

The 'JMMC Stellar Diameter Catalog version 3', a complete open-source, reproducible & open-data analysis pipeline

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The poster is also available at <https://www.jmmc.fr/doc/approved/JMMC-POS-2600-0006.pdf>

JMMC mission "We interfere constructively"

Since 2000, the **Jean-Marie Mariotti Center** aims to coordinate the efforts of the French partner Observatories involved in optical interferometry (OI) to offer the best operational environment to all the potential users of OI facilities open to the community, i.e. the VLTI*/ESO and CHARA**/GSU instruments. Its mission is multiple and consists in:

- developing, producing, documenting and maintaining the software necessary for the exploitation of the current instruments,
- providing a "Face to Face" User support for all the steps, from the preparation of the observations until the data archiving,
- participating actively to the academic formation of non specialists (e.g. by co-organizing VLTI schools or providing video courses and tutorials),
- providing and maintaining an interactive interferometry publication database, named **OLBIN**, gathering all refereed papers related to OI in ADS,
- participating to the prospective around new interferometric instruments or new instrumental configurations (e.g. by providing simulated data).



(*) VLTI: Very Large Telescope Interferometer, see <https://www.eso.org/sci/facilities/paranal/telescopes/vlti.html>
(**) CHARA: Center for High Angular Resolution Astronomy, see <https://www.chara.gsu.edu/>

JMDC & JSDC catalogs

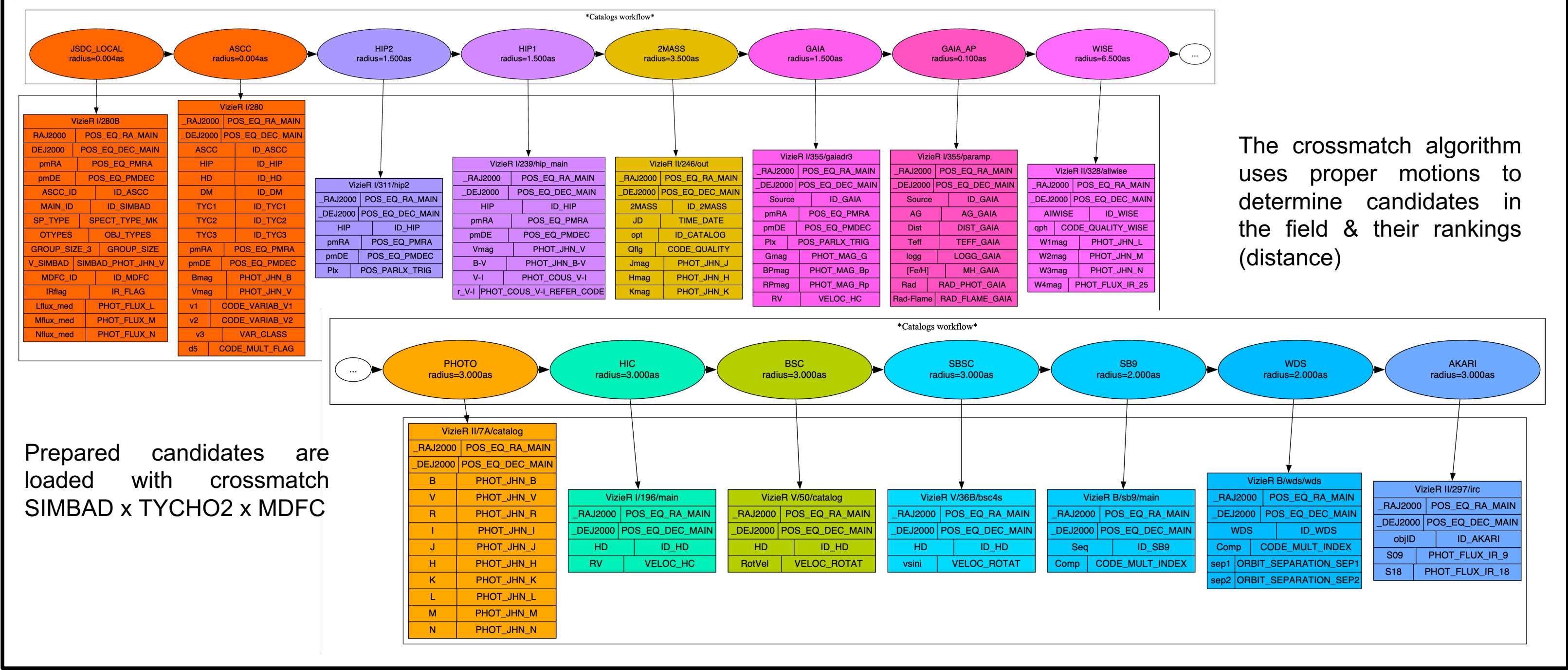
Observing reference stars with a known diameter is almost the only way to calibrate optical interferometry data. The **JMMC Calibrator Workgroup** develops methods to ascertain the angular diameter of stars since 20 years and provides this expertise in the **SearchCal** software and associated catalogs. The JMMC maintains on a regularly basis the **JMDC** (measured stellar diameter catalog, [Vizier \(Cat. II/345\)](#)) and provides the **JSDC** (estimated stellar diameter catalog, version 2 in 2017 at [Vizier \(Cat. II/346\)](#)), and an open-access to the JMMC **SearchCal** & **GetStar** services to help querying such large dataset and providing interoperability with the Virtual Observatory.

For the JSDC third release, the complete software package is available as an open-source repository (GPL2), at <https://github.com/JMMC-OpenDev/SearchCal> to

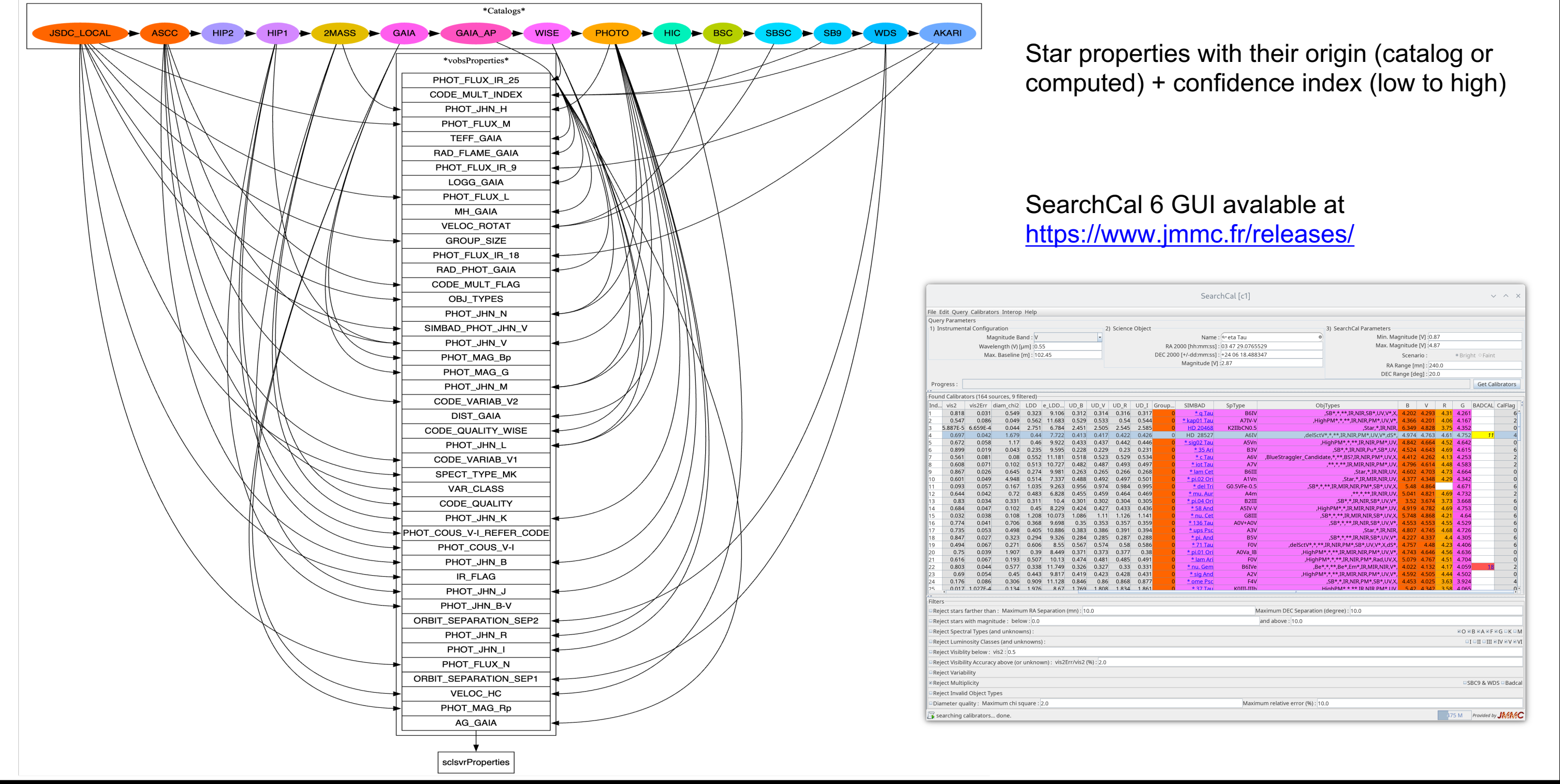
- Filter the JMDC dataset and fit the stellar pseudo-magnitude brightness relations on the JMDC completed with the JMMC GetStar service (shell + GDL scripts)
- Prepare catalog candidates by cross-matching SIMBAD (SpType, ObjTypes), with the TYCHO-2 and MDFC catalogs (shell + xmatch + stilts scripts)
- Run the SearchCal server (C/C++) to execute the JSDC BRIGHT or FAINT scenarios on previous candidates (respectively 525k with known spectral type and 1.95m stars without)
 - Collect and cross match all available information on 2.5 million stars from TYCHO-2 (ASCC), HIP, 2MASS, All-Wise & GAIA DR3... catalogs from the CDS Vizier service
 - Estimate theoretical stellar diameters using the pseudo-magnitude brightness relations using [V J H K] magnitudes (same polynomial laws as JSDC2).
 - Export the complete JSDC dataset (150 properties with origin & confidence indexes)

The faint approach uses a brute-force approach to estimate stellar diameters without spectral type (sampling all fitted range) but with larger uncertainty. the SearchCal / GetStar server are built using docker and the JMMC infrastructure uses a Kubernetes cluster to run these services with local data storage for JSDC datasets.

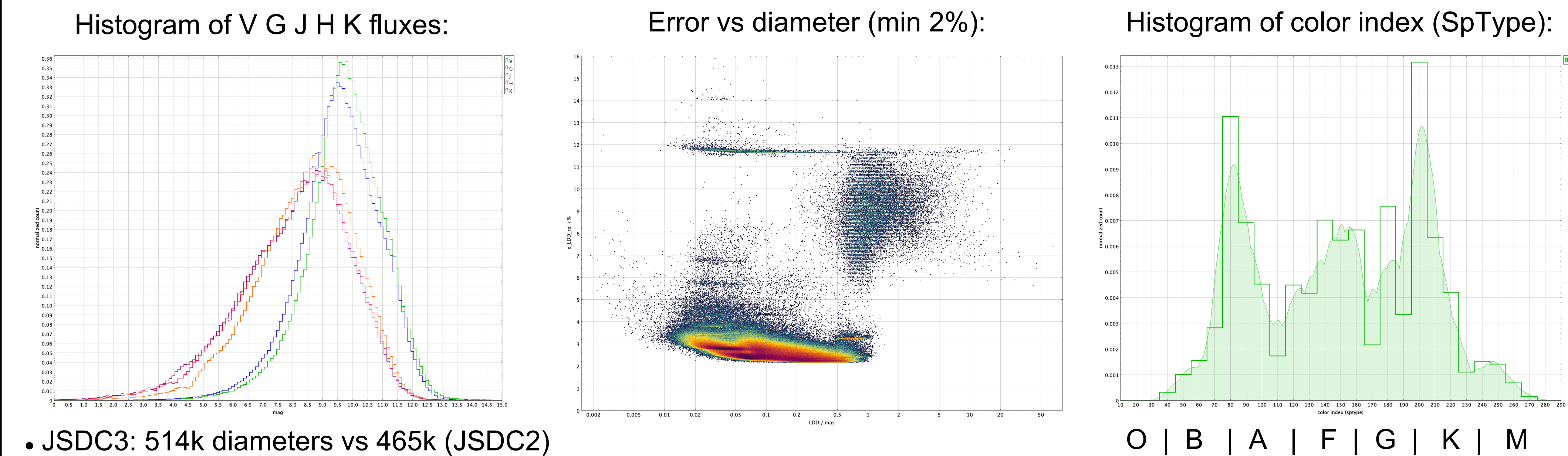
Updated JSDC scenario



Data mapping into JSDC properties



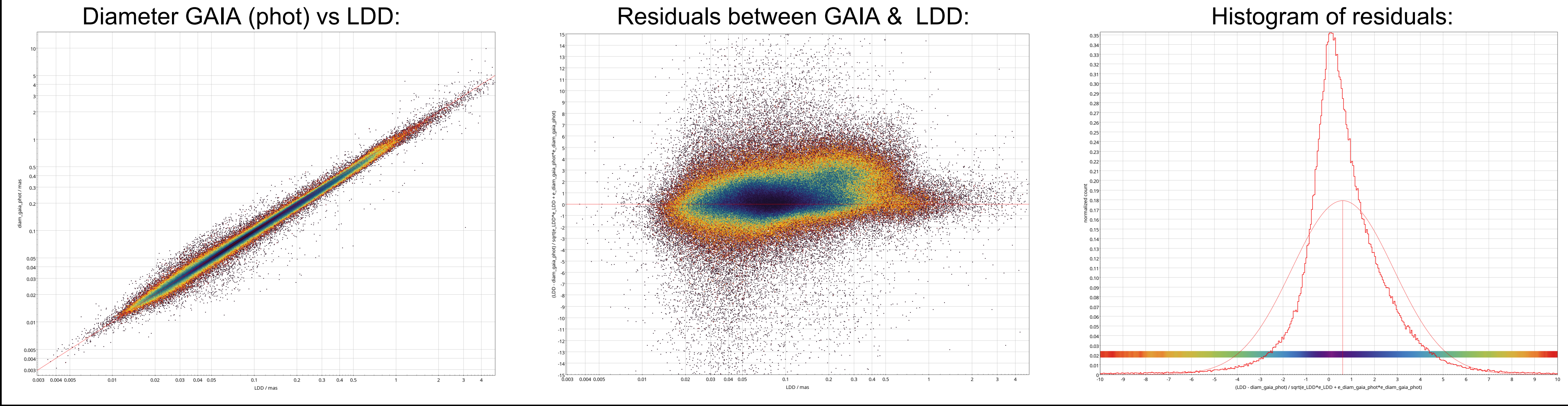
JSDC 3 statistics



- JSDC3: 514k diameters vs 465k (JSDC2)
- JSDC3 diameters are identical to JSDC2 diameters (same JMDC fitted polynomials), But differences explained by different cross-identification or spectral type changes (SIMBAD)

GAIA DR3 radius comparison

- Good agreement between JSDC3 diameter and GAIA rad_phot (within 1 sigma) available on 324k stars



Perspectives

- Compare cross-identification of sources with SIMBAD (identifiers) and GAIA crossmatches
- Improve the Faint approach to use the GAIA distance & effective temperature to constrain the spectral type, hence the stellar diameter possible range
- Refine pseudo-magnitude brightness relations (filtering correlations in JMDC, using more colors with G, Bp, Rp, L, M, N) for the JSDC 4 release dedicated to compare with the GAIA DR4 data release.

Acknowledgments & References

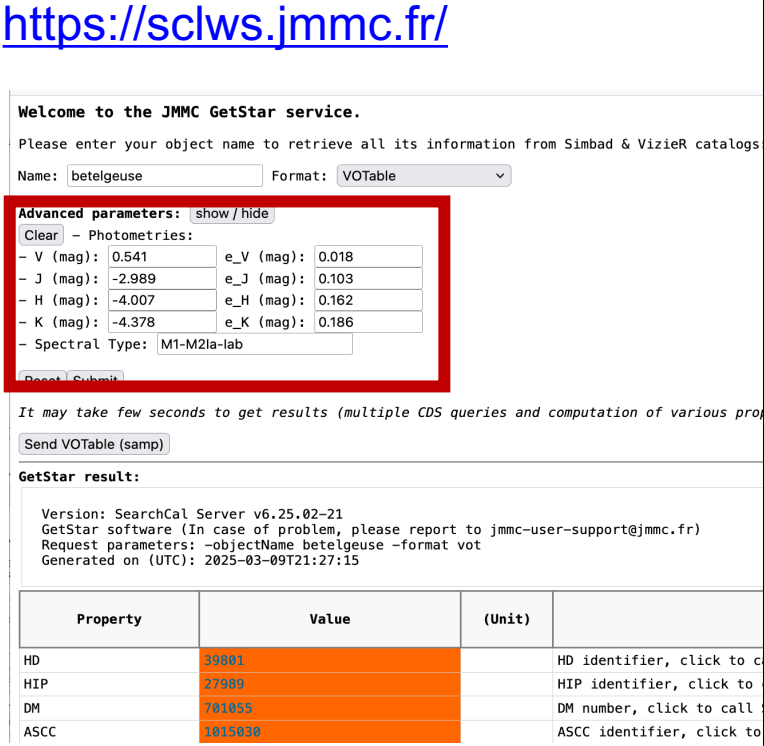
This research has made use of the **SIMBAD** database and **VizieR** catalogue access tool, CDS, Strasbourg, France.
TOPCAT [2005ASPC..347...29T] & **STILTS** [2006ASPC..351..666T],
Chelli A., Duvert G., Bourgès L. et al., 2016, A&A, 589, 112

Detailed description of each software is accessible on the JMMC site, and most of them are available on github: <https://github.com/JMMC-OpenDev/>.

SearchCal server 6 changes:

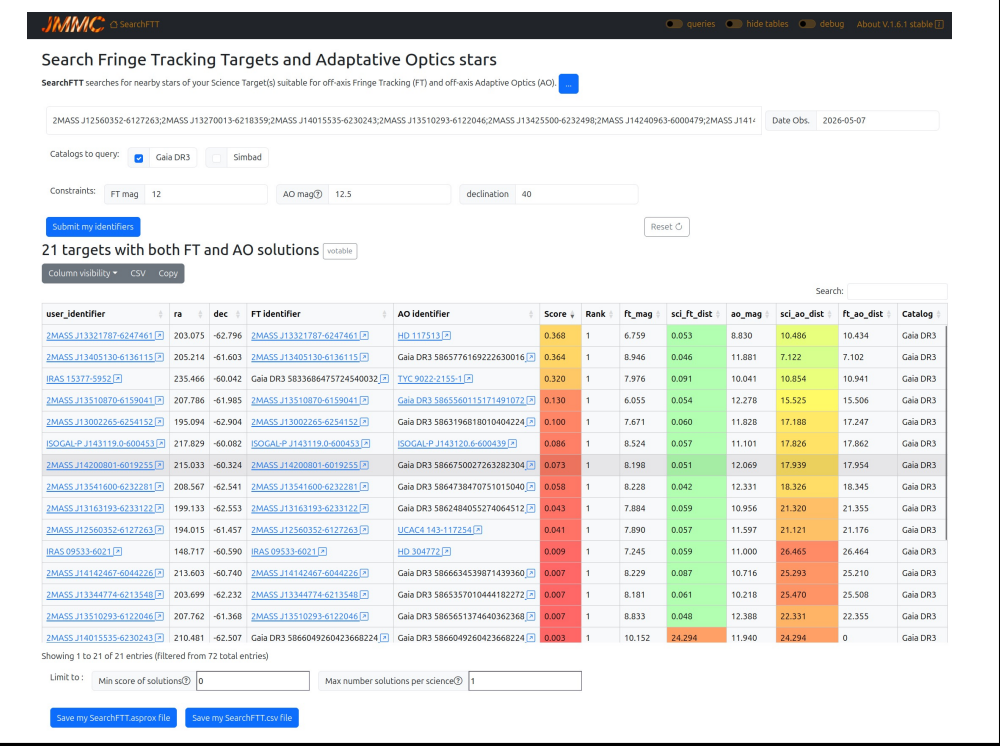
- Updated dataset JSDC 3 BRIGHT: **514k** diameters
 - SIMBAD (20m objects) with spectral & object types
 - GAIA DR3: G Bp Rp Radius with G to V conversion
 - MDFC: IRFlag + LMN fluxes (Jy)
- Improved crossmatch (neighborhood at 3as) + new CalFlag / IRFlag / BadCal flags
- Added GAIA DR3 (G, Bp, Rp) to V, used if no V flux (GetStar)

GetStar 6:



JSDC will become our main all-in-one data source for preparation tools.

SearchFTT is looking for AO / FT stars in GAIA catalog:



Working with **SPICA/CHARA** for an efficient and programmatic survey scheduling. This new instrument will provide valuable diameters for more precise JSDC releases

