Perspectives on a new visible 6T instrument on CHARA

Nice, 16 Mar 2016

Introductive remarks

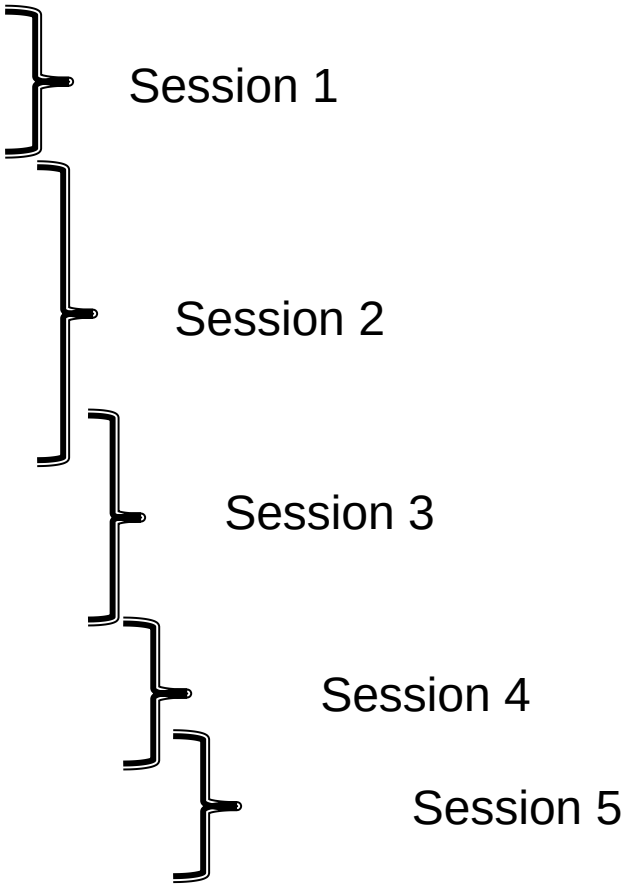
- 8 years of VEGA and PAVO: limitations identified
- AO perspectives and progresses on the FRIEND demonstrator.

- Initial idea presented during CHARA Meeting in Atlanta last year

- Kick-off meeting in Nice on 21 Sep 2015 + follow-up meeting 11 Jan 2016 → a plan in ~20 actions for the conceptual study.
  → this meeting

Main actions

- Science program
- Detector issue
- Beam combination
- Fiber injection
- Fringe tracker
- Software
- General organization



SESSION 1 – SCIENCE WITH VISIBLE BEAM COMBINERS

A short summary of the previous steps

White book for a visible interferometric instrument: Ph. Stee et al.

- Initial start at EII level by Olivier in 2012/2013
- Working groups by Philippe in 2014
- Various ESO meetings end of 2014/early 2015
- Meeting and publications in 2015

VLTI perspectives and CHARA framework

OPPORTUNITY FOR LARGE PROGRAMS

Atlanta 2015

We need a visible 6T beam combiner

- Excellent opportunity for **fundamental parameter** of stars survey or **'legacy' program**. Already started yes but could be extended thanks to visible wavelengths, sensitivity and 'fast' observations with 6T.
- Also excellent case for **imaging and spectral imaging**
- Convergence of various efforts
  - PAVO, VEGA: visible and spectro-interferometry
  - MIRC: imaging and 6T operations
  - FLUOR: high precision
  - AO@CHARA
- Science preparation and technology developments

White book cases for LP

- Surface-brightness-color relations
- Masses
- Fundamental parameters as a function of SpTy
  - Radius
  - Effective Temperature
  - Limb darkening

➔FROM EMPIRICAL MODELS TO MEASURES

- Exoplanets host stars
- Asteroseismic targets

- Original and unique support to a large panel of space missions
- *Doug's opening remark:*
  - *single stars: Gaia, TESS, CHEOPS, PLATO;*
  - *binaries: stellar masses and stellar evolutionary outcomes*

5 years * 50 nights*8★ = 2000obj

- 8 stars / nights
  - 8x(Cal1+Obj+Cal2)*2=48 o/n
- 2015: 187n, 4699o ➔16o/n. Factor 3 missing

- But
  - AO ➔75% of 'good seeing' conditions
  - 6T means 15V²
  - Low spectral resolution and number of channels λ-coverage
- Probably feasible:
  - PAVO/FLUOR experience of fast shift
  - Queue scheduling and optimization

SESSION 2: INSTRUMENTATION

Main open questions

- Detector: OCAM2 – Nüvu
- Beam combiner
  - FRIEND characterization (MAM)
  - Various combining schemes
  - IO tests
- Fibers

SESSION 3: INTERFACES WITH AO AND FT

Main open questions

- Quality of injection behind a partial AO?
  - Additional T/T?
  - Interfaces with the various CHARA loops?
- Need for a 6T coherence/fringe tracker
  - Science limits
  - Coherencing+ Coherent processing?

SESSION 4: CONTROL, OPERATION, DRS

Main open questions

- Principles for the instrument control software
  ➔CHARA standard
- Estimation of data flow, perspectives of archiving
- Data processing principles?

SESSION 5: DISCUSSION

Introduction

- Nice+Grenoble+Lyon initiative
- Based on VEGA+FRIEND
- But should not be a VEGA-like instrument
  - … but a full CHARA one
  - … and if possible and interesting: 1 for CHARA and 1 for VLTI
- Timeline for CHARA >2018?
- Timeline for VLTI >2020?

- Funding request to be prepared for next summer
- Partnership to be defined
  - many CHARA interfaces
  - Experience from PAVO, example of VISION
  - Synergy with MYSTIC/MIRCx for Group delay
  - FT-Gravity

Today's main points of conclusion?

- Science
  - Imaging/spectral-imaging
  - High-efficient θ machine
    - ➔ Sensitivity (detector, AO, FT)
    - ➔ Simple instrument with integrated pipeline, very few modes (2-3 maximum)
- Concept
  - Technology ready
  - Bulk/IO: choice to be sensitivity-driven
  - Multi-axial, dispersed fringes
- Interfaces (important for sensitivity and reliability)
  - Pupil and image trackers, LDC
  - AO and fiber injection
  - NIR for group-delay/fringe tracker: residuals versus magnitude/r0/dispersion…
- Control/operation/DRS
  - To be built on previous experience (see JMC talk) and CHARA integrated
  - More automatic processes towards final products