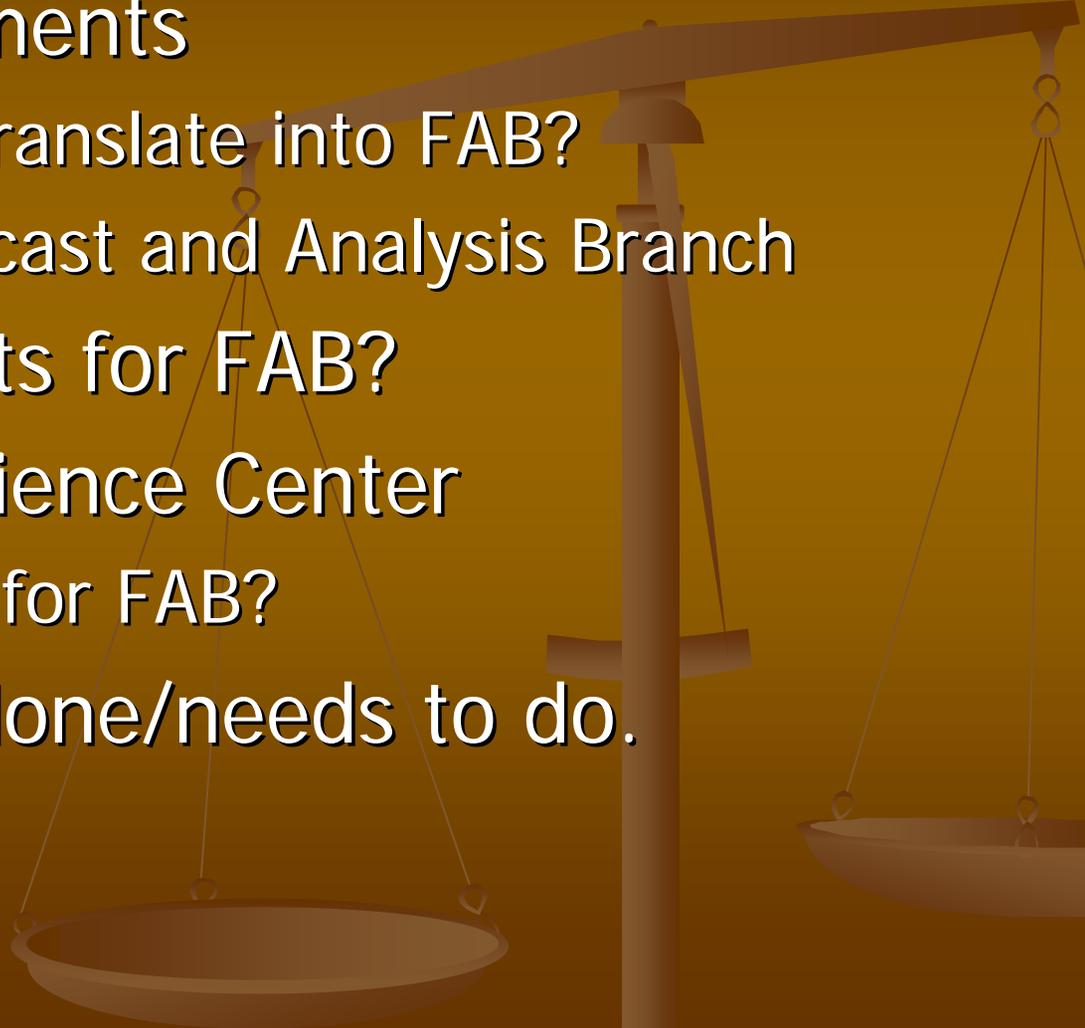
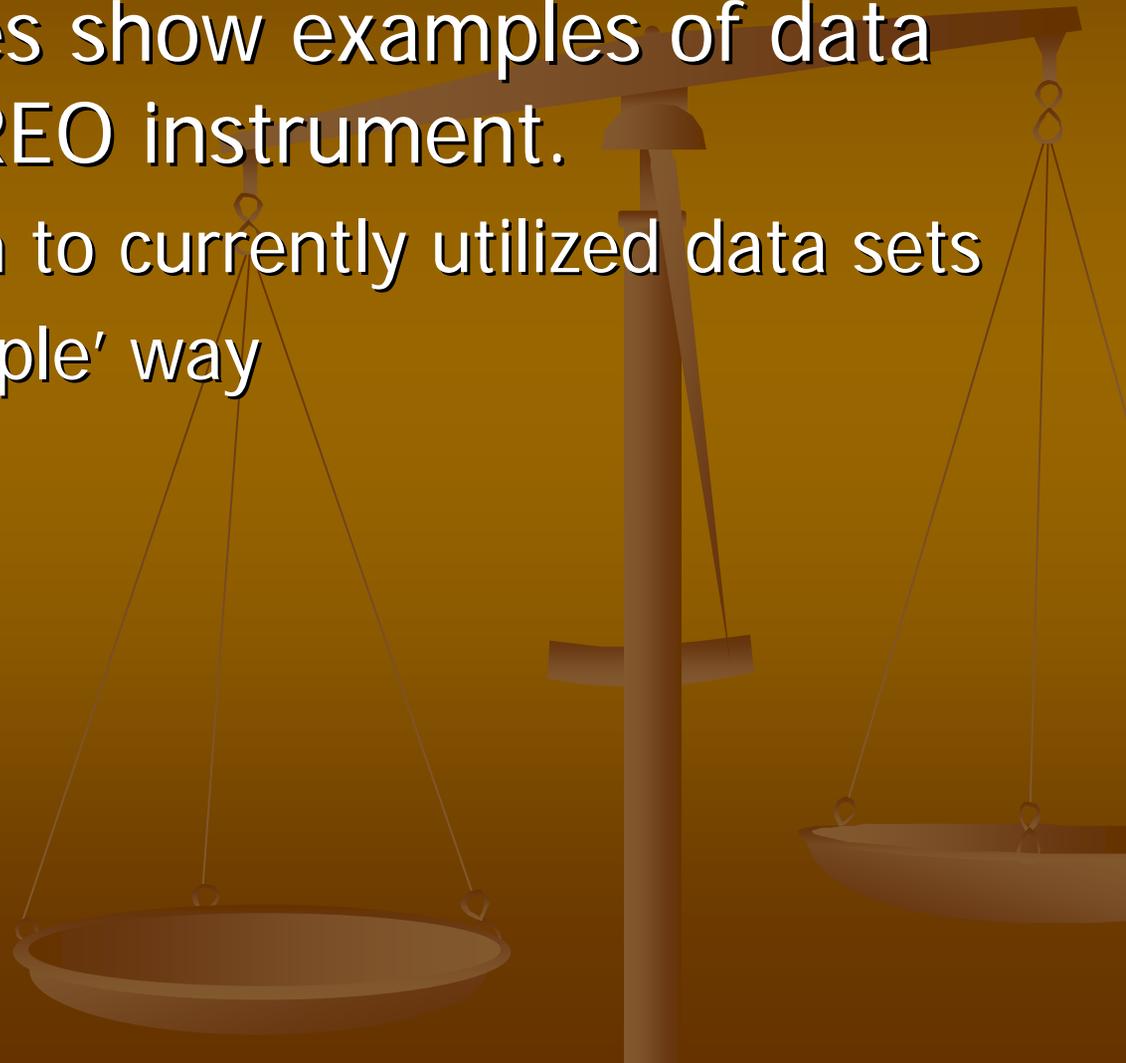


# Outline

- STEREO Instruments
    - How do these translate into FAB?
    - FAB is the Forecast and Analysis Branch
  - Obvious products for FAB?
  - The STEREO Science Center
    - Other products for FAB?
  - What SEC has done/needs to do.
- 

# Comparing STEREO to current data streams

- The next 5 slides show examples of data from each STEREO instrument.
  - Compares them to currently utilized data sets
  - In a rather 'simple' way



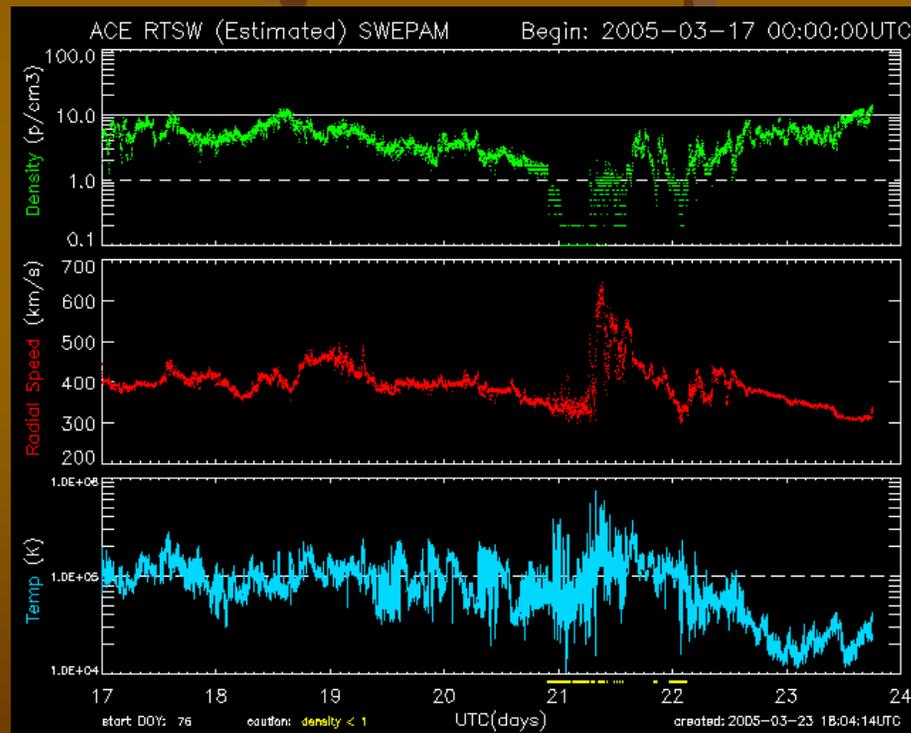
# How does PLASTIC translate to FAB?

- Think SWEPM

Density

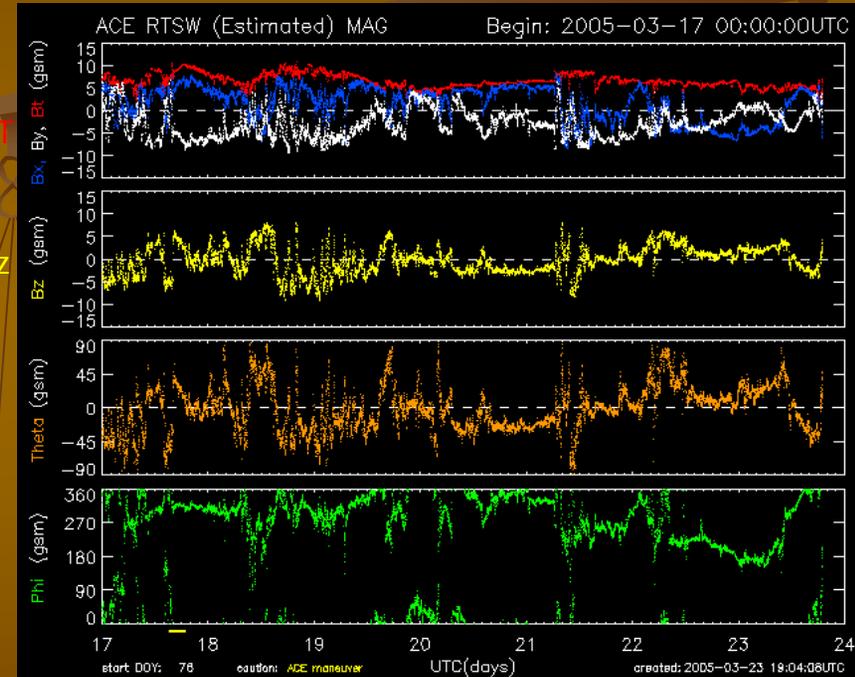
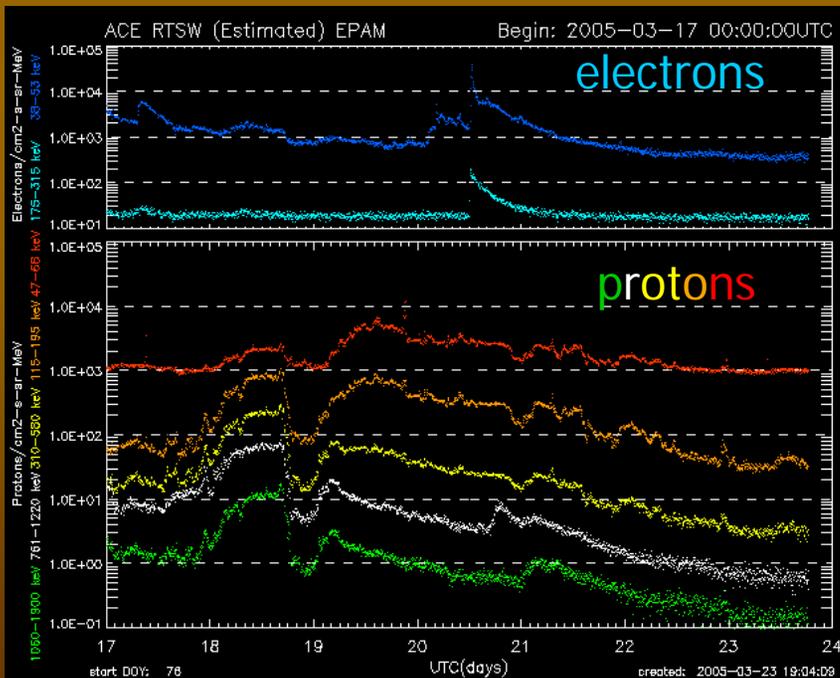
Speed

Temperature



# How does IMPACT translate to FAB?

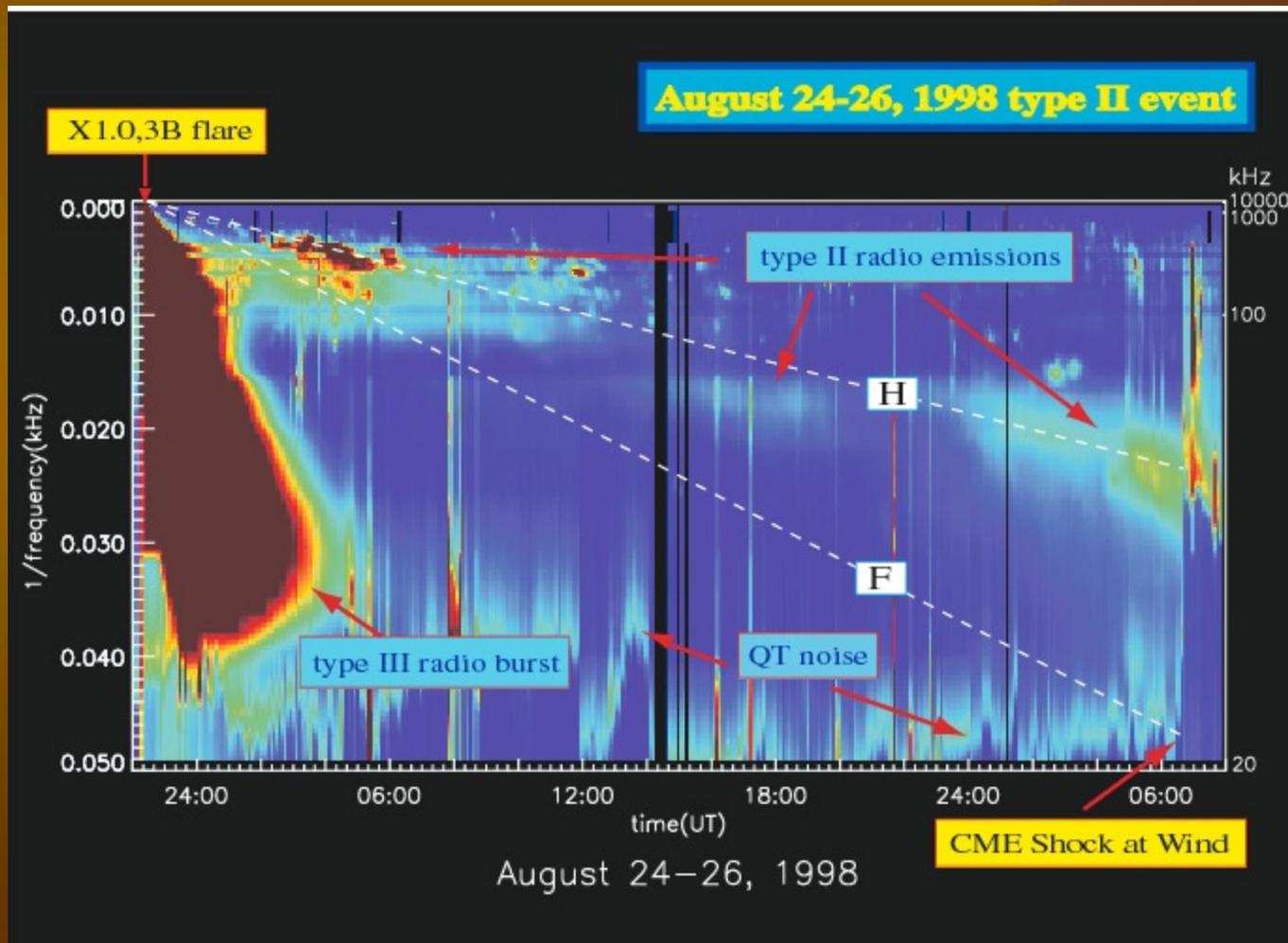
- Think EPAM and MAG



B<sub>x</sub>  
B<sub>y</sub>  
B<sub>z</sub>

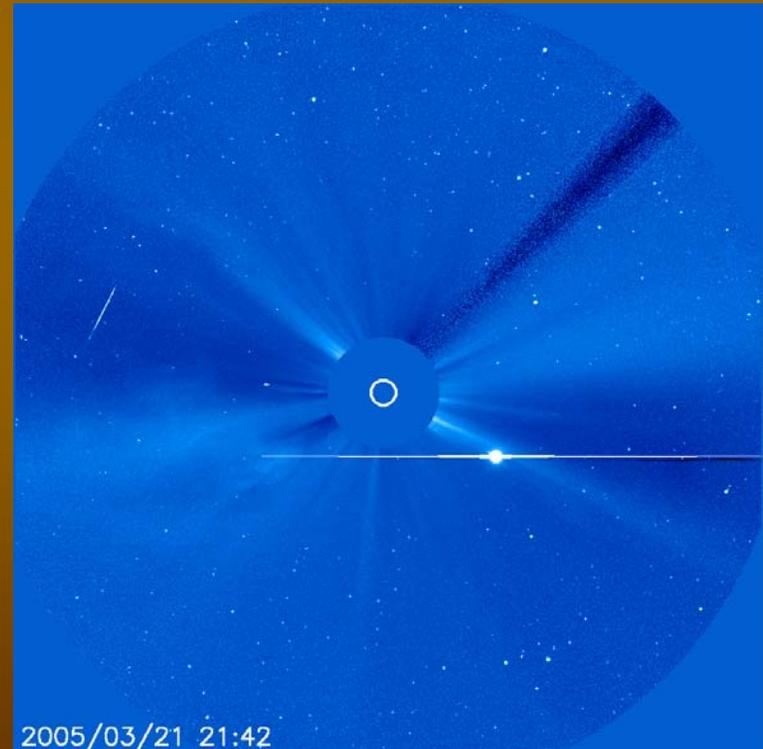
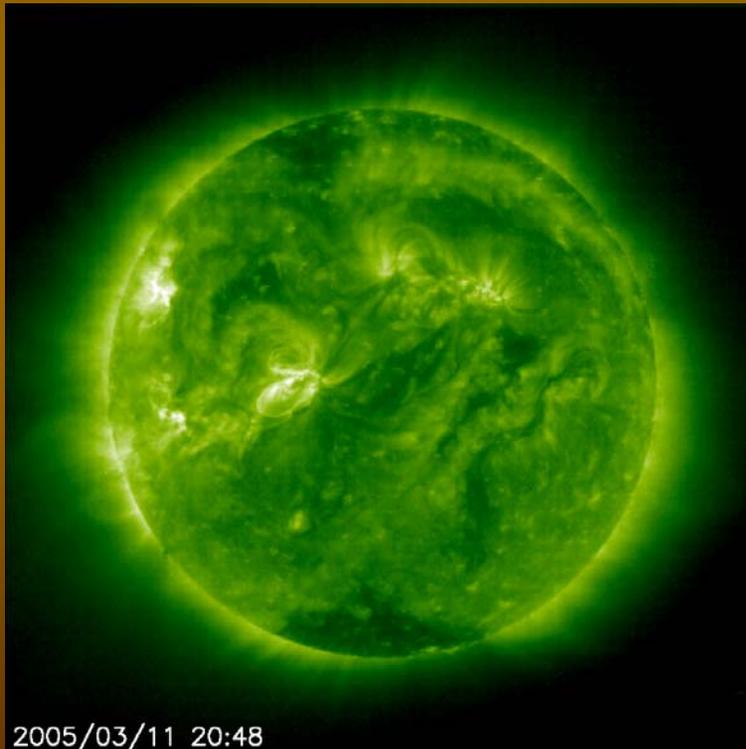
# How does SWAVES translate to FAB?

- Type-II speeds, all the way from Sun to Earth



# How does SECCHI translate to FAB?

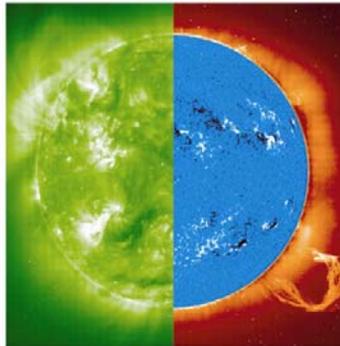
- Think EIT and LASCO



# Don't forget about HI

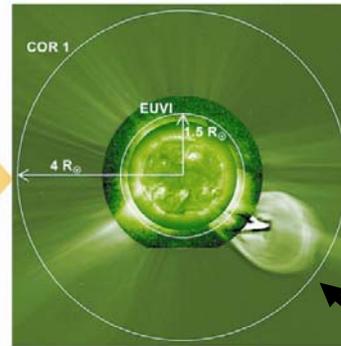
## SECCHI Exploration of CMEs and the Heliosphere on STEREO

- A. What Configurations of the Corona Lead to a CME?
- B. What Initiates a CME?
- C. What Accelerates CMEs?
- D. How Does a CME Interact With the Heliosphere?
- E. How do CMEs Cause Space Weather Disturbances?



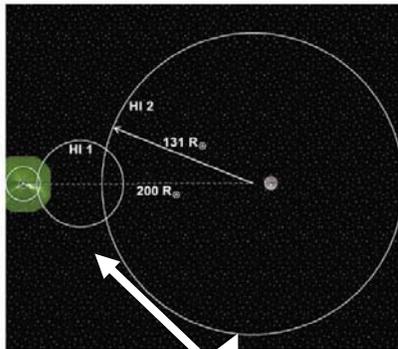
**A. Explore the Magnetic Origins of CMEs**

- Photospheric Shearing Motions
- Magnetic Flux Emergence
- Magnetic Flux Evolution and Decay



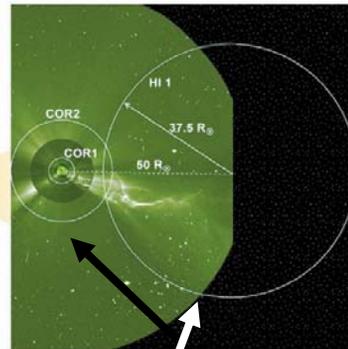
**B. Understand the Initiation of CMEs**

- Reconnection
- The Role of Plasma vs. Magnetic Field Effects
- Rapid vs. Slow Drivers



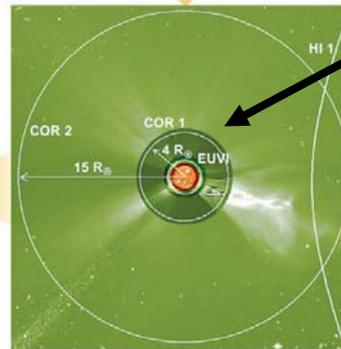
**E. The Sun-Earth Connection. Understand the Role of CMEs in Space Weather**

- Observe Trajectory of Earth-Directed CMEs
- Predict Arrival Time and Geo-Effectiveness of CMEs



**D. Investigate the Interaction of CMEs With the Heliosphere**

- CME Physical Structures at 1 AU
- Generation of Shocks
- Acceleration of Charged Particles
- Interaction With Heliospheric Plasma
- Sheet & Co-Filamenting Interaction Regions
- Interaction With Other CMEs



**C. Study the Physical Evolution of CMEs**

- Reconnection
- Continued Energy Input and Mass Ejection
- Effect on Heliospheric Streamers

COR1

1.25 - 4R<sub>sun</sub>

HI2

70-330R<sub>sun</sub>

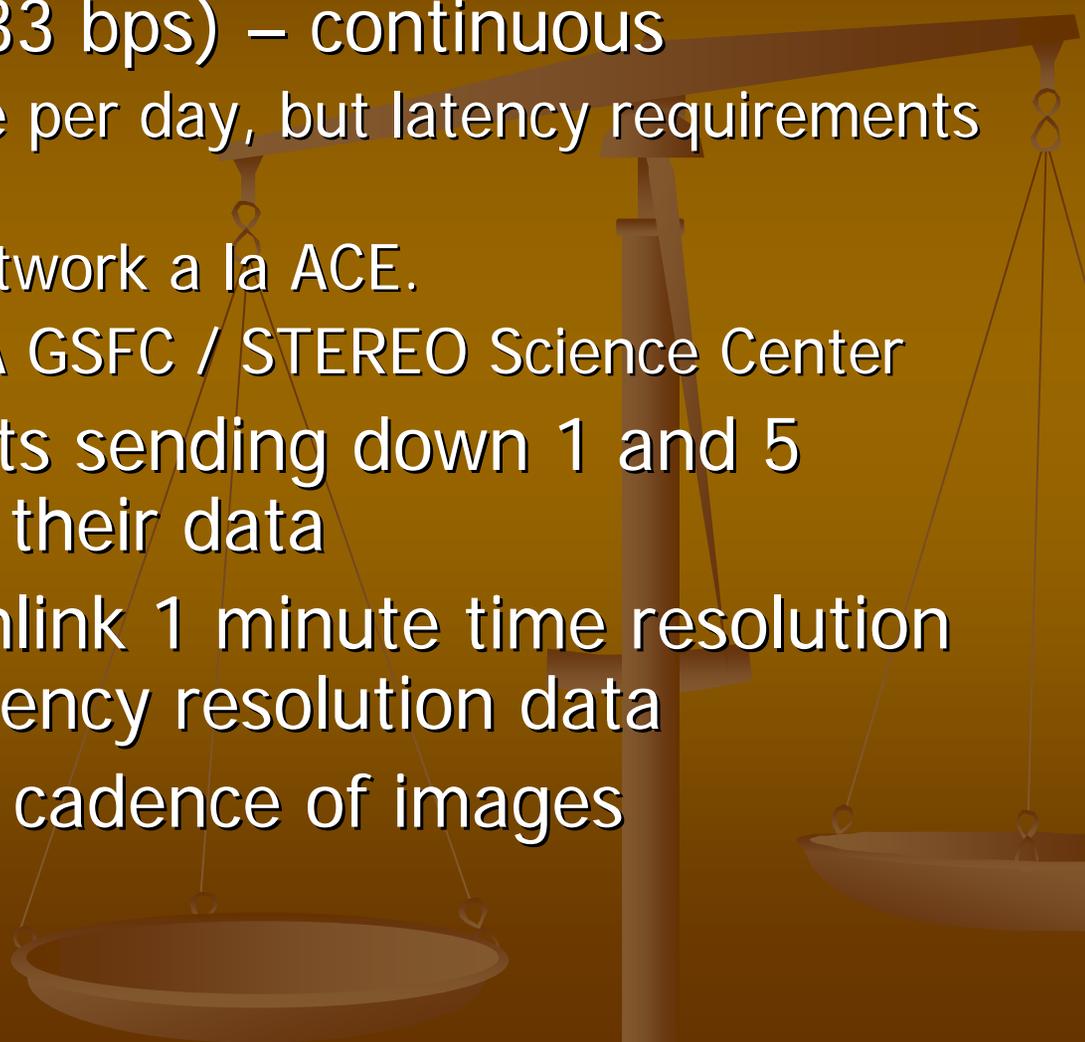
HI1

13-88R<sub>sun</sub>

COR2

2-15R<sub>sun</sub>

# STEREO BEACON

- Real-time data (633 bps) – continuous
    - Level 0 data (once per day, but latency requirements are very poor)
    - Ground station network a la ACE.
    - Data sent to NASA GSFC / STEREO Science Center
  - Particle instruments sending down 1 and 5 minute subsets of their data
  - SWAVES will downlink 1 minute time resolution of moderate frequency resolution data
  - SECCHI moderate cadence of images
- 

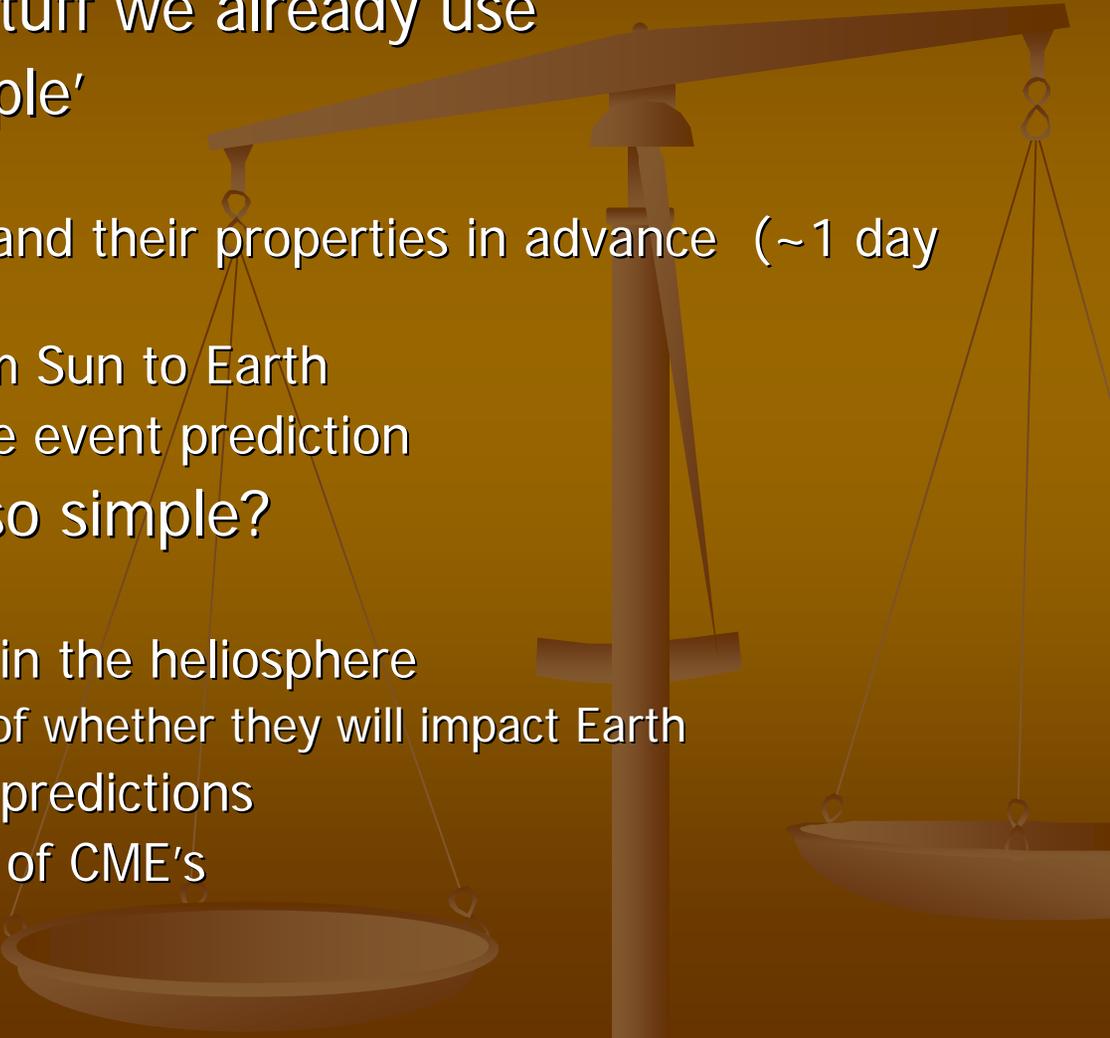
# SECCHI Beacon Data

- SECCHI Beacon data rate is 633 bps
- That allows 7 (256x256 pixel) images per hour, using H-compress (a factor of 5x)
  - And we could download image statistics, such as brightest pixels or CME detection flag
  - Can fit a lot more 128x128 pixel images per hour
- We don't determine which data are taken
  - We pick beacon data from what's available in the daily observing plan
  - Pick from EUVI, COR1, **COR2, HI-1, HI-2**

# NOAA/SEC SECCHI Beacon Preferences

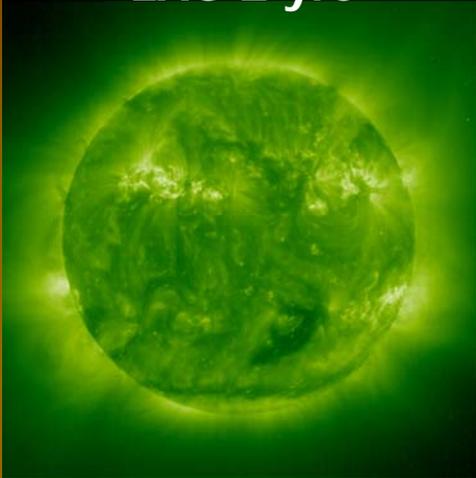
- Given only 7 images per hour
  - We would give priority to COR2, HI-1, and HI-2.
    - As many COR2 per hour as possible, 4 preferred
      - Would give 3-4 images of 2500 km/s CME
    - Next priority is to have HI-1, HI-2 approximately every 2 hours
      - Update CME predictions in real-time as they approach Earth
    - After that, we're open to suggestions.
      - Note, we get X-ray images of the Sun every minute from SXI, so EUVI is only useful for over-the-limb diagnostics

# So what 'new' products can we expect?

- We already saw the stuff we already use
  - The obvious and 'simple'
    - See more of solar disk
    - Solar wind structures and their properties in advance (~1 day for every 6 months)
    - Tracking of CME's from Sun to Earth
    - Solar Energetic Particle event prediction
  - The obvious but not so simple?
    - Automated CME alerts
    - Visualization of CME's in the heliosphere
      - Better identification of whether they will impact Earth
    - Improved arrival time predictions
    - Geometric localization of CME's
- 

# STEREO will see more of the Sun

**LAG 2 yrs**

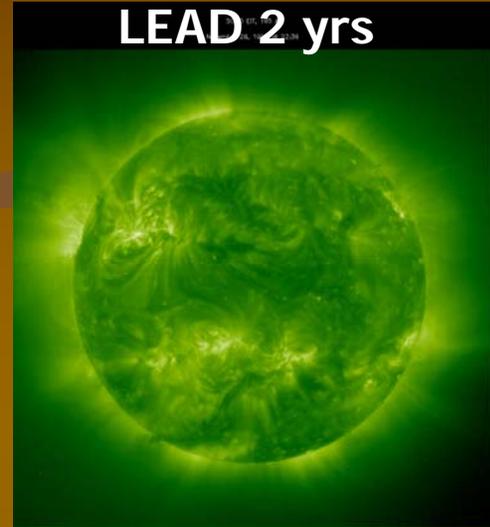


STEREO EU, 190 A  
December 01, 1998 06:22:24

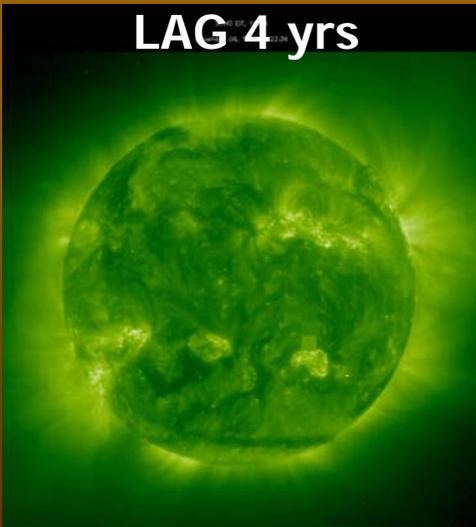


STEREO EU, 190 A  
December 01, 1998 06:22:24

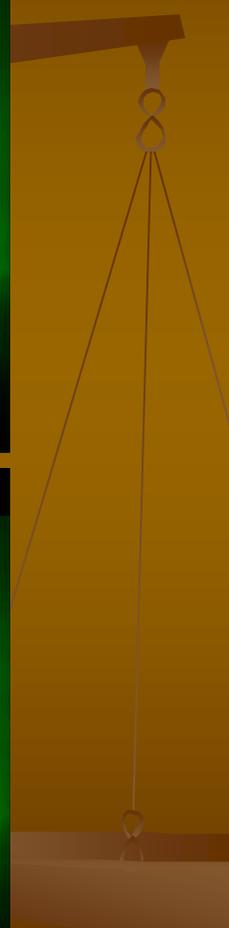
**LEAD 2 yrs**



**LAG 4 yrs**

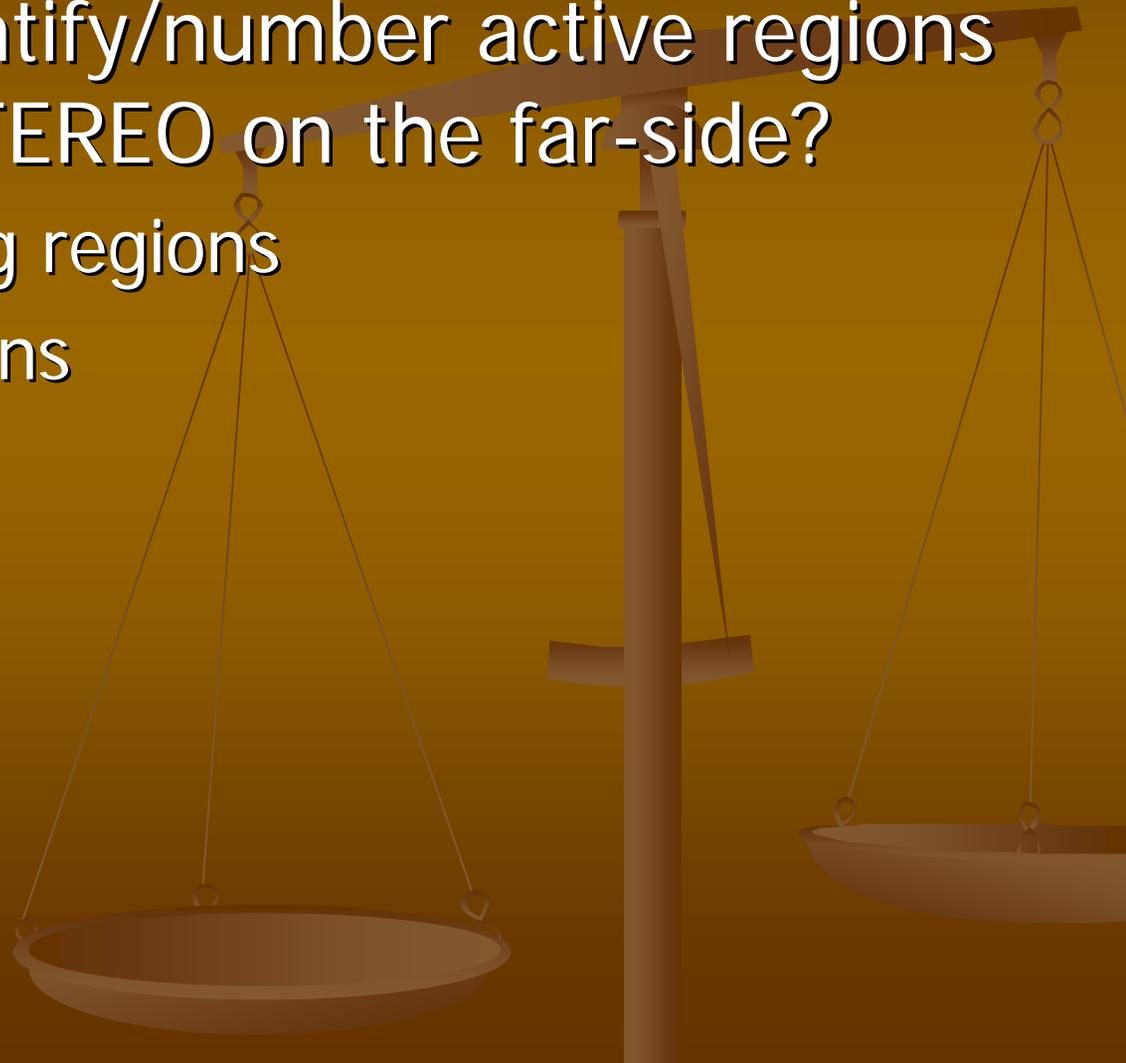


**LEAD 4 yrs**

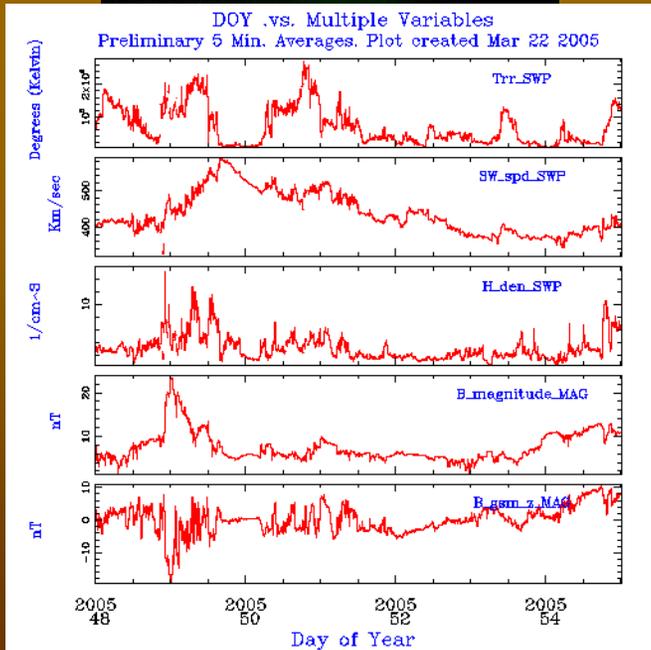
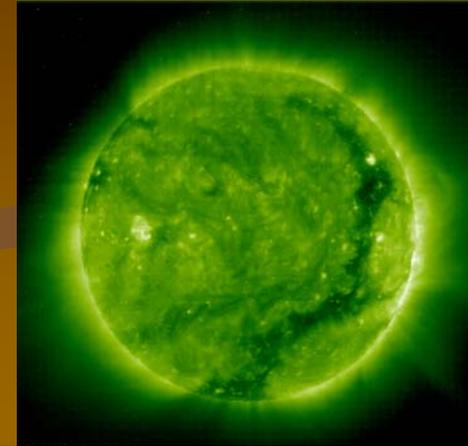
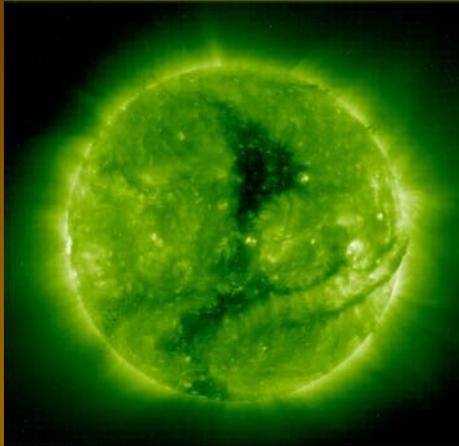


# Here's a question for y'all

- How do we identify/number active regions picked up by STEREO on the far-side?
  - Newly emerging regions
  - Returning regions

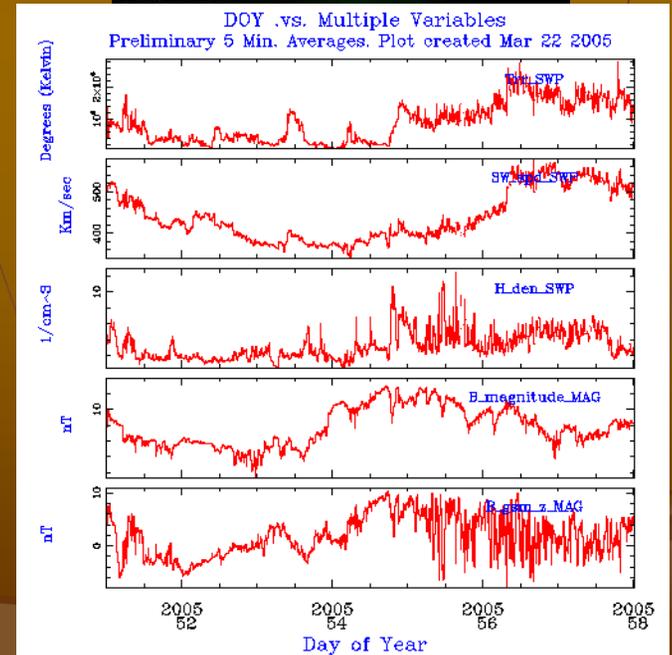


# Coronal Hole/High Speed Stream



What we see from L1

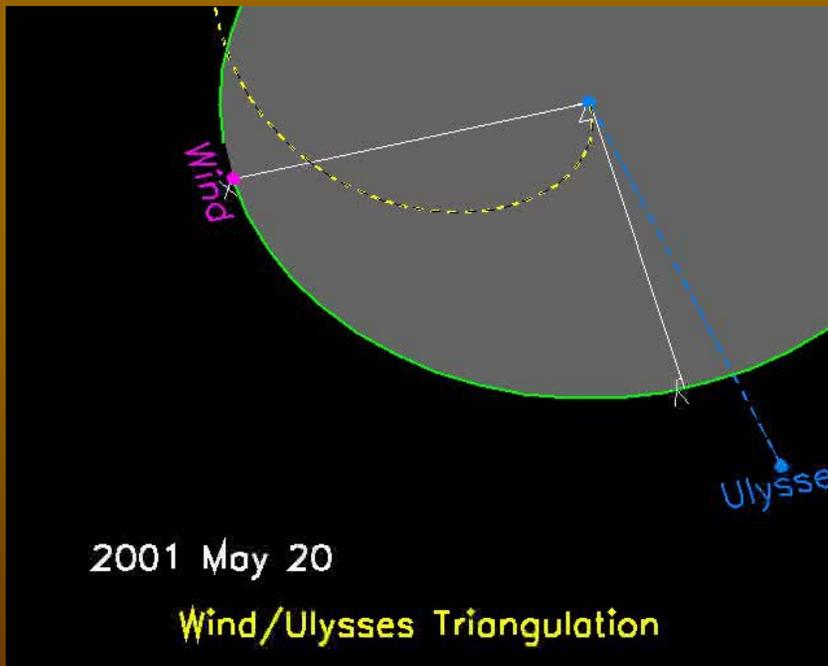
$V_{SW}$

A diagram showing a central point with two arrows pointing horizontally in opposite directions, labeled  $V_{SW}$ . This represents the solar wind velocity vector.

What STEREO-B sees

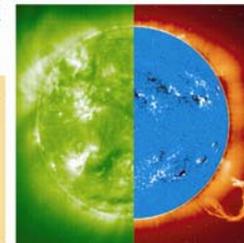
# Tracking CME's

## ■ Tracking CME's from Sun to Earth



### SECCHI Exploration of CMEs and the Heliosphere on STEREO

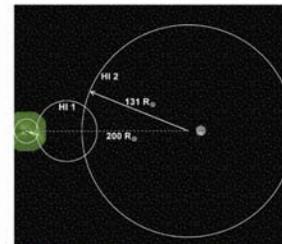
- A. What Configurations of the Corona Lead to a CME?
- B. What Initiates a CME?
- C. What Accelerates CMEs?
- D. How Does a CME Interact With the Heliosphere?
- E. How do CMEs Cause Space Weather Disturbances?



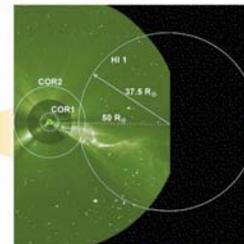
- A. Explore the Magnetic Origins of CMEs**
- Photospheric Shearing Motions
  - Magnetic Flux Emergence
  - Magnetic Flux Evolution and Decay



- B. Understand the Initiation of CMEs**
- Reconnection
  - The Role of Plasma vs. Magnetic Field Effects
  - Rapid vs. Slow Drivers



- E. The Sun-Earth Connection: Understand the Role of CMEs in Space Weather**
- Observe Trajectory of Earth-Directed CMEs
  - Predict Arrival Time and Geo-Effectiveness of CMEs



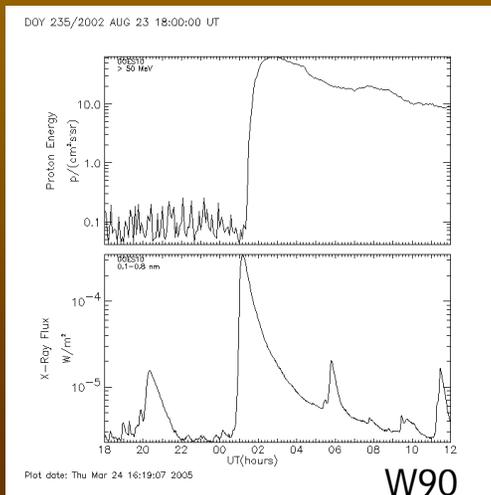
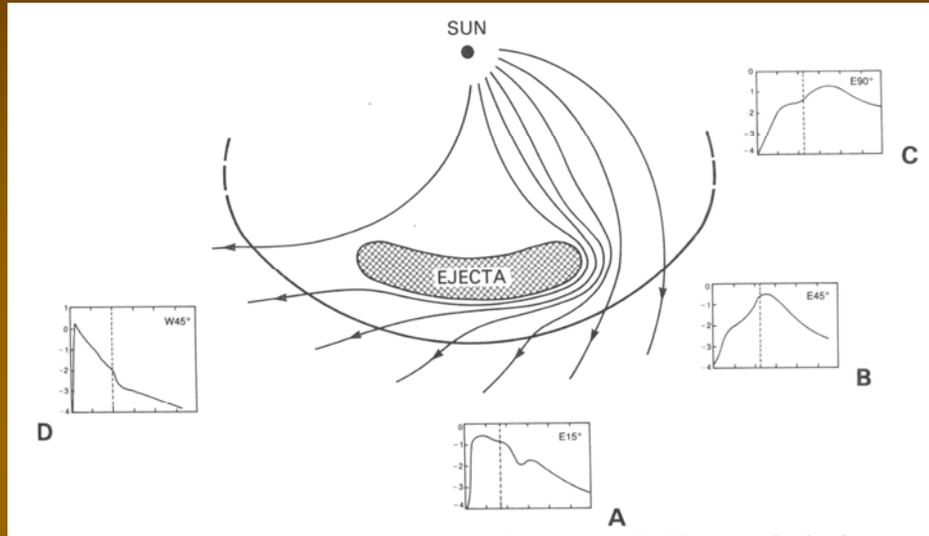
- D. Investigate the Interaction of CMEs With the Heliosphere**
- CME Physical Signatures at 1 AU
  - Generation of Shocks
  - Acceleration of Charged Particles
  - Interaction With Heliospheric Plasma
  - Sheet & Co-Rotating Interaction Regions
  - Interaction With Other CMEs



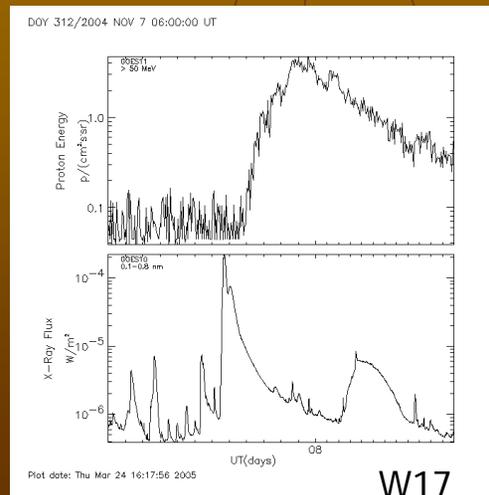
- C. Study the Physical Evolution of CMEs**
- Reconnection
  - Continued Energy Input and Mass Ejection
  - Effect on Helmet Streamers

# SEP events

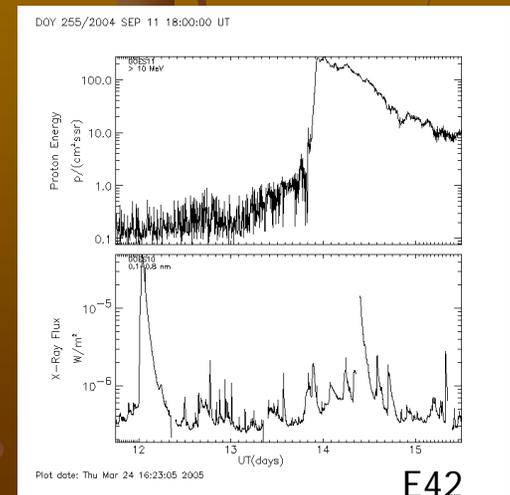
- Event profile depends on observer position relative to event source



STEREO LAGGING



EARTH



STEREO LEADING

# STEREO SWG

- Ideas being presented as relevant to beacon channel
    - Automated CME detection
      - Reliable? False alarms? Information provided?
    - EUV dimming detection
    - Visualization & browsers
      - Berghmans (beacon data)
      - Geometric Localization tool?
      - Other CME visualization tools – SECCHI team says they'll produce at least one
- 