Astronomical Data Analysis Software and Systems VI
ASP Conference Series, Vol. 125, 1997
Gareth Hunt and H. E. Payne, eds.

A User Friendly Planning and Scheduling Tool for SOHO/LASCO-EIT

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Abstract. The LASCO/EIT instruments aboard the *SOHO* satellite (launched Dec. 1995) were developed with complicated image processing/acquisition techniques. The Planning and Scheduling Tool was designed allow the user easily to take advantage of all available resources of the four telescopes (LASCO's three coronagraphs and the EIT Telescope) to maximize the use of the telemetry downlink.

The Planning Tool allows users to develop customized observing sequences while monitoring compression factors and on-board processing times to realistically work within the limits of the instruments. The Scheduling Tool then graphically displays scheduled sequences and highlights potential resource conflicts. Sequences are saved in database tables as "as planned observations" and are available to be retrieved at any later date. Outputs include: database updates, inputs to the *SOHO* science activity plan, and the command loads themselves. Statistics are gathered after the images are received so the tool is constantly improving its estimate of processing time and compression factor.

1. Introduction

The LASCO (Large Angle Spectrometric Coronagraph) / EIT (Extreme Ultraviolet Imaging Telescope) instrument packages having been operating continuously since shortly after launch of the *SOHO* (Solar and Heliospheric Observatory) satellite on December 2, 1995. *SOHO* is located at the Lagrangian L1 point providing uninterrupted observations of the sun. Commanding and data acquisition are performed in real time eight hours of every day with the remaining time provided through solid-state recorder dumps (see Wang et al. 1997, for more on the LASCO data archive). Observation schedules are uplinked daily, consisting of a baseline long-range synoptic program as well as specific observations to take advantage of changing targets on the sun, special science programs, or joint observations with other observatories. The LASCO/EIT electronics are extremely flexible, offering various image compression techniques which are traded off with consideration of scientific goals. The Planning Tool (Figure 1) allows users to develop customized observing sequences while monitoring compression factors

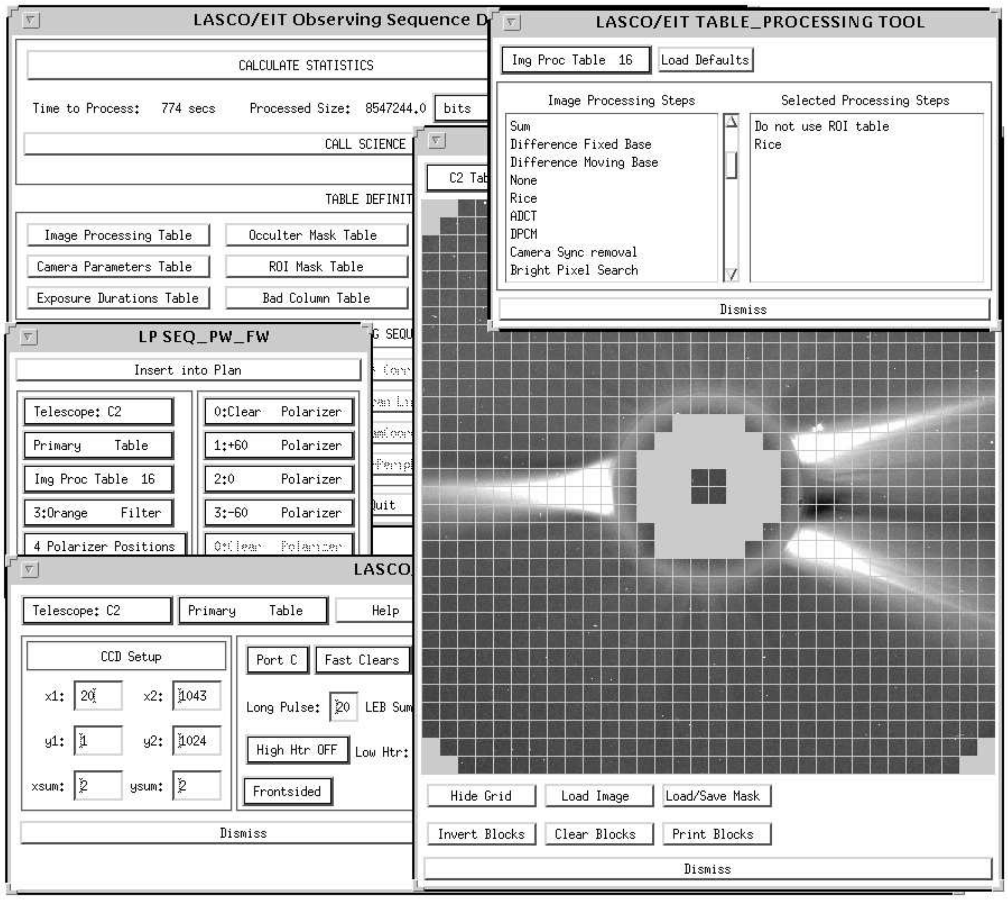

Figure 1. A typical view of the Planning Tool.

and on-board processing times to work realistically within the limits of the instruments. The Scheduling Tool (Figure 2) then graphically displays scheduled sequences and highlights potential resource conflicts. The user can easily add, remove, or modify these sequences.

2. Implementation

The Planning and Scheduling Tool is written in IDL (∼12,000 lines of code) with a call to a C routine to generate the binary command strings. The tool is coupled with a relational database (Esfandiari, Paswaters, & Wang 1997) to archive observing sequences and maintain statistics (compression factor, processing time) of science images. Observing sequences are scheduled to maximize the use of LASCO/EIT science telemetry resources ($5\,\mathrm{kB\,s^{-1}}/60\,\mathrm{MB\,day^{-1}}$ compressed science data) while monitoring on-board processing time to avoid over-scheduling.

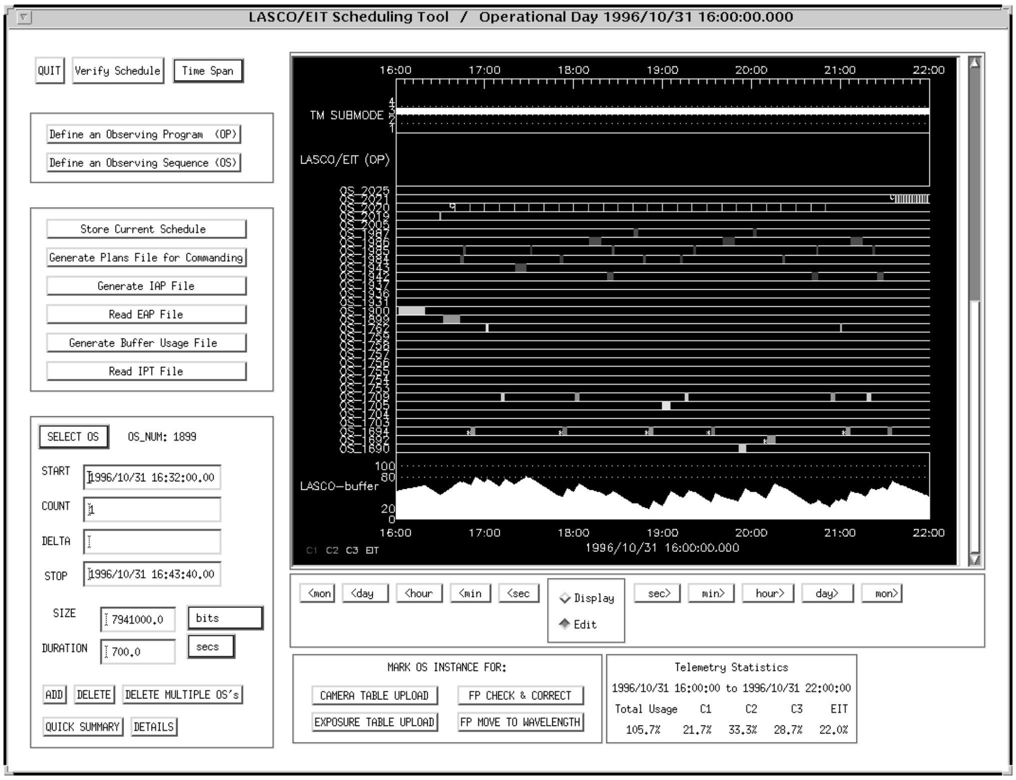

Figure 2. A typical view of the Scheduling Tool.

Table 1. Sample "As Planned Observations" Summary.

Date Obs	Tele	Exp	Nx	Ny	Bin	Filter	Polar	Wavelength	OS
1996/10/31 16:44	C1	100	320	288	1×1	Fe XIV	Clear	5302.4224	1984
1996/10/31 16:46	C1	48	320	288	1×1	Fe X	Clear	6376.4419	1985
1996/10/31 16:50	EIT	9	128	128	1×1	Clear	195A		2020
1996/10/31 16:51	C2	25	1024	576	1×1	Orange	Clear		1694
1996/10/31 17:00	EIT	9	128	128	1×1	Clear	195A		2020
1996/10/31 17:01	EIT	9	1024	1024	2×2	Clear	195A		1762
1996/10/31 17:10	EIT	9	128	128	1×1	Clear	195A		2020
1996/10/31 17:11	C3	19	576	1024	1×1	Clear	Clear		1709
1996/10/31 17:20	EIT	9	128	128	1×1	Clear	195A		2020
1996/10/31 17:21	C1	100	640	640	1×1	Fe XIV	Clear	5302.4224	1943
1996/10/31 17:21	C1	100	640	640	1×1	Fe XIV	Clear	5309.2363	1943

3. Outputs

A summary of "as planned observations" is output as an ASCII readable file providing a top level view of the schedule (Table 1).

A *SOHO* science activity plan file is generated summarizing LASCO's upcoming observations for *SOHO*-wide planning. Binary formatted commands are output into a single command file. Typical daily command loads consist of 300–500 commands. Consistency checks are performed on this file, and then the commands are uplinked through a separate piece of software from a LASCO workstation at GSFC to the instrument.

4. Summary

The Planning and Scheduling Tool is currently being used almost exclusively for commanding the LASCO and EIT instruments. Integrating user's customized observing sequences with the overall synoptic program typically takes on the order of half an hour, thus reducing the burden on the operations staff. Through the use of unique observing sequence numbers, users can correlate their planned observations with the actual data through database queries, and recall specific observations sequences to modify or run in the future.

References

Esfandiari, A. E., Paswaters, S. E., & Wang, D. 1997, this volume, 353

Wang, D., Howard, R. A., Paswaters, S. E., Esfandiari, A. E., & Rich, N. 1997, this volume, 282