

# E-ELT SWG: SIMPLE, OVERVIEW & STATUS



Instead of an introduction ...

- SIMPLE is not an acronym
- it is a commitment
- it may be too good (simple) to be true
- it is one of the replies to the  $\Delta$ -call for additional advanced studies for E-ELT instruments

# SIMPLE, in a nutshell:



technical:

the blue / high frequency equivalent to VLT-CRIRES.

- AO-assisted for bright objects
- AO/LGS-dependent for faint objects
- full frequency coverage from  $\sim 800\text{nm}$  to atmospheric cut-off in K-band
- cross dispersed
- limited “long slit” mode

**note:** the red / low frequency part of VLT CRIRES is being addressed by METIS

# SIMPLE, as in ESO specs



frequency range	specification: 120 000 - 330 000 GHz (900 – 2500 [nm]) goal: 115 000 – 350000 GHz (850 – 2550 [nm])
optical throughput	> 40 % (goal, without detectors); including de-rotator and all beam-splitters required for the AO-feed, but ignoring slit-losses
spectral resolution	goal: $\nu/\Delta\nu \approx 1.5 * 10^5$ at $\nu = 125\ 000$ GHz ( $\lambda/\Delta\lambda \approx 1.5 * 10^5$ at $\lambda = 2400$ nm) minimum: $\nu/\Delta\nu \geq 1.0 * 10^5$
spectral sampling	goal: 3 pixel in dispersion direction ; minimum: Nyquist sampling
spatial sampling	goal: 7 mas (corresponding to $\lambda/D$ at $\nu \approx 240000$ GHz or $\lambda \approx 1250$ nm) ; only relevant for long slit mode; 3 pixel sampling of cross-dispersion profile minimum: 9 mas and spatially Nyquist sampling

# SIMPLE, the consortium:



PI/PM and overall leadership with:

- PI: Livia Origlia, INAF and Bologna Observatory
- PM: Tino Oliva, INAF and Arcetri Observatory
- PS: Roberto Maiolino, INAF and Rome Obs.

Colaborating Institutes:

- Tautenburg
  - Uppsala
  - PUC
- + potentially later University of Vienna

SIMPLE internal science team chaired by Bengt Gustafsson (already chair of CRIRES science team)

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a high resolution near-IR spectrograph for the E-ELT

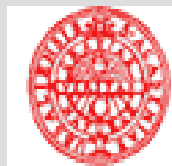


# SIMPLE, the study:

## milestones:

- kick-off of study: Oct. 30<sup>th</sup> 2008
- mid-term review: April 1<sup>st</sup> 2009 passed with few actions

**AB**  
<http://www.bo.astro.it>



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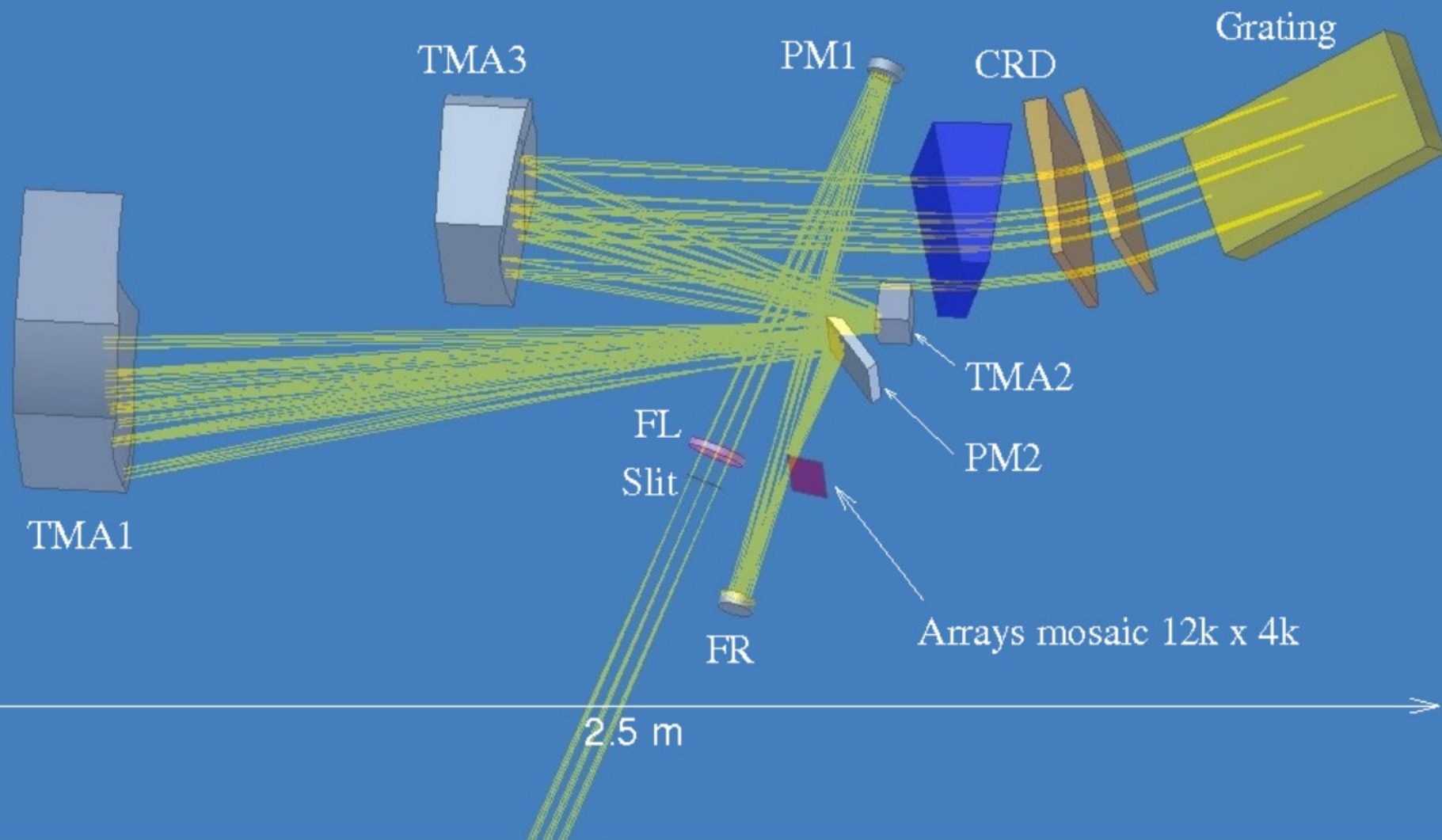


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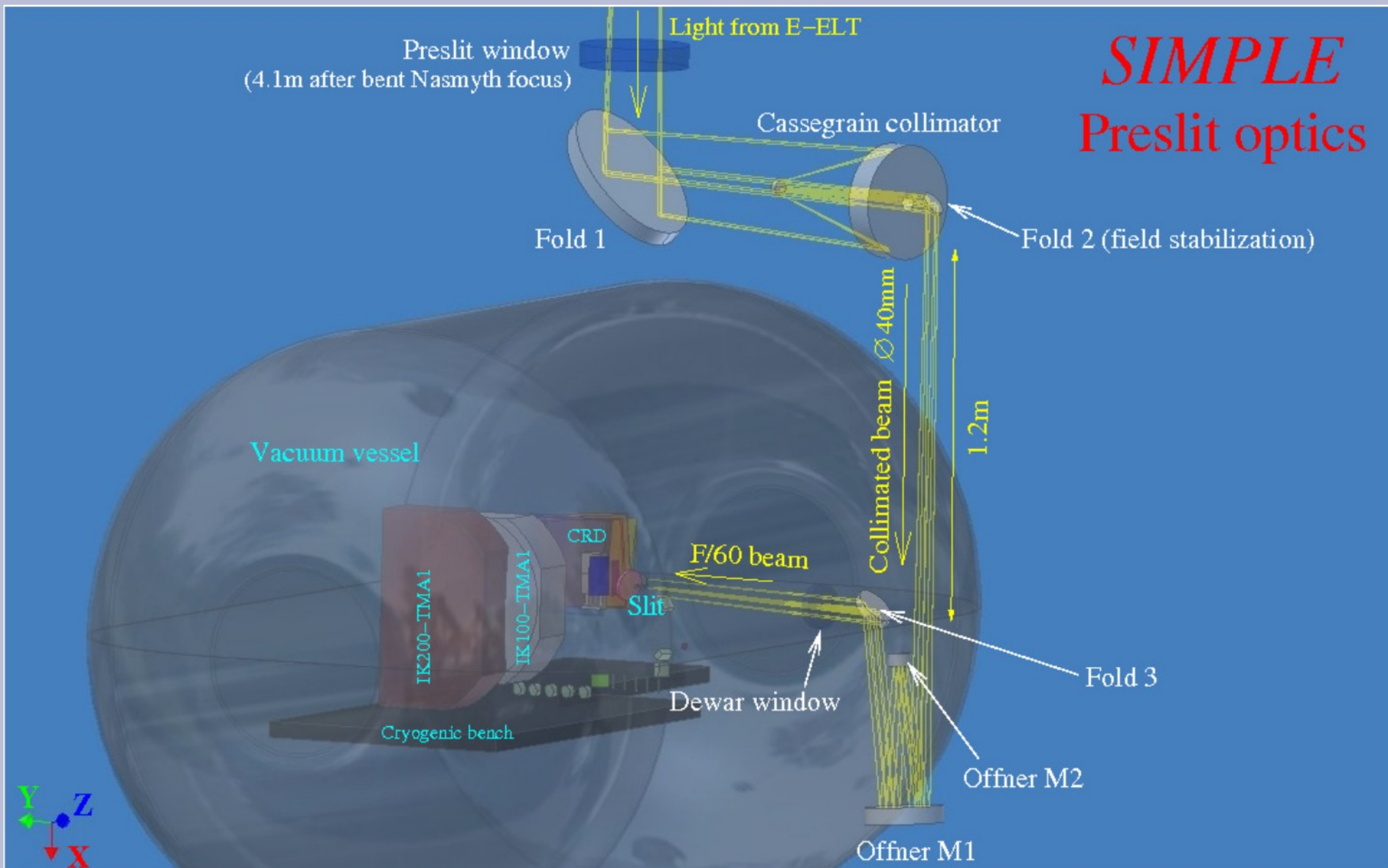
# SIMPLE IK200



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# *SIMPLE* Preslit optics



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## science report summary

- absorption spectroscopy of occulting exo-planets
- exo-planet RV studies for red / obscured objects
- “holy grail”: *finding an Earth like planet in the habitable zone around an M-dwarf*
- circumstellar disks 'imaging', composition & dynamics
- cool star chemistry up to the SMC/LMC
- magnetic stars
- galactic center radial velocities / general relativity
- stellar clusters, local and far
- Lyman  $\alpha$  systems at high  $z$
- GRBs and intergalactic medium approaching reionization
- .....



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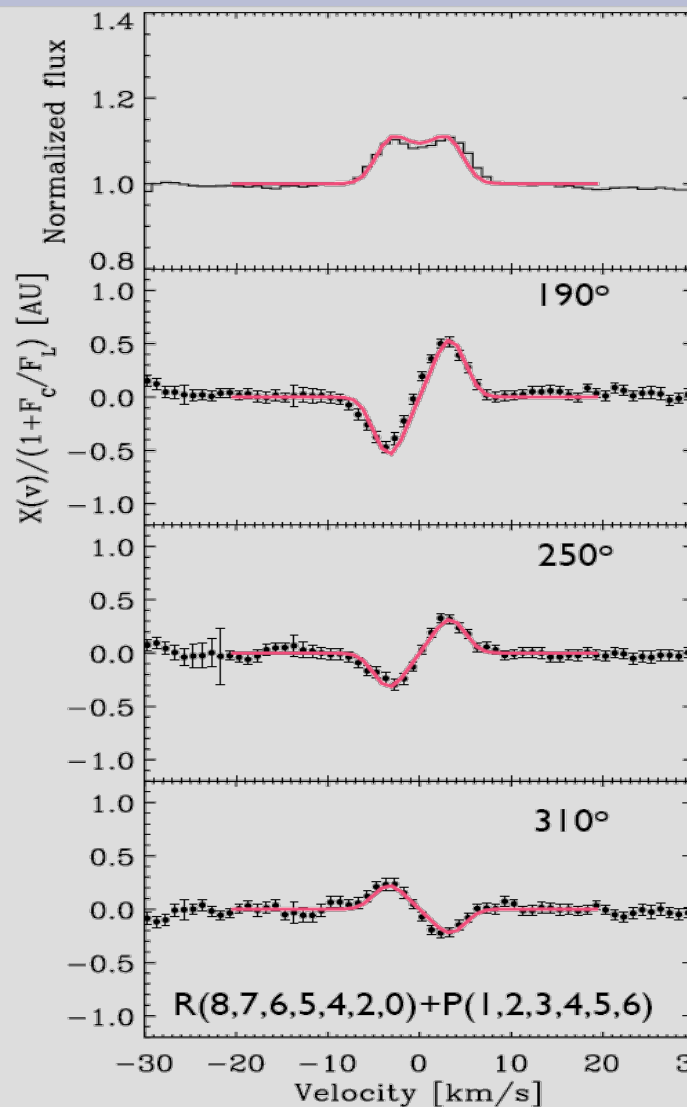
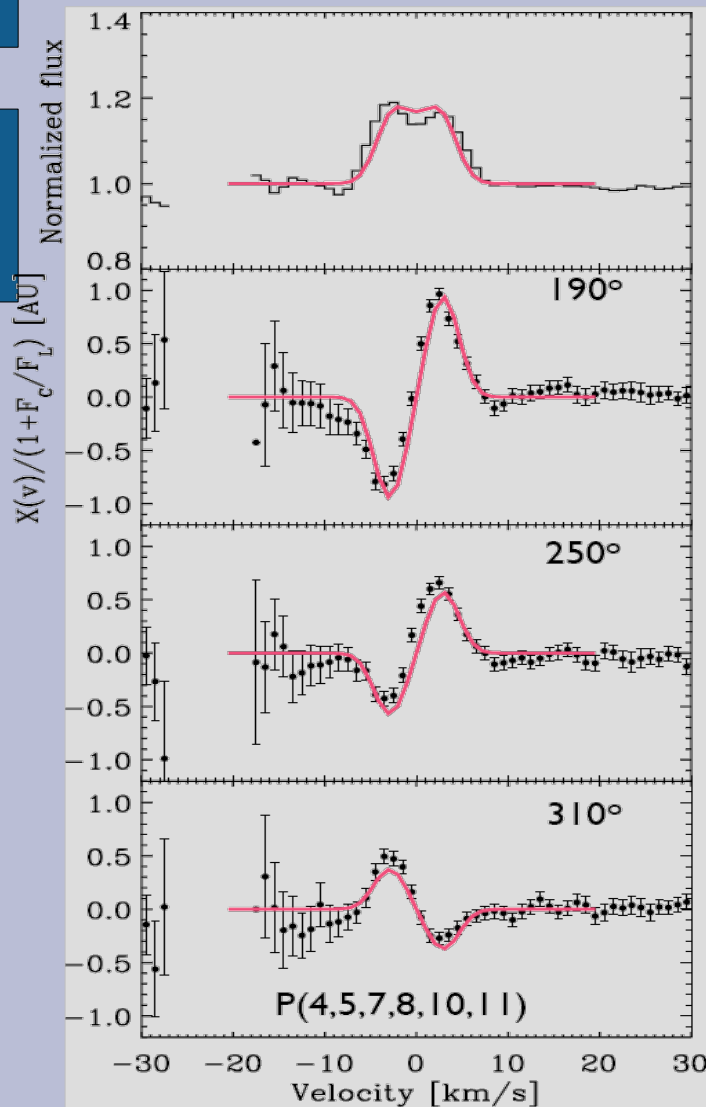
a high resolution near-IR spectrograph for the E-ELT



# SIMPLE, spectroastrometry:

SR21  $v=1-0$

SR21  $v=2-1$



$^{12}\text{CO}$  fundamental band, all rotational lines merged

astrometric signature as a function of Doppler velocity for three slit position angles

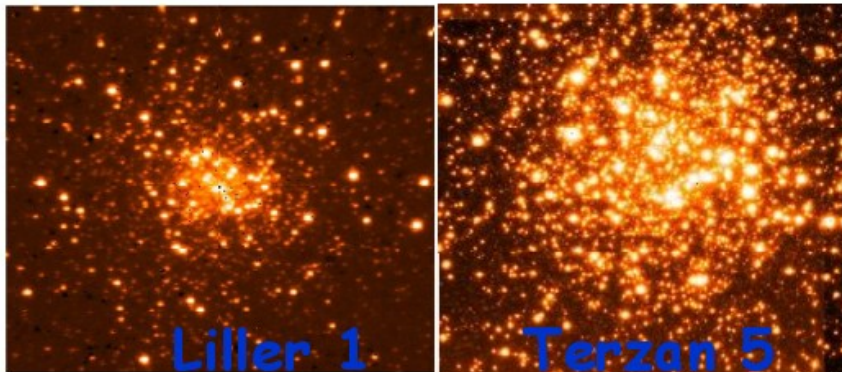
note:  
 spatial resolution  $\sim 0.1$  AU  
 ( $< 1$  mas) !!!!  
 (Pontoppidan et al. ApJ 684, 2008 )  
 @ E-ELT and @  $2\mu\text{m}$ ,  
 $100\mu\text{-arcsecs}$  in reach

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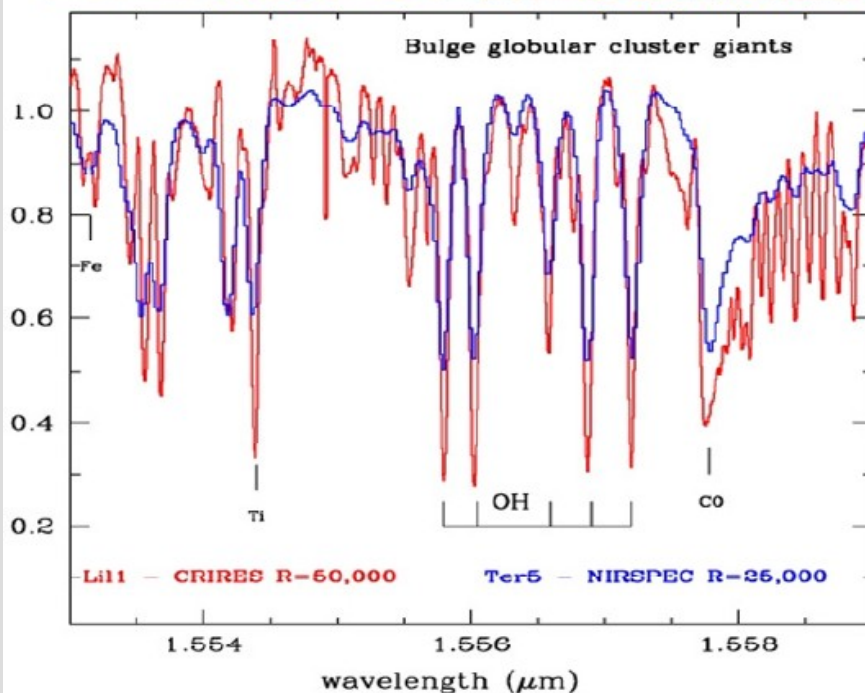


# SIMPLE, GC out to Virgo



## Globular Clusters:

- at least out to Virgo
- chemical composition
- dynamics
- population studies
- more local ones spatially resolved



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# SIMPLE, more science and outlook

- SIMPLE Science Report soon on the web
- integrate SIMPLE in E-ELT exp. time calc.
- study well under way: final report expected on time
  
- Special Session on IR-spectroscopy at IAU Gen. Assy in Aug. 2009:
  - <http://www.astronomy2009.com.br/scientific.html>
  - <http://www.eso.org/sci/meetings/iau2009-sps1/>



the end

# simple

# a high resolution near-IR spectrograph for the E-ELT



	exo-planet atmosphere	Exo-planet RVs	CS disks	Cool stars chemistry	magnetic fields	Galactic Center RVs	stellar clusters	Lyman absorber	
<b>λ range req</b>	full	full	λ/100	full	λ/100	H+K	full	full	
<b>λ range goal</b>	full	full	λ/10	full	λ/10	full	full	full	a
<b>R req</b>	>50,000	100,000	100,000	100,000	100,000	>50,000	100,000	>50,000	b
<b>R goal</b>	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	b
<b>sampling (pix)</b>	2	2-3	2-3	2	2	2-3	2	2	c
<b>S/N</b>	>3,000	100	100	30-100	~1000	20	20	20	d
<b>limiting Vega JHK mag</b>	13	15	16	18	13	18	20	20	
<b>DL pixel</b>	no	no	yes	no	no	no	no	no	e
<b>single object</b>	yes	yes	no	yes	yes	yes	yes	yes	
<b>long slit</b>	no	no	yes	no	no	no	no	no	
<b>scrambler</b>	no	yes	no	no	no	optional	no	no	
<b>polarimetry</b>	no	no	optional	no	optional	no	no	no	
<b>calibration</b>	special	special	standard	standard	standard	standard	standard	standard	f,g
<b>exp time optimal</b>	100hr	30min	1hr	2hr	1hr	2hr	2hr	2hr	h
<b>OGS-WFS</b>	yes, IR	yes, IR	yes	no	no	no	no	no	i
<b>NGS-WFS</b>	yes	yes	yes	yes, IR	yes	yes, IR	rarely	rarely	j
<b>LTAO</b>	optional	optional	optional	useful	useful	useful	mandatory	mandatory	