VIMOS and NIRMOS: Status Report

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At its meeting in Milan in October 1996, the STC recommended the procurement of 2 instruments for imaging and massive multi-object spectroscopy, VIMOS and NIRMOS, as conceptually designed by the VIRMOS consortium. The STC further recommended that ESO reduce the overall development time to ensure that these new instruments are competitive, with respect to e.g. DEIMOS on the Keck telescope and GMOS on the Gemini Telescope.

Consortium

The VIRMOS consortium has accepted with enthusiasm the challenge of building these two instruments on a fast track. The consortium is made of French and Italian institutes, and is headed by Laboratoire d'Astronomie Spatiale (LAS), Marseille, France. The other institutes are:

- in France: Observatoire Midi-Pyrénées (OMP, Toulouse) and Observatoire de Haute-Provence (OHP);
- in Italy: Istituto di Fisica Cosmica del CNR and Osservatorio Astronomico di Brera (IFCTR-OABr, Milano), Osservatorio Astronomico di Capodimonte (Napoli) and Istituto di Radioastronomia CNR and Osservatorio Astronomico di Bologna (IRA-OABo, Bologna).

The VIRMOS consortium is led by Olivier Le Fèvre (P.I.), and Paolo Vettolani (Co-P.I.).

Science Objectives

The main objective of these instruments is the study, through massive deep surveys, of the early universe, when it was 10 to 20% of its current age. VIMOS will mostly observe objects of redshifts below 1 and above ~ 3 (when the Lyman discontinuity is redshifted into the B band), whereas NIRMOS will observe objects in the intermediate range of redshifts (for which there is virtually no spectral signature in the visible).

The main science objectives are:

- Evolution of field galaxies (primeval galaxies, galaxy formation and evolution, influence of merging and of environment)
- Evolution of large-scale structure (formation of structures, evolution, clustering, distribution of visible and dark matter)
- Evolution of galaxies in clusters
- Evolution of QSO absorption systems

In addition, these instruments are of high interest for many Galactic programmes, such as:

- Search / study of sub-stellar objects (brown dwarfs)
- Abundances and ages of stars in clusters and obscured regions

Instrument Concept and Capabilities

VIMOS and NIRMOS are four quadrant spectro-imager. Multi-object spec-

	VIMOS	NIRMOS
Field of view	4 × 7′ × 7′	4 × 6′ × 8′
Spectral range	370 –1000 nm	1100 –1800 nm (J & H)
Spectral resolutions	200 & 2000	2500
Multiplex gain	800 @ R = 300, 170 @ R = 2500	170
Detection limit range in spectroscopy:	V = 24–25	J = 21–22
Detectors	4 × 2k × 4k CCDs	4 × 2k × 2k IR arrays
Integral Field Unit (~ 5000 fibres)	1′ × 1′ / 0.8″ sampling, R = 200 30″ × 30″ / 0.8″ sampling, R = 2000 30″ × 30″ / 0.4″ sampling, R = 200 15″× 15″ / 0.4″ sampling, R = 2000	TBD

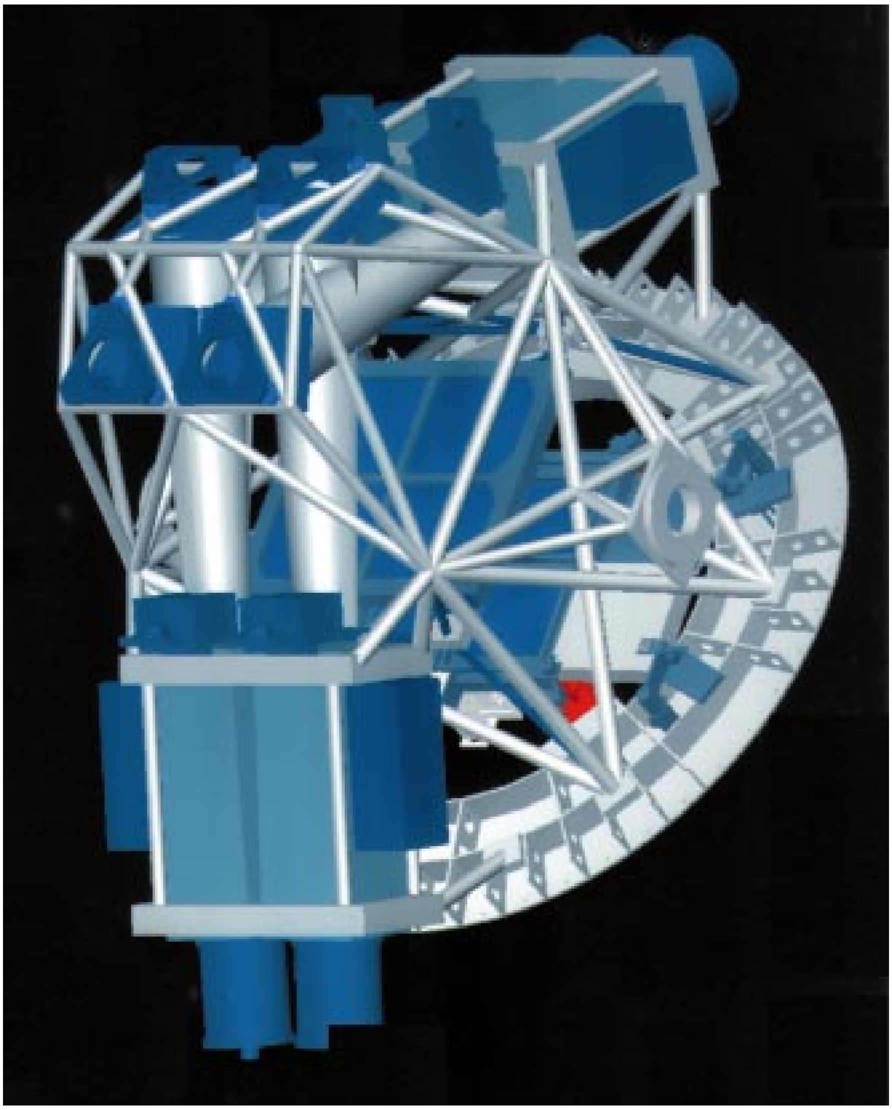
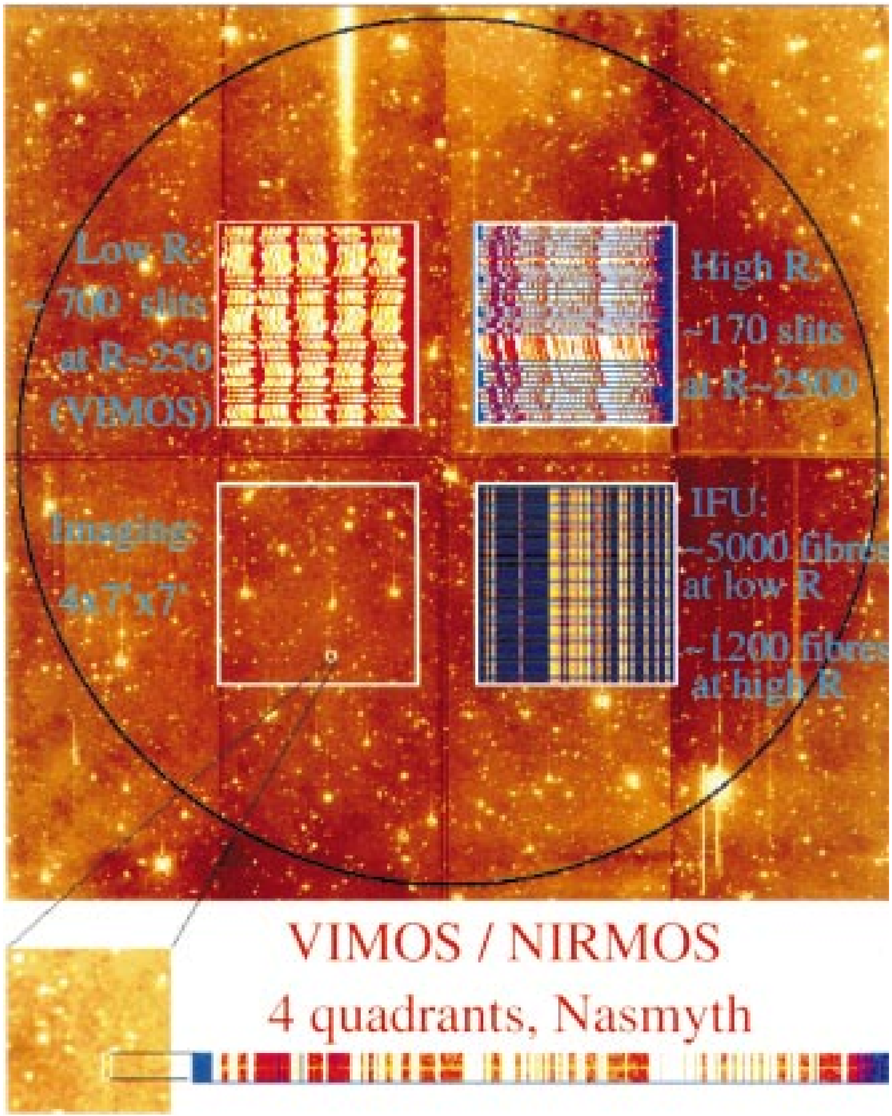


Figure 1: Preliminary VIMOS optomechanical layout. The four cameras, two on each side are clearly visible. The telescope focal plane is corrected and split in four quadrants. Four collimators provide images of the telescope pupil, after folding by flat mirrors, at the entrance of the cameras where the filter exchange units are (in blue on the figure at the entrance side of the four cameras). On the top of the four cameras are the grism exchange units. (Figure courtesy D. Mancini.) ▶

Figure 2: Illustration of the VIMOS and NIRMOS capabilities. The circle represents the Nasmyth field of view. The four squares are the instrument fields of view of the four channels. The four modes are represented: Imaging, low-resolution spectroscopy (VIMOS only), high-resolution spectroscopy, Integral Field Spectroscopy (tbd on NIRMOS). (Background image: courtesy Y. Mellier.) ▶



troscopy is achieved with masks, and the two instruments are complemented by the MMU (Mask Manufacturing Unit), to be located in the VLT buildings. Masks are inserted in cabinets holding up to 15 masks. The cabinets are manually installed in the instruments during daytime. VIMOS has in addition an Integral Field Unit providing contiguous low resolution spectroscopy with fibres in a field of view up to 1 arcmin × 1 arcmin.

Figure 1 shows the opto-mechanical layout of VIMOS.

In the IR (NIRMOS), only medium-resolution spectroscopy will be provided, as this is the most efficient way of observing faint targets between the OH sky emission lines.

VIMOS will reach very high multiplex gains at low spectral resolution, while NIRMOS will be a genuinely unique instrument world-wide.

Figure 2 illustrates the instrument capabilities.

Status

The contract between ESO and the VIRMOS consortium was signed in August 1997. The Preliminary Design Review of VIMOS and of the Mask Manufacturing Unit (MMU) took place in November. The Final Design Review will take place in July 1998.

The planning is the following:

Instrument	UT	Preliminary Acceptance in Chile
VIMOS & MMU	#3	May 2000
NIRMOS	#4	April 2001

Under discussion at the time of writing are the choice for the Mask Manufacturing Unit (milling machine or laser), and the material of the Focal Plane Corrector for NIRMOS.

ESO is responsible for the development and procurement of the four CCD cryostats of VIMOS, and of the 4 IR cryostats of NIRMOS. For VIMOS, continuous-flow cryostats with rotating feed-through are under consideration. For NIRMOS, it is expected to use 2k × 2k IR arrays currently under development at Rockwell. ESO is participating in the development contract, and expects to receive the first science grade array by the end of 1999.

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VISIR at PDR

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In 1995, we were reporting in this journal about the phase A study of VISIR, the VLT Imager and Spectrometer for the mid InfraRed [1]. Since then, the status of the instrument has evolved a lot. In November 1996, the contract to build VISIR was signed [2]. VISIR is built by a French-Dutch consortium of institutes led by the Service d’Astrophysique (SAp) of Commissariat à l’Energie Atomique (CEA, Saclay, France). The Dutch partner is the Netherlands Foundation for Research in Astronomy (NFRA, Dwingeloo, the Netherlands). Other contributing institutes are the Institut d’Astrophysique Spatiale (Orsay, France) and the Netherlands Foundation for Space Research (SRON, Gro-