Designing the TESLA Interaction Region with $l^*=5$ m

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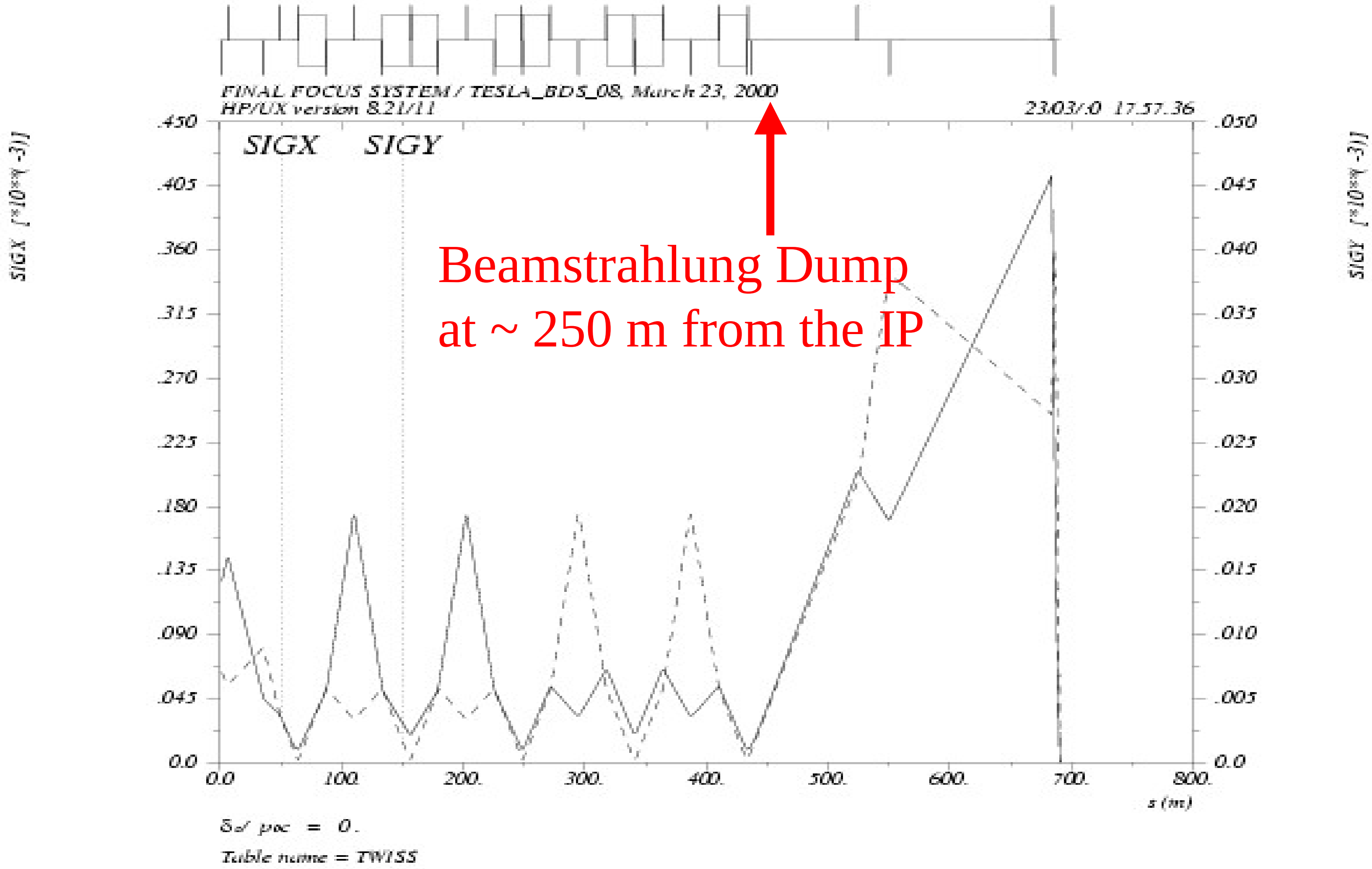
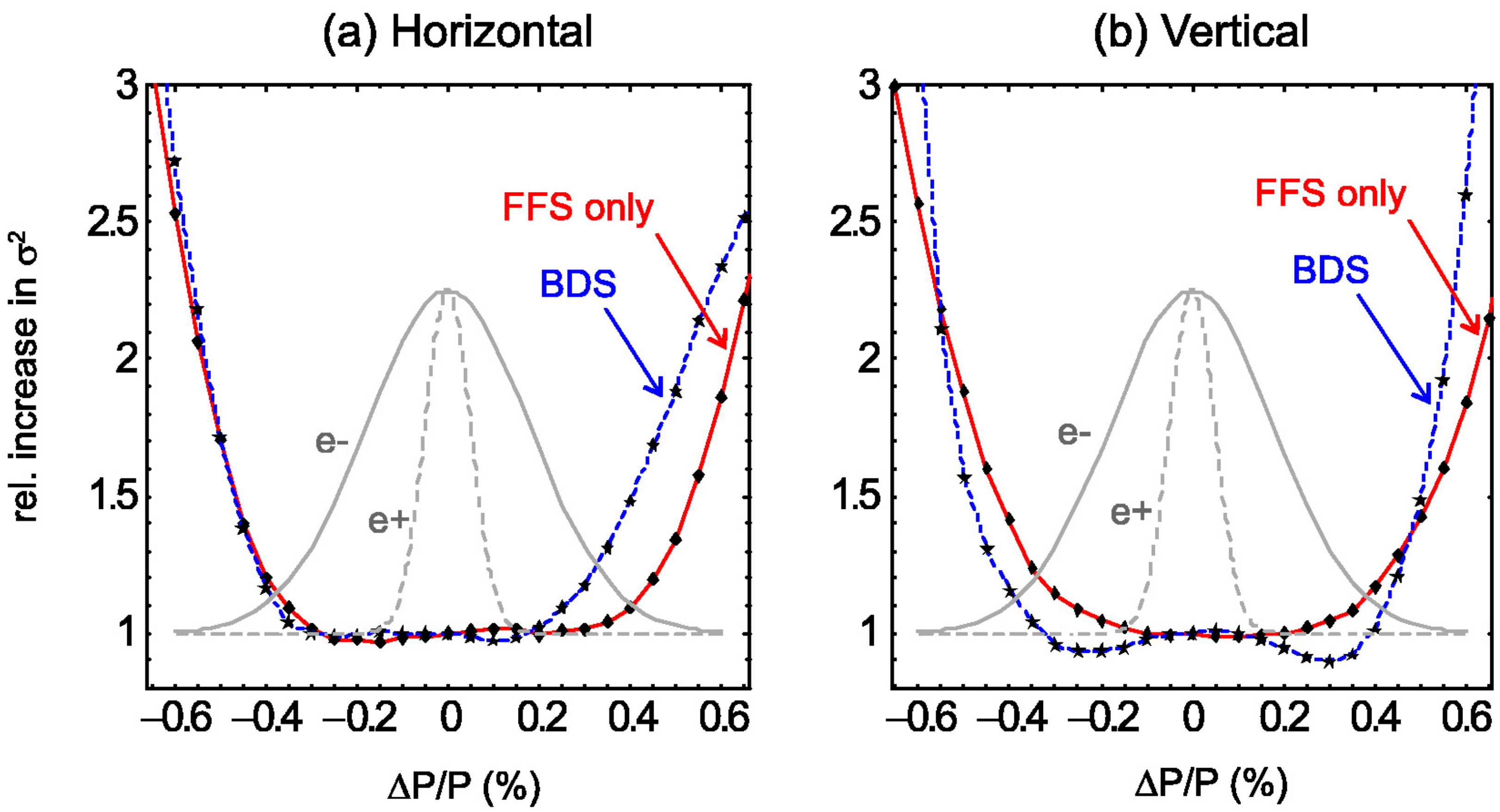
1. Final Focus Optics
2. Extraction of Beam after the interaction
3. Extraction of Synchrotron Radiation from Final Doublet

TDR : TESLA Final Focus
$l^* = 3$ m , $L = 690$ m



Chromatic Acceptance

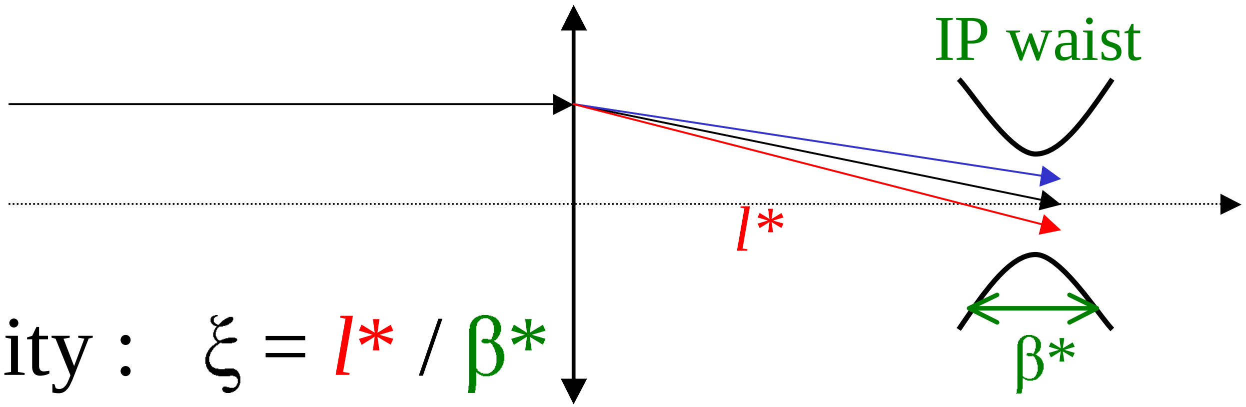


about ±0.4 % $\Delta P/P$

New Final Focus *'à la NLC'*

Advantages from the machine point-of-view:

– Better chromaticity correction $\rightarrow$ larger l^*



chromaticity : $\xi = l^* / \beta^*$

– $l^* = 5\text{m}$ $\leftrightarrow$ final doublet moved out of the detector solenoid

New Final Focus with $l^* = 5$m

Advantages from the detector point-of-view

– Larger forward acceptance at low angles

– Final doublet moved out of the calorimeter

$\Rightarrow$ less background

– Lighter Tungsten-mask and simpler support

Main issues of the Design

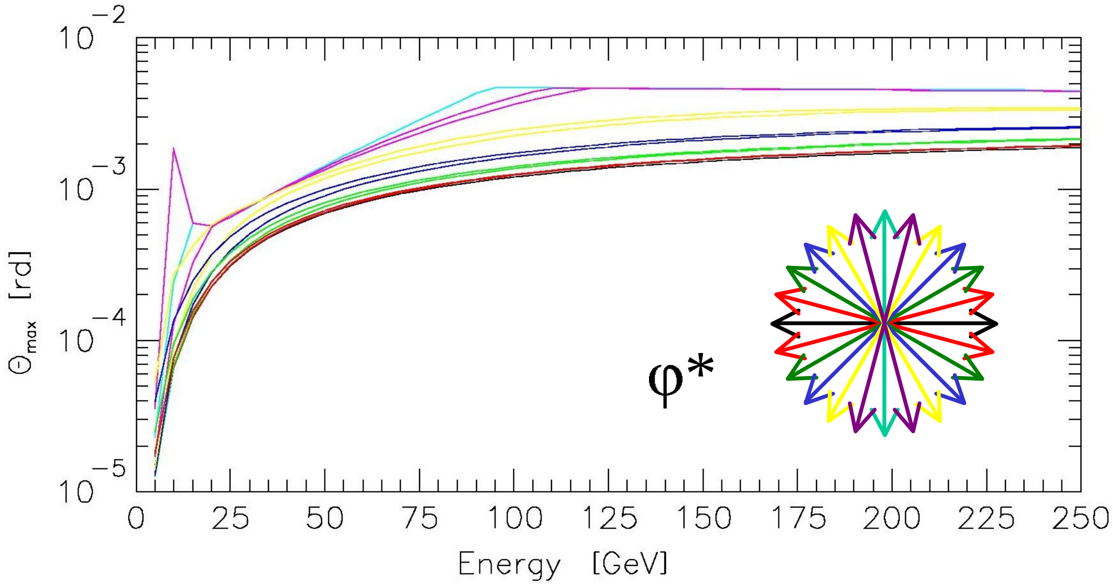
1. Extraction of Beam after the interaction

2. Extraction of Synchrotron Radiation from Final Doublet
   (i.e. check collimation requirements)

3. Final Focus Optics

N.B. : First two issues, independent of the FF optics,
depend only on l^* and on the final doublet apertures Φ.

Beam Extraction



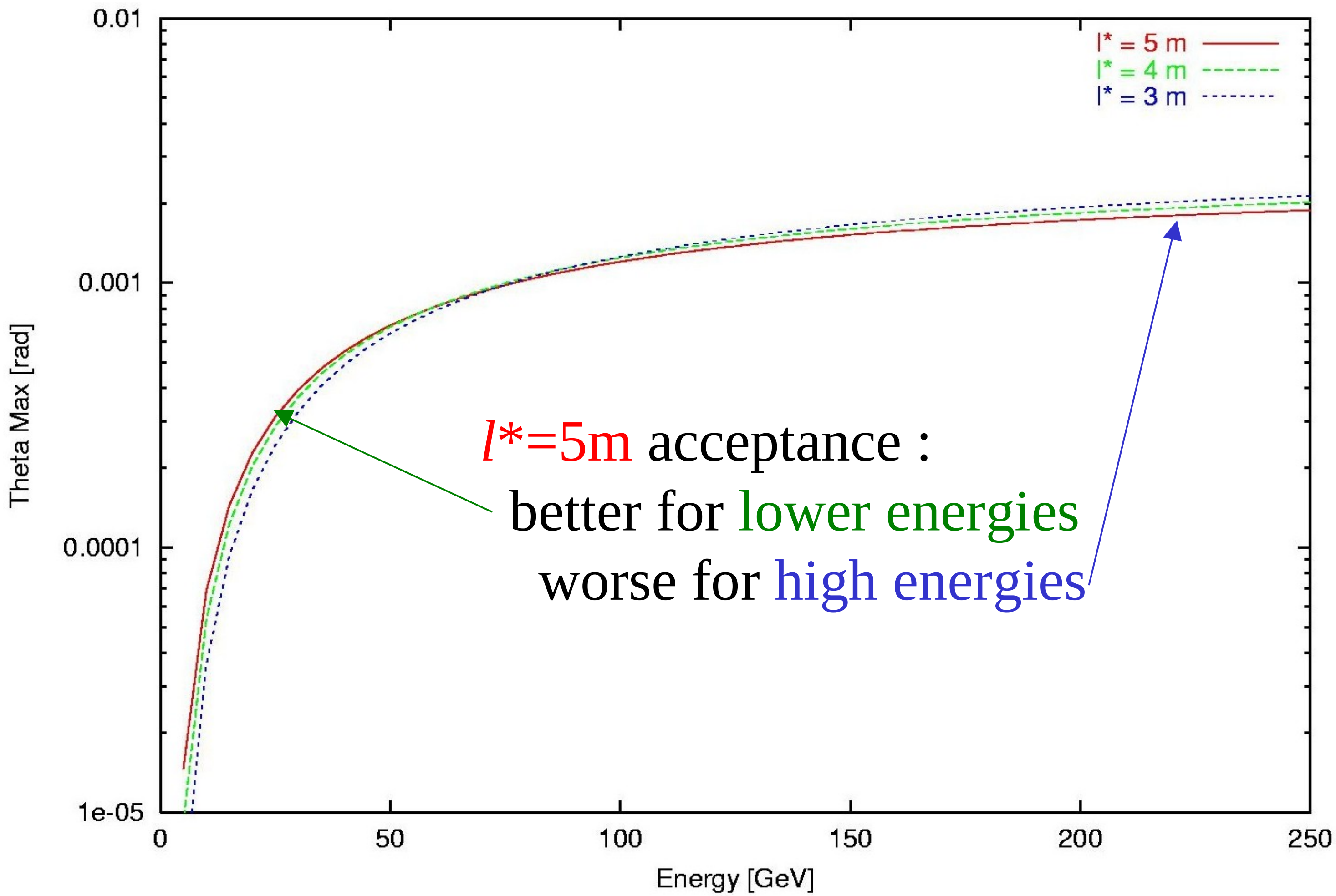
Final doublet acceptance

Θ^*_{max} (E, φ*)

with

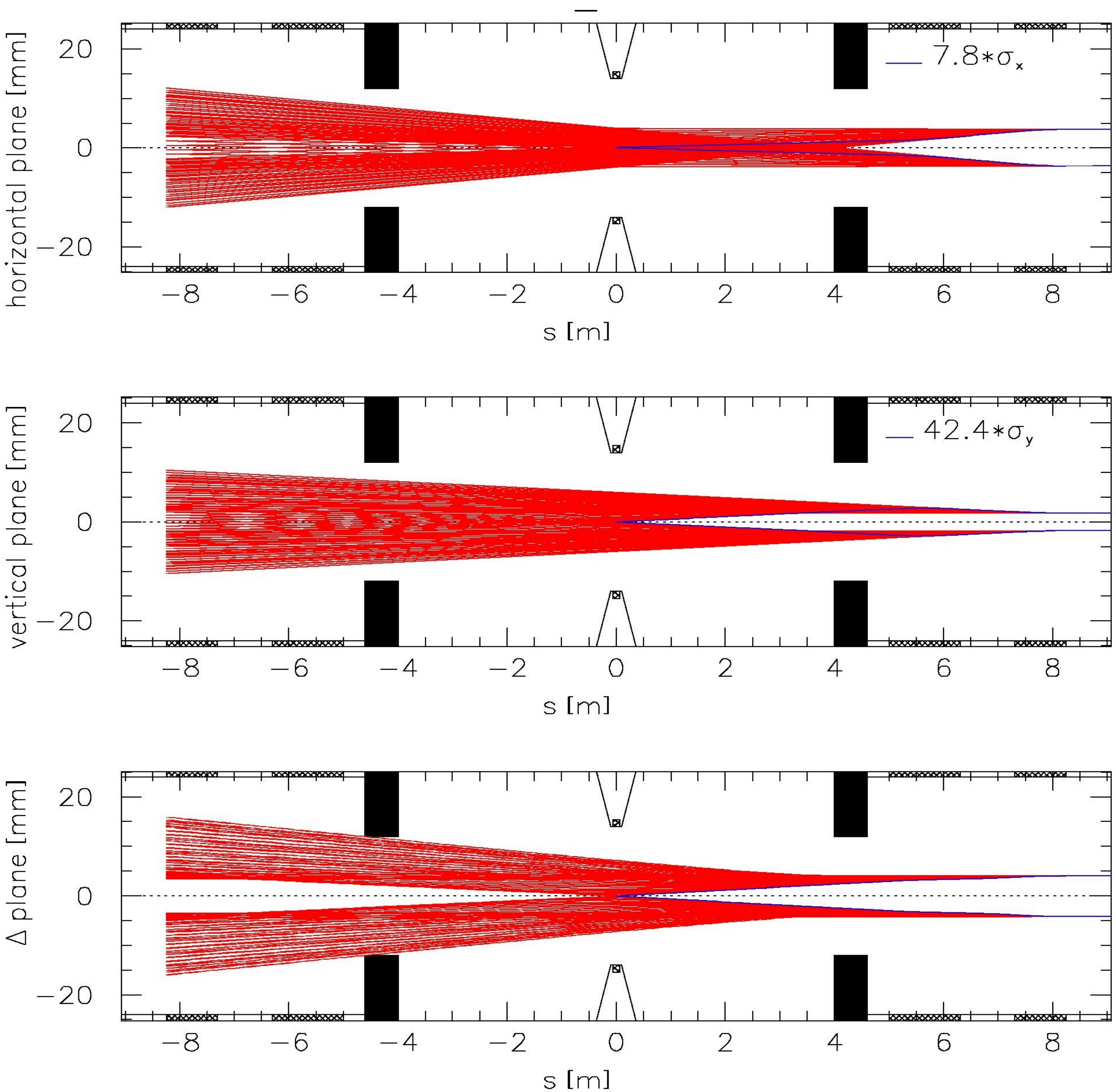
- l^* = 5m
- Φ = 48 mm
- Solenoid B_S = 4 T

Comparison of horizontal acceptances (φ*= 0) for l* = 3,4,5 m



Differences are small. Tracking simulations are needed

Synchrotron Radiation Extraction



Collimation requirements for

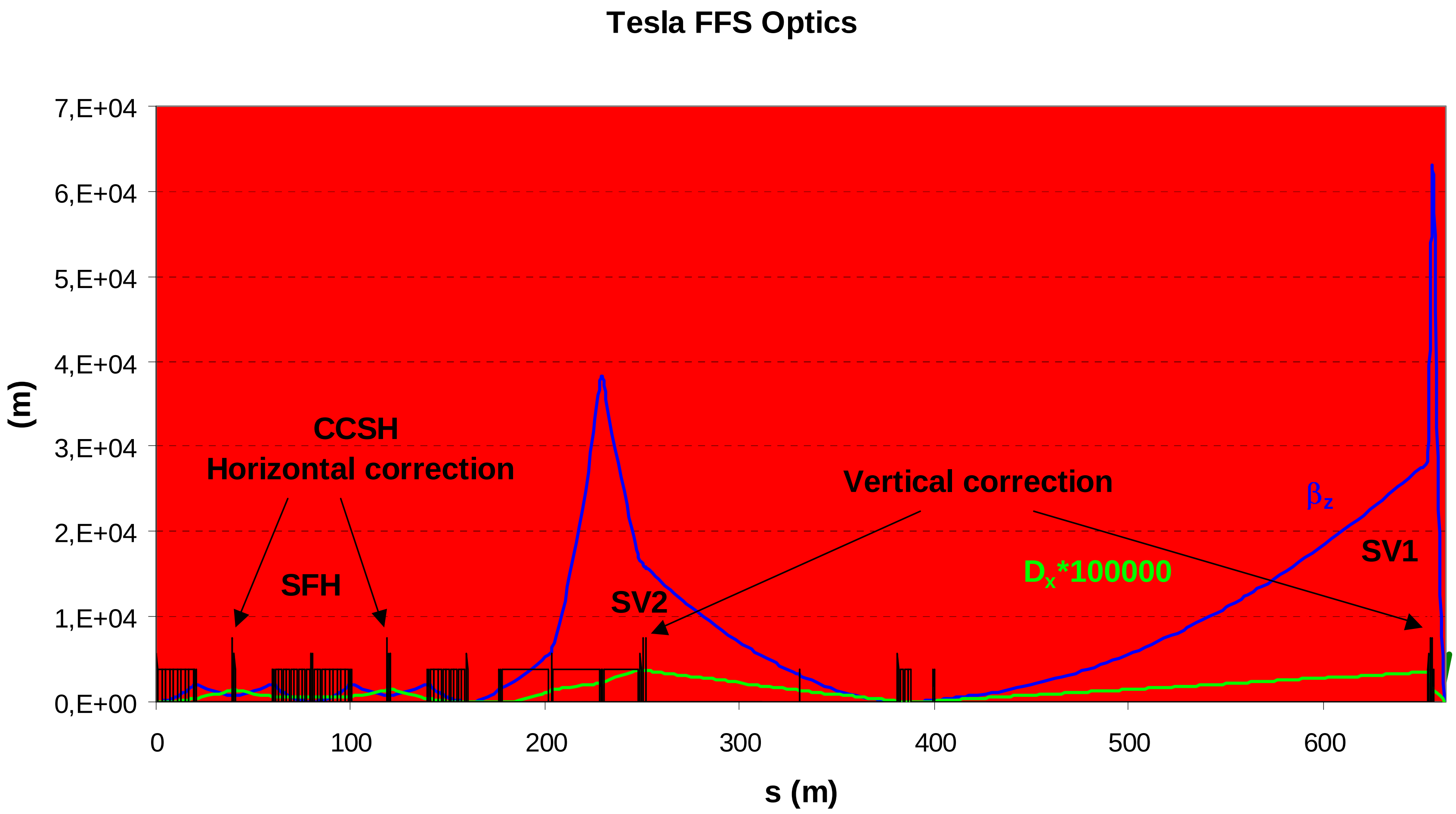
- l^* = 5m
- Φ = 48 mm
- inner mask
    - s = 4 m
    - Φ = 24 mm

Collimation Requirements

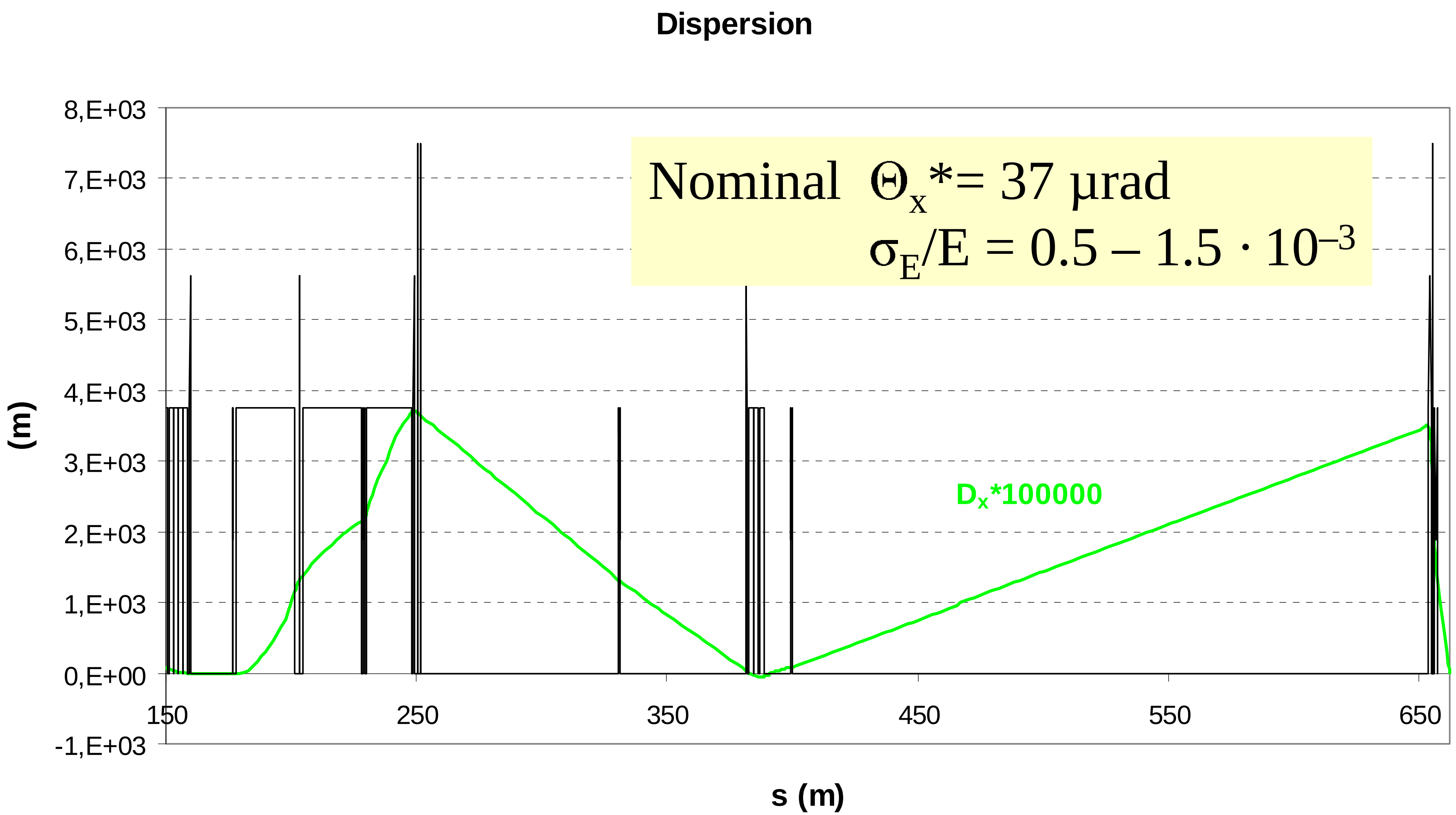
	l^* [m]	s_{mask} [m]	Nx	Ny
TDR	3	2	13	81
New FF	5	2	10	48
New FF	5	4	7.8	42

$\Rightarrow$ new collimation section required
with tail folding by octupoles

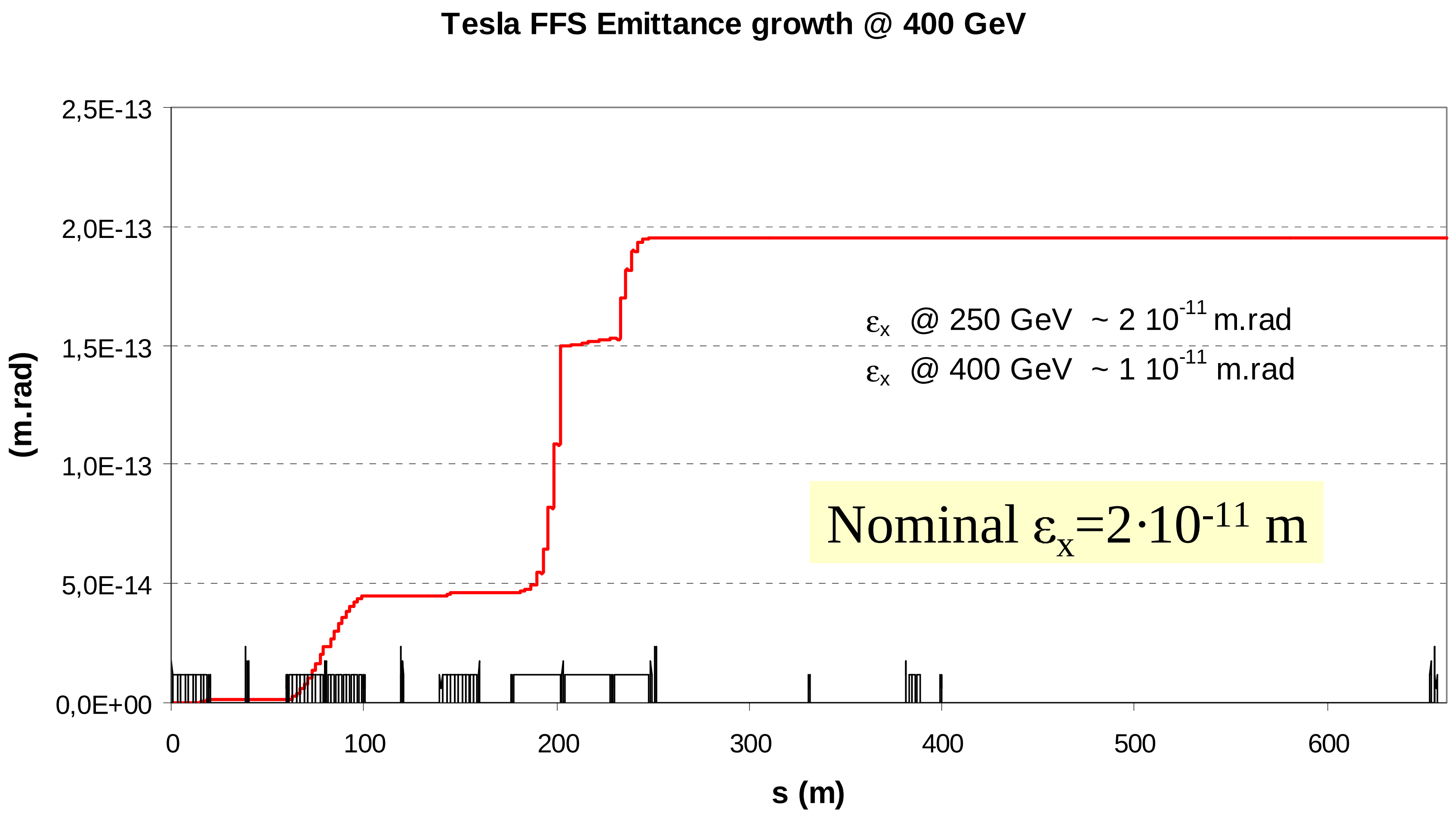
Clear path to the beamstrahlung dump, with *l** = 5 m



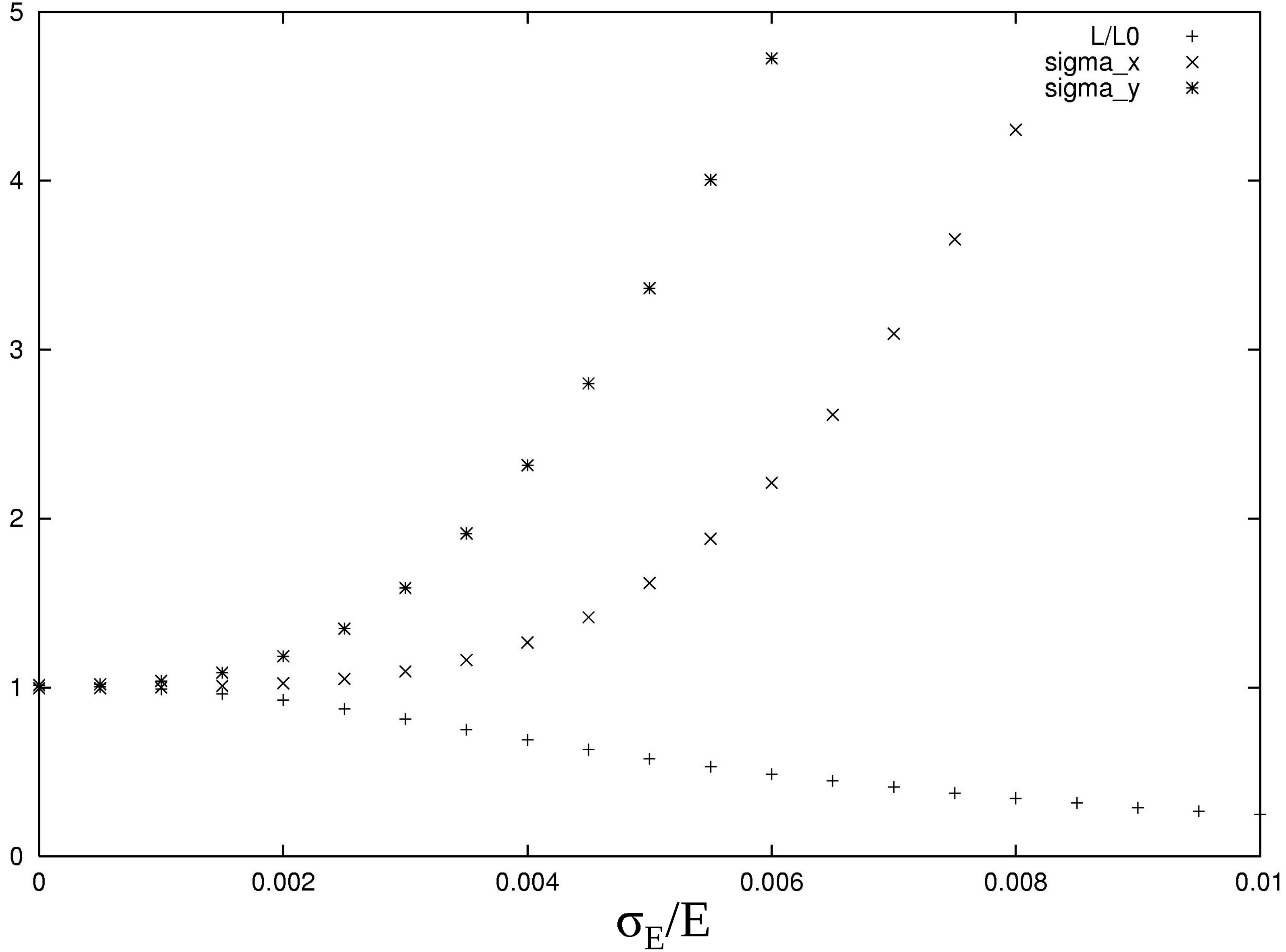
Angular dispersion at the IP
Dx' = 3 mrad



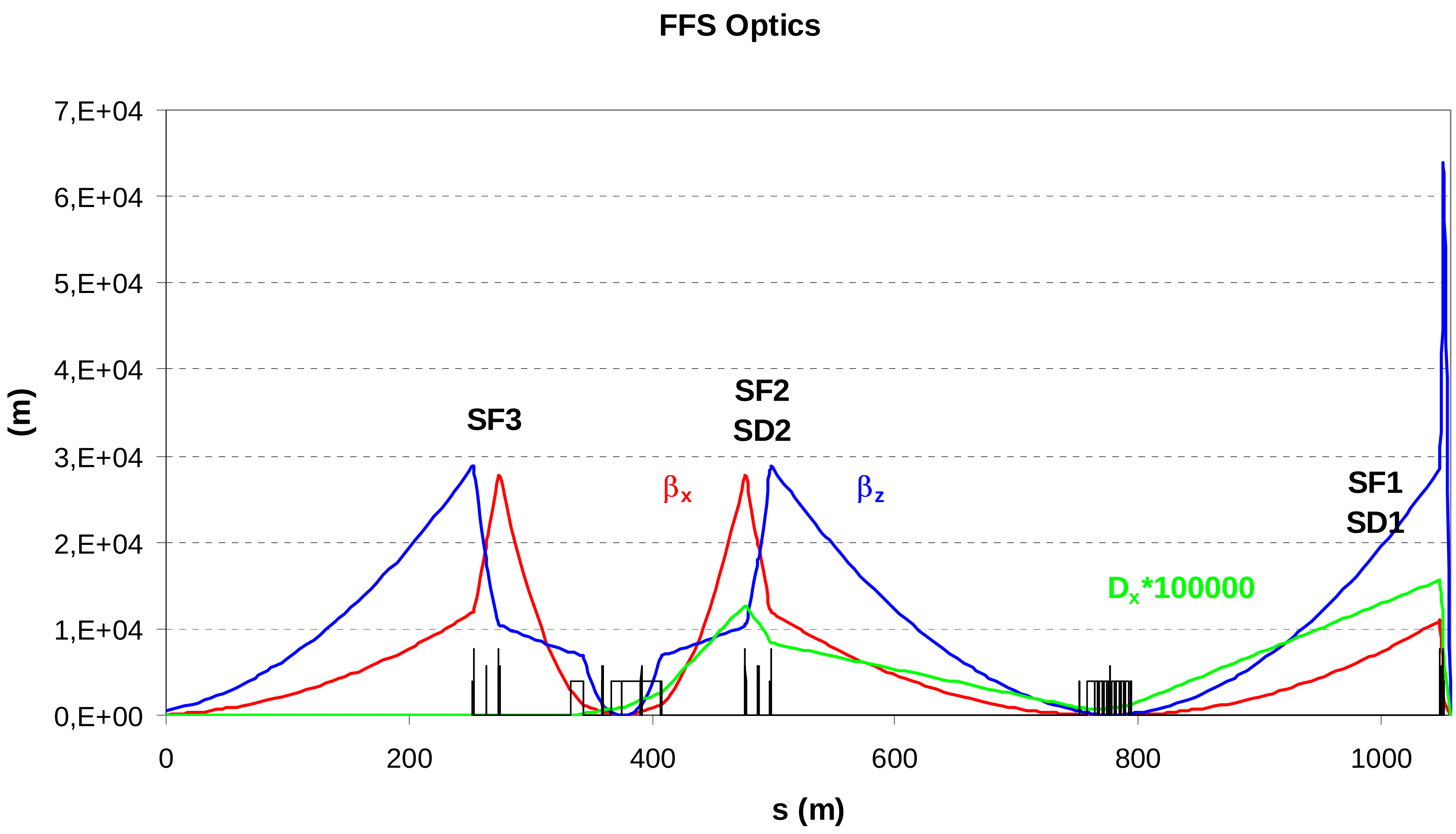
Emittance Growth induced by Synchrotron Radiation



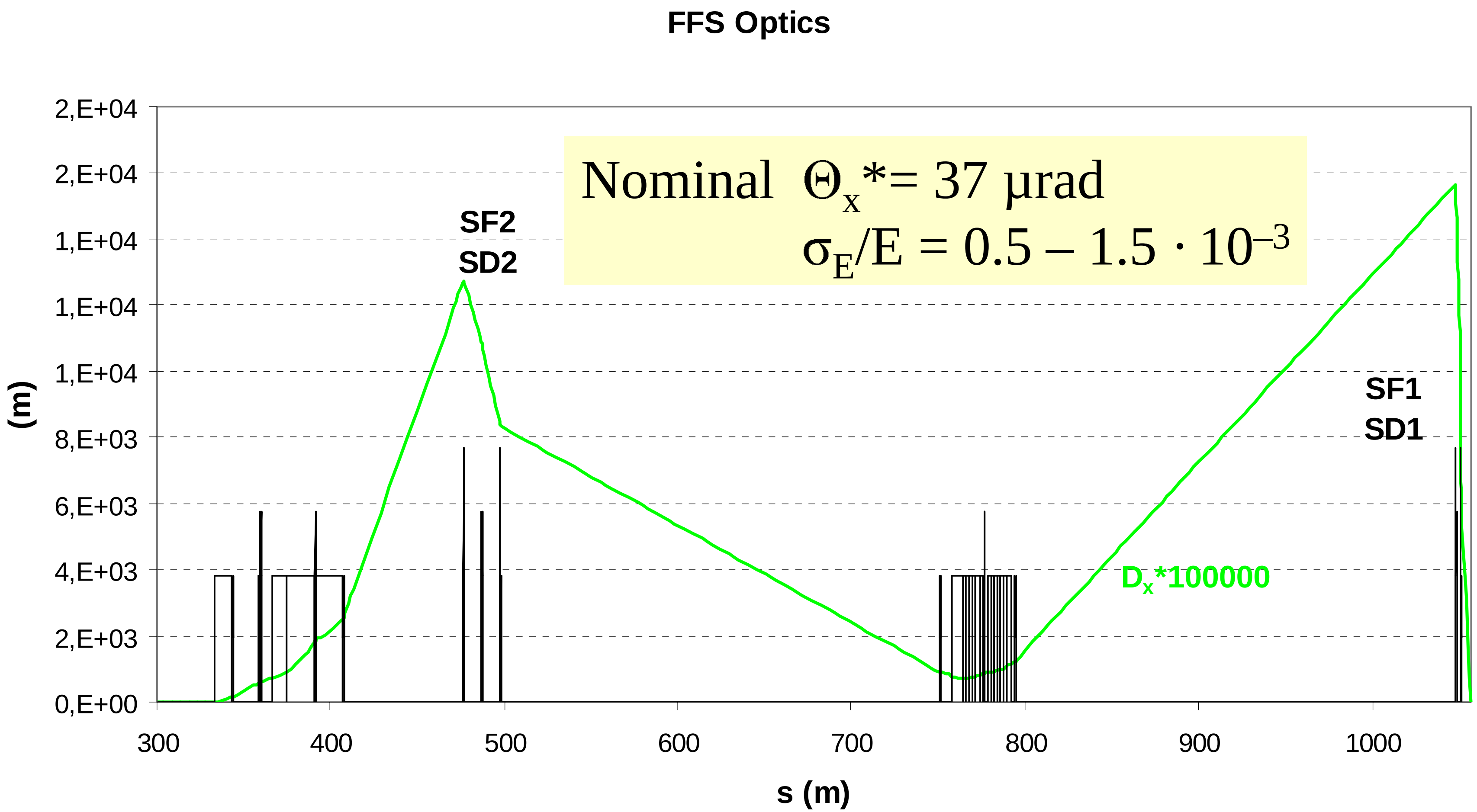
Chromatic Acceptance



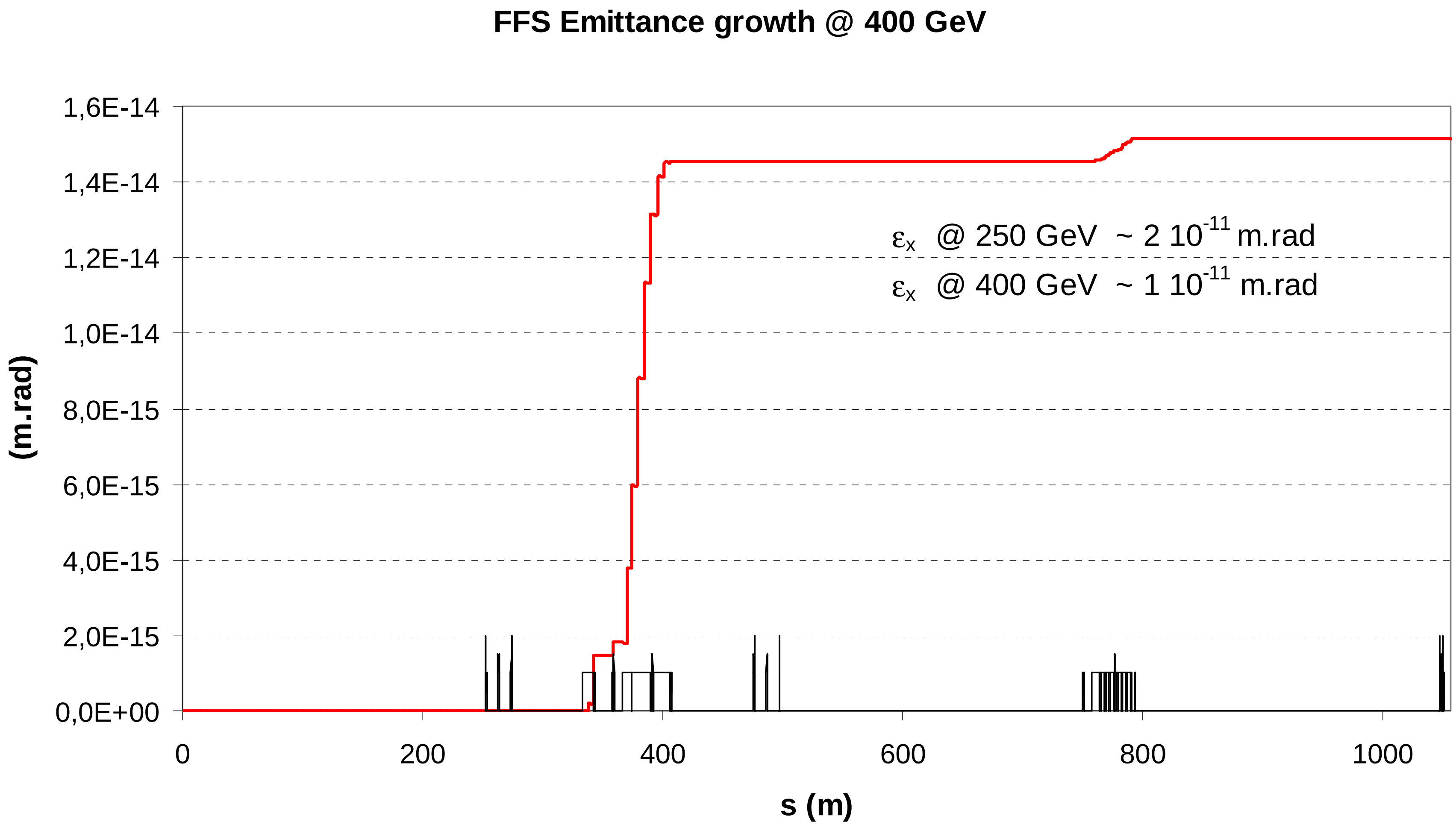
Clear path to the beamstrahlung dump, with *l** = 5 m



Angular dispersion at the IP
Dx’ = 11,7 mrad



Emittance Growth induced by Synchrotron Radiation



Conclusions

- Design for $l^* = 5$ m new optics is in progress
- Several optimisations are still needed

  (w.r.t. to T166 aberrations, sextupole fields, …)
- Beam extraction through final doublet : OK
- Collimation requirements about a factor 2 tighter