THE VVDS PROJECT: CLOSING UP AND LESSONS LEARNED

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The name and the director of an institute can change,
the people and the projects remain

FIRST CONCEPTION

ESO Workshop on science with the VLT

June 28-July 1 1994

NIRMOS: A WIDE FIELD NEAR-IR MULTISLIT IMAGING-SPECTROGRAPH FOR THE VLT

O. Le Fèvre[1], P. Felenbok[1], F. Hammer[1], L. Tresse[1], B. Delabre[2], P. Vettolani[3], Y. Mellier[4], J.P. Picat[4], S.J. Lilly[5]

WFIS: A WIDE FIELD VISUAL MULTISLIT IMAGING SPECTROGRAPH FOR THE VLT

G. Vettolani[3], F. Delabre[2], O. Le Fevre[3], F. Hammer[3], G. Zamorani[4]

We would like, however, to stress another point which is worth mentioning. *Whilst studies as the ones above described have been the major driving force for building 8 meter class telescopes, in the present instrumentation plan of VLT there is almost no room for this kind of work. Not to build an instrument like the one here proposed, or a more clever one but with the same tools, means to throw out European research from the field of observational cosmology.*

A science driven instrument, with a precise scientific goal

Existing redshift surveys (1994)

- **0<z<0.3**
  - Several thousands of galaxy redshifts (2dF, ESP, LCRS). SLOAN planned
- **0.3<z<1.5**
  - Few thousands of galaxy redshifts (CFRS, CNOC at lower z)
- **z~3-4**
  - Few hundreds of galaxies (Steidel et al.) pre-selected (Ly-break)
- **z>4**
  - Few tens of galaxies, Ly-break or Lyα emission

Next step: explore the universe at z>0.3, big volumes, high number of galaxies

« next generarion »
Deep Redshift Surveys

- *Galaxy properties: luminosity, color, environment*
- *And their evolution: several redshift intervals*
- *Minimize cosmic variance: several independent fields*
- *At least 50 galaxies per measurement*

– **LF: 50 × 10 × 3 × 3 × 4 × 7 = 126000 galaxies**

per bin mag.bin colors env. fields time steps

- **Previous Samples: ~10^3 galaxies**

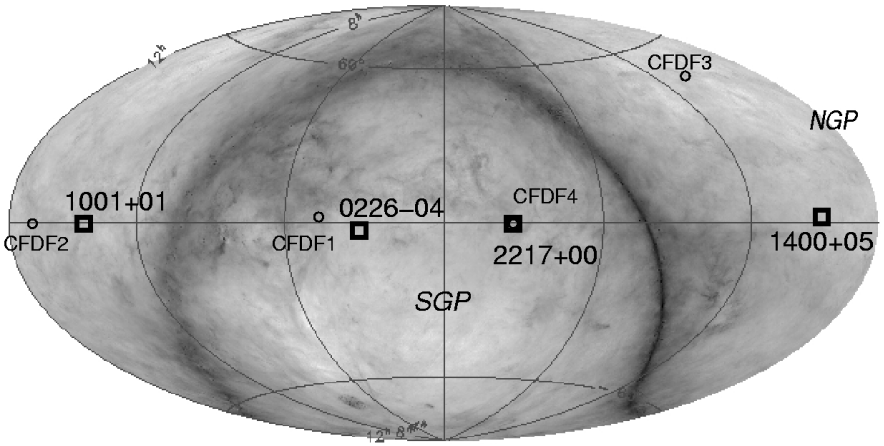
VVDS Strategy

100000 redshifts 0<z<5+

- *Magnitude selected sample*
  - *Complete census of galaxy population at all epochs*
  - *Simple selection function, bias under control*
  - *Drawback: stellar contamination, most galaxies at 0.5<z<1.5,*

DEEP: 17.5≤IAB≤24, 1.2 deg²

WIDE: 17.5≤IAB≤22.5, 10deg²

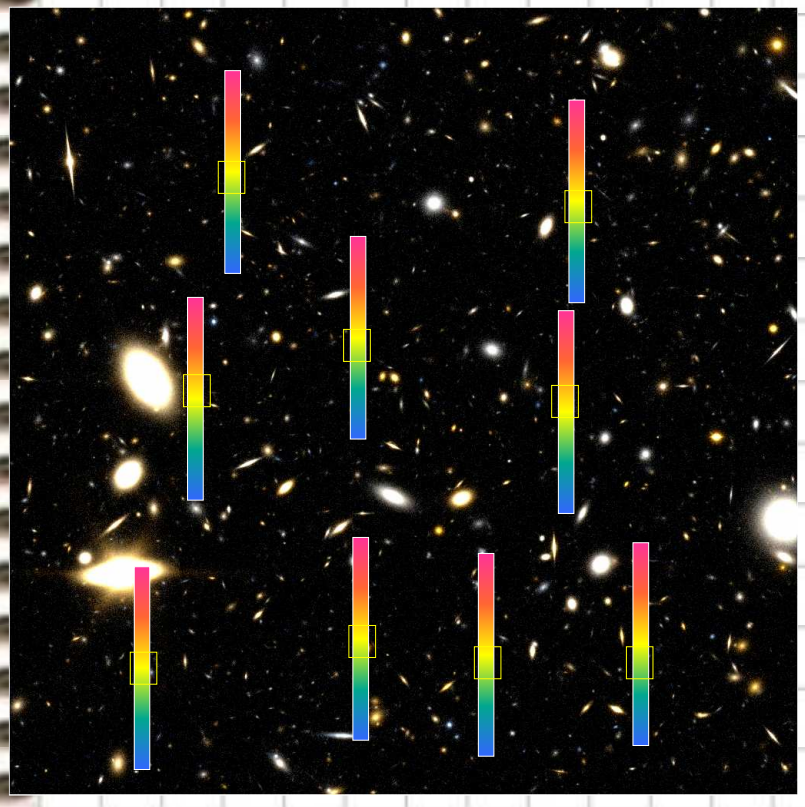


- *Minimize cosmic variance*
  - *N fields, 2x2 deg² each, ~100Mpc @z~1*

5 fields

- 0230-04
- 1000+03 (Now the COSMOS field)
- 1400+05
- 2217+00
- CDFS

How to make a survey



- Multicolor Imaging

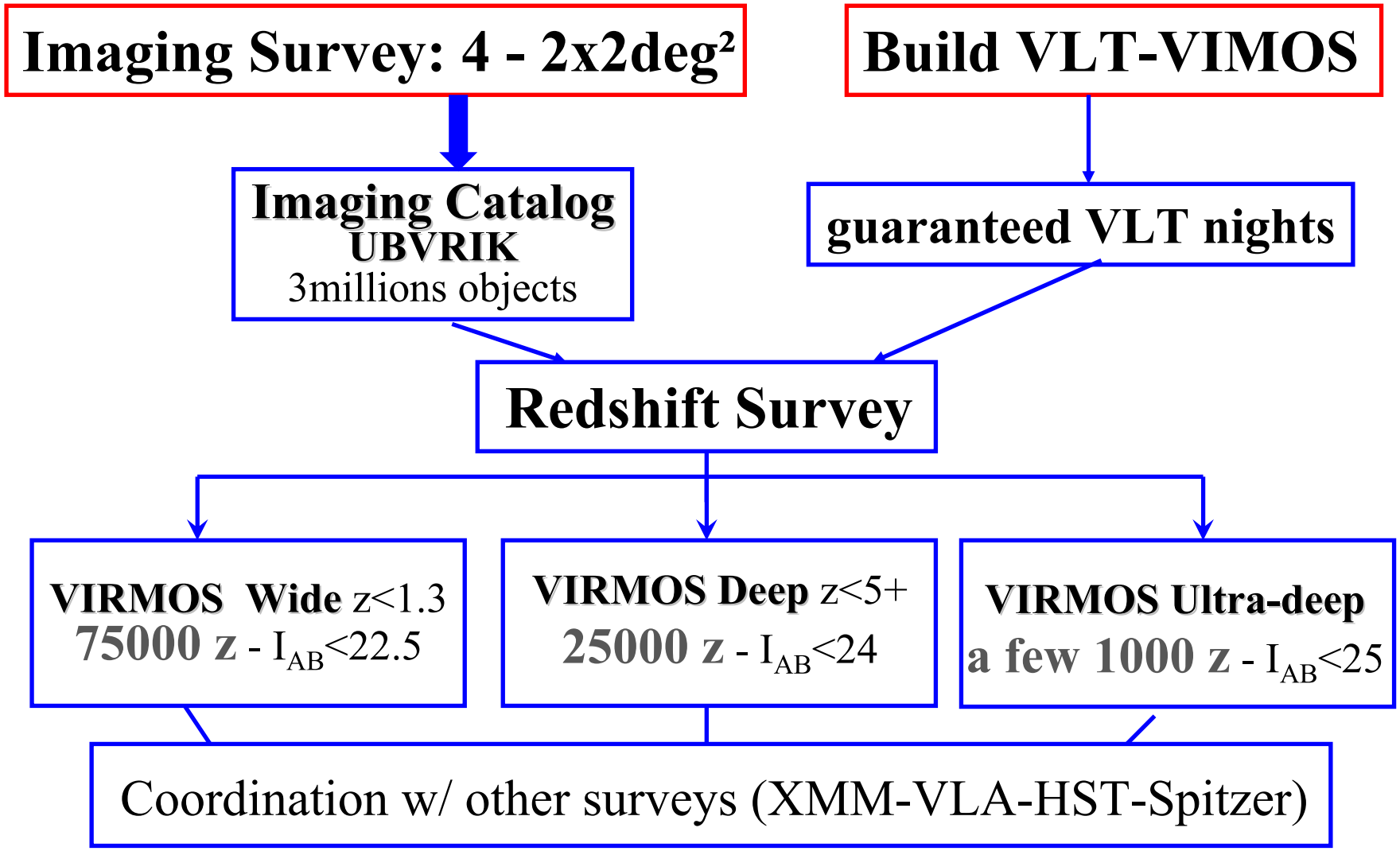
  Magnitudes, colors, Morphologies, environmental density

- Sample selection
  - color, magnitude, etc.

- Multi-object Spectroscopy
  - Redshift
  - Line ratios
  - Mass
  - Star Formation Rate

Need for an efficient Multi Object Spectrograph

CFHTLS did not exist! MOS did not exist



VIMOS @ VLT
Multi Object Spectrograph

- Conceived for big surveys
- Large FOV: 224arcmin^2
- High multiplexing: 600-800 slits
- Spectral resolution R~200-5000
- Multi-Object Imaging-Spectrograph **ESO-VLT**
  - Visible, 0.37-1 microns: **VIMOS (UT3)** 2kx4k CCDs
  - NIR, 1-1.6 microns: NIRMOS

START & PLAN

Phase A: June 1995-june 1996, competition with australian led consortium

Contract signature: August 1997

VIMOS and NIRMOS: Status Report

J.-G. CUBY and R. GILMOZZI, ESO

The Messenger, vol. 91, p. 16-17, 03/1998

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.

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

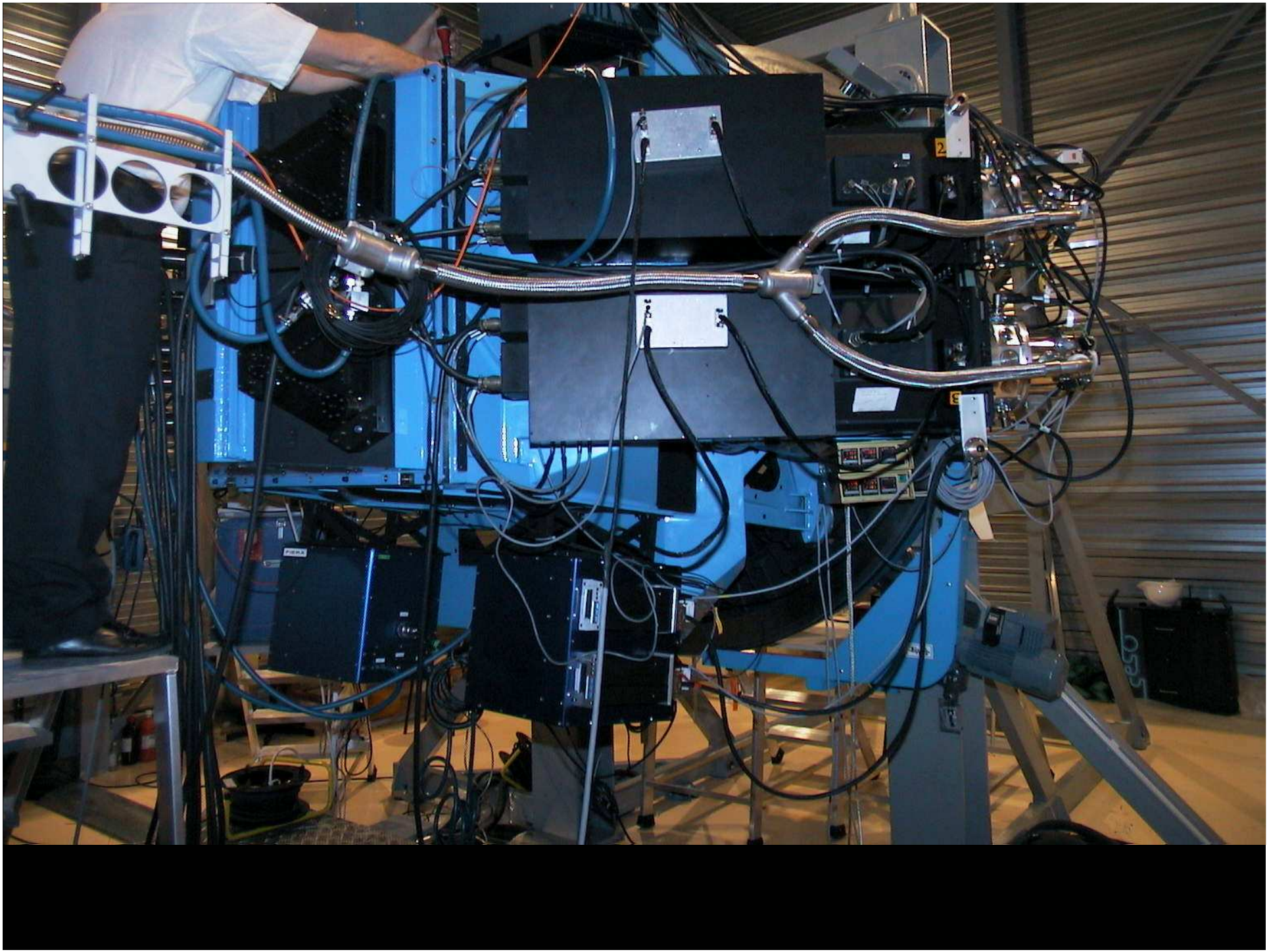
VIRMOS CONSORTIUM

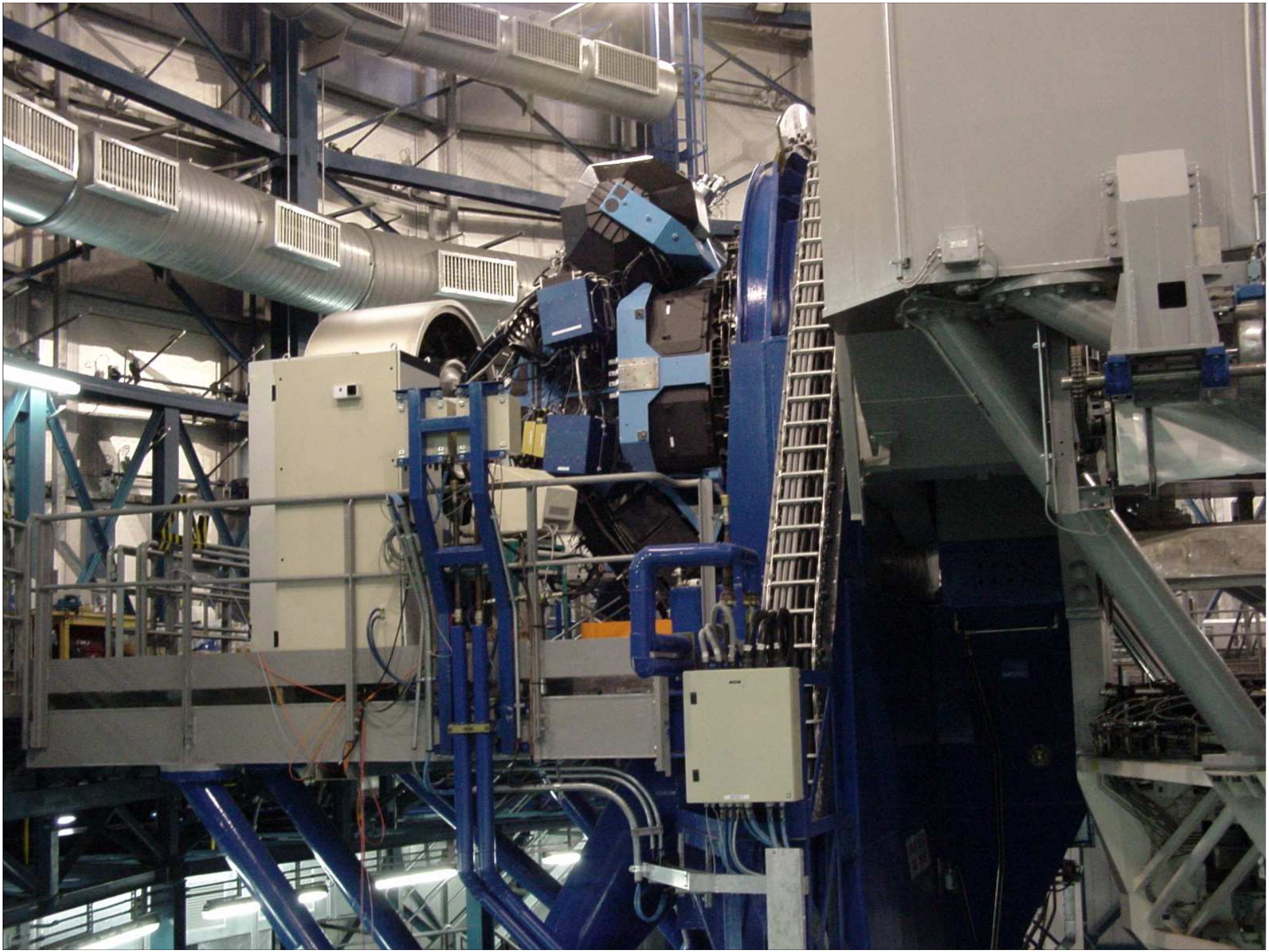
- *PI: Le Fevre (LAM-Marseille)*
- *CO-PI: Vettolani (IRA-Bo)*
- *Participants*
  - *OAMP: Project Office & optics*
  - *OA Capodimonte: Mechanics & electronics*
  - *OA Brera: filters & grisms*
  - *IASF-Mi: MMU & s/w activities coordination*
  - *IRA Bologna: observataion s/w*
  - *OA Bologna: DRS*
  - *OAMP: Instrument control s/w*
  - *OHP: Integration facility*
  - *Detectors provided by ESO*
- *For a total of 66 persons (6 women)*

CONSTRUCTION MILESTONES

- *Phase A: June 1995-june 1996,*
- *Contract signature: August 1997*
- *Preliminary Design Review: July 1998: ON TIME*
- *Final design review: November 1999: ON TIME*
- *Technical first light: May 2000*
- *August 2000: MMU operational at Paranal ON TIME*
- *December 2001: VIMOS leaves OHP for Paranal : 1.5 years late*
- *February 2002 FIRST LIGHT*
- *September 2002: end of commissioning*
- *2003, VIMOS offered to the community for P71 April-September 2003*

NIRMOS dropped
GTO cut by 2



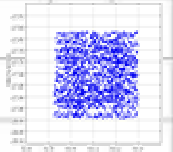


VVDS SAMPLE

Le Fevre et al. 2005, Garilli et al. 2008

- *I<=24 1.0 sq. deg., 2 fields, 0<z<5, 40%sampling, 7000 secure gals, evolution*
- *I<= 22.5 9 sq. deg., 5 fields, 0<z<1.2, 20%sampling, 20000 gals, massive gals properties*

CDFS



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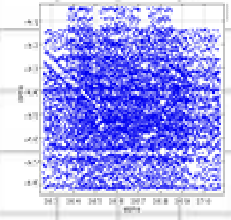

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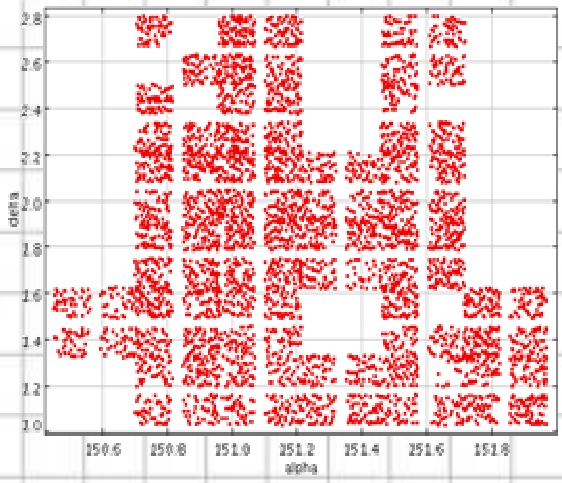

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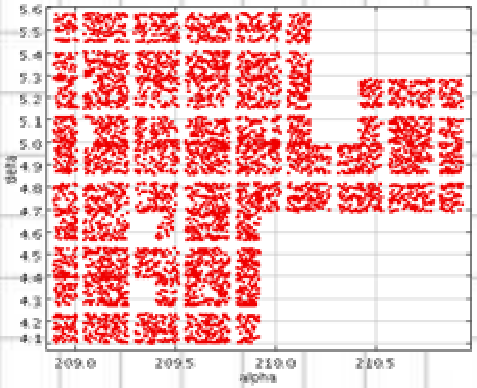

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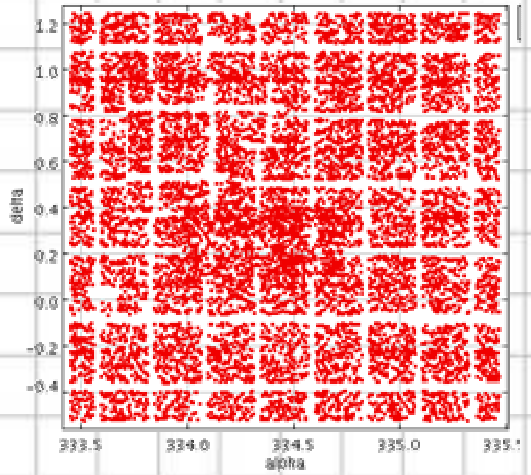

- *49390 redshifts*
- *35875 galaxies*
- *27727 target galaxies, secure (>75%) redshift*
- *455 BL AGNs*

AND NOW?

VVDS has been declared "closed"

Data publicly available at http://cencosw.oamp.fr/

redshift, flags and spectra for 50000 galaxies

Original plan, 1996	*Accomplished 2009*
• *broad redshift range (0 < z < 5)*	*YES*
• *over sixteen square degrees of the sky*	*10 deg²*
• *four separate fields. ……*	*YES*
• *100,000 spectroscopic redshifts.*	*50000*
• *75,000 redshifts for sources up to AB = 22.5.*	*40000*
• *25,000 redshifts for objects up to AB = 24*	*10000*
• *1,000 redshifts for objects up to AB = 26*	*NO*

A number of interesting scientific results
51 papers, ,2 Nature papers
<13> citations/paper/year
>2000 citations

Still a valid idea, infact…

"AFTER VVDS" PROGRAMS

4 ESO LP approved in the last 4 years

name	PI	All. time	# of galaxies	Area deg^2	Mag (I_{AB})	z range	sampling	Main scope
zCosmos Bright	Lilly	600	20000	1.7	22.5	0.2-1.2	70%	LSS, Environment
zCosmos Deep			10000	1	25 (B_{AB})	1.2-3.0	70% *	Galaxy evolution at med z
UltraDeep	LeFevre	147	1500	0.17	22.5-24.75	1.4-5.0	15%	Galaxy evolution at high z
Vipers	Guzzo	423	80000	24 2 fields	22.5	0.5-1.2	50% *	LSS, cosmological parameters
UltraDeep Large	LeFevre	648	12000	1 3 fields	23-25	2.5-6.7	90% *	Galaxy evolution at high z

And many more around the world: AEGIS, BOSS, WiggleZ, etc

* *Involves pre-selection on color-color diagrams (CFHTLS data)*

Does participation to a large collaboration pay back?

- Drawbacks
  - Service work
  - Internal competition to lead a topic
  - Pressure to get the job done
  - Papers signed by >50 people
- Advantages
  - Sign all project papers
  - several team meetings: opportunity to
    - discuss work within a familiar yet attentive audience
    - Learn on many topics
    - know and be known by several people
    - practise english and presentations
  - Higher chances to participate to large cosmological surveys
- 16 PhD thesis on VVDS
  - 11 PhD students got a post-doc on surveys
- 25 post docs working on VVDS:
  - 12 got a permanent position (3 former phD students), possibly a few more in the future

SUMMARY

Well done

- A powerful spectrograph
- Reduction and analysis tools
- Innovative and comprehensive approach to data handling
- Strong scientific driver
- Fair number of publications
- Interesting and innovative results
- A number of follow-up/complementary projects (5 LP)
- The group stayed for 15 years, >100 people involved
- Excellent opportunities for students/post-docs
- A "real equal opportunity" project 31% women

Could do better

- NIRMOS cancelled
- DataBase management not always to the point
- Data dissemination can be improved
- Citation number could be better
- "slow" publication process
- Some people have not been sufficiently motivated
- Data set not fully exploited

GO AND USE THEM!!!

A VERY SUCCESSFUL PROJECT, A WONDERFUL EXPERIENCE

OPTIMOS-DIORAMAS:
A VISIBLE-NIR IMAGER MULTIOBJECT SPECTROGRAPH FOR THE E-ELT