

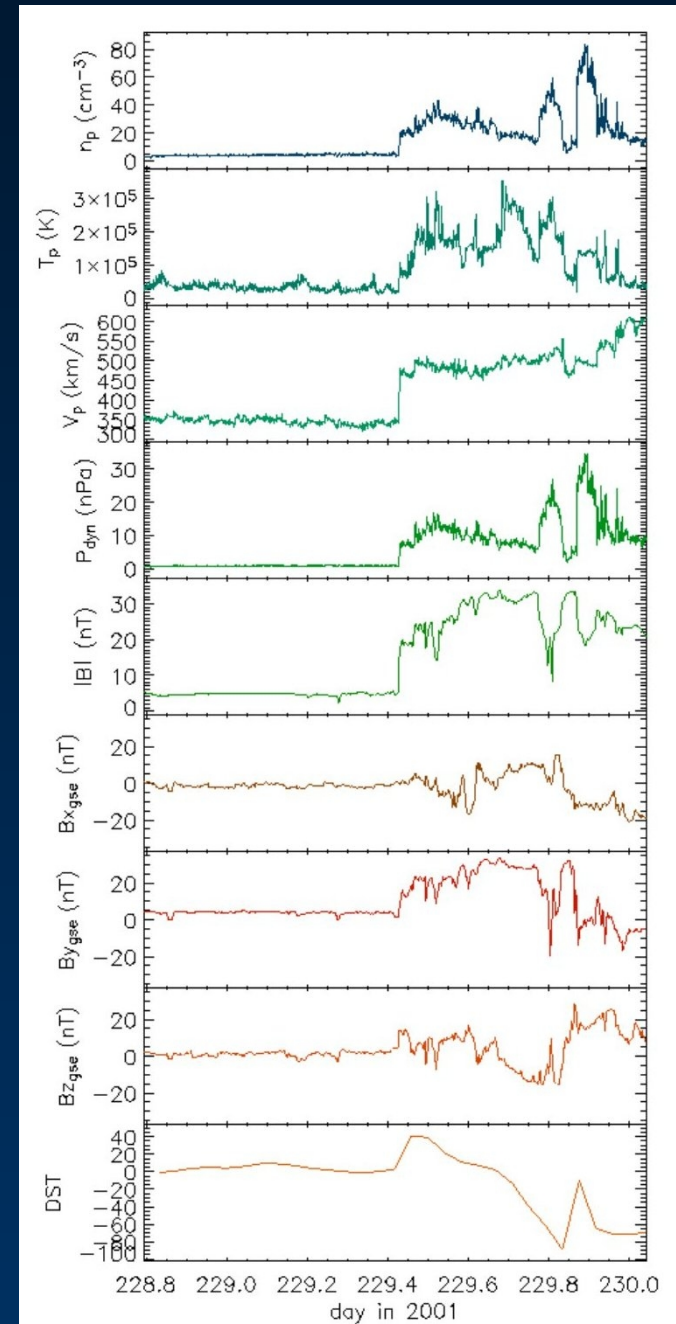
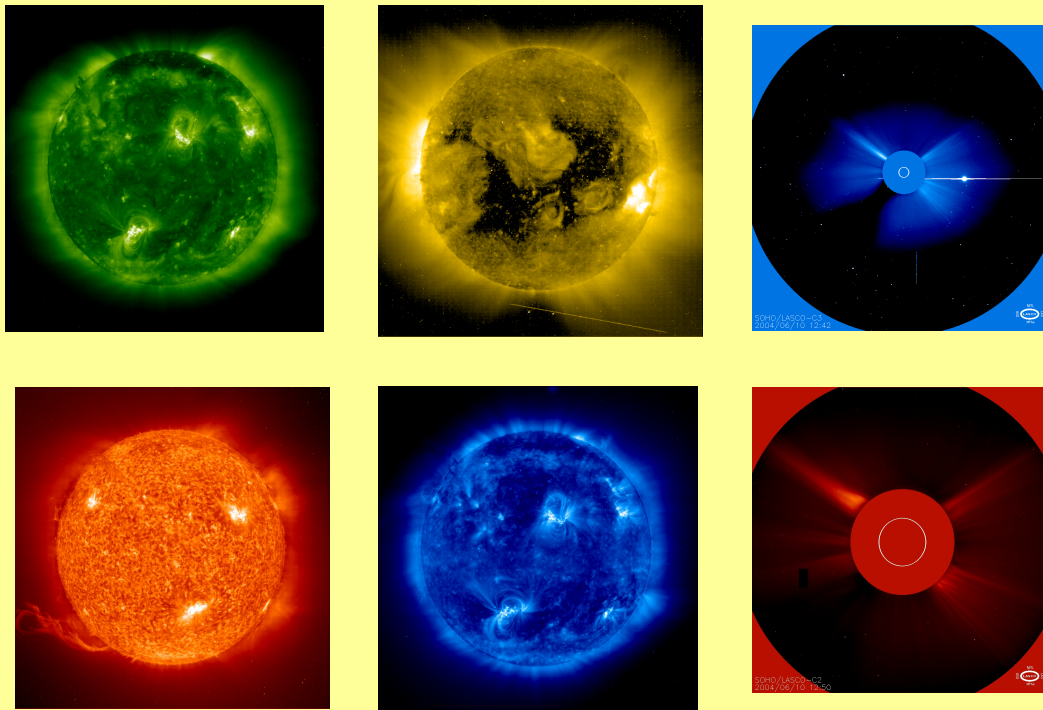
# Solar System data access and analysis with AstroGrid

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# Solar System datasets

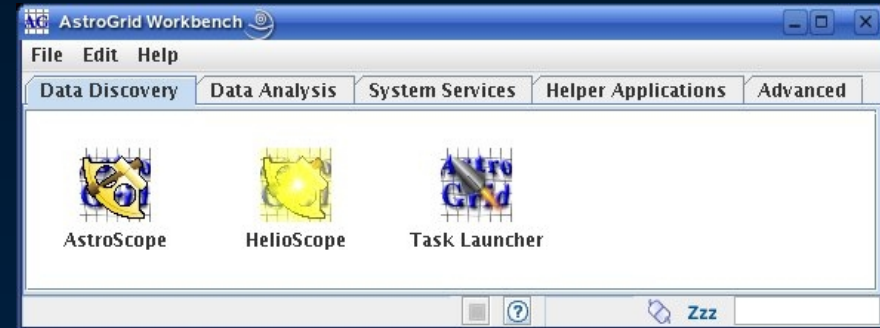
- From solar images to time series data
- Sun, planets, solar wind, near Earth space environment, ...



# Objectives

- Facilitate data retrieval and analysis across traditional Solar System 'boundaries'. See: [HelioScope](#)
- Make available easy-to-use science services. Eg: [Solar Movie Maker](#) application.
- Provide a framework for making models and applications available to the community. Feed real data as input to models.
- Allow users to develop their own science workflows (multi-instrument, large dataset work).

# Data discovery: HelioScope



- Solar system is highly variable in time – time range query

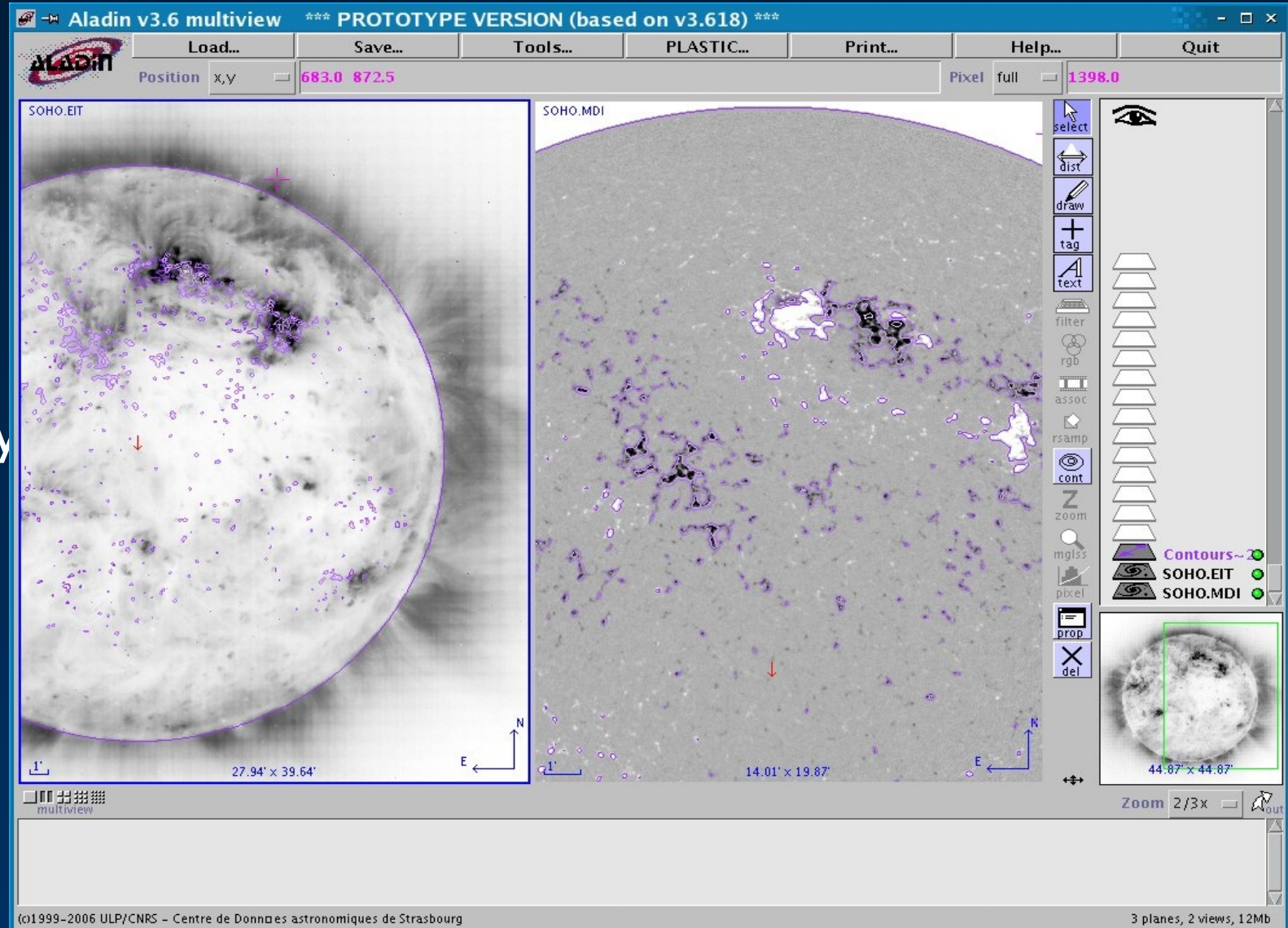
- Solar data from Virtual Solar Observatory + Space Physics data from NASA CDAW

The screenshot shows the Helioscope application window. On the left is a sidebar with three sections: 1. Search (with date and time pickers, checkboxes for Time Series and Graphic, and a Search button), 2. Navigate (with To Top and Clear selection buttons), and 3. Process (with a Save button). The main area has tabs for Radial, Hyperbolic, and Services. It displays a radial search results diagram with a central node 'EIT' and several connected nodes: 'RHESSI (Reuven Ramaty High)', 'TRACE (Transition Region And)', 'ACE spacecraft dataset', 'SOHO Coronal Diagnostic', 'Wind spacecraft dataset', 'SOHO LASCO (Large Angle and)', 'Cluster spacecraft dataset', 'Polar spacecraft dataset', 'Search Results', and 'SOHO EIT (Extreme ultraviolet)'. Time stamps are shown in yellow boxes: '2003-01-08T00:48:10', '2003-01-08T00:36:10', '2003-01-08T00:24:10', '2003-01-08T00:12:10', and '2003-01-08T00:00:10'. A 'Time Series/Images' node is also present.



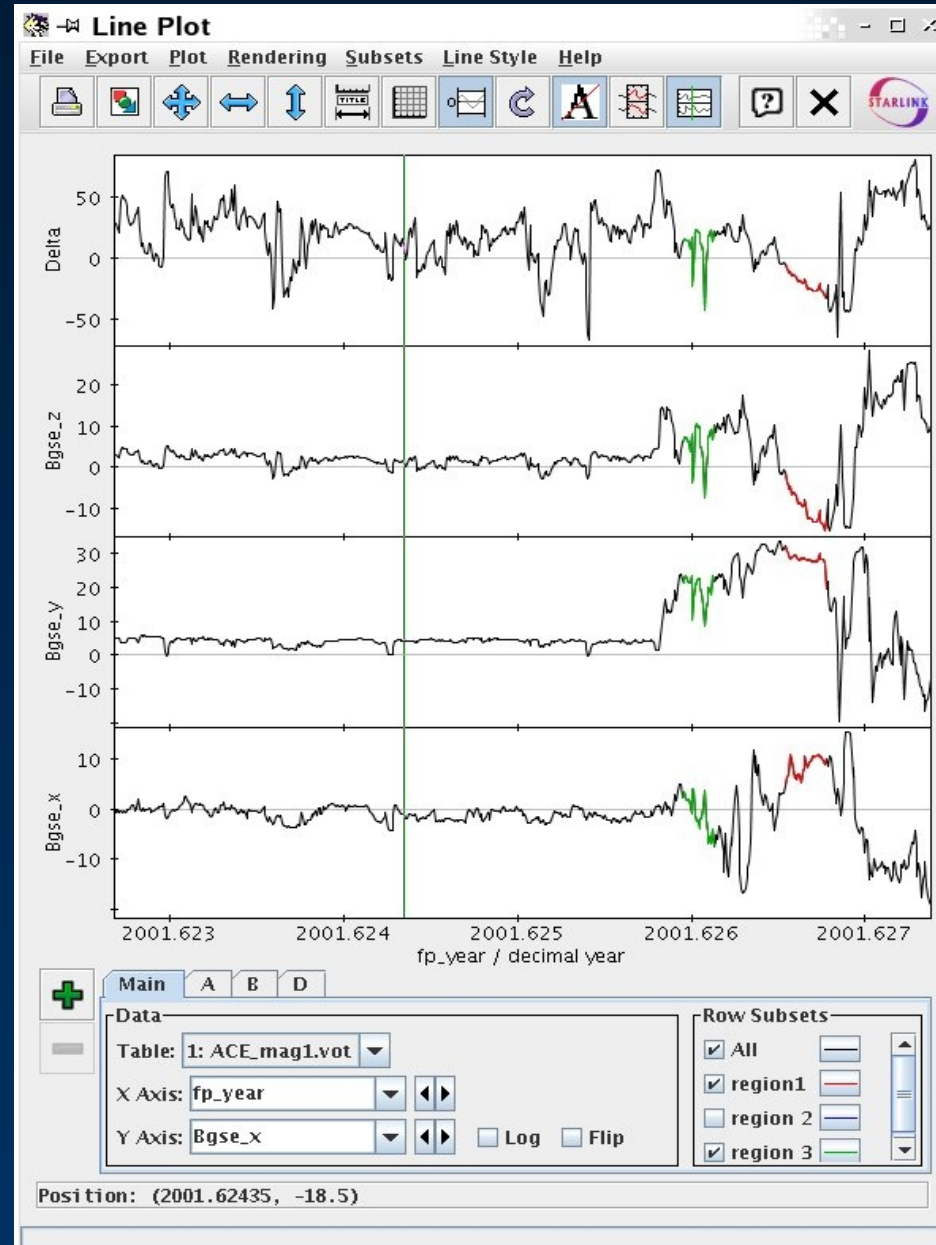
# Solar image visualisation with Aladin

- **PLASTIC** allows streaming of images retrieved by HelioScope to Aladin



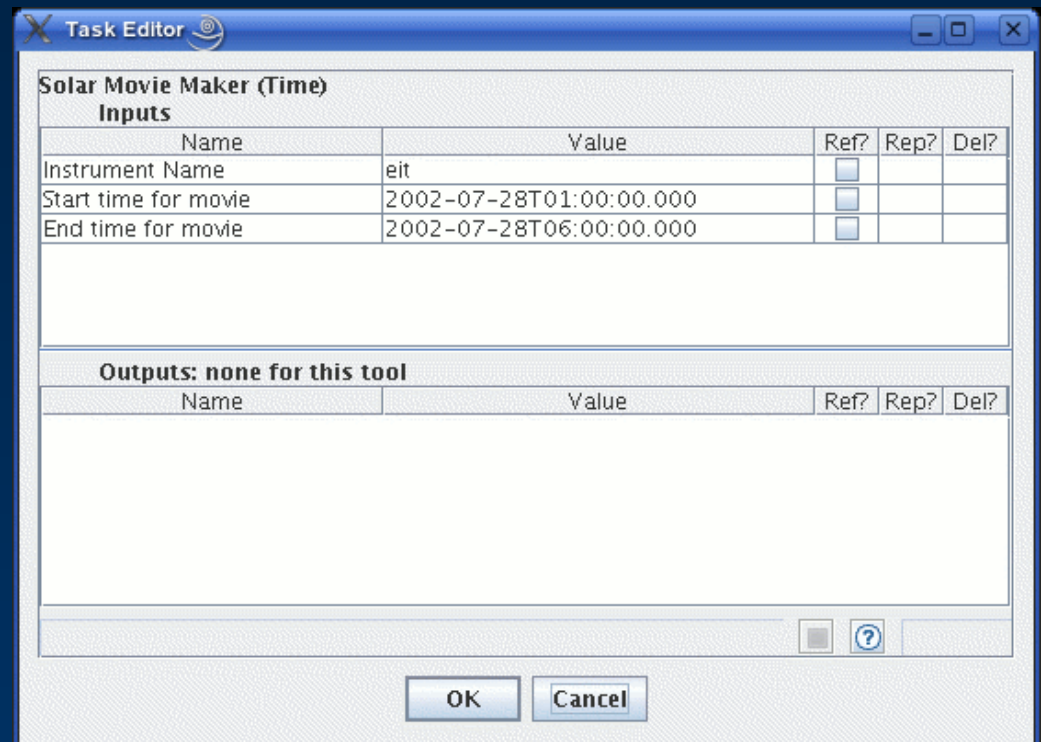
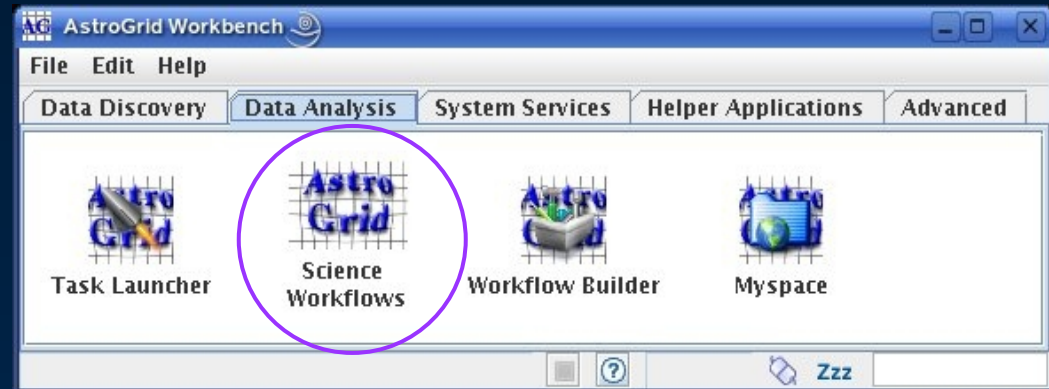
# Topcat time series visualisation

- Topcat stackplots
- Automatic conversion of ISO8601 strings to numeric

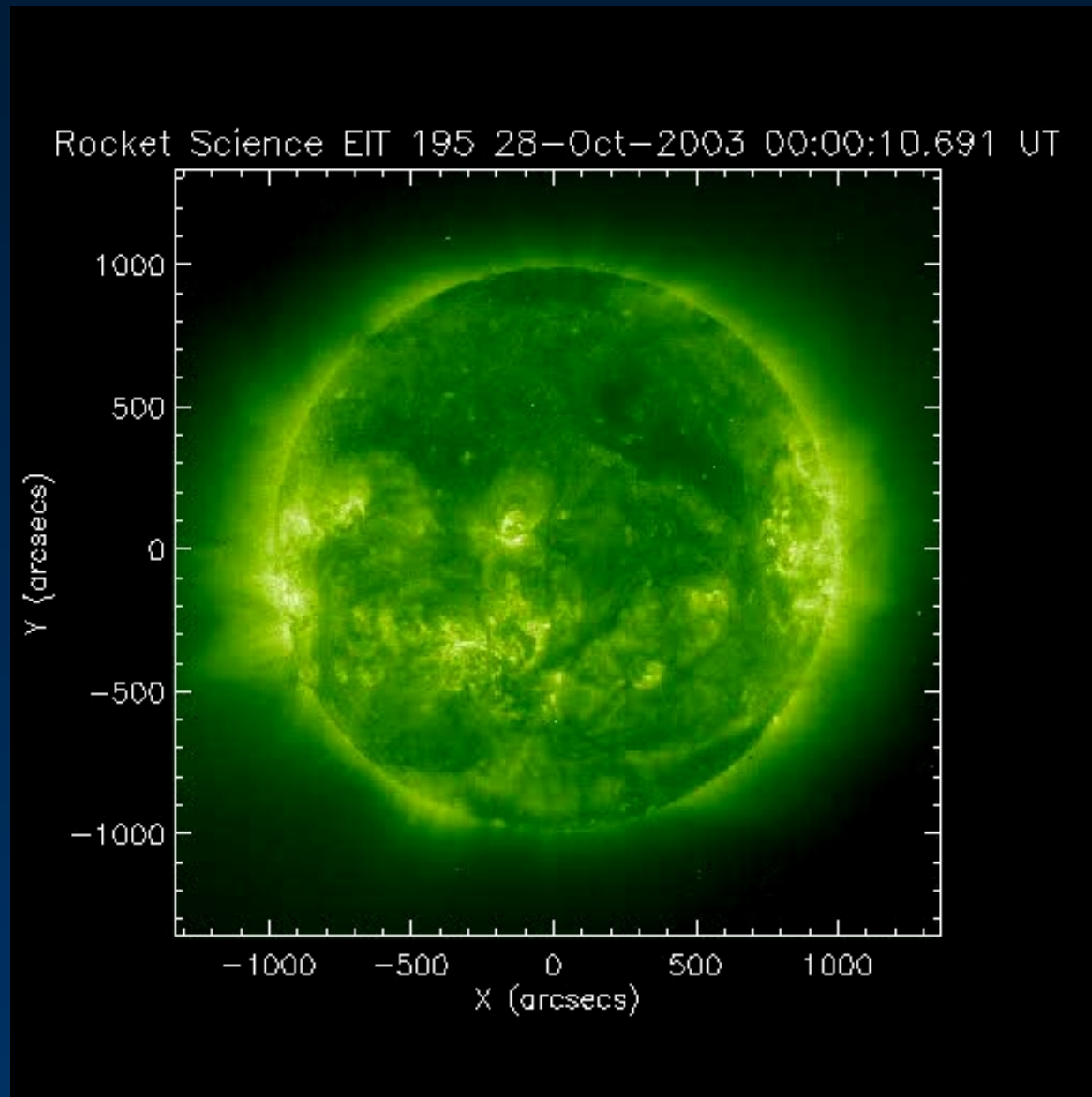


# Solar Movie Maker

- Ready made workflow that retrieves solar images and combines them into a movie
- Based on capability to send an **ADQL query** to database of solar observations (via AstroGrid DSA)+ run **movie maker CEA application**

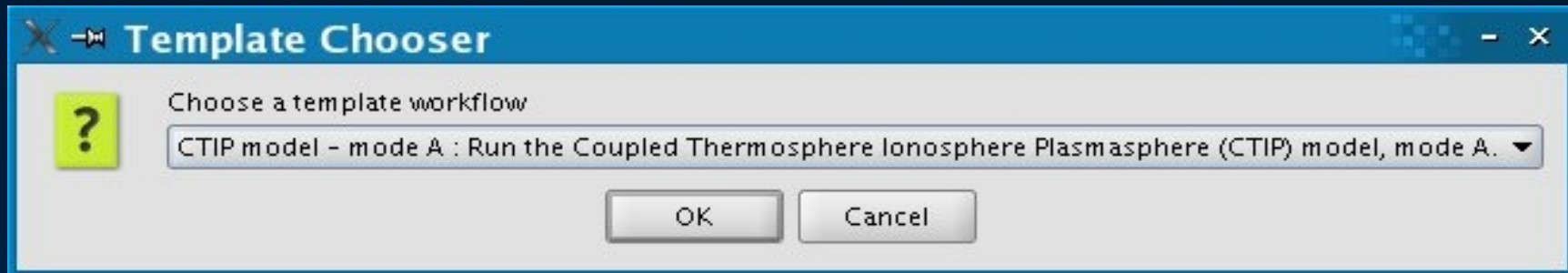


# Output

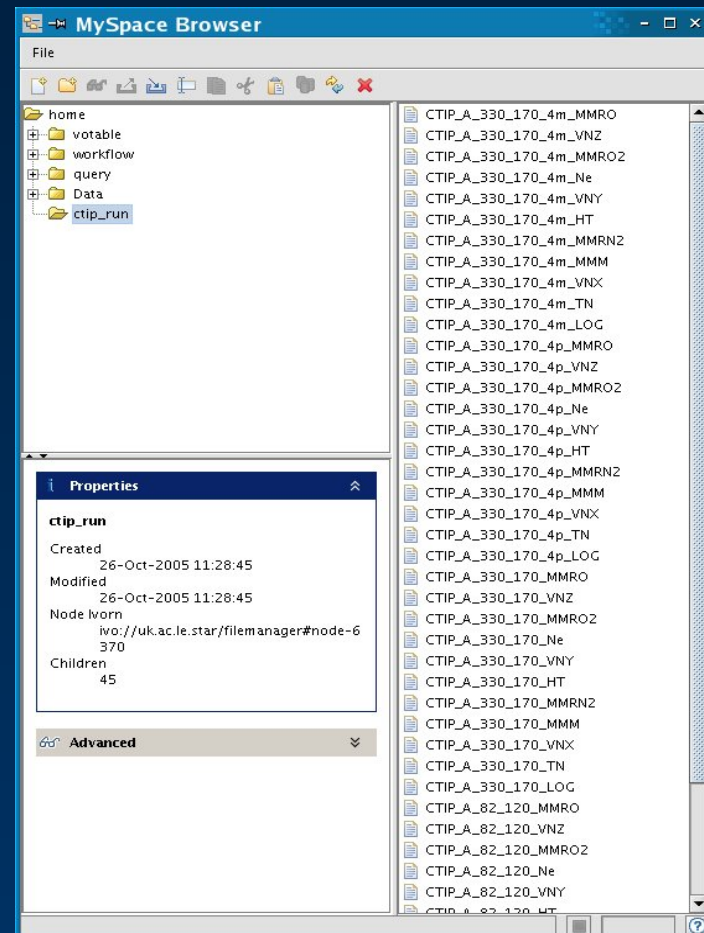




# CTIP model

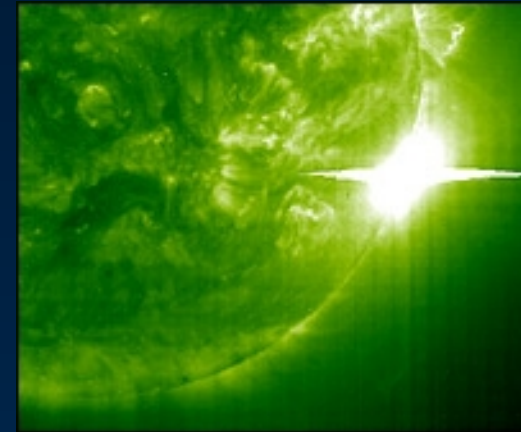


- CTIP (Coupled Thermosphere Ionosphere Plasmasphere) model, Atmospheric Physics Lab, UCL
- Data retrieved from database query is passed as input to the model
- AstroGrid as the means by which model is made available to community
- Output files returned in user's VOSpace

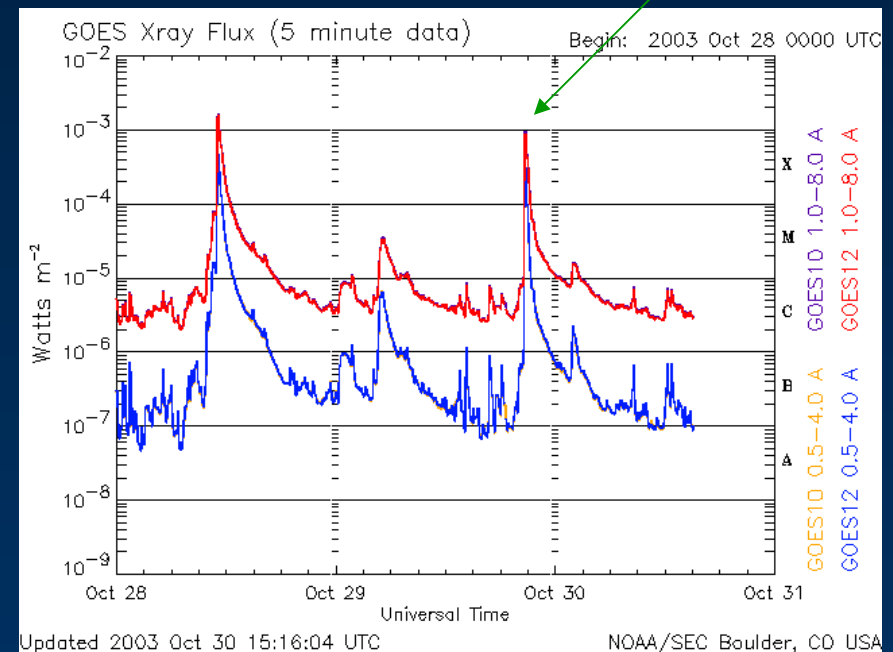


# Solar events

- A variety of events, eg solar flares, coronal mass ejections, filament eruptions etc
- Need to follow up initial solar event observations – IVOA VOEvent
- In addition: need to retrieve data from archives *by event*
- Time-cross matching of events observed by several instrument

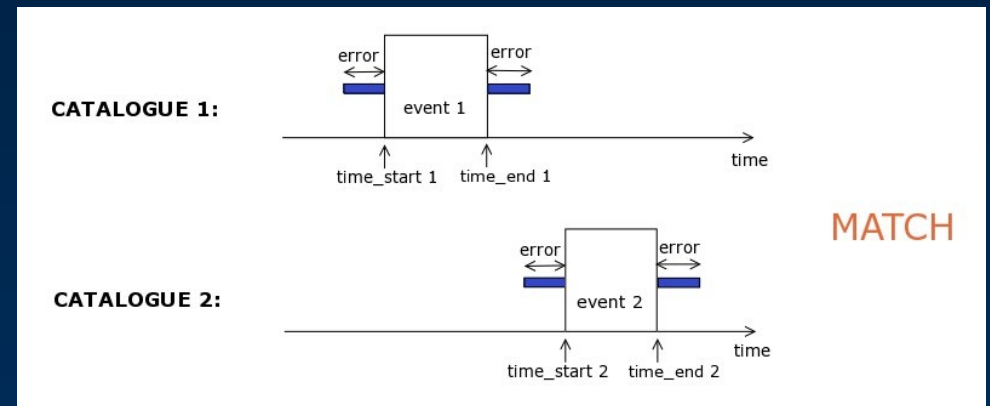
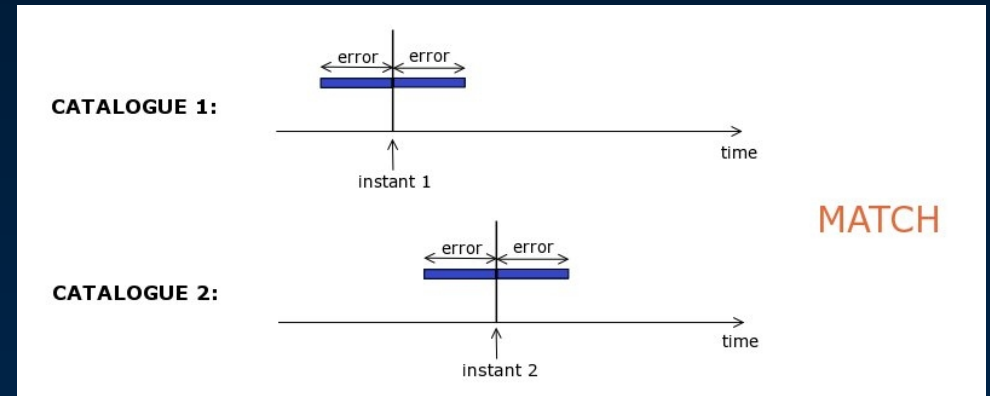
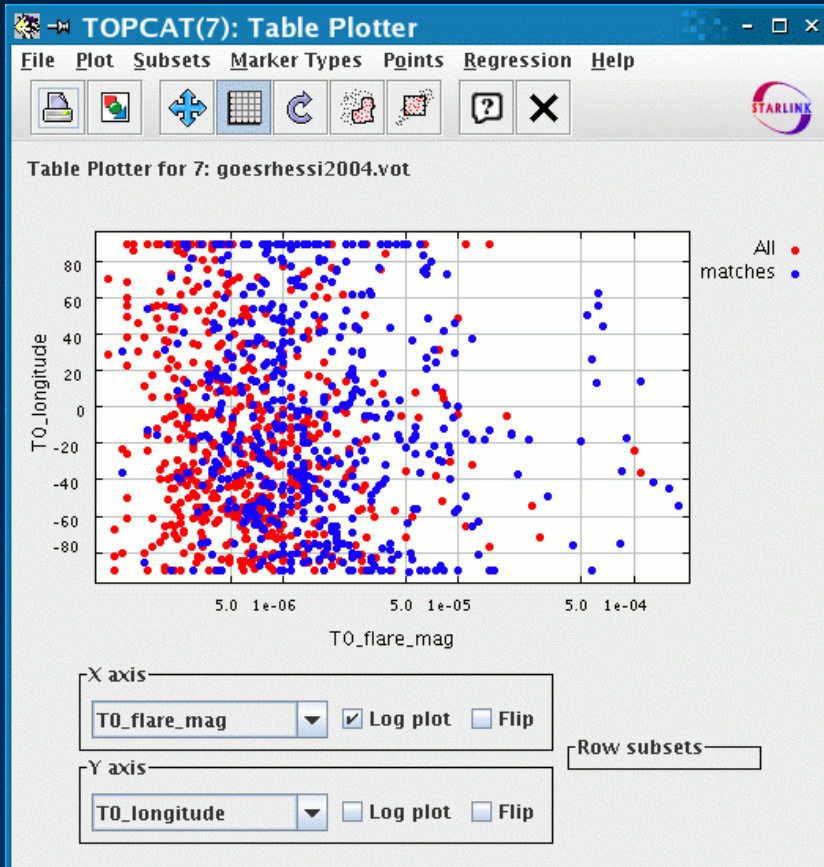


Solar flare



# Cross matching on time

- 1D cross matching either for time instants or intervals



# Conclusions

- Several VO tools are being developed for accessing and analysing Solar System data
- Definition of standards friendly to solar system data, eg data access protocols that allow specification of the coordinate system, etc
- Interaction with Astronomy community very positive – where possible use common tools and standards
- Overlap with time-domain work within Astronomy