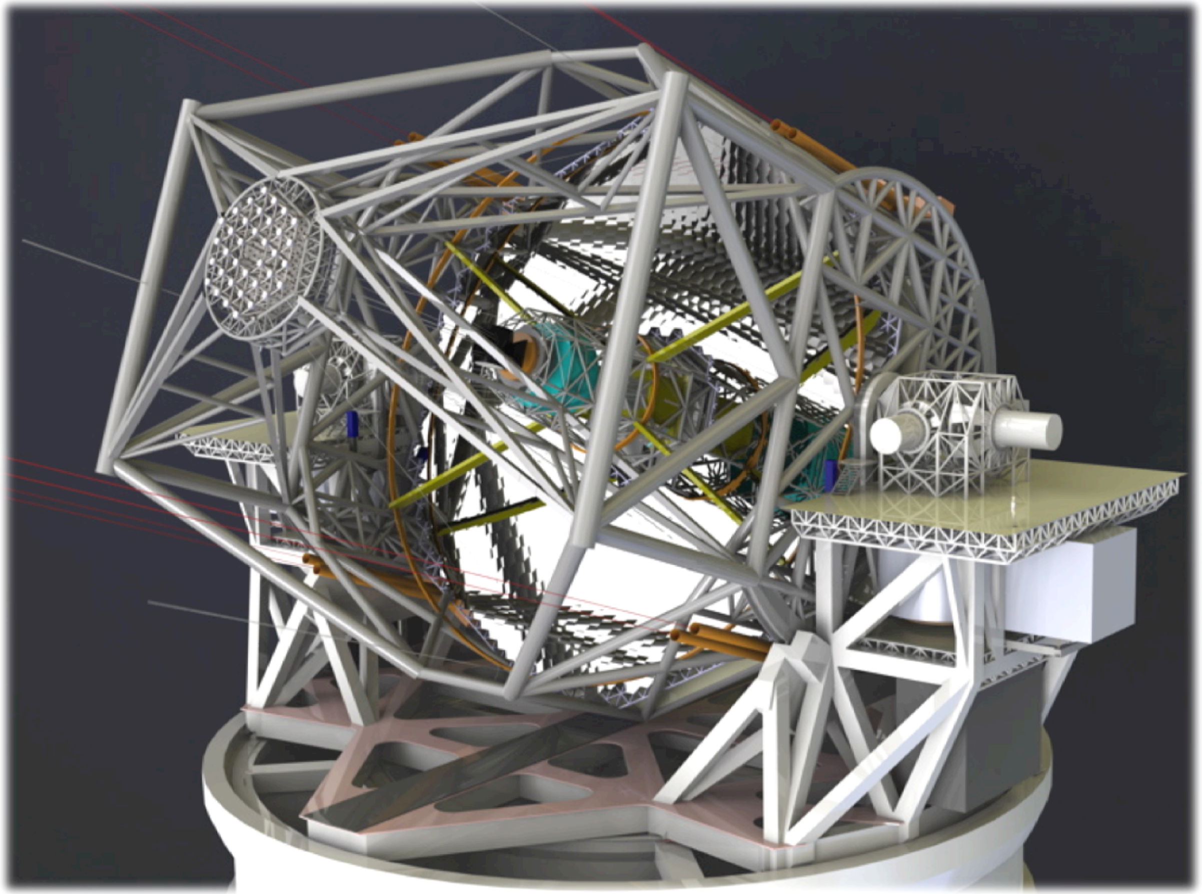
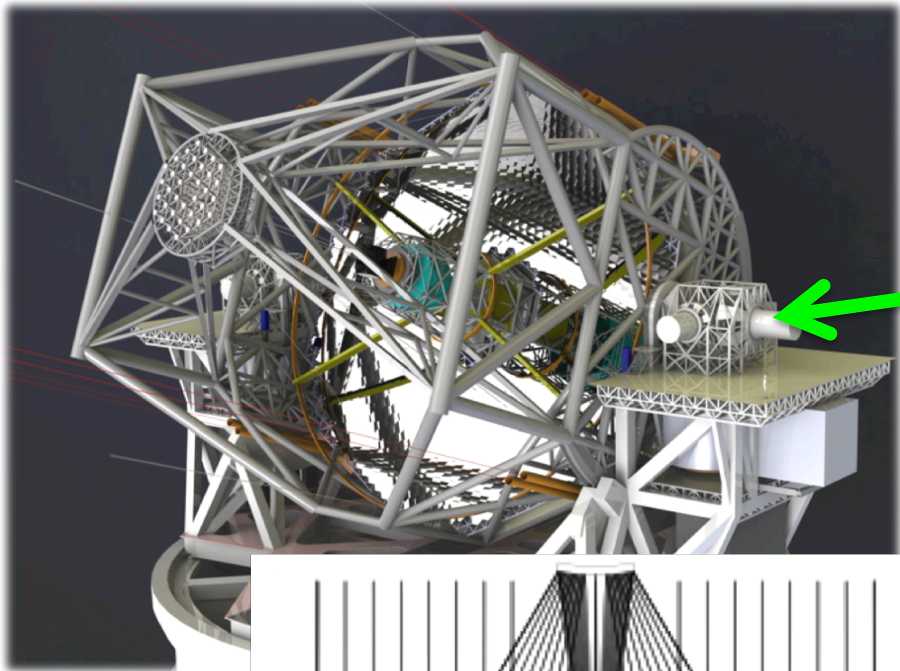


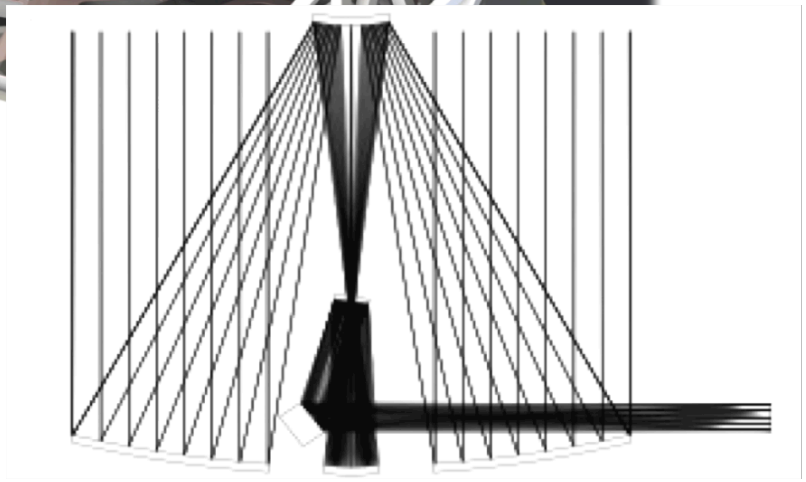
Science requirements for an 'ELT MOS'

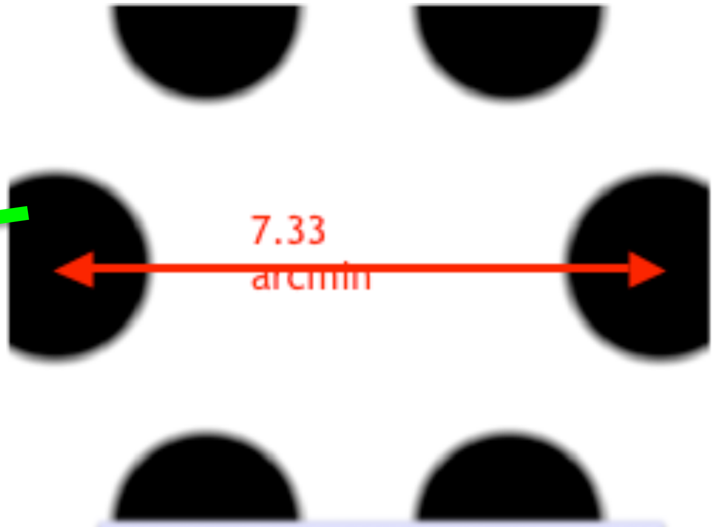
Chris Evans (UKATC/STFC)

Science & Technology Facilities Council
UK Astronomy Technology Centre

E-ELT patrol field



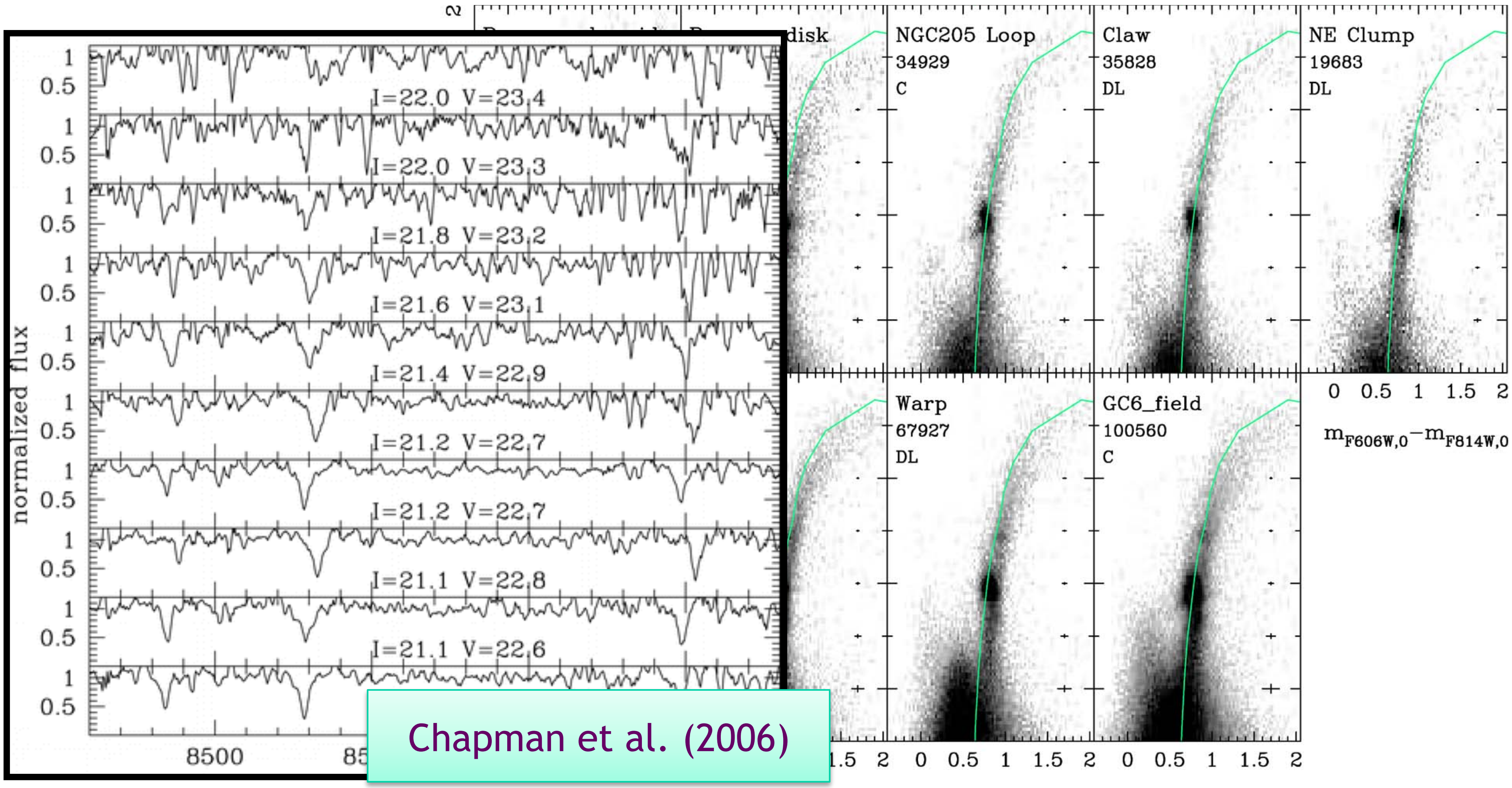




~40 sq. arcmin

Resolved stellar populations

Richardson et al. (2008)

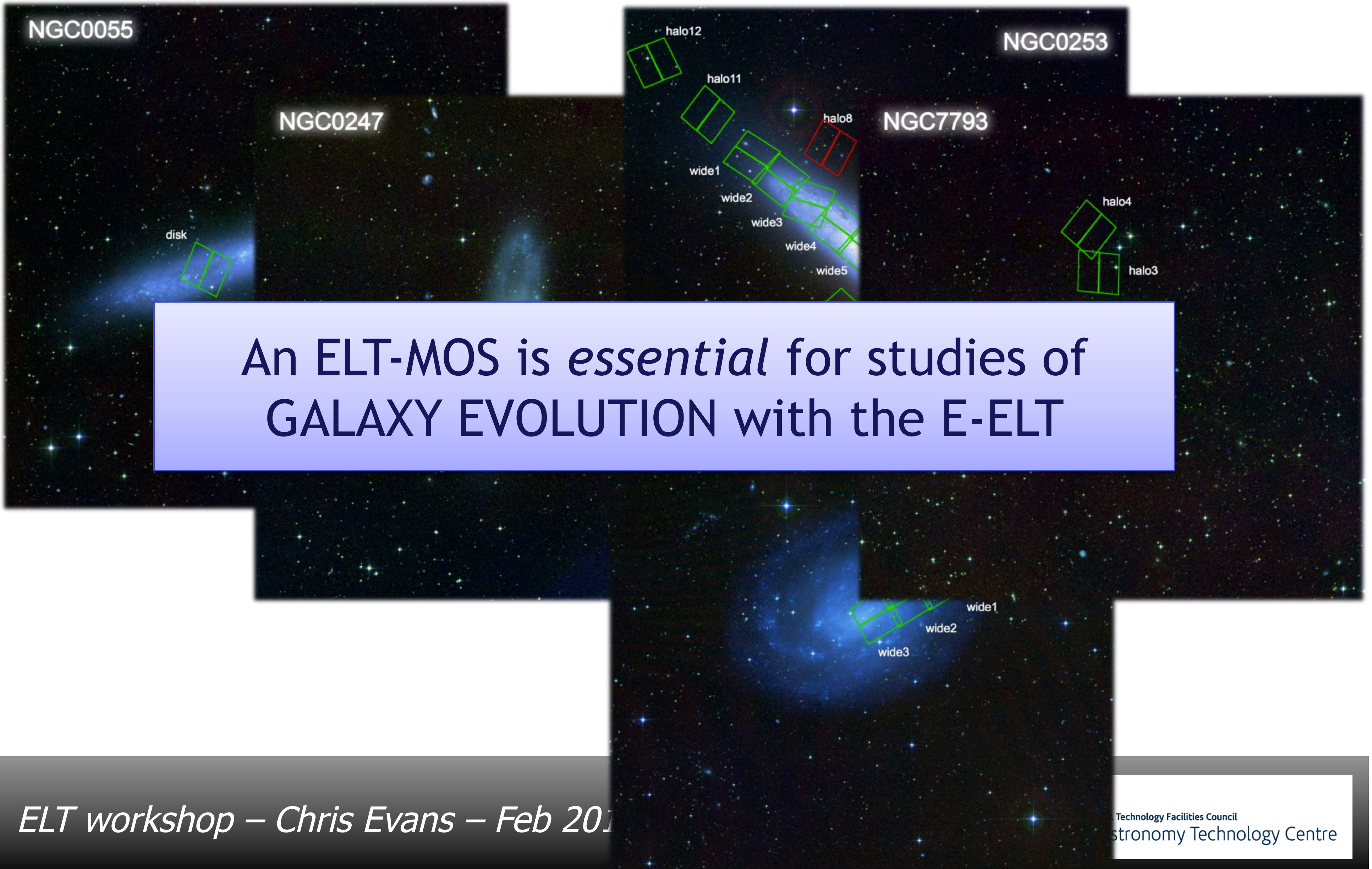


Chapman et al. (2006)

Science & Technology Facilities Council
UK Astronomy Technology Centre

Image Credits: David Radburn-Smith

Resolved stellar populations



An ELT-MOS is *essential* for studies of GALAXY EVOLUTION with the E-ELT

MOS requirements

Evans et al. Proc. SPIE
arXiv:1207.0768

Multi-Object Spectroscopy with the European ELT:
Scientific synergies between EAGLE & EVE

C. J. Evans[1], B. Barbuy[2], P. Bonifacio[3], F. Chemla[3], J.-G. Cuby[4], G. B. Dalton[5,6], B. Davies[7], K. Disseau[3], K. Dohlen[4], H. Flores[3], E. Gendron[8], I. Guinouard[3], F. Hammer[3], P. Hastings[1], D. Horville[3], P. Jagourel[3], L. Kaper[9], P. Laporte[3], D. Lee[1], S. L. Morris[10], T. Morris[10], R. Myers[10], R. Navarro[11], P. Parr-Burman[1], P. Petitjean[12], M. Puech[3], E. Rollinde[12], G. Rousset[8], H. Schnetler[1], N. Welikala[13], M. Wells[1], Y. Yang[3,14]

- ‘High definition’: Observations of tens of channels at fine spatial resolution provided by multi-object adaptive optics (MOAO).

- ‘High multiplex’: Integrated-light (coarsely resolved) observations of >100 objects corrected by ground-layer adaptive optics (GLAO).

MOS requirements

Workshop in Amsterdam

Assembled a science team

Meetings in UK, Italy, Brazil, NL

New science simulations

Multi-object spectroscopy on the European Extremely Large Telescope

25-26th October 2012 - University of Amsterdam

Venue | Accomodation | Programme | Participants | Registration | Contact | links

Turingzaal, NIKHEF, Science Park 105, 1098 XG
dam, The Netherlands

The workhorse instruments of the 8-10m class observatories are their multi-object spectrographs (MOS), providing
d-based and space-borne
imaging surveys from, e.g.,
ere will be a plethora of
believe there is a strong and
compelling case for a MOS as one of the first E-ELT instruments. By exploiting the excellent image quality across
combined with its
will be able to obtain the
e of the key scientific
from studies of stellar
t galaxies.

MOS requirements

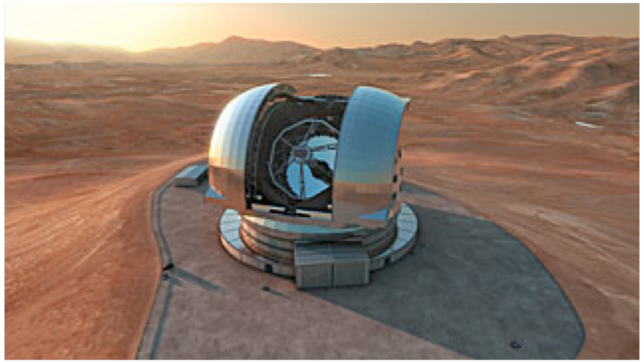
Workshop in Amsterdam

Assembled a scienc

Meetings in U

New s

ELT-MOS White Paper



Document Title	ELT-MOS White Paper: Science Overview & Requirements
Issue	1.0
Date	22 February 2013
Editors	Chris Evans (UK ATC) & Mathieu Puech (GEPI)

Contributors:
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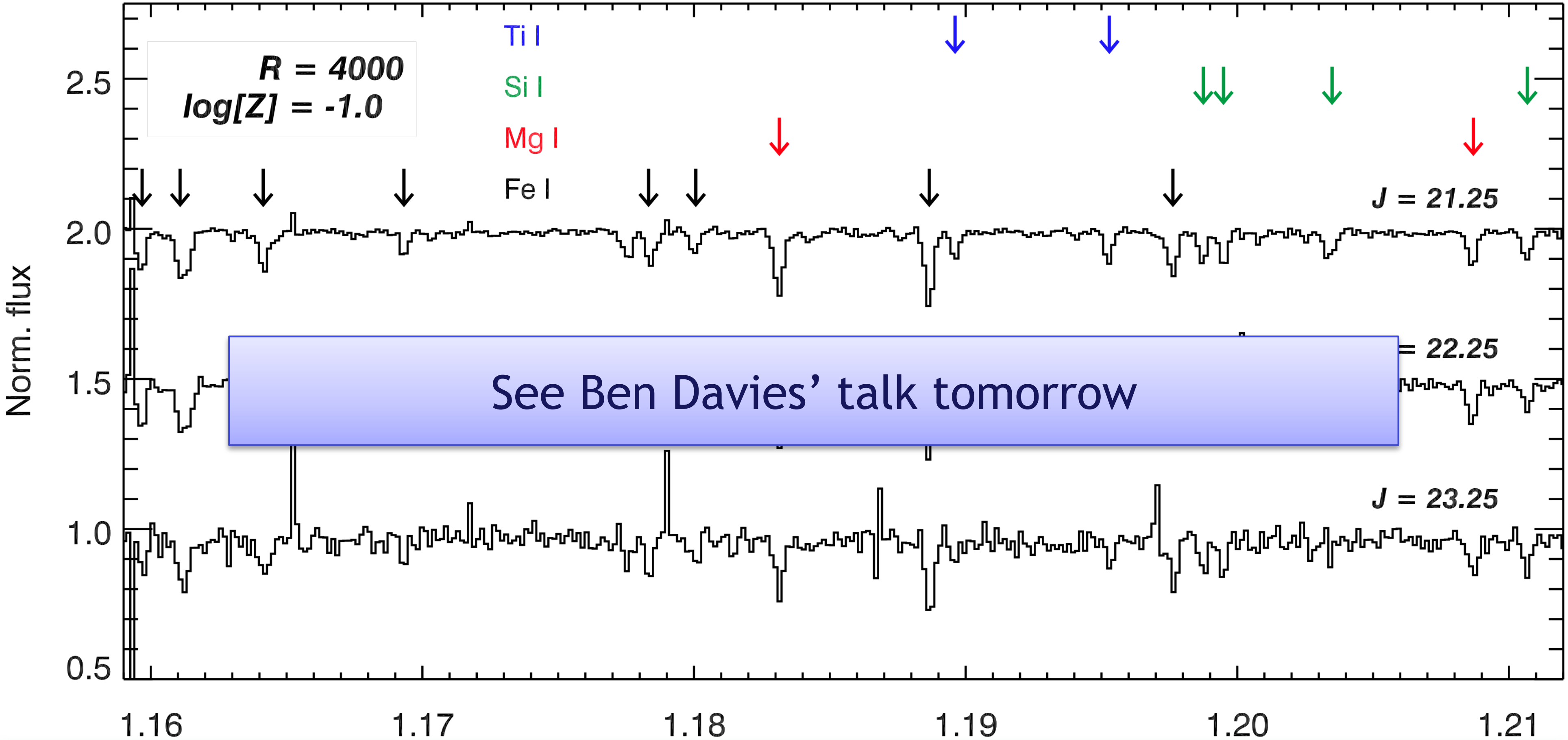
ELT-MOS White Paper

- SC1: First light – spectroscopy of the most distant galaxies
- SC2: Spatially-resolved spectroscopy of high-z galaxies
- SC3: Role of high-z dwarf galaxies in galaxy evolution
- SC4: Tomography of the IGM
- SC5: Resolved stellar populations beyond the Local Group
- SC6: Galaxy archaeology with metal-poor stars

& more…

Example trade-off: Opt. vs. nIR?

Davies et al. (2010)
Evans et al. (2011)



See Ben Davies' talk tomorrow

AO correction better in J-band, and stars are intrinsically red (I-J) = 0.5-1.0

ELT-MOS White Paper

Table 3: Summary of top-level requirements from each Science Case

Case	Target densities	FoV/target	Spatial resolution	λ-coverage (μm)	*R*
SC1	1-2 arcmin^{-2}	2” × 2”[3]	40-90 mas	1.0-1.8 *1.0-2.45*	5,000
	10s arcmin^{-2}	–	(GLAO)	1.0-1.8 *1.0-2.45*	>3,000
SC2	1-2 arcmin^{-2}	2” × 2”	50-80 mas	1.0-1.8 *1.0-2.45*	5,000
	10s arcmin^{-2}	–	(GLAO)	1.0-1.8 *1.0-2.45*	> 3,000
SC3	≥ ~20 arcmin^{-2}	–	(GLAO)	0.8-1.7	≥5,000 *~10,000*
SC4	0.5-1 arcmin^{-2}	2” × 2”	(GLAO)	0.4-1.0 *0.37-1.0*	5,000 *10,000*
SC5	Dense	1” × 1” *1.5” × 1.5”*	≤75 mas *20-40 mas*	1.0-1.8 *0.8-1.8*	5,000
	10s arcmin^{-2}	–	(GLAO)	0.4-1.0	≥5,000 *≥10,000*
SC6	10s arcmin^{-2}	–	(GLAO)	0.41-0.46 & 0.60-0.68 *0.38-0.46 & 0.60-0.68*	≥15,000 *≥20,000*

ELT-MOS White Paper

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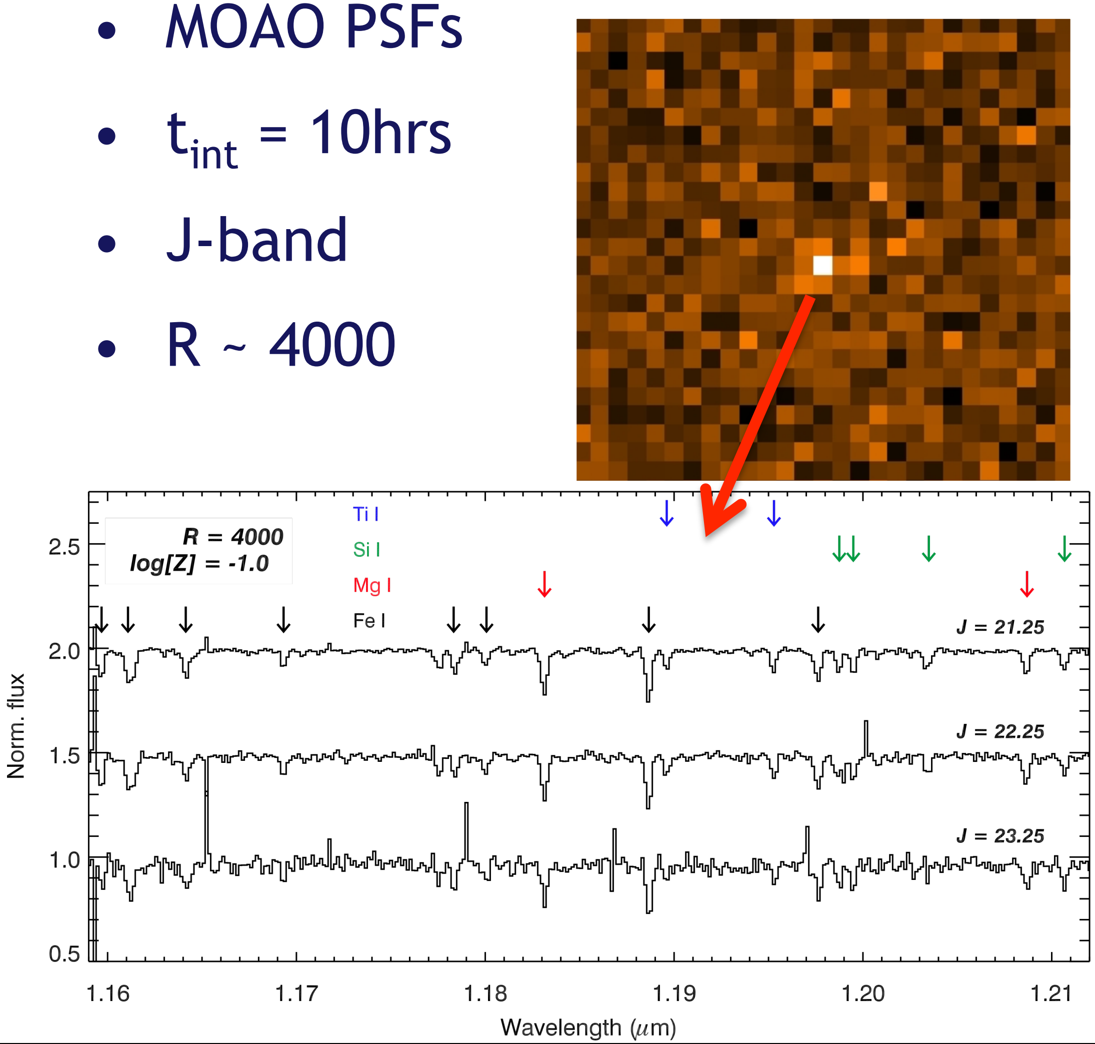
Next stage: prioritise requirements from the different cases via trade-offs, taking into account technical & operational feasibility

Example trade-off: Spatial sampling?

See poster by Puech et al.

- Spectral simulations using 'WEBSIM' from Puech et al. (2008)
- MOAO PSFs
- t_{int} = 10hrs
- J-band
- R ~ 4000



Science & Technology Facilities Council
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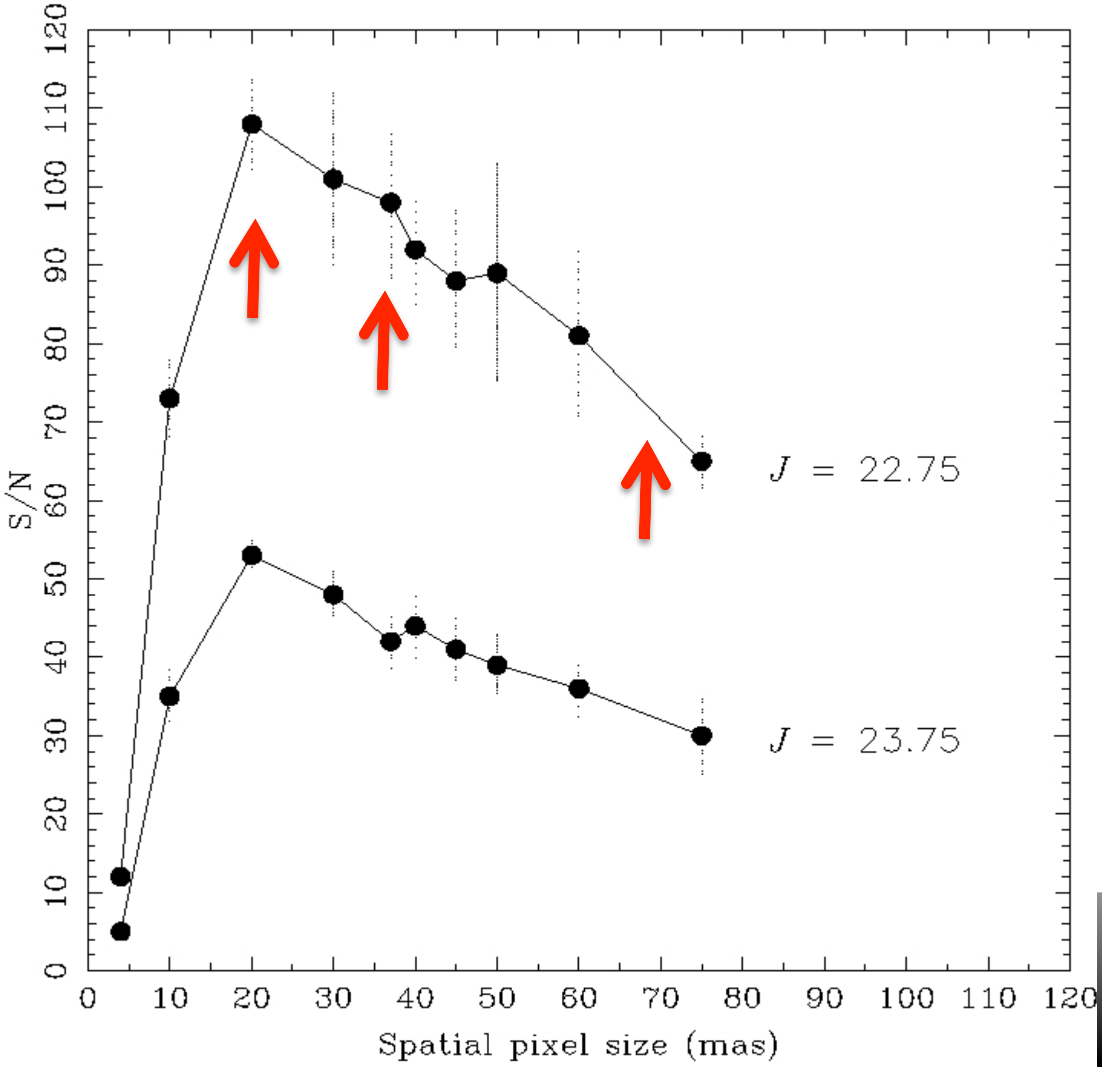
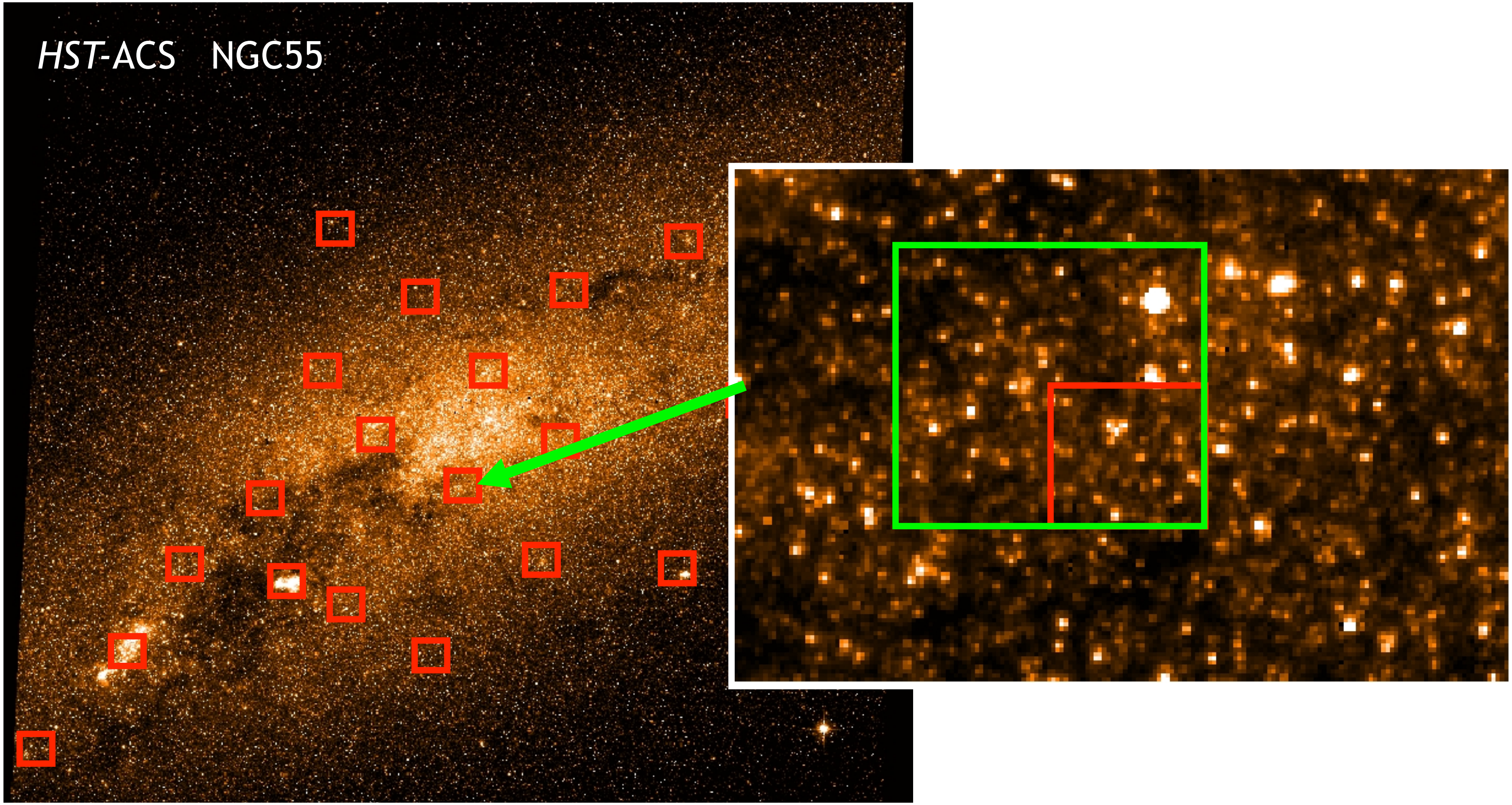


Spatial sampling vs. survey speed



Summary

- Compelling & well-defined cases for an ELT-MOS
- ELT-MOS White Paper presenting top-level cases
- Two modes: 'high multiplex' & 'high definition'
- MOS instruments have become the workhorses of the 8-10m
- MOS instruments early-on in GMT and TMT plans
- An E-ELT MOS will be an essential part of its instrument suite

MOSAIC

Poster by Jagourel et al.

Synergies with HIRES?