A view of the Galactic bar in the Gaia space of observables

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Goal / Outline

- Tool to generate realistic Gaia mock catalogues
- Analysis the Galactic bar in the Gaia space of observables
- First application: Gauge the capabilities of Gaia to characterize the Galactic bar

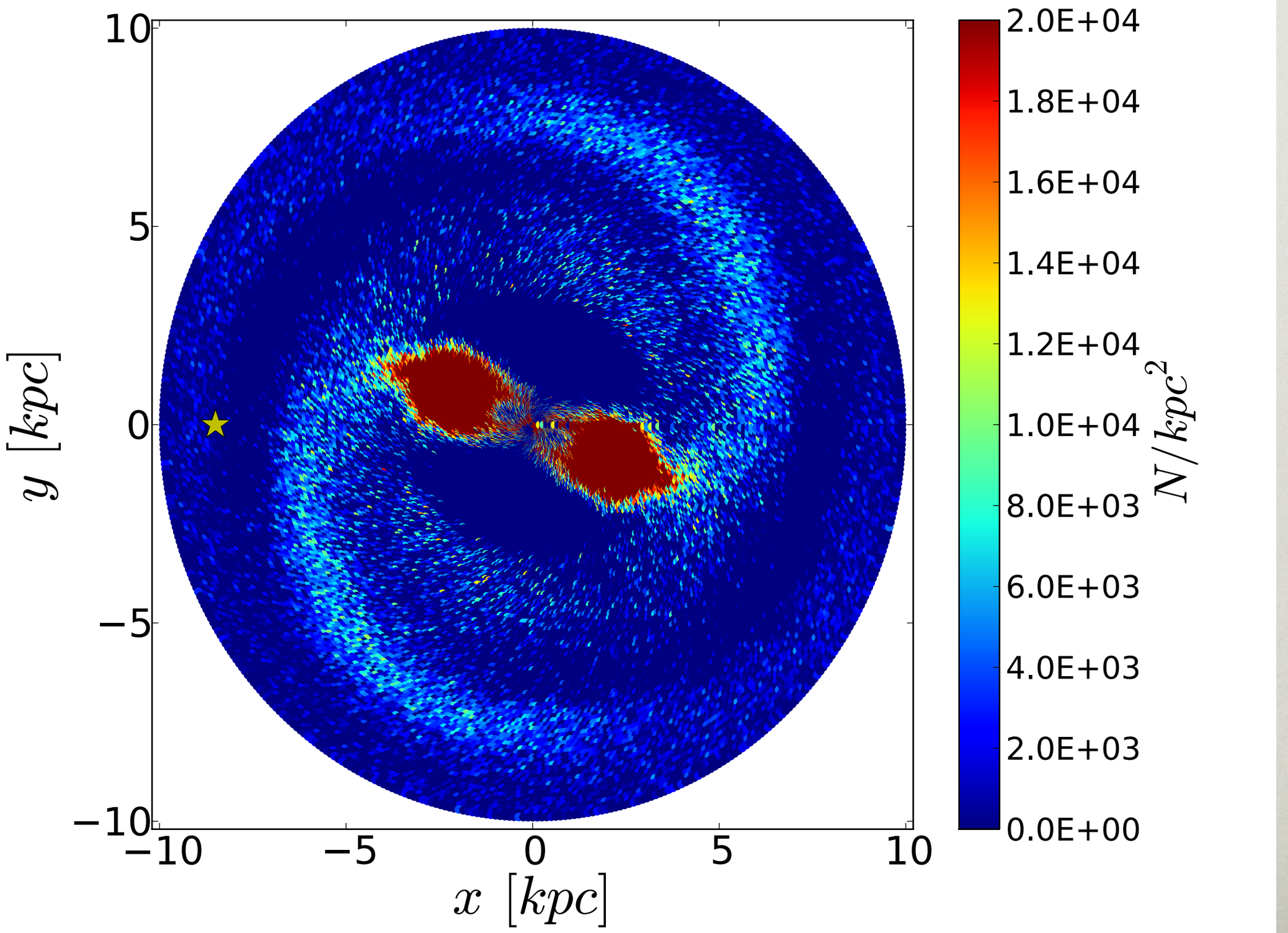
Romero-Gomez et al., 2014, accepted in MNRAS, arXiv:1411.6389

The generation of the mock catalogues

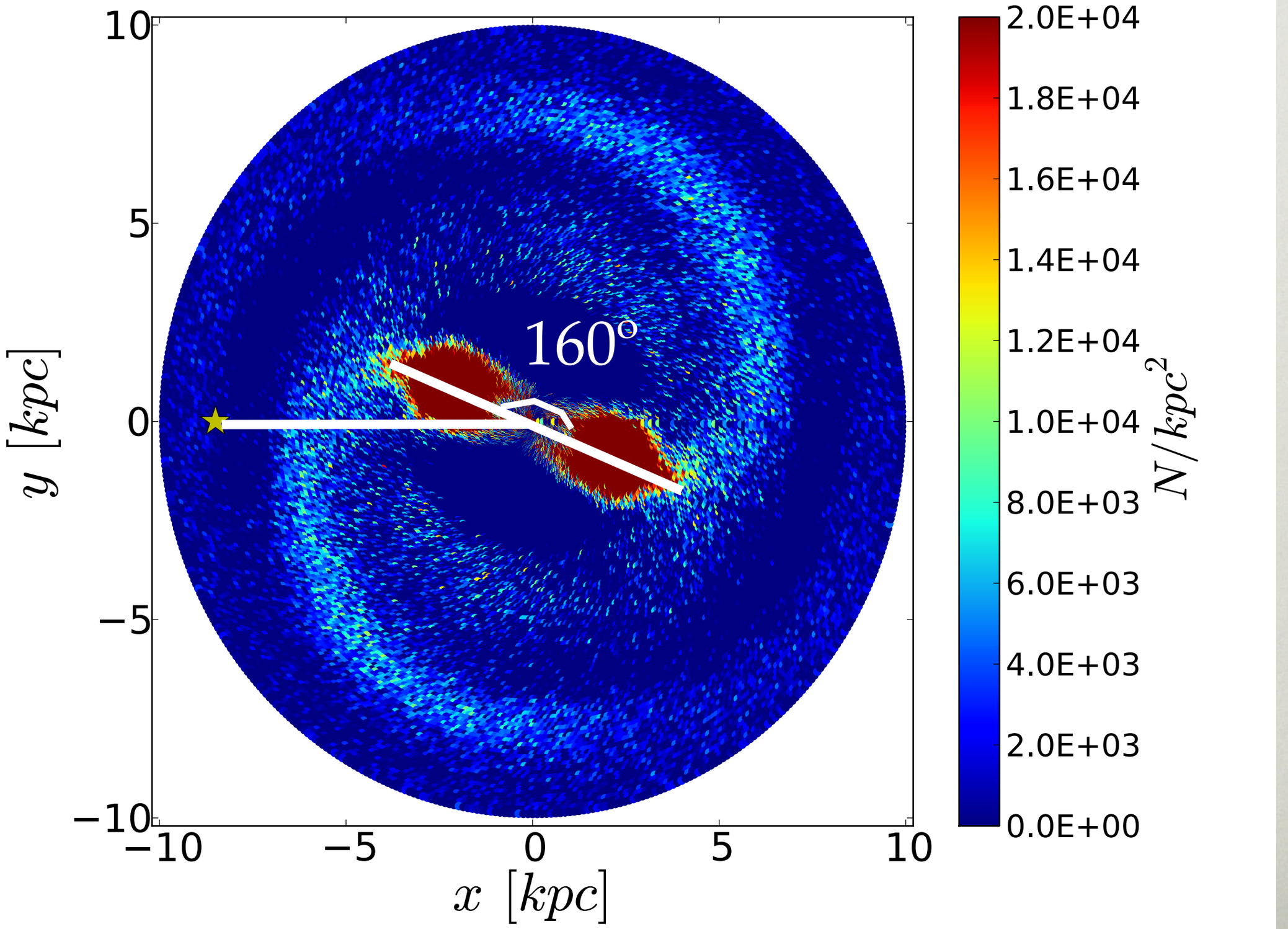
Ingredients:

- Initial conditions: disc density profile+kinematics according to RC stars $\sigma_r(R_\odot) = 30\,km/s$
- 57M particles (normalized to solar neighbourhood according to the New BGM, Czekaj et al., 2014)
- Potential: two components:
  - Axisymmetric component (Allen & Santillan,1991)
  - Galactic bar: grown adiabatically in time for 4 bar rotations

The generation of the mock catalogues



The generation of the mock catalogues



The generation of the mock catalogues

Ingredients:

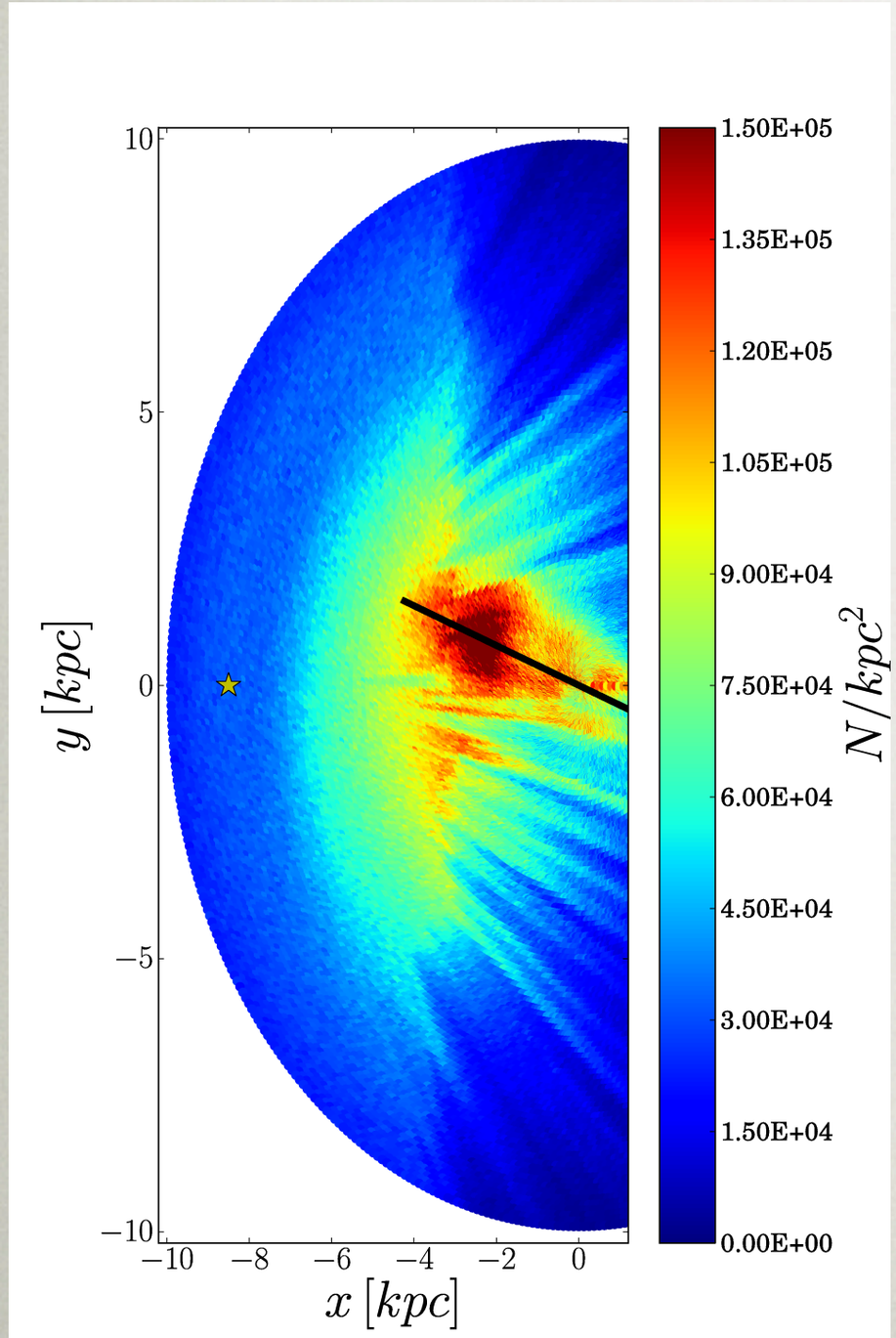
- Physical parameters: disc RC giants (K0-1III stars) with M_K=-1.61 mag, $(V-I)_o$=1, $(V-K)_o$=2.34 (Alves 2000). Cardelli extinction law: $A_K=0.114A_V$ and $A_I=0.479A_V$
- 3D absorption model, Drimmel et al. (2003)
- Gaia error model

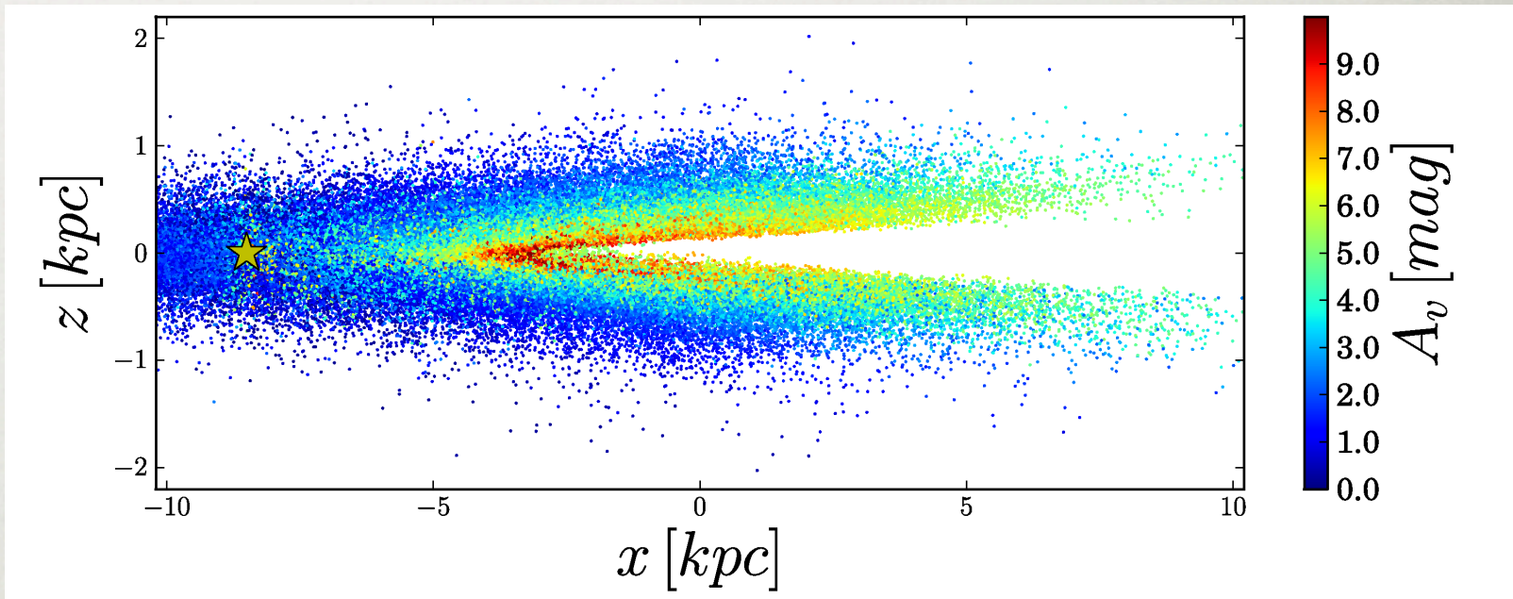
The generation of the mock catalogues

Output:

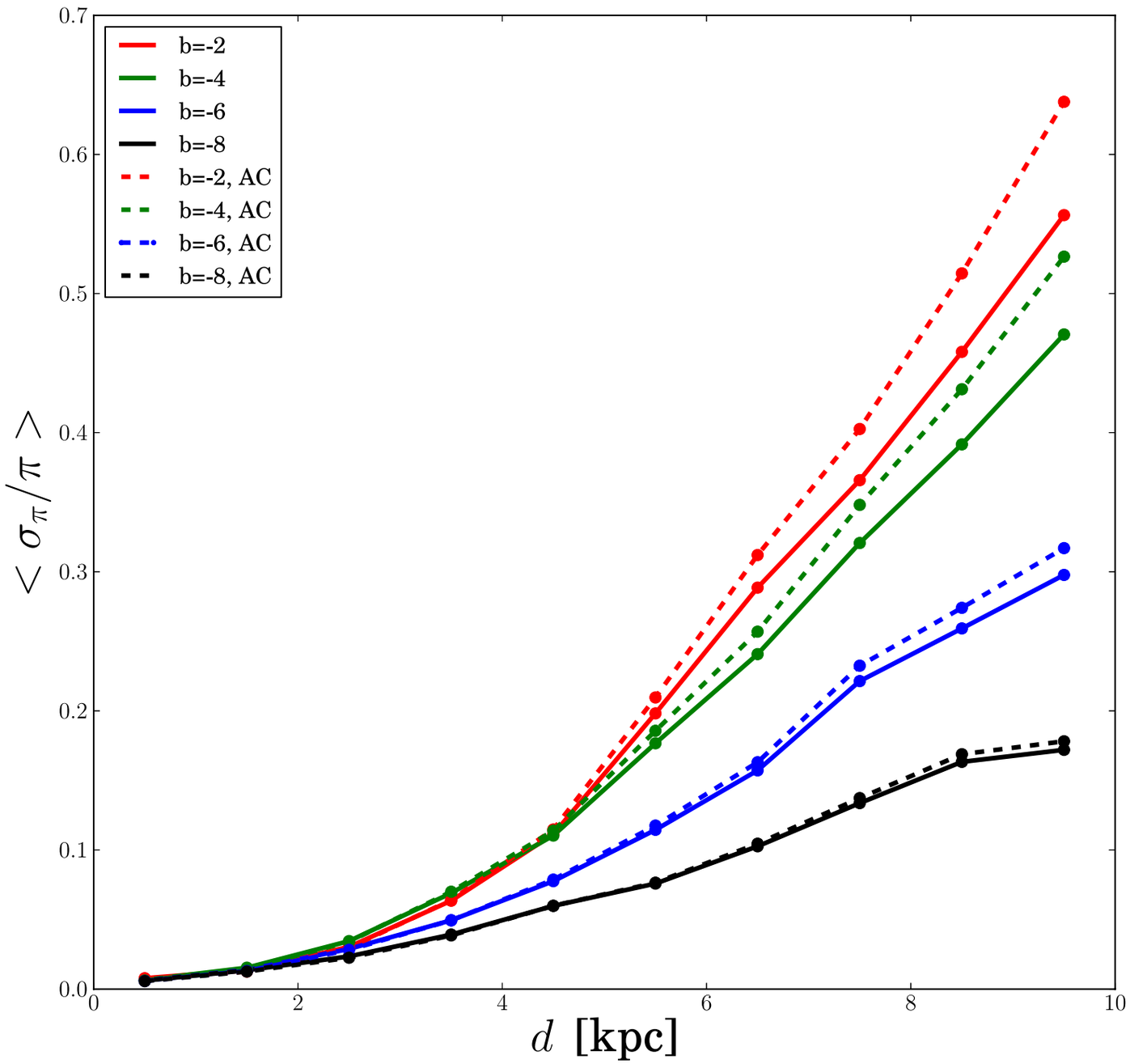
- 6D components (positions and kinematics) real and observed, magnitudes G and G_{rvs} and two samples:
- RC-G20: all particles with Gaia magnitude $G \leq 20$
  - ★ RC-G20-IR: relative error in distances of 10%
- RC-RVS: all particles with $\sigma_{V_r} \leq 10\,km/s$

Analysis of the RC-G20 sample





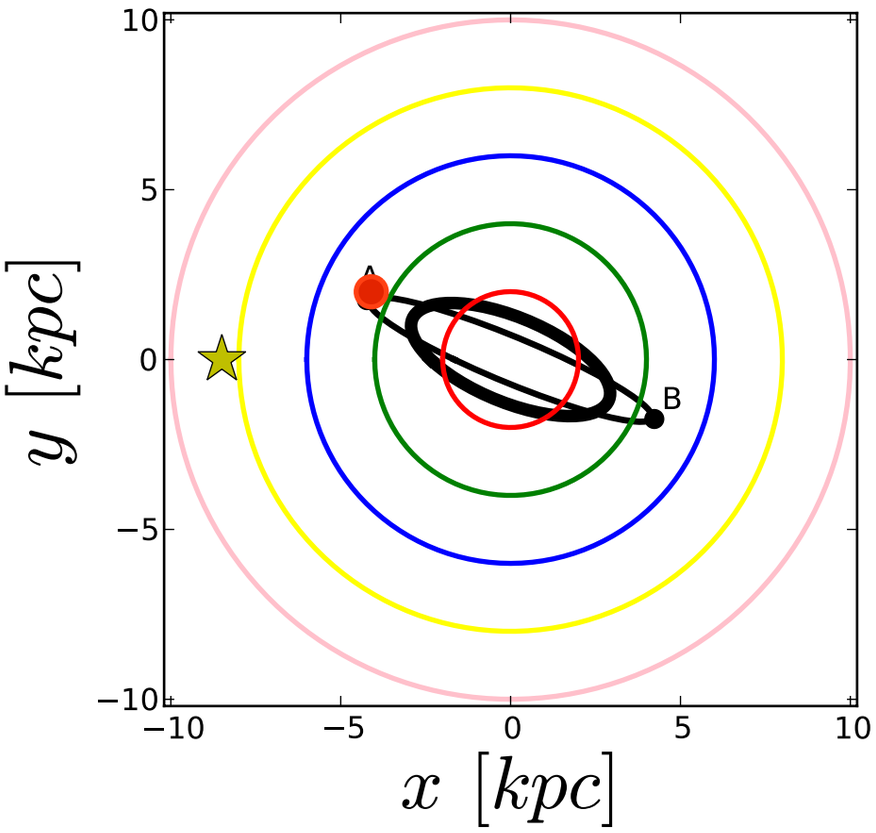
Analysis of the RC-G20 sample

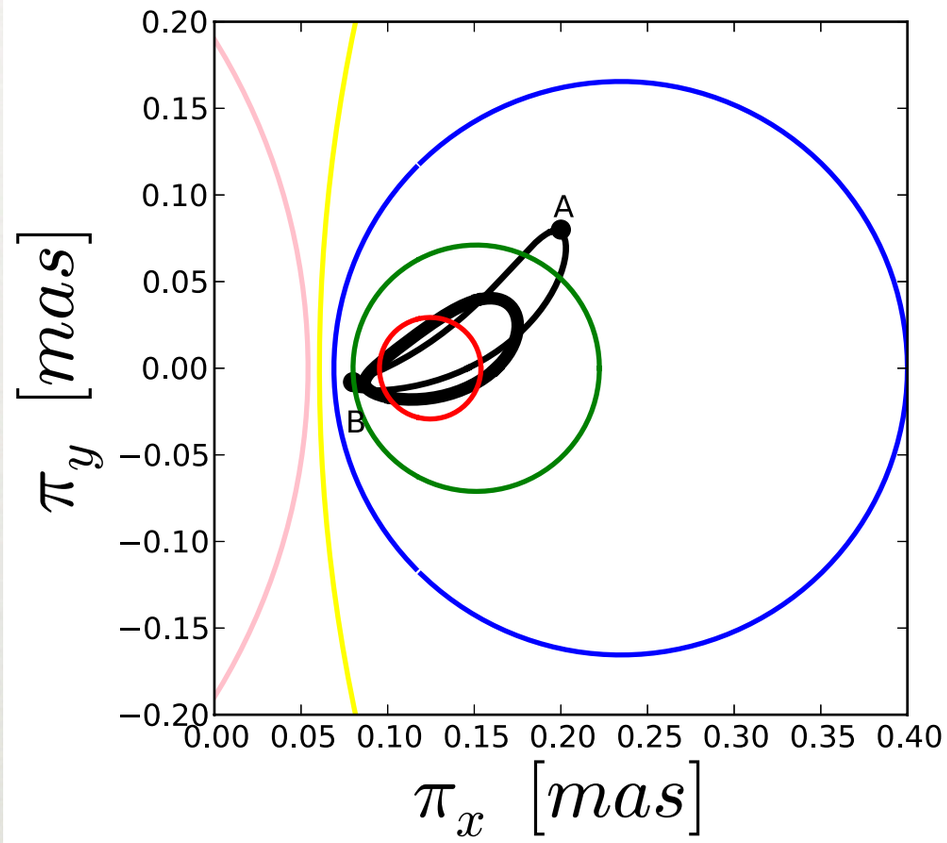


Post-commissioning errors from DeBruijne, Rygl, Antoja (2014)

Mapping the Galactic bar in the space of observables

$$(x, y) \Longrightarrow (\pi_x, \pi_y) = (\pi \cos(l), \pi \sin(l))$$





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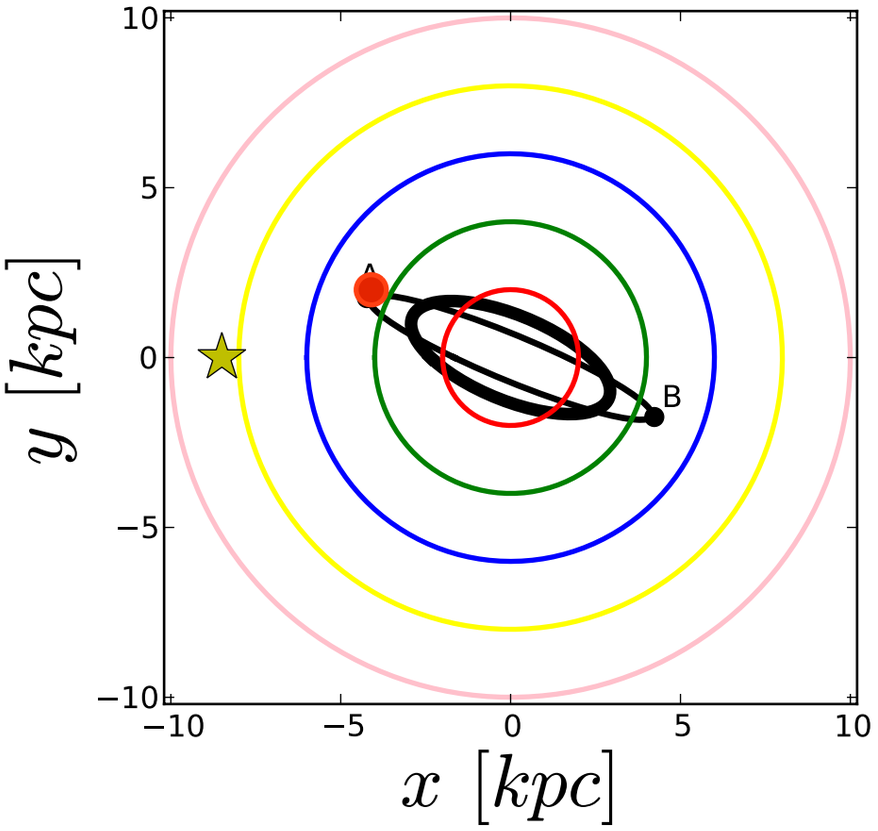

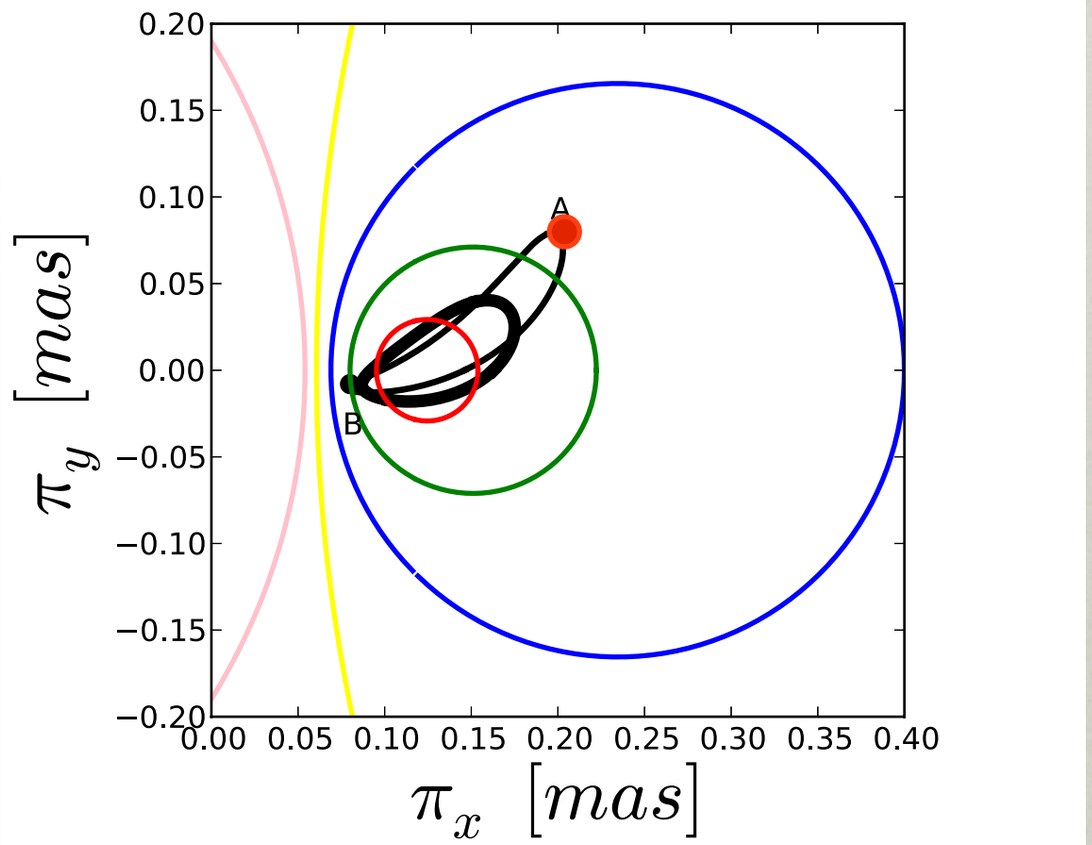

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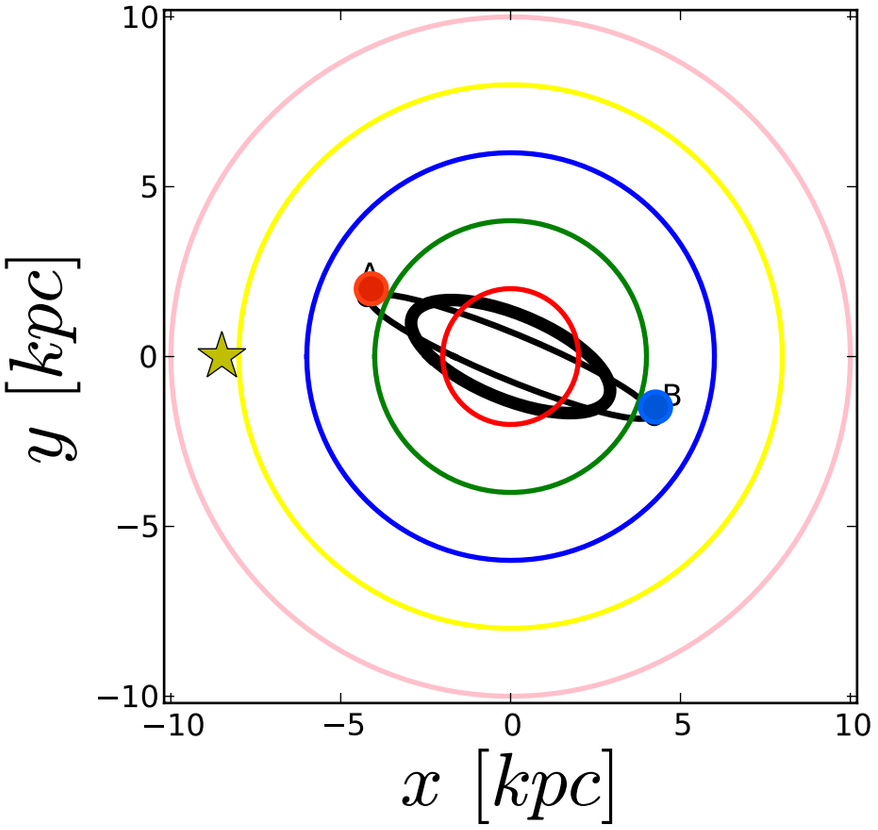

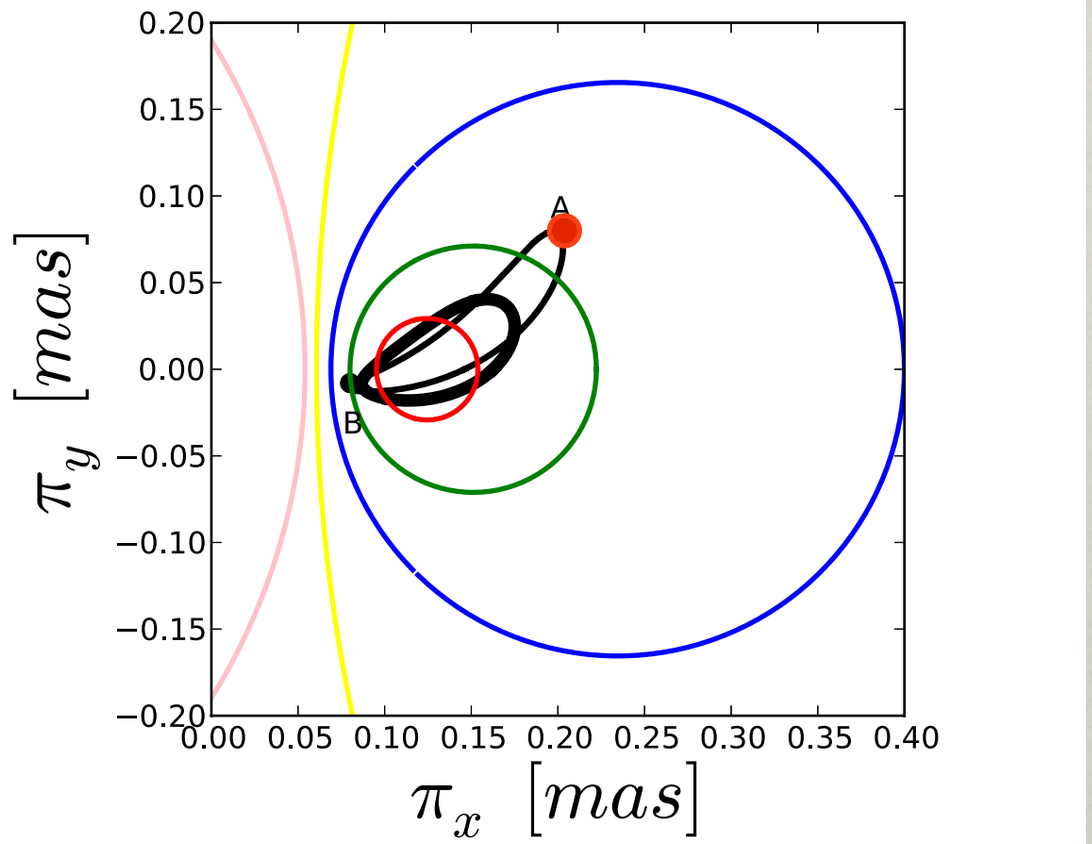

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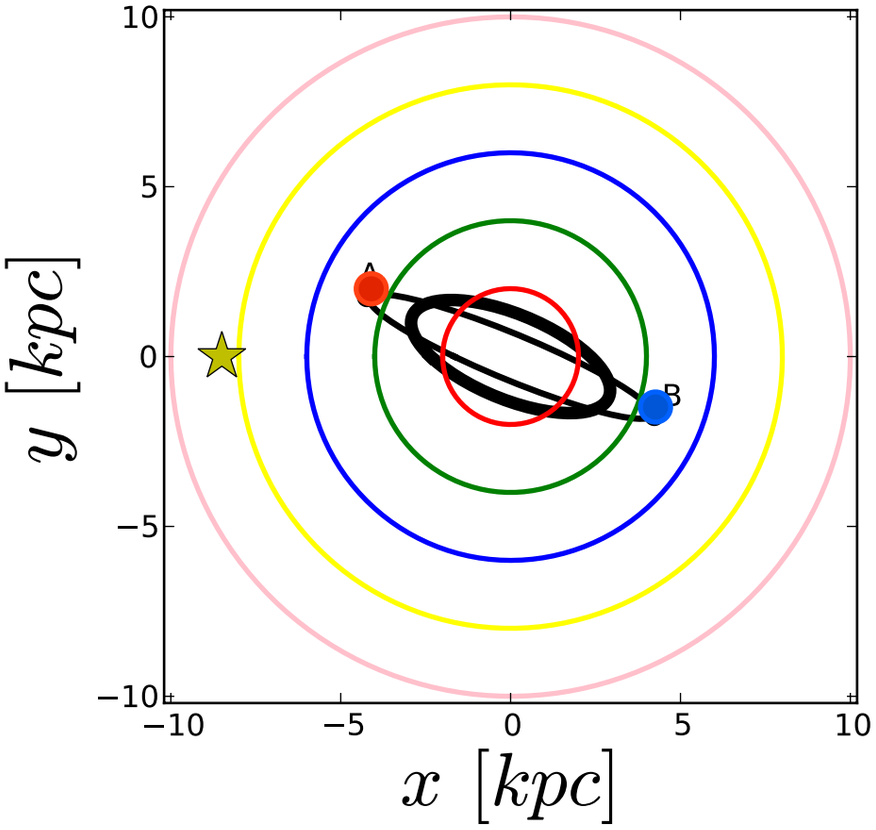

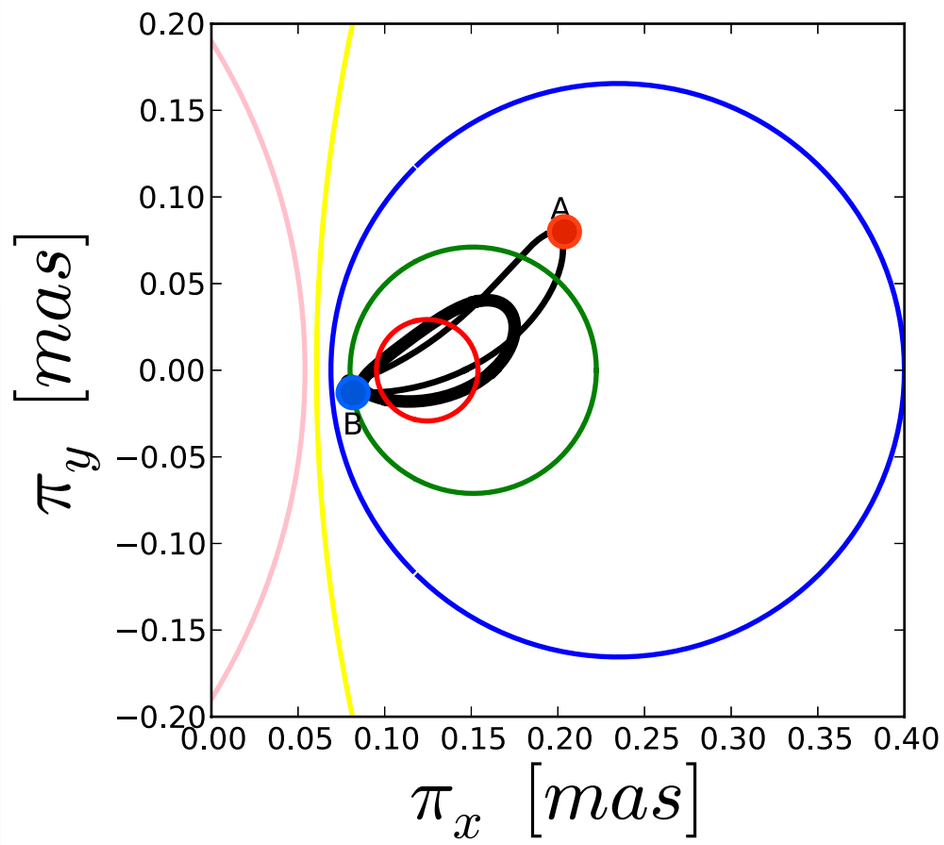

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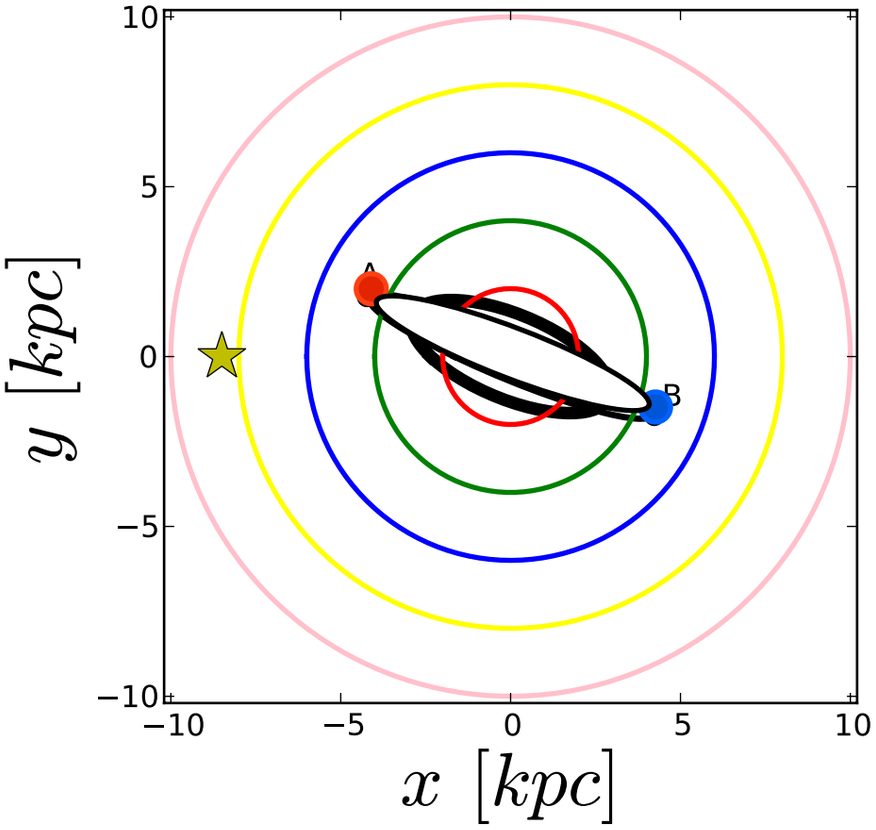

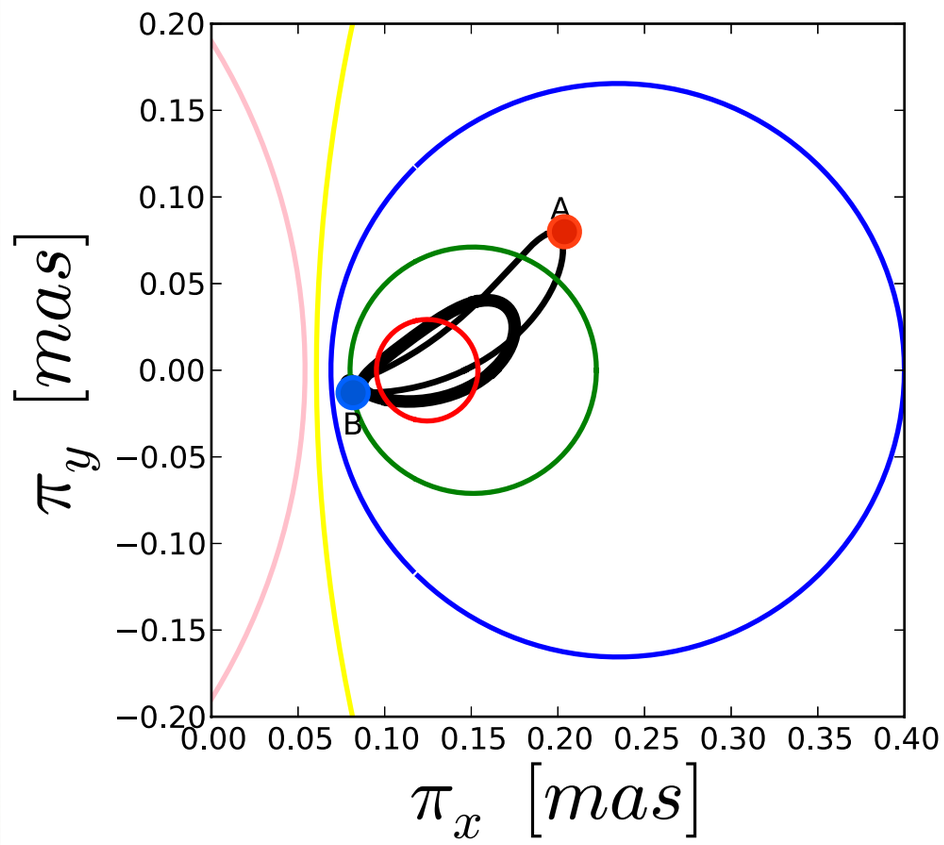

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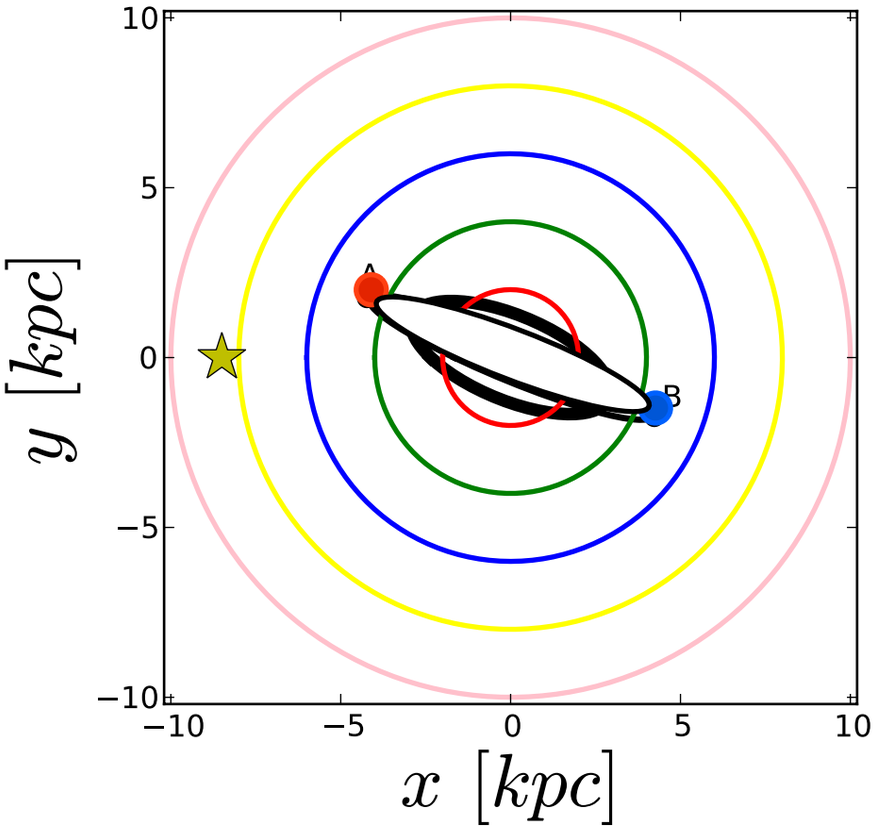
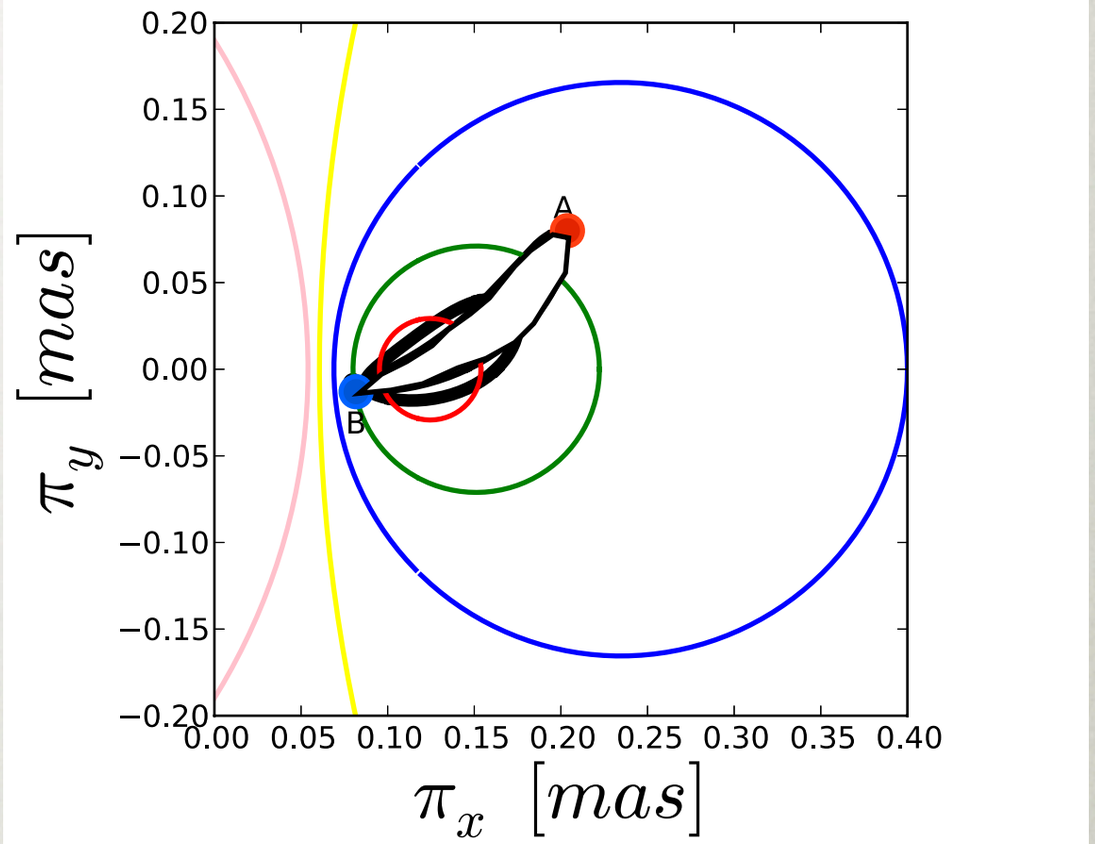
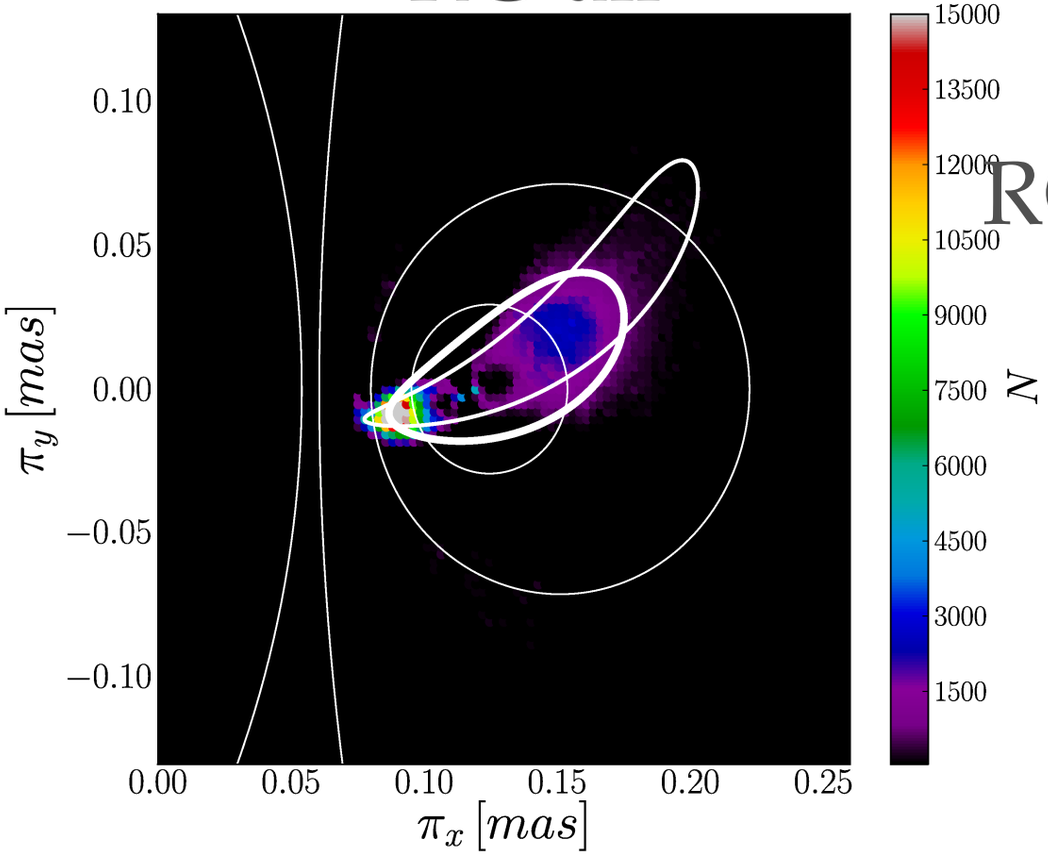


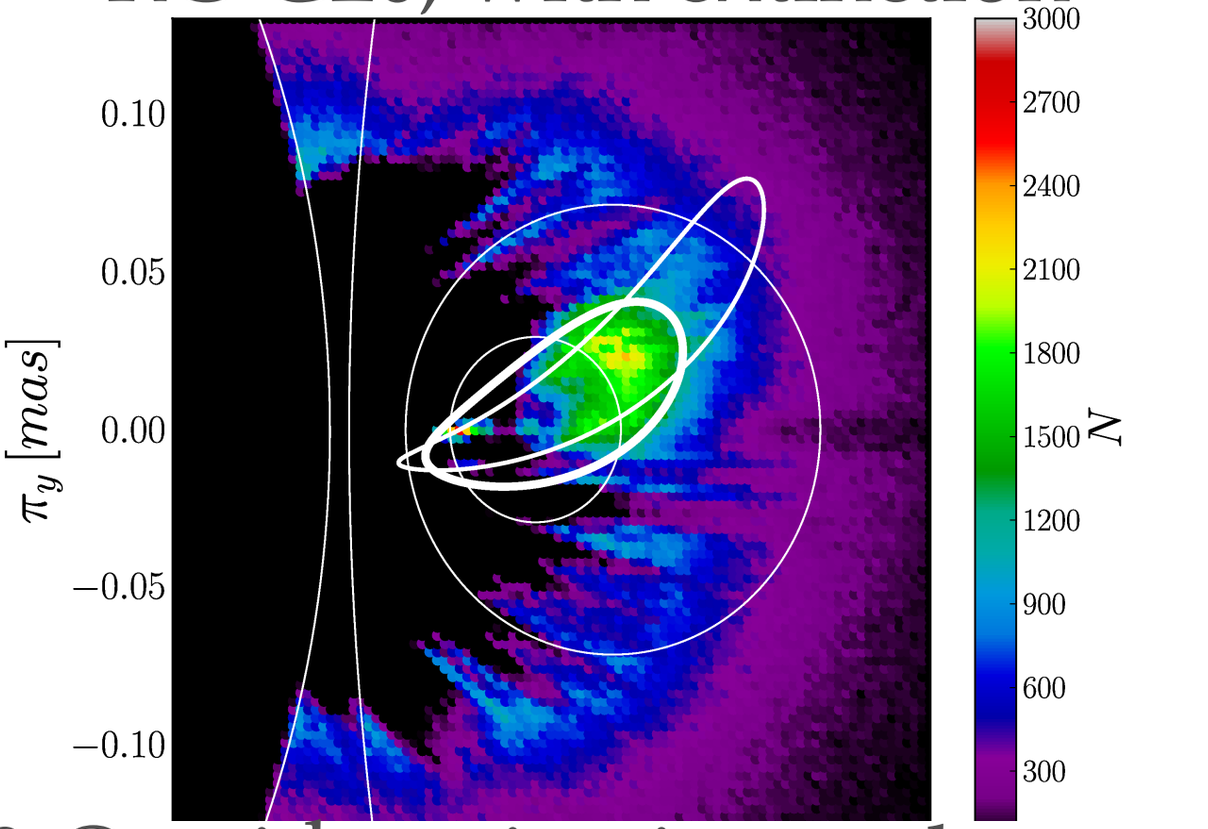


The Galactic
observab

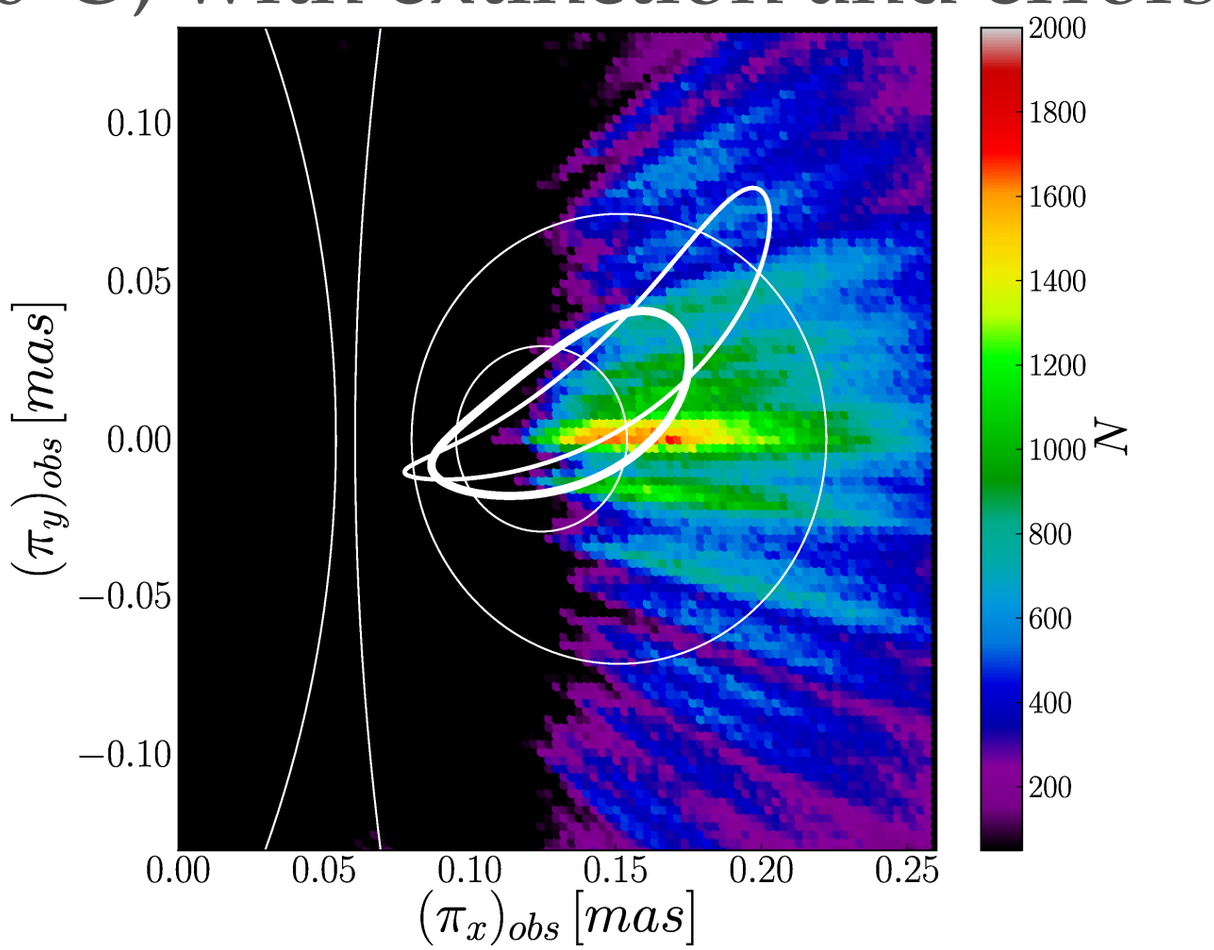
RC-all



RC-G20, with extinction

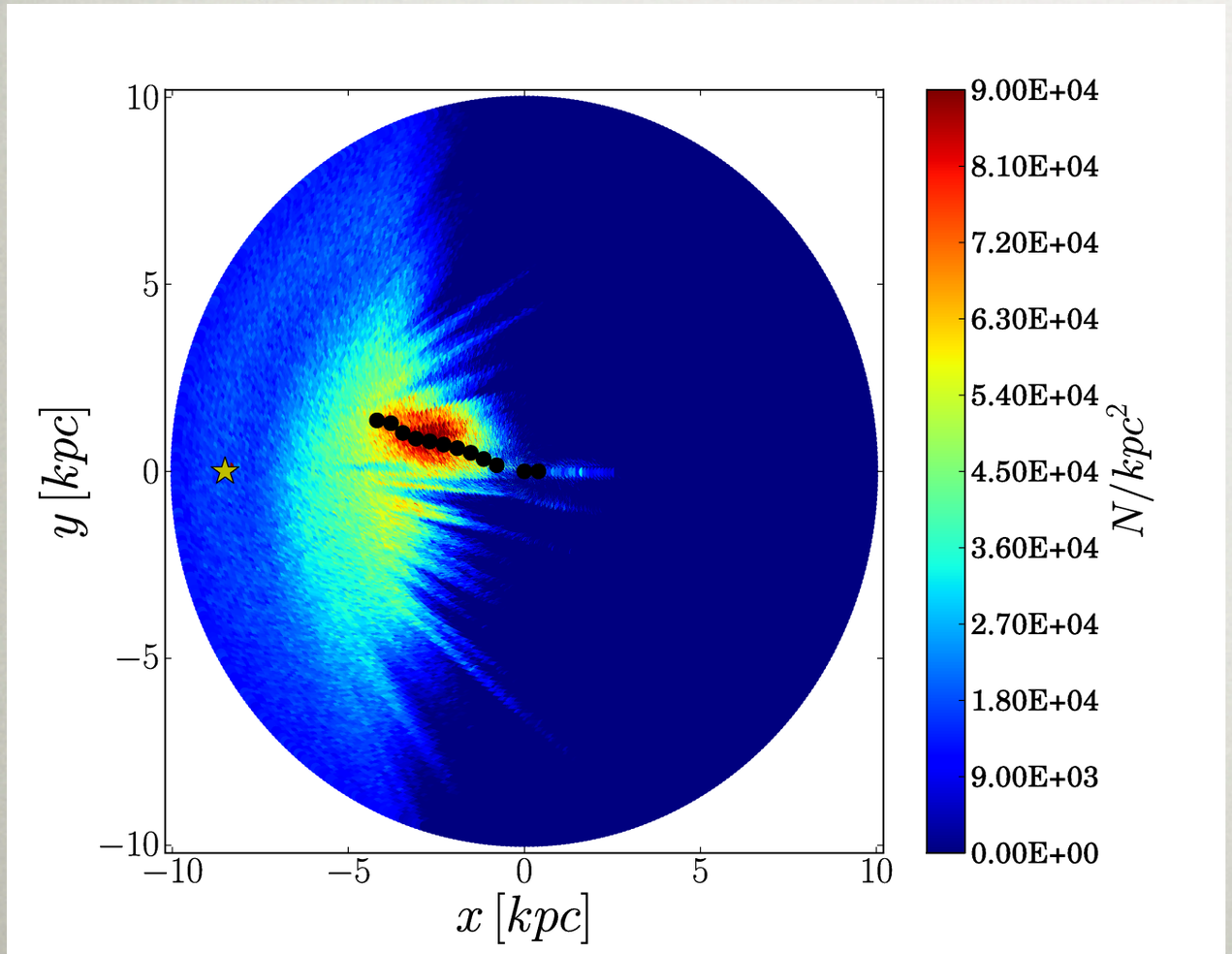


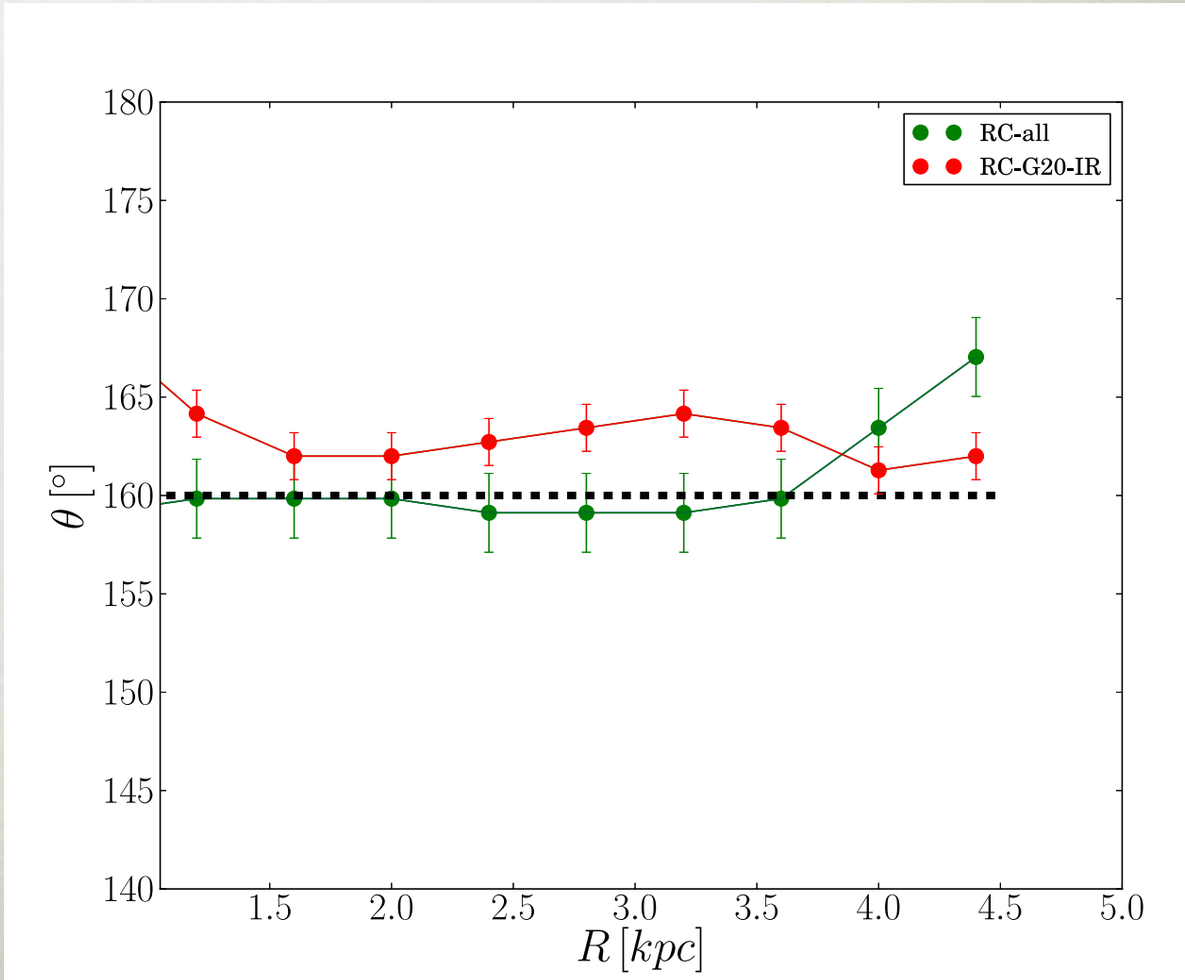
RC-G20-O, with extinction and errors



The need of IR surveys: APOGEE, WEAVE, UKIDSS,...

- Using RC-G20-IR we can determine the angular orientation of the Galactic bar with a 5% accuracy.





Conclusions

- We have a tool to generate Gaia mock catalogues, available to the community and adaptable to any star population and error model.
- The mock catalogues are suitable to make preliminary studies and to be ready for the exploitation of data (Gaia, WEAVE, APOGEE,...).
- As for the Galactic bar, it is very difficult for Gaia alone to determine the Galactic bar.
    - BUT, on-going work exploring the use of proper motions.