The WFIRST view of the Milky Way stellar halo

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With WFIRST-HLS and WINGS, we can

- see beyond the edge of the stellar halo
- fill in the Milky Way's accretion history
- improve measurements of the MW's total mass

Tests of cosmological predictions for structure & substructure in the near field

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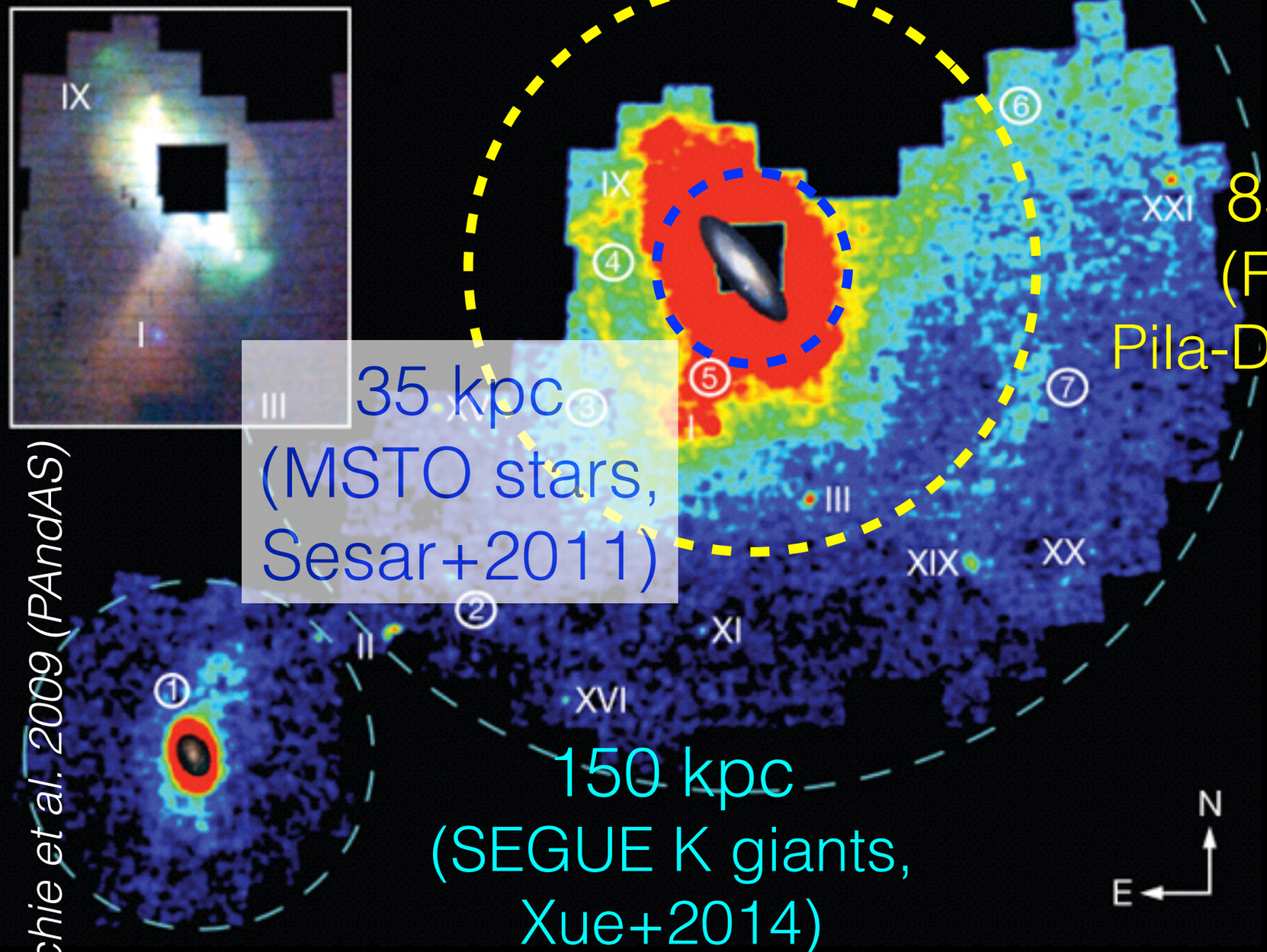
How far does the MW stellar halo extend?



McConnachie et al. 2009 (PAndAS)

35 kpc
(MSTO stars,
Sesar+2011)

85 kpc
(F stars,
Pila-Diéz+2015)

150 kpc
(SEGUE K giants,
Xue+2014)

300 kpc
(Rvir?)

274 kpc
(Most distant M giant,
Bochanski, Willman, Caldwell, RES+2014)

477 kpc
(Leo T)

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What is out there?

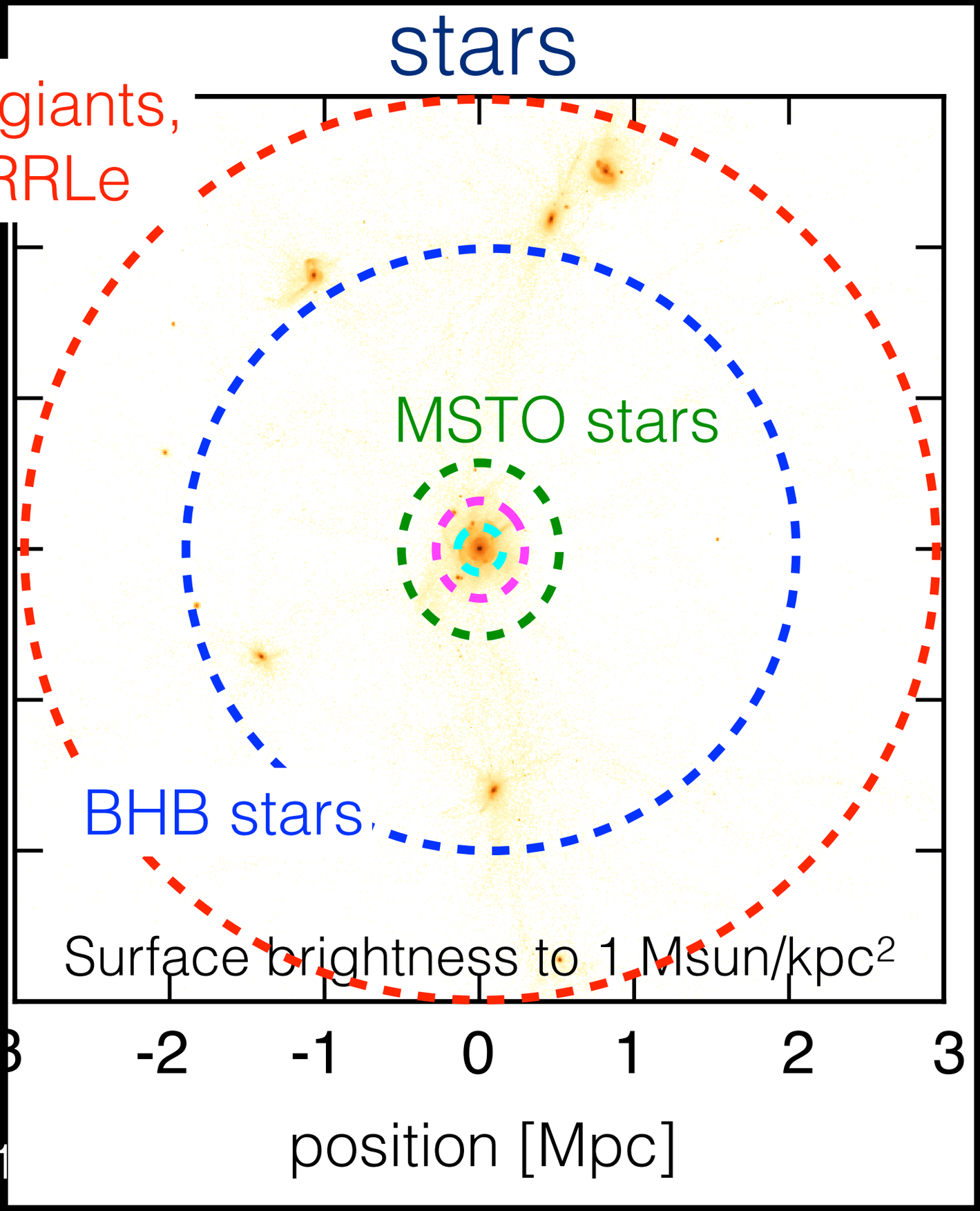

Figure courtesy Andrew Wetzel
Latte Simulation: arXiv:1602.05957

300 kpc
(Rvir?)

150 kpc
(extent of
current
samples)

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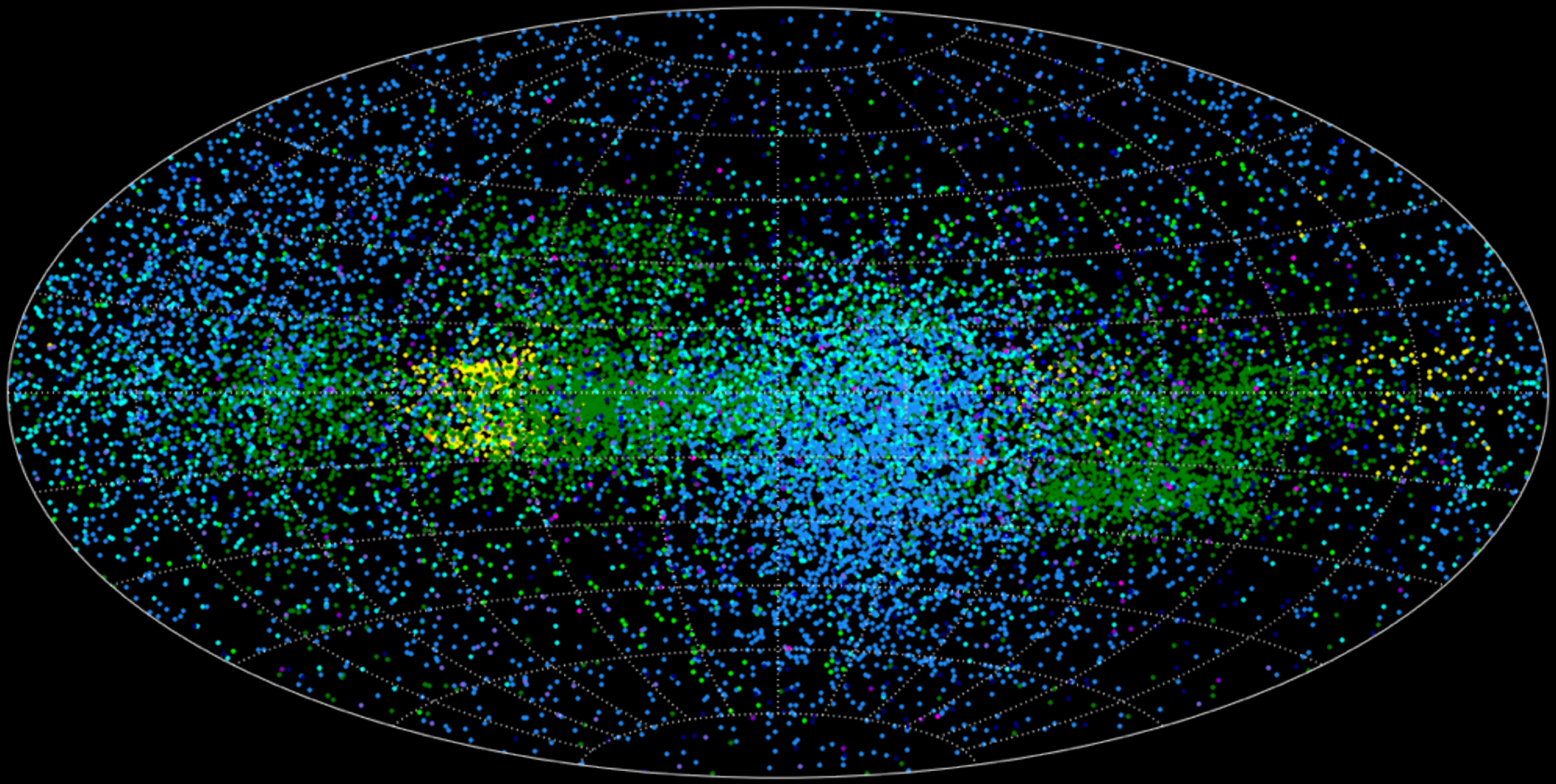
Different tracers, different views

Bullock & Johnston mock stellar halo
+ galaxia (Sharma+2011)
M giants 100-300 kpc
selected ~as in Bochanski+2014



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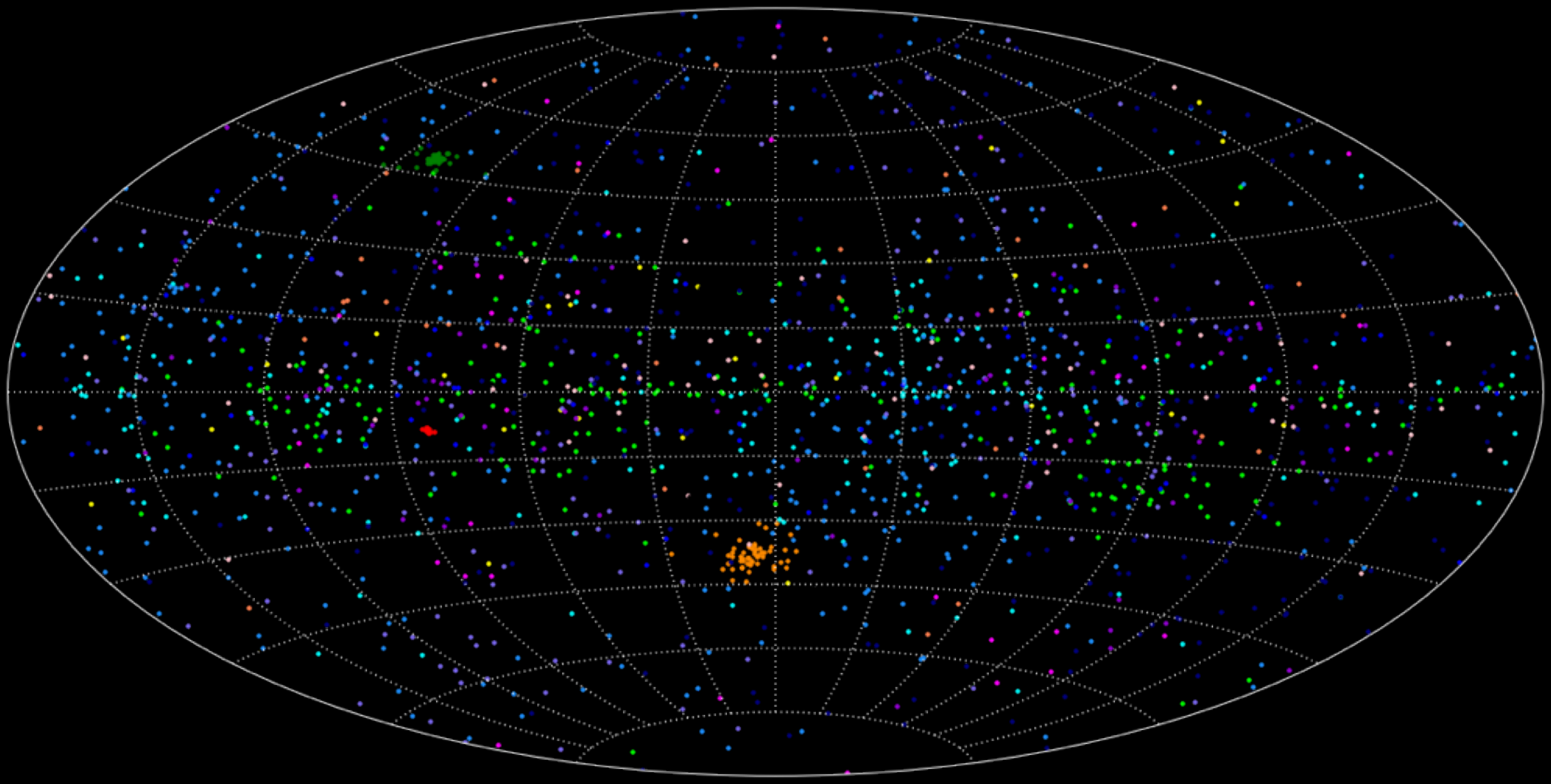
Different tracers, different views

Bullock & Johnston mock stellar halo
+ galaxia (Sharma+2011)
RR Lyr beyond 100 kpc



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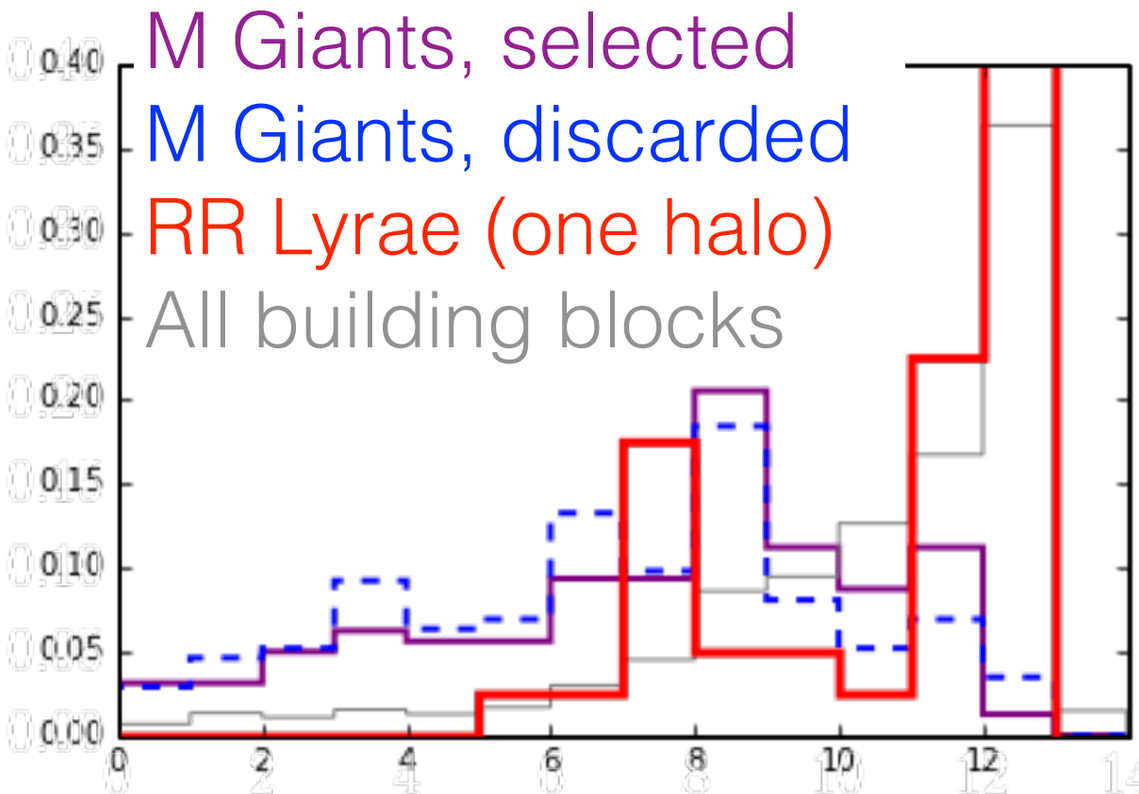
Observational selection effects map to accretion space



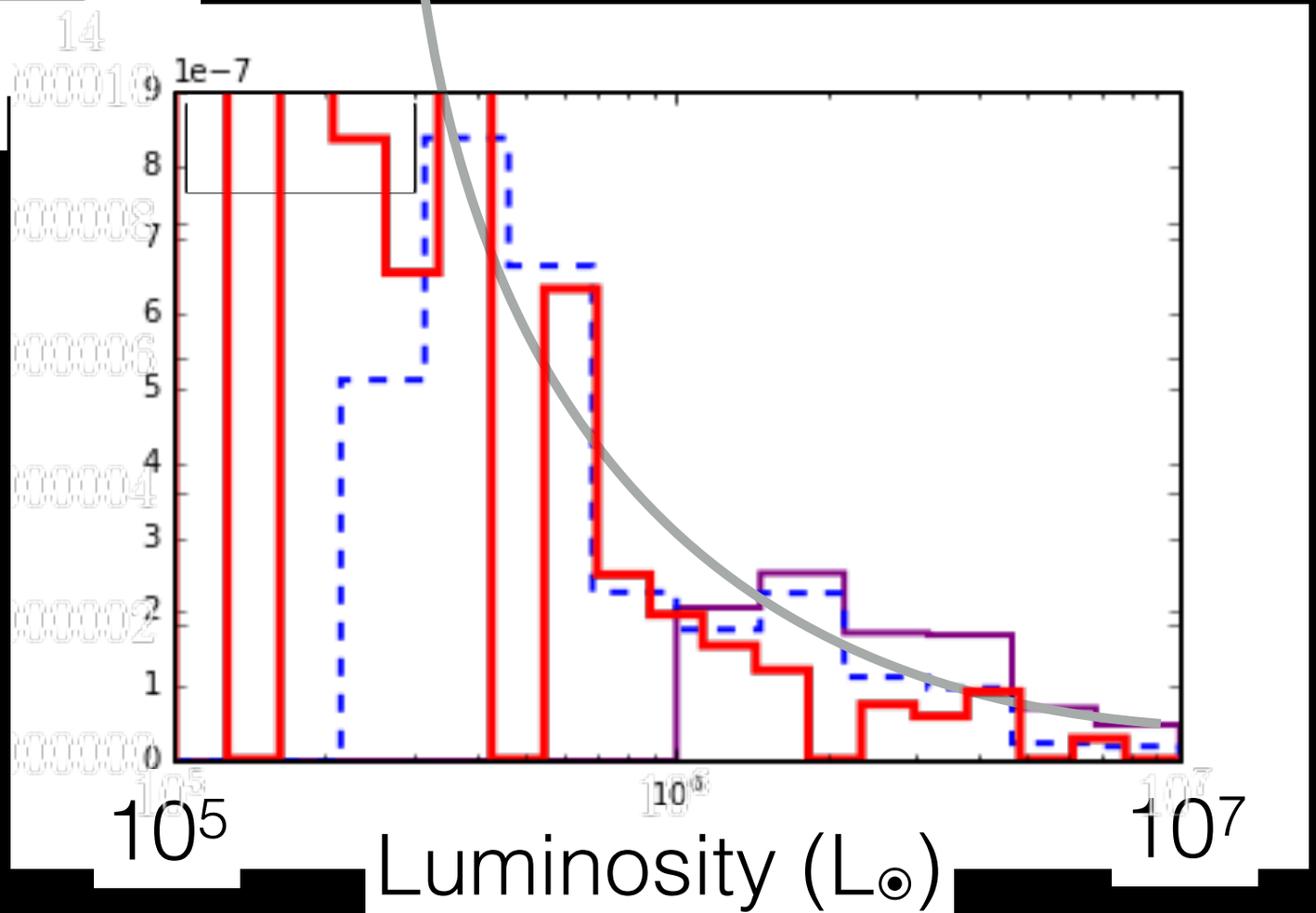
Distant M giants map more recent accretions,

RRLe sensitive to older objects

Figures courtesy Amy Secunda

Higher metallicities select more luminous building blocks,

RRL include less luminous ones



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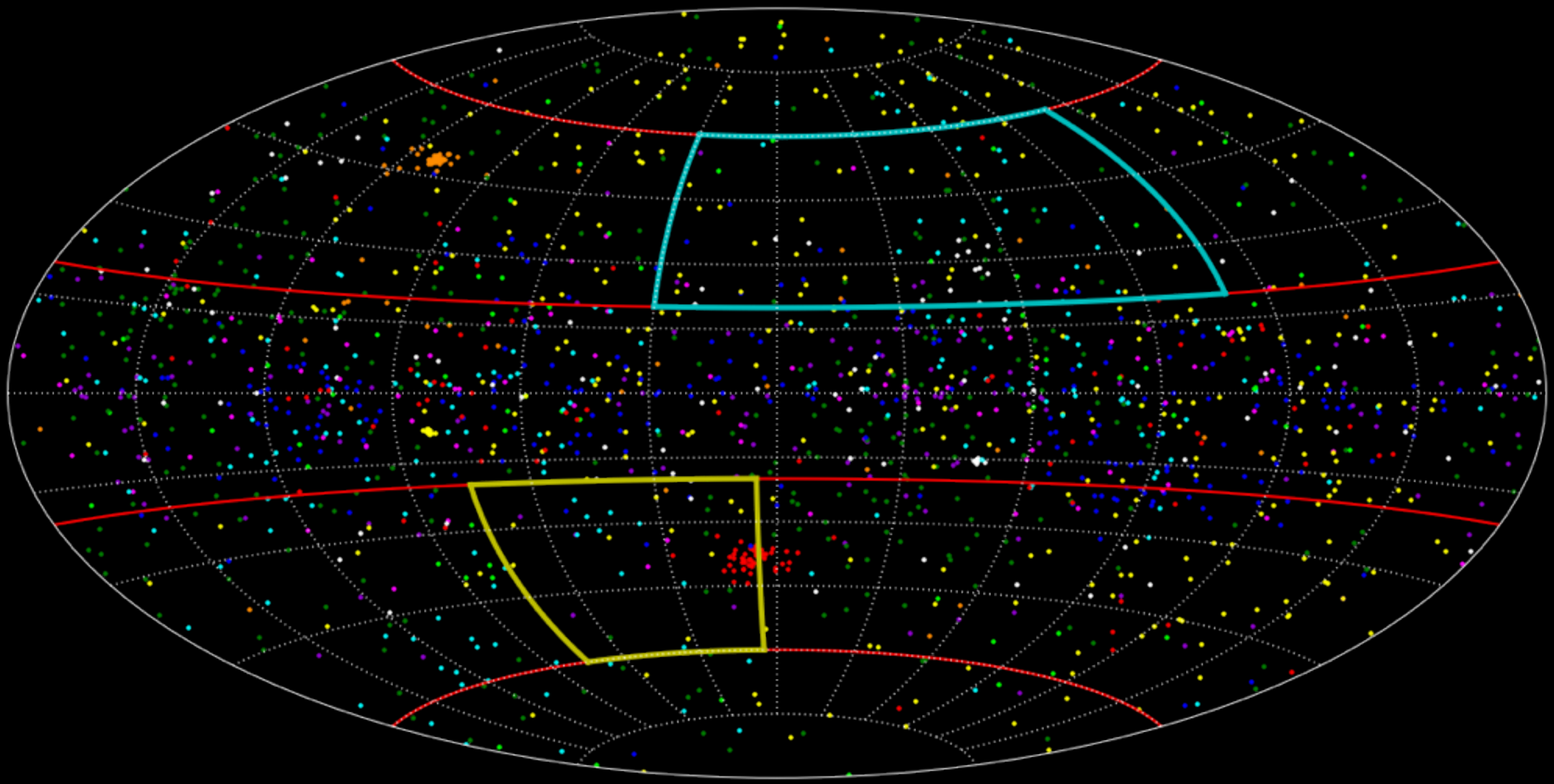
What will WFIRST see?



RR Lyr beyond 100 kpc

HLS only (2200 deg^2)
HLS+WINGS (4200 deg^2)

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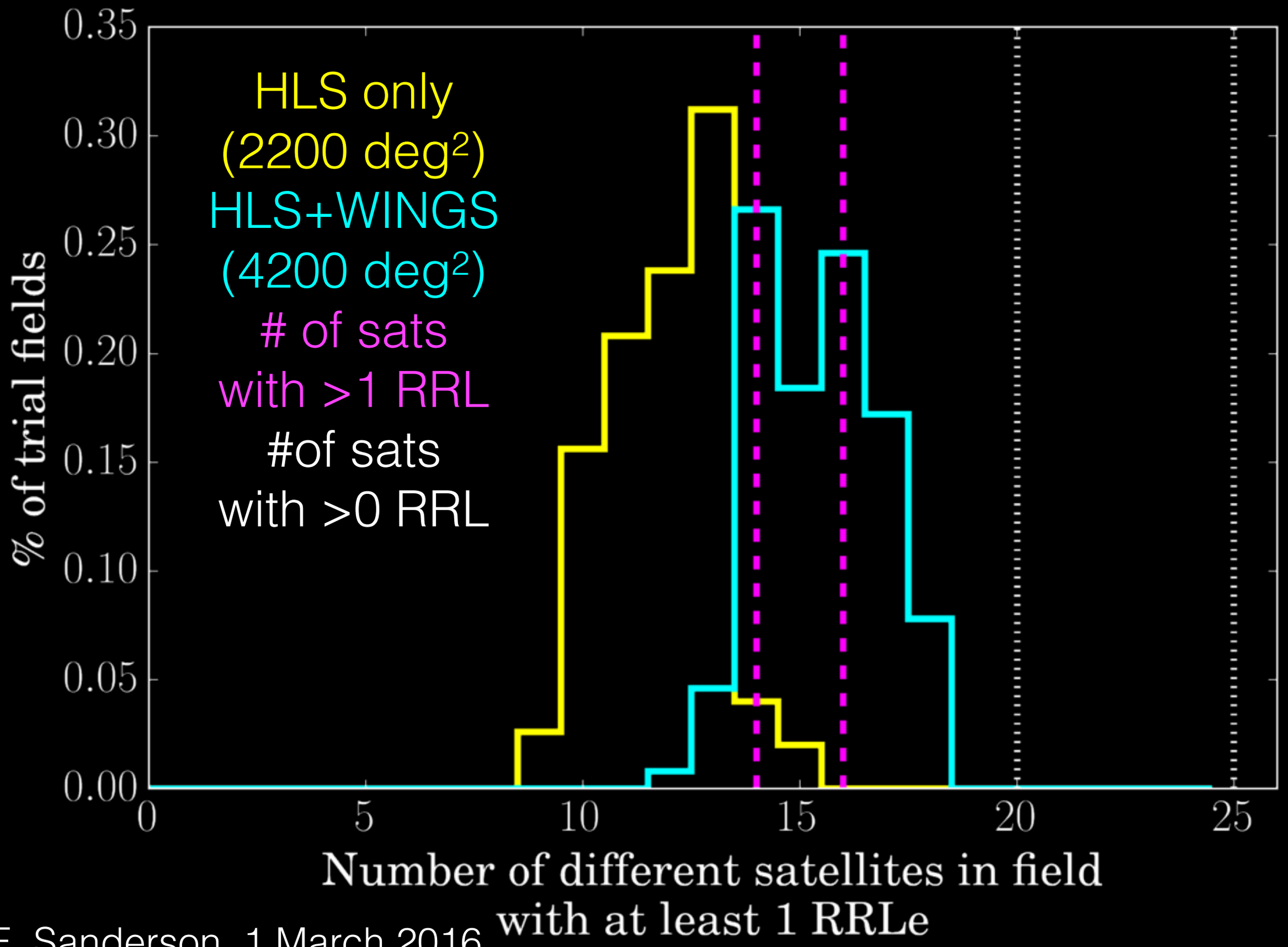
WINGS extends our knowledge of the MW's accretion history



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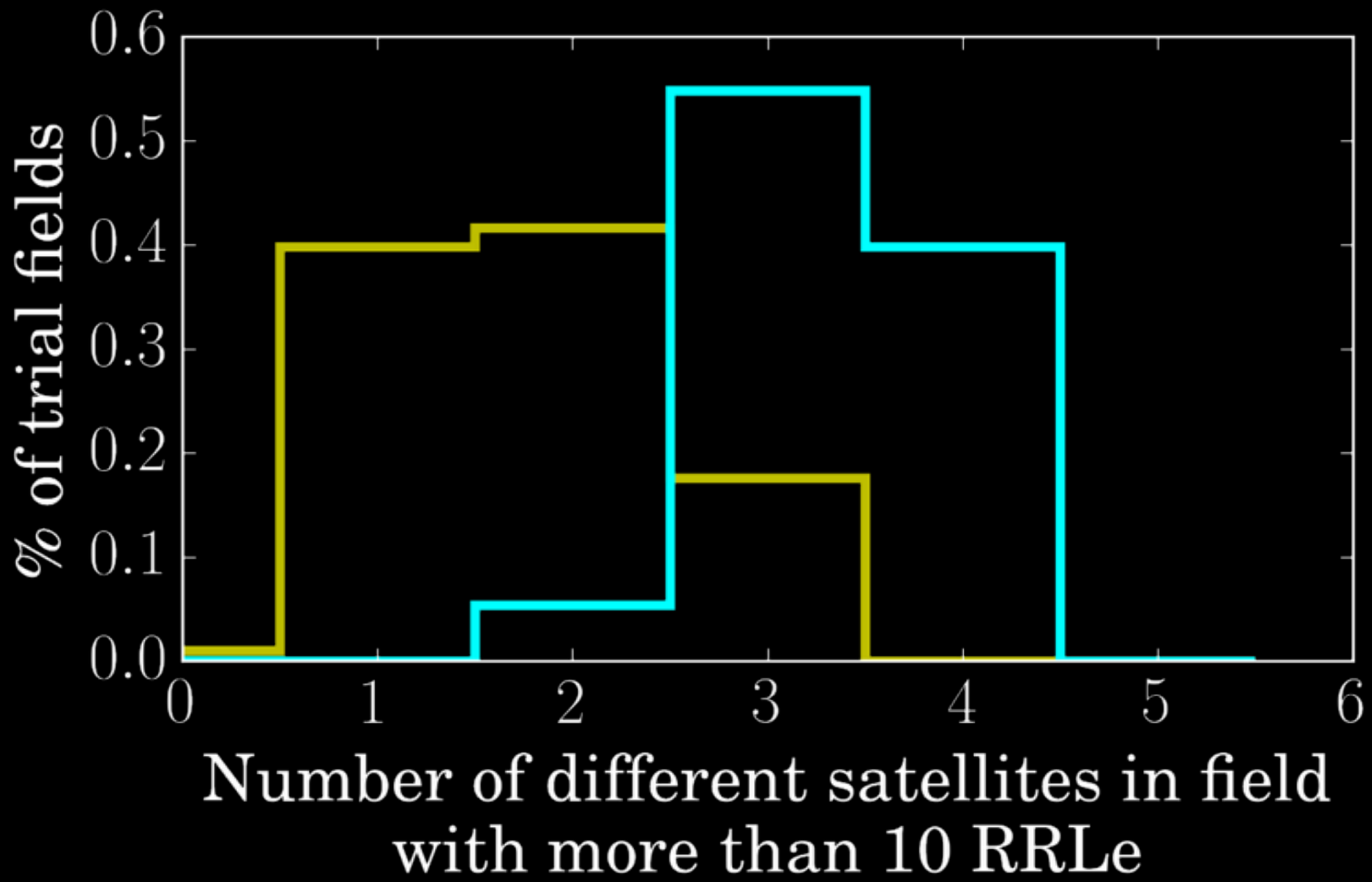

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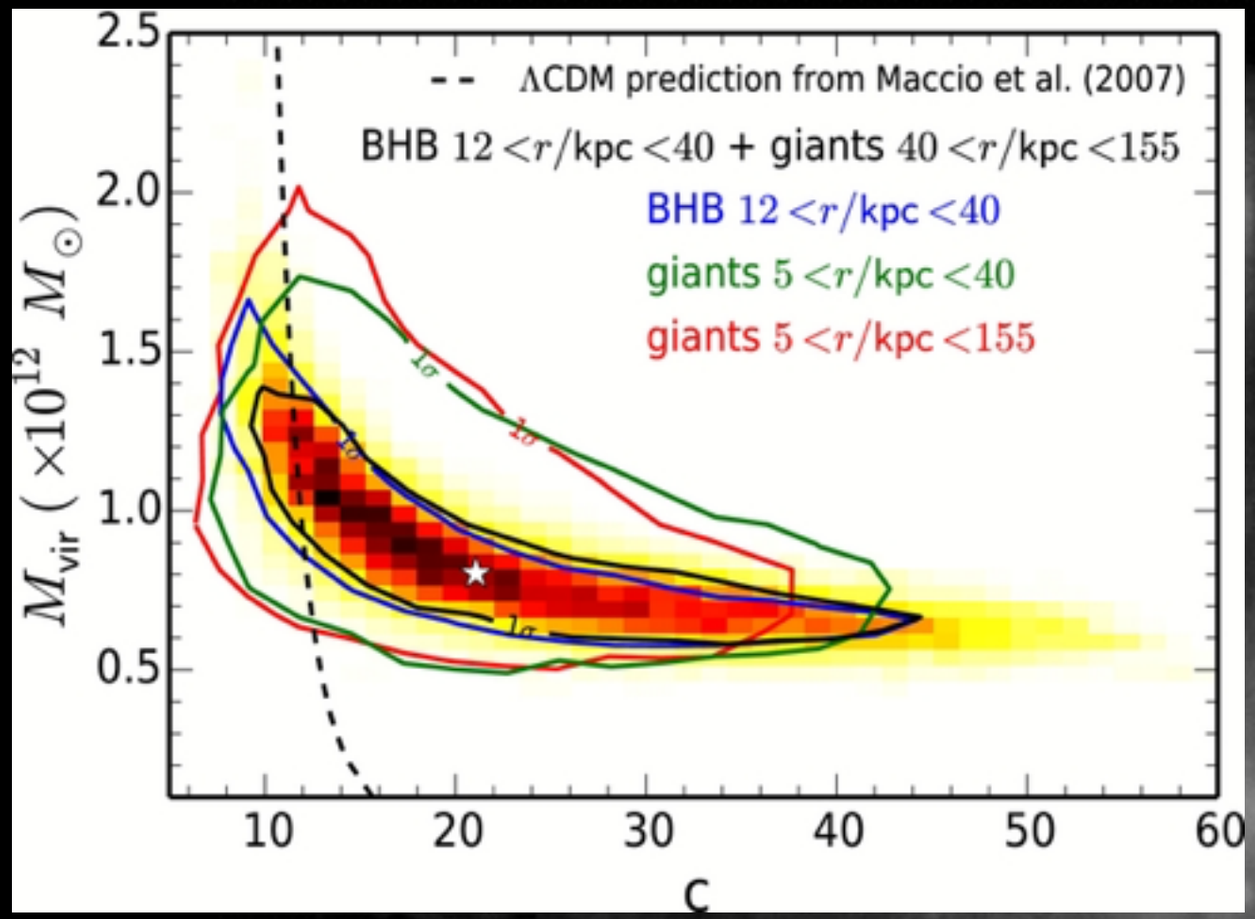
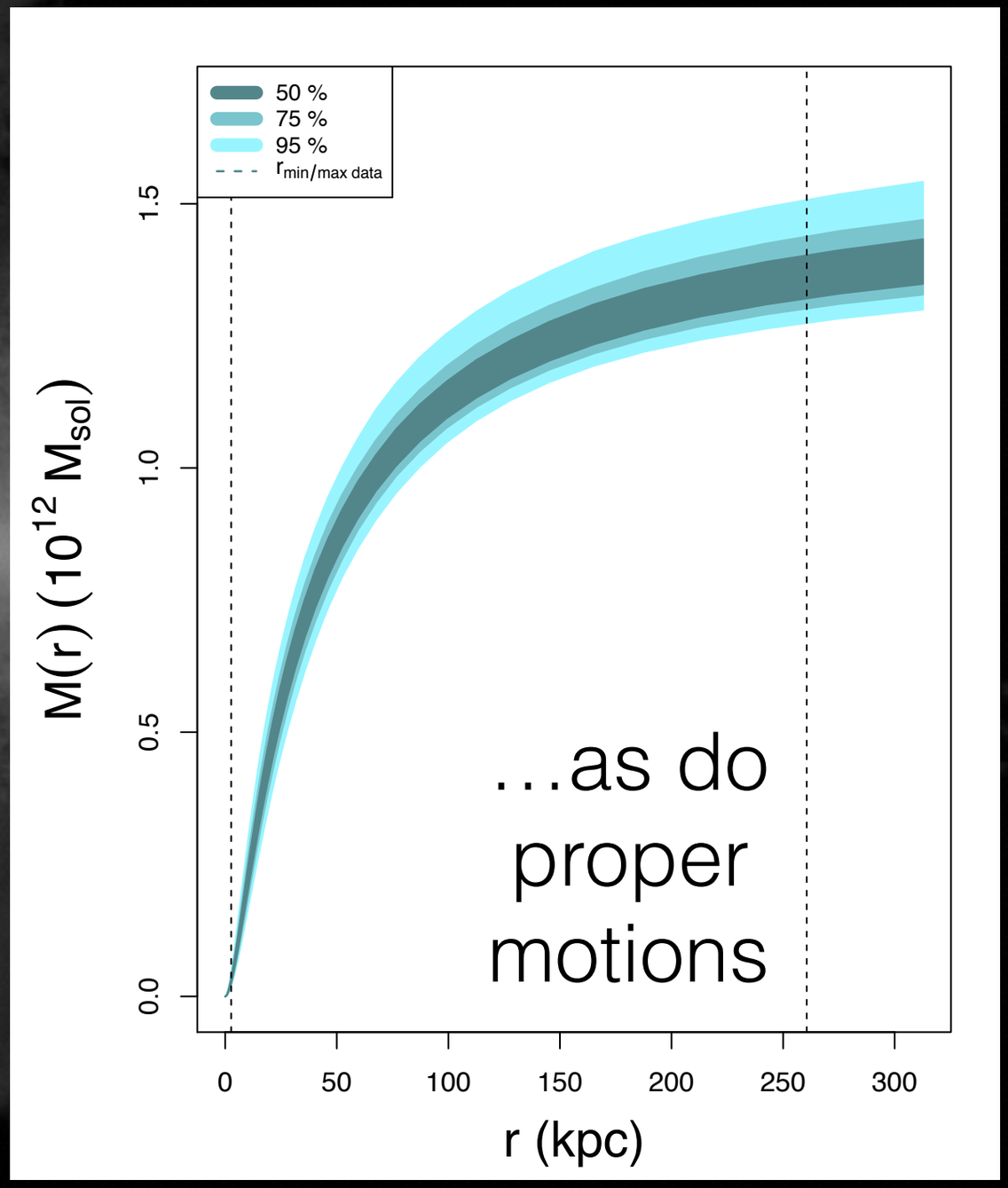
The Milky Way's total mass is uncertain



Kafle+2014

…but having objects at larger distances helps



Eadie, Harris, & Widrow 2015

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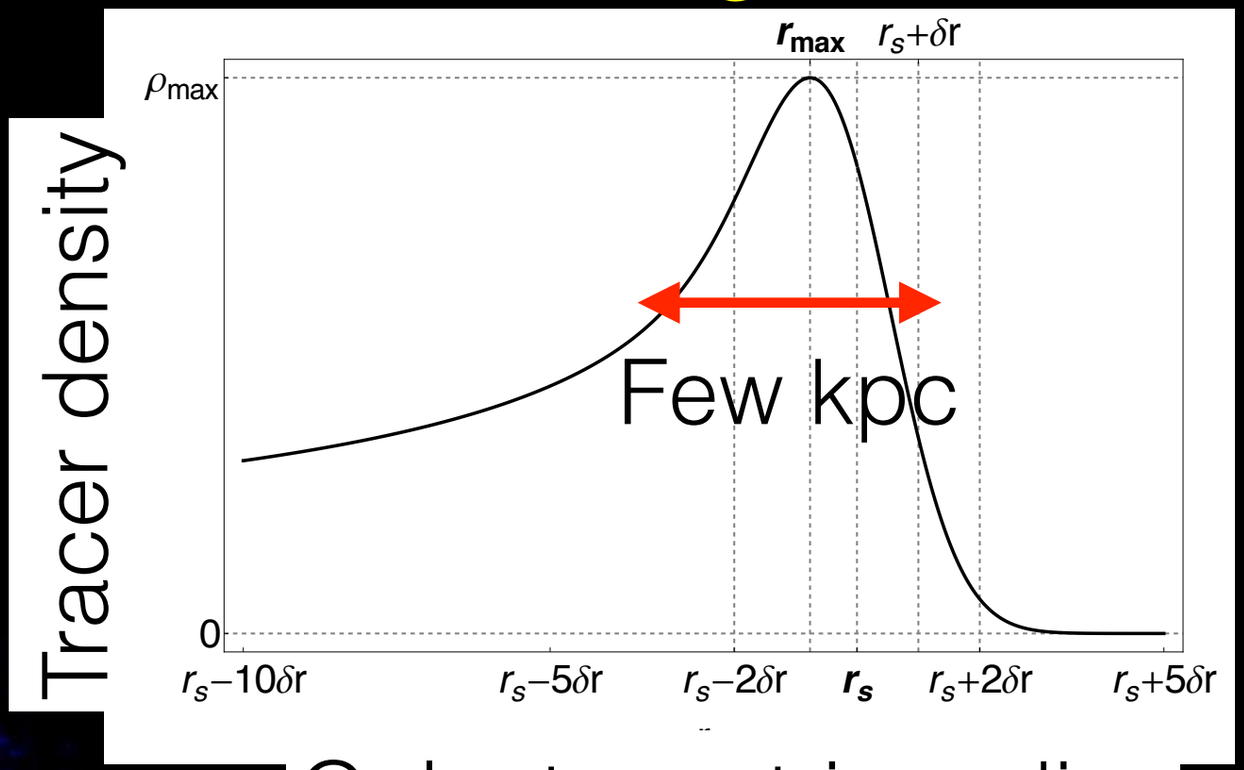
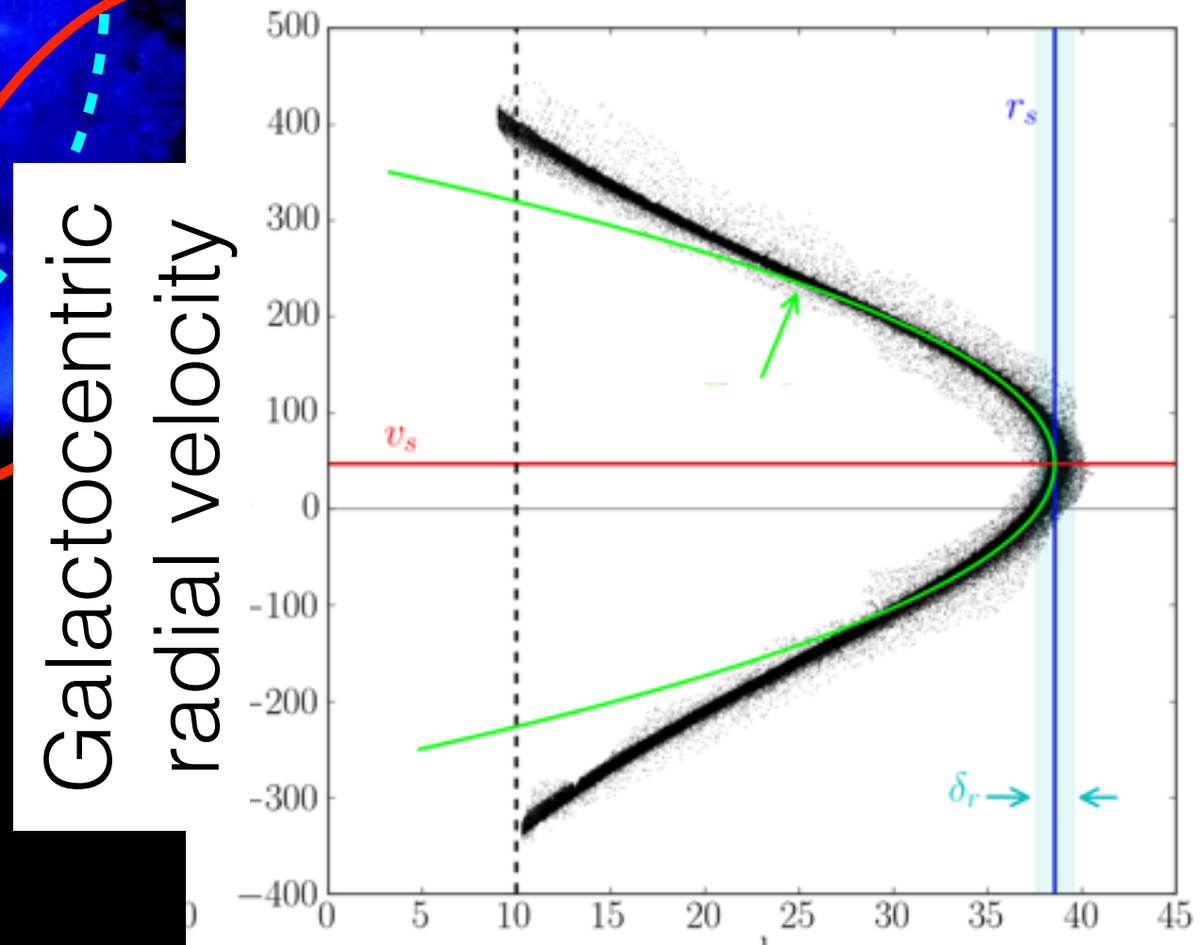
Assuming equilibrium is problematic at large distances

150 kpc

Bullock & Johnston 2005



Sanderson & Helmi 2013



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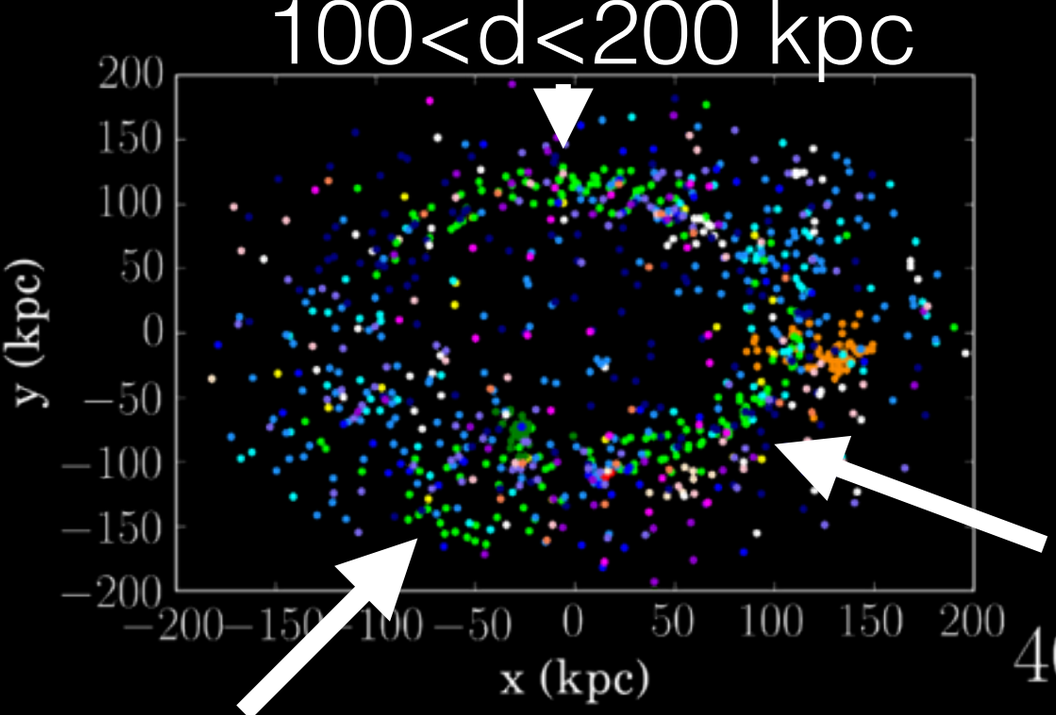
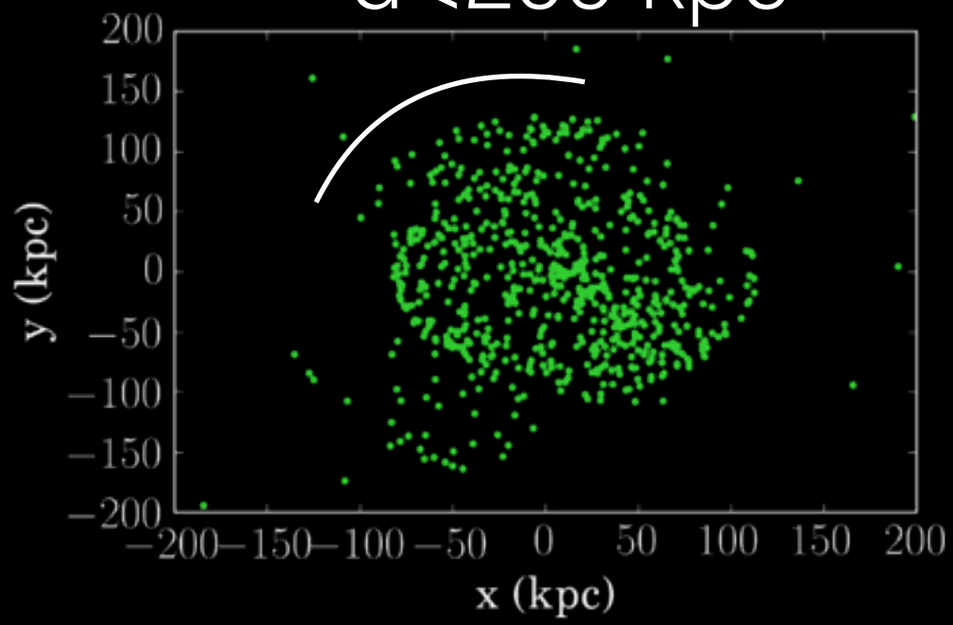
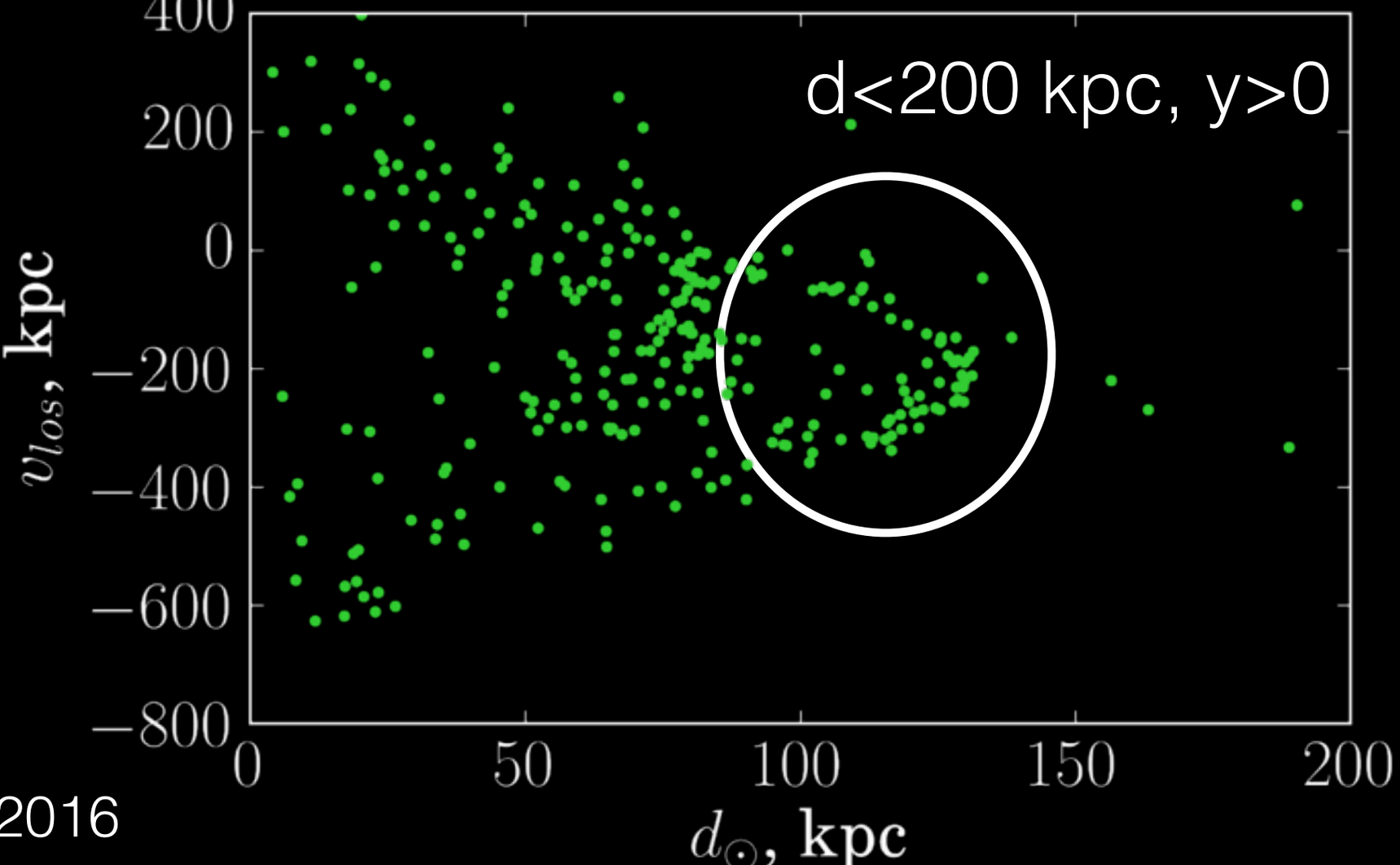
RR Lyr trace shells





Typical errors:
2% distance,
10 km/s RV

LSST
90% complete
to 360 kpc
(Oluseyi+2012)



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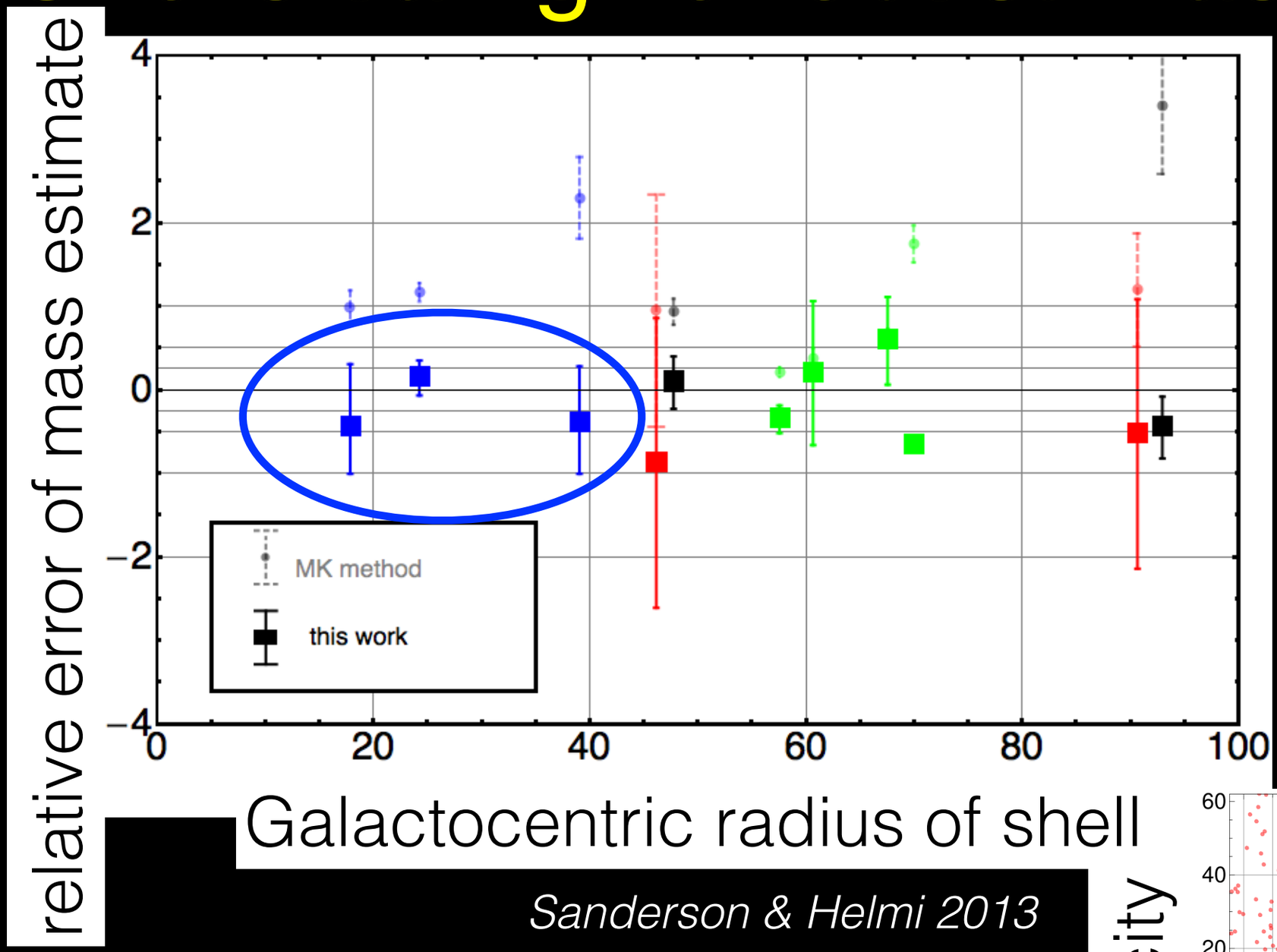
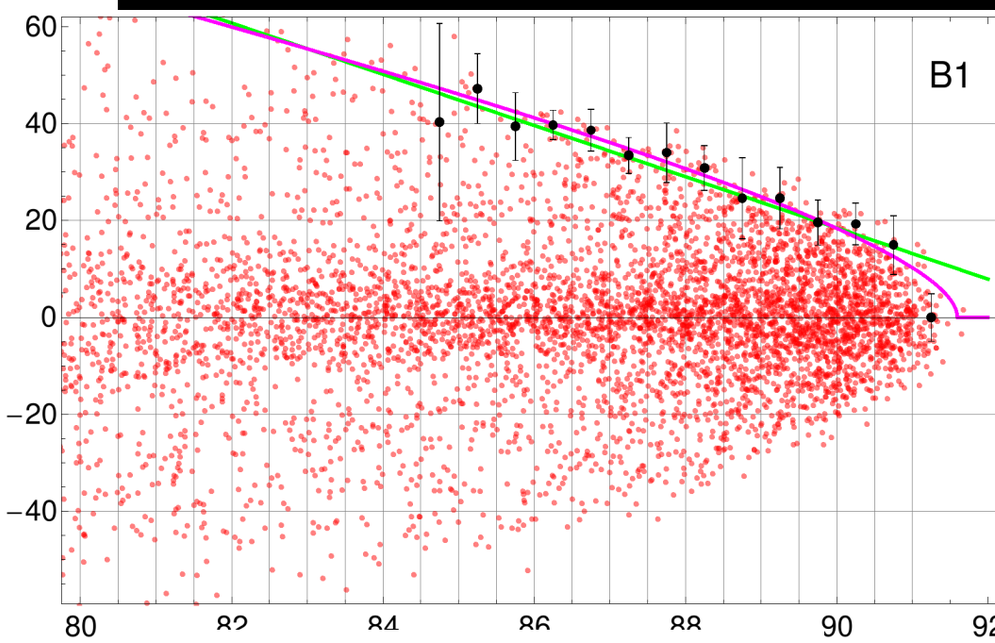
Shells can give robust mass estimates



Sanderson & Helmi 2013

Requires synergy between WFIRST, LSST, & spectroscopy (distances & RVs)



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extra coverage from WINGS
lets us see more variety

WFIRST-HLS proper motions (100 uas/yr)
can start untangling substructures

synergies with LSST, spectroscopy
will help untangle accreted components
& constrain the MW mass

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