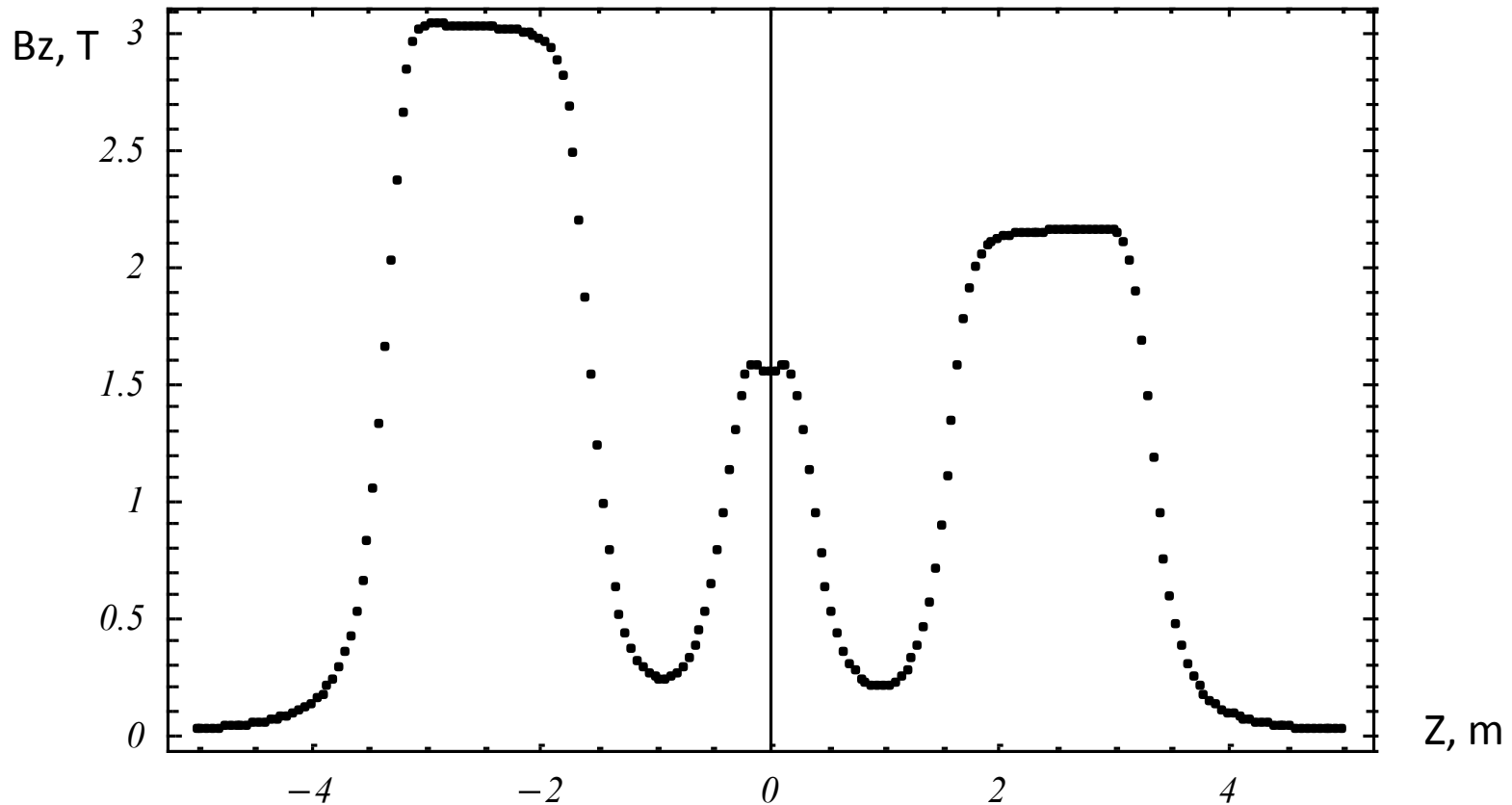


**Final optics  
without any Ms  
for MICE Step IV**

J. Pasternak, IC/RAL-STFC

02/07/2016

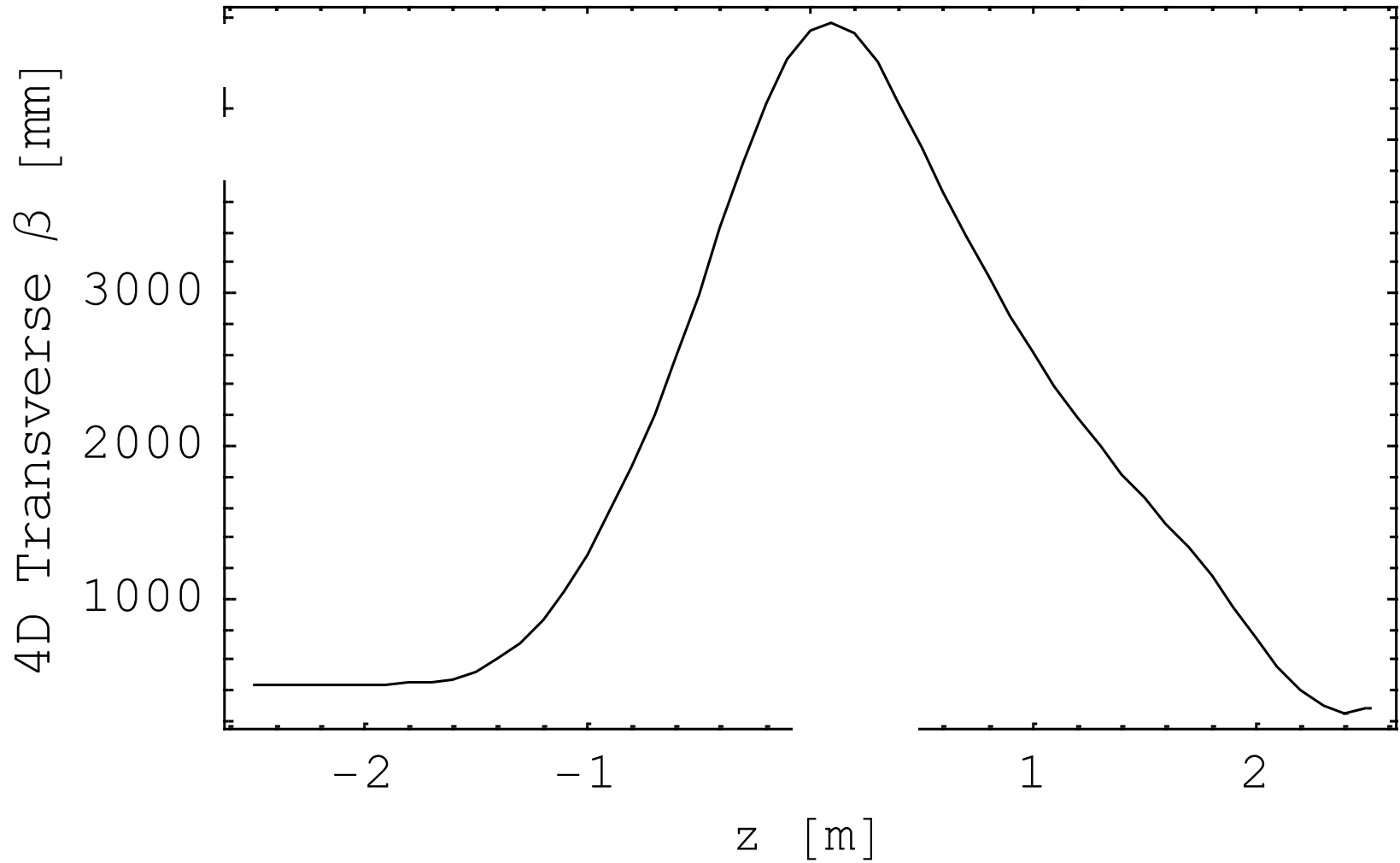
# Ao Liu's optics (one presented at the Readiness Review)



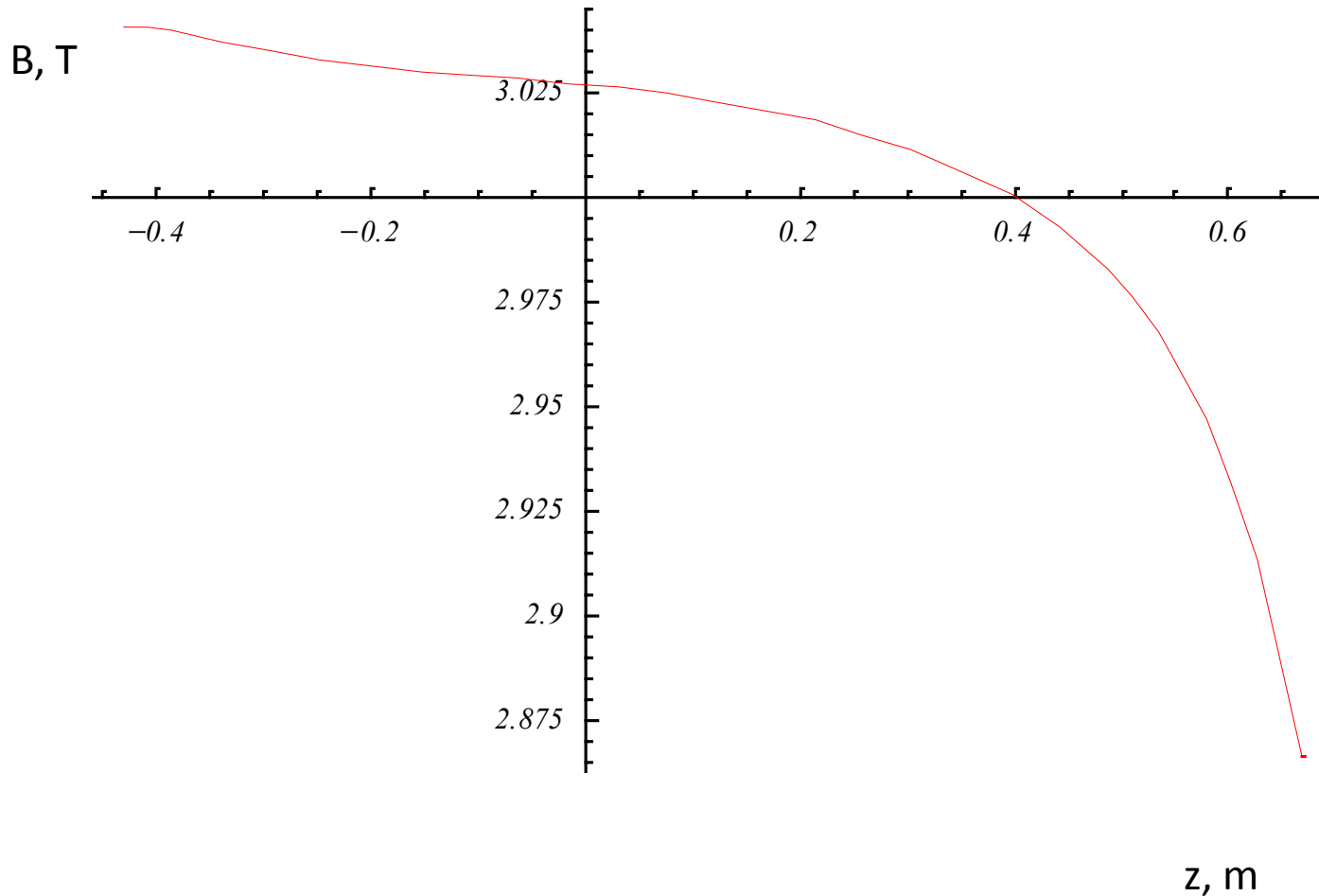
All currents in A.

Setting	E2u	Cu	E1u	M2u	M1u	Fcu	Fcd	M1d	M2d	E1d	Cd	E2d
Sol_200 _noMs	192.45	211.26	187.11	0.0	0.0	55.98	55.98	0	0	132.95	150.11	136.74

# Ao Liu's lattice, optics



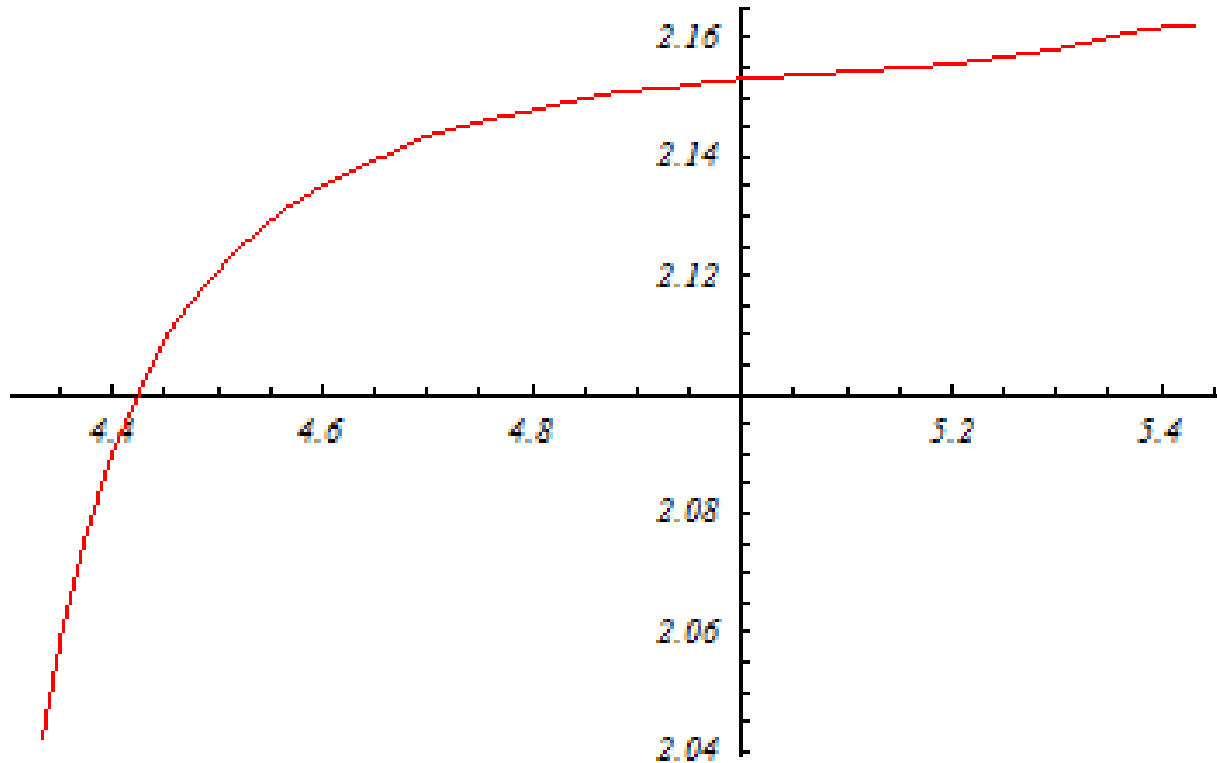
# Zoom in Upstream Tracker



Error:  $\pm 2.5\%$

# Zoom in Downstream Tracker

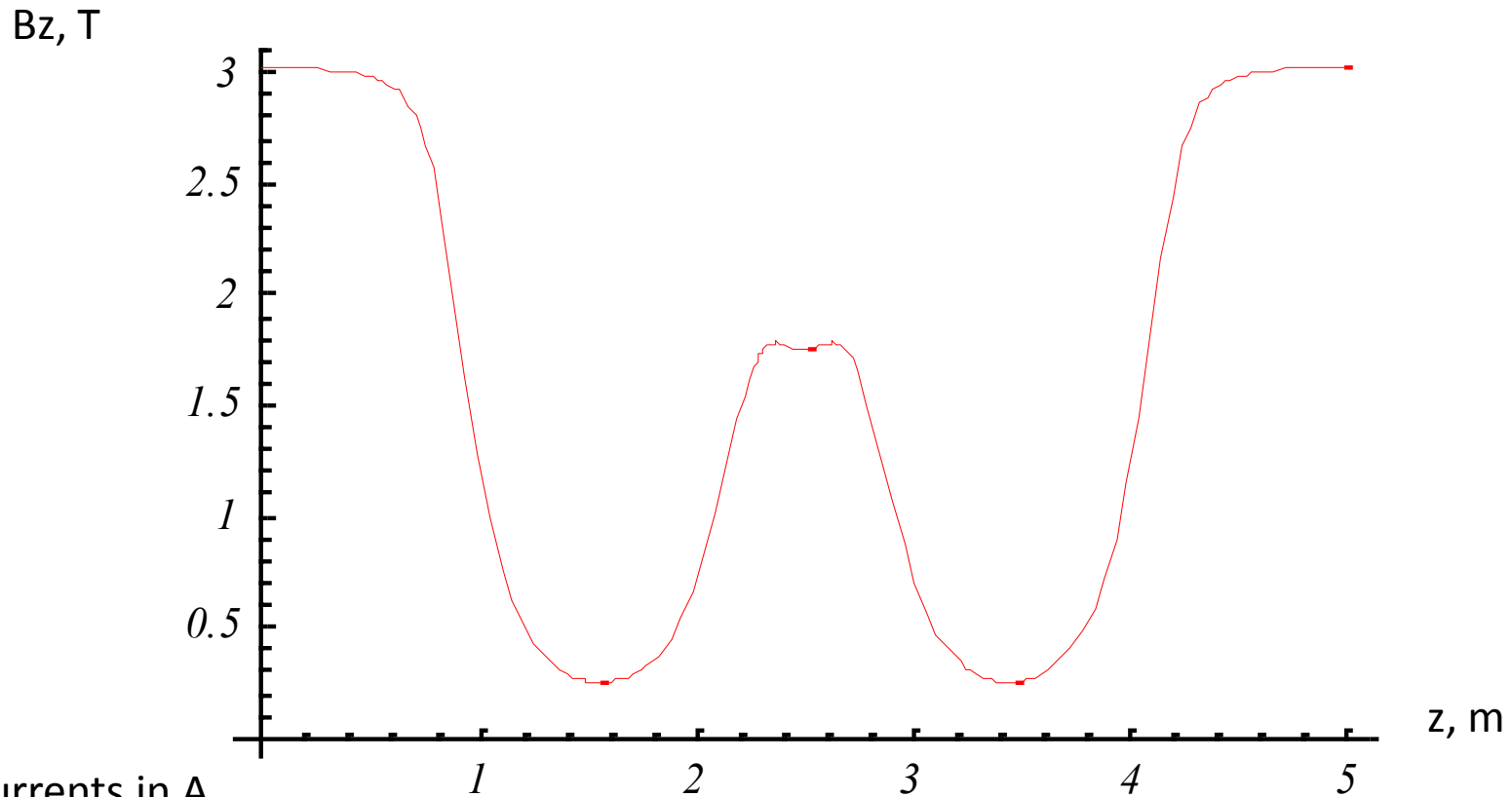
B, T



z, m

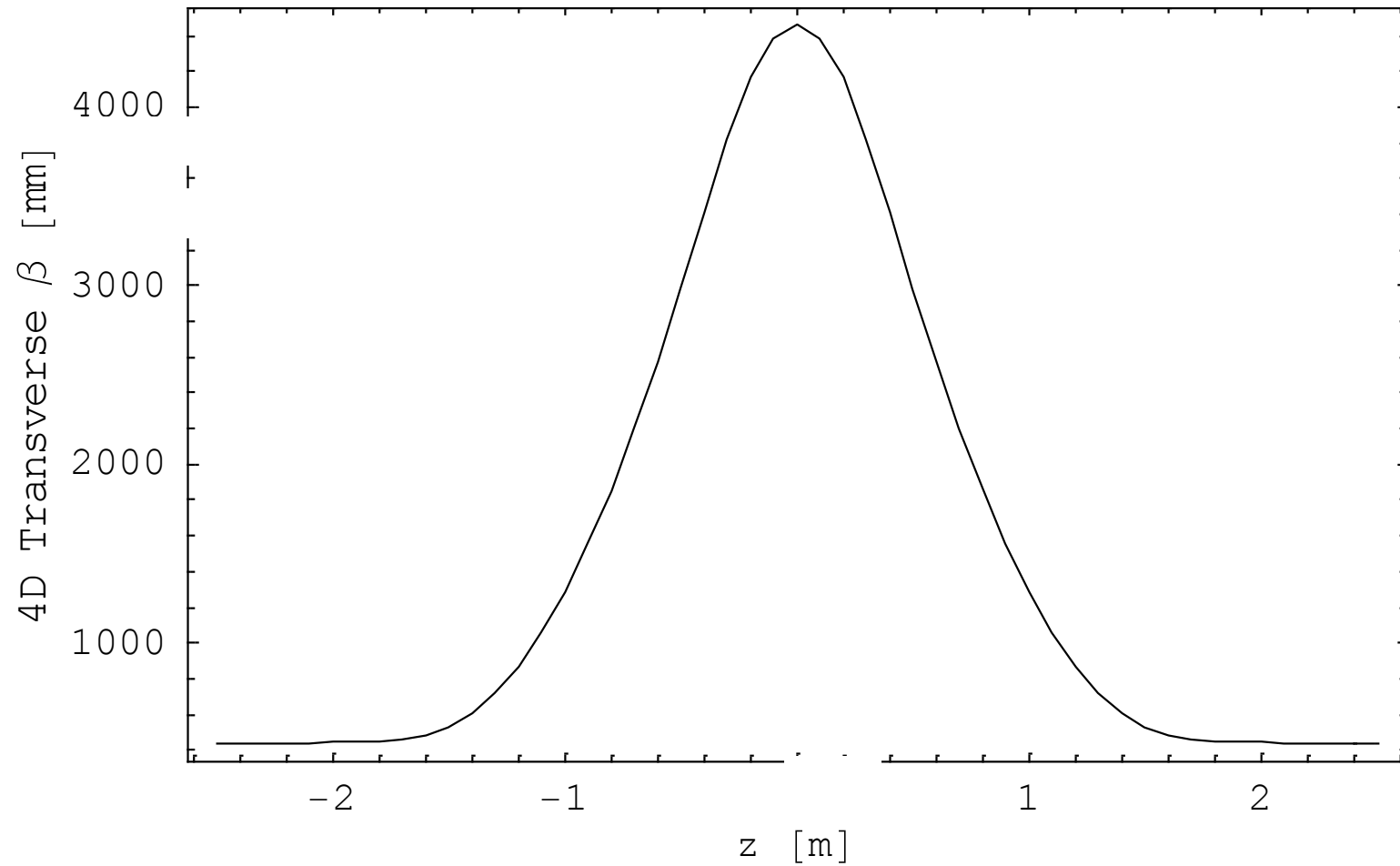
Error:  $\pm 2.8\%$

# Symmetric lattice with 3T in both SSU and SSD



Setting	E2u	Cu	E1u	M2u	M1u	Fcu	Fcd	M1d	M2d	E1d	Cd	E2d
Sol_200 _noMs	192.45	211.26	187.11	0.0	0.0	63.12	63.12	0	0	187.11	211.26	192.45

# Optics in symmetric lattice



# Geometry modifications

- Longitudinal position from survey in mm (from J. Tarrant):
  - SSU DS: 16479.49,
  - FC US: 16534.94,
  - FC DS: 17378.50,
  - SSD UP: 17431.06.
- Cold dimensions:
  - FC: coils closer by 0.8mm, coils shorter by 0.8mm (available information from J. Cobb)
  - SSs (see next slide)

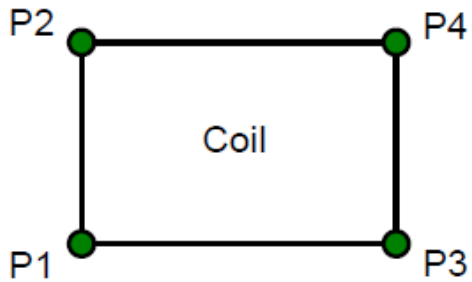


# Cold dimensions for SSs (from H. Witte)

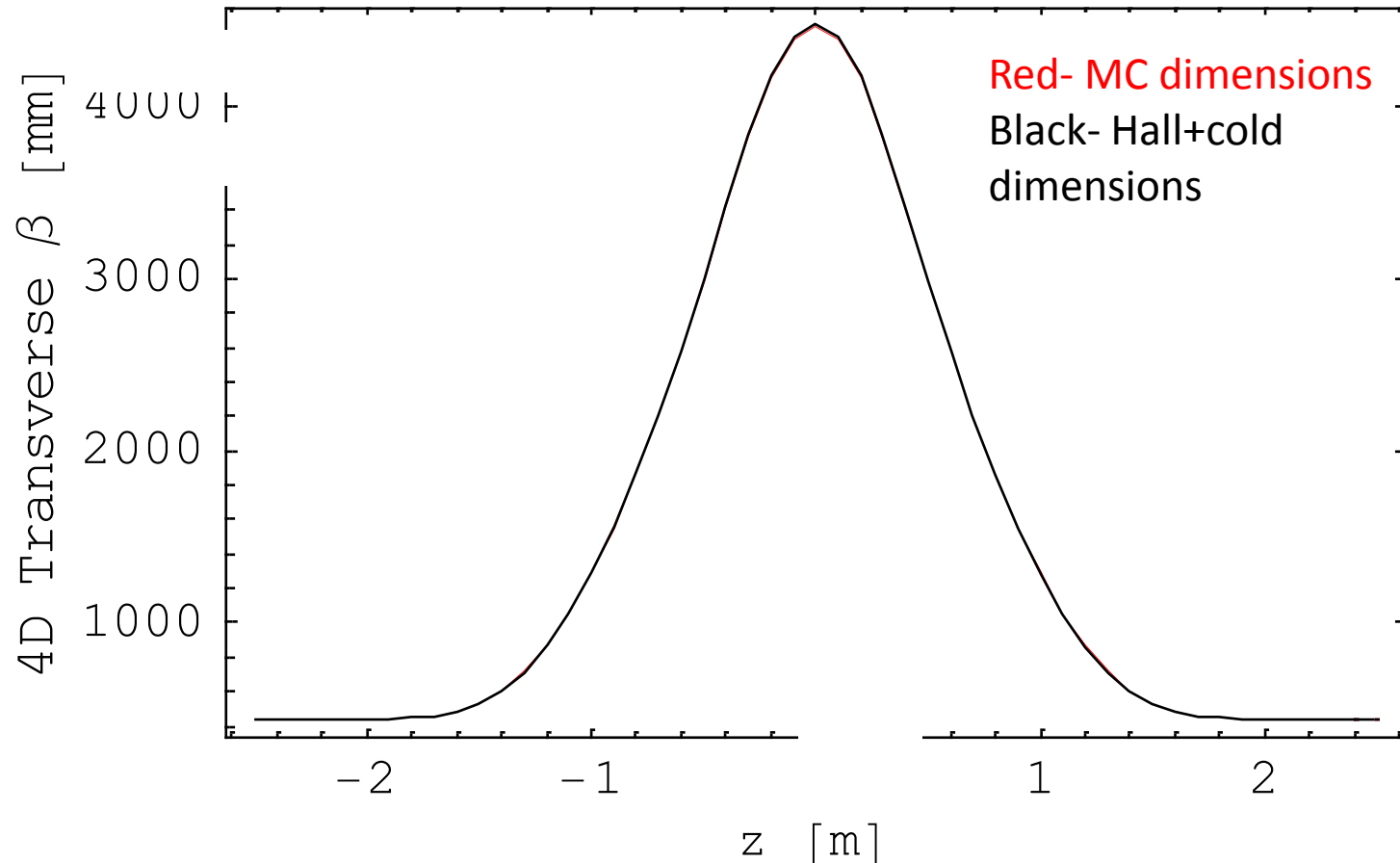
**Coil Coordinates Difference** 

	P1	P2	P3	P4	P1	P2	P3	P4
	R (m)				Z (m)			
E2	0.00082	0.00082	0.00102	0.00101	-0.0037	-0.0033	-0.0036	-0.0034
SS	0.00082	0.00084	0.00088	0.00091	-0.0033	0.0007	-0.0032	0.0006
E1	0.00085	0.00089	0.00102	0.00109	0.0007	0.0011	0.0008	0.001
M2	0.00095	0.00095	0.00105	0.00105	0.002	0.0026	0.002	0.0025
M1	0.00089	0.00087	0.00103	0.00101	0.0034	0.0041	0.0035	0.0039

(Warm dimensions – cold dimensions)



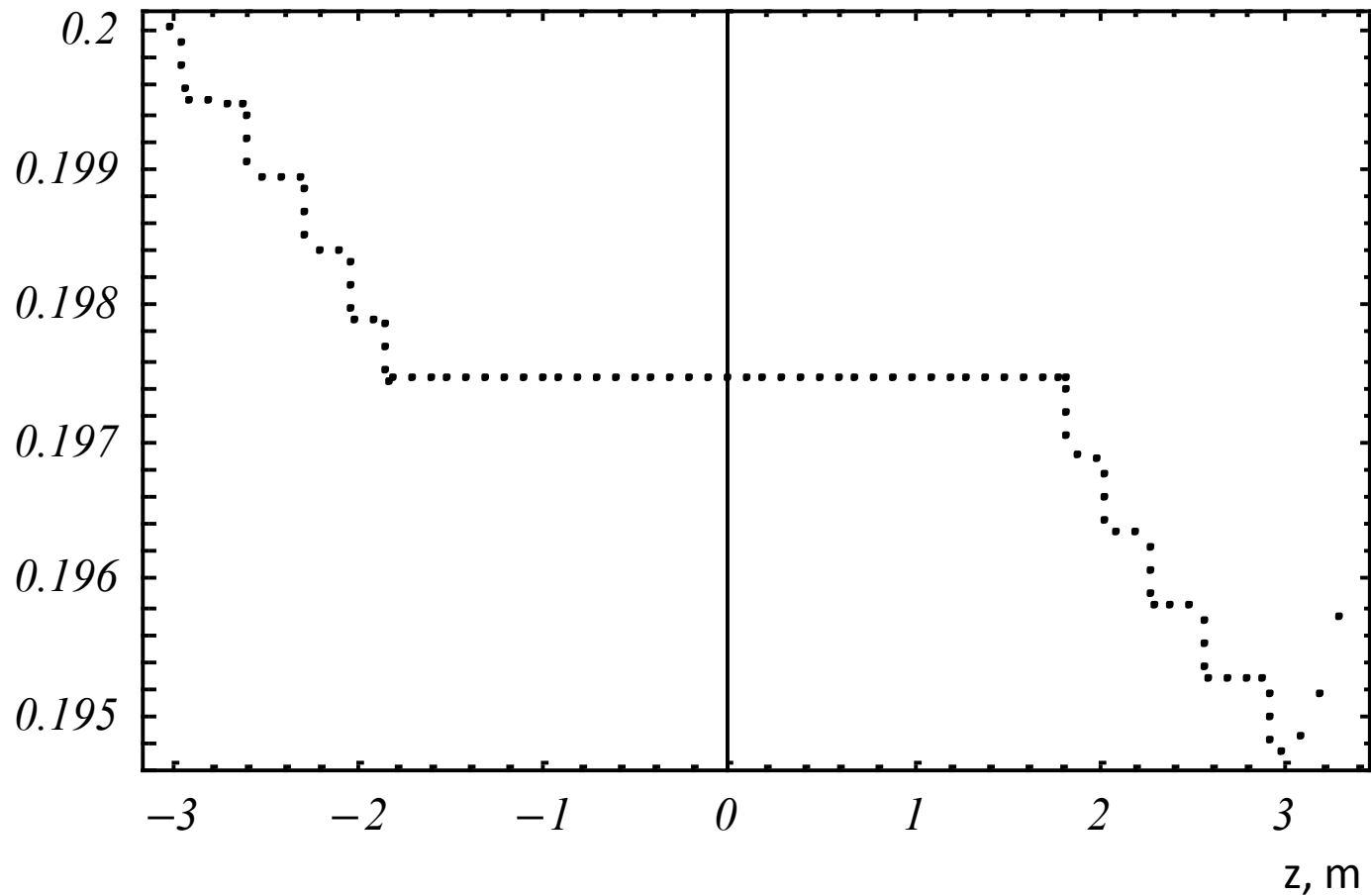
# Optics in symmetric lattice with Hall longitudinal positions (from survey) and cold dimensions



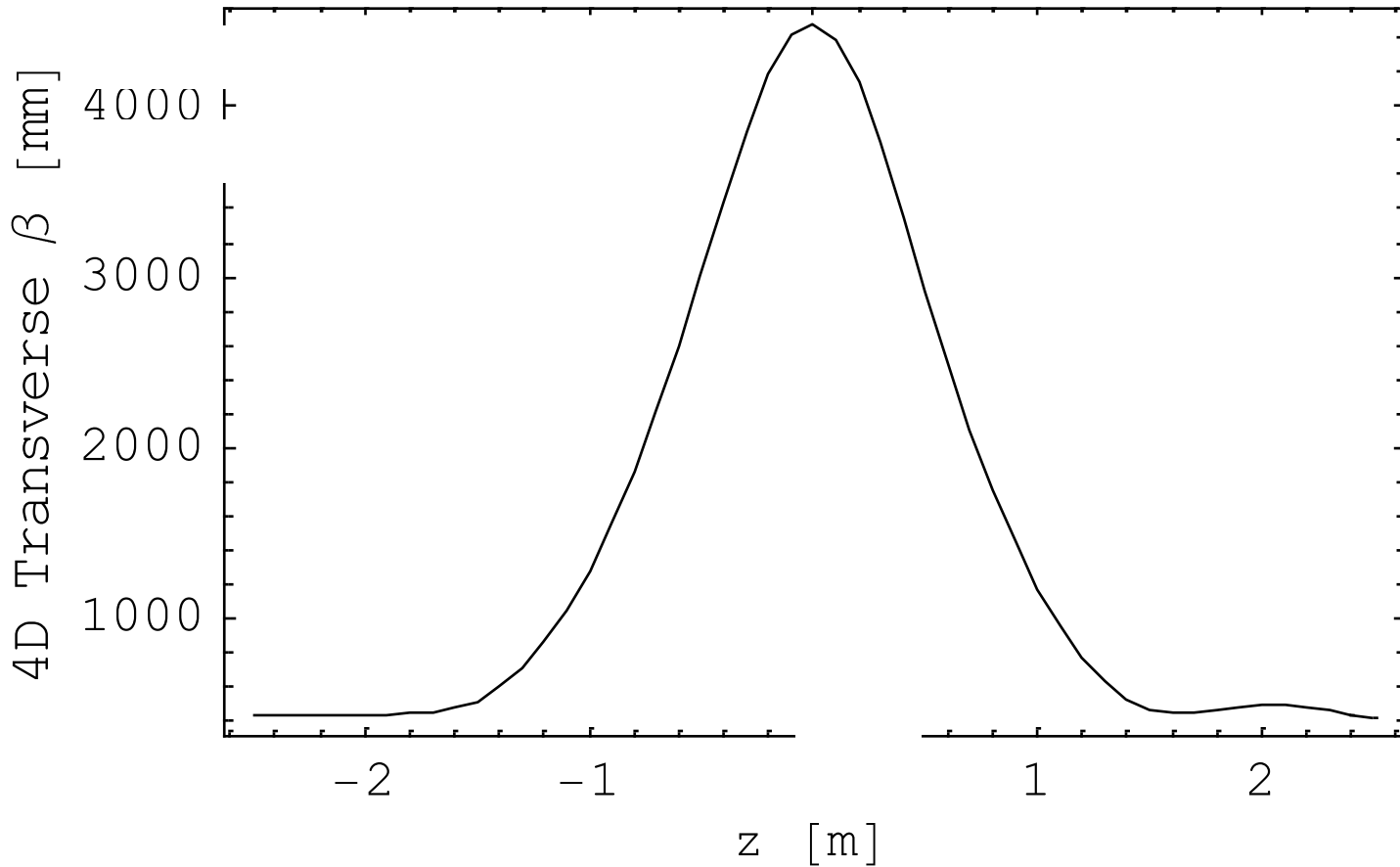
The effect is negligible!

# Assumed momentum profile without Absorber

$p$ , MeV/c

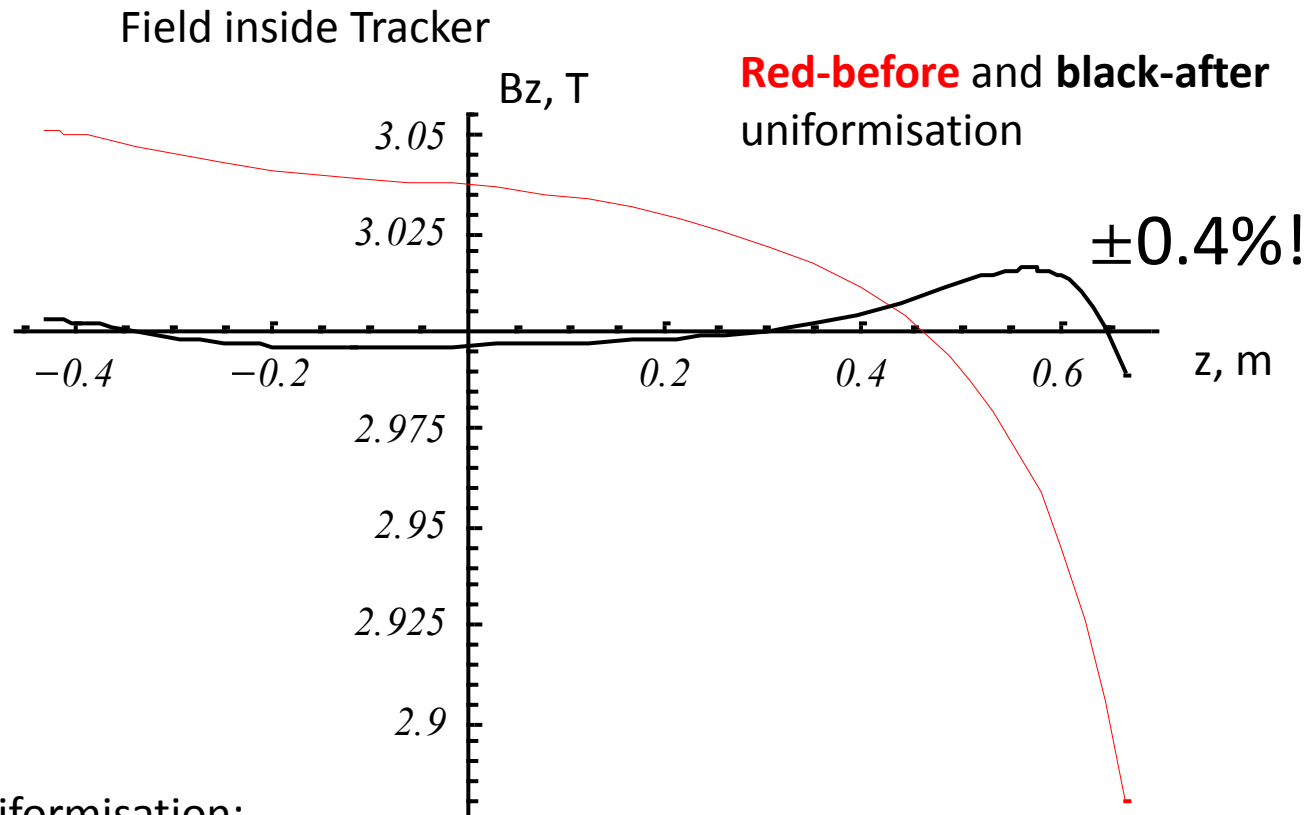


# Optics including momentum profile



No rematching needed.

# Tracker field uniformisation (at 3T)



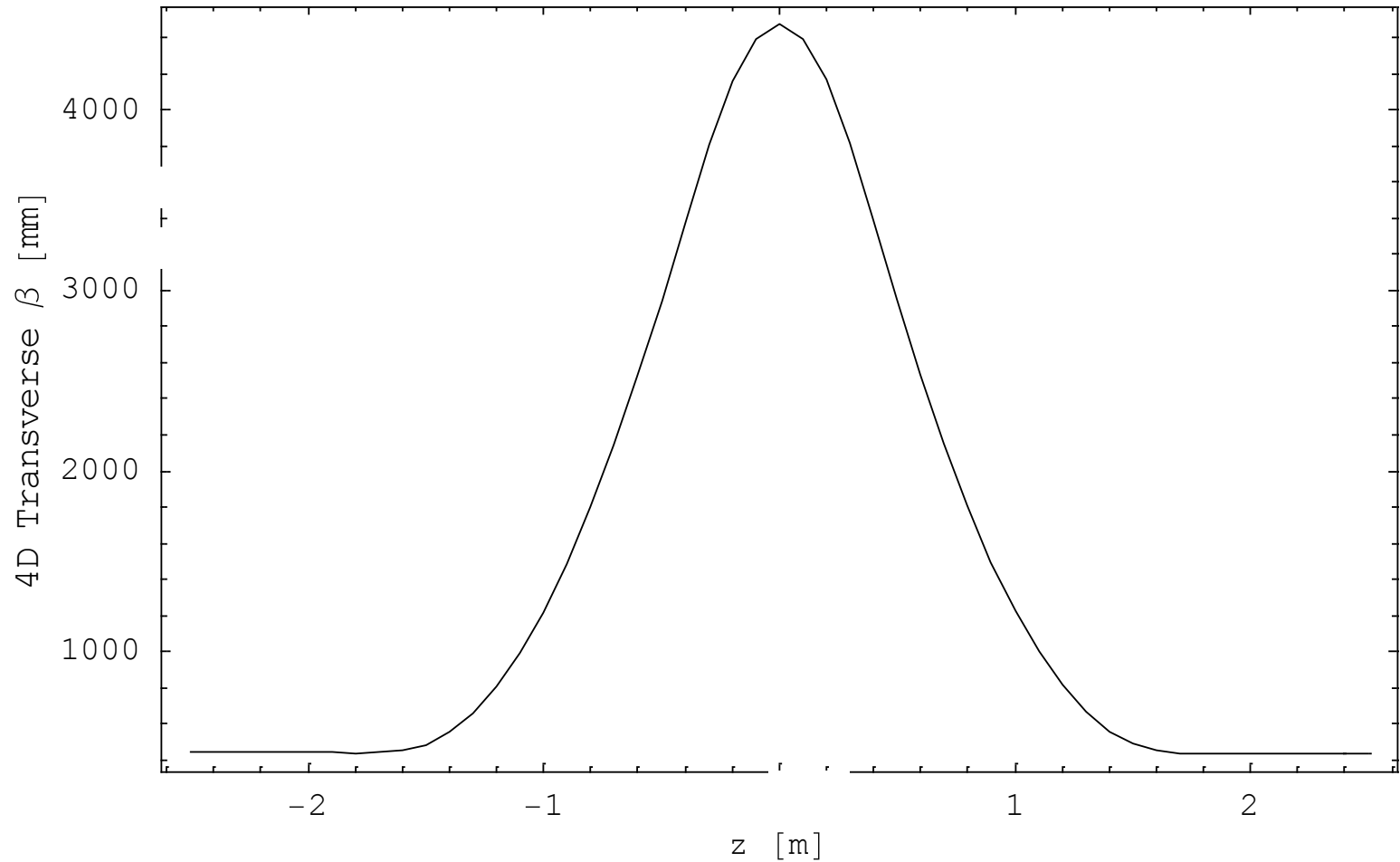
Setting after uniformisation:

All currents in A.

Setting	E2u	Cu	E1u	M2u	M1u	Fcu	Fcd	M1d	M2d	E1d	Cd	E2d
Sol_200_noMs	188.75	207.88	210.32	0.0	0.0	63.12	63.12	0	0	210.32	207.88	188.75

Stronger E1, weaker E2 ->needs checking with SS team!

# Optics after uniformisation



Very nice!

# H. Witte factors for solenoid mode

## Correction Factors Sol



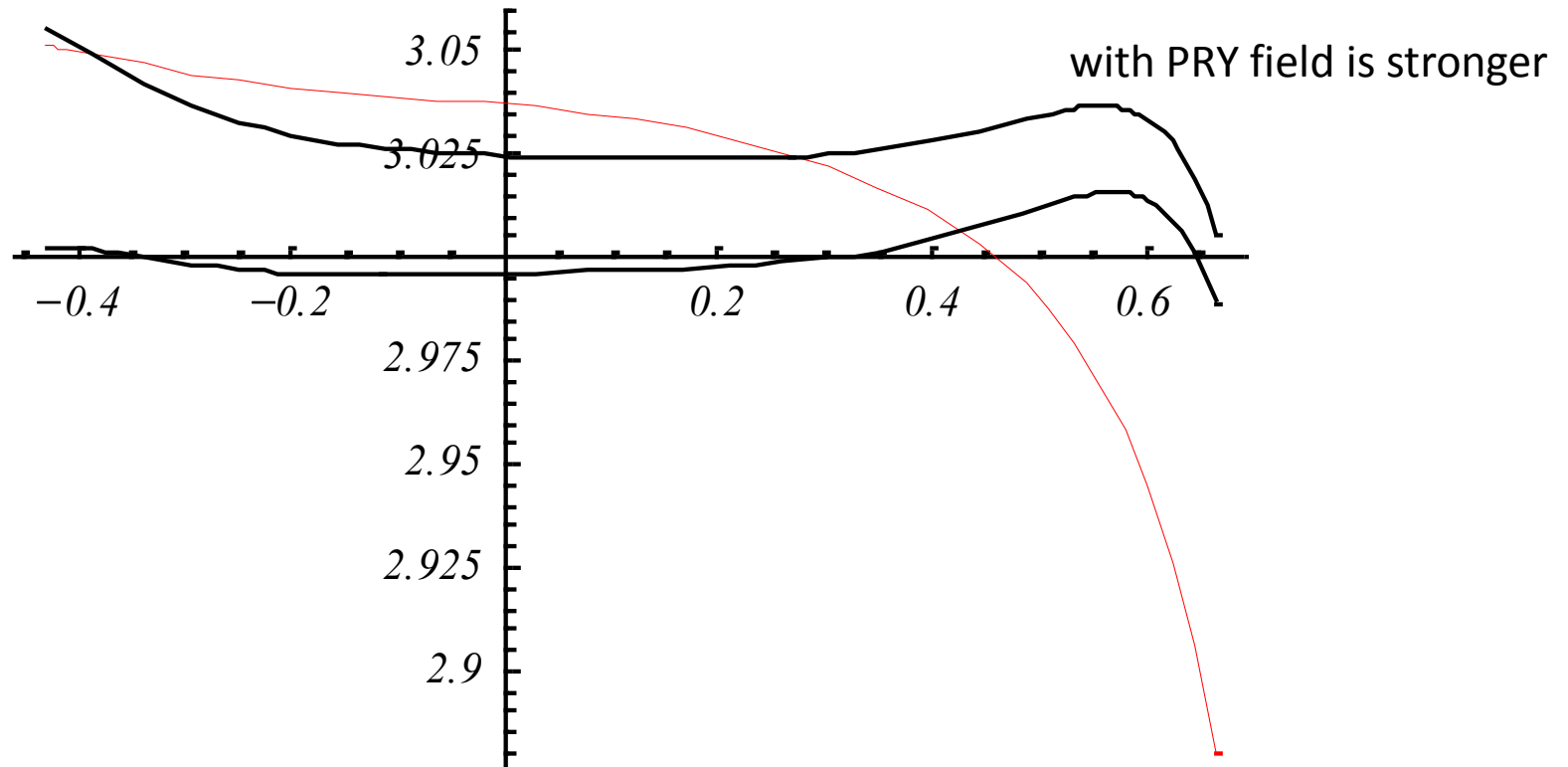
	240 MeV	200 MeV	140 MeV	Mean	St Deviation
E2	0.949886	0.950657	0.950265	0.950269	0.000386
SS	0.992131	0.99185	0.991425	0.991802	0.000356
E1	0.997999	0.998041	0.998297	0.998112	0.000161
M2	0.995372	0.995199	0.994141	0.994904	0.000666
M1	0.997601	0.99784	0.998761	0.998067	0.000613
FC	0.993167	0.99351	0.995671	0.994116	0.001358
FC	0.998271	0.998613	1.000769	0.999217	0.001354
M1	0.998554	0.998711	0.999549	0.998938	0.000535
M2	0.995383	0.995208	0.99415	0.994914	0.000667
E1	0.998032	0.998068	0.998314	0.998138	0.000153
SS	0.992136	0.991854	0.991427	0.991806	0.000357
E2	0.949886	0.950657	0.950265	0.950269	0.000386

I used these factors!

Caveat: These factors are evaluated with 4T in SSs.

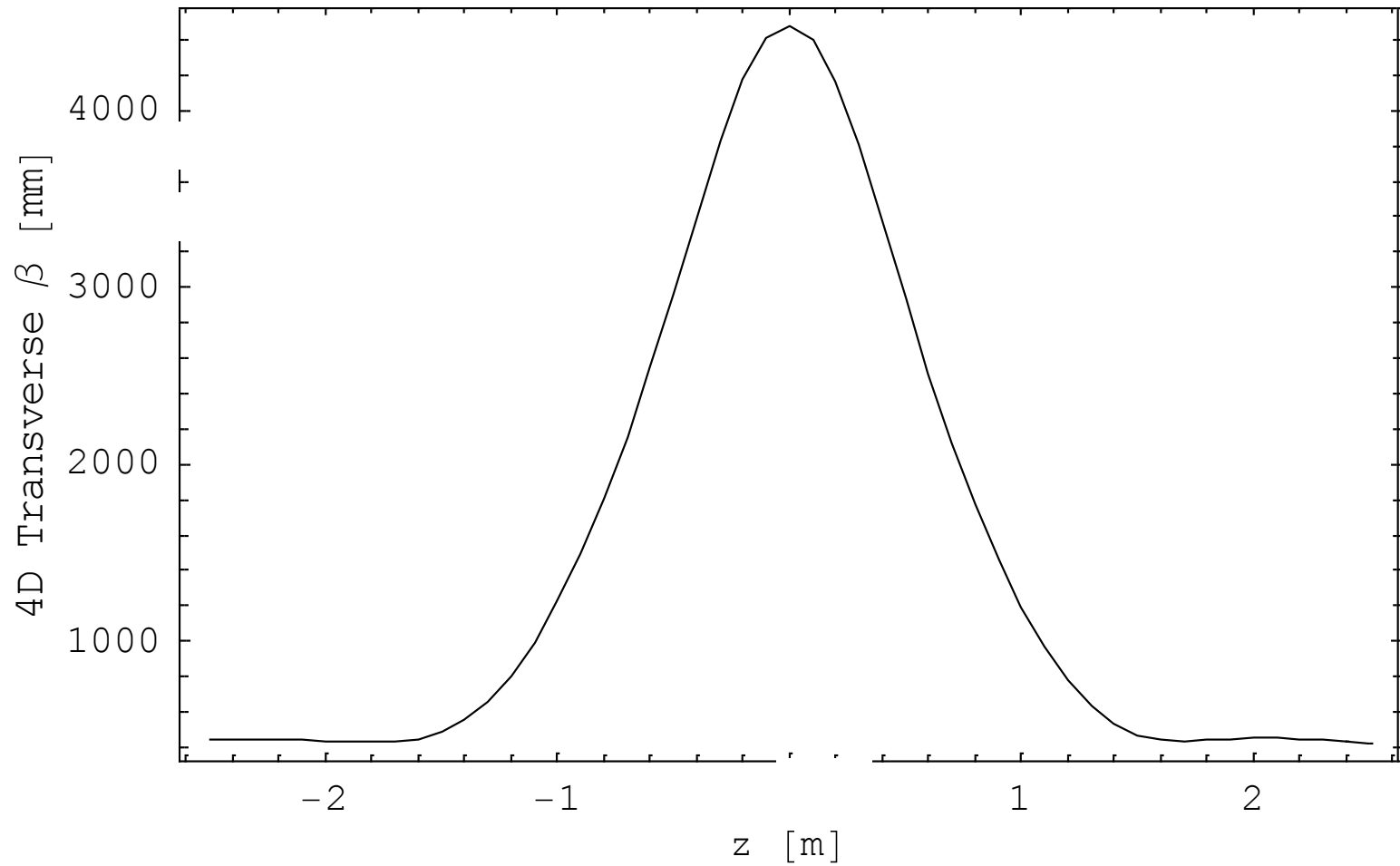
At the moment we do not have 3T ones.

# PRY effect in the Tracker





# PRY effect on optics



Negligible!

# Final hardware currents (after including H. Witte factors)

All currents in A.

Setting	E2u	Cu	E1u	M2u	M1u	FCu	FCd	M1d	M2d	E1d	Cd	E2d
Sol_200_noMs	179.44	206.19	209.91	0.0	0.0	62.87	62.87	0.0	0.0	209.91	206.19	179.44

As expected currents are a bit weaker and the largest change is in E2.

# Summary

- It was decided to use symmetric lattice with 3T in both SSs.
- Implemented final Hall survey dimensions -> done – no measurable effect.
- Implemented cold dimensions ->negligible effect!
- Perform tracker field uniformisation -> calls for weaker E2 and stronger E1 currents ->**needs to be checked with SS team!**
  - **These is the only serious effect ( $dB/B \sim \pm 3\%$  ->  $\pm 0.4\%$ ).**
- PRY effect -> no effect on optics, but stronger Tracker field ->compensated using H. Witte factors.
  - These should have some (small) effect on reconstruction and should be detectable using Hall probes.
- **Final hardware currents provided (see previous slide).**