

Tunable Dual-Wavelength system based on a Polarization Maintaining Large Mode Area Thulium Doped Fiber Laser operated in the 2 μm region

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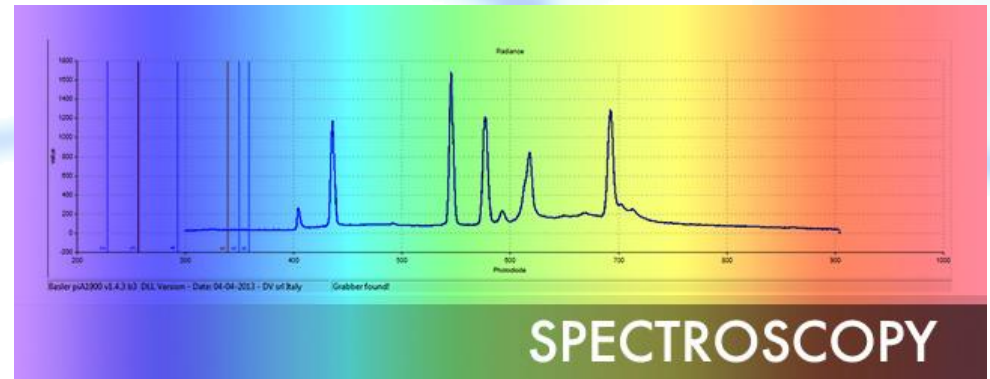
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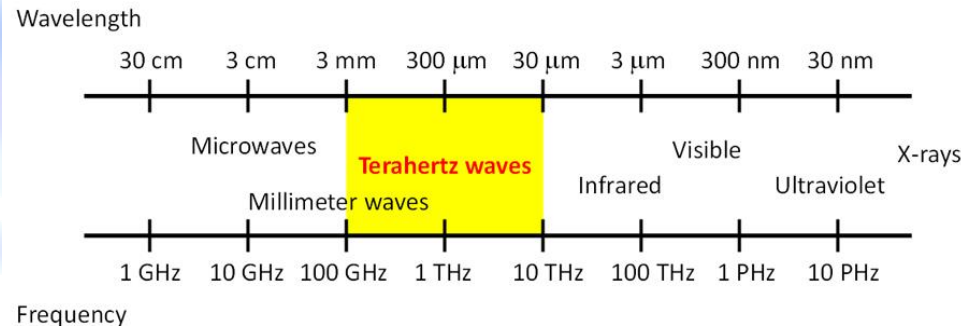
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Dual-frequency lasers applications :

- Distance measurements
- Imaging system
- Spectroscopy
- Terahertz difference frequency generation

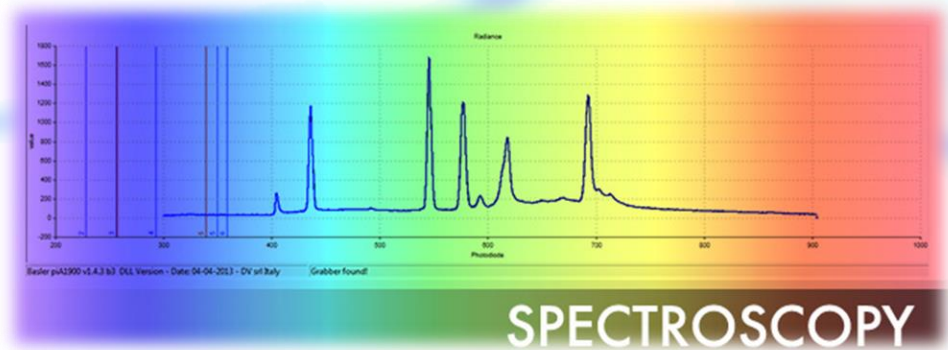


Terahertz Wave Generation

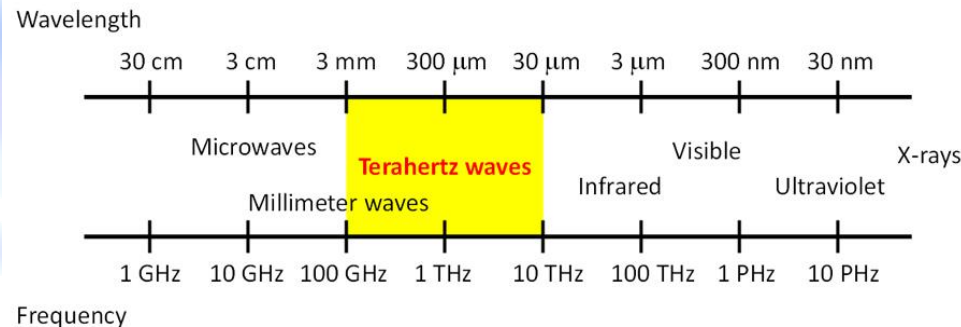


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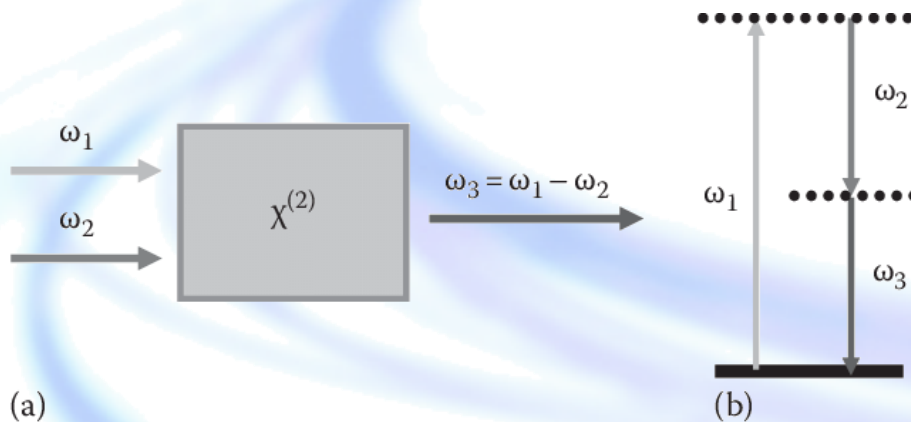


**Terahertz Wave
Generation by
DFG**



Difference frequency generation (DFG)

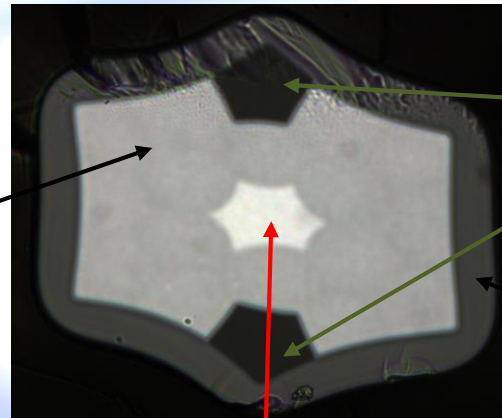
THz generation is based on optical parametric processes :
(DFG) in nonlinear optical (NLO) crystals.



(a) Interaction geometry for difference frequency generation

(a) Energy level diagram of difference frequency generation

PM Tm doped fiber



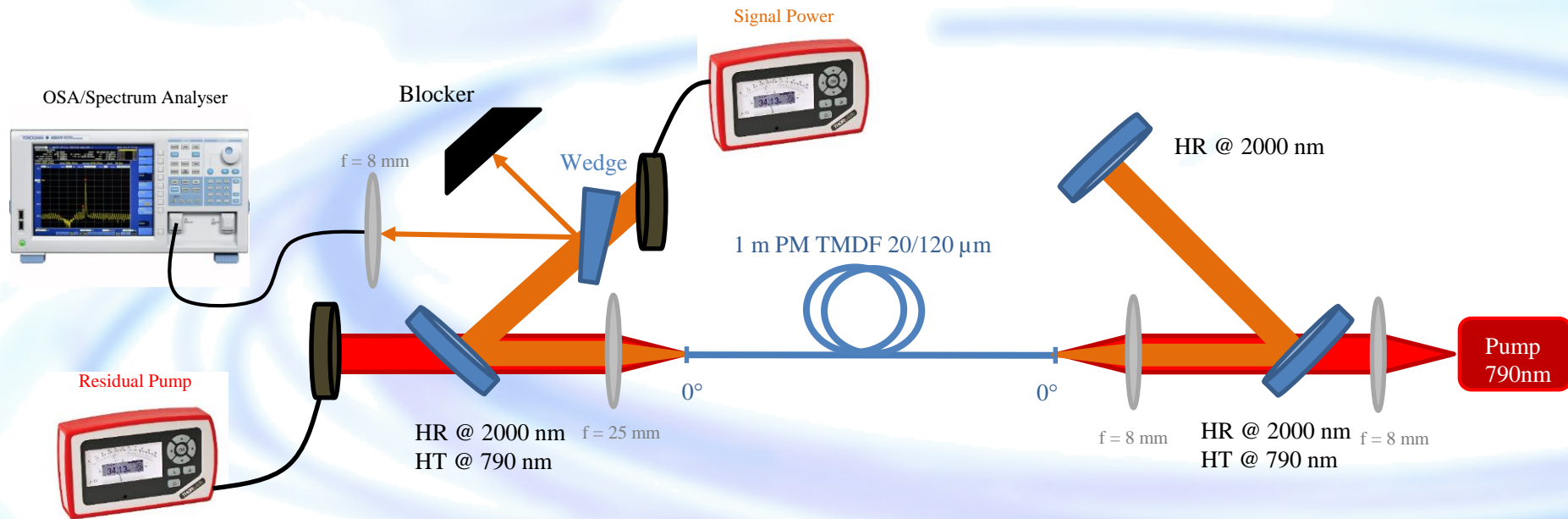
First Clad:
Aluminum doped silica

Boron inclusion

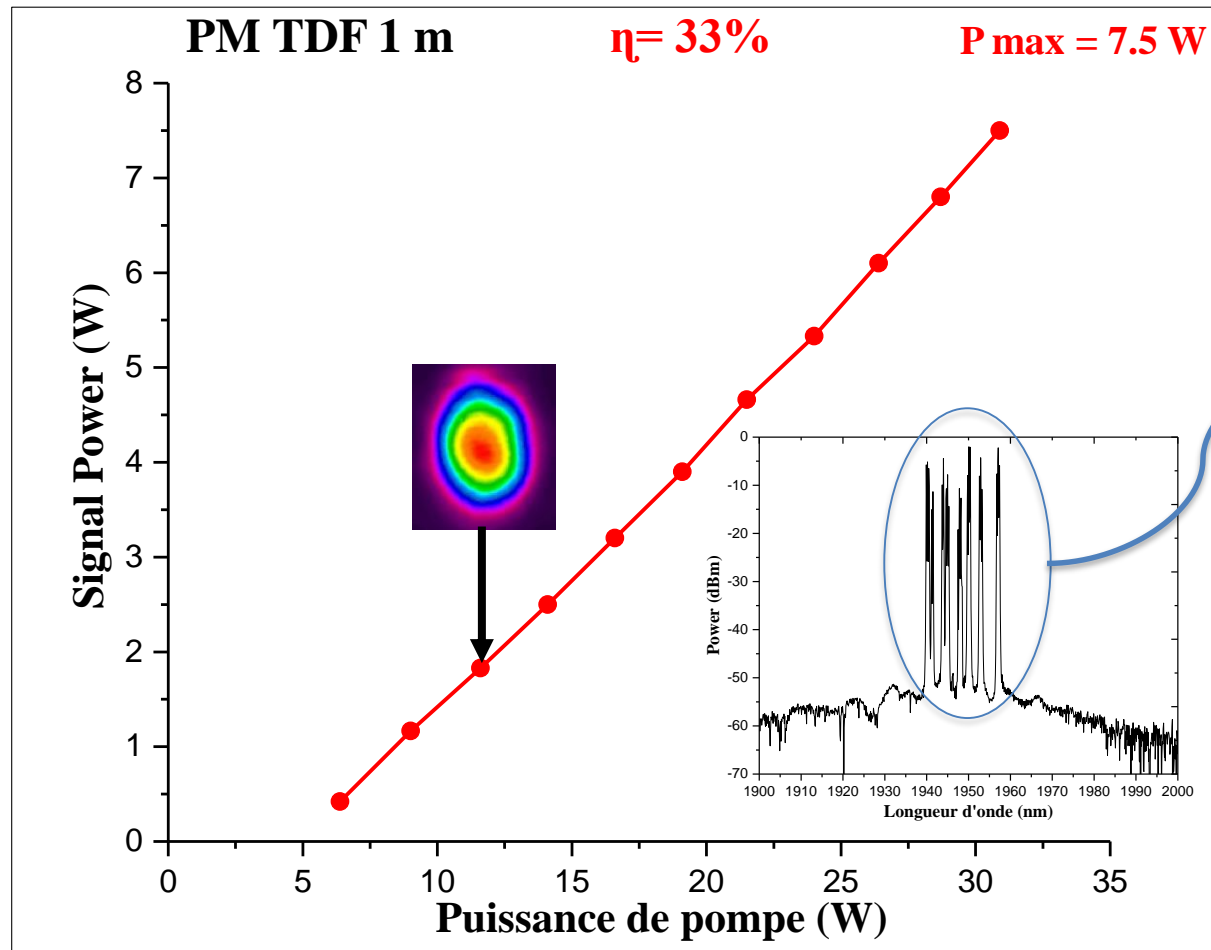
Second Clad:
Pure silica
110-130 μm

Hexagonal core
18-25 μm

PM Tm doped fiber

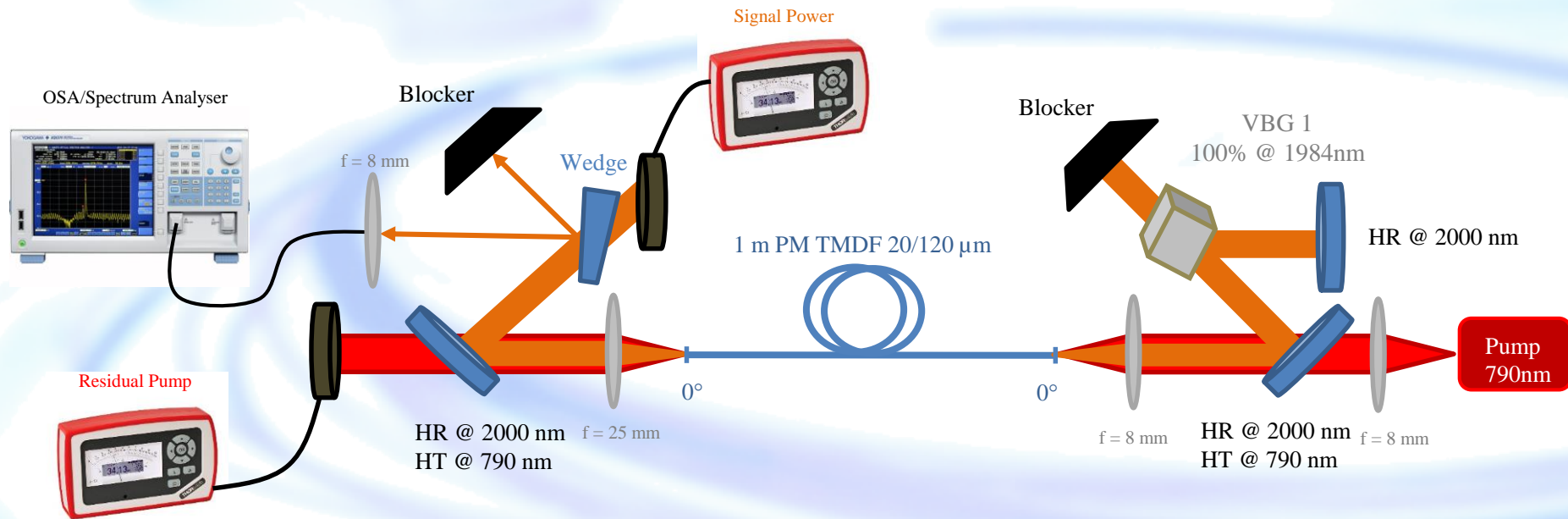


PM Tm doped fiber



Laser Emission at
1940 nm- 1960 nm

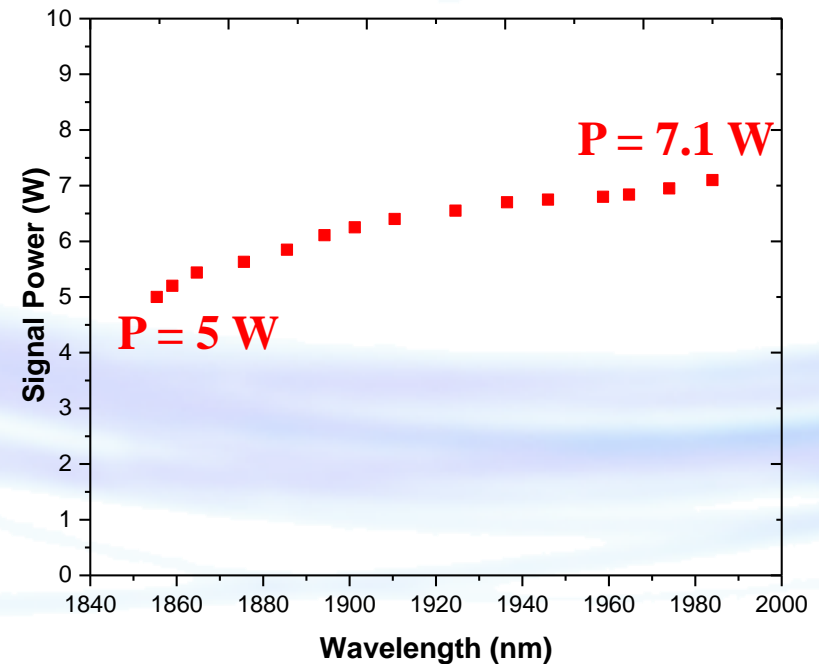
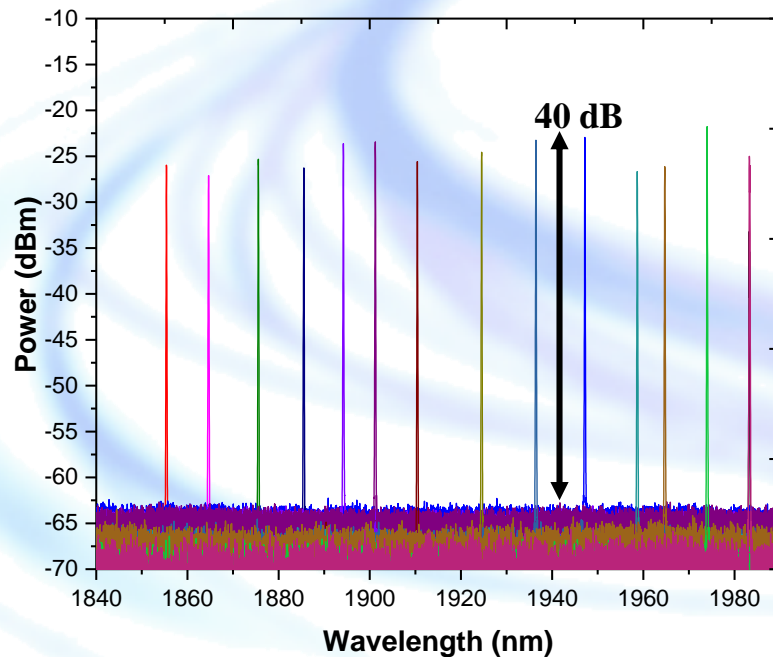
Tunable single wavelength thulium fiber laser



Tunable single wavelength thulium fiber laser

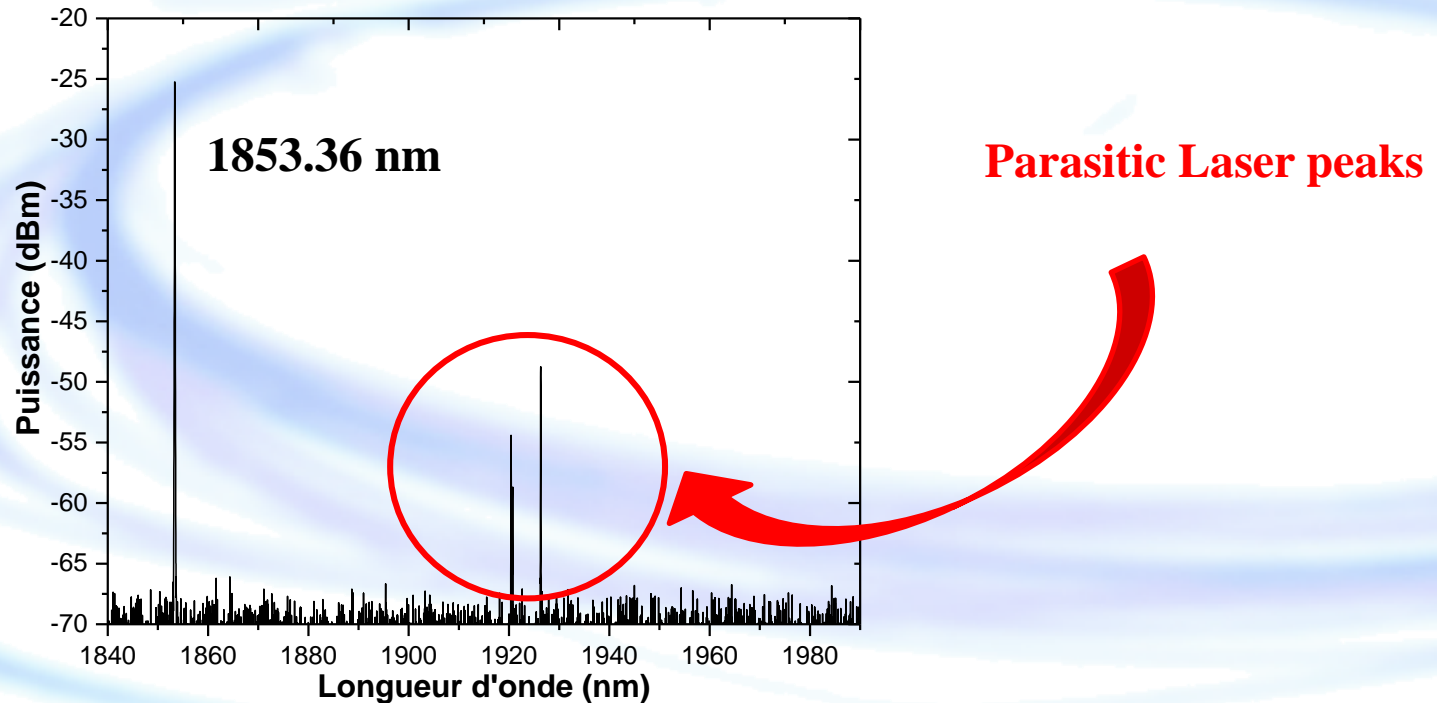
1855 nm → 1984 nm
129 nm Tunability

VBG 1984 nm
MP TDF 95 cm

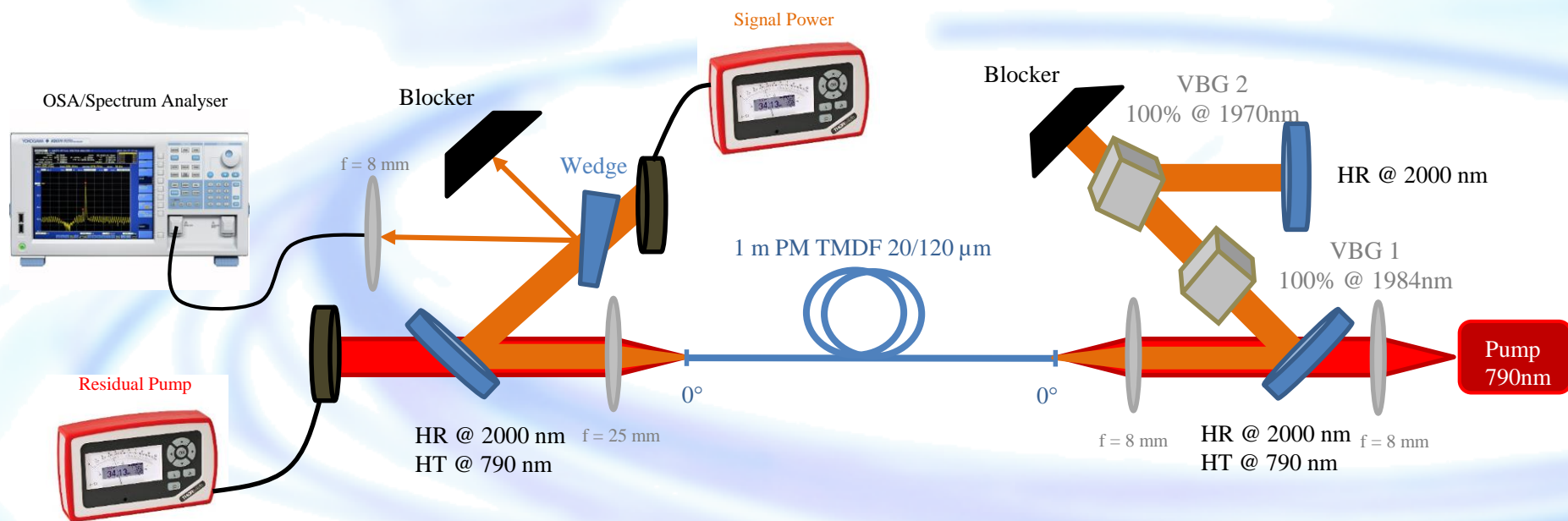


Tunable single wavelength thulium fiber laser

Why we did not go further...

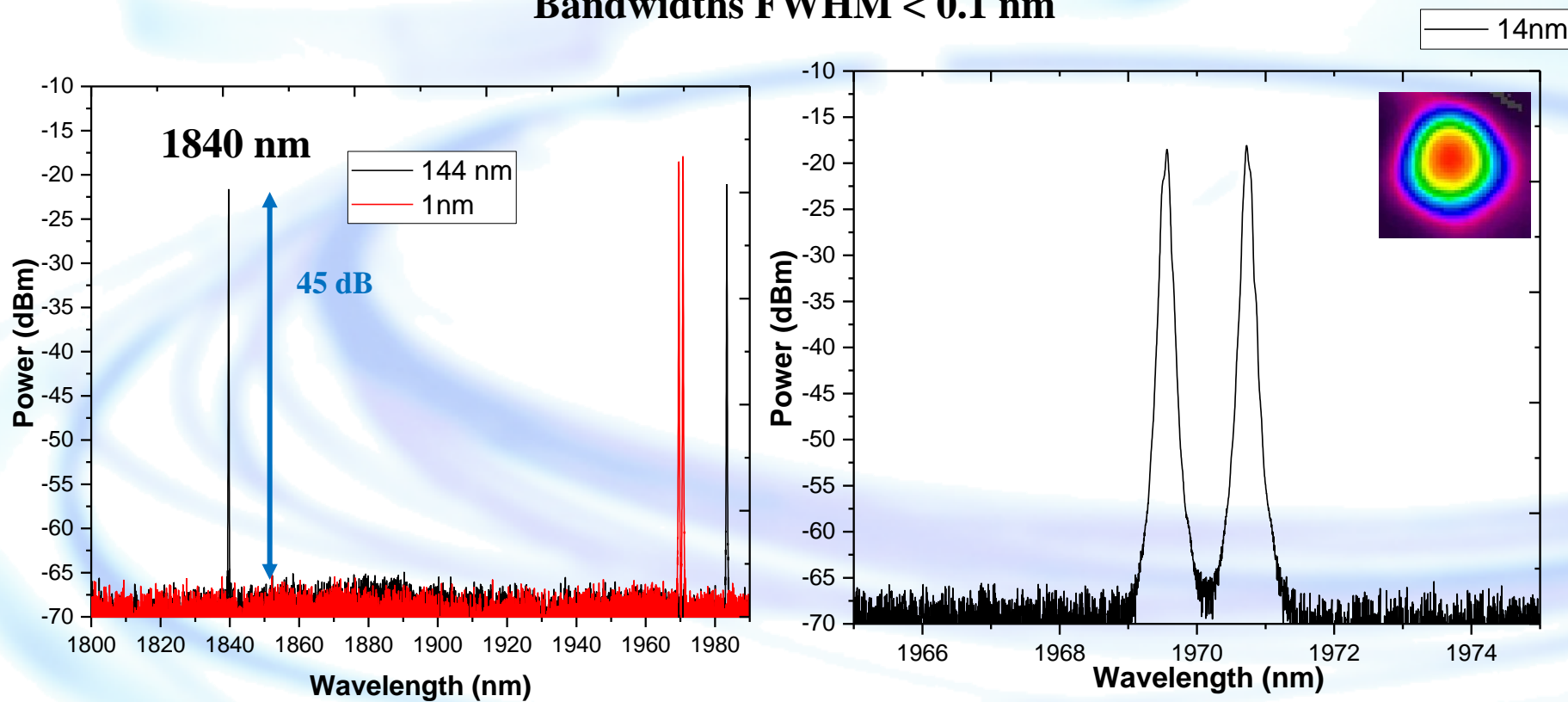


Tunable dual-wavelength thulium fiber laser



Tunable dual-wavelength thulium fiber laser

Bandwidths FWHM < 0.1 nm

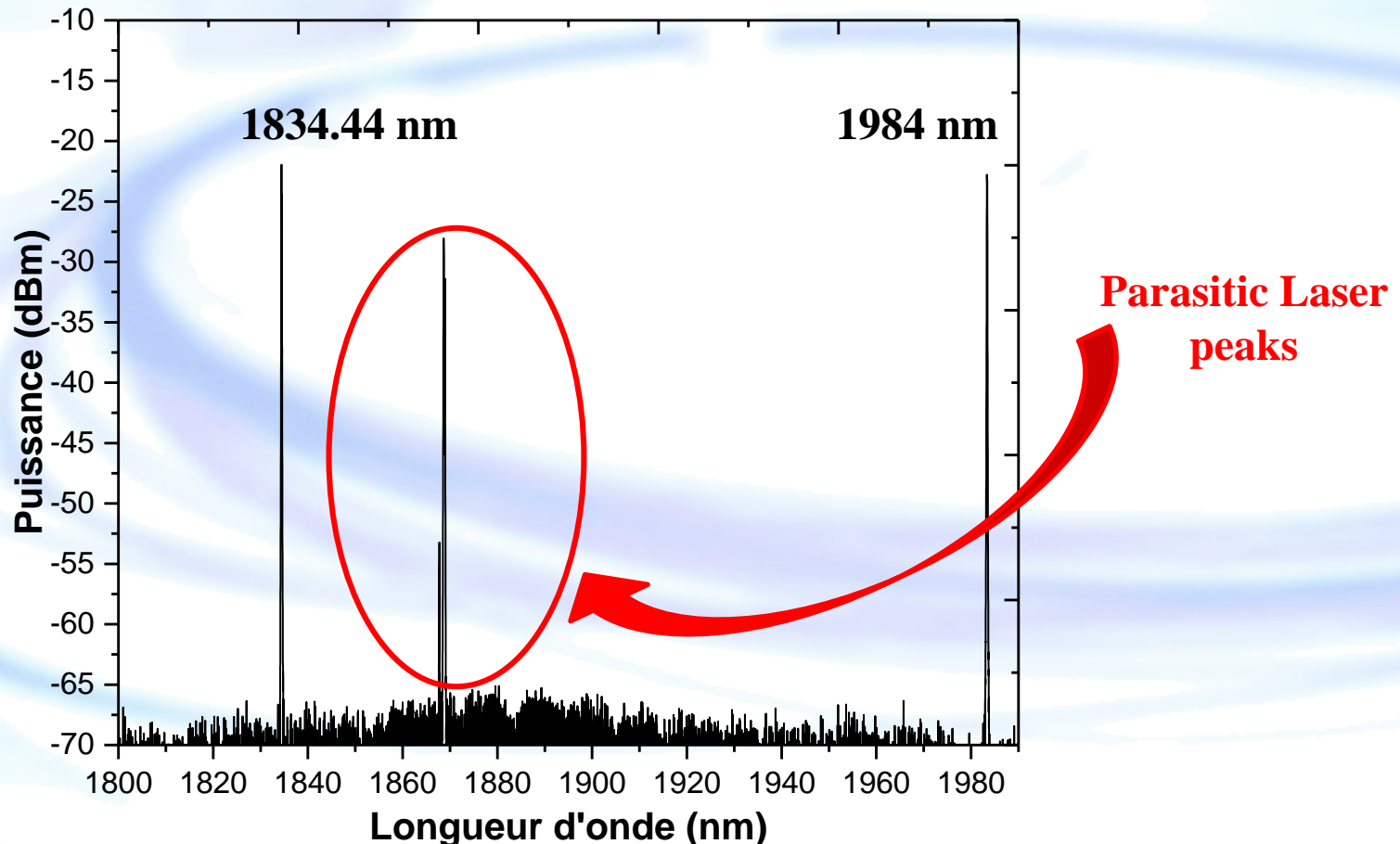


Wavelength difference can be tuned from
1 nm to 144 nm

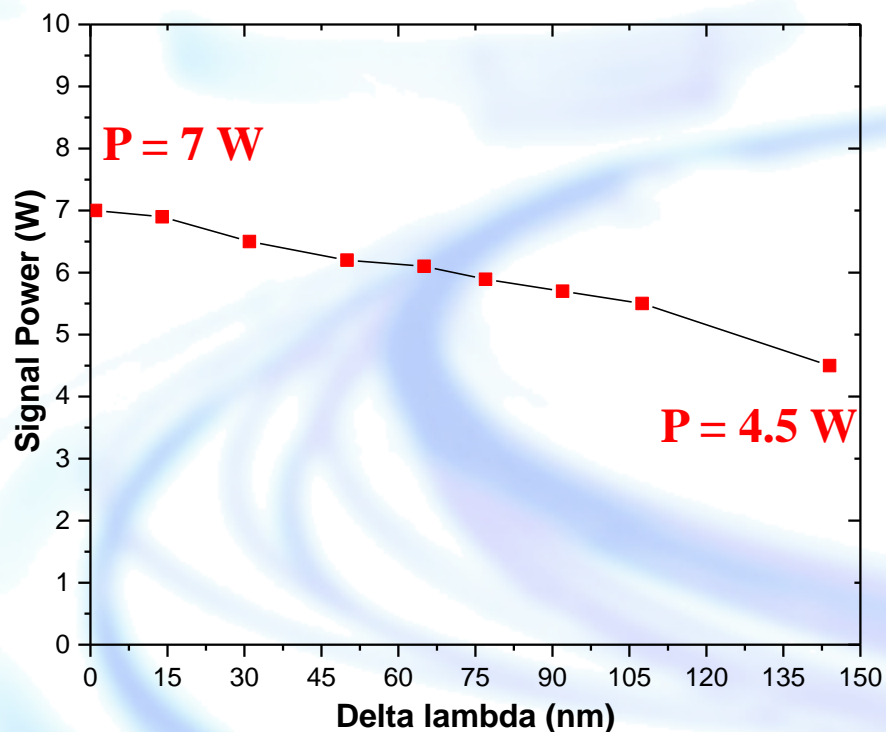
VBGs used at normal incident angle
1984 nm / 1970 nm

Tunable dual-wavelength thulium fiber laser

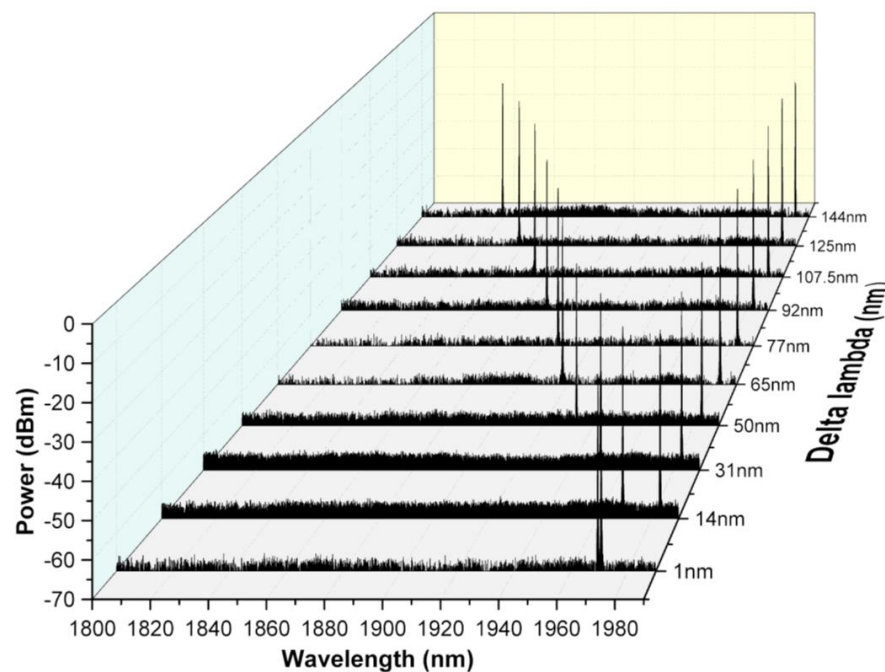
Parasitic peaks are observed for broader gaps...



Tunable dual-wavelength thulium fiber laser



Signal Power vs Delta Lambda



Different dual wavelength spectrums

Perspective

- Obtain dual-frequency synchronous-pulsed by adding an AOM (Acousto Optic Modulator) in free space
- Generate THz waves by DFG using a nonlinear crystal

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Thanks For Your Attention!