Aldo Dell'Oro

Gaia: status and Solar System branch

INAF – Osservatorio Astrofisico di Arcetri
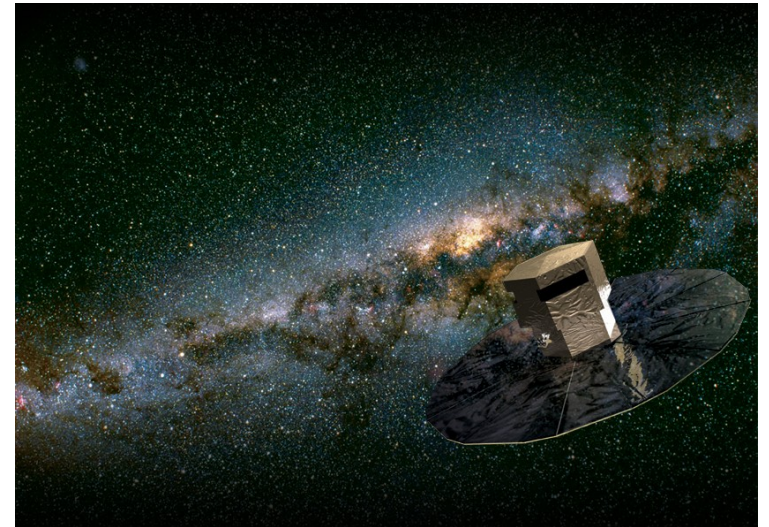
April 23, 2013

Gaia

astrometry space mission
ESA Horizon 2000+ long-term program

Launch: October 2013

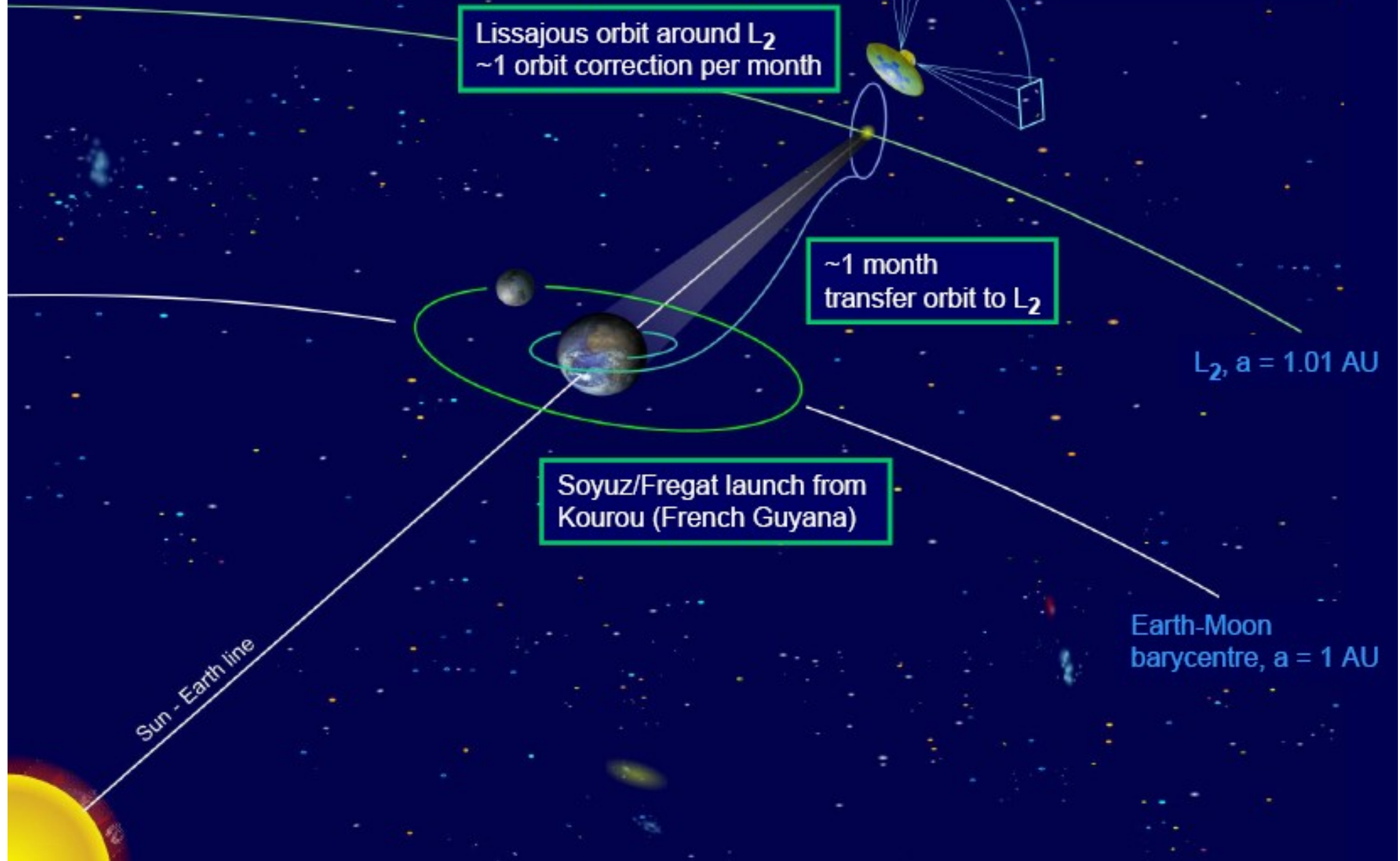Operation period: 2014-2018

Objectives:
1. Galaxy origin and formation;
2. Physics of stars and their evolution;
3. Galactic dynamics and distance scale;
4. **Physics of the Solar System**;
5. Large-scale detection of all classes of astrophysical objects including brown dwarfs, white dwarfs, and planetary systems;
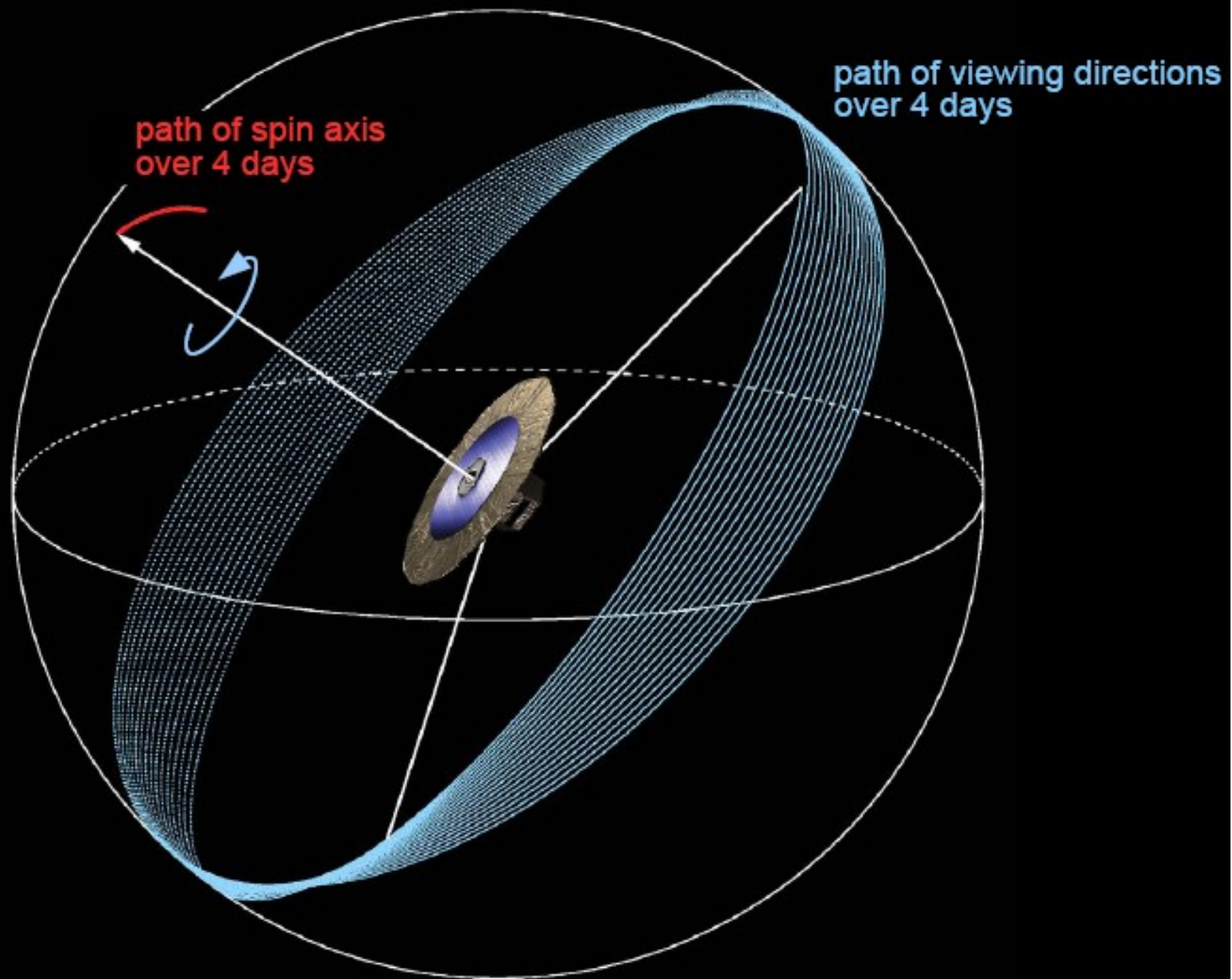6. Fundamental physics

Gaia launch and orbit
(Credit: EADS Astrium)

5 - 6 years of (almost) continuous observation

Lissajous orbit around L_2
~1 orbit correction per month

~1 month transfer orbit to L_2

L_2, a = 1.01 AU

Soyuz/Fregat launch from Kourou (French Guyana)

Earth-Moon barycentre, a = 1 AU

Sun - Earth line

Gaia scanning: Motion of viewing directions over 4 days

path of spin axis over 4 days

path of viewing directions over 4 days

Gaia focal plane (106 CCDs)

detection and FOV discrimination | astrometric measurements | photometry (dispersed images) | radial velocity (dispersed images)

SM1 SM2 | AF1 AF2 AF3 AF4 AF5 AF6 AF7 AF8 AF9 | BP RP | RVS1 RVS2 RVS3

WFS2

0.42 m

BAM-N BAM-R WFS1

0.93 m
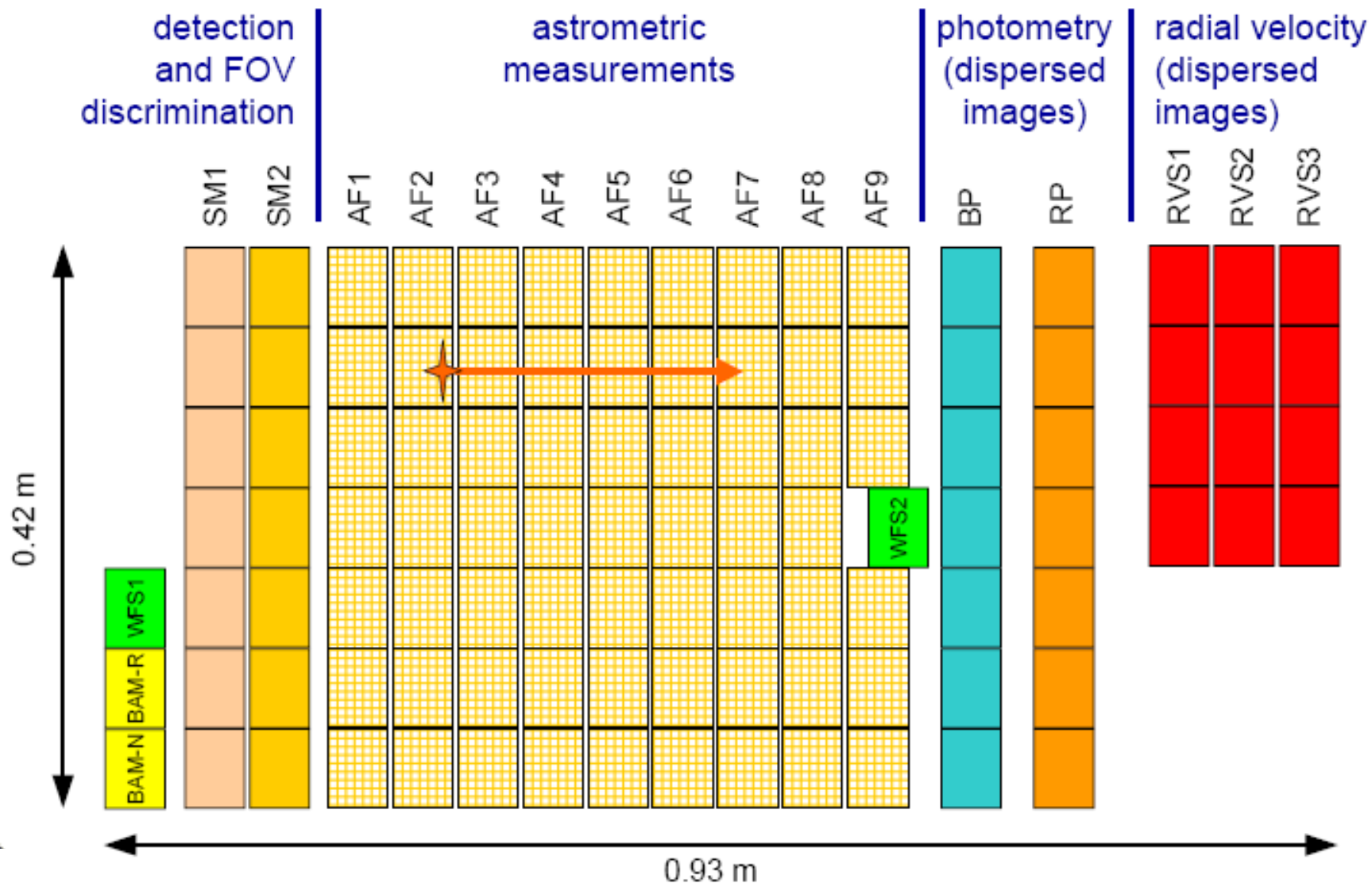
BAM = basic angle monitor, WFS = wavefront sensor

CCD data collection in the astrometric field

on-chip binning of pixels across-scan

window of 6-18 samples transmitted to ground
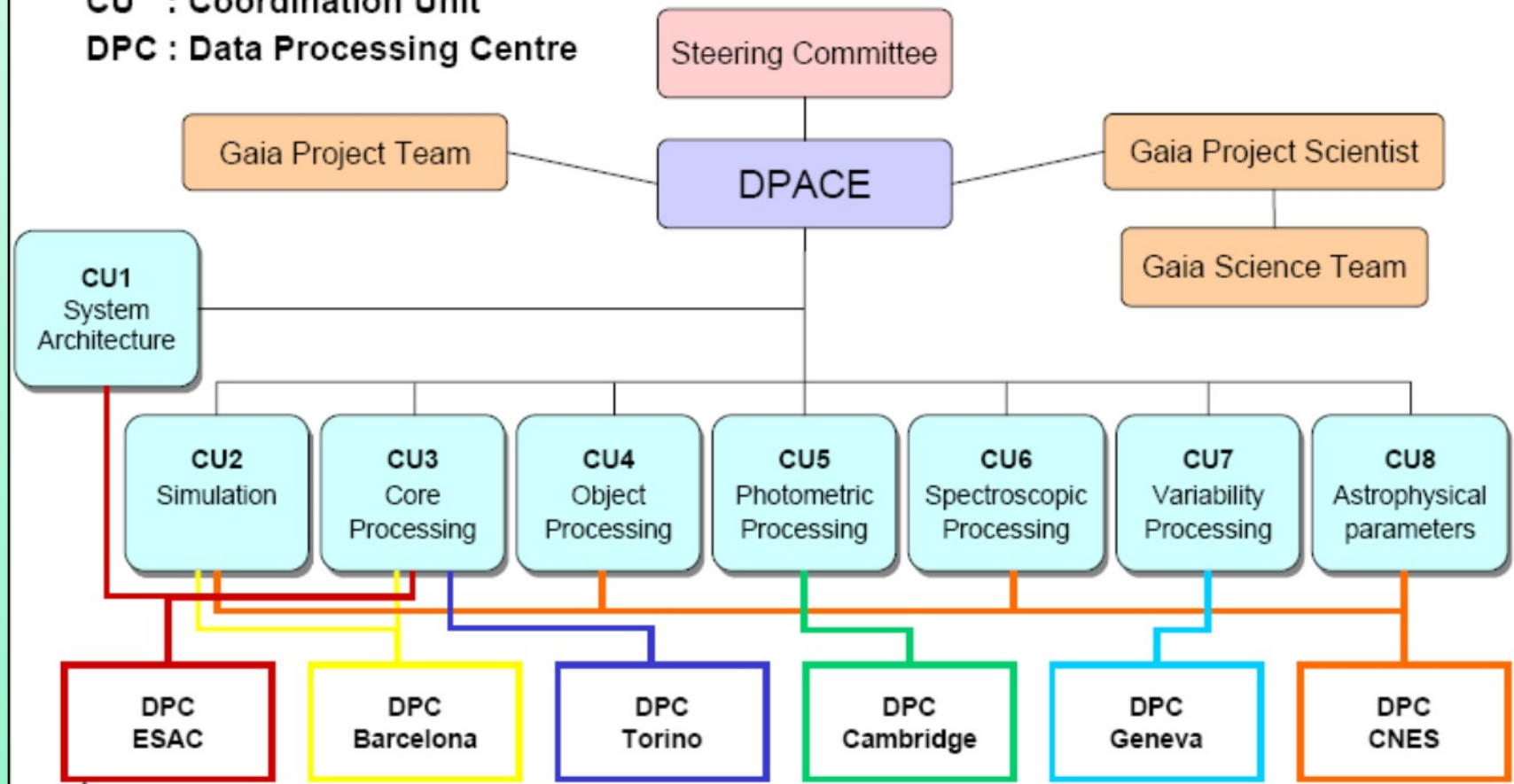
G = 15
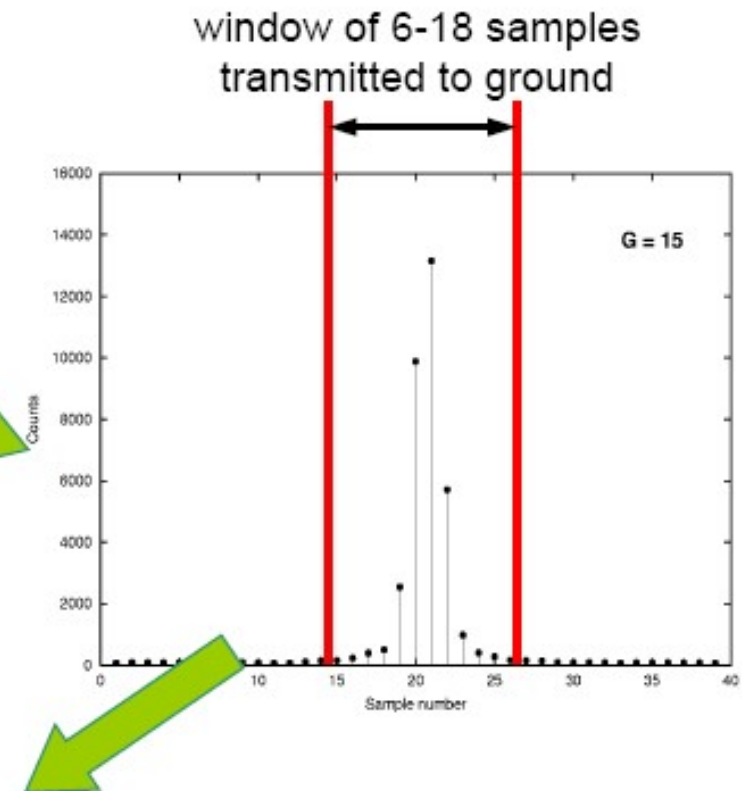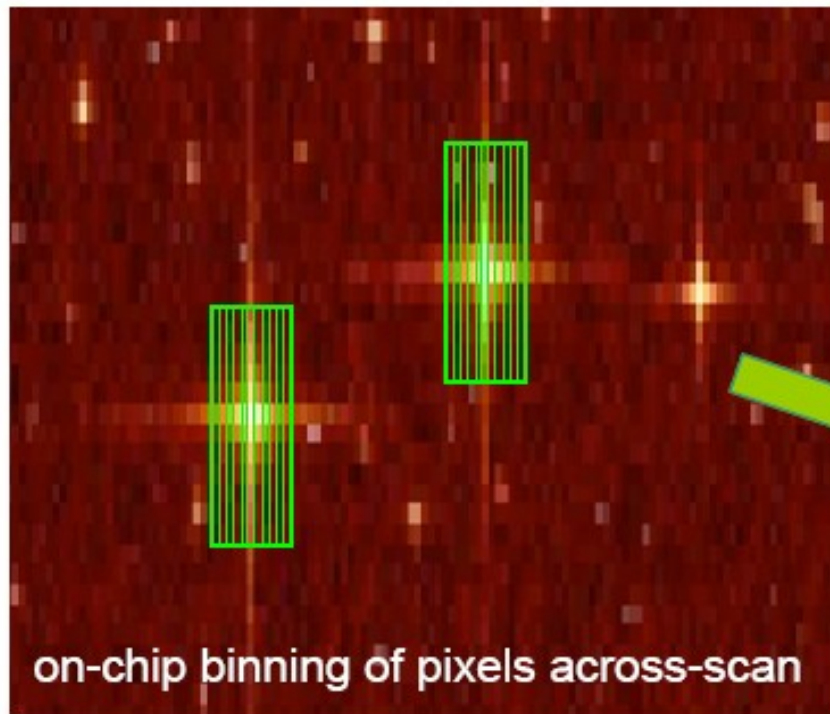
"Time of observation" for image centre

Data Processing and Analysis Consortium (DPAC)

DPAC organization

CU : Coordination Unit
DPC : Data Processing Centre

- Steering Committee
- Gaia Project Team
- DPACE
- Gaia Project Scientist
- Gaia Science Team

- CU1 System Architecture
- CU2 Simulation
- CU3 Core Processing
- CU4 Object Processing
- CU5 Photometric Processing
- CU6 Spectroscopic Processing
- CU7 Variability Processing
- CU8 Astrophysical parameters

- DPC ESAC
- DPC Barcelona
- DPC Torino
- DPC Cambridge
- DPC Geneva
- DPC CNES

Data Processing and Analysis Consortium (DPAC)

ESAC: 18 – Brazil: 3 - Canada: 2 – United States: 2

CU4: Object Processing

The object processing tasks include processing the astrometric and photometric data for more complex objects not handled by the astrometric core processing, specifically:

NSS : non-single stars (binary and multiple stars, exoplanets);
EO :   extended objects;
SSO : Solar System objects (asteroids, near-Earth objects, etc):

SSO :

- Management and implementation   (*Obs. de la Cote d'Azur*)
- Auxiliary data   (*Obs. de Paris - IMCCE*)
- Identification of known objects   (*Obs. de la Cote d'Azur*)
- **CCD processing**   (*INAF – Oss. Arcetri*)
- Astrometric reduction   (*Royal Obs. of Belgium*)
- Object threading   (*Obs. de Besancon*)
- Orbital inversion   (*Univ. of Helsinki*)
- Effects on Dynamics   (*Obs. de Paris - IMCCE*)
- **Physical parameters**   (*INAF – Oss. Torino*)
- Ground-based observations   (*Obs. de Paris - IMCCE*)
- Simulation   (*Obs. de la Cote d'Azur*)

What Gaia will do for asteroid science

A big, homogeneous catalogue of observations of about **3 × 10⁵** asteroids.

Extremely **accurate orbit determinations**, much better than those derived from the ground (~100 times better than present, even after 100 years).

Determination of **masses** (for about 100 objects) by means of measurements of mutual orbital perturbations, thanks to unprecedented astrometric accuracy.
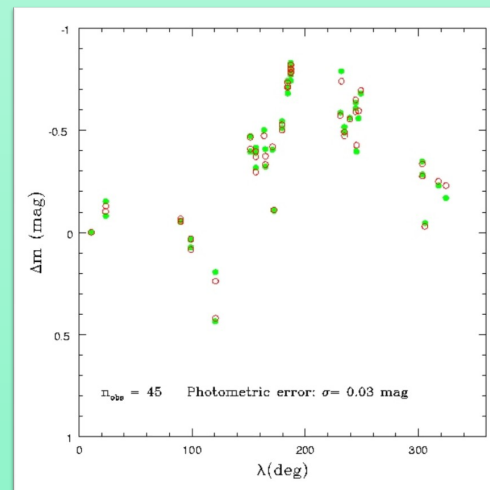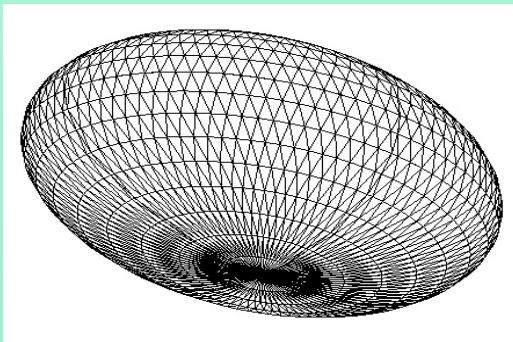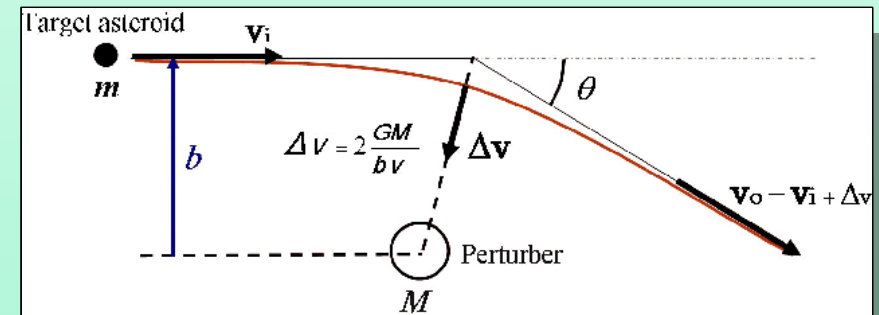
Determination of **shapes** and **poles** from disk-integrated photometry (~ **10.000** objects).

The End