Synchrotron Radiation Results

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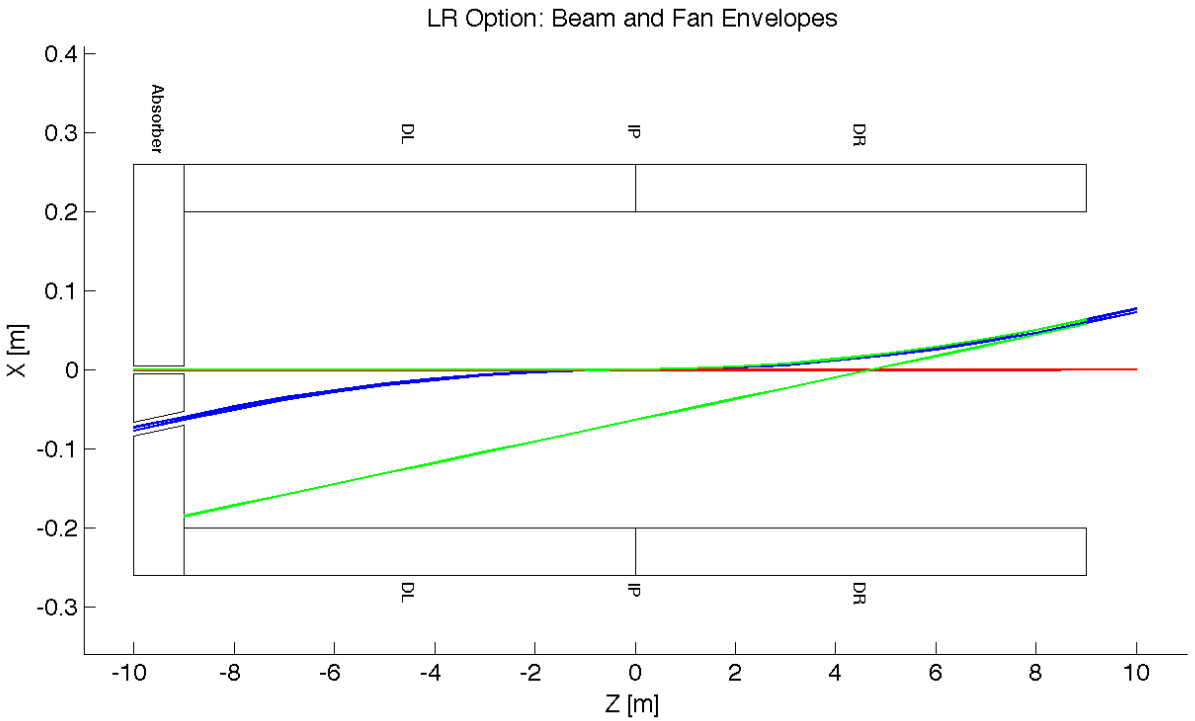
LR Option

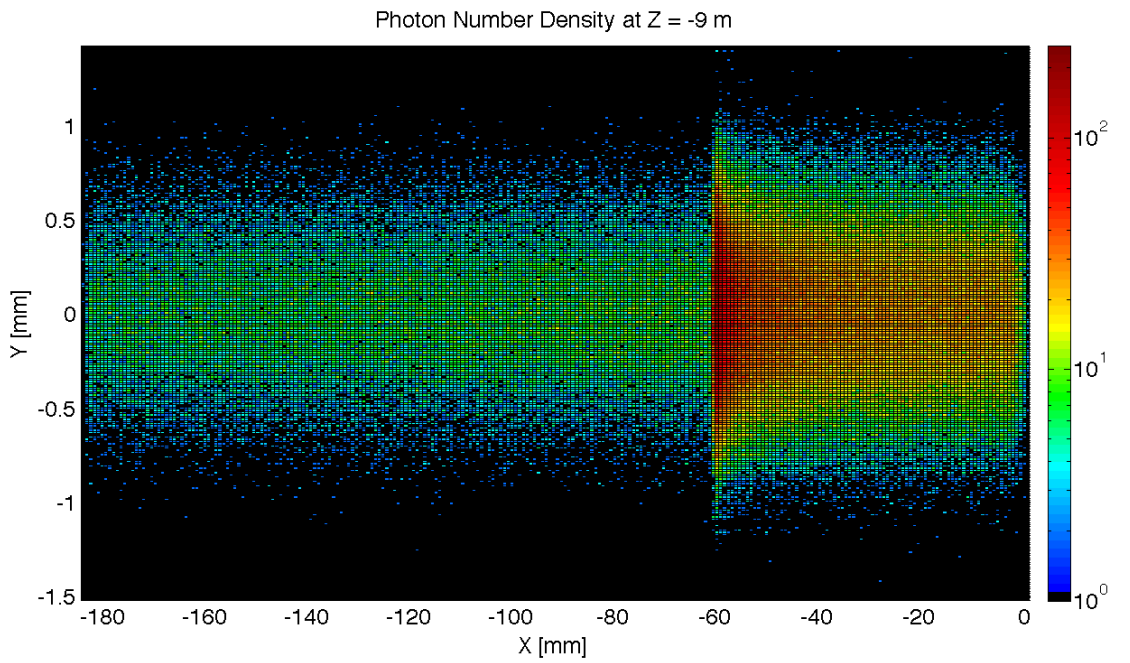
Element	Power [kW]	Critical Energy [keV]
DL	24.1	718
DR	24.1	718
Total/Avg	48.2	718

Table 4.2: LR: Power and Critical Energies [Geant4]

Characteristic	Value
E [GeV]	60
I [mA]	6.6
θ_c [mrad]	0
Abs. Pos. [m]	-9
B [T]	0.3
Separation [mm]	61.4
γ/s	1.37×10^{18}

Table 4.1: LR: Parameters

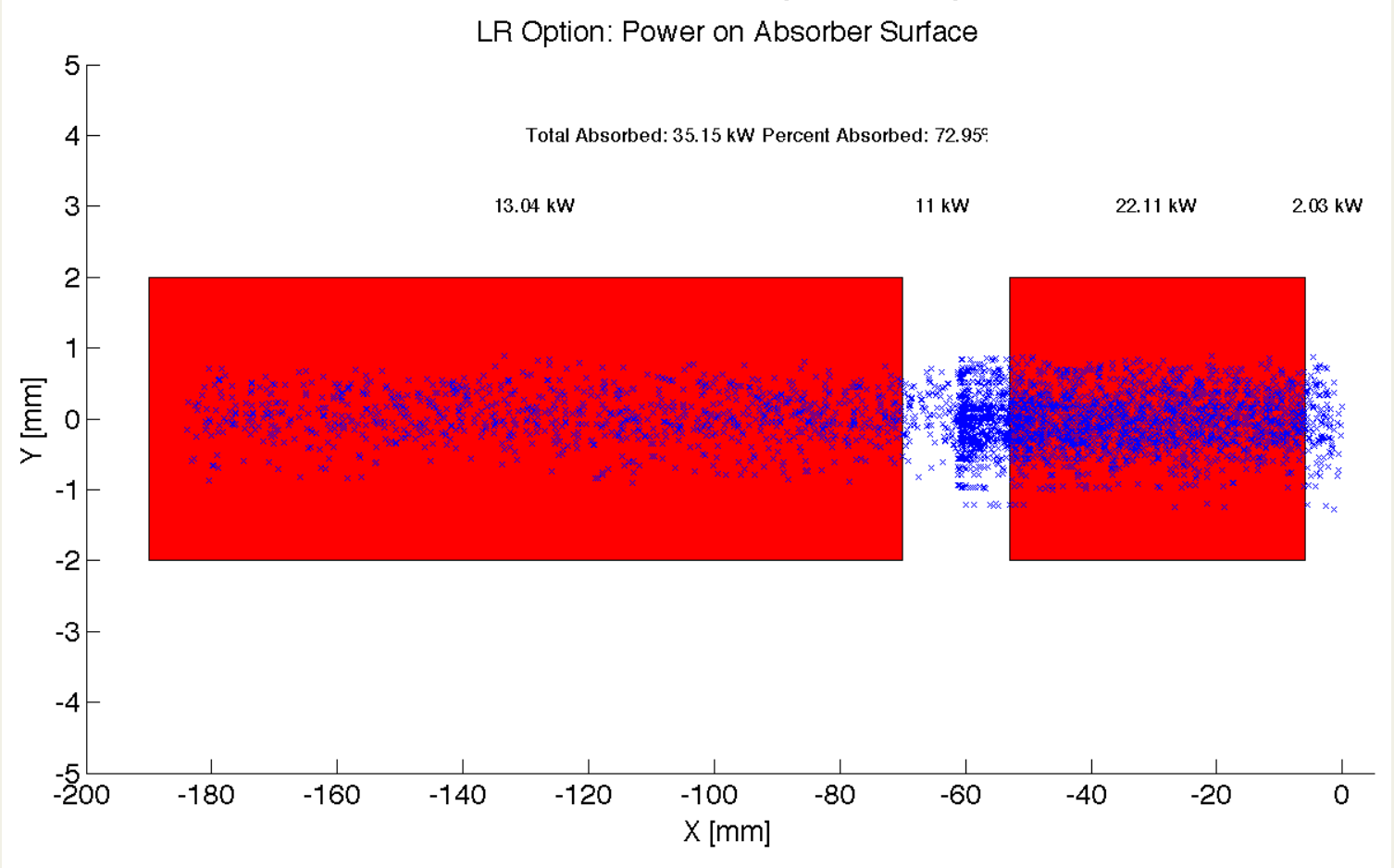




• 35.15 kW or 72.95% will hit the absorber surface.

•11 kW will continue in the electron aperture.

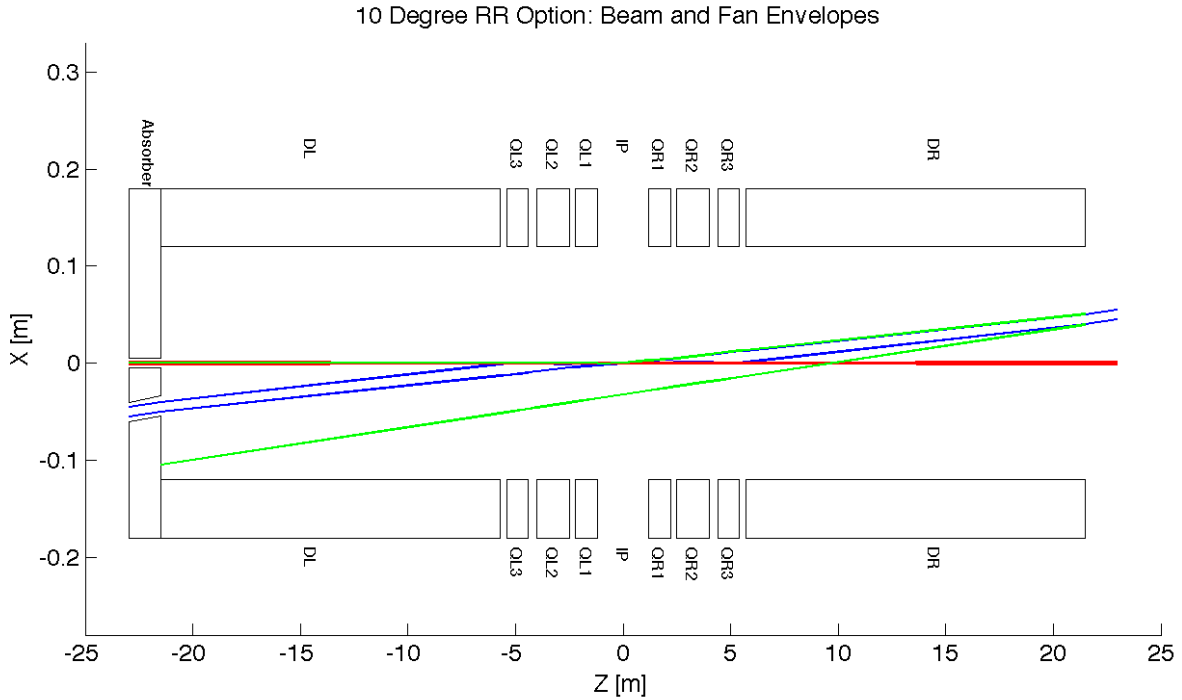
• 2.03 kW will continue in the proton aperture.



RR 10 Degree

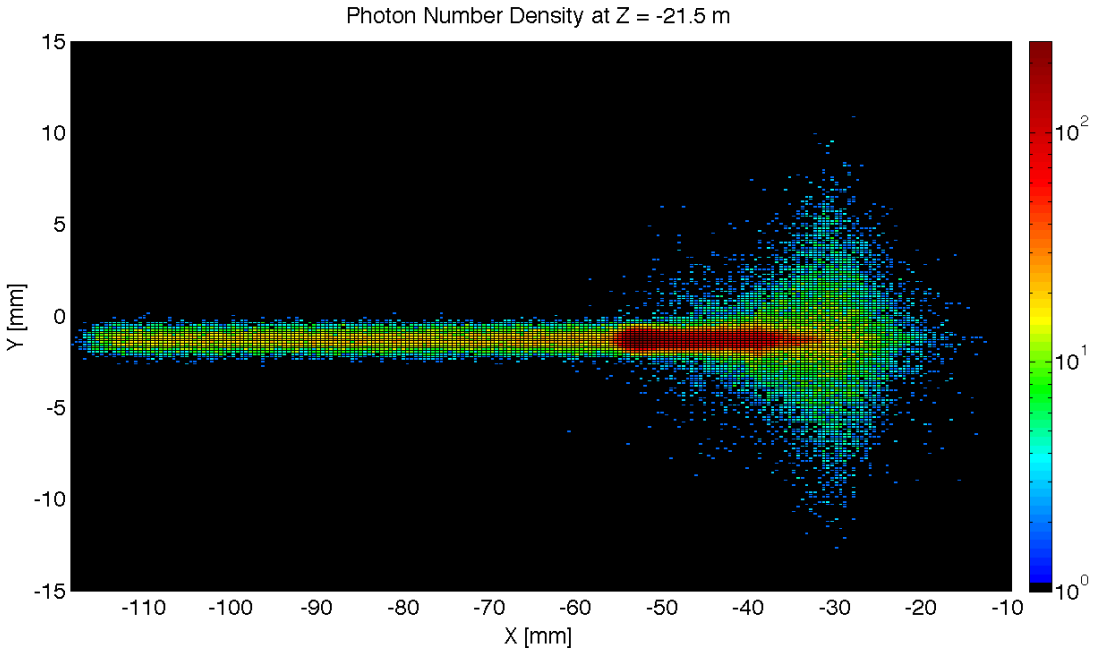
Element	Power [kW]	Critical Energy [keV]
DL	6.4	71
QL3	5.3	308
QL2	4.3	218
QL1	0.6	95
QR1	0.6	95
QR2	4.4	220
QR3	5.2	310
DR	6.4	71
Total/Avg	33.2	126

Table 3.2: 10 Degree: Power and Critical Energies [Geant4]



Characteristic	Value
E [GeV]	60
I [mA]	100
θ_c [mrad]	1
Abs. Pos. [m]	-21.5
B [T]	0.0296
Separation [mm]	55.07
γ/s	5.39×10^{18}

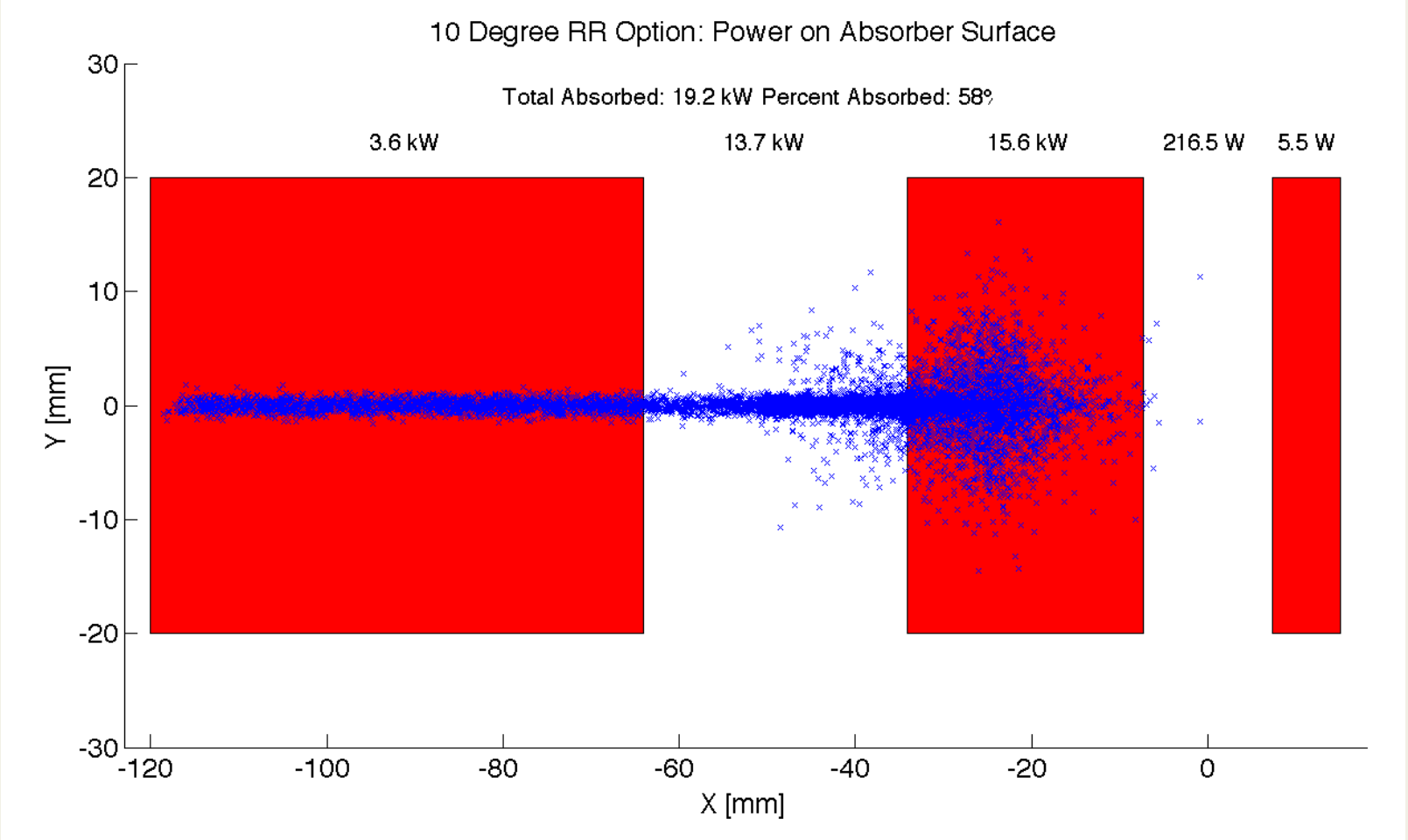
Table 3.1: 10 Degree: Parameters



• 19.2 kW or 58% will hit the absorber surface.

•13.7 kW will continue in the electron aperture.

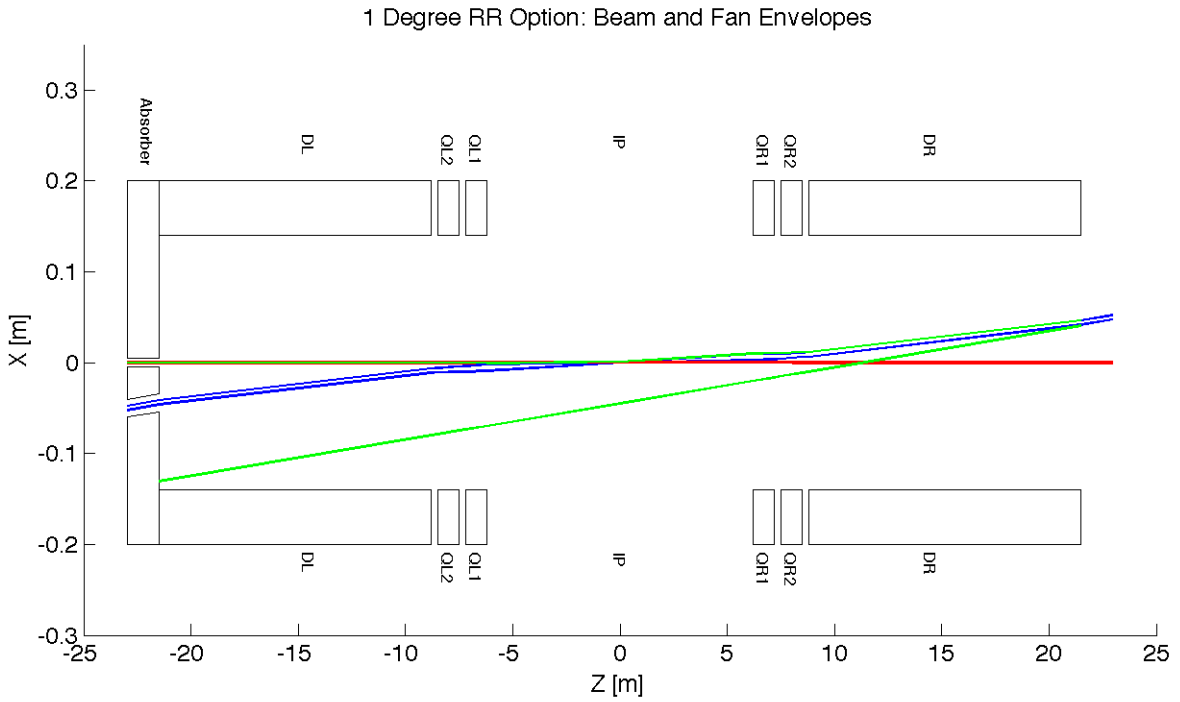
• 216.5 W will continue in the proton aperture.



RR 1 Degree

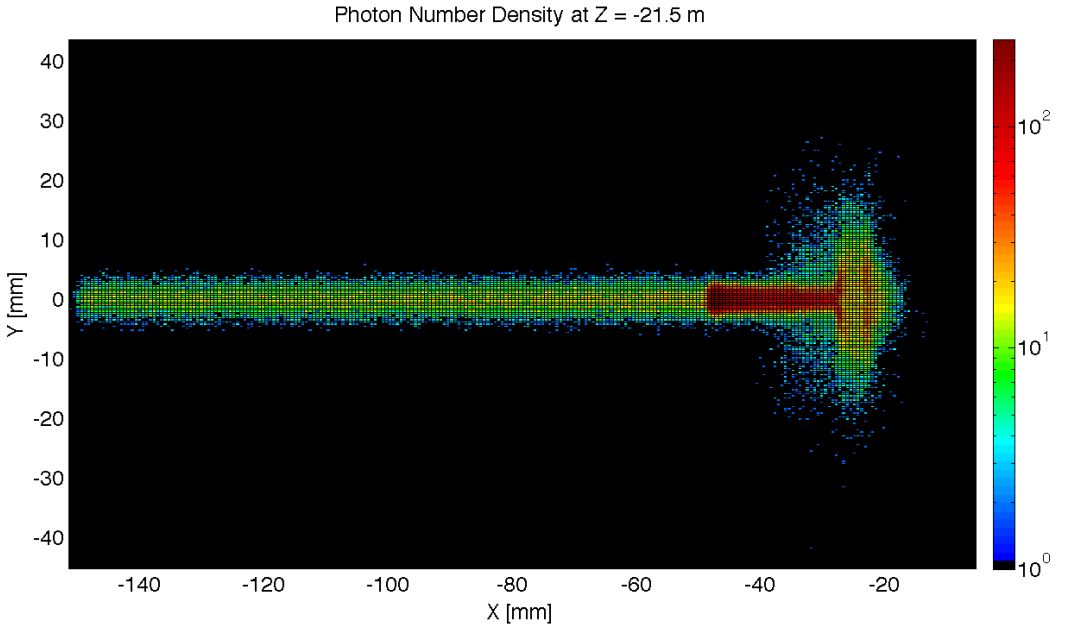
Element	Power [kW]	Critical Energy [keV]
DL	13.9	118
QL2	6.2	318
QL1	5.4	294
QR1	5.4	293
QR2	6.3	318
DR	13.9	118
Total/Avg	51.1	163

Table 3.6: 1 Degree: Power and Critical Energies [Geant4]



Characteristic	Value
E [GeV]	60
I [mA]	100
θ_c [mrad]	1
Abs. Pos. [m]	-21.5
B [T]	0.0493
Separation [mm]	55.16
γ/s	6.41×10^{18}

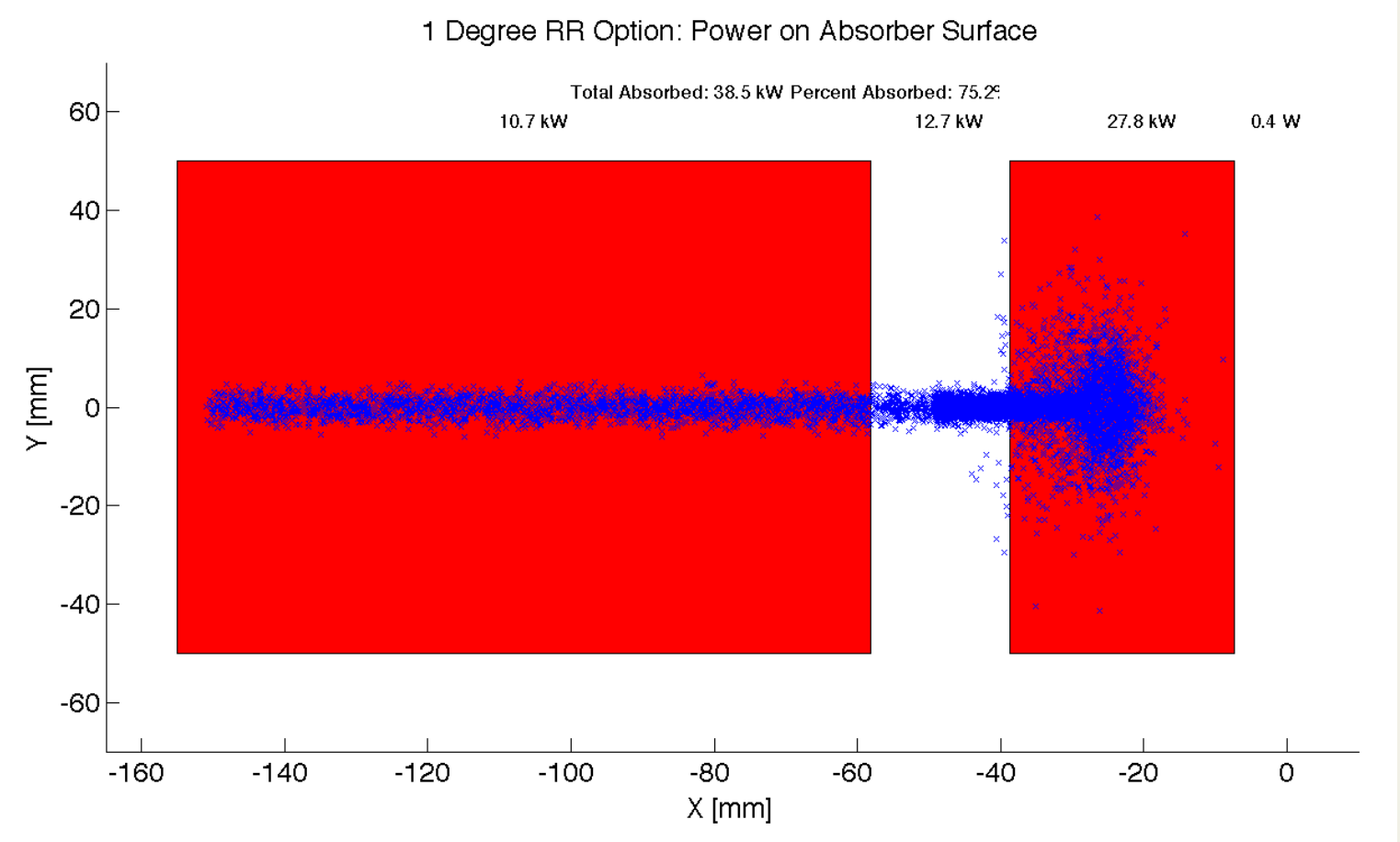
Table 3.5: 1 Degree: Parameters



• 38.5 kW or 75.2% will hit the absorber surface.

•12.7 kW will continue in the electron aperture.

• 0.4 W will continue in the proton aperture.



Cross Check

• Below the results for Geant and the analytic method are compared for radiated SR power.

•This is a test of the analytic method for the quadrupole, hence the quadrupole offsets are left out.

Element	Power [W]	
	Analytic	Geant4
Q1	4226	4231.8 +/- 92.7
Q2	5153.5	5173.7 +/- 91.5
Total	9379.5	9405.5 +/- 130.3

TABLE VI: High Acceptance Comparison

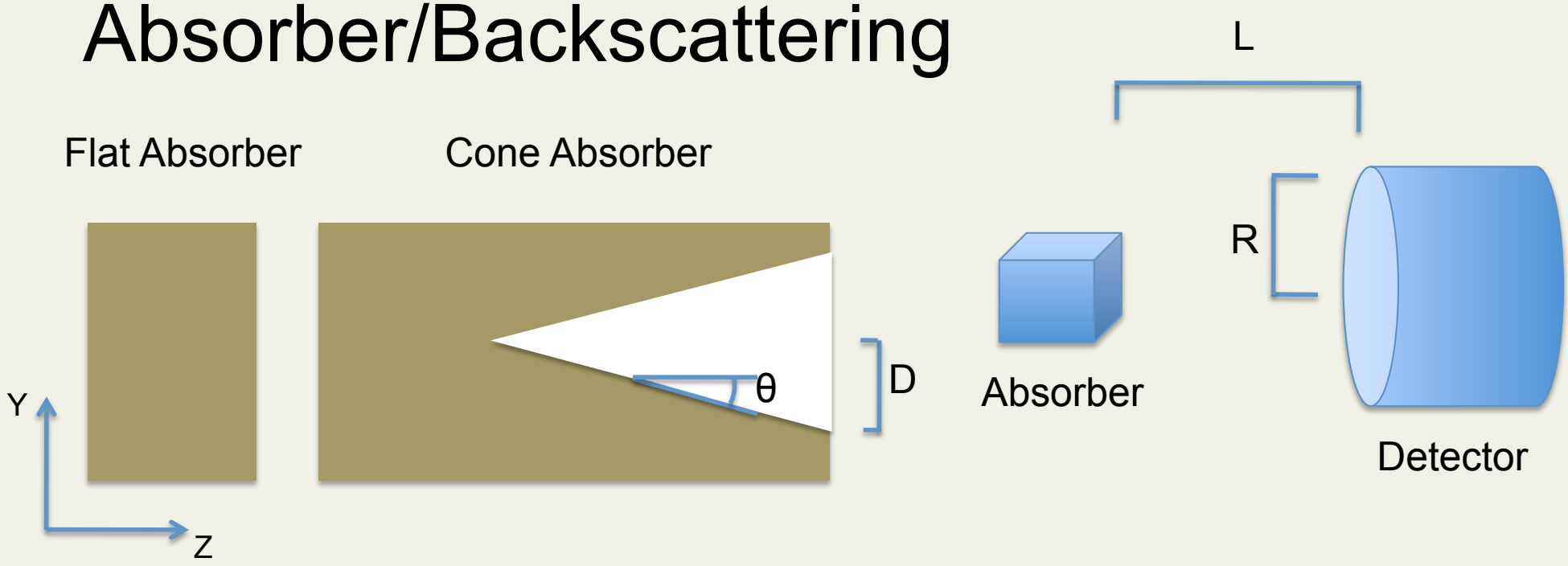
Element	Power [W]	
	Analytic	Geant4
Q1	212.5	210.9 +/- 9.2
Q2	3984	3943.2 +/- 73.5
Q3	5057.1	5017.6 +/- 105.3
Total	9253.6	9171.7 +/- 128.7

TABLE III: High Luminosity Comparison

• The conclusion of these cross checks is that accurate results can be found if multiple seeds are used.

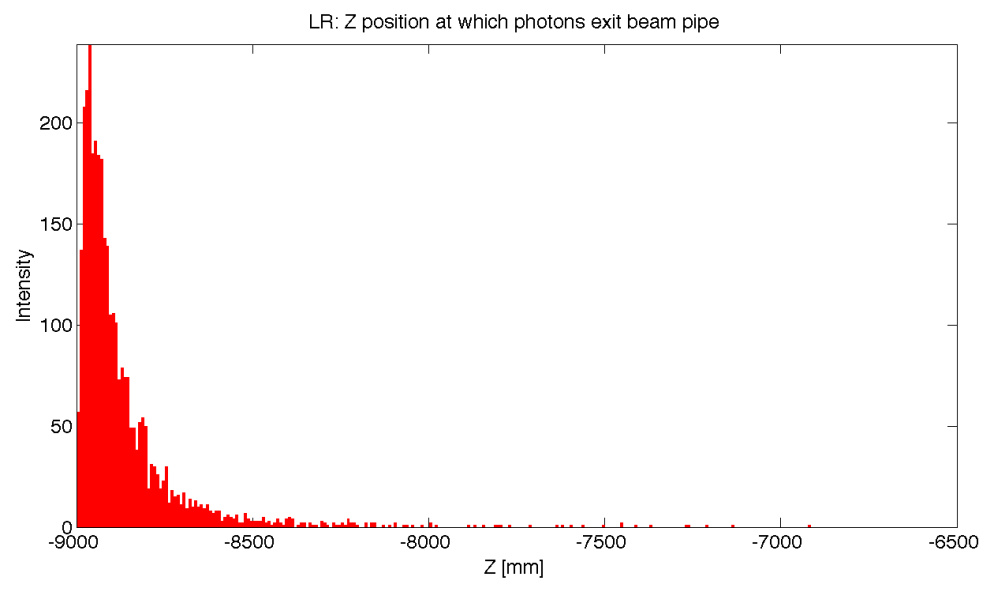
• This should as well be done in IRSYN to understand the standard deviations experienced in not only power but critical energy

Absorber/Backscattering



- γ move in the negative Z direction
- D differs from simulation to simulation based on the Y extension of the SR fan.
- θ is 40 mrad for all simulations.
- L is 3 m for the LR option and 15.5 m for the RR case.
- R is 4 m for all simulations

Backscattering [LR]

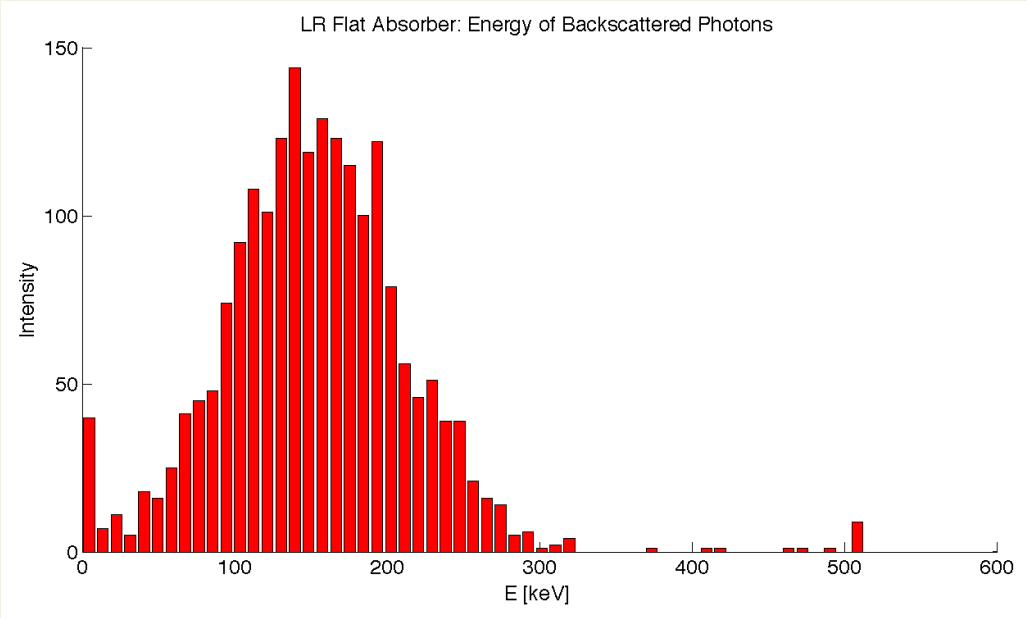


- With a generic beam pipe (as described on the next slide) this graph gives the distribution of photons hitting the beampipe in Z.

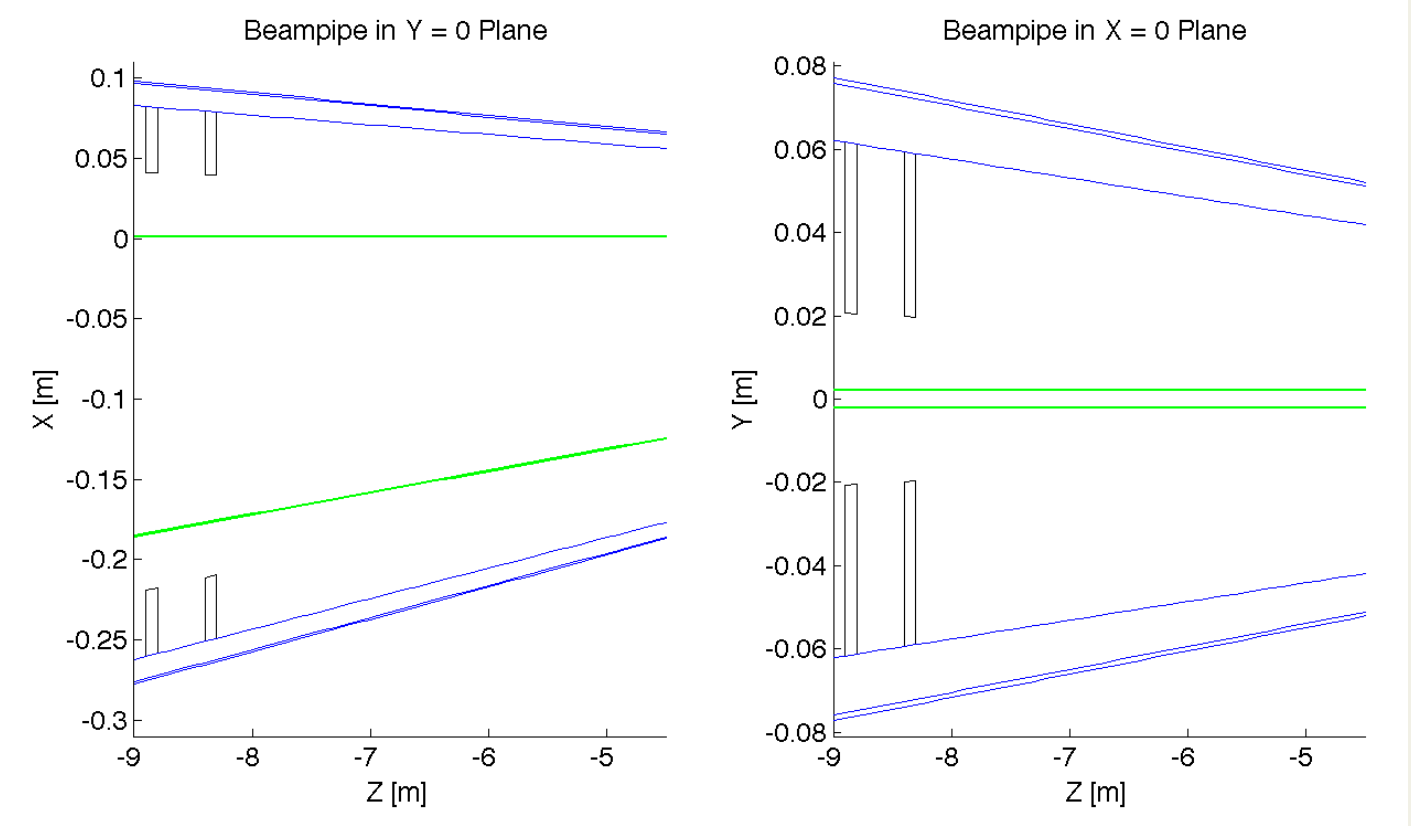
- This shows that mask placement and shielding close to the absorber can stop most of the backscattered photons.

- Backscattered photons have a normal distribution in energy in LR Case.

- For the RR cases less backscattering occurs and therefore more runs need to be made to provide accurate statistics



Mask Placement [LR]

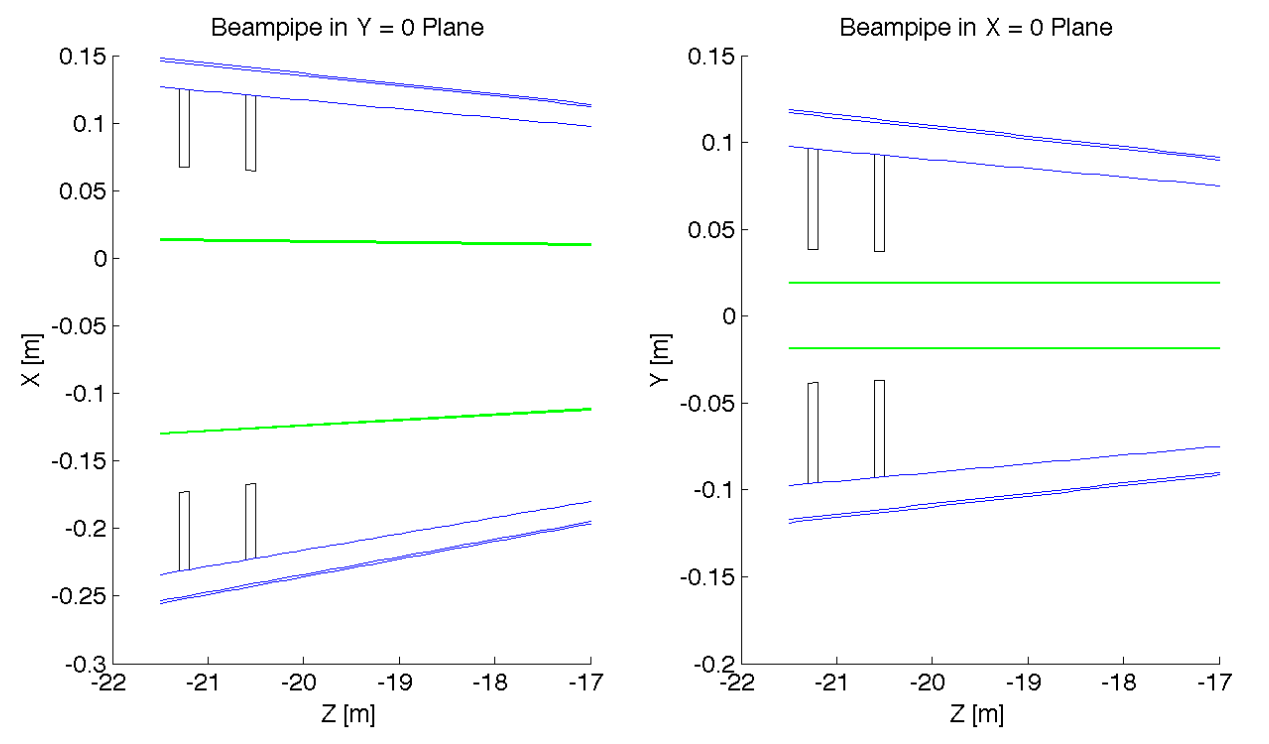


- Beampipe is circular in +X direction and elliptical in –X direction.
- Semimajor axes grow in the –Z direction.
- This has been set up with generic values.

Absorber Type	Power [W]
Flat	645.9
Cone	159.1
Flat & Mask/Shield	32.7
Cone & Mask/Shield	4.3

Table 4.5: LR: Backscattering/Mask

Mask Placement [1 Deg]

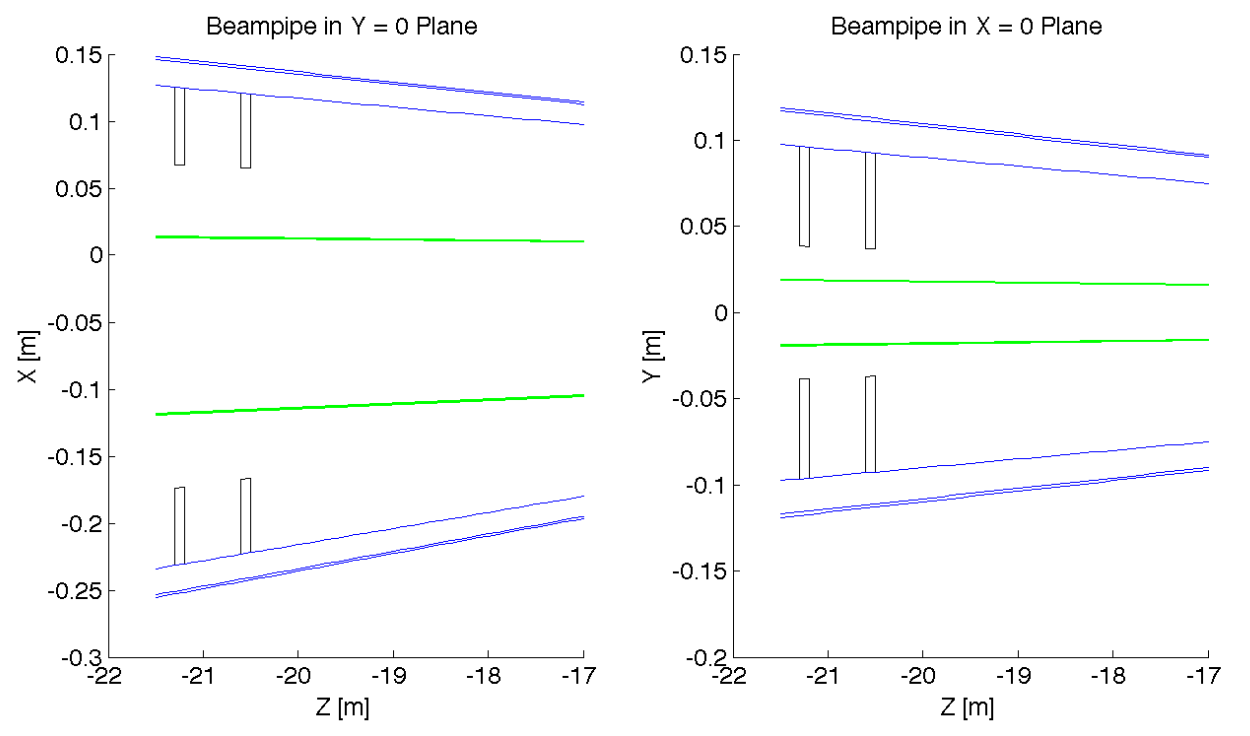


- Beampipe is circular in +X direction and elliptical in –X direction.
- Semimajor axes grow in the –Z direction.
- This has been set up with generic values.

Absorber Type	Power [W]
Flat	91.1
Cone	10
Cone & Mask/Shield	0

Table 3.10: 1 Degree: Backscattering/Mask

Mask Placement [10 Deg]



- Beampipe is circular in +X direction and elliptical in –X direction.
- Semimajor axes grow in the –Z direction.
- This has been set up with generic values.

Absorber Type	Power [W]
Flat	22
Cone	18.5
Cone & Mask/Shield	0

Table 3.5: 10 Degree: Backscattering/Mask

Issues

• Need tolerances for SR fan.

• Current recommendation for tolerance criterion: number density is O(6) less than peak number density in fan + 5 mm.

• Need to know what is maximum shielding thickness possible (in radial direction) and what is maximum mask thickness possible (in z direction)

• Need to know what is acceptable background in detector if non zero

• Need to run everything with higher statistics