EXPERIENCE WITH SERVICE OBSERVING

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Outline

- Introduction
  - Current Observing Models in Ground-Based Astronomy
- DST Service Mode Operations: Towards ATST
  - Lessons Learned
- Summary

Introduction: Observing Models in GB Astronomy

- How are GB large facilities used for observations and made available to the scientist?
  - Classical mode (PI mode, visitor mode)
  - Service mode (queue mode).
- What is the differences between those modes?
  - Scheduling approach
  - Seemingly little difference has a lot of consequences (when major operational guideline is efficiency).

In the following: focus on large GB nighttime and radio facilities

Introduction: Comparison of Service and Classical Mode

- Application for time
  - Proposal based; competitive; phase 1 tools for proposal preparation.
- TAC involvement
  - TAC grades/ranks proposals based on scientific merit; rejection of proposals.
- Scheduling
  - Classical: TAC (typically) allocates fixed observing time to approved proposals (e.g. partial nights, multiple nights).
  - Service: Time is dynamically allocated (daily) when criteria for a specific proposal are fulfilled; increase the execution probability of high ranked rare condition proposals (virtually guarantee).

Introduction: Comparison of Service and Classical Mode

- PI involvement
  - Classical: PI travels and prepares the observations (ahead or on site) supported by local operations staff (phase 2 tools: script preparation) at the facility or in close vicinity; PI might control instruments.
  - Service: PI prepares observations (ahead) supported by operations staff (phase 2 tools: script preparation); PI not present, remote participation.
- Operations staff involvement
  - Classical: Typically local support staff executes observations and PI participates/present at the facility or in close vicinity at operations center/ building.
  - Service: Program list (queue) is generated (daily or for multiple days) based on ranking/grading and observing conditions; observatory staff decides what programs out of the list are executed and executes observations on behalf of PI.

Introduction: Comparison of Service and Classical Mode

- Target selection
  - Observing targets/objects are pre-defined (except for ToO) ahead of time; pointing is pre-defined.
- Specification of observing conditions
  - Minimum observing conditions that can still fulfill the science goal required by PI's in proposal (phase 1 tool).
- Data handling
  - Data centers/archives; data pipelines; proprietary period for PI's but sometimes also public data.

Classical: Keck and LBT (only), ESO/VLT , GEMINI , GTC .

Service: ALMA (only), NRAO/EVLA (only), ESO/VLT , GEMINI , GTC .

Introduction: Gains of Service Mode Operations

- Main motivation: increase of
  - Efficiency: minimize time that telescope is idle.
    - More programs run and completed
    - Make better use of target availability
    - Make better use of observing conditions (highly-ranked proposals are virtually guaranteed to get data).
  - Scientific productivity (more programs run)
  - Attract new users (lower barrier of entry).
- Amenable to broad range of different programs
  - Target of Opportunity programs.
  - Coordinated observations and campaigns!

Introduction: Observing Model in GB Solar

- Application for time:
  - proposal based (web page application form; others: emails with attachments).
- TAC involvement
  - TAC approves proposals and performs scientific and technical assessment; sometimes a prioritization is involved sometimes not; rejection very rare.
- Scheduling
  - TAC (typically) allocates fixed observing time (en block) to approved proposals (several days; 7-10).
- Instruments
  - May/may not be permanently installed; setup time! Light-beam configuration as well (multi-instrument operations); allowing for a lot of flexibility.

Introduction: Observing Model in GB Solar

- PI involvement
  - Travels and makes all decisions at the facility.
  - Decides when to start/stop/repeat an observation based on experience.
  - Completion determined by PI or when time is over.
  - Optimizes/changes instrument settings, etc.
  - PI executes/monitors/oversees the operations (DST: or advises support staff).
- Operations staff involvement
  - Permanent/shifting support staff available helping with setup, opening the telescope, etc. (observers, observing assistants, local instrument scientists).

Introduction: Observing Model in GB Solar

- Target selection
  - PI identifies and selects targets (daily).
- Specification of observing conditions
  - PI decides when to observe; decides when to start/stop/repeat an observation based on his/her experience!
- Data handling
  - PI takes (level 0) data home; reduces the data; sometimes reduction packages available sometimes not; sometimes local instrument scientists help with reduction.

Reardon et al. (2009)

Introduction: Examples of Service Operations in GB Solar

- Rocket launches: SUMI, HI-C, EUNIS, VERIS, VAULT2; short, WSMR launch schedule at noon); start observations before launch and continue after launch (maybe).
- *Hinode* support with IBIS (2008, 2009).
- Campaign participation (e.g. IHY/WHI, 2008).
- *SUNRISE* (2009, 2013)
- *IRIS* (through most of September).
- PI support when absent due to special circumstances (late arrival).
- All proposal based, PI not present, local (science and technical) staff perform observations.

Conceptually still very different from full-time service mode operations !
(target/pointing defined externally)

DST SMO: Towards the ATST Impact of Service

- DST Service Mode Operations and SOLARNET service crucial!

ATST will move away from “classical mode” and plans to be operated for a significant fraction of time in “service mode” during science operations (+access mode).

How are solar observations prepared and obtained in this mode, what tools are needed, where remain questions?

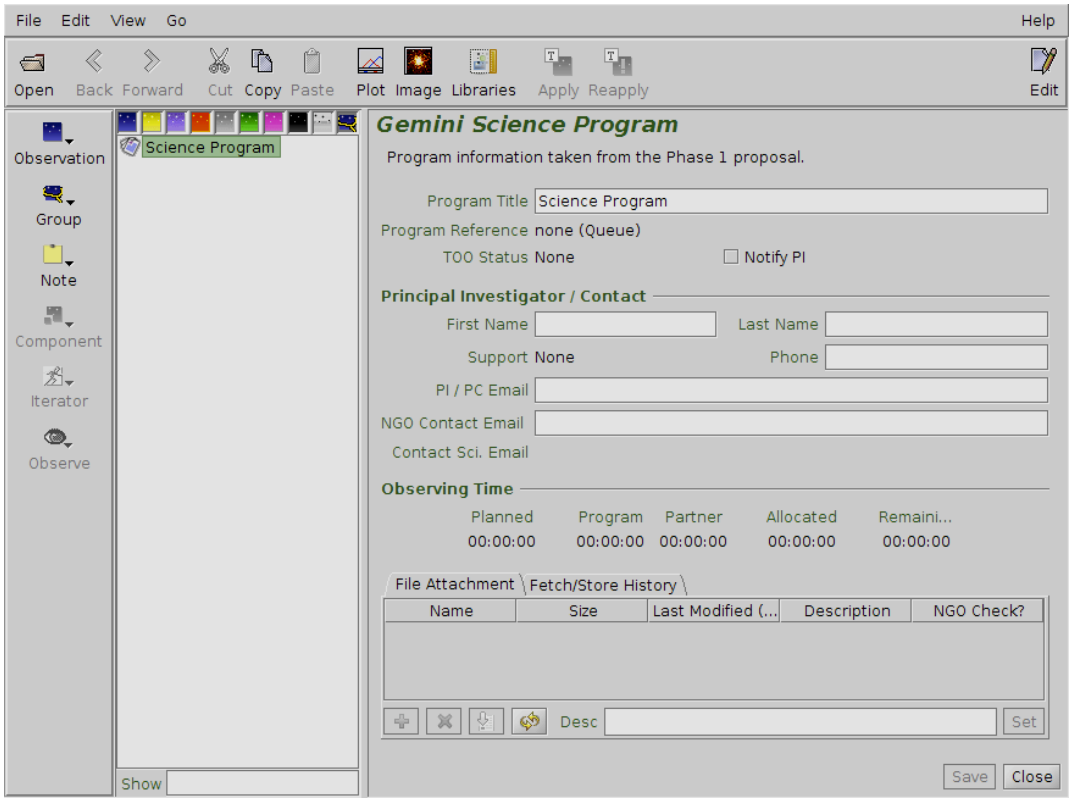
- Preparation/Evaluation: how are proposals prepared and evaluated?
- Planning (daily): when and what observations are obtained?
- Execution: how are observations performed?
- Data handling: how is data made available?

DST SMO: Lessons Learned Proposal Preparation

- No guidance for proposers was given! NSO: web form with science justification appended (others: emails/attachments)
- Proposals need more details and proposers need more guidance preparing a proposal.
  - Structured science justification and observing strategy in standard format.
  - Very detailed target description.
  - Instrument settings (standard instrument modes help).
- Proposal preparation tool; proposal information; instrument explorers (MHD simulations as a tool?); sensitivity calculators; documentation

DST SMO: Proposal Preparation and Submission

- Title, abstract, PI information
- Science justification appended.
- Instrument definition.
- Instrument modes.
- Target selection: object catalogues
- Observing condition definition.



- Example: GEMINI Phase 1 Tool (PIT): http://www.gemini.edu

DST SMO: Lessons Learned Proposal Evaluation

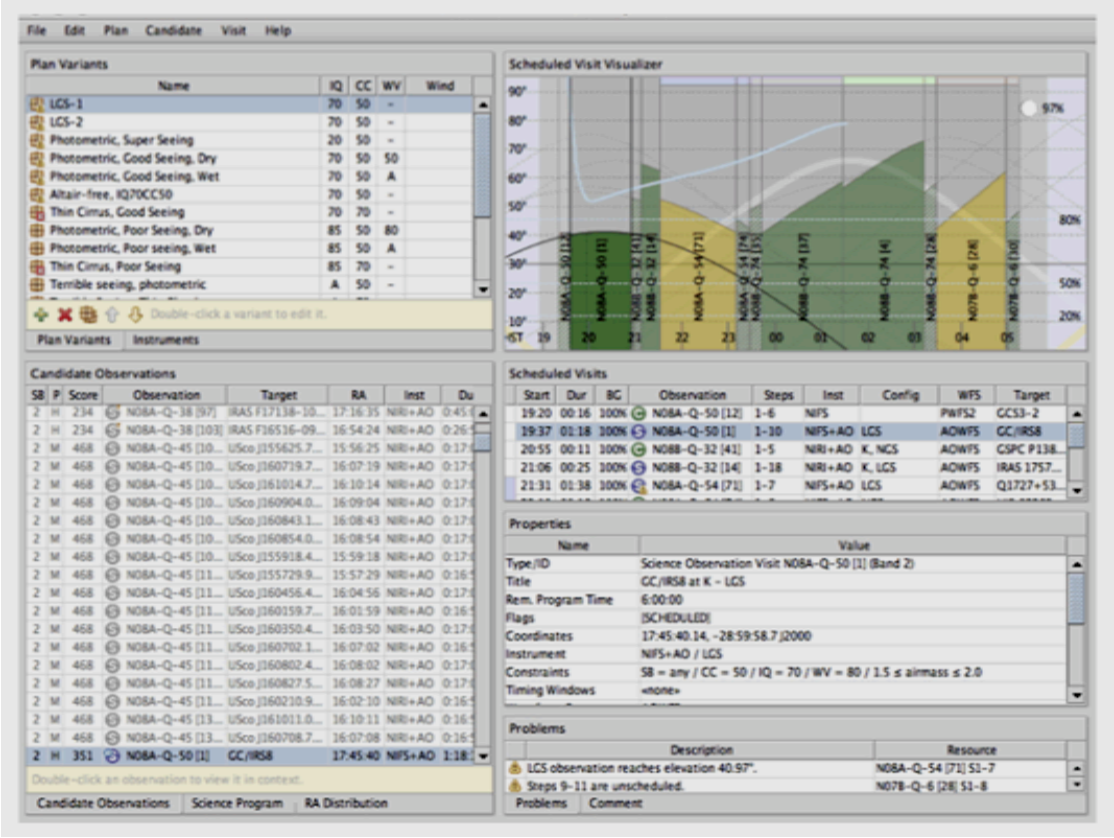
- 21 proposals submitted; ranking of all proposals in the pool independent of program; every team member read all proposals and ranked every one (grades 1-6); grades were averaged; no rejection.
- Lots of work; more TAC members needed (external TAC members).
- Proposal evaluation tool; proposal details; ranking input; conditional formatting/ordering/listing/filtering functionality.

DST SMO: Lessons Learned Planning of Observations

- Program list generation (list of proposals that could be performed on the next day or days) based on:
  - Solar target availability (pre-selection of targets!); instrument configuration; observing constraints (e.g. seeing, coordinated?); order: scientific ranking
- Planning is a daily task; tight coupling to weather and seeing conditions (lists valid for multiple days are not very realistic, except for coordination/campaign)
- Observation planning tool; list of all proposals; proposal details; proposal constraints; completion status; daily program list generation; balancing proposals (corona, on-disk?); conditional formatting; etc.

DST SMO: Observing Planning Tool

- Listing of all proposals in pool.
- Proposal details.
- Special requirements/constraints.
- Timeline: visual demonstration of the schedule.
- Completion status (all data taken?).

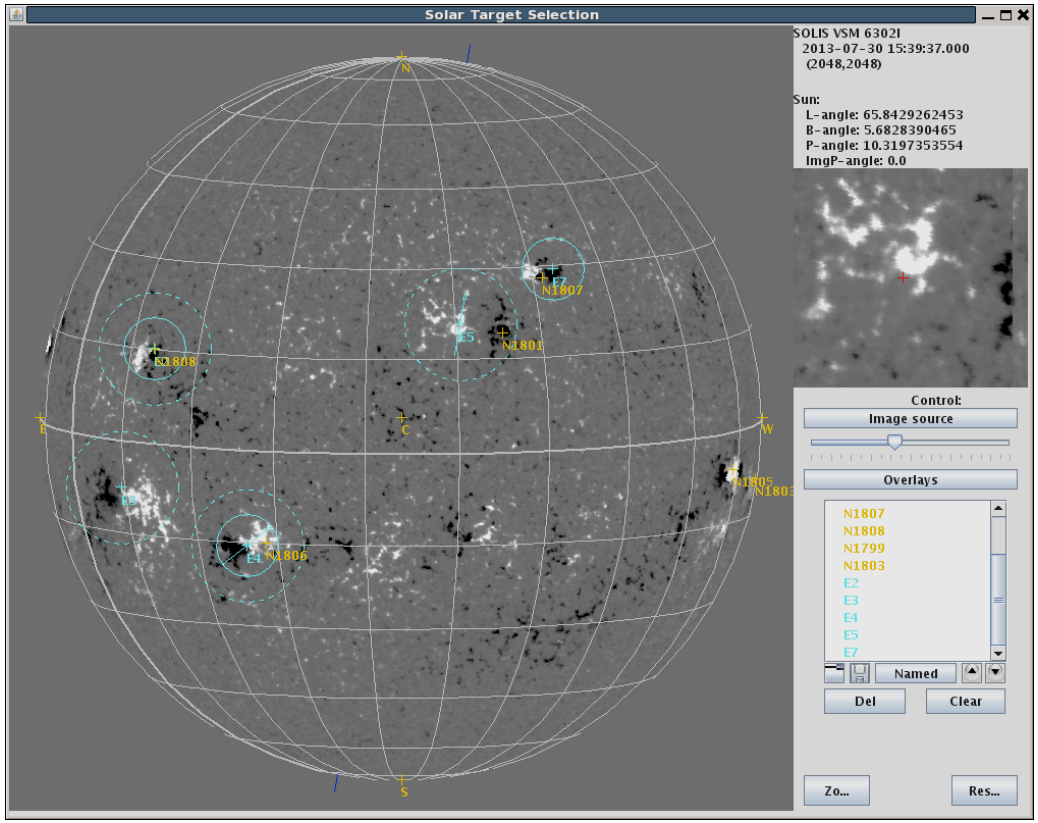


- Example: GEMINI Observing Tool (OT): http://www.gemini.edu

DST SMO: Lessons Learned Planning of Observations

- Target selection/identification was done almost daily; targets were pre-selected on the day before and verified on the day of execution.
- Target selection if easy when you are the PI! But not so for the resident astronomer!
- Heavily relied on external sources (GONG2/ChroTel Hα, SOLIS & SDO/HMI continuum, magnetogram); high-res full-disk images and overlays of those turned out to be crucial.
- Target selection tool: display of full-disk sun; different selectable wavelengths; allocating targets to proposals; moving telescope to targets; comment fields; etc.

DST SMO: Lessons Learned Planning of Observations

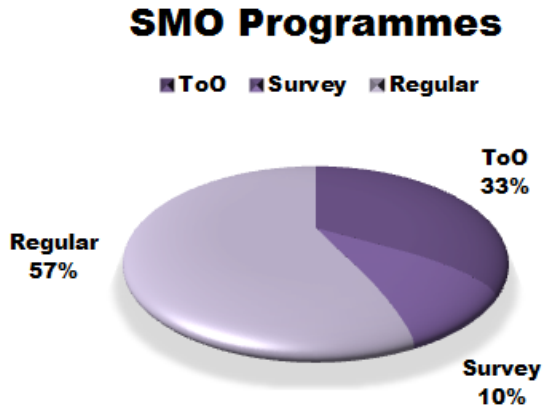


- Target tagging/labeling.
- Switching on/off of labels.
- Coordinate system selection.
- Target activation -> telescope movement.
- Selection of different full-disk sources (here: SOLIS magnetogram)
- Contrast adjustment of input.
- Zooming functionality.

- Prototype of the ATST Target Selection Tool

DST SMO: Lessons Learned Planning of Observations

- Target of Opportunity (flare case)
- 7 ToO proposals (33%); hard trigger, special short-term observing plan (MM#019) under the Max Millennium Program was created specifically tailored to increase the probability to catch lower energetic events. http://solar.physics.montana.edu/max_millennium/

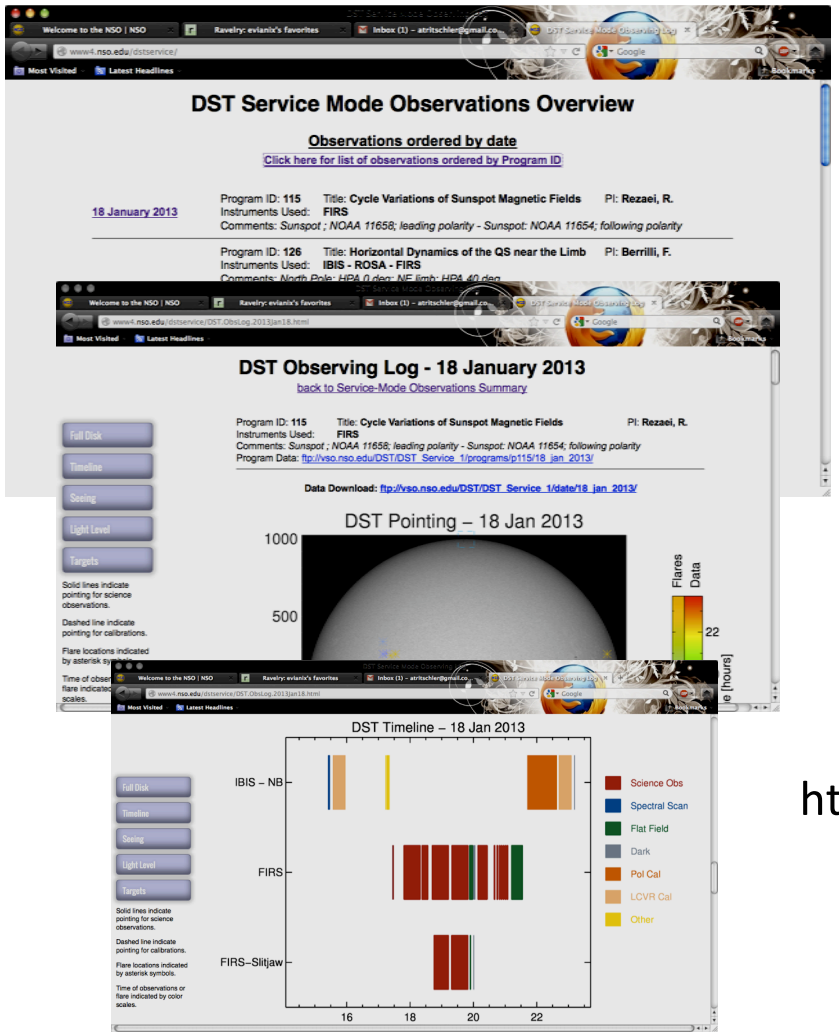


- Challenging in the absence of policies and reliable triggers for such observations.
- Hard trigger versus experience?
- Need to get more experienced (community effort/input initiated)!

DST SMO: Lessons Learned Execution of Observations

- Daily: select program out of (queue) based on solar conditions, seeing and ranking; verify target: pre-selected target still suitable? Initialize data acquisition; repeat process as long as conditions allow; switch to calibrations!
- Process is only complicated by the question when to start/stop an observation! How much variation in seeing is acceptable?
- No reliable guidance for the resident astronomers helping when to initiate/cancel an observation other than experience
- How to reliably quantify seeing? (evolution of Fried parameter?)

DST SMO: Lessons Learned Data Handling



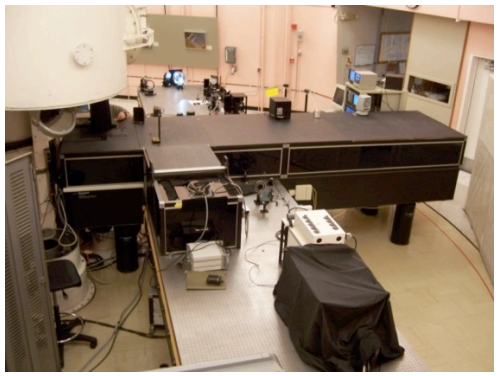
- Only level 0 data provided; no pipelines in place; data made available via VSO ftp download.
- No user feed back yet on data quality or other issues; survey/ questionnaire.
- Ultimately: providing level 1 data unavoidable (new users).

http://www4.nso.edu/staff/kreardon/dstservice/

PI's have downloaded 3TB (out of 4.2TB)

DST SMO: More Lessons Learned

- More than one resident astronomer at the telescope every day; overlapping shifts; continuity in decision making process; allows for discussion; comfort.
- Centralized facility control: observers distributed on the table.
- Instruments need to be able to switch between modes quickly to reduce change-over time between different proposals.



➢ Facility and instruments must be designed to support efficient service

Selected Open Issues

- Granularity of proposal ranking; rejection of proposals.
- Definition of Minimum seeing conditions.
- Target of Opportunity activation (flare case).
- Under which conditions are observations repeated (no failure scenario)? Are they ever repeated within the same cycle?
- Do standard instrument modes limit flexibility too much and do not leave enough room for discoveries?
- Automatic roll-over of high-ranked proposals that could not be executed? Danger: accumulation of proposals.
- How are service mode and classical (access) mode dealt with together within the same cycle?

Summary

- (Efficient) Service has implications on all phases during the operations lifecycle from proposal preparation to data handling.
- Wide range of tools needed to support and ease the decision making process and proposal and data management.
- Observatory assumes responsibility for data quality.
- Facility and instruments must be literally designed for service mode operations.
- Policies.
- Next DST-SMO is on October (deadline: August 15!) Thanks to: Serena Criscuoli, Christian Beck, Kevin Reardon, Han Uitenbroek!
- 1st SOLARNET service this month!