IMP 8 GME Energetic Particle Observations over Three Solar Cycles

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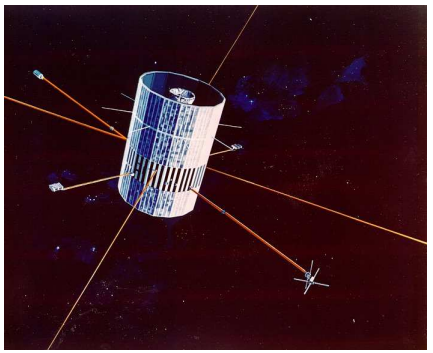
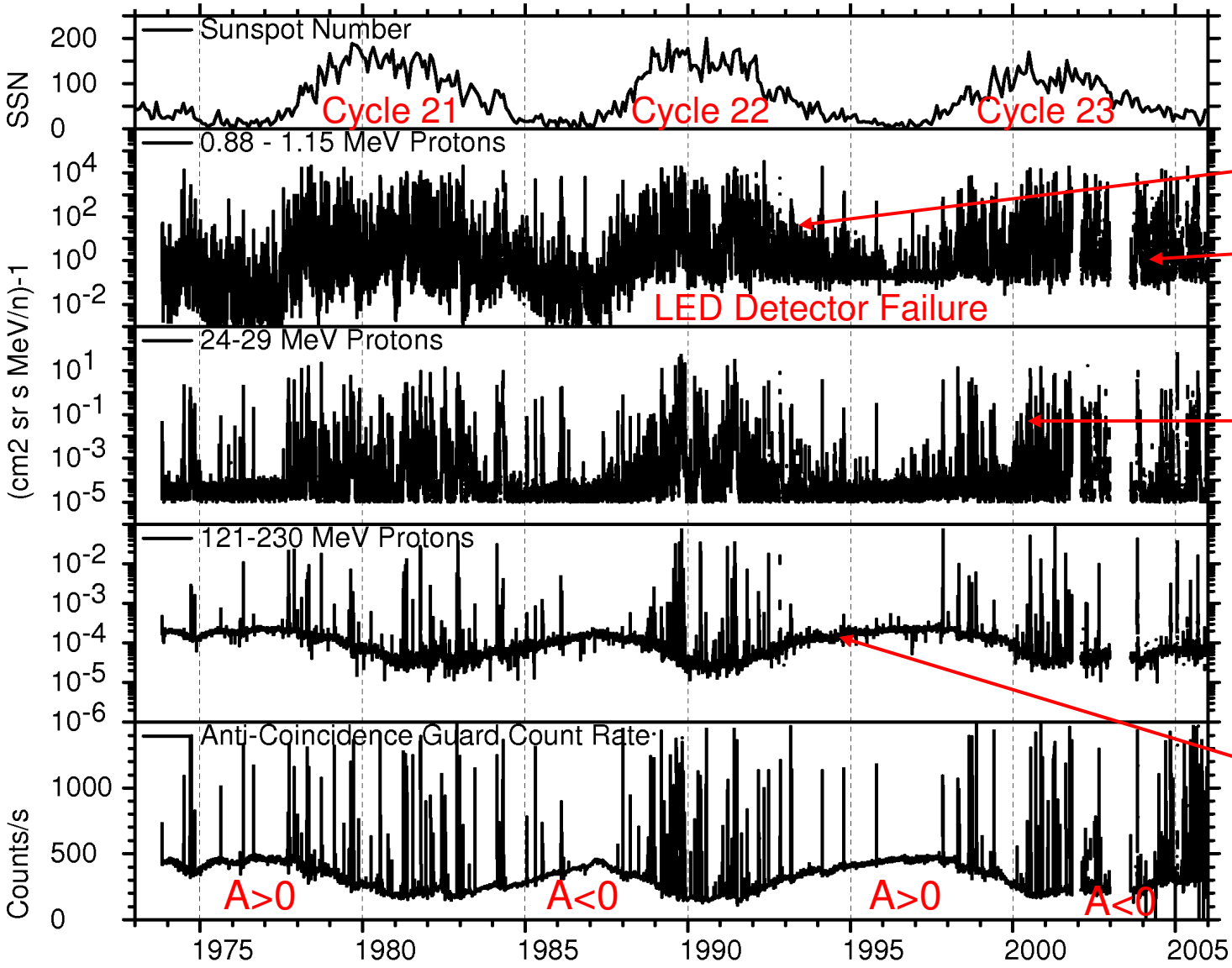
IMP 8



- Launched October 26, 1973;
- ~35 R_e orbit, ~12 day period (~7 days in solar wind);
- Mission officially terminated in October, 2001; tracking continued until contact with the spacecraft was lost in late 2006;
- GME (Goddard Medium Energy) Experiment;
- Measurements of ~1 – 400 MeV/n protons and heavy ions ; 3 - 18 MeV electrons; Intensities and anisotropies;
- 3 separate instruments (VLET, LED, MED);
- http://spdf.gsfc.nasa.gov/imp8_GME/GME_home.html.

Overview of Sunspot Number and IMP 8 GME 0.88 – 230 MeV Proton Observations, 1973 - 2005

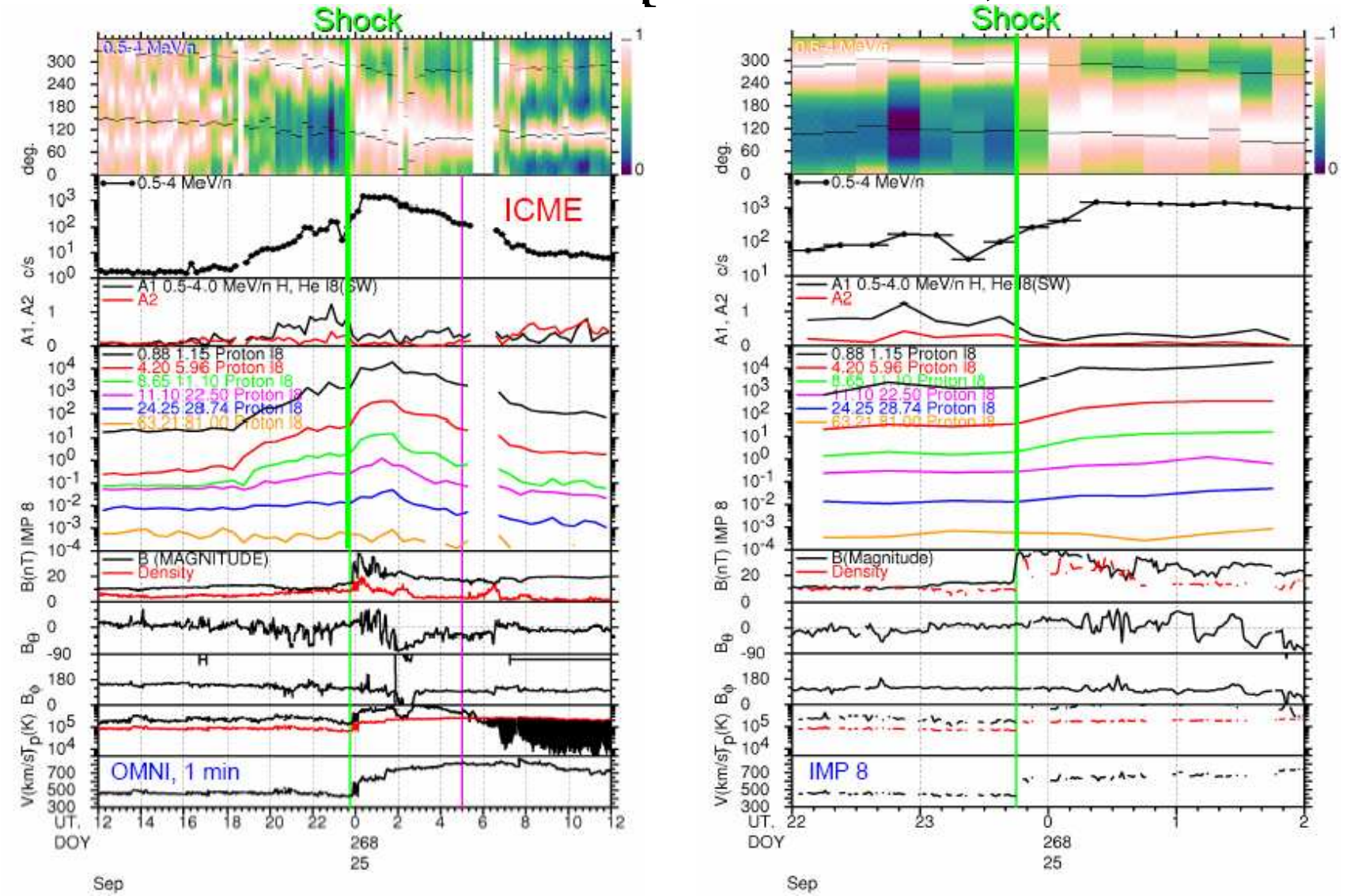


CIR-Accelerated (Bad Data Points)

Solar Energetic Particles

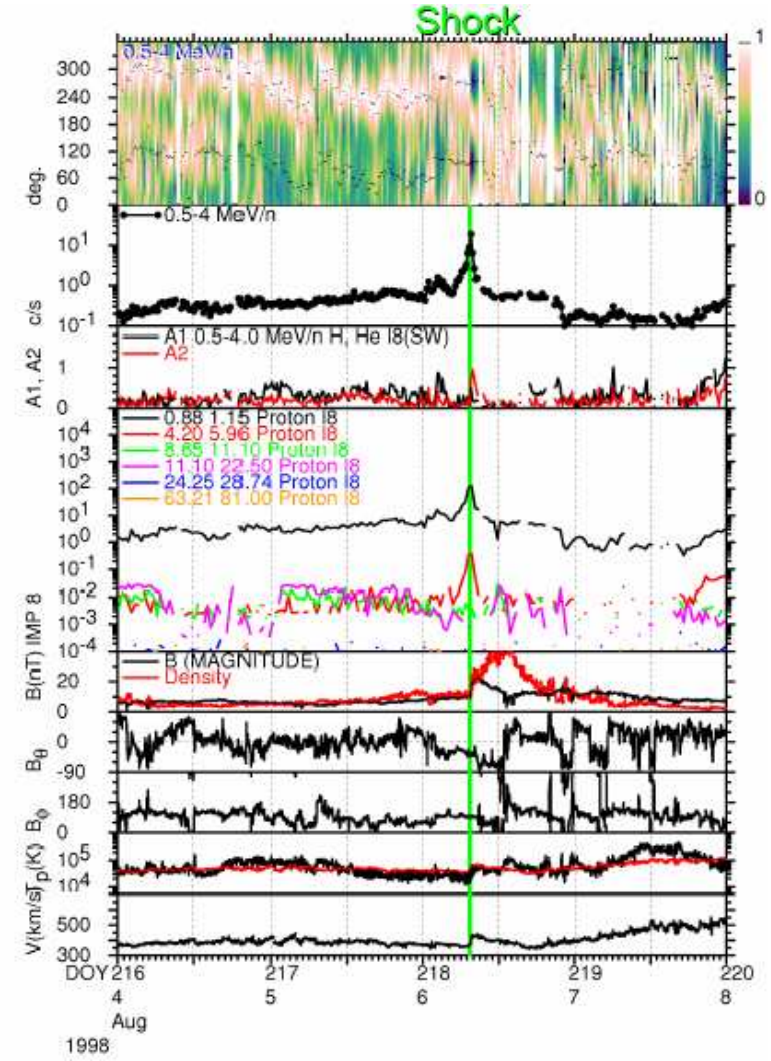
Cosmic Rays

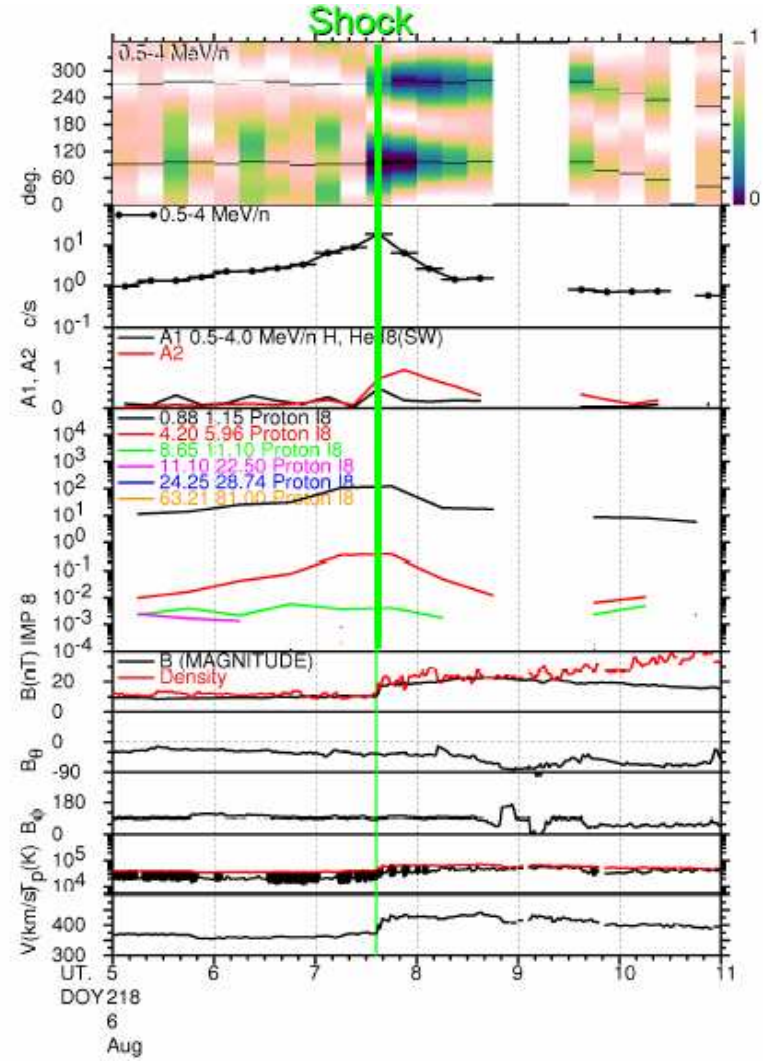
Shock of September 24, 1998



Broad particle peak around shock + clean flow reversal (E09º; θ_{Bn}=78º)

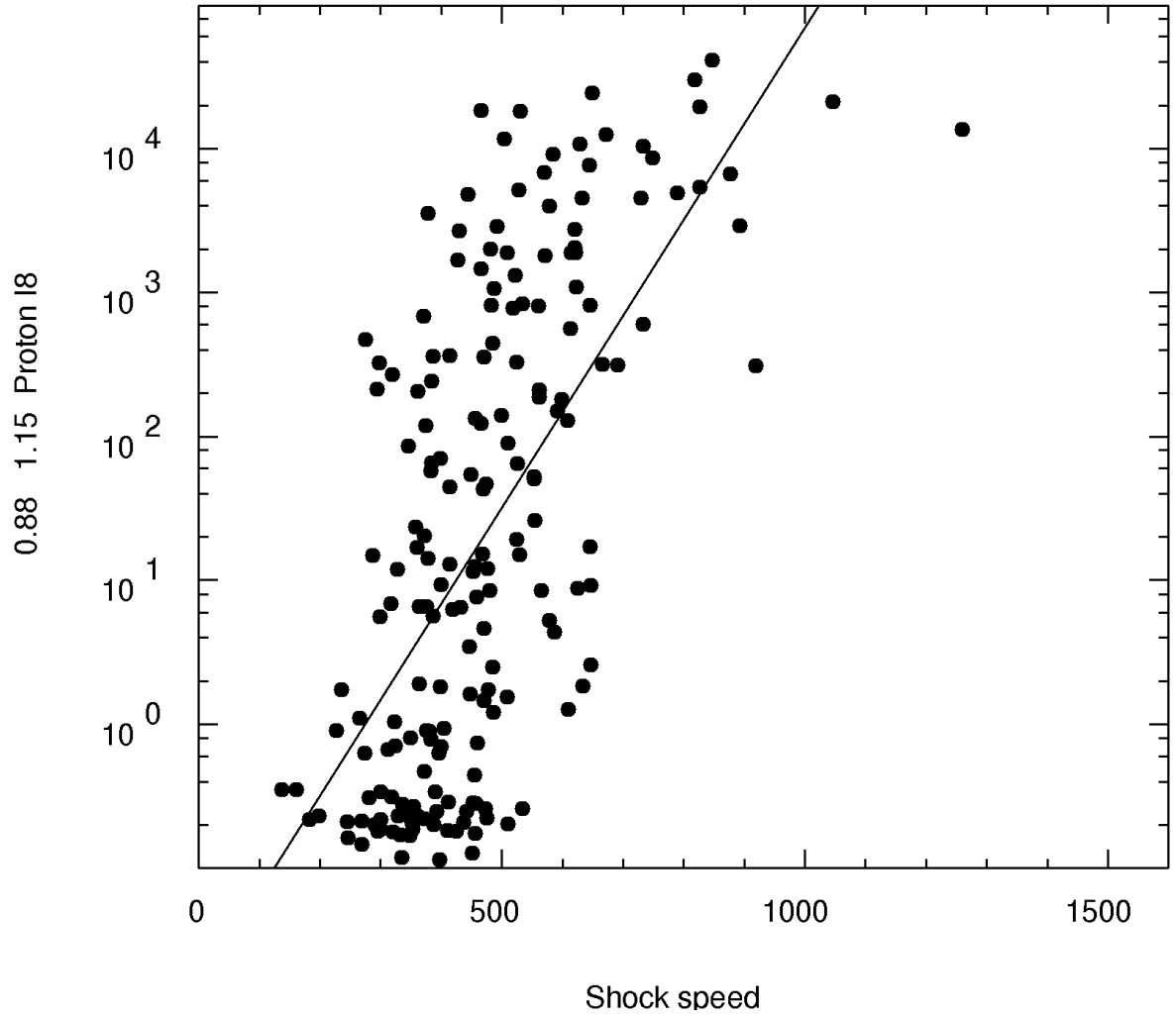
Example of Shock Spike



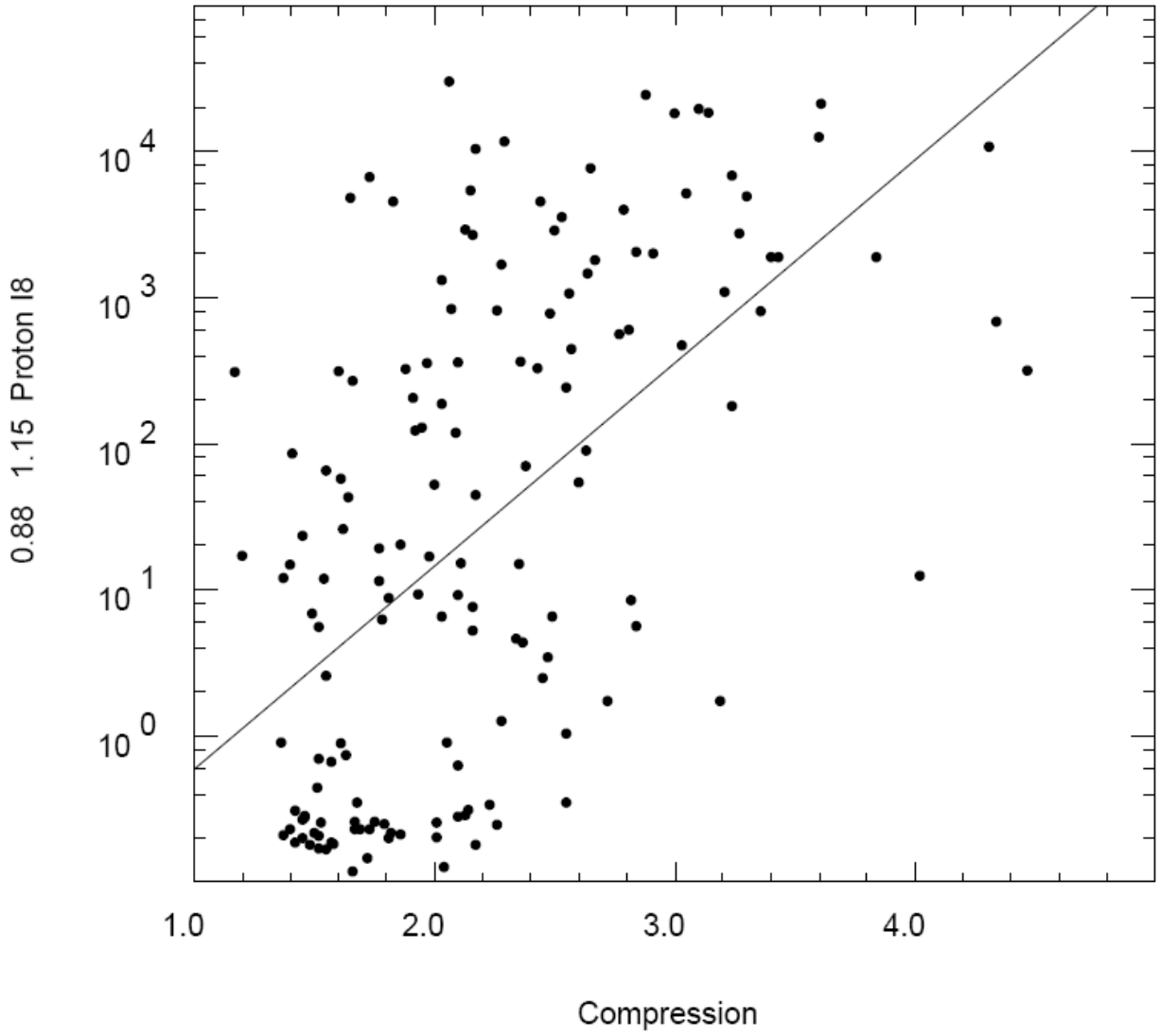


Pancake Distribution => Shock Drift Acceleration; θ_{Bn}=80º

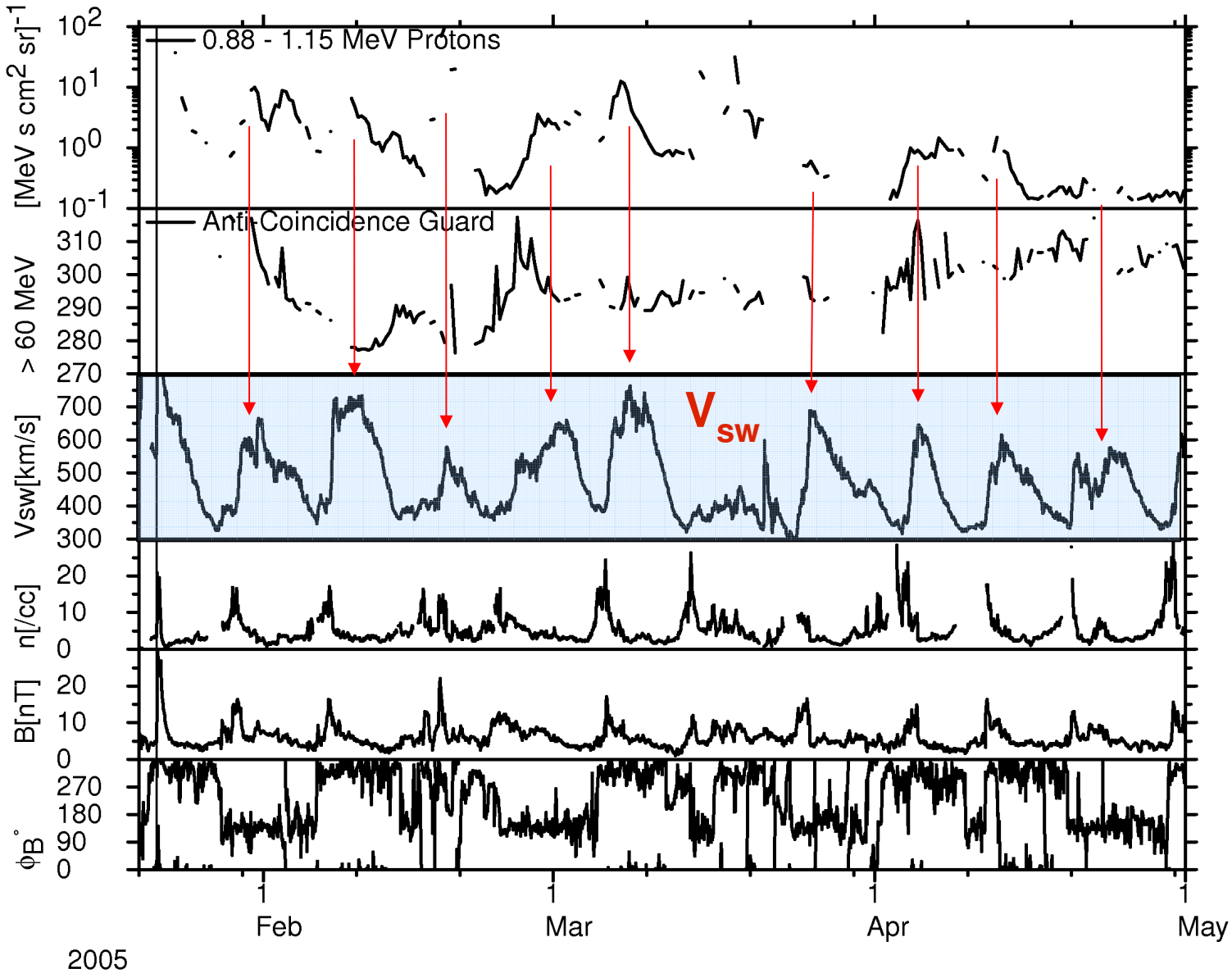
0.88-1.15 MeV Proton Intensity vs Local Shock Speed



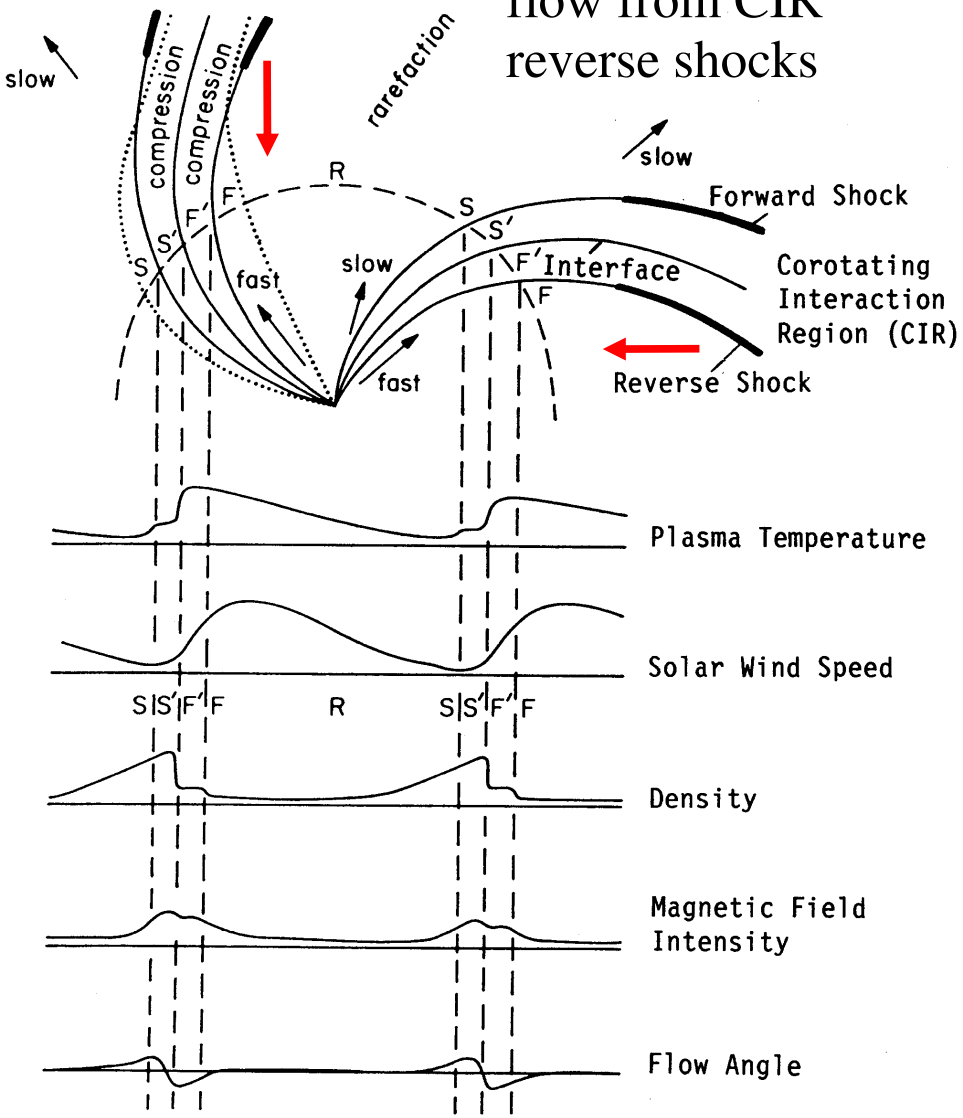
0.88-1.15 MeV Proton Intensity vs Shock Compression



Examples of CIR-Associated 0.88 – 1.15 MeV Proton Enhancements and Cosmic Ray Modulations, January – April, 2005

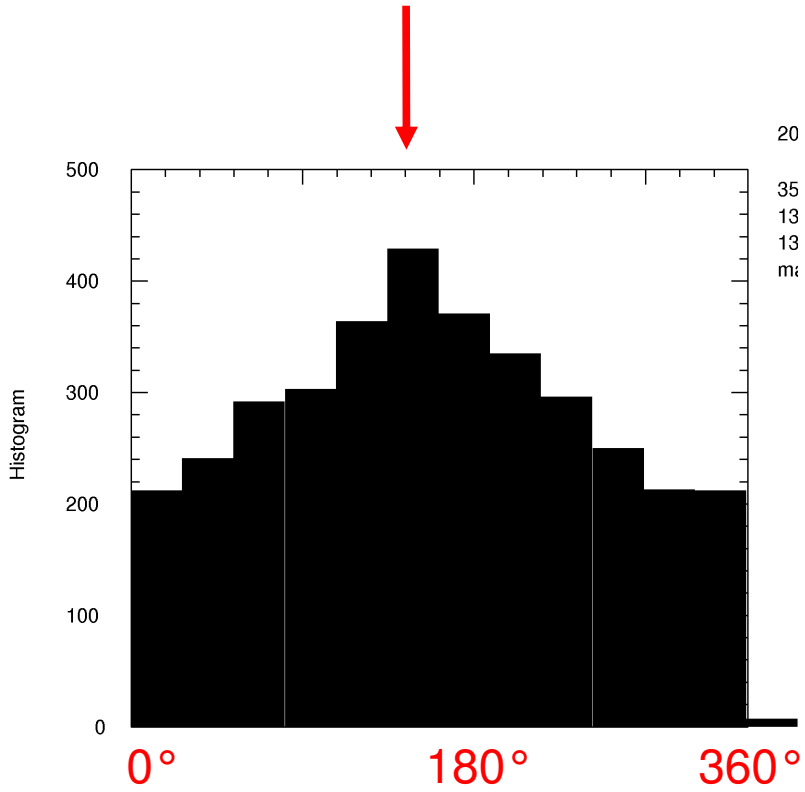


Sunward proton flow from CIR reverse shocks

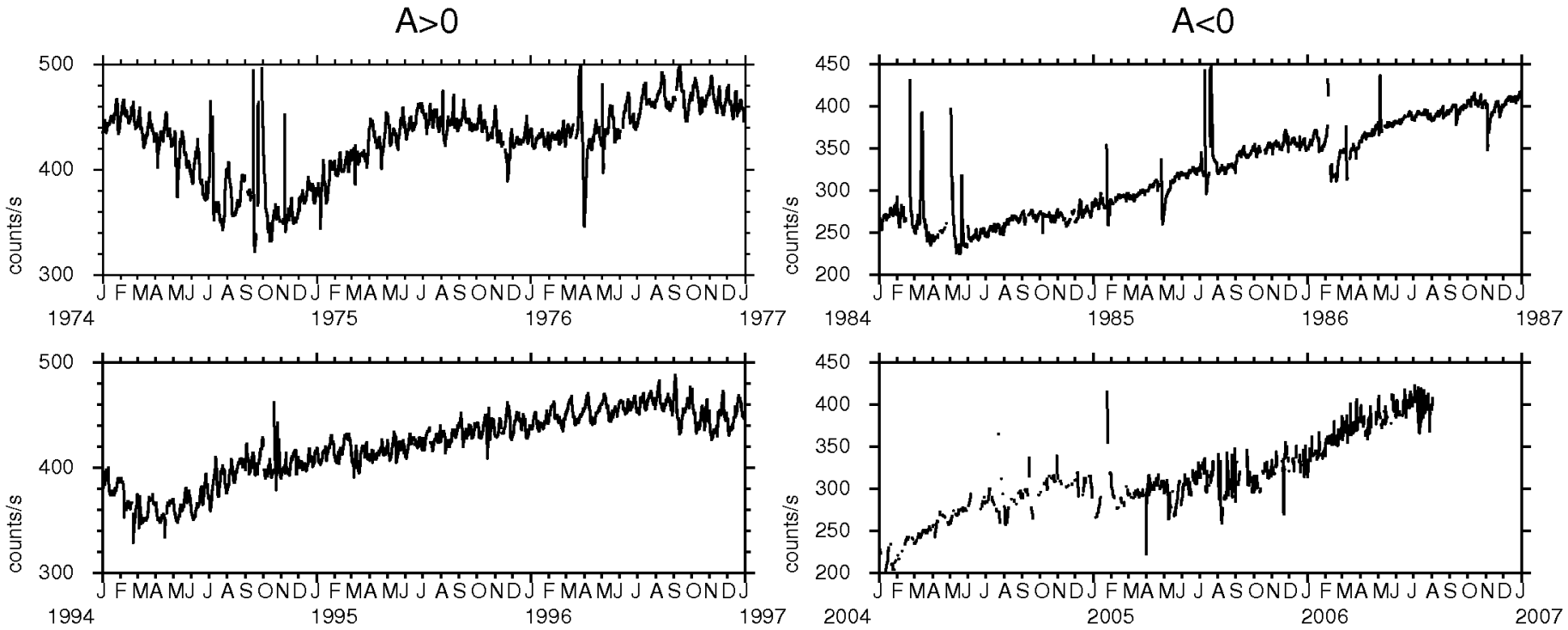


4 - 22 MeV Proton Flow Azimuth Distribution, February 5 – April 30, 2005

Sunward Flow



Anti-Coincidence Counting Rates (3-year intervals around 4 solar minima)



Richardson, Cane and Wibberenz (1999) noted that recurrent (~27 day) galactic cosmic ray modulations are larger in A>0 epochs. The pattern continues in the current epoch (A<0). (Bad data points also present in 2005-2006.)

Summary

- The IMP 8 GME has provided a wealth of observations of energetic particles, including SEP, CIR events, and galactic cosmic rays, extending over three solar cycles (October, 1973 - late 2006).