

HIRES-ELT SCAO - IFU

presented by Enrico Pinna (INAF)

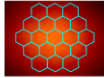


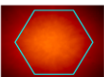

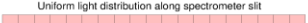
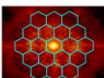

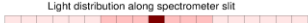
Outline

- Rationale
- Phase A study
- After phase A
- Phase B: WPs and team

Rationale

- M4 = adaptive mirror (D=2.4m - 4k actuators) not exploited by the seeing limited modes of HIRES
- On-axis AO correction using a natural guide star (SCAO-NGS) enabled with «just»
1x AO-WFS + Real Time Computer (no need of: multiple WFS, relay optics, extra WF correctors)
- Boost spatial resolution (DL) and contrast close to «bright» stars
- Science goals

- Exoplanet atmosphere
via reflection spectroscopy
- Protoplanetary disks / Star formation
- Galaxy evolution
- ... maybe more

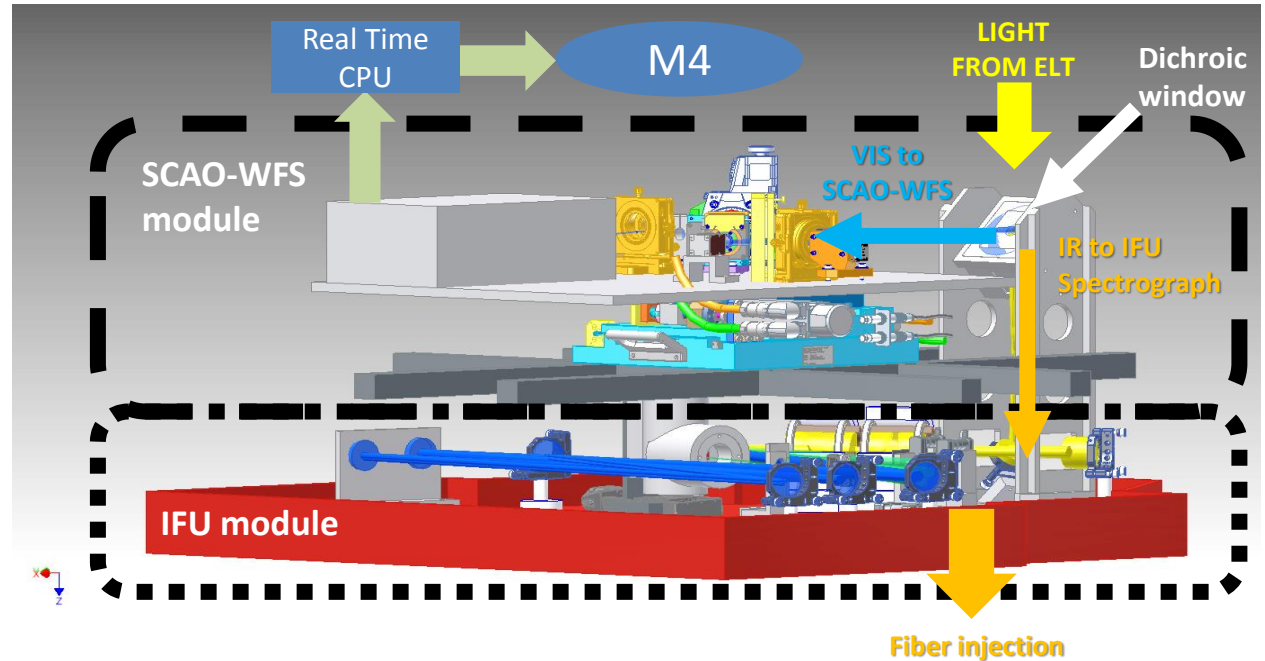
	Front-end	Fiber-to-fiber interface	Spectrometer
<i>High throughput seeing limited observing mode</i>	PSF on microlenses array and fibers bundle 	Light distribution on fibers bundle after fiber to fiber couplers 	Light distribution along spectrometer slit 
<i>High accuracy seeing limited observing mode</i>	PSF on single large fiber 	Light distribution on fibers bundle after scrambler and slicer 	Uniform light distribution along spectrometer slit 
<i>IFU AO corrected observing mode</i>	PSF on microlenses array and fibers bundle 	Light distribution on fibers bundle after fiber to fiber couplers 	Light distribution along spectrometer slit 

Phase A - overview

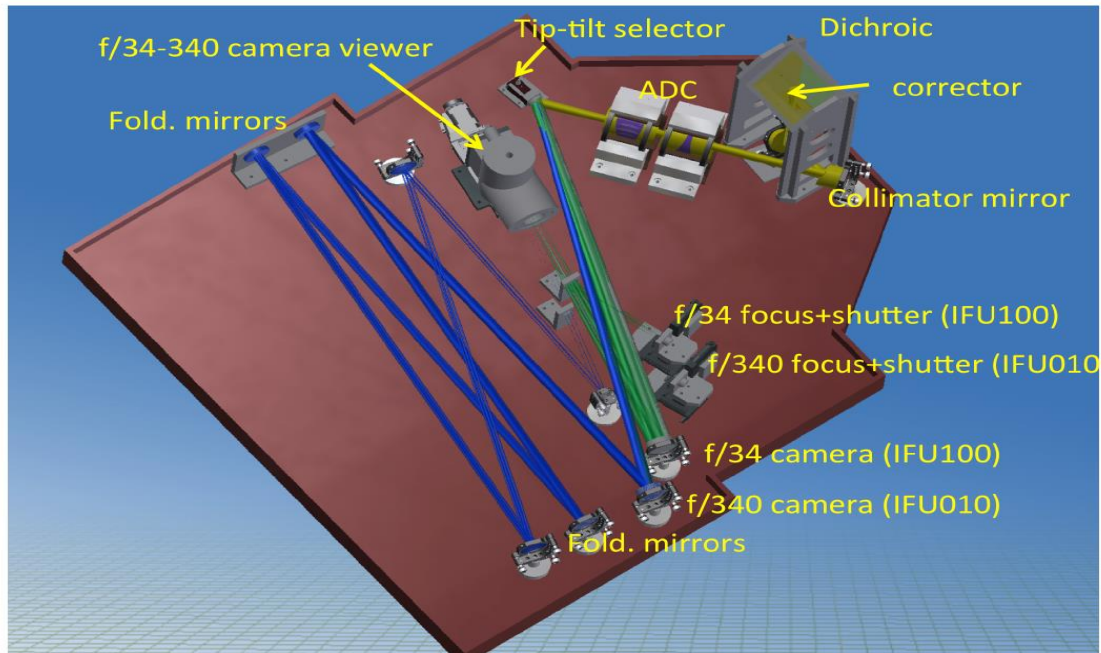
Team (INAF)

- **Marco Xompero** (PM/SE)
- Andrea Tozzi
- Marco Bonaglia
- Christophe Giordano
- Guido Agapito
- Ernesto Oliva
- Simone Esposito

System layout



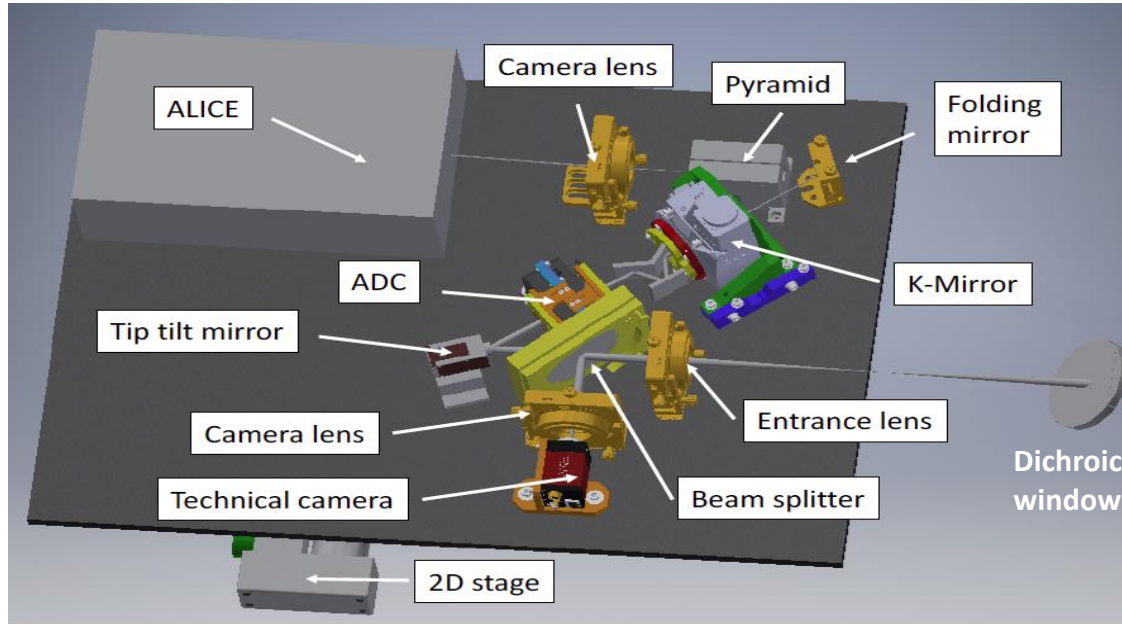
Phase A - IFU



- Single IFU bench
- 2 output plate scales
(10 and 100mas/spaxel)
- WL range Y-J-H
- ADC on board

Parameter	Value
Input focus & FOV	f/17.6 D~20"
Wavelength coverage	950-1800 nm
Output focus IFU100	f/34 D~2"
Scale for mode IFU100	100 mas/spaxel (8x8 HR) 67 mas/spaxel (10x10 UHR)
Output focus IFU010	f/340 D~0.2"
Scale for mode IFU010	10 mas/spaxel (8x8 HR) 6.7 mas/spaxel (10x10 UHR)
FOV of IFU foci	8X8 spaxels 10x10 spaxels - 4
Interfaces to fibers	Arrays of micro-lenses

Phase A – SCAO WFS

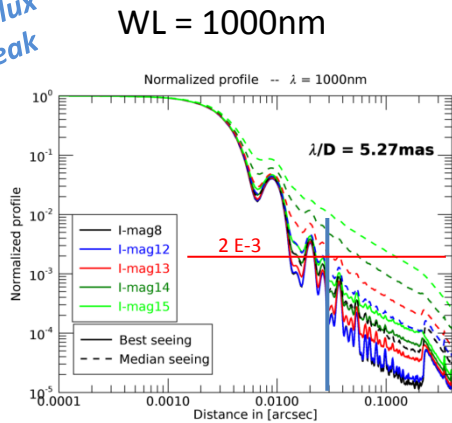


- Modulated Pyramid WFS
- Pyr WFS as for all ELT-class SCAO:
ELT-HARMONI, ELT-MICADO, ELT-METIS,
TMT-NFIRAOS, GMT-NGAO
- Design derived from LBT SCAO systems
- EMCCD WFS camera
- 90x90 Sub-Apertures
- WL range 600-950nm
- AO reference acquisition moving the
full WFS board

Phase A – Performances (2017)

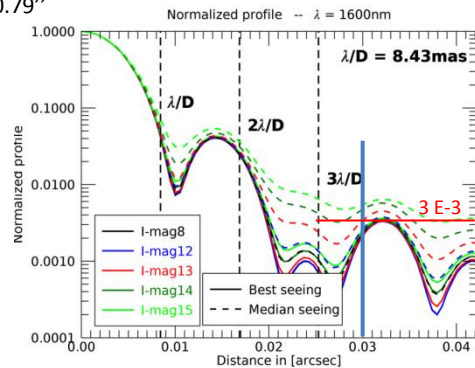
Radial profiles of flux
normalized to peak

@30 mas

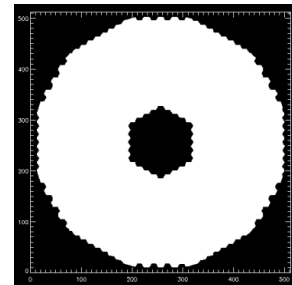


Seeing
Best = 0.47"
Median = 0.79"

WL = 1600nm

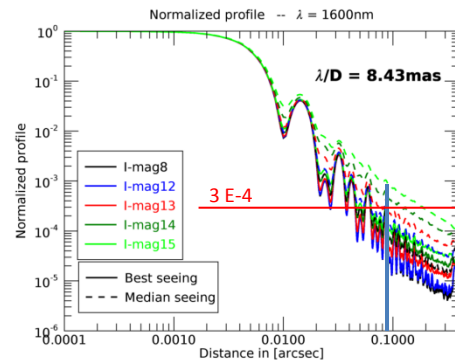
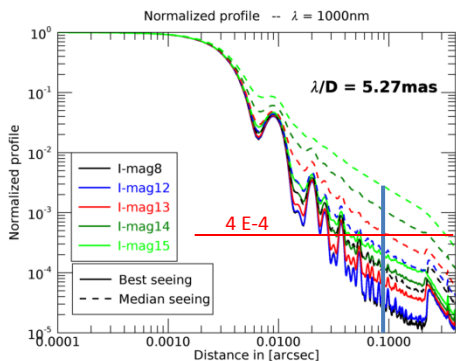


Considered conditions



- No spiders
- No petaling error (M4)
- No low wind effect
- Telescope WFE budget 50nm of which 37nm for M1 phasing
- Residual PSF jitter 2mas RMS
- No NCPA
-

@90 mas



After Phase A

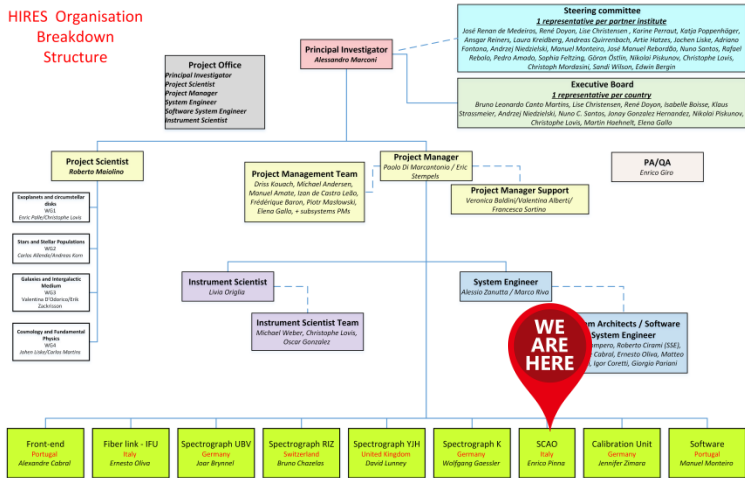
Phase A completed in March 2018

Waiting Phase B kick off:

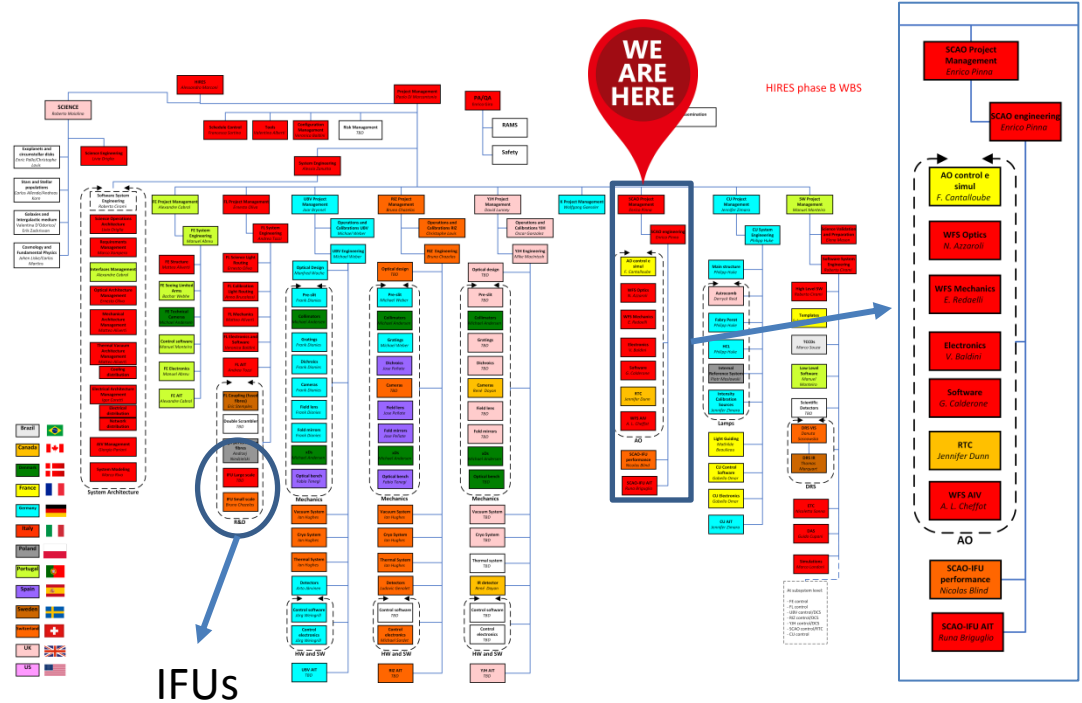
- Increased interest on SCAO-IFU: now we are in the «Science Priorities»
- Re-checking AO performance estimations,
collecting infos from studies on HARMONI and NFIRAOS
- Building an international team for phases B-C-D-E
now we have CAN, FRA and CH on board
- Identifying WBS for phases B-C-D-E

SCAO sub-system

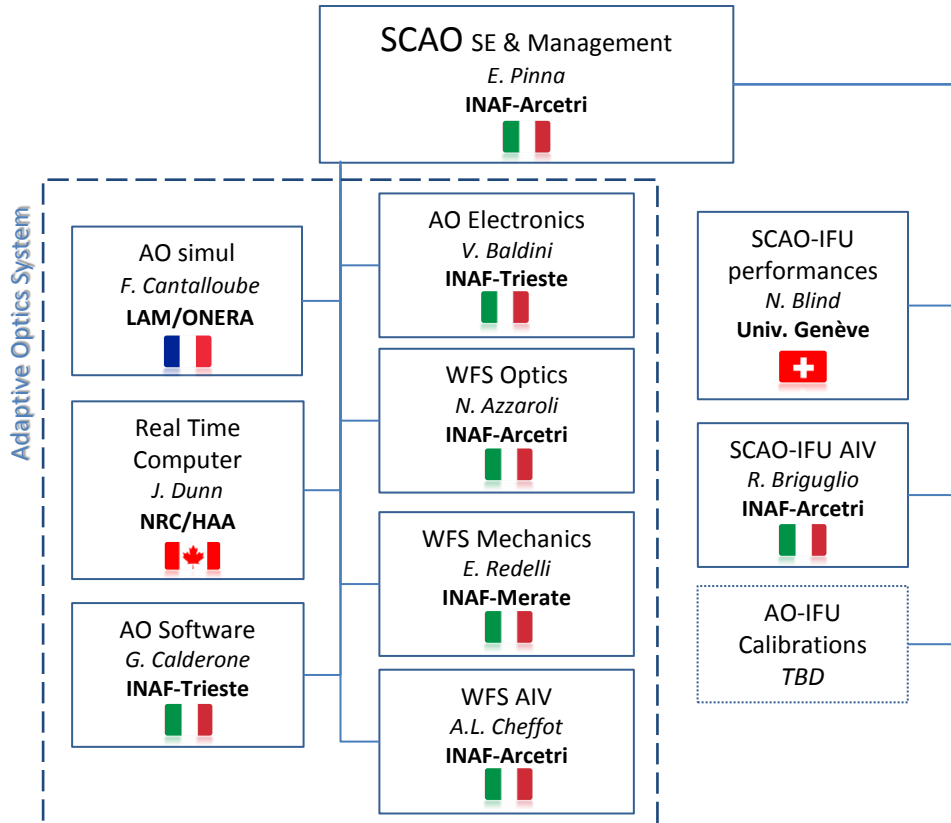
HIRES Organisation Breakdown Structure



- IFU 10 and 100mas WPs moved as R&D under Fiber Link sub-system
- Sub-system «SCAO-IFU» → «SCAO»



SCAO WPs and team



- Flag and name refer to WP leader
- Many WPs will have resources from different partners
- ELT-class SCAO experience
 - GMT NGAO (INAF – Arcetri)
 - TMT NFIRAOS (NRC/HAA)
 - ELT HARMONI (LAM/ONERA)
- DL spectroscopy experience
 - RISTRETTO (Univ. Genève)

Next to come

AO Tiger Team / Science Team /

- Build a preliminary «contrast error budget», collecting already available numbers
- Define with sci-team the key parameters and their sensitivity for scientific goals

First step in Phase B

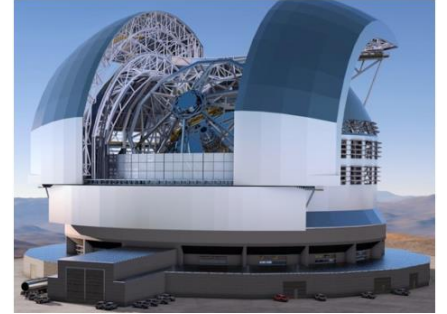
- Dedicated numerical simulations to update the contrast estimation
- Explore possible performance improvements:
 - Extra WFSs (petaling, etc...)
 - Coronagraph
 - Second stage
 - K-band

(instrument complexity Vs. science benefits)



ADVERTISEMENT

Post-doc fellowship HIRES-SCAO numerical simulations



Please
disseminate!

Supervised jointly by
LAM/ONERA (Marseille – FRA) and INAF-Arcetri (Florence – ITA)



Any information, please contact enrico.pinna@inaf.it