The VLT Interferometer

Getting Ready to Observe!

VLTI Tutorial, 20 November 2001

From your idea to your paper in 4 steps

???

Choose an instrument!

Instrument Overview - VINCI

VINCI

(ESO, France)

Paranal: January 2001

K-band, 2-beam

Visibility Accuracy: 0.1% (so far in commissioning with SID)

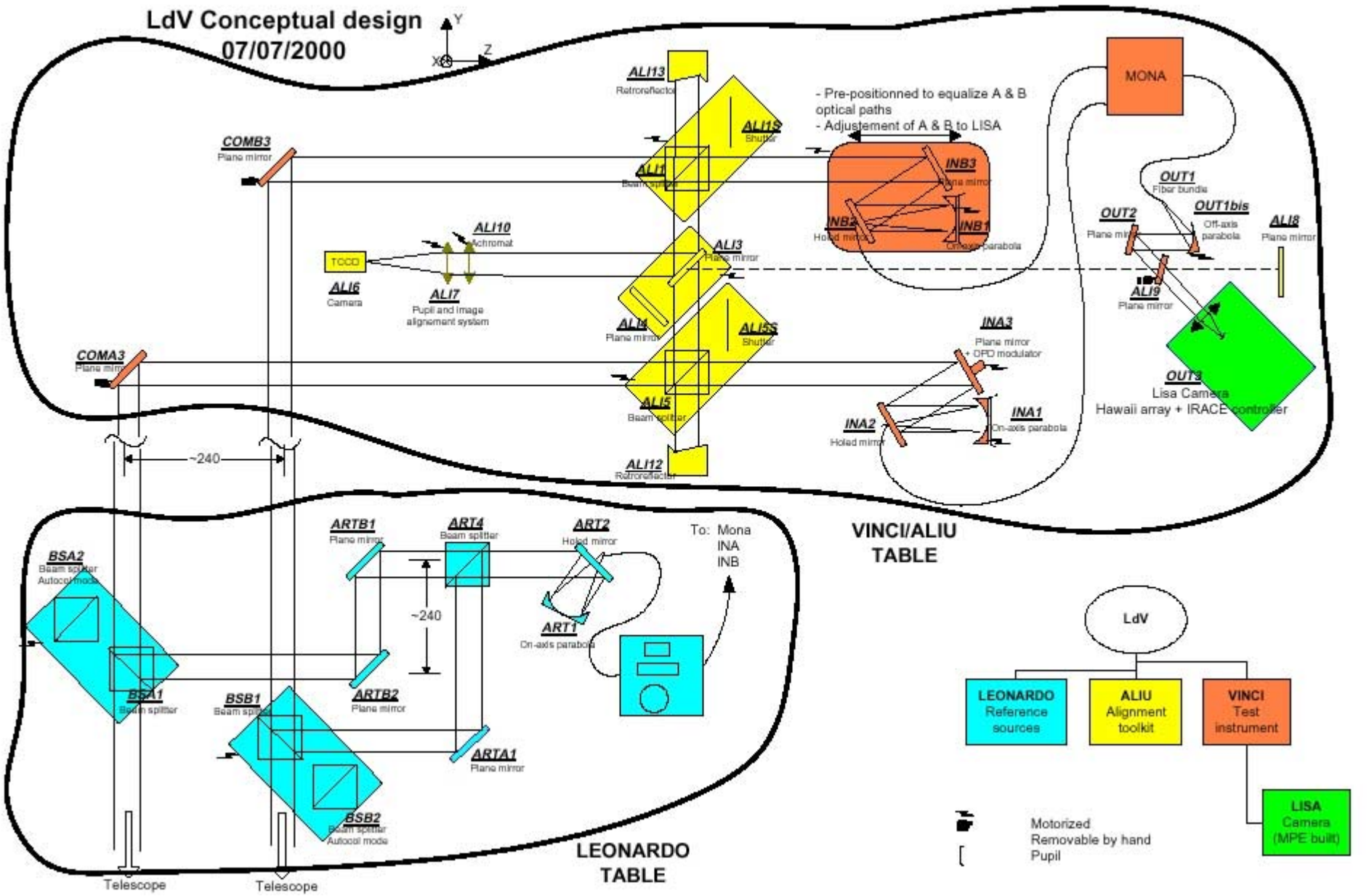
0.01% (goal)

Limiting Magnitude: goal K=6 with SID, K=11 on UT without FT

First Fringes with Siderostats achieved March 2001

First Fringes with UTs achieved October 29, 2001

Main purpose: commissioning, test instrument


LdV Conceptual design
07/07/2000
Y
X
Z
ALI13
Retroreflector
ALI1S
Shutter
ALI1
Beam splitter
COMB3
Plane mirror
- Pre-positionned to equalize A & B optical paths
- Adjustement of A & B to LISA
INB3
Plane mirror
INB2
Holed mirror
INB1
Off-axis parabola
MONA
OUT1
Fiber bundle
OUT1bis
Off-axis parabola
OUT2
Plane mirror
ALI8
Plane mirror
ALI10
Achromat
TCCD
ALI6
Camera
ALI7
Pupil and image alignement system
ALI3
Plane mirror
ALI9
Plane mirror
ALI4
Plane mirror
ALI5S
Shutter
INA3
Plane mirror + OPD modulator
COMA3
Plane mirror
ALI5
Beam splitter
INA1
On-axis parabola
INA2
Holed mirror
OUT3
Lisa Camera
Hawaii array + IRACE controller
ALI12
Retroreflector
~240
VINCI/ALIU TABLE
ARTB1
Plane mirror
ART4
Beam splitter
ART2
Holed mirror
To: Mona
INA
INB
BSA2
Beam splitter
Autocol mode
~240
ART1
On-axis parabola
BSA1
Beam splitter
BSB1
Beam splitter
ARTB2
Plane mirror
ARTA1
Plane mirror
BSB2
Beam splitter
Autocol mode
Telescope
Telescope
LEONARDO TABLE
LdV
LEONARDO
Reference sources
ALIU
Alignment toolkit
VINCI
Test instrument
LISA
Camera
(MPE built)
Motorized
Removable by hand
Pupil

Instrument Overview - MIDI

MIDI

[D/F/NL; PI: Heidelberg]

Paranal: July 2002

First Fringes with UTs: October 2002

Mid IR instrument (10–20 μm) , 2-beam, Spectral Resolution: 30-260

Limiting Magnitude N ~ 4 (1.0Jy, UT with tip/tilt, no fringe-tracker) (0.8 AT)

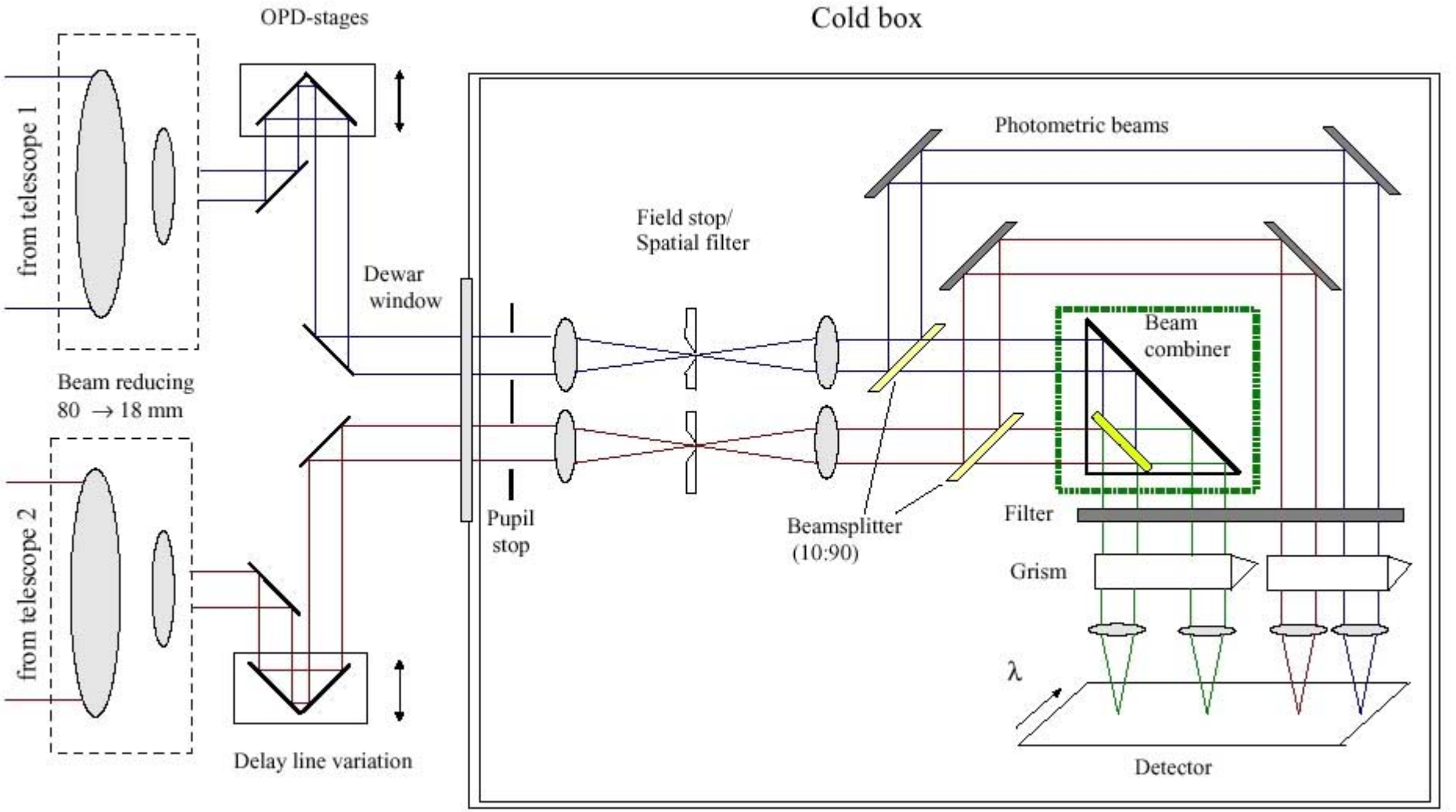
N ~ 9 (10mJ, with fringe-tracker) (5.8 AT)

Visibility Accuracy 1%-5%

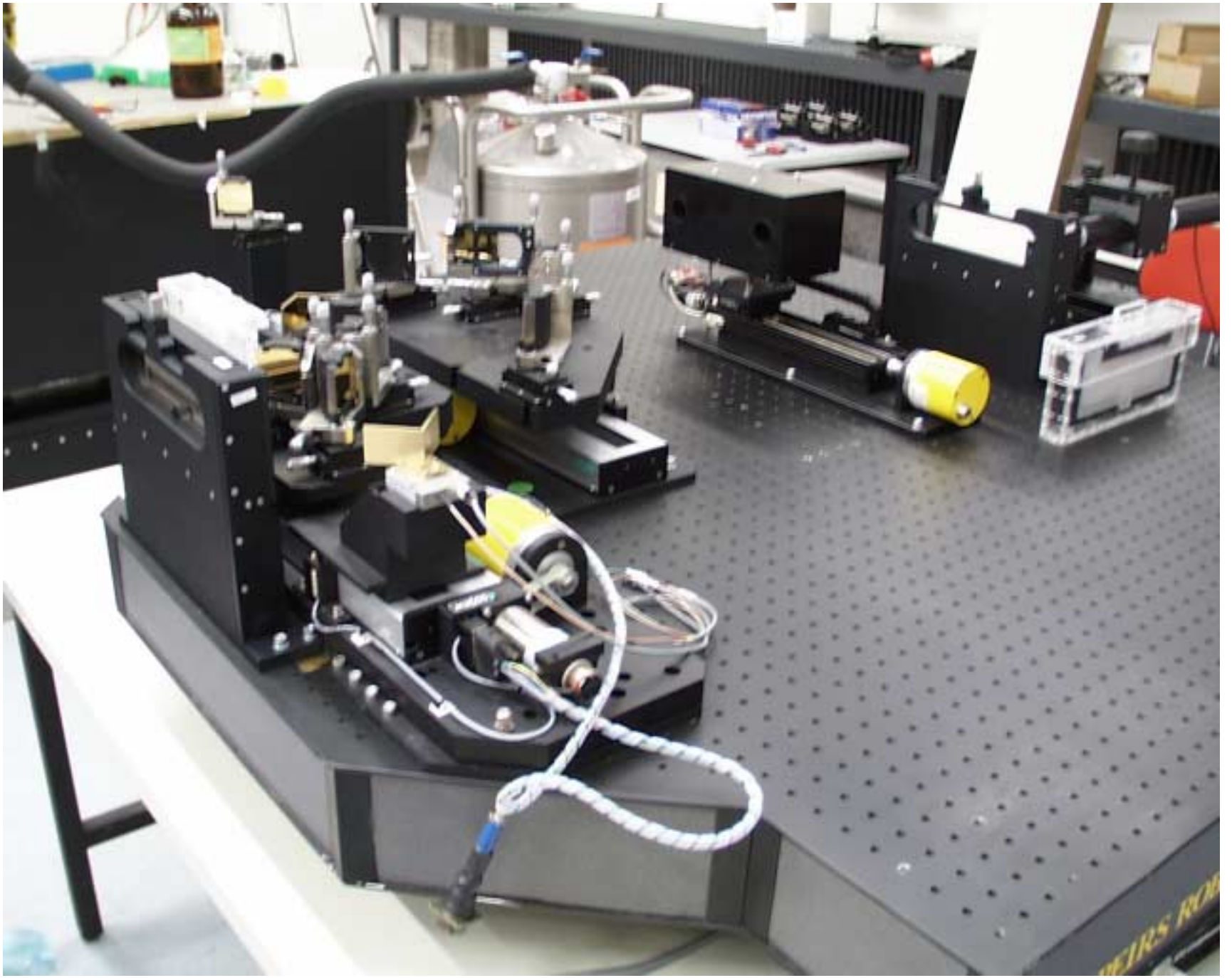
Airy Disk 0.26” (UT), 1.14” (AT)

Diffraction Limit [200m] 0.01”

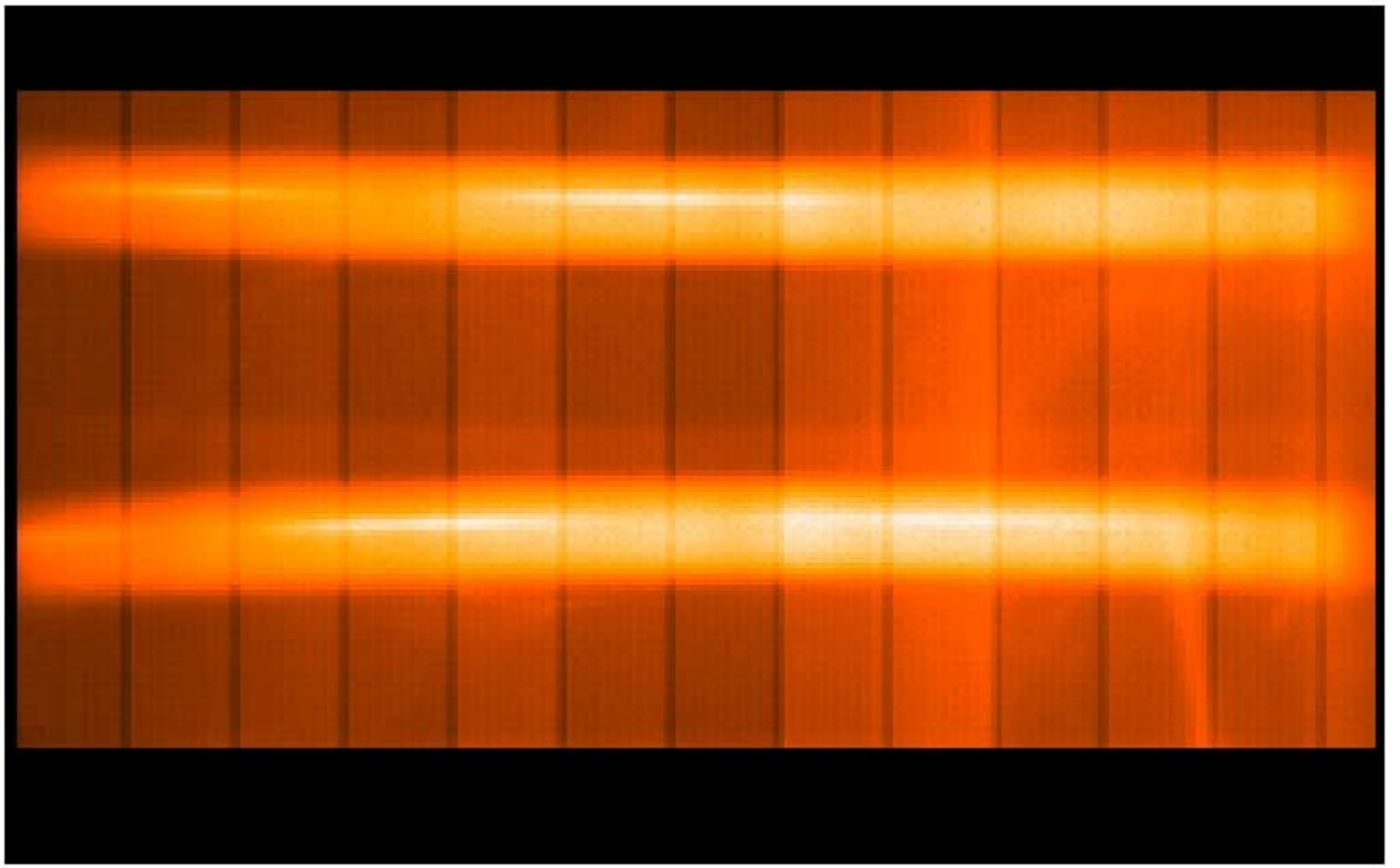
MIDI scheme


OPD-stages
Cold box
from telescope 1
from telescope 2
Beam reducing
80 → 18 mm
Dewar window
Field stop/
Spatial filter
Photometric beams
Beam combiner
Pupil stop
Beamsplitter
(10:90)
Filter
Grism
λ
Detector
Delay line variation


SPEERS ROBERTSON
Newport



MIDI: first fringes in the lab



7.5 μm

13.0 μm

MIDI: first fringes movies

- undispersed fringes

- dispersed fringes
- dispersed fringes (small step)

AMBER overview

AMBER

[F/D/I; PI: Nice]

Paranal: January 2003

First Fringes with UTs (AO): July 2003

Near IR Instrument (1–2.5 μm) , 3-beam combination (closure phase)

Spectral dispersion: ~35, ~1000, ~10000

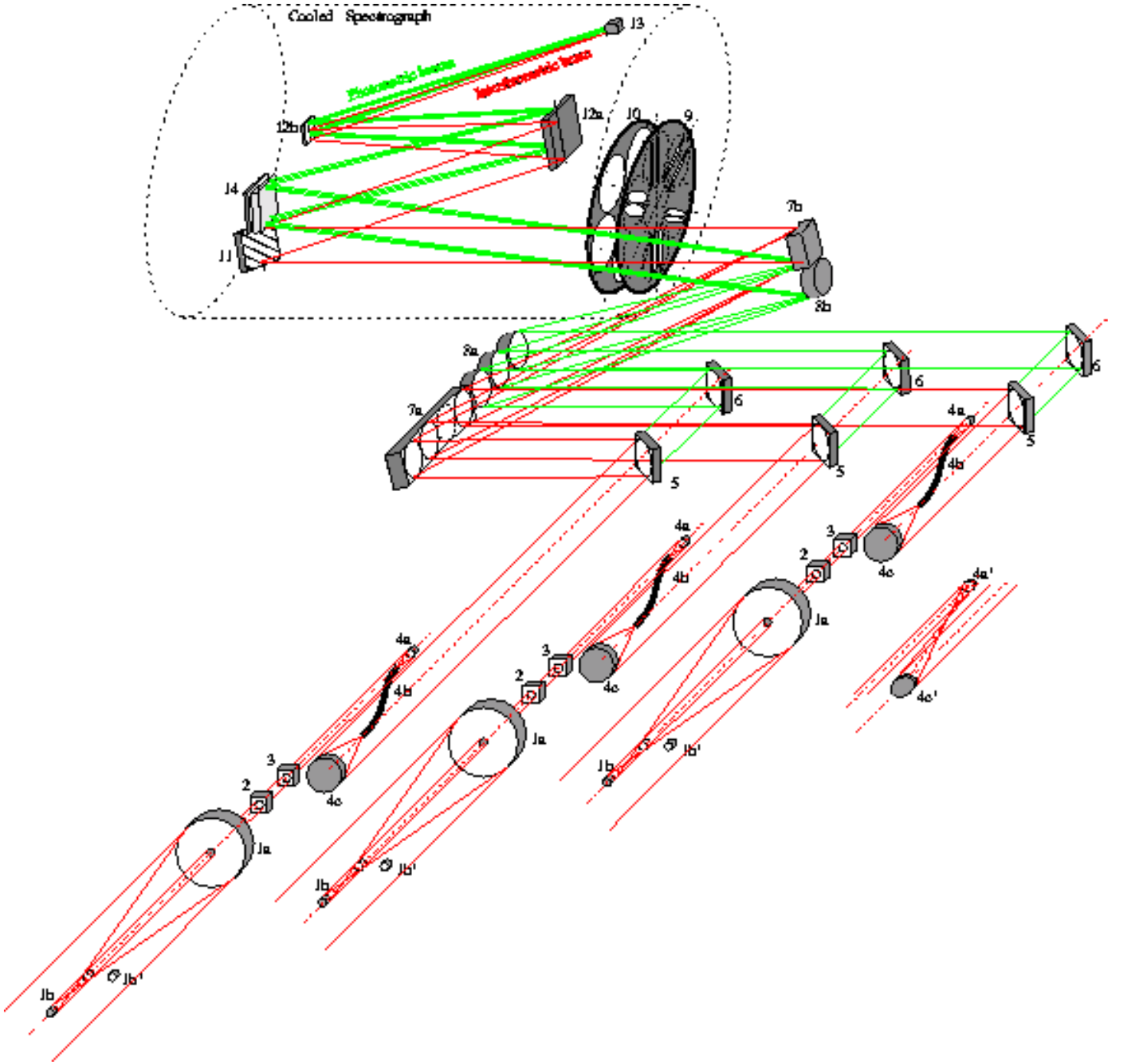
Limiting Magnitude K =11 (specification, 5σ, 100ms self-tracking)

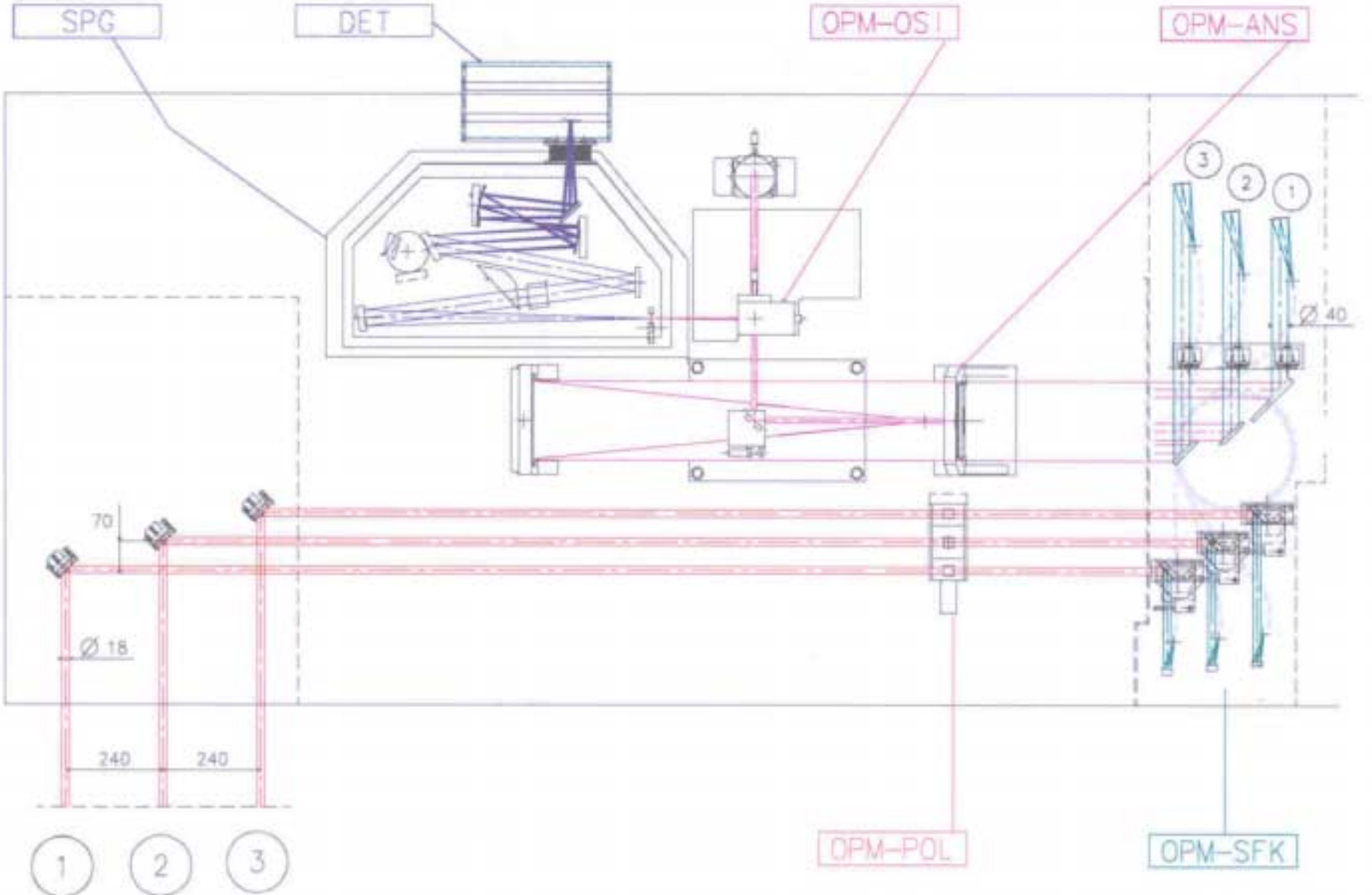
J=19.5, H=20.2, K=20 (goal, FT, AO, PRIMA, 4 hours)

Visibility Accuracy 1% (specification), 0.01% (goal)

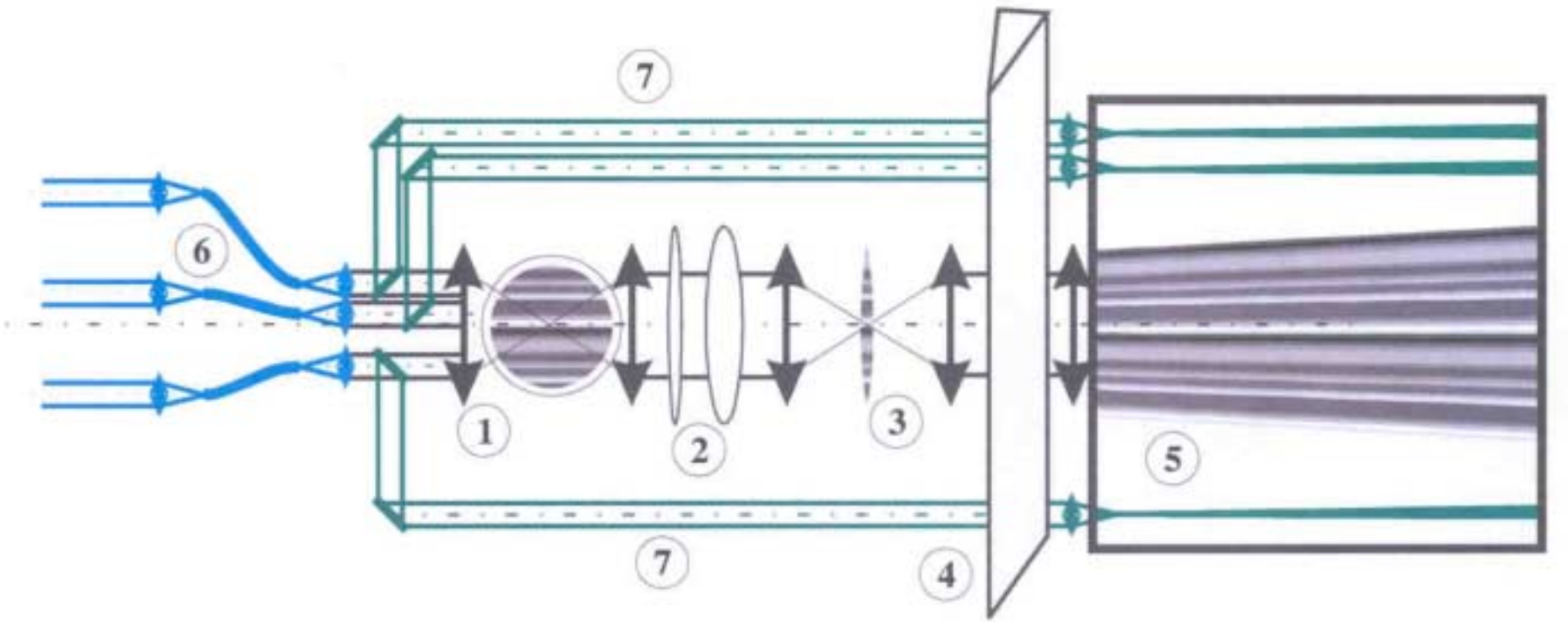
Airy Disk 0.03”/0.06” (UT), 0.14”/0.25” (AT) [J/K band respectively]

Diffraction Limit [200m] 0.001” J, 0.002” K


Cooled Spectrograph
13
Polarimetric beam
Non-Polarimetric beam
12b
12a
10
9
14
11
7b
8b
8a
7a
6
5
4a
4b
4c
3
2
1a
1b
1b'
4a'
4c'


SPG
DET
OPM-OSI
OPM-ANS
3
2
1
Ø 40
70
Ø 16
240
240
1
2
3
OPM-POL
OPM-SFK

AMBER beam combination



Phased Implementation Plan

Date	Instrument	Tel.	Subsystem	What you can do
Today	VINCI (K-band, 2 beams)	SID (UT)	STRAP	Commissioning
2002/07	MIDI (MIR, 2 beams)	(SID) UT		Earliest Call for Proposals October 2002
2002/09			FINITO Fringe Tracker, 3 beams	Extend limiting mag of MIDI & AMBER
2003/02	AMBER (NIR, 3 beams)	SID (UT)		Earliest Call for Proposals April 2003
2003/xx		AT1, AT2		Dedicated to Interf.
2003/07			MACAO UT2, UT4	Use AMBER with 2 UTs
2003/yy		AT3		Closure phases
2004/03			MACAO UT1	Use AMBER with 3 UTs
2004/07			MACAO UT4	
TBD		more ATs ?	PRIMA?	PRIMA?

From your idea to your paper in 4 steps

- ???
- Choose an instrument!
- Write a proposal!

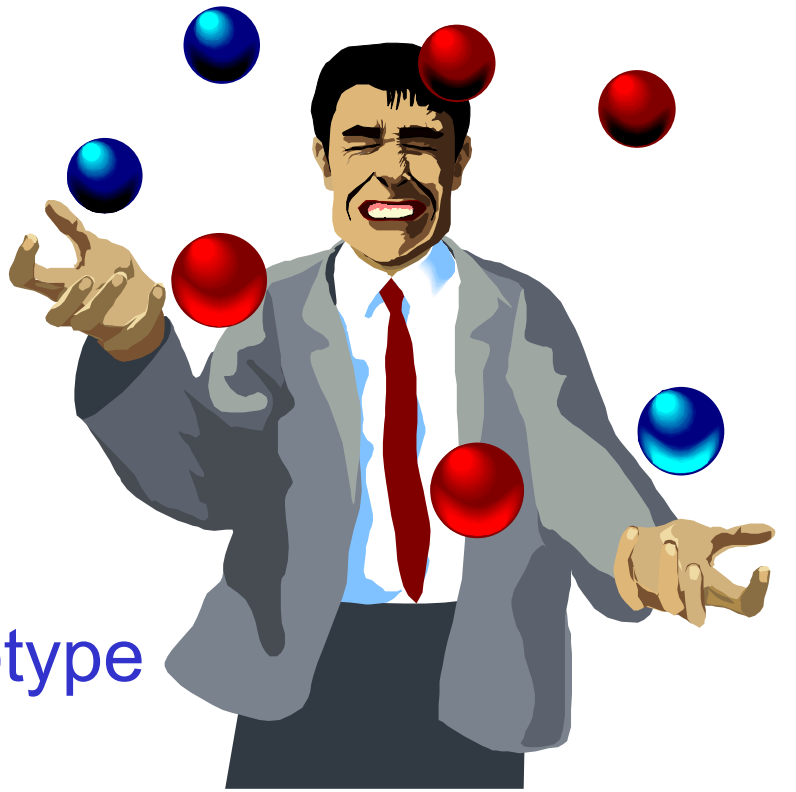
Idiosyncrasies of interferometry

- two telescopes do not point as one
- night shadows on Paranal
- left is right, up is down, 30 = 435 = 254 = 10!
- magnitudes are not magnitudes
- integration time and Earth rotation
- living in Fourier space
- always shoot in the right spot
- calibrate, calibrate, calibrate

astronomer

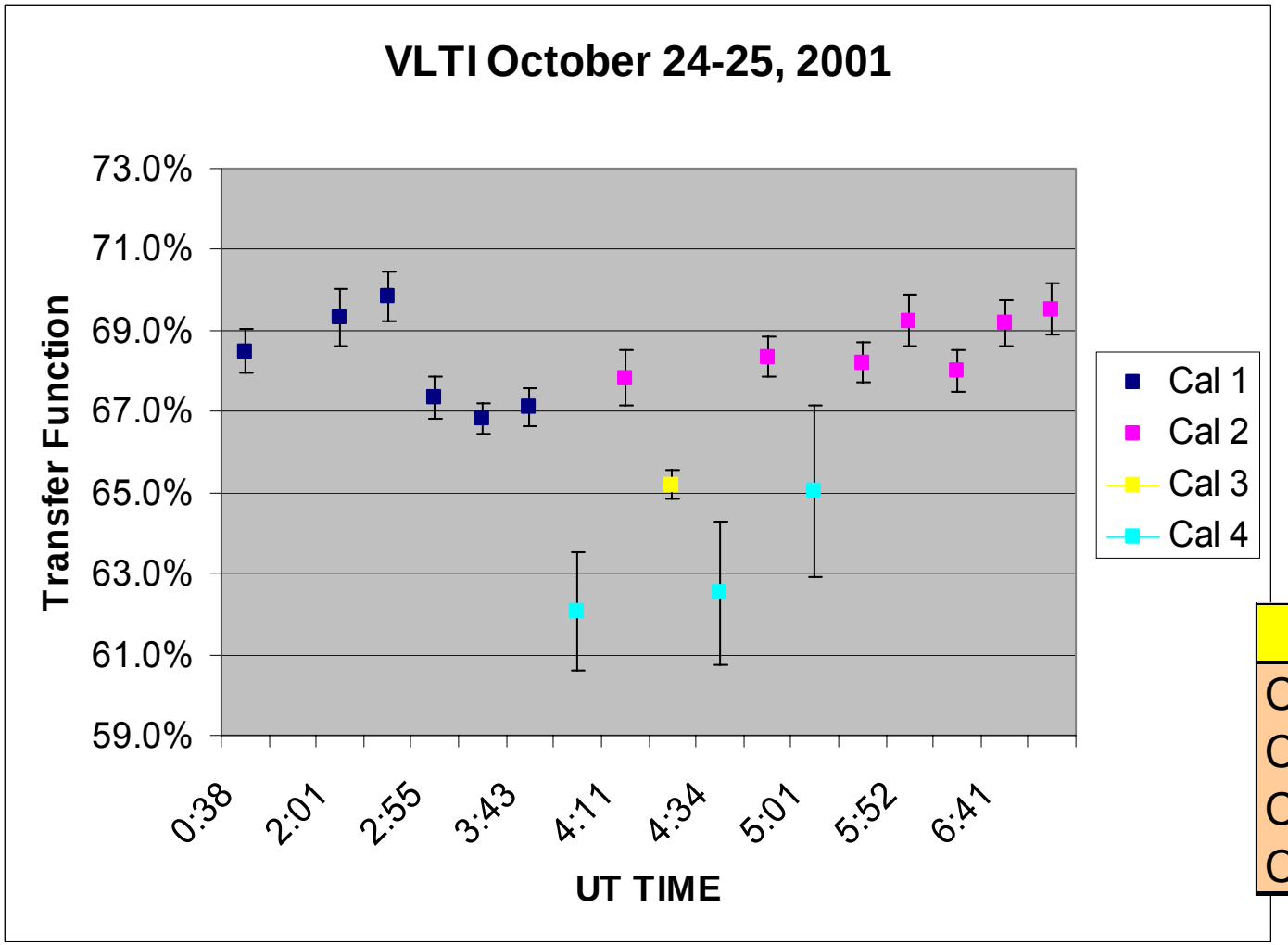
"A ~~leader~~ will not surrender, until surrender is academic" (FGTH)

VLTI preparation tools - Demo



- choosing an object
  - the VLTI simulator - prototype
    - choosing a calibrator

Calibrators!



$V_{m,1} = \alpha V_{o,1}$

$V_{m,2} = \alpha V_{o,2}$

α=transfer f.

Aver.	**67.3%**	**2.3%**
Cal 1 w.m	**67.7%**	**0.2%**
Cal 2 w.m.	**68.6%**	**0.2%**
Cal 3	**65.2%**	**0.4%**
Cal 4 w.m.	**62.8%**	**1.0%**

From your idea to your paper in 4 steps

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- Choose an instrument!
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- Go and observe!

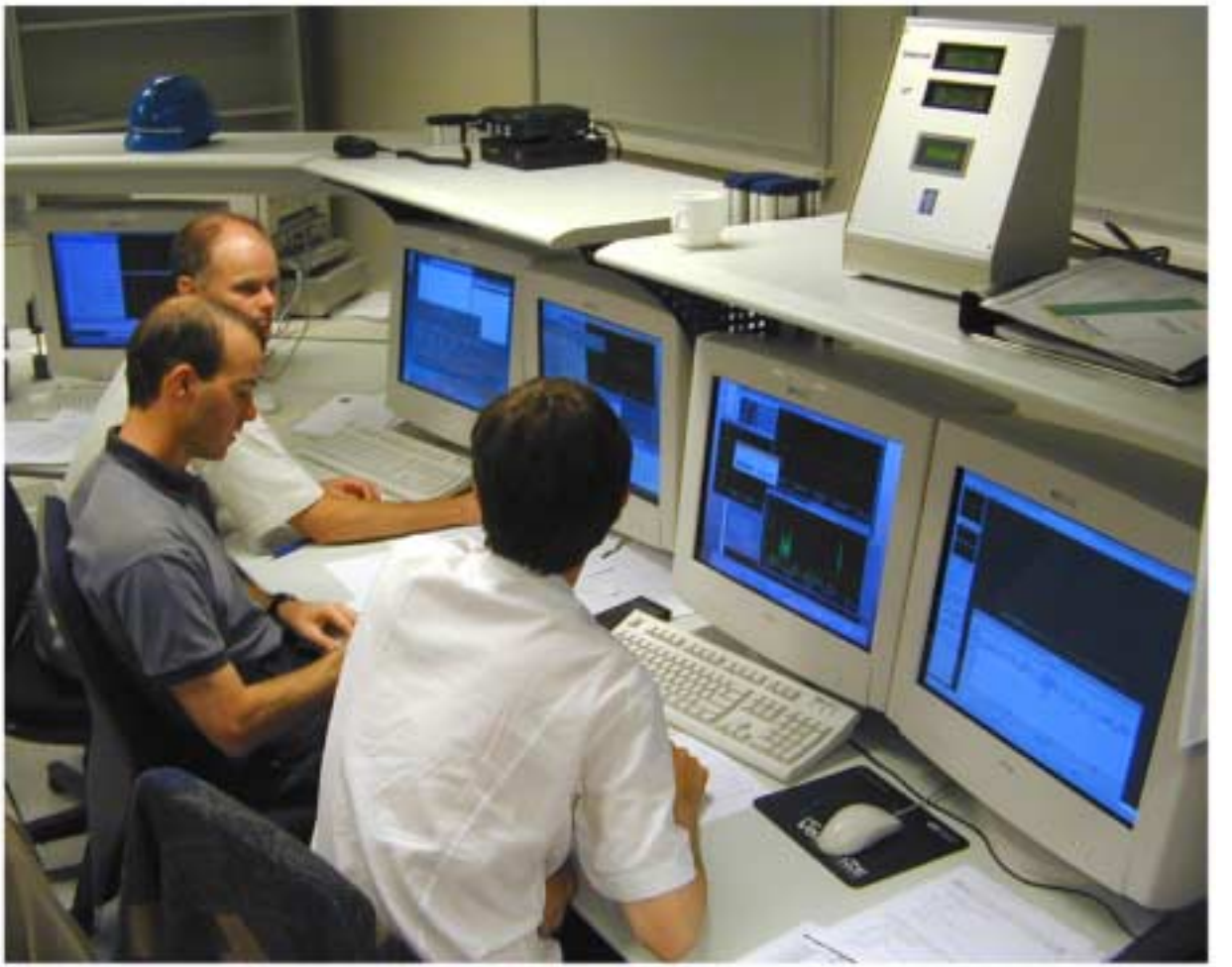
Observing at the VLTI

Celebrating VLTI 'First Fringes'

ESO PR Photo 10b/01 (18 March 2001)

The VLTI control room

- TO
- OB/BOB
- Archive
- Pipeline



The VLTI Control Consoles

ESO PR Photo 10l/01 (18 March 2001)

From your idea to your paper in 4 steps

- The VLTI is necessary for your science!
- Choose an instrument!
- Write a proposal!
- Go and observe!

Fringes on the WEB

ESO VLTI:

http://www.hq.eso.org/projects/vlti/

AMBER:

http://buz.obs-nice.fr/amber/

MIDI:

http://www.mpia-hd.mpg.de/MIDI/

This presentation:

http://www.eso.org/~arichich/download/vltitutorial/