

Introduction & Outline

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<https://indico.in2p3.fr/event/17625/overview>

<http://wiki.e-cmb.org>

The European CMB Coordinators

- [Baccigalupi \(IT\)](#); Bersanelli (IT); Bouchet (FR – Benabed); Brown (UK); Challinor (UK); Ganga (FR); Gonzalez-Martinez (ES); Komatsu (DE); Mohr (DE); Rubino-Martin (ES); ~~[Vittorio \(IT\)](#)~~
- Self-Nominated group of CMB advocates
- Information diffusion,
 - SLAC-2017: Cosmology with CMB-S4 (Ganga)
 - NORDITA-2017: Cosmology (Challinor/Komatsu)
 - CMB in Germany; Jan 31 & Feb 1, 2018 (Vittorio)
 - Teruel-2017: Fundamental Cosmology (Ganga)
 - CMB Foregrounds – October 2018 (Ganga)
 - ...

The Roadmap/Whitepaper

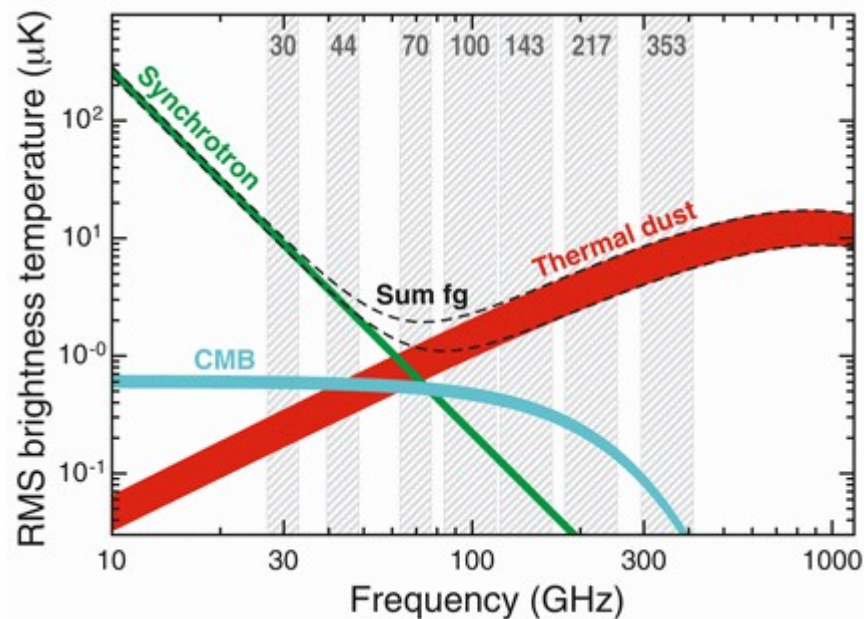
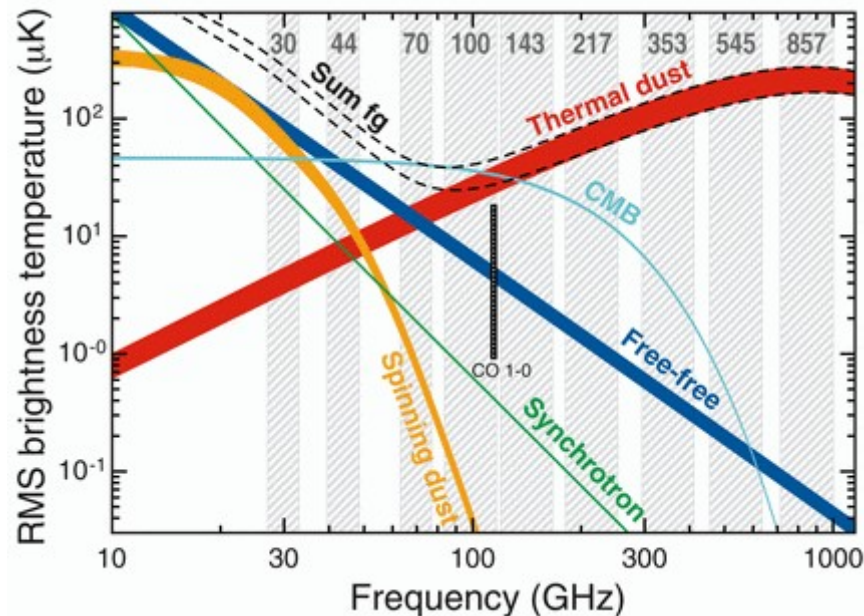
- <https://wiki.e-cmb.org/uploads/Main/Whitepaper.pdf>
- Suggested at the last Florence meeting
- Requires more general community input
- Inputs...
 - Our “E4” Horizons 2020 proposal
 - UK Synergy proposal
 - Global CMB-Stage 4 Participation
 - Ongoing work
 - ...
- Doesn't cover “smaller” projects
- It's quite brief. Thoughts?

The Whitepaper

- Science
 - Primordial Universe & Inflation
 - Cosmic Web & Neutrinos
 - Spectroscopy of the CMB
 - Experimental Landscape
 - Ground: Developed
 - Balloon: Needs work
 - Space: Minimum Required
 - Plus a “Detailed” Ground-Based Experimental Landscape
 - Roadmap
 - Long-Term (2027-...) This is the timescale of both LiteBIRD and CMB-Stage-IV
 - Mid-Term (2022-2026) These are driven by the need to be read in 2027
 - Short-Term (...-2021) These are driven by what is happening today and what we would like to be involved in later
- <https://wiki.e-cmb.org/uploads/Main/Whitepaper2018-09-17.pdf>

Low-Frequency Survey

- In 2014 the field saw how important high-frequency foregrounds were. Soon, we'll see how important low-frequency foregrounds are.
- Half of this can be done from existing European sites
- You will hear more about this from Jose-Alberto Rubino-Martin and Angela Taylor



Large Aperture Telescope(s – LATs)

- By studying the structure in the Universe we can understand neutrinos, dark energy and others
- The design is new – different from ACT, SPT, etc.
- These can be (and are being) built by the German firm VERTEX
- Talks by Joe Mohr, Kaustuv Basu (& Borrill and/or Carlstrom)

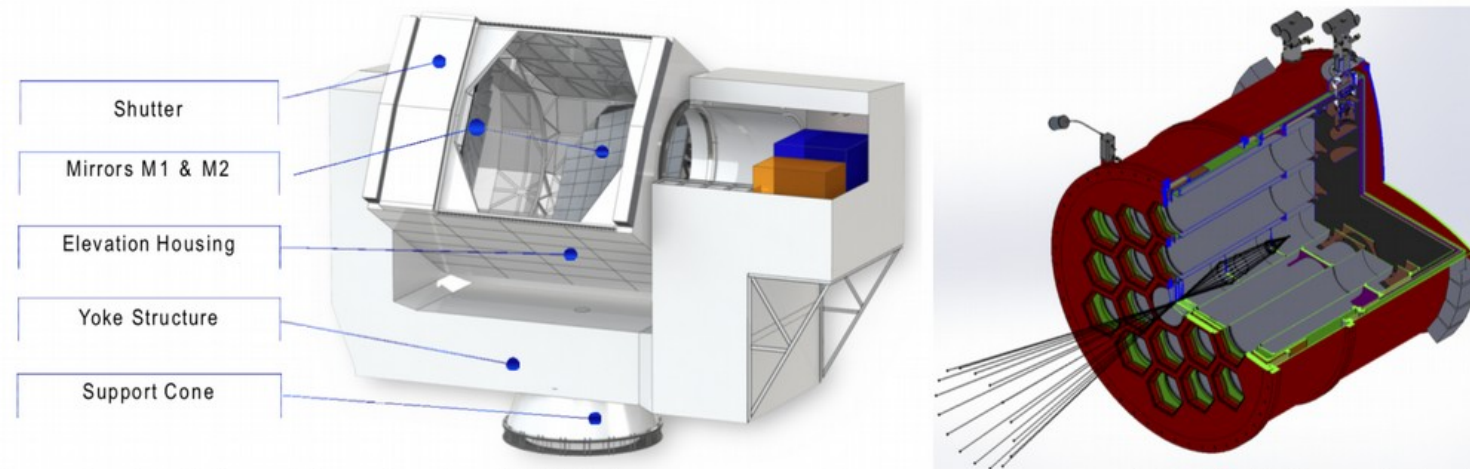


Figure 5: Candidate designs for the CMB-S4 large-aperture telescope and camera. *Left:* Preliminary design for the 6-m-aperture CD telescopes being built by CCAT-prime (www.ccatobservatory.org) and the Simons Observatory (simonsobservatory.org). *Right:* Preliminary design for a CMB-S4-scale camera developed by the Simons Observatory Collaboration, with 19 optics tubes (each with three or four 150 mm detector arrays) for the CD telescope shown on the left.

Small Aperture Telescope(s – SATs)

- For confirming that Inflation was the “root” of the Big Bang, just before the Hubble Expansion we usually talk about.
- “Relatively Simple” refractors with moderate angular resolution – because that’s all we need

Michael Brown will describe these

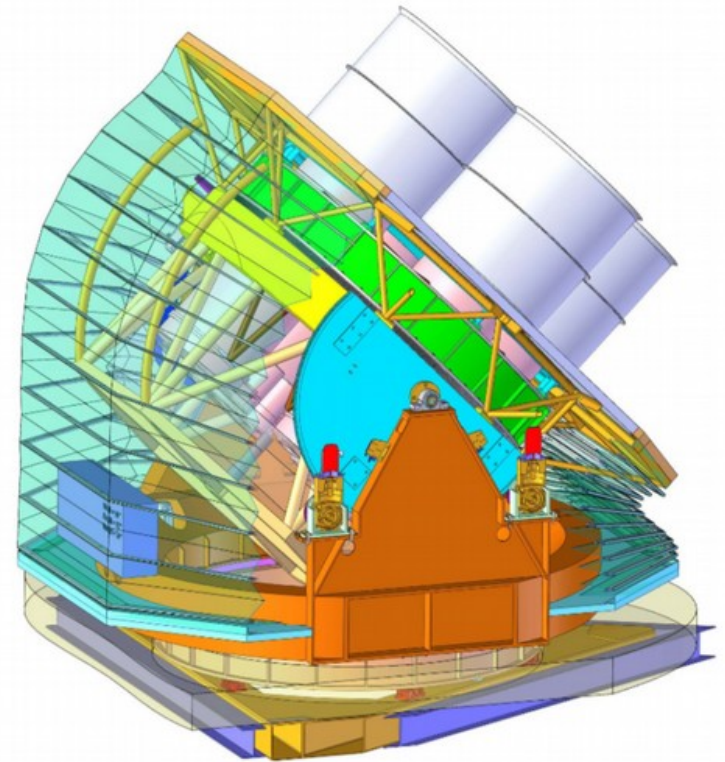
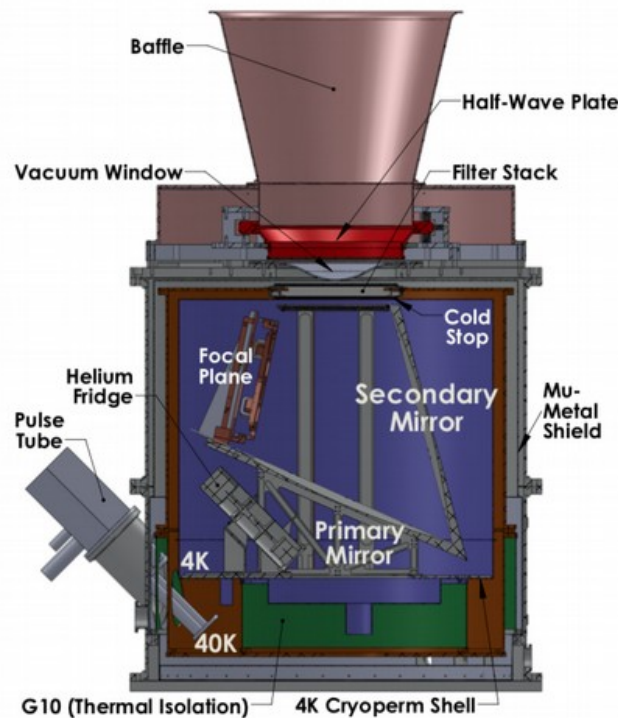


Figure 4: *Left:* Design of the 0.3 m aperture ABS reflector camera. *Right:* Preliminary design of four 0.5 m-aperture BICEP array cameras on a shared mount inside a ground screen.

Smaller Parts of the Program

- Euclid, Athena, etc. will need access to the best CMB data available
- Talk by C. Baccigalupi
- Large Scale KID production
- Talks by A. Catalano and P. Camus
- Below: 2mm KID Array

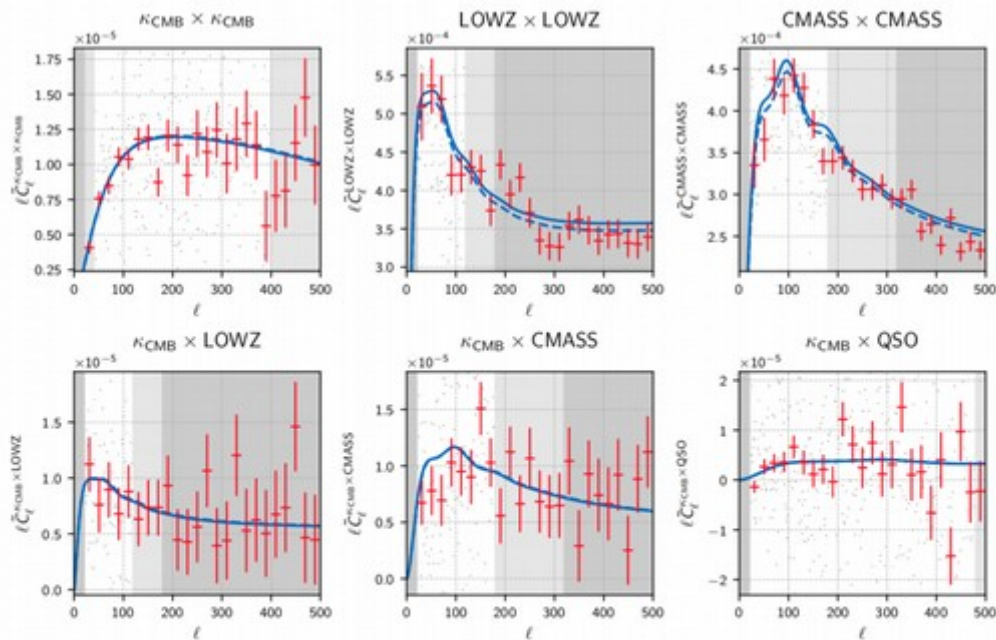
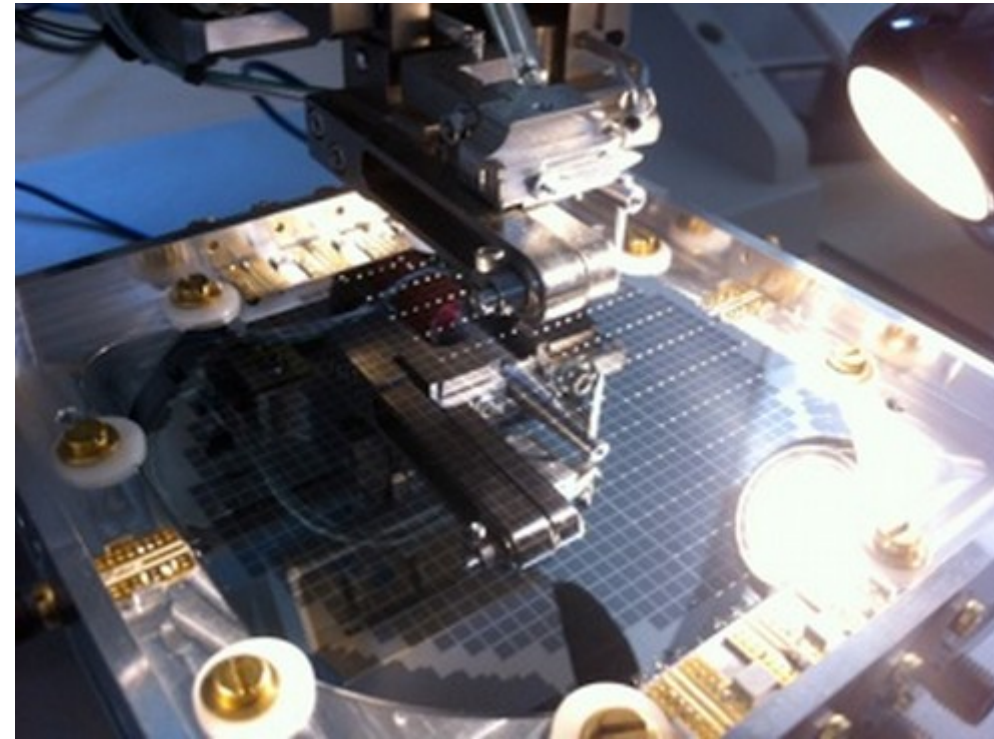
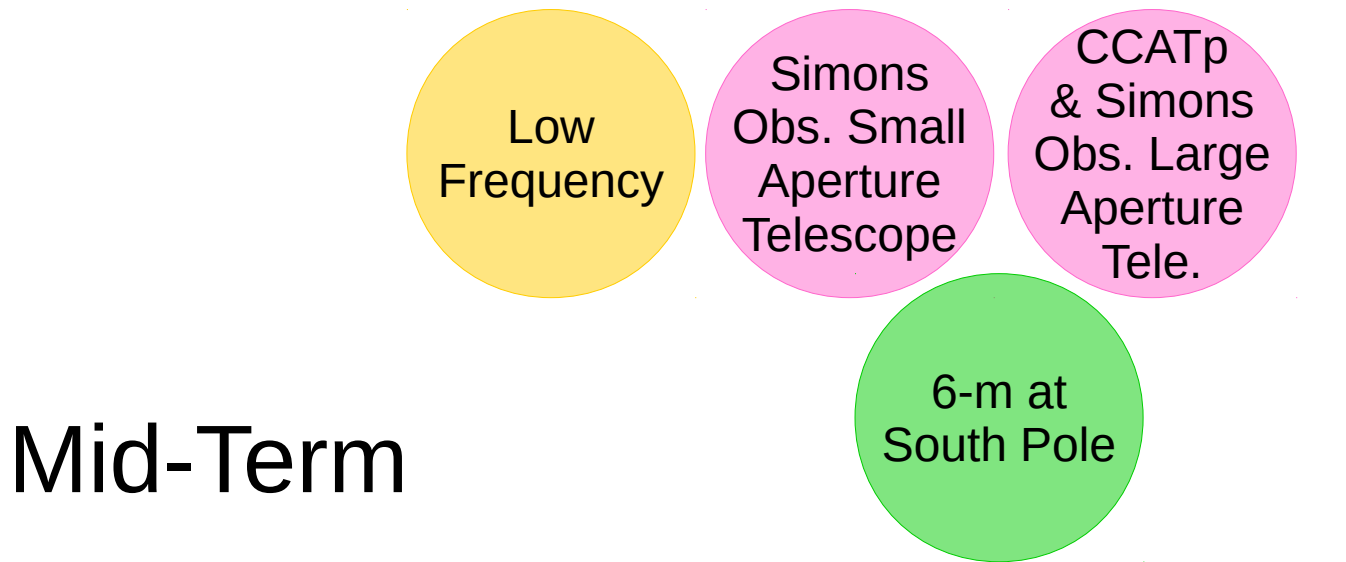


Figure 4. Auto- and cross-pseudo spectra used in this paper for the joint cosmological analysis of CMB lensing and spectroscopic tracers. Observed spectra are represented by the light grey points in the multipole range 20 – 500, and binned as red error bars (only for visualisation). Theoretical curves are shown in blue for the best-fit from the joint analysis on Λ CDM with the optimistic cut (solid lines, see values in table 1) and for best-fit biases using a fixed Planck 2015 cosmology (Planck Collaboration et al. 2016e) (dashed lines) on the full multipole range. Multipole ranges discarded in the cosmological analysis are shaded in grey (light grey shows the conservative cut, dark grey the optimistic one). Pseudo spectra are multiplied by ℓ to help visualise features of the theoretical power spectra, especially the wiggling related to baryon acoustic oscillations (covariance matrices are modified accordingly).

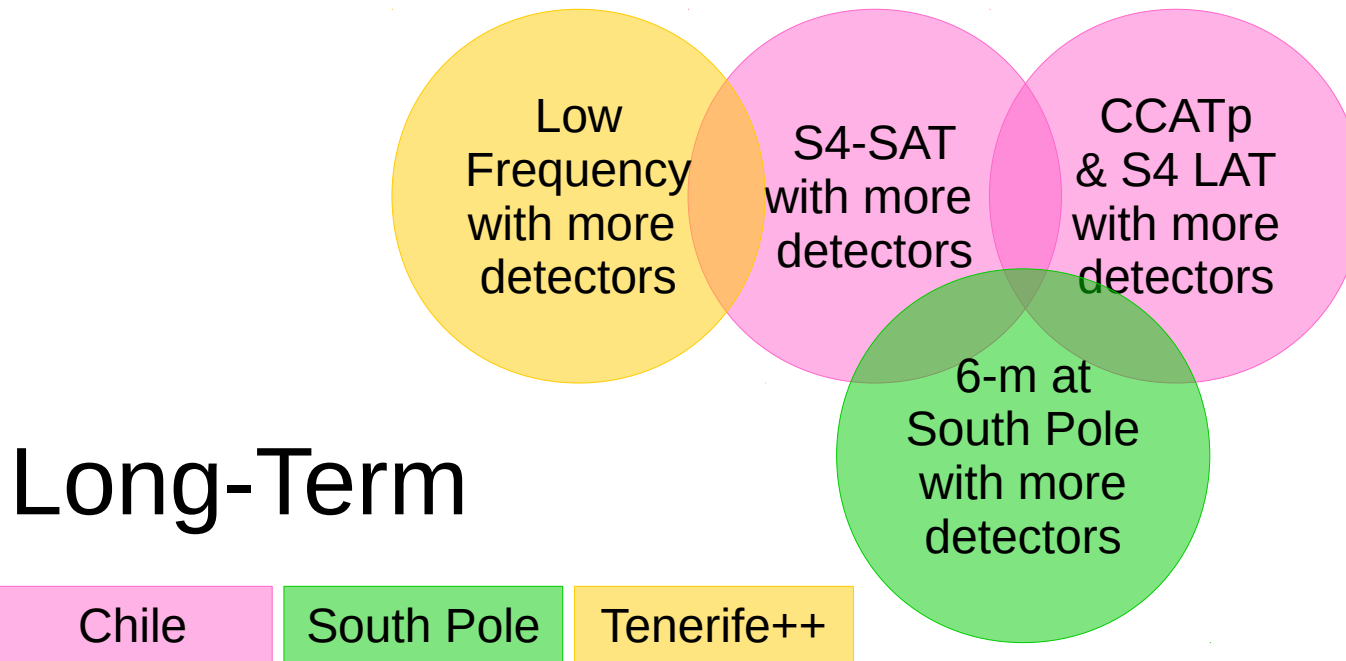


The Program's Main Axes



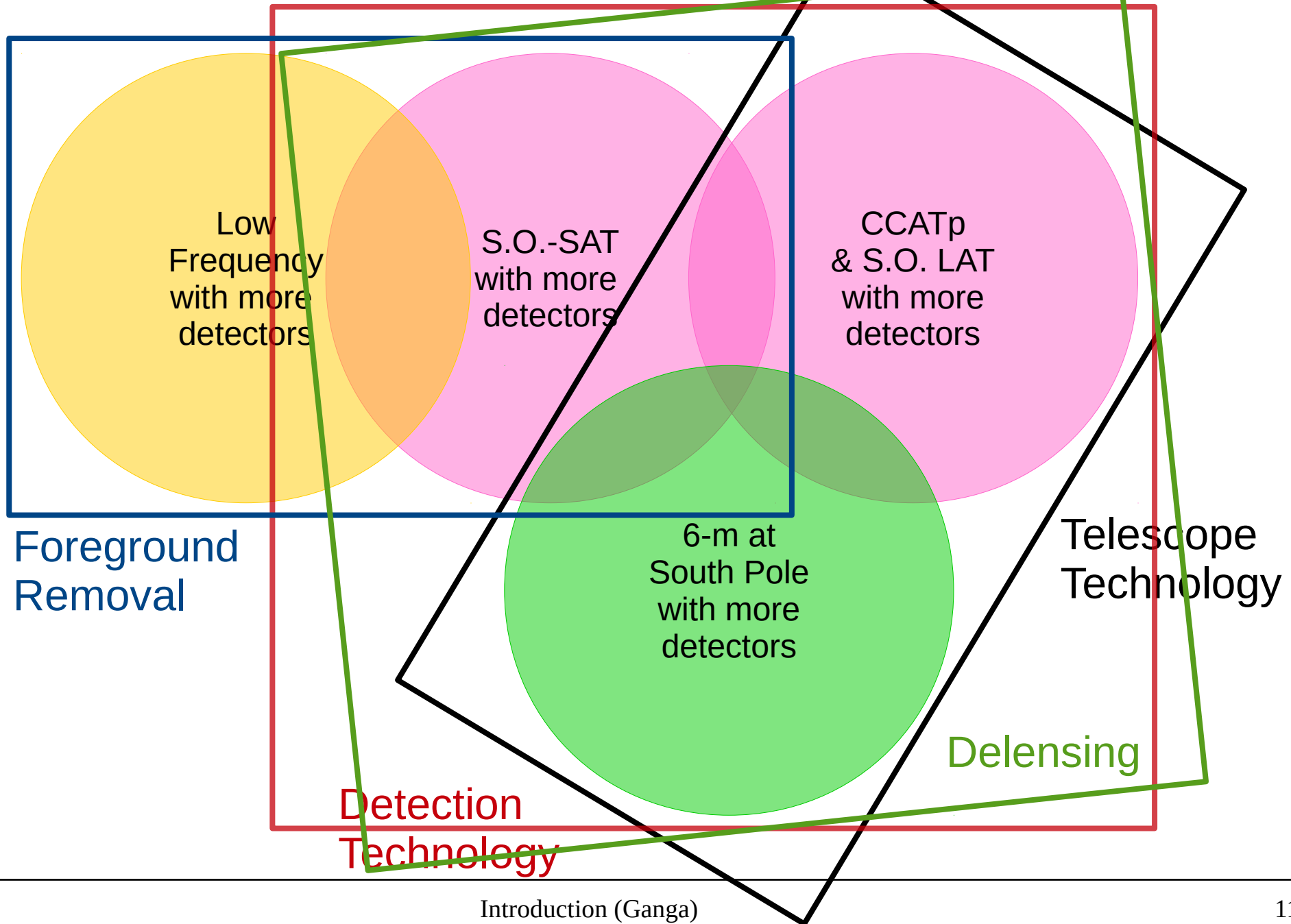
The projects composing the program have begun at the “national” (or ~few-country) level.

Here we want to allow them to expand to the European level.



On a time scale that must be synchronized with that of CMB Stage 4, they will require other contributions and become international in scale.

It Must be a Coherent Program



Space & Ballooning

- These are important parts of the landscape
- In Space, *LiteBIRD* is the most advanced programmatically, but there are efforts for *Pristine* and more ambitious pre-proposals in the US (*PICO*) and India (*CMB-Bharat*) which build upon the legacy of earlier work such as that for *CORE*.
- We do not focus on space or ballooning here because there are well-defined, national and international frameworks to address this (ESA, CNES, ASI, etc.).
- You will have some updates during the “Inflation” and “Spectroscopy” talks about space and you will hear about Ballooning from Silvia Masi

Workshop Format

- Four 1½ – hour sessions per day, separated by coffee or lunch.
 - Two 30-minute talks per session (except this one...)
 - 30-minutes of discussion at the end of each session
- Last session devoted to next steps
- “Coordinators” are required to stay until Saturday ~noon.
- Session “chair/leaders” will be/have been requested/cornered
- Lunch and coffee are provided
- Dinner will be provided tonight

Who (else) is Here?

- CMB'ers
- “Neighboring” Astrophysicists and Technologists
- AstroNet & APPEC & a couple of agencies
- Who's not here?
 - Planck had ~1000 members and ~300 “core team” members
 - 100's of European members of or proposers for CBASS, CONCERTO, CORE, KISS, LiteBIRD, LSPE, NIKA, Pristine, QUBIC, QUIJOTE, Simons, Spider
 - The E4 Horizons 2020 proposal had ~150 members

Next Steps?

- More community input
- Input from AstroNet & APPEC.
 - We can “bless” this as a community. How do we go further?
 - Who else should we be working with? Neutrinos? 21 cm? Others
- ESFRI...
- Collaboration model? LIGO/VIRGO? SKA? LSST?
- Working groups to flesh out the “Axes” of the program.

A Couple of Other Things

- WIFI:
 - villafinally; FINALY18
- Please send (or otherwise make available) your slides to vydelingum@apc.univ-paris7.fr and/or ganga@in2p3.fr
 - I also have a USB key if you want to do it that way...
- We have sporadically tried Skype at previous meetings with mixed success. This time we will have a Zoom connection (thanks to the APC Euclid group):
 - <https://zoom.us/j/916604294>