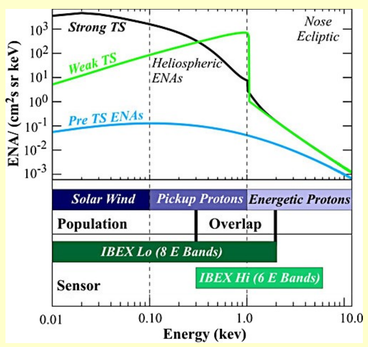
Pseudo IBEX data Generator and Model Interface (PIGMI)

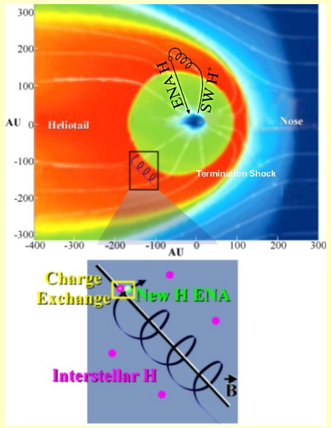
Christina Prested[1], Jacob Heerikhuisen[2], Dave McComas[3], Jamison Passuite[1], Brent Randol[1],
Michelle Reno[3], Nathan Schwadron[1] and Brian Stuart[1]
[1]Boston University, Boston, MA,[2] University of California, Riverside, CA, [3]Southwest Research Institute, San Antonio, TX

Overview

IBEX will image the energetic neutral atoms (ENA's) that illuminate the global structure and properties of the termination shock. In preparation for this mission, a series of goals are being met, guiding the effort to characterize future IBEX data. Synthetic ENA data are being generated to simulate the range of expected count rates from IBEX's Hi and Lo ENA sensors, including viewing times in each all-sky pixel. The synthetic data are generated from current models of ENA emissions based on global simulations of the heliosphere and are being used to optimize the segregation between magnetospheric ENAs, heliospheric ENAs and background sources. From this synthetic data new all-sky maps are produced and compared to the original model ENA maps as a fidelity check. Finally, various heliospheric model results should compared in order to understand the sensitivity of ENA maps to internal and external boundary conditions.



[Above] An example of expected ENA fluxes for strong and weak termination shocks. The IBEX Hi and Lo sensors overlap and compliment each other to provide the best coverage of the energy spectrum.
[Right] Diagram of the highly eccentric IBEX orbit and sun-pointed spinner satellite. (Not to scale)

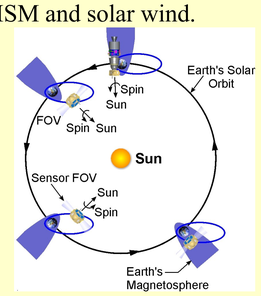


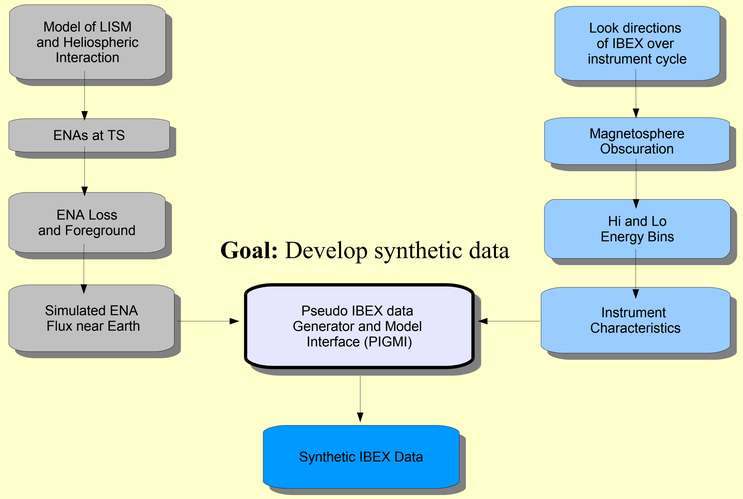
Background

Heliospheric ENAs are primarily produced by charge exchange between energetic solar wind ions and interstellar neutral atoms beyond the termination shock. By studying the distribution of these ENA's in energy and geometric space we can learn about properties of the termination shock and the local interstellar medium.

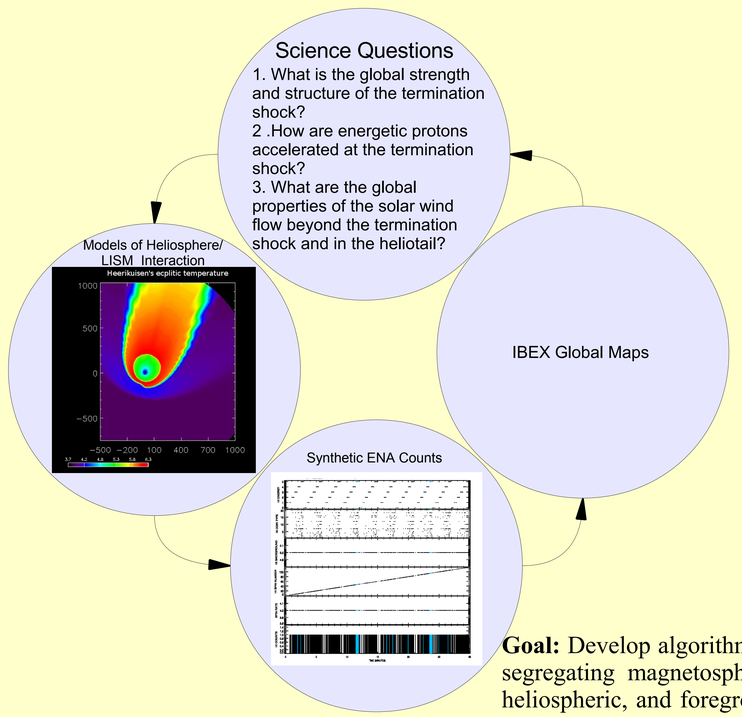
In order to gather global information about asymmetries of the termination shock, IBEX will sweep out an all-sky map in 6 months time. Since the Earth's magnetosphere is a large producer of local ENAs, we will not use count rates produced while the satellite is in or looking at the magnetosphere.

The IBEX Hi and Lo sensors will indirectly measure the strength of the termination shock by recording the distribution of ENAs in energy space. Further information about the boundary of the heliosphere will be found by comparing the IBEX results with models of the interaction between the LISM and solar wind.



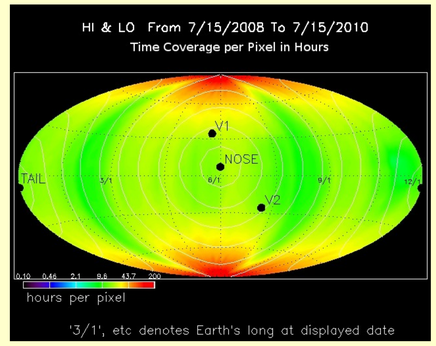


[Above] Physics and model variables (left) are combined with mission parameters (right) in PIGMI to create count rates similar to what IBEX will encounter. This artificial data is providing insight on how to fine tune the data collection process as well as how to standardize the interface between models and IBEX data. The interface will give researchers the tools to readily interact between data and model as the data is provided from IBEX.
[Below] Using the IBEX Science Questions as a guide, synthetic IBEX data from PIGMI is processed into synthetic global maps of the Heliosphere/ LISM interaction. Once IBEX is launched, these synthetic maps can be compared to the IBEX Global Maps. Adjustments can be made to the models which produce the synthetic data and so forth until a satisfactory match is found. Through this process we will be able to best answer the fundamental science questions of the mission.



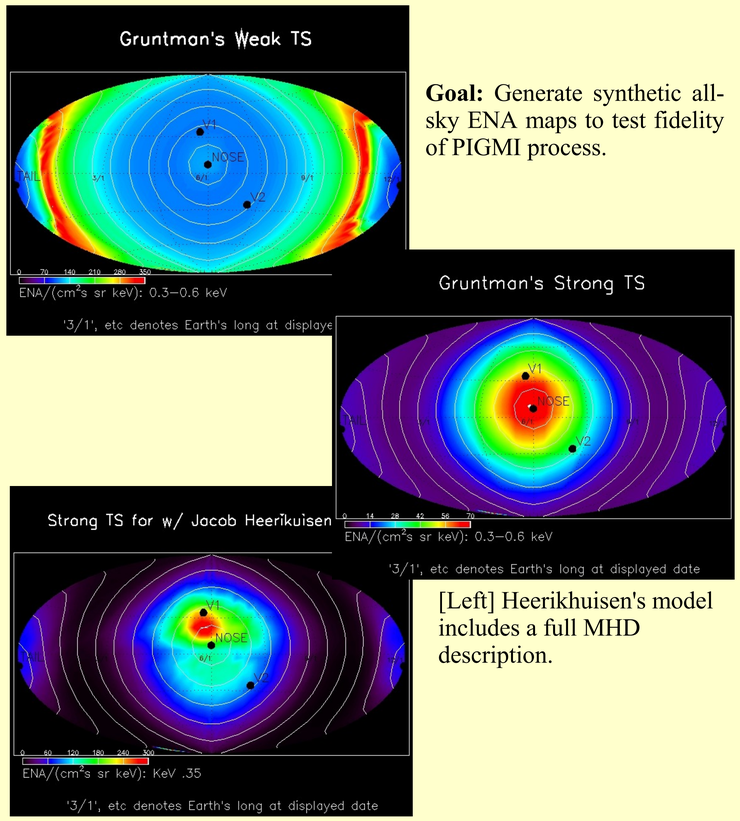
Goal: Develop algorithm for segregating magnetospheric, heliospheric, and foreground ENAs.

Visualizing the amount of viewing time for each pixel over the lifetime of the mission serves two purposes. It helps eliminate potential data outage, and it is one step in obtaining the expected count rates from IBEX.



Conclusions

We are currently creating a well-defined interface that connects global simulations of heliosphere with the ENA emissions and the synthetic IBEX data products that would result. This basic tool will create a standardized mechanism to inter-compare the ENA predictions from an array of different global simulations, to prepare to infer global properties of the interstellar interaction from IBEX data products, and to set the stage for a wealth of unanticipated discoveries from IBEX.



Goal: Generate synthetic all-sky ENA maps to test fidelity of PIGMI process.

[Left] Heerikhuisen's model includes a full MHD description.