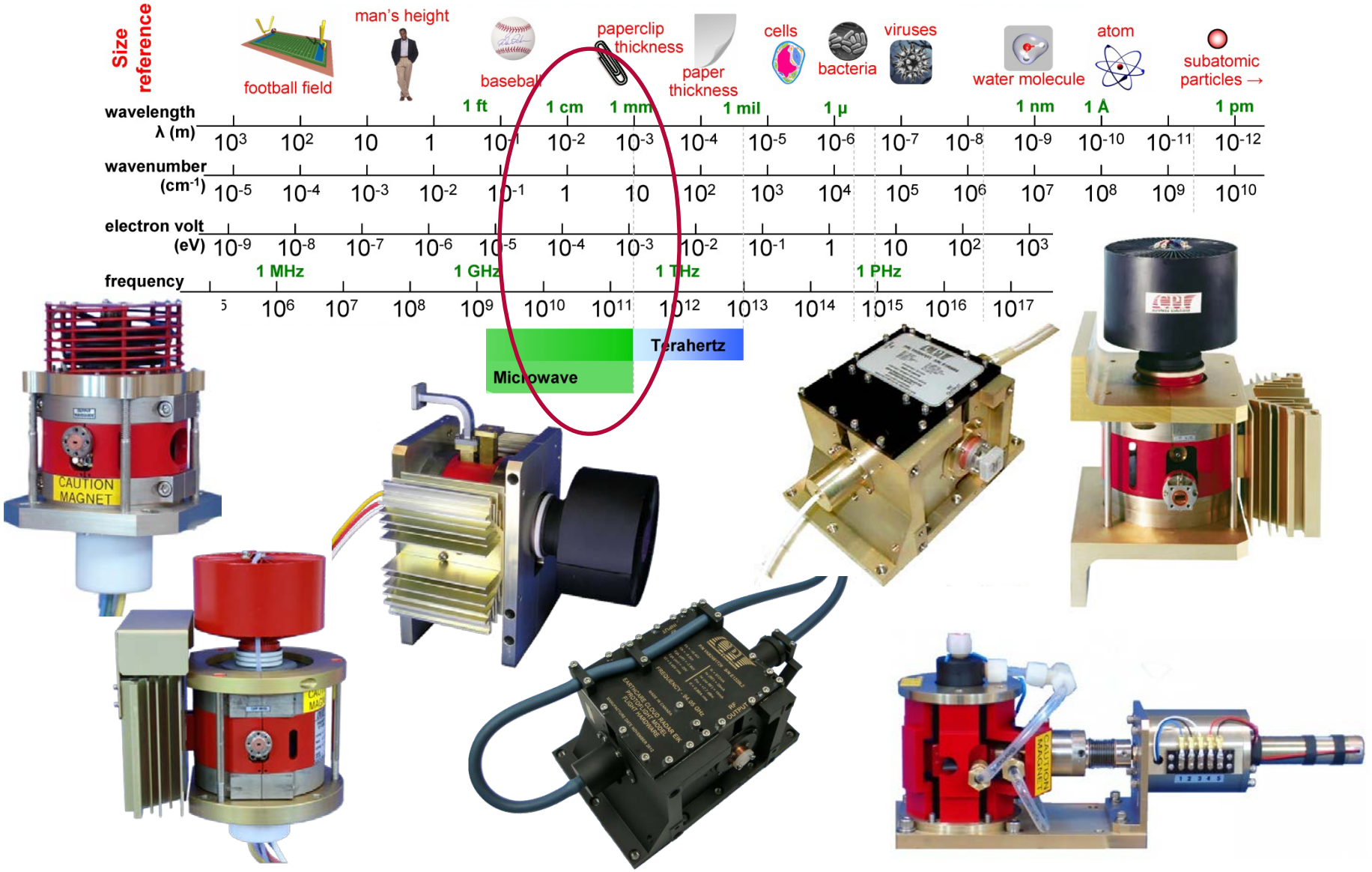
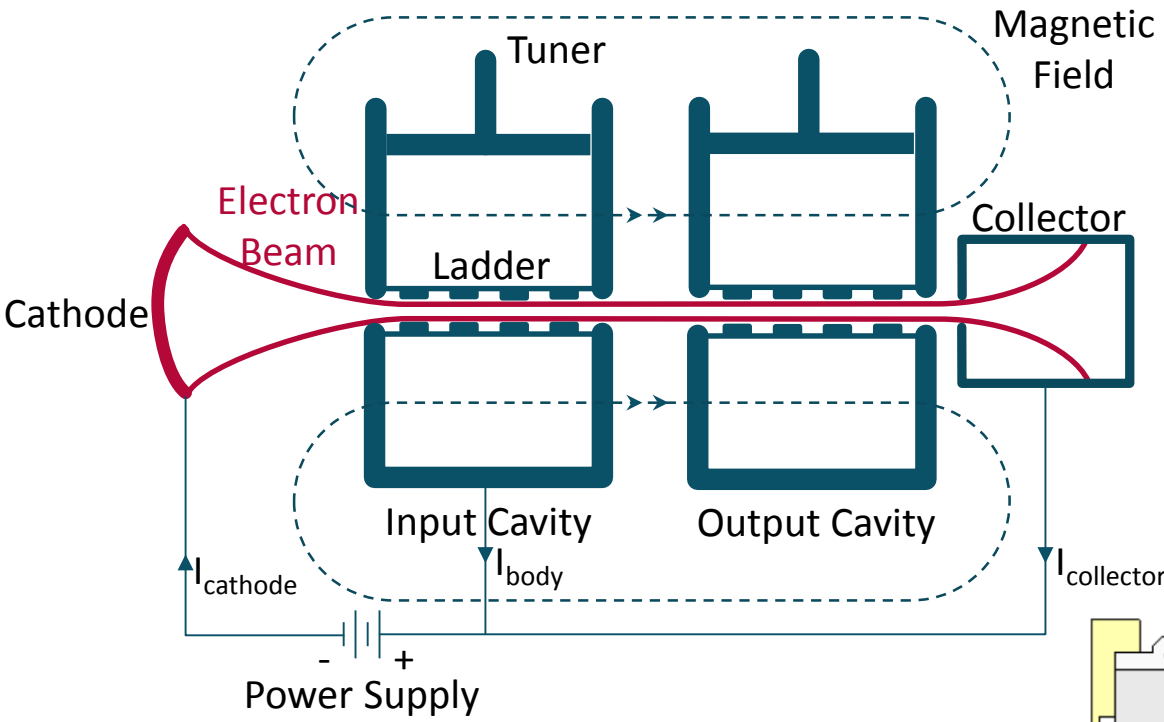
mmW Products

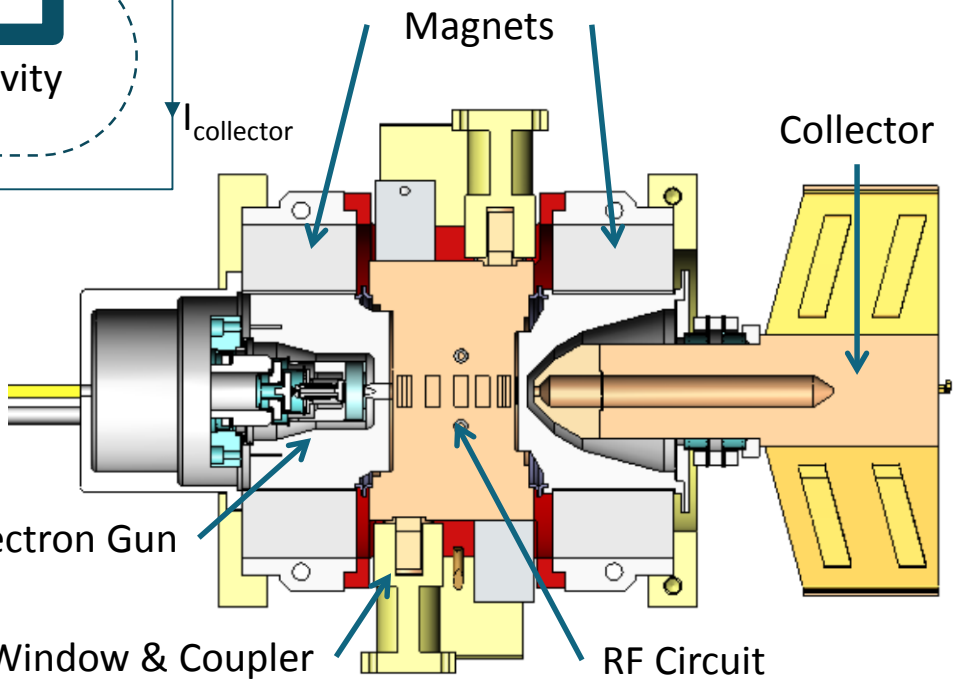


Extended Interaction Klystrons

- EIK Technology
  - Based on Klystrons
    - Rugged
    - Reliable
  - Enhanced
    - Power
    - Bandwidth
    - Efficiency
  - GHz and THz frequencies
  - Moderate voltages
  - Compact
  - Minimal maintenance
- CPI Canada EIKs
  - Design & manufacturing
    - 40 years of experience
  - Applications
    - Radar
      - Airport
      - Space
      - Earth Observations
    - Communications
    - Instrumentation
      - DNP/ESR
  - Frequency range
    - 17 – 280 GHz proven
    - 0.7 THz modeled

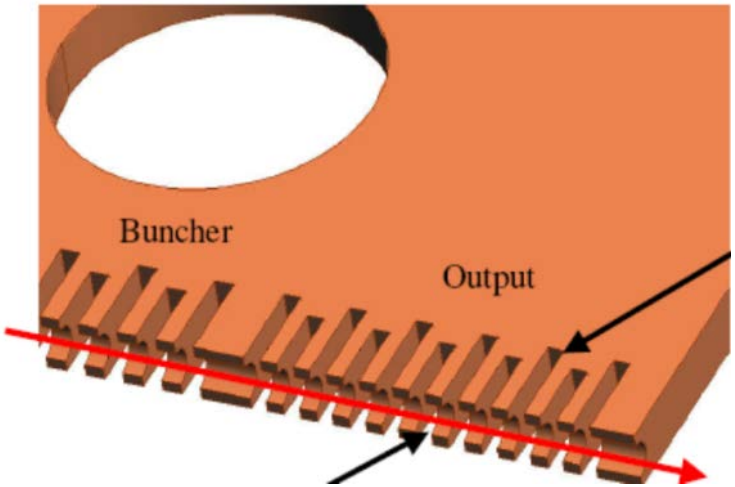
EIK Principle of Operation

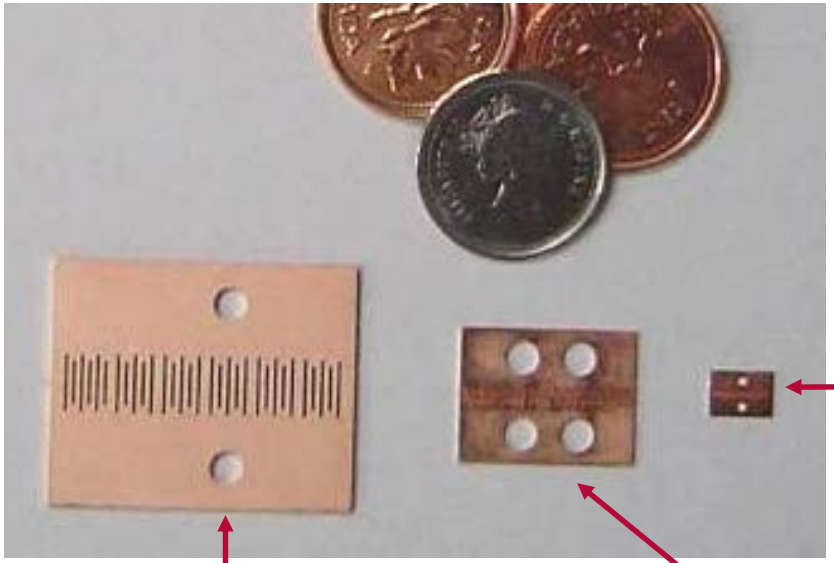




Ladder Structure

- Ladder structures provide
  - High coupling impedance
  - Thermal stability



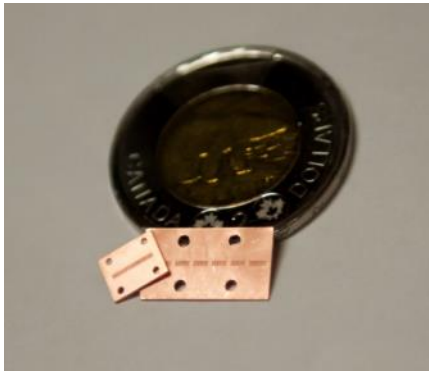


30 GHz
3000 W pulsed
1200 W CW

140 GHz
300 W pulsed
50 W average

95 GHz
2000 W pulsed
400 W average

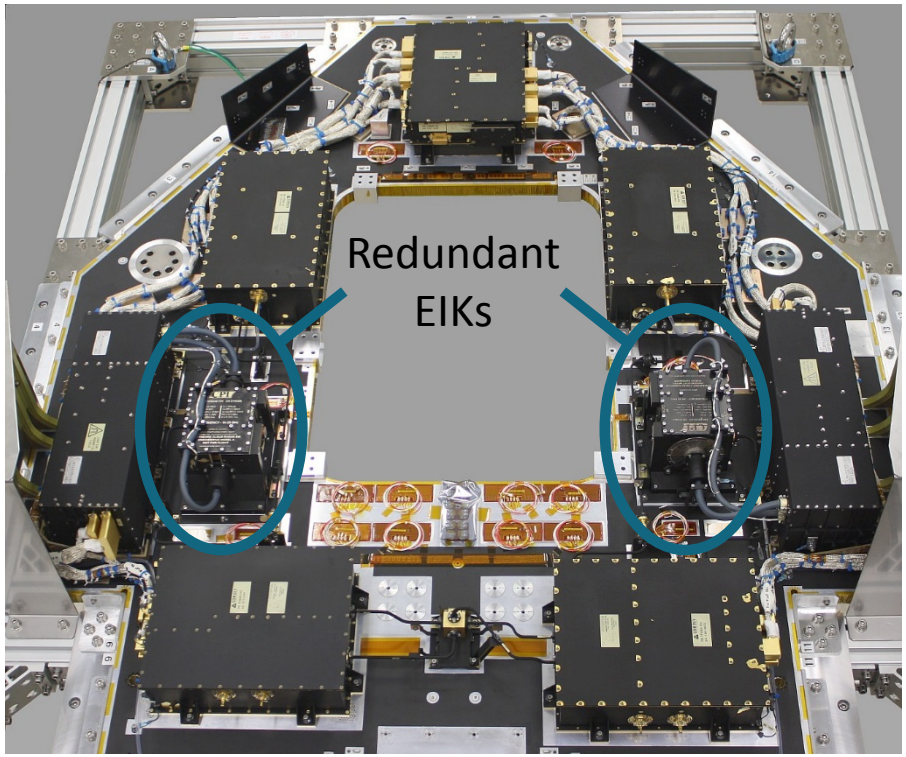
263 GHz
10 W pulsed
5 W CW



EIK Space Programs

Mission	Instrument	EIK Specification	Development Status	Agency
CloudSAT	Cloud Profiling Radar	94 GHz 1.7 kW pulsed amplifier	Flight Models in operation	NASA/JPL/ CSA
EarthCARE	Cloud Radar with Doppler function	94 GHz 1.7 kW pulsed amplifier	Flight Models delivered	ESA/JAXA
SWOT	Ka-band Radar Interferometer	35.75 GHz 1.5 kW pulsed amplifier	Demonstration Model Fabricated	CNES/NAS AJPL/CSA
CoReH2O	Dual band/dual polarization SAR	X & Ku-band 2.5 kW pulsed amplifiers	Engineering Models fabricated and tested	ESA
EGPM	Precipitation Radar	35.5 GHz 1 kW pulsed amplifier	EM1 Fabricated and Tested	ESA
JIMO	Topo-Mapping Radar	35.5 GHz 3 kW high duty amplifier	Development of high duty beamstick complete	NASA/ JPL
ATOMS	Active Atmospheric Sounder	183 GHz 5 W CW oscillator	EM1 delivered to JPL	NASA/ JPL
MetOp SG	Scatterometer	5.3 GHz CW pulsed amplifier	Pre-development	ESA

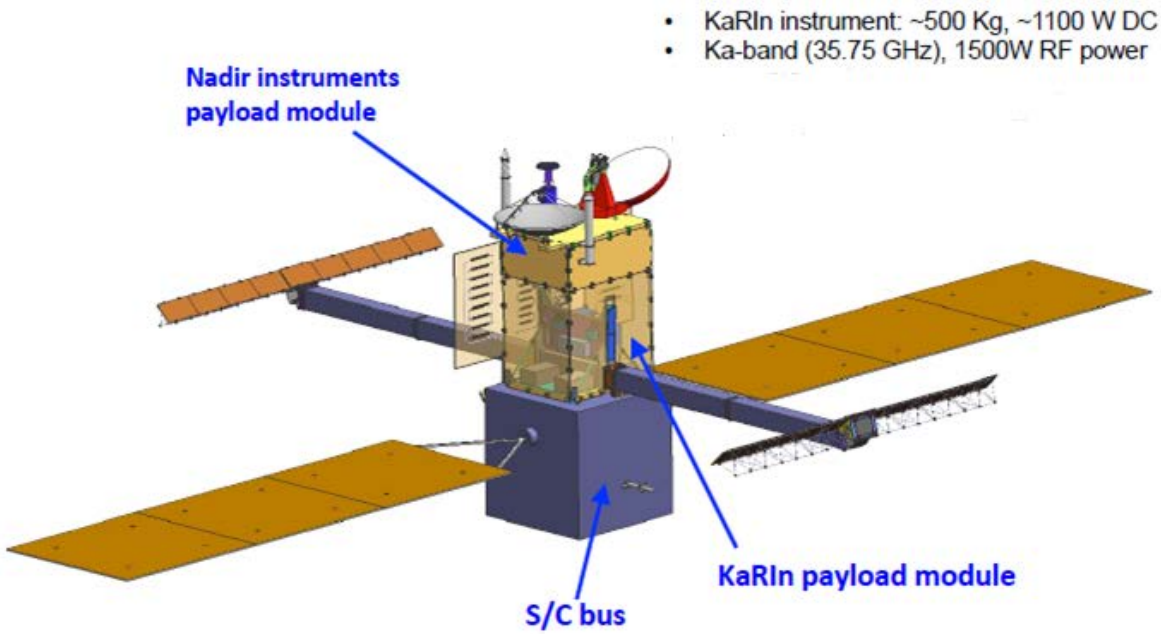
EarthCARE



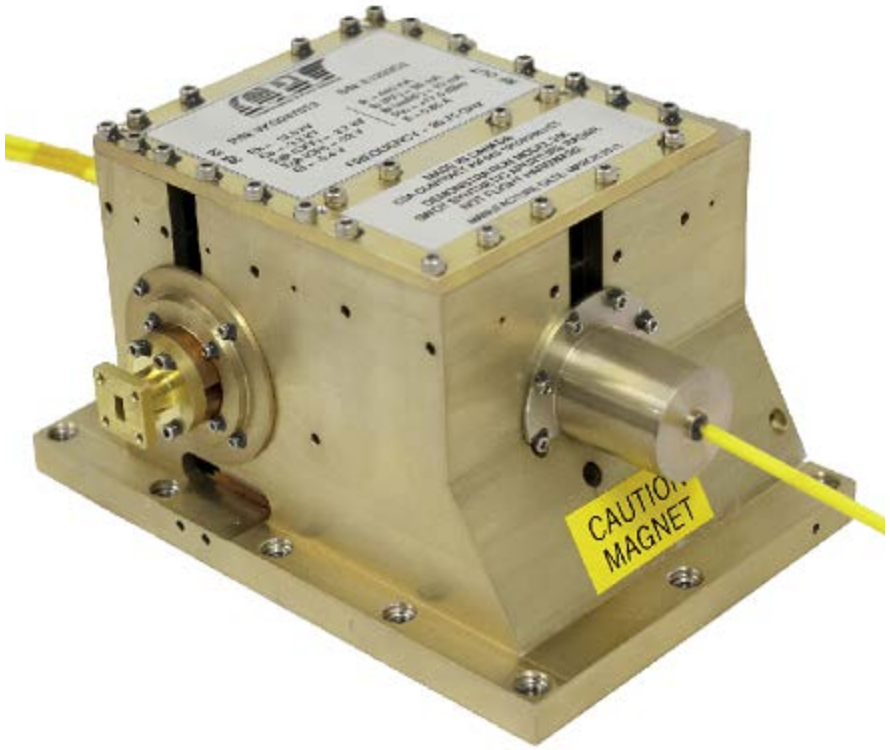
- Mission Includes Advanced CPR with Doppler
- Flight EIKs delivered in 2013
- 94 GHz 1.7 kW pulsed EIK with improved lifetime, structural performance and reliability
- Lifetime to 10% current reduction is 60,000 hours
- FIT: < 10,000

SWOT

- SWOT (Surface Water Ocean Topography) is a swath-based SAR altimetry mission designed to acquire elevations of water surfaces
- Payload includes a Ka-band Radar Interferometer (KaRIN)
- Mission is planned by CNES and NASA/JPL for launch in 2020



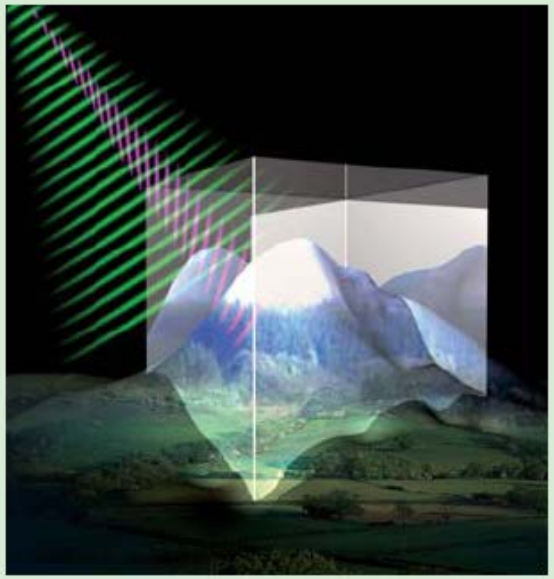
SWOT Demonstration Model EIK



- Designed, fabricated and tested under CSA contract
- Provides pulsed power up to 2 kW with duty cycle up to 10%
- 35.75 GHz center frequency with 320 MHz (-1 dB) bandwidth
- Lifetime to 10% current reduction is 65,000 hours
- Capability to provide over 3 kW pulse power, when tuned for narrow-band operation

$CoReH_2O$

$CoReH_2O$ Characteristics



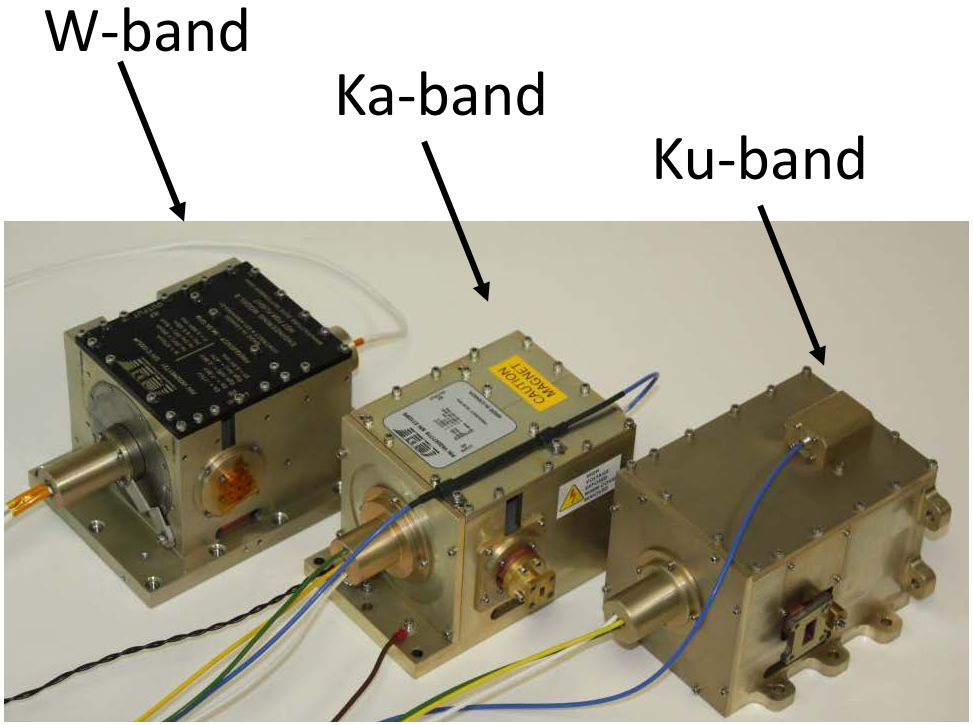
Mission duration: 5 years
Orbit: Sun-synchronous, local time 06:00
Coverage: test sites (phase-1); global coverage of snow and ice areas (phase-2)
Revisit time: 3 days (phase-1); ≤15 days (phase-2)
Instrument: dual-frequency (9.6/17.2 GHz) synthetic aperture radar
Polarisation: dual (vertical-vertical; vertical-horizontal)
Resolution: ≤50 x 50 m (≥5 looks)
Swath width: ≥100 km

High power amplifiers needed for $CoReH_2O$

- at Ku-band, no space heritage exists, nor spec-compliant commercial hardware
- at X-band, space hardware has been demonstrated, but at lower RF power

Requirements	X-band HPA	Ku-band HPA
Frequency	9.6 GHz	17.2 GHz
Peak Power	2100 W	2500 W
Ave. Power	340 W	375 W
Bandwidth	<10 MHz	<10 MHz
Efficiency	40%	40%

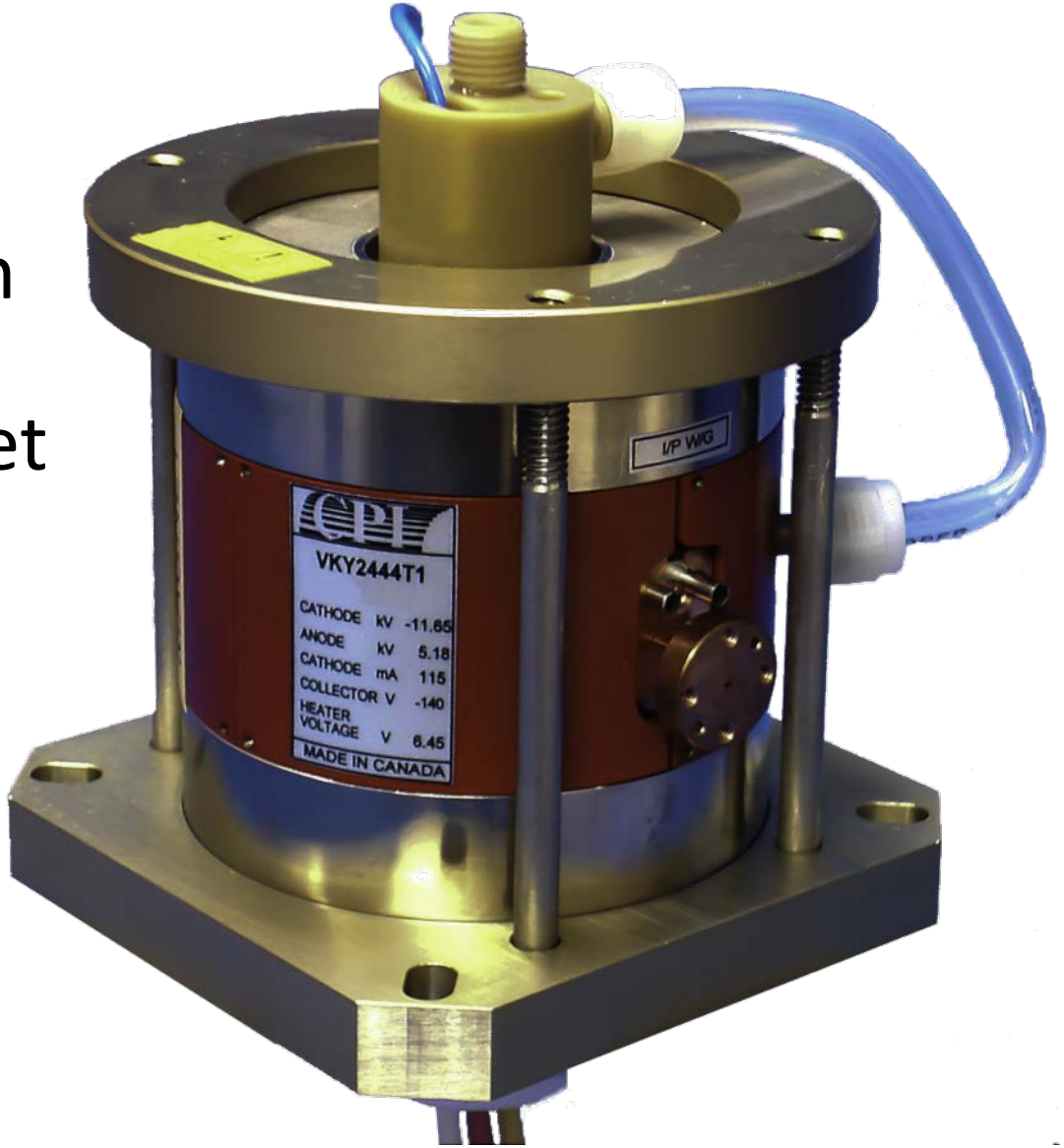
CoReH$_2$O



- EM's built at X-band and Ku-band
- RF performance targets met
- EIKs demonstrated >40% efficiency over broad range of output powers (2 - 4.5 kW)
- Suitable for space-flight: conduction cooled, <8kg
- >10 year cathode life expected

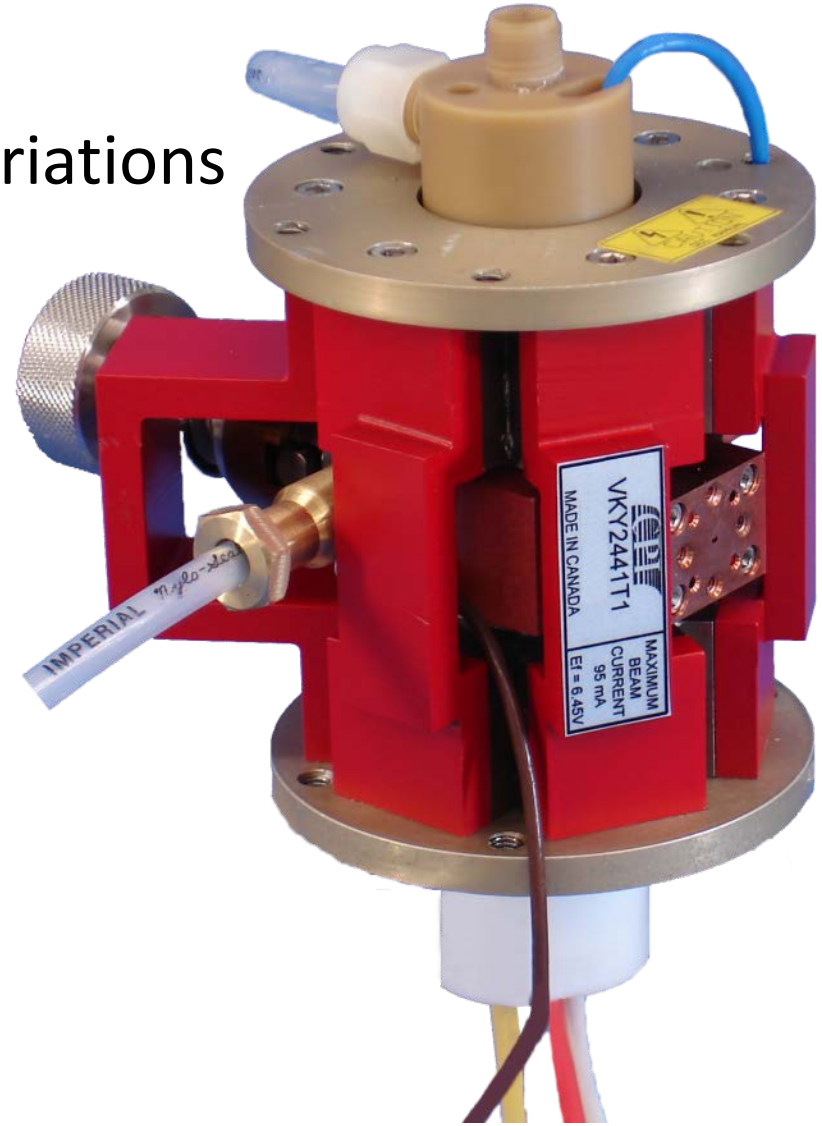
187 GHz CW EIK

- 5 W CW
- 400 MHz Bandwidth
- Single period magnet
- Water cooled
- Single stage depressed collector



263 GHz CW Tunable EIO

- Design Advances
  - Reduced beam diameter variations
  - Increased fill-factor
  - Optimize RF field distribution along circuit
  - 5 W CW output power
  - 10 GHz tuning range



263 GHz Pulsed EIK

- Gun Optics
  - 18.5 kV
  - 250 mA
  - 18 µm x 15 mm tunnel

Extended Interaction Klystrons

- EIK technology is a good choice for many terrestrial and space borne applications
- CPI Canada offers a wide selection of EIK models
- Capabilities for rapid development of the new products to address specific needs


30 GHz EIK


95 GHz HPA


220 GHz EIK


263 GHz EIO


263 GHz EIK

Pulsed and CW EIK Emitters

Power Supplies & Chillers

EIK POWER SUPPLY/MODULATOR
Pulsed Power Supply

Model VPW3493 is a power supply modulator (PSM) intended to operate a wide range of CPI pulsed Extended Interaction Klystrons (EIK) in a variety of applications. It is an integral AC powered unit, configured using a floating deck modulator and filament supply coupled to a synchronously switched high voltage power supply. The power supply is designed to provide high stability for improved EIK performance with low stored energy to protect the EIK should faults occur.

An optional Control and Monitoring Unit (CMU), VZW3556, provides modulation control and monitoring for the PSM. Synchronizing and triggering signals are generated within the control unit which also serves to monitor, protect and report on the status of the transmitter. The CMU functionality could be provided by the user's system.

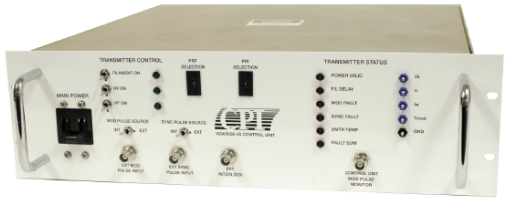
Model VPW3493

The PSM performs the following mechanical and electrical functions:

- Provides suitably regulated cathode-to-body, collector-to-body (or cathode), cathode heater, focus electrode bias and focusing voltages
- Provides coherent high voltage power supply switching and EIK focus electrode pulsing
- Monitors voltages, currents and temperatures for fault conditions and performs suitable trip functions
- Mechanical configuration provides robust mounting, suitable PSM cooling and personnel safety from high voltages and hot surfaces

The optional Control and Monitoring Unit, used for operational monitoring when not supplied by the radar control system, is housed in a standard 19 inch aluminum chassis. It includes an internal preset pulse generator.

Features	
Input Voltage	209 to 241 VAC
Pulse Width	0.2 to 50 µs
Pulse Rate Frequency	Up to 50 kHz
Duty Cycle	Up to 10 %
Temperature Operating	0 to +50 °C
Temperature Non-operating	-40 to +60 °C
Humidity	95% relative non-condensing
Altitude	3,000 m
Dimensions (LxWxH mm)	585x305x190
Mass	40 kg
Conduction Cooled	
Optional Control & Monitoring Unit	
Broad range of pulsed EIKs supported	



EIK POWER SUPPLY/MODULATOR
High Altitude Pulsed Power Supply

The model VPW2888 is a light weight and compact power supply modulator intended to operate a wide range of CPI pulsed Extended Interaction Klystrons (EIKs) in a high altitude environment.

The power supply modulator (PSM) is fully encapsulated in epoxy using a proprietary process developed for the space industry, making it highly resistant to the effects of temperature, altitude, humidity, vibration and shock

This equipment comes with a full complement of operating, control and protective equipment and supporting documentation.

The PSM converts the DC primary power into the high voltages necessary for operation of the EIK. The PSM operating values are factory set

Model VPW2888

CLOSED LOOP HEAT EXCHANGER
Water to Air Laboratory Chiller

Model VJB2002 is a refrigerated, recirculating water conditioning heat exchanger specifically configured for operation with Extended Interaction Klystrons (EIKs). This easy to use chiller is optimized for the demanding purity and cooling requirements of water cooled EIKs. It features a robust refrigeration system designed for continuous operation, providing accurate control of temperature and ensuring water purity needs are met.

With a focus on reduced maintenance, the chiller comes with a level indicator and built-in funnel to make filling easier. The integrated air filter is located behind an easy to remove condenser grill for quick and simple cleaning to optimize chiller performance and maximize operational life.

Model VJB2002

The values listed represent typical performance. Formal controlled specifications for use in equipment design may be obtained from CPI

CANmarketing@cpii.com **www.cpii.com** **+1-905-877-0161**

Contact Us


CANMarketing@cpii.com
+1-905-877-0161
45 River Drive
Georgetown, ON
L7G 2J4
Canada
http://www.cpii.com/product.cfm/7/40