Lost Muon Contamination 6

Quality Flags Applied (No Gain Correction)

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Aims?

“How do lost muons affect beam position measurements”

Lost muons do not pass the energy threshold for the calorimeter wiggle plots, but position measurements from the trackers will still be affected. How to quantify this?...

Find the difference in the means/widths of two sets of radial and vertical tracker only decay vertex histograms; one set without lost muons subtracted, and one with lost muons subtracted.

Questions to answer before this:

1) What is the relative efficiency of the calorimeter compared with the tracker for lost muons – this is needed to scale the lost muon population before subtraction.

Details!

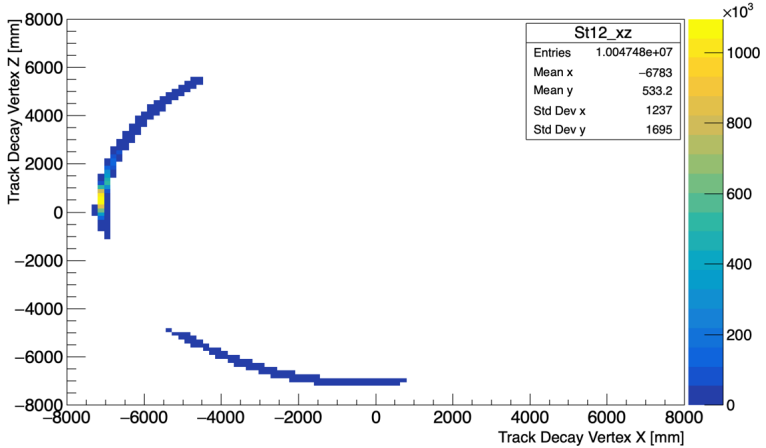
- Using Europa NTuples with available by: gm2/data/g2be/Production/Trees/v9_17_01/60hr/
- “Track quality = true”, “candidate quality = true” and “hit volume = false”
- Additional cuts for cluster matched tracks
  - Cluster track time difference between -8 and +3 ns for station 12, and between -9 and +1 ns for station 18
  - Radial difference, dR < 30 mm
- **Lost muon selection:**
  - **Momentum > 2300 MeV,**
  - **-3.2 < log(E/p) < -2.4 ***
- Magic Radius (7112 mm) is set to zero throughout!

*Consistent with lost muon selection used by Europa omega_a group (Feb 2019):

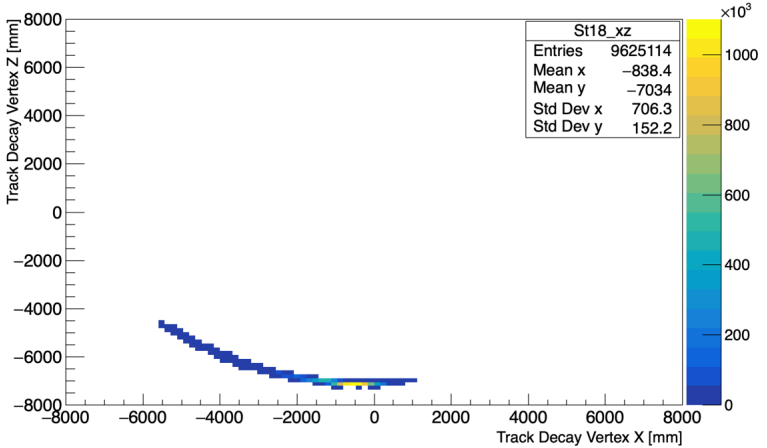
https://gm2-docdb.fnal.gov/cgi-bin/private/RetrieveFile?docid=16402&filename=Nota5_LostMuons.pdf&version=3

Bug in Europa NTuples?

Stn 12



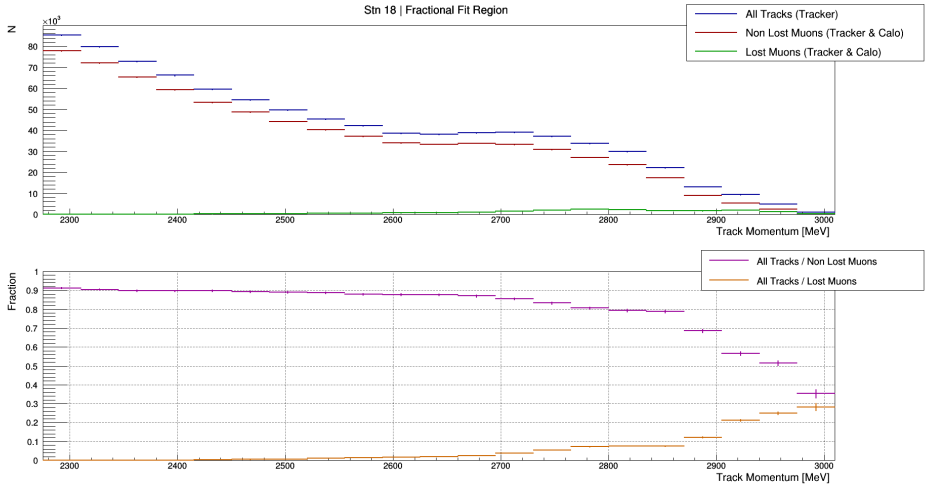
Stn 18

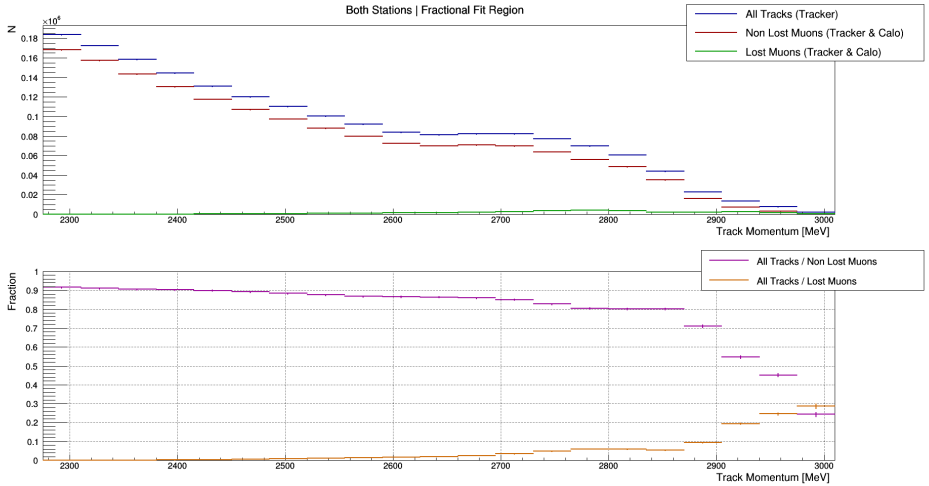


- For tracker only Ntuples, there is some mixing up of tracks with station 12.
- Temporary solution: do a combined analysis with both stations.
- (Also do a station 18 analysis)

Contents

Relative efficiency of the calorimeter and scale factor for lost muons





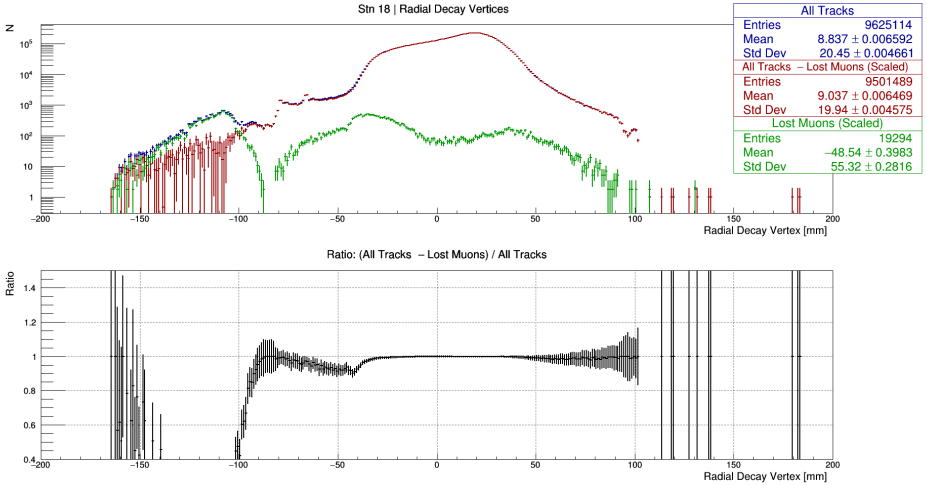
Station	Fraction	Efficiency	Scale Factor
18	0.0388±0.0008	58±1%	1.73±0.04
Combined	0.0383±0.0006	47.7±0.8%	2.10±0.04

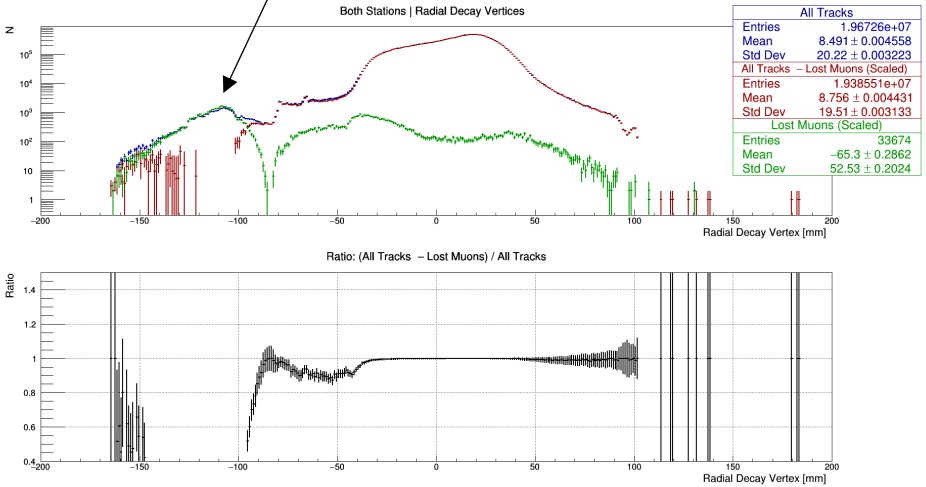
Table 1: Results from the fractional fit at high momentum (2300-3000 MeV) for lost muons.

Radial decay vertices of all tracks (tracker only) with lost muons and non lost muons subtracted

Showing the lost muon only distribution as well...

Overcorrection?





********** RESULT **********

St 18 dMean = 0.199761+/-0.00923631

St 18 dRMS = -0.510212+/-0.00653106

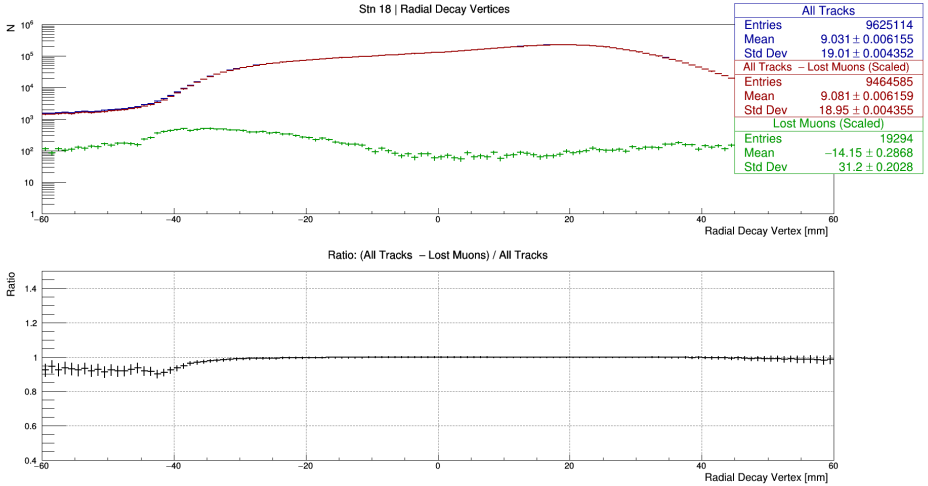
********** RESULT **********

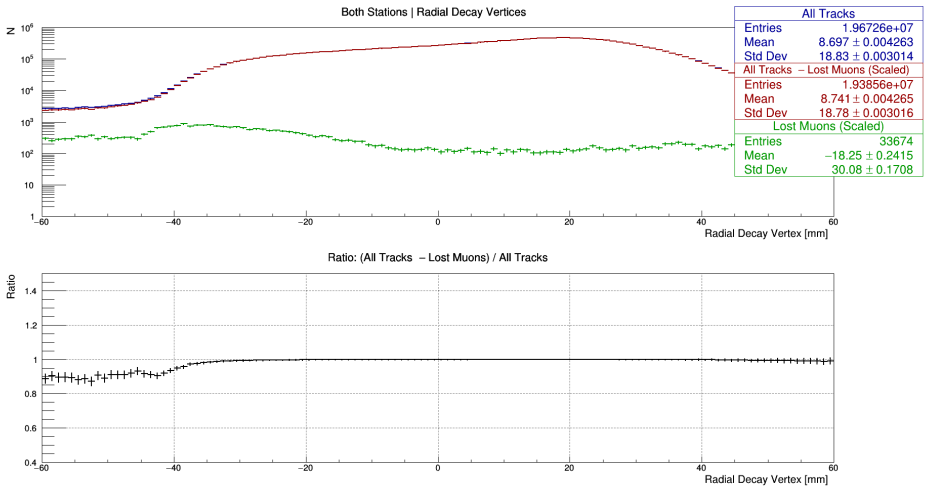
Combined dMean = 0.265951+/-0.00635663

Combined dRMS = -0.706982+/-0.00449481

Radial decay vertices of all tracks (tracker only) with lost muons and non lost muons subtracted

+/-60 mm





********** RESULT **********

St 18 dMean = 0.049911+/-0.00870726

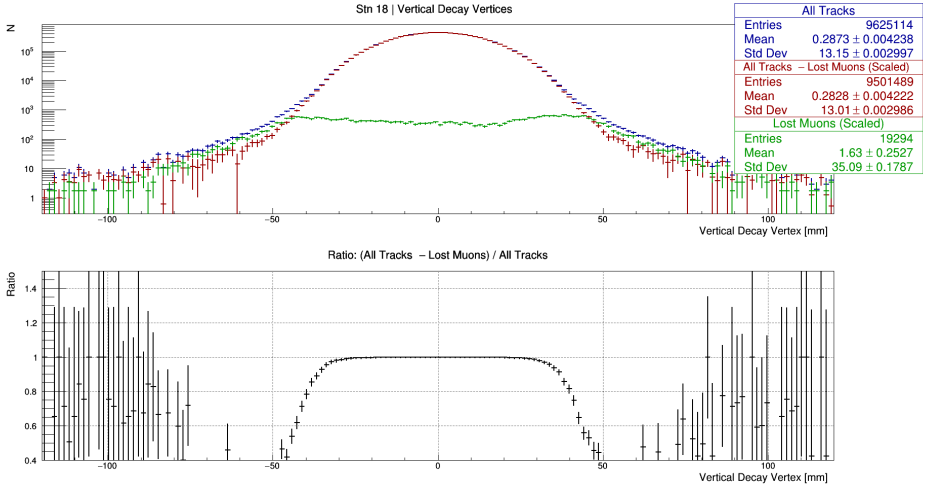
St 18 dRMS = -0.0630797+/-0.00615696

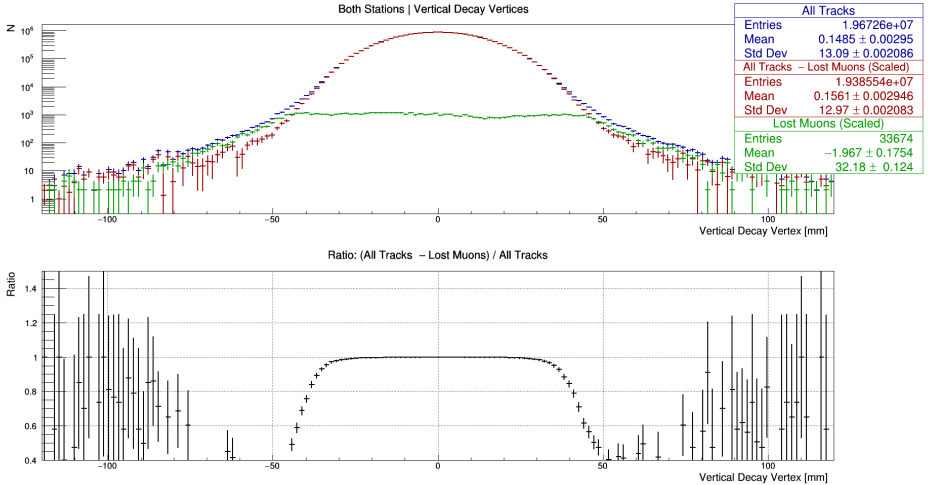
********** RESULT **********

Combined dMean = 0.0449787+/-0.00603013

Combined dRMS = -0.0545994+/-0.00426395

Vertical decay vertices of all tracks (tracker only) with lost muons and non lost muons subtracted





********** RESULT **********

St 18 dMean = -0.00456875+/-0.00598232

St 18 dRMS = -0.133843+/-0.00423014

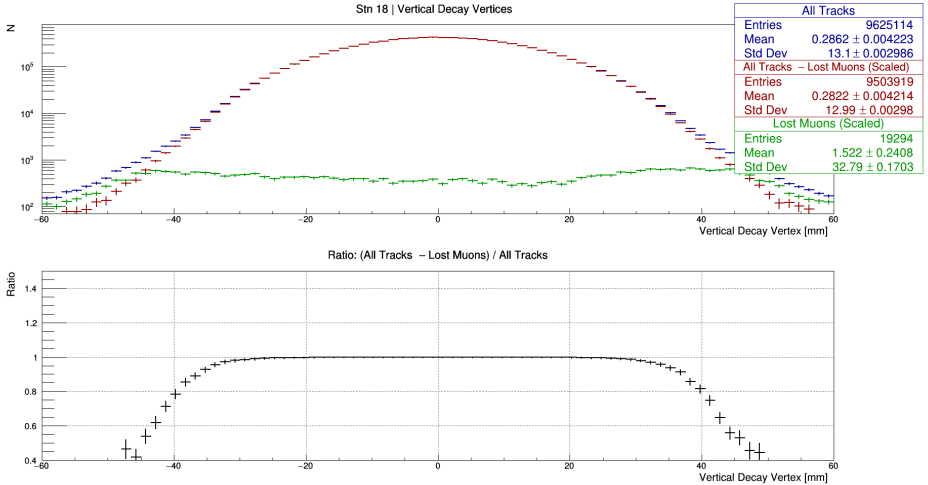
********** RESULT **********

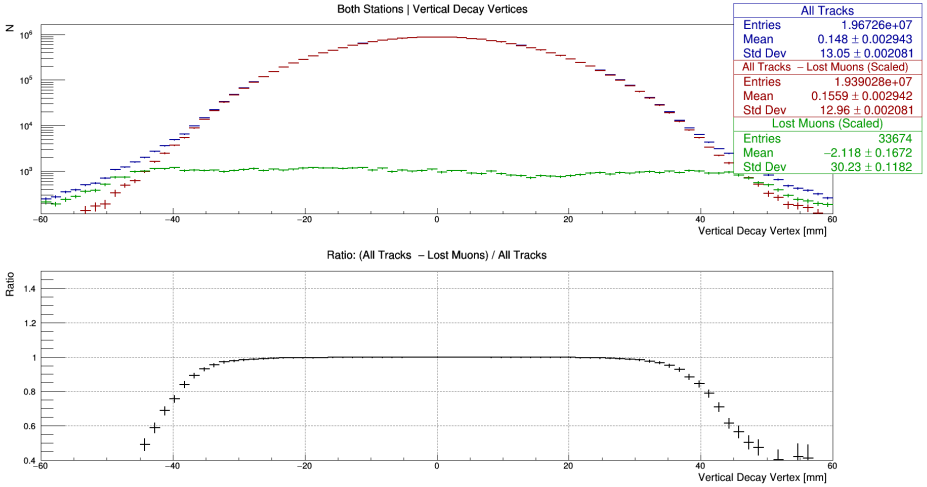
Combined dMean = 0.00765212+/-0.00416957

Combined dRMS = -0.113017+/-0.00294833

Vertical decay vertices of all tracks (tracker only) with lost muons and non lost muons subtracted

+/-60 mm





********** RESULT **********

St 18 dMean = -0.00403079+/-0.00596568

St 18 dRMS = -0.108883+/-0.00421838

********** RESULT **********

Combined dMean = 0.00796125+/-0.00416132

Combined dRMS = -0.0935658+/-0.0029425

Results, presented nicely

	Station 18	Combined
Δ Radial Mean [mm]	0.200 ± 0.009	0.266 ± 0.006
Δ Radial Width [mm]	-0.510 ± 0.007	-0.707 ± 0.004
Δ Vertical Mean [mm]	-0.005 ± 0.005	0.008 ± 0.004
Δ Vertical Width [mm]	-0.134 ± 0.004	-0.113 ± 0.003

Table 2: Shifts in means and widths due to lost muons.

	Station 18	Combined
Δ Radial Mean [mm]	0.050 ± 0.009	0.045 ± 0.006
Δ Radial Width [mm]	-0.063 ± 0.006	-0.055 ± 0.004
Δ Vertical Mean [mm]	-0.004 ± 0.006	0.008 ± 0.004
Δ Vertical Width [mm]	-0.109 ± 0.004	-0.094 ± 0.003

Table 3: Shifts in means and widths due to lost muons, ± 60 mm range.