InP COMPONENTS FOR COMMUNICATION AND SENSING IN SPACE

EPIC Meeting on New Space

Fraunhofer HHI

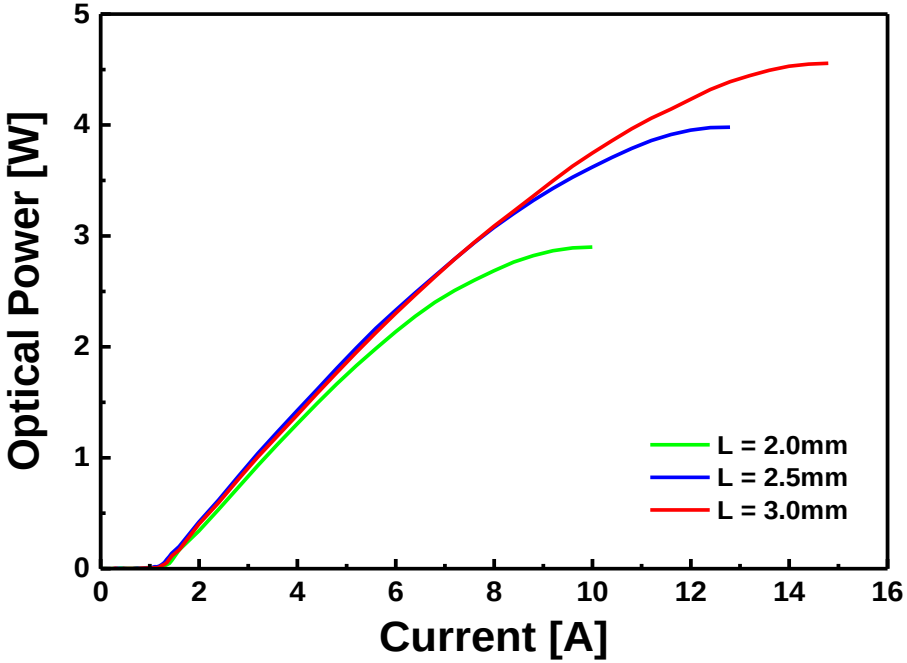
In-House Epitaxial Growth and Wafer Fabrication

35+ years experience in InP design & processing

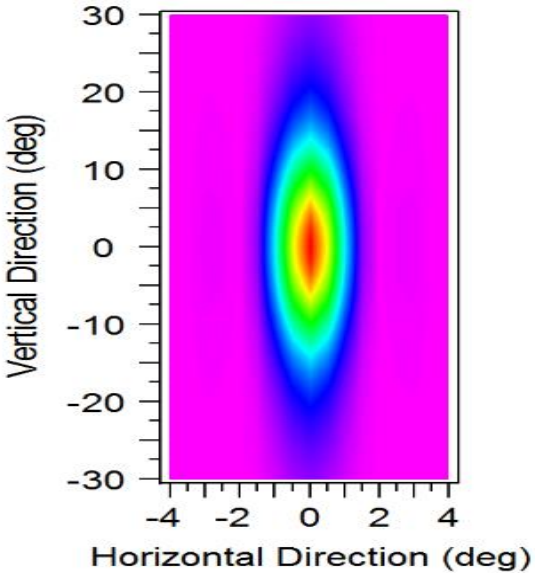
- 3 MOVPEs and 1 gas phase MBE (growth of InGaAsP and InAlGaAs compositions)
- complete process line from e-beam direct / mask writing to AR coating and chip singulation

1550nm High-Power Laser

Performance at CW operation and 20°C



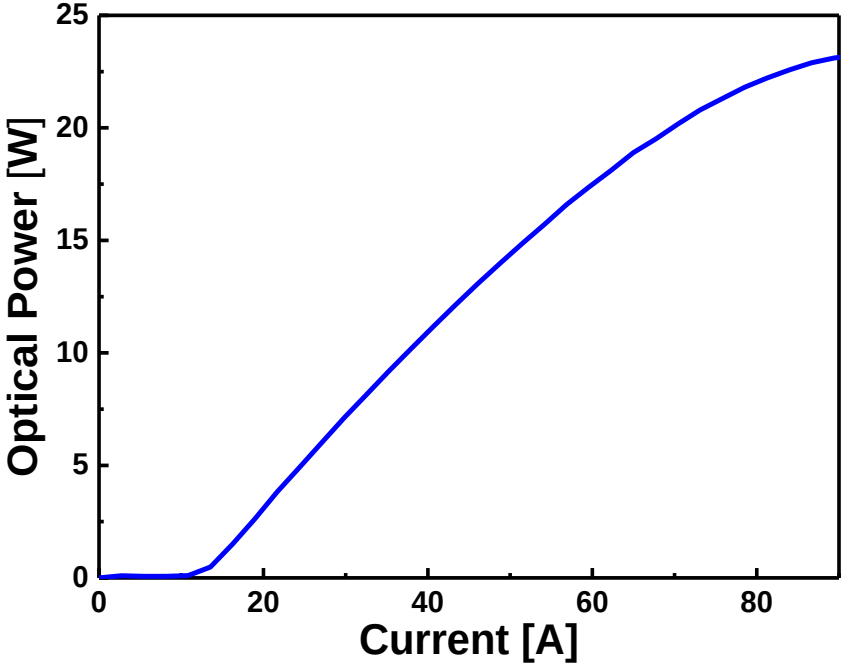
Far Field



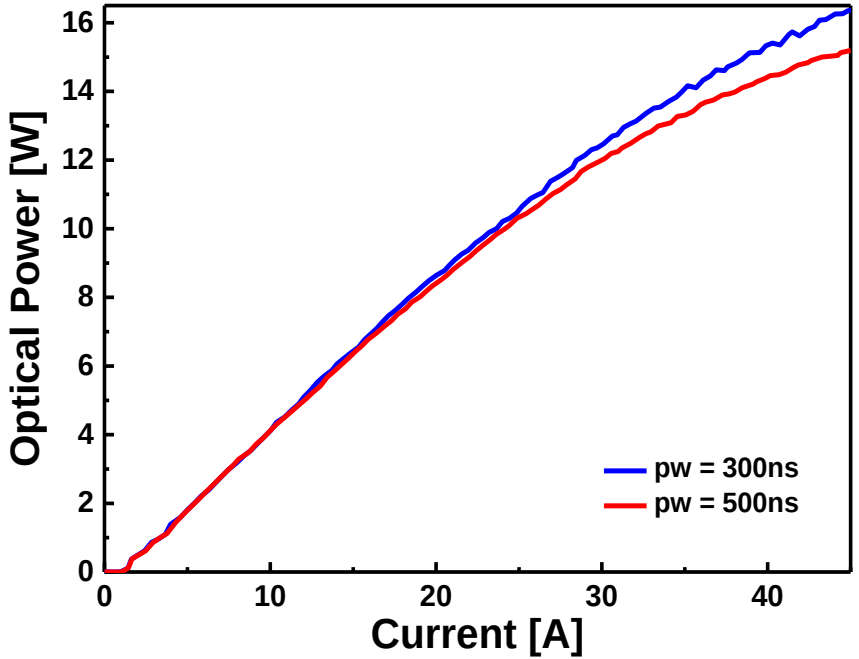
1550nm High-Power Laser

Increasing the optical output power

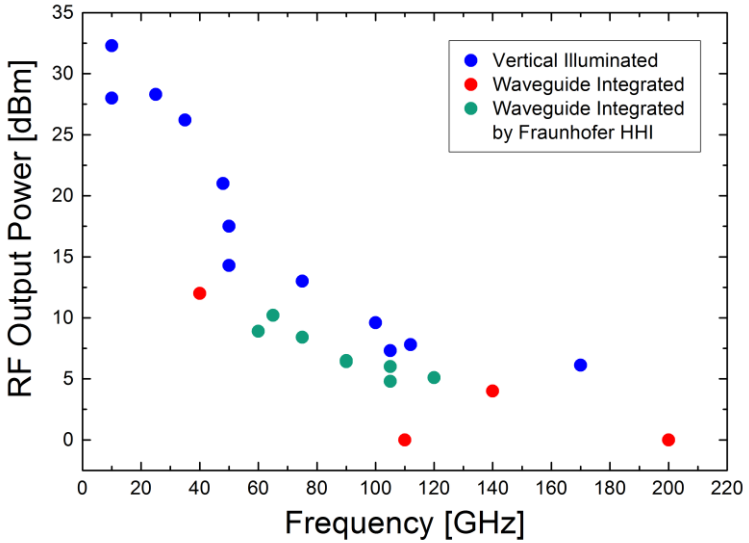
Bar Configuration (20 Laser @ CW Mode)

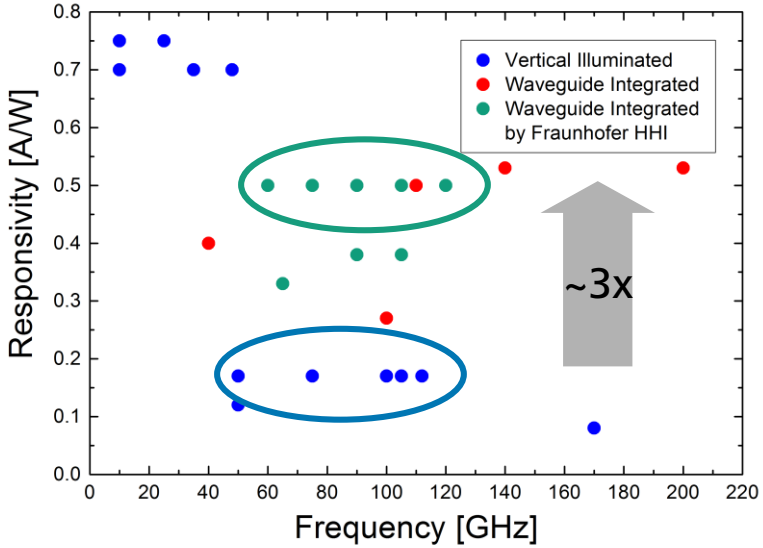


1kHz Pulsed Operation



High RF Output Power Photodetectors

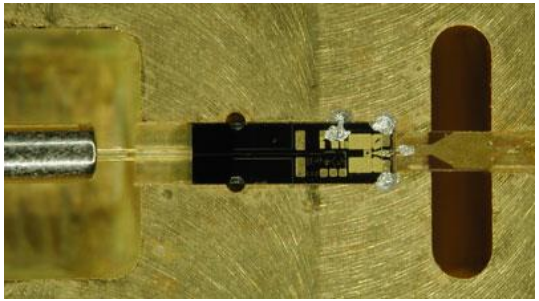




- 3x more responsivity for HHI waveguide photodiodes results in 10dB less optical power
- no lensed fibers needed - simple butt coupling to 10µm MFD SM fibers

High RF Output Power Photodetectors

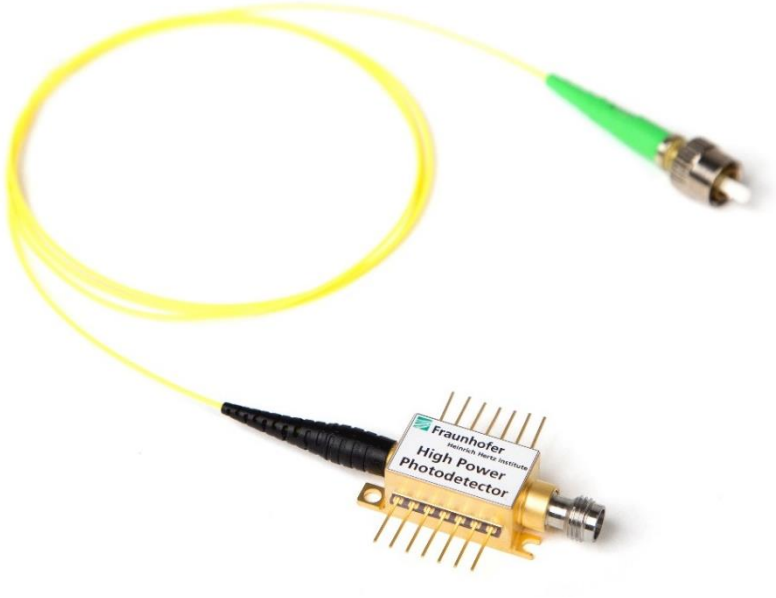
PDs by HHI, packaged by Rutherford Labs, now in ALMA Telescope

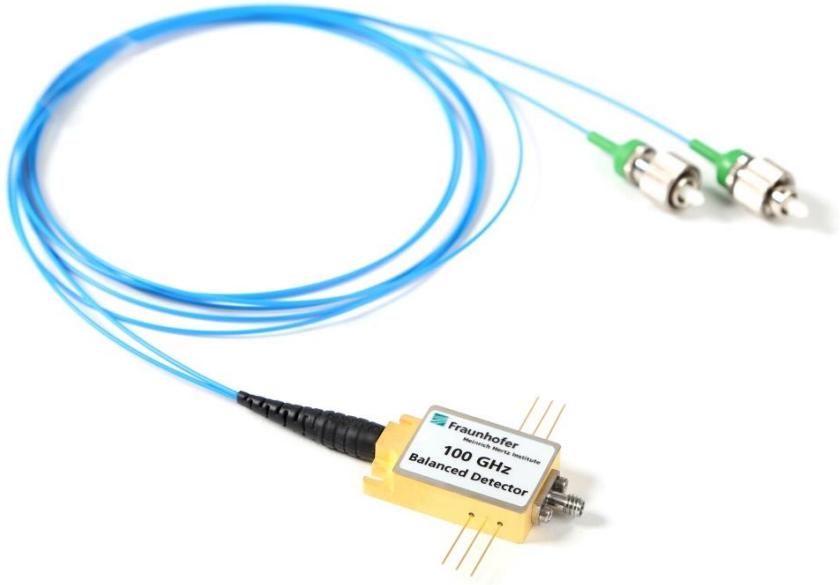


Atacama Large Millimeter Array Telescope (ALMA)

Experienced Demand for Packaged Components

HHI photodetector modules with operation frequencies up to 110GHz



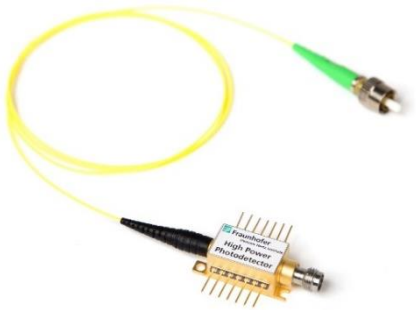


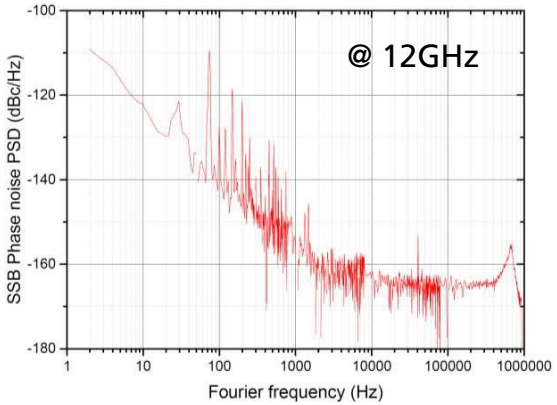
Funded project for space-qualification of V-connector modules started

High RF Output Power Photodetector

High precision optical clocks for radar

- fs-pulse generates ultra-stable spectral comb, HHI photodetector converts fs-pulse into RF domain
- optically generated RF signal in the GHz region with phase noise far below electrically generated RF signals

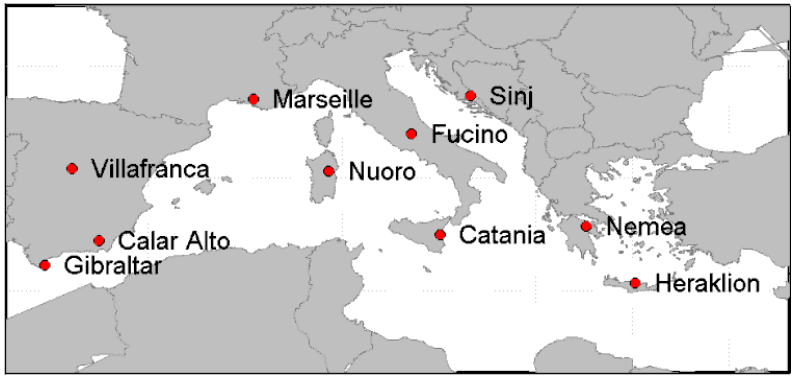




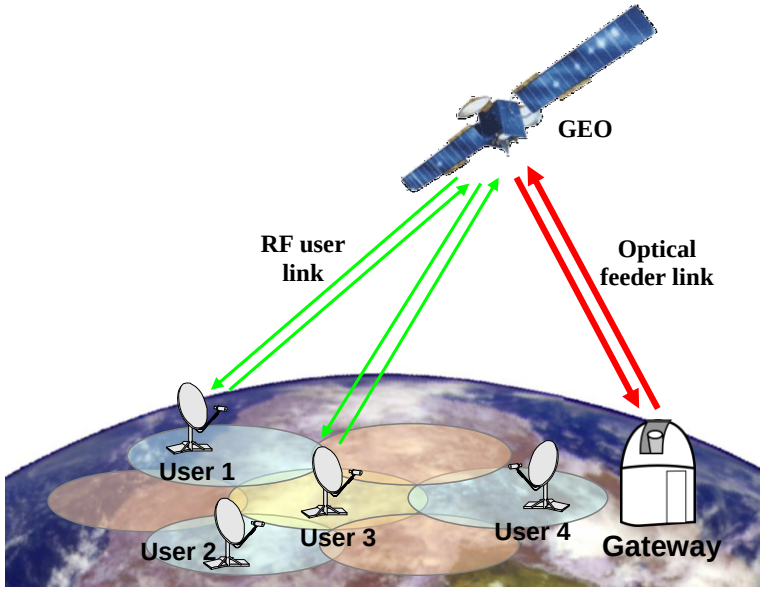
Optical Satellite Communication

Optical feeder link design

- Design of next-generation terminals at 1550 nm
- Optical feeder link to GEO telecom satellite
- > 1 Tb/s bidirectional over 36,000 km
- Design of ground station network



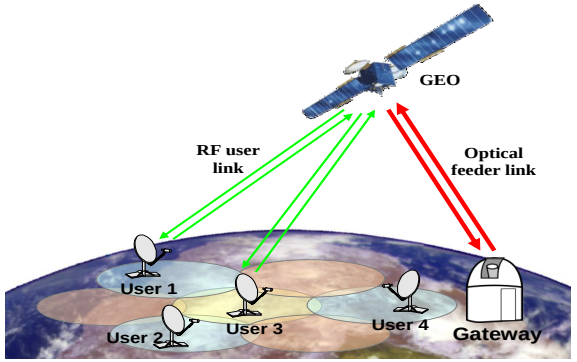
99.9 % availability

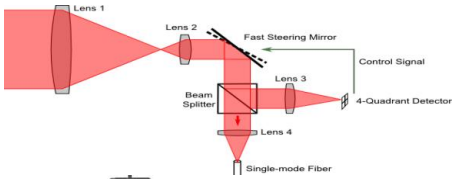


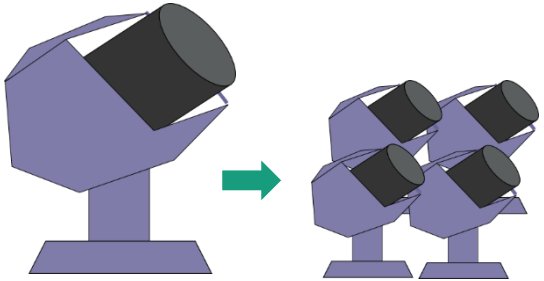
Optical Up- / Downlinks Antennas

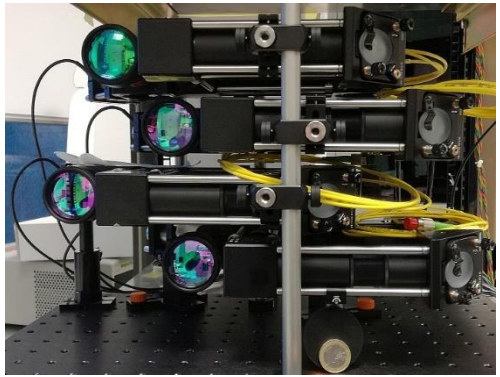
GEO feeder link, earth-observation downlink

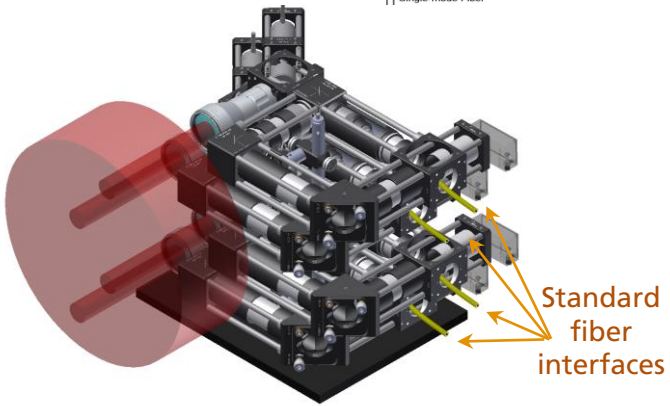
- Tbit/s capabilities, DWDM at 1550nm
- On ground: Telescope array → no adaptive optics
  - Uplink: optical incoherent combining
  - Downlink: digital combining
- Partners esa ThalesAlenia Space











Customized Devices for Satellite Communication

10+ years running application and qualified for space

satellites in orbit with HHI detectors:

- US-NFIRE 2007-2017
- TerraSAR-X since 2007
- Alphasat since 2013
- Sentinel 1A since 2014
- Sentinel 2A since 2015
- Sentinel 1B since 2016
- EDRS-A since 2016
- Sentinel 2B since 2017
- EDRS-C since 2019

beam tracking sensors and photodetector for data transmission in LCT from HHI

Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute, HHI

CUSTOMIZED SOLUTIONS

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