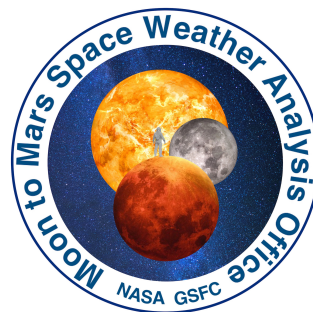
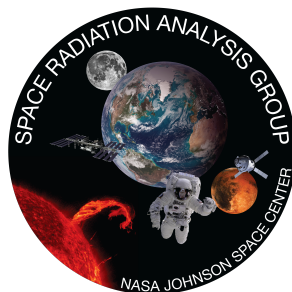
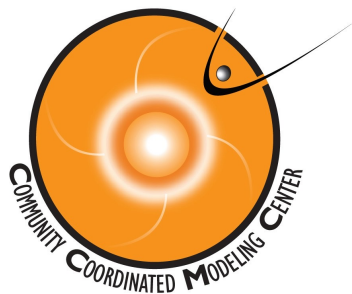


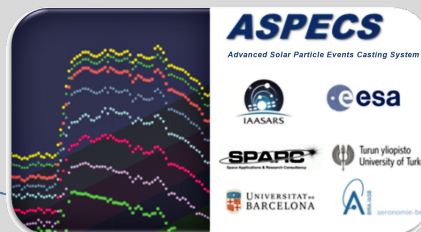
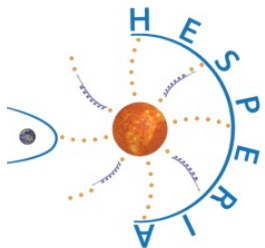
Scoreboard

M. Leila Mays and Joycelyn Jones

with the CCMC, SRAG, and M2M teams, and international participants



Meets SWxSA (Space Weather Science Application) Team Goals: ● Goal 2: Analyze ● Goal 3: Predict ● Goal 4: Transition ● Goal 5: Support ● Goal 6: Partner





Models at CCMC

SWMF.SC+EEGGL+CME

AWSoM EEGGL SRPM

PFSS.Petrie ANMHD

PFSS.Macneice

PFSS.Luhmann

MAG4 UMASEP

ASAP ASSA AMOS

WSA NLFFF

MAGIC SNB3GEO

GCR BON NOVICE

NAIRAS CARI-7

WSA-ENLIL

WSA-ENLIL+Cone

WSA-ENLIL+EPREM

WSA-ENLIL+SEPMOD

REleASE

PREDICCS

EMMREM

iPATH

EXO Solar Wind

CORHEL

Heltomo SMEI

Heltomo IPS

BRYNTRN

DBM

SWMF.SH

DIPS

Heliosphere

LFM-TING

LFM-MIX

OpenGGCM+CTIM

SWMF+RCM+deltaB

SWMF+RCM

SWMF+RCM+RBE

SWMF+RCM+CRCM

LFM-MIX-TIEGCM

WINDMI LANLstar

IGRF Tsyganenko

PS VP Weigel-deltaB

AACGM Apex

AMPS

GUMICS

GIC

LANLstar

Tsyganenko

Weigel-deltaB

Apex

VPIC

PAMHD

PIC-Hesse

Local Physics

TIE-GCM

GMAT

CTIPe

RCM

Fok.CIMI

Fok.RBE

UPOS RB

AE-8/AP-8

AE-9/AP-9

VERB

Inner Magnetosphere

SAMI-3

SAM

IDA4D

USU-GAIM

SWACI-TEC

ABBYNormal

NRLMSISE

GITM

PBMOD

TRIPL-DA

Weimer IE

Weimer-deltaB

IRI JB2008

IMPACT DTM

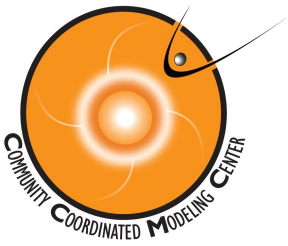
COSGROVE-PF

Ovation Prime

Ionosphere/ Thermosphere

Corona

Magnetosphere



Validation: CCMC community scoreboards

<https://ccmc.gsfc.nasa.gov/challenges/>



Flare Scoreboard
Upload your Flare Predictions for Full Disk and/or Active Regions.

Leads: **Trinity College Dublin** (S. Murray), **ROB** (J. Andries)



SEP Scoreboard
Under development Help us plan and design.

Leads: **NASA SRAG**, **CCMC** (L. Mays), **BIRA-IASB** (M. Dierckxsens)



CME Scoreboard
Submit your CME arrivable time predictions and compare with others.

Leads: **CCMC** (L. Mays), **UK Met Office**

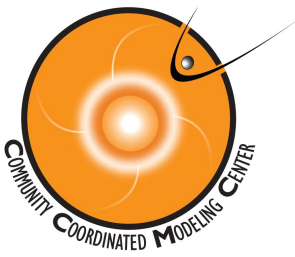


IMF Bz Scoreboard

Leads: **PredSci** (P. Riley), **University of Reading** (M. Owens)

PLANNING PHASE

- Scoreboards collect forecasts from the community before event is observed
- Allows a consistent **real-time** comparison of various operational and research forecasts
- Over time enough statistics are collected for validation studies
- Provides valuable feedback for model developers to make improvements



SEP Scoreboard

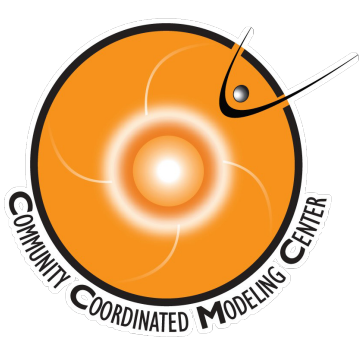


<https://ccmc.gsfc.nasa.gov/challenges/sep.php>

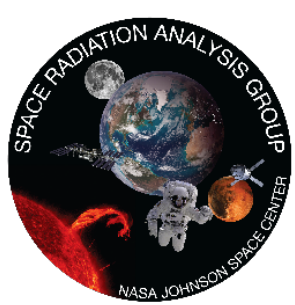
- Planning for the SEP Scoreboard started in 2016 - led by Mark Dierckxsens, Ian Richardson, Mike Marsh, and Leila Mays



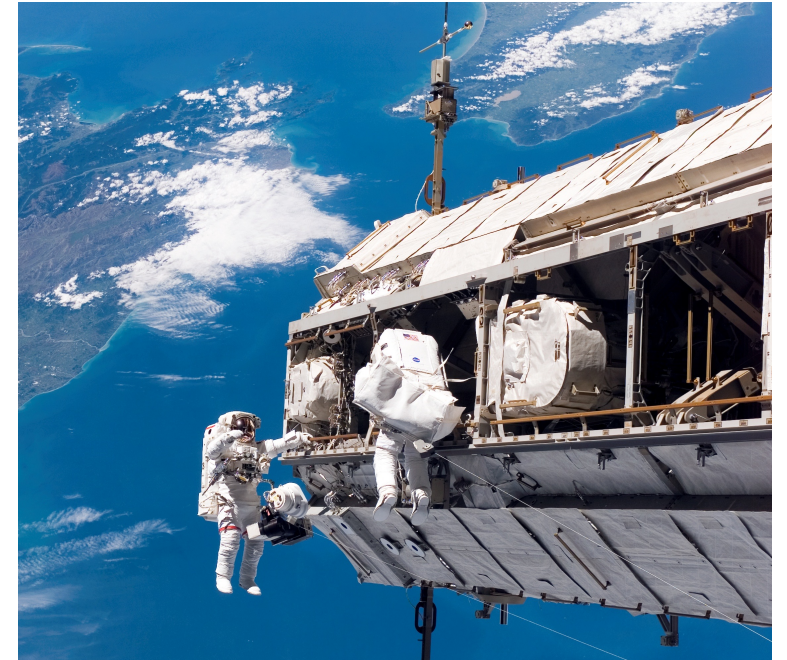
- Builds upon the flare scoreboard and CME arrival time scoreboard
- Automated system: CCMC runs the models or model developers can routinely upload their predictions to an anonymous ftp.
- Forecast data is parsed and stored in a database which is accessible to anyone via an API



SEP Scoreboard: CCMC R2O Collaboration with NASA Johnson Space Center SRAG



- In 2018 CCMC started a multi year project (ISEP) with NASA Space Radiation Analysis Group to **transition research Solar Energetic Particle models to operations**
- **Project goals:**
 - identify, transition, and evaluate new models (R2O)
 - develop software tailored for SRAG
 - implement these capabilities within CCMC as a non-operational prototype.
- CCMC has transitioned 6+ real-time models and built **the SEP Scoreboard application** that will be used operationally by SRAG and M2M for human missions beyond LEO.
- The Scoreboard is already in use by SRAG and M2M for ISS support and will be used for ARTEMIS.



<https://ccmc.gsfc.nasa.gov/challenges/isep>

SEP Models in the Community

Continuous/
Probabilistic

AFRL SFS
ASPECS/FORSPEF
GSU
MAG4 (Falconer)
SPRINTS
SWPC
UK Met Office

Solar Event
Triggered

Flare:
AFRL SFS
COMESSEP SEPForecast (BIRA)
SPARX (Dalla, Marsh)

Flare and/or CME:
COMESSEP SEPForecast
ASPECS/FORSPEF (NOA)
GSU
SOLPENCO (Arans)

Flare and proton intensity:
UMASEP (Núñez)
Boubrahimi model

Electron intensity:
HESPERIA REleASE

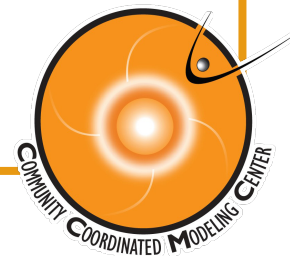
CME:
SEPSTER, SEPSTER2D (Richardson, Bruno)
MLSO K-Cor (St. Cyr)

Flare, Radio, H-alpha:
SWPC PPM

Flare, Radio:
ESPERTA (Laurenza)

Physics
based

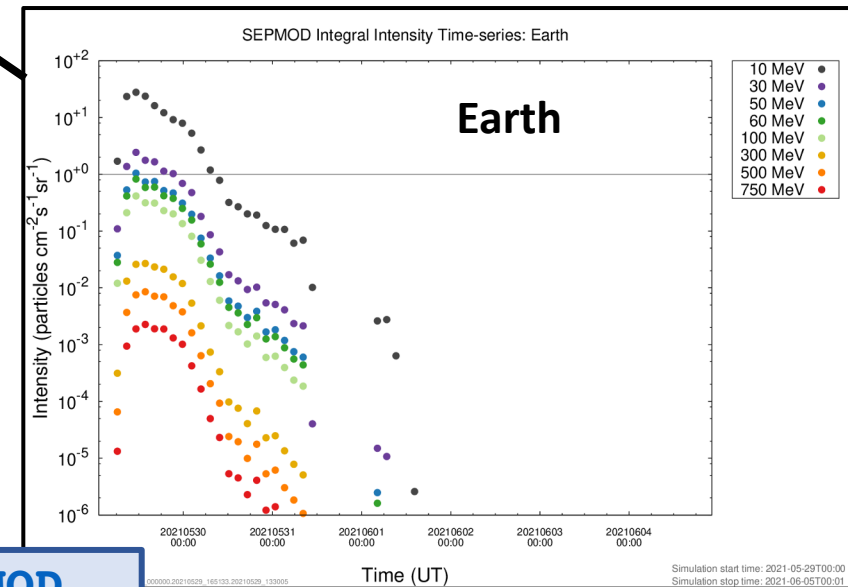
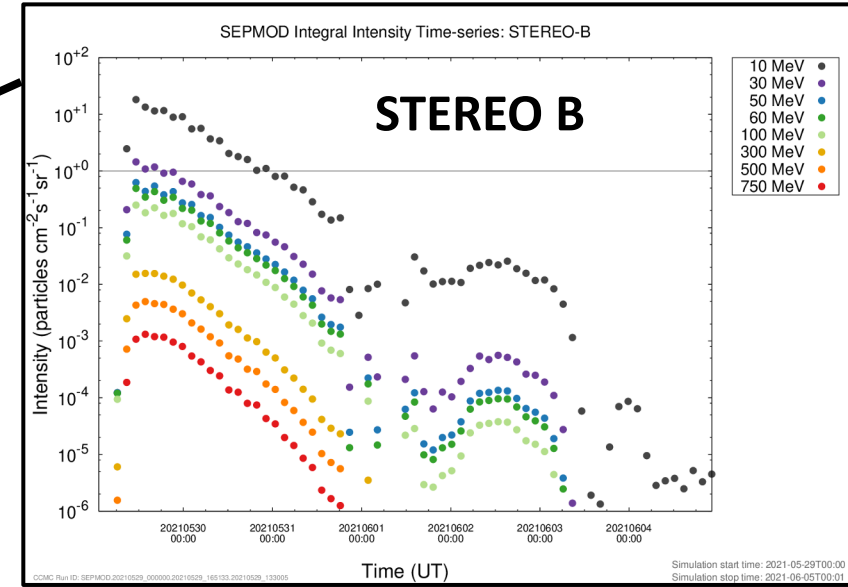
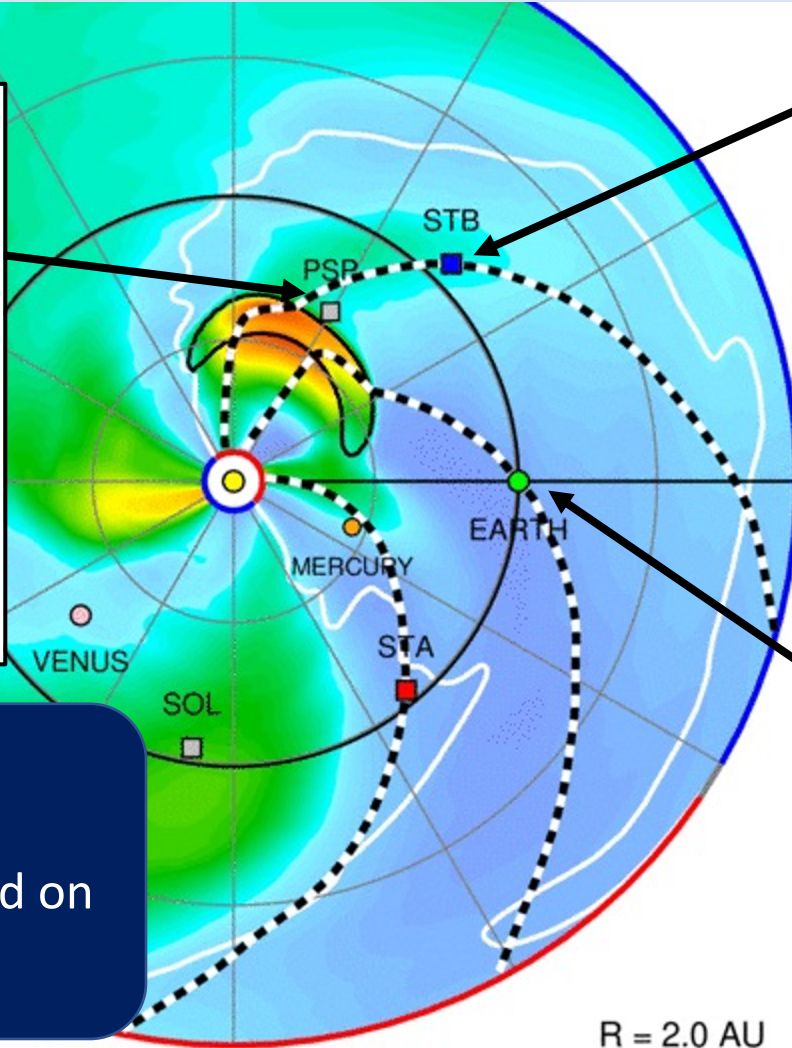
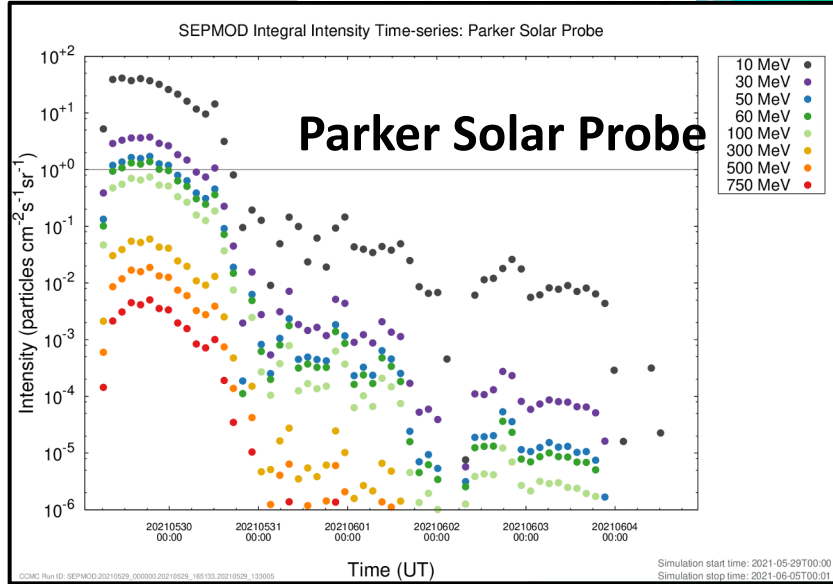
WSA-ENLIL+EPREM (Odstroicil, UNH)
ZEUS+iPATH (Li)
SWMF+iPATH (Li, Jin)
PARADISE (EUHFORIA)
WSA-ENLIL+SEPMOD (Luhmann)
SPARX (Dalla, Marsh)
STAT: MAS+EPREM (PSI and UNH)
SWMF M-FLAMPA (UMich)
Zhang Model (FIT)



Real-time physics-based SEP forecast with WSA-ENLIL-SEPMOD

Also available for community use via Runs-on-Request

2021-05-30T12:04



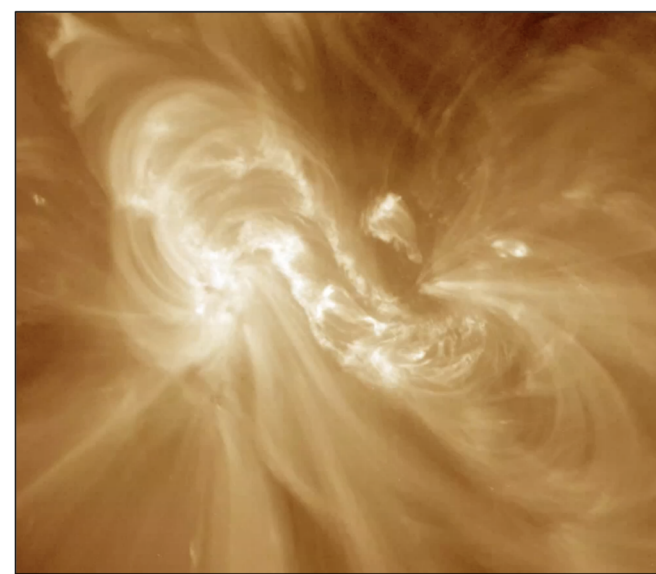
- SEPMOD inputs are taken from WSA-ENLIL CME driven shocks
- Real time run outputs are displayed on the SEP Scoreboard automatically



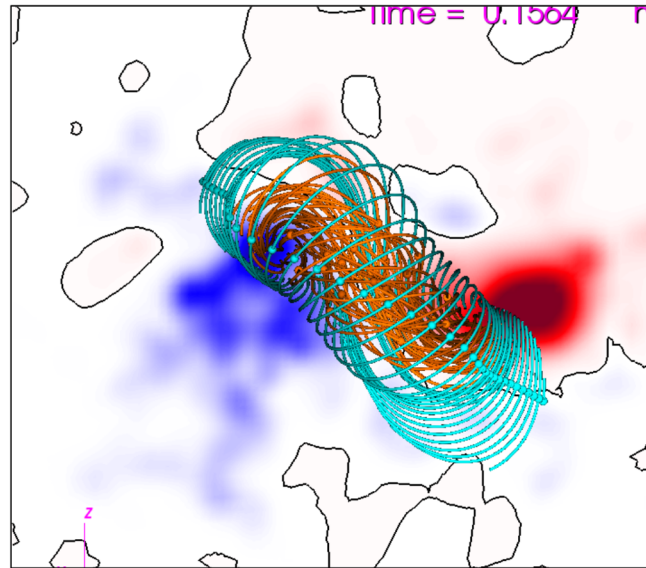
<https://ccmc.gsfc.nasa.gov/models/modelinfo.php?model=SEPMOD>

CORHEL/MAS-TDm (Predictive Science Inc.)

An Interface for Modeling Stable and Unstable Flux Ropes in Realistic Solar Magnetic Fields

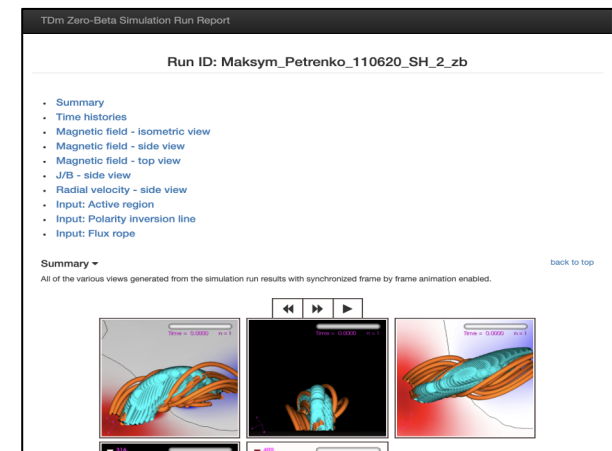
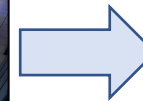
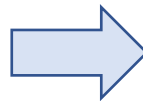
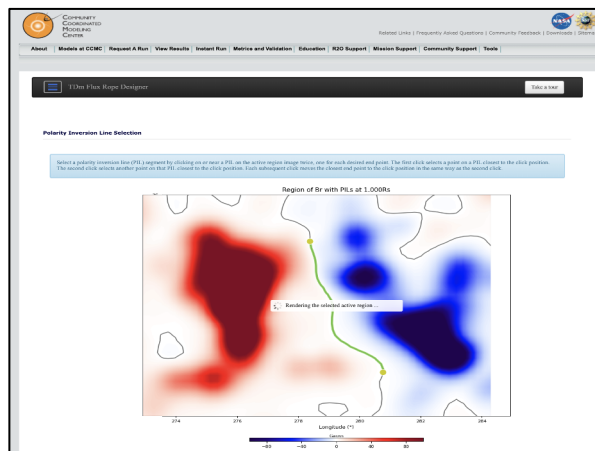


SDO AIA 193 (from jHelioviewer)

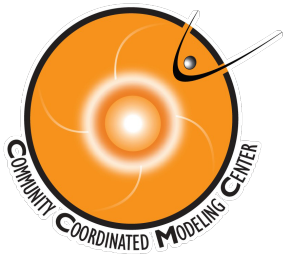


TDM Top Down view

- Inserts user designed Titov-Demoulin (TDm) flux rope into observed active region field
- Output drives MAS MHD model of flux rope evolution to simulate CME eruption
- TDm Flux Rope Designer web interface available via CCMC runs on request website
- MHD evolution runs executed locally or on Pleiades



<https://ccmc.gsfc.nasa.gov/models/modelinfo.php?model=CORHEL/MAS-TDM>



SEP Scoreboard Displays



Displays have been built for multiple forecast types:

Probability app:

- probability heat map and time series (MAG4, SWPC, ASPECS, GSU, SPRINTS)

<https://sep.ccmc.gsfc.nasa.gov/probability/>

Intensity app:

- intensity heat map (SEPSTER, UMASEP, SEPMOD, STAT, ASPECS, IPATH)
- intensity time series (REleASE, SEPMOD, UMASEP, STAT, ASPECS, IPATH)

<https://sep.ccmc.gsfc.nasa.gov/intensity/>

All Clear app:

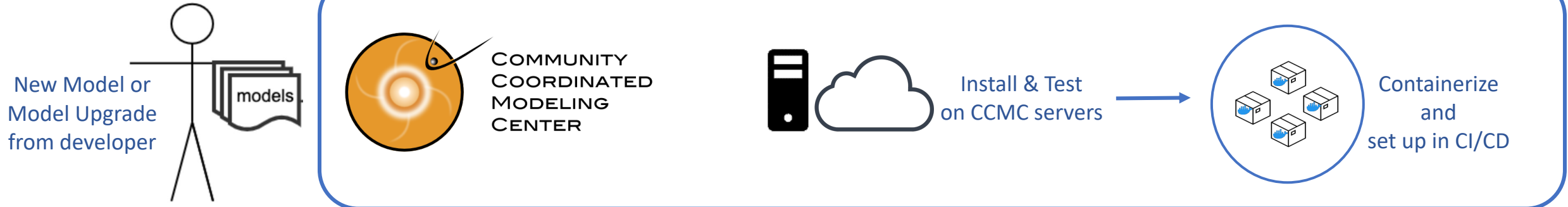
- all clear forecast heat map (all models)

<https://sep.ccmc.gsfc.nasa.gov/allclear/>

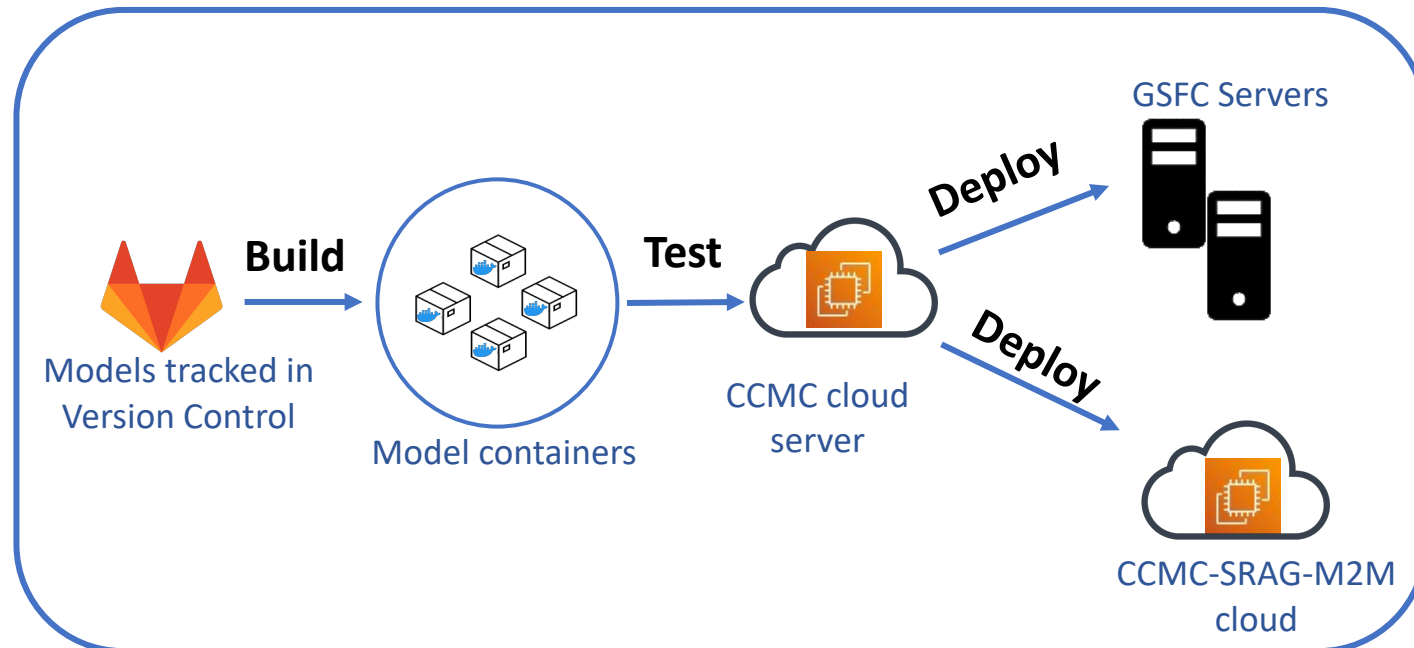
Research to Operations (R2O) at CCMC: Model onboarding and synchronization



ISEP Model onboarding:

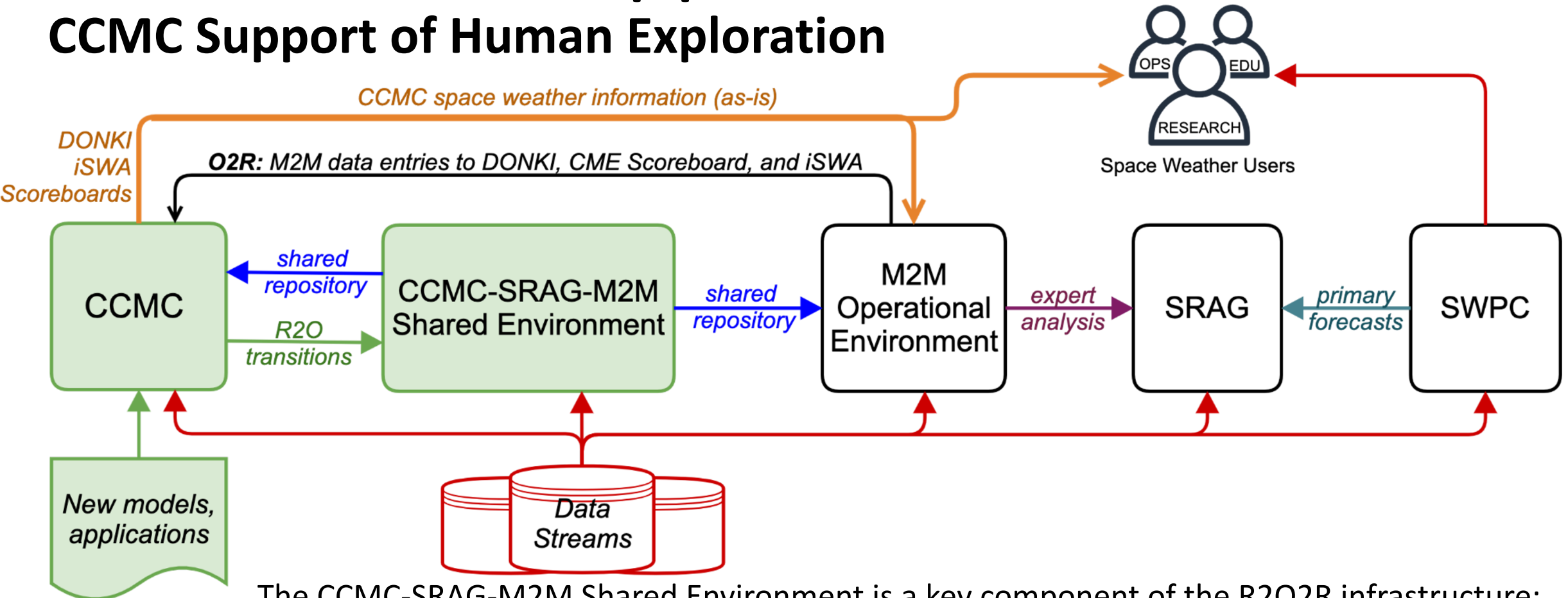


Continuous Integration and Deployment (CI/CD) System at CCMC:



Lead: Chinwe Didigu

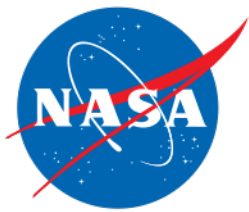
NASA in-house R2O2R pipeline: CCMC Support of Human Exploration



The CCMC-SRAG-M2M Shared Environment is a key component of the R2O2R infrastructure:

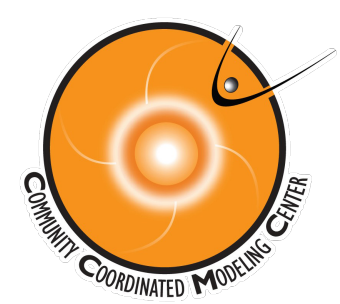
- Shared GitLab repositories with detailed documentation
- Continuous Integration and Continuous Deployment software
- Containerized models and applications to ensure portability and ease of upgrades

The NASA GSFC Moon to Mars Space Weather Office (M2M) was established to support NASA's Space Radiation Analysis Group (SRAG) with human space exploration activities by providing expert analysis of the space radiation

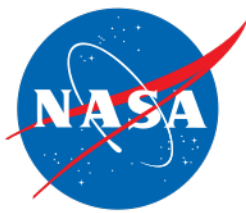


CCMC-M2M PARTNERSHIP

- The goal of the partnership between CCMC and M2M is to establish and maintain an effective NASA in-house Research-to-Operations-to-Research (R2O2R) pipeline for space radiation environment predictive capabilities in support of human missions beyond LEO.
- One key element of the partnership is the transitioning of ISEP models and the SEP Scoreboard application from the CCMC non-operational prototype to M2M operations (with model developer permission).
- M2M is not part of CCMC, however M2M and CCMC partner closely with each other



Space Weather at CCMC



- Real-time space weather activities that require **human-in-the-loop** analyses, previously performed by CCMC staff, have **transitioned from CCMC to M2M**.
- CCMC continues to be the **primary interface with model developers and the research community for all model onboarding**, including real-time space weather and ISEP models.
- CCMC is continuing all other **real-time space weather activities** including: developing real-time systems, running real-time simulations, ingesting and serving information through CCMC's iSWA, DONKI and Scoreboards.
- CCMC will continue **publicly serving the SEP Scoreboard to the community** and is open to including any SEP model -- whether it is formally part of the ISEP project or not.



CCMC-M2M PARTNERSHIP

- The M2M team populates CCMC's DONKI and CME Scoreboard during their real-time analysis of space weather conditions, and sends real-time simulation results to CCMC's iSWA.



DONKI:

CCMC's real-time SW
Event Catalog-Populated
by M2M



CCMC CME Arrival
Time Scoreboard

- M2M will continue to support NASA robotic missions with space weather notifications and anomaly analysis support.
- SRAG, CCMC, and M2M partner together on model validation

Comprehensive Assessment of Models and Events based on Library tools (CAMEL)



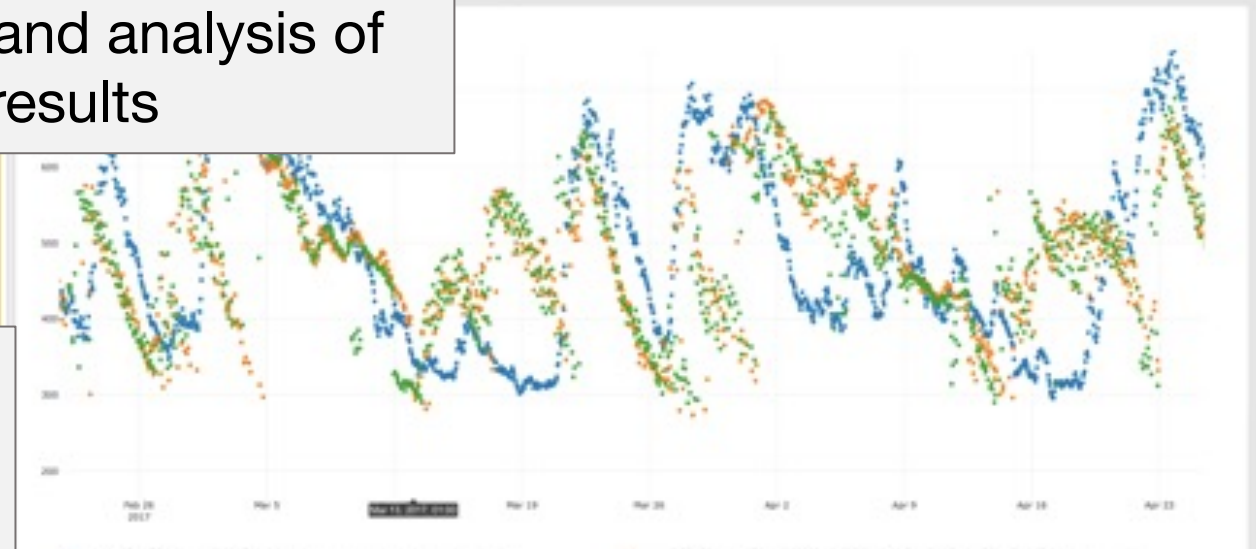
<https://ccmc.gsfc.nasa.gov/camel>

CAMEL
Comprehensive Assessment of Models and Events based on Library tools

Domain: Heliosphere
Validation Study: Solar Wind Parameters at L1
Parameters: Flow_Speed (km/s), Polarity
Resources: spase://CCMC/NumericalOutput/WSA/Version2.2/PredictedSolarWindOutput/1Day, spase://CCMC/NumericalOutput/WSA/Version2.2/PredictedSolarWindOutput/2Day, spase://CCMC/NumericalOutput/WSA/Version2.2/PredictedSolarWindOutput/3Day
Date Range: 01/01/2017 - 01/31/2017

Interactive web interface for display and analysis of evaluation results

CCMC Metadata Registry stores SPASE-based metadata for all runs



Validation for single and multiple events

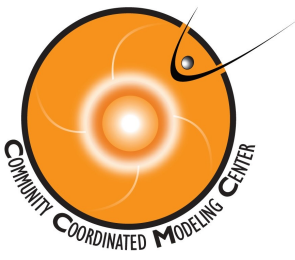
Library of metrics (tailored for specific studies)

Database (with API access) of time series, derived from model output and observational data

Framework to combine tools to perform model execution, post-processing and evaluation

Root Mean Square Scores

Resource	Flow_Speed
spase://CCMC/NumericalOutput/WSA/Version2.2/PredictedSolarWindOutput/1Day	113.1
spase://CCMC/NumericalOutput/WSA/Version2.2/PredictedSolarWindOutput/2Day	112.5



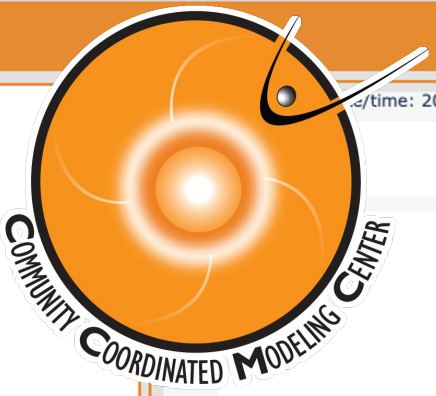
Summary: SEP Scoreboard



<https://ccmc.gsfc.nasa.gov/challenges/sep.php>

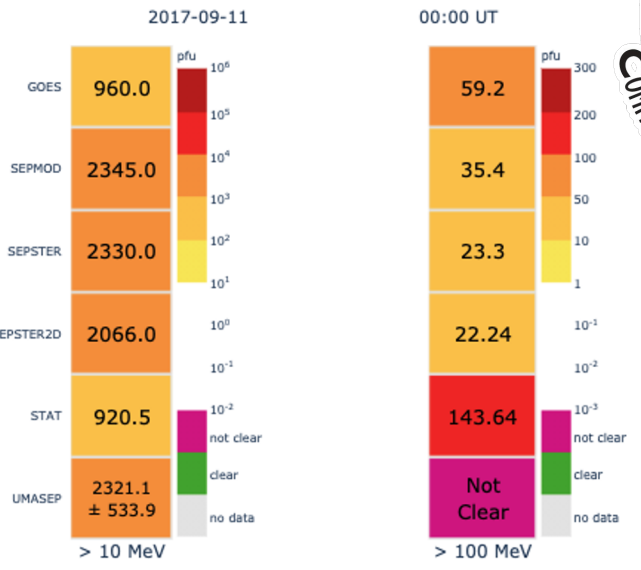
- Models are being added to the scoreboard as part of a project with NASA Space Radiation Analysis Group; all models are welcome.
- The Scoreboard displays are available publicly on the web
- **Everyone in the community is welcome to participate!**
 - Models that run in real-time: provide model outputs to the **scoreboard** via ftp
 - Models that run in historical mode/for science studies: provide results and participate in the **ISWAT SEP Validation Team** activities
- **Demo Time!**

Supplemental slides



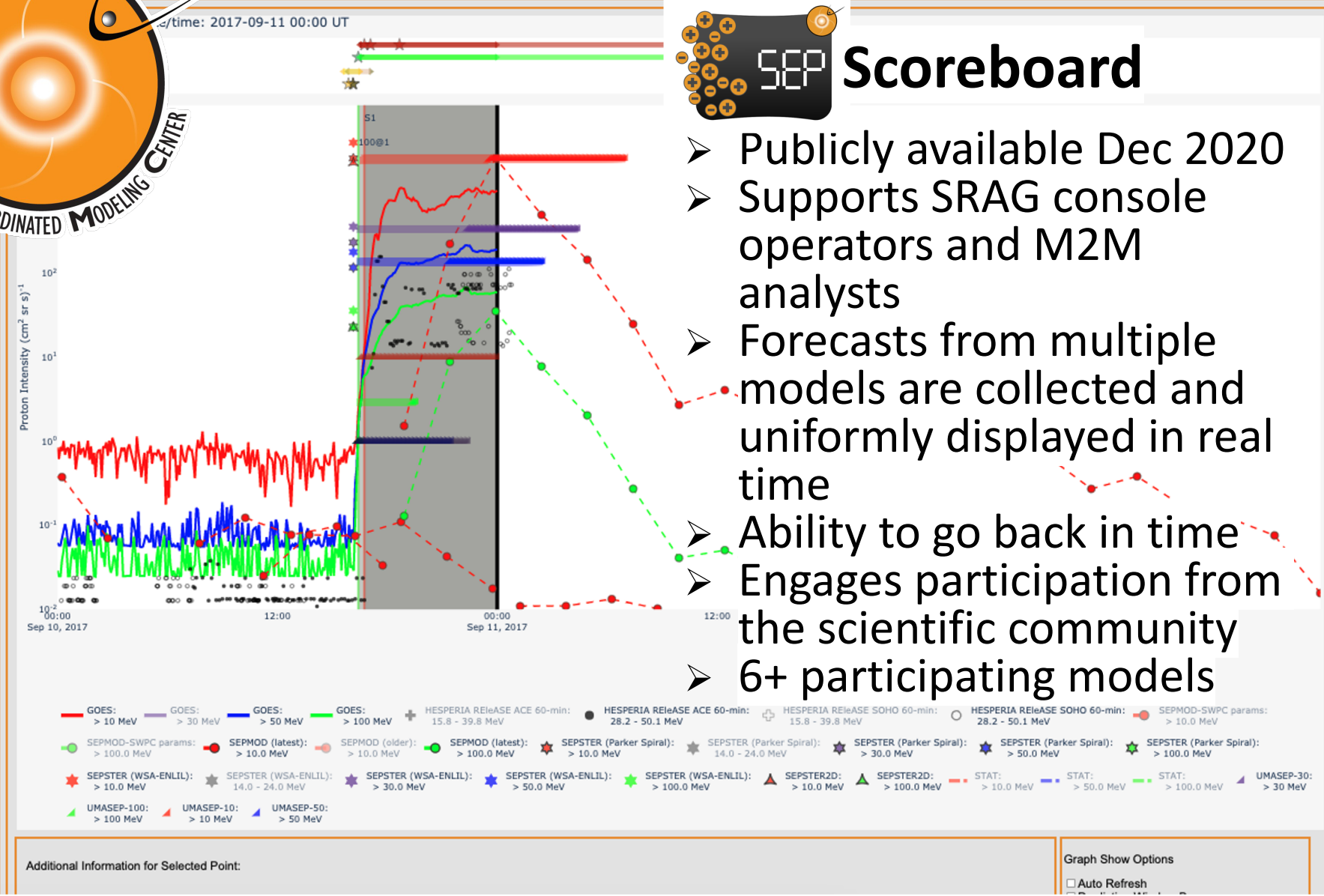
SEP Scoreboard

Proton Intensity Forecasts:



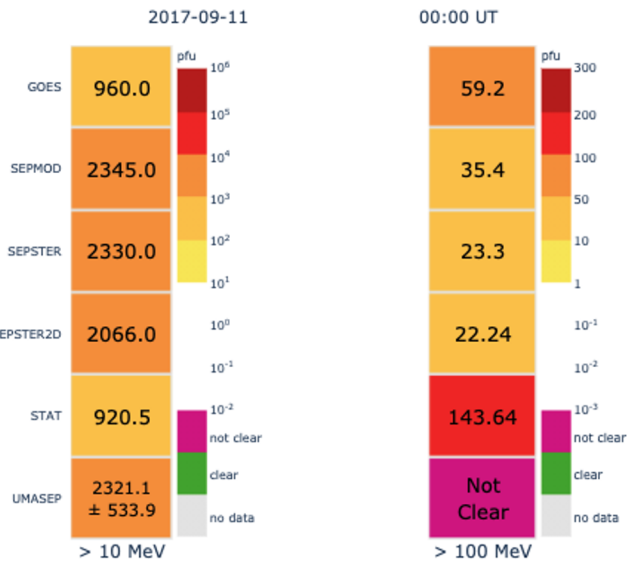
Proton All Clear Forecasts:

Model	> 10 MeV	> 100 MeV	> 500 MeV
GOES	Not Clear	Not Clear	N/A
SEPSTER	Not Clear	No Data	N/A
STAT	Not Clear	Not Clear	N/A
UMASEP	Not Clear	Not Clear	Clear



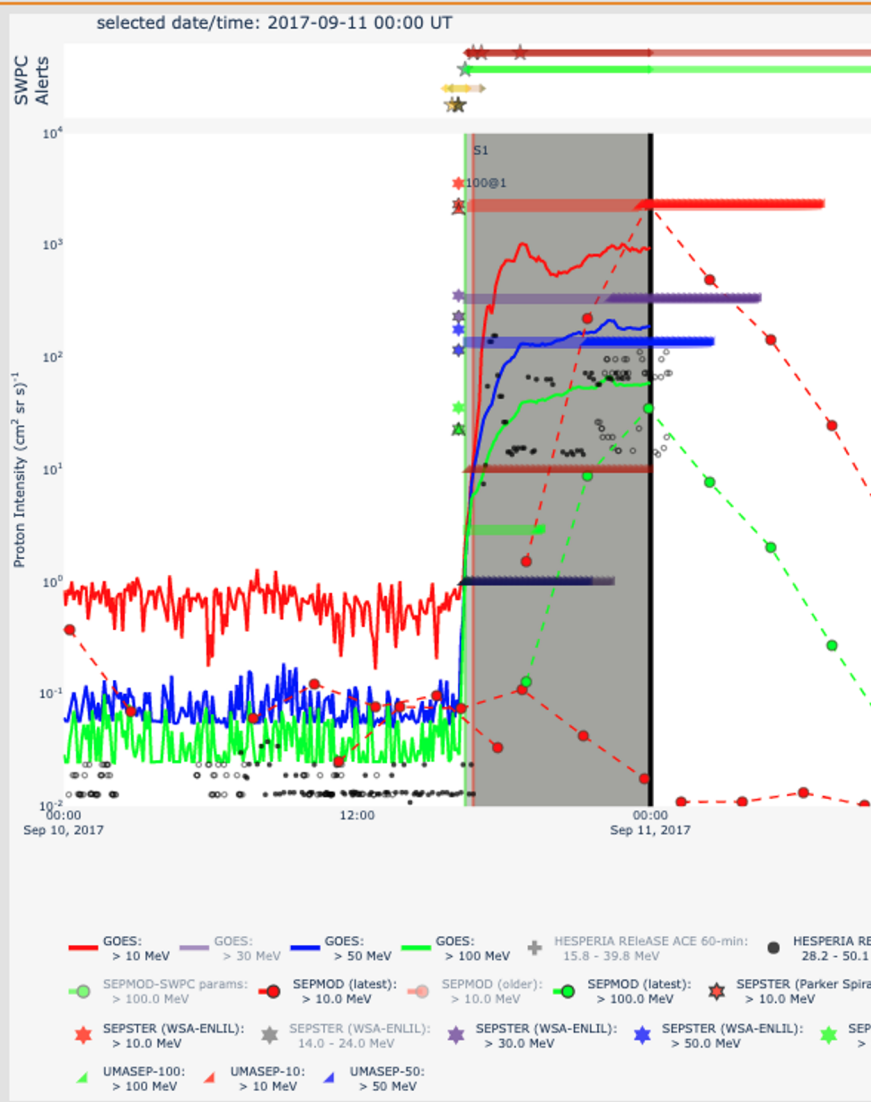
- Publicly available Dec 2020
- Supports SRAG console operators and M2M analysts
- Forecasts from multiple models are collected and uniformly displayed in real time
- Ability to go back in time
- Engages participation from the scientific community
- 6+ participating models

Proton Intensity Forecasts:



Proton All Clear Forecasts:

Model	> 10 MeV	> 100 MeV	> 500 MeV
GOES	Not Clear	Not Clear	N/A
SEPMOD	Not Clear	Clear	N/A
SEPSTER	Not Clear	No Data	N/A
SEPSTER2D	Not Clear	Not Clear	N/A
UMASEP	Not Clear	Not Clear	Clear



Scoreboard

- ★ Publicly available Dec 2020
- ★ Supports SRAG console operators and M2M analysts
- ★ Forecasts from multiple models are collected and uniformly displayed in real time
- ★ Ability to go back in time
- ★ Engages participation from the scientific community
- ★ 8 participating models

Additional Information for Selected Point:

Graph Show Options

Auto Refresh

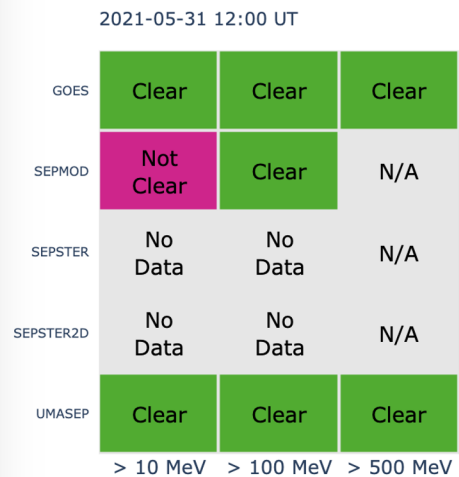
<https://sep.ccmc.gsfc.nasa.gov/intensity/>

<https://sep.ccmc.gsfc.nasa.gov/probability/>

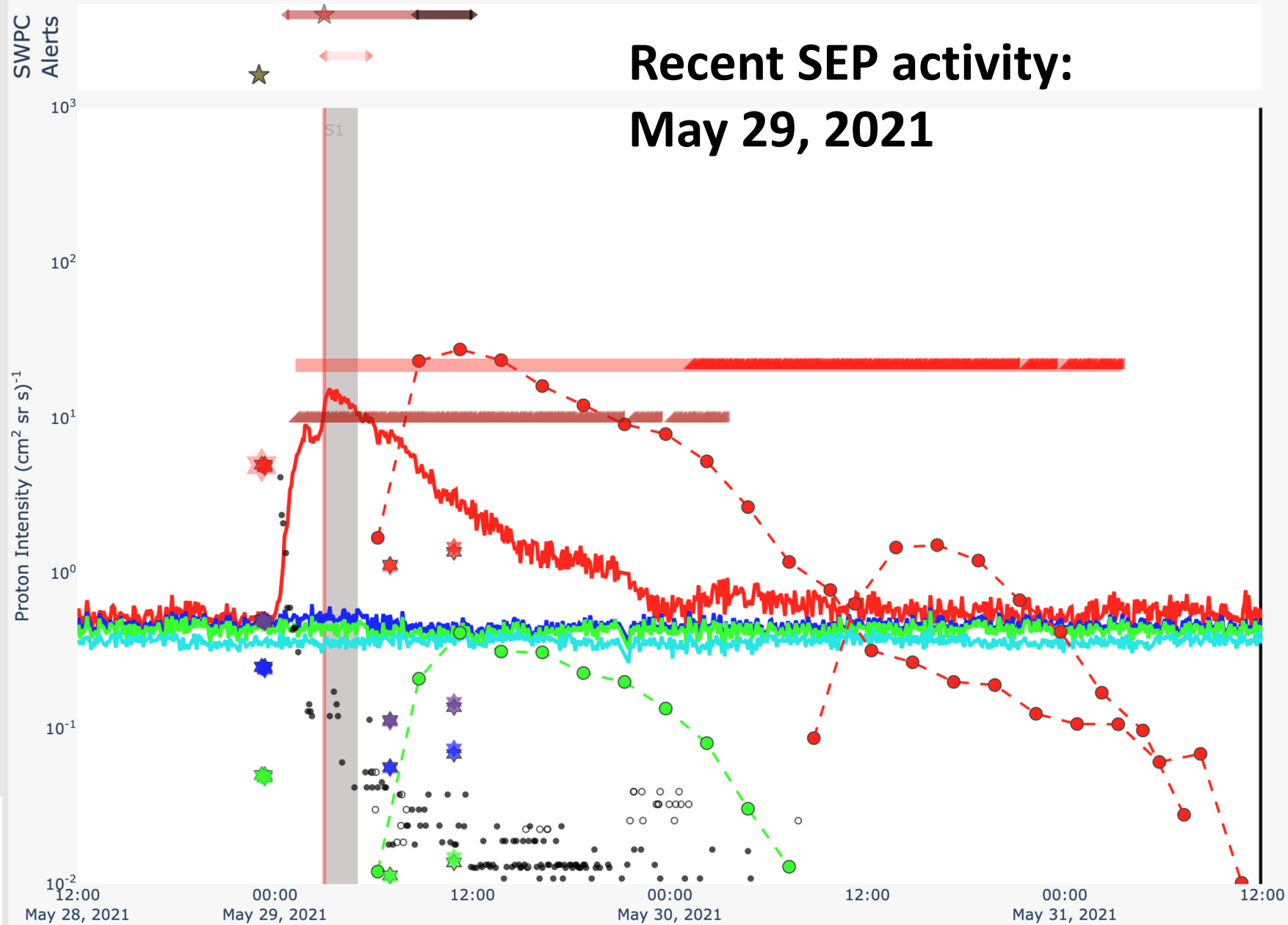
Proton Intensity Forecasts:



Proton All Clear Forecasts:



selected date/time: 2021-05-31 12:00 UT





SEP Scoreboard Links

ISEP home page:

<https://ccmc.gsfc.nasa.gov/isep/>

SEP Scoreboard home page:

<https://ccmc.gsfc.nasa.gov/challenges/sep.php>

SEP Scoreboard Probability app:

<https://sep.ccmc.gsfc.nasa.gov/probability/>

SEP Scoreboard Intensity app:

<https://sep.ccmc.gsfc.nasa.gov/intensity/>

SEP Scoreboard All Clear app:

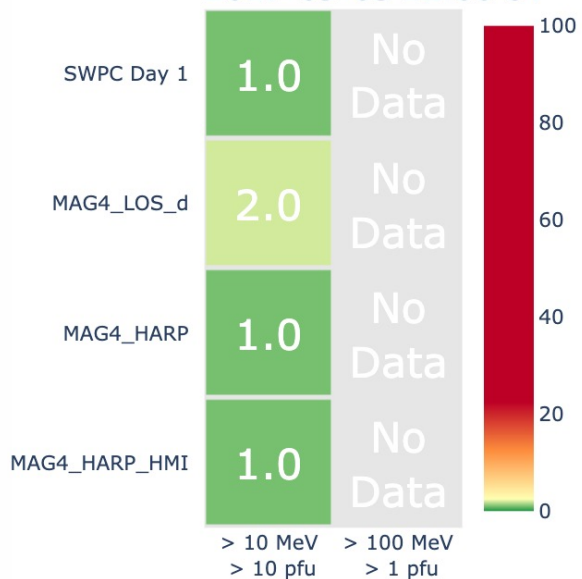
<https://sep.ccmc.gsfc.nasa.gov/allclear/>

Demo Screenshots: Probability Time Series

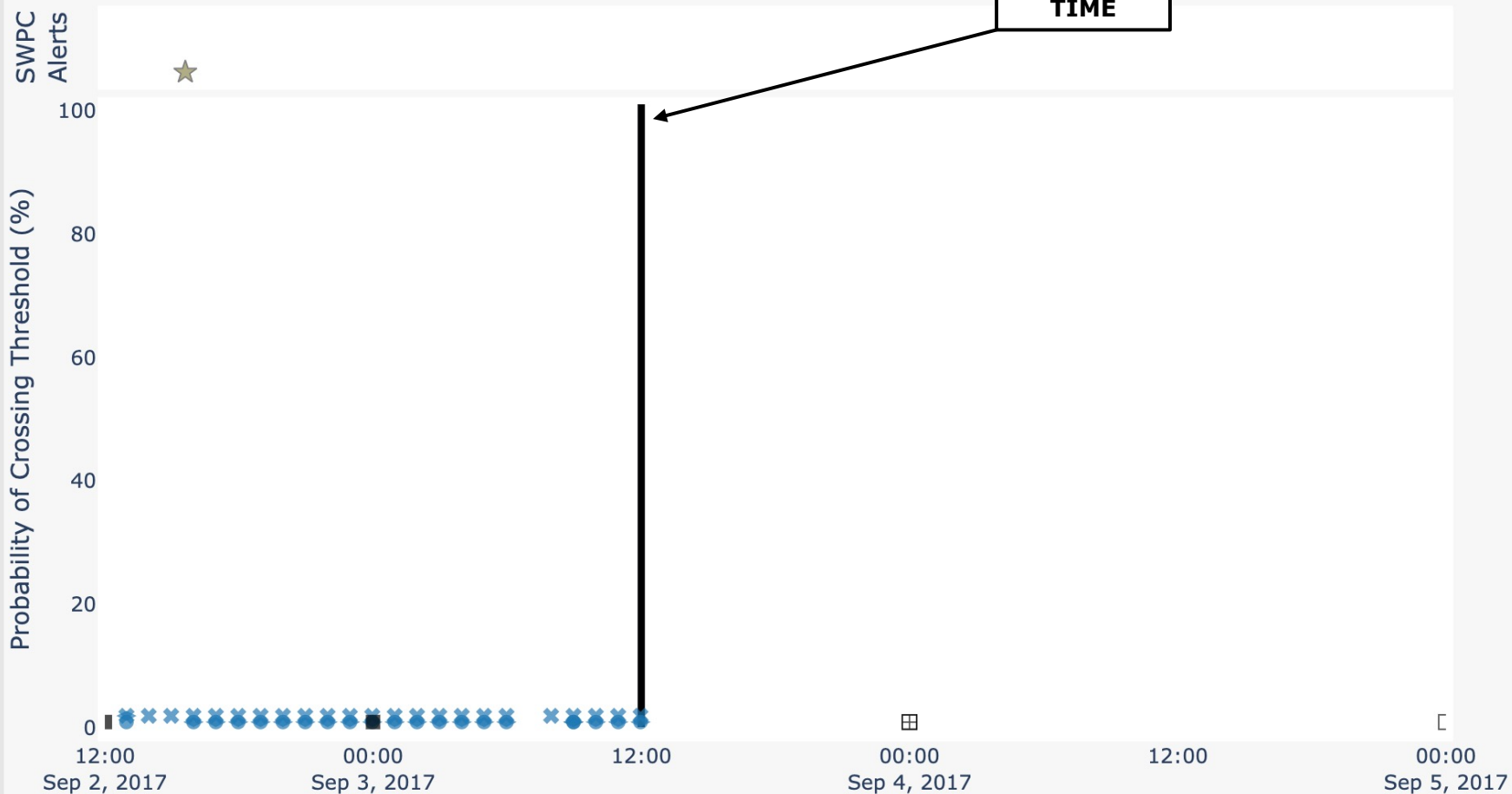
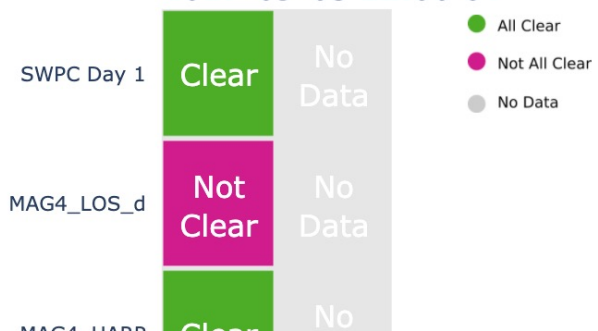


Probability of Crossing Threshold (%)

Proton Probability Forecasts: 2017-09-03 12:00 UT



Proton All Clear Forecasts: 2017-09-03 12:00 UT



- MAG4_HARP: > 10 MeV > 10 pfu
- MAG4_LOS_d: > 10 MeV > 10 pfu
- MAG4_HARP_HMI: > 10 MeV > 10 pfu
- SWPC Day 1: > 10 MeV > 10 pfu
- SWPC Day 2: > 10 MeV > 10 pfu
- SWPC Day 2 (future only): > 10 MeV > 10 pfu
- MAG4_LOS_d: > 10 MeV > 10 pfu
- SWPC Day 3: > 10 MeV > 10 pfu
- SWPC Day 3 (future only): > 10 MeV > 10 pfu
- MAG4_HARP_FE: > 10 MeV > 10 pfu



SEP Scoreboard

Probability of Crossing Threshold (%)

Proton Probability Forecasts: 2017-09-03 12:00 UT



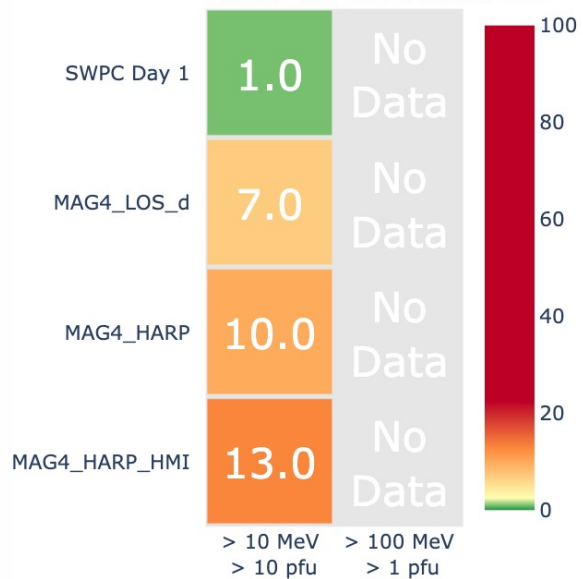
Demo: all clear display

Proton All Clear Forecasts: 2017-09-03 12:00 UT

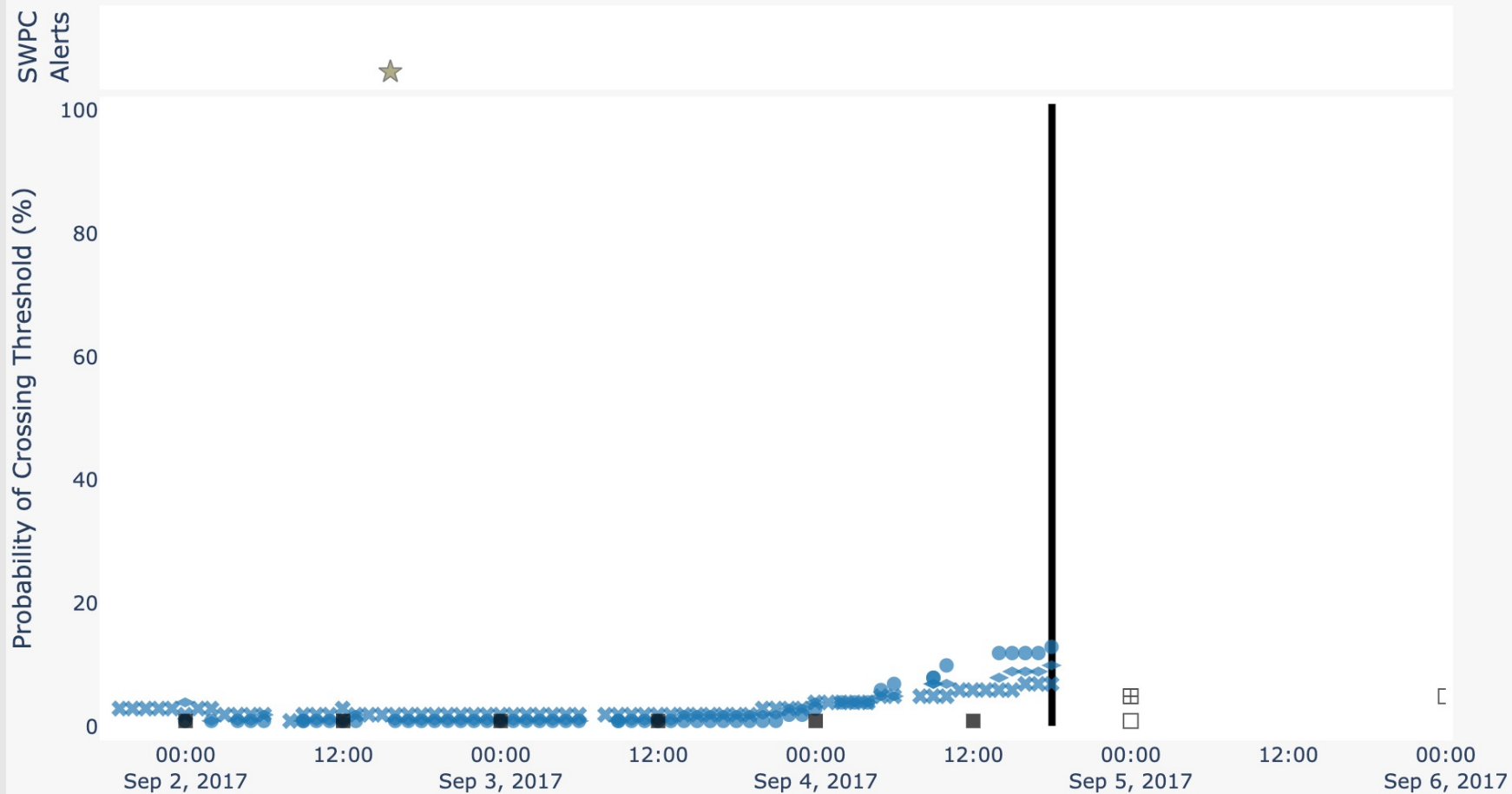
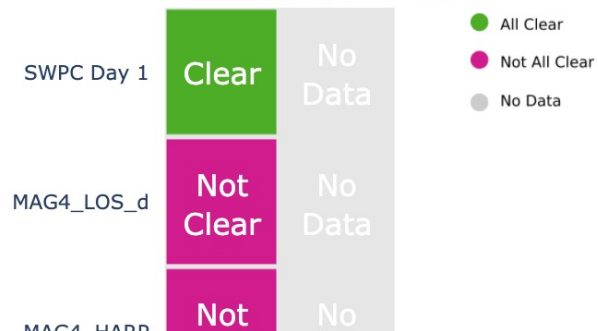




Proton Probability Forecasts: 2017-09-04 18:00 UT



Proton All Clear Forecasts: 2017-09-04 18:00 UT



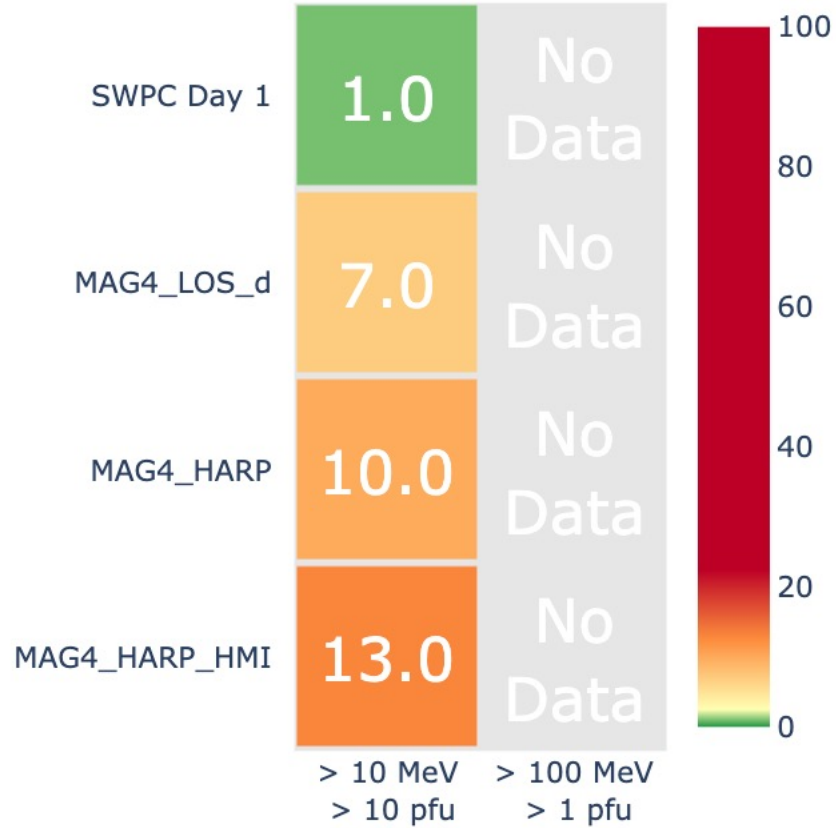
- ◆ MAG4_HARP: > 10 MeV > 10 pfu
- ◇ MAG4_HARP_FE: > 10 MeV > 10 pfu
- MAG4_HARP_HMI: > 10 MeV > 10 pfu
- ✕ MAG4_LOS_d: > 10 MeV > 10 pfu
- ⊗ MAG4_LOS_FED: > 10 MeV > 10 pfu
- SWPC Day 1: > 10 MeV > 10 pfu
- ⊞ SWPC Day 2: > 10 MeV > 10 pfu
- ⊞ SWPC Day 2 (future only): > 10 MeV > 10 pfu
- SWPC Day 3: > 10 MeV > 10 pfu
- SWPC Day 3 (future only): > 10 MeV > 10 pfu



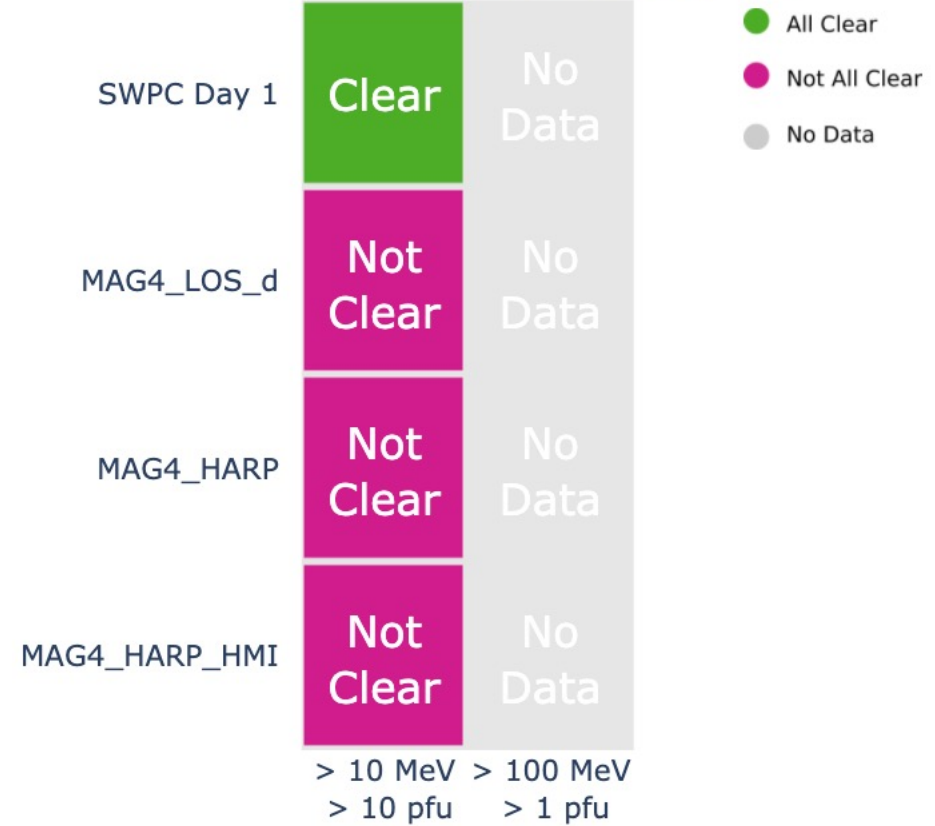
SEP Scoreboard

Probability of Crossing Threshold (%)

Proton Probability Forecasts: 2017-09-04 18:00 UT



Proton All Clear Forecasts: 2017-09-04 18:00 UT





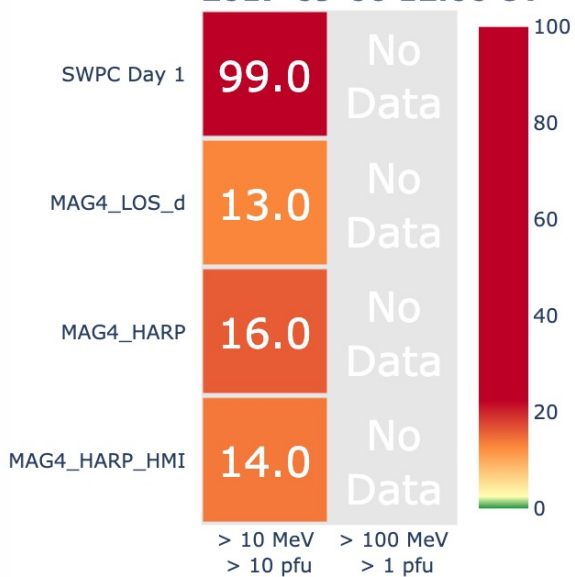
SEP Scoreboard

red line:
S1 event onset
(>10 MeV first exceeds 10pfu)

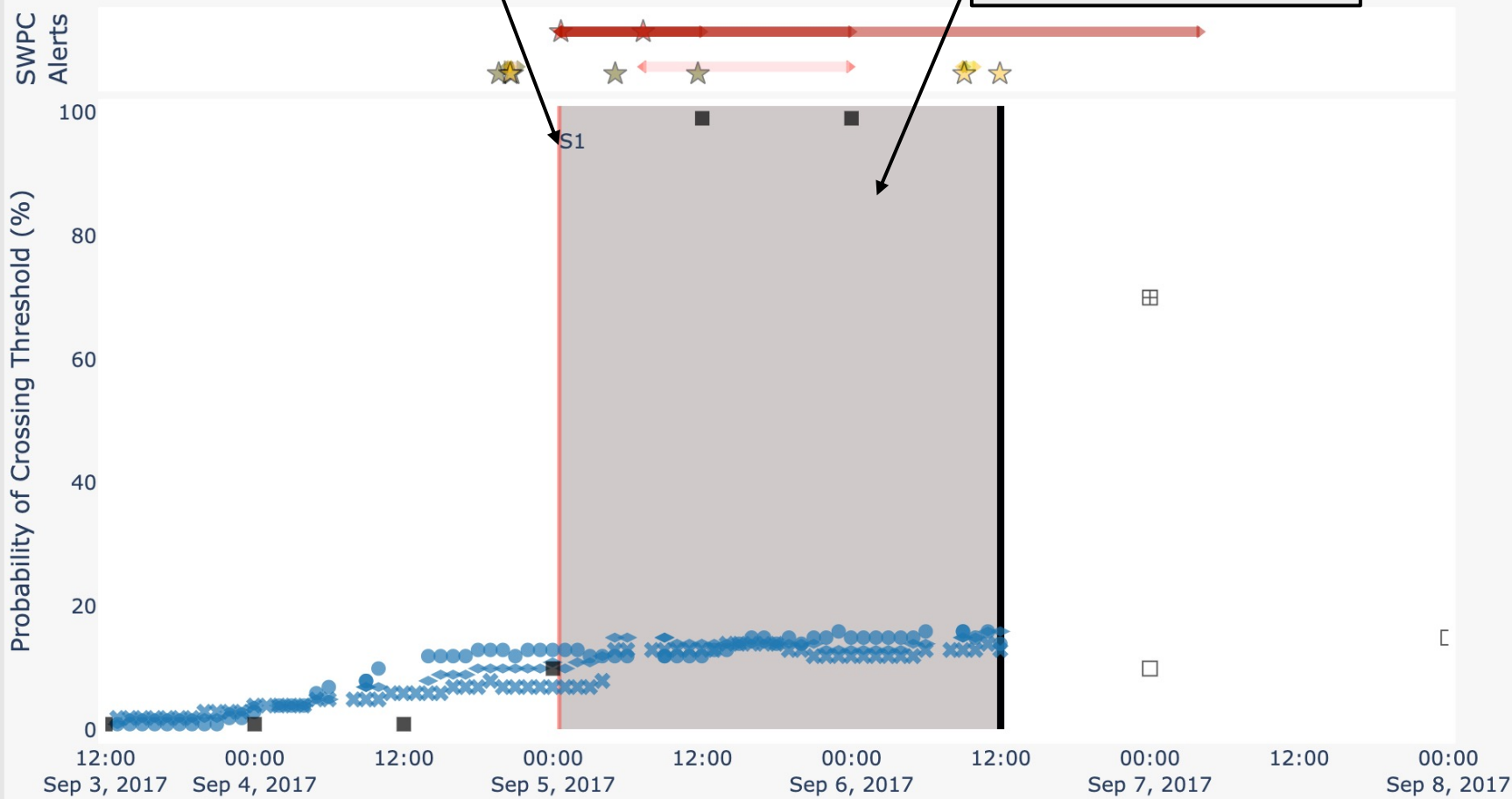
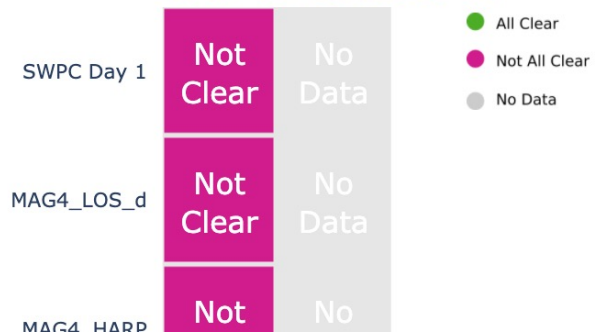
-1 week -1 day -1 hour 2017-09-06 12:00 +1 hour +1 day +1 week Today
Refresh Plots

gray shading:
S1 event
(>10 MeV exceeds 10pfu)

Proton Probability Forecasts: 2017-09-06 12:00 UT



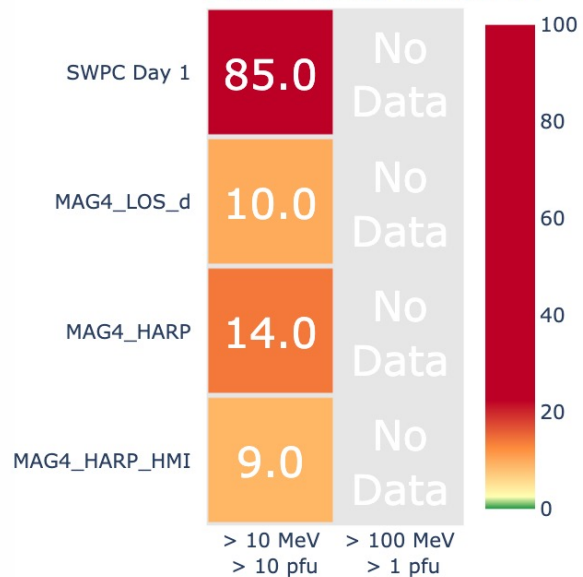
Proton All Clear Forecasts: 2017-09-06 12:00 UT



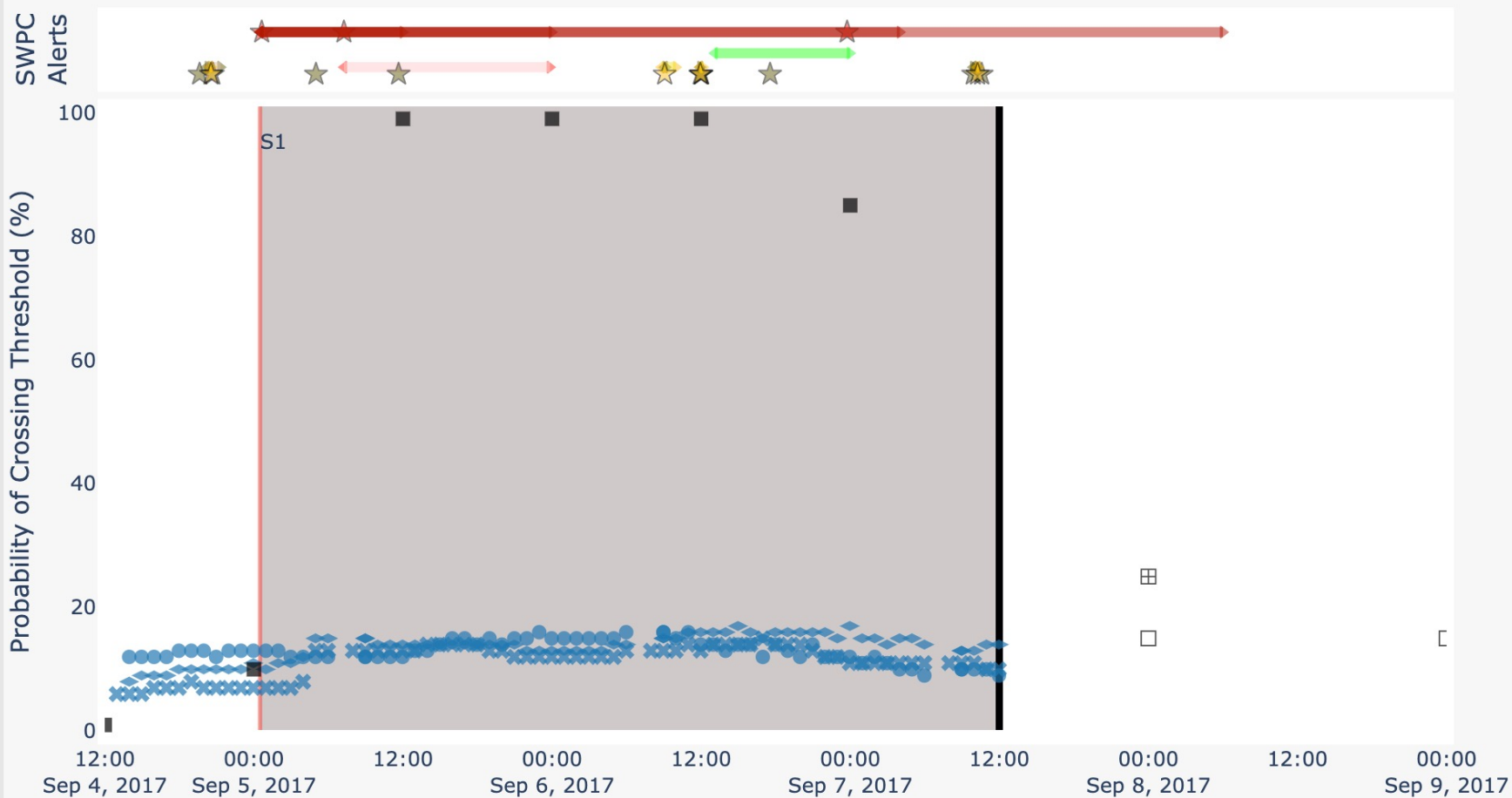
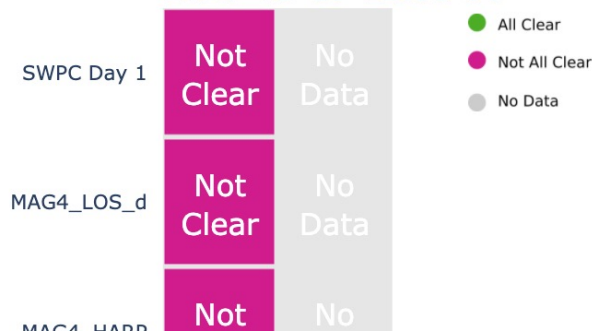
- ◆ MAG4_HARP: > 10 MeV > 10 pfu
- ◇ MAG4_HARP_FE: > 10 MeV > 10 pfu
- MAG4_HARP_HMI: > 10 MeV > 10 pfu
- ✕ MAG4_LOS_d: > 10 MeV > 10 pfu
- ⊠ MAG4_LOS_FEd: > 10 MeV > 10 pfu
- SWPC Day 1: > 10 MeV > 10 pfu
- ⊠ SWPC Day 2: > 10 MeV > 10 pfu
- ⊠ SWPC Day 2 (future only): > 10 MeV > 10 pfu
- SWPC Day 3: > 10 MeV > 10 pfu
- SWPC Day 3 (future only): > 10 MeV > 10 pfu



Proton Probability Forecasts: 2017-09-07 12:00 UT



Proton All Clear Forecasts: 2017-09-07 12:00 UT



- ◆ MAG4_HARP: > 10 MeV > 10 pfu
- ◇ MAG4_HARP_FE: > 10 MeV > 10 pfu
- MAG4_HARP_HMI: > 10 MeV > 10 pfu
- ✕ MAG4_LOS_d: > 10 MeV > 10 pfu
- ⊠ MAG4_LOS_FEd: > 10 MeV > 10 pfu
- SWPC Day 1: > 10 MeV > 10 pfu
- ⊠ SWPC Day 2: > 10 MeV > 10 pfu
- ⊠ SWPC Day 2 (future only): > 10 MeV > 10 pfu
- SWPC Day 3: > 10 MeV > 10 pfu
- SWPC Day 3 (future only): > 10 MeV > 10 pfu



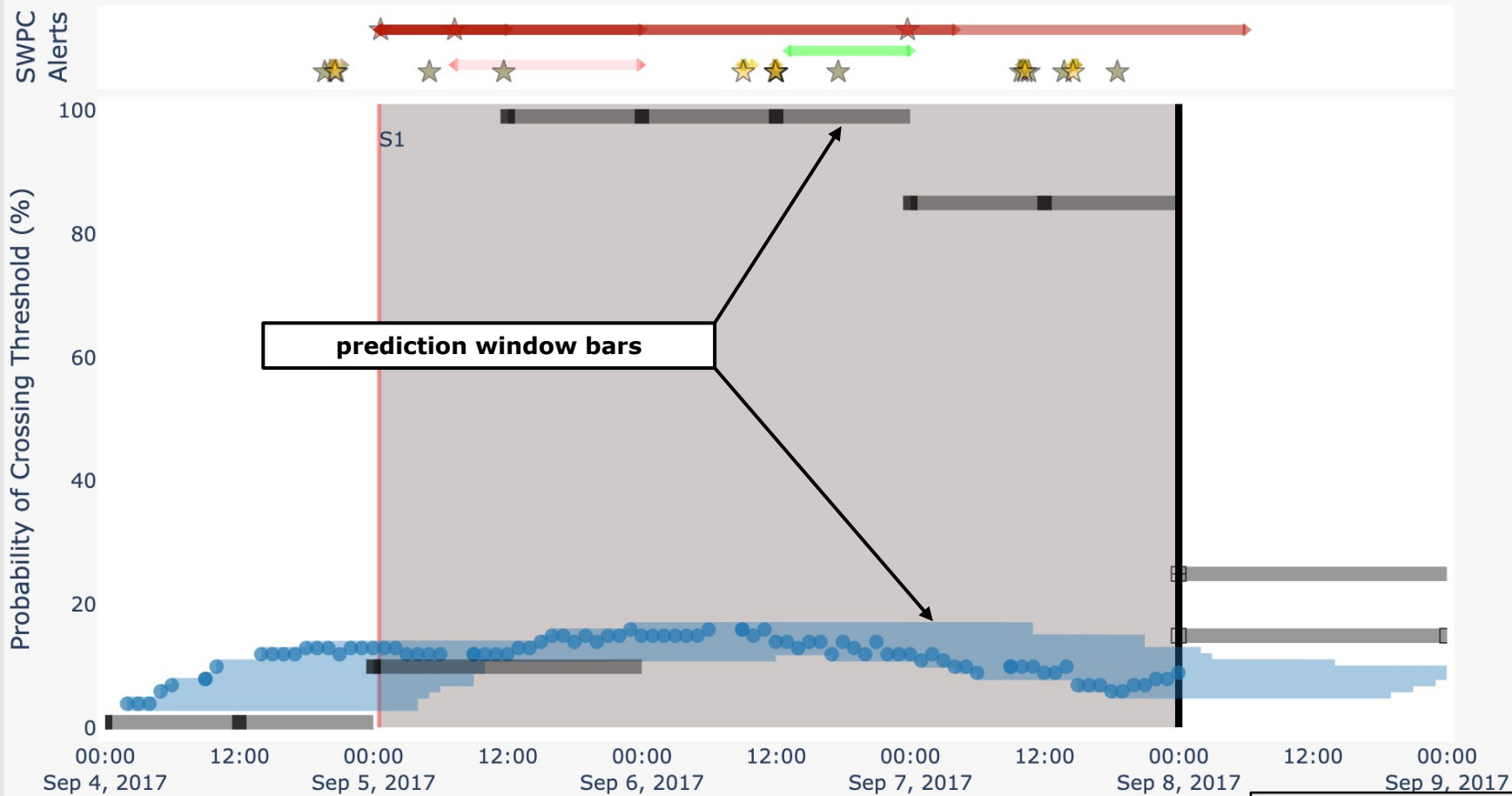
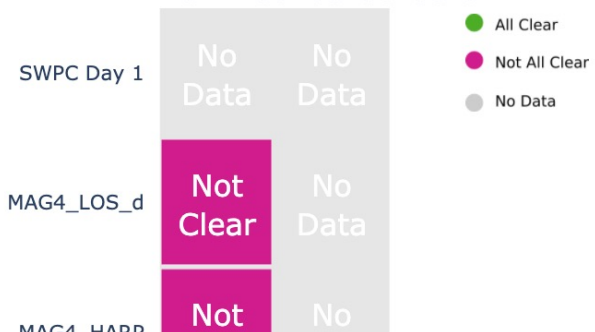
SEP Scoreboard

Probability of Crossing Threshold (%)

Proton Probability Forecasts: 2017-09-08 00:00 UT



Proton All Clear Forecasts: 2017-09-08 00:00 UT



- ◆ MAG4_HARP: > 10 MeV > 10 pfu
- ◇ MAG4_HARP_FE: > 10 MeV > 10 pfu
- MAG4_HARP_HMI: > 10 MeV > 10 pfu
- ✕ MAG4_LOS_d: > 10 MeV > 10 pfu
- ⊗ MAG4_LOS_FEd: > 10 MeV > 10 pfu
- SWPC Day 1: > 10 MeV > 10 pfu
- ⊞ SWPC Day 2: > 10 MeV > 10 pfu
- SWPC Day 3: > 10 MeV > 10 pfu
- SWPC Day 3 (future only): > 10 MeV > 10 pfu
- ⊞ SWPC Day 2 (future only): > 10 MeV > 10 pfu

Graph Show Options

- Auto Refresh
- Prediction Window Bars
- Model Family as One
- Forecast Probability Error Bars

Range of X Axis

4 days of data



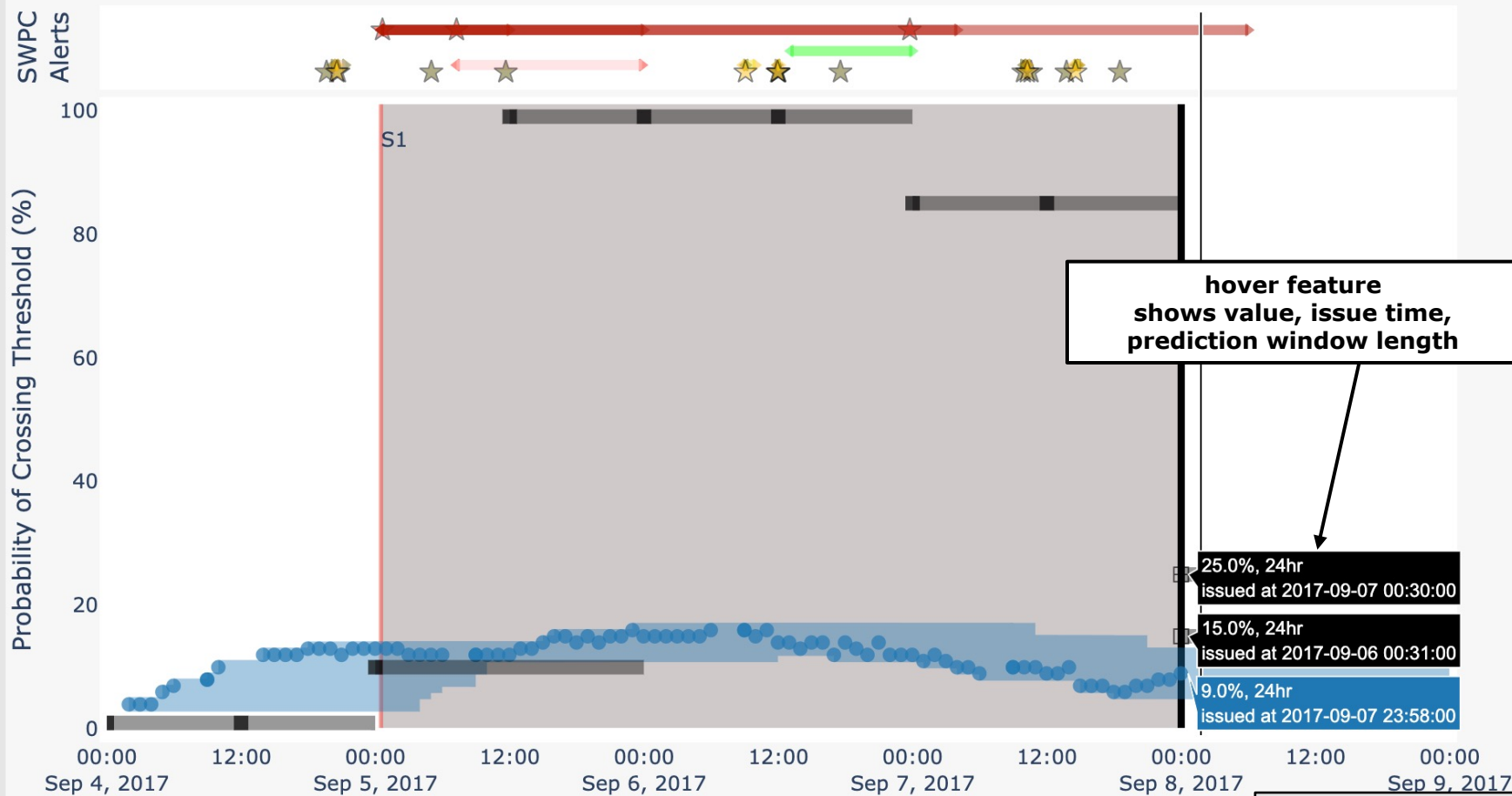
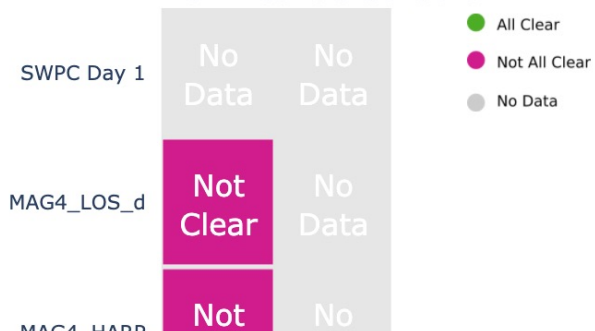
SEP Scoreboard

Probability of Crossing Threshold (%)

Proton Probability Forecasts: 2017-09-08 00:00 UT



Proton All Clear Forecasts: 2017-09-08 00:00 UT



Graph Show Options

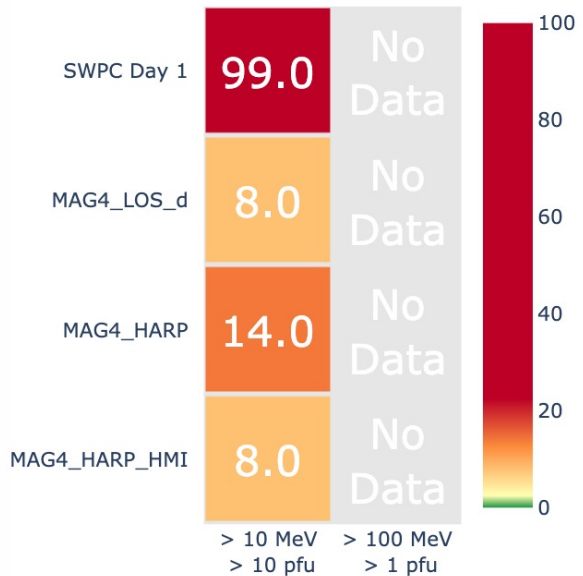
- Auto Refresh
- Prediction Window Bars
- Model Family as One
- Forecast Probability Error Bars

Range of X Axis

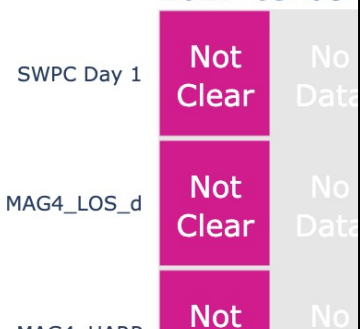
4 days of data

Probability of Crossing Threshold (%)

Proton Probability Forecasts: 2017-09-08 01:00 UT



Proton All Clear Forecasts: 2017-09-08 01:00 UT



Graph Show Options

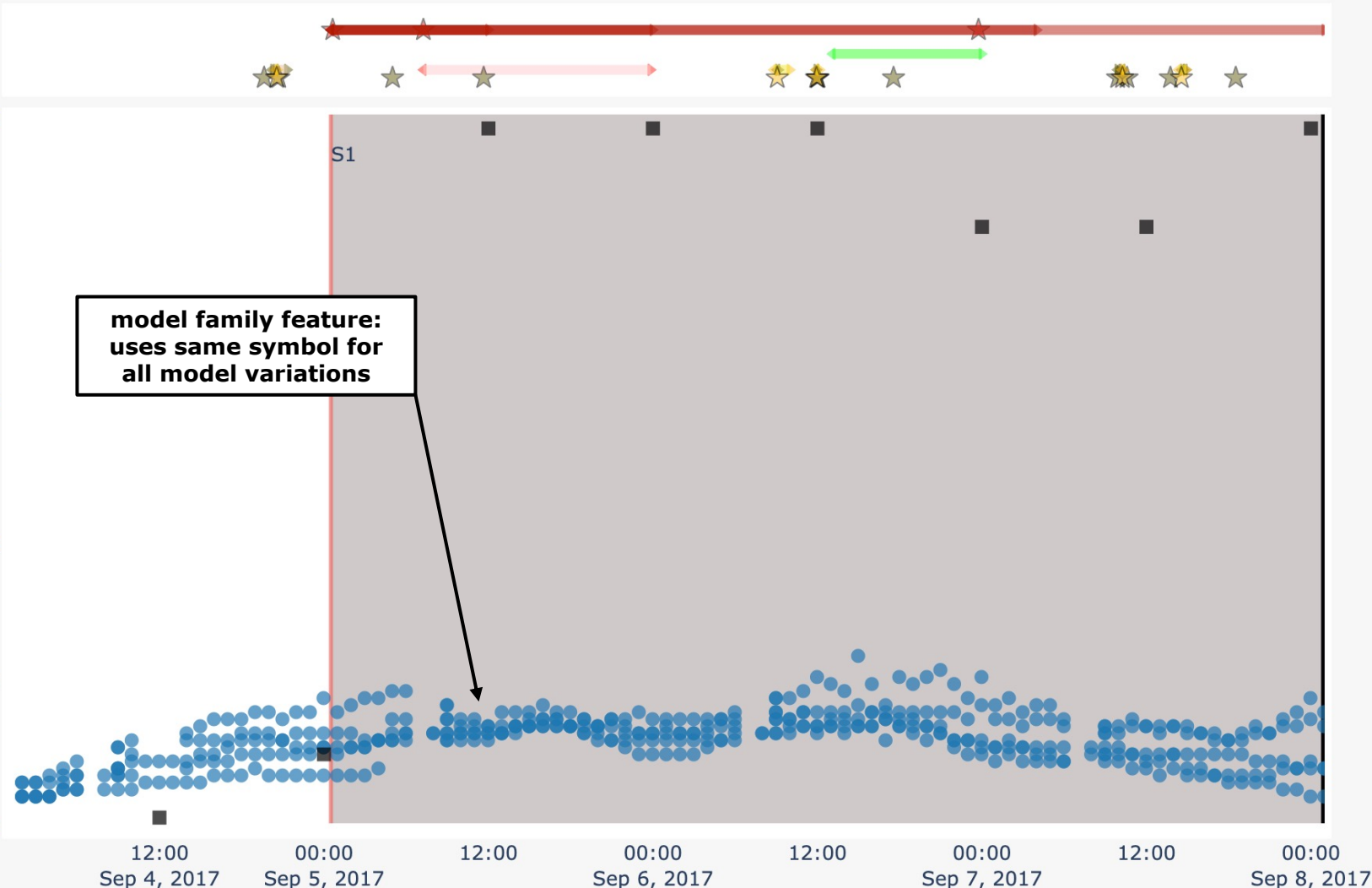
- Auto Refresh
- Prediction Window Bars
- Model Family as One
- Forecast Probability Error Bars

Range of X Axis

4 days of data x

SWPC Alerts

Probability of Crossing Threshold (%)



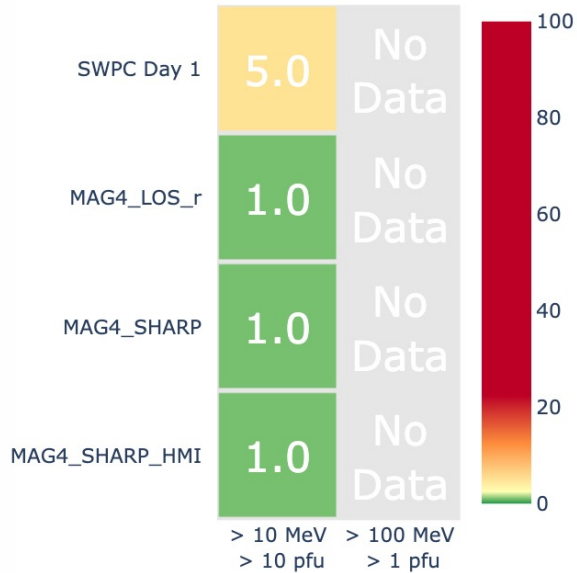
● mag4: > 10 MeV > 10 pfu
 ■ swpc: > 10 MeV > 10 pfu



Refresh Plots

Probability of Crossing Threshold (%)

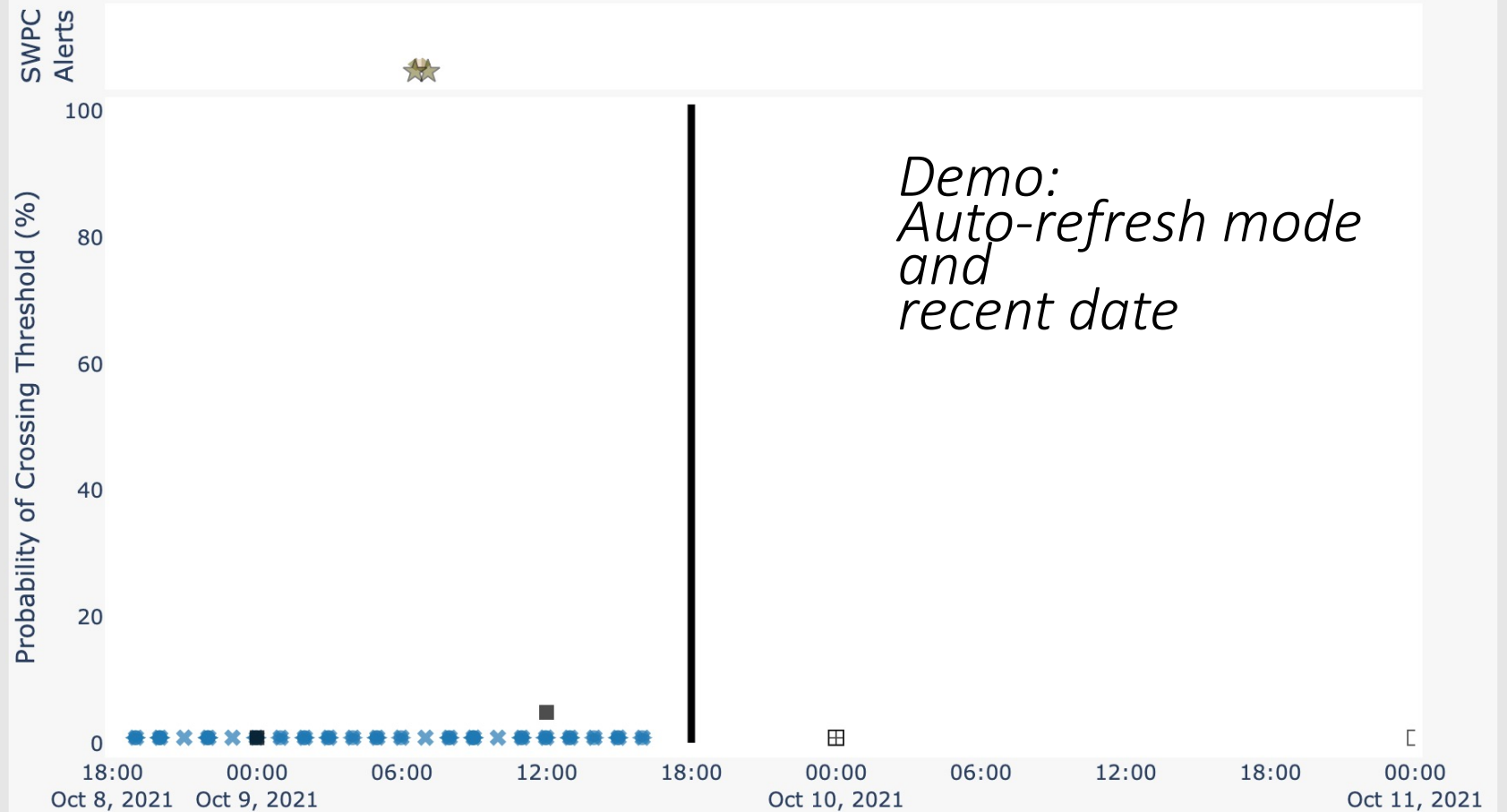
Proton Probability Forecasts: 2021-10-09 18:00 UT



Proton All Clear Forecasts: 2021-10-09 18:00 UT



selected date/time: 2021-10-09 18:00 UT



- MAG4_LOS_FEr: > 10 MeV > 10 pfu
- MAG4_LOS_r: > 10 MeV > 10 pfu
- MAG4_SHARP: > 10 MeV > 10 pfu
- MAG4_SHARP_FE: > 10 MeV > 10 pfu
- MAG4_SHARP_HMI: > 10 MeV > 10 pfu
- SWPC Day 1: > 10 MeV > 10 pfu
- SWPC Day 2: > 10 MeV > 10 pfu
- SWPC Day 2 (future only): > 10 MeV > 10 pfu
- SWPC Day 3: > 10 MeV > 10 pfu
- SWPC Day 3 (future only): > 10 MeV > 10 pfu

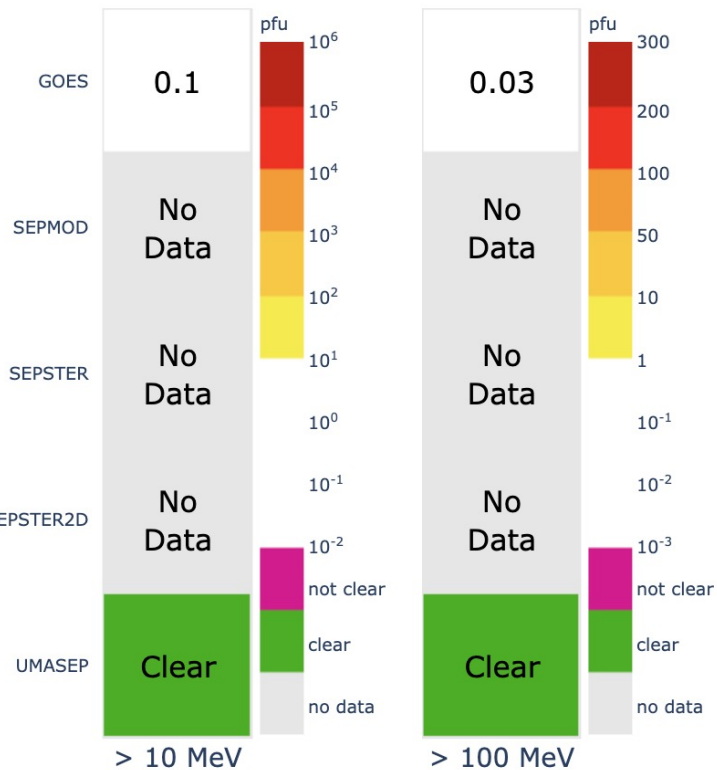
Demo Screenshots: Intensity Time Series

(shown in simulated real-time mode)



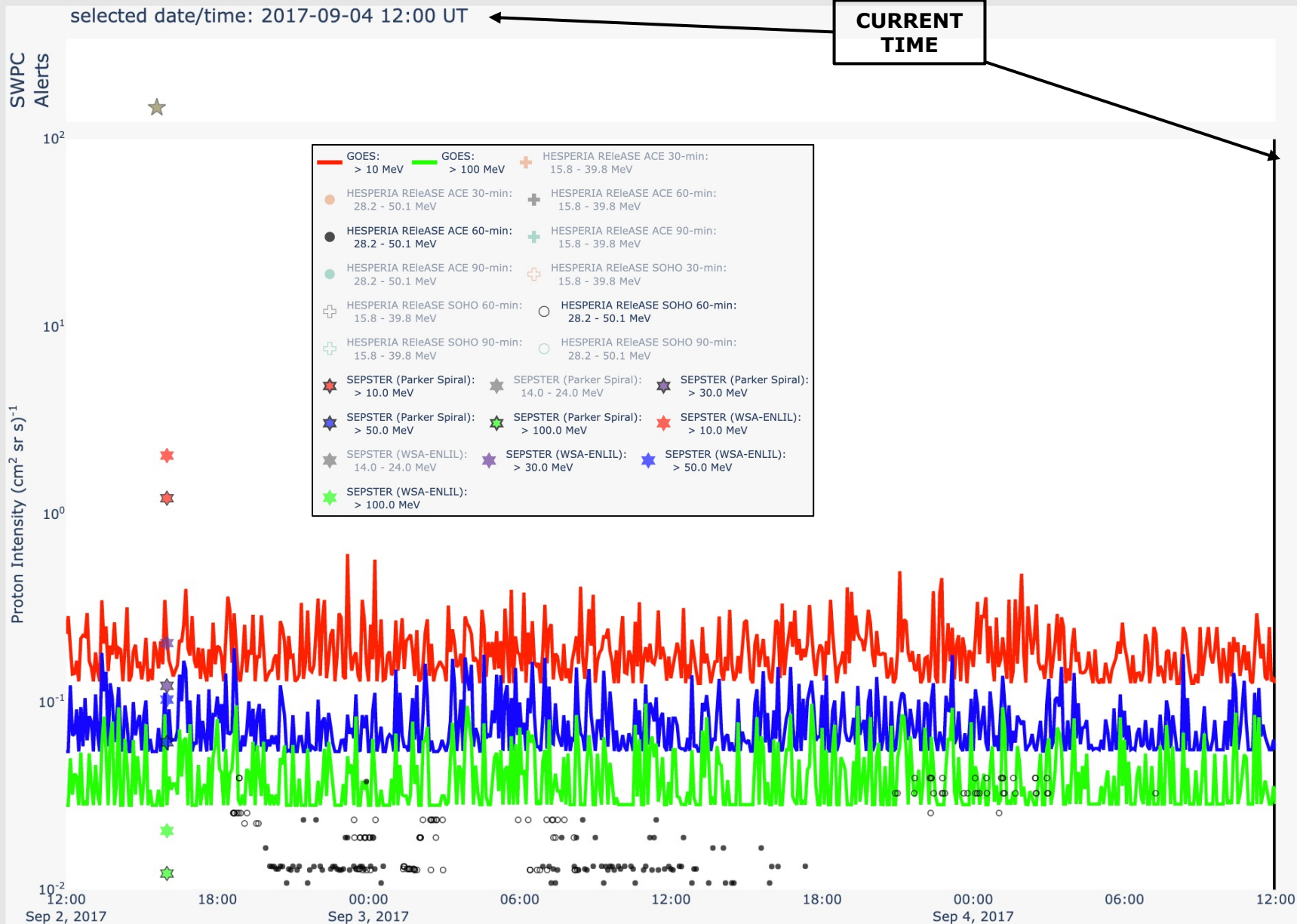
Proton Intensity Forecasts:

2017-09-04 12:00 UT



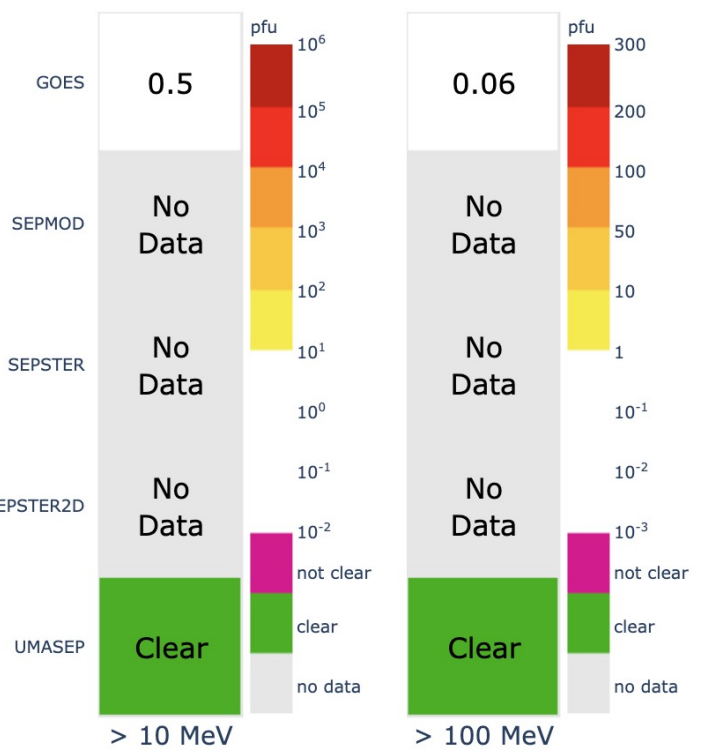
Proton All Clear Forecasts:

2017-09-04 12:00 UT



Proton Intensity Forecasts:

2017-09-04 22:40 UT

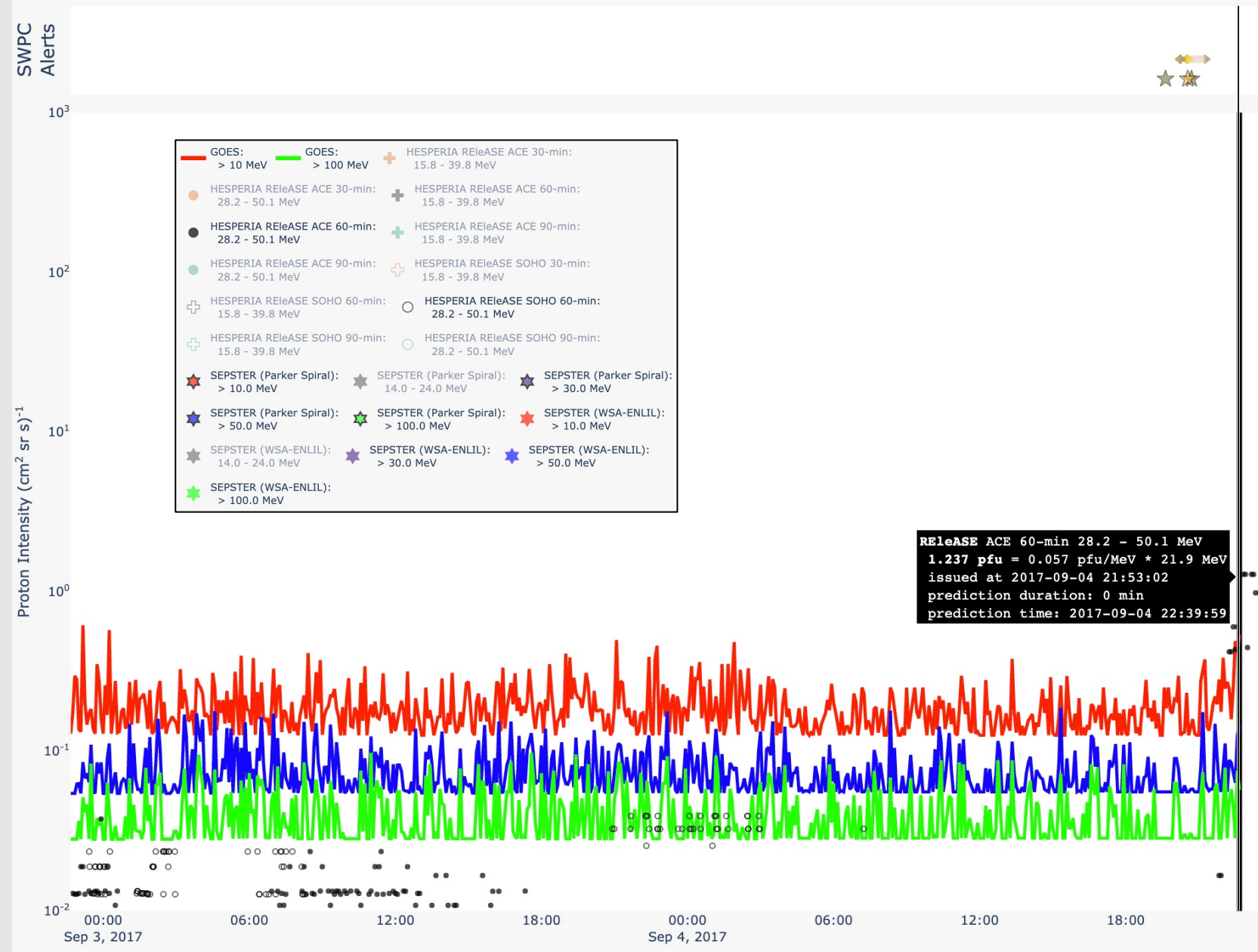


Proton All Clear Forecasts:

2017-09-04 22:40 UT



selected date/time: 2017-09-04 22:40 UT





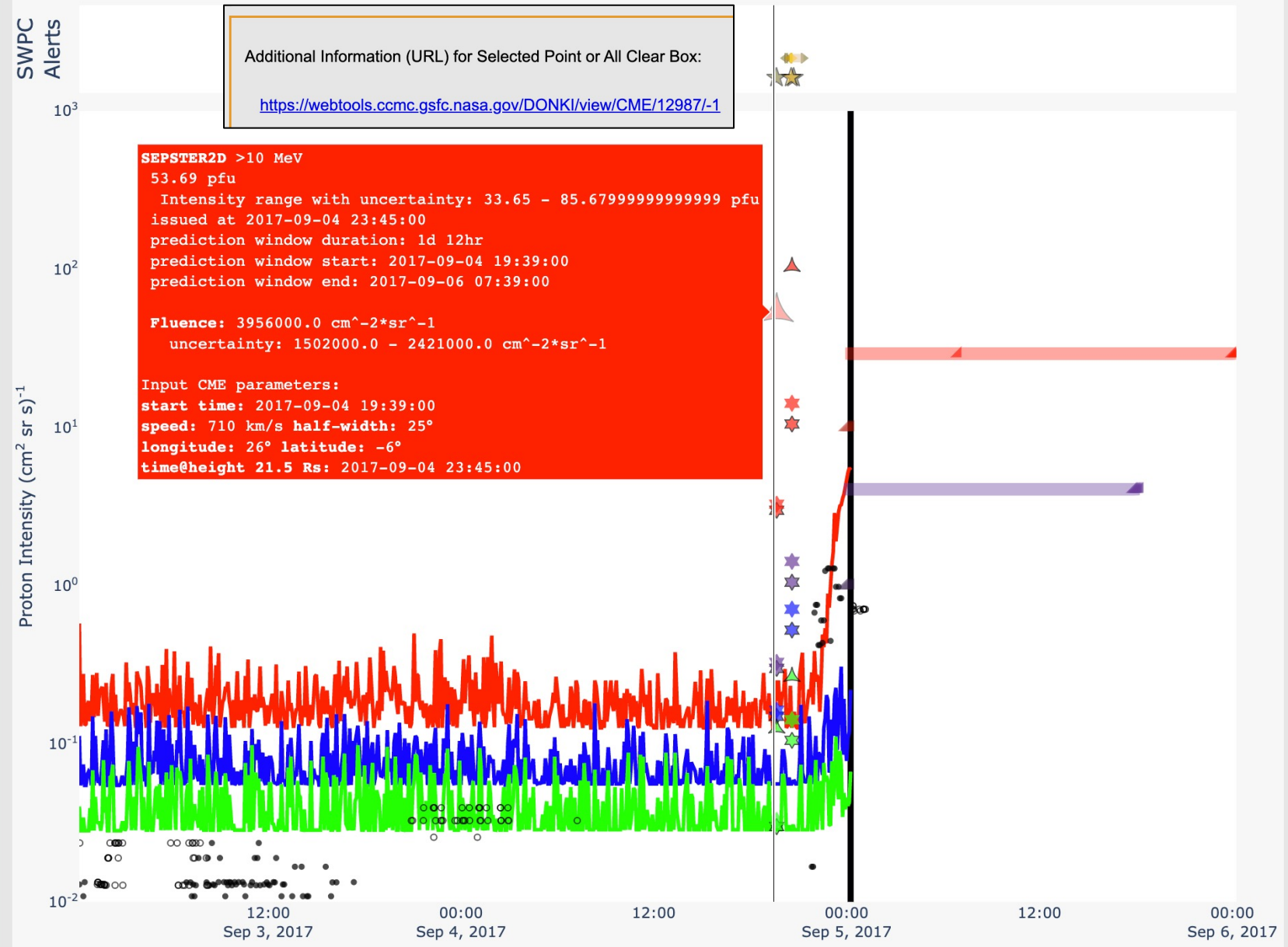
Proton Intensity Forecasts:

2017-09-05 00:15 UT



- ACE Electron: 175.0 - 315.0 MeV
- GOES: > 10 MeV
- GOES: > 30 MeV
- GOES: > 50 MeV
- GOES: > 100 MeV
- HESPERIA ReleASE ACE 60-min: 15.8 - 39.8 MeV
- HESPERIA ReleASE ACE 60-min: 28.2 - 50.1 MeV
- HESPERIA ReleASE SOHO 60-min: 15.8 - 39.8 MeV
- HESPERIA ReleASE SOHO 60-min: 28.2 - 50.1 MeV
- SEPSTER (Parker Spiral): > 10.0 MeV
- SEPSTER (Parker Spiral): 14.0 - 24.0 MeV
- SEPSTER (Parker Spiral): > 30.0 MeV
- SEPSTER (Parker Spiral): > 50.0 MeV
- SEPSTER (Parker Spiral): > 100.0 MeV
- SEPSTER (WSA-ENLIL): > 10.0 MeV
- SEPSTER (WSA-ENLIL): > 30.0 MeV
- SEPSTER (WSA-ENLIL): > 50.0 MeV
- SEPSTER (WSA-ENLIL): 14.0 - 24.0 MeV
- SEPSTER (WSA-ENLIL): > 30.0 MeV
- SEPSTER (WSA-ENLIL): > 50.0 MeV
- SEPSTER2D: > 10.0 MeV
- SEPSTER2D: > 100.0 MeV
- UMASEP-10: > 10 MeV
- UMASEP-30: > 30 MeV

selected date/time: 2017-09-05 00:15 UT



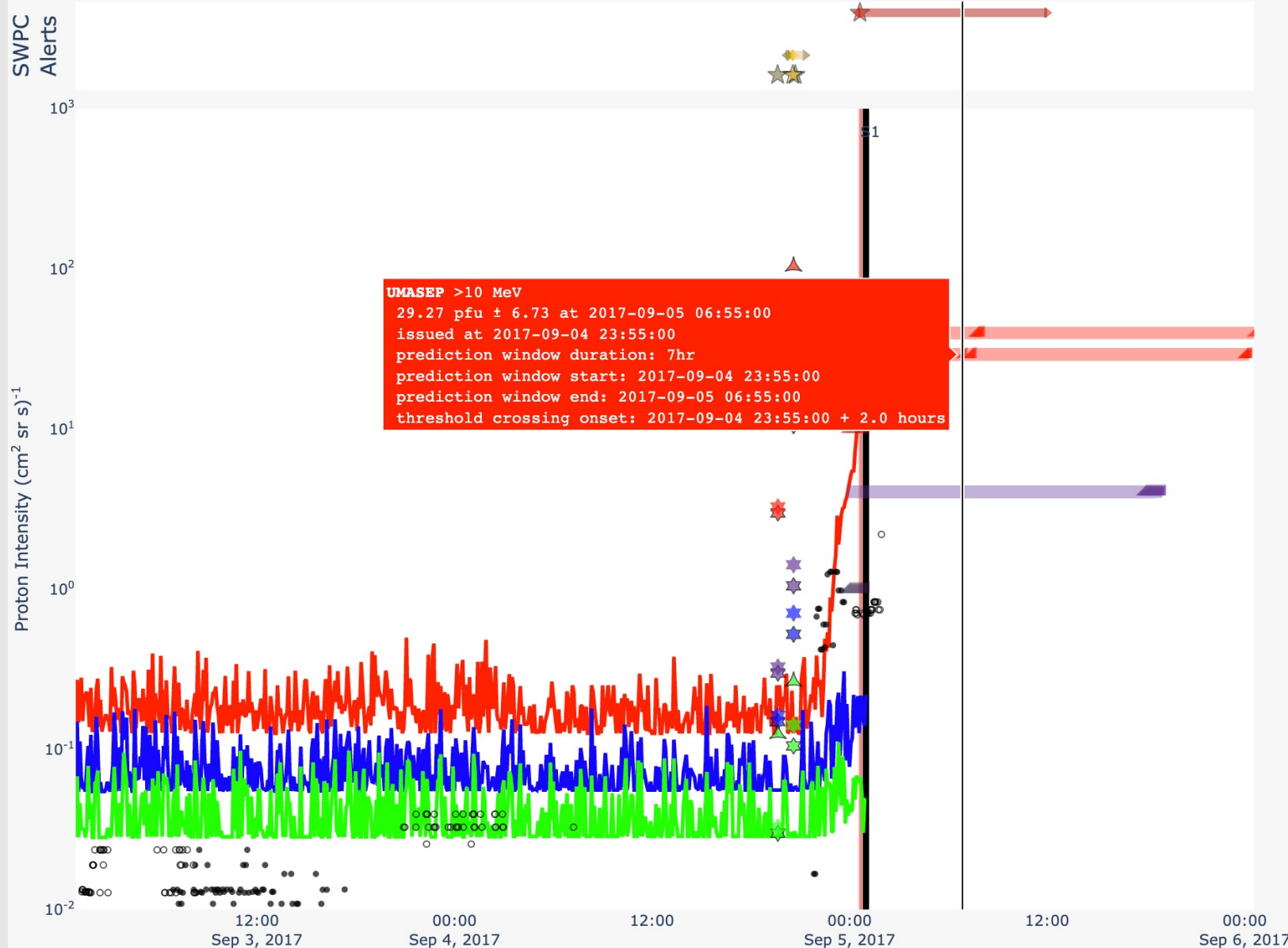


Proton Intensity Forecasts:

2017-09-05 01:00 UT



selected date/time: 2017-09-05 01:00 UT





Proton Intensity Forecasts:

2017-09-05 02:00 UT

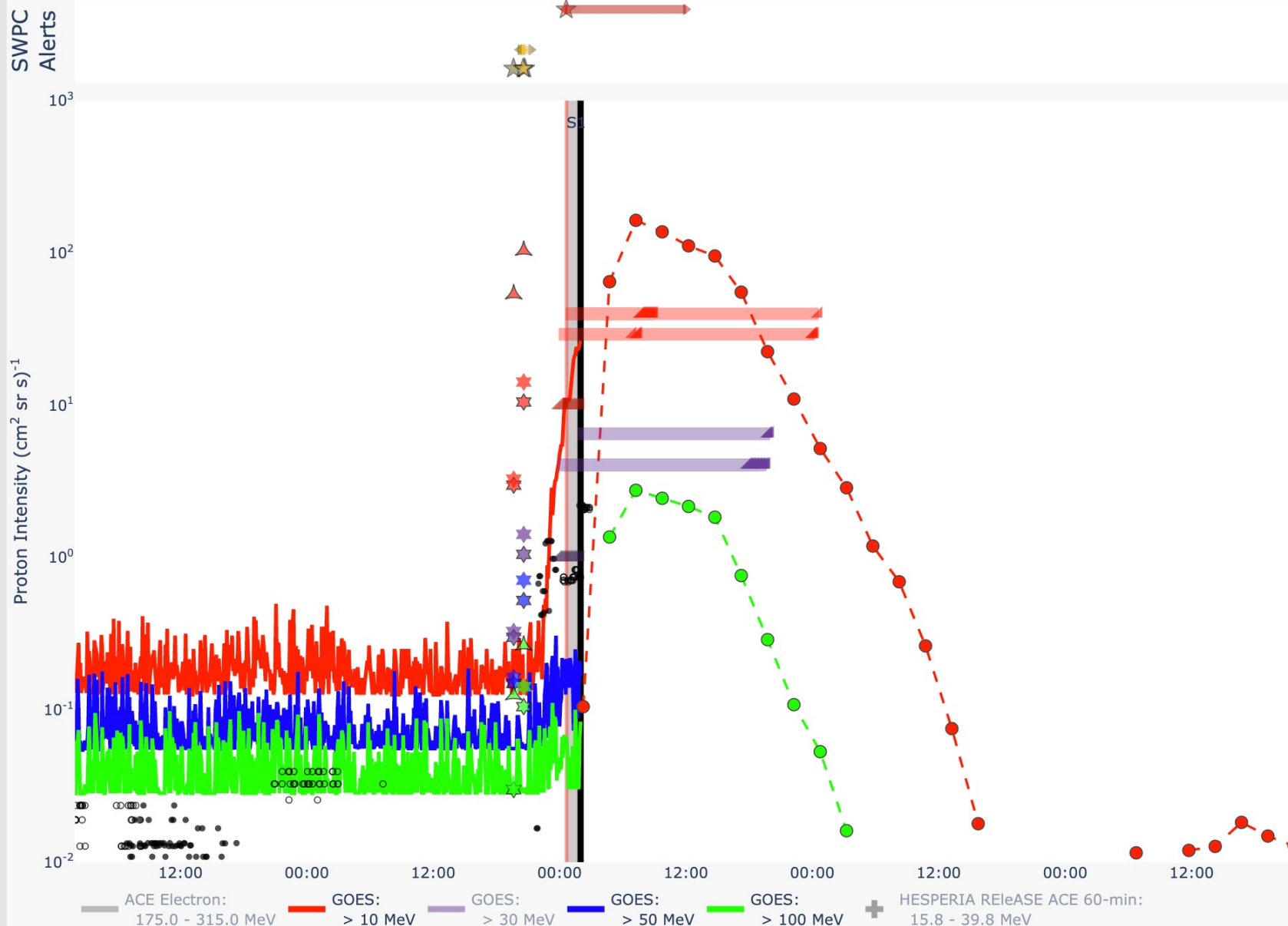


Proton All Clear Forecasts:

2017-09-05 02:00 UT



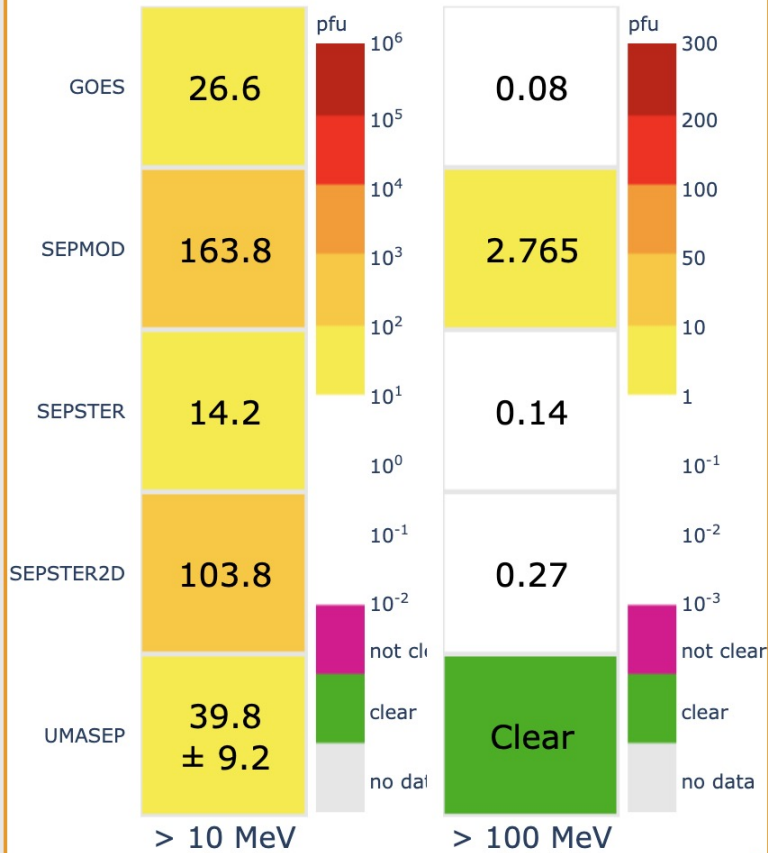
selected date/time: 2017-09-05 02:00 UT





Proton Intensity Forecasts:

2017-09-05 02:00 UT



Proton All Clear Forecasts:

2017-09-05 02:00 UT



selected date/time: 2017-09-05 02:00 UT

SWPC Alerts



SEPMOD (DONKI) >10.0 MeV
 163.8 pfu
 2017-09-05 07:15:00
 peak intensity max: None
 peak intensity onset: 163.8 pfu
 peak intensity ESP: None
 issued at 2017-09-05 01:38:00

prediction window duration: 7d 0hr
 start: 2017-09-04 00:00:00
 end: 2017-09-11 00:02:00

threshold crossing onset: 2017-09-05 02:15:00 (0.001 pfu)

Event Length:
 start: 2017-09-05 02:15:00
 end: 2017-09-05 07:15:00
 threshold: 0.001 pfu

Fluence: 76031400.0 cm⁻²

Input CME parameters:
 start time: speed: hw: lon: lat: time@height 21.5 Rs:
 (1) 2017-09-04 20:36:00 1550 km/s 46° 10° -10° 2017-09-04 22:38:00

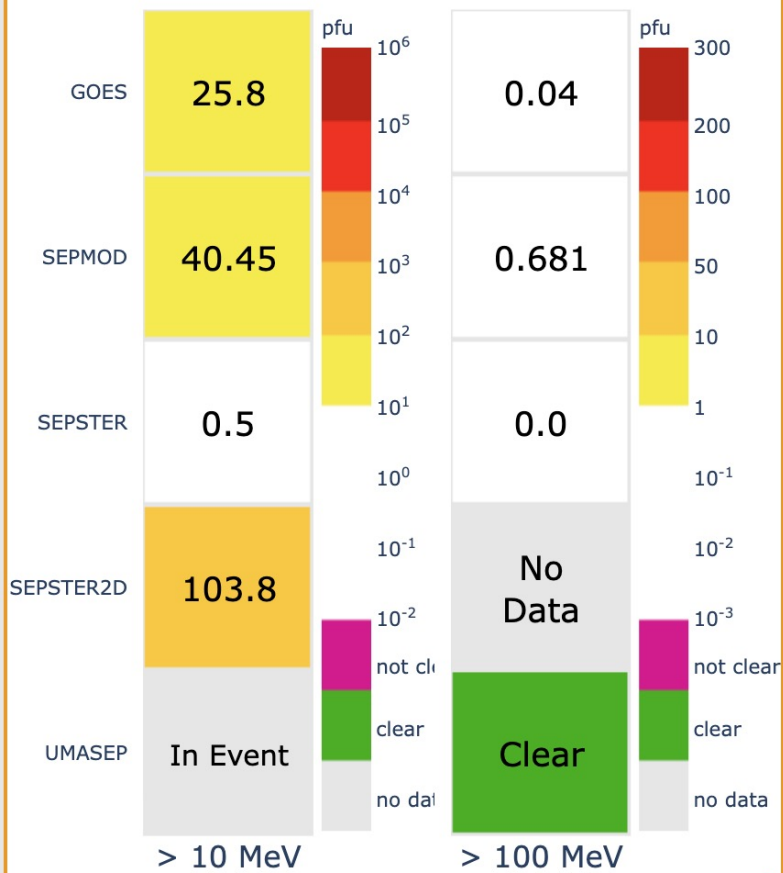
Additional Information (URL) for Selected Point or All Clear Box:
<https://webtools.ccmc.gsfc.nasa.gov/DONKI/view/WSA-ENLIL/12988/1>



[Refresh Plots](#)

Proton Intensity Forecasts:

2017-09-06 12:15 UT

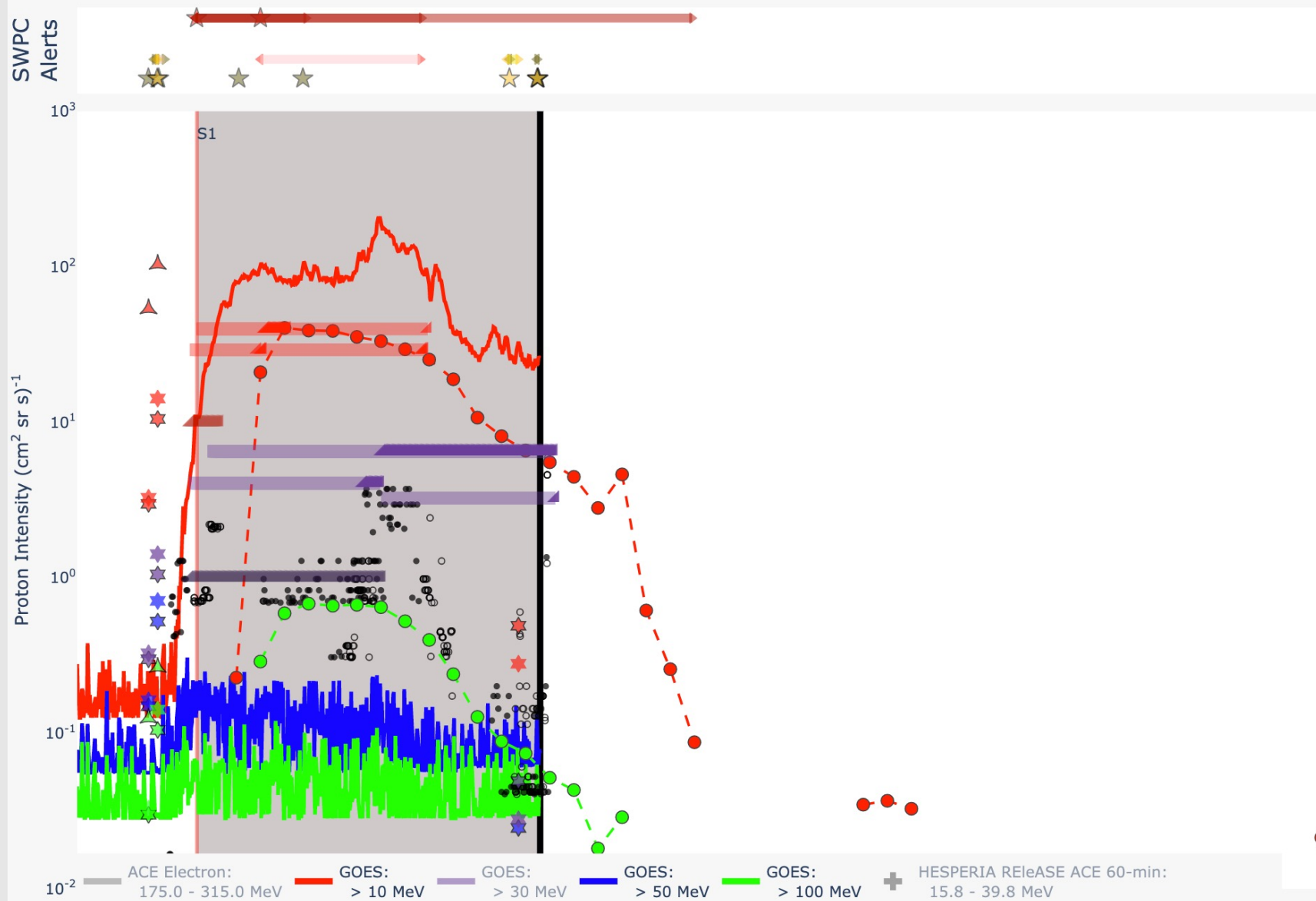


Proton All Clear Forecasts:

2017-09-06 12:15 UT



selected date/time: 2017-09-06 12:15 UT

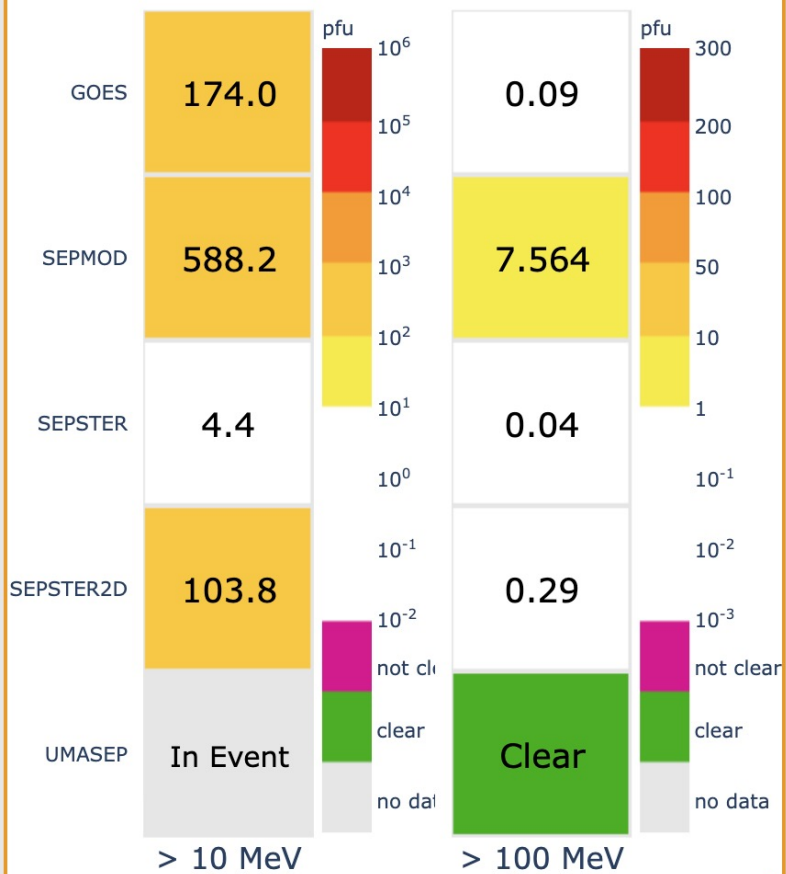


ACE Electron: 175.0 - 315.0 MeV
 GOES: > 10 MeV
 GOES: > 30 MeV
 GOES: > 50 MeV
 GOES: > 100 MeV
 HESPERIA Release ACE 60-min: 15.8 - 39.8 MeV
 HESPERIA Release ACE 60-min: 28.2 - 50.1 MeV
 HESPERIA Release SOHO 60-min: 15.8 - 39.8 MeV
 HESPERIA Release SOHO 60-min: 28.2 - 50.1 MeV
 SEPMOD-SWPC params: > 10.0 MeV



Proton Intensity Forecasts:

2017-09-07 02:00 UT

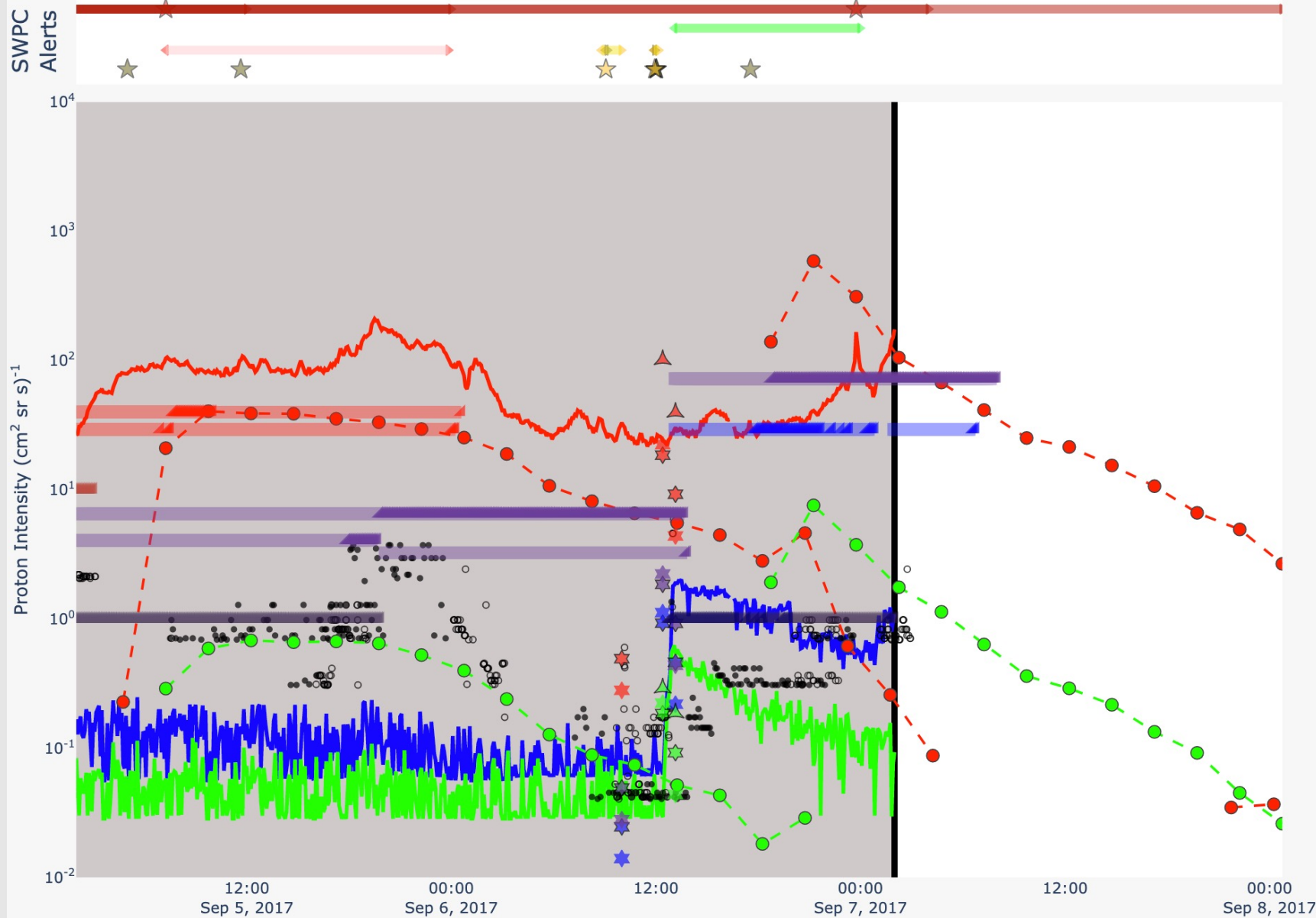


Proton All Clear Forecasts:

2017-09-07 02:00 UT



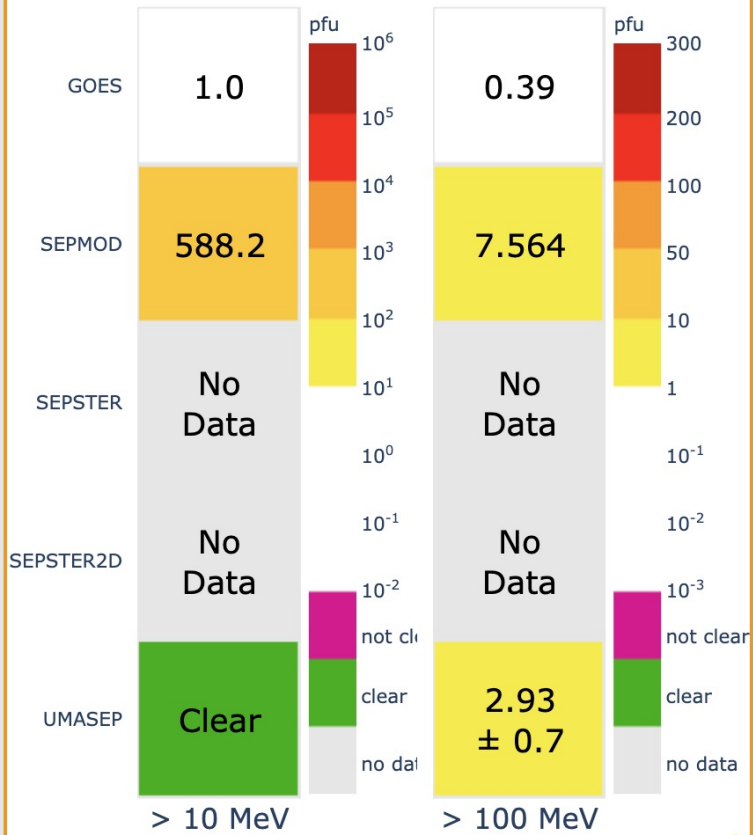
selected date/time: 2017-09-07 02:00 UT





Proton Intensity Forecasts:

2017-09-10 16:20 UT



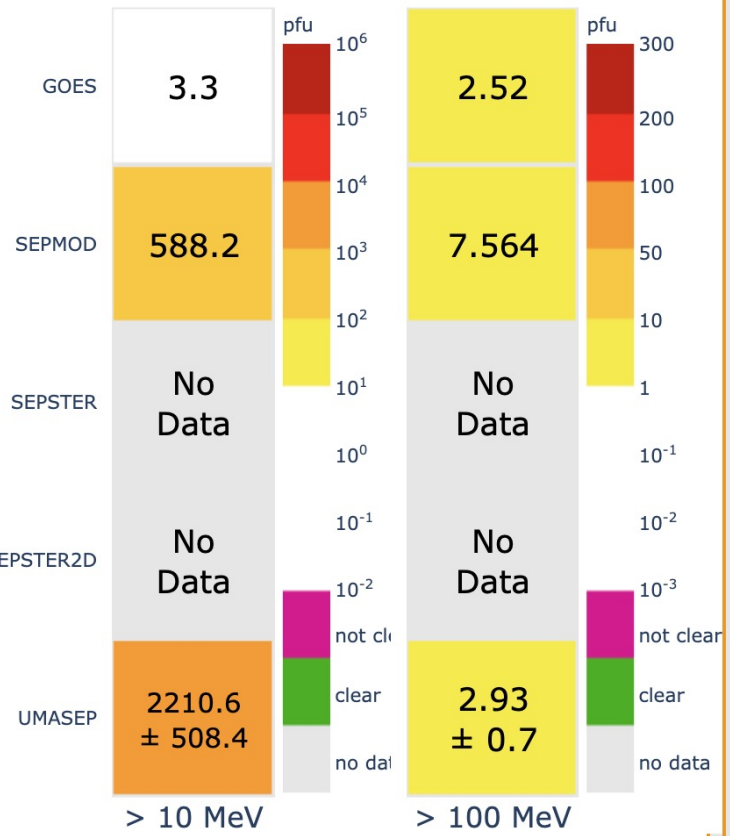
Proton All Clear Forecasts:

2017-09-10 16:20 UT



Proton Intensity Forecasts:

2017-09-10 16:31 UT

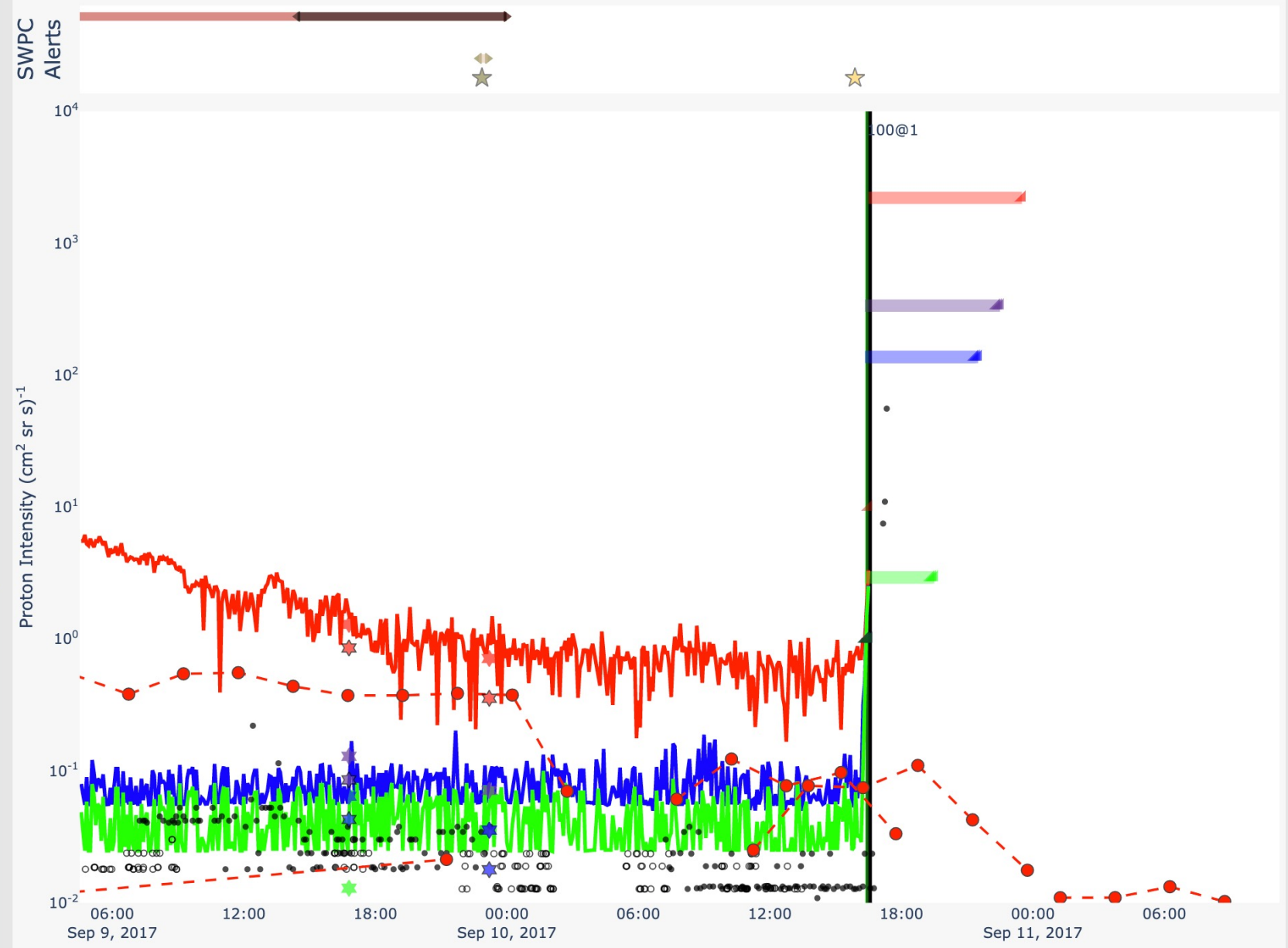


Proton All Clear Forecasts:

2017-09-10 16:31 UT

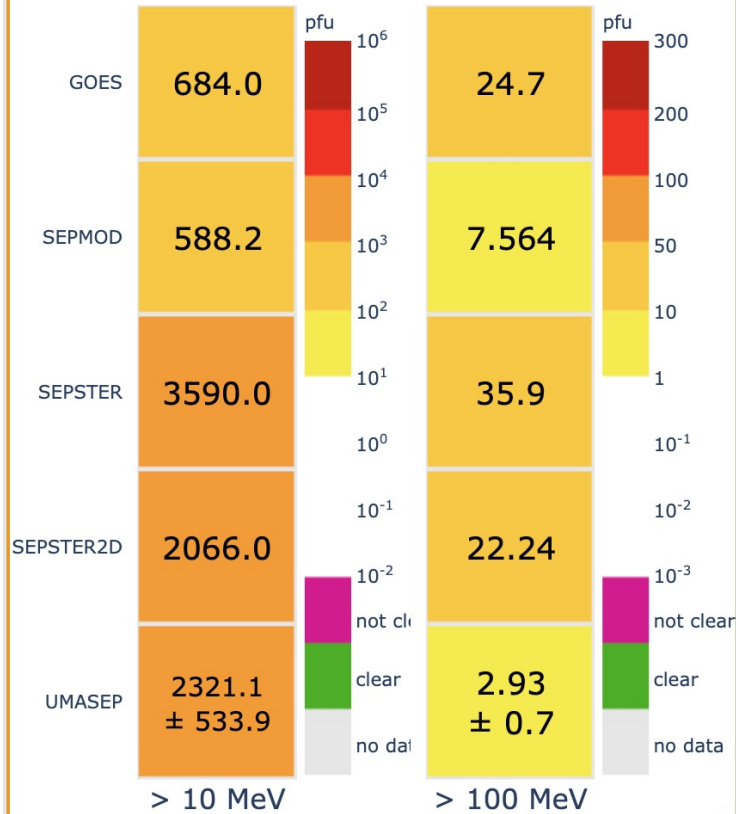


selected date/time: 2017-09-10 16:31 UT



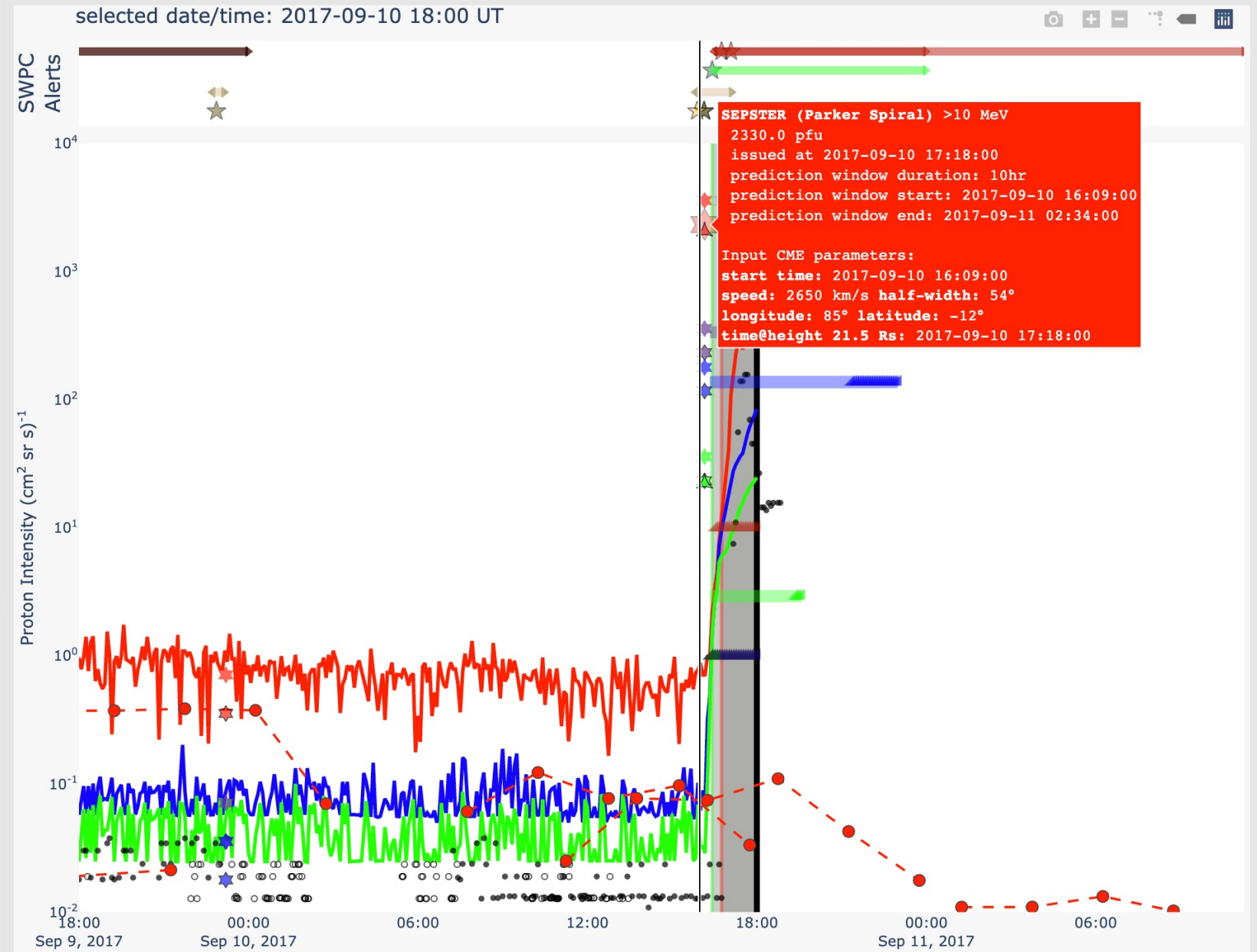
Proton Intensity Forecasts:

2017-09-10 18:00 UT



Proton All Clear Forecasts:

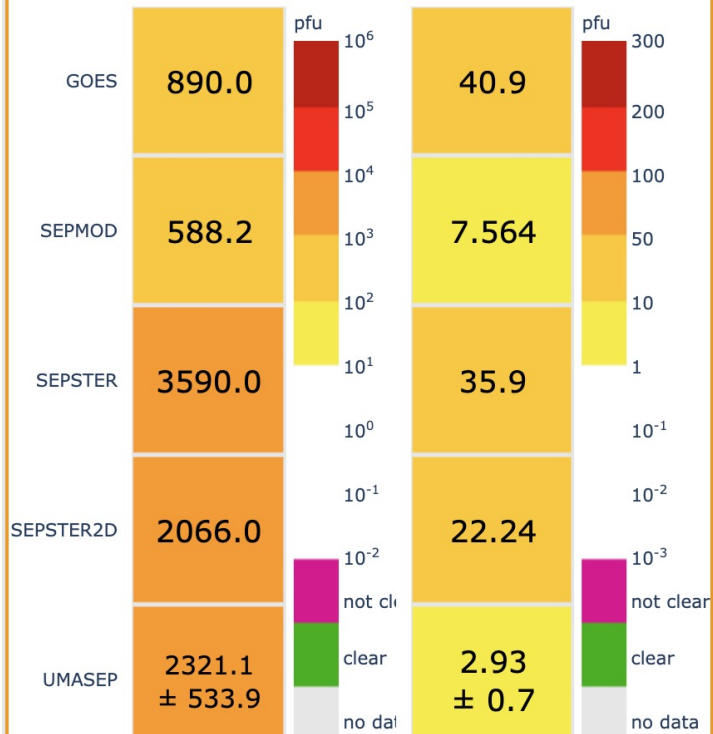
2017-09-10 18:00 UT



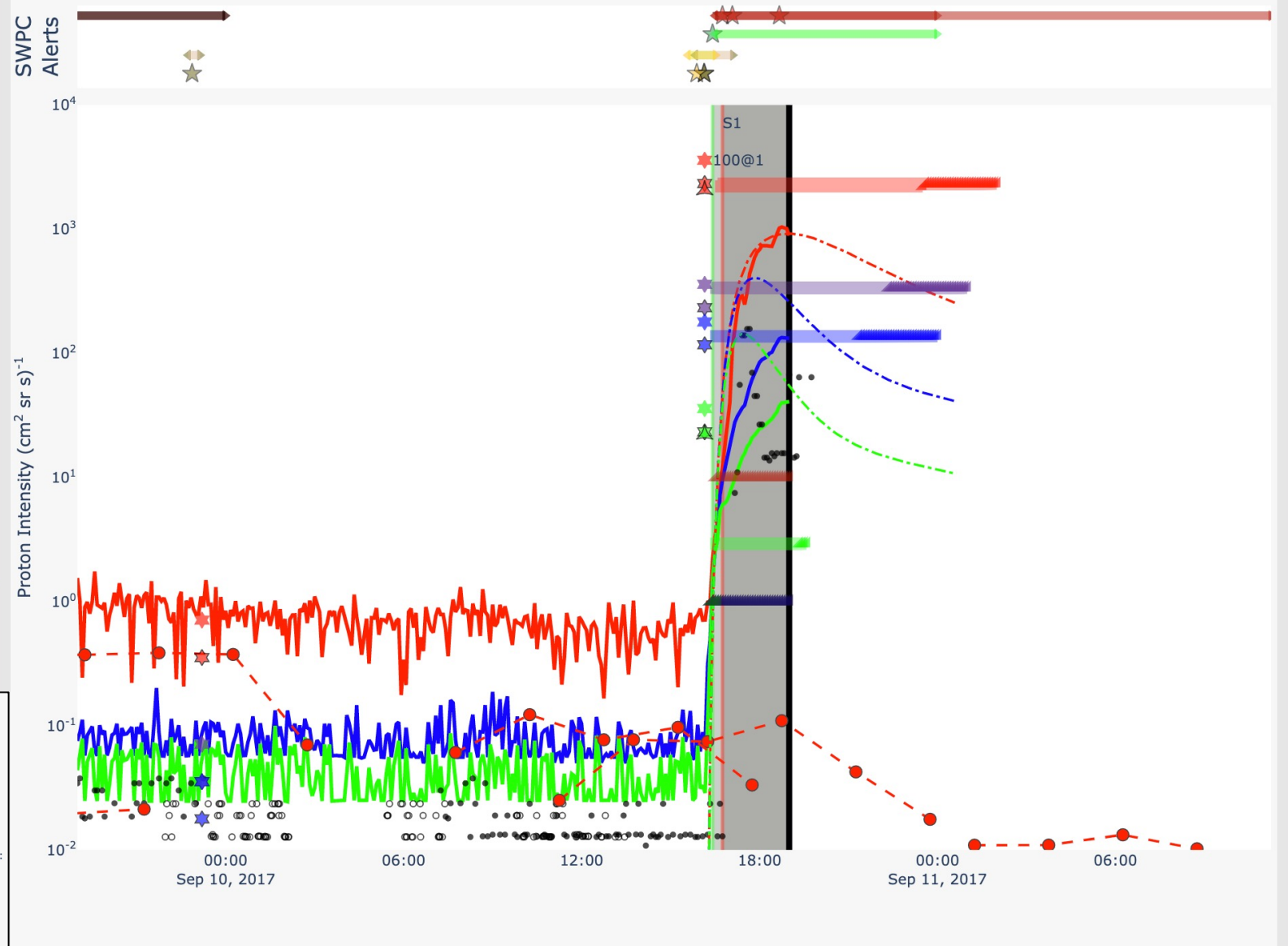


Proton Intensity Forecasts:

2017-09-10 19:00 UT



selected date/time: 2017-09-10 19:00 UT

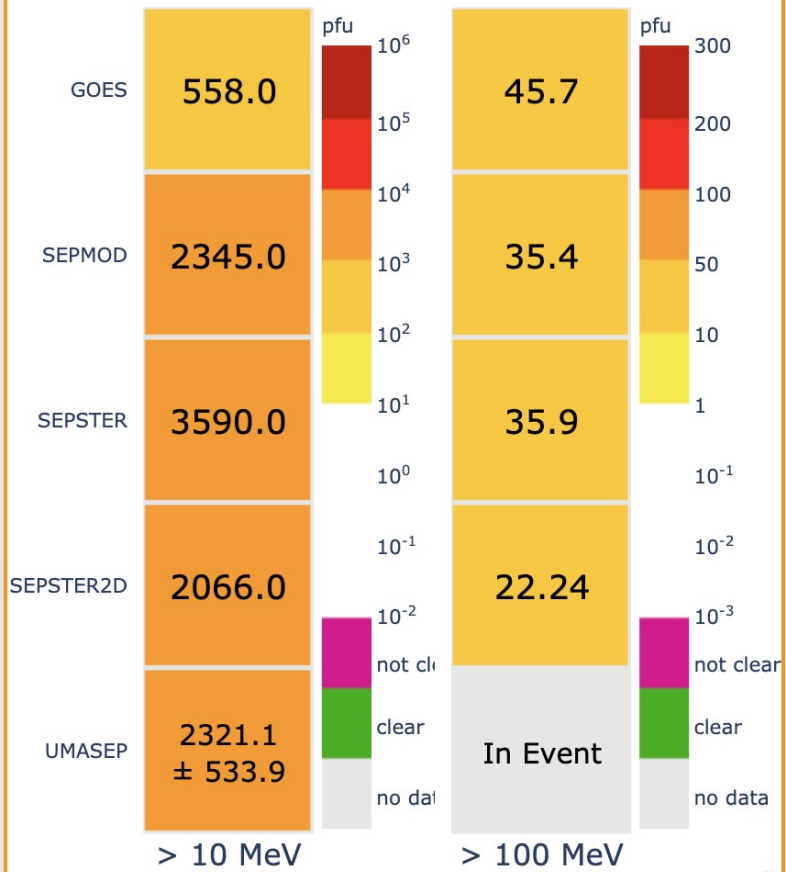


GOES: > 10 MeV	GOES: > 100 MeV	HESPERIA ReleASE ACE 30-min: 15.8 - 39.8 MeV	HESPERIA ReleASE ACE 30-min: 28.2 - 50.1 MeV
HESPERIA ReleASE ACE 60-min: 15.8 - 39.8 MeV	HESPERIA ReleASE ACE 60-min: 28.2 - 50.1 MeV	HESPERIA ReleASE ACE 90-min: 15.8 - 39.8 MeV	HESPERIA ReleASE ACE 90-min: 28.2 - 50.1 MeV
HESPERIA ReleASE SOHO 30-min: 15.8 - 39.8 MeV	HESPERIA ReleASE SOHO 30-min: 28.2 - 50.1 MeV	HESPERIA ReleASE SOHO 60-min: 15.8 - 39.8 MeV	HESPERIA ReleASE SOHO 60-min: 28.2 - 50.1 MeV
HESPERIA ReleASE SOHO 90-min: 15.8 - 39.8 MeV	HESPERIA ReleASE SOHO 90-min: 28.2 - 50.1 MeV	SEPSTER (Parker Spiral): > 10.0 MeV	SEPSTER (Parker Spiral): > 30.0 MeV
SEPSTER (Parker Spiral): > 100.0 MeV	SEPSTER (Parker Spiral): > 300.0 MeV	SEPSTER (WSA-ENLIL): > 10.0 MeV	SEPSTER (WSA-ENLIL): > 30.0 MeV
SEPSTER (WSA-ENLIL): > 50.0 MeV	SEPSTER (WSA-ENLIL): > 100.0 MeV	STAT: > 10.0 MeV	STAT: > 50.0 MeV
UMASEP-100: > 100 MeV	UMASEP-10: > 10 MeV	STAT: > 100.0 MeV	



Proton Intensity Forecasts:

2017-09-10 20:00 UT

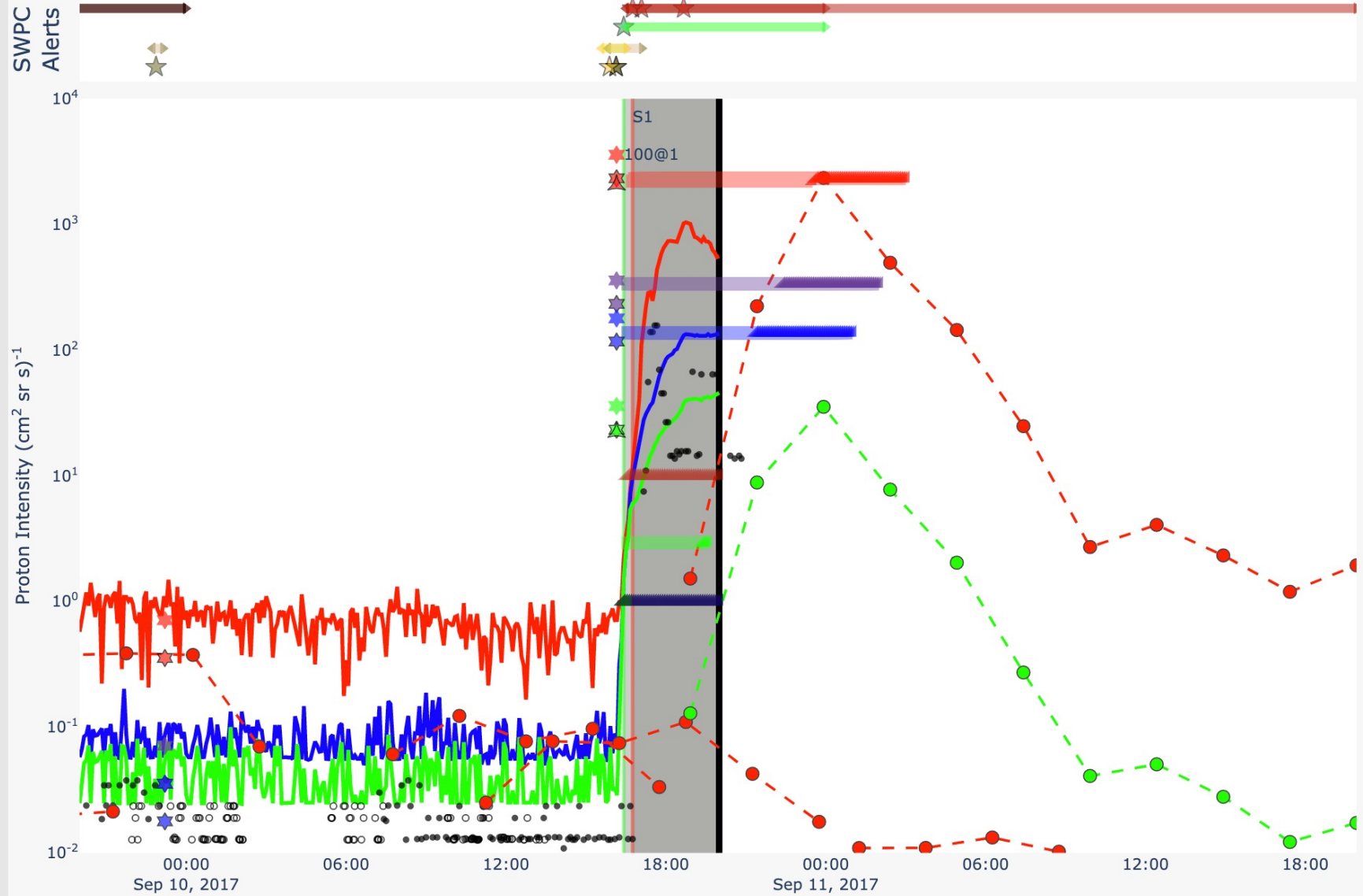


Proton All Clear Forecasts:

2017-09-10 20:00 UT



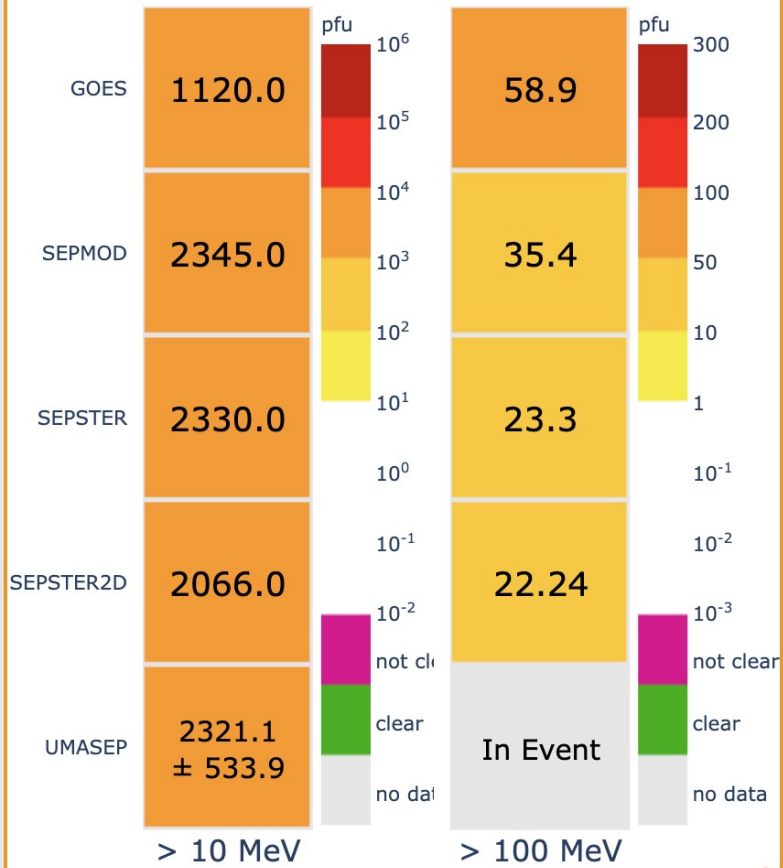
selected date/time: 2017-09-10 20:00 UT





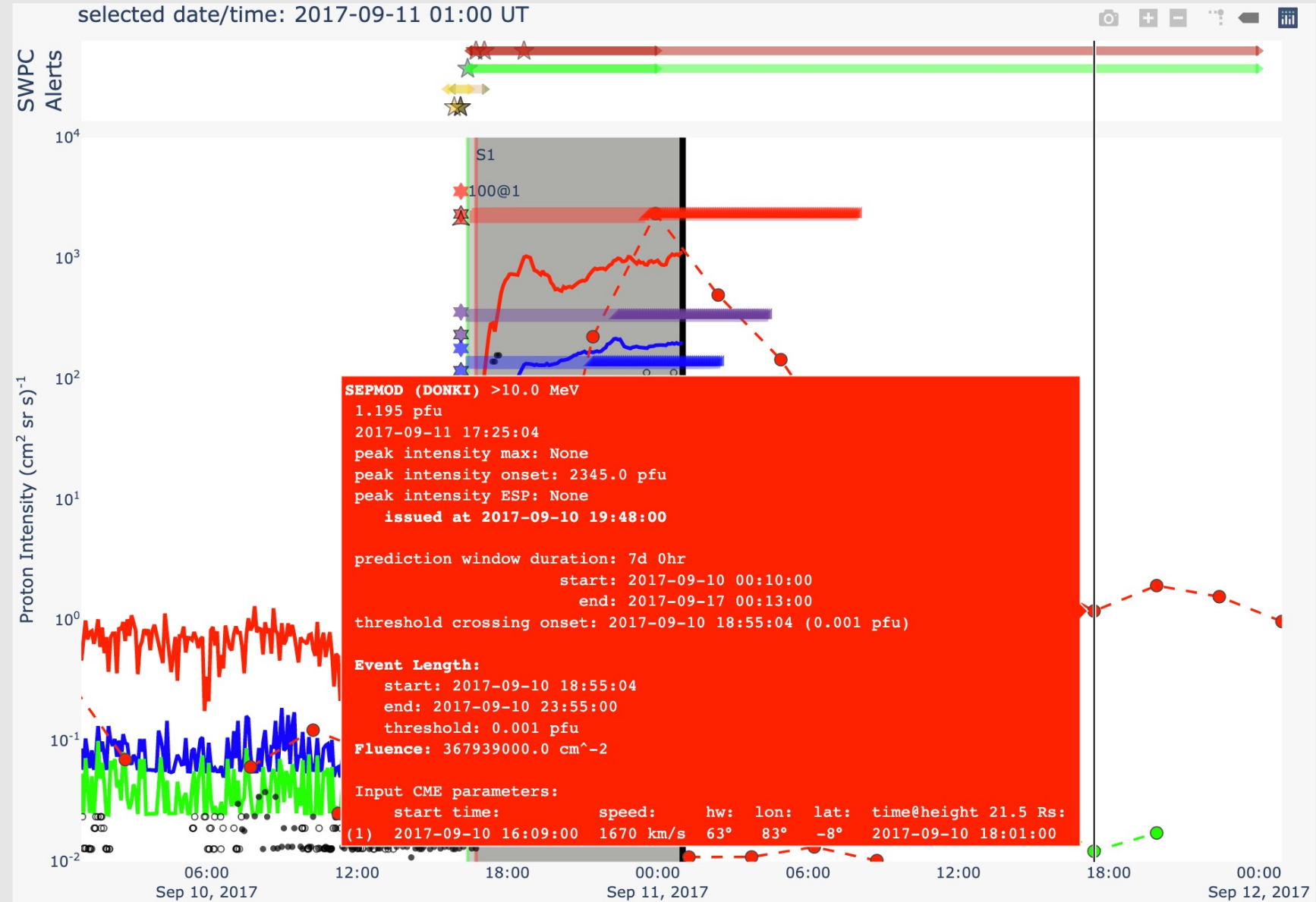
Proton Intensity Forecasts:

2017-09-11 01:00 UT



Proton All Clear Forecasts:

2017-09-11 01:00 UT





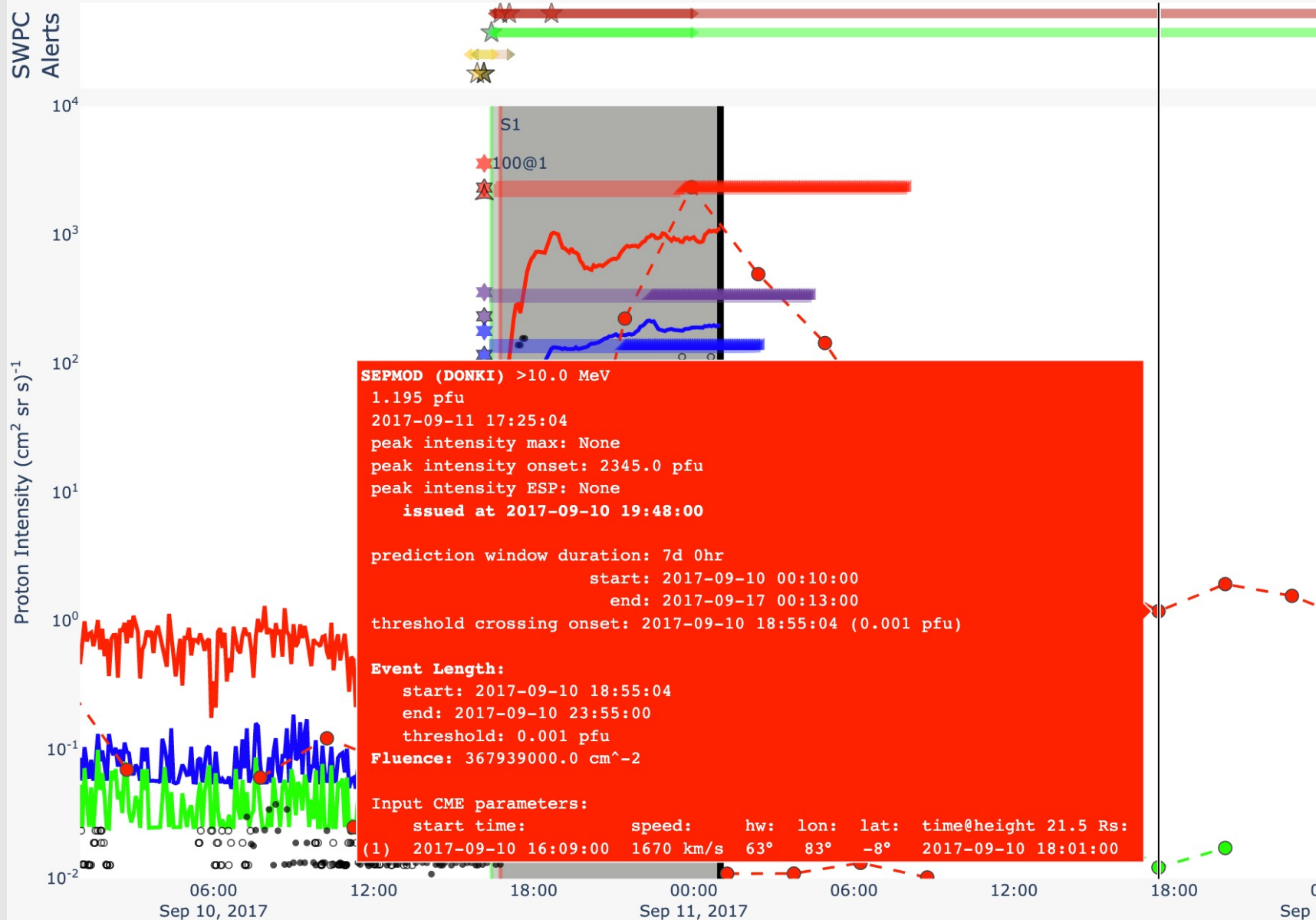
Proton Intensity Forecasts:

2017-09-11 01:00 UT



Proton All Clear Forecasts:

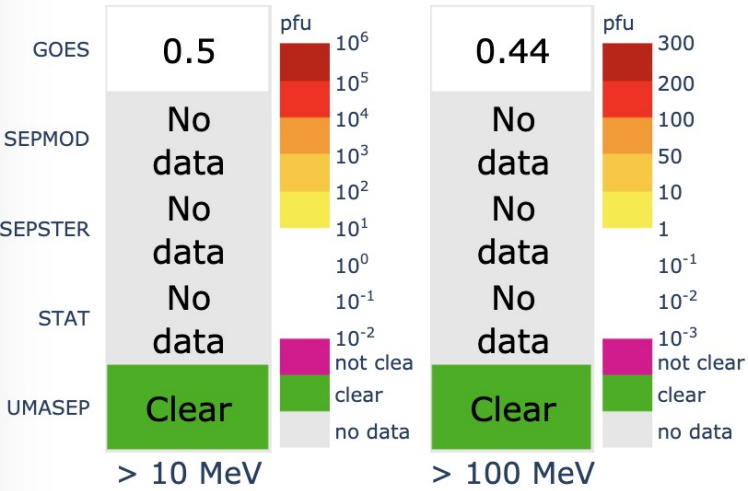
selected date/time: 2017-09-11 01:00 UT



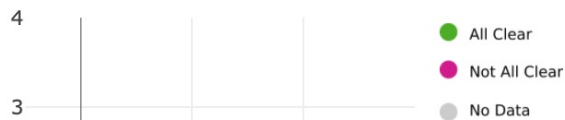


Proton Intensity Forecasts:

2020-10-11 00:54 UT



Proton All Clear Forecasts:



selected date/time: 2020-10-11 00:54 UT

