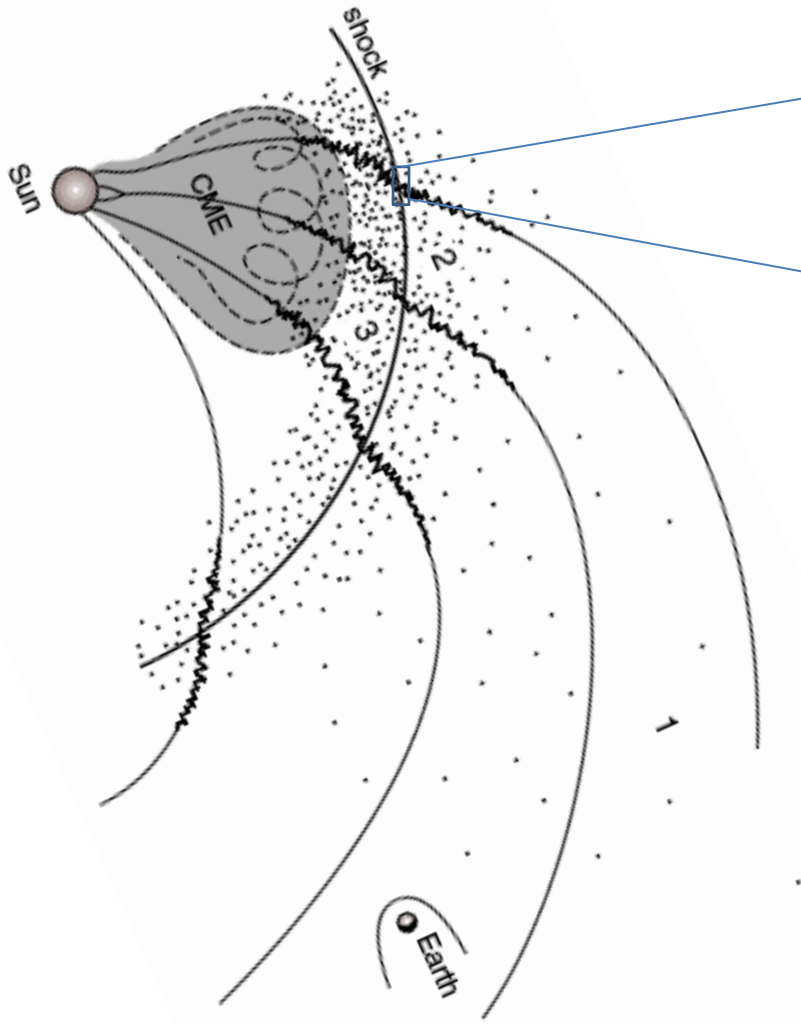


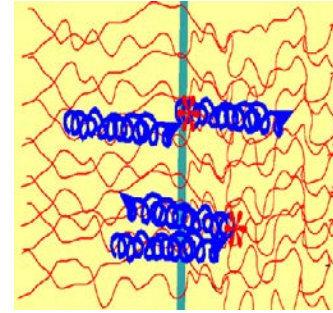
# ***What does the dearth of large SEP events in Solar Cycle 24 tell us about the physics of particle acceleration?***

- Some important clues:
  - SEPs are known to be associated with shocks driven by coronal mass ejections (CMEs), but there is not obviously fewer CMEs this cycle
  - The solar wind flux and interplanetary magnetic field strength are weaker in cycle 24 compared to previous cycles

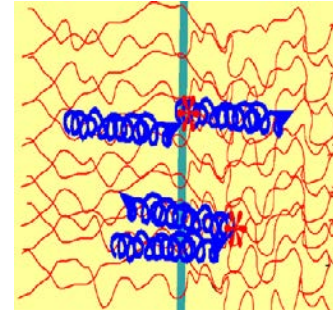
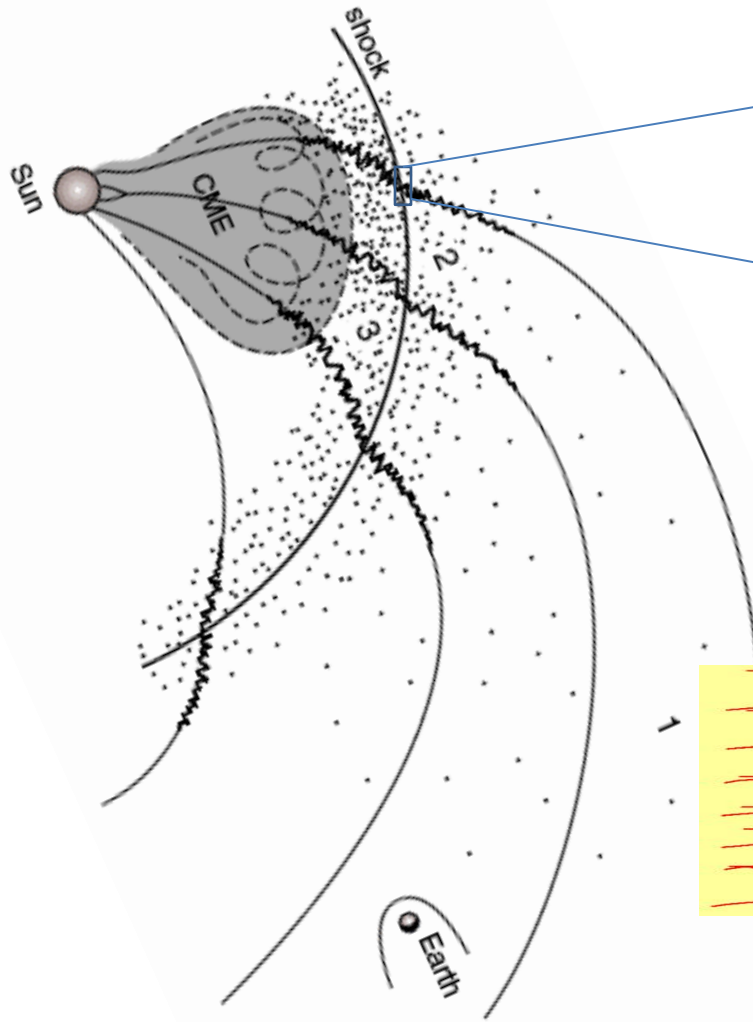
A schematic of a CME and the acceleration of SEPs



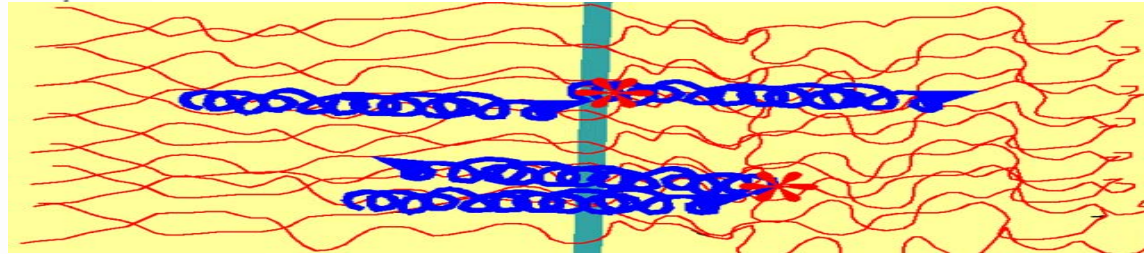
A close-up of the region near the shock showing particles (blue) moving back-and-forth across the shock, gaining energy



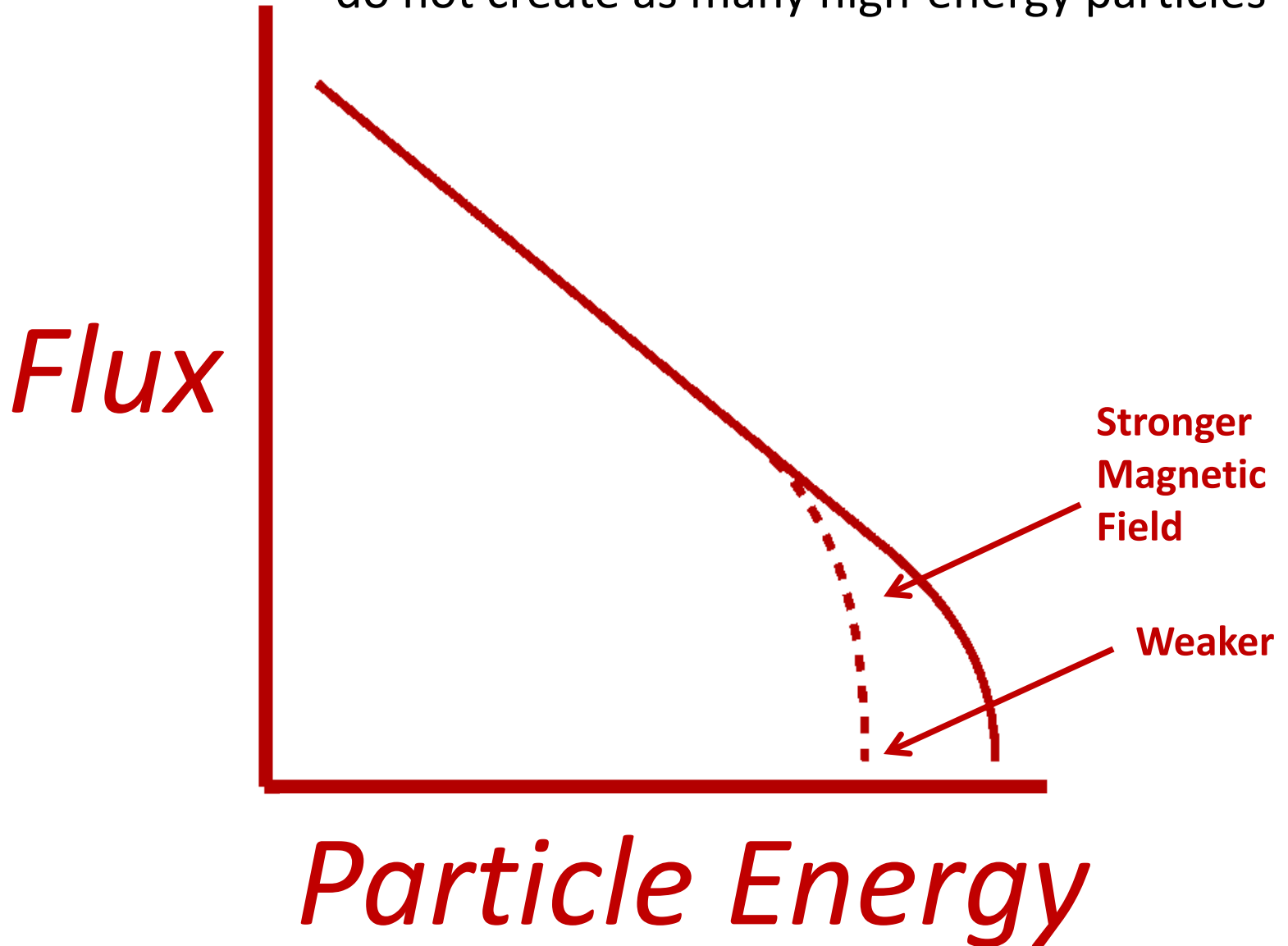
# A schematic of a CME and the acceleration of SEPs



If the magnetic field is **weaker**, the particles are not as well trapped near the shock, and don't reach as high an energy

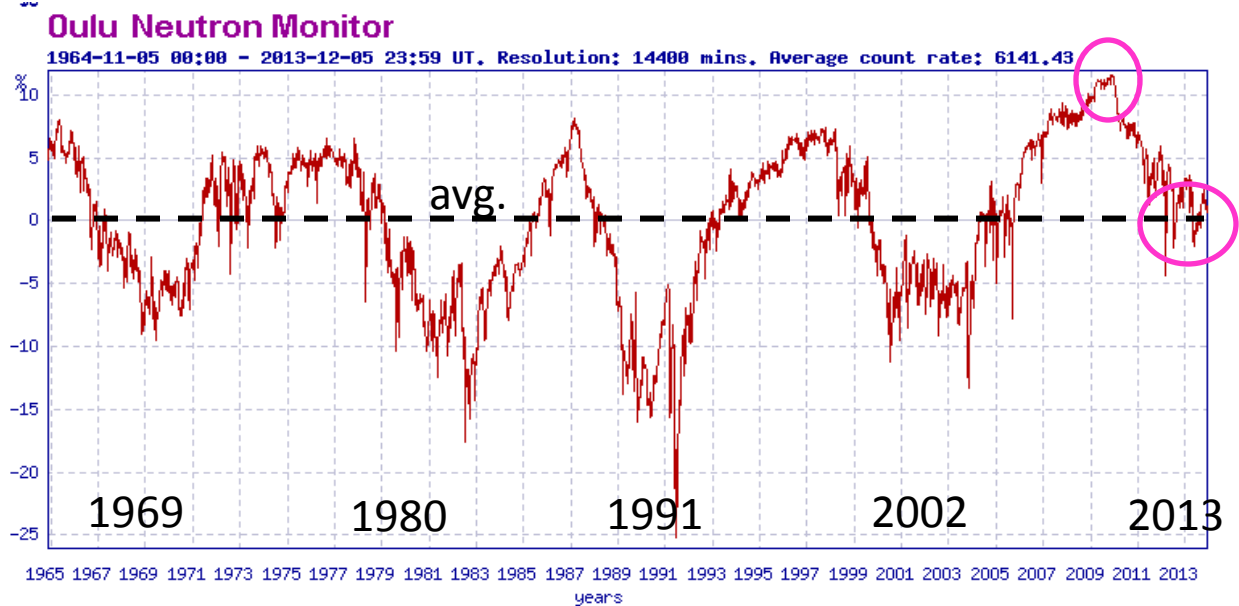


When the solar magnetic field is weaker, shocks do not create as many high-energy particles

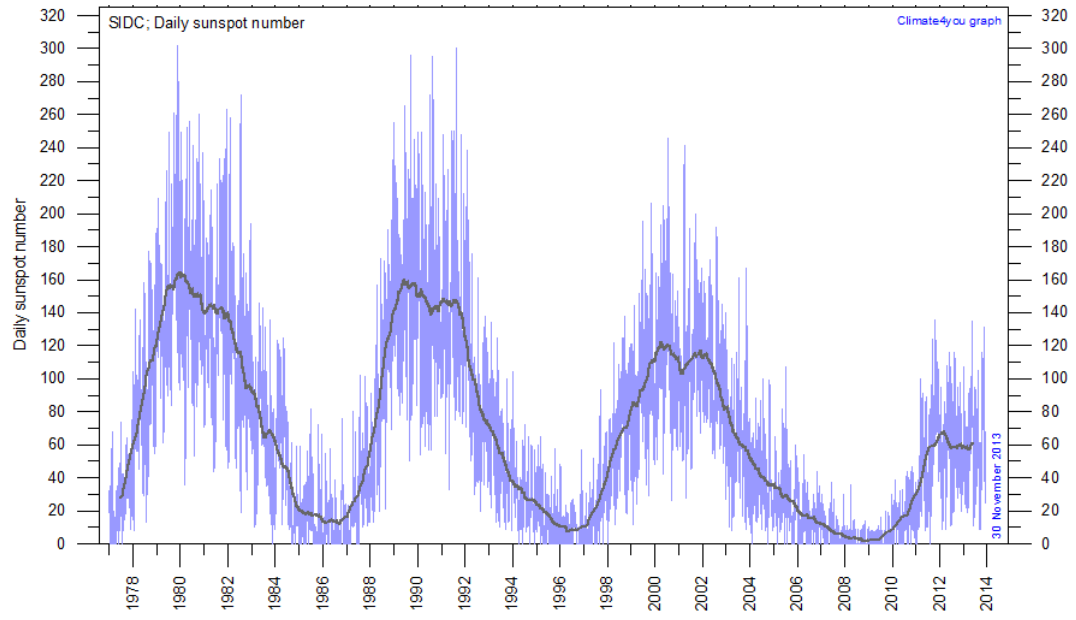


**Galactic Cosmic Rays (GCR) reached record intensities during the last solar minimum, and their intensity during the current maximum is higher than in previous cycles (surprisingly near the overall average!)**

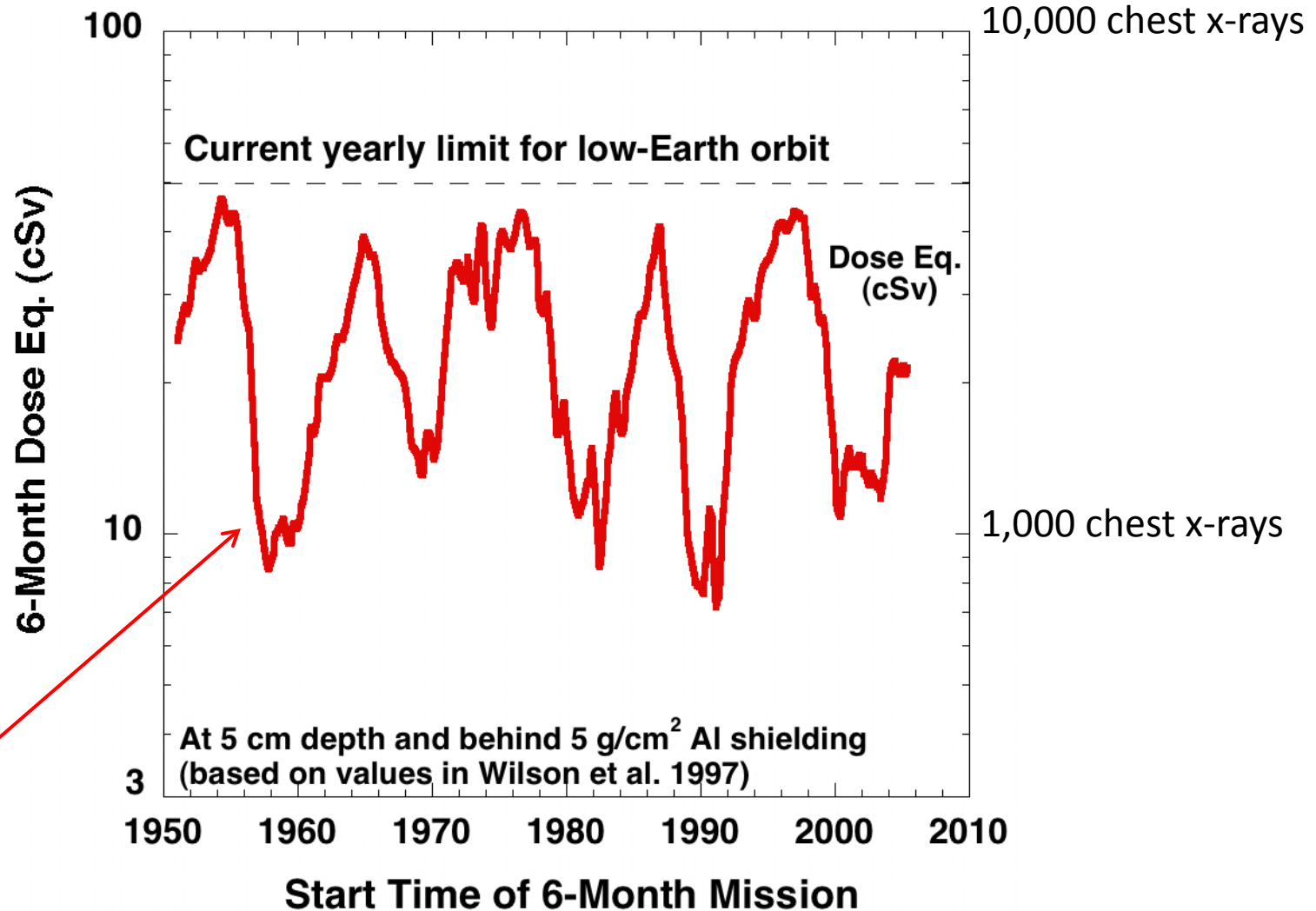
GCRs  
(Oulu, Finland)



Sunspot Number  
(SIDAC, Belgium)



# Cosmic Rays pose a significant radiation-threat to astronauts



1 AU neutron monitor data converted to radiation dose equivalent

Extra slides

A numerical simulation for the large SEP event seen on Oct 29, 2003 showing by how much it would be reduced in a weaker magnetic field

Proton  
flux

