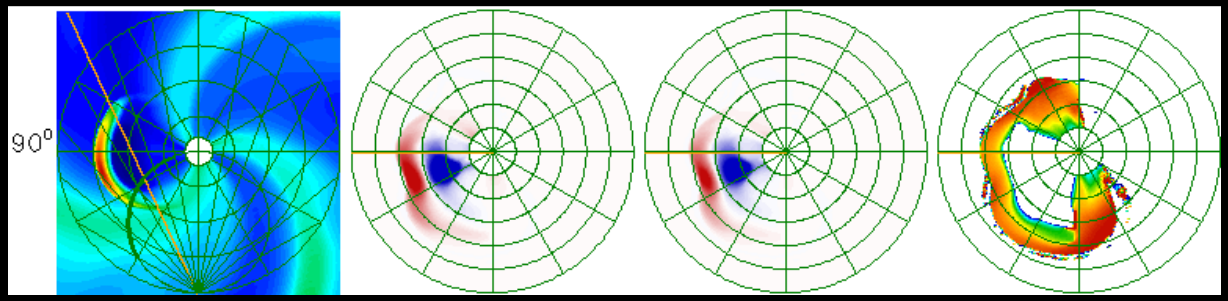
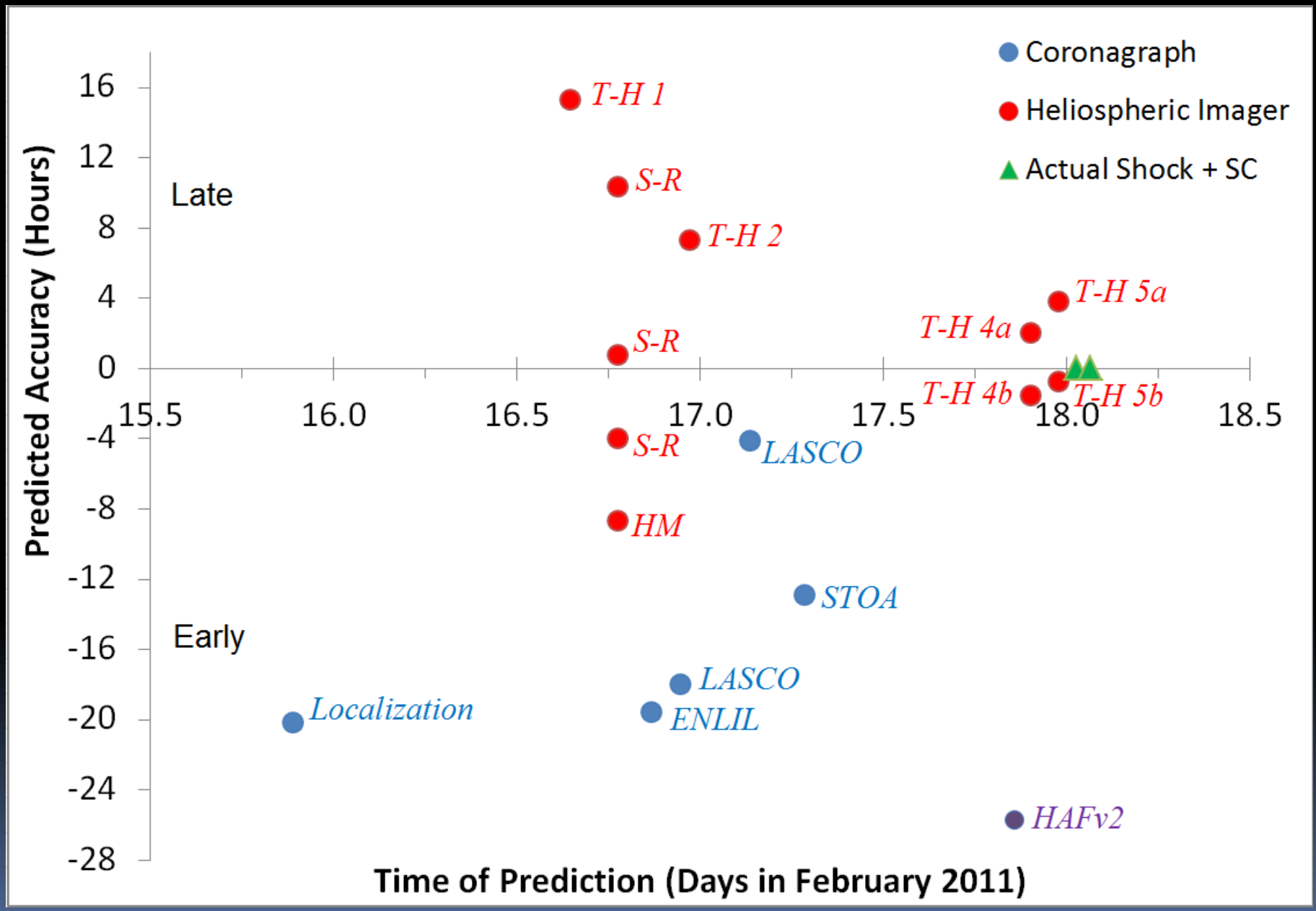
Heliospheric Imaging at L5



T.A. Howard & C.E. DeForest
Southwest Research Institute, Boulder, CO, USA

Predicting the St Valentine's Day CME



White Light Imaging

The Binding Agent Between Solar Observations, In-situ Measurements, and Modeling

~~Problems With Coronagraphs~~

~~Background removal~~

Nature of Thomson scattering – broad sensitivity across LOS ✓

Observed medium is optically thin

Leading to

Observing range close to the Sun

Uncertainty in photometry ✓

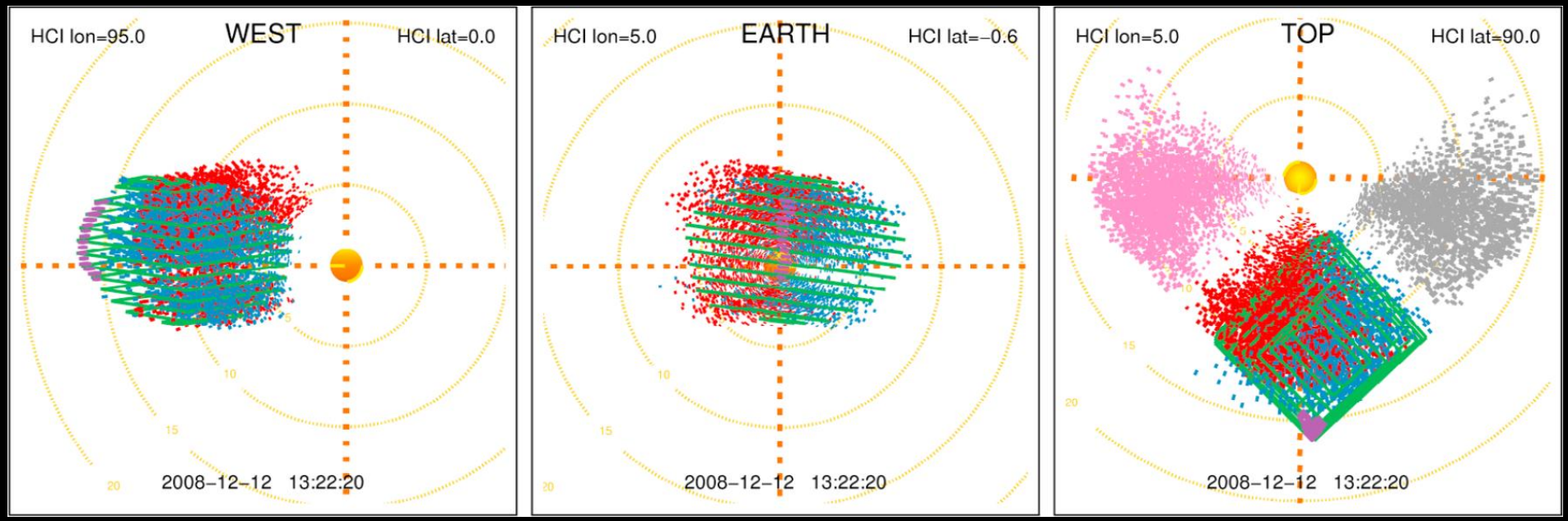
Cannot track features across the sky ✓

Still work to do →

No 3-D information ✓

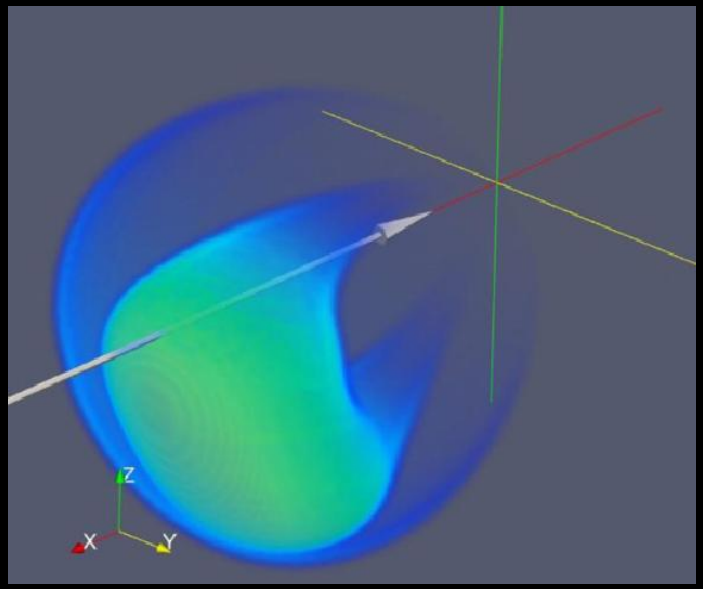
Extracting 3-D Information

With Coronagraphs

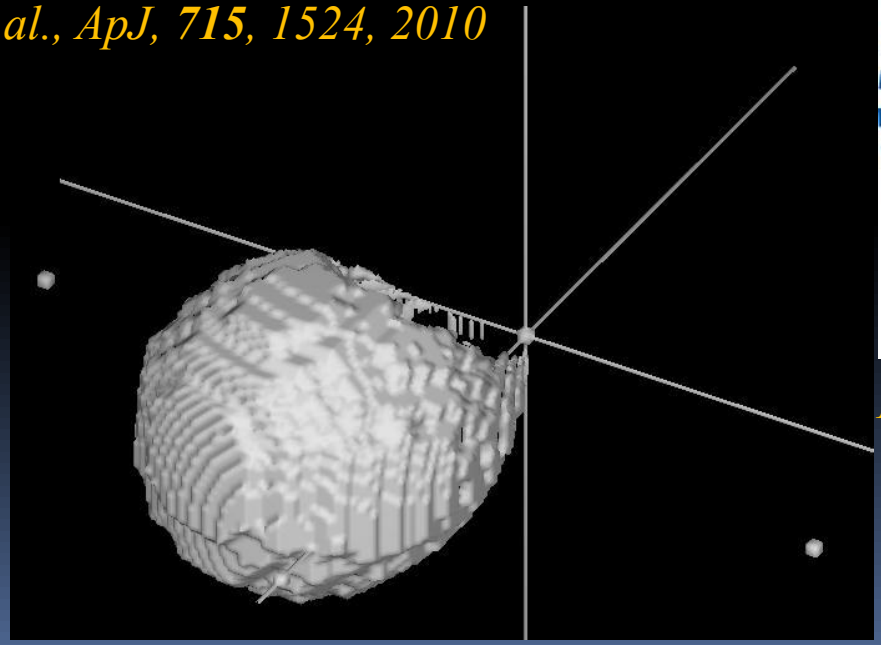


de Koning and Pizzo,
Space Weather, 9, S03001, 2011

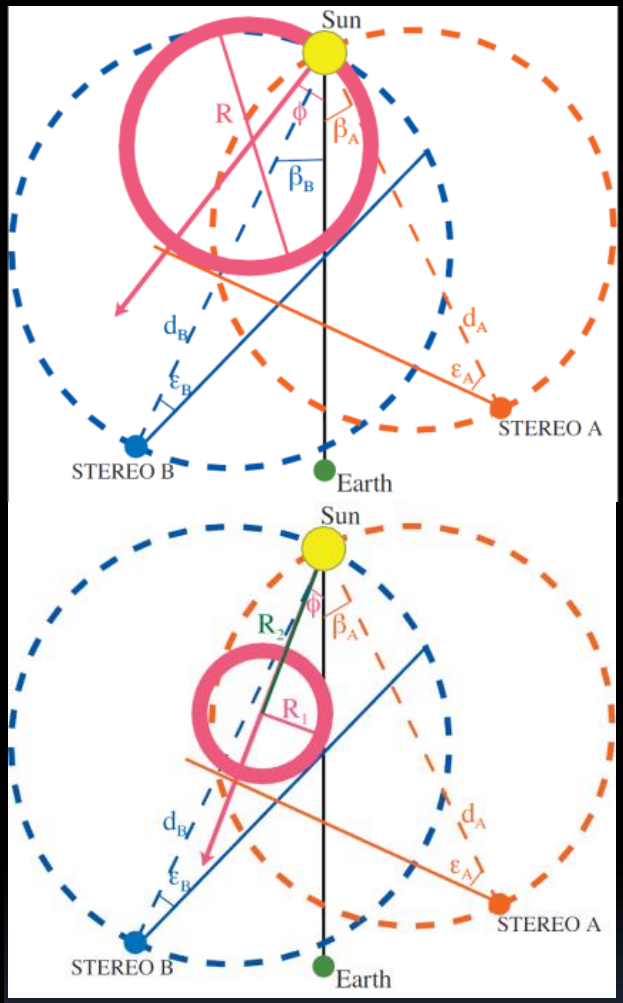
3. Extracting 3-D Information



*Wood et al., ApJ, **715**, 1524, 2010*



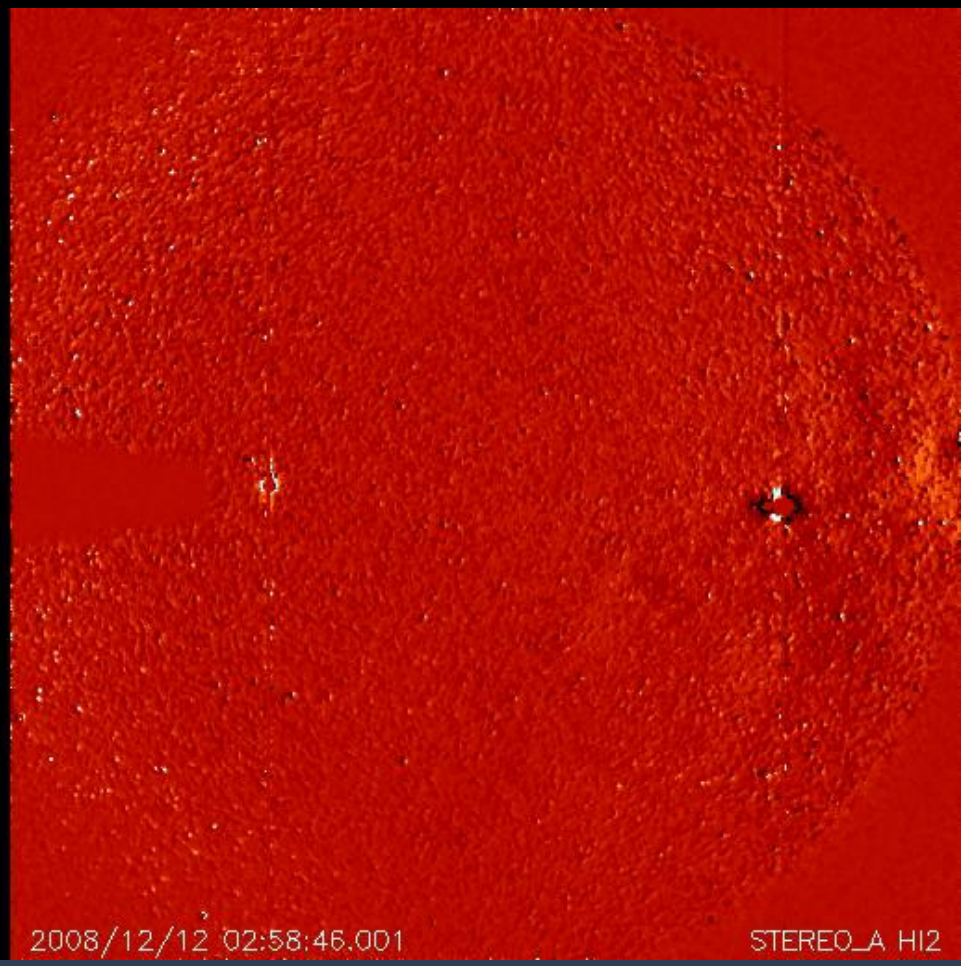
*Howard & Tappin, Space Weather, **8**, S07004, 2010*



*Lugaz et al., ApJ, **715**, 493, 2010*

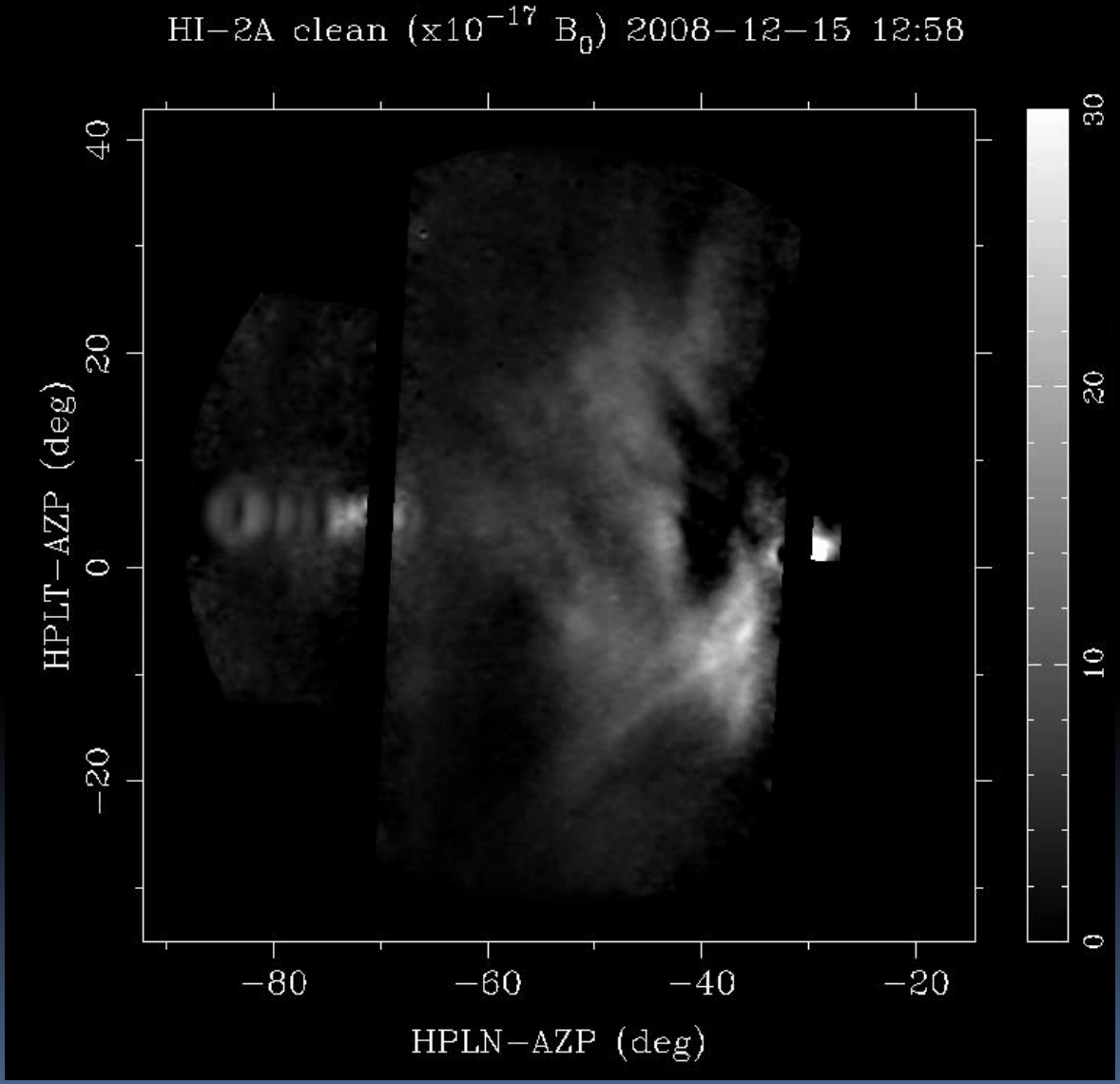
Photometric Measurements

Prior to 2011



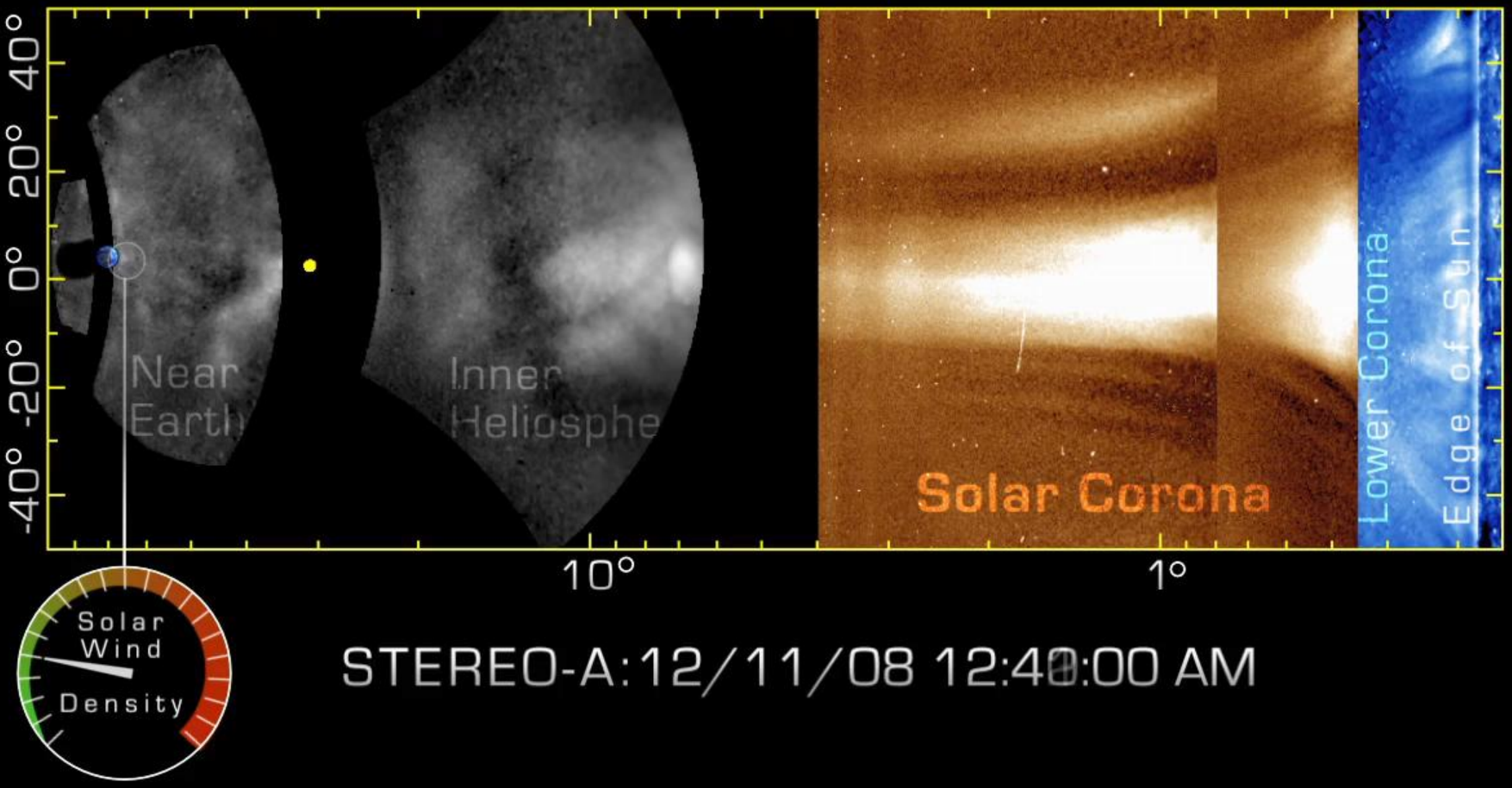
Photometric Measurements

Post-2011

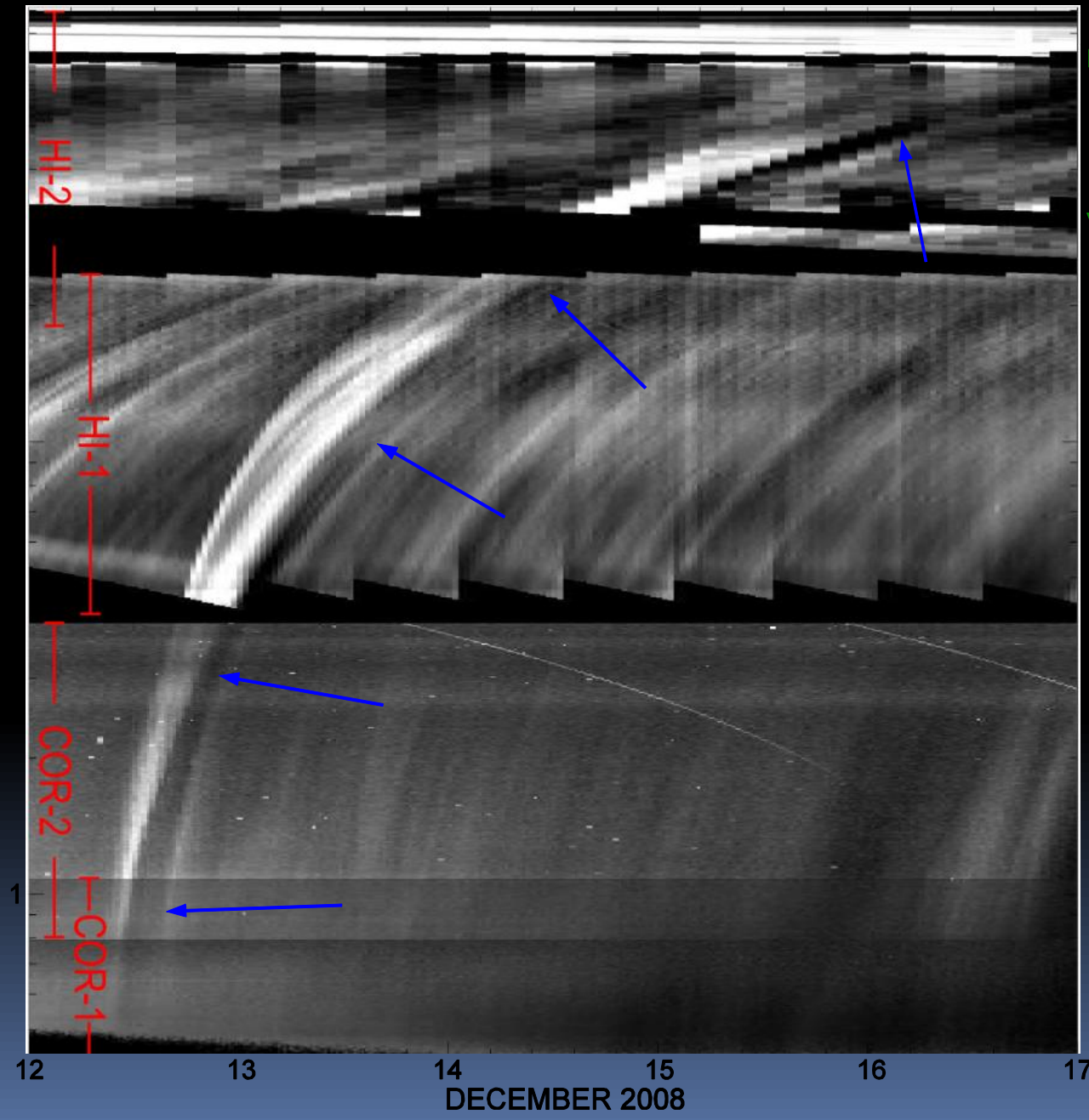


*DeForest et al., ApJ, **738**, 103, 2011*

Continuous Tracking of Features Across the Sky



2. Continuous Tracking of Features Across the Sky



Howard & DeForest, ApJ, 746, 64, 2012.

The Future

Remaining Challenges

Resolving smaller features

Operational capabilities

3-D reconstruction

Modeling comparison

Big picture narrative

The Future

Transferring to Operations

High speed downlink ✓

High speed 3-D reconstruction ✓ Demonstrated with STEREO

Large data rate ✓

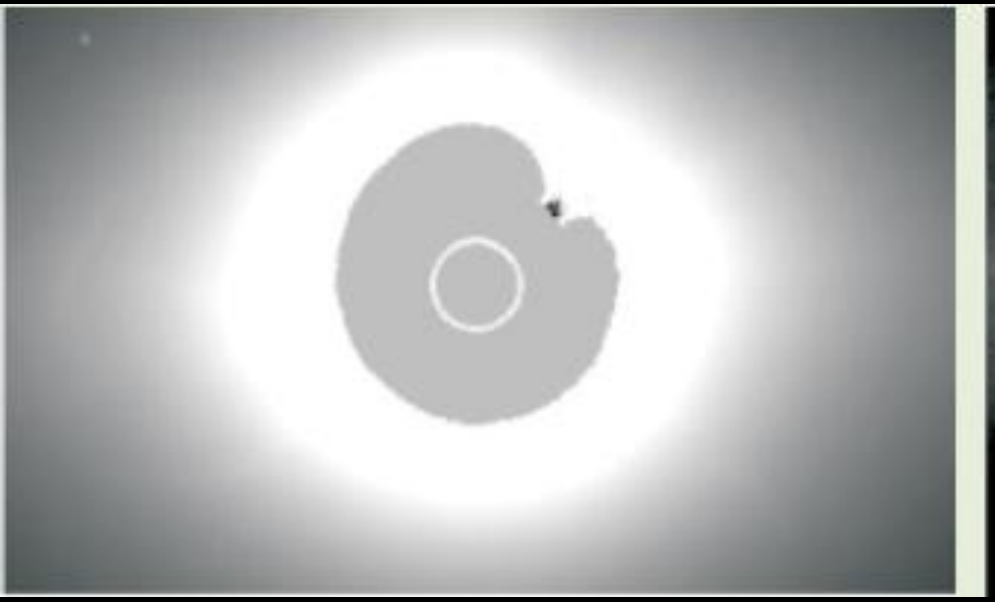
Reliability
(Traditional engineering or scattershot constellation approach)

Buy-in from Space Weather Prediction Institutions

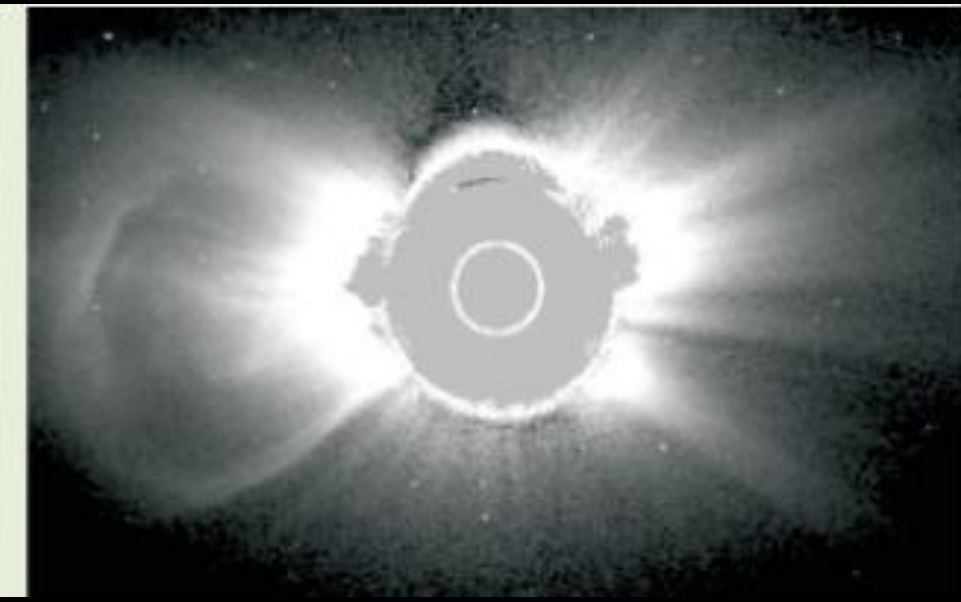
→ Flight Demonstration (Polarizing HI is TRL6; cf. unpolarized, TRL9)

The Future

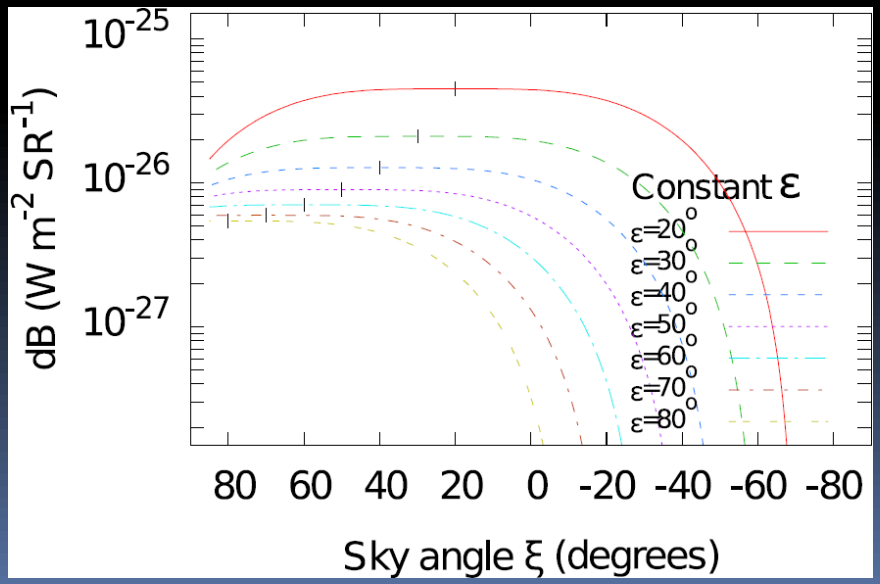
The Benefits of Polarimetry

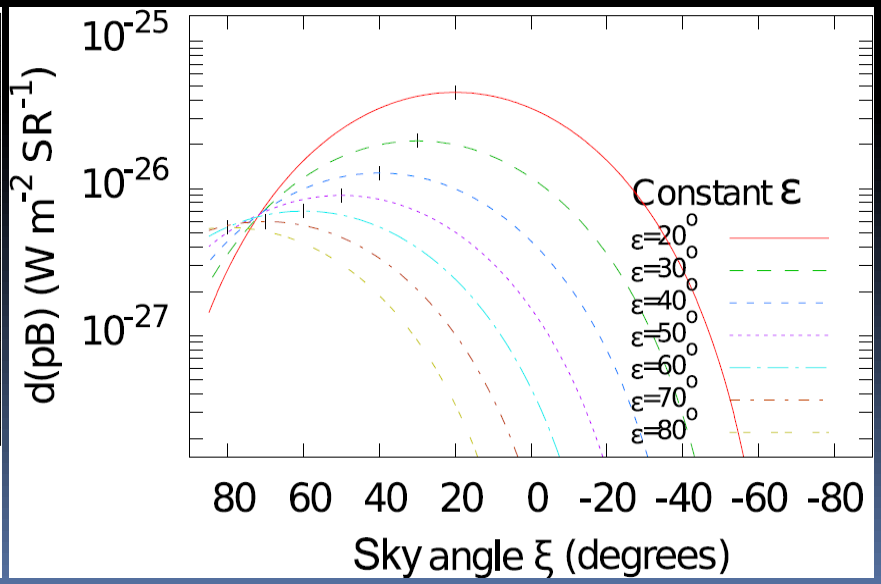


Unpolarized

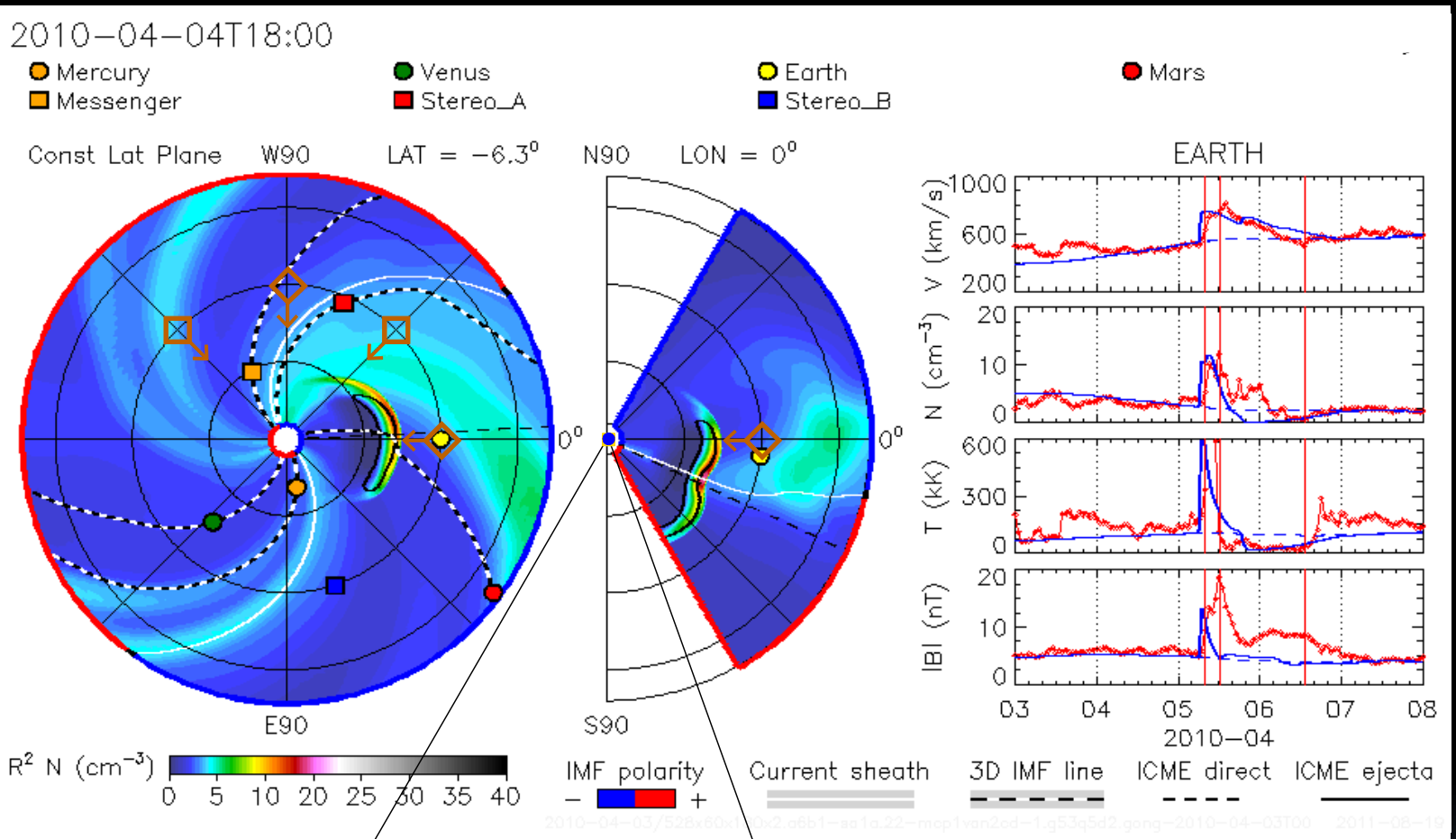


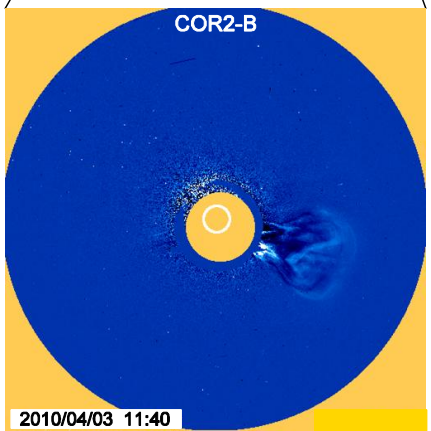
Polarized





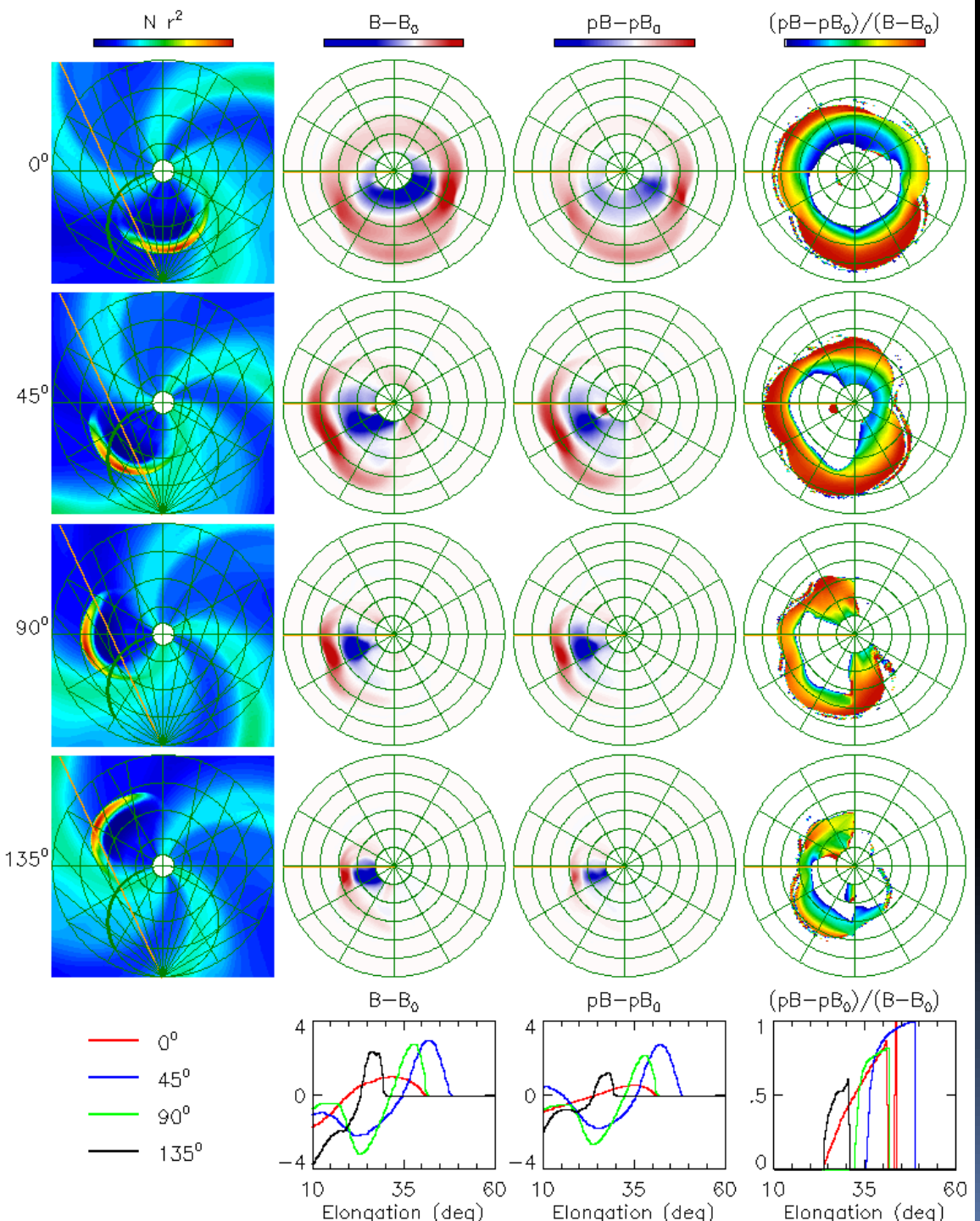
The Future





*Howard et al., ApJ., **765**, 45, 2013*

Example Event: April 2010

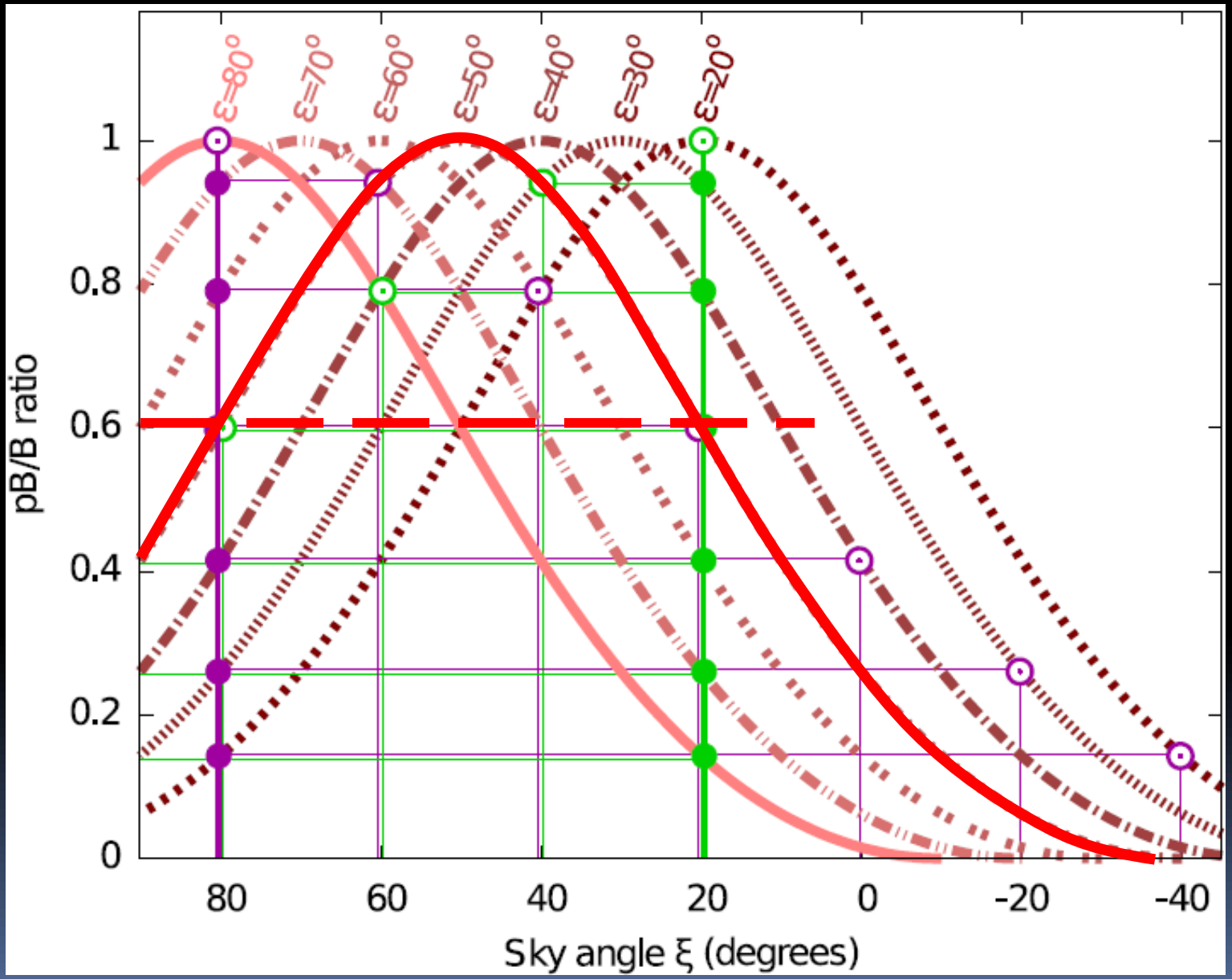


*Howard et al., ApJ., **765**, 45, 2013*

The Future

3-D Identification

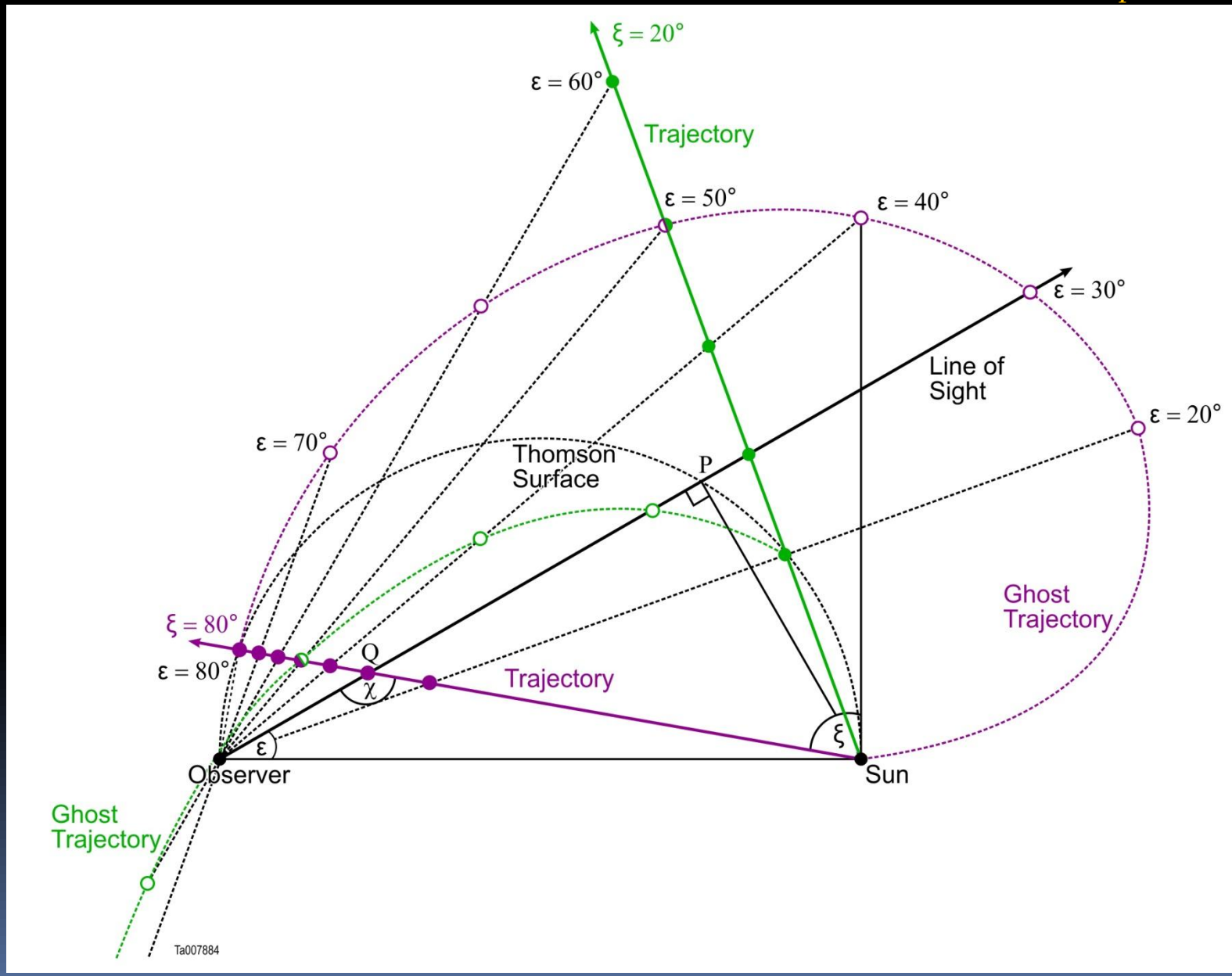
*DeForest et al., ApJ., **765**, 44, 2013*



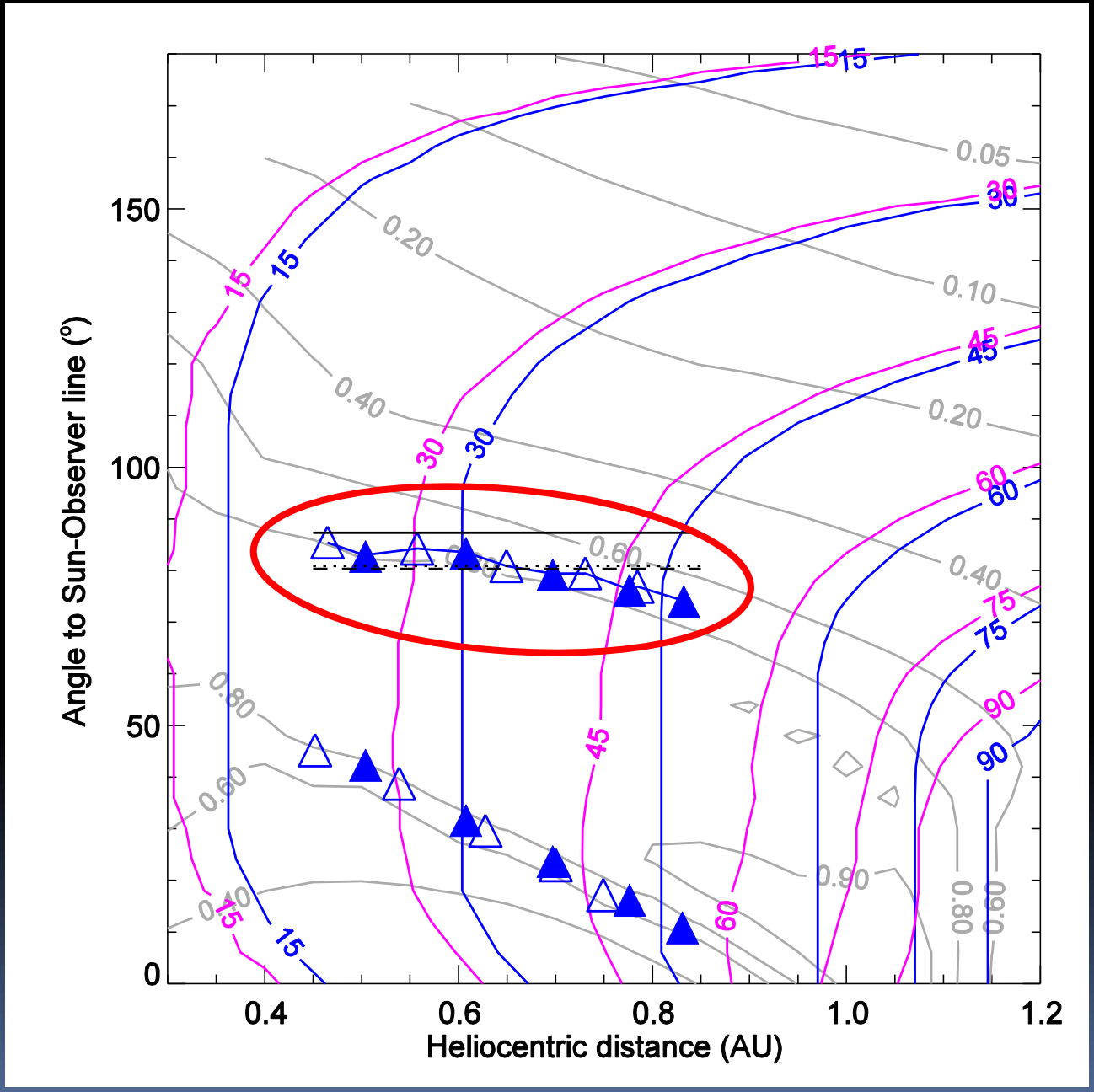
The Future

3-D Identification

*DeForest et al., ApJ., **765**, 44, 2013*



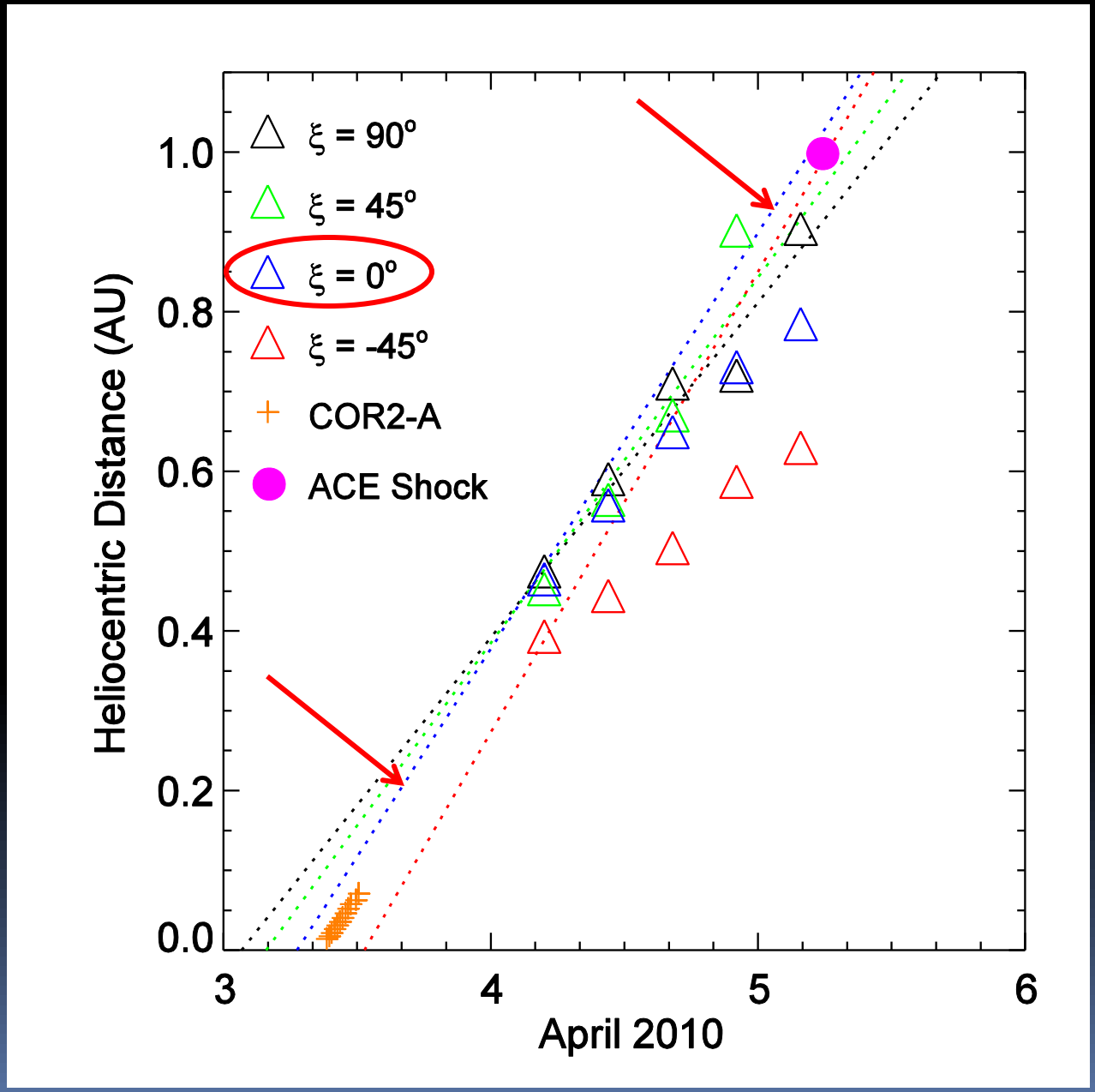
60° Wide CME



*Howard et al., ApJ., **765**, 45, 2013*

60° Wide CME

Distance-Time



*Howard et al., ApJ., **765**, 45, 2013*

L5 Mission Benefits (from and to)

1. Bridges the gap between solar and Earth observations

2. Enables 3-D reconstruction capabilities not available from coronagraphs

3. Off-axis viewpoint enables measurement of CME substructure

4. L5 Provides a Continual Optimal View (60°) of the Sun-Earth line

5. Depolarization indicates CMEs off the Sun-Earth line