THE OBSERVATORIO ASTROFÍSICO DE JAVALAMBRE

CEFCA
Centro de Estudios de Física del Cosmos de Aragón

Javier Cenarro (+ the J-PAS collaboration)
CEFCA
Ramón y Cajal Fellow
OAJ Project Manager

The *Observatorio Astrofísico de Javalambre*

Spanish Participation in Future Programs
Deep galaxy surveys, LSS and DE
Valencia, March 2012

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1. OAJ MOTIVATION
2. THE OAJ SITE
3. JST/T250 (Javalambre Survey Telescope)
4. JAST/T80 (Javalambre Auxiliary Survey Telescope)
5. OAJ CIVIL WORK & GENERAL INSTALLATIONS
6. THE DATA MANAGEMENT

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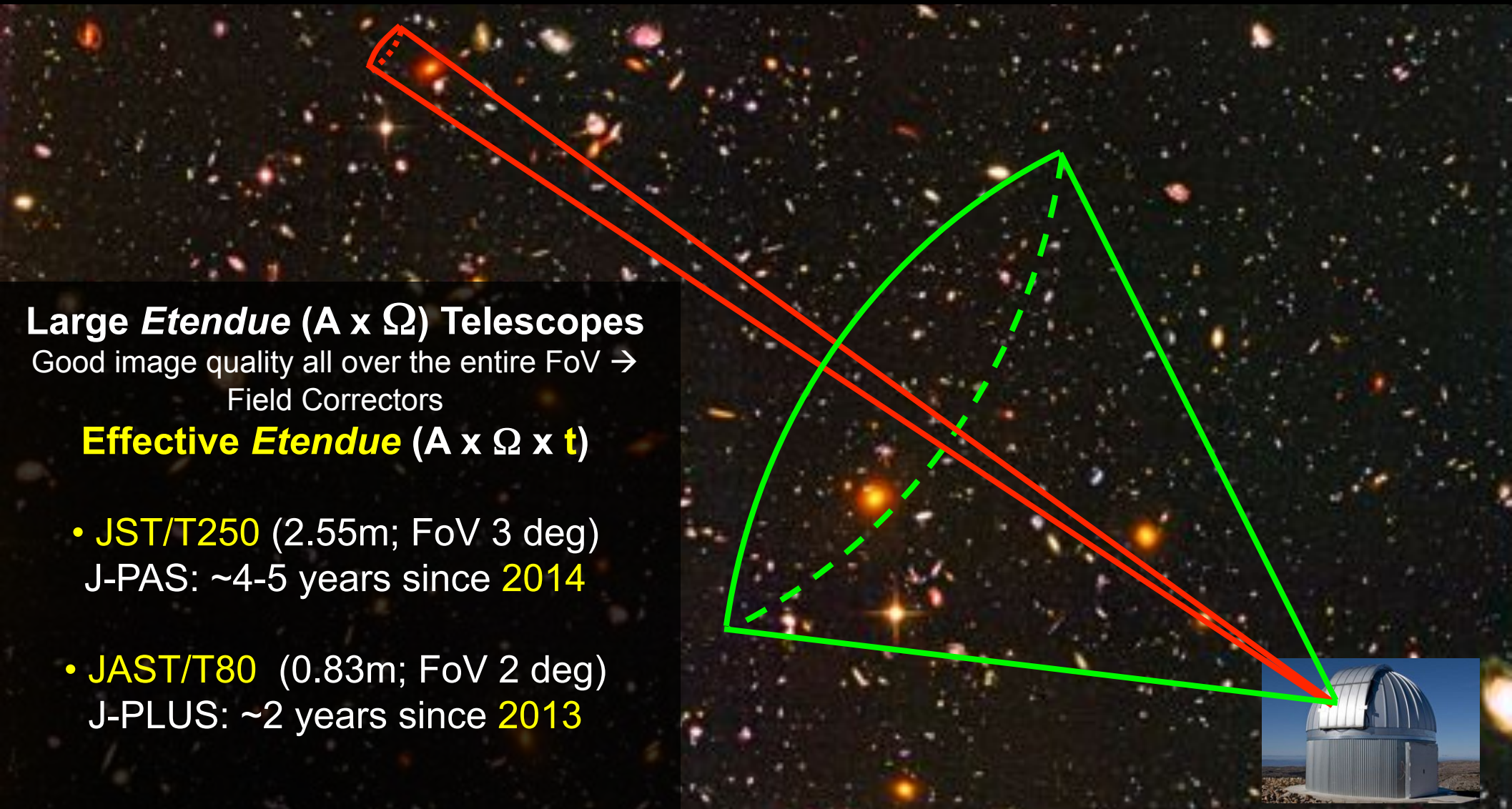
THE *OBSERVATORIO ASTROFÍSICO DE JAVALAMBRE* (OAJ): A NEW OBSERVATORY FOR CARRYING OUT LARGE SKY SURVEYS

Large *Etendue* (A x Ω) Telescopes
Good image quality all over the entire FoV → Field Correctors
Effective *Etendue* (A x Ω x t)

- JST/T250 (2.55m; FoV 3 deg)
  J-PAS: ~4-5 years since 2014

- JAST/T80 (0.83m; FoV 2 deg)
  J-PLUS: ~2 years since 2013



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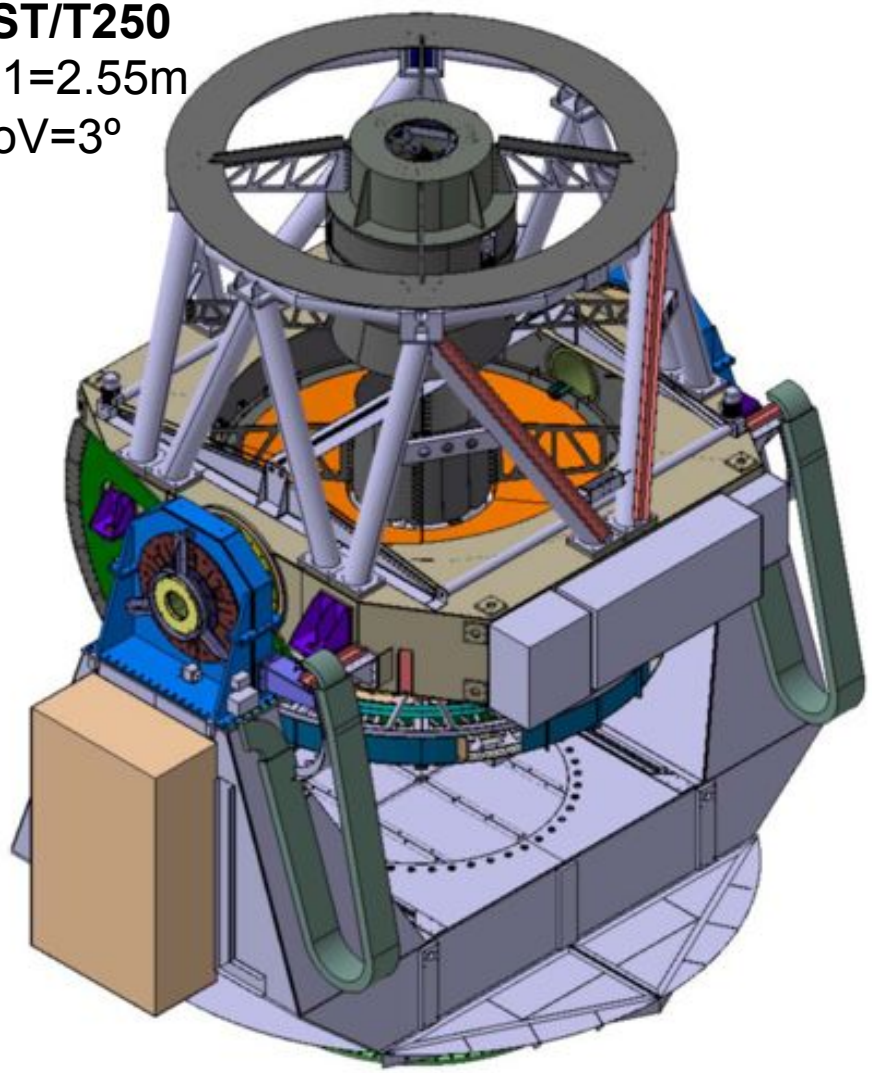
THE OAJ TELESCOPES

- CEFCA (http://www.cefca.es)
- Design: AMOS & CEFCA. Kick-off Mar 2010
- Supervised by a international committee of experts (ODR, PDR, FDR)

JST/T250
M1=2.55m
FoV=3º



JAST/T80
M1=0.83m
FoV=2º

Fabrication
- T250: AMOS (Belgium)
- T80: ASTELCO (Germany)

- Main subcontractors: FC & M2's (USA), Mirror blanks (Germany), Hexapodes (France & Germany),TCS (UK), etc.

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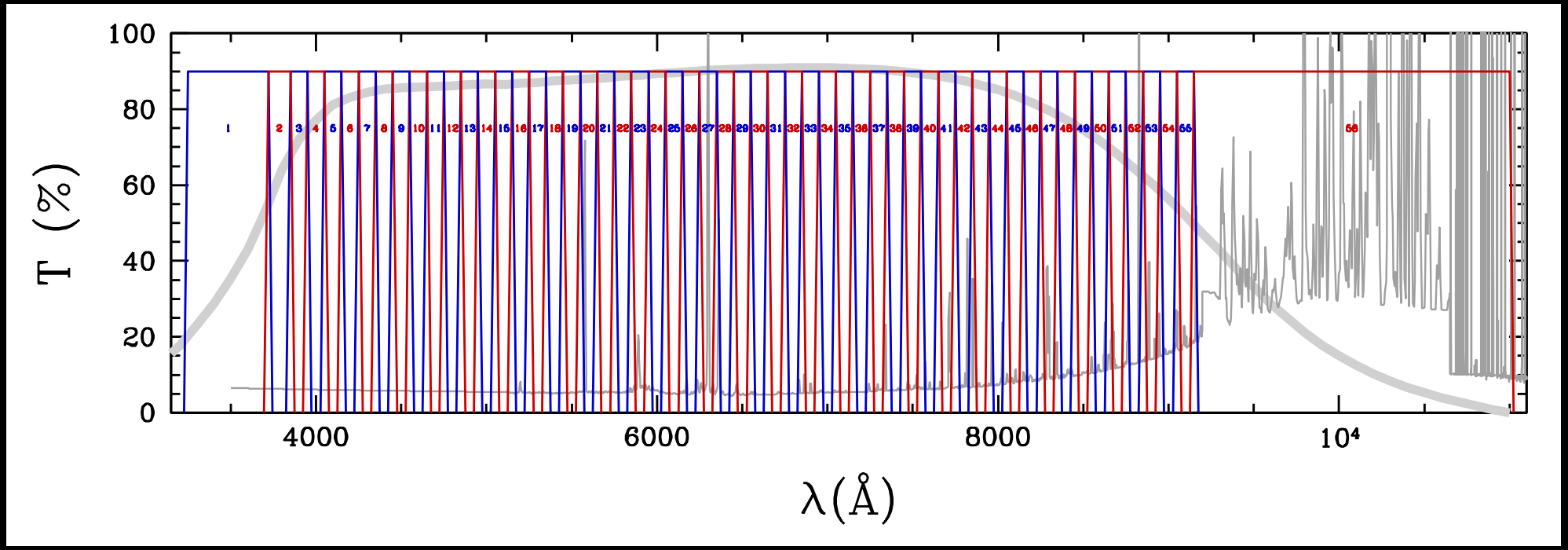
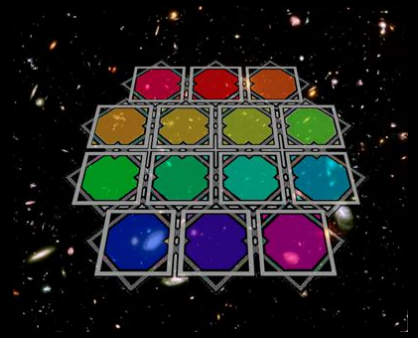
J-PAS @ JST/T250

Javalambre-PAU Astrophysical Survey



~8000 deg^2 with 54 (+2) filters of ~100Å width down to AB~23 – Time: ~ 5 years



Barionic Acoustic Oscillations

Photo-z's (Δz~0.3%) for tens of millions of LRGs, ELGs and QSOs.

Plus many other scientific returns:

Galaxy evolution, SFR evolution, galaxy clusters, 2D stellar populations, Milky Way structure, SNe, GRBs, very low mass objects, exoplanets, Solar System minor bodies…

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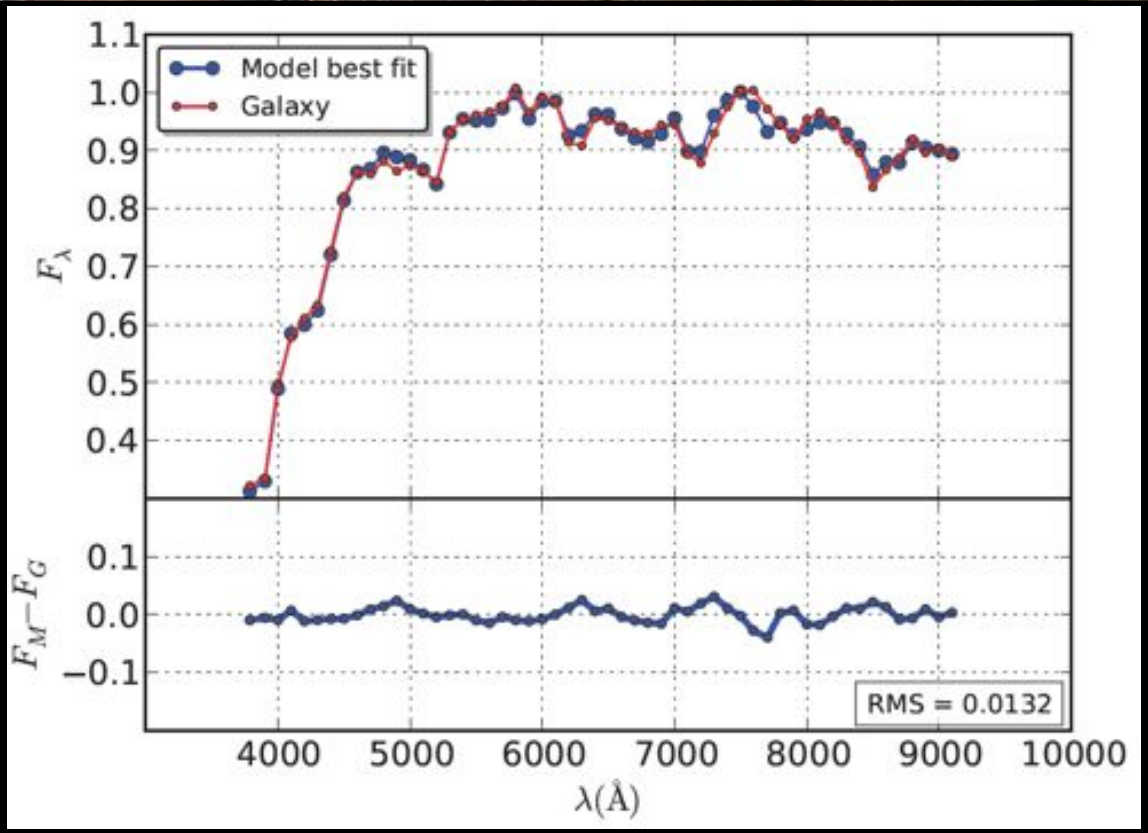
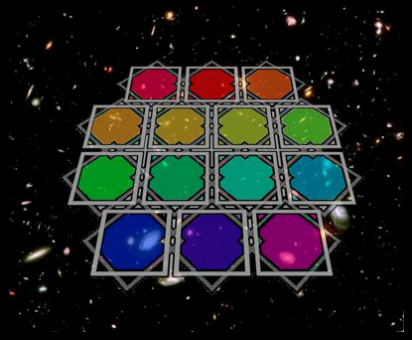


~8000 deg^2 with 54 (+2) filters of ~100Å width down to AB~23 – Time: ~ 5 years



Barionic Acoustic Oscillations
Photo-z's (Δz~0.3%) for tens of millions of LRGs, ELGs and QSOs.

Plus many other scientific returns:
Galaxy evolution, SFR evolution, galaxy clusters, 2D stellar populations, Milky Way structure, SNe, GRBs, very low mass objects, exoplanets, Solar System minor bodies…

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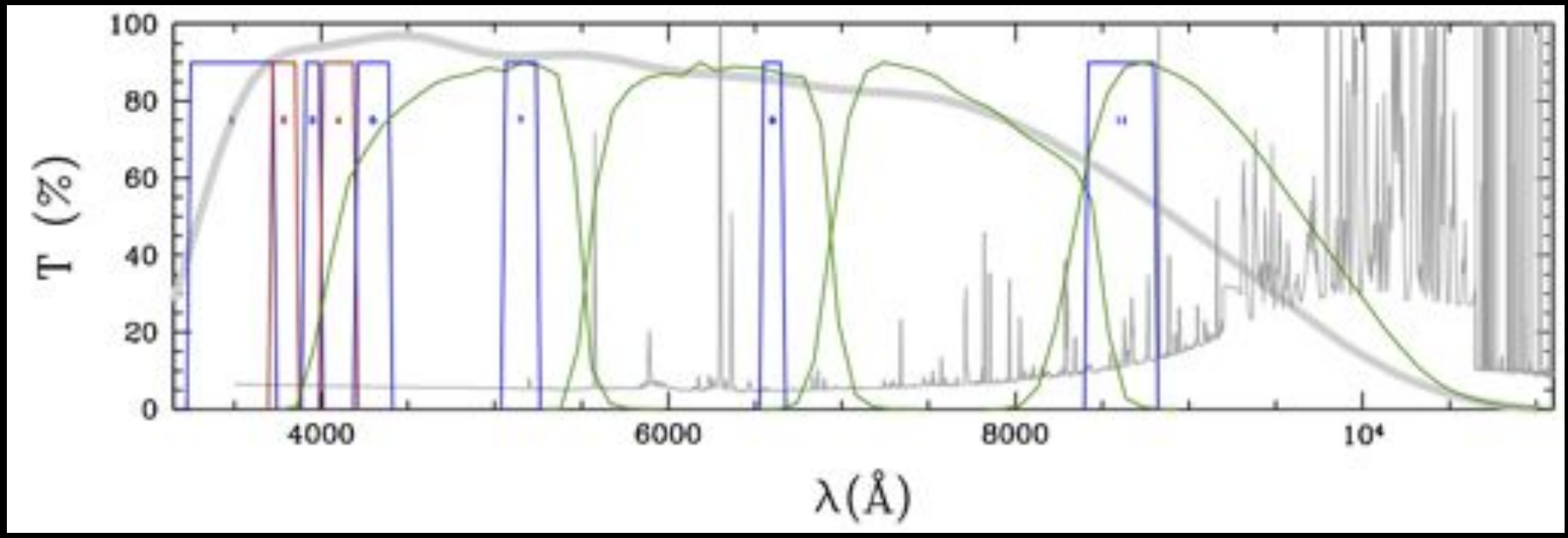
J-PLUS @ JAST/T80

Javalambre Photometric Local Universe Survey



Based on lessons learned from Bailer-Jones (2000, 2004), Bessell (2005), Jordi et al. (2006), etc

"*Stellar physical parameters can be recovered with a combination of **10-15 medium and broad band filters with S/Ns ~50***"

SDSS (*g*, *r*, *i*, *z*) + u_J + J378_[OII] + J395_[H+K] + J410_[Hδ] + J430_[G-band] + J515_[Mgb-Fe] + J655_[Hα] + J861_[CaT]

T80Cam STA CCD 10.5k x 10.5k 0.5"/pix → **FoV = 2.12 deg²**

>1000 calibrating stars per pointing with AB < 18 and S/N > 50 at the North Galactic pole

In ~1800s integration time "on target" (u_J, g, r, i > 23; others > 22; S/N > 5)

8000 deg² in 2-2.5 years, starting in Spring 2013

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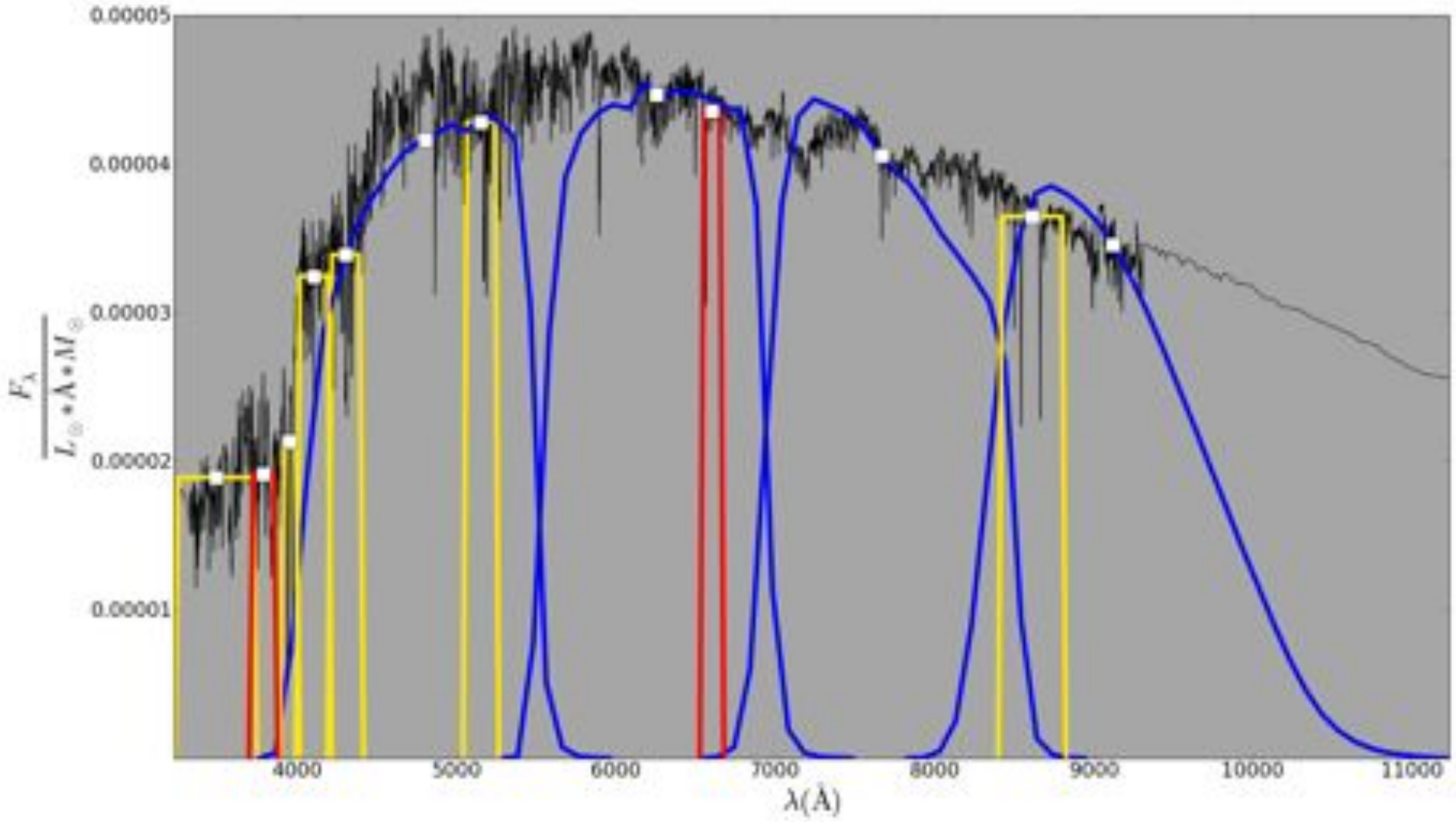

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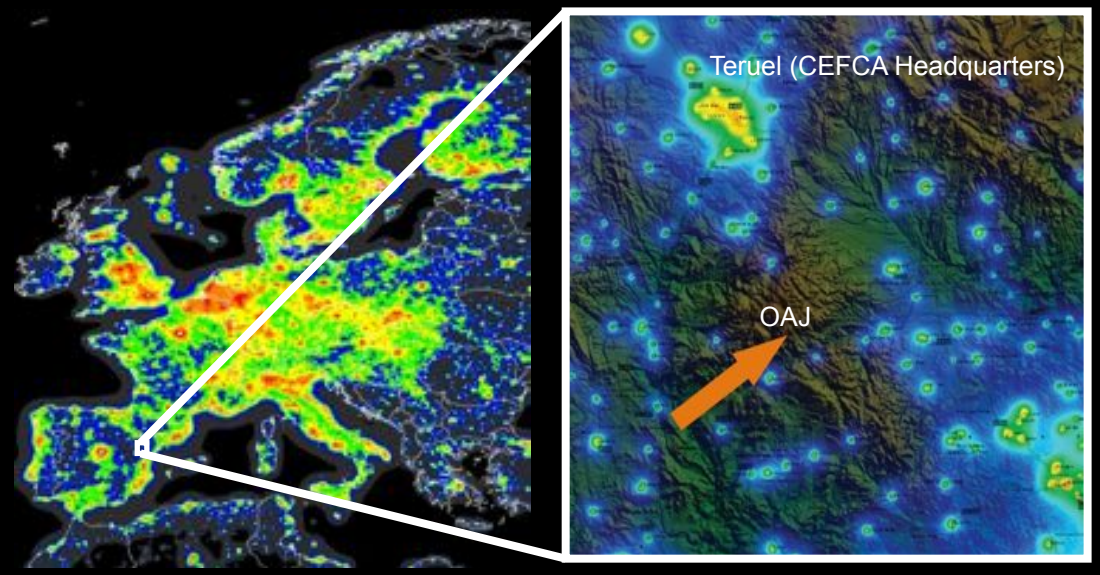
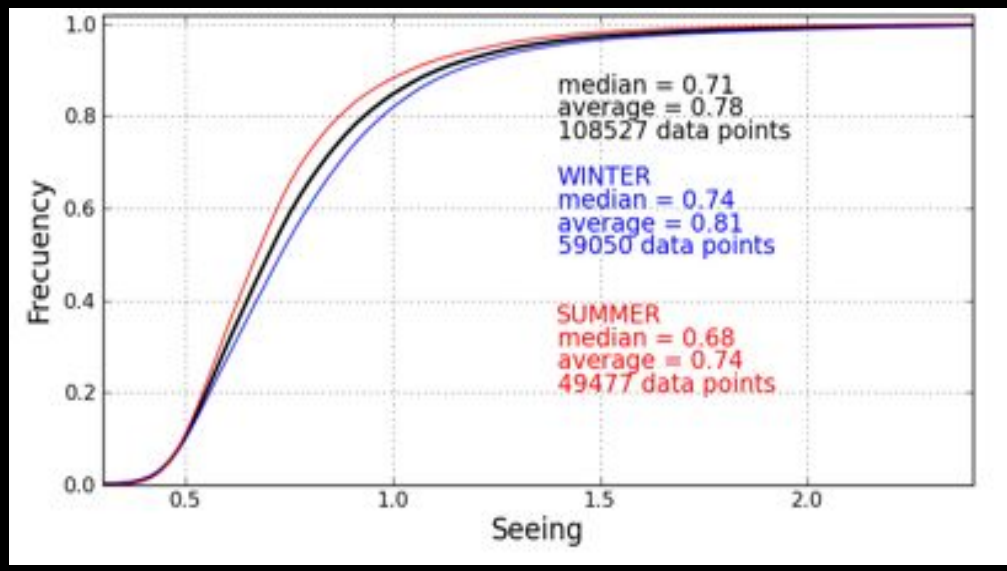
AT A NEW ASTRONOMICAL SITE

Site testing since 2007 @ Moles et al. (2010), PASP, Vol. 122, 889, 363





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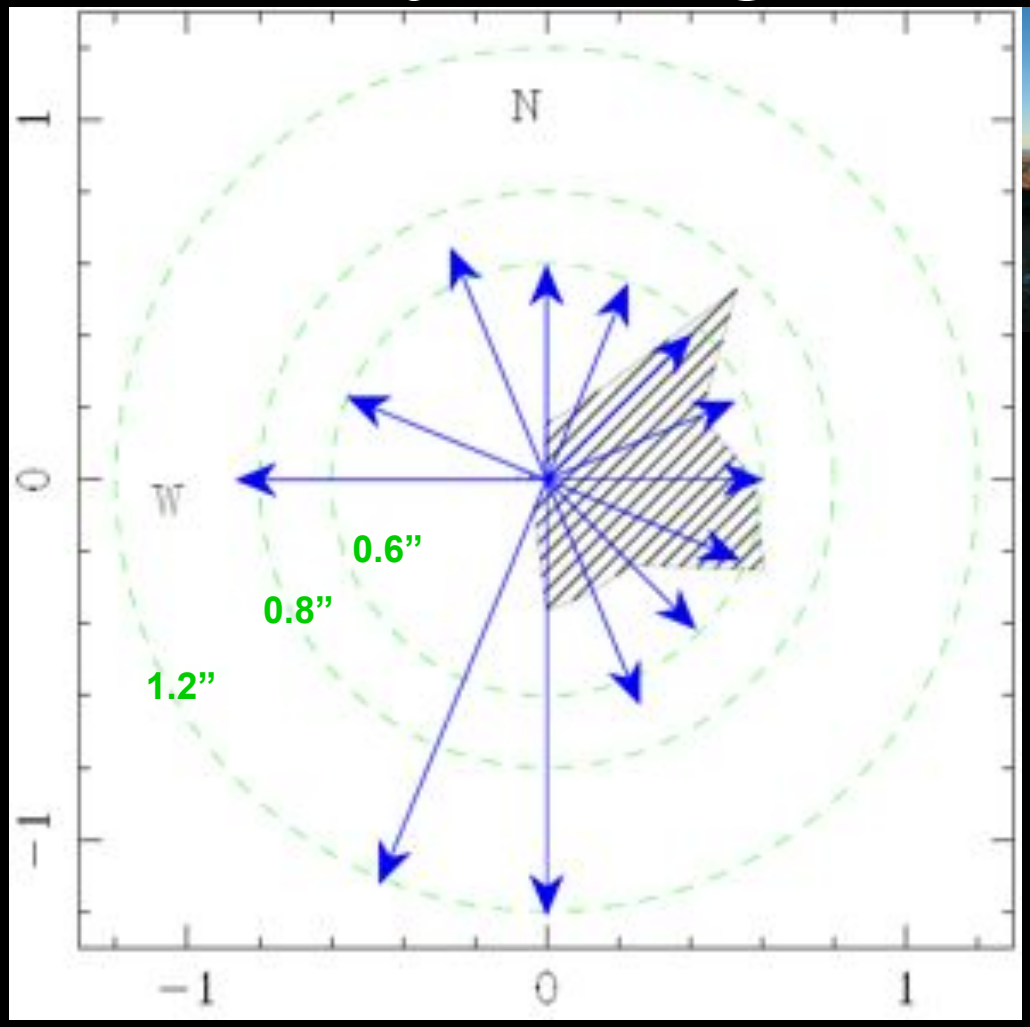

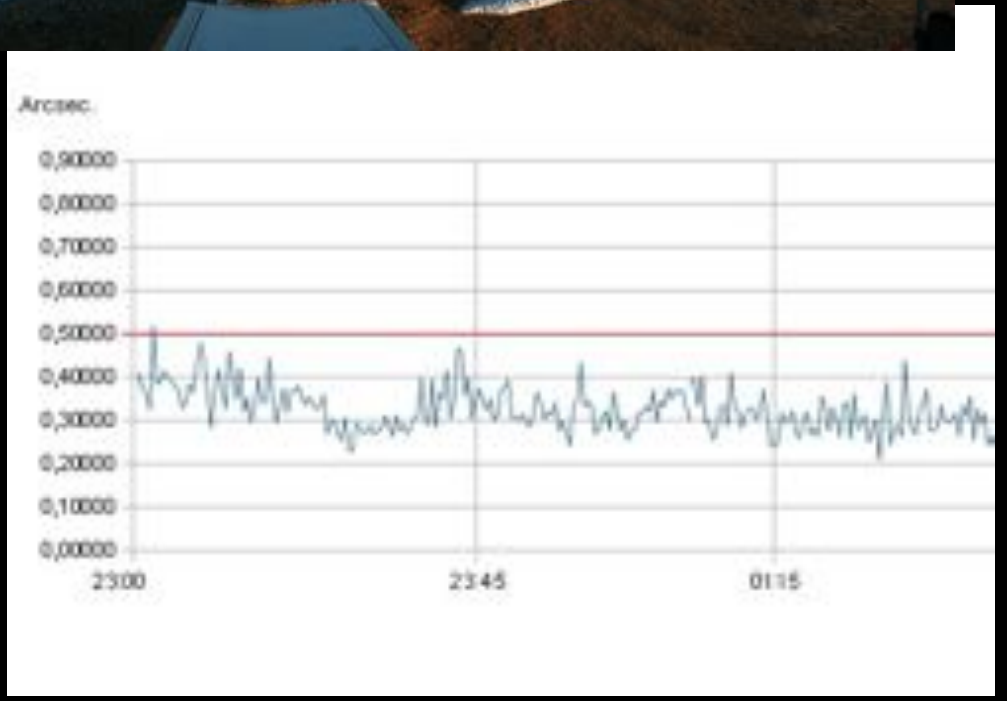

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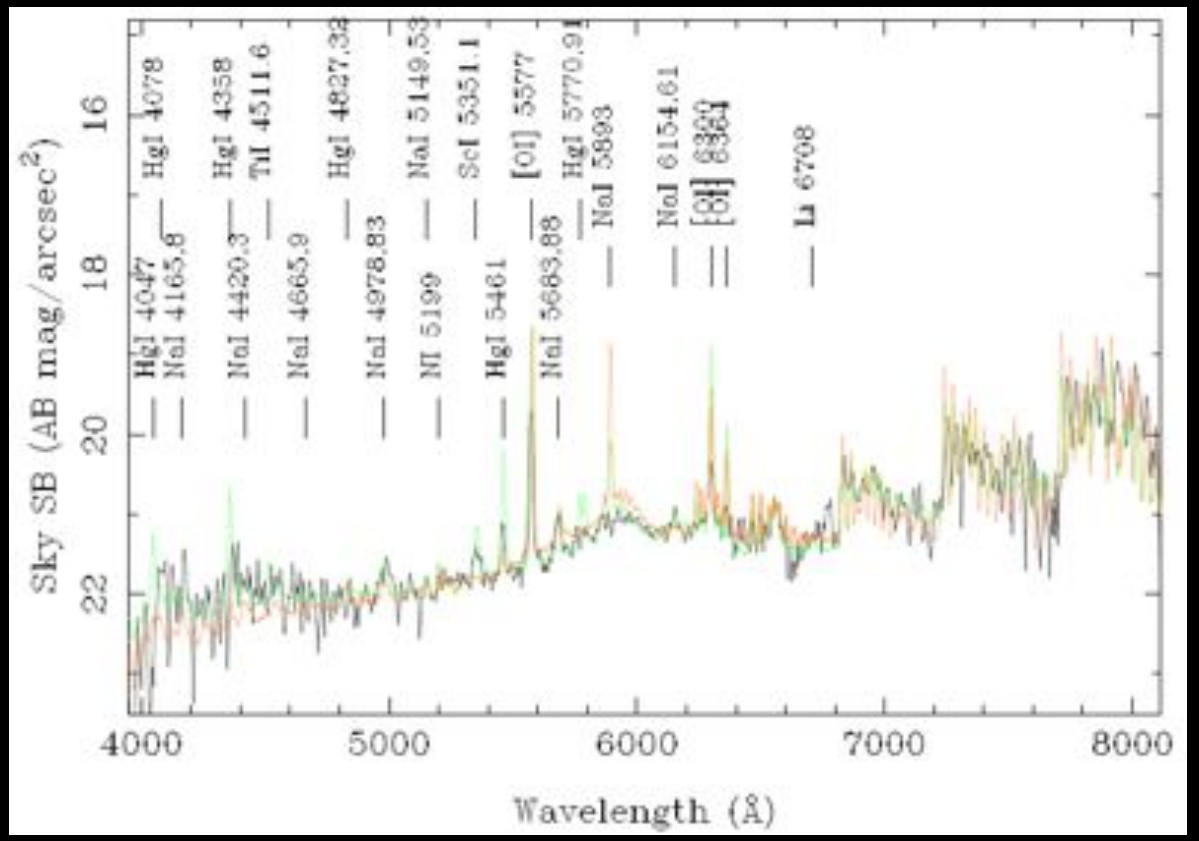

"Dark site" according to the IAU prescriptions

$\mu B \sim 22.8$ mag/"^{2}
$\mu V \sim 22.1$ mag/"^{2}
$\mu R \sim 21.5$ mag/"^{2}
$\mu I \sim 20.4$ mag/"^{2}

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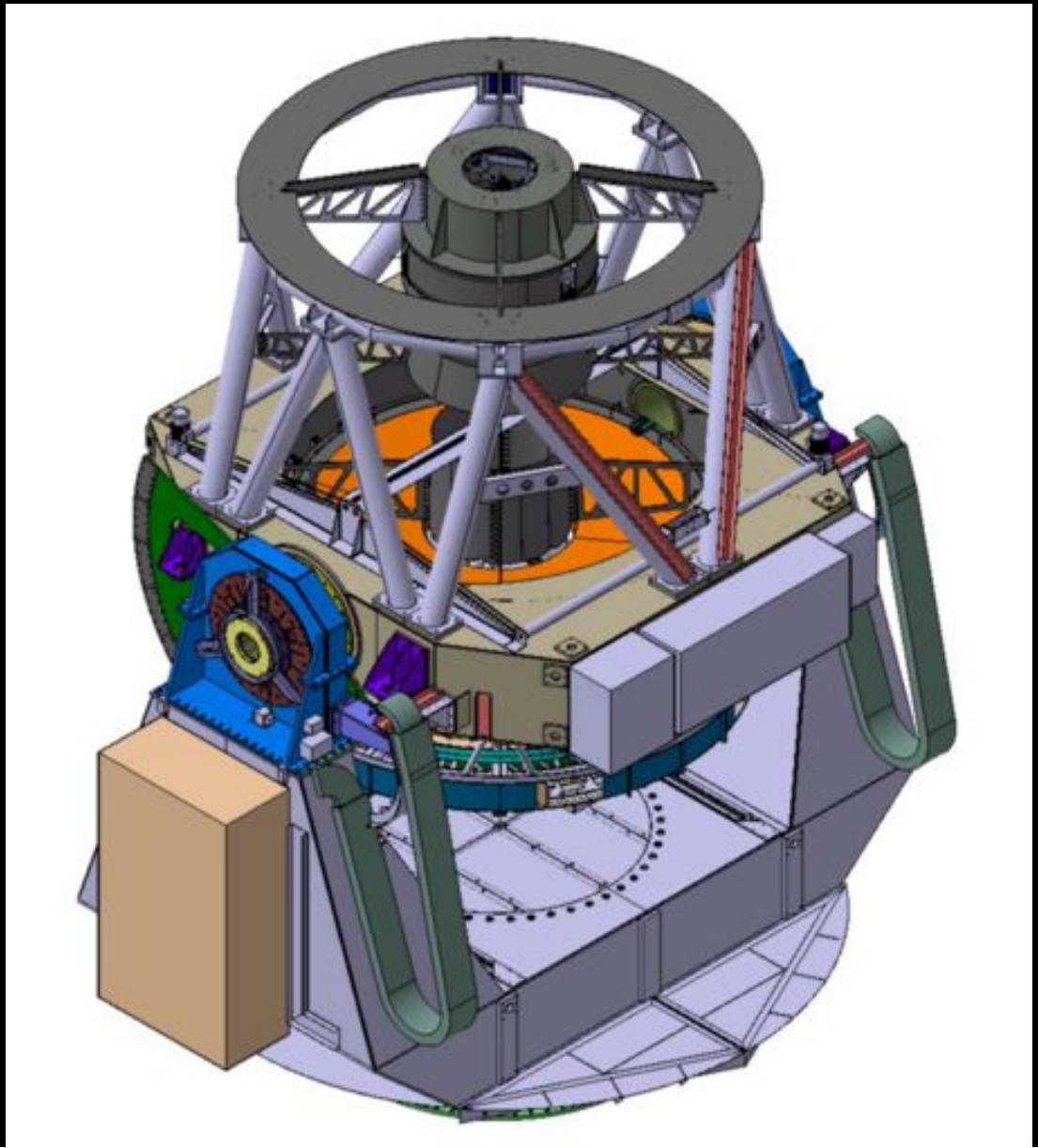


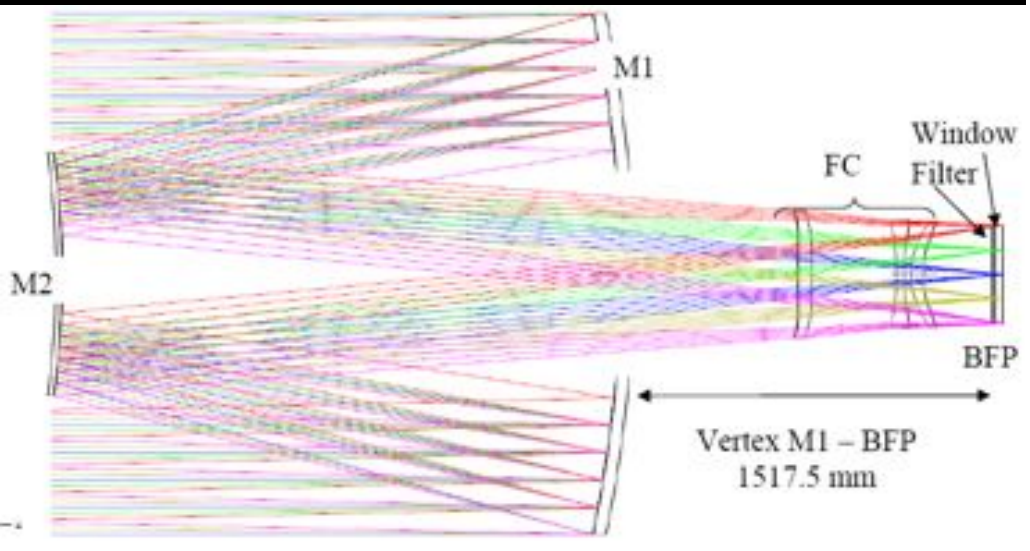
JST/T250

- M1 (∅) = 2.55 m
- FoV (∅) = 3 deg = 476 mm at FP
- Effective collecting area = 3.89 m^2
- Etendue = 27.5 $m^2 deg^2$
- Plate scale = 22.67 arcsec/mm
  = 0.22 arcsec/pix
- Focal length = 9098mm → F#3.5
- IQ EE50 (∅) < 12μm = 0.27 arcsec
- IQ EE80 (∅) < 20μm = 0.45 arcsec

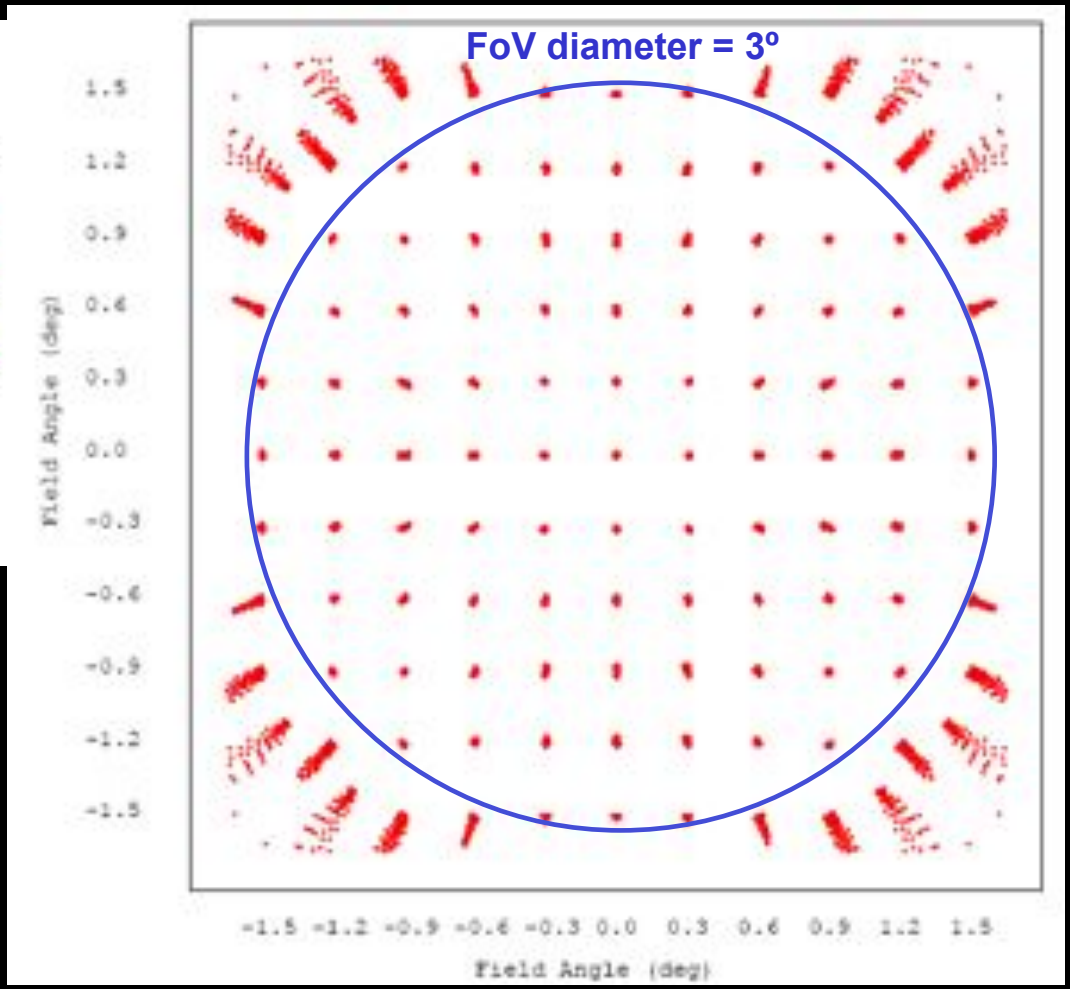
- Mount = Alt-azimuthal
- Config. = Ritchey Chrétien-like
- Focus = Cassegrain
- Field corrector of 3 lenses
- Mass ~45.000 kg
- 1st Eigenfrequencies > 10 Hz

- Manufacturer: AMOS (Belgium)
- Current Status: AIV – Integration
- On site by **Fall 2012**

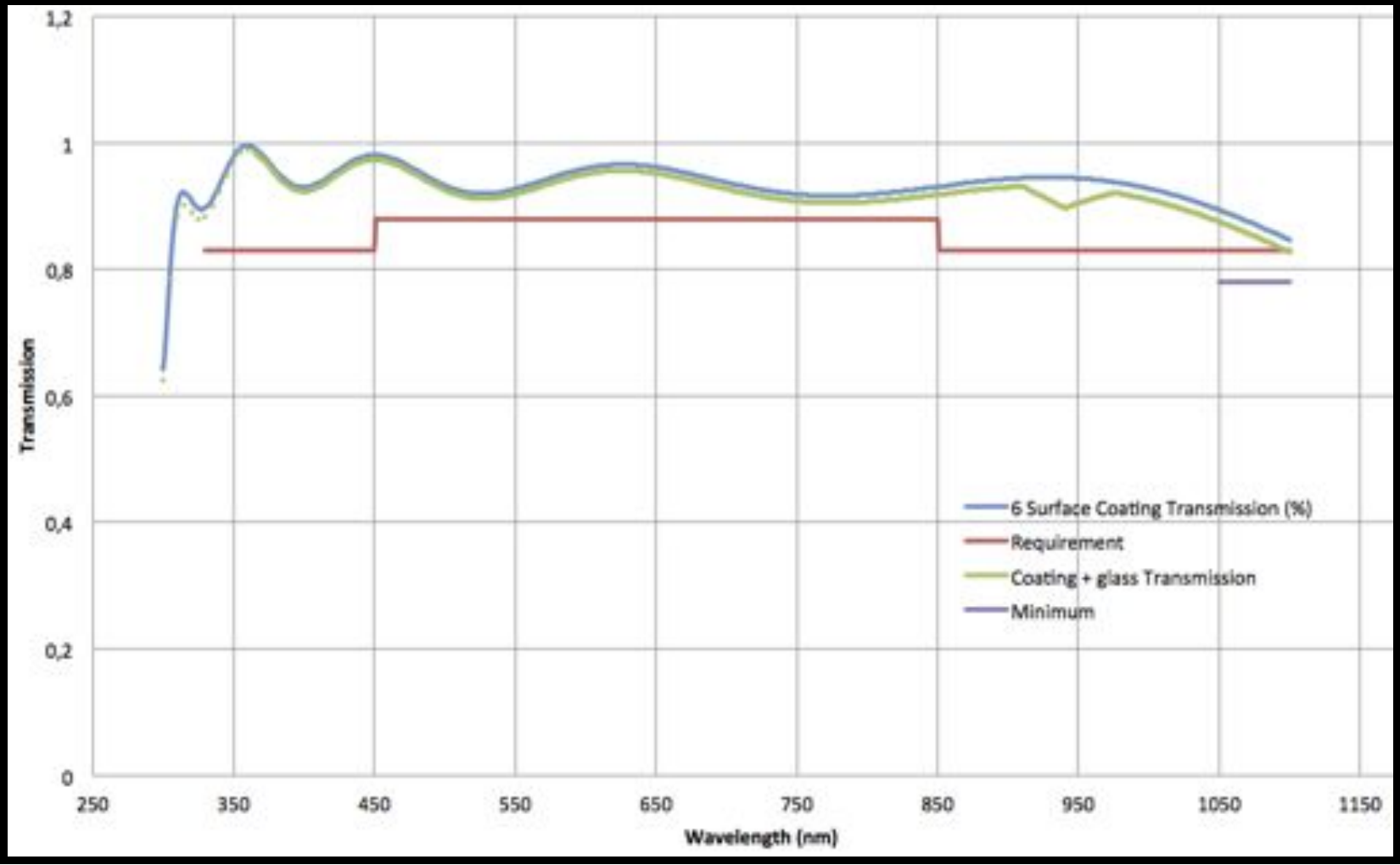
JST/T250
FINAL OPTICAL DESIGN



	Distance (mm)
M1 – M2	2207.7
M2 – L1	2909.654
L1 – L2	335.0225
L2 – L3	27.35545
L3 – Filter	273.2982
Filter – Dewar window	4
Dewar Window – CCD plane	8



JST/T250
FINAL OPTICAL DESIGN
FC Coating



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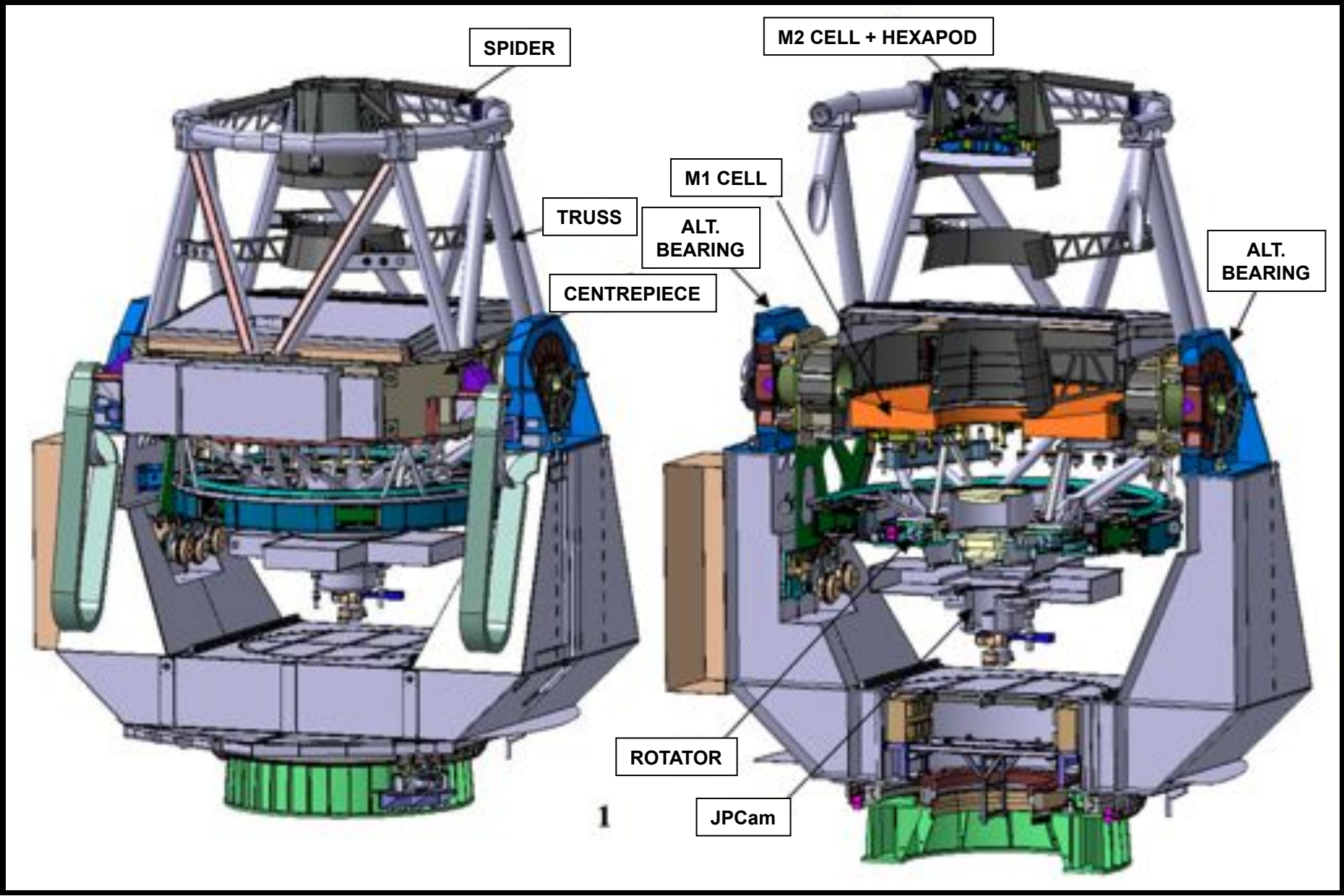

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JST/T250
Dec 2010 – Primary Mirror (M1)

Zerodur (Schott AG)

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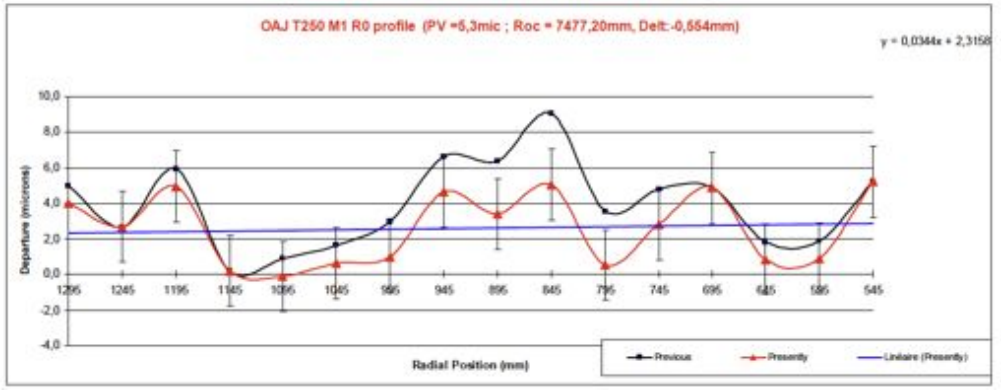
JST/T250

Sep 2011 – Primary Mirror Polishing & Metrology

Aspherical grinding completed. Aspherical polishing in progress

The dedicated profilometer designed for T250 M1 OAJ set on the mirror

Meridian R0 at best mean Rc = 7477.20mm



JST/T250

Aug 2011 – Secondary Mirror at the Optical Metrology Test Tower Steup (Hindle Sphere @ Brashear)

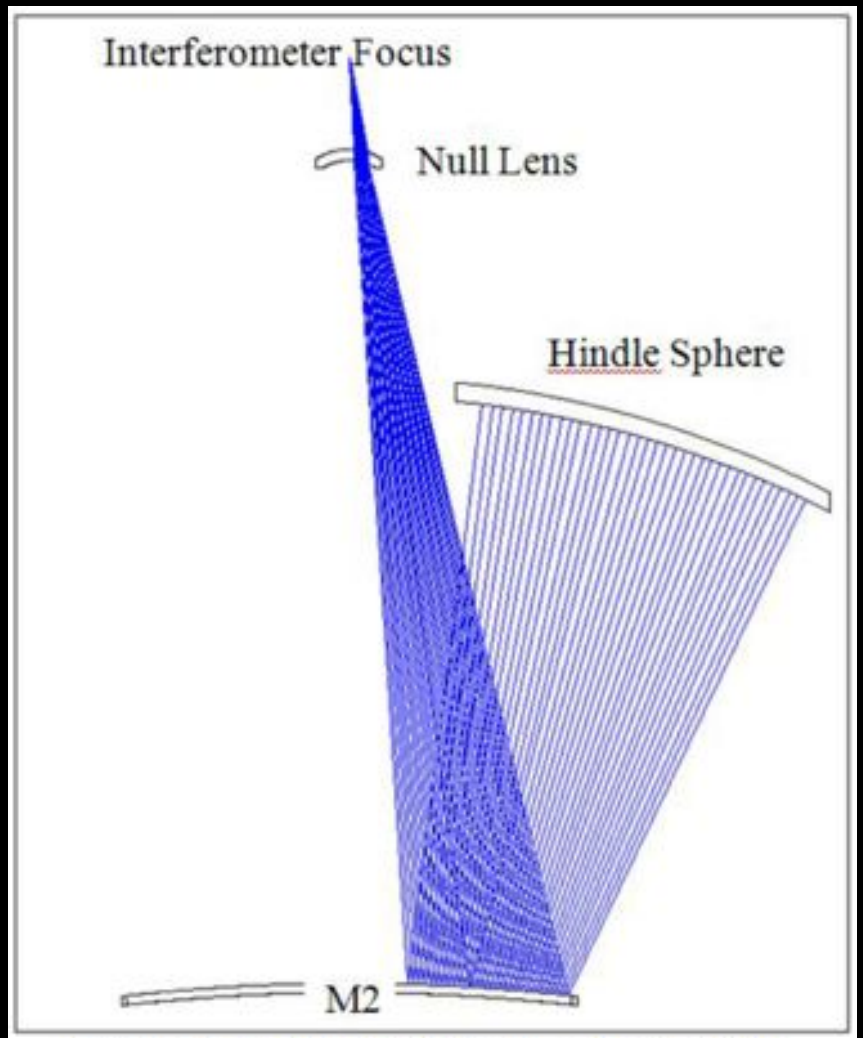


Figure 5-1 Optical Metrology Test Set-Up

JST/T250

FIELD CORRECTOR. FDR ACCEPTED Sep 2011 – FACTORY ASSEMBLY Jul-Aug 2012

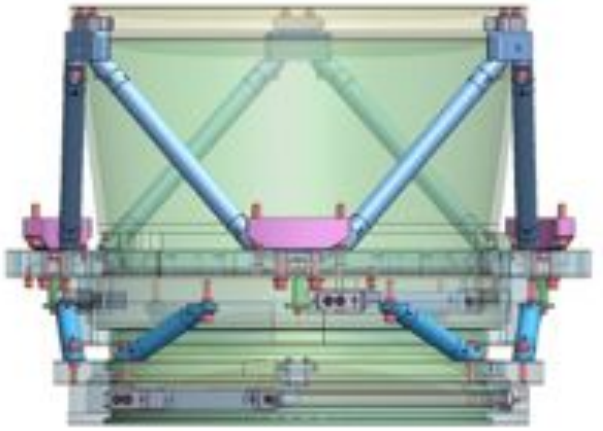


Figure 3. - Basic Mechanical Structure - view up Y-axis - without housings (L1, L2, L3, and Cell 2 transparent to reveal detail behind)

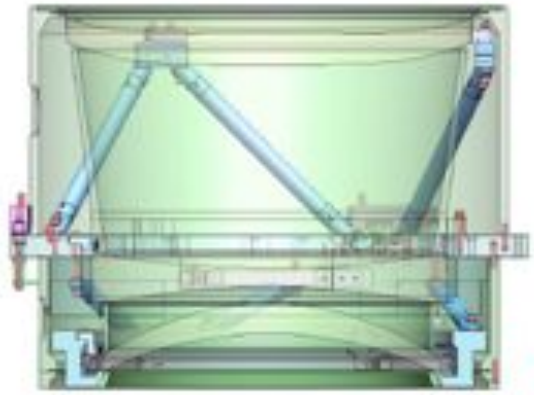
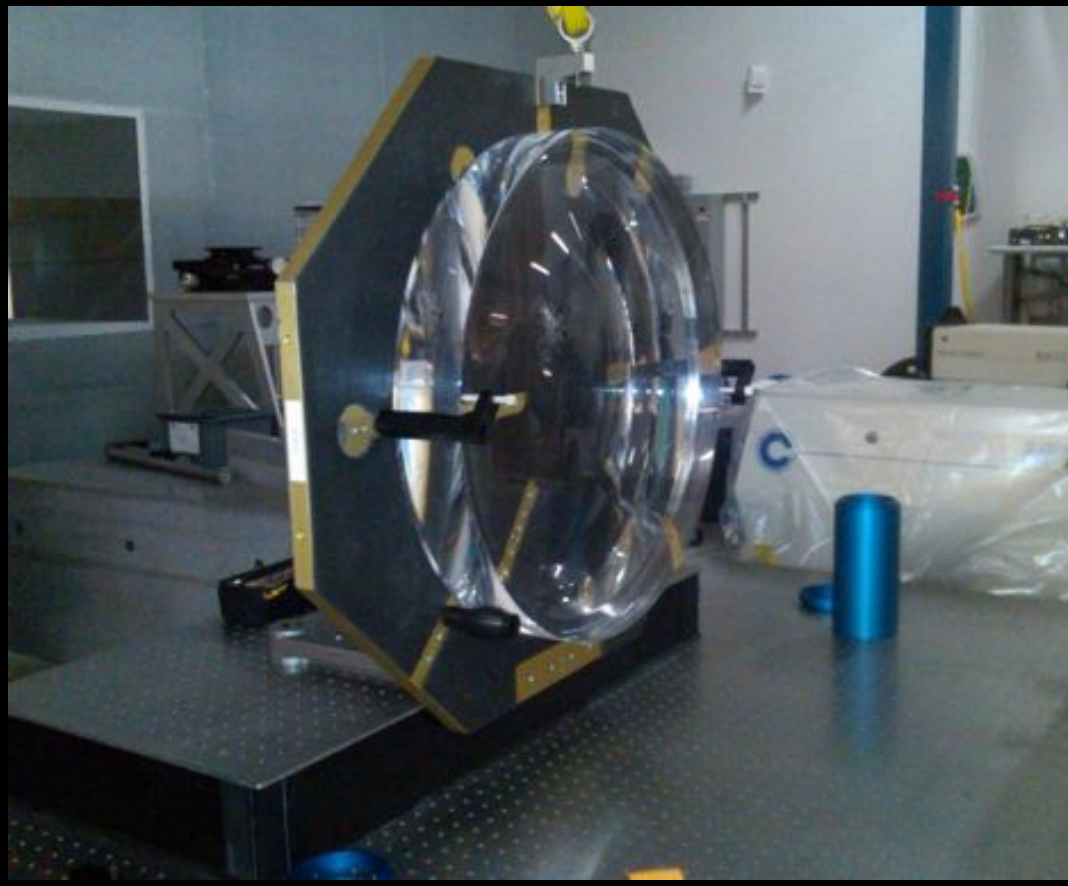
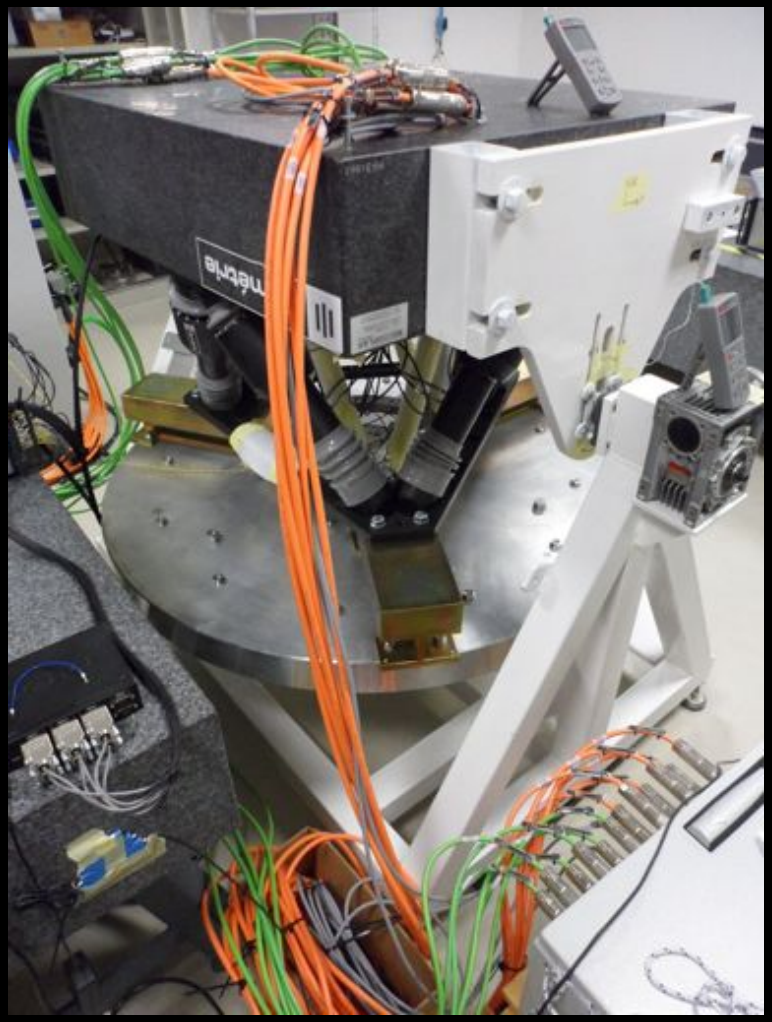


Figure 4. - Basic Mechanical Structure - view down elevation axis - section (L1, L2, L3, and Cell 2 transparent to reveal detail behind)



JST/T250

HEXAPOD. FDR Sep 2011 – FACTORY ASSEMBLY March 2012



Active control of the secondary mirror (piston/tip/tilt)

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JST/T250

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JST/T250
SCHEDULE AND WORK PLAN

- JST/T250 is in AIV Phase
  - Manufacturing of main parts at 90% completion
  - Integration of large parts already started
- Fully integrated and “operative” with dummy optics: Jun 2012
- Final optics acceptance by Sep 2012
  - FC in the critical path
- Factory acceptance (control & mechanics) Oct 2012
- Delivery to the OAJ in Fall 2012
- Final acceptance with JST/T250 verification (x2) camera in Fall 2012
- Engineering commissioning Fall 2012 – Winter 2012/2013
- Engineering 1st light with OAJ verification camera (15 x 15´ FoV) March 2013
- Scientific operations with OAJ verification camera June 2013

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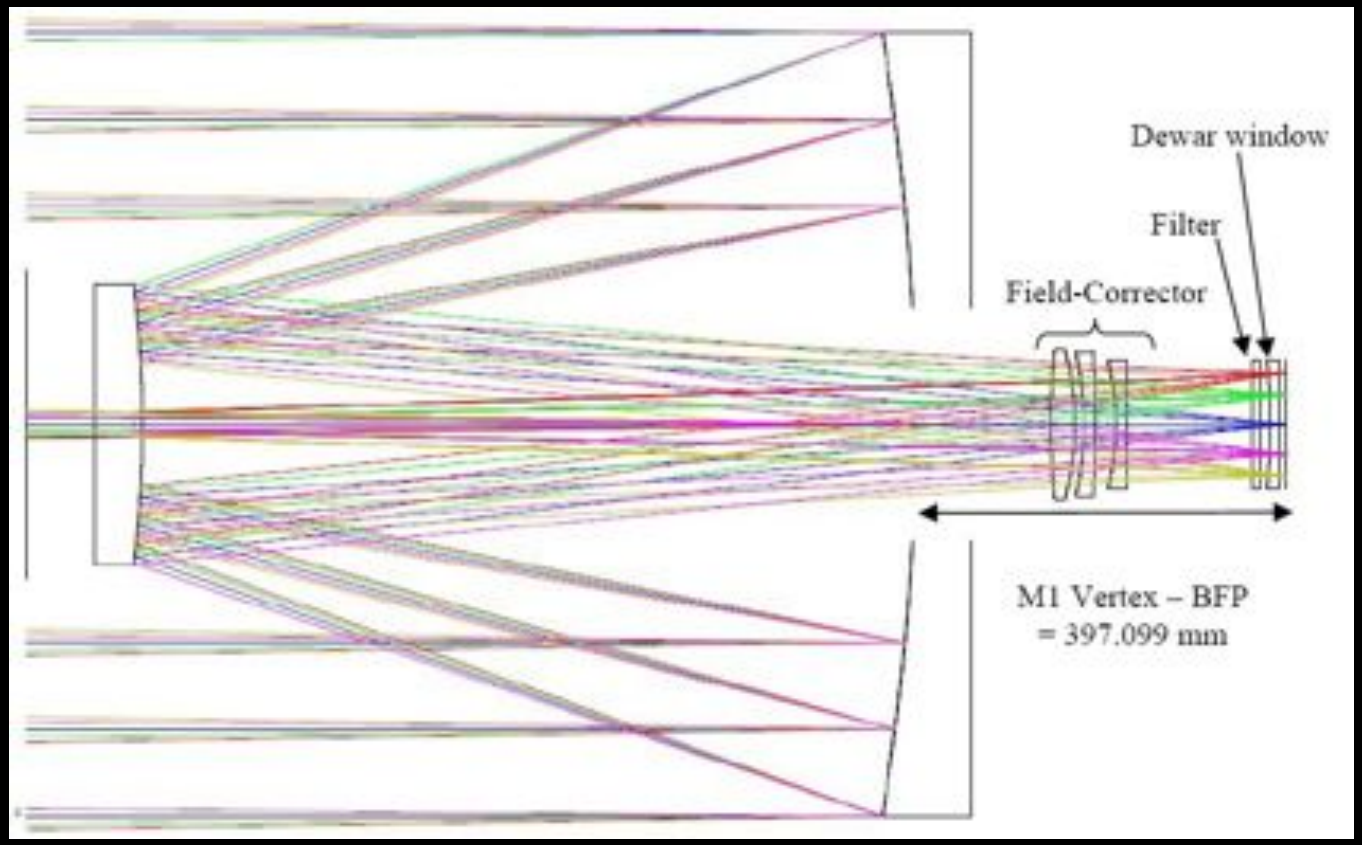
JAST/T80

- M1 (∅) = 0.83 m
- FoV (∅) = 2 deg = 130 mm at FP
- Effective collecting area = 0.44 m^2
- Etendue = 1.5 $m^2 deg^2$
- Plate scale = 55.56 arcsec/mm
  = 0.50 arcsec/pix
- Focal length = 3712mm → F#4.5
- IQ EE50 (∅) < 7μm = 0.39 arcsec
- IQ EE80 (∅) < 14.5μm = 0.81 arcsec

- Mount = German equatorial
- Config. = Ritchey Chrétien
- Focus = Cassegrain
- Field corrector of 3 lenses
- Mass 2.500 kg
- 1st Eigenfrequencies > 10 Hz

- Manufacturer: ASTELCO (Germany)
- Current Status: AIV - Verification
- On site by **Spring 2012**

JAST/T80
FINAL OPTICAL DESIGN



	Distance (mm)
M1 – M2	825.7695
M2 – L1	971.3435
L1 – L2	9.321
L2 – L3	20.904
L3 – Filter	134
Filter - Dewar Window	10
Dewar Window - CCD	8

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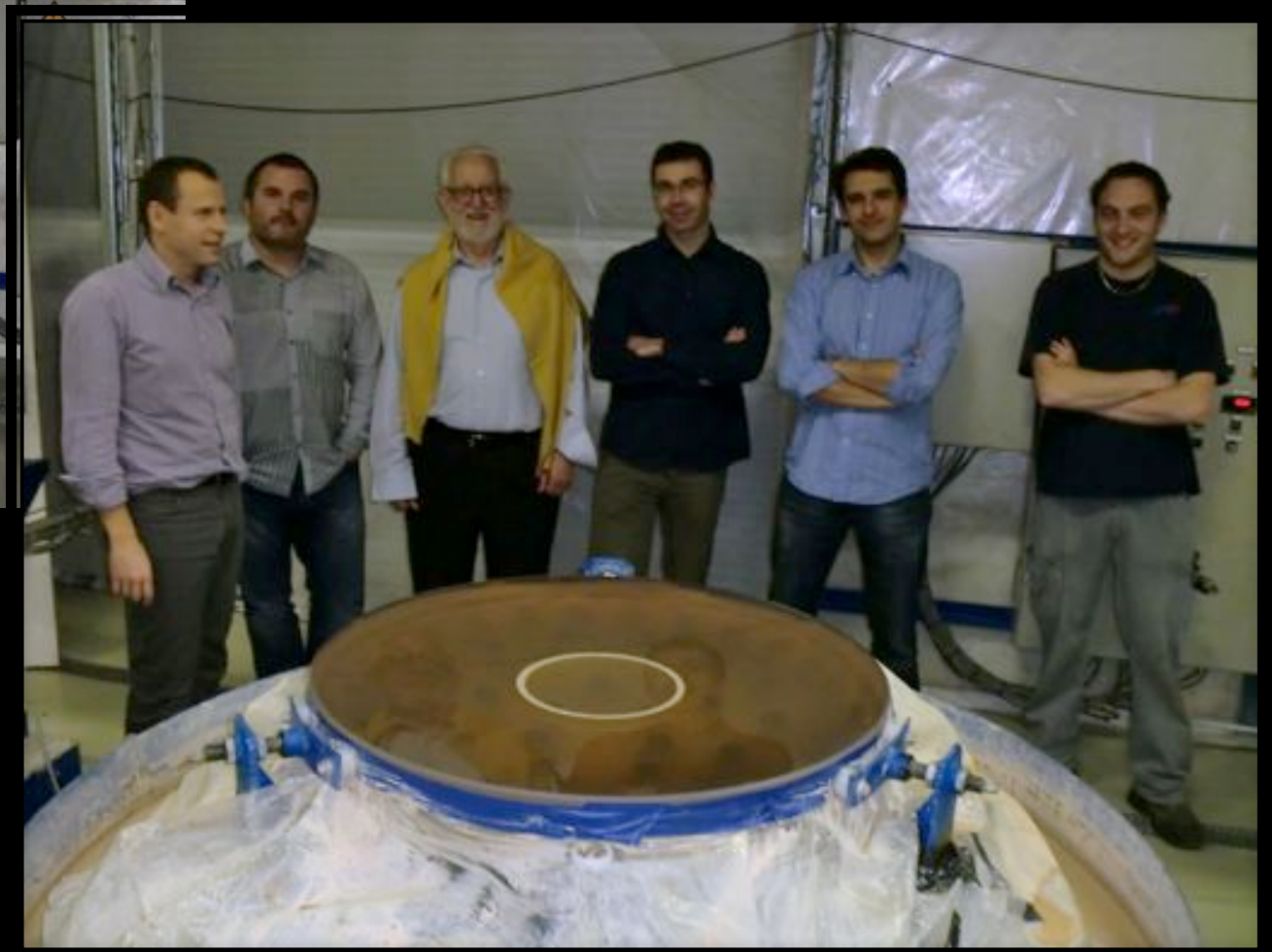
JAST/T80

Dec 2010 – Primary Mirror(M1)



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JAST/T80

Sep 2011 – Field Corrector

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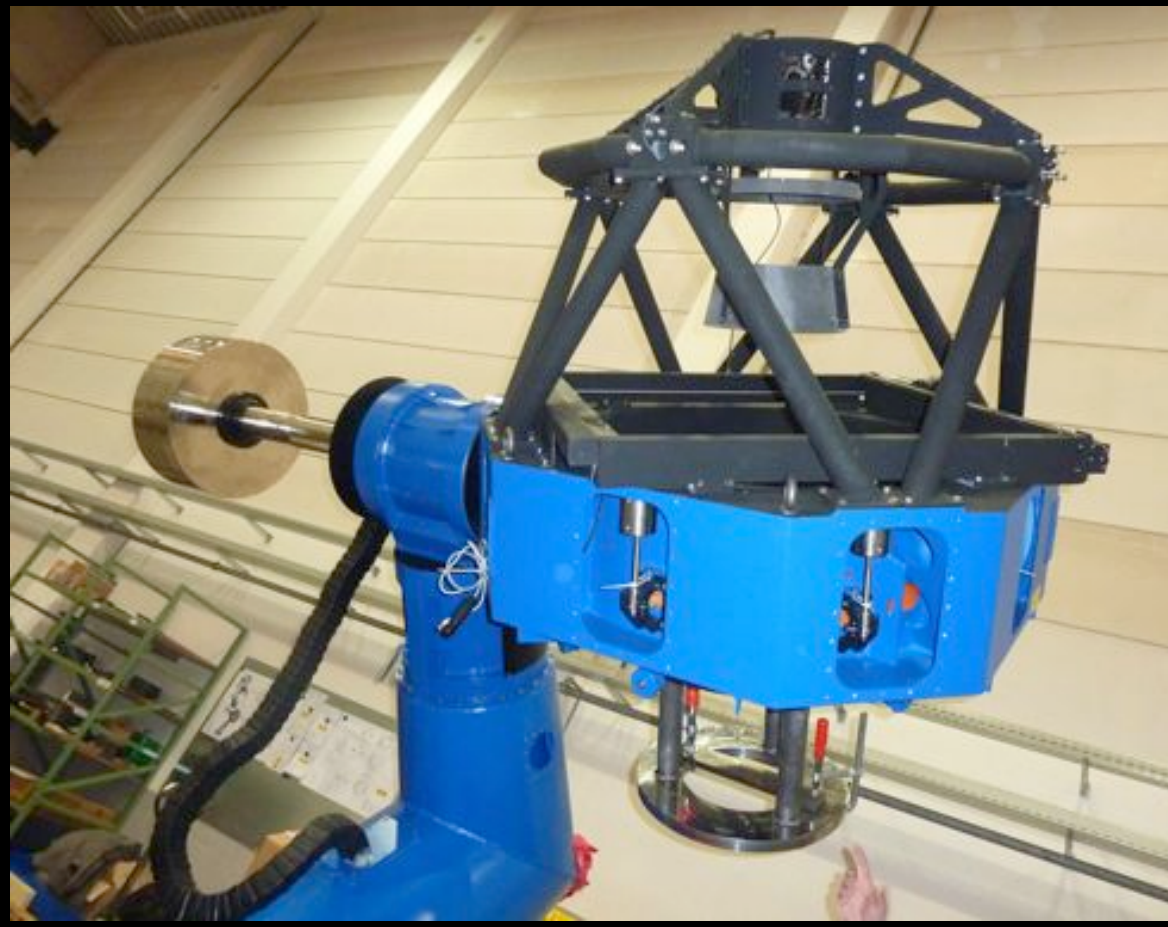
JAST/T80



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JAST/T80

JAST/T80
SCHEDULE AND WORK PLAN

- JAST/T80 is close to finish AIV Phase
- Fully integrated with dummy optics: March 2012
- Final optics acceptance by April 2012
- Factory acceptance with sky test by May 2012
- Delivery to the OAJ in May/June 2012
- Final acceptance with JAST/T80 shack-hartmann in June 2012
- Engineering commissioning June 2012 – August 2012
- Engineering 1st light with OAJ verification camera August 2012
- Scientific operations with OAJ verification camera October 2012

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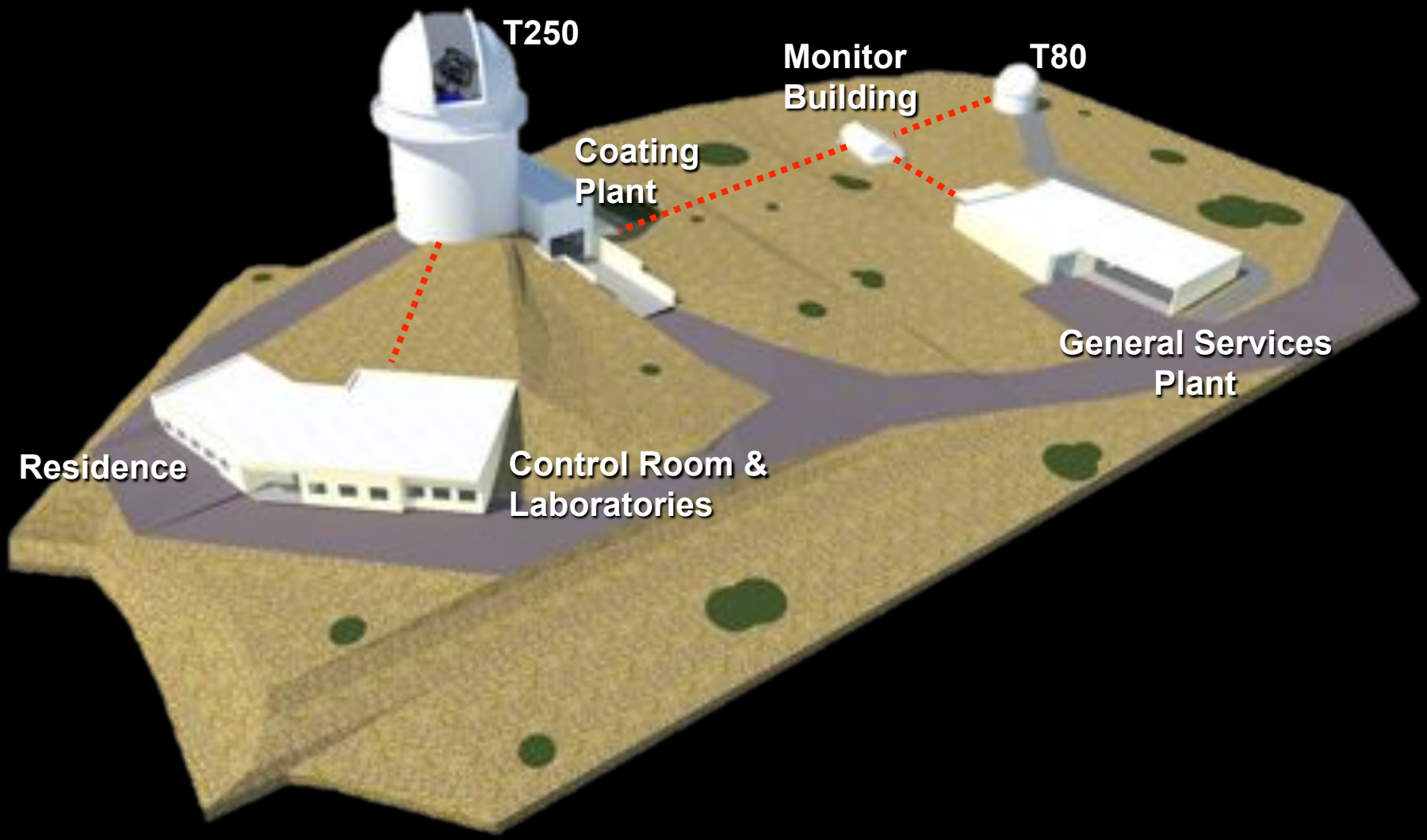
5. OAJ CIVIL WORK & GENERAL INSTALLATIONS
6. THE DATA MANAGEMENT

The *Observatorio Astrofísico de Javalambre*

Spanish Participation in Future Programs
Deep galaxy surveys, LSS and DE
Valencia, March 2012

CEFCA
Centro de Estudios de Física del Cosmos de Aragón

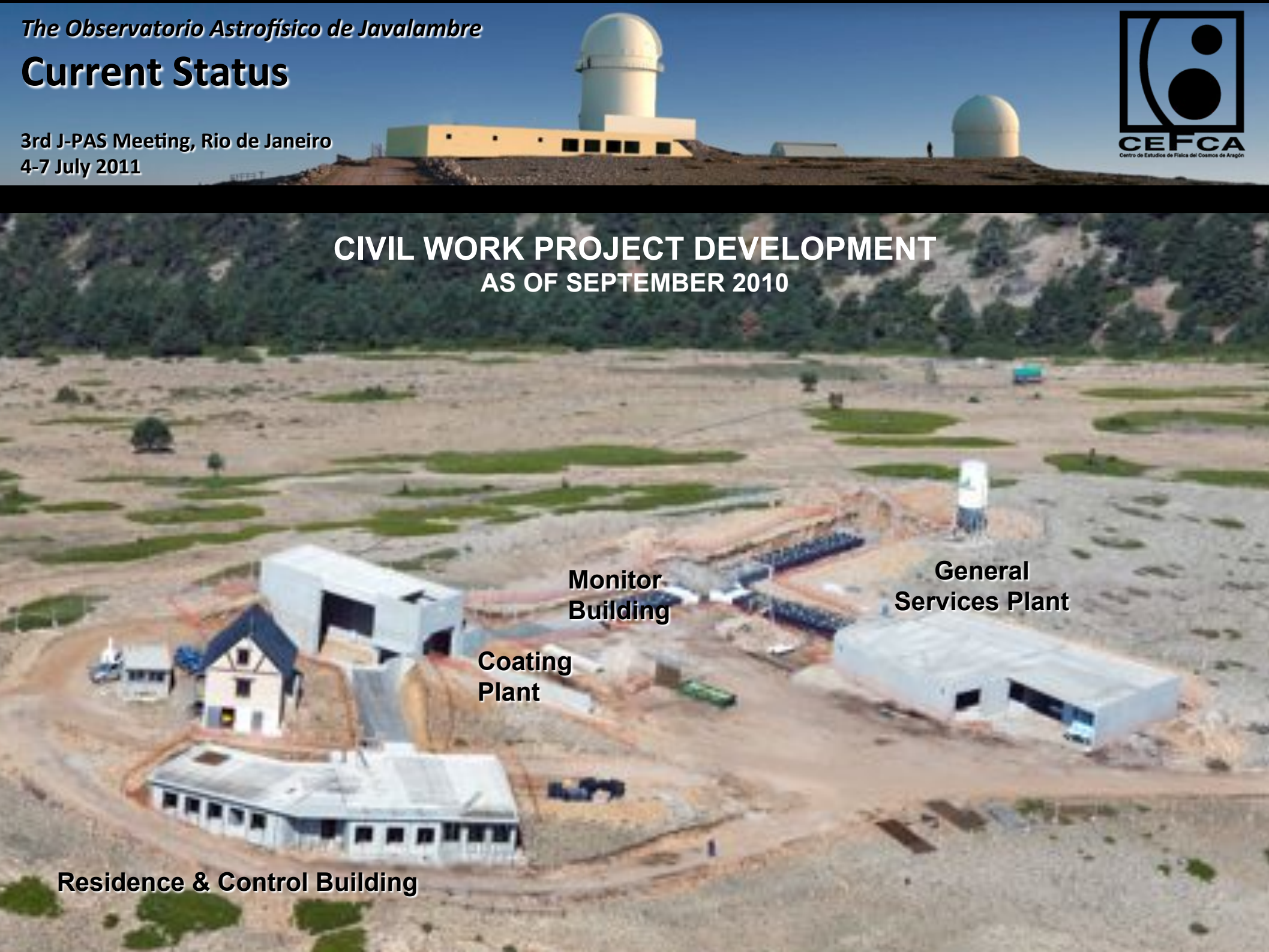
OAJ FINAL DESIGN



The Observatorio Astrofísico de Javalambre

Current Status

3rd J-PAS Meeting, Rio de Janeiro
4-7 July 2011



The Observatorio Astrofísico de Javalambre

Current Status

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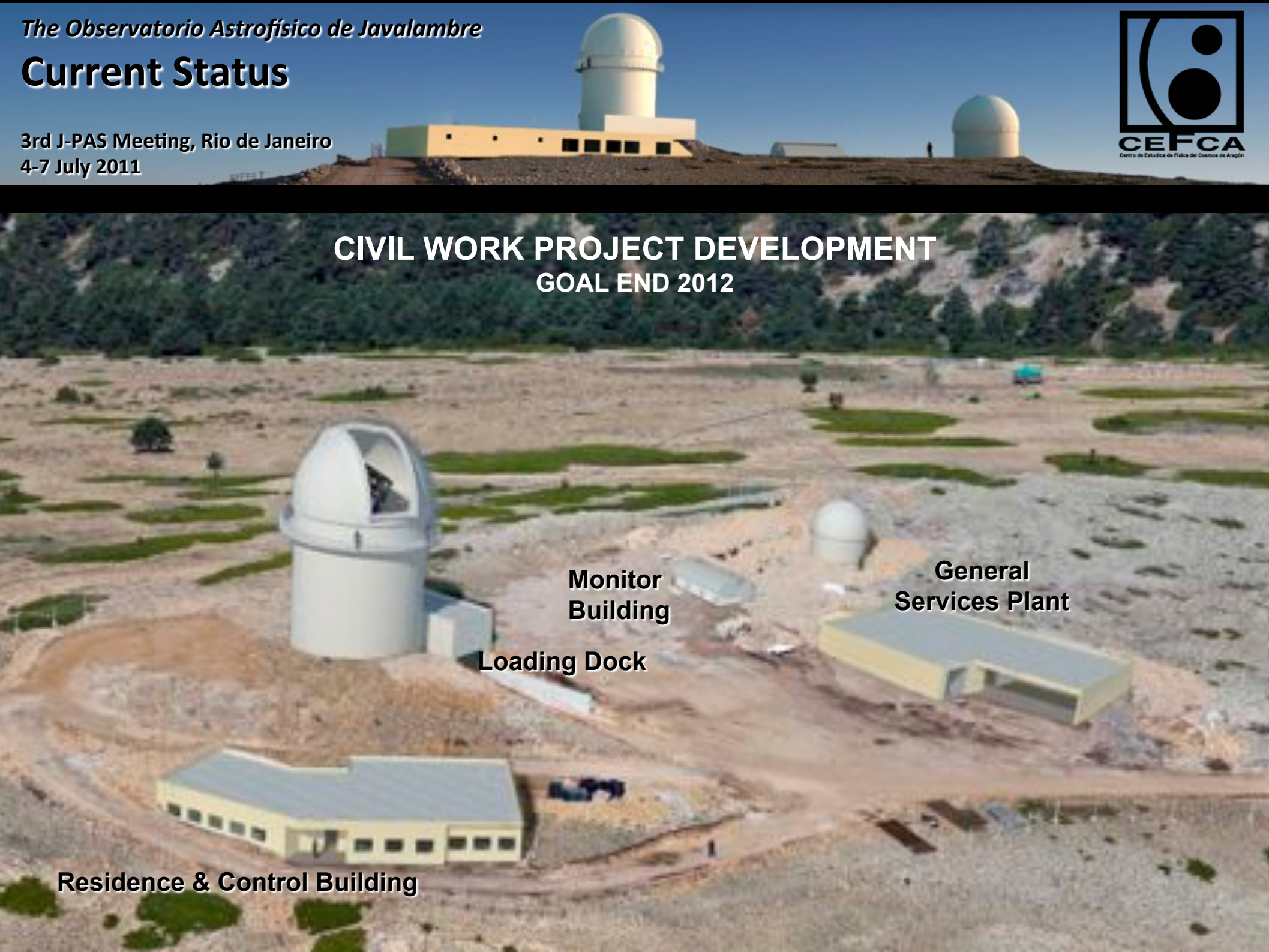

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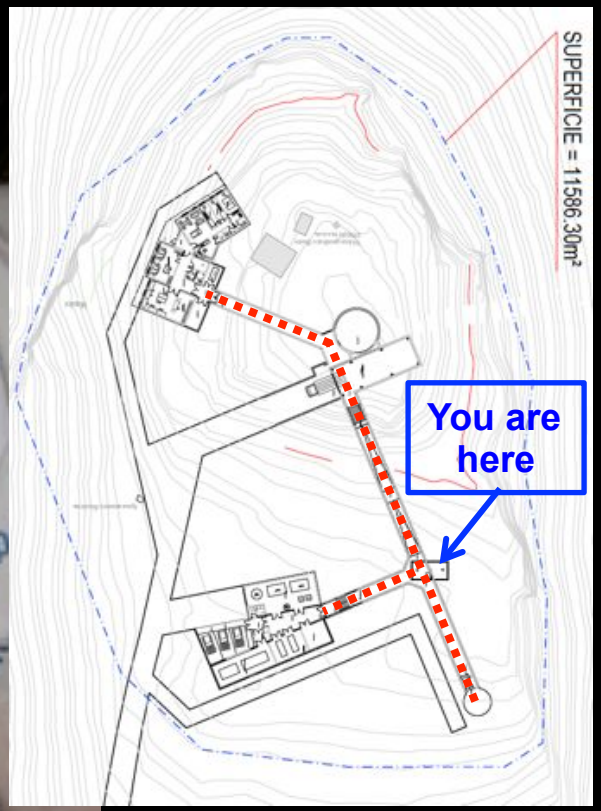
OAJ TUNNELS



OAJ GENERAL INSTALLATION AND SUPPLIES

- Voice/Data Network (fiber optic links, redundant topology)
- Radiolink OAJ – CEFCA (2x700Mb/s)
- Glycolate water to the telescopes
- Dry compressed air to the telescopes and laboratories
- ACS (T250 floor and dome, laboratories, etc)
- Lightenig protection
- Fire protection
- Low voltage electrical installation (Generators, cabling, UPSs, illumination, grounding, etc)
- Gas oil (tanks and pipes)
- Water supply (pipes, tanks for drinkable water and raining water)

OAJ GENERAL INSTALLATION AND SUPPLIES

GENERATOR, CHILLER, GAS/WATER TANKS, COMPRESSOR

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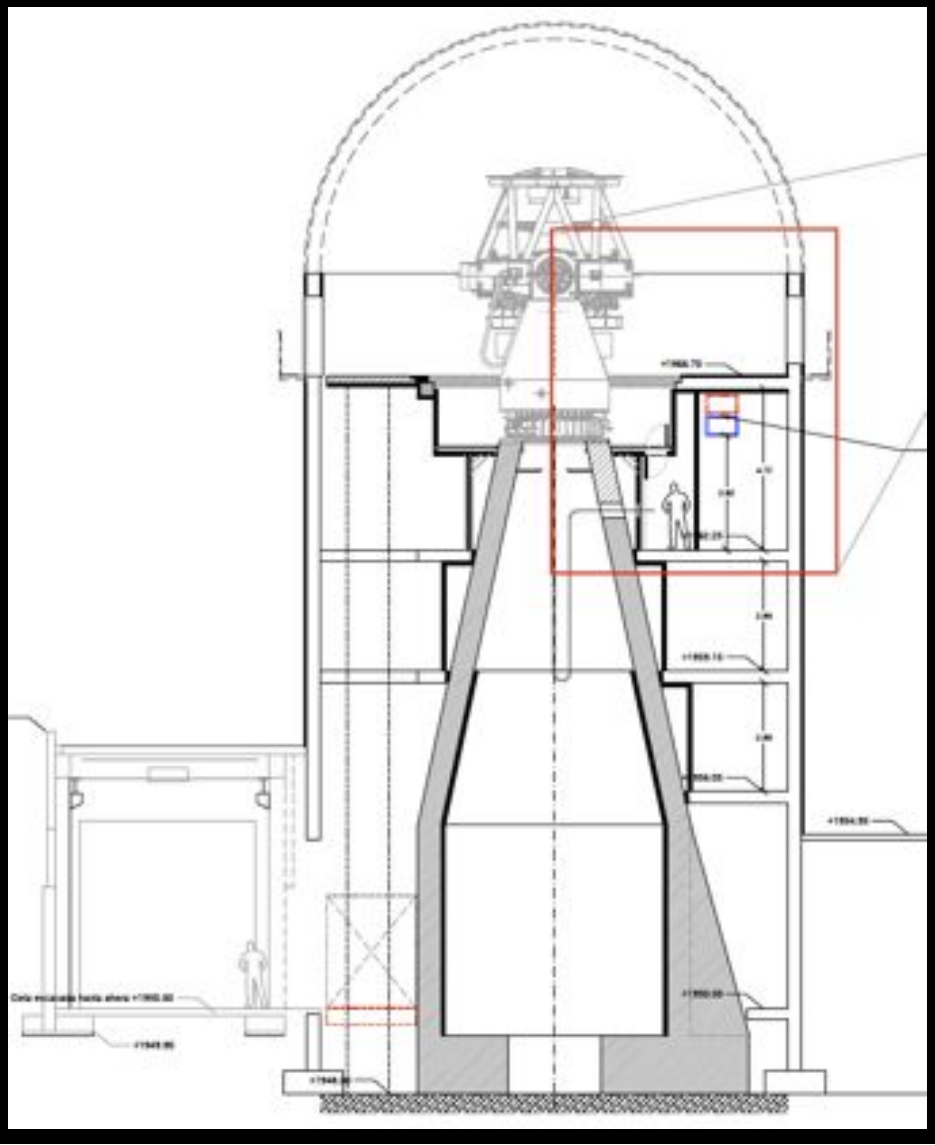
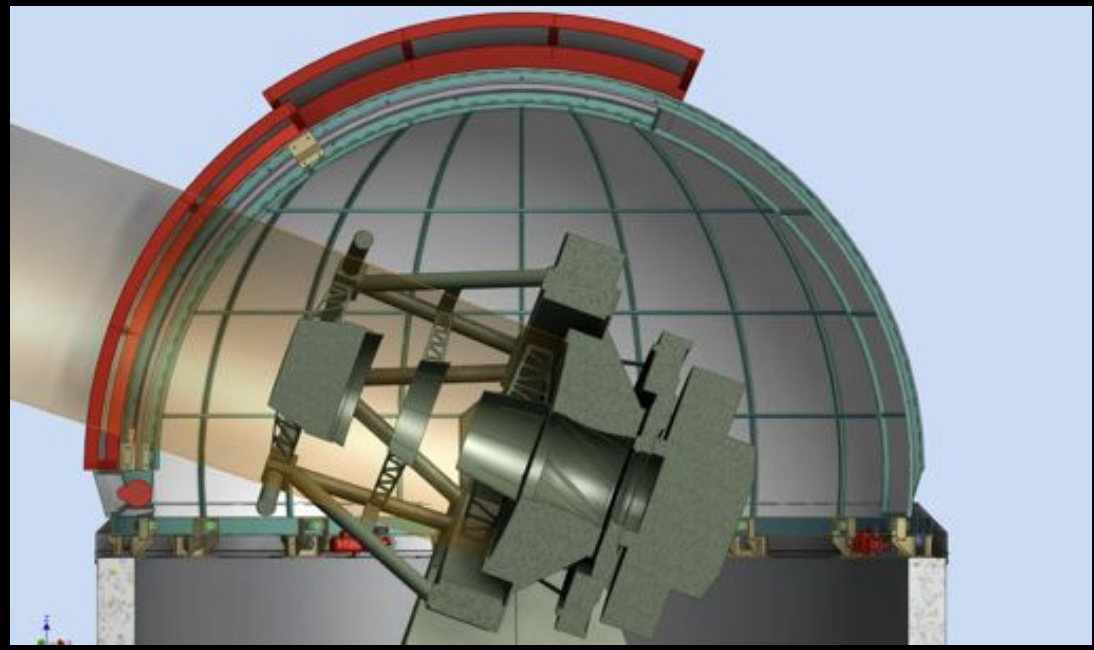
JST/T250 BUILDING & DOME



Building: Final Design to be approved in April 2012. Execution starting right afterwards.

∅ **Dome** 12.5m. Final design April/May 2012
Under design by USA company.



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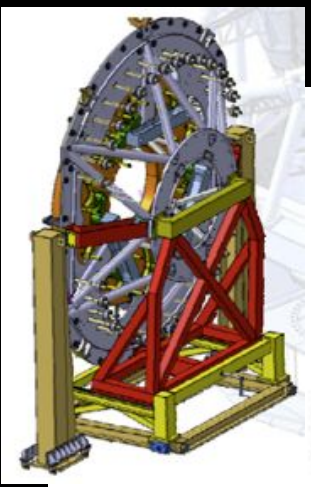
JST/T250 BUILDING & DOME



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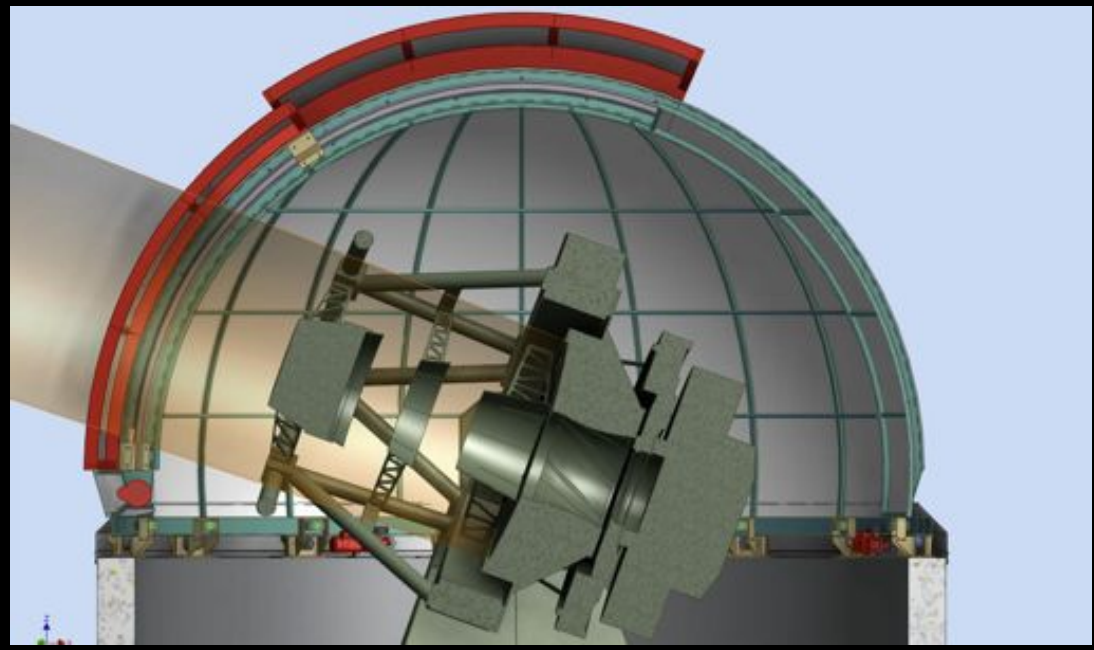

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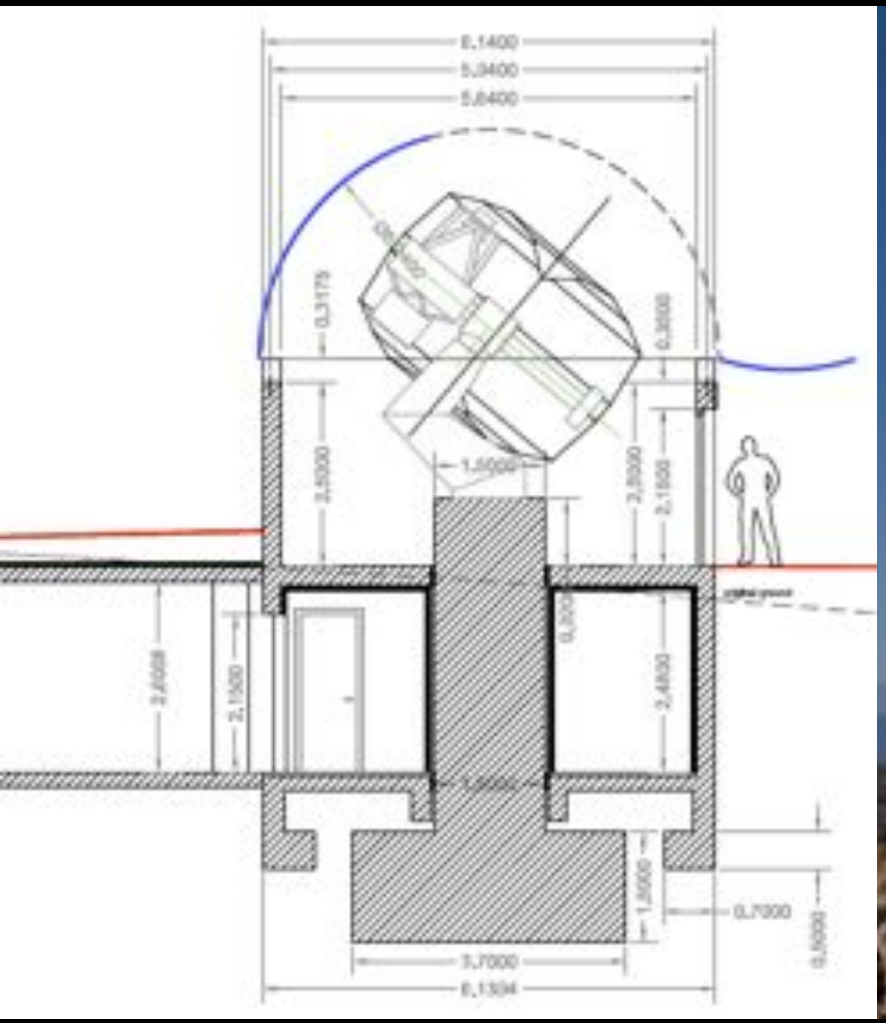
JAST/T80 BUILDING



MONITOR BUILDING

- *Seeing* monitor (ROBO-DIMM)
- Extinction monitor (EXCALIBUR)
- Clouds monitor (ASTMON)
- 51cm telescope (spectroscopy)
- Weather station

Monitor enclosure is operative. Definition and control by CEFCA.
Monitors will be installed right after the acceptance of Phase 1 Civil Work

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1. OAJ MOTIVATION
2. THE OAJ SITE
3. JST/T250
4. JAST/T80
5. OAJ CIVIL WORK & GENERAL INSTALLATIONS
6. THE DATA MANAGEMENT

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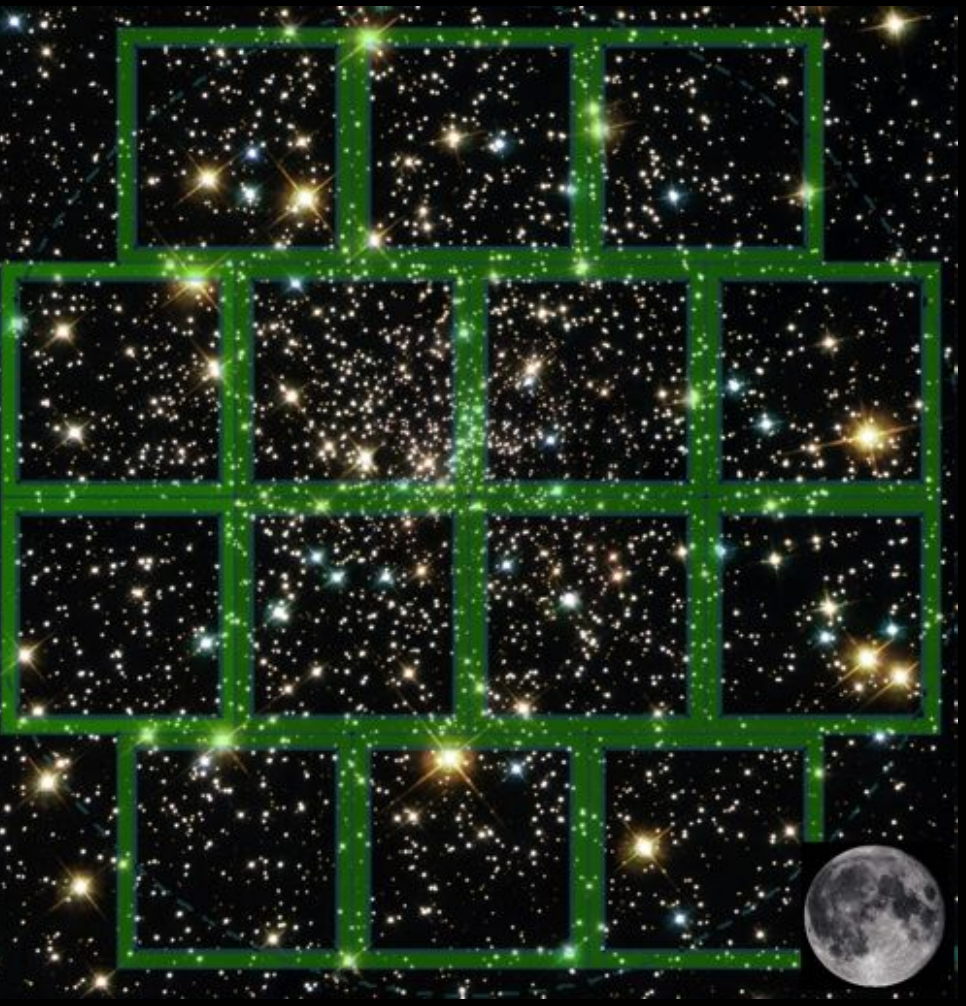
DATA MANAGEMENT



- Mosaic coverage of 5 deg^2. Every J-PAS night, OAJ will produce ~1.5 TB of data.

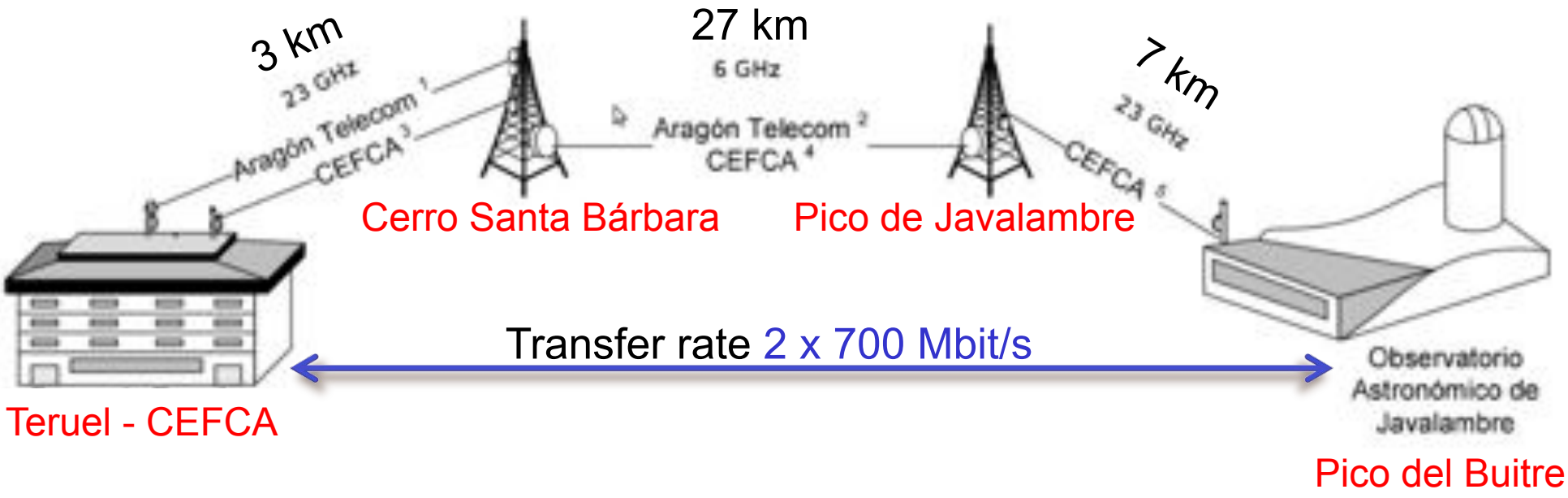
- Data is transferred next day to the *Data Processing Center* at CEFCA headquarters in Teruel (33 km away), using unidirectional antennas (2x700 Mbits/s).

- Data is validated, reduced and stored. Feedback is sent back to the OAJ Control System (Scheduler) for continuing the survey or repating fields.

- 8000 deg^2 → 2.6 Tpix × 56 filters × 4-5 dithered images-per-pointing + 30-50% overheads →

J-PAS will finally amount to ~2.5 PB.
Data publicly available: Legacy Project.

OAJ – CEFCA RADIOLINK



- Data Management is responsability of CEFCA
- Based on previous experience with ALHAMBRA pipelines and calibration
- A call for bidders for a 2.5 PB data center is about to be open (FEDER funds)

OAJ SUMMARY

- OAJ conceived for dedicated large sky surveys. Site with excellent atmospheric conditions. Median seeing ~0.7".
- OAJ civil work Phase 1 is received in April 2012. To get ready to receive T80 and start operations with monitors and small telescopes.
- JAST/T80 at the OAJ throughout Spring 2012.
- T250 building begins in April 2012. Finished in July-August 2012. T250 Dome is expected to arrive the OAJ in September 2012.
- JAST/T80 scientific operations in September 2012.
- JST/T250 at the OAJ in Autumn 2012 after the arrival of the dome.
- JST/T250 scientific operations in June 2013.

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Javalambre Physics of the Accelerating Universe Astronomical Survey

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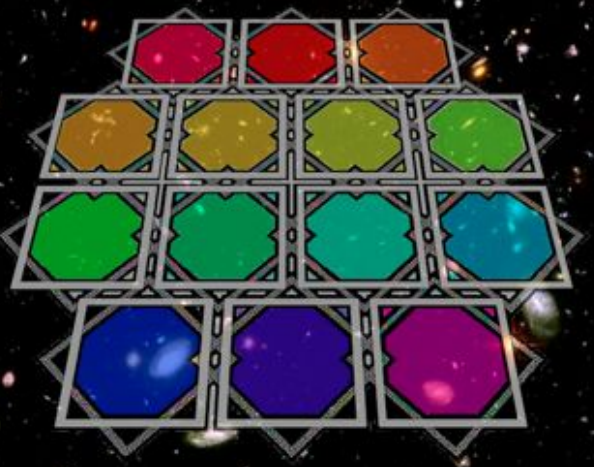
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS
Ministério da Ciência e Tecnologia
BRASIL
FAPESP
FINEP
FAPERJ

J-PAS



http://j-pas.org

~ 100 members (mainly Spain + Brazil)
- Telescopes + OAJ (CEFCA)
- Cameras (Brasil + CEFCA). A. Marin's talk…
- Data Center (CEFCA)

Ongoing T80 South in Cerro Tololo
T250 South in Cerro Pachón (rising funds in progress)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