gaia

esa
European Space Agency

agenzia spaziale italiana

The Spectrophotometric Standard Stars Grid for the Gaia absolute calibration

Giuseppe Altavilla

&

G. Cocozza, S. Galleti, S. Ragaini

E. Pancino, M. Bellazzini, A. Bragaglia, C. Cacciari, L. Federici, P. Montegriffo, S. Marinoni, G. Tessicini, G. Valentini

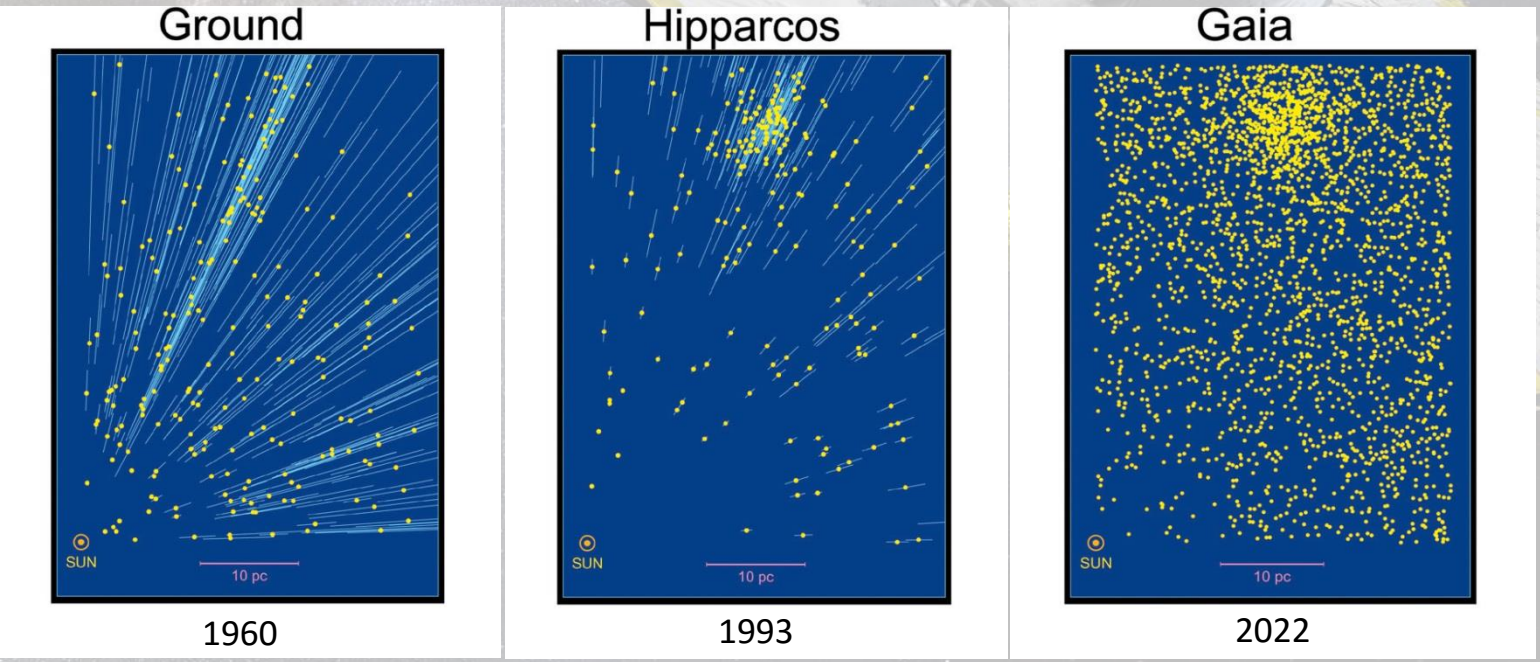
Gaia DPAC
Data Processing & Analysis Consortium

INAF

ISTITUTO NAZIONALE DI ASTROFISICA
OSSERVATORIO ASTRONOMICO DI BOLOGNA

Gaia objectives

- The largest and most precise 3D chart of our Galaxy (6D space survey: α, δ, π, $\mu\alpha$, $\mu\delta$ + complementary radial velocities) + astrophysical parameters
- Composition, Formation and Evolution of our Galaxy, unraveling the chemical and dynamical history of our Galaxy… And much more!



Astrometric accuracy: the Hyades D~47 pc

Gaia DPAC

DPAC: Data Processing and Analysis Consortium

- CU1: System Architecture
- CU2: Data Simulations
- CU3: Core Processing
- CU4: Object Processing
- CU5: Photometric Processing
- CU6: Spectroscopic Processing
- CU7: Variability Processing
- CU8: Astrophysical Parameters
- CU9: Catalogue Access

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Gaia@Bologna

CU5 - photometric processing

- **DU13**: Instrument absolute response characterization: ground-based preparation (E. Pancino, G. Altavilla deputy)
- **DU14**: Instrument absolute response characterisation: definition and application (C. Cacciari)

G. Cocozza, S. Galleti, S. Ragaini,
M. Bellazzini, A. Bragaglia, L. Federici, P. Montegriffo, E. Rossetti

- **DU17**: Flux and classification-based science alerts

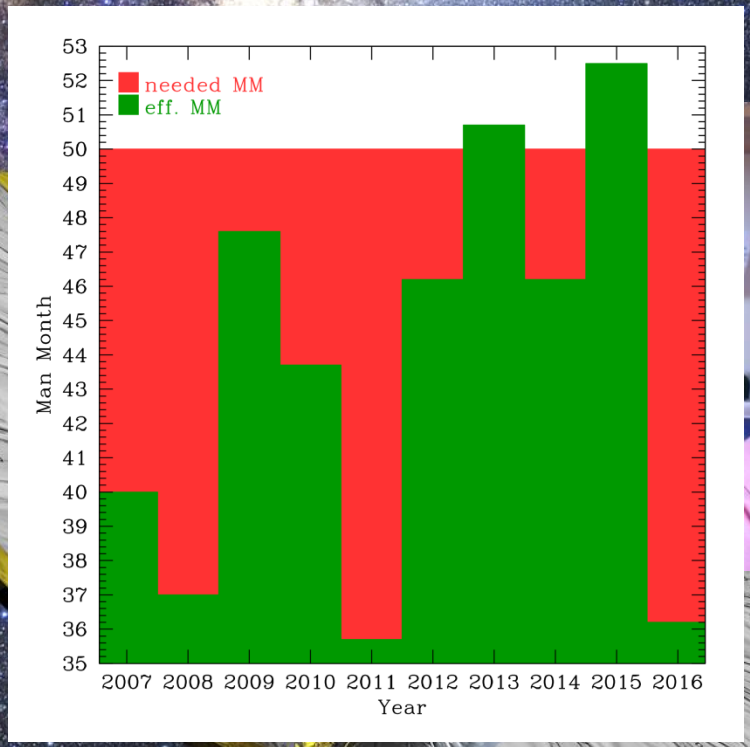
CU7 - variability processing (G. Clementini)

The Bologna CU5DU13 goal

- Provide a grid of ~200 Spectro-Photometric Standard Stars (SPSS) for the absolute spectro-photometric calibration of the Gaia G-band and low resolution (BP/RP) spectrophotometry

- Existing grids are not sufficient, we need:
  - Spectral type coverage (all spectral types)
  - Well distributed in the sky
  - Precision and accuracy of 1-3%
  - Good statistics (100-200)
  - Full coverage of Gaia range (330-1100 nm)
- See Pancino et al., 2012, MNRAS, 426, 1767, Altavilla et al. 2015, AN, 336, 515

The Bologna CU5 ASI funded Team

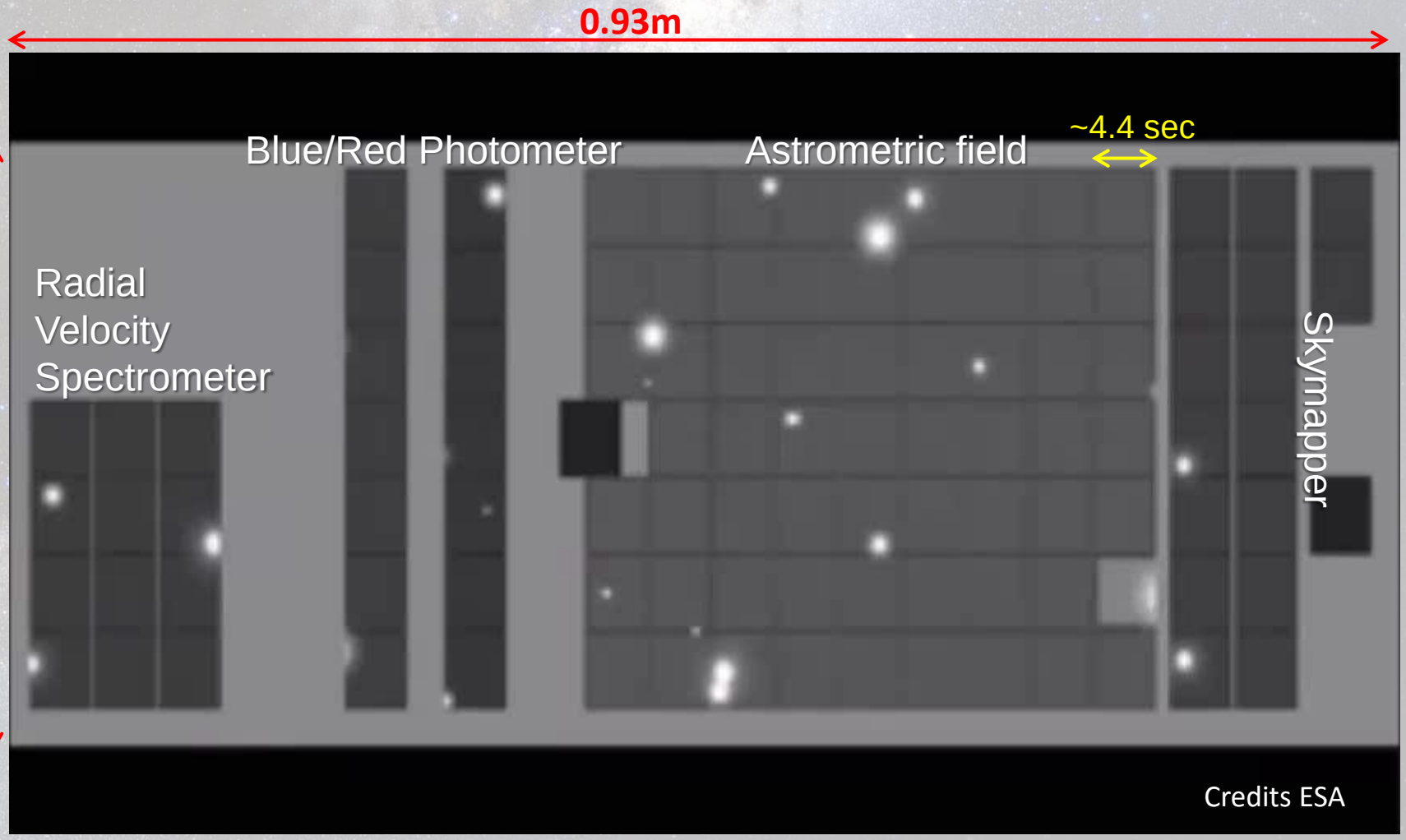


All 3 AR contracts renewed for 2016

TD renewed (-> July 2016)

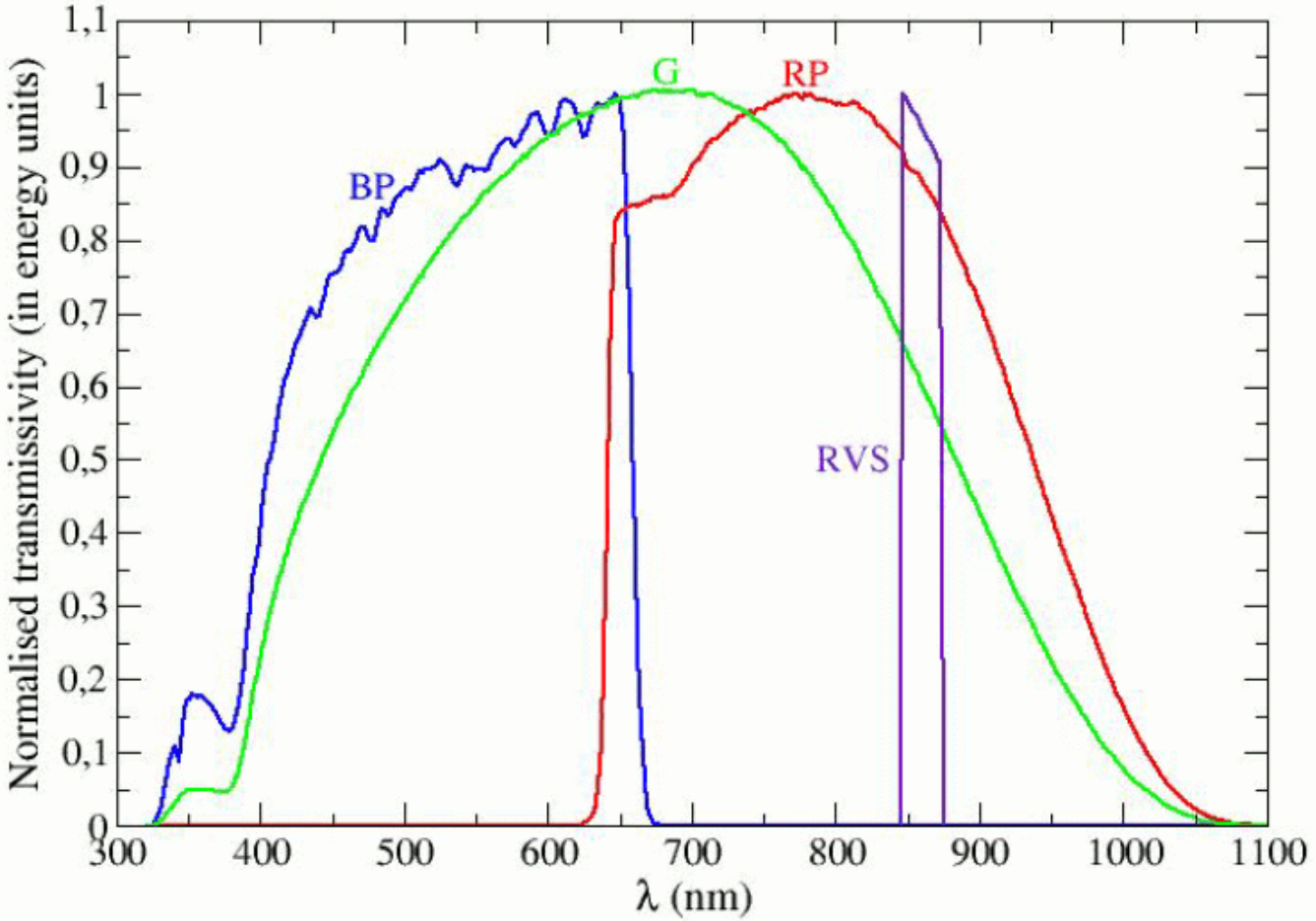
~3 FTE in contracts + 0.6 FTE OABo staff + outside personnel

Gaia focal plane



FoV: 0.7 deg x 0.7 deg, pixel (10 µm x 30 µm): 0.059”(AL) x 0.177”(AC)
106 CCD 4500x1966 px (TDI)

Gaia passbands



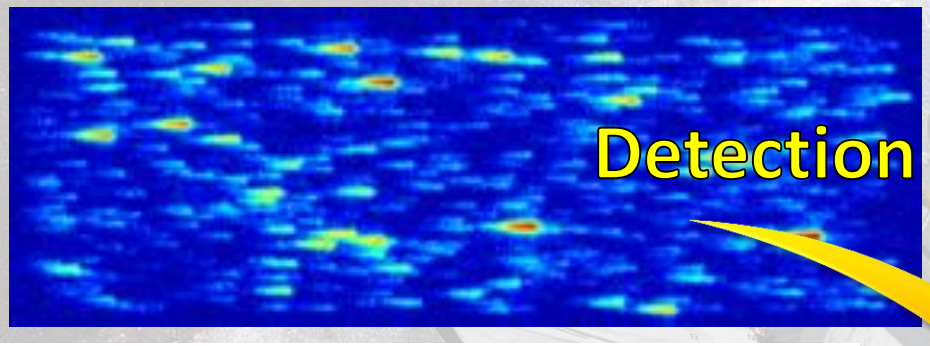
BP 3300-6800Å, R=80-20

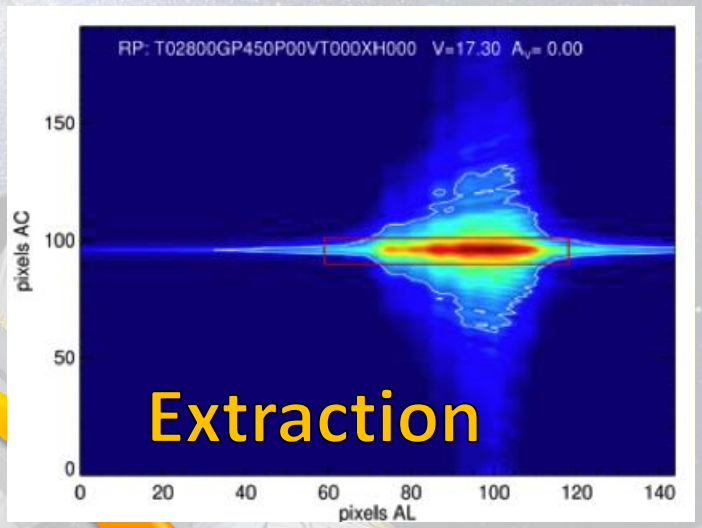
G 3300-10500Å

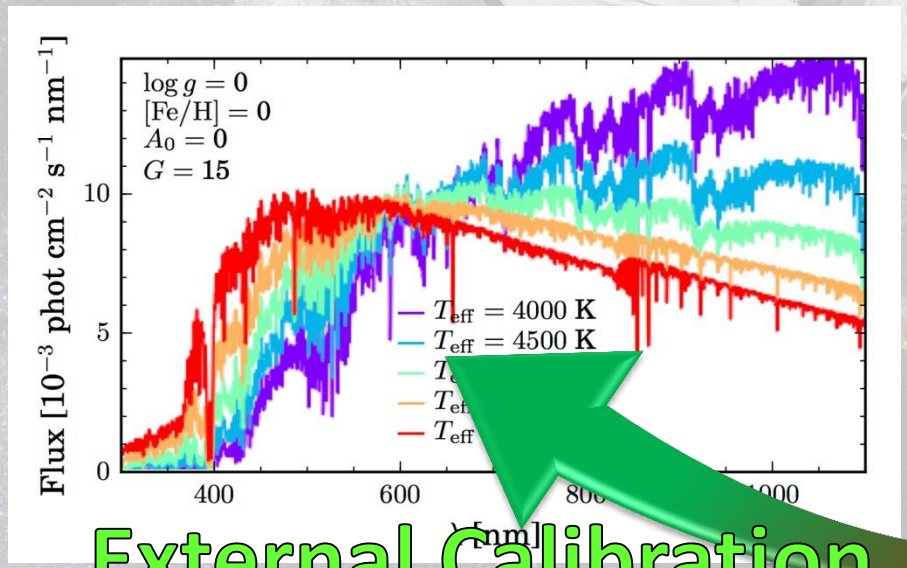
RP 6400-10500Å, R=90-70

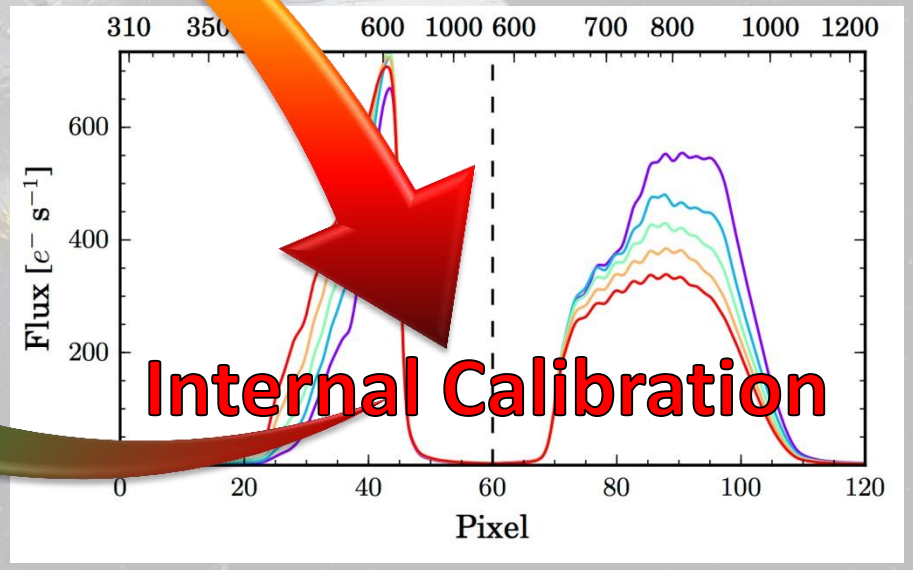
RVS 8470-8740Å, R=11500

Gaia absolute calibration



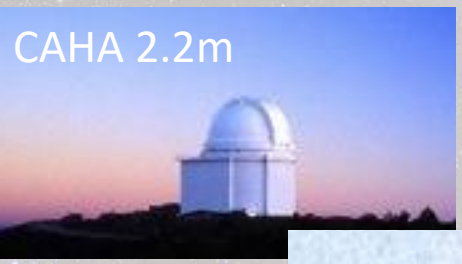


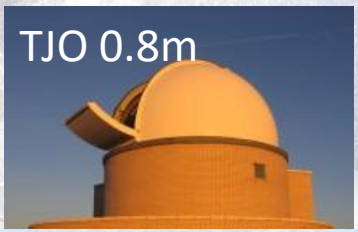




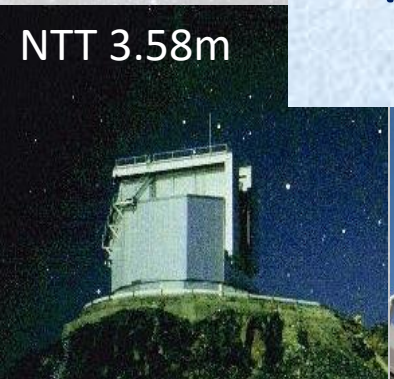
Astraatmadja, 2015, GAIA-C8-TN-MPIA-TLA-001

Gaia SPSS





- **A large observational effort to collect the required data started in 2006, completed in 2015.**
- **Almost 5000 hours (the equivalent of 500 nights)**
- **>900 different nights, 66 observing runs from 2006 to 2015**
- **6(+1) telescopes and instruments**
- **Comparable to one of the large modern surveys (GES)**



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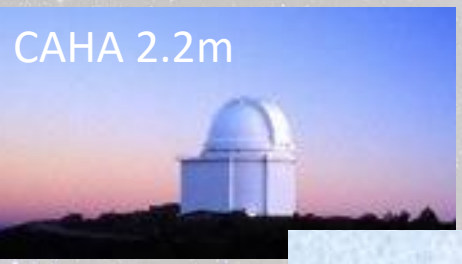
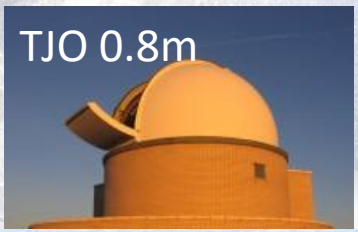
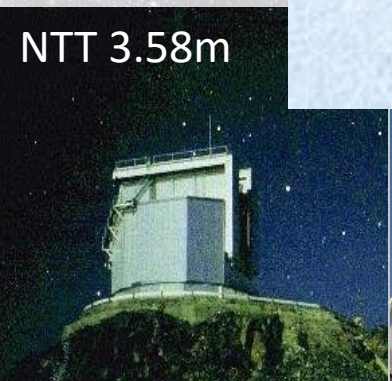
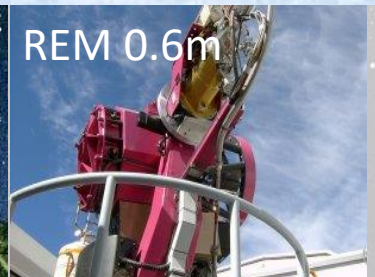




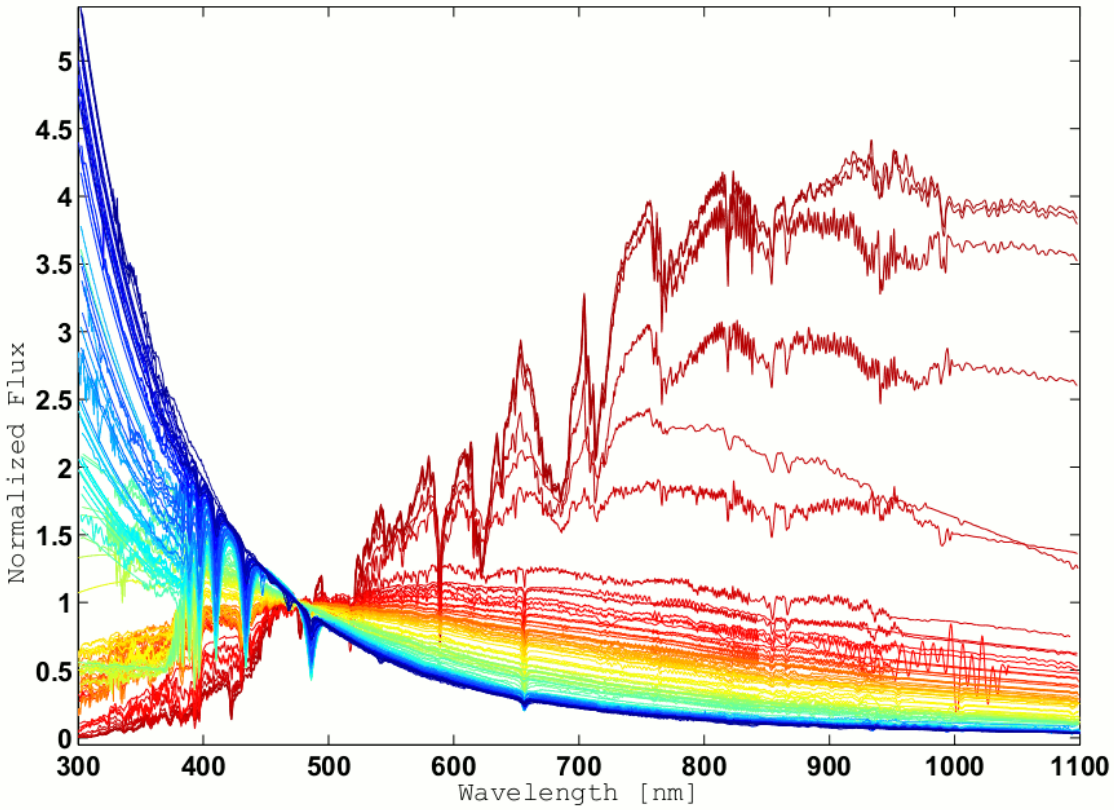
- **~200 calibrators (SPSS), ~1% internal and a few % external accuracy, to model the instruments response**





SPSS V1 release

July 2015



94 SPSS

- Extended with theoretical or empirical template spectra (CALSPEC, Gaia spectral libraries, Public libraries)
- Can calibrate 1st Gaia release (end summer 2016), G band only
- Already exceeding DPAC requirements

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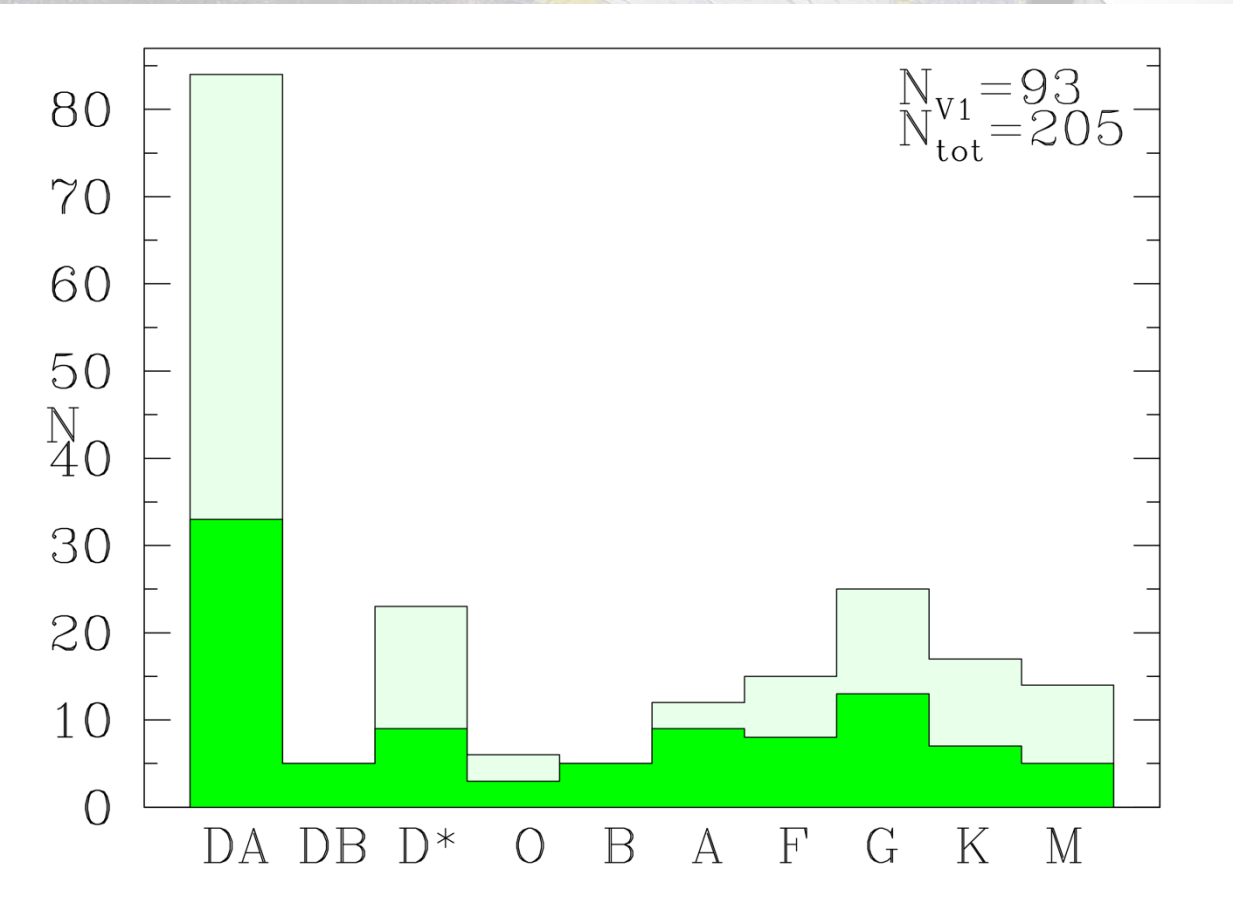

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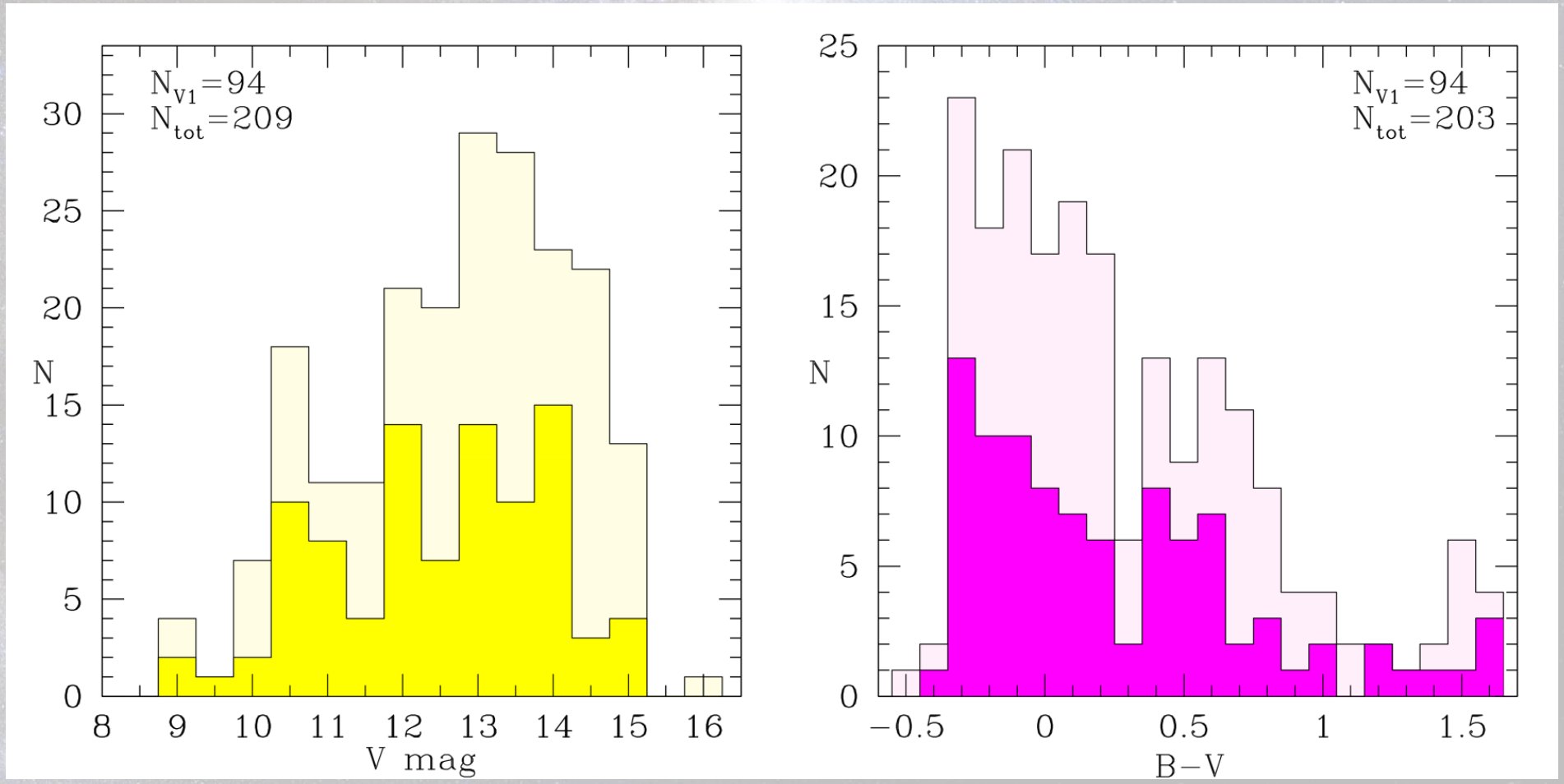
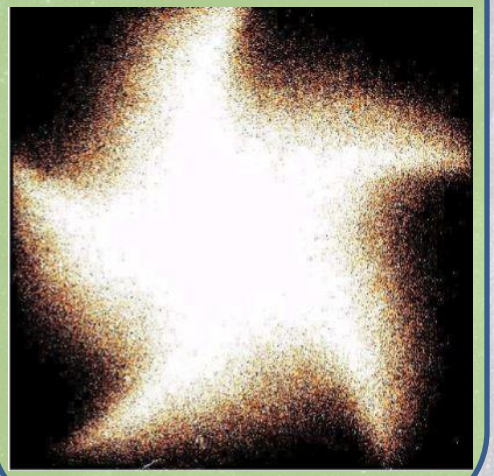


SPSS… not only spectroscopy

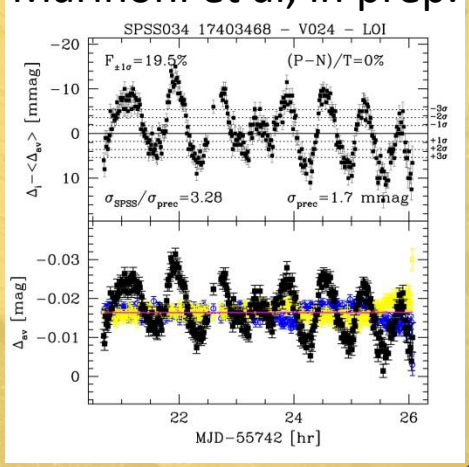
Instruments characterization

Altavilla et al. 2015AN.336.515A

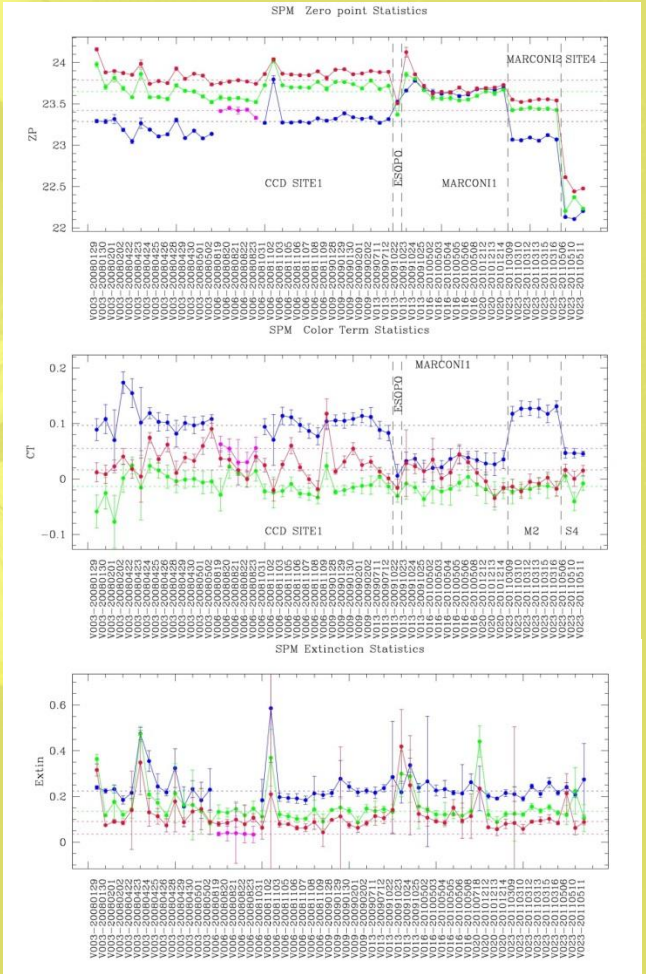


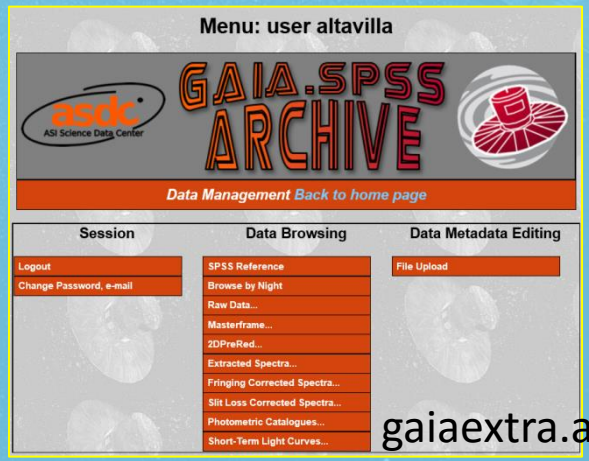
Constancy assessment:

Marinoni et al, in prep.



Absolute Photometry





The ASDC Gaia SPSS archive

gaiaextra.asdc.asi.it:8900

SPSS V2 release

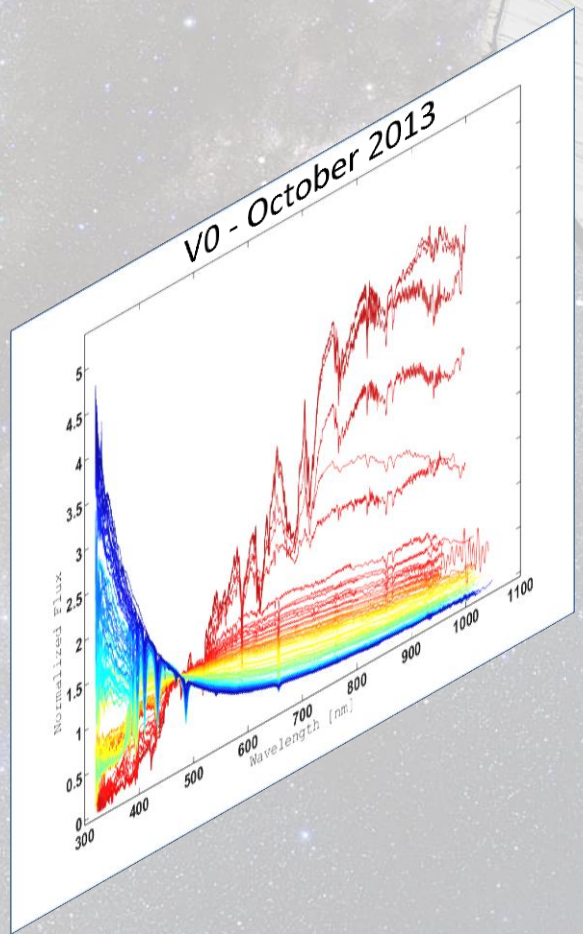
mid 2016 for Gaia 2nd release

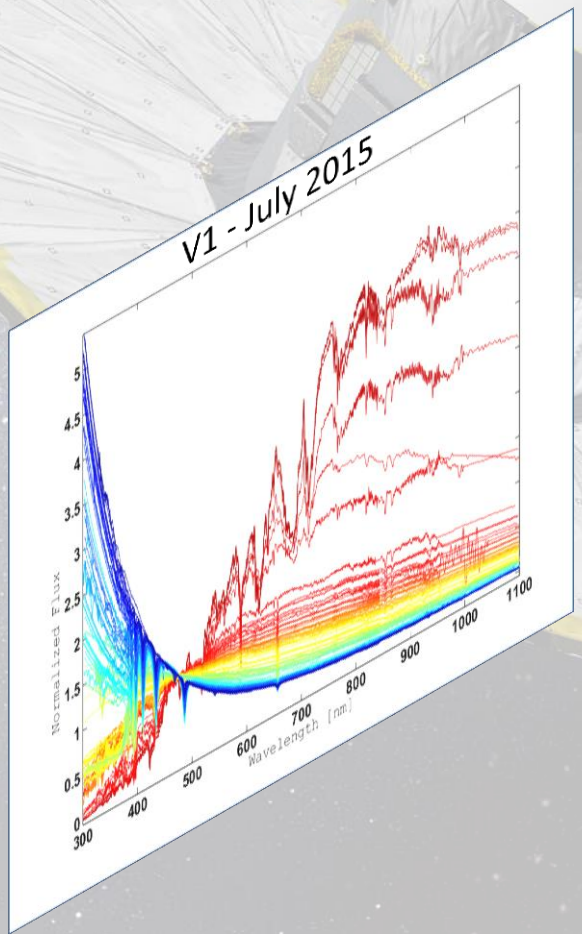
Including

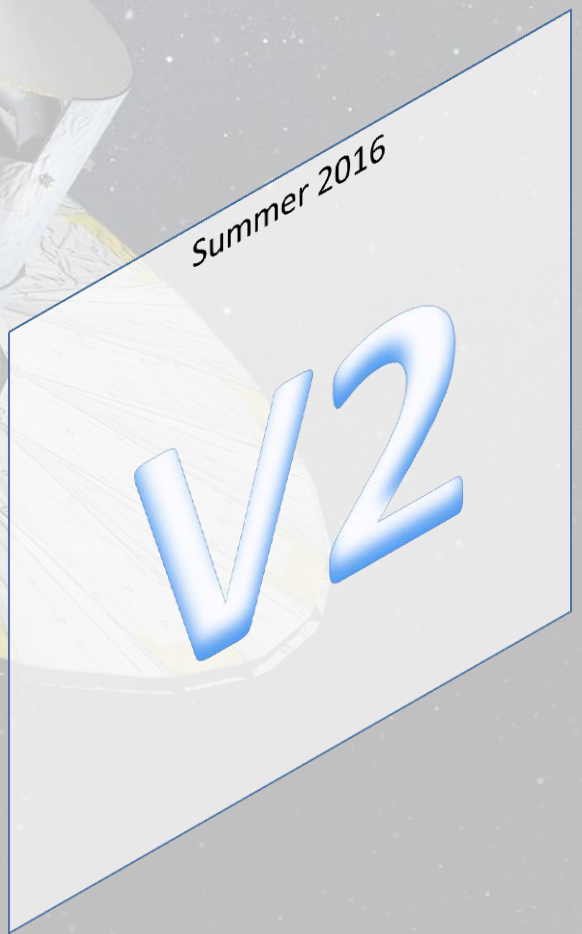
- constancy assessment
- absolute photometry

Improving the SPSS grid:

- more spectra, fringing corr. …
- more SPSS







First release: end summer 2016	Positions (α, δ) and G magnitudes (single-star and good astrometric behaviour). Photometric data of Ecliptic Poles Scanning RR Lyrae and Cepheid variable stars. The five-parameter astrometric solution - positions, parallaxes, and proper motions - for stars in common with the Tycho-2 Catalogue. The catalogue is based on the Tycho-Gaia Astrometric Solution
Second release: summer 2017	Five-parameter astrometric solutions (single-star). Integrated BP/RP photometry. Mean radial (no radial-velocity variation).
Third release: summer 2018 (TBC)	Orbital solutions, system radial velocity and five-parameter astrometric solutions, for binaries having periods between 2 months and 75% of the observing time will be released. Object classification and astrophysical parameters, together with BP/RP spectra and/or RVS spectra they are based on (well-behaved objects). Mean radial velocities (no radial-velocity and with available atmospheric-parameter estimates).
Fourth release: summer 2019 (TBC)	Variable-star classifications will be released together with the epoch photometry used for the stars. Solar-system results will be released with preliminary orbital solutions and individual epoch observations. Non-single star catalogues.
Final release: 2022 (TBC)	Full astrometric, photometric, and radial-velocity catalogues. All available variable-star and non-single-star solutions. Source classifications, astrophysical for stars, unresolved binaries, galaxies, and quasars. An exo-planet list. All epoch and transit data for all sources.All ground-based observations made for data-processing purposes.