Gaia Science Summary

- Astrometry and (Spectro)photometry 6-20 mag for 1 billion objects
- Radial Velocity Spectrometer 6-17 mag for 150 million objects
- Unbiased full sky survey
Gaia Status Summary

- Gaia has arrived to the launch site
- Launch campaign has started
- Launch scheduled on 20 November 2013 08:57:30 UTC
- Scientific Performance estimates unchanged
Science Topics

• Structure and dynamics of the Galaxy
• The star formation history of the Galaxy
• Stellar astrophysics
• Binaries and multiple stars
• Brown dwarfs and planetary systems
• Solar system
• Galaxies, Quasars and the Reference Frame
• Fundamental physics: General relativity
Payload and Telescope
Focal Plane

**Total field:**
- active area: 0.75 deg$^2$
- CCDs: $14 + 62 + 14 + 12 (+ 4)$
- 4500 x 1966 pixels (TDI)
- pixel size = 10 $\mu$m x 30 $\mu$m = 59 mas x 177 mas

**Sky mapper:**
- detects all objects to 20 mag
- rejects cosmic-ray events
- field-of-view discrimination

**Astrometry:**
- total detection noise $\sim 6$ e$^-$

**Photometry:**
- spectro-photometer
- blue and red CCDs

**Spectroscopy:**
- high-resolution spectra
- red CCDs

Figure courtesy Alex Short
1. $6 < G < 12$: bright-star regime (calibration errors, CCD saturation)
2. $12 < G < 20$: photon-noise regime, with sky-background noise and electronic noise setting in around $G \sim 20$ mag

Non-uniformity over the sky: 70% – 116%

End-of-mission parallax standard error [mas] vs $G$ [mag]
Hipparcos
Gaia & Hipparcos
Parallax statistics
Photometry Measurement Concept

Blue photometer: 330 – 680 nm

Red photometer: 640 – 1000 nm

Figure courtesy EADS-Astrium
Transit level integrated photometry
Spectro-photometry

- Illustrative spectra for G=15 mag stars (Jordi et al. 2010)
- Goals at G=15 mag e.g. extinction within 0.1 mag, surface gravity 0.2 dex, metallicity 0.2 dex and effective temperature within 200K (Bailer-Jones 2010)
Radial-Velocity Measurement Concept

Spectroscopy: 847 – 874 nm (resolution 11,500)

RVS grating and afocal field corrector

M5 & M6 fold mirrors

Figure courtesy EADS-Astrium
Spectroscopy

- Interstellar reddening, atmospheric parameters, and rotational velocities, for stars brighter than $G_{RVS} \approx 12$ mag (~5 million stars)
- provide element abundances for stars brighter than $G_{RVS} \approx 11$ mag (~2 million stars)

Single CCD S/N estimate
End-of-life Radial Velocity Errors
Sky-Scanning Principle

Spin axis: 45° to Sun
Scan rate: 60 arcsec s⁻¹
Spin period: 6 hours

Figure courtesy Karen O'Flaherty
- Done by our colleagues in the Data Processing and Analysis Consortium (DPAC)
- One billion objects observed on the average 70 times over 5 year mission is 40 million stars a day (and more than 400 million measurements a day)
- Spectroscopy of 150 million stars i.e. 10 million spectra a day of 3.3 million stars
Intermediate Data Releases

- Intermediate Data Release Scenario agreed to have a planning baseline
- Science Alerts as soon as possible
- L+22m positions, G-magnitudes, proper motions to Hipparcos stars, ecliptic pole data
- L+28m + first 5 parameter astrometric results, bright star radial velocities, integrated BP/RP photometry
- L+40m + BP/RP data, some RVS spectra, astrophysical parameters, orbital solutions for short period binaries
- L+65m + variability, solar system objects
- Scenario => Schedule when in-orbit performance known
Conclusions

- Launch campaign underway
- Payload Module is under electrical testing
- Sun Shield Deployment test 10-11 October
- S/C fuelling 2-5 November
- Launch 20 November