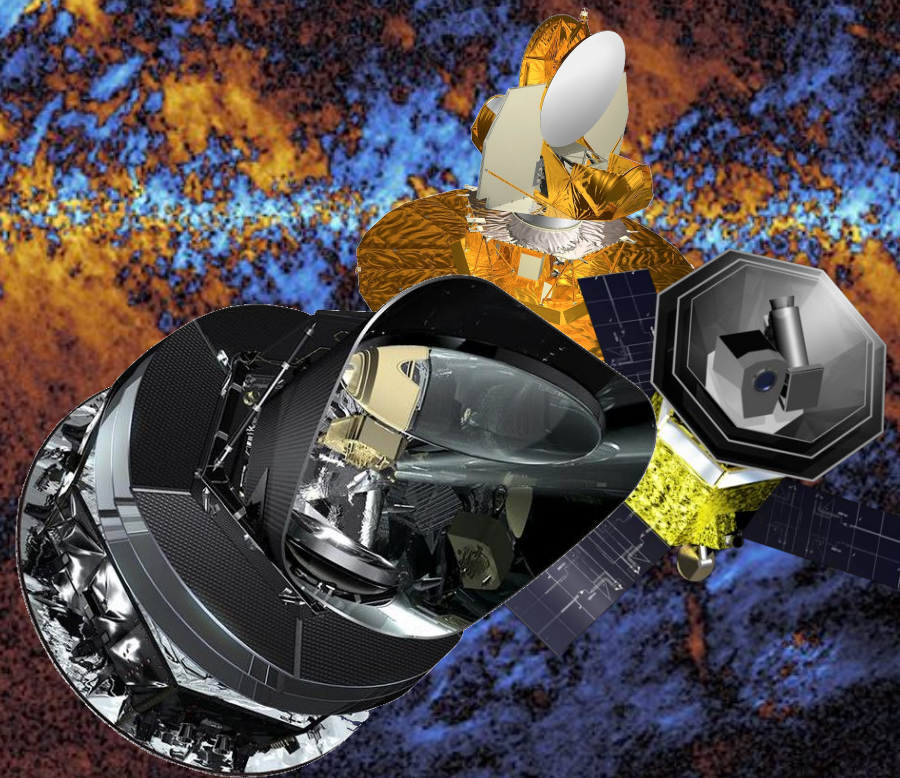# WP5 Summary

Anna-Stiina Suur-Uski

BeyondPlanck final review, December 15, 2020

**Objectives**

Production of beam-deconvolved maps.

Integration of the necessary tools with the pipeline.

Description of work

Use the ArtDeco deconvolver code (Keihänen and Reinecke, A&A 548, (2012)), to produce beam-deconvolved maps, where the effective beam is symmetric, and leakage from temperature to polarization due to asymmetric beams has been eliminated. The exact role of the deconvolved maps in the pipeline is yet to be determined. At minimum the are used for cross-check and validation purposes. The mentioned code package involves tools related to forward beam convolution, and associated analysis. These are integrated with the pipeline as need arises.

The work is done by a yet unnamed Postdoc under the supervision of EK.

- Removes effects of beam asymmetry

  - leakage of temperature signal to

    polarization through beam shape mismatch

  - deformed point source shapes

- Produces sky maps with effective symmetric beam

ArtDeco
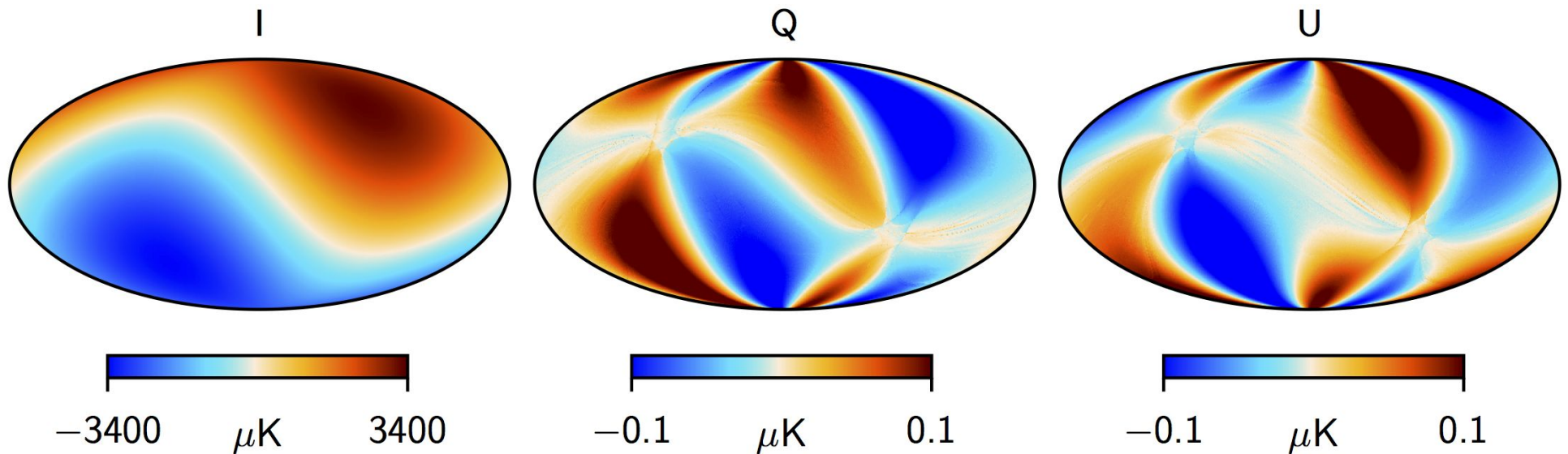
- ## Deconvolver designed for Planck like data

  - Has been applied to Planck LFI data previously

- ## Required inputs

  - Cleaned TOD (destriped TOD)

  - Detector pointing

  - Beam model

  } Imported as "3D maps"

- ## Output

  - Harmonic coefficients a_{lm} , representing the beam-free sky

- ## References

  - [ArtDeco: a beam-deconvolution code for absolute cosmic microwave background measurements](#)

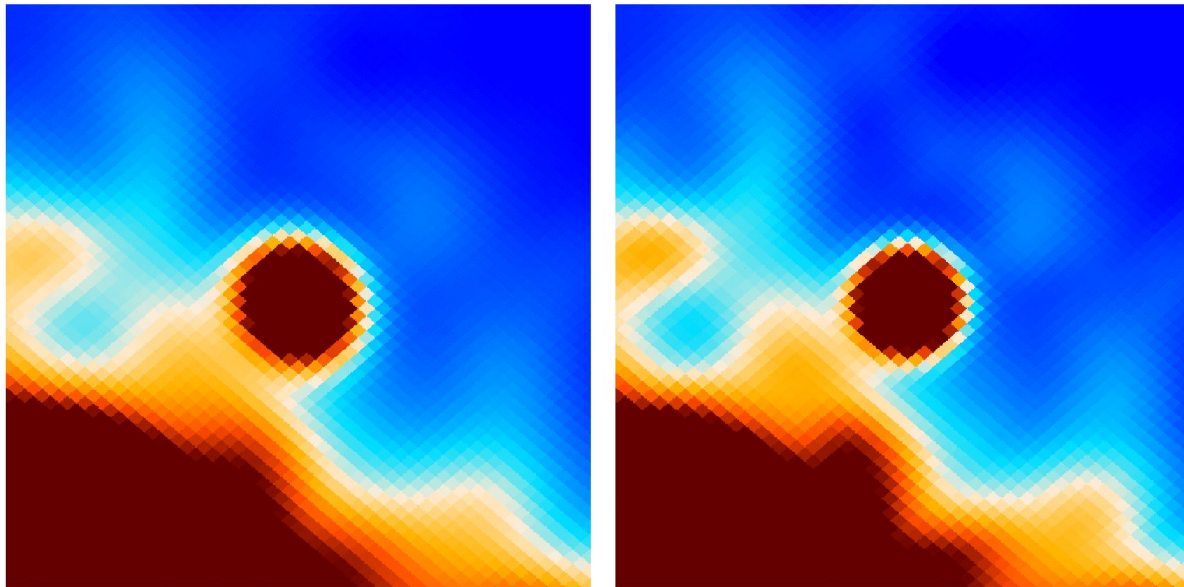 - [Impact of deconvolution on noise properties in CMB measurements: Application to Planck LFI](#)

Deliverables The deliverables from the WP are:
- Beam deconvolution map maker module in Gibbs sampler, due in Month 15
- Associated low-resolution noise covariance matrix module, due in Month 18

- **Deliverable 5.1:** Beam deconvolution map maker
  - Installed, tested and run ArtDeco on Oslo cluster.
  - Submitted: 21 Nov 2019
- **Deliverable 5.2:** Low-resolution noise covariance matrix
  - Explored and tested sample-based error propagation method.
  - Submitted: 3 Dec 2019
- **Deliverable 5.3:** Low-level visualization tools
  - Collection of Python visualization tools for low-level BeyondPlanck data
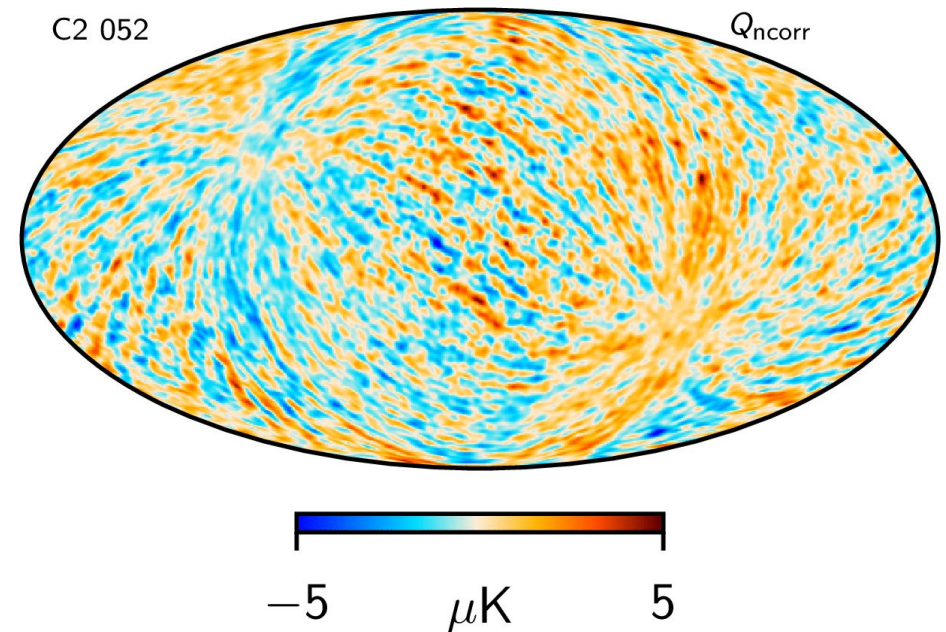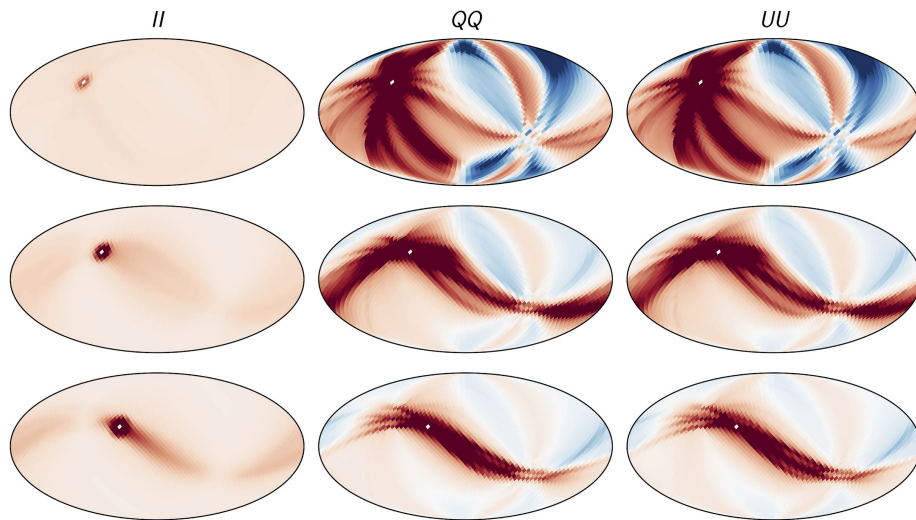 - Submitted: 30 Nov 2020

Beyond
PLANCK

- Installed, tested and run ArtDeco on Oslo cluster.
  - Connected Commander3 4D map interface with the ArtDeco beam deconvolution code
  - Can produce beam deconvolved Commander3 maps

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-1500 μK 1500

- **Description of residual noise in sky maps**
  - Traditional pipeline: noise covariance matrix
  - BP pipeline:
    - Explored and tested sample-based error propagation method.
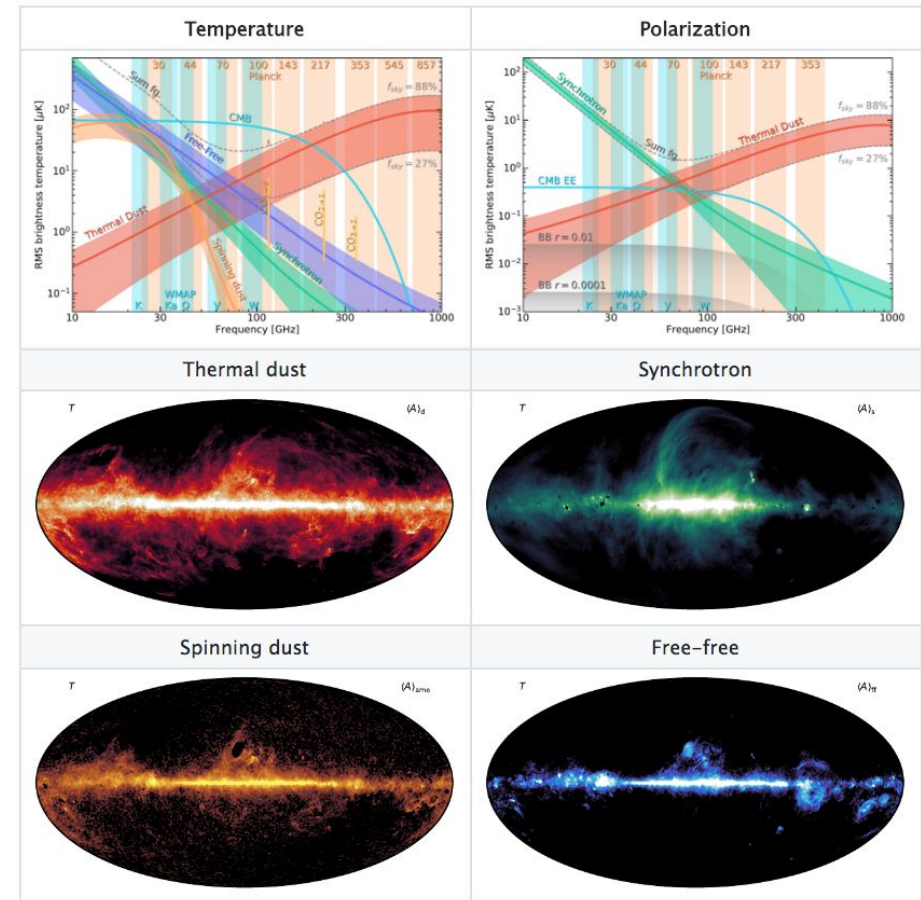   - Commander postprocessing tool (c3pp)

- **Commander3 postprocessing tool (c3pp)**
  - Tool for visualization results and handling the BeyondPlanck data structures.
- The code is publicly available at https://github.com/cosmoglobe/c3pp
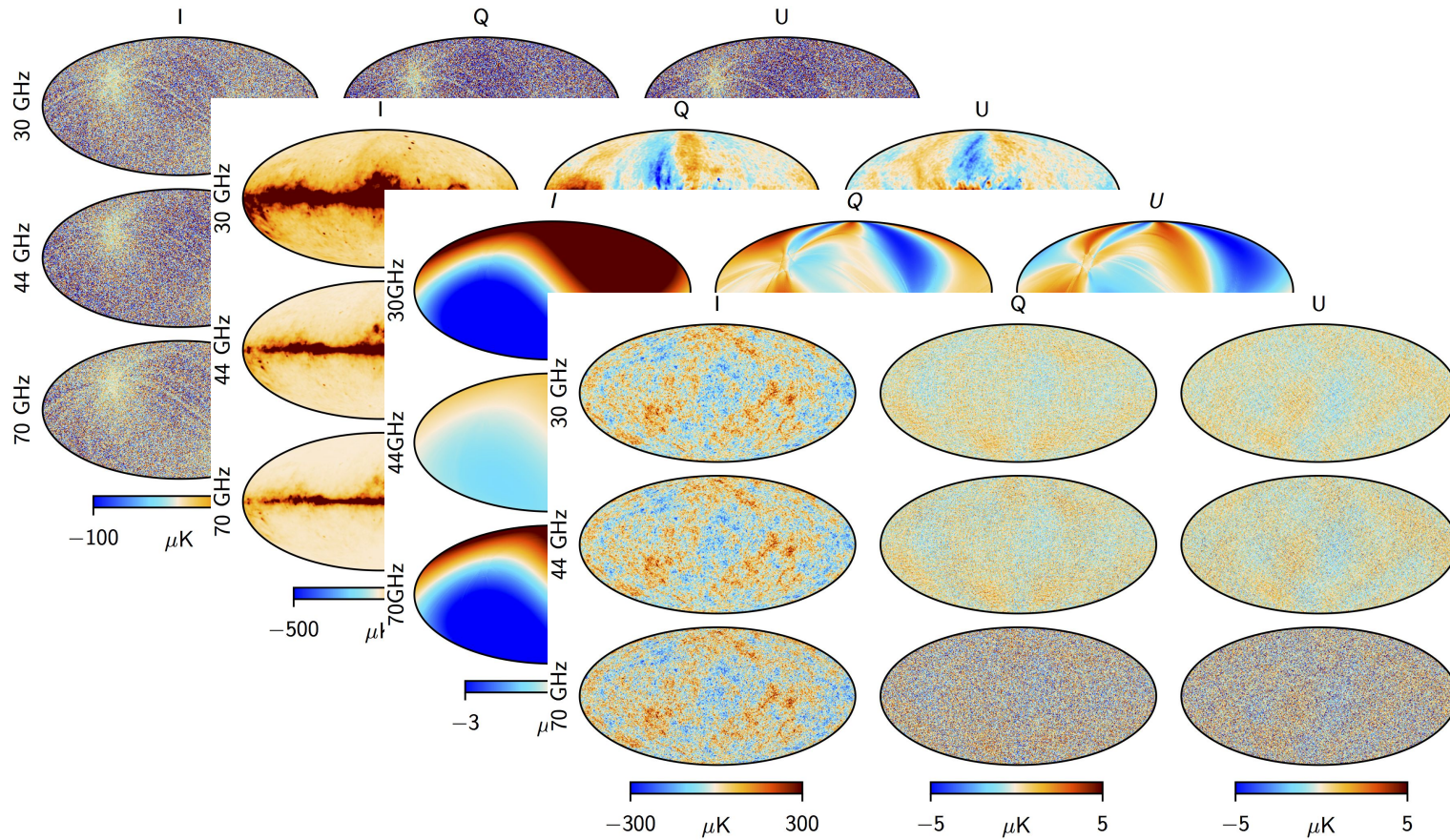

Commander3 postprocessing tool (c3pp)

A python code for processing and plotting *commander3* files.

Installation

Install tools by running

Beyond PLANCK

- Produced TOD smulations with LevelS software.

WP5 Timesheets

Participant	EU Funded Person Months	In-Kind Person Months
Helsinki	8	0
Total	8	0
Budgeted	6	
Deviation	2	

We have coupled Commander TOD products with existing 4pi beam deconvolution code, ArtDeco, through the use of 4D maps, and can now produce asymmetric beam deconvolved Commander-based frequency maps.

EU-funded institutions

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Ranajoy Banerji
Maksym Brilenkov
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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 776282

- *"BeyondPlanck"*
  - COMPET-4 program
  - PI: Hans Kristian Eriksen
  - Grant no.:   776282
  - Period: Mar 2018 to Nov 2020

Collaborating projects:

- *"bits2cosmology"*
  - ERC Consolidator Grant
  - PI: Hans Kristian Eriksen
  - Grant no: 772 253
  - Period: April 2018 to March 2023

- *"Cosmoglobe"*
  - ERC Consolidator Grant
  - PI: Ingunn Wehus
  - Grant no: 819 478
  - Period: June 2019 to May 2024