

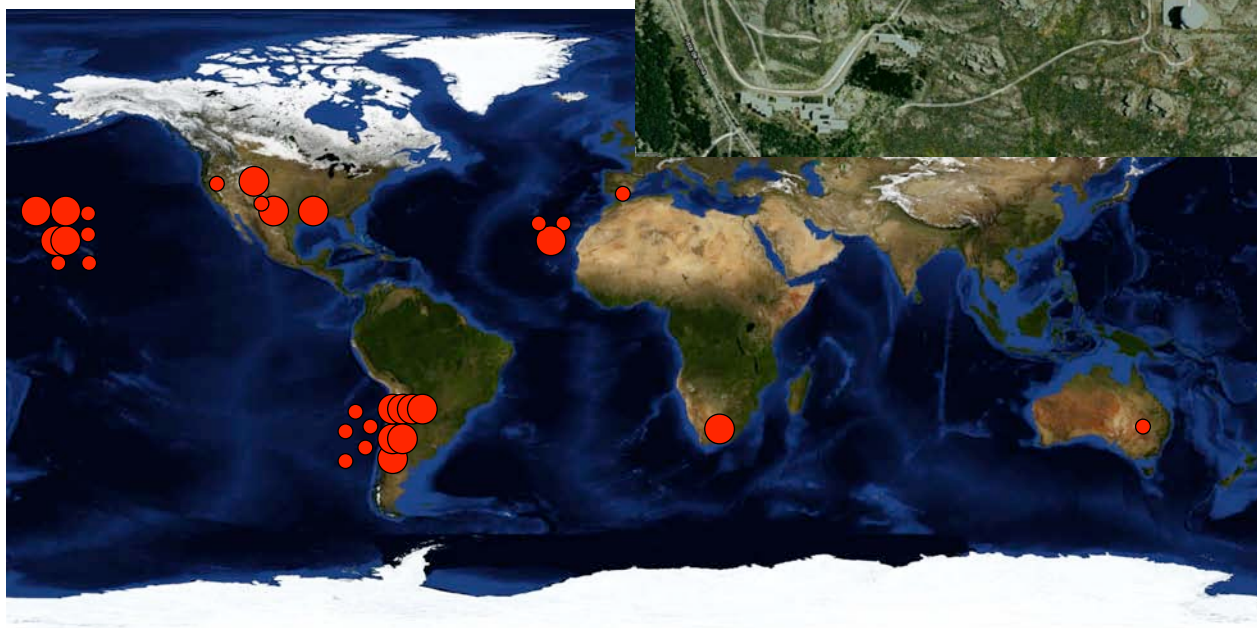
Contribución de CAHA a Gaia



El papel de Calar Alto

● Clase 8 m

● Clase 4m



Telescopios e instrumentos



	OPTICAL (moonless nights) 2011	Near-infrared (shiny nights)	OPTICAL (moonless nights) 2014	Near-Infrared (shiny nights)
3.5m .-	PMAS TWIN LAICA MOSCA	Omega2000 OmegaCass	PMAS (TWIN)	Carmenes (PANIC)
2.2m.-	CAFOS BUSCA CAFÉ (2011)	MAGIC PANIC (2012)	CAFÉ (CAFOS)	PANIC
1.23m.-	CCD camera		?????	
	As many changes as requested		- Two changes per month (every 15 days, from dark nights to bright and back)	

Recomendación de Astronet		Calar Alto	
CAHA 3.5	PMAS-PPAK	CARMENES if selected, if not →	1 deg ² NIRCам?¹
CAHA 2.2	CAFE	CAFOS	PANIC

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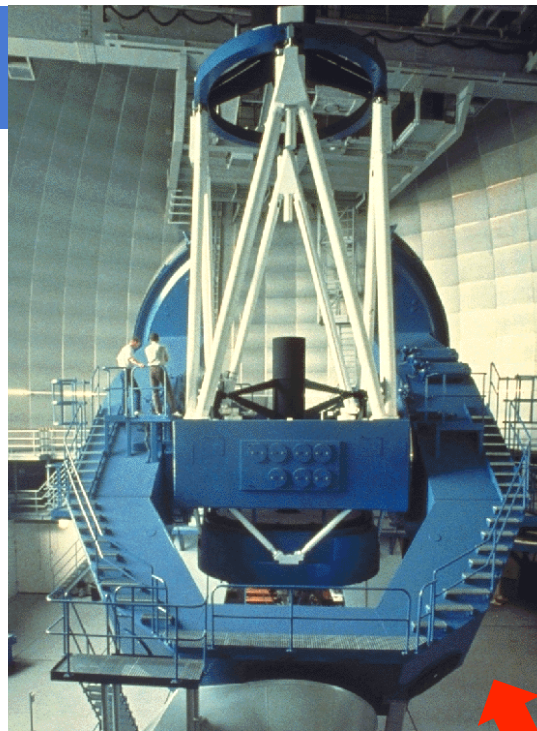
Telescopios



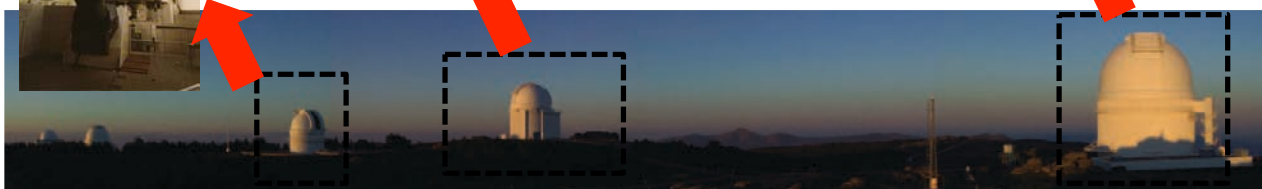
2.2m



3.5m



1.2m



Contaminación lumínica



➤ Julio 2007.- Ley de protección ambiental, con un capítulo dedicado a la contaminación lumínica

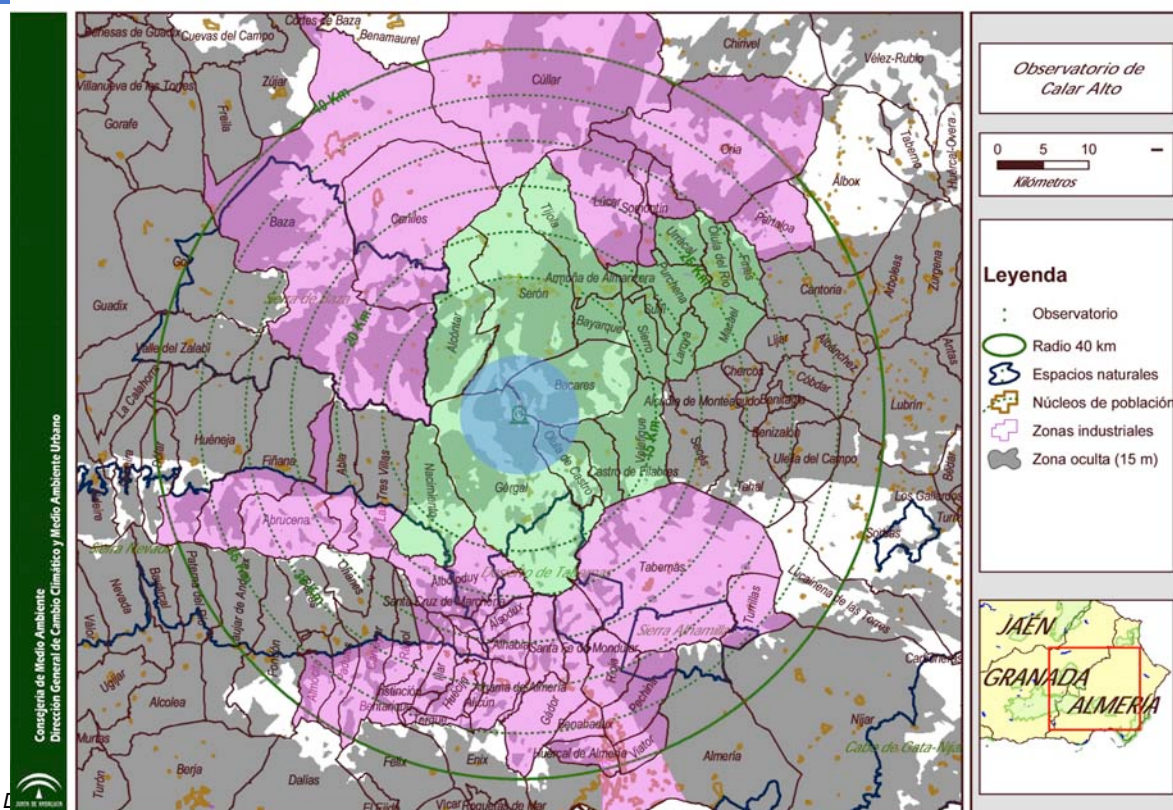
➤ Agosto 2010.- Regulación
- Oficina de protección del cielo
- CAHA es un observatorio de referencia

➤ Septiembre 2010.- CAHA como parte de la red de Cambio Climático.

➤ Septiembre 2011.- Publicación definitiva mapa contaminación lumínica. Inicio actuaciones.



Condiciones óptimas para el futuro



Nueva instrumentación: CAFÉ (2011)



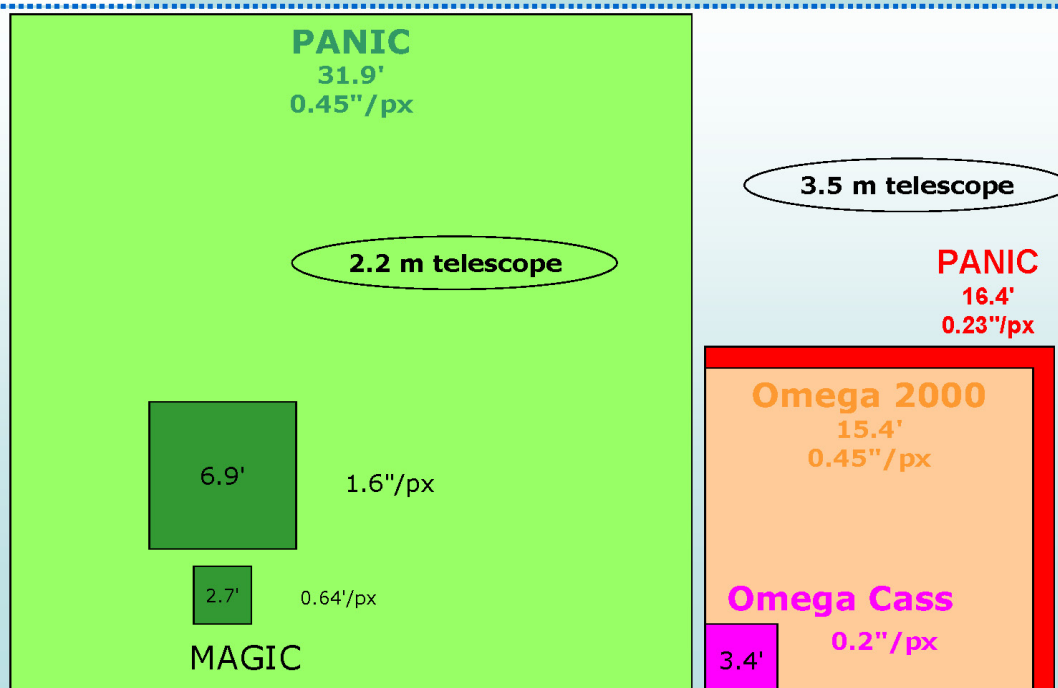
FOCES	CAFE
Echelle spectrograph design	Echelle spectrograph design
Calar Alto 2.2m (1997-2009)	Calar Alto 2.2m (2011...)
R=46000/64000 on 24/15 μ m CCD	R=70000 on 13.5 μ m CCD
Wavelength range: Visible	Wavelength range: Visible
L-N2 cooled	Peltier cooled
Un-stabilized	P,T stabilized
Moving parts (slit, grating, prisms..)	No moving parts
Th-Ar lamps	Iodine-cell, detection of exoplanets
Optical quality of elements $\lambda/10$	Optical quality of elements $\lambda/20$
S/N=100 for 10 th mag G-star: 1h	S/N=100 for 10 th mag G-star: 1h

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Nueva instrumentación: PANIC (2012)



FOV and Plate scale

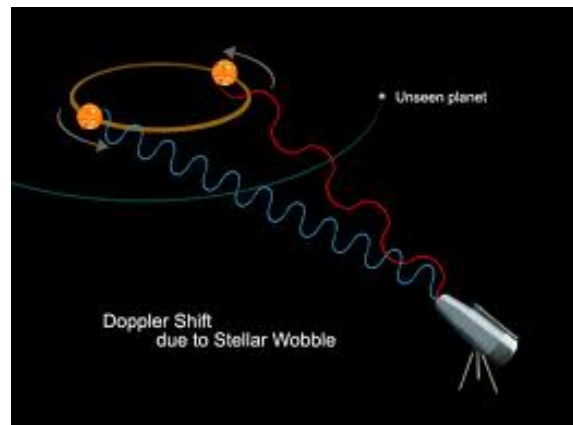
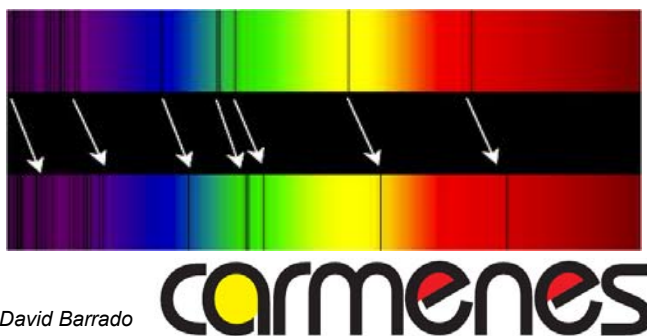


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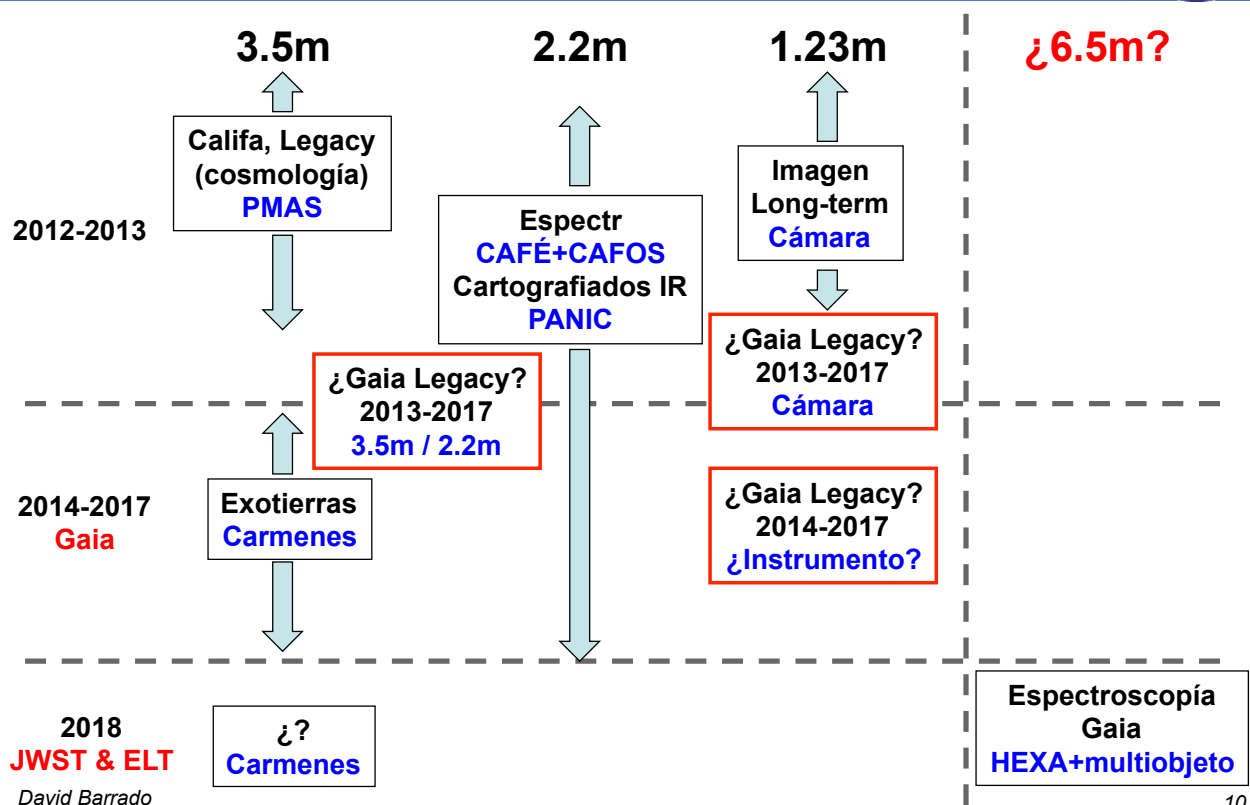
Nueva instrumentación: Carmenes (2014)



- Objetivo: búsqueda y caracterización de **exotierras** alrededor de estrellas frías
- Técnica: Velocidad radial
- Hardware: Espectrógrafo en los rangos ópticos (Heidelberg) e **IR (IAA, Granada)**



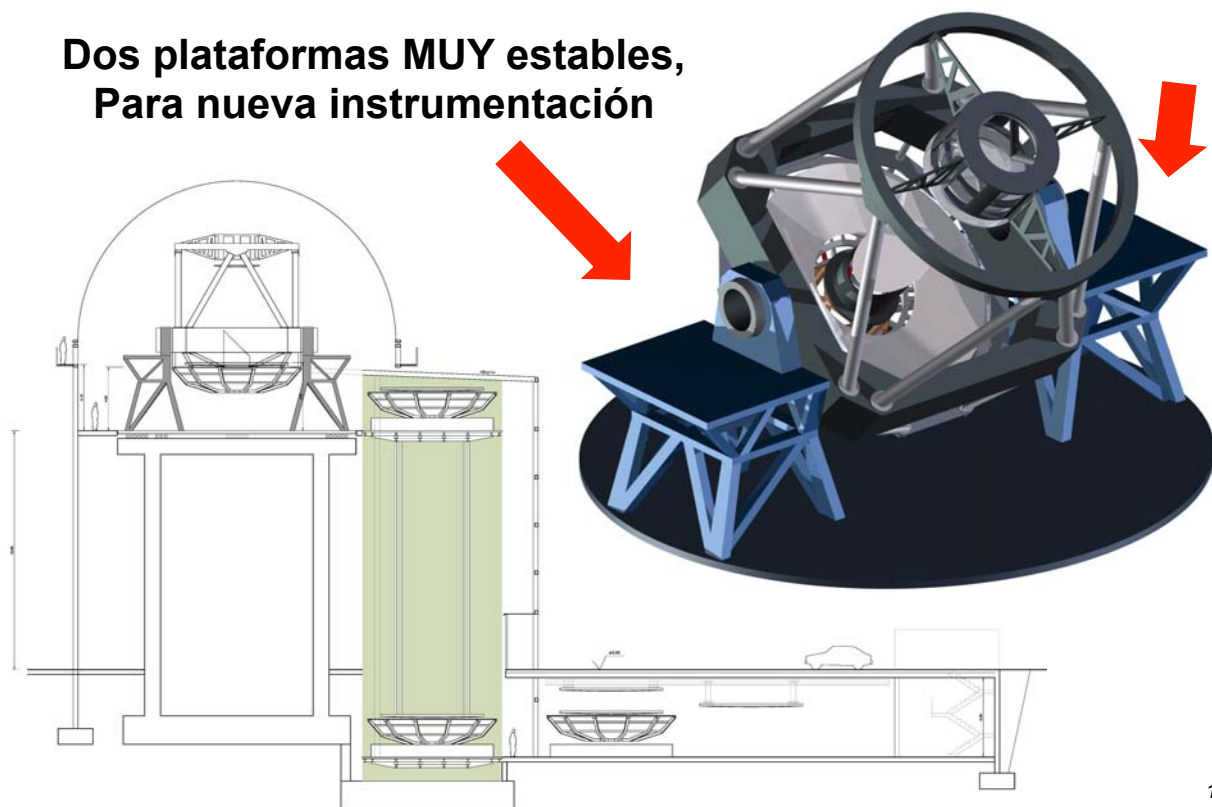
CALA ALTO: 2012-2018



2018: HEXA, 6.5m para cartografiados



**Dos plataformas MUY estables,
Para nueva instrumentación**



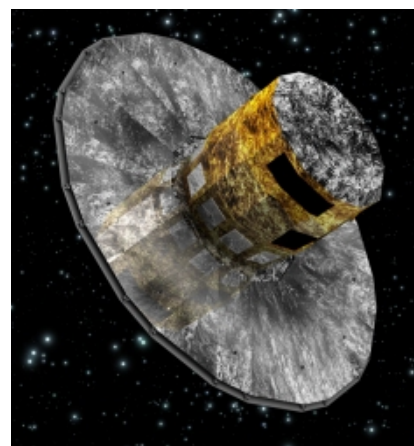
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¿Por qué? La necesidad de HEXA



**La ESA lanzará un telescopio en el 2013,
que cartografiará la Galaxia:
Posiciones y movimientos propios de
1,000,000,000 estrellas.**

**La explotación de esta extraordinaria base
de datos requiere espectroscopía**

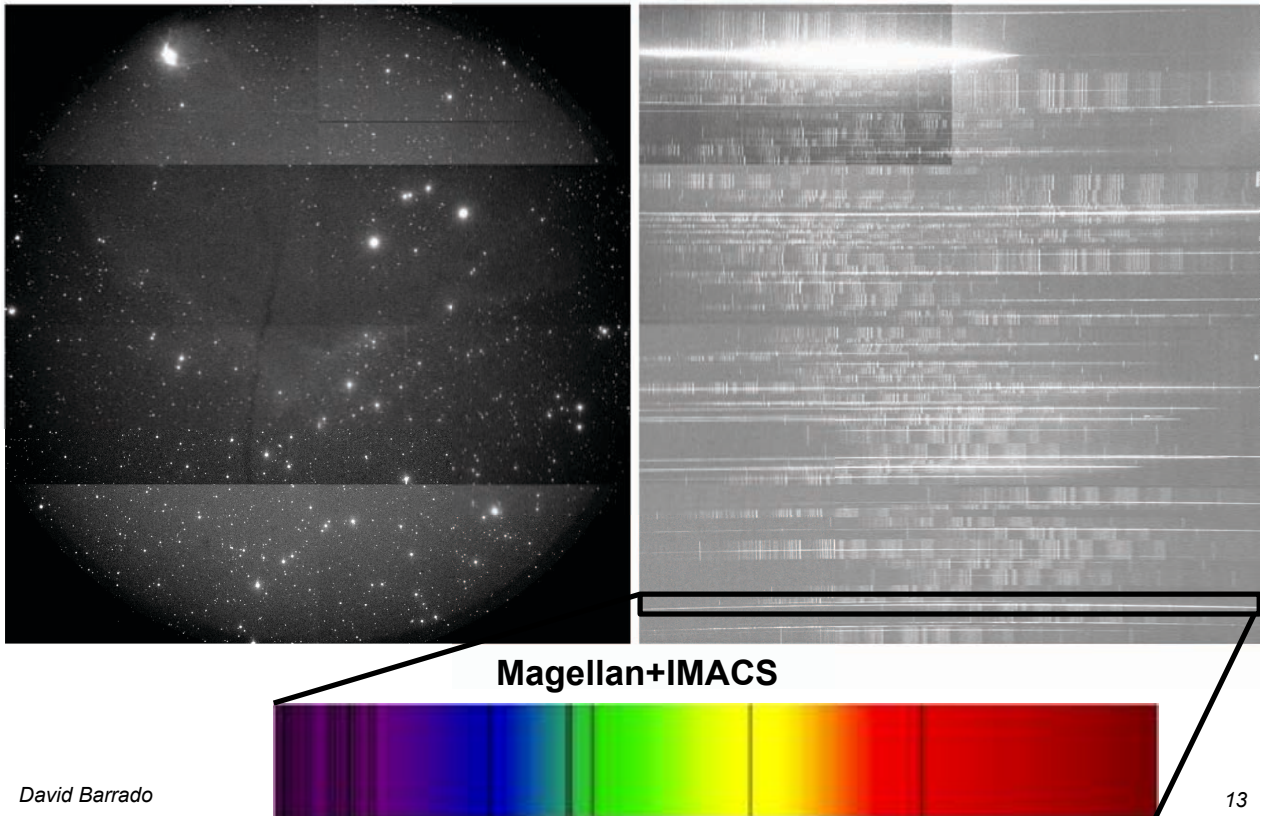


Primer catálogo: 2015+

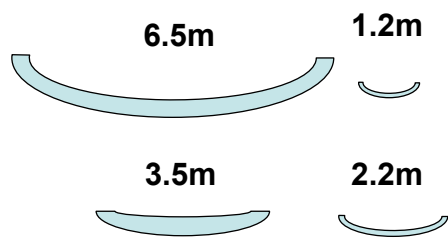
Catálogo final: 2021+

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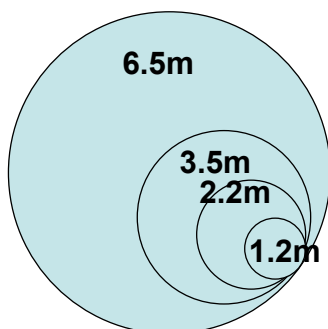
Multiplexing (simultaneidad)



Eficiencia de HEXA



Diámetro



Capacidad colectora

**156 veces más potente
que el 3.5m**

**7 veces más potente
(con el multiplexing) que
GTC -10m-
(y en un campo 70 más
grande)**

6.5m

3.5m



Eficiencia (multiplexing)

HEXA: 6.5m telescope for spectroscopic mapping



Base-line:

- Aperture 6.5m
- FOV 1.5 deg
- 500 multiplexing
- High-spectral resolution ($R > 20,000$, optimal 50,000)

Science with HEXA: some examples

- a) *Gaia follow-up: properties and evolution of stars and stellar associations*
- b) *Plato: characterization of exoplanets*
- c) *Extragalactic: post-CALIFA*
- d) *Cosmology: post-ALHAMBRA*
- e) *Cosmology: dark energy and acoustic barionic oscillations*

Requirements Summary



- Aperture: 6.5m diameter
- Output F# number = 3.6. (for the prime focus solution F#2.5 was used)
- Plate scale for 2M and 3M: 8.84 arcsec/mm (focal length 23.4m, F#3.6).
- Plate scale for 1M: 12.2 arcsec/mm (focal length 16.25 m, F#2.5)
- FOV: 1° to 2° Ø (diameter)
- Image quality: seeing limited
- Spectral range: narrow band filters 100 Å in the whole wavelength range : 380 Å -11000 Å
- Optimized for fibers: Telecentric system and flat focal plane



Multifiber spectrograph: Flames/MEGARA

Multislit: Magellan/IMACS

Near-IR: 3.5m/MICS

Slitless

Wide Field IFU

Conceptual design: the baseline

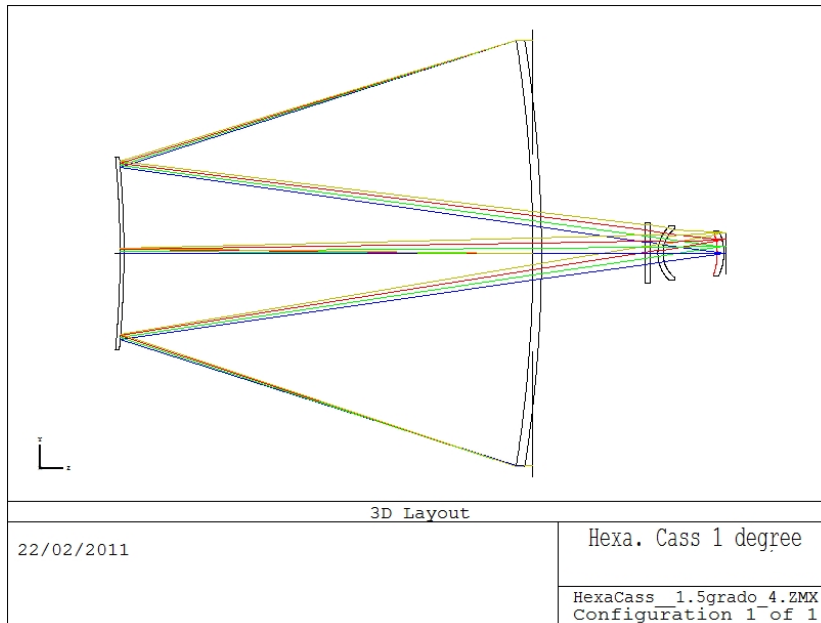


2-mirror R-C
M1=6.5 m, FOV=1.5°Ø

HEXA 2 RC FOV 1.5°



9300 mm



- 3 lenses corrector. Max Diameter 940mm
- One aspheric lens in the corrector

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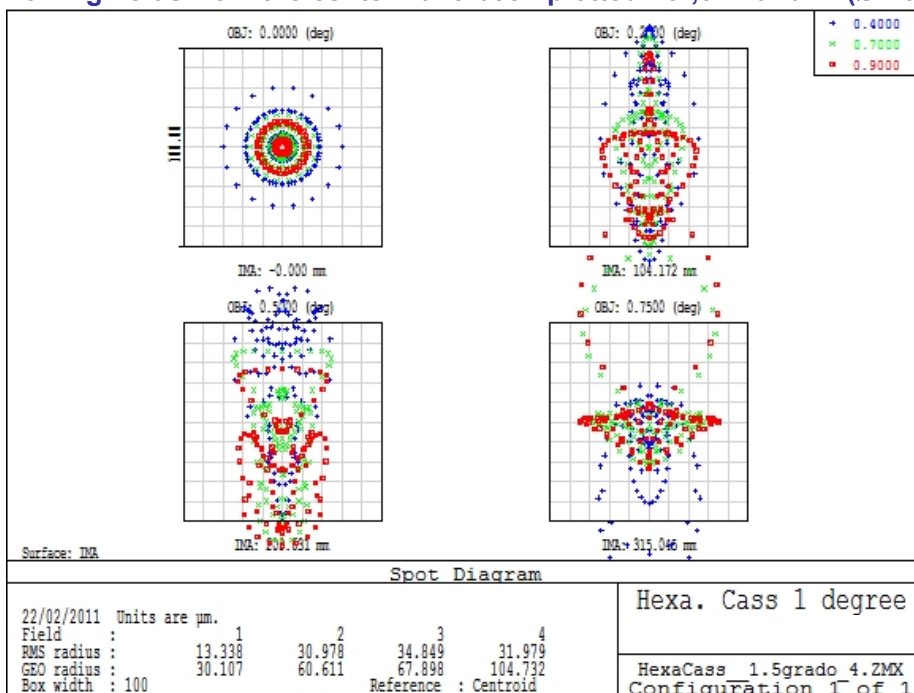
Image Quality



Spot Diagram

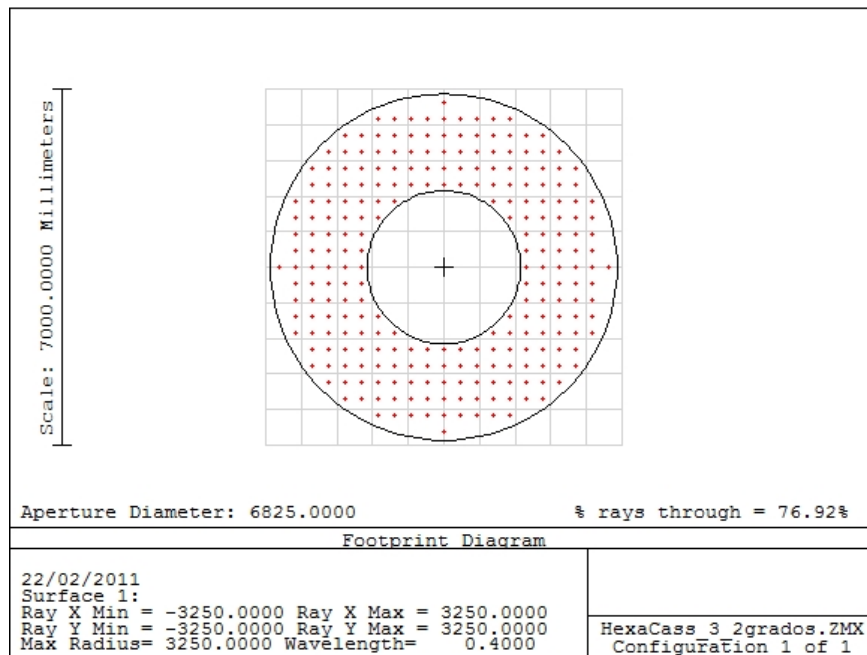
Each circle is $1'' \varnothing$ (113 μ m).

The following fields from the center have been plotted: $0^\circ, 0.7^\circ$ and 1° ($\varnothing = 0^\circ, 1.4^\circ, 2^\circ$)



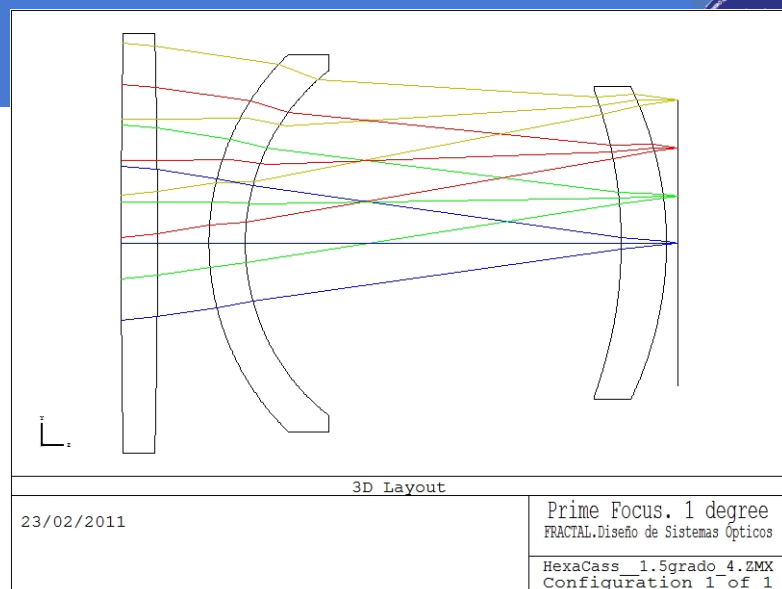
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Effective Aperture



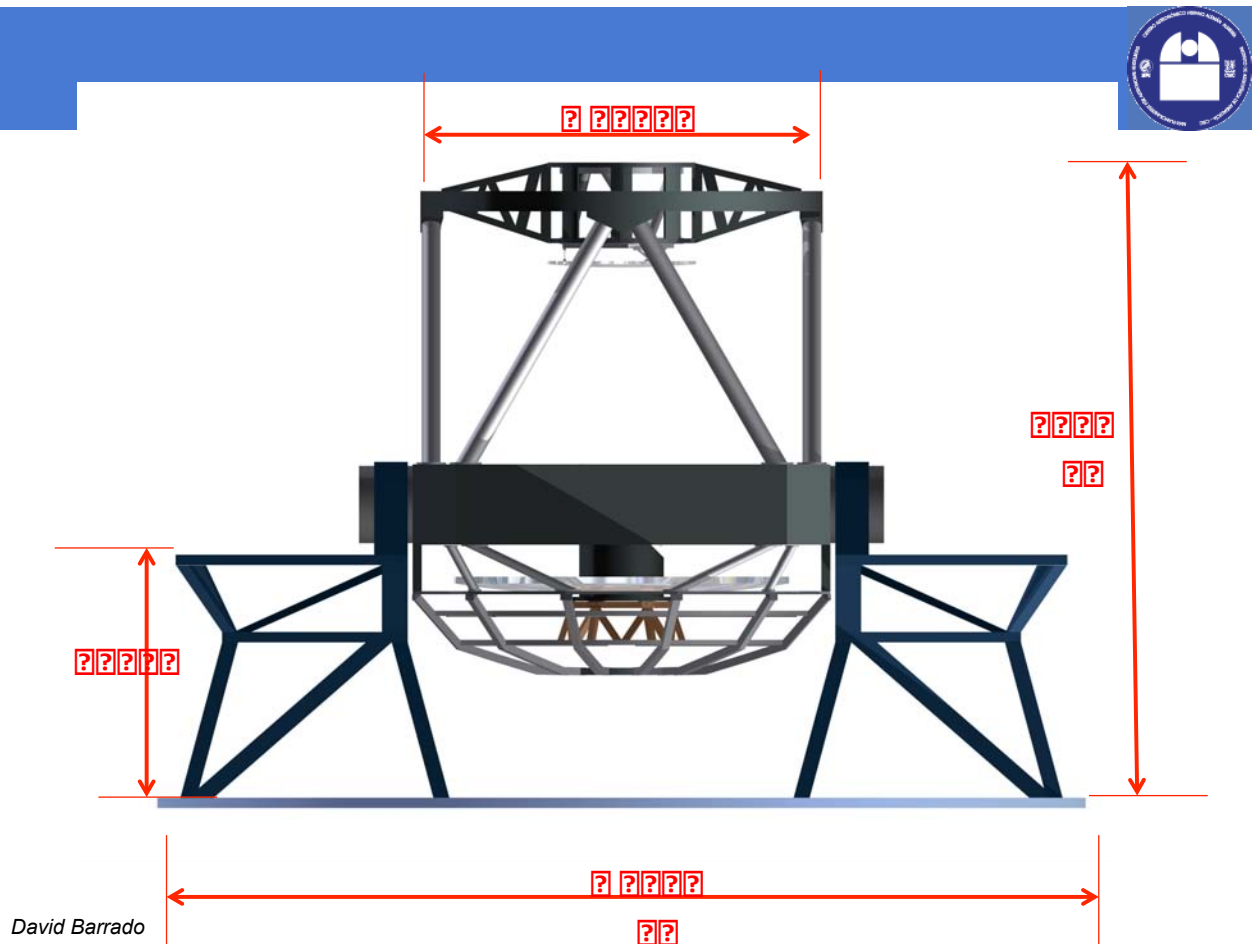
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Corrector

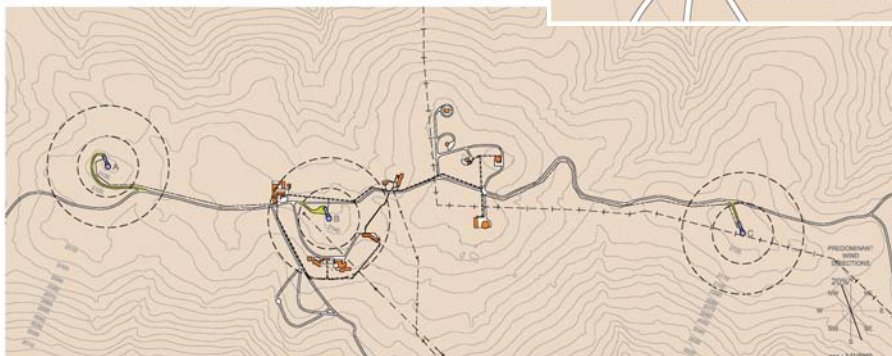


	Glass	Diameter	Center Thickness	R1	R2	Aesf coeff
L1	LLF1	930	80	flat	-18000	
L2	LLF1	830	80	581	485	
L3	N-BK7	690	100	-1111	-792	yes

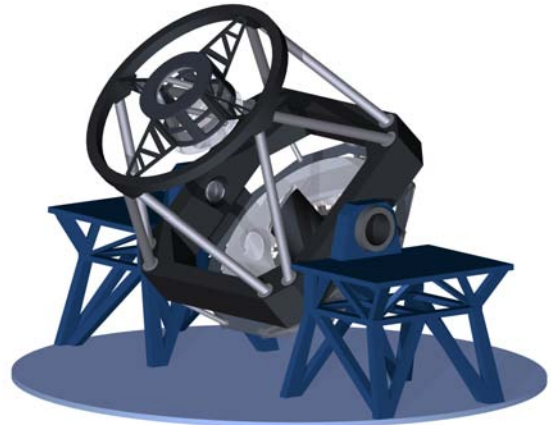
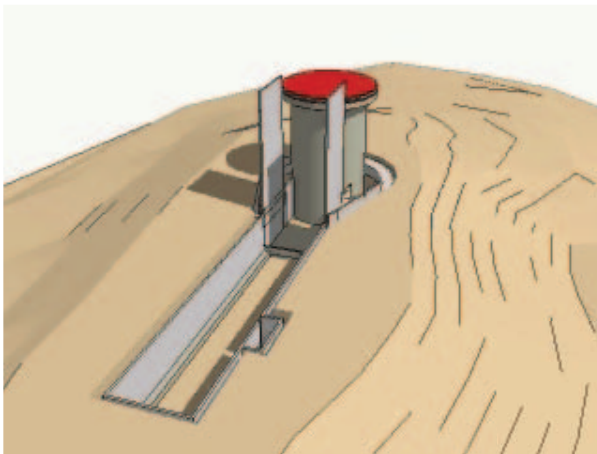
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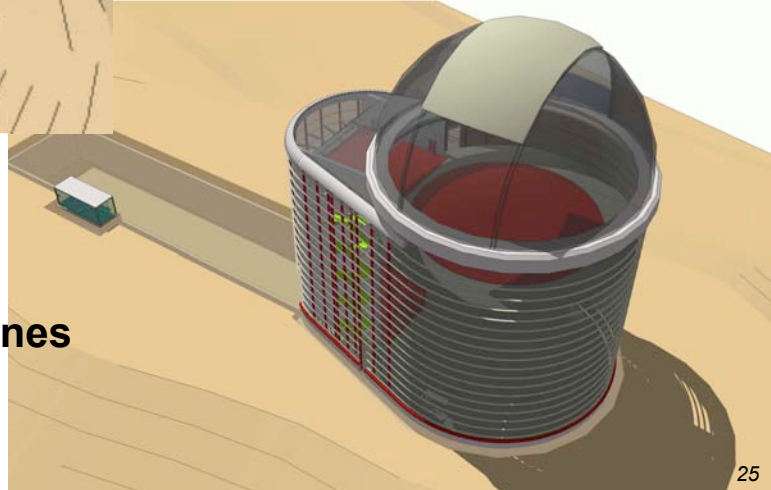
TELESCOPE BUILDING
NEW BUILDING SERVICE ROAD
NEW INSTALLATION GALLERY



2017: HEXA en CAHA



2015, fin obra civil
2017, commissioning
2018, inicio observaciones



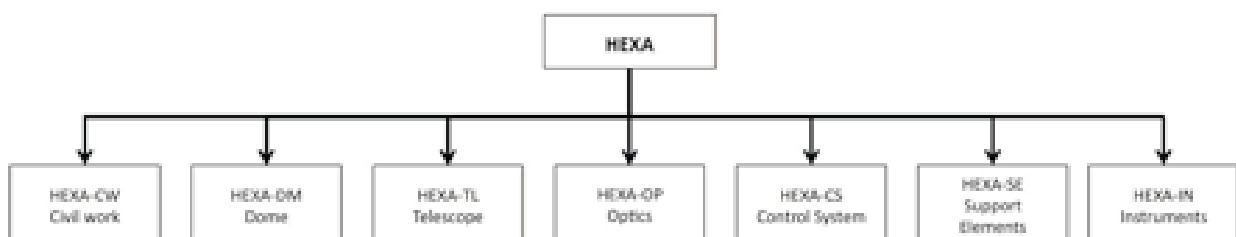
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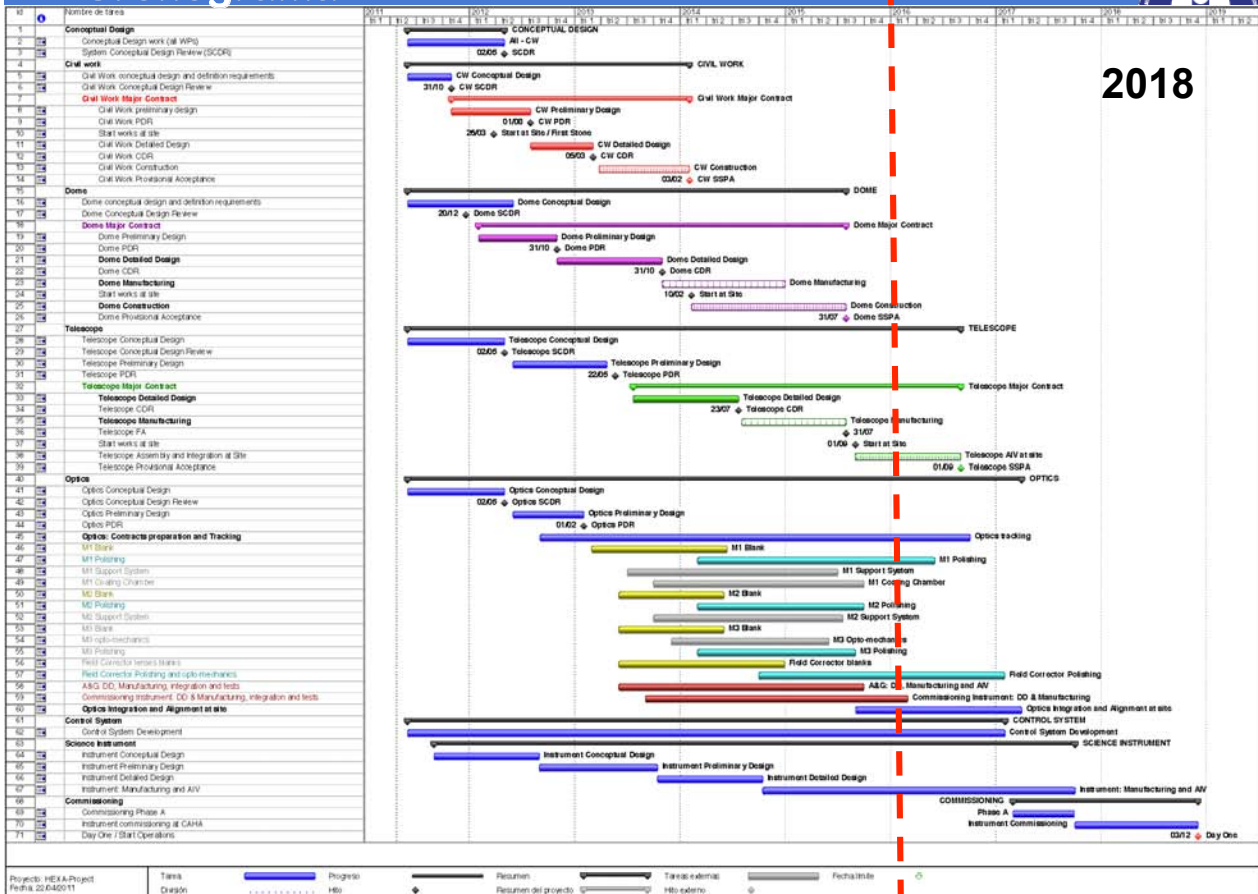
Phasing and milestones



Phase	Name	Milestone at the end of the phase	Abbrev.
Phase 1	Conceptual Design	System Conceptual Design Review	SCDR
Phase 2	Preliminary Design	Preliminary Design Review	PDR
Phase 3	Detailed Design	Critical Design Review	CDR
Phase 4	Manufacturing and subsystem tests	Subsystem Acceptance Reviews	SSAR
Phase 5	Assembly, Integration and Verification	System Preliminary Acceptance Review (at site)	SPAR
Phase 6	Commissioning	System Acceptance Review (SA) at site and on sky (Final Acceptance)	FA



Cronograma

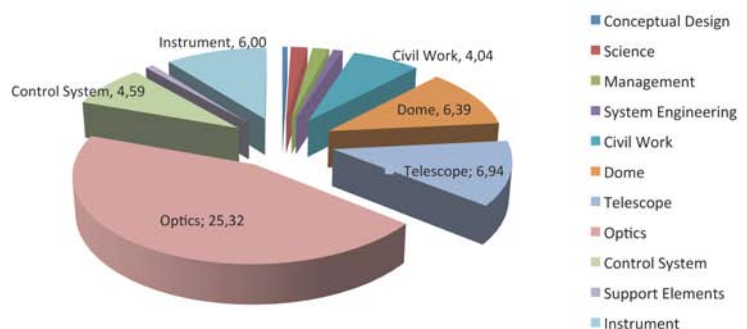


Presupuesto

WP-HEXA-000	Conceptual Design	300.000,00	0,30	0	0,30	WP-0
WP-HEXA-001	Science	982.049,30	0,98	1	0,98	WP-1
WP-HEXA-002	Management	989.549,30	0,99	2	0,99	WP-2
WP-HEXA-003	System Engineering	573.413,34	0,57	3	0,57	WP-3
WP-HEXA-004	Civil Work	4.035.000,00	4,04	4	4,04	WP-4
WP-HEXA-005	Dome	6.385.000,00	6,39	5	6,39	WP-5
WP-HEXA-006	Telescope	6.935.000,00	6,94	6	6,94	WP-6
WP-HEXA-007	Optics	25.320.000,00	25,32	7	25,32	WP-7
WP-HEXA-008	Control System	4.585.000,00	4,59	8	4,59	WP-8
WP-HEXA-009	Support Elements	500.000,00	0,50	9	0,50	WP-9
WP-HEXA-010	Instrument	6.000.000,00	6,00	10	6,00	WP-10

56 Meuro + contingencia

Million Euros



FEDER: 2013, ejecutable hasta final 2015