Beam Selection Testing

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Overview

- After Chris Hunt's departure to CERN, started testing the beam selection routines he implemented
- Attempted to select samples that have matched optics in the upstream tracker
- Used NO ABSORBER 3, 4, 6, 10 mm, 140 MeV/c, flip mode data

Beam Selection (slide adapted from Chris Hunt)

- The magnet issue led to an improperly matched beam into the downstream of the cooling channel, limiting the transmission
- Initial matching into the upstream tracker was determined by beamline design
- Selecting the correct initial beam parameters should allow us recover the cooling performance
- Procedure:
  1. Generate some data
  2. Find a function that describes the data (the parent)
  3. Find a function that describes the required distribution (the daughter)
  4. Randomly select events based on the ratio of probabilities between the parent and the daughter

For a given event x,

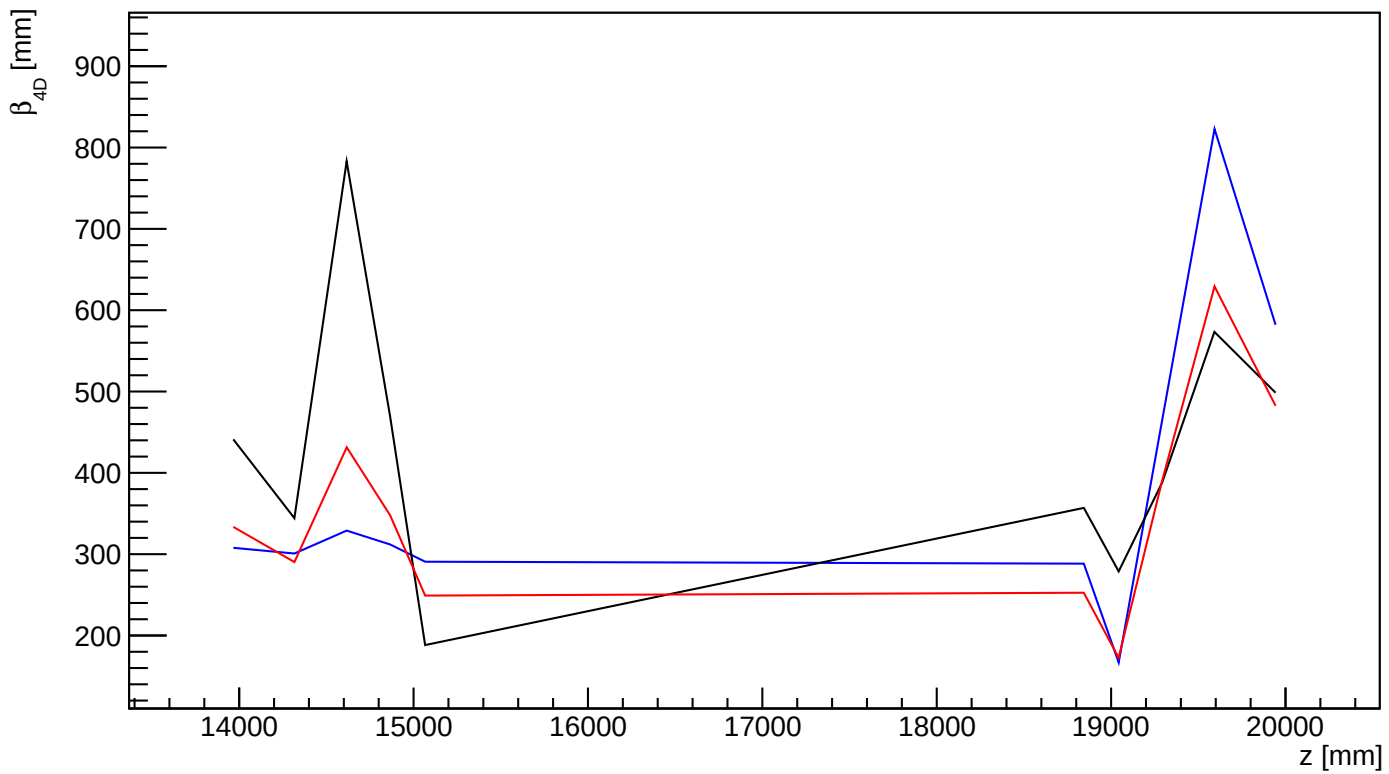
$$\text{Prob. of Selection} = \frac{Daughter(x)}{Parent(x)} \text{ x Some Normalisation}$$

Cuts

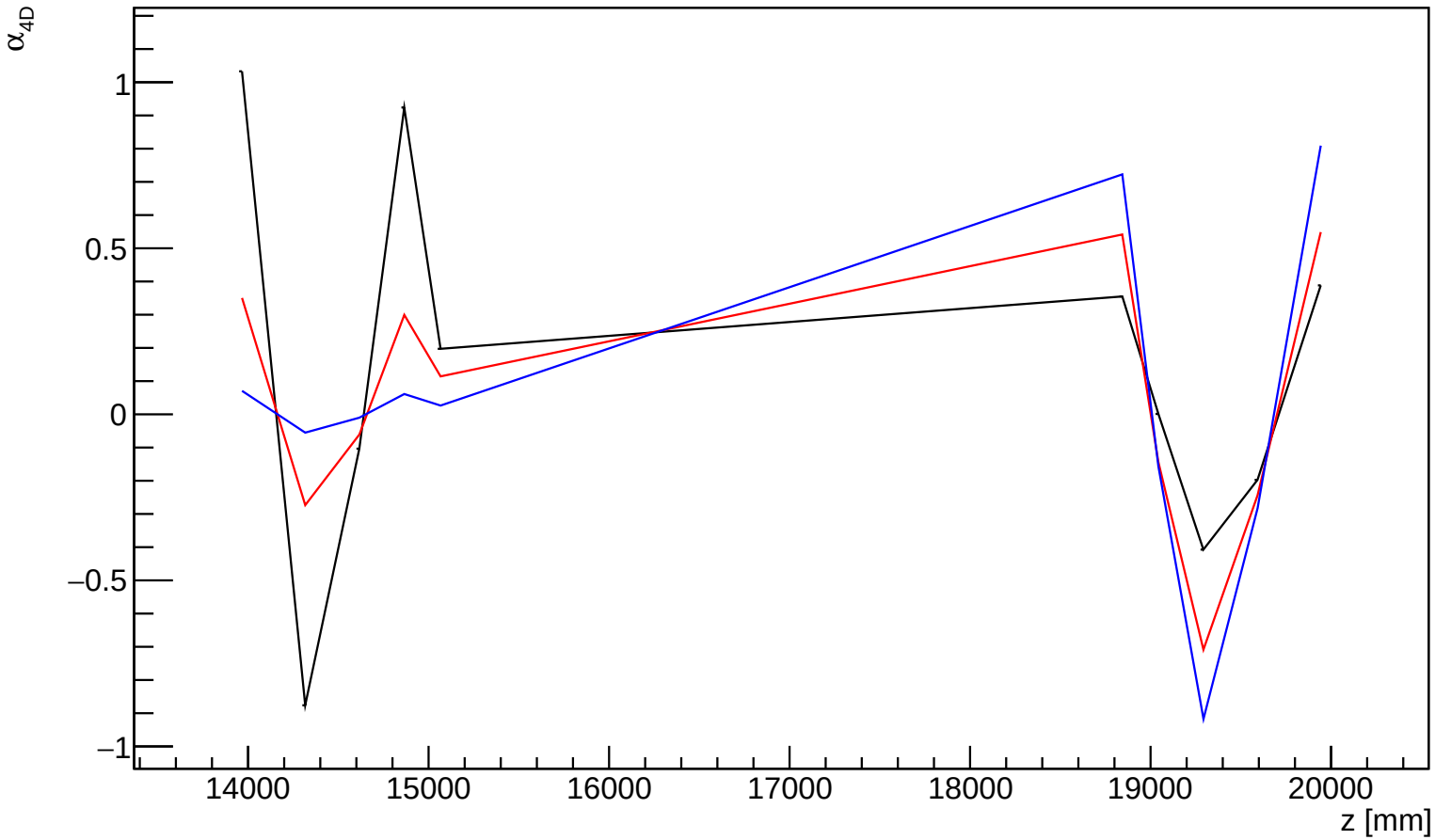
- 1 SP in both TOF0 and TOF1
- TOF01 consistent with muon peak
- TKU: 135 MeV/c $<$ total momentum $<$ 145 MeV/c
- χ^2/ndf $<$ 8 TKU
- Diffuser radius cut: r $<$ 90 mm

3 mm: β_{4D}

- Selection parameters: $\alpha = 0.0$, $\beta = 310.0mm$, $\epsilon = 3.0mm$, $L = 1.1$
- Black - initial sample, T = 98.4%
- Red - selected subsample from the 3 mm data, T = 98.8%
- Blue - selected subsample from the 3 mm and 4 mm data, T = 98.9%



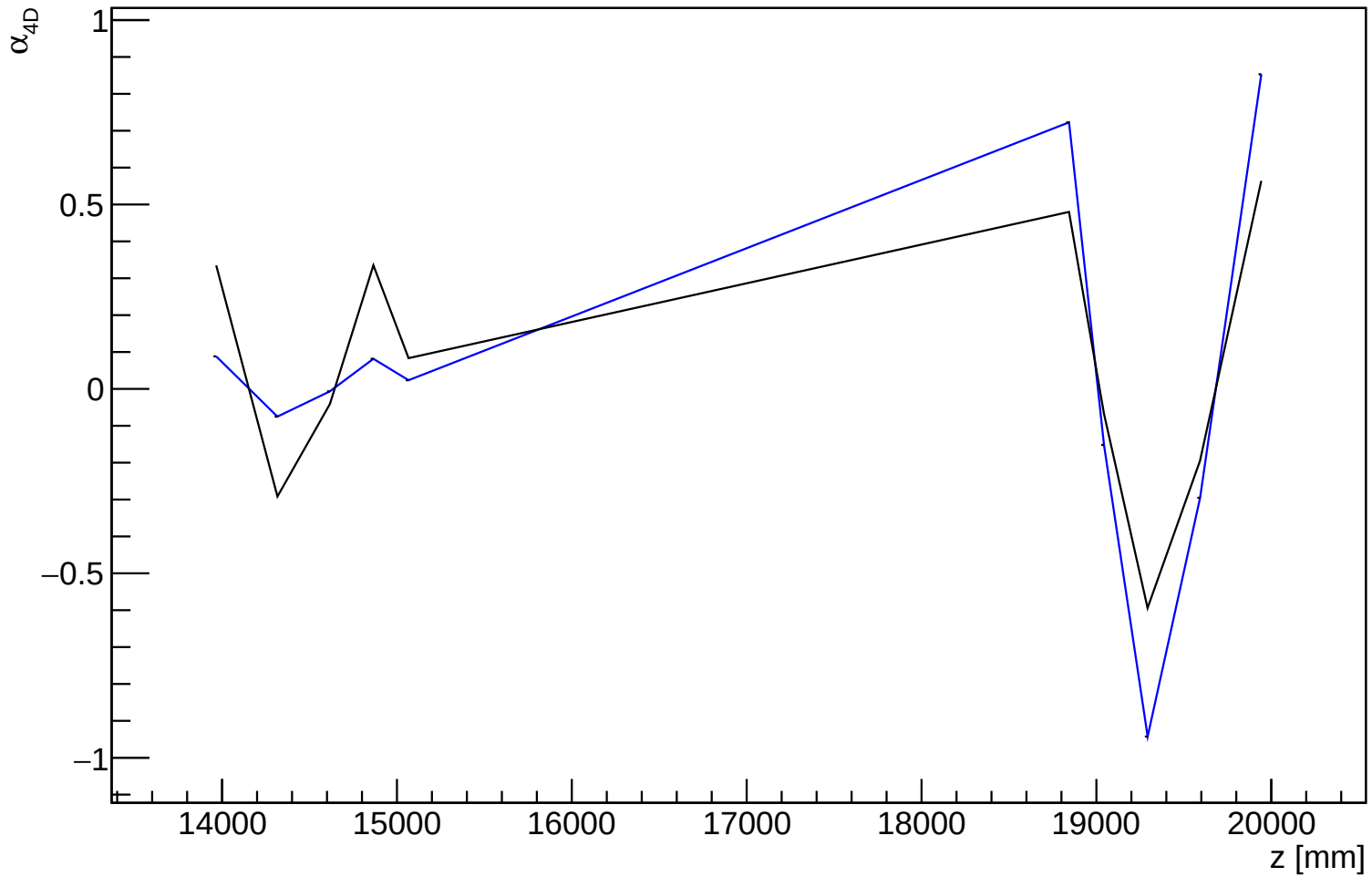
3 mm: α_{4D}


α_{4D}
1
0.5
0
−0.5
−1
14000
15000
16000
17000
18000
19000
20000
z [mm]

4 mm: β_{4D}

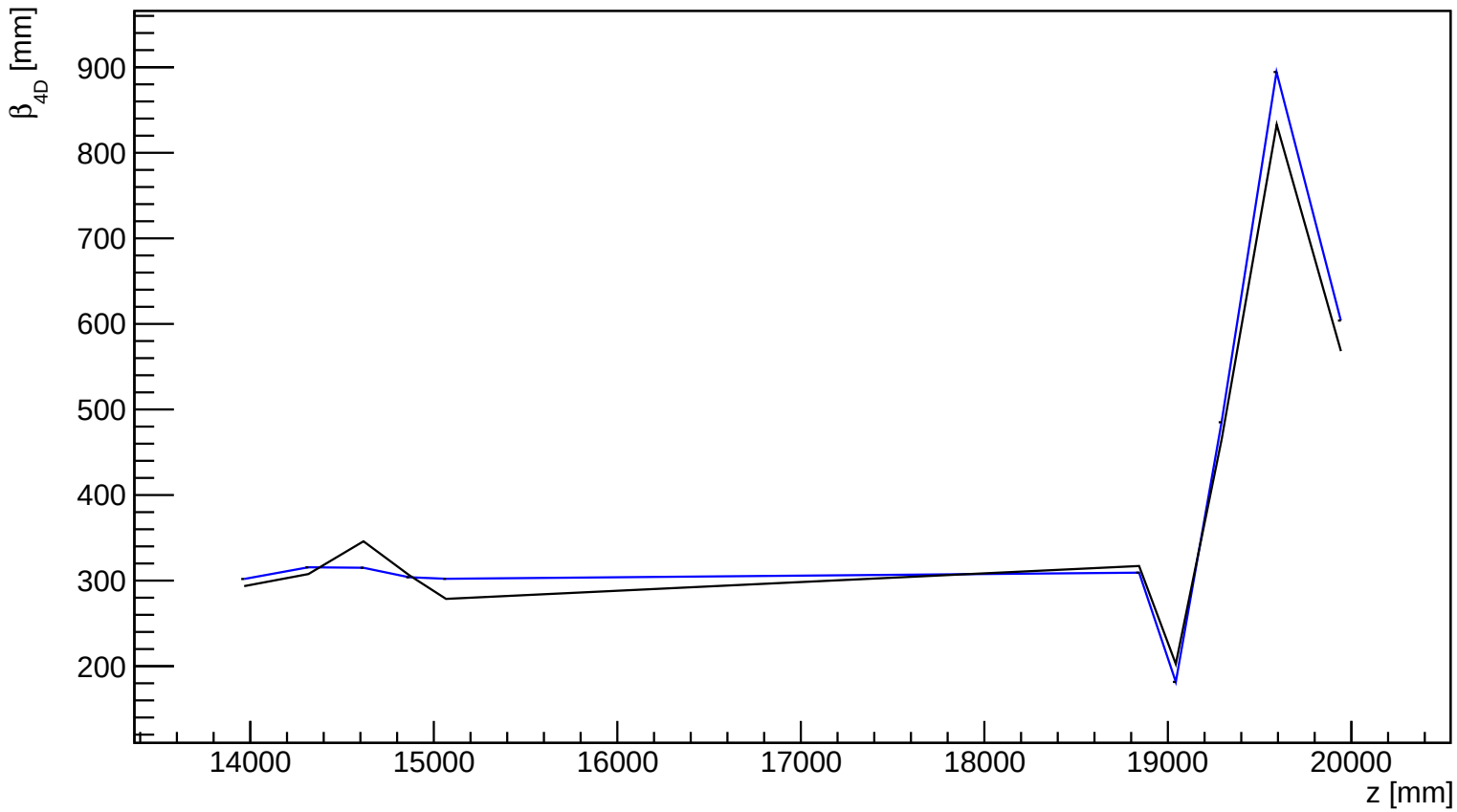
- Selection parameters: $\alpha = 0.0$, $\beta = 310.0mm$, $\epsilon = 4.0mm$, $L = 1.1$
- Black - initial sample, T = 97.4%
- Blue - selected subsample, T = 98.9%

4 mm: α_{4D}

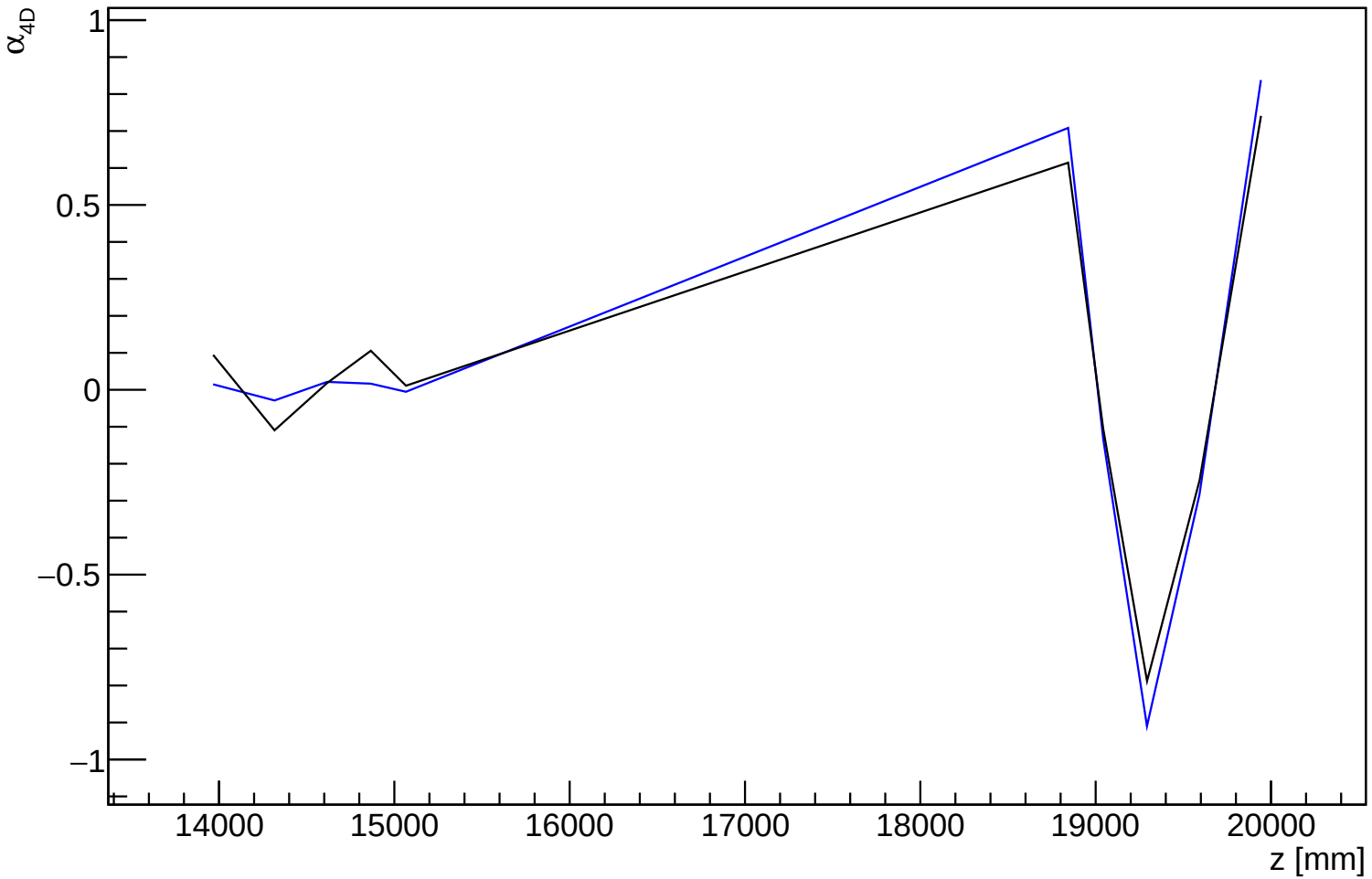


6 mm: β_{4D}

- Selection parameters: $\alpha = 0.0$, $\beta = 310.0mm$, $\epsilon = 6.0mm$, $L = 1.1$
- Black - initial sample, T = 94.3%
- Blue - selected subsample, T = 96.5%

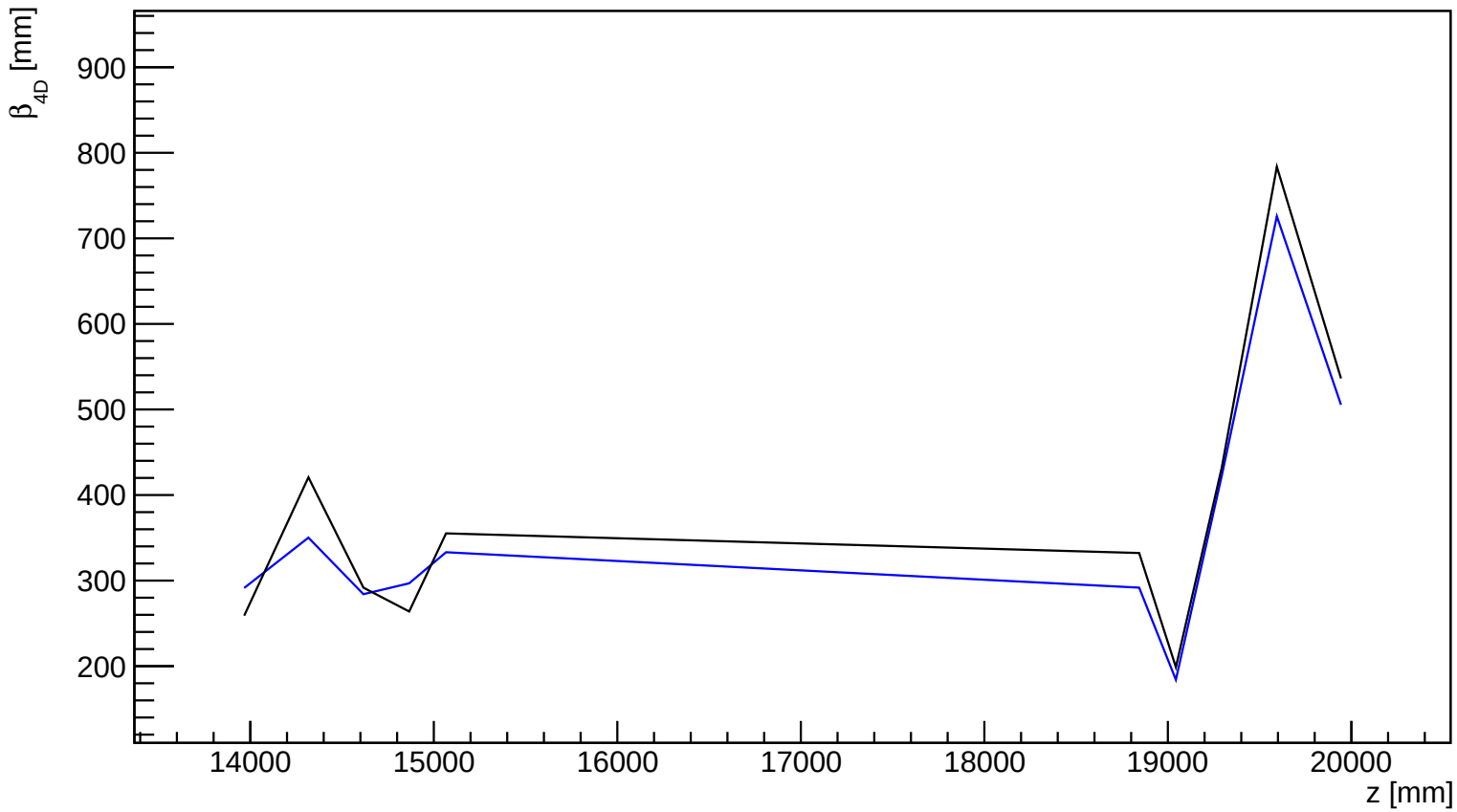


6 mm: α_{4D}

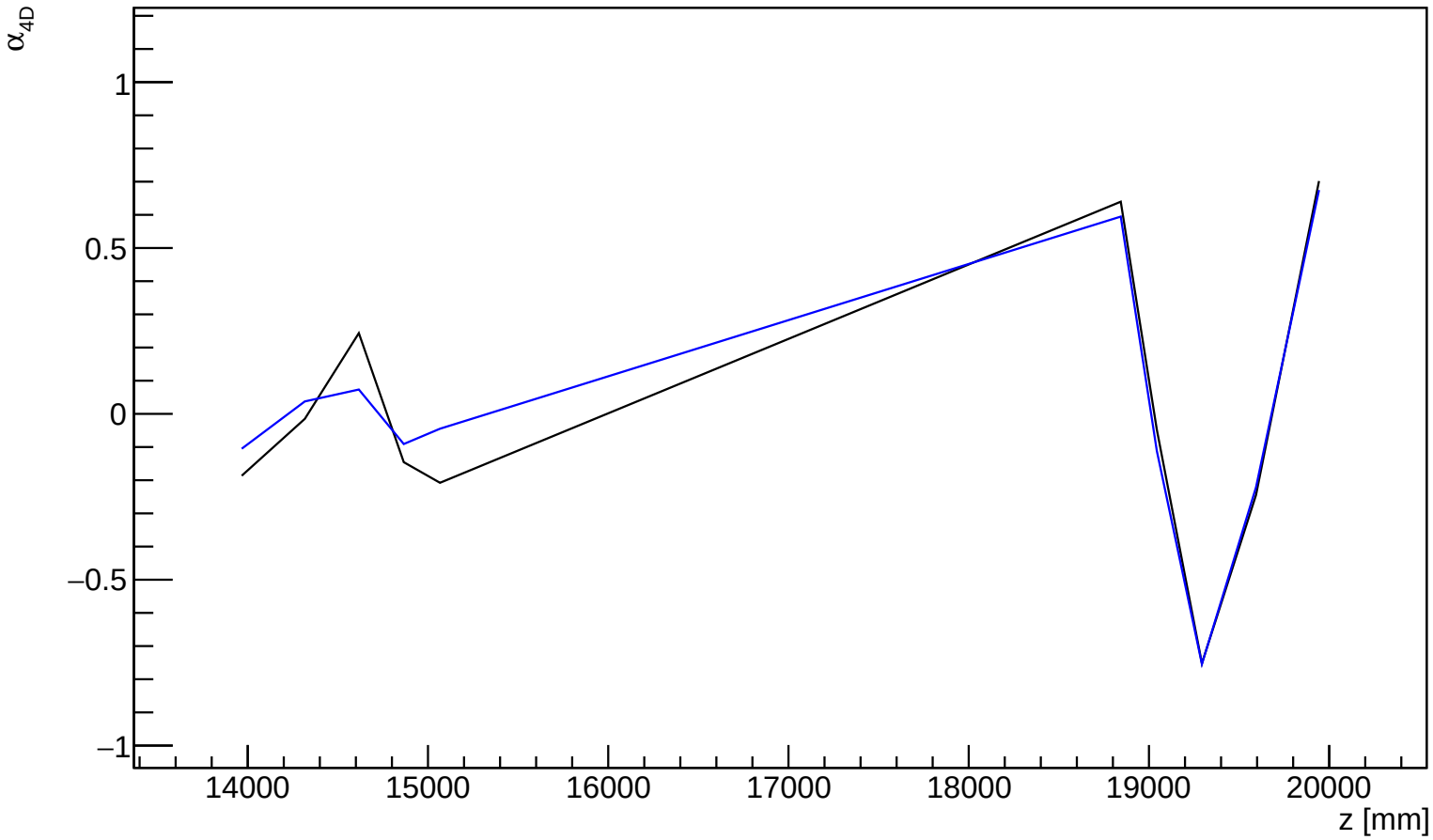


10 mm: β_{4D}

- Selection parameters: $\alpha = 0.0$, $\beta = 310.0mm$, $\epsilon = 9.0mm$, $L = 1.1$
- Black - initial sample, T = 75.8%
- Blue - selected subsample, T = 87.2%



10 mm: α_{4D}



Summary

- Beam selection routine improves the beam matching into the cooling channel
- Next steps:
  - Need to apply more cuts: 'banana' plot cut, TKD χ^2/ndf, TKD momentum cut, fiducial cuts
  - Apply selection routine to absorber data