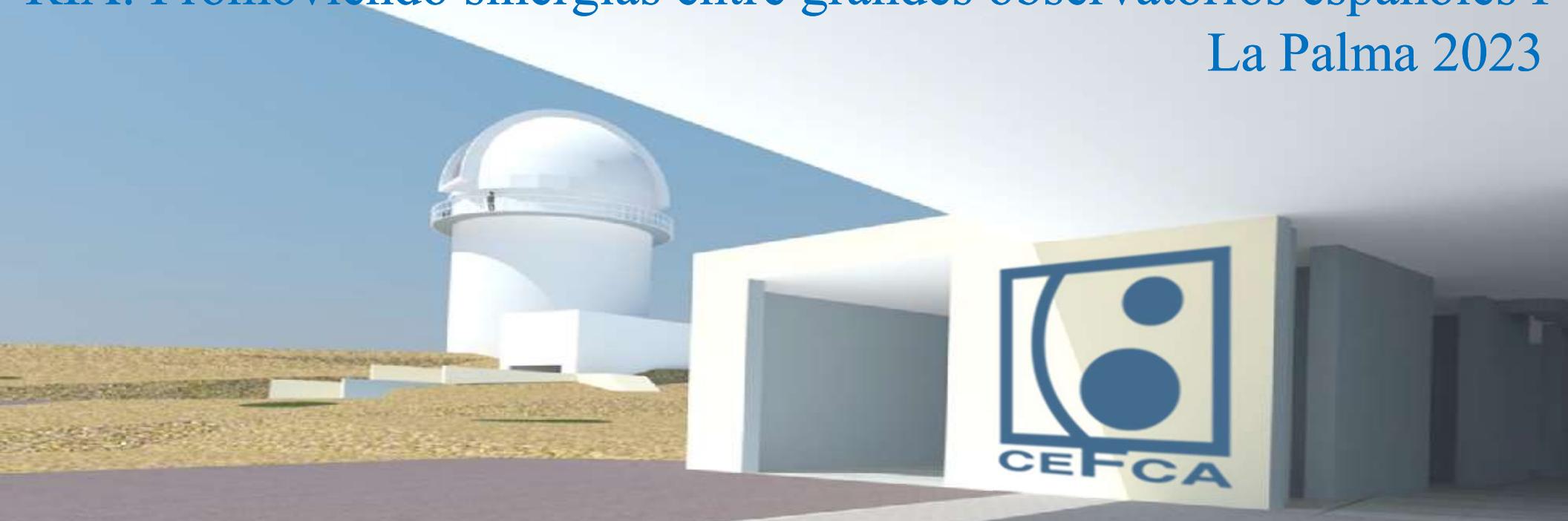


RIA: Promoviendo sinergias entre grandes observatorios españoles I

La Palma 2023



Gestión Efectiva del Departamento del Ingeniería
Maximizando el Rendimiento en el OAJ

Axel Yanes – Head of Engineering and Control Systems at CEFCA
La Palma, Monday 23rd October 2023 at 17:40



Loading our mindset concepts to show you our point of view



DING
perspective

12 years
In
12 minutes



- 
- 1. Introduction**
 2. OAJ, CIA and GOCS
 3. Management Challenges
 4. Teamwork Optimization
 5. Emerging Technologies
 6. Conclusions



Gestión efectiva del Departamento de Ingeniería – La Palma 2023

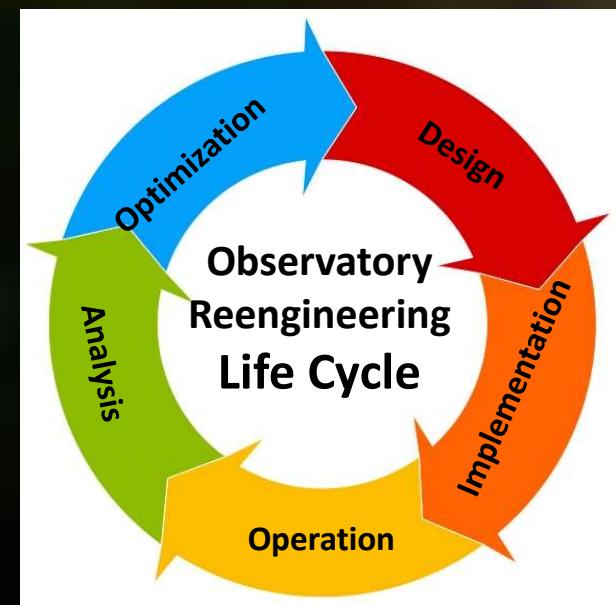
Introduction



Boosting Observatory Operation Performance

Axel Yanes – ayanes@cefca.es





An Astrophysical Observatory is a **Dynamic Complex Macro System** that needs to be adapting continuously to updated demanding requirements

The observatory is a dynamic system

Axel Yanes – ayanes@cefca.es

The observatory is a dynamic system... It is alive!
Circumstances are changing continuously...

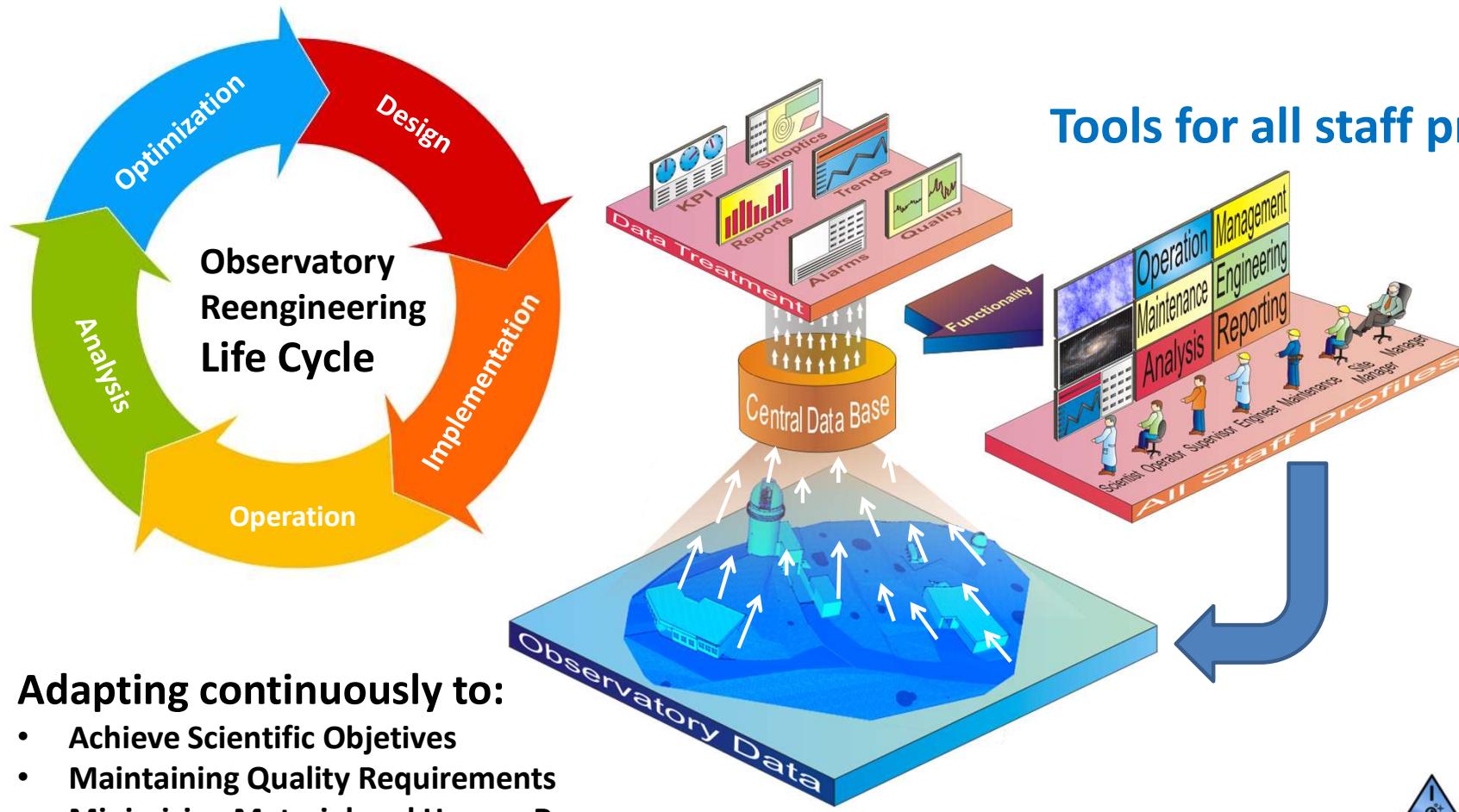


Needs, constrains and requirements are updated continuously...











1. Introduction
2. **OAJ, CIA and GOCS**
3. Management Challenges
4. Teamwork Optimization
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6. Conclusions



Picture: Solaiman Hossen at Unsplash



OAJ civil Works started in summer 2010



The background of the slide features a close-up photograph of a small green seedling with three leaves growing out of dark brown soil. Sunlight streams in from the upper left, creating bright rays and lens flare against a dark, out-of-focus background.

SCIENCE

SUPPORT



Gestión efectiva del Departamento de Ingeniería – La Palma 2023

Control Architecture for Observatory Operation

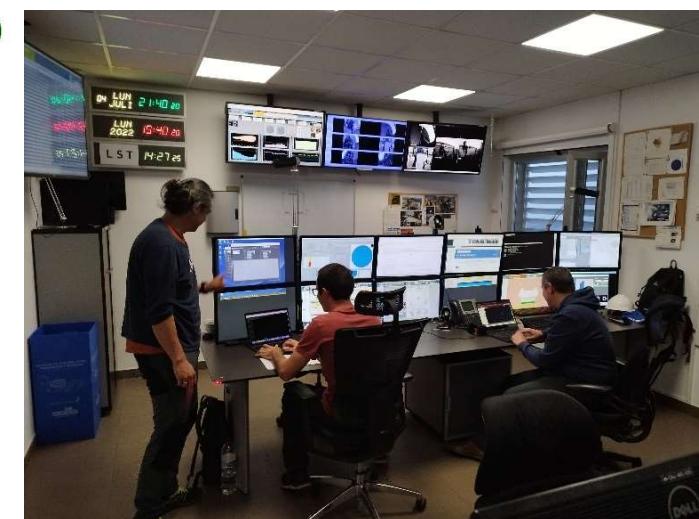
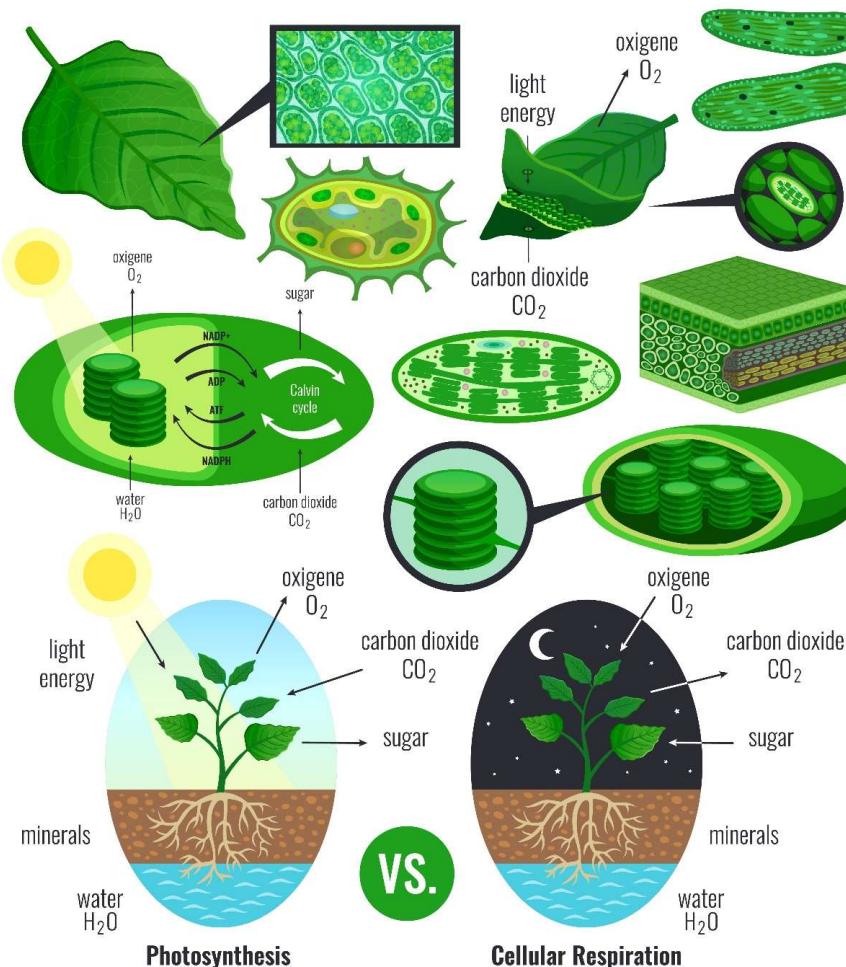
From Science



to Support



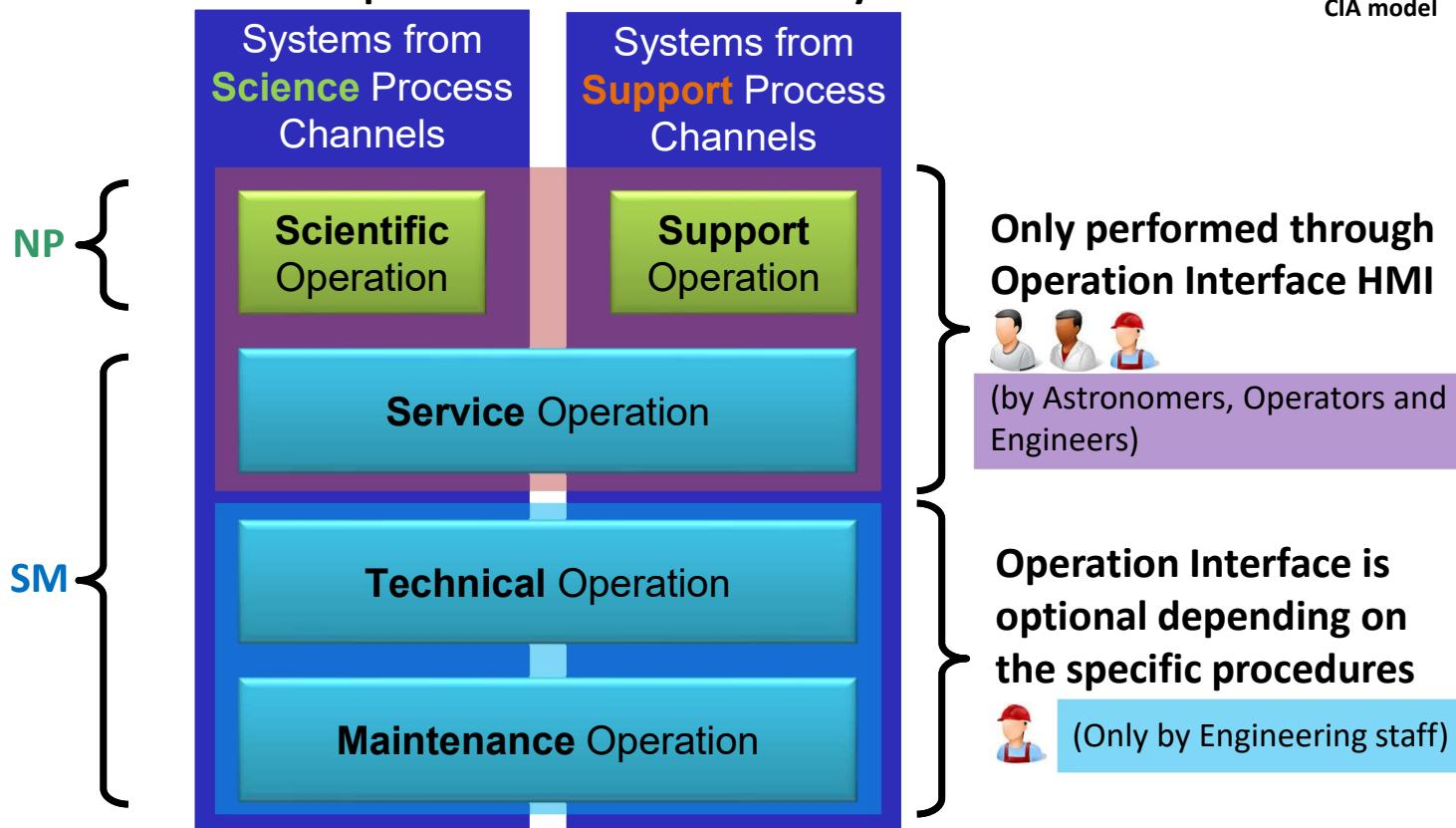
Boosting Observatory Operation Performance





GOCS : Global Observatory Control System

Global Operation of the Observatory





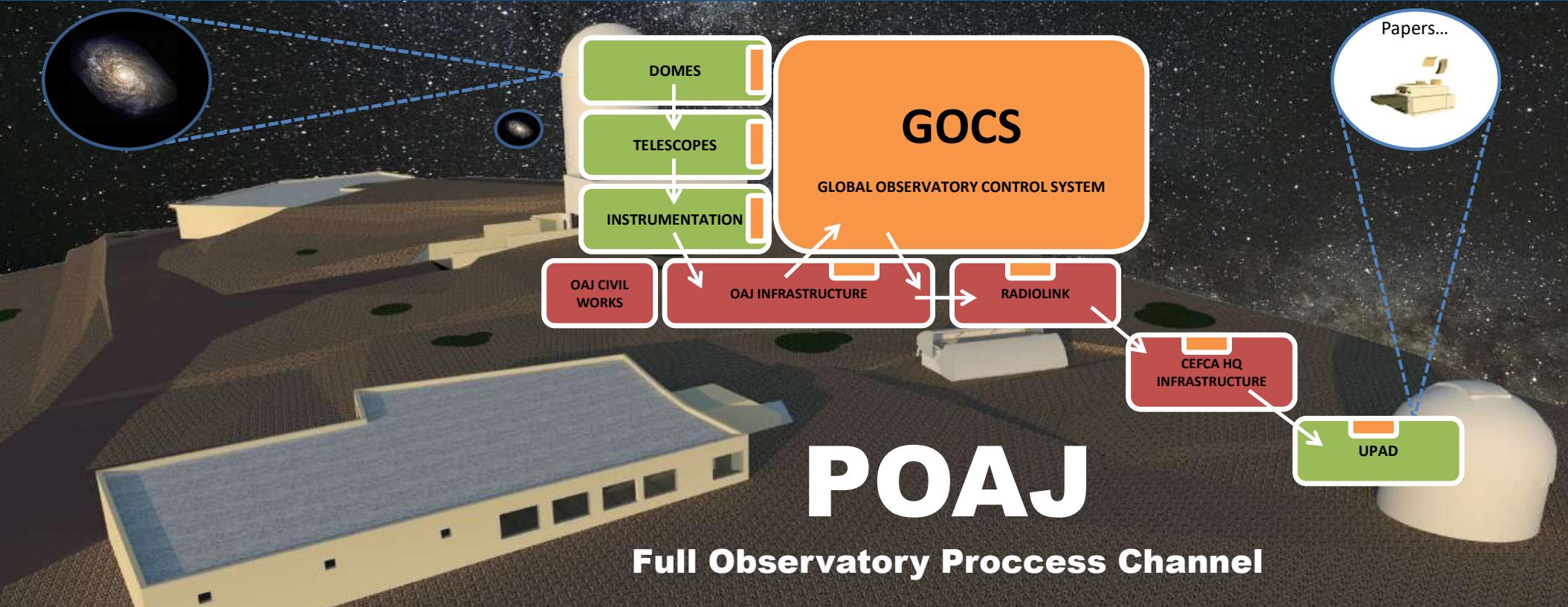
Gestión efectiva del Departamento de Ingeniería – La Palma 2023

Control Architecture for Observatory Operation



Science Process Channels working together with **Support** Process Channels

Axel Yanes – ayanes@cefca.es



CEFCA ENGINEERING SERVICES POWERING POAJ

OPTICS

MECHANICS

ELECTRONICS

CONTROL
HARDWARE

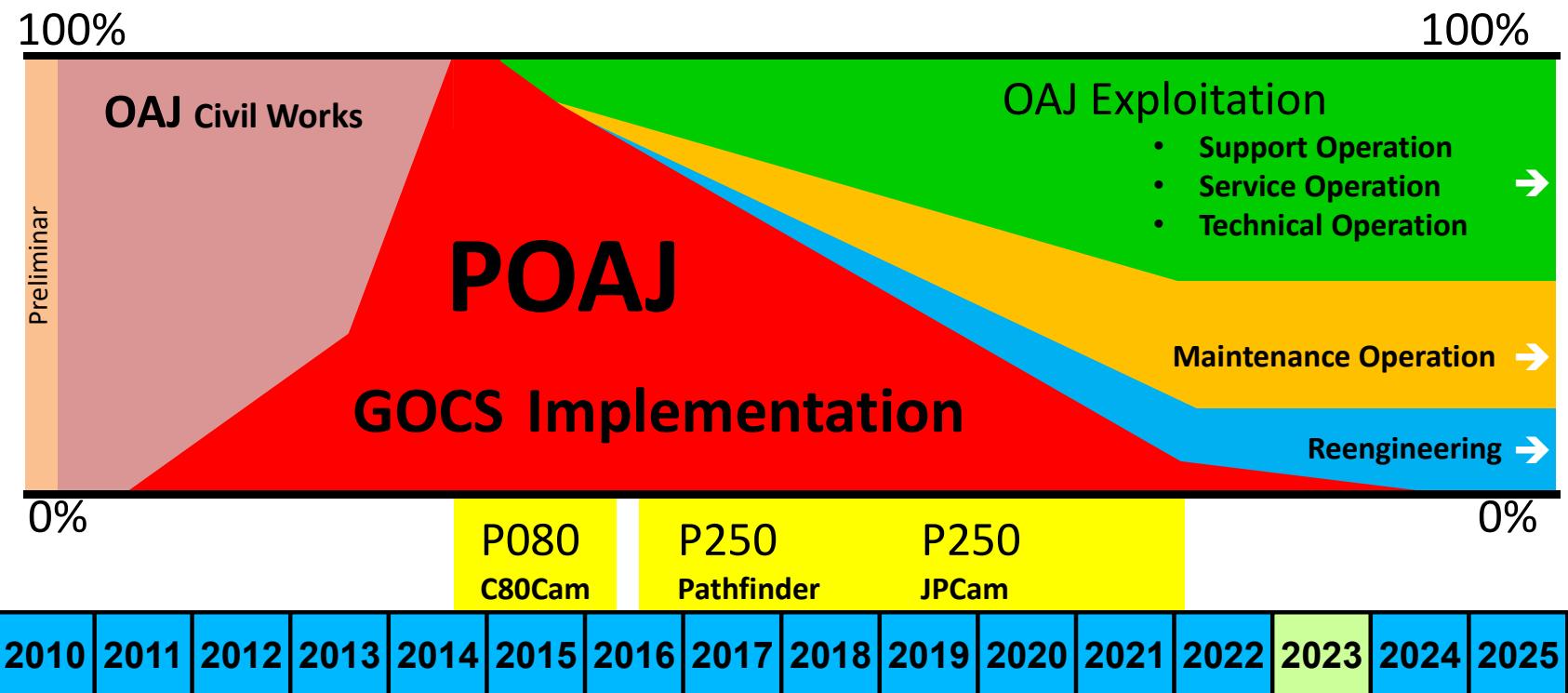
CONTROL
SOFTWARE

NETWORKS &
COMUNICACIONES

LOGISTICS
& MAINTENANCE

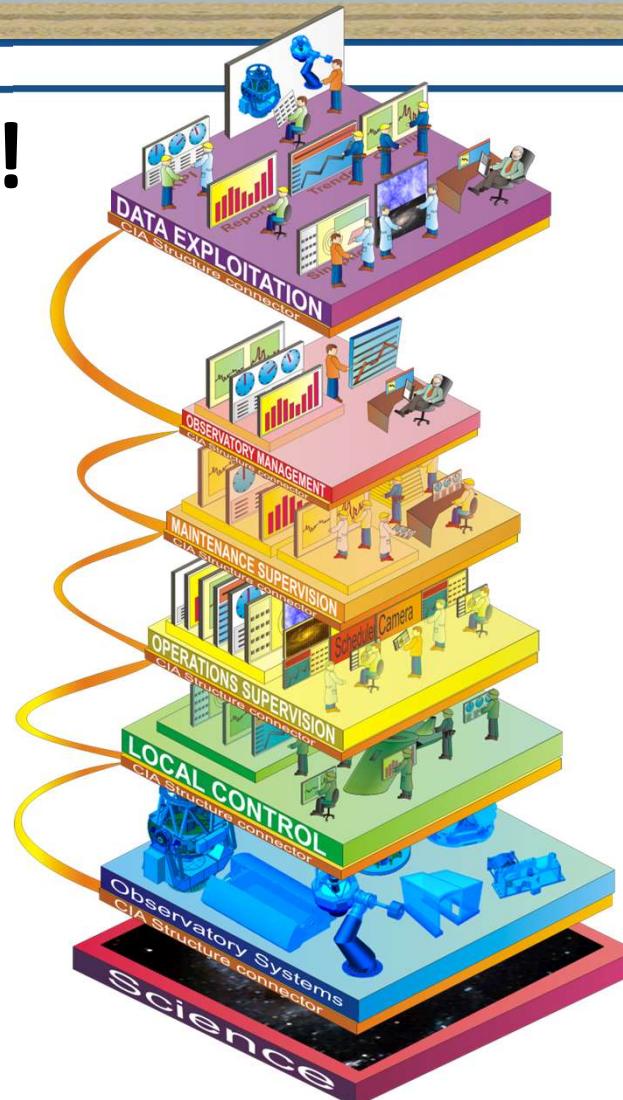


Fully Automated Observatory Dedication Distribution History (Control System Engineering)





Current Status!!



LEVEL 6: EXPLOITATION

High Performance Processes

ERP & CMMS = 85%
Reengineering

LEVEL 5: Global Management = 100%

Maintenance = 100%

LEVEL 4: Support = 100%

Control Integrated Architecture

LEVEL 2: Control = 100%

LEVEL 1: Observatory Systems = 100%

LEVEL 0: Nature





The Observatorio Astrofísico de Javalambre is a fully automated observatory based on CIA model

Axel Yanes – ayanes@cefca.es

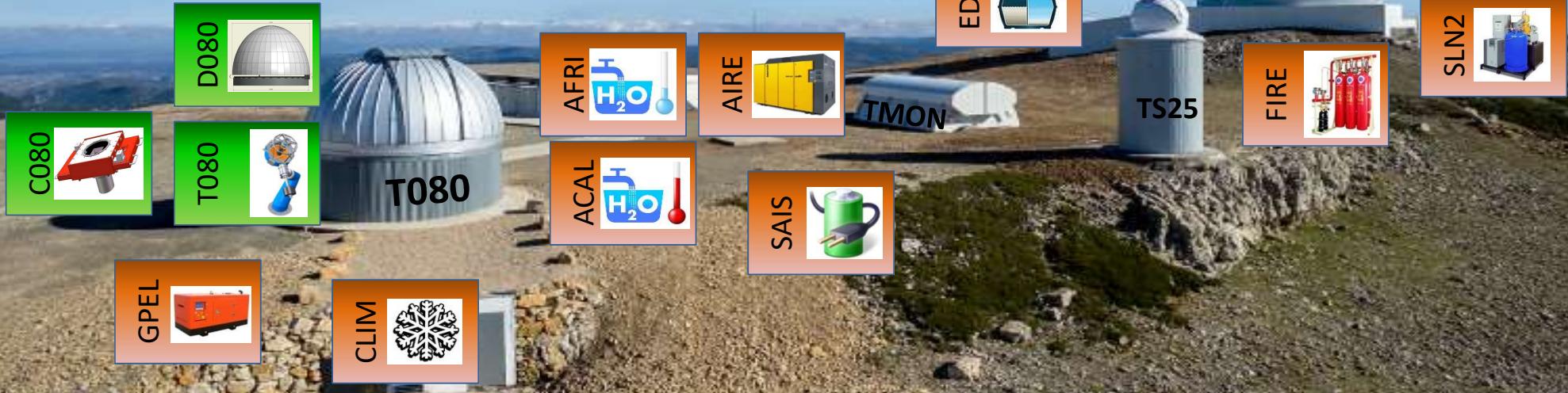
OAJ is a fully automated Astrophysical Observatory

Two main telescopes: T080 and T250

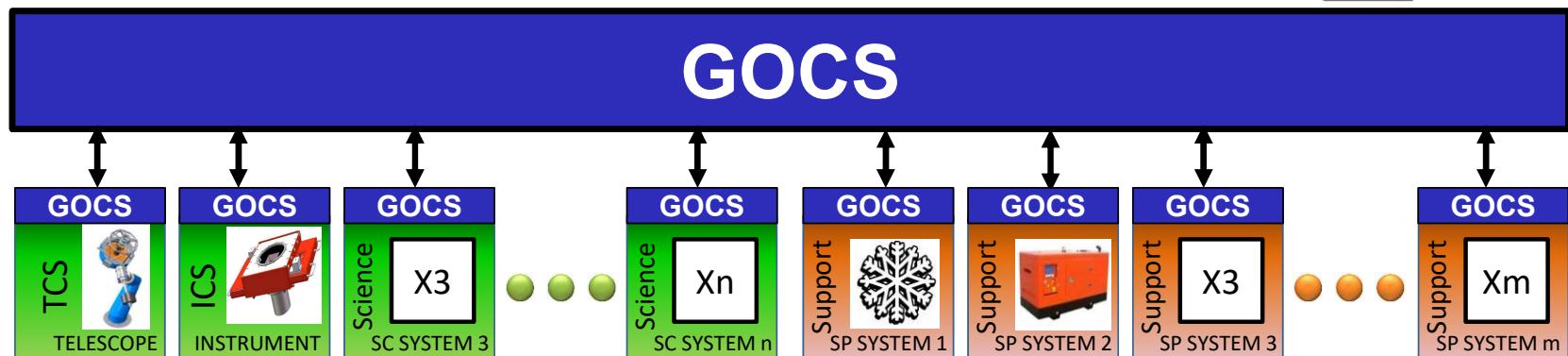
Auxiliary telescopes for sky monitoring

Performing Scientific operation mainly for all Sky surveys

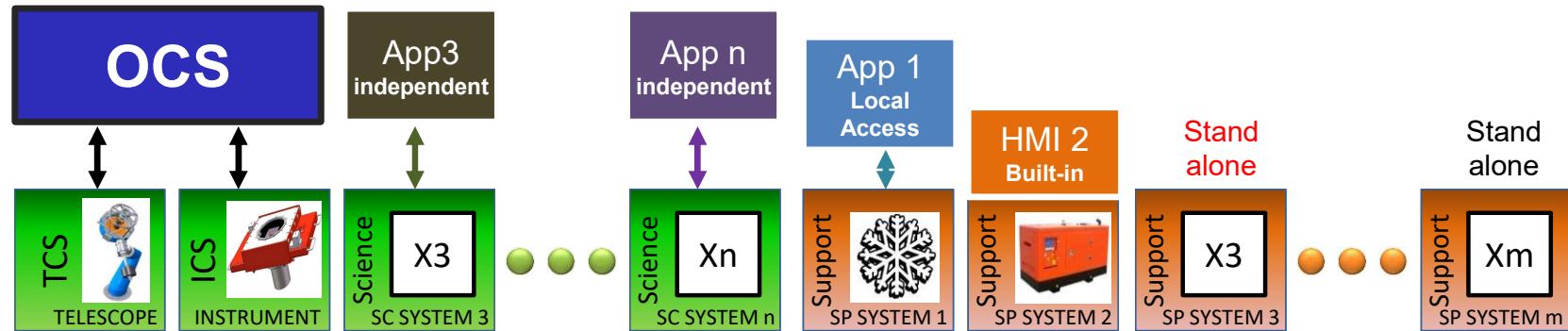
Finished GOCS implementations



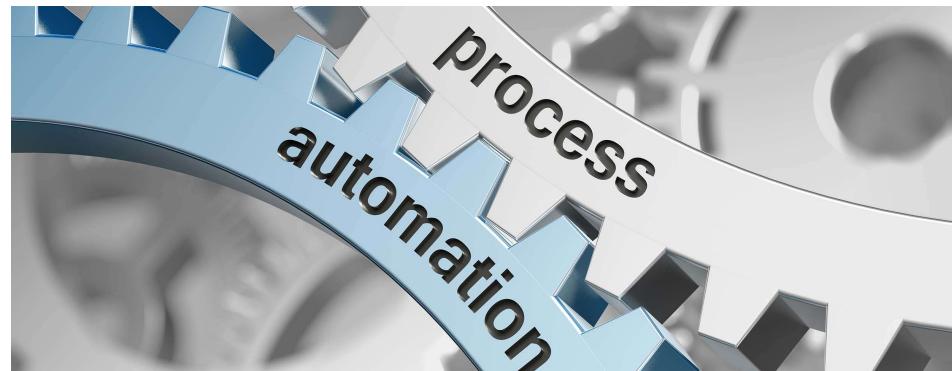
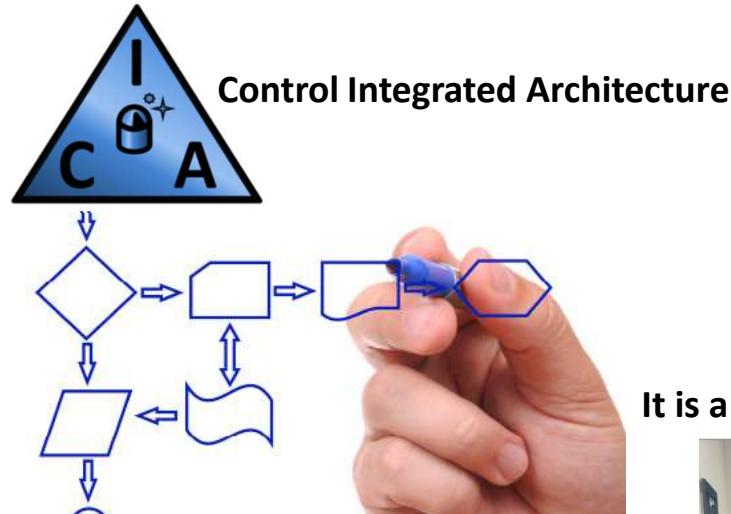
"GOCS" : Global Observatory Control System


 CIA model


"OCS et al": Observatory Control System et al



Boosting Observatory Operation Performance



It is a control engineering model for Astrophysical Observatories



CIA Concepts: Standard System Classification Nomenclature

Systems codification				Comp	Signals				
DESCRIPTION	PROCESS CHANNEL	SYSTEM	SUBSYSTEM	DIVISIONS	COMPONENTS	ITEMS	SIGNAL TYPE	NUMERATION	FUNCIONALITY
CODE	xxxx	xxxx	xxxx	xxxx	xx	xx	xx	xx	xx
DIGITS	4	4	4	4	2	2	2	2	2

Location codification					
DESCRIPTION	INFRASTRUCTURE	AREA	ZONE	SECTION	ENCLOSURE
CODE	xxxx	xxxx	xxxx	xxxx	xxxx
DIGITS	4	4	4	4	4

Global systems codification, components and signals

Group codification

4 digits

System codification

8 digits

Subsystem codification

12 digits

Division codification

16 digits

Component codification

20 digits

Local PLCs signal codification

PLC / System		
xxxx	xxxx	xxxx
4	4	4

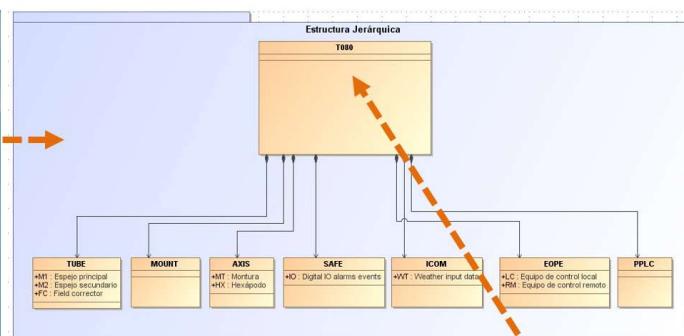
COMP			SIGNAL		
xxxx	xx	xx	xx	xx	xx
4	2	2	2	2	2

PLC Adress: 12 digits

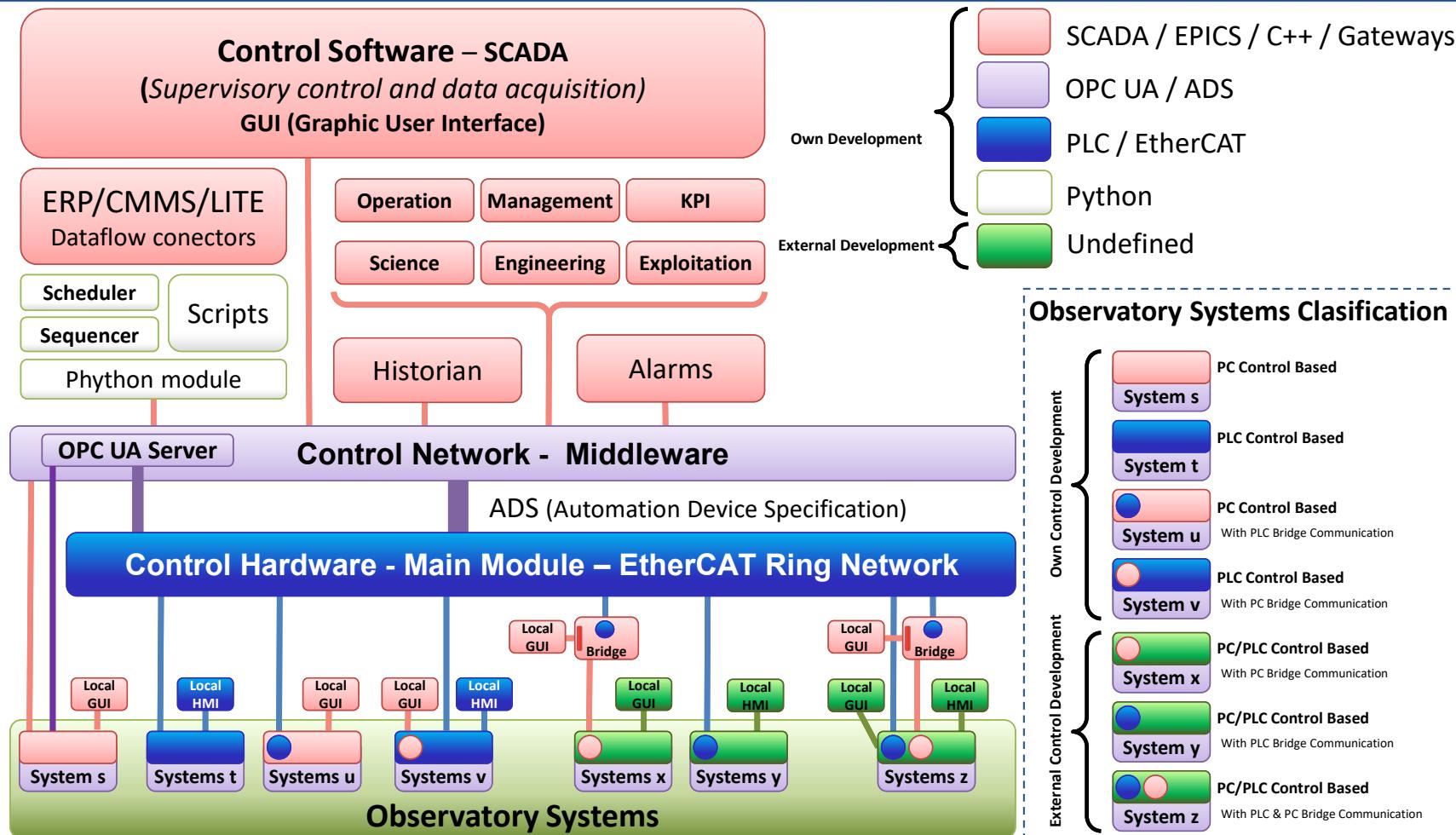
Señal:14 digits

The screenshot shows a software application for system classification. It includes tabs for 'GRUPO', 'SISTEMA', 'SUBSISTEMA', 'DIVISION', 'COMPONENTE', and 'SEÑAL/ VARIABLE'. Each tab displays a hierarchical tree structure with various components and their descriptions. A red dashed arrow points from the 'COMPONENTE' tab to the right side of the screen.

- Create modeling guidelines for all system aspects, hierarchy levels and views.
- Build a comprehensive model, which serves as the basis for providing different views to different engineering aspects and subsequent activities.

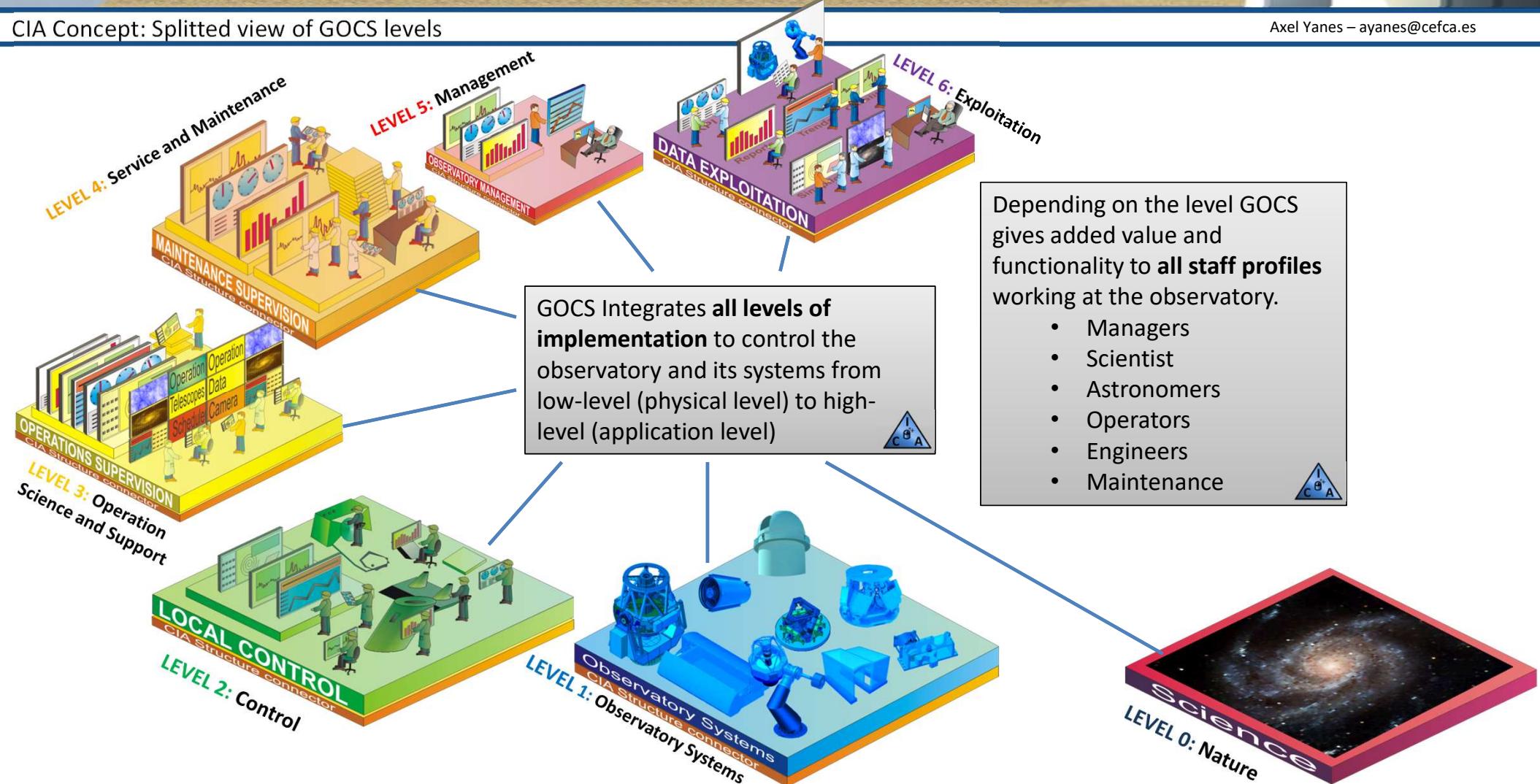


Control Integrated Architecture





CIA Concept: Splitted view of GOCS levels

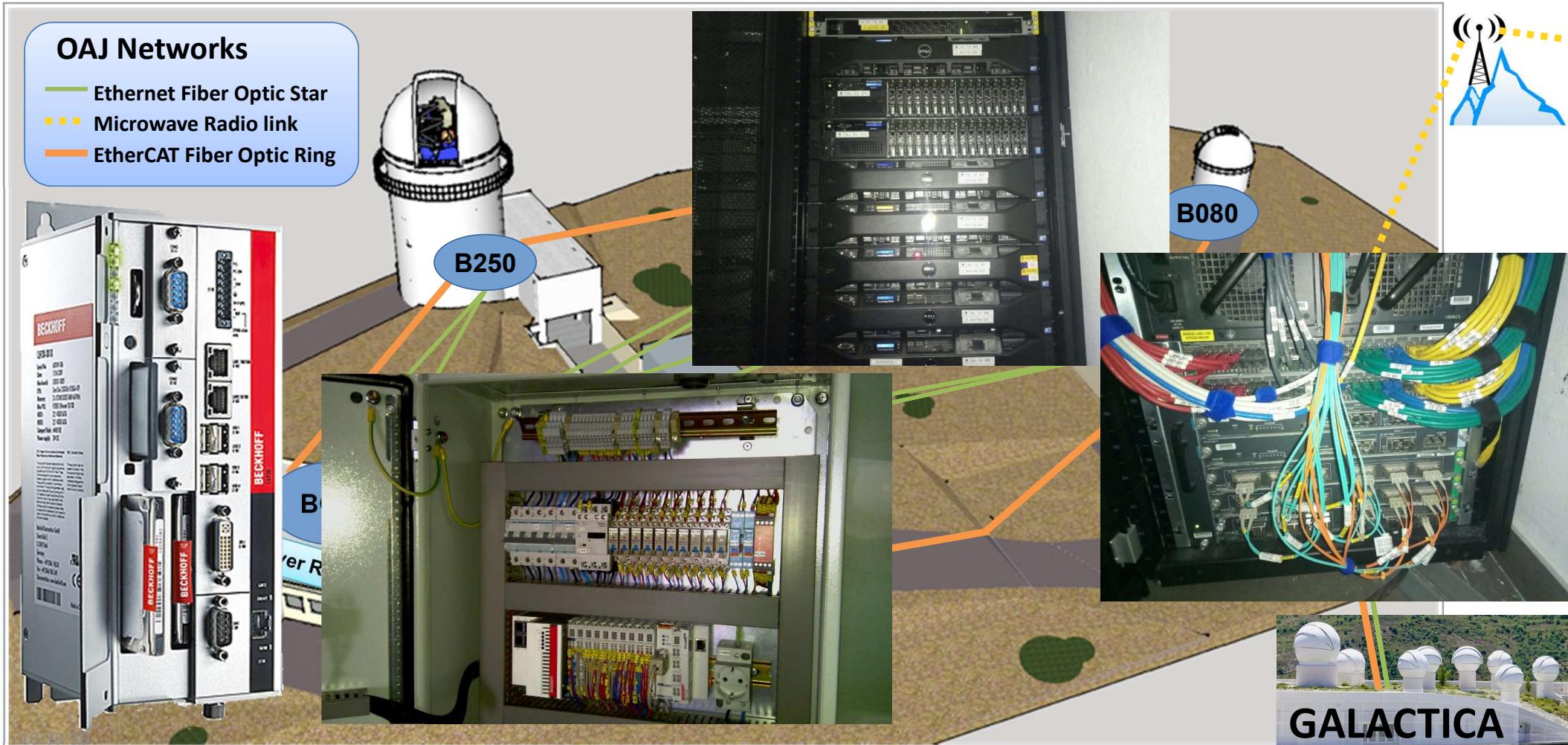




OAJ InterBuilding Control Communications

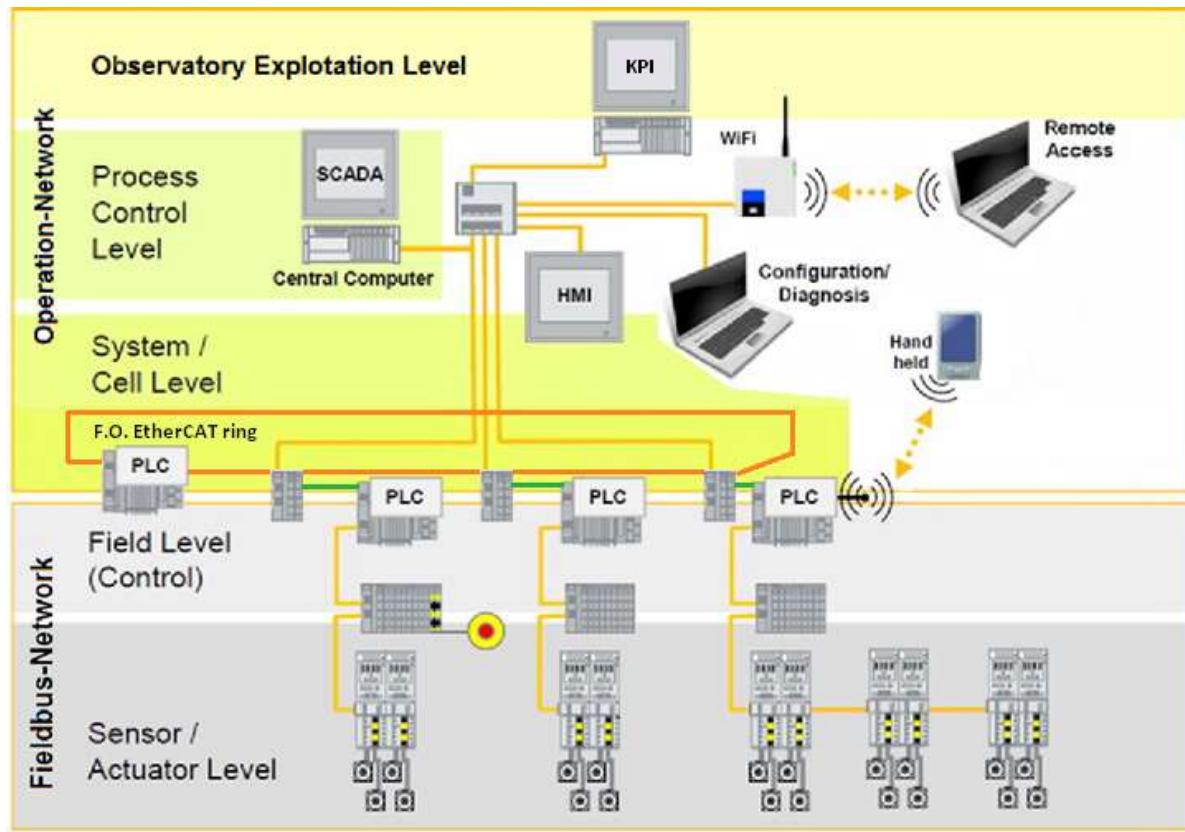
OAJ Networks

- Ethernet Fiber Optic Star
- Microwave Radio link
- EtherCAT Fiber Optic Ring

**GALACTICA**

Architecture: PLC & fieldbus for OCSH: Deployment of Ethercat Protocol

EtherCAT (Ethernet for Control of Automation Technology)



- ✓ Connection to OCS
- ✓ Configuration/Diagnosis (also Remote)
- ✓ Control/Visualization
- ✓ Standard Ethernet Components
- ✓ Master-Master Communication
- ✓ Routing to any device connected
- ✓ Wireless device integration

EtherCAT Protocol

- ✓ Open Protocol: ISO, IEC and SEMI Standard
- ✓ Used at Field Level
- ✓ Hard Real-Time
 - Fast Cycle Times
 - Precise Sync.
- ✓ Flexible Topologies
- ✓ Standard Ethernet Components



Gestión efectiva del Departamento de Ingeniería – La Palma 2023

Development plan for Operation

Distributed Information System for Operation Support



Axel Yanes – ayanes@cefca.es

Sistema de Control del OAJ - Navigation

PG... META

ECAT: Red EtherCAT OAJ Estado

ESTADO Actividad ON Alerta READY

MODOS Habilitación ENABLED Trabajo NP Calidad OK

Control Funcionamiento AUTO Operación <Select O...

Sistema de Control Global del Observatorio
Departamento de Ingeniería
OAJ GOCS - Basado en modelo CIA

CEFCA FITE 2018 GOBIERNO DE ARAGÓN

Red eCAT zona BGEN

Red eCAT zona BG250

Red eCAT zona BMON

Red eCAT zona B080

Red eCAT zona BINS

Red eCAT OAJ

Logged: admin

Logout Alertas

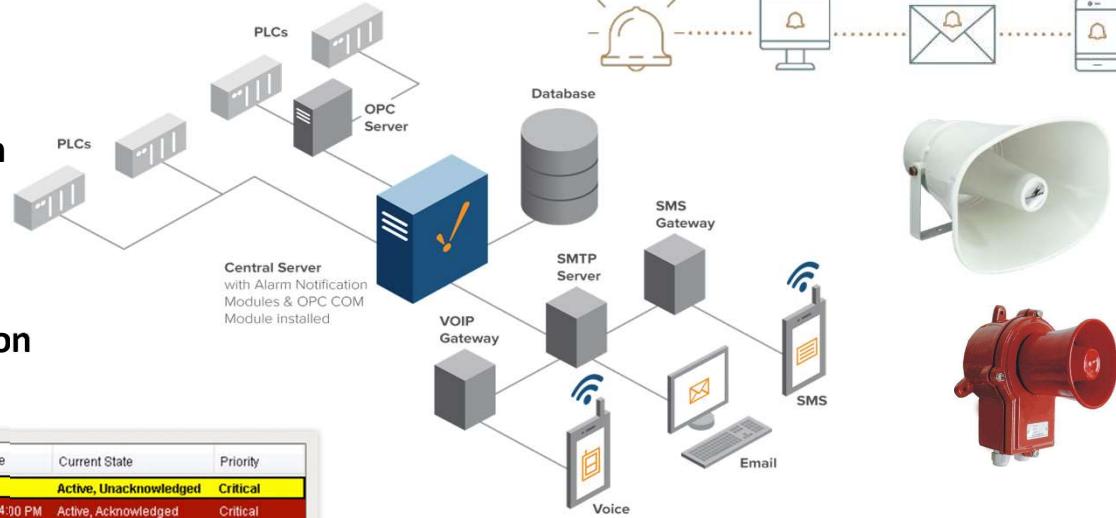
Current Time (UTC):
22/06/2022 11:50:50

2 Alertas

Global Alert System

Global Alert System

- SCADA notification
- Beacons notification
- Acoustic buzzers notification
- Public Address notification
- e-mail notification
- Phone call notification
- SMS text message notification



Display Path	Name	Active Time	Ack'd By	Ack Time	Current State	Priority
<input checked="" type="checkbox"/>	Machine D	High Alarm	3/30/16 2:18 PM		Active, Unacknowledged	Critical
<input type="checkbox"/>	Machine B	High Alarm	3/21/16 8:12 AM	admin	Active, Acknowledged	Critical
<input type="checkbox"/>	Machine B	:pw Alarm	3/21/16 8:05 AM	admin	Active, Acknowledged	Medium
<input type="checkbox"/>	Machine B	Low Alarm	3/28/16 8:57 AM	admin	Active, Acknowledged	Medium
<input type="checkbox"/>	Machine B	High Alarm	3/21/16 8:05 AM		Cleared, Unacknowledged	Critical
<input type="checkbox"/>	Machine B	Low Alarm	3/21/16 8:12 AM		Cleared, Unacknowledged	Medium
<input type="checkbox"/>	Machine B	Low Alarm	3/22/16 11:45 AM		Cleared, Unacknowledged	Medium
<input type="checkbox"/>	Machine B	Low Alarm	3/21/16 8:05 AM		Cleared, Unacknowledged	Medium
<input type="checkbox"/>	Machine B	Low Alarm	3/24/16 11:58 AM		Cleared, Unacknowledged	Medium
<input type="checkbox"/>	Machine B	Low Alarm	3/25/16 10:42 AM		Cleared, Unacknowledged	Medium

Details **Notes** Low Alarm

Clear Pipeline Deadband: 0
 Active delay (seconds): 0
 Clear delay (seconds): 0
 Timestamp Source: System
 Ack Mode: Manual
Notes
 Is Shelved?: Machine High
 Shelf Expiration eventid: False
 a8f0d8ab-06f5-4127-a66f-7683645
 Ahme Rønning

Acknowledge **Shelfe**

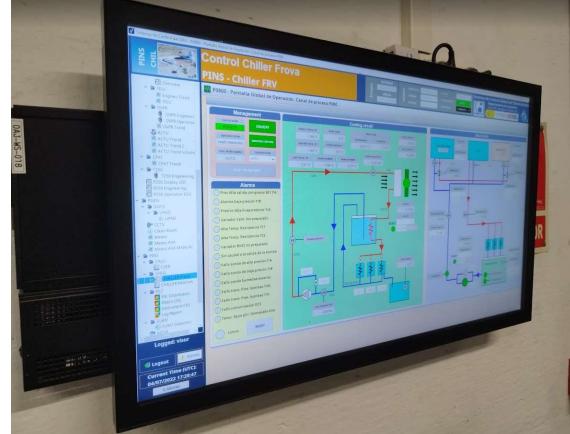
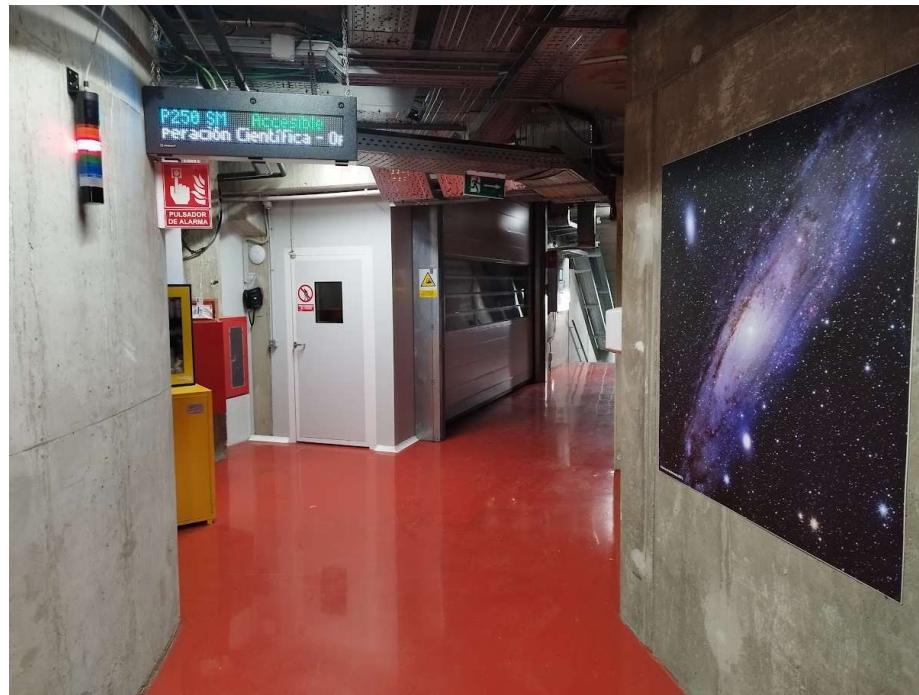


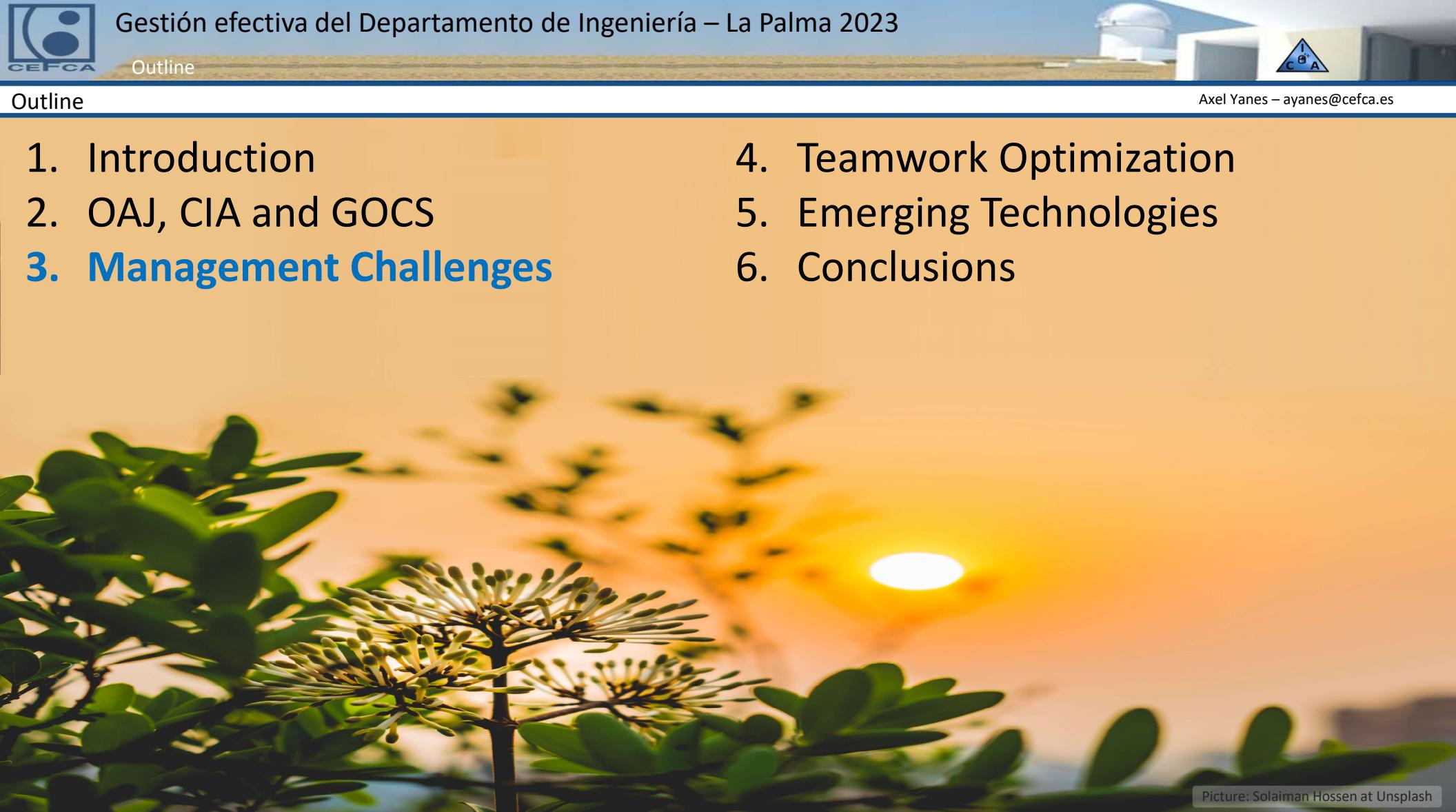
Distributed Information System for Operation Support

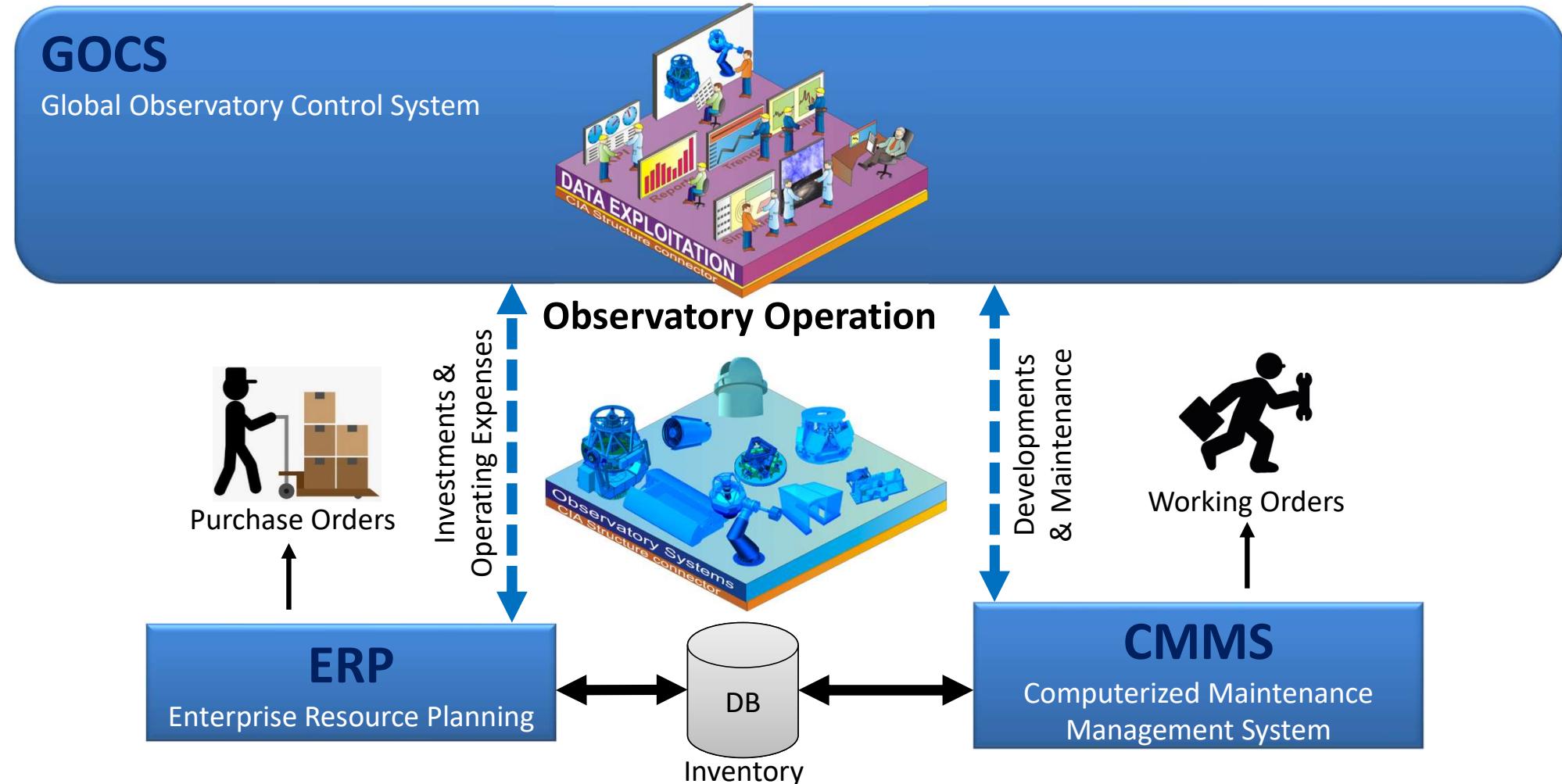


- Control rooms
- Video Walls
- Status Beacons
- PA system
- Support terminals
- Tablets
- Smartphones

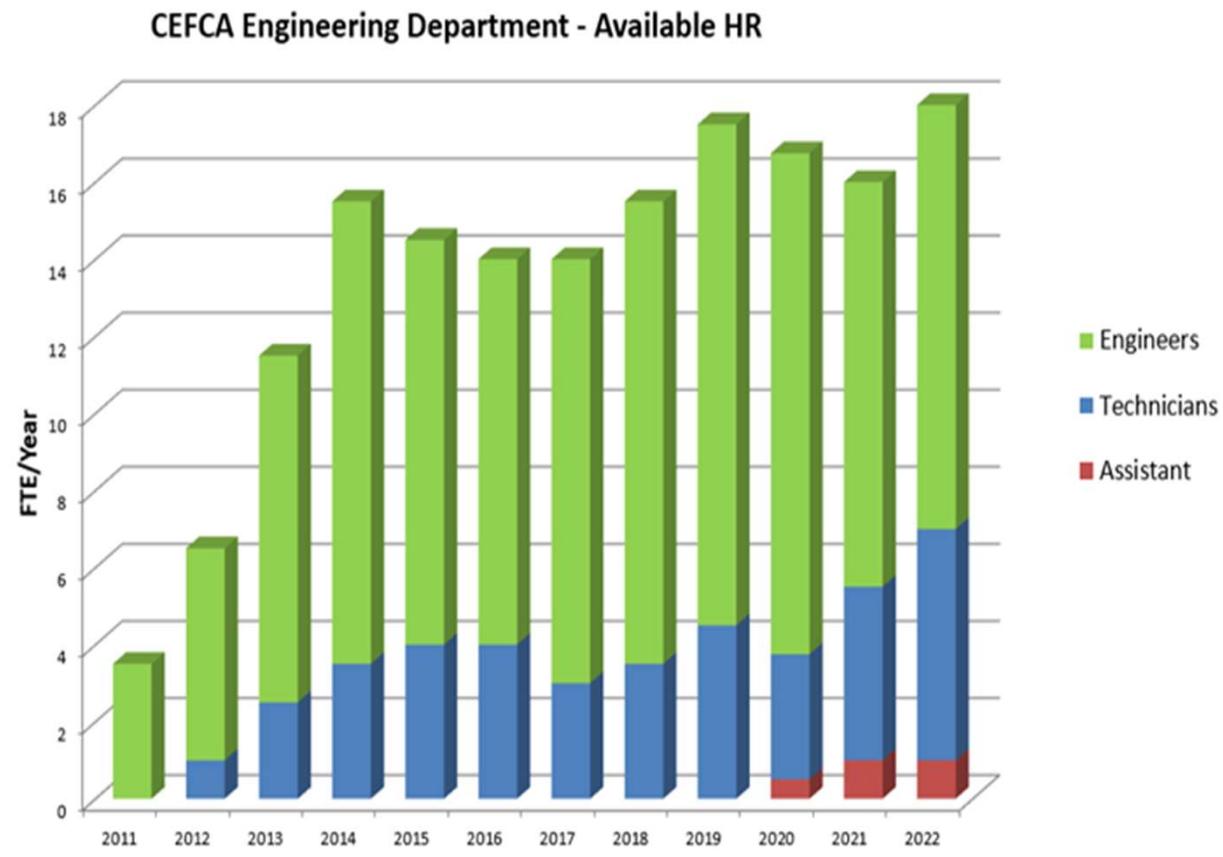




- 
1. Introduction
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Costs – Workforce (FTE full-time equivalent)





Organización del servicio de Ingeniería de CEFCA



Organizarnos para remar en la misma dirección





Organización del servicio de Ingeniería de CEFCA



Organizarnos para remar en la misma dirección



Servicio de calidad





Características del Servicio de Ingeniería de CEFCA

- **Servicio Coordinado**
- **Servicio Planificado**
- **Servicio Profesional**
- **Servicio Cualificado**



Servicio de Calidad

Entre todos garantizamos la calidad del servicio de Ingeniería

Facilitar el trabajo al máximo posible

Dentro de las circunstancias intrínsecas al trabajo



- 
1. Introduction
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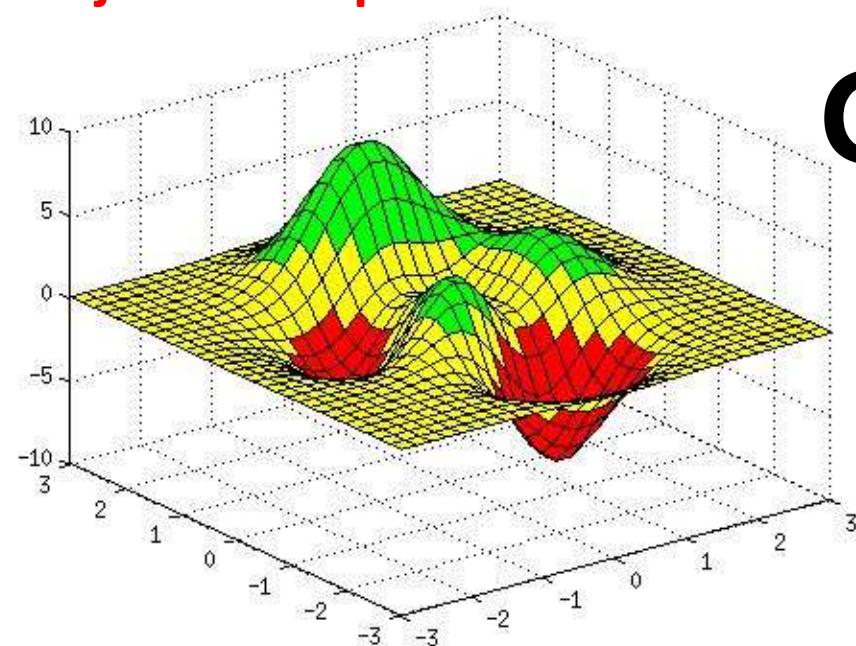


**Como trabajadores....
¿Qué se espera de nosotros?**

Servicio de calidad en Ingeniería

**Necesitamos saber cuando estamos cumpliendo expectativas y
cuando estamos por debajo de lo esperado**

Servicio de Calidad



GMAO

¿Cómo se valoran las tareas?

- Por cuatro indicadores objetivos:

- Automáticos

1. Plazo de finalización
2. Rendimiento del trabajo
3. Comentarios

- Manual

4. Revisión de seguimiento

- Realización las tareas asignadas por orden de prioridad
- Notificación de problemas relevantes a los responsables
- Interacción de coordinación
- Adecuación de estado y % realizado
- Adecuación de comentarios
- Efectividad en la obtención de resultados
 - Focalización/dispersión hacia los criterios de éxito de las tareas
- Documentación clara, concisa y completa
- Aporte de fotografías sobre el trabajo realizado

The collage contains various mathematical elements including:
 - A graph of a function $y = \sin x$ with a point labeled (x_1, y_1) .
 - A diagram of a right-angled triangle with hypotenuse c , angle α , and trigonometric ratios $\sin \alpha = \frac{a}{c}$, $\cos \alpha = \frac{b}{c}$, $\tan \alpha = \frac{a}{b}$.
 - Equations for $\sin 2x$ and $\cos 2x$: $\sin 2x = 2\sin x \cos x$, $\cos 2x = \cos^2 x - \sin^2 x$.
 - Trigonometric identities: $\sin^2 x + \cos^2 x = 1$, $\sin x \cdot \cot x = 1$, $\tan x = \frac{\sin x}{\cos x}$, $\cot x = \frac{\cos x}{\sin x}$.
 - A 3D plot of a rectangular prism with vertices labeled A, B, C, D.
 - A diagram of a right-angled triangle with legs a and b , hypotenuse c , and angles α and β .
 - Various algebraic and integral equations involving variables $x, y, z, a, b, c, \alpha, \beta$.



¿Cómo se hace la valoración manual objetiva de las tareas?

Se realizan las siguientes preguntas para el conjunto de tareas que se están siguiendo

Son preguntas de tipo si o no. Cuantos **más síes** se contesten **mejor será la valoración**

-   • ¿Se están realizando las tareas por **orden de prioridad**?
  • ¿Se **notifican los problemas** relevantes a los responsables?
  • ¿Se está **respondiendo** a los problemas? 
  • ¿Cuando se ha **cambiado** la periodicidad? 
  • ¿Los **estados** que tiene las tareas son claros?
  • No hay ninguna tarea que sea más importante que otra. ¿La periodicidad que el responsable establece les tocan?
  • ¿Está bien **actualizada** la documentación?
  • ¿Son adecuados los **comentarios**? Veremos esto con más detalle
  • ¿Está bien enfocado el trabajo hacia la obtención de **resultados**?
  • ¿Hay **progresión** adecuada hacia los **criterios de éxito** de las tareas?
  • Podemos decir que la **documentación** es **clara, concisa y completa** ¿verdad?
  • ¿Se han aportado **fotografías** sobre el trabajo realizado?
  • ¿El trabajo realizado cumple los criterios de **calidad y estándares** establecidos?

SI

NO



Gestión efectiva del Departamento de Ingeniería – La Palma 2023

Concepts



Axel Yanes – ayanes@cefca.es

Boosting Observatory Operation Performance

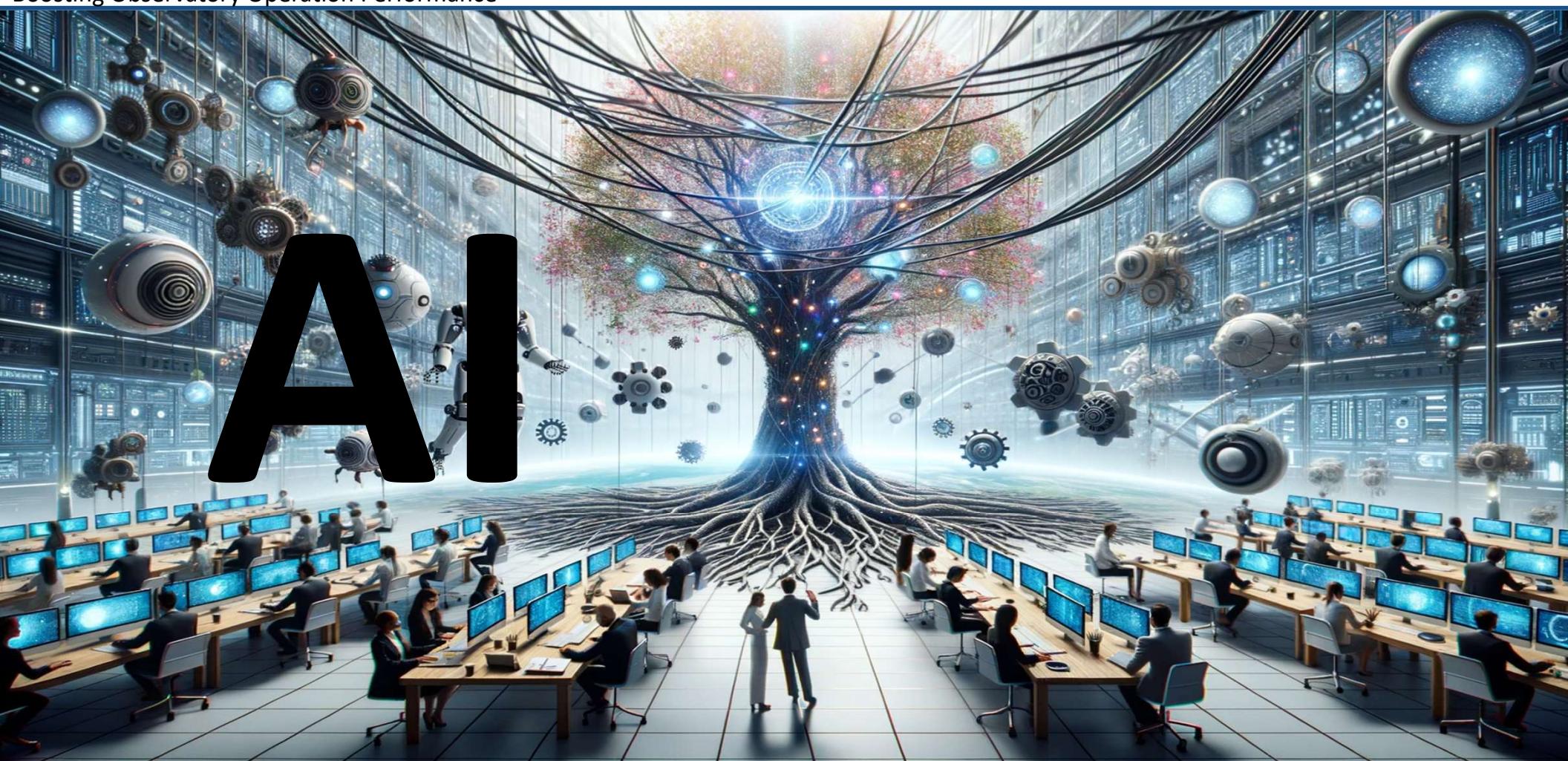
ID	Tarea	Responsable	Coordinador	Prioridad	Fecha Límite	Fecha FIN o Estimada	Plazo	Trab.	Ejecución del trabajo	Eficiencia	Adecuación	Estado
5418	CALU: Suministro Limpieza Espejos			Urgent	31/3/2021	9/4/2021	Complicado	880%	Excelente	135%	Ejemplar	WAIT
7560	MONI: Revisar sonda temperatura ASTMON (GL)			Urgent	11/4/2021	3/4/2021	En plazo	850%	Excelente	117%	Ejemplar	WAIT
7739	MONI: Revisión llama norte de cúpula Javadimm (SB)			Immediate	31/3/2021	3/4/2021	Complicado	815%	Excelente	89%	Muy Buena	WAIT
5965	GOCS Update licencias Ignition & Kepware (MUY URGENTE)			Immediate	30/4/2021	5/4/2021	En plazo	613%	Excelente	78%	Buena	WAIT
7366	POAJ.OCS: Comprar material FITE 18 a.7			Urgent	28/2/2021	3/4/2021	Fuera de plazo	614%	Excelente	117%	Ejemplar	WAIT
6375	SCAD: Gestión de integración de pantallas Ignition			Urgent	31/3/2021	6/4/2021	Complicado	396%	Excelente	131%	Ejemplar	WAIT
6567	TREE: Arbol de sistemas e ubicaciones MySQL			Urgent	31/7/2021	17/4/2021	En plazo	182%	Impecable	65%	Buena	WAIT
7588	GRAL: Reparación llamas persianas 2 (DHK)			Urgent	30/4/2021	1/4/2021	En plazo	299%	Excelente	82%	Muy Buena	WAIT
7595	C250.ACTU Caracterización rango movimiento operativo de Actuadores			Urgent	31/3/2021	13/4/2021	Complicado	339%	Excelente	68%	Buena	WAIT
7596	HARD: Revisión equipos sala de control			Immediate	26/2/2021	13/4/2021	Fuera de plazo	307%	Excelente	292%	Excelente	WAIT
7469	LABS: Crear listado material a reponer (CC)			Urgent	30/4/2021	5/4/2021	En plazo	169%	Impecable	86%	Muy Buena	WAIT
7742	PGAL: Sanejar rack			Urgent	31/3/2021	1/4/2021	Complicado	149%	Ejemplar	193%	Impecable	WAIT
7798	PGEN: Aislamiento puerta anexo muelle (CC)			Urgent	30/4/2021	17/4/2021	En plazo	100%	Ejemplar	222%	Excelente	WAIT
7677	GLIC: Caracterizar instalación glicol			Immediate	16/5/2021	26/5/2021	Complicado	104%	Ejemplar	300%	Excelente	WAIT
7727	RGBT: Rack Instalaciones Sanejar (apoyo)			Immediate	30/3/2021	21/4/2021	Complicado	183%	Impecable	300%	Excelente	WAIT
7075	P250.C250 presupuestos, documentación y compra repuestos FITE (EL)			Urgent	31/3/2021	31/3/2021	En plazo	157%	Impecable	58%	Suficiente	WAIT
6352	LITE Upgrade Portal LITE integración PLAN V1.0 (MD)			Immediate	30/4/2021	6/4/2021	En plazo	41%	mejorable	131%	Ejemplar	WAIT
6781	INFO: Documento de normativa IT para staff			Immediate	30/4/2021	1/4/2021	En plazo	30%	Baja	117%	Ejemplar	WAIT
6682	SERV: Licitación cabina discos SEDE			Immediate	31/3/2021	2/4/2021	Complicado	49%	Suficiente	186%	Impecable	WAIT
7692	TREE: Instalar sistema en producción			Urgent	26/3/2021	28/4/2021	Fuera de plazo	100%	Ejemplar	300%	Excelente	WAIT
6502	CALU: Comprobación de cálculos en APP limpieza			Urgent	26/2/2021	18/4/2021	Fuera de plazo	100%	Ejemplar	300%	Excelente	WAIT
7533	POAJ: Inventariar las compras FITE recibidas (EL)			Immediate	28/2/2021	4/4/2021	Fuera de plazo	96%	Destacable	118%	Ejemplar	WAIT
6549	GLIC: Verificar presencia de lodos y residuos (apoyo)			Urgent	29/3/2020	1/4/2021	Fuera de plazo	508%	Excelente	61%	Buena	WAIT
6480	SERV: Renovación de CA en todos los servidores (MD)			Urgent	30/10/2020	5/5/2021	Fuera de plazo	96%	Destacable	83%	Muy Buena	WAIT



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Picture: Solaiman Hossen at Unsplash





AI

Machine learning → specific training for problem solving



ChatGPT

→ Programming assistant



GitHub
Copilot



→ Text analysis



Gaussian Splatting → 3D modeling

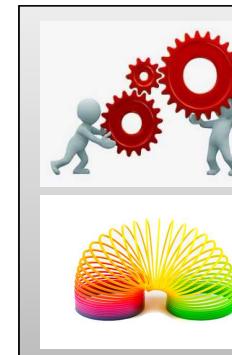
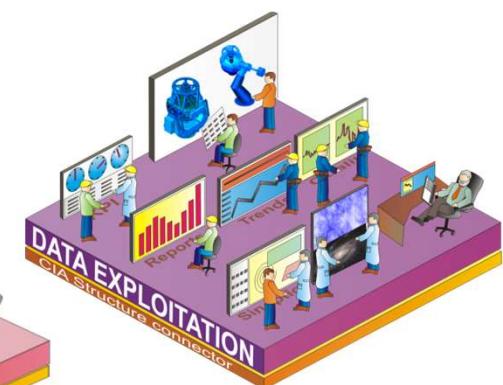


1. Introduction
2. OAJ, CIA and GOCS
3. Management Challenges
4. Teamwork Optimization
5. Emerging Technologies
6. **Conclusions**



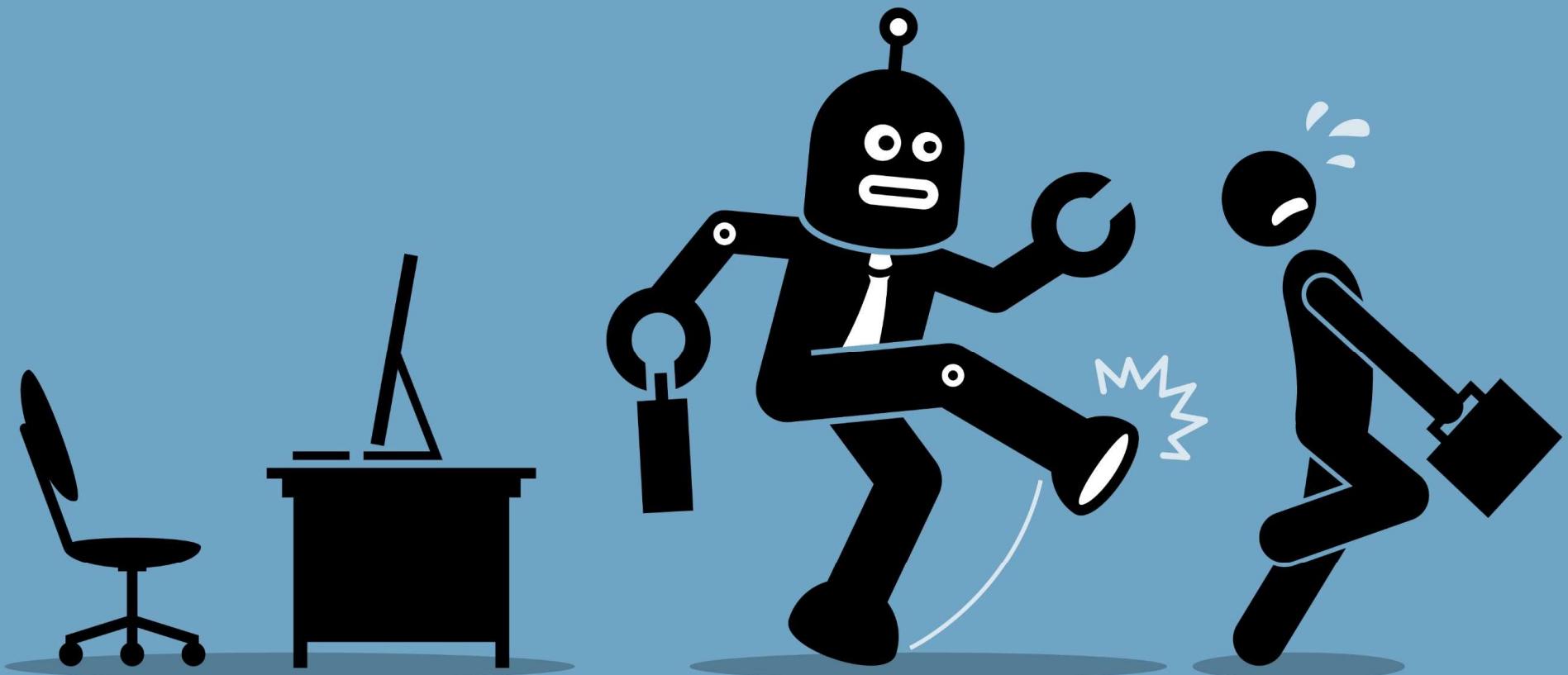
Automation helps to upgrade continuously observatory operation

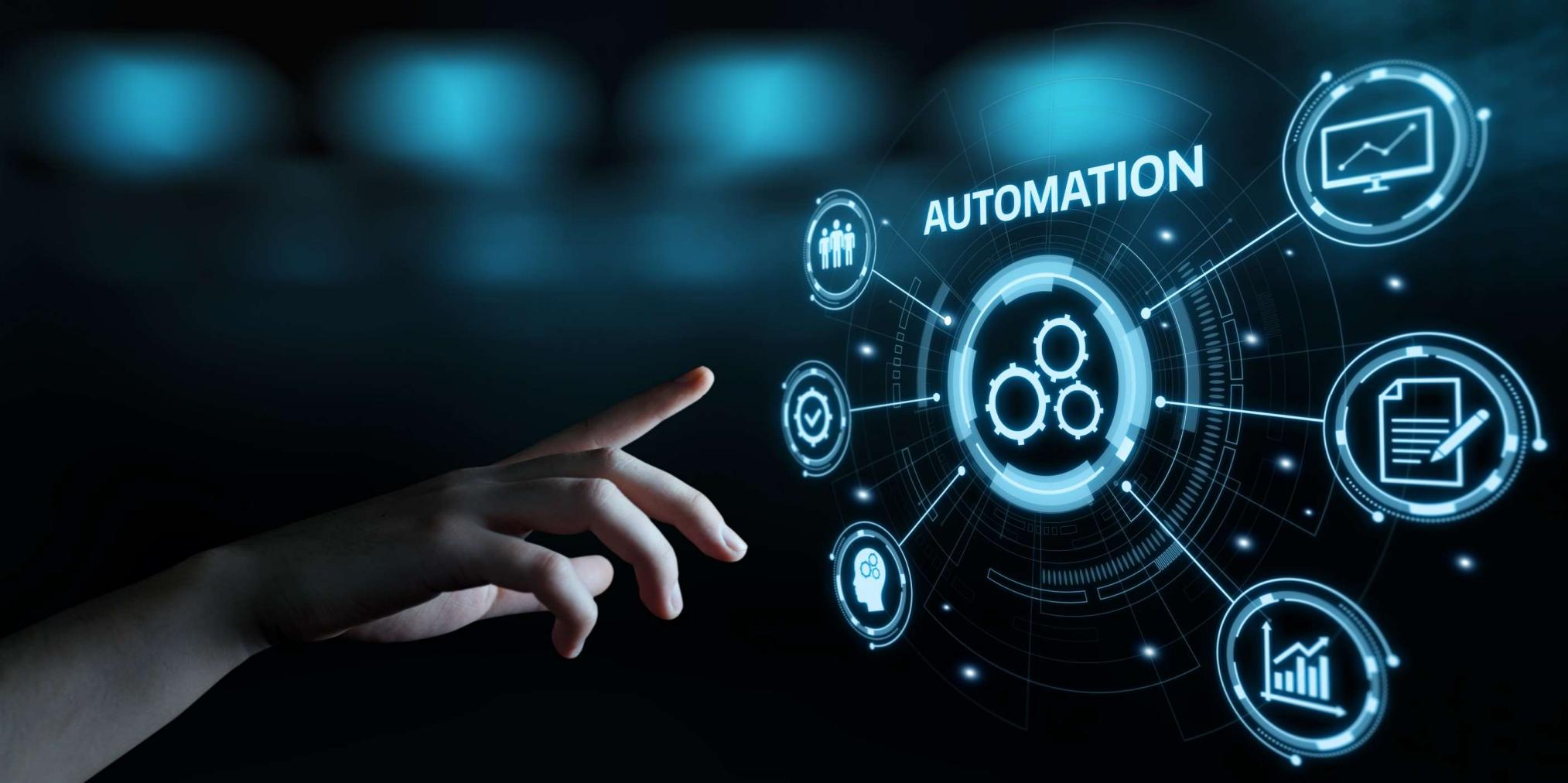
The flexibility of automation allows easy adaptation to the continuous observatory changes

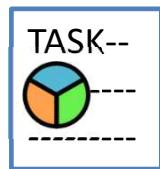


Automation flexibility can easily update functionality for **all staff profiles**.

- Managers
- Scientist
- Astronomers
- Operators
- Engineers
- Maintenance



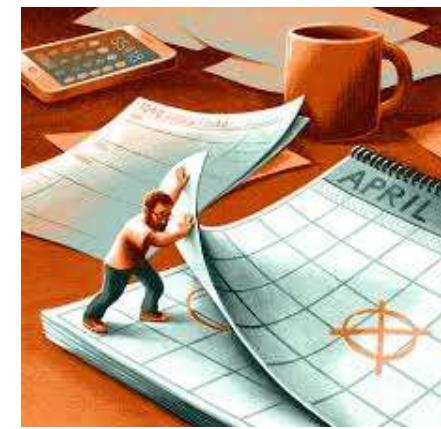


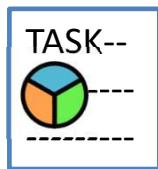


Organización del trabajo

Calidad del Servicio

No se trata de exprimir a los trabajadores con sobrecarga de trabajo, tiempos asfixiantes o plazos imposibles de cumplir.





Organización del trabajo



No se trata de exprimir a los trabajadores con sobrecarga de trabajo, tiempos asfixiantes o plazos imposibles de cumplir.
Al contrario... Tan solo queremos que se trabaje bien el tiempo disponible...
Sin sobrecargas, ni agobios, con calma, con tiempo y plazos suficientes para hacer las cosas bien... Sin mayores pretensiones.





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Available Data Releases

Data Releases: <https://archive.cefca.es/catalogues>



Axel Yanes – ayanes@cefca.es

The CEFCA Catalogues Portal

The Catalogues Portal of the Centro de Estudios de Física del Cosmos de Aragón (CEFCA) provides access to data of the large astronomical surveys catalogues carried out in the Observatorio Astronómico de Javalambre (OAJ). This portal provides data visualization and download through several different online tools, each suited to a particular need, and services based on the visualizations.

The Observatorio Astronómico de Javalambre (OAJ) is a Spanish astronomical ITC (Infraestructura Científica Táctica Singular) located at the Sierra de Javalambre in Teruel, specifically conceived and constructed for carrying out large sky astronomical surveys. The OAJ mainly consists of two professional telescopes with large fields of view (FoV) and seeing limited to 0.8 arcseconds. The main telescope is the JAV080, with a FoV of 1.2 deg², a 0.8m diameter, and the 80m Javalambre All-Sky Survey Telescope (JAS80), with a FoV of 2deg². Both telescopes are equipped with panoramic cameras, state-of-the-art, large format CCDs and unique sets of optical filters suited to survey the Universe in an unprecedented way all over the optical spectral range.

OAJ is mostly devoted to conduct two unprecedented large sky multi-filter surveys – Javalambre Photometric Local Universe Survey (JP-LUS) and the Javalambre All-Sky Survey (JAS80). They will cover 8500 deg² of the sky visible from Javalambre using a set of broad, intermediate and narrow band optical filters providing powerful 3D views of the Universe. JP-LUS is being carried out using the JAS80 telescope and TBOCAN instrument using a set of 12 filters and J-PAS is going to be carried out using JAS80 telescope and T-Can instrument using a set of 59 filters.

J-PLUS DR2

J-PLUS DR2 Data Release (July, 2020) provides access to combined scientific images in 12 filters covering a total area of ~ 2000 square degrees. J-PLUS DR2 is based on images collected from November 2019 to February 2020 by the JAS180 telescope.

[Info about data >](#)
[Access to data >](#)

J-PLUS-DR1

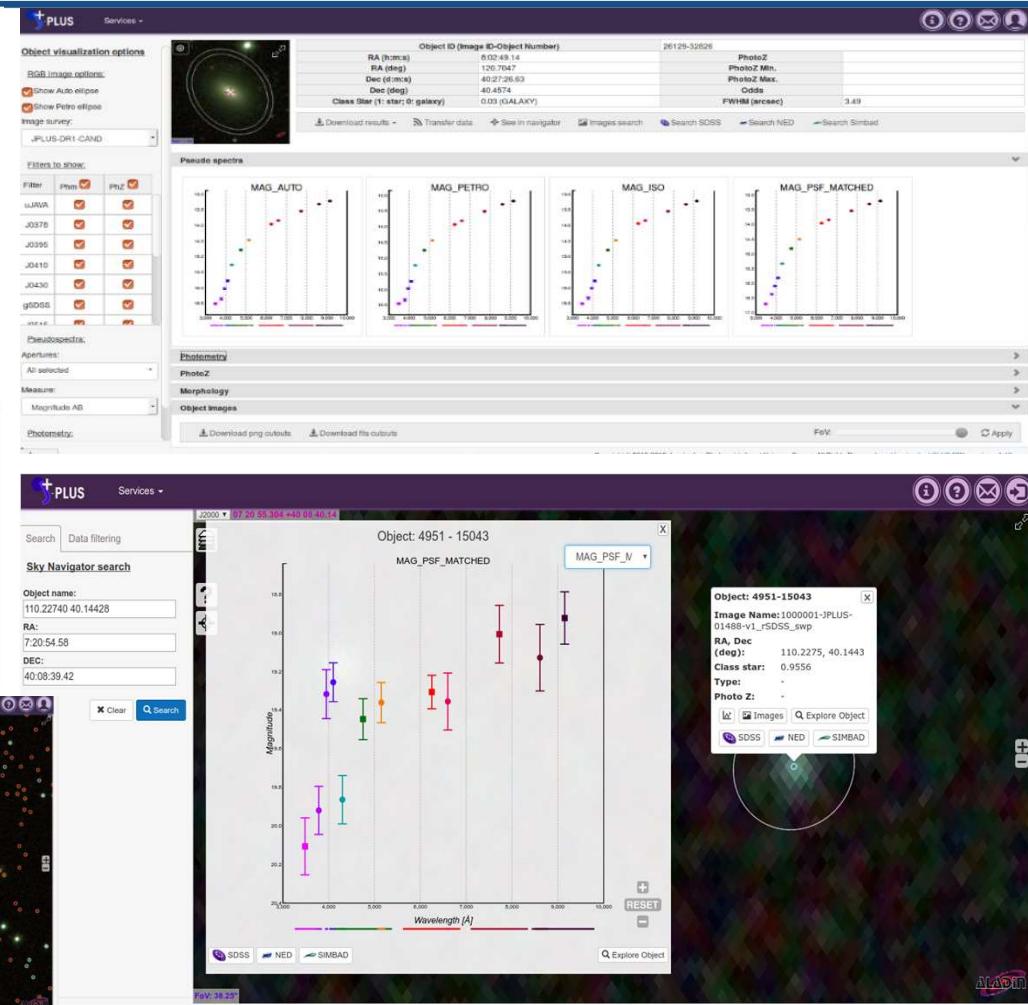
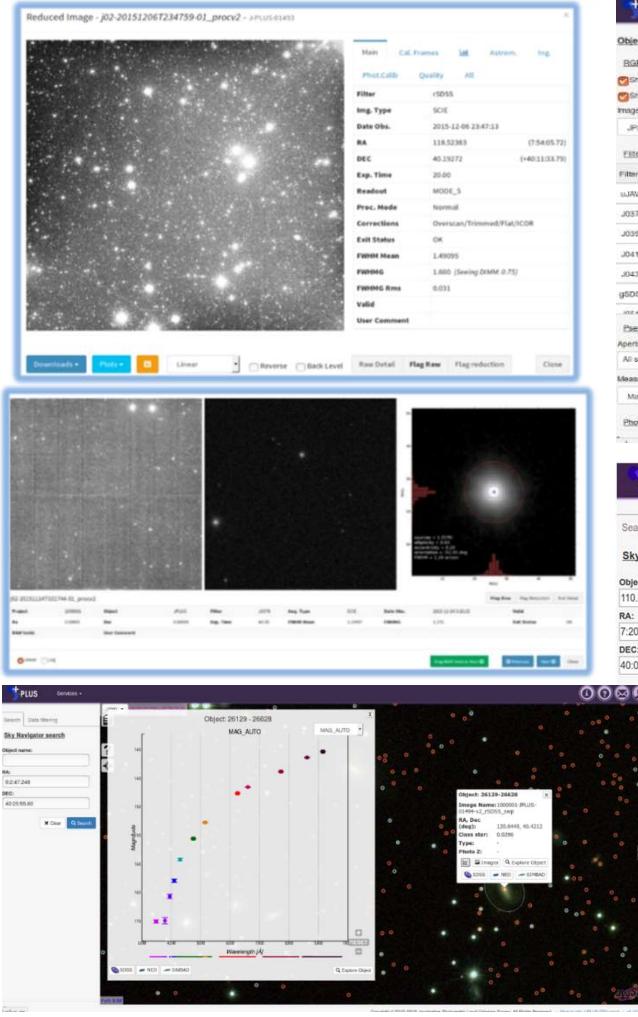
J-PLUS First Data Release (July, 2018) provides access to combined scientific images in 12 filters covering a total area of ~ 1020 deg². J-PLUS-DR1 is based on images collected from November 2015 to January 2018 by the JAS180 telescope.

[Info about data >](#)
[Access to data >](#)

Alhambra_Quiiescent_Galaxies-DR1

The value-added catalogue of quiescent galaxies in the ALHAMBRA survey (VAQA) is a flux-limited sample of 10,000 galaxies in the redshift range 0.1-0.21, and 1623, which includes stellar population properties constrained by the SED-fitting code MUFIT.

[Info about data >](#)
[Access to data >](#)



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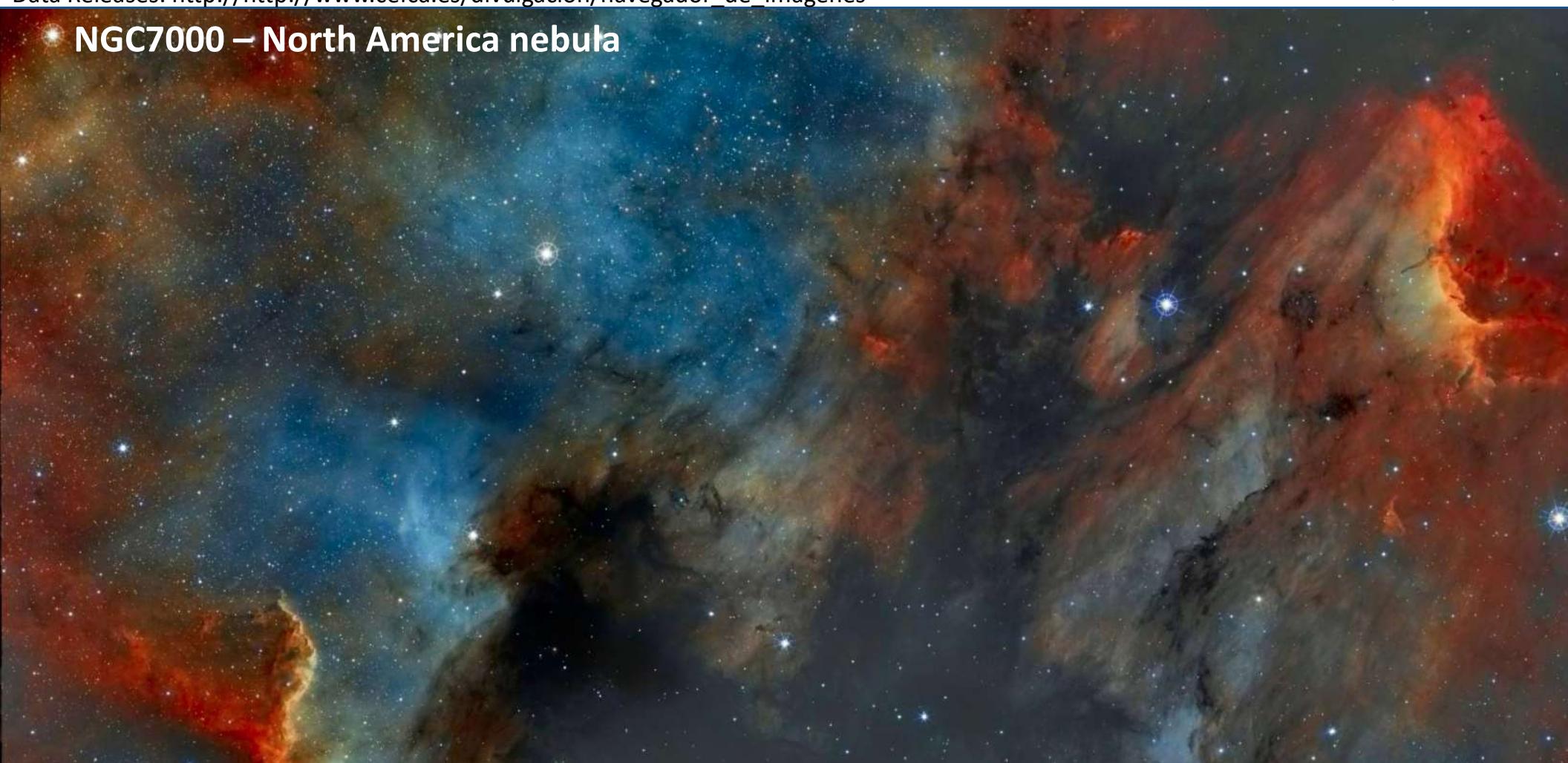
Data Releases: EDR + DR1 + DR2 + DR3

Data Releases: http://www.cefca.es/divulgacion/navegador_de_imagenes



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NGC7000 – North America nebula





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Thanks

GOCS Looking after the Global Observatory Operation



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You're very welcome to Teruel to learn more about our GOCS. You're Invited to visit us!

Thanks for your attention!!!

Sharing paths for improving observatory operations



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Sharing paths for improving observatory operations



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Concepts



Boosting Observatory Operation Performance

Axel Yanes – ayanes@cefca.es



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Emerging Technologies

Boosting Observatory Operation Performance



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