# COSPAR ISWAT2021 Virtual Working Meeting

## S2-05 – Connectivity team (Rui Pinto, Jon Linker)

### Context and goals:

. determine **causal links** between events at the Sun and at Earth or s/c,
relate **remote observations to in-situ data**.

. **Connectivity for past events and forecasts** for science ops. and space weather

. **Beyond instantaneous mag. field connectivity:** SEP or solar wind propagation, time-dependence

. **Many sources of uncertainty**, **no direct observables** (how to define well-posed validation schemes?)

### The team has be working on:

. Selection events that maximize the possibilities of **relating multi-s/c RS and IS measurements**

. **Three classes of events:** SEP events, low-latitude CHs, calm (solar min) wind conditions

. Defining **diagnostics / metrics**

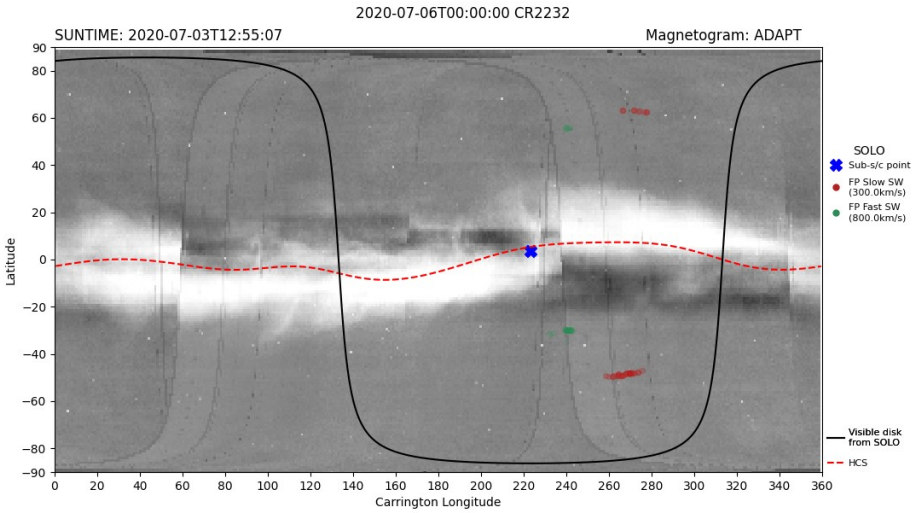
### Team members

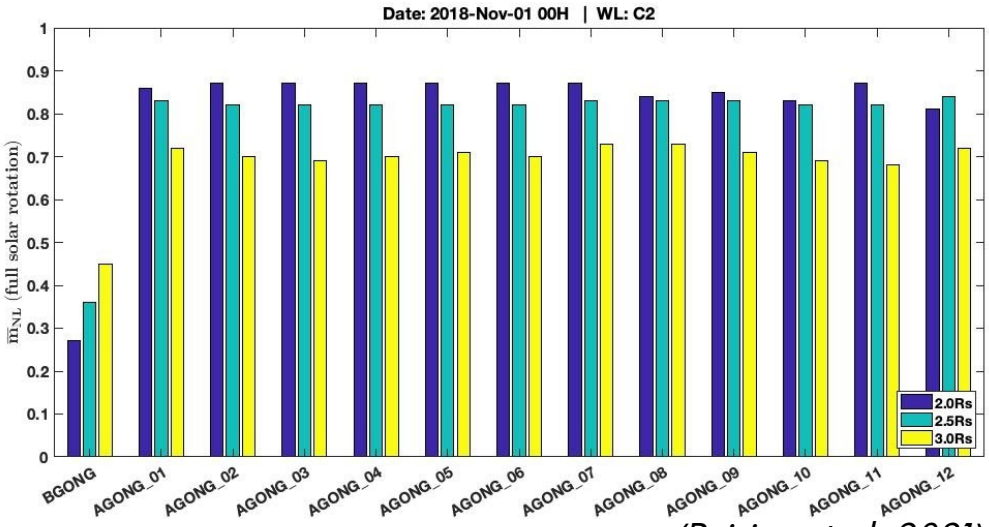
Rui Pinto, Jon Linker, Carl Henney, Nick Arge, Peter MacNeice, Barbara Perri, Martin Reiss, Alexis Rouillard, Clementina Sasso, Gherardo Valori, Marco Velli, Yannis Zouganelis, Karin Muglach, Yuan-Kuen Ko, Tamas Gombosi

# Previous discussions on diagnostics for ensemble reduction

**Evaluation criteria based on global mag field topology:**

. rank **magnetogram + extrapolation parameter combinations** based on **HCS position vs. white-light** bright band




*(Poirier et al, 2021)*

*http://connect-tool.irap.omp.eu/*

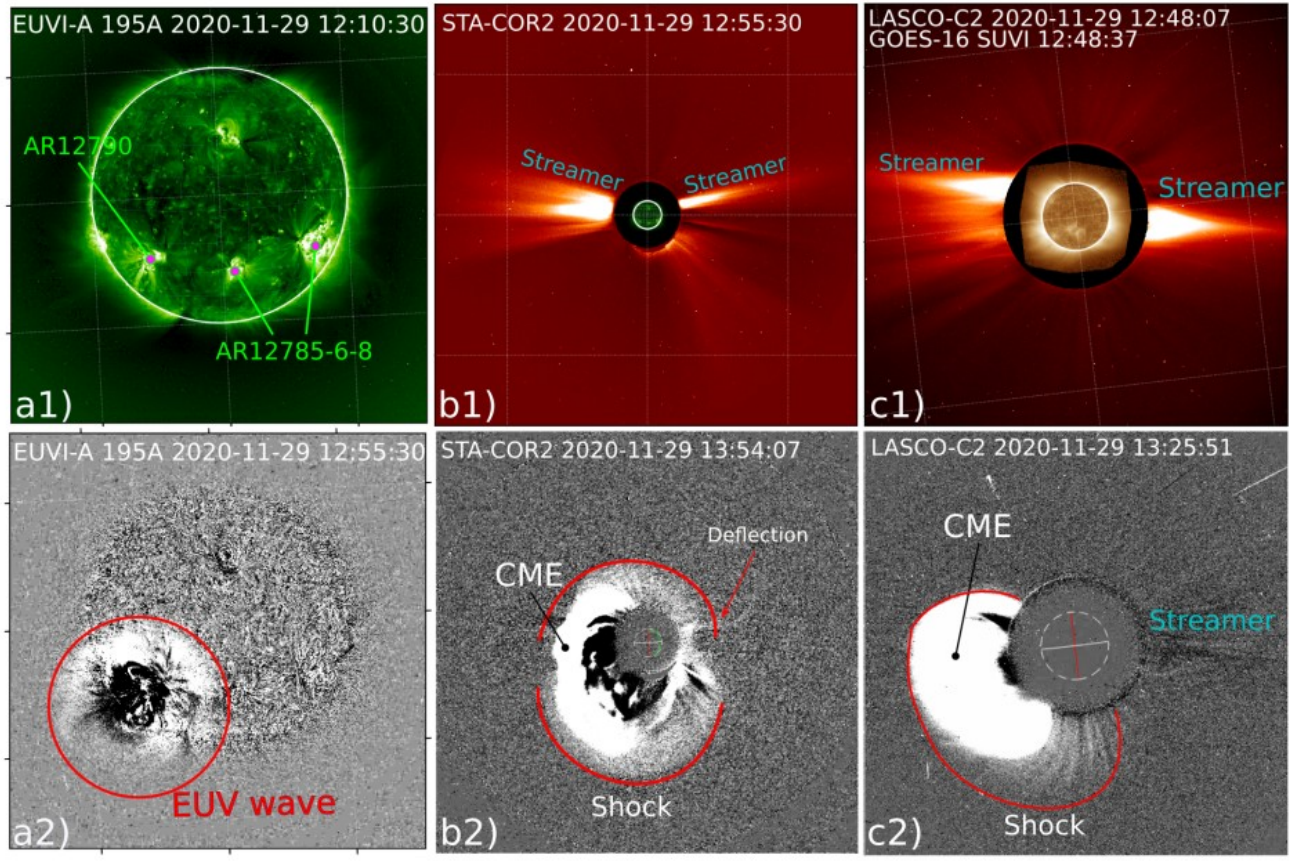
**Evaluation criteria based on in-situ properties:**

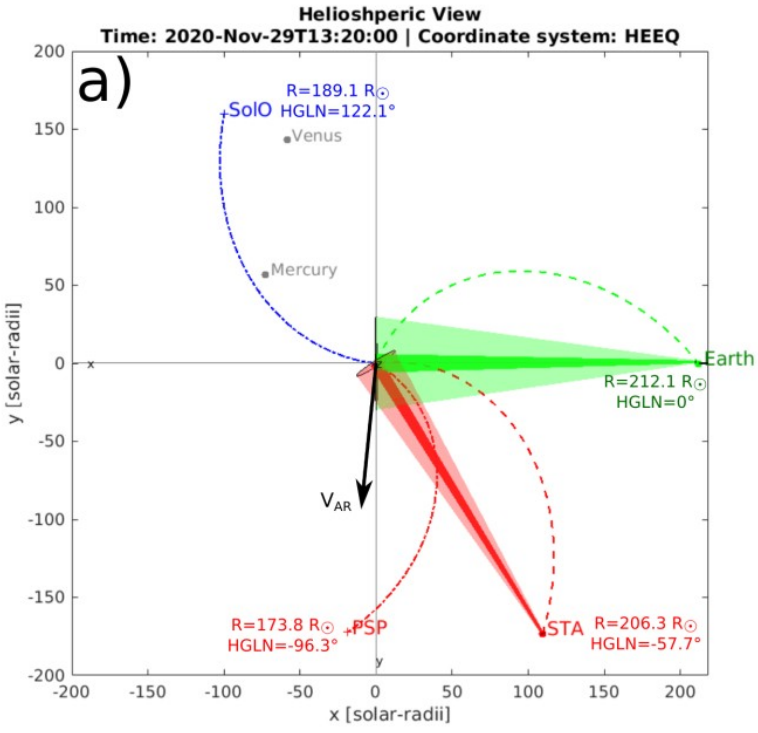
. rank **magnetogram + extrapolation parameter combinations** based on in-situ **polarity and wind speed**

**Other criteria?**

. compare to observed coronal features, types of wind stream vs. source, abundances, particle detection?

# SEP event (following CME on 2020-11-29)



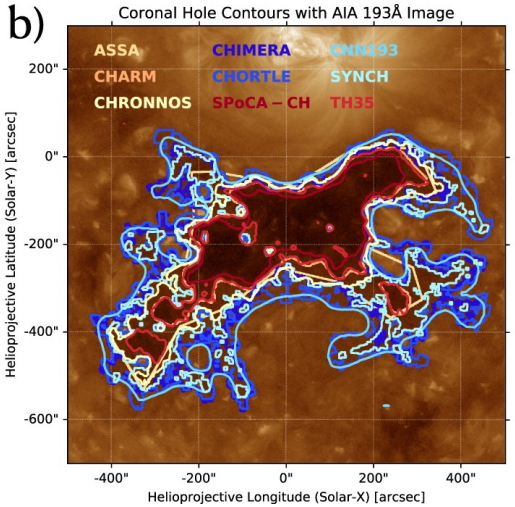



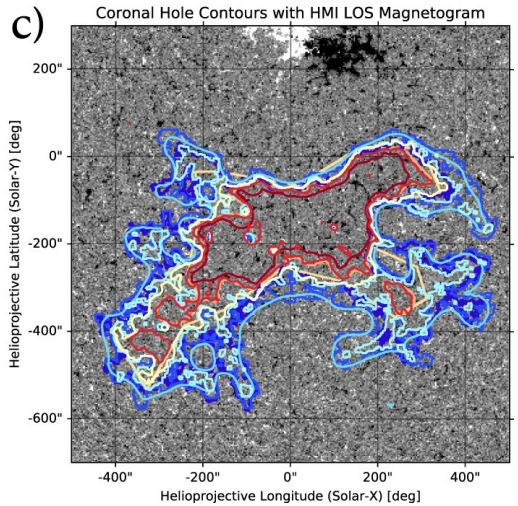

*(Kouloumvakos et al, 2021)*

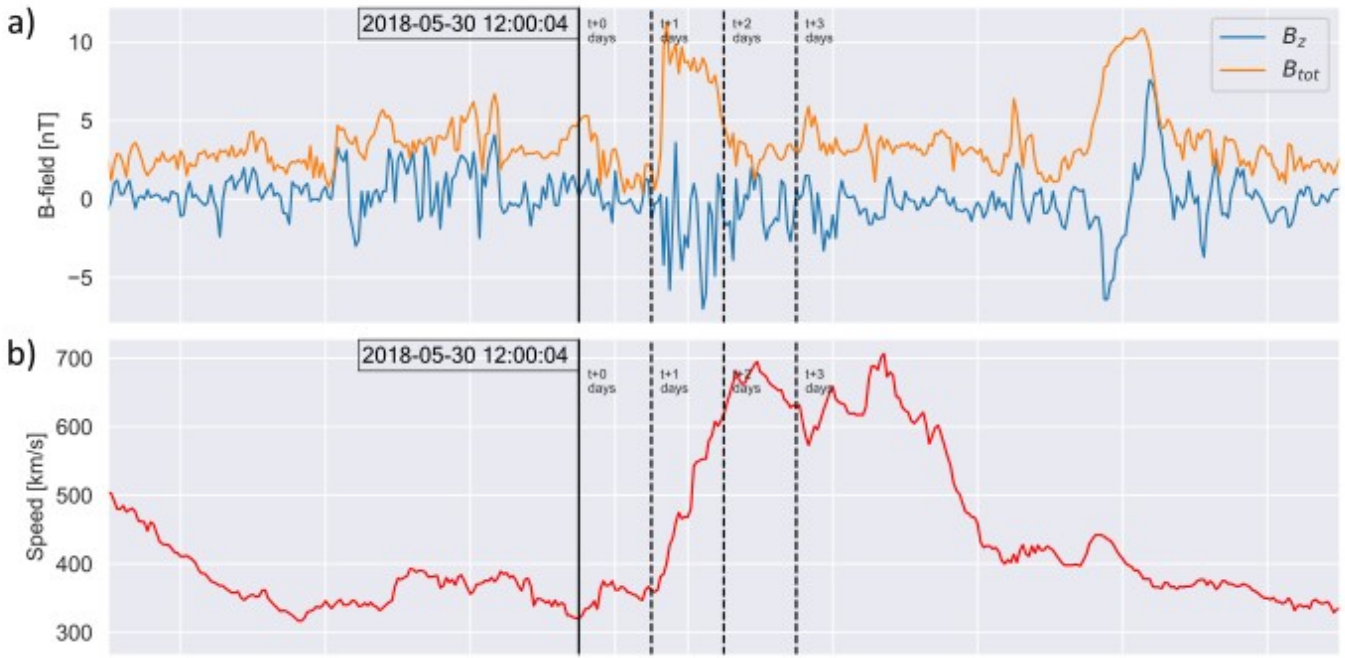
**Test for possibility of SEP detection at all s/c position**

**CME → time-dependent connectivity** (test to MHD models, but also to "background corona" models)

# Coronal hole boundaries (cross-work with S2-01)




**Uncertainties in CH boundary detection**

**CH properties → HSS properties, complementary information for assessing uncertainties in solar wind source mapping**

*(Reiss et al, 2021)*

# Coronal holes, spectroscopy

**Well defined low-lat CHs**
(CRs 2176 and 2183)

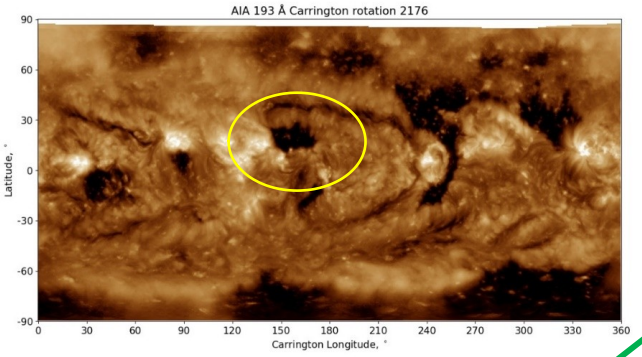
**Hinode/EIS spectral diagnostics**

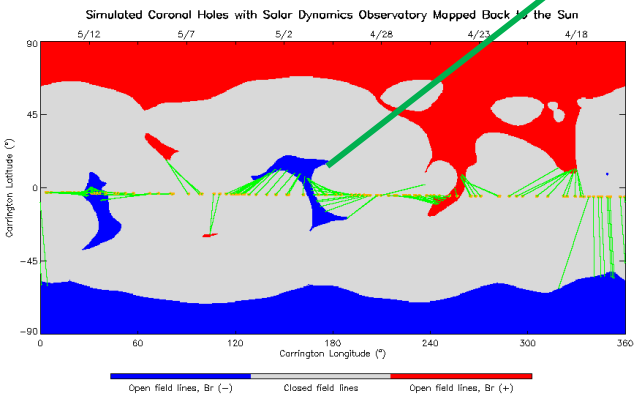
**Wind streams with**
**low and high alfvenicity**

**HCS crossings**

**Stream interactions b/w streams with the same polarity**

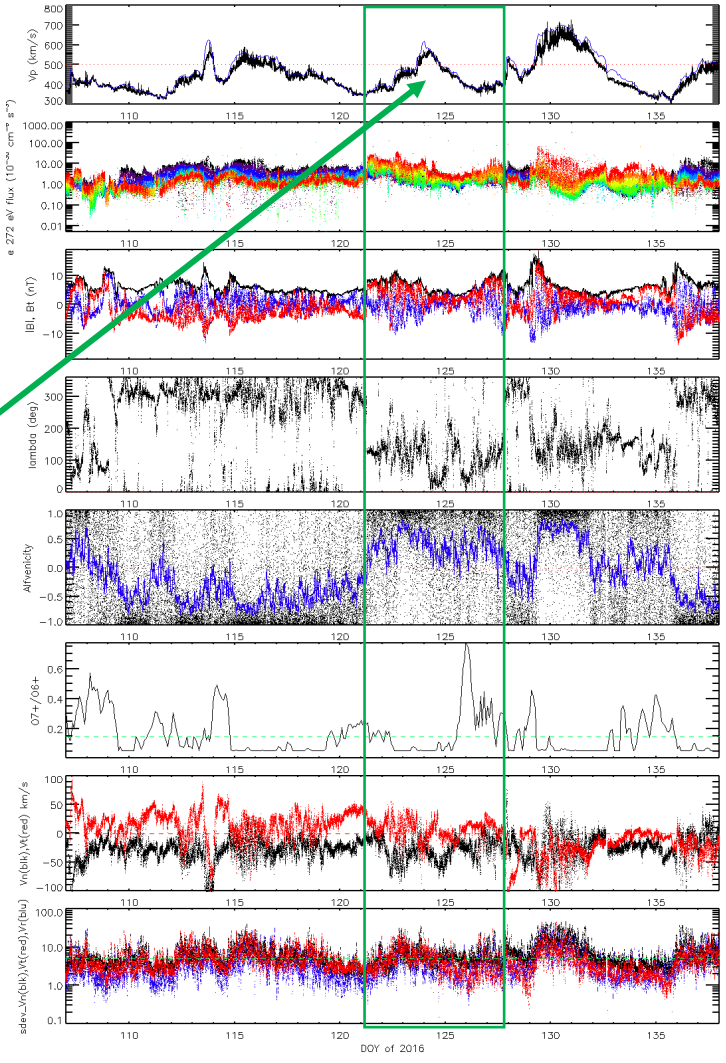
**Some info on relation to fine structure**
(e.g transition from core to CH boundary)



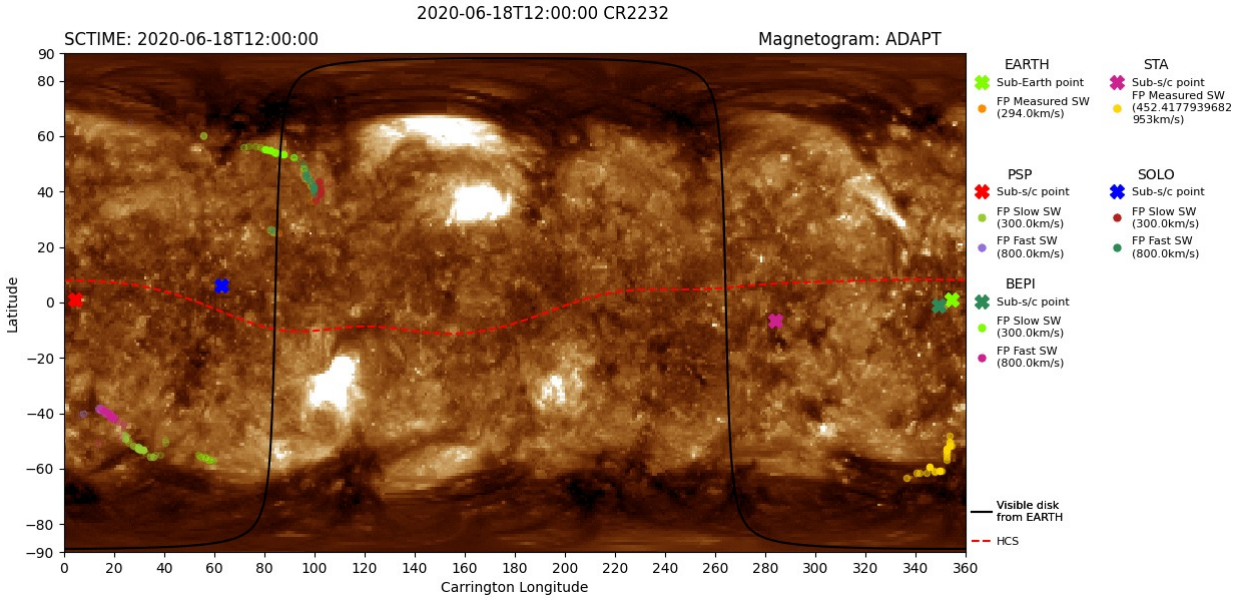



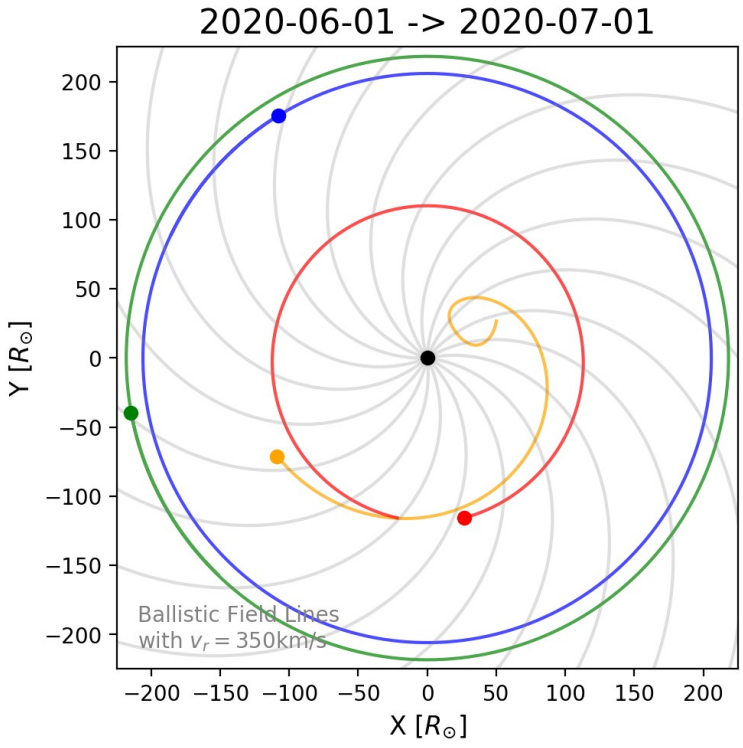

Predictive Science MHD Model (CR2176)

*(Ko, et al)*



# Calm solar wind




**Consecutive probing of same solar wind streams/wind sources** (circa June 2020)

**Connections (with low-uncertainty) to polar CH extensions**

**Multiple s/c data** (PSP, SolO/SWA, STA, L1)

*(Pinto, et al)*

# Summary

## S2-05: Sun to spacecraft/Earth connectivity team

- **Establish causal links b/w solar and heliospheric events, RS and IS measurements**
  (scope: science, s/c ops., space weather warnings)

- **Cross-work with other teams**
  (SEP, CH boundary, Helio magnetic field and solar wind)

## Tasks

1. **Rank the different events**

2. **Produce connectivity estimations**
   - all/as many events as possible
   - as many model/dataset combinations as possible

3. **Qualitative analysis**
   - check for consistency of different diagnostics, etc

4. **Metrics?**