First light of the FRIEND visible fibered combiner

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OVERVIEW

- Why FRIEND ?
- What is FRIEND ?
- FRIEND in the CHARA focal lab
- First Technical Run
- Conclusions and Perspectives

Why FRIEND?

Preparation of the next generation of visible interferometric instruments

- Successor of VEGA, currently in operation at CHARA
- VEGA main limitations

  Photon-counting detectors (ALGOL): saturation at high flux and photon centroiding hole
  Multi-mode regime: limitation in magnitude and accuracy

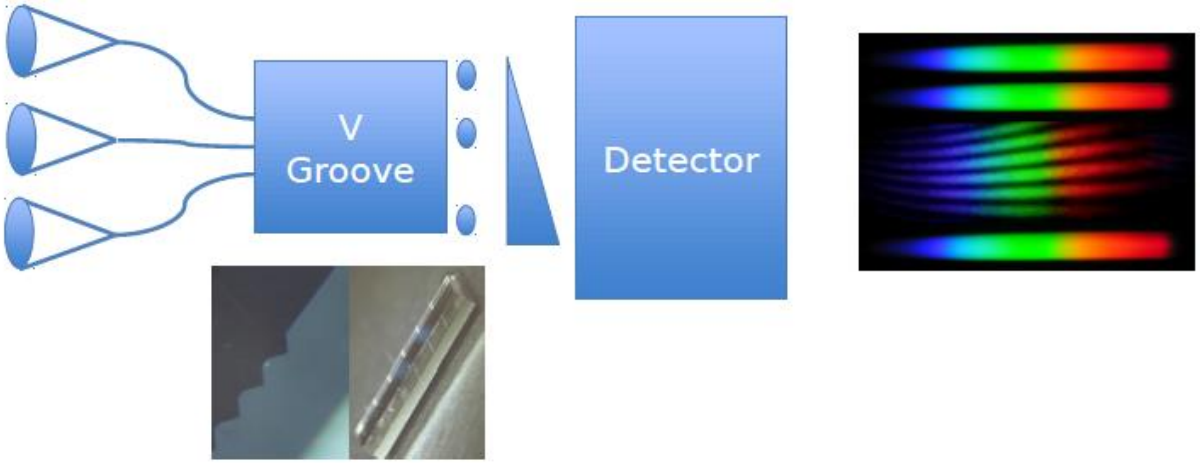
  ⇒ no low visibility and closure phase measurements
- Installation of AO systems on CHARA (in progress) and on VLTI/AT (NAOMI)
- Very low noise (<0.5e$^-$) and fast (up to 2000 fr/s) analogic detector: OCAM2
- Combination of up to 6 telescopes simultaneously in the visible

FRIEND ⇒ validation of spectrally-resolved interferometric observations in the visible in the case of partial correction by AO

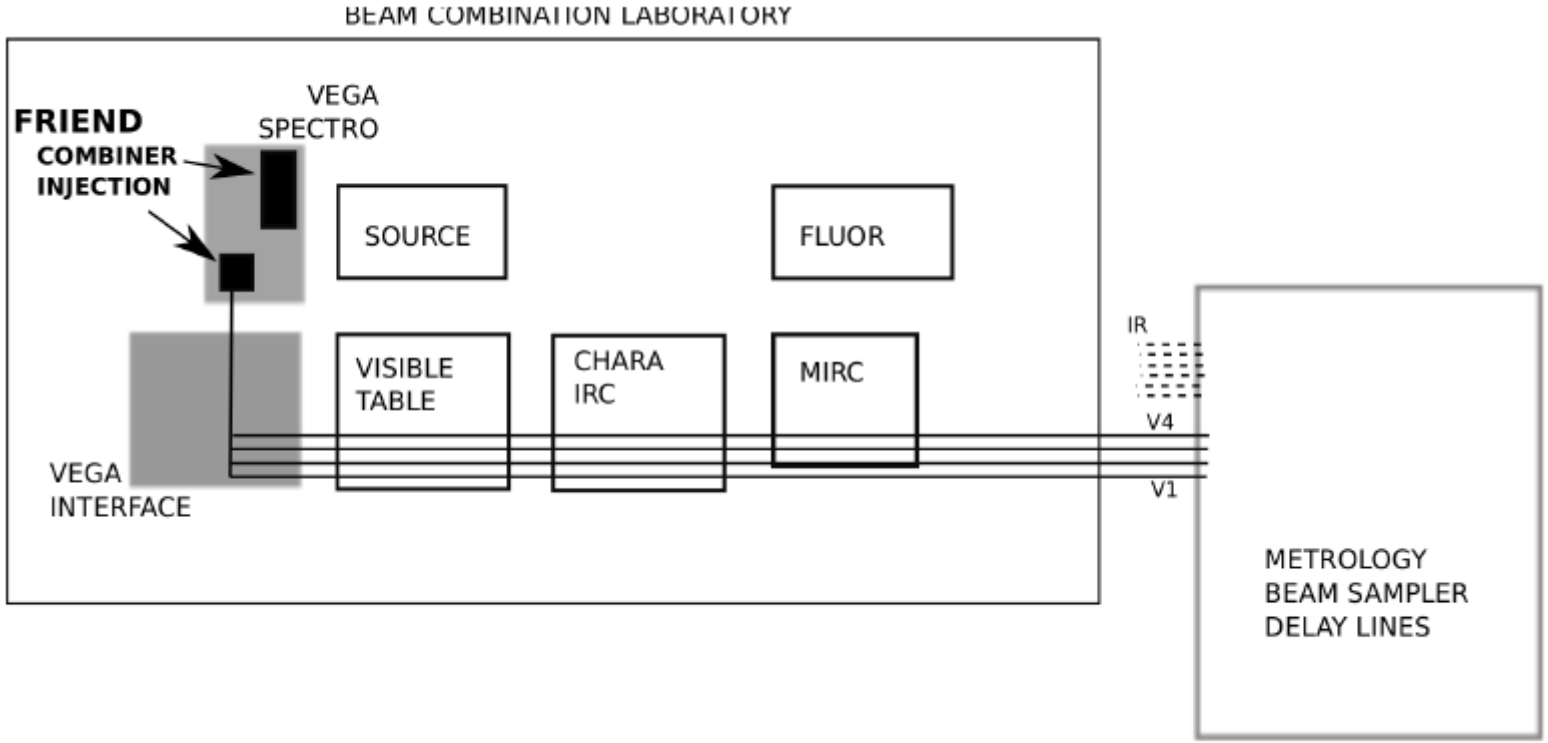
What is FRIEND ?

FRIEND is a demonstrator/prototype

- 3 telescopes
- Spatial filtering with mono-mode optical fibers (as AMBER and MIRC)
- Photometric channels
- Multi-axial 'all-in-one' beam recombination scheme
- Dispersed fringes mode (as VEGA, AMBER and MATISSE)
- 2 Spectral Resolution (R=400/$\Delta\lambda$=120nm and R=2500/$\Delta\lambda$=30nm)
- Use of analogic very low noise camera: OCAM2



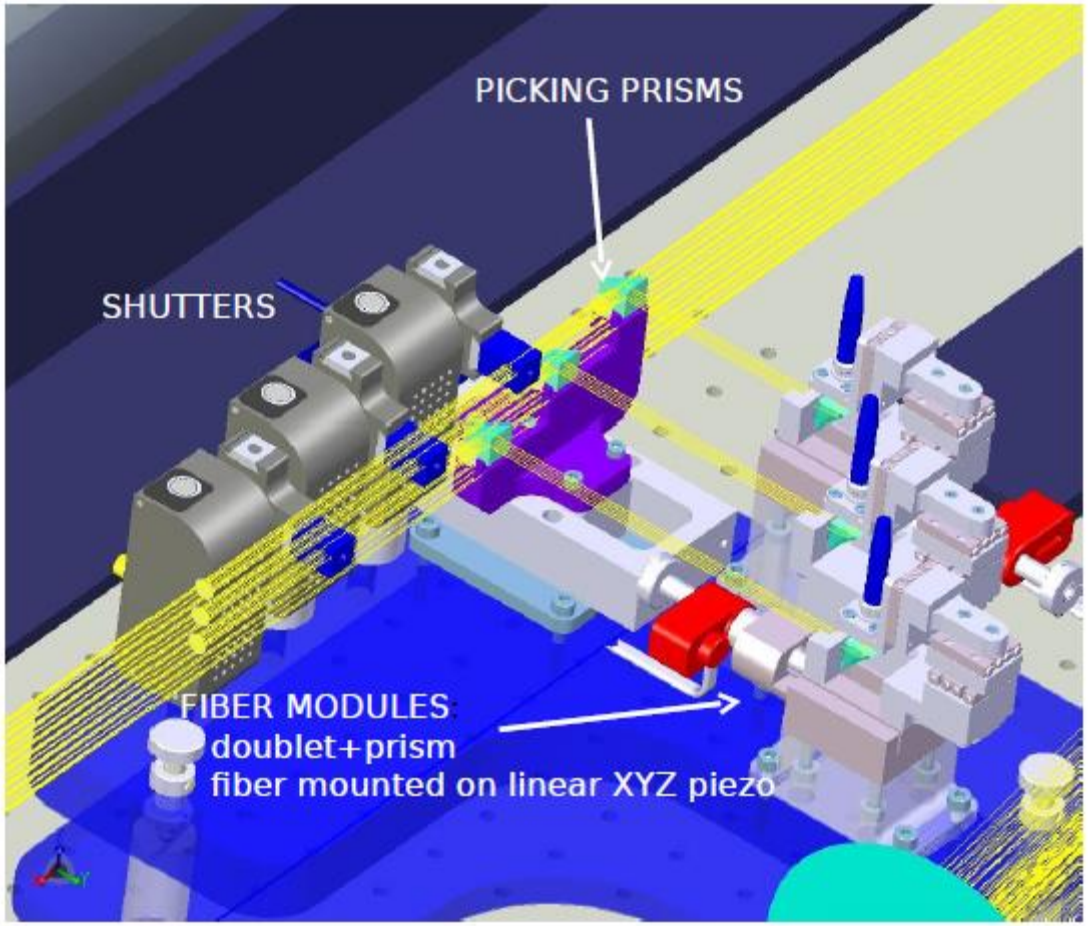
FRIEND in the CHARA focal Lab



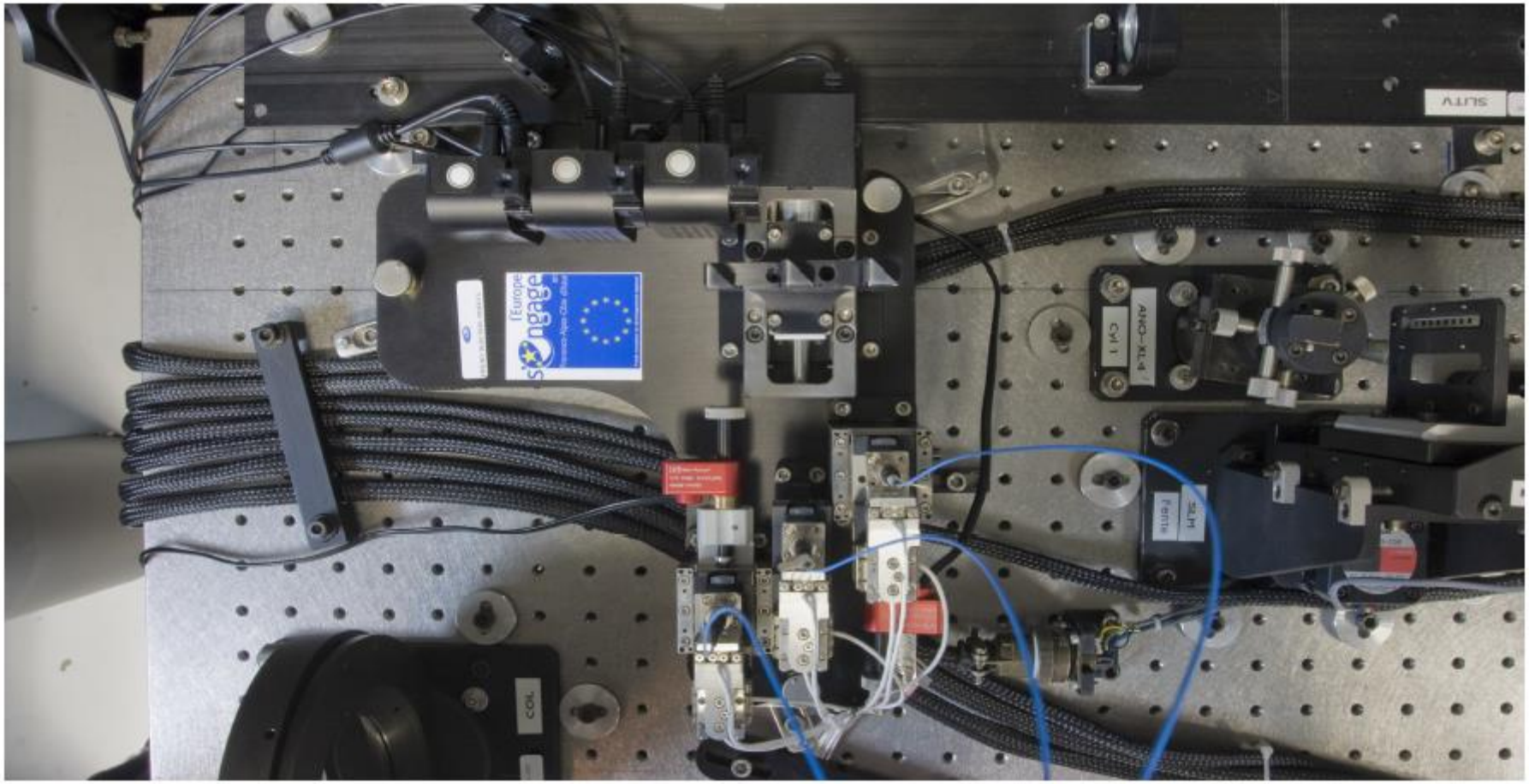
FRIEND can use the alignment (pupils and images) and source devices of VEGA

FRIEND in the CHARA focal Lab

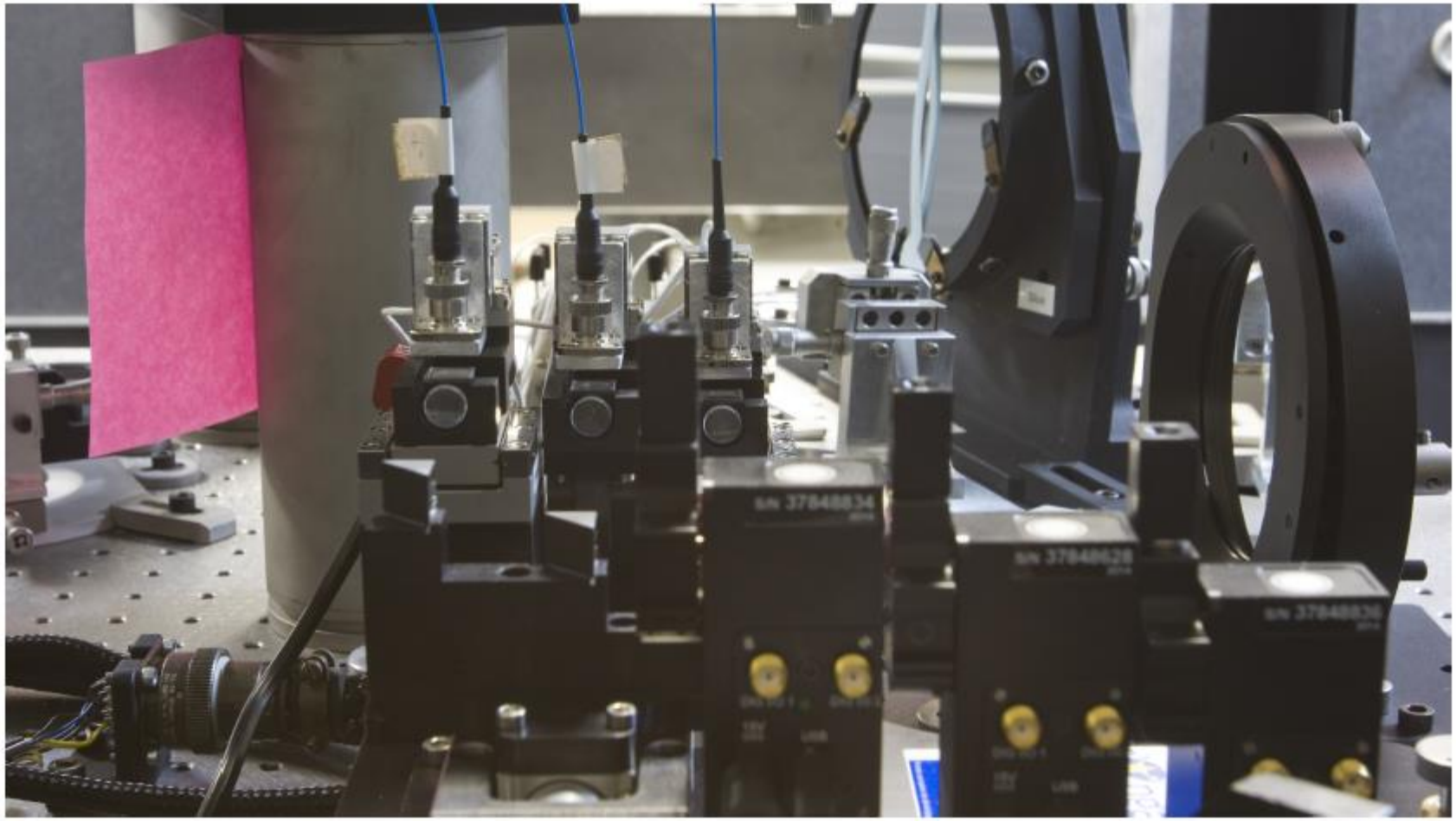
INJECTION MODULE



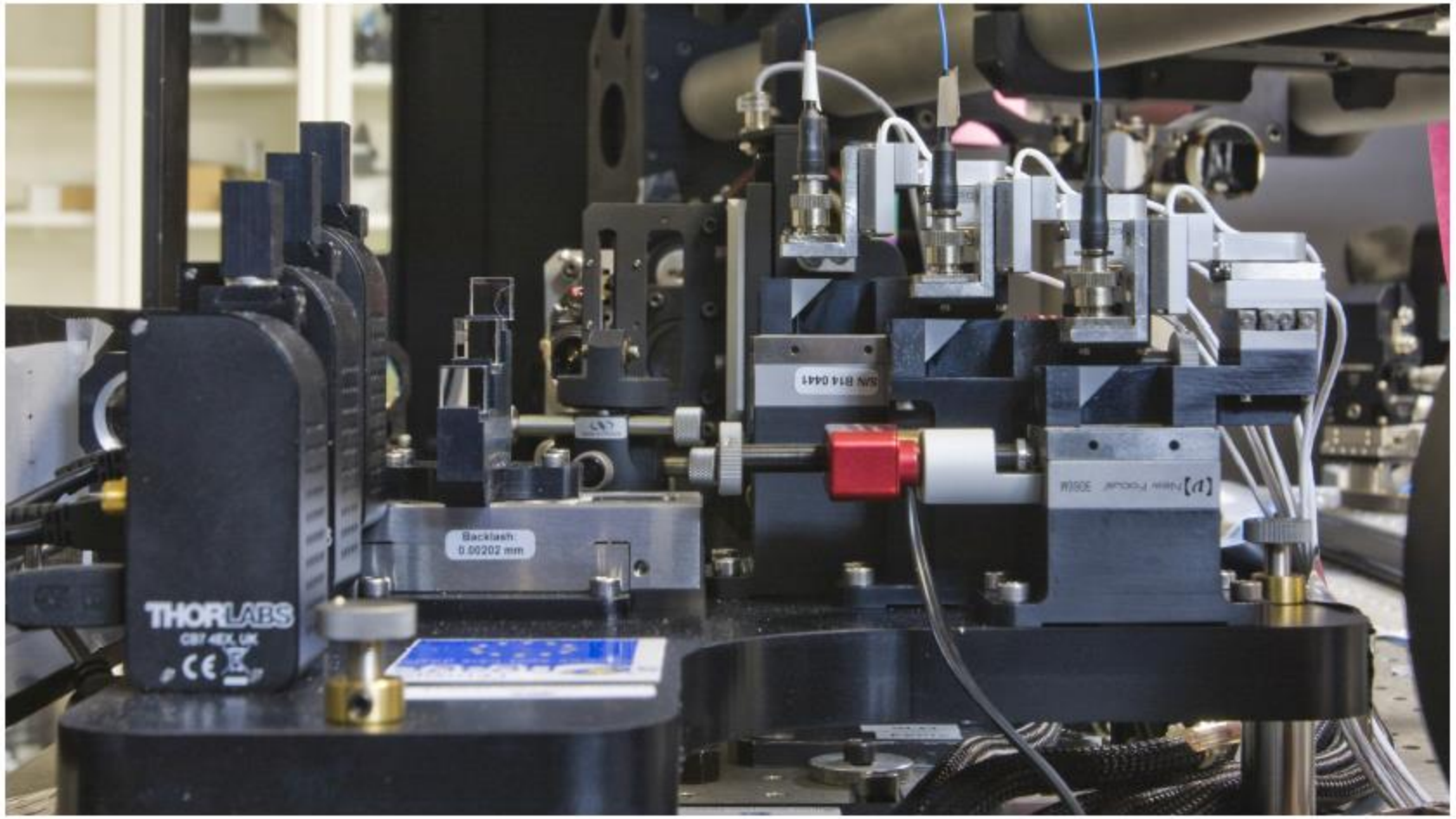
FRIEND in the CHARA focal Lab



FRIEND in the CHARA focal Lab

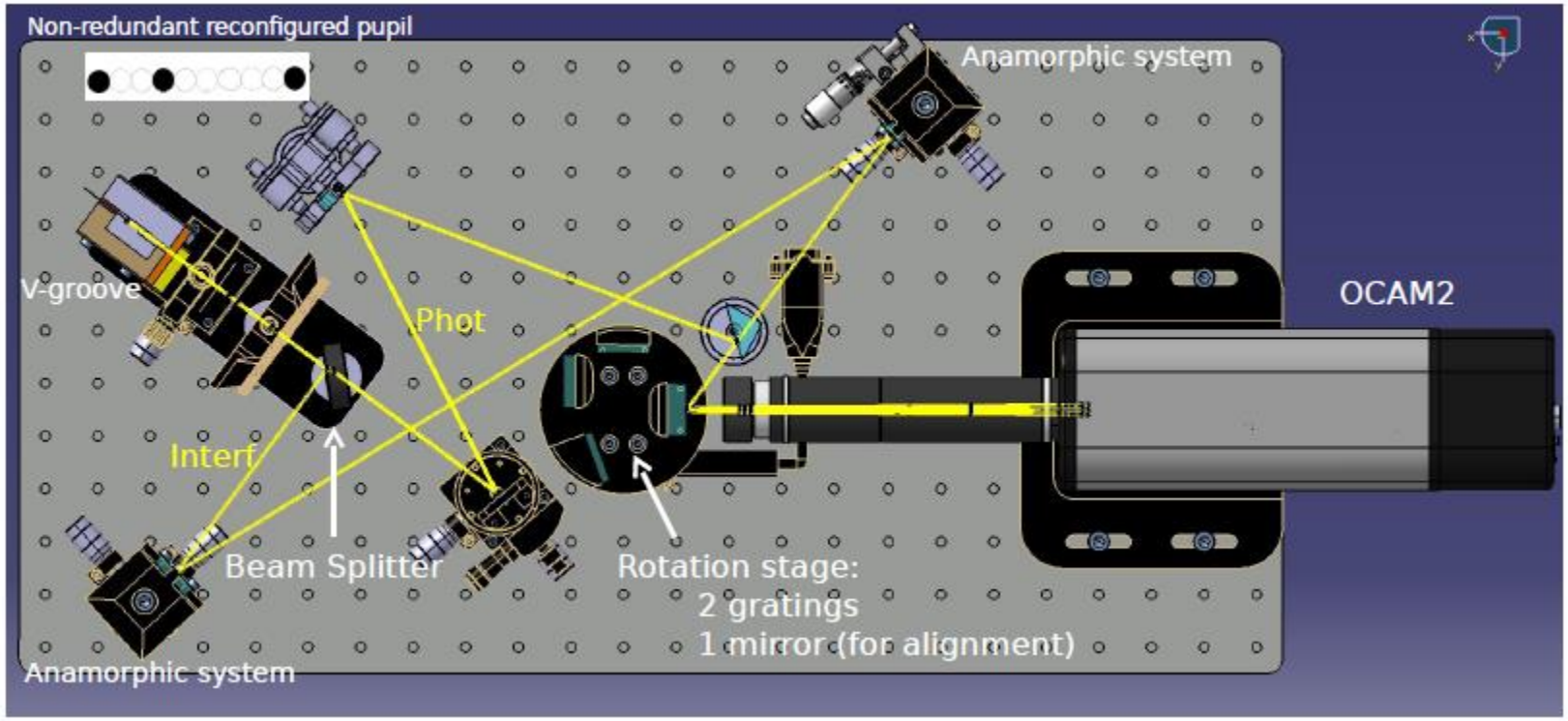


FRIEND in the CHARA focal Lab



FRIEND in the CHARA focal Lab

COMBINER MODULE



FRIEND in the CHARA focal Lab

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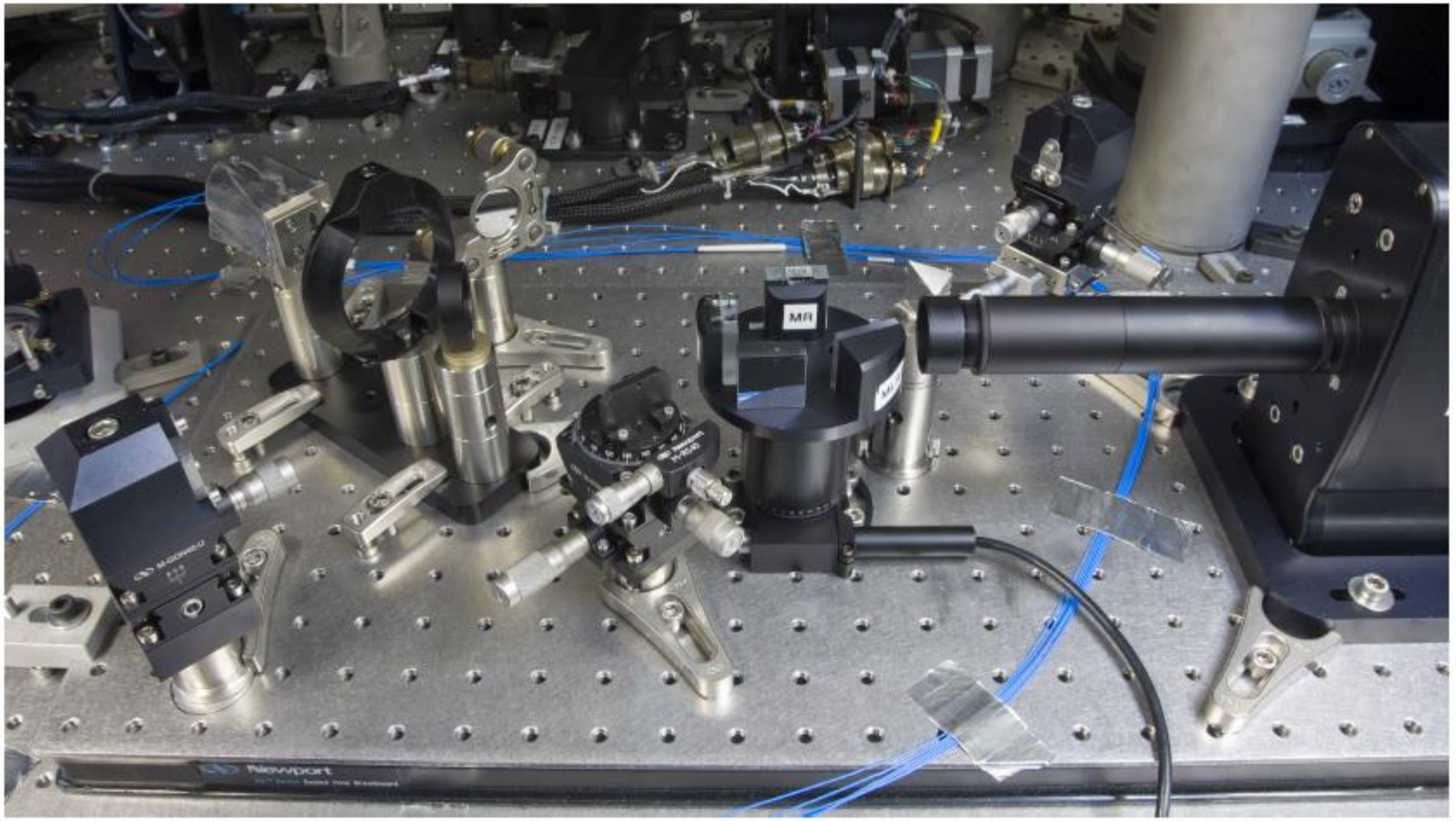
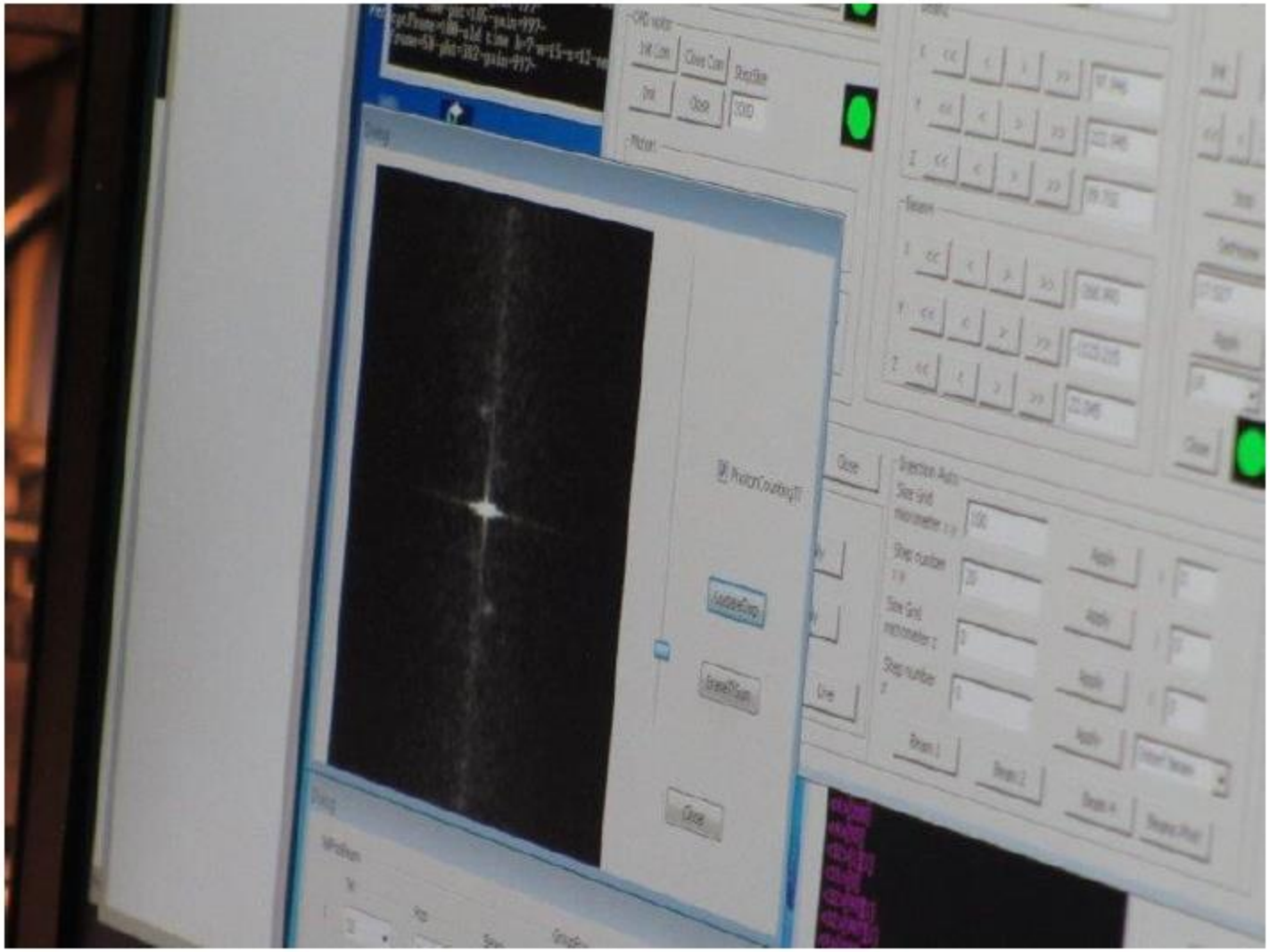


First Technical Run

- **3 Nights allocated**
  December 18-19-20, 2014
- **FRIEND installed and aligned in 2 days**
  Fringes with the VEGA internal source
- **Poor seeing and bad weather conditions**
  r_0<5cm and Clouds/Humidity
- **However first fringes obtained on Regulus**
  2T and Low Resolution mode

First Technical Run



First Technical Run

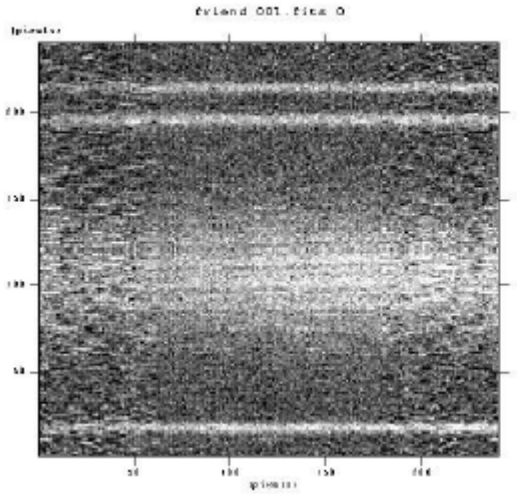
OBSERVATIONS LOG

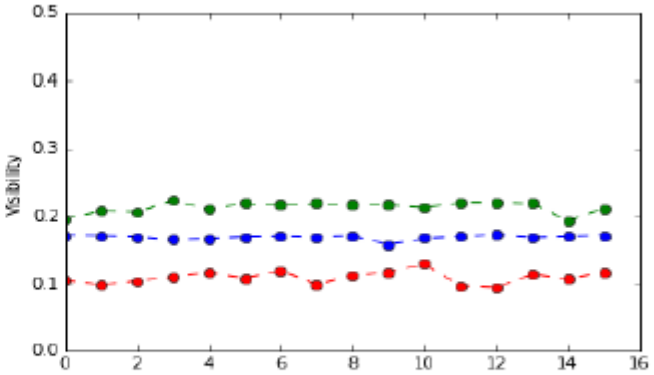
Date	Star	DIT	Gain	Spectral Resolution	Telescopes	Comments
18/12/14	Regulus	10	471	None	E2	Photometric test
18/12/14	Aldebaran	10	471	None	E2	Photometric test
18/12/14	Aldebaran	10	1000	LR	E2	Photometric test
18/12/14	γ Ori	10	1000	None	E2	Photometric test
18/12/14	κ Ori	10	1000	None	E2	Photometric test
18/12/14	Aldebaran	10	471	None	E2	Photometric test
18/12/14	Aldebaran	10	471	None	E2	Photometric test
18/12/14	Aldebaran	100	653	LR	E2	Photometric test
19/12/14	Regulus	40	997	LR	E1E2	Fringes
19/12/14	Regulus	20	997	LR	E1E2	Fringes
19/12/14	Regulus	10	997	LR	E1E2	Fringes
19/12/14	Regulus	5	997	LR	E1E2	Fringes
19/12/14	Regulus	2	997	LR	E1E2	Fringes
19/12/14	γ Cas	20	997	LR	E1E2	?
20/12/14	α Cep	10	997	LR	S1S2	Fringes
20/12/14	κ Ori	10	997	LR	S1S2	?
20/12/14	Regulus	10	997	LR	E1E2	?

First Technical Run

PRELIMINARY RESULTS

Artificial Source





Low Visibility

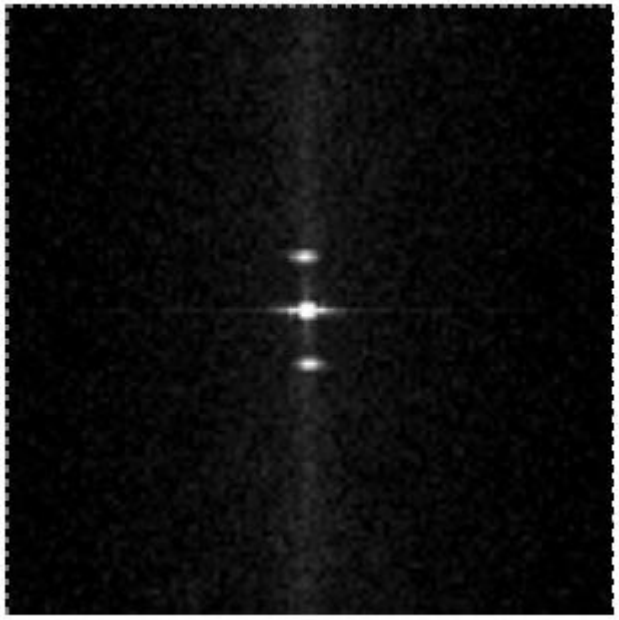
⇒ Polarization effects

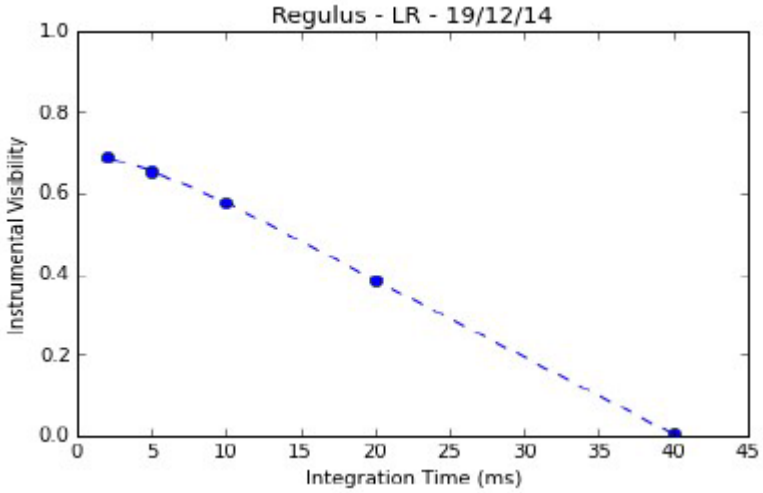
⇒ Size of the source pinehole

First Technical Run

PRELIMINARY RESULTS

Observation of REGULUS





Short DIT

⇒ reduce the OPD jitter effect

⇒ High Instrumental Visibility but Low Flux

What is the optimal configuration of the detector?

Conclusions and Perspectives

- Fringes recorded on Regulus (m_V=1.4) and α Cep (m_V=2.4) in 2T/LR mode
- Estimated coupling ~ 0.2 % (bad seeing conditions)

  ⇒ however consistent with simulation

  ⇒ expected coupling in case of good seeing ~ 3-5 %
- Fringes Search and Coherencing done with VEGA and CLIMB
- FRIEND does not replace VEGA. Both inst. could work alternatively

Conclusions and Perspectives

- Next Technical Run in July 2015
  - ⇒ 3T observations
  - ⇒ Medium spectral resolution
  - ⇒ Polarization analysis
  - ⇒ Optimal configuration of OCAM2
  - ⇒ Low visibility and Closure Phase measurements
- First Scientific Run in September 2015
  - ⇒ Science case to be defined
- Final Goal = Test FRIEND with AO
  - ⇒ in 2016 ?