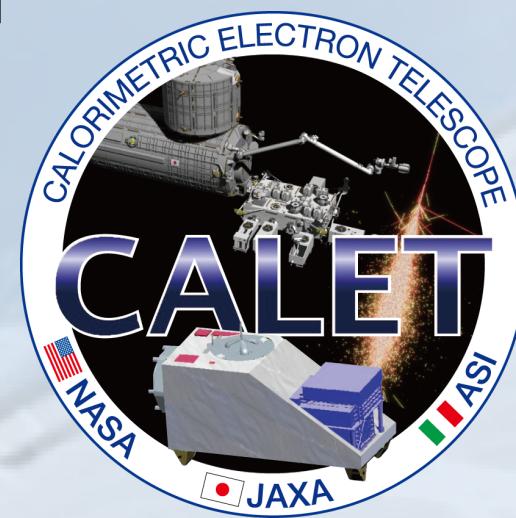


Solar Modulation of Galactic Cosmic-Ray Electrons Measured with CALET

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CALET Collaboration

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16) National Inst. of Radiological Sciences, Japan

17) National Institute of Polar Research, Japan

18) Nihon University, Japan

19) Osaka City University, Japan

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25) University of Denver, USA

26) University of Florence, IFAC (CNR) and INFN, Italy

27) University of Padova and INFN, Italy

28) University of Pisa and INFN, Italy

29) University of Rome Tor Vergata and INFN, Italy

30) University of Siena and INFN, Italy

31) University of Tokyo, Japan

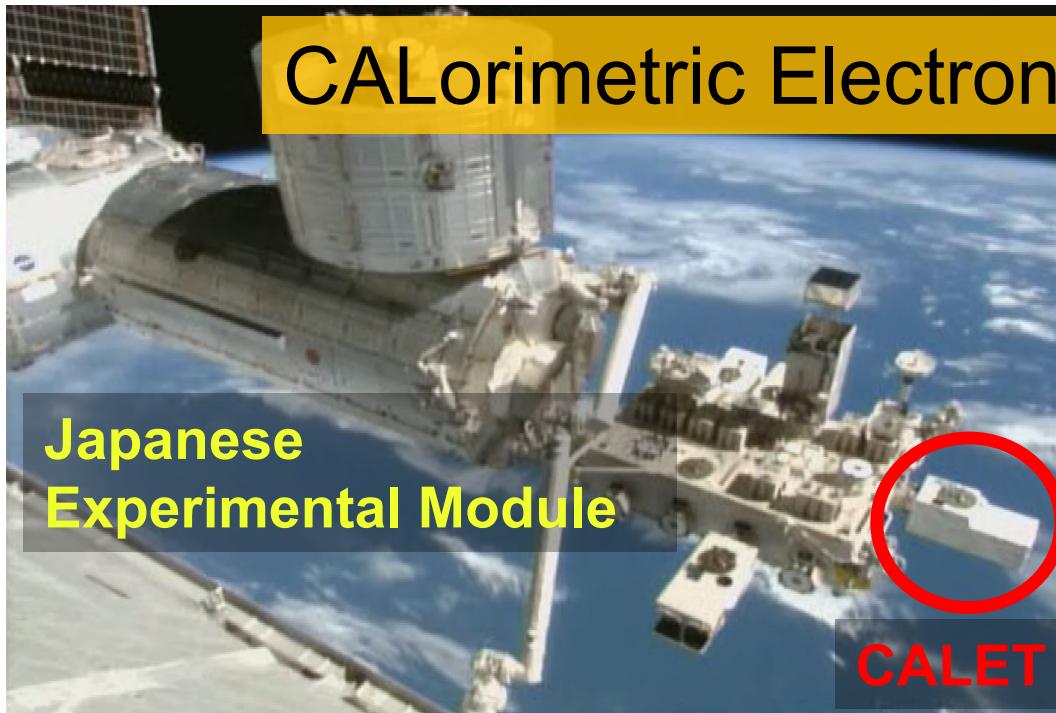
32) Waseda University, Japan

33) Washington University-St. Louis, USA

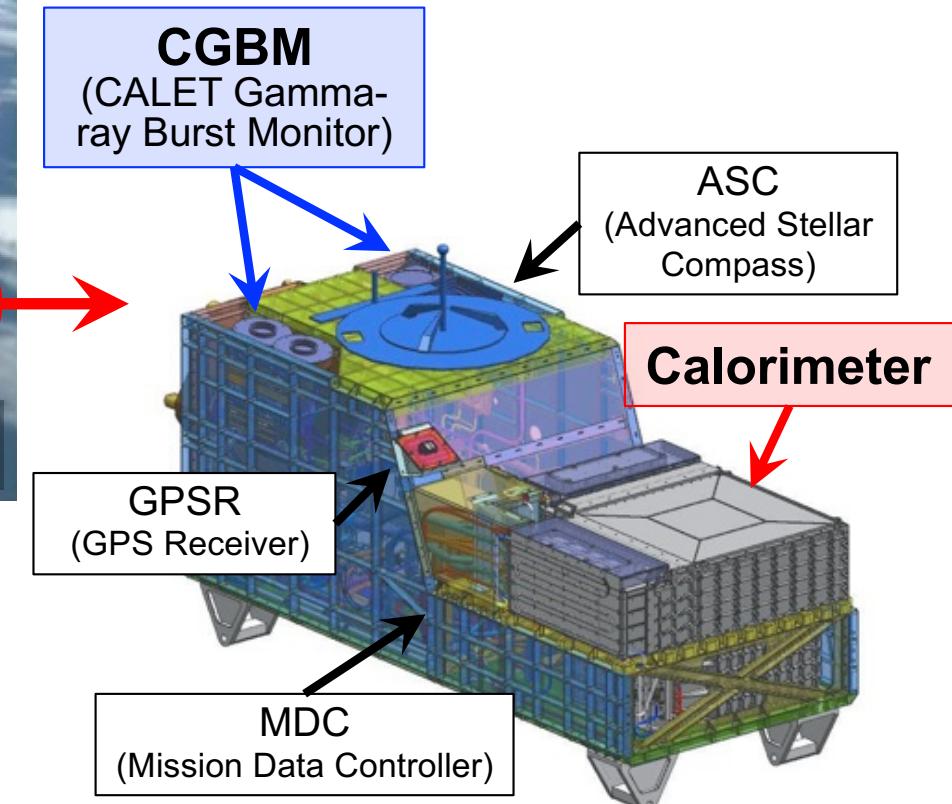
34) Yokohama National University, Japan

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CALET on the ISS



CALorimetric Electron Telescope (CALET)



Launch: Aug. 19, 2015

Observations: Oct. 13, 2015

Observation Targets:

Electron ($e^- + e^+$): 1 GeV – 20 TeV

p--Fe: 10 GeV – 1000 TeV

Ultra heavy ions ($26 < Z \leq 40$): > 600 MeV/n

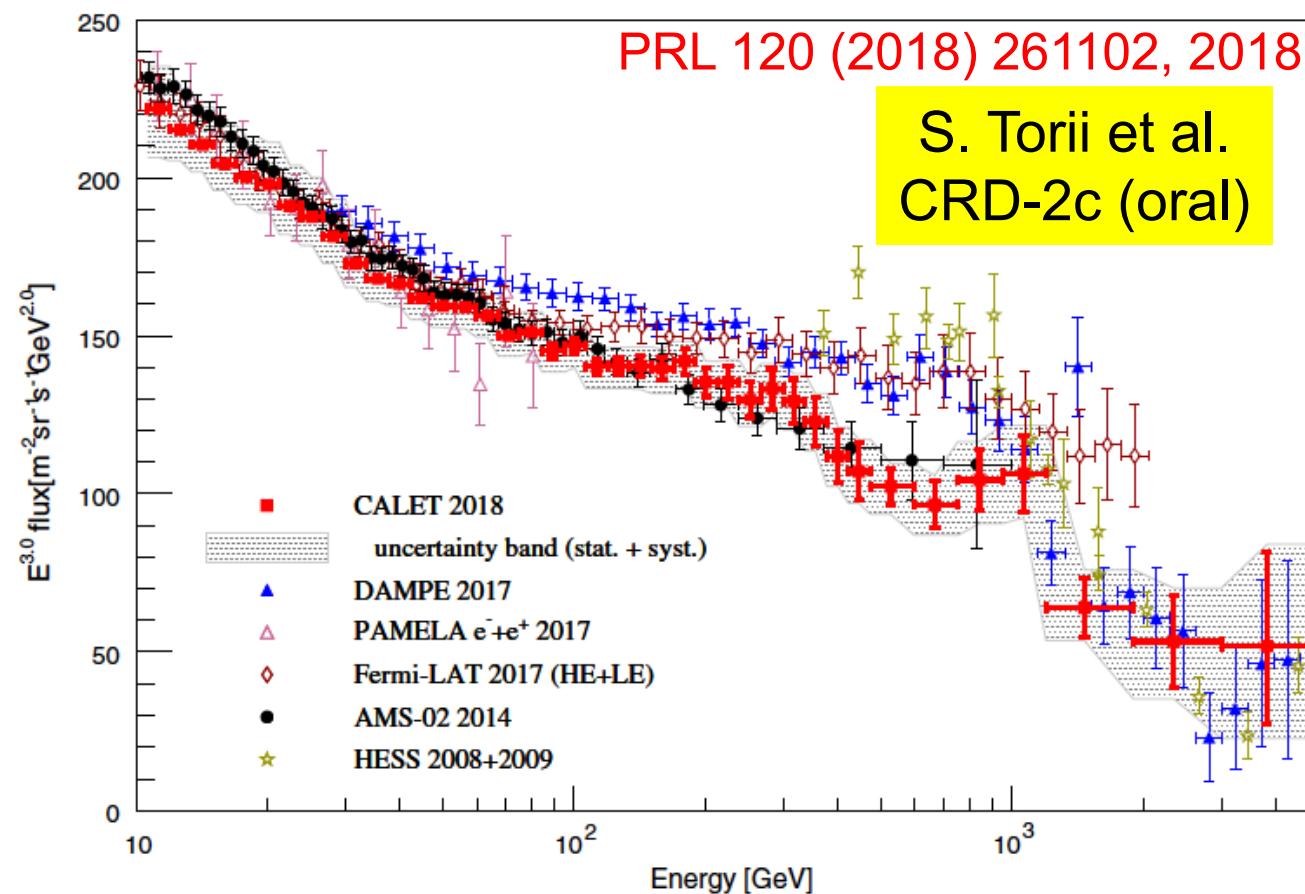
Gamma-rays (Diffuse + Point sources): 1 GeV – 1 TeV

Measurements of the CR $e^- + e^+$ with High-Energy Trigger

High-energy shower trigger (HE-Trigger):

- Energy thresholds are set to detect shower events with energies over 10 GeV.
- HE-trigger is always active.

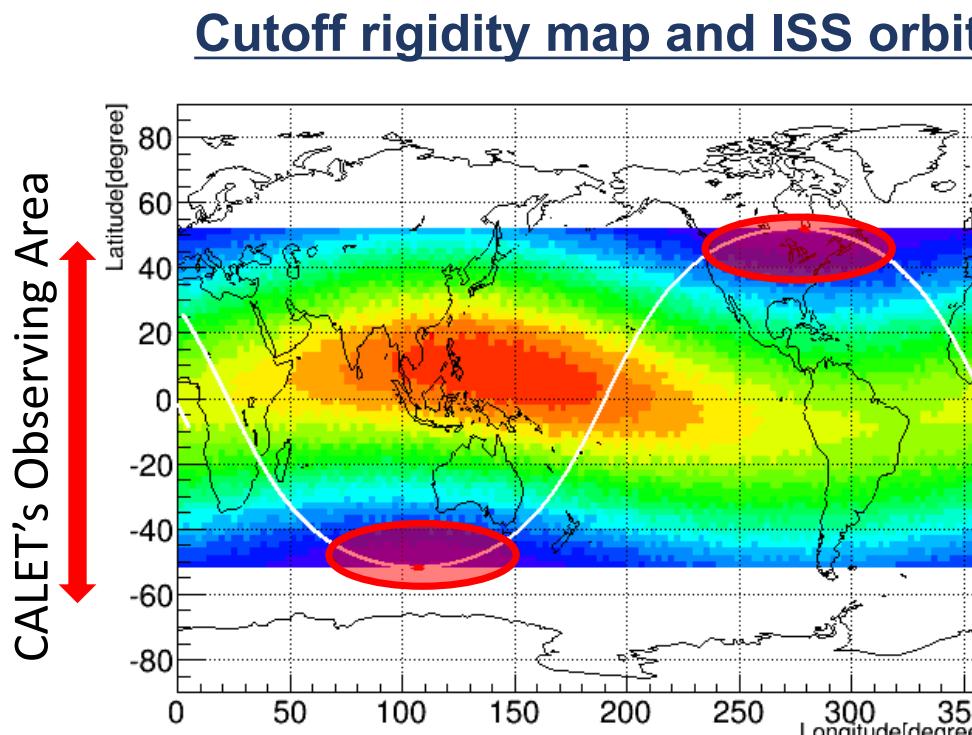
CR $e^- + e^+$ spectrum from 11 GeV to 4.8 TeV



Measurements of the CR $e^- + e^+$ with Low-Energy Trigger

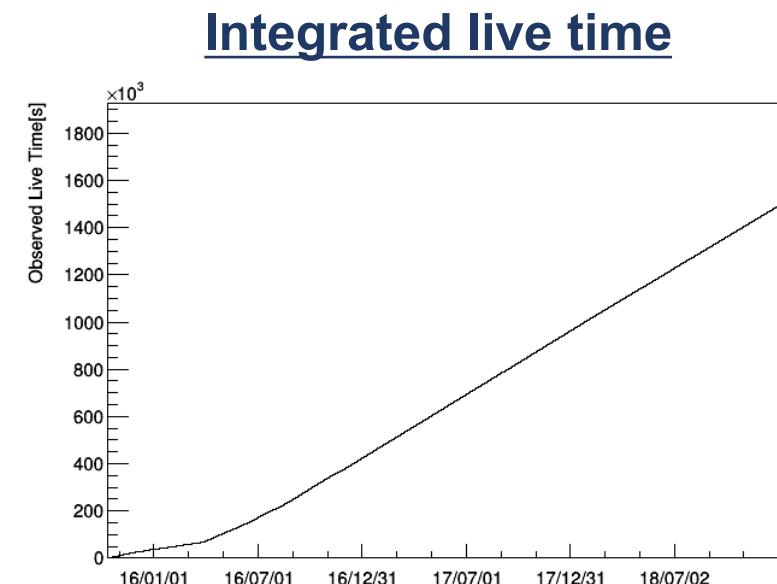
Low-energy shower trigger (LE-Trigger):

- Energy thresholds are set to detect shower events with energies over 1.0 GeV.
- Measurement of low energy electrons (1GeV ~ 10GeV) with LE-trigger is active only at high latitude where maximum cutoff rigidity is 5.0GV.
→ In 1 cycle, LE mode works 2 times for 90 sec

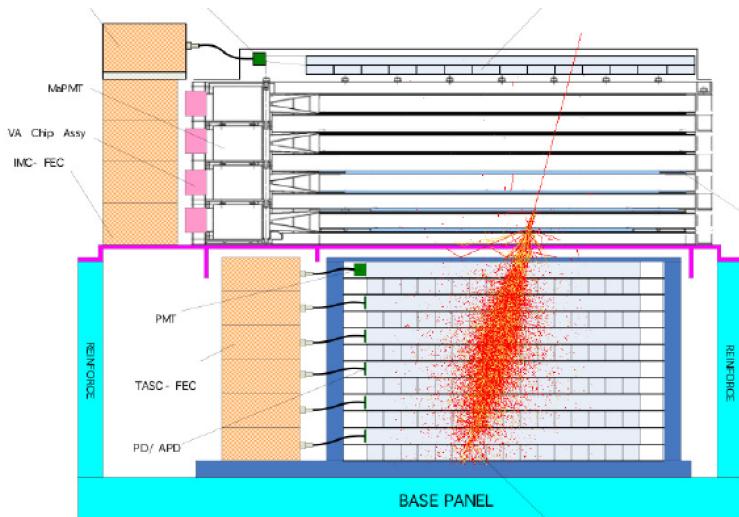


<http://www.ngdc.noaa.gov/IAGA/vmod/igrf.html>

Oct. 12, 2015 ~ April 30, 2019
 Total Live Time: ~470 [hours]
 Total events : ~ 55×10^6 [events]

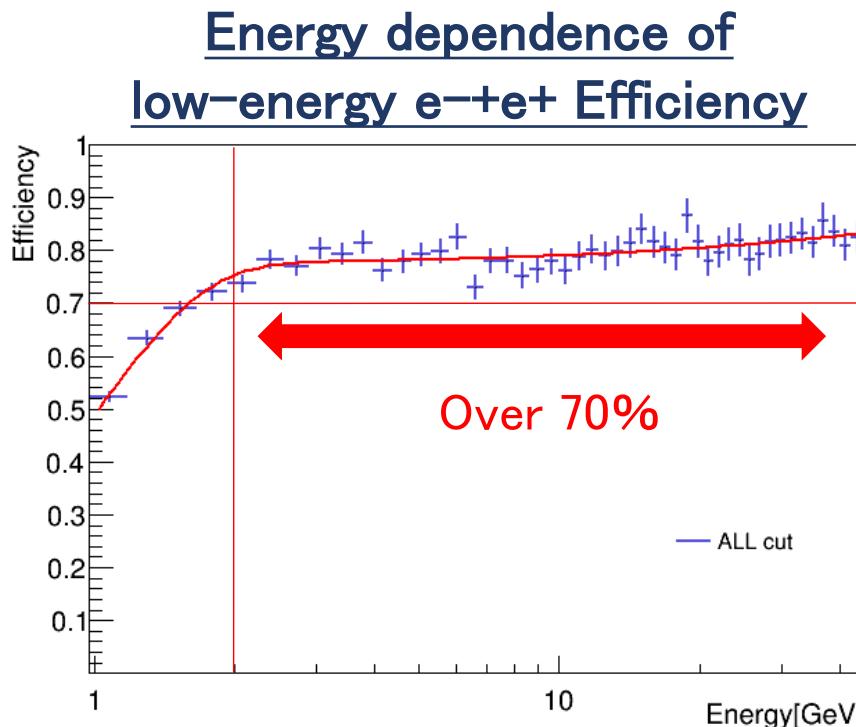


Analysis Procedure for Low-Energy $e^- + e^+$

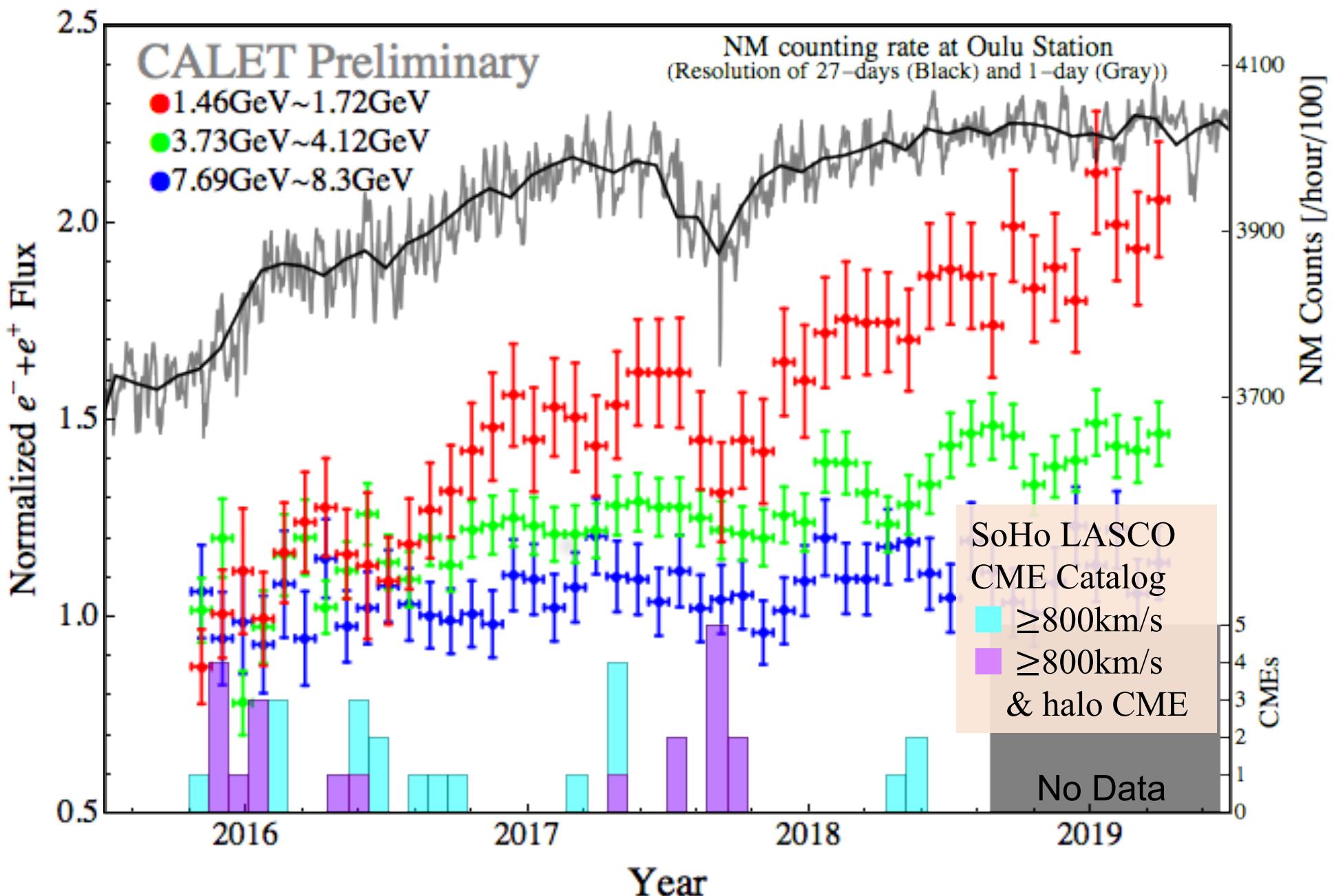


CHD (Charge Detector)
IMC (Imaging Calorimeter)
TASC (Total Absorption Calorimeter)
Event selections for low energy $e^- + e^+$

- ① Energy threshold: **IMC7–8 and TASC top layer**
 - Trigger GeV-energy events
- ② Tracking and geometry condition: **IMC**
 - Kalman filter track reconstruction with IMC
 - Entire trajectory is inside IMC and TASC
- ③ Charge determination: **CHD**
 - CHD energy deposit to remove $Z \geq 2$
- ④ e/p separation: **IMC bottom layer and TASC top layer**
 - Energy deposit and Shower concentration of IMC bottom layer
 - R_E of TASC top layer
- ⑤ Energy determination: **IMC and top 3 layers of TASC X, Y**
 - Energy deposit of top 3 layers of TASC X, Y and IMC



Short-Period Disturbance of the Normalized Flux



Summary

- The ability of CALET low-energy trigger for measuring 1 GeV - 10 GeV e^-+e^+ flux has been successfully demonstrated.
- We obtained the continuous variation of the low-energy electron flux increasing as time passes, which have been expected from a recent weakening solar cycle.
- We also confirmed that there are additional small fluctuations in the flux, that has a potential to be explained by the effects of the interplanetary coronal mass ejections or the co-rotating interaction region of the solar wind.
- Further investigation with continuous measurements of the low-energy electrons by CALET may provide a crucial key to the understanding of the details of the 27-day variation of the solar modulation.