Analysis of the Magnetic shield for ILC Cavities

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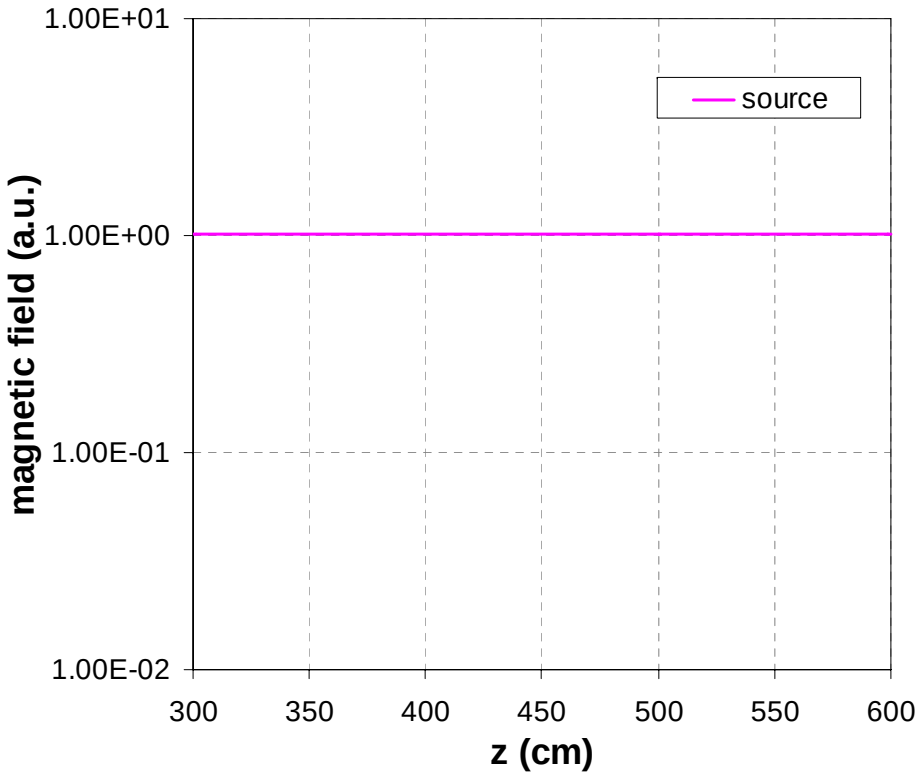
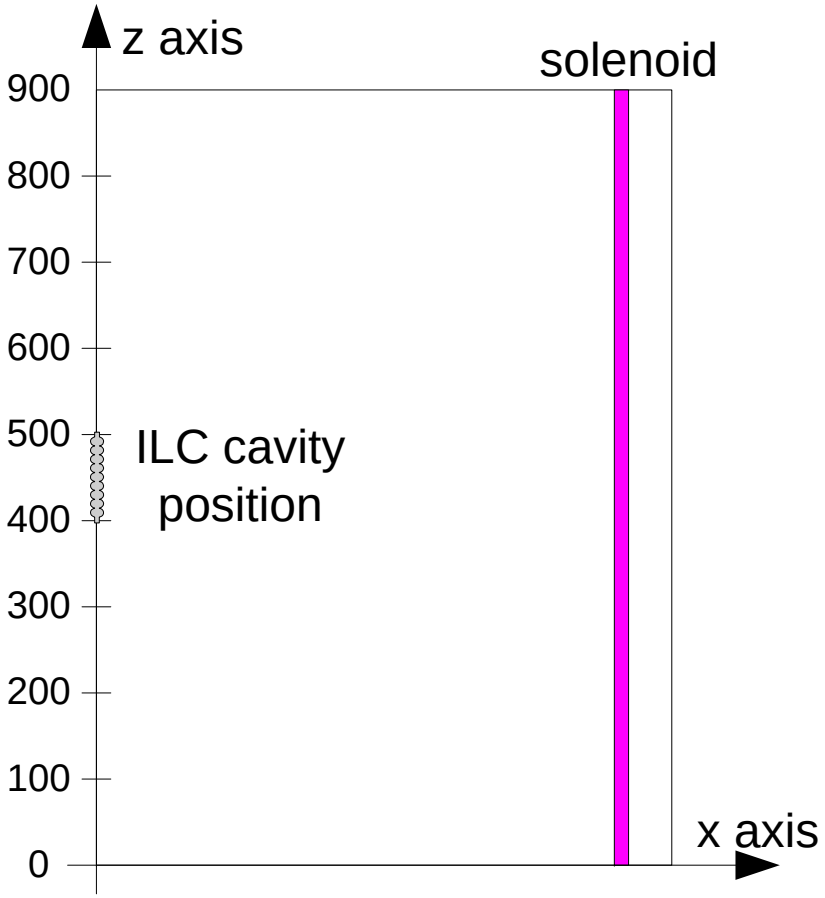
Magnetic Field Generation

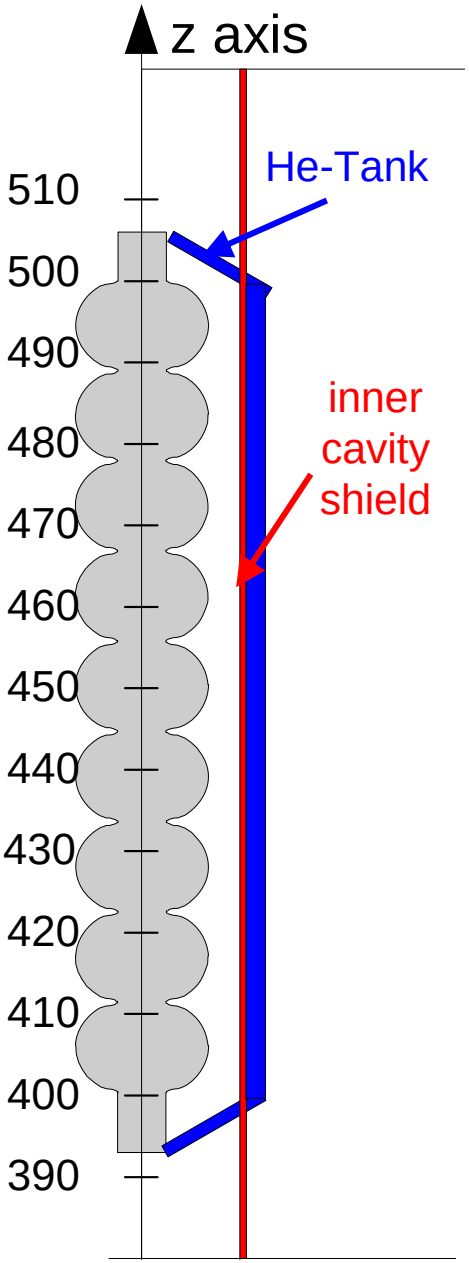
Code: POISSON

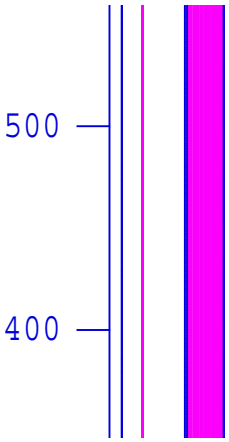
- A uniform magnetic field has been generated with a solenoid.
- The field magnitude is 1 on the axis.
- The field is parallel to the cavity axis
- The cavity is placed between 400 and 500 cm.



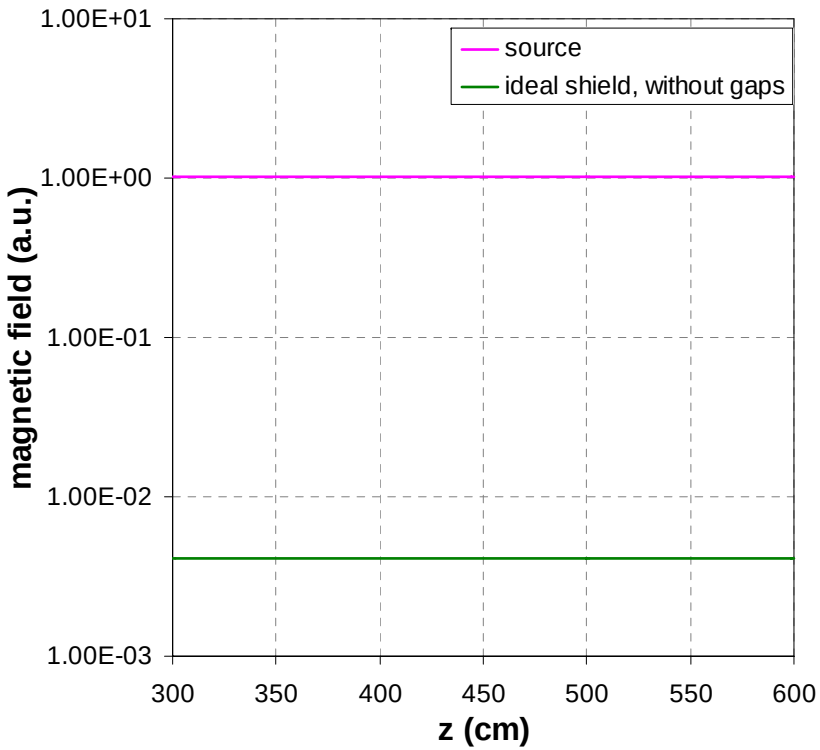


Ideal shield without gaps





Simulated
field lines



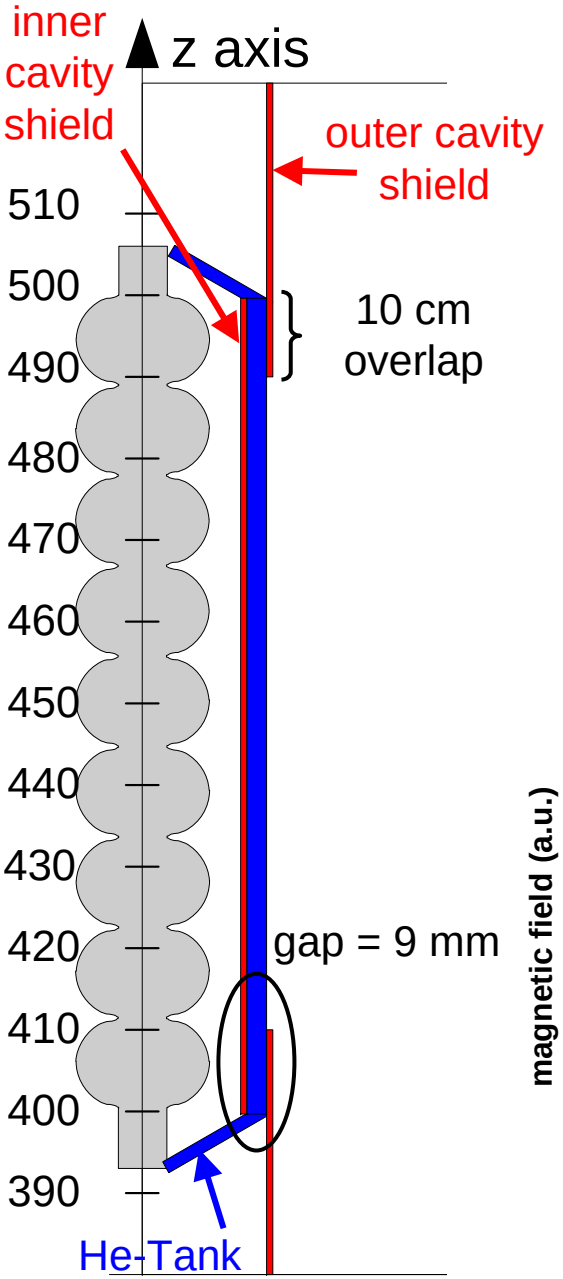
Infinite inner shield

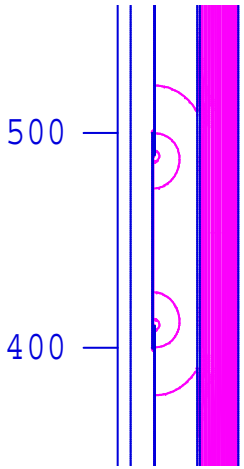
(shielding material:
thickness = 3 mm;
μ_r = 100000)

Uniform field distribution
on cavity axis.

$R_{inner/outer}(450cm) = 4 \cdot 10^{-3}$

Outer ideal shield with gaps

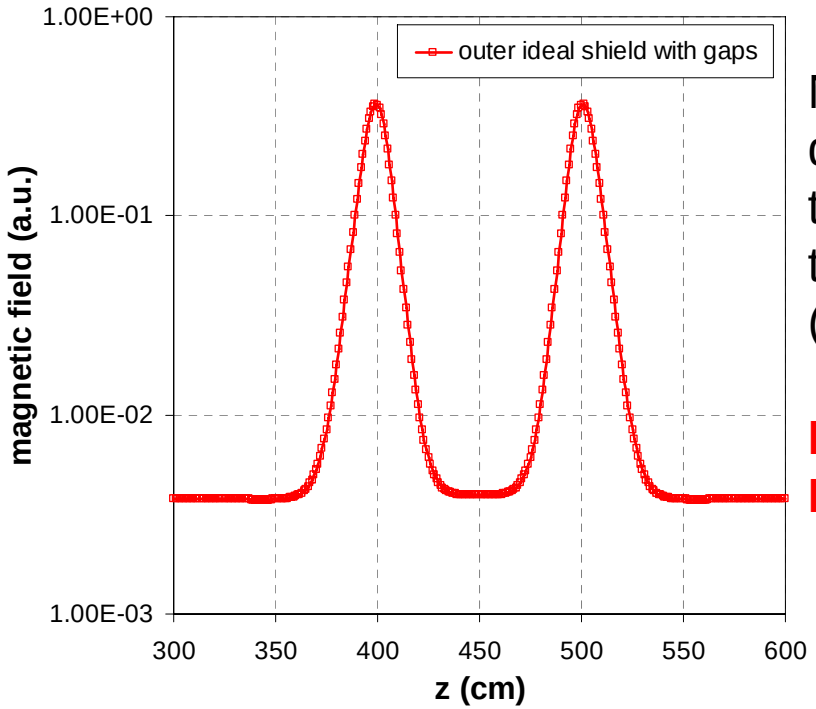




Simulated field lines

- inner shield
- outer shield infinite with 10 cm overlap

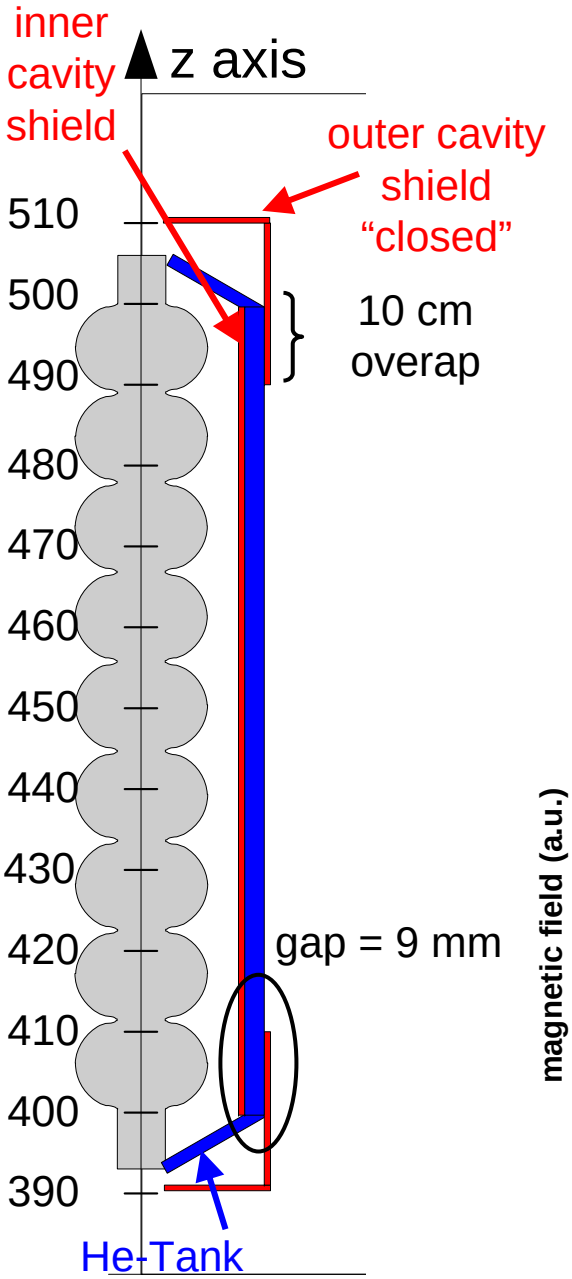
(shielding material: thickness = 3 mm; μ_r = 100000)

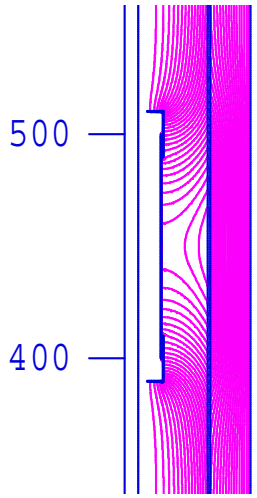


Not uniform field distribution on cavity axis: two peaks corresponding to the inner shield borders (gaps)

$R_{inner/outer}$(gaps) = 0.35
$R_{inner/outer}$(450cm) = $4 \cdot 10^{-3}$

Outer shield “closed” with gaps

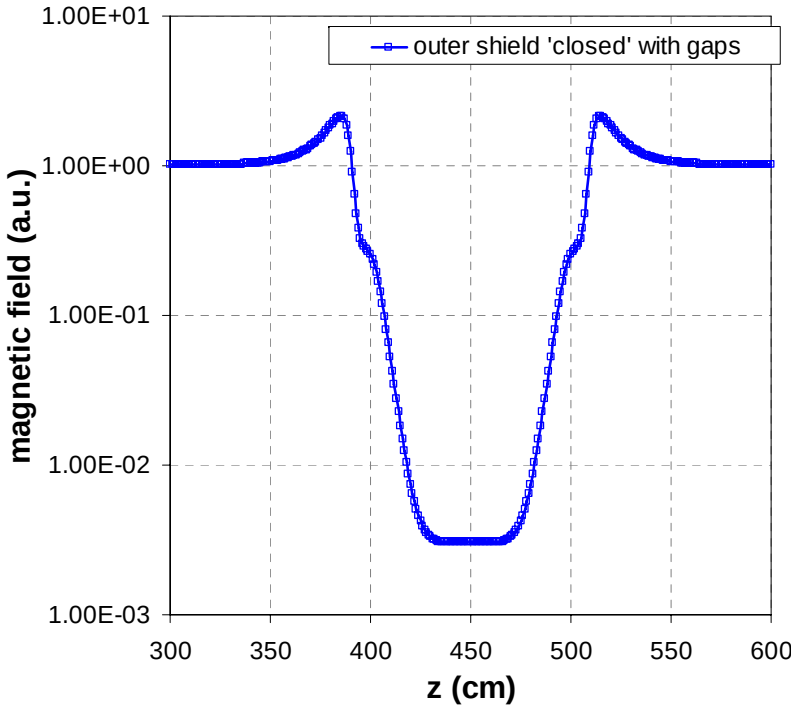




Simulated field lines

- inner shield
- outer shield “closed” (on the cut-off tube) with 10 cm overlap

(shielding material: thickness = 3 mm; μ_r = 100000)

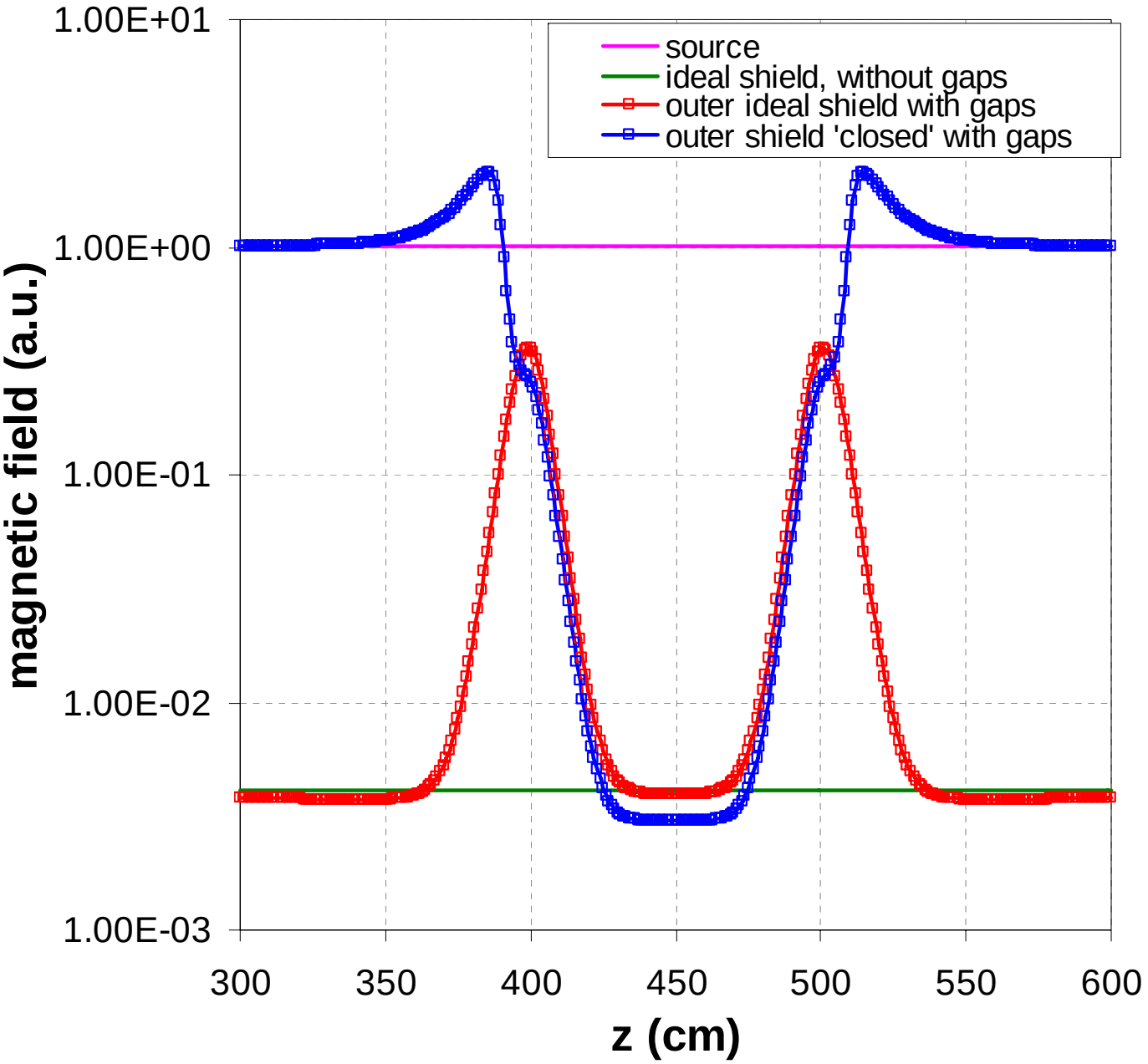


Not uniform field distribution on cavity axis:

- two maxima corresponding to the border of the shield ‘cap’
- two flexes corresponding to the inner shield borders (gaps)

$R_{inner/outer}$(gaps) = 0.28
$R_{inner/outer}$(max) = 2.11
$R_{inner/outer}$(450cm) = $3 \cdot 10^{-3}$

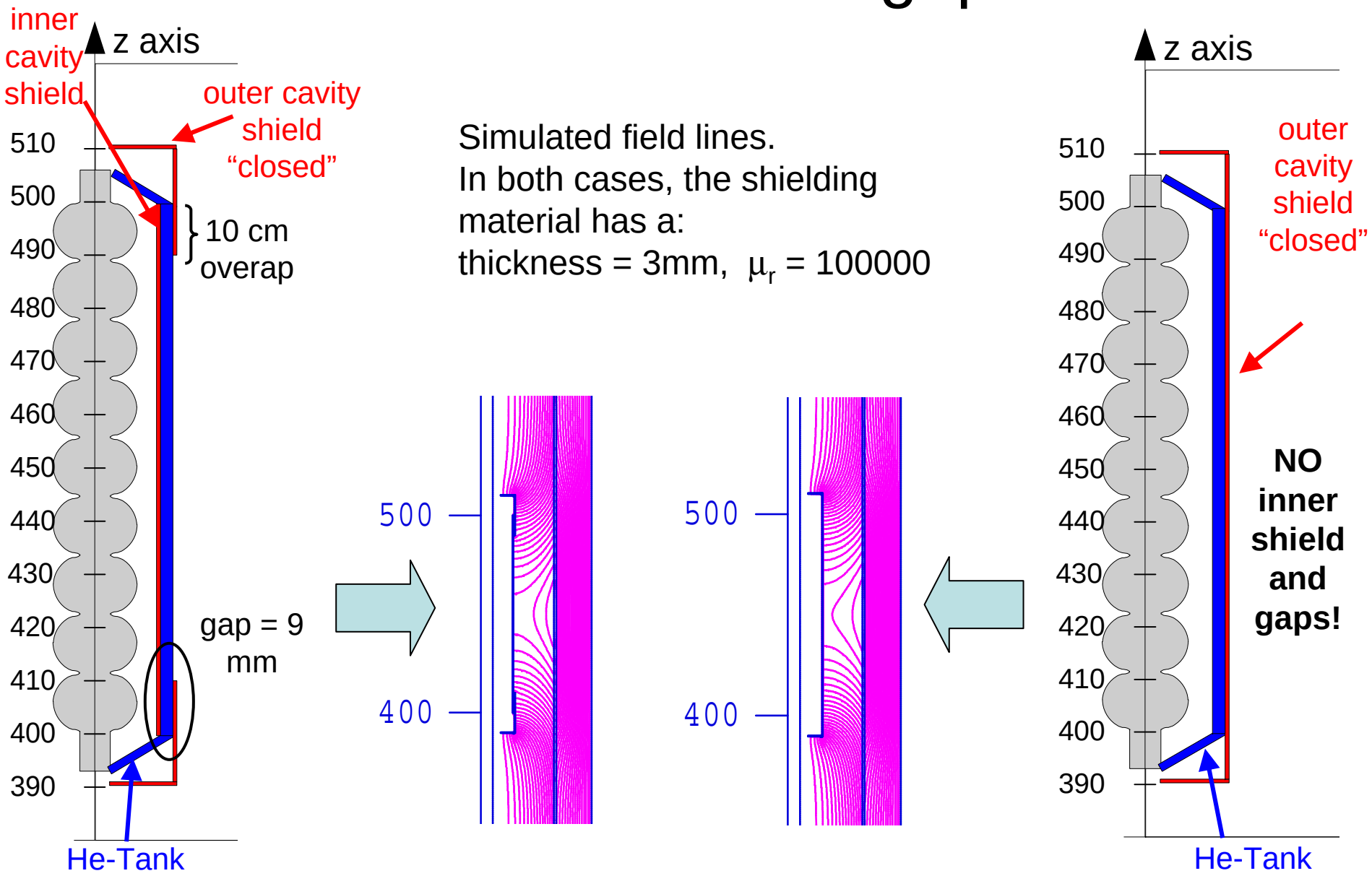
Summary of the studied shield cases



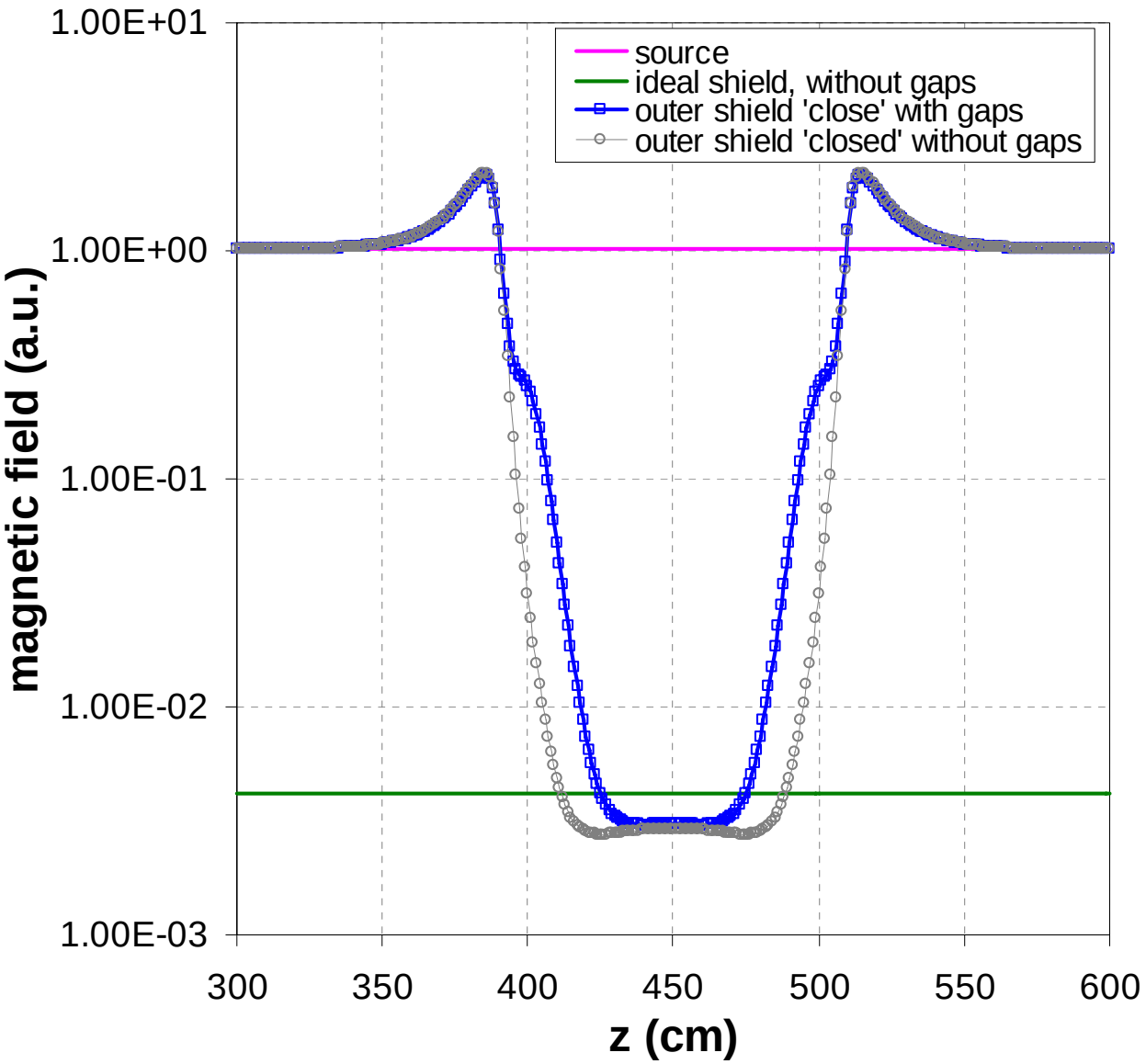
From simulation, main results obtained with the inner shield (inserted in the He-tank) are:

- The residual magnetic field in the center of the cavity is low (better with the "closed" solution)
- The magnetic field sharply increases approaching the end of the inner shield (near 400 cm) both in the ideal and in the closed solution
- Corresponding to the end of the inner shield a maximum (ideal case) or a flex (closed case) are present

The outer shield “closed” solution: with and without gaps



The outer shield “closed” solution: with and without gaps



Comparing the two cases we observe:

- two maxima in the same position and of the same magnitude (because of the same external shield border position and dimension in both cases)
- the flexes are not present with the external shield alone: the field is lower!
- playing with the size of the external border give the possibility to lower the residual magnetic field in the cavity region

Better without the inner shield:

- **No gaps means no magnetic field peak or flex in the gap region!**