tau Charm IR layout

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La Biodola 2013

Requirements

- Image point of the IP 10 m downstream the IP
- QD0 and QF1 as long and weak as possible
- QD0 and QF1 as wide as possible
- l* as short as possible
- Work hypothesis PM made of Sm Co (Remnant field 1.1 Tesla, conservative assumption)

Quadrupoles: Halbach configuration

r_{in} set by the beam stay clear, r_{out} set by the requiredgradient

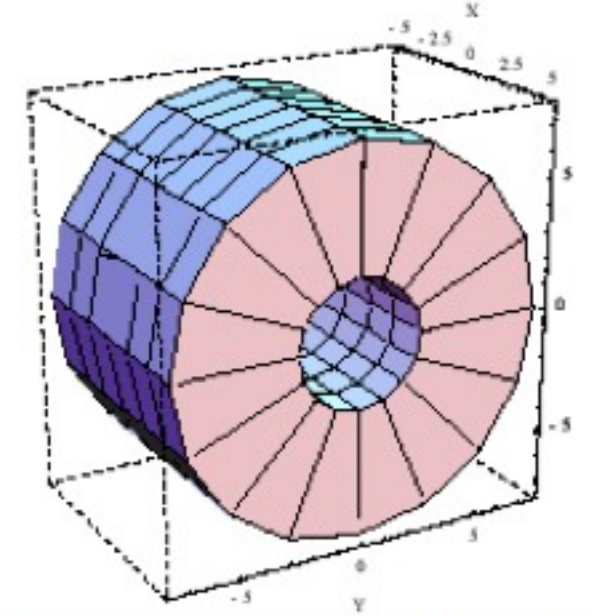
$$\frac{\partial B_y}{\partial x} = 2\,B_r\left(\frac{1}{r_{\text{in}}} - \frac{1}{r_{\text{out}}}\right)$$

Remnant Field B_r	12.2 kG
Coercive Force H_c	11.7 kOe
Intrinsic Coercive Force H_{ci}	23 kOe
Maximum Energy	36 MGOe
Recoil Permeability	1.05
Density	7.5 g/cm^3
Electric Resistivity	$2.0 \times 10^{-4}\Omega \cdot cm$
Temp coefficient of B_r	$-0.1\ \%/^0C$
Curie Temperature	$310\ ^0C$

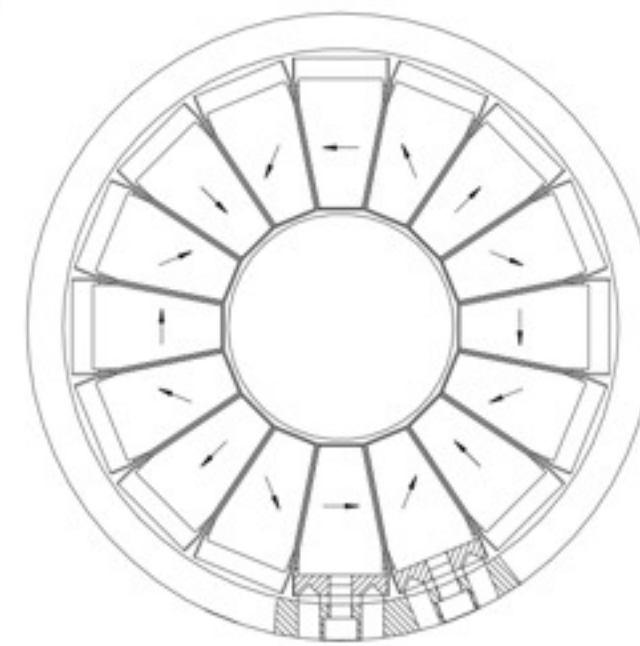
Table 1: Typical characteristic for NdFeB 36SH.

	r_i cm	r_o cm	Pole Field kG	k m^{-2}
Front Section	3.35	6.40	9.7	1.64
Outer Section	3.35	7.04	10.7	1.81

Table 2: Quadrupole magnetic strength.



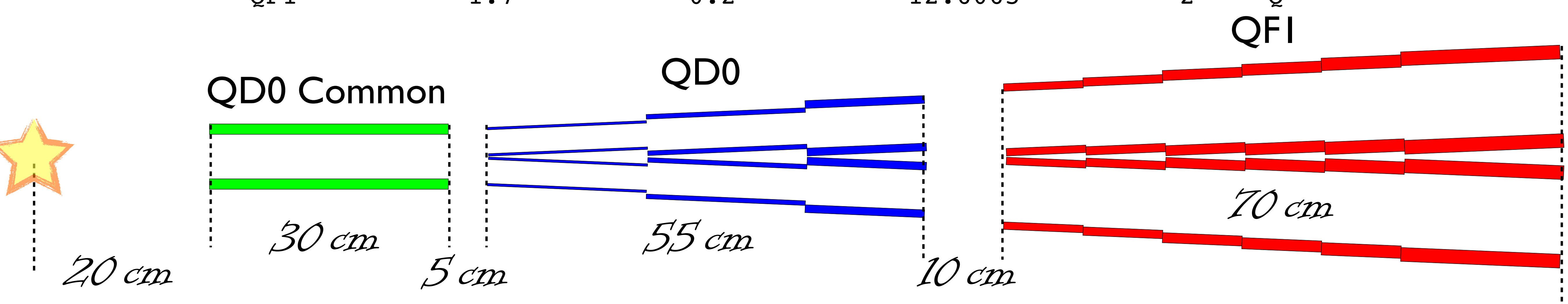
UCLA PMQ RADIA model



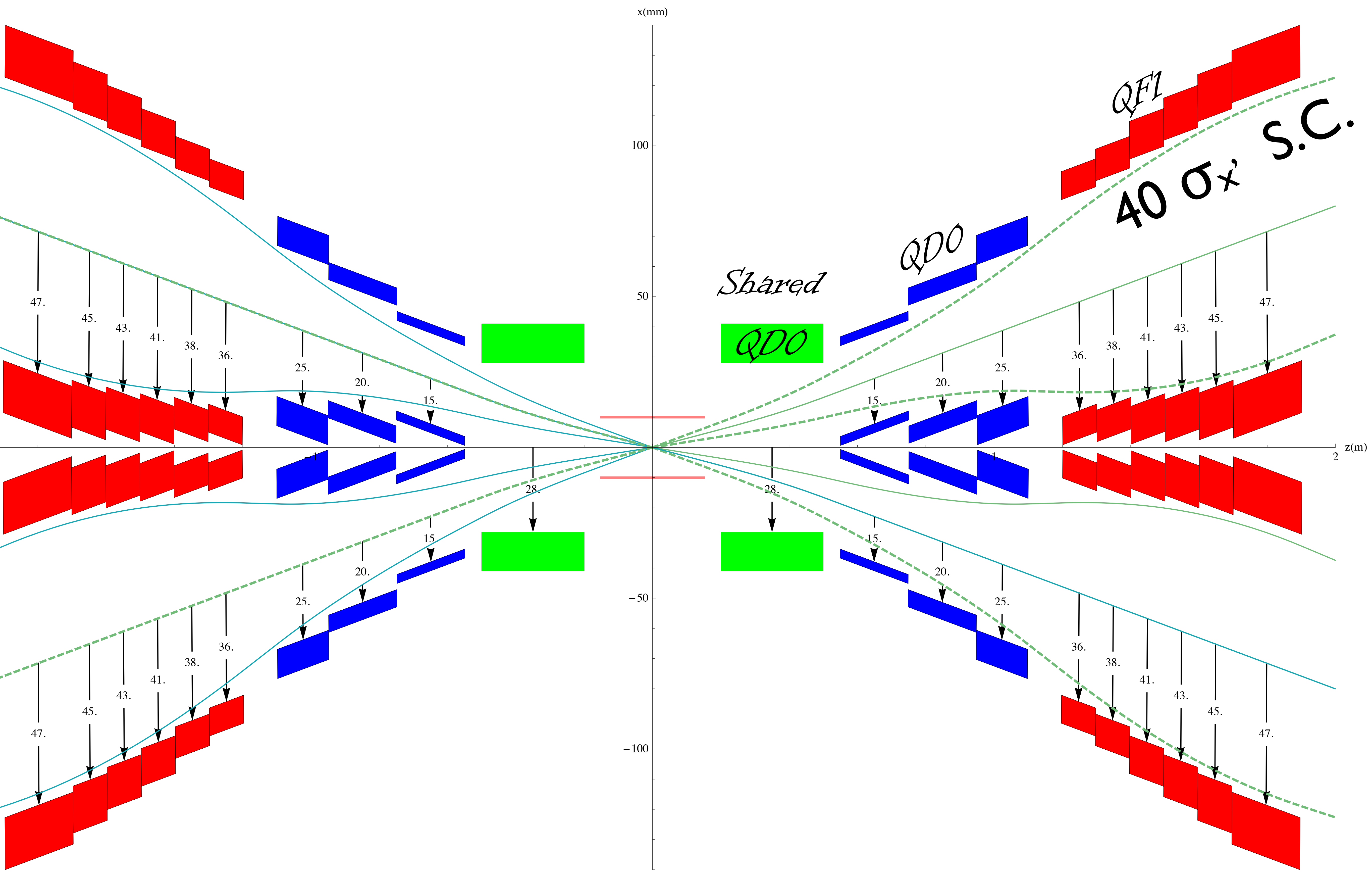
CESR collider final focus PMQ cross-section

First Attempt

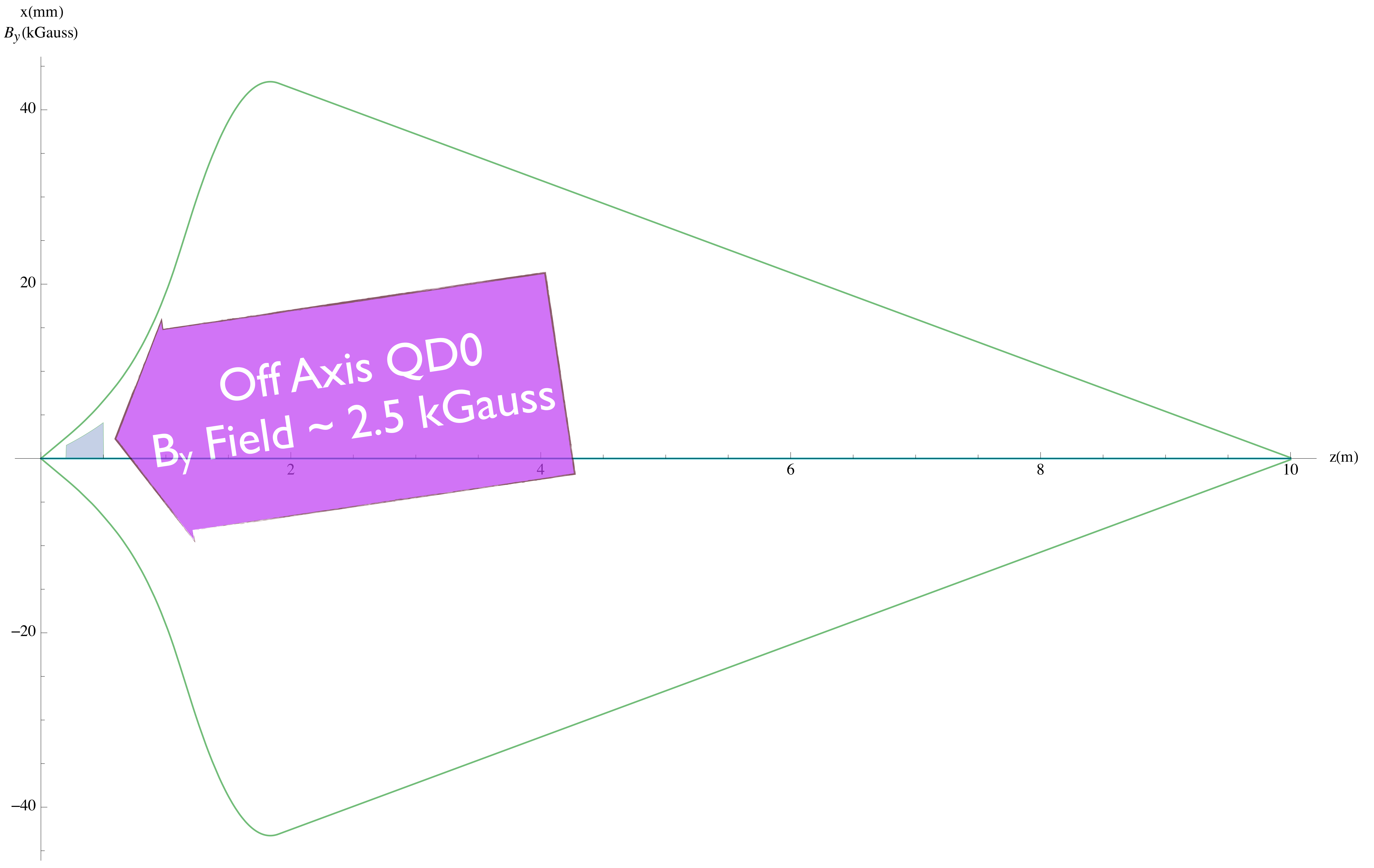
Name	Z face (m)	Length (m)	G (T/m)/B(T)	On	Type
QD0common+	0.2	0.3	-24.9117	1	Q
QD0common-	0.2	0.3	-24.9117	2	Q
QD0+	0.55	0.2	-24.7335	1	Q
QD0+	0.75	0.2	-24.7335	1	Q
QD0+	0.95	0.15	-24.7335	1	Q
QD0-	0.55	0.2	-24.7335	2	Q
QD0-	0.75	0.2	-24.7335	2	Q
QD0-	0.95	0.15	-24.7335	2	Q
QF1+	1.2	0.1	12.6065	1	Q
QF1+	1.3	0.1	12.6065	1	Q
QF1+	1.4	0.1	12.6065	1	Q
QF1+	1.5	0.1	12.6065	1	Q
QF1+	1.6	0.1	12.6065	1	Q
QF1+	1.7	0.2	12.6065	1	Q
QF1-	1.2	0.1	12.6065	2	Q
QF1-	1.3	0.1	12.6065	2	Q
QF1-	1.4	0.1	12.6065	2	Q
QF1-	1.5	0.1	12.6065	2	Q
QF1-	1.6	0.1	12.6065	2	Q
QF1-	1.7	0.2	12.6065	2	Q



Stay Clear & Layout (Mike style)



Tracking to the IP image point



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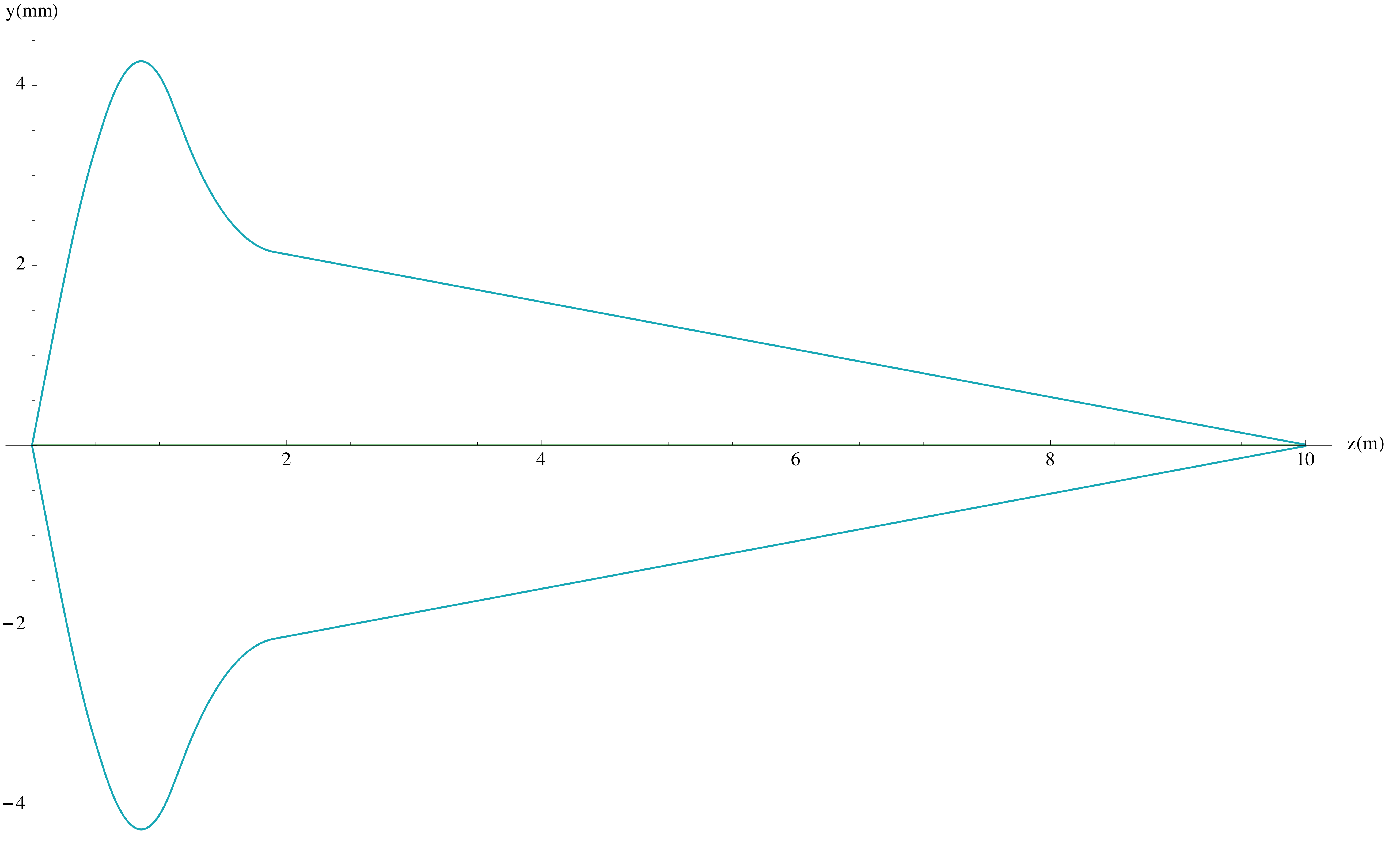
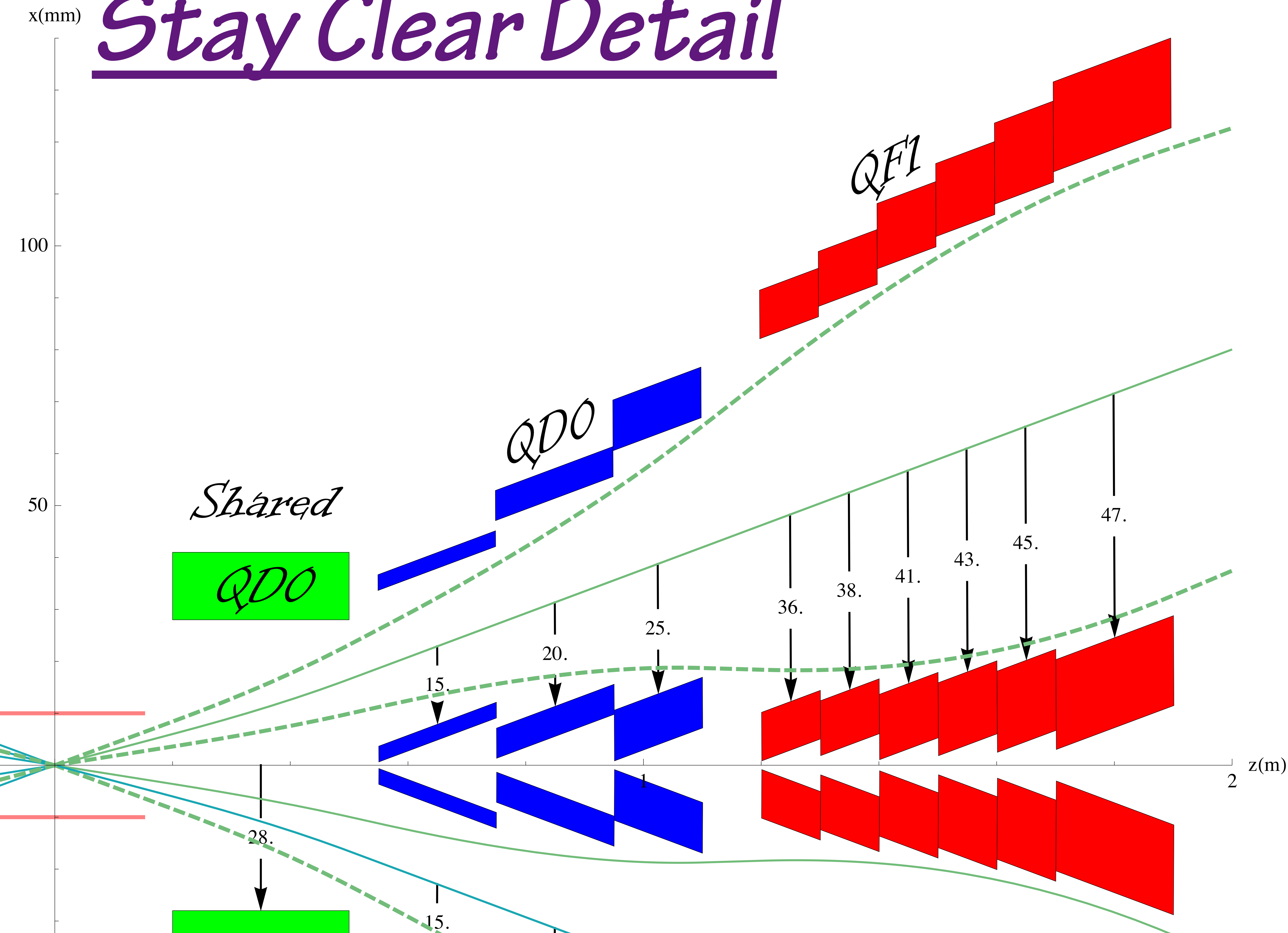


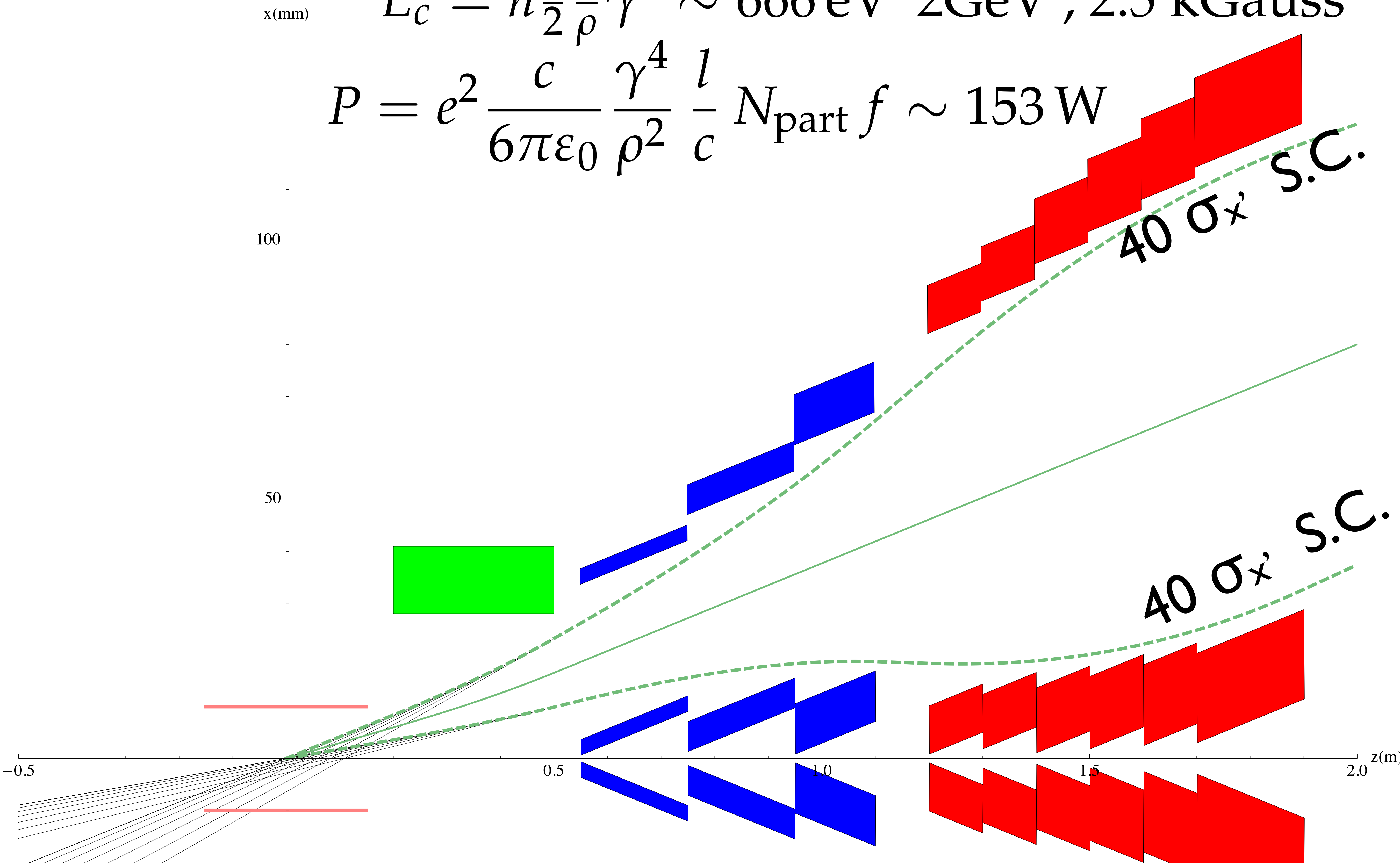
Stay Clear Detail



Radiation fans from the common QDO

$$E_c = \hbar \frac{3}{2}\frac{c}{\rho}\gamma^3 \sim 666\,\mathrm{eV}\quad 2\mathrm{GeV}\ ,\ 2.5\ \mathrm{kGauss}$$

$$P = e^2 \frac{c}{6\pi\varepsilon_0}\frac{\gamma^4}{\rho^2}\frac{l}{c} N_{\mathrm{part}}\, f \sim 153\,\mathrm{W}$$



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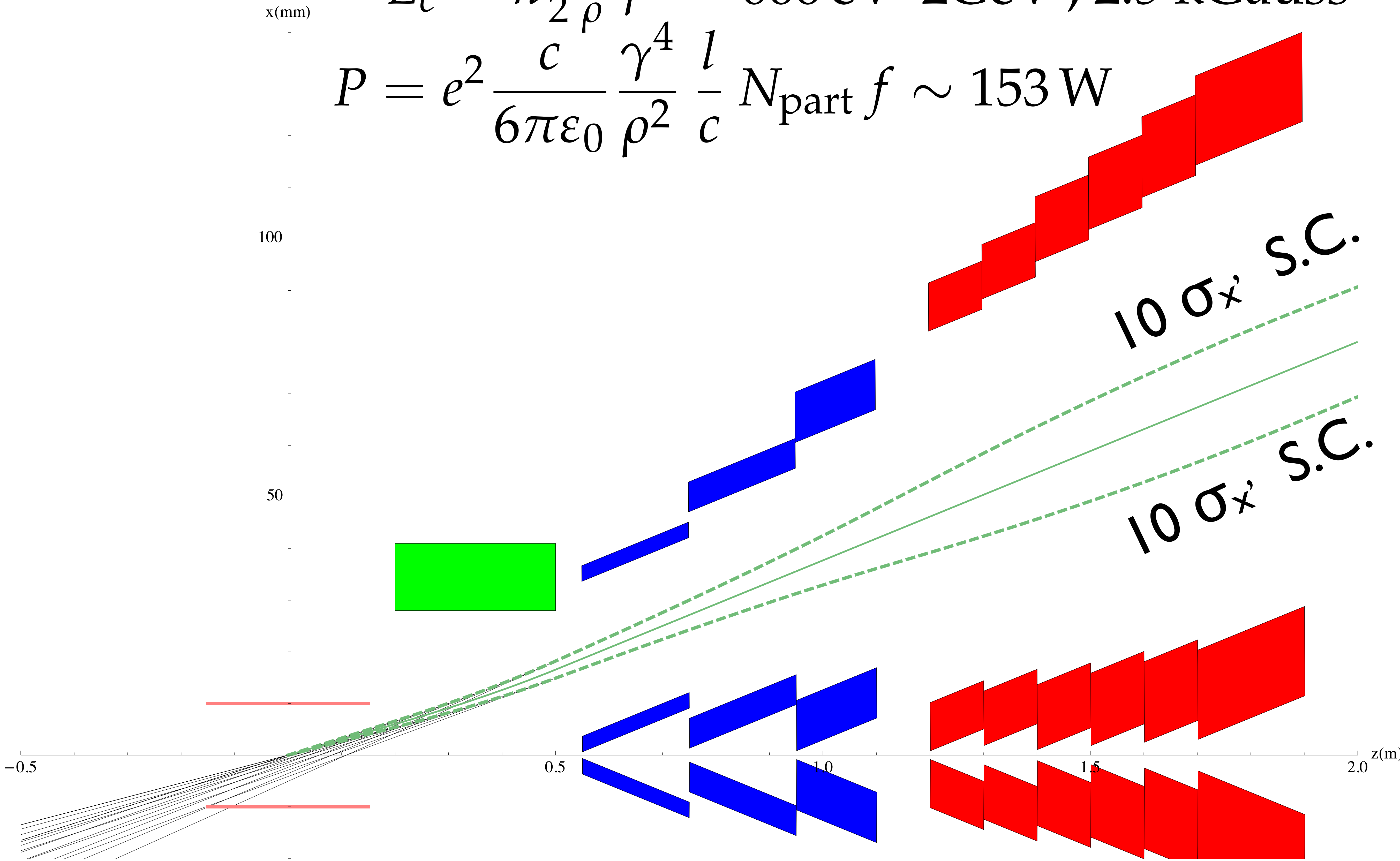
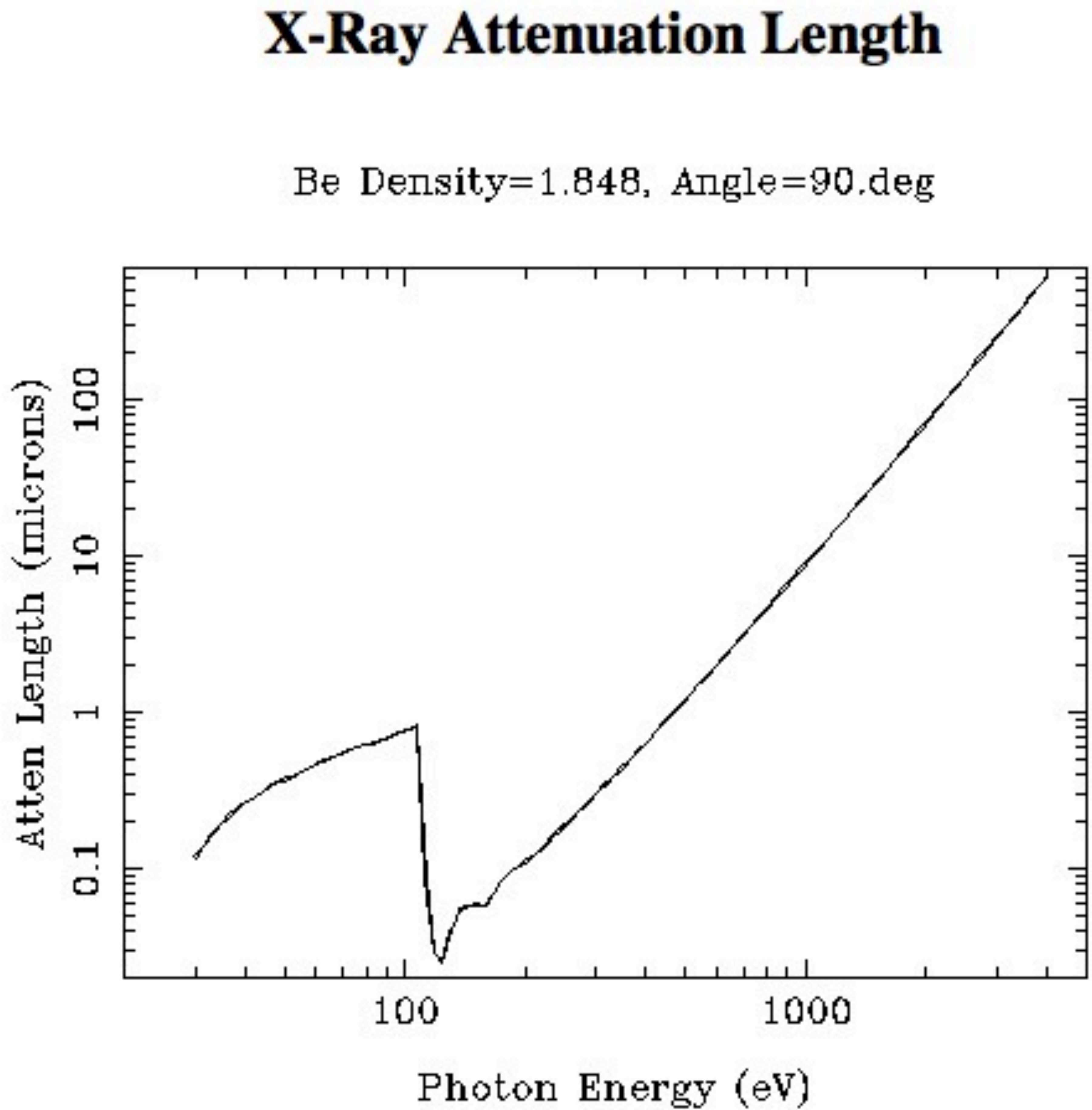


666 eV what the heck???



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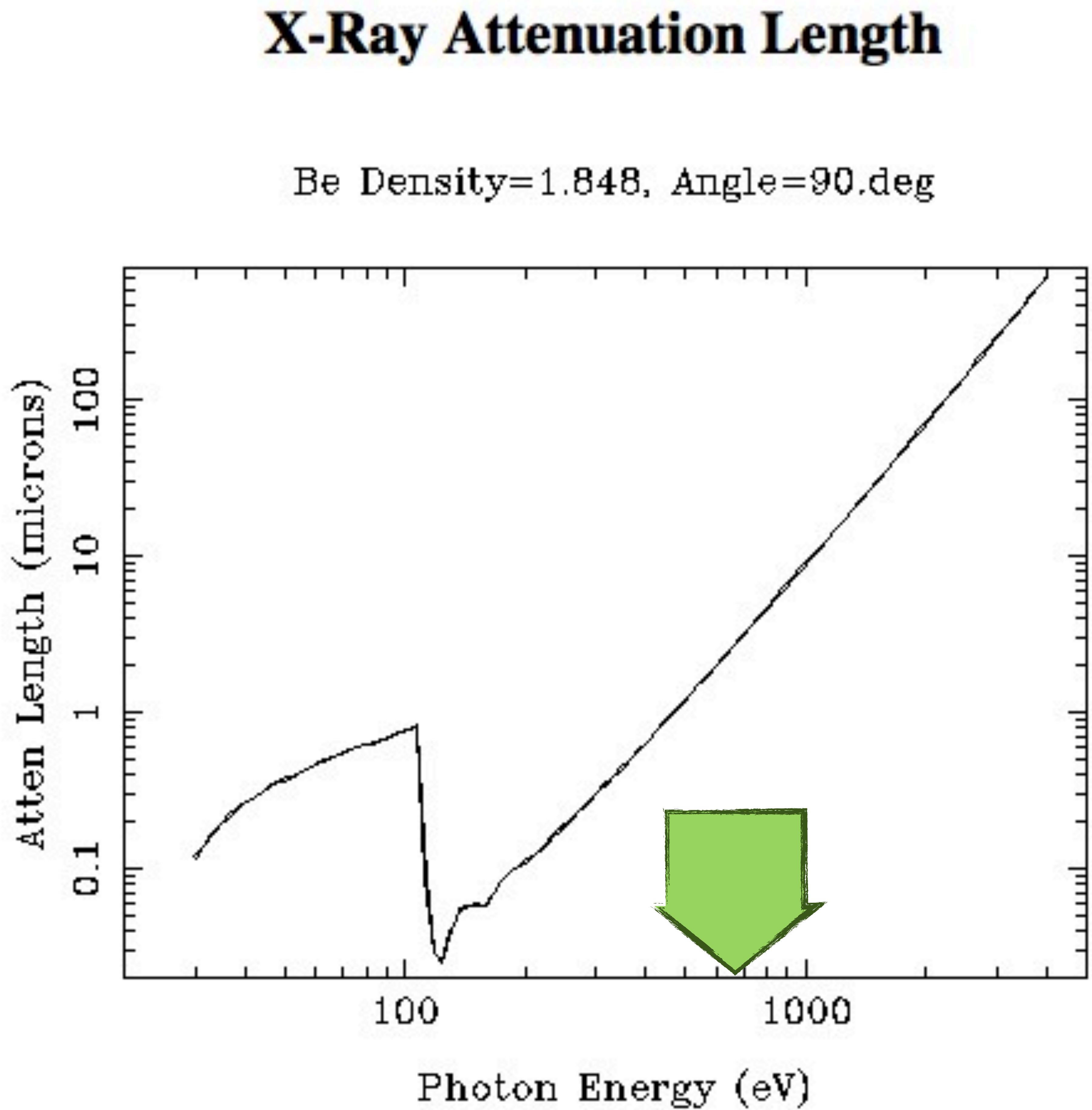

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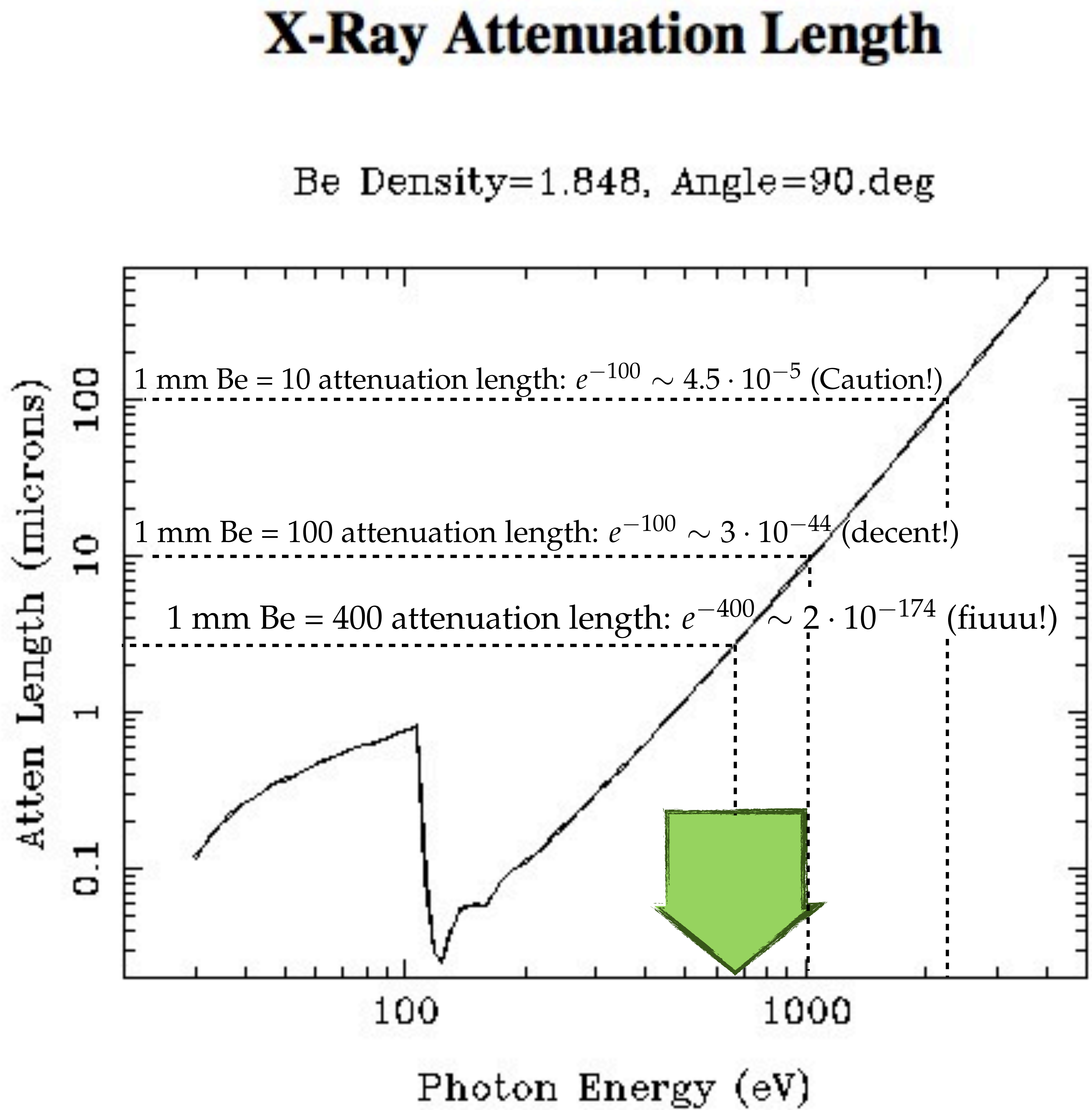
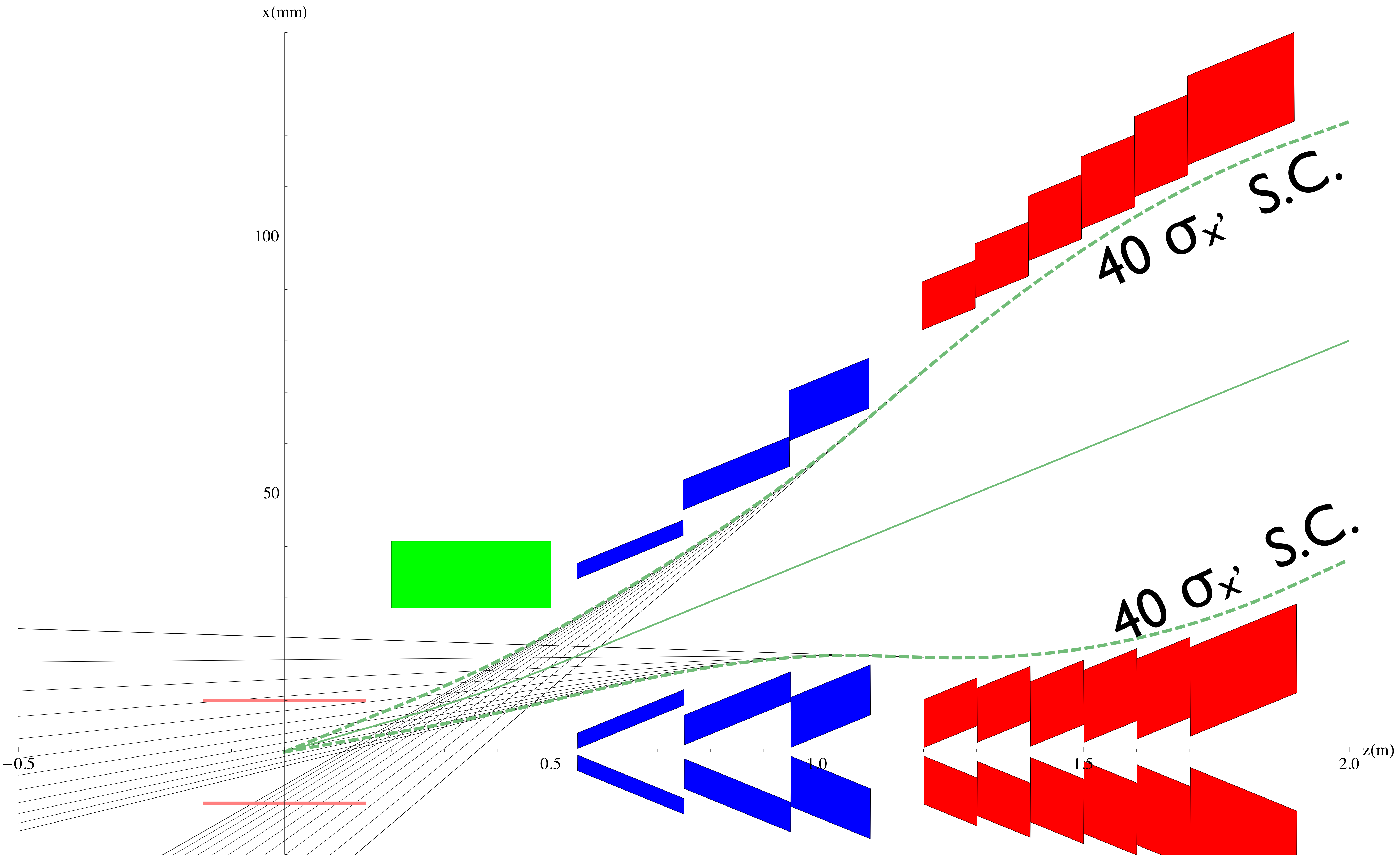
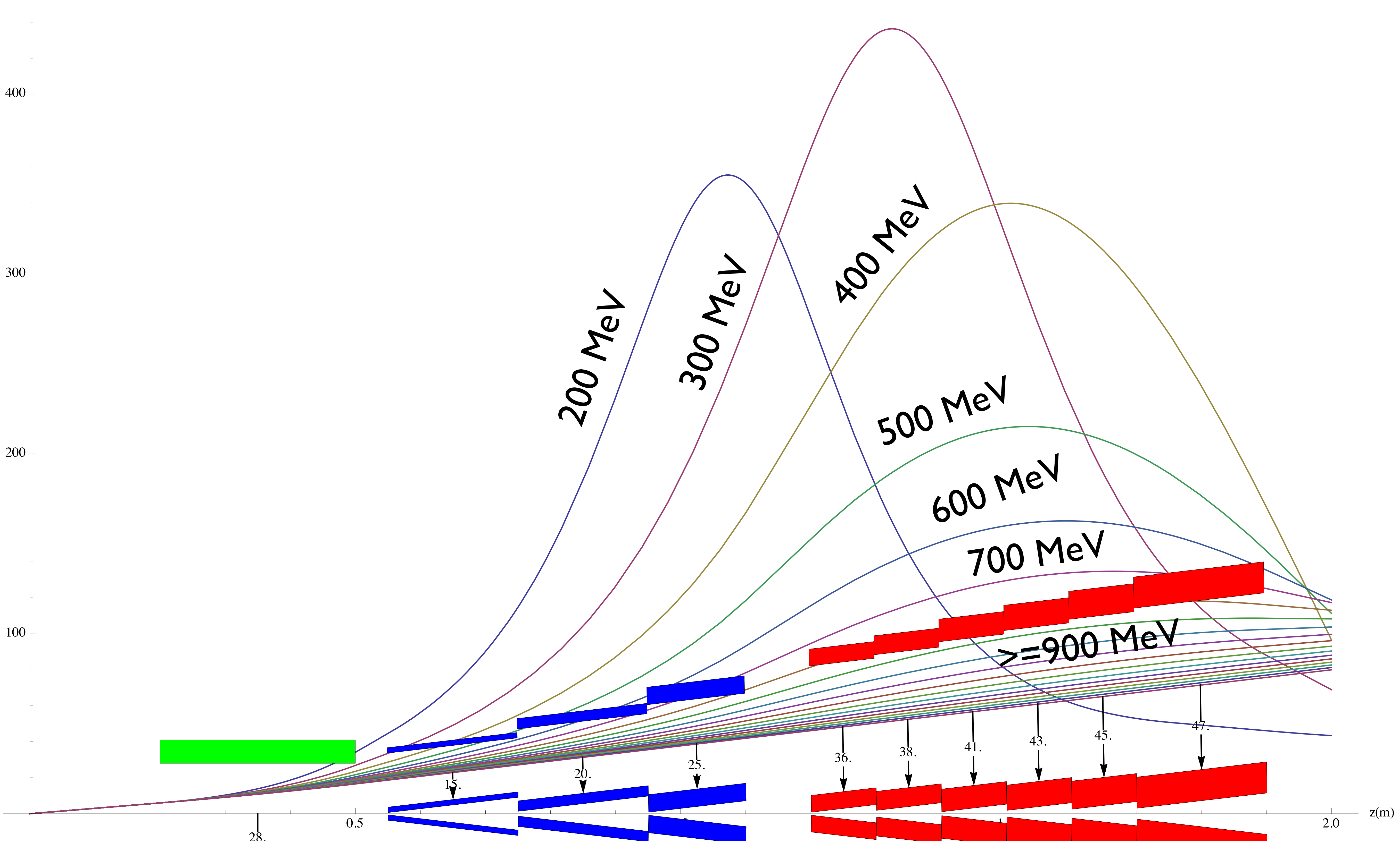


Radiation fans from the QDO



Out of energy tracking



Backgrounds? Oh my gosh!! Again?

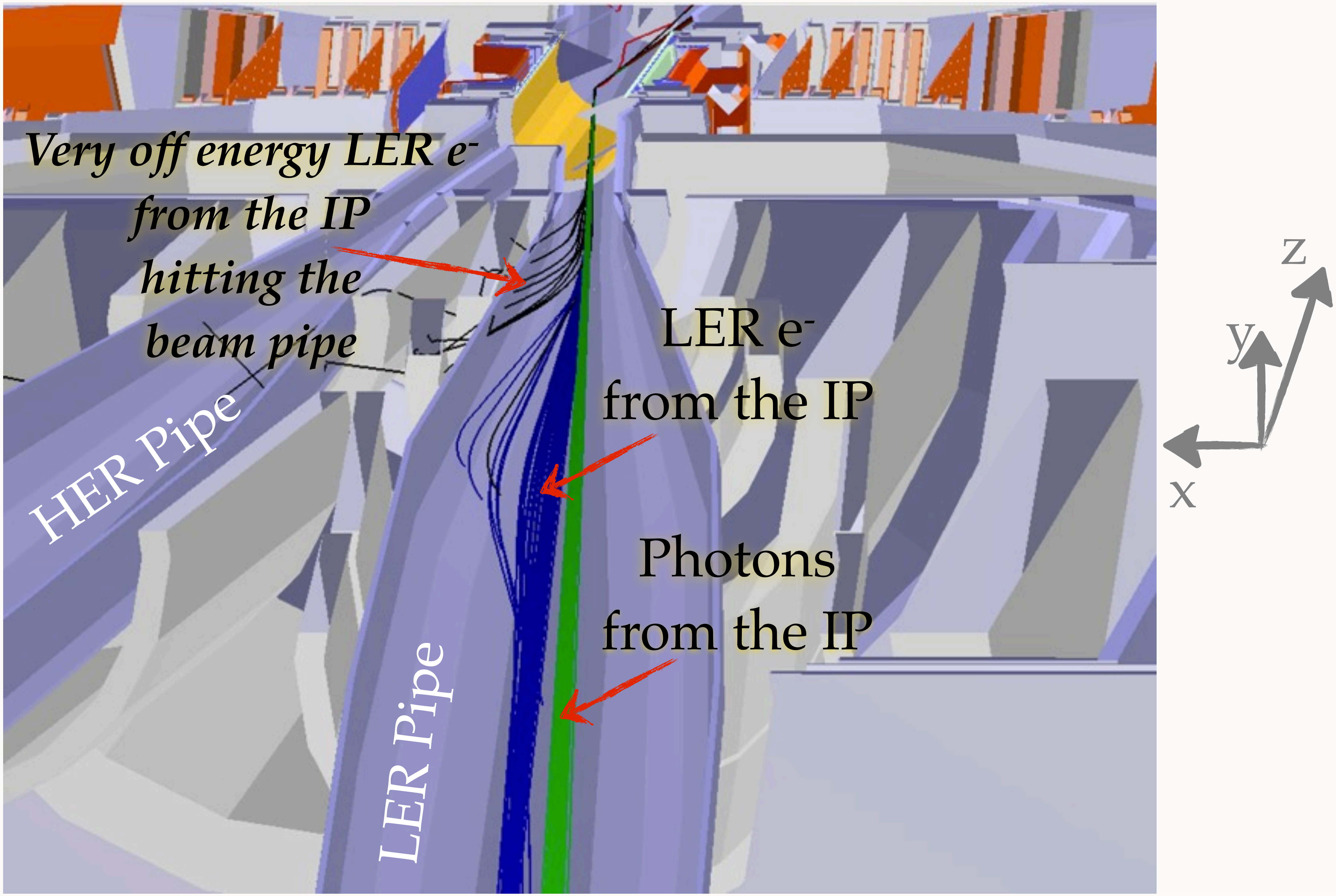
"I WISH I HAD AN ANSWER TO THAT BECAUSE I'M TIRED OF ANSWERING THAT QUESTION."

"IF YOU ASK ME ANYTHING I DON'T KNOW, I'M NOT GOING TO ANSWER."

(Yogi Berra)

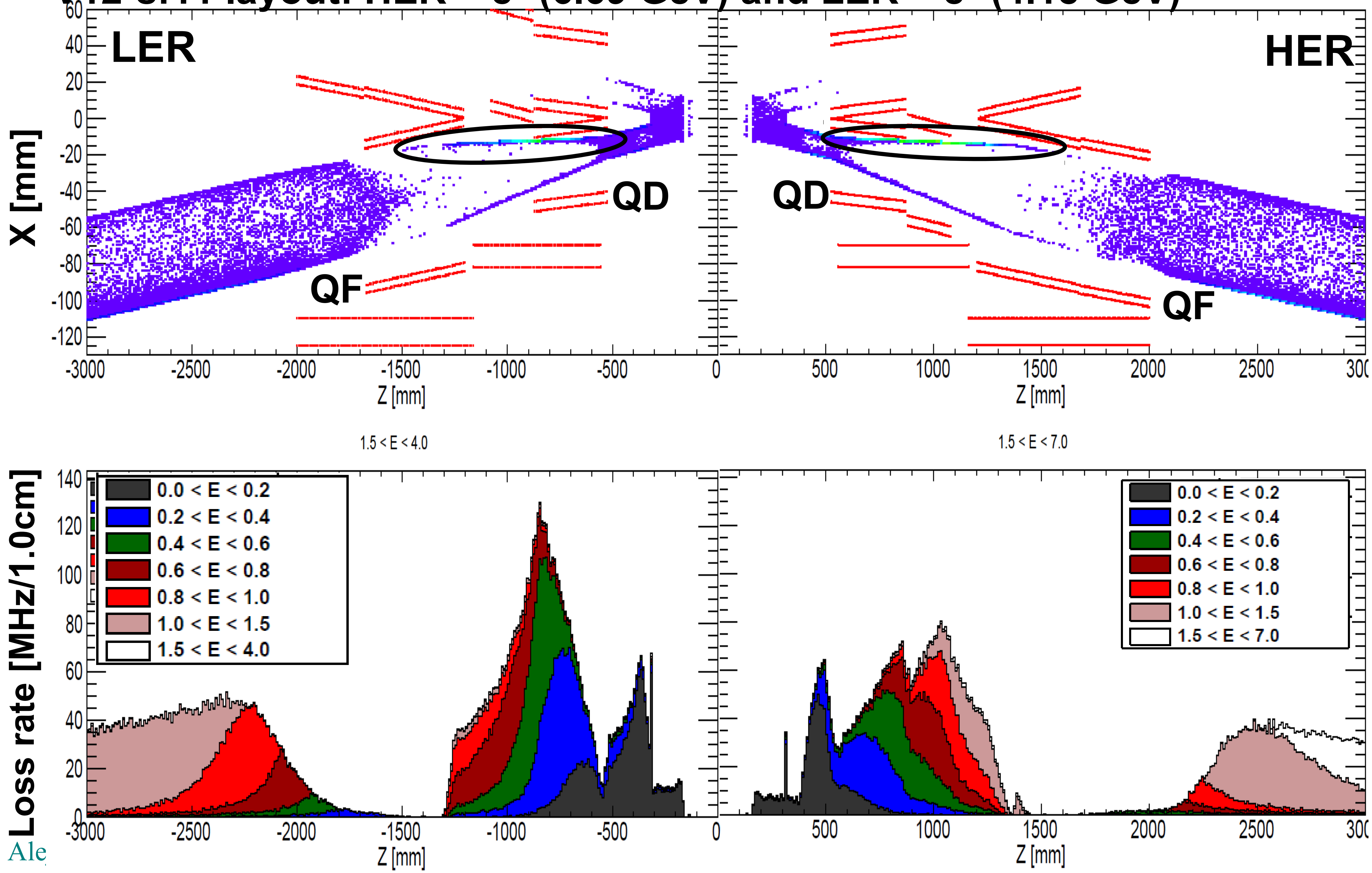
How it was in SuperB?

Radiative Bhabha (Primaries Only)



PRIMARIES LOSS RATE

- V12-sf11 layout: HER = e^+ (6.69 GeV) and LER = e^- (4.18 GeV)



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Conclusions

- A permanent magnet solution seems viable
  - Hard to find a solution working over a factor 4 energy span
- Synchrotron radiation doesn't seems a major problem
- The shared QD0 ~~can~~ *will* be a trouble maker for radiative Bhabha backgrounds
- Same configuration should be viable even with SC magnets
  - Tapered Double Panofsky (energy span?)
  - Conical double helix with local octupolar compensation
- What about anti solenoids? Do we need them?

Workshop on τ-charm at High Luminosity