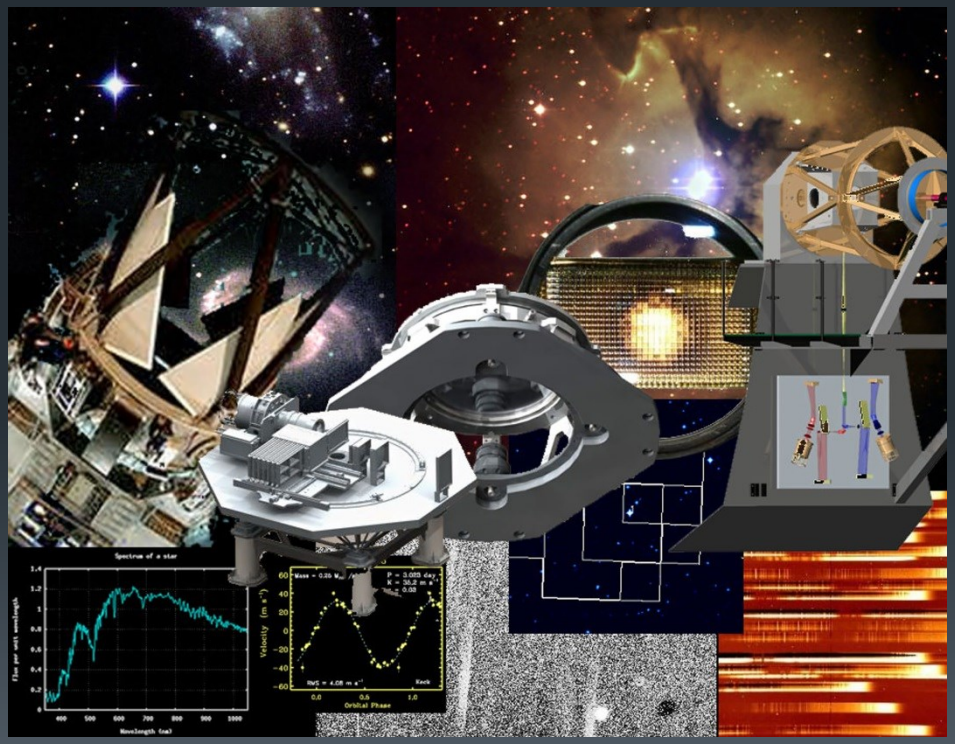
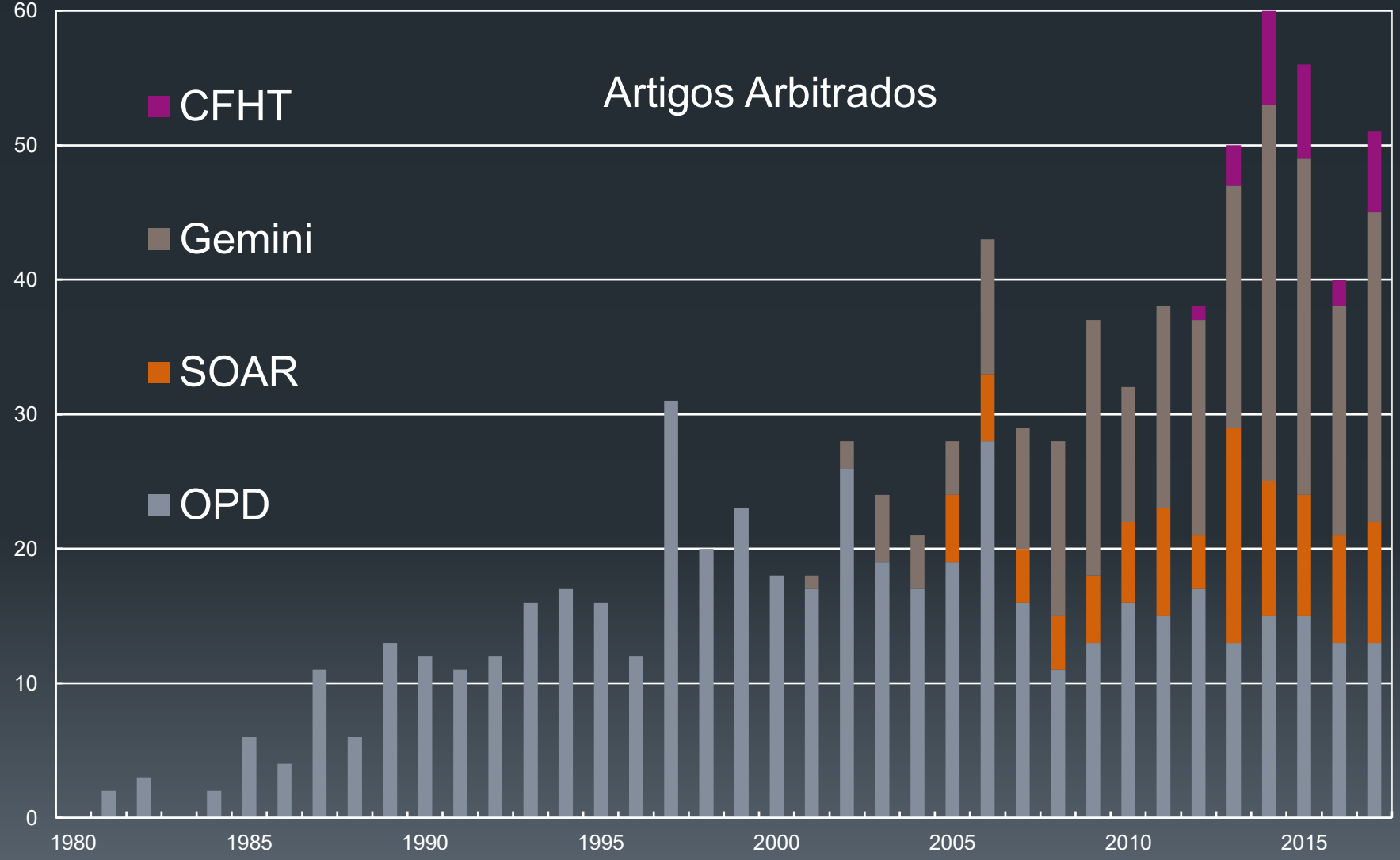
Desafios da infraestrutura e instrumentação astronômica óptica no Brasil para a próxima década



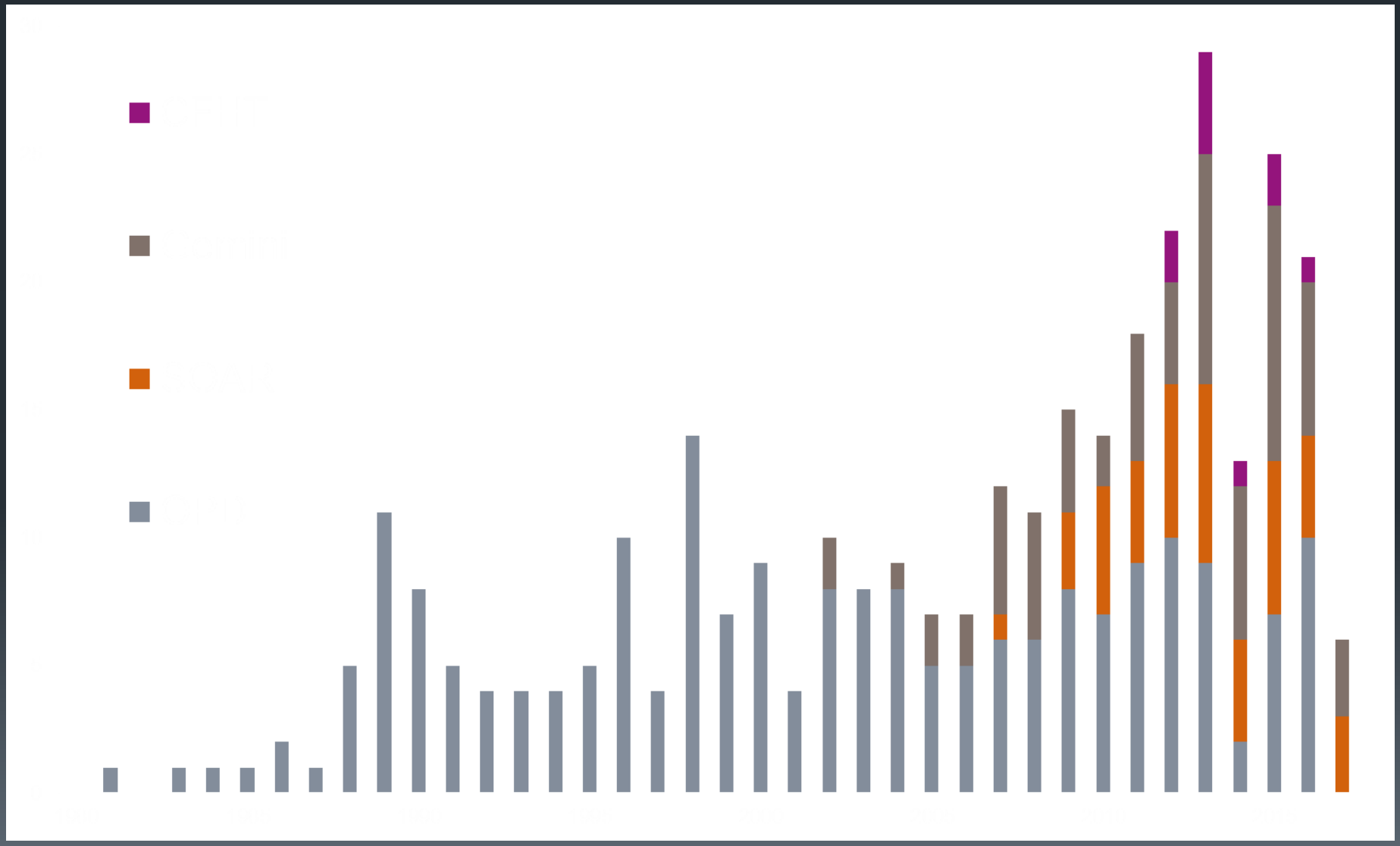
Bruno Castilho

ORATÓRIO
ROFÍSICA

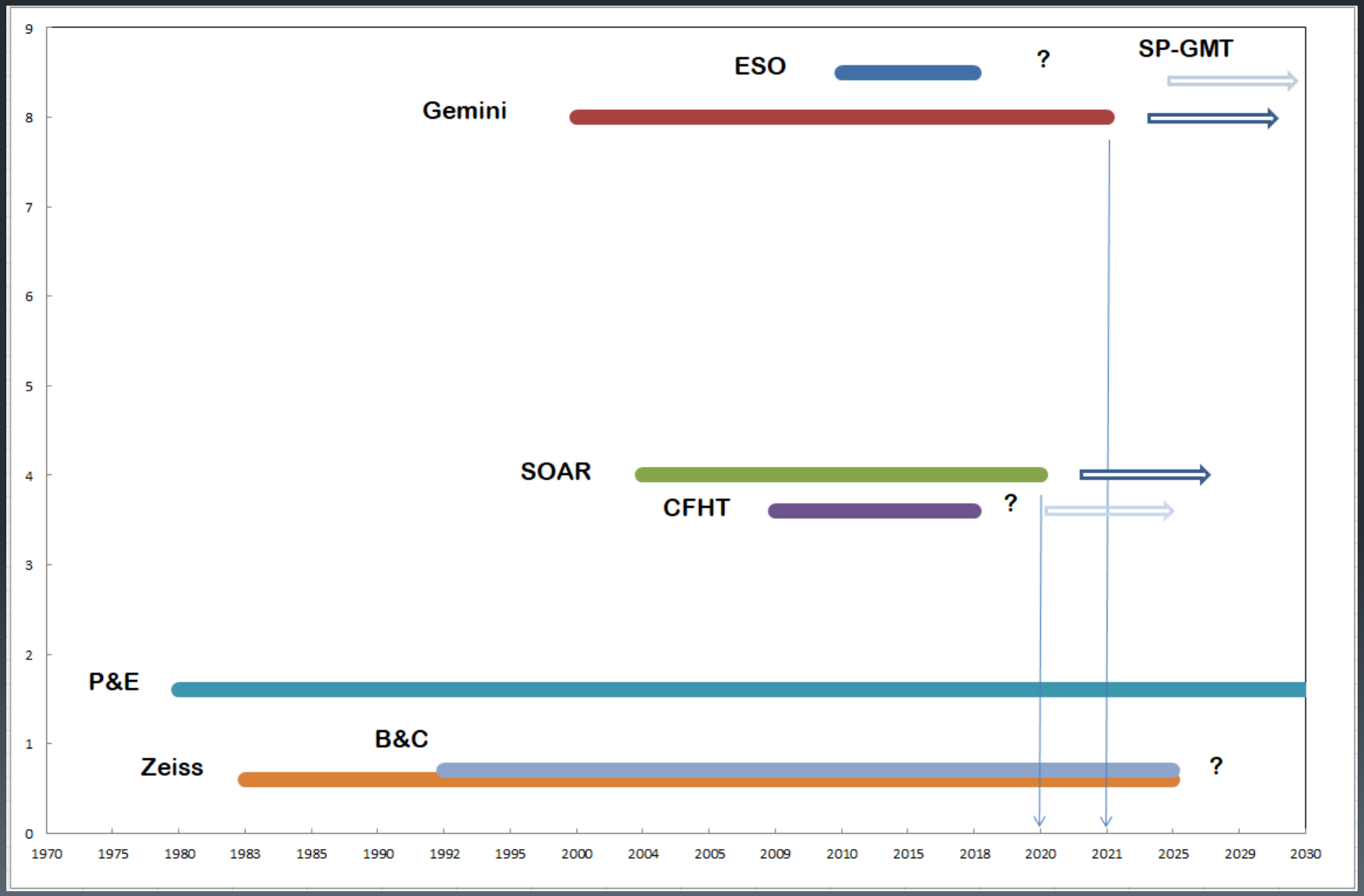
Publicações (dados dos telescópios gerenciados p LNA)



Teses e Dissertações (dados dos telescópios LNA)



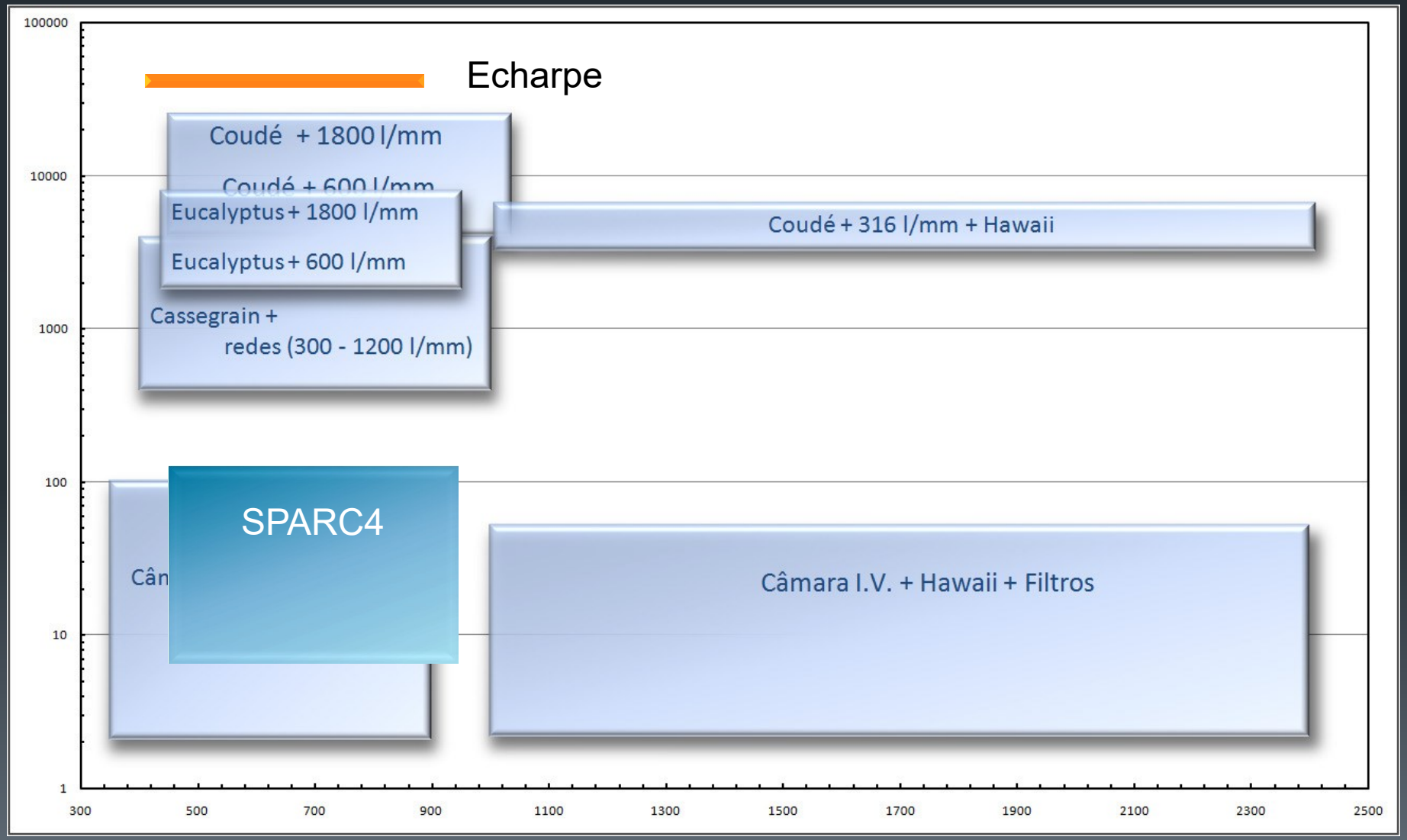
Telescópios Multipropósito - O e IR



Telescópios Multipropósito - O e IR

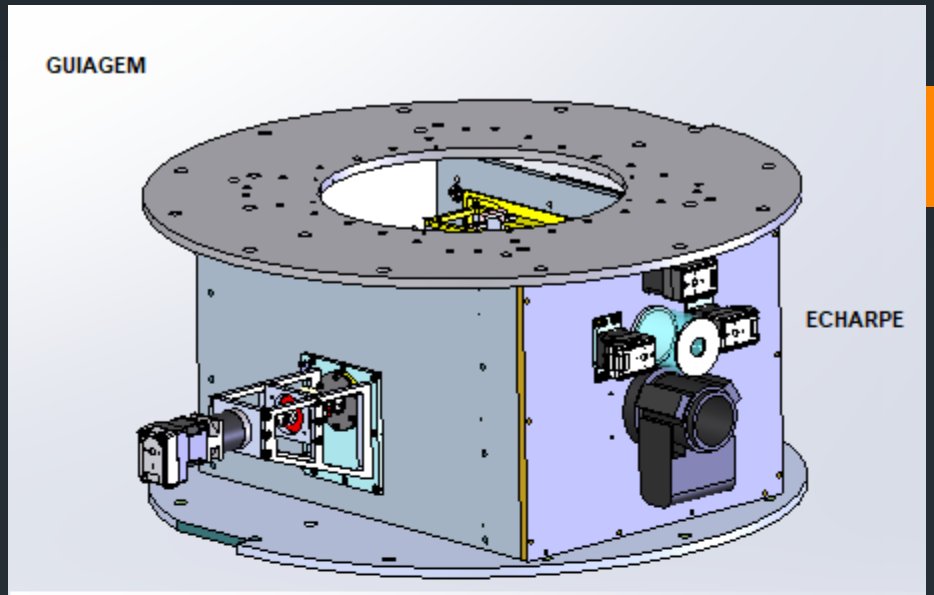
- OPD
  - Revisão do workshop de 2010 ?
- SOAR
  - 30/09/2020 – Planejamento Estratégico, Rio 2017
- Gemini
  - 31/12/2021 – NCOA
- CFHT
  - Comunidade tem interesse, CONJUR na hora errada
  - CFHT esta aberto
  - SPIROU
- Classe de 30metros ??????

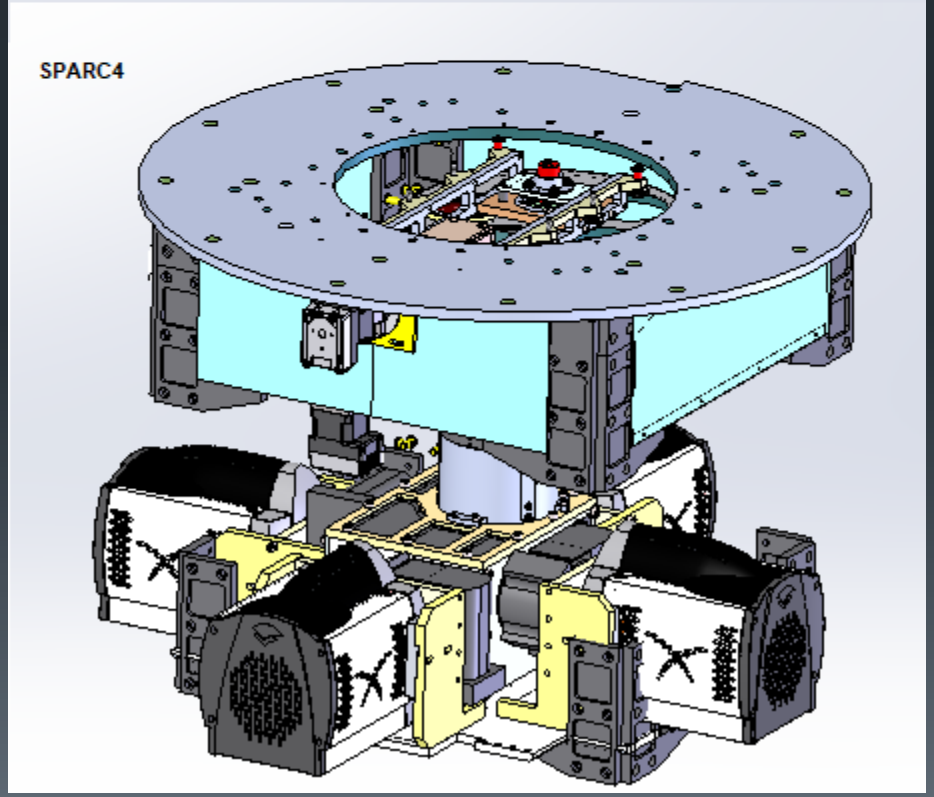
Instrumentação P&E

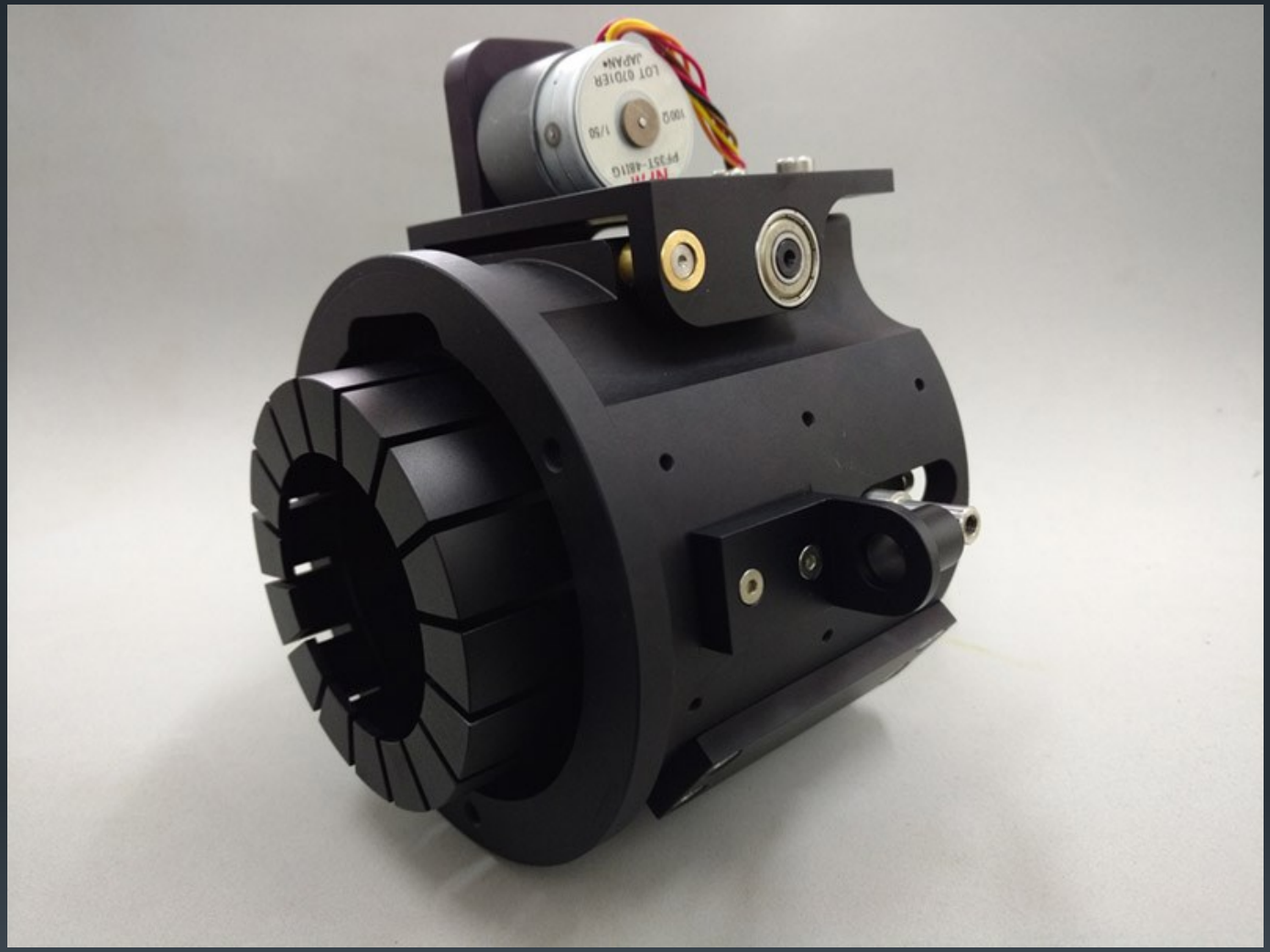


SPARC4

- Polarimetric Camera OPD
- INPE / LNA
  - 4 channels
  - Simultaneous
  - Fabrication phase
    - Optics done
    - Cameras done
    - Mech ongoing
    - Eletr ongoing

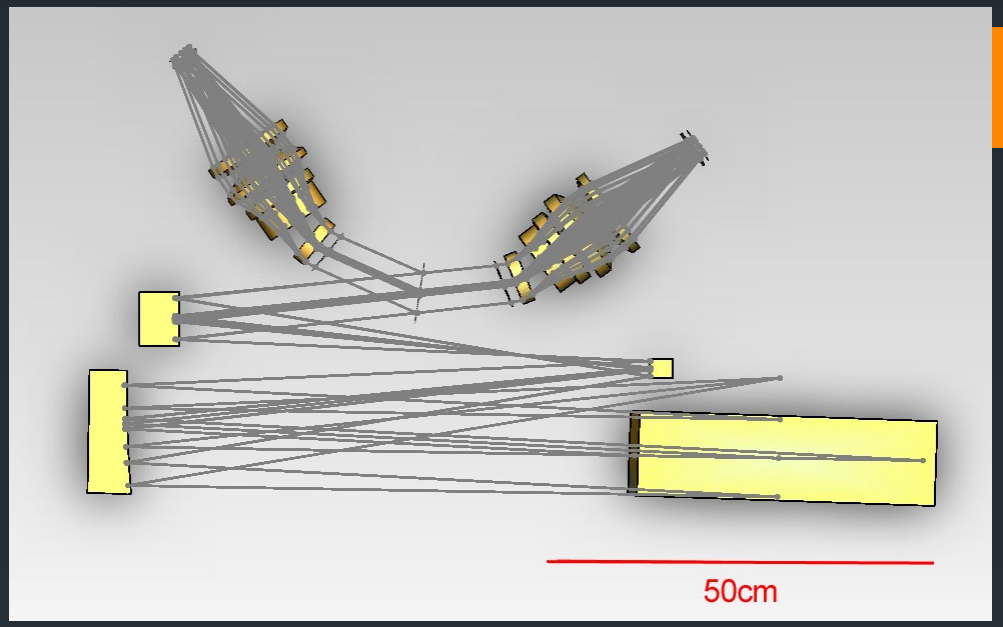






ECHARPE

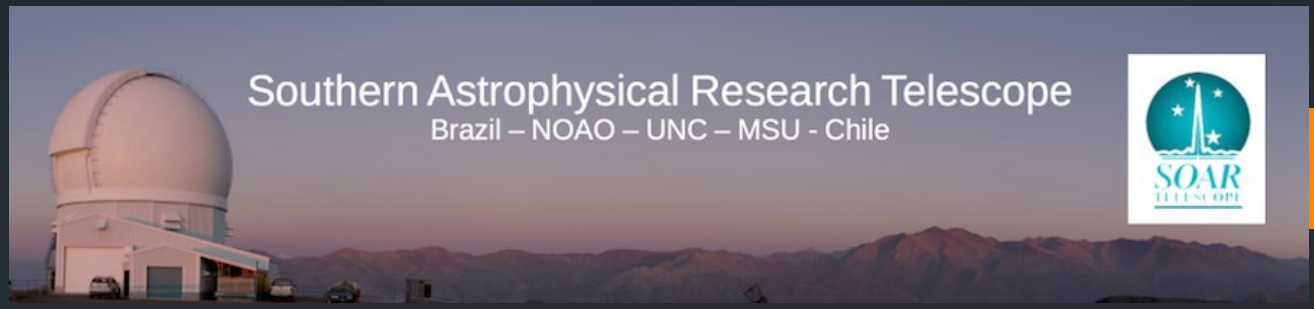
- Echelle spectrograph for OPD
- LNA, USP, UFMG, ON etc…
  - Fiber fed
  - 380-900nm, R=50K
  - Simultaneous
  - Fabrication phase
    - Optics 70%
    - Cameras done
    - Mech 30%
    - Eletr ongoing


50cm


SODERN
ECHARPE


Newport

SOAR



- Setembro 2020
- SOAR na era dos 30metros e do LSST ??
  - Follow up LSST – grande parcela
  - ToO – mudança nas operações
- Planejamento estratégico
- Como o Brasil quer participar ??
  - Atual 31% - US$ 600k
  - Após 2020 – 31% = US$ 1000k
- Novos parceiros ?? Brasil mantem 31% ou diminuimos?

SOAR

- Planejamento Estratégico
  - Início – Rio 2017

SOAR – Proposed **Vision**

"Together, we pursue SOAR science objectives in an era of large surveys."

Diverse science programs and objectives remain central to our vision, but follow-up of LSST and other large survey discoveries expands our science horizons. We prioritize the development of students and the future scientific workforce; we encourage the development of partner infrastructure and technology in service of science goals; and the SOAR observing system provides observer support from proposal to publication stage.

SOAR – Suggested PRIORITIES (and objectives)

DRAFT

I. Improve observer efficiency
   1. Macros/scripting with TCS/pointing
   2. Automated target acquisition
   3. Implement WFSG and M1 actuator upgrades

II. Enhance our Capabilities
   1. Enable LSST and large survey follow-up
      A. Implement flexible, dynamic queue capability for some modes
      B. Coordinate with Gemini, LSST, and event brokers
      C. Broaden operator functions
   2. Improve end-to-end support system
      A. Expand proposal and data reduction tools/pipeline
      B. Maintain, protect, and reward staff.
      C. Enhance documentation and training
   3. Strategically Tailor our Instrument Suite

III. Ensure continued robust operations
   1. Preventive maintenance throughout the facility
   2. Targeted renewal of obsolescent sub-systems
   3. Secure funding stream

IV. Promote Student and Workforce Development
   1. Provide staff development and training opportunities
   2. Support student training in observation and instrumentation

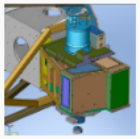
SOAR

Optical Instrumentation at SOAR

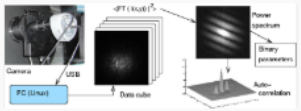
Imaging

SOAR Optical Imager (SOI)

SOAR Adaptive Optics Module (SAM)

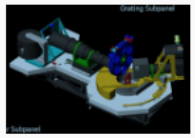


SOAR High Resolution Camera (HRCam)
(Visitor Instrument; Special Access)

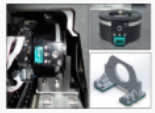


Imaging/Spectroscopy

Goodman High Throughput Spectrograph (Goodman HTS)



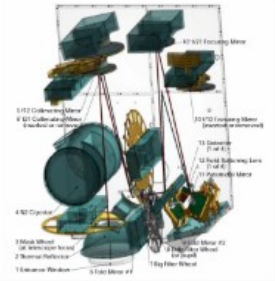
SOAR Fabry-Perot Module on SAM
(Visitor Instrument; Special Access)



SOAR Integral Field Spectrograph (SIFS)
(offered in campaign mode - not yet available for general use)

Infrared Instrumentation at SOAR

Imaging
SPARTAN Near-IR Camera



Imaging/Spectroscopy
Ohio State Infrared Imager/Spectrograph (OSIRIS)
RETIRED, NO LONGER AVAILABLE

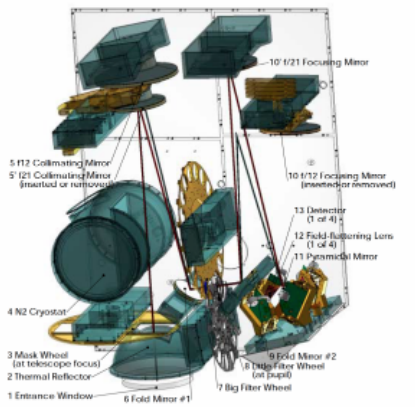
STELES
ARCoIRIS
SAM_Plus
IGRINS

~~Sorceress~~

SPARTAN Near-IR Camera

System Overview

The Spartan Infrared Camera is a high spatial resolution near-IR imager. Spartan has a focal plane consisting of four "Hawaii-II" 2048x2048 pixel HgCdTe detectors. **NOTE -** the detectors don't have all quadrants fully functional - see the "Cookbook" for details. Although two different scales were provided, only one is now supported: the f/12 channel offers an FOV of 5.04 x 5.04 arcmin at 0.066 arcsec/pixel; the scale was chosen to resolve the diffraction-limited core of tip-tilt-corrected images in the H, and K bands. The f/21 channel, which has been disabled, had an FOV of 3.05 x 3.05 arcmin with a scale of 0.040 arcsec/pixel (Loh et al., 2012, PASP, 124, 343). Spartan has two filter wheels which together can hold a total of 29, 50mm diameter filters of thickness up to 15mm. Broadband Y, J, H and K (based on the MKO-NIR prescription) and 9 narrow-band filters are available.
For more information, contact the SPARTAN support staff.



SPARTAN Cheat Sheet

Geometric Parameters

Pixel size	66 mas
Field width (edge-to-edge)	5.04'
Field width (single detector)	2.25' (2048 pix)
Blank strip	0.56'
Min. Exposure Time	10 s
Skew and distortion	24 pix max; 10 pix RMS
Distortion (after removing skew, quadratic terms, and barrel distortion)	0.16 pix max; 0.03 pix RMS

Detector Parameters

Parameter \ Detector	0	1	2	3
Gain [e/DU]	4.9	3.6	3.8	4.6
Detector noise [e]	15	11	14	16
Saturation [kDU]	30	33	33	26

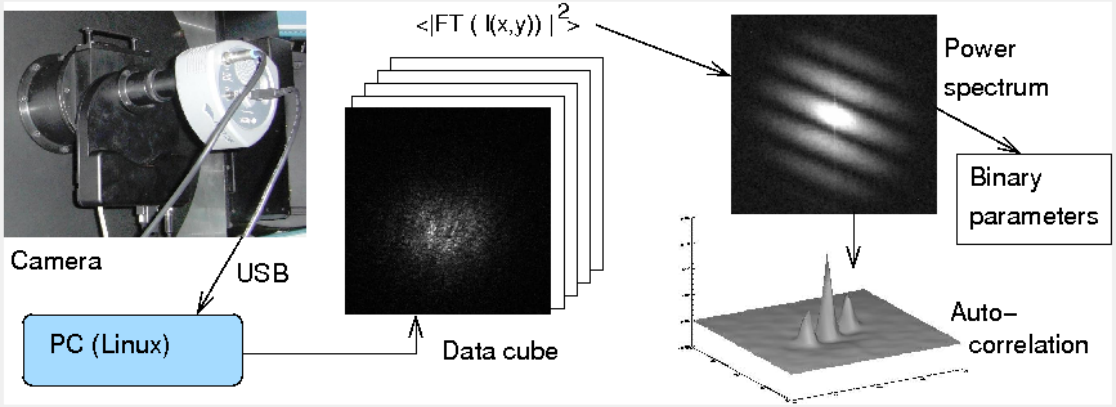
Parameter[1] \ Filter	J	H	K
QE (photons above atmosphere → electrons)	0.35	0.41	0.41
Rate for 15th mag star [ke s^{-1}]	11	15	7.5
Sky [ke $s^{-1}arcsec^{-2}$]	3.5	23	46

[1]The parameters are for detector 0. The values for detectors 1-3 are similar.

Speckle interferometry at SOAR

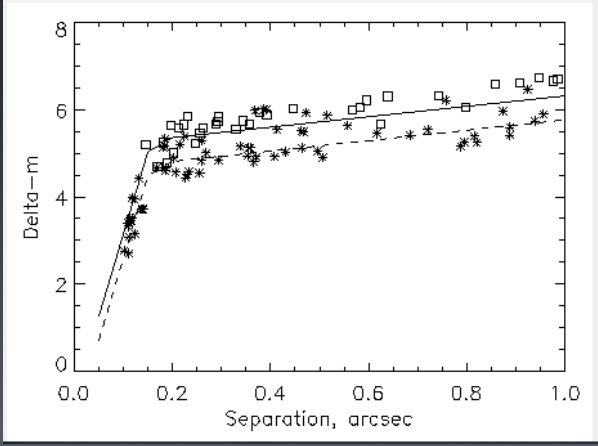
Speckle interferometry attains diffration-limited resolution by processing short-exposure images taken with high magnification. This method works on relatively bright stars. The *High-Resolution Camera (HRCAM)* at the SOAR 4.1-m telescope is used since 2008 for speckle interferometry. Presently it is mounted at the SOAR Adaptive Module (SAM). This is a restricted-use instrument supported by its PI Andrei Tokovinin.

Brief description. The figure below shows the HRCAM (see also the instrument manual). The data are transmitted by an extended USB link to a PC and registered as image cubes, typically 400 frames of 200x200 pixels each (speckle movie). The data are procesed by IDL programs to compute power spectrum and auto-correlation function, ACF. A binary star is detected by "fringes" in the power spectrum or by symmetric peaks in the ACF. Its parameters are measured by fitting a model to the data. Details of the data processing are explained in the paper.

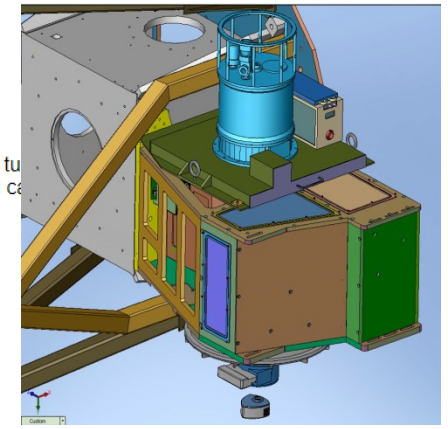


Capabilities. Most observations are made in the Stroemgren *y* or Cousins *I* filters with resolution of 25 mas and 36 mas, respectively. The maximum detectable magnitude difference can reach 6 mag at 1 arcsecond, it is less at smaller separations (in the Figure below, asterisks are detections of simulated binaries, squares are non-detections, and the curve is the estimated limiting magnitude difference) and in the *I* filter. The *limiting magnitude* strongly depends on the seeing and is deeper in the *I* band. Stars as faint as V=12 mag were observed under good seeing, but V=10 mag is a more realistic limit under median seeing. Typically, some 100 to 150 stars per night are observed. The effficiency is determined by the telescope pointing and target acquisition time, the data cubes are collected for only a few seconds. The raw data are processed by A. Tokovinin using his software. The data products are measurements of resolved binary and triple stars and the detection limits at 0.15 and 1 arcsec separation for unresolved targets.

In March 2017, the failed Luca-S detector was replaced by the iXon-888 camera, on loan from the UNC (courtecy N. Law). It has a higher quantum efficiency, so a gain of ~1 magnitude in sensitivity is expected.



SOAR Adaptive Optics Module (SAM)



Instrument Scientist: Andrei Tokovinin [1]
CTIO & Chile Instrument Support Scientists: Cesar Briceno, [2] Andrei Tokovinin [1]
Brazilian Instrument Support Scientists: Bruno Quint [3]

The **SOAR Adaptive Module** (SAM) is a laser-assisted adaptive optics system at the 4.1-m SOAR telescope. By compensating selectively low-altitude tu
improves resolution at visible wavelengths. The sky coverage is nearly full. SAM contains a 4Kx4K CCD imager covering the 3-arcmin square field and ca
attached to its port (Tokovinin et al. 2016) [4].

For further information, contact the SAM Support staff [5].

About SAM

Introduction

The **SOAR Adaptive Module** (SAM) is a laser-assisted adaptive optics instrument at the 4.1-m SOAR telescope. By compensating selectively low-altitude turbulence, it improves resolution at visible wavelengths. The instrument contains a 4Kx4K CCD imager covering the 3-arcmin square field. The paper describing the instrument is Tokovinin et al. (2016). [4]

Images as sharp as 0.3″ have been obtained under favorable conditions of weak high-altitude turbulence which happen ~50% of the scheduled SAM nights. Under such conditions, the typical FWHM resolution delivered by SAM is 0.4″ in the I band and 0.5″ in the V band. The compensation quality is uniform over the field (FWHM variation of few percent). On nights with strong high turbulence (which does not necessarily mean poor seeing), SAM brings only a marginal resolution gain in closed loop and delivers V -band FWHM between 0.6″ and 1″.

The first paper using SAM commissioning data on the globular cluster NGC 6496 was published by Fraga et al. (2013, [6] AJ, 145, 165) [6]. It demonstrates that the photometric precision and limiting magnitude in crowded stellar fields are improved by using the SAM AO system and that good-quality photometry can be derived from the SAMI images.

In the figure 1 from Fraga et al. 2013 shown above, we show the full-frame image of NGC 6496 in the I-band taken with the SAM Imager (SAMI; north is up, east to the left). The enlarged fragments of 15 × 12 arcsecond size compare closed-loop (upper) and open-loop (lower) images taken with the same exposure time of 120 s and displayed on the same intensity scale, at the center and near the edge of the field.

SAM in Numbers [7]

Documentation for the SAM User

- SAM Imager (SAMI) Instrument Manual [8]
- SAMI Software manual [9]
- Filters available for SAMI [10]
- Contact SAM support staff [5]

SOAR Optical Imager (SOI)

Instrument Scientist: Sean Points
CTIO Instrument Support Scientists: Cesar Briceno, Sean Points
Brazilian Instrument Support Scientists: Bruno Quint

The SOAR Optical Imager (SOI) is a bent-Cassegrain mounted optical imager using a mini-mosaic of two E2V 2k x 4k CCDs to cover a 5.26 arcminute square field of view at a scale of 0.077"/pixel. It was designed, built, and integrated at SOAR by an NOAO/CTIO team lead by Drs. Alistair Walker and Hugo Schwarz.

Two views of the SOI mounted at one of the bent Cassegrain foci of the SOAR telescope. The smaller blue cylinder is the CCD mosaic dewar and is flanked by the two rectangular Leach controllers, the round black part is the cable wrap, and the large blue tube bolted onto the telescope is the main body of the instrument holding the linear ADC prisms, one of which can move over a distance of nearly one meter. The drawing shows the basic lay-out of the instrument in a cut-out view. From left to right the light encounters: ADC prisms, optics module, two filter slides, the shutter, and finally the CCD mosaic.

DOCUMENTATION FOR SOI USERS:

- The **SOI Manual**
- **The step-by-step SOI Observer's Guide**
- Filters used with SOI
- Exposure times for Dome Flat with various Filters
- A Data Reduction example
- Exposure Time Calculator (ETC)
- Publishing results using SOI data?: ADS link to SOI instrument SPIE paper
- Contact SOI support staff

Last update: C. Briceño, Jul 25, 2018

Printer-friendly version |

SOAR Integral Field Spectrograph (SIFS)

SIFS Information

The SOAR Integral Field Spectrograph (SIFS) is currently available in campaign mode; this means that LNA staff provide support for both the actual observing and for data reduction. A brief summary is provided in the information for SIFS proposals. An extensive recent presentation regarding the instrument is **here**. That presention gives an overview of the instrument and the procedures for reducing data.

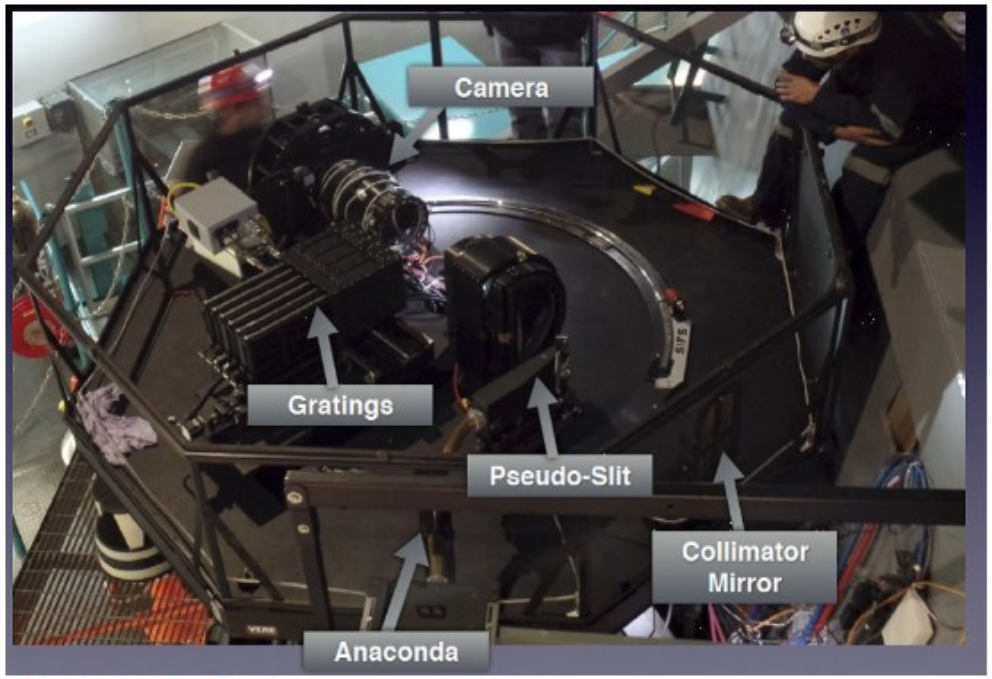


Figure - View of the SIFS spectrograph (after the fiber feed).

Additional information will be posted as it becomes available. Prospective proposers should contact the SIFS instrument scientist, Luciano Fraga (LNA), at *lfraga at lna.br*.

SAM-FP

This page contains useful information regarding this new mode that is running now at SOAR. At the moment, SAM-FP is considered to be a Restricted User Instrument. In order to use it, the astronomer needs to get in touch with the instrument's P.I., Dra. Cláudia Mendes de Oliveira. We have now an open call for Early Science Observations that will happen in mid-February 2018. It will be a total of four nights shared between all the astronomers that request their object to be observed. The observations will be in service mode. That means that SAM-FP team will do the observations and reduce the data. The data-cubes provided will be already corrected with bias and flat. The phase-correction will also be applied by the team. Wavelength calibration and astrometric calibration will be done together with the astronomer.

Proposals

SOAR scheduled four nights for Early Science observations with SAM-FP from Feb 16th to Feb 19nd, 2018. The 2016 call for proposals is linked here. It describes the technical capabilities. **Interested parties MUST contact Claudia Oliveira no later than December 15, 2017.** The publication regarding this mode can be found in Oliveira et al 2017.

Since we do not know how many targets or science projects will be submited, we ask all the astronomers interested to send an e-mail to our team with the following information:

- Science justification - one or two paragraphs is sufficient.
- List of targets in the SOAR's standard format or in following format (no other format will be accepted):

```
# OBJECT     RAJ2000    DECJ2000
AB01_XXXXX    HH:MM:SS   +DD:MM:SS
AB02_XXXXX    HH:MM:SS   +DD:MM:SS
   ...           ...        ...
AB0N_XXXXX    HH:MM:SS   +DD:MM:SS
```

A : Last name first letter
B : First name first letter
N : Objetc priority number

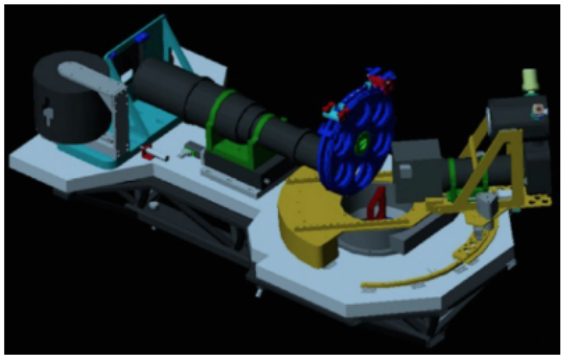
- The list of targets has to be sorted by priority.
- Number of objects required to get proper results.

Goodman High Throughput Spectrograph

Updated Jul 25, 2018 (César Briceño)

Instrument Scientist: Sean Points
CTIO Support Scientists: César Briceño, Regis Cartier, Sean Points, Alfredo Zenteno
CTIO/Chile Goodman Support: Goodman Support
SOAR/Brazil Support: Tina Armond, Bruno Quint

The Goodman High Throughput Spectrograph (GTHS) was built in the Goodman Laboratory at the University of North Carolina under the leadership of Prof. J. Christopher Clemens. It is an imaging spectrograph, capable of producing excellent image quality across a 7.2 arcmin diameter FOV (with a 0.15 arcsec/pixel scale), and spectra at various resolutions from the atmospheric UV cutoff all the way out to 850nm. It employs all transmissive optics, and Volume Phase Holographic (VPH) Gratings to achieve the highest possible throughput for low resolution spectroscopy over the 320-850 nm wavelength range. The paper describing the instrument is Clemens et al. (2004)



- **Applying for time**
  - **Instrument Characteristics: plate scale, gratings, slits,filters, etc**
  - **Goodman Spectrograph Overview (At least read this!)**
  - Goodman HTS Manual

Observing with Goodman

- Before, during, and after your run
- **Goodman Cheat Sheet**
- The Goodman step-by-step Observing Guide (PDF presentation)
- Optimizing the CCD read out
- Calibration information
- Goodman Support Staff

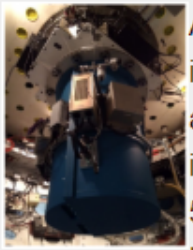
Data Reduction and Publishing Results

- **Goodman Data Reduction Pipeline (NEW)**
- A presentation from Cesar Briceño on reducing Goodman MOS data with IRAF.
- Publishing results based on Goodman data?: ADS link to 2004 SPIE Goodman Spectrograph

ARCoIRIS

ARCoIRIS

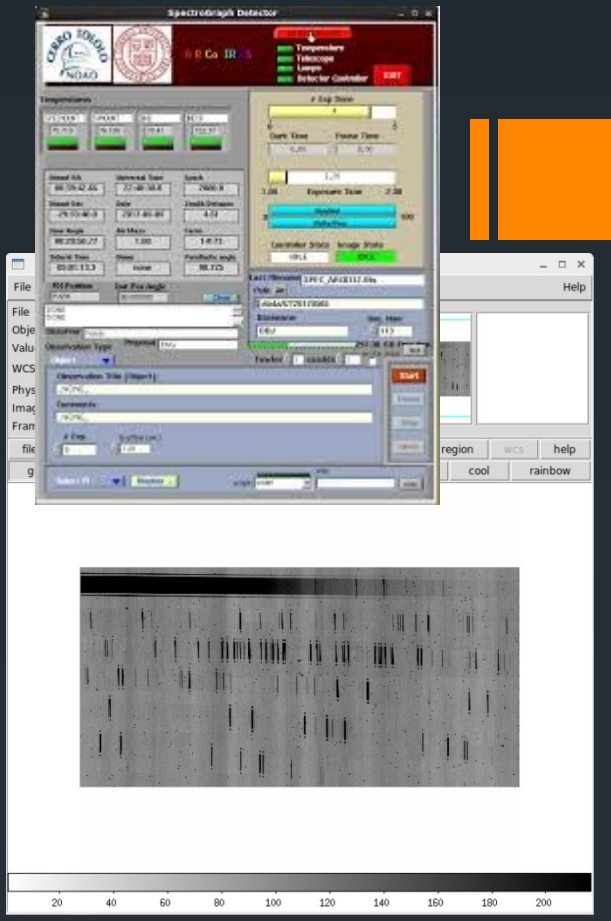
TS4 ARCoIRIS - Astronomy Research using the Cornell Infra Red Imaging Spectrograph

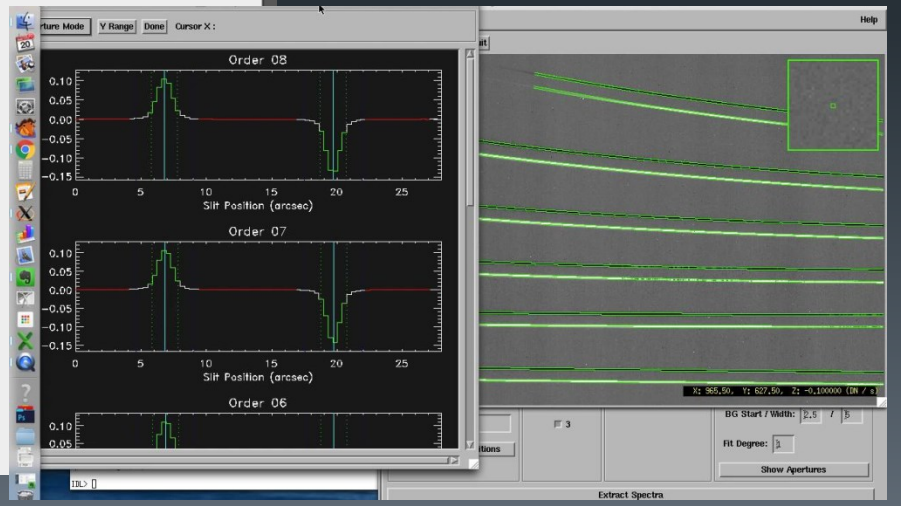


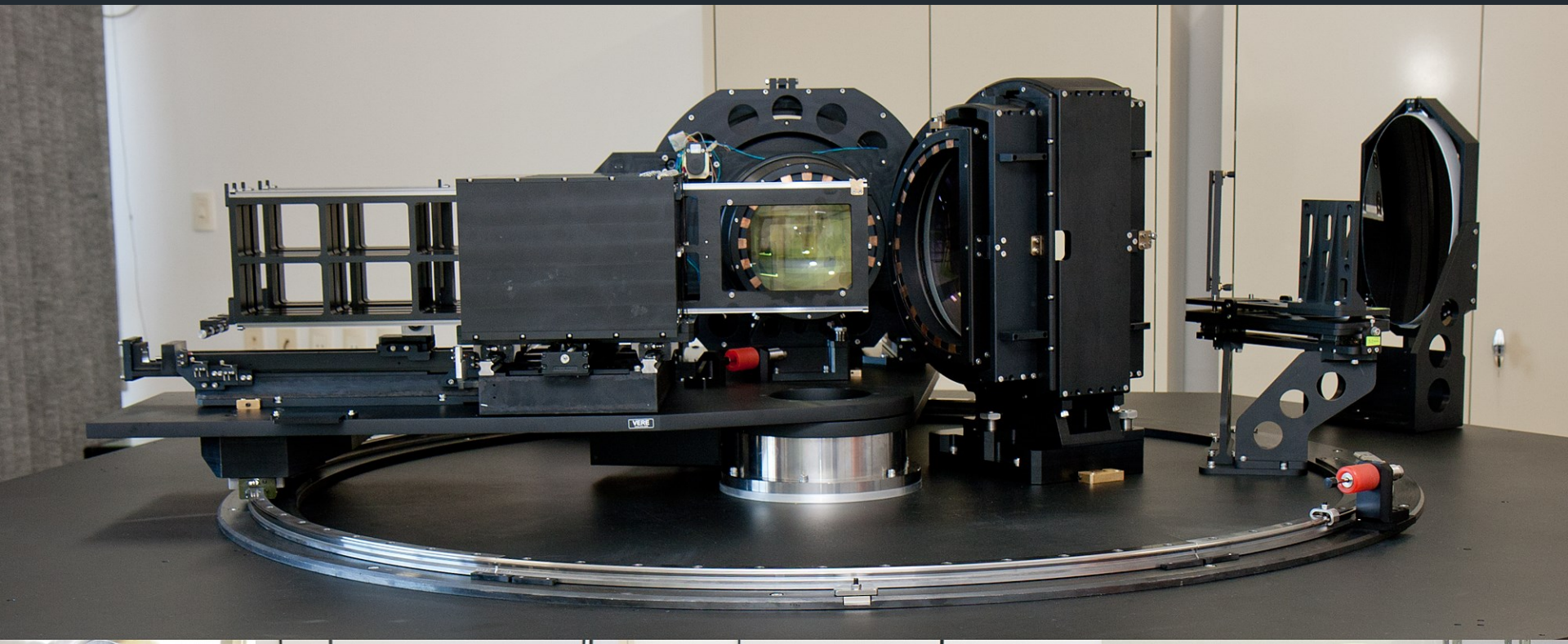
ARCoIRIS is a cross-dispersed, single-object, longslit, infrared imaging spectrograph, containing no moving parts, and is based on an updated design of the three existing TripleSpec spectrographs installed on the 3.5m telescope at Apache Point Observatory, the 5m Hale telescope at Palomar Observatory, and on the 10m KECKII telescope on Maunakea. ARCoIRIS features a fixed slit assembly of 1.1-arcsecs by 28-arcsecs. Spectra cover a simultaneous wavelength range of 0.80 to 2.47 microns, at a spectral resolution of approx. 3500, encompassing the entire z'YJHK photometric range.

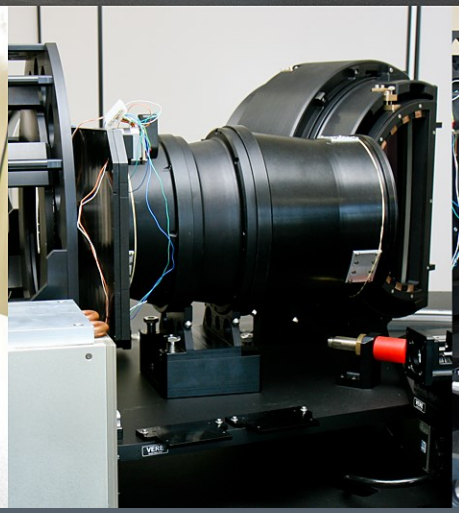
- Instrument Characteristics
- Startup and Shutdown Guide
- Observing Guide
- Instrument Calibration
- Data Reduction
- Request for Assistance
- Acknowledgments
- History

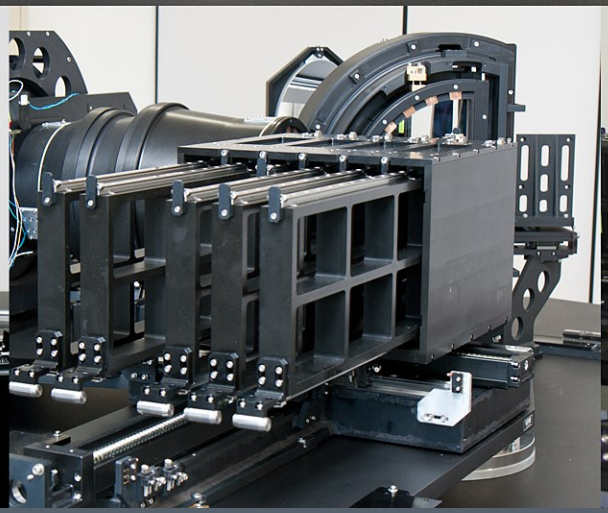
Last Updated: 02 March 2016 (SDP)

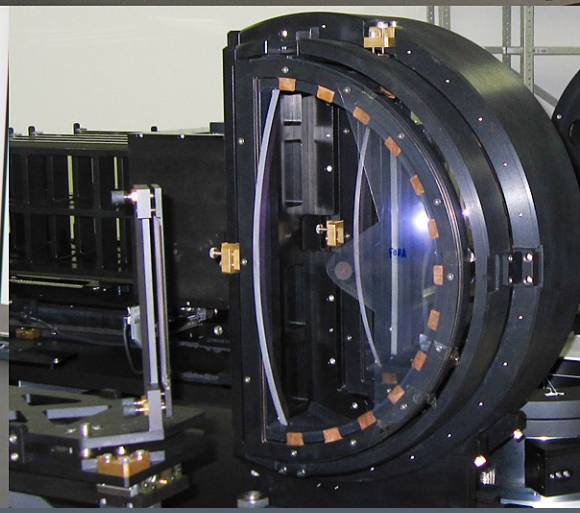


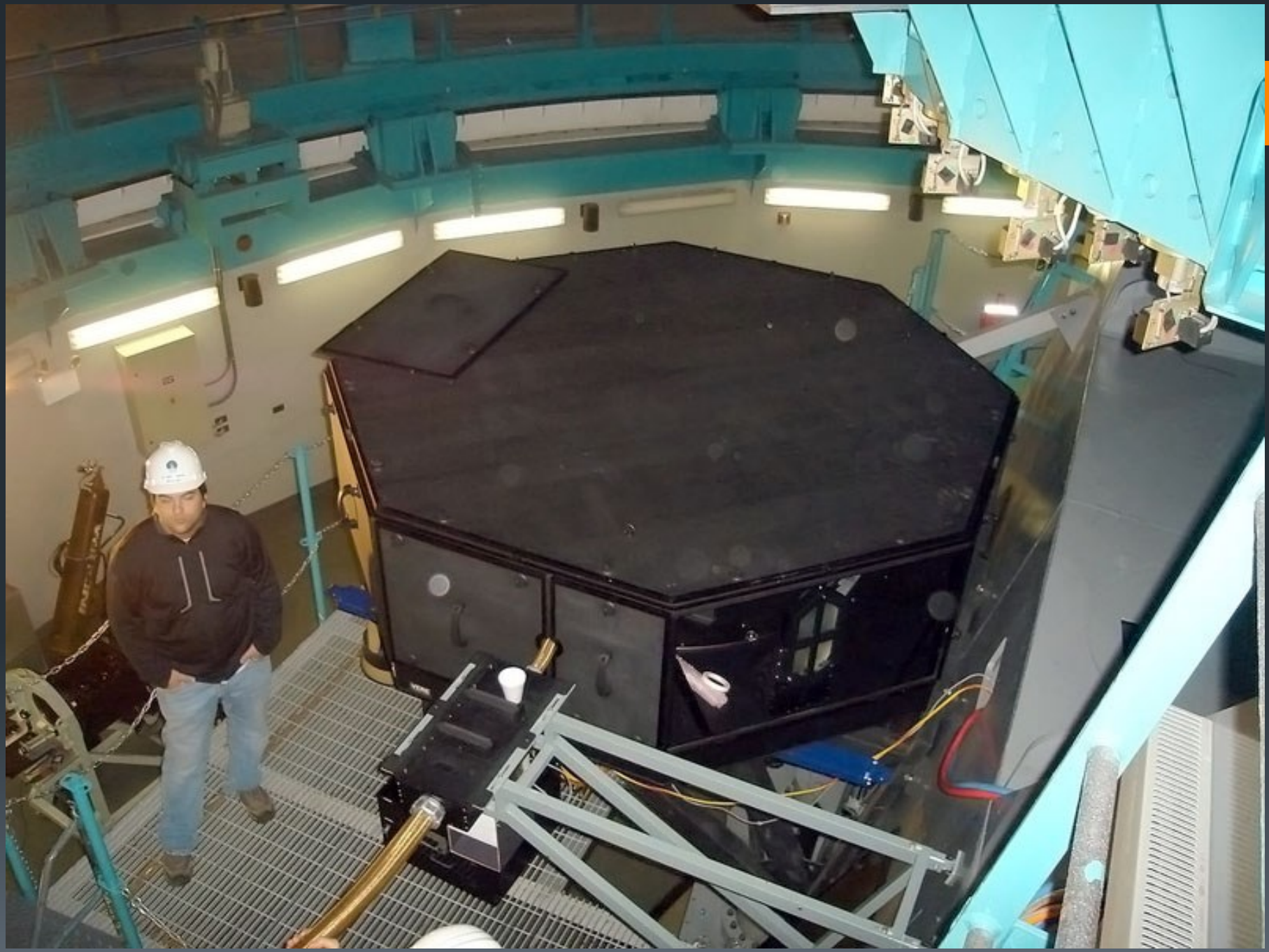


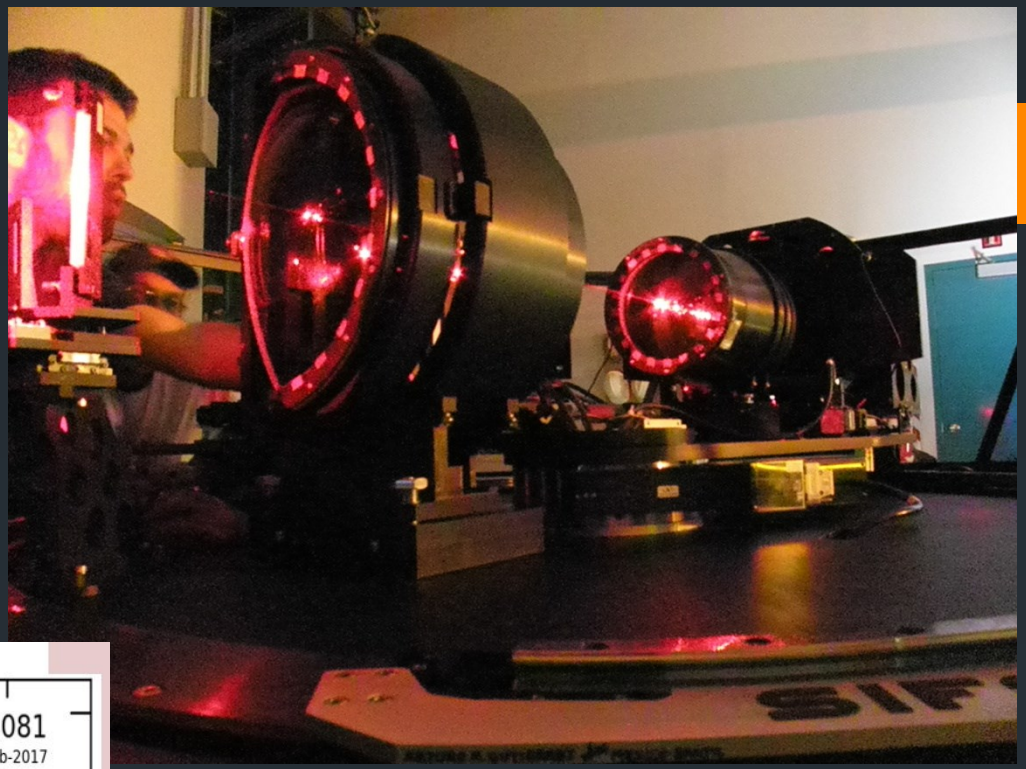












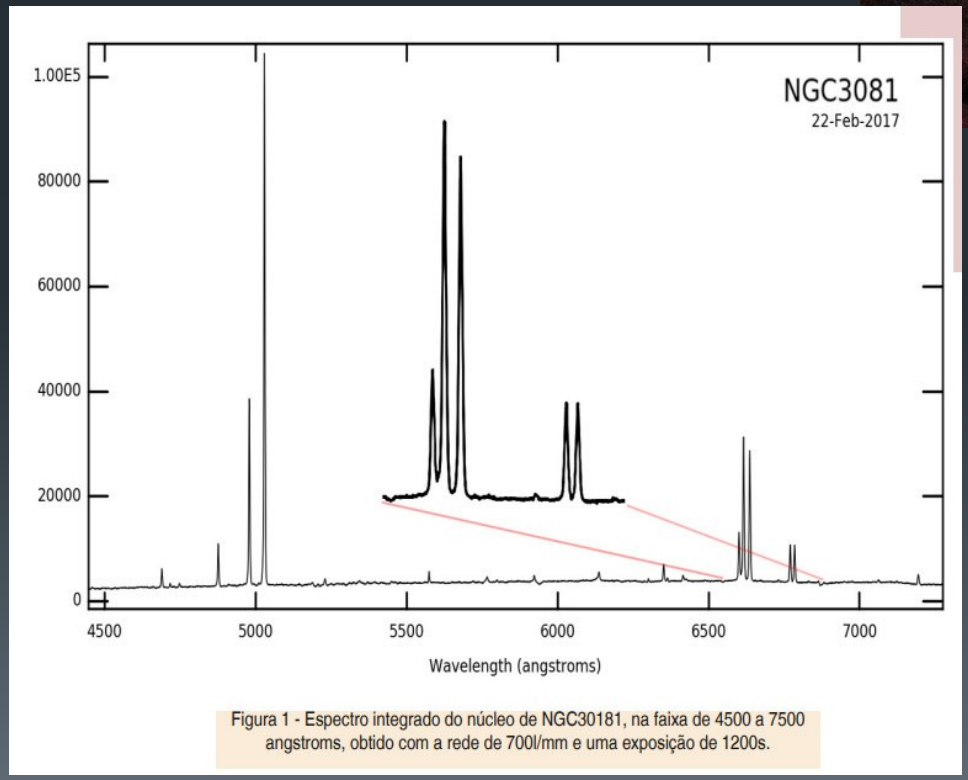
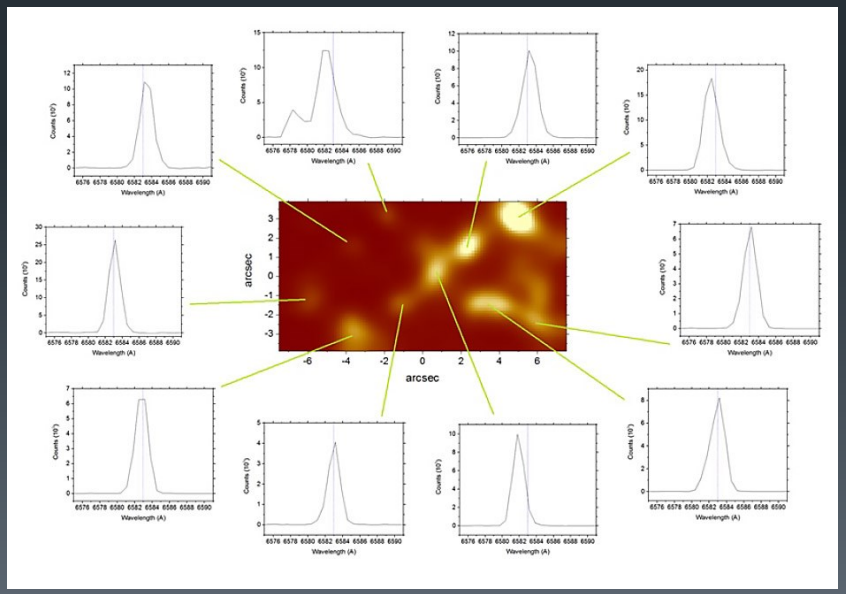
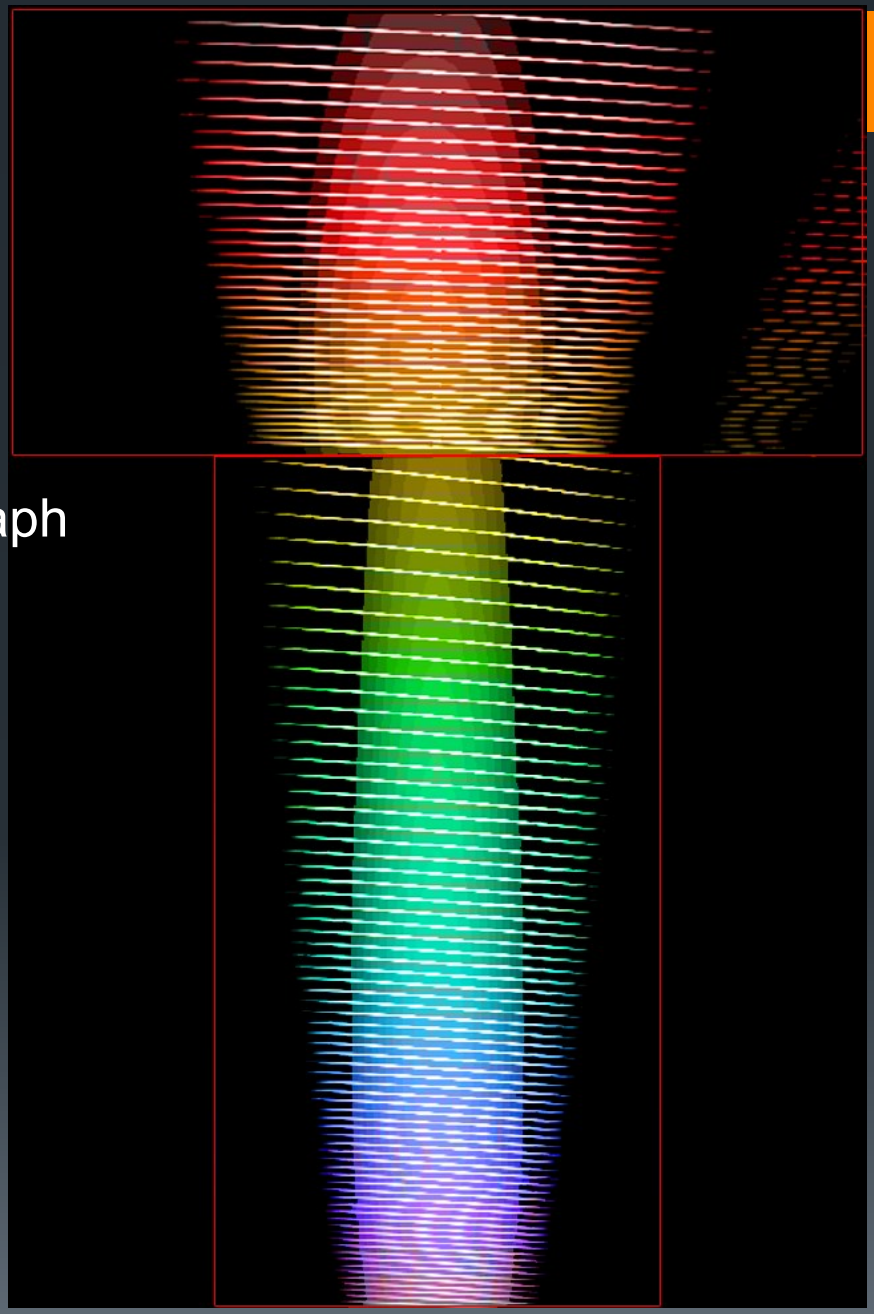


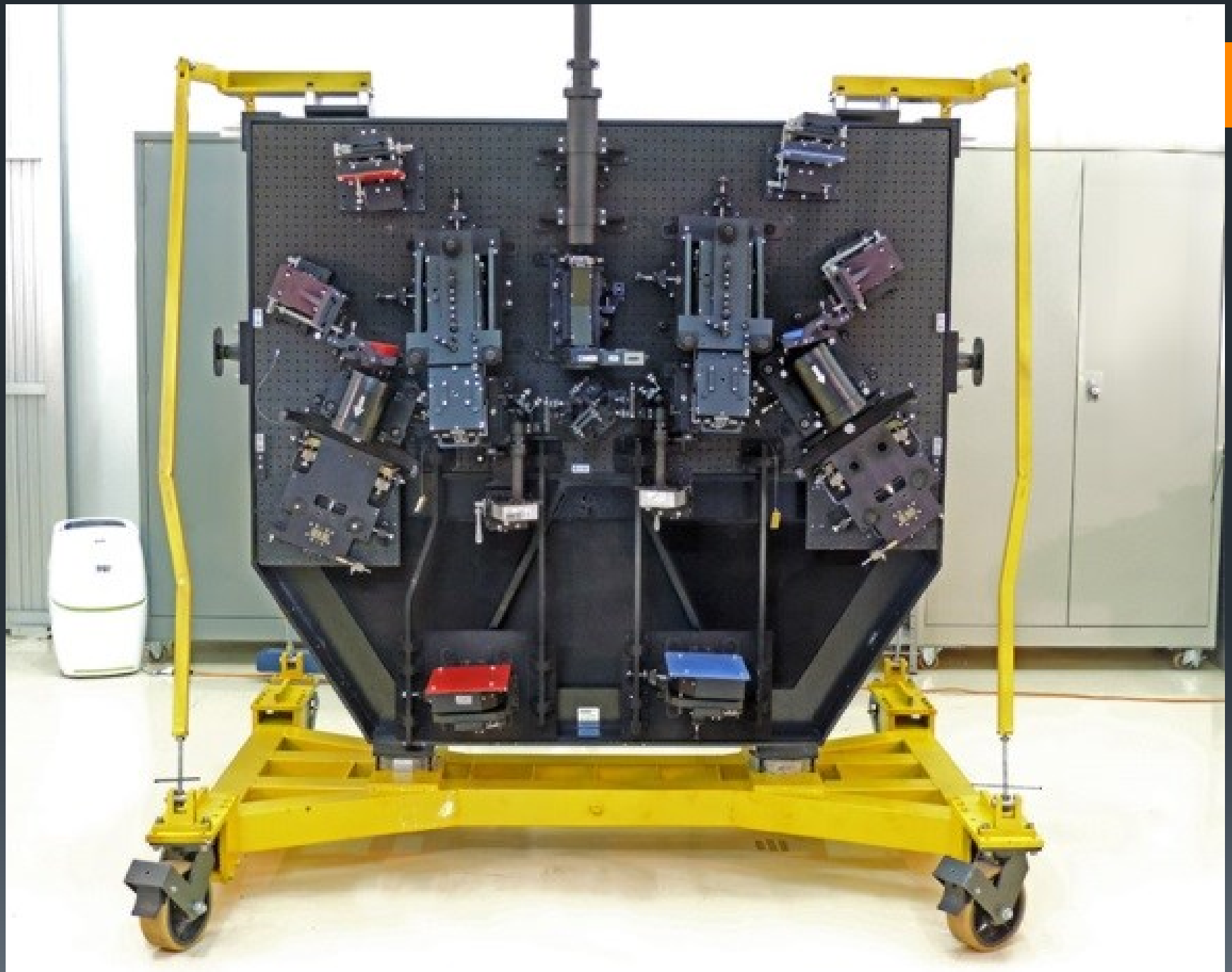
Figura 1 - Espectro integrado do núcleo de NGC30181, na faixa de 4500 a 7500 angstroms, obtido com a rede de 700l/mm e uma exposição de 1200s.

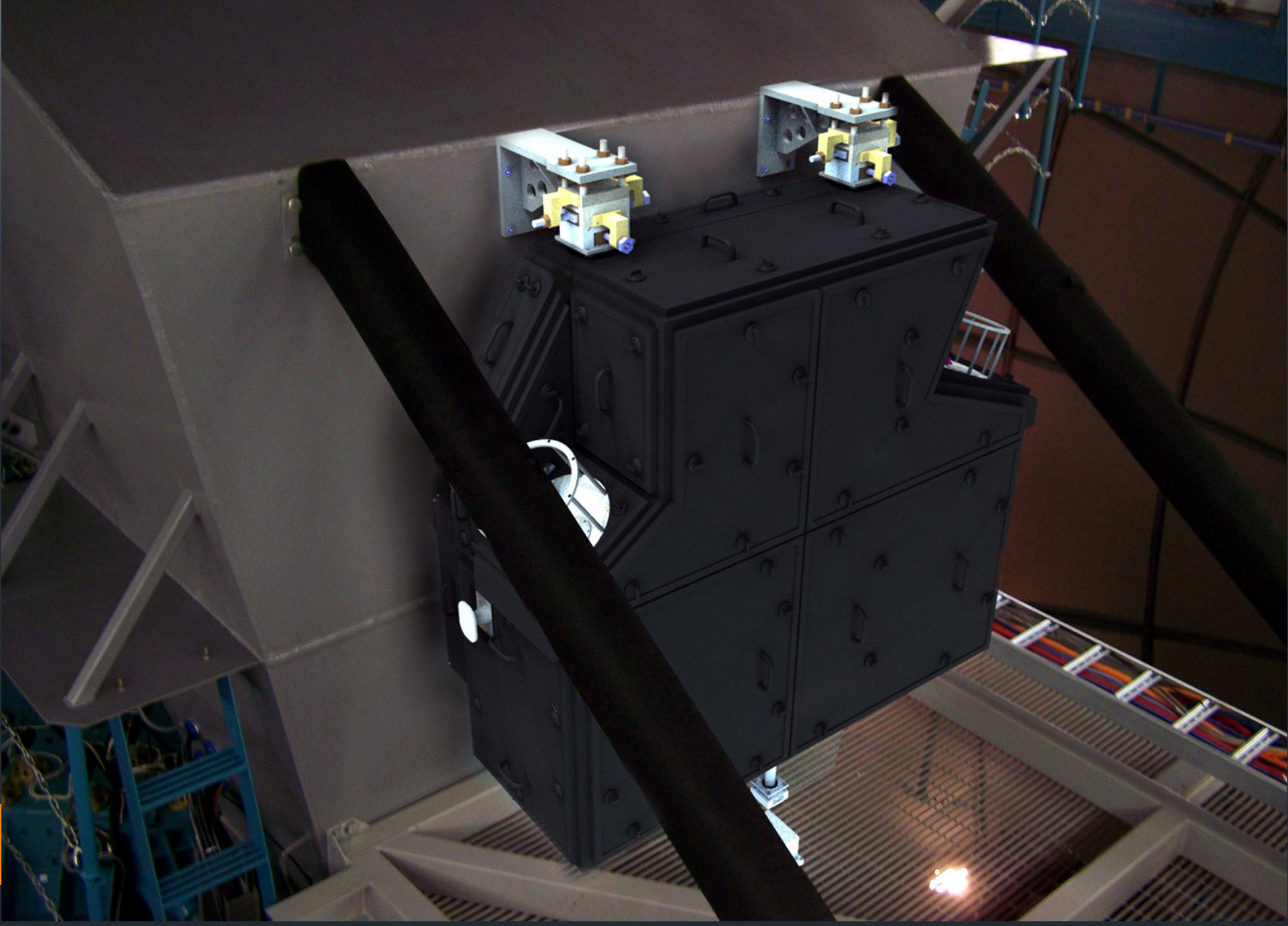


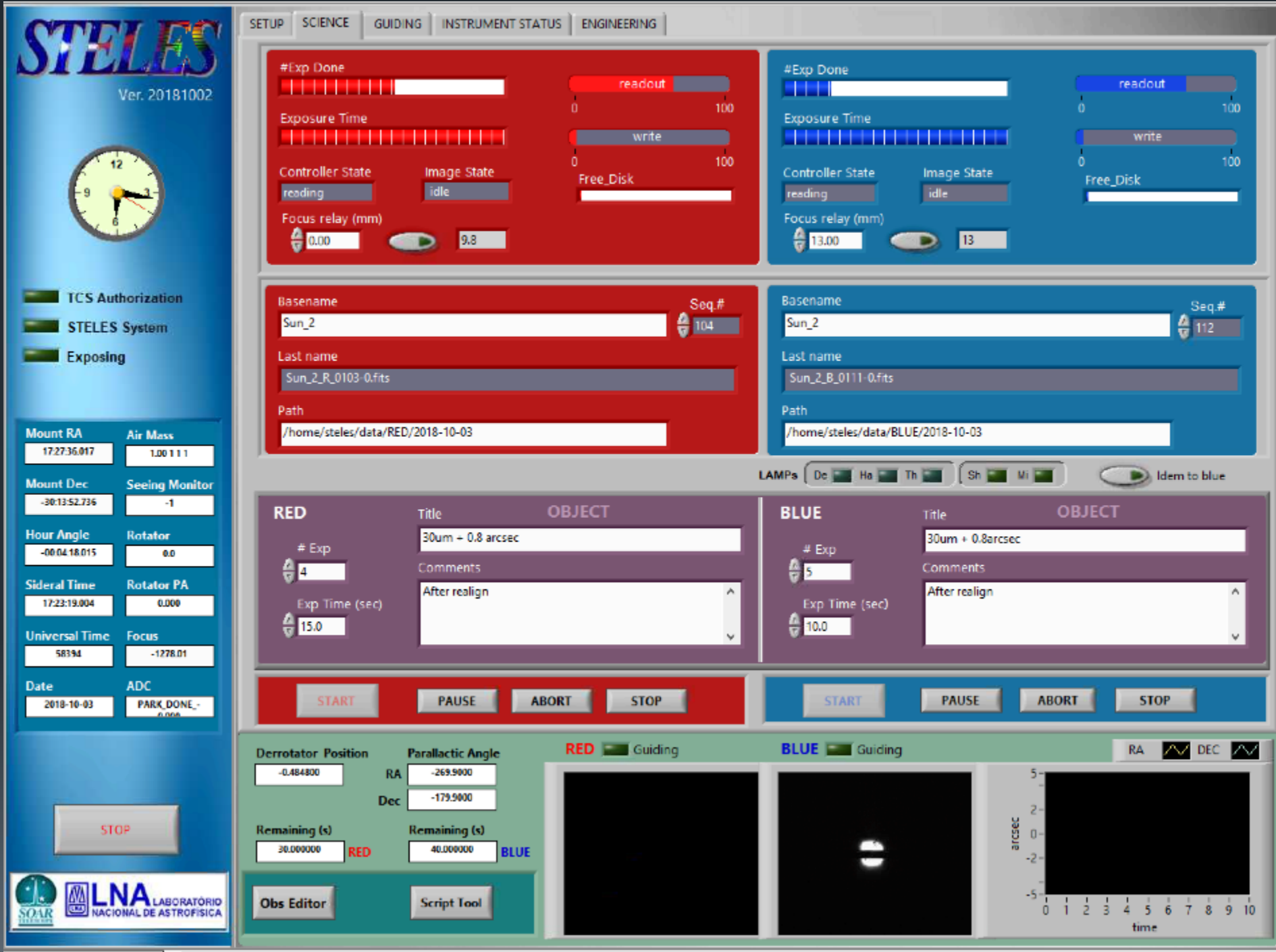
STELES

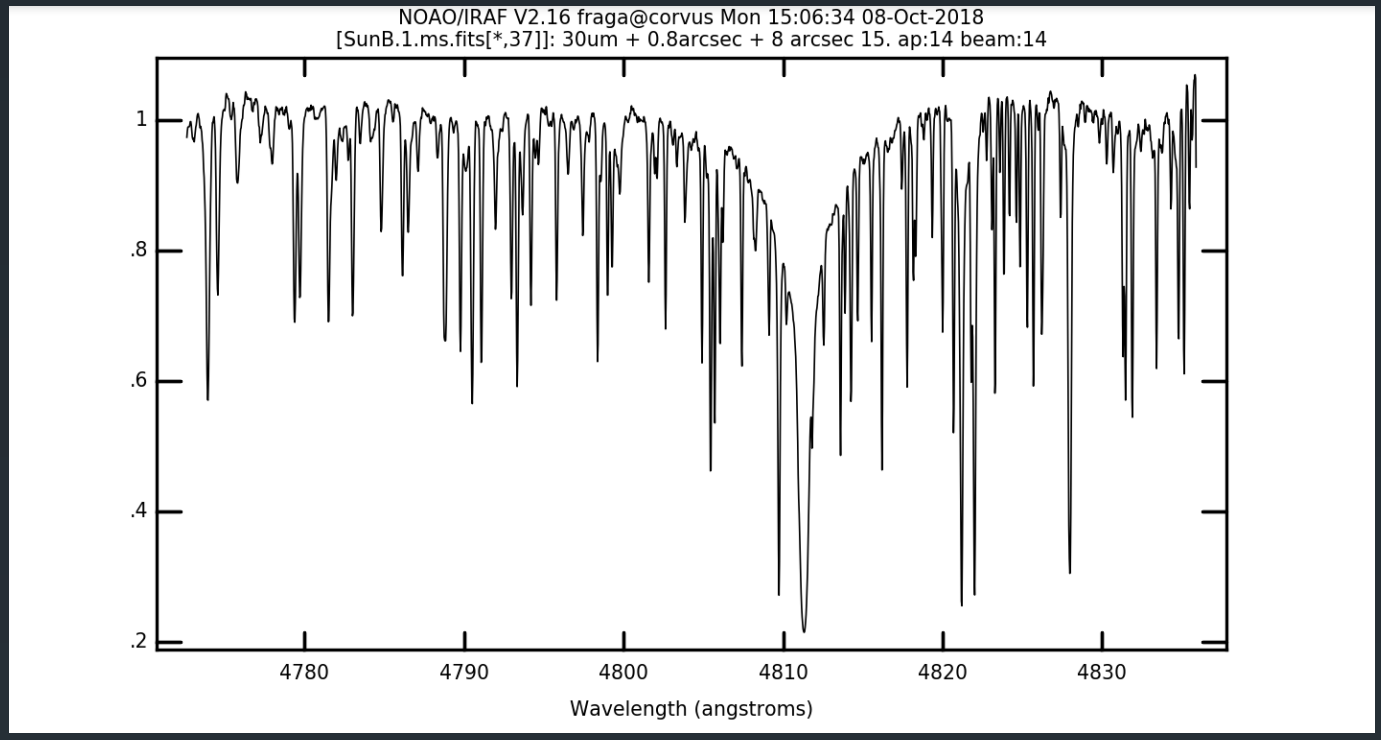
- SOAR Telescope Echelle Spectrograph
  - R = 50k (75k max)
  - 300 – 900nm in one shot - UV
  - Nasmith fed – flux calibration
  - Fixed configuration - stability
  - No moving optical parts
  - 1.8 x 1.5m
  - 800kg
- LNA / USP

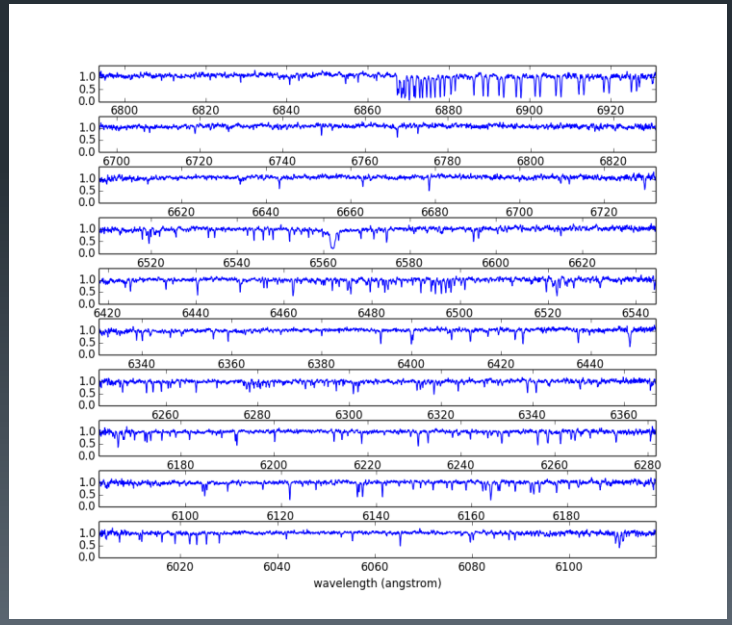


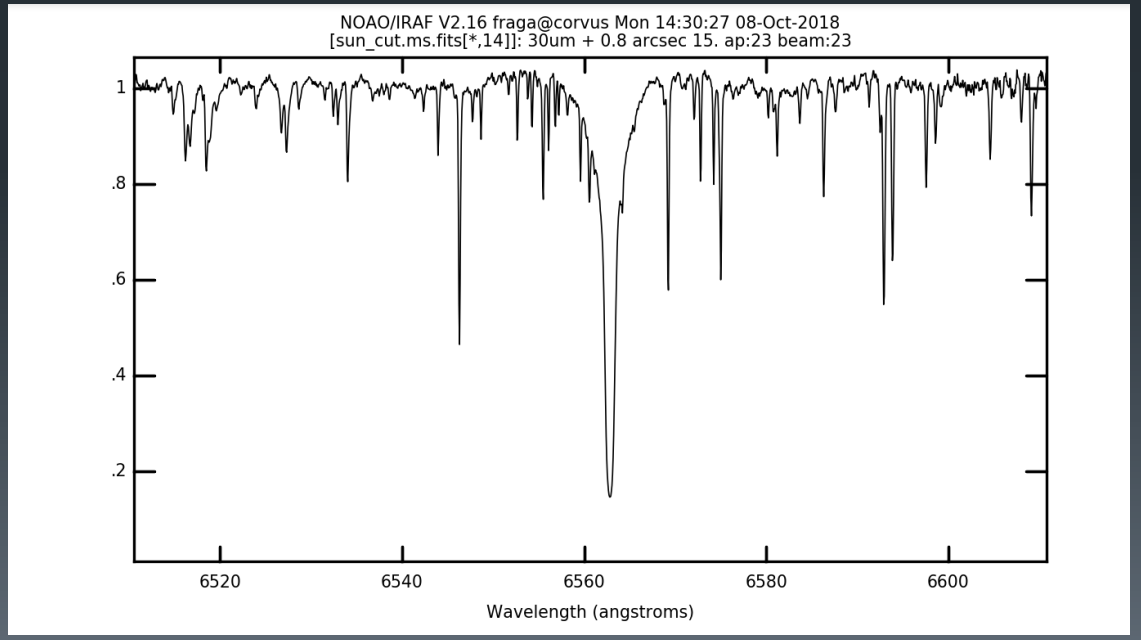





STELES
Ver. 20181002
TCS Authorization
STELES System
Exposing
Mount RA
17:27:36.017
Air Mass
1.00 1 1 1
Mount Dec
-30:13:52.736
Seeing Monitor
-1
Hour Angle
-00:04:18.015
Rotator
0.0
Sideral Time
17:23:19.004
Rotator PA
0.000
Universal Time
58394
Focus
-1278.01
Date
2018-10-03
ADC
PARK_DONE_-
STOP
LNA LABORATÓRIO NACIONAL DE ASTROFÍSICA
SETUP
SCIENCE
GUIDING
INSTRUMENT STATUS
ENGINEERING
#Exp Done
Exposure Time
readout
write
Free_Disk
Controller State
reading
Image State
idle
Focus relay (mm)
0.00
9.8
#Exp Done
Exposure Time
readout
write
Free_Disk
Controller State
reading
Image State
idle
Focus relay (mm)
13.00
13
Basename
Sun_2
Seq.#
104
Last name
Sun_2_R_0103-0.fits
Path
/home/steles/data/RED/2018-10-03
Basename
Sun_2
Seq.#
112
Last name
Sun_2_B_0111-0.fits
Path
/home/steles/data/BLUE/2018-10-03
LAMPs
De
Ha
Th
Sh
Mi
Idem to blue
RED
Exp
4
Exp Time (sec)
15.0
Title
OBJECT
30um + 0.8 arcsec
Comments
After realign
BLUE
Exp
5
Exp Time (sec)
10.0
Title
OBJECT
30um + 0.8arcsec
Comments
After realign
START
PAUSE
ABORT
STOP
START
PAUSE
ABORT
STOP
Derrotator Position
-0.484800
Parallactic Angle
RA
-269.9000
Dec
-179.9000
Remaining (s)
30.000000
RED
Remaining (s)
40.000000
BLUE
Obs Editor
Script Tool
RED
Guiding
BLUE
Guiding
RA
DEC
arcsec
time

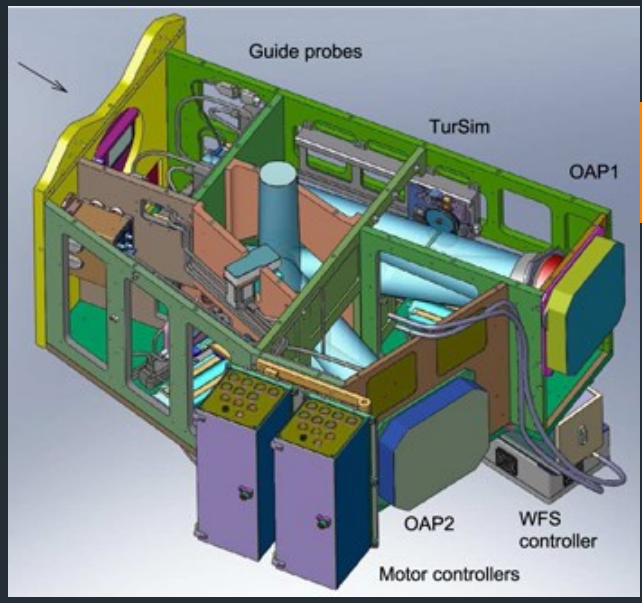

NOAO/IRAF V2.16 fraga@corvus Mon 15:06:34 08-Oct-2018
[SunB.1.ms.fits[*,37]]: 30um + 0.8arcsec + 8 arcsec 15. ap:14 beam:14
1
.8
.6
.4
.2
4780
4790
4800
4810
4820
4830
Wavelength (angstroms)

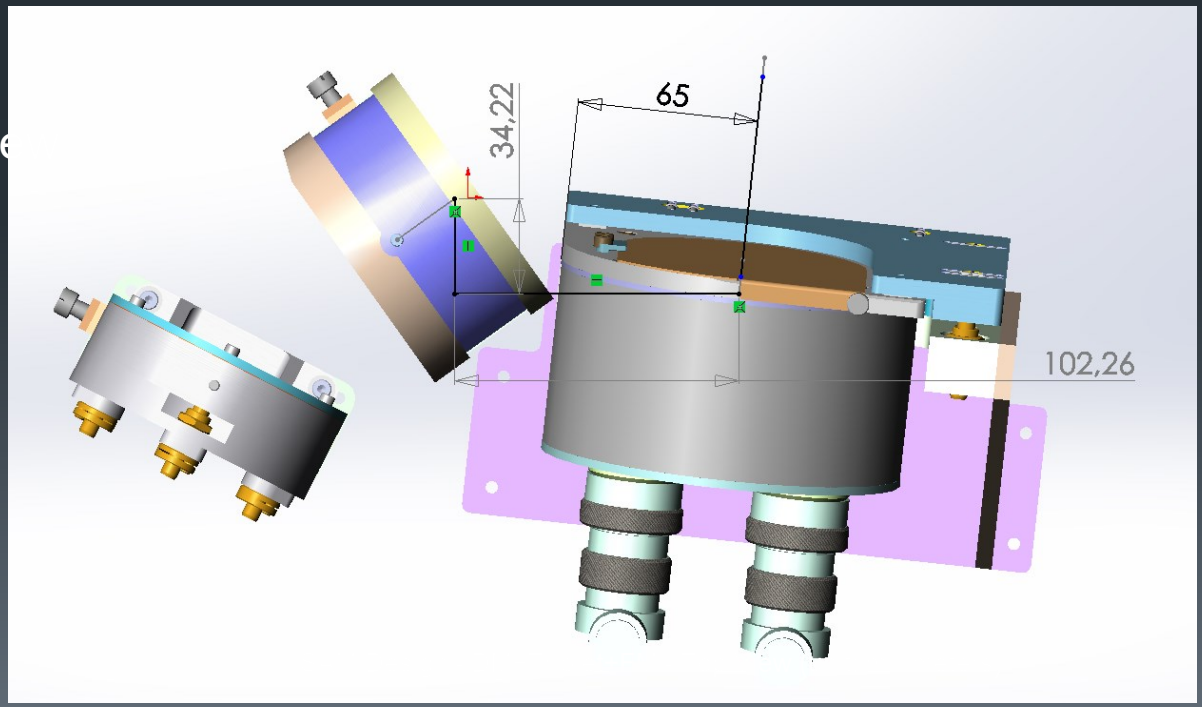

wavelength (angstrom)


NOAO/IRAF V2.16 fraga@corvus Mon 14:30:27 08-Oct-2018
[sun_cut.ms.fits[*,14]]: 30um + 0.8 arcsec 15. ap:23 beam:23
1
.8
.6
.4
.2
6520
6540
6560
6580
6600
Wavelength (angstroms)

SAM-Plus

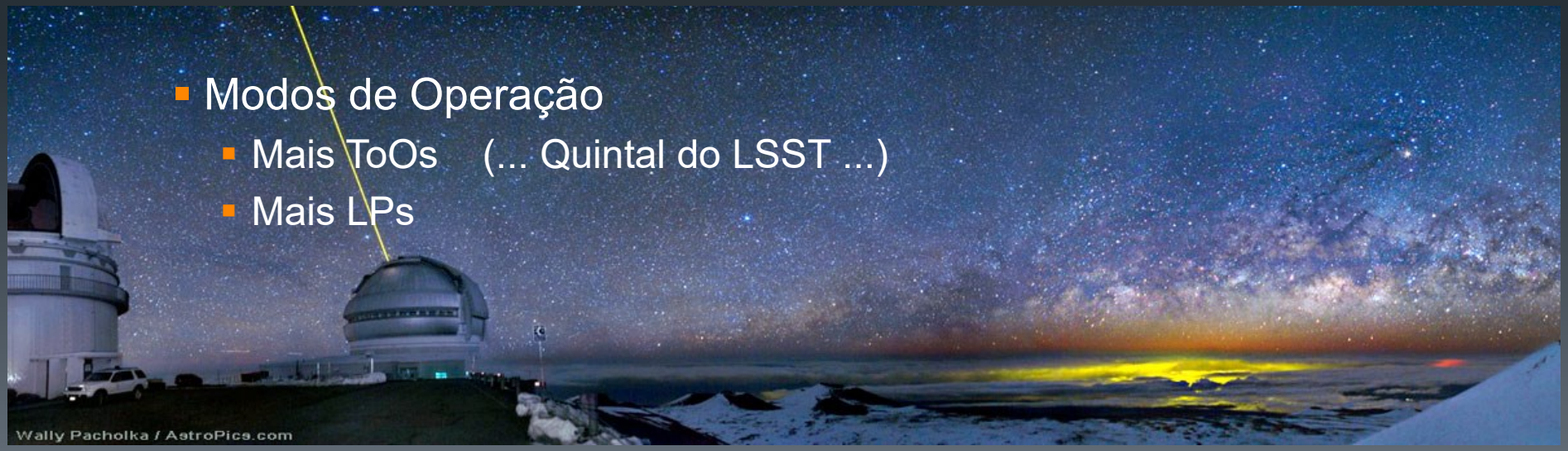
- SOAR Adaptative module upgrade
- IAG / SOAR / LNA
  - Upgrade for the present SOA AO
  - IAG leading project
  - Fabrication at USP
  - Conceptual design revie
    - 2018-10-16





Gemini

- Dez 2021
  - %
  - Atual – 6% US$ 2M
- NCOA
  - LSST, CTIO integrados na mesma administração
- Instrumentação
- Modos de Operação
  - Mais ToOs (... Quintal do LSST ...)
  - Mais LPs



Gemini

Gemini North Instruments

VISIBLE	NEAR-IR	MID-IR	OTHER FACILITIES
Facility Instruments			
GMOS (multi-object, long-slit and IFU spectrograph and imager) Instrument Fact Sheet	NIRI (1-5μm imager) Instrument Fact Sheet		GCAL (facility calibration unit)
	NIFS (1.0-2.5μm integral field spectrograph) Instrument Fact Sheet		ALTAIR (facility natural/laser guide star AO system)
	GNIRS (1-5μm long-slit and 0.9-2.5μm cross-dispersed spectrograph; formerly at Gemini South) Instrument Fact Sheet		
Visiting Instruments			
GRACES (0.4-1.0μm high resolution spectrograph)			
'Alopeke (diffraction-limited optical imager)			
POLISH2 (optical polarimeter)			
Expected to be available in 2019A. For more info on these or other Visiting Instruments, contact gemini-vip@gemini.edu			

Gemini South Instruments

VISIBLE	NEAR-IR	MID-IR	OTHER FACILITIES
Facility Instruments			
GMOS (multi-object, long-slit and IFU spectrograph and imager) Instrument Fact Sheet			GCAL (facility calibration unit)
	GSAOI (high-resolution imager for use with Multi-Conjugate Adaptive Optics system "GeMS") Instrument Fact Sheet		GeMS (Multi-conjugate adaptive optics system)
	GPI (adaptive-optics imaging polarimeter/integral-field spectrometer) Instrument Fact Sheet		
	FLAMINGOS-2 (long-slit spectrograph and imager) Instrument Fact Sheet		
Visiting Instruments			
DSSI (diffraction-limited optical imager)	Phoenix (high-resolution spectrograph)		

Expected to be available in 2019A. For more info on these or other Visiting Instruments, contact gemini-vip@gemini.edu

Default

Future Instrumentation & Current Development

SCORPIO

With great pleasure we proudly announce SCORPIO as our next facility-class instrument. SCORPIO will be a wide-band medium-resolution spectrograph and imager. This powerful facility will be designed to support a wide range of science and to take advantage of the Large Synoptic Survey Telescope follow-up opportunities. SCORPIO stands for Spectrograph and Camera for Observations of Rapid Phenomena in the Infrared and Optical.

A contract to design, build, and commission the instrument was signed between the Southwest Research Institute (SwRI) in San Antonio, Texas, and the Association of Universities for Research in Astronomy (AURA) in March 2017. The project is in the Critical Design Stage of instrument build.

Gemini High-resolution Optical SpecTrograph (GHOST)

Gemini has contracted with the Australian Astronomical Observatory (AAO) for the continued design and construction of the **G**emini **H**igh-resolution **O**ptical **S**pec**T**rograph (GHOST). The AAO has, in turn, subcontracted the National Research Council Herzberg (NRC-H) for the construction of the spectrograph and The Australian National University (ANU) for instrument software.

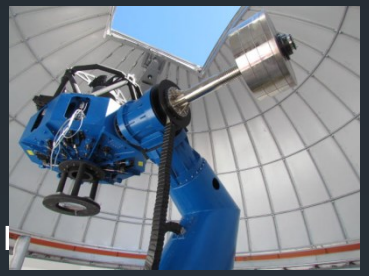
The project is currently in the build phase. GHOST will provide two-object plus sky spectroscopy with full wavelength coverage from ~363 - 950 nm at resolutions from 50,000 to 75,000.

NGS2

NGS2 is a project to improve the sky coverage of GeMS by upgrading the current natural guide star sensor. The Natural Guide Star (NGS) Next Generation Sensor (NGS2) team, led by the Australian National University (ANU) held its design review at Mt. Stromlo, Australia from 24 to 27 March 2015. Overall, the review was successful and we have a high degree of confidence that the project will meet the science goals of a 1.5 magnitude boost in sensitivity compared to the current NGS in GeMS. This sensitivity increase will approximately triple sky coverage for GeMS while the NGS2 unit itself is also designed to make the overall system easier to support. We are aiming for installation in 2018.

Telescópios Dedicados

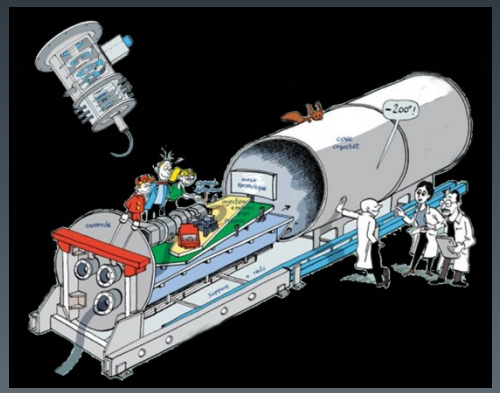
- Impacton
  - dedicado ao estudo de pequenos corpos do Sistema Solar
- T80S
  - Southern Photometric Local Universe Survey (S-PLUS)
- Telescópio solar INPE
- Abras (Argentina-Brazil Astronomical Center)
  - pequeno telescópio otimizado para o infravermelho a 5.000 m de altura em Cerro Macon, Argentina
- ....

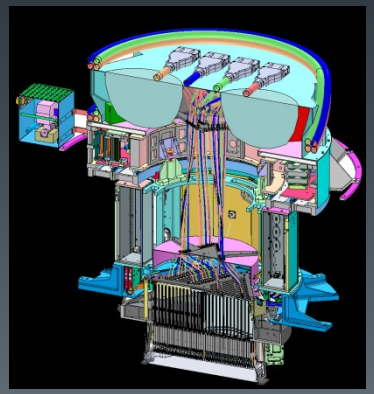


- Projetos de grupos
  - Mesmo quando abertos a iniciativa foi restrita
- Até agora não foram excludentes com os demais projetos
- Vamos investir mais em telescópios dedicados ou nos abertos?

Surveys

- Dedicados
  - J-PAS (Javalambra Physics of Accelerating Universe Astrophysical Survey)
  - Sloan Digital Sky Survey III
  - Dark Energy Survey (DES)
  - Transneptunian Occultation Network
- LSST (Large Synoptic Survey Telescope)
- De instrumentos
  - SPIROU
  - Subaru PFS

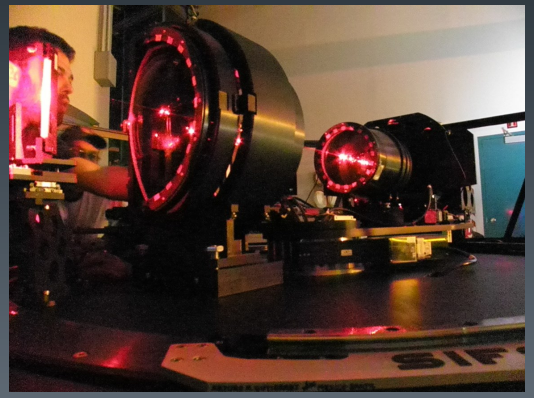


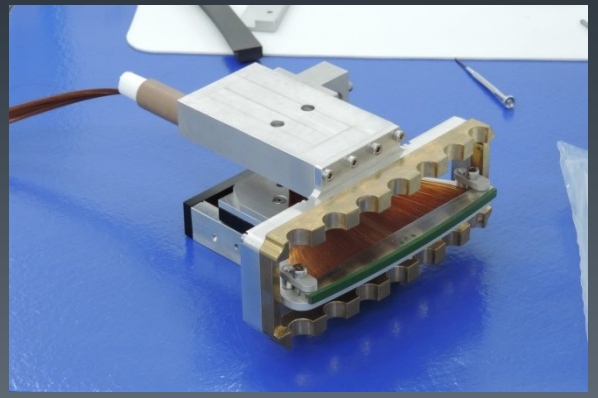


Instrumentação

- Usar ou construir?
  - SOAR -> construção de instrumentos de classe mundial
  - Investimentos em desenvolvimento
    - Laboratórios e pessoal capacitado (MCT, I.Milenio, Pronex, INCT)

- Astrofísica potencializada com desenvolvimento de instrumentação de ponta
  - incentivar a *cultura da inovação tecnológica*
  - treinamento de cientistas e técnicos em tecnologias emergentes
  - “ na astronomia para que possa haver avanço científico, é necessário avançar as fronteiras tecnológicas e promover a inovação ”



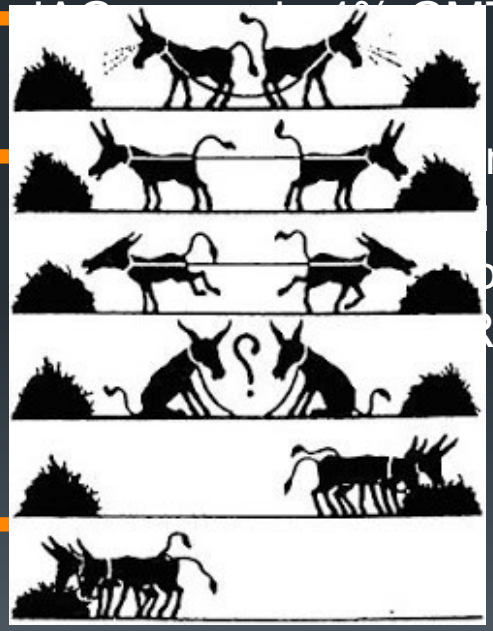


Instrumentação

- Projetos de instrumentação
  - Vários pesquisadores de muitas instituições apoiam, mas poucos são os apoios institucionais
- Hardware
  - LNA, INPE, IAG começando, CBPF(cosmololgia, altas energias)
- Gerenciamento de projetos
  - LNA, ON, IAG
- Software, Banco de Dados
  - ON + Linea, UFSC, LNA, CBPF, IAG
- Aumentar o número de instituições envolvidas
  - Sinergia - É importante - mas as instituições querem – podem devem ?
  - Sair do circuito da astronomia ?

O que fazer

- Jeito mais fácil
  - (pra comunidade....)
    - LNA renova Gemi SOAR
    - ON Linea renovam *surveys*
    - T
    - ncia e
      ir $
      s na
      J



- Forma certa
  - Mapeamento da nossa ciência
  - Mapeamento das prioridades
  - Ferramentas necessárias
  - Infraestrutura necessária
  - Trabalho em conjunto p conseguir a $$

Para pensar

- Comunidade
  - Pensar e trabalhar nas prioridades p próxima década
  - SAB planejamento
- Workshop – G.S.O 2020 ??
  - OPD – como manter atualizado, ensino ?
  - Gemini – SOAR – termos da renovação
  - CFHT ou outros de médio porte – queremos? Investigar, $$
- 30 metros
  - Opções – batalhar pela participação e $$
- Surveys e telescópios dedicados
  - Quanto e onde investir ? Comunidade ou projetos de grupo ?

Obrigado

ORATÓRIO
TROFÍSICA