



# Observing Strategies For NOAO proposers

Chris Farrington

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# What science do you want to do?

- Can we do it overall?
- Which instrument is the best for the science?
- Is the timing realistic?
  - How much data will be needed?
  - Is it in a part of the year that will facilitate the time needed?



# About requesting time: The Technical Part of the Proposal

- From the proposal form-
  - Describe the observations to be made during this observing run. Justify the specific telescope(s), the number of nights, the instrument, and the lunar phase. List objects, coordinates, and magnitudes (or surface brightness, if appropriate) in the Target Tables section.



# Choosing Baselines/Telescopes

- Instrument?
- Star type?
  - Single star (diameters)
  - Binaries/Multiple stars (separation, position angles)
  - Imaging?
  - Multi-wavelength?
- Can it be done at the time needed?
  - Delay?
    - Fixed increments – PoPs
    - Variable delay - carts

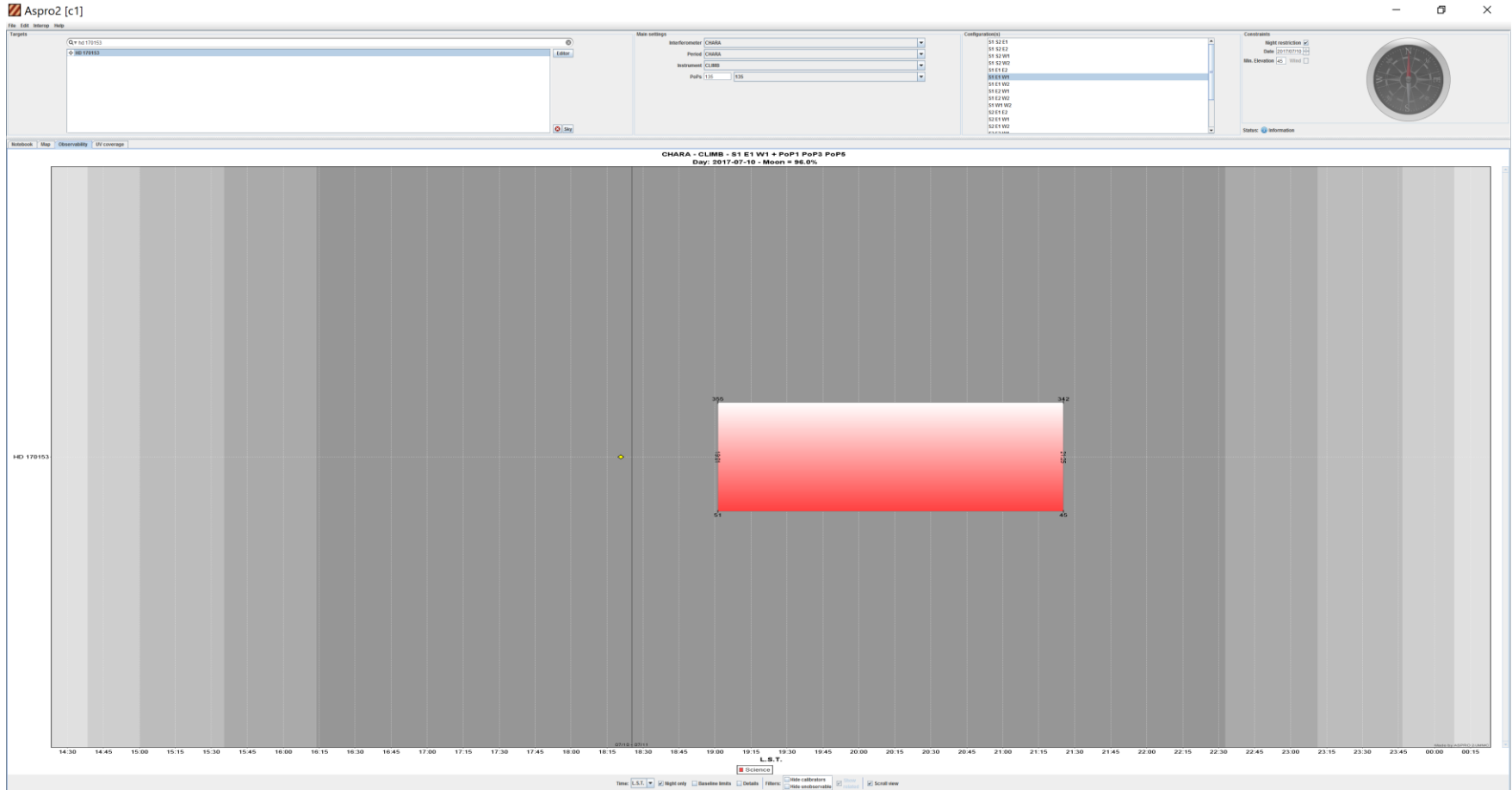


# CHARA Plan and ASPRO

- Planning tools
  - ASPRO – Java
    - [http://www.jmmc.fr/aspro\\_page.htm](http://www.jmmc.fr/aspro_page.htm)
    - Multi-star, full night planning tool.
  - CHARA Plan – Linux
    - [http://www.astro.gsu.edu/~theo/chara\\_reduction/index.html](http://www.astro.gsu.edu/~theo/chara_reduction/index.html)
    - Most accurate, duplicate of control software, one star at a time.
- Complementary, not one or the other.
- Why use both?



# ASPRO



Observatoire de la COTE d'AZUR



# CHARA Plan and ASPRO

The screenshot shows the CHARA\_PLAN application interface on the left and a Gnuplot window on the right. The CHARA\_PLAN window displays a table of observation parameters for various beams (S1, S2, E1, E2, W1, W2) and a status log. The Gnuplot window shows a plot of Elevation (degrees) versus UT (hours) for HD\_170153, with data series for Elevation, Delay Limits, S1, E1, and UT Now.

Beam	POP	Beam	Object	When	Find IRC	HD	SAO
S1	POP1	BEAM1	S1	UT Year: 2017, UT Month: 07, UT Day: 10	NOT SET		
S2	POP1	BEAM1	S2				
E1	POP3	BEAM1	E1	HD_170153			
E2	POP1	BEAM1	E2	NUM: 221715, IRC: +70144, HR: 6927, HD: 170153, SAO: 9087			
W1	END	BEAM1	W1				
W2	POP1	BEAM1	W2				

Status Log:  
Data file created.  
Data file plotted.  
HD\_170153 Above 20 degree from 3:36 to 12:22  
Transit or highest elevation at 6:58 at elevation 51.5 degrees.  
Twilight from UT 03 36 00.000 to 12 22 00.000.  
Delay possible 7:39 to 11:01  
Whenstar calculation complete.  
Running job DO NOTHING.  
Do Nothing.  
Running job UNLINK PLOT DATA.

Gnuplot Plot:  
Title: HD\_170153 HD\_170153 2017(07)10 Ref = 01  
Y-axis: Elevation (degrees)  
X-axis: UT (hours)  
Legend: Elevation (red), Delay Limits (green), S1 (blue), E1 (magenta), UT Now (cyan)



# Beams and PoPs

- CLIMB – Beams 1-3 or 4-6
- Classic – Beams 5-6
- JouFLU – Beams 3-4 or 5-6
- MIRC – ALL
- PAVO – Beams 1-3
- VEGA – Beams 1-3 (4)
- PoPs – Used for selecting general areas of the sky.  
Can be switched during the night to follow stars (with some limitations).





# Limitations of the Instruments

- Magnitude and wavelength
  - Array as a whole – Star tracking – 12-14 in R
  - Classic – 8.5  $m_K$  (limit untested in H, 8?)
  - CLIMB – 7.0  $m_K$  (limit untested in H, 6.5?)
  - JouFLU – 5.0  $m_K$
  - MIRC – 5.0  $m_H$
  - PAVO – 7.0  $m_R$
  - VEGA – 6.0  $m_R$  (Needs fringe tracking with CLIMB + LDCs ~ 5.5-6.0  $m_K$ )



# Choosing Calibrators

- As the system as a whole has multiple factors that bring the ideal system visibility down from 1.0 to some fraction, we have to use calibrators to determine the real visibility of the target.
- Each combiner has different requirements for calibrators
- In general, we want single unresolved stars with somewhat similar magnitudes within a 10 degree square around the target.
- If the star passes near zenith, need calibrators on the same side (north or south) of zenith to avoid long slews.
- The smaller the difference the faster the data sequence, less fringe movement, etc.
- SearchCal tool from JMMC
  - [http://www.jmmc.fr/searchcal\\_page.htm](http://www.jmmc.fr/searchcal_page.htm)
- Minimum of two calibrators per object, three is better
  - Always finding unknown binaries



# Actual Observing

- Observing Cadence
  - Also depends on instrument
  - Cal-Obj-Cal in general
    - For fast instruments (Classic, CLIMB, JouFLU, PAVO)
    - Cal1-Obj-Cal2-Obj- Cal1 or Cal1-Obj-Cal2-Cal1....
  - Slewing between object/cal from command to data sequence start generally less than 5 minutes including cart movement
  - Data sequence times (from star acq to end of file):
    - Depends on seeing
    - Fast instruments - approximately 5-7 minutes minimum
    - VEGA – Between 5-20 minutes
    - MIRC – 45-60 minutes



# Observing Cont...

- The type of object will determine how much data you need
  - Diameters – Several brackets of data per baseline on two separate nights (for Classic/JouFLU/2T PAVO)
  - Binaries – Minimum of two brackets or SFP observations on 3 baselines (triangle)
  - Imaging – As many brackets that can be obtained in the time allowed, the more the better



# Coming to the Array

- If awarded time, please contact me to discuss any questions you might have, and if you have never been to the CHARA Array before, please consider coming out to observe in person at least on the first night(s)
- [farrington@chara-array.org](mailto:farrington@chara-array.org)