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Astrometry of Long-Period Variable Stars: Specific Problems and Possible Actions

A. Jorissen

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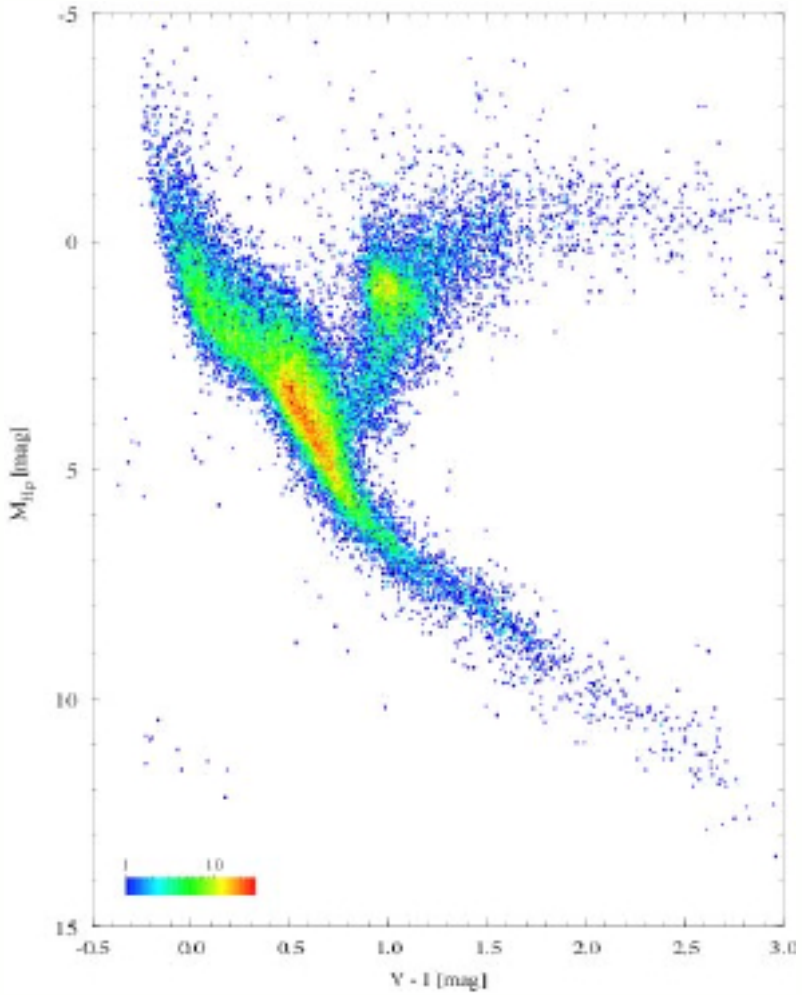
Astrometry of Long-Period Variable Stars: Specific Problems

- **Very red colours:**
  V-I > 2 for C stars,
  V-I > 3 for M stars

The chromaticity correction is very important for those stars, albeit difficult to calibrate!

(because difficult to find stars to calibrate the chromaticity correction in this V-I range,
which are not suffering from the problems specific to LPVs)



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Astrometry of Long-Period Variable Stars: Specific Problems

- **Variability:**
  - **Δ V-I as large as 3 mag**
  - **→ chromaticity correction**
  - **is varying over the light cycle**

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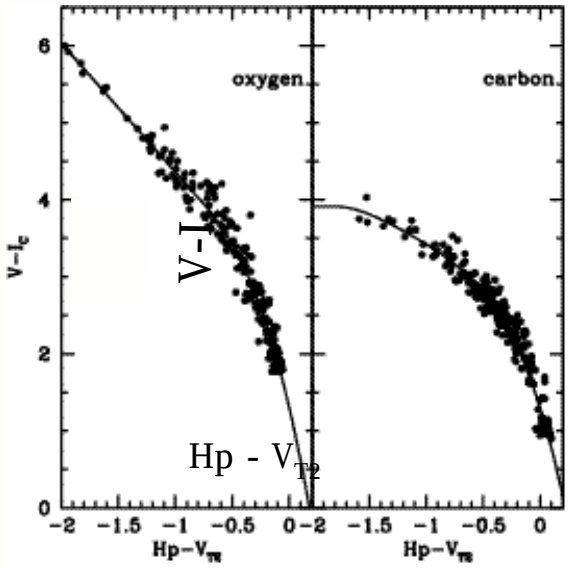
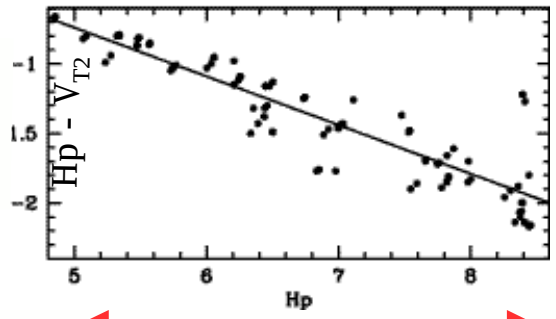


Example: Oxygen-rich Mira T Cep (HIP 104451)

5.0 ≤ Hp ≤ 8.5



Platais et al., 2003, A&A 397, 997

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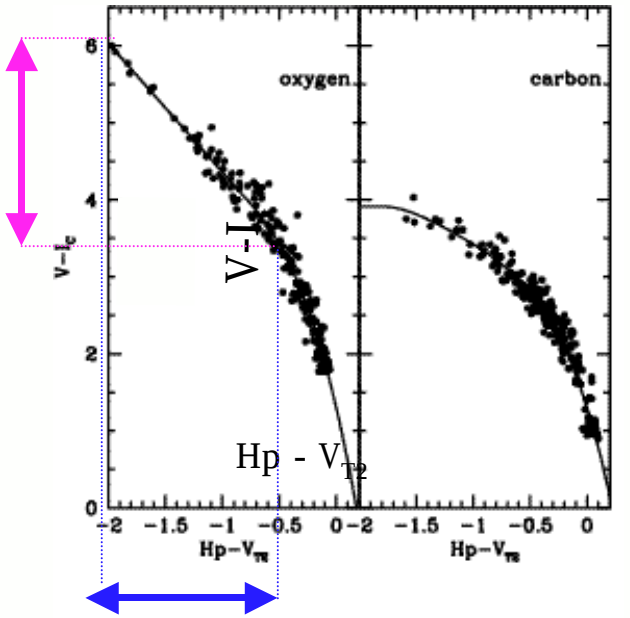

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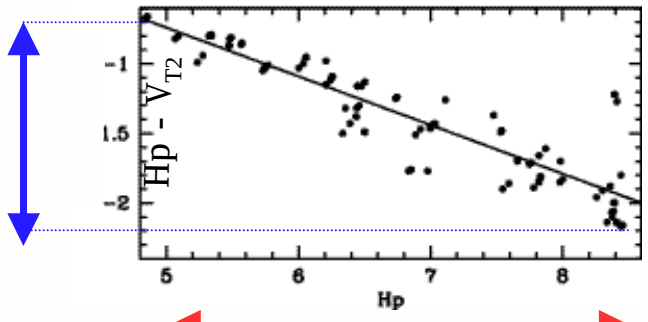

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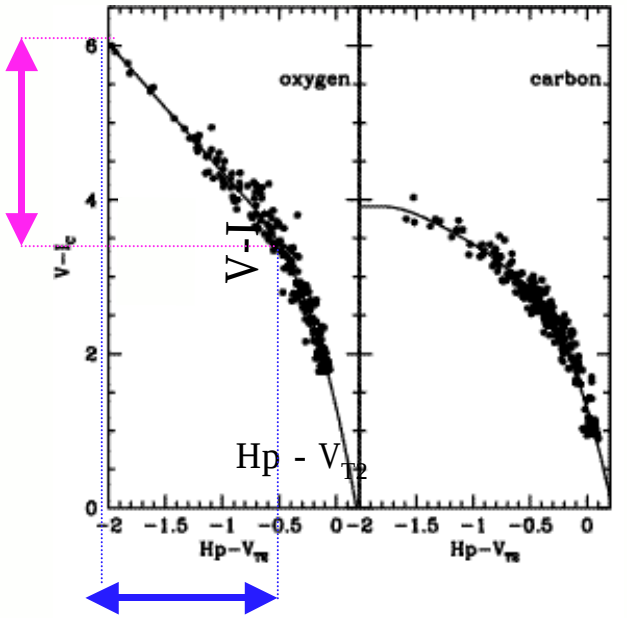
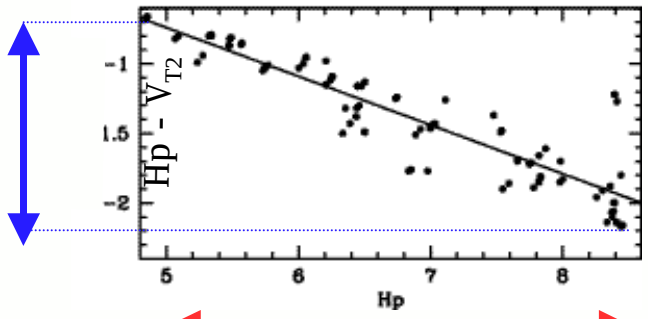


Example: Oxygen-rich Mira T Cep (HIP 104451)

5.0 ≤ Hp ≤ 8.5 → 3 ≤ V-I ≤ 6



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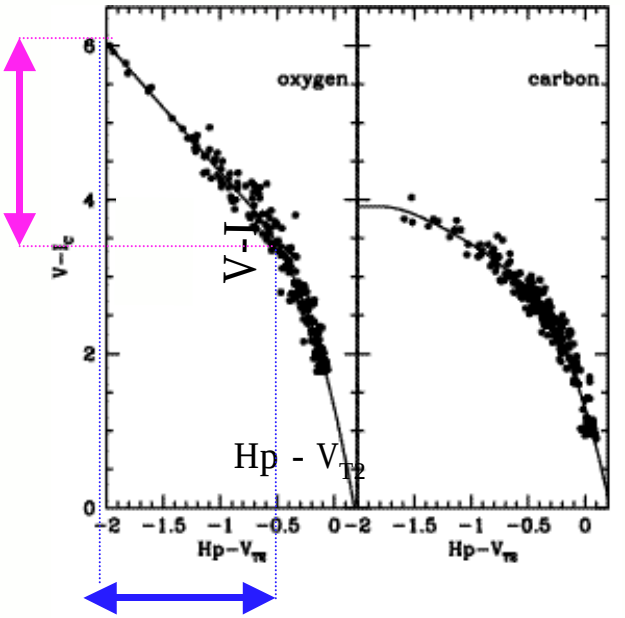

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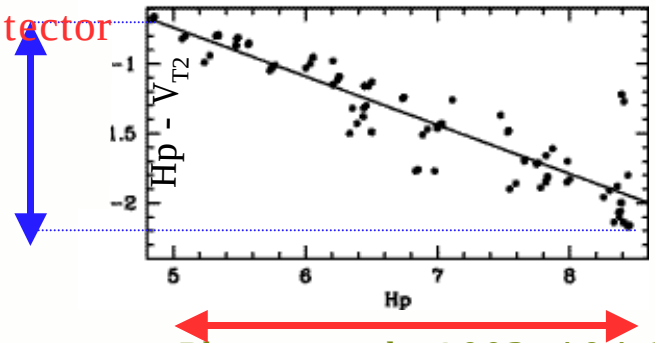
Eqs. (16.8) and (16.12-16.18) of Vol. 3 of Hipparcos Catalogue
→ photocenter moves by 1.9 mas on the Hipparcos detector



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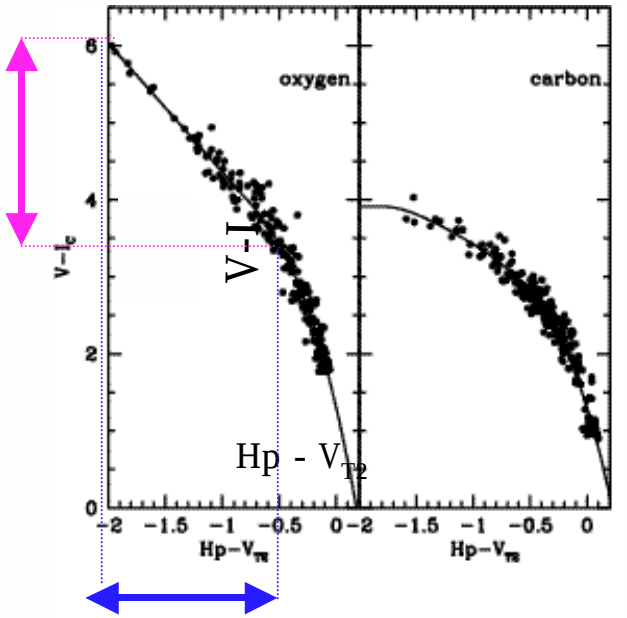

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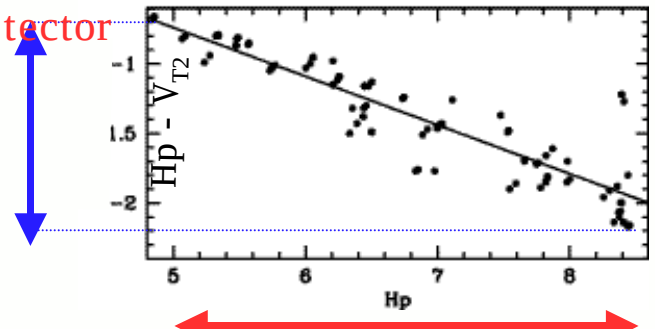

Important that GAIA reduction pipeline uses
epoch photometry
to perform the chromaticity correction

Platais et al., 2003, A&A 397, 997

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Astrometry of Long-Period Variable Stars: Solutions

- **Variability:**

  When reduction pipeline uses *epoch V-I index* instead of average to perform the chromaticity correction, most *Variability-Induced Movers (VIMs)* disappear !!

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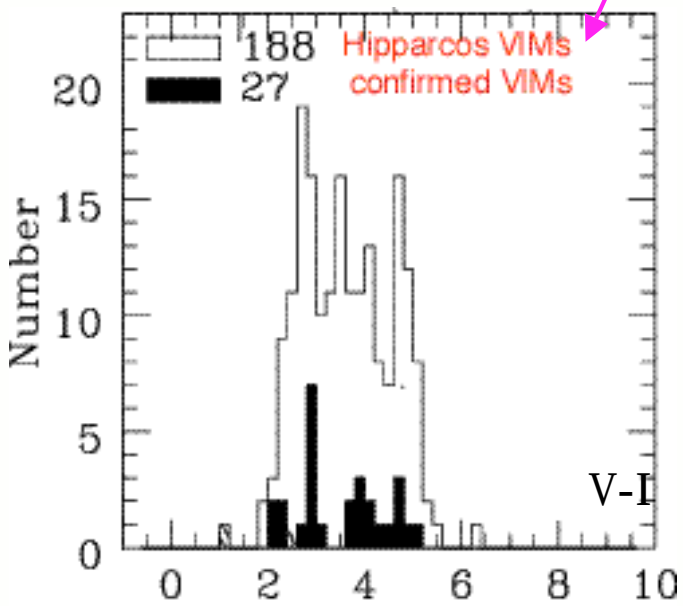
Hipparcos VIMs
vs
confirmed VIMs



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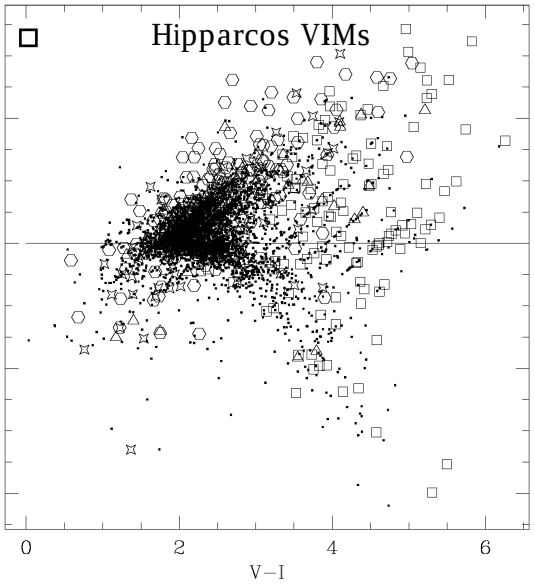
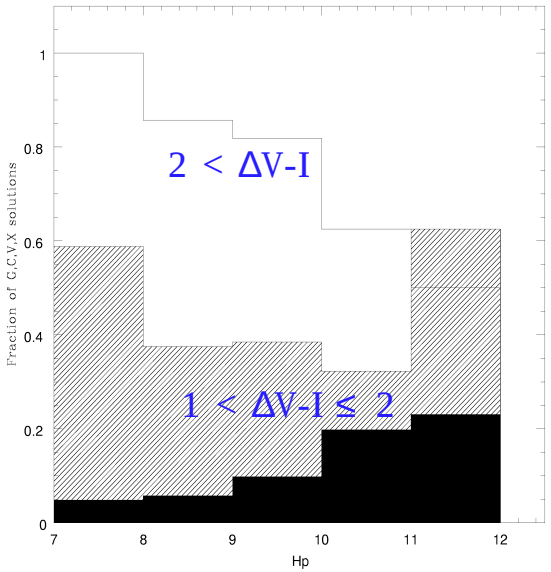
Hipparcos V-I (H75) vs Recalibrated V-I (from Hp - V_{T2})



Fraction of Hipparcos VIMs vs Hp for various ΔV-I



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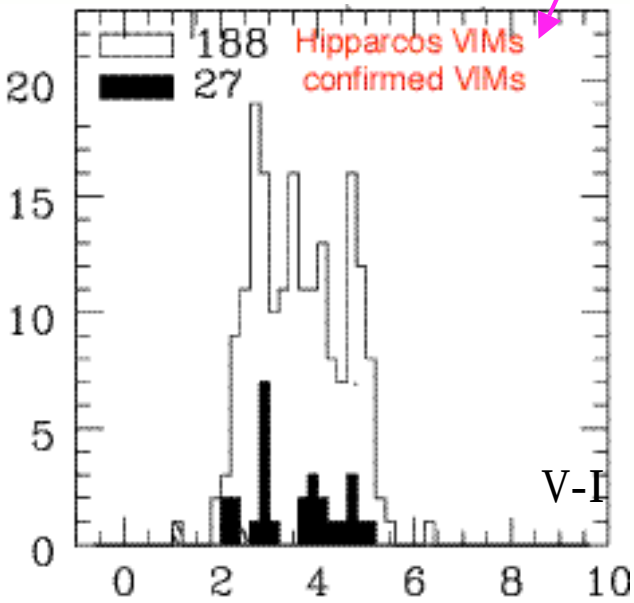

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Examples:

Oxygen-rich Mira R Hya (HIP 65835)

ϖ_{HIP} = 1.62 ± 2.43 mas (VIM)
$\varpi_{revised}$ = 8.44 ± 1.00 mas (non-VIM!) — Pourbaix et al., 2003, A&A 399, 1167
ϖ_{P-L} = 7.14 mas — Whitelock & Feast, 2000, MNRAS 319, 759

Oxygen-rich Mira T Cas (HIP 1834)

ϖ_{HIP} = 0.59 ± 1.07 mas (VIM)
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Oxygen-rich Mira R And (HIP 1901)

ϖ_{HIP} = -0.06 ± 6.49 mas (VIM)
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The last word has not yet been said!