Planning your interferometric observations with VLTI

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Charles University, Prague

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ESO-MEYS Traineeship

First year of my PhD at Garching

- 6-12 months at Garching or Chile (Msc, PhDs, postdocs), call every April
- Straightforward application process, a very high chance of success (meanwhile, you have a similar position as ESO Studentship)
- Very lively student community – many seminars, events, and social activities
- Significant scientific growth – you meet the best people in the field, many visitors, everybody is very active and open to collaboration
- You gain a lot of experience – organization, observing proposals, projects, papers,…

ESO Studentship

Currently staying at ESO as part of the Studentship – 18 months

- 6-24 months, must be enrolled in PhD, call every April/October
- More difficult application process – you compete against students from all over the world, you must have a well-prepared project
- The first year helped me gain a lot of essential experience and knowledge of ESO and its people → I was able to prepare a good project and succeed in the official ESO Studentship call
- I was able to expand my project significantly, will now also include ALMA
- Most of my PhD I will spend at ESO

Many seminars for everyone

ESO regular science meetings

	Monday	Tuesday	Wednesday	Thursday	Friday
9:30		Star and planet formation (SPF) coffee (Fornax & hybrid)			
10:00		SPF seminar (online) *bi-weekly			
10:30	Science coffee (old cafeteria)	Science coffee (new cafeteria)	Science coffee (old cafeteria)	Science coffee (new cafeteria)	Science coffee (old cafeteria); Journal Club (Eridanus)
11:00			Informal discussion (Eridanus)		Journal Club (Eridanus)
11:30					Student and fellows meeting (Eridanus) *bi-weekly
12:00		Lunch talk (Eridanus)			Student and fellows meeting (Eridanus) *bi-weekly
12:30					
13:00					
13:30					
14:00					
14:30	Stellar coffee and planetary tea				
15:00	Galaxy evolution coffee *bi-weekly			Joint Astronomy colloquium (Eridanus)	
15:30				Joint Astronomy colloquium (Eridanus)	
16:00	Student organized session (Eridanus) *bi-weekly		AI Forum (online)		
16:30	Student organized session (Eridanus) *bi-weekly				Beer Friday

Updated: 22.8.2022

Seminars, Colloquia, and Lunch Talks

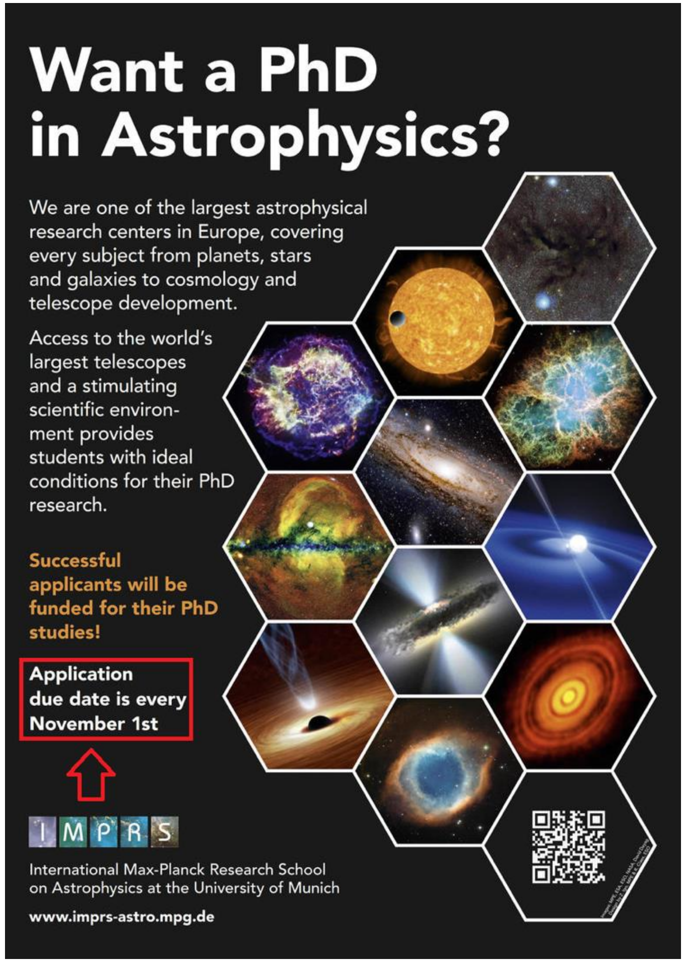
Local information about Seminars, Colloquia, and Lunch Talks:

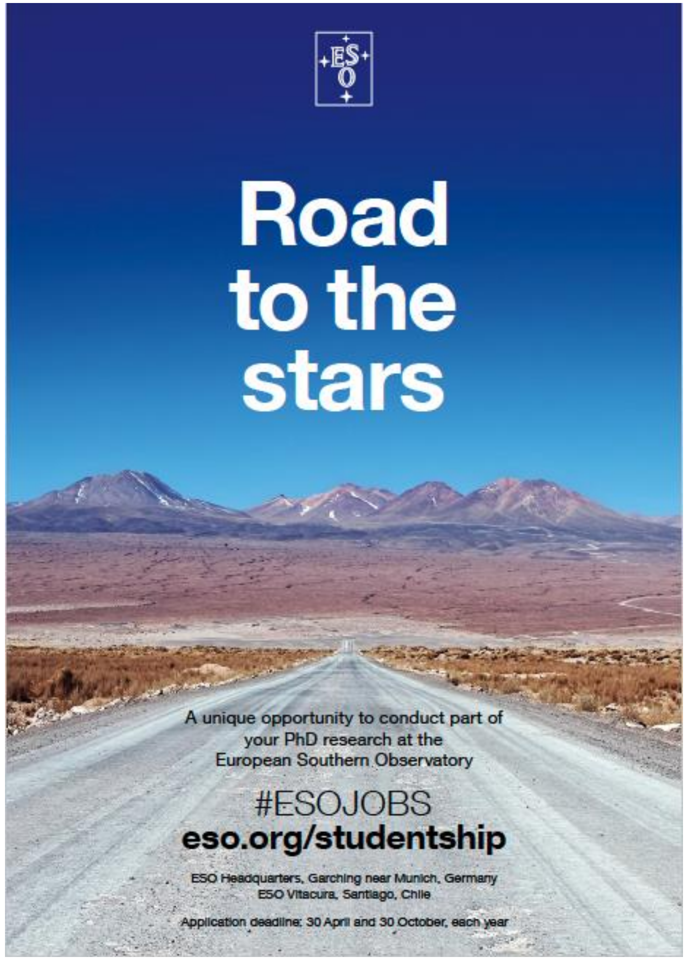
Garching

- Upcoming Talks
- Past Talks (all)
- Past Talks (only with videos)
- Talks
  Most talks at ESO Garching fall into one of the following categories:
  - ***AI Forum*:** usually Wednesdays at 14:00.
    Contacts: Amelia Bayo, Natalie Behara, Henri Boffin, Faviola Molina, Nicolás Monsalves (U La Serena) and Paula Sanchez Saez
  - ***AGN Coffee*:** usually Wednesdays at 15:00 [not taking place weekly].
    Contacts: Vincenzo Mainieri.
  - ***Bayes Forum*:** usually Fridays at 15:30.
    Contacts: Michael Burgess (MPE), Torsten Enßlin (MPA), Fabrizia Guglielmetti (ESO), Lukas Heinrich (ODSL), Oliver Schulz (MPP), Andy Strong (MPE), Udo von Toussanit (IPP).
  - ***Science Coffee*:** from 10:30 to 10:45, Mon-Wed-Fri in the cafeteria of the old building, Tue-Thu in the cafeteria of the new building.
  - **Career Seminar (ESO/LMU/MPA/MPE)**
    Contact: Organisers mailing list
  - ***Cosmic Duologues***
    Contact: Organisers email
  - ***ELT Meetup for Fellows and Students***
    Contacts: Michele Cirasuolo
  - ***Gaia Coffee*** (Online): alternate between Wednesdays at 15:00 and Mondays at 10:30.
    [not taking place at the moment]
  - ***Galaxy Cluster Discussion Group*:** usually Wednesdays at 14:00.
    Contact: Tony Mroczkowski
  - ***Galaxy Evolution Coffee:*** ussulay Thursdays at 09:30.
    Contacts: Claudia Pulsoni (MPE), Ilaria Marini, and Pierrick Verwilghen.
  - ***Gas Matters Club*:** every second Monday at 11:00.
    [not taking place at the moment]
  - ***Hypatia Colloquium***
    Contact: Organizers email
  - ***Informal Discussion*:** usually Wednesdays at 10:00 [*in person only*].
    Contacts: Ashley Barnes, Cristine Koelin, Hannah Osborne and Julia Bodensteiner.
  - ***Joint Astronomy Colloquia*:** usually Thursdays at 15:15, preceded by tea and coffee at 15:00.
    Contacts: Alice Concas, Celine Peroux and Giacomo Beccari
  - ***Journal Club*:** usually Fridays at 10:30.
    Contacts: Alice Somigliana, Amanda Rubio, Haochang Jiang, Jakub Klencki, Julia Bodensteiner, Luca Cacciapuoti and Victoria Toptun (organisers ml: jc-organizers@eso.org)
  - ***KES lecture*** *(knowledge transfer from senior to young scientists)*: [not taking place at the moment]
  - ***Lunch Talks/ ESO Colloquia*:** usually Tuesdays at 12:00.
    Contacts: Hannah Stacey and Morten Andersen
  - ***SAOSY Lunch Talks*:** usually Wednesdays at 12:30.
    Contact: Miska Le Louam
  - ***Star and Planet Formation Coffee*:** every alternate Friday at 10:00.
    Contact: Carlo Felice Manara
  - ***Star and Planet Formation Seminars*:** every alternate Tuesday at 10:00.
    Contact: Claudia Toci and Karina Mauco
  - ***Stellar Coffee and Planetary Tea*:** every Monday at 14:30.
    Contacts: Henri Boffin and Jiri Zak
  - ***Wine & Cheese Seminars*:** usually once per month on Wednesdays at 16:30.
    Contacts: Aashish Gupta, Felipe Lohmann, Francisco Nogueras Lara, Luca Cacciapuoti and Marta De Simone
- Talks at Neighbouring Institutes
  For info about talks at neighbouring institutes, see also the Web pages of the:
  - Max-Planck-Institut für Astrophysik (MPA);
  - Max-Planck-Institut für Extraterrestrische Physik (MPE);
  - Universitäts-Sternwarte München (USM);
  - Max-Planck-Institut für Quantenoptik (MPQ);
  - Max-Planck-Institut für Plasmaphysik (IPP);
  - Max-Planck-Institut für Physik (MPP);
  - Excellence Cluster Universe.

Apply yourself – many opportunities

However, ESO/MEYS remains the easiest way of getting to ESO – apply in April!



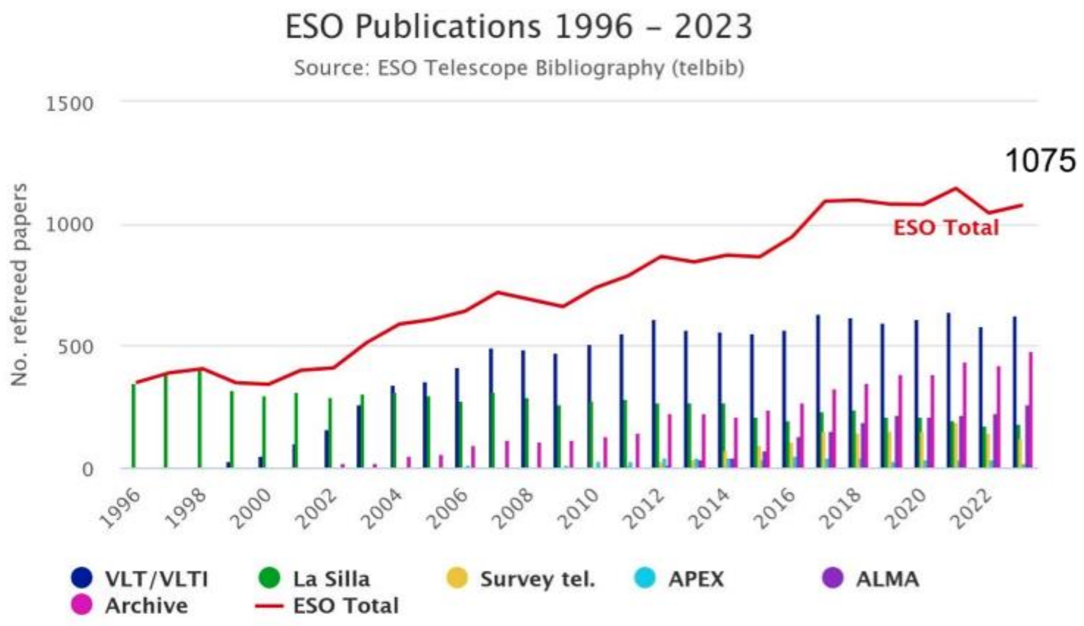


Submitting your proposal (Phase 1)

Your science case

The starting point

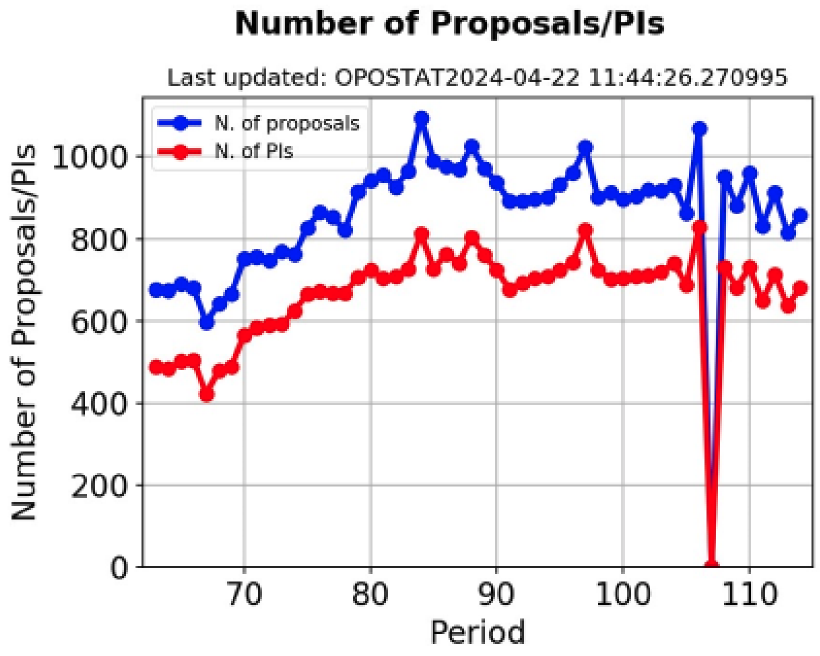
- Does your science case require new observations?
- Was it already observed? Check ESO archive
- What telescope/instrument would be suitable?
- **What are your options?**
  - Calls twice per year for Normal proposals (<100h), once for Large proposals
  - Also possible to apply any time for Director's Discretionary Time (DDT), about 5% of time
  - Other: Monitoring, GTO, Joint proposals, …
  - → upcoming change to the Yearly Proposal Cycle!

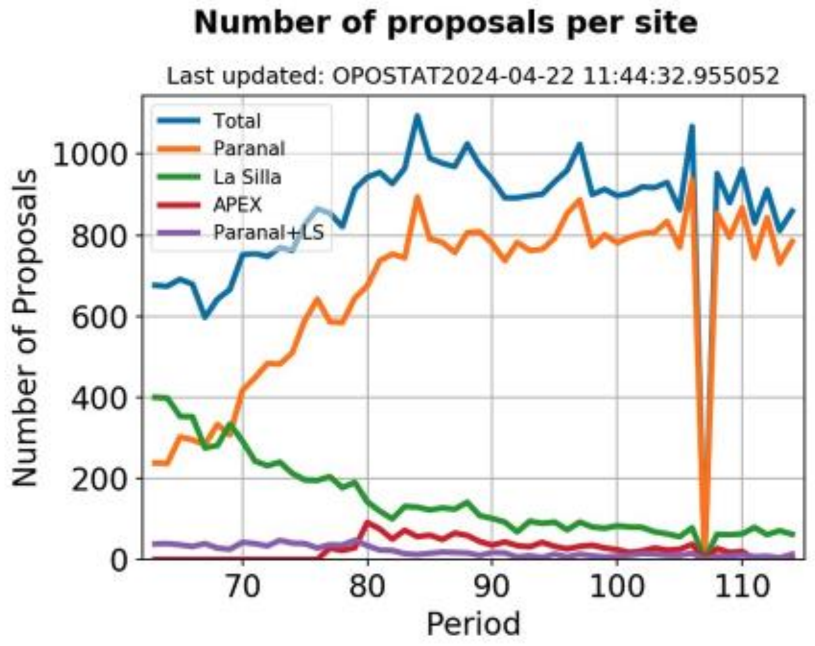


The statistics

You are not the only one with the idea

- The total number of observing time is limited → on average, ~3 times more nights requested than scheduled → many instruments are heavily over-subscribed (some up to 10 times!)
- About ~950 proposals each semester (most submitted in the 24 hours before the deadline)





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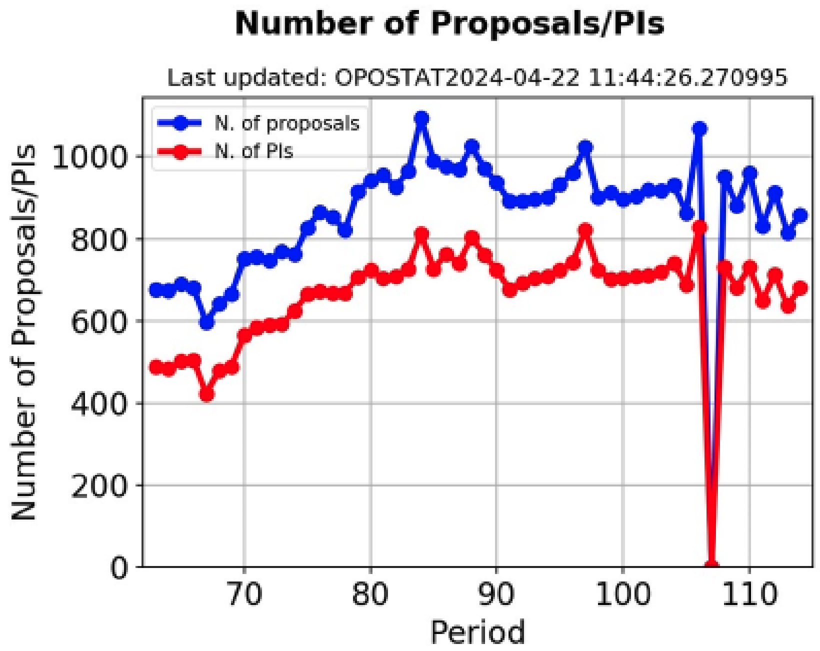
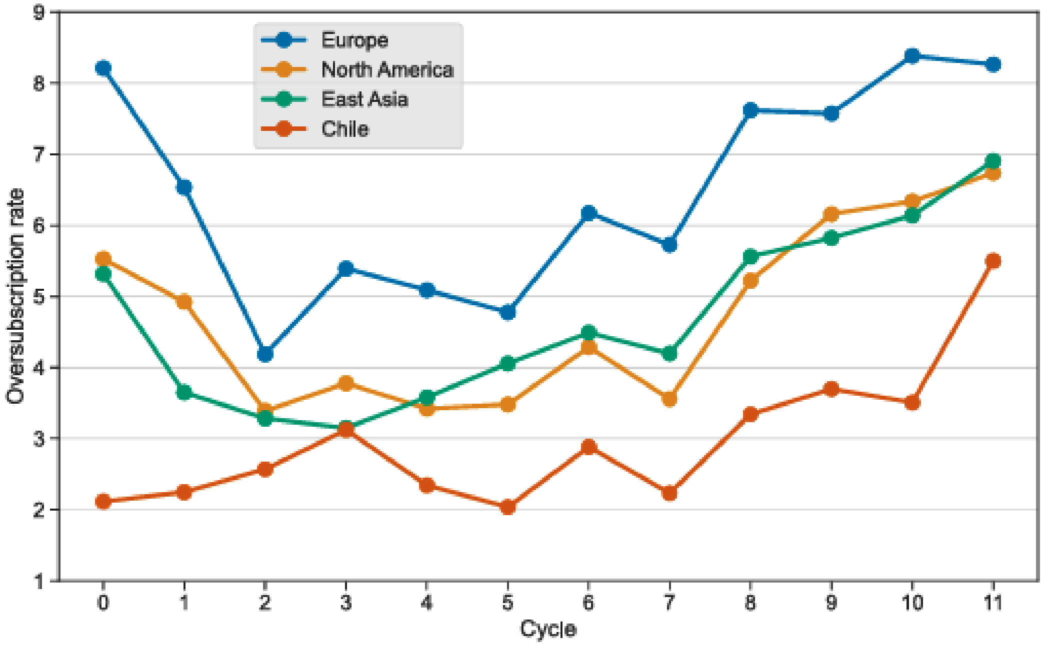
- Even more for ALMA

		Time requested (hours)		
	Number of proposals	12-m	7-m	Total Power
All proposals	1712	31,610	12,995	8928
ACA standalone	87	-	4770	2437
Large Programs	42	4713	2152	1337



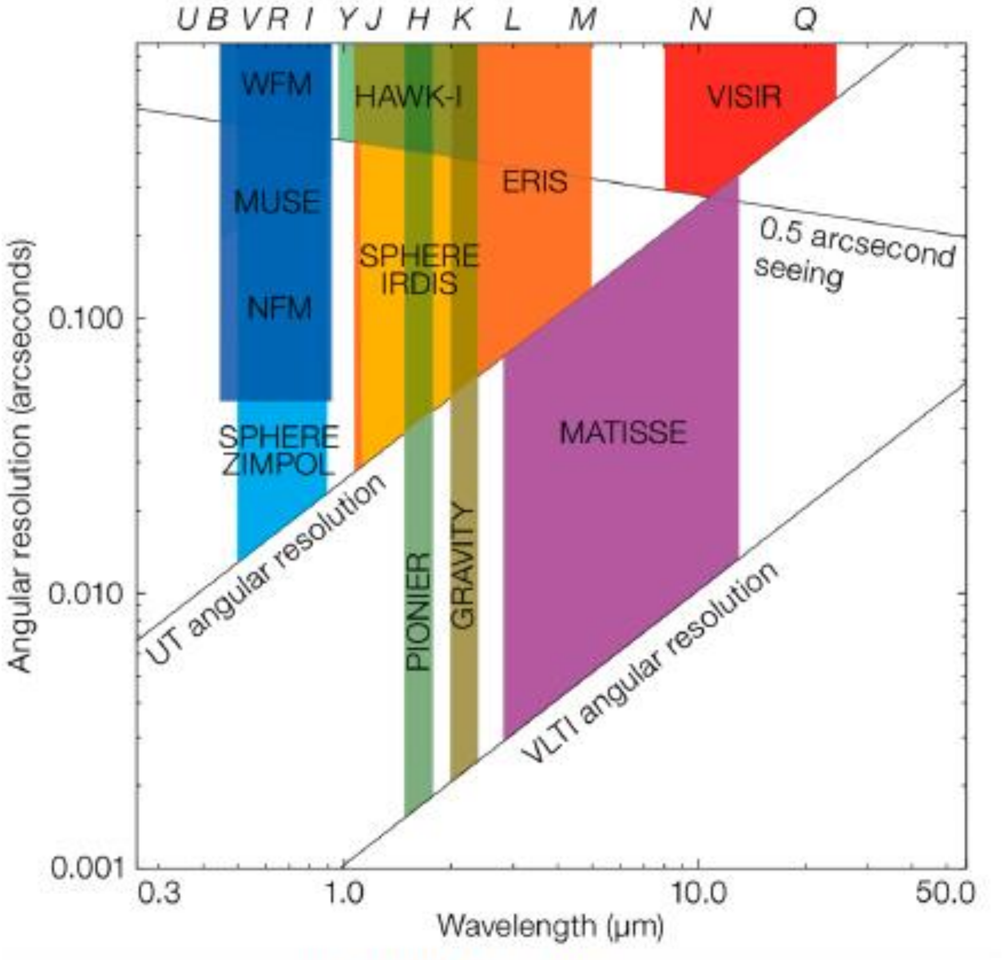


Selecting the instrument/telescope

Are your observations feasible?

- Many various instruments
- What spectral band/resolution do you need?
- Are your goals realistic?
- Visitor vs Service mode

- **For interferometry:**
  - PIONIER – H-band, R<30
  - GRAVITY – K-band, R < 4000
  - MATISSE – LMN-bands, R <3300



Credits: ESO Messenger

Writing the proposal

Is your science case compelling enough?

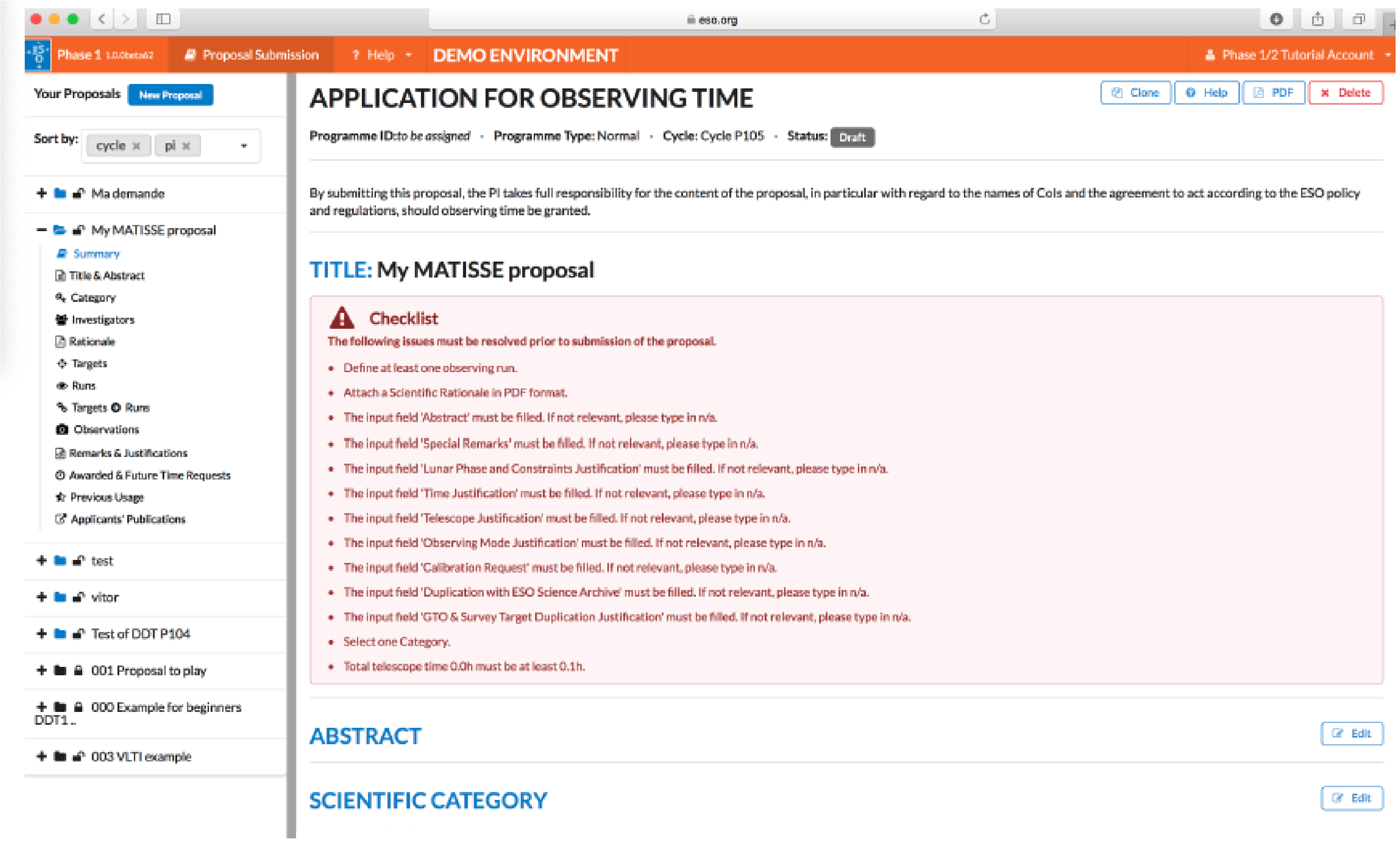
- You should answer these questions (from the guidelines for reviewers https://www.eso.org/sci/observing/phase1/distributed-peer-review.html)

- While reviewing the proposals you should keep in mind these aspects:
    - Does the proposal clearly indicate which important, outstanding question/s will be addressed?
    - Is there sufficient background/context for the non-expert (i.e., someone not specialized in this particular sub-field)?
    - Are previous results (either by proposers themselves or in the published literature) clearly presented?
    - Are the proposed observations and the Immediate Objectives pertinent to the background description?
    - Is the sample selection clearly described, or, if a single target, is its choice justified?
    - Are the instrument modes, and target location(s) specified clearly?
    - Is the signal-to-noise ratio specified in the proposal sufficient to reach the scientific goals?
    - Will the proposed observations add significantly to the knowledge of this particular field?

- Your science justification can have only 2 pages for Normal proposals!

Submitting the proposal

You submit in Phase 1 portal https://www.eso.org/p1



Evaluation process

Even if your science case is great, it may not get scheduled…

- Depending on how many hours you request, your proposal may be evaluated differently
- **Distributed Peer Review (DPR):**
  - Proposals requesting <16 hrs → every PI reviews 10 other proposals
  - Exceptions: Joint proposals, Target of Opportunity, etc
- **Observing Proposal Committee (OPC):**
  - Proposals requesting >16 hrs → panel members rank the proposals
- The PI receives rank (A, B, C) and comments from DPR/OPC

Proposal review and grading

- For each proposal you will be providing a grade (**between 1=outstanding and 5=unsuitable**).

  1.0 – outstanding: breakthrough science

  1.5 – excellent: definitely above average

  2.0 – very good: no significant weaknesses

  2.5 – good: minor deficiences do not detract from strong scientific case

  3.0 – fair: good scientific case, but with definite weaknesses

  3.5 – rather weak: limited science return prospects

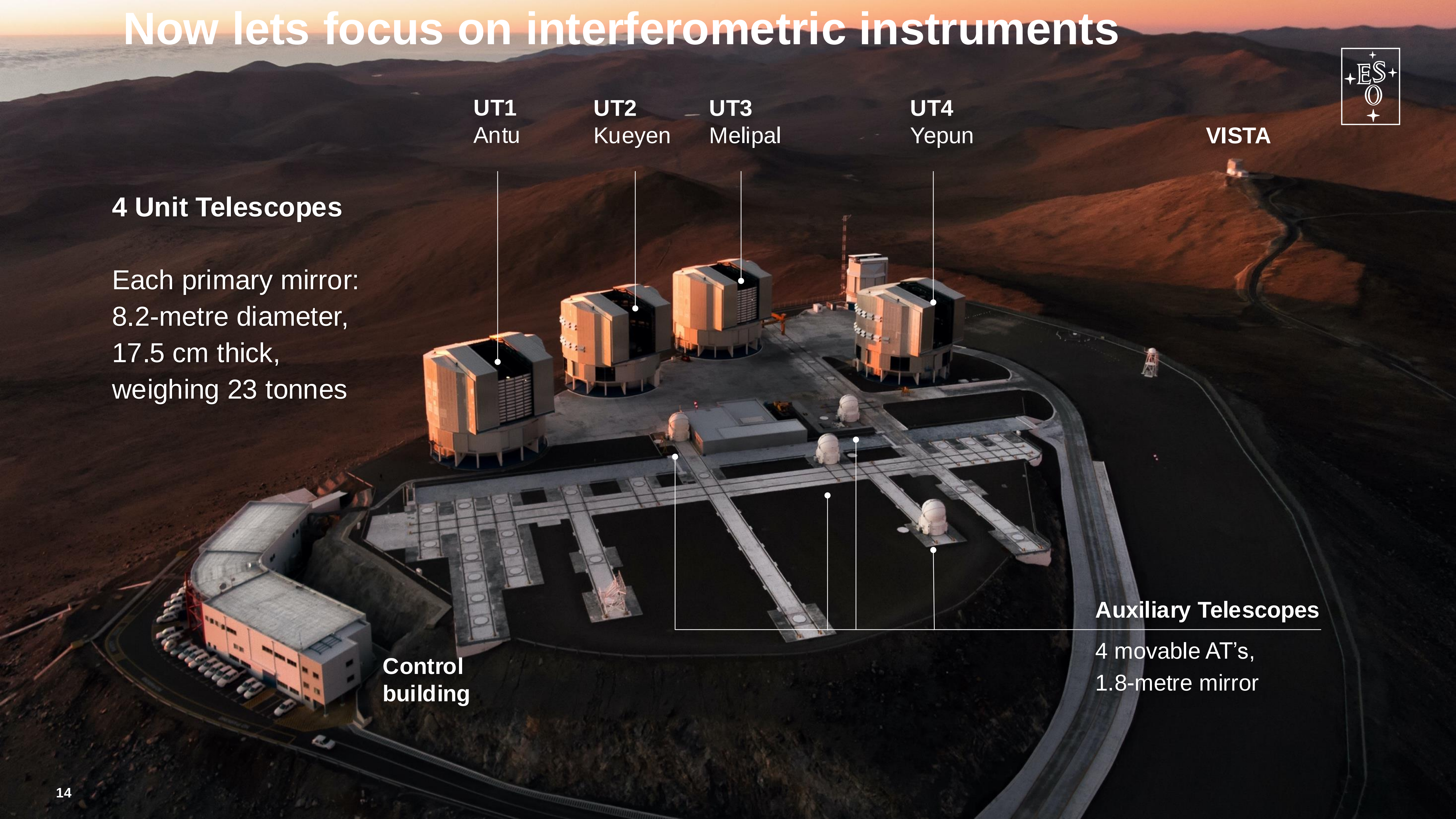
  4.0 – weak: little scientific value and/or questionable scientific strategy

  4.5 – very weak: deficiences outweight strengths

  5.0 – unsuitable

- Proposals with grades larger than 3.0 **will not be considered for scheduling**;

Now lets focus on interferometric instruments



4 Unit Telescopes

Each primary mirror:
8.2-metre diameter,
17.5 cm thick,
weighing 23 tonnes

Auxiliary Telescopes

4 movable AT’s,
1.8-metre mirror

Interferometric proposals

Many specific settings for your proposal

- In Phase 1, you already need to specify which VLTI configuration you will need (but you can also select more configurations)
- Service mode preferred
- VLTI-UTs vs VLTI-ATs: Unit Telescopes are much more oversubscribed
- Weather constraints are very important, loose constraints increase your chances! --> all weather programmes

Paranal			
Telescope	Focus		
	Nasmyth A	Cassegrain	Nasmyth B
UT1		FORS2	KMOS
UT2	FLAMES	VISIR	UVES
UT3	SPHERE	X-SHOOTER	CRIRES
UT4 - AOF	HAWK-I	ERIS	MUSE
ICCF	ESPRESSO		
VLTI/UT	GRAVITY MATISSE Visitor Focus		
VLTI/AT	GRAVITY MATISSE PIONIER Visitor Focus		

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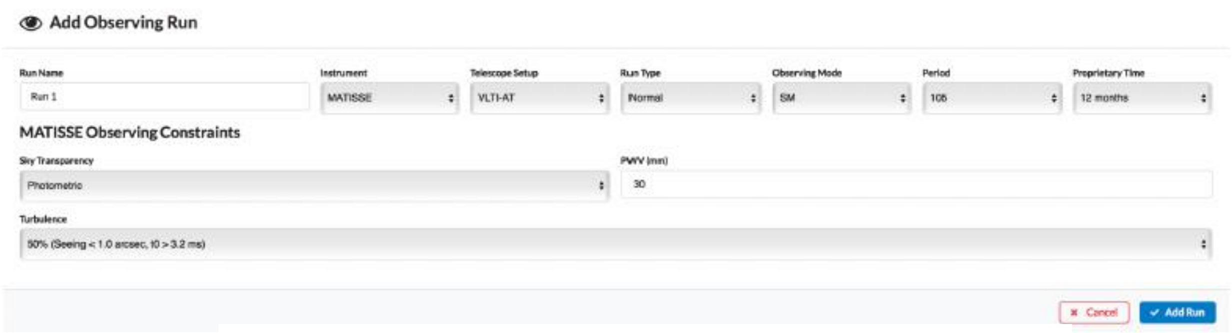

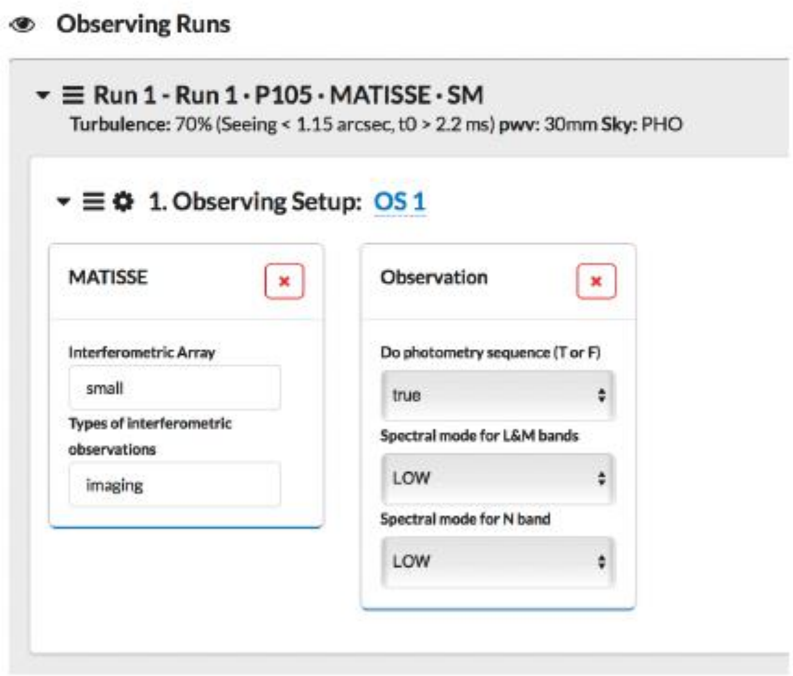

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- Weather constraints are very important, loose constraints increase your chances! --> all weather programmes
- Define your observing runs: one observation usually takes about 0.5 hr → CAL-SCI sequence 1hr, CAL-SCI-CAL 1.5 hrs!
- You don't have to specify calibrators in Phase 1 However, it's good to check beforehand

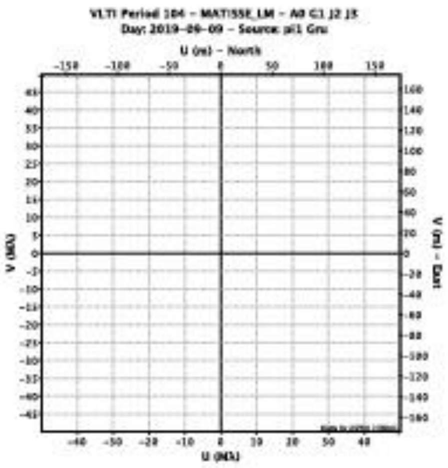
Overheads

Direct links to instruments on UT1, UT2, UT3, UT4, ICCF, VLTI, VISTA, VST.

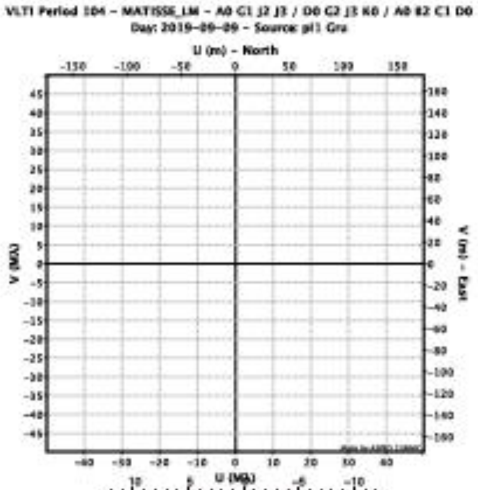
Telescope/ Combined focus	Instrument	Action	Time (seconds)
VLTI			
	GRAVITY	One calibrated visibility, CAL-SCI [7]	3600
	GRAVITY	One calibrated visibility, CAL-SCI-CAL[7]	5400 (requires waiver)
	GRAVITY	Swapping template in dual-field observation	300
	MATISSE	CAL-SCI L-band low and medium resolution, no N-band photometry	2400
	MATISSE	CAL-SCI L-band high resolution, no N-band photometry	3000
	MATISSE	CAL-SCI-CAL L-band low and medium resolution, no N-band photometry	3600
	MATISSE	CAL-SCI-CAL L-band high resolution, no N-band photometry	4500
	MATISSE	CAL-SCI L-band low and medium resolution, with N-band photometry	3600
	MATISSE	CAL-SCI L-band high resolution, with N-band photometry	4200
	MATISSE	CAL-SCI-CAL L-band low and medium resolution, with N-band photometry	5400
	MATISSE	CAL-SCI-CAL L-band high resolution, with N-band photometry	6300
	PIONIER	Hmag -1.0 to 5.0 One calibrated Visibility CAL-SCI-CAL [7]	1800
	PIONIER	Hmag -1.0 to 5.0 One calibrated Visibility CAL-SCI-CAL-SCI-CAL [7]	2700
	PIONIER	Hmag 5.1 to 6.5 One calibrated Visibility CAL-SCI-CAL [7]	2400
	PIONIER	Hmag 5.1 to 6.5 One calibrated Visibility CAL-SCI-CAL-SCI-CAL [7]	3600
	PIONIER	Hmag 6.6 to 8.0 One calibrated Visibility CAL-SCI-CAL [7]	3600
	PIONIER	Hmag 6.6 to 8.0 One calibrated Visibility CAL-SCI-CAL-SCI-CAL [7]	5400

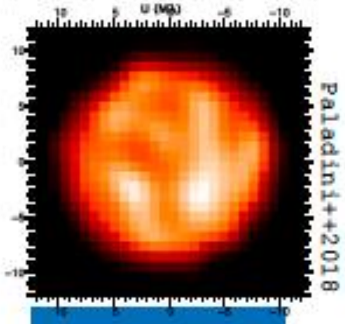
Interferometric proposals

Different types of observations

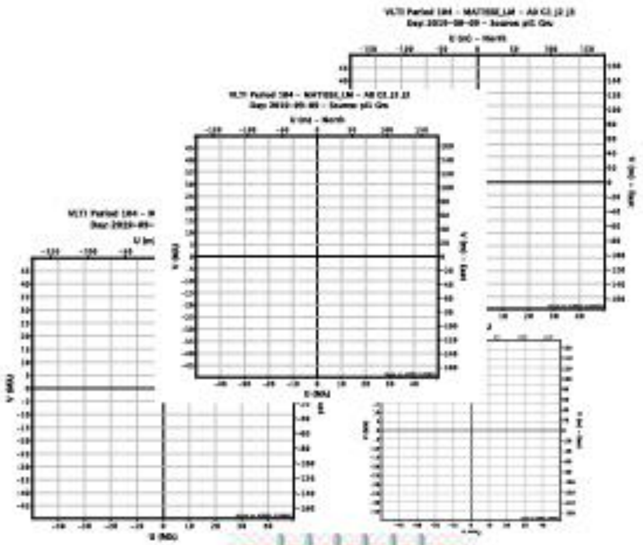


snapshot





imaging



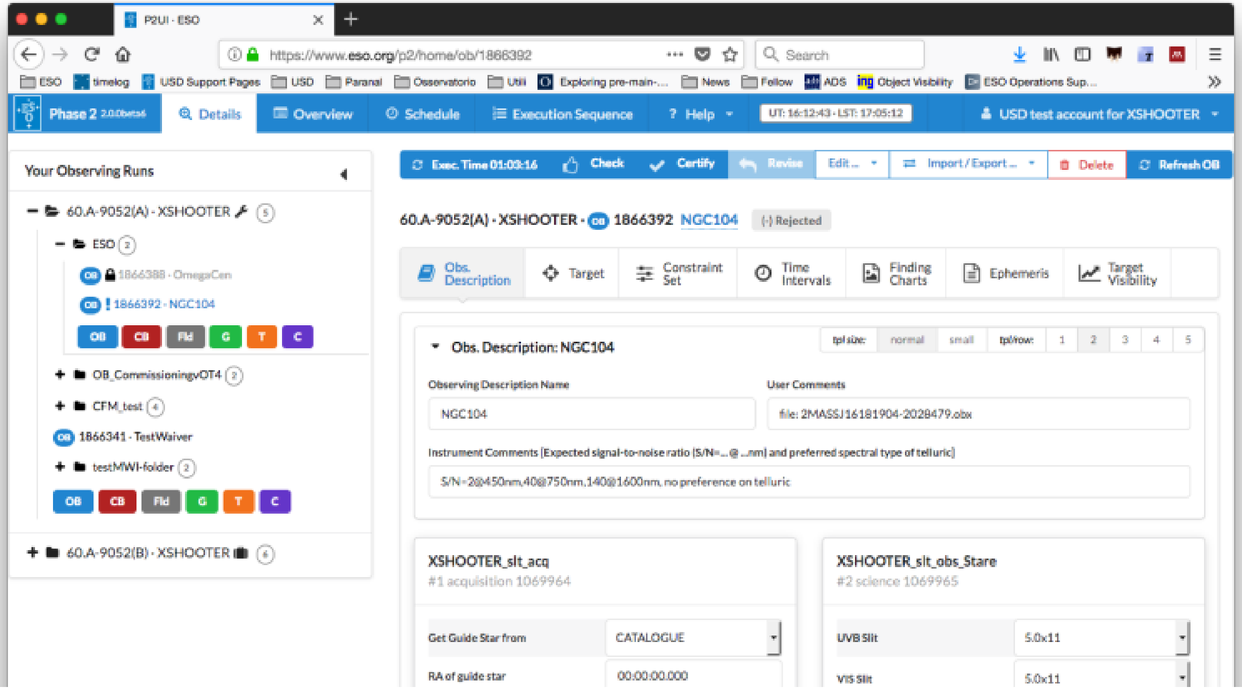
Time-series

Preparing your observations (Phase 2)

Define your observing runs

Another deadline… this time on https://www.eso.org/p2/

- In case you were allocated time, you have to **prepare observing runs** (OBs) for execution:
  - Define each observing run, i.e., each CAL-SCI(-CAL)
  - Decide on instrument mode, exposure times, finding charts, etc..
  - Find suitable calibrators
  - Add time constraints



- In case you have Visitor mode, you don't have to submit this

Technical details

Manuals for each instrument are available at ESO

- Based on the brightness of your target, you should select fringe tracker mode, guiding, number of frames, and exposure time… (see tables in ESO VLTI manual)

GRAVITY_single_onaxis_acq

#1 acquisition 2711955

FringeTracker mode	AUTO
Mode for Metrology Laser	ON
SC object name	omi01_CMa
SC object K band magnitude	0.42
SC object H band magnitude	0.65
SC object diameter (mas)	4.5
SC object expected visibility	0.77
SC object parallax (arcseconds)	0.00129
Science spectrometer resolution	HIGH
Fringe-tracker spectrometer Wollaston	IN
Science spectrometer Wollaston	IN
Type of Coude guiding	ADAPT_OPT
Coude guide star (GS) input	SCIENCE
if SETUPFILE: GS RA	00:00:00.000
if SETUPFILE: GS DEC	00:00:00.000
if SETUPFILE: GS parallax (arcseconds)	0
if SETUPFILE: GS PM in RA	0
if SETUPFILE: GS PM in DEC	0
if SETUPFILE: GS Epoch	2000
GS magnitude	3.27
Interferometric Array	medium,small
Types of interferometric observations	time-series

Delete

GRAVITY_single_obs_exp

#2 science 2711956

Science integration time (DIT in s)	3
Number of science frames (NDIT)	64
Number of sky frames (NDIT)	64
Sky dRA offset in milliarcsecond	2000
Sky dDEC offset in milliarcsecond	2000
Sequence of HWP offsets (deg)	0
Sequence of observations Object (O) and Sky (S)	O S O S O

Duplicate Delete

DIT [s]	Polarisation	Spectral Resolution (INS.SPEC.RES): *LOW*	*MED*	*HIGH*
0.3	Combined	$4.5 < K < 6.5$	$1.0 < K < 3.0$	$-1.5 < K < 0.5$
1.0	Combined	$5.5 < K < 7.5$	$2.5 < K < 4.5$	$0.0 < K < 2.0$
3.0	Combined	$7.0 < K < 9.0$	$3.5 < K < 5.5$	$1.0 < K < 3.0$
10.0	Combined	$8.0 < K < 10.0$	$5.0 < K < 7.0$	$2.5 < K < 4.5$
30.0	Combined	$9.5 < K < 11.5$	$6.0 < K < 8.0$	$3.5 < K < 5.5$
100.0	Combined	—	$7.5 < K < 9.5$	$5.0 < K < 7.0$
300.0[1]	Combined	—	$8.5 < K < 10.5$	$6.0 < K < 8.0$
0.3	Split	$4.0 < K < 6.0$	$0.5 < K < 2.5$	$-2.5 < K < -0.5$
1.0	Split	$5.0 < K < 7.0$	$2.0 < K < 4.0$	$-1.0 < K < 1.0$
3.0	Split	$6.5 < K < 8.5$	$3.0 < K < 5.0$	$0.0 < K < 2.0$
10.0	Split	$7.5 < K < 9.5$	$4.5 < K < 6.5$	$1.5 < K < 3.5$
30.0	Split	$9.0 < K < 11.0$	$5.5 < K < 7.5$	$2.5 < K < 4.5$
100.0	Split	—	$7.0 < K < 9.0$	$4.0 < K < 6.0$
300.0[1]	Split	—	$8.0 < K < 10.0$	$5.0 < K < 7.0$

[1] DIT = 300 s only offered in Visitor Mode

ESO

Table 1: Currently defined fringe-tracker modes. Magnitude ranges are given for the ATs; for the UTs, the same modes apply but for 3^m fainter magnitudes.

FT mode	magnitude range (ATs)	gain	DIT [ms]	Kalman mode
1	$K_{tot} < 2^m$	low	0.85	2
2	$2^m \leq K_{cor} < 7^m$	high	0.85	2
7	$7^m \leq K_{cor} < 9^m$	high	3	2
9	$9^m \leq K_{cor}$	high	10	2

Selecting VLTI configuration

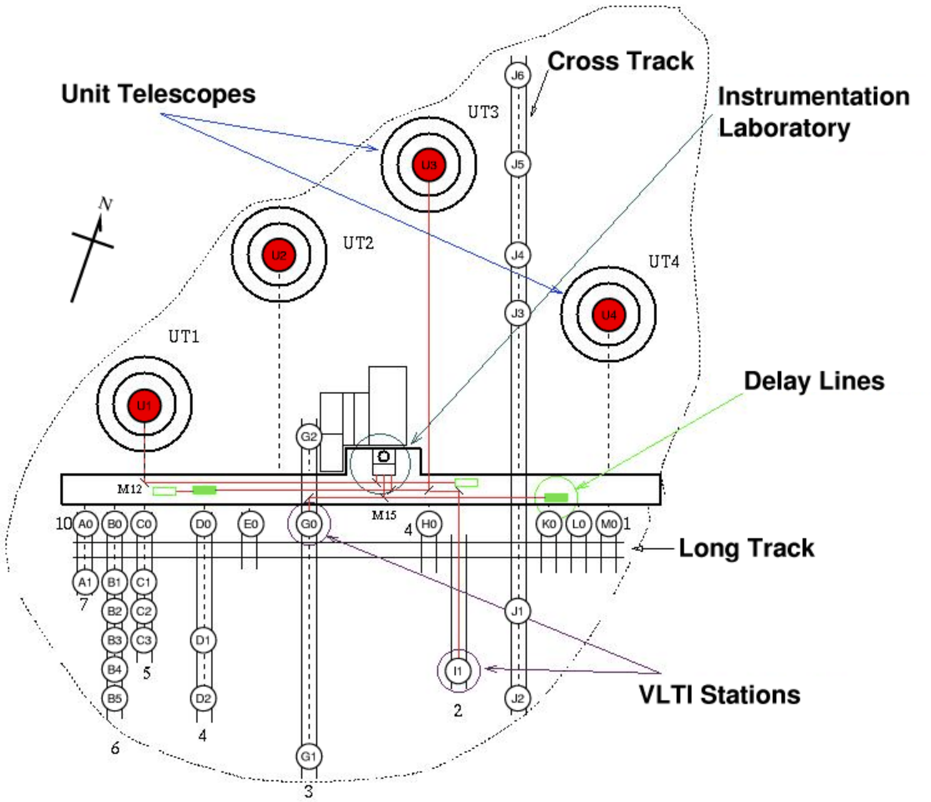
Now we finally get to do some interferometry!

- UTs are more powerful, but they can't be moved → for imaging you can use only ATs, they can be moved to different positions (you gain more UV coverage)
- A larger configuration gives a higher angular resolution → select configuration based on (the expected) size of your target
- In interferometry, B/w (baseline / wavelength) gives you spatial frequency → smaller baselines gives smaller spatial frequency and vice versa
- Meanwhile, <u>smaller objects become resolved at higher sp. frequencies and larger objects become resolved at smaller sp. frequencies!</u>
- → now we can select our configuration

VLTI Configurations Overview

AT configurations are requested by generic names rather than explicit configurations using AT positions. Th
configuration. By clicking on their name, the user can see the sky coverage corresponding to the standard

AT Configurations	PIONIER, MATISSE, GRAVITY single-feed	GRAVITY dual-feed GRAVITY wide
Small	yes	yes
Medium	yes	no
Large	yes	yes
Extended	yes	no



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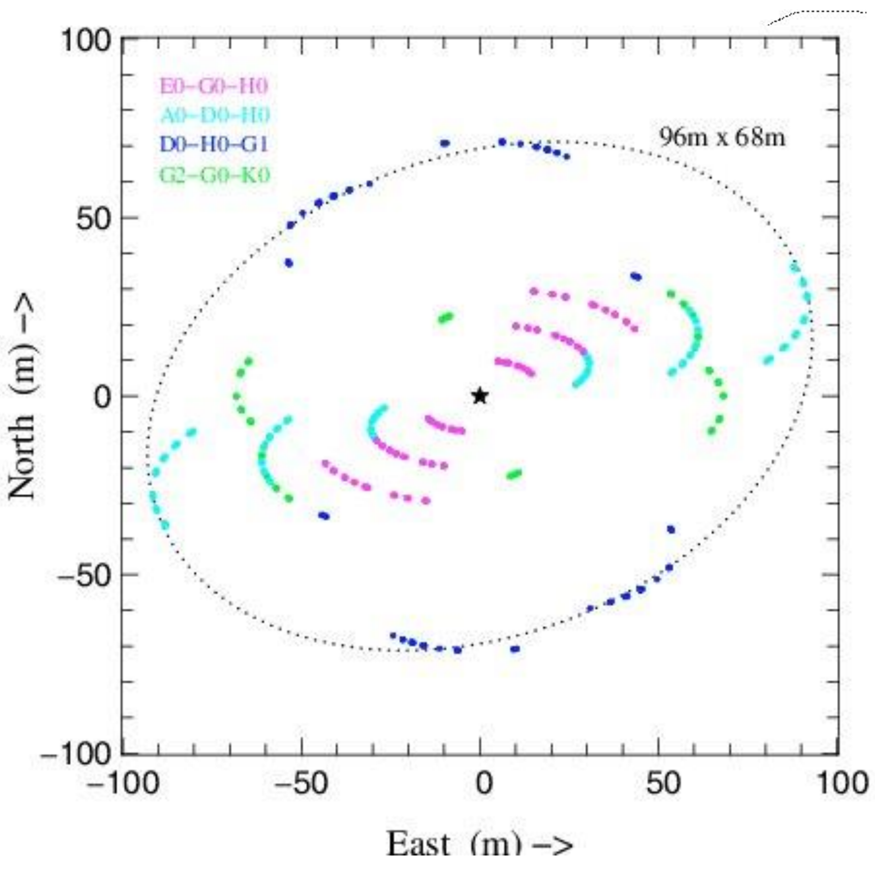
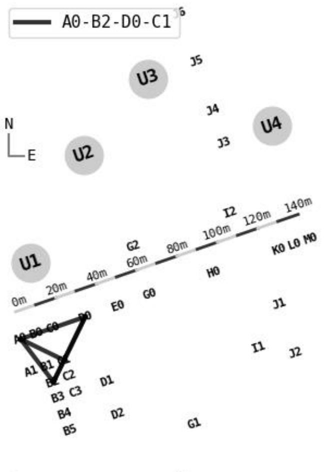
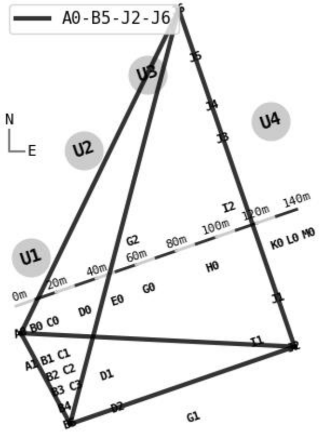






Interferometry

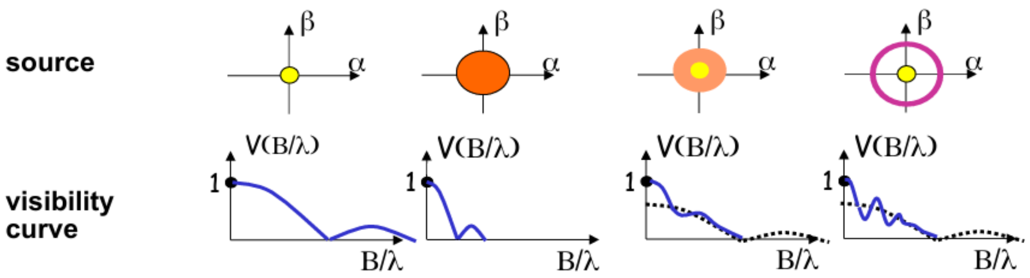
Visibility function

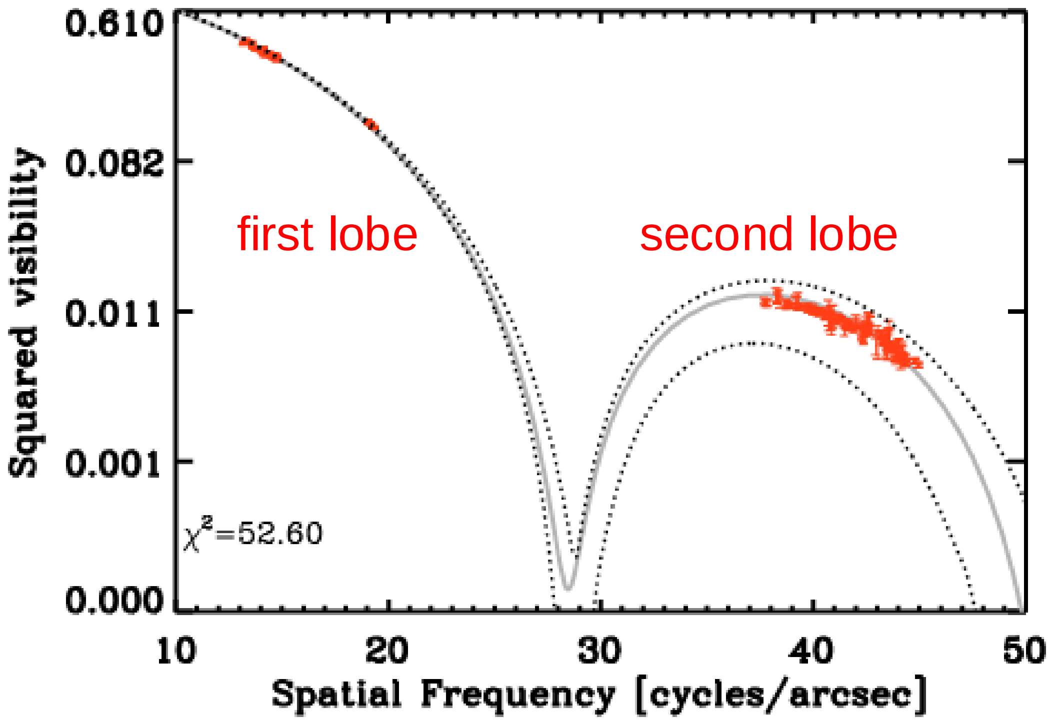
- Ideally, you would like to use all configurations. However, using all baselines for imaging is very time-consuming (e.g., PIONIER + MATISSE → 36 hrs!)
- → often, it is more feasible to do just snapshots or time series at fewer configurations
- For example, if you would like to measure the overall size of your object, you need to measure the first lobe of the Visibility function. Meanwhile, at higher spatial frequencies, you would be sensitive to smaller structures

→ An unresolved target has sq. visibility (V^2) = 1

→ A fully resolved target has $V^2 = 0$

We are interested in the part in between





Interferometry

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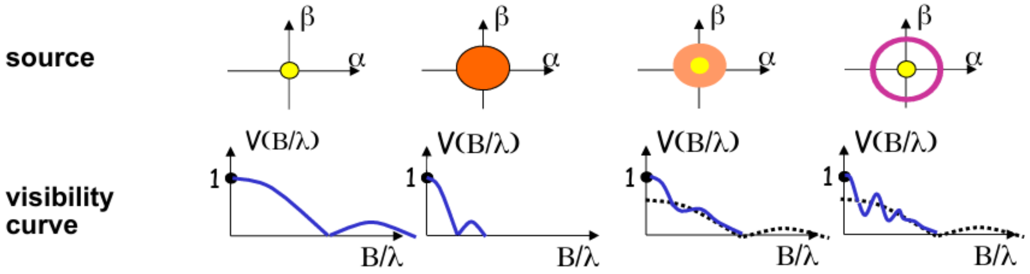
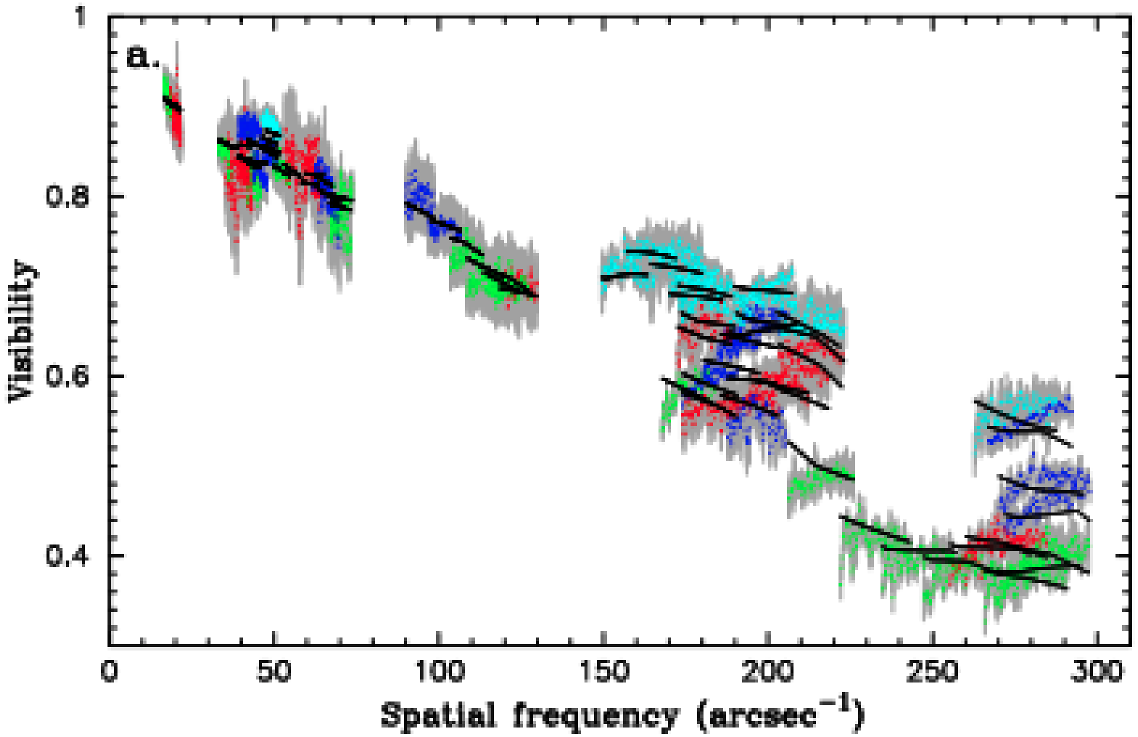


But of course, real observations are more complicated

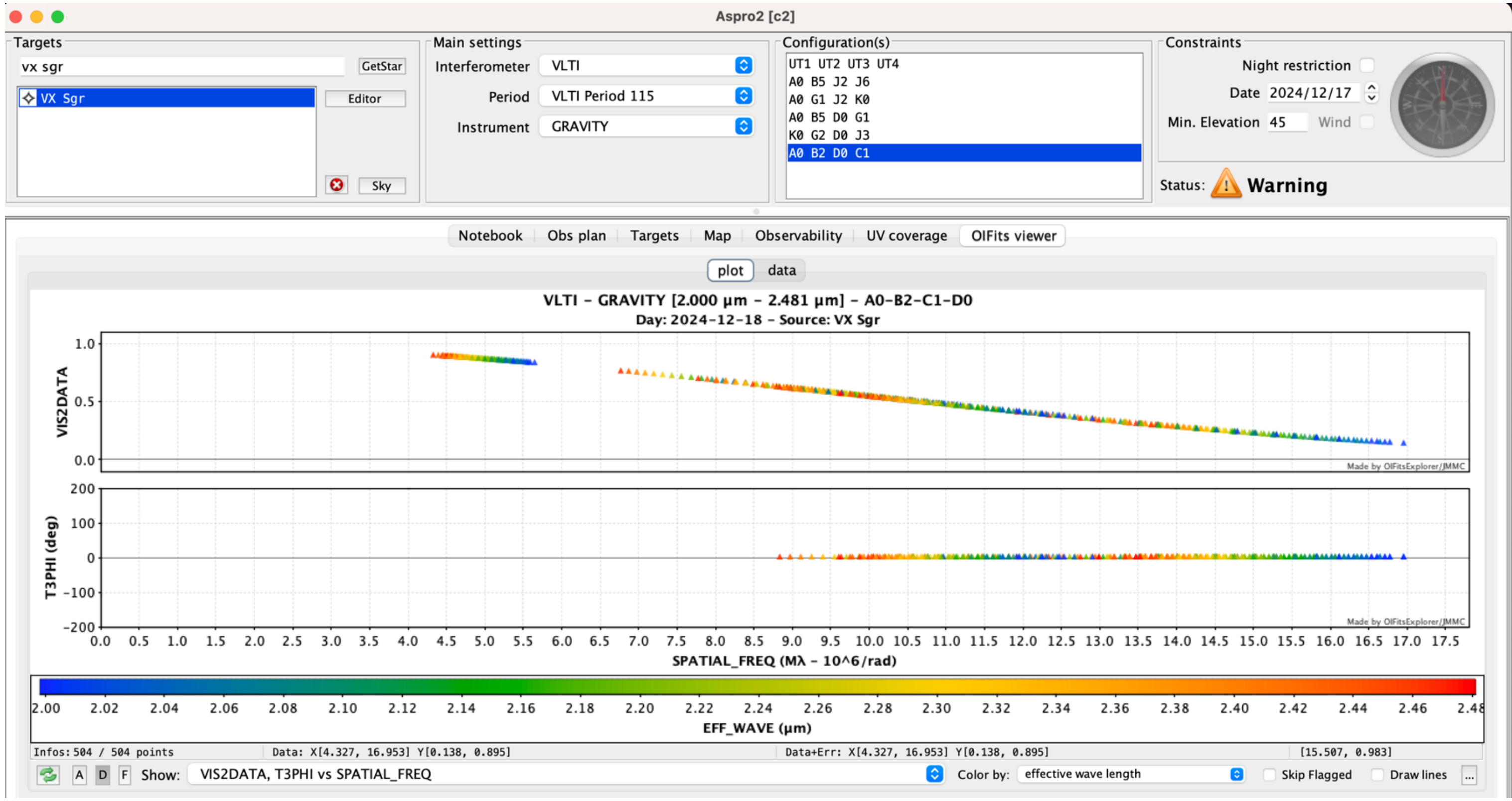


Interferometry

ASPRO

- ASPRO allows you to easily make simple models for your targets (e.g., a uniform disk, binary, rings) and test suitable configurations

- Example: VX Sgr star at the small VLTI configuration, assuming a uniform disk of 10 mas



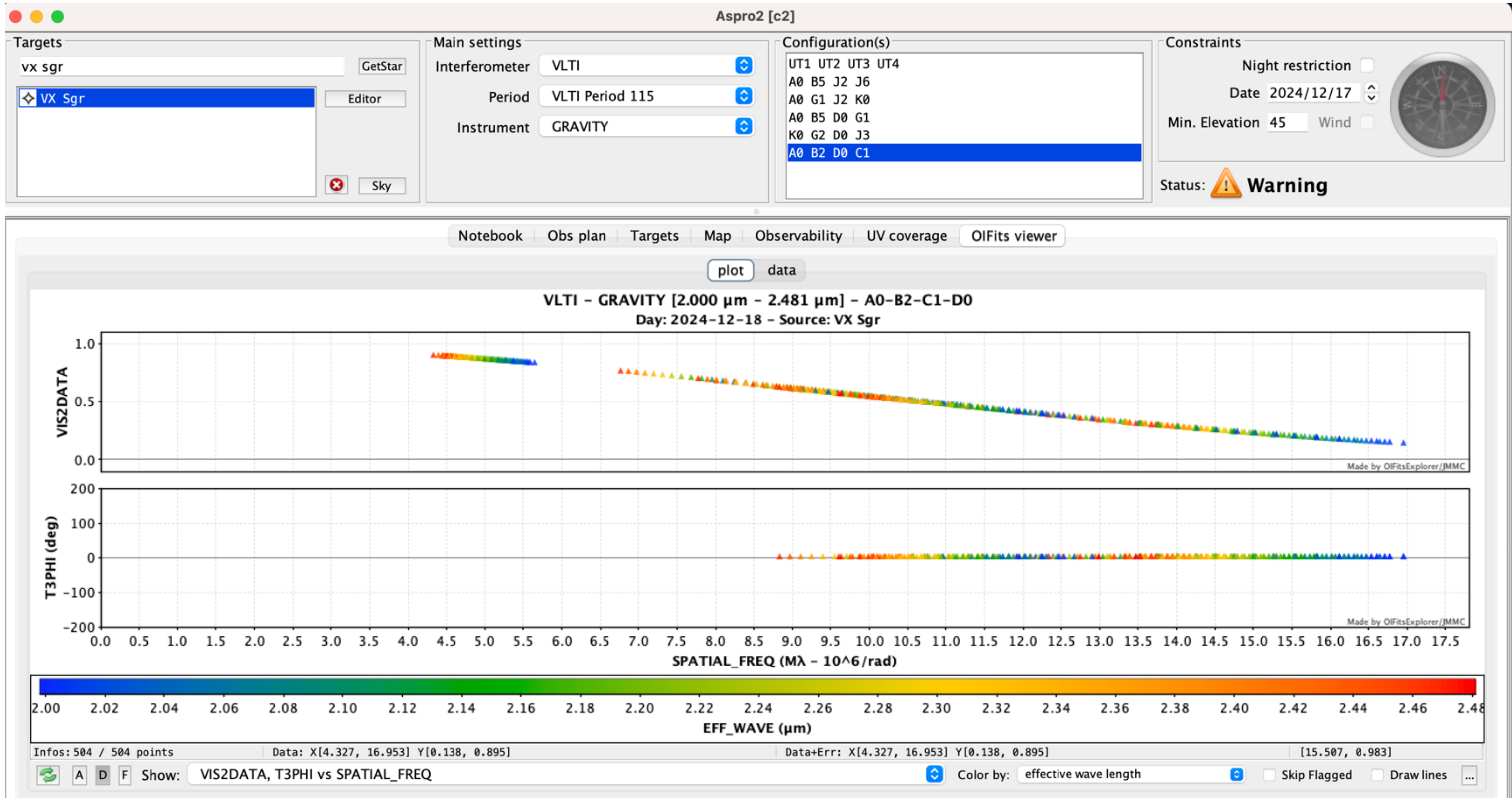
Interferometry

ASPRO

- ASPRO allows you to easily make simple models for your targets (e.g., a uniform disk, binary, rings) and test suitable configurations

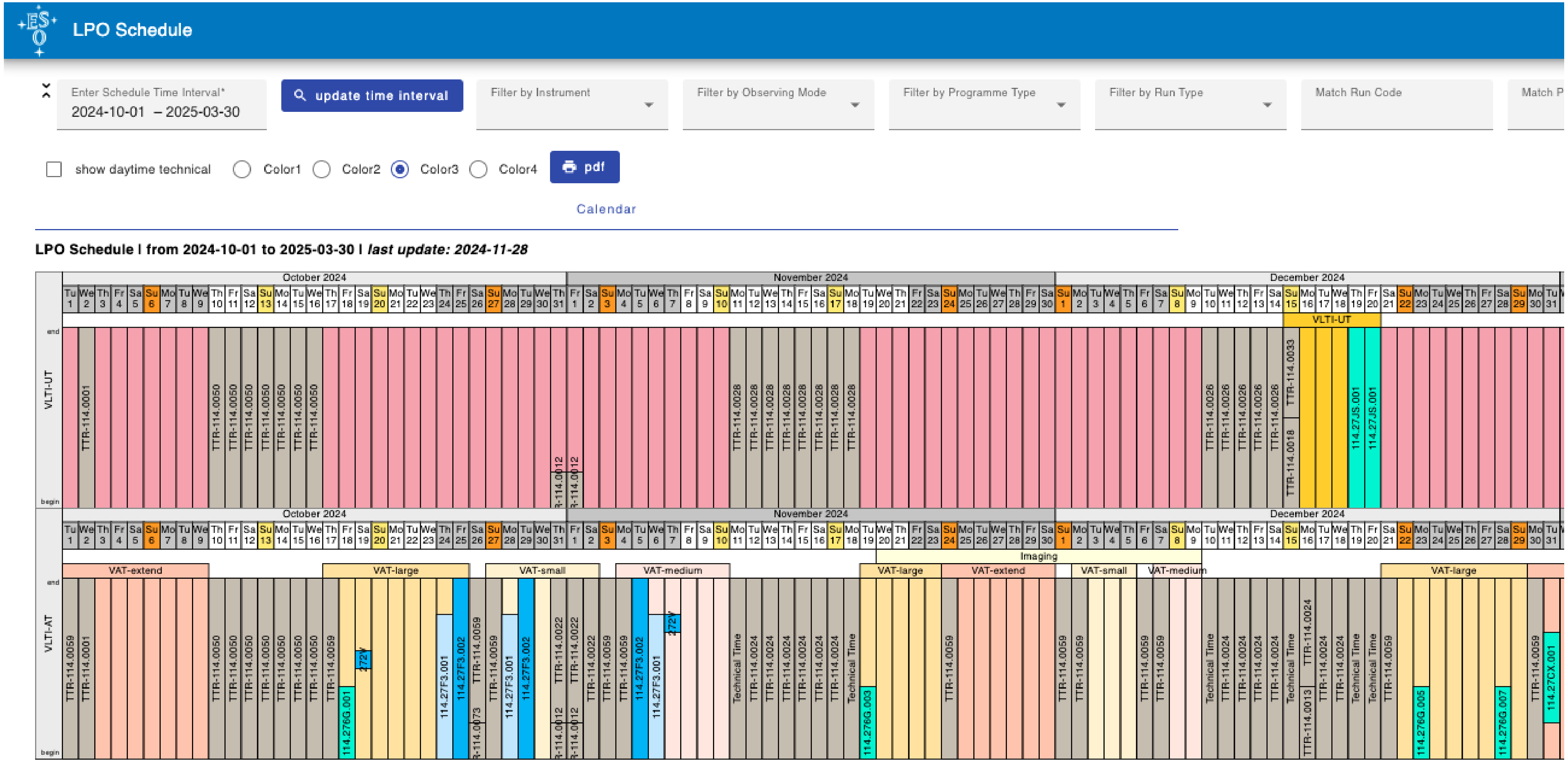
- Example: VX Sgr star at the small VLTI configuration, assuming a uniform disk of 10 mas

- However, its not that simple, you also need to look on the schedule of VLTI configurations!



Observing schedule

Each configuration is offered only a few times in a semester… See https://www.eso.org/LPOschedule/public



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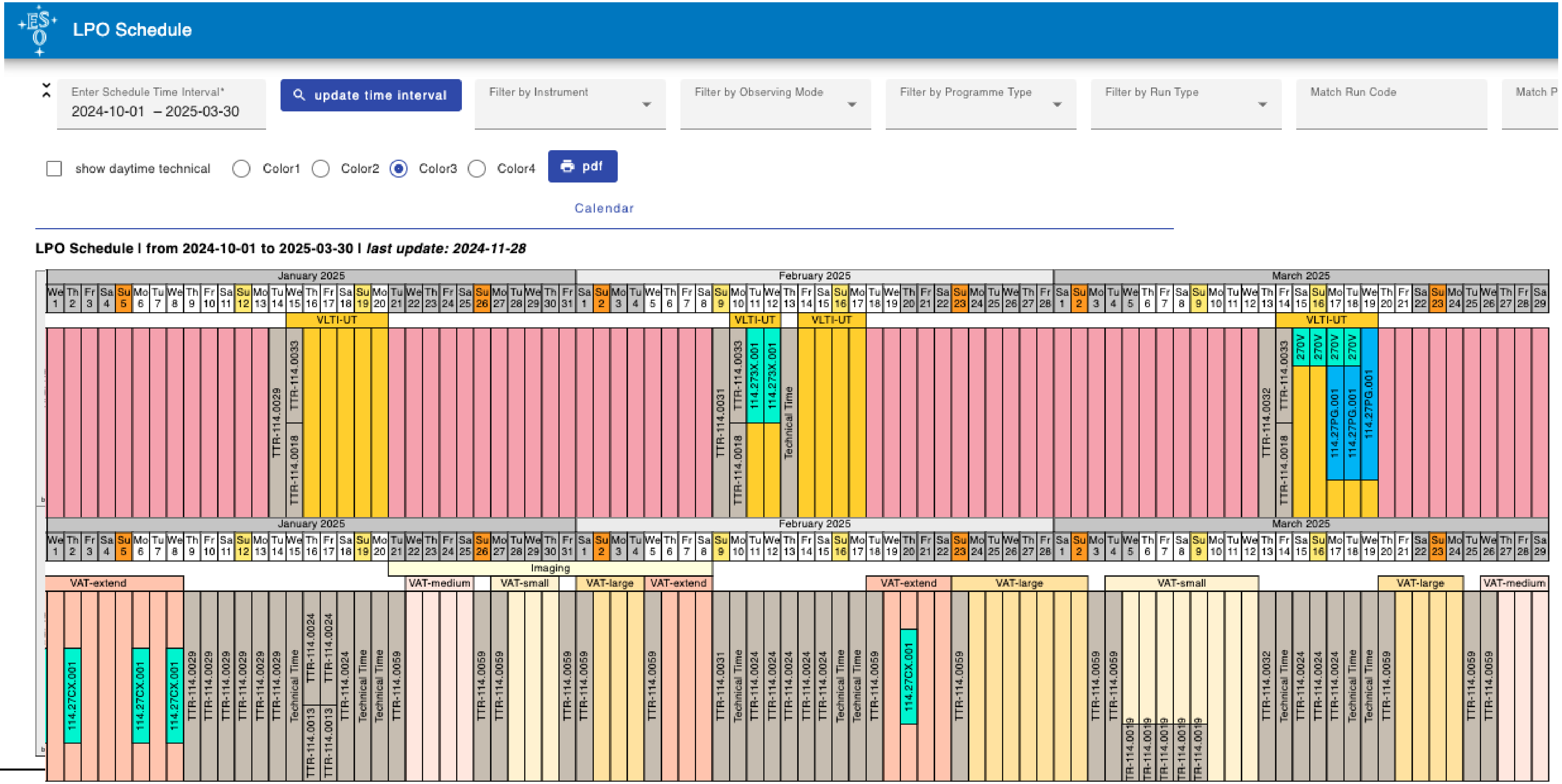


Searching for calibrators

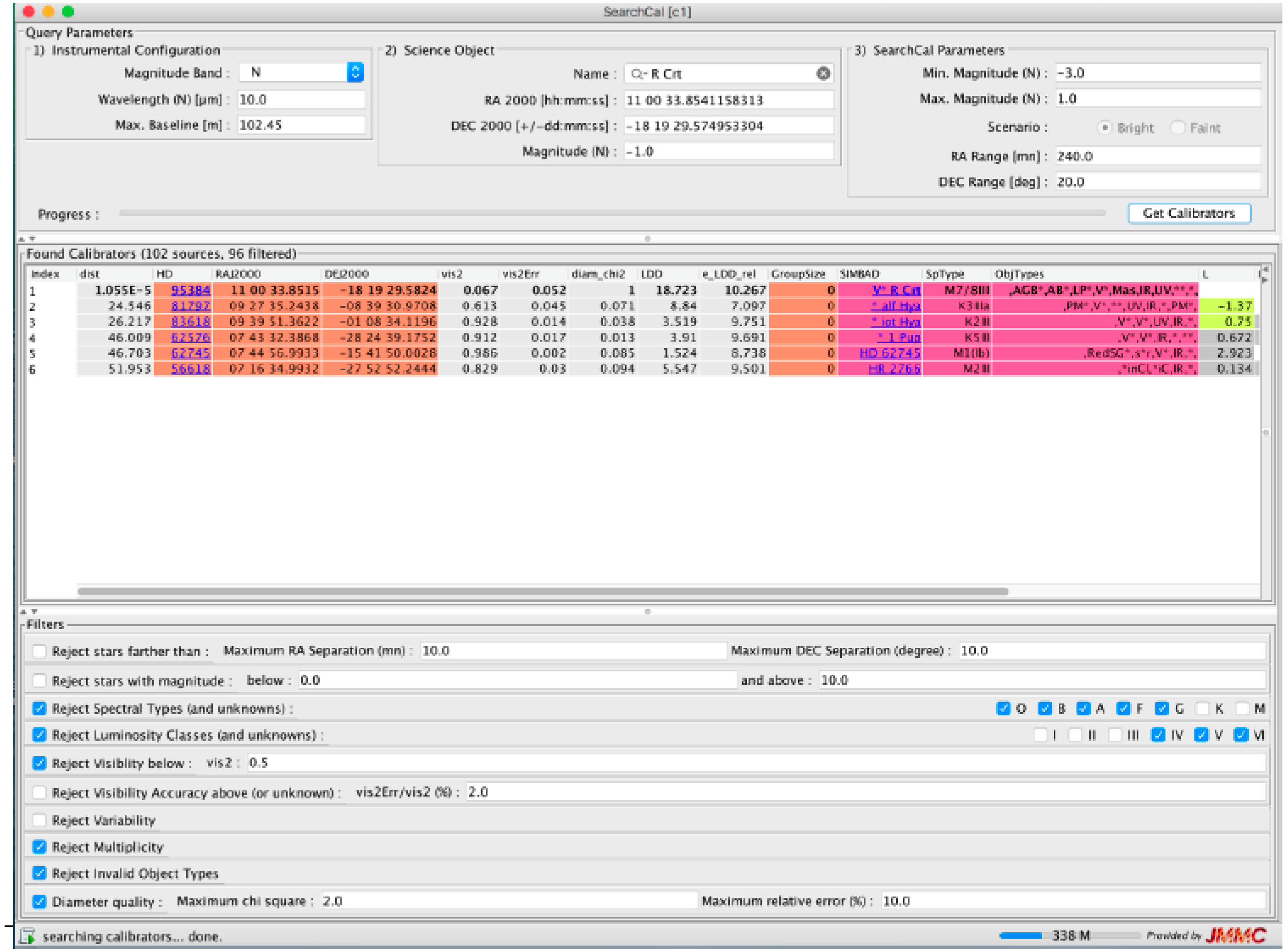
Now comes the most important but difficult part

- Using good calibrators is essential → to calibrate the interferometric visibility of your science target, you also need to measure the fringe contrast of an object with known visibility (=diameter)
- If CAL-SCI-CAL, you can use 2 different calibrators.
- For MATISSE, it is difficult to find good calibrators for both bands. Usually, you have to use different CAL for LM and N band → CAL_LM – SCI – CAL_N
- **Suitable calibrators:**
  - Not variable stars, binaries, etc
  - Well-known diameter (low error)
  - Unresolved object: $V^2 = 1$ (or at least higher V^2 than your target)
  - If possible, it should have a similar infrared brightness (-+1 mag)
  - Not far away from your target (up to 10 deg, max 25 deg but not recommended), ideally about 20 min in RA and up to 2 degrees in DEC

Searching for calibrators

SearchCal

- SearchCal allows you to find calibrators, connected to ASPRO → you can export your target, VLTI configuration, instrument, etc
- Also possible to use the ESO CalVin tool. In general, one should also compare with other catalogs of infrared diameters to make sure (e.g., Cruzalèbes et al. 2019)



Hands-on session
(ASPRO, SearchCal)

Tasks

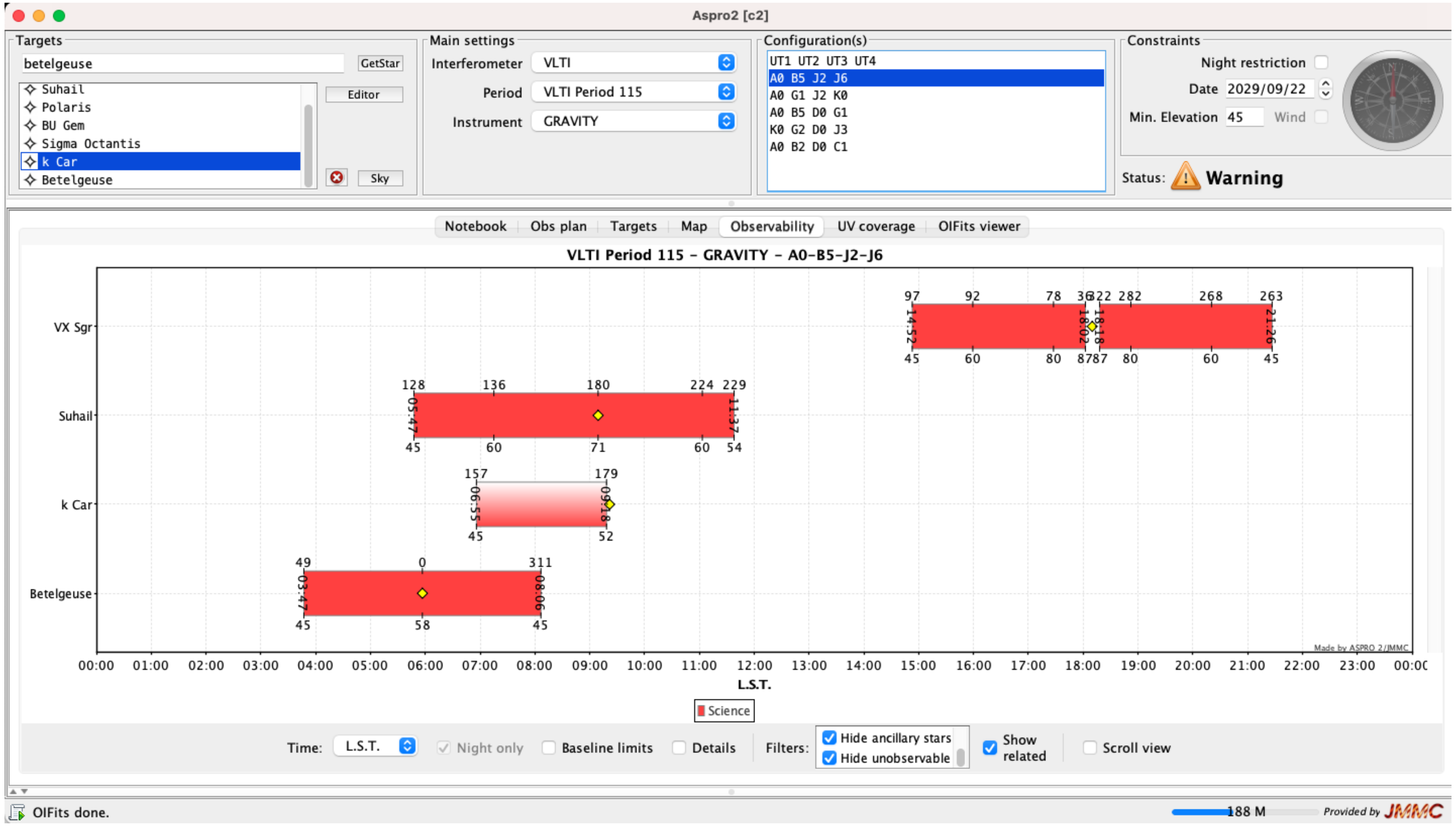
A few very simple tasks to let you learn the basic use of ASPRO and SearchCal. Feel free to ask questions

- 1) **ASPRO**: Find RA and DEC limits of observability for VLTI (Observability window), by adding stars of various coordinates and checking if they are observable throughout the year
  - for example, test Polaris, BU GEM, Betelgeuse, Suhail, k Car, sig Oct
- 2) **ASPRO**: Use Suhail, assume a disk of 11 mas (ASPRO → Editor → Models → add_model: disk) → GRAVITY: which VLTI configuration is the most suitable to constrain the size of this object (V^2 is in the first lobe and close to the first minimum)?
- 3) **ASPRO**: Find a range of disk diameters, for which we can constrain the size as above (= not unresolved or fully resolved) → GRAVITY: try different disk diameters and VLTI configurations. Can we study large stars like Betelgeuse (50 mas)?
- 4) **SearchCal**: Use GRAVITY (K-band), and try to find the best calibrator for Suhail and VX Sgr (assume 11 mas), use the smallest configuration. (In ASPRO, click on Interop → Search Calibrators to export your targets to SearchCal)
- 5) **SearchCal**: Let's assume you would like to do imaging (all ATs configurations with GRAVITY). Are the calibrators you found good at all configurations?

Solutions

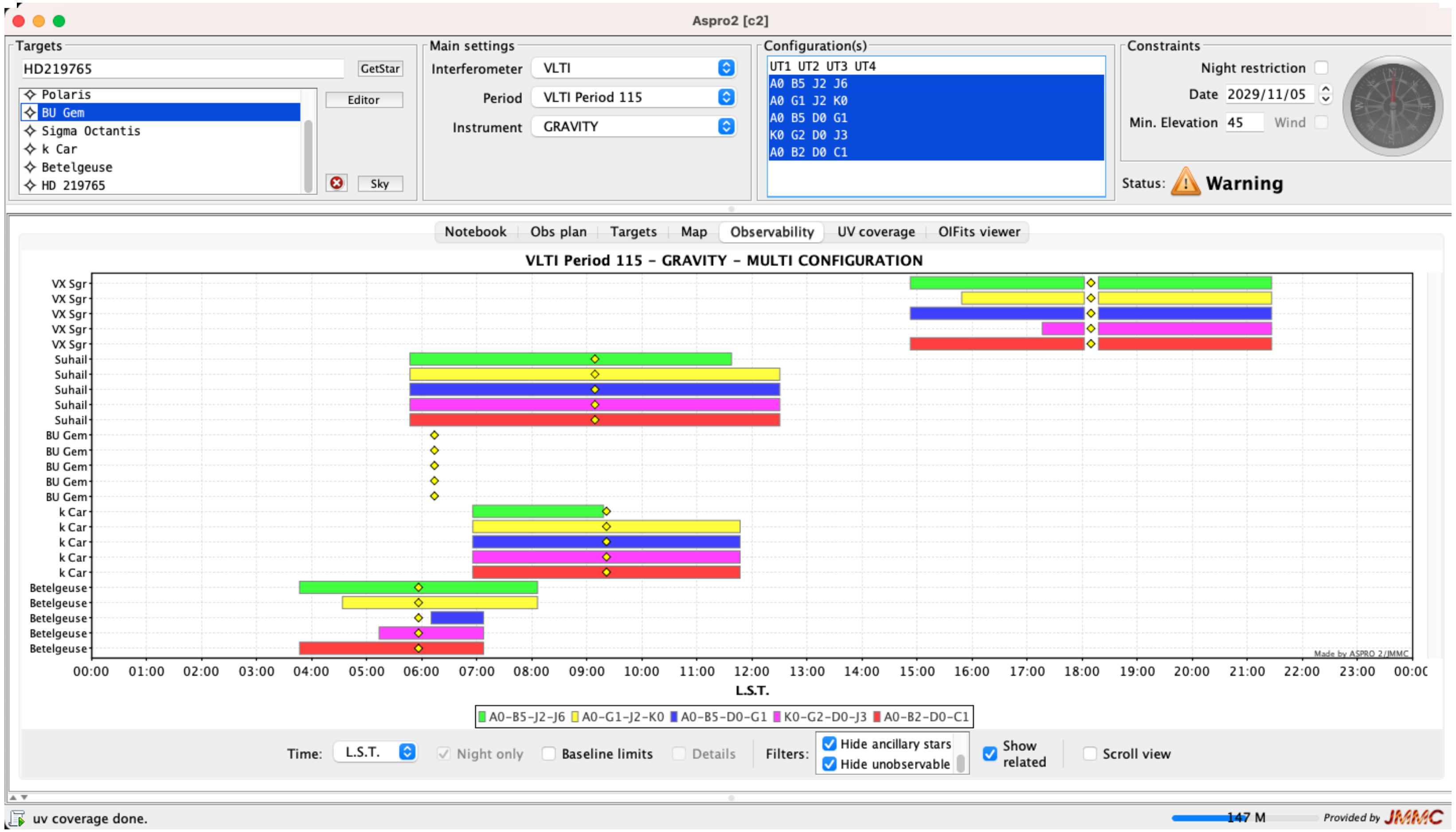
- 1) **ASPRO**: Find out RA and DEC limits of observability for VLTI (Observability window), by adding stars of various coordinates and checking if they are observable throughout the year

- → from about -65 to +15 DEC (using min elevation 45)



Solutions

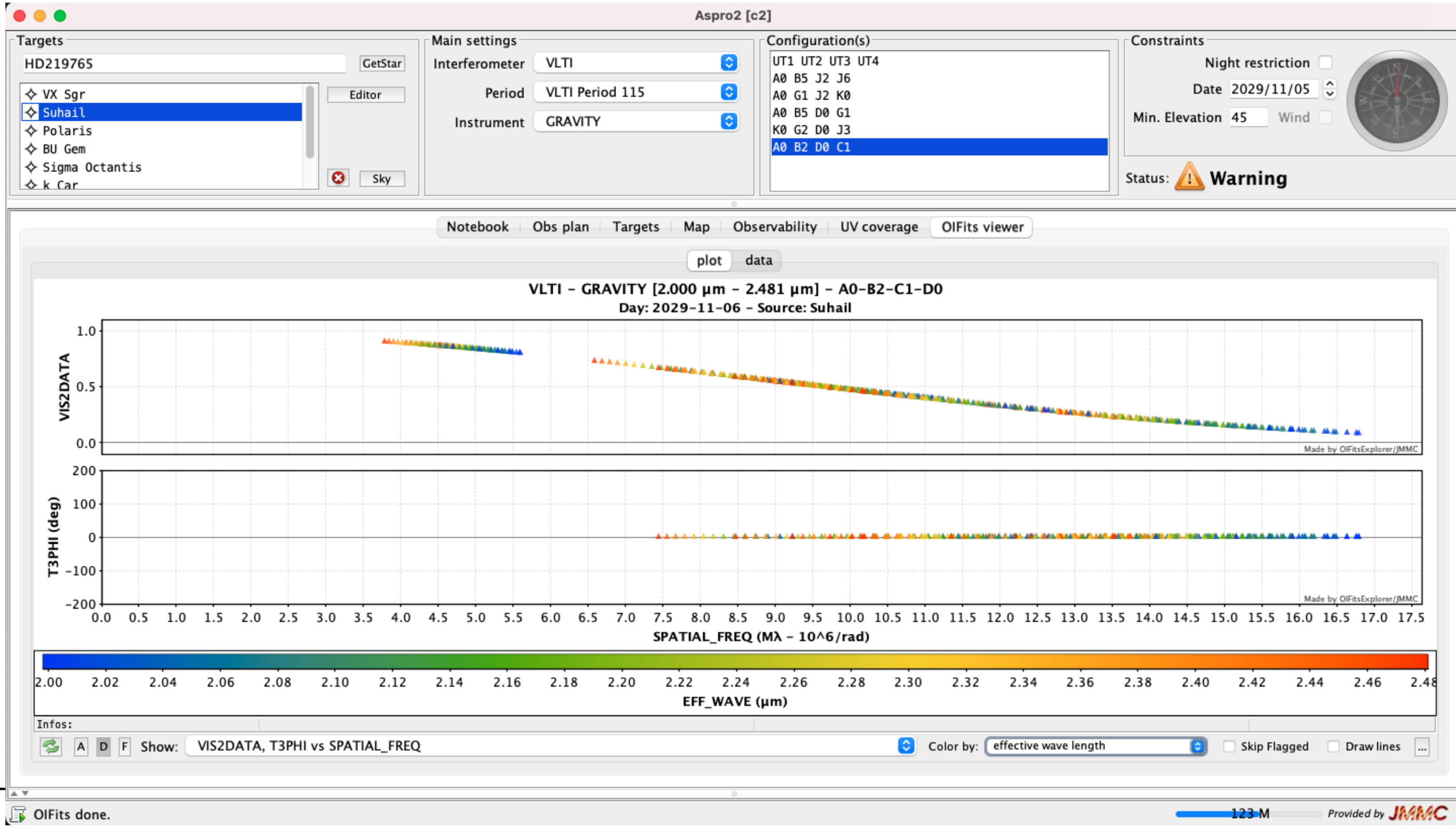
- 1) **ASPRO**: Find out RA and DEC limits of observability for VLTI (Observability window), by adding stars of various coordinates and checking if they are observable throughout the year
- → from about -65 to +15 DEC (using min elevation 45)
- Changes between configurations due to UT domes shadow!



Solutions

- 2) **ASPRO**: Use for example Suhail, assume a disk of 11 mas (ASPRO → Editor → Models → add_model: disk) → GRAVITY: which VLTI configuration is the most suitable to constrain the size of this object (V^2 is in the first lobe and close to the first minimum)?

- → SMALL

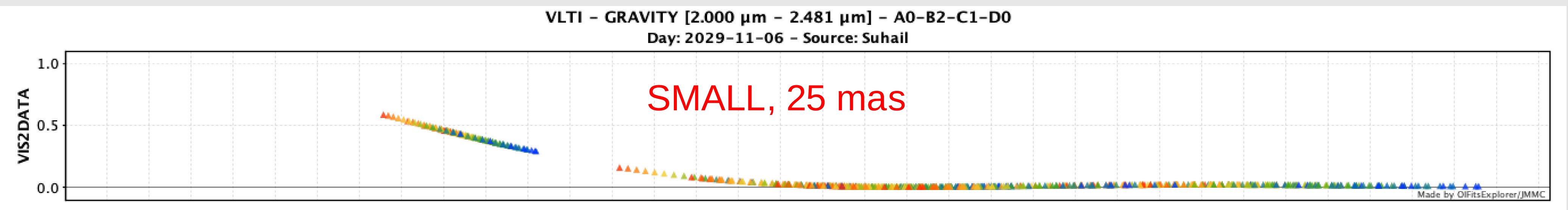


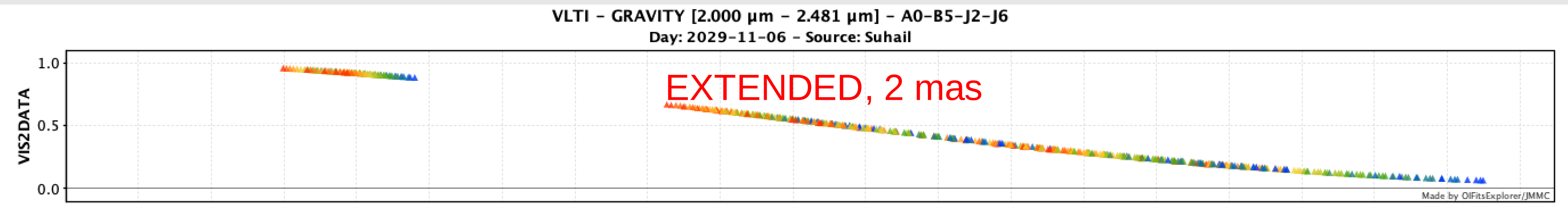
Solutions

- 3) **ASPRO**: Find out a range of disk diameters, for which we can constrain the size as above (=not unresolved or fully resolved) → GRAVITY: try different disk diameters and VLTI configurations. Can we study large stars like for example, Betelgeuse (50 mas)?

- → Largest: about 20-30 mas
  (though debatable)

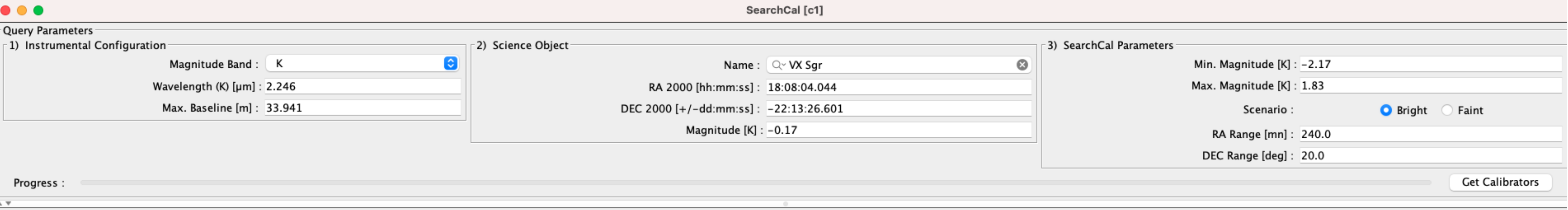
- → Smallest: about 1-2 mas





Solutions

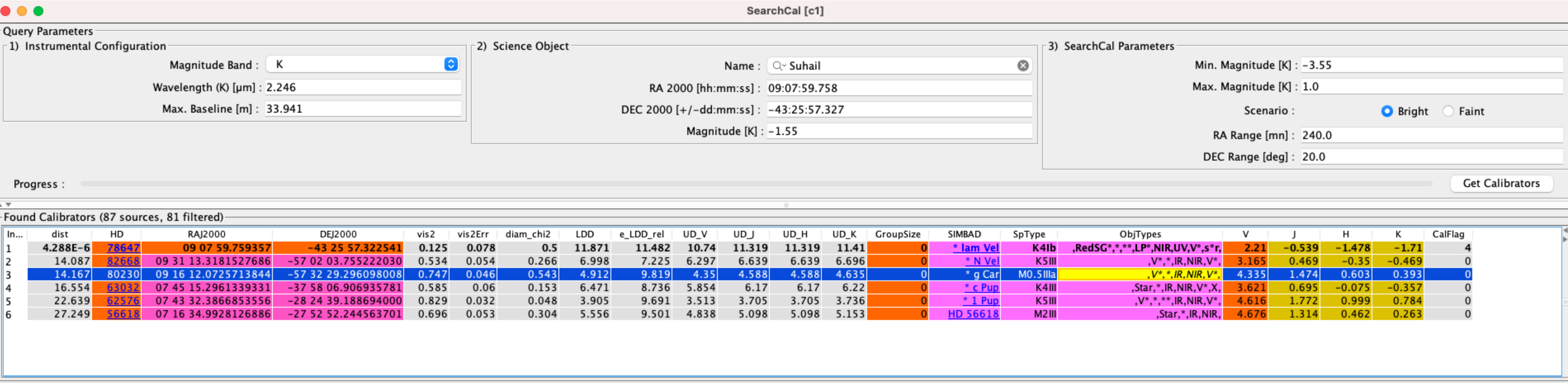
- 4) **SearchCal**: Use GRAVITY (K-band), and try to find the best calibrator for Suhail and VX Sgr (assume 11 mas), use the small configuration. (In ASPRO, click on Interop → Search Calibrators to export your targets to SearchCal)
- →There is no definitive answer, the bright ones are also partly resolved (V^2 ~< 0.8) → compromise



Index	dist	HD	RAJ2000	DEJ2000	vis2	vis2Err	diam_chi2	LDD	e_LDD_rel	UD_V	UD_J	UD_H	UD_K	GroupSize	SIMBAD	SpType	ObjTypes	V	J	H	K	CalFlag
1	8.88E-6	165674	18 08 04.046263	-22 13 26.606888										0	V* VX Sgr	M8.5Ia	,RedSG*,*,AB*,IR,LP*,Mas,NIR,OH*,V*,s*r,	9.562	1.744	0.55	-0.122	4
2	3.045	163428	17 57 07.4593944808	-23 56 21.282950835	0.888	0.021	0.048	3.109	9.627	2.797	2.949	2.949	2.975	0	HD 163428	K5Ib	,RedSG*,*,IR,NIR,V*,s*r,	6.6	2.68	1.74	1.46	0
3	8.216	165135	18 05 48.4842371189	-30 25 26.499601242	0.83	0.03	1.0	3.852	9.252	3.525	3.696	3.696	3.721	0	* gam02 Sgr	K0+III	,PM*,*,IR,NIR,PM*,UV,V*,	3.239	1.315	0.671	0.545	0
4	8.853	173460	18 46 20.6109922323	-22 23 31.823445375	0.908	0.017	0.019	2.806	9.054	2.524	2.662	2.662	2.685	0	* 28 Sgr	K5III	,Star,*,**,IR,MIR,NIR,	5.379	2.482	1.717	1.531	0
5	8.918	159881	17 38 11.9881032239	-28 02 48.350675554	0.907	0.016	0.065	2.818	8.61	2.536	2.674	2.674	2.696	0	HD 159881	K5III	,Star,*,IR,NIR,	6.863	2.902	1.947	1.697	0
6	11.71	157236	17 23 21.5908786602	-28 08 34.200755619	0.91	0.016	1.0	2.774	8.732	2.503	2.639	2.639	2.661	0	* 43 Oph	K4/5III	,Star,*,IR,NIR,	5.302	2.479	1.706	1.531	0
7	12.149	160748	17 43 06.8633568968	-33 03 04.632928618	0.895	0.021	0.216	3.064	9.627	2.705	2.851	2.851	2.88	0	HD 160748	M1III	,V*,*,IR,NIR,V*,	6.435	2.737	1.832	1.588	0
8	13.136	156462	17 18 19.2728936394	-16 18 42.751330457	0.917	0.014	0.733	2.753	7.917	2.397	2.526	2.526	2.553	0	HD 156462	M2-IIICa1	,V*,*,IR,NIR,V*,	6.293	2.895	2.007	1.77	0
9	14.136	160810	17 43 25.9977203299	-35 17 51.585868736	0.885	0.022	0.146	3.186	9.373	2.831	2.988	2.988	3.018	0	HD 160810	M0Ib	,RedSG*,*,IR,NIR,V*,s*r,	6.951	2.802	1.822	1.581	0
10	15.333	161892	17 49 51.4808976914	-37 02 35.794961894	0.833	0.029	0.049	3.822	8.924	3.48	3.659	3.659	3.686	0	* G Sco	K2III	,Star,*,**,IR,NIR,UV,	3.183	1.333	0.711	0.621	0

Solutions

- 4) **SearchCal**: Use GRAVITY (K-band), and try to find the best calibrator for Suhail and VX Sgr (assume 11 mas), use the small configuration. (In ASPRO, click on Interop → Search Calibrators to export your targets to SearchCal)
- →There is no definitive answer, the bright ones are also partly resolved (V^2 ~< 0.8) → compromise
- → Suhail very difficult, not many stars.



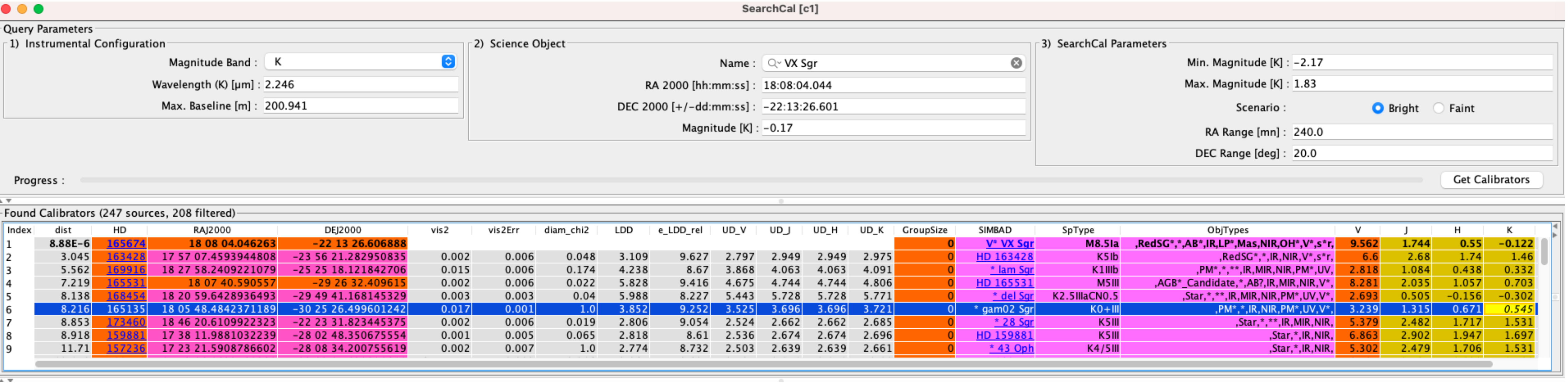
In...	dist	HD	RAJ2000	DEJ2000	vis2	vis2Err	diam_chi2	LDD	e_LDD_rel	UD_V	UD_J	UD_H	UD_K	GroupSize	SIMBAD	SpType	ObjTypes	V	J	H	K	CalFlag
1	4.288E-6	78647	09 07 59.759357	-43 25 57.322541	0.125	0.078	0.5	11.871	11.482	10.74	11.319	11.319	11.41	0	* lam Vel	K4Ib	,RedSG*,*,**,LP*,NIR,UV,V*,s*r,	2.21	-0.539	-1.478	-1.71	4
2	14.087	82668	09 31 13.3181527686	-57 02 03.755222030	0.534	0.054	0.266	6.998	7.225	6.297	6.639	6.639	6.696	0	* N Vel	K5III	,V*,*,IR,NIR,V*,	3.165	0.469	-0.35	-0.469	0
3	14.167	80230	09 16 12.0725713844	-57 32 29.296098008	0.747	0.046	0.543	4.912	9.819	4.35	4.588	4.588	4.635	0	* g Car	M0.5IIIa	,V*,*,IR,NIR,V*,	4.335	1.474	0.603	0.393	0
4	16.554	63032	07 45 15.2961339331	-37 58 06.906935781	0.585	0.06	0.153	6.471	8.736	5.854	6.17	6.17	6.22	0	* c Pup	K4III	,Star,*,IR,NIR,V*,X,	3.621	0.695	-0.075	-0.357	0
5	22.639	62576	07 43 32.3866853556	-28 24 39.188694000	0.829	0.032	0.048	3.905	9.691	3.513	3.705	3.705	3.736	0	* 1 Pup	K5III	,V*,*,**,IR,NIR,V*,	4.616	1.772	0.999	0.784	0
6	27.249	56618	07 16 34.9928126886	-27 52 52.244563701	0.696	0.053	0.304	5.556	9.501	4.838	5.098	5.098	5.153	0	HD 56618	M2III	,Star,*,IR,NIR,	4.676	1.314	0.462	0.263	0

Solutions

- 5) **SearchCal**: Lets assume you would like to do imaging (all ATs configurations). Are the calibrators you found good at all configurations?
- Try just EXTENDED configuration for simplicity. Are the calibrators you found in 4) still good?

Solutions

- 5) **SearchCal**: Lets assume you would like to do imaging (all ATs configurations). Are the calibrators you found good at all configurations?
- Try just EXTENDED configuration for simplicity. Are the calibrators you found in 4) still good?
- Not anymore… using the same CALs would be ideal, but that makes the selection even more difficult → have to break some "calibrator selection rules"



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3	5.562	169916	18 27 58.2409221079	-25 25 18.121842706	0.015	0.006	0.174	4.238	8.67	3.868	4.063	4.063	4.091	0	* lam Sgr	K1IIIb	,PM*,*,**,IR,MIR,NIR,PM*,UV,	2.818	1.084	0.438	0.332
4	7.219	165531	18 07 40.590557	-29 26 32.409615	0.002	0.006	0.022	5.828	9.416	4.675	4.744	4.744	4.806	0	HD 165531	M5III	,AGB*_Candidate,*,AB?,IR,MIR,NIR,V*,	8.281	2.035	1.057	0.703
5	8.138	168454	18 20 59.6428936493	-29 49 41.168145329	0.003	0.003	0.04	5.988	8.227	5.443	5.728	5.728	5.771	0	* del Sgr	K2.5IIIaCN0.5	,Star,*,**,IR,MIR,NIR,PM*,UV,V*,	2.693	0.505	-0.156	-0.302
6	8.216	165135	18 05 48.4842371189	-30 25 26.499601242	0.017	0.001	1.0	3.852	9.252	3.525	3.696	3.696	3.721	0	* gam02 Sgr	K0+III	,PM*,*,IR,NIR,PM*,UV,V*,	3.239	1.315	0.671	0.545
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Congratulations, hopefully now you know more about how to prepare your own observations! :)

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Thank you!

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