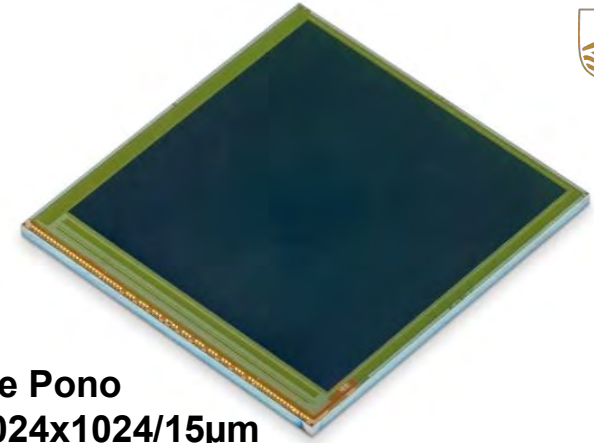


Update of LmAPDs for low background flux applications



- Linear Mode avalanche photo diode (LmAPD) technology - **Disruptive technology**
- In collaboration with University of Hawai'i, Institute of Astronomy
- Funded under a NASA ROSES project
- Initial development and low-background flux APD assessment on 'Ike Pono'
- Proposed 2kx2k 3-side buttable development for UoH.
- 2kx2k version funded by European Space Agency – called 'IBEX'
- Low dark current and high gain.



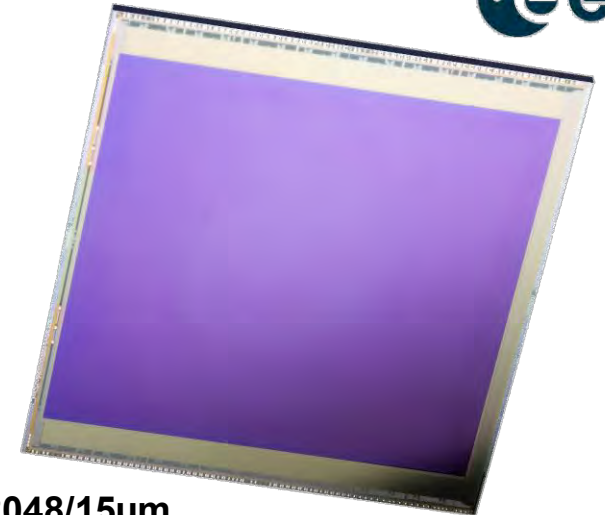
Ike Pono
1024x1024/15 μ m

Status:

- 'Ike Pono' - first science grade devices under assessment
- 'IBEX' – prototype arrays manufactured, awaiting delivery

New generation of detectors:

- Very low background (Hz imaging) for Astronomy
- Very high speed APD response enables:
 - **LIDAR**, 2D/3D Imaging, TDI Imaging, Photon counting, Free Space Optical Comms.



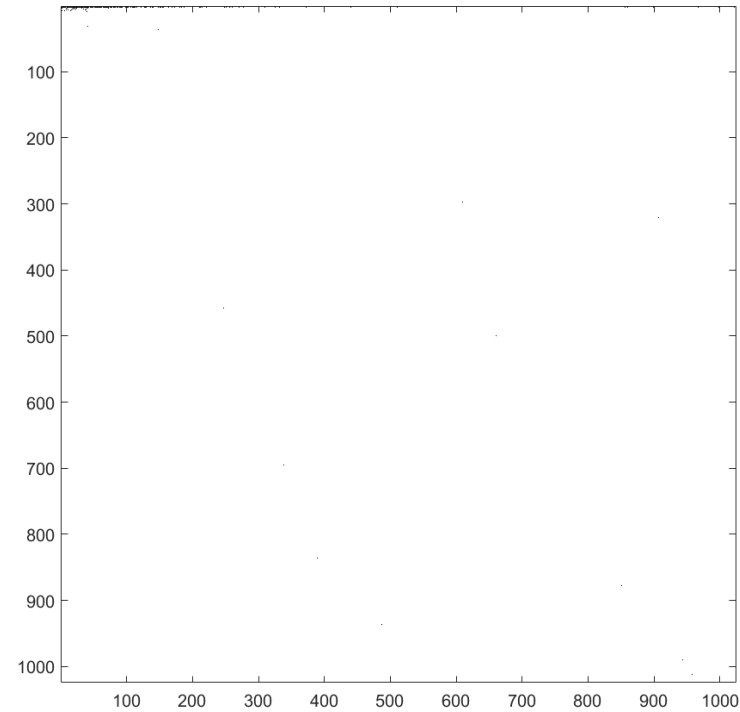
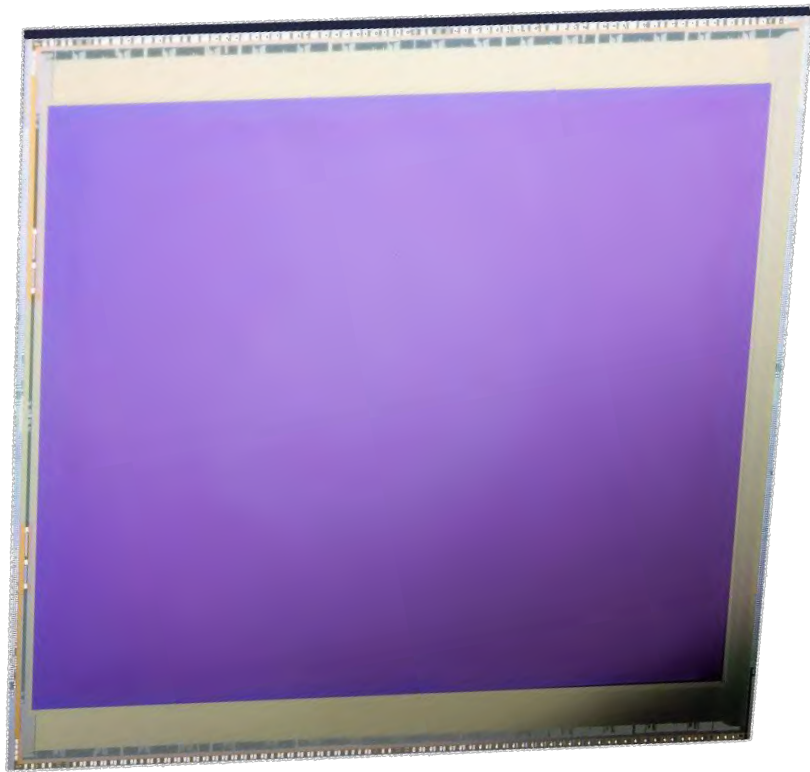
IBEX
2048x2048/15 μ m



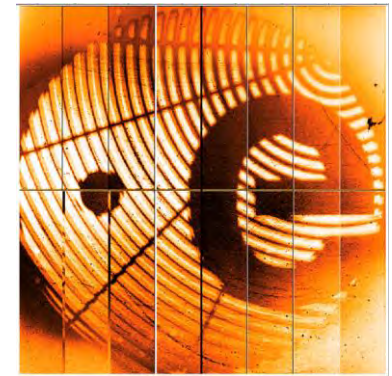
Development Achievements in Science

Demonstrated first data from a 2kx2k 15 μ m Shortwave APD array

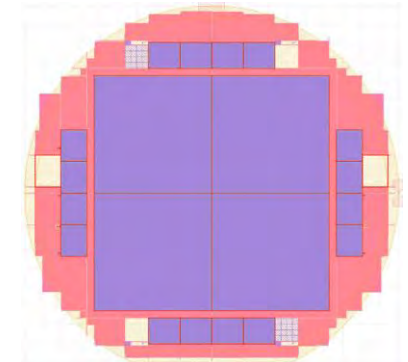
- Brings large format imaging in the short wave to Europe



0.005% pixels with signal
$0.5 \times \text{median}$ at 15 V bias at 85K
Avalanche gain of 40



ROIC without MCT @ ESA



4" MCT Wafer



Space Flight 2024 – NASA PACE Ocean Color Instrument Detectors

Launched 8th February 2024 06:35GMT, Space X Falcon 9



- **Short Wave IR MCT** large area diode co-packaged with discrete electronic components for the TIA front end
- **PACE** is NASA's **P**lankton, **A**erosol, **C**loud, ocean **E**cosystem mission, currently in the design phase of mission development. It launched 8th Feb 2024, extending and improving NASA's over 20-year record of satellite observations of global ocean biology, aerosols (tiny particles suspended in the atmosphere), and clouds.
- Leonardo supplied engineering and flight sub-assemblies consisting of large area MCT diodes and other components.
- Seven instrument wavebands 940, 1038, 1250, **1378, 1615, 2130, and 2260** nm using one material design of which four are Leonardo supplied (in bold).
- 350 μ m diameter diode produced by connecting together 24 μ m pitch mesas
 - Bump bonded to GaAs lead-out on which discrete electronic chip components are also mounted
- Low capacitance design
 - Enabled by MESA diode structure.
- MCT with n-absorber and p-common (n on p)
 - Illumination through common
 - Absorption starts at junction giving high internal QE and good linearity
- Gold plated Kovar non-hermetic package



Space Flight 2024 – AIRBUS IASI NG

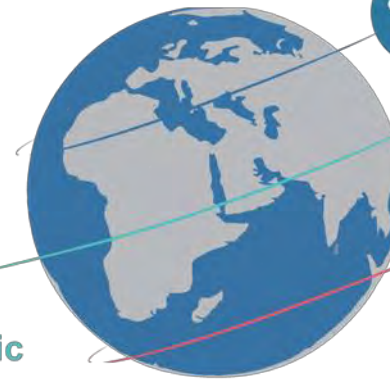
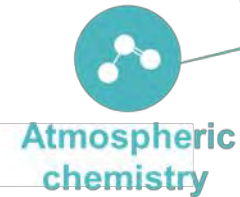
Launch 2nd half of 2024, Ariane 6

IASI NG - Infrared Atmospheric Sounder Interferometer - New Generation

Temperature/humidity sounding, ozone profile, monitoring of green-house gases

(C2H2, C2H4, C2H6, CFC-11, CFC-12, CH3OH, CH4, CO, H2CO2, HCN, HNO2, HNO3, N2O, NH3, PAN, SO2)

- Deployed on the Next generation of MetOp weather satellite for Europe
- IASI NG Program 2011 – pre development, final completion 2023
- Four detector bands, covering 3.62µm up to 15.5µm MW to LW
- Two detector technologies, PV for mid wave and long wave and PC for very long wave
- **Custom ROIC, MCT and Package**
- Stand alone Space assembly and test cleanrooms in Southampton
- Particle and Molecular monitoring of assembly area
- Fully space qualified detector including extensive radiation campaign



Meteorology



Climatology



Space Flight 2024 – AIRBUS IASI NG

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MetOp-SG on the Shaker at Airbus



Space Flight 2024 – AIRBUS IASI NG

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Band 1,2,3,4 detectors mounted into the flight cryostat at Airbus Toulouse

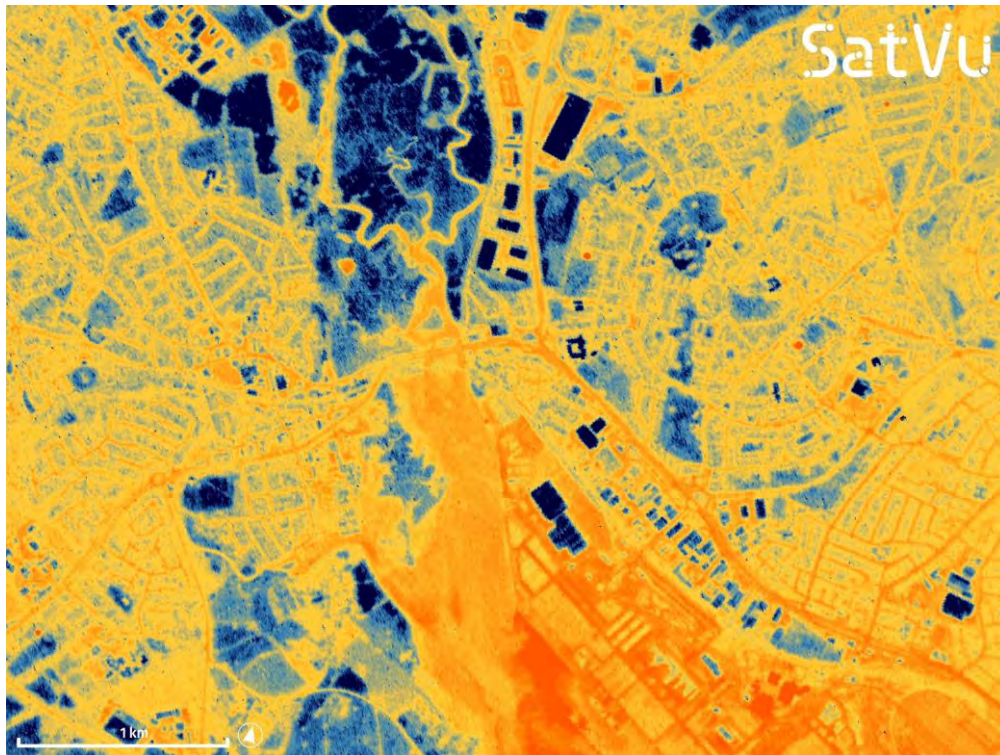


Space Flight 2024 – HOTSAT-1

Launched June 2023, SpaceX Falcon 9

First launch of a **Leonardo SuperHawk**, a **COTS** tactical detector, on a commercial satellite, 1280 x 1024 8µm Mid wave detector (3.7µm-5µm)

SatVu's Revolutionary "HOTSAT-1" Set to Launch, Unleashing Unprecedented Thermal Monitoring Capabilities



Chief Executive at the UK Space Agency, Dr Paul Bate, commented: "Space already plays a vital role in enabling us to understand and mitigate the risks of climate change. HOTSAT-1 is a milestone moment for the evolution of Earth observation technology and the benefits it can bring us."

Thank you

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