

# Reconstruction of the heliospheric magnetic field utilizing an accelerated computational grid

M. Kruse, T. Peleikis

Christian-Albrechts-Universität zu Kiel

IEAP, Department for Extraterrestrial Physics

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# Overview

- (accelerated) computational grid
- Mathematical description of the magnetic field  
(Potential Field Source Surface model)
- What has been done so far?
- Utilizing the results

# (Accelerated) computational grid

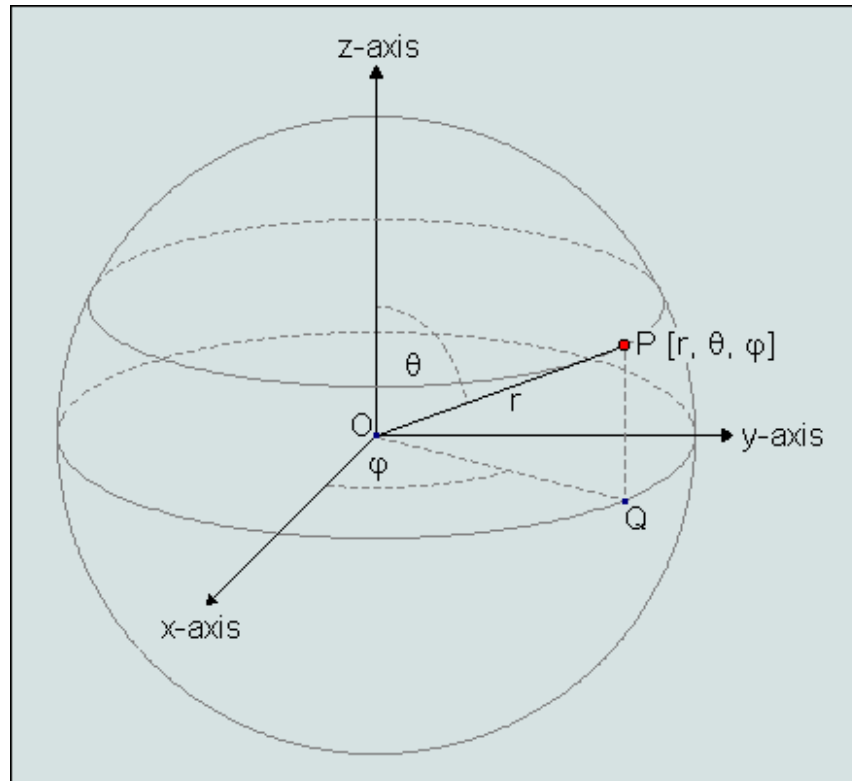
- Finite computational and storage capacity demands computations take place on a finite number of grid points distributed over the domain of interest (here: near sun heliosphere) → methods of Computational Fluid Dynamics (CFD) and Magnetohydrodynamics (MHD)

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- Physics “happen” at the grid points, values in between assumed to be interpolated linearly (if that is not good enough, increase number of grid points)

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- Employing spherical geometry ( $r$ ,  $\theta$ ,  $\phi$ ), not necessarily uniform



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- Support of a wide variety of mathematical problem descriptions (as long as the equations can be converted to finite difference form...)

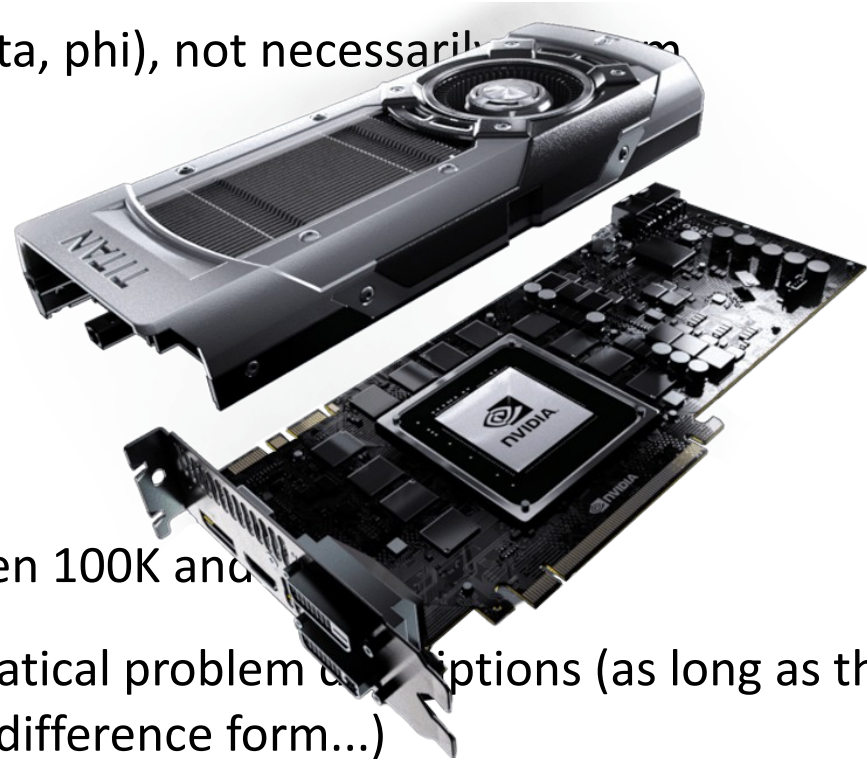


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# Mathematical description of the magnetic field

- As a first approximation and proof-of-concept for the computational grid, we are using a potential field source surface (PFSS) model
- If the need arises, more complicated equations can be incorporated into the grid (CSSS, full MHD-approach, ... ?)

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$$\nabla^2 \psi = 0$$
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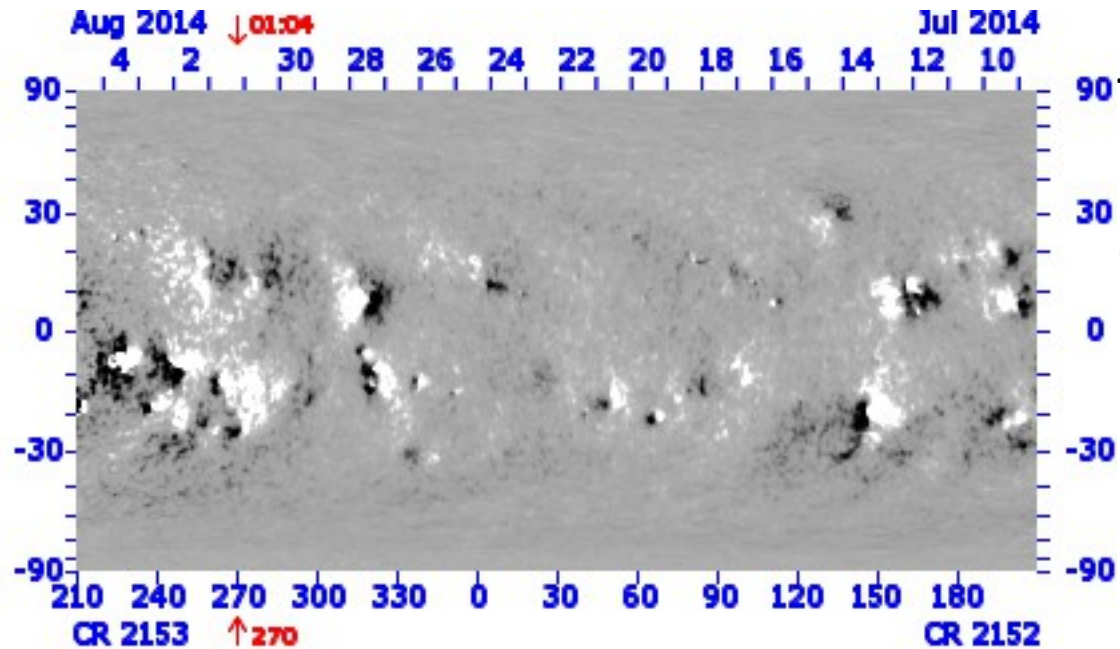
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National Solar Observatory – Global Oscillation Network Group

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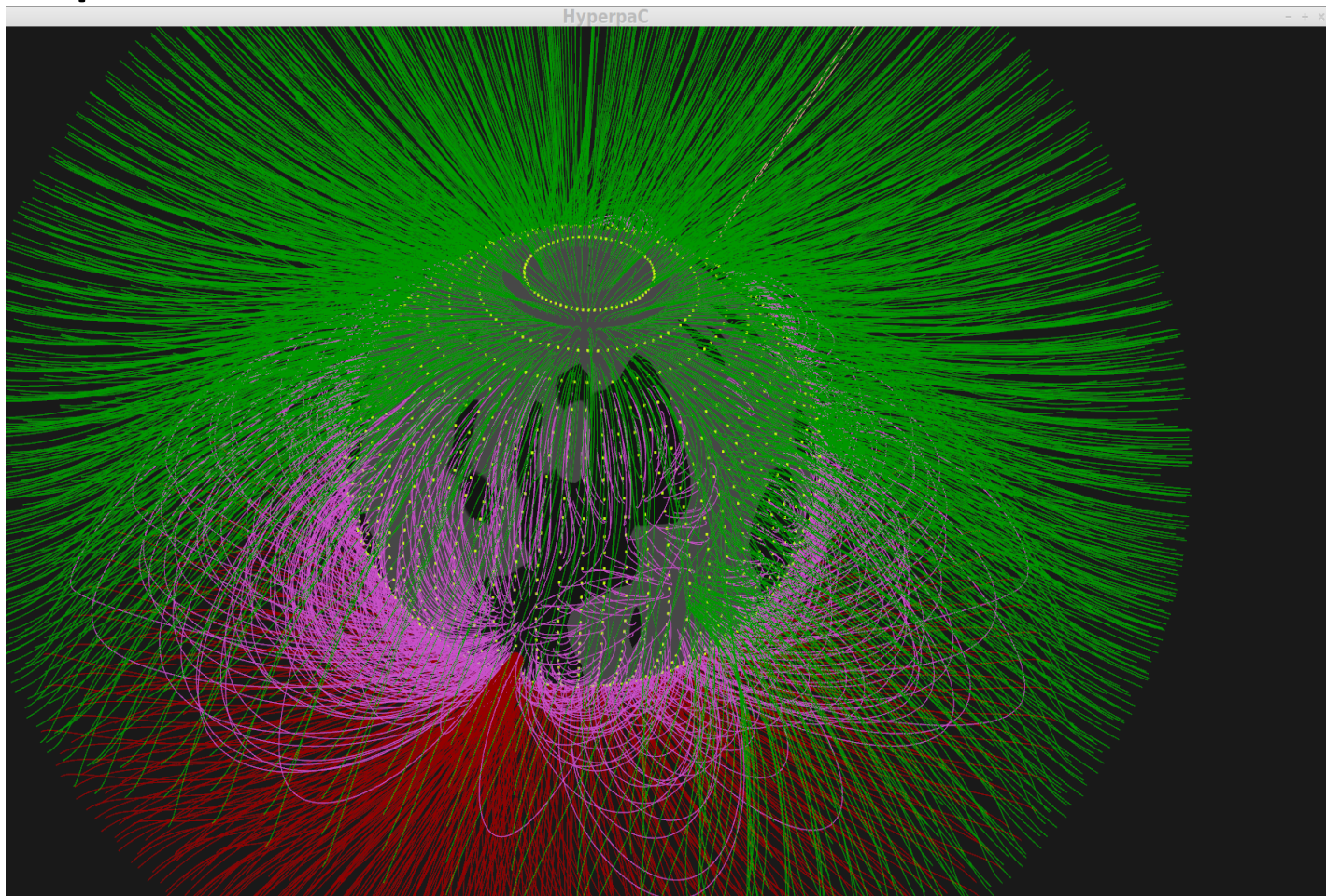
- Crude model (imposed geometrical symmetry, no dynamic processes for an entire Carrington rotation,...)
- Current free approach is only valid for the quiet sun (at most)

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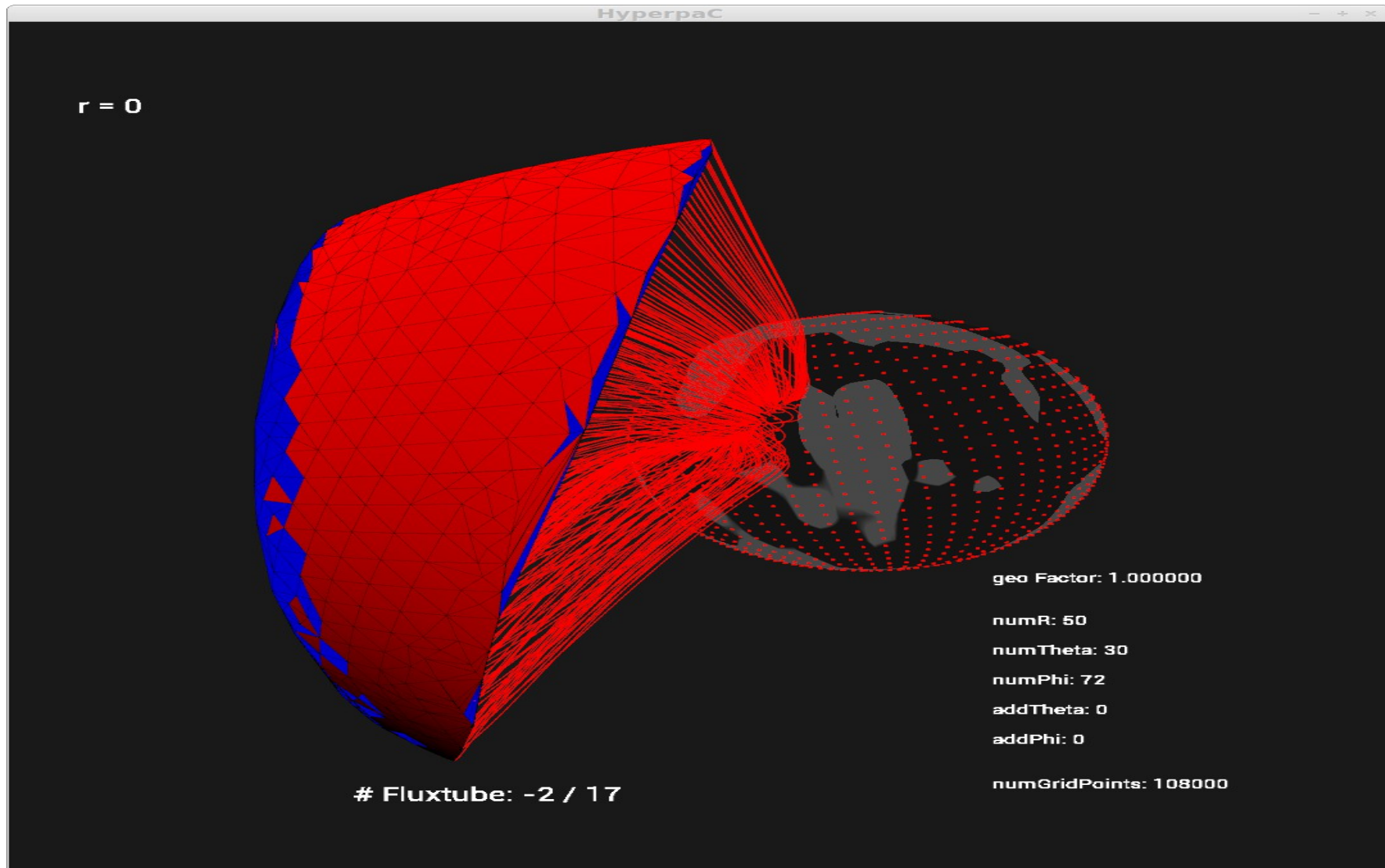
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- Utilization of different photospheric boundary data (Wilcox Solar Observatory, NSO's Kitt Peak Vacuum Telescope, more to come)
- Mapping of magnetic configurations in 3D (Thies Peleikis will tell you more)

# Utilizing the results

... or what is that data useful for?

- Mapping heliospheric in-situ measurements to corresponding photospheric locations (again: Thies Peleikis will tell you more)
- As a seed for solar wind models

# Utilizing the results



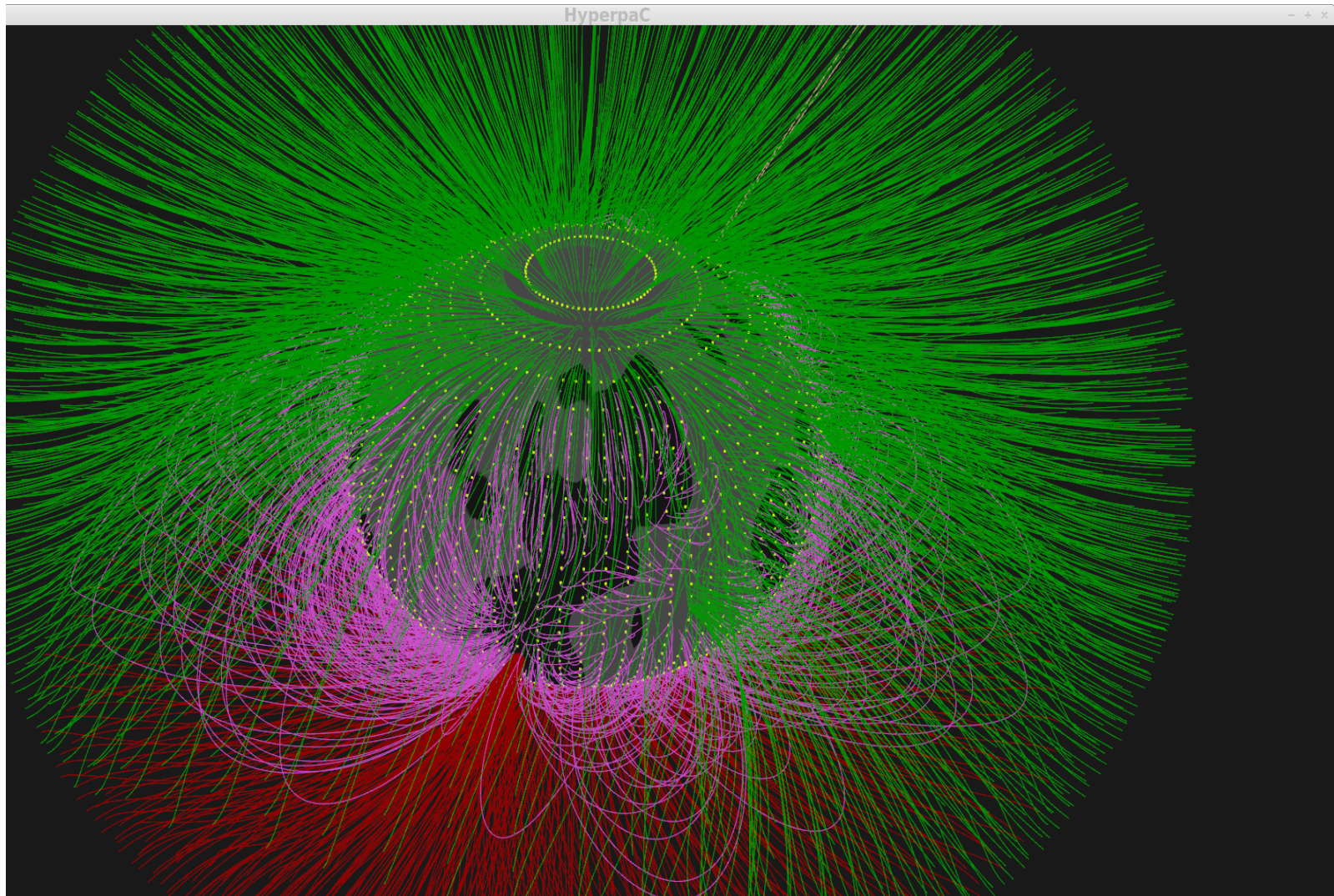
so..... let's take a look!



Thank you for attention.

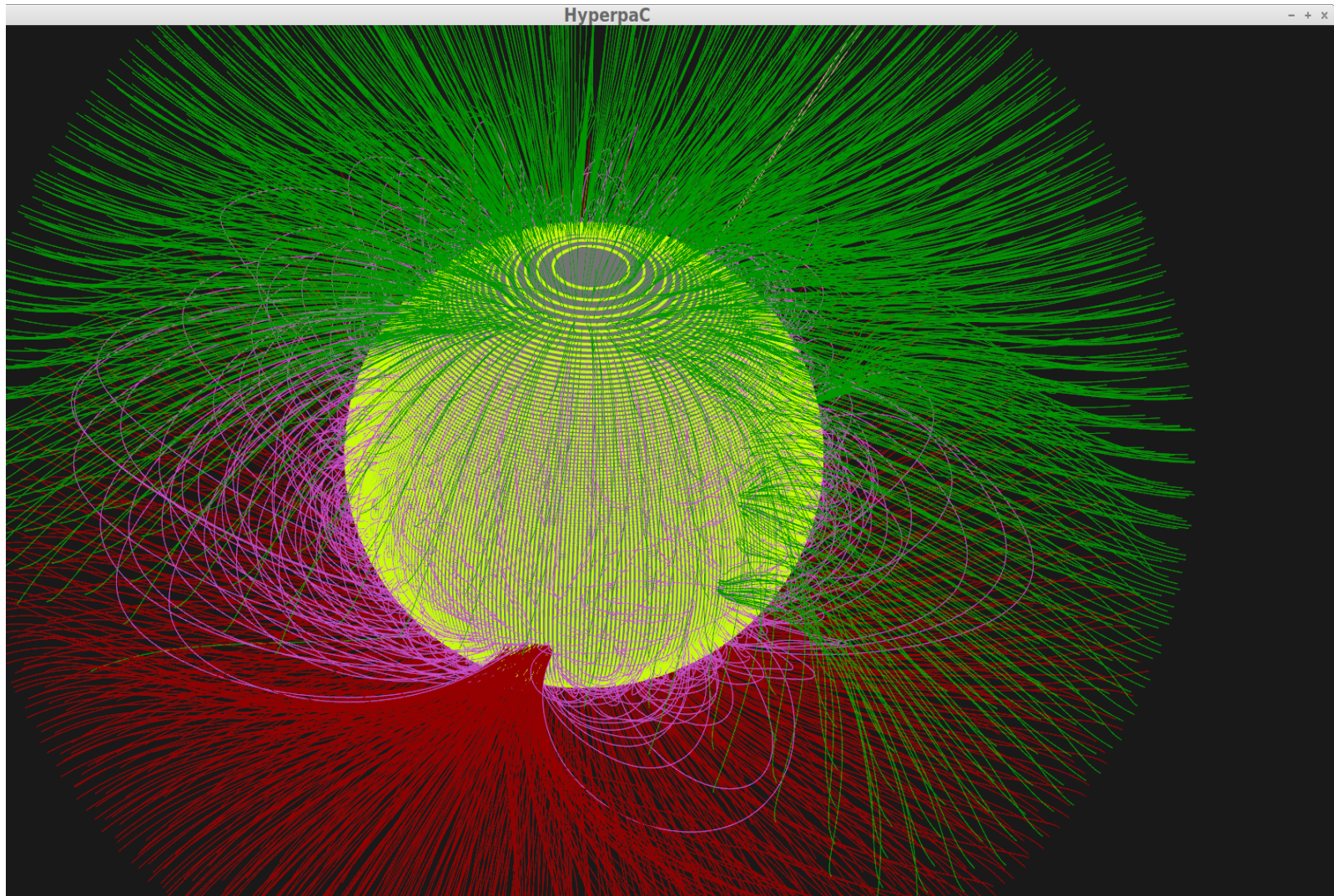
Questions? Suggestions?

# Hairy Ball - WSO



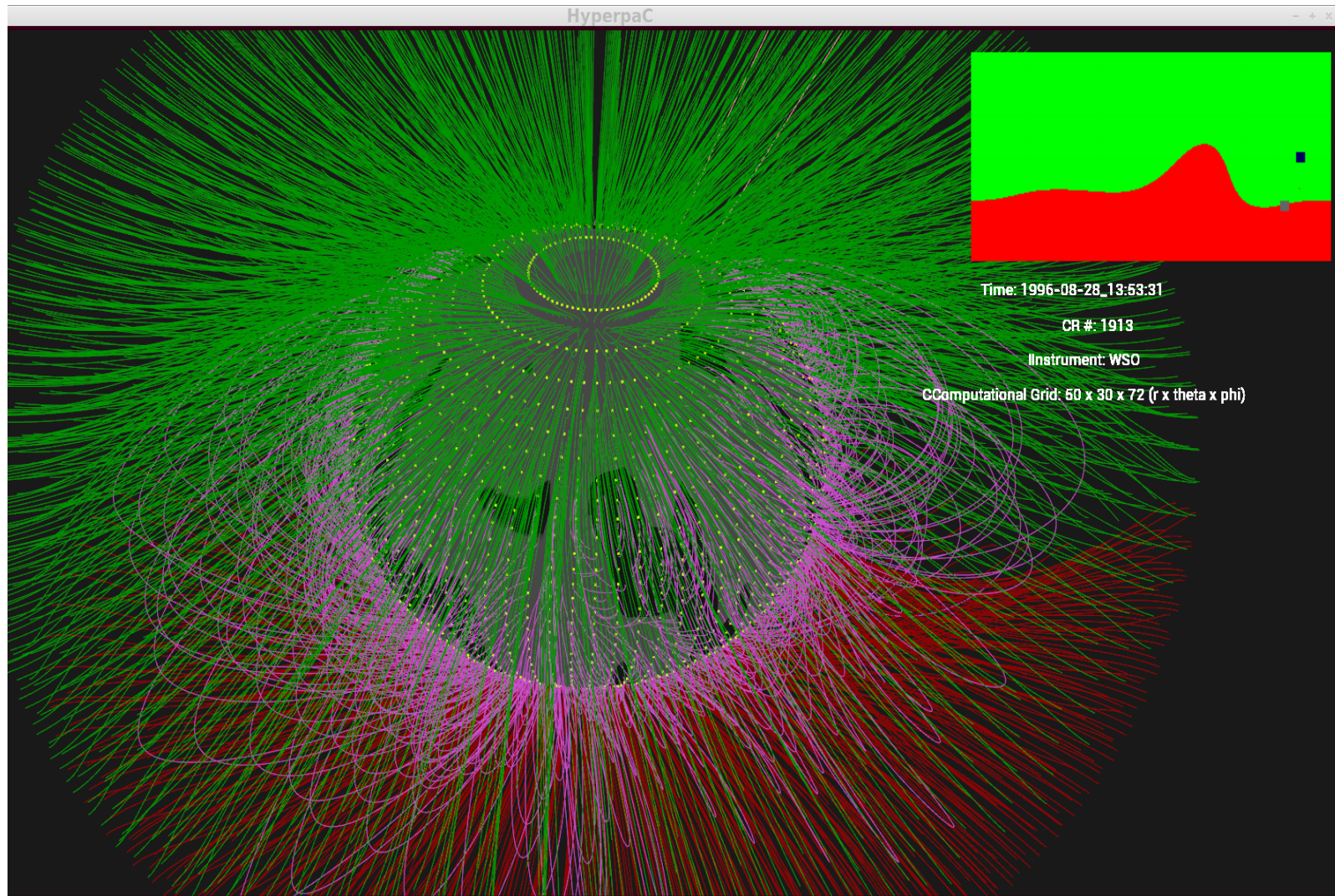


# Hairy Ball - KPVT



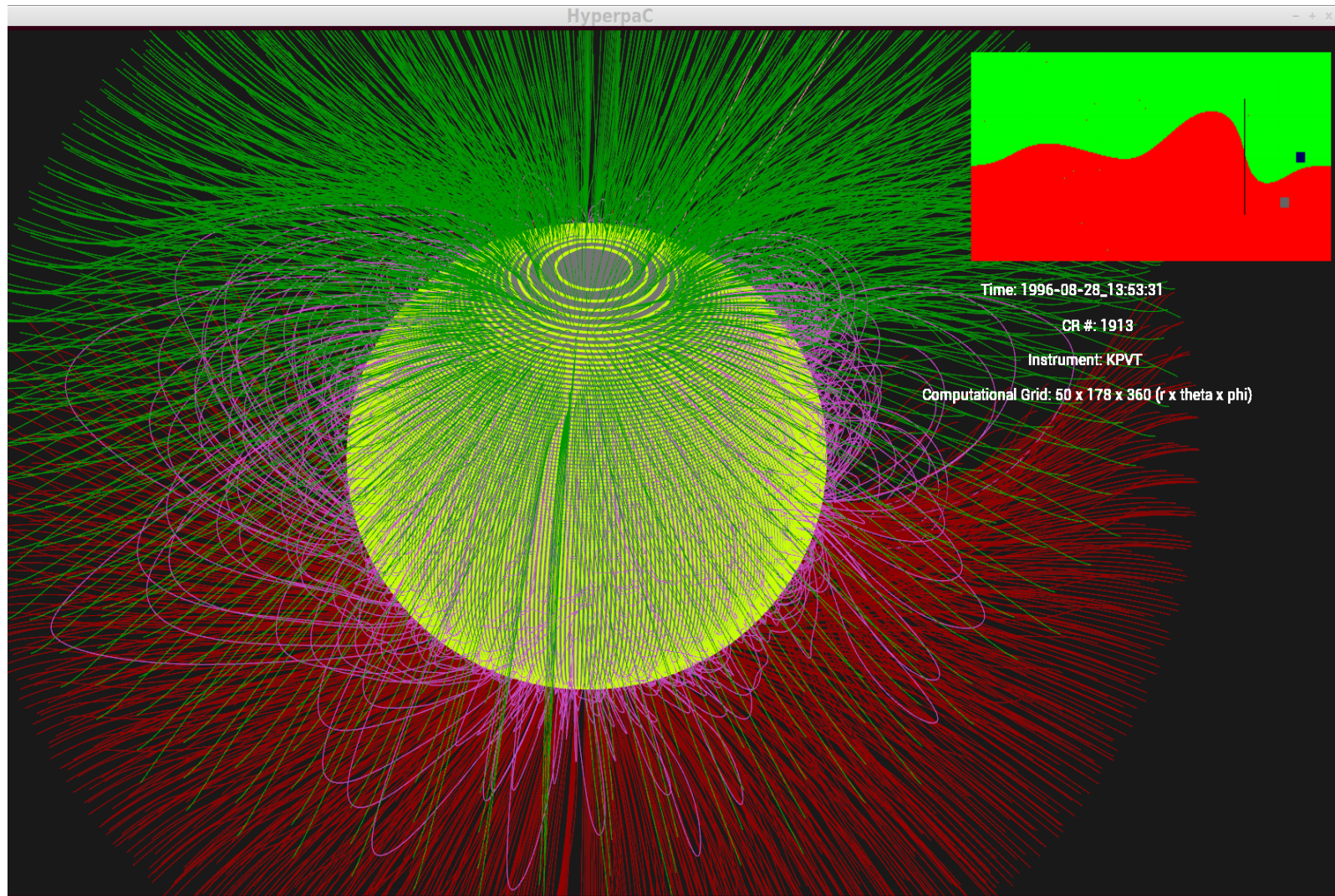


# Hairy Ball – WSO with ballistic mapping

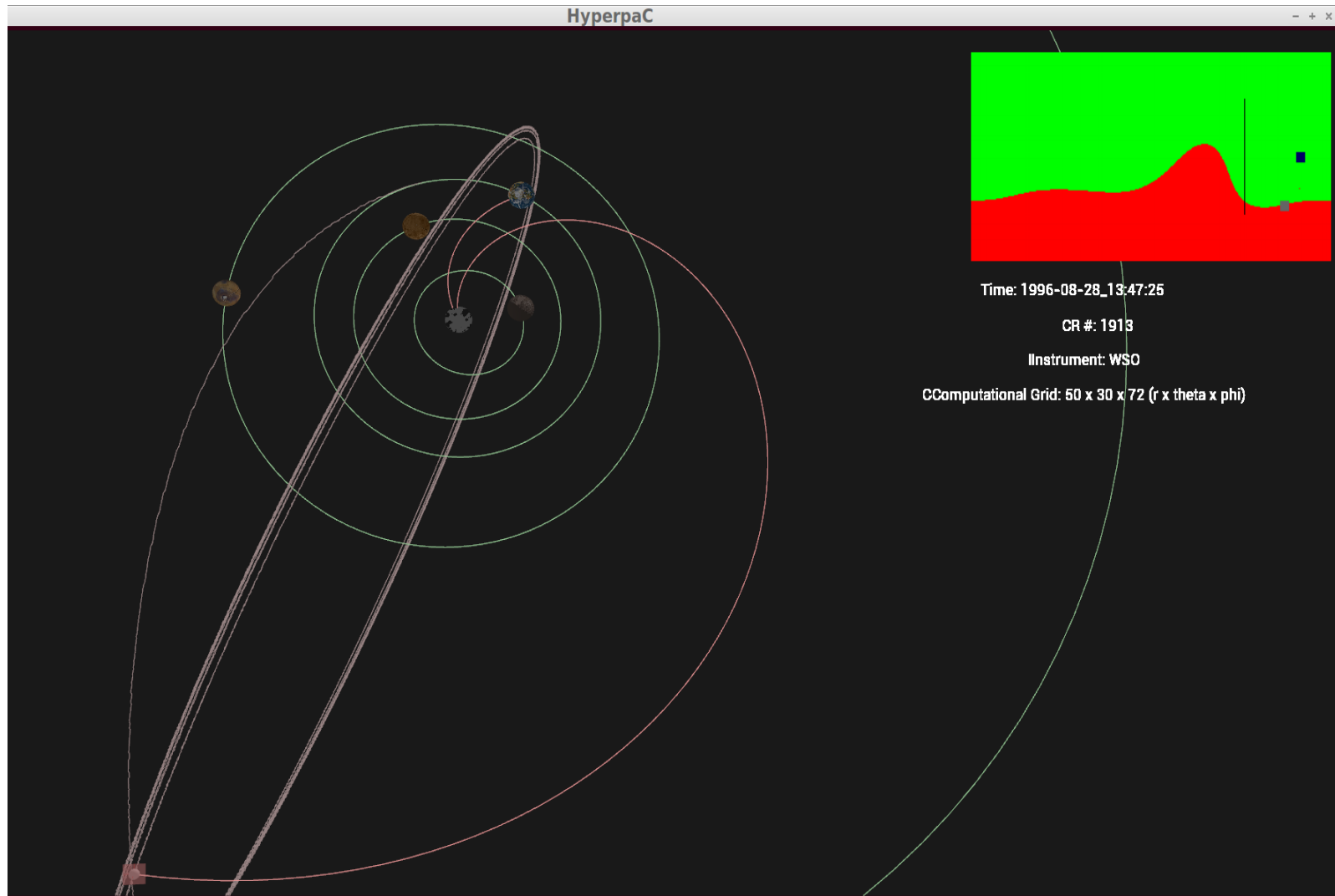




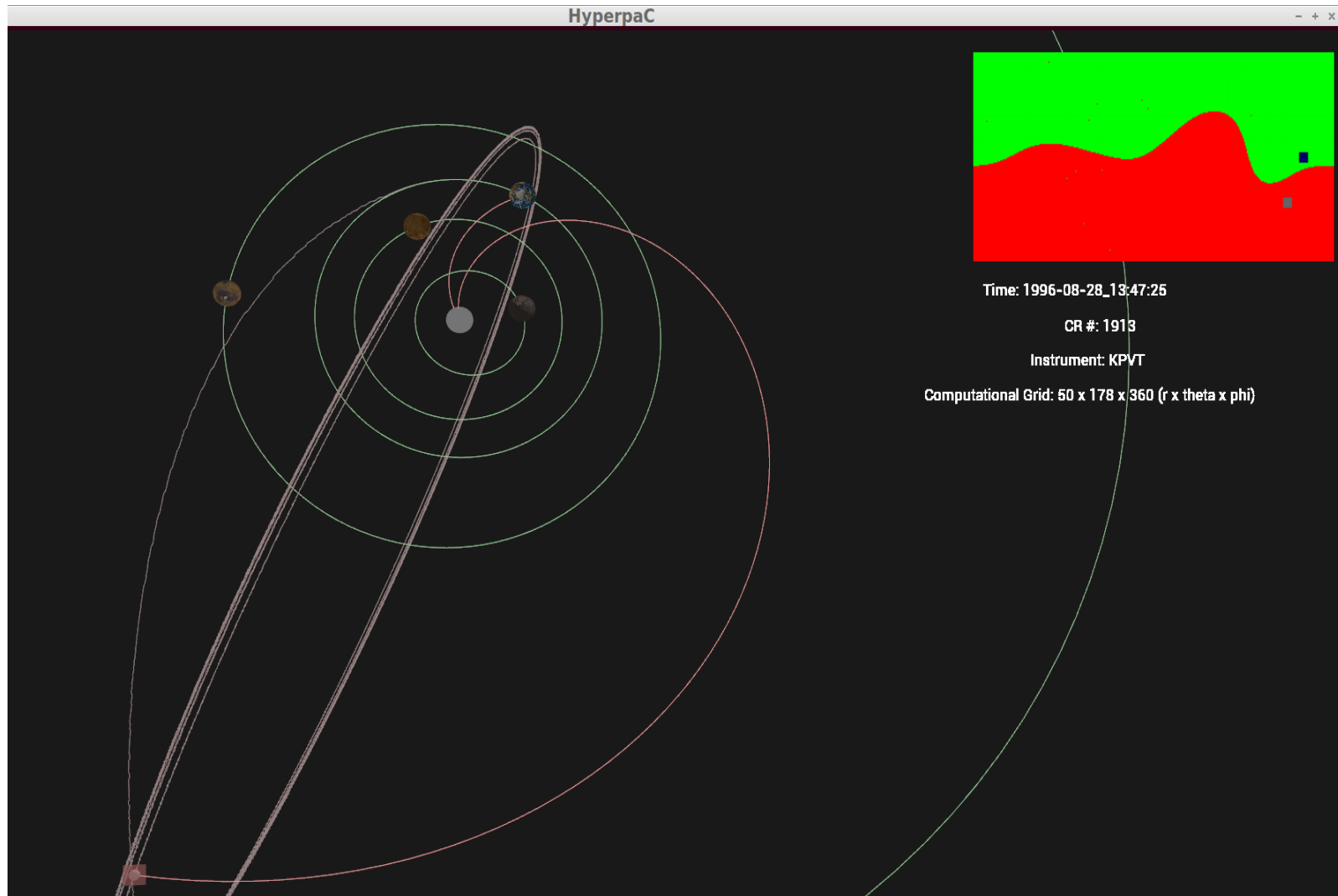
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# Ballistic backmapping - WSO



# Ballistic backmapping - KPVT



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