UNIVERSITÀ DEGLI STUDI DI FERRARA
- EX LABORE FRUCTUS -

LSPE
the Large-Scale Polarization Explorer

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LSPE
Large Scale Polarization Explorer

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agenzia spaziale italiana

INFN Istituto Nazionale di Fisica Nucleare

LSPE in a nutshell

- The **Large-Scale Polarization Explorer** is:
  - an experiment to measure the polarization of the **CMB** at large angular scales
  - Frequency coverage: 40 – 250 GHz (5 channels, 2 instruments: **STRIP** & **SWIPE**)
  - **SWIPE:** a spinning stratospheric balloon payload at high frequency to avoid atmospheric noise flying long-duration, in the polar night. Equipped with a polarisation modulator to achieve high stability
  - **STRIP:** Using a ground based complementary instrument at low frequency, located at high altitude in Tenerife
  - Current collaboration: Italy + UK (Cardiff, Manchester and Oxford)
- Angular resolution: 1.3 degree FWHM. Sky coverage: ~30% of the sky
- Combined polarizaton sensitivity: <10 μK arcmin per flight
- Targets:
  - CMB **B-Mode** reionization and recombination bumps
  - Cosmic **variance limited reionization optical depth** measure

PI ASI **SWIPE** (balloon borne) Paolo de Bernardis (Università La Sapienza, Roma, Italy)

PI ASI **STRIP** (ground based) M. Bersanelli (Università di Milano Statale)

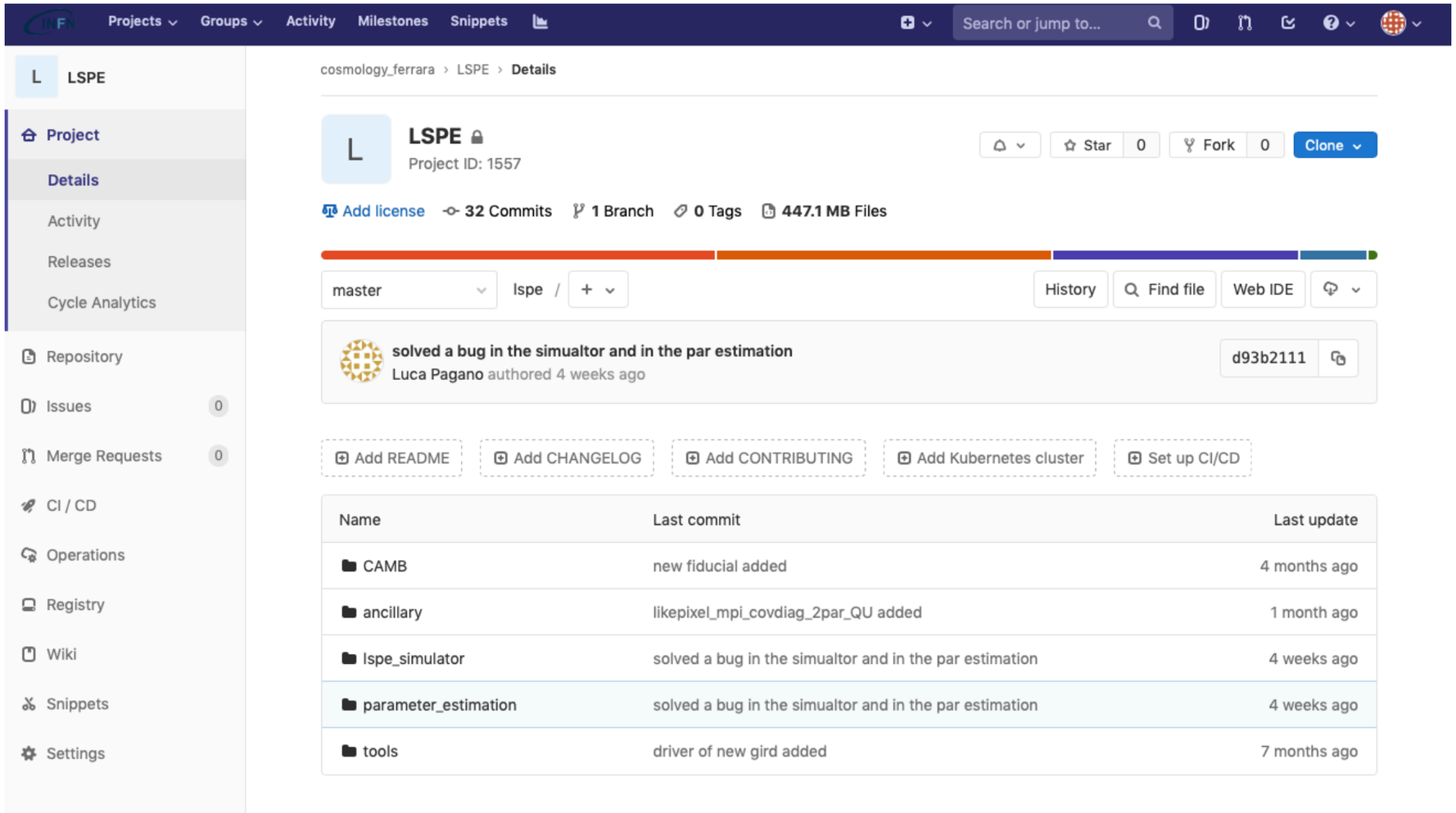
Sigla INFN: GE (Gatti), FE (Pagano), MI (Caccianiga) PI (Signorelli), RM1 (de Bernardis), RM2 (Rocchi)

Activity in Ferrara (…/2020/2021/2022/…)

Suite of codes under development within the INFN gitlab:

https://baltig.infn.it/cosmology_ferrara/lspe

- Flight Simulator
- Component separation
- Spectrum estimation
- Likelihood
- Cosmological Parameters



Activity in Ferrara (2021/2022)

We moved the simulation and data analysis pipelines to litebird_sim

This is interfaced with SWIPE through

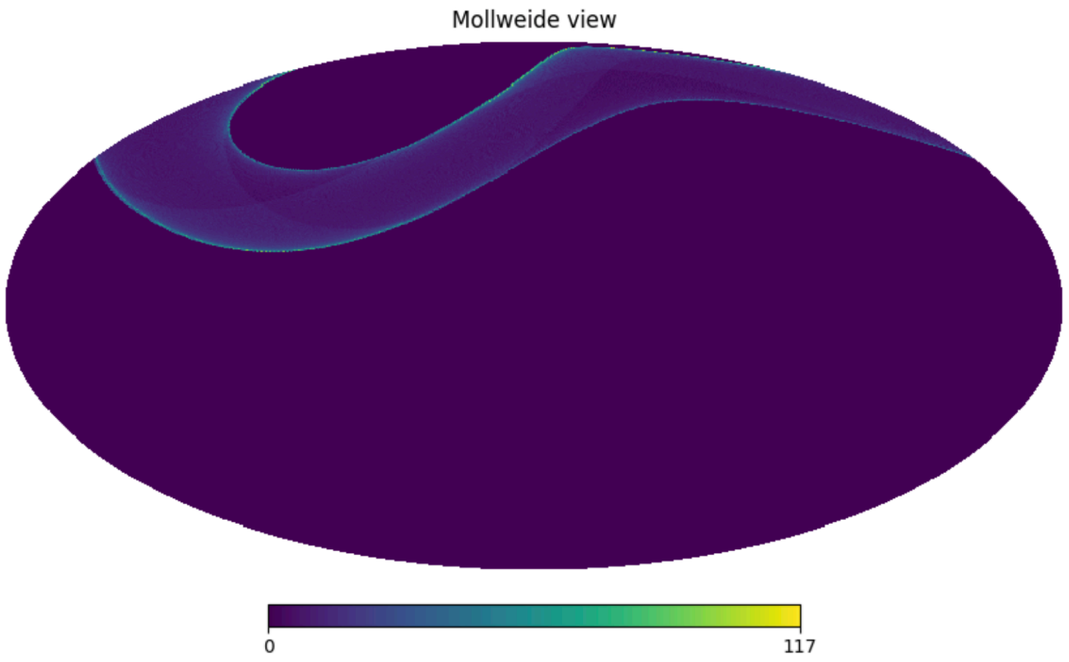
https://github.com/paganol/swipe_modules

SWIPE Modules

This repository contains routines that adapt litebird_sim to LSPE-SWIPE.

It sould contain:

- A module which takes care of the scanning strategy for a Balloon
- A number of modules that can ingest systematic effects in the timelines



Activity in Ferrara (2021/2022)

We built a Instrument Model Database based on RESTful API

https://github.com/ziotom78/instrumentdb

Currently the database contains detector characteristics
(quaternions, bandpass, instantaneous noise, fwhm, etc…)
Potentially can include external files
(Beams, calibration curves, HWP profiles, etc…)

https://github.com/paganol/swipe_imo

SWIPE IMO

It contains the Instrument MOdel of LSPE-SWIPE and some routines for creating it.

How to use it

Clone the repository, and run

```
python -m litebird_sim.install_imo
```

Activity in Ferrara (2022/2023)

1. Preparation of the SWIPE pipeline:
   a. Beam convolution with realistic beams (currently under production)
   b. Systematic effects injection (cosmic rays, HWP non-idealities). Codes ready
   c. Mapmaking, destriper already interfaced, validation needed
2. High-level analysis pipeline preparation (substantially ready, some optimization necessary):
   a. Component separation (shared with TS)
   b. Likelihood
   c. Parameter estimation

Main collaborations with:

- Roma1, for instrument model and data handling
- Milano, Roma1 for optimization of observational strategy
- SISSA, for foreground cleaning

Anagrafica e Richieste (2023)

- Luca Pagano: **1.0**
- Alessandro Gruppuso (INAF Bo): **0.25**
- Nicolò Raffuzzi: **1.0**

Variazione:

- Raffuzzi in, Chiocchetta out

Totale FTE: **2.25**

Richieste (da confermare con RN):

- Meeting di collaborazione in Italia (uno ogni 3 mesi x 2 persone su 2gg): 2 K€
- Conferenza internazionale di cosmologia per 2 persone, per pubblicizzare LSPE: 3k€