The Trans-Iron Galactic Element Recorder for the International Space Station (TIGERISS)

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for the TIGERISS Collaboration

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TIGERISS Collaboration

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NASA Goddard Space Flight Center

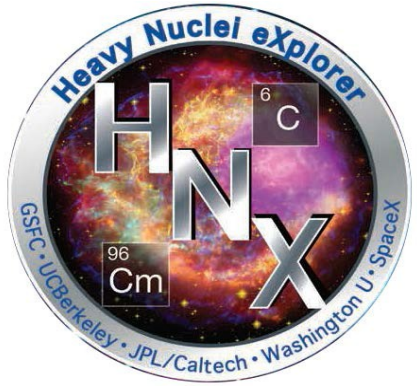
University of Maryland, Baltimore County

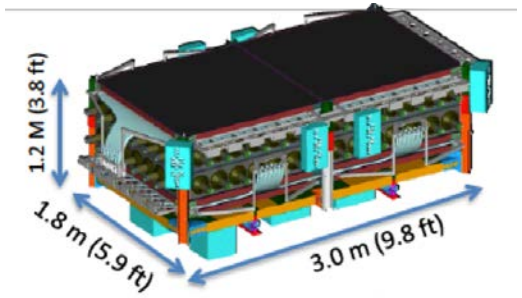
Howard University

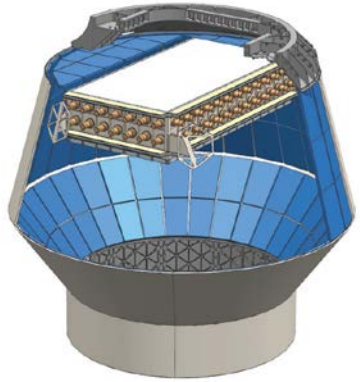
JPL-Caltech

Pennsylvania State University

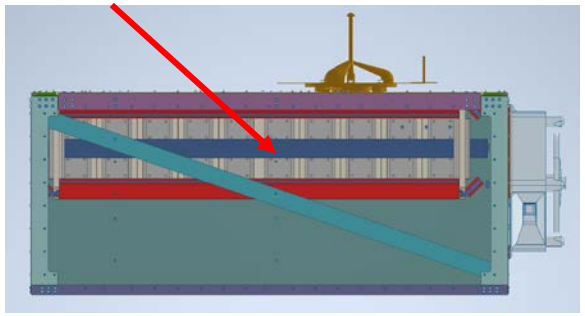
Northern Kentucky University







Instrument: 1.67 m × 0.67 m × 0.36 m



TIGERISS as JEM-EF payload

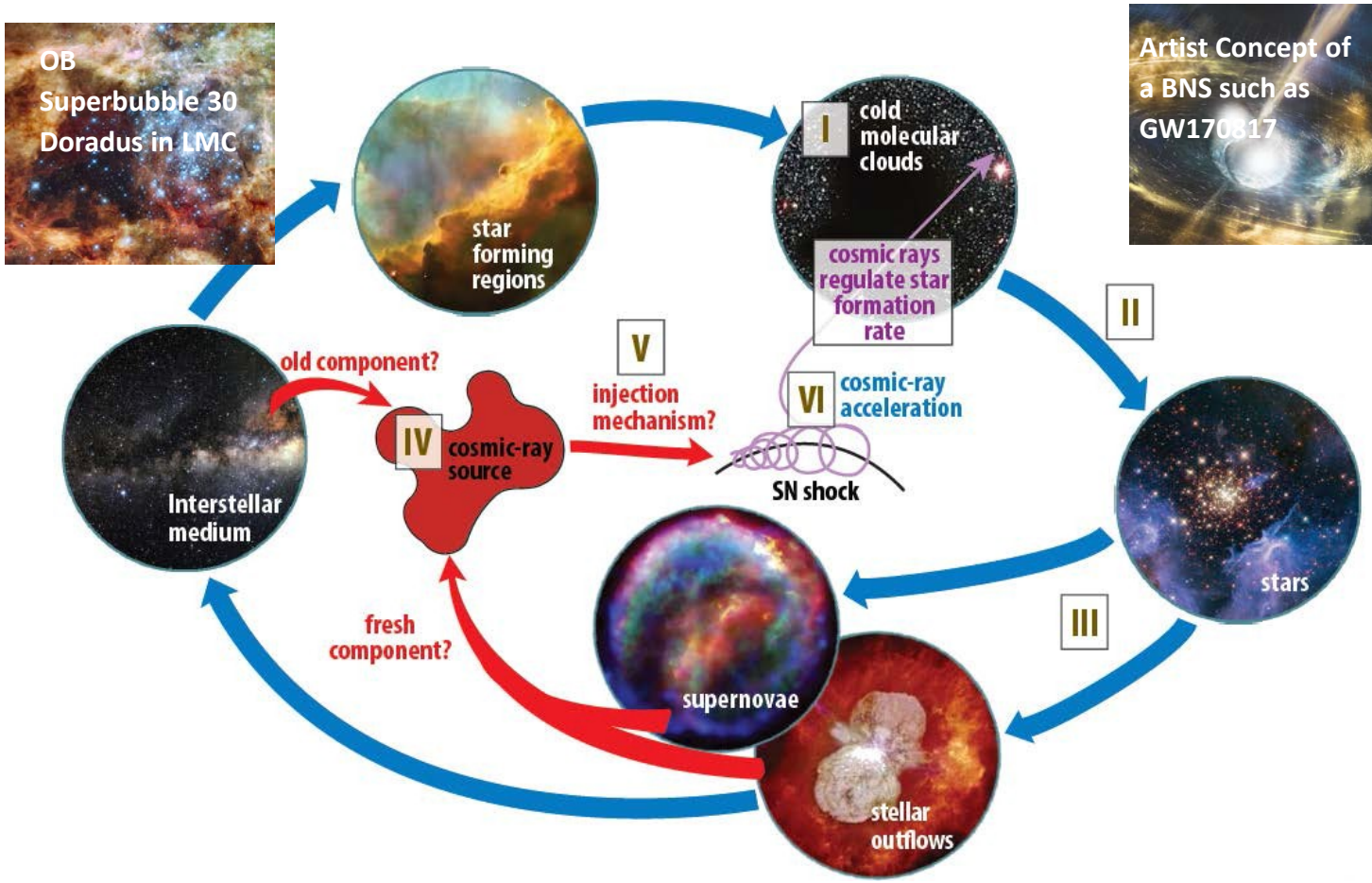
TIGERISS - Heritage

TIGERISS Science

Probe two stages in the grand cycle of matter in the Galaxy

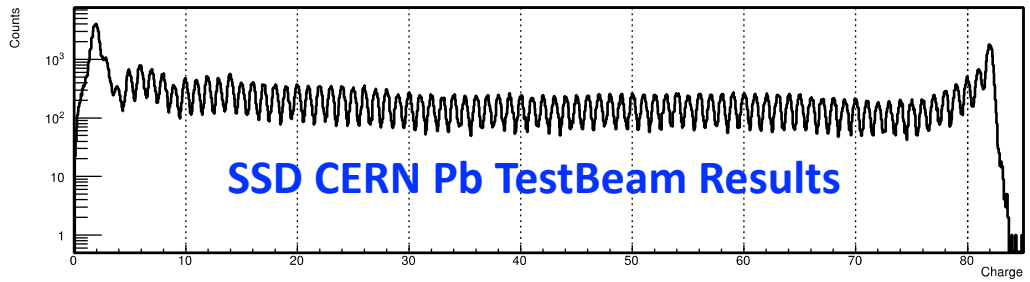
How nuclear is matter synthesized and distributed through the Galaxy:

- Nature of the **astrophysical reservoirs** of nuclei at the cosmic-ray source
- Mechanisms by which nuclei are **removed from the reservoirs and injected into the cosmic accelerators.**

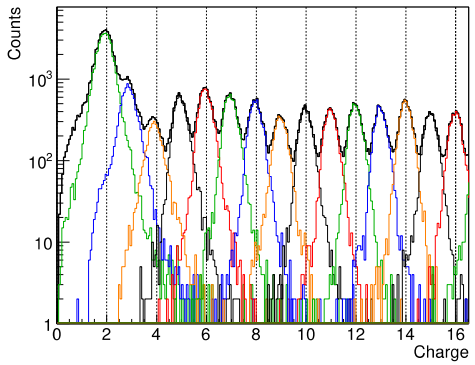


TIGERISS Instrument

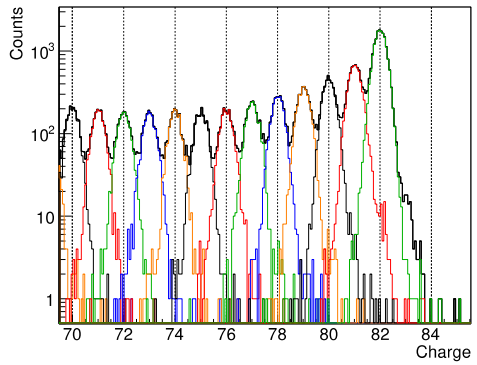
Silicon strip detector (SSD) for precision charge measurement 5 ≲ Z ≤ 82 and SiPM Cherenkov detector readout based on CERN testing.



(a) $Z = 2 - 82$



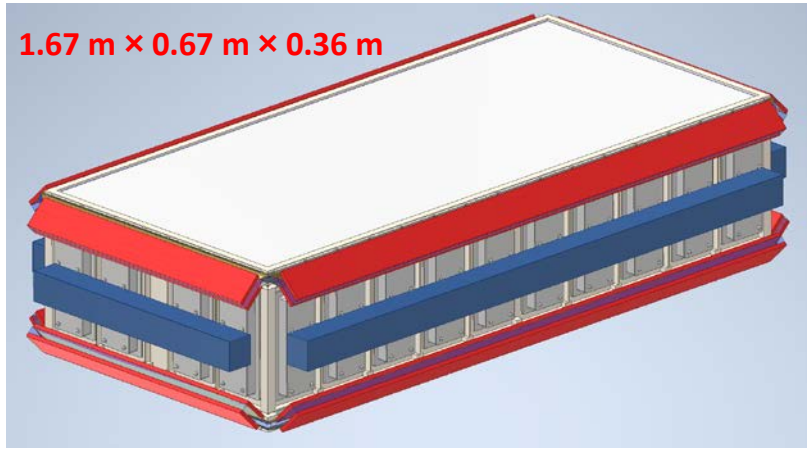
(b) $Z = 2 - 16$



(c) $Z = 70 - 82$

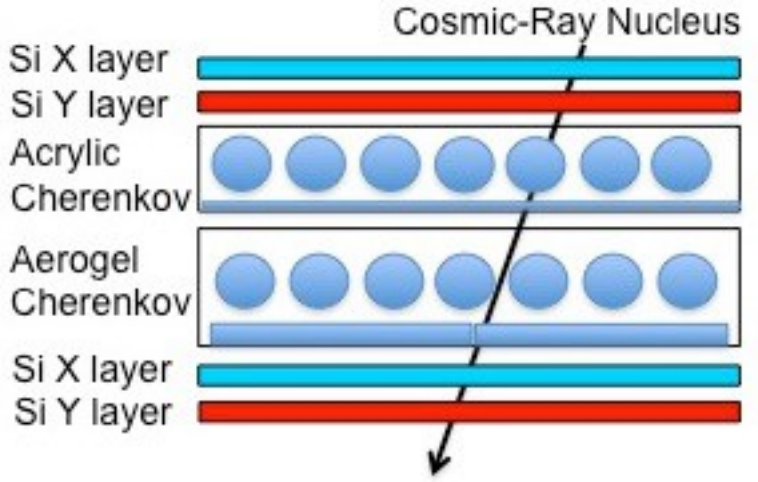
σ_Q < 0.24e for 5 ≲ Z ≤ 82

- Large electronic particle detector system – 1.1 m^2 active area, AΩ > 1.6 m^2 sr (JEM-EF version)



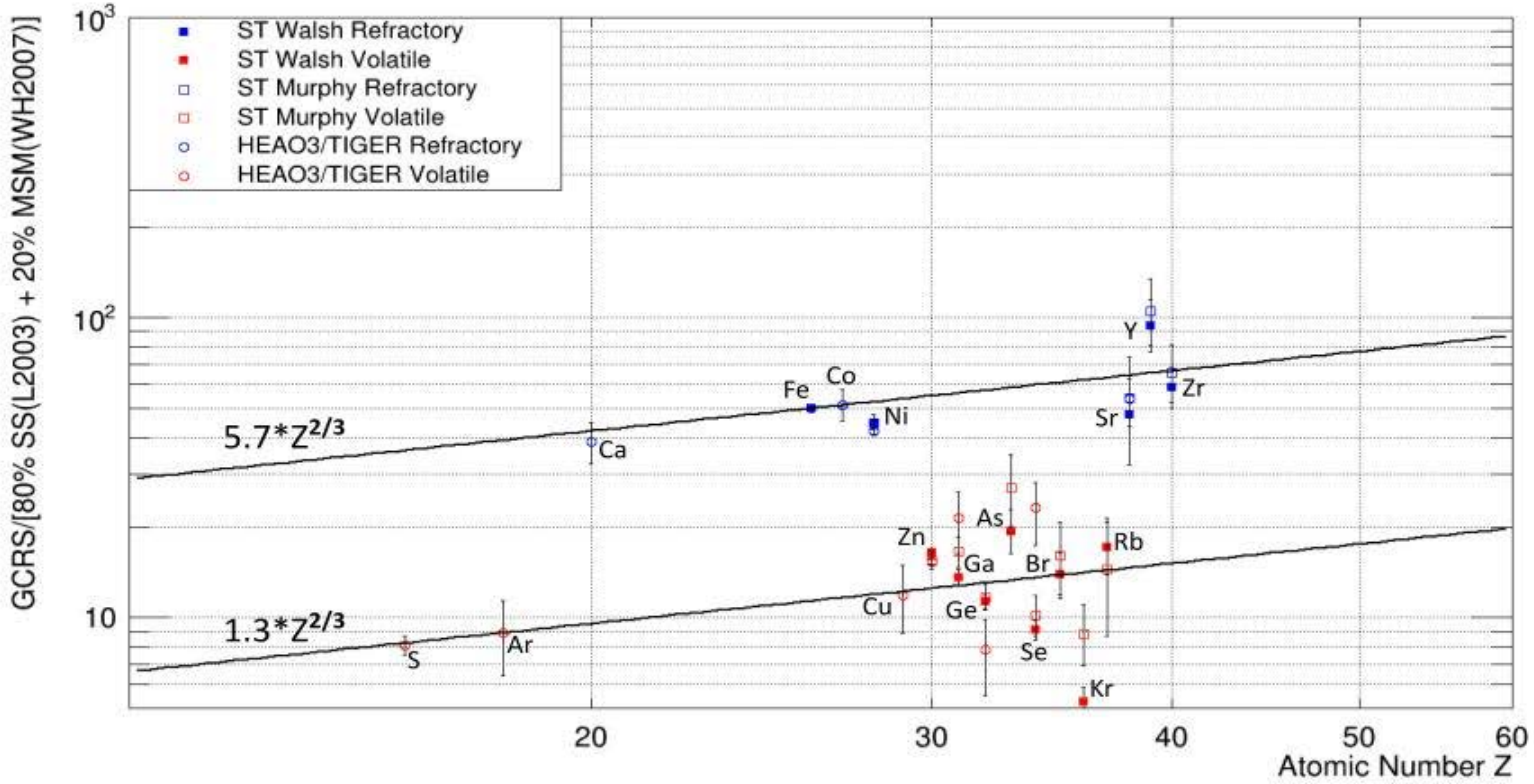
Charge measurement:

- dE/dx vs. Cherenkov
- Cherenkov vs. Cherenkov techniques:



Volatility Based SN Shock Acceleration from OB Associations

- GCRS ~80% ISM + ~20% MSO
- Refractory elements more likely in dust grains favored over volatiles
- Injection for both refractory and volatile $Z^{2/3}$ dependence from grain sputtering



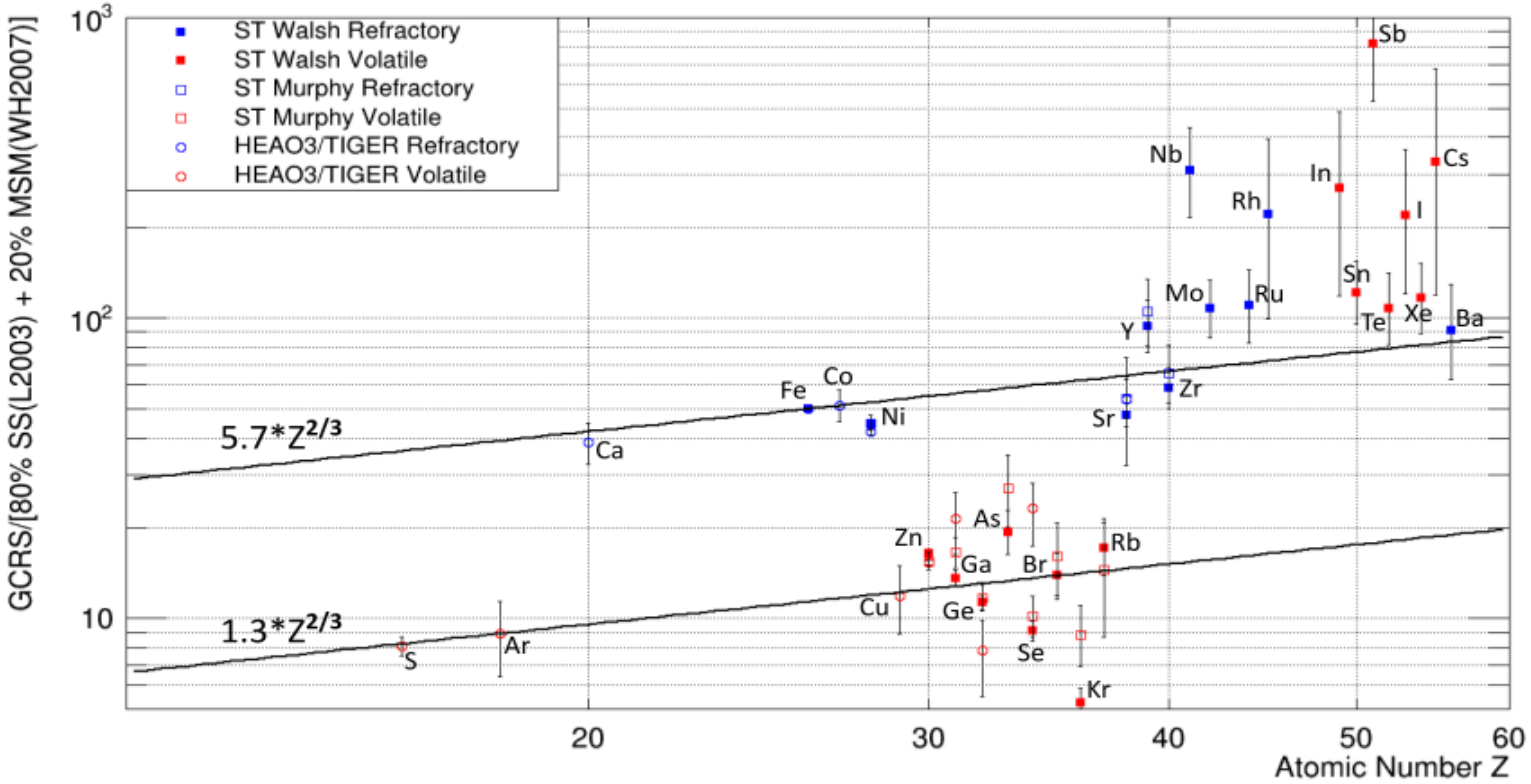
Results based on:
Nathan Elliot Walsh, SuperTIGER Elemental Abundances for the Charge Range41≤Z≤56, PhD thesis, Washington University in St. Louis, 2020.

Rauch et al. 2009
Murphy et al. 2016

988. SuperTIGER Abundances of Galactic Cosmic Rays for the Atomic Number (Z) Interval 30 to 56

Apparent Model Breakdown for Z>40 (w/ odd Z included)

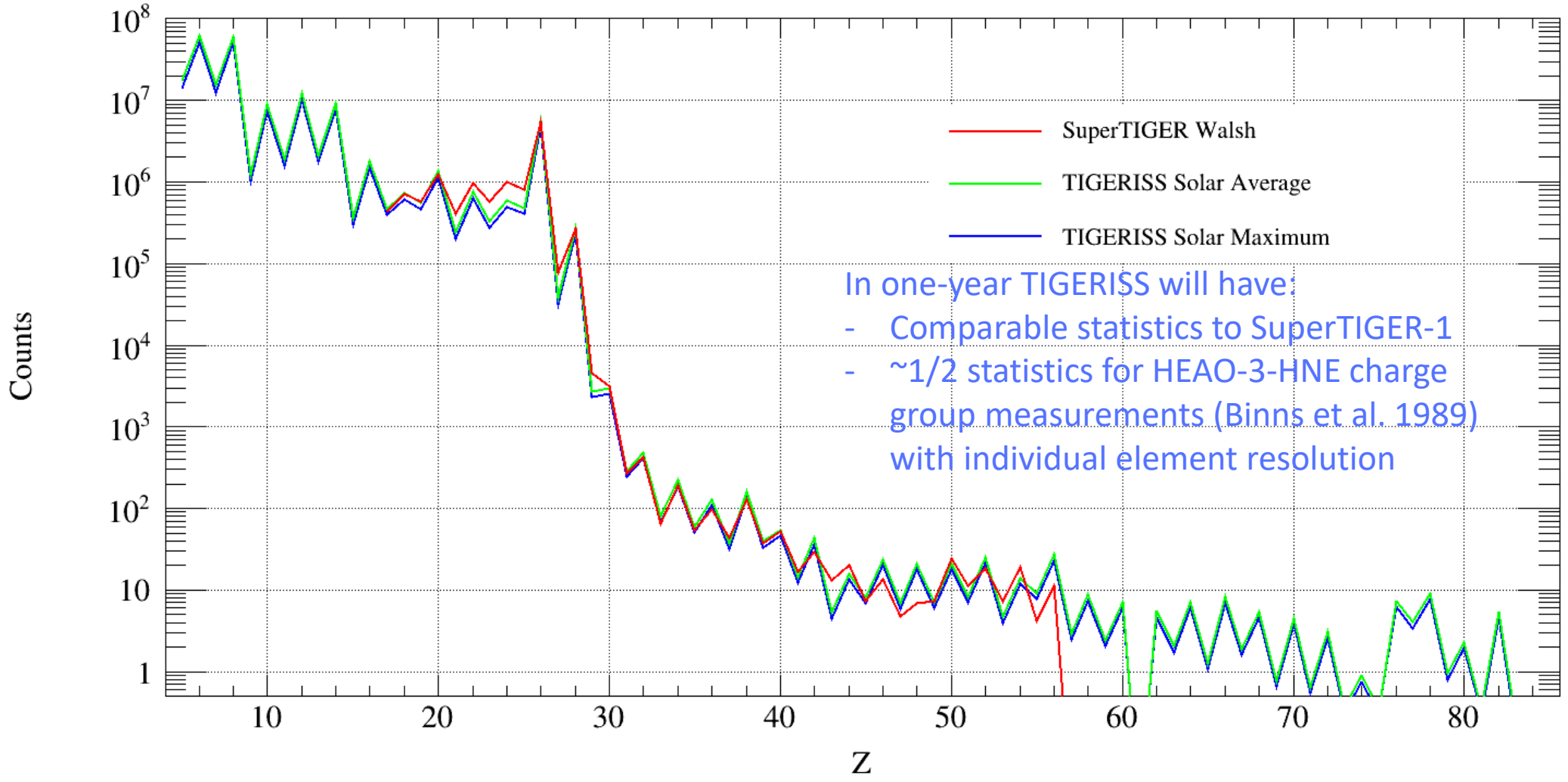
- Z > 40 everything is over refractory line
- Model is missing something



Results based on: Nathan Elliot Walsh, SuperTIGER Elemental Abundances for the Charge Range41≤Z≤56, PhD thesis, Washington University in St. Louis, 2020.

988. SuperTIGER Abundances of Galactic Cosmic Rays for the Atomic Number (Z) Interval 30 to 56

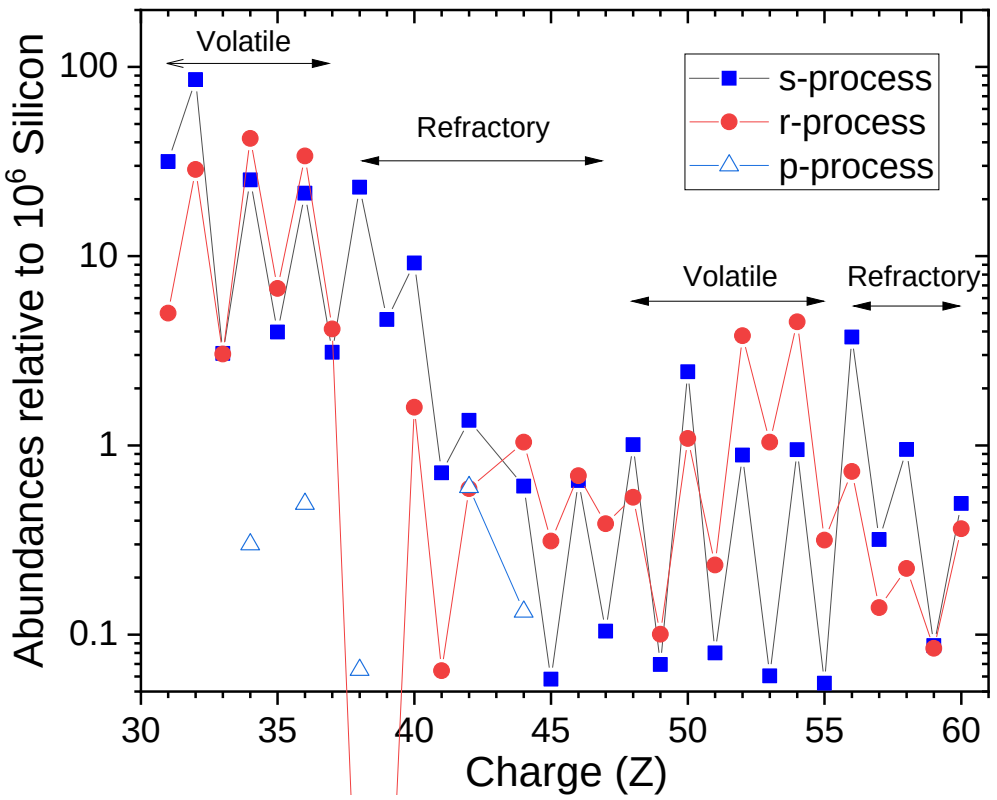
Predicted TIGERISS Measurements



1341. Determination of Expected TIGERISS Observations

Cosmic Ray r- and s-Process Contributions

- Probe relative amount of nucleosynthesis by s- and r-processes in GCR.
- In one-year significant measurements for abundances of dominant:
  - s-process elements $_{50}$Sn, $_{56}$Ba
  - r-process elements $_{52}$Te, $_{54}$Xe



r- ,s-, and p-process decomposition of solar system abundances (West & Heger, 2013 ApJ 774 75).

Acknowledgements

- This TIGERISS effort has been supported at Washington University in St. Louis by a grant from the Peggy and Steve Fossett Foundation and by the McDonnell Center for the Space Sciences.
- TIGERISS builds on work under NASA grants for CALET (NNX11AE02G, NNX16AC02G, and 80NSSC20K0399) and SuperTIGER (NNX15AC23G and 80NSSC20K0405).
- The material contained in this document is based upon work supported by a National Aeronautics and Space Administration (NASA) grant or cooperative agreement. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the author and do not necessarily reflect the views of NASA.
- We thank the NASA Columbia Scientific Balloon Facility, the NASA Balloon Program Office, and the NSF United States Antarctic Program for the record long-duration balloon flight for SuperTIGER-1, the successful recovery efforts, and the 32-day SuperTIGER-2.3 flight providing scientific and technical background for TIGERISS

McDonnell Center for the Space Sciences

Peggy and Steve Fossett Foundation