



CubeSat VERTECS: Measuring the **EBL** -Development of the Data Downlink Pipeline

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Introduction

What is the origin of the Extragalactic Background Light (**EBL**)?

- ◆ **EBL**: Integrated line-of-sight radiation from the early to present universe (Figure 1).
- ◆ Directly related to the star formation in the early universe.
- ◆ VERTECS (Visible Extragalactic background RadiaTion Exploration by CubeSat) is a 6U CubeSat designed to measure the **EBL** in the visible wavelength.
- ◆ VERTECS can avoid atmospheric interference, making it superior to ground-based telescopes.
- ◆ Large field of view (FoV) is not sensitive to local fluctuation, which is advantageous for measuring background light.

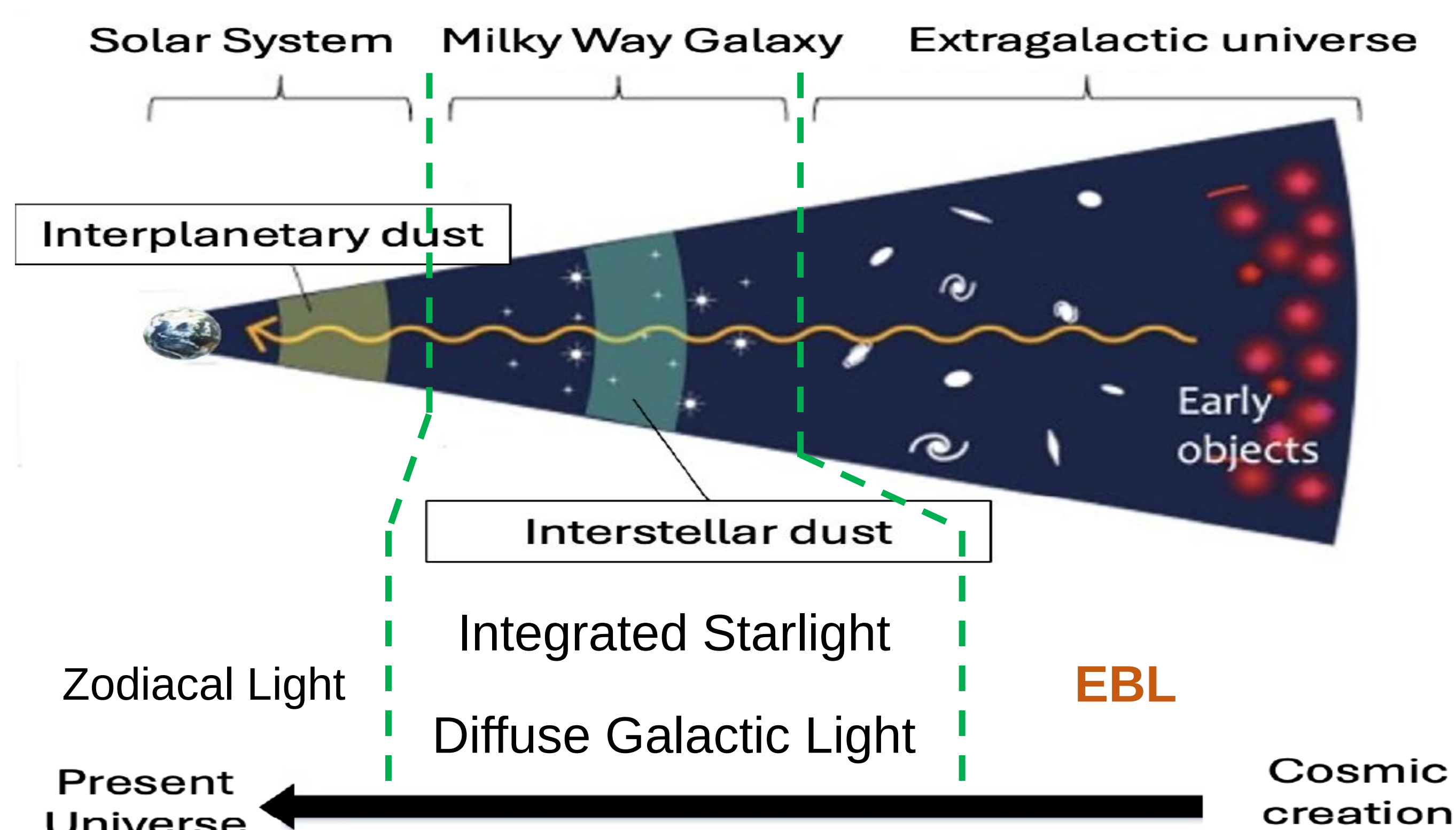


Figure 1. Schematic diagram of the **EBL**.¹

Science Goal

Reveal the nature of **EBL**.

- ◆ Integrated Galaxy light itself is insufficient to fit the observed **EBL** in near-infrared.
- ◆ 2 proposed models predict distinct spectra in optical (Figure 2).
- ◆ VERTECS will cover >40% of the sky to measure 4 photometric points in the optical.

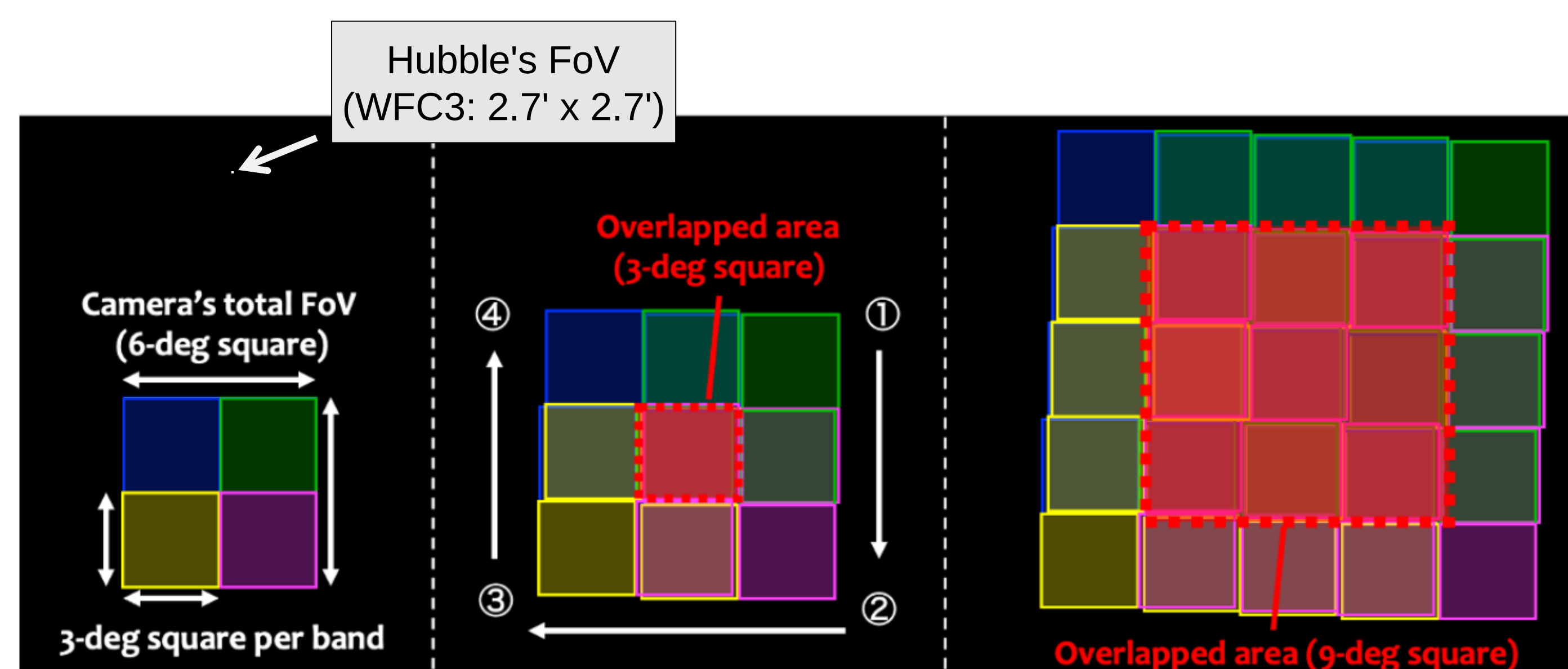


Figure 3. Image units in blank-sky observation by VERTECS.¹

Pipeline Development

Since data might be lost and corrupted during the downlink process, our pipeline aims to identify and recover the incomplete data.

This pipeline will be utilized at four ground stations (including NCU) to ensure the quality of downlinked data. This is crucial for the **EBL** analysis.

Functions:

- ◆ Identify lost and corrupted parts of the data.
 - ◆ By the sequential count in each packet.
- ◆ Generate commands to require the desired data again from the satellite.
- ◆ Combine the requested data with the incomplete data.
- ◆ Convert the binary files to the widely-used **image** format: Flexible Image Transport System (FITS).
- ◆ Build a database easy for users to access.

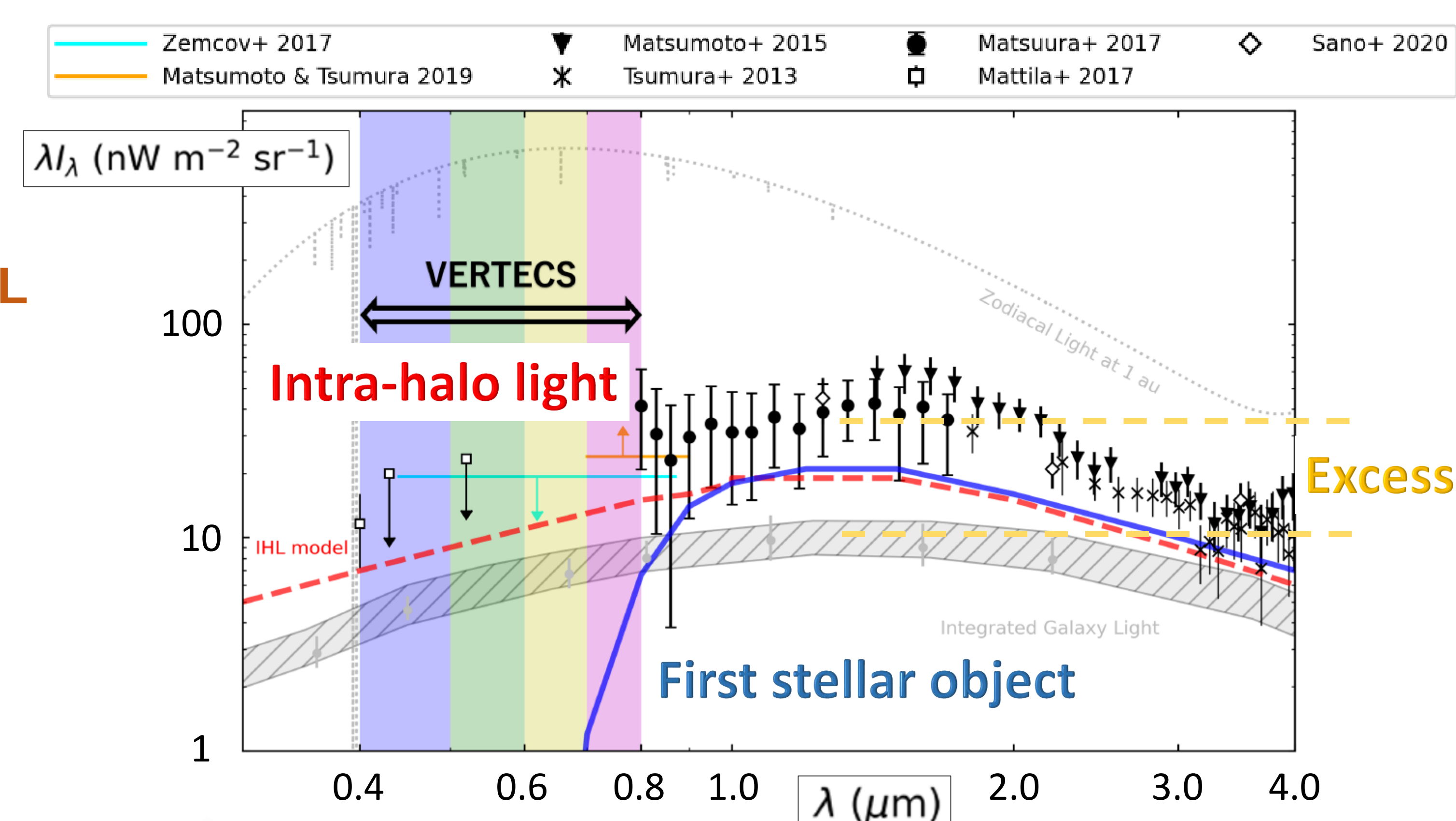


Figure 2. Observed **EBL** and models.¹

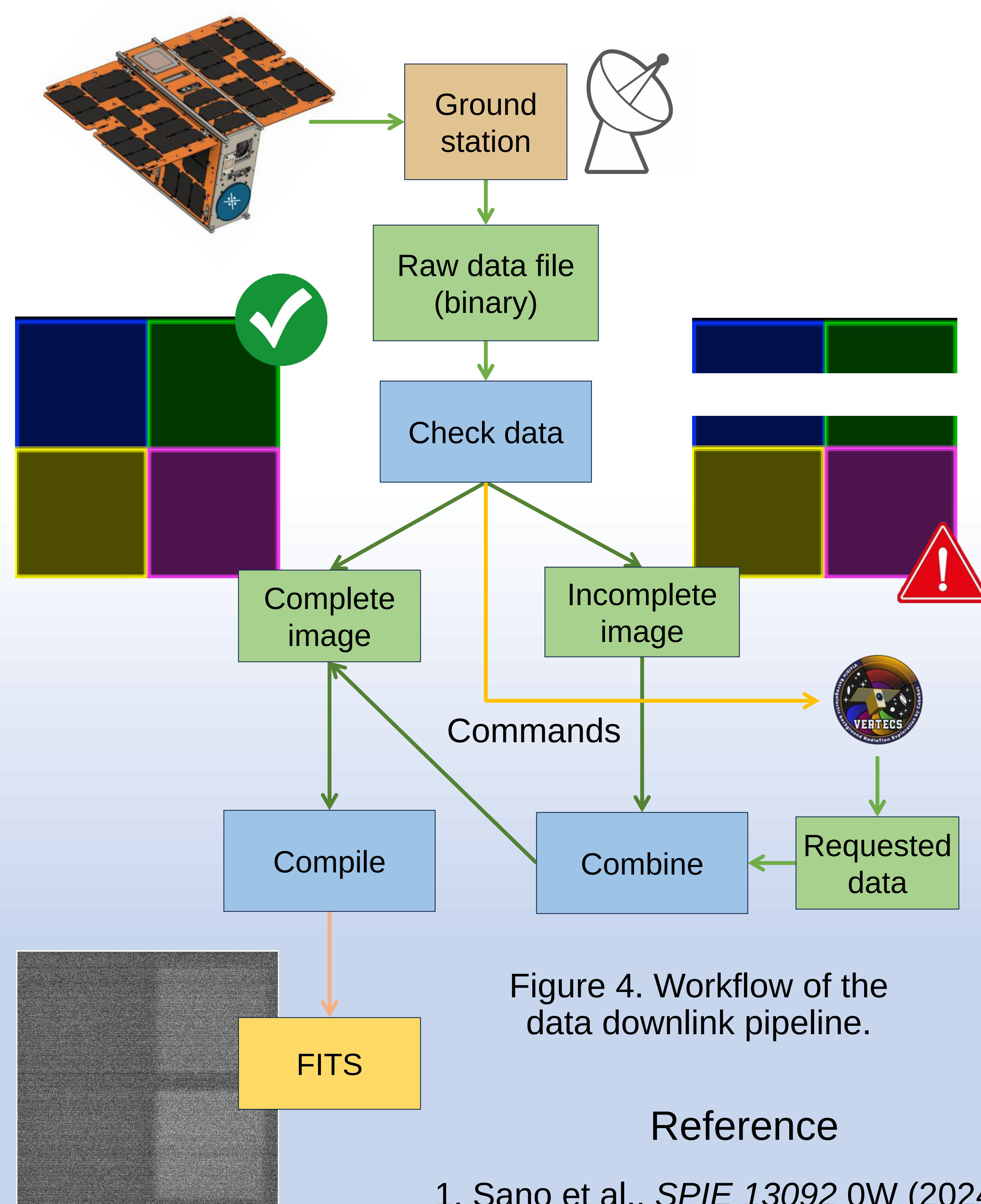


Figure 4. Workflow of the data downlink pipeline.

Reference

1. Sano et al., *SPIE* 13092 0W (2024)