



Status report on VEGA and moving towards FRIEND

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VEGAS

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Olivier Chesneau, Jean Michel Clause, Alain Spang,
and
...**Anthony Meilland**

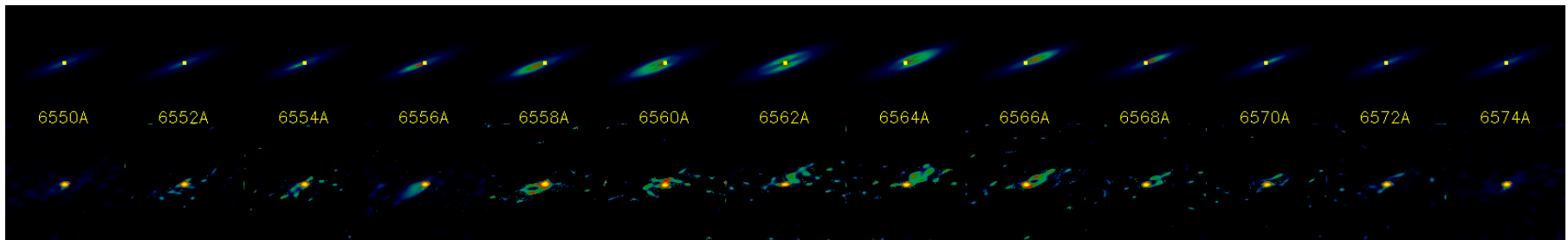
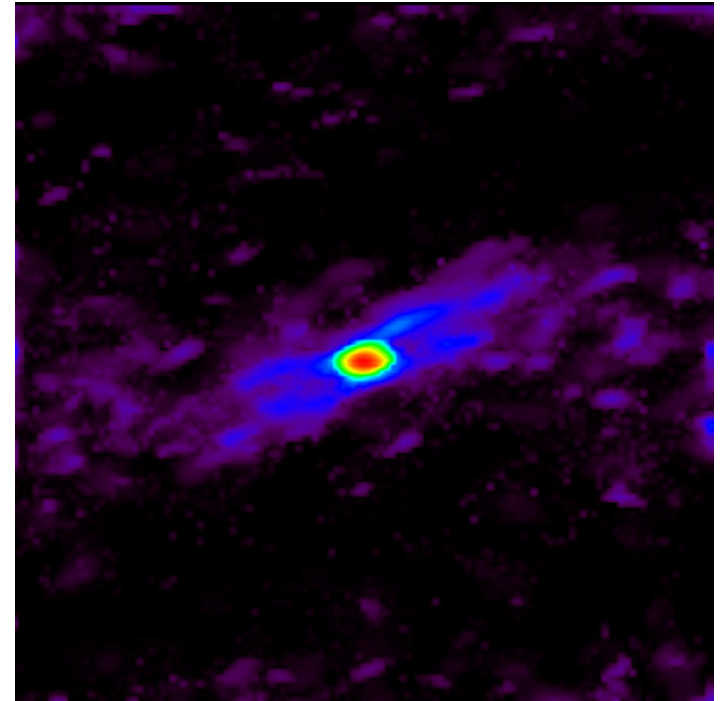


Breaking news!

First image with VEGA and First hyperspectral image with CHARA

The circumstellar disk of the
edge-on Be star ϕ Per

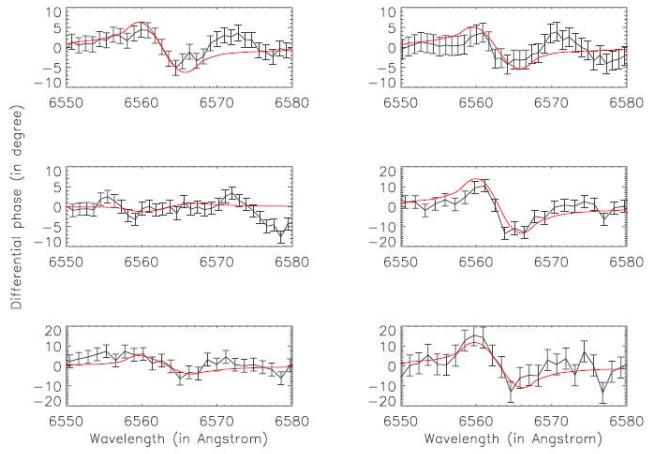
(More about this in Wednesday talk)



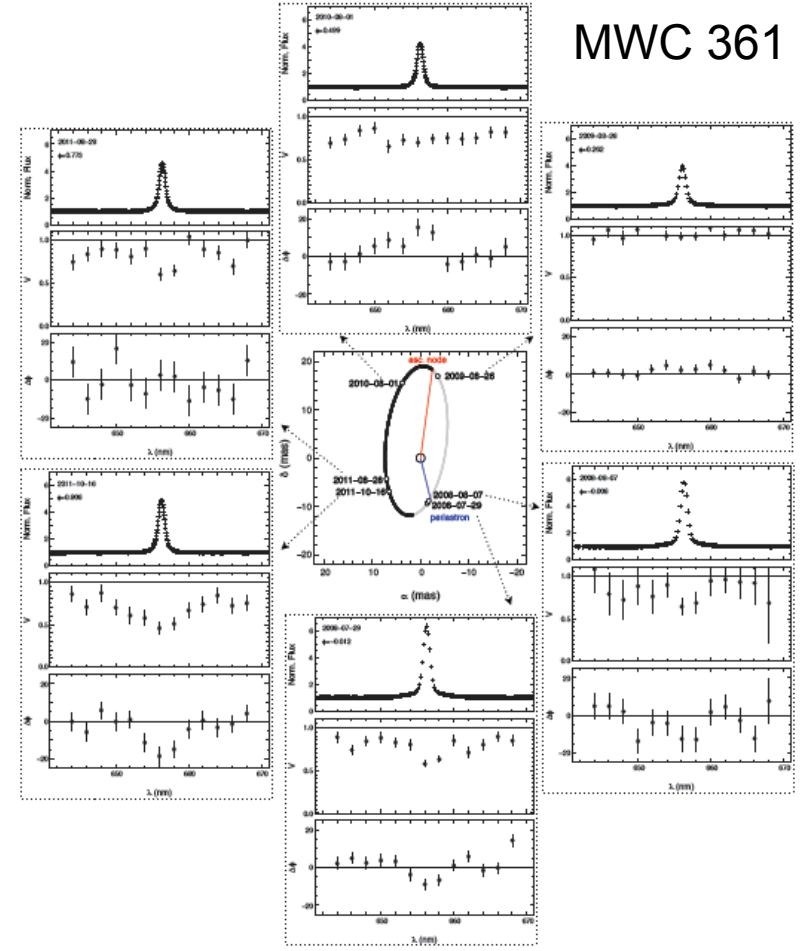


2013 published papers

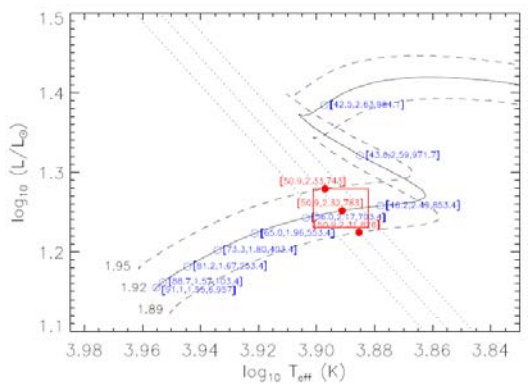
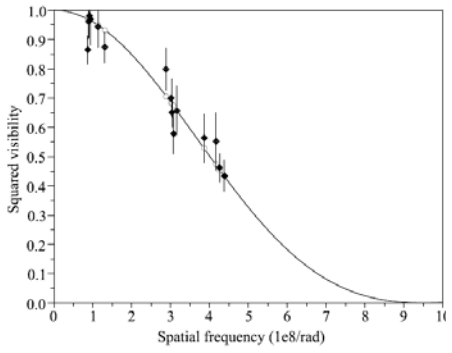
α Cep



MWC 361



10 Aql



+ 89 Herculis with other instruments
 + 48 And (SFP)

2013 observations

- 9 runs : 2 VEGA+MIRC (ϵ Uma and β Lyr), 2 VEGA+FLUOR, 6 in remote
- 5 Run managers (Isabelle, Karine, Nicolas, Denis, Philippe) and 13 observers
- 59 nights: 17 bad conditions, 7 poor condition and 35 with good conditions (60%)
- 312 measurements: (~ 7.5 /night)

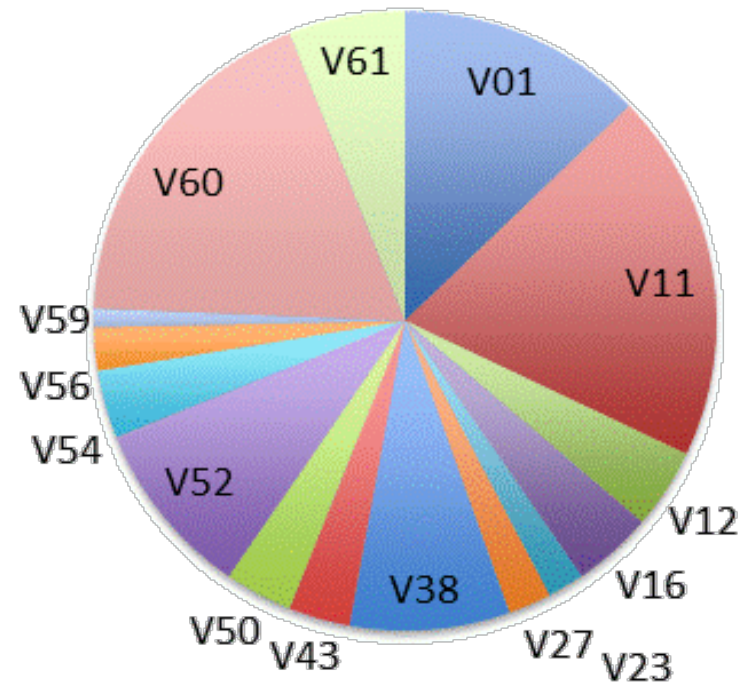
V11 : β Lyr (Imaging VEGA + MIRC)

V60 : Surface-Brightness relations (late-type)

V38 : Surface-Brightness relations (early-type)

V01 : Exoplanet host stars

V52 : δ Cep (Main backup target)





Future publications in 2014

- Surface-brightness of early-type star (Challouf, submitted)
- Spatio-spectral imaging of ϕ Per (Mourard, in preparation)
- Exo planet host stars (Ligi, in preparation)
- Metal poor stars (Creevey, almost ready to submit)
- Symbiotic star SS Lep (Blind, in preparation)
- Nova (Chesneau, in preparation)
- Asteroseismic target (Bigot, in preparation)
- δ Cep (Nardetto, in preparation)
- The eclipsing binary λ Tau (Nardetto, in preparation)

...



2014 programs

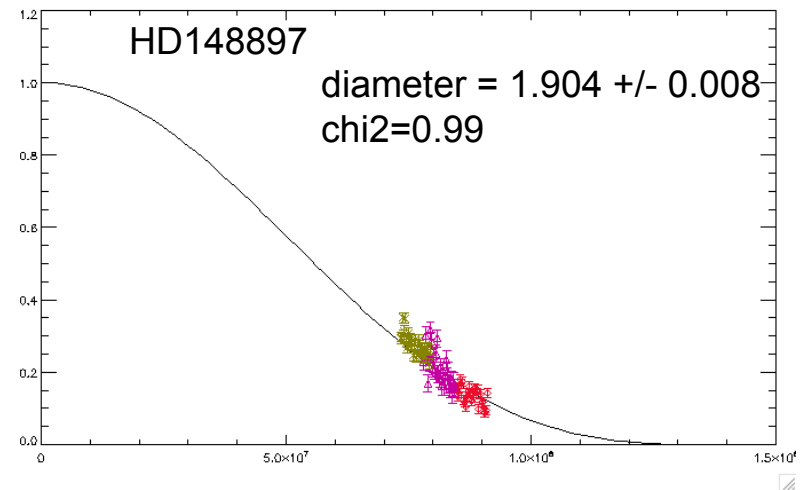
- 17 proposals (4 new) for almost 70 nights requested. 48 nights allocated to VEGA.
- Priority given by the CHARA-TAC analysis
- 6 runs over the year. Importance of April and December despite poorest conditions...
- Quite easy to adapt the run's schedule with scope's availability. Good to know in advance!

Priority list (based on chara-tac scores)

	PI	Title	nights allocated by the chara-tac	
V60	NardettoA	Improving the calibration of the surface brightness – color relation for late type stars	4,60	
V62 (new)	Meilland	Critical rotation and mass-loss: new insights from the study of edge-on Be stars.	3,30	
V55	Valls-Gabaud	The distance to the Pleiades using the double-lined detached eclipsing binary HD23642	2,20	
V16	PerrautA	Fundamental parameters of the magnetic rapidly oscillating Ap stars	2,50	
V12	PerrautB	Accrétion/Ejection in intermediate mass young stars	2,00	
V64 (new)	SteeB	Global Fast Rotation and Surface Differential Rotation of Bn stars	1,60	
V50	CreeveyA	The radius of the metal-poor post T-O star: HD140283	0,90	60% good nights
V52	NardettoB	Breaking the frontier to the cosmic distance scale using Cepheids.	6,80	
V43	CreeveyB	Determining masses of asteroseismic targets	1,80	
V54	Jamialahmadi	The late youth of fast rotating stars: connecting the environment and the photosphere of 51Oph and HD141569	2,30	
V27	Mourard	Post eclipse high spectral and spatial resolution follow-up of ϵ Aurigae	0,60	
V48	PerrautC	Observing the accretion disk and wind in the symbiotic star SS Leporis.	0,80	75% good nights
V38	Challouf	Calibration of the surface-brightness relation of BA early type stars: Toward a very accurate distance determination of LMC eclipsing binaries	0,50	
V57	Chesneau	Time monitoring of the angular diameter of two yellow hypergiants: long-term follow-up and short-term activity (eruptions)	0,50	
V61 (new)	Bigot	Fundamental parameters and chromospheric extents of active magnetic Red Giants	5,70	
V63 (new)	SteeA	Investigation of the magnetic effects on the disk around the classical Be star ω Ori	1,60	
V01	Ligi	Characterization of exoplanet host stars	2,20	

Hidden side of VEGA

- New generation photon counting detector commissioned in June 2013.
Gain of 1 mag $T_{exp}=10\text{ms}$ Global efficiency improved
- Improved real-time processing for cophasing and quality check.
A huge improvement that greatly facilitates all the night operations
- Upgrade of computers (CentOS)
New data-reduction computer in Nice
- Contribution to the definition JMMC OIDataBase
OIDB is now feeded by the VEGA data
- Tests of new method for diameter estimation
(*Differential processing + model fitting*)





Beyond VEGA ...and towards FRIEND

The intrinsic VEGA limitations are now well analyzed and understood:

Limitations: No closure phase

Difficulties at low Visibilities

Limitation of the measurement's accuracy

Reasons: Multimode regime

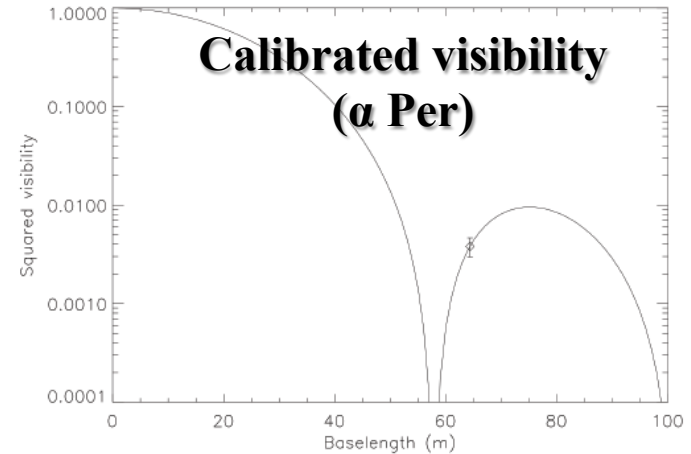
Photon counting detector : Saturation effect

Photon centroiding hole

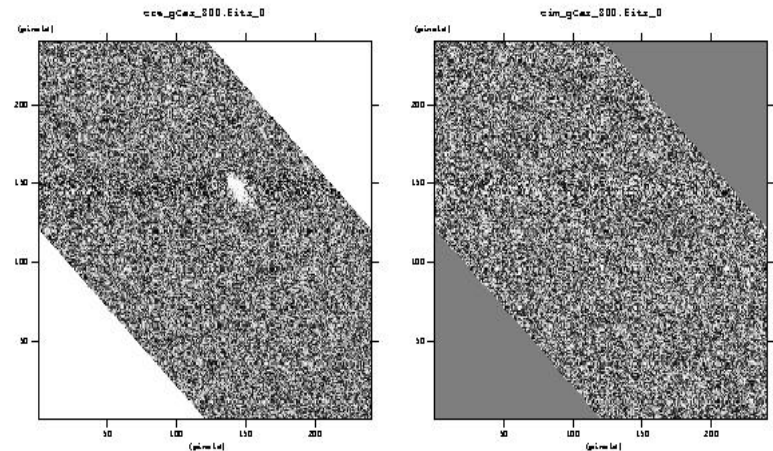
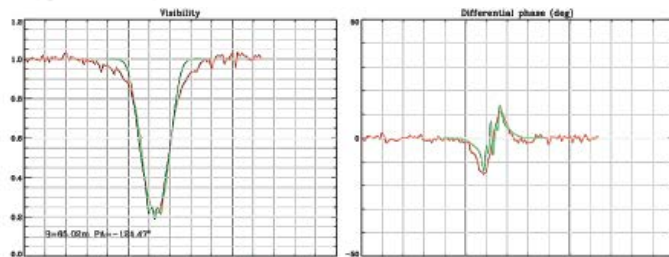
Context: Test of a promising new analogic detector in the visible (OCAM²)

Future Adaptive Optics on CHARA

First tests OCAM² on VEGA (Nov 2012)



Differential visibility and phase (gamma Cas)

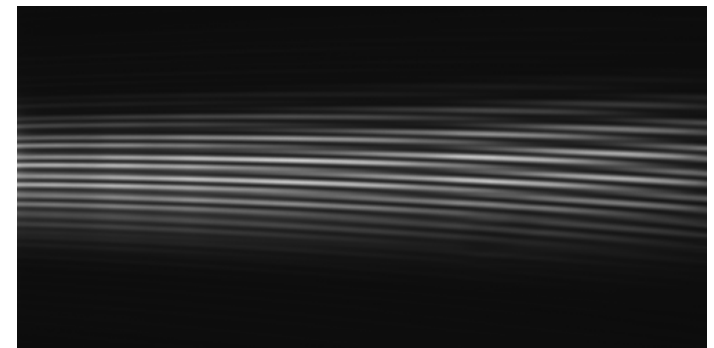
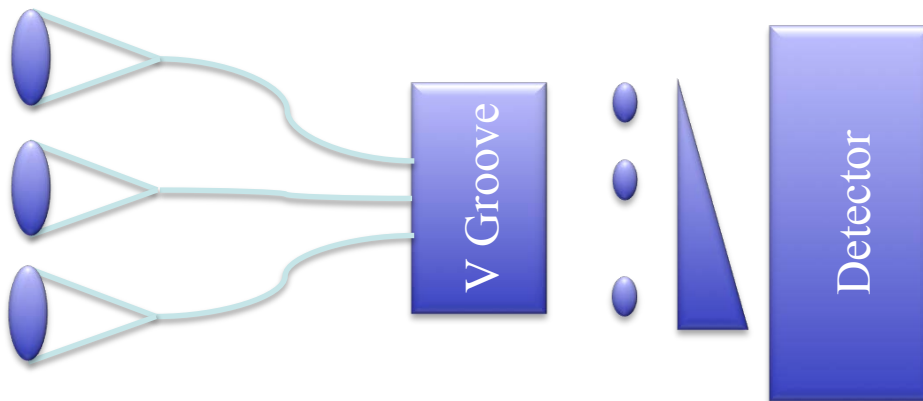


Bispectrum: 3T (gamma Cas) => Closure phase

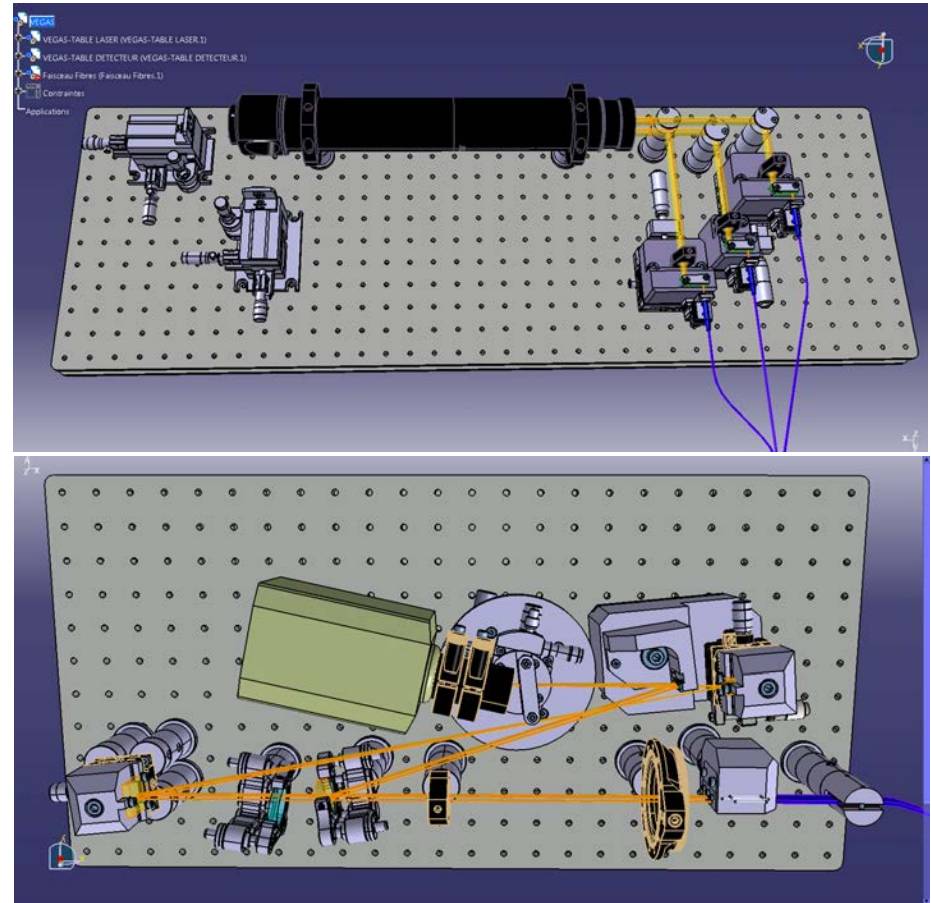
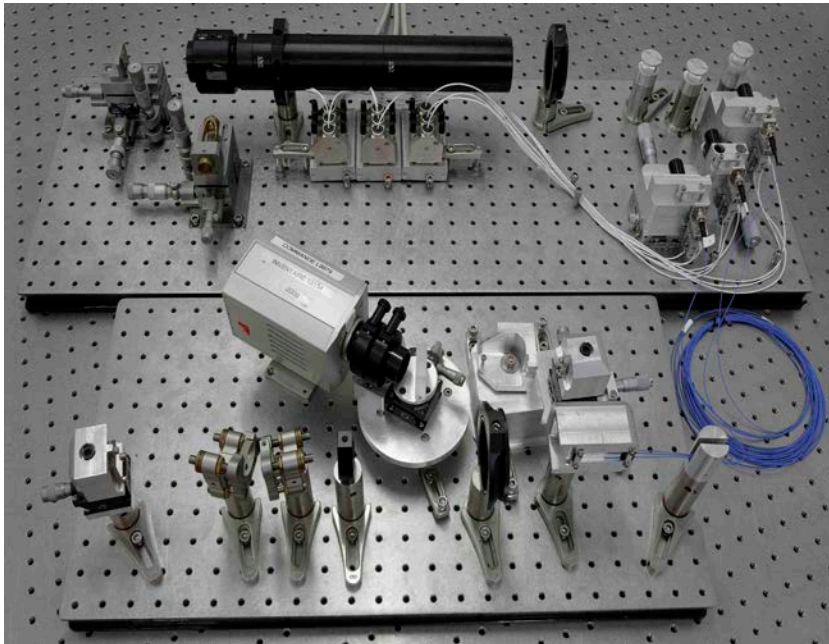
What is FRIEND?

A prototype for a future visible instrument

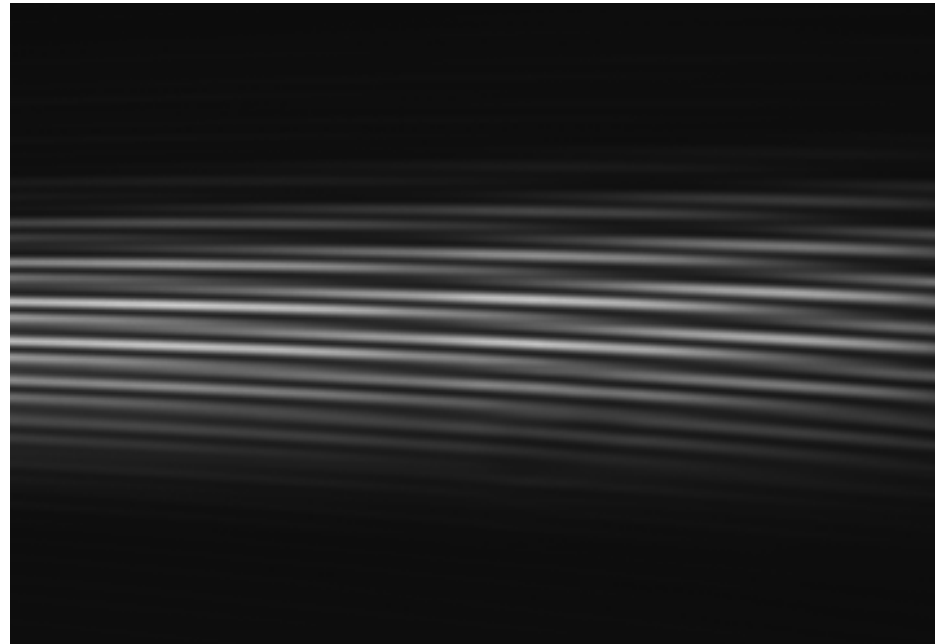
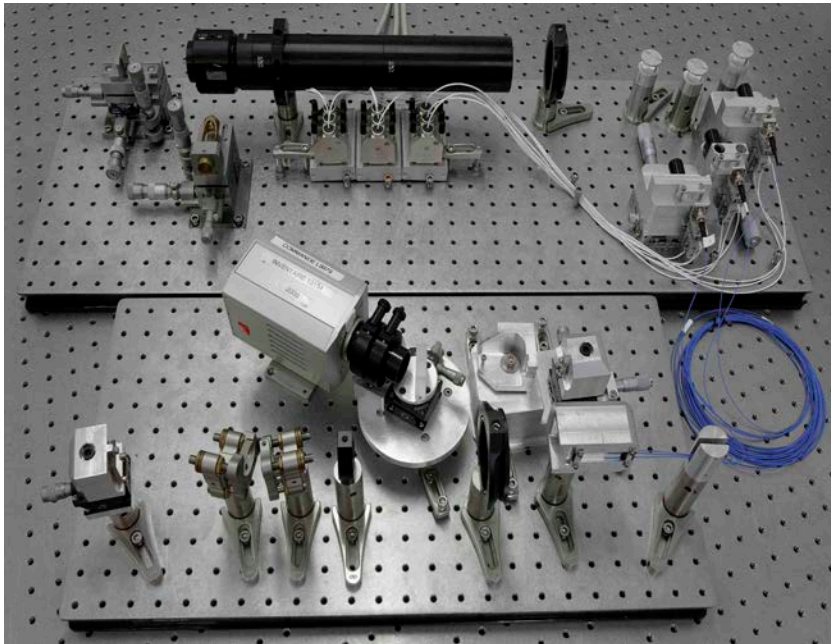
- 3 telescopes combiner
- in multi-axial mode
- Spectrally-dispersed fringes with $R=1500$
- Spatial filtering using optical fibers
- Use of a Vgroove
- Simultaneous photometry in dedicated channels
- Low noise ($<1\text{ev}$) visible detector OCAM2



FRIEND in the Nice optical Lab

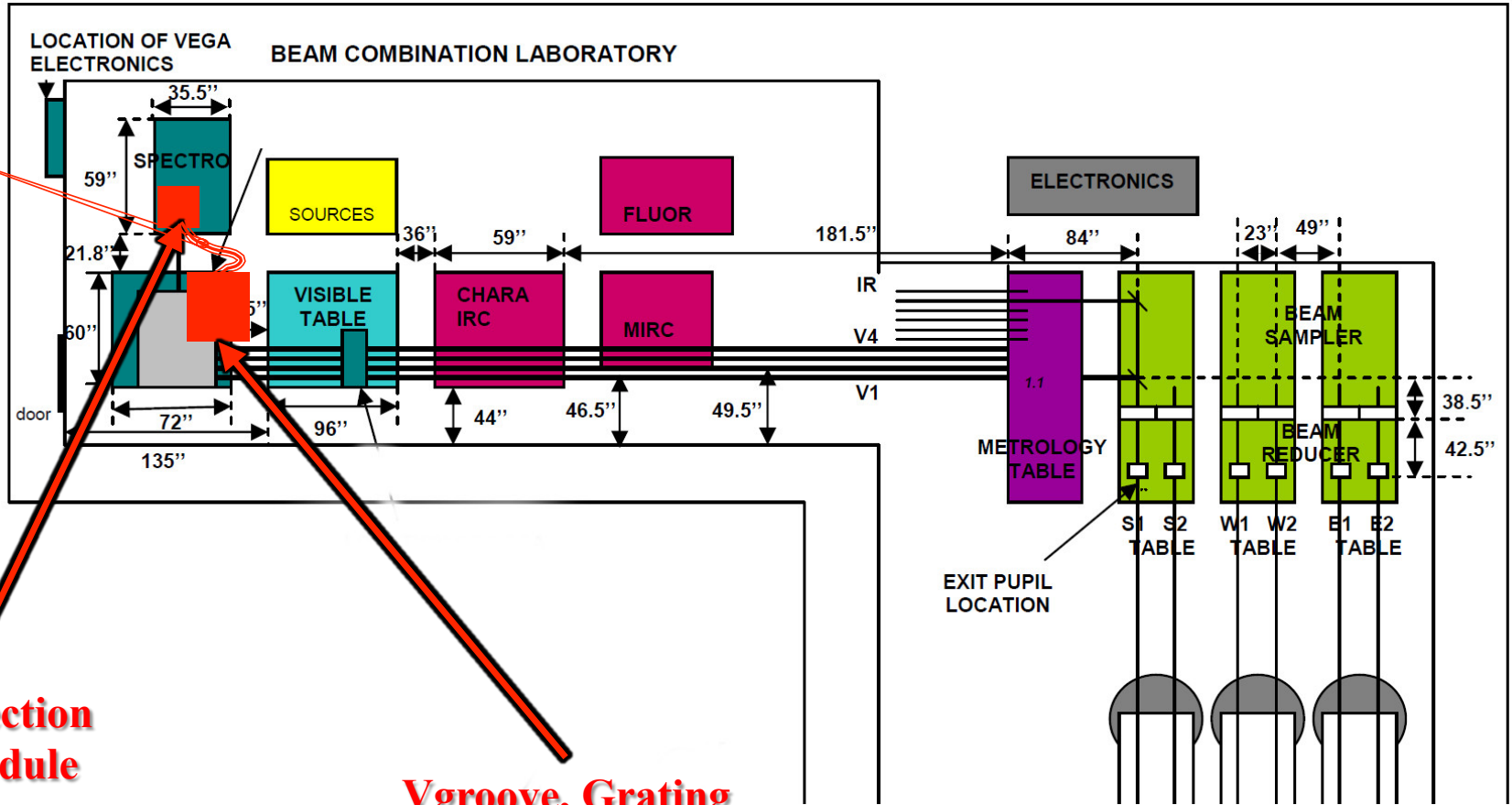


FRIEND in the Nice optical Lab





FRIEND on CHARA (Dec 2014)

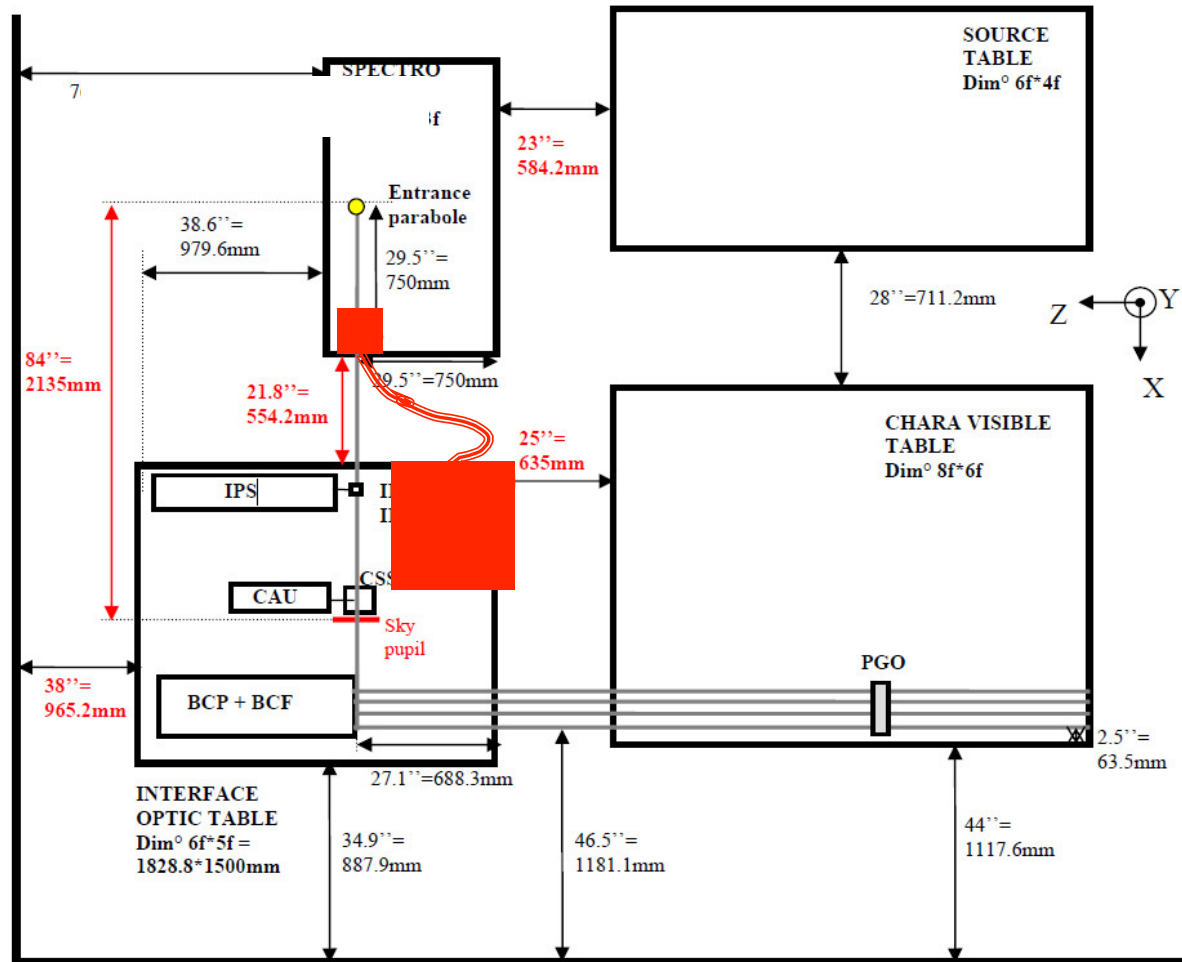


Injection module

Vgroove, Grating and detector



FRIEND on CHARA (Dec 2014)





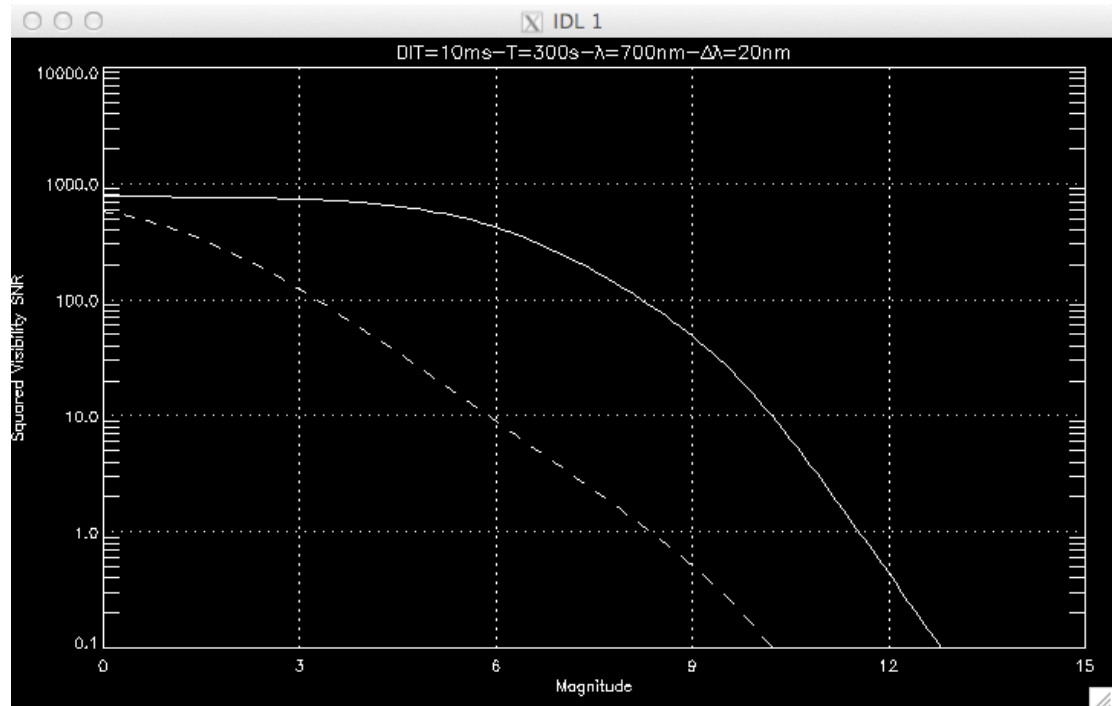
FRIEND (expected sensibility)

$$N_{ph} = N_{tel} \cdot T_{FRIEND} \cdot T_{CHARA} \cdot T_{PC} \cdot T_{Coupling} \cdot QE \cdot S_{tel} \cdot \Delta\lambda \cdot DIT \cdot 10^{-0.4m} \cdot \phi_0 \cdot \frac{\lambda}{hc}$$

$$SNR_{V^2} = \sqrt{n_c} \sqrt{n_{im}} \frac{N_{ph} DSP_{hf}}{\sqrt{N_{ph}^4 DSP_{hf}^2 + 2N_{ph}^3 DSP_{hf} + N_{ph}^2 + n_{px/channel}^2 N_{CIC}^2}}$$

$$DSP_{hf} = \frac{1}{n_{tel}^2} V_{inst}^2 V_{target}^2$$

- $T_{CHARA} = 0.16$
- $T_{optic} = 0.45$
- $T_{phot} = 0.7$
- $T_{polar} = 0.5$
- $T_{OA} = 0.8$
- $T_{Coupling} = 0.2$
- $QE = 0.9$
- $T_{PC} = 0.78$
- $N_{CIC} = 0.0023 \text{ ph/px/im}$
- $V_{inst} = 0.8$
- $n_{tel} = 3$
- $R = 800$





FRIEND and beyond...

-Nov 2012

Tests of an OCAM² camera on VEGA

-2013-2014

Development of a testbed in Nice

-Summer 2014

Acquisition and implementation of the OCAM²

-18-20 Dec 2014

First test of the prototype on the VEGA table

-2015

Performances and science demonstration

-2016

Design of 6T combiner with spectral-dispersion(s)
and definition of the sciences cases
(We are open to collaborations)

-2017

6T On sky?

- ?

Clone as a visible visitor instrument on VLTI?



Max-Planck-Institut für Radioastronomie





Thank you CHARA!

