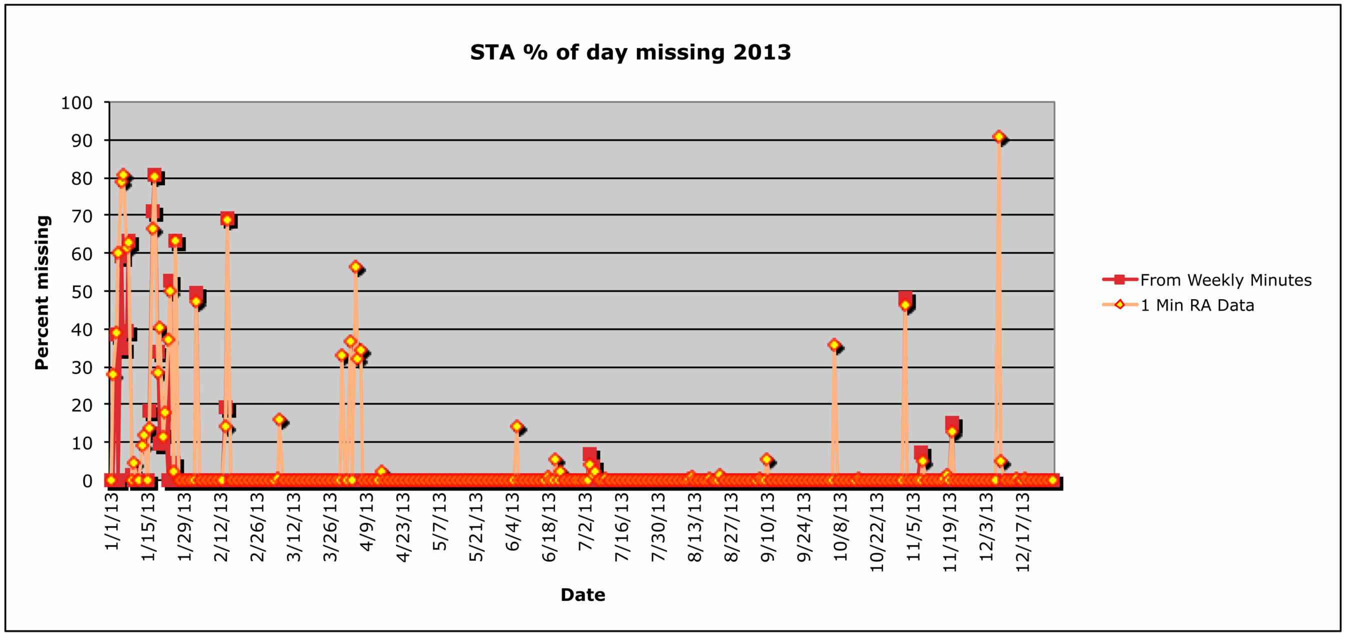
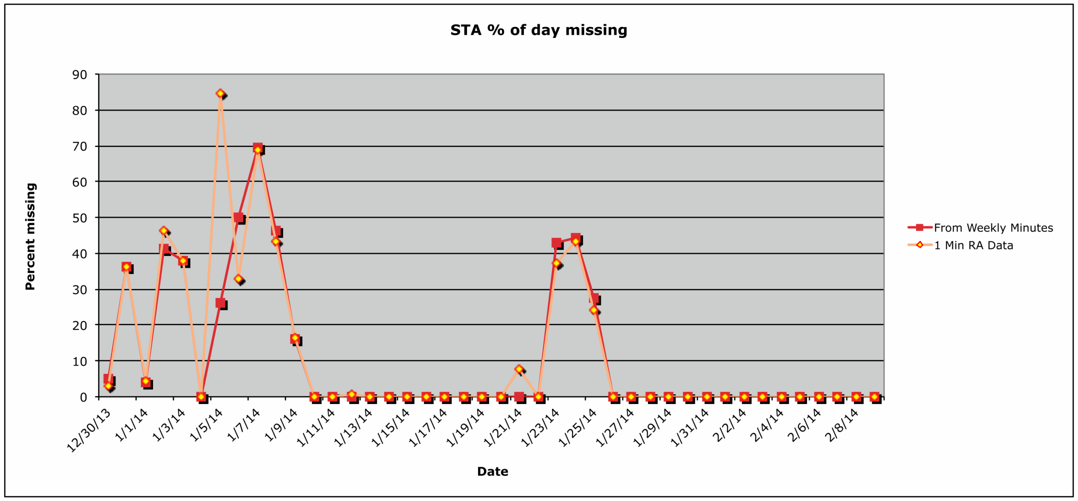
STEREO PLASTIC STATUS

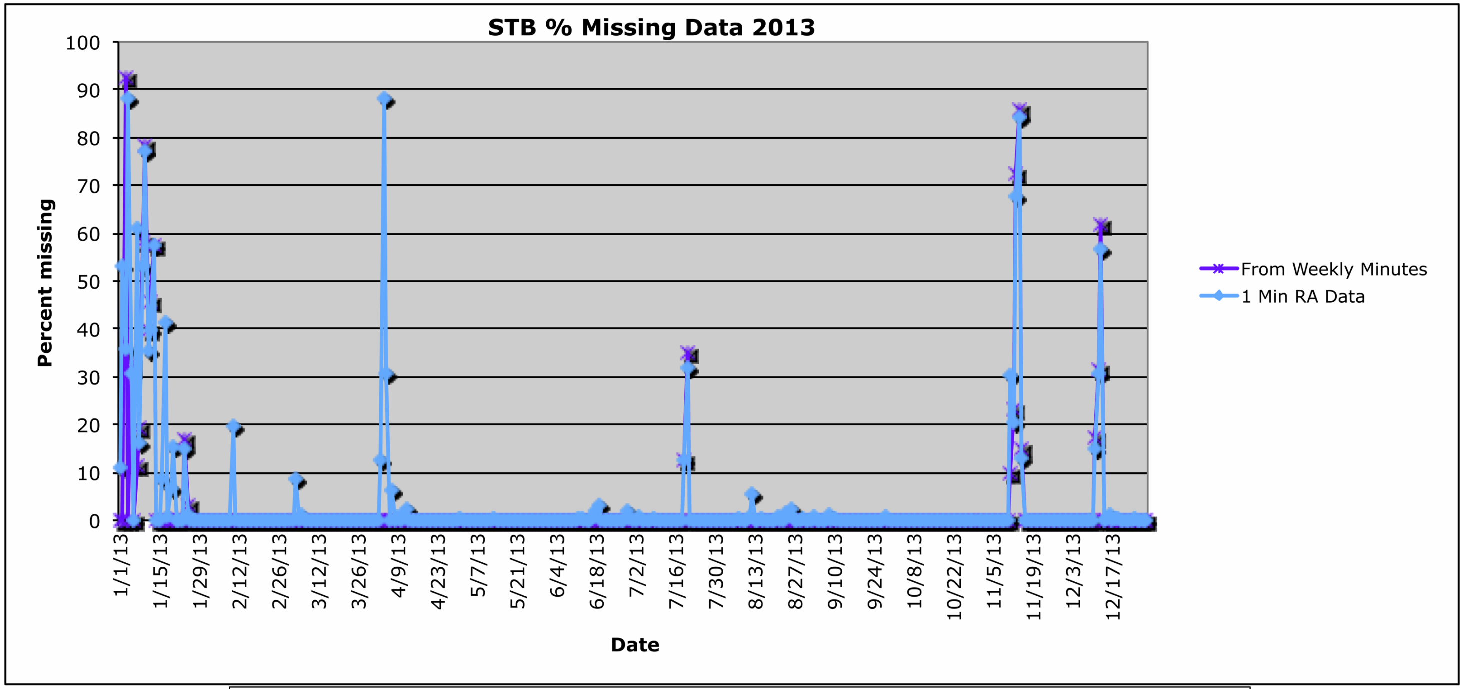
A.B. Galvin with contributions by C. Farrugia and L. Ellis

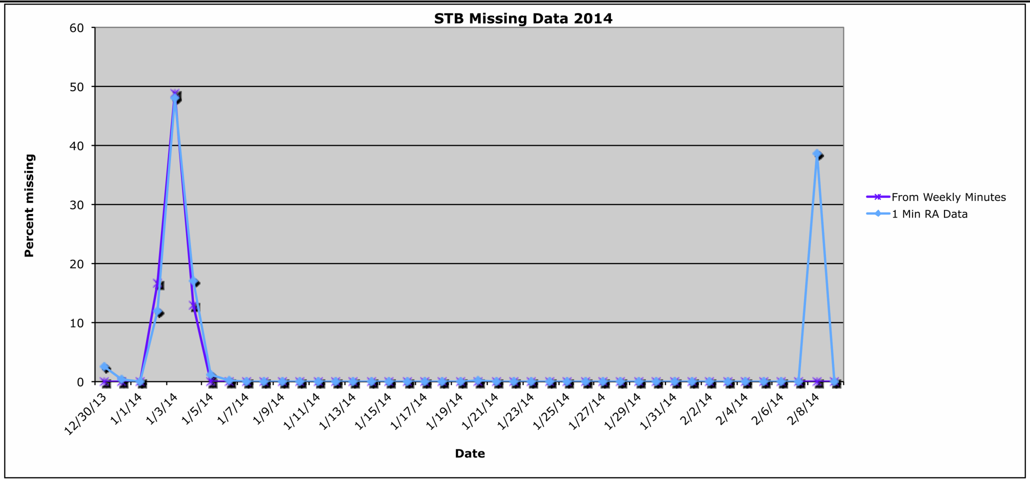
Telemetry Losses - STA





Telemetry Losses - STB





Operations

- In order to meet reduced telemetry we have been eliminating some ApIDs (31A, 31B, 31E, 31F, 320) and in other cases (31C, 31D) have extended accumulation times up to 2 hours.
- Some routine processing programs are currently under revision to accommodate variable accumulation times.
- This will allow us to extend accumulation times for priority rates, if it becomes necessary to reduce telemetry further.

Operations

- Operation is nominal, except for
  - The reduced telemetry, creates data gaps and some APIDs have been commanded either off or with increased time accumulation
  - Apparently the new telemetry reduction requires a new turn on procedures after an IDPU reboot (aka MAG anomaly recovery operations)
  - Reduced efficiency on MCPs, particularly for STB
    - Issue stems from the entrance system design, which did not meet specifications
    - Primarily affects minor species, not the protons
    - Looking at what over head is left in operational voltages
    - Problem should be alleviated once s/c flips (new section of MCPs exposed)

After the Flip

- Have started team planning for changes to processing programs to accommodate new orientation (L. Ellis)
- Instrument efficiencies will be different as different parts of the detectors will be exposed (K. Simunac and A. Galvin)
- Have started planning "recommissioning" activities (J. Gaidos and M. Popecki)
- Have some concern about how cold the power supplies will become under extended non-operations.
- John Gaidos has been returned to STEREO activities with these operational plans (was the system engineer on PLASTIC).

Level 2 data products

- STEREO B updated through Dec 31, 2013
- STEREO A updated through Nov 30, 2013

Level 3 data products

- STEREO A He+ pickup ions through 2012
- 2013 in process

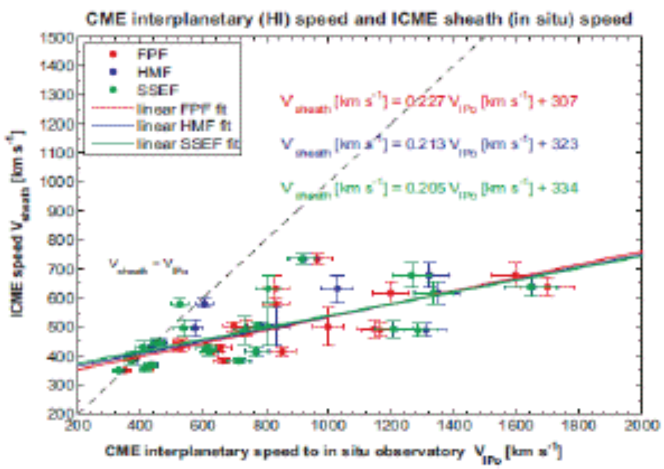
Some Science Nuggets

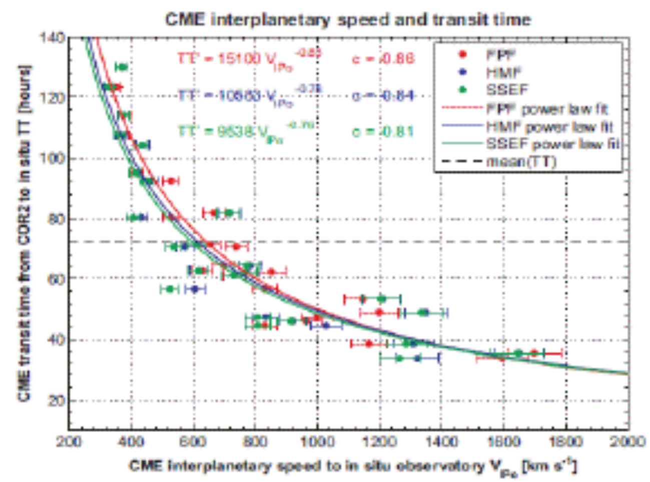
Connecting white light to in situ observations of 22 coronal mass ejections from Sun to 1 AU

- *Moestl, C., K. Amla, J. R. Hall, P. C. Liewer, E. M De Jong, R. C. Colannino, A. M. Veronig, T. Rollett,. M. Temmer, V. Peinhart, J. A. Davies, N. Lugaz, Y. Liu, C. J. Farrugia, J. G. Luhmann, B. Vrsank, R. A. Harrison, and A. B. Galvin,* Connecting speeds, directions and arrival times of 22 coronal mass ejections from the Sun to 1 AU, *Astrophys. J.*, under review 2014.

CME parameters were predicted mainly from STEREO/HI with 3 different models.
With STEREO we connected CME observations from coronagraph to HI to in situ data at 1 AU.
● Three different model geometries of the ICME shape were used for propagating the disturbance in interplanetary space. The results were checked against in situ observations made by STEREO B and Wind.
● Relationships were found which make it possible to optimize these predictions.
● The result is that with the new relationships, in situ speeds can be predicted within 100 km/s for 88 % of all events.
● For the arrival times, prediction works within +/8 hours (71% of all events).
● While these inferences are valid for this particular set of 22 CME events, we note that the data set includes a quite full spectrum of CME speeds (range: 300-2700 km/s).

Speed Prediction





(Left) **Interplanetary and in situ CME speeds**: Correlation between HI interplanetary CME speeds in the direction of the in situ observatory (VIPo) and observed proton bulk speeds (Vsheath) inside the ICME sheath regions. Linear fits derived for each of the three models are shown in the respective colors. Using this relationship we can calculate "corrected speeds" for geometrical modeling.

(Right) Interplanetary speeds and CME transit times: HI interplanetary speeds (VIPo), in the direction of the in situ observatory, plotted against CME transit times TT, defined by the time from the first appearance of the CME in a STEREO/COR2 image to the in situ arrival time around 1 AU. For each event, the speeds by the three geometrical models are given: FPF (red), HMF (blue), and SSEF (green). Power law fits for each model are plotted.

Complex evolution of coronal mass ejections in the inner heliosphere: a review

As they propagate, CMEs interact with the solar wind and preceding eruptions, which modify their properties.

In the past ten years, the evolution of CMEs in the inner heliosphere has been investigated with the help of numerical simulations, through the analysis of remote sensing observations, especially with the SECCHI suite onboard STEREO, and through the analysis of multispacecraft in situ measurements. Most studies have focused on understanding the characteristics of the magnetic flux rope thought to form the core of most CME.

- *Lugaz, N., C. J. Farrugia, and N. AlHaddad, Proc. IAU Symposium No. 300, Nature of Prominences and their role in space weather*, eds. B. Schmieder, J.M. Malherbe, S.Wu, 2014.

Regarding modeling: We have magnetic flux ropes as a sufficient model to understand CMEs, but is it also necessary? More importantly, most flux rope models used to analyze observations appear overly simplistic as compared to observations, which often reveal bends and writhe as well as a varying cross section shape along the CME “axis”.

Combination of successive coronal mass ejections causing an extreme storm in interplanetary space

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MAGNETFELD 18.03.2014

Wie extreme Sonnenstürme entstehen

Heftige Eruptionen auf der Sonne verursachen elektromagnetische Störungen, die Satelliten, Kommunikations- und Energiesysteme beeinflussen können. Neue Analysen der "Stereo"-Sonnensatellitendaten der NASA relativieren bisherige Modelle. Aufeinanderfolgende Massenauswürfe können sich enorm aufschaukeln.

Nach sogenannten koronaren Masseauswürfen (CME) werden große

Die Studie in "Nature Communications": "Observations of an extre… interplanetary space cau… coronal mass ejections" … erschienen am 18. März …

Ученые исследовали причины сильнейшей солнечной бури

В статье, опубликованной в издании Nature Communications, команда ученых из разных стран описывает происхождение и причины солнечной бури, случившейся 22 июня 2012 года; скорость солнечного ветра, которую удалось зарегистрировать, превышала все значения, которые когда-либо удавалось получить с помощью прибора для измерения скорости ветра, установленного на борту солнечной обсерватории STEREO.

Ведущим автором публикации является Йинг Д. Лью (Ying D. Liu), сотрудник Китайской Академии Наук.

…положение, что причиной этой солнечной …ные, быстрые солнечные извержения, …ронарной массы. В результате вещество …во со скоростью 3000 километров в …вещества было невозможно.

…о газа, состоящего из заряженных частиц. …ены» почти одновременно, стала эта

…ований прибора PLASTIC (PLAsma and …емально быстрые солнечные протоны, …чных извержений, в результате которых

…е прибора IMPACT.

… двух почти идентичных космических …лнца. PLASTIC дает данные о …солнечного ветра и альфа-частицы …тся основными компонентами,

Business Standard

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Origin and cause of Sun's 'perfect storm' revealed

ANI | Washington March 19, 2014 Last Updated at 10:08 IST

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Researchers have published a paper that uncovers the origin and cause of an extreme space weather event that occurred on July 22, 2012, at the sun and generated the fastest solar wind speed ever recorded directly by a solar wind instrument.

Y. D. Liu , J. G. Luhmann, P. Kajdic, E. K. J. Kilpua, N. Lugaz, N. V. Nitta, C. Moestl,, B. Lavraud, S. D. Bale , C. J. Farrugia, A. B. Galvin,

Nature Communications

March 20, 2014

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nature | by Elizabeth Gibney

Posted: 03/19/2014 8:45 am EDT | Updated: 03/19/2014 8:59 am EDT

Extreme Event

Using multipoint remote sensing and *in situ* observations, we report an extreme event occurring on the farside of the Sun and observed by STEREOA on 2012 July 23.

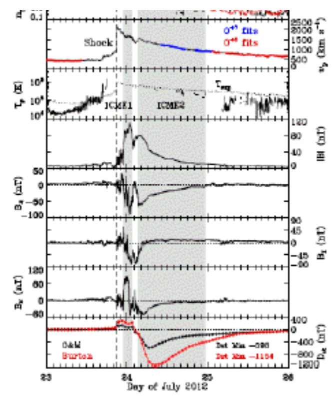

Figure*: Plasma and magnetic field data from STERE-A: proton density, bulk speed, proton temperature, magnetic field strength and components, and Dst index. Vertical dashed line: leading shock; shaded regions: ICME intervals. First panel, red curve: number density (x 5) of electrons of engergies > 45 eV. Second panel: speeds derived from O6+ and O7+ fits, which are consistent with the proton bulk speed.*

● Maximum speed near the Sun: 3050 km/s.

● At STEREOA, a peak solar wind speed of 224 km/s was observed followed by a magnetic cloud whose peak magnetic field strength reached 109 nT.

● Such conditions would have produced a record genoagnetic storm if the eruption were Earthdiredted.

● Novel features:

(1) The interaction of two closely launched coronal mass ejections resulted in the extreme enhancement of the magnetic field strength and

(2) A preconditioning of the upstream solar wind by an earlier solar eruption led to the unusually weak deceleration of the event.

This event gives us clues as to how severe geomagnetic storms may be generated through CME interactions near the Sun in special conditions.

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