The '**JMMC Stellar Diameters Catalogue' v2** (JSDC)

A new release based on **SearchCal** improvements

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This poster is also available online at
http://www.jmmc.fr/doc/approved/JMMC-POS-2600-0004.pdf

The **JMMC Calibrator Workgroup** has long developed methods to ascertain the angular diameter of stars, and provides this expertise in the **SearchCal** software. **SearchCal** dynamically finds calibrators near science objects by querying **CDS** hosted catalogs according to observational parameters using either the bright (magK ≤ 5.5) or the faint (magK > 5) scenarios.

This 2nd **JSDC** release is based on a new **SearchCal** scenario (derived from the bright one) applied to 110 000 *Hipparcos* stars instead of aggregating **SearchCal** results on the whole celestial sphere. It benefits from important **SearchCal** improvements for 3 years: new catalog queries (*HIP2*, *AKARI*), enhanced cross match algorithm taking into account proper motions / catalog epochs (*ASCC*, *HIP2*, *2MASS*) and important changes on diameter and error computations (more color relations used and magnitude error propagation).

We describe the new **JSDC** scenario and **SearchCal** improvements, study catalog results (more than 55 000 stars, more giant stars) and compare this new release with the former one (***VizieR*** *II/300*).

Building the JSDC v2

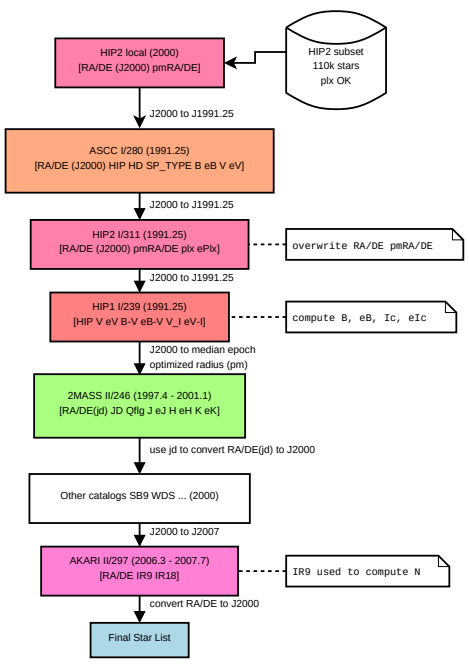
SearchCal scenario for JSDC

- Use filtered *HIP2* stars as input (RA/DE pmRA/DE)
  - **good parallax (bright scenario)** ie 0 < e_plx / plx < 50%
  - J1991.25 coordinates converted to J2000
- Optimized **VizieR** querying by chunks of 512 stars
- Use new catalogs:
  - *HIP2:* better coordinates, proper motions and parallaxes
  - *HIP:* compute B = V + (B-V) and Ic = V – (V – I)
  - *AKARI:* compute N from IR fluxes
- **Proper motion** handling when querying **VizieR** catalogs
  - J1991.25 (*ASCC, HIP2, HIP*)
  - varying epoch (*2MASS / AKARI)*
    - adjust cone search radius
    - correct RA/DE coordinates according to observation date
    - perform internal cross match (separation = 1.5 arcsec)
- Get **photometric magnitude errors** when available from catalogs (*ASCC, HIP, 2MASS)*
- **New Color relations used** (15) => improved diameter estimations and errors using magnitude errors and interstellar absorption (Av)

Filtering script (STILTS)

VOTABLE / FITS pipeline:

- Filter SB9 / WDS stars (binarity)
- Filter multiplicity, variability, reject **BadCal** stars
- Use **Simbad** to filter by object types (algol, binaries ...)
- Filtered but complete JSDC: http://jmmc.fr/jsdc



JSDC columns

- RA/DE (J2000), pmRA/DE
- plx, sp_type, teff, logg
- Magnitudes [B V R I J H K L M N]
- LDD / UDD: Limb-Darkened / Uniform Disk diameters

New Angular diameter / Color relations

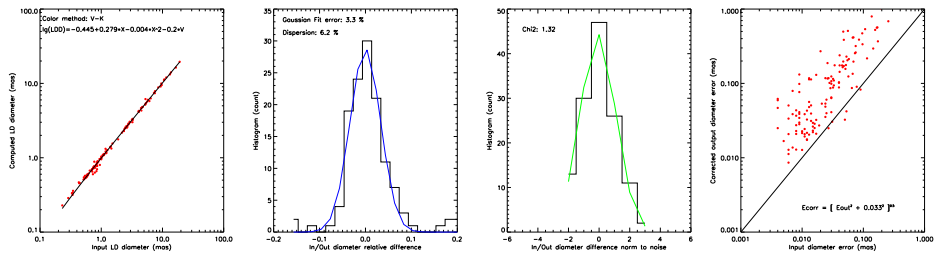
- New compilation built of measured angular diameters and errors (see Ref.)
  ~ 130 stars completed with their 'best' magnitudes [B V I J H K] and errors
- Perform iterative polynomial fits (IDL) for all color indexes [M1-M2]

  ALOG10(DIAM/9.306) + 0.2*M1=POL(M1-M2)

  M1 and M2 corrected by interstellar absorption (Av)
  - Polynomial coefficients COEFS (2nd degree) and covariance matrix MAT
  - Diameter error EDIAM = f(M1, EM1, EM2, COEFS, MAT) (papoulis)
  - Error bias estimated
  - Correlation coefficients between color indexes [V-K] [B-V] [I-K] ...

Angular diameter fit results for [V-K] color relation

- Dispersion: 6.2% and error bias: 3.3%



Remaining tasks before final release

- Improve diameter error propagation due to interstellar absorption
- Use correlations to estimate the weighted mean diameter and its error

Results & comparison

Statistics:

- 57 000 stars with computed diameters
  - JSDC v1: 38472 stars
  - 35 000 matches
  - 22000 more stars
  - 3500 lost stars

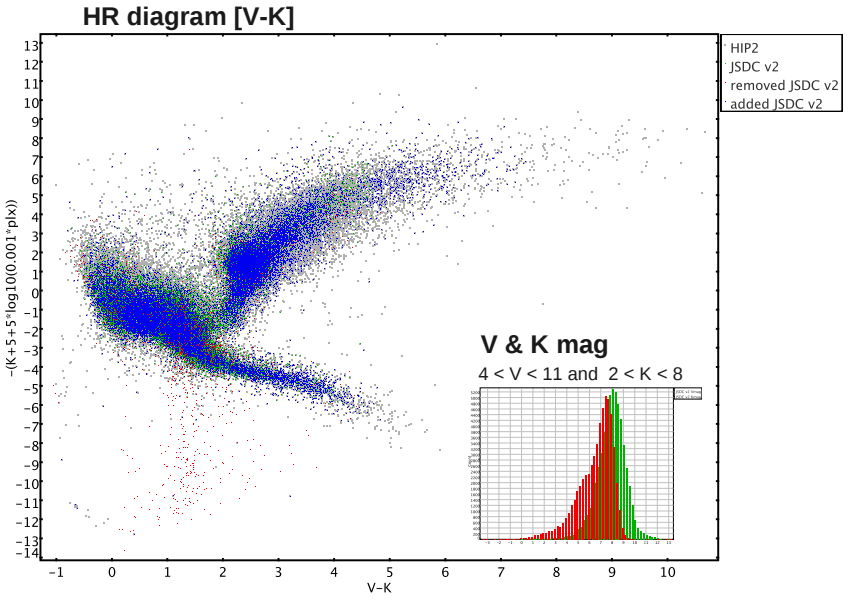
Analysis:

- Comparison on HR diagram:
  - More giant stars
  - Lost stars are not present in HIP2 catalog (JSDC v1) or rejected for consistency reasons
- Better sky coverage (poles, dec > 0)
- Diameter Error computation [V-K]
  - JSDC v1: 7% fixed
  - Correlated to K error (2MASS)
    - ~ 4% for 50 000 stars
    - > 10% for 4 500 stars (K < 4)

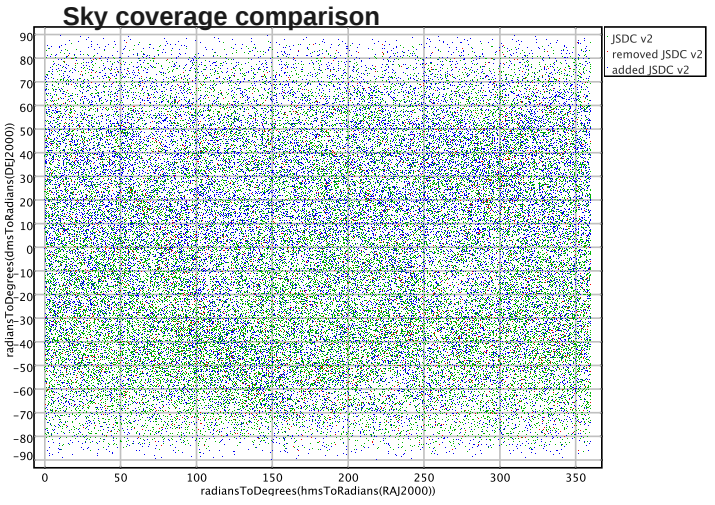
Solutions:

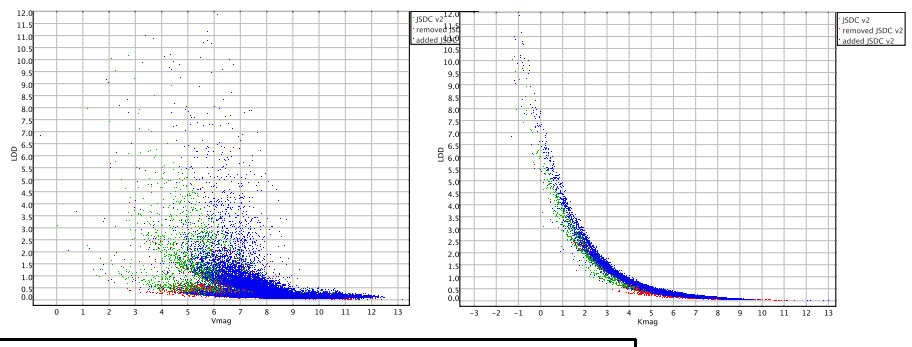
- Use a robust estimator on computed diameters and errors (15 color relations) to decrease the diameter error
- query new catalogs:
  - IR bands [J H K] for bright stars
  - photographic bands [B V R] for fainter stars

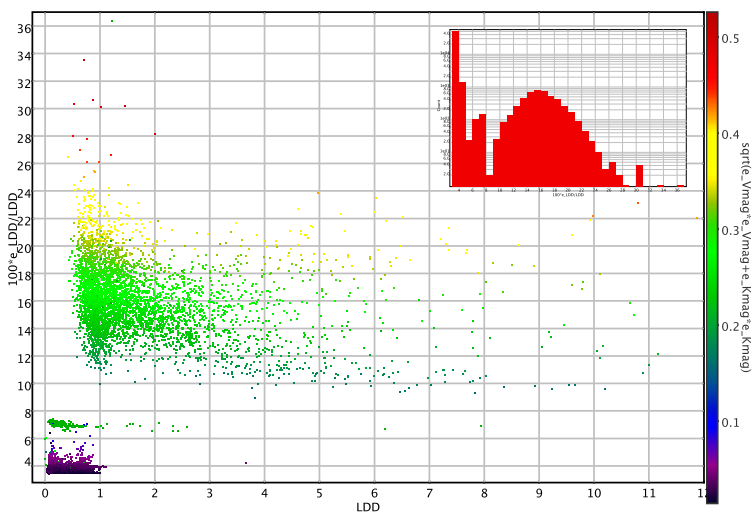
HR diagram [V-K]



Sky coverage comparison







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]

Barnes et al. (1978), Segransan et al. (2003), Mozurkewich et al. (2003), Kervella & Fouqué (2008), Boyajian (2012, 2013), Pickles (2010)