# FP7 Project – HELCATS – WPs 5, 6 and 8

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# WP5: Catalogue of CIRs

• To construct a community-oriented catalogue of CIRs observed by STEREO/HI, with their main parameters, from 2007 to 2015 (minimum through maximum and early declining phase of solar cycle 24).

• To derive the 3-D trajectories and kinematic properties of CIRs using fitting procedures.

• To compare the back-projected results of CIR evolution with solar source observations; to determine the time-dependent effects of the dynamic streamer belt and of coronal holes.

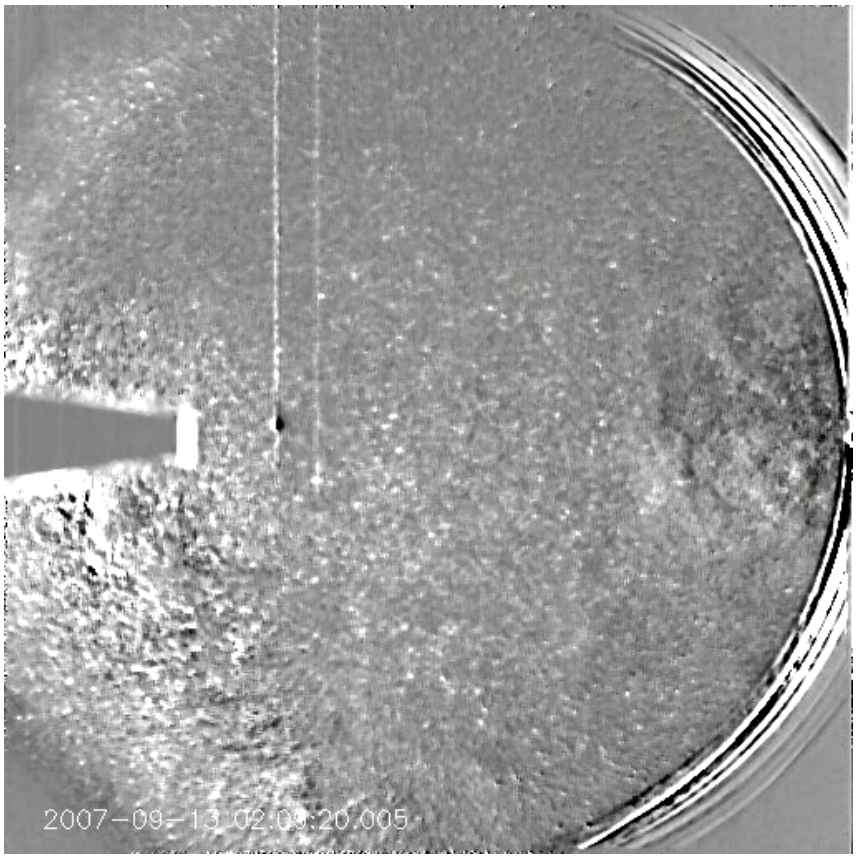
• To compare the forward projected results of the fitting procedure with in-situ measurements of CIRs and the transient slow solar wind.

## D5.1: Cataloguing the occurrence of CIRs

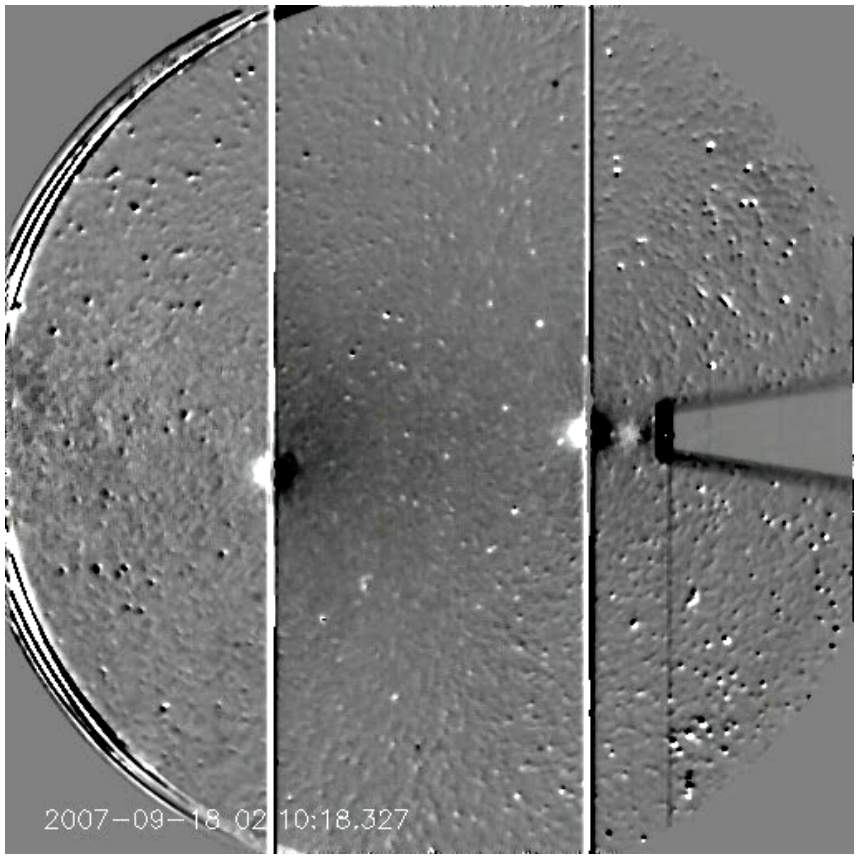
Using J-maps and optimized running-difference images, we will

- list the times of observations of each CIR in HI images,
- measure the number of small-scale transients entrained inside each CIR in the ecliptic plane,
- determine the minimum and maximum radial distance at which CIR are observed, and establish a common timeline (first order catalogue) of remote-sensing and in-situ measurements of CIRs.
- From the in-ecliptic CIR fitted trajectories, we will provide an estimate of the arrival times of CIRs at Mercury, Venus, Mars, Earth, Saturn, thereby providing support to European-funded space missions around these planets.

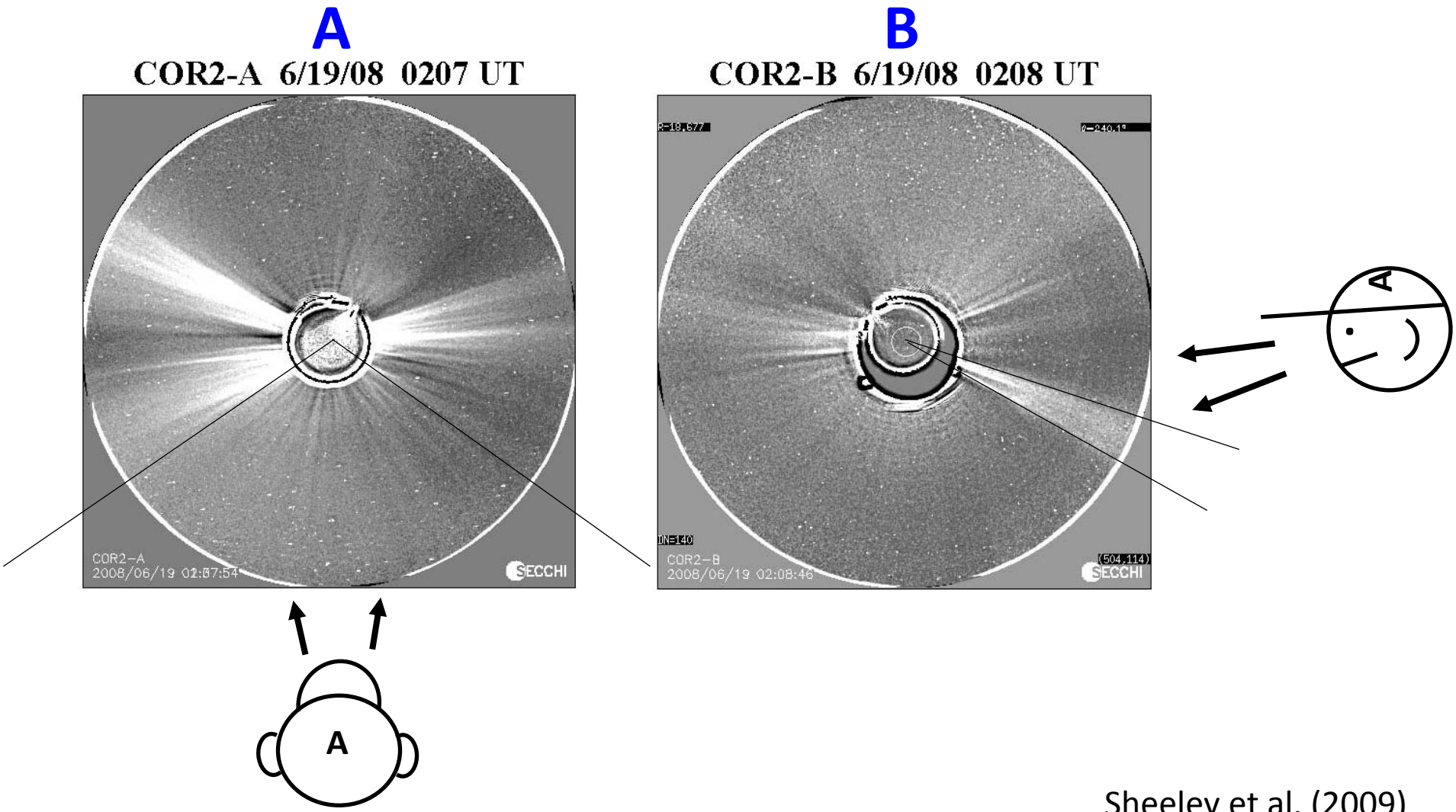
⟶ Post-doc working on CIRs




HI-2A



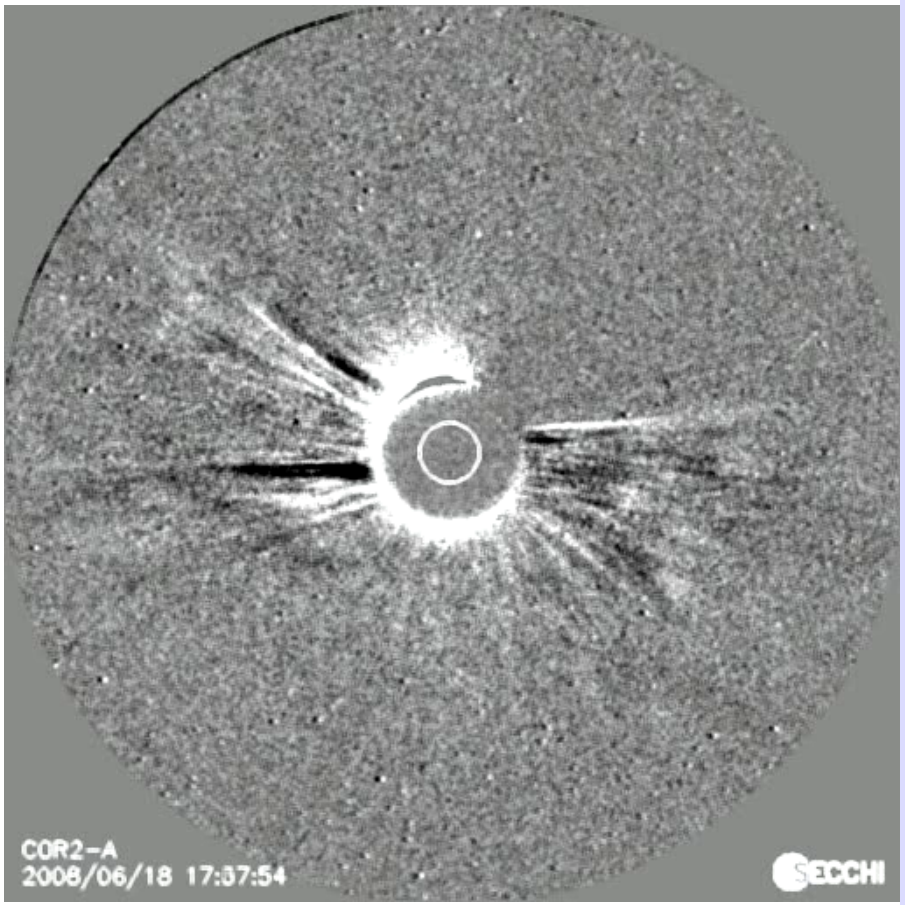

HI-2B




Sheeley et al. (2009)

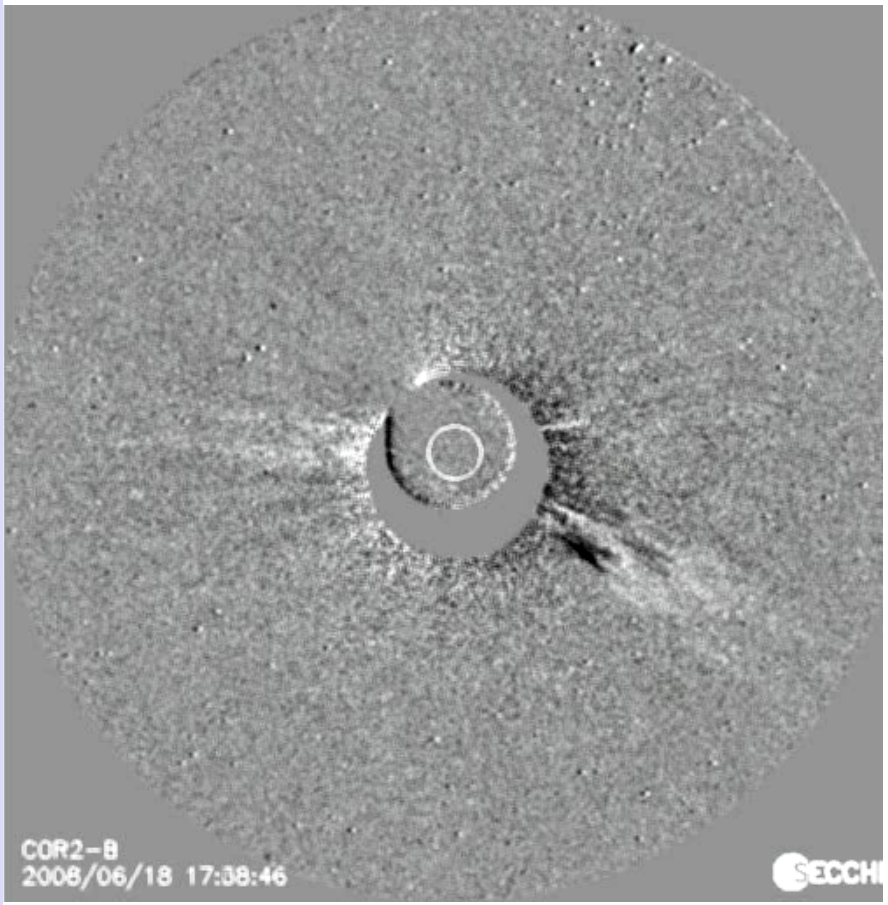
# WP5: Catalogue of CIRs

## COR-2A




Arc-like structures emitted over 20-40 degrees PA range

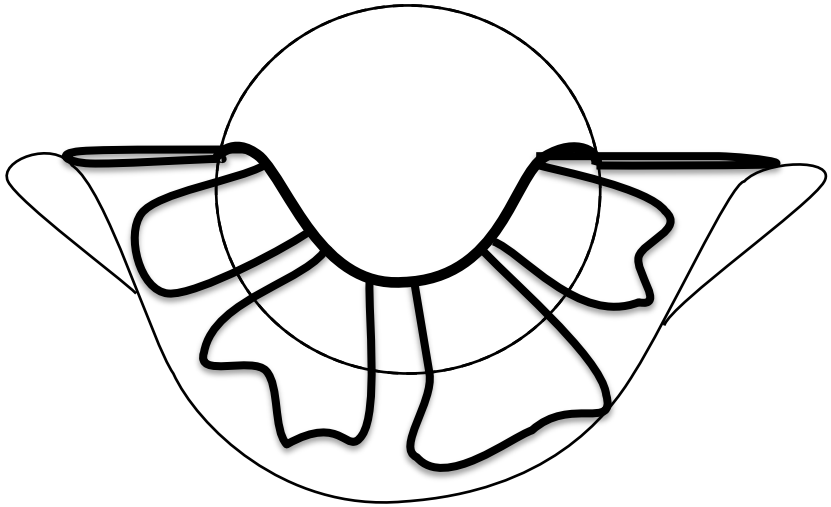
## COR-2B

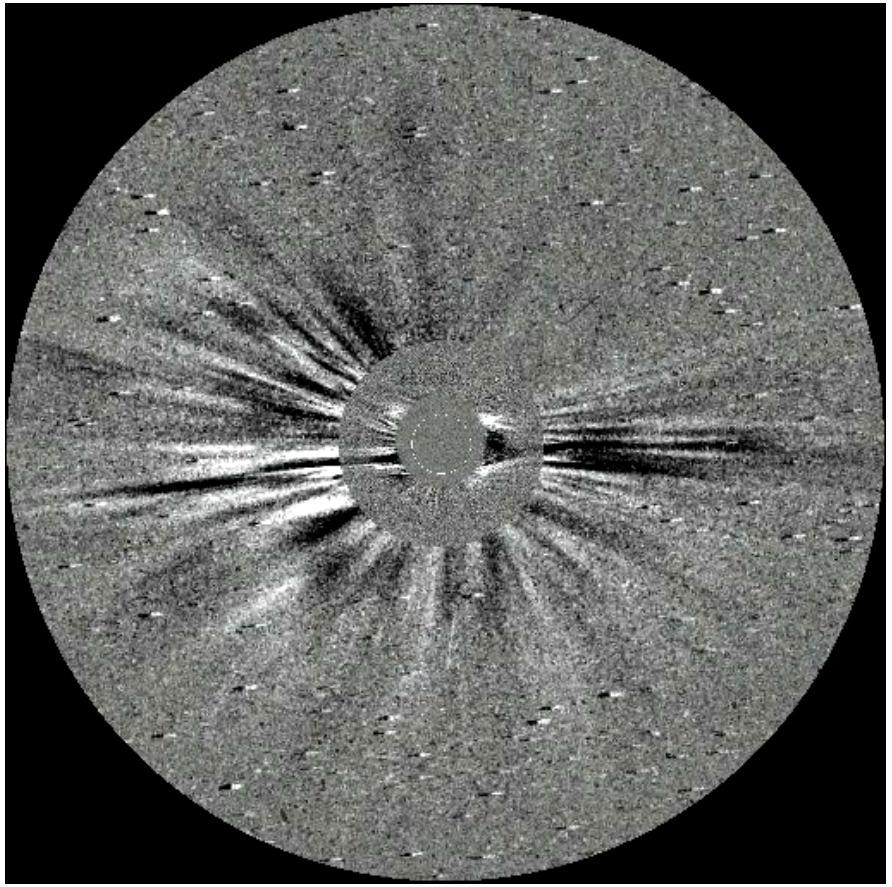



2-3 edge-on blobs per day

# WP5: Catalogue of CIRs

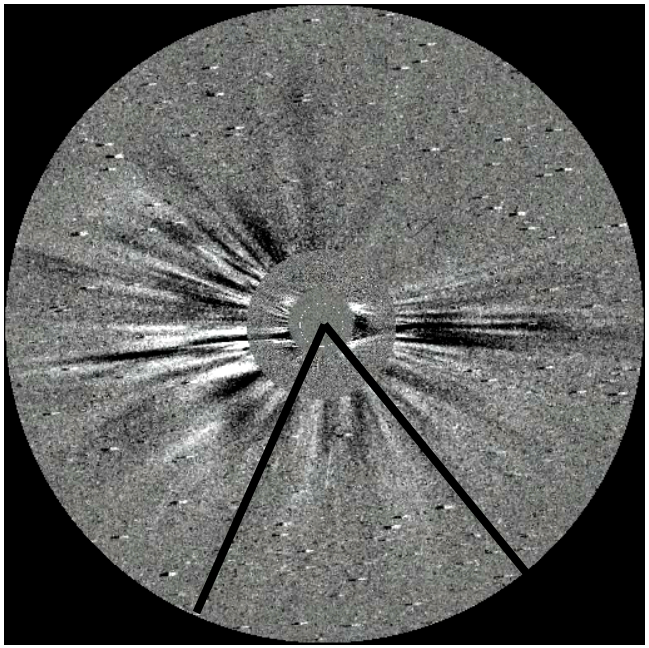
Blobs observed face-on at high latitudes tend to be faint so we average and subtract a combination of16 running COR-1 frames and 6 running COR-2 frames: many more arc-shaped structures appear!





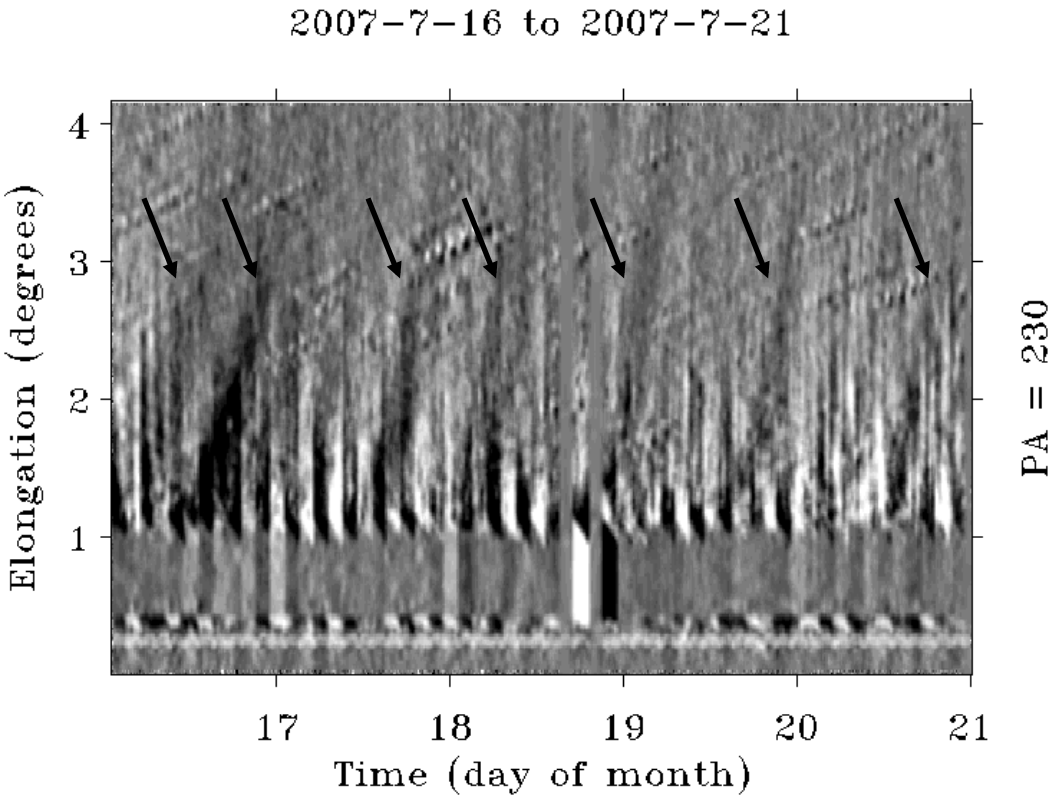
COR-1B and COR-2B: June 2008

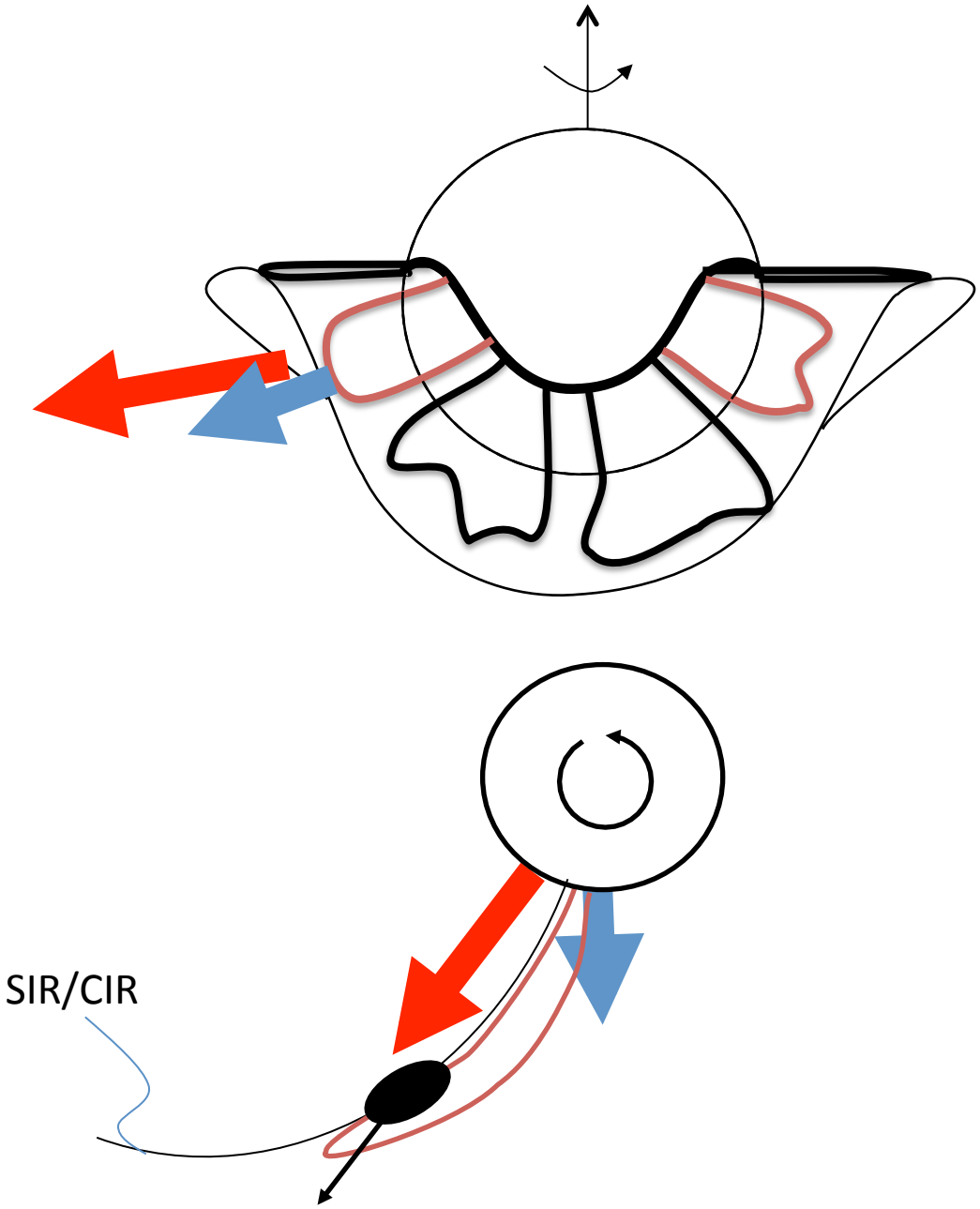
# WP5: Catalogue of CIRs

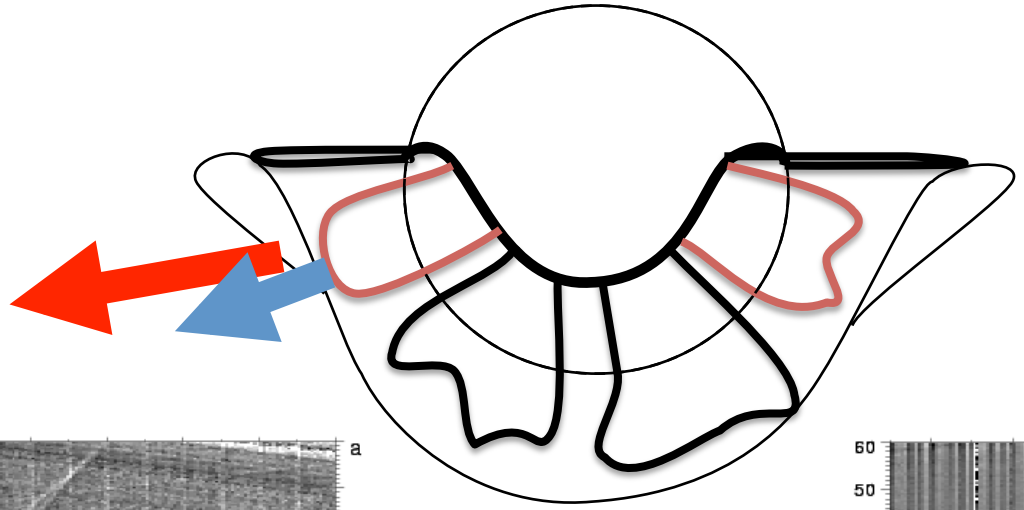


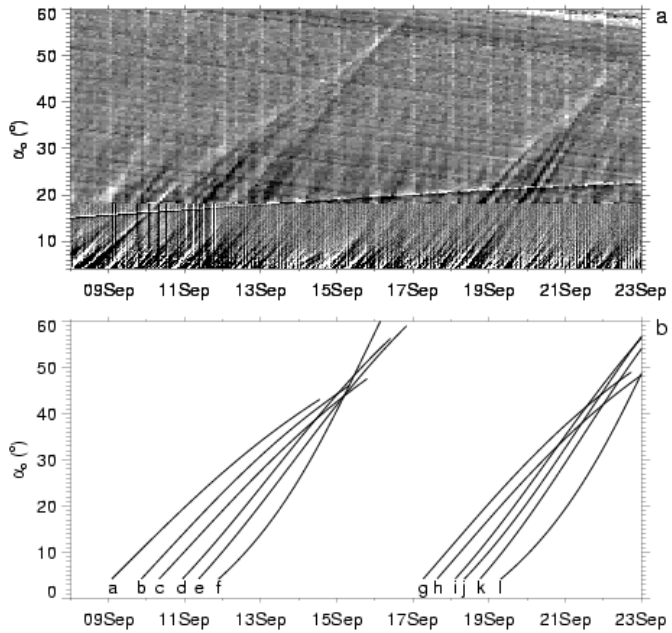
2-3 face-on blobs per day along one position angle.

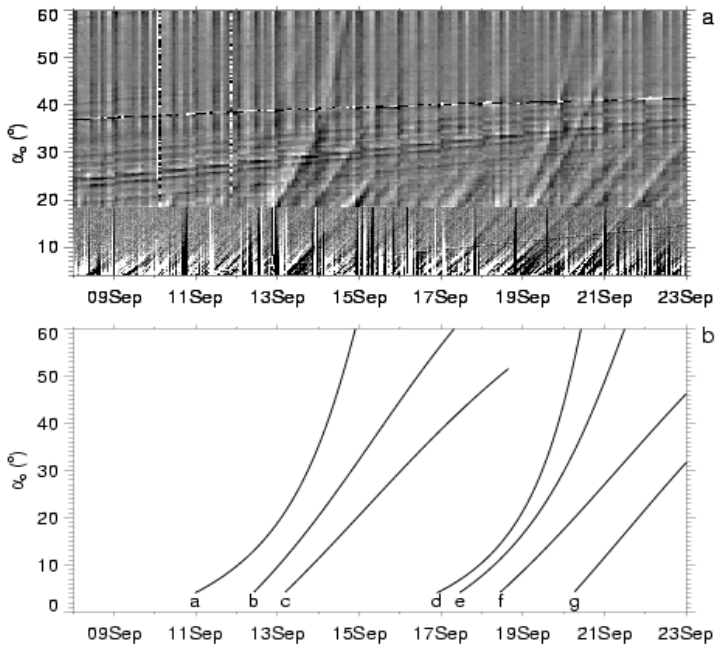
30-40 degrees PA range



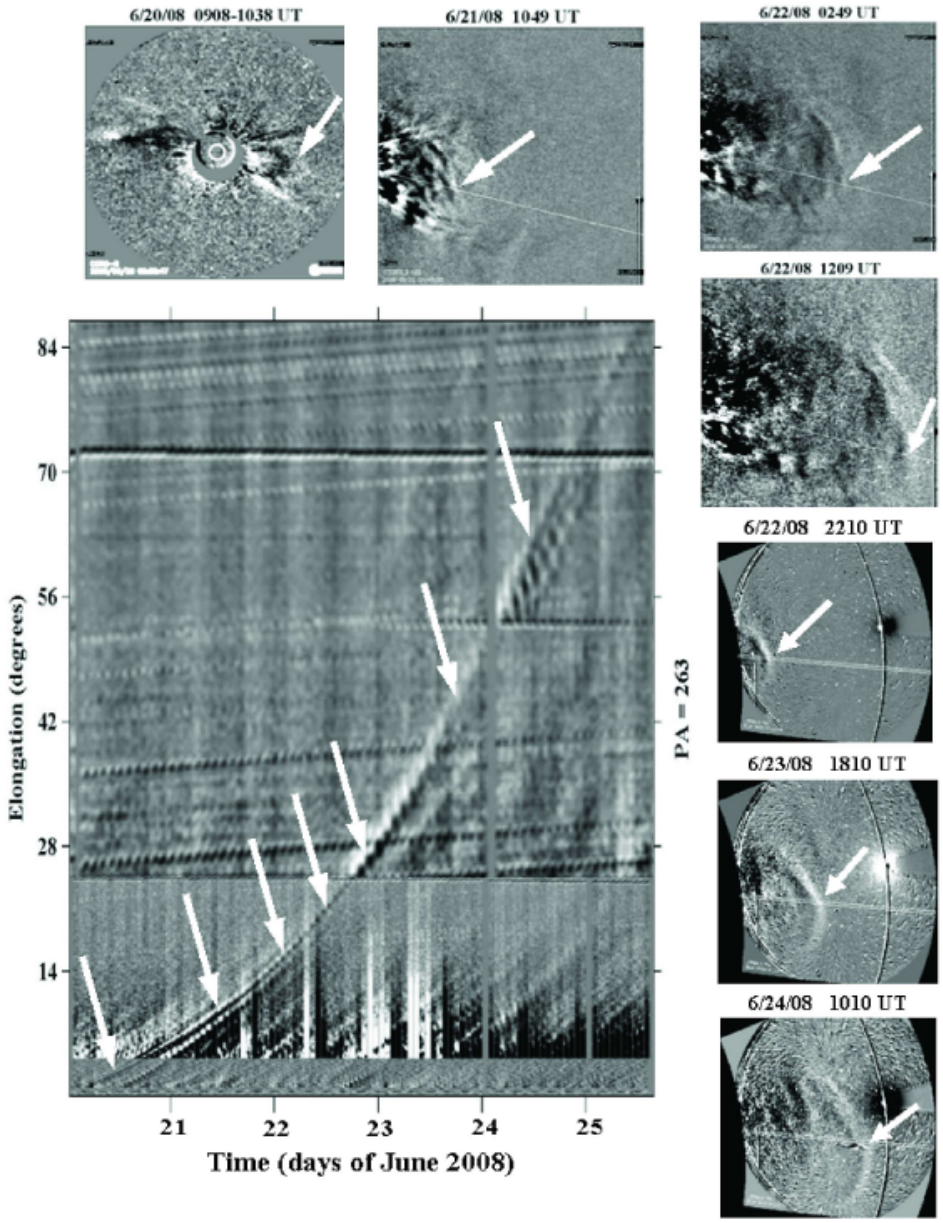

SIR/CIR



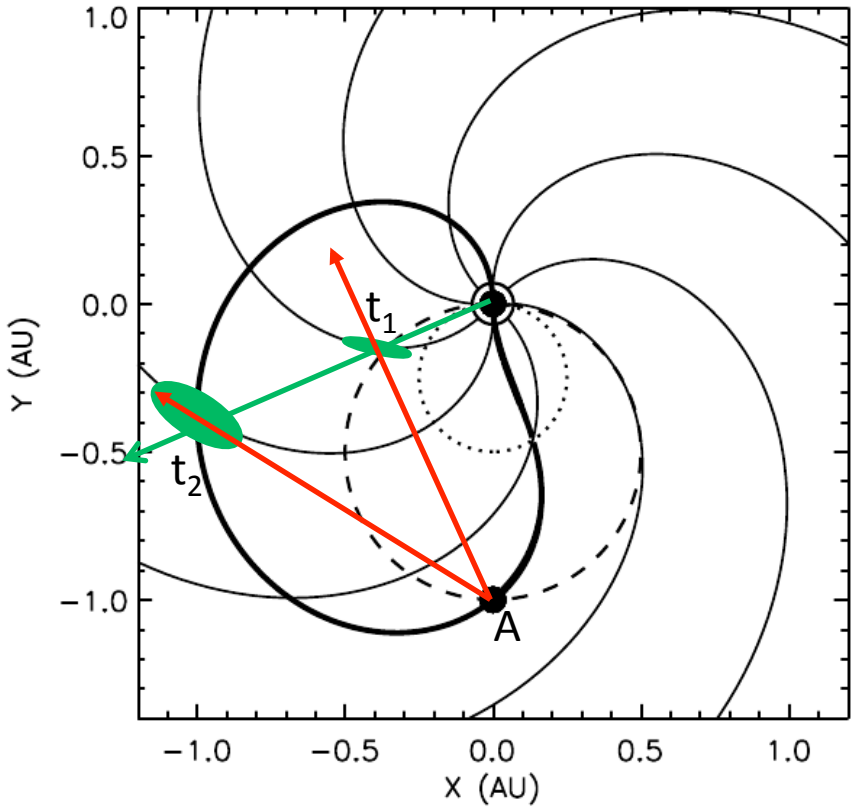


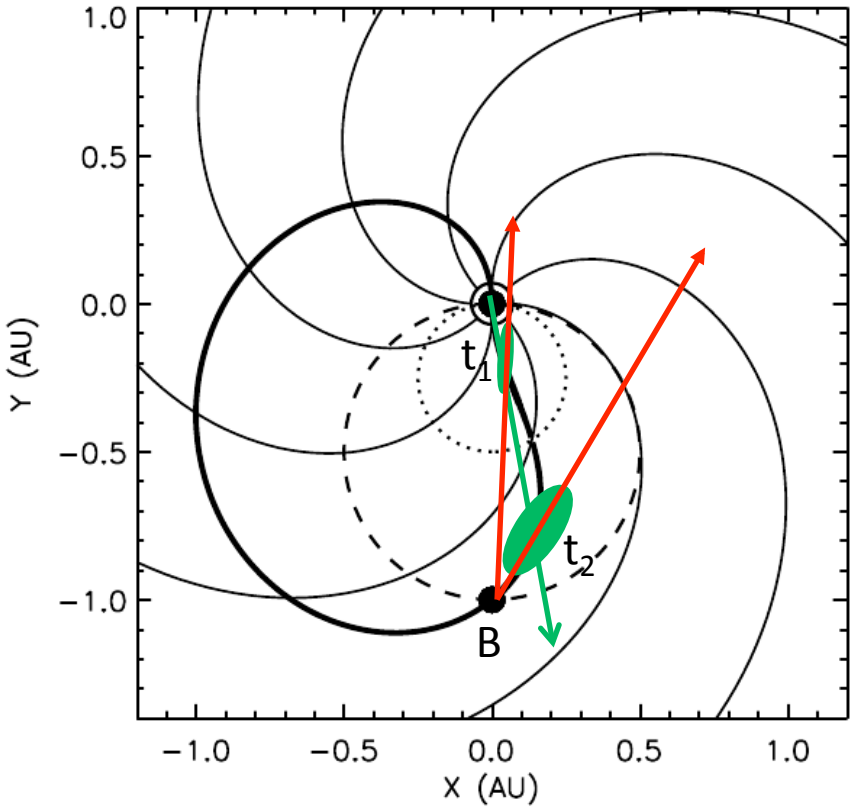

These traces mark are associated with the variability of plasma density along the CIR. Probably the compression of face-on blobs by high speed streams [Rouillard et al., 2008, 2010a,b; Sheeley et al. (2008)]




Sheeley and Rouillard (2010)




Sheeley and Rouillard (2010)



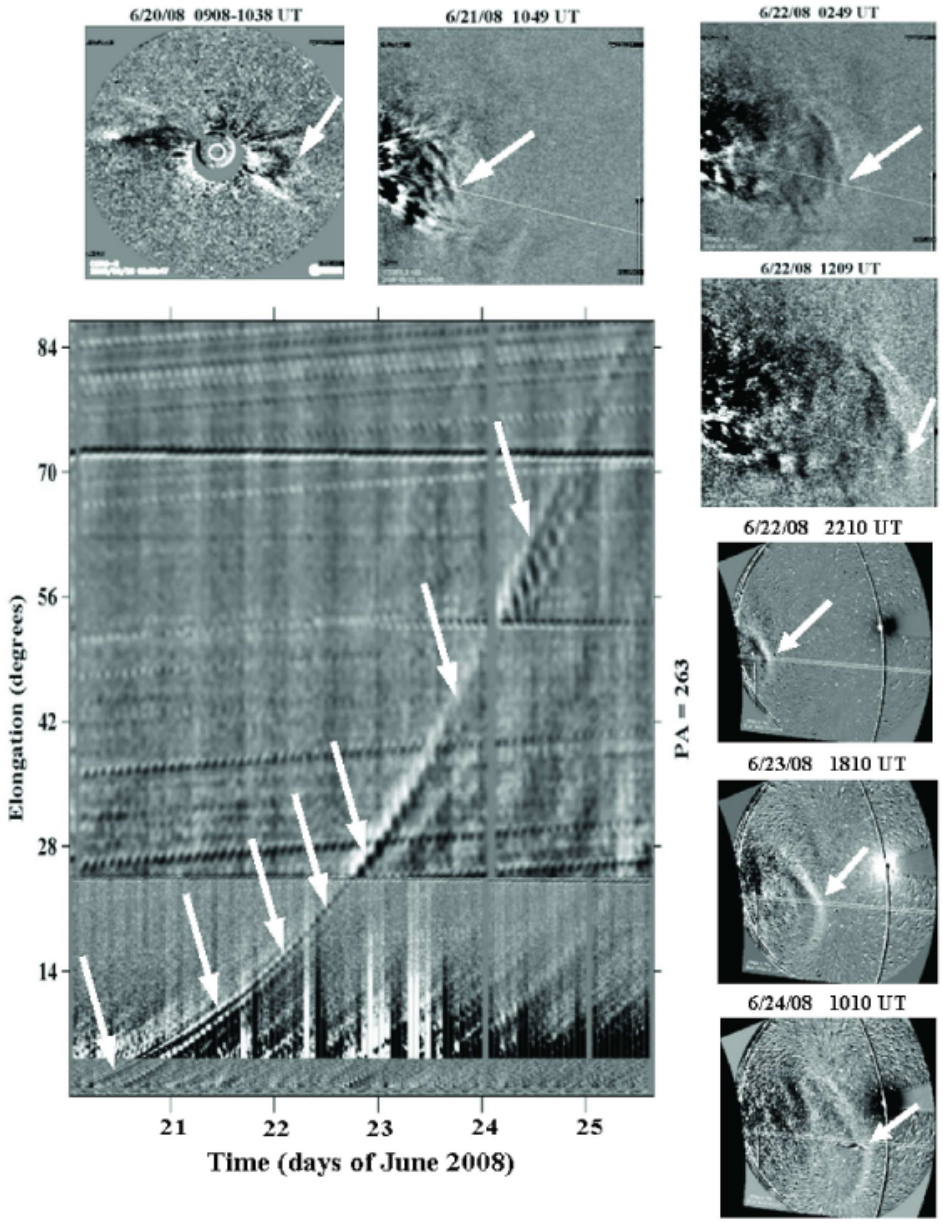

Sheeley and Rouillard (2010)

**T5.2 Deriving/cataloguing the kinematic variation of CIRs**

D5.2:

- We will fit the leading edge of each CIR in HI J-maps derived at all available latitudes to obtain the spatial/temporal evolution of each CIR over ~180o longitude and ~90o latitude.
- We will fit the kinematic evolution of transients entrained inside CIRs using different fitting techniques. For small-scale transients identified simultaneously in STEREO-A/HI and STEREO-B/HI, we will use triangulation techniques to detect potential speed variations near the Sun.
- This catalogue will be useful to determine the kinematic properties of the slow-solar wind in the upper corona. [month 24]

UPS staff: PhD student working on CIRs and the slow solar wind (preparation for Solar Probe + and Solar Orbiter




Sheeley and Rouillard (2010)

**T5.3 - Comparing back-projected CIR tracks with coronal sources** [Months: 1-36]
**UPS**

D5.3 :

- Using the derived trajectories and kinematic properties of CIRs and their small-scale transients, we will determine for each CIR observed in white-light images if there is an associated coronal hole observed in EUV.
- We will create a catalogue of these identified coronal holes by combining EUV images from STEREO and SDO images with potential field source surface calculations based on HMI and GONG magnetograms. This catalogue will enable scientists to study the time-dependent evolution of coronal holes with direct space-weather applications.
- Using trajectories of small-scale transients derived from HI we will determine the portions in the streamer belt that generate small-scale transients. [month 36]

UPS staff: PhD working on CIRs and coronal holes

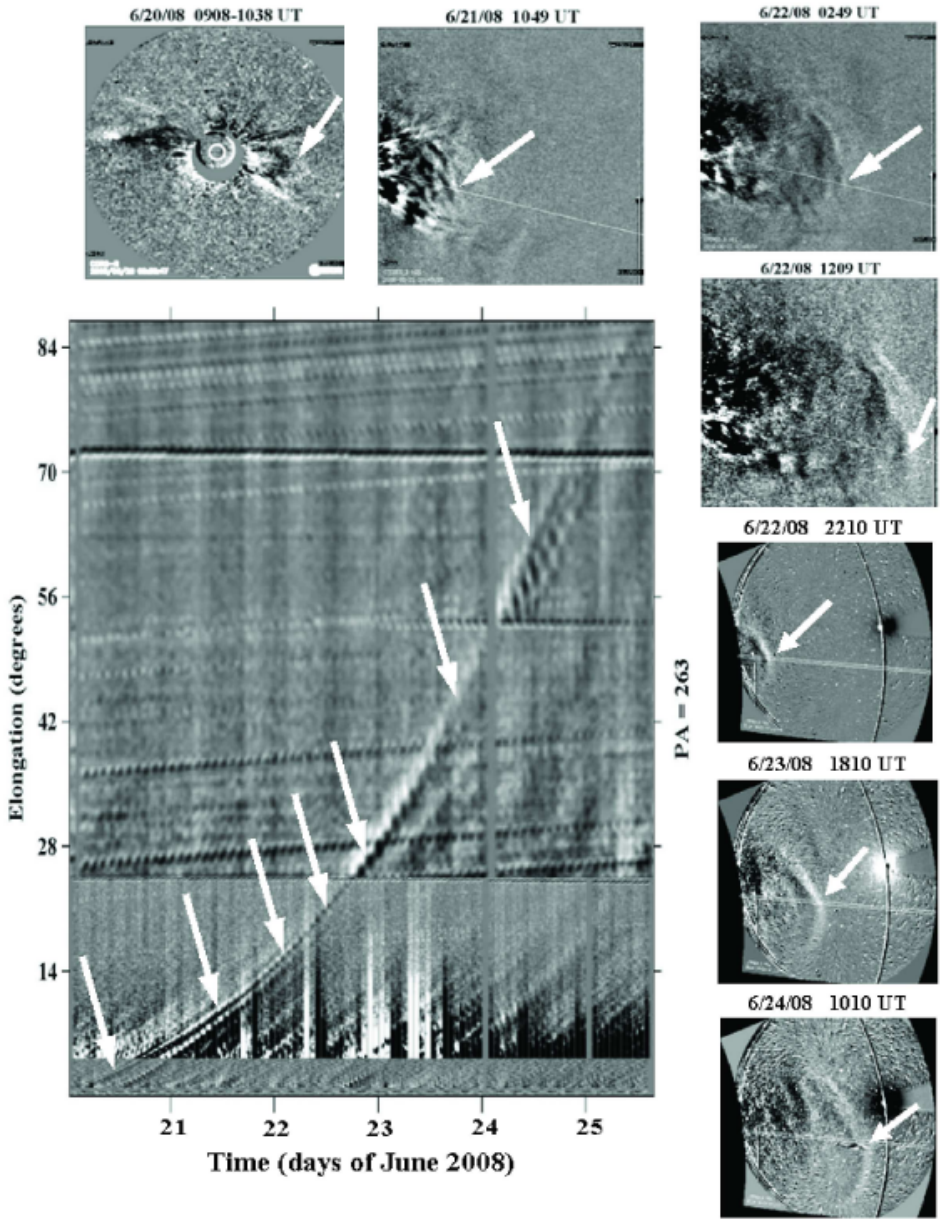
**T5.4 - Comparing forward-projected CIR tracks with in-situ measurements** [Months: 1-36]
**UPS,** UH

D5.4 :
- We will track small-scale transients to 1 AU and make a list of predicted impacts at points in the heliosphere where in-situ measurements are taken.
- We will catalogue the in-situ properties of each small-scale transient. This latter catalogue will enable scientists to study the origin and variability of the slow solar wind. [month 36]

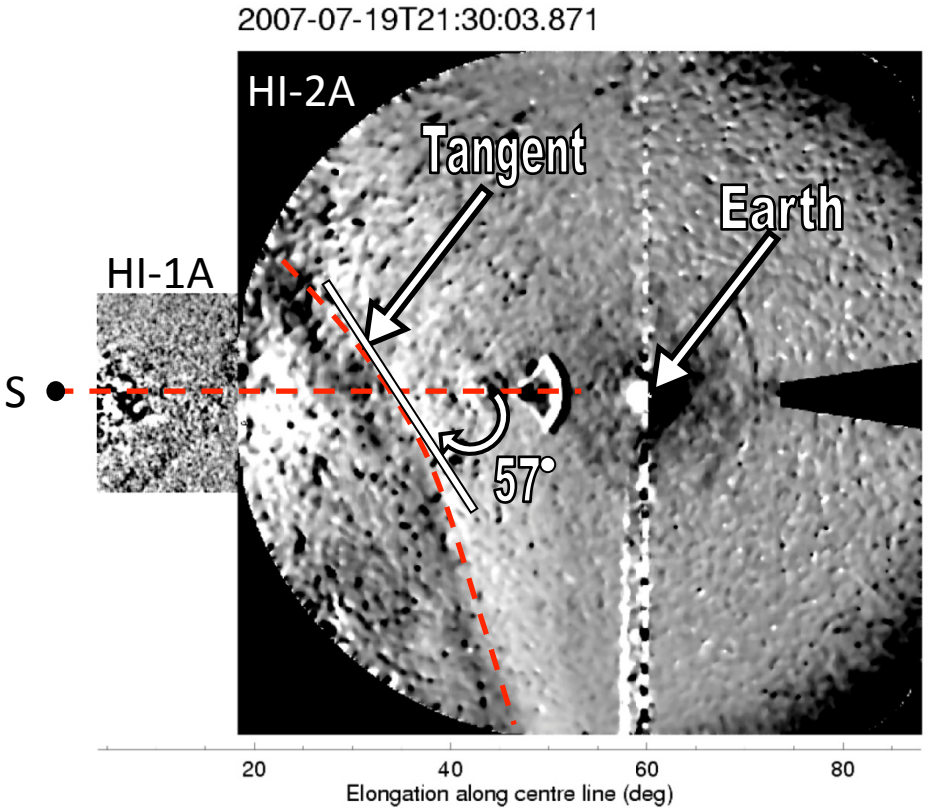
D5.5 : We will analyse the in-situ signature of small-scale transients that are predicted to impact a spacecraft. We will provide a report on the magnetic, plasma and particle signatures of these small transients. [month 36]

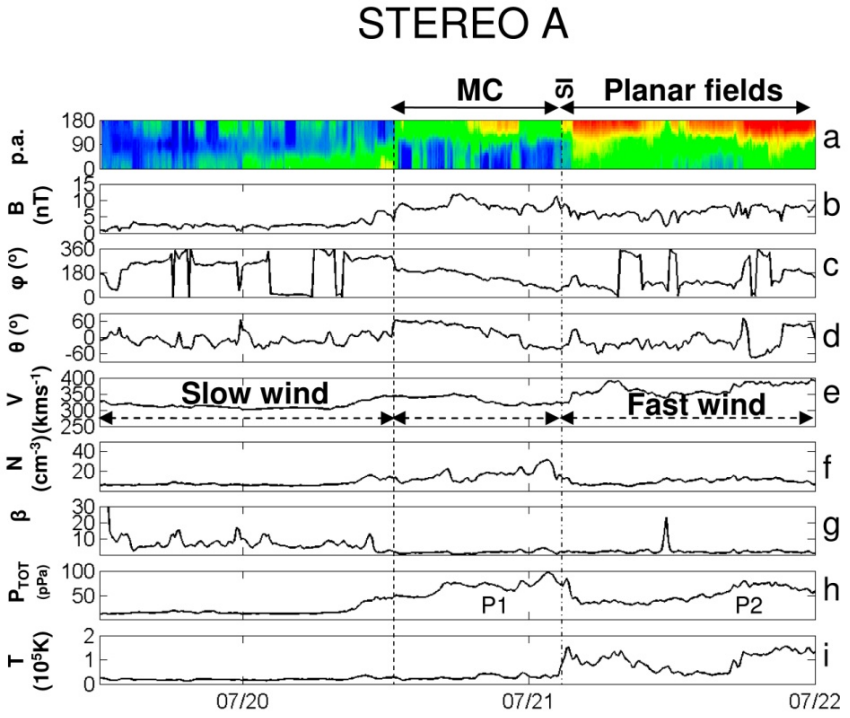
UPS staff: PhD working on the slow solar wind

⟷ Collaboration with University of Helsinki




Sheeley and Rouillard (2010)




Rouillard et al. (2009)

Rouillard et al. (2010a,b)

Kilpua et al. 2009