Electric field calculations with MaGe and Maxwell

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Motivation

The aim of this work is compare weighting potential and electric field calculations from MaGe (work done by D.Lenz at MPI) and Maxwell.

Calculations:

- Comparisons is done for coaxial detectors.
- Well type detectors and non-segmented BEGE's (will skip this).
- And finally for segmented BEGe's.

Introduction

MaGe:

- Can do field calculations for simple detectors (coaxial, well type, etc.) and segmented coaxial detectors (non-realistic).
- Bias and impurity are used as an input.
- Field calculations are done on predefined grid points and then interpolated.

Introduction

MaGe:

- Can do field calculations for simple detectors (coaxial, well type, etc.) and segmented coaxial detectors (non-realistic).
- Bias and impurity are used as an input.
- Field calculations are done on predefined grid points and then interpolated.

Maxwell:

- Used for field calculations for any type/shape detector.
- Bias and impurity are used as an input.
- Field calculations are done on predefined grid points and then interpolated (like MaGe).
- Results are imported into MaGe for comparisons.

A Simple Case

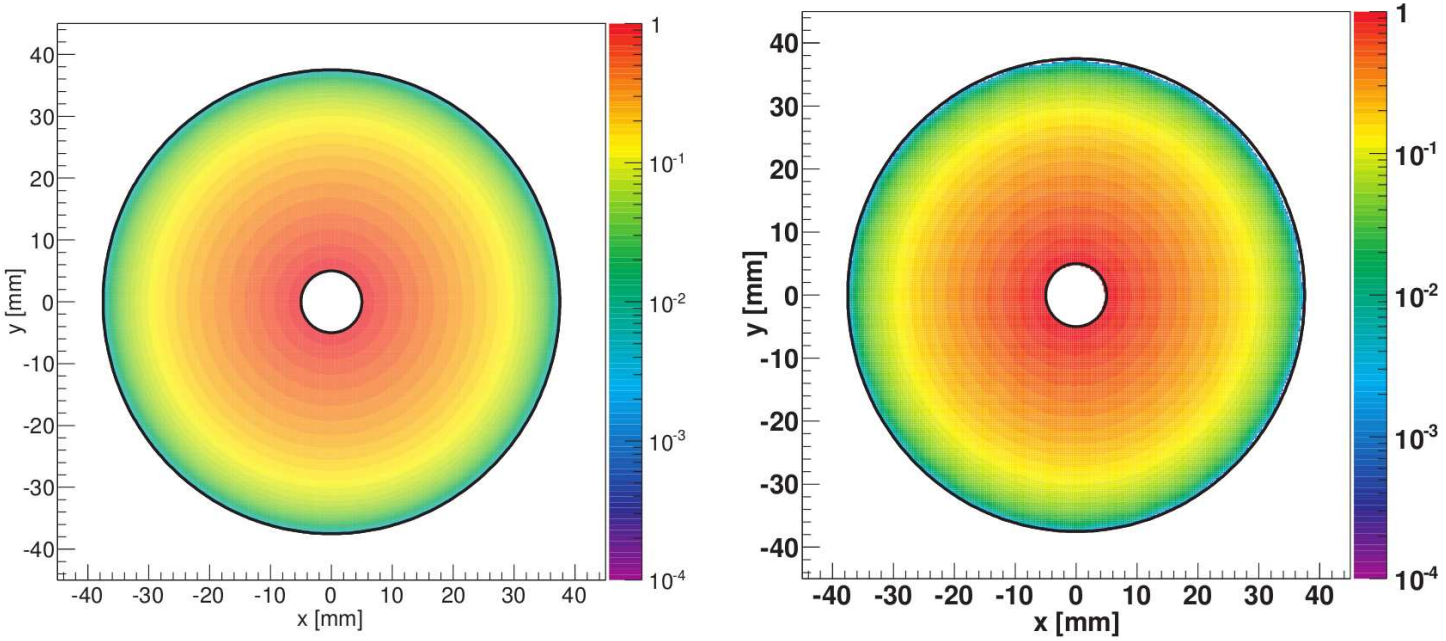
Consider a non-segmented true coaxial detector for a start.

Parameters:

- Detector dimensions are 70 mm (height), 10 mm (inner diameter) and 75 mm (outer diameter).
- +3000 V bias applied to the core in field calculations.
- Impurity density of 1×10^{10} cm^3 is used.

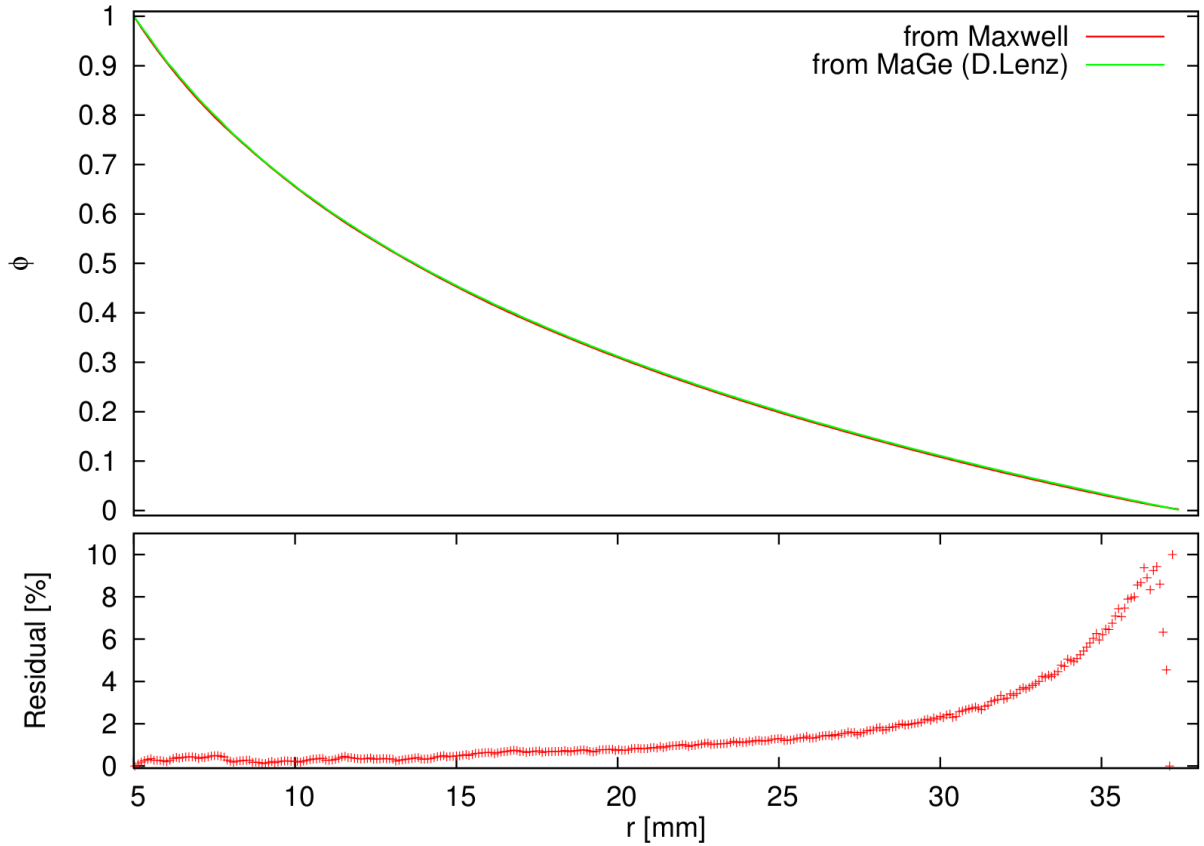
A Simple Case

Comparison of weighting potential for core signal in MaGe (left) and Maxwell (right) for a true coaxial detector.



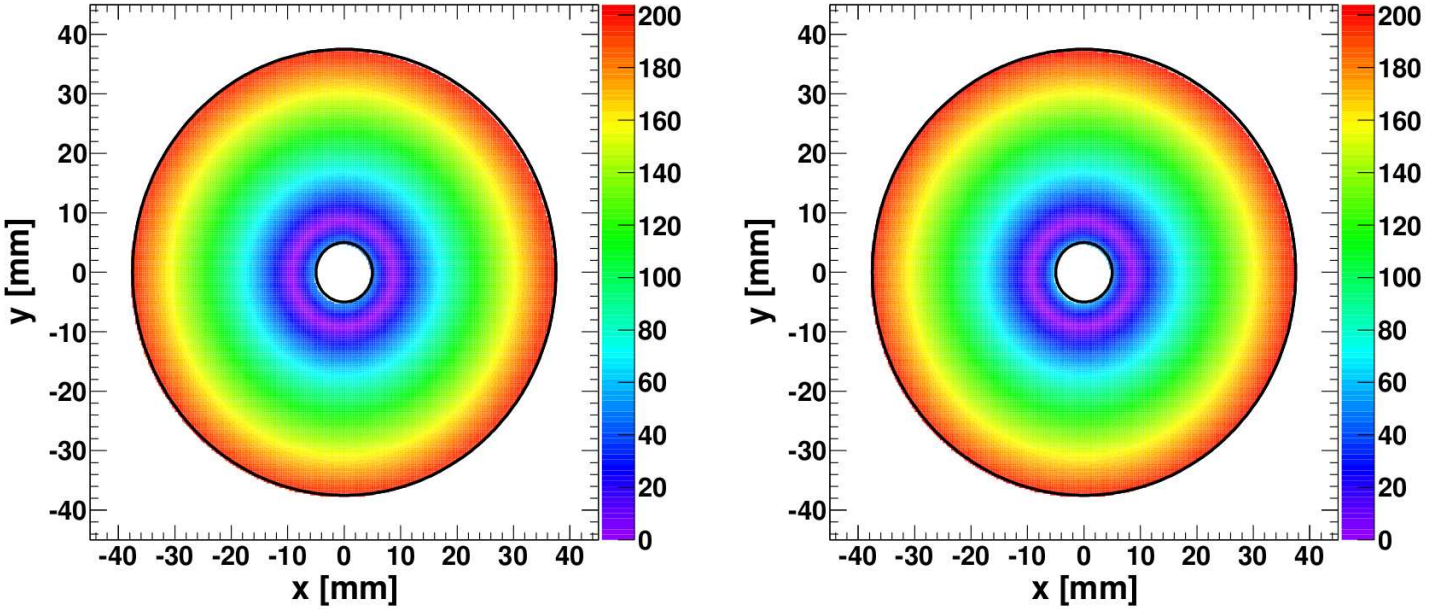
A Simple Case

Comparison of weighting potential for core signal in MaGe (left) and Maxwell (right) for a true coaxial detector.



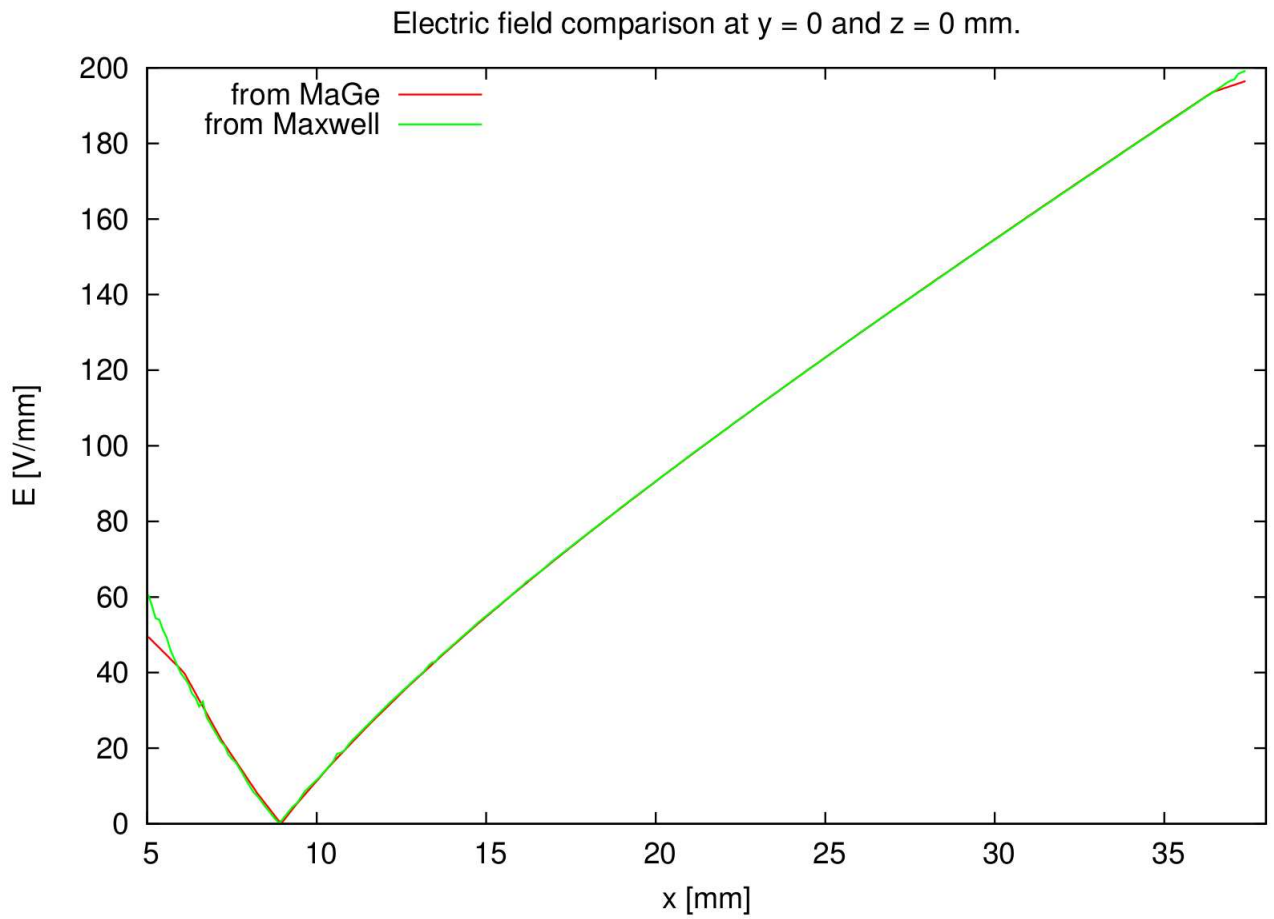
A Simple Case

Comparison of electric field for core signal in MaGe (left) and Maxwell (right) for a true coaxial detector.



A Simple Case

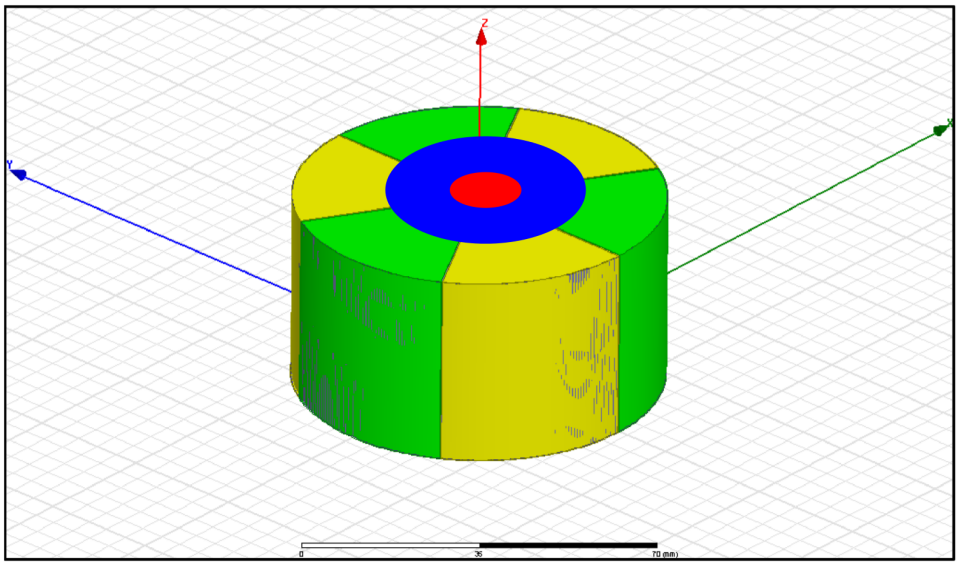
Comparison of electric field for core signal in MaGe (left) and Maxwell (right) for a true coaxial detector.



MaGe with adaptive grid

With current MaGe, we were unable to simulate realistic detectors. Therefore, a new method is added to MaGe (A. Volynets).

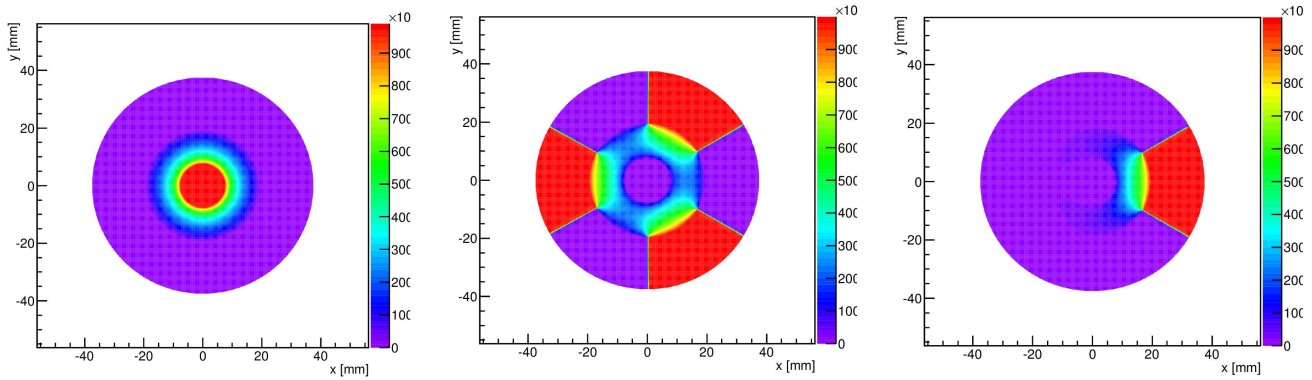
- User sets a default grid points for field calculations.
- More grid points might be added depending on the grid refining limit.
- We can design a segment geometry as we want (almost!).



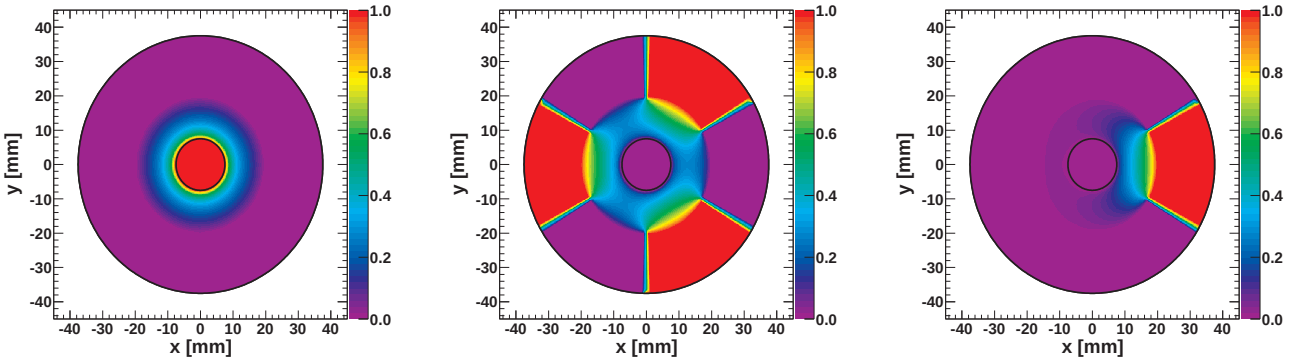
MaGe with adaptive grid

Consider a segmented BEGe weighting potential calculations for point contact (left), mantle (center) and a segment (right).

MaGe:



Maxwell:

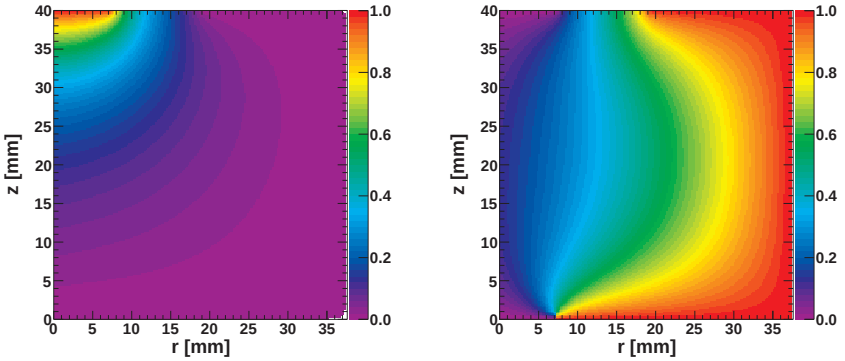


View from the top.

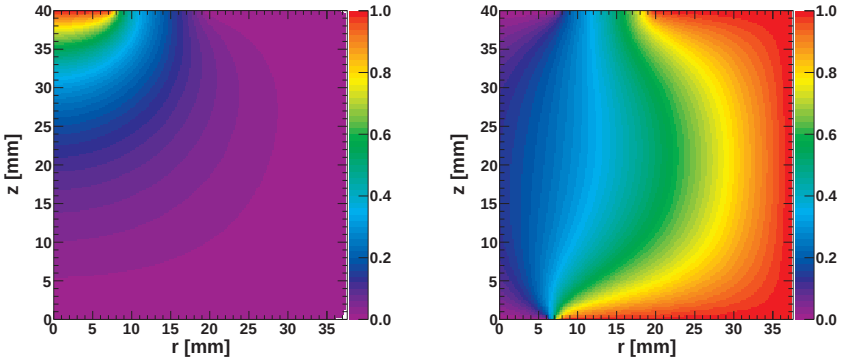
MaGe with adaptive grid

Consider a segmented BEGe weighting potential calculations for point contact (left) and a segment (right).

MaGe:



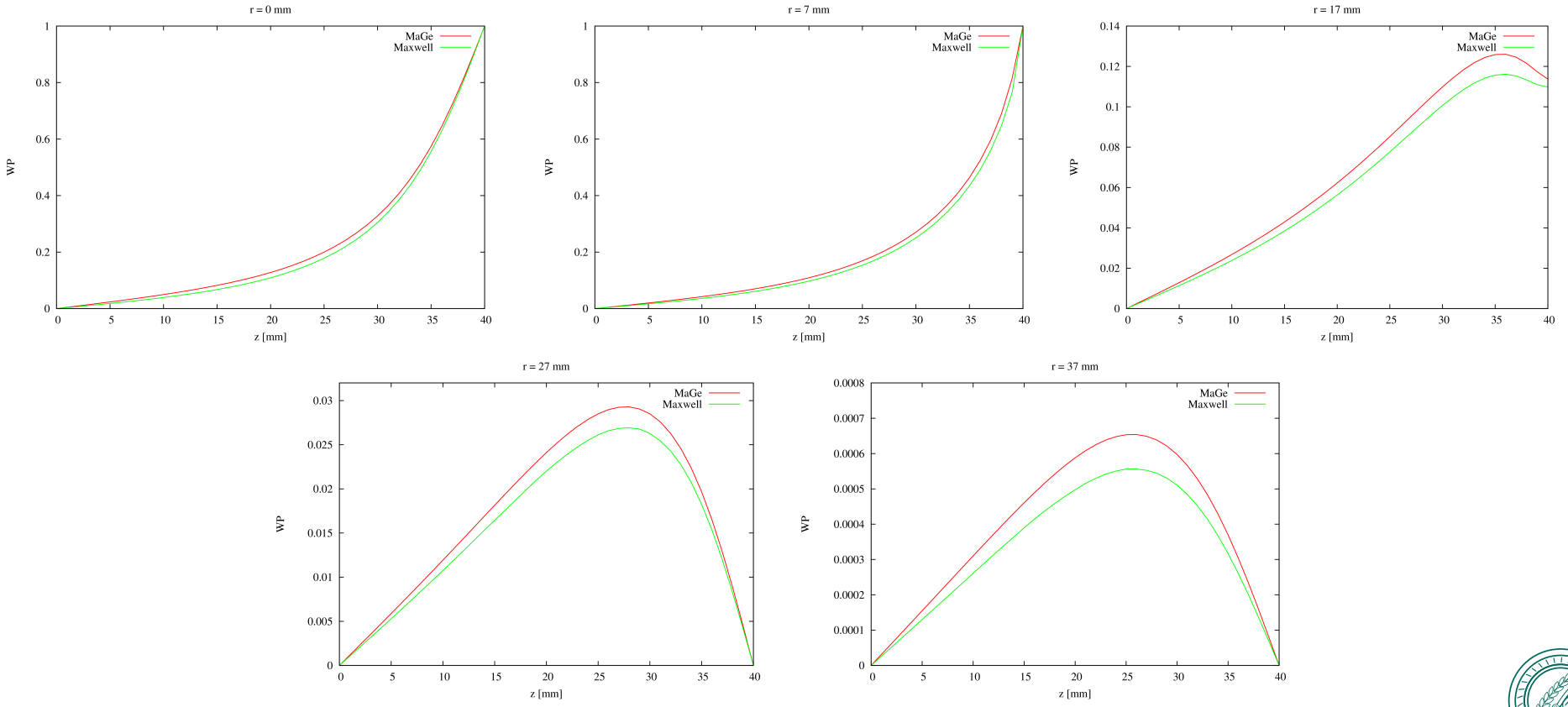
Maxwell:



View from the side, sliced at the center.

MaGe with adaptive grid

Consider a segmented BEGe weighting potential calculations for point contact select different radii.



Summary

- MaGe does quite good job in calculating fields and weighting potentials.
- Maxwell extension is added to MaGe so that we can import field calculations.
- By use of adaptive grid, we can simulate more realistic detectors.
- The new method is still in development phase. We would like to finish our checks as soon as possible.
- For our segmented BEGe detector electric field calculations will be compared.
- The same comparison will be done our special detector (SuSie) with 19-segments.