WP4 - Verifying the kinematic properties of STEREO/HI CMEs against in-situ CME observations and coronal sources

overview and task 4.3

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with input from

UNIGRAZ, UH, UGOE, IMPERIAL, ROB, UPS

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Summary WP4

- WP4 runs months 10–36 (started in March 2015)

- builds on WP2+3, WP4 data and events can be used in WP6+7

- **Tasks:**
  4.1 comparison to coronal sources, **UGOE**: STEREO, SOHO, SDO, Proba2
  4.2 in situ data: UH, UNIGRAZ, UPS, UGOE, Imperial
  categorization of ICMEs and ICME parameters, modeling:
  STEREO, ACE, Wind, MESSENGER, VEX, Ulysses, MSL, MAVEN?
  4.3 validation of HI modeling with in situ: UNIGRAZ, UPS, ROB, UGOE, UH

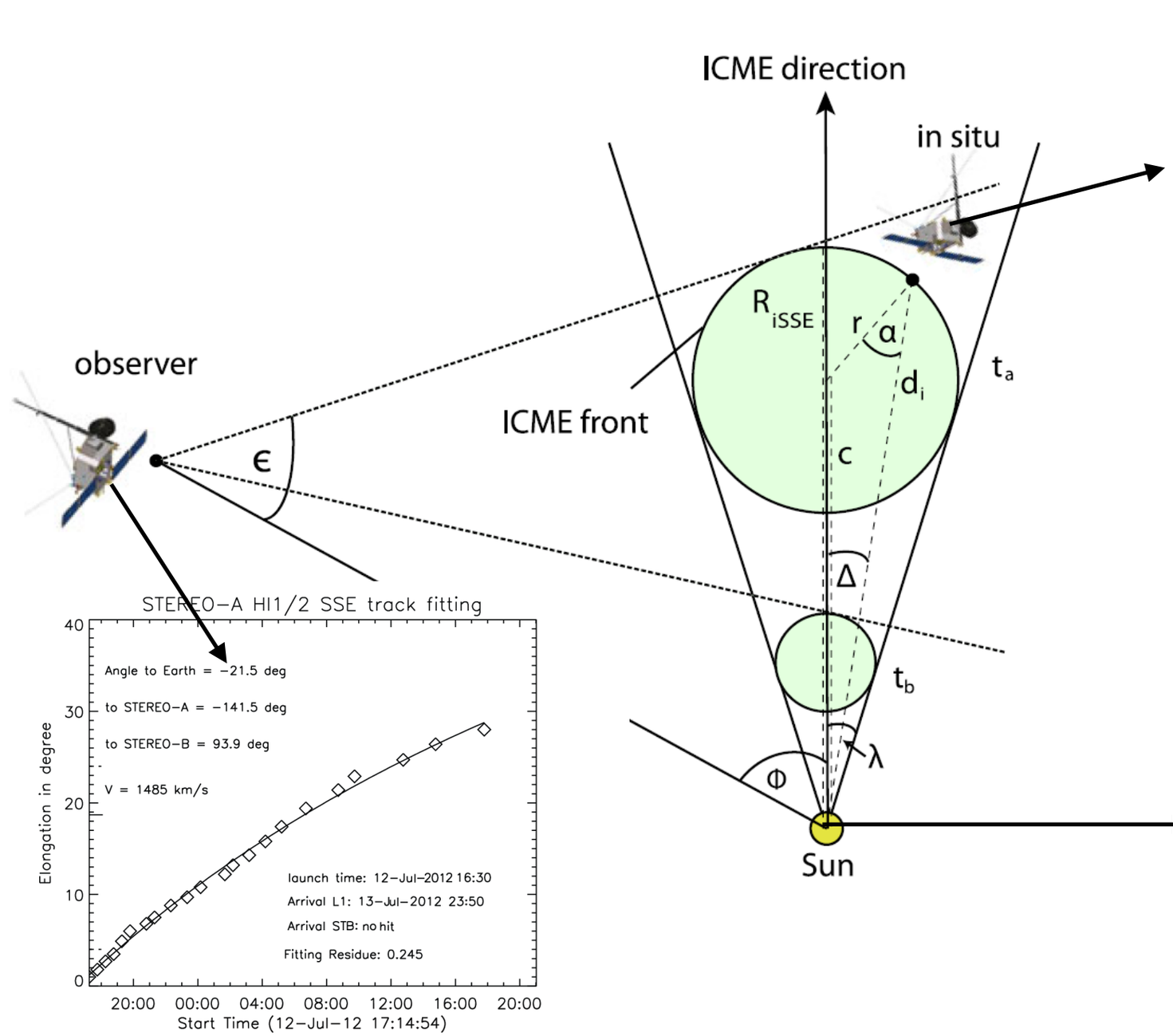
- **Deliverables:**

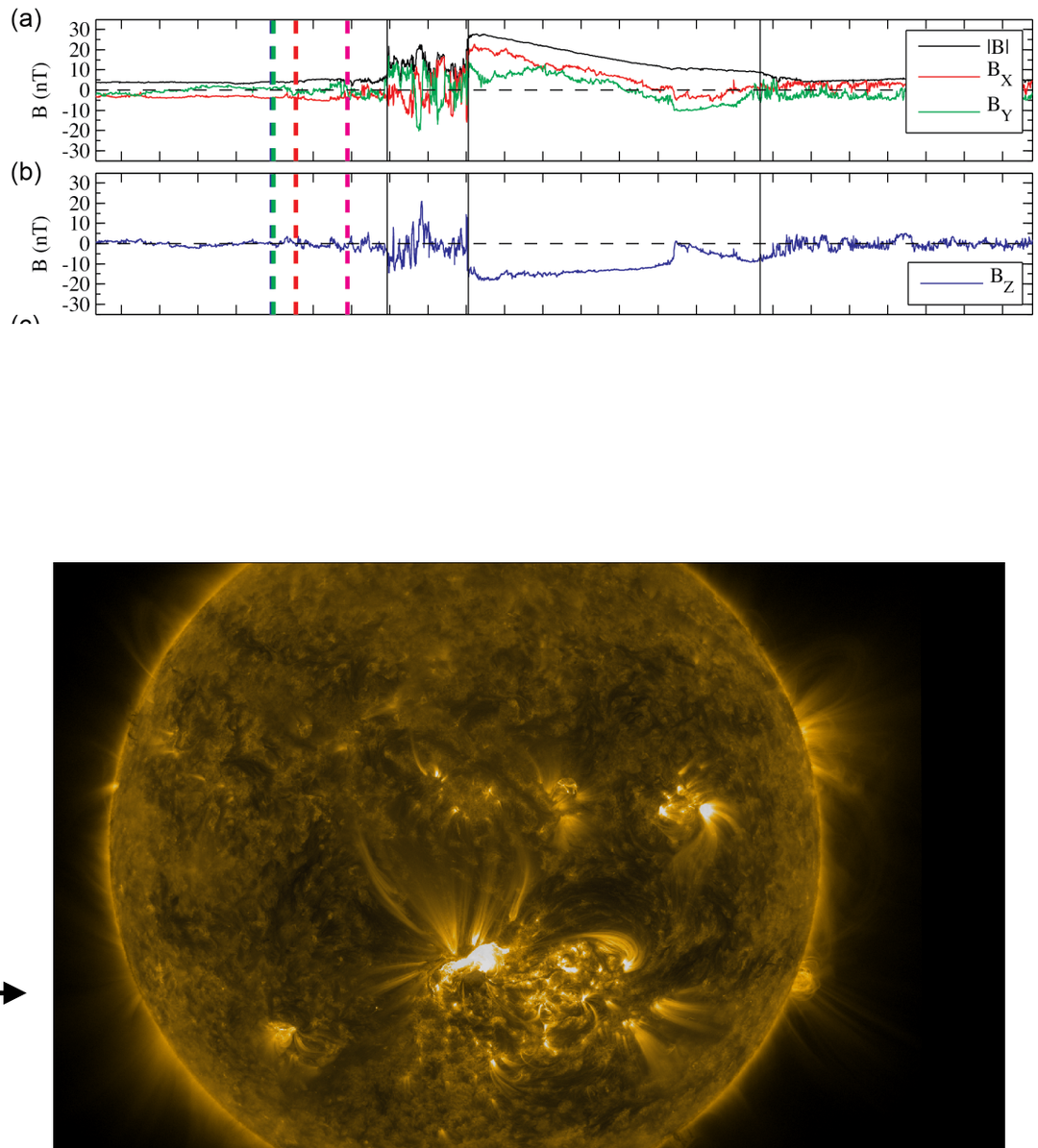
  1. **April 2016, M24:** Establishing an **online catalogue of potentially associated solar source and in-situ** phenomena for the timeframe 2007–2015

  2. **October 2016, M30:** Report on **validation** of the HI modeling: comparison of HI results with coronal and in situ data; assessment of forecasting accuracy.

CME from low corona to in situ

- Davies et al. 2012 ApJ, Möstl and Davies 2013 Sol. Phys., Möstl et al. 2014 ApJ





Where we are….

Where we are

- **existing:**
- **HICAT** – „HI catalogue“ from WP2+3 (but we used prelimin. catalogue so far)

- **LOWCAT** – „low corona catalogue“ event list from UGOE website

- **ARRCAT** – „arrival catalogue“ predicts in situ impacts from HICAT (taken from WP3)
  planetary arrivals of those CMEs which extend over the SEQ plane are calculated
  contains e.g. **267 events at Earth (2007–2013) predicted by STEREO/A-HI**

- **DATACAT** – „data catalogue“ includes all the in situ magnetic field data
  (MES, VEX, Wind, STA, STB) ~ 1.5 GB V, N, T for STA/STB/WIN to be included

- **ICMECAT** – „interplanetary CME catalogue“ – includes all the ICME lists available
  107 events at Earth (2007–2013)

-> the basic IDL infrastructure exists for all these CATs + visualizations of their content

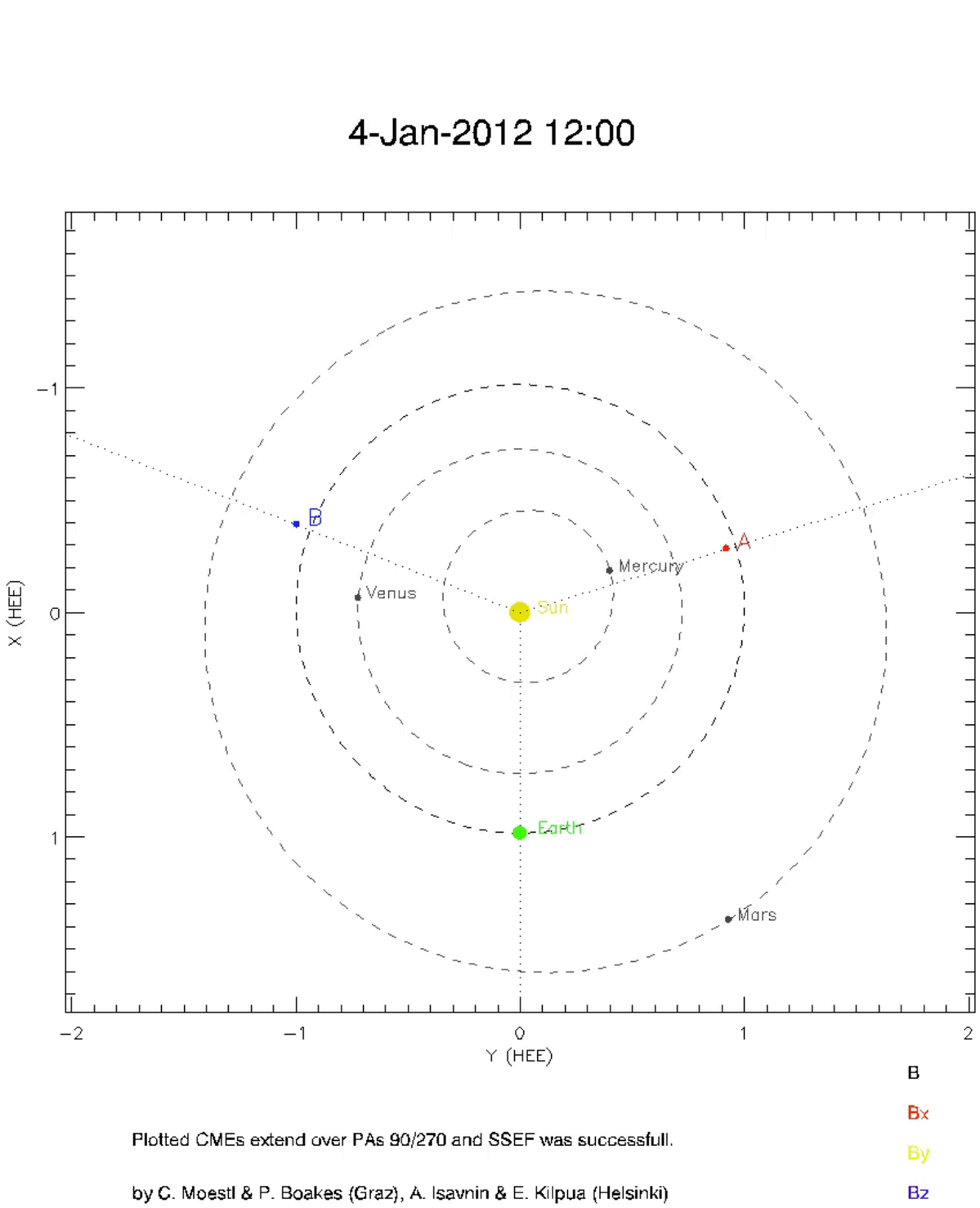
to be done:

- **LINKCAT** – „linked catalogue“ will contain the linked list from low coronal to in situ CME events

-> in python

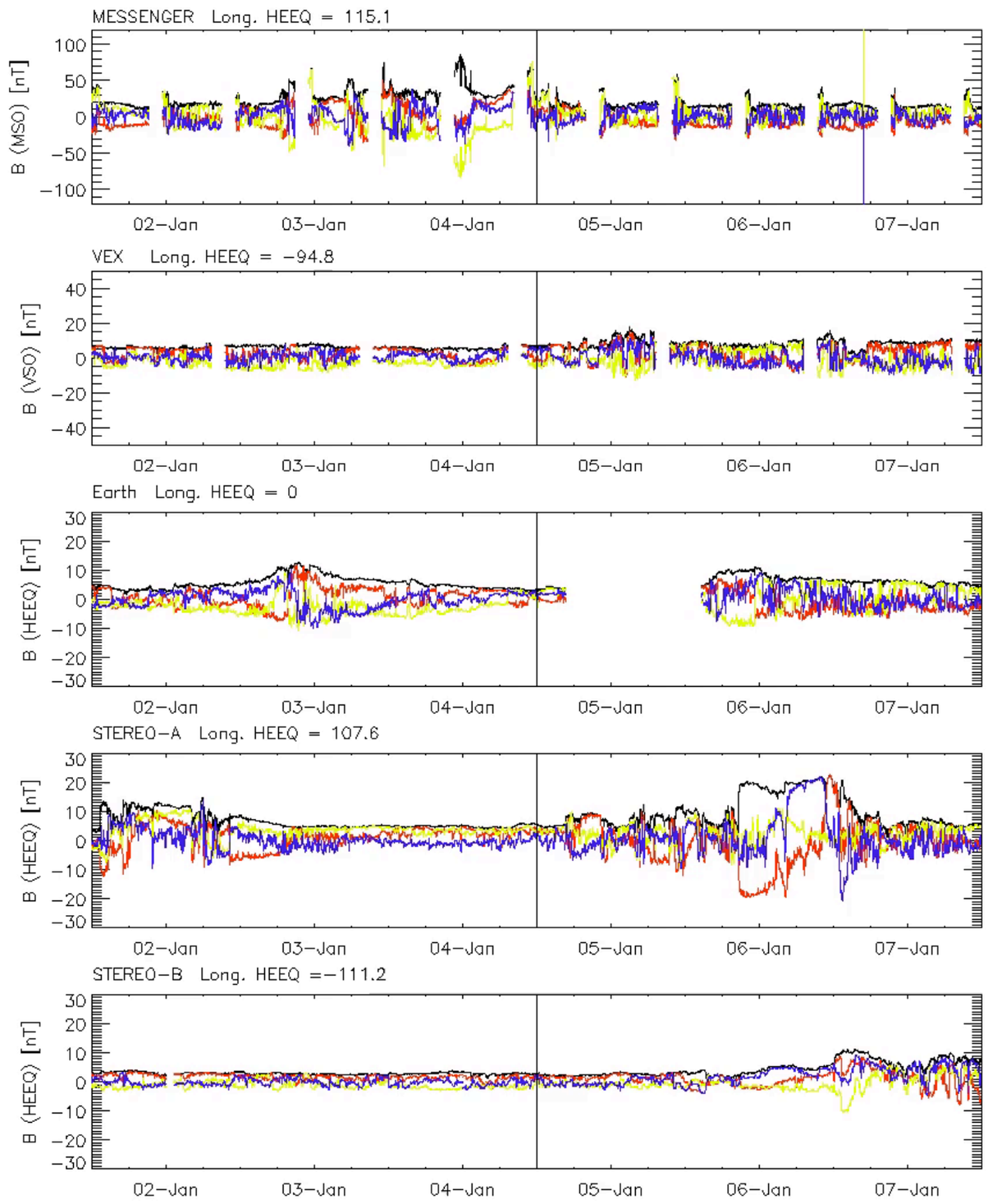
DATACAT

HELCATS in situ magnetic field visualization



Plotted CMEs extend over PAs 90/270 and SSEF was successfull.

by C. Moestl & P. Boakes (Graz), A. Isavnin & E. Kilpua (Helsinki)



ARRCAT

WP4 Catalogue

ICME EARTH ARRIVAL CATALOGUE

Project Wiki | Contact Us

The catalogue of insitu based Earth arrival CME paramters produced as part of the WP4 activities are shown below

This is version: TBD of the catalogue, released yyyy-mm-dd

Arrival Date From 2007-01-01 to 2015-01-01

Arrival Speed: **100 to 2000 km/s**

Apex offset: **0 to 45 degrees**

Show 100 entries

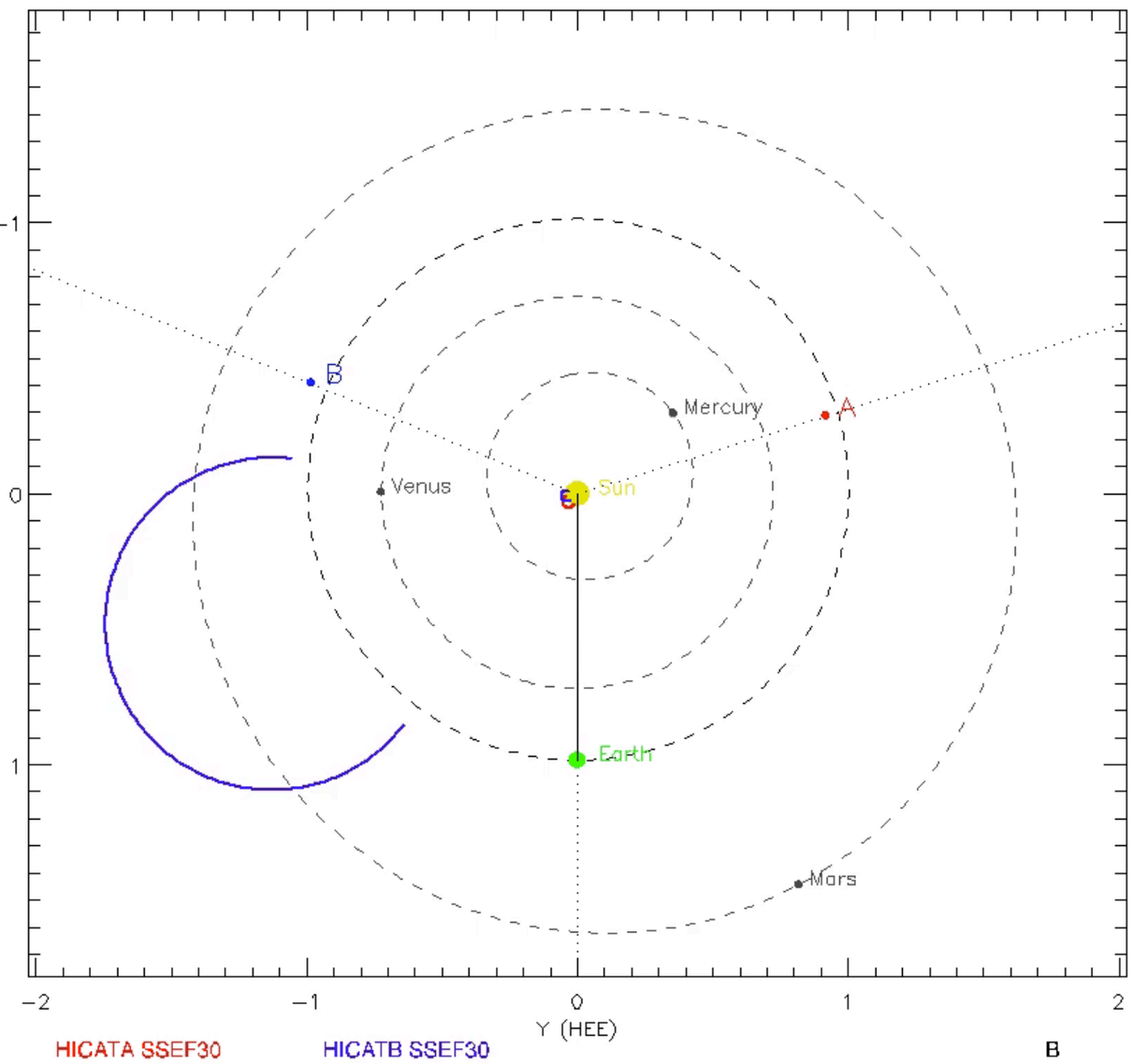
Search:

Show / hide columns

ID	SC	Apex Offset [deg]	Speed [km/s]	Arrival [UT] [deg]	Dist [AU]	Lat [deg]	Long [deg]
HCME_A__20071220_01	A	20.0	260	2007-12-26 15:10	0.98381397	-1.49703	-0.00000
HCME_A__20080213_01	A	23.0	271	2008-02-19 22:16	0.98730455	-6.74196	-0.00000
HCME_A__20080409_01	A	25.0	214	2008-04-17 14:31	1.00178489	-5.99623	0.00000
HCME_A__20080521_01	A	20.0	266	2008-05-28 09:35	1.01229287	-1.84155	0.00000
HCME_A__20080602_01	A	28.0	261	2008-06-08 22:02	1.01429036	-0.48398	0.00000
HCME_A__20080607_01	A	24.0	277	2008-06-14 05:50	1.01505733	0.20600	-0.00000

ARRCAT

HELCATS in situ magnetic field visualization



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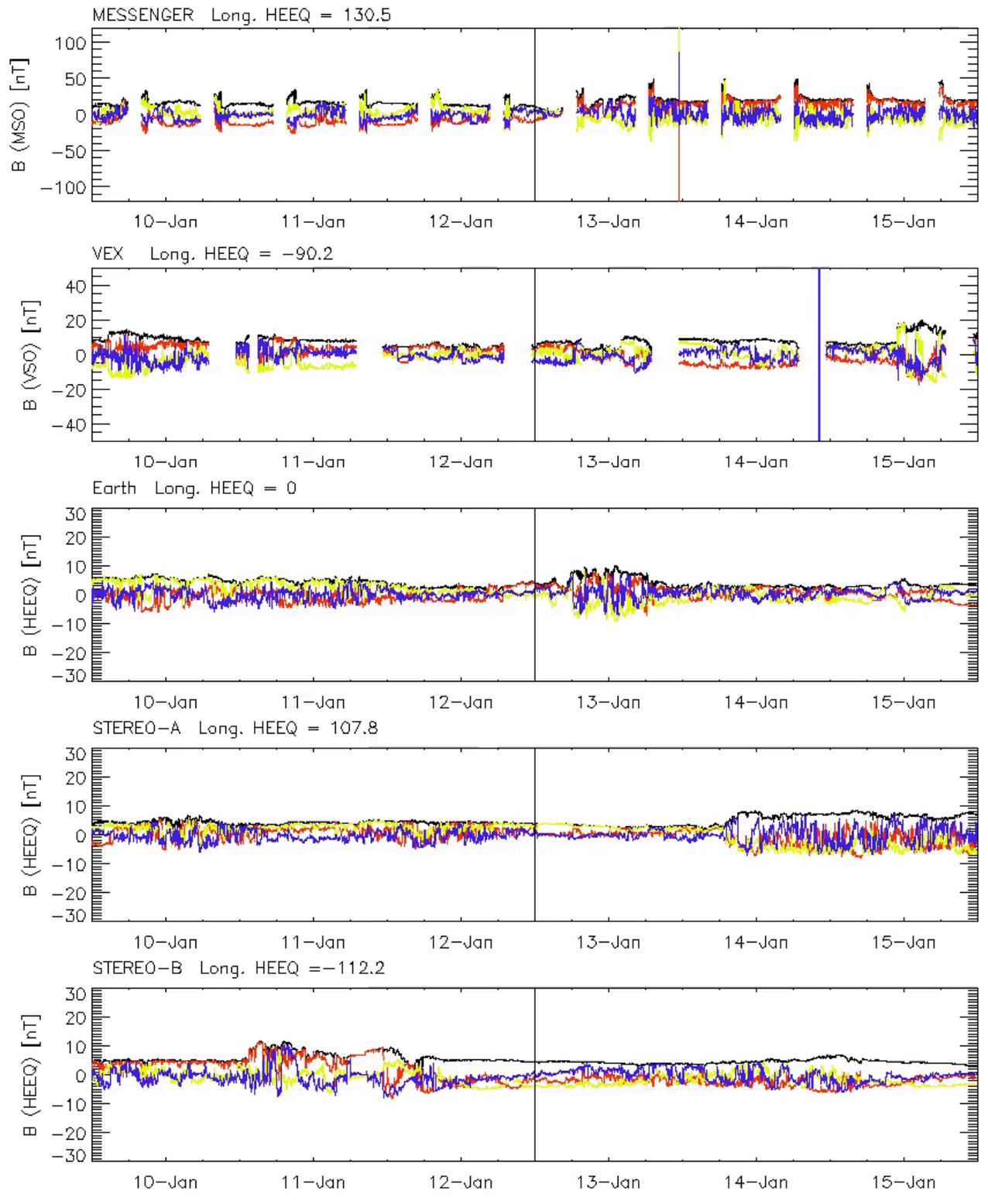
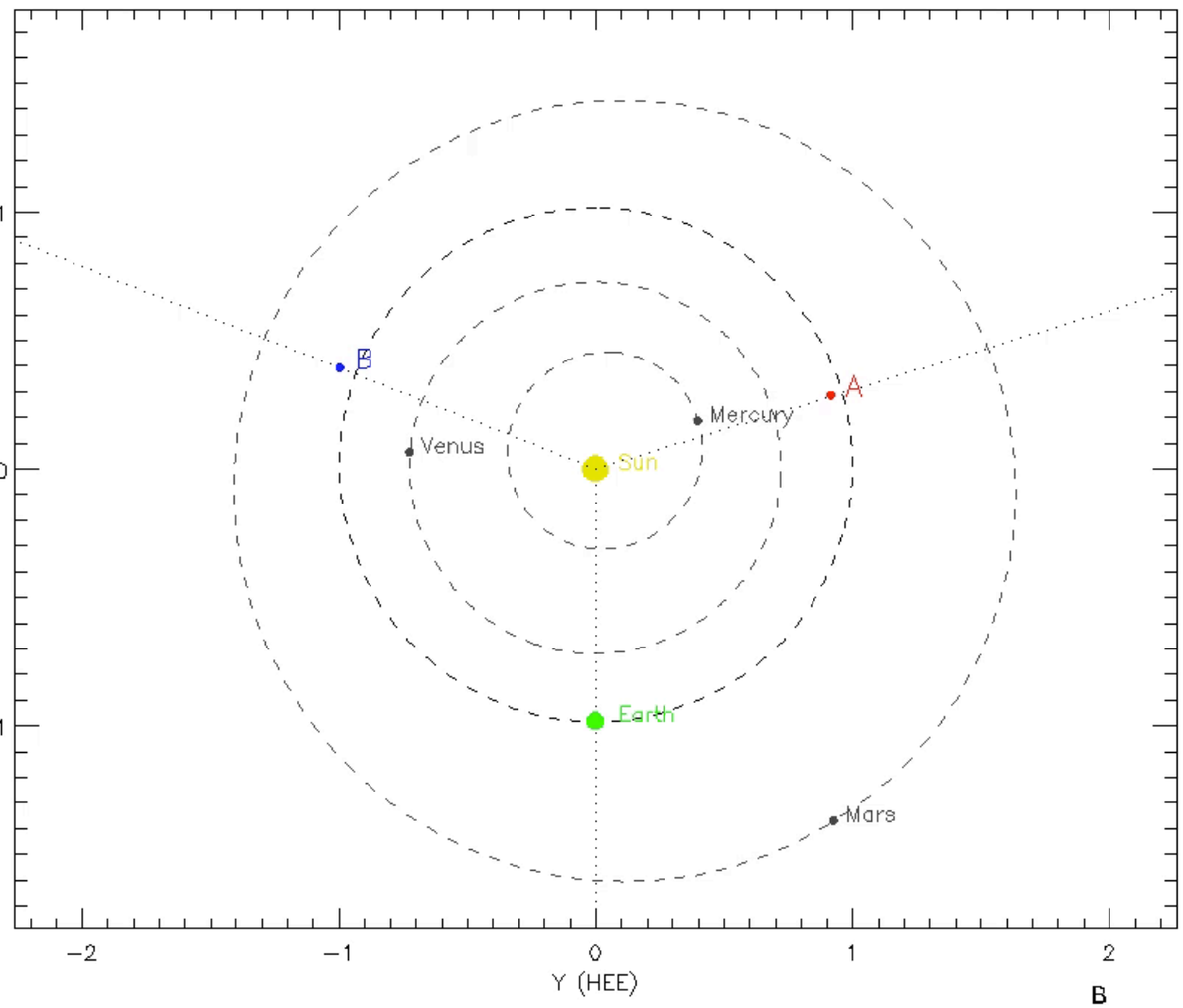


ICMECAT

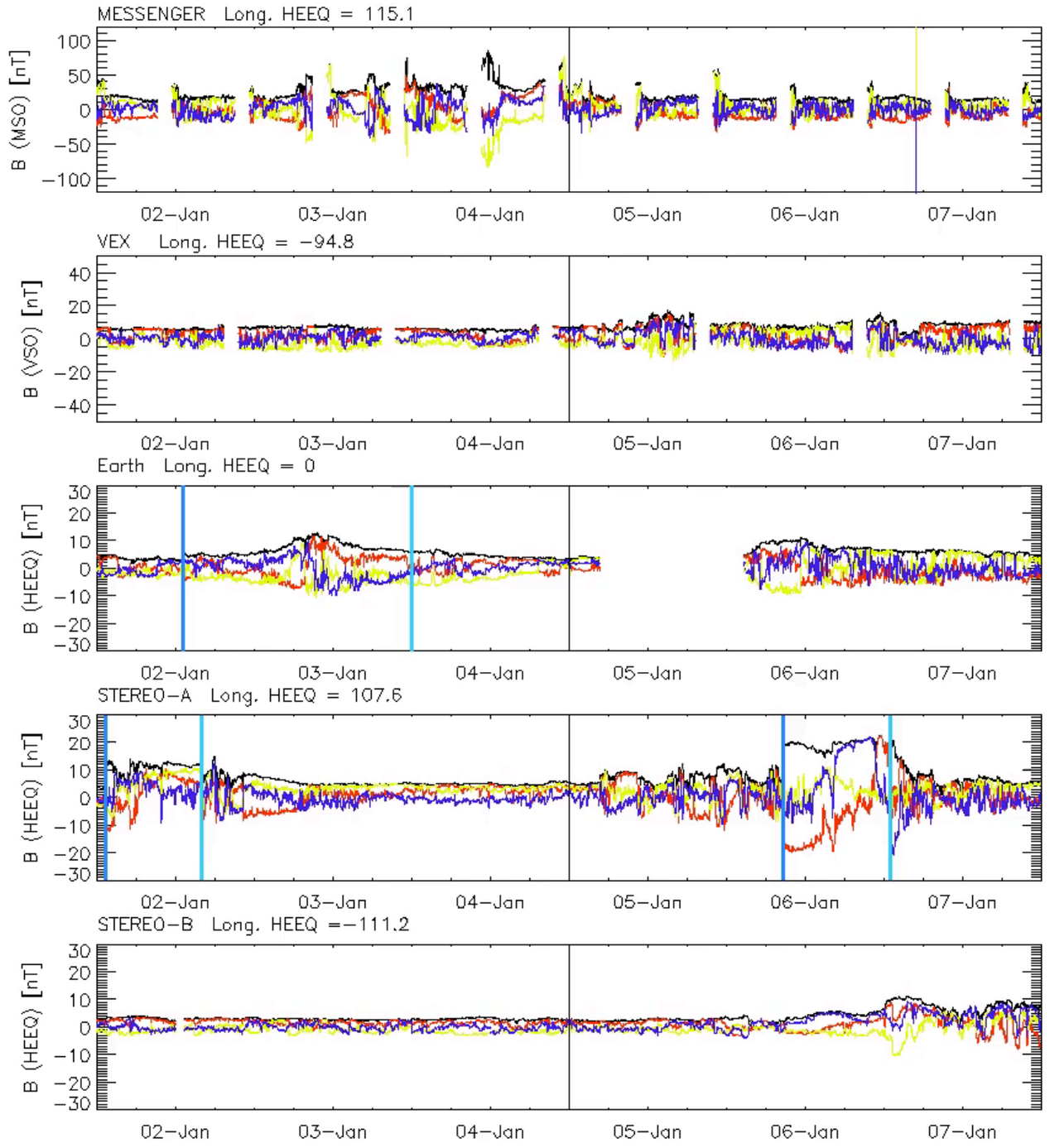
HELCATS in situ magnetic field visualization



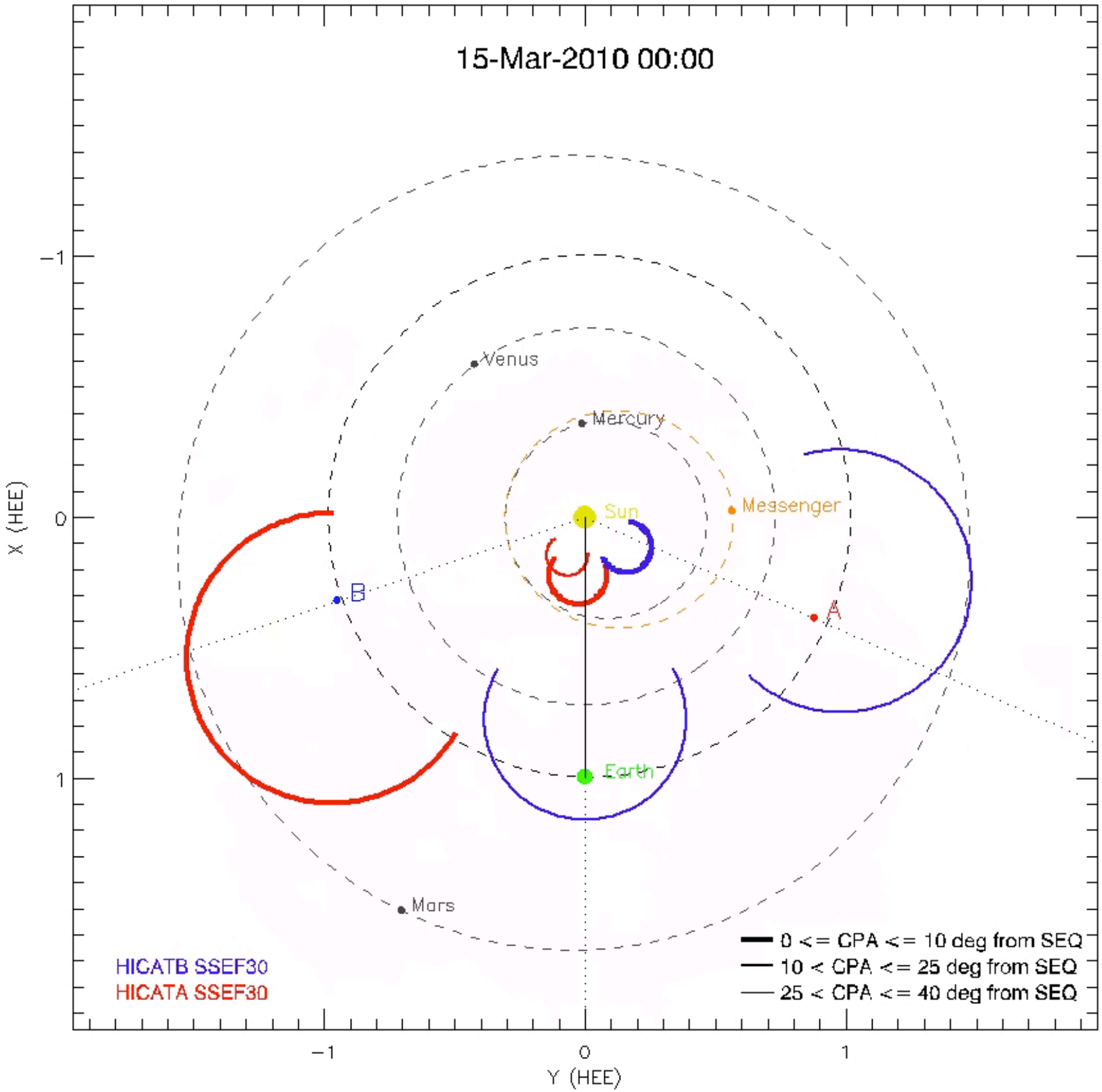
ICMEs: Good/Isavnin NASA Jian

HI CMEs extend over PAs 90/270 and SSEF was successfull.

by C. Moestl & P. Boakes (Graz), A. Isavnin & E. Kilpua (Helsinki)



HELCATS visualization of CME fronts



Plotted CMEs extend over PAs 90/270 and SSEF was successfull. C. Moestl & P. Boakes (Graz) and Jackie Davies (RAL)

Where to go…

Status and Summary

Current Status:
- Basic versions of underlying catalogues are established and visualizations are available (used prelim. HICAT)
- all tasks 4.1-4.3 have been started

Upcoming tasks:

- **HICAT**: when update available, finalize results in ARRCAT (UNIGRAZ)
- **LOWCAT**: update (UGOE)
- **ICMECAT** + **DATACAT**: furnish with parameters and data (UH and UNIGRAZ)
- **LINKCAT**: UNIGRAZ establishes the codes in **python** for
  - **DELI 1:** getting the LINKCAT lists using windows for back- and forward projection (e.g. Tucker-Hood et al. 2015, Möstl et al. 2014)
  - **DELI 2:** validation of the HI modeling results, goodness of arrival time, hit vs. miss etc.

- **Whats in the LINKCAT? How to present many parameters clearly?**
  - basic version: CMEs are selected where there are clear links from sun to in situ
  - put all the different data & catalogues we used on HELCATS catalogue website

- **The established catalogues open up many possibilities on studying CMEs from a massive sample of events - now 1-20 is the standard for studying HI prediction (L5 mission) with arrivals at Earth mainly, we will make this >100 and include Venus, Mercury, Mars, STEREO** …