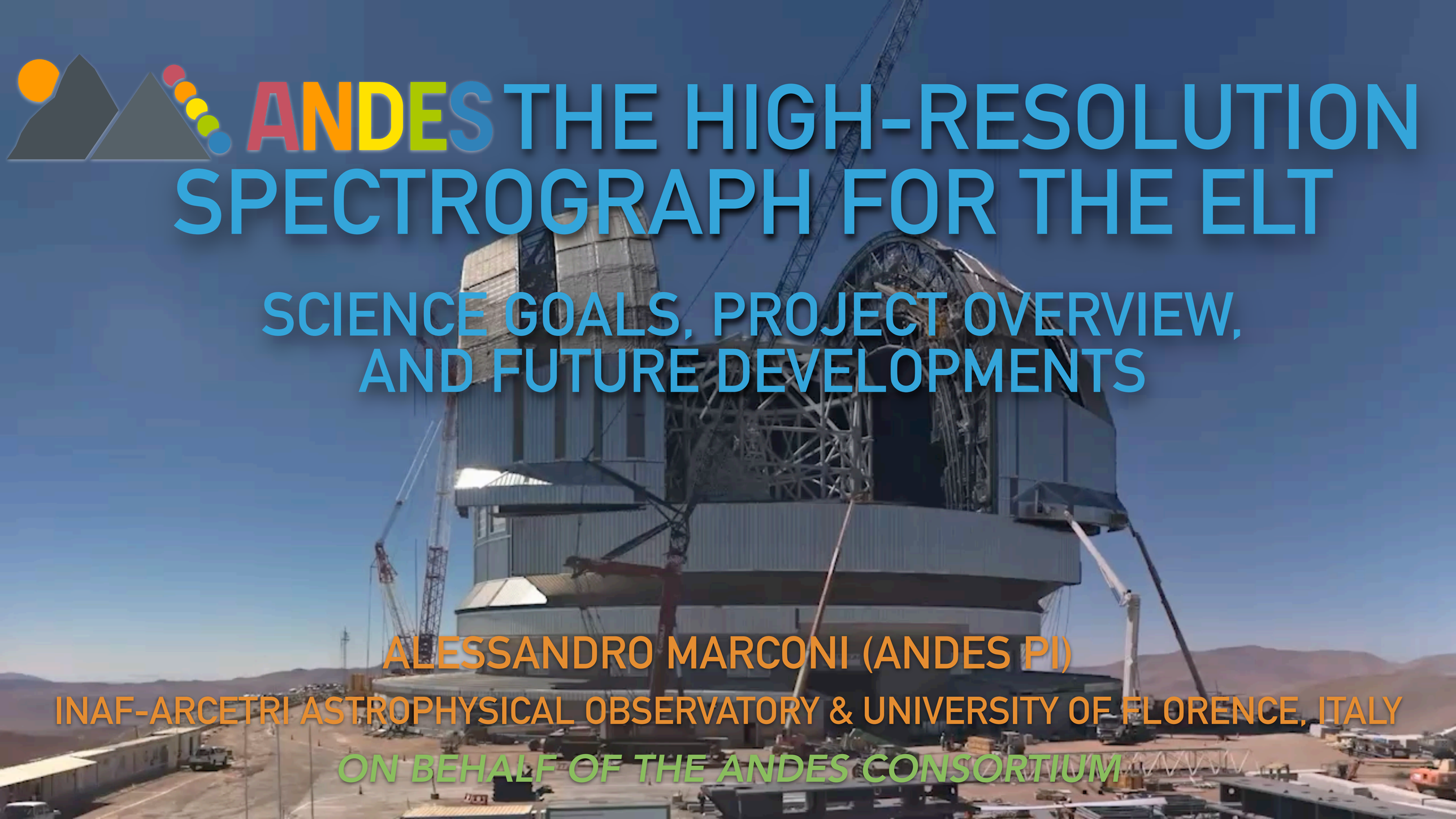

ANDES THE HIGH-RESOLUTION SPECTROGRAPH FOR THE ELT

SCIENCE GOALS, PROJECT OVERVIEW, AND FUTURE DEVELOPMENTS

ALESSANDRO MARCONI (ANDES PI)

INAF-ARCETRI ASTROPHYSICAL OBSERVATORY & UNIVERSITY OF FLORENCE, ITALY

ON BEHALF OF THE ANDES CONSORTIUM

NOT THAT ANDES . . .

Select L

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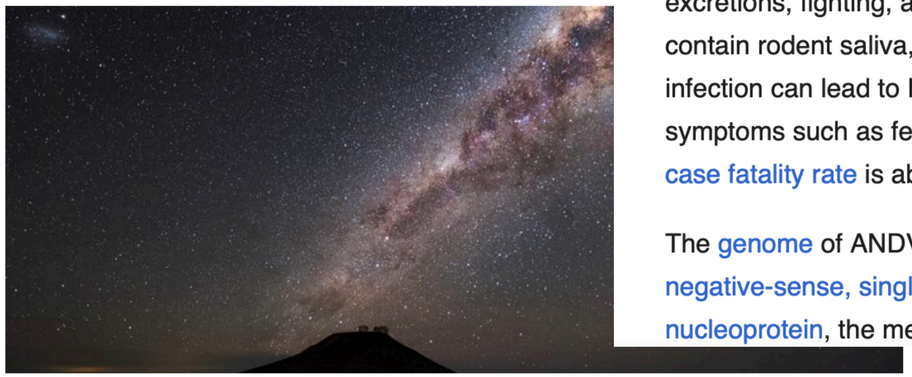
European Southern Observatory

Press Release

AES Andes announces cancellati industrial complex planned near F

2 February 2026

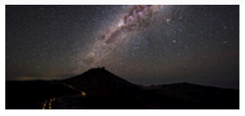


Cerro Paranal and the Milky Way above it (Credit: A. Ghizzi Panizza/ESO)

AES Andes announced that it will step back from the megaproject INNA, planned to be located near the European Southern Observatory's (ESO's) Paranal Observatory. ESO welcomes this announcement and expects that the project will be withdrawn from Chile's Environmental Assessment Service (SEA) soon, which would formally confirm INNA is not going ahead.

"When the cancellation is confirmed, we'll be relieved that the INNA industrial complex will not be built near Paranal," said ESO Director General Xavier Barcons. "*Due to its planned location, the project would pose a major threat to the darkest and clearest skies on Earth and to the performance of the most advanced astronomical facilities anywhere in the world.*"

AES Andes, a subsidiary of the US company AES Corporation, announced on Friday 23 January that they had decided to discontinue INNA, a green hydrogen and green ammonia project, to focus on their renewable energy portfolio instead. A detailed technical analysis by ESO last year revealed that INNA would cause severe, irreversible damage to the dark skies of Paranal and to the capacity of its facilities to operate as designed. The most significant impacts, affecting facilities such as the Very Large Telescope (VLT), the VLT Interferometer (VLTI), the Extremely Large Telescope (ELT), and CTAO-South, would be caused by light pollution, micro-vibrations, dust, and an increase of the air turbulence in the area.



PR Image eso2602a
Cerro Paranal and the Milky Way above it

Andes virus

17 languages

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From Wikipedia, the free encyclopedia

(Redirected from Orthohantavirus andesense)

This article **may be affected by a current event**. Its information may change rapidly. Please update outdated or incomplete information with citations to reliable sources. *(May 2026) (Learn how and when to remove this message)*

Andes virus (**ANDV**) is a cause of hantavirus pulmonary syndrome (HPS) in Chile and Argentina. It is spread mainly by the long-tailed pygmy rice rat (*Oligoryzomys longicaudatus*). In its natural reservoir, ANDV causes an asymptomatic, persistent infection and is spread through excretions, fighting, and grooming. Humans can become infected by breathing in aerosols that contain rodent saliva, urine, or feces, as well as through bites and scratches. In humans, infection can lead to HPS, an illness characterized by an early phase of mild and moderate symptoms such as fever, headache, and fatigue, followed by sudden respiratory failure. The case fatality rate is about 40%.

The genome of ANDV is about 12.1 kilobases (kb) in length and segmented into three negative-sense, single-stranded RNA (–ssRNA) strands. The small strand encodes the viral nucleoprotein, the medium strand encodes the viral spike protein, which attaches to cell

Andes virus	
Virus classification	
(unranked):	Virus
Realm:	*Riboviria*
Kingdom:	*Orthornavirae*
Phylum:	*Negarnaviricota*
Class:	*Bunyaviricetes*
Order:	*Elliovirales*
Family:	*Hantaviridae*
Genus:	*Orthohantavirus*

LARGE INTERNATIONAL CONSORTIUM

ANDES

ANDES, the high resolution spectrograph for the ELT: science goals, project overview and future developments

A. Marconi[1,2], M. Abreu[3], V. Adibekyan[4,5], V. Alberti[6], S. Albrecht[7], J. Alcaniz[8], M. Aliverti[9], C. Allende Prieto[10,11], J. D. Alvarado Gómez[12], C. S. Alves[13,14], P. J. Amado[15], M. Amate[10], M. I. Andersen[16,17], S. Antoniucci[18], E. Artigau[19,20], C. Bailet[21], C. Baker[22], V. Baldini[6], A. Balestra[23], S. A. Barnes[12,24], F. Baron[19,20,25], S. C. C. Barros[4,5], S. M. Bauer[12], M. Beaulieu[21], O. Bellido-Tirado[12], B. Benneke[19,20], T. Bensby[26], E. A. Bergin[27], P. Berio[21], K. Biazzo[18], L. Bigot[21], A. Bik[28], J. L. Birkby[29], N. Blind[30], O. Boebion[21], I. Boisse[31,32], E. Bolmont[30,33], J. S. Bolton[34], M. Bonaglia[2], X. Bonfils[35], L. Bonhomme[36], F. Borsa[9], J.-C. Bouret[31], A. Brandeker[28], W. Brandner[37], C. H. Broeg[38,39], M. Brogi[40,41,42], D. Brousseau[43], A. Brucalassi[2], J. Brynnel[12], L. A. Buchhave[44], D. F. Buscher[22], L. Cabona[9], A. Cabral[3], G. Calderone[6], R. Calvo-Ortega[15], F. 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Wehbe[3], J. Weingrill[12], M. Woche[12], M. Xompero[2], E. Zackrisson[74], A. Zanutta[9], M. R. Zapatero Osorio[93], M. Zechmeister[56], and J. Zimara[56]

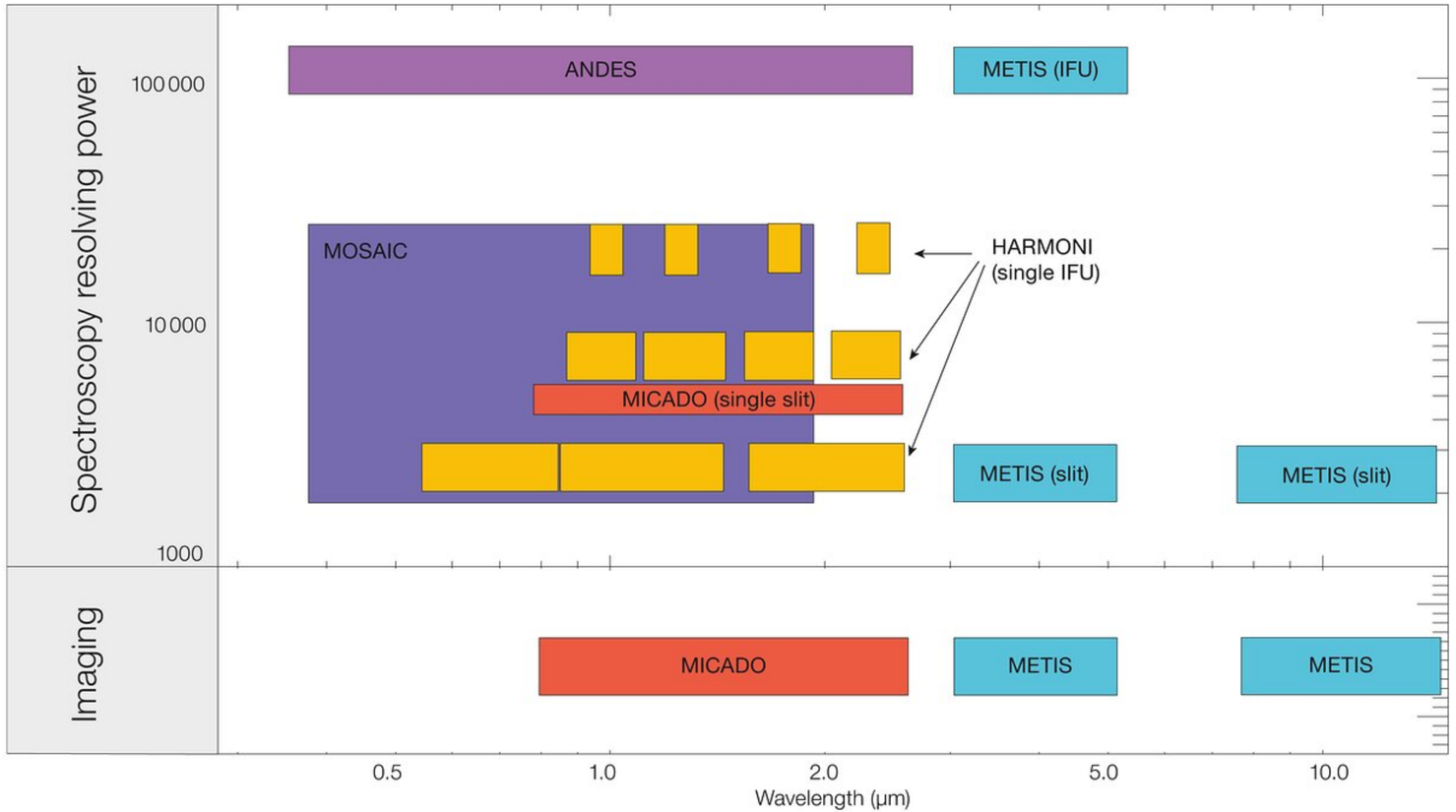
>300 people contributing to ANDES!

Marconi et al. 2024, SPIE

ANDES AT THE ESO EXTREMELY LARGE TELESCOPE

- **ELT first light in 2030** will mark the beginning of operations of the largest Opt-IR telescope ever built.
- **ELT Flagship science cases** are the detection of life signatures in Earth-like exoplanets and the direct detection of the cosmic expansion re-acceleration (both require high resolution spectroscopy)
- **The ArmazoNes high Dispersion Echelle Spectrograph (ANDES)** will be the optical-near infrared high resolution spectrograph of the ELT

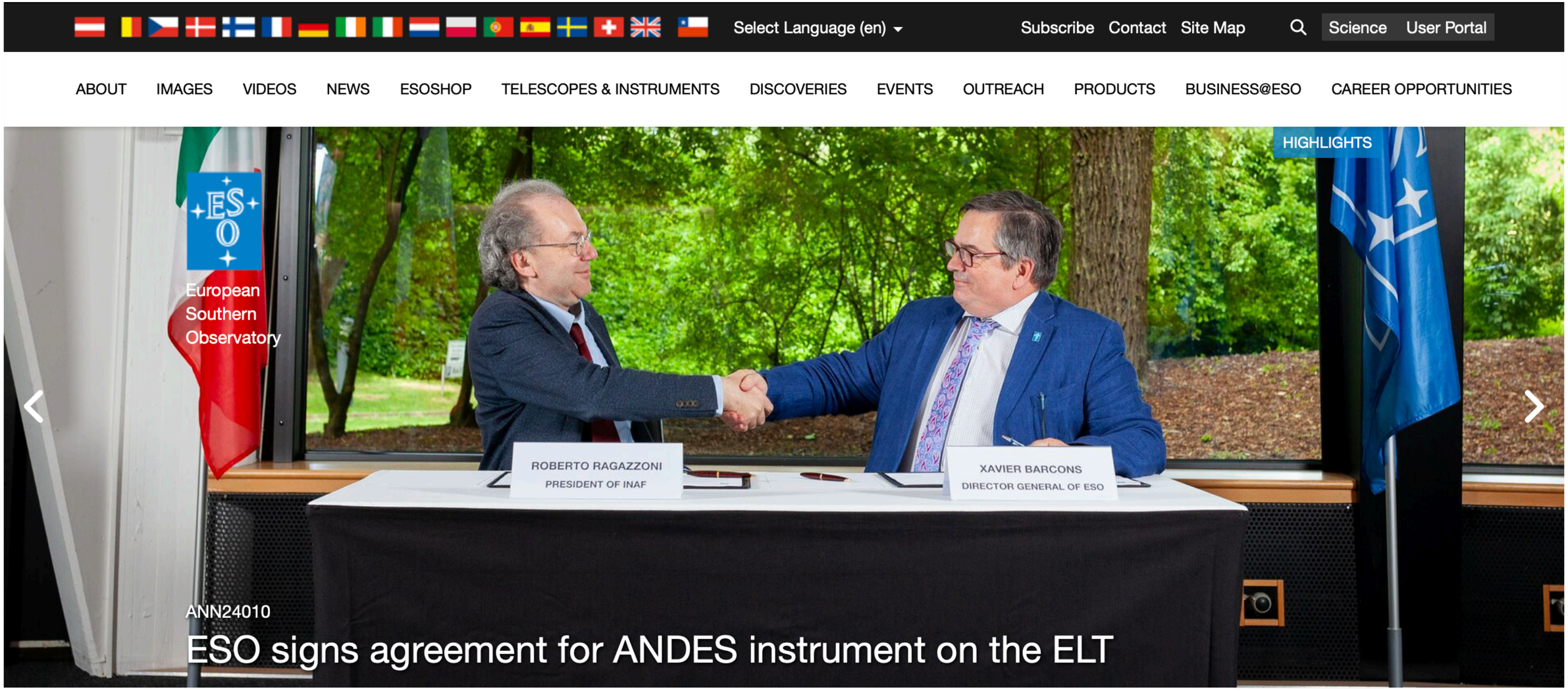
- Simultaneous spectral range 0.4-1.8 μm (0.37-2.4 μm goal)
- Spectral resolution ~100,000
- Interchangeable, observing modes: seeing limited & SCAO+IFU module
- Sensitivity: 1h, 10σ, $m_{AB}(R) = 21.0$ [AM = 1.2, days from new moon 7, 2x2 binning]



BRIEF ANDES HISTORY

- ESO commissioned **two phase-A studies for high-resolution spectrographs, CODEX and SIMPLE,** in the framework of "ESO instrumentation roadmap for ELT construction proposal" (successfully completed in 2010)
- **HIRES initiative: merging of CODEX and SIMPLE** with a preparation of community white paper (2013)
- **HIRES Phase A study:** started 2016, successfully concluded beginning 2018
- the **"waiting-for-approval phase"**: new partners (USA and Canada) joined the (existing) consortium, modified baseline design adopted, new organisation of consortium developed, preparation of agreements
- **ESO Council approves HIRES Construction** (December 2021)
- New name adopted: **ANDES (ArmazoNes high Dispersion Echelle Spectrograph)**
- **Start of construction phase** after SAR (System Architecture Review) as a first milestone (June 2024)

SIGNATURE OF CONSTRUCTION AGREEMENT



SIGNATURE OF THE ANDES AGREEMENT INAF – ESO , 5 JUNE 2024

ORIGIN OF HIRES

- Merging of CODEX (high resolution optical spectrograph) and SIMPLE (high resolution near-infrared spectrograph)
- HIRES: **high resolution (R~100,00)** optical-near infrared spectrograph with **wide simultaneous spectral range ($0.37 - 2.4\,\mu m$)**
- What science can you do with a *ANDES (ex HIRES)* at the 39m ELT?

ANDES SCIENCE CASE: WHITE PAPERS

What science cases can you address with a high resolution (~100,000), simultaneous wide range (from U to K) spectrograph attached at ESO's extremely large telescope?

Ground-breaking Exoplanet Science with the ANDES spectrograph at the ELT
Palle et al. 2024 https://arxiv.org/abs/2311.17075

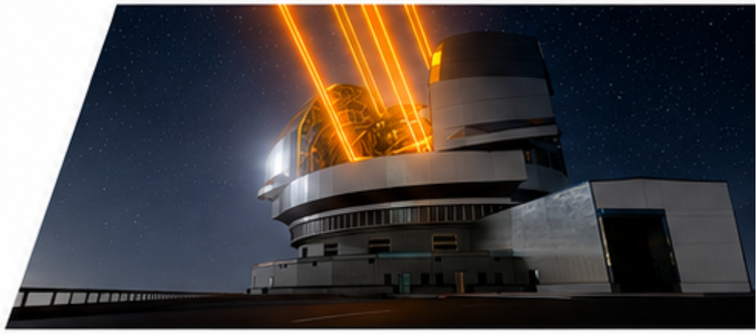
The discovery space of ELT-ANDES. Stars and stellar populations
Roederer et al. 2024 https://arxiv.org/abs/2311.16320

Galaxy Formation and Symbiotic Evolution with the Inter-Galactic Medium in the Age of ELT-ANDES
D'Odorico et al. 2024 https://arxiv.org/abs/2311.16803

Cosmology and fundamental physics with the ELT-ANDES spectrograph
Martins et al. 2024 https://arxiv.org/abs/2311.16274

ANDES Science Cases

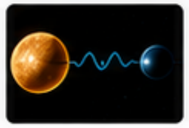
High-resolution spectroscopy from exoplanets to cosmology



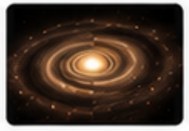
WG1 EXOPLANETS AND PROTOPLANETARY DISKS

Atmospheric characterization via transmission and reflected-light spectroscopy

Chemical composition and structure of exoplanet atmospheres



High-precision radial-velocity detection of exoplanets



Protoplanetary disks and planet-formation processes

Star–planet interactions and stellar activity

WG2 STELLAR PHYSICS AND ATMOSPHERES

Chemical abundances and isotopic ratios in Milky Way and Local Group stars

Extremely metal-poor stars and fossils of the first stellar generations

Galactic archaeology and chemical tagging across environments

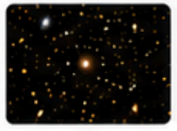
Stellar evolution, mixing, and nucleosynthesis

WG3 GALAXIES AND IGM

Chemical enrichment of the ISM, CGM, and IGM

Damped Lyman-α systems and metal-poor absorbers

Gas inflows, outflows, and feedback in galaxy evolution

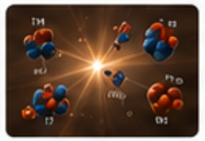


Galaxy assembly and star formation across cosmic time

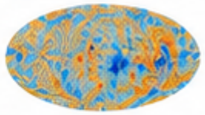
Synergies with JWST and ALMA

WG4 COSMOLOGY AND FUNDAMENTAL PHYSICS

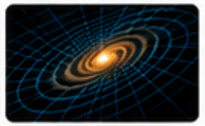
Tests of fundamental constants and physical laws



Big Bang nucleosynthesis and early-Universe chemistry



CMB temperature–redshift relation



Redshift drift and precision cosmology

Tests of gravity and the Einstein Equivalence Principle

ANDES will deliver **ultra-stable, ultra-high-resolution** spectra across a wide wavelength range, enabling transformative discoveries across astrophysics and fundamental physics.

ANDES SCIENCE CASE: EXOPLANETS AND PROTOPLANETARY DISKS

Exoplanets and Protoplanetary Disks

- Atmospheric characterization via tra
  light spectroscopy
- Chemical composition and structure
- High-precision radial-velocity detectio
- Protoplanetary disks and planet-forma processes
- Star–planet interactions and stellar activity

Following talks by
Francesco Borsa (ST member),
Federico Biassoni
and previous talks by
Matteo D'Arpa, Luca Malavolta,
Eleonora Fiorellino

Ground-breaking Exoplanet Science with the ANDES spectrograph at the ELT, Palle et al. 2024 https://arxiv.org/abs/2311.17075

ANDES SCIENCE CASE: A BROAD DISCOVERY SPACE

Stars and Stellar Populations

- Stellar physics and atmospheres
- Chemical abundances and isotopic
  Group stars
- Extremely metal-poor stars and fossils
  generations
- Galactic archaeology and chemical tagging across environments
- Stellar evolution, mixing, and nucleosynthesis

Following talks by
Alessio Mucciarelli (ST member),
Laura Salmeri
and previous talks by
Emanuela Luongo

The discovery space of ELT-ANDES. Stars and stellar populations
Roederer et al. 2024 https://arxiv.org/abs/2311.16320

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Galaxies and IGM

- Chemical enrichment of the ISM, CGM, and IGM
- Damped Lyman-α systems and metal
- Gas inflows, outflows, and feedback
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Cosmology and Fundamental Physics

- Tests of fundamental constants and physical laws
- Big Bang nucleosynthesis and early-Uni
- CMB temperature–redshift relation
- Redshift drift and precision cosmolo
- Tests of gravity and the Einstein Equivalence Principle

Following talks by
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Dinko Milakovic

Cosmology and fundamental physics with the ELT-ANDES spectrograph
Martins et al. 2024 https://arxiv.org/abs/2311.16274

ANDES SCIENCE PRIORITIES

ANDES

ESO's Technical specifications

Priority 1: Exoplanet atmospheres via transmission spectroscopy

(potential detection of li

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THIS IS NOT A PRIORITISATION OF SCIENCE CASES,
IT IS A PRIORITISATION TO DRIVE THE BASELINE DESIGN

THE DERIVED TECH SPECS ALLOW ADDRESSING MANY SCIENCE CASES

CHECK THE WHITE PAPERS!

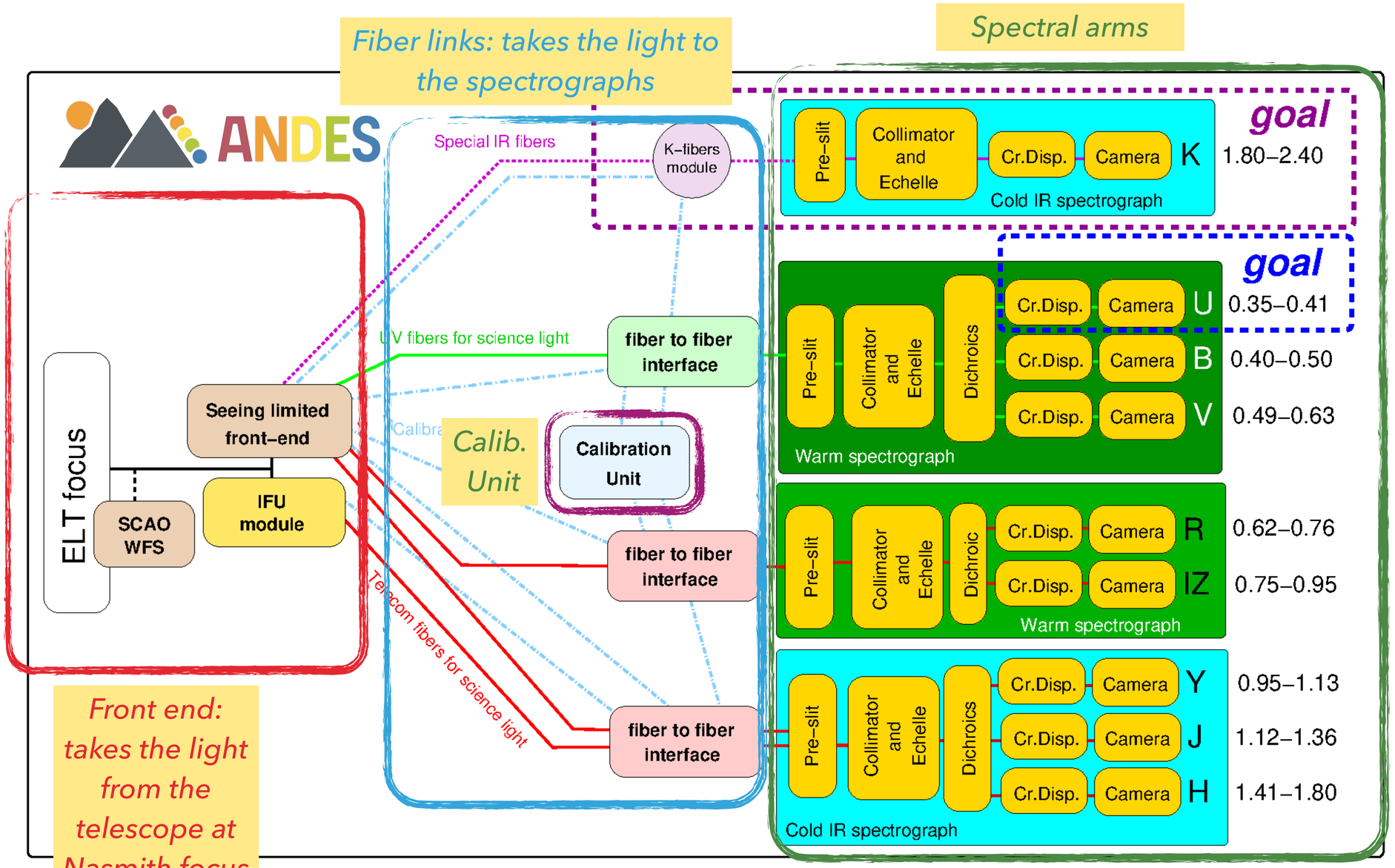
PRIORITIZATION IN 2016: BEING REVISED BY SCIENCE TEAM NOW . . .

)

$_{exp}$=1h

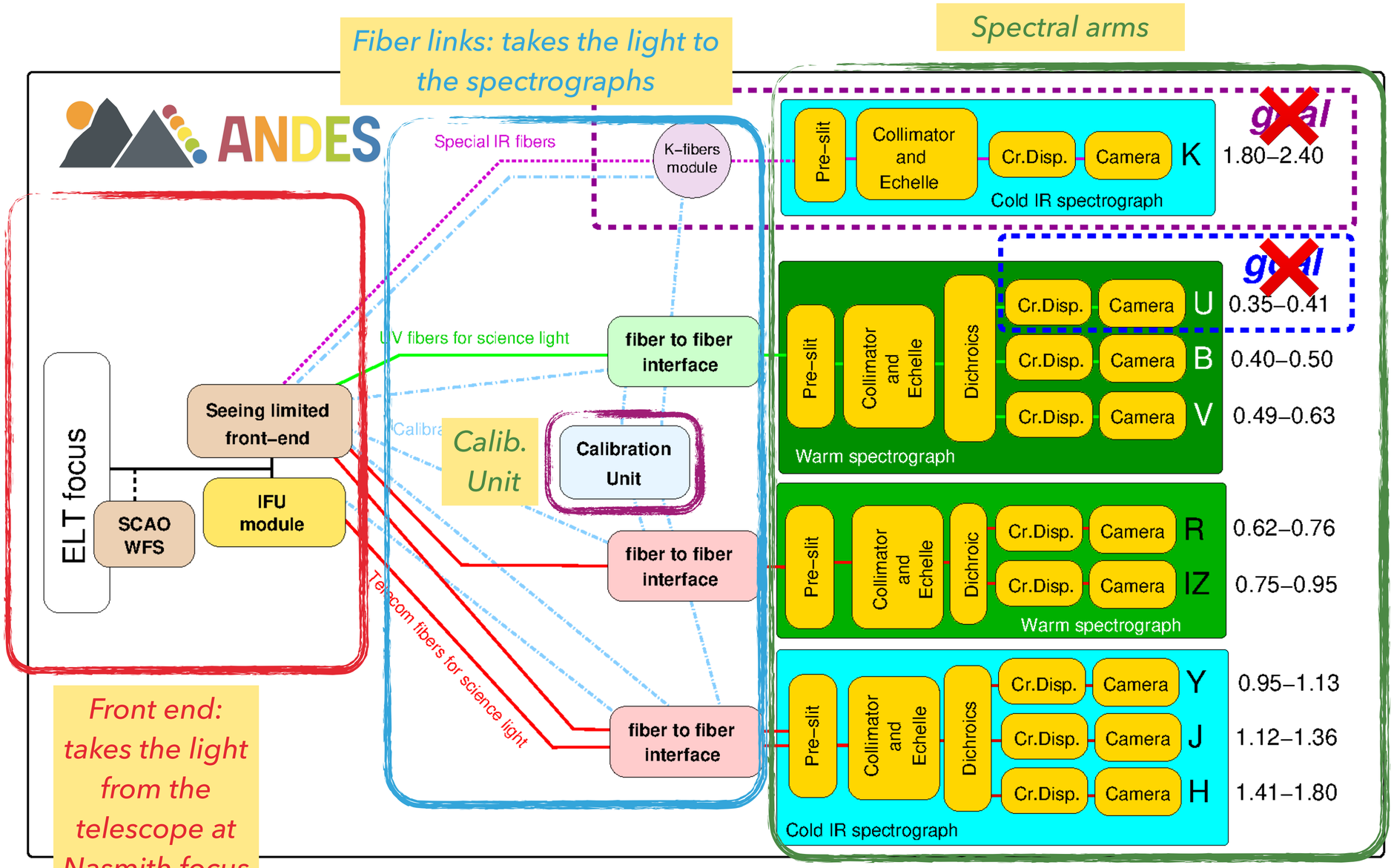
Precision on wavelength calibration
< 1 m/s (goal: 0.1 m/s) over 0.4-1.8 μm
Long term (10 yr) < 0.02 m/s (0.4-0.67 μm)

INSTRUMENT ARCHITECTURE



- Modular fibre-fed cross dispersed Echelle spectrograph
- Simultaneous range 0.4-1.8 μm (ultra-stable BV+RIZ+YJH) Goal 0.37-2.4 μm (with U and K); Resolution ~100,000
- Several interchangeable, observing modes: Seeing limited & SCAO+IFU

INSTRUMENT ARCHITECTURE



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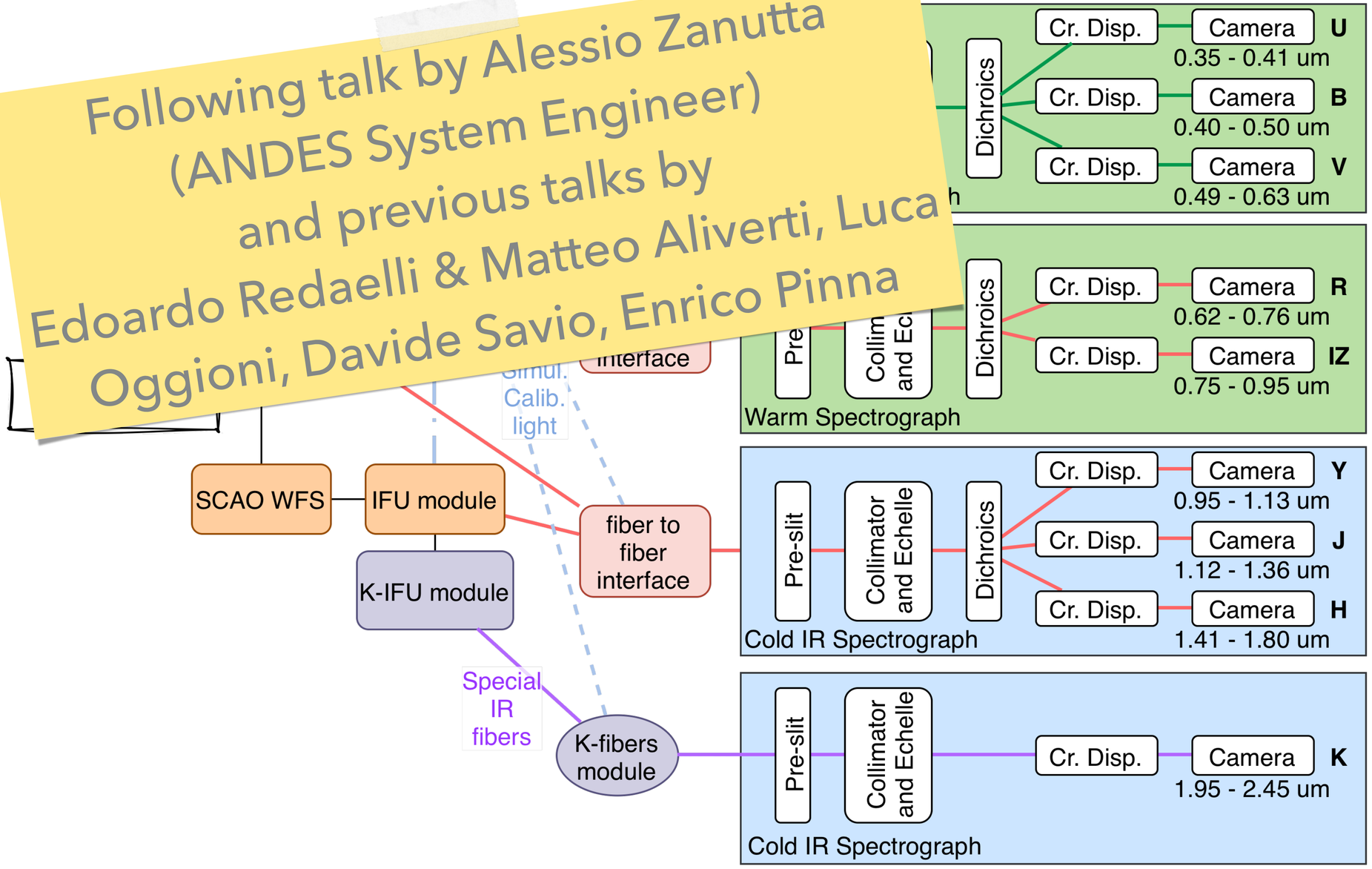
INSTRUMENT ARCHITECTURE

Following talk by Alessio Zanutta (ANDES System Engineer) and previous talks by Edoardo Redaelli & Matteo Aliverti, Luca Oggioni, Davide Savio, Enrico Pinna



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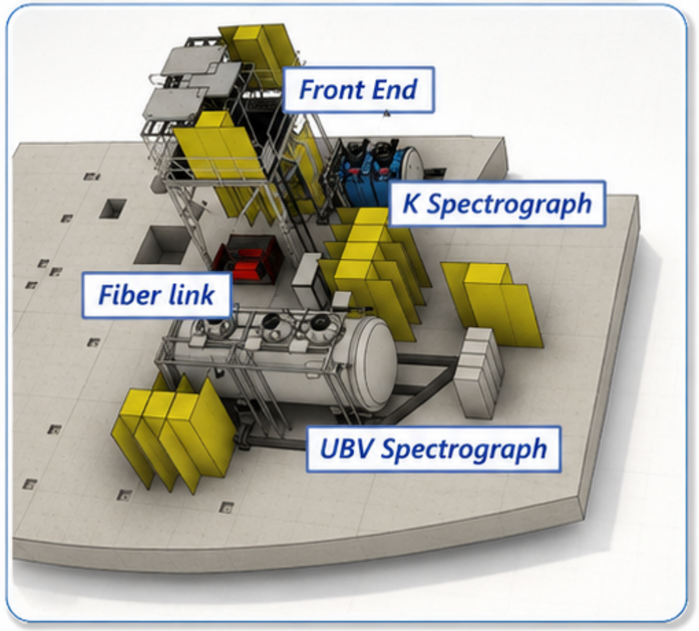
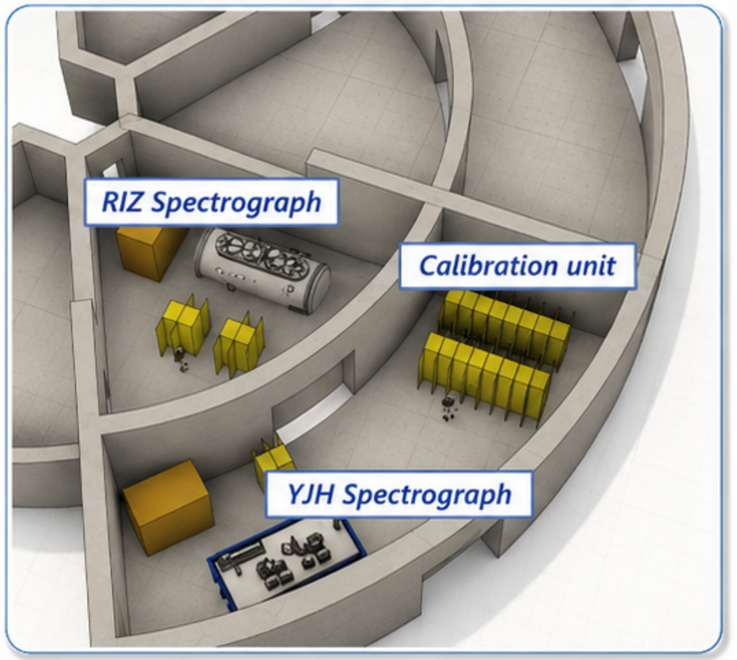
ANDES AT ELT

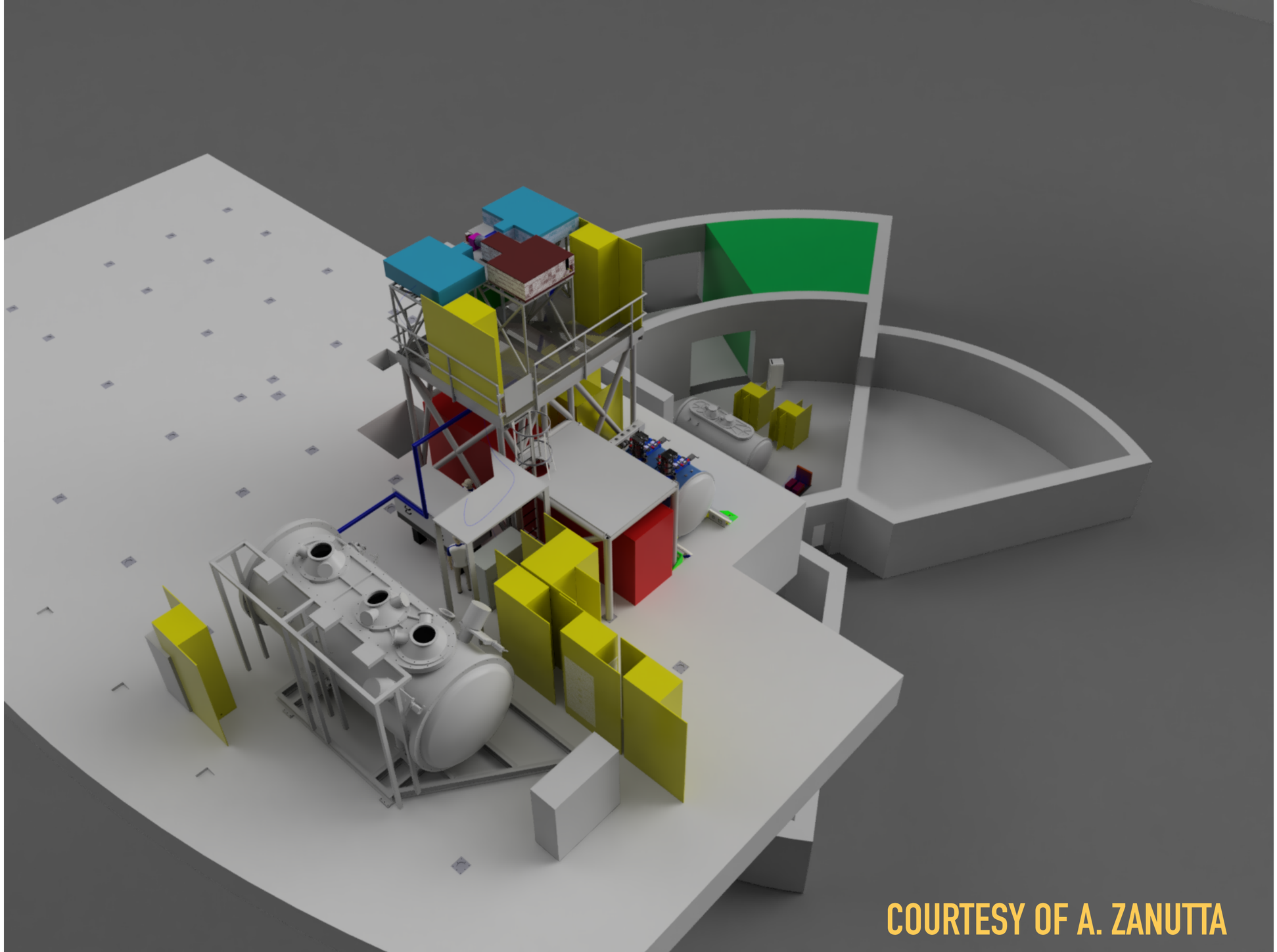
Telescope

Nasmyth platform B

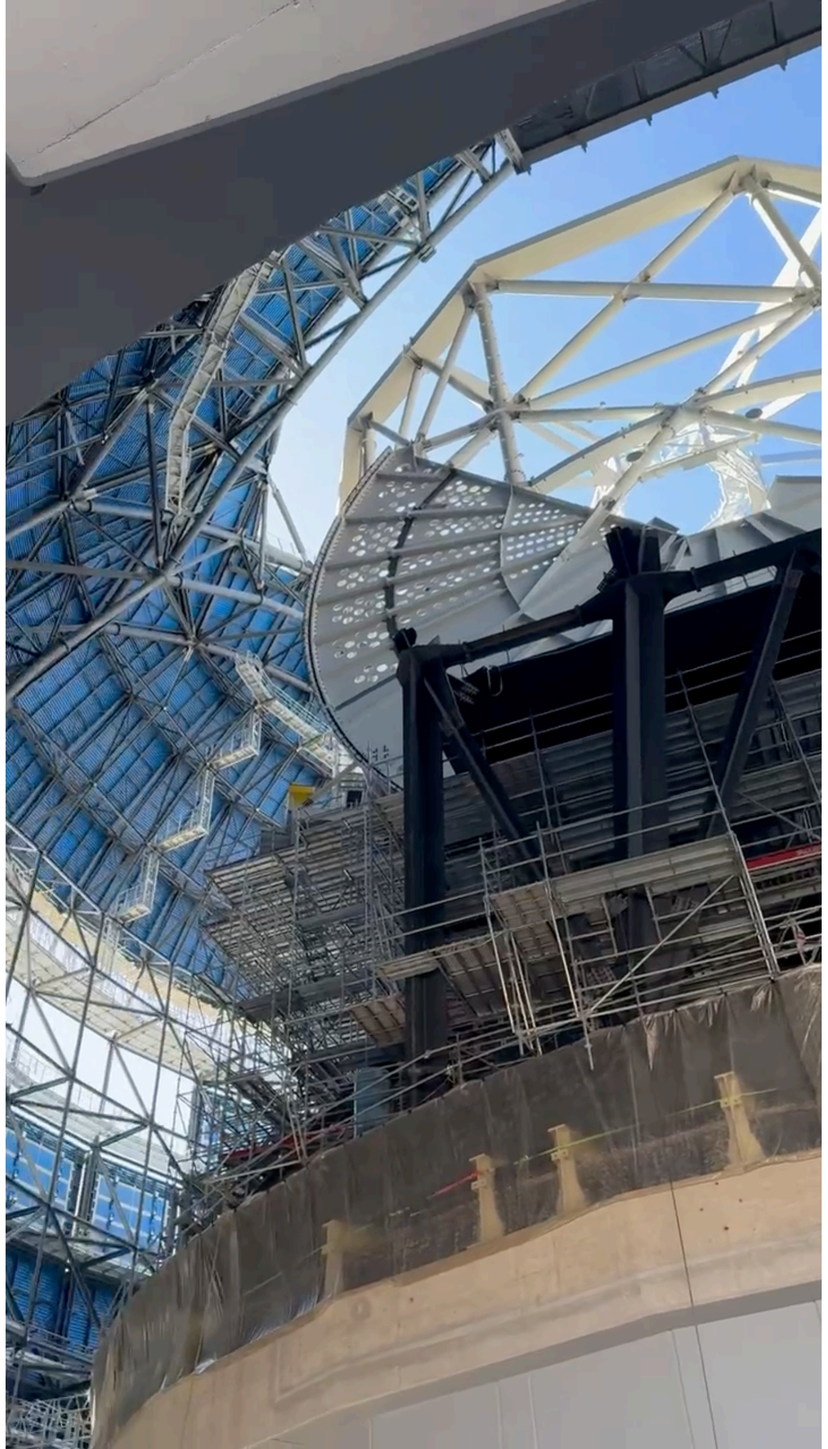


Coudé room




COURTESY OF A. ZANUTTA

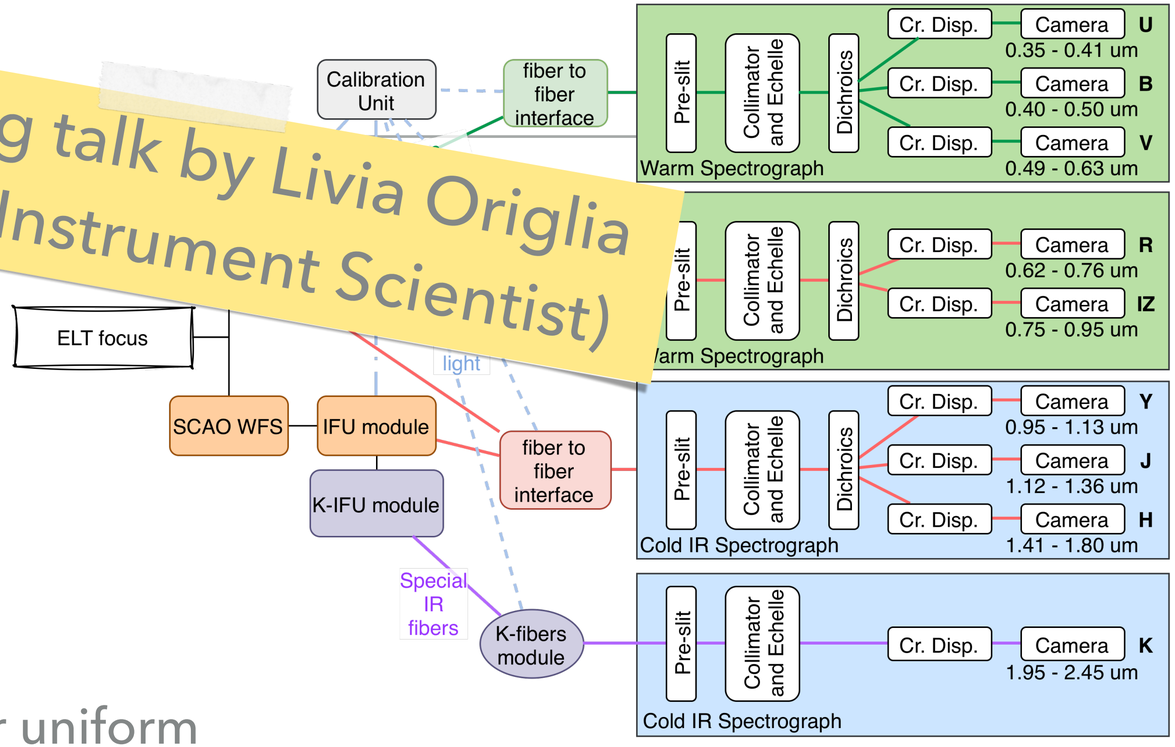

ANDES




armacell Amaflex

ANDES OBSERVING MODES

Following talk by Livia Origlia (ANDES Instrument Scientist)



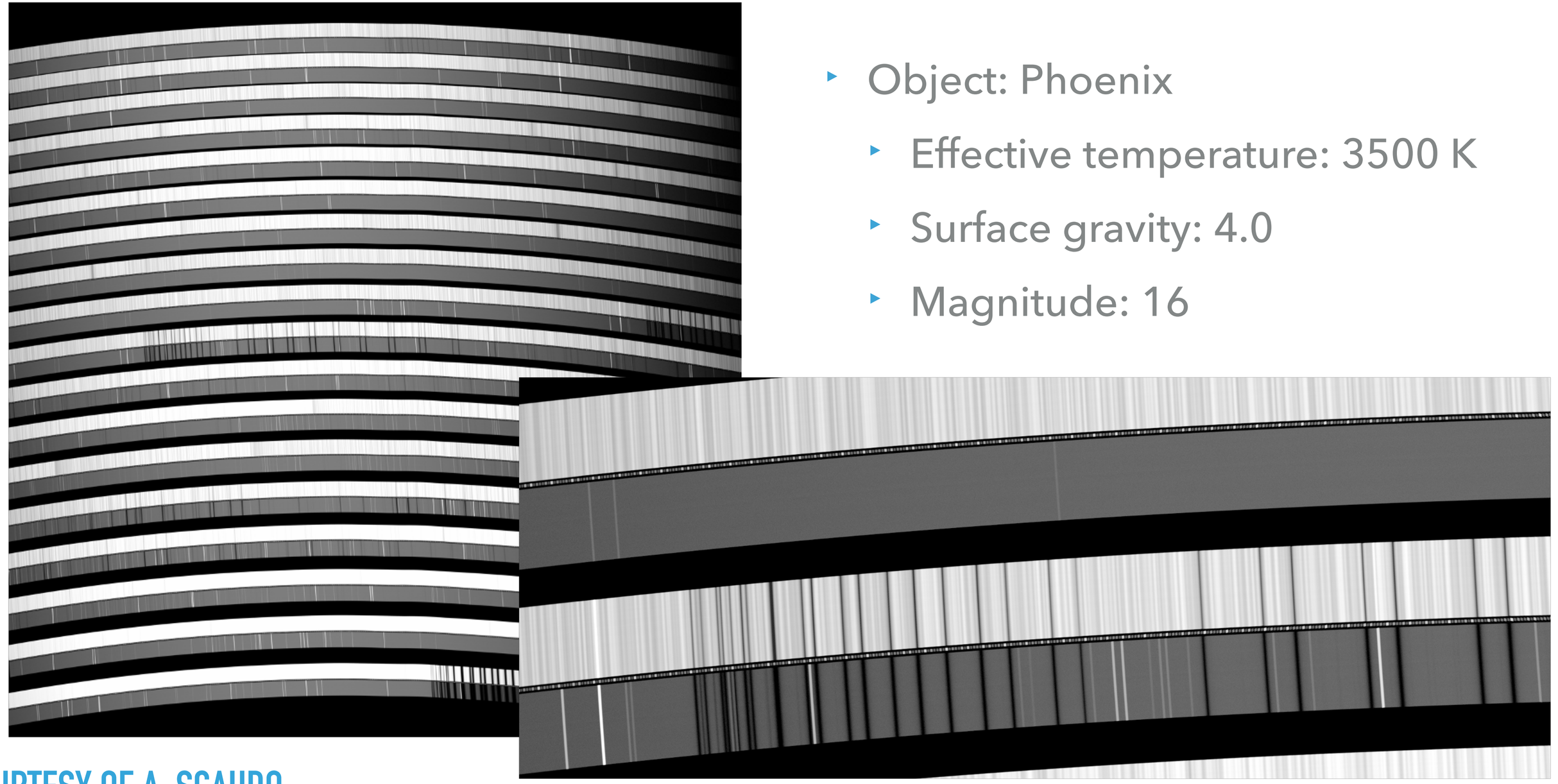
Concept

- different observing modes will be obtained using different and independent groups of fibers (bundles) feeding each spectrograph and selectable in the FE
- inside the spectrographs there will be a slit for each observing mode

Two baseline observing modes at R~100,000

- **SL-UNI** (where SL stands for seeing-limited and UNI for uniform illumination of the apertures) for SL spectroscopy optimized for **high spectral fidelity** in the UBVRIZYJH bands; with two identical apertures on sky
  - [**possibility of a Faint Target mode**]
- **IFU-AO**, for i**ntegral-field spectroscopy assisted by adaptive optics** (SCAO) in the YJH bands
  - **possibility to use a coronagraph**
- **small IFU-AO (7 spaxels) in K band** with IFU-AO in YJH
- during an observation, a **few free fibers could be optionally illuminated by a calibration (FP) light** at the level of the FL to provide a simultaneous wavelength reference

END-TO-END SIMULATIONS: SCIENCE SPECTRUM (RIZ)



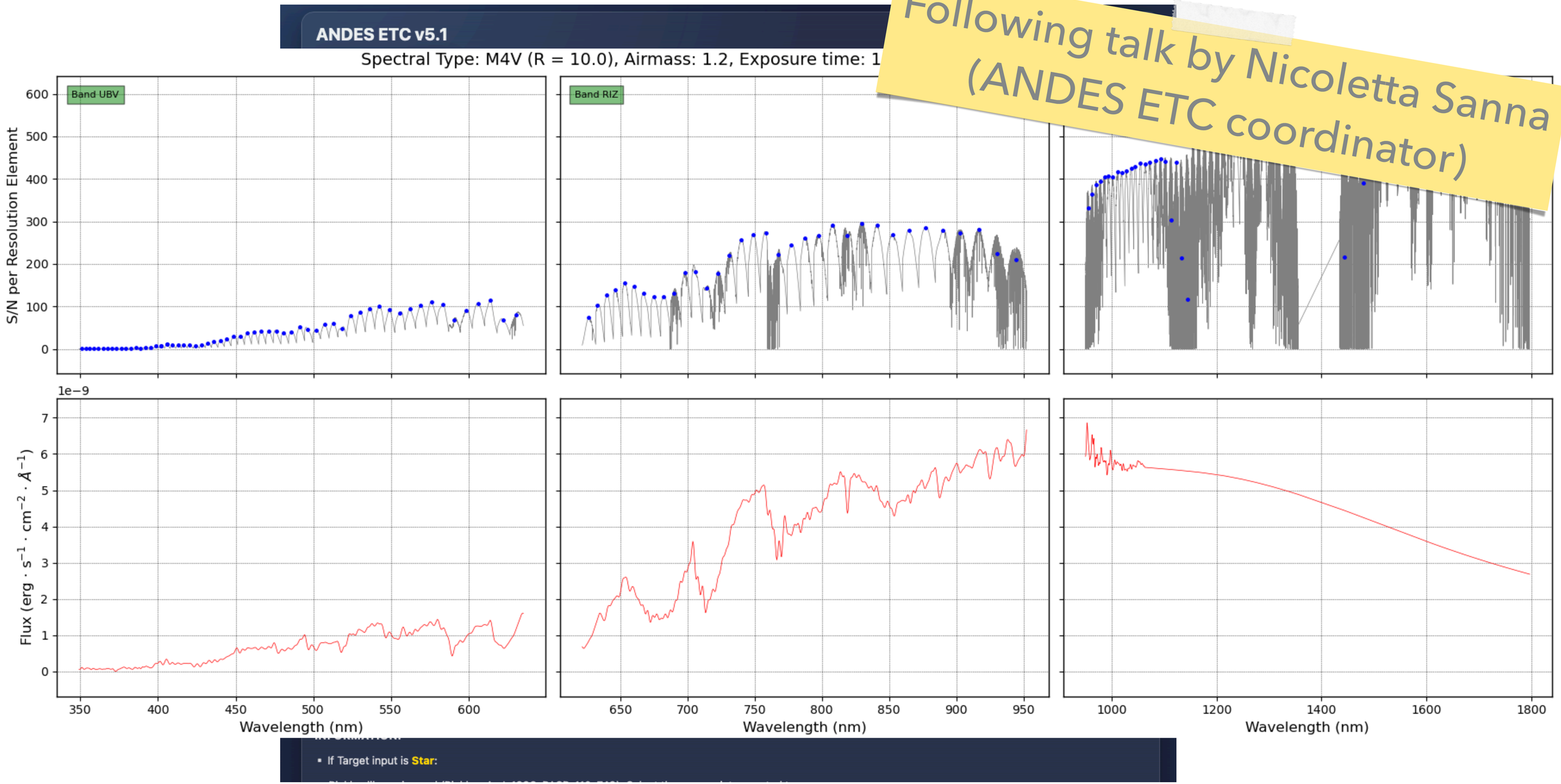
- Object: Phoenix
  - Effective temperature: 3500 K
  - Surface gravity: 4.0
  - Magnitude: 16

COURTESY OF A. SCAUDO

EXPOSURE TIME CALCULATOR

HTTPS://ANDES.INAF.IT → TOOLS

Following talk by Nicoletta Sanna (ANDES ETC coordinator)



ANDES

CONSORTIUM

- **Brazil:** Federal Univ. of Rio Grande do Norte
- **Canada:** Univ. De Montreal, Herzberg Astrophysics Victoria
- **Denmark:** Univ. Copenhagen, Univ. Aarhus, Danish Tech. Univ.
- **France:** LAM Marseille, LAGRANGE Nice, IPAG Grenoble,
  IRAP/OMP Toulouse, LUPM Montpellier
- **Germany:** AIP Potsdam, Univ. Göttingen, Landessternwarte Heidelberg, MPIA Heidelberg, Thüringer Landesternwarte Tautenburg, Univ. Hamburg
- **Italy:** INAF Istituto Nazionale di AstroFisica (Lead) (Arcetri, Bologna, Brera, Padova, Trieste)
- **Poland:** Nicolaus Copernicus Univ. in Toruń
- **Portugal:** Inst. Astrofísica e Ciências do Espaço, CAUP Porto, Lisbon
- **Spain:** Inst. Astrofísica de Canarias (IAC), Inst. Astrofísica de Andalucía (IAA - CSIC), Centro de Astrobiología (CSIC-INTA) Madrid
- **Sweden:** Uppsala Univ., Lunds Univ., Stockholm Univ.
- **Switzerland:** Univ. de Genève, Univ. Bern
- **United Kingdom:** Univ. of Cambridge, UK Astronomy Technology Centre, Heriot-Watt Univ.
- **USA:** Univ. of Michigan

CONSORTIUM ORGANISATION

ANDES

Following talk by Paolo Di Marcantonio (ANDES Project Manager)

Steering committee
1 representative per partner institute
Renan de Medeiros, Frédérique Baron, Lise Christensen, Karine Perraut, Katja [illegible]häger, Ansgar Reiners, Laura Kreidberg, Andreas Quirrenbach, Markus Roth, Jochen Liske, Marcella Marconi, Andrzej Niedzielski, Manuel Monteiro, José Manuel Rebordão, Nuno Santos, Rafael Rebolo, Maria Rosa Zapatero Osorio, Jens Hoeijmakers, Göran Östl[illegible] Stempels, Christophe Lovis, Christoph Mordasini, Sandi Wilson, Michael Meye[illegible]

Steering Committee

Executive Board
1 representative per country
Bruno Leonardo Canto Martins, Lise Christensen, René Doyon, Isabelle Boisse, K[illegible] Poppenhäger, Marco Riva, Andrzej Niedzielski, Nuno C. Santos, Jonay Gonzalez Her[illegible] Nikolai Piskunov, Christophe Lovis, Martin Haehnelt, Elena Gallo

Executive Board

Marco Marconi

Project Scientist
Project Manager
System Engineer
Software System Engineer
Instrument Scientist

Project Office

PM Team

Science Team

Project Scientist
Roberto Maiolino

Exoplanets and circumstellar disks
WG1
Enric Palle/Paul Mollier/Emeline Bolmont

Stars and Stellar Populations
WG2
Julian Alvarado-Gomez/Carlos Allende

Galaxies and Intergalactic Medium
WG3
Valentina D'Odorico/Allison Man/Erik Zackrisson

Cosmology and Fundamental Physics
WG4
Carlos Martin/Pasquier Noterdaeme/Michael Murphy

[illegible]ager
Paolo Di Marcantonio / Eric Stempels

Project Management Team
Omar Gabella, Lise Christensen, Manuel Amate, Izan de Castro Leão, Frédérique Baron, Piotr Masłowski, Elena Gallo + subsystems PMs

Project Manager Support
Veronica Baldini/Valentina Alberti/ Francesca Sortino/Lorenzo Monet

PA/QA
Enrico Giro

Outreach
Rossella Spiga

IS Team

System Team

Instrument Scientist
Livia Origlia

Instrument Scientist Team
Silva Järvinen, Christophe Lovis, Oscar Gonzalez, Wolfgang Brandner, Elena Mason, Ansgar Reiners

System Engineer
Alessio Zanutta / Marco Riva

System Architects / Software System Engineer
Marco Landoni (SSE), Lorenzo Cabona, Chiara Selmi, Ernesto Oliva, Matteo Aliverti, Edoardo Redaelli, Igor Coretti, Giorgio Pariani

Front-end	Fiber link - IFU	Spectrograph UBV	Spectrograph RIZ	Spectrograph YJH	Spectrograph K	SCAO	Calibration Unit	Software
Portugal	Italy	Germany	Switzerland	United Kingdom	Germany	Italy	Germany	Portugal
Alexandre Cabral / Bachar Wehbe	*Monica Rainer / Andrea Tozzi*	*Domenico Giannone / Joar Brynnel*	*Yevgeniy Ivanisenko*	*Rory Gillespie*	*Wolfgang Gaessler / Heidi Korhonen*	*Enrico Pinna/ Chiara Selmi*	*Jennifer Zimara / Michael Debus*	*Manuel Mont[illegible]*

Subsystems (parts of instrument)

governance bodies at institute and at country level

15 countries, more than 30 institutes

>300 people

The state-of-the-art scientific and technological expertise in high-resolution spectroscopy in Europe

coordinated teams

modularity

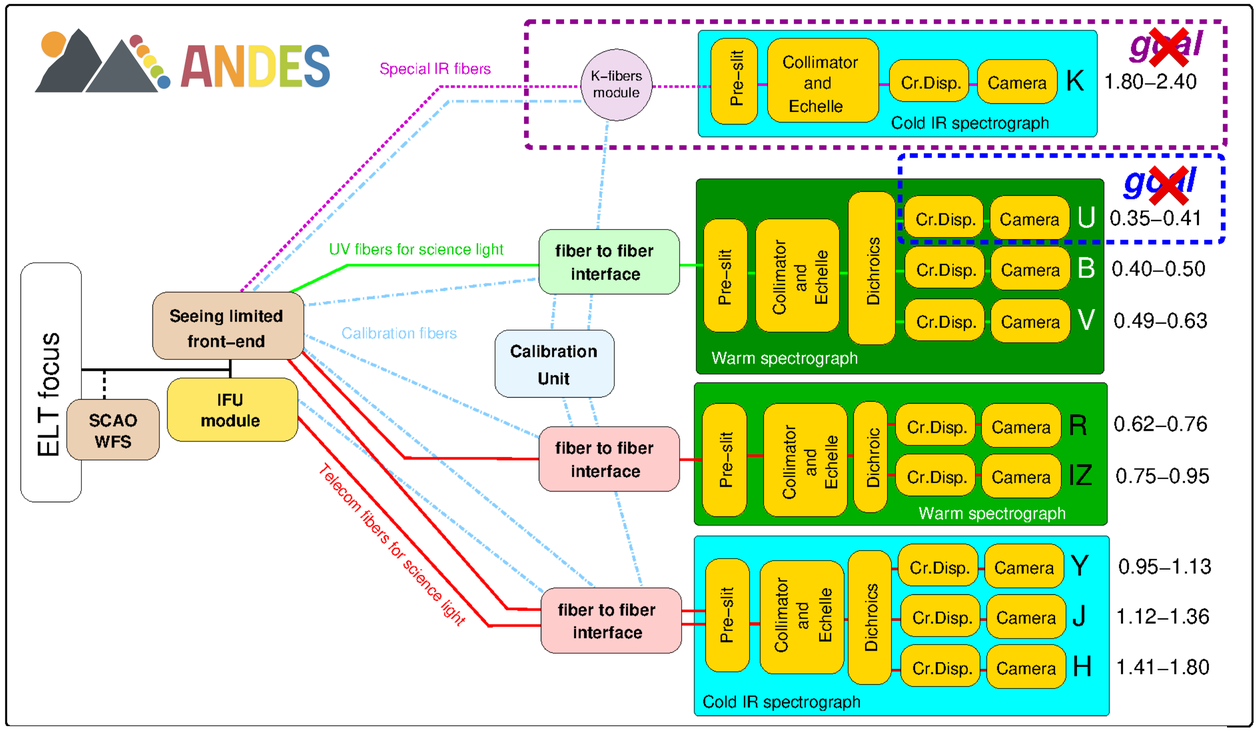
COST, GTO & SCHEDULE

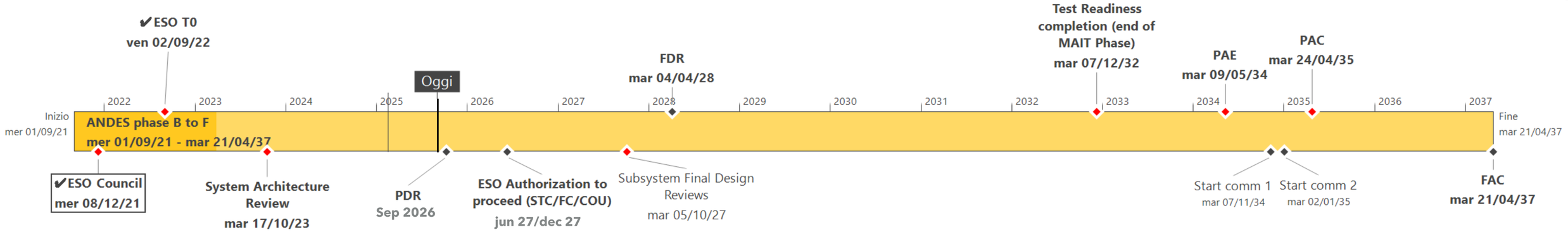
Hardware and FTEs (overall >100 MEUR) will be raised by the Consortium:

- more than 125 GTO nights which will be used for Consortium science programs

Schedule

- Phase B2 (PDR): 2024-2026
- Phase C (FDR): 2027-2029
- Integration (PAE): 2029-2035
- Commissioning & PAC: 2035

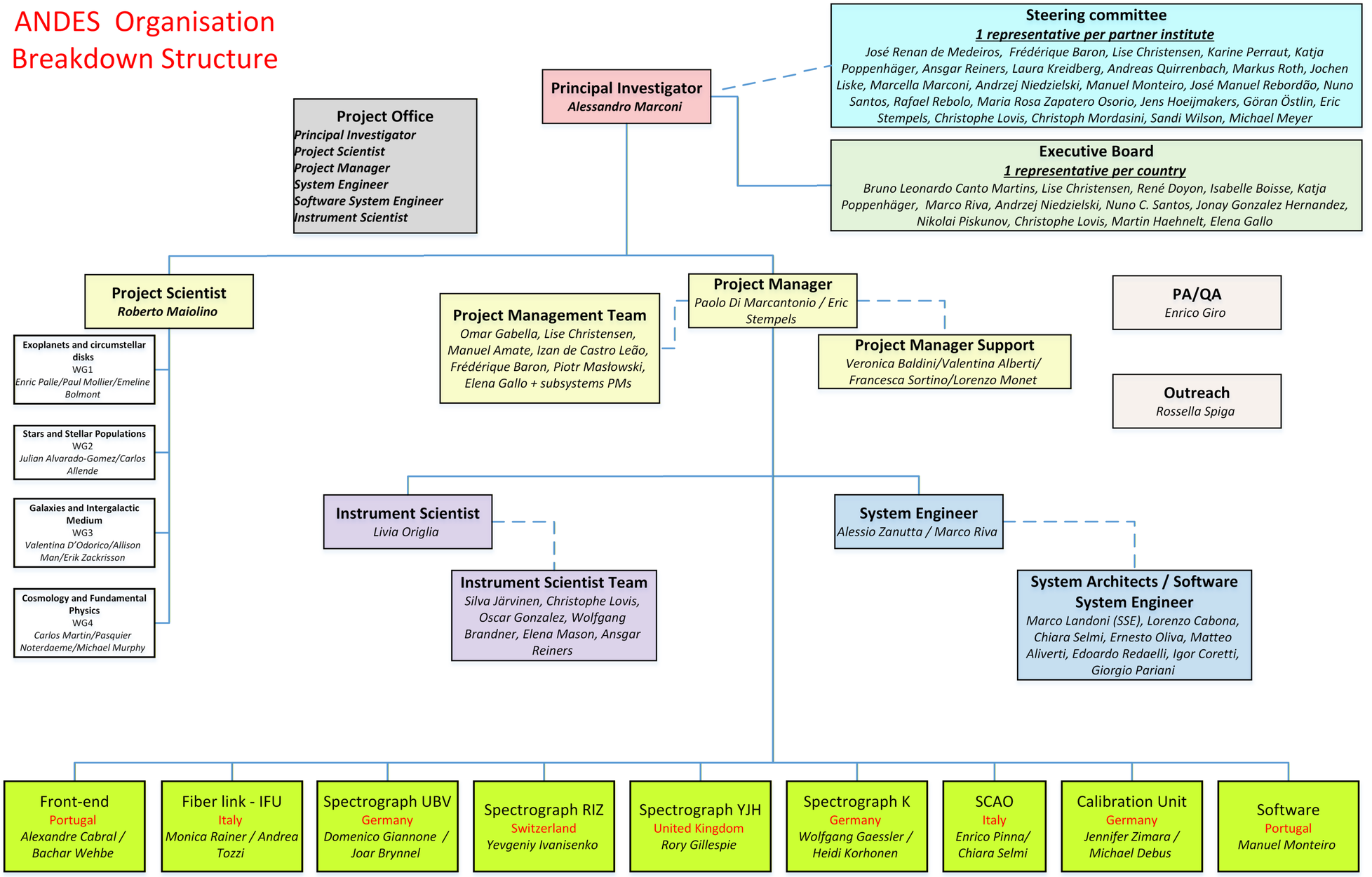


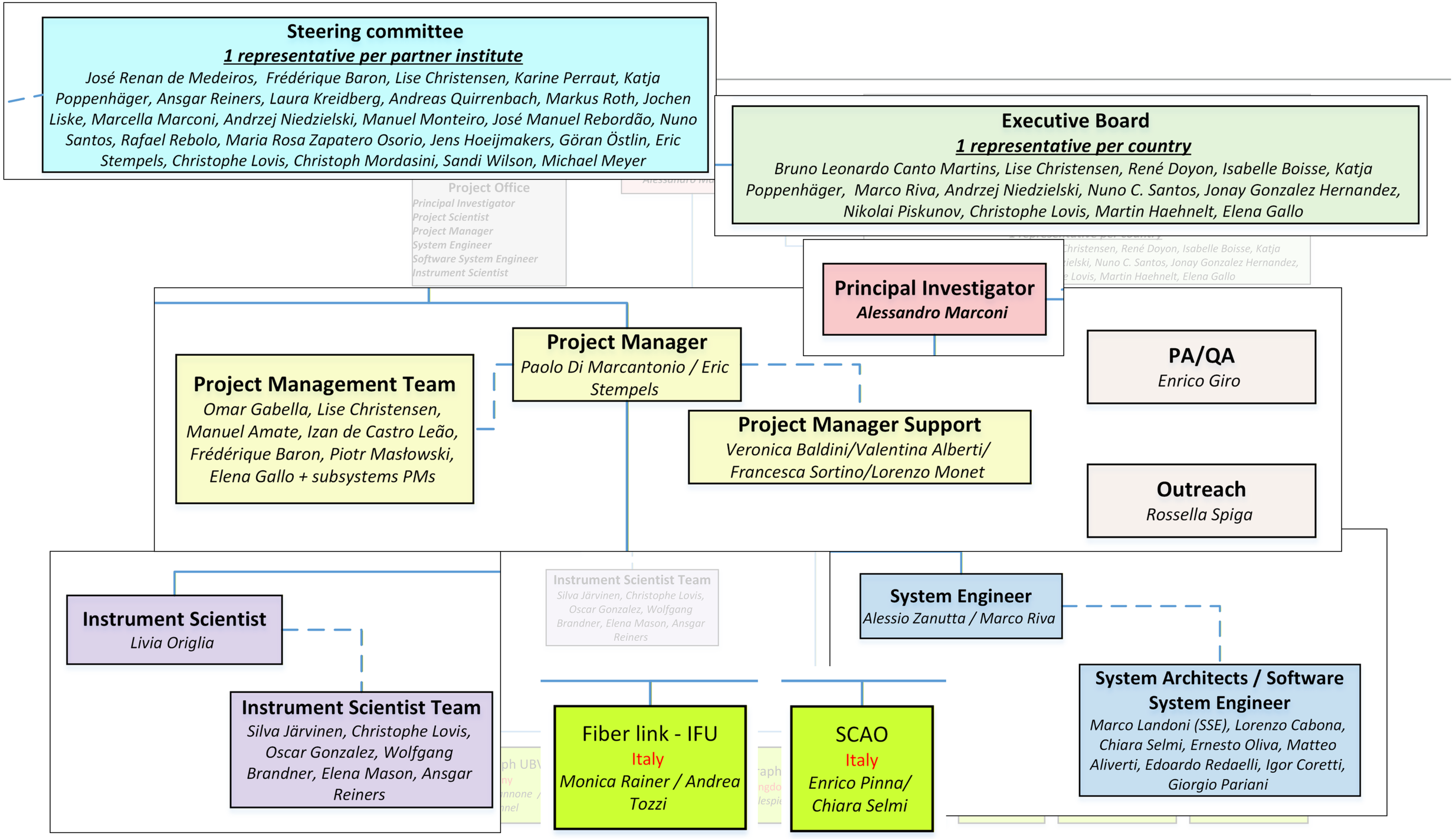


GUARANTEED TIME OF OBSERVATIONS

- Estimated GTO allocation: from 125 up to >200 nights, depending on final hardware costs and ESO Council approval
- GTO allocation among Partners is proportional to their Science Shares, proportional to FTE and cash contributions
- All GTO time will be devoted to Consortium science programmes
- Each Partner will decide how its GTO allocation is distributed among the four Science Team working groups
- The Science Team will define the GTO scientific programme, analyse and interpret the data, and coordinate publications
- Consortium data can be accessed by members of the Science Team, Technical Teams and governing bodies but *scientists, postdocs and PhD students from Partner institutions will also be able to join specific GTO scientific projects and access consortium data according to the Data Access and Publication Policy (document to be prepared after PDR)*
- The Data Access and Publication Policy will regulate project leadership, data access and publication coordination, while aiming to ensure a fair scientific return across the Consortium (proportional to FTE and cash contributions)

THE ITALIAN CONTRIBUTION TO ANDES

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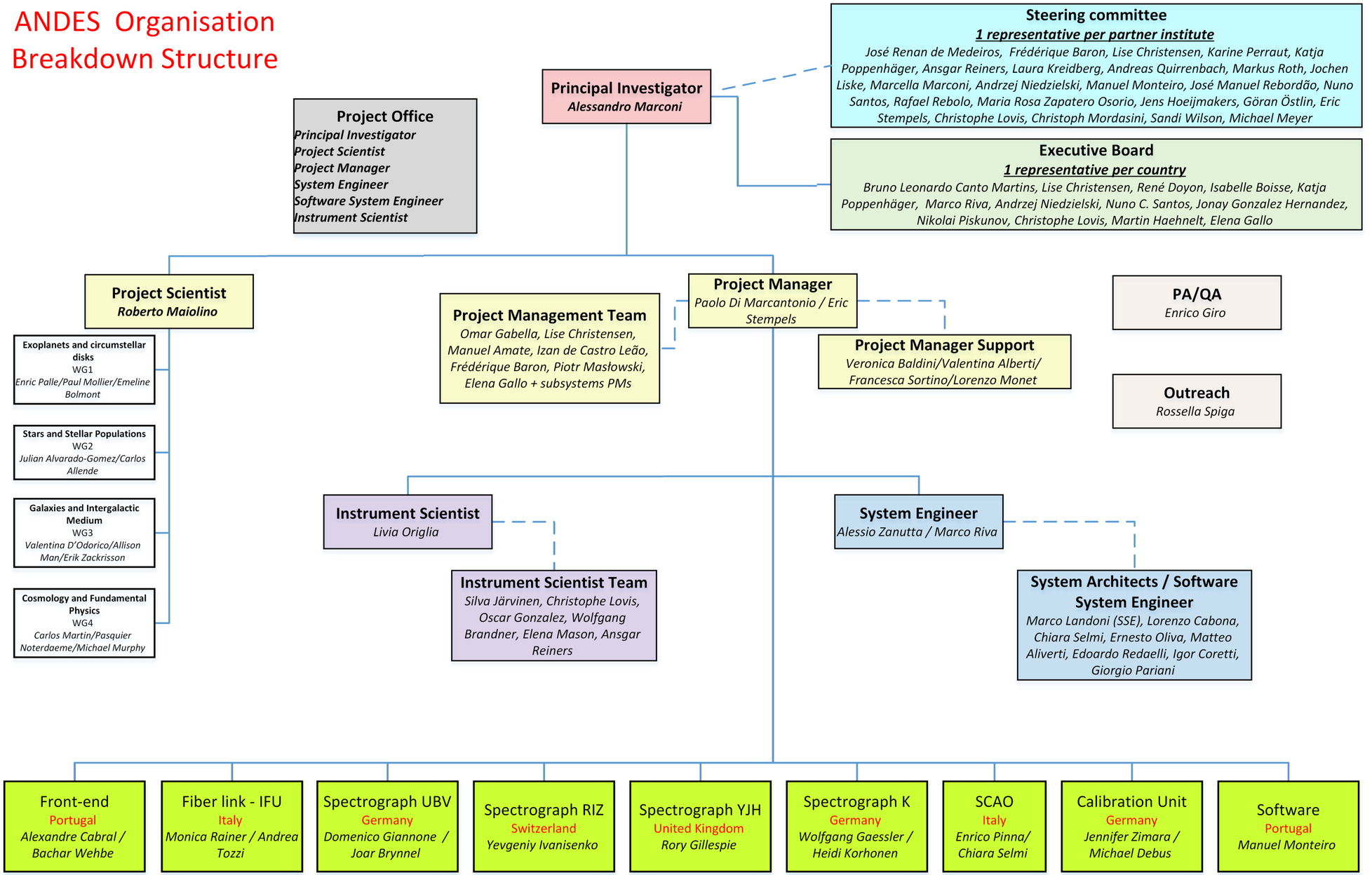
Fiber link - IFU
Italy
Monica Rainer / Andrea Tozzi
SCAO
Italy
Enrico Pinna/ Chiara Selmi

THE ITALIAN CONTRIBUTION TO ANDES



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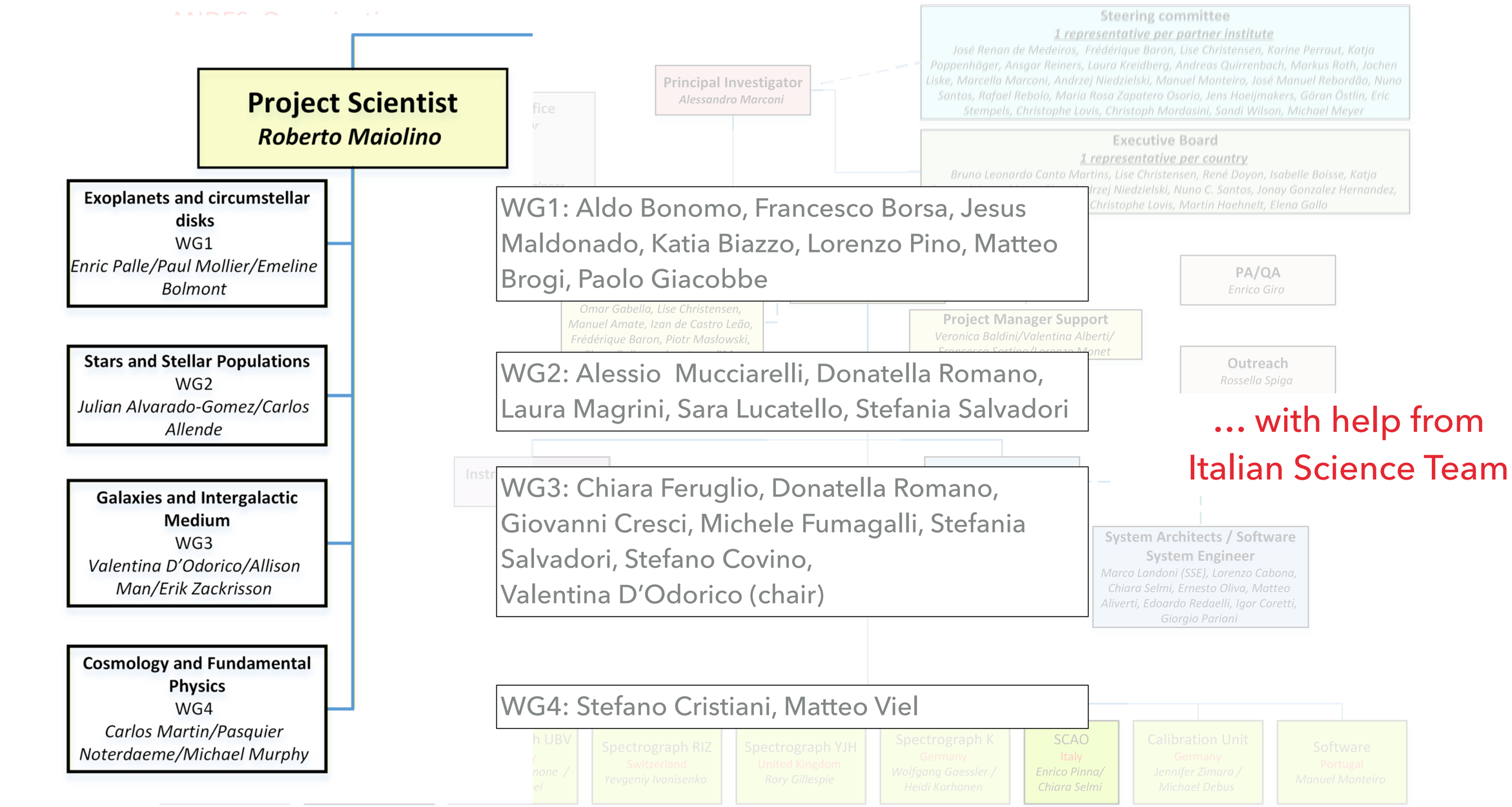

… with help from Italian Science Team

MAIN GOALS OF THE ITALIAN ANDES SCIENCE TEAM

- **Maximize the scientific return for the Italian community**
  - Identify and prioritize science cases where the Italian community can play a leading role, focusing on programs that are realistic given ANDES' expected performance and that build on established national expertise.
- **Prepare the Italian community for effective exploitation of ANDES**
  - Develop scientific and technical readiness ahead of first light through simulations, analysis tools, and representative science cases.
  - Actively disseminate updates on ANDES science, capabilities, and timelines, ensuring that the Italian community remains informed and aligned with the instrument's evolution.
- **Support Italian participation in the international ANDES Science Team**
  - Carry out coordinated scientific and preparatory work at the national level—such as analyses, simulations, and science-driven studies—that directly contribute to consortium activities.
  - This supports Italian members of the international Science Team by enabling well-founded contributions that reflect the size, expertise, and scientific breadth of the Italian community, while remaining aligned with the overall ANDES science strategy.

THE ITALIAN ANDES SCIENCE TEAM

- **Chair: Valentina D'Odorico**
- **WG coordinators**
  - WG1 Katia Biazzo, Matteo Brogi, Lorenzo Pino (katia.biazzo@inaf.it, matteo.brogi@unito.it, lorenzo.pino@inaf.it)
  - WG2 Alessio Mucciarelli (alessio.mucciarelli2@unibo.it)
  - WG3 Michele Fumagalli (michele.fumagalli@unimib.it)
  - WG4 Matteo Viel (viel@sissa.it)
- **Composition (as of May 13, 2026)**
  - WG1 italian members of Consortium ST + 50 members
  - WG2 italian members of Consortium ST + 21 members
  - WG3 italian members of Consortium ST + 38 members
  - WG4 italian members of Consortium ST + 5 members

Join by filling form at https://tinyurl.com/andes-scienceteam-it

SUMMARY OF ANDES PROJECT

HTTPS://ANDES.INAF.IT/

- Consortium: **32+ institutes, 13 countries, >250 people**
- Successful Phase A study 03/2016 - 03/2018
- **Schedule: Phase B 2022-2026, @ELT in ~2035**
- **Science priorities (and many other science cases):**
  1. biomarkers from exoplanet atmospheres in transmission
  2. variation of fundamental constants of Physics
  3. biomarkers from exoplanet atmospheres in reflection
  4. direct detection of cosmic acceleration (Sandage effect)
- **Modular fiber-fed cross-dispersed echelle spectrograph**
- **Simultaneous range 0.37-2.4 μm (ultrastable UBV+RIZ+YJH+K)**
- **Resolution ~100,000**
- **Several interchangeable, observing modes: Seeing limited & SCAO+IFU**
- **Total cost of baseline >100 MEUR (hardware+FTEs)**
- **System design (PDR level):**
  - technically “simple”
  - almost pupil independent
  - great science cases (fulfills top 4 priorities)
  - modular, staged deployment possible

UPPSALA UNIVERSITET

Science and Technology Facilities Council

UK Astronomy Technology Centre

NICOLAUS COPERNICUS UNIVERSITY IN TORUŃ

Faculty of Physics, Astronomy and Informatics

INSTITUT DE RECHERCHE SUR LES EXOPLANÈTES

INSTITUTE FOR RESEARCH ON EXOPLANETS

Université de Montréal

Leibniz-Institut für Astrophysik Potsdam

b UNIVERSITÄT BERN

UNIVERSITÉ DE GENÈVE

FACULTÉ DES SCIENCES
Département d'astronomie

INAF
ISTITUTO NAZIONALE DI ASTROFISICA

AARHUS UNIVERSITY

ZENTRUM FÜR ASTRONOMIE

UNIVERSITY OF CAMBRIDGE

Centro de Astrofísica da Universidade do Porto

GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN IN PUBLICA COMMODA SEIT 1737

Institut de Planétologie et d'Astrophysique de Grenoble

Universität Hamburg
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