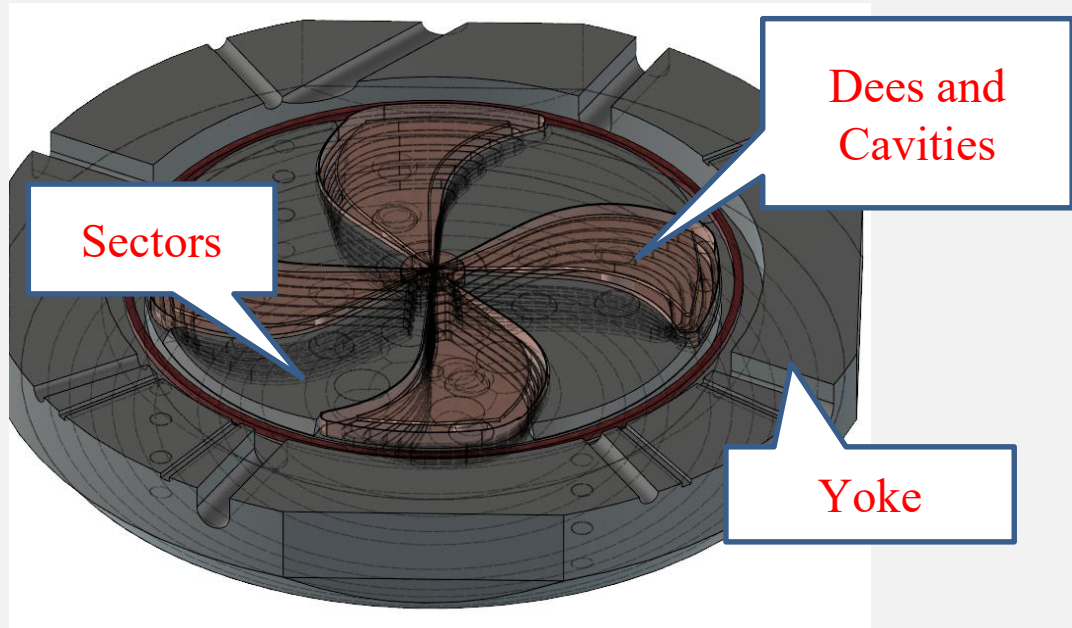


EXTRACTION SYSTEM OPTIMIZATION FOR THE MSC230 CYCLOTRON

Dmitry Popov
DLNP, JINR
podivs@jinr.ru

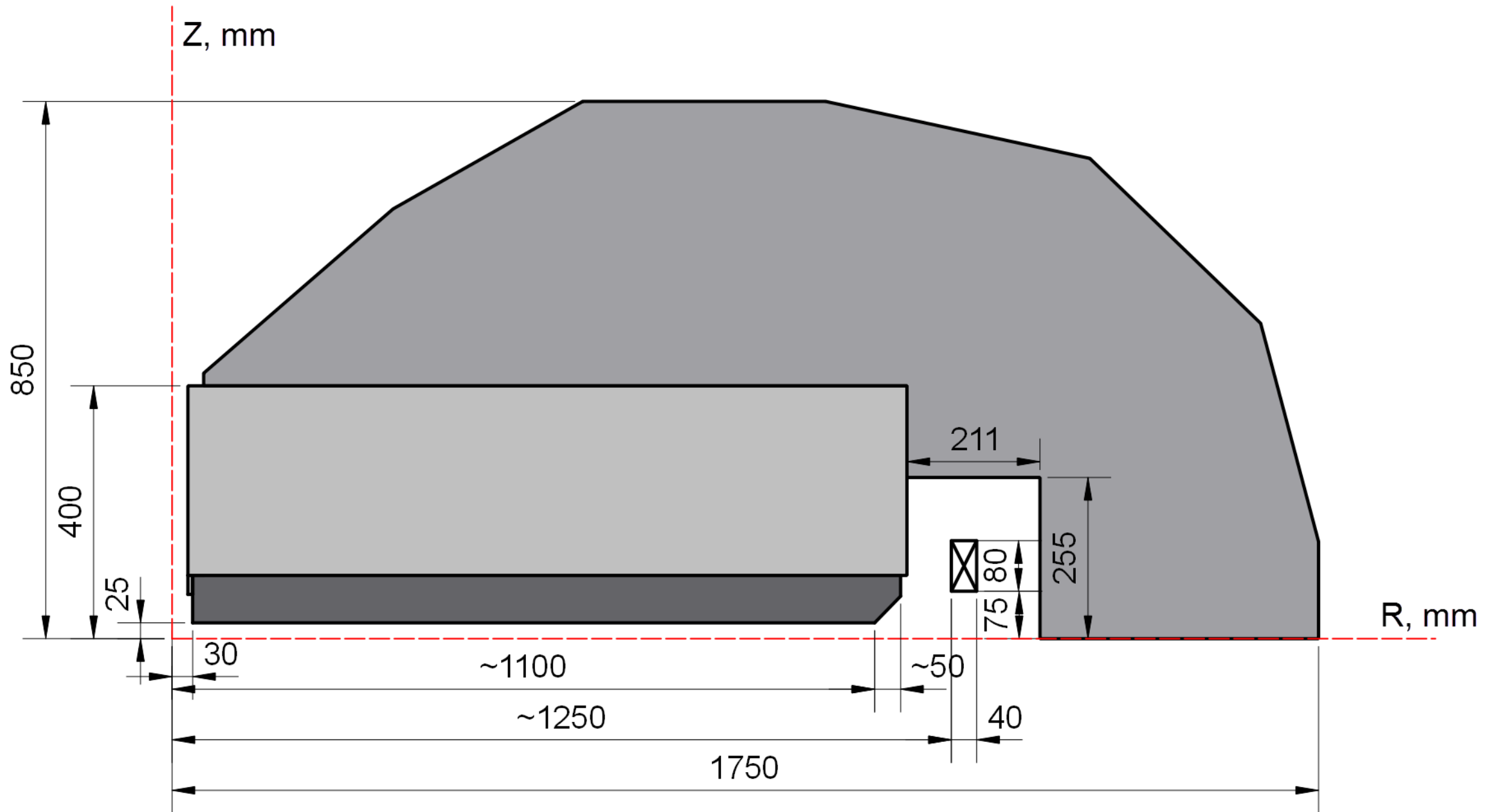
MSC230 PROJECT

SC230 design reasoning and specifications.



Inside the SC230

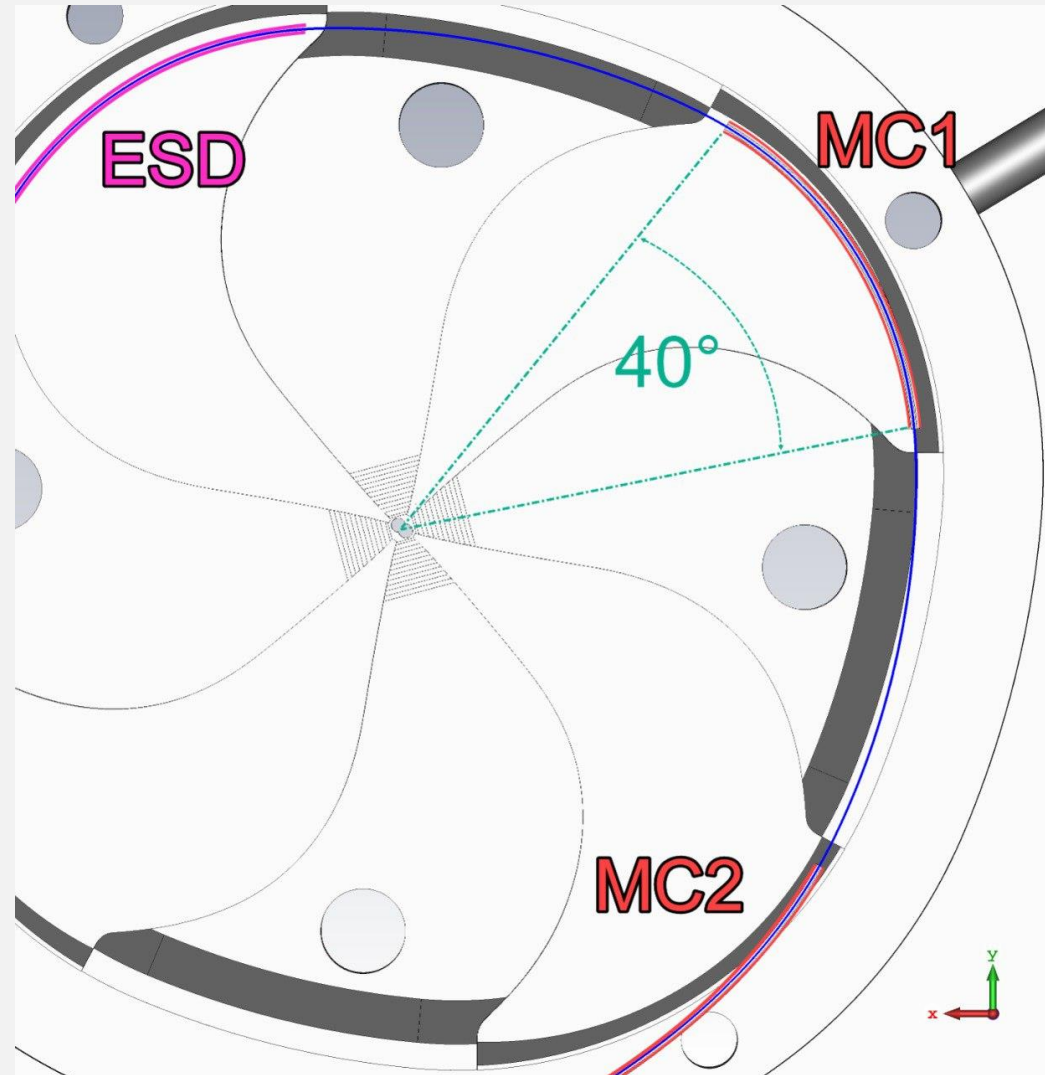
Accelerated Particles	Protons
Magnet Type	Compact, SC coil, warm yoke, $B \approx 1.5$ T
Number of Sectors	4
Number of RF Cavities	4
Ion Source	Internal, PIG
Final Energy	230 MeV
Number of Turns	600



SC230 magnet quarter cross section.

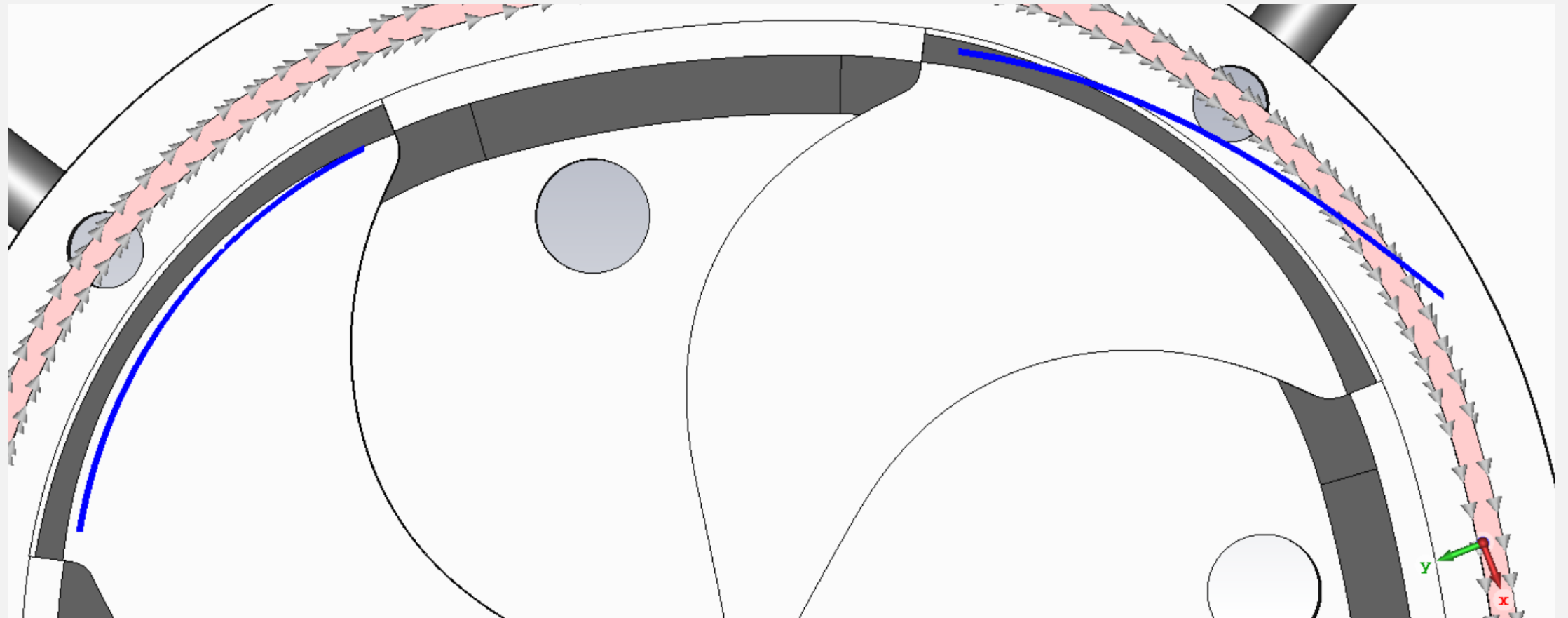
EXTRACTION SYSTEM

Main elements of the extraction system



MAGNETIC CHANNELS

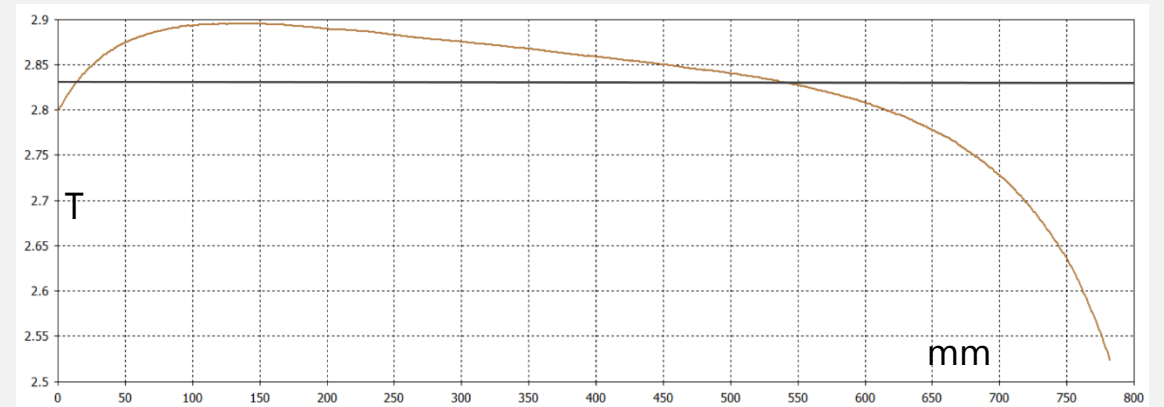
The location of MCs along beam trajectory with relation to the rest of the magnet.



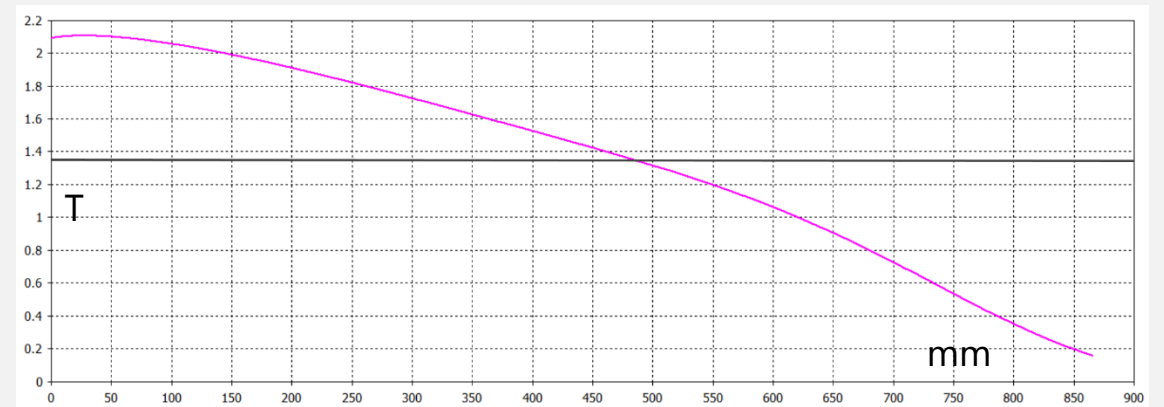
The trajectory intervals to deploy MCs around.

Field distribution & Requirements.

	MC1	MC2
Aperture	10 mm	10 mm
Gradient	100 Gs/mm	170 Gs/mm
Bz shift	-600 Gs	0 Gs



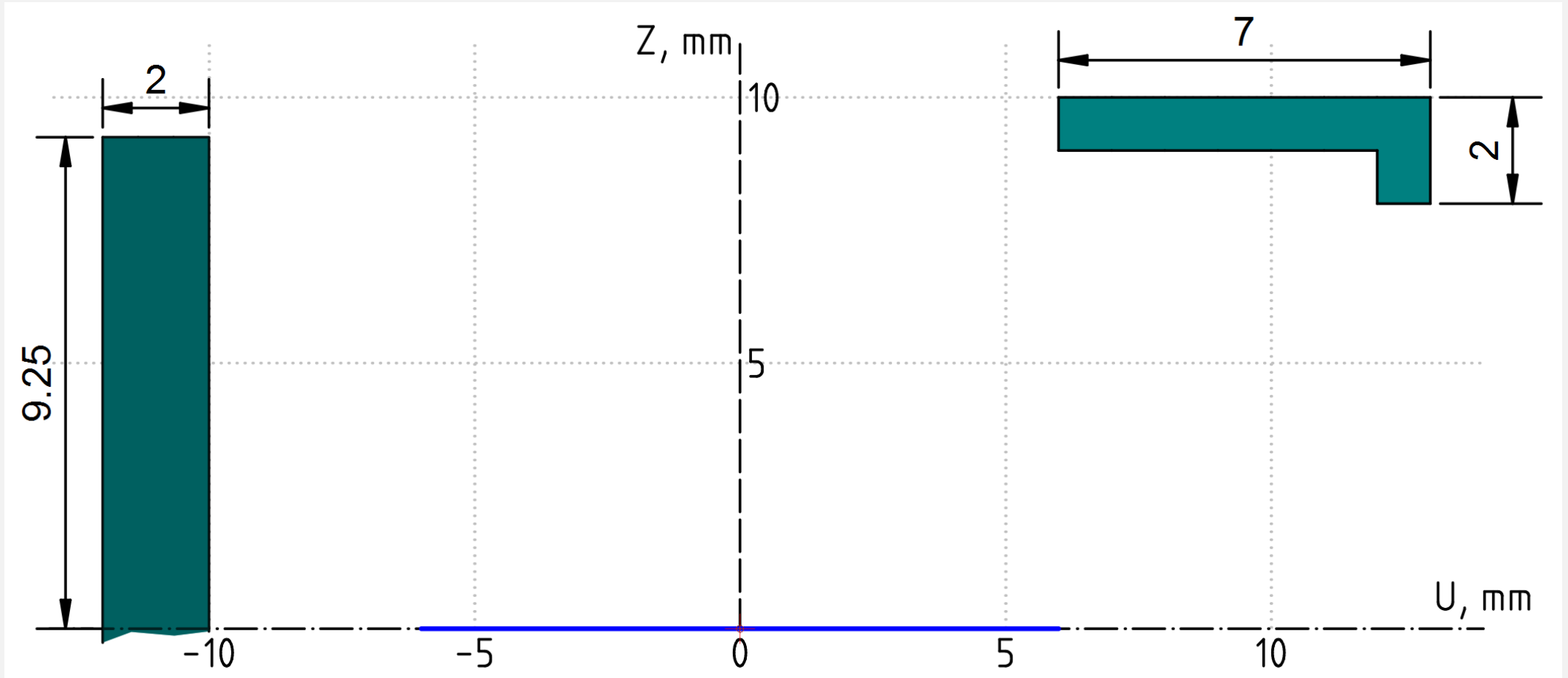
Vertical field on MC1 trajectory.



Vertical field on MC2 trajectory.

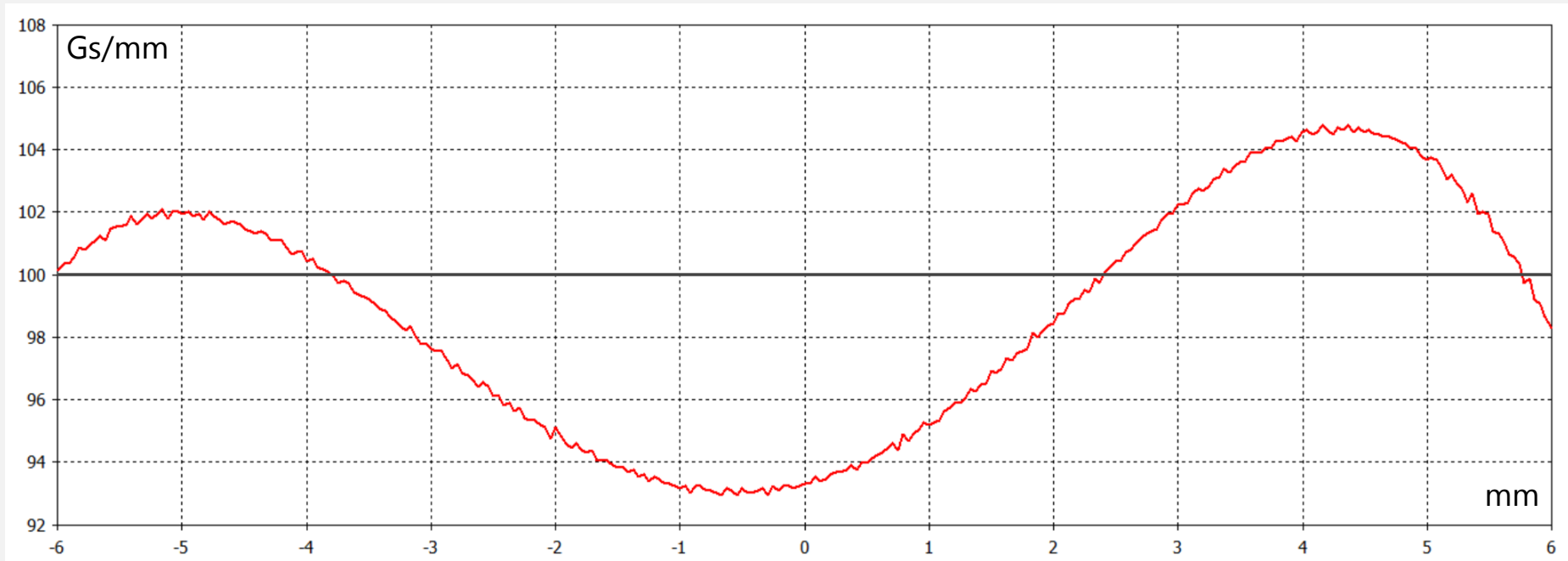
MC DESIGN

MC1

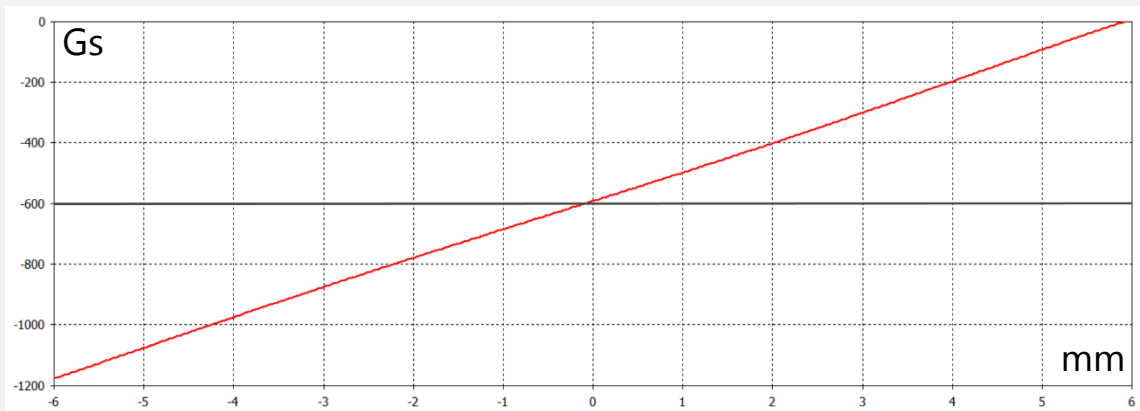


The cross section of the MC1 centered around main particle.

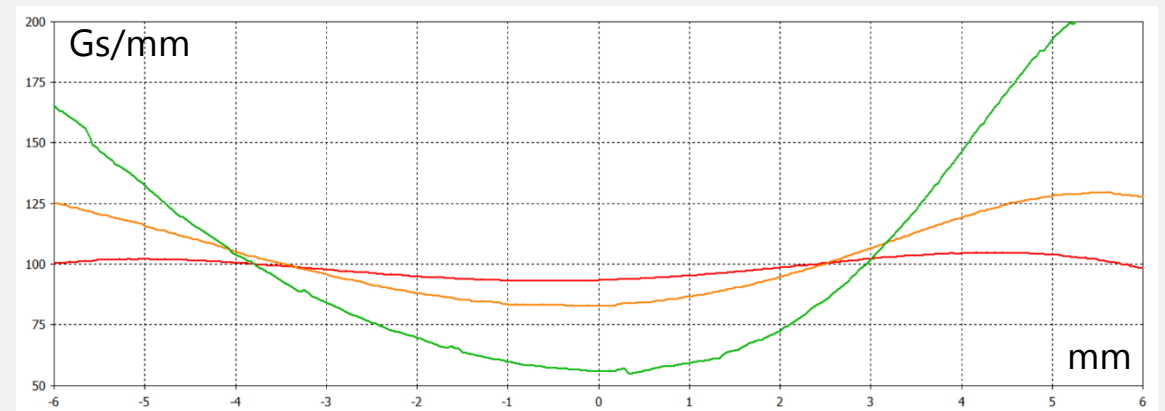
MC1



MC1 gradient.

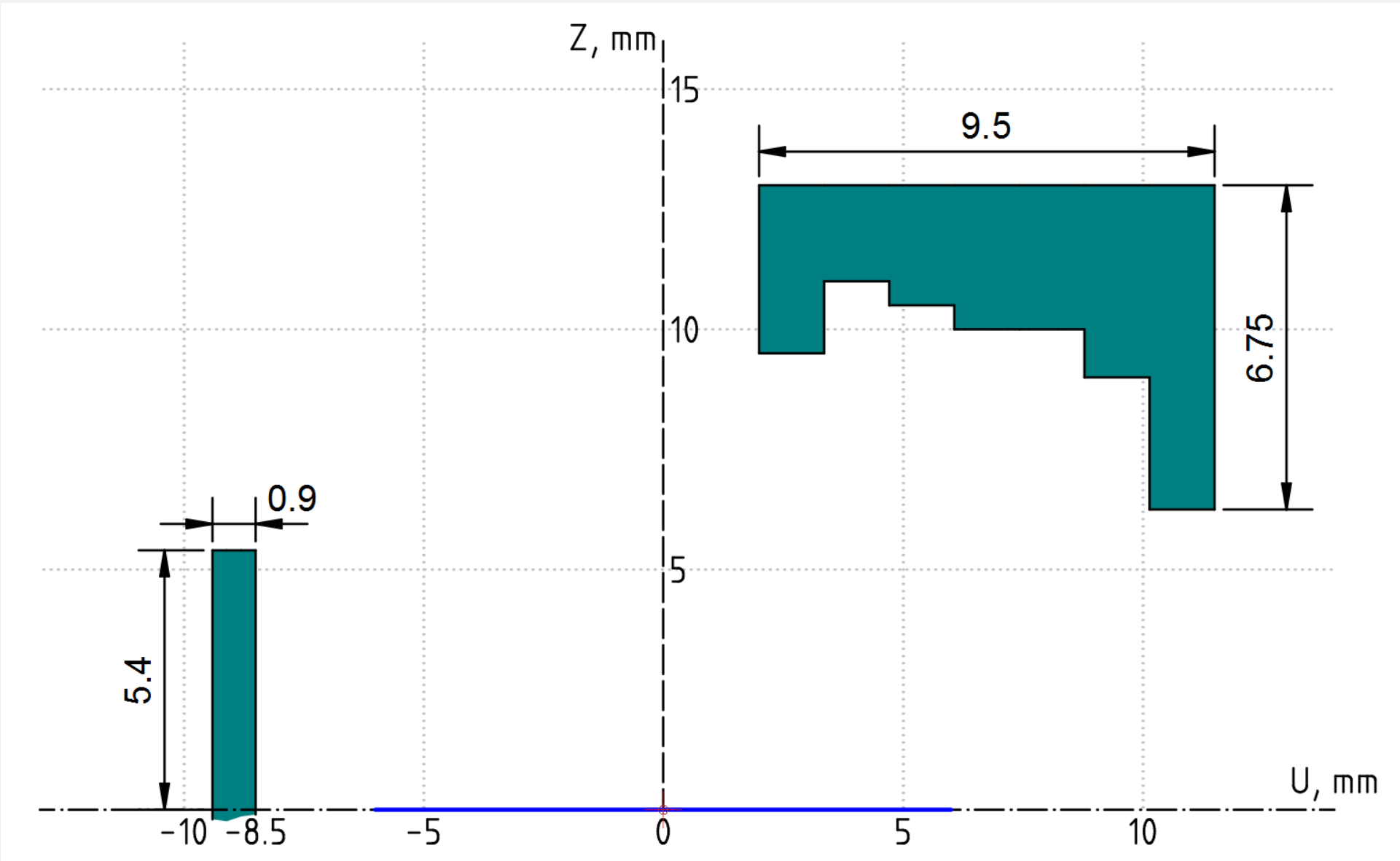


MC1 Bz impact.



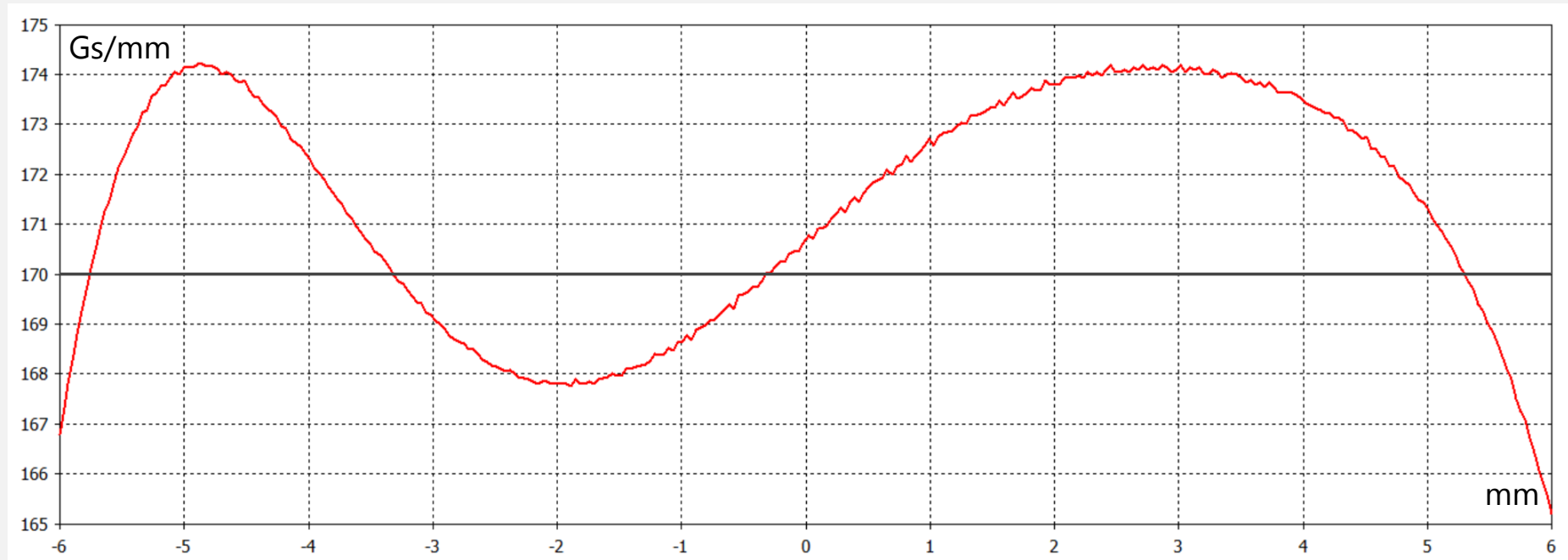
MC1 gradient degradation in vertical direction.

MC2

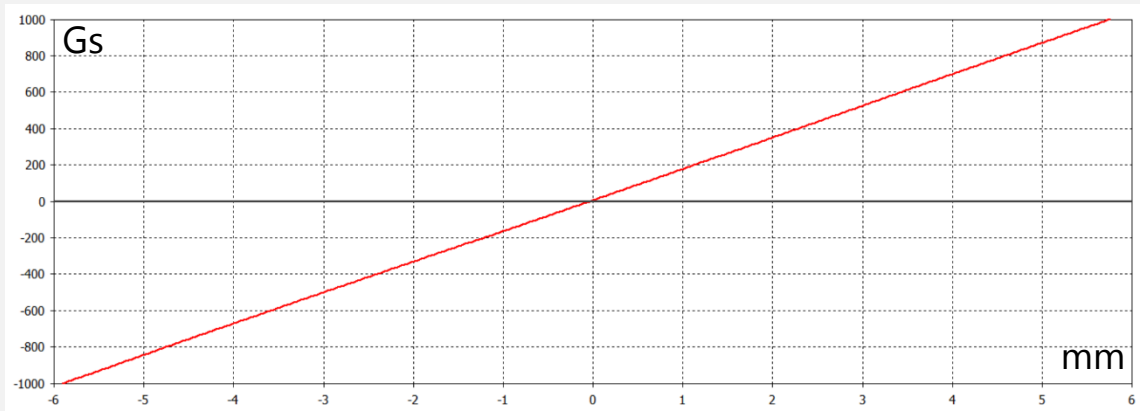


The cross section of the MC2 centered around main particle.

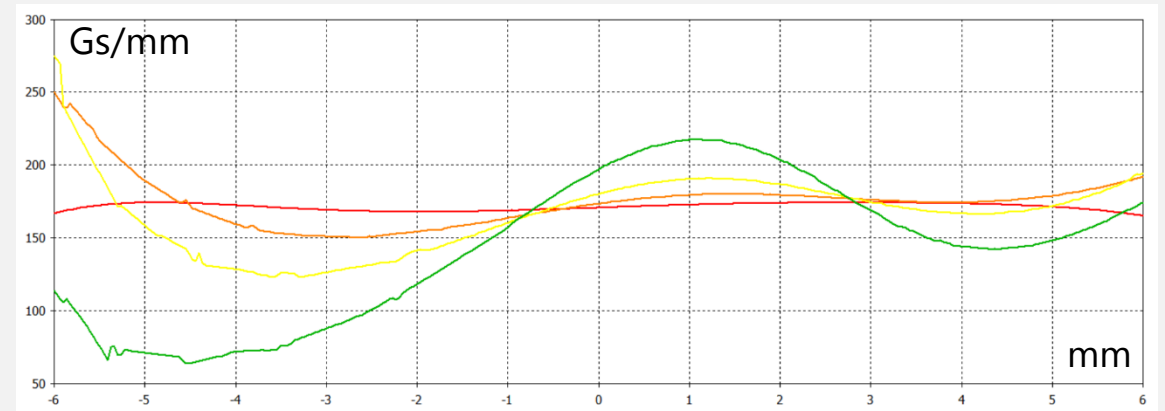
MC2



MC2 gradient.



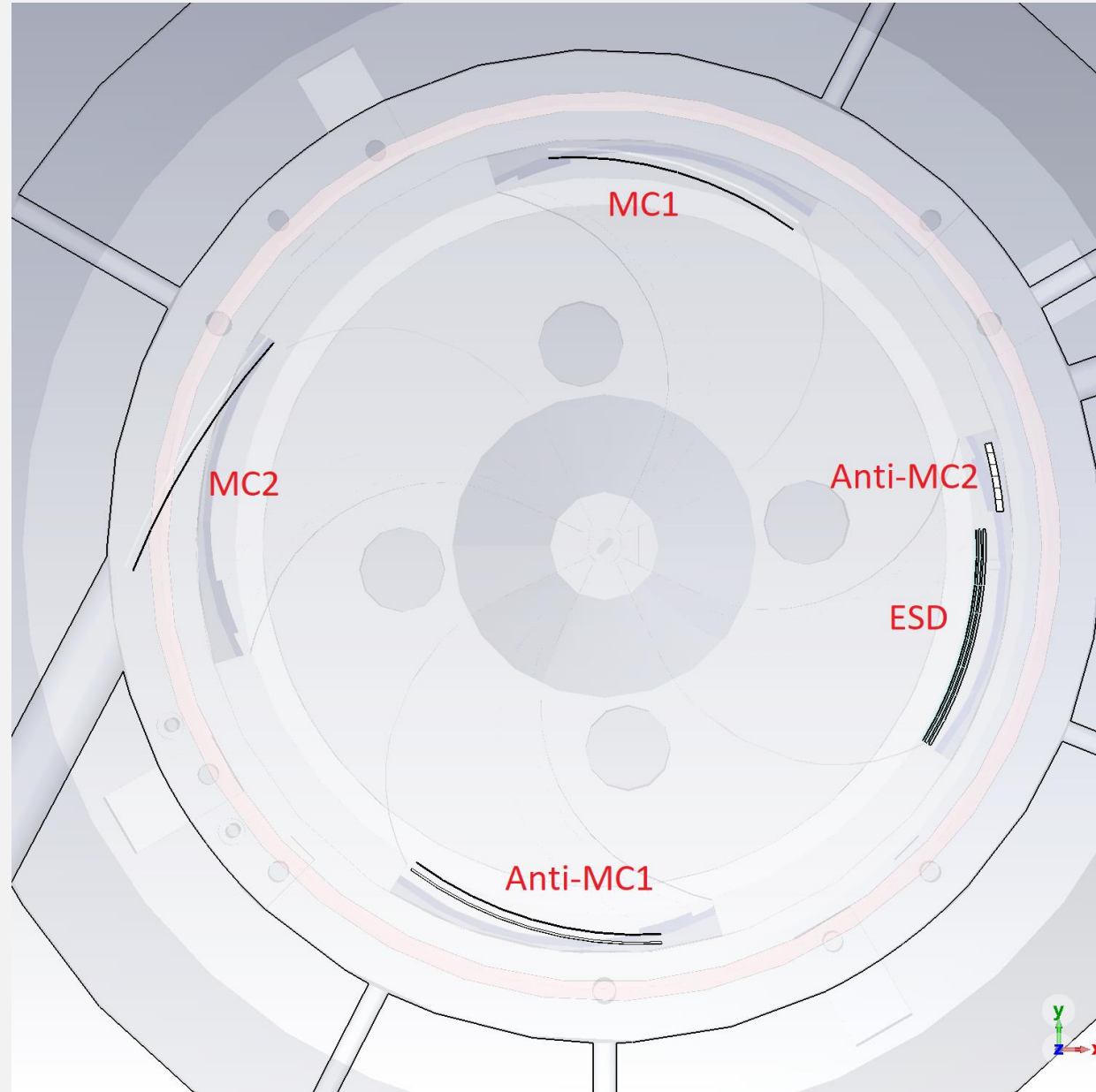
MC2 Bz impact.



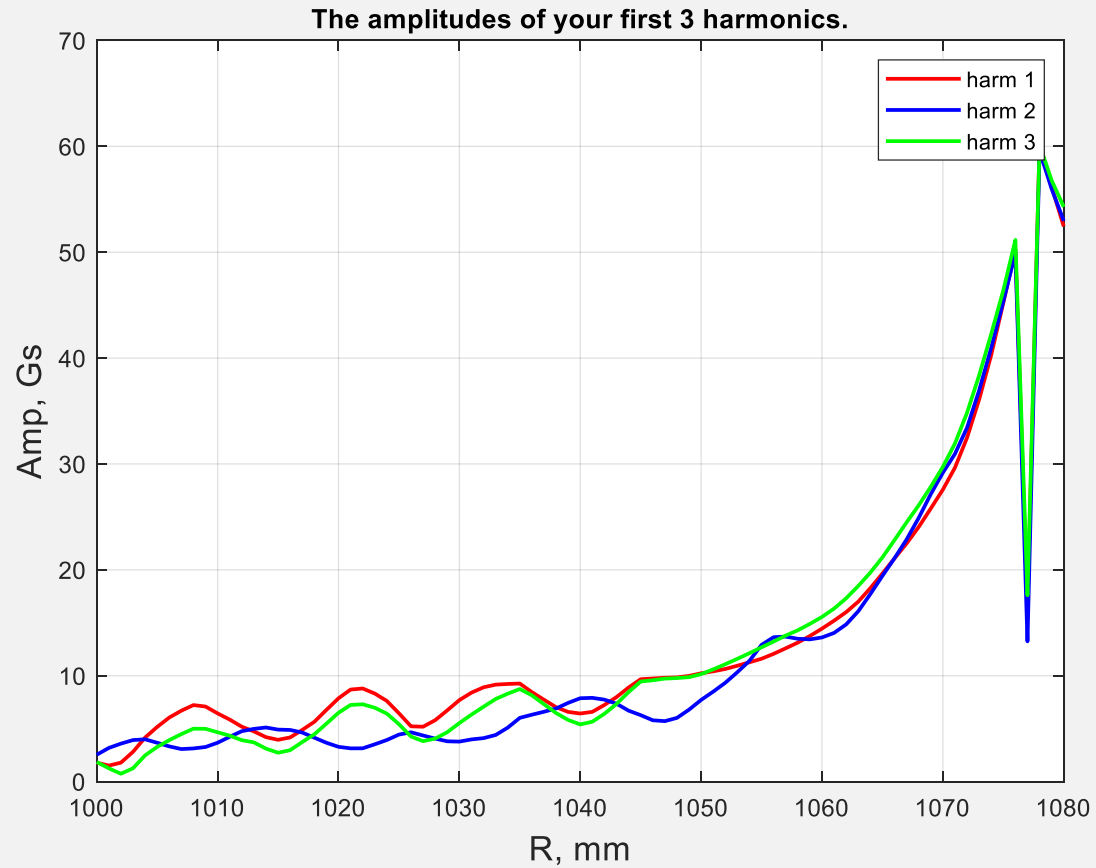
MC2 gradient degradation in vertical direction.

ANTI MAGNETIC CHANNELS

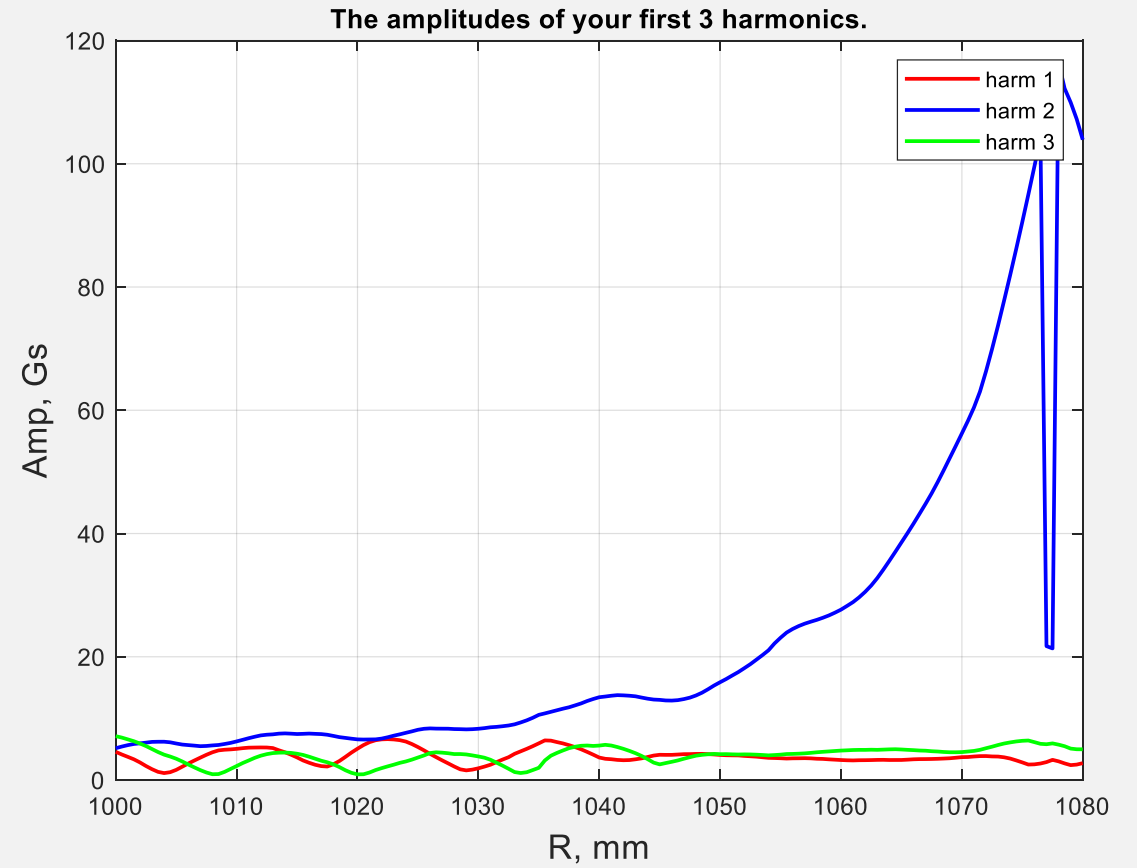
The location of anti MCs



Anti-MC2



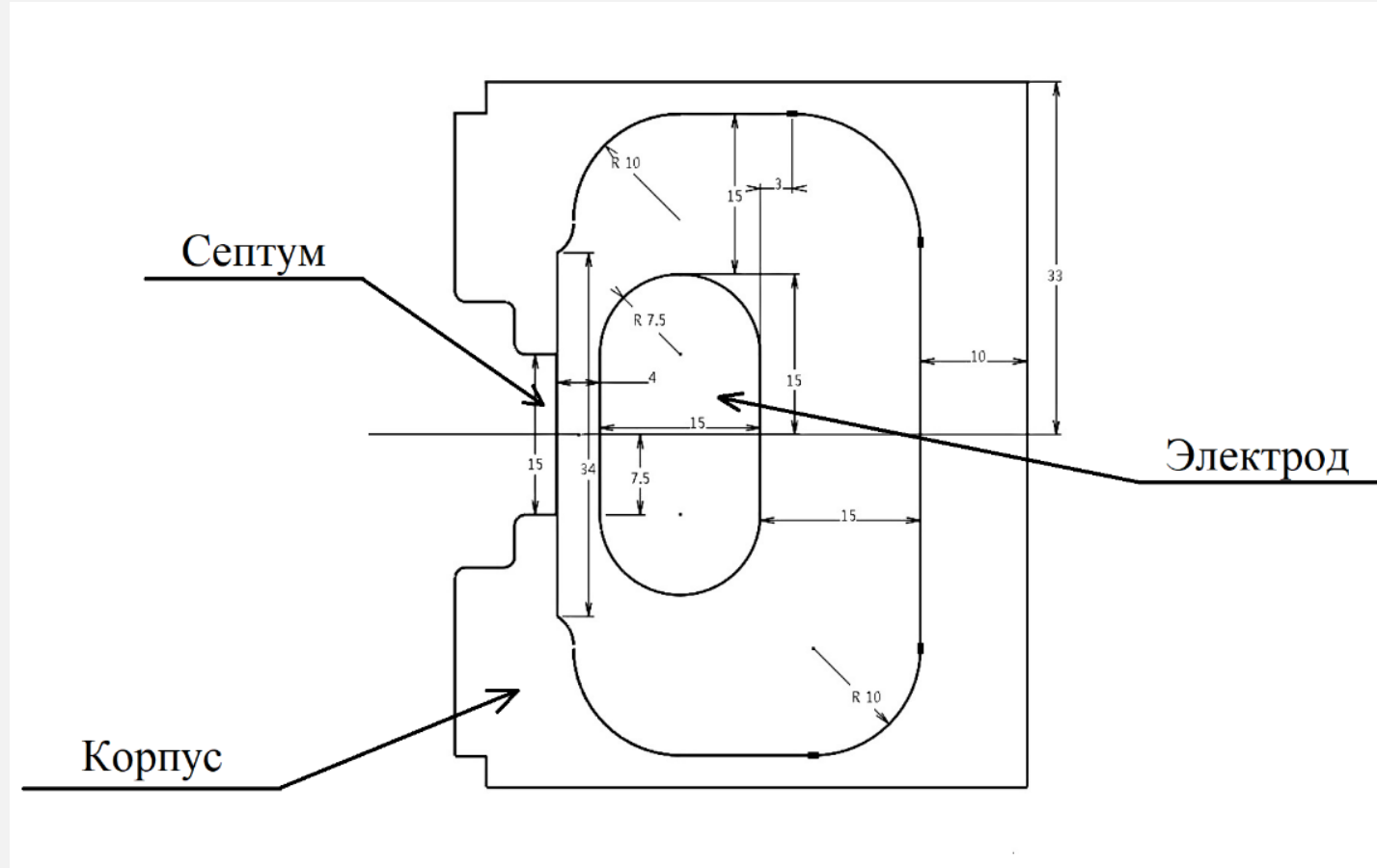
Without anti-MC2



Anti-MC2 installed

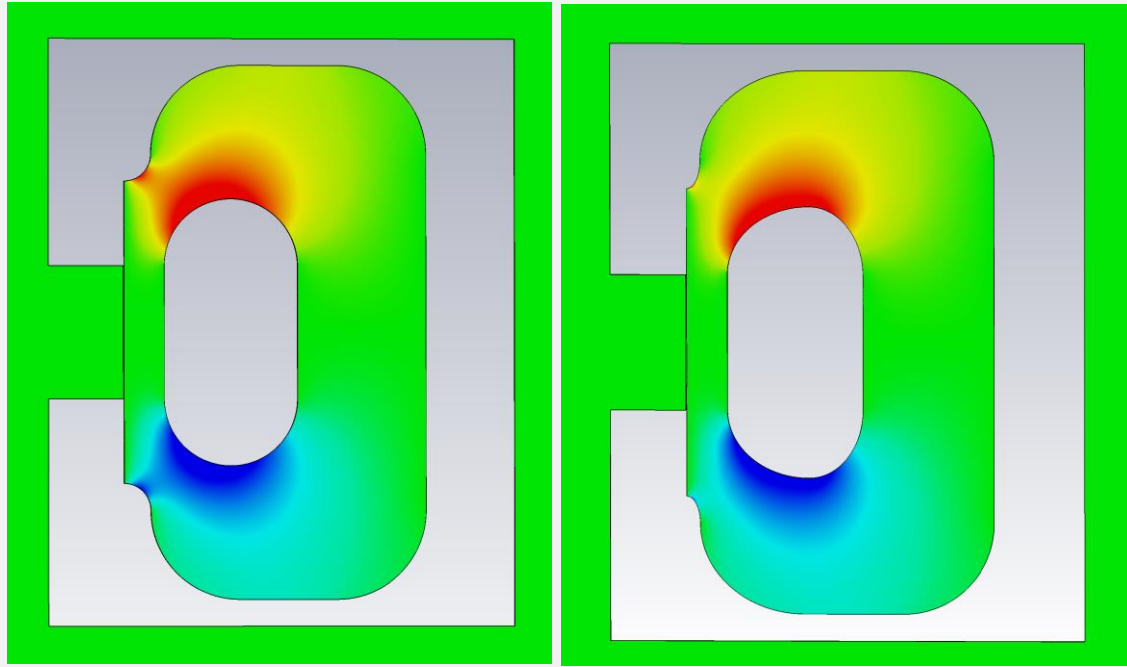
ELECTROSTATIC DEFLECTOR

Initial ESD design

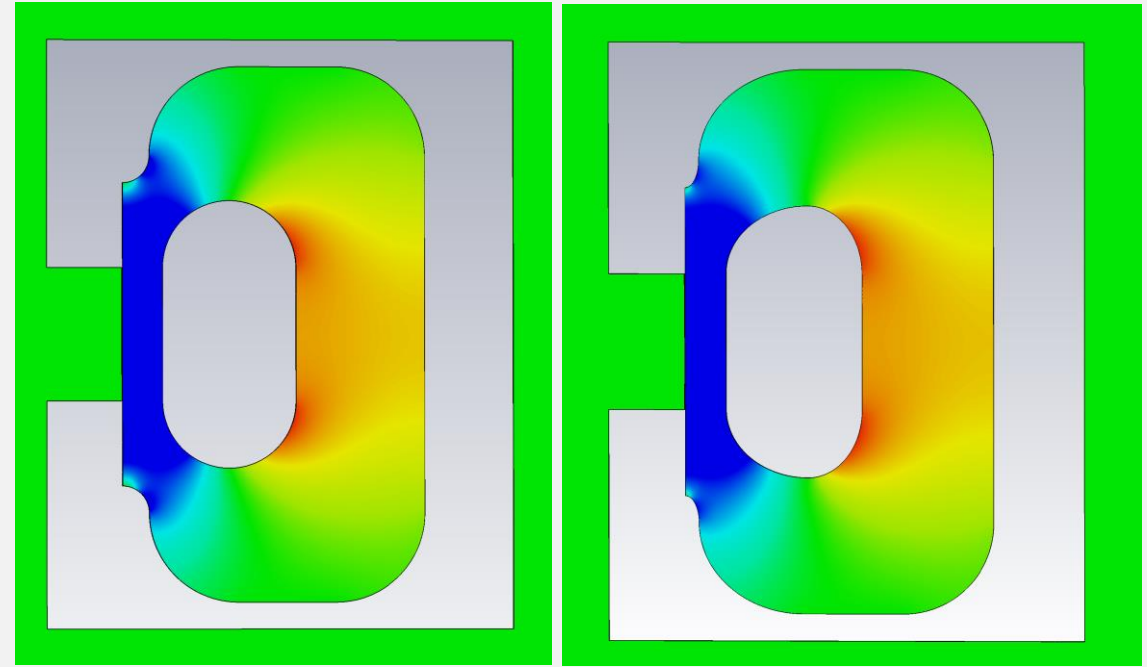


Deflector schematic cross section.

ESD optimization

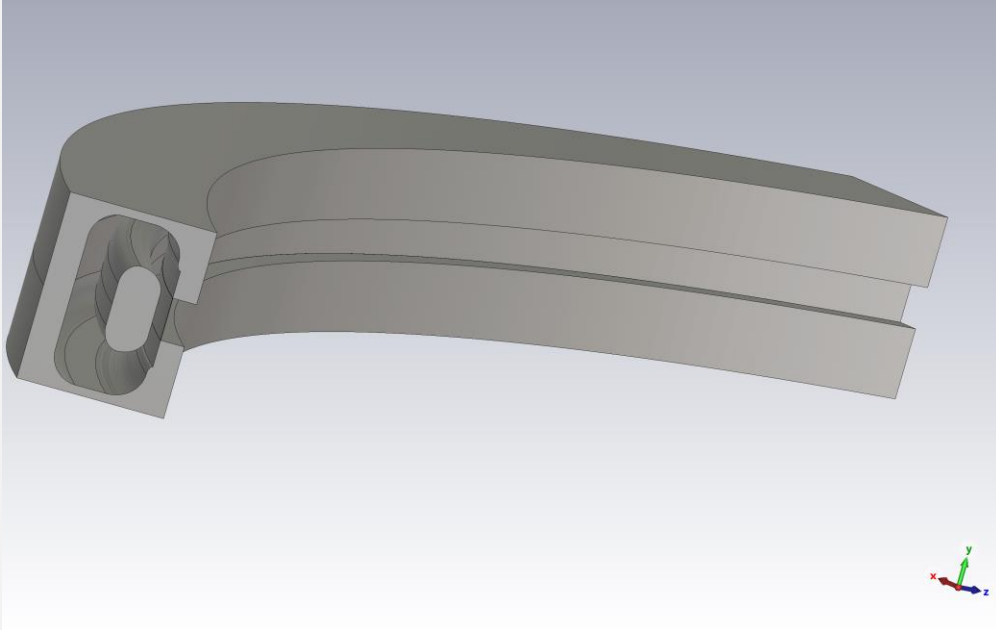


Optimization for E_z component.

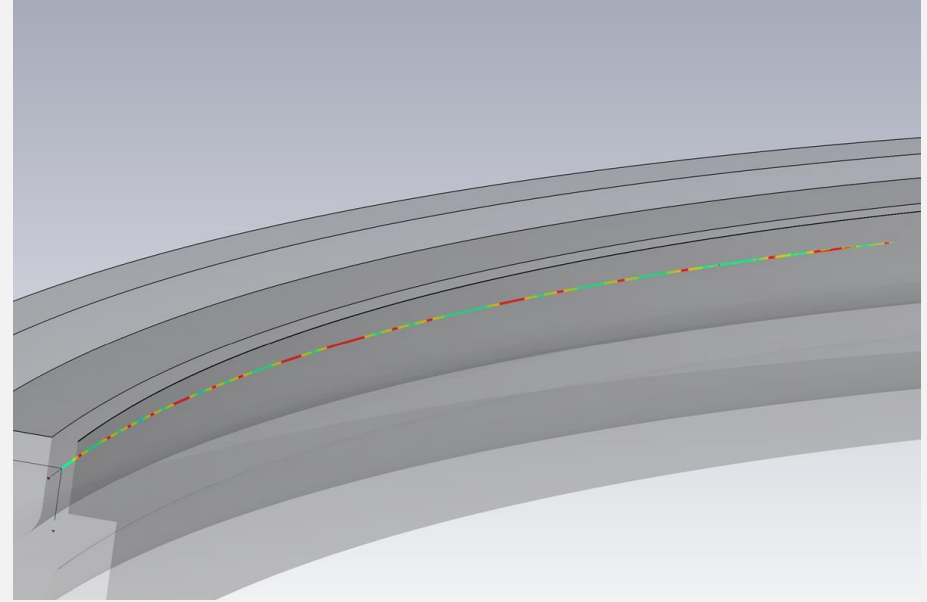


Optimization for E_r component.

Particle tracking



ESD 3D simulation model.



Particle tracking through ESD

CONCLUSION

- The design procedure could be automated, if there is demand.
- The first harmonic of the magnetic channels was negated.
- The deflector cross section geometry was optimized to minimize voltage breakdowns.

THANK YOU FOR YOUR ATTENTION