

Radiation Hardness Assessment of DFB and Widely Tunable Lasers

ESA Contract No.: 17884/03

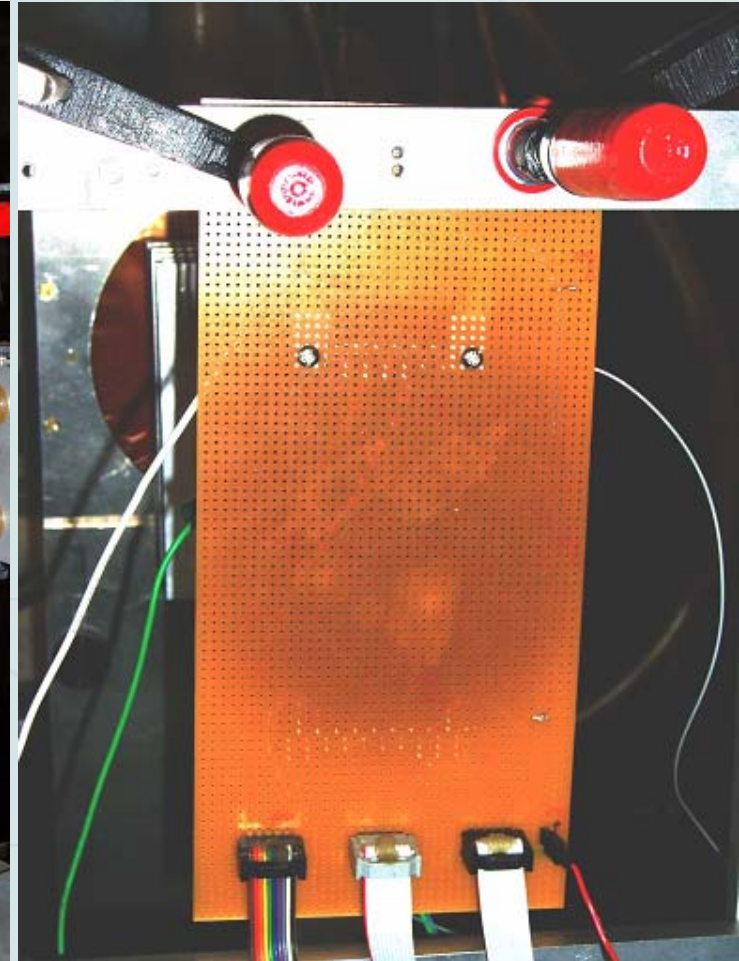
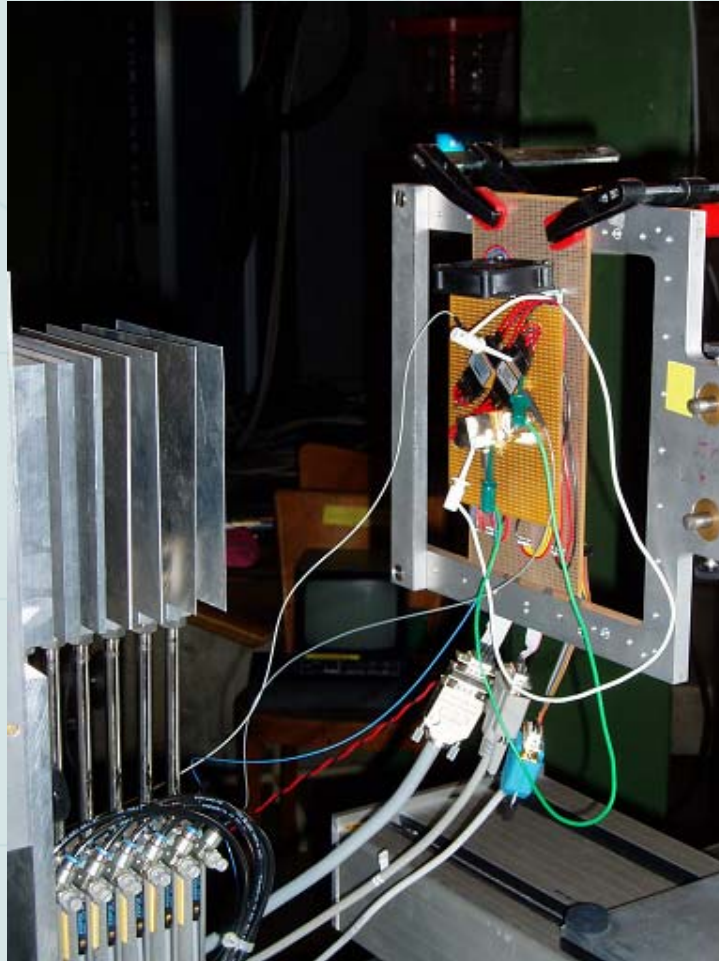
Date: 05/10/2005

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- Evaluate radiation hardness of emerging laser technologies – DFB, DBR, SG-DBR.
- Examine: threshold, wavelength, SMSR, linewidth, modulation.
- Proton irradiation
 - 1) 2-year LEO, 4mm Al shielding
Energy = 10 MeV
Fluence = $4 \times 10^9 \text{ cm}^{-2}$
 - 2) High energy exposure
Energy = 50 MeV
Fluence = $2 \times 10^{13} \text{ cm}^{-2}$

Type	Package	Wavelength
DFB	TO-8 w/ TEC	935nm
DFB	TO-9 No TEC	935nm
DFB	Butterfly	1550nm
DBR	Butterfly	1550nm
SG-DBR	Butterfly	1550nm

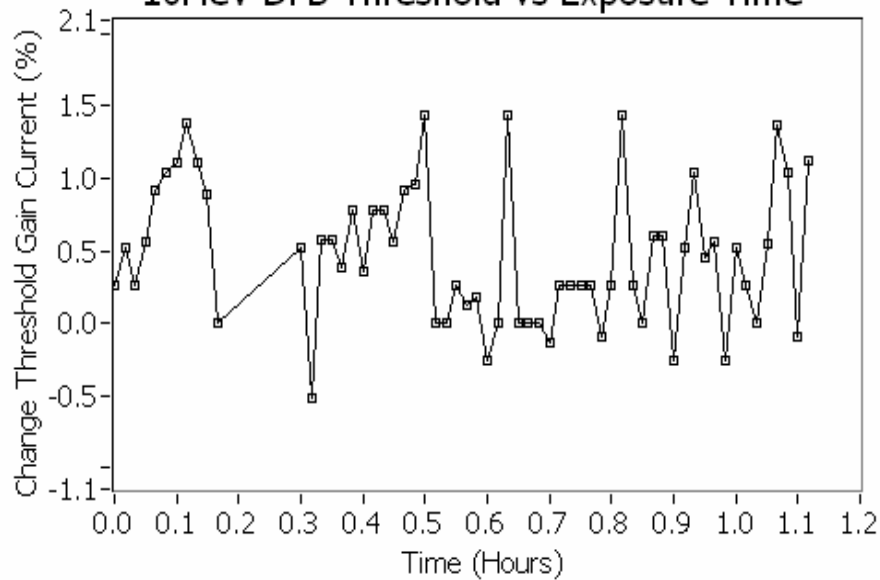
- 2 batches of lasers for both low- and high-energy irradiation
- In situ testing of DFB and DBR. Results shown here.
- Lasers exposed to high-energy protons are still too active to return even after 7 months.



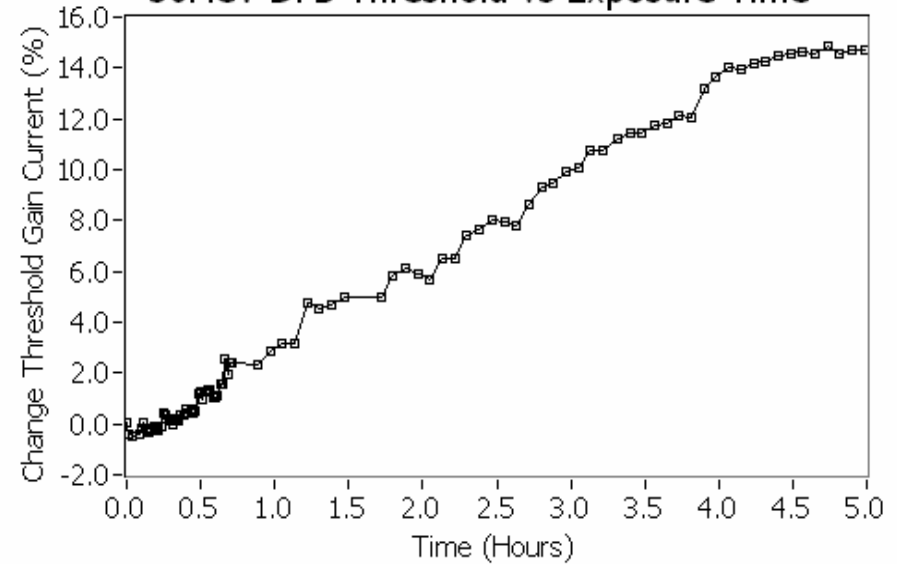
10 MeV

50 MeV

10MeV DFB Threshold vs Exposure Time



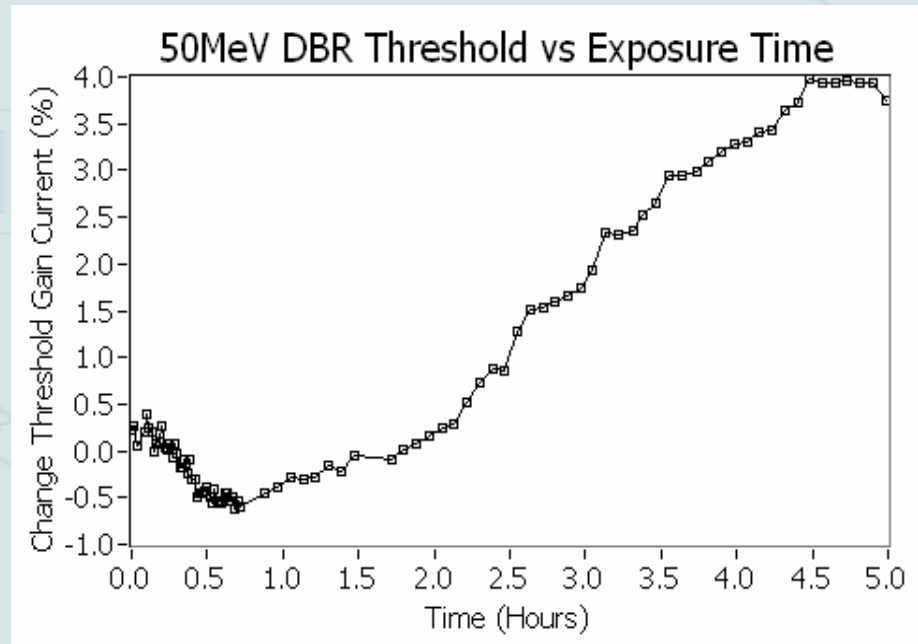
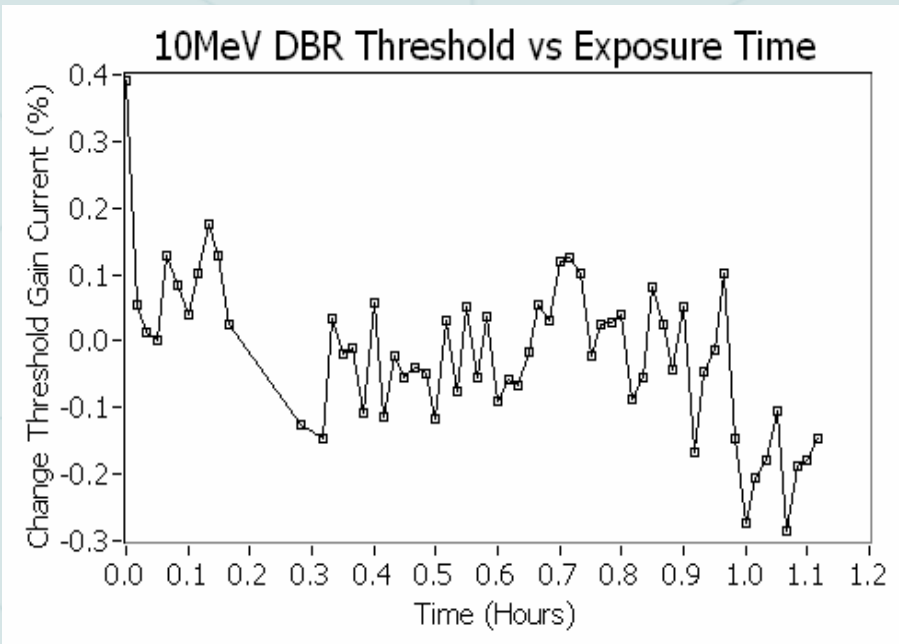
50MeV DFB Threshold vs Exposure Time



Threshold Deterioration (DBR)

10 MeV

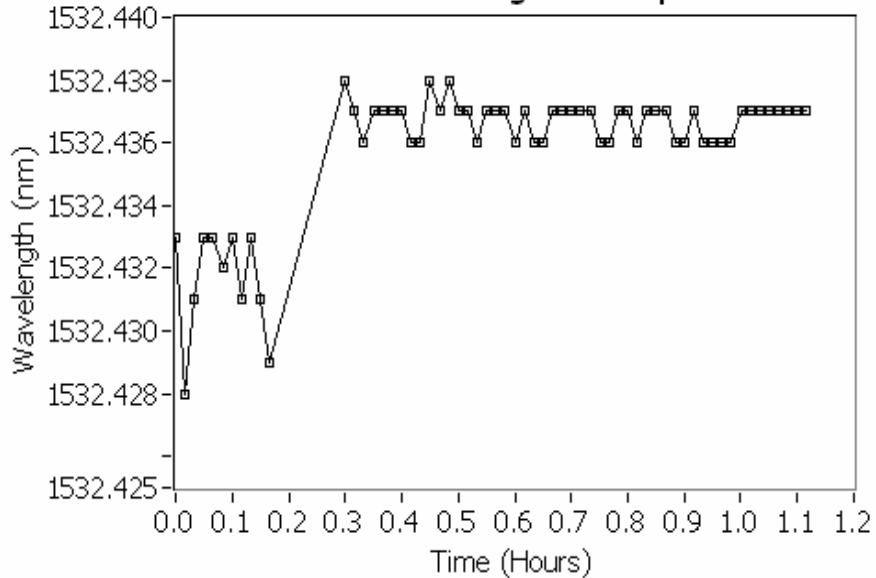
50 MeV



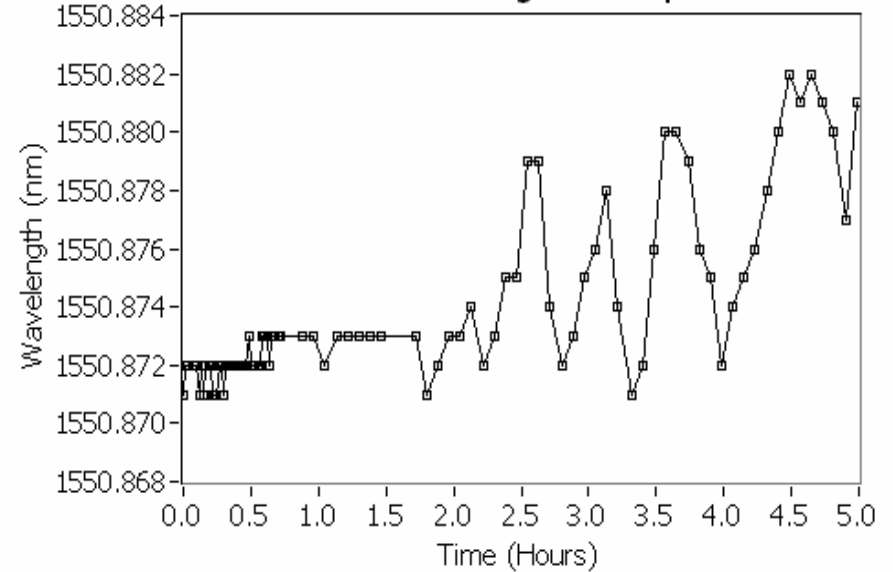
10 MeV

50 MeV

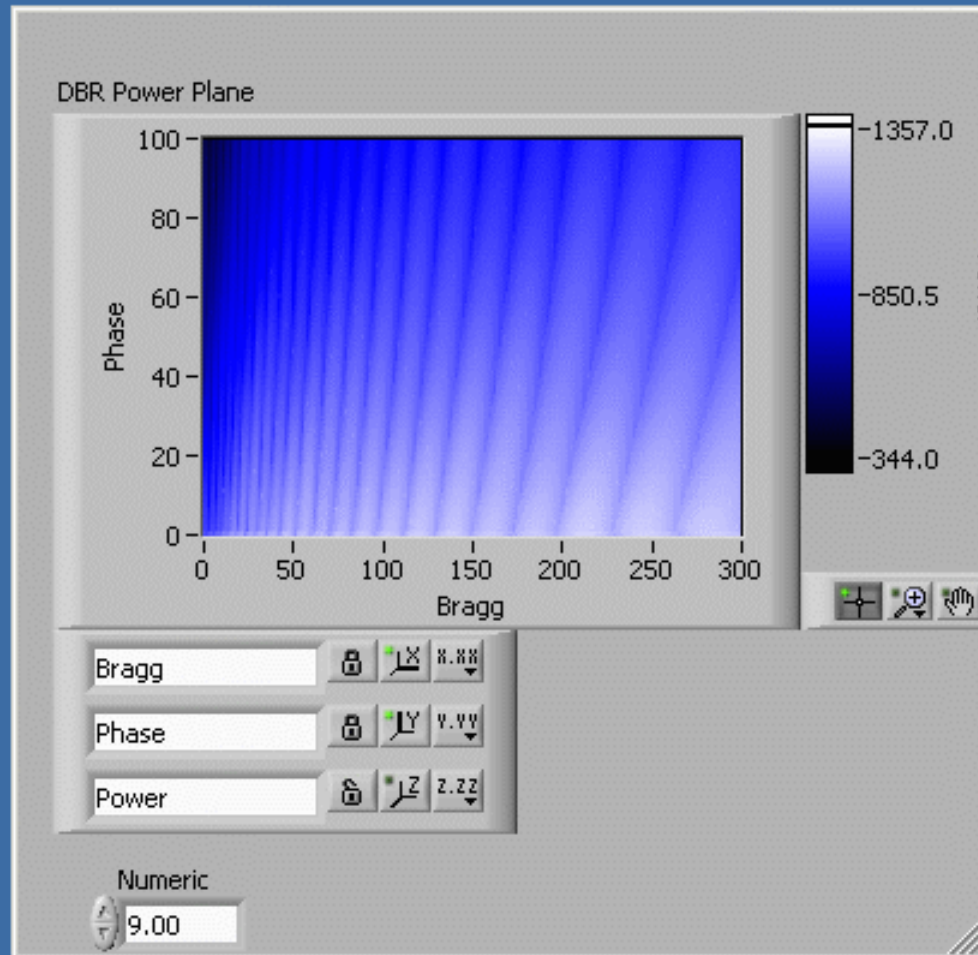
10MeV DFB Wavelength vs Exposure Time



50MeV DFB Wavelength vs Exposure Time

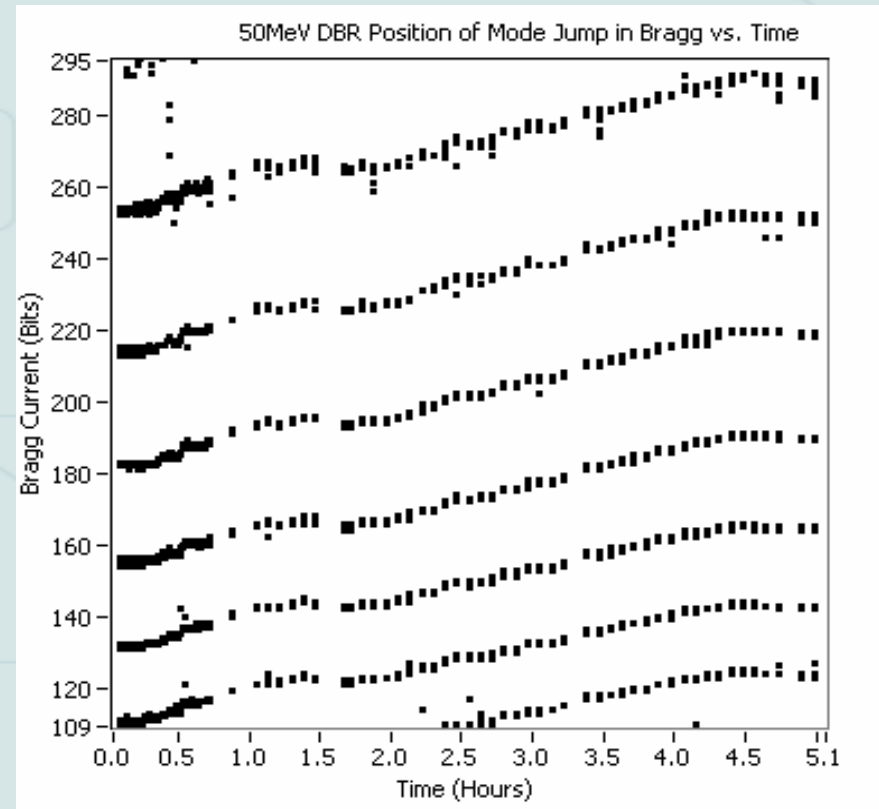
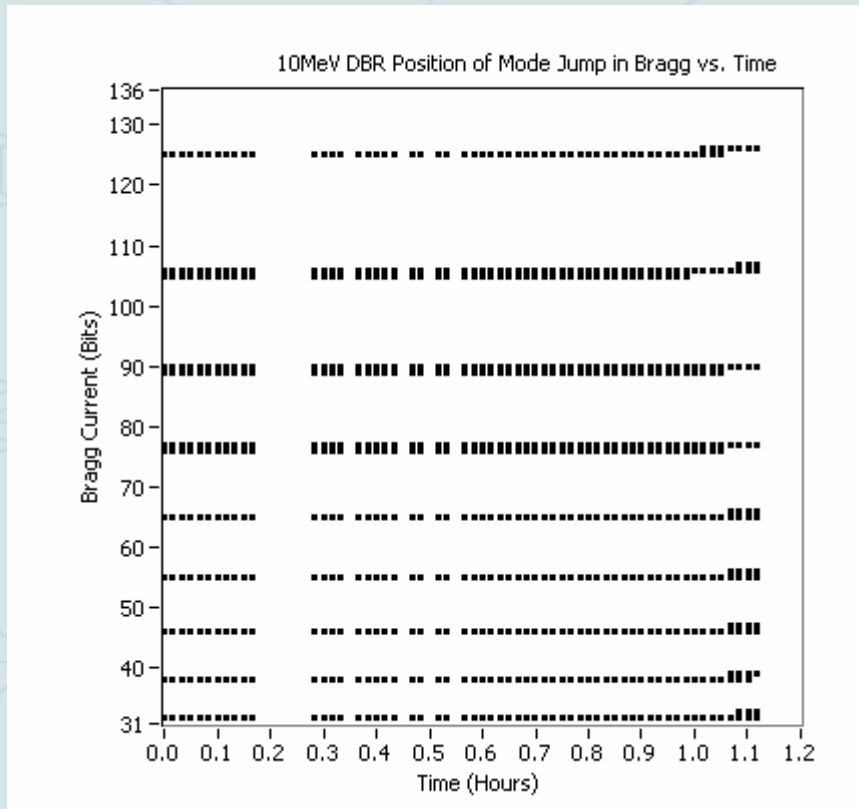


DBR Modal Structure



10 MeV

50 MeV



- The tests indicate minimal deterioration of tunable lasers at low exposure (10 MeV).
- Modest degradation in the lasing threshold of both device types at high exposures.
- Increasing wavelength instability (10pm) of DFB with increasing exposure ($>1 \times 10^{13} \text{ cm}^{-2}$, 50 MeV).
- Modal structure of the DBR laser is preserved despite high energy exposures.
- Final analysis is not completed. Expected Nov 2005.