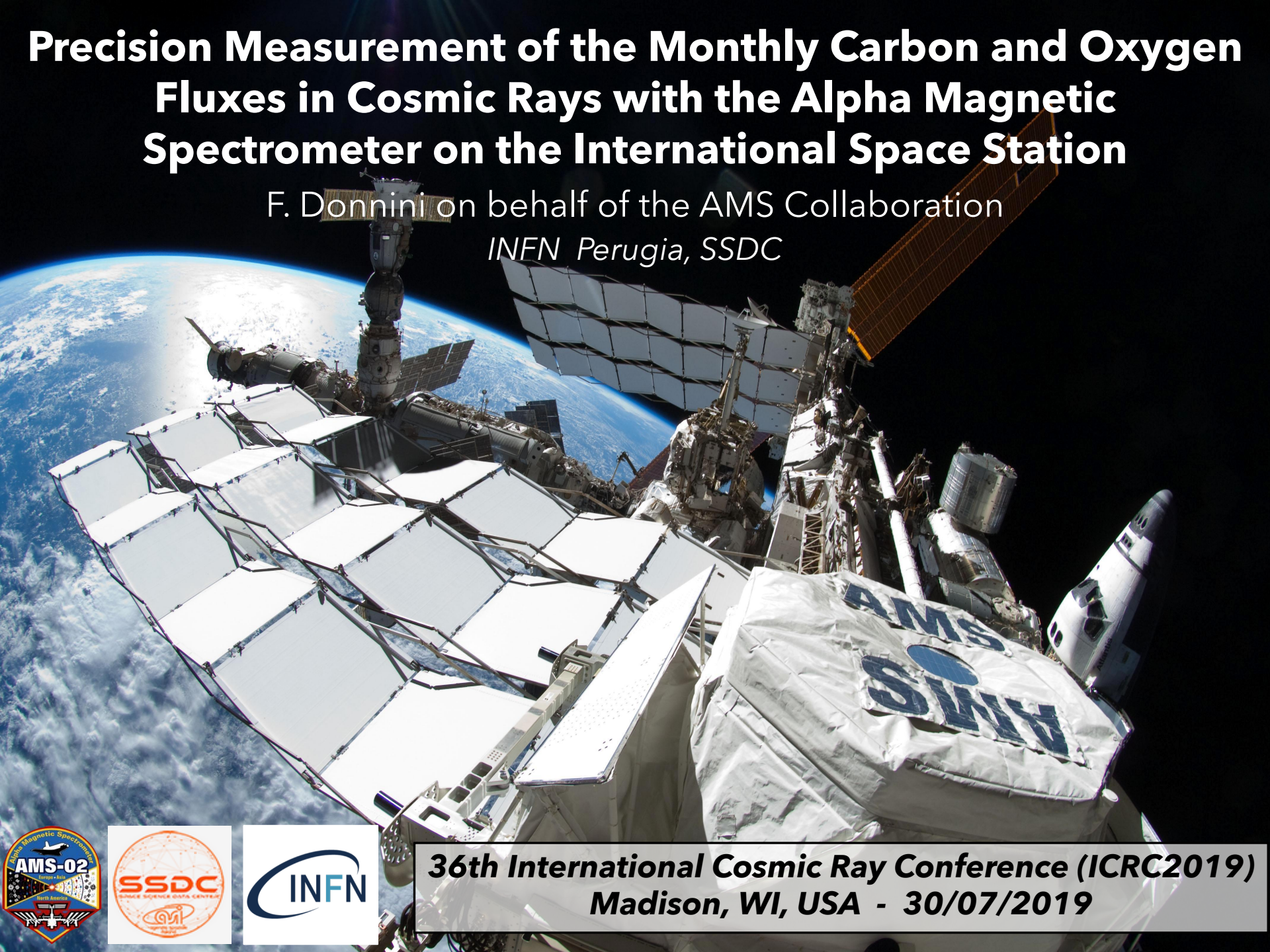
Precision Measurement of the Monthly Carbon and Oxygen Fluxes in Cosmic Rays with the Alpha Magnetic Spectrometer on the International Space Station

F. Donnini on behalf of the AMS Collaboration

INFN Perugia, SSDC



36th International Cosmic Ray Conference (ICRC2019)

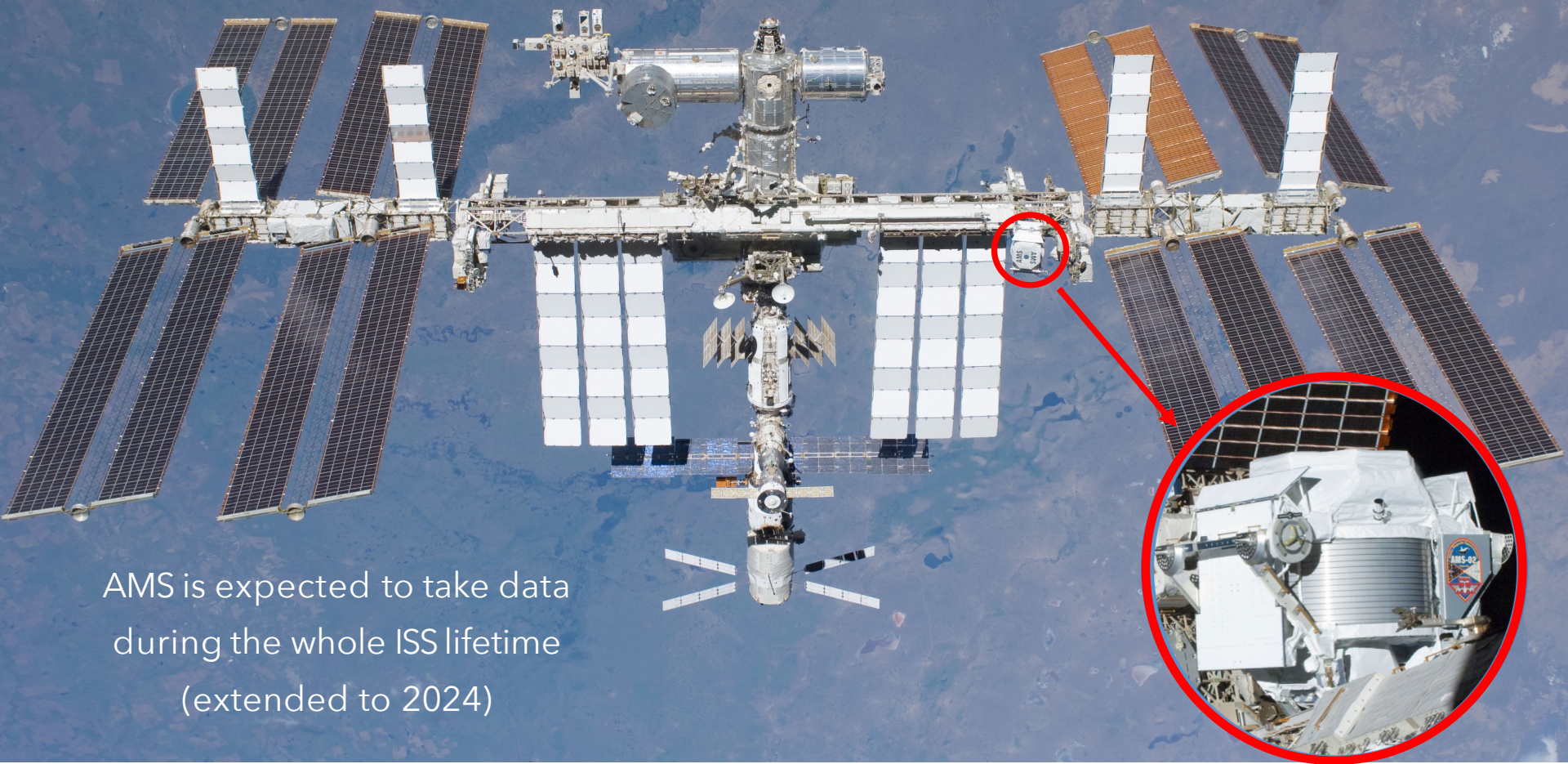
Madison, WI, USA - 30/07/2019

AMS-02 in orbit

AMS-02 is a large-acceptance high-energy magnetic spectrometer able to perform precision measurements of particles in the GeV-TeV energy range.

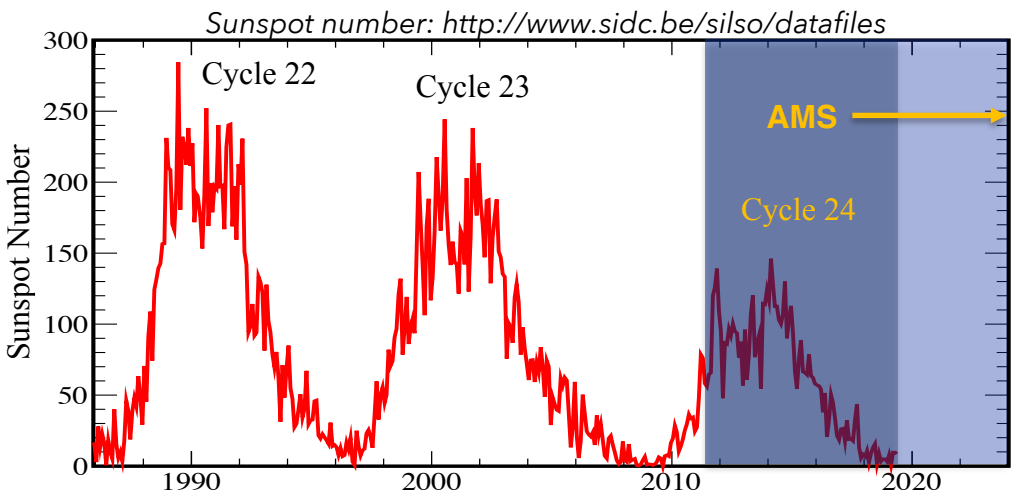
AMS-02 is operating onboard the International Space Station (ISS) since 2011 May 19th.

AMS-02 recorded more than 142 billion CR triggers in ~8 years of operation.



AMS is expected to take data during the whole ISS lifetime (extended to 2024)

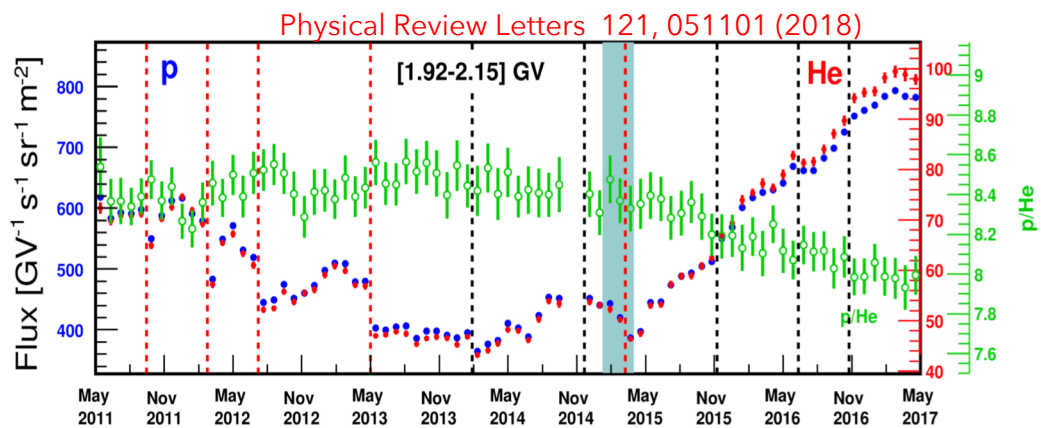
Monthly C and O fluxes: Physical Motivation



AMS-02 is able to study the time evolution of GCR during both periods of maximum and minimum of solar activity

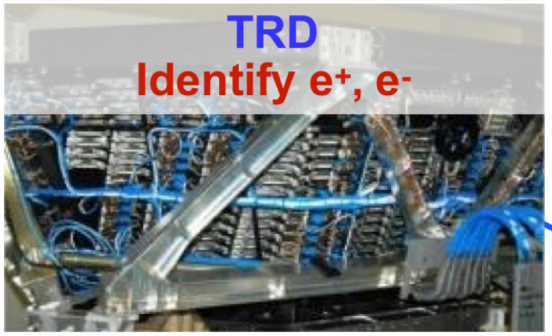
Latest results from AMS show discrepancies on the spectral behavior of p and He, starting from February 2015
See N. Tomassetti talk (CRD8d)

- Differences in diffusion coefficients?
- 3He and 4He isotopic composition?
- Differences in the local interstellar spectra?

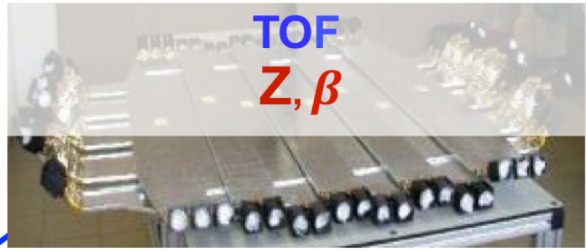


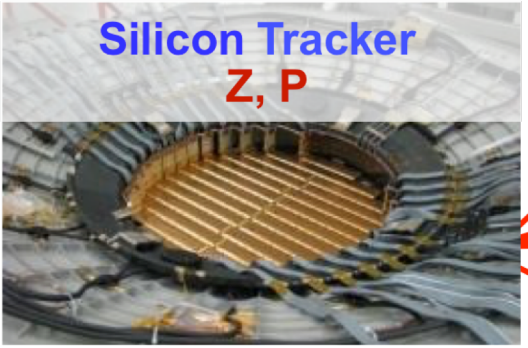
Carbon and Oxygen are the closest most abundant species, they can be used to understand the discrepancies on p and He, improving the knowledge of the nuclei propagation in the heliosphere

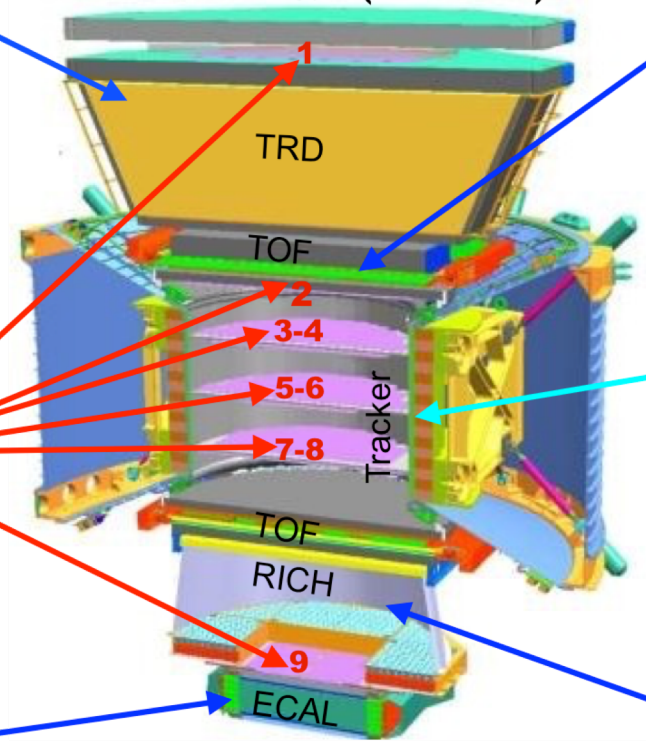
AMS-02

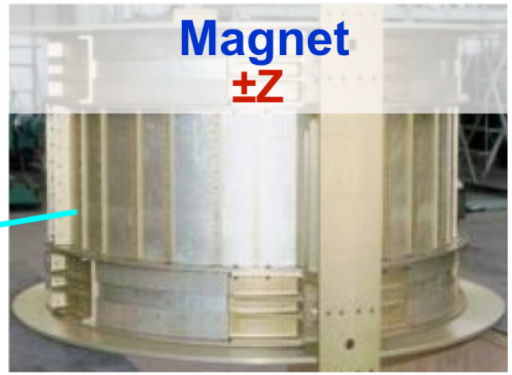


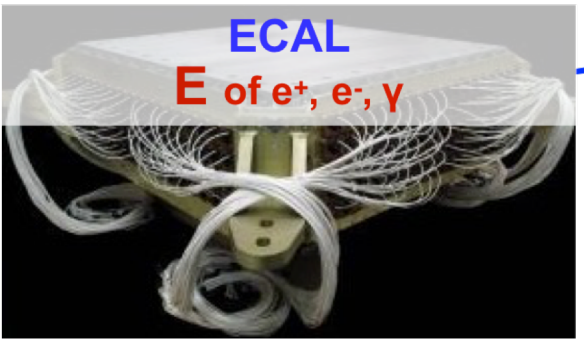
Particles and nuclei are defined by their charge (Z) and energy (E ~ P)



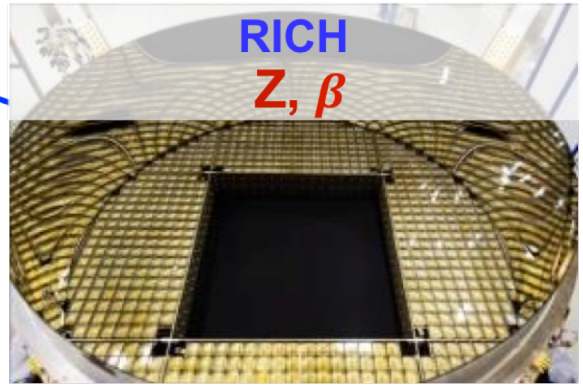




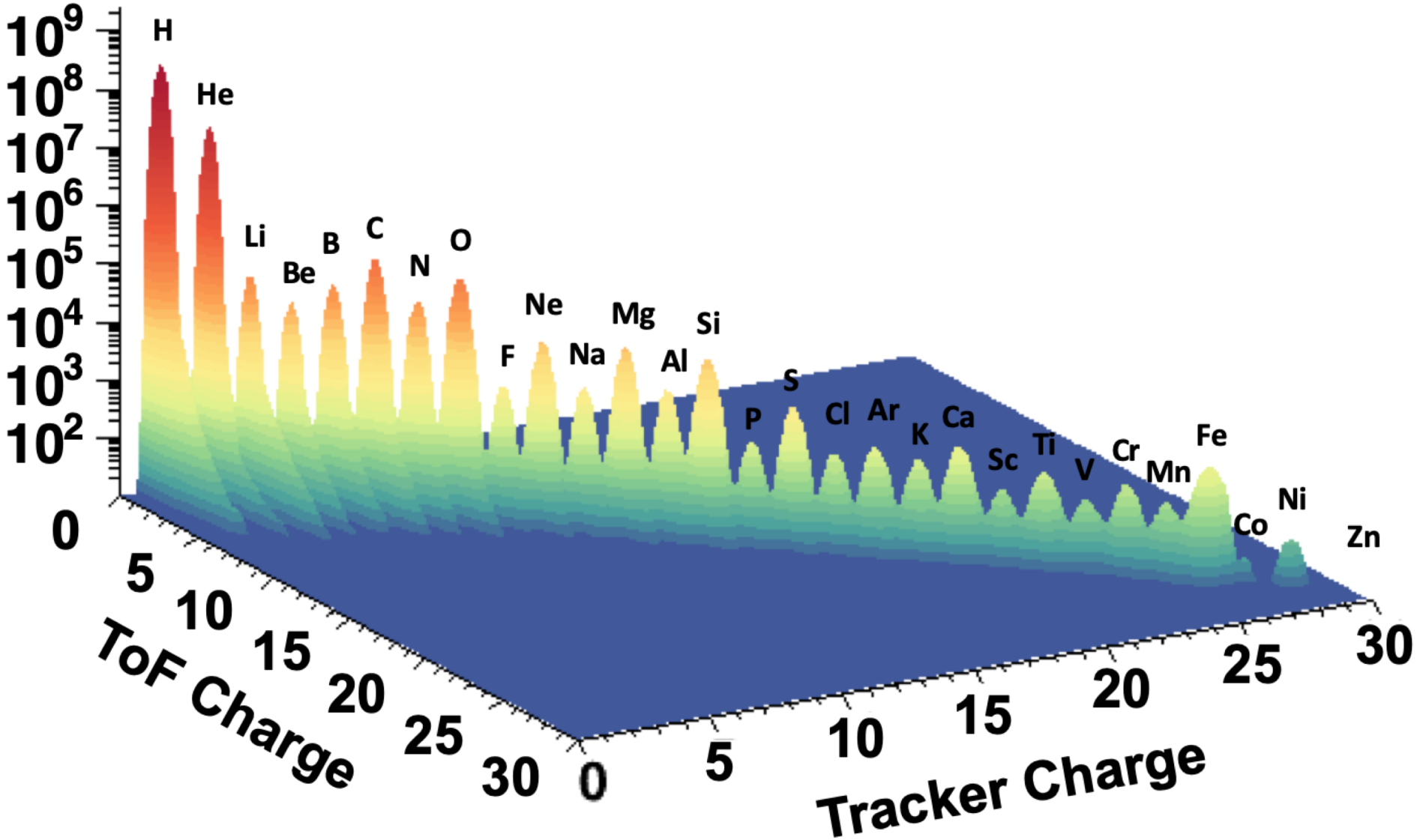




Z, P are measured independently by the Tracker, RICH, TOF and ECAL



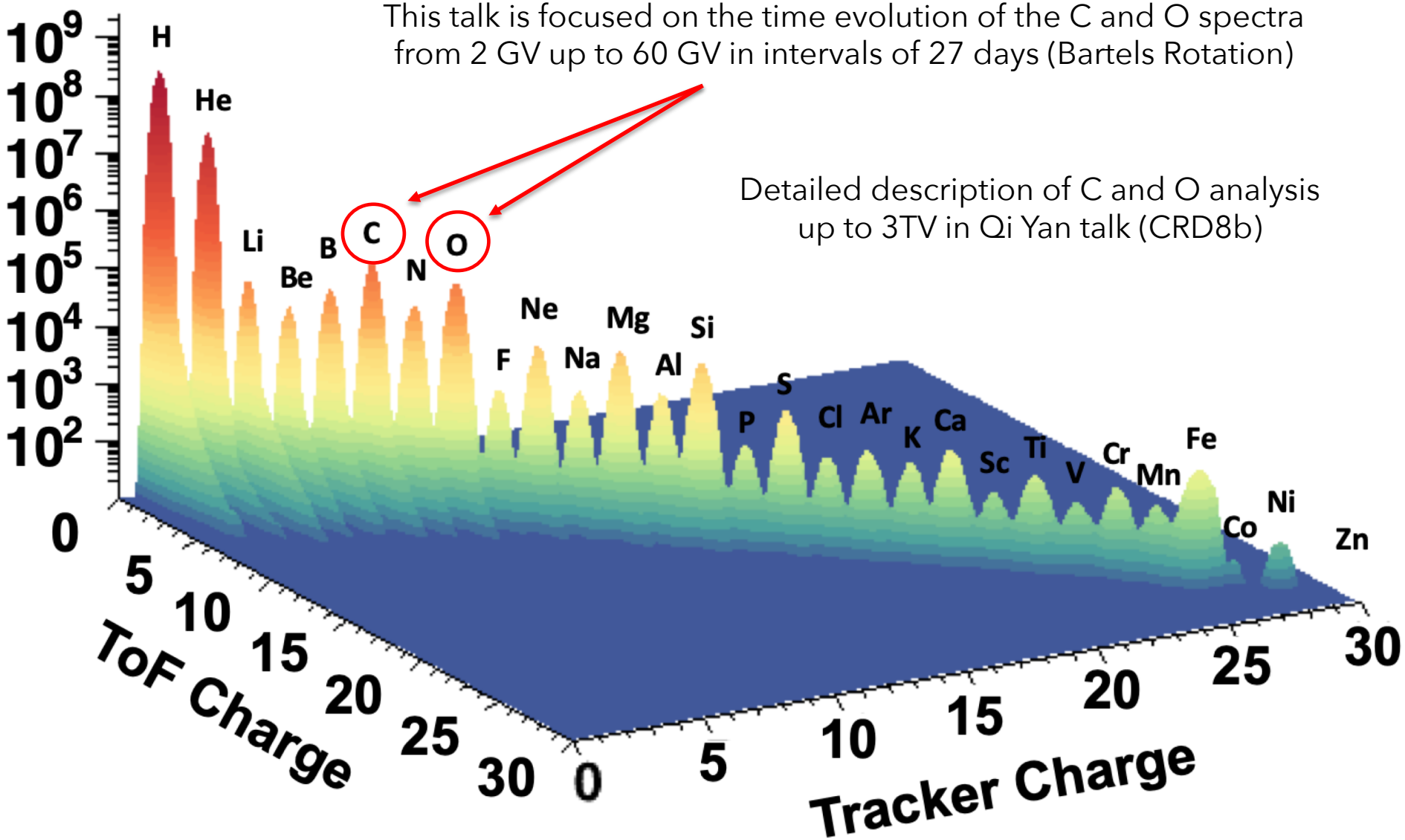
Chemical composition measured by AMS-02



Chemical composition measured by AMS-02

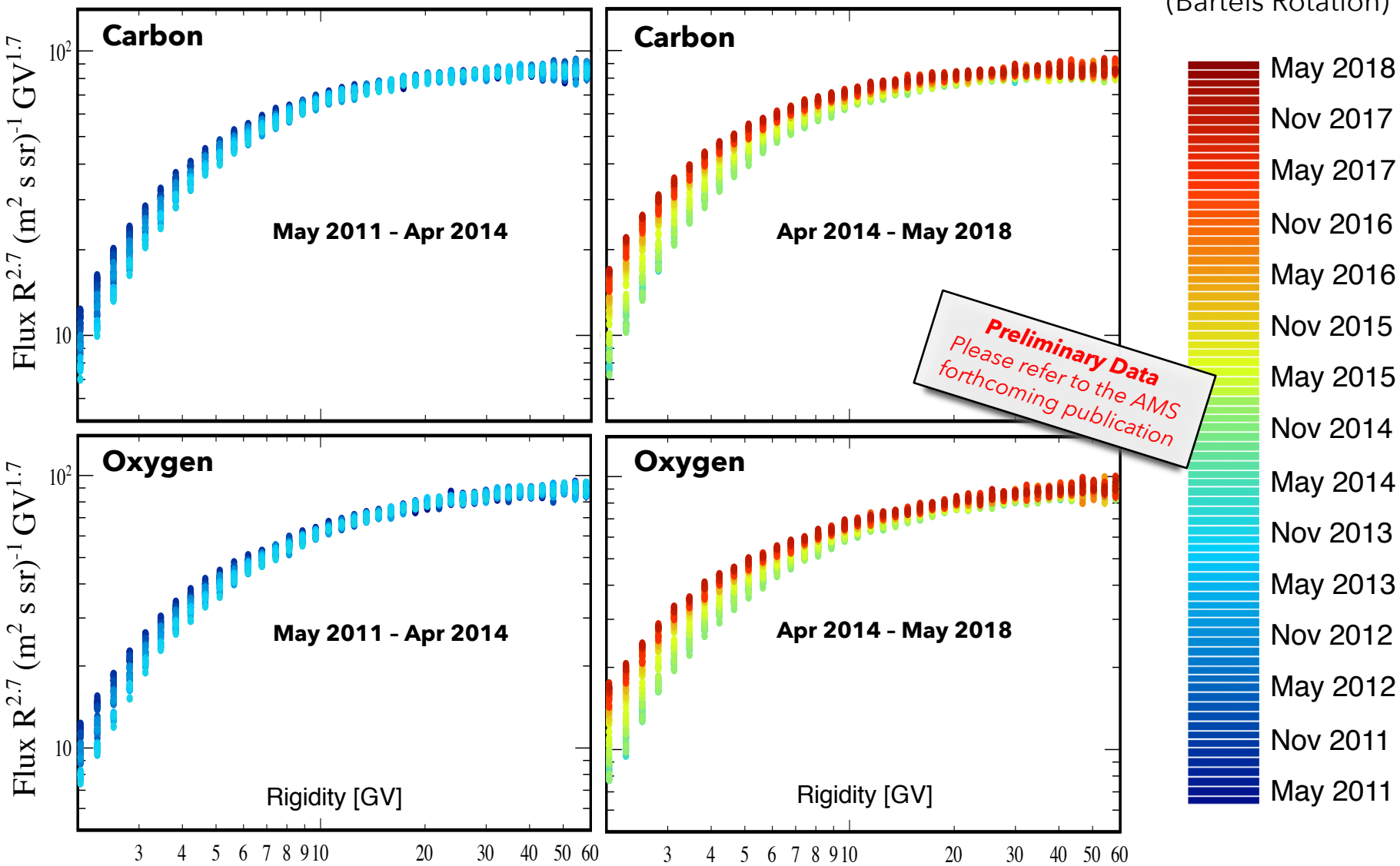
This talk is focused on the time evolution of the C and O spectra from 2 GV up to 60 GV in intervals of 27 days (Bartels Rotation)

Detailed description of C and O analysis up to 3TV in Qi Yan talk (CRD8b)



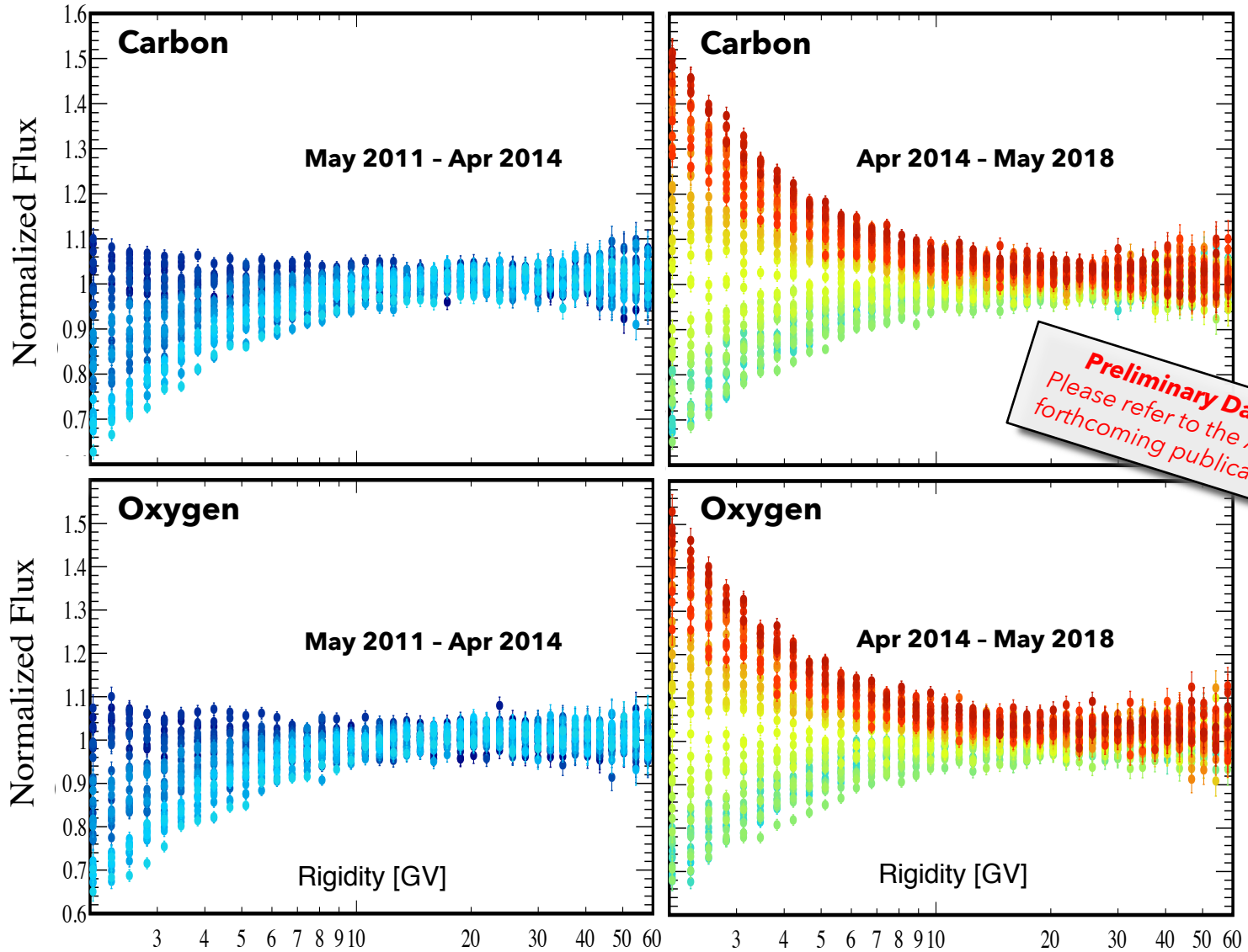
Monthly C and O Fluxes

Monthly Carbon and Oxygen fluxes up to 60 GV

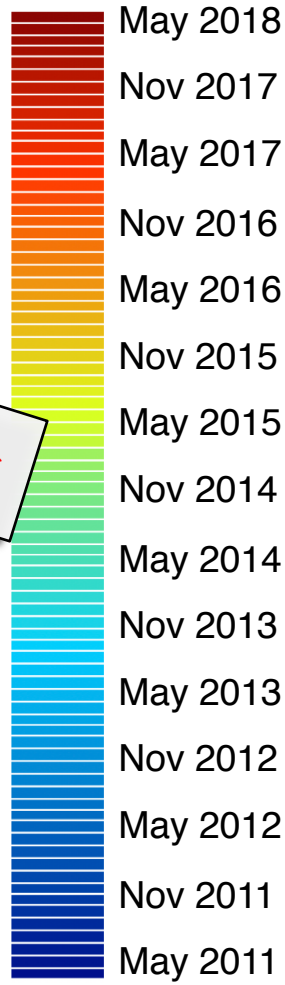


Monthly C and O Fluxes

Relative variation of montly fluxes with respect the overall period

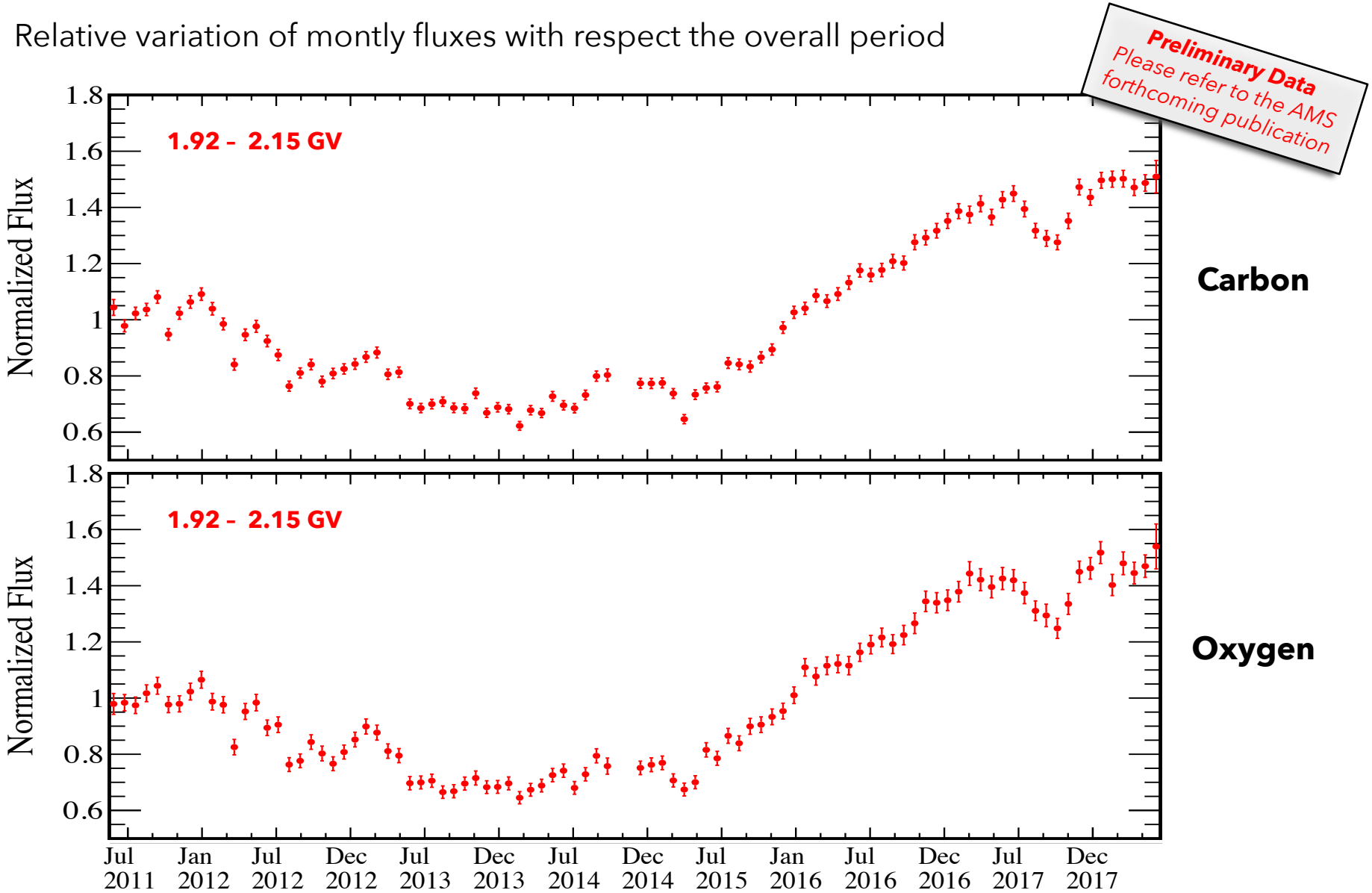


Time intervals of 27 days (Bartels Rotation)



Monthly Fluxes Relative Variation

Relative variation of montly fluxes with respect the overall period



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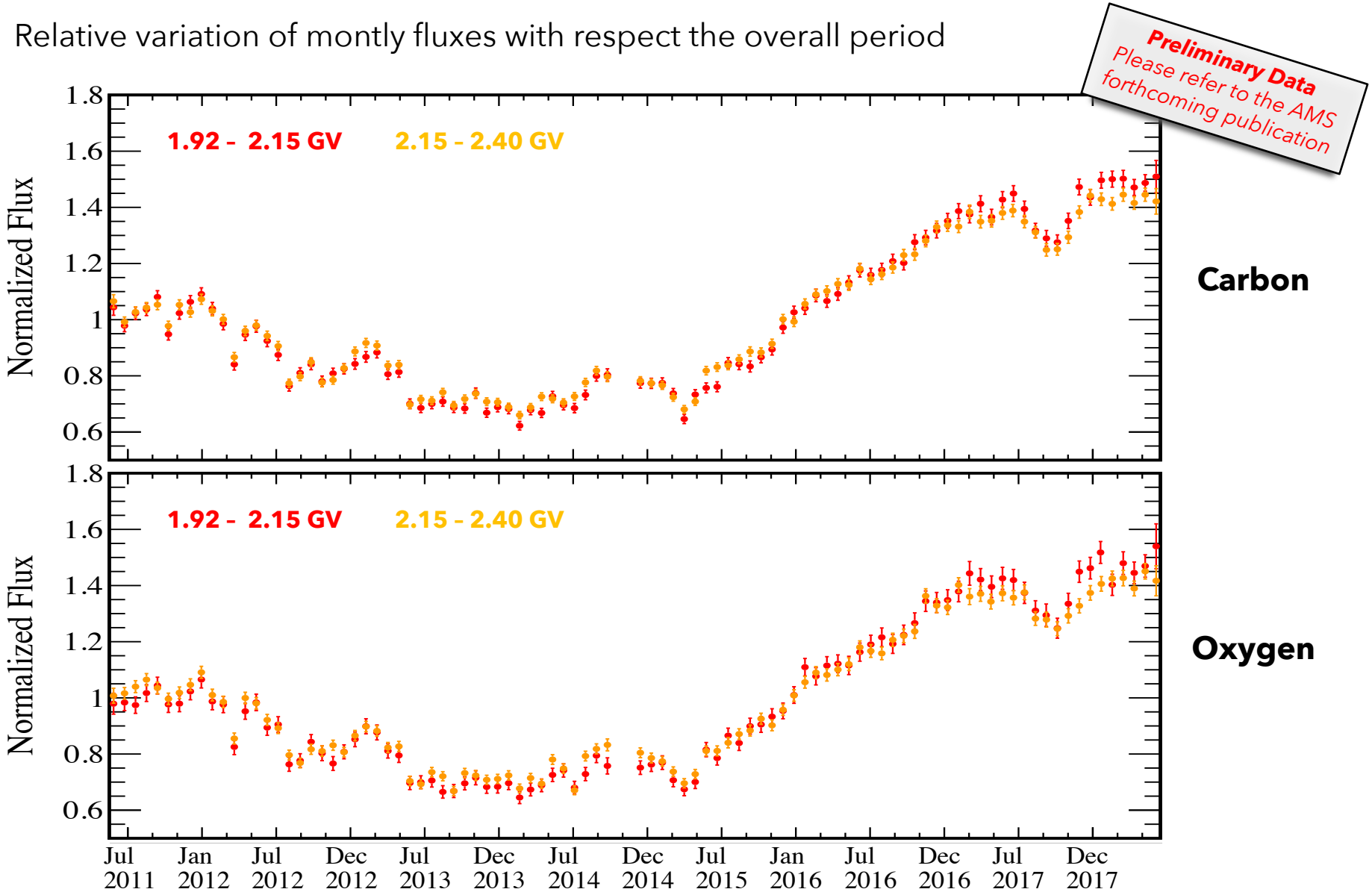

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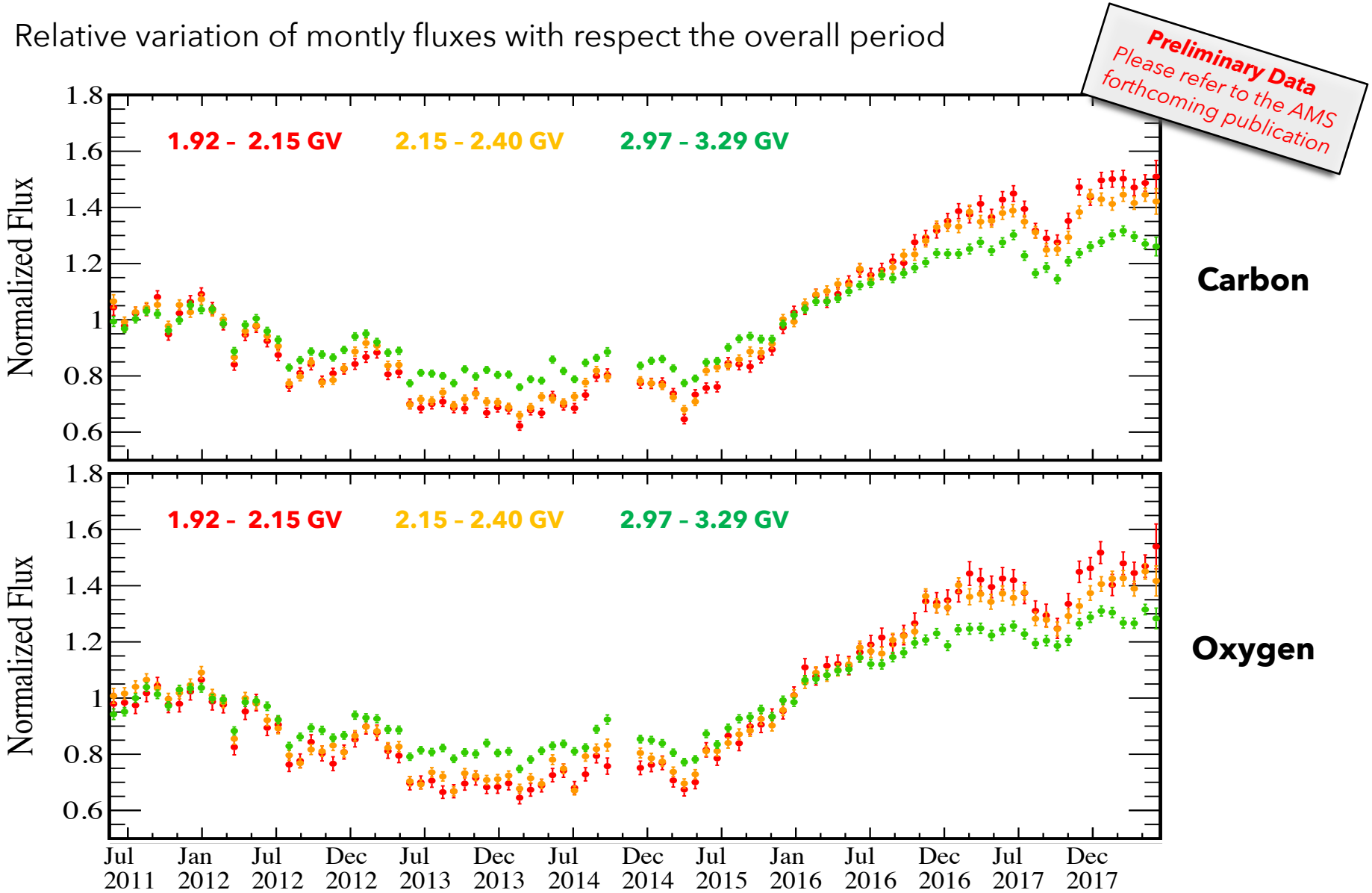

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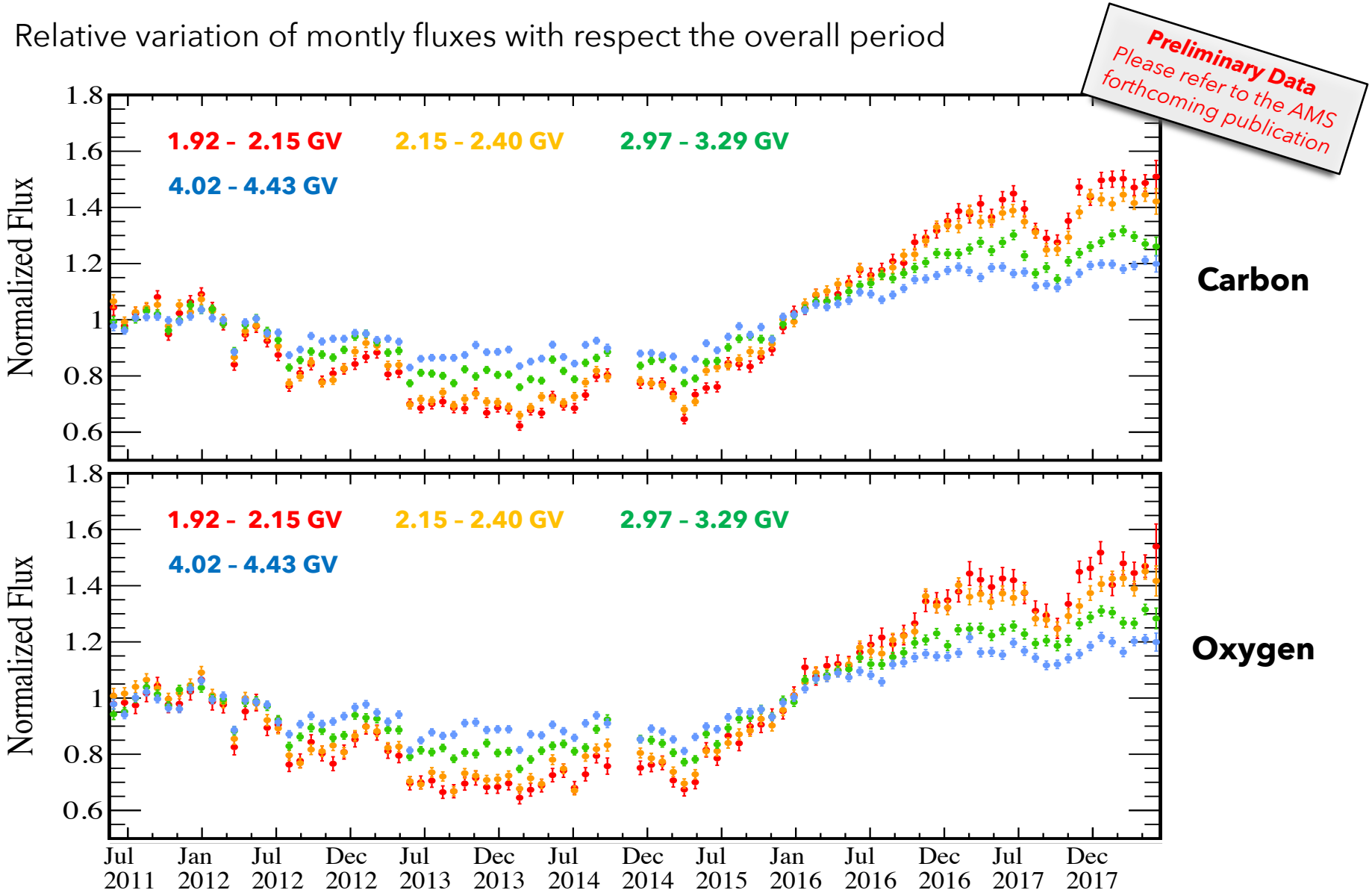

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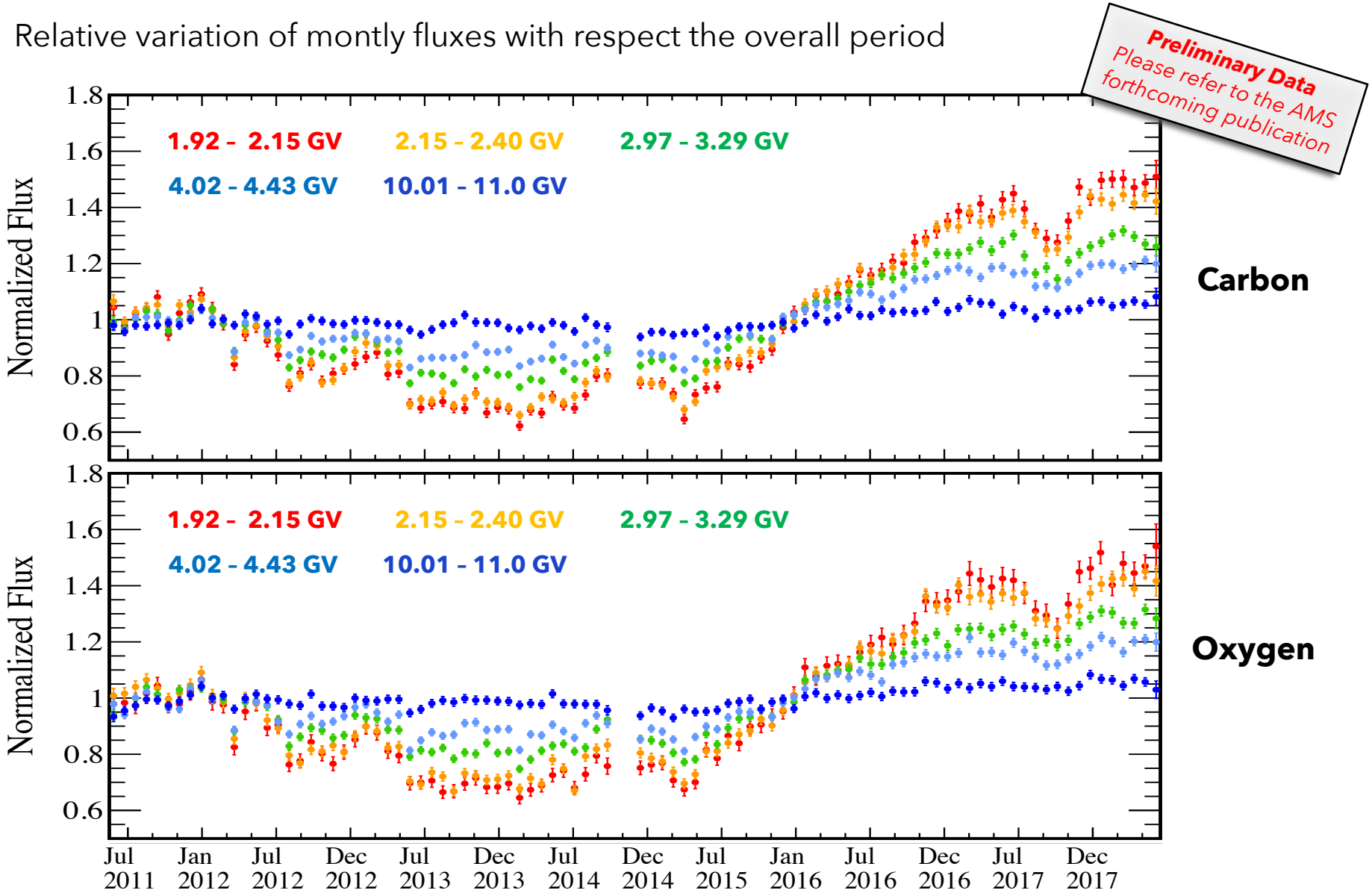

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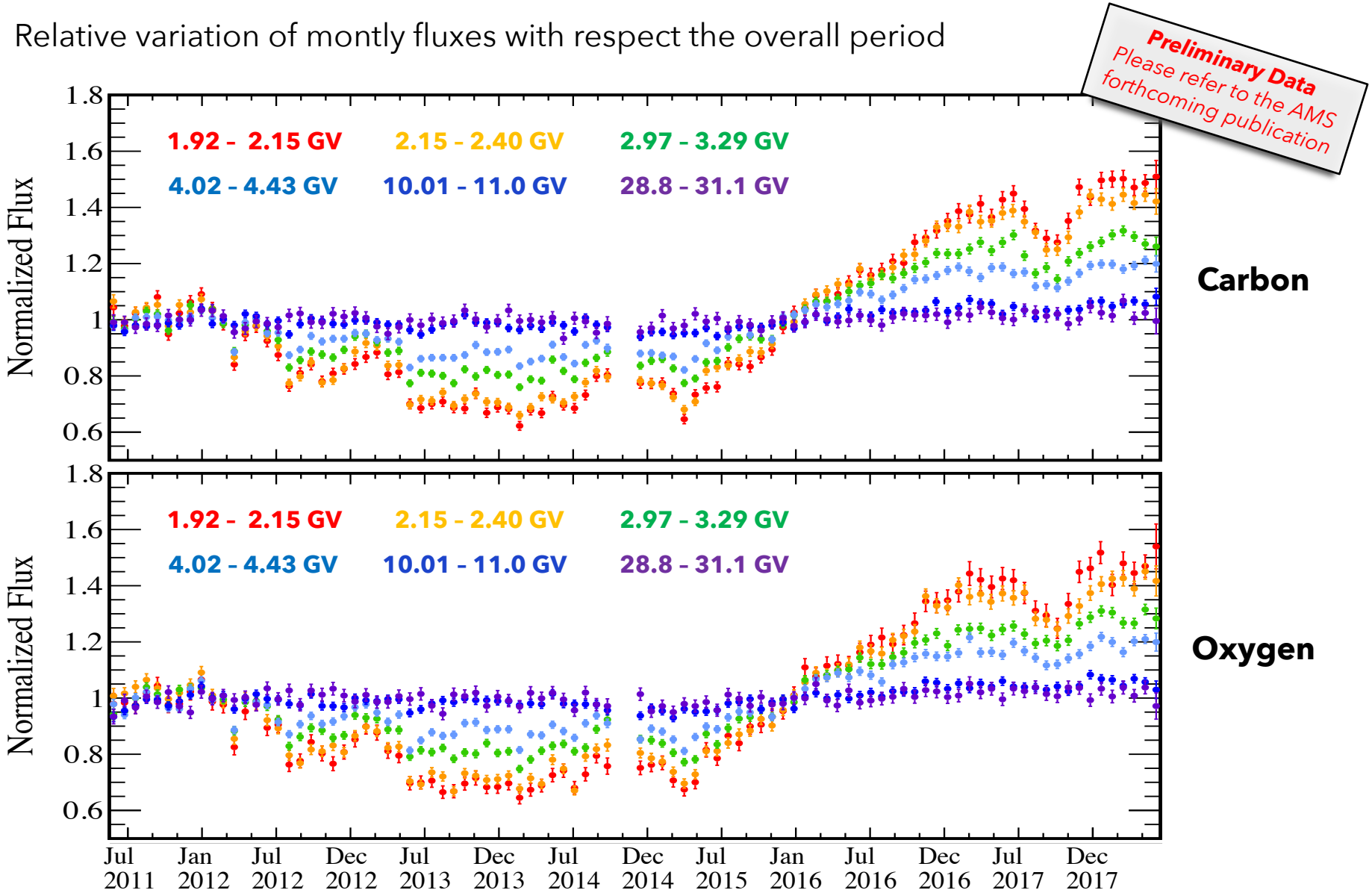
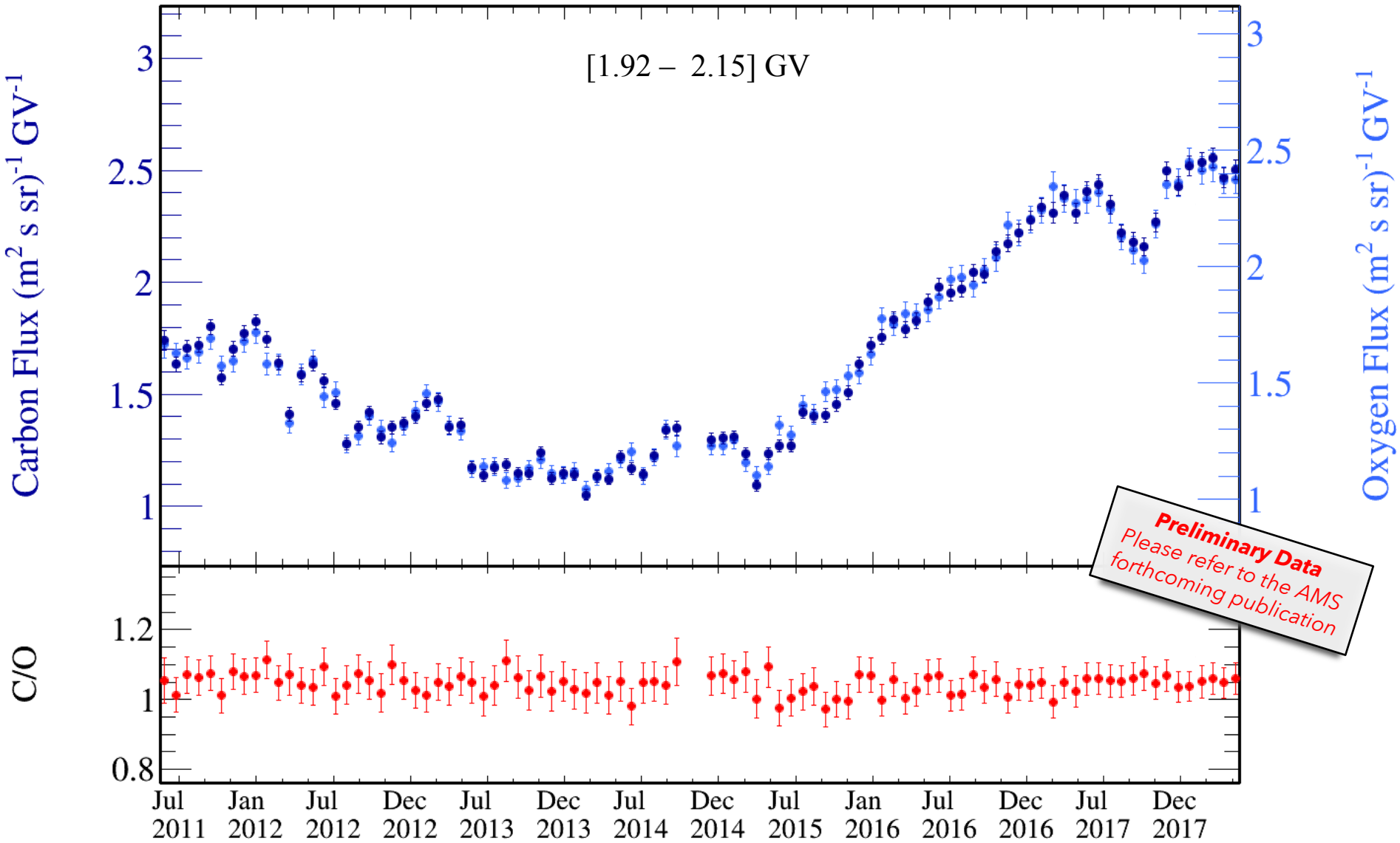


Monthly C and O Fluxes Comparison



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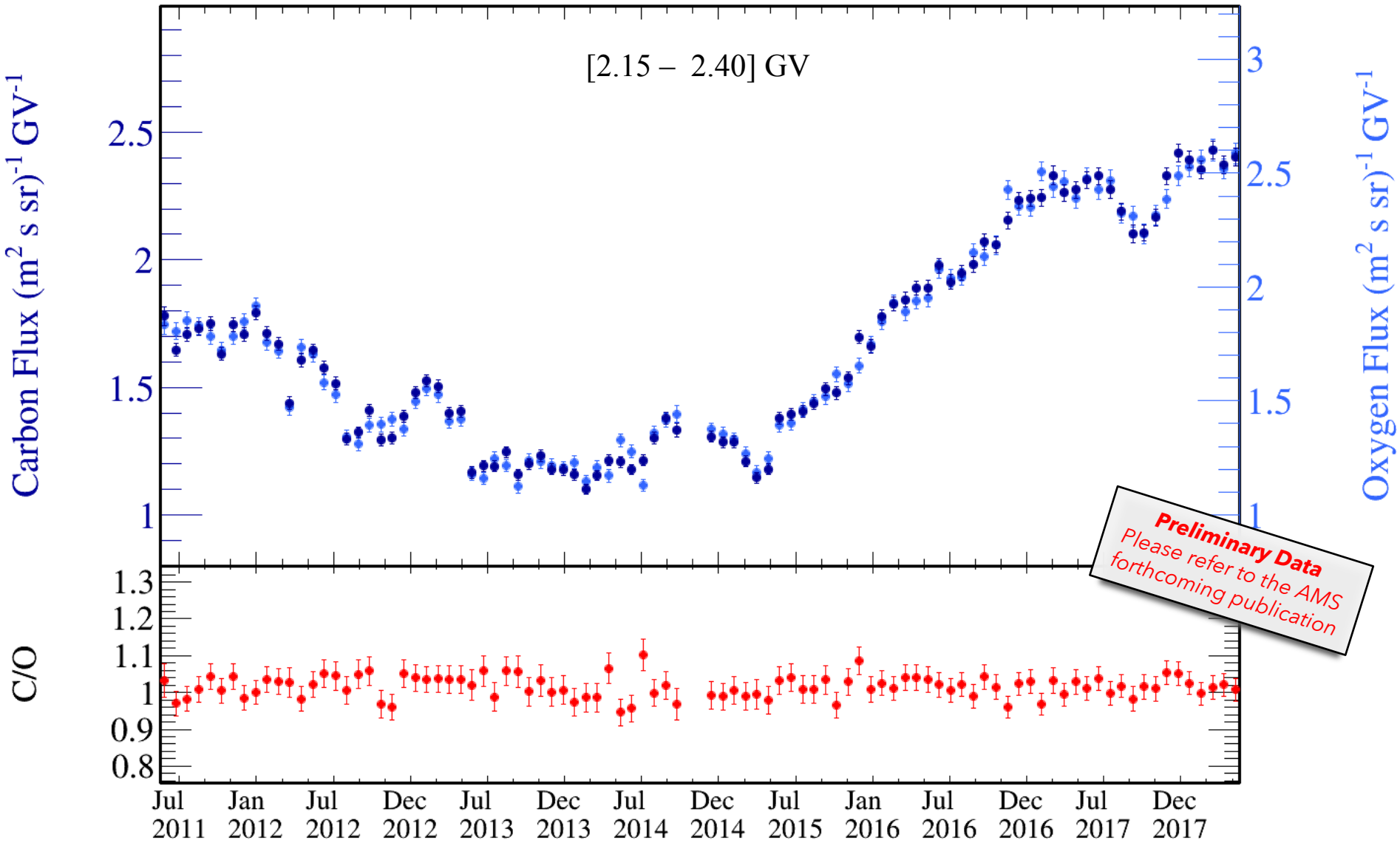

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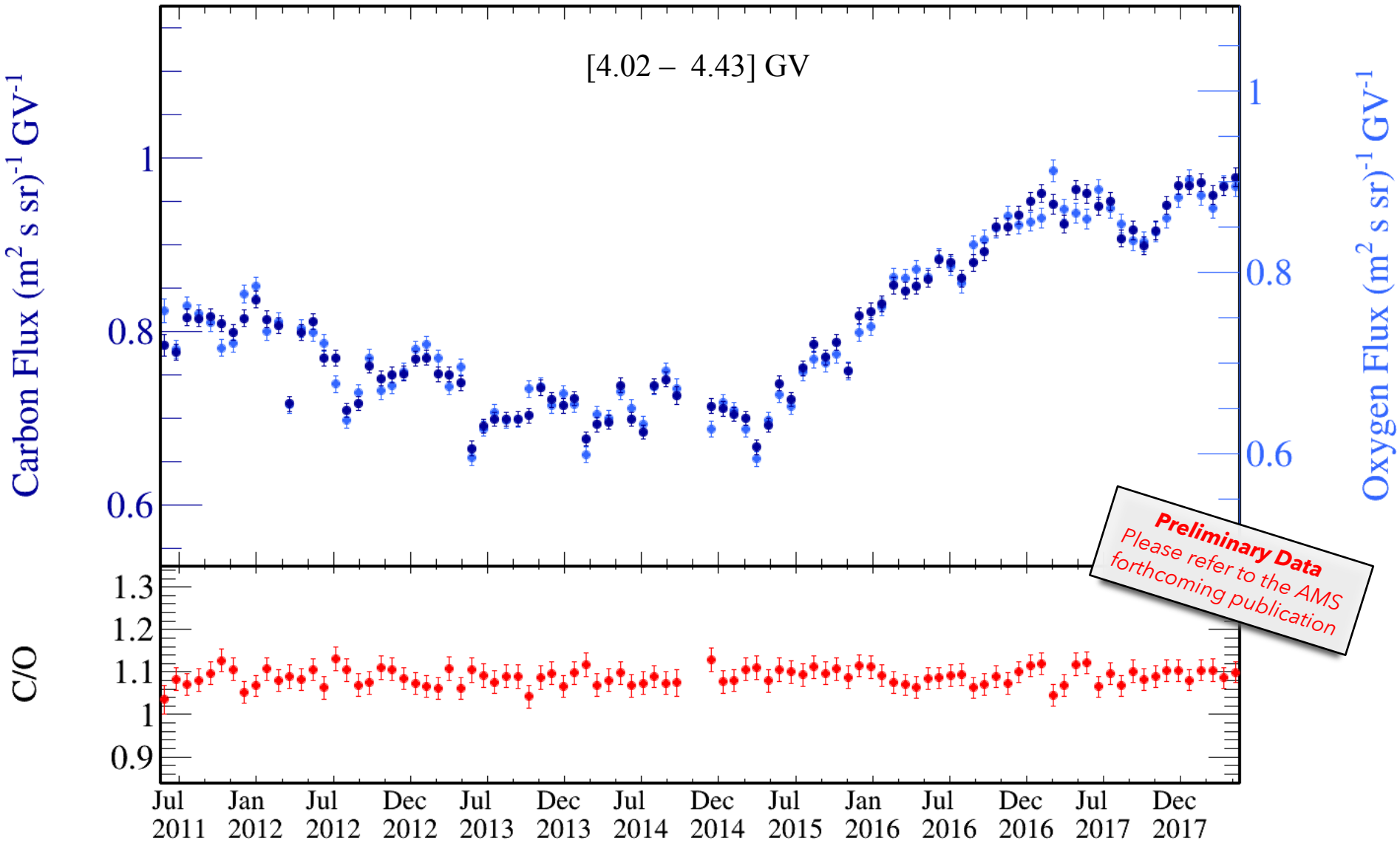

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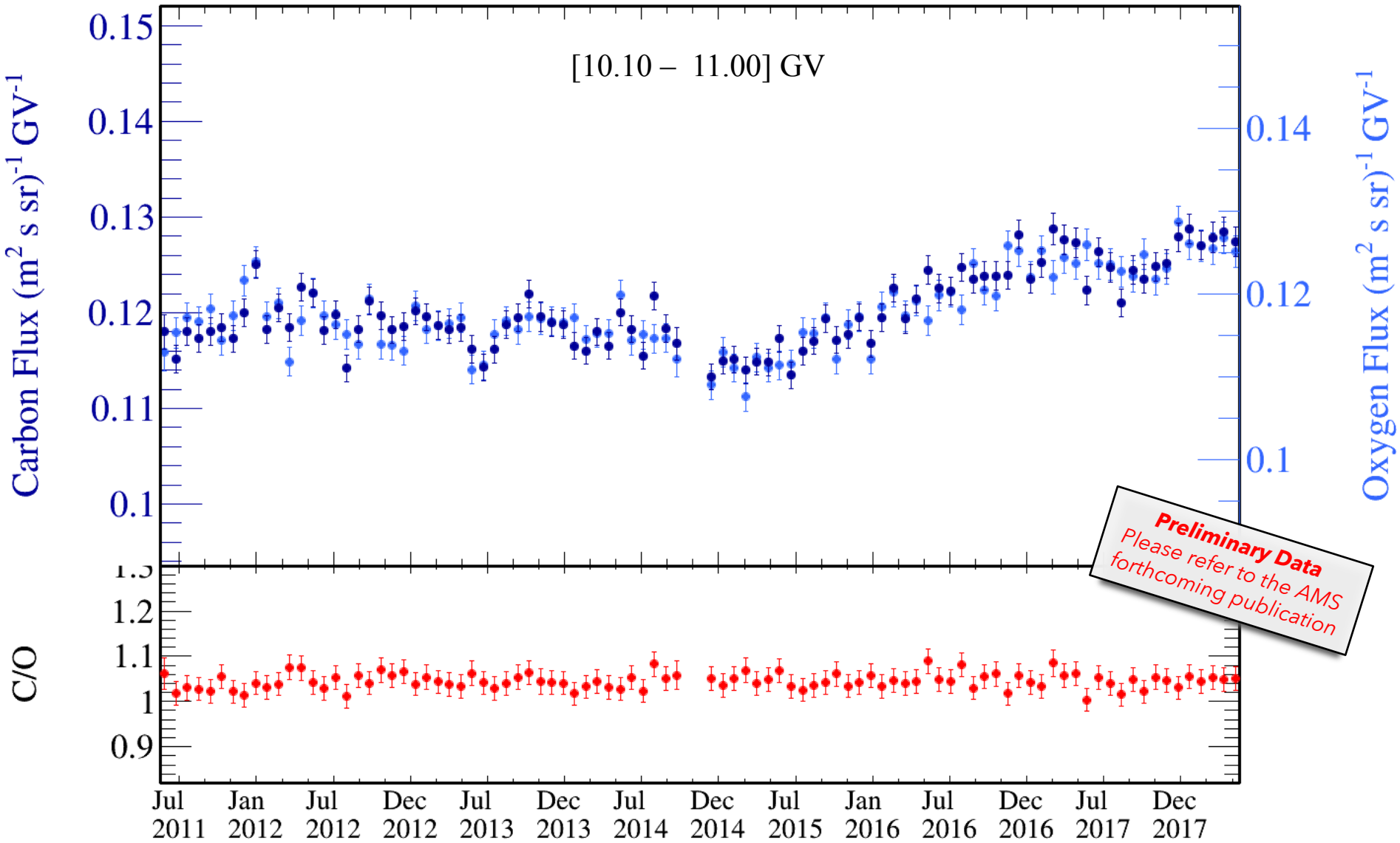

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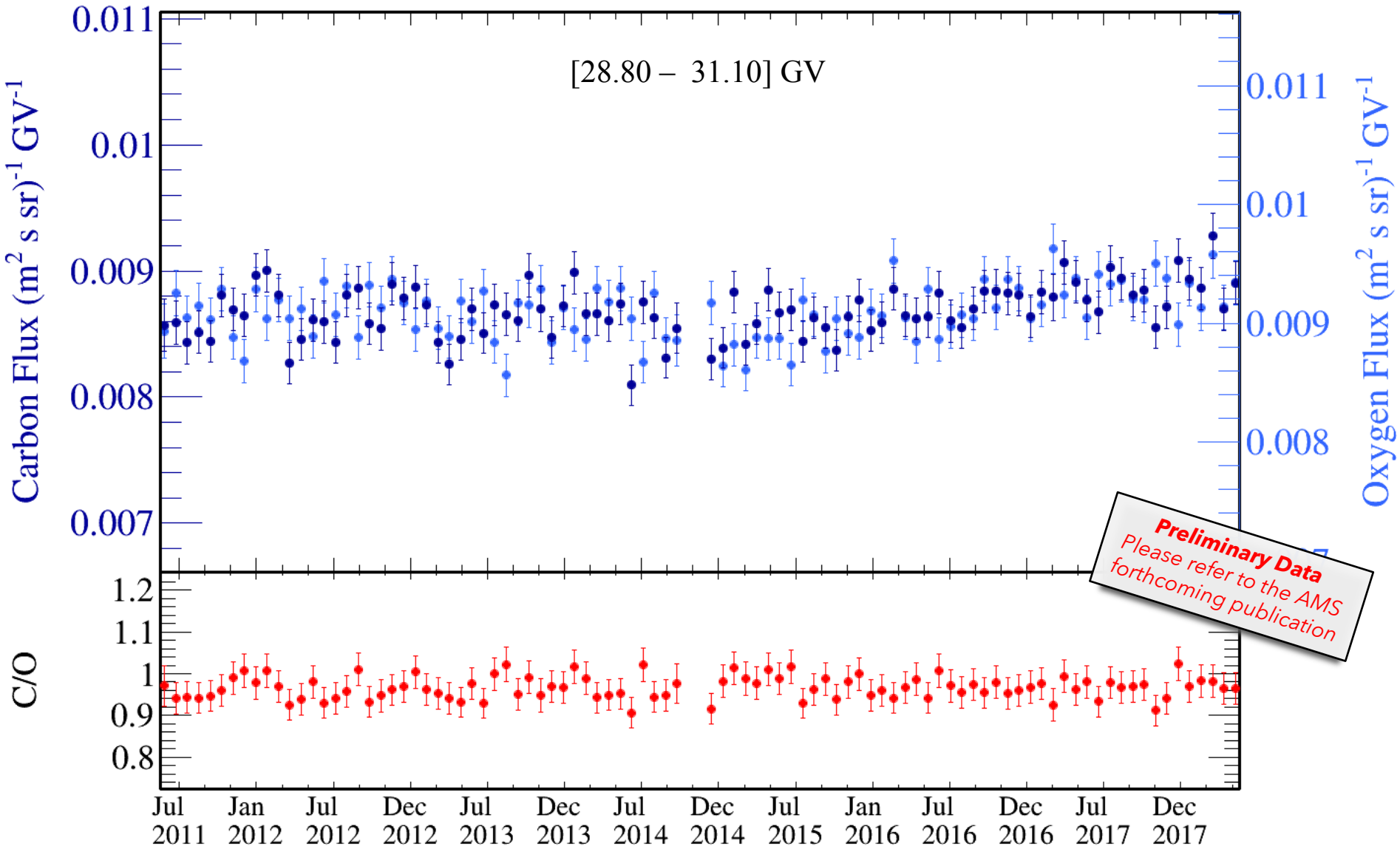
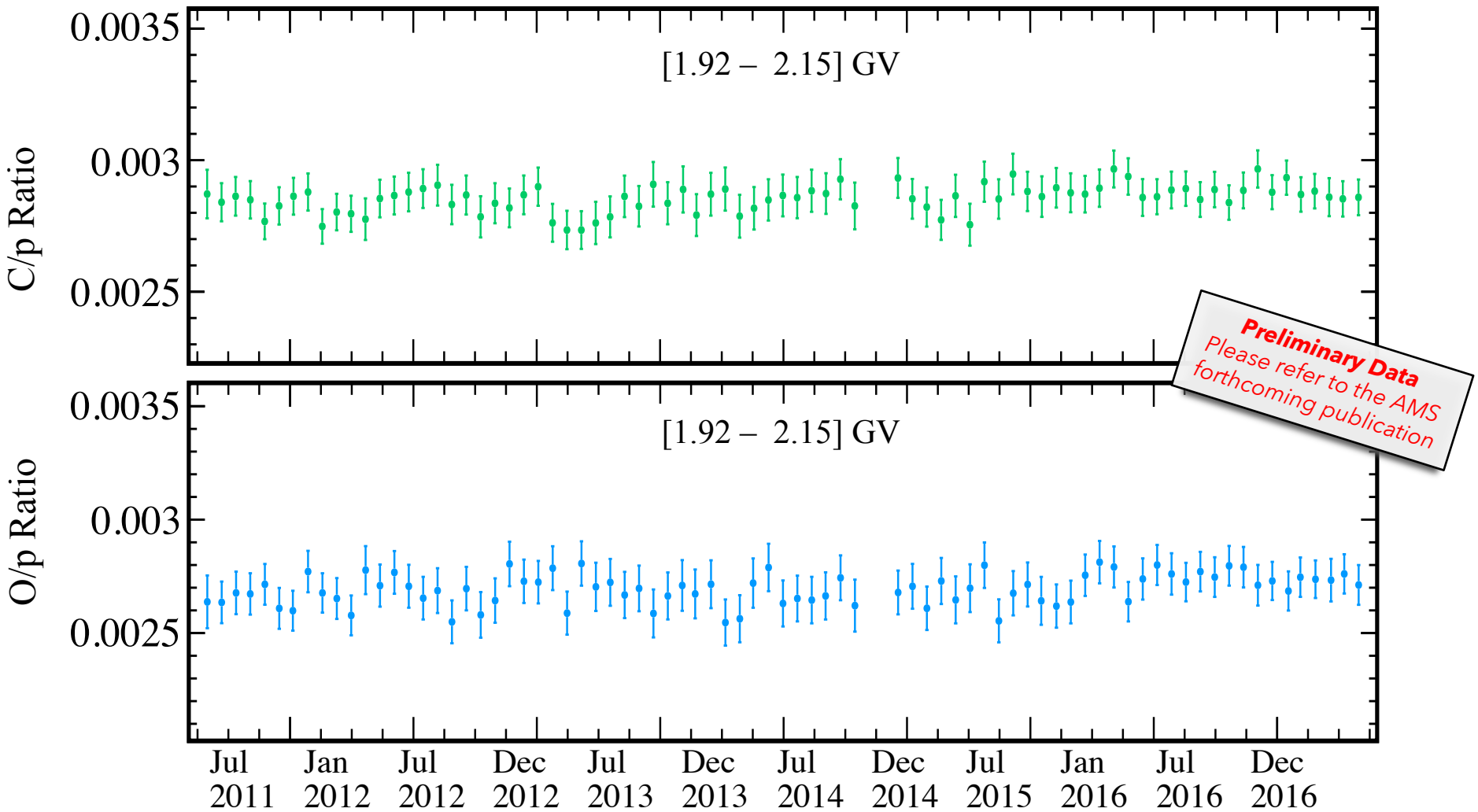


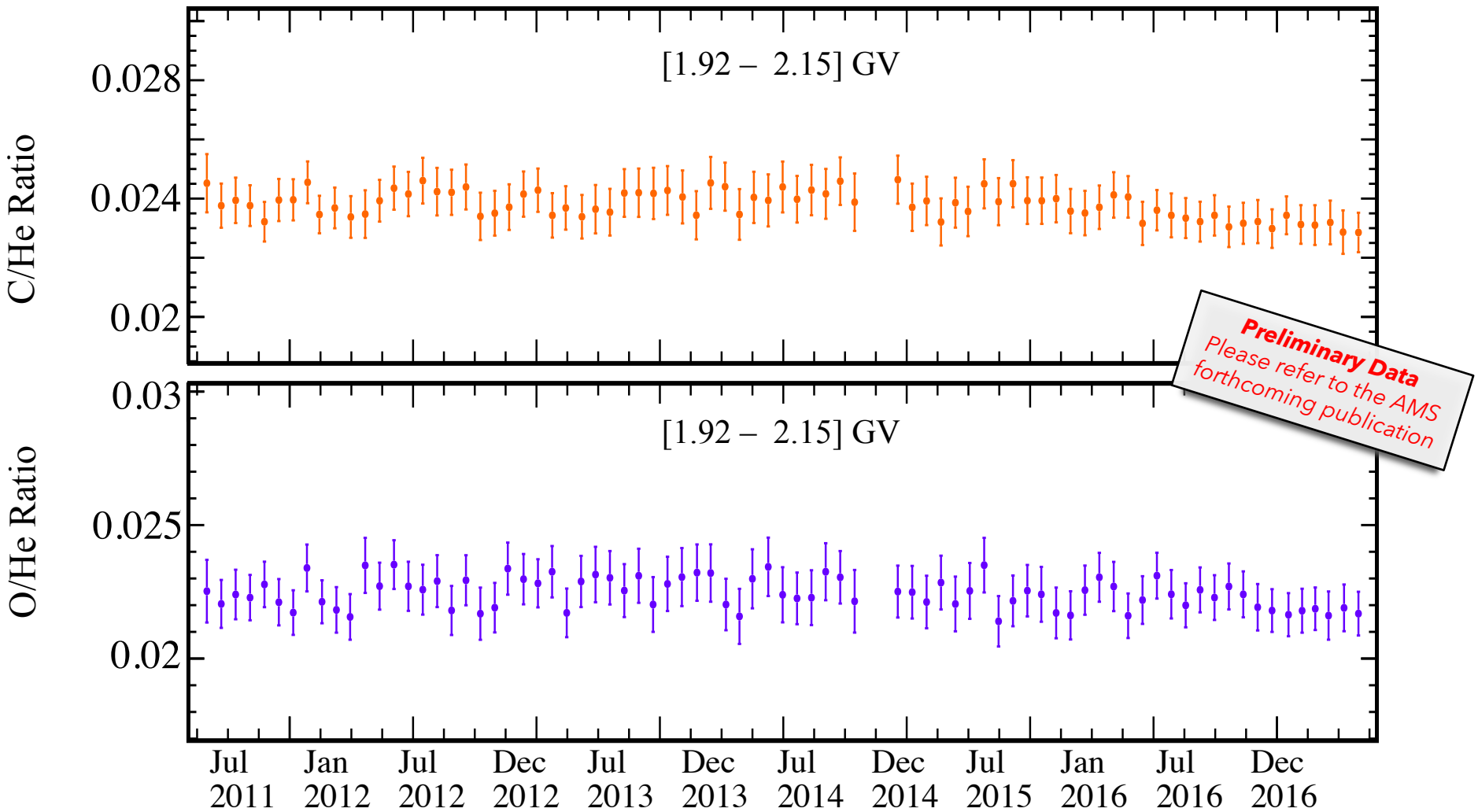
Monthly C/p and O/p Fluxes Ratios

C/p and O/p fluxes ratios up to May 2017 for the first rigidity interval



Monthly C/He and O/He Fluxes Ratios

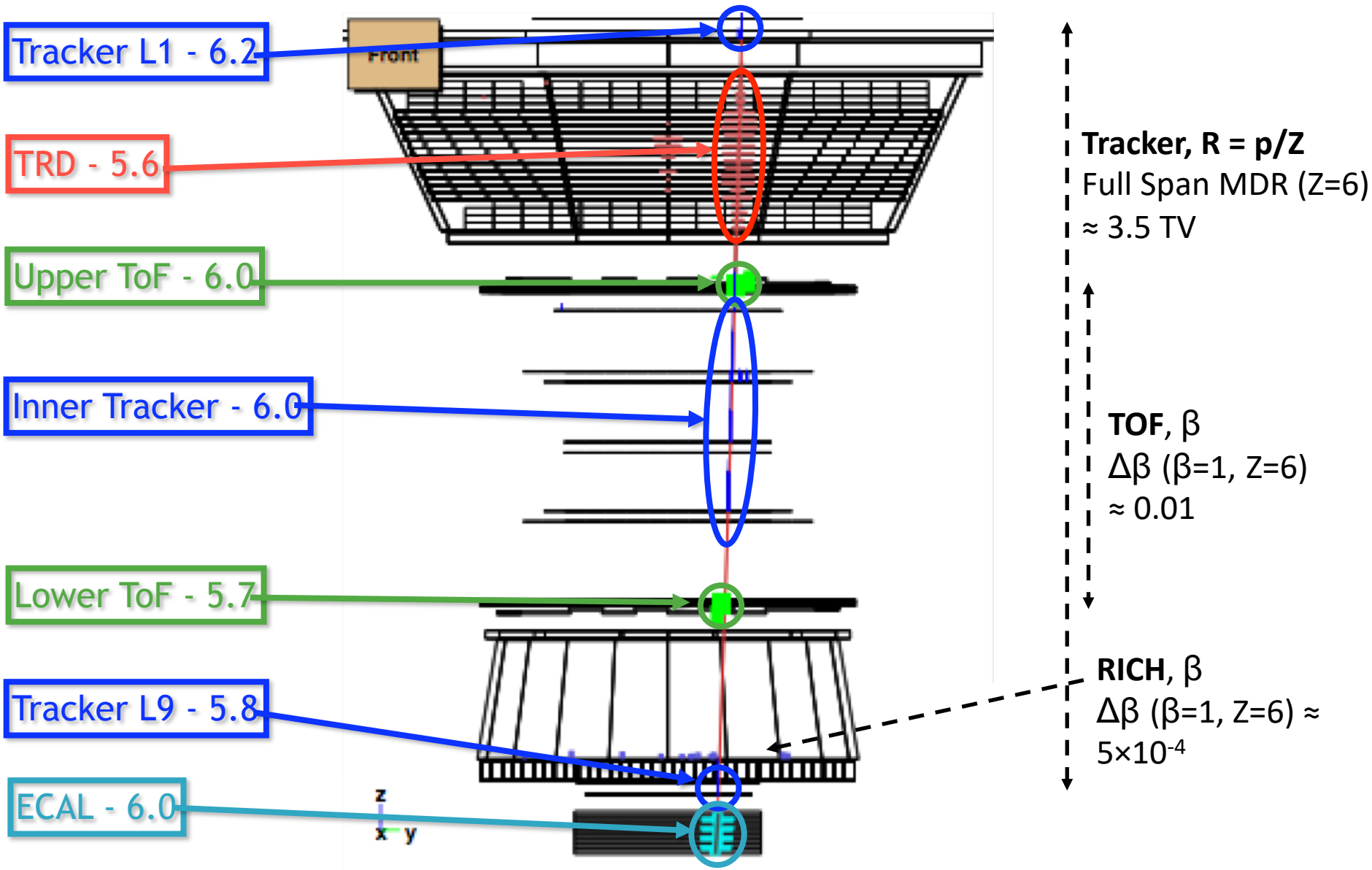
C/He and O/He fluxes ratios up to May 2017 for the first rigidity interval



Conclusions

- AMS measurements provide information on the propagation of charged particles in the heliosphere
- AMS is providing precision measurements of Carbon and Oxygen time dependent fluxes with a few percent precision.
- The results show that Proton, Carbon and Oxygen have a similar behavior.
- AMS will continue taking data for the entire duration of the ISS, continuing the search for dark matter, primordial antimatter and, in particular, a more detailed description of cosmic rays fluxes, in both rigidity and time.

Charge Measurement in AMS-02



Data Purity

With the track defined by the Inner Tracker (L2-L8), examine the charge distribution on the tracker L1. The high redundancy of charge measurements allows to keep under control interactions in the upper part of the detector (between Tracker L1 and L2)