



Optical Filters and OISL *Challenges and Solutions*

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Who we are at Iridian

Canadian supplier of custom optical filter solutions

- ~170 staff providing extensive expertise in all optical filter design and manufacturing
- Canadian corporation, established in 1998; ***now part of IDEX Optical Technologies***
- All manufacturing done in Ottawa, Ontario, Canada
 - Achieved ISO9001:2015 certification in May 2016
 - Registered in Canadian Controlled Goods Program
- *Officially opened 45,000 sq. ft. custom-built facility Nov 2012*





OPTICAL TECHNOLOGIES

an IDEX Corporation platform



CVI LASER OPTICS
IDEX Optical Technologies



CVI INFRARED OPTICS
IDEX Optical Technologies



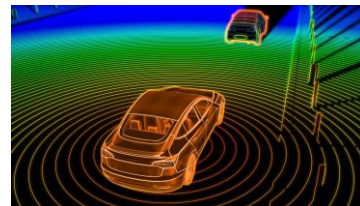
ADVANCED THIN FILMS
IDEX Optical Technologies



IRIDIAN
SPECTRAL TECHNOLOGIES



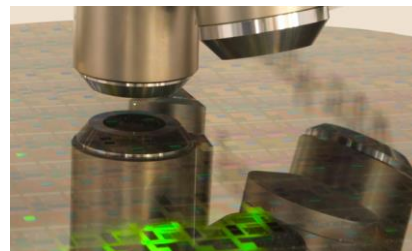
Lasercom



Remote Sensing



Directed Energy -HEL

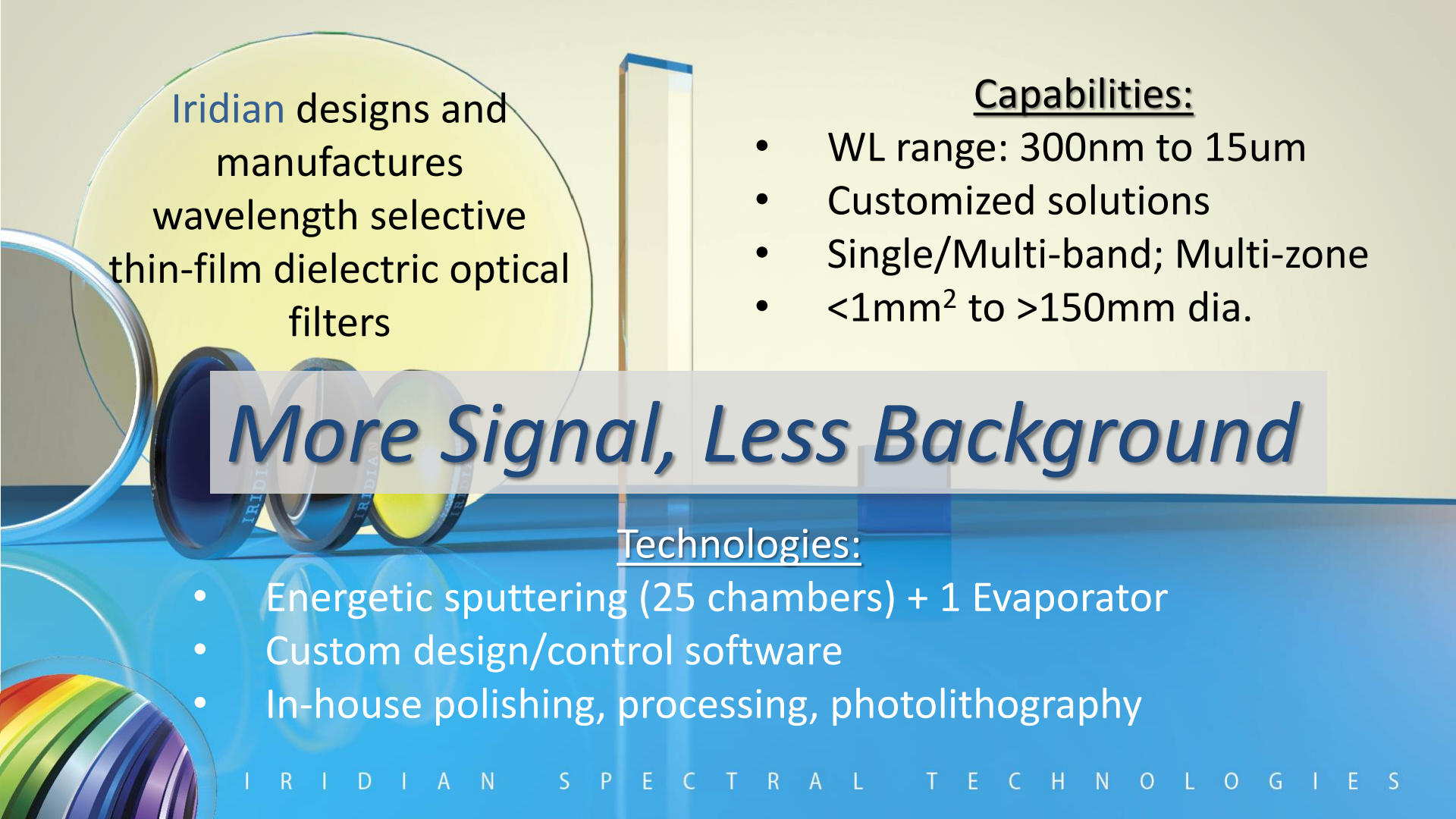


*Semicon
Inspection & Metrology*



Shutters

Focused on the Future of Controlled Light™



Iridian designs and manufactures wavelength selective thin-film dielectric optical filters

Capabilities:

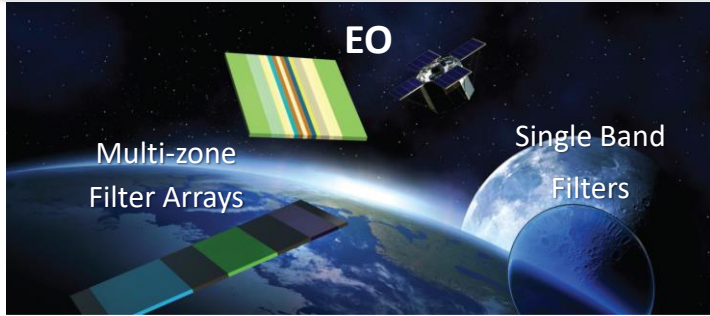
- WL range: 300nm to 15um
- Customized solutions
- Single/Multi-band; Multi-zone
- <math><1\text{mm}^2</math> to >150mm dia.

More Signal, Less Background

Technologies:

- Energetic sputtering (25 chambers) + 1 Evaporator
- Custom design/control software
- In-house polishing, processing, photolithography

Optical Filters for "New Space"



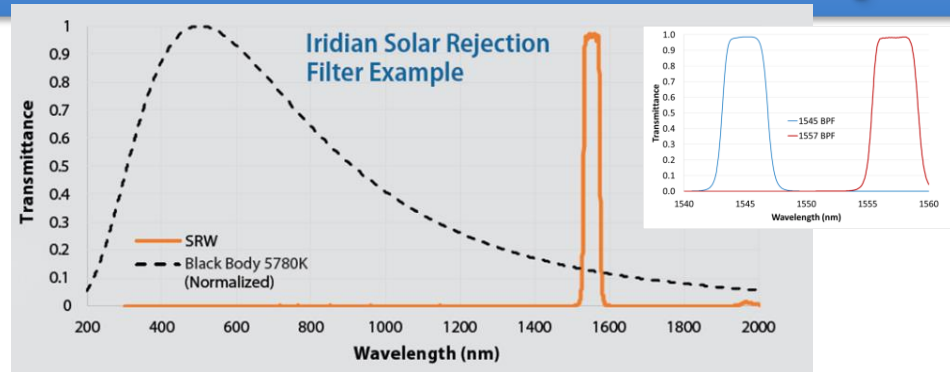
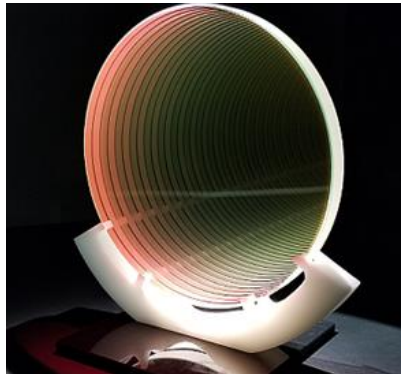
→ REMOTE SENSING



← OISL



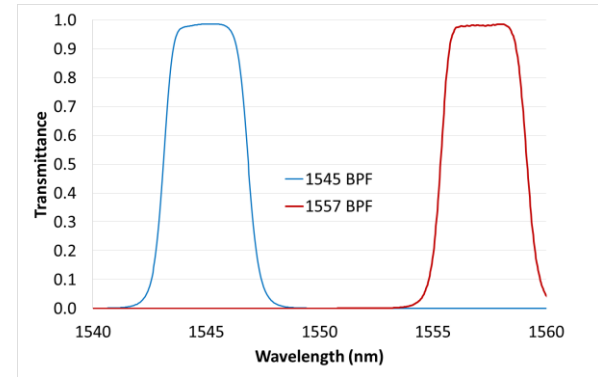
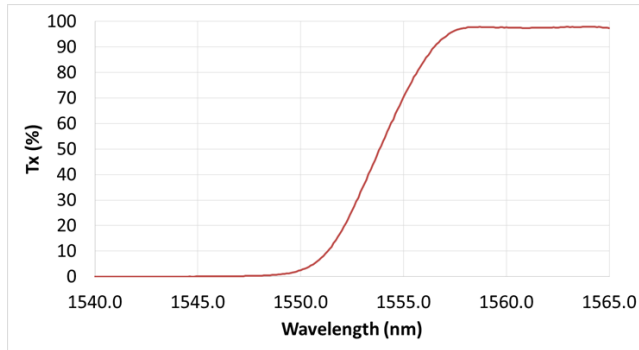
Laser/Satcom Filters – Example SRF



- Function: improve signal to noise, reduce heating in satellite
 - High Tx in signal band (~1550; WL is customizable)
 - Broad deep blocking of solar spectrum
 - Low TWE
- Filter challenges:
 - Often large (up to 150mm)
 - Wavelength selectivity, Uniformity, Low TWE

Band-pass and Dichroic filters

- Beam splitting/combining -> wavelength selectivity
 - Narrow bandwidth / Steep transition from Tx-Rx
 - High Tx , High Rx
 - Steep transition from Tx-Rx
 - Low TWE/RWE

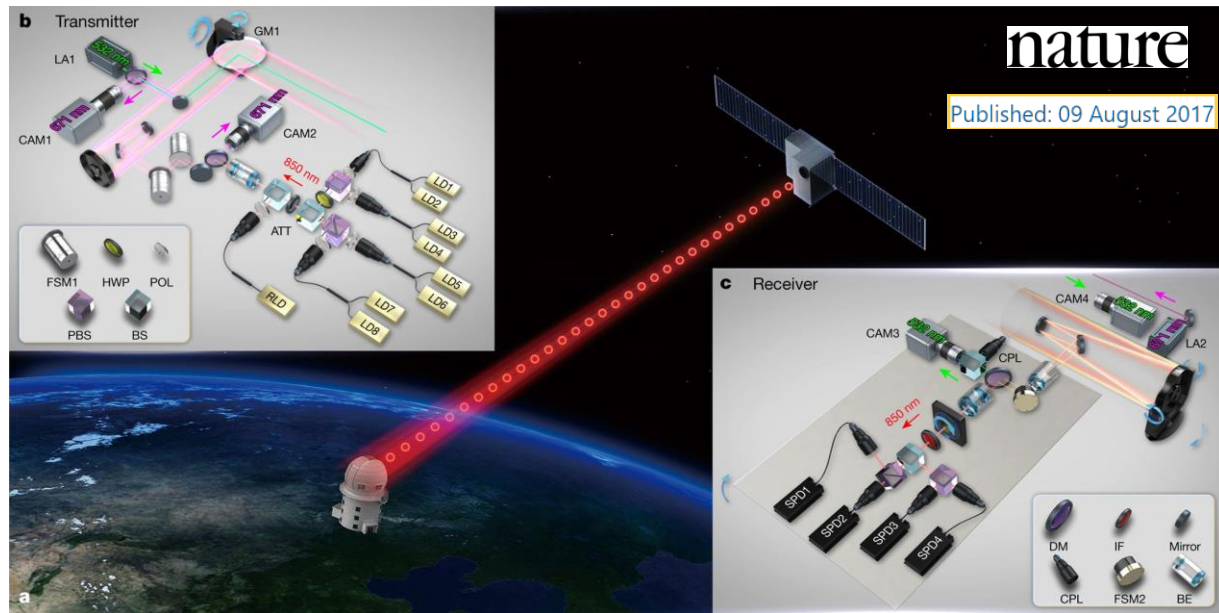


Filter challenges:

- Wavelength selectivity
- Uniformity
- Angle tolerance/wavelength budget

Polarization preserving filters

- Quantum Key Distribution
 - Same spectral functionality as Dichroics/BPFs
 - Polarization maintaining!
 - Low TWE and RWE
- Filter challenges:
 - Wavelength selectivity
 - Uniformity
 - Angle tolerance/wavelength budget
 - + polarization maintenance



Challenge: Wavelength Budgeting

Application Influences

- Angle of incidence and range
- Source/signal wavelength variation
- Operating Temperature Range
- Polarization control

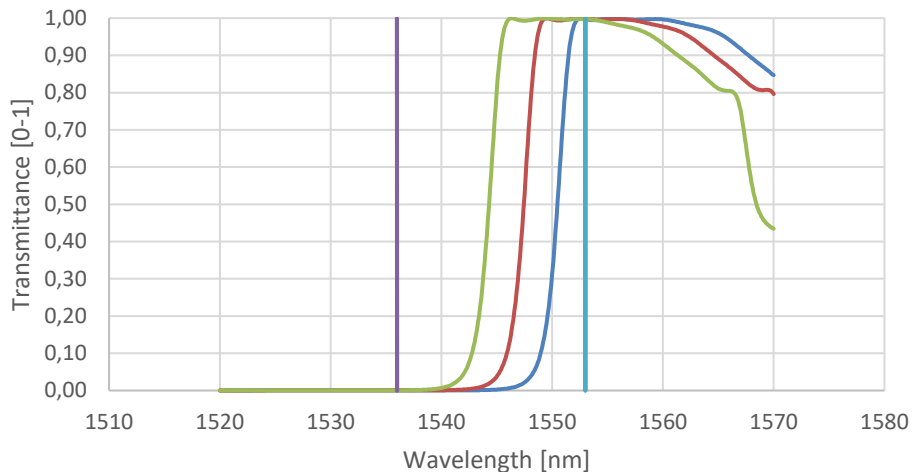
Filter Manufacturing Influences

- Filter Design/Steepness
- Wavelength Targeting
- Coating non-Uniformity

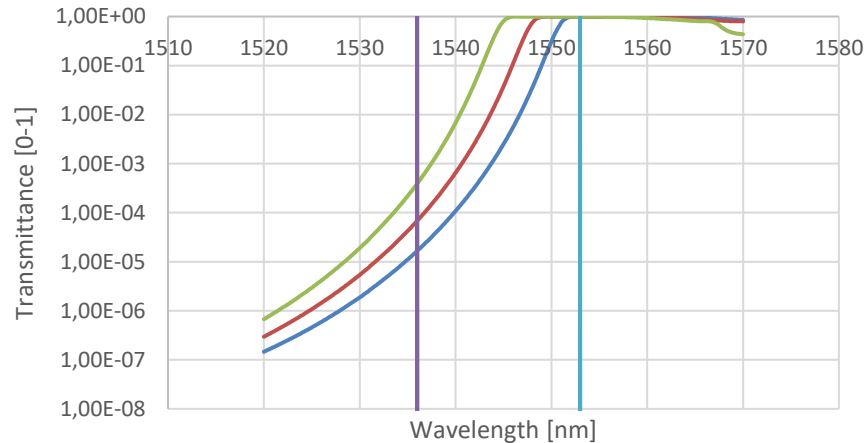


The impact of AOI

Generic Lasercom Dichroic Mirror



Generic Lasercom Dichroic Mirror

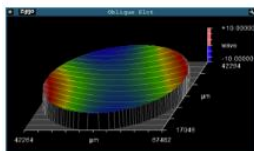


- Tavg, 24.0 degrees AOI
- Tavg, 25.0 degrees AOI
- Tavg, 26.0 degrees AOI
- Channel 1
- Channel 2

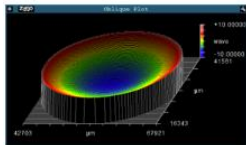


Challenge: WFE (the world is not flat or uniform)

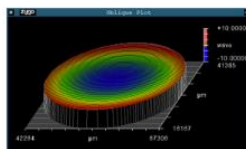
Flatness Side A (388nm Peak-to-Valley (p-v)):



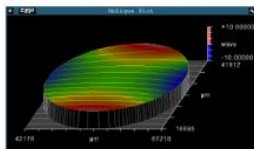
Flatness Side A (7541nm p-v):



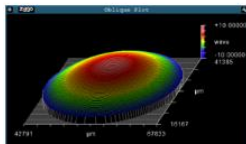
Flatness Side A (1417nm p-v):



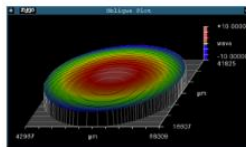
Flatness Side B (333nm p-v):



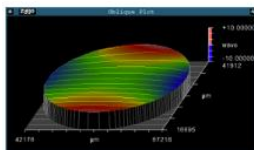
Flatness Side B (7569nm p-v):



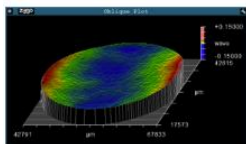
Flatness Side B (1386nm p-v):



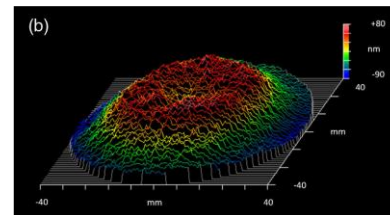
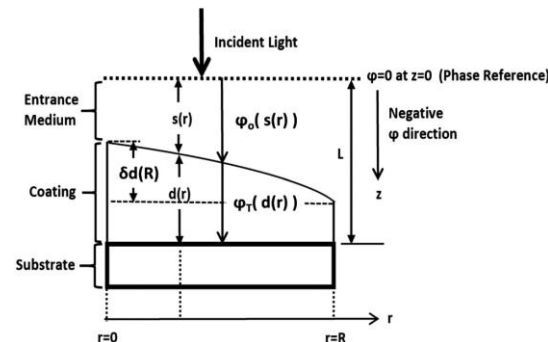
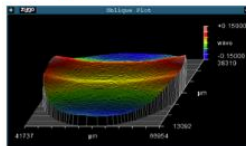
TWD (26nm p-v):



TWD (30nm p-v):



TWD (129nm p-v):



	Flatness Side A (p-v)	Flatness Side B (p-v)	TWD (p-v)
Uncoated	388nm	333nm	26nm
Side A coated	7541nm	7569nm	30nm
Stress balanced	1417nm	1386nm	129nm

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I R I D I A N S P E C T R A L T E C H N O L O G I E S