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Inverse Mass Segregation in Taurus

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Mass Segregation

- Over-concentration of particular mass range of stars with respect to random stars.
- ‘Inverse’ mass segregation is an under-concentration of a mass range.
- Most methods for finding it are reliant on the definition of a cluster centre.
- They also bin the data, which removes (sometimes) vital information.

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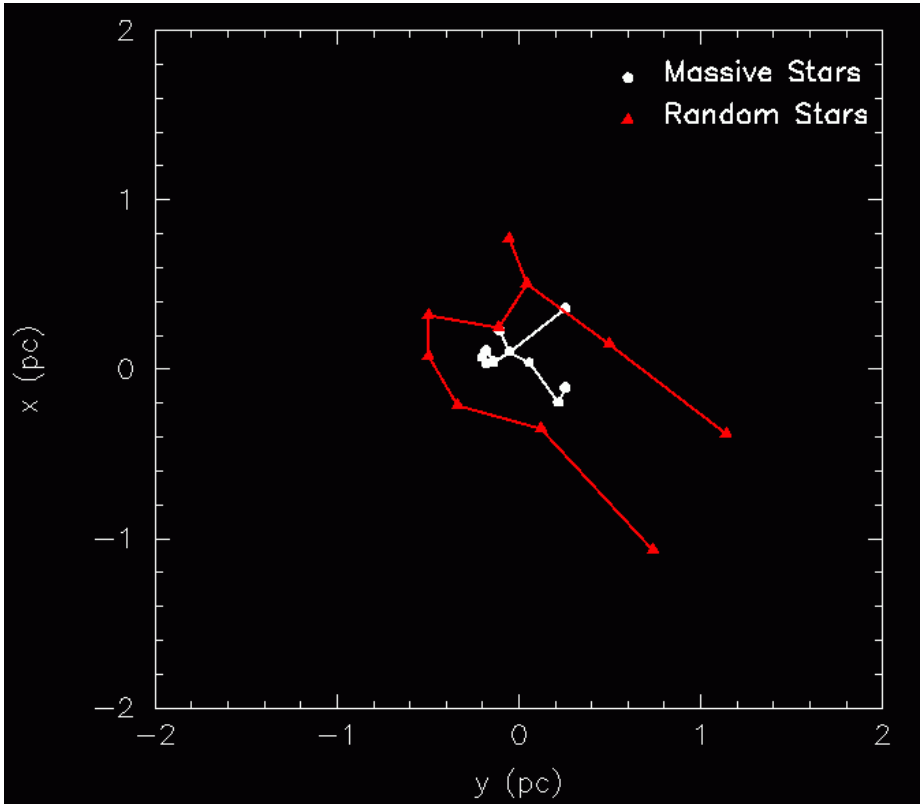
The MST Method

- Compare MST of subset of objects to random subsets.
- Ratio of average MST length to subset length gives us quantitative mass segregation ratio:

$$\Lambda_{\mathrm{MSR}} = \frac{\langle l_{\mathrm{average}} \rangle^{+\sigma_{5/6}/l_{\mathrm{subset}}}}{l_{\mathrm{subset}}{}_{-\sigma_{1/6}/l_{\mathrm{subset}}}}$$



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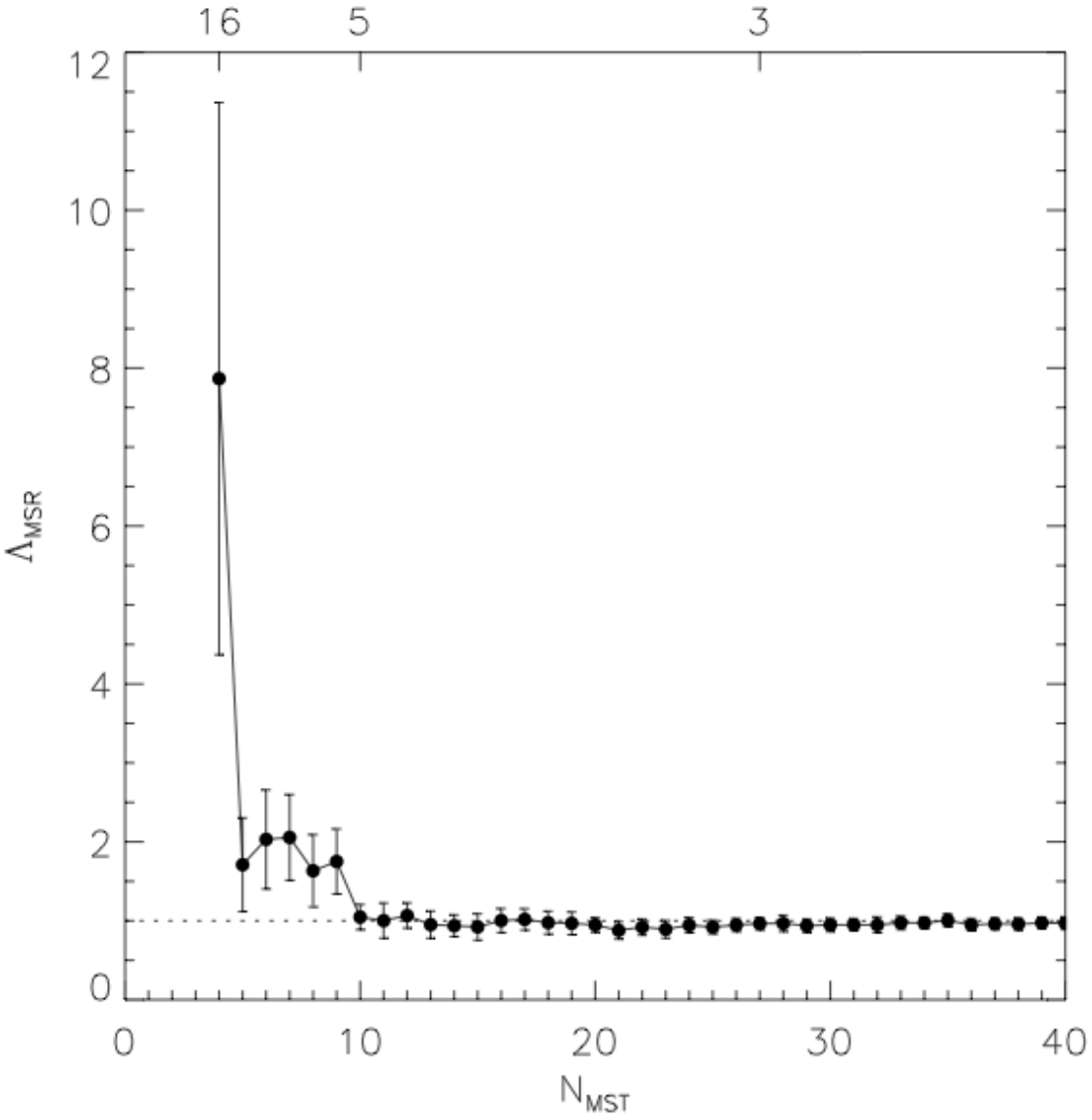
The ONC

- Allison et al. (2009, MNRAS, 395, 1449) find Λ_{MSR} = 8.0±3.5 for most massive stars in the ONC.
- Also find stars down to $5M_{\odot}$ are mass segregated with Λ_{MSR} = 2.0±0.5.
- Advantage of MST – does not require definition of cluster centre.



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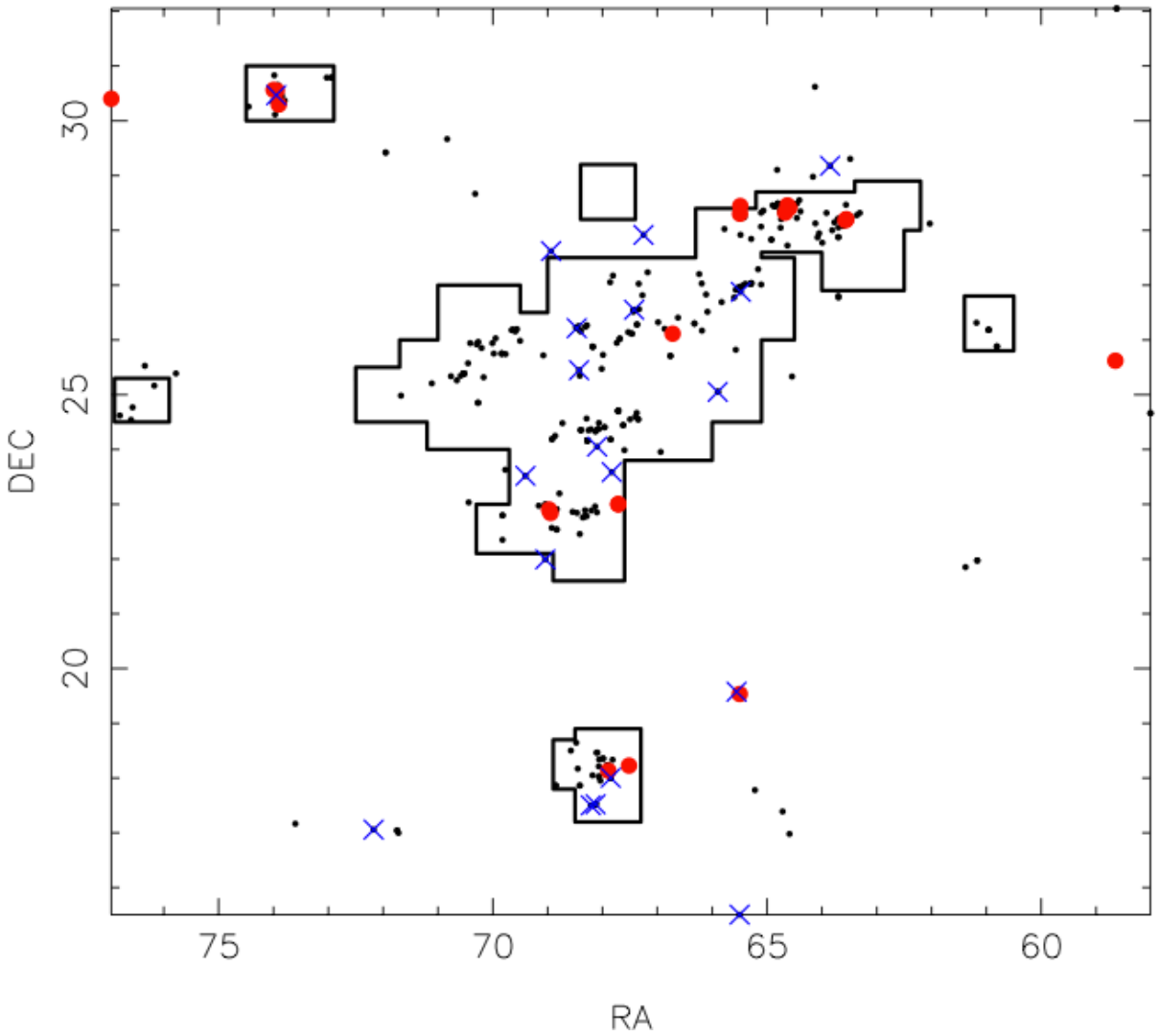
Taurus

- Data compiled for XEST survey & updated from recent surveys.
- Red = 20 most massive objects.
- Blue = 20 least massive objects.



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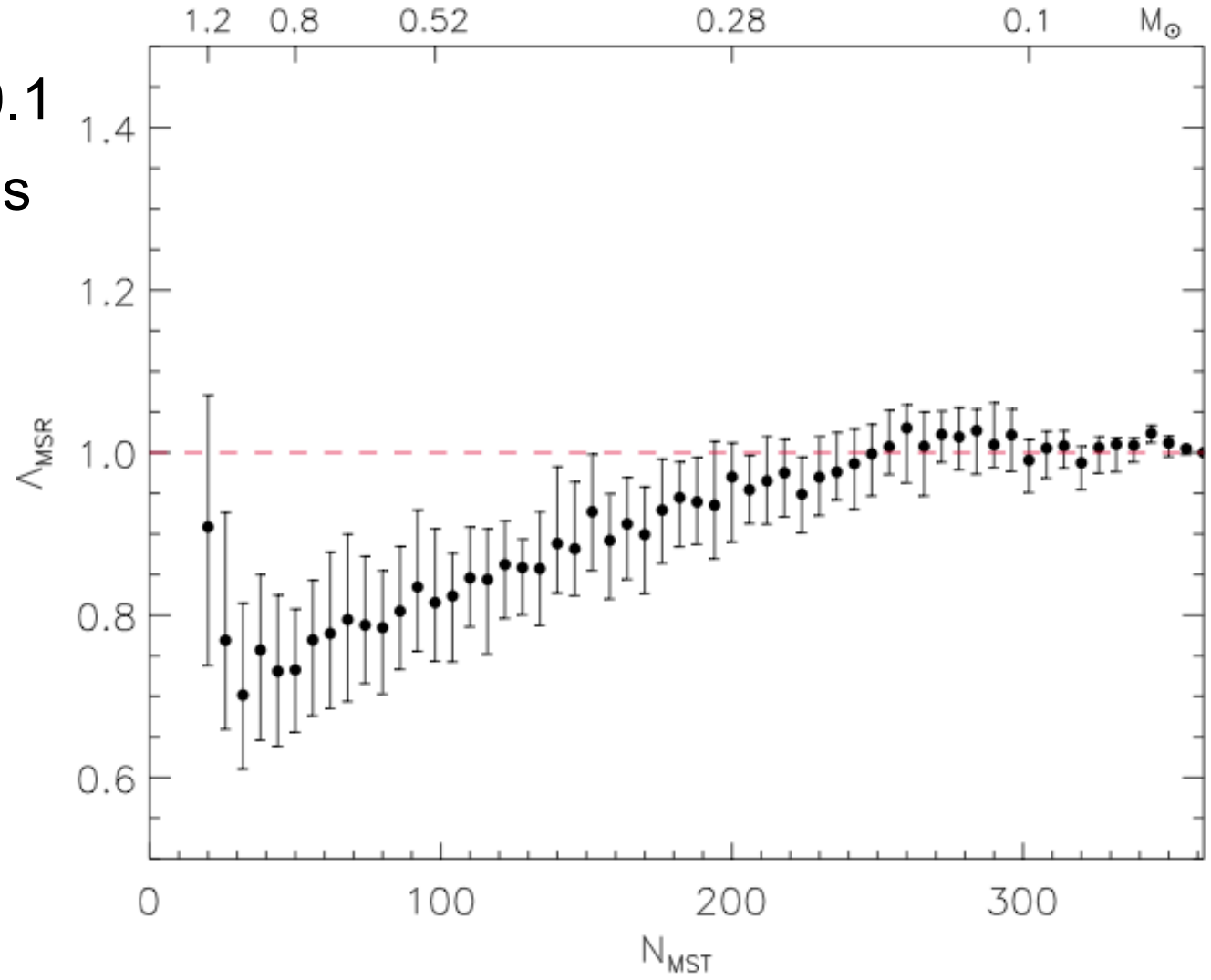
Most Massive Objects

- Λ_{MSR} = 0.7±0.1 (inverse mass seg.).



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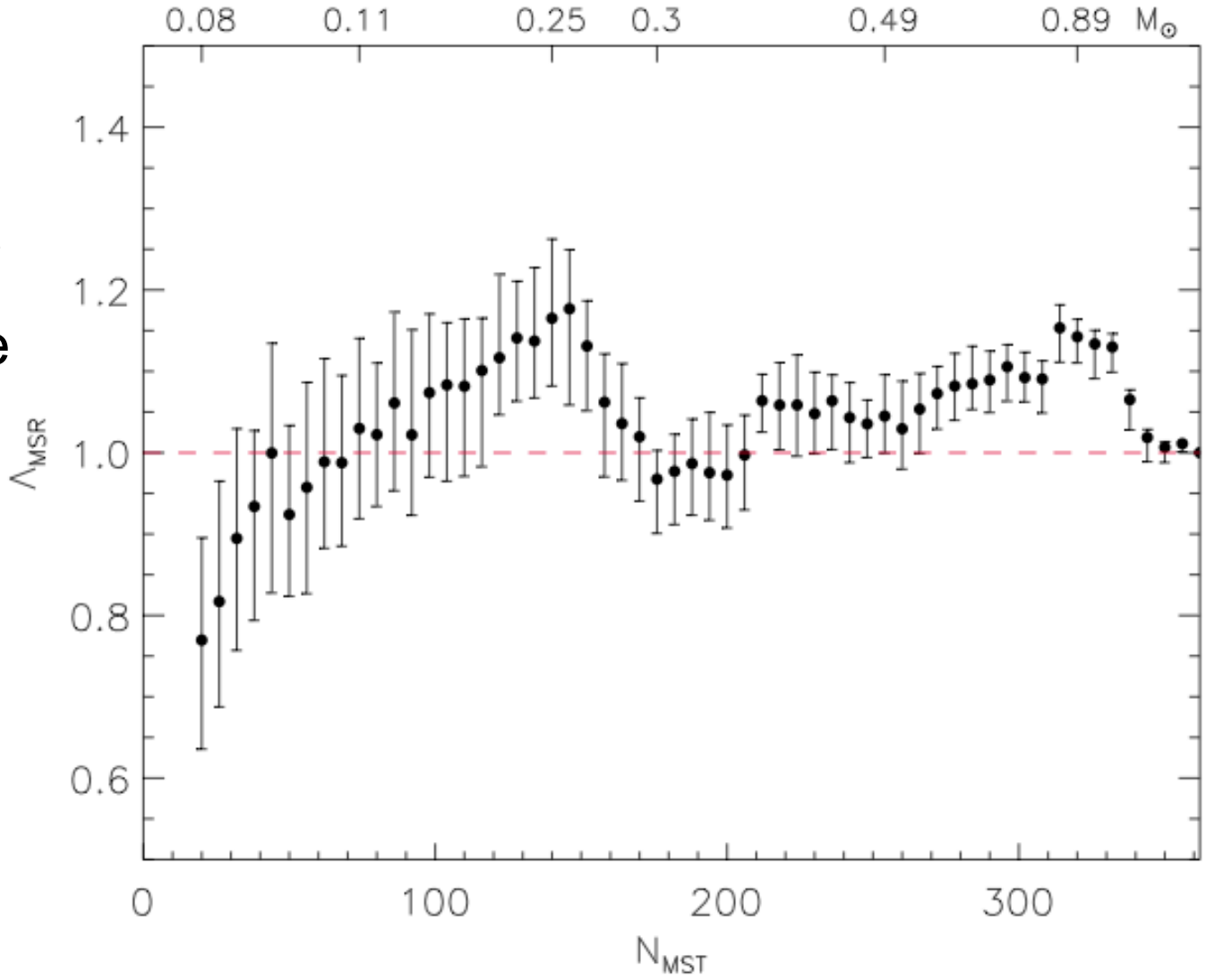
Least Massive Objects

- BDs also inversely segregated?
- Need to take another approach…



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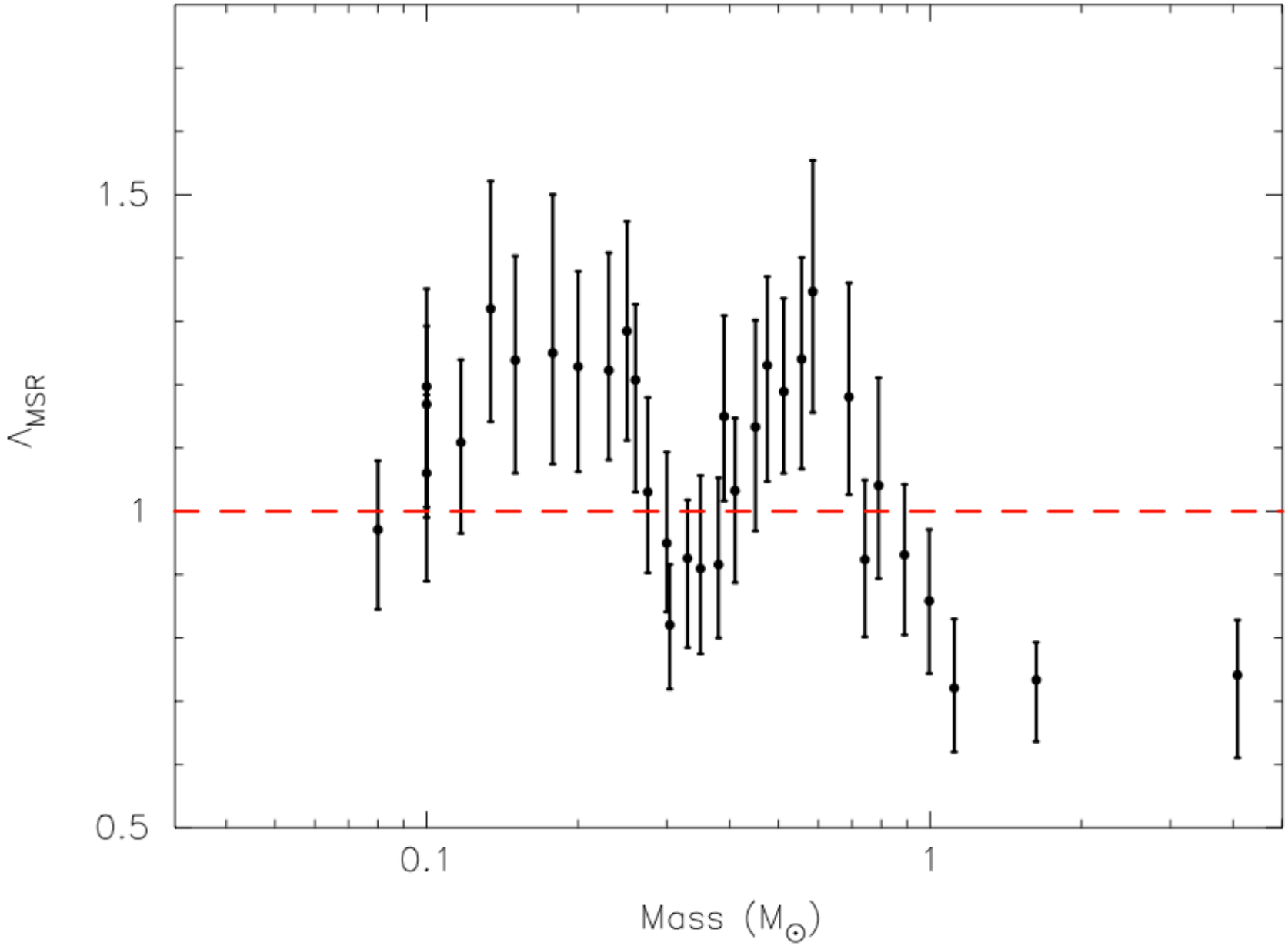
The ‘Slide’ Technique



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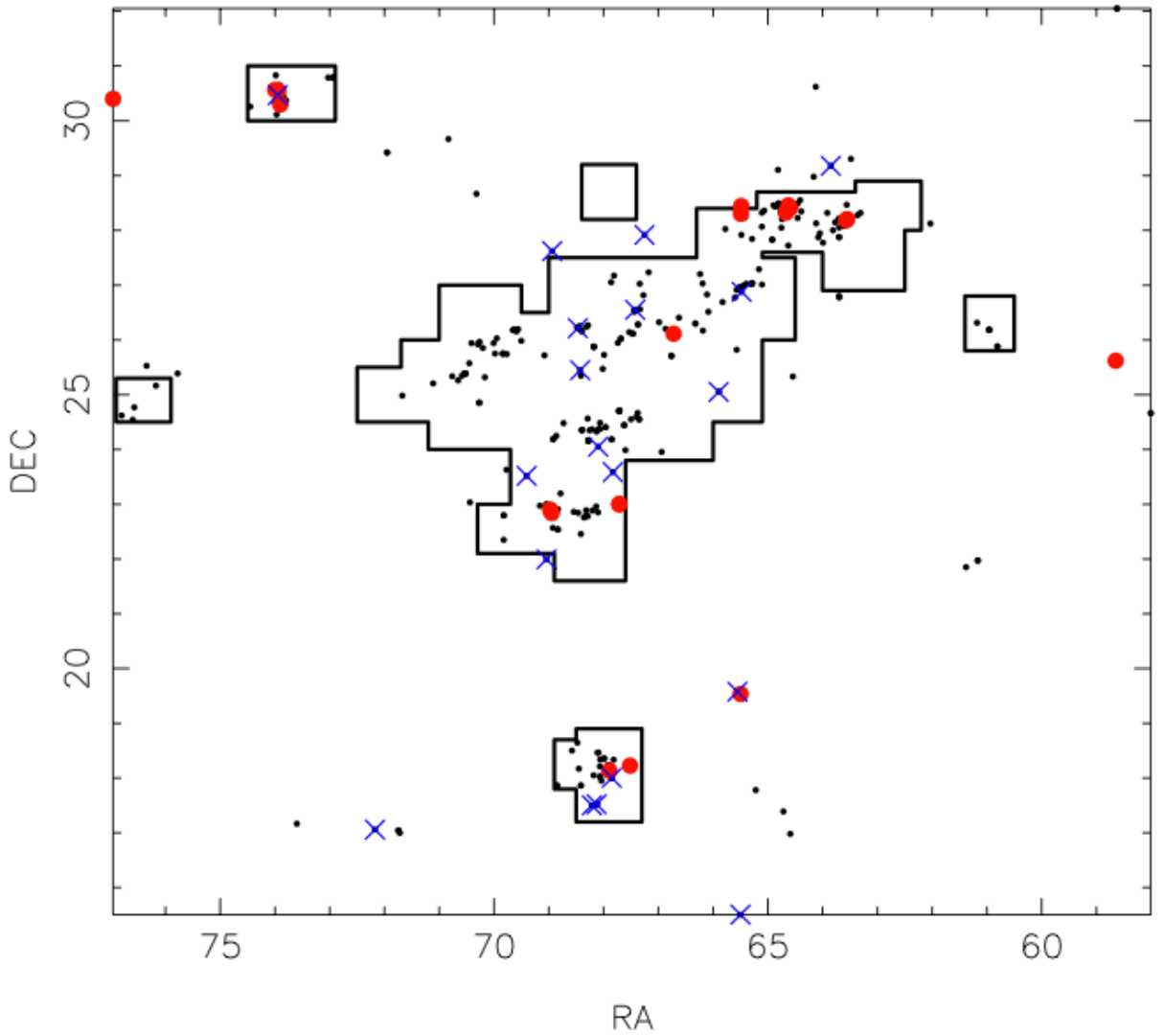
Taurus – central region

- Complete fields shown by black outlines (e.g. Luhman 2010).
- Red = 20 most massive objects.
- Blue = 20 least massive objects.



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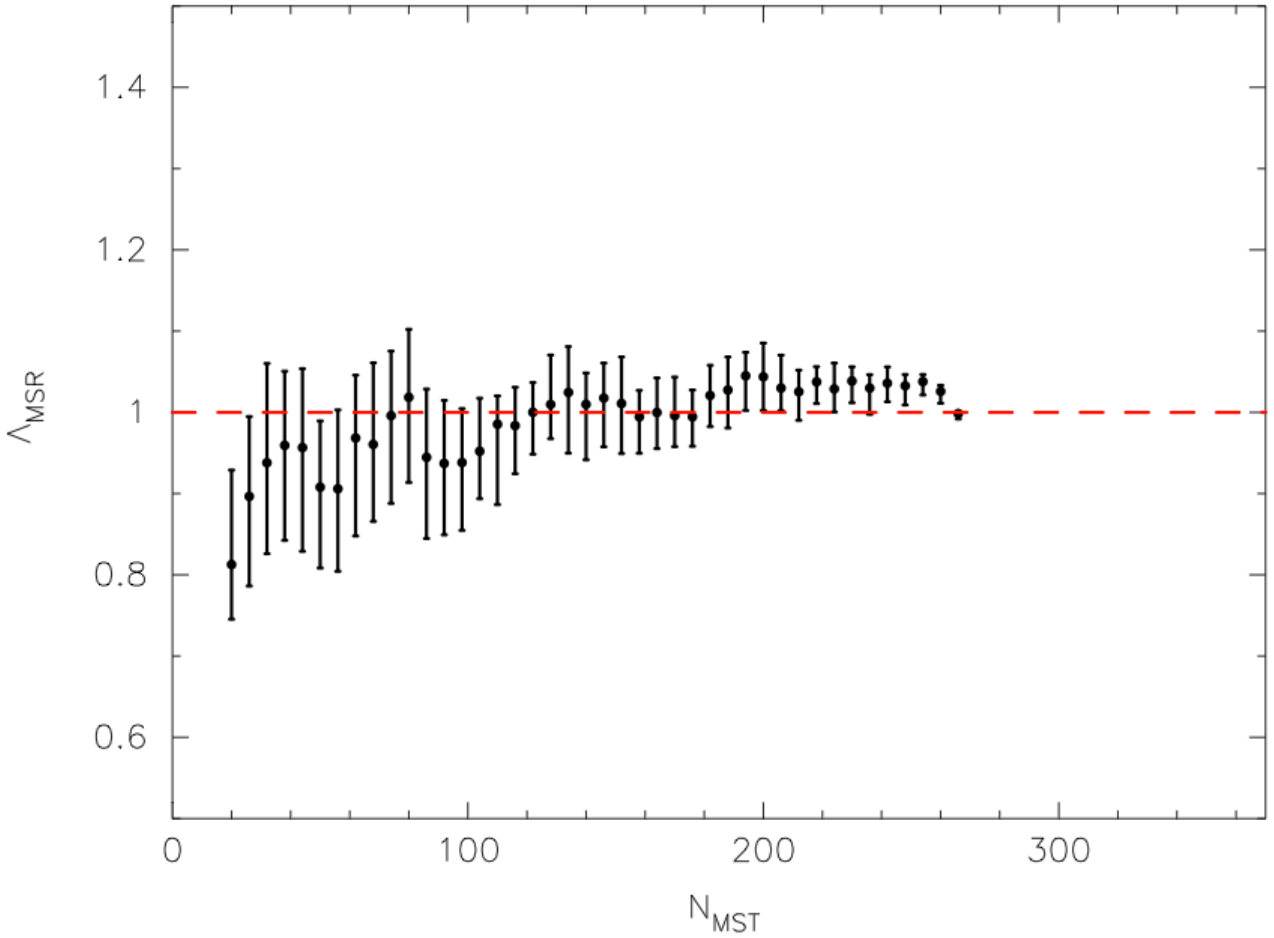
Most Massive Objects

- $\Lambda_{MSR} = 0.8 \pm 0.1$ (still some inverse mass seg.).
- But many of the most massive stars not in central region



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Summary

- ‘Slide MST’ method confirms that the stars m > 1$M_{\odot}$ are slightly inversely mass segregated (Λ_{MSR} = 0.7±0.1).
- Effect is diluted when considering only the central region.
- This result is for the whole association – see Helen Kirk’s talk for results from the various sub-groups.
- Tentative evidence for slight mass segregation of low-mass stars (Λ_{MSR} = 1.25±0.15)
- Brown dwarfs have (Λ_{MSR} = 1).