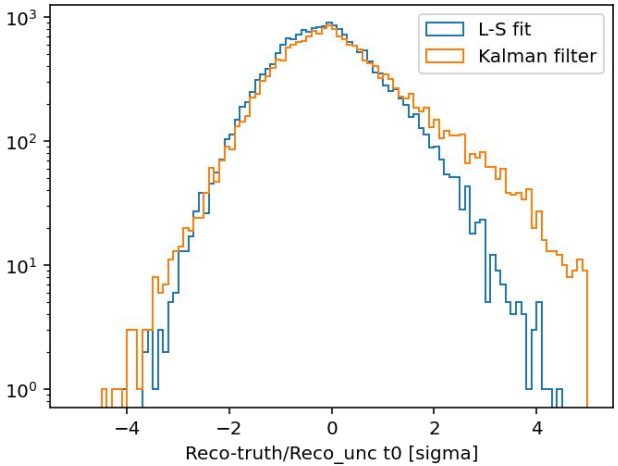

L-S fit
Kalman filter
Reco-truth x0 [cm]

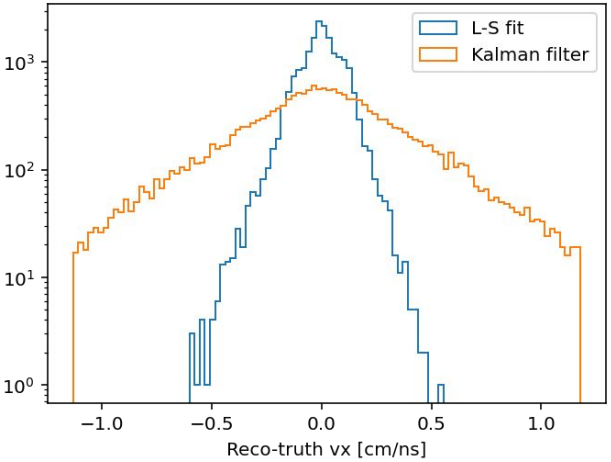

L-S fit
Kalman filter
Reco-truth/Reco_unc x0 [sigma]

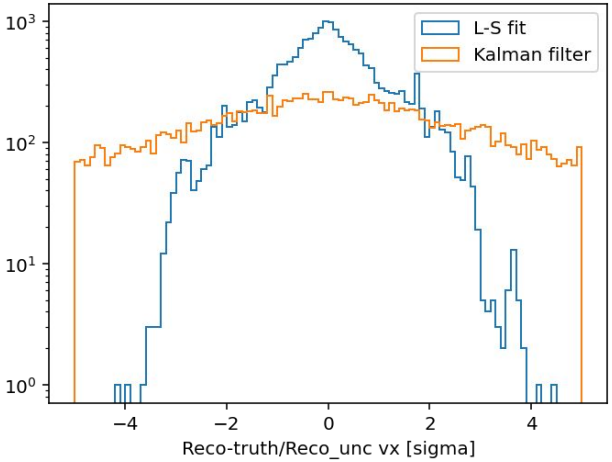

L-S fit
Kalman filter
Reco-truth y0 [cm]

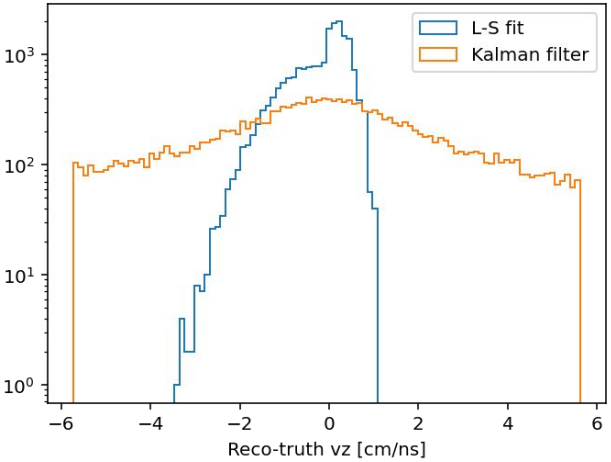

L-S fit
Kalman filter
Reco-truth/Reco_unc y0 [sigma]

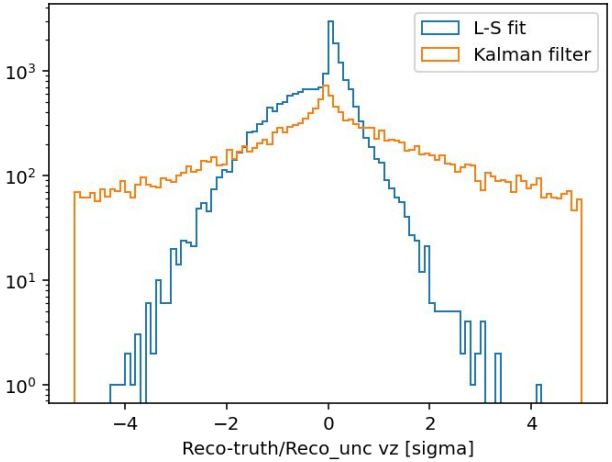

L-S fit
Kalman filter
10^2
10^1
10^0
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
Reco-truth t0 [ns]


L-S fit
Kalman filter
10^3
10^2
10^1
10^0
−4
−2
0
2
4
Reco-truth/Reco_unc t0 [sigma]


L-S fit
Kalman filter
Reco-truth vx [cm/ns]


L-S fit
Kalman filter
Reco-truth/Reco_unc vx [sigma]


L-S fit
Kalman filter
Reco-truth vz [cm/ns]


L-S fit
Kalman filter
Reco-truth/Reco_unc vz [sigma]