How narrow is narrow …

contributors

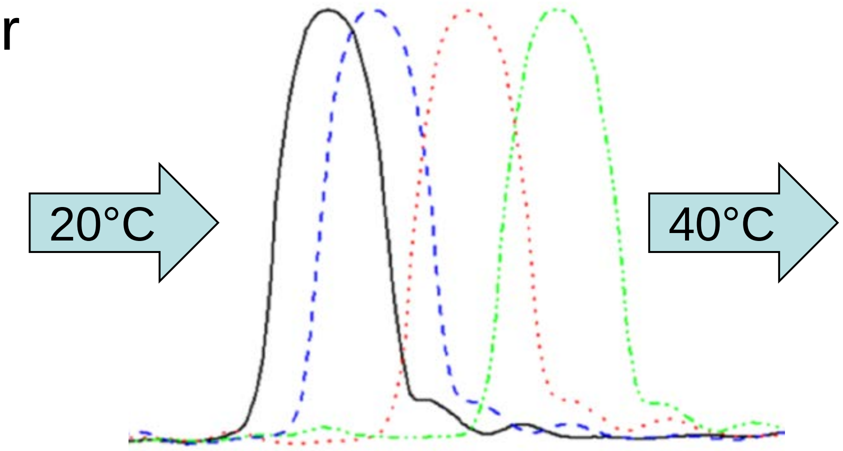
- Daisuke Umeda
- Frank Effenberger
- John Johnson
- Marek Hajduczenia
- Tomoyuki Funada

(alphabetic, by first name)

transmission window size / 1

- Temperature drift of the laser center wavelength within target operating window

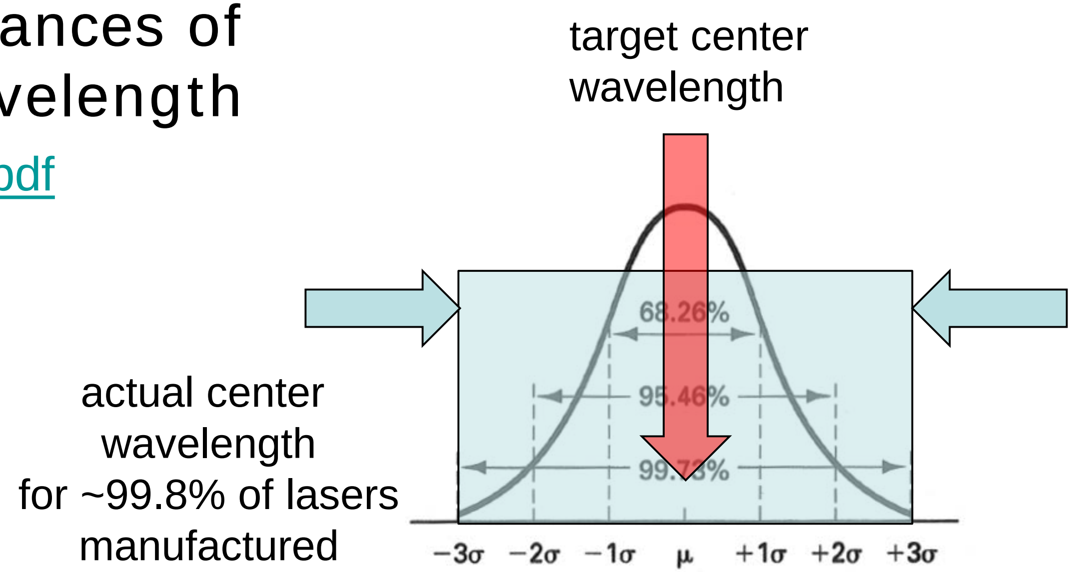
~0.09nm/°C



- Manufacturing tolerances of the laser center wavelength

[johnson_01_0108.pdf]

6(?)nm for 3σ



transmission window size / 2

- Accounts for TOSA to module and module (air inside ONU case) to ambient (outside ONU case)
  - Typical ~20°C, ~25-30°C in poor designs
  - Added to ambient temperature range

~0.09nm/°C

- Include burst shift penalty and spectral width penalty
  - Burst shift penalty: 45GHz over target temp range
  - Spectral width penalty: 50GHz over target temp range
  - Reference: park_3ca_2b_0517.pdf

0.54nm

adding it all up …

- Target temperature range: **0-40°C**
- Center wavelength drift due to temperature: 40×0.09 = **3.6nm**
- Manufacturing tolerances: **6nm** / 3σ
- Burst and spectral shift penalty: **0.54nm**
- Center wavelength drift due to imperfect thermal resistance (TOSA ⇔ heat sink, worst case) 30×0.09 = **2.7nm**

grant total: 12.84nm

13nm industrial standard per G.694.2

ways to minimize further

- Improved thermal resistance: target 25°C worst case ⇨ **2.25nm** vs **2.7nm**
- Further restrict temperature range: target 10-40°C ⇨ **2.7nm** vs **3.6nm**
- Burst and spectral shift penalty: **0.54nm**
- Tighten manufacturing tolerances: **4nm** / 2σ (~95.5% yield)

9.49nm

- Further improvements would require more dramatic temperature range restriction and/or tightening manufacturing process (yield loss)