

CME assignment two, **ANSWERS**

For the CMEs listed below, follow the CME analysis procedure described in the lesson and also submit answers to the following questions for each CME.

HW#2 CMEs starting at

- 1) 2013-03-15T06:54Z
- 2) 2013-04-11T07:36Z
- 3) 2012-09-28T00:12Z
- 4) 2012-09-28T10:54Z
- 5) 2013-01-21T08:00Z

(two CMEs)

Resources & iSWA layouts

- * StereoCAT: <http://ccmc.gsfc.nasa.gov/analysis/stereo/>
- * 40 Frame coronagraph and EUV movies <http://go.nasa.gov/16bTvzK>
- * Where is STEREO? http://stereo-ssc.nascom.nasa.gov/cgi-bin/make_where_gif
- * <http://cdaw.gsfc.nasa.gov/movie/>
- * Solar Images with grid overlays <http://www.solarmonitor.org/>

Part 1: a) What is the source location for this CME? (list the location e.g. N15E20, instrument/wavelength, and time of the observation).

b) Describe the EUV lower coronal signature for this CME (e.g. flare, post eruption arcade/loops, rising loops, dimming, filament eruption).

c) Is the CME a halo in any of the coronagraphs? If so, is it moving away from or towards the observer?

d) Which coronagraph instrument first observed the CME at the start time?

e) What are your final **CME parameters** (radial speed, half width, longitude, latitude, and time at 21.5 Rs (solar radii)).

f) Compare your EUV source location obtained in (a) with the parameters obtained in (e). Discuss why they might be different.

g) Submit your "Save URL" of your measurements.

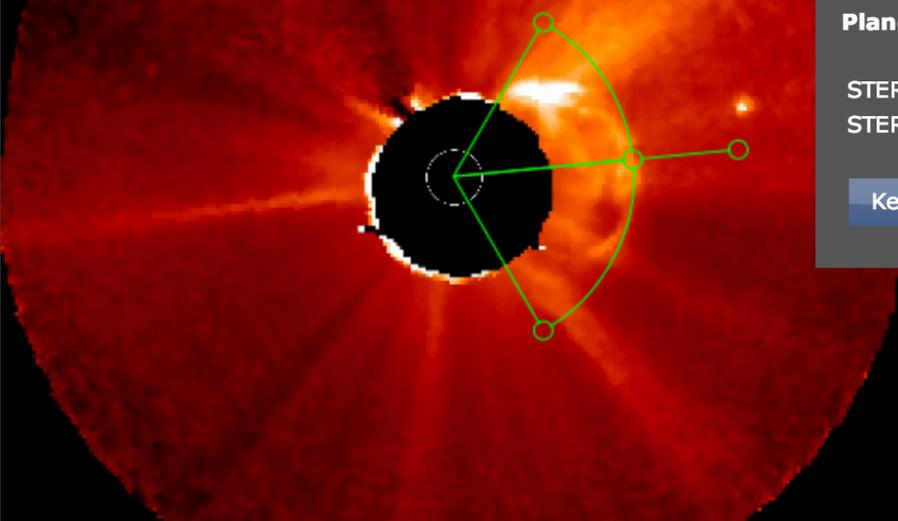
Part 2: Reanalyze the CMEs above using single spacecraft mode and the CME Projection Graph:

h) Single Spacecraft mode: for both spacecraft chosen in Part 1 use your longitude derived in (e) to determine the "angle from plane of the sky" for each measurement. Use this in single spacecraft mode to get the 3D speed.

i) Now use the CME projection graph with your width and your 3D longitude from (e) to derive two estimates of the 3D speed for each spacecraft viewpoint.

j) Now do the same (j), only using the source longitude from (a) instead of the longitude from (e).

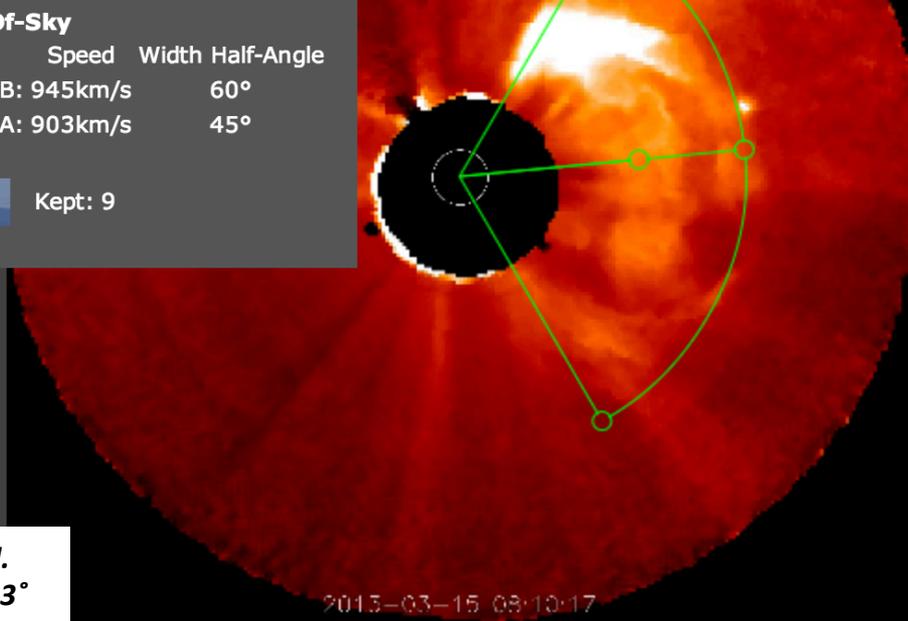
k) You now have determined the 3D speed with several different methods. How much do they match? Why are there differences?



Plane-Of-Sky

	Speed	Width	Half-Angle
STEREOB: 945km/s			60°
STEREOA: 903km/s			45°

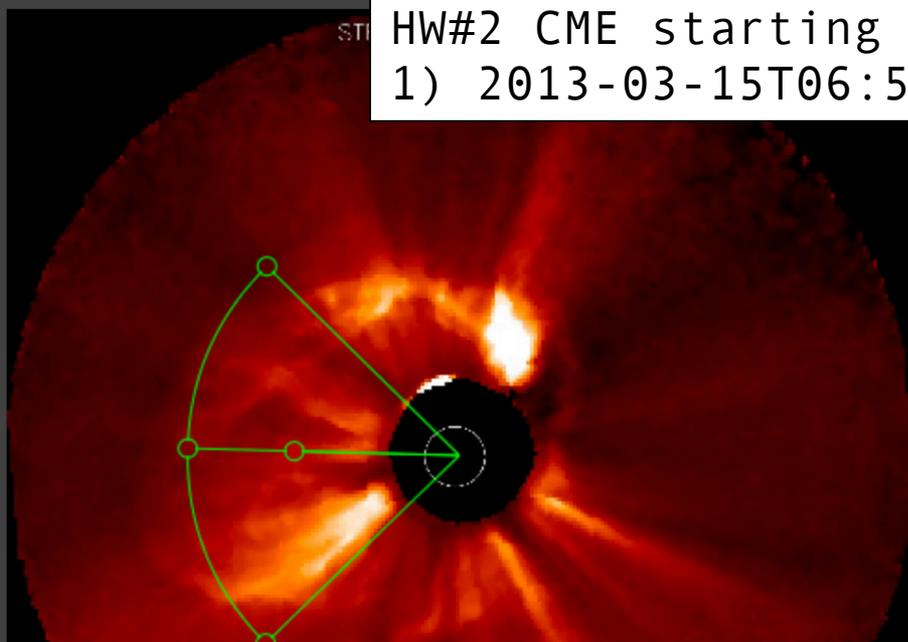
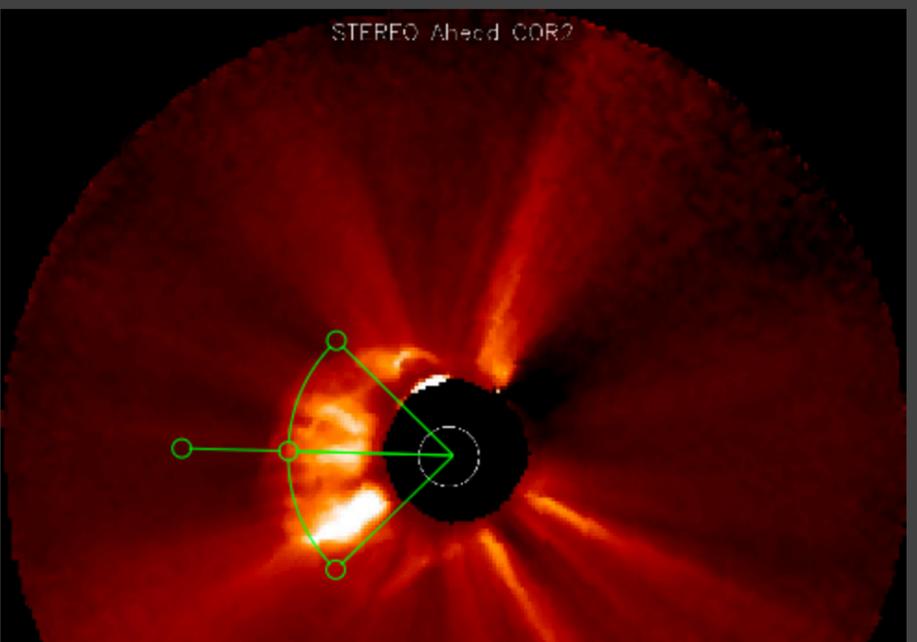
Kept: 9



This is an Earth directed halo CME, triangulation cannot be performed. Using POS speeds & geometry the answer is $v=1000$ km/s lon/lat $-2^{\circ}/-3^{\circ}$

STEREOB COR 2 Fri, 15 Mar 2013 07:24:24 GMT

STEREOB COR 2 Fri, 15 Mar 2013 08:09:35 GMT



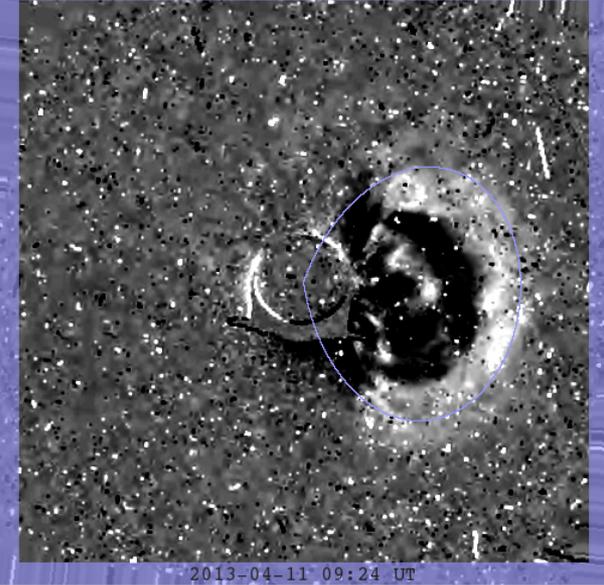
HW#2 CME starting at
1) 2013-03-15T06:54Z

EUV Signatures: AIA: Flare brightening, eruption, post-eruption arcade from AR north of disk center, dimming below AR. EUVI: Rising loops from behind NW limb in B.

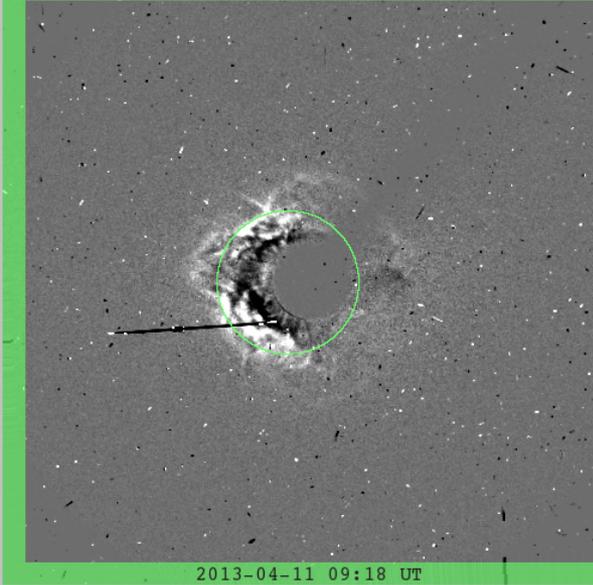
2) 2013-04-11T07:36Z

CAT (CME Analysis Tool)

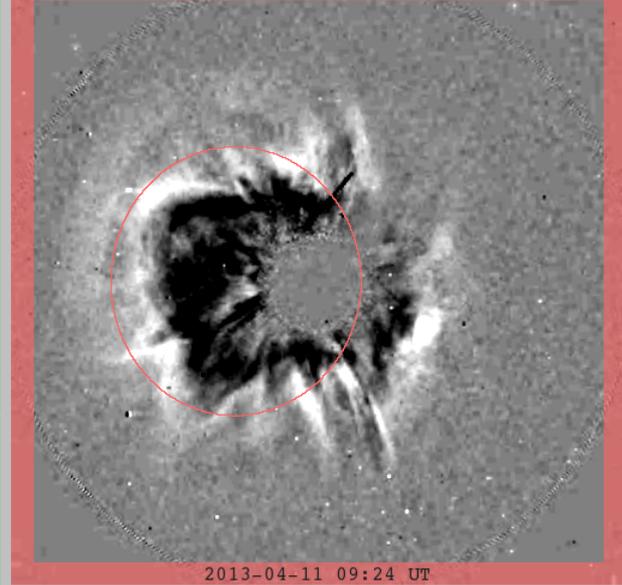
STEREO B COR2



SOHO LASCO C3



STEREO A COR2



START / END TIMES

Start [Y M D H M]
2013 4 11 08 1
End [Y M D H M] +12h +24h
2013 4 11 20 0

Load Images

ANIMATION CONTROLS

L C R
Play
Speed
Altern8

IMAGE ADJUST

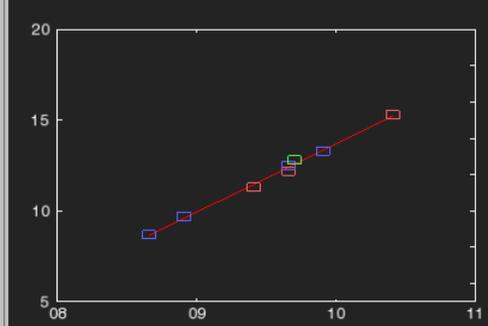
L C R
Stretch Bottom
Stretch Top
Gamma Correction
image saturation value
Reset
Copy to C -> Copy to R ->

CME CONTROLS

Latitude
Longitude
Angular Width (cone)
Radial Distance (dist)

CME Params
lat : -5.9
lon : -15.3
cone : 100.0
dist : 15.3

CME LEADING EDGE (Rs) vs TIME (UT)

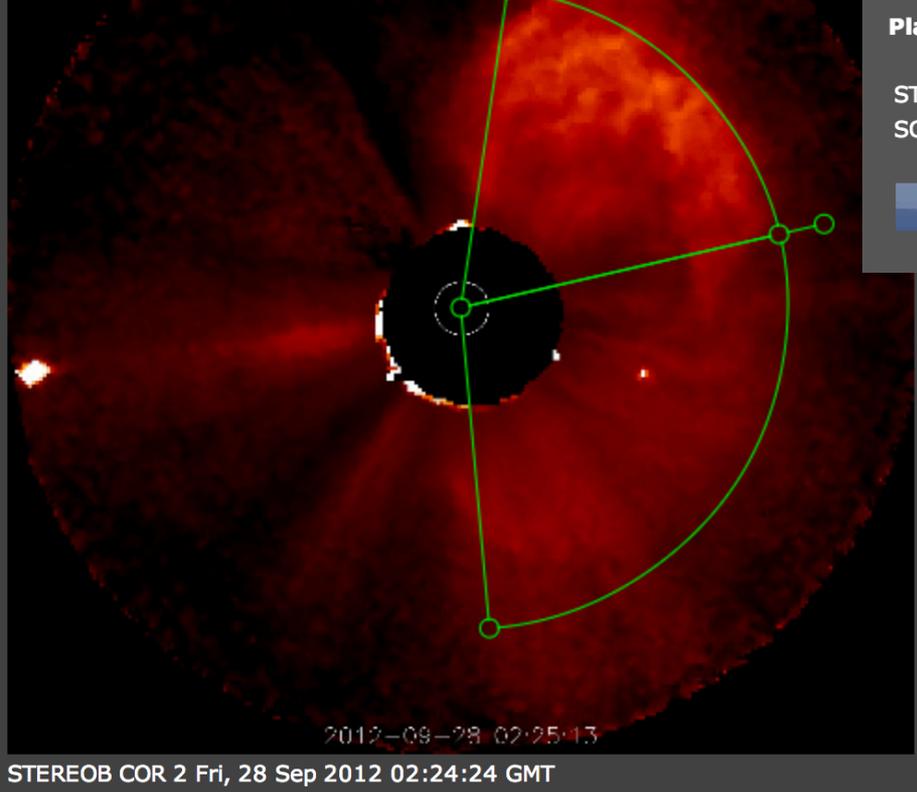


ENLIL PARAMETERS

T 2013-04-11 12:04
lat -6
lon -15
cone 50
Vel 725

Calculate Velocity
Export Analysis
Reset Analysis

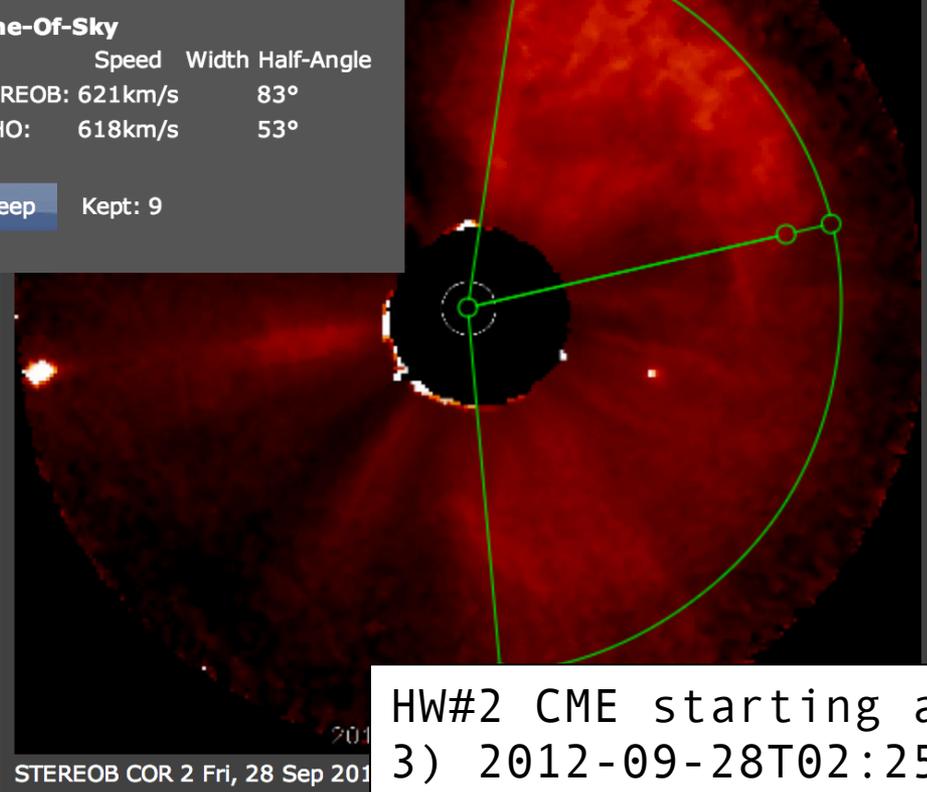
yielding a triangulated speed of $850 \pm 200 \text{ km s}^{-1}$, $-5^\circ \pm 5^\circ$ latitude, $-15^\circ \pm 10^\circ$ longitude, $50^\circ \pm 5^\circ$ half width



Plane-Of-Sky

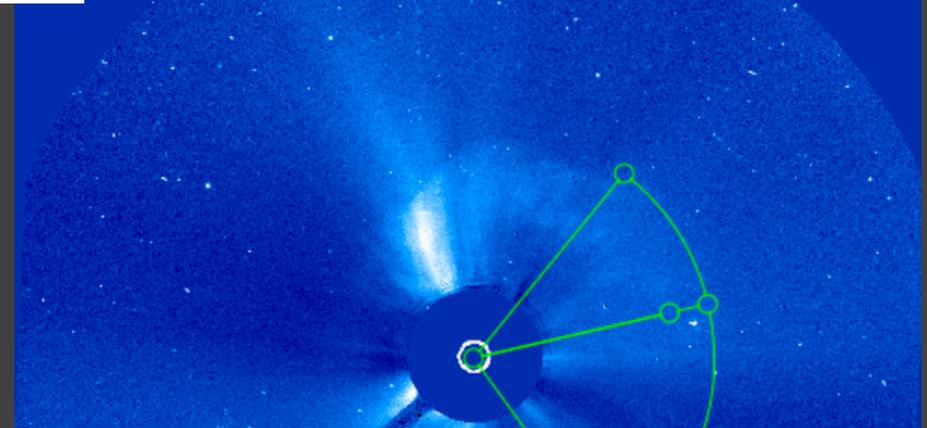
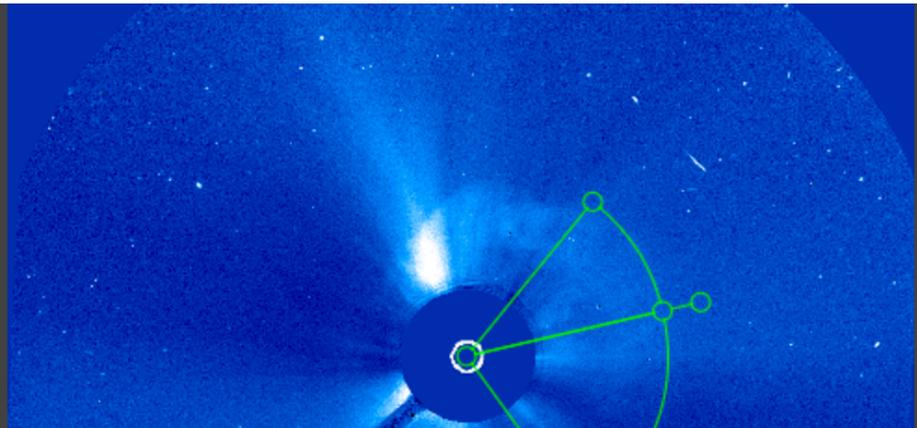
	Speed	Width	Half-Angle
STEREOB:	621km/s		83°
SOHO:	618km/s		53°

Kept: 9

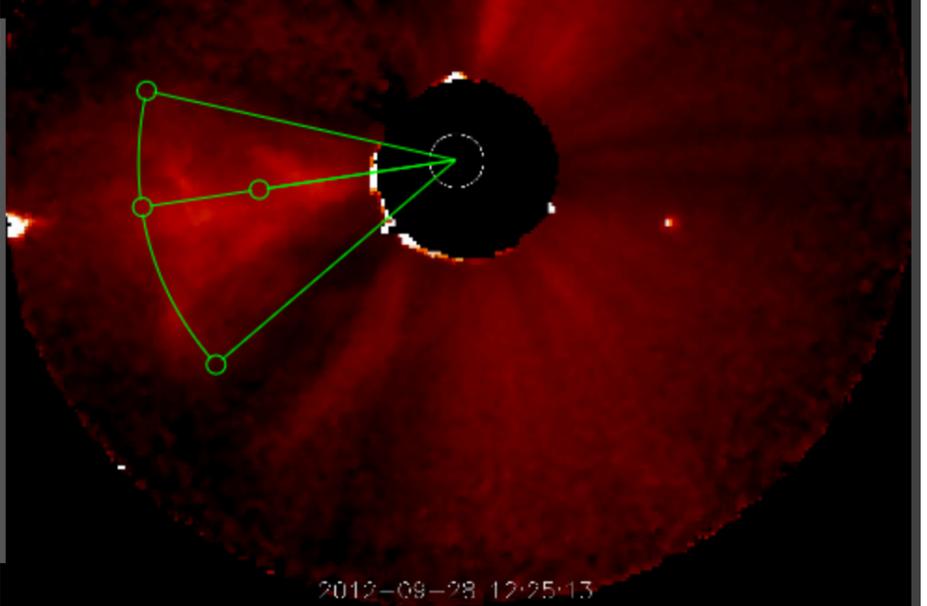
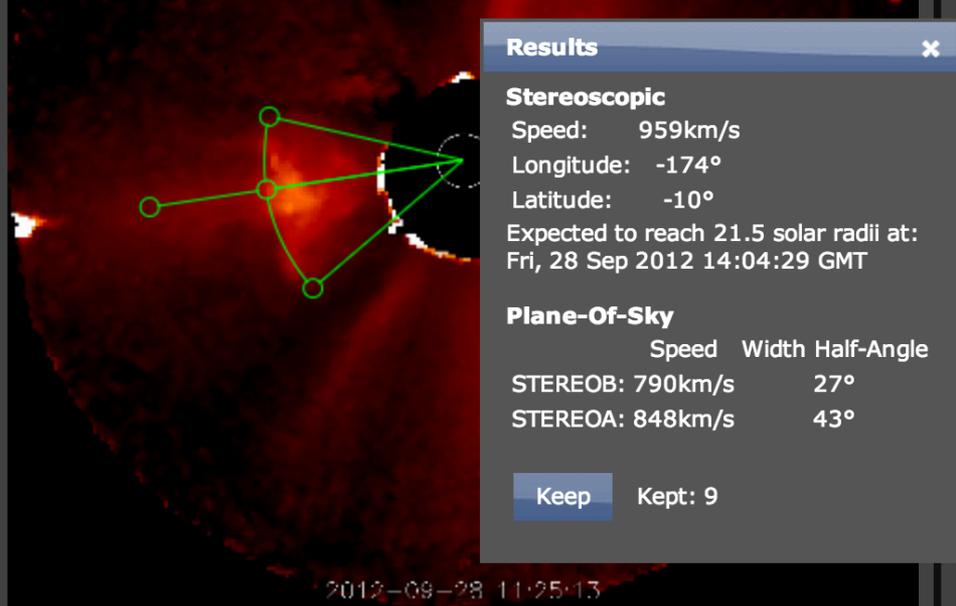


HW#2 CME starting at
3) 2012-09-28T02:25Z

*This is an Earth directed halo CME, triangulation cannot be performed.
Using POS speeds & geometry the answer is $v = 1150$ km/s lon/lat $30^\circ/5^\circ$*

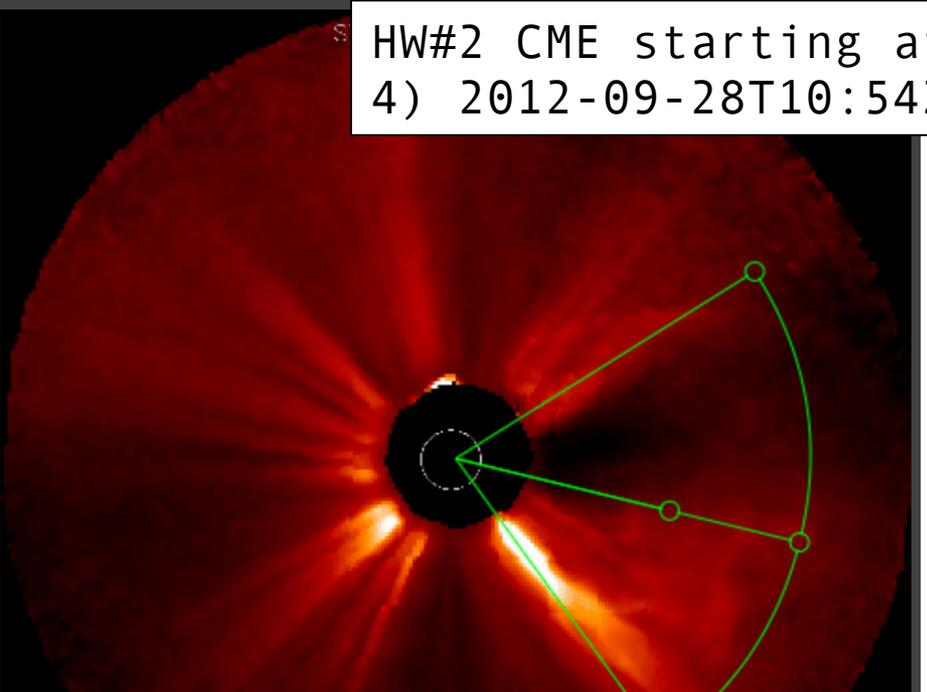
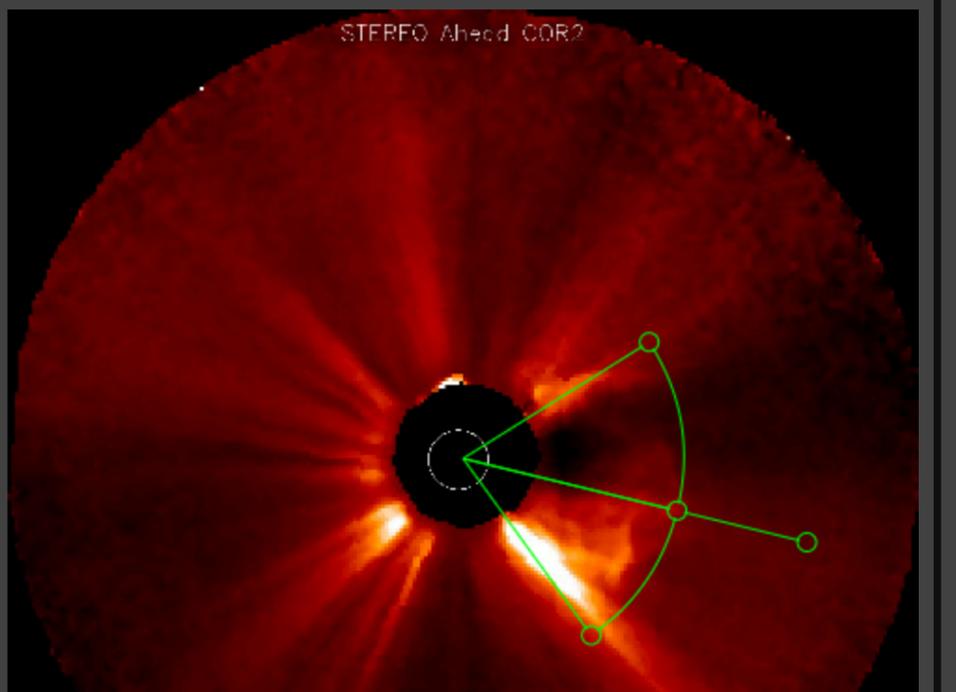


EUV Signatures: AIA: Filament eruption near AR west of disk center. Post-eruption arcade. EUVI: Filament eruption just beyond E limb in A (304Å), rising loops.



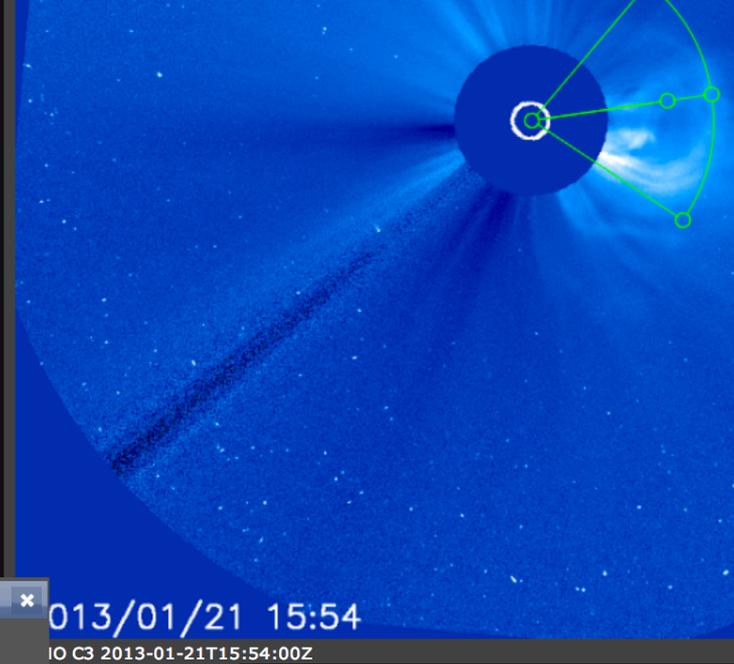
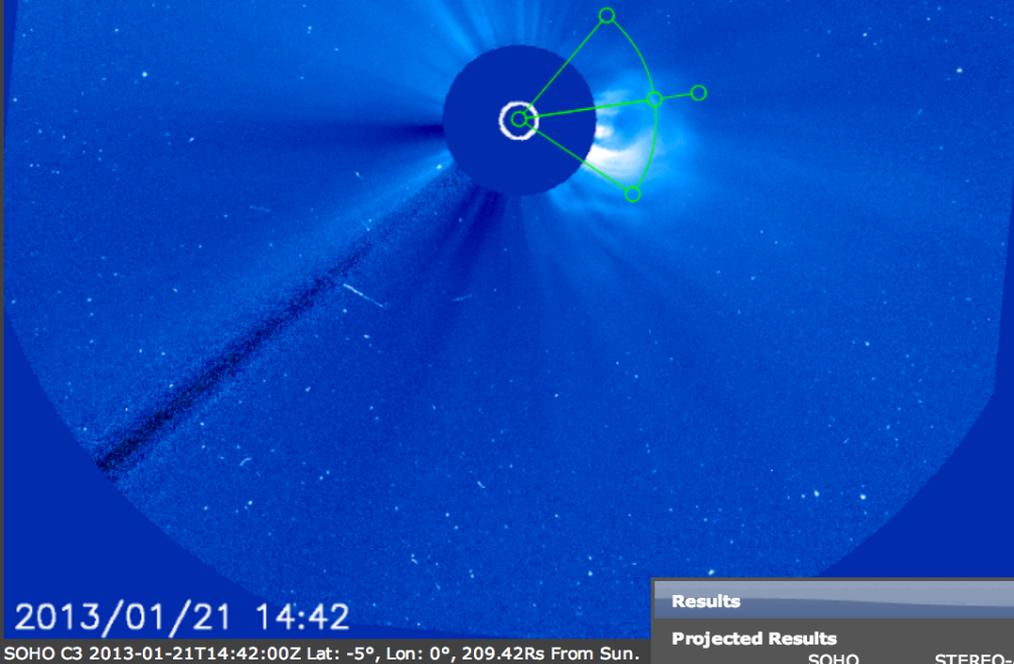
STEREOB COR 2 Fri, 28 Sep 2012 11:24:24 GMT

STEREOB COR 2 Fri, 28 Sep 2012 12:24:24 GMT



HW#2 CME starting at
 4) 2012-09-28T10:54Z

EUV Signatures: EUVI: Flare and eruption from nearby AR in SW of A, SW of B.



Results ✕

Projected Results

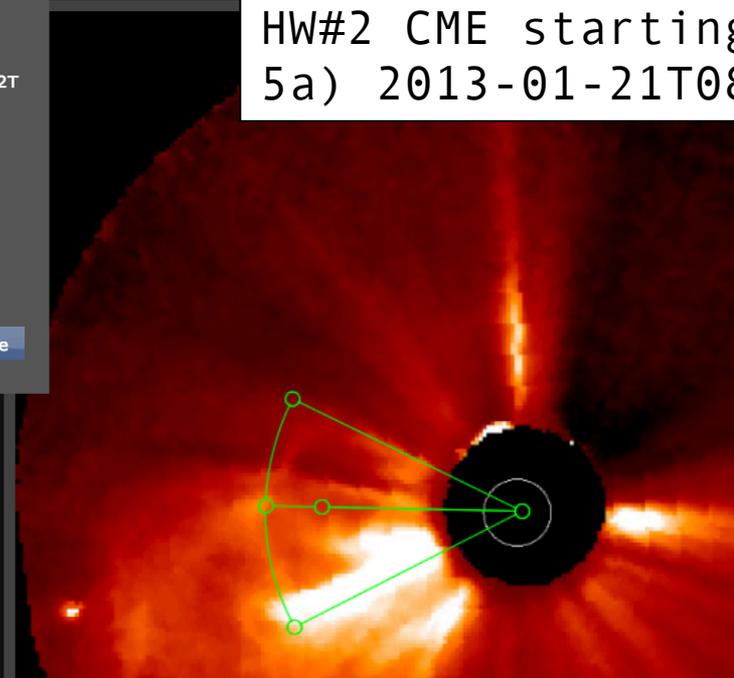
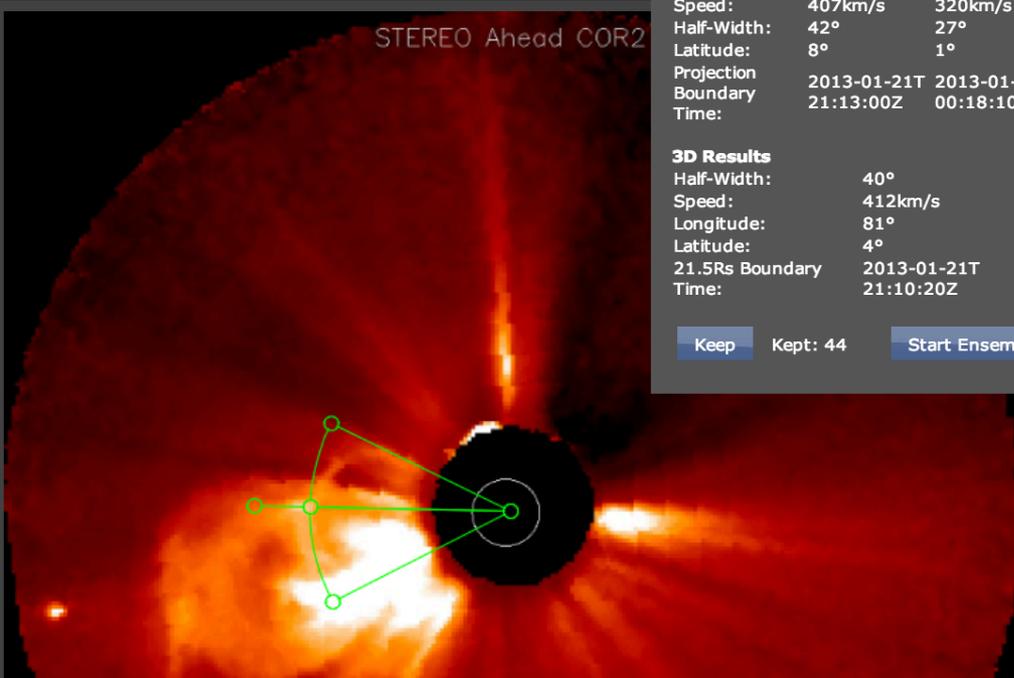
Speed:	SOHO 407km/s	STEREO-A 320km/s
Half-Width:	42°	27°
Latitude:	8°	1°
Projection Boundary Time:	2013-01-21T 21:13:00Z	2013-01-22T 00:18:10Z

3D Results

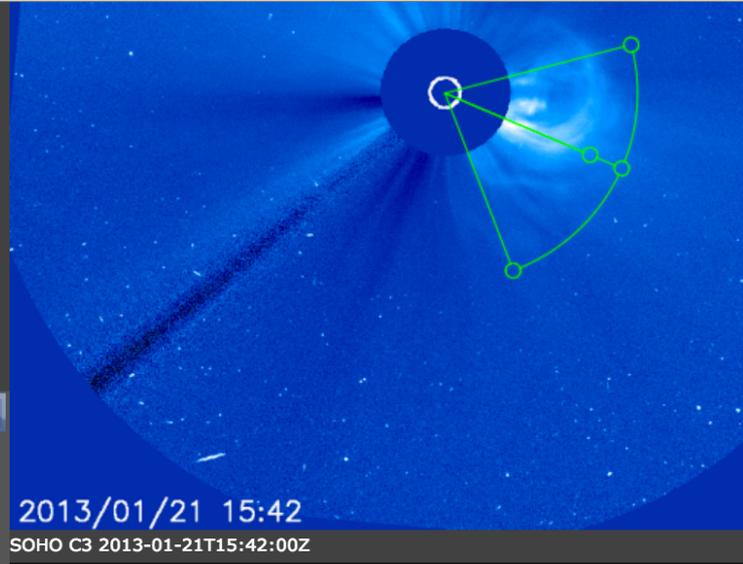
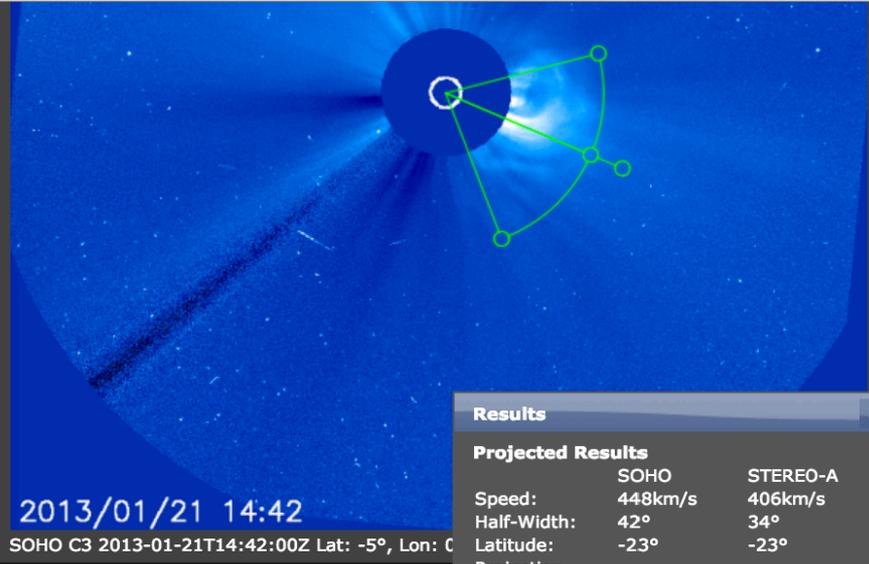
Half-Width:	40°
Speed:	412km/s
Longitude:	81°
Latitude:	4°
21.5Rs Boundary Time:	2013-01-21T 21:10:20Z

Keep Kept: 44 Start Ensemble

HW#2 CME starting at
5a) 2013-01-21T08:00Z



EUV Signatures: EUVIA: some activity in AR in the NE (near limb), AIA SDO: some activity in the AR at the NW limb



Results [X]

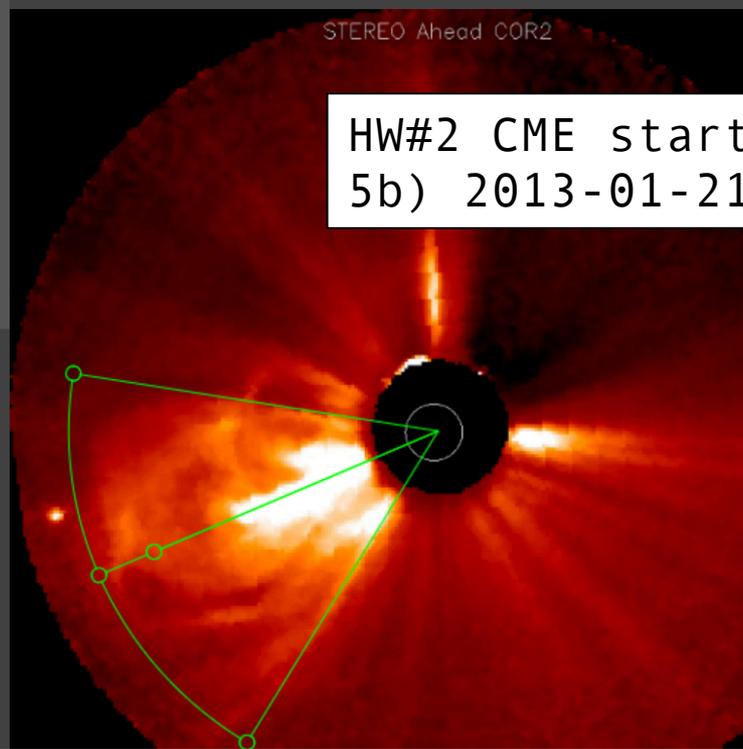
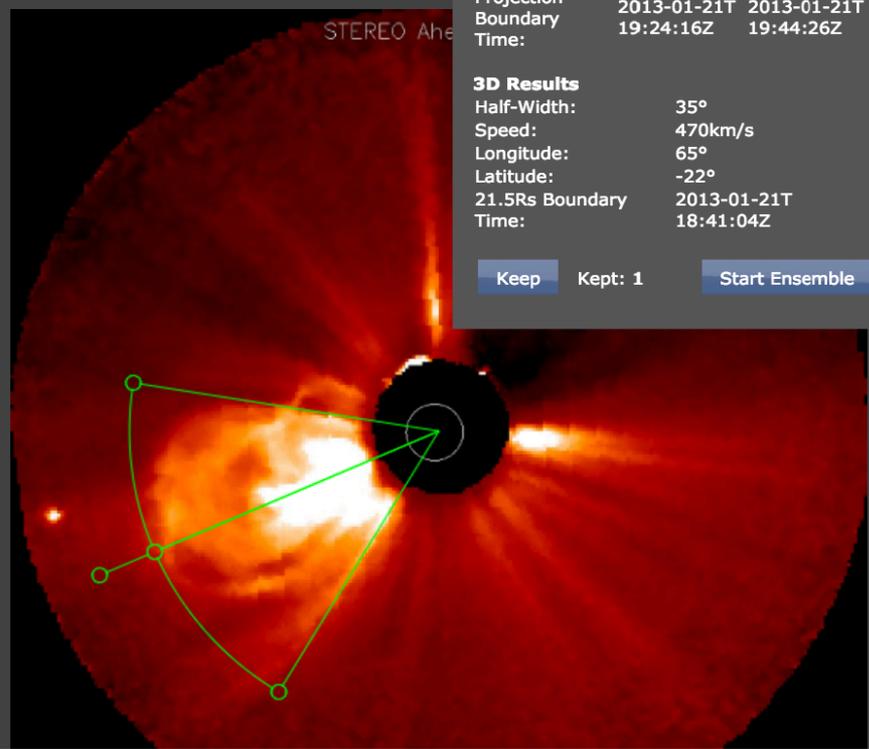
Projected Results

	SOHO	STEREO-A
Speed:	448km/s	406km/s
Half-Width:	42°	34°
Latitude:	-23°	-23°
Projection	2013-01-21T	2013-01-21T
Boundary	19:24:16Z	19:44:26Z
Time:		

3D Results

Half-Width:	35°
Speed:	470km/s
Longitude:	65°
Latitude:	-22°
21.5Rs Boundary	2013-01-21T
Time:	18:41:04Z

Keep Kept: 1 Start Ensemble



HW#2 CME starting at
5b) 2013-01-21T08:24Z

EUV Signatures: EUVIA: rising loops off SE limb, hard to see in AIA SDO, but some activity in the SW.