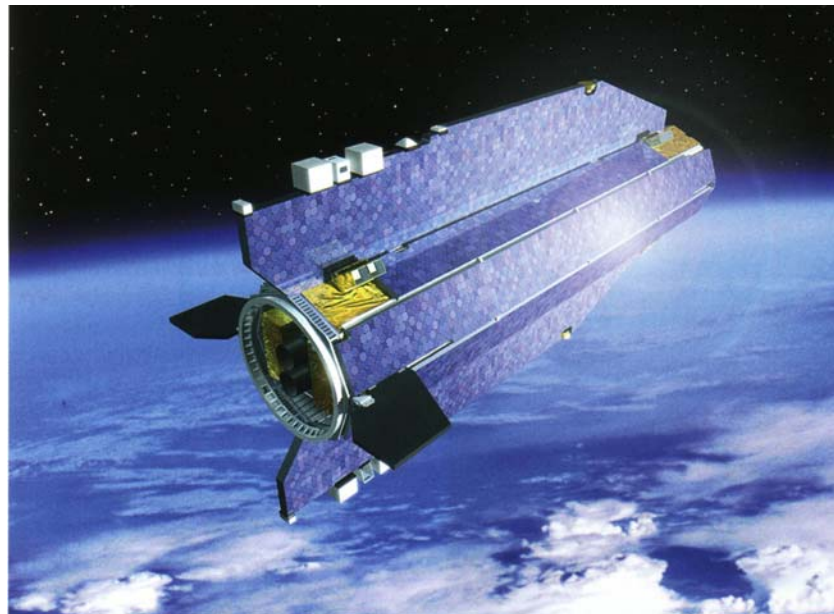


High Level Processing Facility for GOCE: Products and Processing Strategy

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1. The High Level Processing Facility

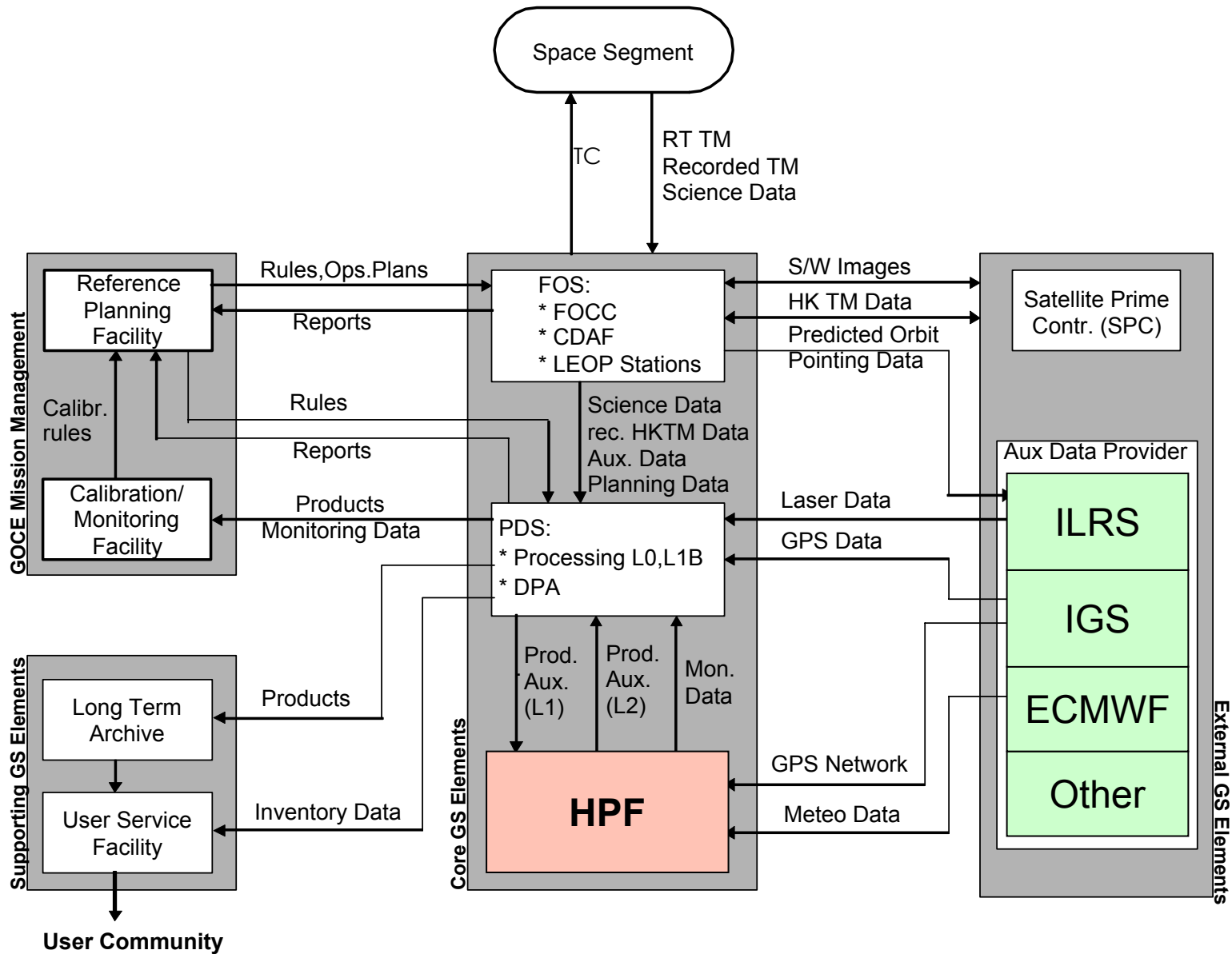
- **Tasks**
- **Architecture**

2. Processing Strategy

3. Level 2 Products

4. Conclusions

GOCE Ground Segment



Tasks

1. Generation of **level 2 products** from level 1b data generated by the PDS (nominal and calibration products for the gradiometer and the GPS-receiver).
e.g. Nominal gradiometer level 1b products content:
 - Control & polarisation voltages
 - Nominal & internal calibrated linear and angular accelerations
 - Nominal & internal calibrated common and differential accelerations
 - Nominal gradiometer angular accelerations & angular rates
 - Gradiometer inertial attitude quaternions
 - Gravity gradient tensor in the gradiometer reference frame and transformation matrix to the inertial frame
2. Generation of GOCE **calibration and validation products**:
 - External calibration of gradiometer data
 - Quick-look gravity field and orbit solutions for data validation
3. Acquisition of **auxiliary data** needed for level 2 products generation.

Architecture

1. The **European GOCE Gravity Consortium (EGG-C)** has submitted a proposal to ESA covering the HPF development and operations. The proposal is currently under review by ESA.
2. EGG-C is composed of 10 European institutes working in the field of gravity field research and orbit determination (see map).
3. The HPF is planned to be a **distributed system** composed of a central processing facility (located at SRON) and several sub-processing facilities (located at various institutes of EGG-C members).
3. The HPF will be **led by a Principal Investigator** (Reiner Rummel) **and a management team** composed by IAPG (Th. Gruber) and SRON (R. Koop). The main contract for the HPF will be signed between ESA and IAPG. High-level work packages will be sub-contracted to EGG-C members.

Geographical Architecture

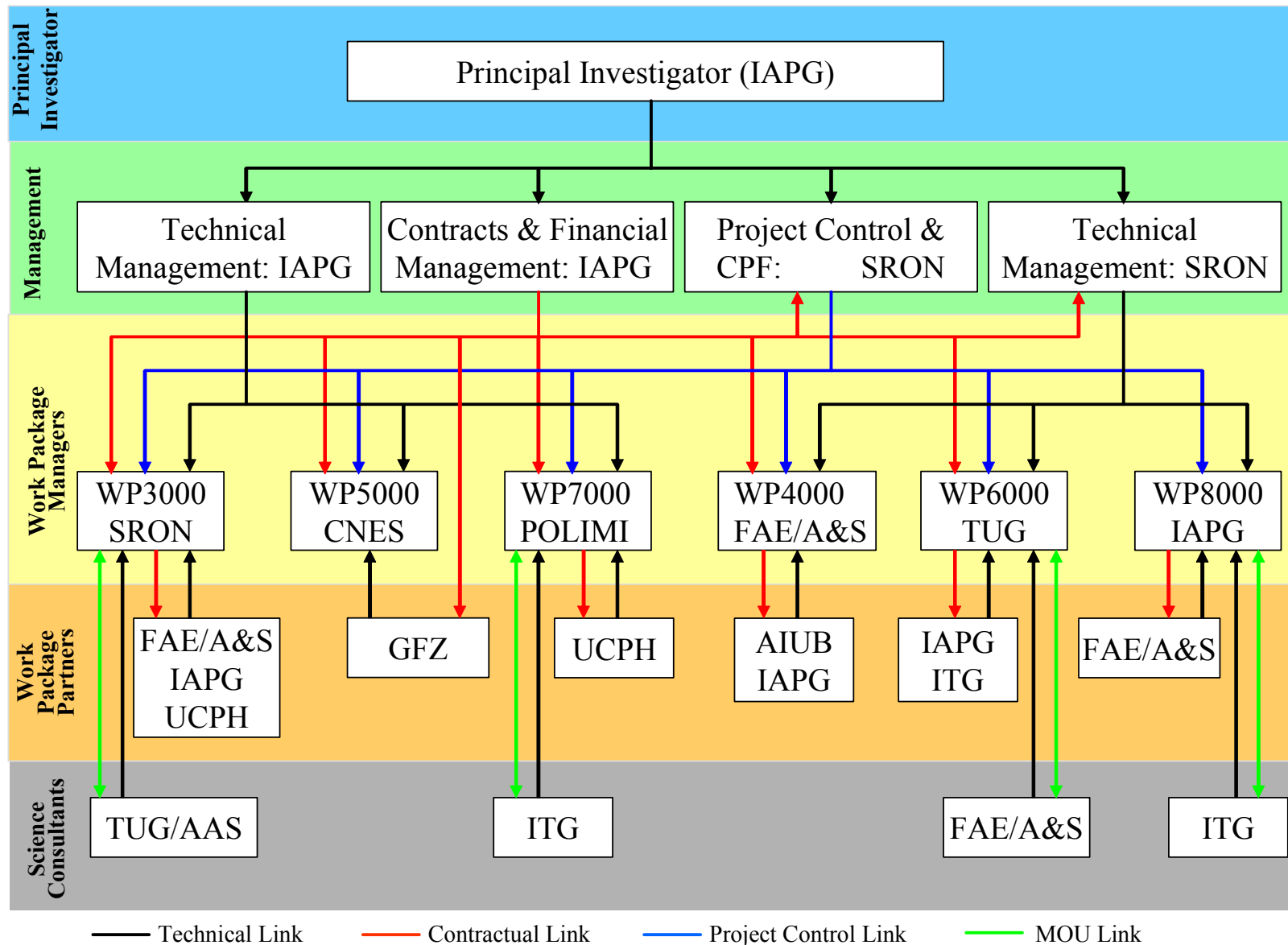
- AIUB: Astronomical Institute University Bern
- CNES: Centre Nationale d'Etudes Spatiale, Toulouse
- FAE/A&S: Delft University of Technology, Faculty of Aerospace Engineering
- GFZ: GeoForschungsZentrum Potsdam
- IAPG: Institute of Astronomical and Physical Geodesy, Techn. University Munich
- ITG: Institute for Theoretical Geodesy, Univ. Bonn
- POLIMI: Politecnico di Milano
- SRON: National Institute for Space Research, The Netherlands
- TUG: Institute of Navigation and Satellite Geodesy, Techn. University Graz
- UCPH: Department of Geophysics, University Copenhagen



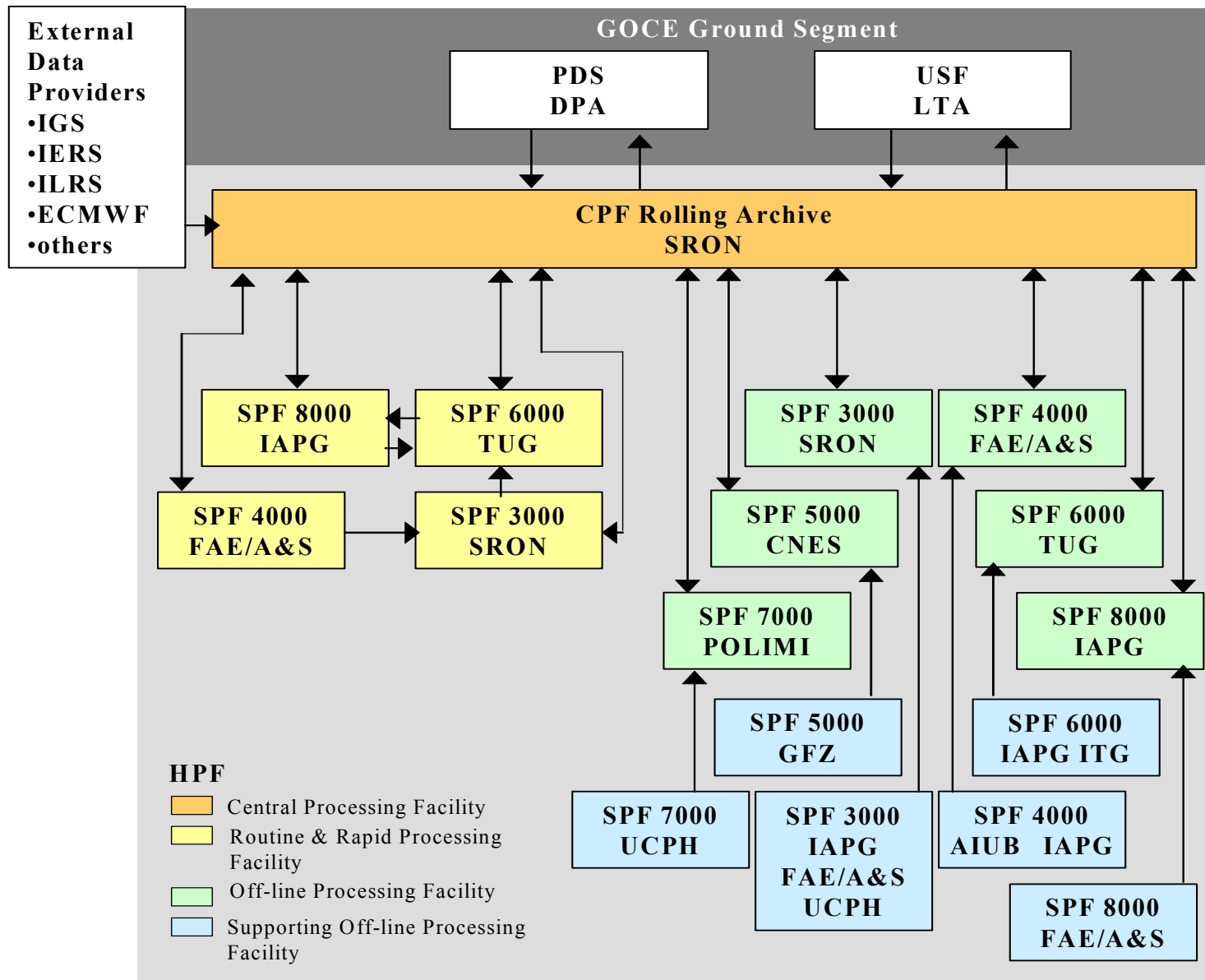
Work Package Architecture

WP ID	WP Description	Responsibility
WP3000	Scientific Pre-processing and External Calibration <ul style="list-style-type: none"> • Gradiometer External Calibration • Corrections for Temporal Gravity (tidal & non-tidal) • Data Screening and Data Gaps 	SRON
WP4000	Orbit Determination <ul style="list-style-type: none"> • Rapid Science Orbits (kinematic & reduced dynamic) • Precise Science Orbits (kinematic & reduced dynamic) 	FAE/A&S
WP5000	Gravity Field Determination – Direct Approach <ul style="list-style-type: none"> • SST: Orbit Perturbation; SGG: Normal Equations • Combination by Normal Equations 	CNES
WP6000	Gravity Field Determination – Time-wise Approach <ul style="list-style-type: none"> • SST: Energy Conservation; SGG: Semi-Analytical & Normal Equ. • Combination by Normal Equations • Quick-Look and Precise Solutions 	TUG
WP7000	Gravity Field Determination – Space-wise Approach <ul style="list-style-type: none"> • SST: Energy Conservation; SGG: Wiener Filtering • Combination by Collocation 	POLIMI
WP8000	Level 2 Products Validation <ul style="list-style-type: none"> • Extensive Validation Reports, Recommendation of Final Products by independent committee. 	IAPG

Organisational Architecture

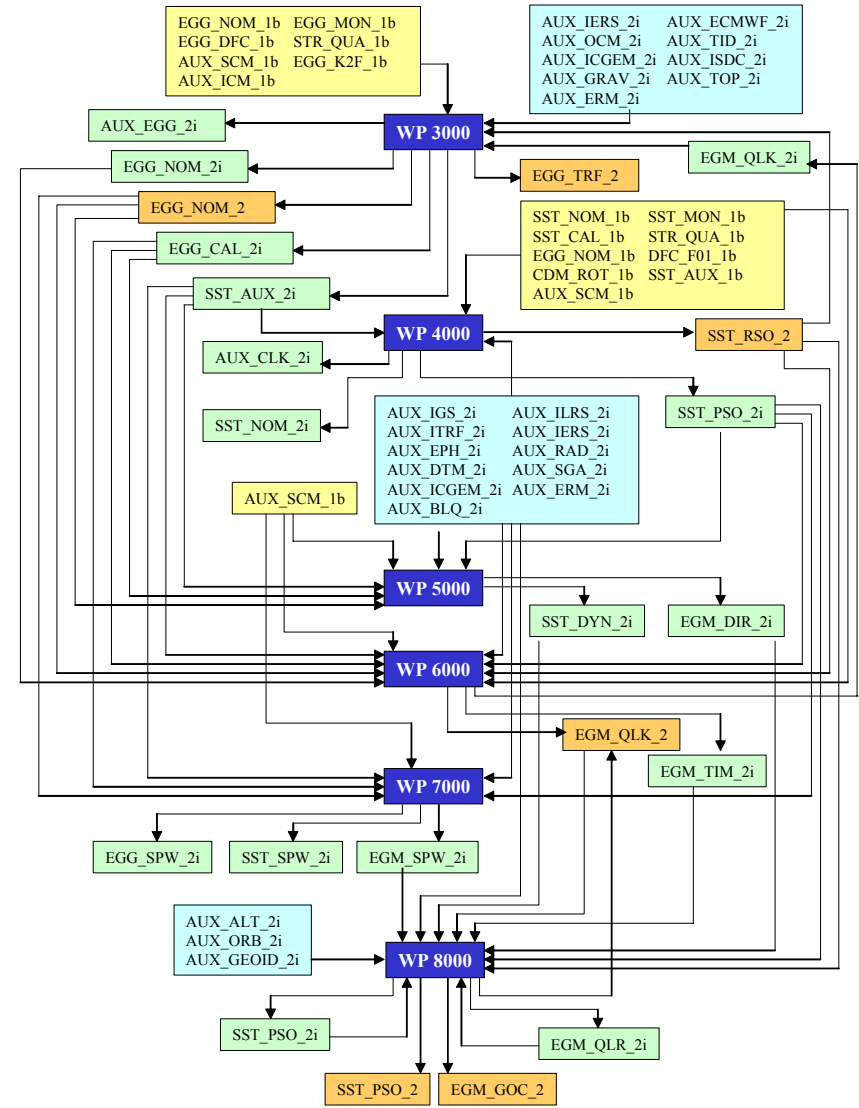


Operational Architecture



Processing Strategy

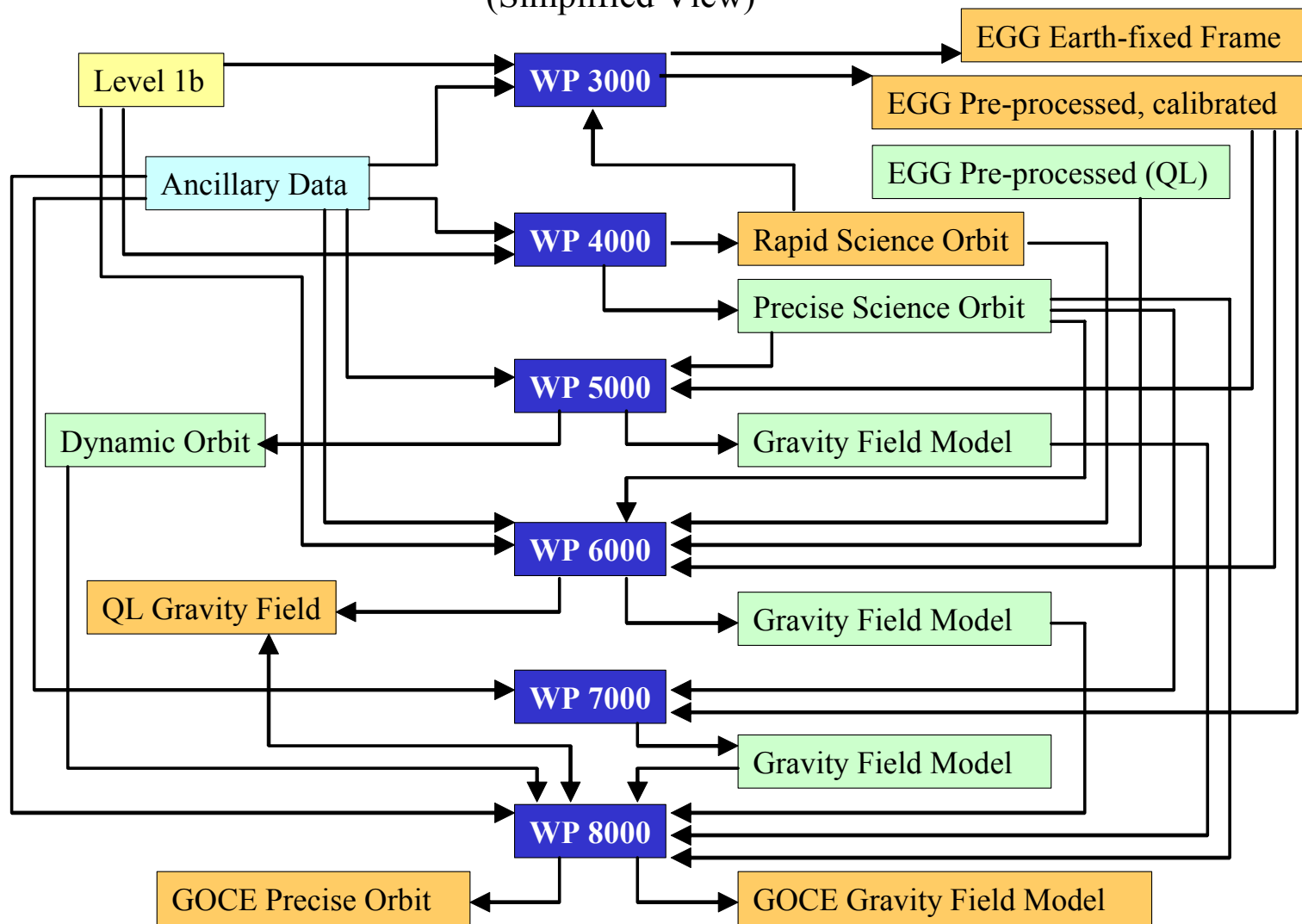
1. The HPF will use **all level 1b** data and a **variety of ancillary data** for generation of level 2 products.
2. **Intermediate level 2 products** will be generated in all work packages. In most cases they are used as input for another work package.
3. Level 2 products are divided into **quick-look products** targeting for a low latency with reasonable accuracy and **final products** targeting for ultimate precision.



Level 1b Input Products Level 2 Ancillary Products Level 2 Intermediate Products Level 2 Final Products

Processing Strategy

(Simplified View)



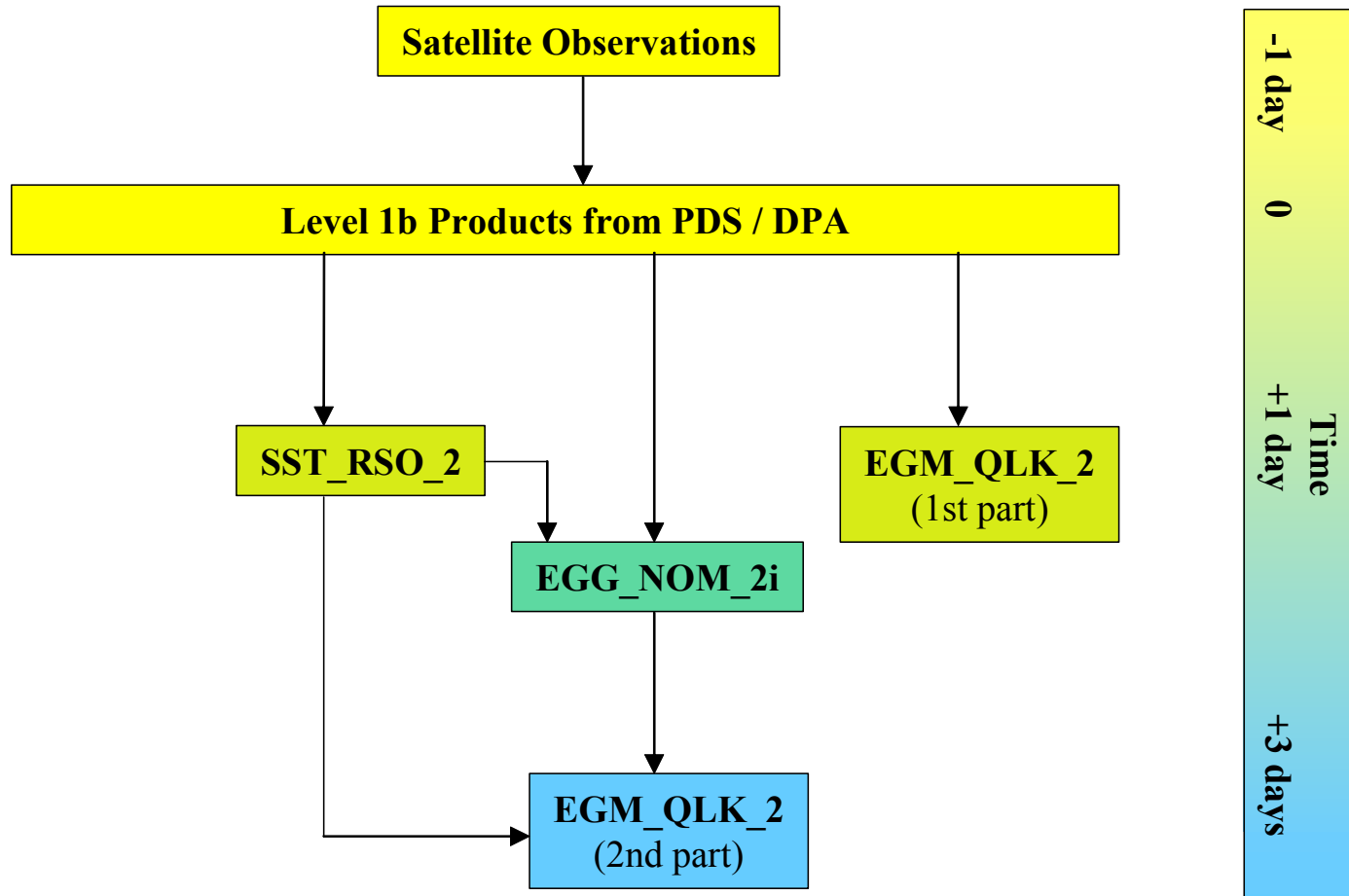
Level 1b Input Products Level 2 Anciliary Products Level 2 Intermediate Products Level 2 Final Products

Final Level 2 Quick-Look Products

Identifier	Description
Products of WP 4000	
SST_RSO_2	<ul style="list-style-type: none">• Rapid science orbit from reduced dynamic approach• Rapid science orbit from kinematic approach• Rapid science orbit quality assessment
Products of WP 6000	
EGM_QLK_2	<ul style="list-style-type: none">• Quick-look Earth gravity field model from SST only• Quick-look Earth gravity field model from SGG only• Quick-look Earth gravity field model from SST and SGG combination• Diagnosis report sheets for all models
Products of WP 8000	
EGM_QLK_2	<ul style="list-style-type: none">• Quick-look gravity field quality assessment report

Final Level 2 Quick-Look Products

Timelines of Quick-Look Products



Final Level 2 Precise Products

Identifier	Description
Products of WP 3000	
EGG_NOM_2	<ul style="list-style-type: none">• Externally calibrated and corrected gravity gradients in GRF (2 weeks latency)• Corrections to gravity gradients due to temporal gravity variations• Flags for outliers, fill-in gravity gradients for data gaps with flags• Statistical information
EGG_TRF_2	<ul style="list-style-type: none">• Externally calibrated gravity gradients in Earth fixed reference frame including error estimates for transformed gradients• Transformation parameters to Earth fixed reference frame
Products of WP 8000	
SST_PSO_2	<ul style="list-style-type: none">• GOCE precise science orbits final product• Quality report for precise orbits
EGM_GOC_2	<ul style="list-style-type: none">• Final GOCE Earth gravity field model as spherical harmonic series including error estimates. Target: 1-2 cm / 1 mGal up to degree and order 200 corresponding to 100 km spatial resolution.• Variance-covariance matrix of final GOCE Earth gravity field model• Grids of geoid heights, gravity anomalies and geoid slopes computed from final GOCE Earth gravity field model including propagated error estimates• Quality report for final GOCE gravity field model

Conclusions

1. The HPF will be developed and operated under ESA contract by the European GOCE Gravity Consortium.
2. The HPF will be generate systematically quick-look and ultimate precision level 2 products. These are:
 - Pre-processed, externally calibrated, fully corrected gravity gradients
 - Rapid and precise science orbits
 - Gravity field solutions including variance-covariance matrix and derived quantities (geoid heights, gravity anomalies, geoid slopes).
3. These products represent the official outcome of the mission and are the input for subsequent level 3 processing (geodesy, oceanography, solid Earth sciences, etc.).