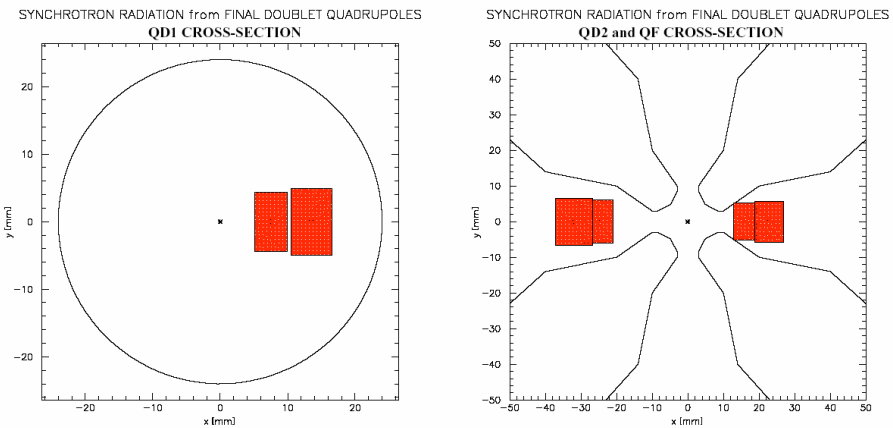
International Linear Collider
at Stanford Linear Accelerator Center

Difficulties of Small Horizontal x-ing

Andrei Seryi

23 September 2004

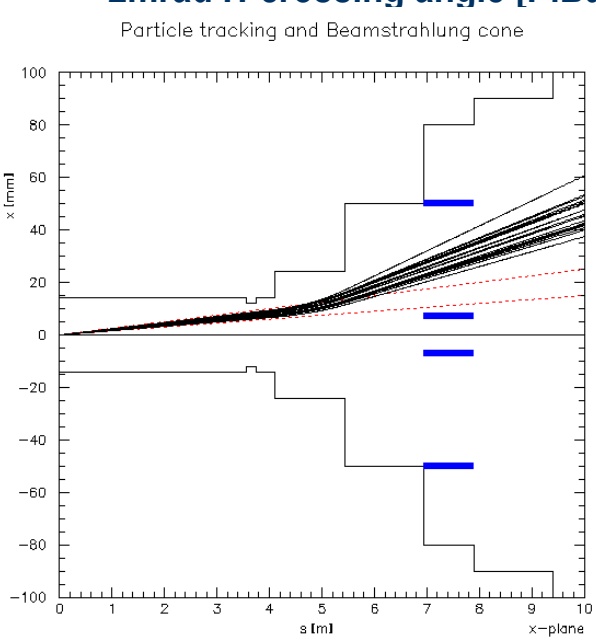
Small H θ_{c1}



(a) (b)

Figure 5: Transverse profiles of the synchrotron radiation at the entrance (small rectangle) and exit (large rectangle) faces of : (a) QD1, (b) QD2 (right) and QF (left) in the extraction line.

Suggested to apply CLIC 97 concept to TESLA and use 2mrad H-crossing angle [P.Bambade et al, 2004]



First look
[R. Appleby, D. Angal-Kalinin, et al, LCWS04]

Design of a final focus system for CLIC in the multi-bunch regime

Olivier NAPOLY
CEA, DSM/DAPNIA/SEA
CEA/Saclay, F-91191 Gif-sur-Yvette Cedex, France

December 10, 1997

Quadrupoles	Length [m]	Aperture diameter [mm]	Gradient [T/m]
QD1	1.2	48	250
QD2	1.378	13.7	219
QF	1.330	13.7	219
last drift	1.5		
between quads	0.50		

Table 2: Doublet parameters

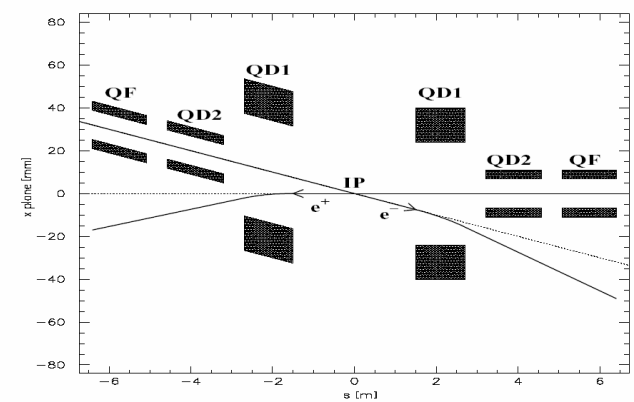


Figure 3: Magnet layout with a 5 mrad crossing-angle. The e^+ and e^- orbits (solid lines) correspond to the nominal energy of 250 GeV.

Need detailed main beam and halo background analysis

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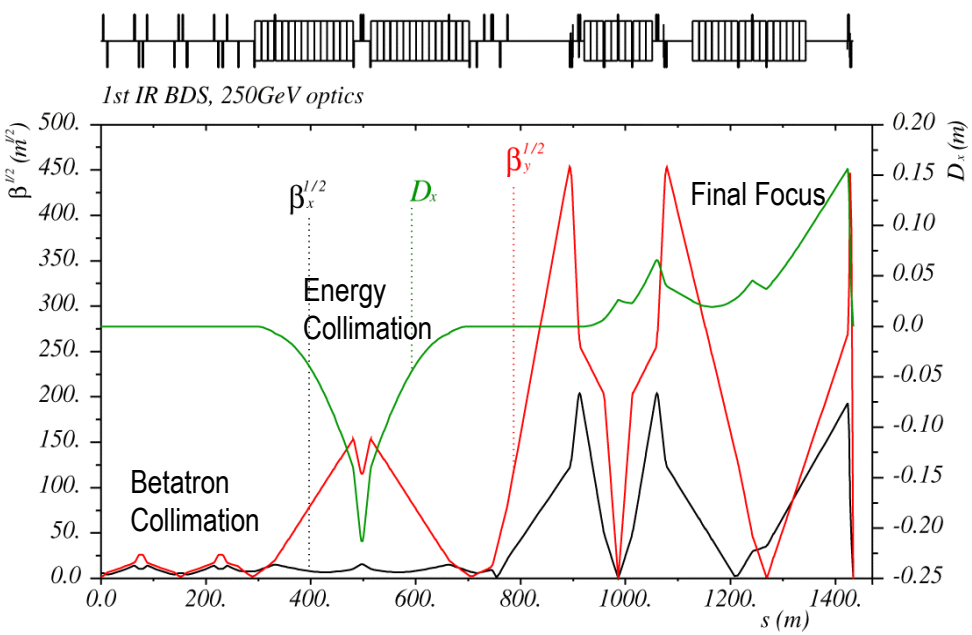
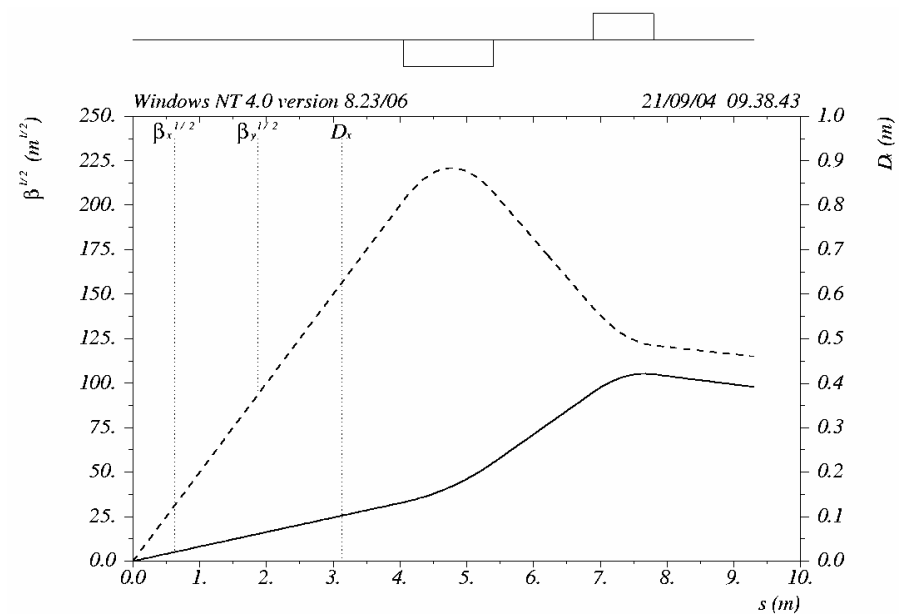
Check small H x-ing

- The small H x-ing idea needs to be checked with beam halo tracking
- The following study uses simple ray tracing, to determine photon trajectories
- More detailed and accurate analysis is being done with Geant by Takashi Maruyama

Assumptions

- NLC BDS optics is used upstream of IP
- L*=4.05 m FD is used downstream of IP
- Beam halo tracking is done with Turtle





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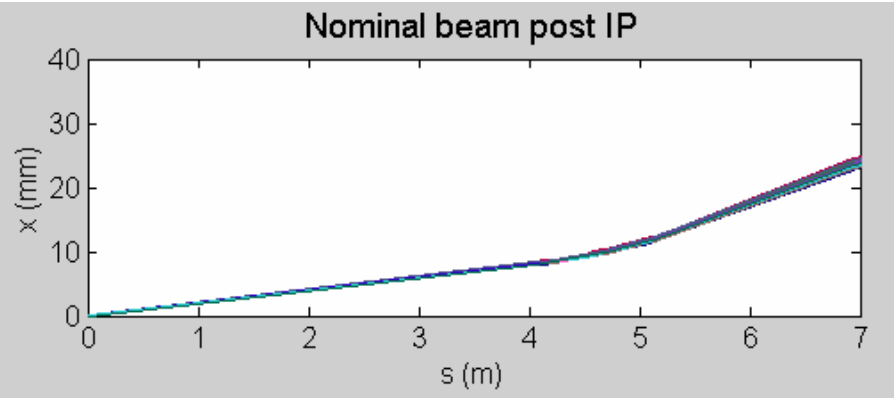
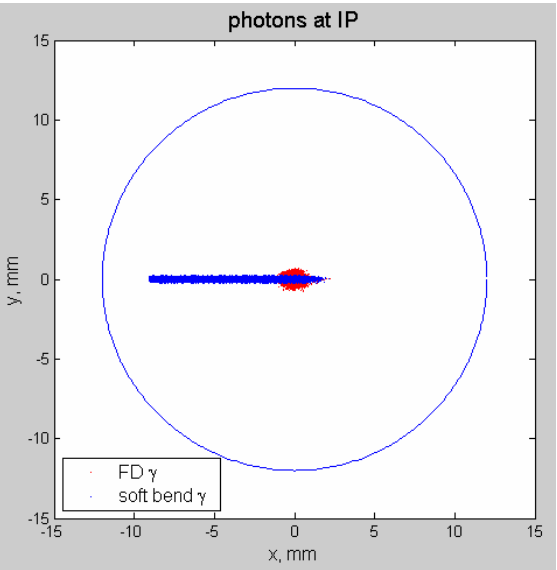
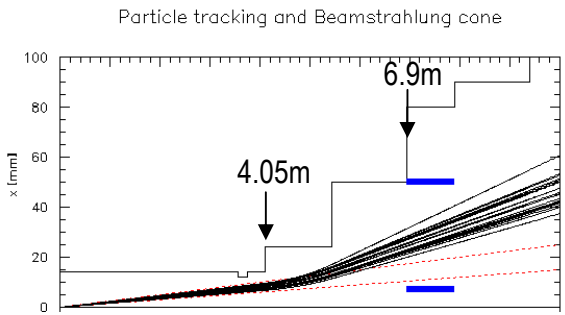
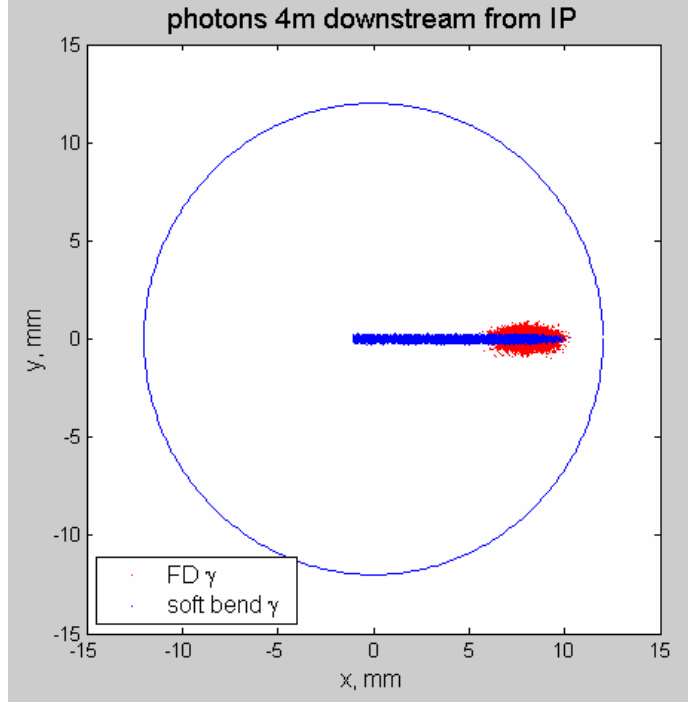
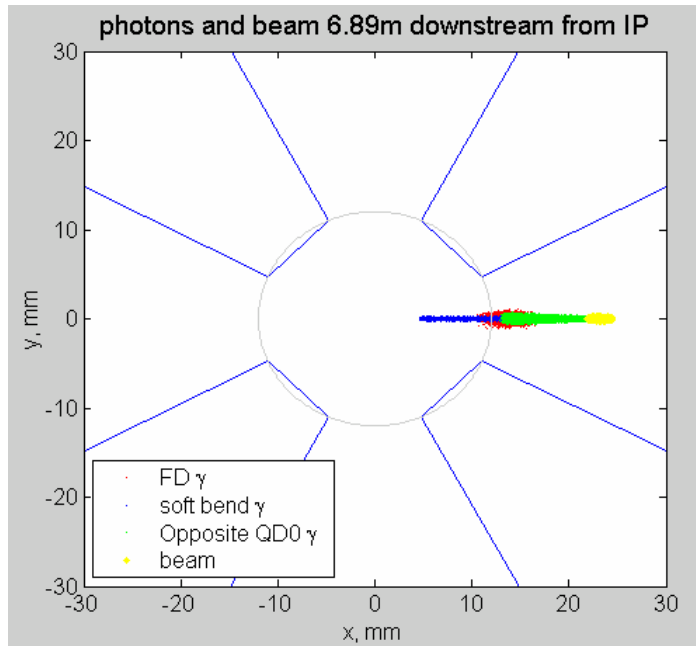
Nominal beam and γ past IP











Red: FD γ, Blue: soft bend γ, Green: opposite QD0 γ, Yellow: beam

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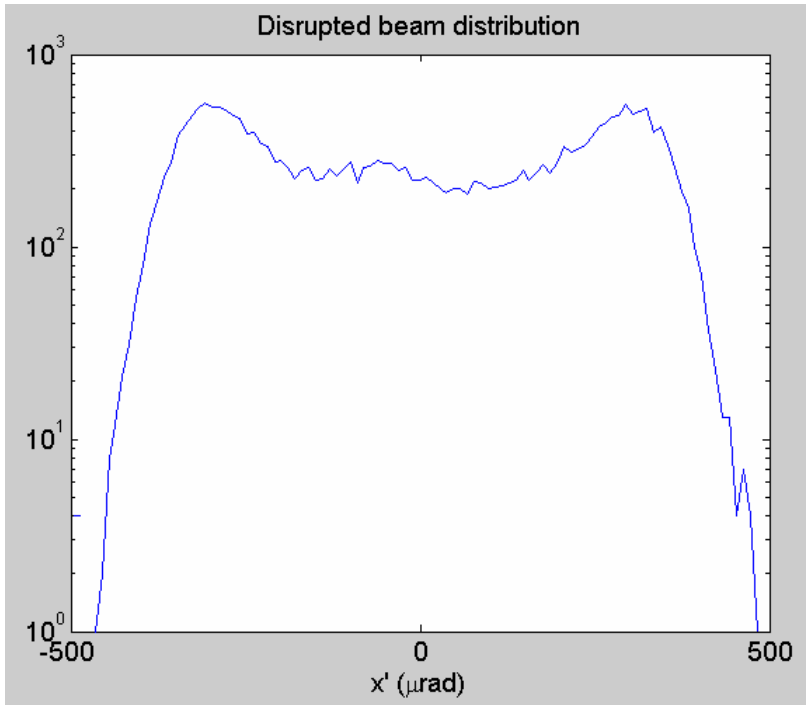
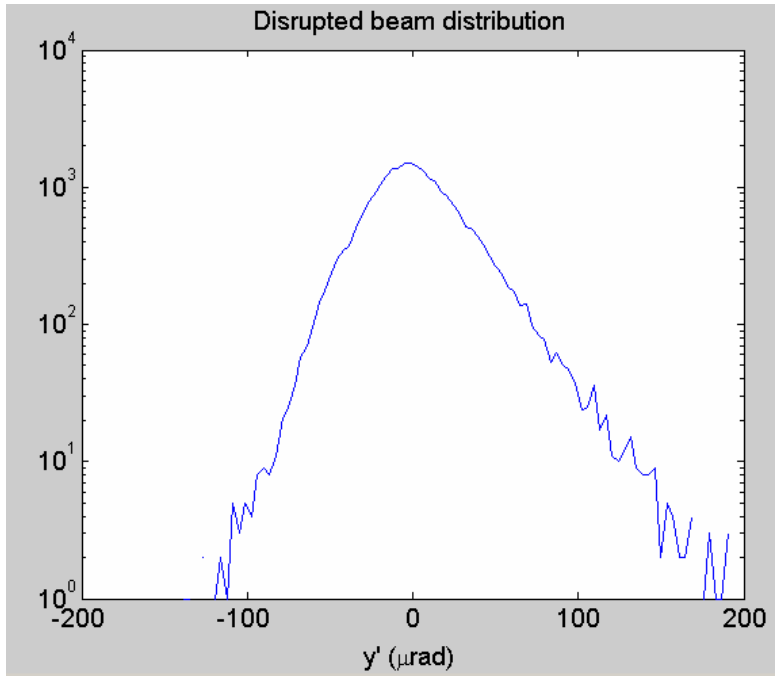
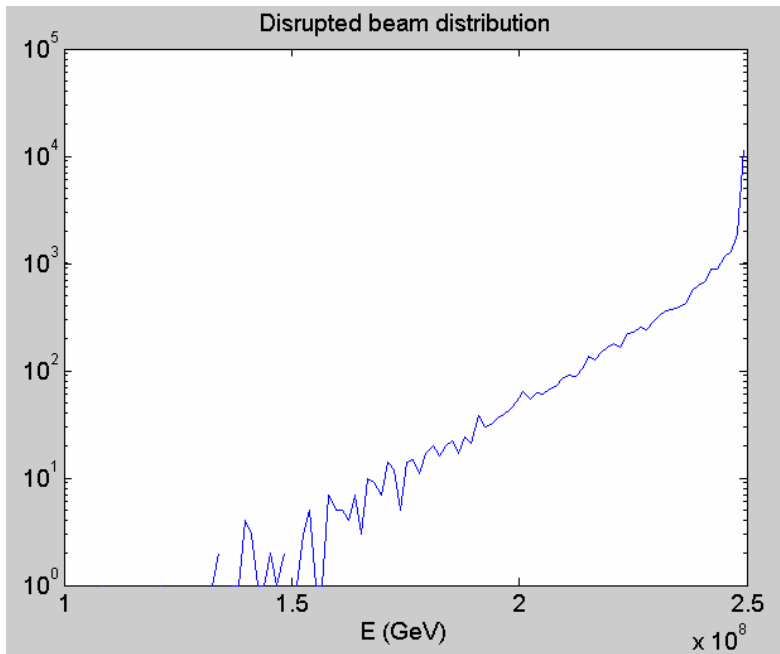
Disrupted beam distributions





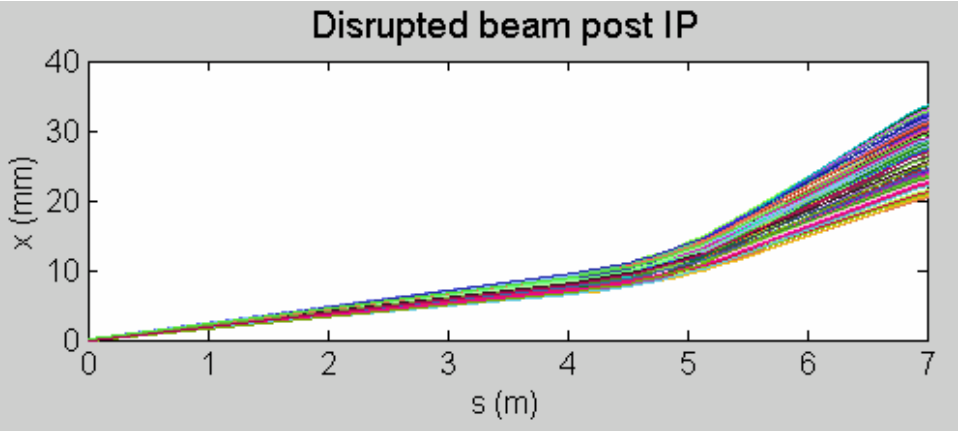


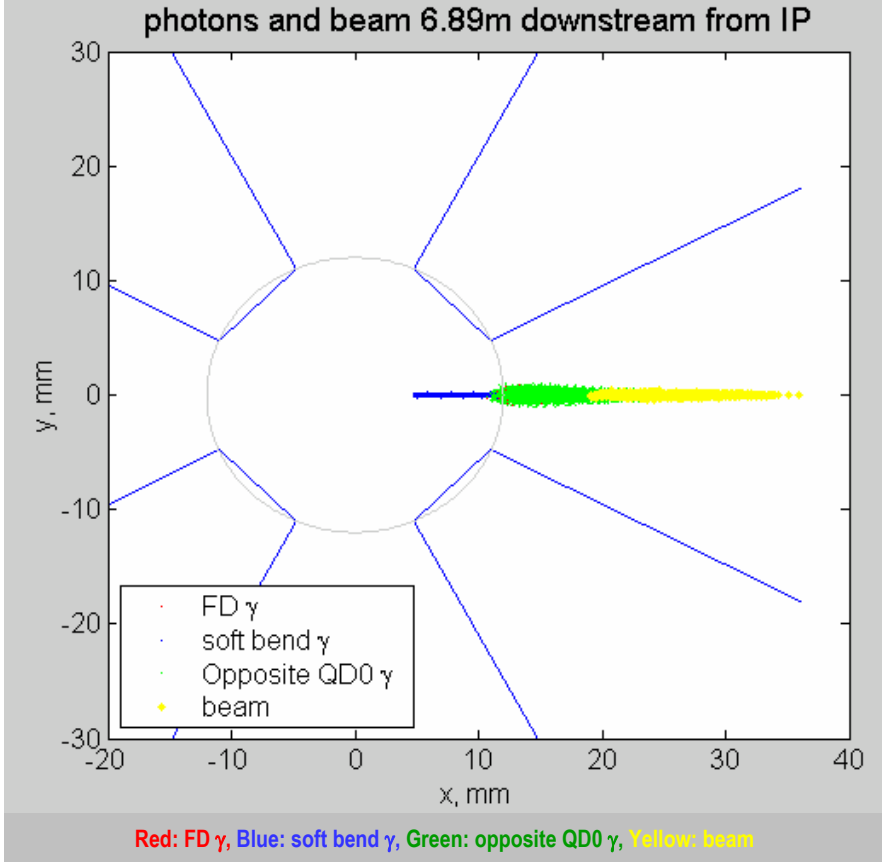
Nominal TESLA IP parameters, ideal beam, GP

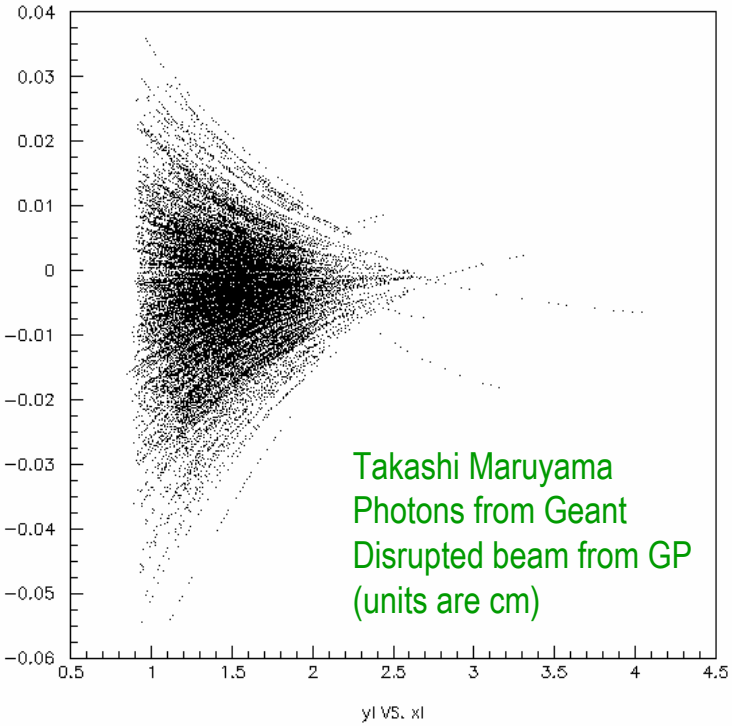
To crudely model this beam in Turtle tracking, modify the beam at IP by reducing energy by 20% and adding rms spread of

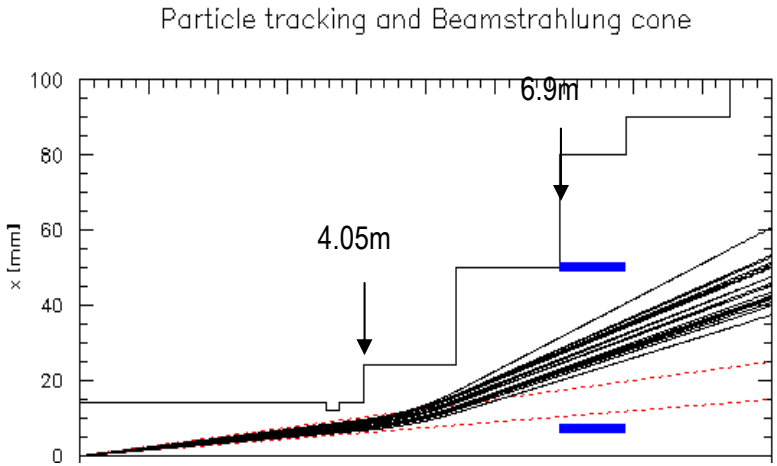
$\Delta\sigma_{x'}$ =400μrad, $\Delta\sigma_{y'}$ =100μrad, $\Delta\sigma_E$ =20%

"Disrupted" beam and γ past IP









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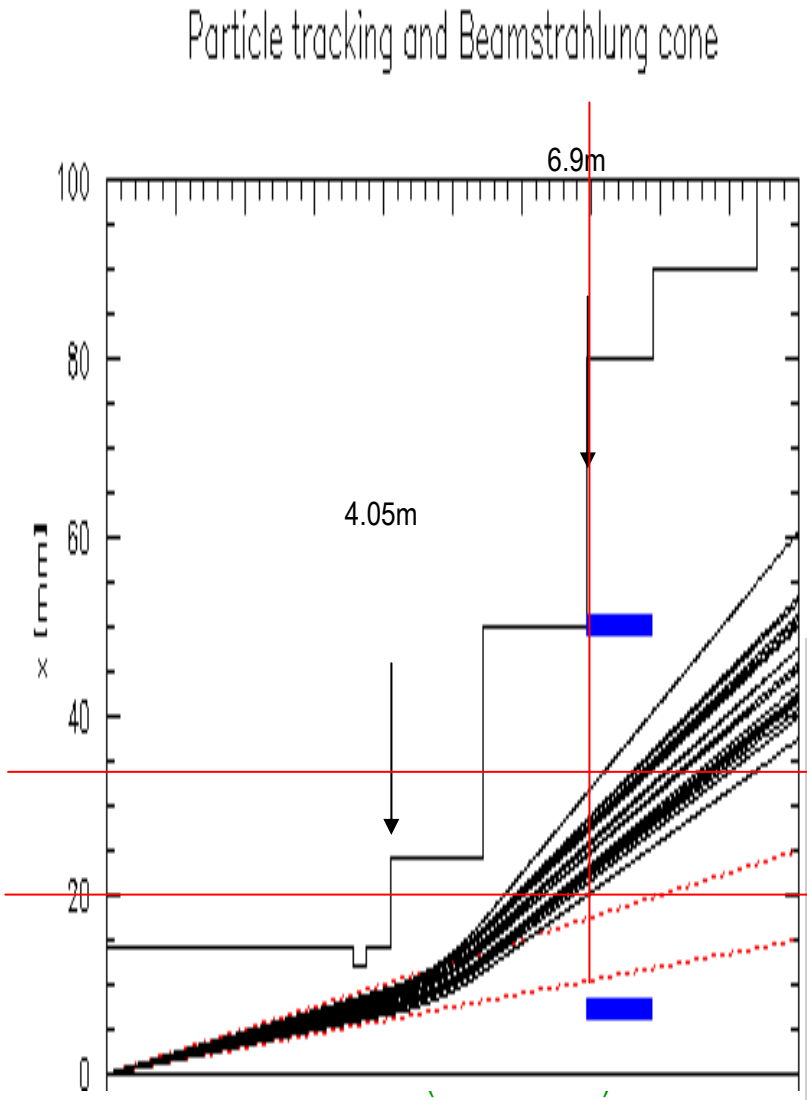
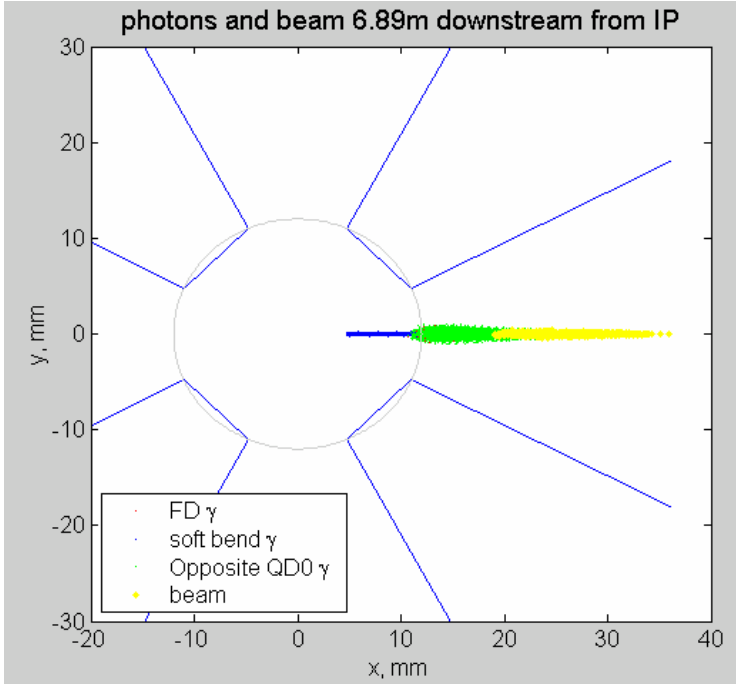
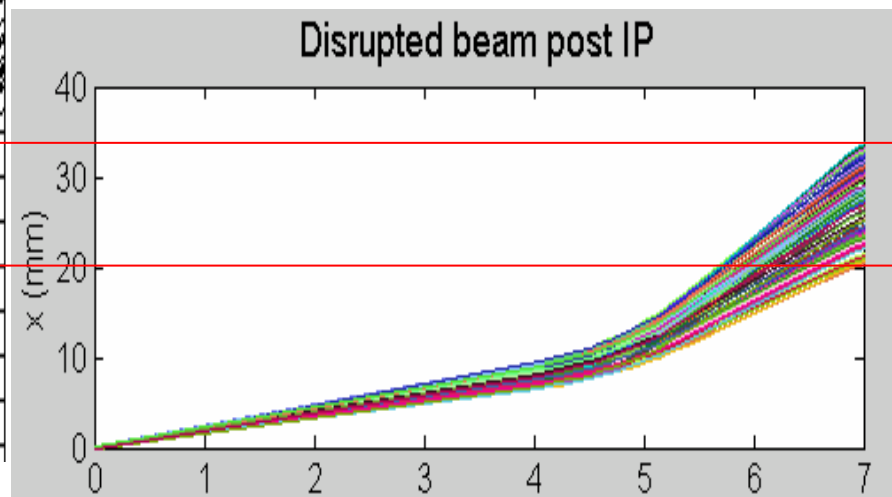
"Disrupted" beam and γ past IP







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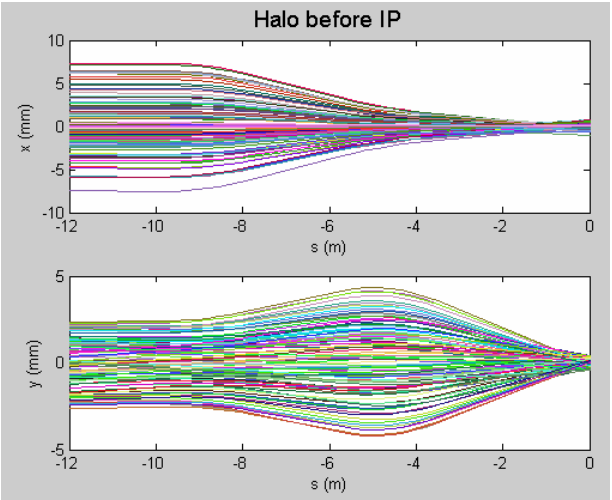
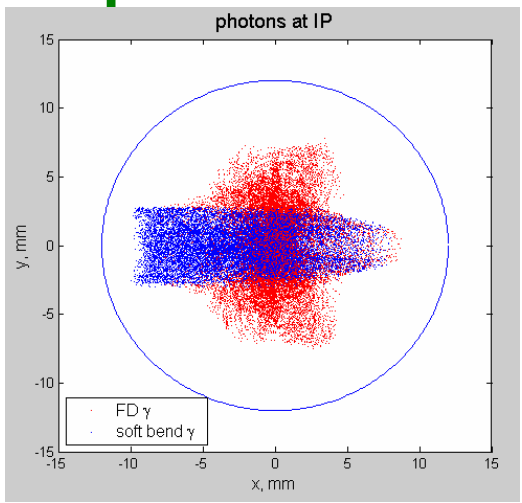
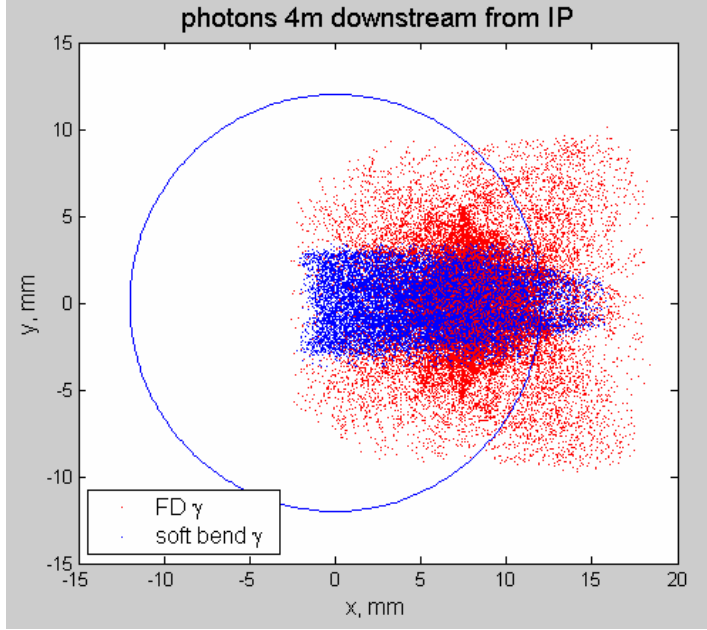
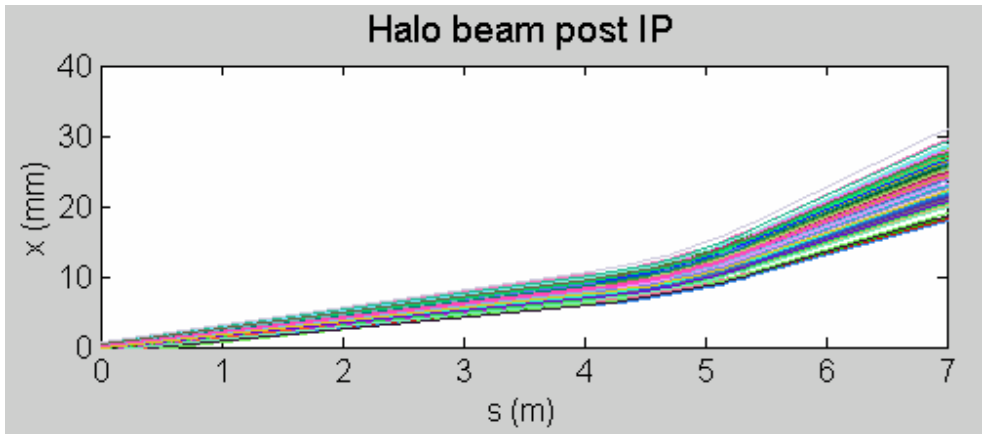
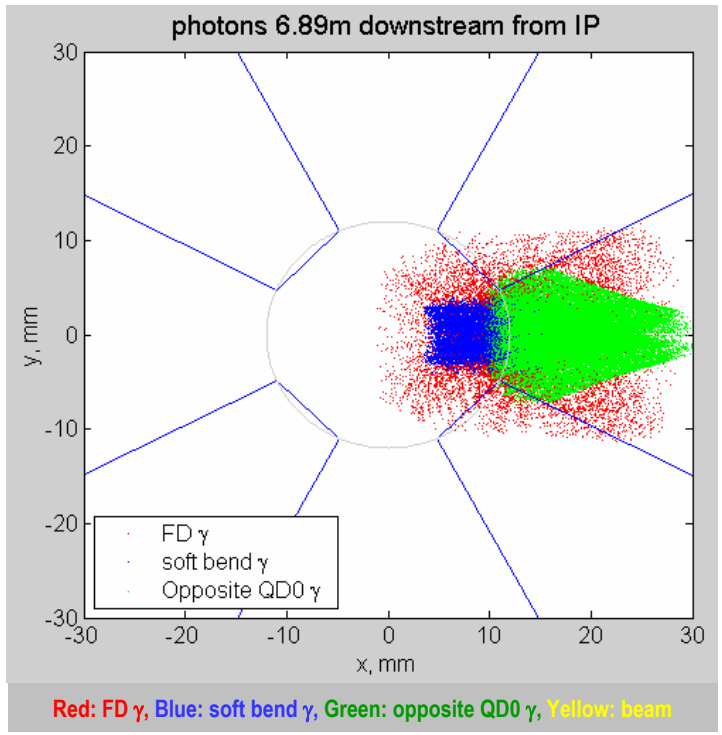
Halo and γ before and past IP



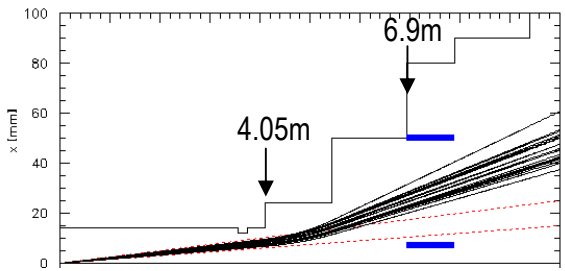








Particle tracking and Beamstrahlung cone



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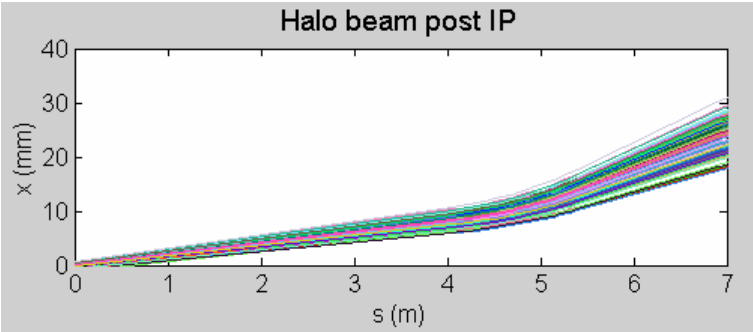
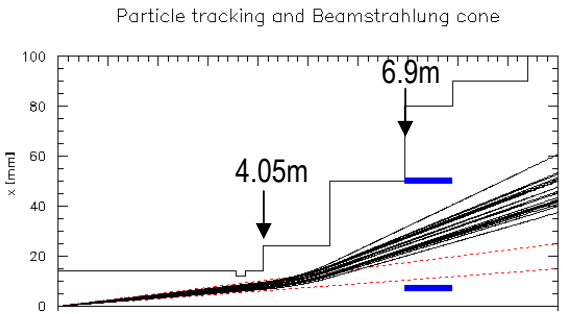
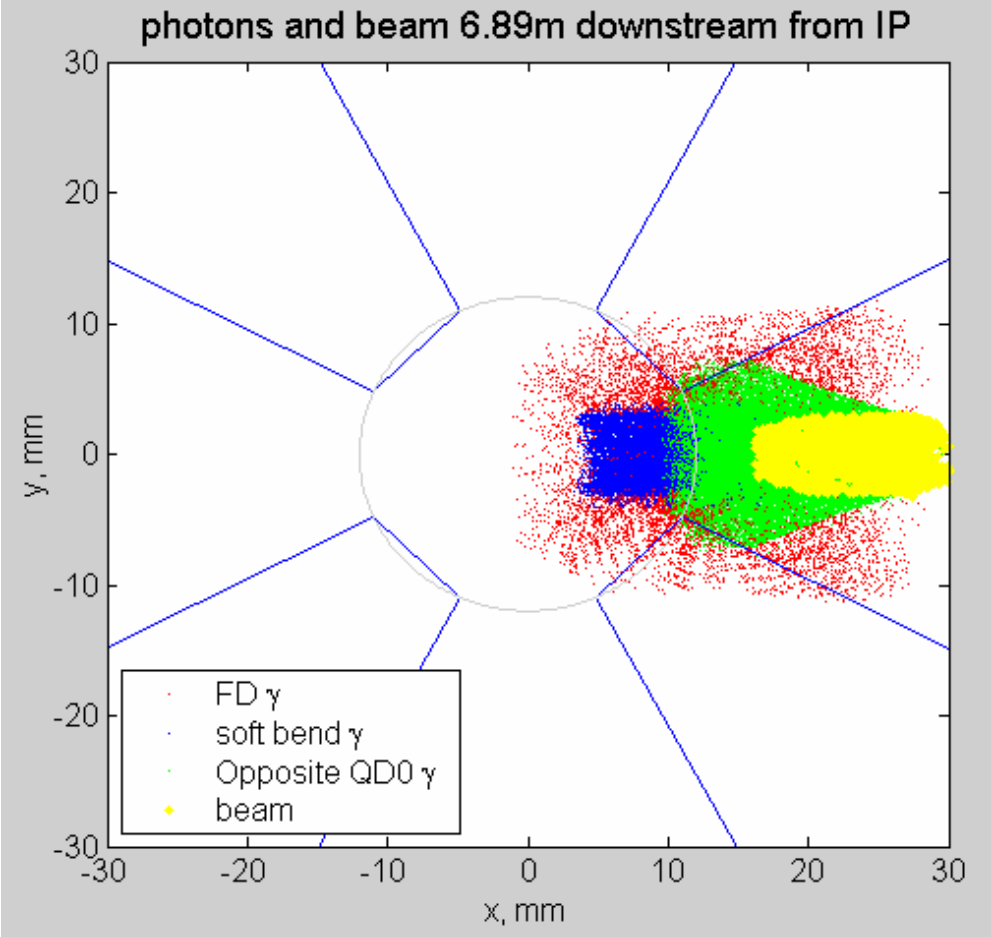
Halo and γ past IP







Is it possible to shape the poles or increase QF1 aperture to avoid losses of the beam on the poles?

Opening the QF1 aperture would create field in the region of the beam, which would deflect it back to the beamline.

Is it possible to collimate the beam tighter by more that a factor of two?

It would create many other problems.

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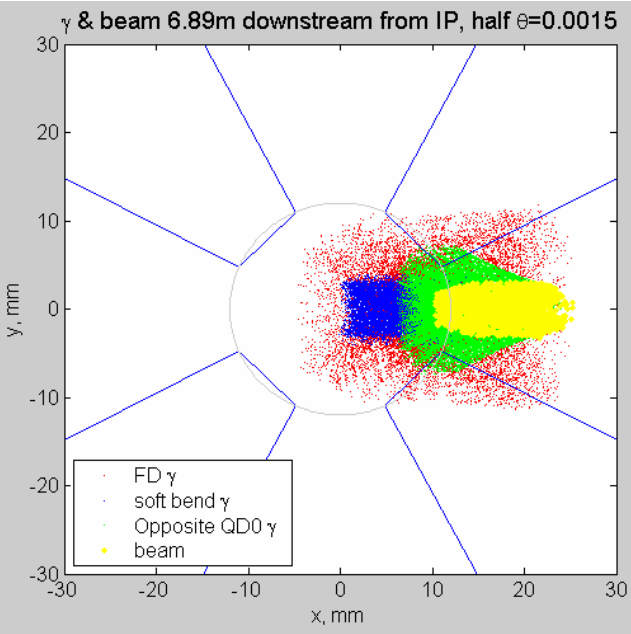
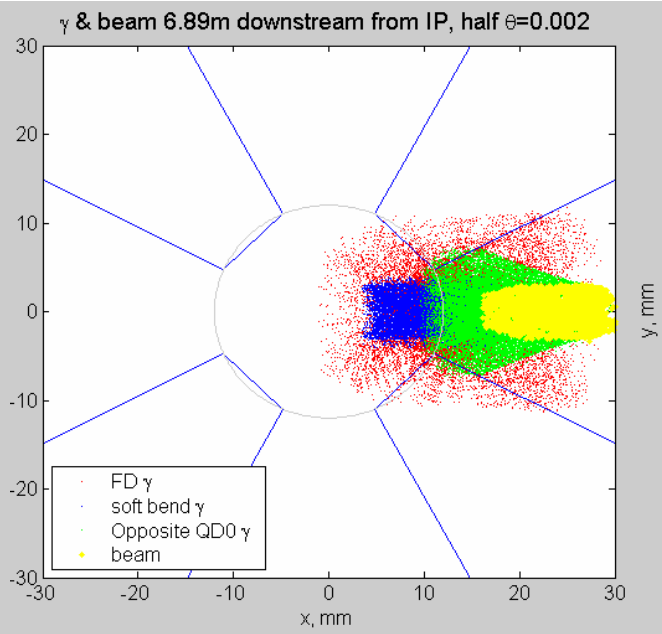
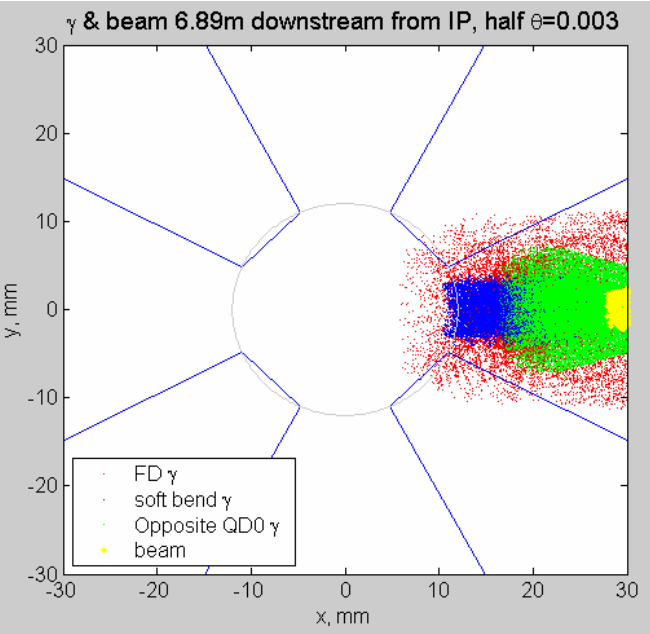
Halo and γ past IP vs crossing angle







Red: FD γ, Blue: soft bend γ, Green: opposite QD0 γ, Yellow: beam

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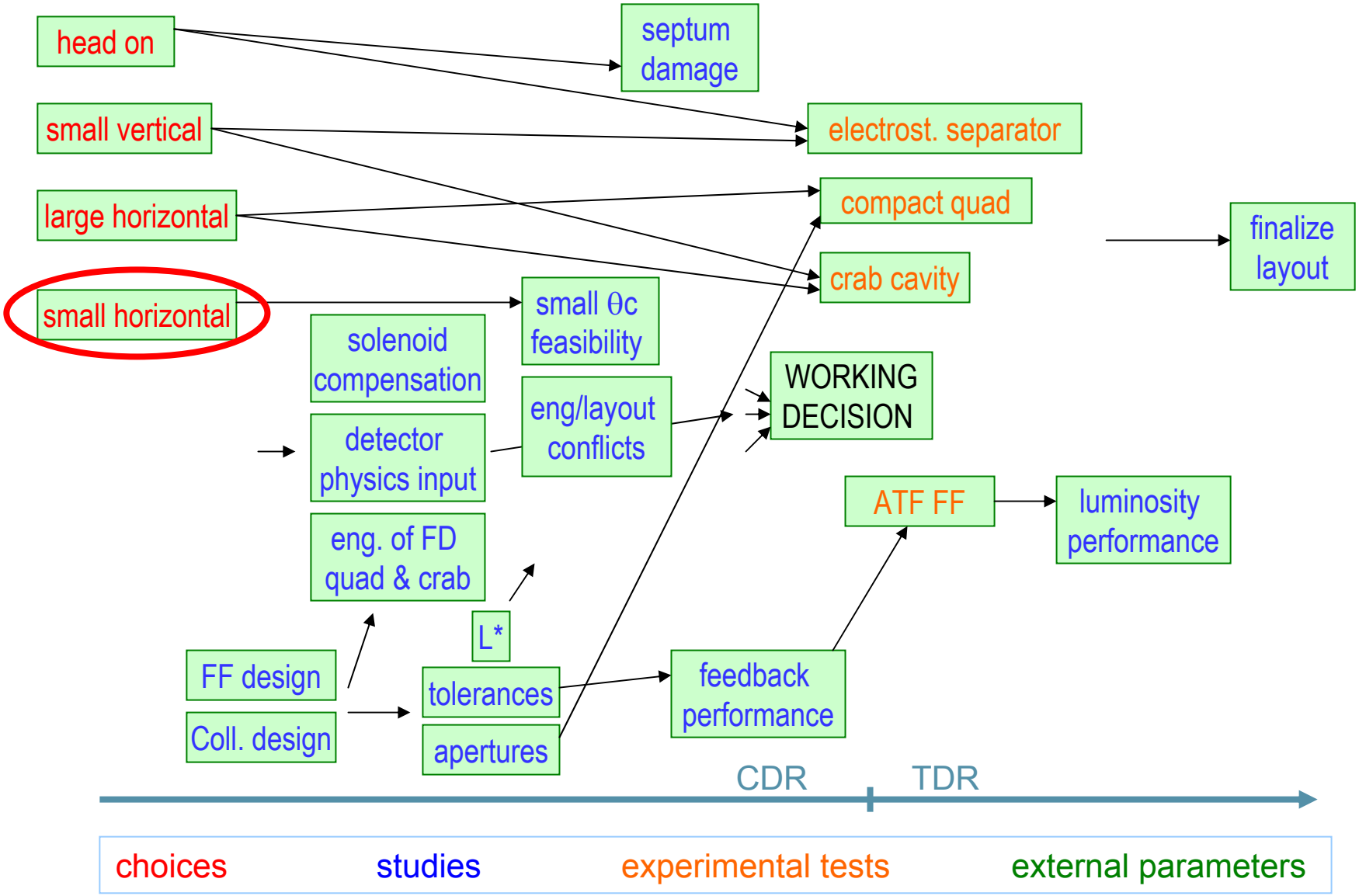
Most likely, small H x-ing is not viable

θ_{c1} : 0 / V0.3mrad / H2mrad / H6-20mrad



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Summary

- Preliminary studies show that, most likely, small horizontal x-ing (4mrad total angle), with beam going between QF1 poles, is not a viable solution
- Ongoing studies with Geant will give more info to make a well justified decision