



# NExSci Interferometry tools: getCal and VMT

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# Overview

- NExSci has maintained tools from PTI and developed tools for KI
- The tools most relevant to other interferometers are:
  - getCal: observation planning and calibrator selection
  - VMT (visibility modeling tool): calculation of visibilities (and other quantities) using real array parameters for geometric and user supplied source configurations



# getCal

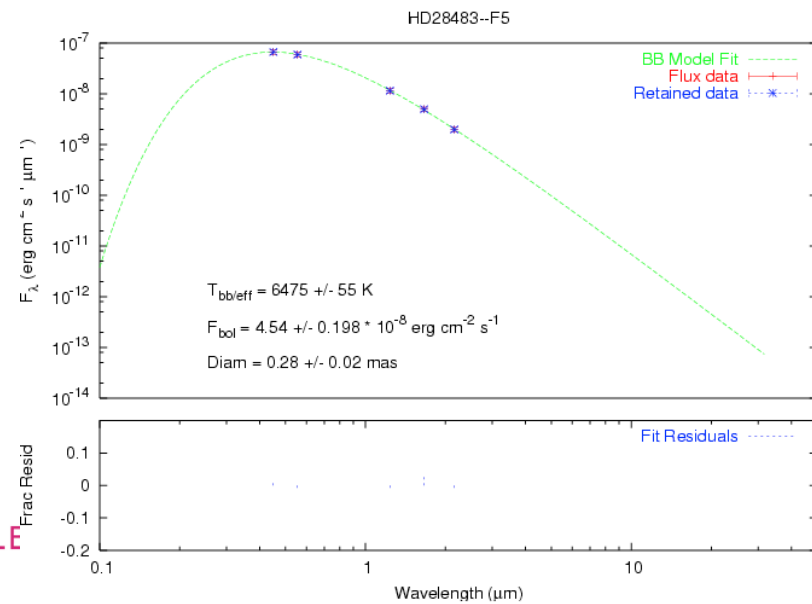
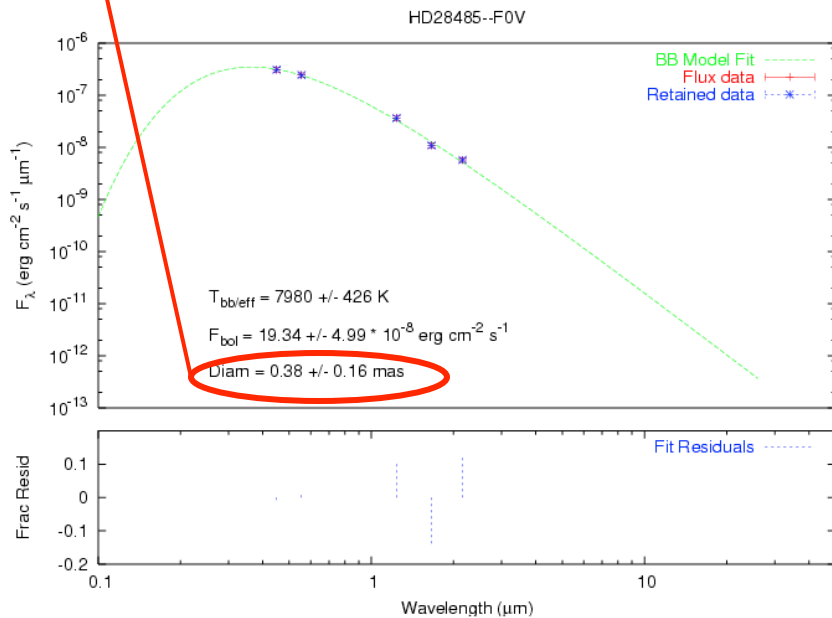
- Extracts potential visibility calibrators from Hipparcos according to geometric and astrophysical criteria (e.g. brightness, luminosity class, estimated angular diameter)
- Estimates calibrator angular diameters by a variety of methods, including bolometric flux/ effective temperature methods based on spectrophotometry retrieved from Simbad.
- Computes both temporal and calendar target and calibrator accessibility (zenith angle and delay) restrictions for user-defined observation locations and/or baselines.
- Generates displays of target (list) timings, and runs in real-time against a nightly observing list, displaying LST and sunset/sunrise indicators.
- Generates displays of target (list) calendar accessibilities.
- Displays u-v tracks limited by delay and zenith-angle restrictions on user-selectable target and baselines. Also runs in real time to provide current u-v and relative geometry information.
- Online version: <http://nexsciweb.ipac.caltech.edu/gcWeb/gcWeb.jsp>



# getCal calibrator searches

- Currently uses Hipparcos catalogs as basis
  - Multiplicity/astrometry annex info automatically returned
  - Can include bolometric flux fitting for all potential calibrators

```
# HIP 20995 (HD 28485) has his multiple component flag set to C
# the C designation indicates solutions were found for individual components
# 2 components:
# A component -- V= 5.748
# B component -- V= 8.265 at sep 1.65 arcsec/PA 18 deg
# Simbad Search HD28485: HD 28485 -- Double or multiple star F0V V=5.552
HD28485 04 30 08.598 +15 38 16.226 0.112 -0.024 5.6 4.9 0.32 SPECTYP=F0V... DIAM=0.4 DIAMERR=0.2 ROLE=CAL CALFOR=t_tau D=4.4
# Simbad Search HD28483: HD 28483 -- High proper-motion Star F5 V=7.10
HD28483 04 30 17.972 +19 50 26.073 0.101 -0.028 7.1 5.9 0.47 SPECTYP=F6V DIAM=0.2 DIAMERR=0.1 ROLE=CAL CALFOR=t_tau D=2.0
```



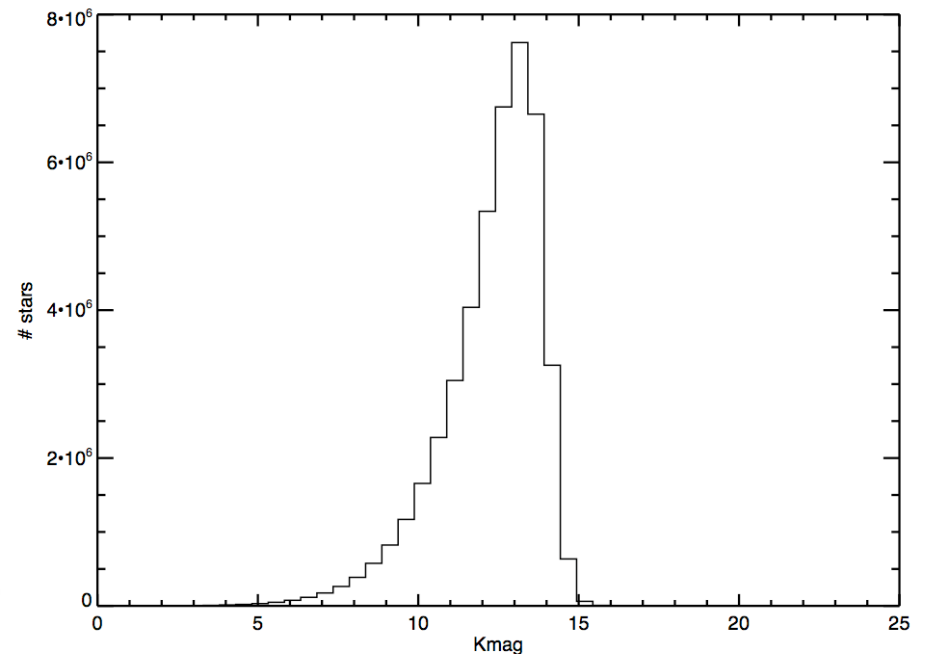
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# Current getCal Development

- getCal 2.11:
  - Access to NOMAD catalog for installed version
    - Catalog compiled by USNO with astrometric and photometric data for about 1.1 billion stars derived from the Hipparcos, Tycho-2, UCAC2, Yellow-Blue 6, and USNO-B catalogs for astrometry and optical photometry, supplemented by 2MASS near-infrared photometry.
    - We have constructed a subset catalog of sources with good VJHK photometry
      - No external queries needed
    - 45M objects with histogram peaking at  $K=13-14$
    - Available late spring



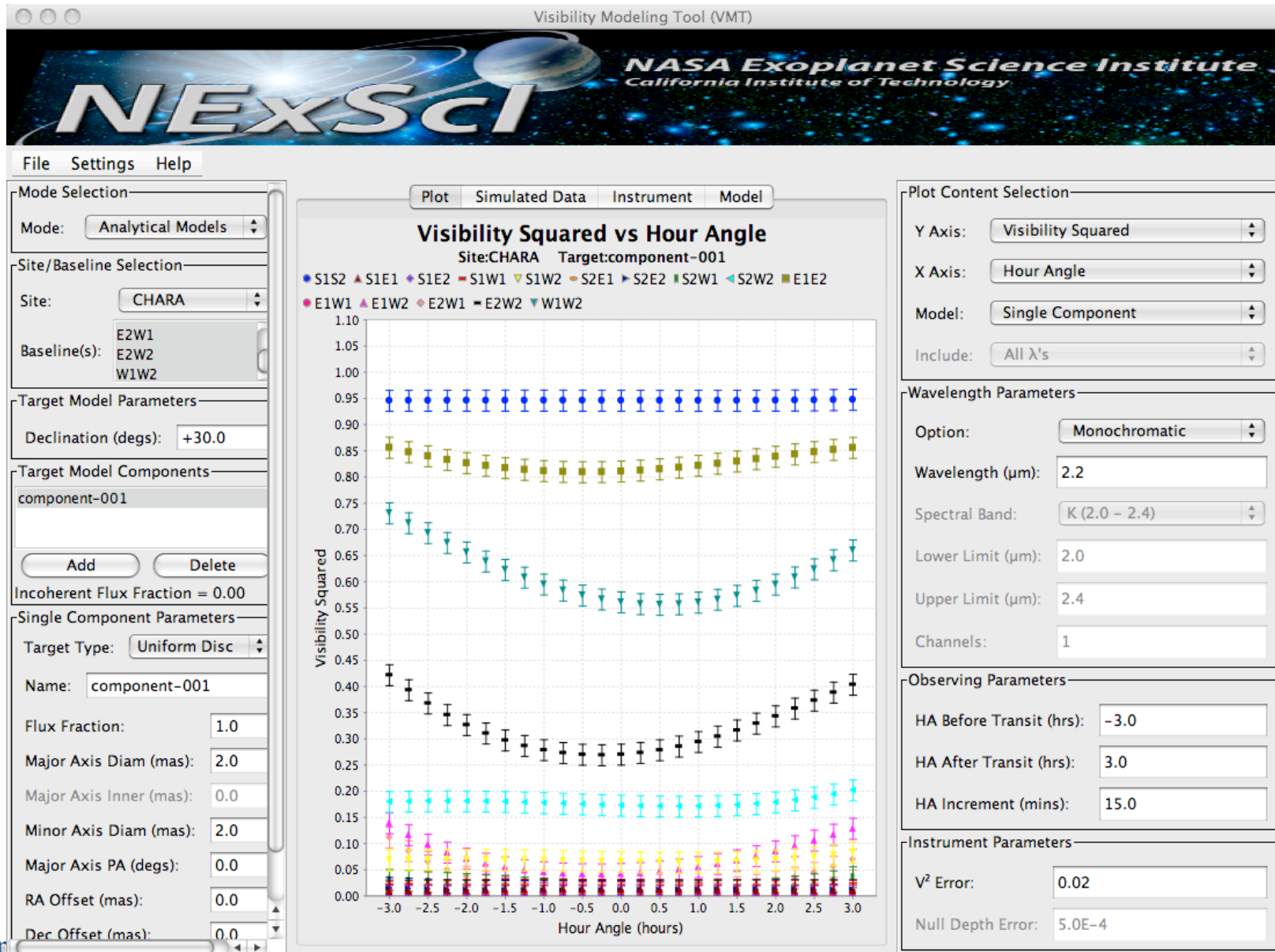


# VMT

- VMT performs visibility amplitude predictions
  - Geometrical models constructed as combinations of elementary morphologies (point source, uniform disk or ring, and Gaussian)
  - Arbitrary brightness uploaded as a FITS image.
- Data in the OI-FITS standard can be uploaded and plotted alongside the VMT simulations.
- Can run online or download java file
  - <http://nexsciweb.ipac.caltech.edu/vmt/vmtWeb/>
  - <http://nexsciweb.ipac.caltech.edu/software/>

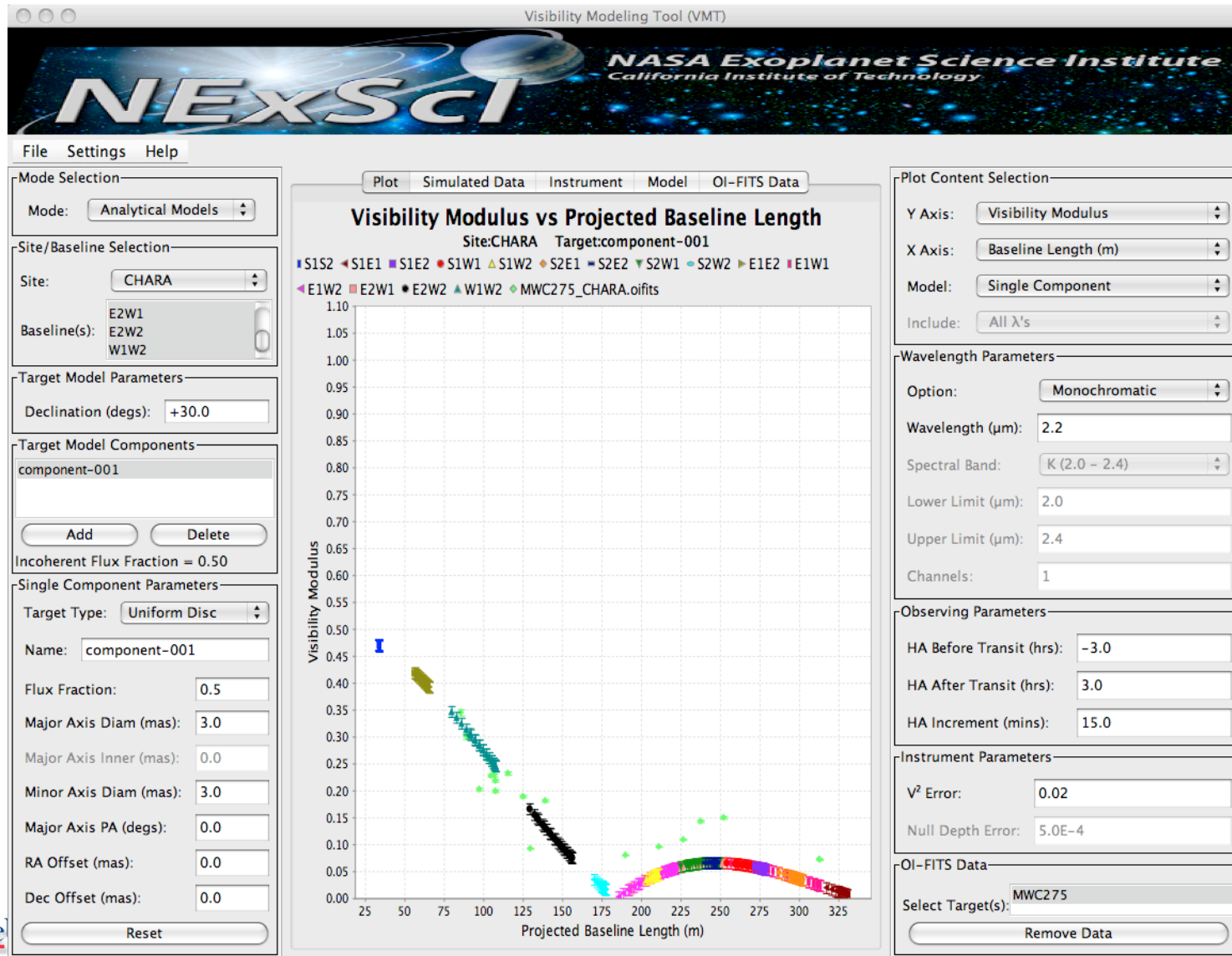


# VMT example: resolved source





# VMT Example: input data







# VMT example: input image

Visibility Modeling Tool (VMT)

NASA Exoplanet Science Institute  
California Institute of Technology

NEXSCI

File Settings Help

Mode Selection  
Mode: Upload Image

Site/Baseline Selection  
Site: CHARA  
Baseline(s): E2W1, E2W2, W1W2

Target Model Parameters  
Declination (degs): +30.0

Image Upload Parameters  
Pixel Scale (mas/pixel): 0.5

Plot Simulated Data Instrument FITS Image Image 2D Vis Modulus

Visibility Map  
Uploaded Image: image\_example.fits

Legend: S1S2, S1E1, S1E2, S1W1, S1W2, S2E1, S2E2, S2W1, S2W2, E1E2, E1W1, E1W2, E2W1, E2W2, W1W2

Y Axis: Visibility Modulus  
X Axis: Baseline Length (m)  
Model: FITS Image  
Include: All  $\lambda$ 's

Wavelength Parameters  
Option: Monochromatic  
Wavelength ( $\mu$ m): 2.2  
Spectral Band: K (2.0 - 2.4)  
Lower Limit ( $\mu$ m): 2.0  
Upper Limit ( $\mu$ m): 2.4  
Channels: 1

Observing Parameters  
HA Before Transit (hrs): -3.0  
HA After Transit (hrs): 3.0  
HA Increment (mins): 15.0

Instrument Parameters  
 $V^2$  Error: 0.02  
Null Depth Error: 5.0E-4

uv=[0.356, 0.376] Modulus=0.0026

Zoom In Zoom Out Gridlines Line Profile

Upload FITS Image



# Future Development

- getCal 2.12/gcWeb 2.0:
  - Access to NOMAD in web version of getCal, uniform treatment of all stars i.e. implement SB relations for ang. Diameter estimates.
  - Available by late summer
- VMT
  - Add support for phases
    - Requested by several users.
  - Considering various options for funding support