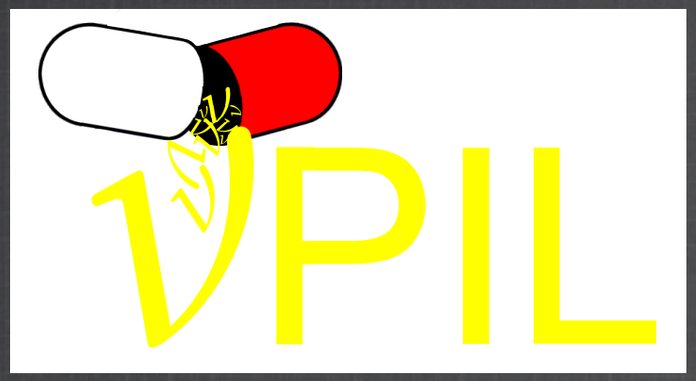


FFAG update

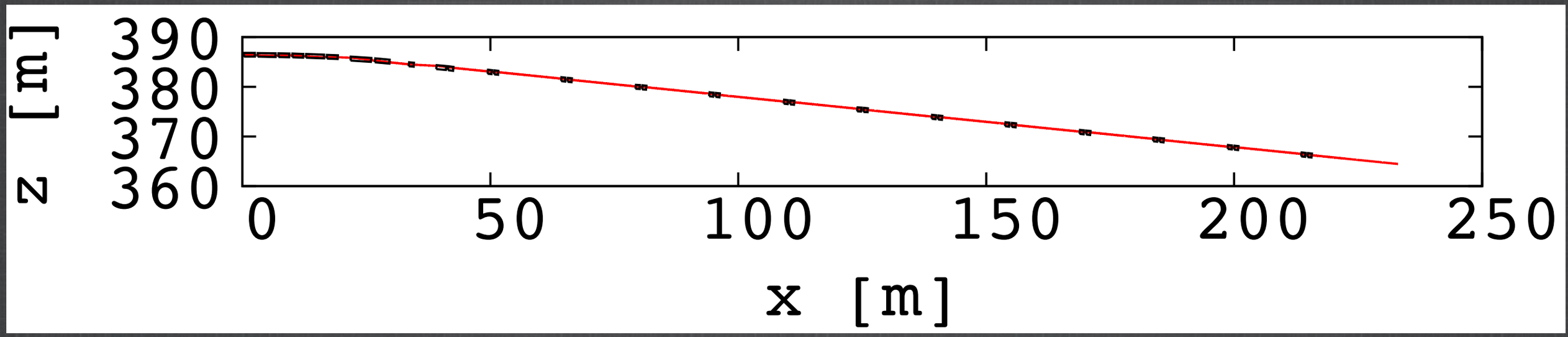
JB. Lagrange

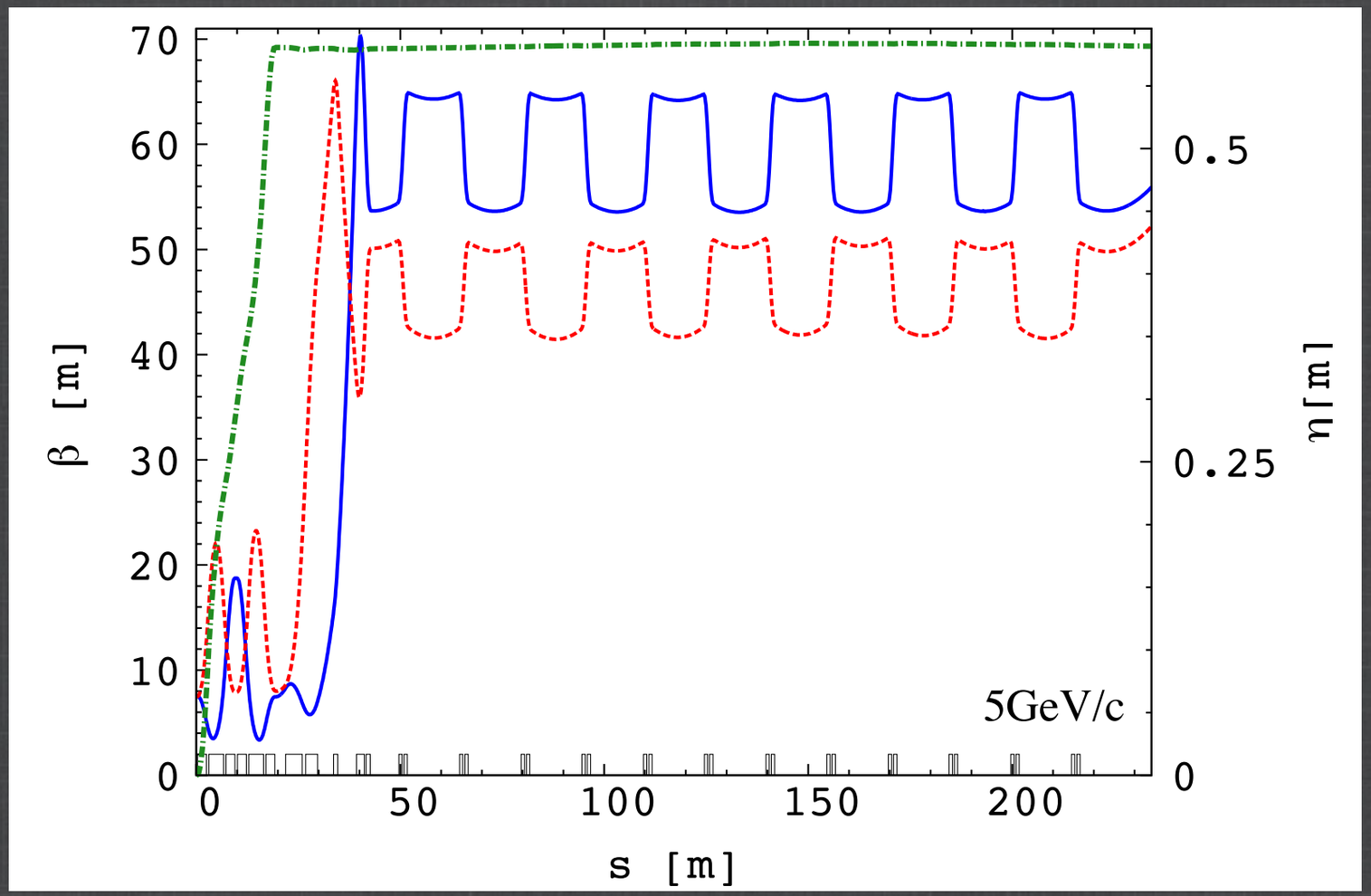
Imperial College, UK
FNAL, USA

Outline

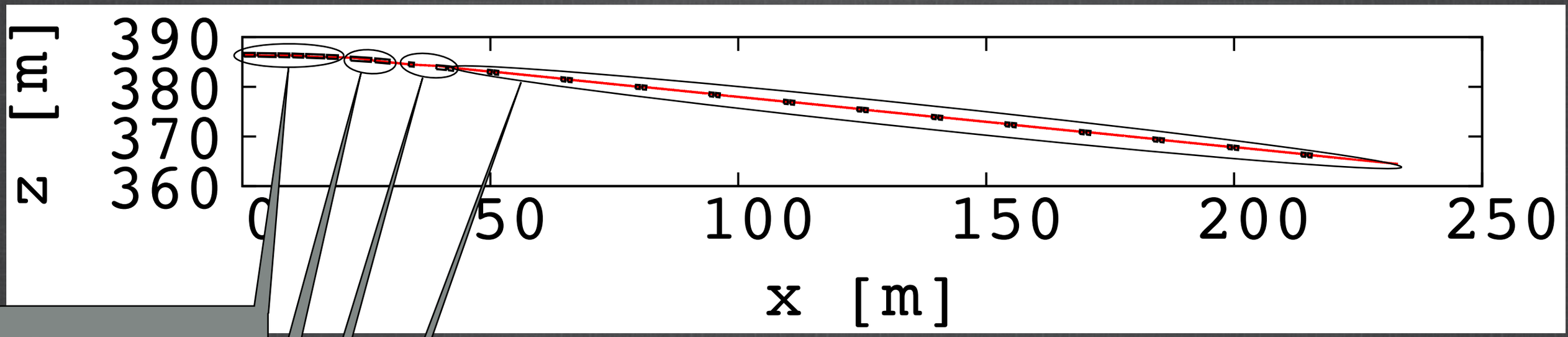
- nuPIL lattice
- Performances
- Collimators
- Dispersion suppressor
- Wrong sign collection
- Optimization

nuPIL lattice

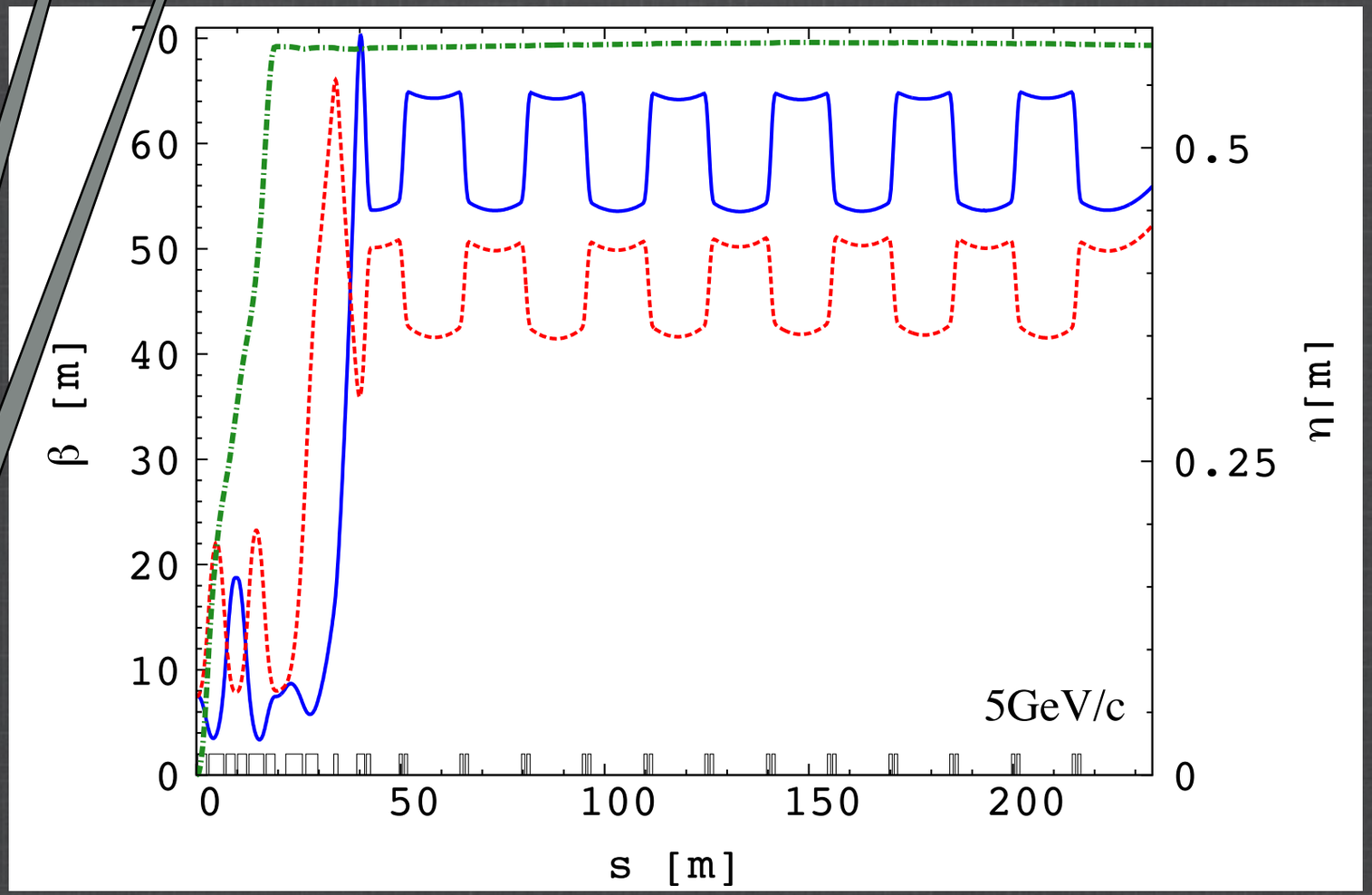




nuPIL lattice



- Dispersion creator
- Bending part
- Straight matching
- Straight part



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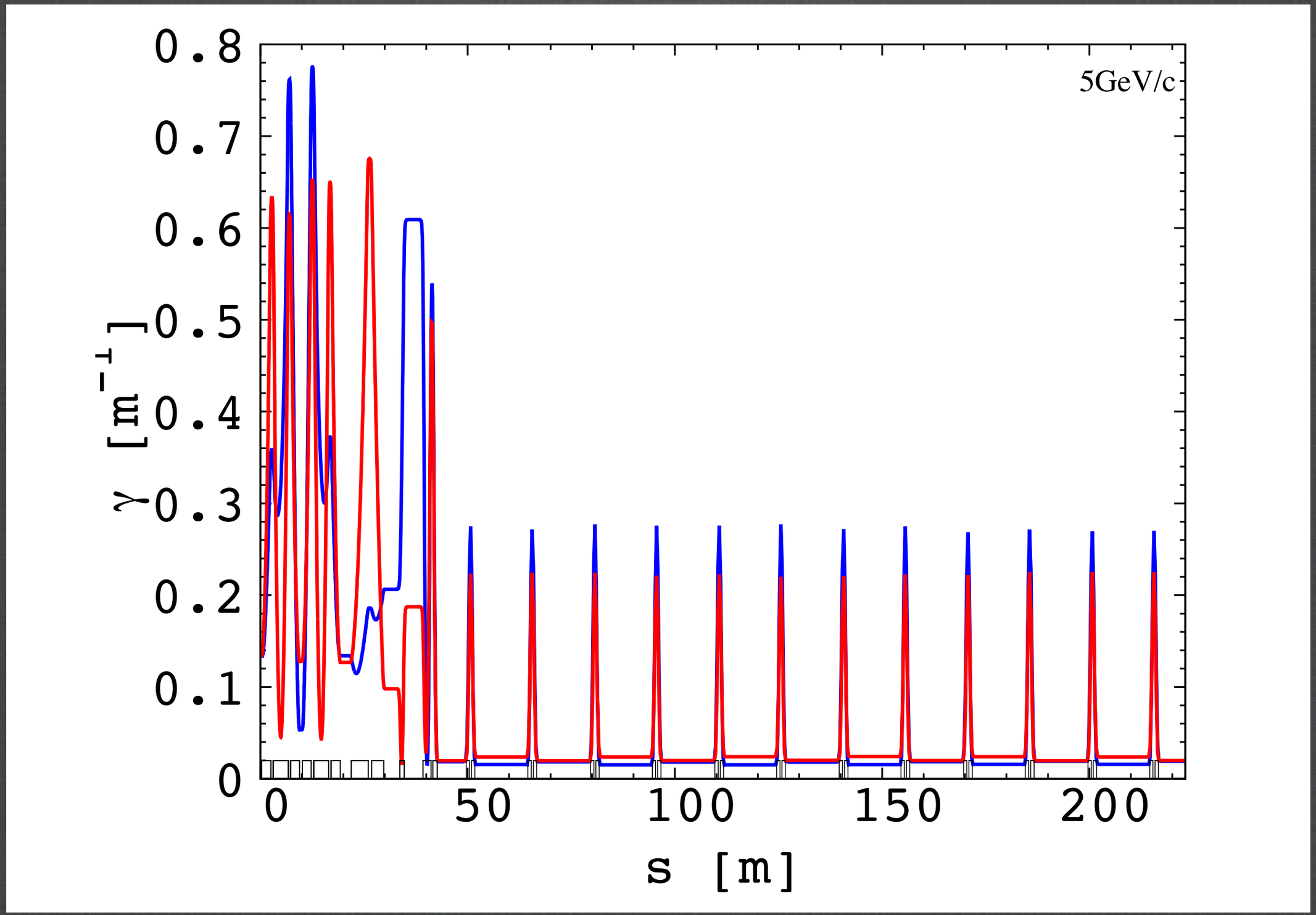
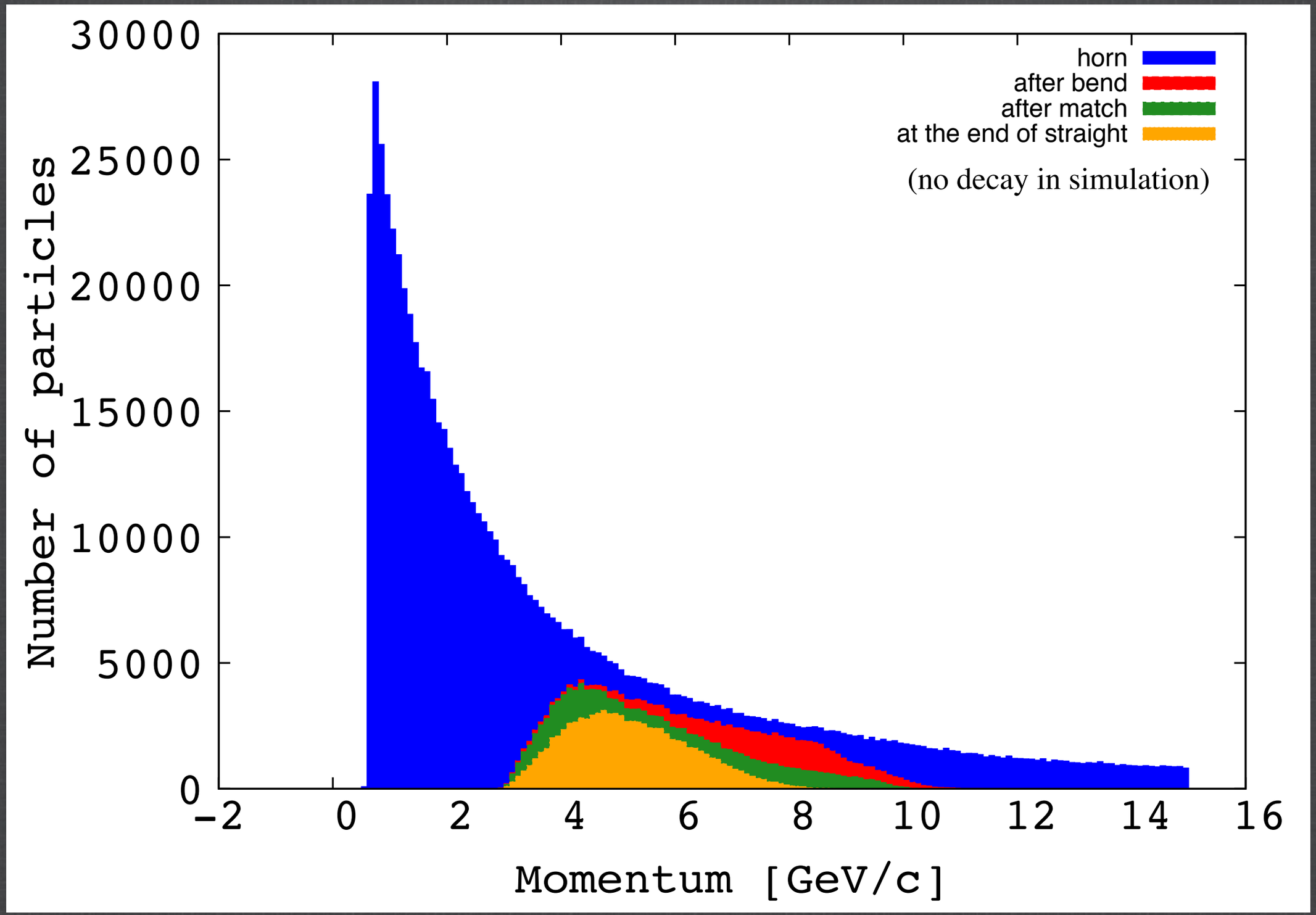
nuPIL lattice



nuPIL lattice



Outline

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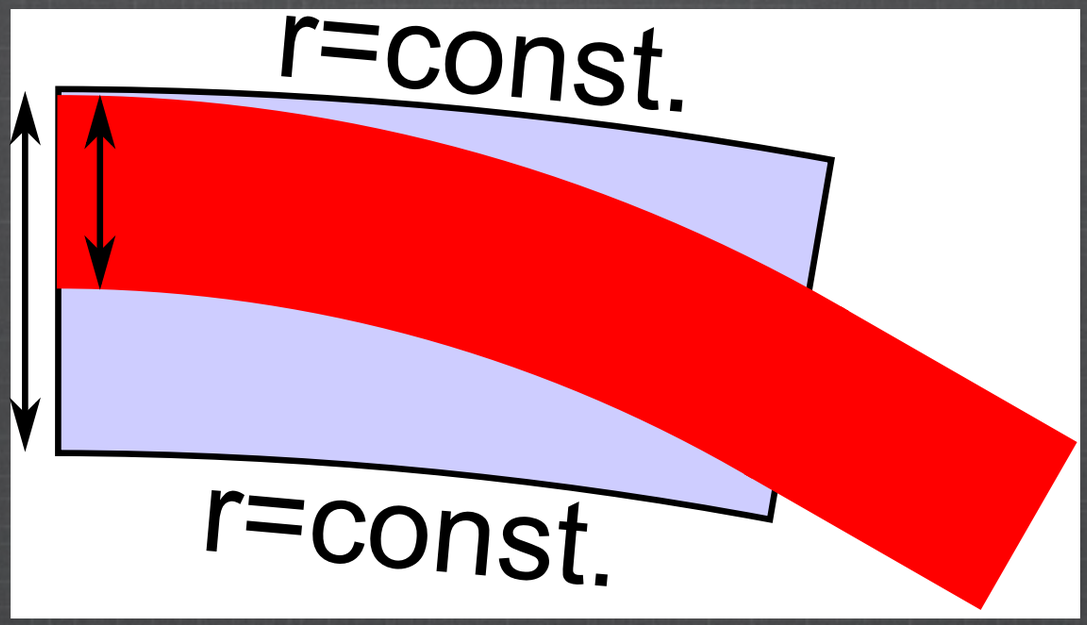
Collimators

	Excursion	Intrinsic accepted momentum (collimators)
Dispersion creator	F: 75 cm D: 62 cm	3 GeV/c to 9.95 GeV/c
Bending part	F: 80 cm D: 80 cm	3 GeV/c to 9 GeV/c
Straight matching	F: 80 cm D: 80 cm	2.8 GeV/c to 8.1 GeV/c
Straight cell	F: 80 cm D: 80 cm	2.5 GeV/c to 9.9 GeV/c

Collimators



In the simulation, the collimators are done with constant radius / abscissa

⇨ excursion much larger than beam

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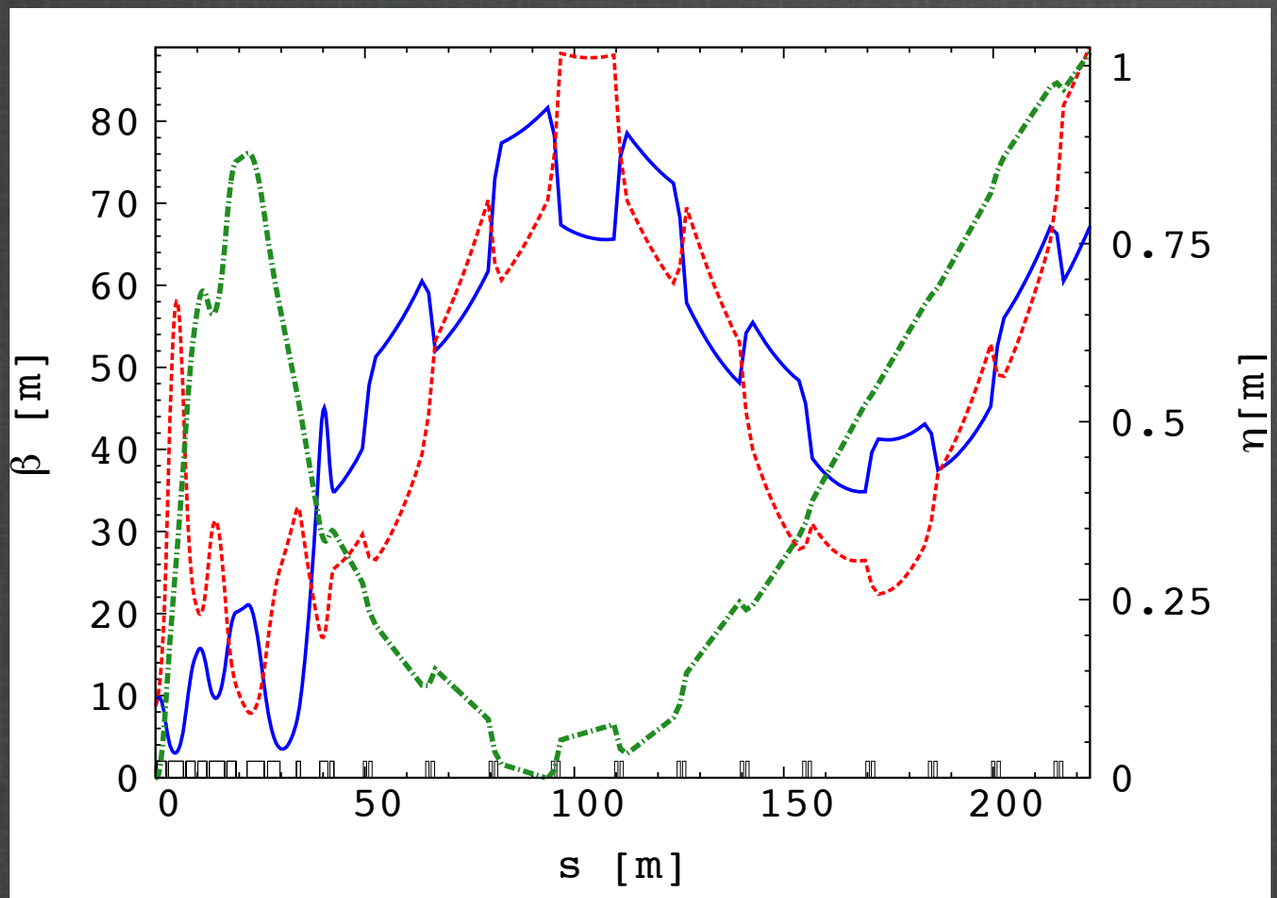
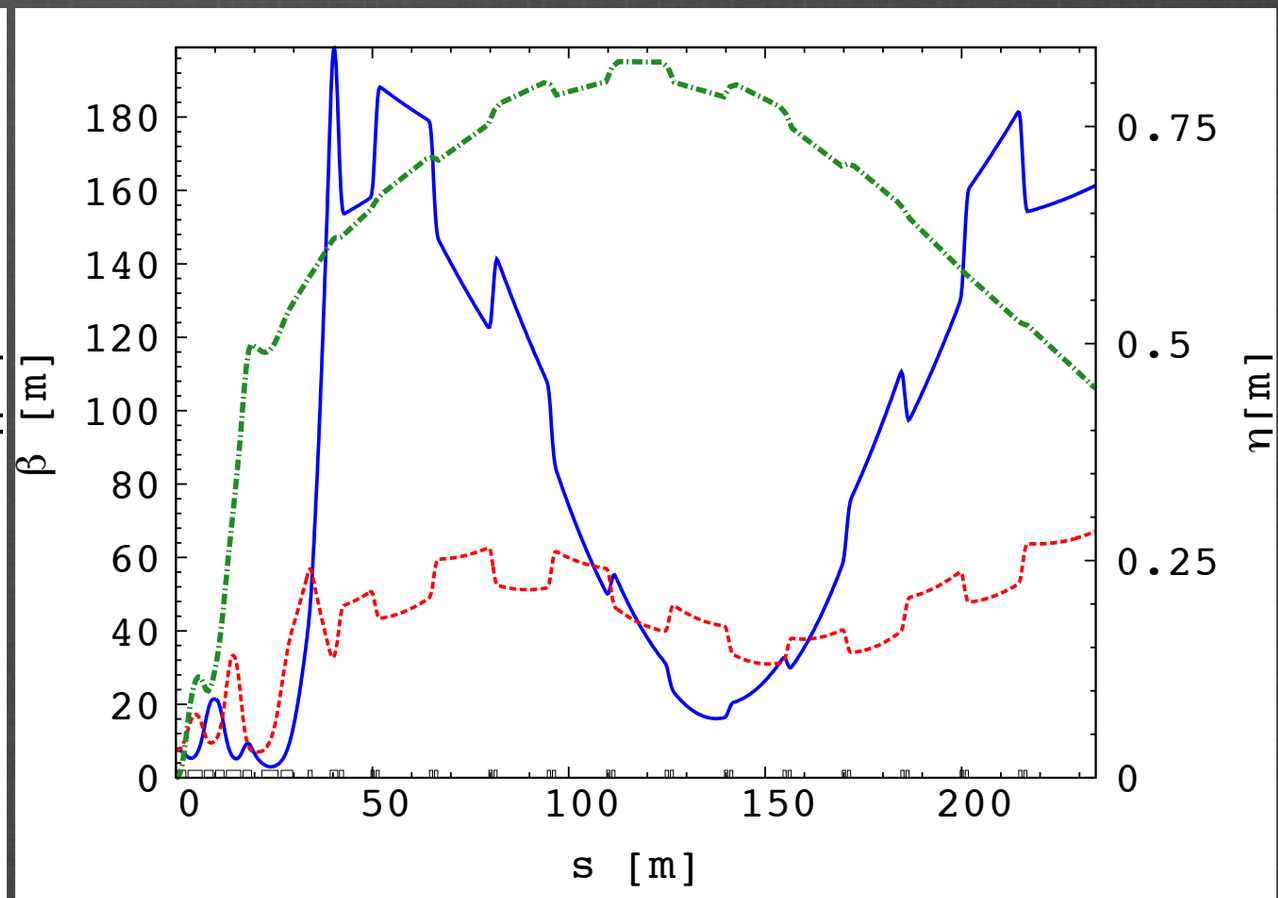
nuPIL lattice



3 GeV/c



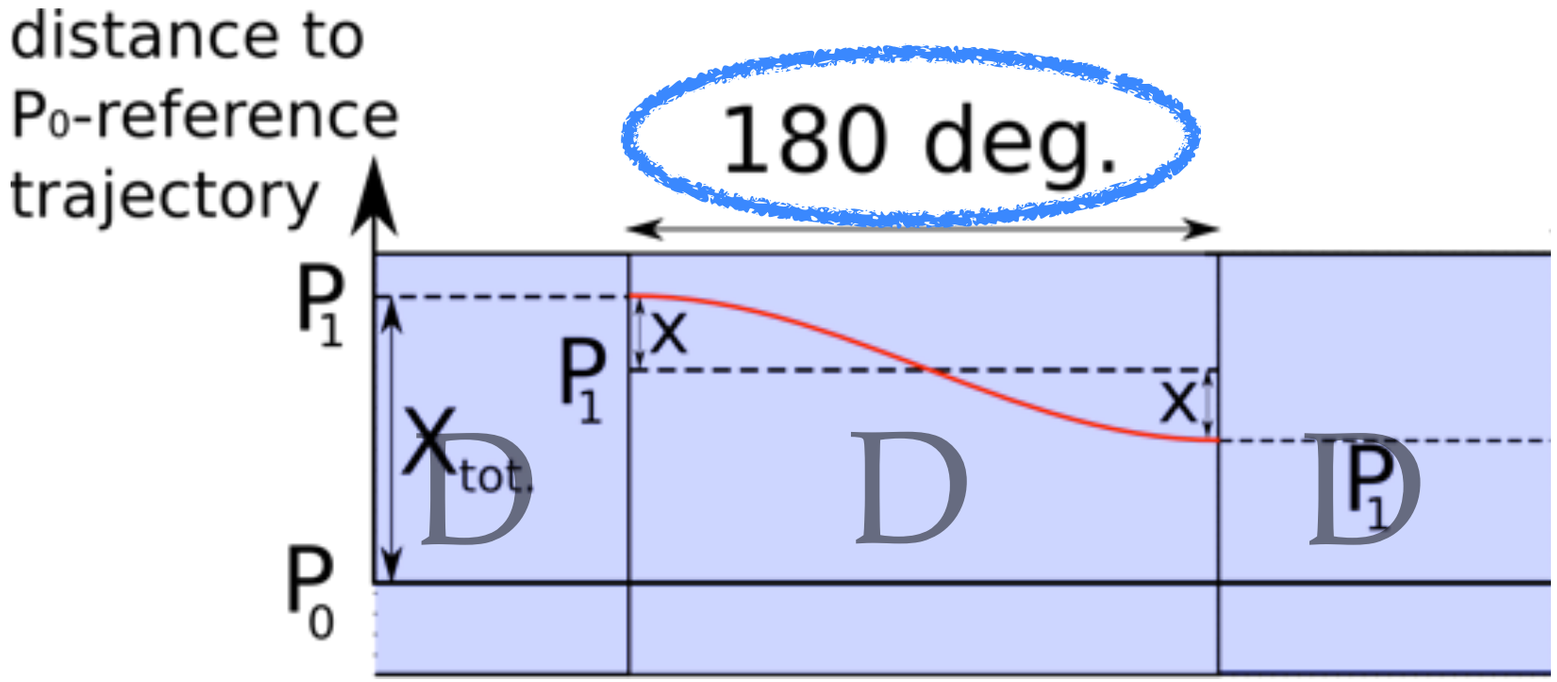
8 GeV/c

Dispersion suppressor principle

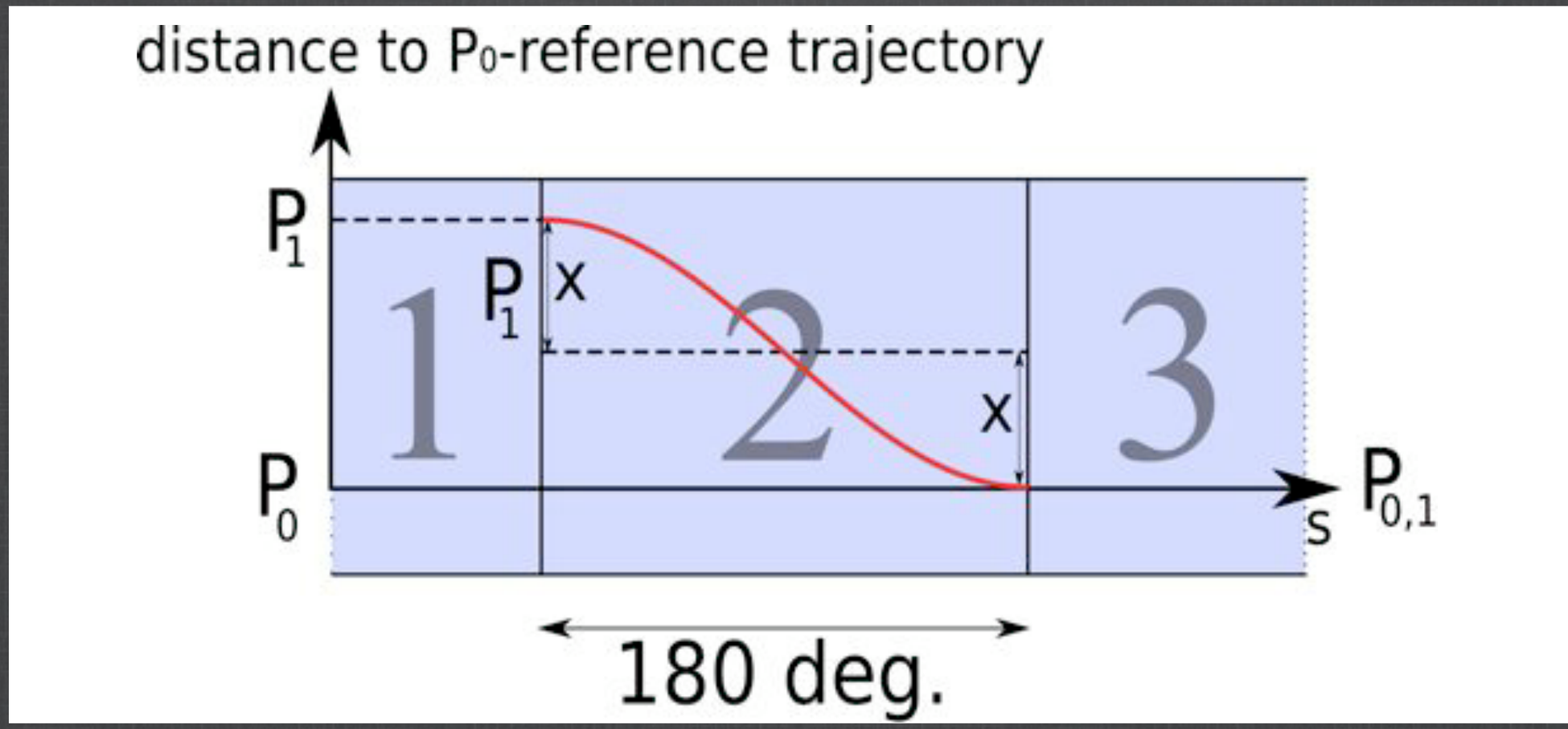
Use of 3 different scaling FFAG cells

a) Matching of a special momentum P_0.

b) Matching of cell dispersions such as $D_2 = \frac{D_1 + D_3}{2}$ (linear approximation)



Dispersion suppressor principle

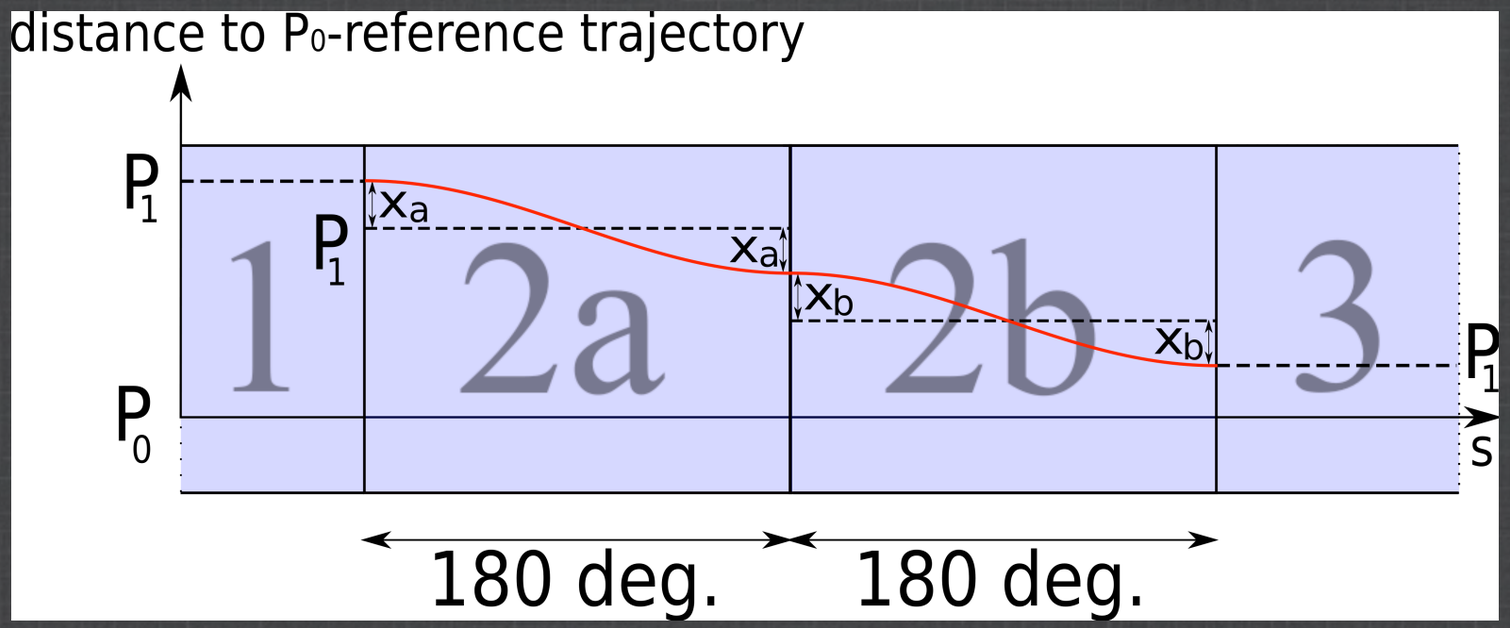


Dispersion suppressor principle

Zero-chromatic system as long as amplitude detuning can be neglected.

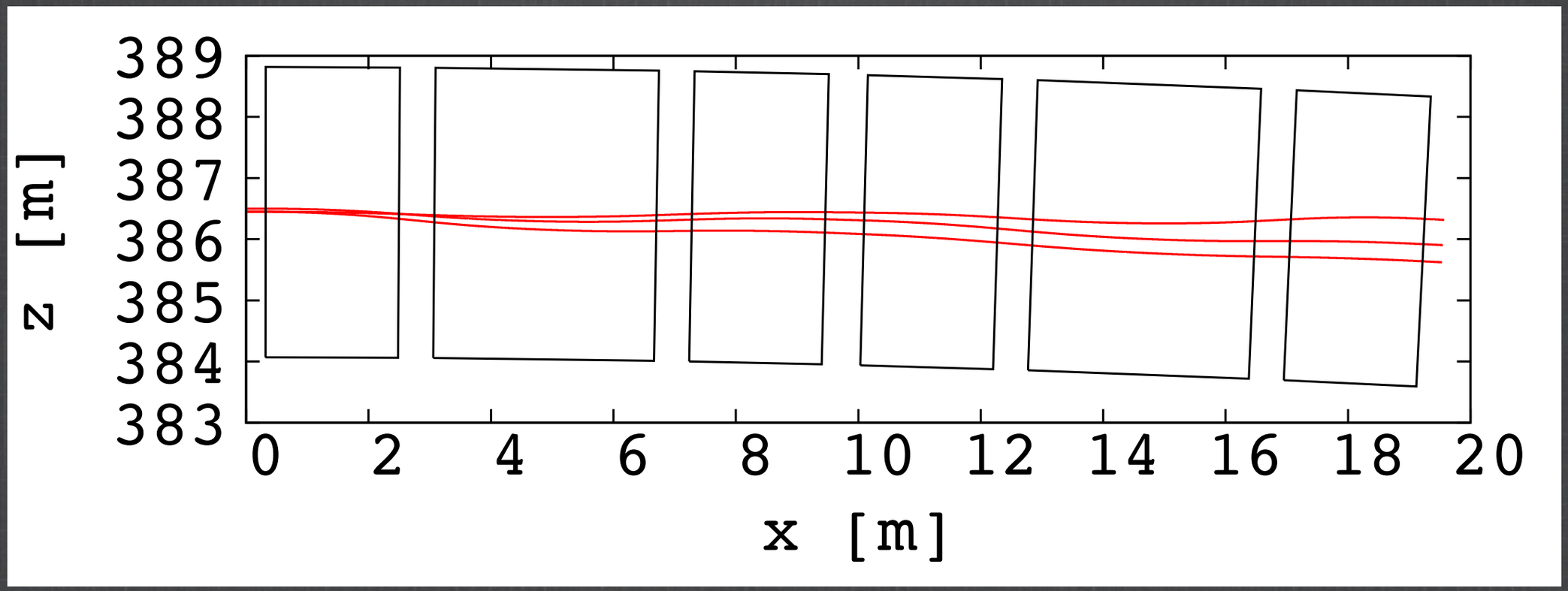
→ several dispersion suppressors in cascade if the difference of dispersion is too large

$$D_{ini} + (-1)^{n+1} D_{fin} = 2 \sum_{i=1}^{n} (-1)^{i+1} D_i$$



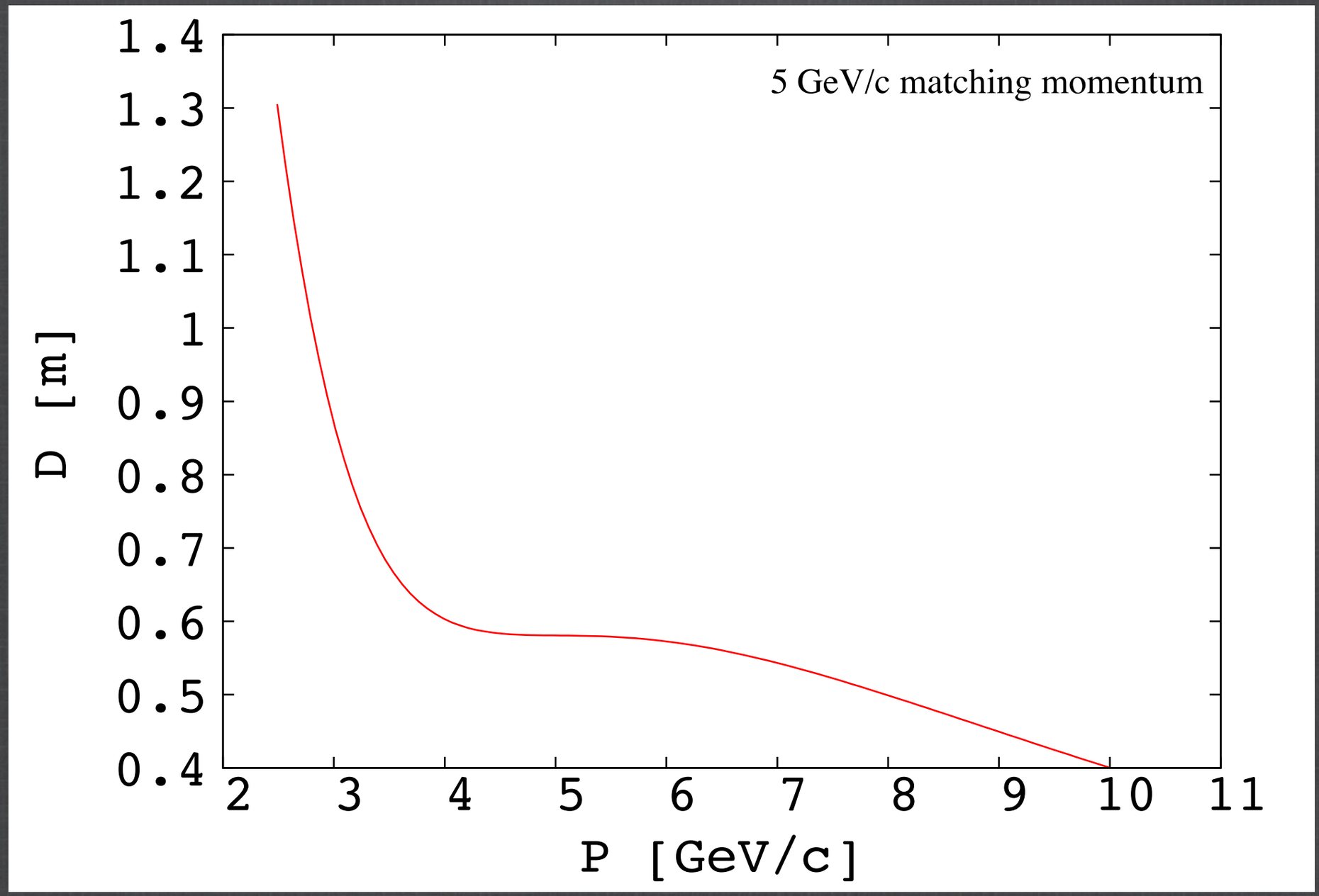
nuPIL dispersion creator

(Far collimators)



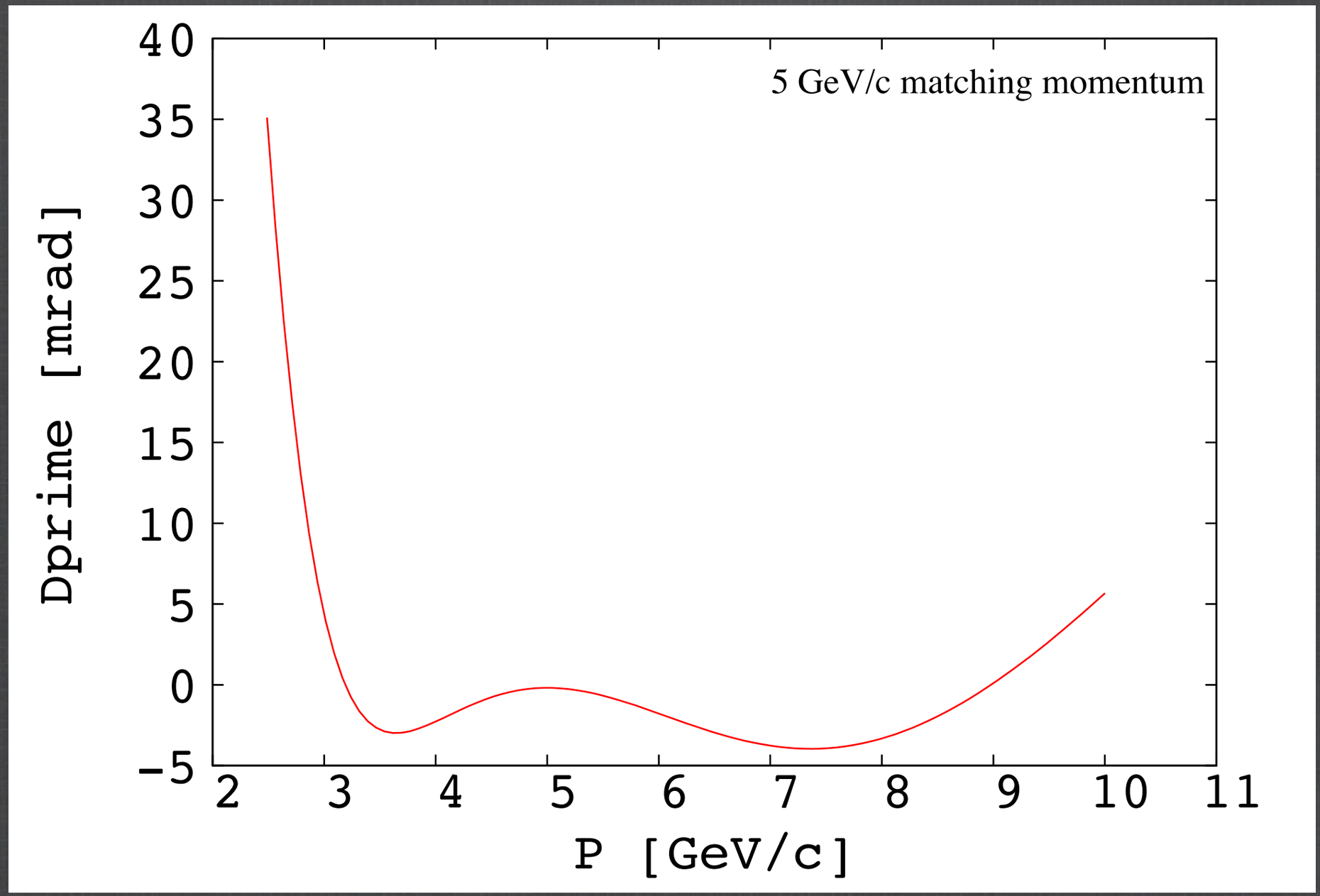
Trajectories of 3 GeV/c, 5 GeV/c (matching momentum) and 10 GeV/c

nuPIL dispersion creator



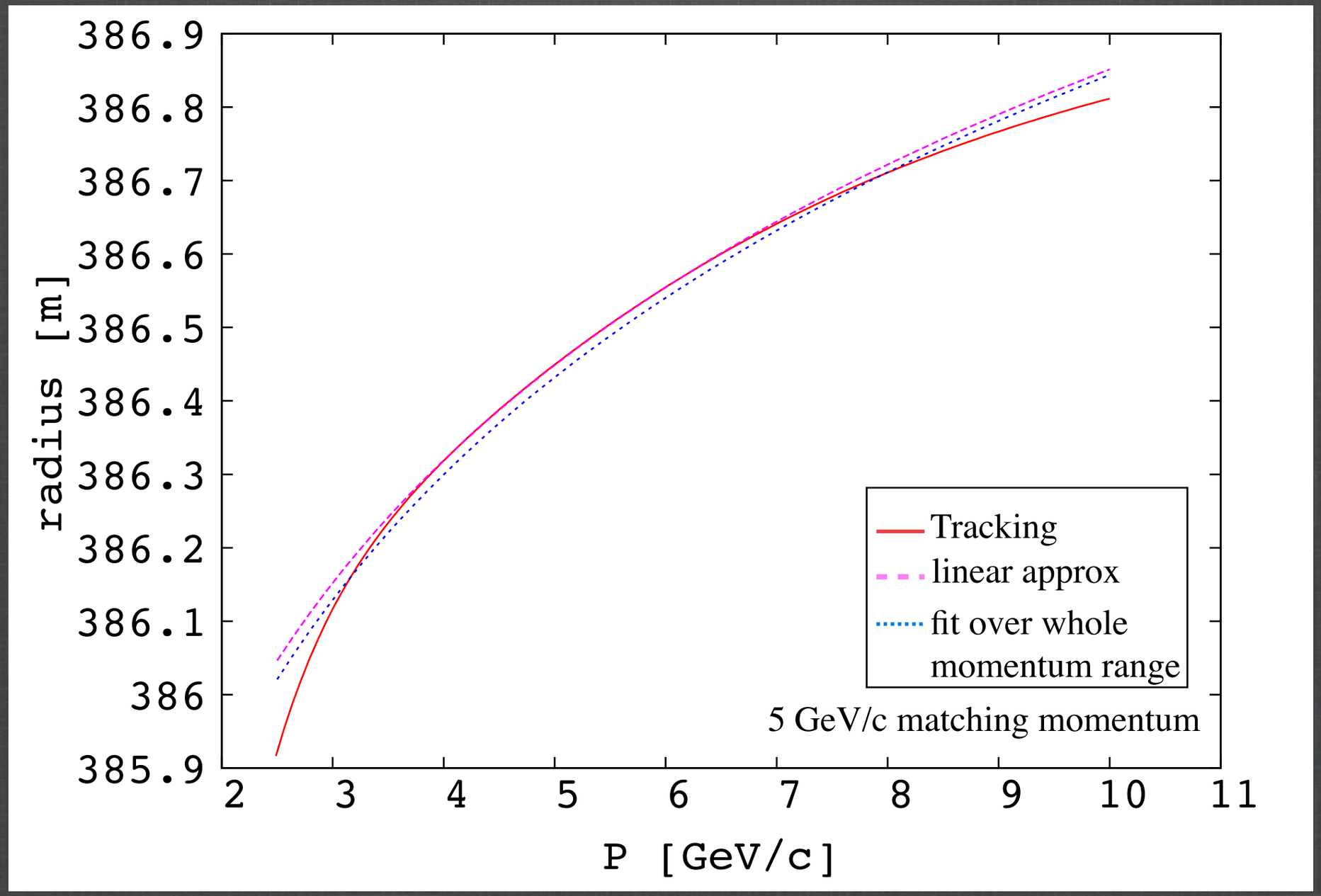
Dispersion at the end of the dispersion creator vs. momentum

nuPIL dispersion creator



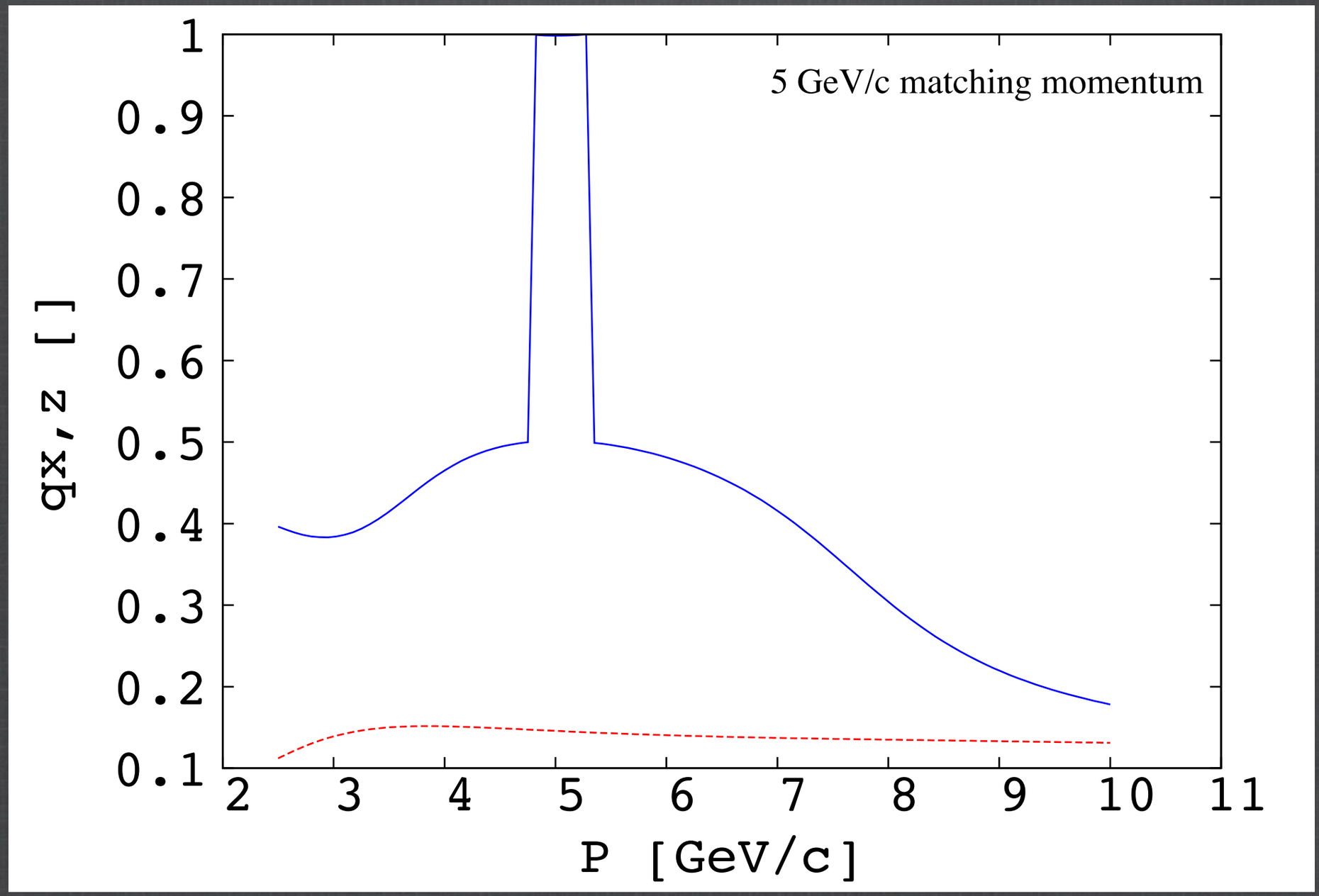
Angle of dispersion at the end of the dispersion creator vs. momentum

nuPIL dispersion creator



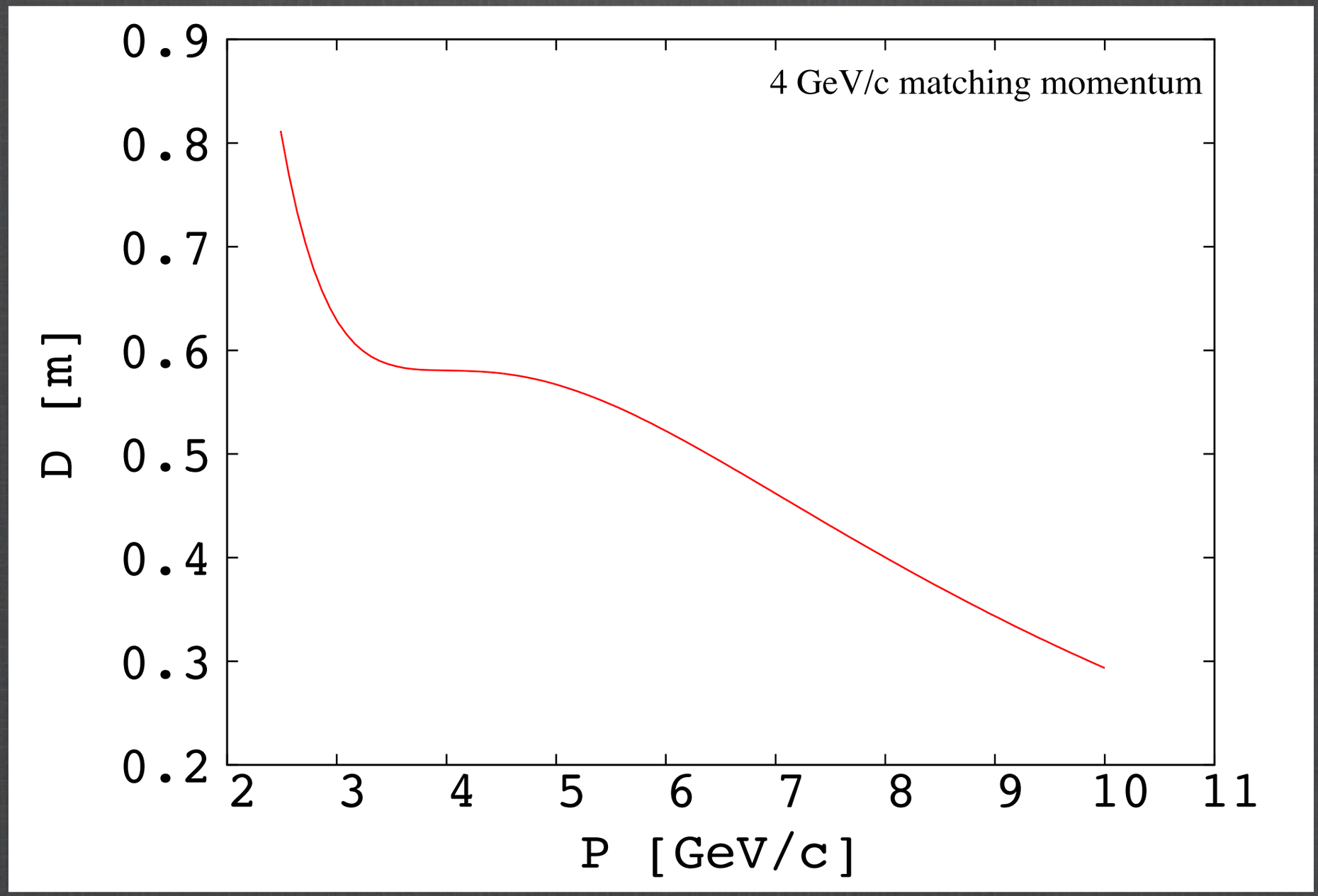
radius of reference trajectory at the end of the dispersion creator vs. momentum

nuPIL dispersion creator



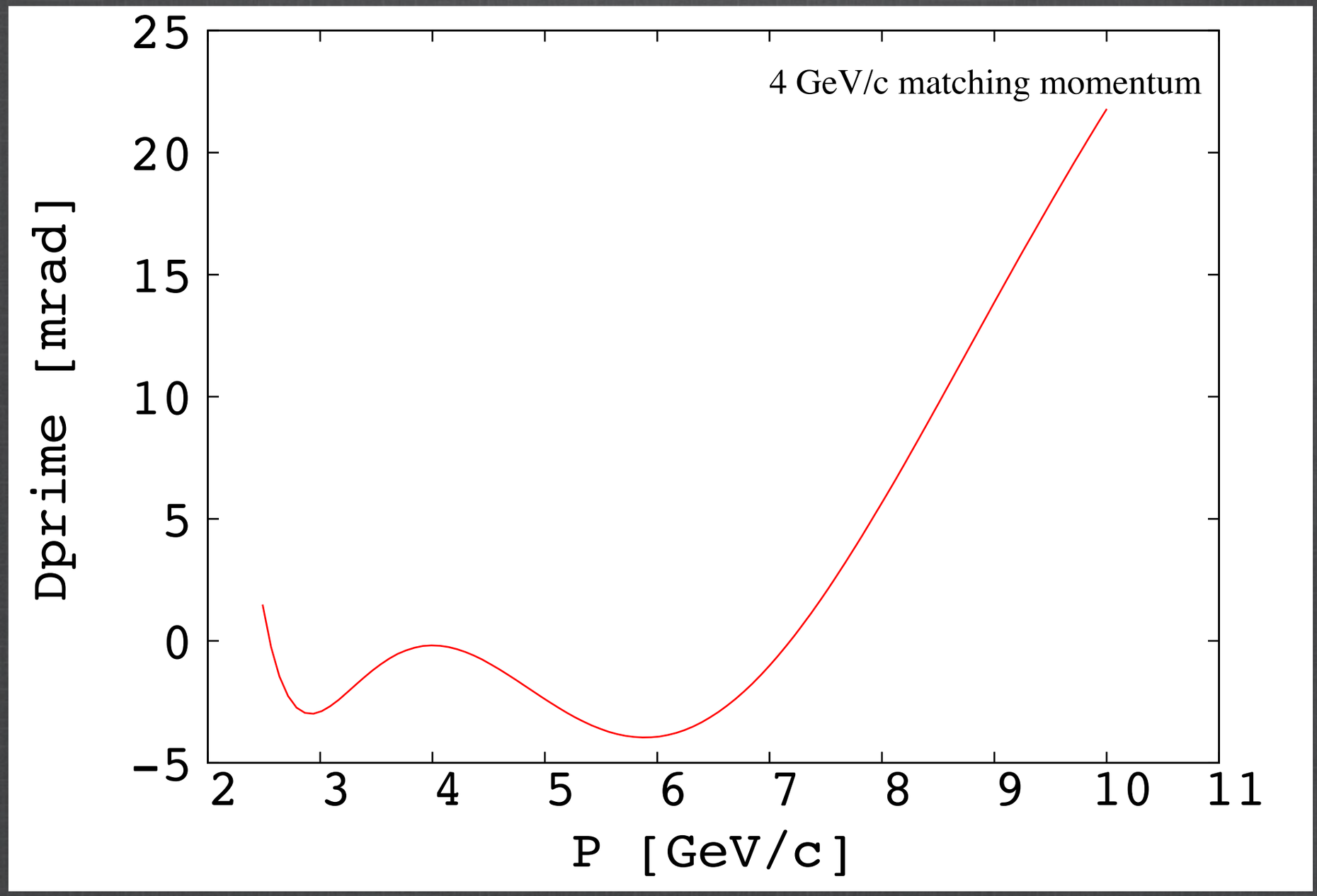
phase advance in bending direction (blue) and non-bending direction (dotted red) vs. momentum

nuPIL dispersion creator



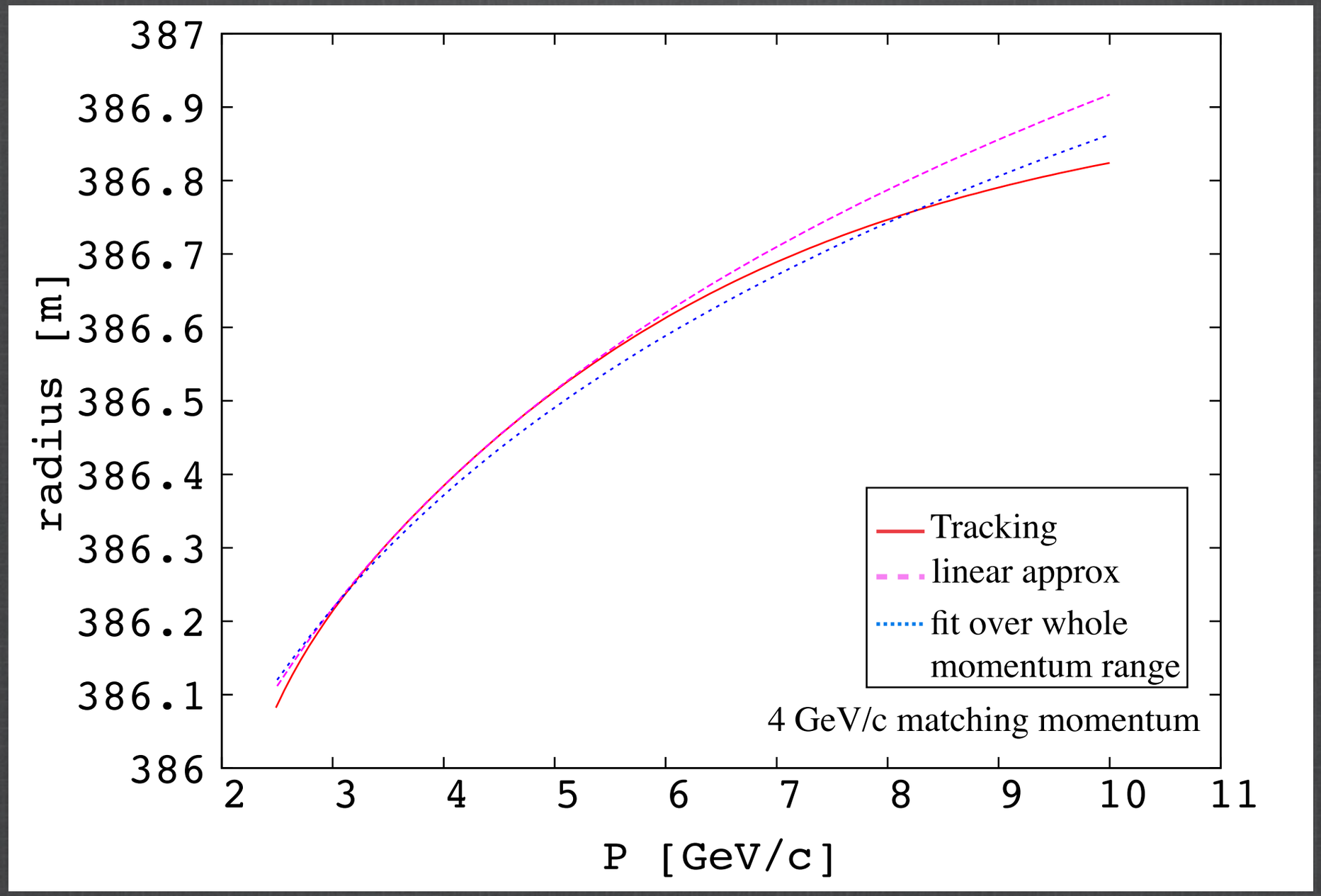
Dispersion at the end of the dispersion creator vs. momentum

nuPIL dispersion creator



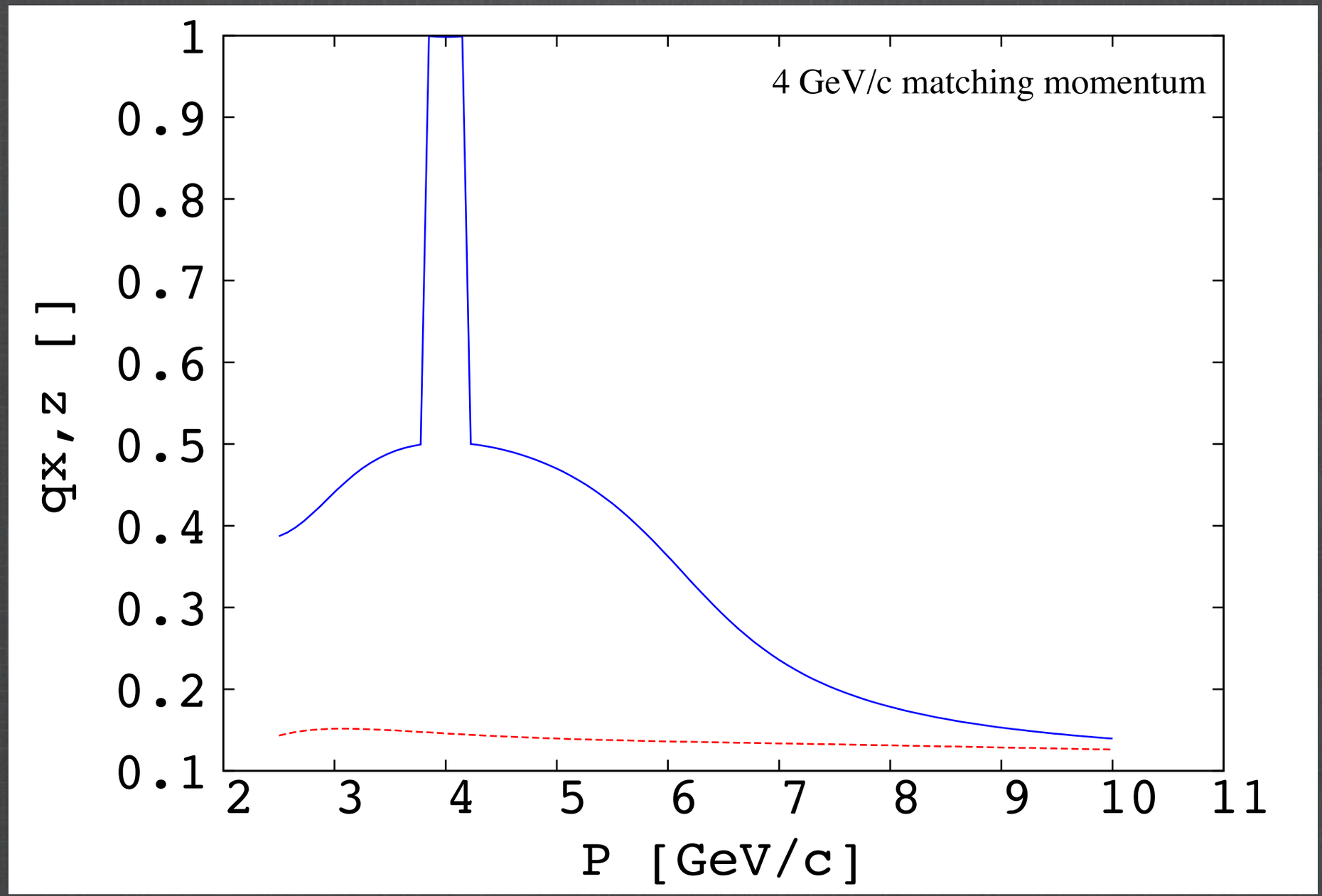
Angle of dispersion at the end of the dispersion creator vs. momentum

nuPIL dispersion creator



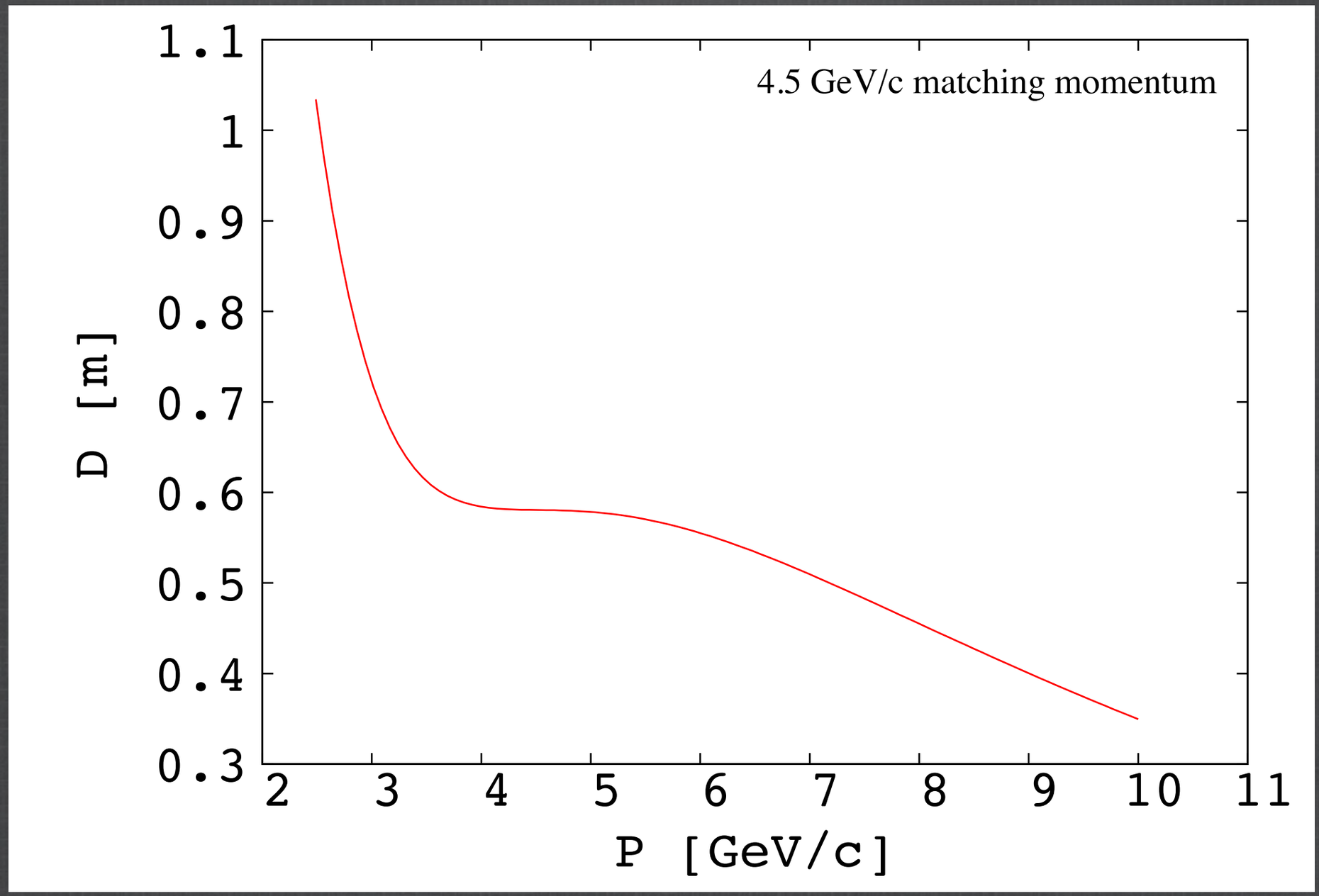
radius of reference trajectory at the end of the dispersion creator vs. momentum

nuPIL dispersion creator



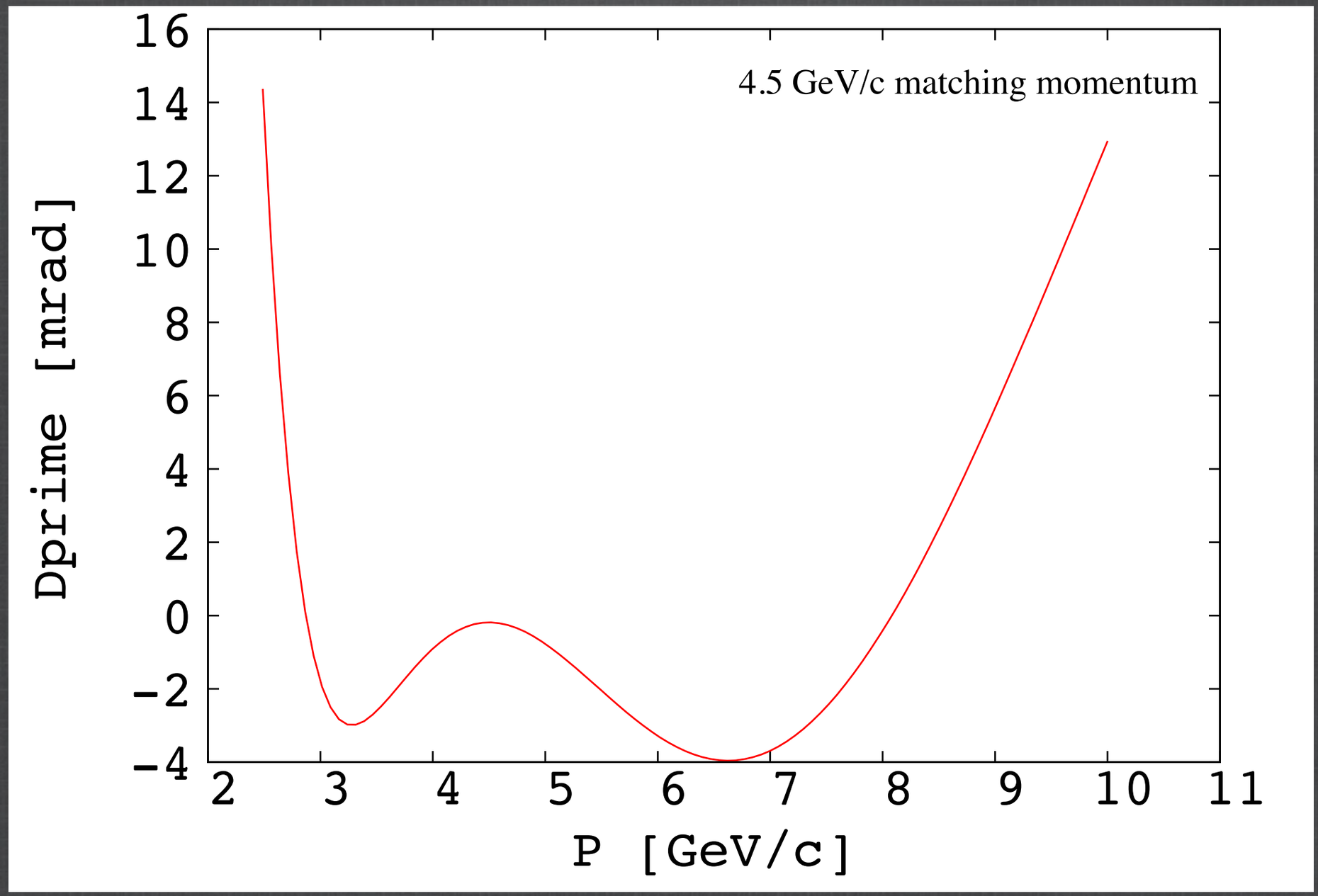
phase advance in bending direction (blue) and non-bending direction (dotted red) vs. momentum

nuPIL dispersion creator



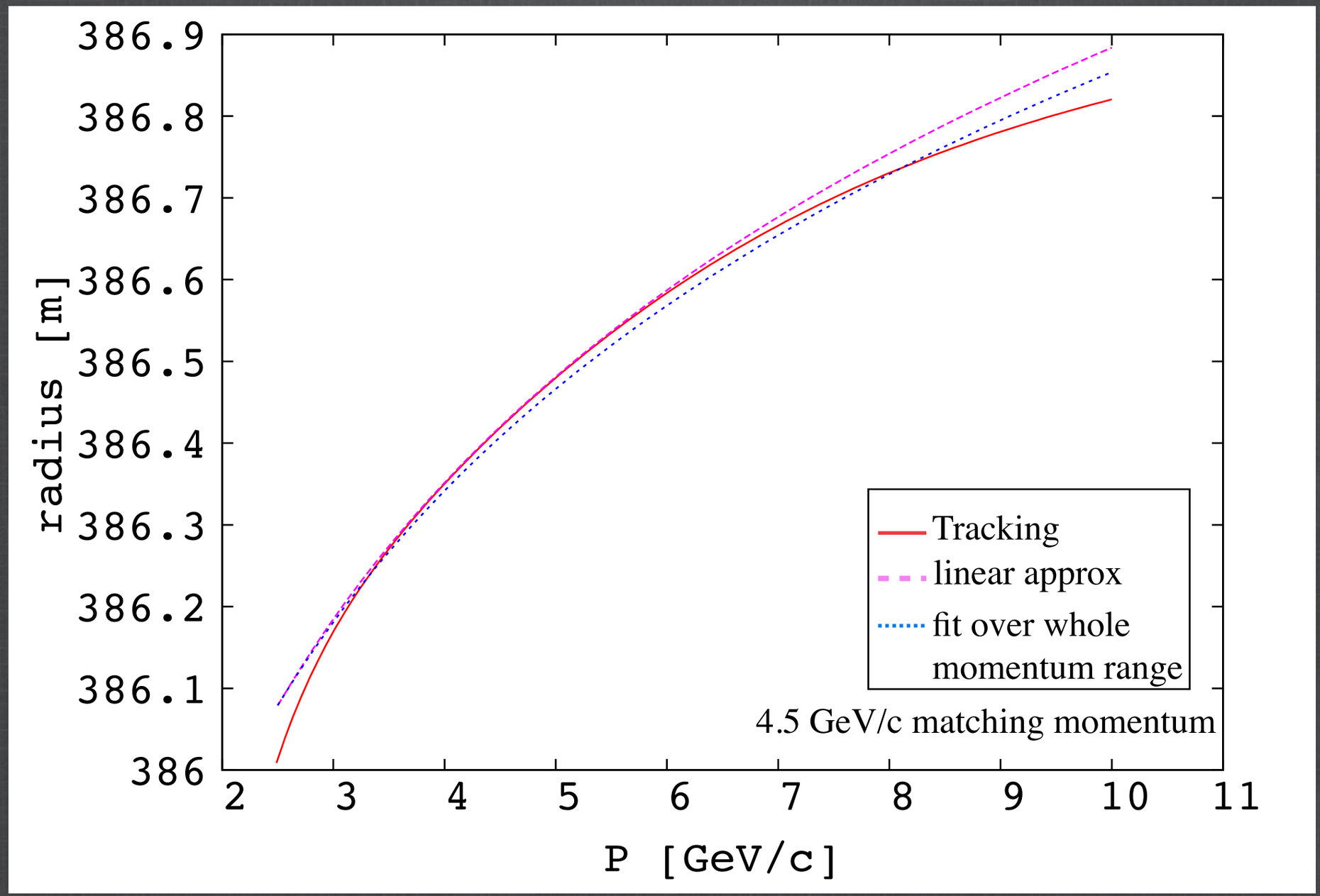
Dispersion at the end of the dispersion creator vs. momentum

nuPIL dispersion creator



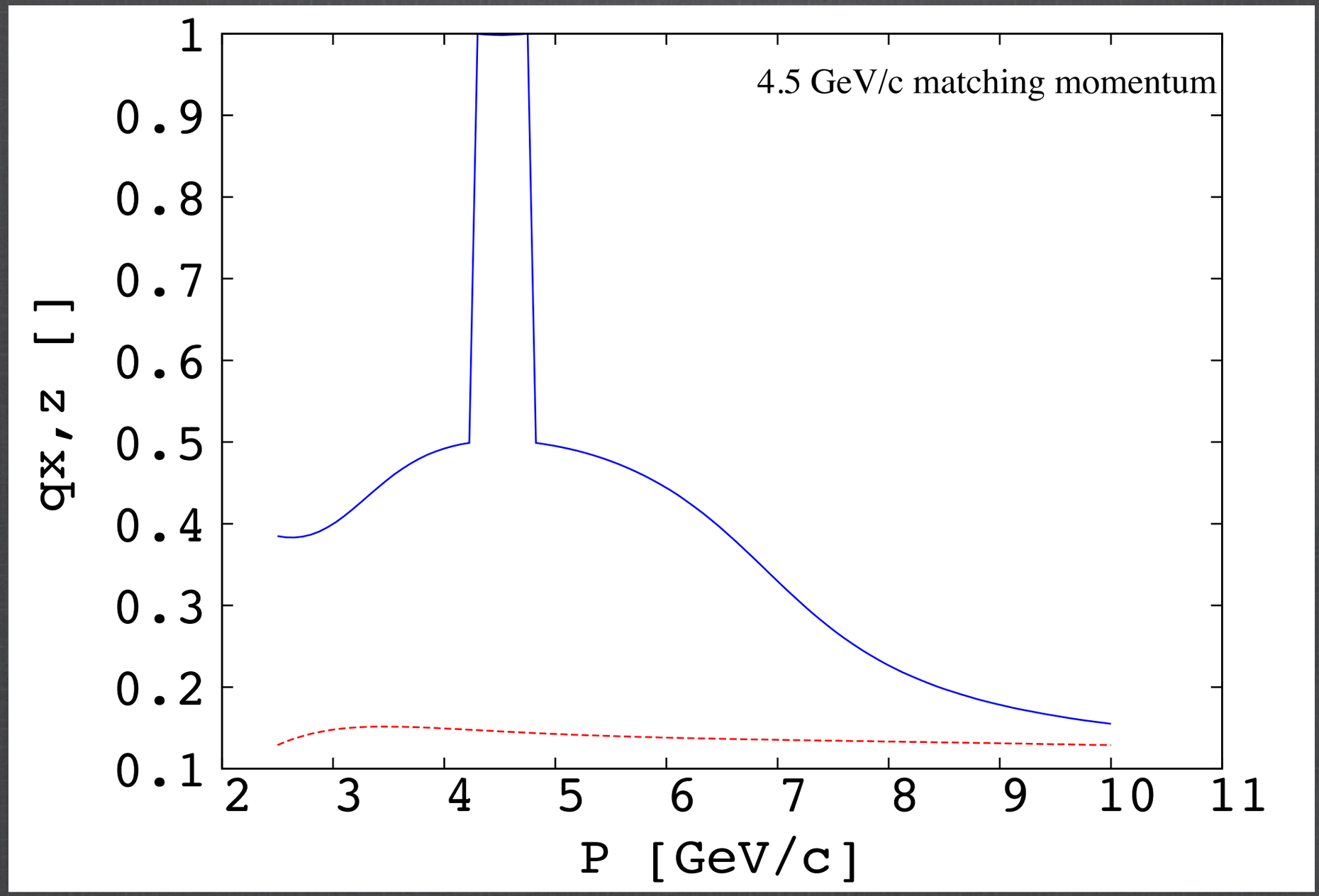
Angle of dispersion at the end of the dispersion creator vs. momentum

nuPIL dispersion creator



radius of reference trajectory at the end of the dispersion creator vs. momentum

nuPIL dispersion creator



phase advance in bending direction (blue) and non-bending direction (dotted red) vs. momentum

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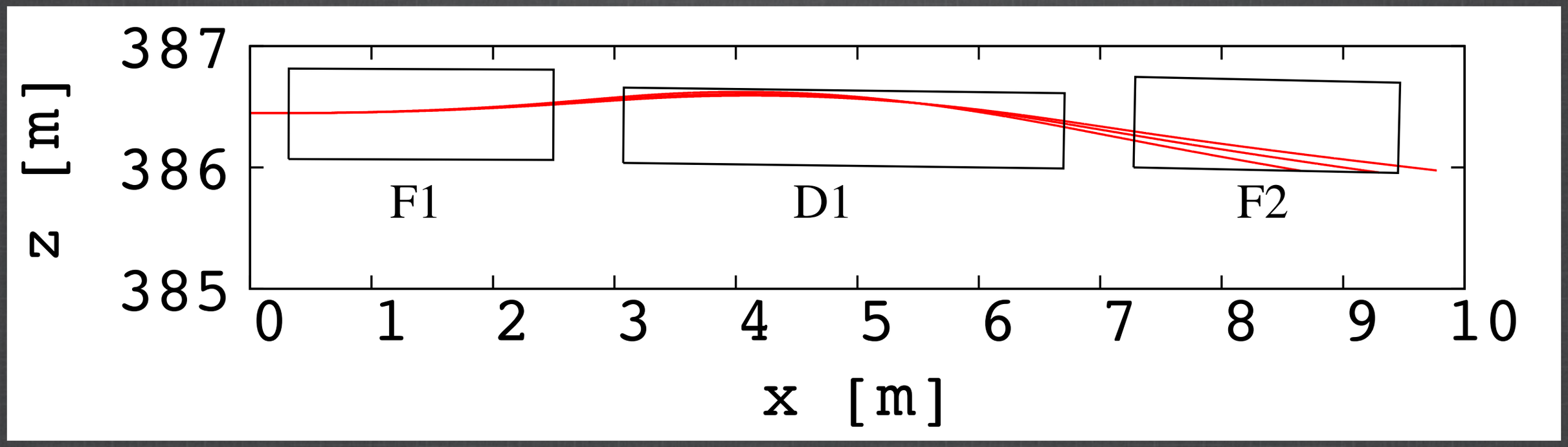
nuPIL wrong sign collection



Trajectories of 4.5 GeV/c, 5 GeV/c and 5.5 GeV/c wrong sign pion

Outline

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Optimization

- Adjust collimators (which momentum range?).
- Longitudinal optimization: Better fit of dispersion after dispersion creator and choice of matching momentum.
- Transverse optimization: Horn optimization at central momentum, and beta matching for this momentum in the beam line.
- Decrease number of magnets.
- Adjust gap size in the bend ($\beta_{\text{disp. creat.}} < 25$ m).
- Lower maximum magnetic field.
- Longer F1/shorter D1 for wrong sign pions collection.