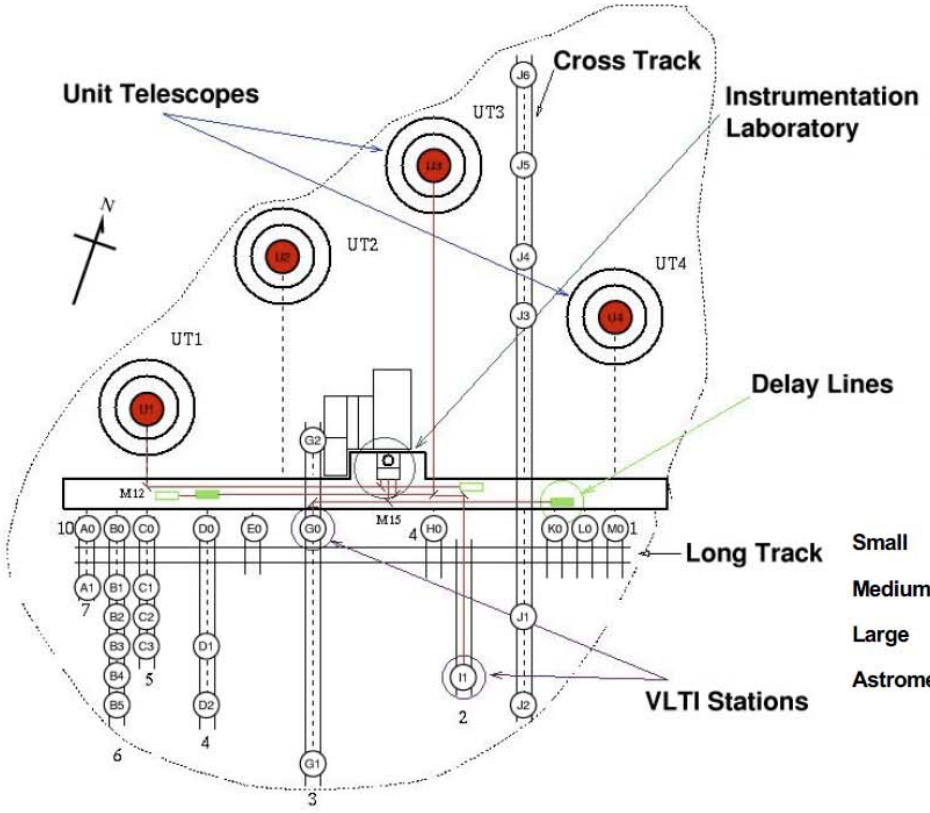
An update on VLTI

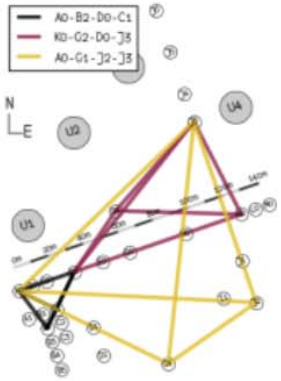
Christian Hummel

(based on slides by F. Gonte and

J. Woillez)

VLTI telescopes



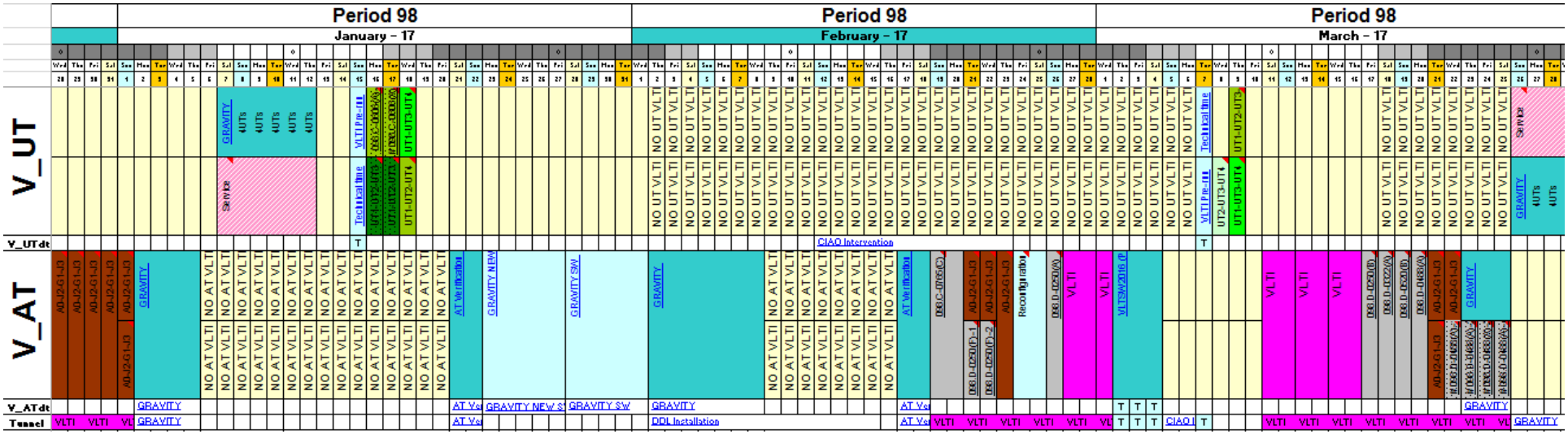


	AT1	AT2	AT3	AT4
Small	A0/DL6	B2/DL5	D0/DL1	C1/DL2
Medium	K0/DL4	G2/DL2	D0/DL1	J3/DL3
Large	A0/DL6	G1/DL5	J2/DL4	J3/DL3
Astrometry	A0/DL1	G1/DL5	J2/DL4	K0/DL3

Operations

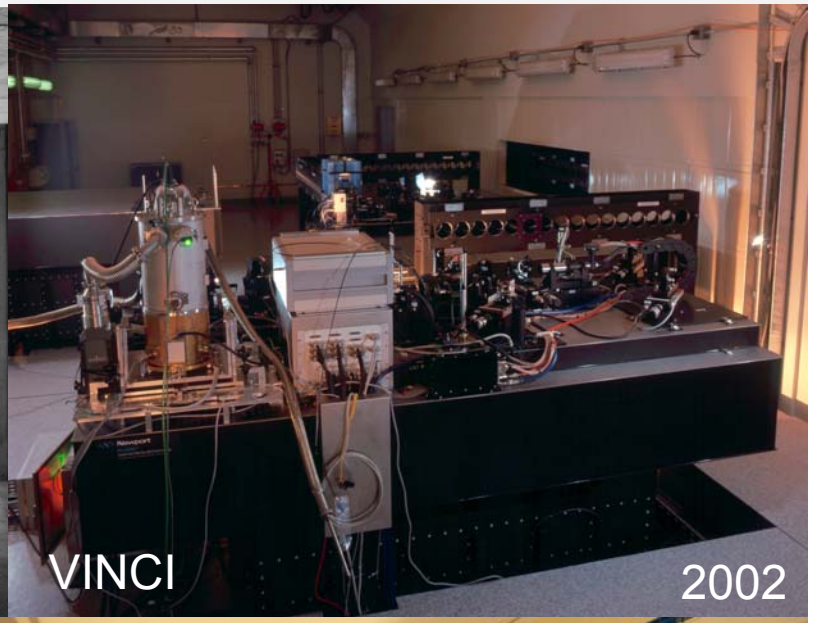
- All operations are done by a team including:
  - One Night Astronomer (NAs)
  - One Telescope Operator (TIO)
- Workforce *(as of march 2017)*:
  - Five (5) VLTI Astronomers
  - Nine (7) VLTI TIOs
    - Two new TIOs (2) in training starting p99
- All NAs know and operate the *ATs* from the simplified panels in the *ISS* and all TIOs operate all instruments or are on their way to being certified.
- In order to follow the Observatory operations scheme by the end of this year ***Sciops 2.0*** should be implemented fully on VLTI

Scheduling

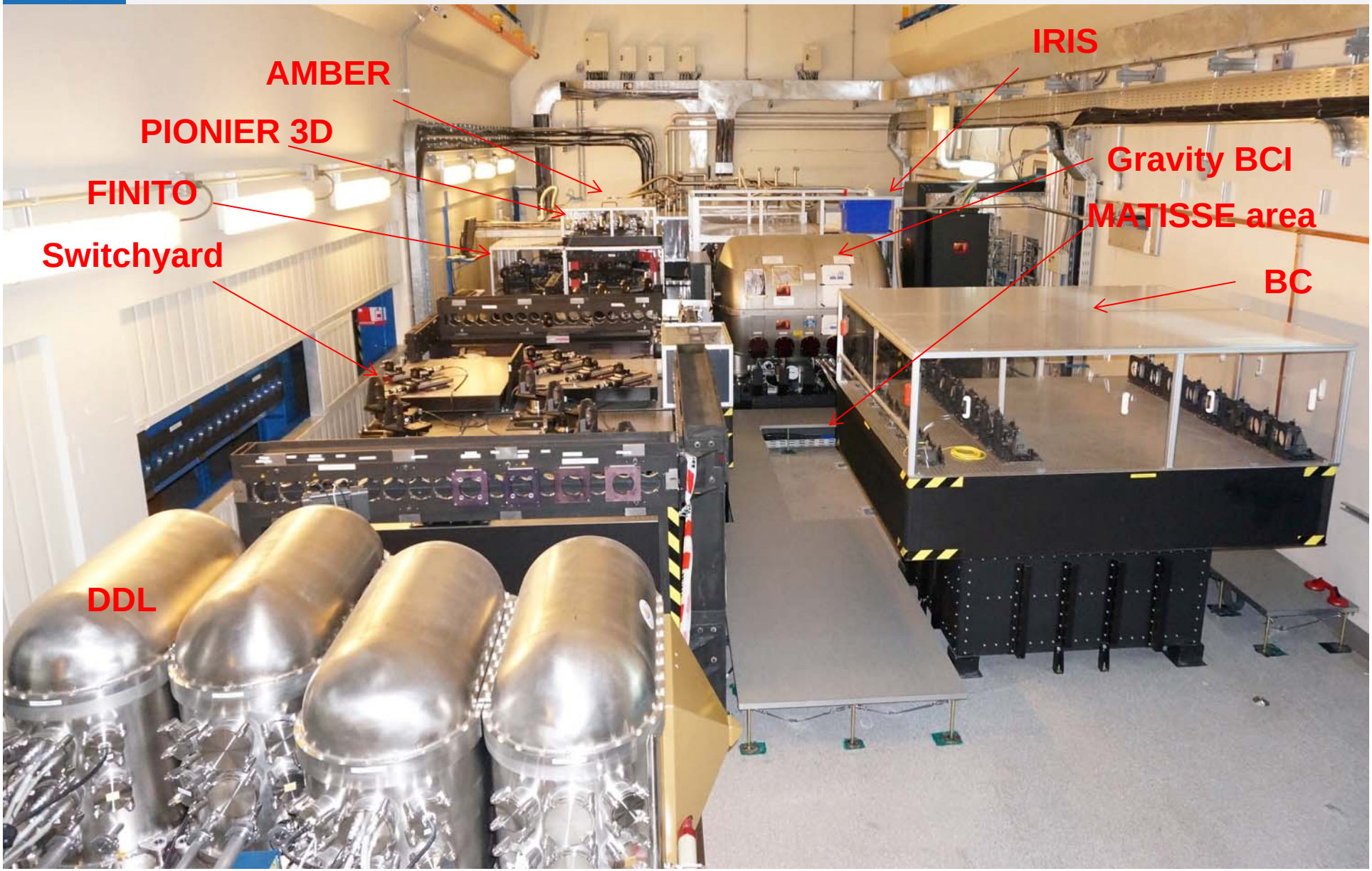

Period 98
January – 17
Period 98
February – 17
Period 98
March – 17
V_UT
V_UTdt
V_AT
V_ATdt
Tunnel
GRAVITY
NO AT VLTI
AT Verification
GRAVITY NEW
GRAVITY SW
CIAO Intervention
VLTI
DDL Installation
Reconfiguration

March-September 2015: VLTI shutdown

VLTI lab. from 1996 to 2014



Now

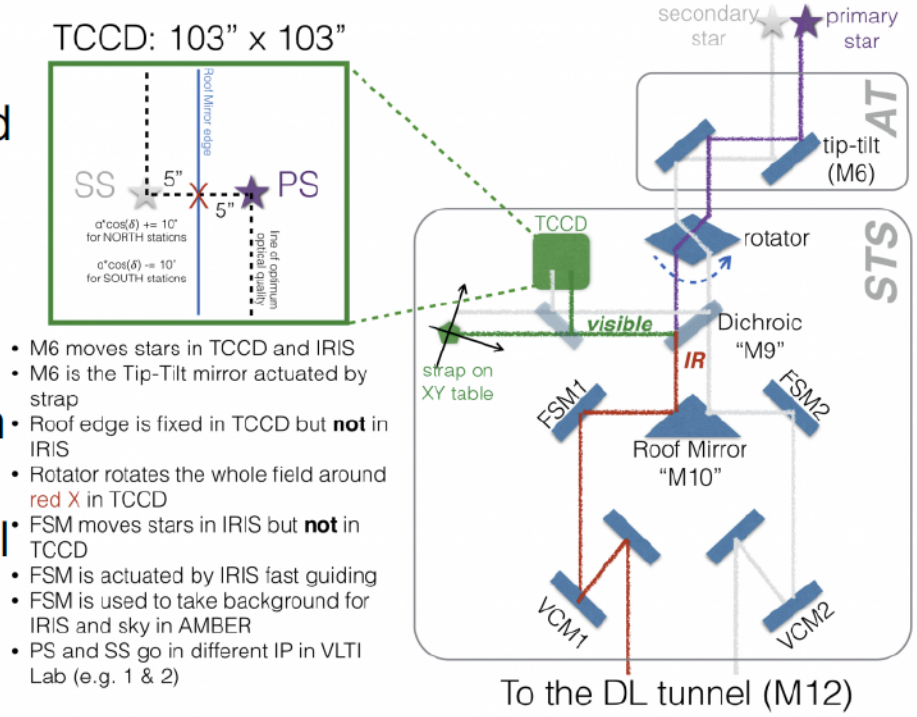

AMBER
PIONIER 3D
FINITO
Switchyard
DDL
IRIS
Gravity BCI
MATISSE area
BC

STar Separator

- Originally implemented for PRIMA
- Purpose & Main Functions of the Star Separators:
  - Split the Focal (Coude) Plane into 2 parts and select two objects
  - Propagate both objects down the VLTI
  - Each sub-FoV has minimum 2 arcsec diameter
  - Separated by up to 120 arcsec
  - Relay pupil from Telescope to Delay Lines
    (STS-AT equipped with active VCM's controlled for each AT station)
- Star Separators same specification for AT and UT
- Location: at Coude Focus of the Telescope
  - UT's: in Coude Rooms
  - AT's: in ROS under the telescope

Star separators

- Single Feed ROS suffered from poor pupil steering (M10) and poor longitudinal imaging (DL VCM could not reach desired pressure)
- It was introduced so the VLTI could acquire **two stars**, using the same DL
- It is located in the *ROS*
- Each STS has its own **VCM**, which helps the DL-VCM out reimaging the pupil in the middle of the tunnel
- Larger FOV. Necessary for GRAVITY

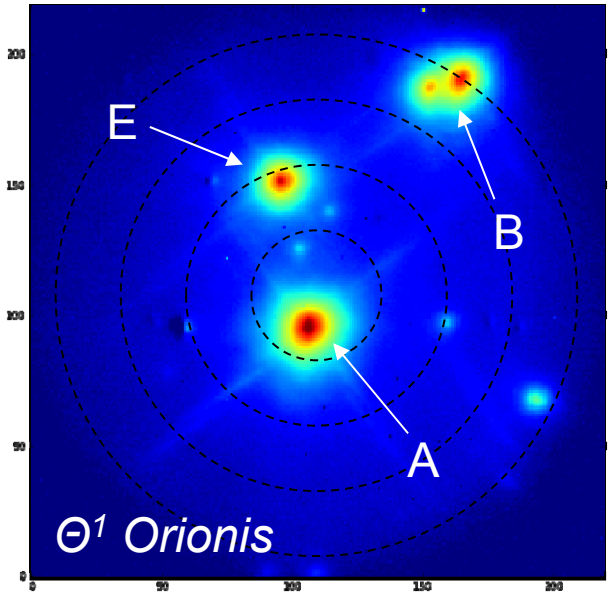


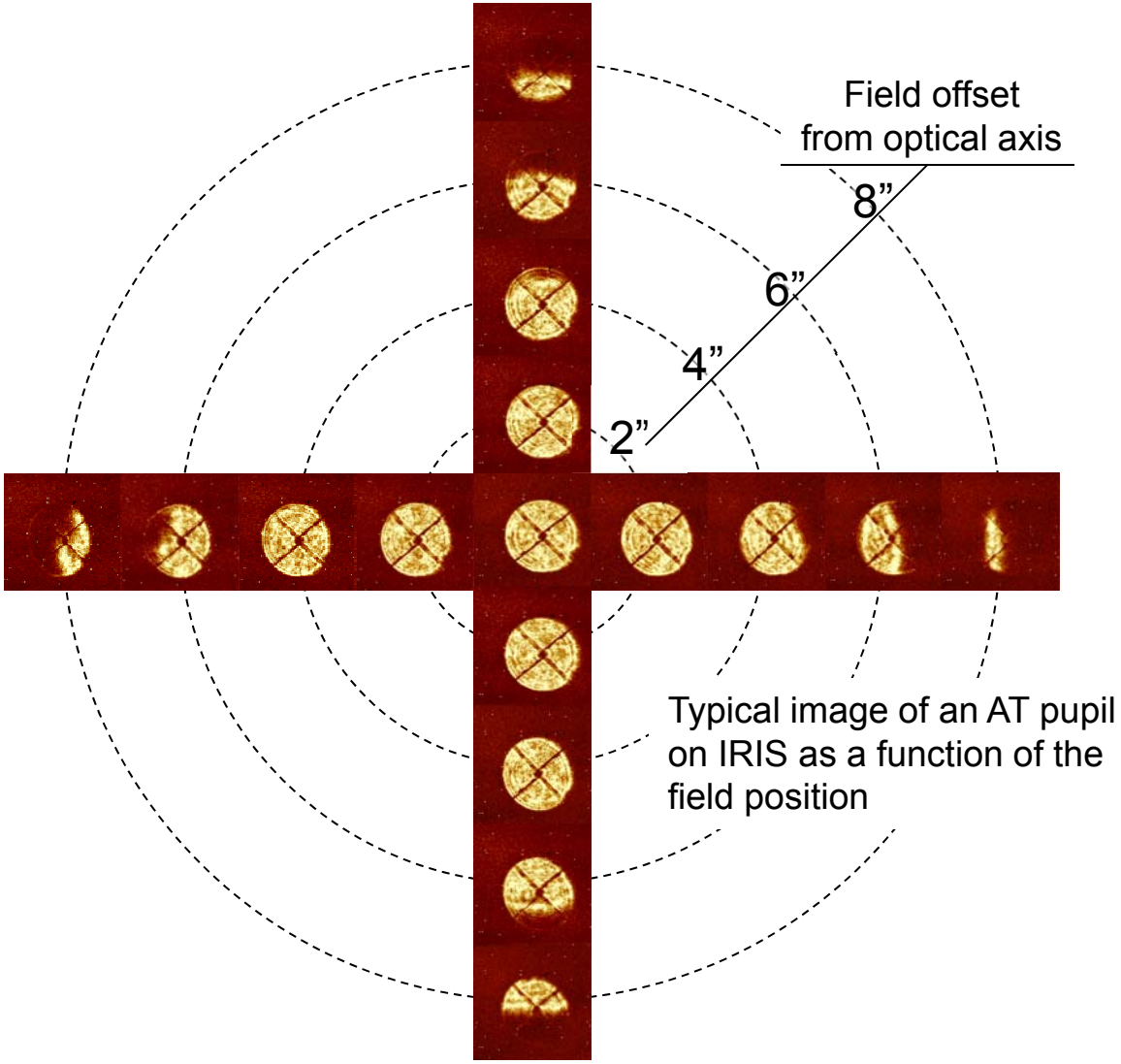
- M6 moves stars in TCCD and IRIS
- M6 is the Tip-Tilt mirror actuated by strap
- Roof edge is fixed in TCCD but **not** in IRIS
- Rotator rotates the whole field around red X in TCCD
- FSM moves stars in IRIS but **not** in TCCD
- FSM is actuated by IRIS fast guiding
- FSM is used to take background for IRIS and sky in AMBER
- PS and SS go in different IP in VLTI Lab (e.g. 1 & 2)

AT: Star Separators installation

Larger field of view with ATs

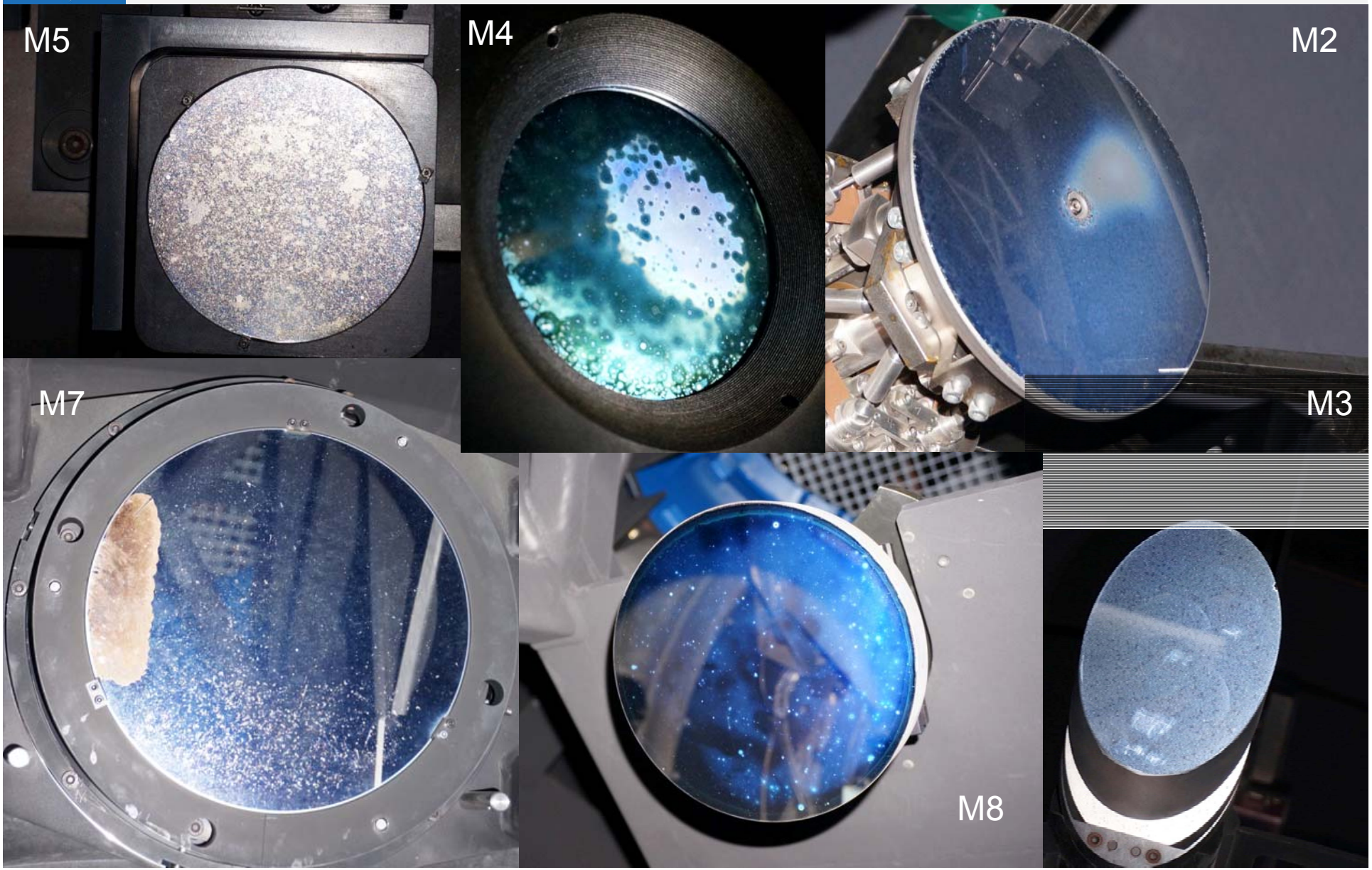
AT field detected with
the Gravity acquisition camera



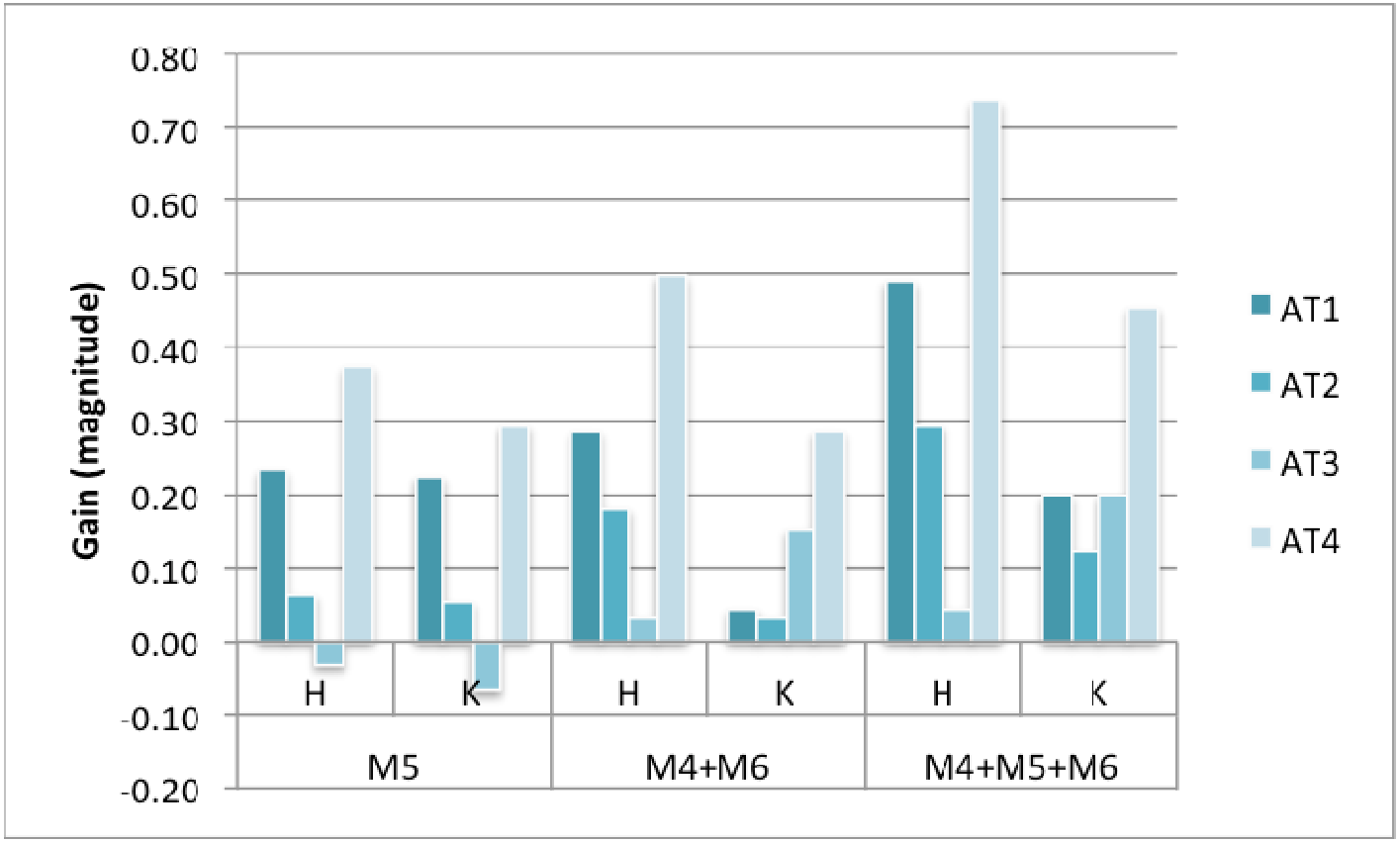


Typical image of an AT pupil
on IRIS as a function of the
field position

AT: Mirrors and Coude train in 2015



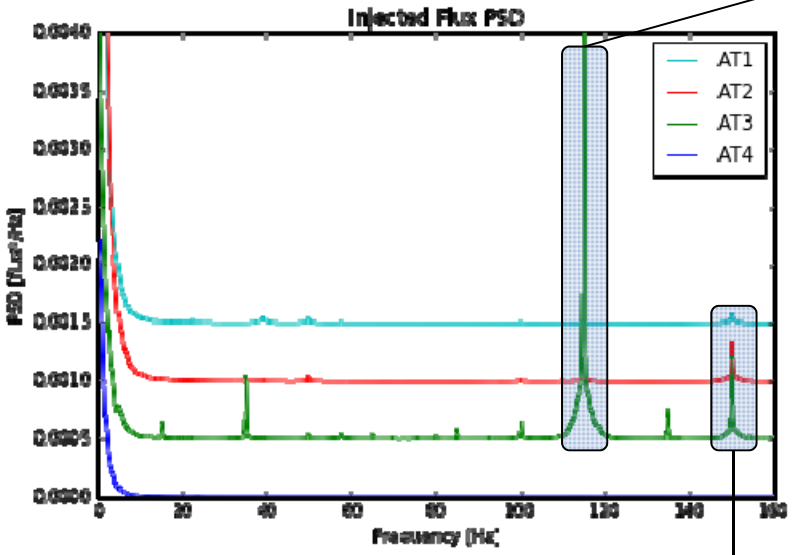
AT coude train mirrors

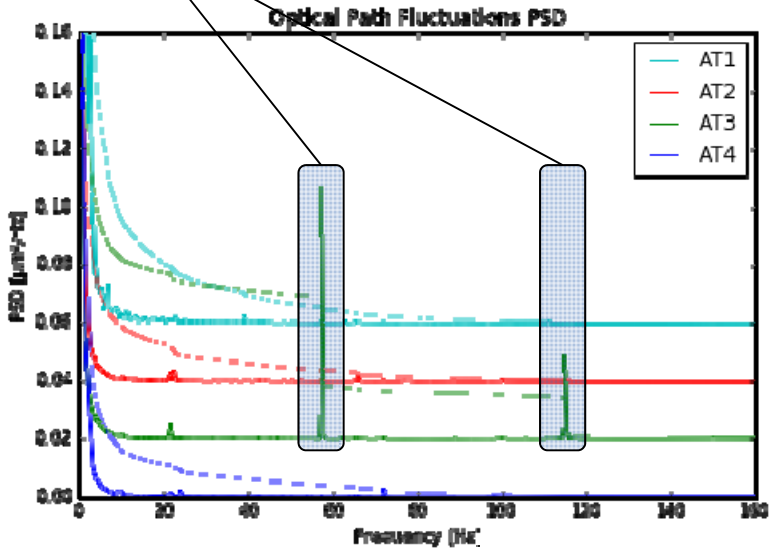


AT: Vibration hunt with Gravity FT

- Before…

AT3 TCCD controller fan
(57.5 Hz / 115 Hz)

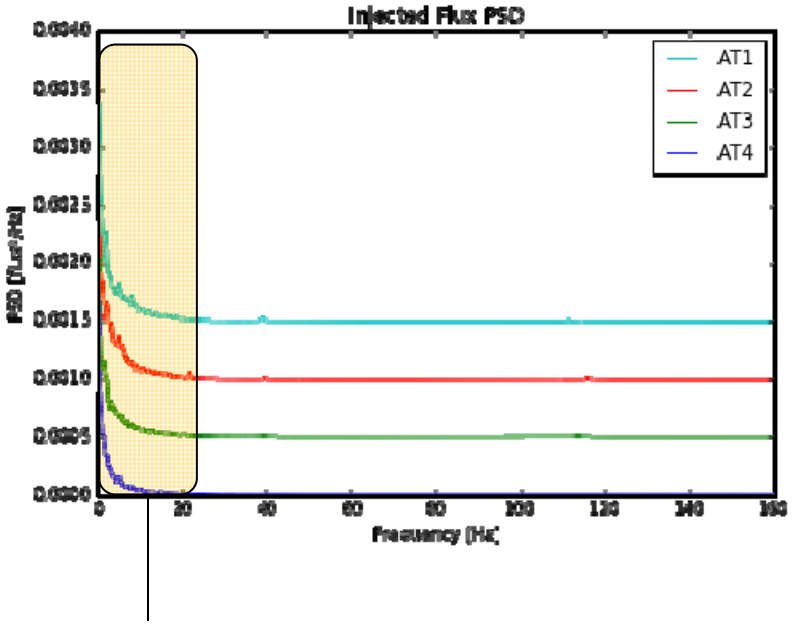




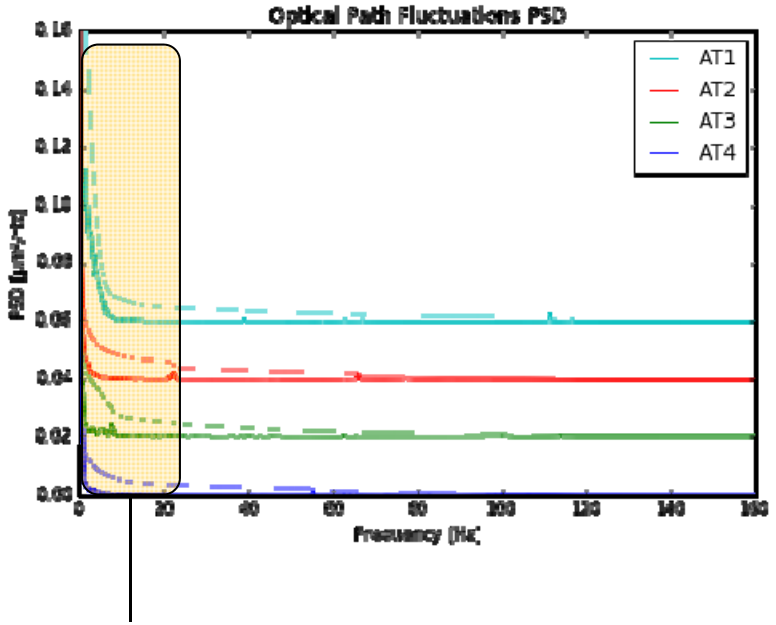
M6 induced
“Ultra-Fast Flux Dropouts”
(~50+n100 Hz)

AT: Vibration hunt with Gravity FT

- ...after…



Low frequency injection fluctuations
to be addressed by NAOMI



Can achieve 100 nm RMS residuals with Gravity FT
on median nights <u>with low wind speed</u>

NAOMI

REPORT ON THE VLT INTERFEROMETRY REVIEW
(6-7 MAY 1992)

Professor John Davis
University of Sydney
Chatterton Astronomy Department
N.S.W. 2006, Australia

Dr. Michael Shao
California Institute of Technology
MS 169-214
4800, Oak Grove Drive
Pasadena, CA 91109, USA

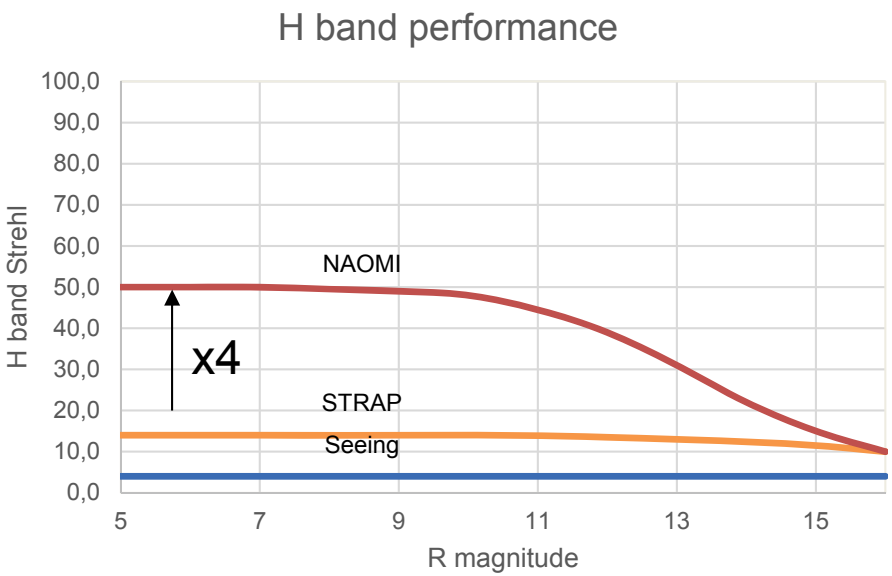
Adaptive Optics for ATs

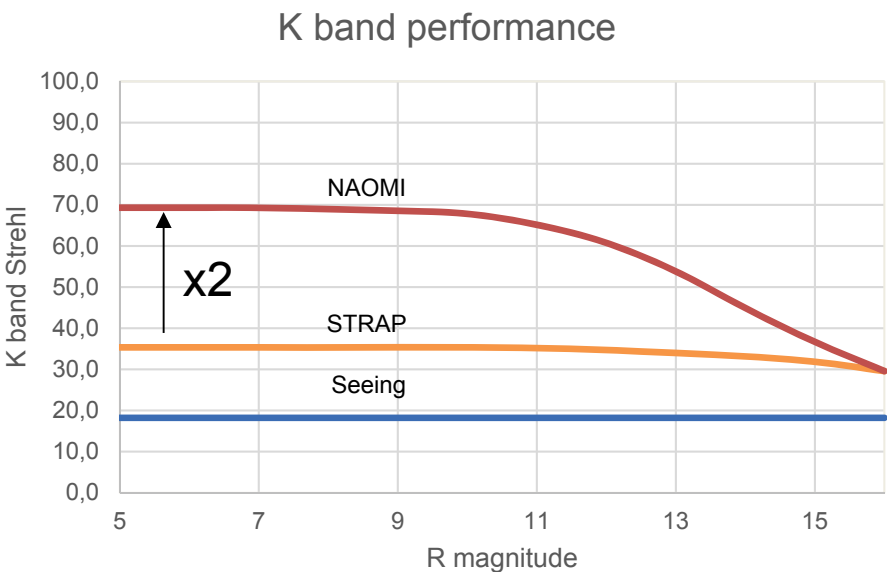
We note the advantages of using the adaptive optics sensors in the alignment of critical off-axis elements in the optical train of the VLTI. We also note the large visibility losses which will occur (e.g. ~ 40% at 2.2 μm) without adaptive optics.

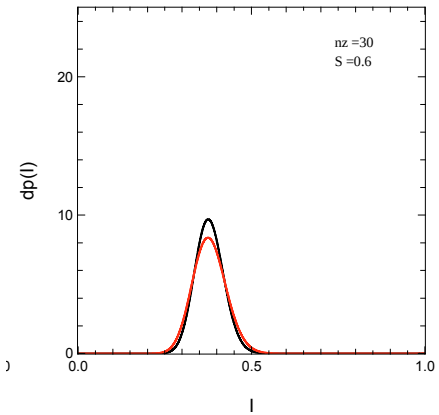
We recommend the implementation of adaptive optics on the 1.8 m ATs as early as possible and, ideally, prior to the commissioning of the first interferometer baseline.

NAOMI

Expected Strehl versus R magnitude



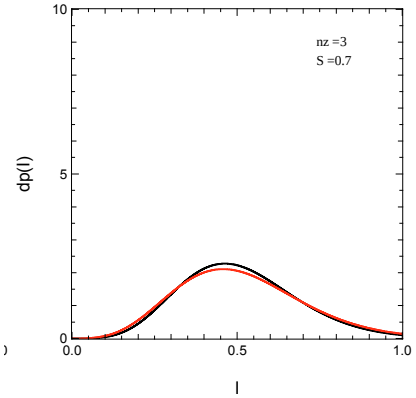




MACAO

vs

STRAP

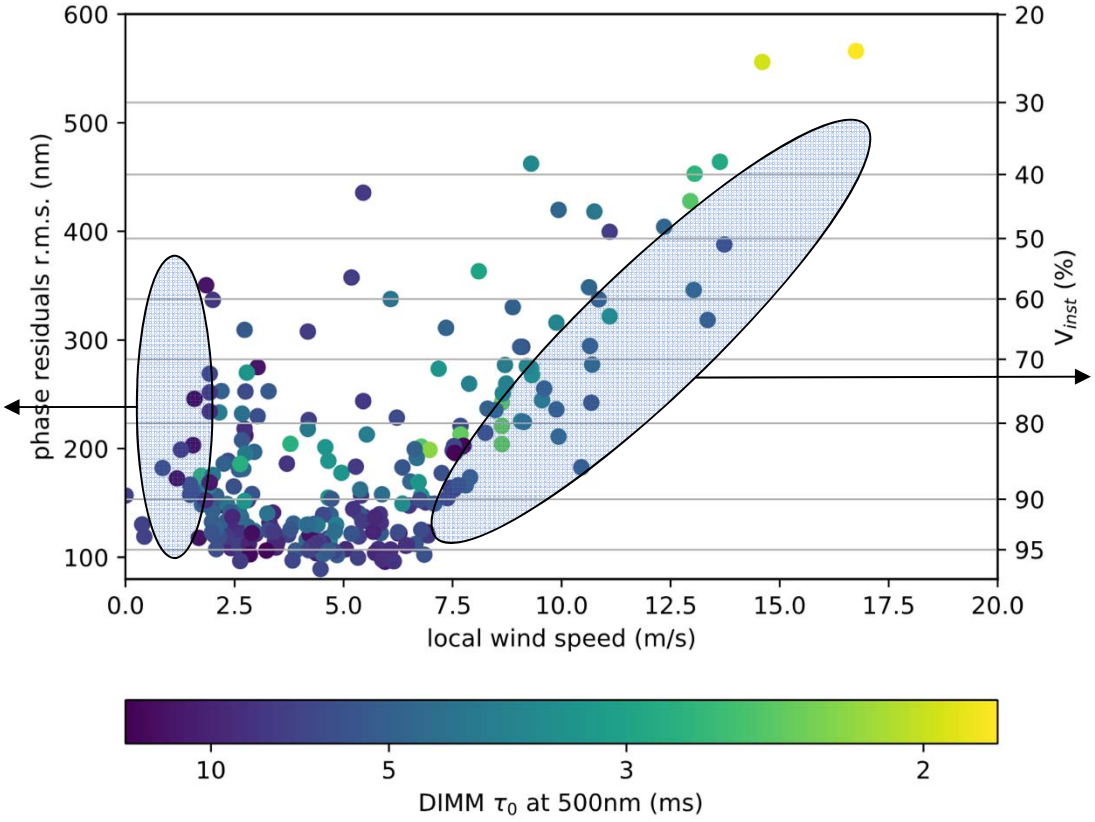


Tatulli et al., A&A 524 (2010)

NAOMI

Gravity Fringe Tracker performance versus wind/turbulence speed

“Boiling”
low wind-speed



“Wind shake”
high wind-speed

NAOMI

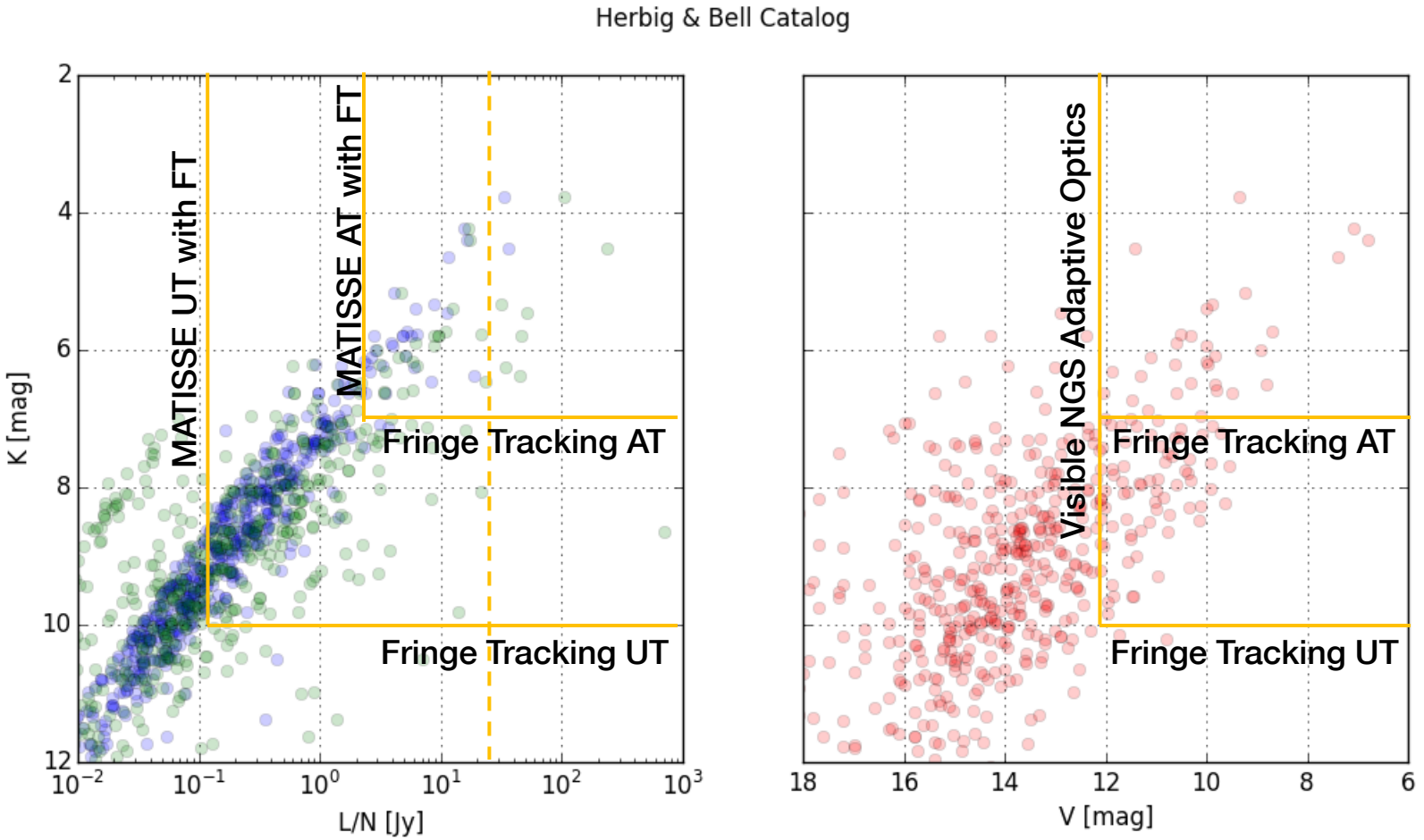
- 2007 NAOMI Proposal
- 2011 Conceptual Design Review
- 2015 Preliminary Design Review
- 2016.01 Contractual agreement with IPAG
- 2016.11 Final Design Review
- 2017.05 Delta Final Design Review on DM and RTC
- 2017.07 Start of system tests on test-bench
- **2017.12 Preliminary Acceptance Europe**
- **2018.01 NAOMI 1 commissioning**
- **2018.06~08 NAOMI 234 commissioning**

MATISSE

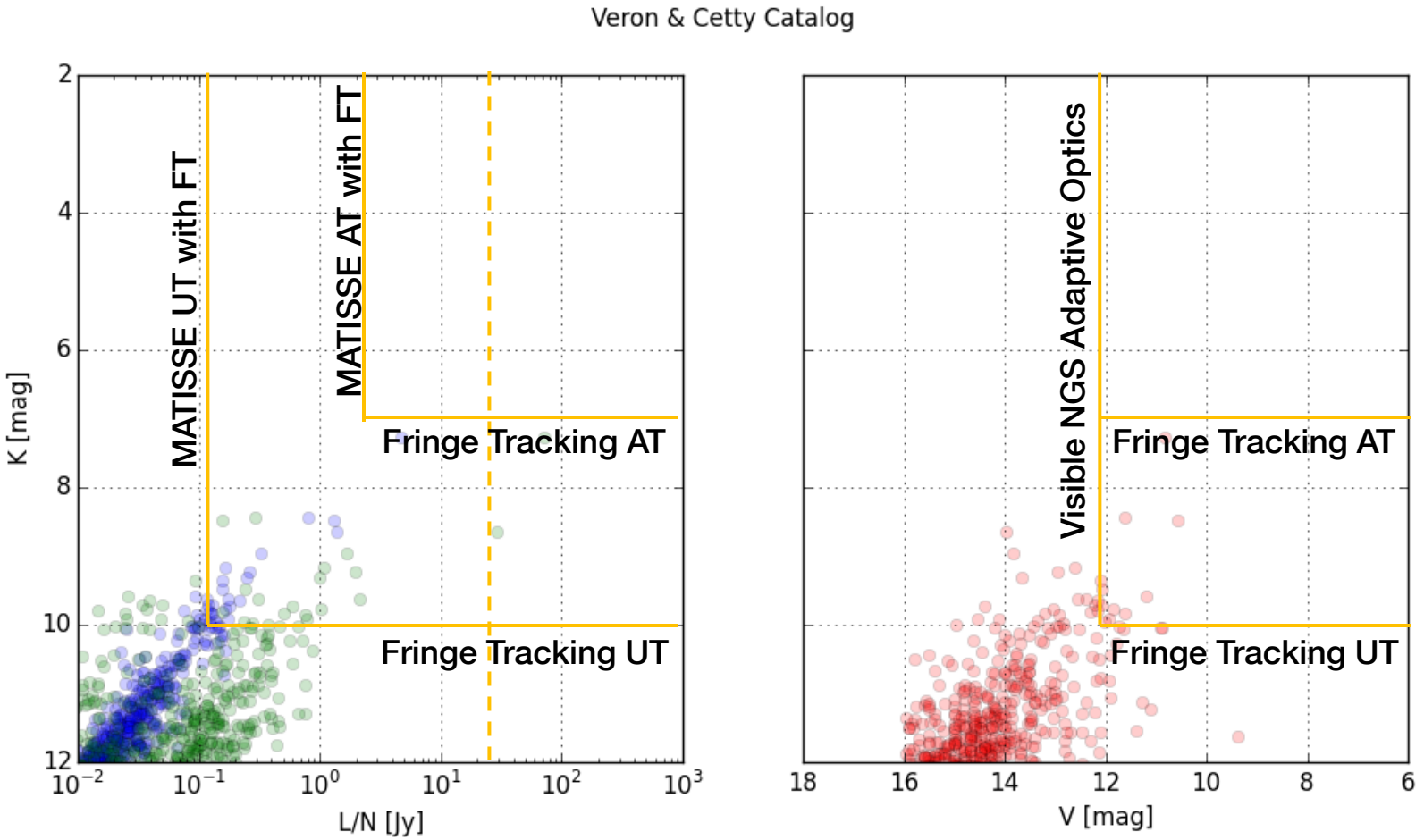
MATISSE limits (w/out FT)

	L-band sensitivity	*N*-band sensitivity
AT	Spec = 6.5 Jy (*L* = 4.1), Goal = 1.25 Jy	Spec = 45 Jy (*N* = −0.25), Goal = 10 Jy
UT	Spec = 0.65 Jy (*L* = 6.6), Goal = 0.12 5Jy	Spec = 3 Jy (*N* = 2.7), Goal = 0.75 Jy

GRA4MAT (young stars)



GRA4MAT (AGN)


Veron & Cetty Catalog
MATISSE UT with FT
MATISSE AT with FT
Fringe Tracking AT
Fringe Tracking UT
K [mag]
L/N [Jy]
Visible NGS Adaptive Optics
Fringe Tracking AT
Fringe Tracking UT
V [mag]