

# IMAGING MIRA STARS

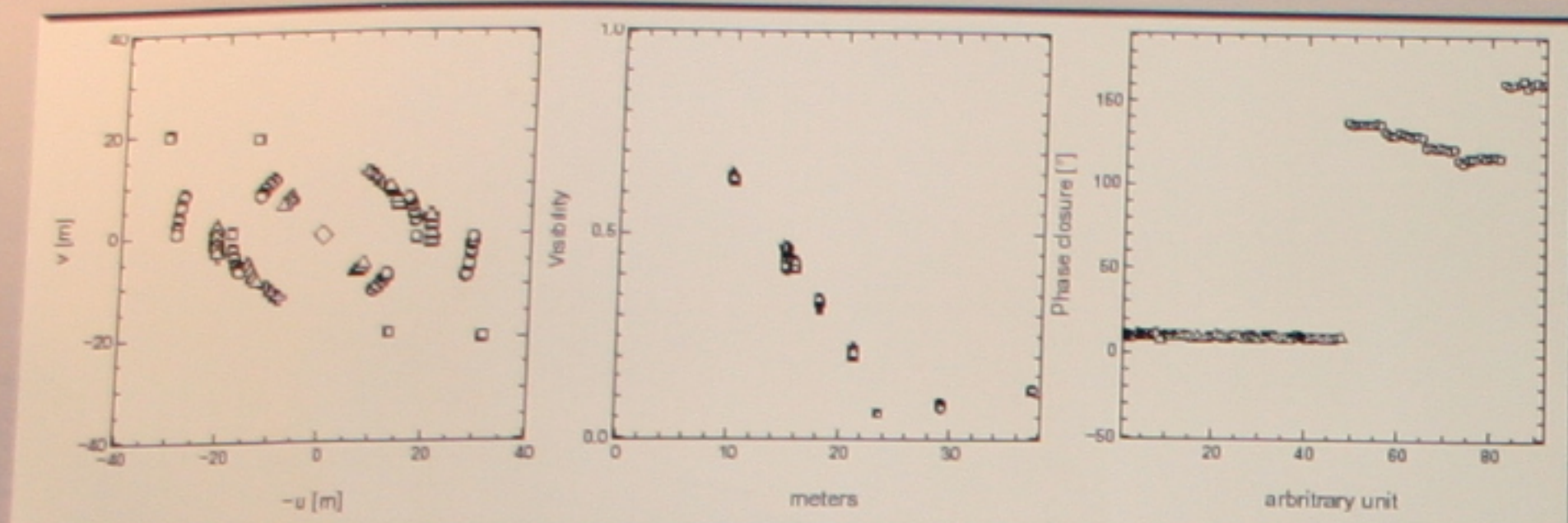
S. Lacour, G. Perrin, X. Haubois, S. Meimon, J. Woillez, P. A. Schuller, and S. T. Ridgway



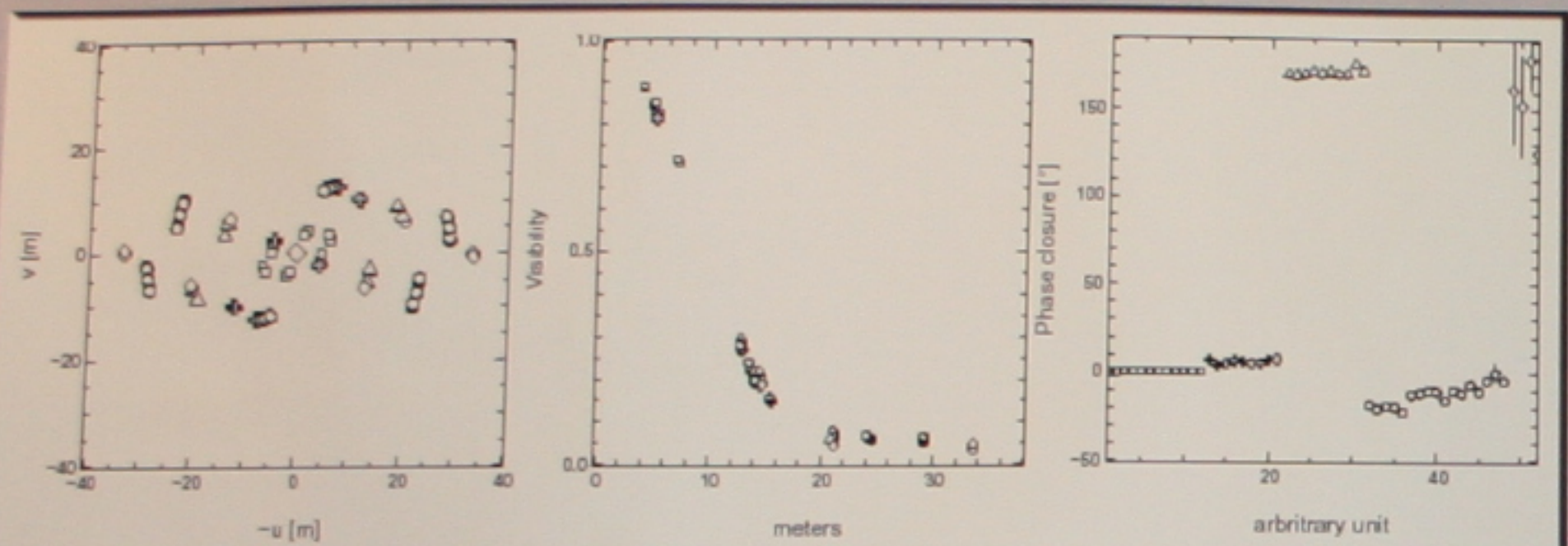
Interferometric data of Mira type stars in the near-infrared have already produce radial visibility curves with a shape far from the simple limb darkening profile. The measured visibilities as a function of wavelength revealed the presence in K band of a close ( at  $\sim 1$  stellar radius distance above the photosphere ) molecular layer. Now, thanks to the phase closure and telescope mobility of the IOTA interferometer, we have now access to the two dimensional complex visibility profile.

## I) THE DATA

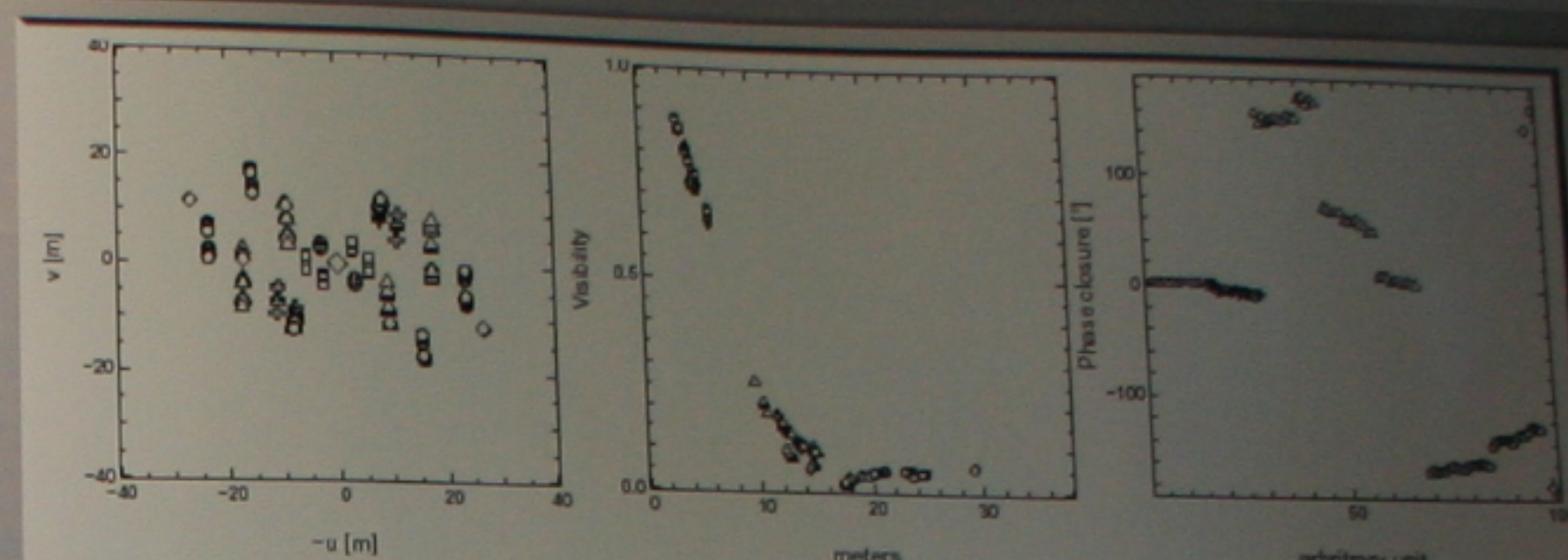
These data were obtained during 2 observation runs in May and October 2005. These plots show the u-v plane coverage, the visibility as a function of the baseline, and the phase closures.



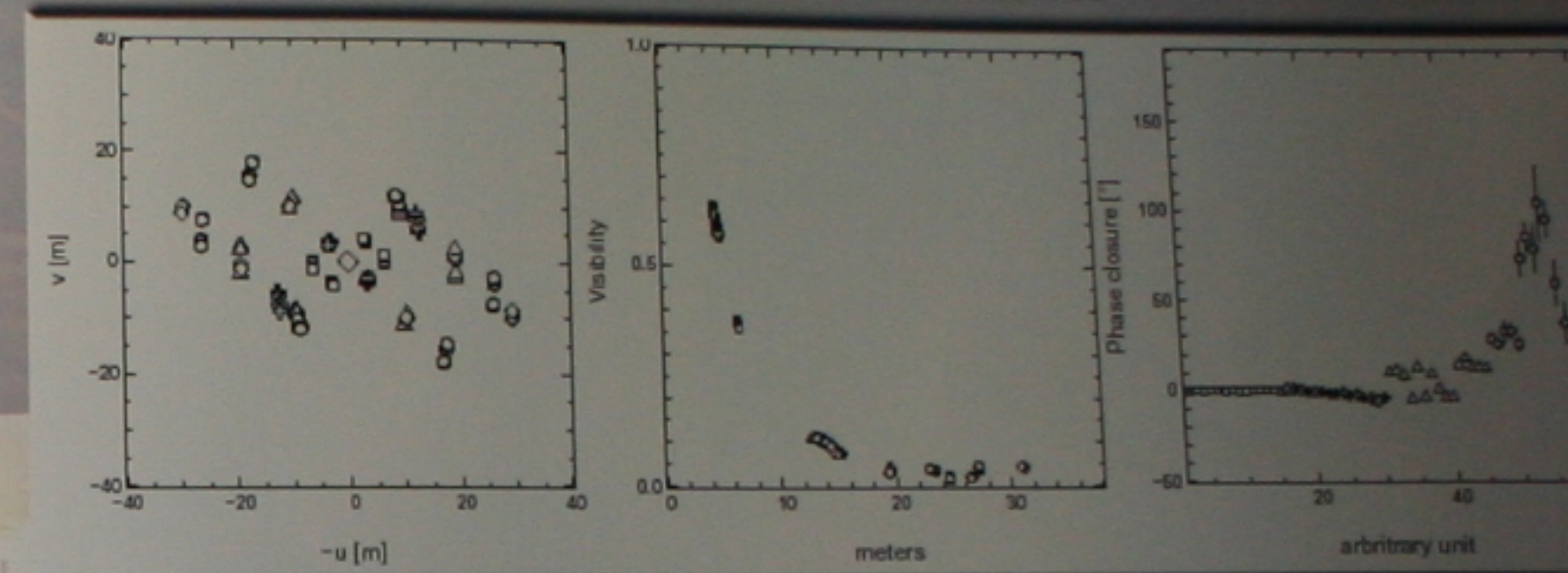
Chi Cyg in May 2005



Chi Cyg in October 2005



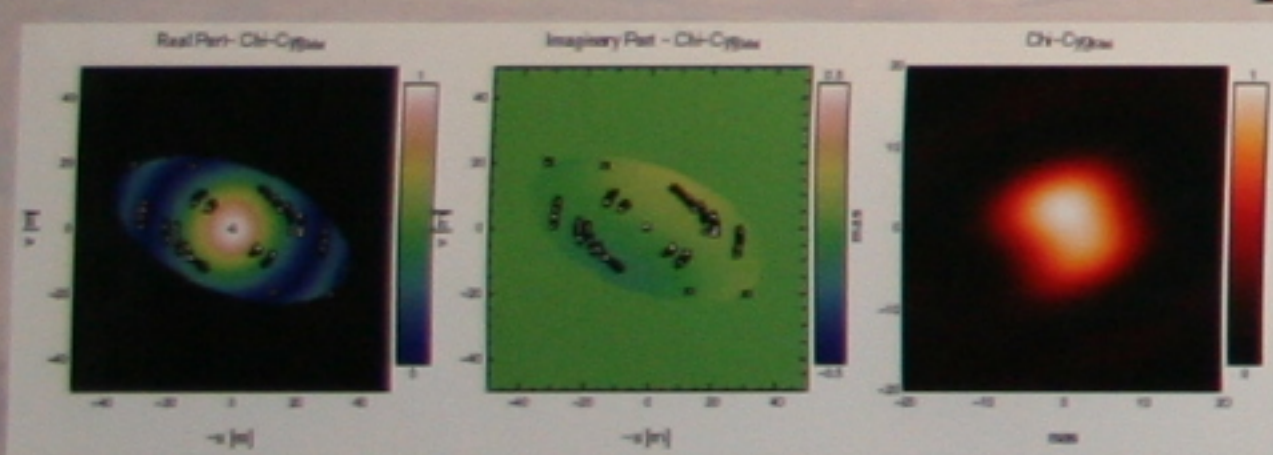
Mira in October 2005



Betelgeuse in October 2005 (yes, it is not a Mira star)

## II) IMAGE RECONSTRUCTION

Chi Cyg in May 2005



Right and left : Image reconstruction obtained by fitting polynomes directly in the Fourier domain.

Chi Cyg in October 2005

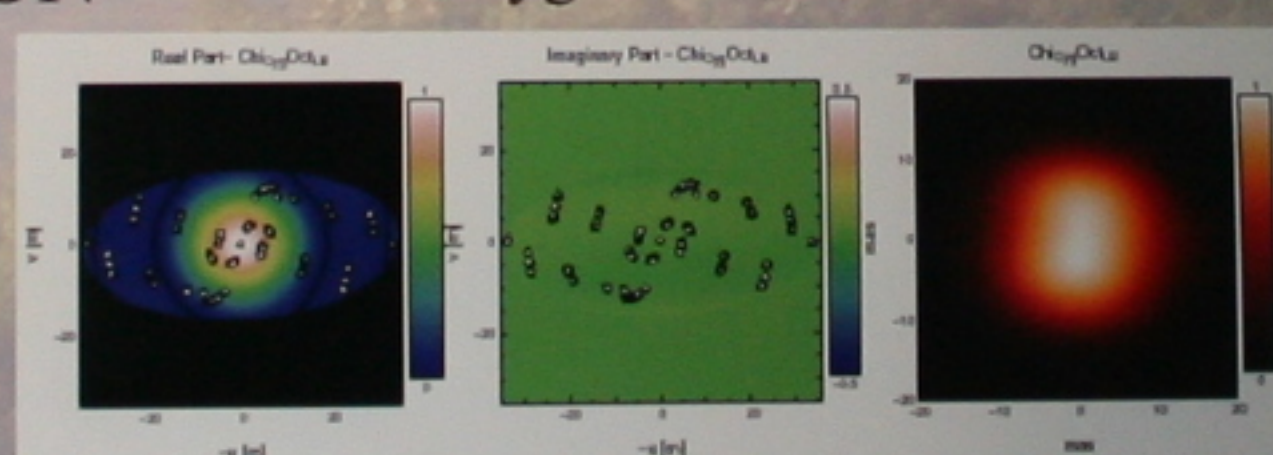
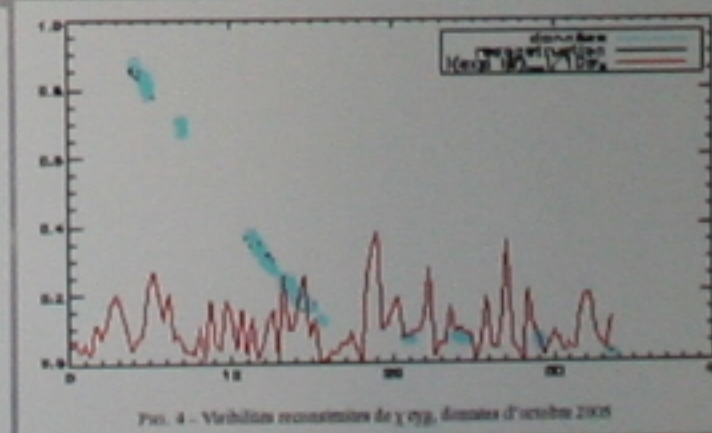
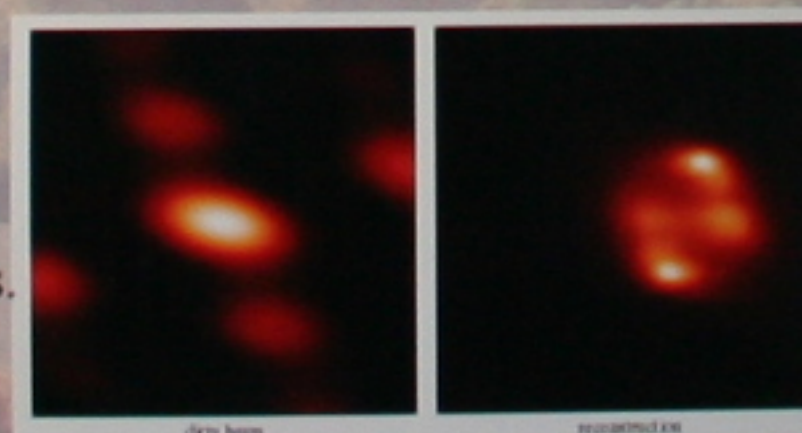


Image reconstruction using the WIZARD and MIRA algorithms.



Work in progress ...

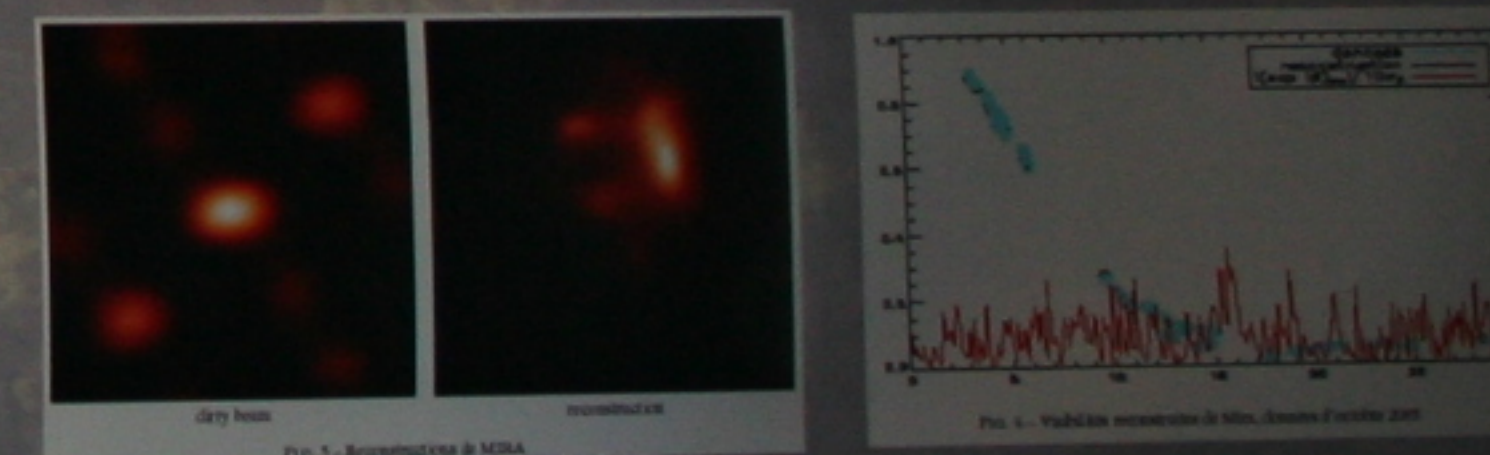


Image reconstruction of Mira. The reconstruction shows clearly the asymetry of the star, which can be seen on the visibility curve.

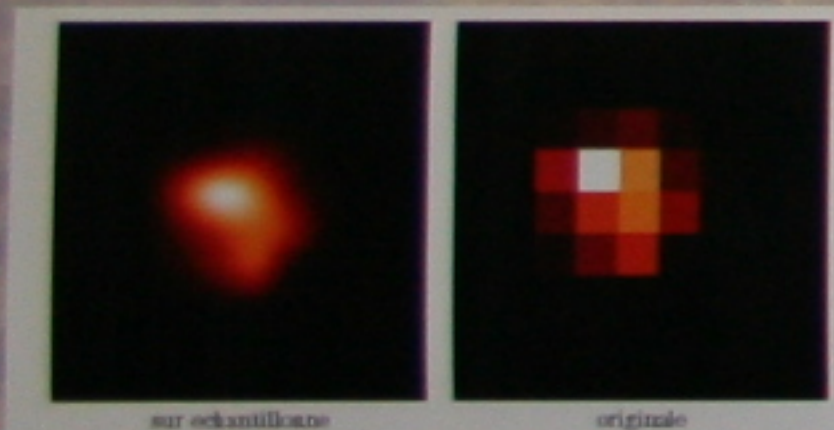


Figure 2: Chi du Cygne. FOV 40mas x 40 mas. Reconstitutions originale et sur-échantillonnage. La tache brillante concentre 17% du flux. Régularisation: rappel quadratique vers un disque uniforme de diamètre 15.5 mas

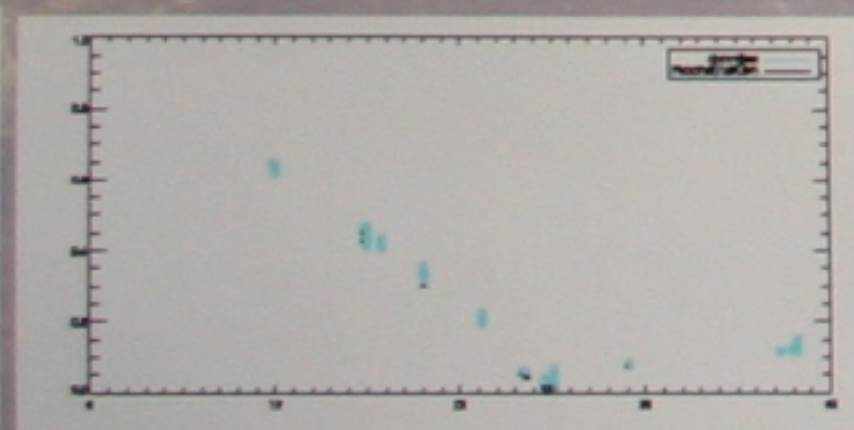
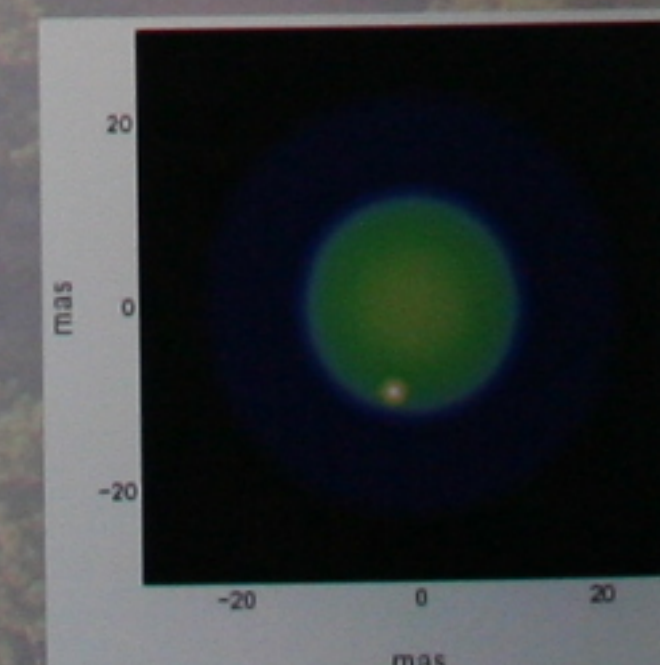


Figure 1: Chi du Cygne. L'effet de bande large est pris en compte. On voit que l'écart type est plus grand pour des visibilités proches de 0. Les données reconstruites prennent un 0, pas les visibilités mesurées.

Parametric reconstruction using the dot-disk-shell model :

Star diameter :  $8.7 \pm 0.4 \pm 0.8$  mas  
 Shell diameter :  $21.9 \pm 3.6 \pm 3.9$  mas  
 Shell extinction :  $8.7 \pm 9.2 \pm 5.3$   
 Dot amplitude :  $6.2 \pm 0.5 \pm 0.9\%$

Star diameter :  $11.4 \pm 1.2 \pm 0.7$  mas  
 Shell diameter :  $22.7 \pm 2.7 \pm 1.7$  mas  
 Shell extinction :  $3.9 \pm 5.1 \pm 2.3$   
 Dot amplitude :  $1.5 \pm 0.7 \pm 1.5\%$



Parametric reconstruction of Betelgeuse using a limb darkening profile, plus a background emission. The size of Betelgeuse is 43.2 mas

