

Are We Alone?

Searching for Extraterrestrial Intelligence and the Origins of the Universe at the Allen Telescope Array

Luigi Cruz, Staff Engineer, SETI Institute

Adam Thompson, Principal Technical Product Manager, NVIDIA

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What is SETI?

Search for Extraterrestrial Intelligence

The Quest

- Exploring the possibility of **intelligent life** beyond Earth.
- Utilizing **advanced technology** to listen for signals from distant civilizations.

The Mission

- A worldwide effort involving telescopes, scientists, and engineers.
- Answering "Are we alone?".

The Challenge

- Distinguishing the civilizational whispers from the cosmic noise.
- $$N = R_* \cdot f_p \cdot n_e \cdot f_l \cdot f_i \cdot f_c \cdot L$$

Allen Telescope Array

Hat Creek, CA



Allen Telescope Array

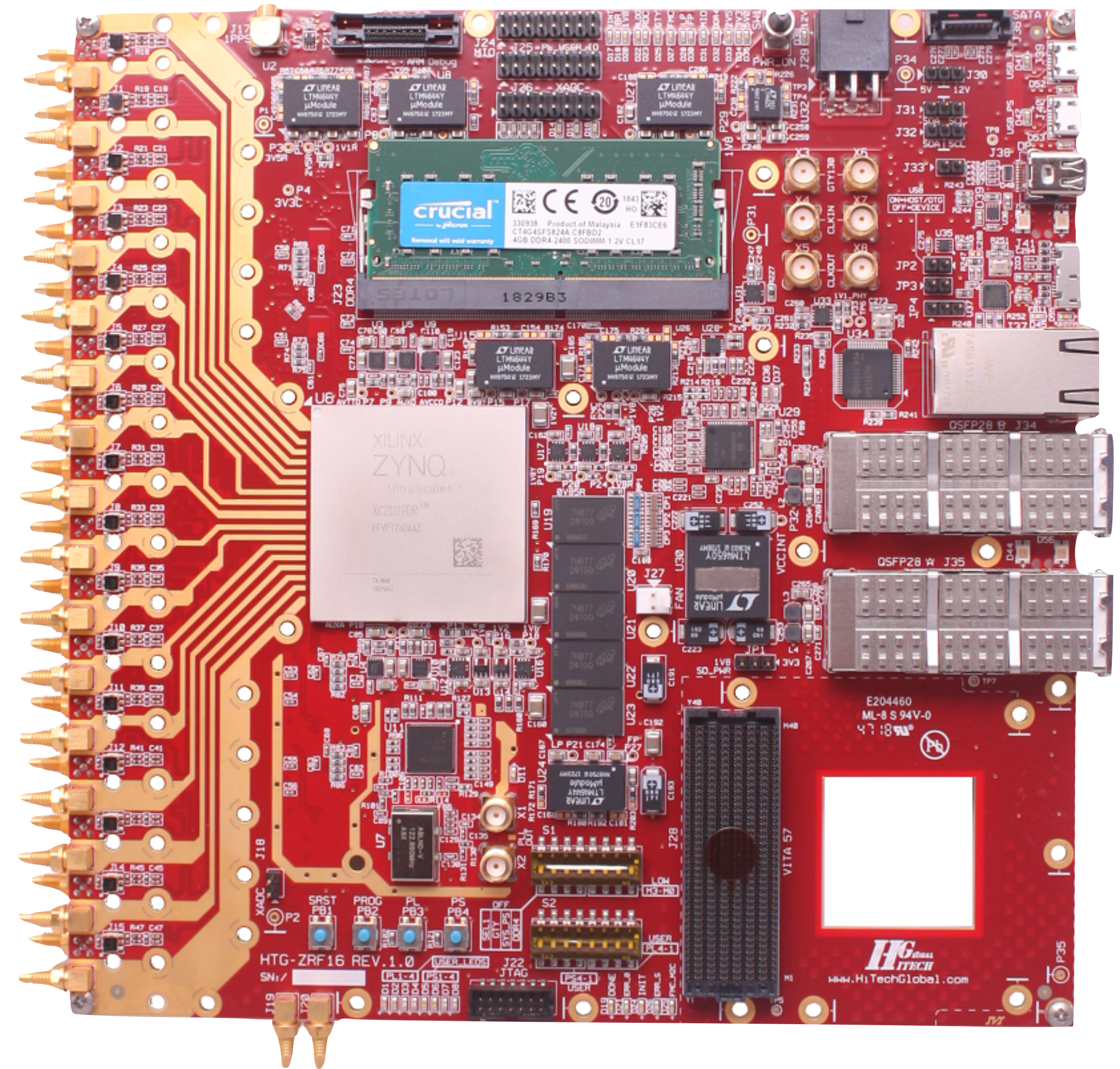
Offset Gregorian Dish

- Each of the 42 antennas has 20 feet (6.1 m) in diameter.
- Produces ~ 1.5 GHz of bandwidth for each polarization (~ 3.0 GHz in total).
- The entire telescope equates to ~ 60 GHz or ~ 1 Tbps at 8 bits per sample.
- Connected to the DSP Room via RF over fiber.
- Ultra-wideband reception from 300 MHz to 12 GHz.



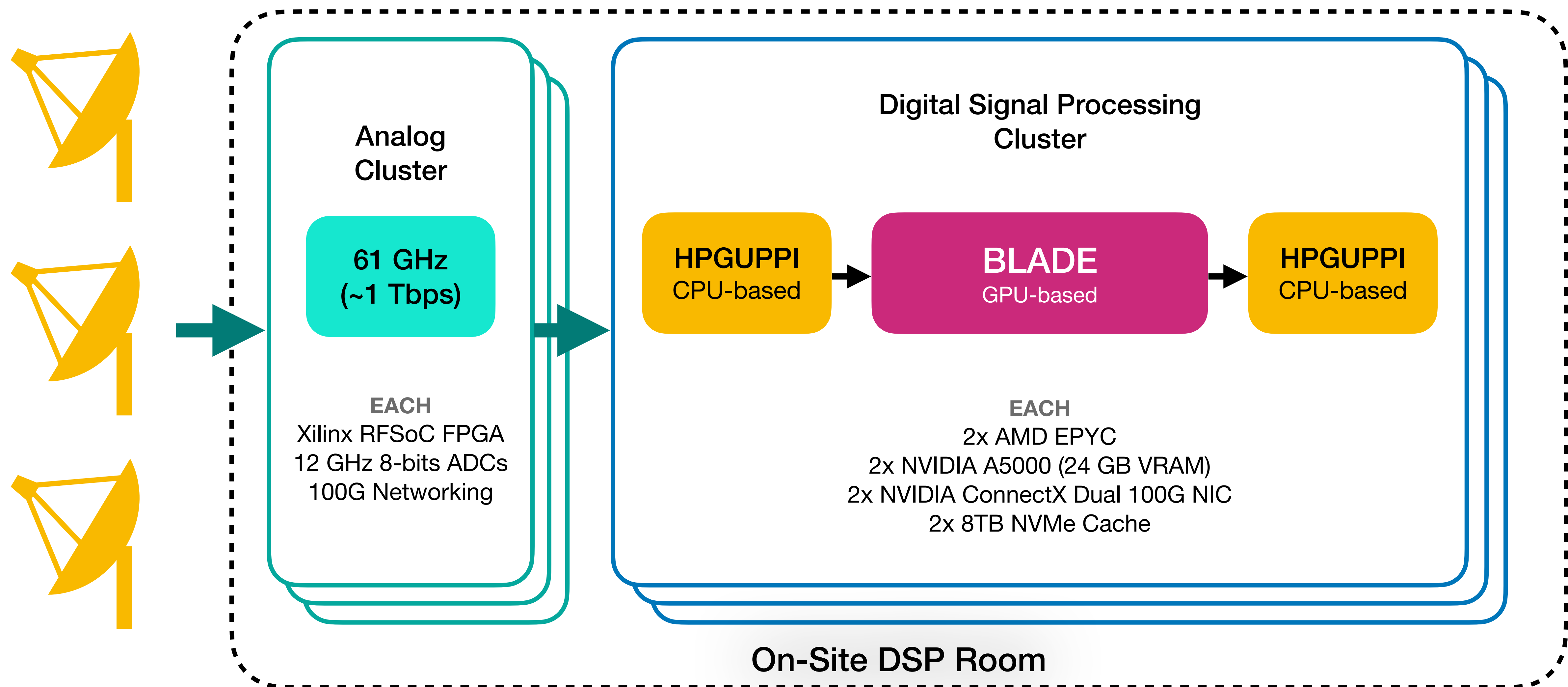
Allen Telescope Array Data Acquisition

- Received radio signal is transmitted to the DSP room via RF over fiber.
- Signal is converted back to copper, pre-amplified, mixed, and distributed to the data-acquisition boards.
- Signal is digitized using RFSoc FPGA boards where it is pre-channelized, packetized, and sent over the network via 100G fiber.
- Data is received in the processing nodes.



Data Processing

Current Pipeline



Holoscan

NVIDIA's Streaming Sensor Platform

What is Holoscan?

- High-performance platform for sensor data processing and AI inferencing.
- Leverages the power of NVIDIA GPUs for efficient data movement and computation.

Benefits

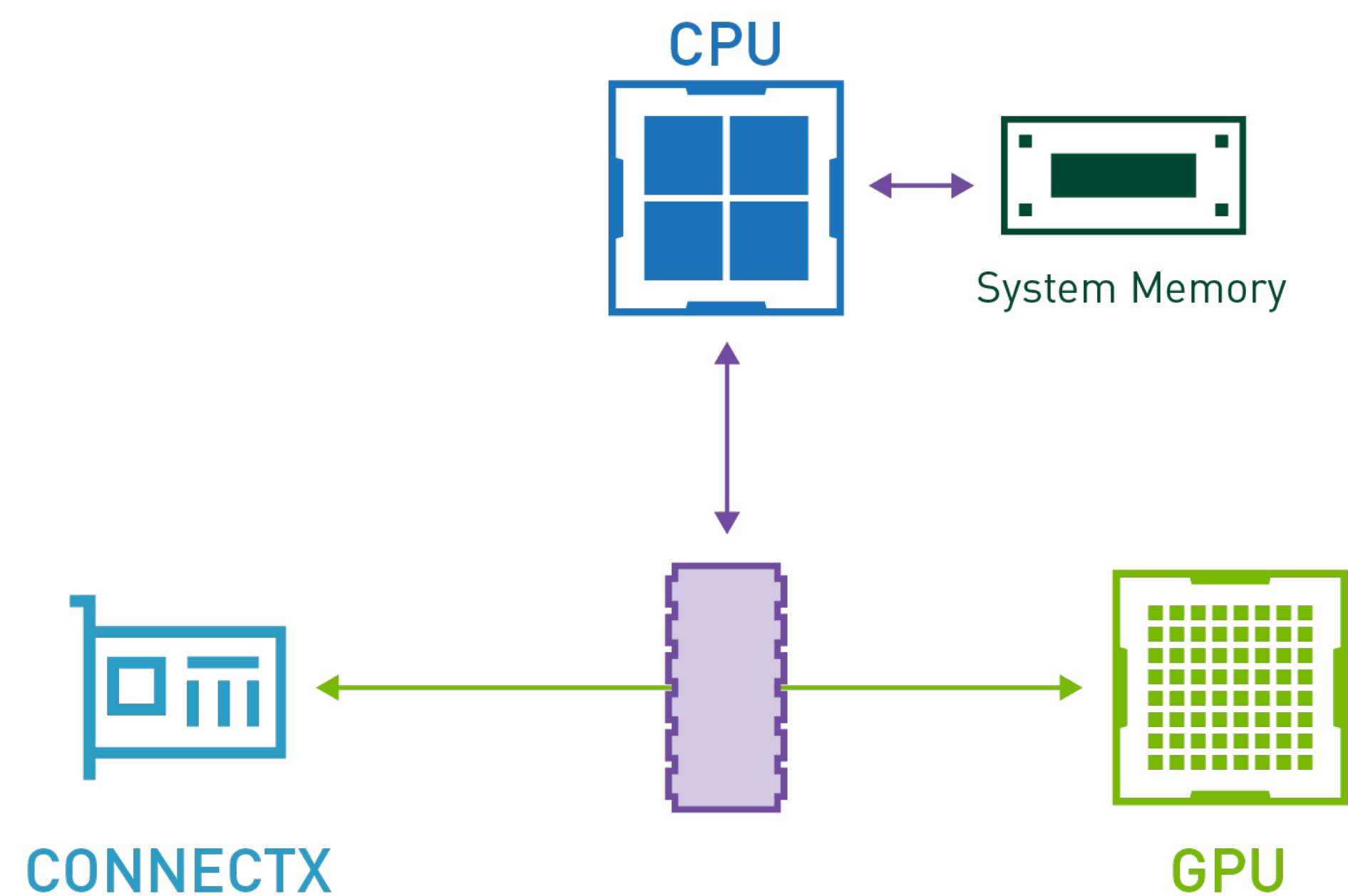
- Scalability: Handles high data volumes and scales with additional hardware.
- Simplicity: Easier to build and deploy sensor processing applications.

Advanced Network Operator (ANO):

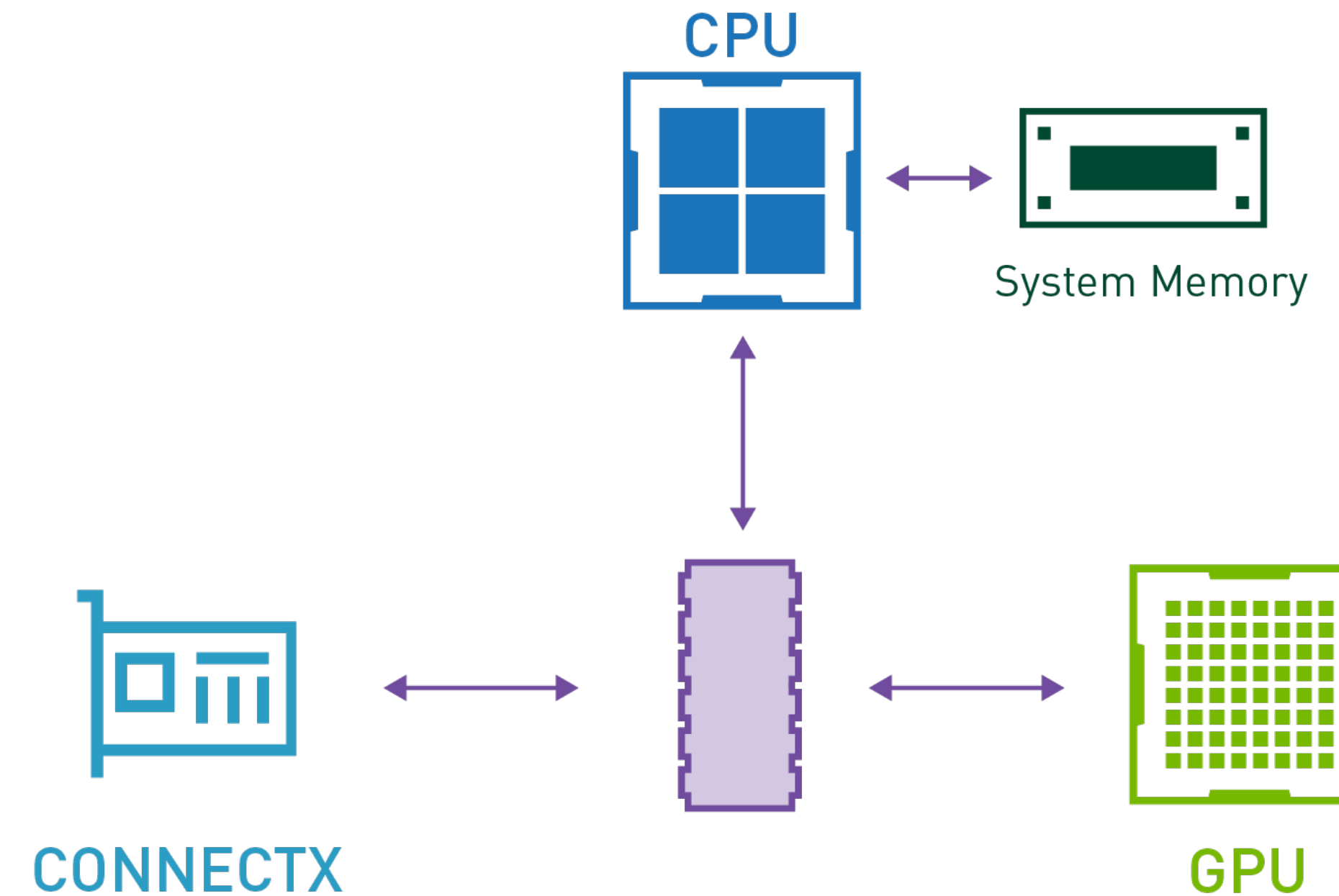
- Abstracts system tuning and GPUDirect RDMA implementation.
- Enables data to bypass CPU and directly reach GPUs for faster processing.

Holoscan

Advanced Network Operator (ANO)



Single RDMA Transfer
(NIC -> GPU)



Two Transfers
(NIC -> CPU -> GPU)



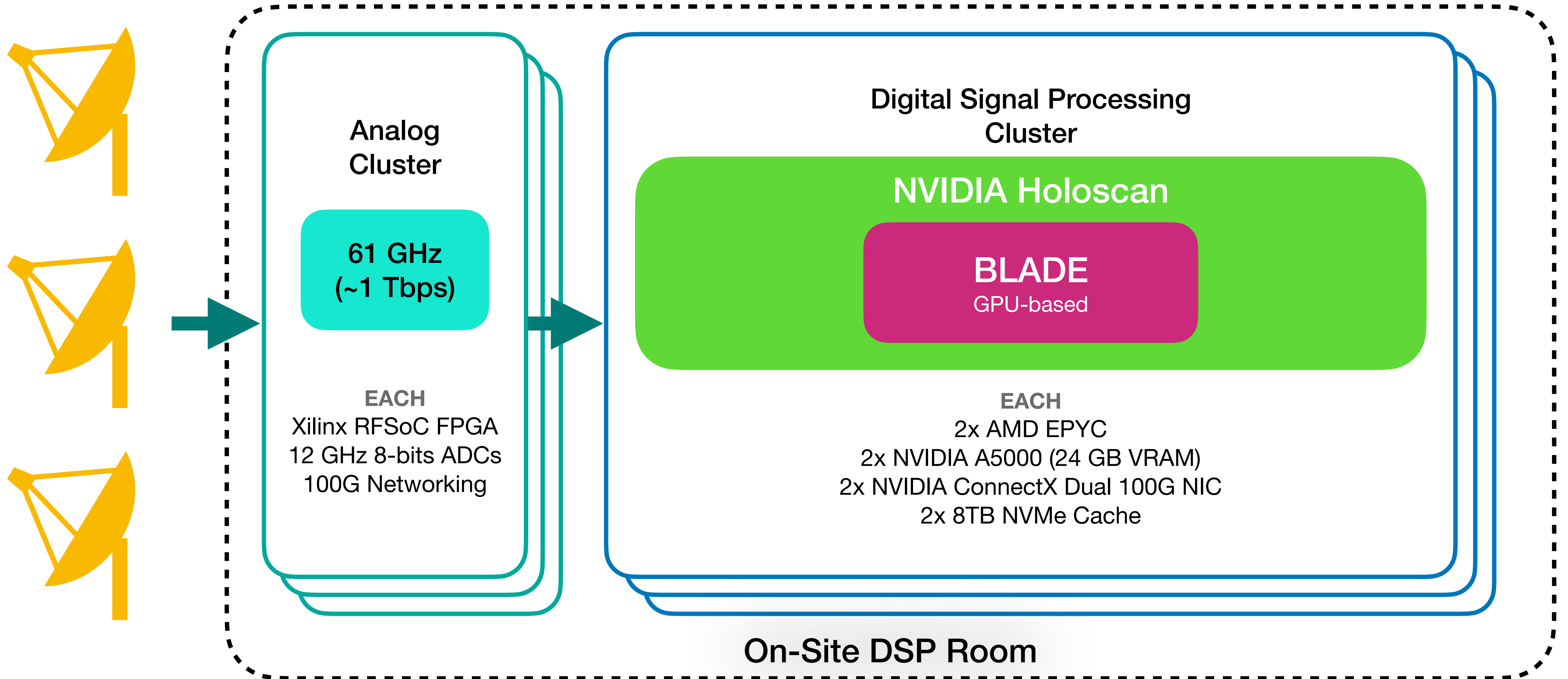
PCIe Switch



GPUDirect RDMA

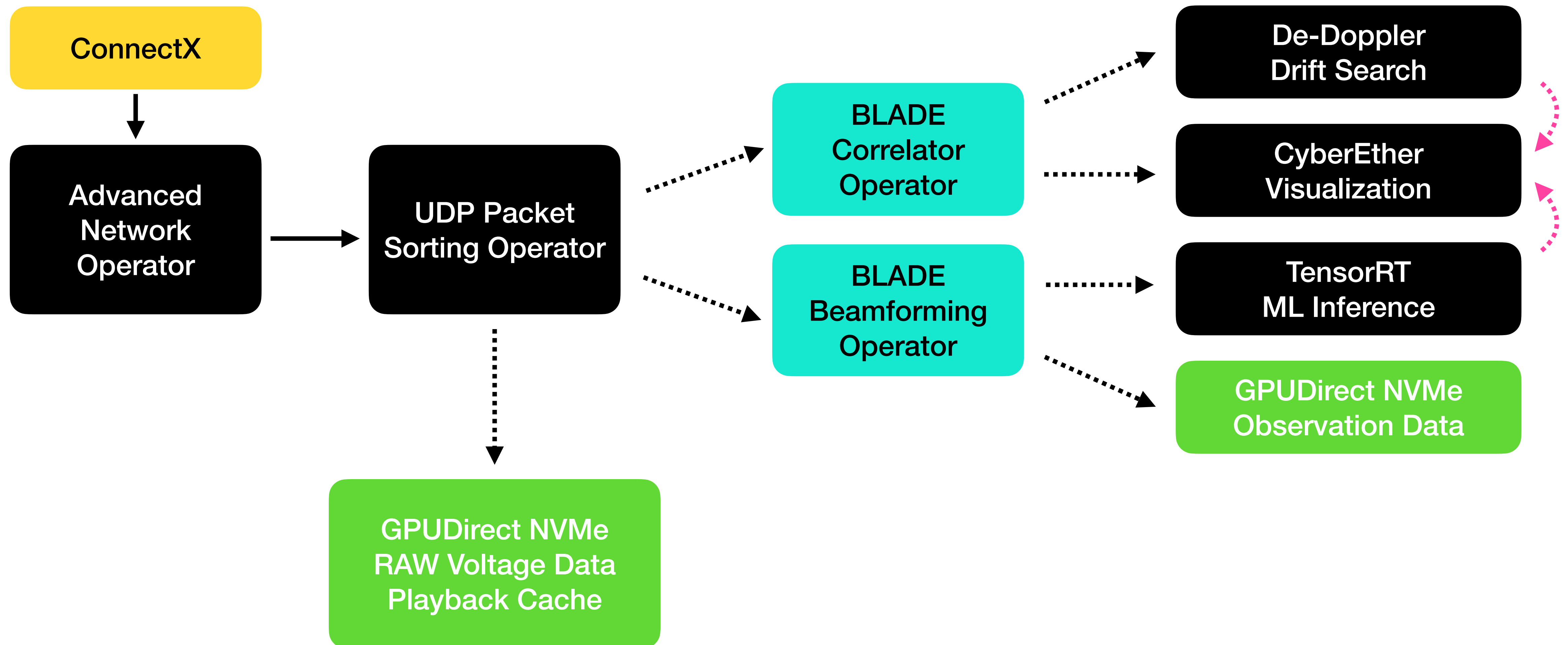
Data Processing

Future Pipeline



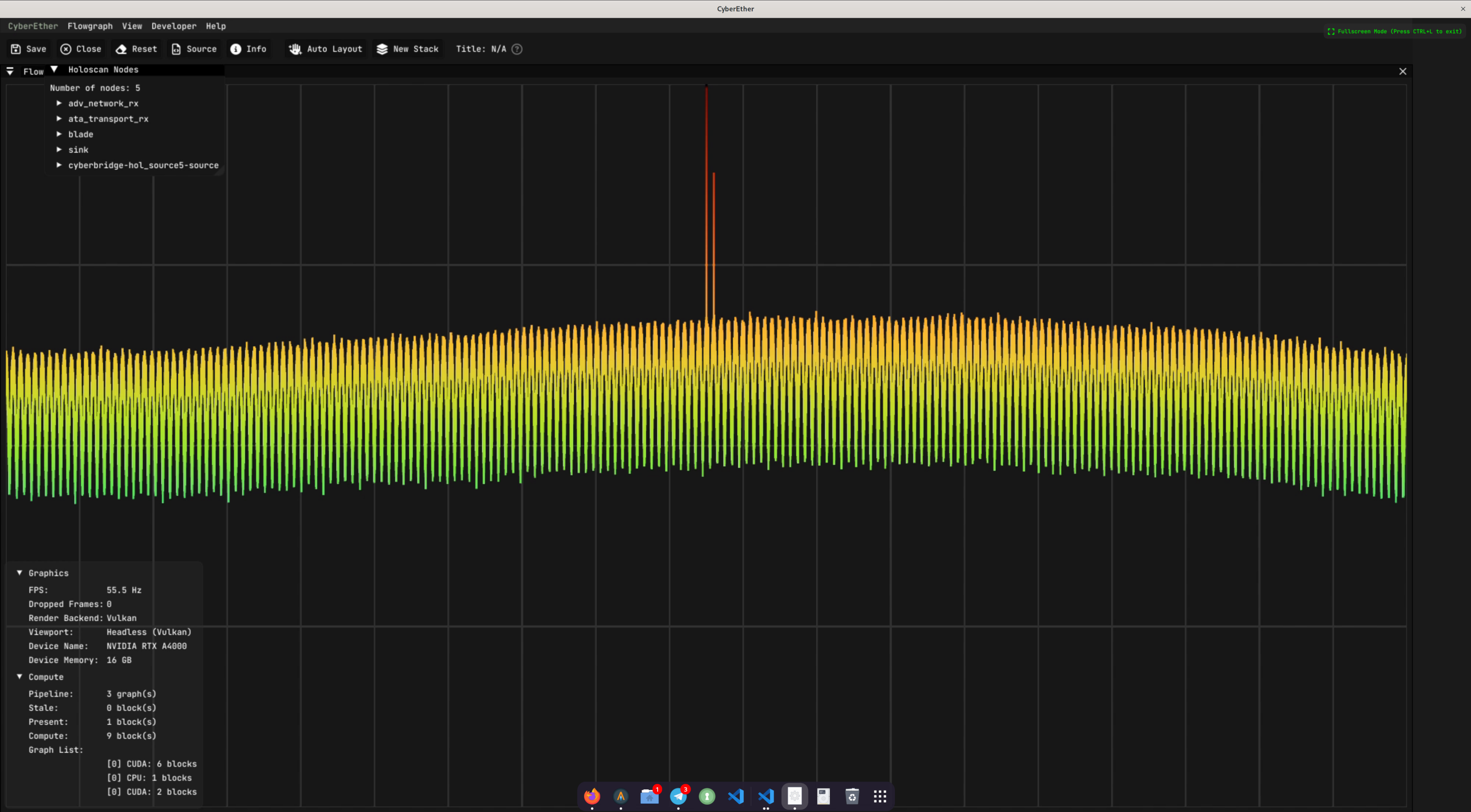
Future

Extending the ATA's Capabilities with Holoscan



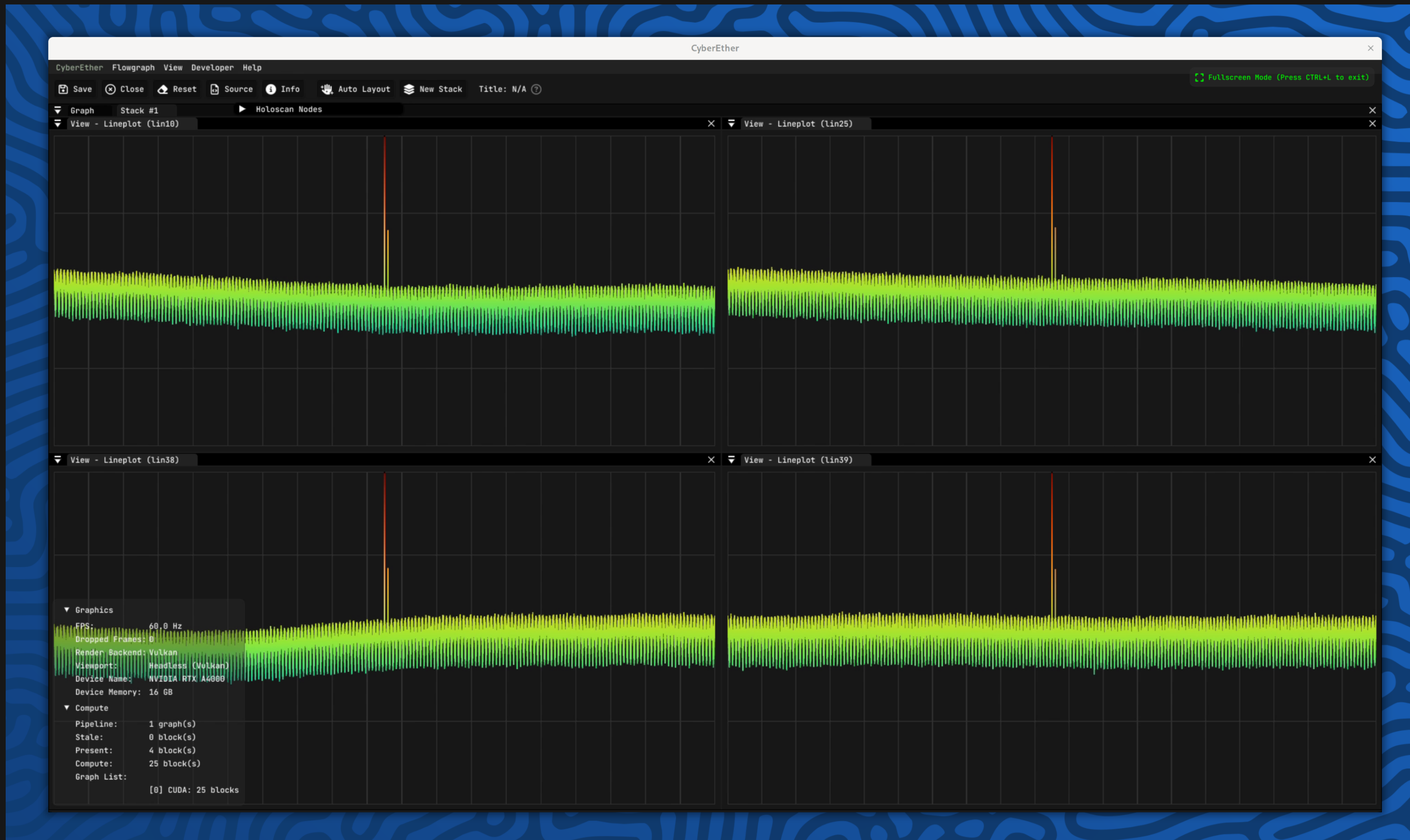
Data Processing

Holoscan + CyberEther Pipeline



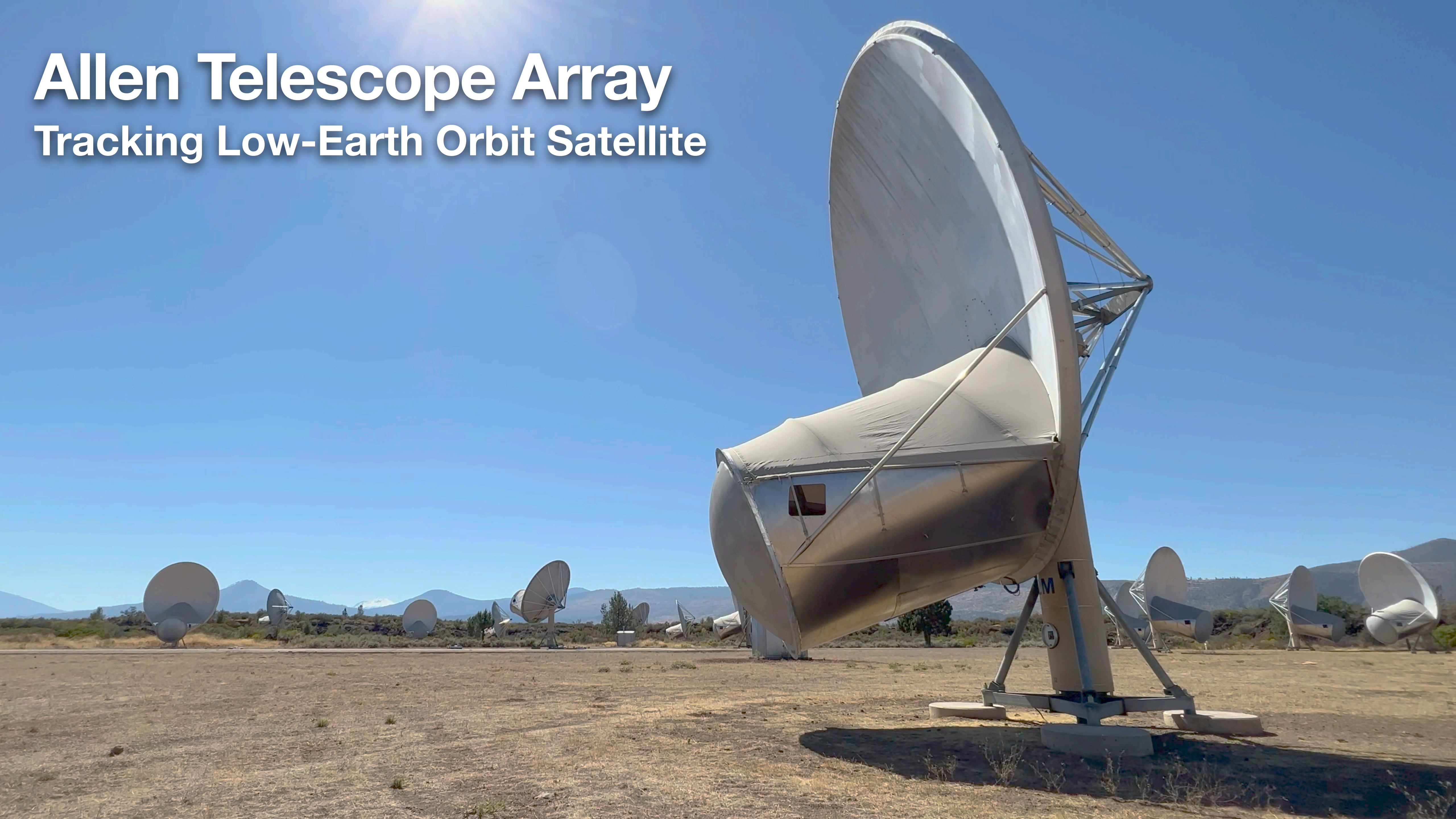
Data Processing

Holoscan + CyberEther Pipeline



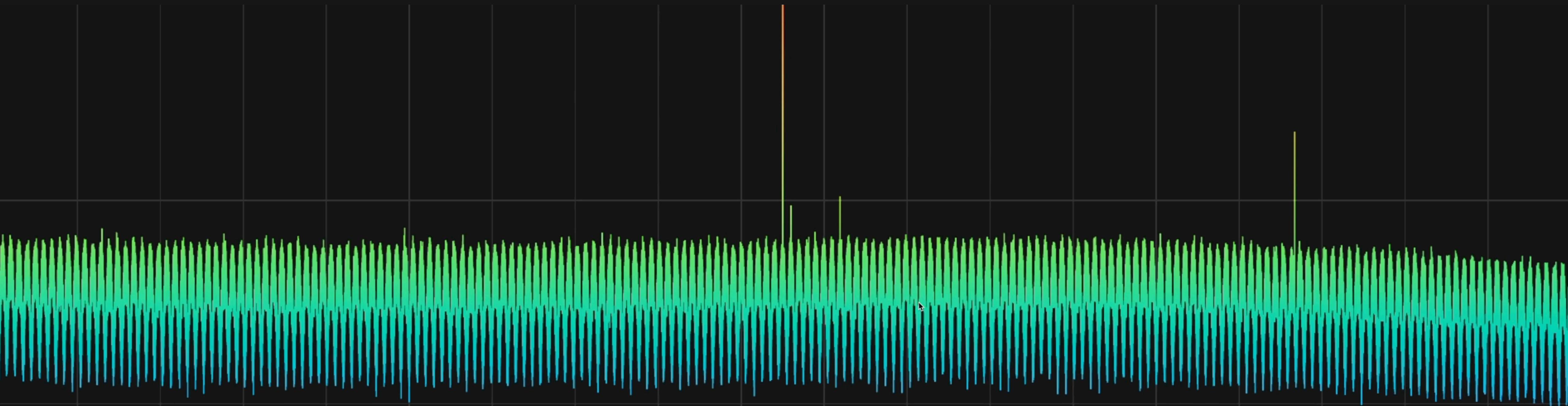
Allen Telescope Array

Tracking Low-Earth Orbit Satellite



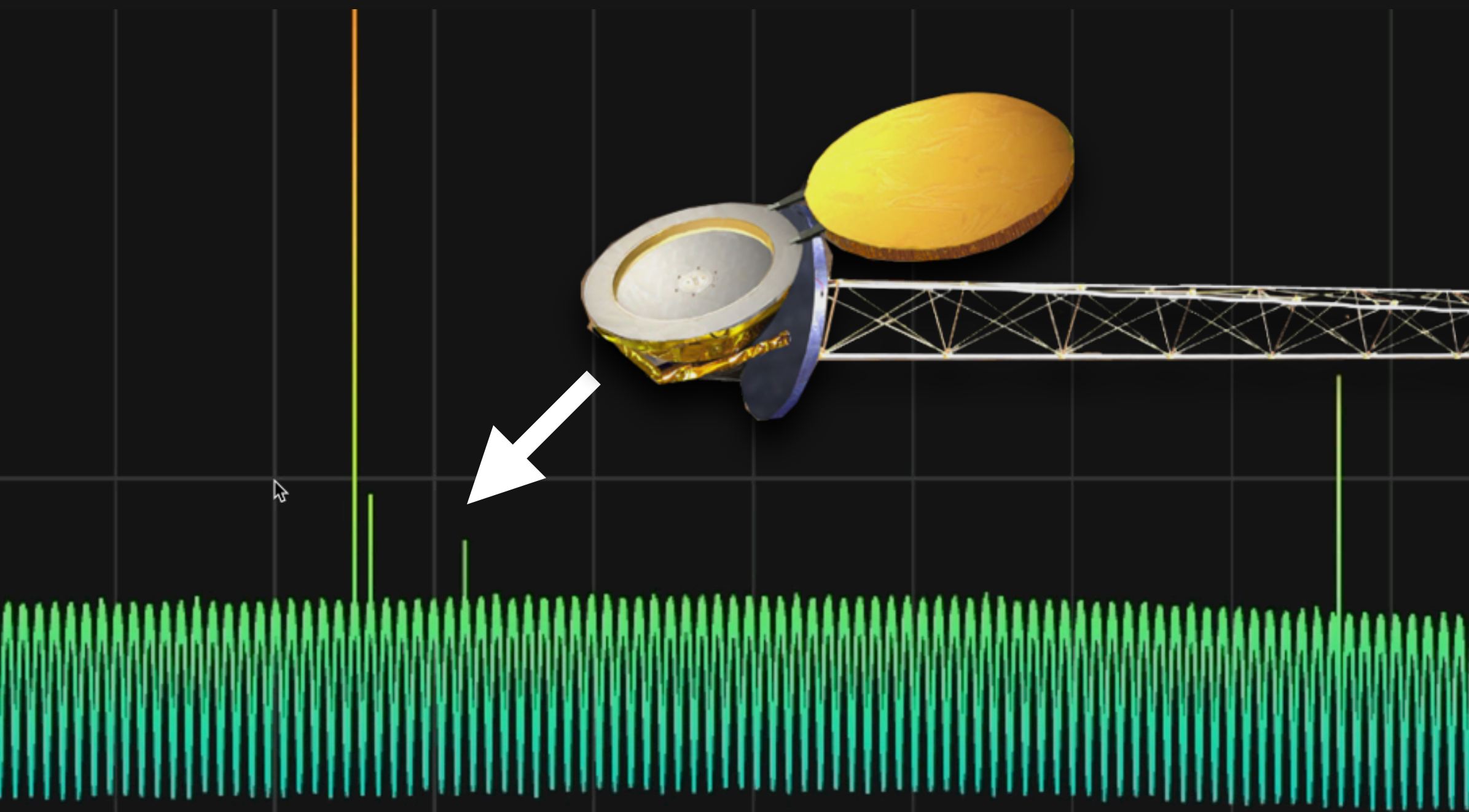
Deep Space Demonstration

Allen Telescope Array Holoscan Pipeline



Deep Space Demonstration

Allen Telescope Array Holoscan Pipeline

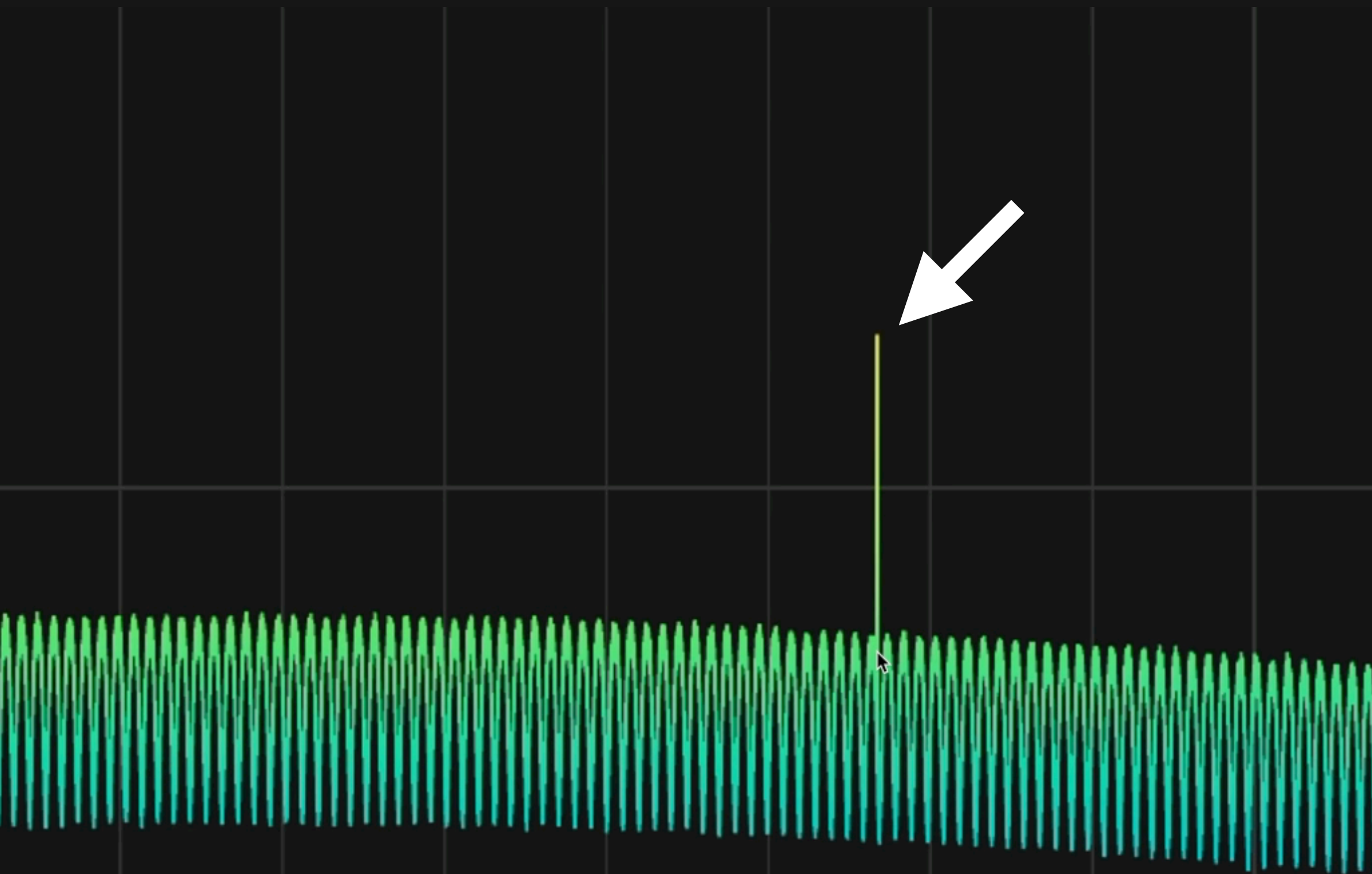


~8406 MHz

Mars Odyssey

Deep Space Demonstration

Allen Telescope Array Holoscan Pipeline



~8430 MHz

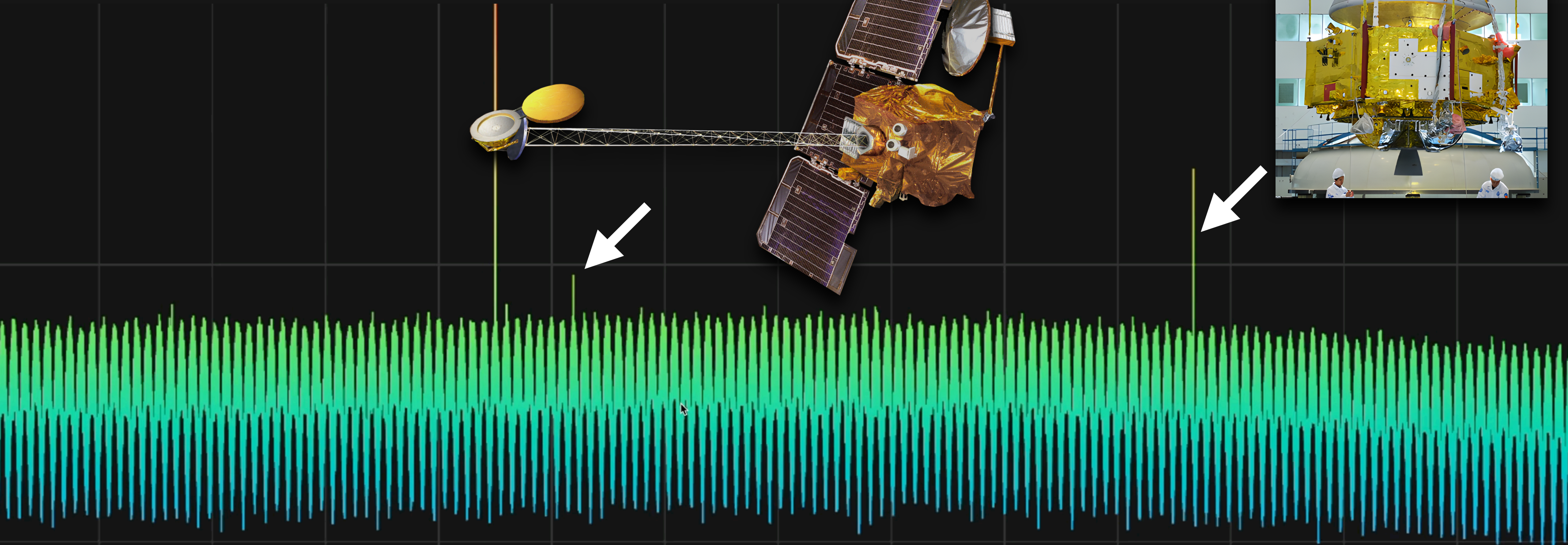


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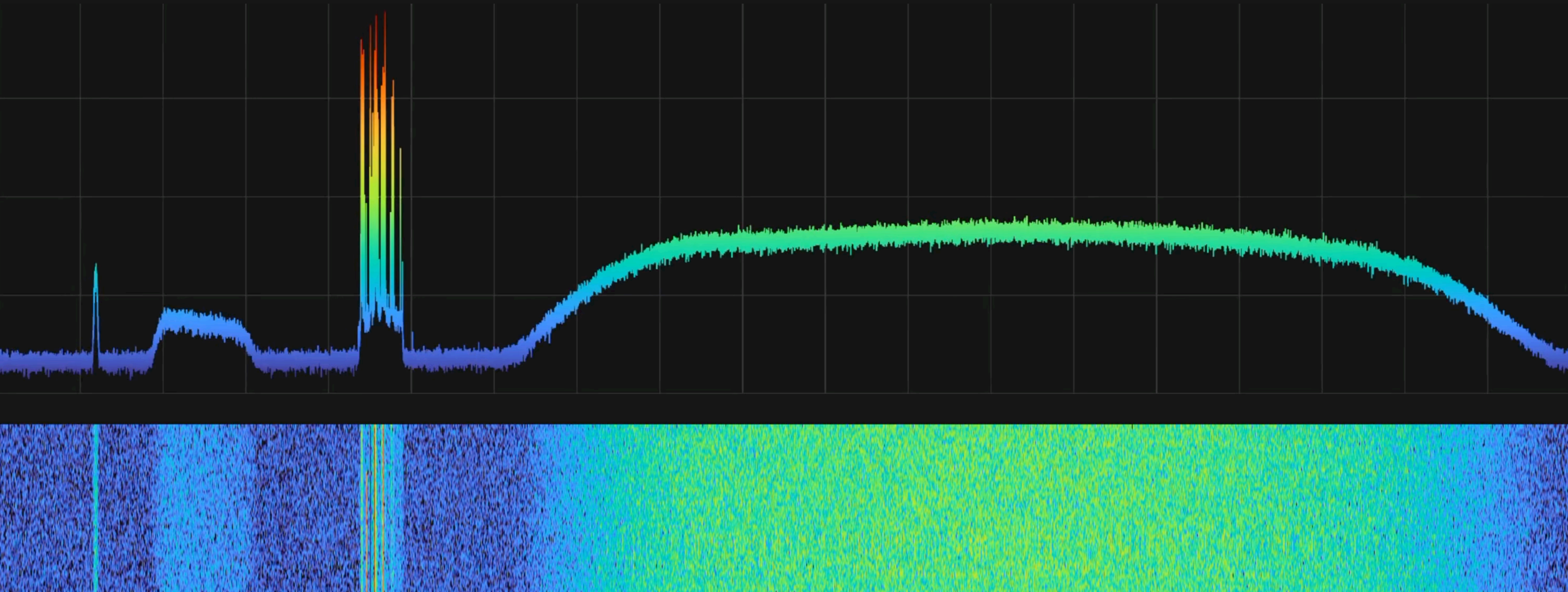
Deep Space Demonstration

Allen Telescope Array Holoscan Pipeline



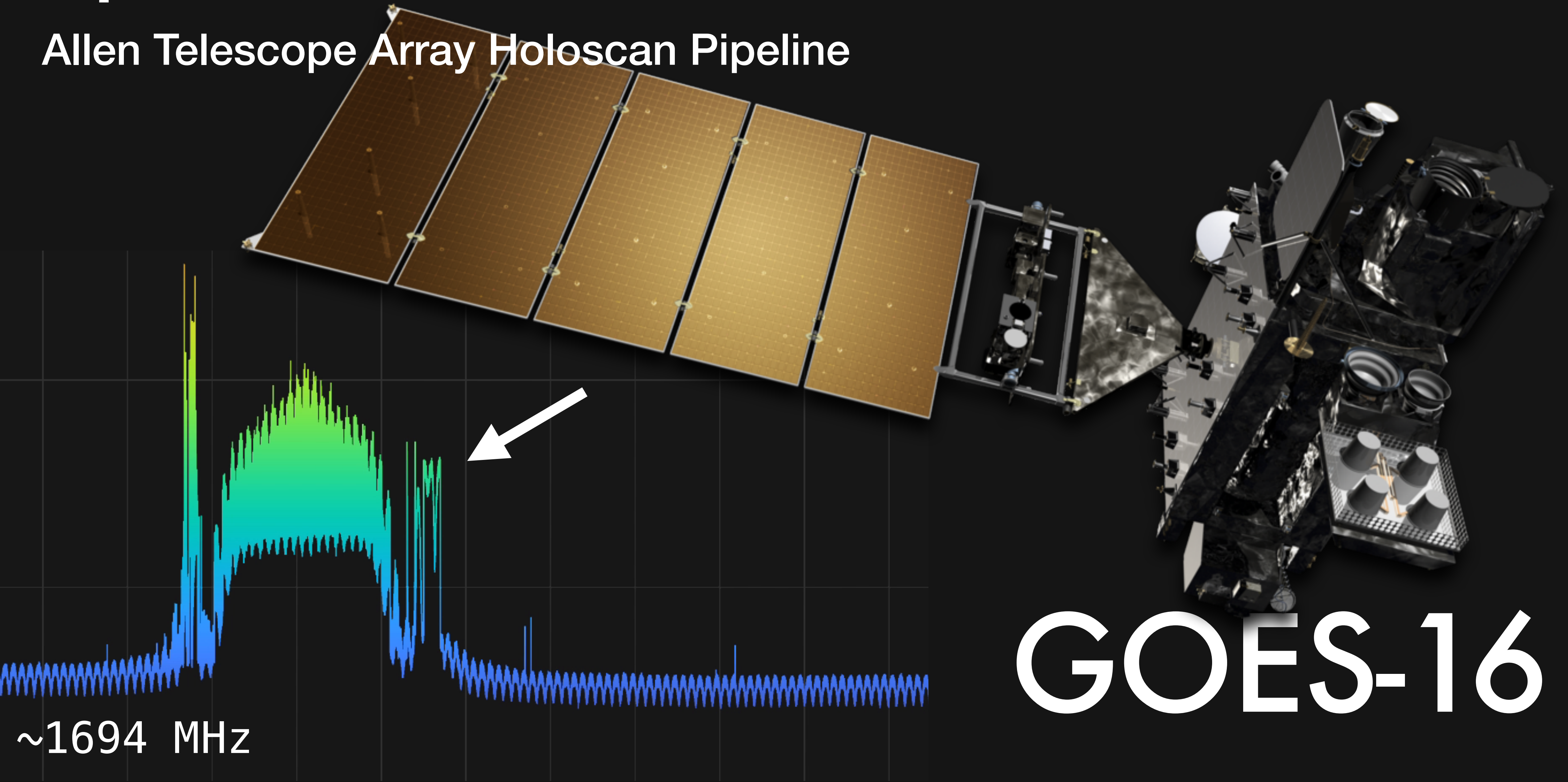
Space Demonstration

Allen Telescope Array Holoscan Pipeline



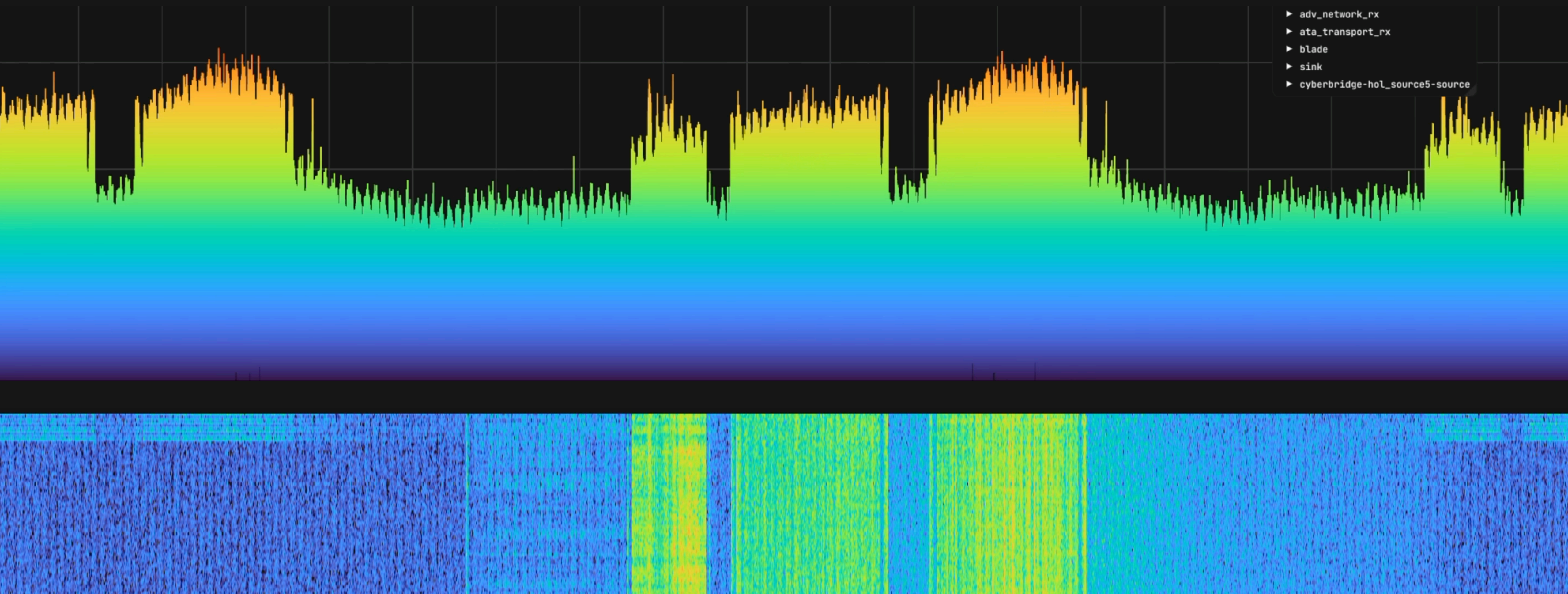
Space Demonstration

Allen Telescope Array Holoscan Pipeline



Space Demonstration

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Luigi Cruz, lfacruz@seti.org
Adam Thompson, adamt@nvidia.com

Thank You!
Questions?

