Project 8:
Comparison of CME and SEP Energies

Top 50 proton events (fluence >30MeV)

Ontiveros, Vourlidas, Mewaldt

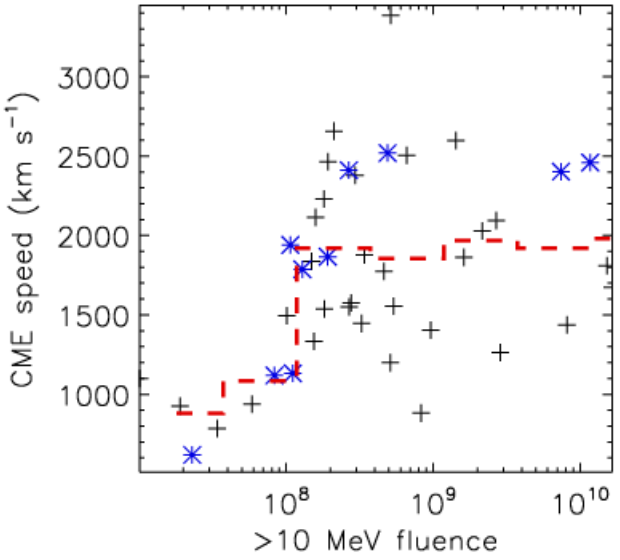
CME energetics vs SEP fluency

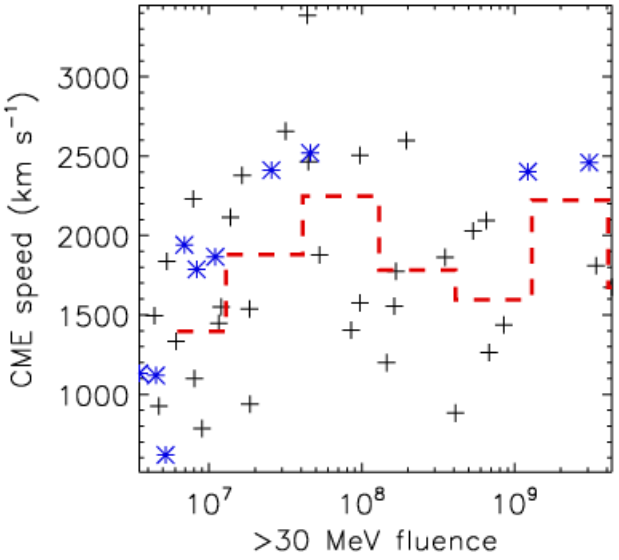
- Top 50 solar proton events fluence of >30 MeV protons (Dr. Mewaldt's list).
- We obtained reliable mass (+ E_{kin}) measurements for 42 of the associated CMEs (calibrated LASCO images).
- How well are the SEP events correlated with global CME plasma parameters?

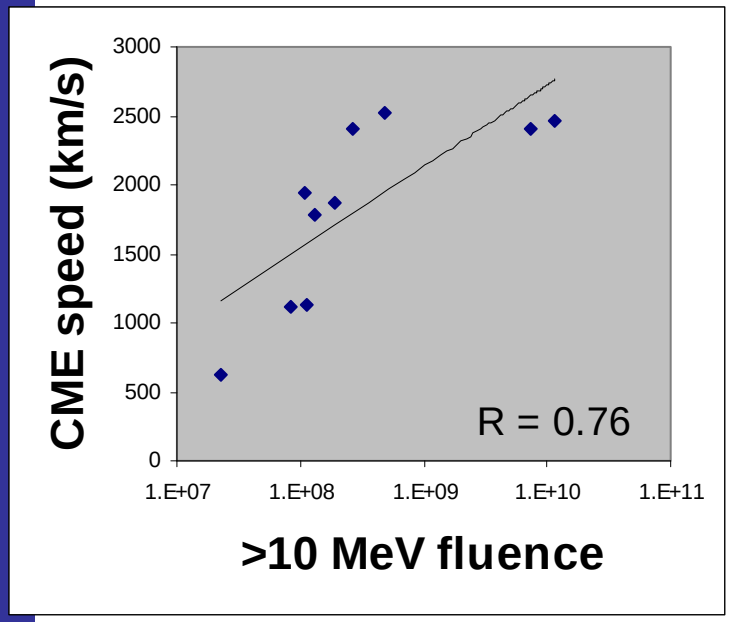
(Work reported in Space Weather Workshop + recent additions)

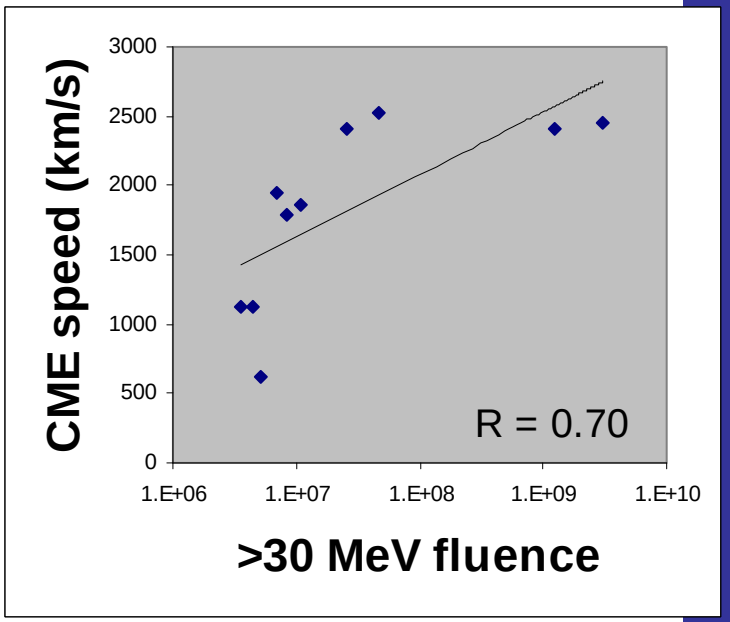
What’s special in this study

- Careful measurement CME mass, outline for each event.
- Correlations w/ proton fluence
- Separation of East & West events

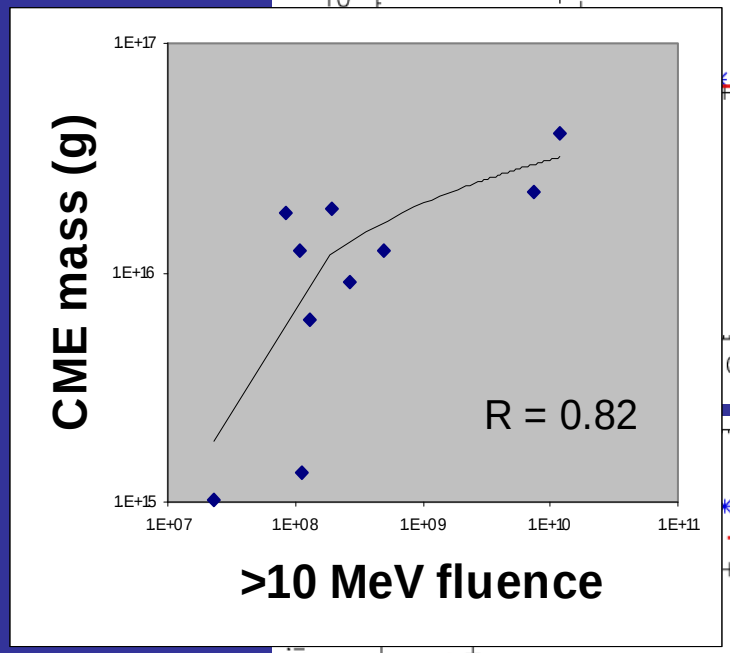


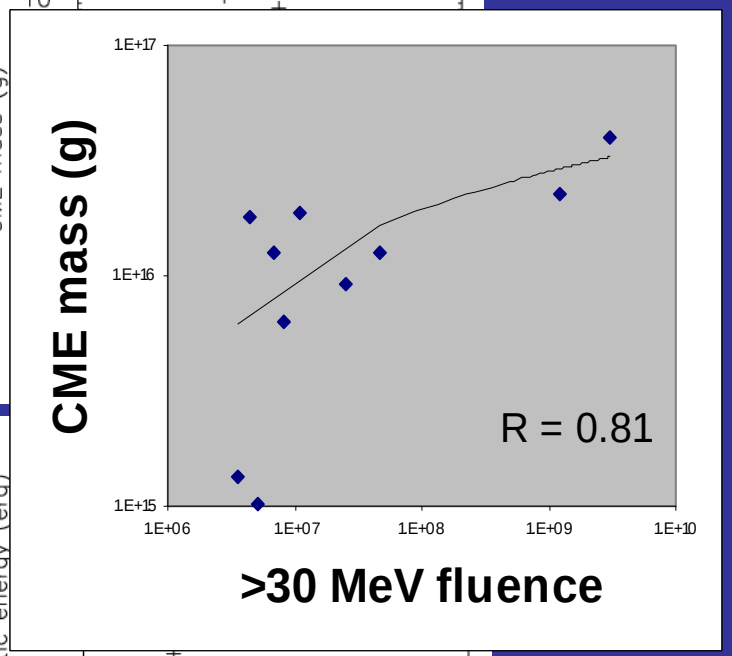


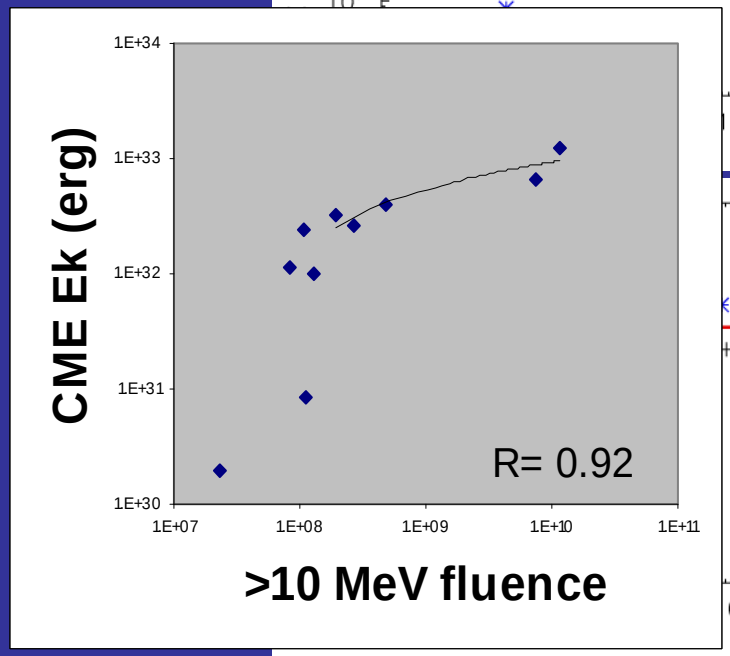


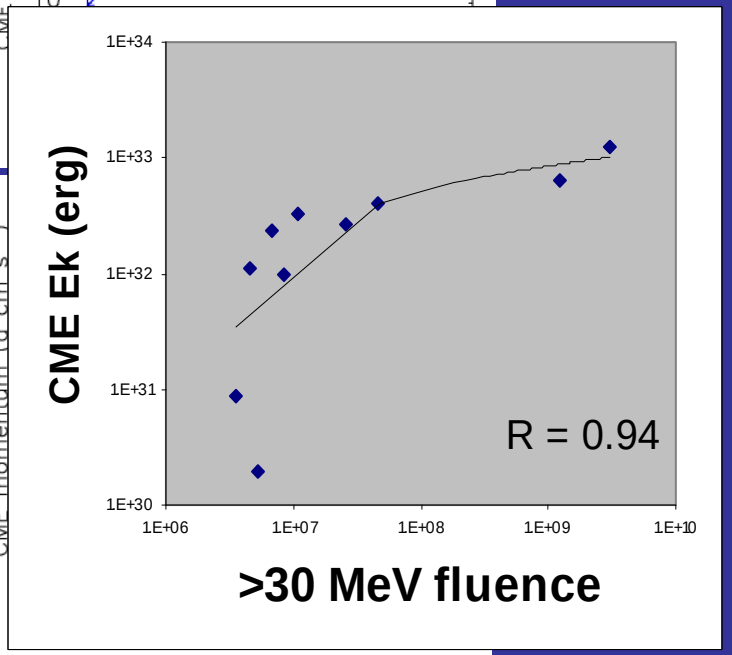


- All CMEs associated with eastern position angles (10 events) are halo CMEs.

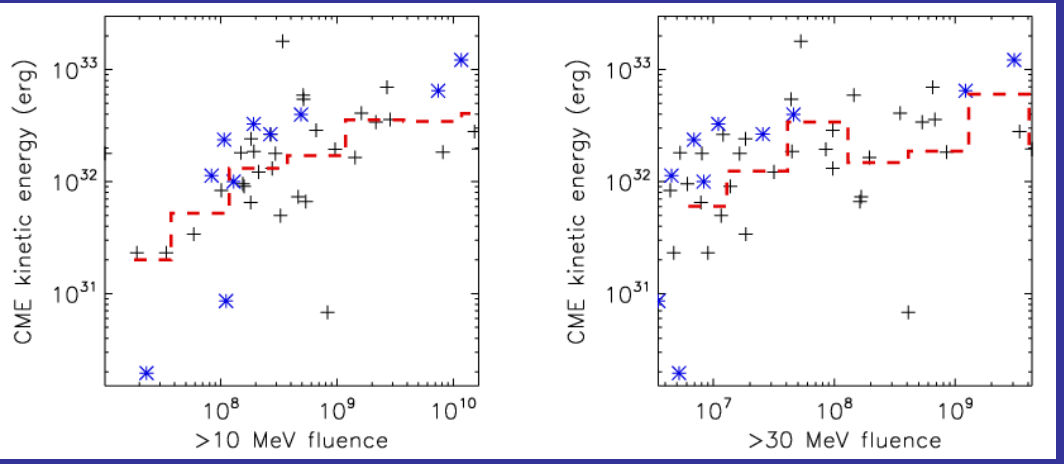

CME mass (g)
1E+17
1E+16
1E+15
1E+07
1E+08
1E+09
1E+10
1E+11
R = 0.82
>10 MeV fluence

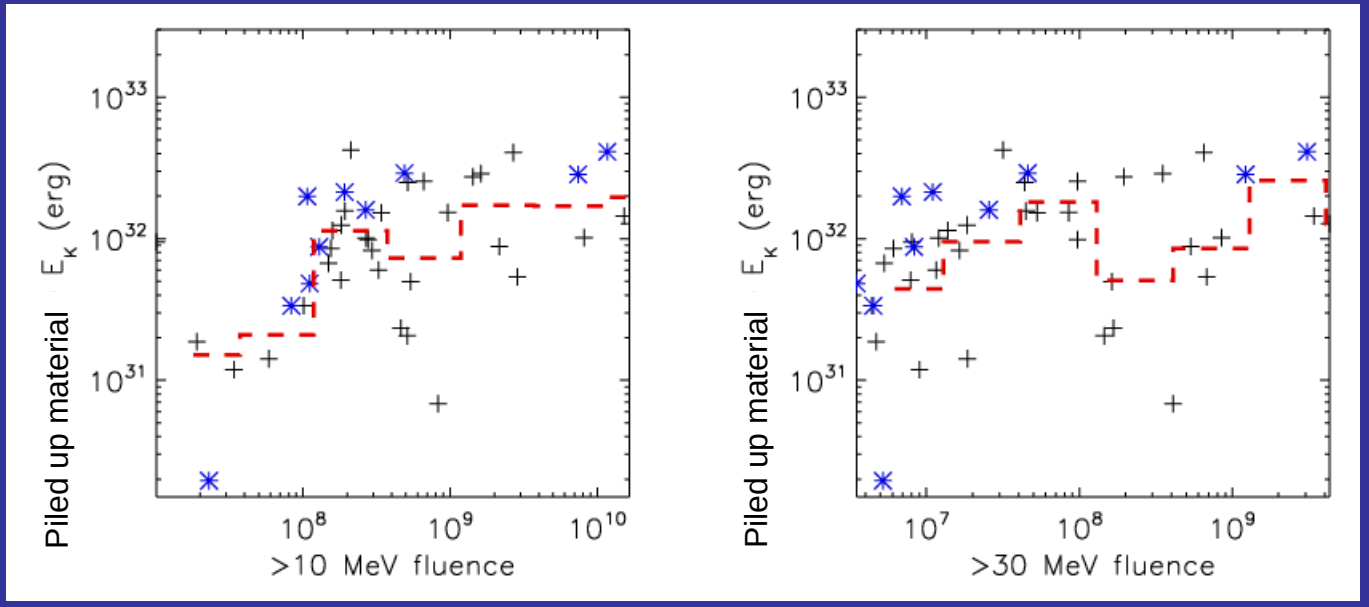

CME mass (g)
1E+17
1E+16
1E+15
1E+06
1E+07
1E+08
1E+09
1E+10
R = 0.81
>30 MeV fluence


CME Ek (erg)
1E+34
1E+33
1E+32
1E+31
1E+30
1E+07
1E+08
1E+09
1E+10
1E+11
R= 0.92
>10 MeV fluence


CME Ek (erg)
1E+34
1E+33
1E+32
1E+31
1E+30
1E+06
1E+07
1E+08
1E+09
1E+10
R = 0.94
>30 MeV fluence

‘Shock-only’ measurements

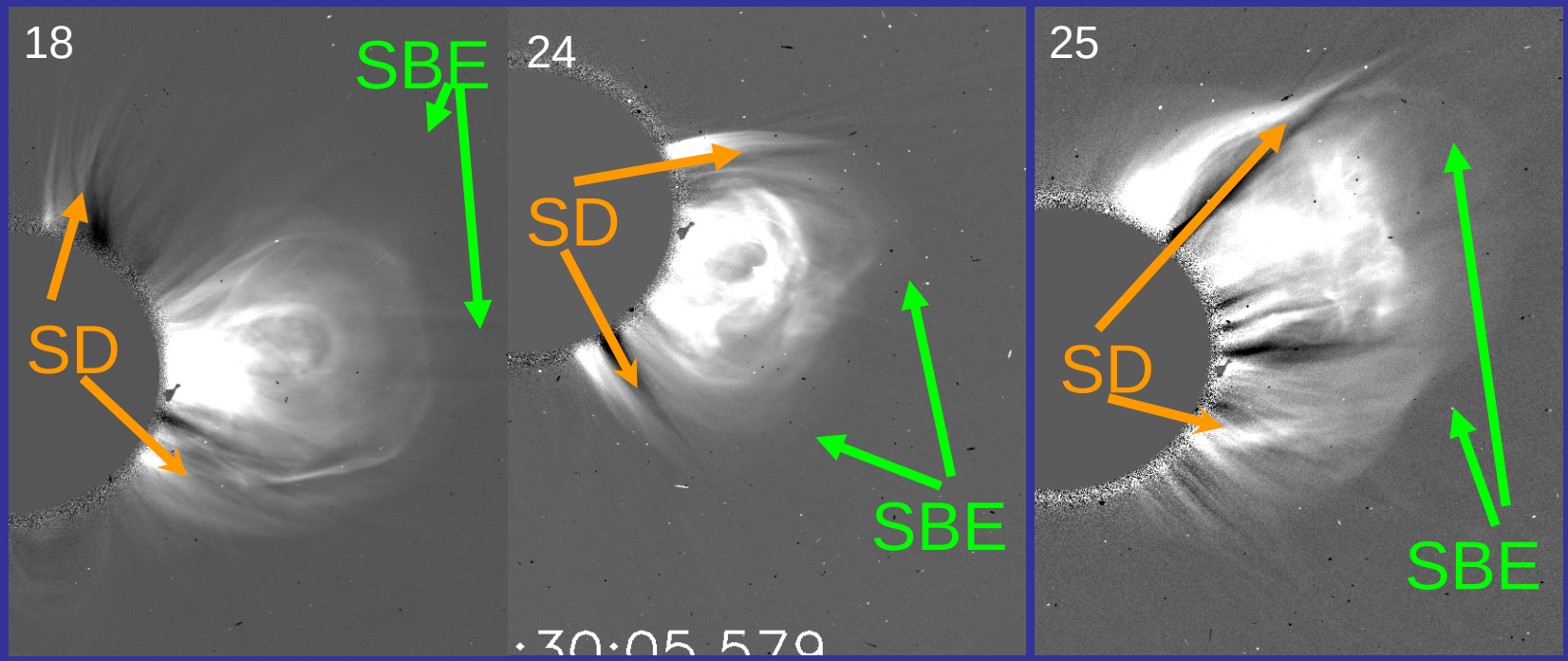




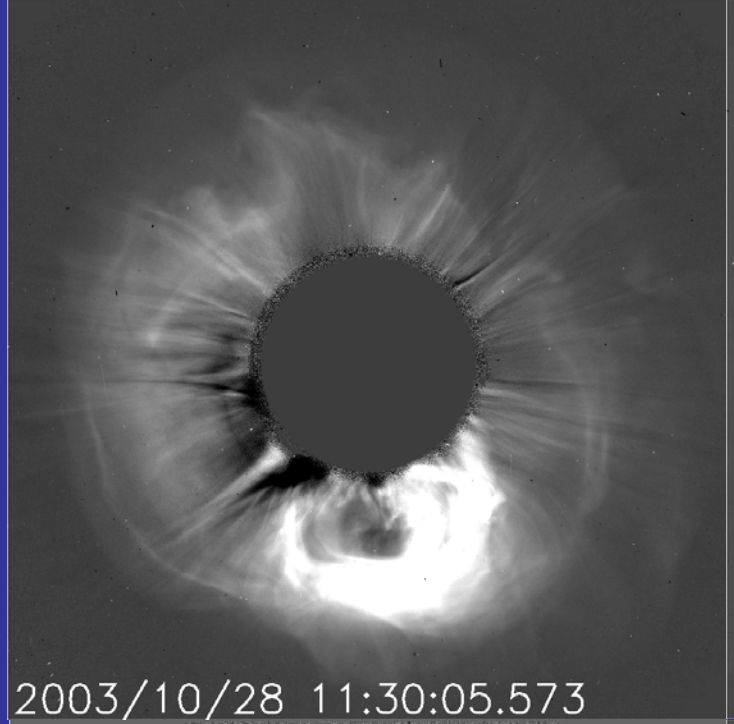
17 CMEs show a clear white light shock signature

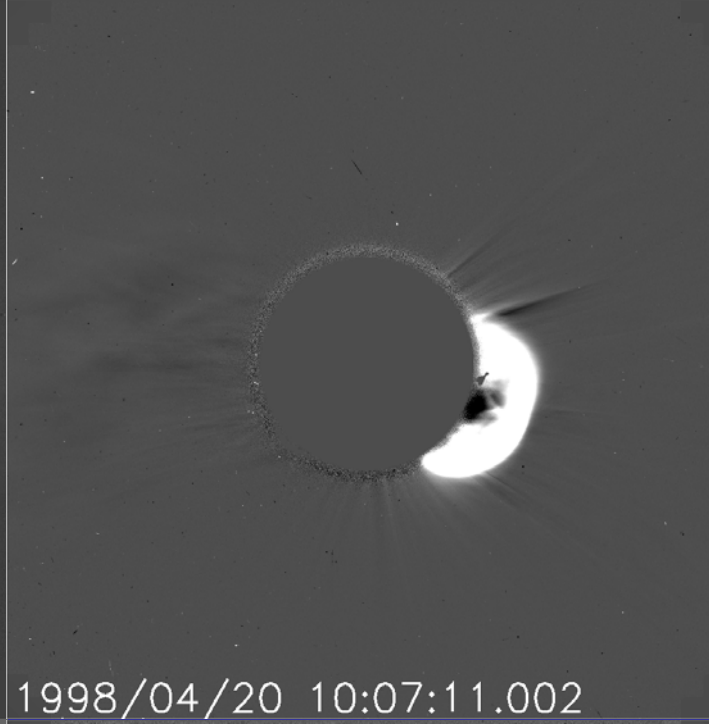
(1) A Sharp but faint Brightness Enhancement (SBE) ahead of the CME.

(2) A Streamer Deflection (SD) well-connected to the expansion of the sharp front.

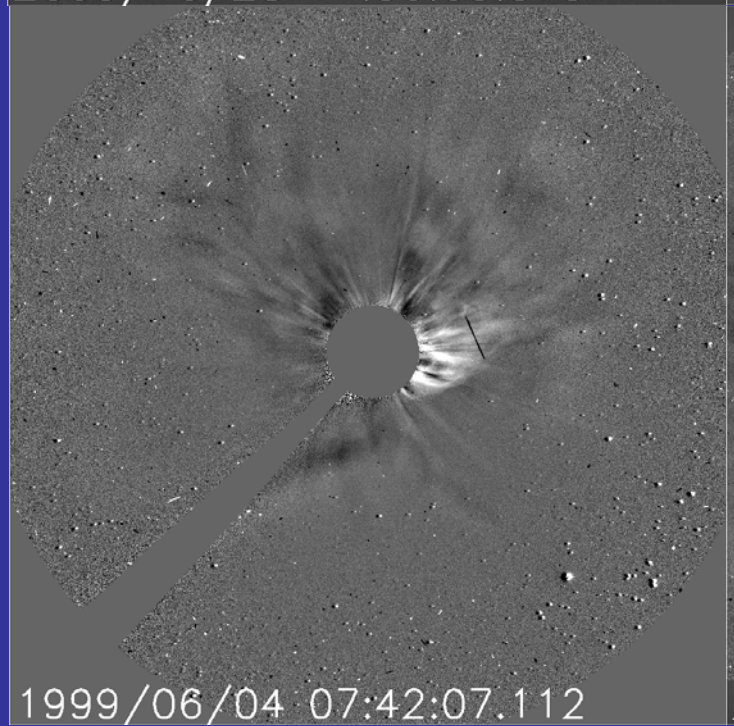


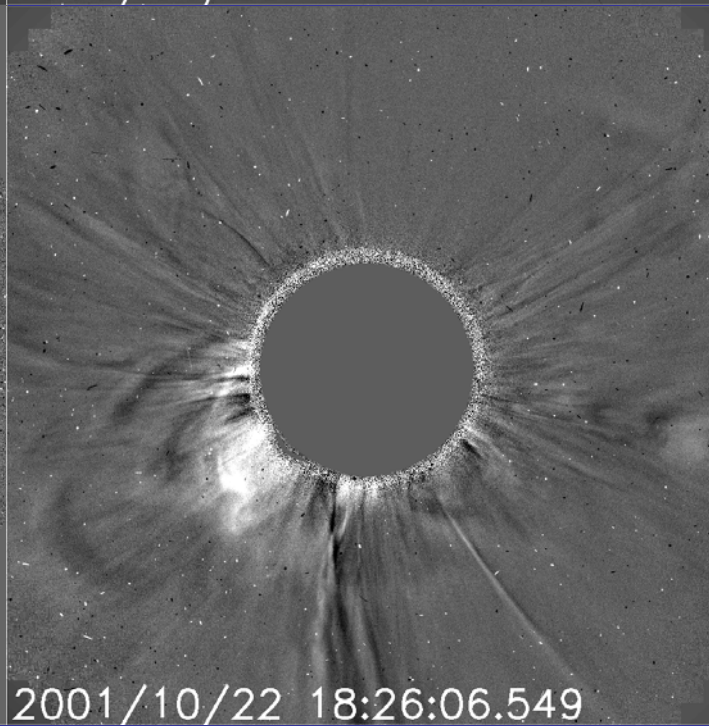
Shock indication
(20 events)





Jagged front
(5 events)





Conclusions

- 40% of events show unambiguous shock signature in C28
  - 48% have strong indication of a shock
  - 12% have a jagged front
- Speeds (deprojected or not), accelerations, flare intensity DO NOT show trends/correlations w/ fluence
- BUT mass, E_{kin}, momentum show positive trends w/ fluence.
- ‘East’ events show the best correlations w/ fluence.
  - Could this be due to purely flank crossings?