Galactocentric variation of the abundance structure in the Milky Way stellar disk

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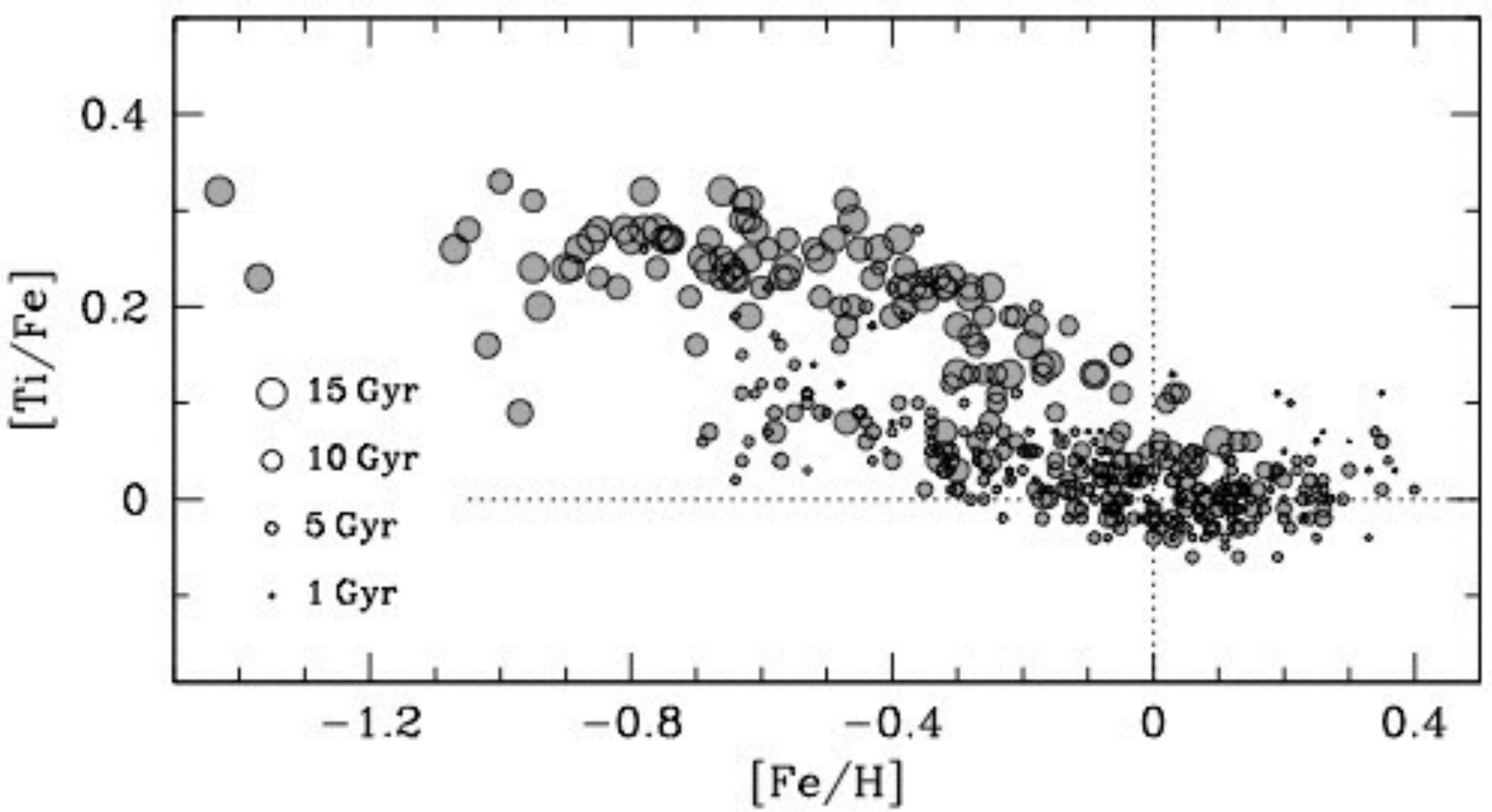
Solar neighbourhood

Bensby et al. (2014, A&A, 562, A71)

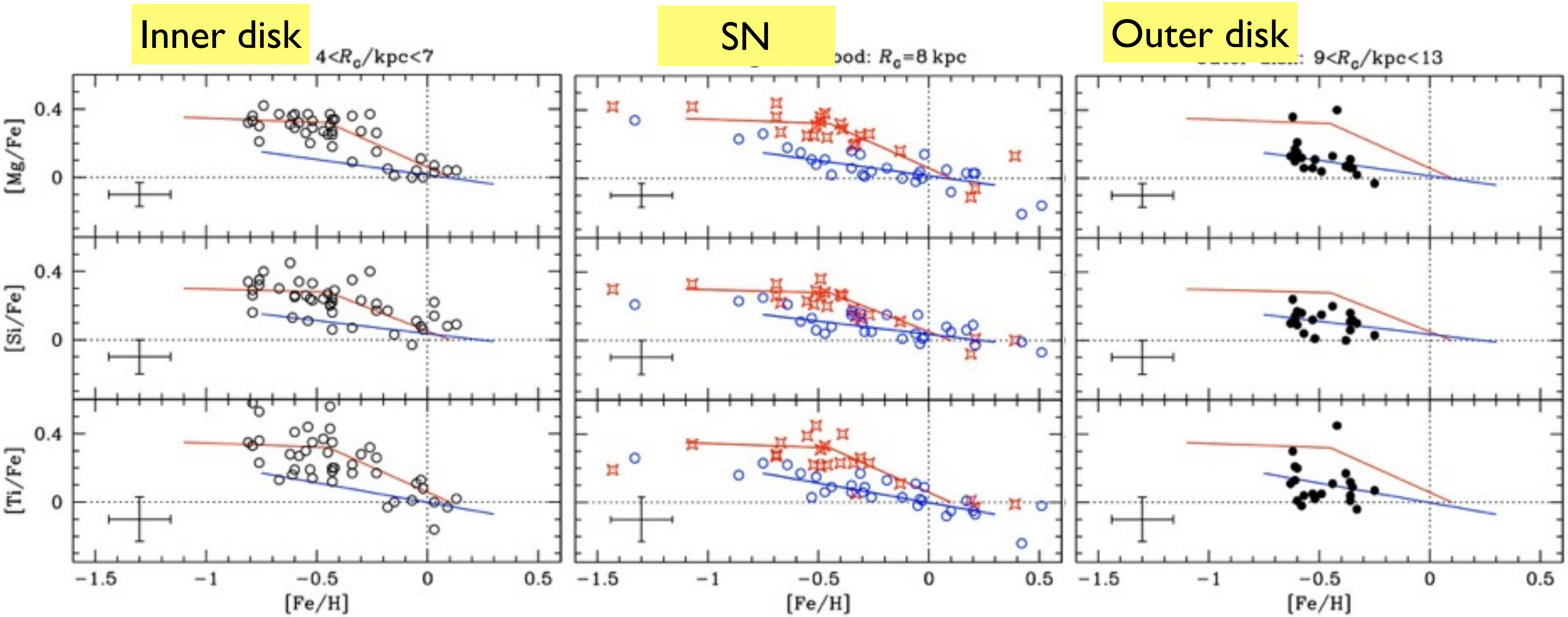
A kinematically selected sample of 712 nearby F and G dwarf stars



Similar dichotomy seen in many other Solar neighbourhood studies, e.g., Bensby+2003,2004,2005,2006,2007, Reddy+2003,2006, Adibekyan+2012, Fuhrmann 1998,2001,2004,2008,2011

Inner and outer Galactic disk

44 inner disk at R=4-7 kpc, and 20 outer disk K red giants, 4-7 kpc and 9-12 kpc from the Galactic centre, up to 3 kpc from the plane. Should probe both the thin and thick disk stellar populations



Inner disk red giants

Bensby, Alves-Brito, Oey, Yong, & Melendez, 2010, A&A, 516, L13

Thin and thick disk red giants in the solar neighbourhood

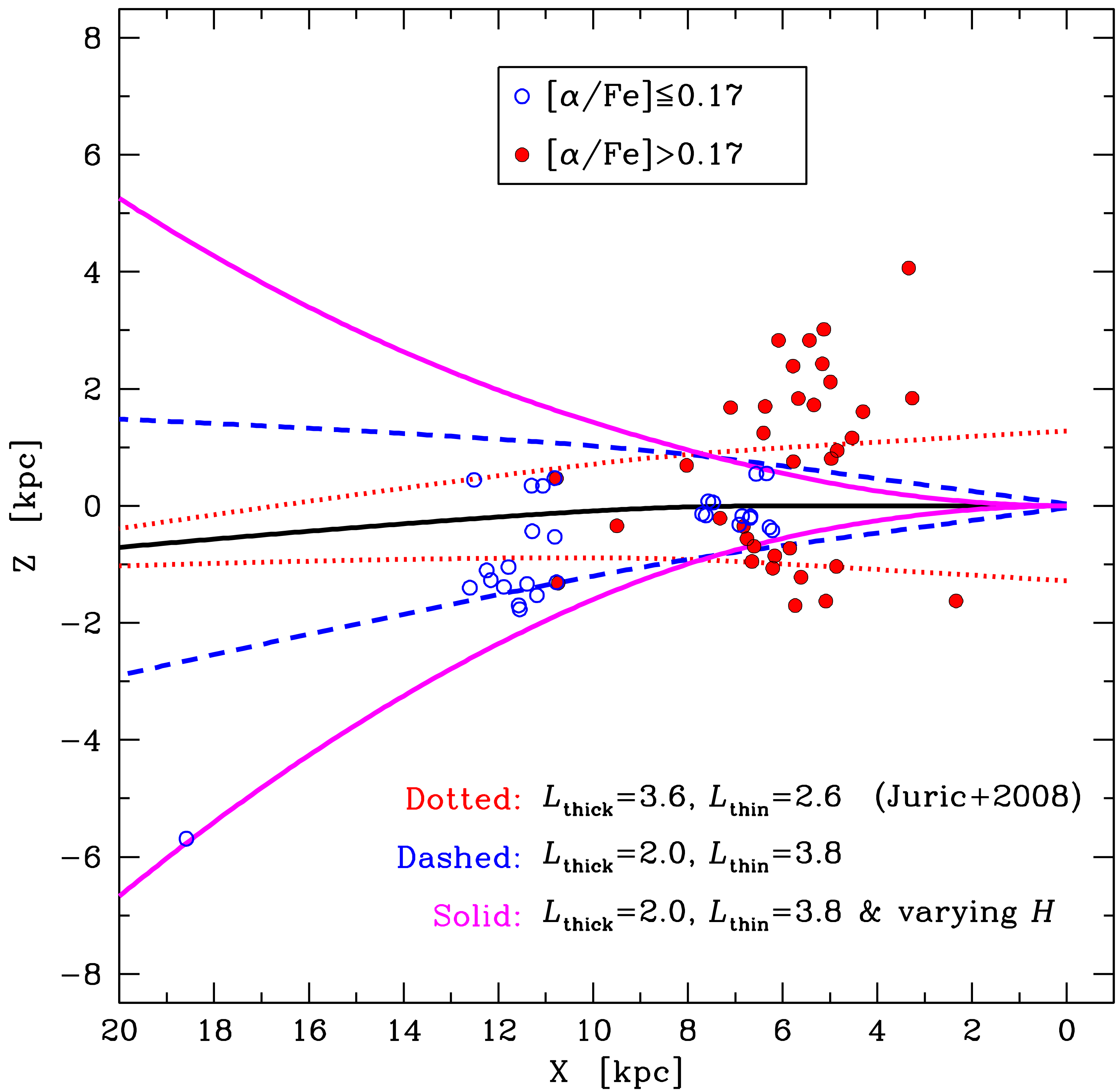
Alves-Brito et al. (2010)

Outer disk red giants

Bensby, Alves-Brito, Oey, Yong, & Melendez, 2011, ApJ, 735, L46

Thick disk has a short scale-length

Bensby, Alves-Brito, Oey, Yong, & Melendez, 2011, ApJ, 735, L46

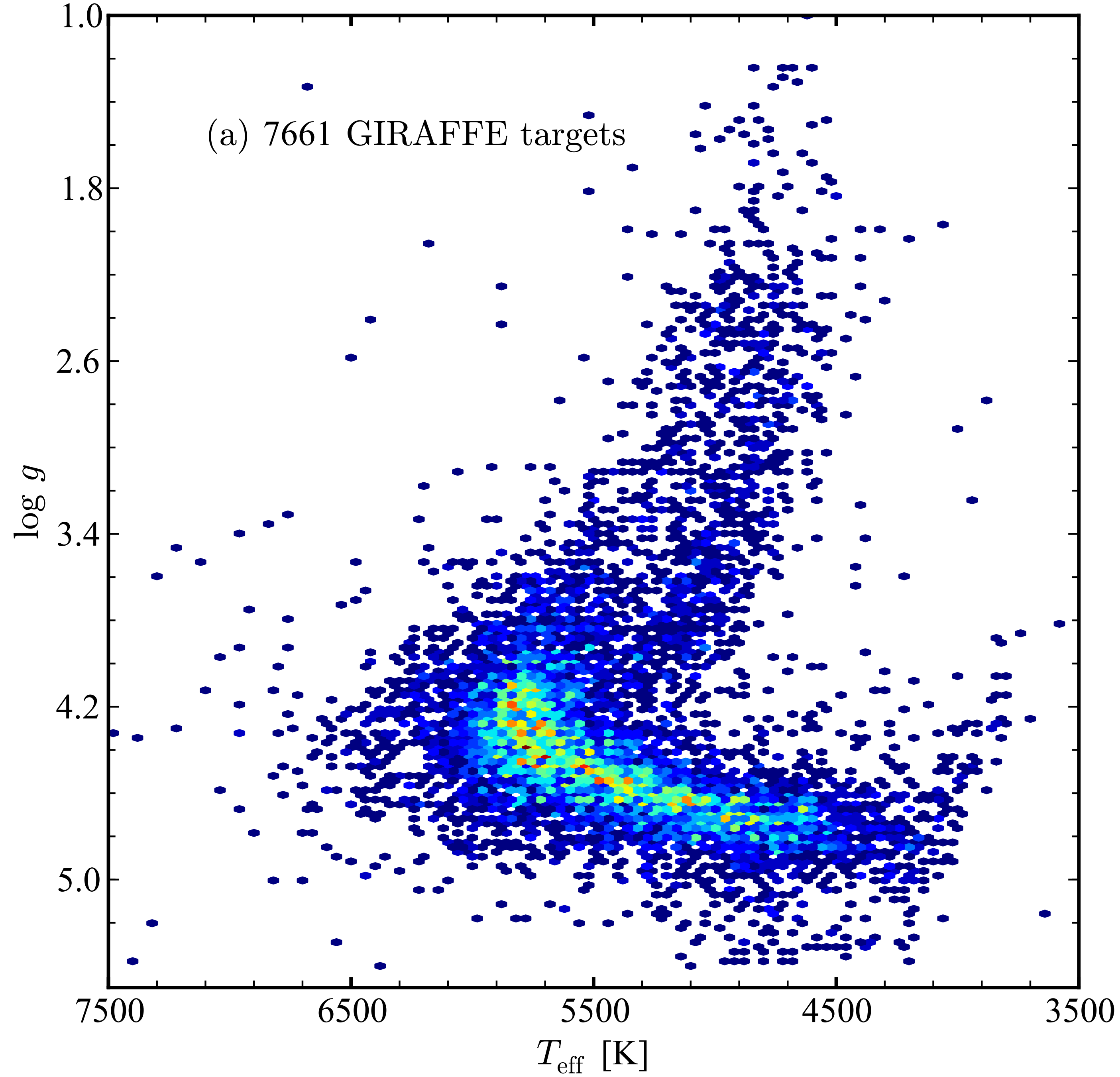


Curved lines mark the distance from the plane where thin and thick disk stellar densities should be equal

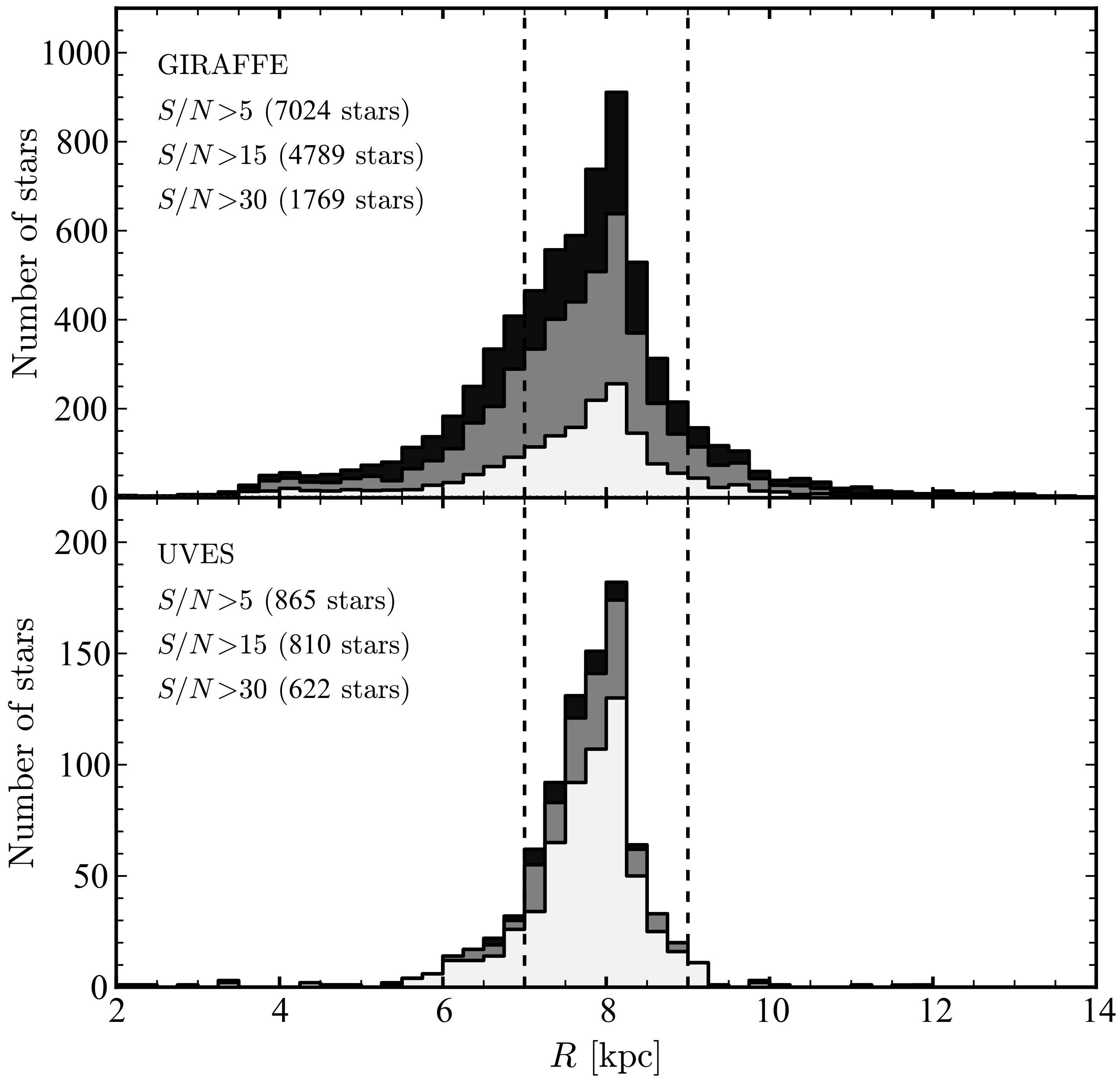
see also
Cheng et al 2011
Bovy et el 2012

GESiDr2

- First 18 months of observations
- Stellar parameters and abundances for18 000 stars based on 59 000 acquired spectra
  - 7661 FLAMES-GIRAFFE Milky Way field stars
  - *870 FLAMES-UVES Milky Way field stars will not be considered here*



Distances

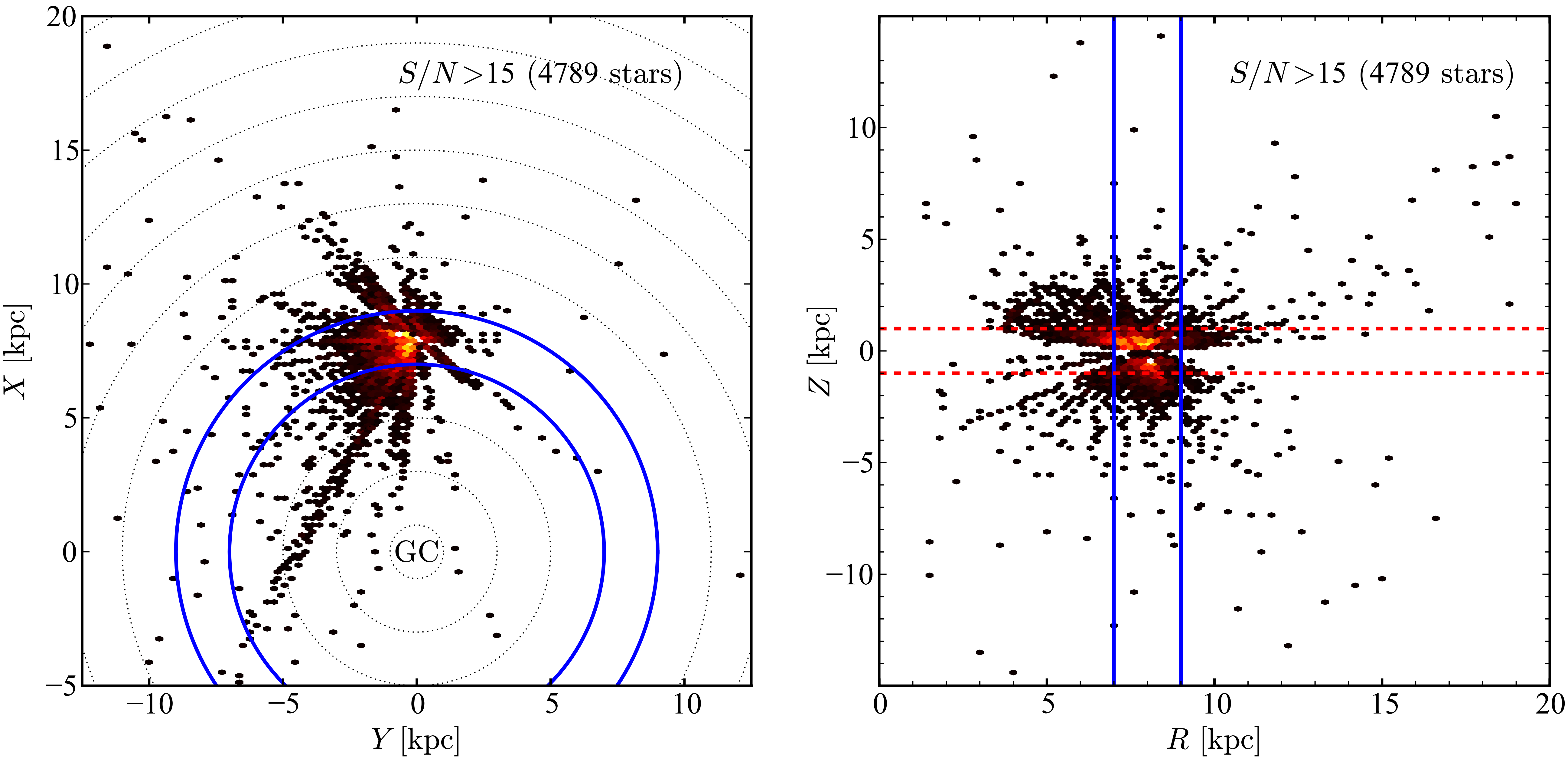


Distances estimated for 7024 GIRAFFE stars and 865 UVES stars

GIRAFFE data probe much farther distances, while UVES data mainly located 1 kpc from the Sun

The ages and absolute magnitudes of the stars were determined using the Bayesian pipeline BeSPP developed by Serenelli et al. (2013). Distances were then estimated using a Monte Carlo technique based on the probability distribution function (PDF) for the absolute magnitude obtained from the fits to evolutionary tracks plus the error distributions in the 2MASS Ks magnitudes, the UCAC4 proper motions, and the radial velocities from the GESiDr2.

R, X, Y, Z

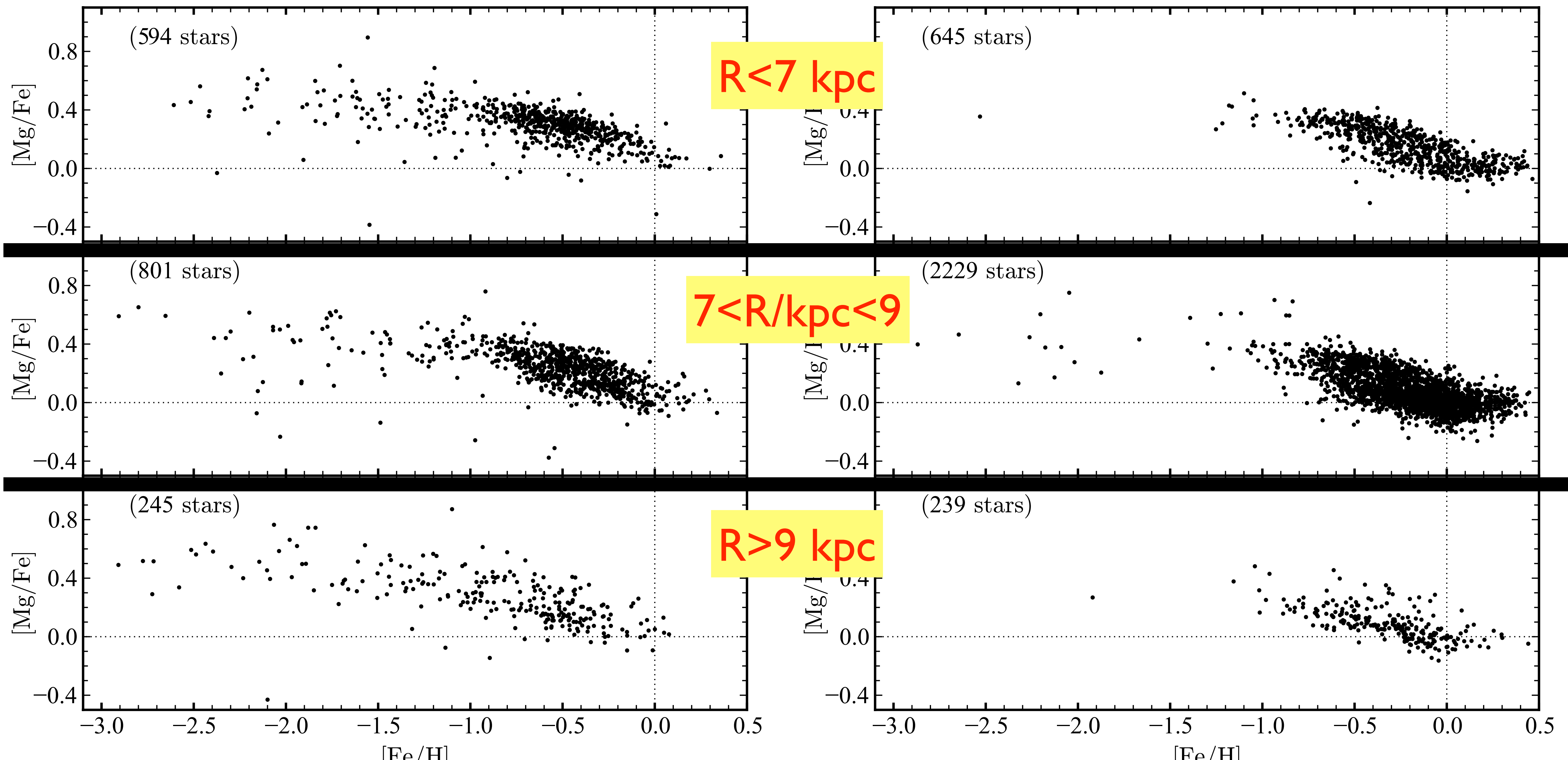


S/N>15 (4789 stars)
GC
X [kpc]
Y [kpc]
20
15
10
5
0
−5
−10
−5
0
5
10
S/N>15 (4789 stars)
Z [kpc]
R [kpc]
10
5
0
−5
−10
0
5
10
15
20

[Mg/Fe] - [Fe/H]

(S/N>15)

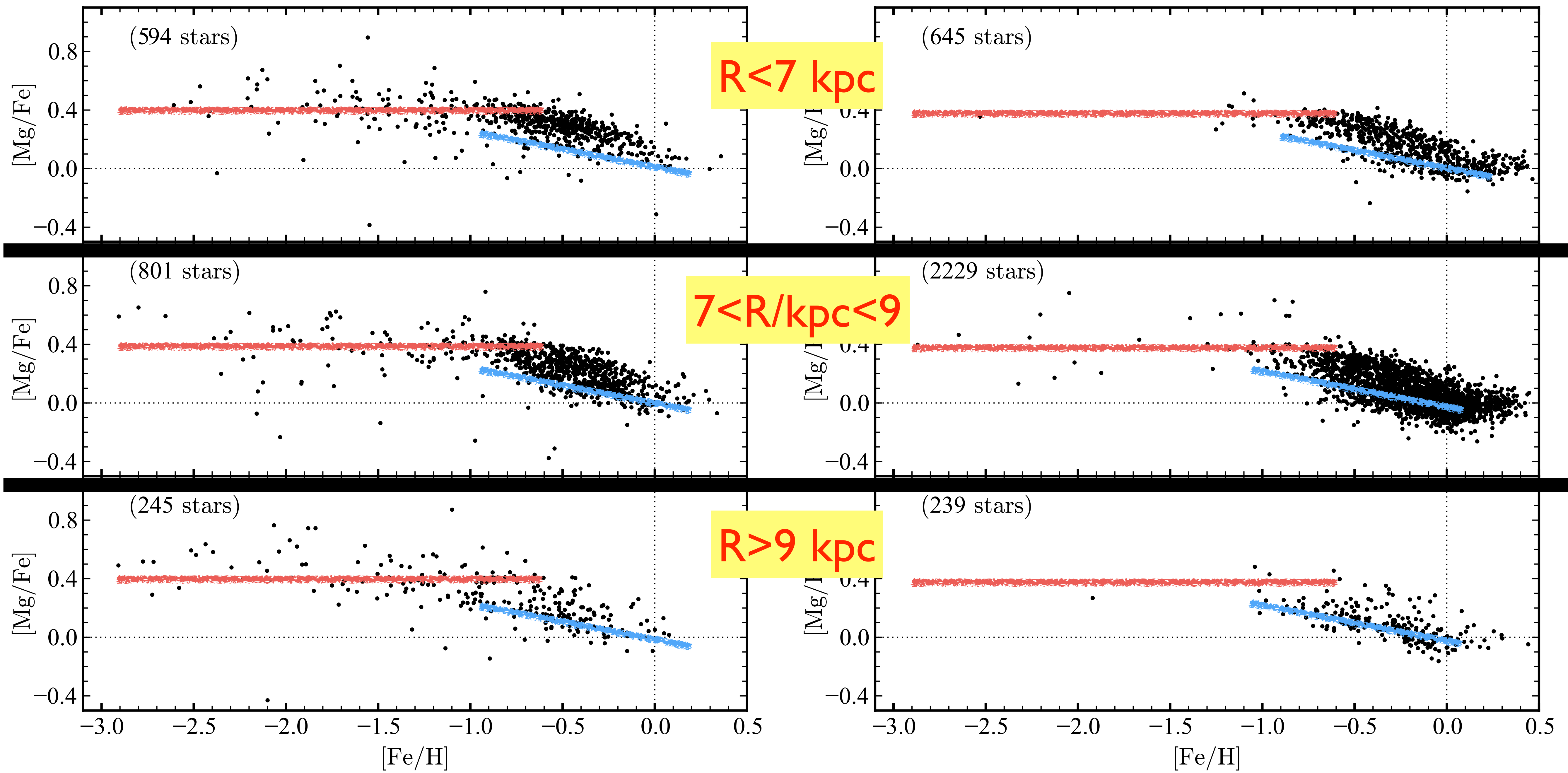
Stars with |Z| > 1 kpc | Stars with |Z| < 1 kpc



[Mg/Fe] - [Fe/H]

(S/N>15)

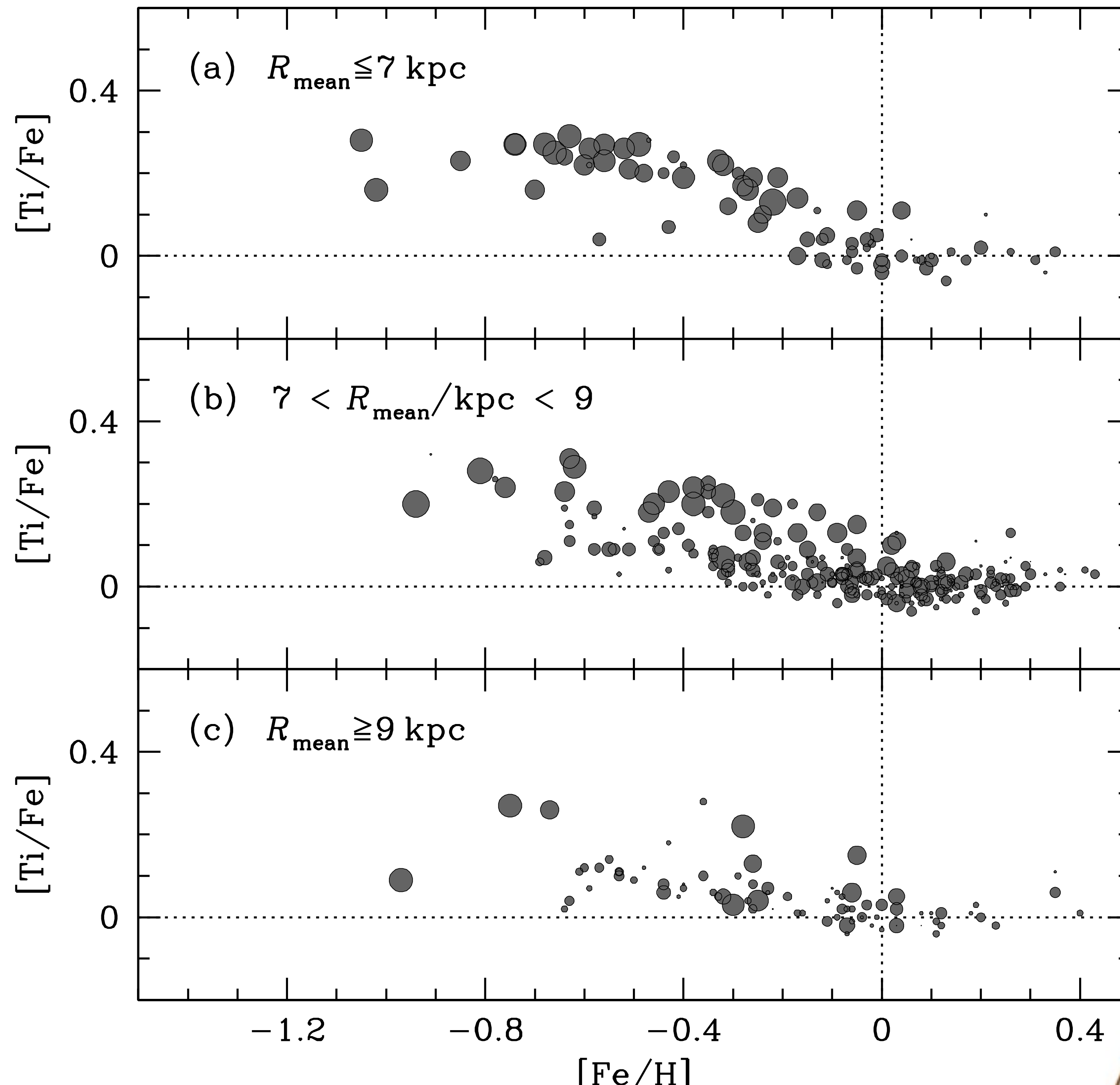
Stars with |Z| > 1 kpc Stars with |Z| < 1 kpc



Similar signature seen in local data

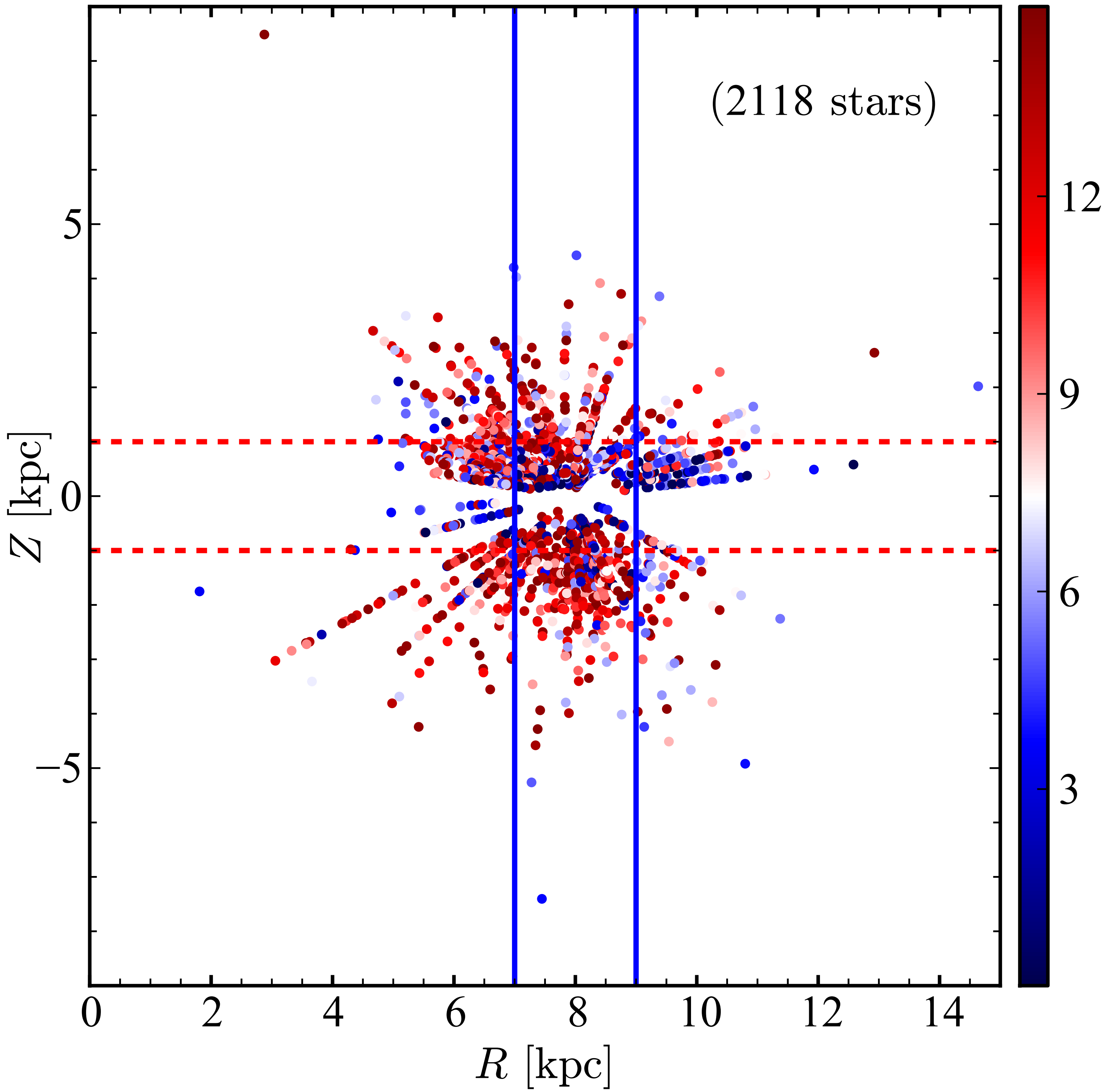
Bensby et al. (2014, A&A, 562, A71)

- 714 F and G dwarfs in the solar neighbourhood (d<100 pc).
- Calculating stellar orbits to get $R_{mean} = (R_{min} + R_{max})/2$
- Almost no (old) high-alpha stars with R_{mean}>9kpc
- Almost no (young) low-alpha stars with R_{mean}<7kpc



Sizes of circles prop. to age (larger = older)

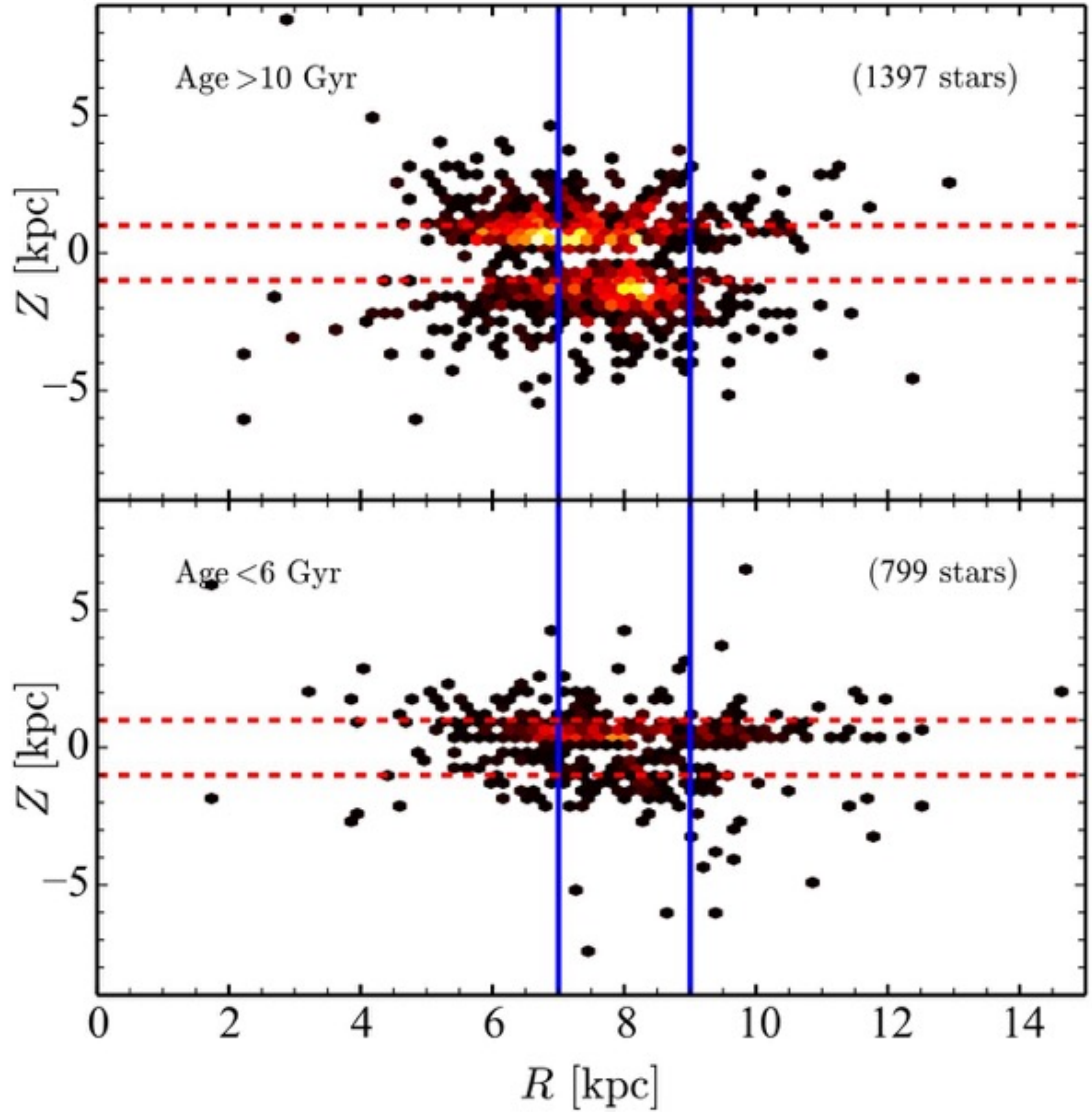
Stellar ages



S/N>15

Difference between upper and lower age estimates smaller than 4 Gyr

Stellar ages



S/N>15

Difference between upper and lower age estimates smaller than 4 Gyr

Young stars appears to be:

- more confined to the plane
- almost symmetrically distributed around R = 8 kpc (although observations so far have an excess of stars with R<8 kpc)

Summary

- *Milky Way appears to have two distinct disk populations, a thin and a thick disk*
- *A lack of high-alpha stars with $R>9$kpc*
- *An excess of high-alpha stars with $R<7$kpc*
- *Gaia-ESO targeting turn-off and subgiant stars, possible to determine individual stellar ages. Uncertainties are quite large due to the uncertainties in the stellar parameters*
- *Outer disk stars tend to be younger than inner disk stars, consistent with the low-alpha signature*
- *Gaia-ESO results consistent with other recent results, e.g., APOGEE (Nidever+2014).*

To be continued…..

- *Constrain the relative fraction of thin and thick disk stars as a function of Galactocentric radius*
- *New estimates on the radial (and vertical…) scale lengths of the two disks*