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
Software Tools

• 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 not 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 not 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
    • No 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 not require that all partners participate, however
      • Example Brazilian queue operation in the past