Gaia launch time talk

André Moitinho de Almeida
(SIM - U. Lisbon)

on behalf of the national collaboration for the Gaia DPAC and science exploration

Launch is comming

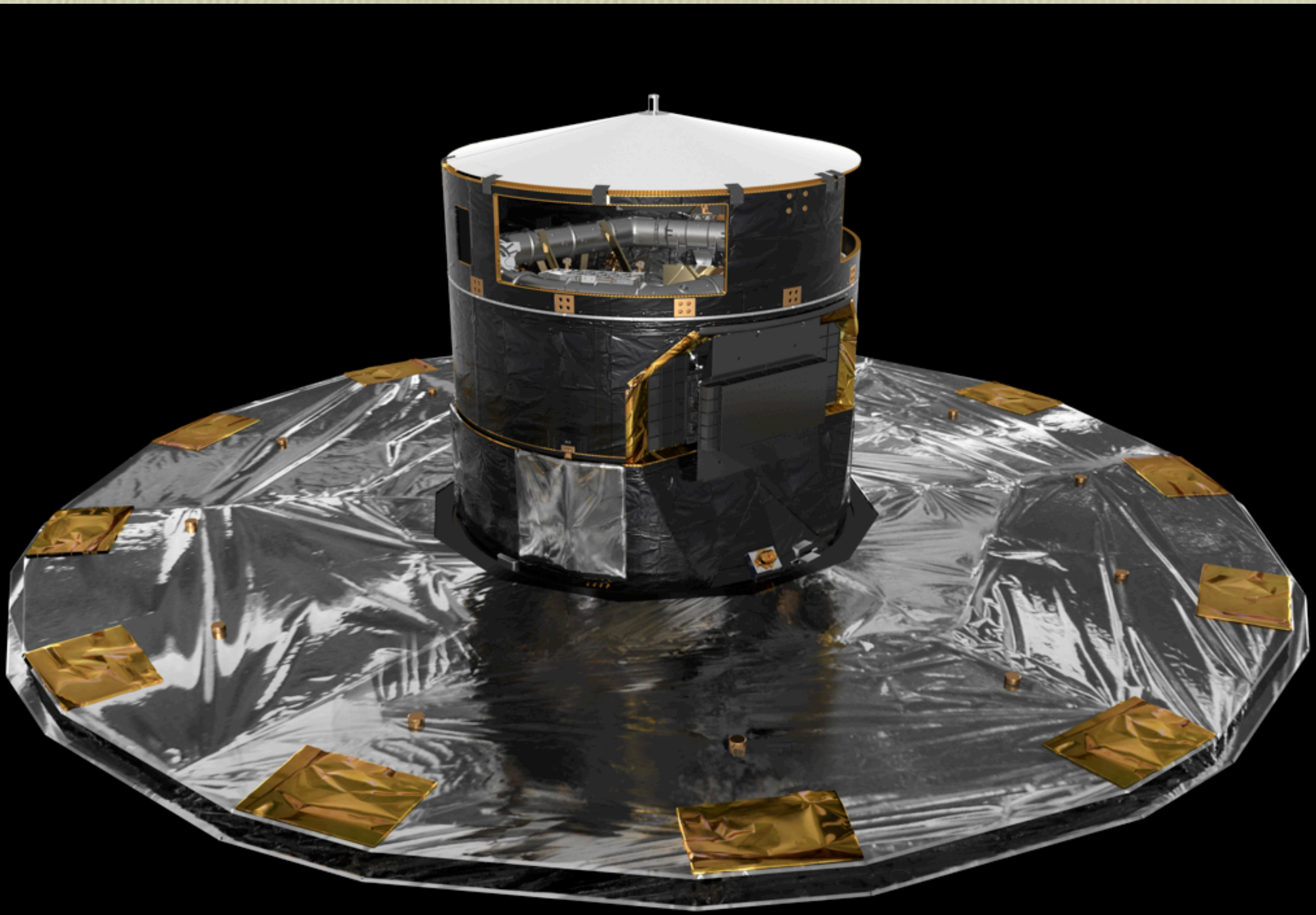
- Flight Acceptance Review completion 22 July authorising shipment to Kourou
- L
  - la
    - From: Timo Prusti <tprusti@rssd.esa.int>
      Subject: [gaia-gst] launch
      Date: 18 July2013 10:08:25 AM GMT+02:00
      To: Gaia Science Team <gaia-gst@rssd.esa.int>, dpace Executive <gaia-dpac-executive@rssd.esa.int>

      Dear Colleagues,

      Arianespace has allocated launch slot for Gaia in the window 17 November – 5 December. No formal decision from the higher ESA levels yet, but Giuseppe has cancelled the Antonov transport in August and Gaia s/c is now going to Kourou 4/5 September. Yet another unwanted one month delay (not caused by Gaia), but at least we have now a slot.

      Regards,
      Timo

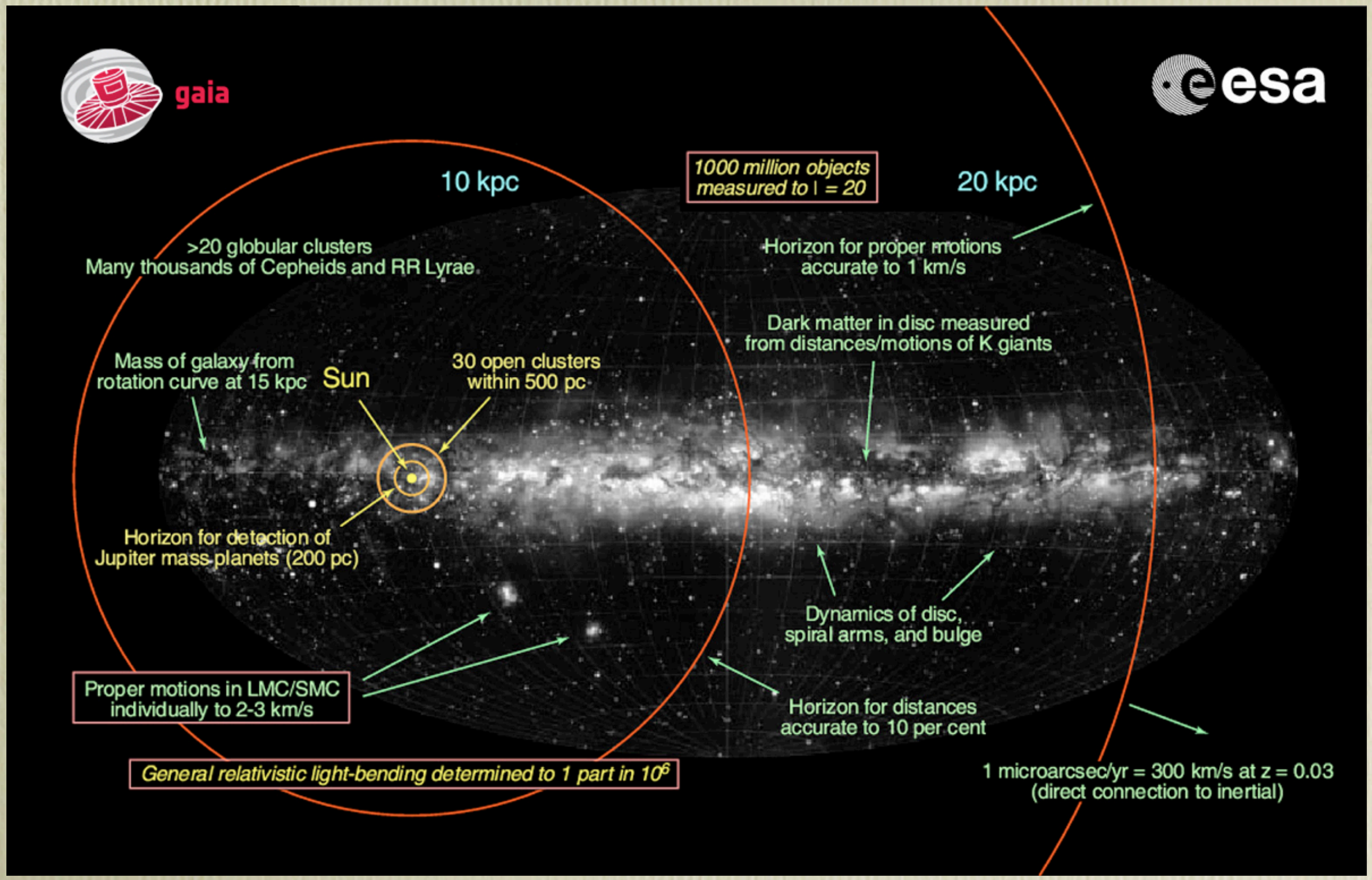
- Gaia ready, but so are other satellites ...



ASTRIUM

Overview

Gaia at 10% - The Milky Way in 3D



Complete, faint, accurate

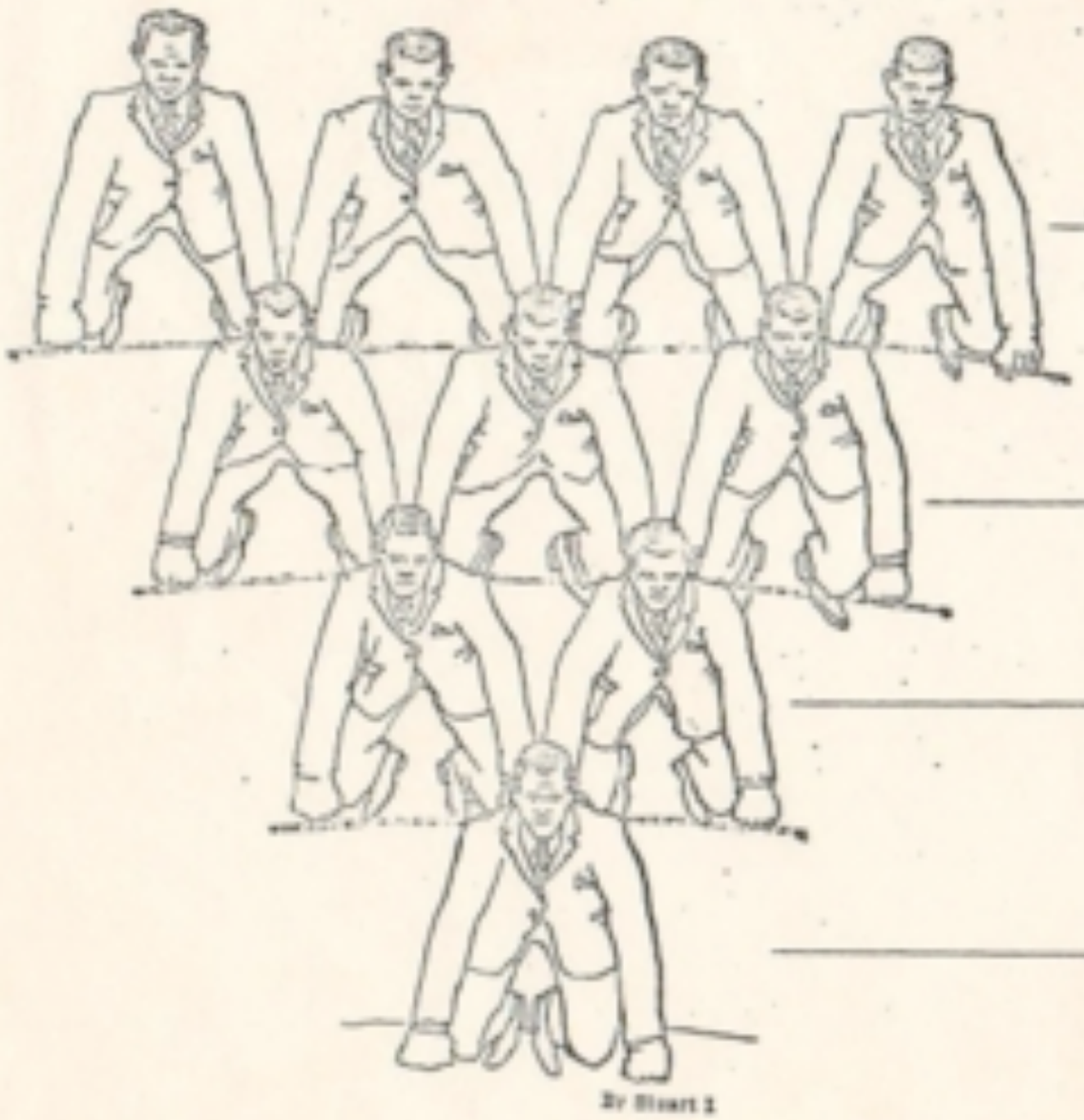
	Hipparcos	**Gaia**
Magnitude limit	12 mag	20 mag
Completeness	7.3 – 9.0 mag	20 mag
Bright limit	0 mag	6 mag
Number of objects	120,000	26 million to V = 15 250 million to V = 18 1000 million to V = 20
Effective distance	1 kpc	50 kpc
Quasars	1 (3C 273)	500,000
Galaxies	None	1,000,000
Accuracy	1 milliarcsec	7 μarcsec at V = 10 10 – 25 μarcsec at V = 15 300 μarcsec at V = 20
Photometry	2-colour (B and V)	Low-res. spectra to V = 20
Radial velocity	None	15 km s^{-1} to V = 17
Observing	Pre-selected	Complete and unbiased

Mission products

- Structure and evolution of the Milky Way
- Stellar physics, time resolved
- Exoplanets (astrometric, transits, ..)
- Solar system objects (including NEOs)
- Distance scale (Magellanic clouds)
- Reference frame
- Alerts, microlensing, quasars, SN & GRB can start already in 2014.
- General relativity
- Dark matter
- and more

THE ASTRONOMICAL PYRAMID

ILLUSTRATING THE INTERDEPENDENCE OF THE VARIOUS AREAS OF STUDY



COSMOLOGISTS, GENERAL RELATIVISTS, CRANKS,
OTHER FUZZY-BRAINED PENCIL-PUSHERS.

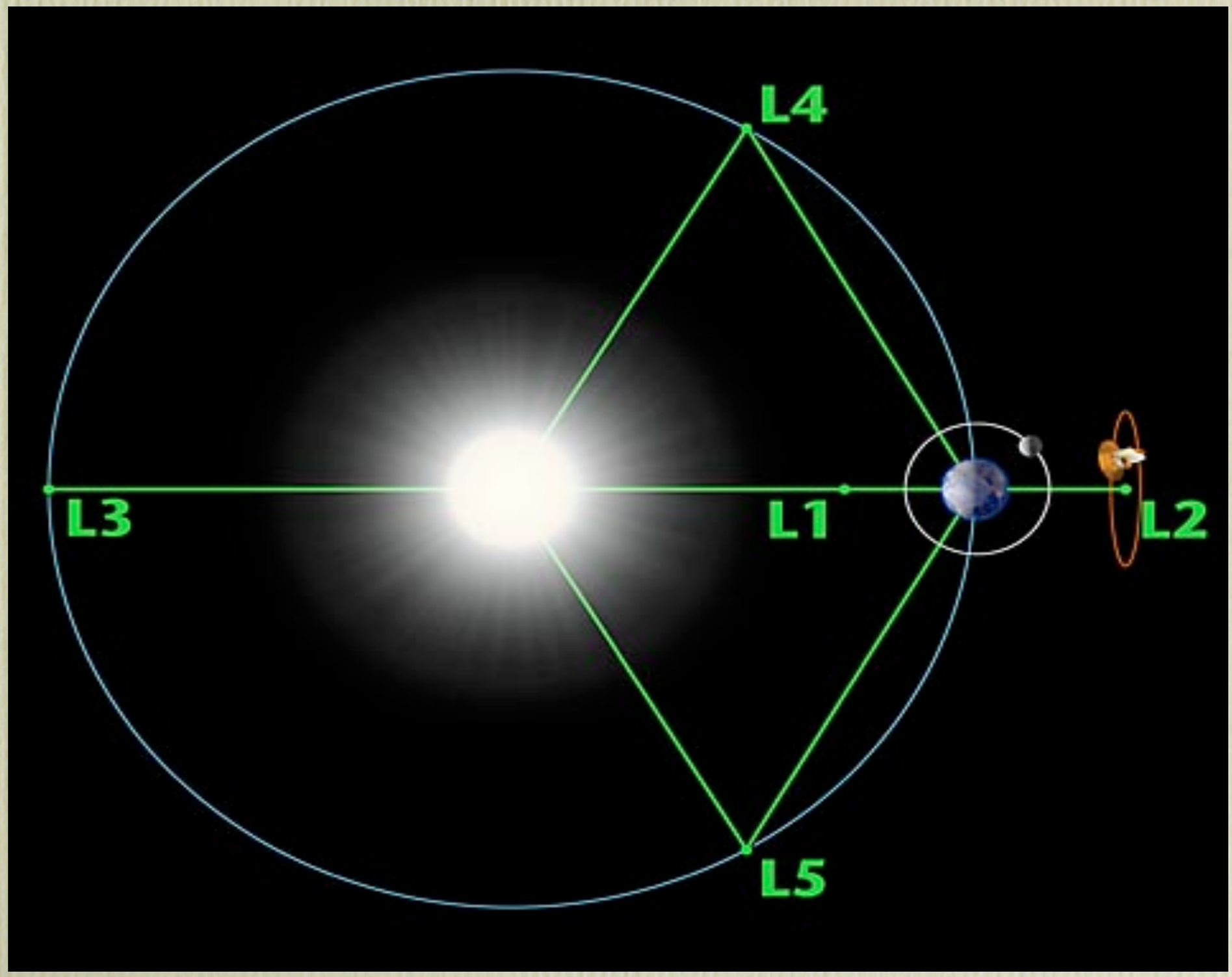
ATMOSPHERES, INTERIORS, INTERSTELLAR MED.
THEORISTS

SPECTROSCOPISTS PHOTOMETRISTS

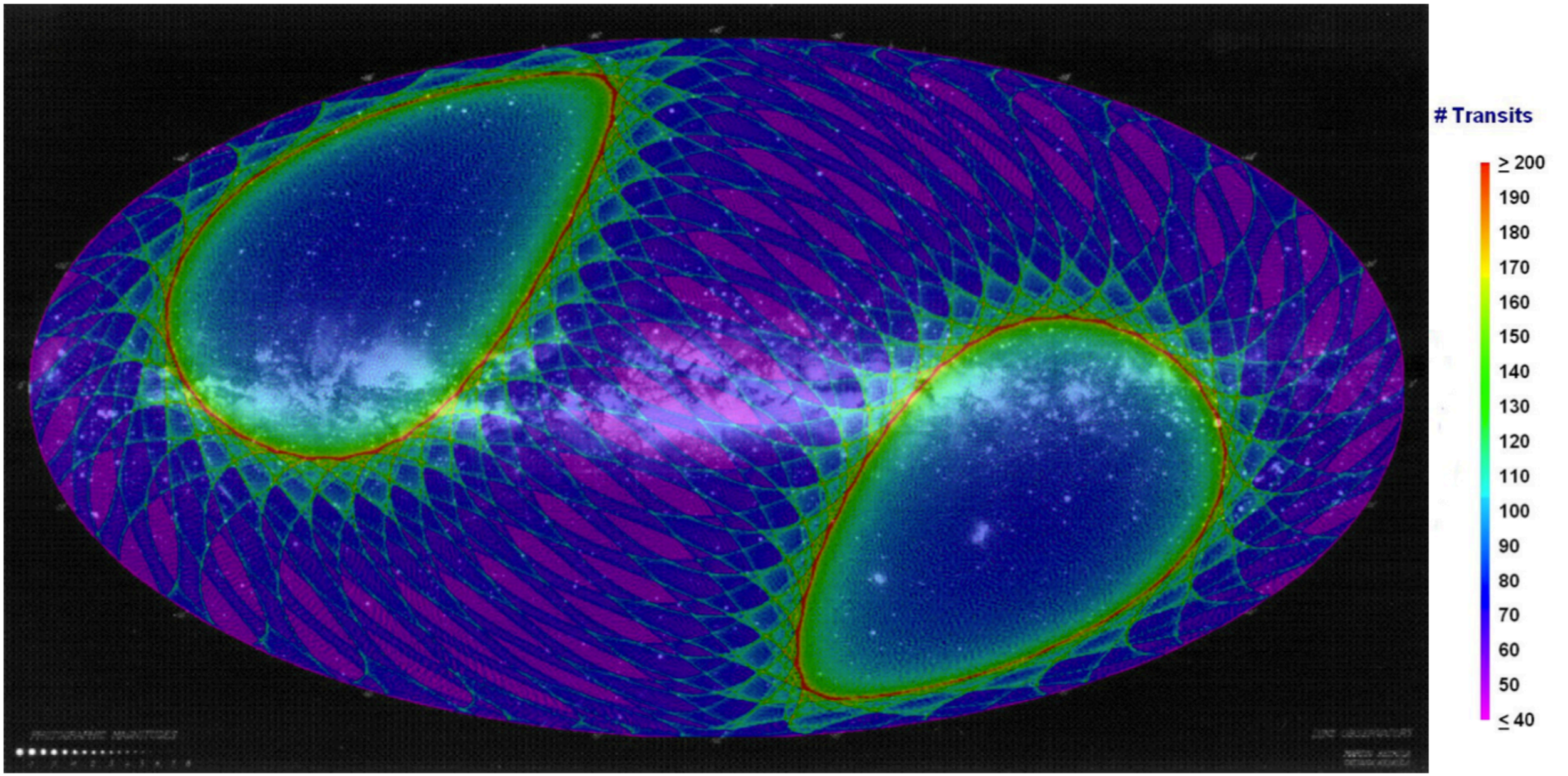
ASTROMETRISTS

GET BACK TO BASICS -- SUPPORT ASTROMETRY

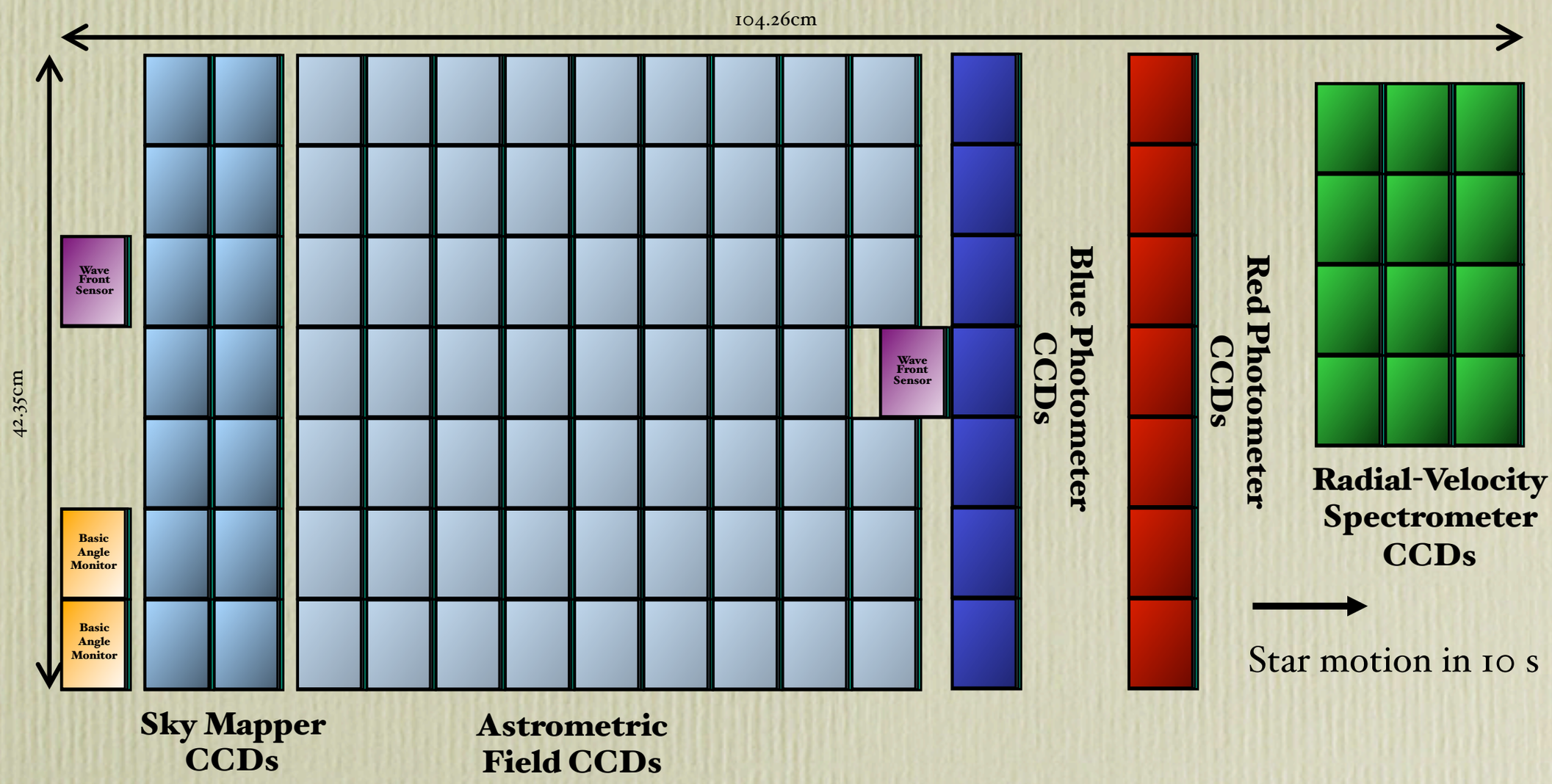
The sky as seen by Gaia - I



The sky as seen by Gaia - II



Focal Plane - 106 CCD, 938 million pixels



Total field:
- active area: 0.75 deg²
- CCDs: 14 + 62 + 14 + 12 (+ 4)
- 4500 x 1966 pixels (TDI)
- pixel size = 10 µm x 30 µm
  = 59 mas x 177 mas

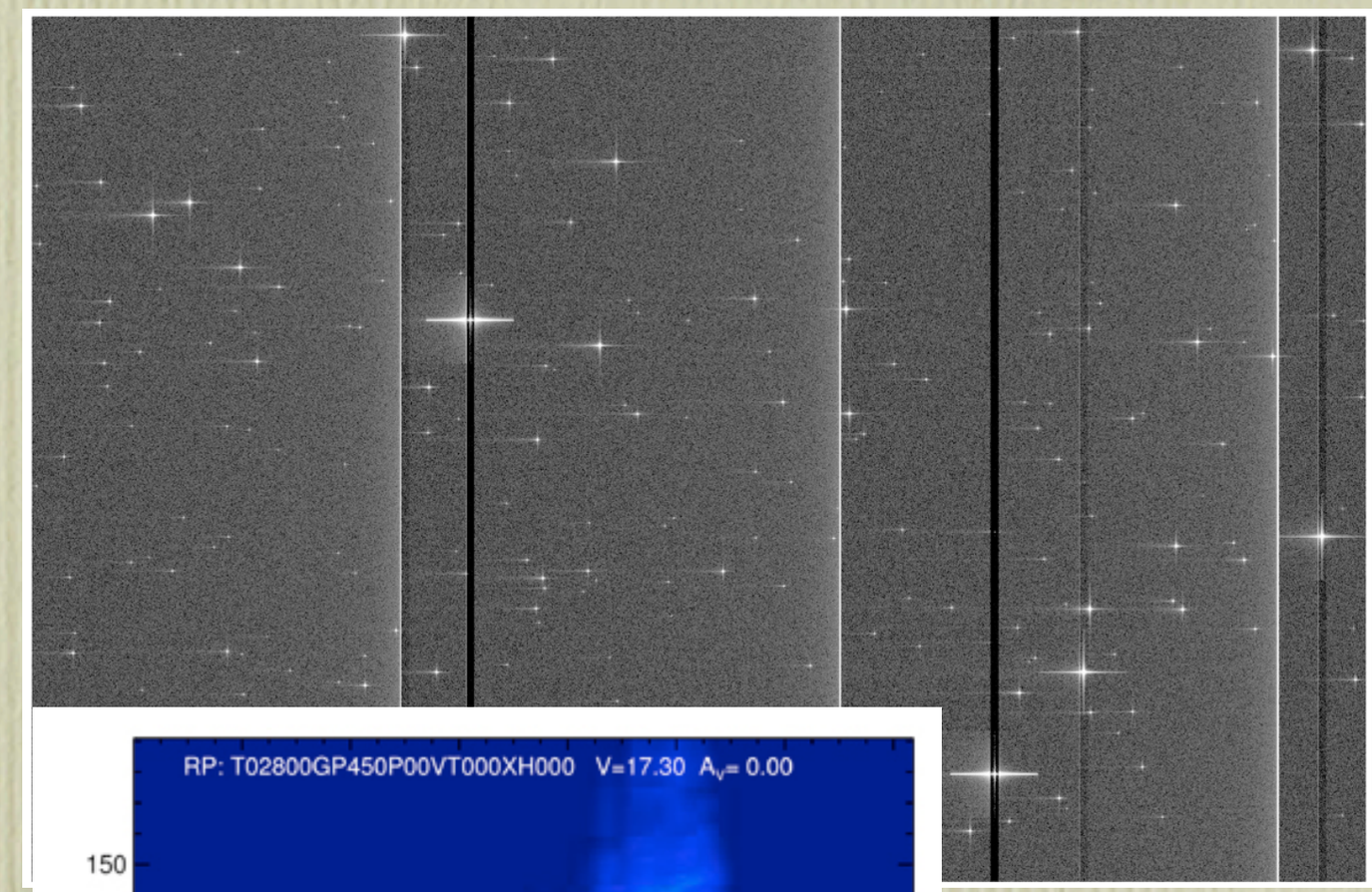
Sky mapper:
- detects all objects to 20 mag
- rejects cosmic-ray events
- field-of-view discrimination

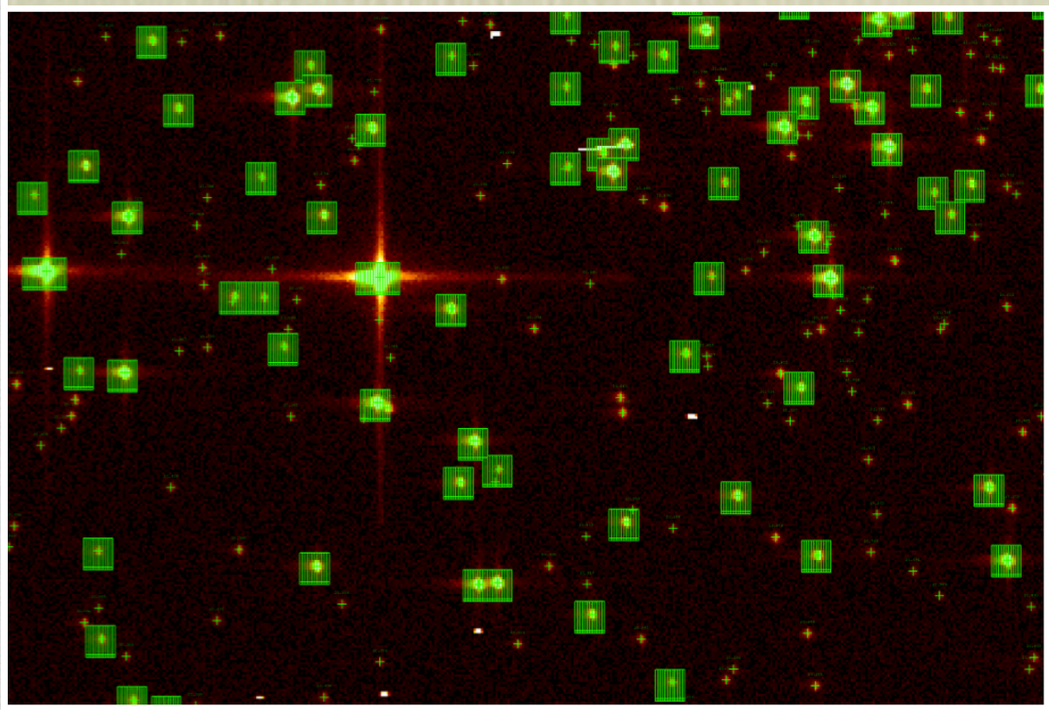
Astrometry:
- total detection noise ~ 6 e^-

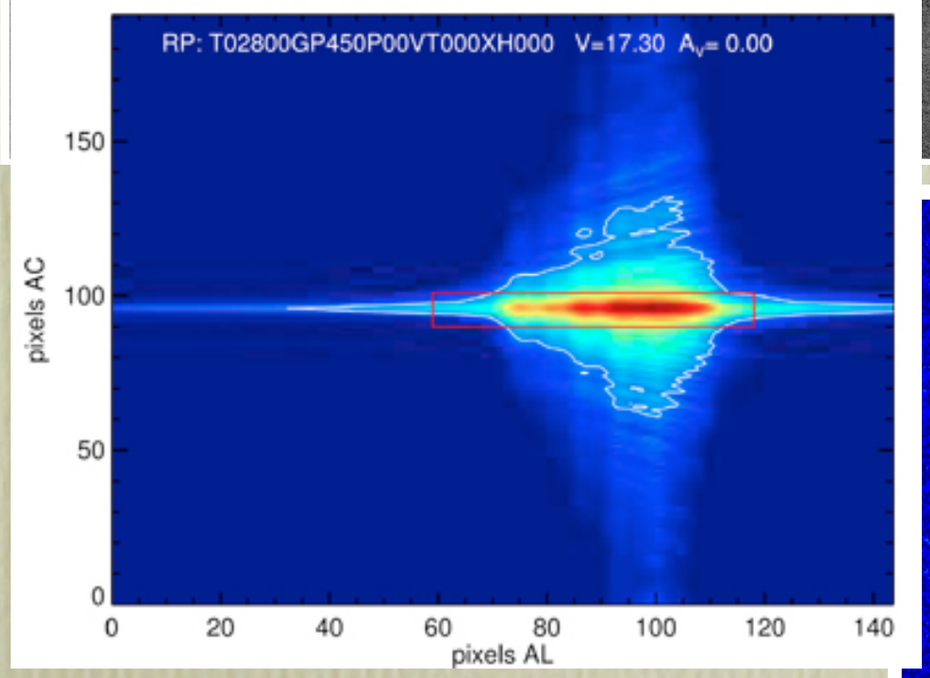
Photometry:
- spectro-photometer
- blue and red CCDs

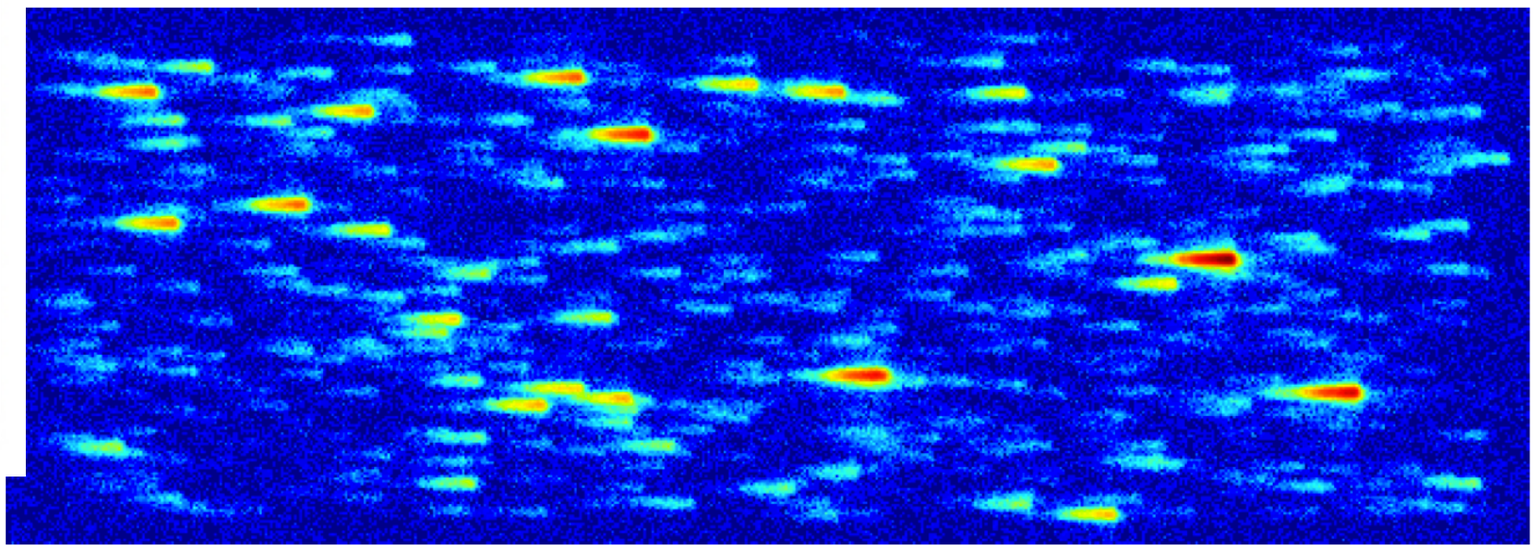
Spectroscopy:
- high-resolution spectra
- red CCDs

The sky as seen by Gaia - III









Industrial participation in Gaia

United Kingdom
- ABSL
- e2v Technologies
- EADS Astrium
- MSSL
- Selex Systems

Ireland
- Mc Ginley

France
- Boostec
- EADS Astrium
- Intespace
- Latelec
- Onera
- Sagem
- SESO

Spain
- Crisa
- EADS Casa
- Mier
- Rymsa
- Sener
- Thales Alenia Space

Portugal
- Deimos
- Ineti
- Lusospace
- Skysoft

Italy
- Selex Galileo
- SILO
- Thales Alenia Space

USA
- Arde
- Barr
- Maxwell

Netherlands
- Dutch Space
- SSBV
- TNO

Norway
- Kongsberg
- Prototech

Finland
- Patria
- SSF

Sweden
- RUAG Space

Denmark
- Rovsing
- Terma

Germany
- EADS Astrium
- IOF
- Schunk GmbH
- Zeiss

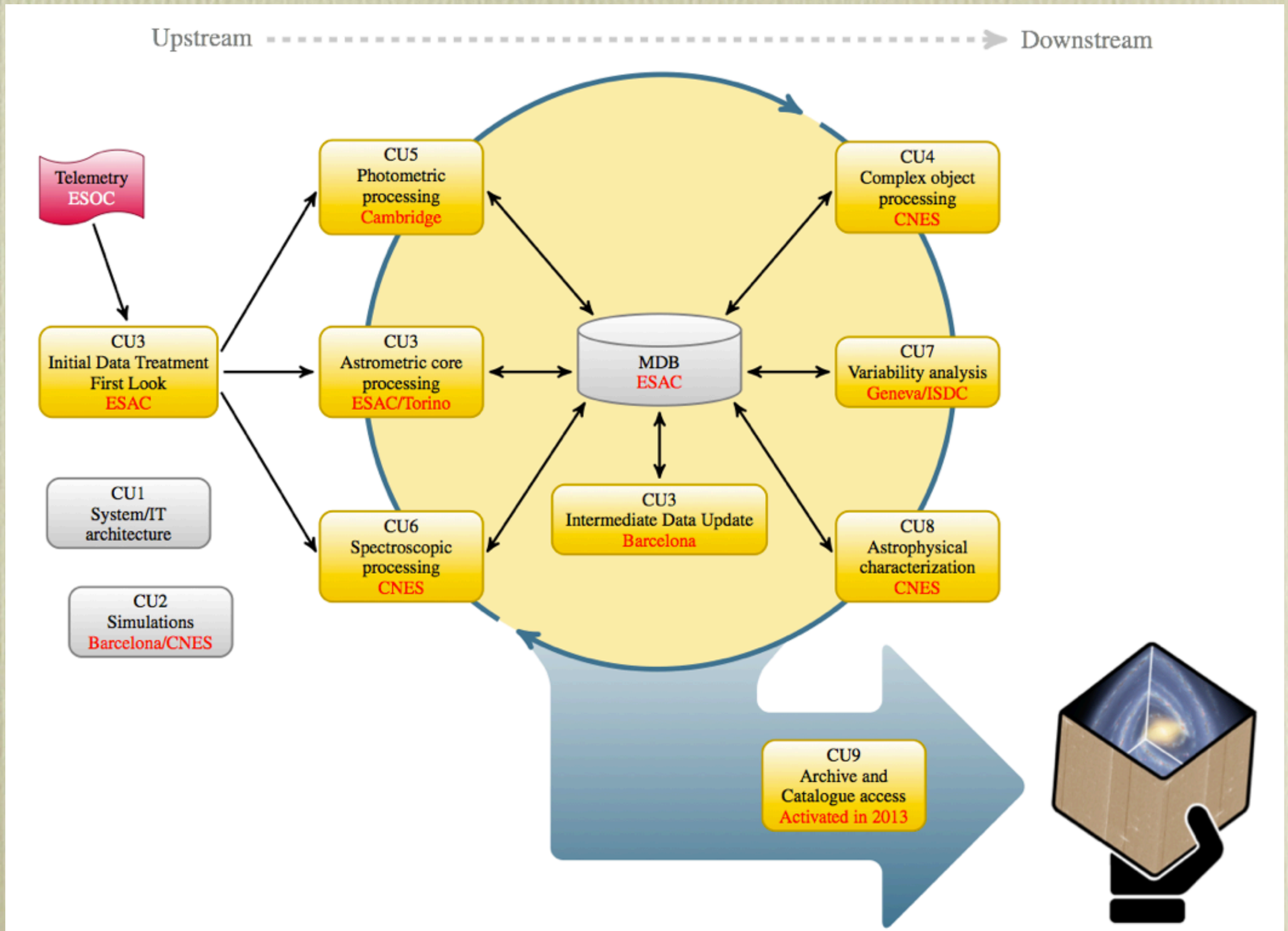
Belgium
- AMOS
- CSL
- SpaceBel
- Thales Alenia Space

Switzerland
- APCO
- RUAG Space
- SpectraTime
- Syderal

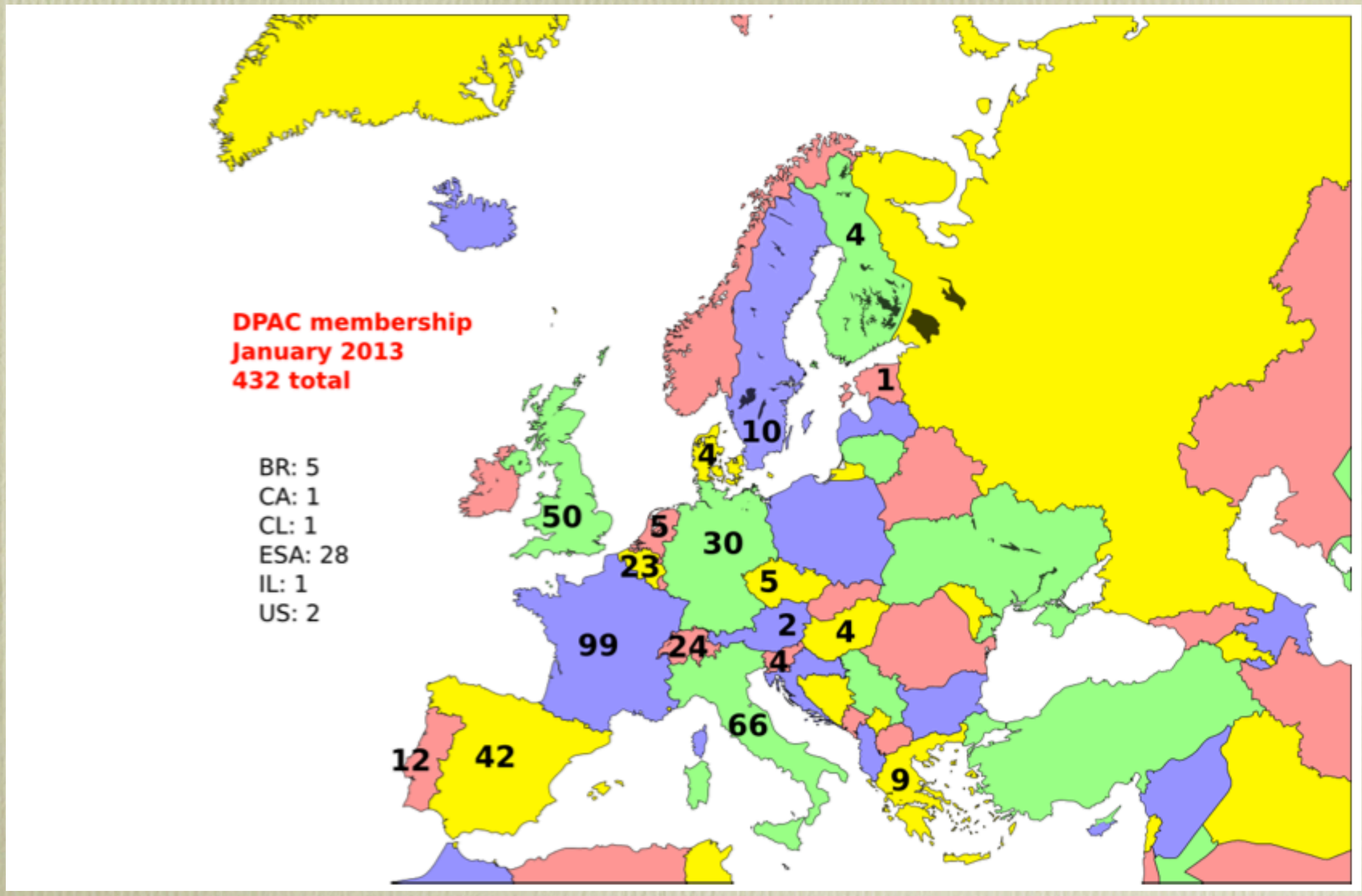
Austria
- RUAG Space
- Siemens

©NASA/Goddard Space Flight Center Scientic Visualization

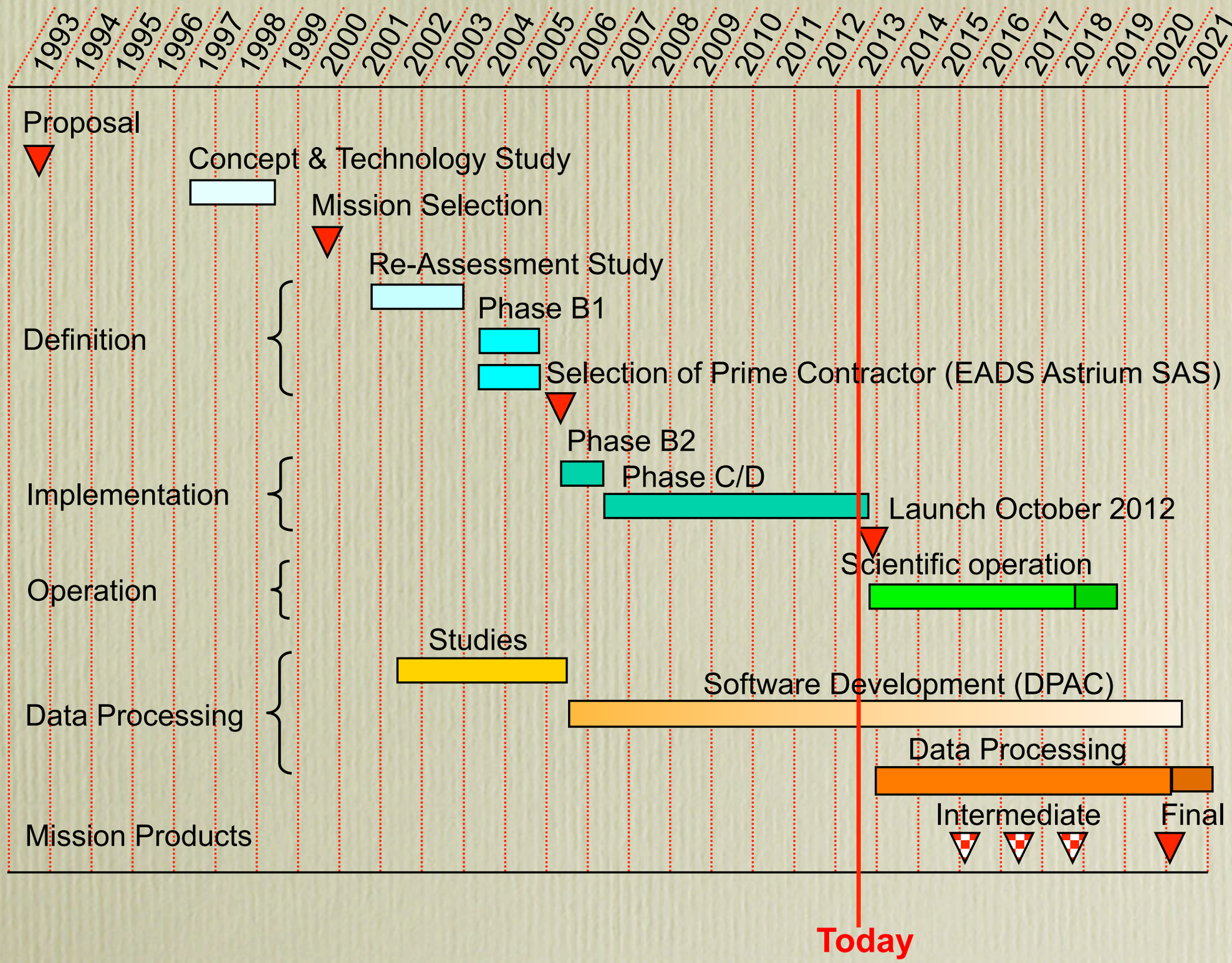
Data Processing - the DPAC



DPAC membership as of January 2013



Schedule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2018
2019
2020
2021
Proposal
Concept & Technology Study
Mission Selection
Re-Assessment Study
Definition
Phase B1
Selection of Prime Contractor (EADS Astrium SAS)
Phase B2
Implementation
Phase C/D
Launch October 2012
Operation
Scientific operation
Studies
Software Development (DPAC)
Data Processing
Data Processing
Intermediate
Final
Mission Products
Today

National participation

History

- Started in 2006 (industry started before) just in time for the DPAC AO response
- Emails circulated, meeting organised
- Broad range of interests: several sub-fields of astronomy, optical engineering, data acquisition and storing, artificial intelligence
- Original participants (DPAC): ~12 from SIM, INETI, UNINOVA, U. Coimbra, CICGE, CAUP, CAAUL, + Holos, Critical Software
- Now (DPAC, Sci. exploration): ~12 from SIM, UNINOVA, CICGE, CAAUL, U. Coimbra

Funding

- May 2006-Aug 2007 funding from Centres, 1 trip from GRICES
- 2007-2011 - PDCTE - 265.000 Eur
- 3 CIÊNCIA contracts
- 1.5 FCT Postdocs
- 2012-2013 - standard FCT project - 120.000 Eur
- 2014-2016 - FP7 (for specific WP)
- 2014-... ???
- 2010-2015 - Some support from GREAT

Activity - I

- CU1 - System architecture:
  - Data Base interface and infrastructure. Done
  - Support to national distributed data processing
- CU2 - Data Simulations:
  - Optical Instrument Model
- CU3 - Core Processing
  - Reference frame
  - Definition and acquisition of auxiliary data
- CU4- Object Processing:
  - Image reconstruction of extended objects

Activity - II

- CU7 - Variability Processing:
  - Quality control (bias estimation)
  - Unsupervised classification

- CU8 - Astrophysical Parameters:
  - Luminosity, Age and Mass determinations. Done

- CU9 - Catalogue Access
  - Visualisation

Activity - III

Gaia has no proprietary data rights

- Science Preparation (GREAT):
    - Memberships of stellar populations
    - Galactic structure. MCMC machinery.
    - Synergies with other surveys
    - Minor solar system bodies
    - GRB (and first stars) detectability
    - Quasars
    - Gaia-ESO

- Organised several DPAC and GREAT meetings

Gaia General

- Home
- Science performance
- Data release scenario
- DPAC
- Gaia vacancies
- Contact us

Gaia Resources

- Who's who in Gaia?
- Calendar of meetings
- Library & Livelink
- Tools, data & software
- Related sites

Gaia Outreach

- Calendar of outreach events
- Flyers
- Posters
- Information sheets
- Presentation material
- Image & movie gallery
- Gaia in the media
- Educational material

Restricted Items

- IT Services
- Document Portal
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Picture of the Week

"Gaia" meets at Gaia - with entertaining side effects

Last month, a very special place on this planet saw two consecutive Gaia meetings, namely the AGIS meeting and the CU3 plenary meeting. Upon an invitation of CU3 members at the

Picture of the Week archive

2013

- 07/11: Model Soyuz Fregat video
- 07/01: Acoustig Testing
- 06/21: SOVT
- 06/03: CU4 meeting #15
- 04/04: DPCC (CNES)
- 03/26: Gaia artist impression
- 02/11: Gaia payload testing
- 01/04: Space flyby with Gaia-like data

2012

- 12/10: DPAC OR#2. Testing with Planck
- 11/05: Galaxy detection with Gaia
- 10/09: Plot of part of the GUMS-10 catalogue
- 07/23: "Gaia" meets at Gaia
- 06/29: The Sky as seen by Gaia
- 05/31: Panorama of BAM clean room
- 03/29: GREAT school results
- 03/12: Scanning-law movie
- 02/21: Astrometric microlensing and Gaia
- 02/03: BAM with PMTS
- 01/12: FPA with all the CCDs and WFSs

2011

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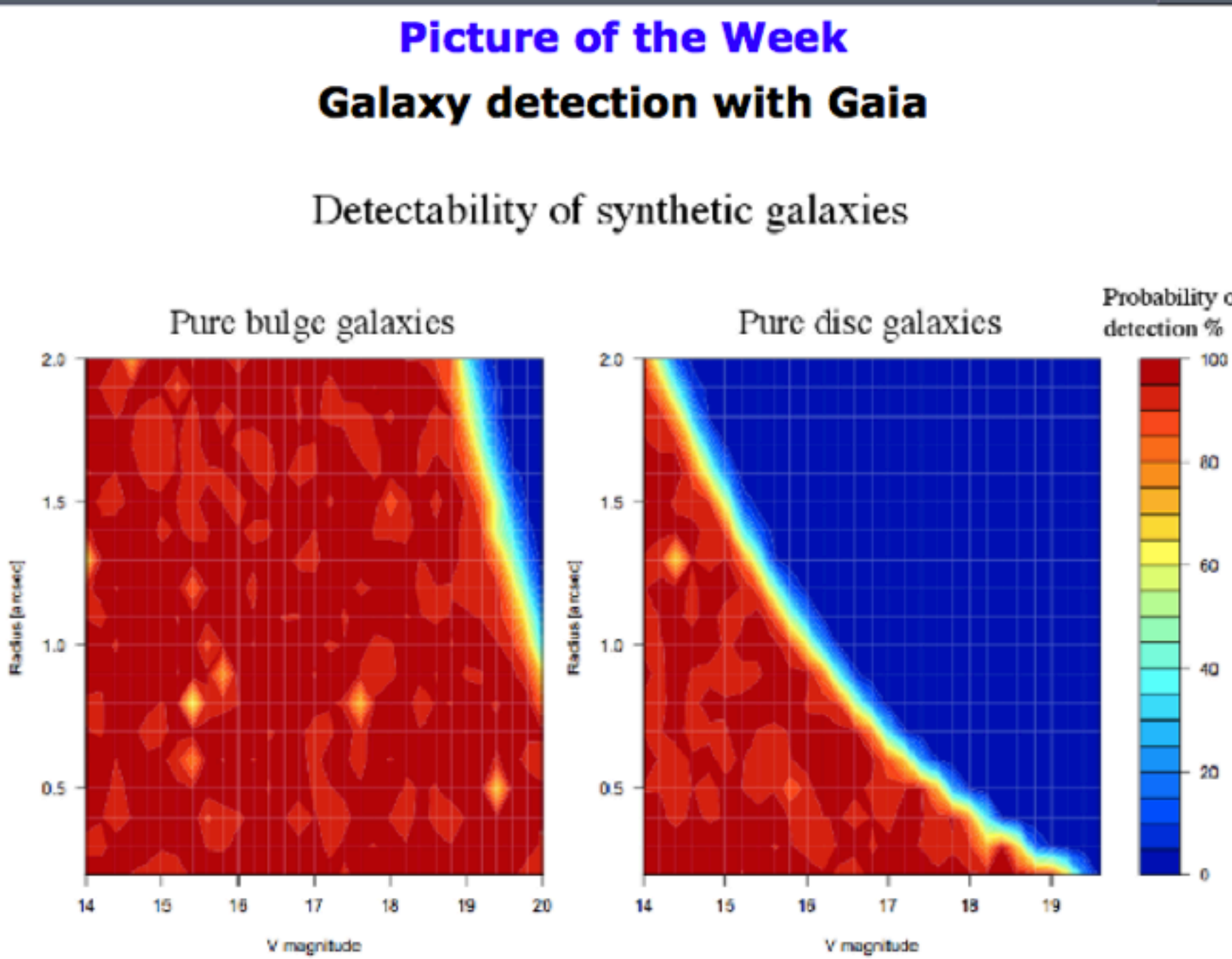
Galaxy detection with Gaia



Gaia's main goal is to study our Galaxy and its stellar content and to provide us with their highly accurate astrometric and photometric parameters. However the satellite will also survey many others objects. Especially Gaia will observe a few millions of galaxies and will give us a unique chance to access a whole sky survey of these objects, something that no ground-based survey has ever recorded. The high resolution of Gaia's observations,

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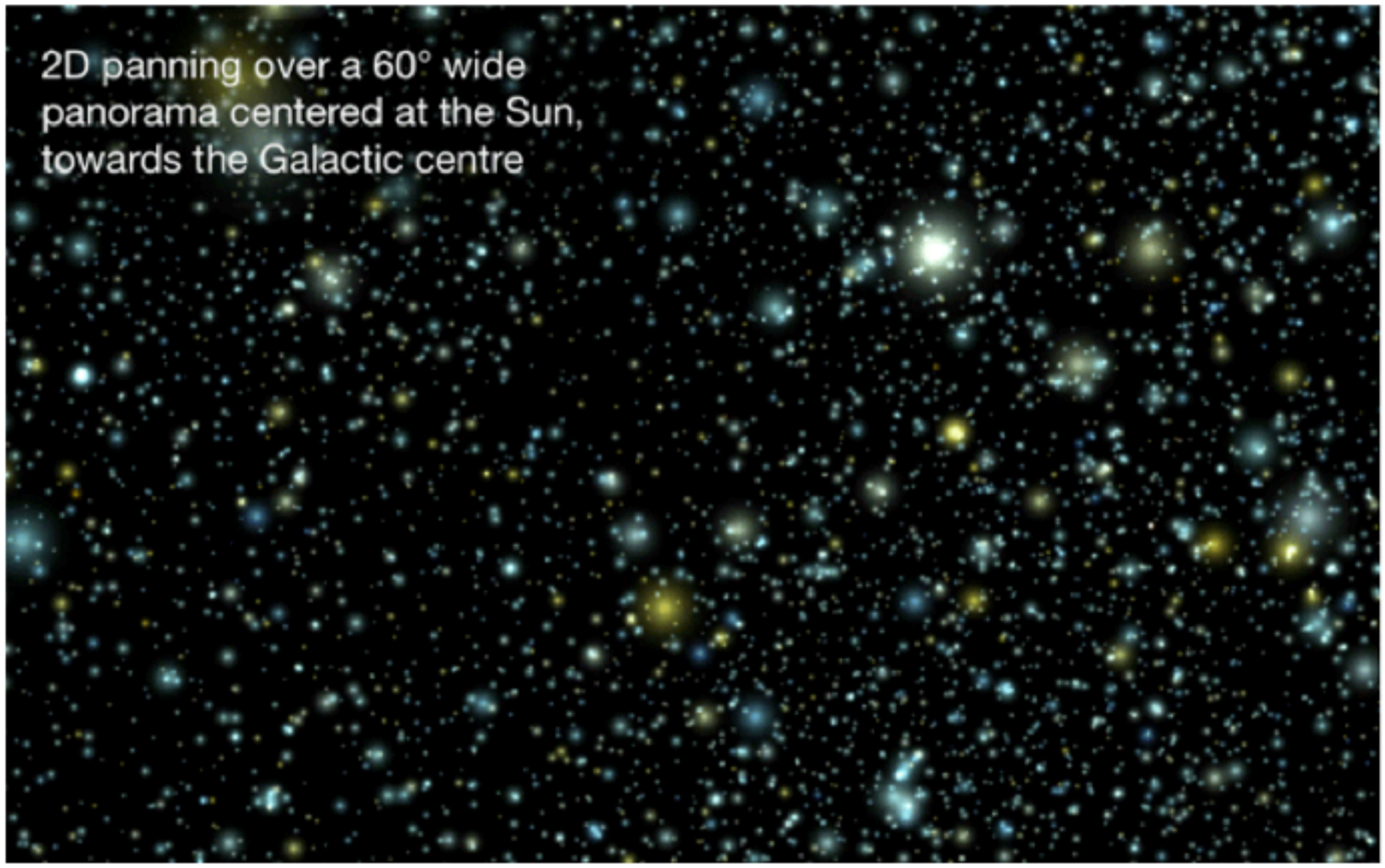
Space flyby with Gaia-like data



Credits:

- SIM - University of Lisbon (www.sim.ul.pt)
- CA3 - UNINOVA (http://www.ca3-uninova.org)

Download the mov file (198M) to see the complete movie.

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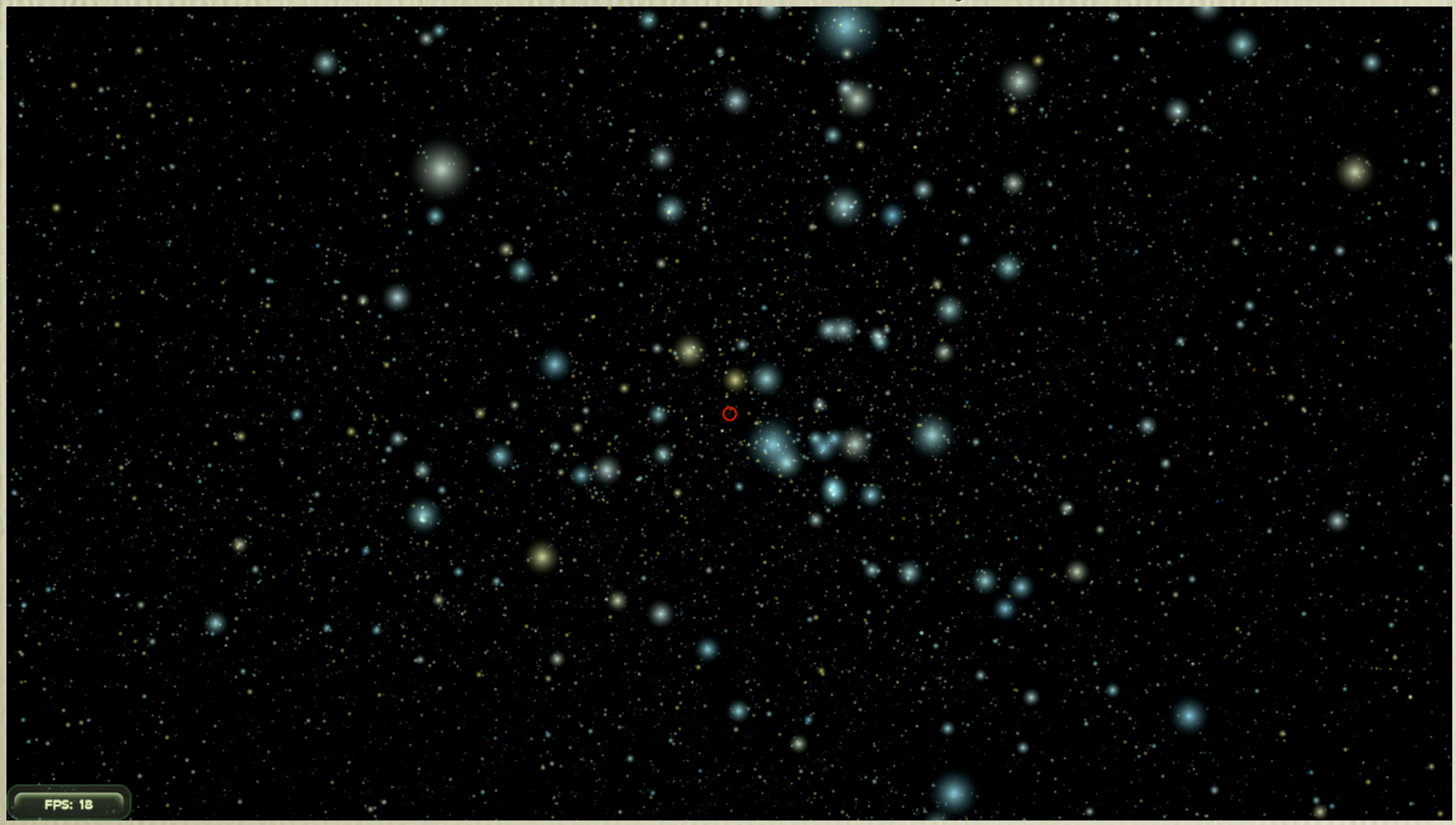
2011

CSI-VEGA

Sun seen from the back side of the Hyades



Lessons learned

- People come and go: reflects on degree of participation
- Junior technicians are essential
- Panels underestimate the importance of attending the collaboration meetings
- There is no adequate mechanism in Portugal for supporting large teams and/or long term missions
- Decision making process in FCT has an extremely volatile memory and emits contradictory messages to community and evaluators.
- Adaptation, cold blood! Insistence…