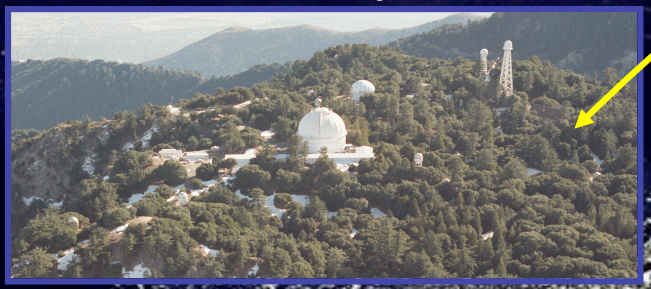
VEGA : Status, Science Overview and Future Plans

http://www-n.oca.eu/vega/en/publications/index.htm
VEGA : Mourard et al. (2009)

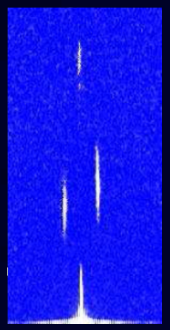
CHARA Array



Remote control

09-2007: Integration
07-2008: First science light
10-2008 : Mode 3T
07-2009: Remote operation
06-2010: First science papers
10-2010: Mode 4T
06-2013 : 17 publications
3T VEGA + IR instruments (CLIMB, MIRC)
30 programs, 50 nights per year

2013 : Service d'Observation labellisé
SO2 + S05 (http://www.jmmc.fr/job_offers.htm)
Instrument ouvert à la communauté



Mode 3T

Mode 4T

N. Nardetto, D. Mourard, K. Perraut
and all the VEGA team

Main characteristics of VEGA/CHARA

Spectrograph Characteristics

Grating	R	$\Delta\lambda$ (Blue)	$\Delta\lambda$ (Red)	$\lambda_R - \lambda_B$
R1: 1800 gr/mm	30 000	5 nm	8 nm	25 nm
R2: 300 gr/mm	5000	30 nm	45 nm	170 nm
R3: 100 gr/mm	1700	100 nm	150 nm	not possible

Magnitude limit R0=8cm R0=15cm

Resolution	R	Typical lim. magnitude	Best perf.
Low	1700	6.8	7.5
Medium	6000	6.5	7.5
High	30 000	4.2	5.5

→ **8 (r0=5cm) 21/09/12**

Two VEGA niches :

- **High angular resolution** (330m of baseline in optical = 0.3 mas)

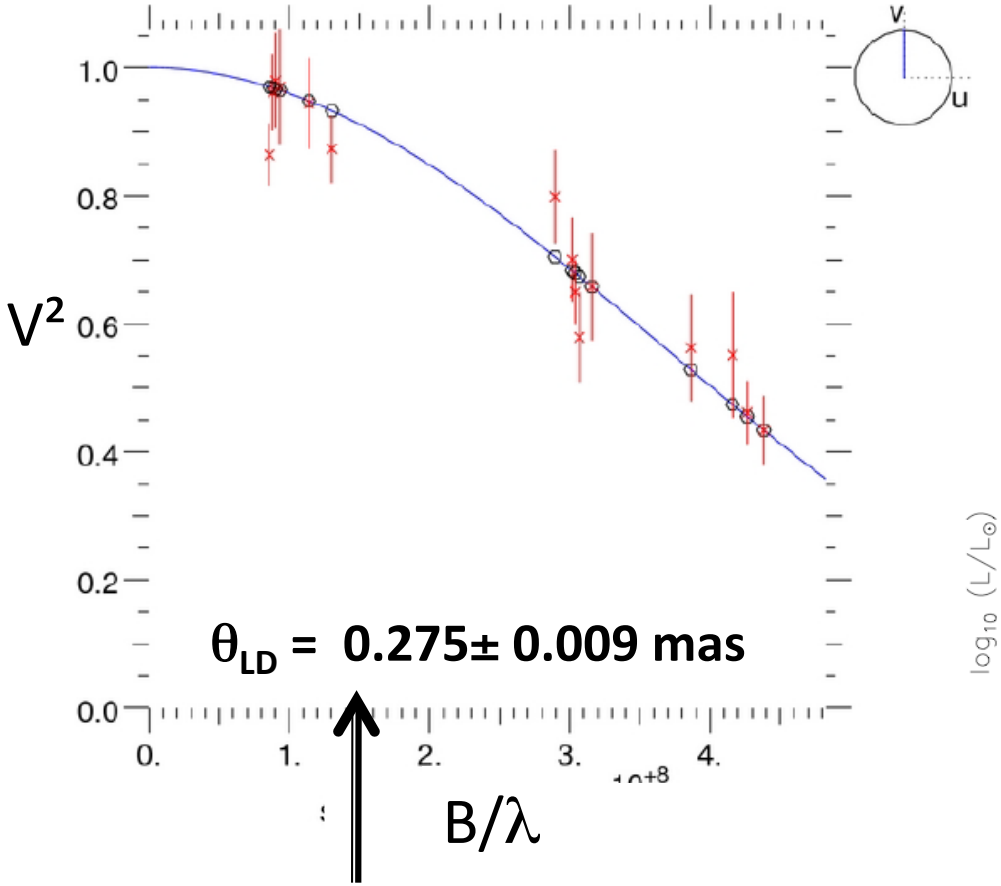
→ photospheric angular diameters, asteroseismology, binaries

- **High spectral resolution** (R = 30000)

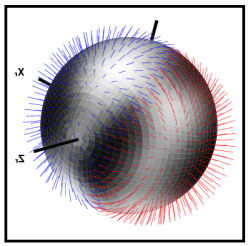
→ environment & kinematics, rotation, disks

10 Aql (RoAp) : Perraut et al. (submitted)

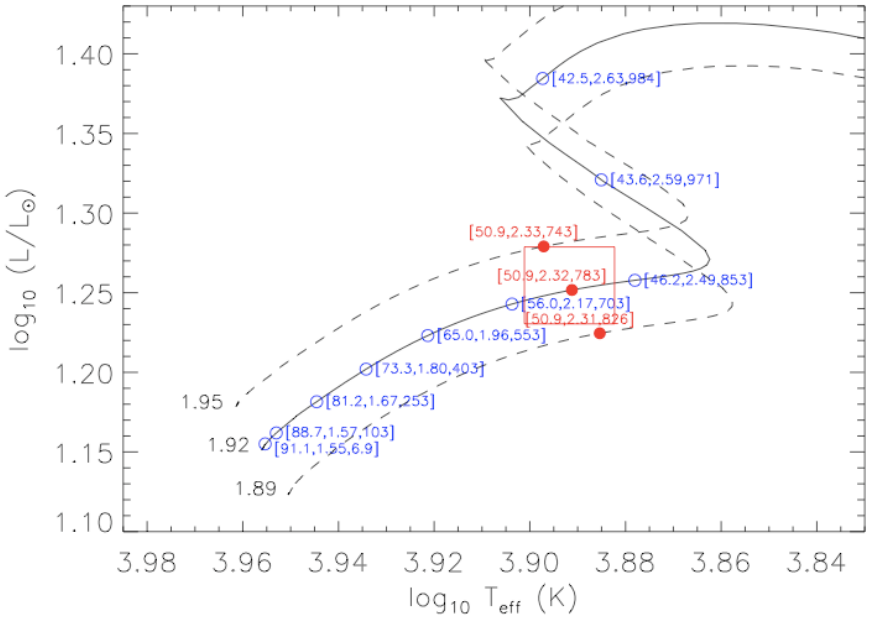
Determining the position of 10 Aql in the HR diagram to constrain Teff law (biased by spots) and also to better understand the pulsating mechanisms.



θ_{LD} = 0.275± 0.009 mas

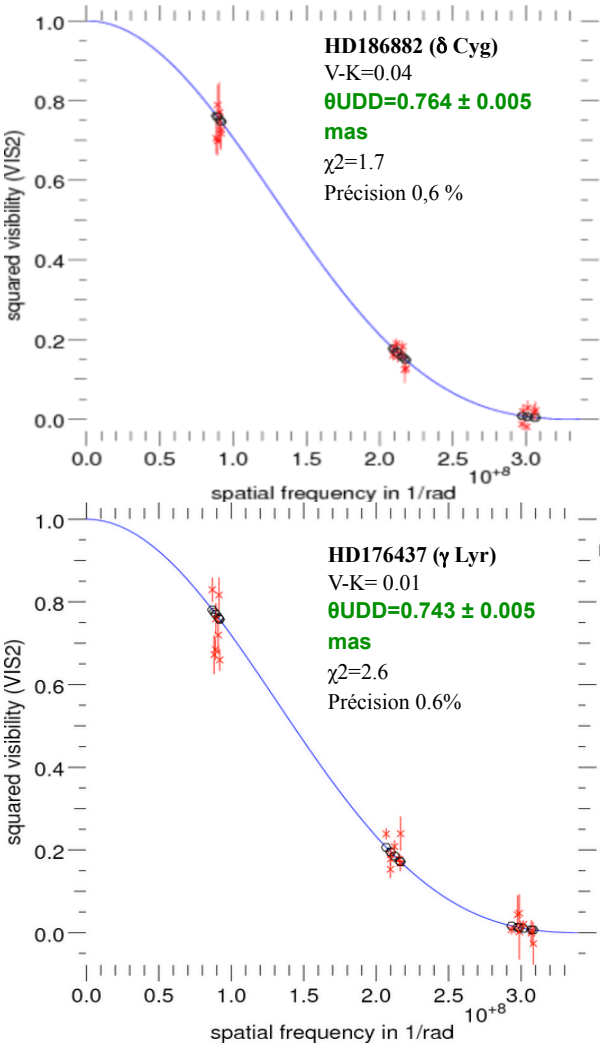


R = 2.318 ± 0.090 $R_\odot$



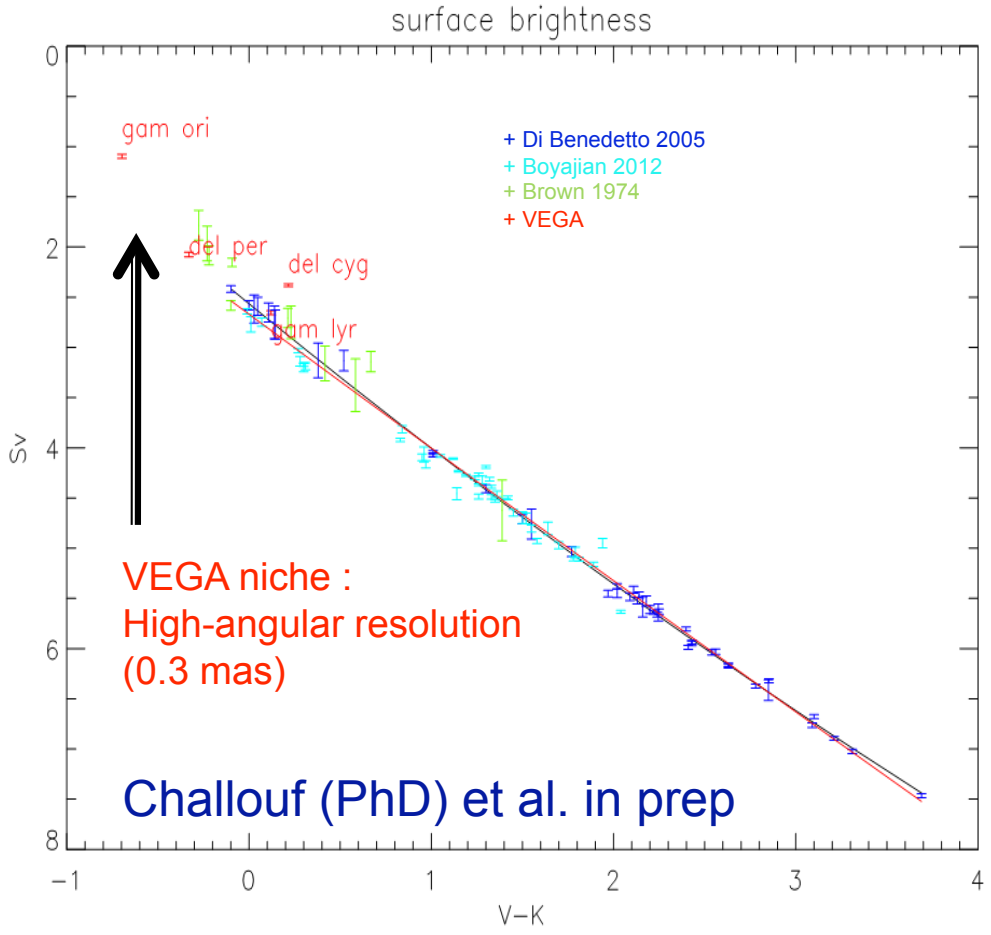
At the limit of the spatial resolution of VEGA (3% of precision)

Improving the surface brightness relation for the distance determination of Eclipsing Binaries in the Local Group (Araucaria Project: *Pietrzynski et al. 2013, Nature, 495, 76 (LMC distance at 2%)*



R+θ=d

The main limitation is the precision on θ (surface-brightness relation)



VEGA niche :
High-angular resolution
(0.3 mas)

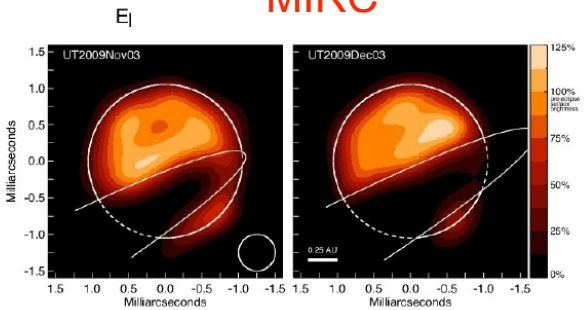
Challouf (PhD) et al. in prep

A high angular and spectral resolution view into the hidden companion of ε Aurigae*,**,***

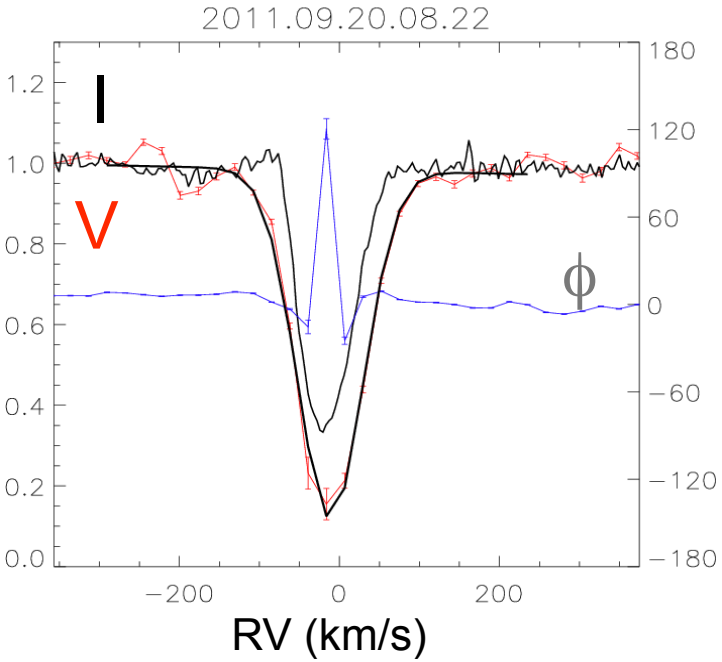
D. Mourard[1], P. Harmanec[2], R. Stencel[3], Ph. Bério[1], O. Chesneau[1], J. M. Clausse[1], R. Ligi[1], N. Nardetto[1], K. Perraut[4], Ph. Stee[1], I. Tallon-Bosc[5], H. McAlister[6,7], T. ten Brummelaar[7], S. Ridgway[8], J. Sturmann[7], L. Sturmann[7], N. Turner[7], C. Farrington[7], and P. J. Goldfinger[7]

VEGA

MIRC



VEGA niche :
Spectro-interferometry
(environment + kinematics)



- Confirmation of dark disk and of its orbital motion
- Hα very close to the F star
- Existence of a wind and of a possible filling Roche lobe on the F atmosphere

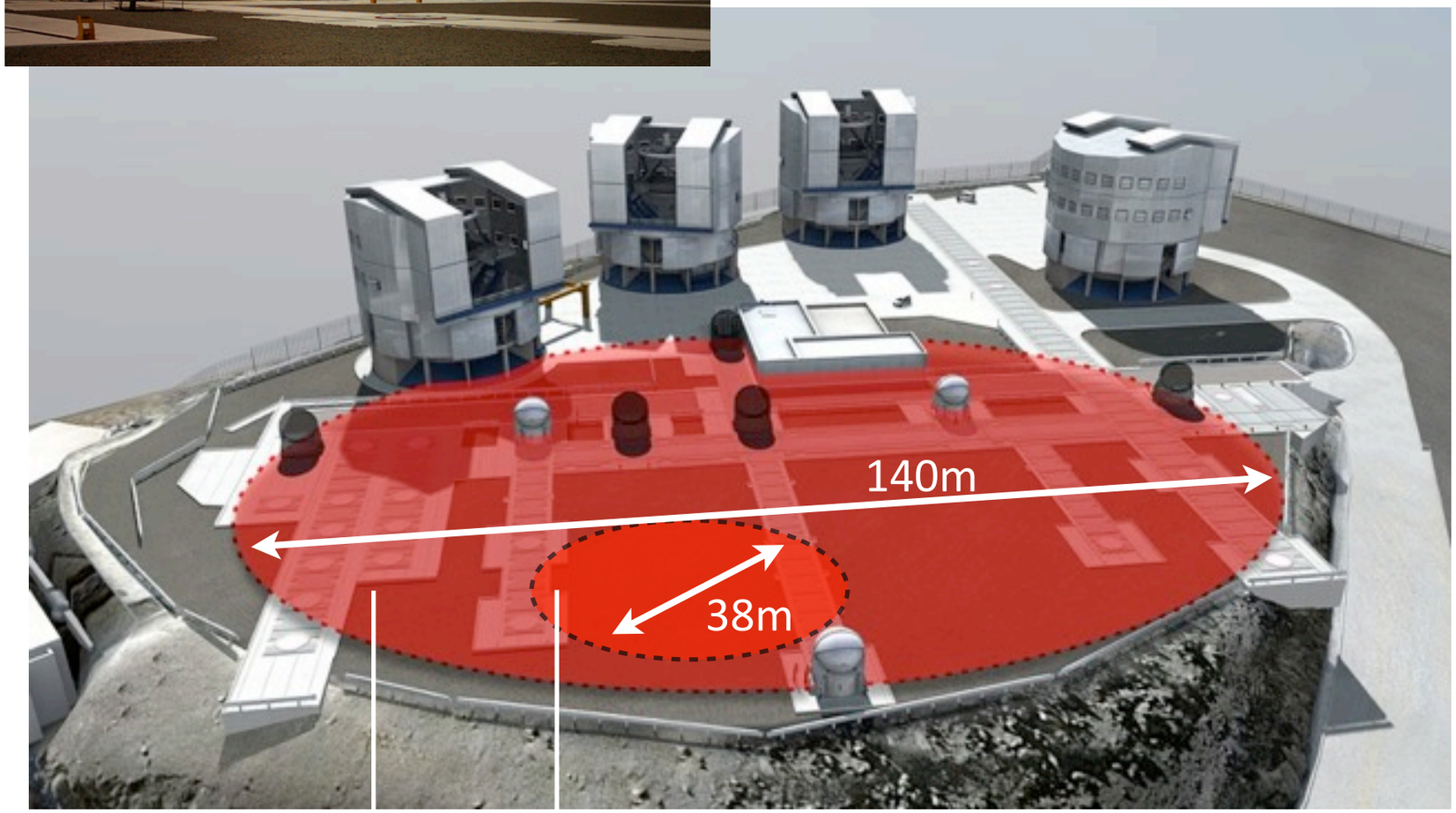
Merci pour votre attention

Calern meeting, february 6th, 2012

PIONIER :

A visitor instrument for the VLTI

- Provide VLTI with imaging capabilities (4 telescopes simultaneously).
- Increase sensitivity, reliability and precision.



VLT-I ELT

IPAG
Institut de Planétologie et d'Astrophysique de Grenoble

UNIVERSITE JOSEPH FOURIER
SCIENCES. TECHNOLOGIE. SANTÉ

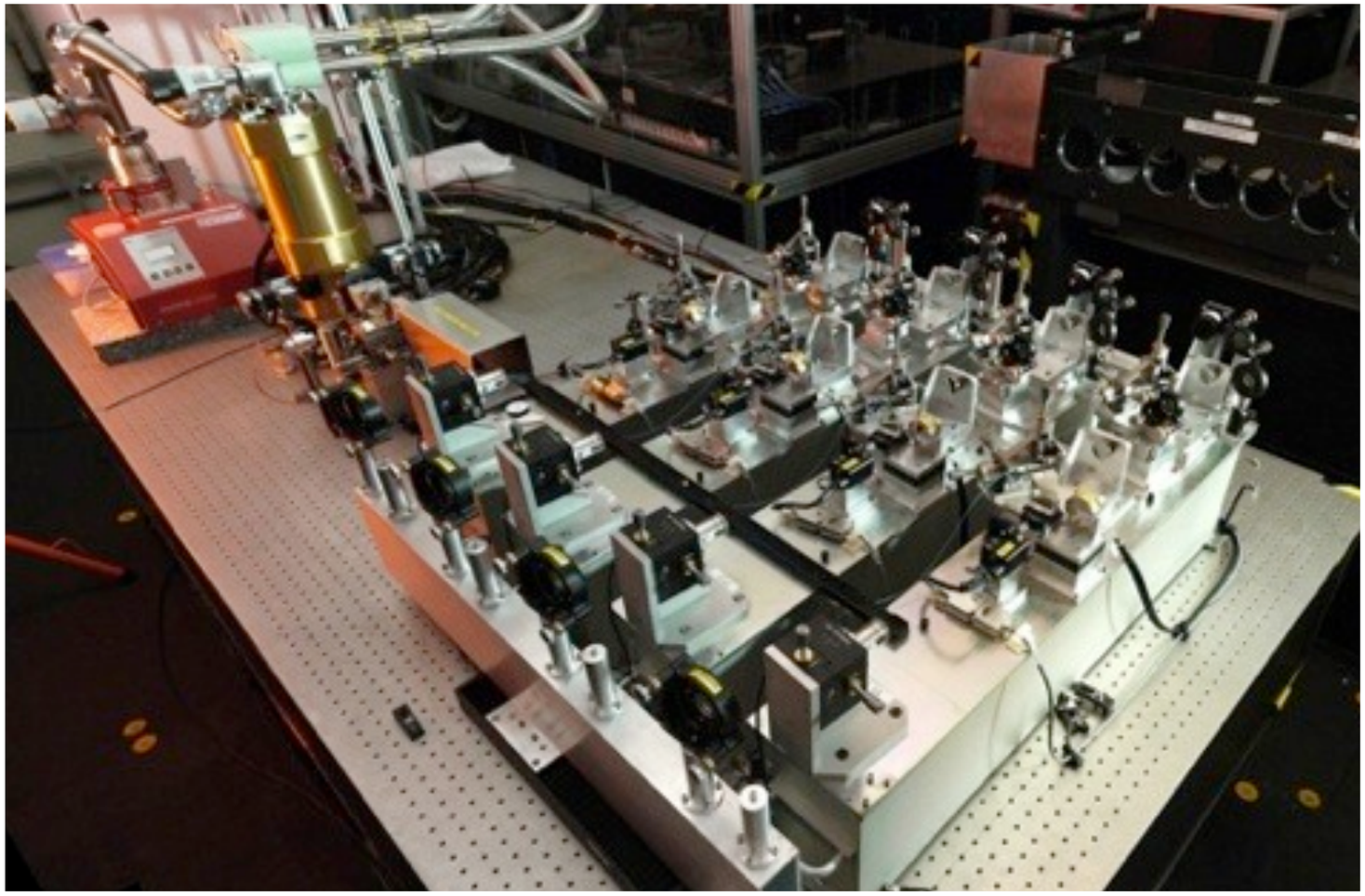
cnrs ANR
Observer & comprendre

cnes

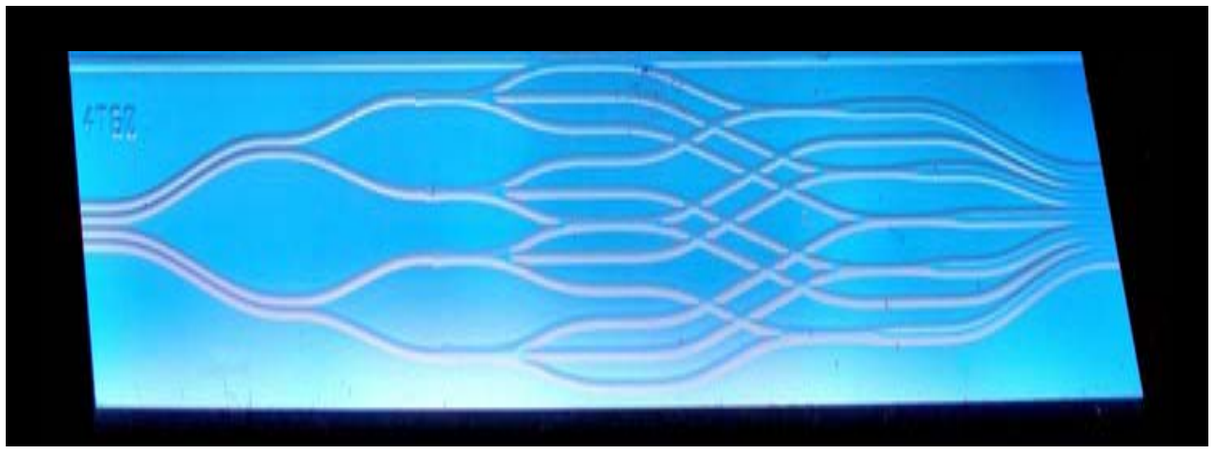
A successful fast track project

- Approved by ESO in 09/2009
- Integrated at IPAG in 2010
- Installed at VLTI in 10/2010 then science
- Based on proved concepts and Integrated Optics technologies

PIONIER at VLTI



Picture of the integrated optic chip (1.5 x 4cm)



Integrated Optics:

- Result from 10 years of R&D funded by CNES / INSU / ASHRA
- Compact, stable, efficient.

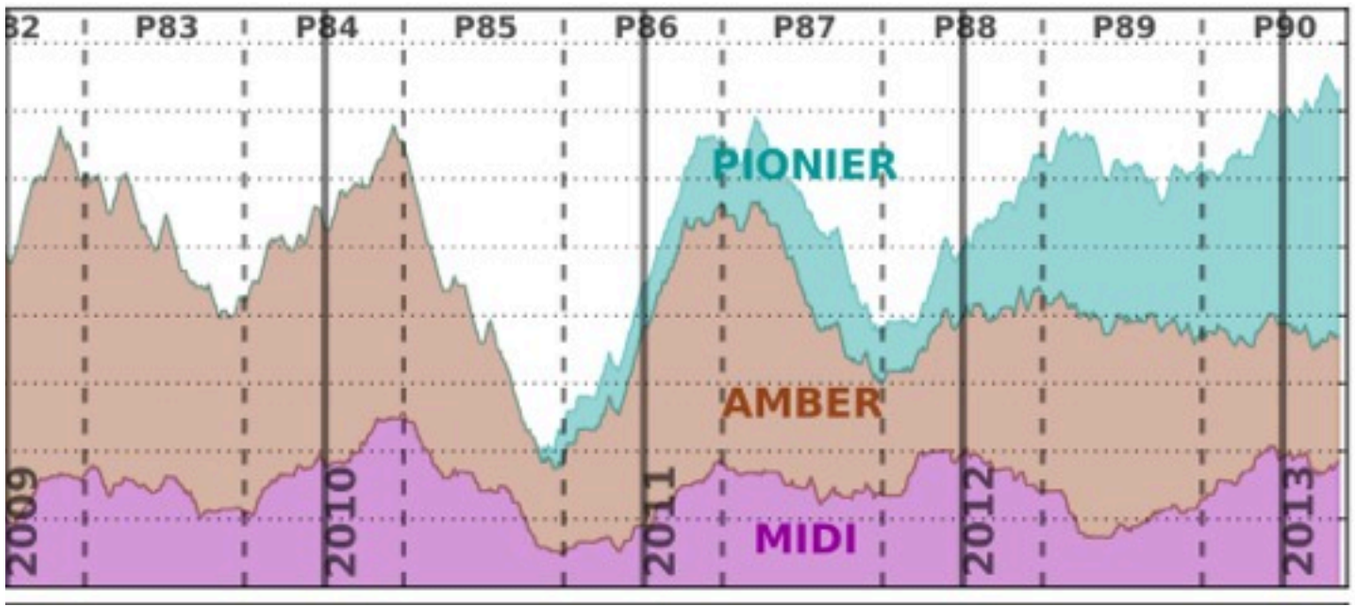
Overall performances

- Near-IR (1.6 microns)
- Spat. Resol. θ=2mas
- Broad-band: R=15
- Hmag > 8 on ATs

Table 1. Summary of the scientific requirements compared to the already demonstrated performances. Error is defined as the accuracy for one calibrated data point.

Topic	Sp. Band	Mag.	V^2 error	CP error
Herbig AeBe disks	H,K	> 5	5%	5deg
T Tauri disks	H,K	> 7	5%	2deg
Debris disks	H,K	-	1%	1deg
Faint companions	H,K	-	-	0.5deg
Hot Jupiters	H,K	-	-	0.03deg
Demonstrated	H	7.5 (AT)	15 – 3%	0.5deg

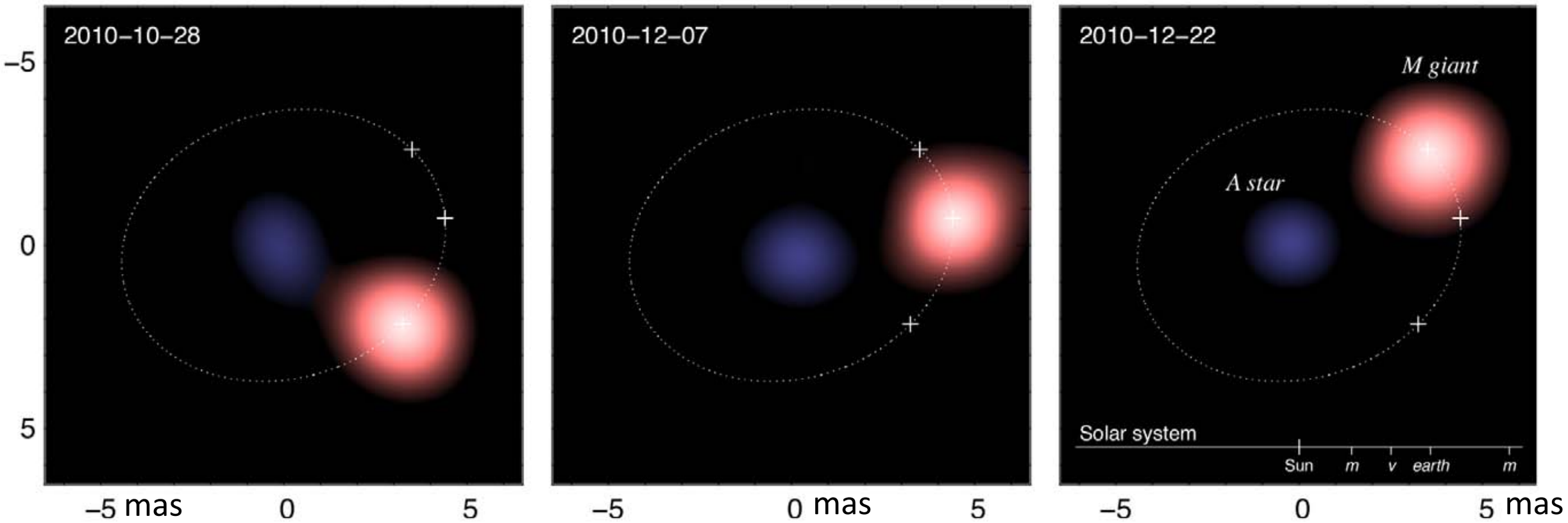
Occupation of VLTI science time



- 12 papers with astrophysical results so far
- 3 large-program still on-going
- Instrument most used from VLTI

Result : interacting binaries

PIONIER image reconstruction

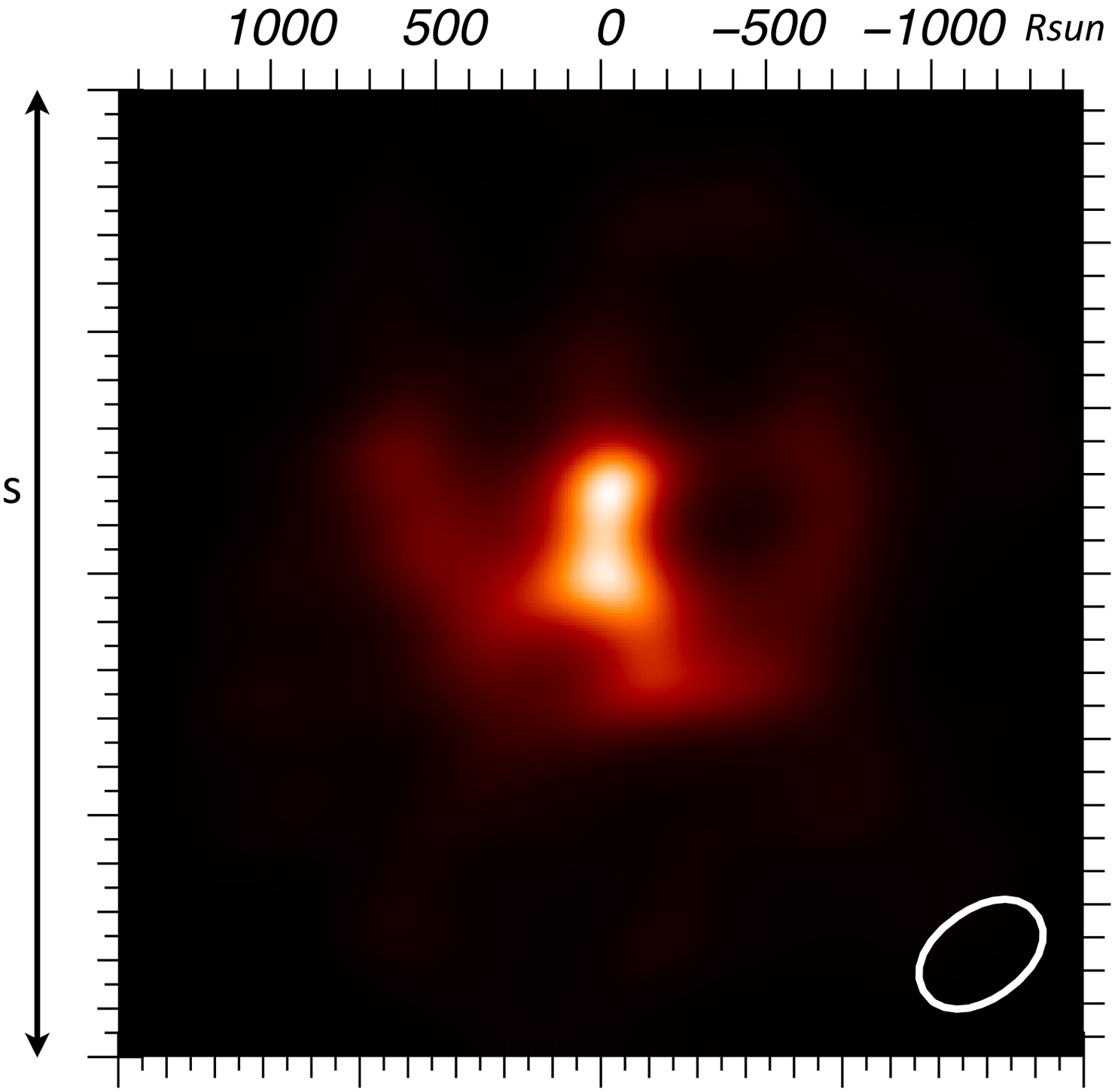


- Orbit, masses, radius (M giant), temperatures, envelope
- Constraints on co-evolution of Algol-like system

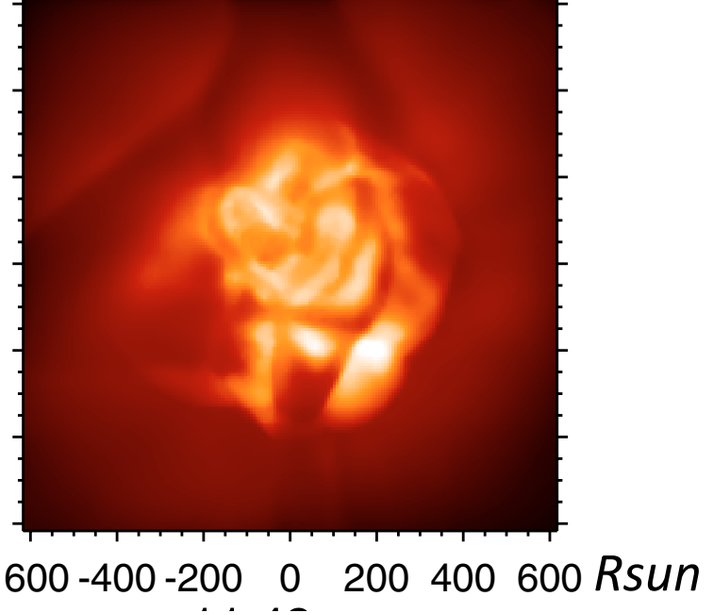
Blind et al., 2011A&A...536A..55B: The symbiotic star SS Leporis: Milli-arcsecond imaging with PIONIER/VLTI

Results : evolved stars

Actual PIONIER image reconstruction



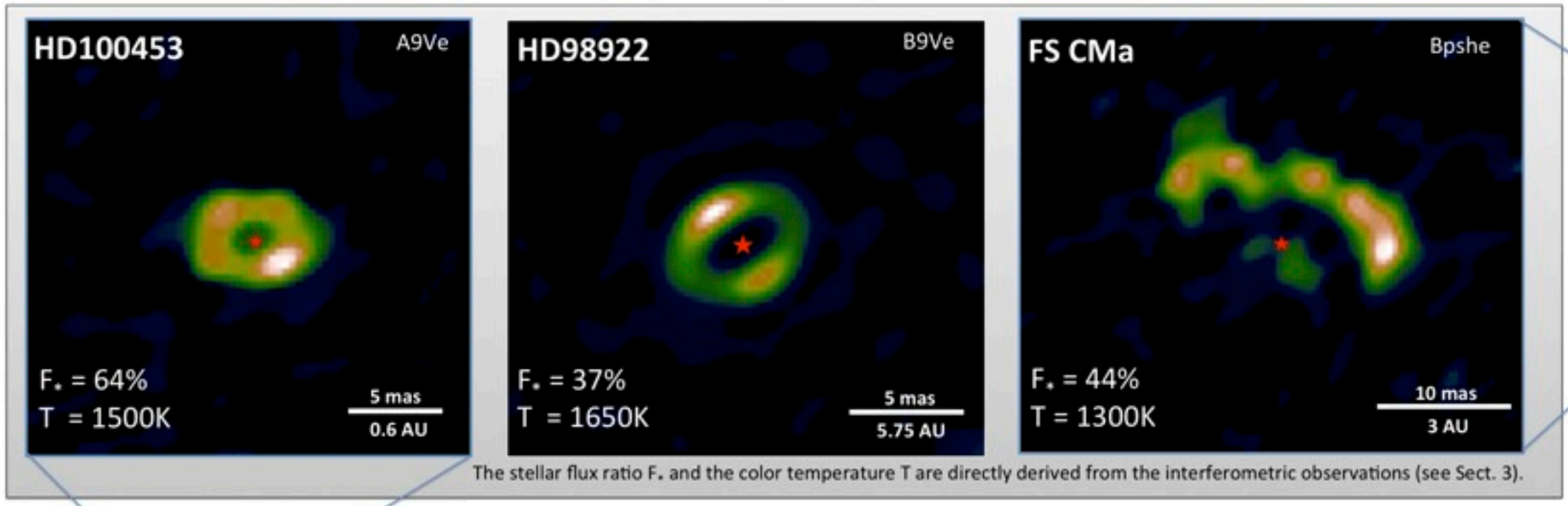
A **possible** interpretation, with a convection photosphere by Freitag + dynamical mass-loss and molecule condensation by Hoefner.

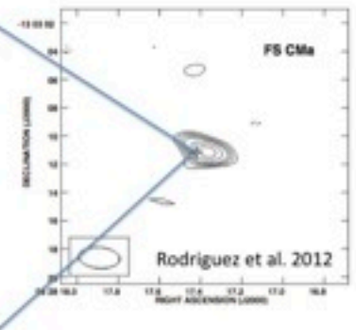


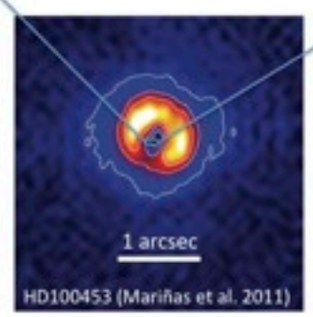
Paladini et al. in prep.

Results : Young Stellar Object

PIONIER image reconstruction







- On-going survey of 30 early-type YSO and 15 late-type YSO
- Statistical analysis
- Image reconstruction on targeted interesting objects.

Observations resolve the sublimation radius of the dusty disk

Kluska, Malbet, Berger et al, 2013EAS.59.41K :
Imaging the Surroundings of MWC 158 by Optical Interferometry

Perspectives ...

Instrument / Technique

- Upgrade with RAPID detector in dec. 2013

ESO is considering to support PIONIER as a “normal” instrument :

- Service mode observation
- Support for a larger community
- Long-term perspective

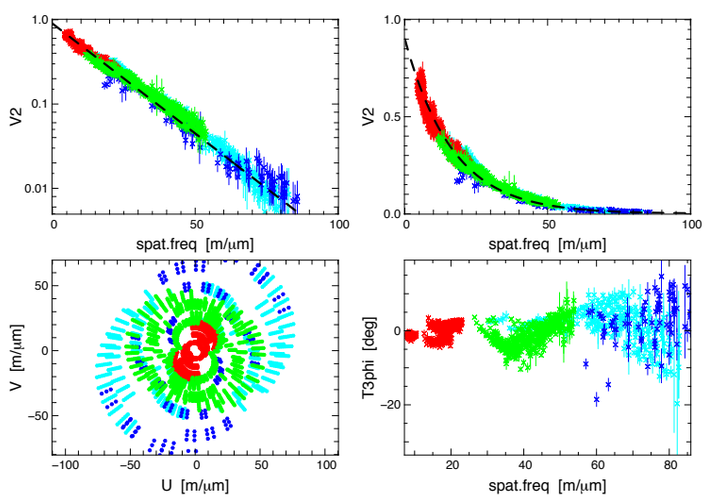
Science

Finish on-going surveys of

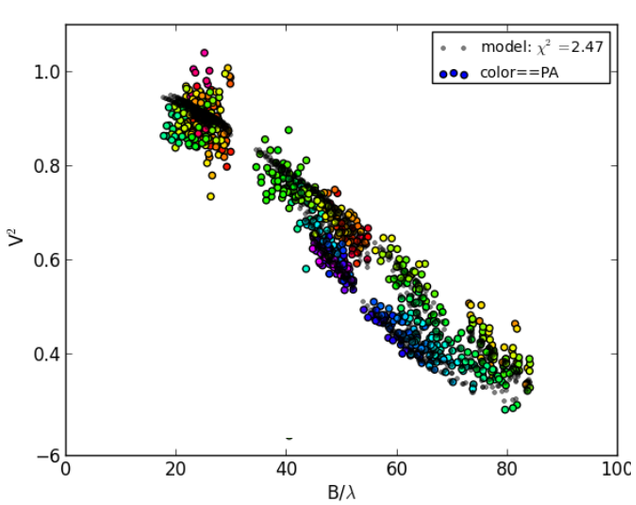
- Massive stars (>100 obj.)
- Exozodi disks (>100 obj.)
- Young Stellar Object (>50 obj.

- Exploit the capabilities in the very broad science cases still poorly explored so far.

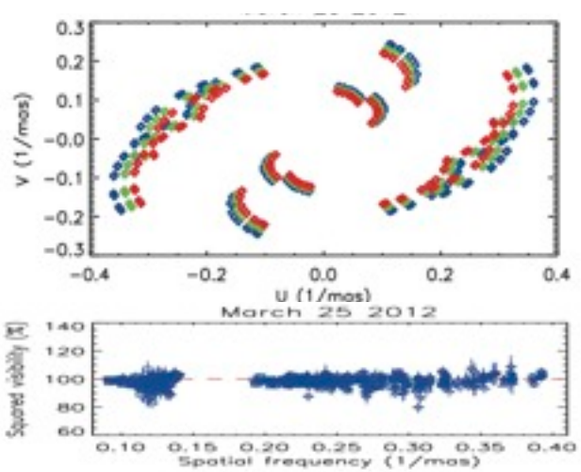
Eta Car



Achernar



Vela X-1



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