UniDAM – A **Uni**fied tool to estimate stellar **D**istances, **A**ges and **M**asses from spectrophotometric data.

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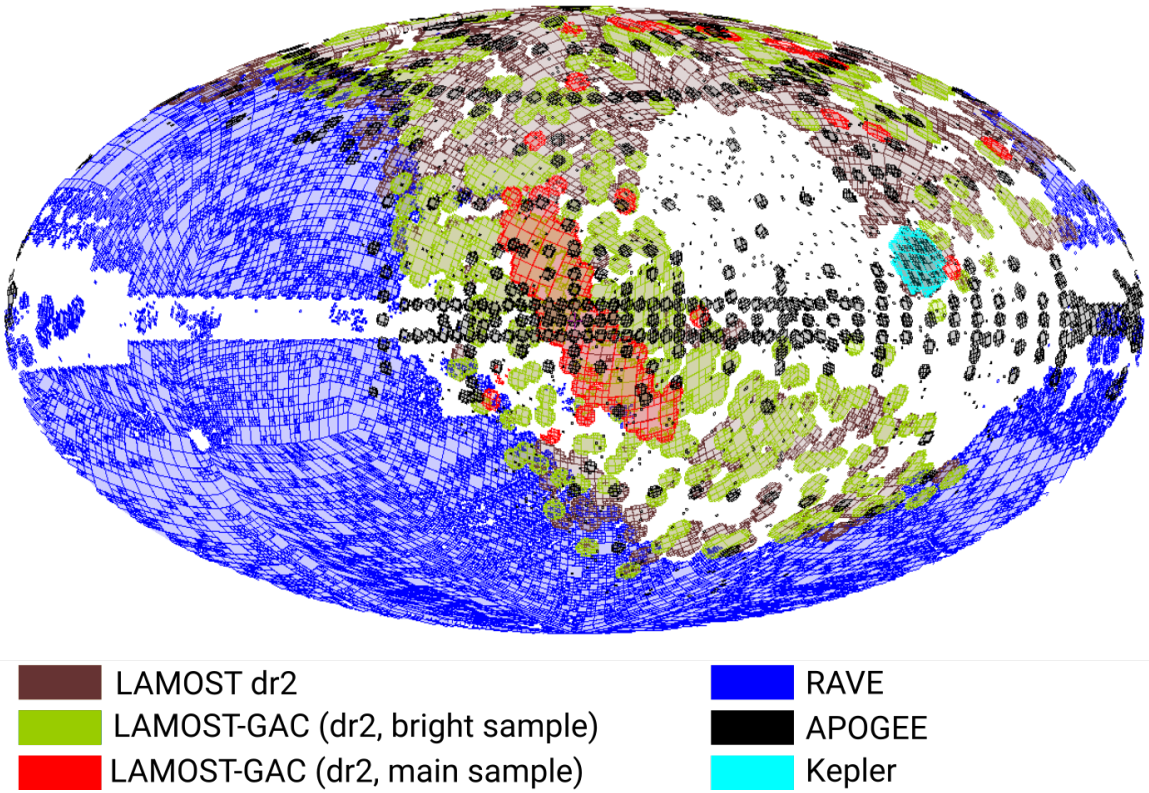
Aims of this work

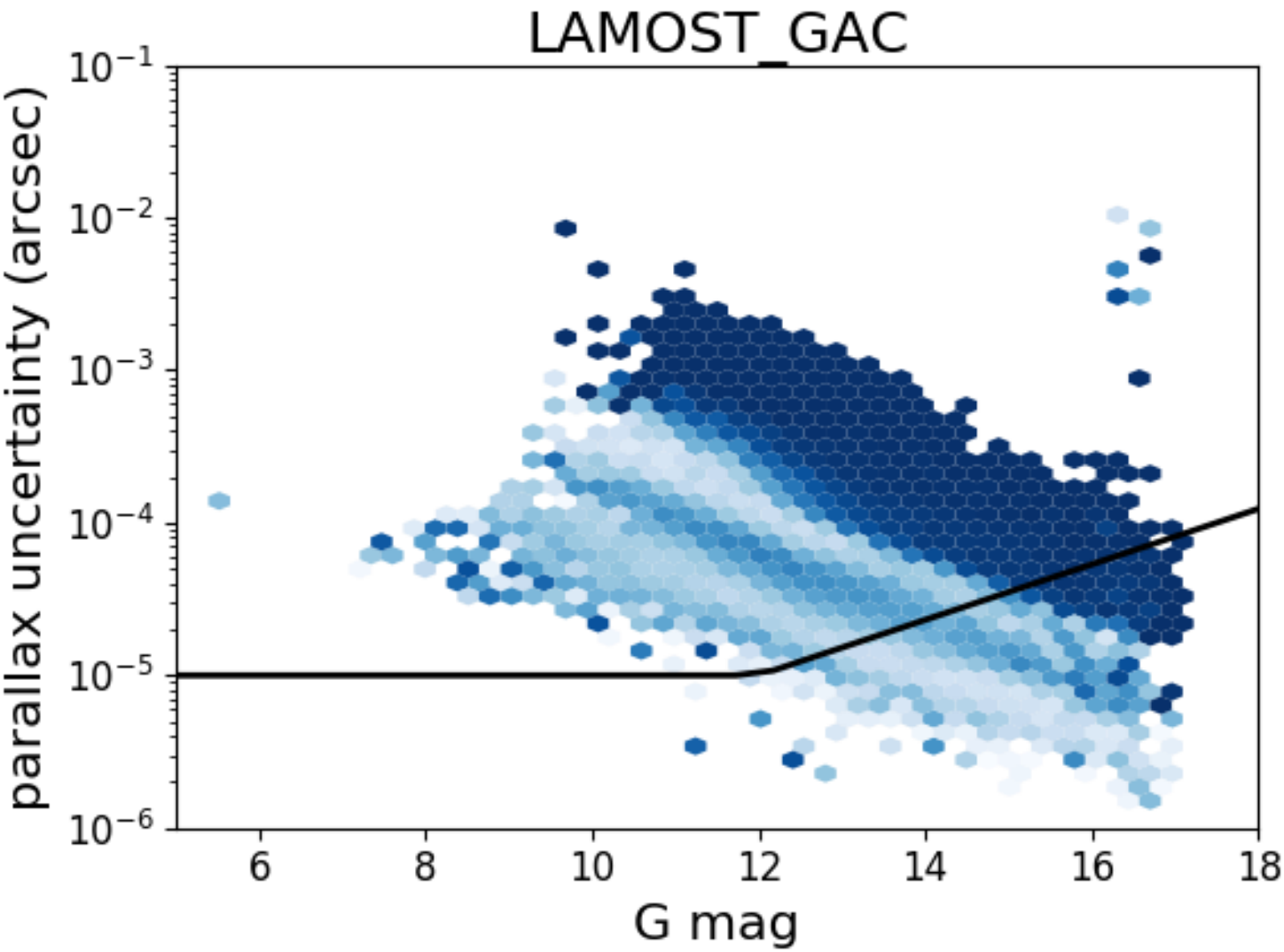
- Estimate distances, ages and masses of stars by means of isochrone fitting of spectrophotometric data.
- Do that for as many surveys as possible.
- Keep as much information about PDF as possible, while keeping the volume of output reasonable.

Data used

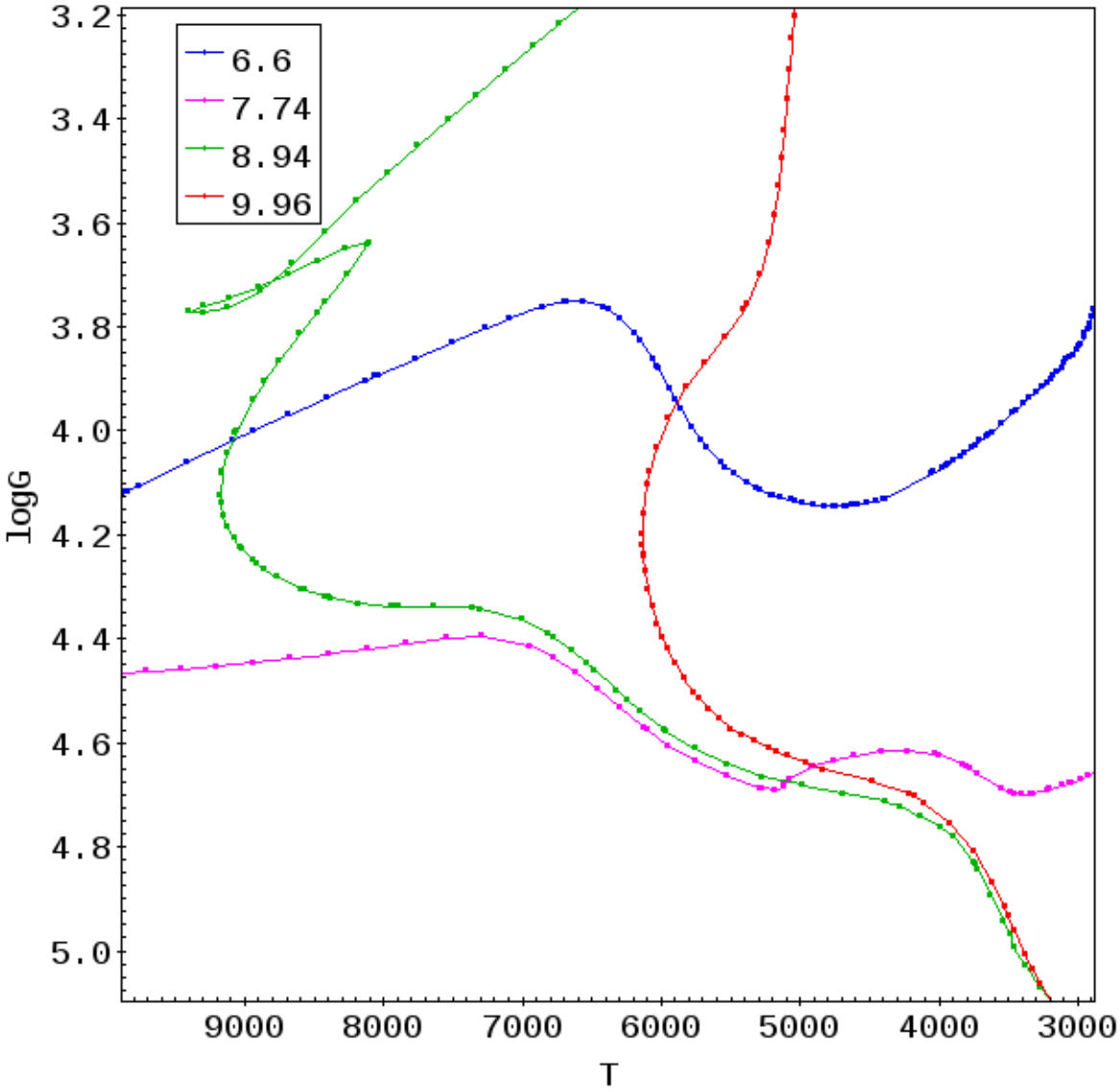


Not shown here, but also used: AMBRE, GALAH, GCS, Gaia-ESO, SEGUE

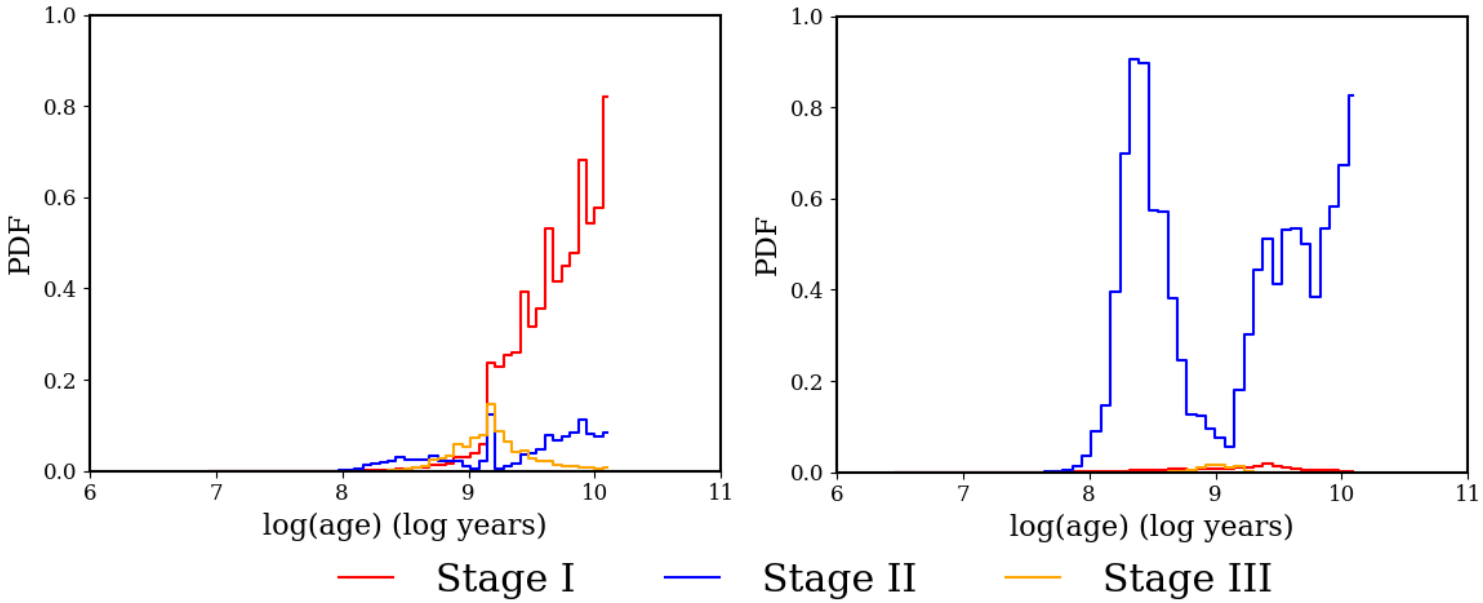
Why do we need distances?



Problems with isochrones



Multimodal PDFs



- Stage I – main-sequence and ascending giant branch (pre-core-helium burning)
- Stage II – core-helium burning stars
- Stage III – asymptotic giant branch (post-core-helium burning)

Unimodal sub-PDFs (USPDFs)

We fit the following functions:

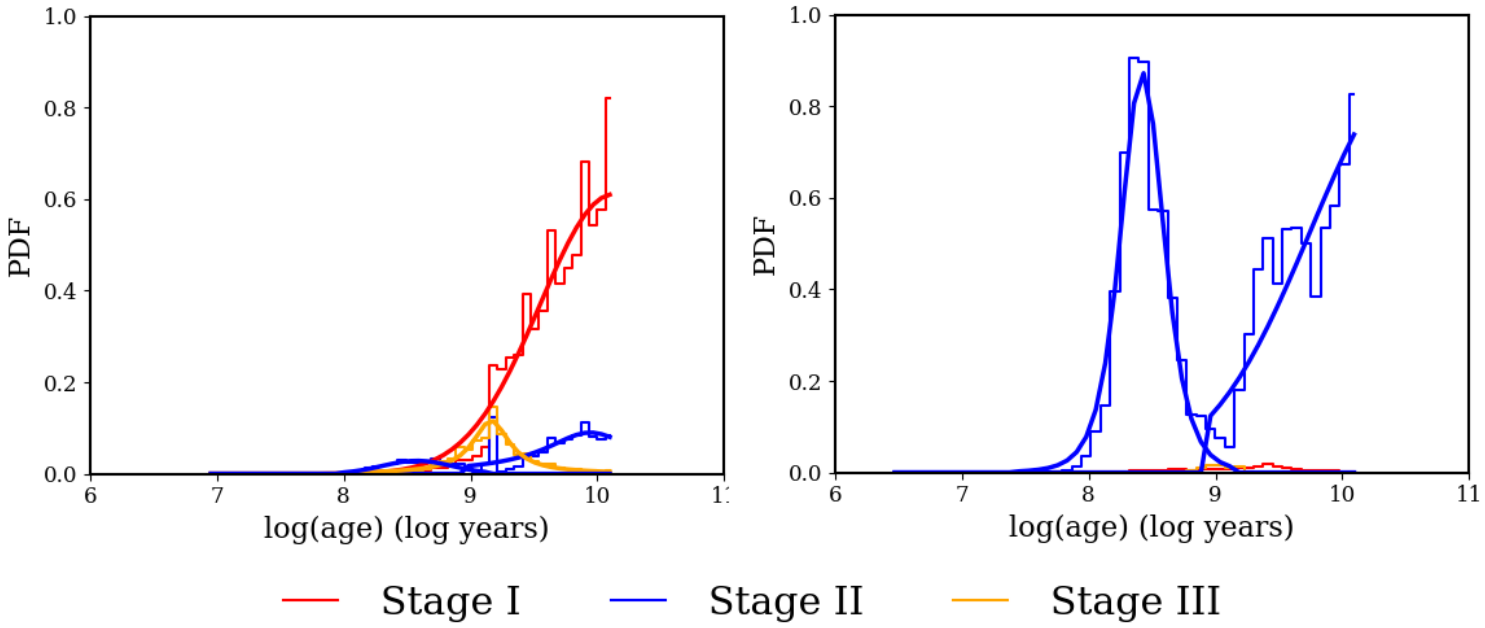
- Gaussian;
- truncated Gaussian;
- skew Gaussian;
- truncated Student's t-distribution.

We selected the function that gives the lowest Kullback-Leibler divergence value:

$$D_{KL} = \sum_i H_i \log \frac{H_i}{F_i},$$

where H_i are histogram counts and F_i are fitted function values.

Multimodal PDFs



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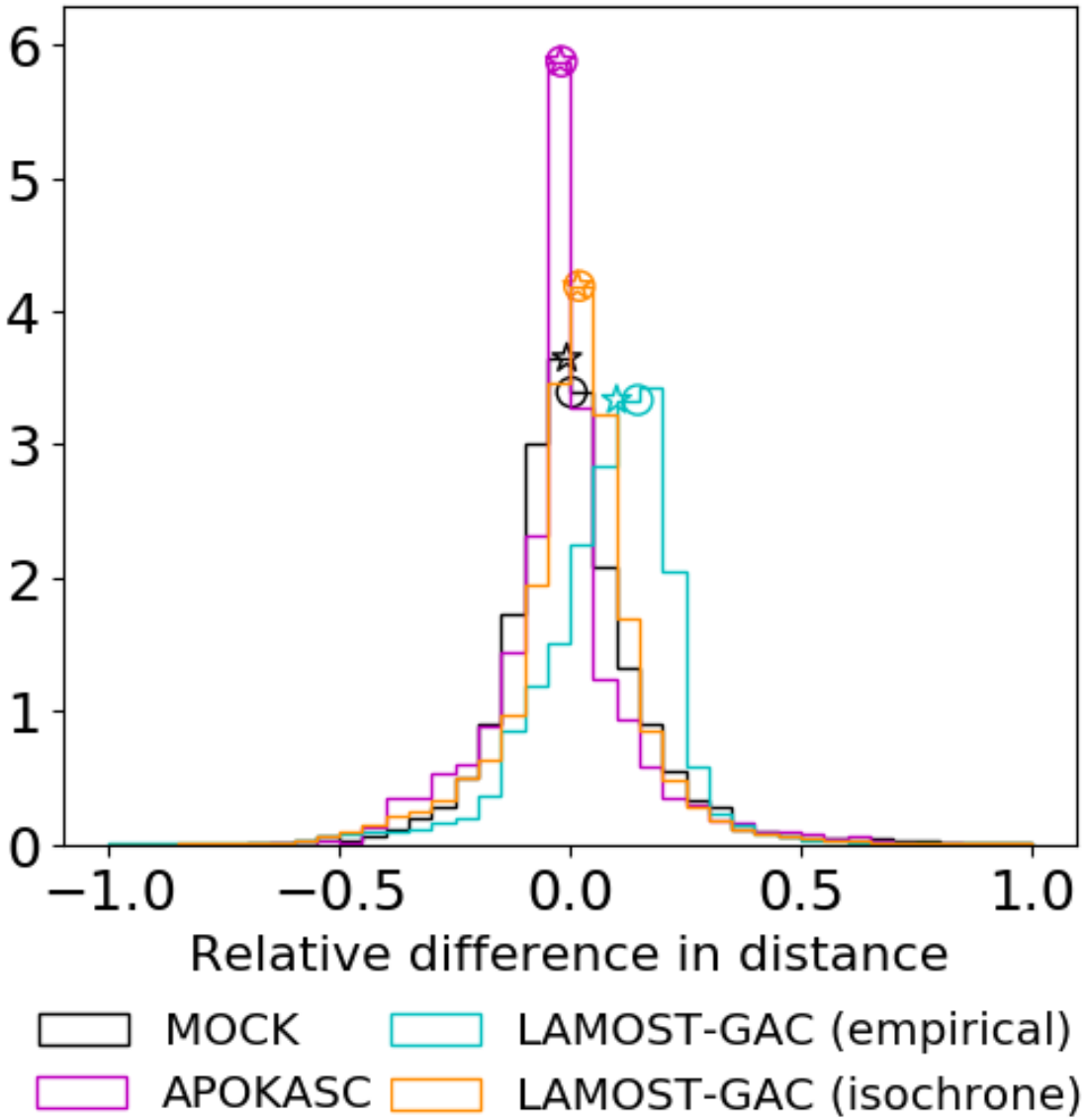
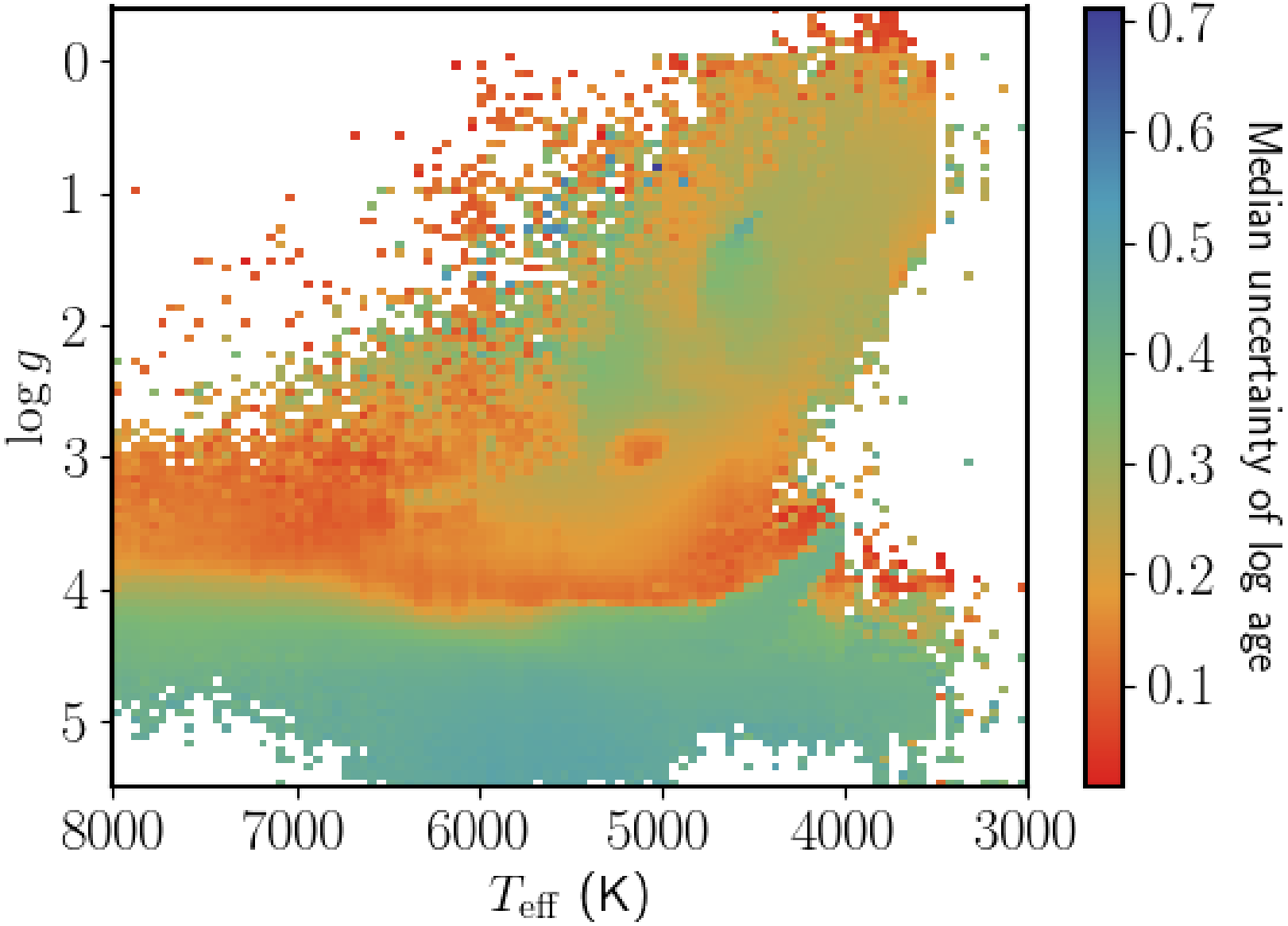
Validating our results



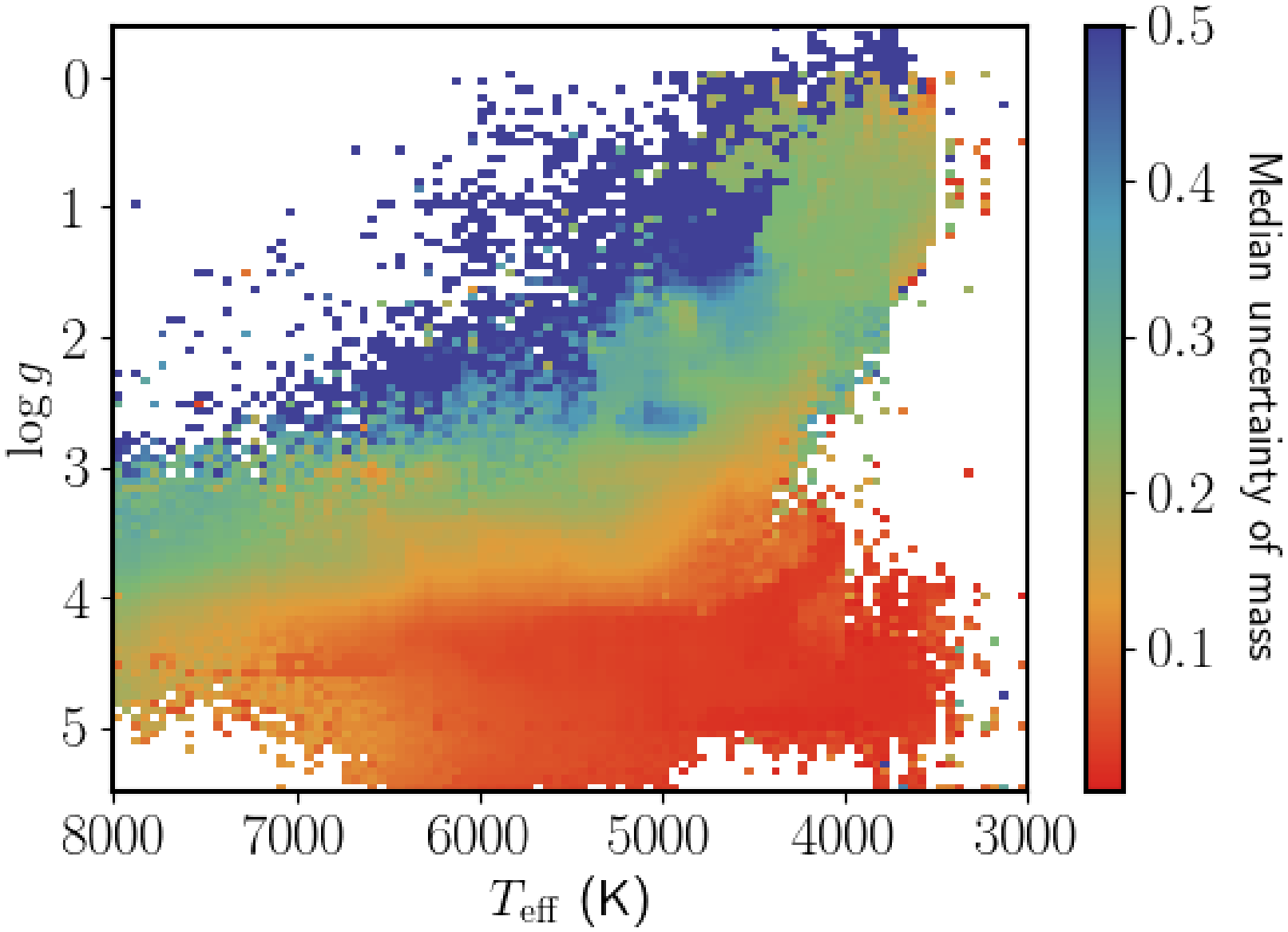
First results

- Distance, ages and masses for ≈ 2.5 million stars.
- Mints and Hekker (2017a, submitted)

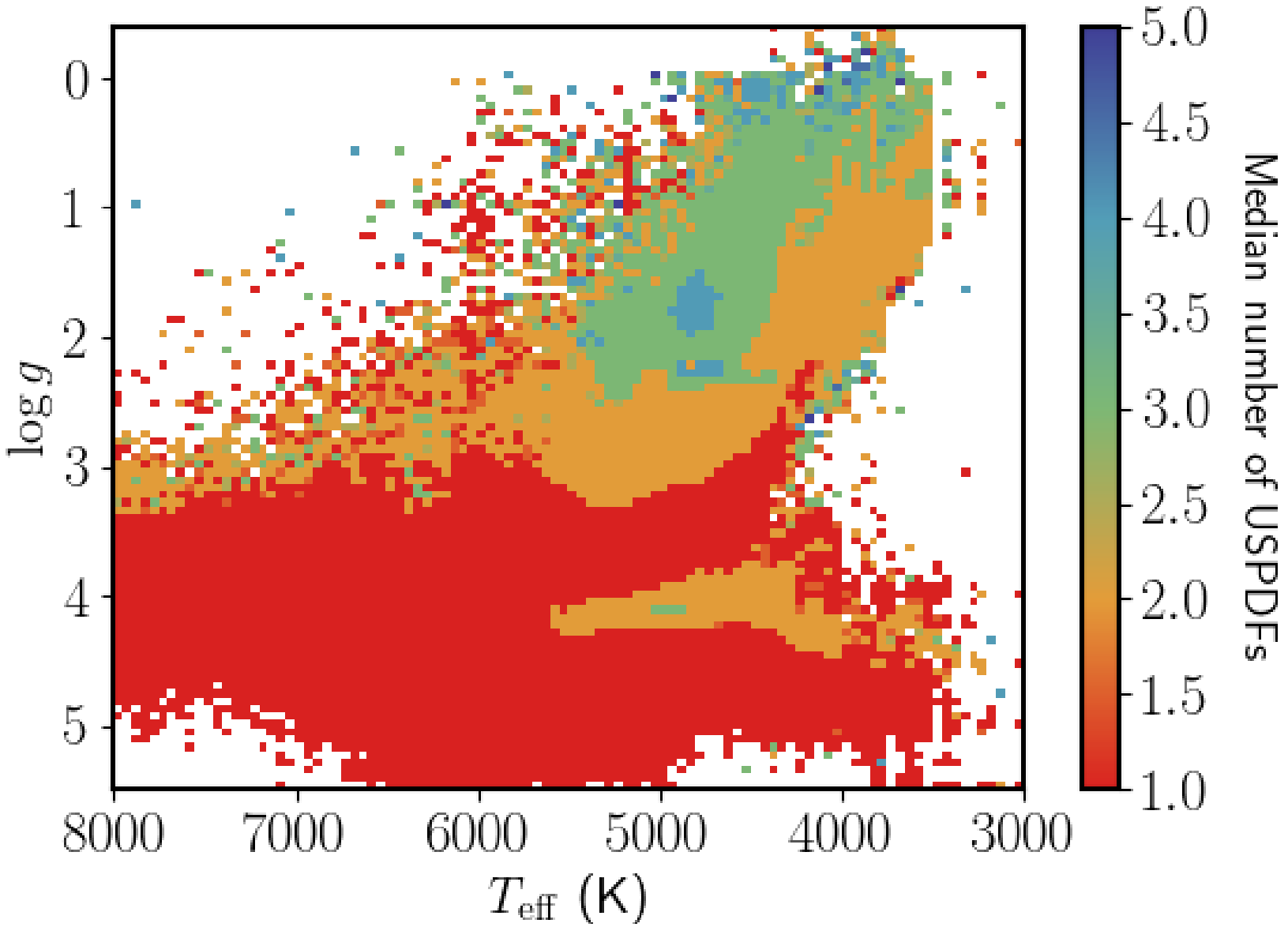
Summary of results



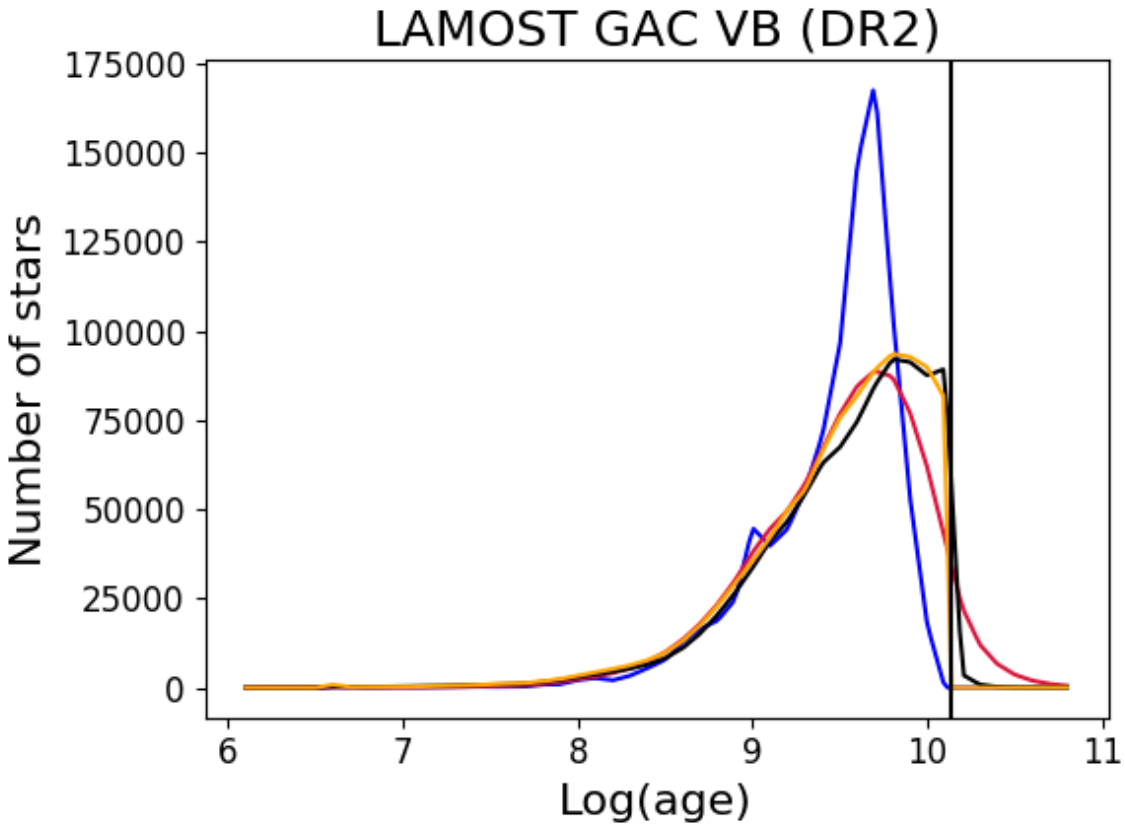
Summary of results



Summary of results



Stacked age distributions (Mints and Hekker (2017b, in prep))



Yellow – stacked PDF; Blue – histogram of mean values; Red – histogram of mean values smoothed with Gaussian uncertainties; Black – stacked USPDF fits;

Conclusions and outlook

- UniDAM tool was used to produce estimates of distance, age and mass for 2.5 million stars.
- We plan to explore systematic offsets between surveys.
- Then we can proceed with Galactic archaeology studies.
- New surveys can be included.
- Waiting for Gaia DR2 parallaxes.