National Aeronautics and Space Administration

PANFTS-DFPA Interface, Onboard Processing and CLARS Validation

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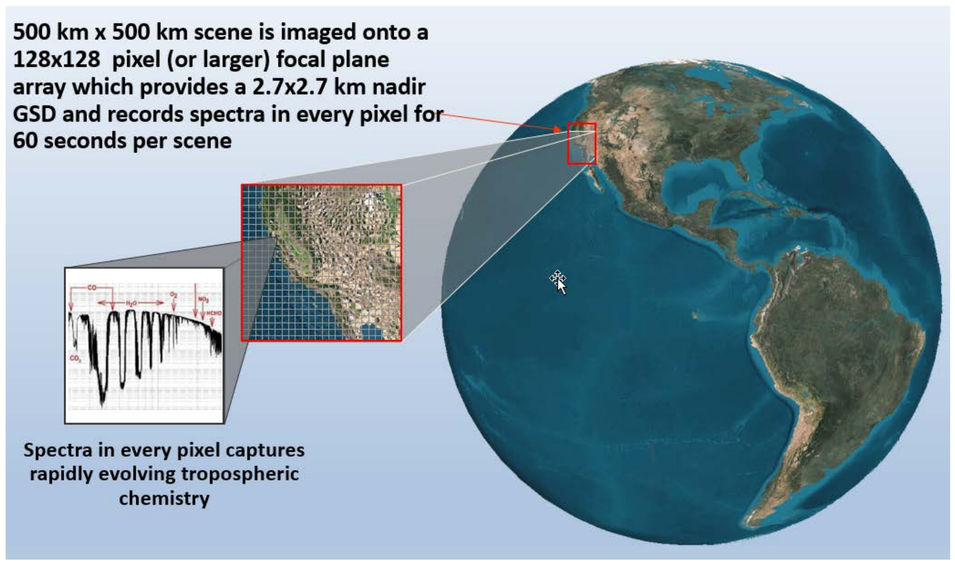
Program: Strategic R&TD/Earth Science Instruments

Project Objectives:

- Demonstrate the performance of digital focal plane technology for use with JPL's PanFTS atmospheric composition instrument, thereby enhancing its readiness for future flight proposal opportunities including NASA Explorer-class missions and NOAA geostationary sounders.
- Design, build and demonstrate the electrical interface between a digital focal plane array (DFPA) and a Xilinx Kintex Ultrascale (XCKU060-1FFVA1517I) FPGA based instrument controller.
- Implement onboard data processing to convert raw data (interferograms) to radiance spectra using FPGAs embedded in the instrument controller.



Benefits to NASA and JPL (or significance of results):

- In year 1 of this 3-year task, we significantly increased the design maturity of the detector and onboard processing systems for imaging Fourier transform spectrometers such as PanFTS.
- In Year 2, hardware and software for both the DFPA interface and Onboard Processing system will be completed.
- In Year 3, the DFPA and onboard processing hardware will be interfaced to interferometers in B306 and JPL's CLARS facility on Mt. Wilson to acquire atmospheric spectra.

FY19 Results:

- Completed the design of the onboard processing system which will be used to ingest the PanFTS data stream (digitized interferogram acquired from each DFPA pixel) and transform to spectra. Depending on the desired spectral bandpass(es), this will reduce the downlink data requirement by a factor of ~20. The onboard processing board is called FIRESpec.
- Completed the design of the camera board (Lighthouse) which is the interface between the DFPA and the processing board.
- Obtained and analyzed the ICD from MIT Lincoln Labs for their DFPA which will be used by PanFTS
- Obtained a 1280x480 InGaAs DFPA from Lincoln Labs and optically interfaced it to the IIP-10 PanFTS thermal infrared interferometer in B306. Because the DFPA was not electronically synchronized to the PanFTS metrology system, the instrument could not produce high-resolution spectra. However, the demonstration showed that, once the new camera interface with synchronization capability is developed in FY20, the JPL FTS and the LL DFPA will be fully compatible. Figure 1 shows the PanFTS TIR interferometer interfaced to the LL DFPA. Figure 2 shows a solar image recorded by the DFPA through the PanFTS instrument, as well as an interferogram captured at 1000 frames per second (3.6Gb/s sustained data rate). It was necessary to return this camera to Lincoln Labs after a few days.
- Obtained a 640x480 HOT-BIRD DFPA from Lincoln Labs as a long-term loan. This camera will be used to generate images that will be acquired by the JPL Lighthouse board.

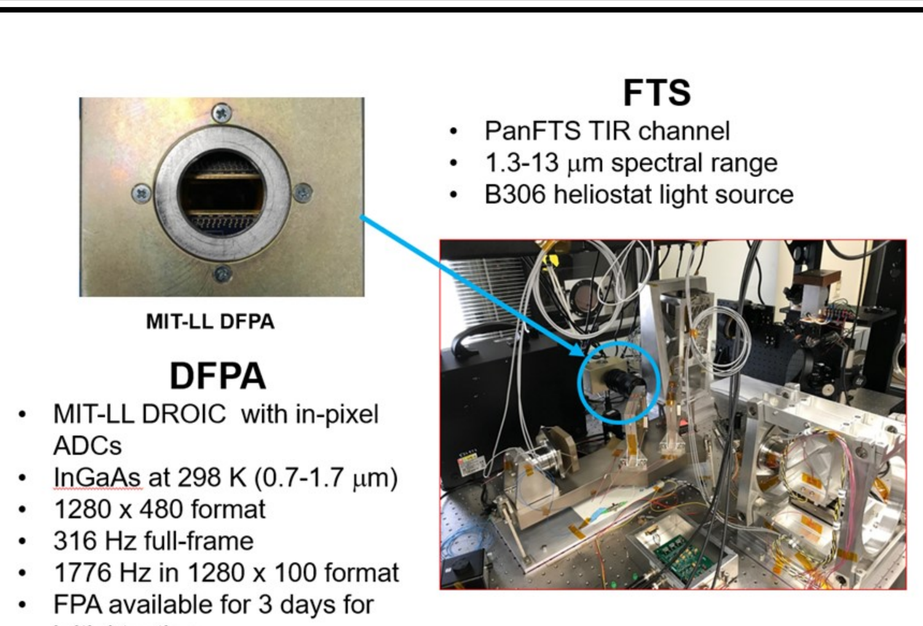


Figure 1. Images showing MIT-LL focal plane array interfaced to PanFTS instrument.

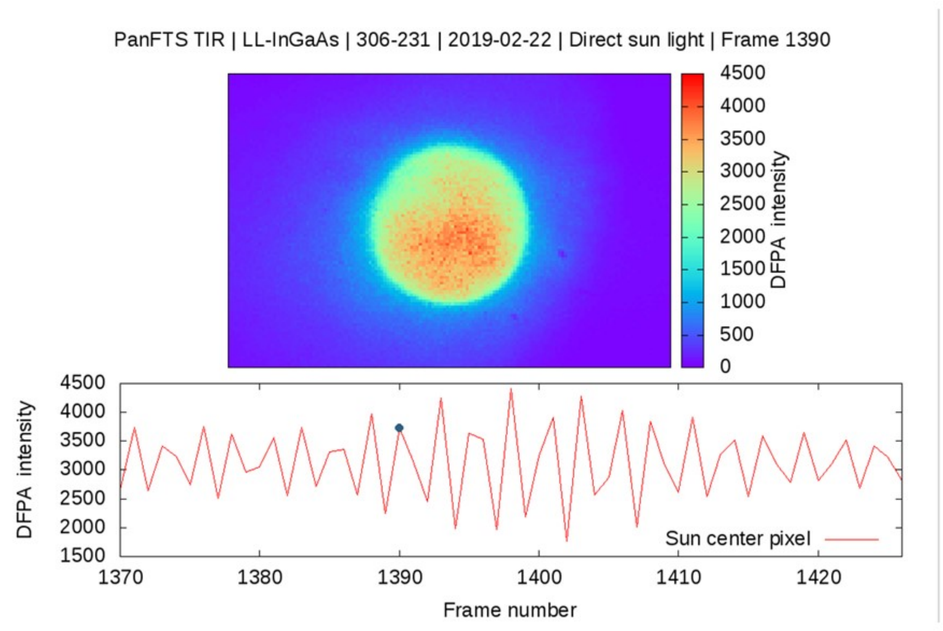


Figure 2. Successful demonstration of PanFTS-DFPA system at sustained 3.6 Gb/s data rate.

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Publications: None

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Poster No. RPC-053