



HerbigAeBe PIONIER Large program

Wing-Fai Thi, IPAG
on behalf of Jean-Philippe Berger
(ESO/IPAG)

French ANR POLCA project



Parametric fit study

Work in progress, Bernard Lazareff

Aim: to search for ring and non-axisymmetry using V2 and closure phases

Method:

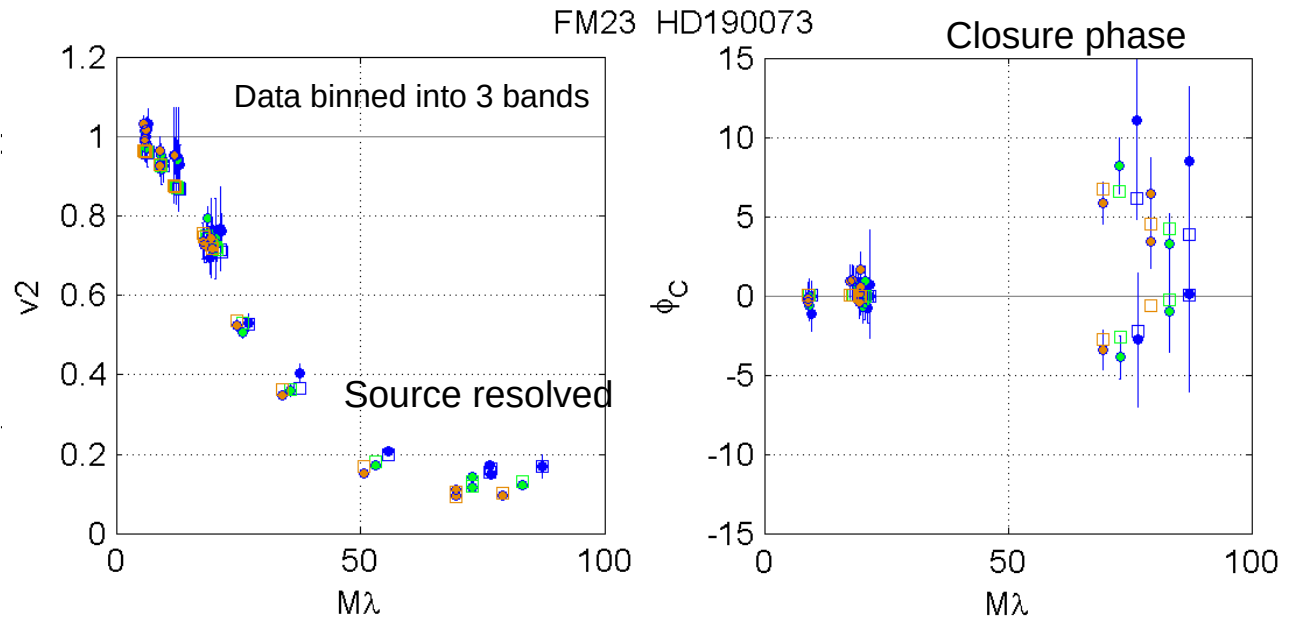
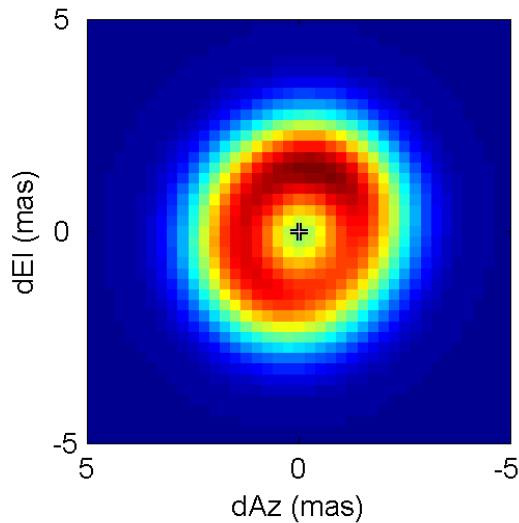
Point source

Thin elliptical ring

Azimuthal modulation (non-axisymmetry)

Convolved with axisymmetric kernel (total 11 free parameters)

Model image



A physical thick ring is the most likely explanation

The consortium

ESO/IPAG: J.-P. Berger

IPAG: **B. Lazareff**, W.-F. Thi, M. Benisty, J. Kluska, J.-B. Le Bouquin, F. Malbet

UMI-FCA : C. Pinte, F. Ménard

Michigan State University: J. Monnier

Georgia State University : F. Baron

University of Leiden: A. Juhasz

Caltech: R. Millan-Gabet, A. Isella

GRAL, Lyon : E. Thiebaut

Exeter University: S. Kraus

University of Amsterdam: C. Dominik

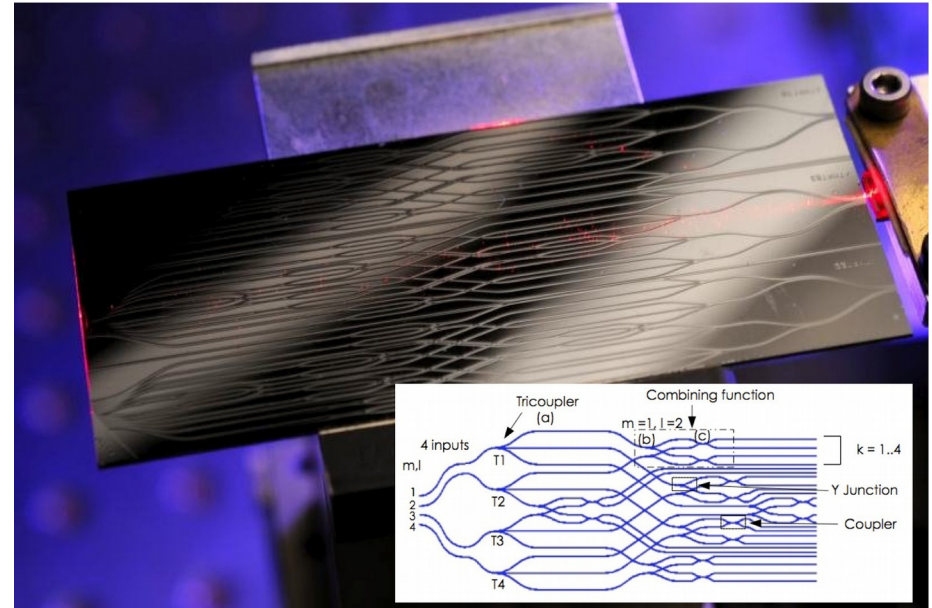
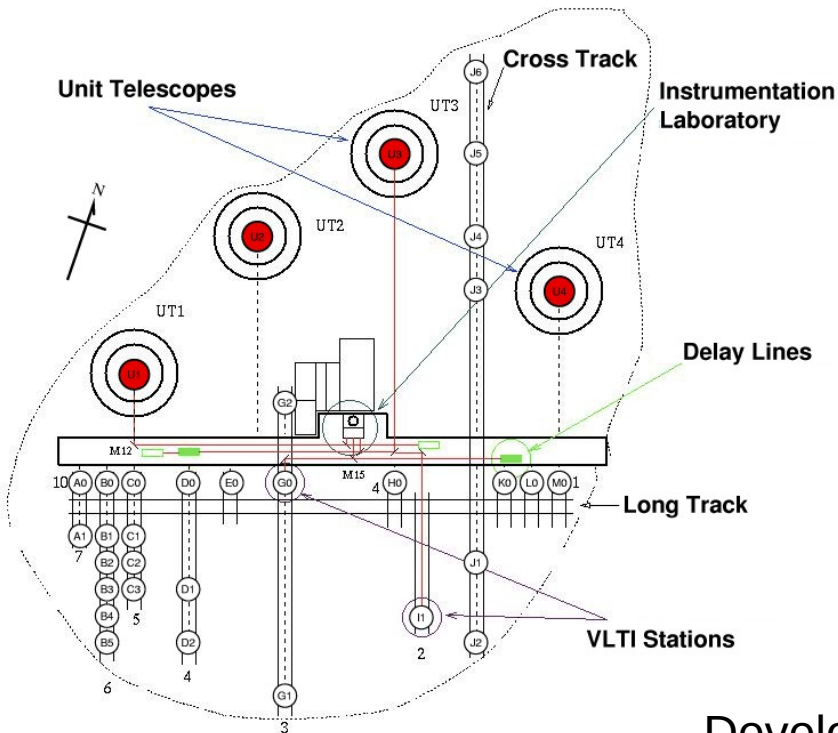
Universidad Catolica de Chile: R. Lachaume

A survey of Herbig AeBe stars

- ESO Large Program 090C-0963 (PI Berger)
- Visitor instrument PIONIER: 4 auxiliary telescopes, H-band, small spectral resolution (6 baselines, 4 closure phases)
- VLTi 3 configurations:
 - small-medium-large (short to long baselines)
- 30 nights awarded: ~3 lost due to bad weather

PIONIER at VLT

Integrated optics beam combiner



Developed at IPAG (Berger, Lebouquin)
 4 beams (auxiliary telescopes or UTs) : 6 baselines
 H-band: sensitivity 7-8 mag, R=20, on AT

The sample & the aims

- 55 targets:
 - B0 to G type stars
 - taken from the catalogues of Hillenbrand + (1992), Thé + (1994), and Malfait+ (1998)
- Aims: statistics and on individual objects
 - Constraining the shape of the inner disk:
 - Vertical extend
 - Non-axisymmetry
 - Determining the composition (gas, dust)
 - Determining the temperature

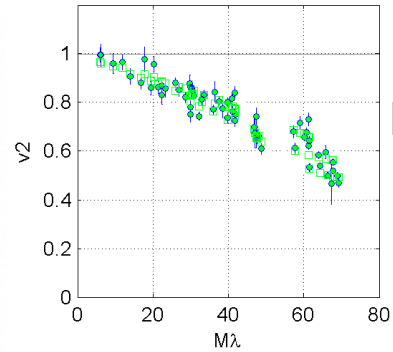
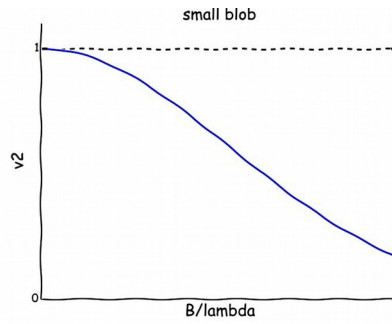
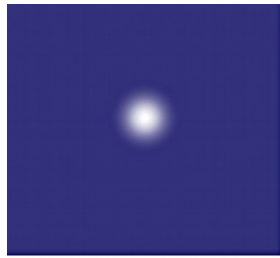
Observing strategy

- Obtain highest possible UV coverages at low spectral resolution for the best sources for the purpose of image reconstruction (Jacques Kluska)
- Snapshot UV coverage to constraint morphology basic parameters for faint and/or marginally resolved sources

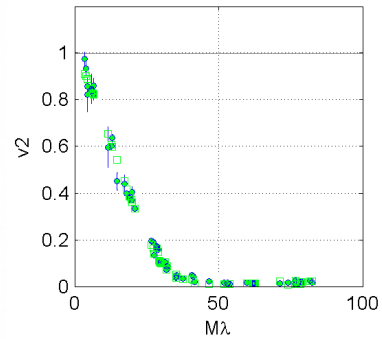
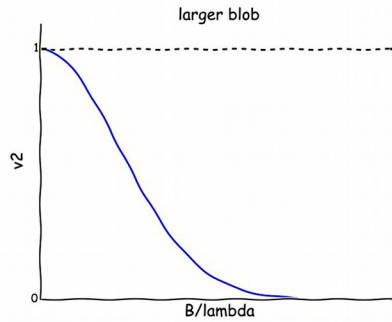
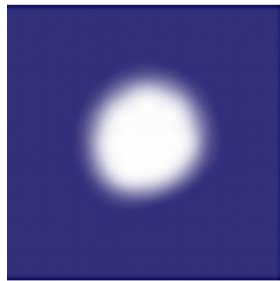
The analysis methods

- **Multiple approaches**
 - A subset of the sample with very good UV-coverage is being analyzed by image reconstruction (talk by Jacques Kluska)
 - Parametric fits to the visibilities and closure phases
 - Advanced modelling with radiative-transfer and gas-dust disk codes
 - HD100546 with MCFOST
 - HD 45677 with MCFOST and ProDiMo
 - HD135344A with MCFOST+ProDiMo
(Carmona+2014, talk by Christophe Pinte)

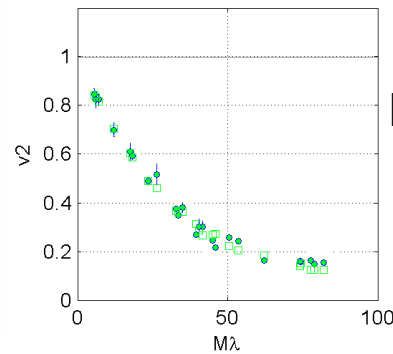
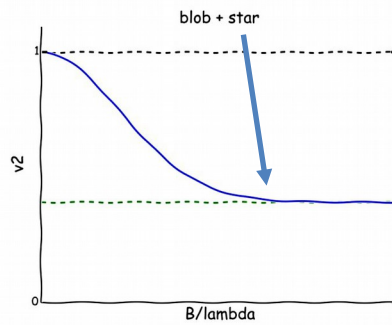
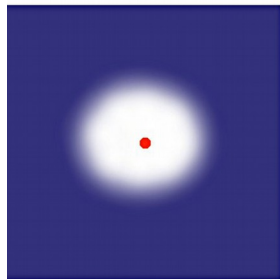
Examples of visibility patterns 1



HD 85587



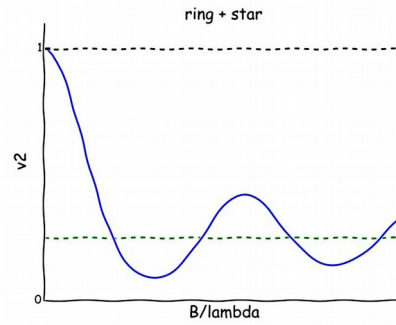
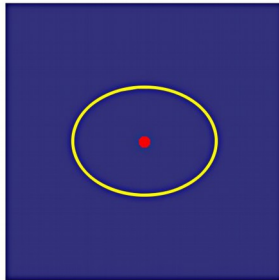
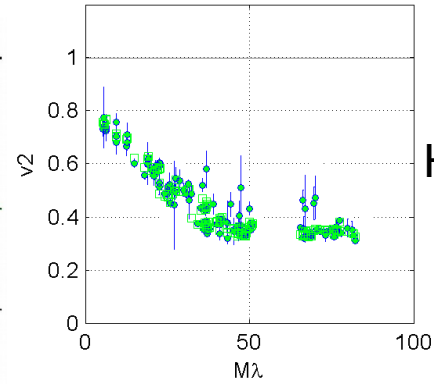
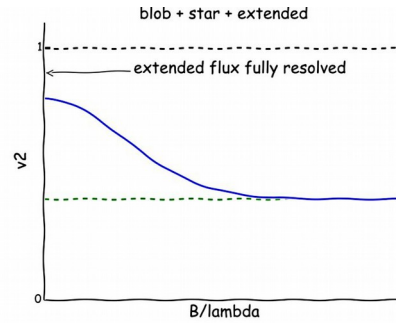
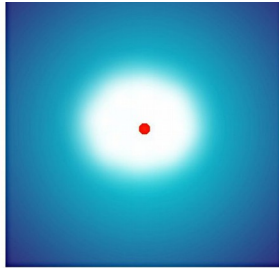
MWC297



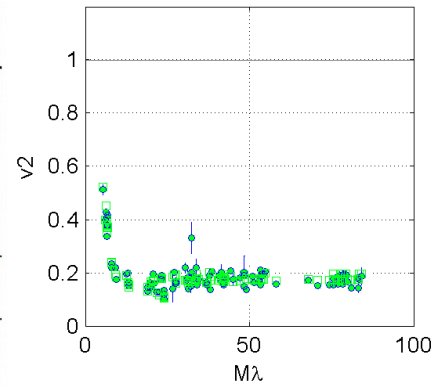
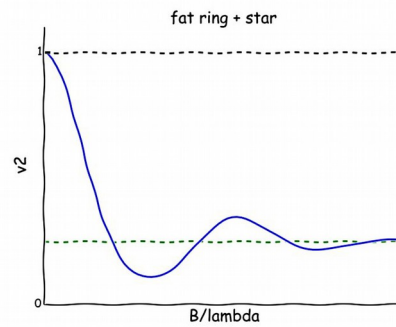
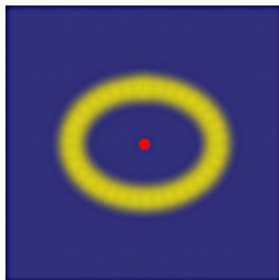
HD150197

B. Lazareff

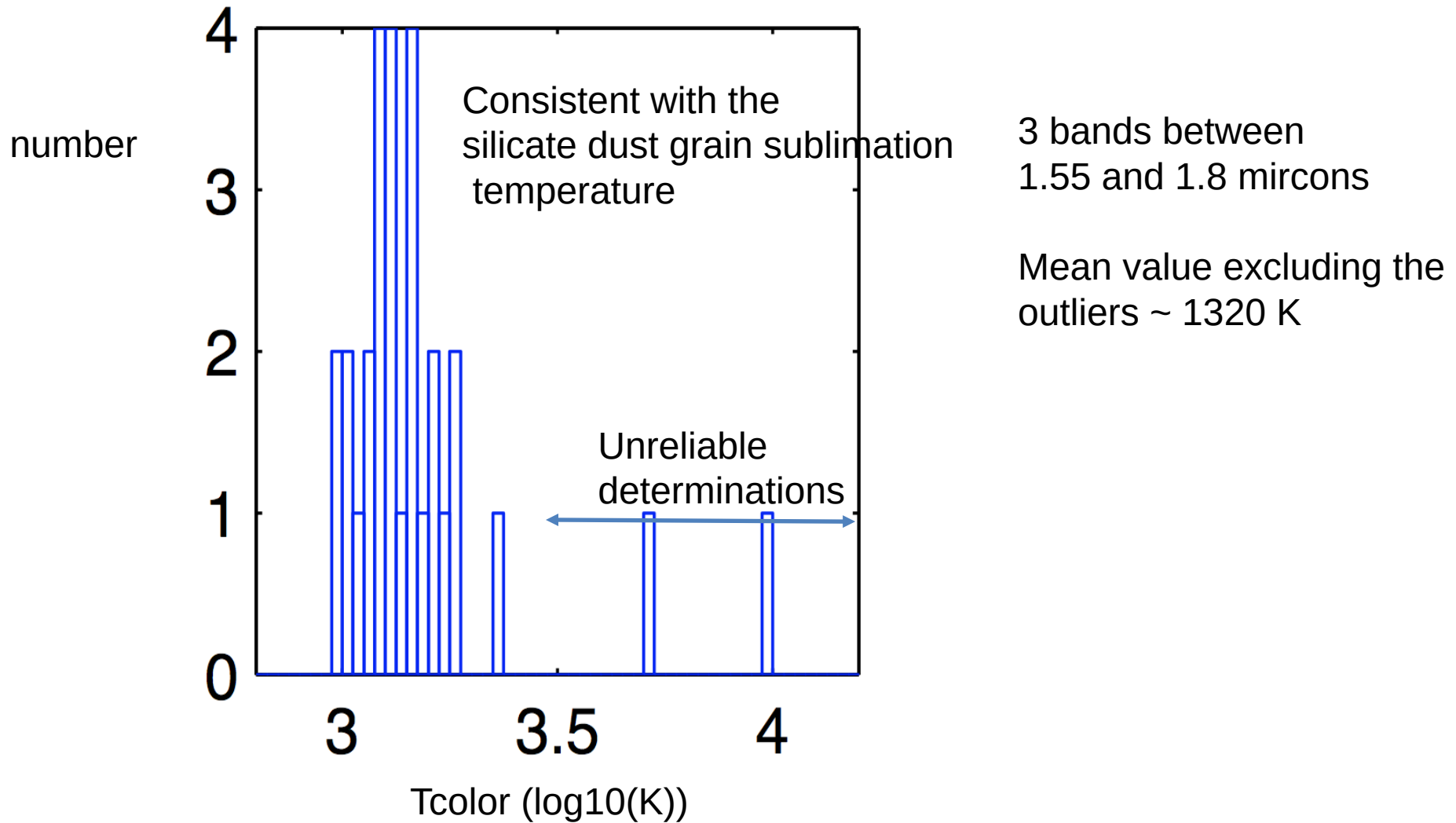
Examples of visibility patterns 2



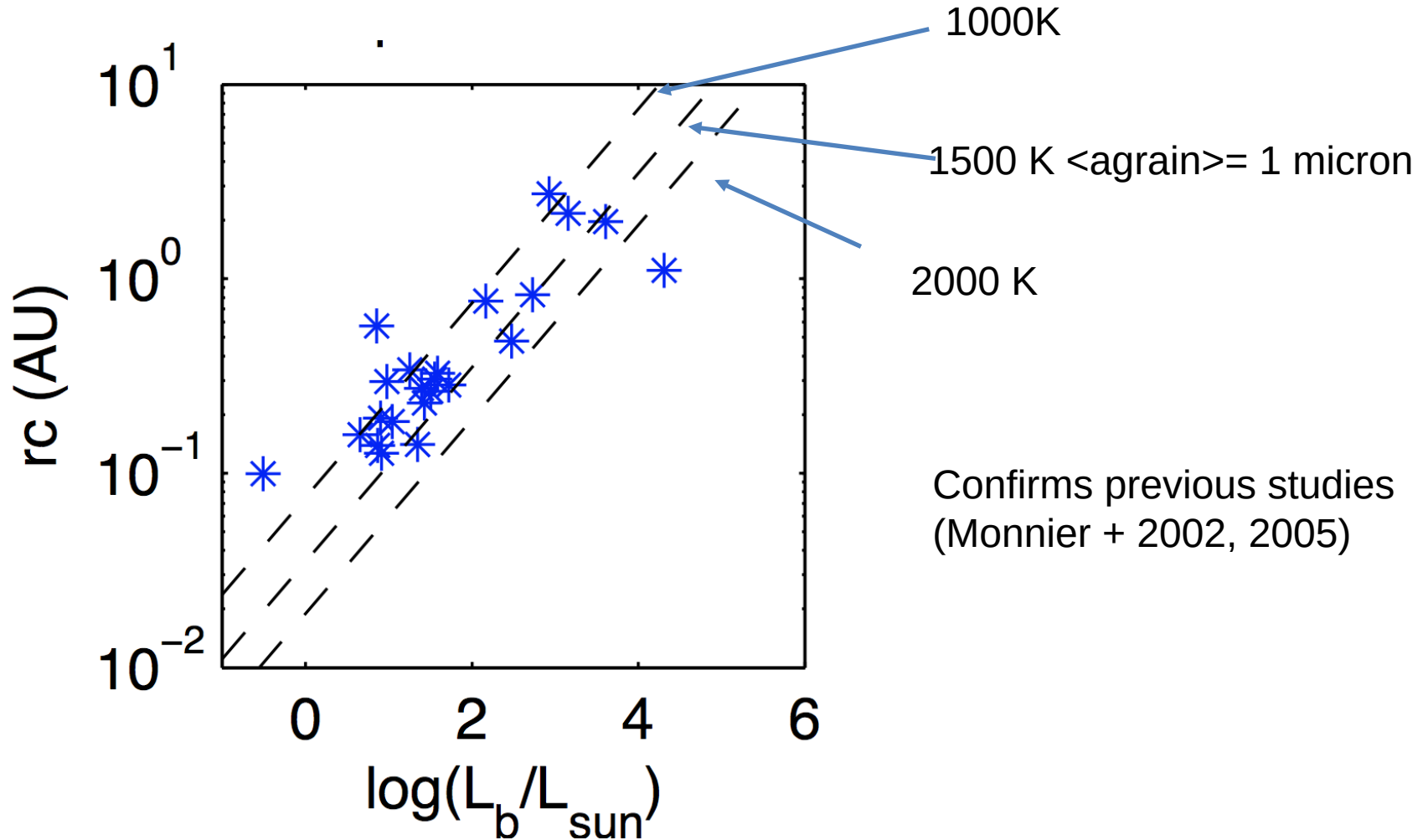
No source in the sample shows this V2 pattern



Extended emission H-band color temperature



Extended H-band L_{bol}/L_{sun}

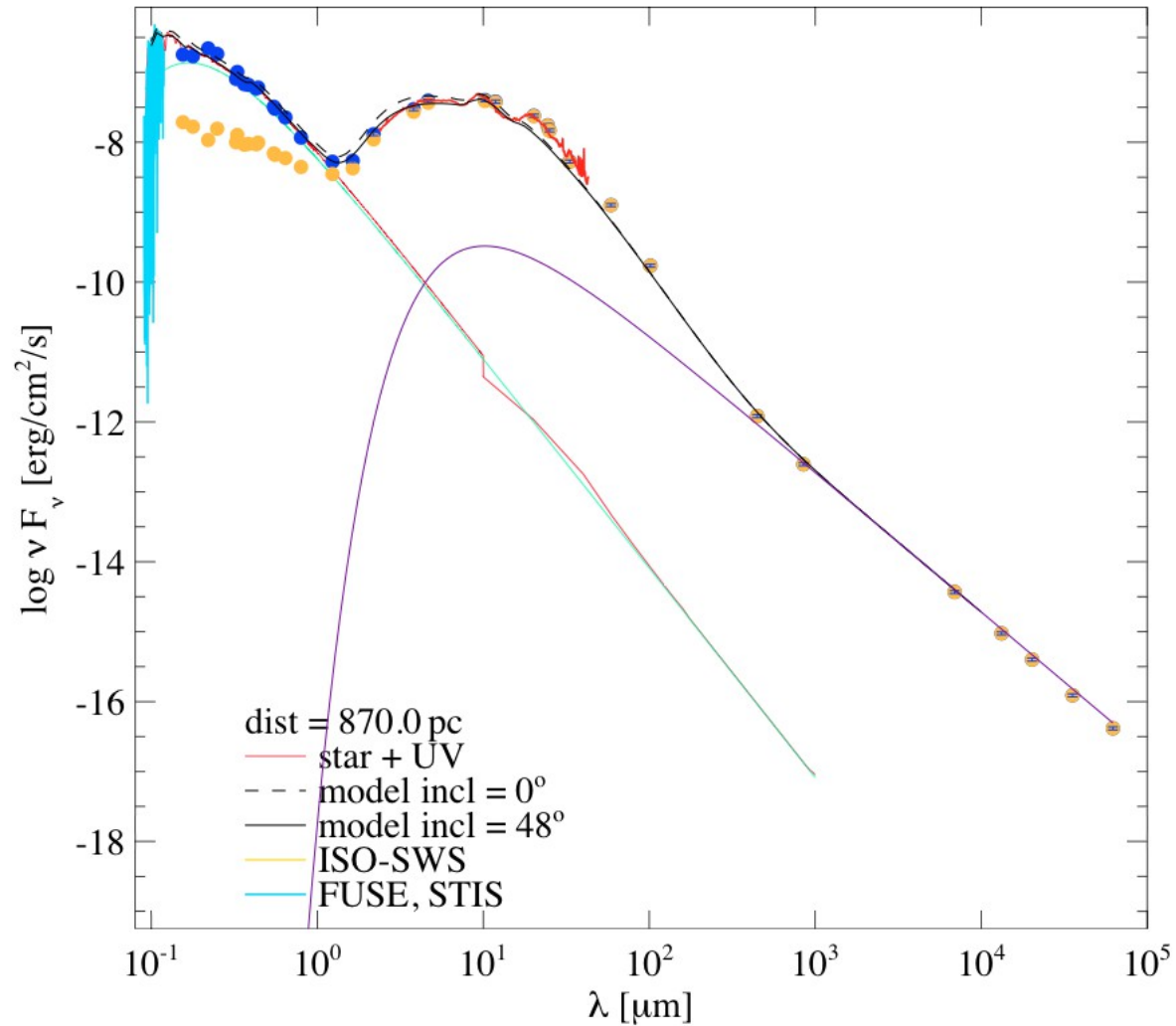


HD45677

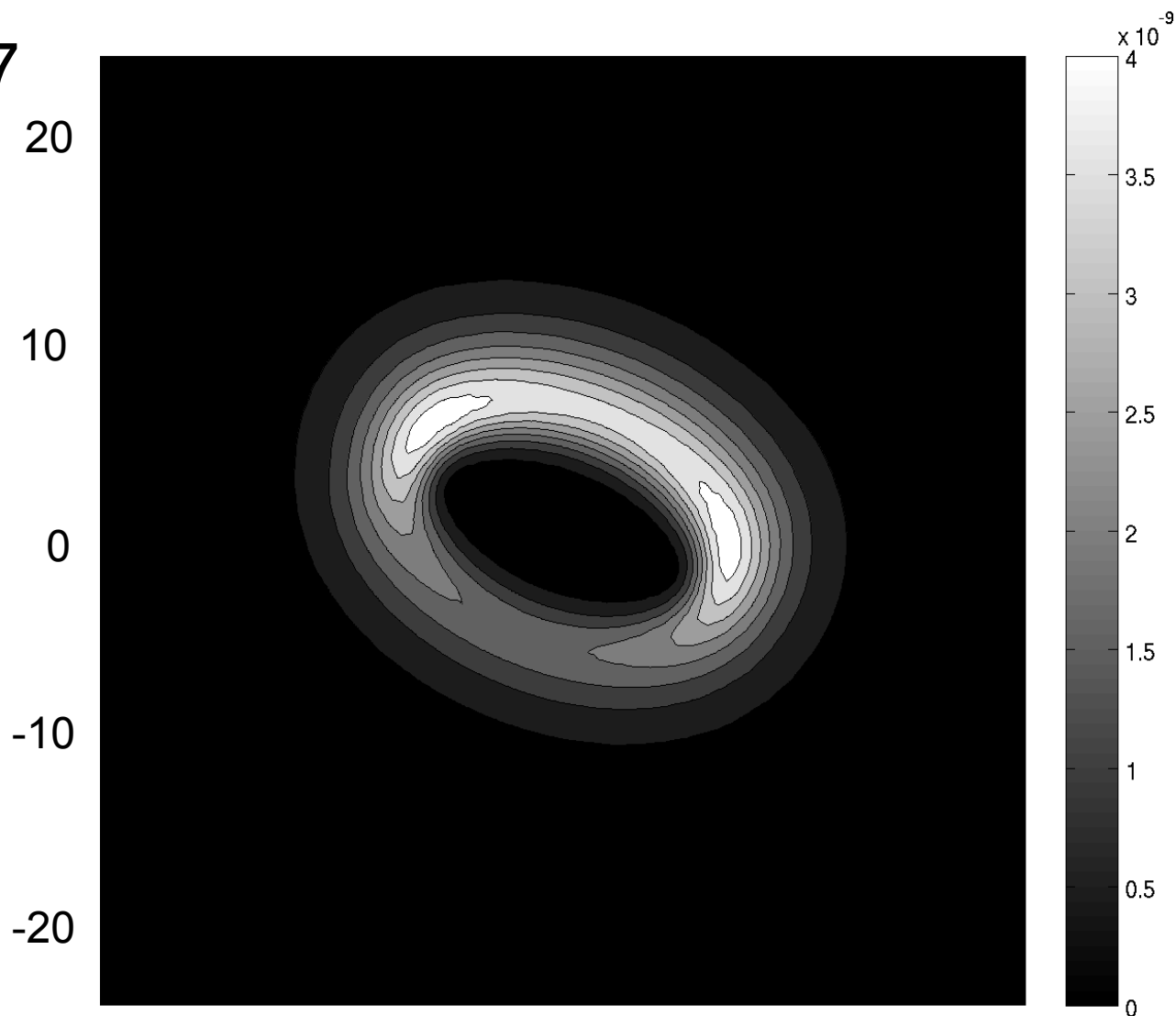
ProDiMo (Woitke+ 2009)

B3III at 650-750 pc

- vertical hydrostatic axisymmetric disk model



HD45677

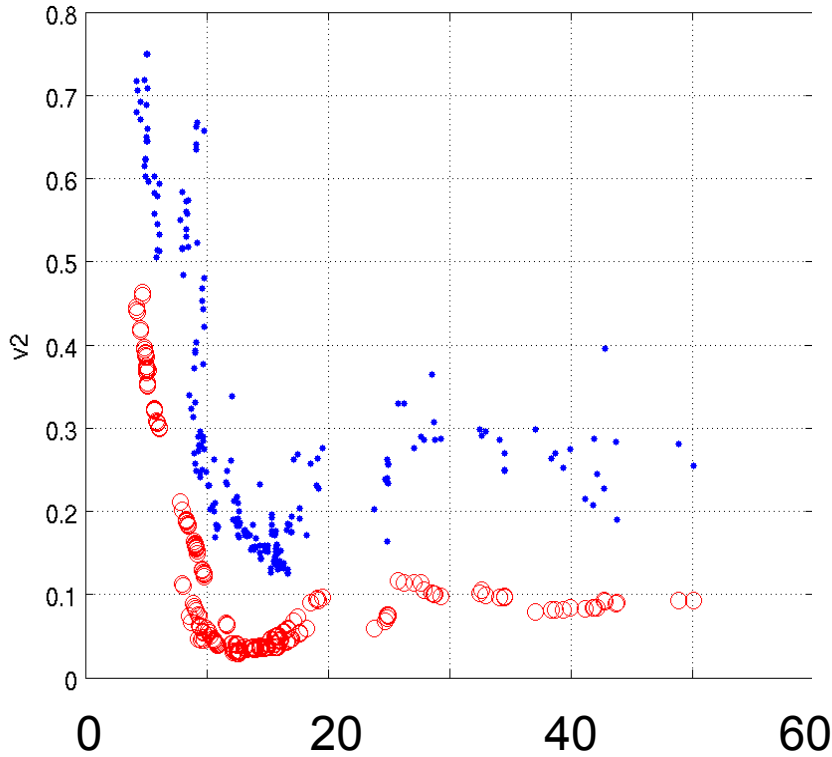


Model image in
the H-band

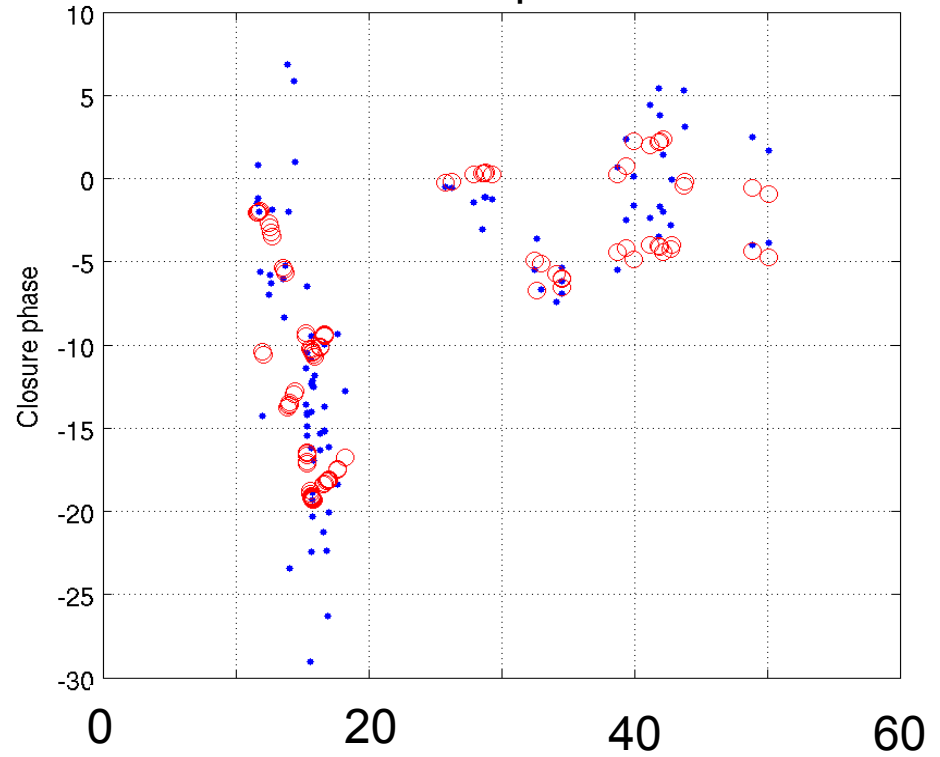
mas

HD45677

V2



Closure phase



M-lambda

Symmetric emission CP=0

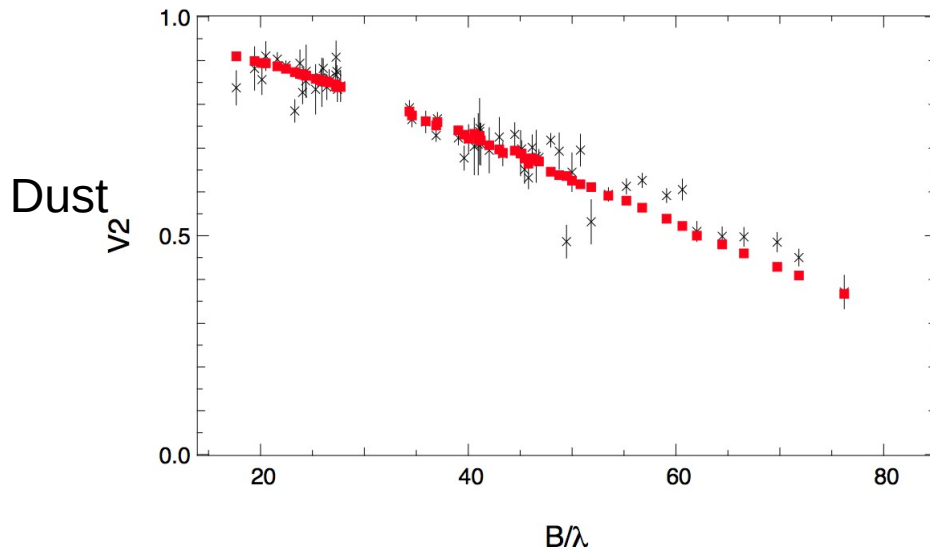
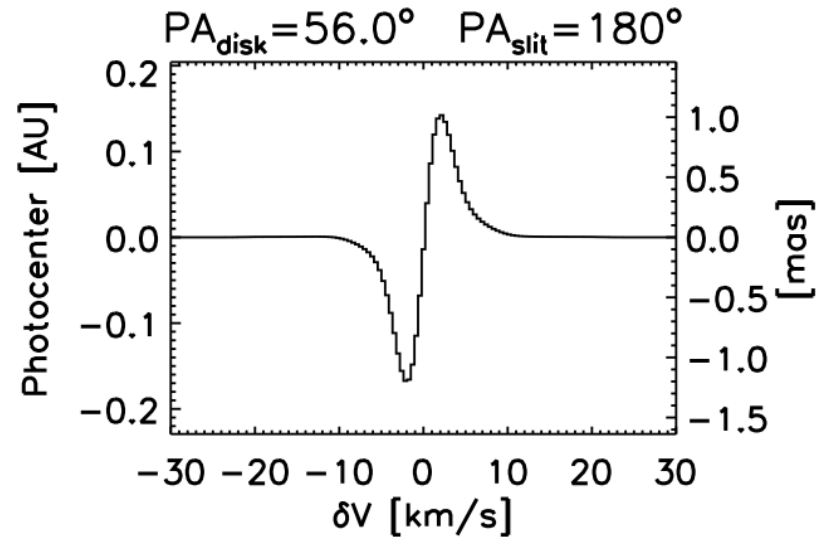
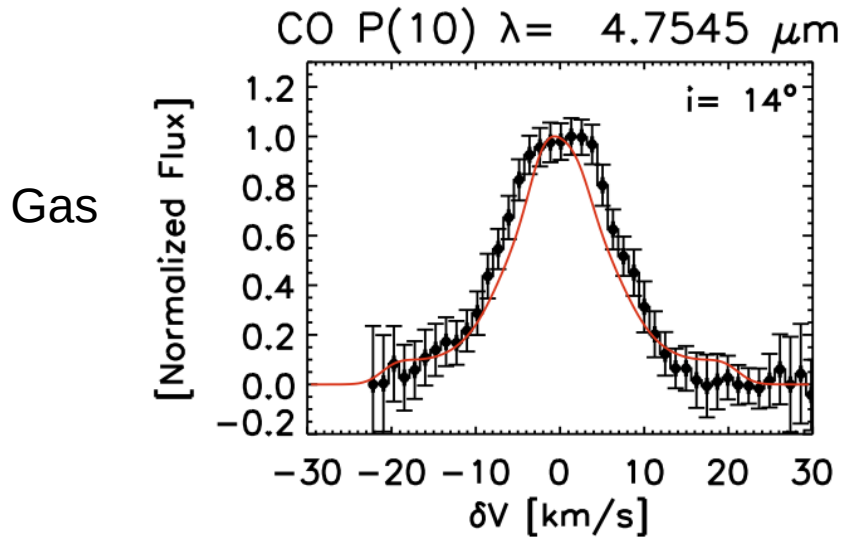
. obs. data

o model

We still fail to simultaneously fit SED, V2, and CP with a gas-dust ProDiMo model

Constraints from the gas and dust

- Simultaneous fit to the continuum and line data



HD135344 at 100 pc

See talk C. Pinte on Friday

Summary

- All the data have been taken
- A multi-approach method is being used to analyze the data
- The large program constitutes a Legacy study of the inner region of HerbigAeBe stars
- The reduced data will be made available to the community