Gaia and its data

Introduction, November 17th 2014

Gaia is a new astrometry mission (heir of Hipparcos)

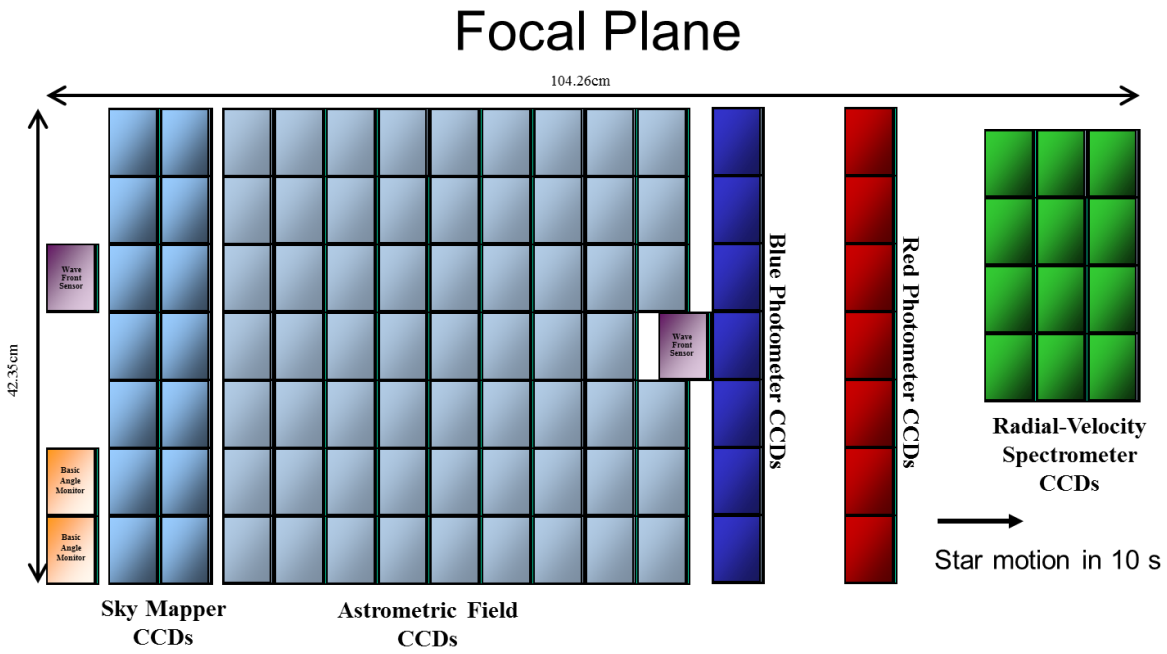
Main mission characteristics

- Spacecraft orbiting around L2 point, stabilized by spinning with telescope windows located perpendicular to rotation axis
- Precession of axis optimized to maximize sky coverage during its 5 year mission
  - On average, each object will be observed 70 times, but there is some dispersion (xx min & xx max)

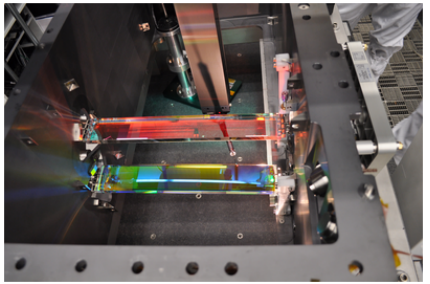
Resulting catalogue

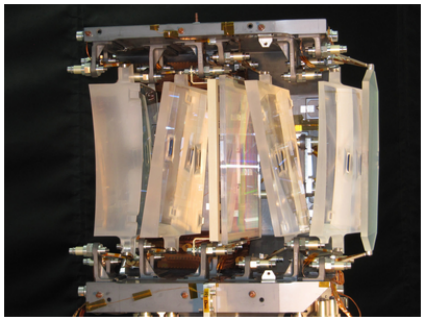
- ~10^9 stars, complete to G = 20
- Parallax accuracy from 7 µas at G = 10 to 600 µas at G = 20
- Other object classes
  - 10^6-10^7 galaxies
  - 5 10^5 quasars
  - 2.5 10^5 solar system objects
  - 500 BDs, 2 10^5 WDs
  - 1.5 10^4 exoplanets
  - …
- White light broad band photometry
- Low resolution spectro-photometry (BP, RP)
- Narrow band spectroscopy for RVS measurements

Data from sources is acquired as they drift over the instrument

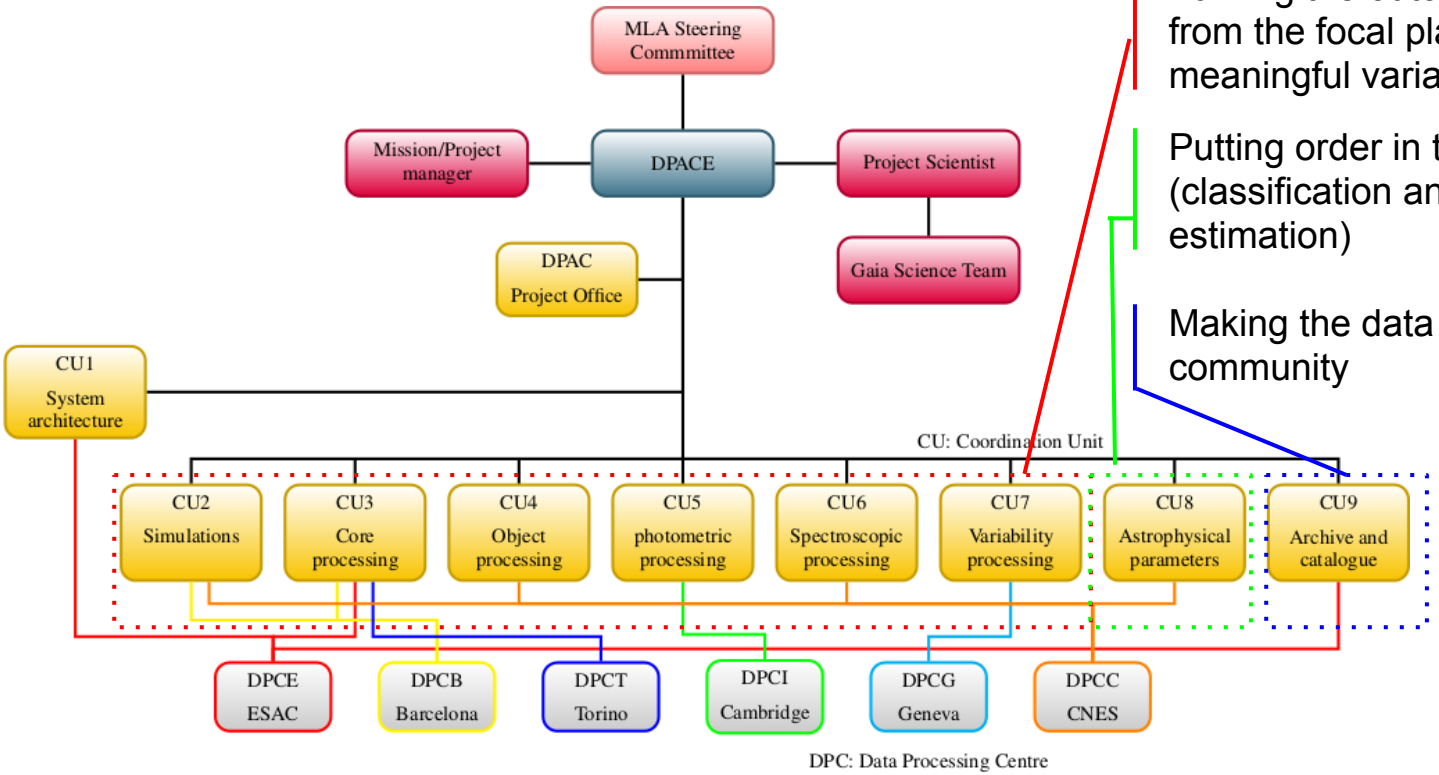


Video





Data management structure

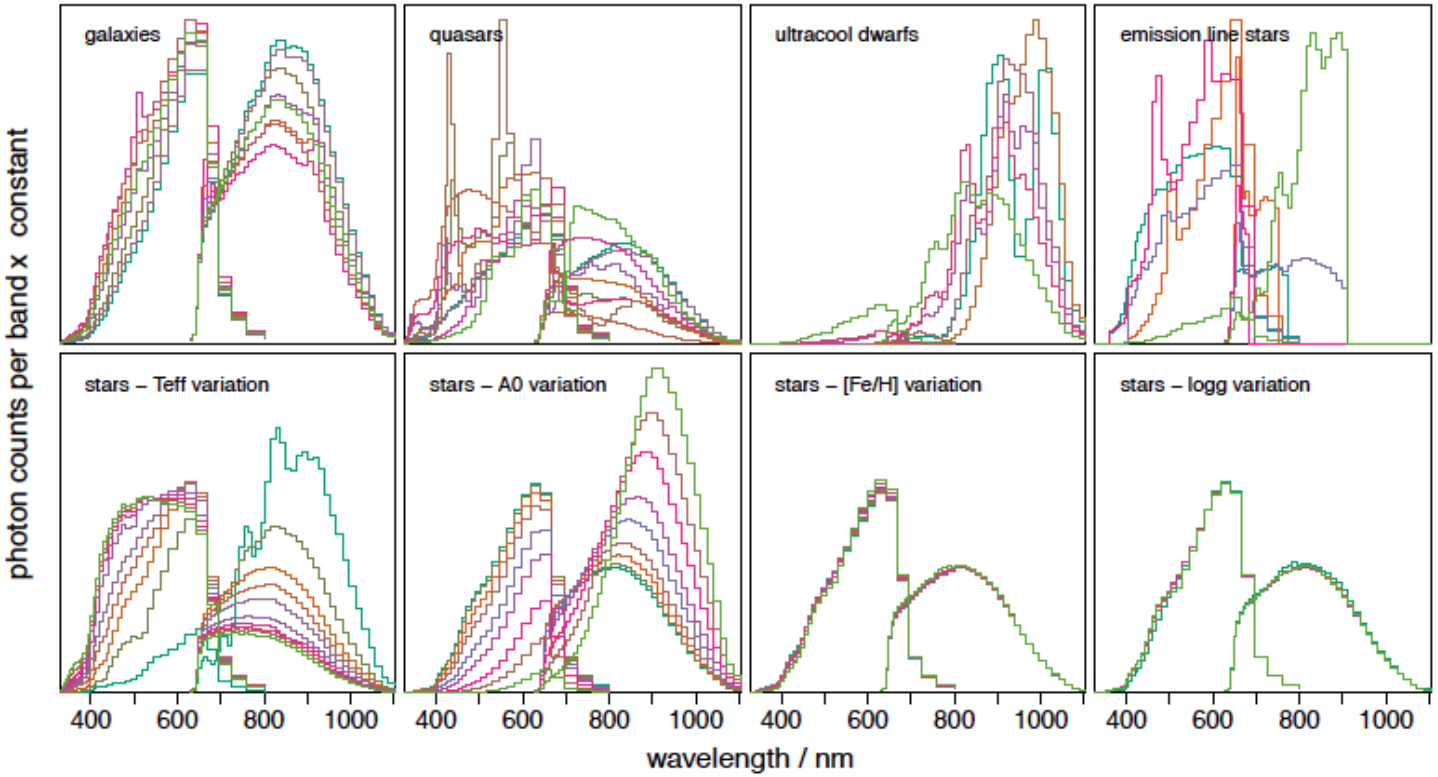


Turning the outcome signals from the focal plane into meaningful variables

Putting order in the variables (classification and parameter estimation)

Making the data available to the community

Photometry data (simulated)



Classification and parameter estimation

Table 1. Apsis modules

Acronym	name
DSC	Discrete Source Classifier
ESP	Extended Stellar Parametrizer:
-CS	ESP – Cool Stars
-ELS	ESP – Emission Line Stars
-HS	ESP – Hot Stars
-UCD	ESP – Ultra Cool Dwarfs
FLAME	Final Luminosity Age and Mass Estimator
GSP-Phot	Generalized Stellar Parametrizer – Photometry
GSP-Spec	Generalized Stellar Parametrizer – Spectroscopy
MSC	Multiple Star Classifier
OA	Outlier Analysis
OCA	Object Clustering Algorithm
QSOC	Quasar Classifier
TGE	Total Galactic Extinction
UGC	Unresolved Galaxy Classifier

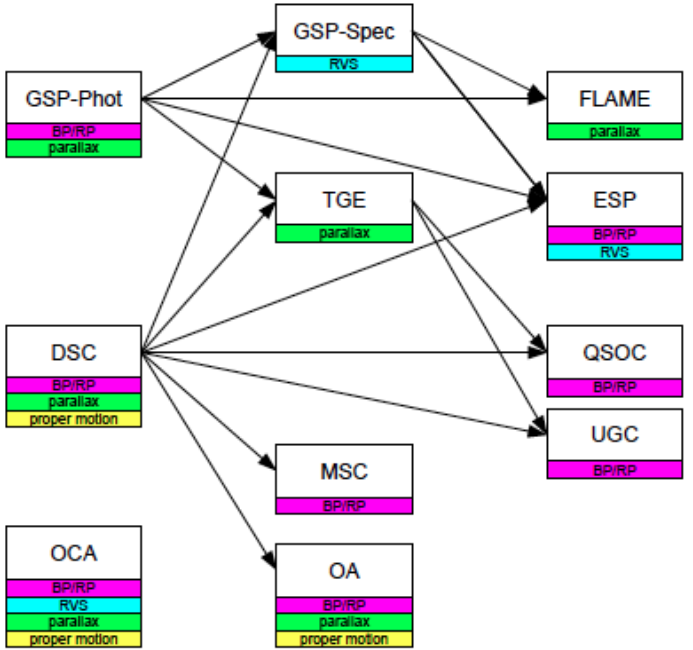


Fig. 5. Component modules in Apsis and their interdependency. The module names are defined in Table 1. The arrows indicate a dependency on the output of the preceding module. The coloured bars underneath each module indicate which data it uses. Most of the modules additionally use the photometry and some also the Galactic coordinates.

Algorithms used

To be discussed today

Module	Classification	Parameter estimation
DSC	SVM	-
GSP-Phot	-	SVM (Priam), Newt-Raph (Ilium), Bayesian MC (Aeneas)
GSP-Spec	-	Mult regression (Matisse), K-D tree (Degas), Gauss-Newt (Gaugin)
ESP	ELS: NN, K-N, IGA UCD: Cuts	HS: Simplex CS: Chi-square UCD: K-N, Gaussian process, Bayesian Inf.
MSC	-	SVM
FLAME	-	Chi-square, Bayesian
QSOC	SVM	Extremely randomnized tree
UGC	SVM	-
OA	Self-organizing Map	-
OCA	HMAC	-