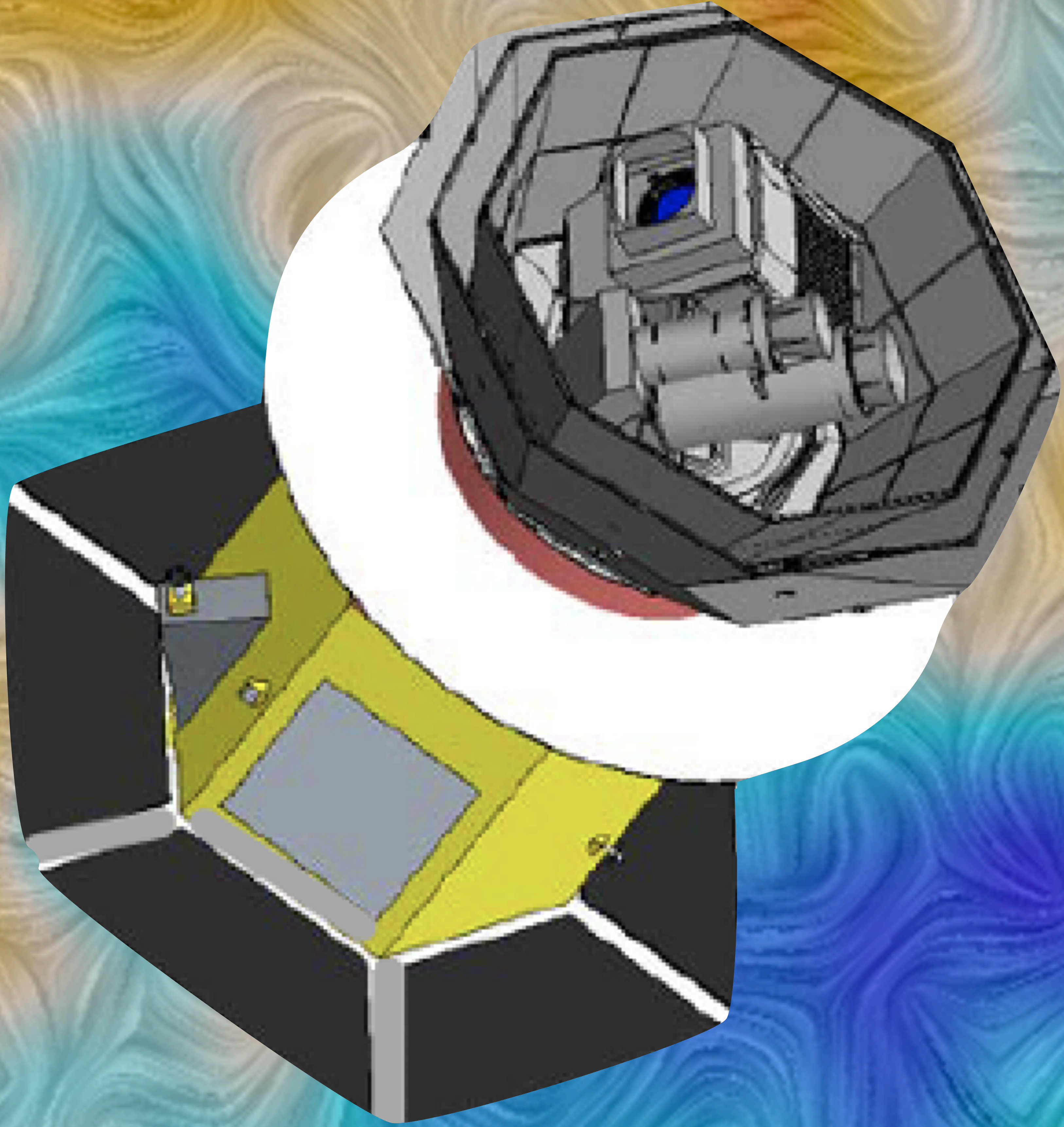


LiteBIRD Data-Analysis Introduction

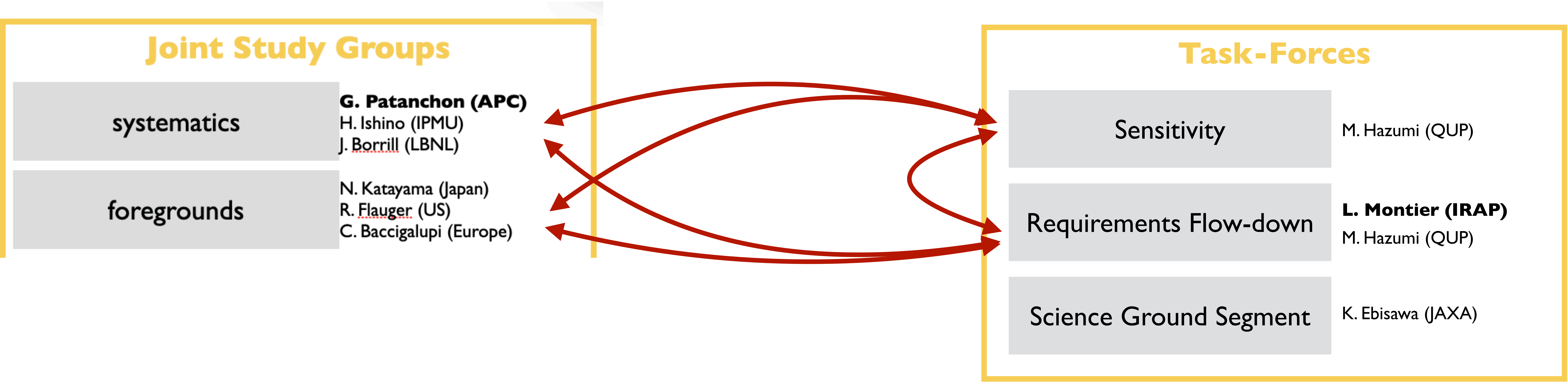
M. Tristram & L. Montier
on behalf of LiteBIRD Collaboration

LiteBIRD Day

13 May 2024

Data-Analysis

Systematics / Foregrounds / Requirements Analyses



Data-Analysis

Systematics / Foregrounds / Requirements Analyses

The theoretical Flow Down Process

Mission Requirements

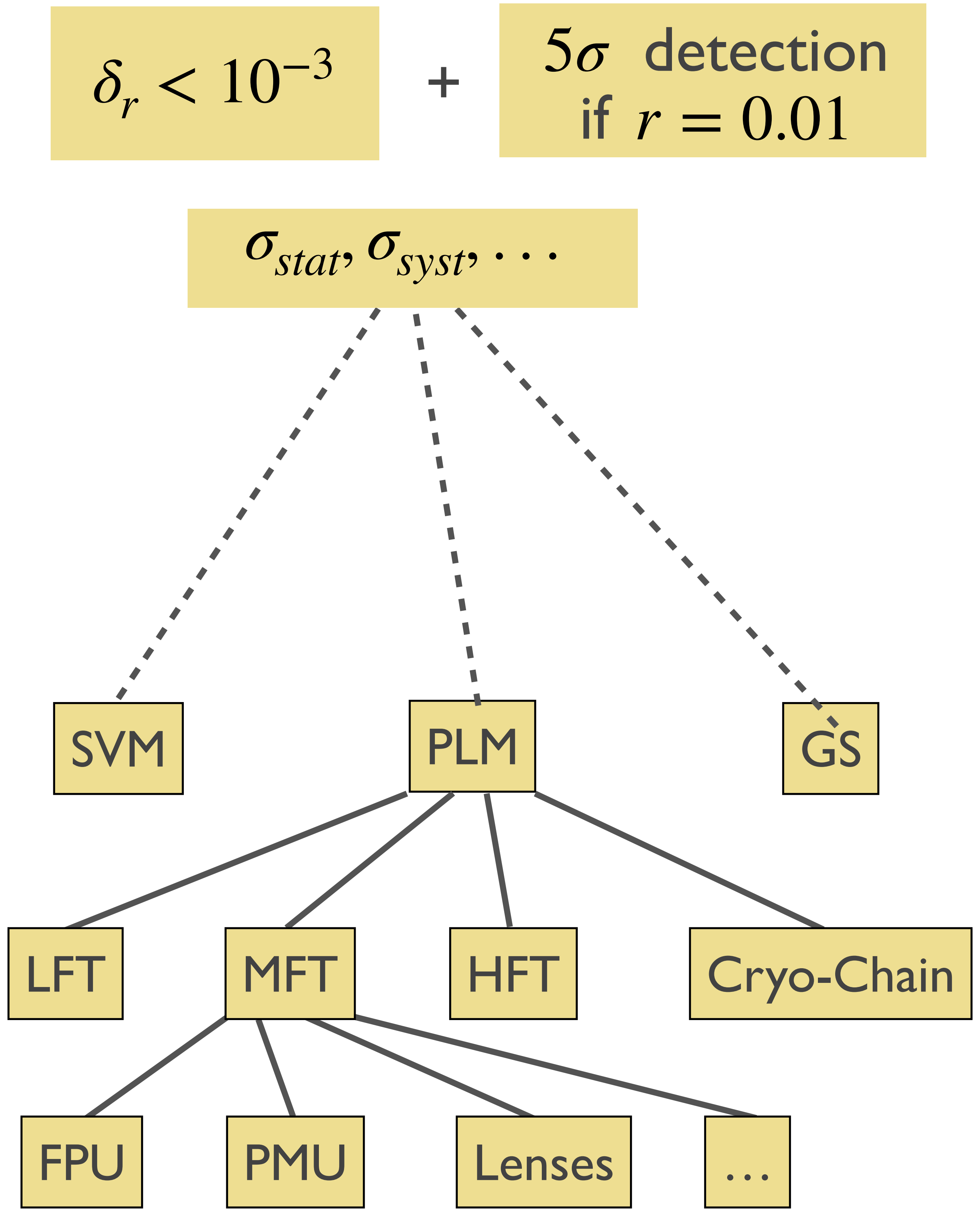
L1	Science Requirements	Top-level quantitative science requirements that are directly connected to the full success of the mission.
L2	Measurements Requirements	Measurement requirements to achieve Lv1. No assumption is made on an instrument.

Trade-off Studies

Interfaces
Operation contraints
Agencies Standards

System Requirements

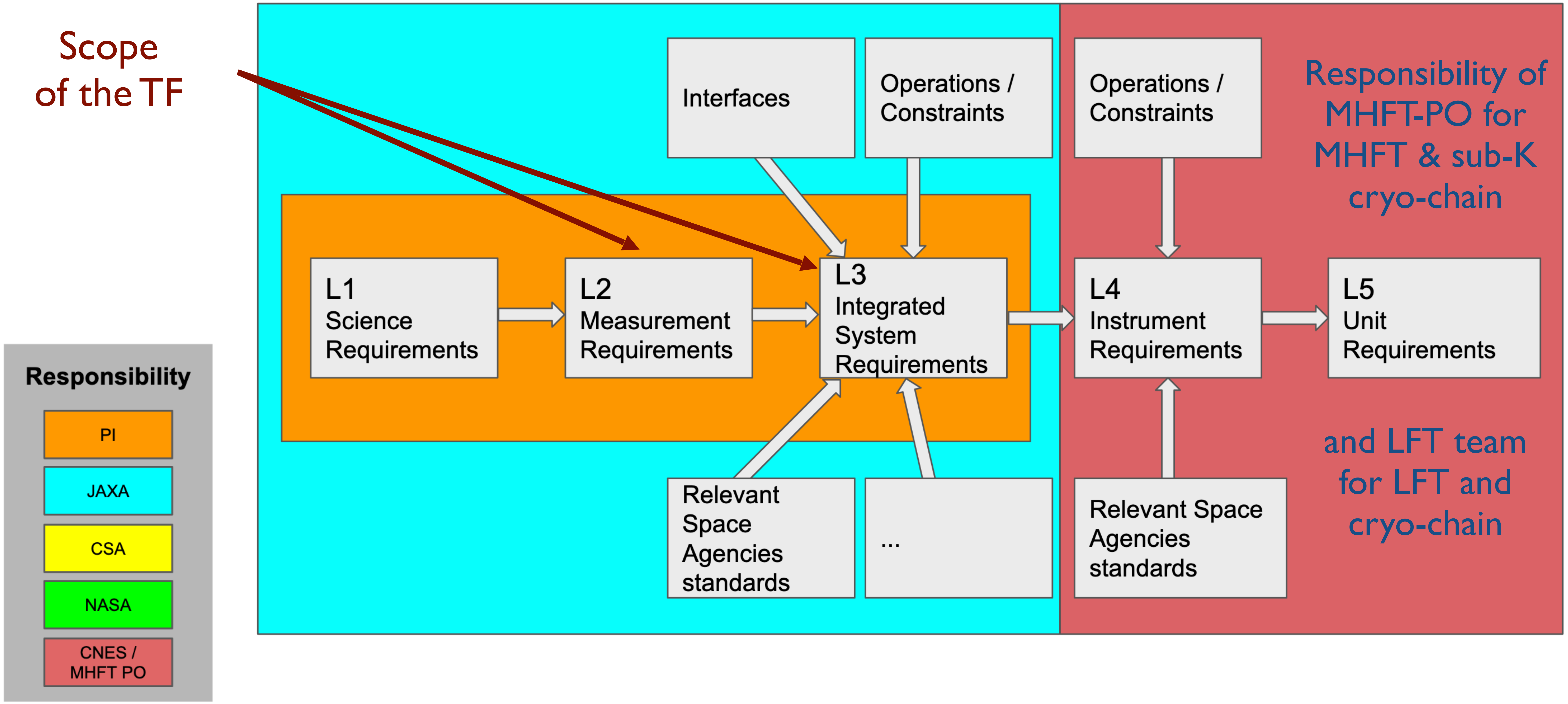
L3	Integrated system Requirements	Top-level implementation requirements for a chosen instrument to achieve Lv2. Between Lv2 and Lv3 are tradeoff studies for instrument selection.
L4	Instrument Requirements	Instrument requirements to achieve Lv3.
L5	Unit Requirements	Requirements on units composing each instrument to achieve Lv4.



Data-Analysis

Systematics / Foregrounds / Requirements Analyses

The theoretical Flow Down Process



Data-Analysis

Systematics / Foregrounds / Requirements Analyses

List of Instrumental Systematic effects

Category	Systematic effect	Δr	Source	Type
Beam	Far sidelobes	4.4×10^{-5}	$B \to B, E \to B$	R
	Near sidelobes	5.7×10^{-6}	$B \to B, E \to B$	R
	Main lobe	$<10^{-6}$	$E \to B$	E
	Ghost	5.7×10^{-6}	$E \to B$	R
	Polarization and shape in band	$<10^{-6}$	$E \to B$	R
Cosmic ray	Cosmic-ray glitches	Noise	Power to B, E	E
HWP	Instrumental polarization	$<10^{-6}$	$T \to B$	E
	Transparency in band	5.7×10^{-6}	$E \to B$	R
	Polarization efficiency in band	5.7×10^{-6}	$B \to B$	R
	Polarization angle in band	5.7×10^{-6}	$E \to B$	R
Gain	Relative gain in time	5.7×10^{-6}	$E \to B$	R
	Relative gain in detectors	5.7×10^{-6}	$E \to B$	R
	Absolute gain	1.9×10^{-6}	$B \to B$	E
Polarization angle	Absolute angle	9.1×10^{-6}	$E \to B$	E
	Relative angle	5.7×10^{-6}	$E \to B$	E
	HWP position	1.0×10^{-6}	$E \to B$	E
	Time variation	$<10^{-7}$	$E \to B$	E
Pol. efficiency	Efficiency	5.6×10^{-6}	$B \to B$	E
Pointing	Offset	5.7×10^{-6}	$E \to B$	R
	Time variation	$<10^{-6}$	$E \to B$	E
	HWP wedge	5.7×10^{-6}	$E \to B$	R
Bandpass	Bandpass efficiency	5.3×10^{-6}	$E \to B$	R
Transfer function	Crosstalk	5.7×10^{-6}	$B \to B$	R
	Detector time constant knowledge	5.7×10^{-6}	$E \to B$	R

These activities require:

- Strong involvement into the flow-down of the performances requirements
- Strong connection with Design / Calibration Teams
- Commitment into simulations tools

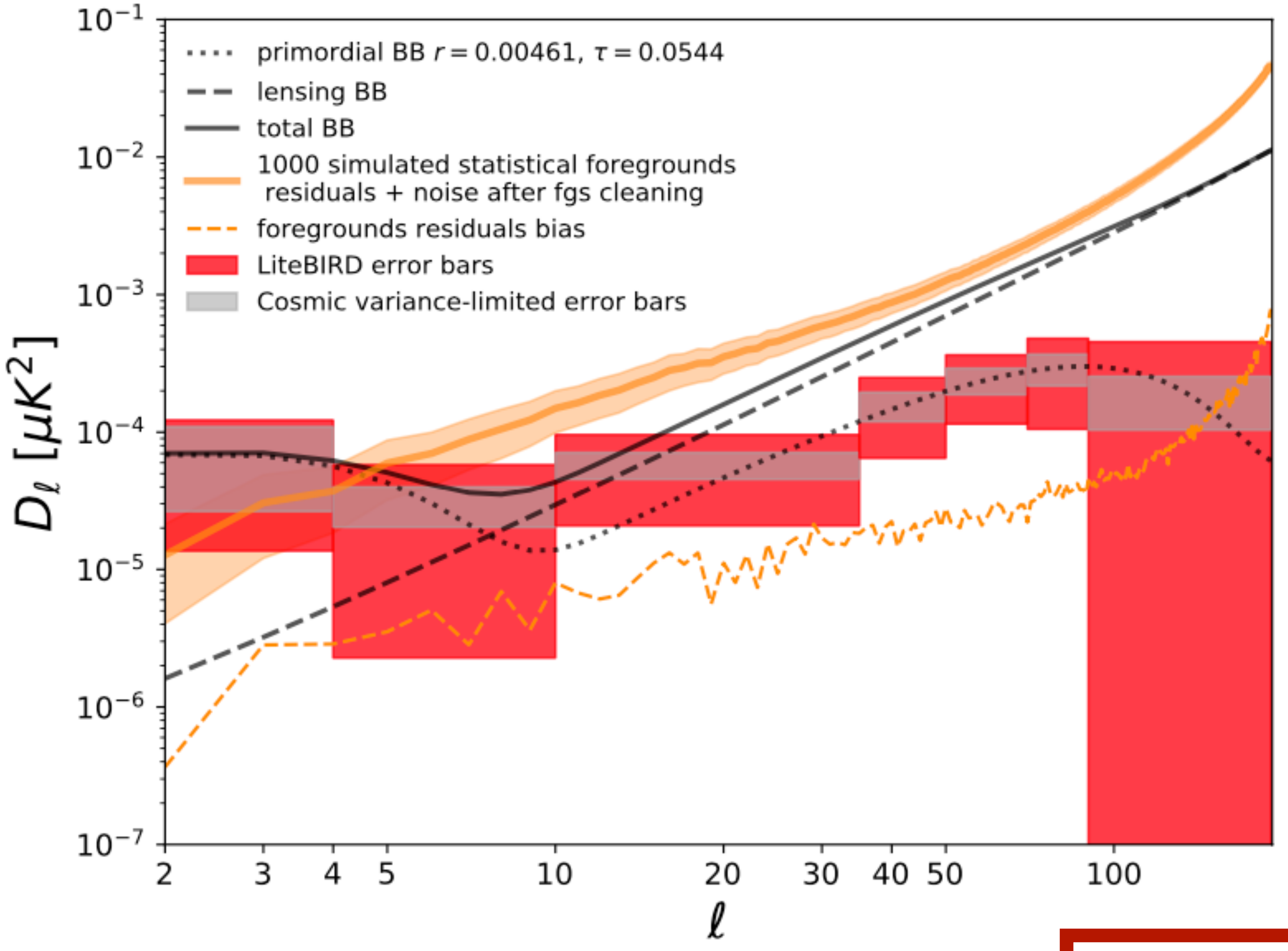
Coupling of Systematics with Foregrounds is the key

Impact of Foregrounds Modelling & Component Separation on Requirements Flow-down ?

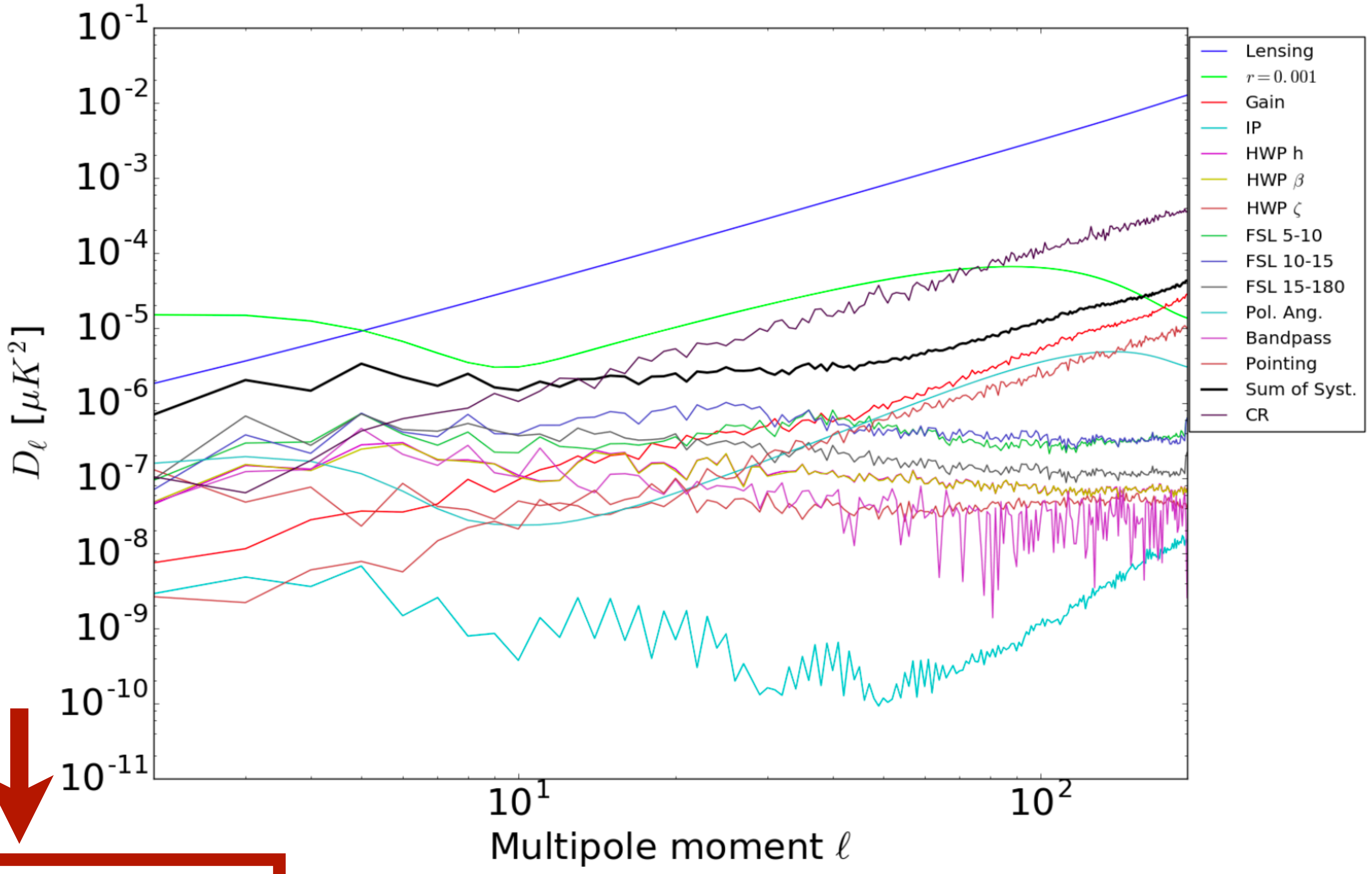
Data-Analysis

Forecasts combining Systematics & Component Separation

Foregrounds



Instrumental Systematics



$$\delta r = 1.0 \times 10^{-3}$$

Data-Analysis

Simulation Pipeline Development / Production Effort

Data Management Group

- Instrument Model Team → Consolidation / Maintenance / Diffusion of Instrument Model (IMo)
- Simulation Team → Development of simulation modules & pipelines
- Production Team → Production of strategic simulations
- Map-making, Power-spectrum estimates, Likelihood algorithms

Opportunity to contribute on simulation and data analysis preparation !

Development of Map-making and Likelihood Estimates Tools

- Consolidation / Comparison of tools in a common & consistent framework
- r estimates including error & bias and w/wo systematics

Data-Analysis

The Science Ground Segment

Task-Force:

- Prepare a document summarizing information and discussion at past LiteBIRD IGB meetings and global meetings on science ground segments (SGSs) and related collaboration governance.
- Identify differences between projects led by Europe, Japan, and the US.
- Study possible LiteBIRD SGS configurations(1). Evaluate, compare, and score them(2).

Members:

- Japan: Ken Ebisawa, Yuki Sakurai
- Europe: Paolo Natoli, Matthieu Tristram, Hans Kristian Eriksen
- North America: Renee Hlozek, Raphael Flauger

\+ Ex officio members:

- Masashi Hazumi
- Adrian Lee
- Ludovic Montier

→ Global organisation to be clarified first before agreeing on SGS