

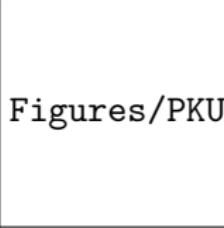
Peking University Beamer Template

lightweight designed

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Figures/PKUlogo.png

① Introduction

② Soil in MCNP

③ Results

④ Conclusion

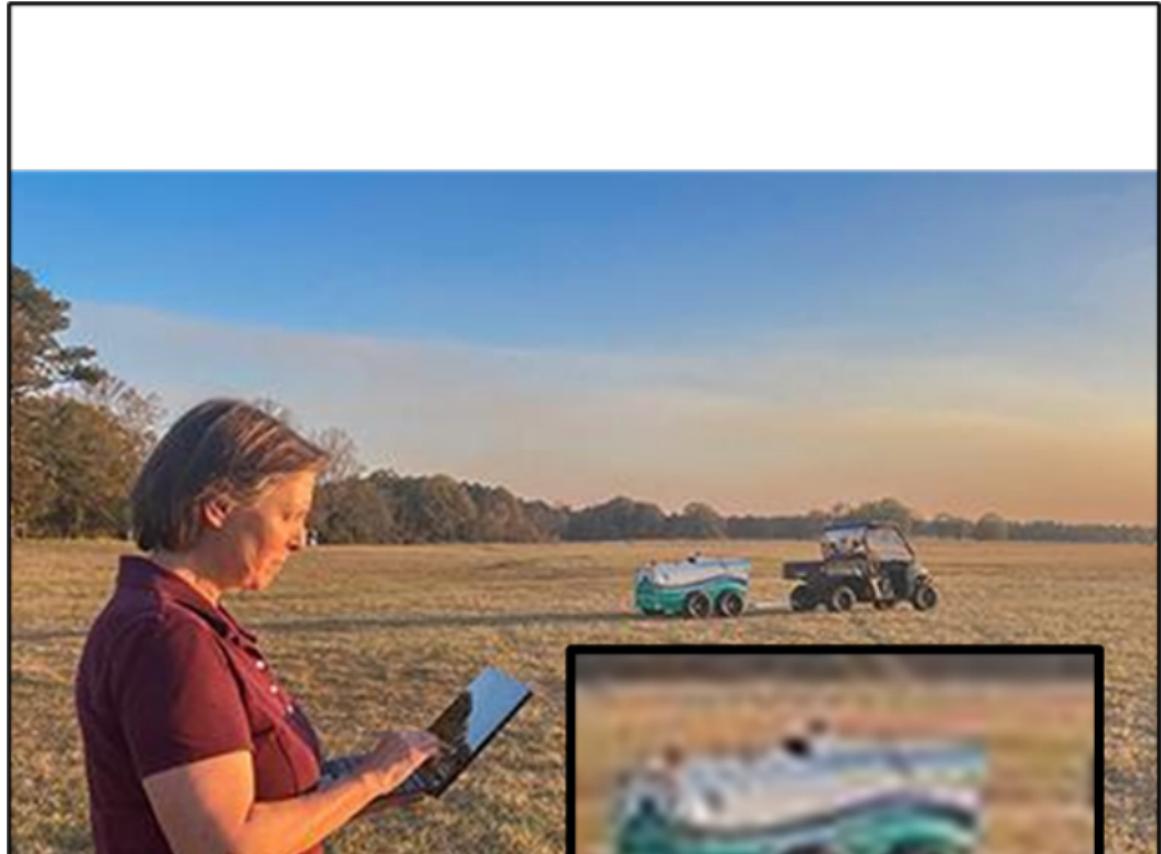
Background



Core Harvesting



In Situ Spectroscopy Device



Simulation is done in MCNP

- ① My role: Mathematical support and simulation
- ② Analyze and generate spectroscopy results Simulations performed in MCNP6.2
- ③ Presenting challenges addressed with MCNP

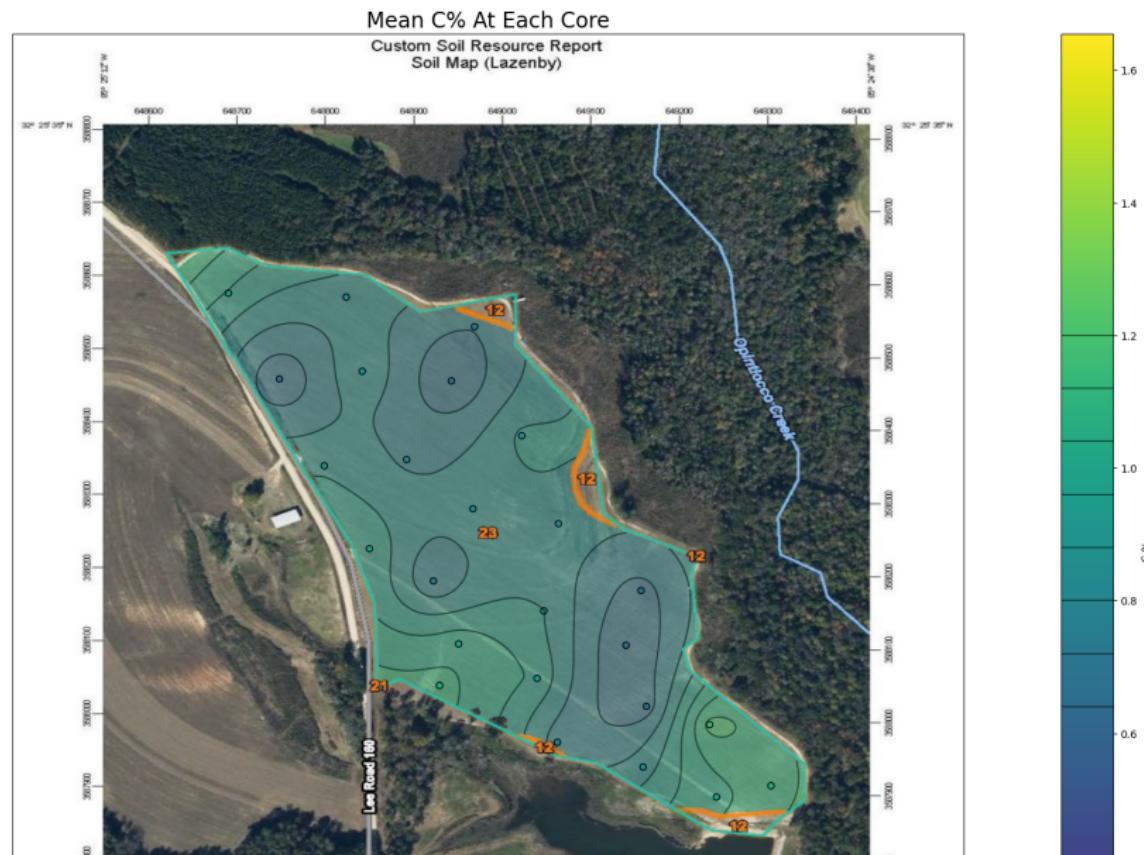
1 Introduction

2 Soil in MCNP

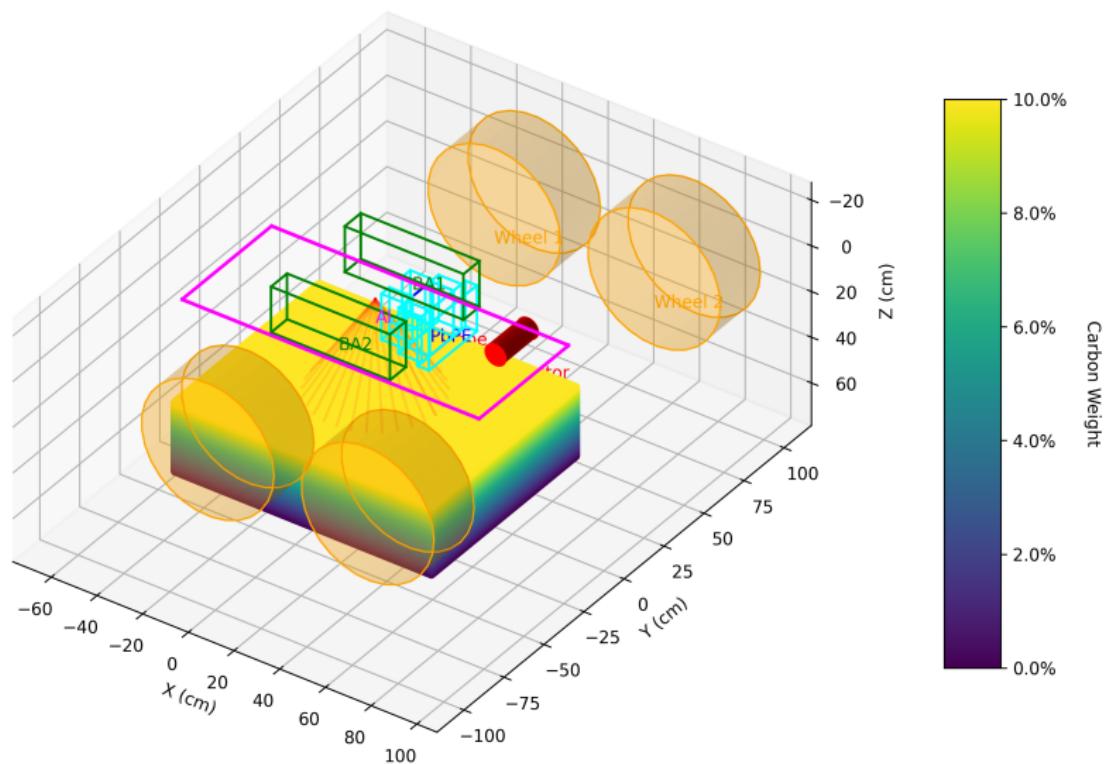
3 Results

4 Conclusion

Soil is a Nonhomogenous Material

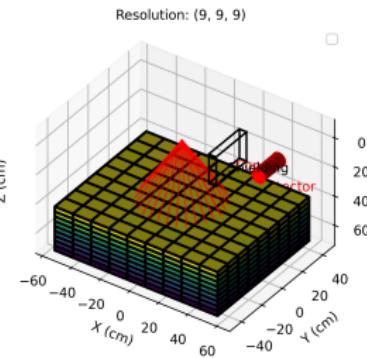
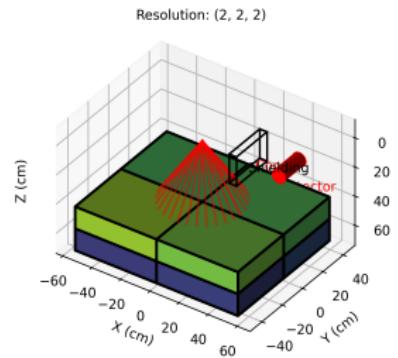
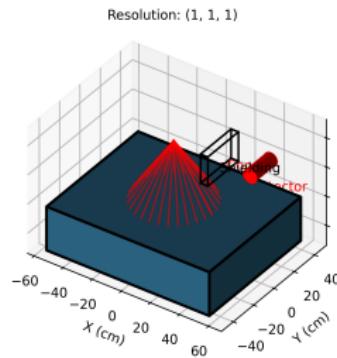


Functionally Defined Soil



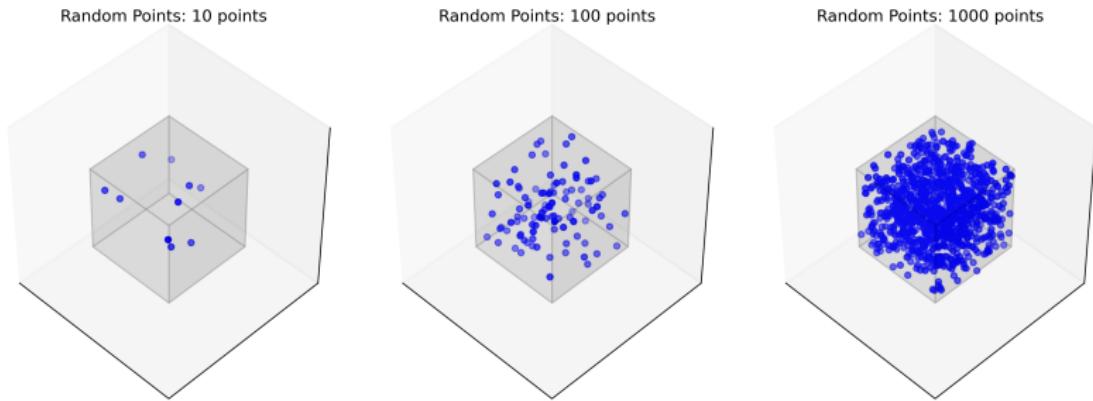
Mesh Cells

Carbon Levels as Cells increased



- ➊ Divide soil into a mesh of smaller cells Approximate functional characteristics in discrete space
- ➋ Higher mesh resolution = more accurate representation

Defining cell characteristics



- ① Use Monte Carlo sampling to average properties in each mesh cell
- ② Assign average values to each cell Results in a more detailed, accurate soil mode

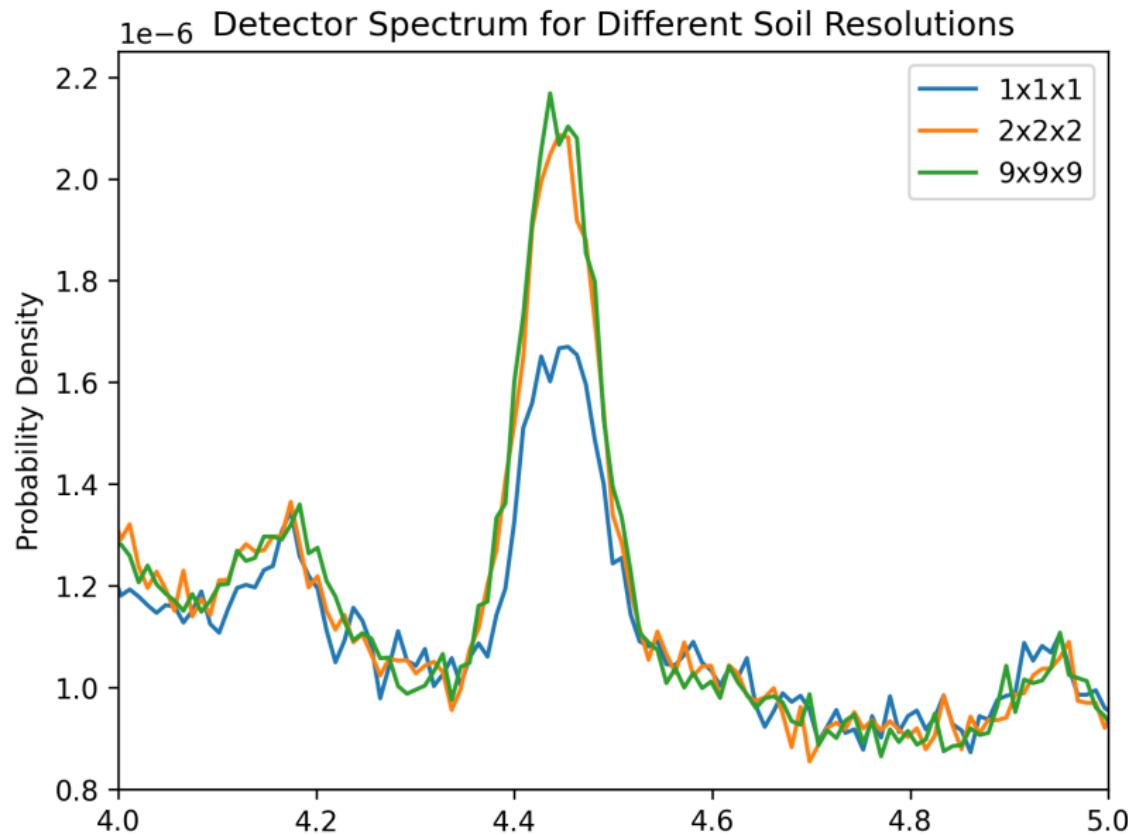
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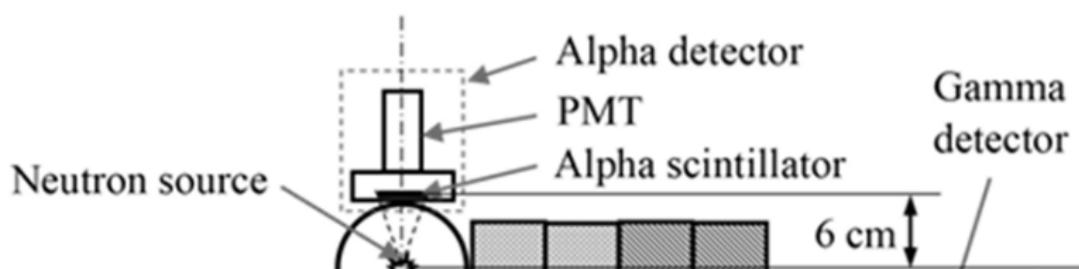
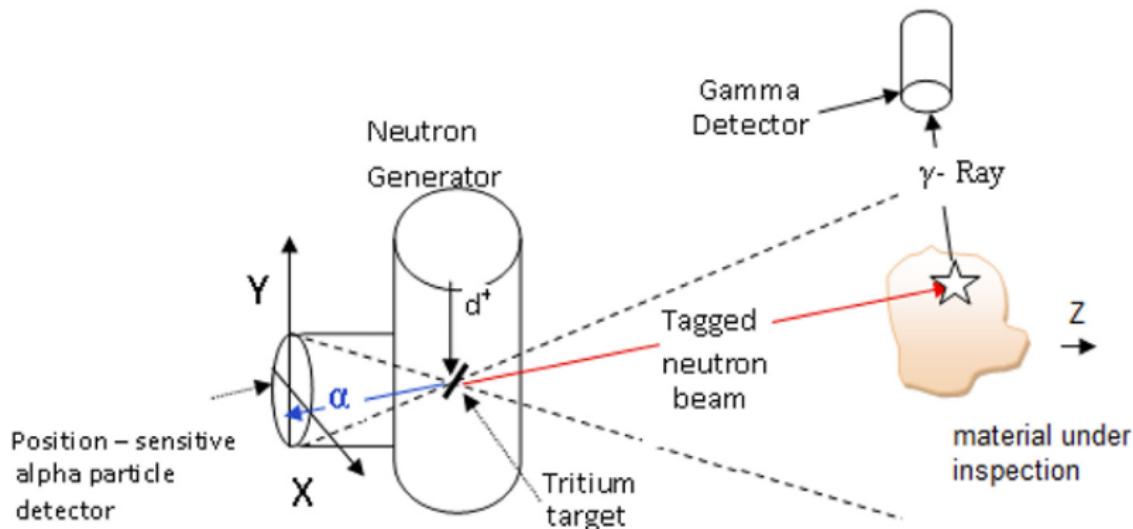
3 Results

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effects on detection



Soil is a Semi-Infinite Sample



Cell Mesh vs FMESH

```
(FMESH
FMESH836:p,n ORIGIN= 0 0 42 IMESH= -56 9i 56 JMESH= -45 9i 45 KMESH= 0 9i 20

(1x1x1)
F836:p,n 101
E836 0 1e-5 932i 8.4295
FU836 9000000 10000000000
FT836 TAG 3

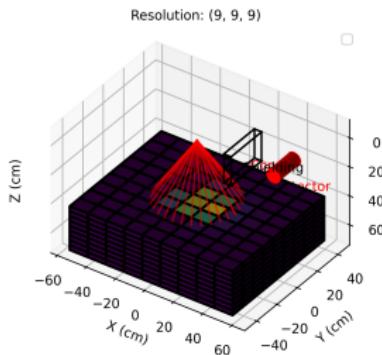
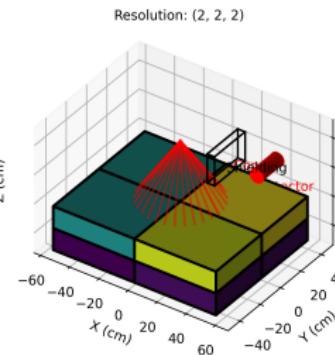
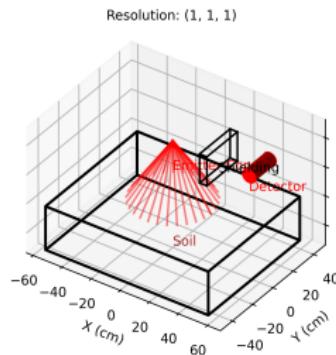
(2x2x2)
F836:p,n 101
E836 0 1e-5 932i 8.4295
FU836 9000000 9100000 9200000 9300000 9400000 9500000 9600000 9700000 10000000000
FT836 TAG 3

(9x9x9)
F836:p,n 101
E836 0 1e-5 932i 8.4295
FU836 900000000 900100000 900200000 900300000 900400000
         900500000 900600000 900700000 900800000 900900000 901000000
         901200000 901300000 901400000 901500000 901600000 901700000
         901800000 901900000 902000000 902100000 902200000 902300000
         902500000 902600000 902700000 902800000 902900000 903000000
         903100000 903200000 903300000 903400000 903500000 903600000...
```

- ① MCNP FMESH: tally results in mesh bins (for imaging, range studies)

Independent Cell Functionality

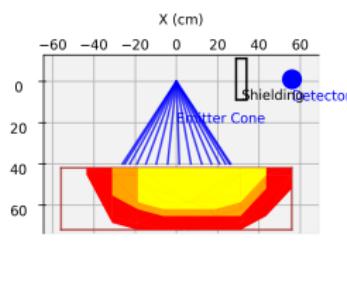
Detection ratios as Cells increased



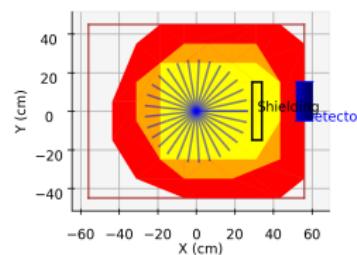
- ① Treat mesh cells as independent
- ② CU card: bins tally by cell of interaction
- ③ Allows investigation of where detections originate

Cell clouds

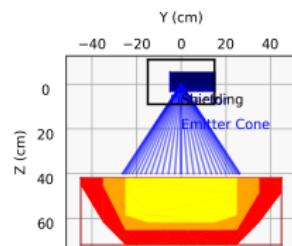
Side View



Top View

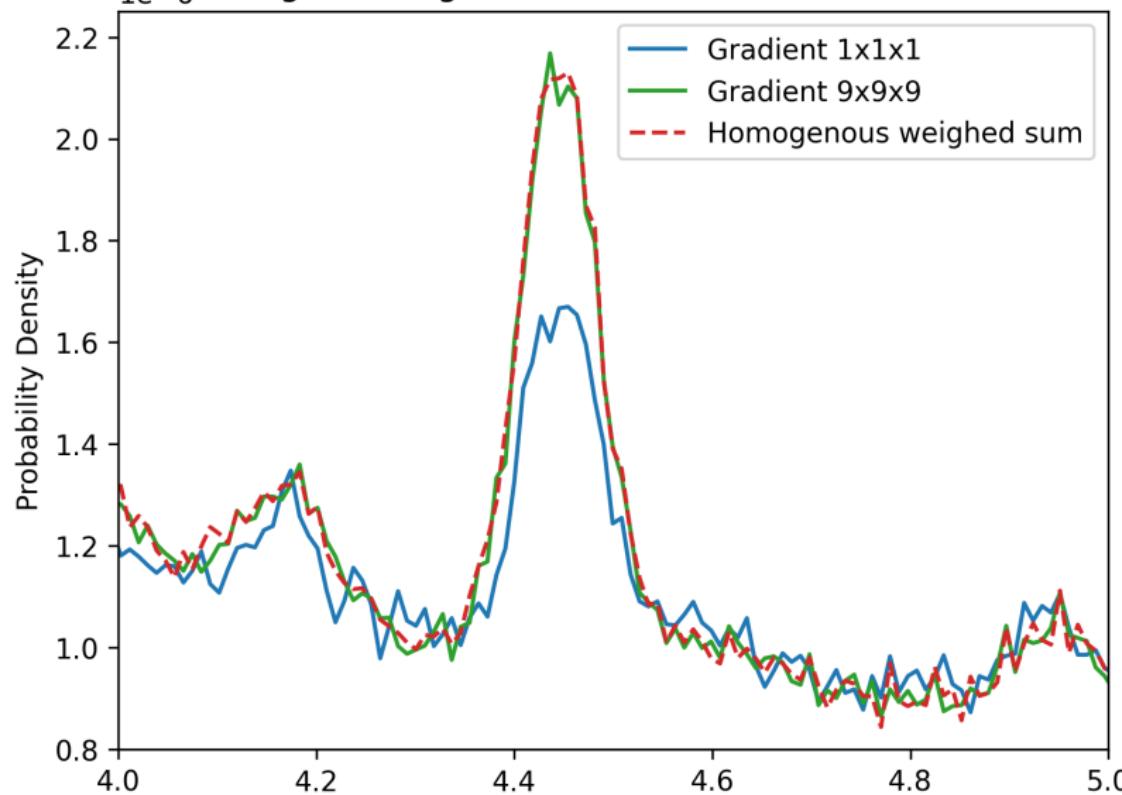


Front View



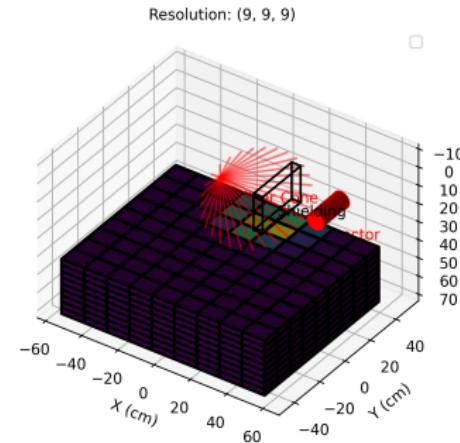
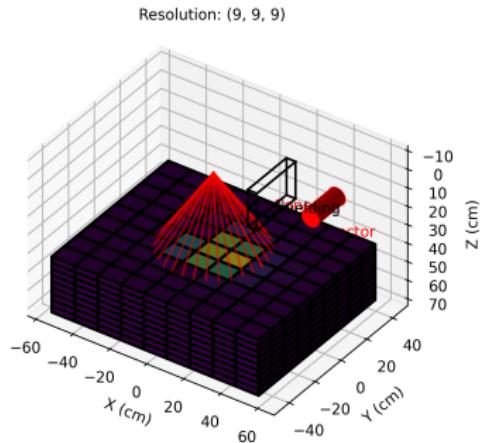
Range measurement

$1e-6$ Using the Weighed Sum for Soil Characterization



Usage Example

Reorienting The Emitter



- ① When machine design changes, simulate new detection results
- ② Range can be re-evaluated
- ③ Example: pointing emitter under detector changes detection range

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Summary

- ① Mesh cells allow for detailed soil modeling in MCNP
- ② Enables accurate simulation of in situ spectroscopy
- ③ Helps understand detection range and sensitivity

Future Work

- ① Further refine mesh resolution for improved accuracy
- ② Explore additional soil characteristics (hydration)
- ③ Accurate comparison with core harvesting results

Code

Acknowledgements

References

References