Science & Technology Facilities Council

STFC Contribution to WP3:

Geometrical Modelling of HI CMEs

Overview

- **Task 3.1: Geometrical Modelling of STEREO/HI CMEs**

  - CMEs identified in Task 2.1 are tracked in time-elongation 'J-maps' (Davies et al. 2009)

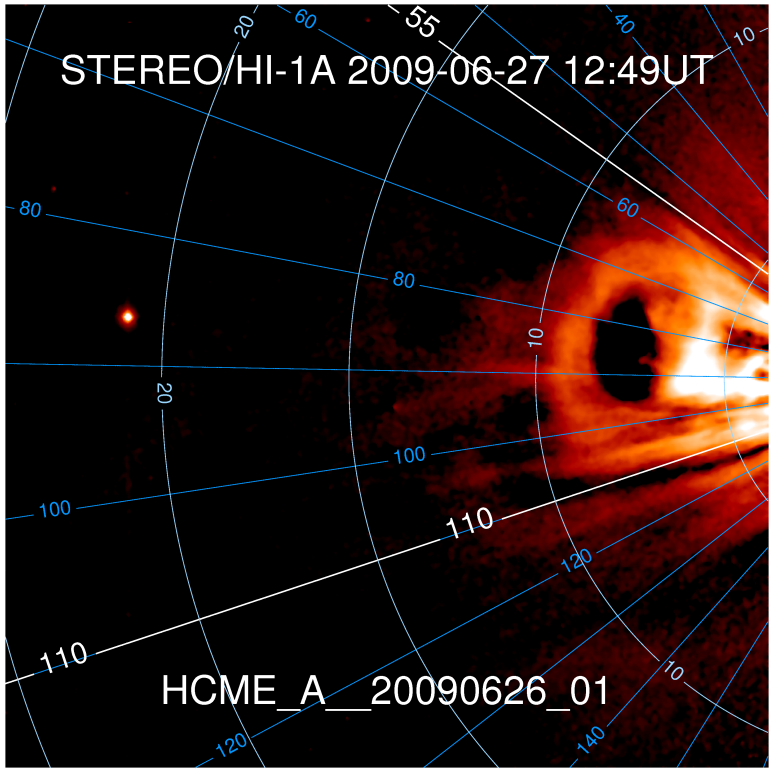
  - Three geometrical models are applied to these data to extract kinematic properties

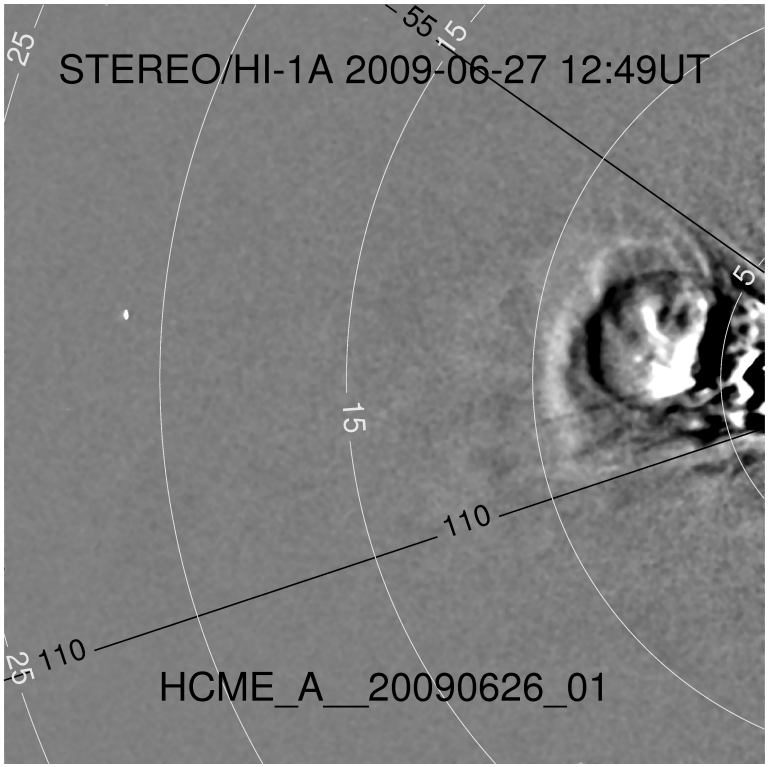
  - These include speeds, directions and launch times

  - This is currently complete to the end of 2013.

Science & Technology Facilities Council

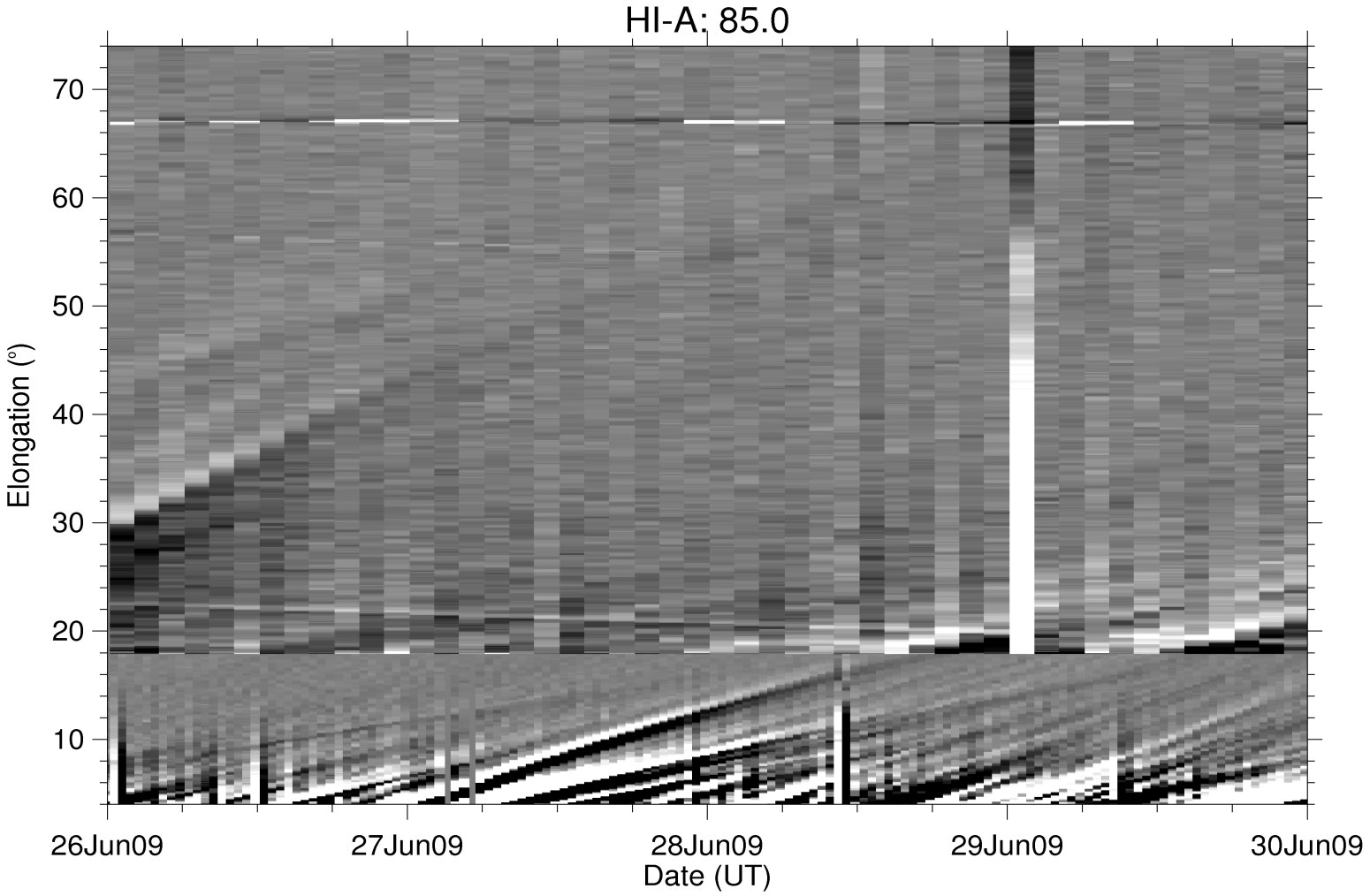
CME Identification



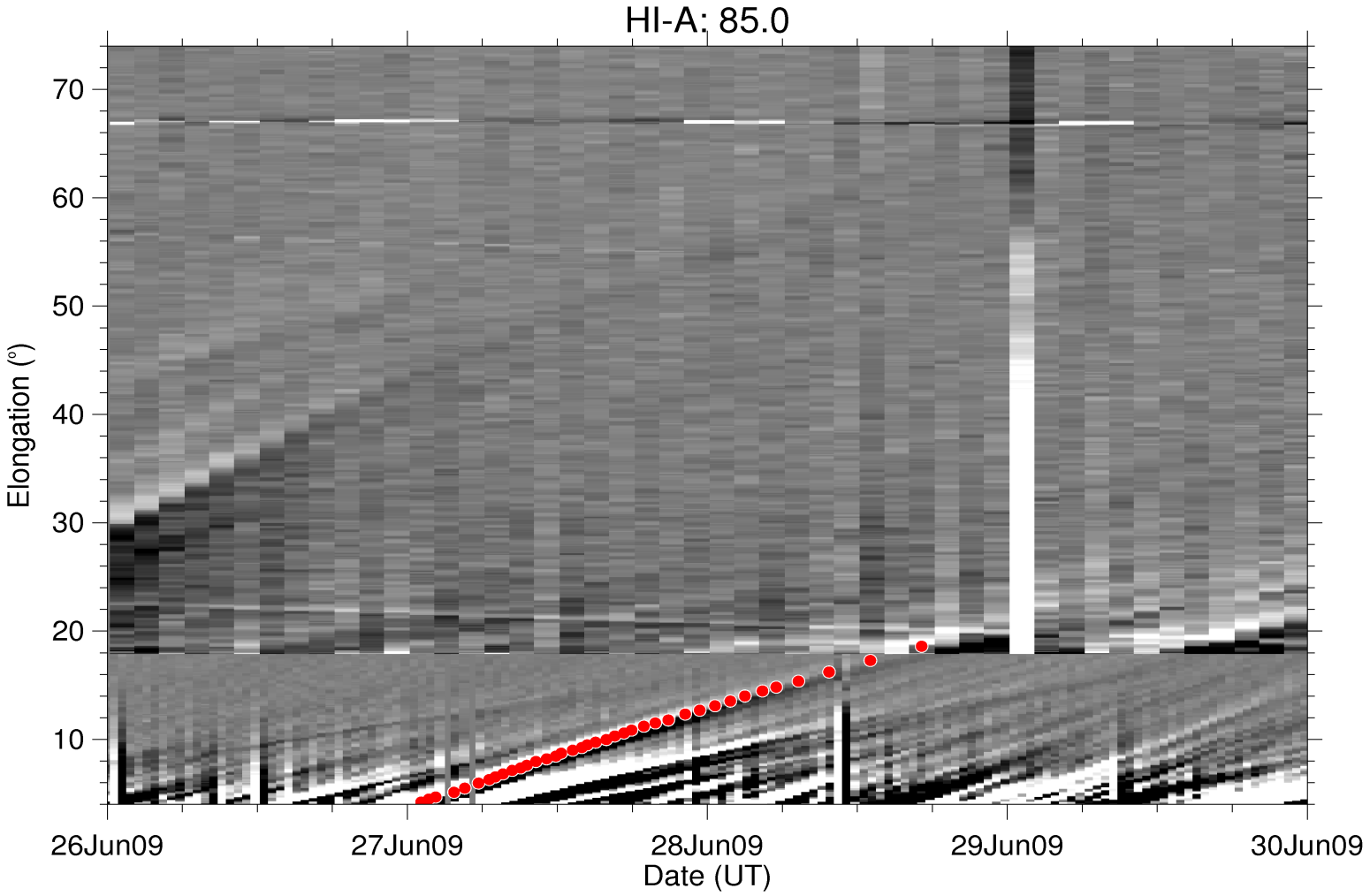


Science & Technology Facilities Council

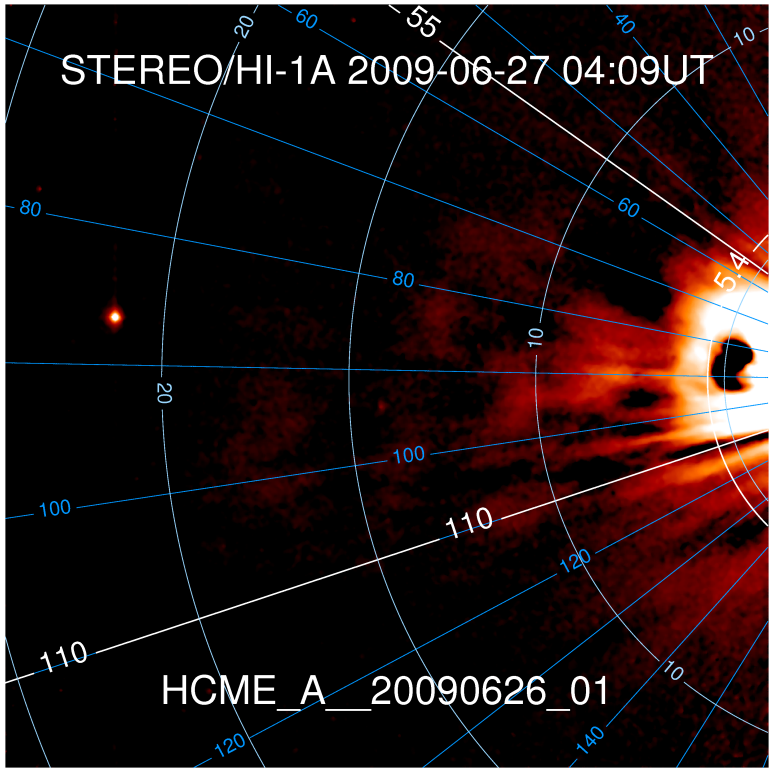
Time vs Elongation Profile

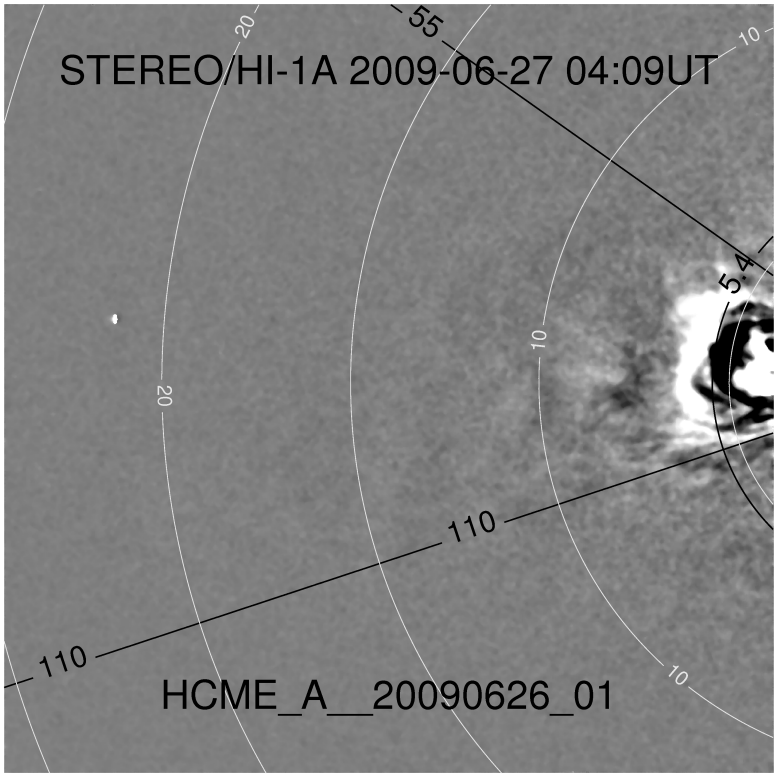


Time vs Elongation Profile



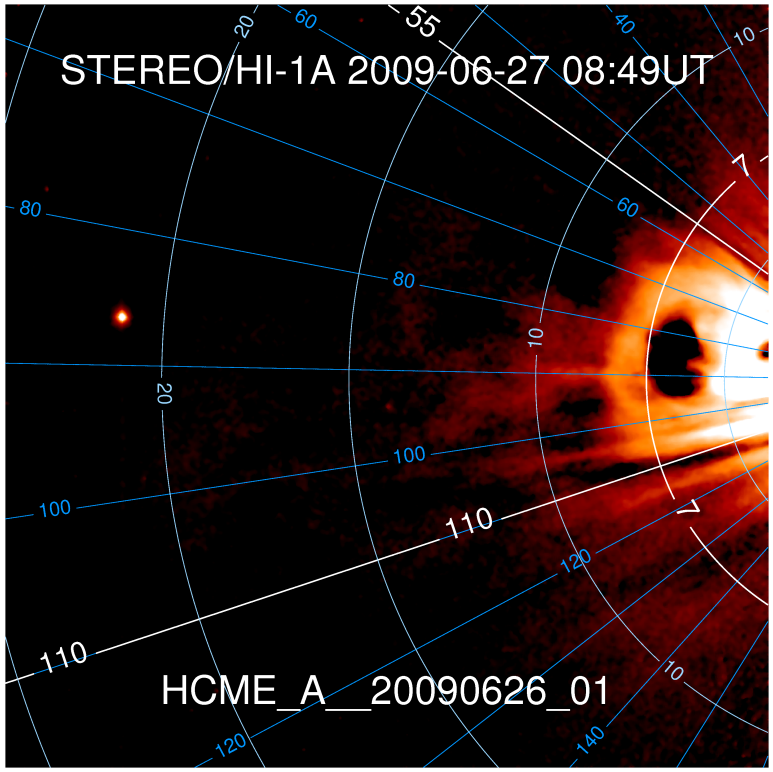
CME Identification

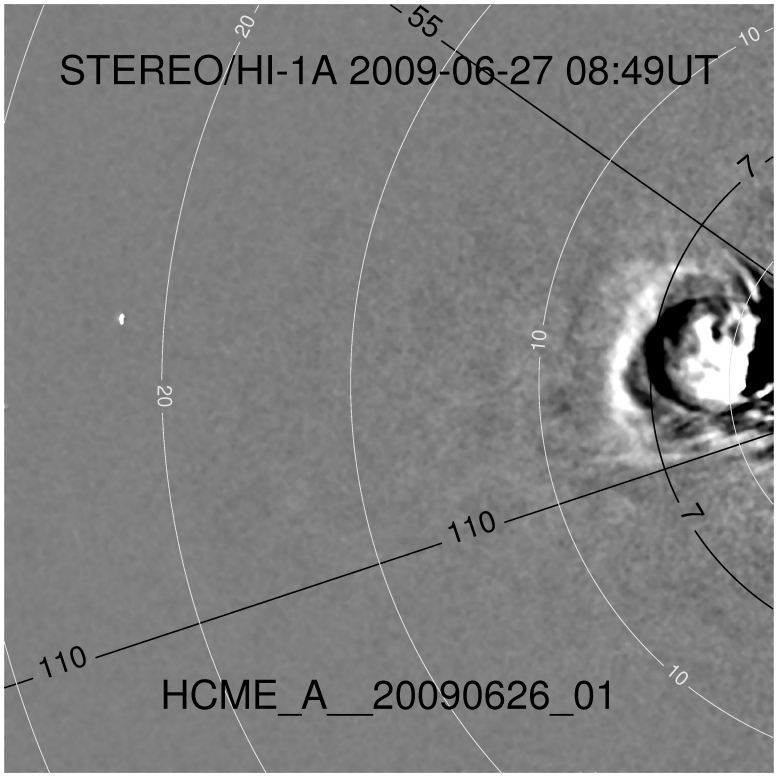




Science & Technology Facilities Council

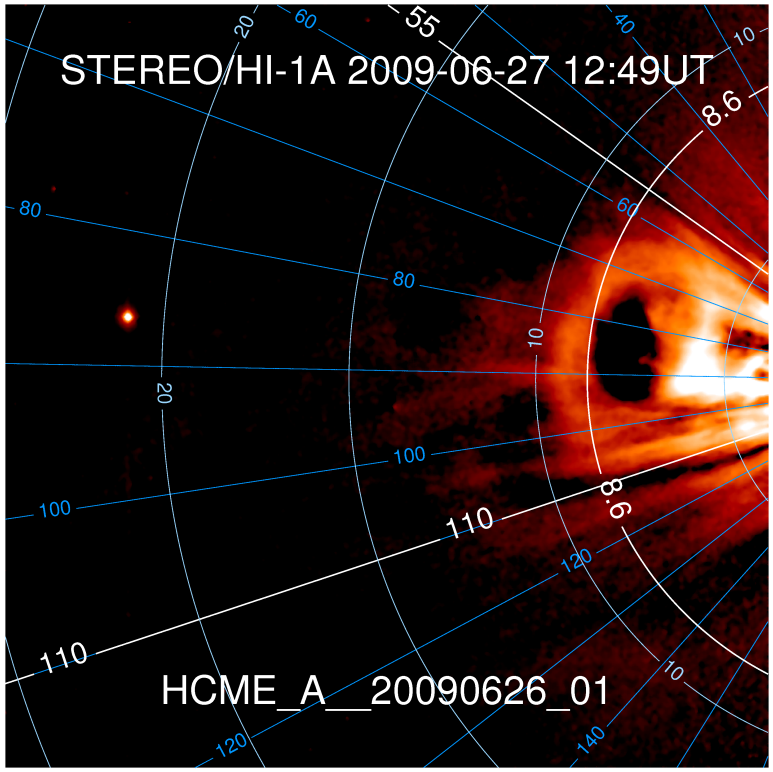
CME Identification

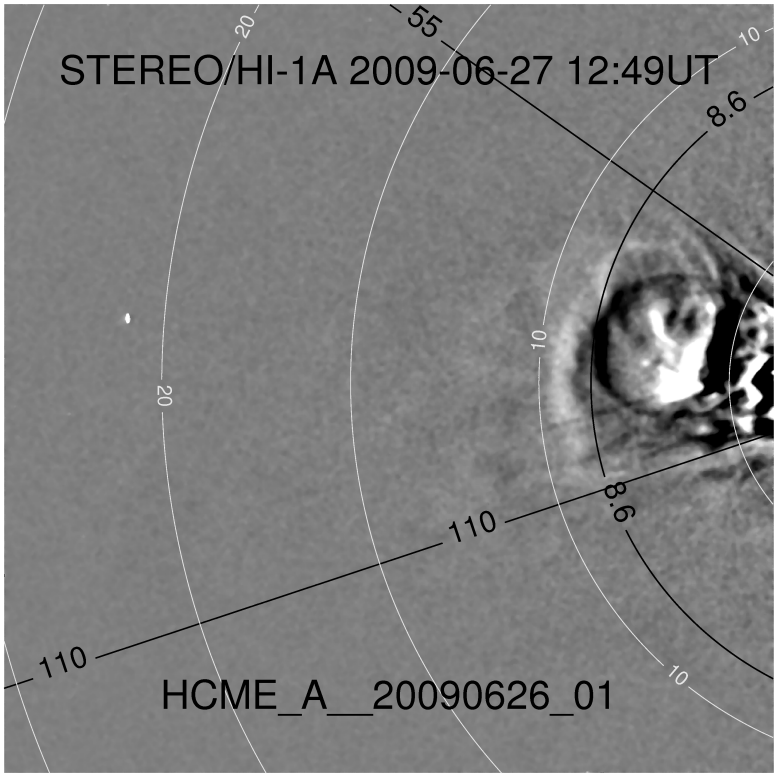




Science & Technology Facilities Council

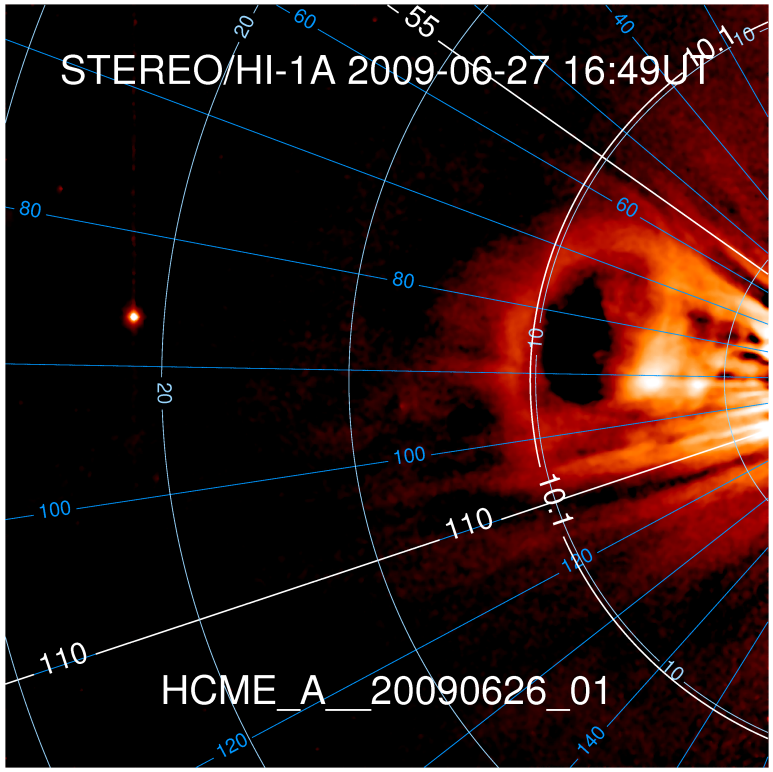
CME Identification

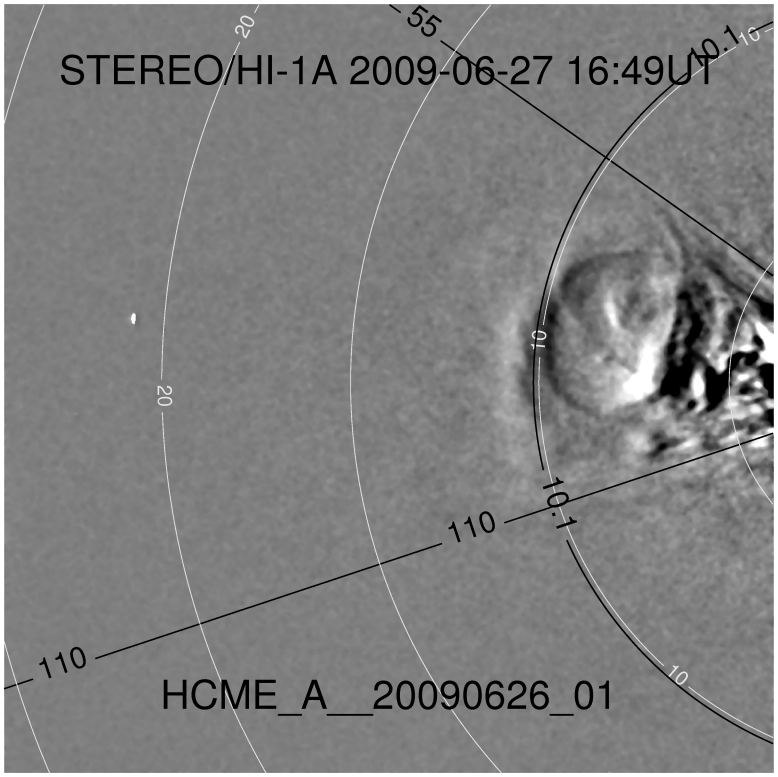




Science & Technology Facilities Council

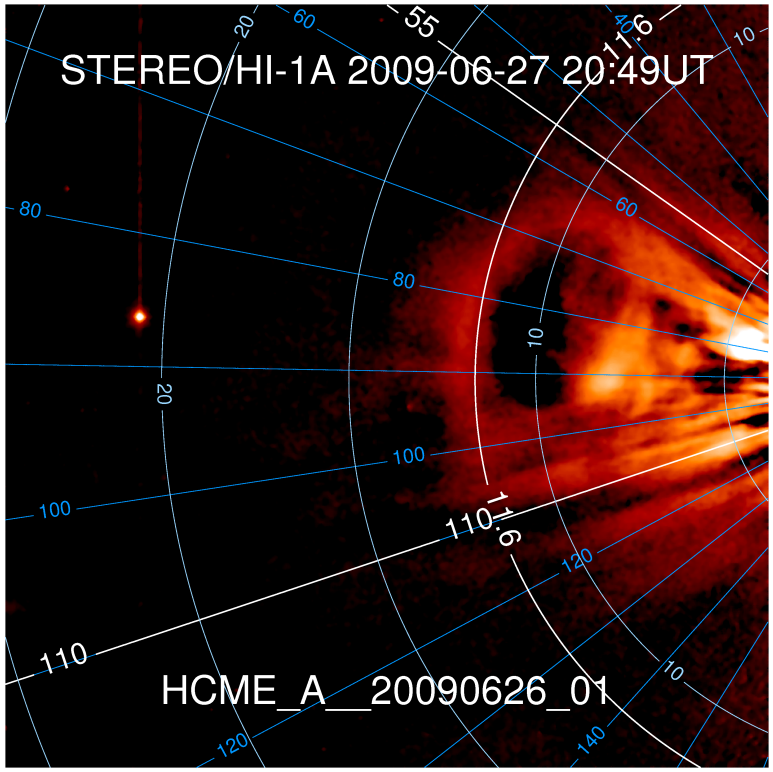
CME Identification

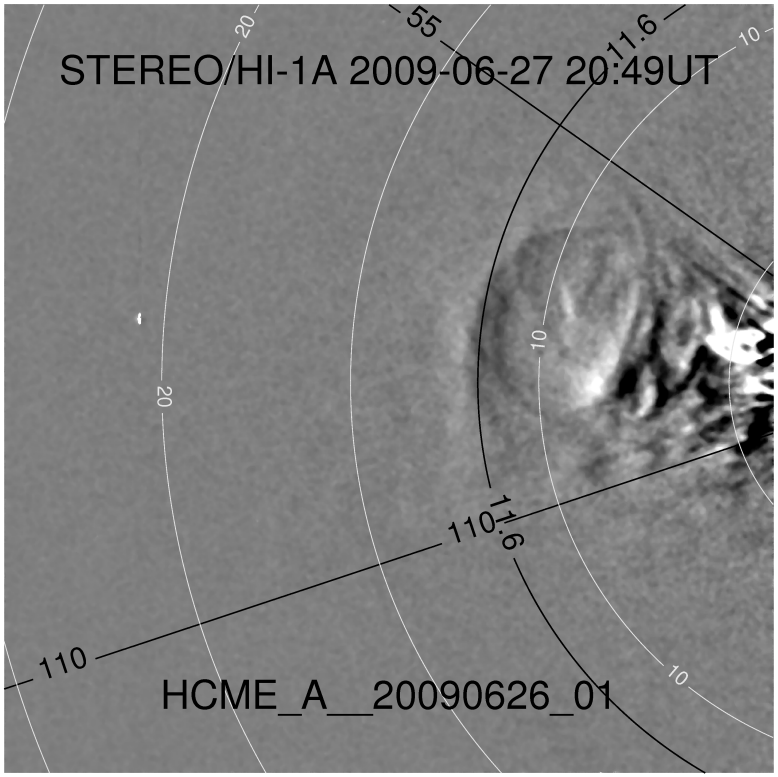




Science & Technology Facilities Council

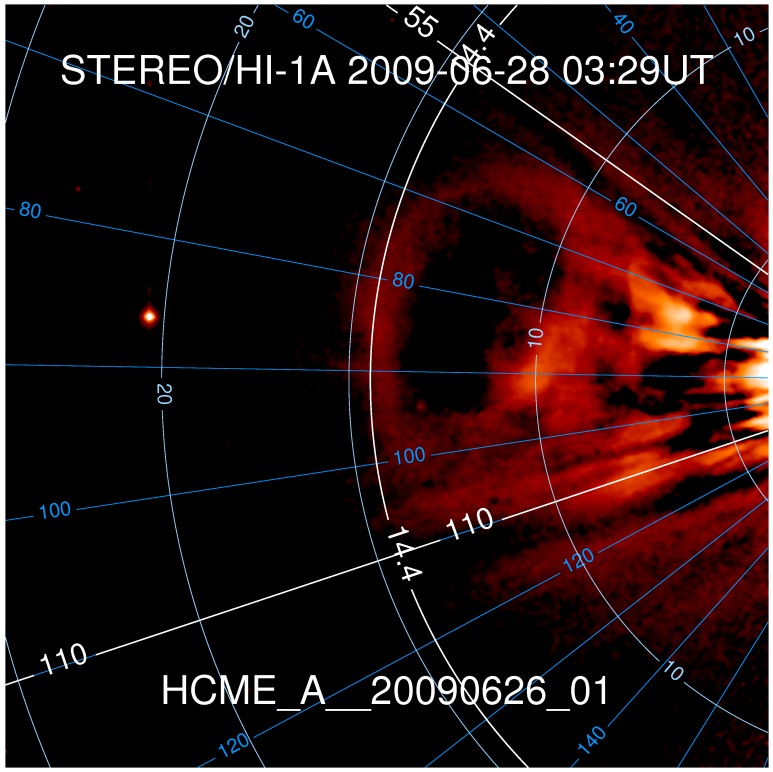
CME Identification

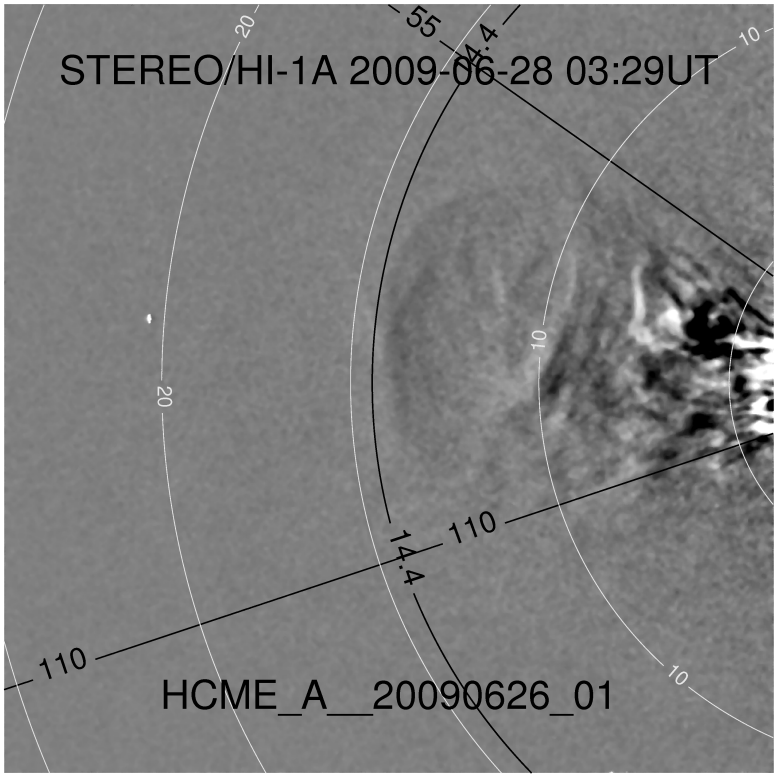




Science & Technology Facilities Council

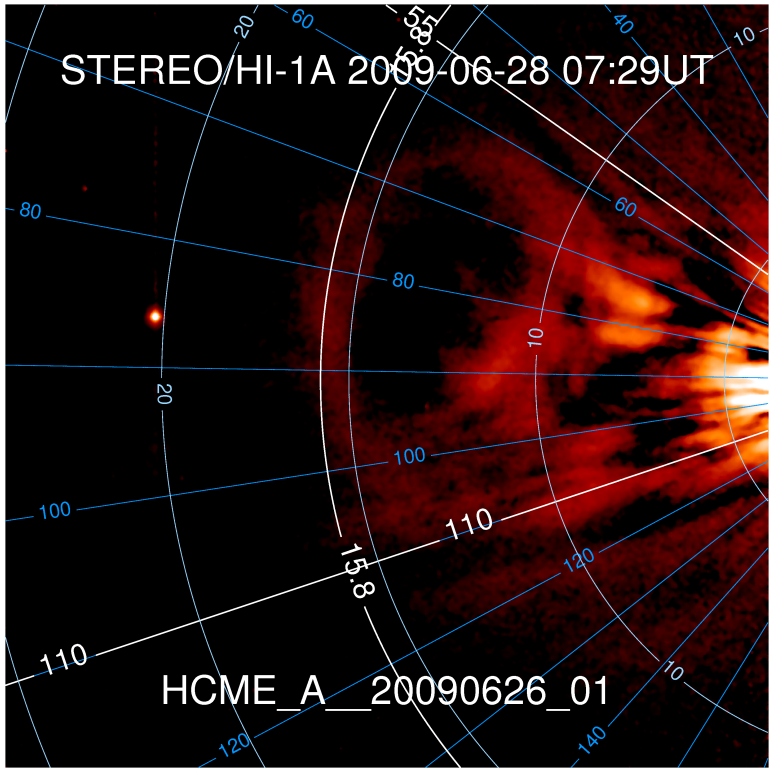
CME Identification

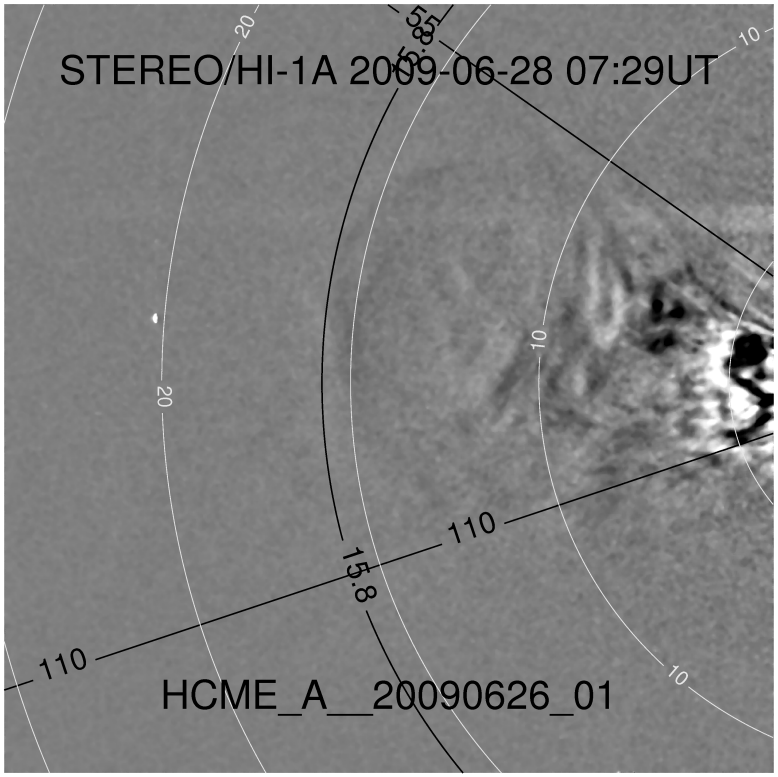




Science & Technology Facilities Council

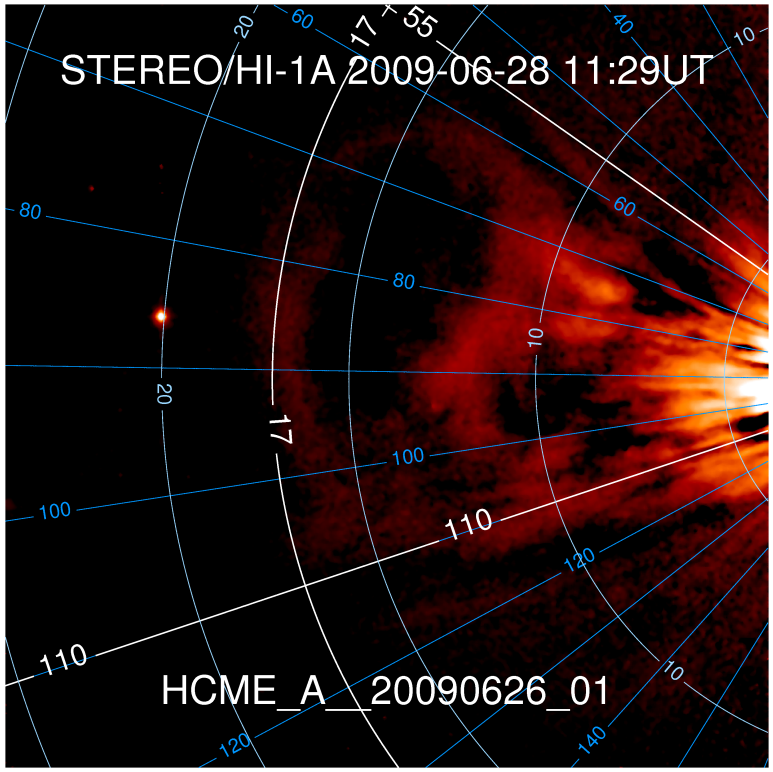
CME Identification

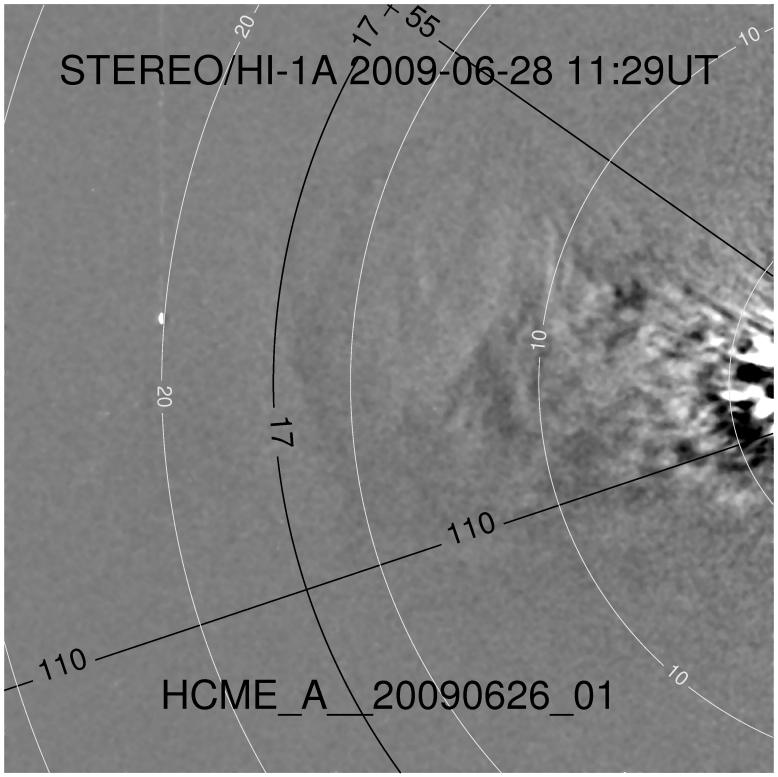




Science & Technology Facilities Council

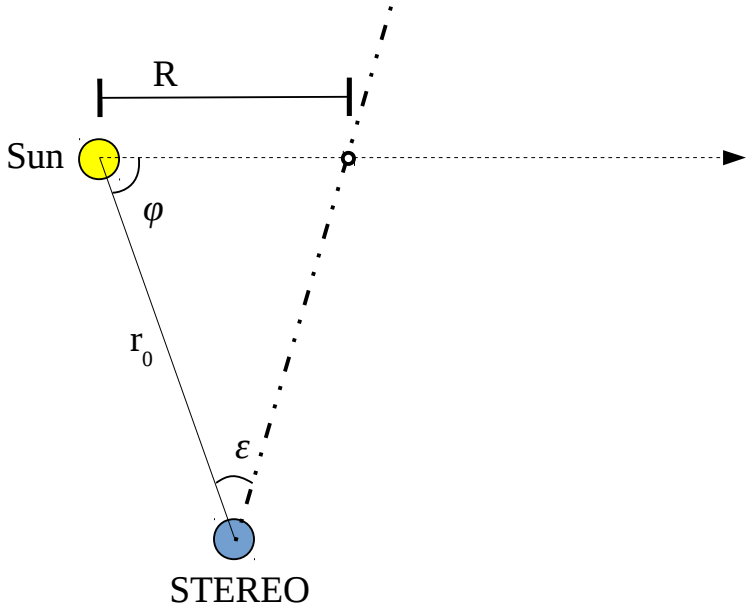
CME Identification





Science & Technology Facilities Council

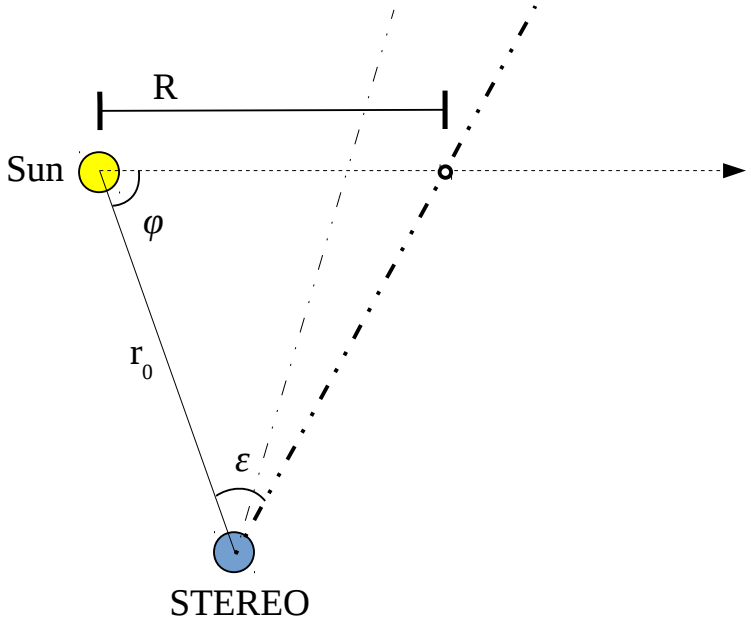
1st Model: Fixed-phi



$$v(t - t_0) = \frac{r_0 \sin(\epsilon(t))}{\sin(\epsilon(t) + \phi)}$$

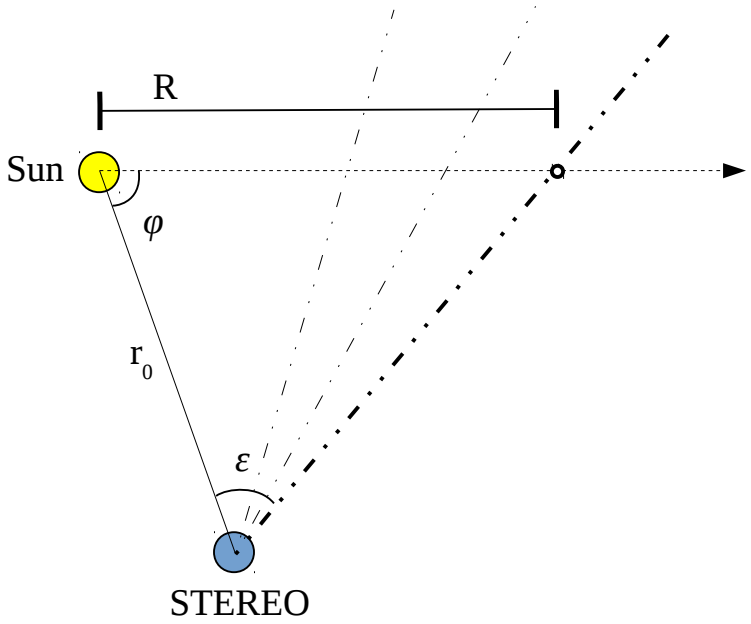
Science & Technology Facilities Council

1st Model: Fixed-phi



$$v(t - t_0) = \frac{r_0 \sin(\epsilon(t))}{\sin(\epsilon(t) + \phi)}$$

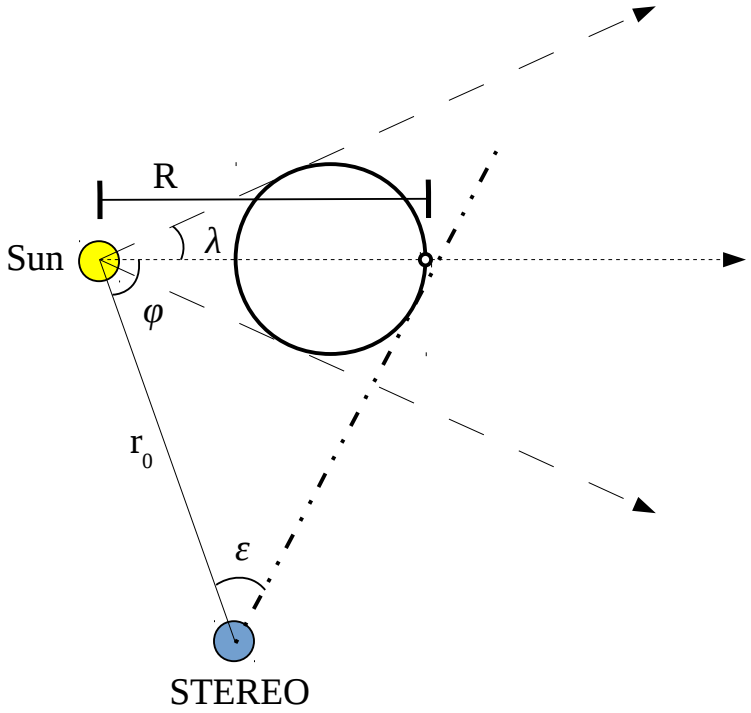
1st Model: Fixed-phi



$$v(t - t_0) = \frac{r_0 \sin(\epsilon(t))}{\sin(\epsilon(t) + \phi)}$$

Science & Technology Facilities Council

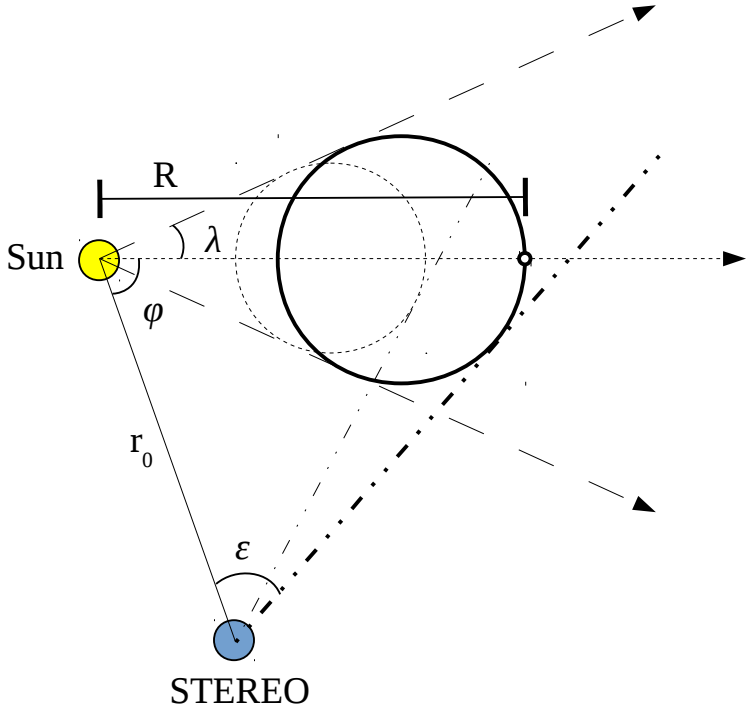
2nd Model: Self-Similar Expansion



$$v(t-t_0) = \frac{3r_0 \sin(\epsilon(t))}{2\sin(\epsilon(t)+\phi)+\frac{1}{2}}$$

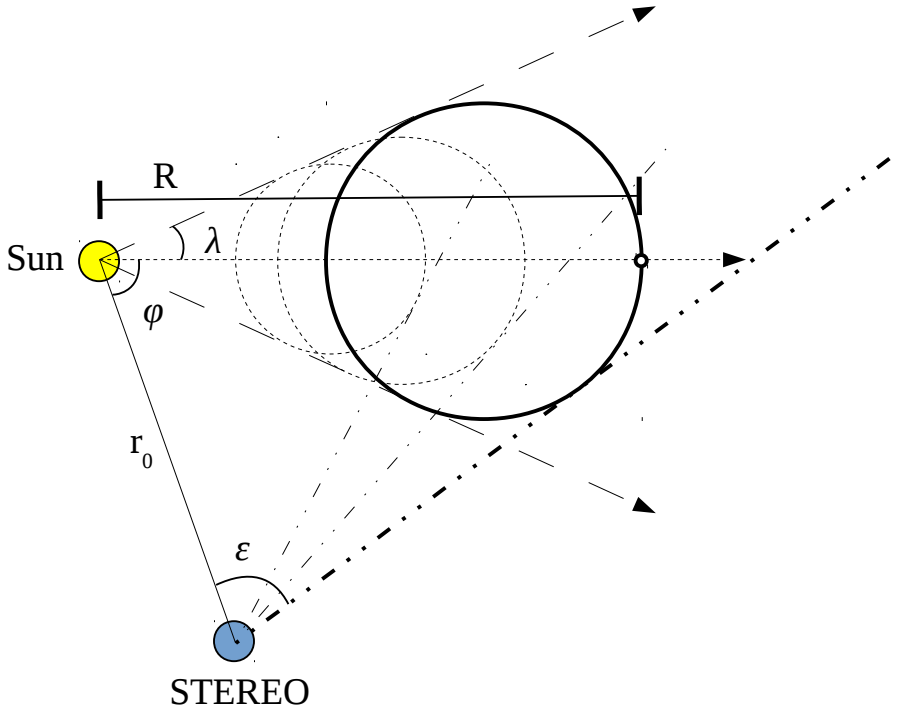
Science & Technology Facilities Council

2nd Model: Self-Similar Expansion



$$v(t-t_0) = \frac{3r_0 \sin(\epsilon(t))}{2\sin(\epsilon(t)+\phi)+\frac{1}{2}}$$

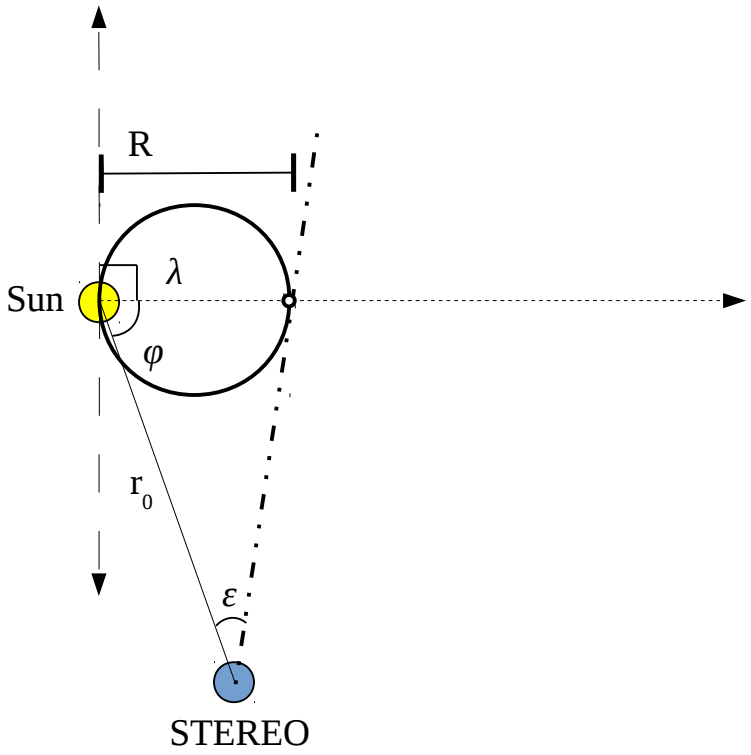
2nd Model: Self-Similar Expansion



$$v(t-t_0) = \frac{3r_0 \sin(\epsilon(t))}{2\sin(\epsilon(t)+\phi)+\frac{1}{2}}$$

Science & Technology Facilities Council

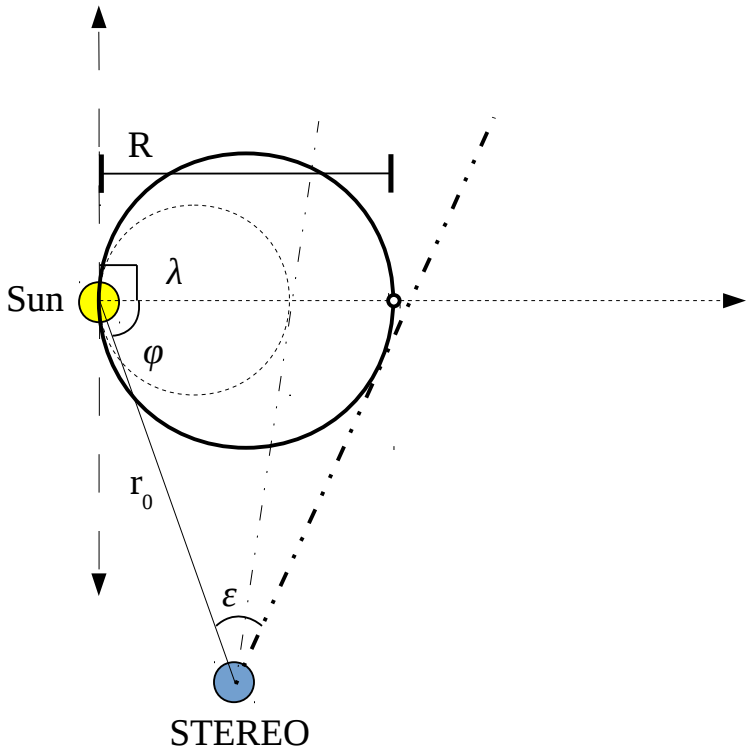
3rd Model: Harmonic Mean



$$v(t - t_0) = \frac{2r_0 \sin(\epsilon(t))}{\sin(\epsilon(t) + \phi) + 1}$$

Science & Technology Facilities Council

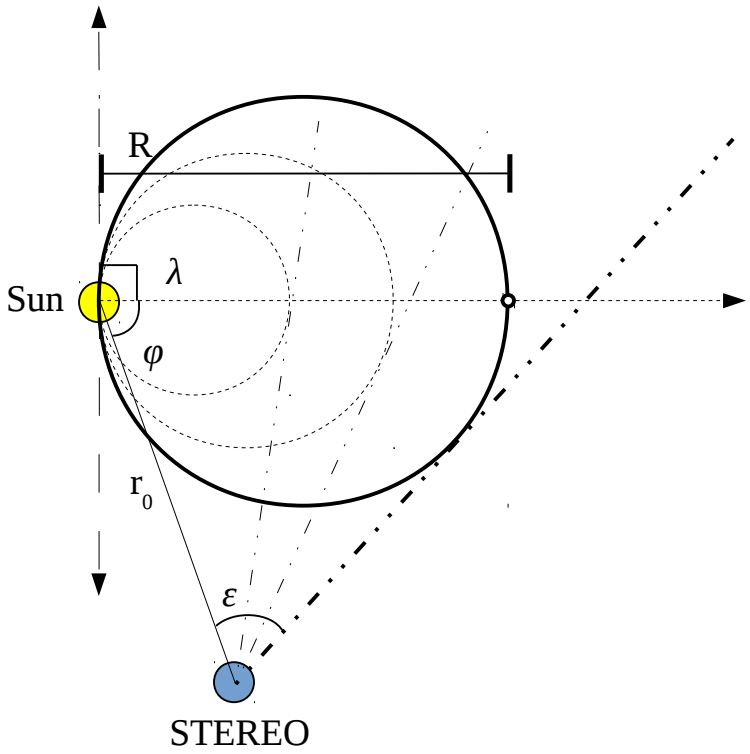
3rd Model: Harmonic Mean



$$v(t-t_0) = \frac{2r_0 \sin(\epsilon(t))}{\sin(\epsilon(t)+\phi)+1}$$

Science & Technology Facilities Council

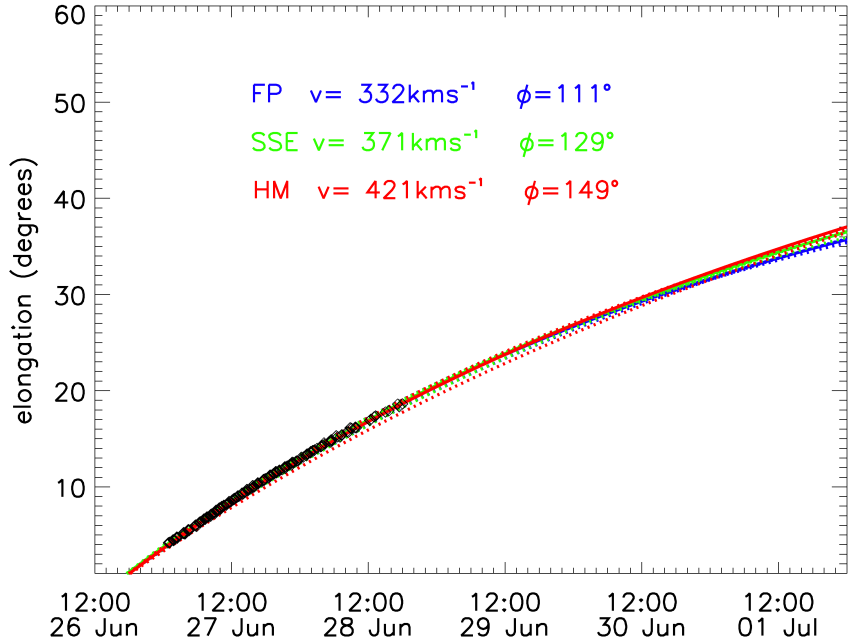
3rd Model: Harmonic Mean

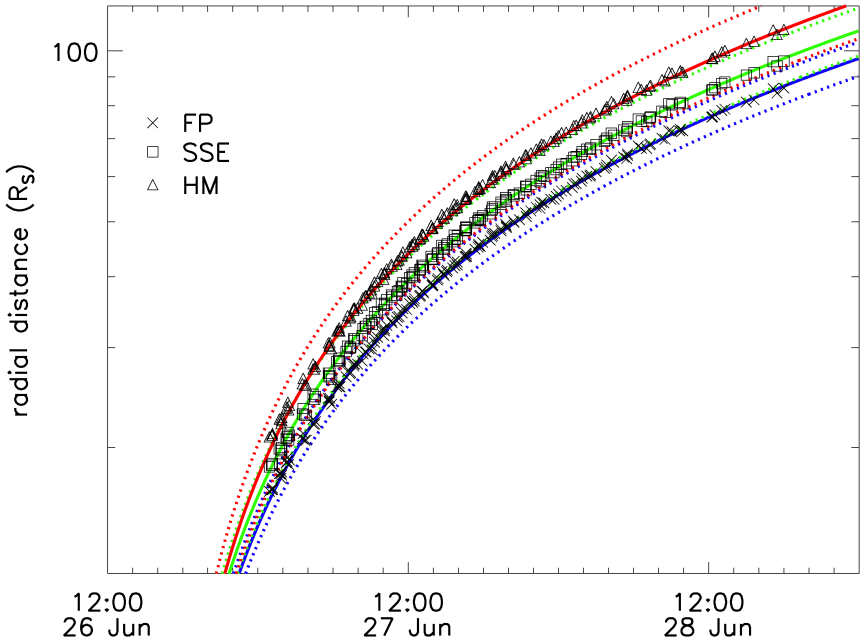


$$v(t-t_0) = \frac{2r_0 \sin(\epsilon(t))}{\sin(\epsilon(t)+\phi)+1}$$

Science & Technology Facilities Council

Time vs Height Profile





Science & Technology Facilities Council

Catalogue

ID	SC	Quality	PA-fit	SSE speed [kms-1]	SSE Phi [deg]	SSE HEEQ Long [deg]	SSE HEEQ Lat [deg]	SSE Carr Long [deg]	SSE Launch [UTC]
HCME_A__20090616_01	A	fair	95	371	60	-7	-1	126	2009-06-16 11:43
HCME_A__20090620_01	A	fair	75	386	147	-96	2	348	2009-06-20 04:39
HCME_A__20090623_01	A	good	100	357	59	-5	-5	35	2009-06-23 11:44
HCME_A__20090626_01	A	good	85	371	129	-76	0	283	2009-06-26 15:27
HCME_A__20090630_01	A	fair	80	173	78	-25	11	284	2009-06-30 08:31
HCME_A__20090711_01	A	fair	90	258	59	-4	3	168	2009-07-10 16:09
HCME_A__20090713_01	A	fair	105	224	76	-18	-12	118	2009-07-13 09:45
HCME_A__20090716_01	A	fair	95	288	32	22	3	128	2009-07-15 19:19
HCME_A__20090726_01	A	good	75	440	105	-51	12	273	2009-07-26 10:27
HCME_A__20090731_01	A	fair	80	329	67	-11	11	249	2009-07-31 07:00

Showing 101 to 110 of 1,201 entries (filtered from 1,210 total entries)

Select Save Print Previous 1 .. 10 11 12 .. 121 Next

Science & Technology Facilities Council

Catalogue

ID	SC	Quality	PA-fit	SSE speed [kms-1]	SSE Phi [deg]	SSE HEEQ Long [deg]	SSE HEEQ Lat [deg]	SSE Carr Long [deg]	SSE Launch [UTC]
HCME_A__20090616_01	A	fair	95	371	60	-7	-1	126	2009-06-16 11:43
HCME_A__20090620_01	A	fair	75	386	147	-96	2	348	2009-06-20 04:39
HCME_A__20090623_01	A	good	100	357	59	-5	-5	35	2009-06-23 11:44
HCME_A__20090626_01	A	good	85	371	129	-76	0	283	2009-06-26 15:27
HCME_A__20090630_01	A	fair	80	173	78	-25	11	284	2009-06-30 08:31
HCME_A__20090711_01	A	fair	90	258	59	-4	3	168	2009-07-10 16:09
HCME_A__20090713_01	A	fair	105	224	76	-18	-12	118	2009-07-13 09:45
HCME_A__20090716_01	A	fair	95	288	32	22	3	128	2009-07-15 19:19
HCME_A__20090726_01	A	good	75	440	105	-51	12	273	2009-07-26 10:27
HCME_A__20090731_01	A	fair	80	329	67	-11	11	249	2009-07-31 07:00

Showing 101 to 110 of 1,201 entries (filtered from 1,210 total entries)

Select Save Print Previous 1 .. 10 11 12 .. 121 Next

speed

Science & Technology Facilities Council

Catalogue

ID	SC	Quality	PA-fit	SSE speed [kms-1]	SSE Phi [deg]	SSE HEEQ Long [deg]	SSE HEEQ Lat [deg]	SSE Carr Long [deg]	SSE Launch [UTC]
HCME_A__20090616_01	A	fair	95	371	60	-7	-1	126	2009-06-16 11:43
HCME_A__20090620_01	A	fair	75	386	147	-96	2	348	2009-06-20 04:39
HCME_A__20090623_01	A	good	100	357	59	-5	-5	35	2009-06-23 11:44
HCME_A__20090626_01	A	good	85	371	129	-76	0	283	2009-06-26 15:27
HCME_A__20090630_01	A	fair	80	173	78	-25	11	284	2009-06-30 08:31
HCME_A__20090711_01	A	fair	90	258	59	-4	3	168	2009-07-10 16:09
HCME_A__20090713_01	A	fair	105	224	76	-18	-12	118	2009-07-13 09:45
HCME_A__20090716_01	A	fair	95	288	32	22	3	128	2009-07-15 19:19
HCME_A__20090726_01	A	good	75	440	105	-51	12	273	2009-07-26 10:27
HCME_A__20090731_01	A	fair	80	329	67	-11	11	249	2009-07-31 07:00

Showing 101 to 110 of 1,201 entries (filtered from 1,210 total entries)

Select Save Print Previous 1 .. 10 11 12 .. 121 Next

speed

direction

Science & Technology Facilities Council

Catalogue

ID	SC	Quality	PA-fit	SSE speed [kms-1]	SSE Phi [deg]	SSE HEEQ Long [deg]	SSE HEEQ Lat [deg]	SSE Carr Long [deg]	SSE Launch [UTC]
HCME_A__20090616_01	A	fair	95	371	60	-7	-1	126	2009-06-16 11:43
HCME_A__20090620_01	A	fair	75	386	147	-96	2	348	2009-06-20 04:39
HCME_A__20090623_01	A	good	100	357	59	-5	-5	35	2009-06-23 11:44
HCME_A__20090626_01	A	good	85	371	129	-76	0	283	2009-06-26 15:27
HCME_A__20090630_01	A	fair	80	173	78	-25	11	284	2009-06-30 08:31
HCME_A__20090711_01	A	fair	90	258	59	-4	3	168	2009-07-10 16:09
HCME_A__20090713_01	A	fair	105	224	76	-18	-12	118	2009-07-13 09:45
HCME_A__20090716_01	A	fair	95	288	32	22	3	128	2009-07-15 19:19
HCME_A__20090726_01	A	good	75	440	105	-51	12	273	2009-07-26 10:27
HCME_A__20090731_01	A	fair	80	329	67	-11	11	249	2009-07-31 07:00

Showing 101 to 110 of 1,201 entries (filtered from 1,210 total entries)

Select Save Print Previous 1 .. 10 11 12 .. 121 Next

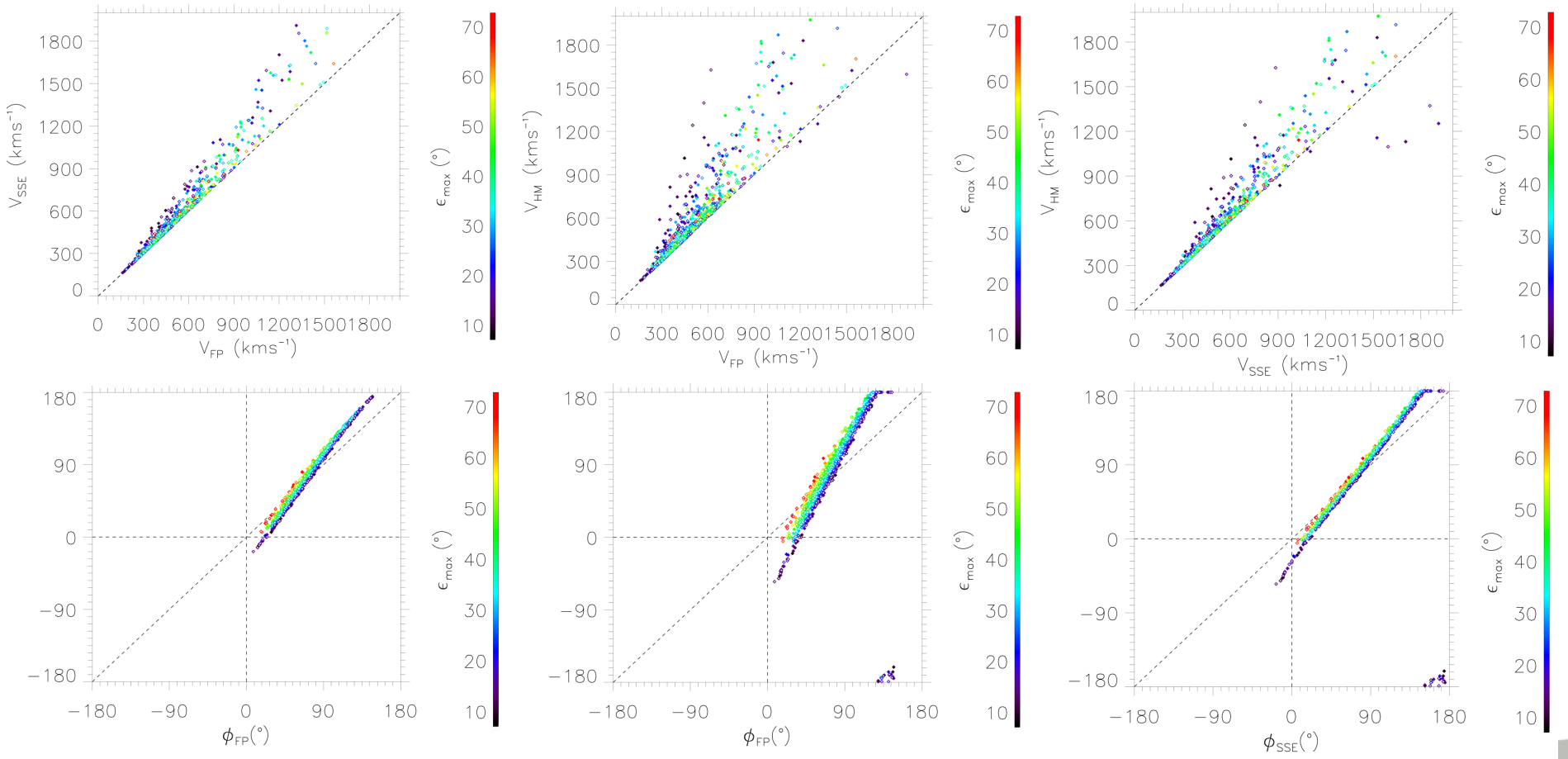
speed

direction

launch time

Science & Technology Facilities Council

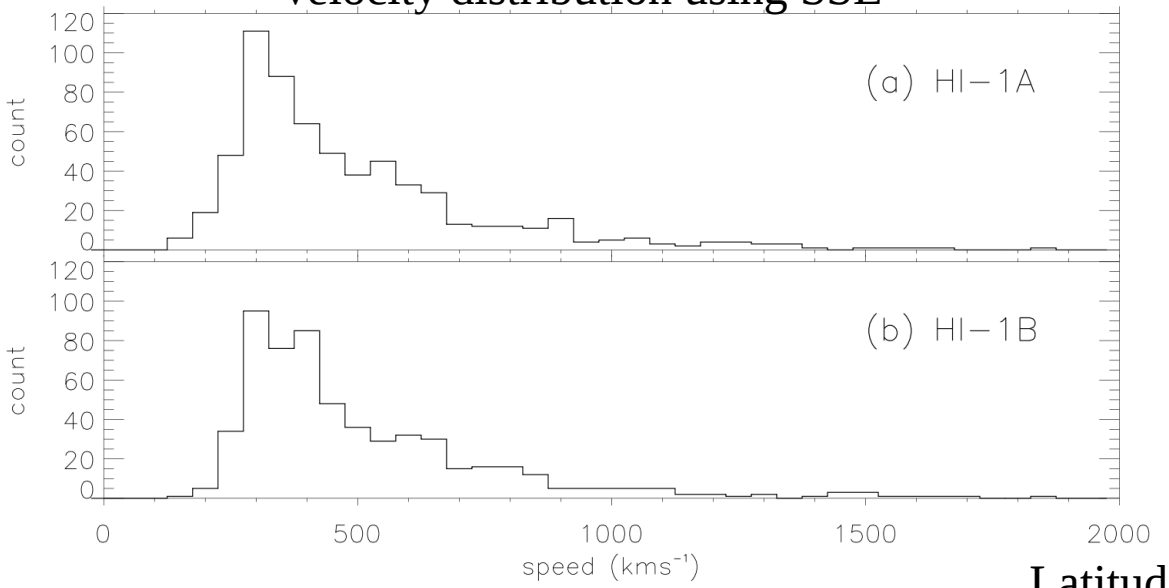
Comparison of fitting methods



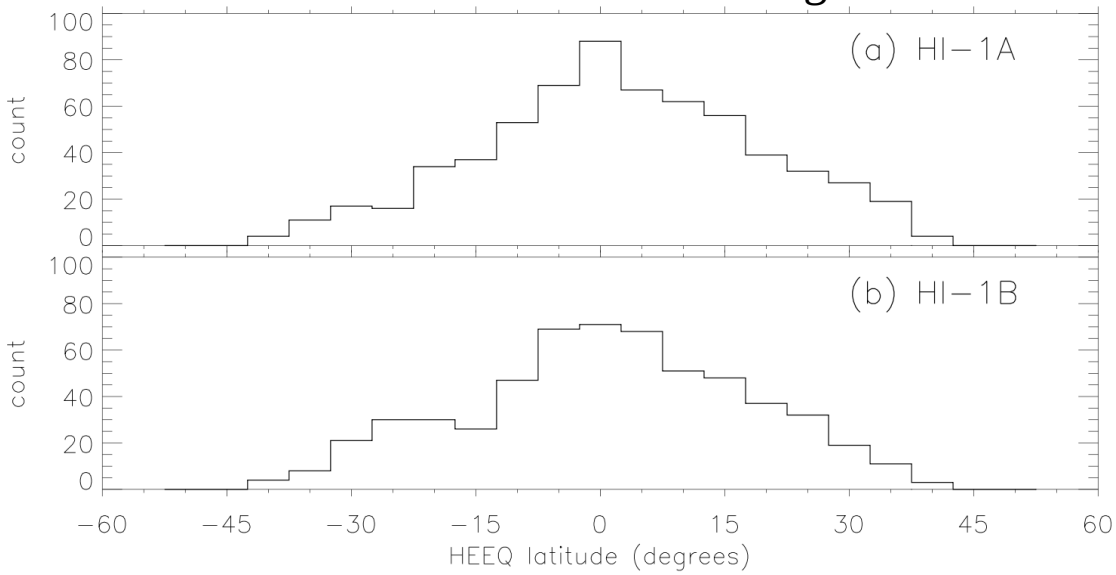
Science & Technology Facilities Council

Velocities and directions

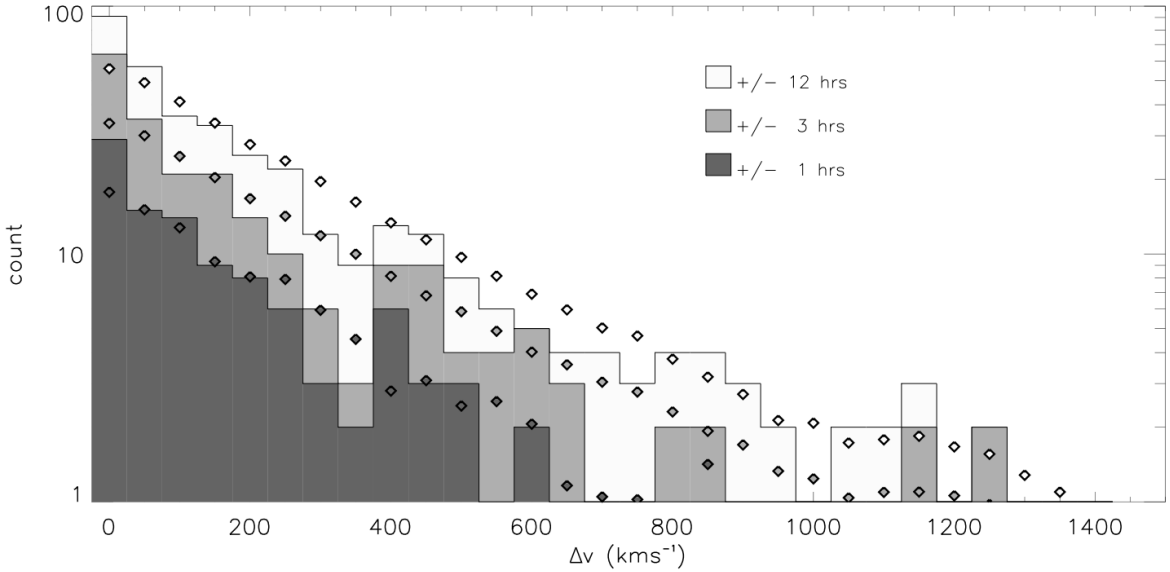
Velocity distribution using SSE



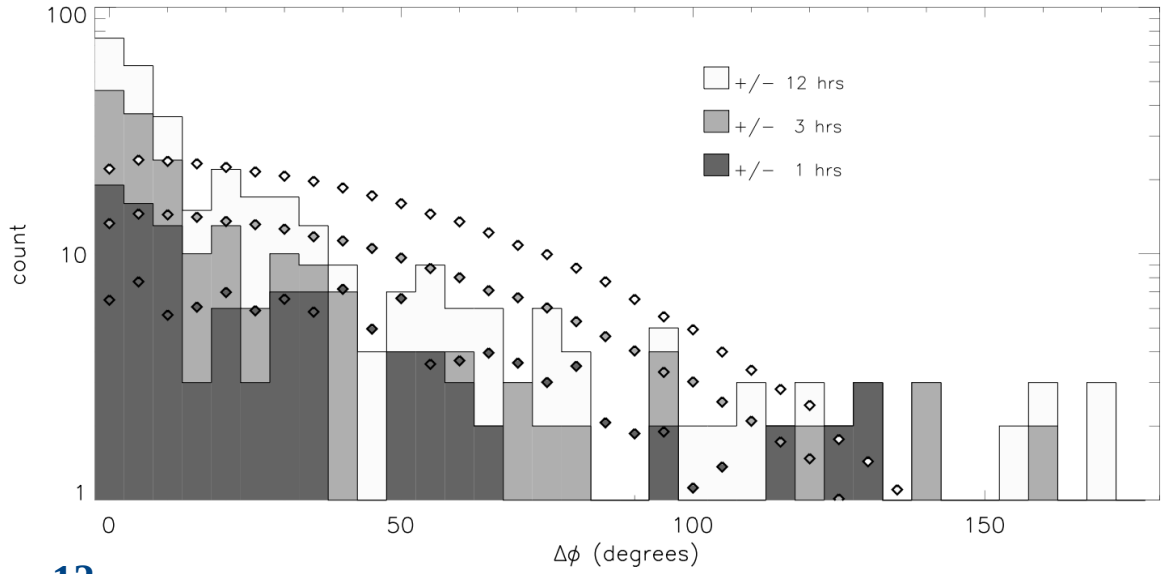
Latitude distribution using SSE



Comparison between STEREO-A & B



Speed difference between coincident events that occur in a given time-window.



Difference in direction between coincident events.

Science & Technology Facilities Council

Summary

- **Task 3.1: Kinematics catalogue**

HCME_A__20090626_01:	Fixed-phi	Self-Similar	Harmonic Mean
Velocity	**332 ± 23** kms^{-1}	**371 ± 36** kms^{-1}	**421 ± 59** kms^{-1}
phi	**111 ± 3°**	**129 ± 5°**	**149 ± 7°**
HEEQ lon/lat	**-58°, 2°**	**-76°, 0°**	**-95°, -3°**
Carrington lon/lat	**300°, 2°**	**283°, 0°**	**263°, -3°**
Launch time	**26/06 15:31**	**26/06 15:27**	**26/06 15:51**

- Complete for **STEREO-A** and **B, April '07 – December '13**
- Available on HELCATS website **http://www.helcats-fp7.eu**

Science & Technology Facilities Council