Critical Design Decisions
Of
The Planck LFI Level 1 Software

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PLANCK OVERVIEW 1/3

✓ First European CMB satellite
✓ Height: 4m
✓ 1.5m primary mirror
✓ 1.9t
✓ 2 cooled instruments LFI & HFI
✓ 2 consortia: 41 institutes
✓ 2 DPCs: Paris & Trieste
PLANCK OVERVIEW 2/3

HFI
- 100-900GHz
- 36 feedhorns
- cooled at 0.1K

LFI
- 30-44-70GHz
- 11 feedhorns
- cooled at 20K
PLANCK OVERVIEW 3/3

Diagram showing the relative positions of the Sun, Earth, Moon, and L2 point. The Earth and Moon are shown orbiting around the Sun, and the satellite is positioned at a specific angle indicating an angle of 1 deg/day.
MISSION STATUS

14-MAY-09
Launch

JULY 09
Planck @ L2

AUGUST 09
Verifications & Tuning

SEPTEMBER 09
First Light Survey

DECEMBER 2010
2 Surveys
Sky mapped by Planck during the First Light Survey.

Map of the emission imaged by Planck in different frequencies

Credits: ESA, LFI & HFI Consortia. Background optical image: Axel Mellinger
✓ ISDC, **Data Centre for several astrophysics missions** in Geneva, Switzerland.

✓ First mission: The ESA INTEGRAL gamma-ray satellite

✓ **PLANCK LFI DPC** (Data Processing Centre, INAF-OATs) in Trieste, Italy.
LEVEL 1 MAIN TASKS

Level 1 Pipeline

- Data Request
- Data Decoding
- Data Sorting
- Display Tools
- Limit Check

FITS TOIs

FITS2DMC

DMC Database

Level 2
Map making

Level 3
Component Separation

Level 4
CMB analysis
Deriving cosmological parameters

MOC
Darmstadt, Germany

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Planck LFI Level 1 Design Decisions
Adass2009, 06-Oct-2009
CRITICAL SOFTWARE DECISION 1/3

Reusing INTEGRAL Software?

Decision drivers

1. Deliver quickly the software for test phases
2. Level 1 is part of the Mission Critical items
3. Test phases & Operations are done by the same team
CRITICAL SOFTWARE DECISION 1/3

Evolution to the OPERATIONAL Software

Why to evolve?

1. Features specific to INTEGRAL
2. Input/output interfaces changed for the OPERATIONS
3. Less maintenance
Advantages

1. Components dedicated for PLANCK/LFI data processing
2. Less complex => Less maintenance
### WHICH DATA FORMAT?

<table>
<thead>
<tr>
<th>FITs</th>
<th>DMC database (Data Management Component)</th>
<th>FITs &amp; DMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>§ Standard</td>
<td></td>
<td></td>
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<tr>
<td>§ Libraries already existing for I/O</td>
<td></td>
<td></td>
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<tr>
<td>§ Used in every Planck/LFI processing levels</td>
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<td></td>
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<tr>
<td>§ New Product by MPA Munich</td>
<td></td>
<td></td>
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<tr>
<td>§ Late for level 1 at that time (2003)</td>
<td></td>
<td></td>
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<tr>
<td>§ Installation &amp; Maintenance time consuming at that time</td>
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<td>§ Full control of the Level 1 Software</td>
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<tr>
<td>§ Ingest data into DMC after producing the TOIs (FITS files)</td>
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<tr>
<td>§ Less risk at critical processing</td>
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<td></td>
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<tr>
<td>§ Disk Space</td>
<td></td>
<td></td>
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<tr>
<td>§ CPU Time</td>
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</tbody>
</table>
### WHICH PIPELINE SYSTEM?

<table>
<thead>
<tr>
<th>System</th>
<th>Positive Points</th>
<th>Negative Points</th>
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</thead>
<tbody>
<tr>
<td>ProC (PROcess Coordinator)</td>
<td>- Used by the other Planck/LFI processing levels</td>
<td>- New Product by MPA Munich</td>
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<tr>
<td></td>
<td></td>
<td>- Late for level 1 at that time (2003)</td>
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<tr>
<td>PERL Scripts</td>
<td>- Simple</td>
<td>- Not a GUI</td>
</tr>
<tr>
<td></td>
<td>- Maintenance</td>
<td></td>
</tr>
</tbody>
</table>
 Helpful to be part of the Test phases & Operations

 Accept to throw away software

 Make it simple  ➔ ease maintenance

 The Level 1 software is running smoothly since launch
First Light Survey

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