Tomographic Reconstruction of the January 2010 Corona

Preliminary Results from JOP 225

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Problem

What are plumes ?

Source of the fast wind (Teriaca 2003) ?
Or is it interplumes (Gabriel 2005) ?
Geometry: Tubes ? Curtains ? Both ?
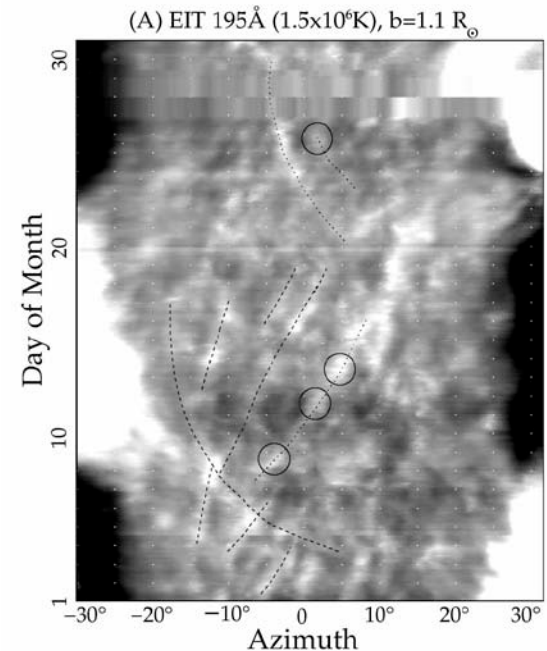Lifetime: < 1 day ? few days ?

Can tomography help ?

Plumes are dynamic objects
Tomography needs weeks of data

Yes.

Using three strategies

1. Reduce the acquisition time
2. Time dependent (4D) tomography
      Barbey et al. 2008, Sol. Phys, 248(2), 213
3. All of the above

DeForest et al. 2001, ApJ, 560, 490

Reducing the acquisiton time

1 viewpoint: 28 days (full corona) or 14 days (poles)
2 viewpoints @ 90°: 7 days (March 2009)
3 viewpoints @ 60°: 4.2 days (September 2009)
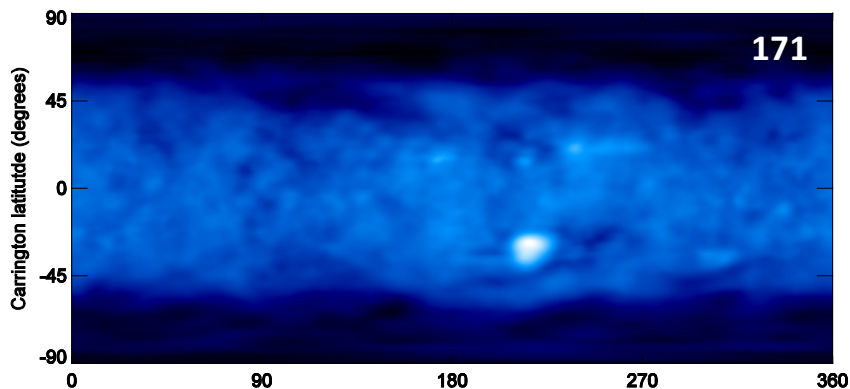   **Lifetime of (some) plumes !**

JOP 225
    10-18 January 2010: ~65° / 70°, but
    EUVI: ICER3 binned 2x2, increased exp. times
    EIT: 195, additional 284, increased exp. times
    SWAP: 171, best effort (commisionning)
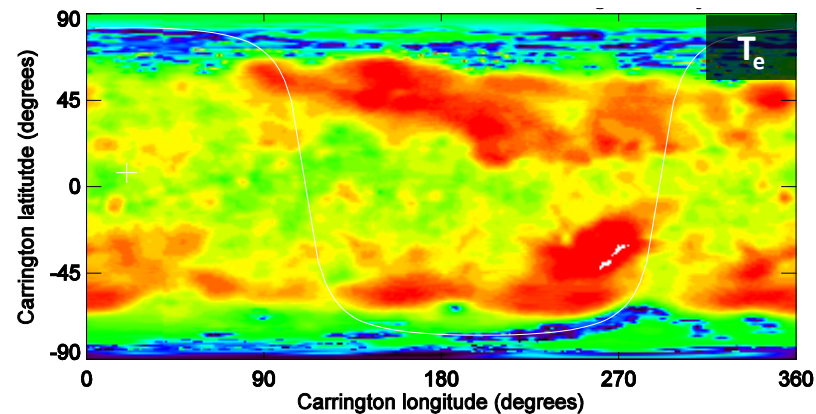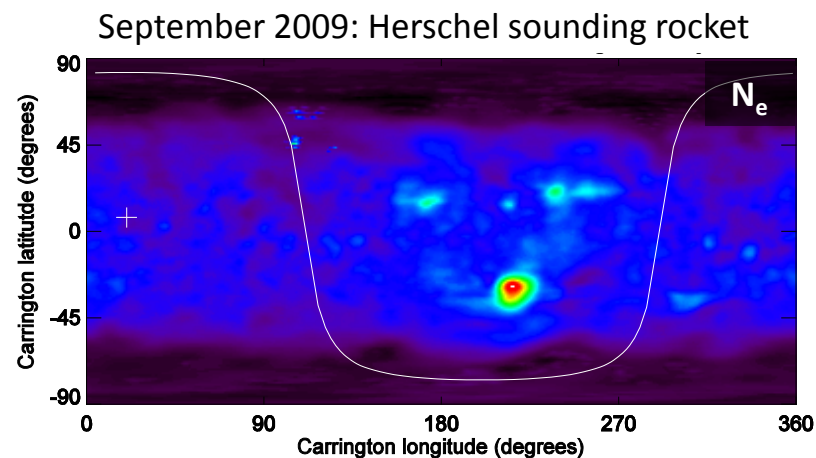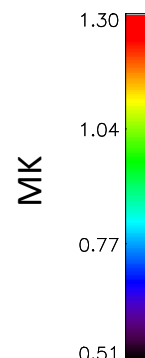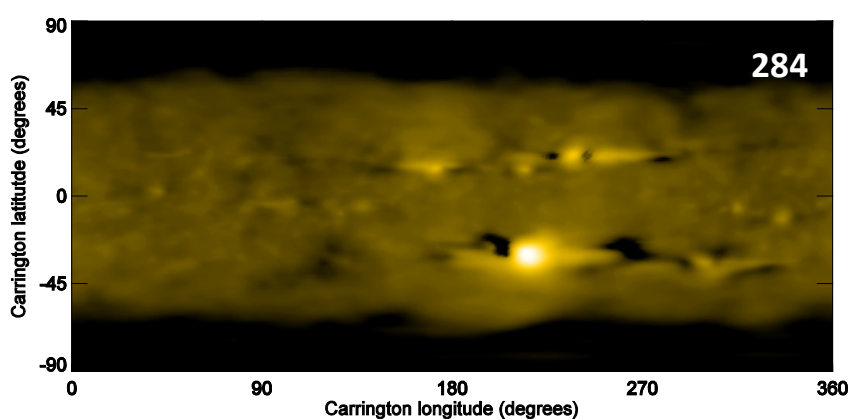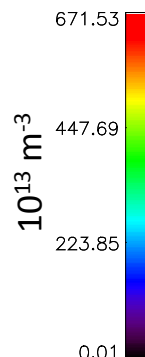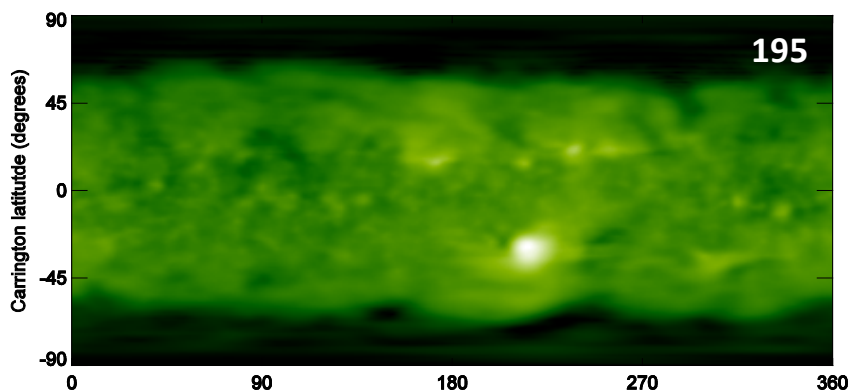   **Thanks to the SECCHI and SWAP ops. teams !**
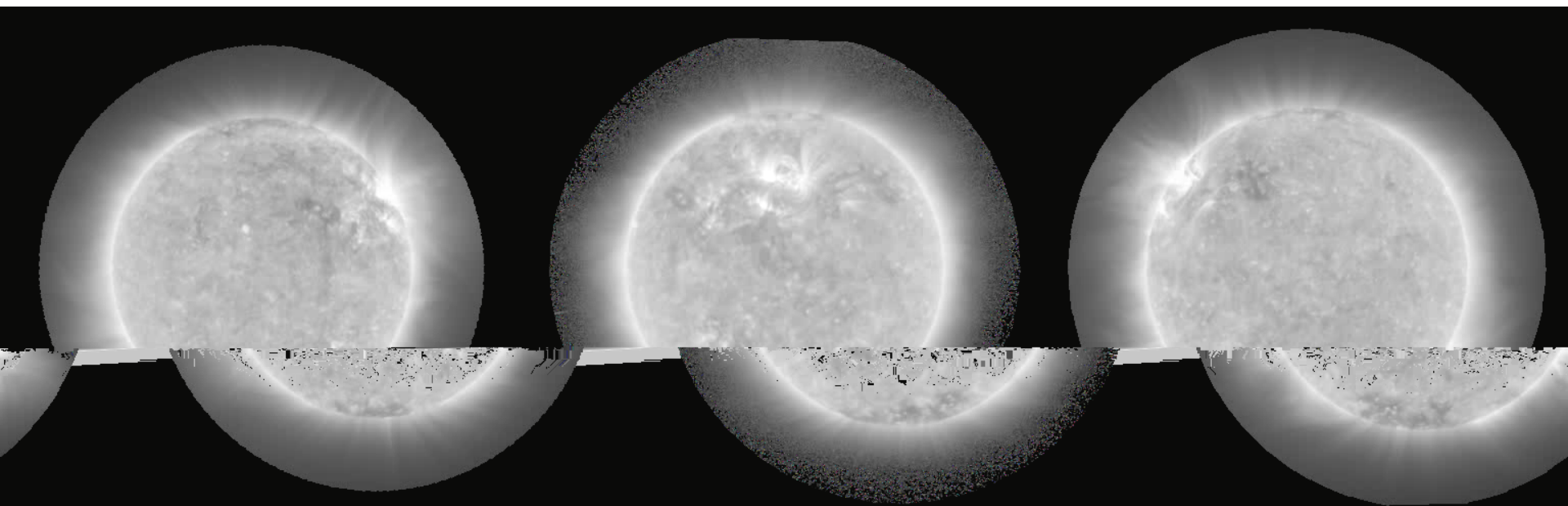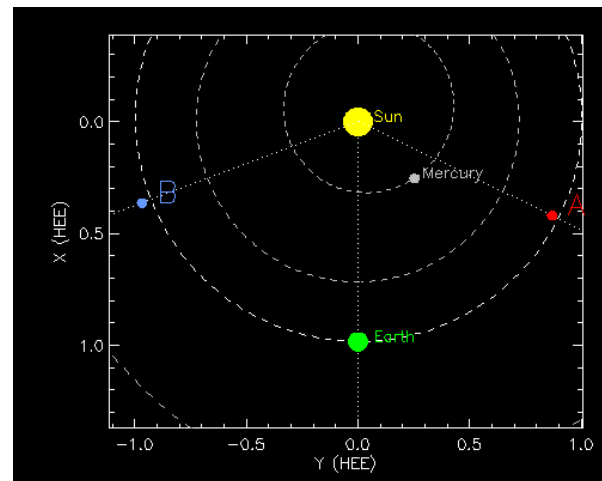
The tomography code

Typically: 3 R_s 128 x 128 x 128 reconstruction cube
6 images per day
Images binned 512 x 512

2 or 3 bands + isothermal hypothesis > N_e, T_e
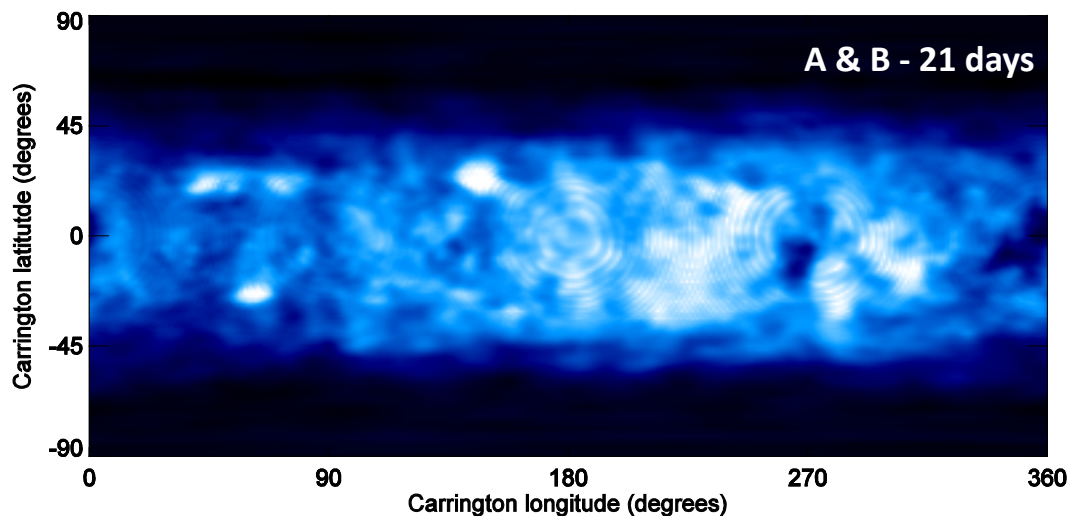
September 2009: Herschel sounding rocket

6 days of data: 13 – 18 January 2010
B0 < 0 on A and SWAP: south pole
Some structures last several days

F. Auchère – SECCHI meeting – JOP 225 Tomography
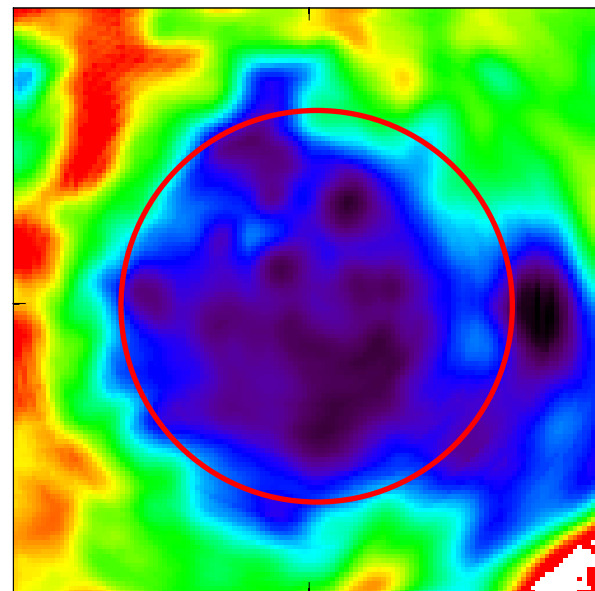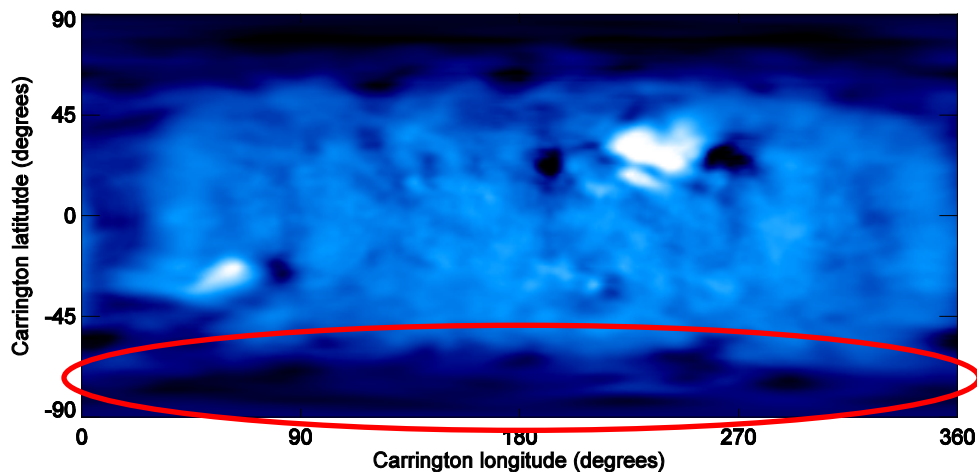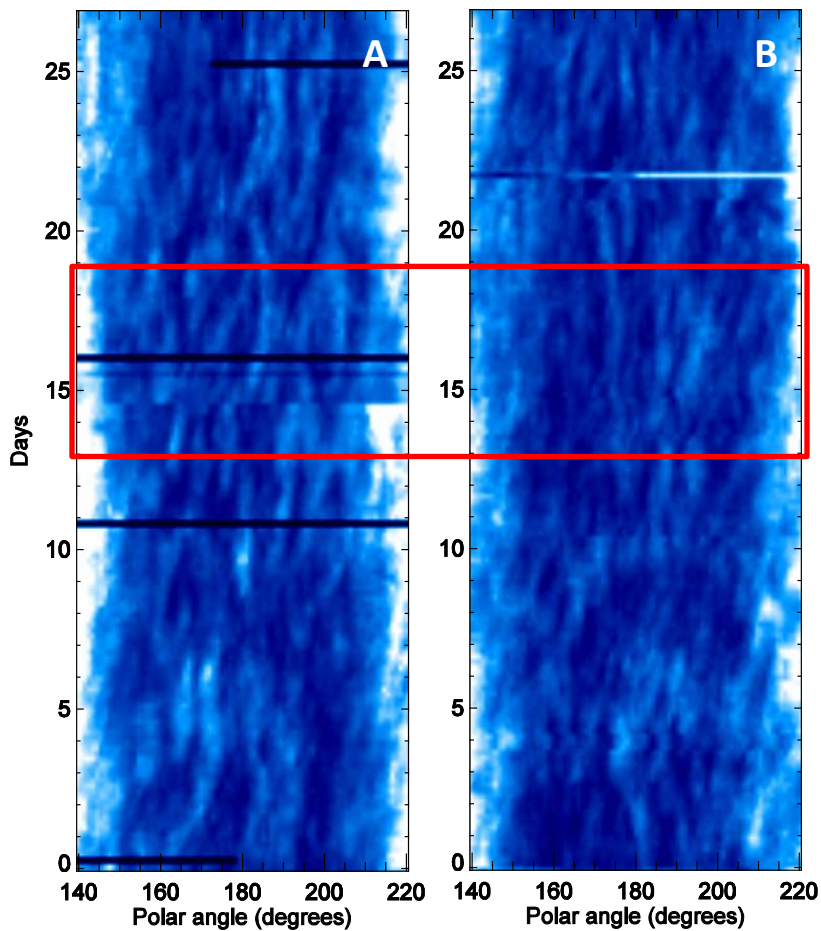
A + B reconstructions @ 90°

A & B - 21 days

A & B - 7 days

March 2009: spacecraft separation = 90°
B0 ~ -5°: good coverage of the south pole
Only 7 days needed
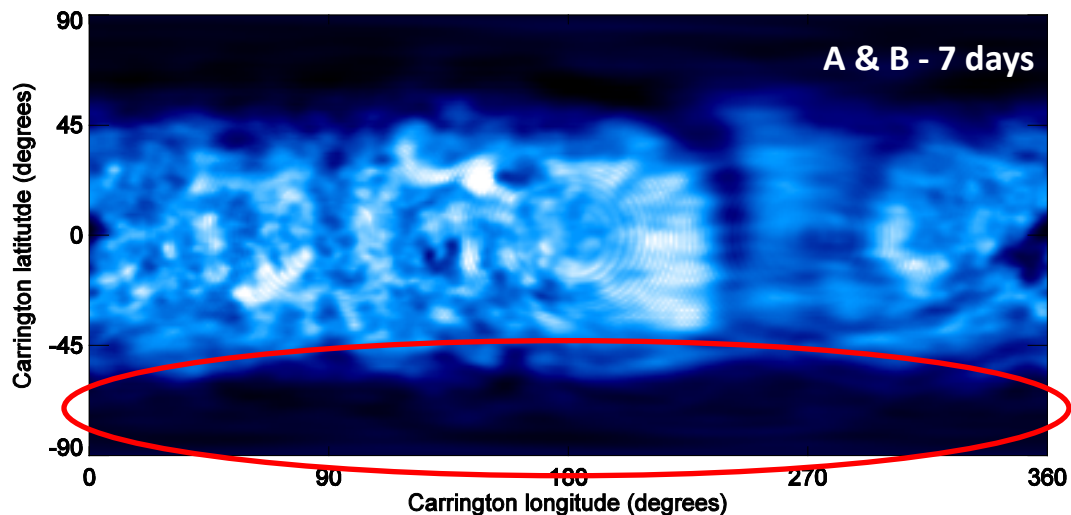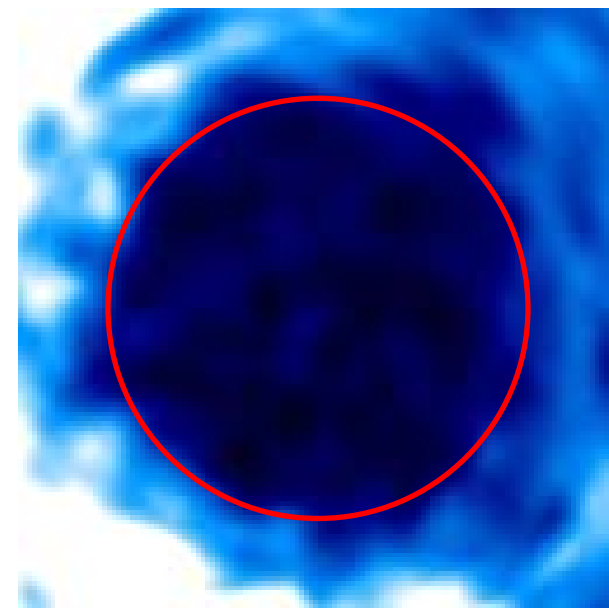
7 days running over 4 weeks

Average of N reconstructions over p days
= Reconstruction over p x N days

A 3D reconstruction is an average over
the acquisition time

Conclusions

3 point tomography !
- Helps
- Reduced acquisition time: 6 days
- Disparity of viewpoints: that's good
- Disparity of data: that's bad
- SWAP: still learning (pointing, noise, response, etc.)

Shortest snapshot of polar plumes !
- Interpretation still challenging
- Average quantities
- Quantification of artefacts

Work in progress
- Process 195 and 284
- Temperature, density
- Putting it all together: 3 viewpoints time dependent tomography

THANKS to the SECCHI and SWAP operations teams !