HELCATS WP 5: CIR catalogue

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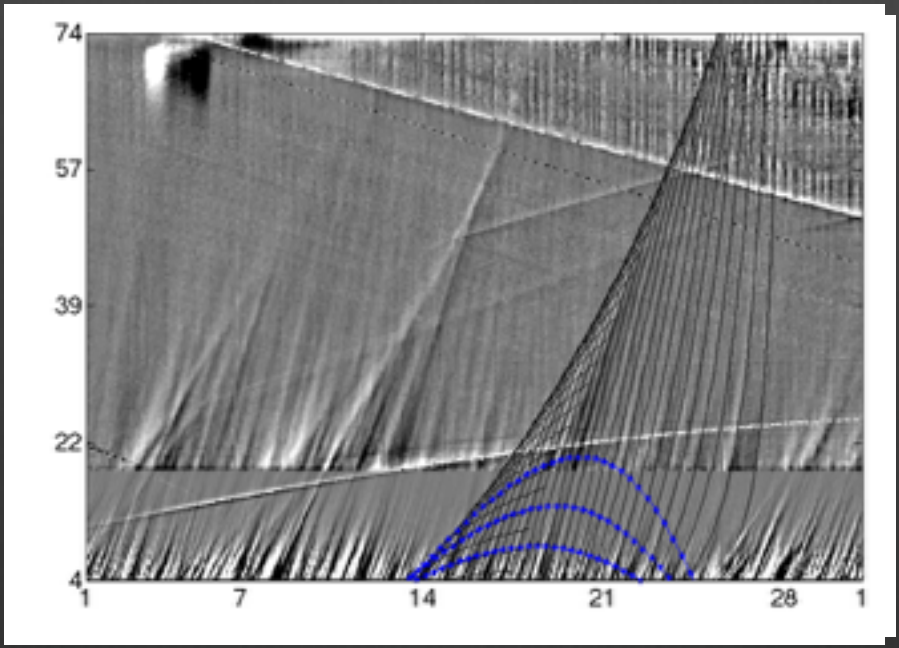
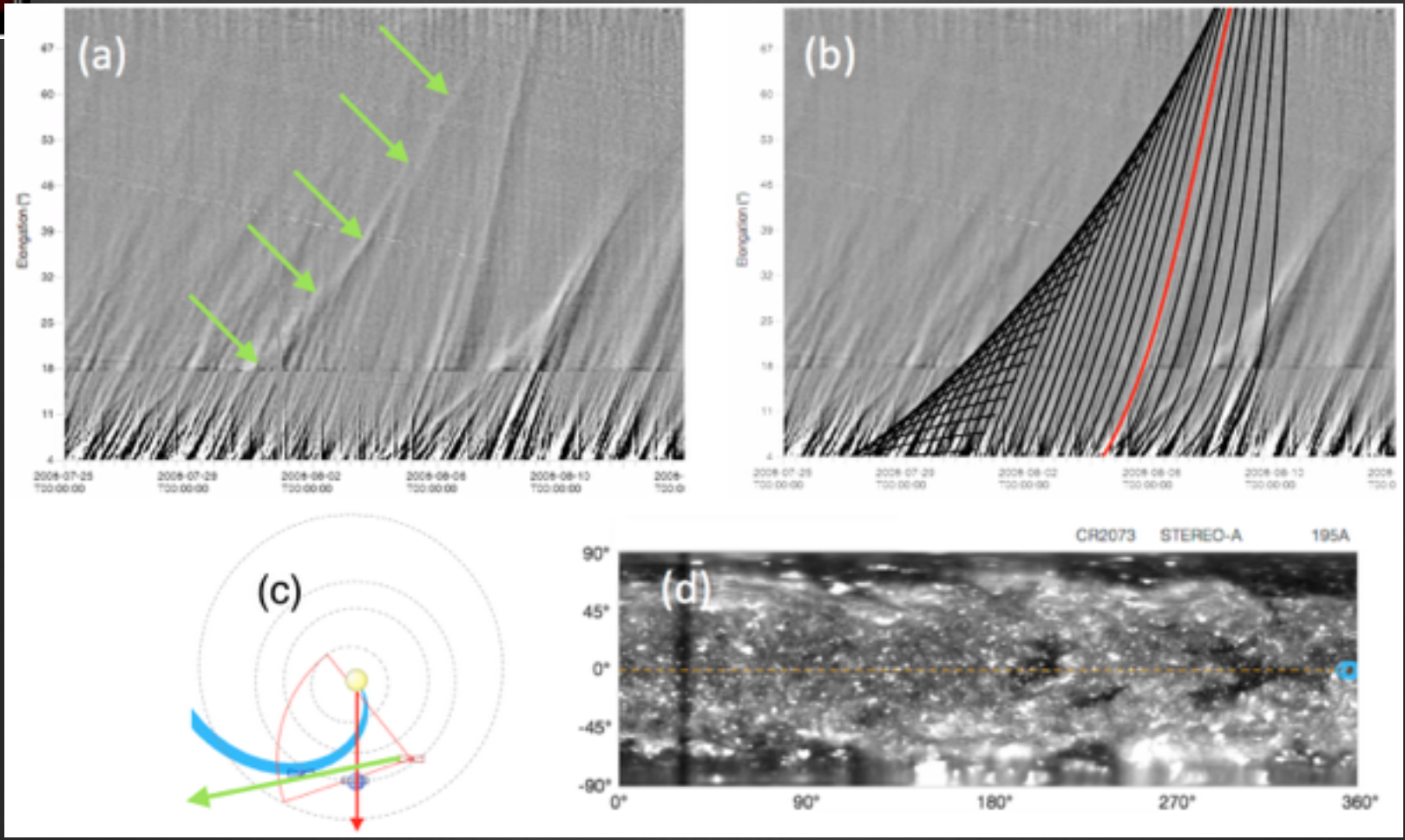
Corotating density structures seen in HI-A

- A series of structures from the same solar region released at different times, moving radially outwards with the same speed.



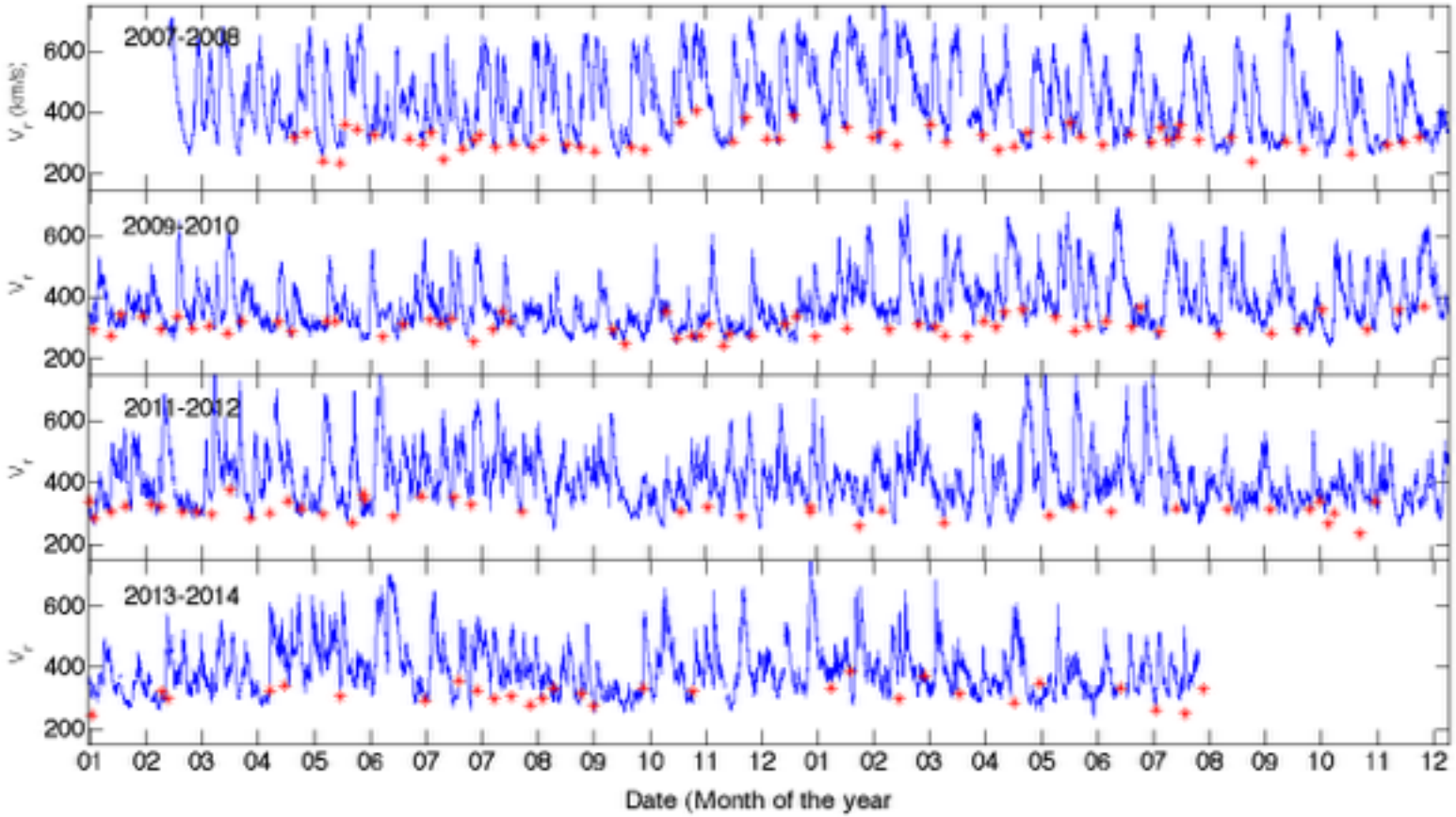
- Visual signature of a corotating pattern
- Assumes unique speed for all tracks
- Fixed-phi technique

Propagation Tool is used



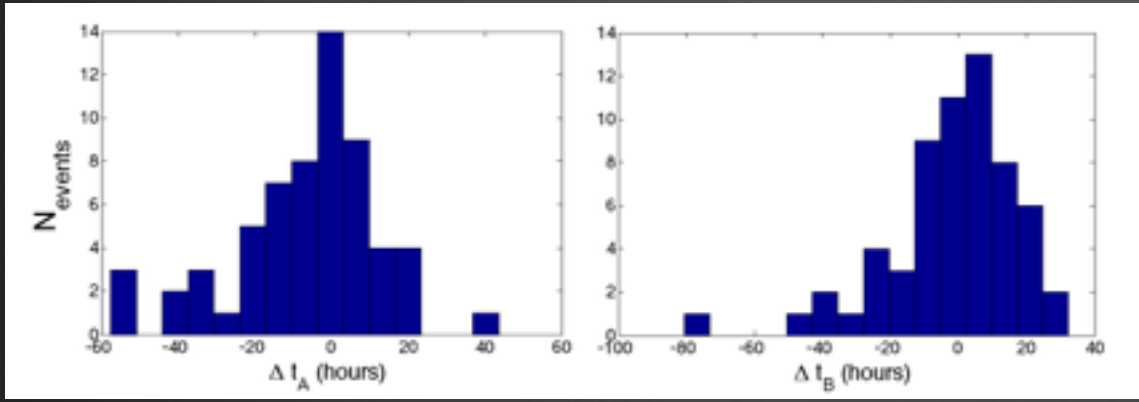
- Fit of one well chosen track reproduces the whole pattern (blobs released at 8 hours diff.)
- Back tracing: anchor point on the Carrington map
- Propagation to 1AU: comparison with the in-situ data

1AU predictions versus measurements (all events)



- Almost all events are fitted during the solar minimum but much less at the solar maximum
- Predicted speeds are those of the slow wind before the stream interface inside the interaction region (see also Conlon et al. 2015)

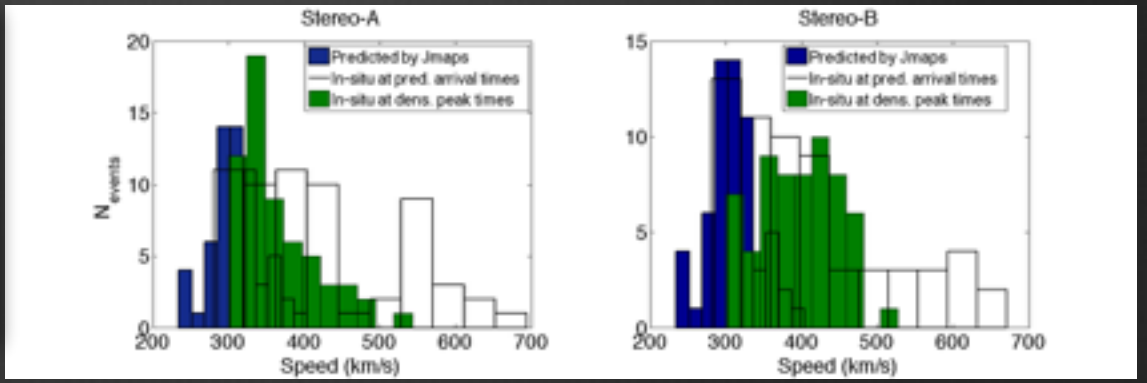
Predictions accuracy: time delays and speeds



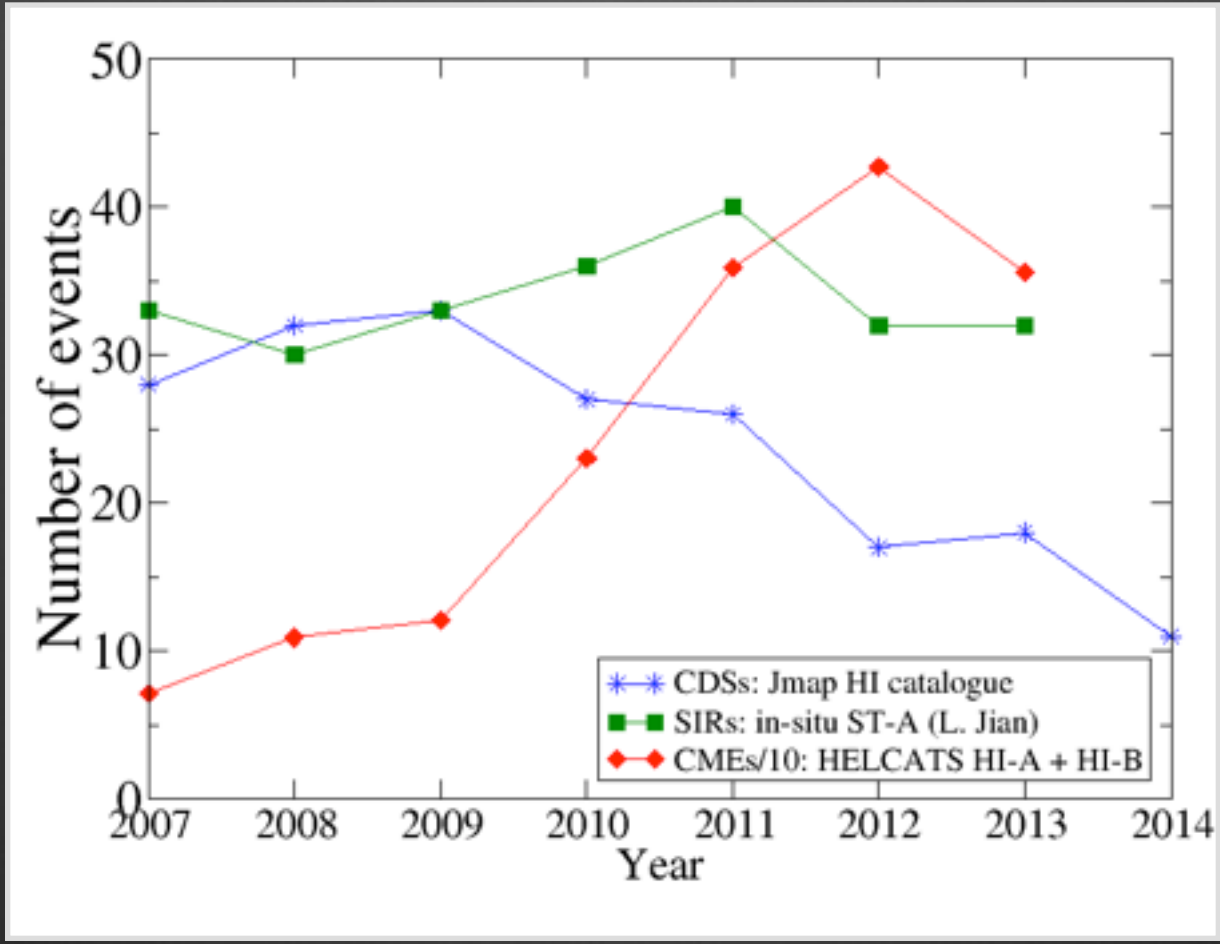
- Time delays :
  predicted - closest density peak

Most probable value is 11 hours

- Mean predicted speed 310 km/s
- While when measured at predicted times broad distribution.
- At the closest density peaks the mean speed is about 390 km/s



Number of events per year



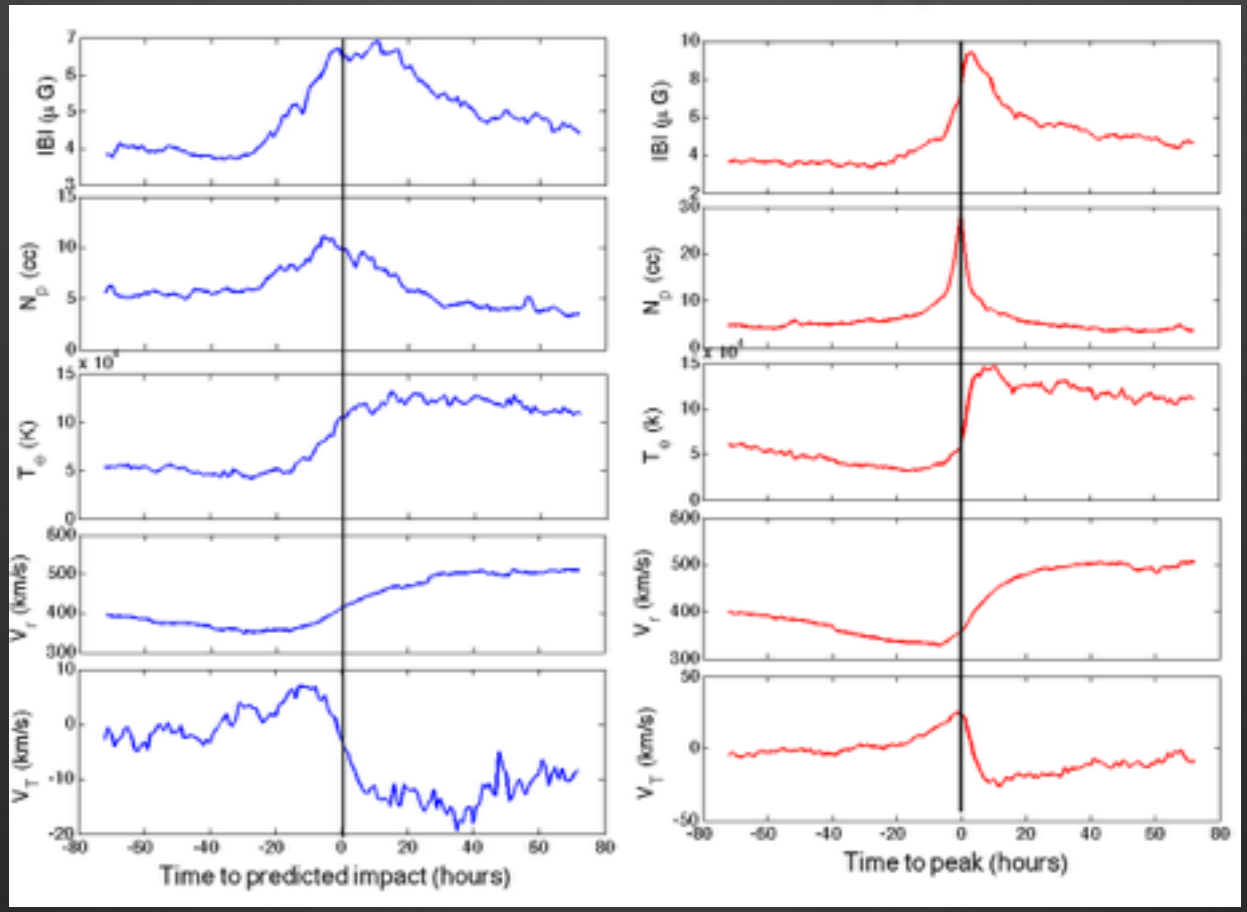
- **To be taken into account:**

- CMEs activity: perturbation in J-maps (from moderate in 2007 to high in 2014)
- Passage of the Milky Way prevents some events to be identified

Superposed epoch at 1AU (2007-2008 events)

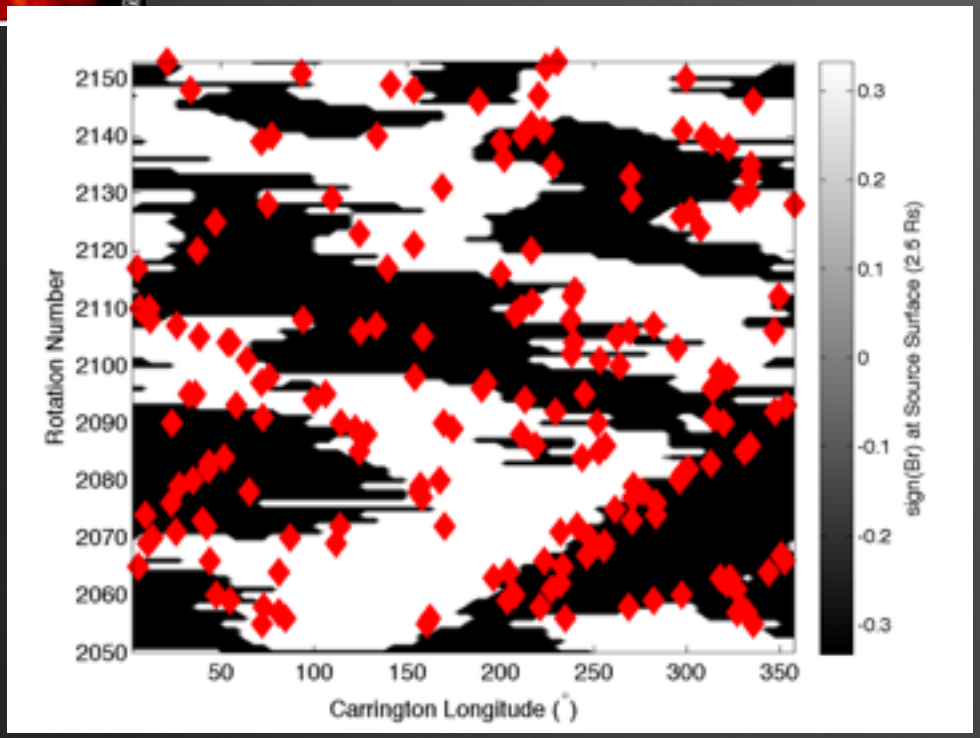
Predicted time

Density peak time



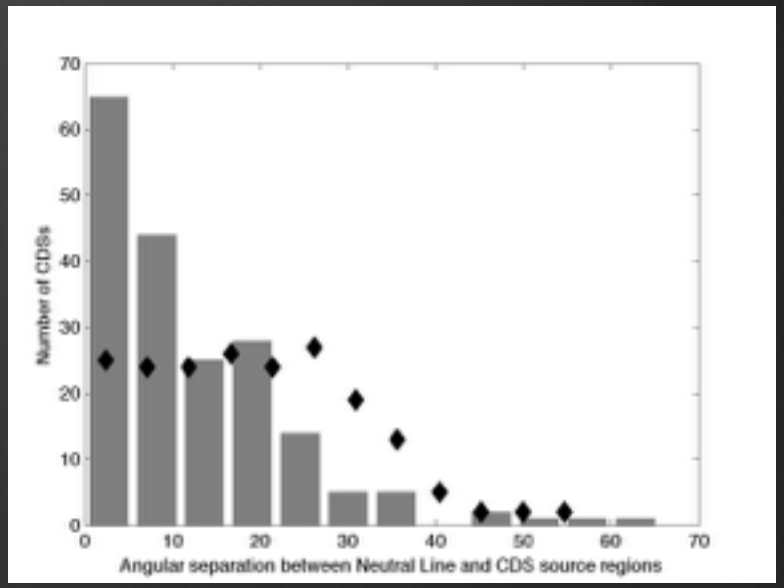
Typical CIR in-situ at 1AU
(e.g. Hundhausen 72,
Pizzo & Gosling 94,
Borovsky & Denton 08)

Relationship to the HCS and magn. sectors



Minimim Period (Rotations < 2100): Association with the polarity inversion of the magnetic field. Sectoring of the large part of events.

Angular separation between the anchor point and the HCS at the Source Surface. Excess of events with <10 degrees separation ascompared to a random distribution.



Catalogue overview

%ID of the SIR	Probe	Start Time	CIR params				SECCHI Coronal Hole				Pred arriv StA	Pred arriv StB C
%			Date	Velocity (km/s)	Err vel (km/sec)	beta (deg)		err beta	Carr source long (deg)		HAE source long (deg)	
HSIR_STA_20070412_183439	Stereo A	2007-04-12T18:34:39	317	23	40	3	160.4	165.4	130	-8	2055	2007-04-21T10:40:12
HSIR_STA_20070419_092623	Stereo A	2007-04-19T09:26:23	332	20	42	3	71.7	170.3	33	-10	2055	2007-04-27T22:29:13
HSIR_STA_20070425_200116	Stereo A	2007-04-25T20:01:16	244	25	53	3	335.7	166	283	-30	2055	2007-05-07T03:23:24
HSIR_STA_20070504_003120	Stereo A	2007-05-04T00:31:20	234.6	12	60	2	234.6	179.4			2056	2007-05-16T03:57:42
HSIR_STA_20070509_065728	Stereo A	2007-05-09T06:57:28	361	22	61	22	162	182	112	-20	2056	2007-05-18T19:59:05
HSIR_STA_20070516_004342	Stereo A	2007-05-16T00:43:42	347	14	50	4	84.3	199.4	31	-12	2056	2007-05-24T22:28:07
HSIR_STA_20070525_004208	Stereo A	2007-05-25T00:42:08	326	6	49	4	327	210.1	284	-14	2057	2007-06-03T04:27:07

Done on the Catalogue of CIRs:

- A list of events and track fits from 2007 up to 2014. First release. Included into the Propagation Tool (CIR fits database).
- Anchor point Carrington coordinates.
- Arrival times at different probes (ST-B, Ace, Wind, ST-A…)

In progress:

- Upgrade to the HELCATS website.
- Possible improvements in the tracking procedure.
  All orbital motions to be taken into account. Speed issue…
- Input from ST-B fits when possible.