SWAP Tomographic Reconstruction of the solar corona : large-scale structures

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Warning ! Work in progress

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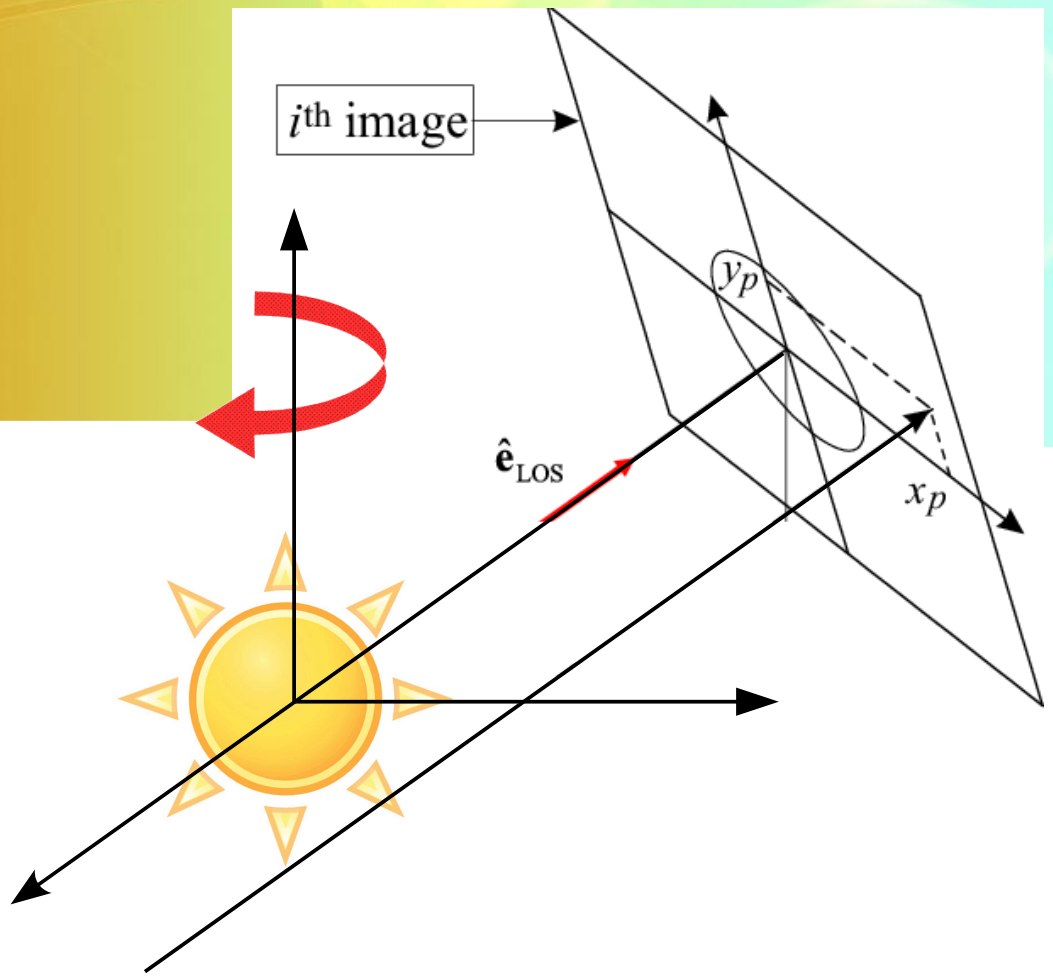
What is Solar Rotational Tomography (SRT) ?

- Integration along LOS → affects interpretations of the solar data

Tomography = 3D reconstruction of an object
+
Solar Rotation → Multiple point of views
=
SRT

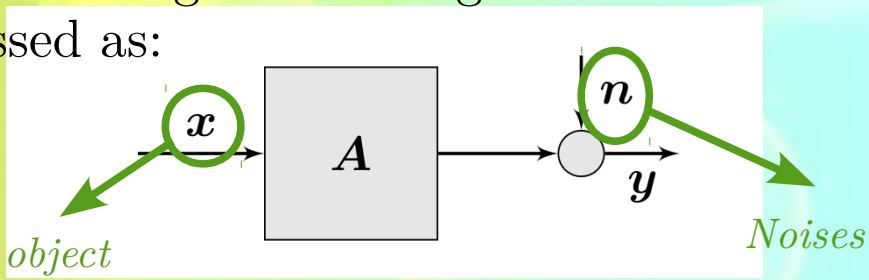


SRT with TomograPy

- Parallelized 4D code, WL or EUV input
- **Isotropic emission + optically thin plasma** → integration along the LOS = linear operator → image acquisition can be expressed as:

$$y = Ax + n$$

Data



- *A:* projection matrix taking into account the exact geometry of the SWAP observations
- Bayesian framework → solution is the maximum *a posteriori* (MAP)

$$x_{map} = argmin(||y\text{-}Ax||^2 + \lambda ||Dx||^2)$$

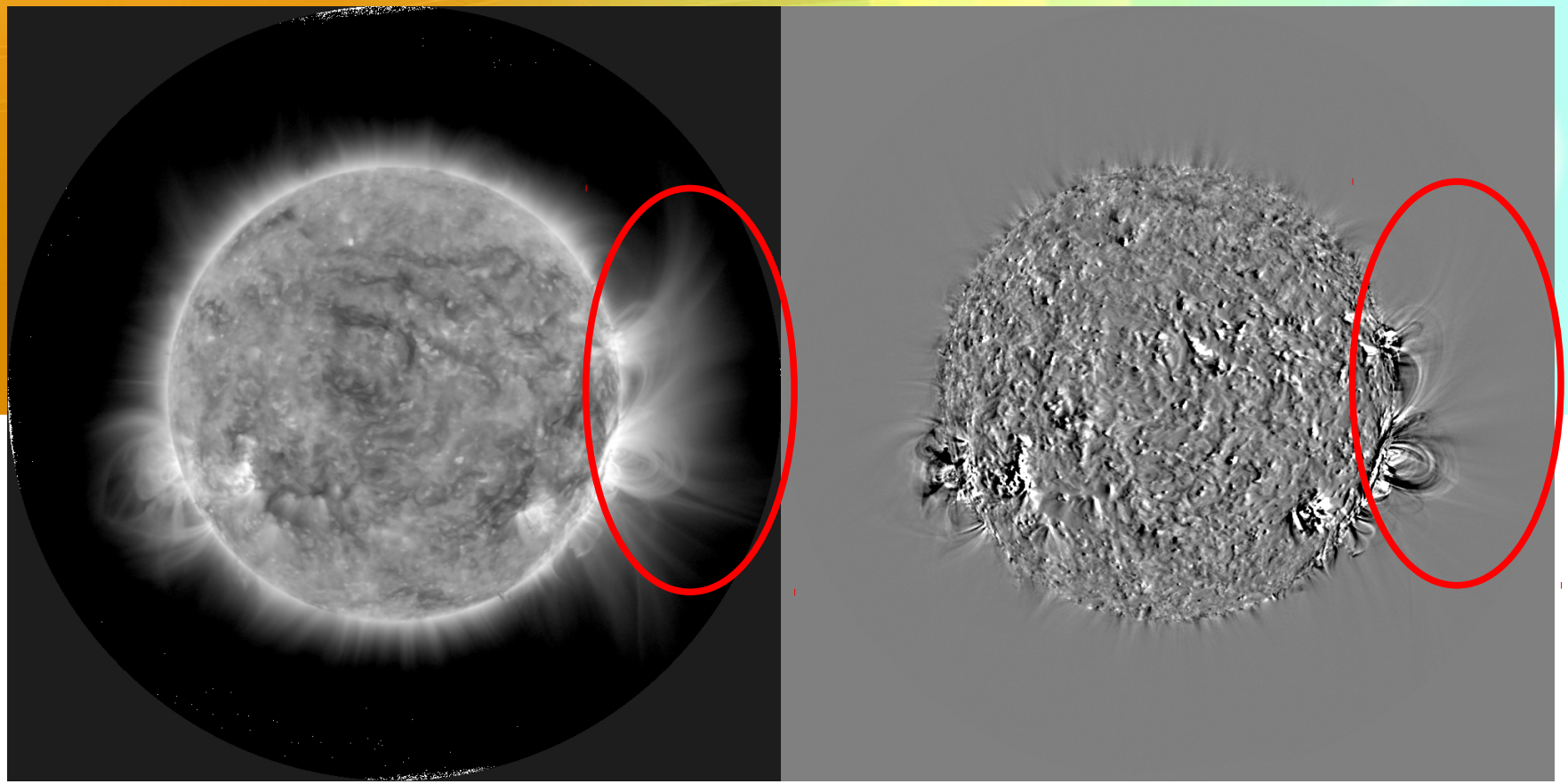
(*D* a smoothness operator and λ a free parameter)

- Estimation of the MAP → iterative gradient method

(Barbey, N., Guennou, C., Auchère, F., Solar Physics, page 181, July 2011)

TomograPy : SWAP data

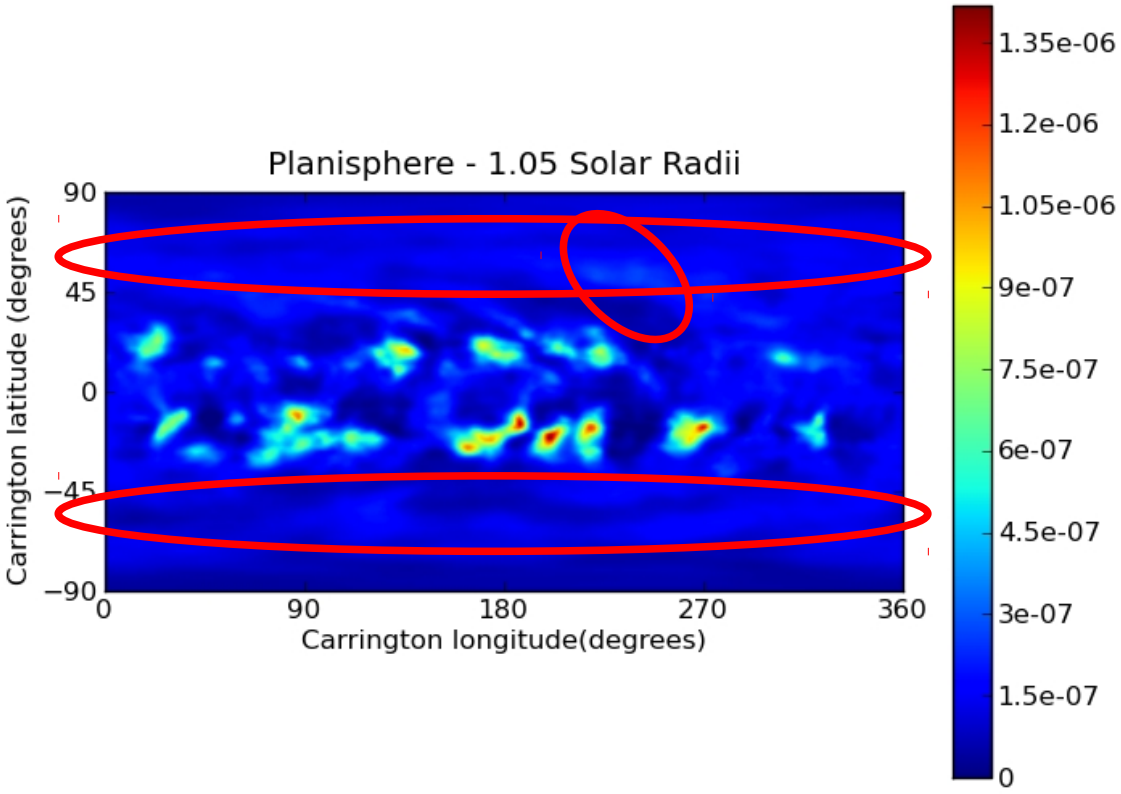
- Typically: 3 Rs 256 x 256 x 256 reconstruction cube
- 6 images per day in 174

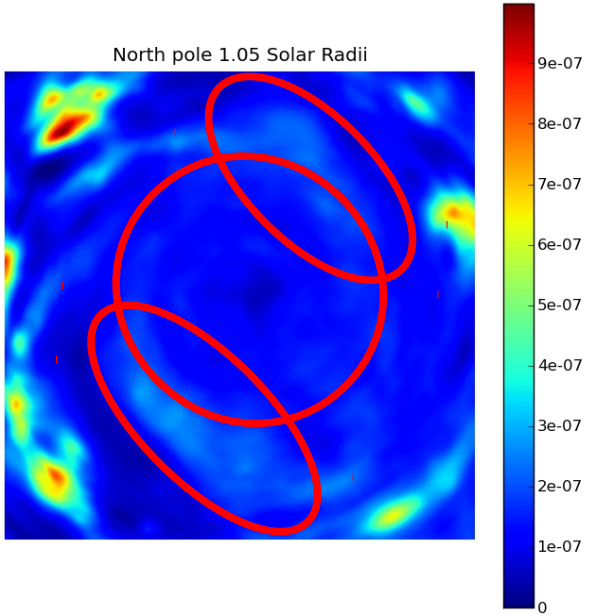


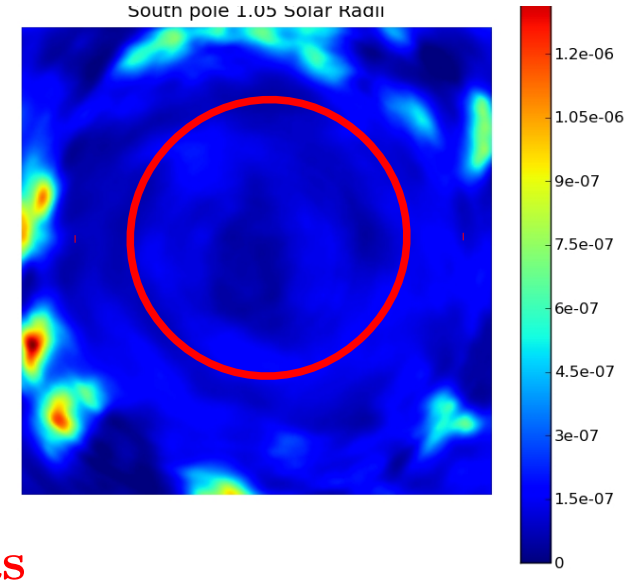
Data → From 18, July to 14, August 2012

TomograPy : SWAP first results

However....







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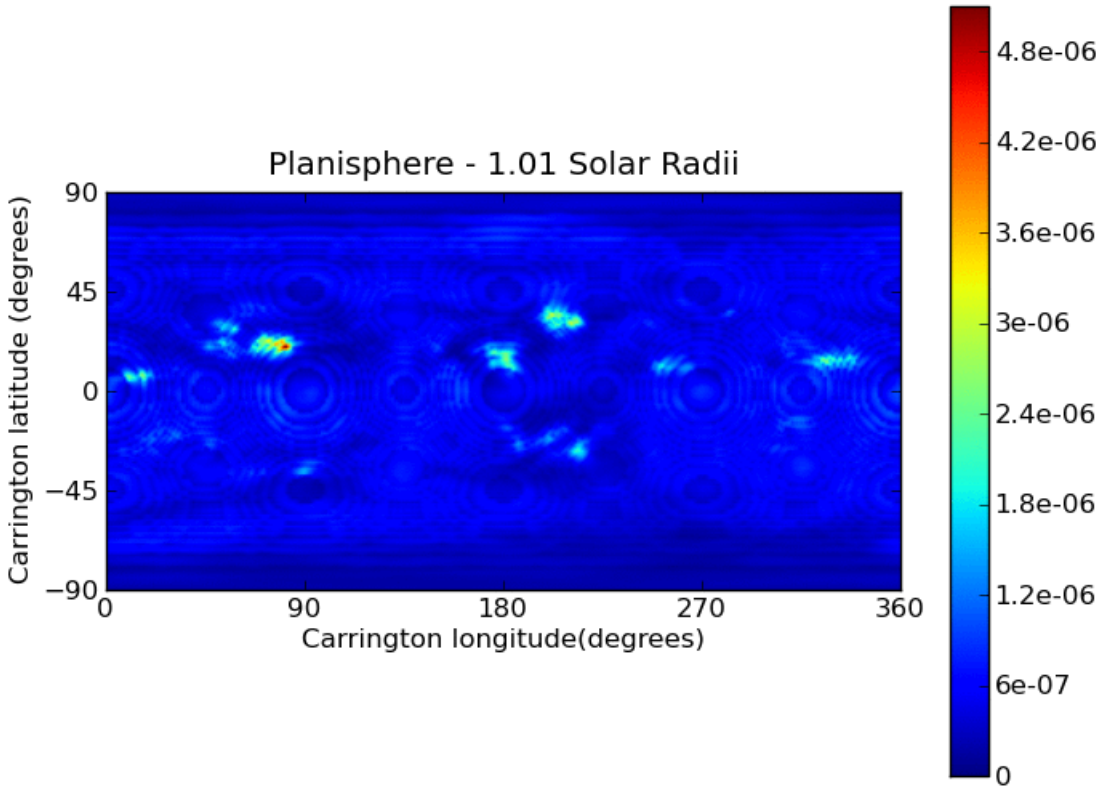
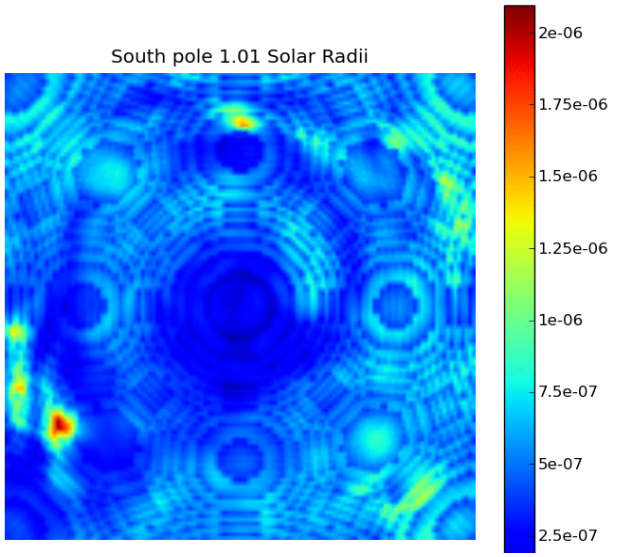
Strong artifacts for an altitude > 1.25 Rs

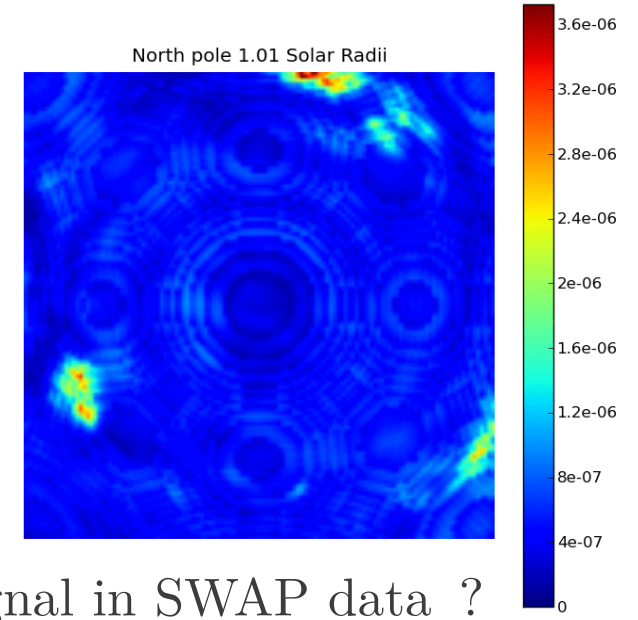
Why ?

Comparison with AIA tomographic inversion (december 2010)

- Same code, but different data







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→ No artefacts in this case

→ could be due to regions with low signal in SWAP data ?

Conclusions

- Tomographic inversion can be a powerful tool for steady large-scale structures
- PROBA2/SWAP data → high altitude solar corona data
- However, some problems appear for the high altitude data : $z > 1.25$ Rs
  - ➔ Lack of signal at high altitude ?
- Need to understand the origin of such artifacts → to obtain better and higher reconstructions

Thank you !

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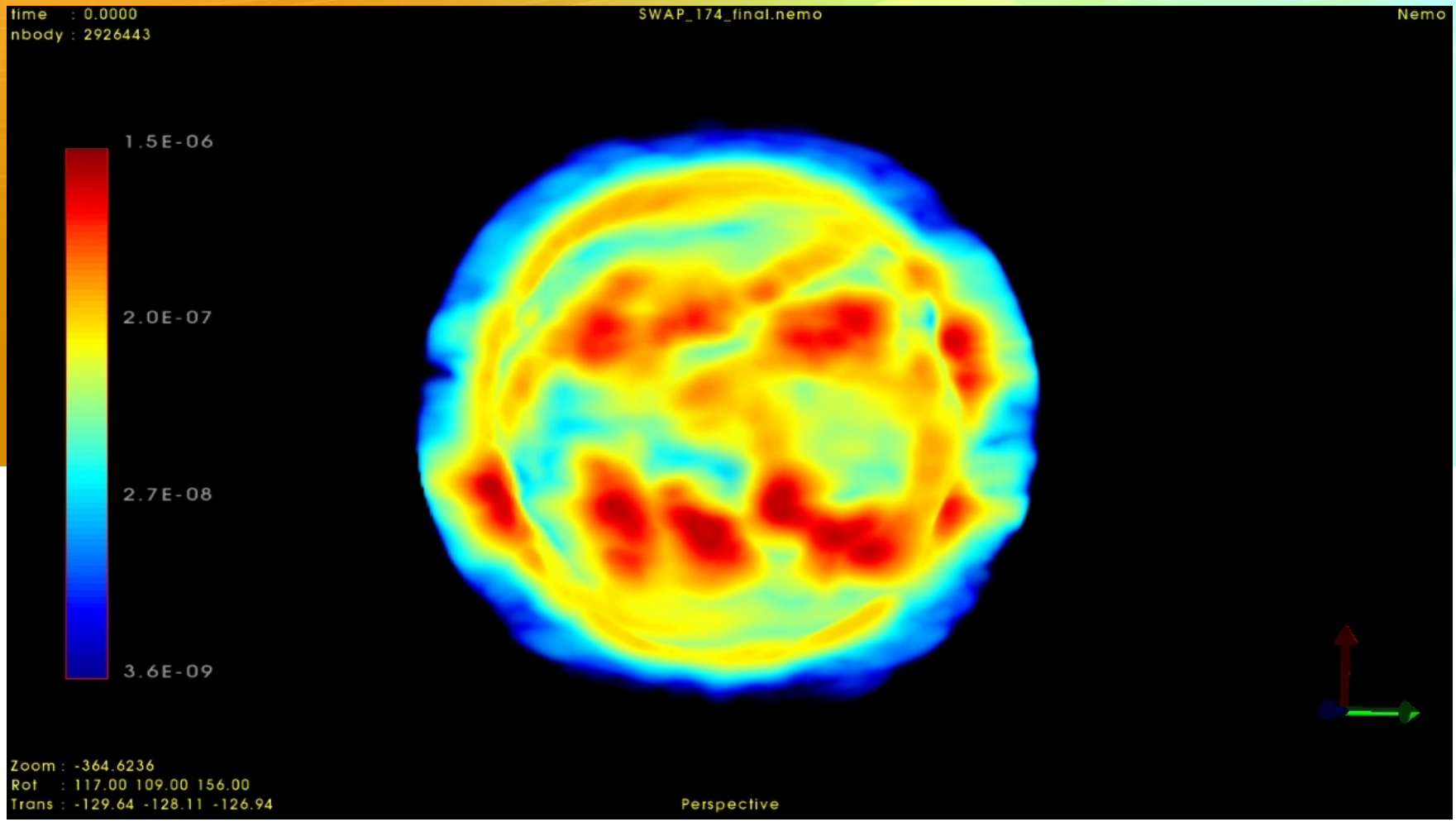
TomograPy : SWAP first results



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