

# Ultra-compact DWDM Filter Tunable Across the C-band

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## Abstract

We demonstrate a third-order cascaded microring filter with 2.5  $\mu\text{m}$ -radius resonators, showing a flat-top response and a 35-nm free spectral range. Continuous wavelength tuning over the C-band has been achieved.

## Motivation

Design an add-drop filter which exhibits:

- Flat-top response, sharp roll-off and large bandwidth;
- Small footprint;
- Large free spectral range (FSR);
- Tunability across a large wavelength range;
- Insensitivity to fabrication non-uniformities.

## Filter Design

• Third-order cascaded microring filter with rings of radius 2.5  $\mu\text{m}$ .

• Gaps were chosen in order to target a maximally flat (Butterworth) filter shape.

• Small footprint

Passive  $\rightarrow$  15 x 5  $\mu\text{m}^2$

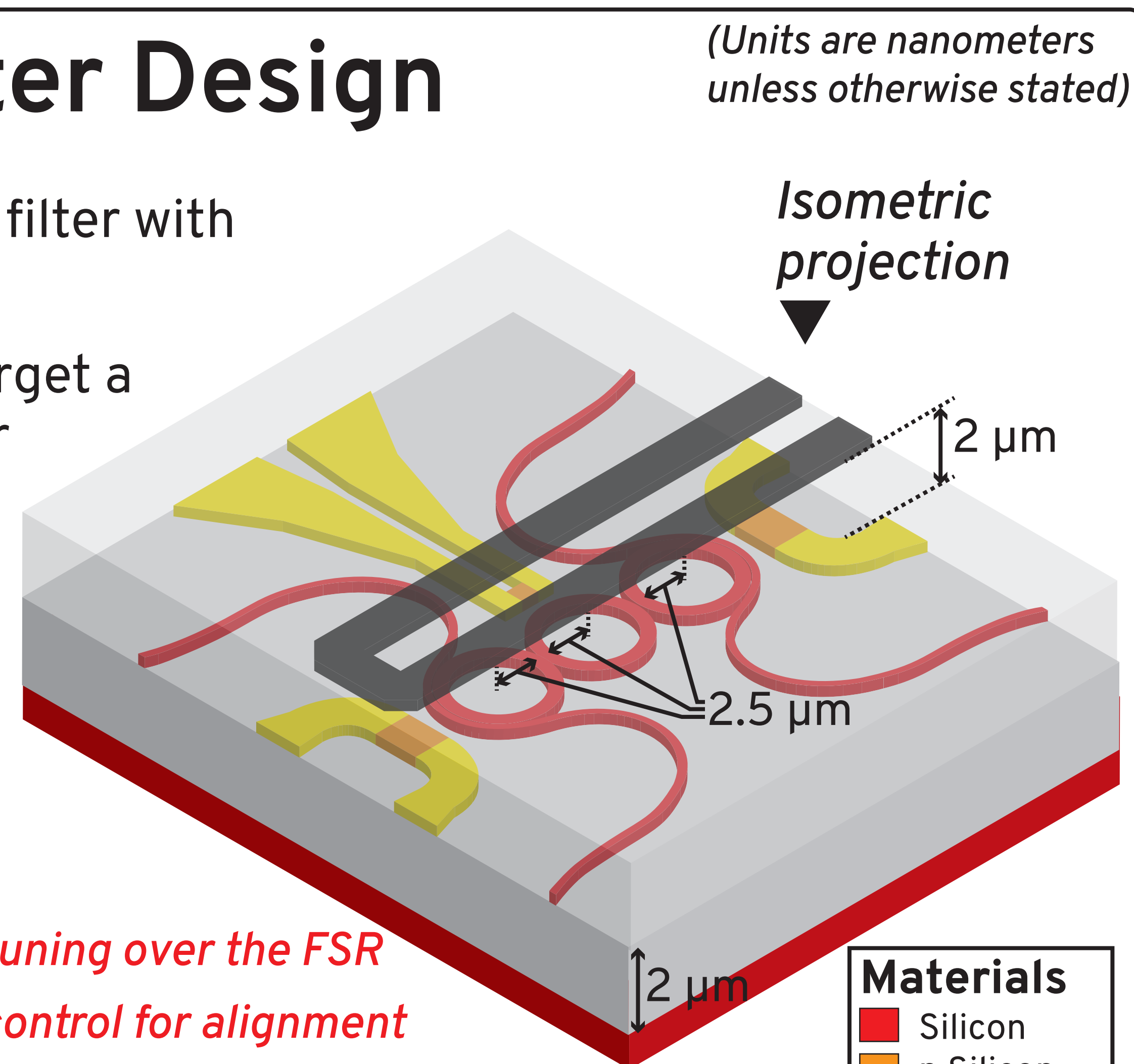
Active  $\rightarrow$  25 x 25  $\mu\text{m}^2$

• 2 Tuning mechanisms

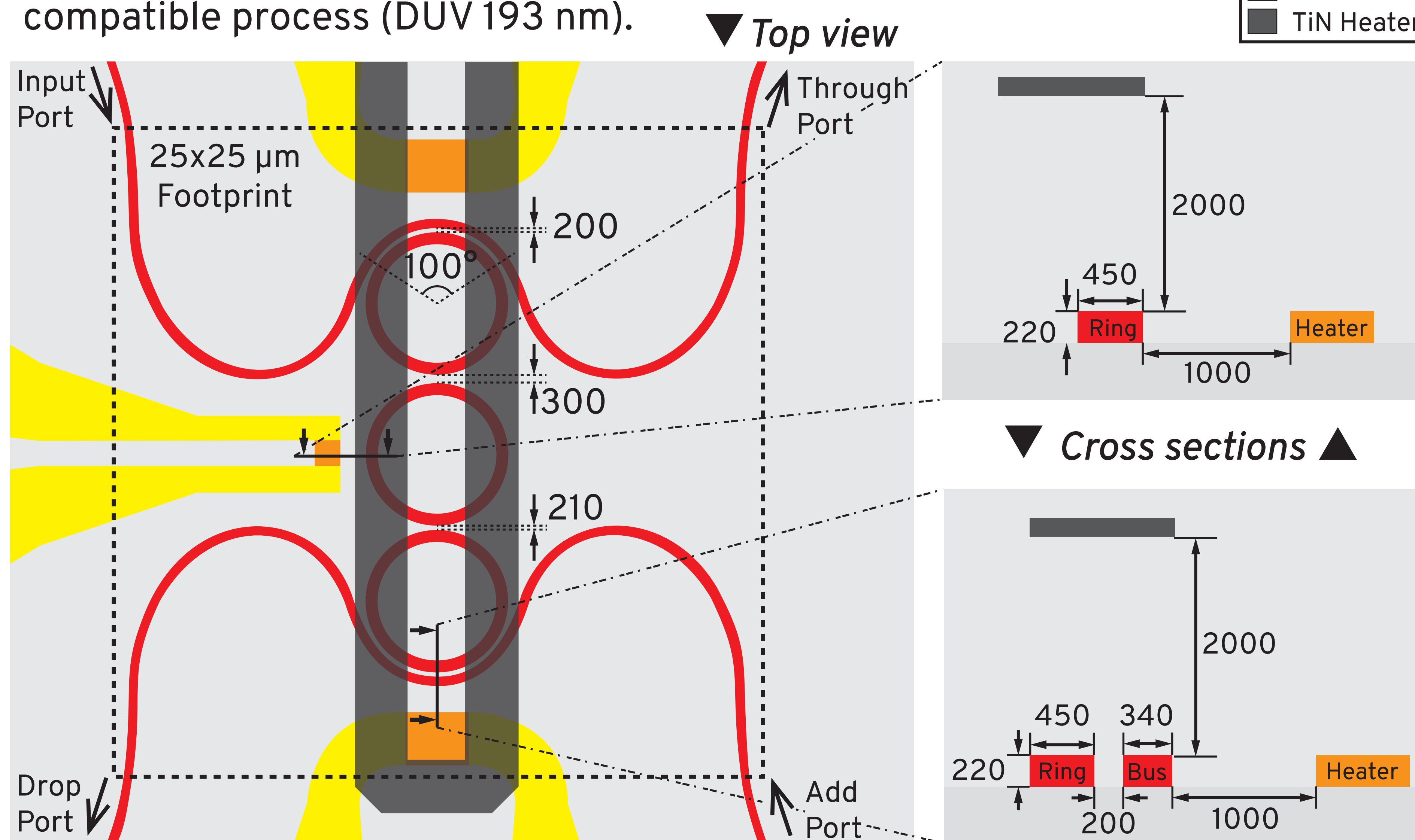
Metal Heater  $\rightarrow$  Coarse control for tuning over the FSR

Semiconductor heaters  $\rightarrow$  Precise control for alignment

• Fabricated at A\*STAR IME using a CMOS compatible process (DUV 193 nm).

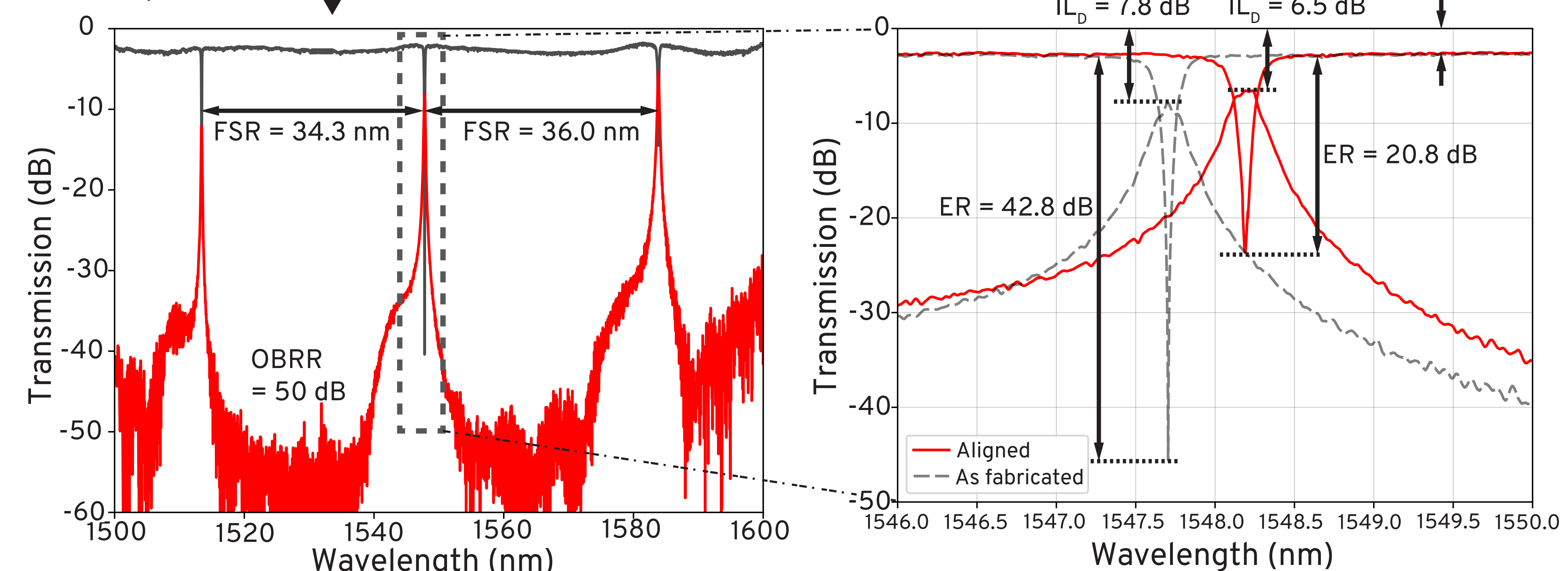


Materials	
■	Silicon
■	n Silicon
■	n++ Silicon
■	Oxide
■	TiN Heater

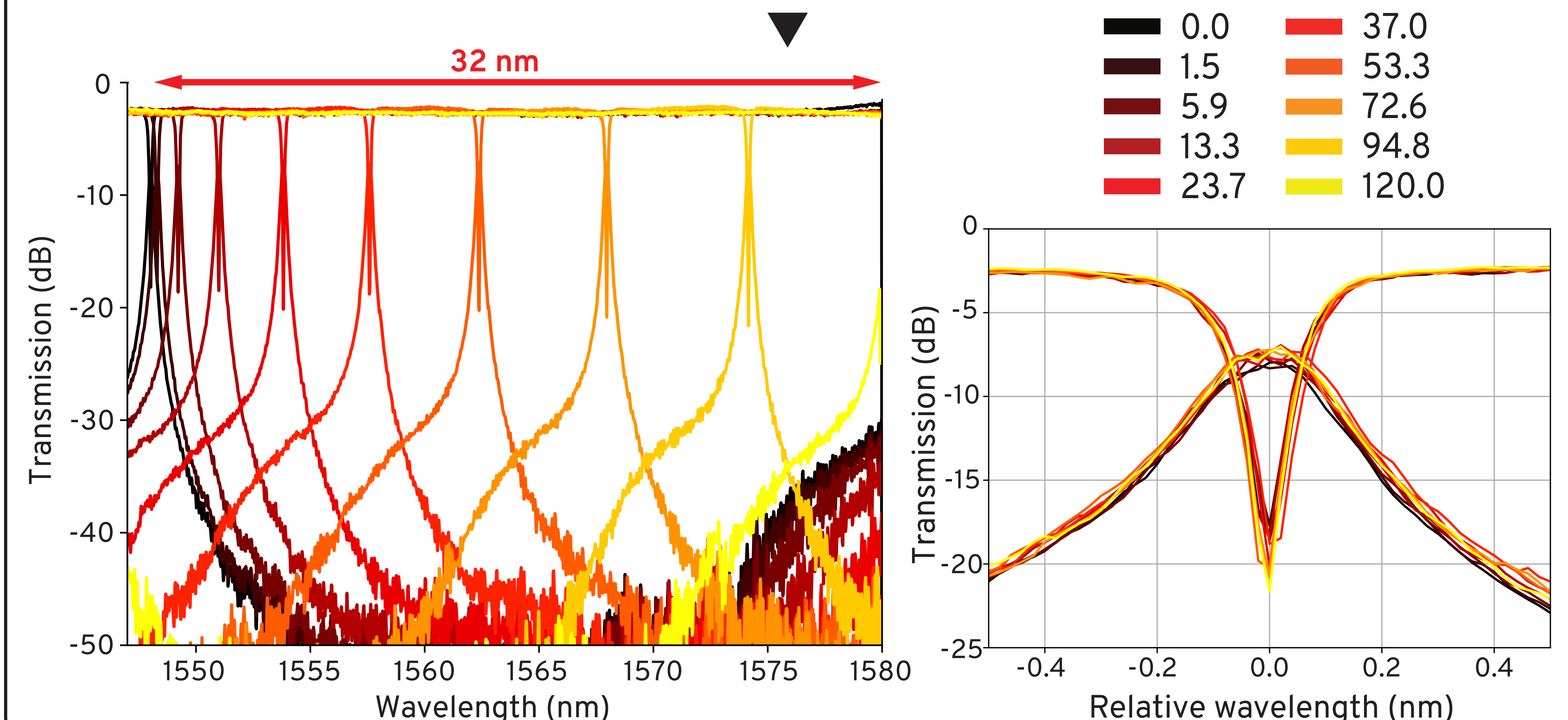


Transmission spectrum

## Spectral Response



Tuning across the c-band



## Conclusion

We demonstrated a novel third-order cascaded microring filter made of ultra-small rings with a radius of 2.5  $\mu\text{m}$ . The filter can be continuously tuned over 32 nm with a power consumption of 120 mW. With an ultra-compact footprint of 25  $\times$  25  $\mu\text{m}^2$  and low complexity, this device paves the way for integration in photonic systems on a chip. It may find applications in flexible DWDM multiplexing and wavelength routing.

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