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Comparative study between in-situ measurements and a 3D efficient model for the computation of magnetic fields in High Field Polyhelix magnets

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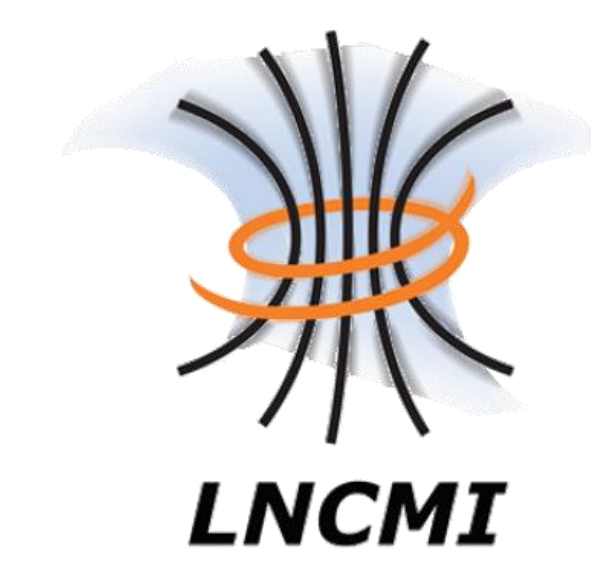
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Comparative study between in-situ measurements and a 3D efficient model for the computation of magnetic fields in High Field Polyhelix magnets

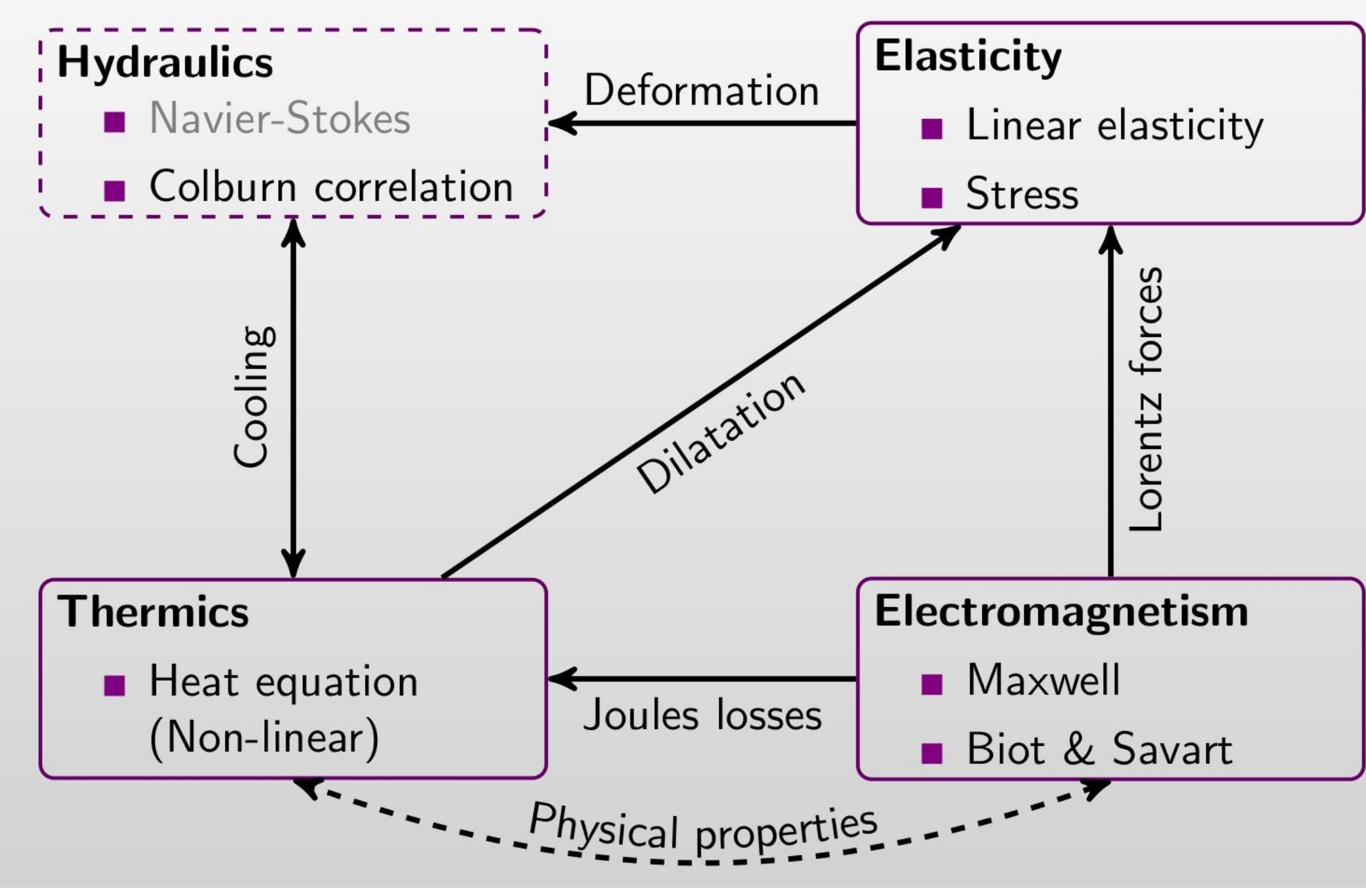
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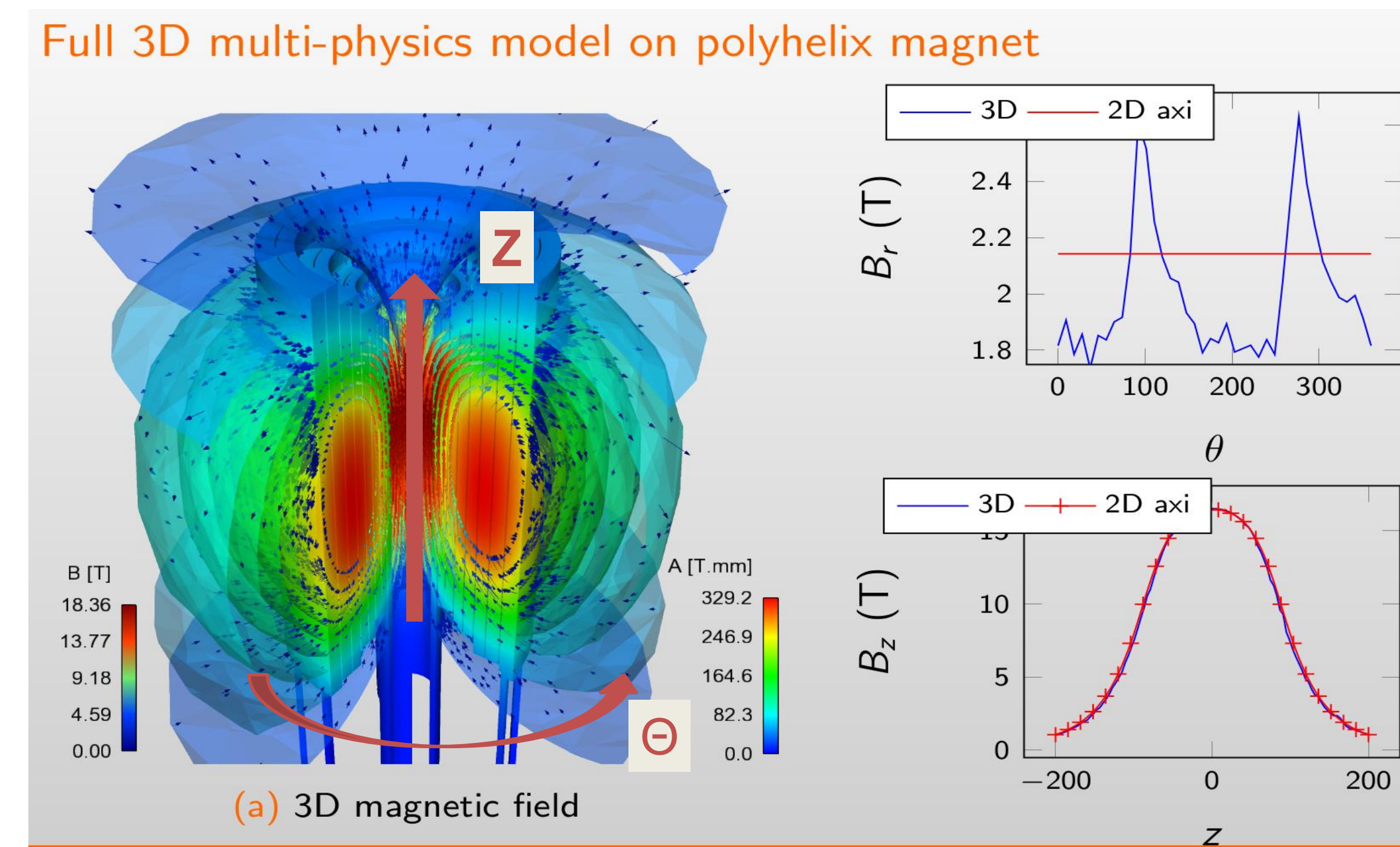


Tue-Af-Po2 [169]

PolyHelix Magnet Modeling



- Full 3D NL Multi-Physics model**
- Use **Feel++ C++-14** FEM library
 - ThermoHydraulics: 0D
 - **Parallel Biot-Savart** Magnetic Field
 - Automatic CAD and Meshing (**Salome**)
- Up to 1024 procs
• Up to 70 10⁶ elts



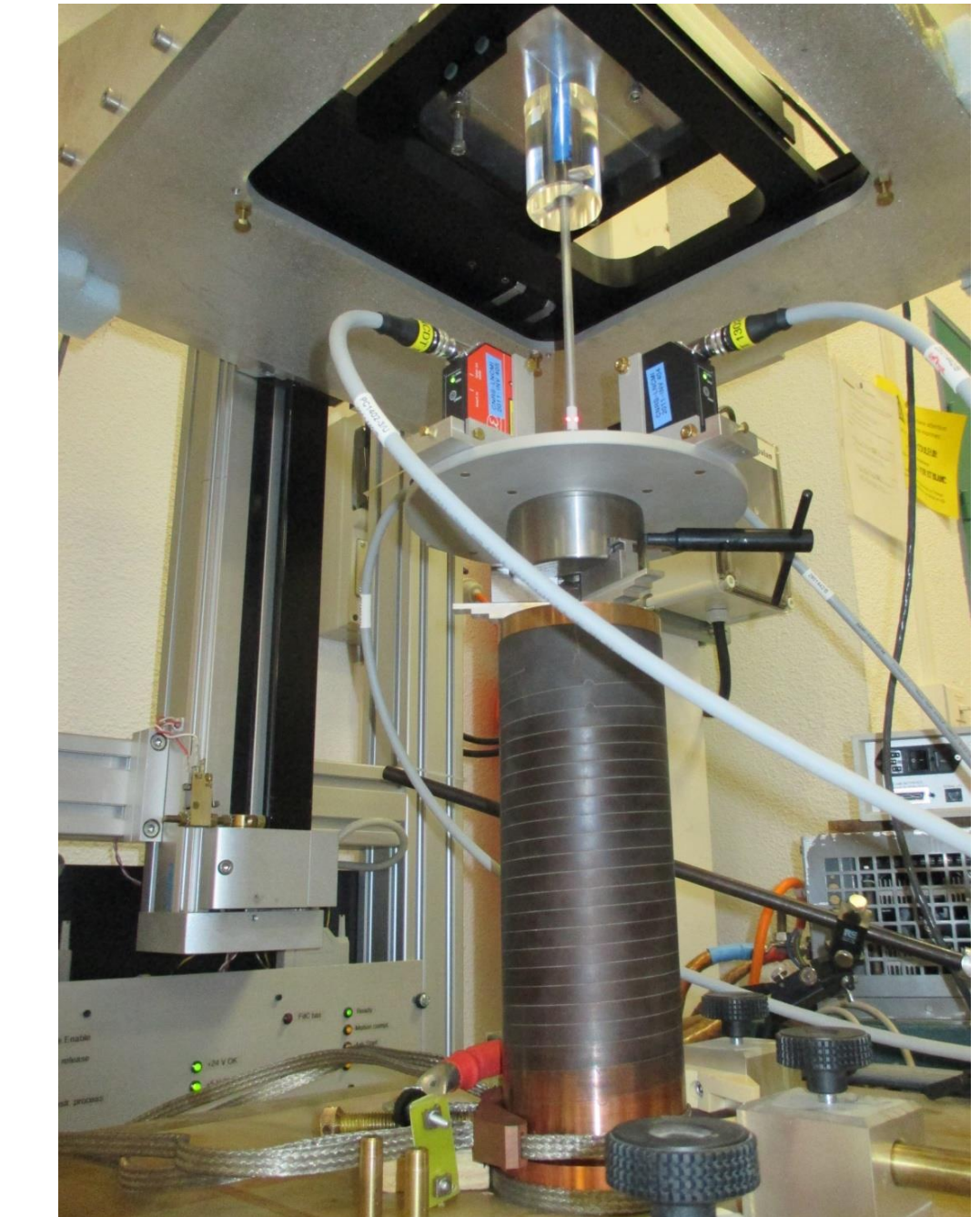
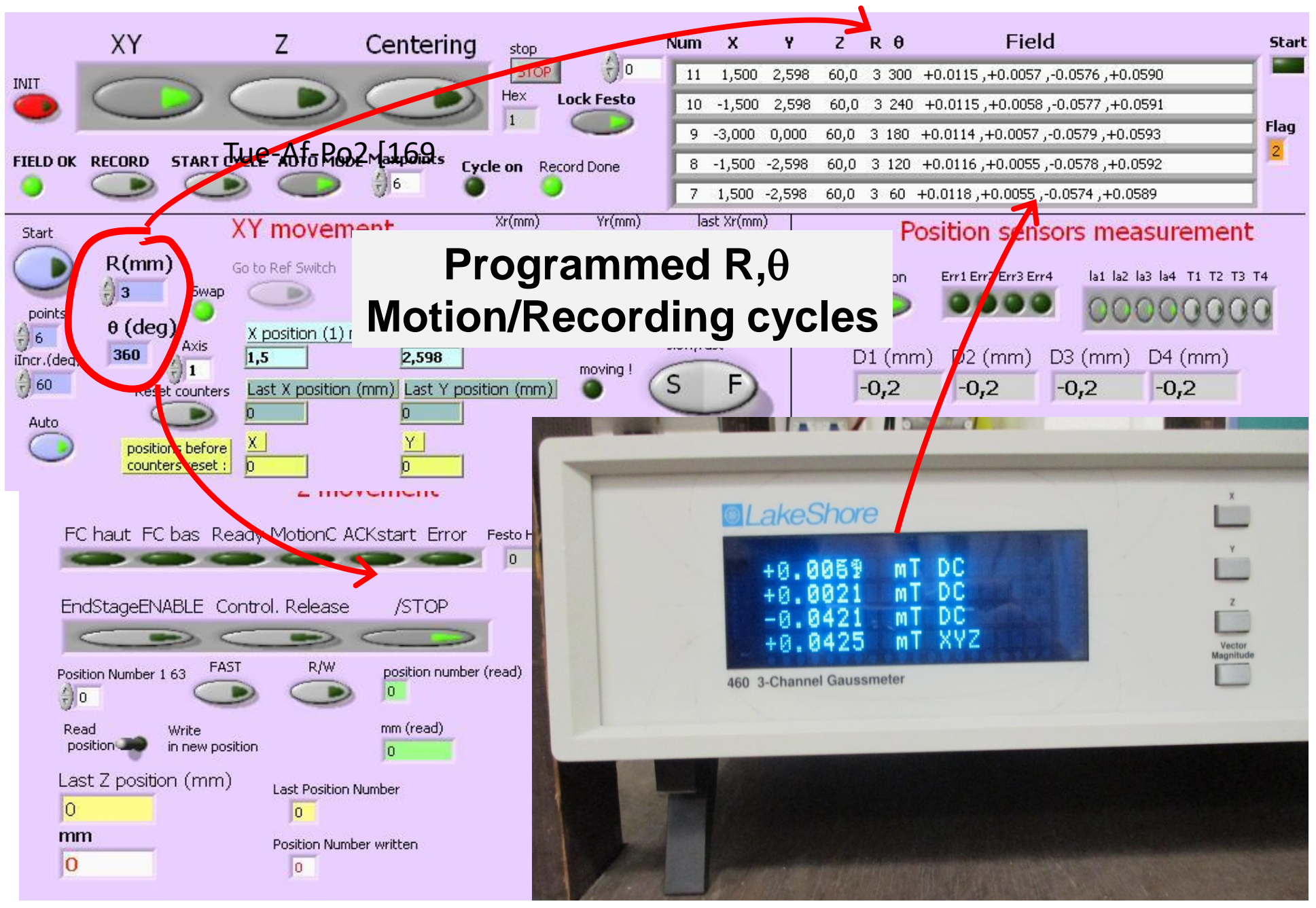
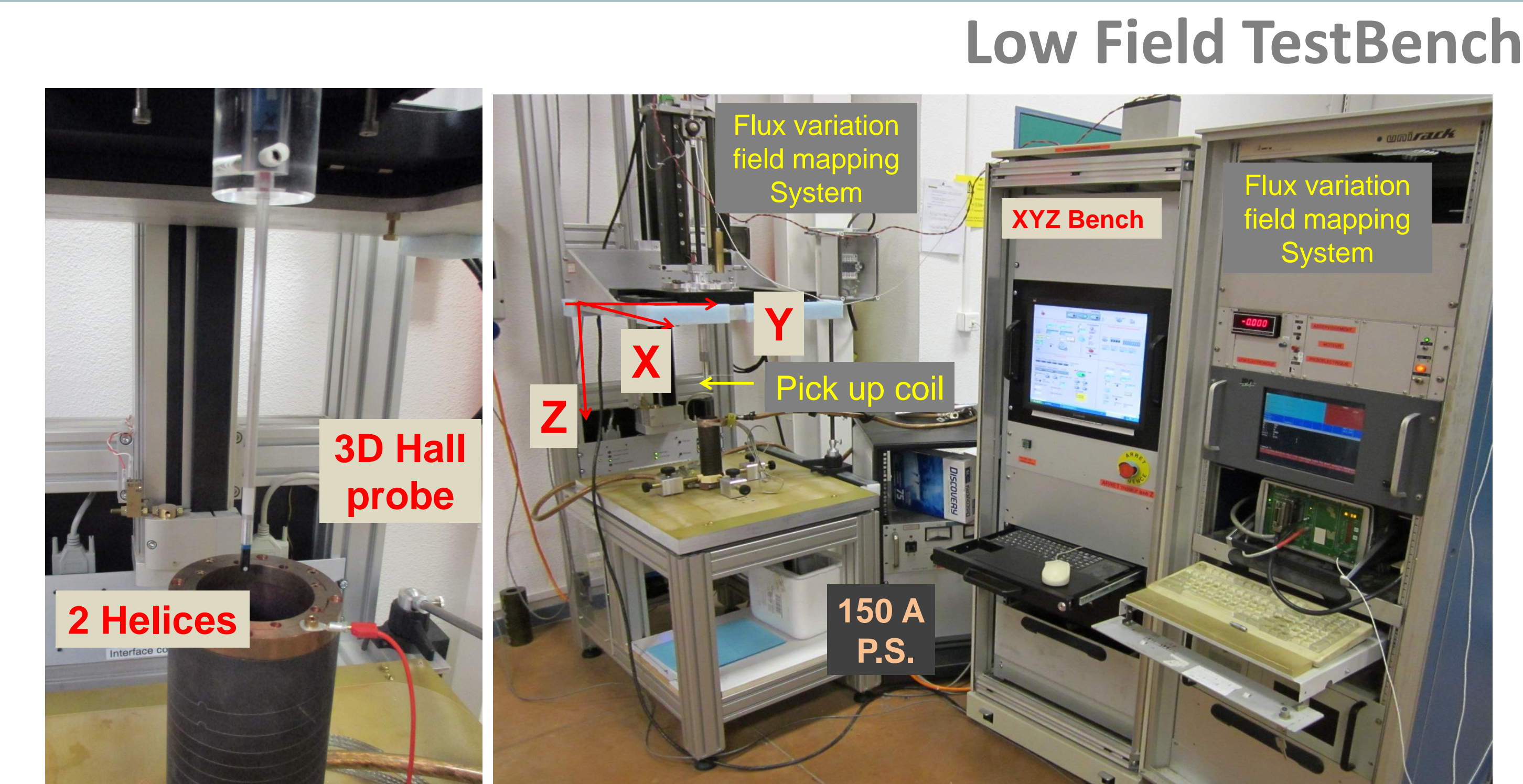
Unexpected 3D B Field profile observed in calculation

Elements: 27 10⁶
Cpus: 48 procs
Time: 1640s
Mem: 785 Gb

Objectives

- Confirm the 3D effects predicted**
- Validate Numerical Model(s)
- Existing Mag. Field profile : only available**
- on Oz axis
 - in a small sphere of 1 cm³
- Need for Dedicated experimental setup**
- On Magnet Site setup
 - Low Field TestBench

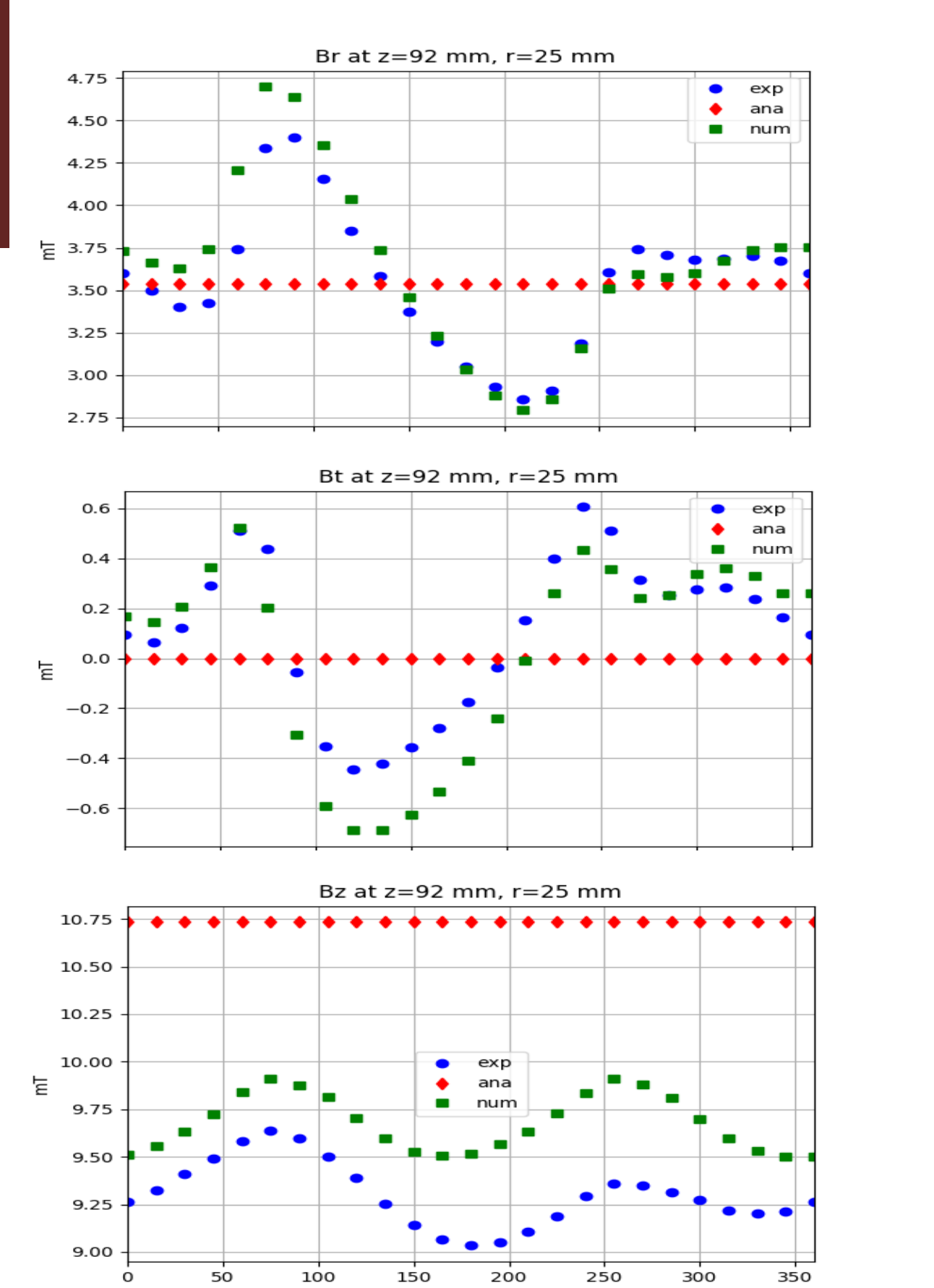
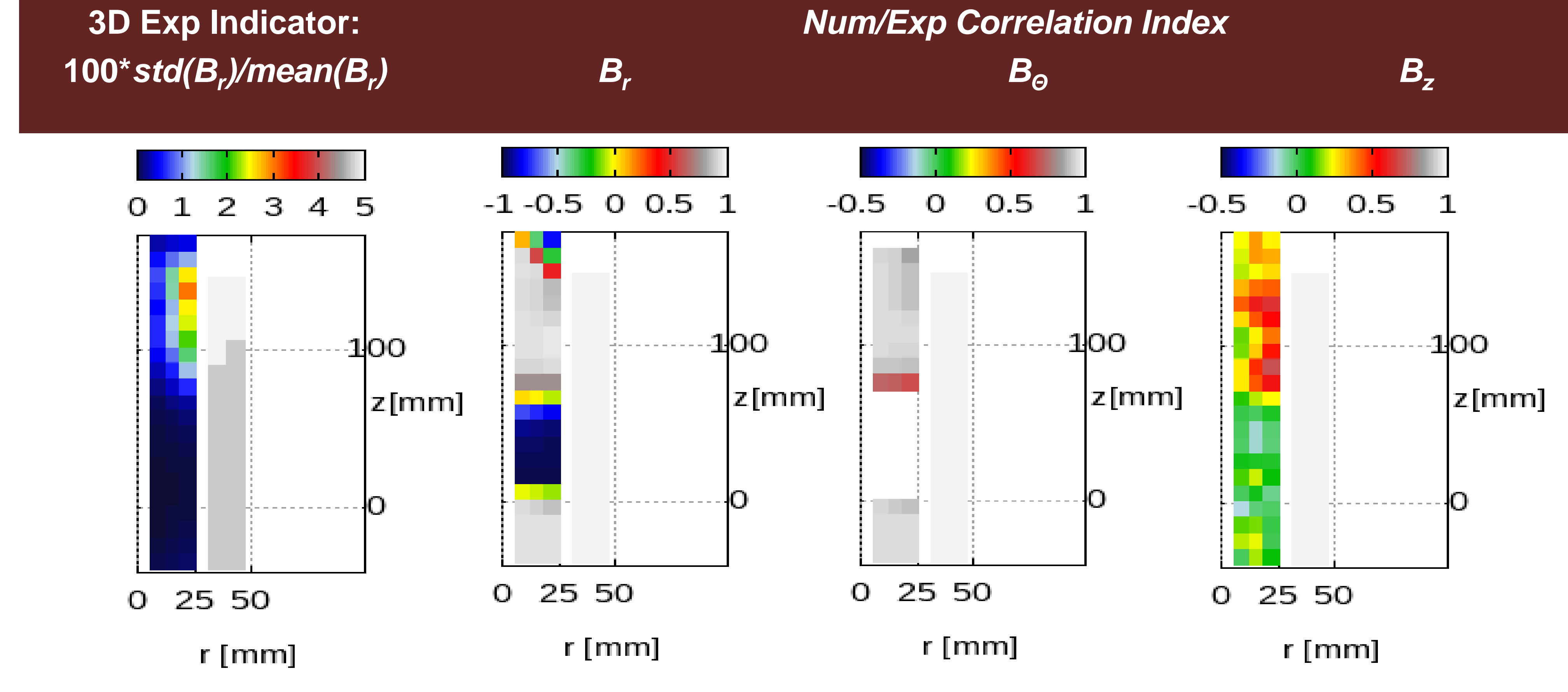
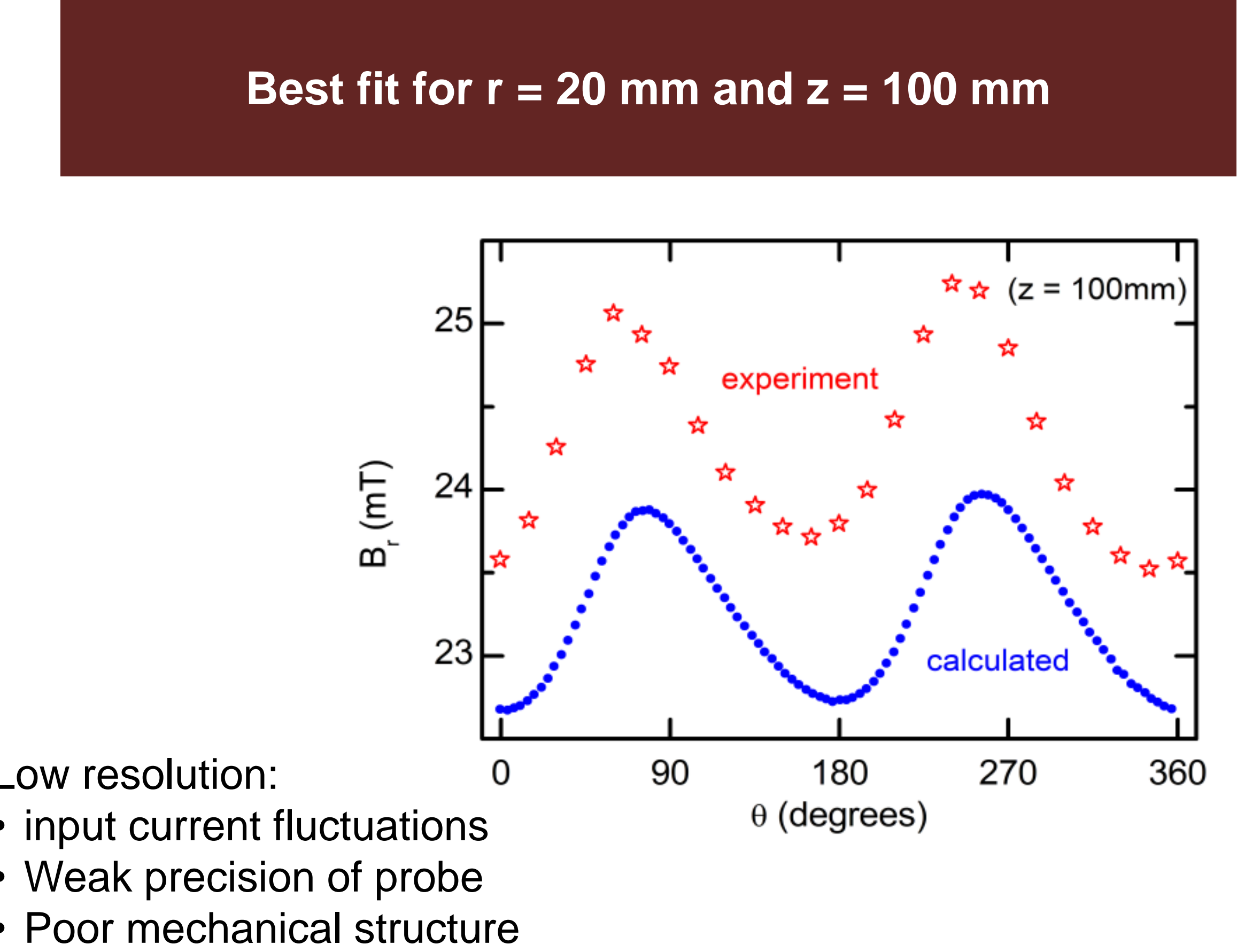
Experimental Setups



3D Hall probe (limited to 3 T)

	On Site	Test Bench
Displ.	Translation Z + Rotation t	Translation X, Y, Z
Automated	No	Partly
Precision	-	++
Alimentation	500 A	150 A (stabilized)

Results



Conclusions

- Experiments**
- 3D Magnetic Field B profile
 - Work needed to improve setups
 - Improve Precision of On Magnet Site setup
- Full 3D multi-physics model**
- Validation
 - Add RB feature to investigate UQ on B
 - In progress Consequence on Mechanical Efforts
- Perspectives**
- 3D effects in Bitter? (expected to be less import.)
 - PolyHelix Magnet design
 - Address Users demand for specific B profile: eg, NMR, Levitation, Ions sources