



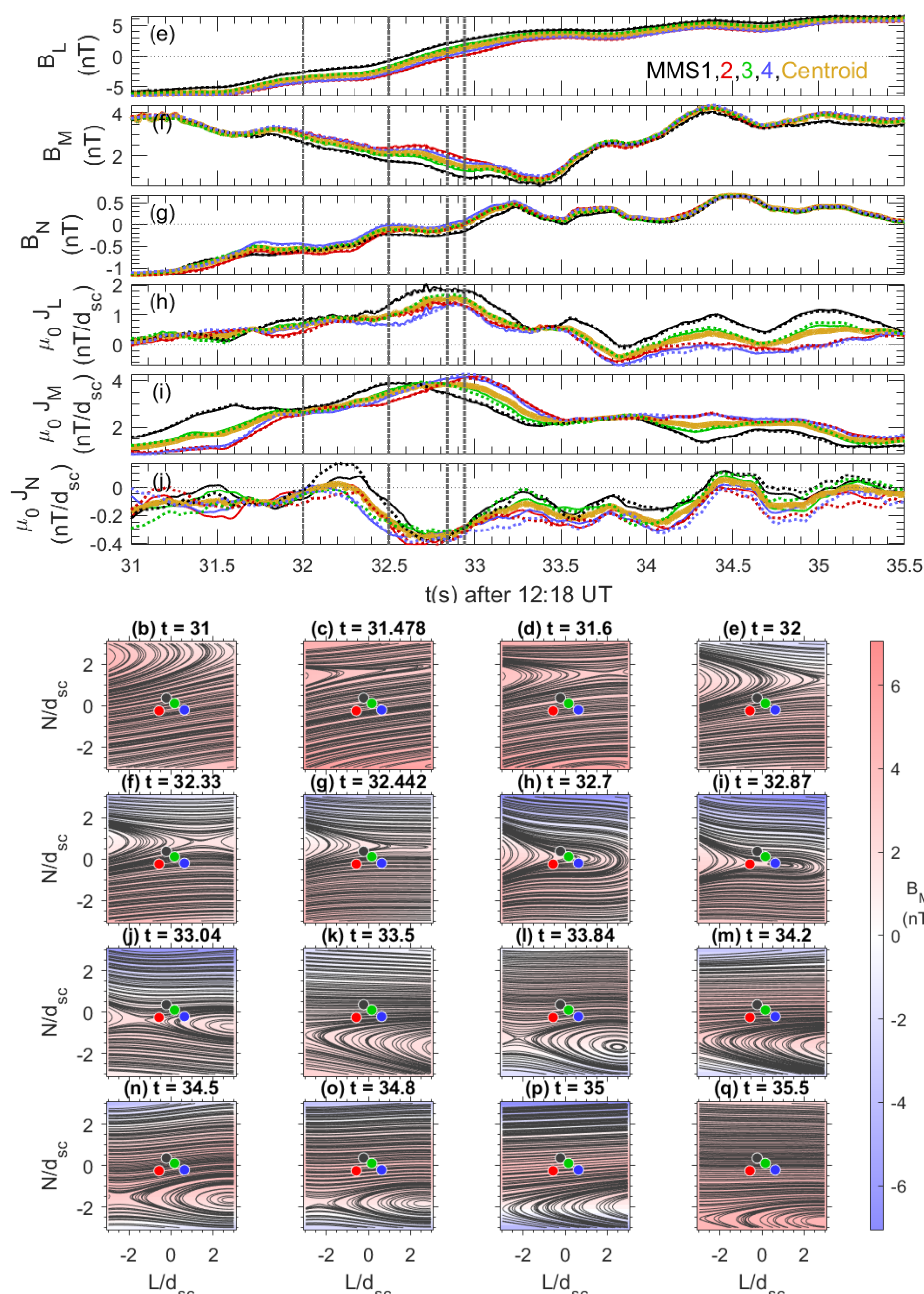
A Virtual Reality Environment for 3D Reconstructions of Magnetic Reconnection Events Observed by the Magnetosphere Multiscale Mission

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Introduction

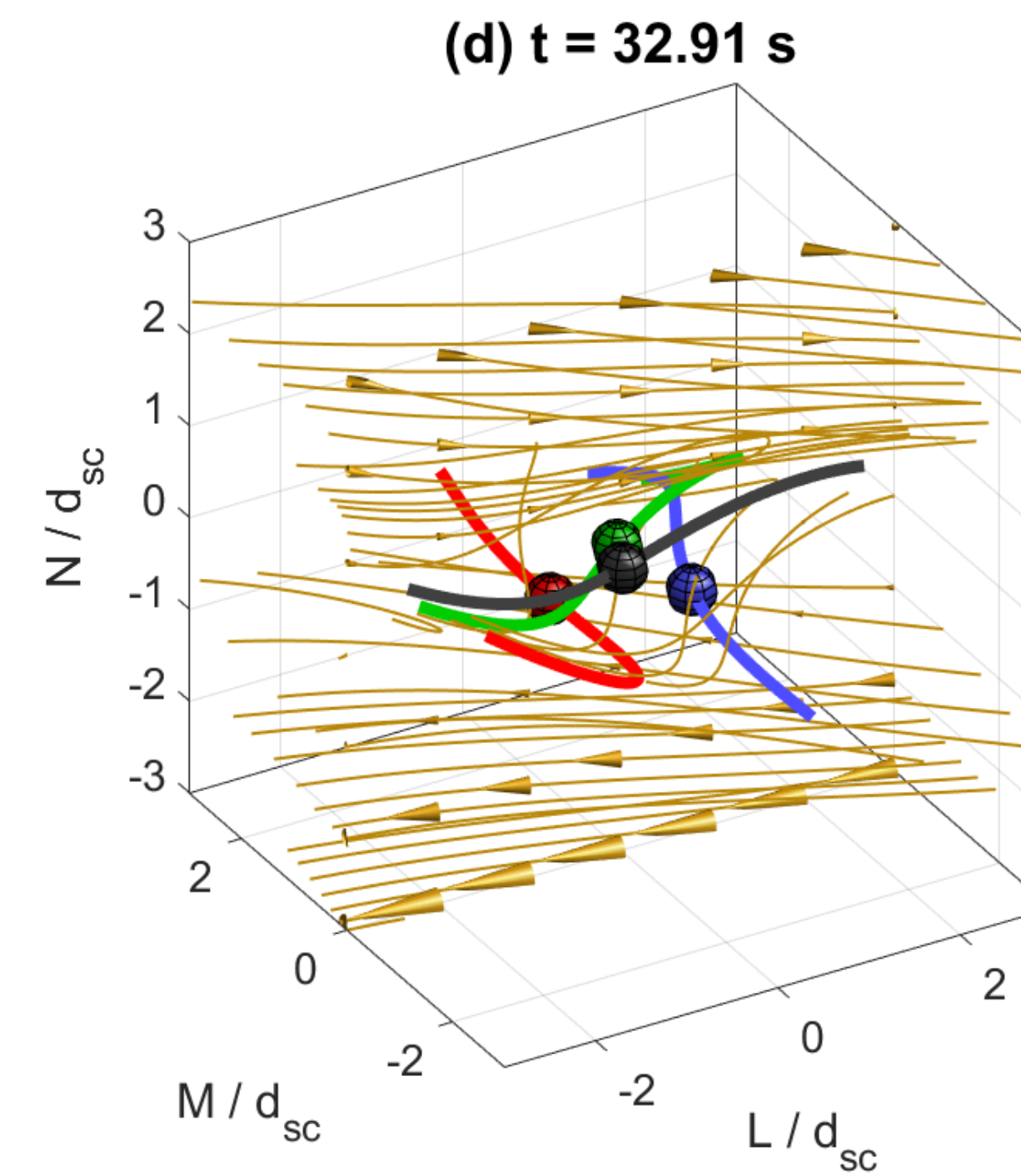
The magnetic field is not a visible substance that we can see with our eyes or take pictures of. The way we understand it is through precise measurement with complex instrumentation. This makes learning about the magnetic field difficult, especially for young people. The aim of this project is to change that by allowing people to literally step into a vector-field reconstruction of Earth's magnetic field.

Data



MMS Data of the magnetic field. Note the magnetic reconnection visible in plots d, f, i, j, l, n, and o.

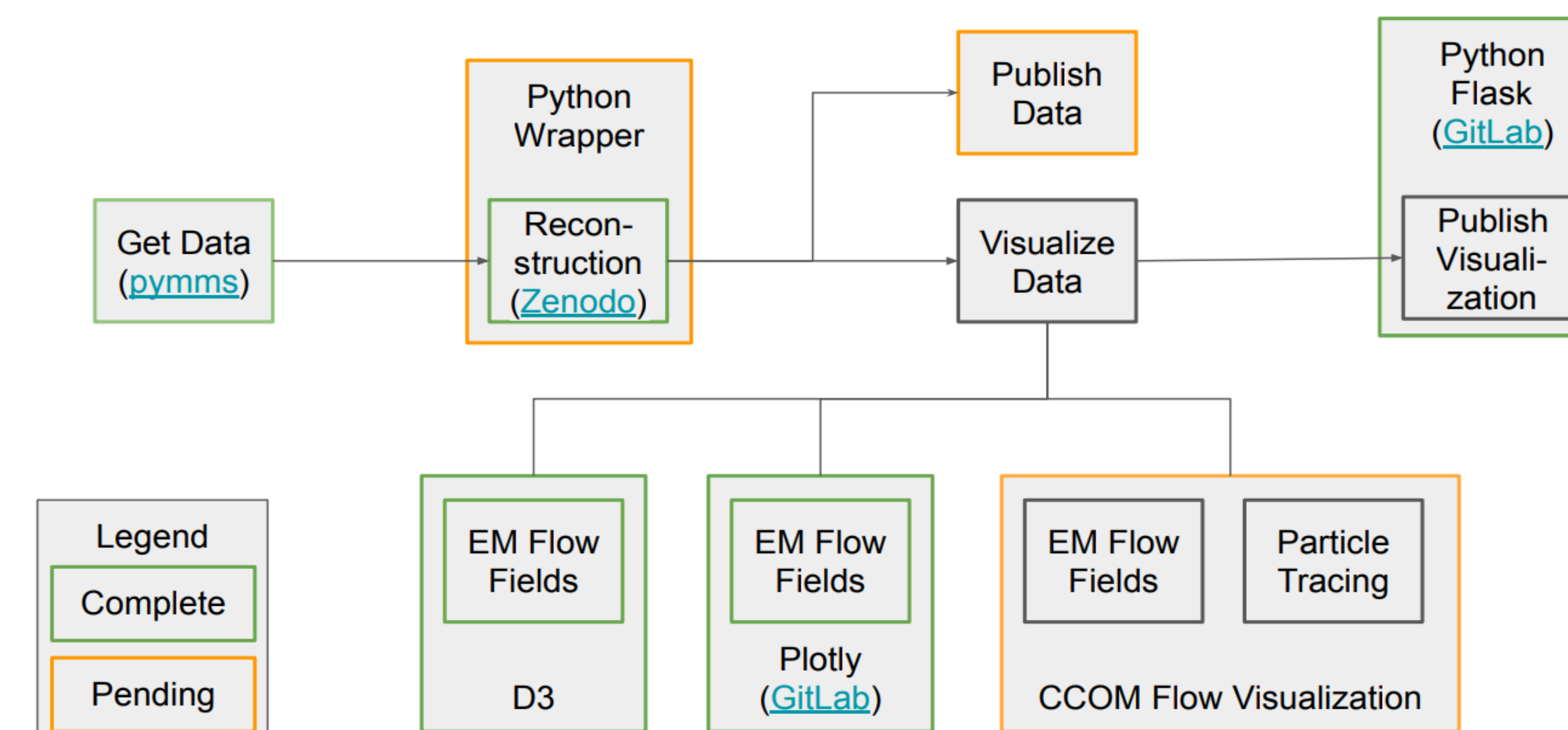
MMS Mission



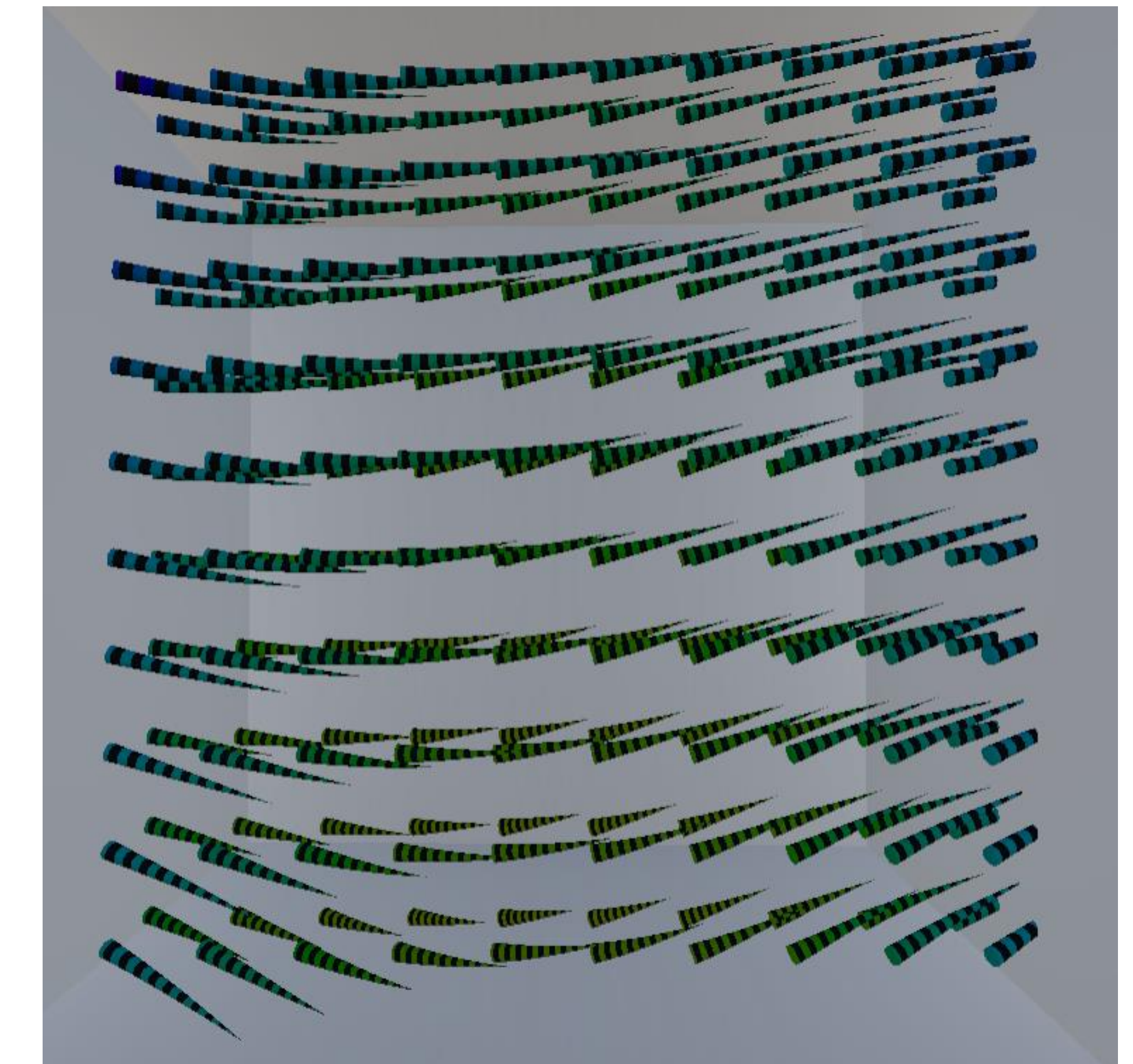
The MMS Mission was launched in 2015 and uses four identical satellites to collect data on Earth's magnetic field. The main purpose of this was to study points of magnetic reconnection. Magnetic reconnection happens when magnetic field lines are stretched or compressed enough to break and reconnect in different ways, causing massive eruptions of energy in the plasma of the magnetosphere.

Methodology

- Data came in a 100x100x100 cube
 - E data, B data, and XYZ data
- Reformatted the data in Python
 - Flat vector of 3D coordinates
- Saved the data as vector field files
 - .vf binary file, to be read by Unity
- Unity VR environment created by UNH CCOM



Results



Slices of MMS B field data shown as a vector field in the game engine Unity.

Future Work

- Create a Python wrapper for the reconstruction code
- Add particle tracing to Unity program
 - Want the user to be able to drop a particle in the vector field and watch it flow through

Acknowledgements

I would like to thank Dr. Thomas Butkiewicz and Dr. Drew Stevens of UNH CCOM for their help with the Unity VR environment as well as advising with the formatting of the vector field data.

References

Torbert, R. B., Dors, I., Argall, M. R., Genestreti, K. J., Burch, J. L., Farrugia, C. J., Forbes, T. G., Giles, B. L., & Strangeway, R. J. (2020). "A new method of 3-D magnetic field reconstruction" *Geophysical Research Letters*, 47(3). <https://doi.org/10.1029/2019gl085542>