AI#15:
Pre-Launch GI Proposal Tools

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GUC Action Item #15

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The GSSC will present a plan for the proposal tools that will be ready by the GLAST Science Symposium and the Cycle 1 NRA.

This presentation describes these proposal tools, which simulate observations with increasing complexity.

Overview

- We plan to provide a series of GLAST GI proposal tools with increasing complexity and accuracy. Most of these tools focus on the LAT.
  - S-01—Source Detection Calculator
  - S-05—LAT and GBM Spectrum Simulator (WebSpec)
  - S-03—Orbit Simulator (SAE)
  - S-04—Observation Simulator (SAE)
  - S-06—LAT 3D Simulator (SAE)

  } Not provided for Cycle 1

- We will also provide other information that investigators will find useful in preparing proposals, such as plots of the diffuse background and the response functions. We will link to useful utilities (e.g., name and date converters). The helpdesk is not included here.

S-01: Source Detectability Calculator

- Purpose of tool: allow the user to determine the detectability of a source at a given location. This is the simplest, most general tool.

- Function: assume a point source on top of the diffuse background (nearby point sources are not considered)
  - Given: the background flux, observing mode (e.g., survey vs. pointing), and the source's spectral index
  - User inputs two of {source normalization, observation duration, detection significance}
  - Tool returns third value

S-01: Source Detectability Calculator, cont.

- Coordinates can be entered in Galactic, J2000 and B1950 systems, or a source name can be given.
- A gamma-ray version of PIMMS may (eventually) be used to input source fluxes.
- Interface: webpage as part of GSSC website. The basic tool has been created; see http://glast.gsfc.nasa.gov/ssc/dev/jd/sensitivity.html The detectability formula needs to be refined (see below).

S-01: Methodology

- The observing mode (survey vs. pointed, specific orbit precession angle vs. precession-averaged) gives an average effective area (e.g., for survey mode ~1/5 on axis effective area).

  (Average effective area)×(time)=exposure

- Location gives background rate/sr; background is assumed constant over PSF.

  (Background rate)×(exposure)=background counts

- Source normalization and spectral index gives source flux.

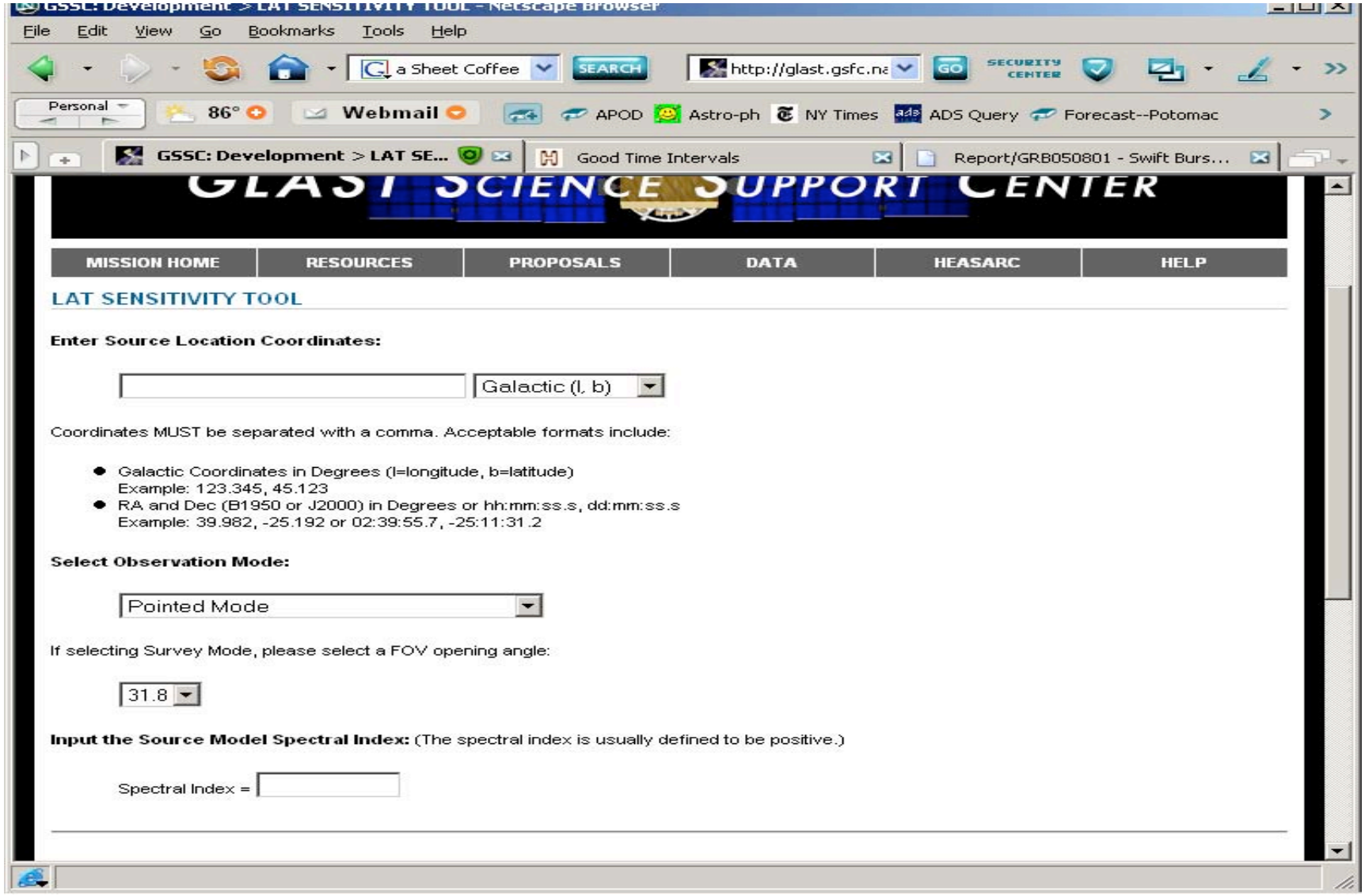
  (Source flux)×(exposure)=source counts

- The detectability will be based on a semi-analytic likelihood calculation, resulting in a 'test-statistic' that maps into the detection significance.

S-01: Input

- **Input:**
  - **Source position—galactic, B1950, J2000, source name**
  - **Observation mode—pointed vs. survey, at given orbit precession angle or averaged over precession angle**
    - **For survey, the maximum inclination angle**
  - **Source spectral index**
  - **Two of the following:**
    - **Source normalization (photon flux >100 MeV)**
    - **Observation time (on timescale greater than a few orbits)**
    - **Detection significance**

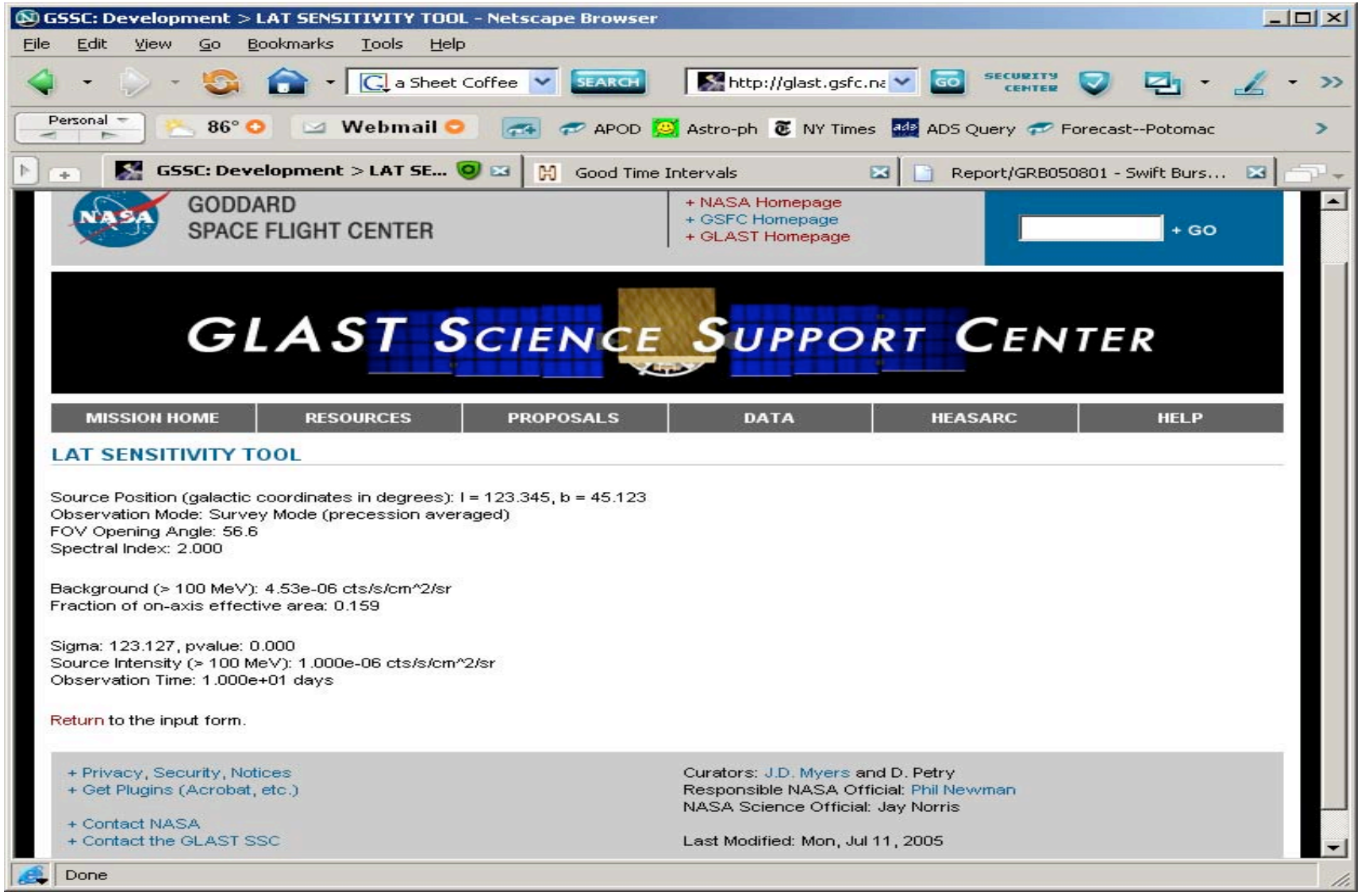
Input Screen



S-01: Output

- Output
  - Remaining one of the following
    - Source normalization
    - Observation time
    - Detection significance

Output Screen



S-01: Content

- Toby Burnett and cohorts are working on a semi-analytical calculation of the likelihood for a point source on a spatially constant background.
- If this calculation leads to scaling relations, these relations will be implemented.
- If the number of parameters can be reduced to a reasonable number, a table lookup might be feasible.
- Running the semi-analytical calculation may be necessary.
- The nature of calculation will determine the energy range dependence.

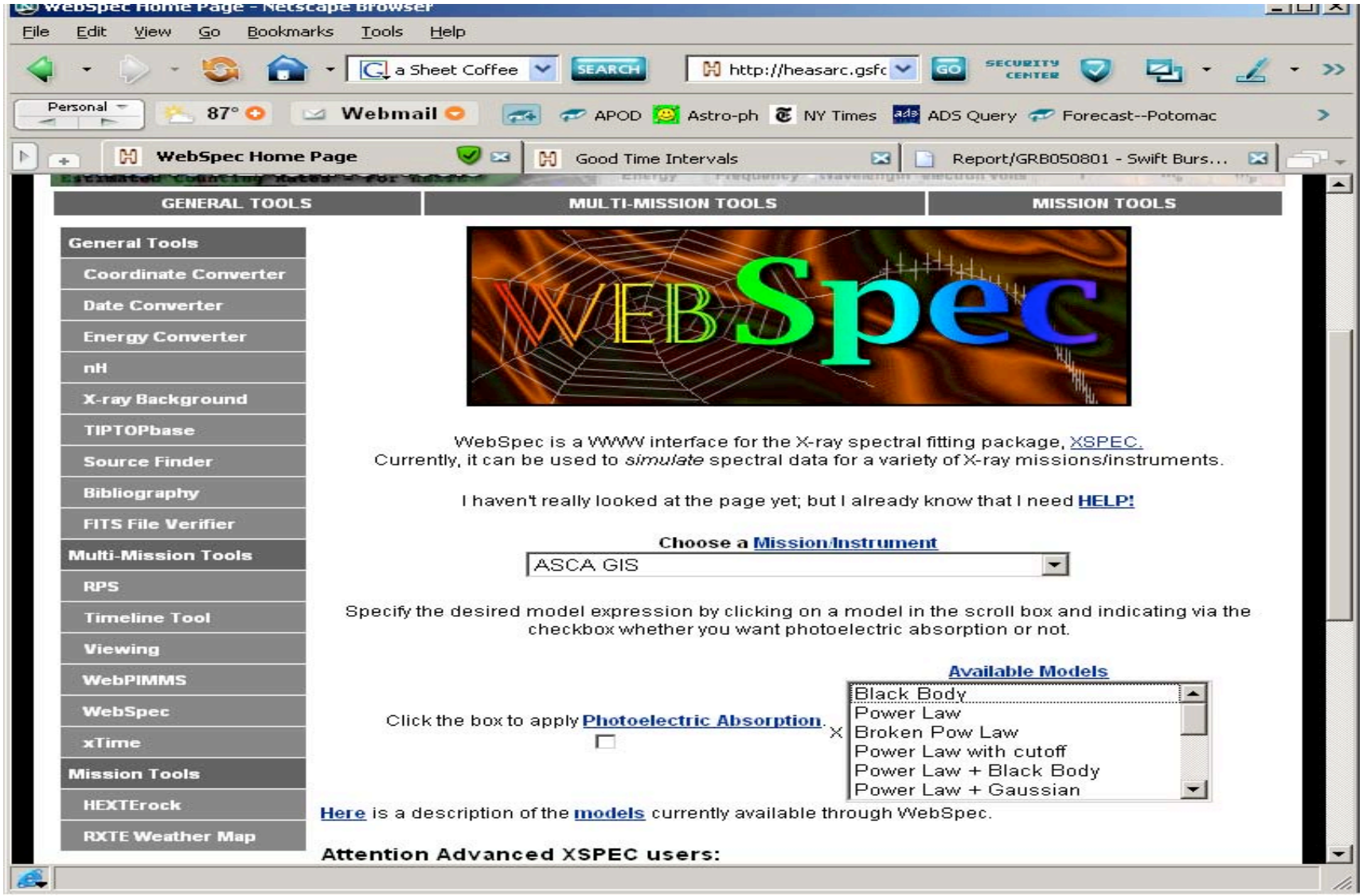
S-05: WebSpec

- S-05 performs XSPEC 'fakeit' spectral analysis simulations for the LAT and GBM. This is the next level of complexity.
- 'fakeit' simulates a count spectrum by folding the spectral model through the response function. The simulated count spectrum is then fit as if it were real data. The simulated spectrum shows the channels with significant numbers of counts, and the fit shows the uncertainties on the fitted parameters.

S-05: WebSpec, Cont.

- WebSpec is a web interface for running 'fakeit'; see http://heasarc.gsfc.nasa.gov/webspec/webspec.html
  - Current version is X-ray astronomy-specific (e.g., model types)
  - We will clone a GLAST version with our models (e.g., grbm, power law with 100 MeV pivot)
  - We also need to provide a large number of response functions and backgrounds
- We have to supply RSP and BAK files. For each instrument we need a series for the different inclination angles, LAT front/back, observation modes.
  - We have already created GBM files from Marc Kippen's software; but the GBM response functions will be updated
  - LAT files can be created by running the SAE tools
- Users can download these RSP and BAK files for use in XSPEC (e.g., if their spectral models are not in our version of WebSpec).

Current WebSpec Front Page



S-03, S-04, S-06: SAE Simulators

- The final level of complexity consists of the simulation capabilities within the Standard Analysis Environment (SAE). The simulators use the same LAT response functions that the analysis software uses, and the user will analyze the simulated data with the same tool he/she will analyze real observations.

- S-03—Orbit simulator.
- S-04—Observation simulator.
- S-06—Spectral analysis simulator—the likelihood tool.

- Since GIs will not analyze LAT photon data in Cycle 1, these simulators will NOT be provided for Cycle 1.

Proposal Submission

- Proposers will submit their GI proposals through RPS. We plan a totally electronic submission.
- Even with NASA's proposal system we will continue using RPS because:
  - RPS 'understands' observations
  - RPS is tied into the OGIP proposal database system
- OGIP's revision of RPS will not require any additional work on our part; 'all' we have to do is design the interface.

- RPS will also handle TOO requests—separate forms will be created for TOOs approved by the GI program and 'out-of-the-blue' TOOs.

Schedule

- The GI proposal tools are part of Release 8 on 11/1/06 (with a code freeze 6 weeks earlier). Most of these tools will actually be done earlier.
  - Most of these tools exist (RPS, WebSpec) and need to be customized for GLAST.
  - A prototype exists for S-01.
- The rest of the User Support tools (mostly posting tools) are part of Release 9 (6/6/07), but again most of the tools will be done long beforehand.