



European ELT

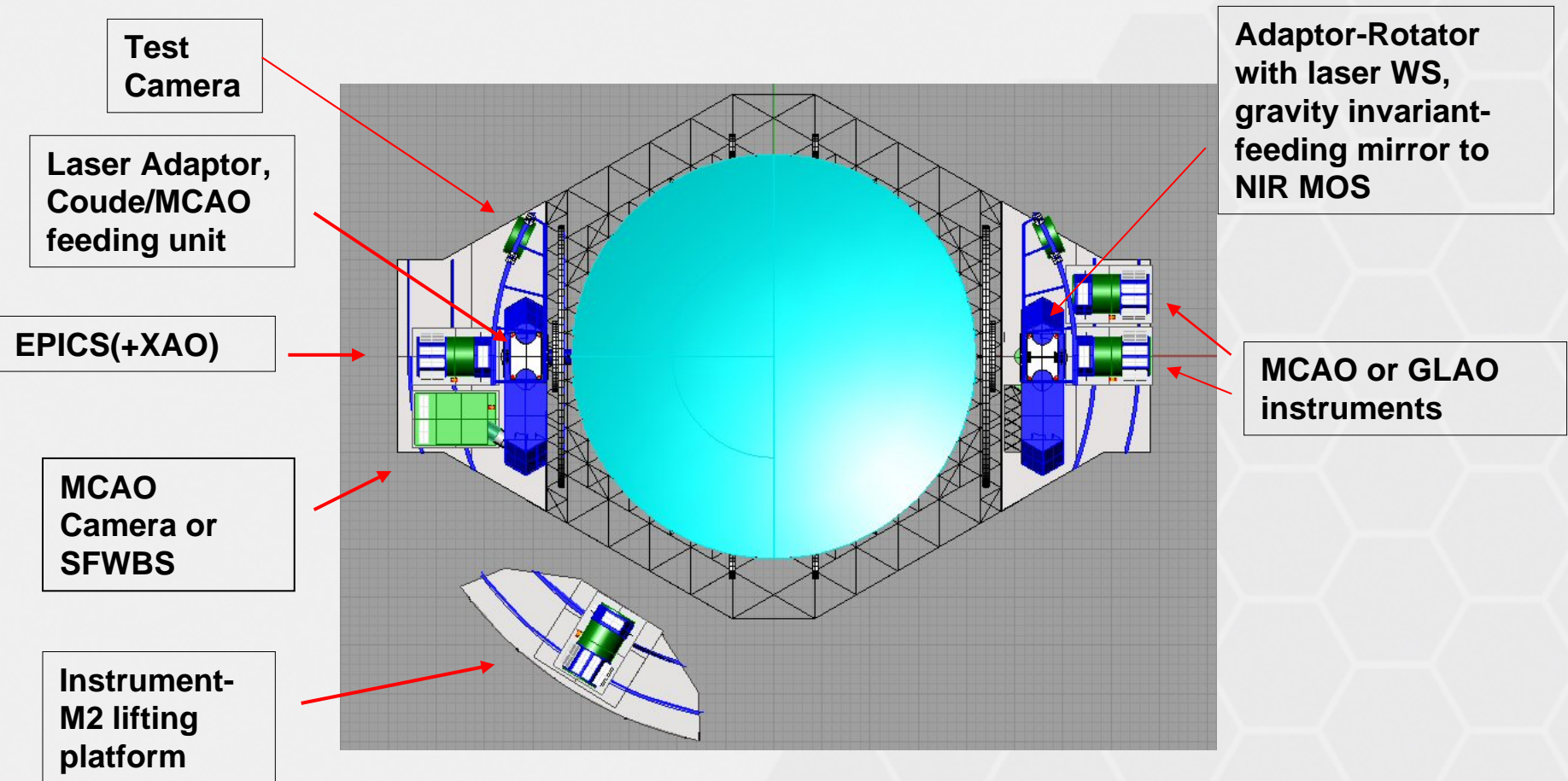


Studies of Instruments and associated AO Systems
during the telescope Phase B





Possible Population of the two Nasmyth foci





E-ELT INSTRUMENTATION PROCUREMENT (1)

- ❑ ELT Instrumentation Office within the ELT program to coordinate the instrumentation work with the community. Basic policy of ELT instrument procurement to follow the VLT scheme.
- ❑ External Consortia to continue play major role in E-ELT Instrumentation. ESO likely to contribute with subsystems (detectors, AO) and in the area of optical design, system engineering, system integration and testing, hardware and software standards, depending on the expertise of the Consortium.
- ❑ Realistic goal is to build 5 (+/-1) 1st Generation Instruments. To be distributed at the different foci and be operative at all times. First estimate on total hardware budget at 85 M€ plus ~20 ESO FTEs/year over 8 years.

E-ELT INSTRUMENTATION PROCUREMENT (2)

- ❑ Present budget envelope based on an adjusted “FTEs for GTO” paradigm. With respect to the VLT experience, more careful FTE evaluation with an upper ceiling needed. Assuming 150 external FTE for each instrument + associated AO system, this would correspond (at 100k€/FTE) to 60 M€ spread over ~10 years.
- ❑ This approach is still less demanding than in the ESA’s policy for space instruments where the member states have to pay both hardware and manpower
- ❑ Alternatives:
 - **Total instrumentation budget will have to be increased or the number of 1st generation instrument decreased**
 - **Full competition for the procurement of all instruments likely to result in savings. Policy/resources situation is different from country to country.**
 - **ESO as main contractor could become the most cost-effective choice**



E-ELT Instrumentation: Phase A-Concept Studies (2007-2009)

- ❑ **Background:** → ELT Science Case by SWG (2006)
 - ELT Instrument complement by IWG (2006)
 - OWL and FP6 ELT Instrument Concept studies (2004-2006)
- ❑ **Proposal** to Council in December 2006 identified 7 high priority instruments plus additional 8 concepts in “fishing pond” among which to select the ones to be studied in this phase
- ❑ **Current plan** is to launch 10 E-ELT Instruments and AO systems Phase A- Concept studies in collaboration with institutes. To be ready in 2009 for the definition of a 1st generation instrument construction proposal .
- ❑ **Plan approved** by Scientific Technical Committee in April 2007. Currently working on the TS and SoW of the first two studies



“Prominent Science Cases” from the ELT Science WG Report
(4.2006) drive requirements for telescope and instrumentation

1) Planets and Stars:

Extrasolar Planets (S3)

Circumstellar disks (S8)

IMF in Stellar Clusters (S5) **(Including Galactic Centre science)**

2) Stars and Galaxies:

Resolved Stellar Populations (G4) **(To the distance of Virgo and beyond)**

Black Holes/AGN (G9)

3) Galaxies and Cosmology

First light-the highest redshift galaxies (C4)

Studies of Absorption lines: Dynamical measurement of universal expansion,

IGM studies (C2, C7)

Physics of high redshift galaxies (C10)



E-ELT Instrument Phase A Studies

STUDIES will raise the level of preparation to start the project in the community and significantly contribute to the science case

RISKS:

- This activity is in parallel to the telescope studies with possible changes in the optical design & telescope interfaces.
- Limited manpower at ESO to prepare study framework specifications , negotiate study contract, follow up of the studies , perform the final reviews.
- Not clear whether there is a sufficient number of qualified groups in Europe to carry out the projects starting in 2010 (taking up part of the costs).



Presentation of E-ELT Instrument Phase A Study Plan since the beginning of April

- ❑ SWG, ESE, April 2-3 (Table of studies)***
- ❑ SSWG (Plan, policy of procurement)***
- ❑ Budget, FTEs, Policy, List of Studies in documents for Committee of Council***
- ❑ STC66- STC 430***
- ❑ Finance Committee (SSP for MOS and MACAO, Call for LTAO, SFWBS)***
- ❑ ESRC on 22.5 (policy of procurement, plan)***

Table: Instrument+ Associated AO Studies 2007-2009

INSTRUMENT STUDY	PROCUREMENT MODE	TIMEFRAME
<i>WF, Multi IFU NIR Spectrograph. +AO</i>	SSP with external consortium	Contract to be in place by July 2007
<i>CODEX</i>	ESO coordination of Consortium with external Institutes	Study Specs to be fully defined by 4Q 2007
<i>MCAO Module</i>	SSP with external consortium	Contract to be in place by July 2007
<i>MCAO Camera</i>	Open Call	Call to be launched in 3Q , replies in 4Q 2007
<i>EPICS + AO</i>	ESO coordination of Consortium with external Institutes	Study Specs to be fully defined by 4Q 2007
<i>Single Field, Wide Band Spectrograph</i>	Open Call	Call to be launched in 3Q , replies in 4Q 2007
<i>LTAO Module</i>	Open Call	Call to be launched in 3Q , replies in 4Q 2007
<i>MIR Instrument + AO</i>	SSP (tbc)	Contract to be in place by 4Q 2007
<i>New Instrument Concept- 1</i>	SSP or Open Call (tbd)	Contract to be in place by 1 st Q 2008
<i>New Instrument Concept-2</i>	SSP or Open Call (tbd)	Contract to be in place by 1 st Q 2008



E-ELT Post Focal AO Systems: Phase A- Concept Studies (2007-2009)

- ❑ **GLAO** provided by M4 in the telescope. MOAO and XAO studied as part of the instrument studies (MOS and EPICS respectively)

- ❑ **MCAO module** (2 additional DM, wavefront sensing, cooled) to feed camera and/or spectrograph operating close to DL over a field up to 2', subject of an external study (SSP)

- ❑ **LTAO module** (lasers in compact configuration, =SCAO using M4, to feed narrow field spectrograph or camera operating close to DL., open Call for Proposal)



E-ELT Instrumentation: Phase A- Concept Studies (2007-2009)-2

Single Field, Wide Band Spectrograph :

Science Goals: faint, high z galaxies, QSOs and GRBs, extragalactic stars and PNs

Remarks: first spectrograph at the telescope to exploit the photon collecting power of the ELT for observations of uniquely faint galaxies and stars, synergy with JWST. Will use GLAO, LTAO, later MCAO.

Diffraction Limited NIR Camera

Science Goals: Resolved Stellar Populations to Virgo, Galactic Center

Remarks: it requires 2 DM in a MCAO system to fully exploit the unique angular resolution of the ELT.

CODEX, High resolution, high stability visual spectrograph.

Science Goals: Terrestrial Planets in Extra-solar Systems, Primordial Nucleo-Synthesis, Direct Measurement of the Dynamics of the Universe, Cosmological Behavior of the Fine Structure Constant;

Remarks: At coudè focus, not requiring AO, only instrument to work at blue-V wavelengths



E-ELT Instrumentation: Phase A- Concept Studies (2007-2009)-3

Wide Field, Multi IFU NIR Spectrograph :

Science Goals : highest redshift galaxies, physics of galaxies at $z= 2-3$

Remarks: for statistical studies of large sample of objects, to observe targets detected in imaging with JWST. Requires energy concentration at selected position over a relatively large field (MOAO system).

EPICS: Exoplanets Imager and Spectrograph

Science Goals: heavy, rocky planets at 1-10 AU (within 30pc), warm Jupiters at $< 1AU$

Remarks: requires Extreme AO systems, coronagraphy, superb control of telescope scattered light and aberrations

MIR Camera and Spectrograph

Science Goals: proto-planetary discs, star formation regions, dusty AGN

Remarks: angular resolution 6 times better than equivalent instrument in JWST



NIR MOS at the E-ELT: 4 possible configurations

1. >20 targets over a field =>5', with 2D capability, moderate AO (MOAO)- **first priority from SWG high z galaxies "prominent" science cases-**
2. Aiming at stellar sources in crowded fields- approaching DL to resolve crowding, medium-high resolution for stellar abundances
3. (A) MOS for full (5-7') GLAO or best seeing field – could be first use of Nr.1 or dedicated instrument- to be studied
4. (B) Adaptation of 8m slit spectrograph to 42m → small field of 1-2'- to be used with natural seeing or GLAO (or MCAO module as Nr.2?) ,to be studied.



RUNNING WORK IN JUNE-SEPTEMBER 2007

- 1. Technical Specs and SoW for the NIR MOS with the EAGLE CONSORTIUM (P.I. J.G. Cuby; LAS, Obs. Paris, ONERA, ATC, Durham)- Contract by August 2007**
- 2. Same for MACAO module study (INAF , ONERA, Obs. Paris)- Contract by August 2007**
- 3. Telescope interface document; v1.0 to be ready July 2007**
- 4. TS and SoW for Calls of Proposals for SFWBS and LTAO module- to be launched by August 2007**
- 5. Negotiations for Studies by Consortia led by ESO (EPICS, CODEX) – to be closed by 3Q 2007**
- 6. Preparatory work on the TS and SoW for MIR and DL CAMERA**
- 7. Preparatory work for the selection of New Instrument Concept Studies**