SOAR Time-Domain Overview

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Operated by a Consortium

- Time allocation according to partner share –
  - NOAO/Brazil/UNC/MSU/Chile -> 30/30/18/12/10%
  - Note that ~70% of the time allocated through a formal TAC process (somewhere)
  - Time allocation by semester although longer-term programs supported; no DD time or similar rapid access
- Partners set data access policies; generally follow standard NOAO policy

Telescope & Site

- Site properties – image quality
  - 25%: 0.50"
  - 50%: 0.62"
  - 75%: 0.75"

- Telescope and enclosure should degrade top quartile seeing by no more than 10%
  - Active optics tune mirror to achieve this DIQ performance, but it is hard to maintain
  - Upgraded guider should help

- Multiple instruments mounted at Nasmyth/bent cass foci
  - Transfer between instruments in minutes if they are on stand-by

Instruments (Current)

- Goodman High-Throughput Spectrograph (optical)
  - Spectroscopy & imaging (7 arcmin dia)
  - Many modes available but not all at the same time – limit of 3 gratings, 9 filters
  - 70%+ of scheduled use (but many modes)
- SOI (optical imager – 5x5 arcmin field)
  - Evaluate redundancy w/ Goodman in considering long term
- Spartan (NIR imager)
  - YJHK+ narrowband imaging (5x5 arcmin)
  - Needs upgrade to keep viable in long-term
- SOAR Adaptive Module (SAM) + optical imager (SAMI)
  - Visible wavelength GLAO
  - 3 x 3 arcmin field
- "Visitor" instruments with open access – HRCam (speckle); SAM + Fabry-Perot

Instruments (Coming Soon)

- SIFS (IFU spectrograph)
  - Commissioning/science verification underway
- STELES (2 channel [red/blue] echelle spectrograph)
  - Integration at SOAR underway; commissioning this year (probably)
- ARCOIRIS (ex Tspec 4, NIR spectrograph, R~3000)
  - Currently operational on Blanco
  - Reconfigure and transfer to SOAR in 2018

<u>Software Tools</u>

- Automation
  - Improved sequencing of instruments (mainly Goodman needing more work)
  - Improved integration of telescope/guider/instruments
  - Initial phase underway – outcome likely to leave some human intervention (e.g., target confirmation, slew approval)
  - Goals:
    - Increase observer efficiency
    - Increase telescope operator efficiency
    - Evolve (ideally) to mode where simple observations require only the telescope operator
    - Necessary for queue operation, but queue operation is not the primary driver at present
  - Robotic operation is <u>not</u> a goal

Software Tools

- Data reduction
  - Development effort for Goodman "baseline" modes underway
  - Intended data product is reduced data, not discardable "quick look"
  - Baseline operation is using computers at SOAR, not installing elsewhere (code and installation instructions available but human support limited)
  - Pipelines for other instruments exist in some form; need to make them more user-friendly and generally available
    - Heterogeneous source languages, interfaces
    - Phase 2 could involve regenerating them in better compliance with standards

Observing Modes (Now)

- Classical, in-person (on mountain)
  - At this point, maybe 10% of total time

- Classical, remote (somewhere on Earth with internet)
  - Most observing done this way
  - Can result in reduced productivity with unprepared observers
  - Allocation unit full or half nights (latter hard to schedule)

- Target of Opportunity
  - Observer connects remotely – currently used for events with advance notice (days to hours) but faster response possible in theory (done in the past)

- Service/Queue
  - Current SOAR staffing levels can't support this
  - Brazil used to do this but it stressed their local staff
  - Would simplify fractional night issues

Observing Modes (Future?)

- Extended Time-Domain Participation Issues:
  - Definitely need increased automation – solution in progress
  - Definitely prefer automatic data reduction – solution in progress
  - Biggest conflict is <u>not</u> between instruments but within instruments – Goodman gratings/filters/detectors; SOI filters
  - Calibrations potentially an issue also
  - Scheduling a serious issue:
    - Current target-of-opportunity observing has limited impact on classical programs (few hours/semester)
    - Multiply by a factor >10 and there will be issues unless classical time adjusted in advance
    - Multiply by a factor >100 (LSST scale) and classical observing is meaningless
    - <u>No</u> comprehensive (let alone automatic) mechanism for conflict resolution; a problem at current levels and will only be worse with more triggers
    - Fractional nights a persistent issue

Observing Modes (Future?)

- Extended Time-Domain Participation Issues (2):
  - Queue mode is a logical solution but ----
    - Requires completion of the automation effort
    - Requires additional scientific staff even so
    - Does not support all science programs –
      - Likely to require limiting the available modes with Goodman (& SOI if it continues)
      - Need to leave space for continued classical observing with only highest-priority interrupts (for excluded modes, visitor instruments, coordination with other facilities, etc.)
  - Interfaces to Time-Domain "System"
    - Need to define interfaces between SOAR and external target manager
    - Probably implies work for people on both sides of the interface
  - Does <u>not</u> require that all partners participate, however
    - Example Brazilian queue operation in the past