

# Cryogenic operation of a polarisation converter and directional coupler in LiNbO<sub>3</sub> for quantum circuits

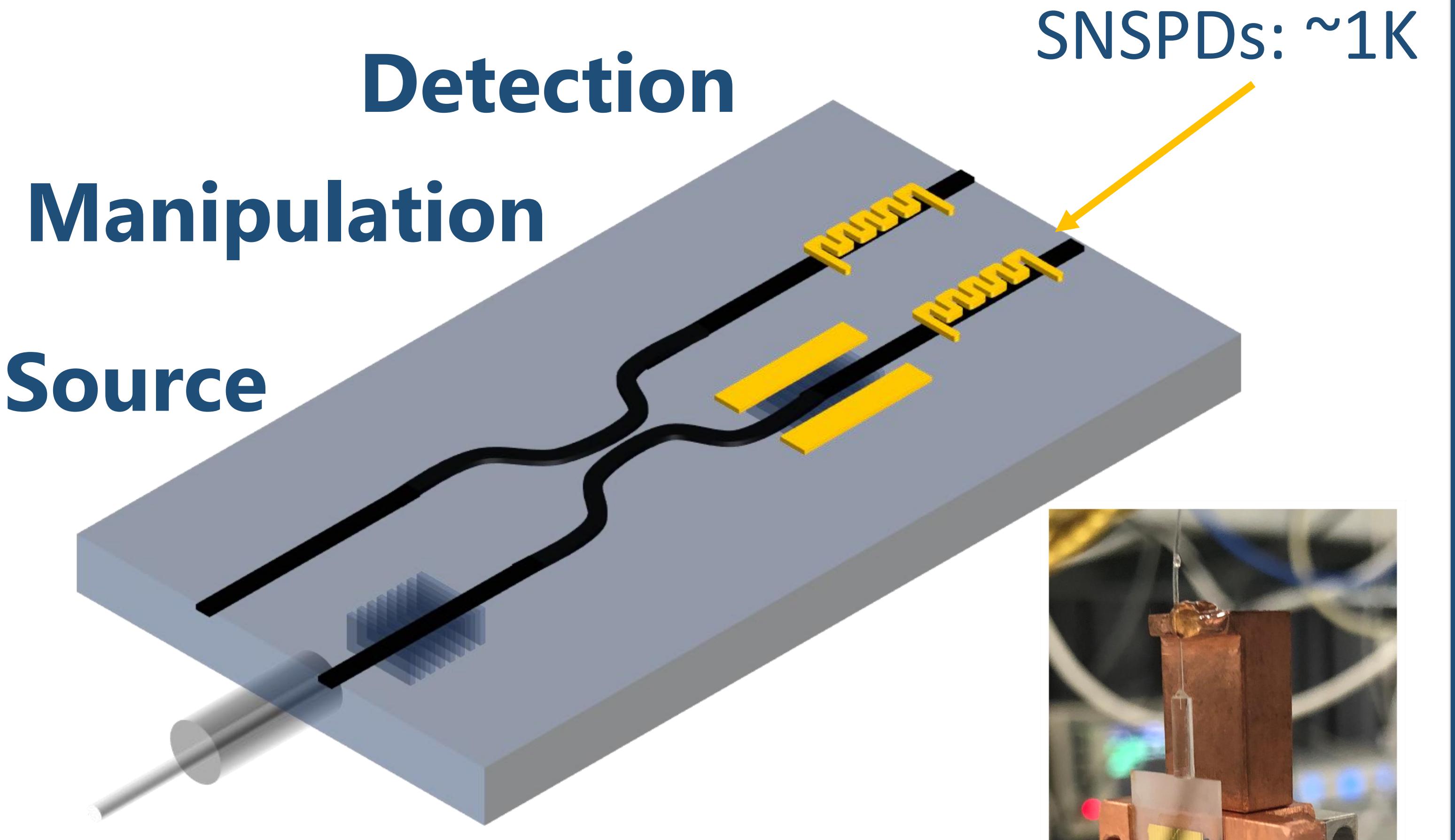


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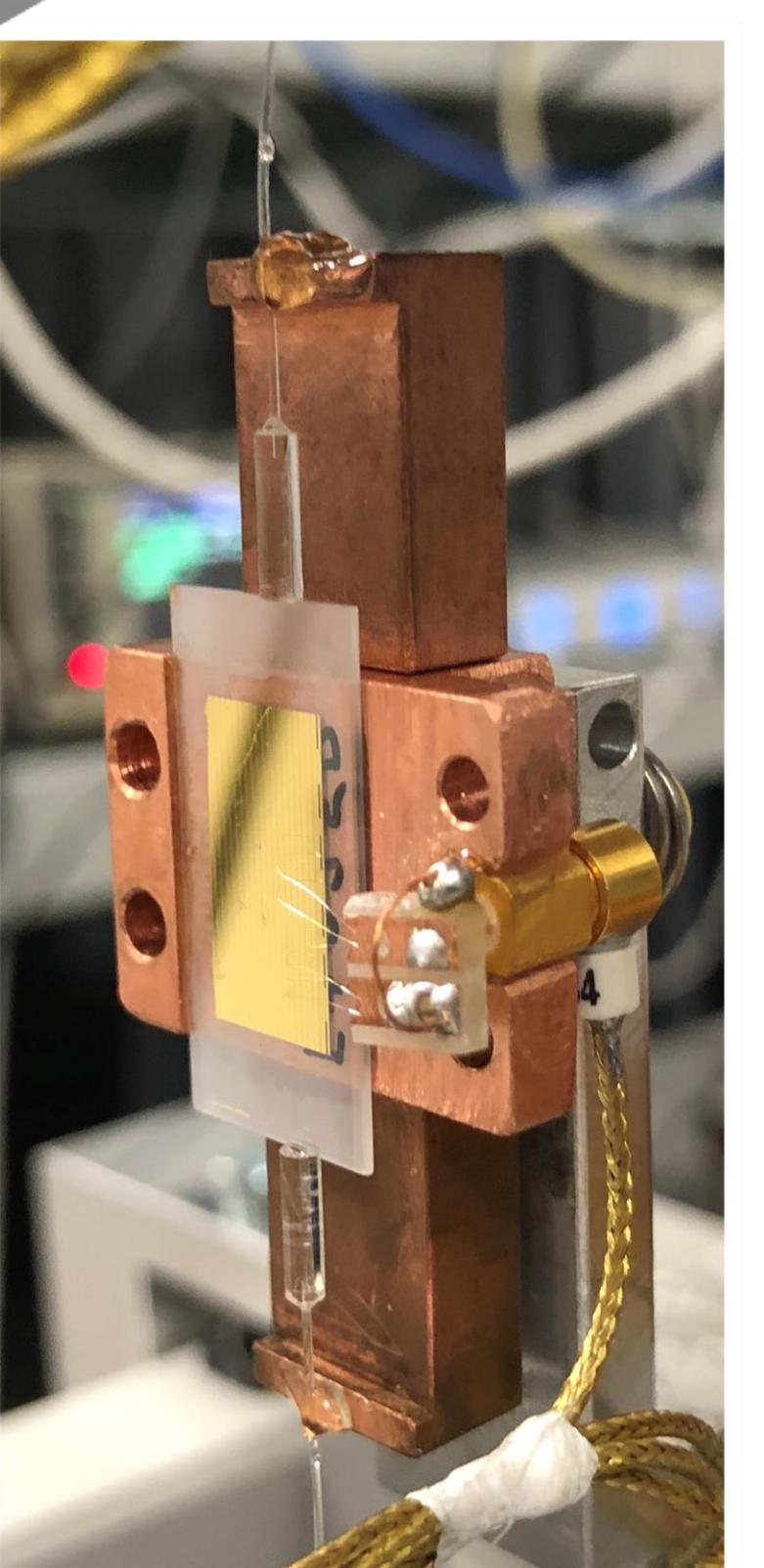
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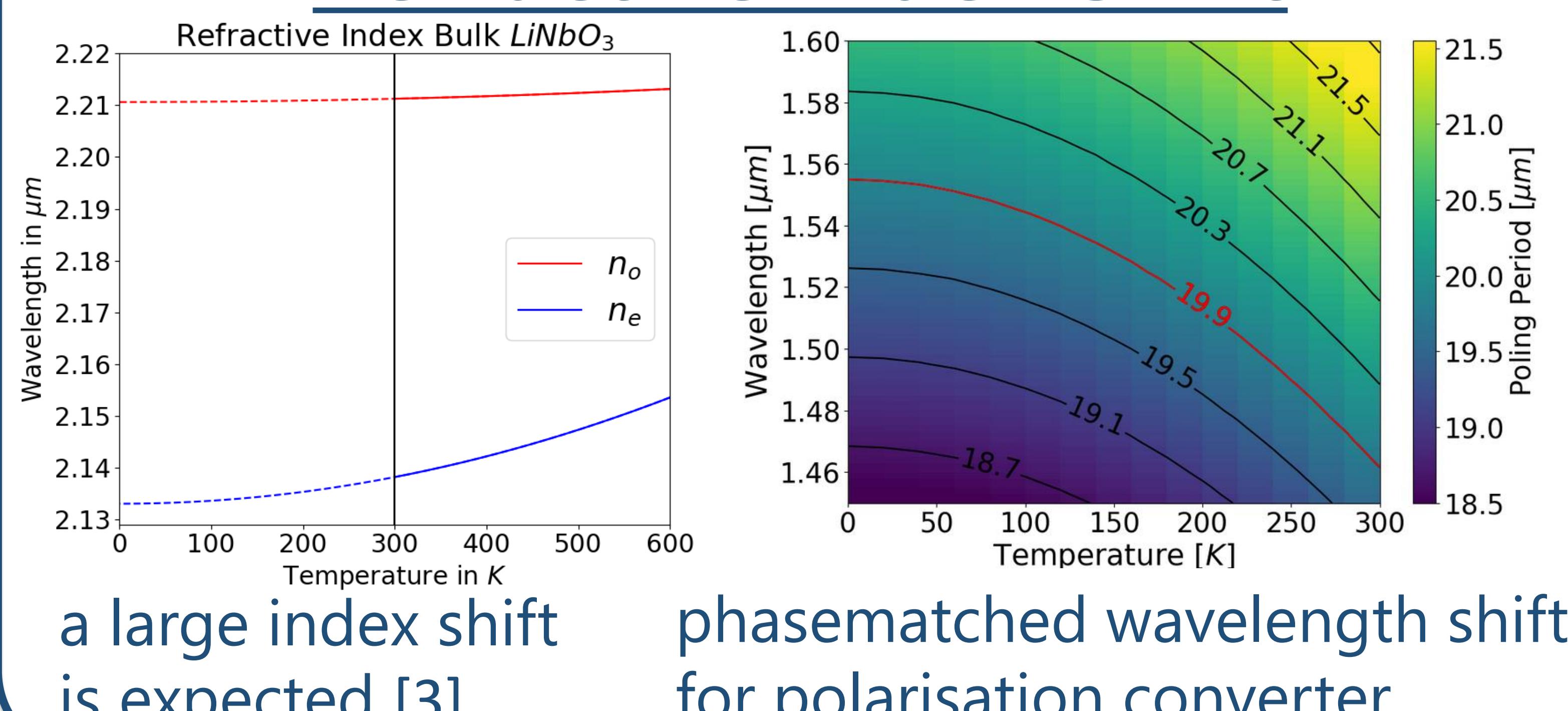
## 1) Quantum Photonic Chip



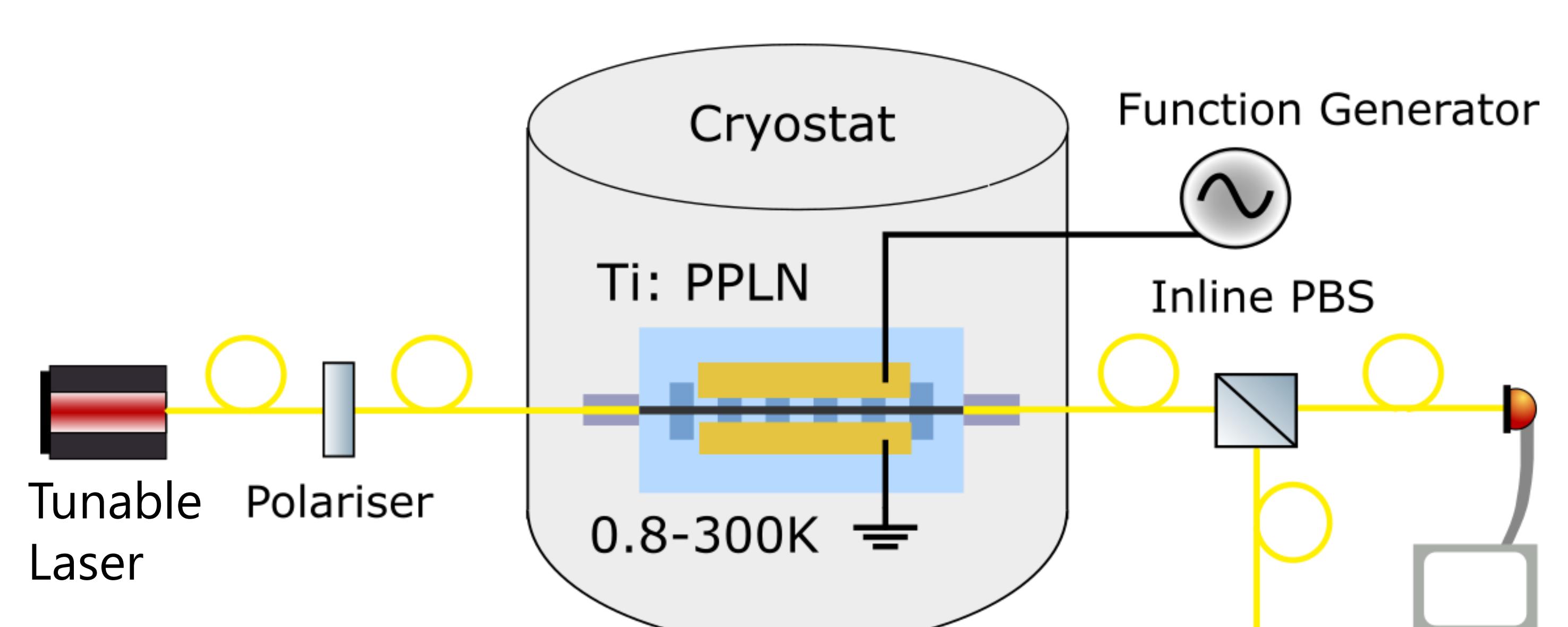
z-cut Lithium Niobate :  
• Ti waveguides loss: 0.1dB/cm  
• 90% fibre overlap  
• large  $\chi^2$ -nonlinearity  
• electro-optical effect [1,2]



## 2) Temperature Dependent Refractive Index Shift



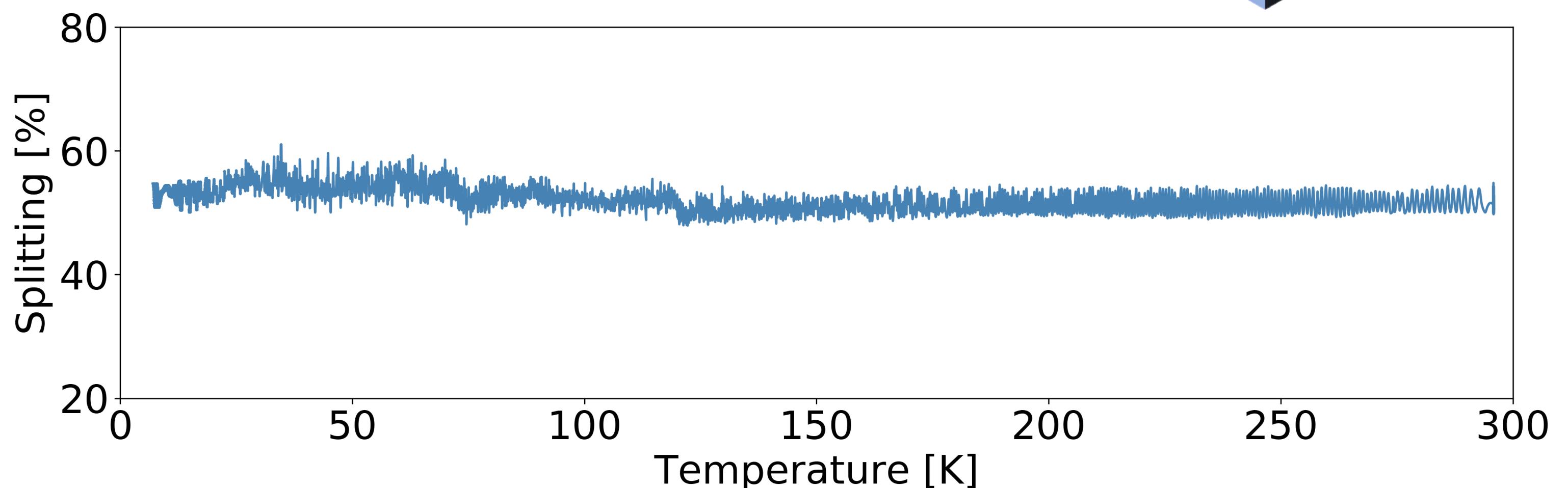
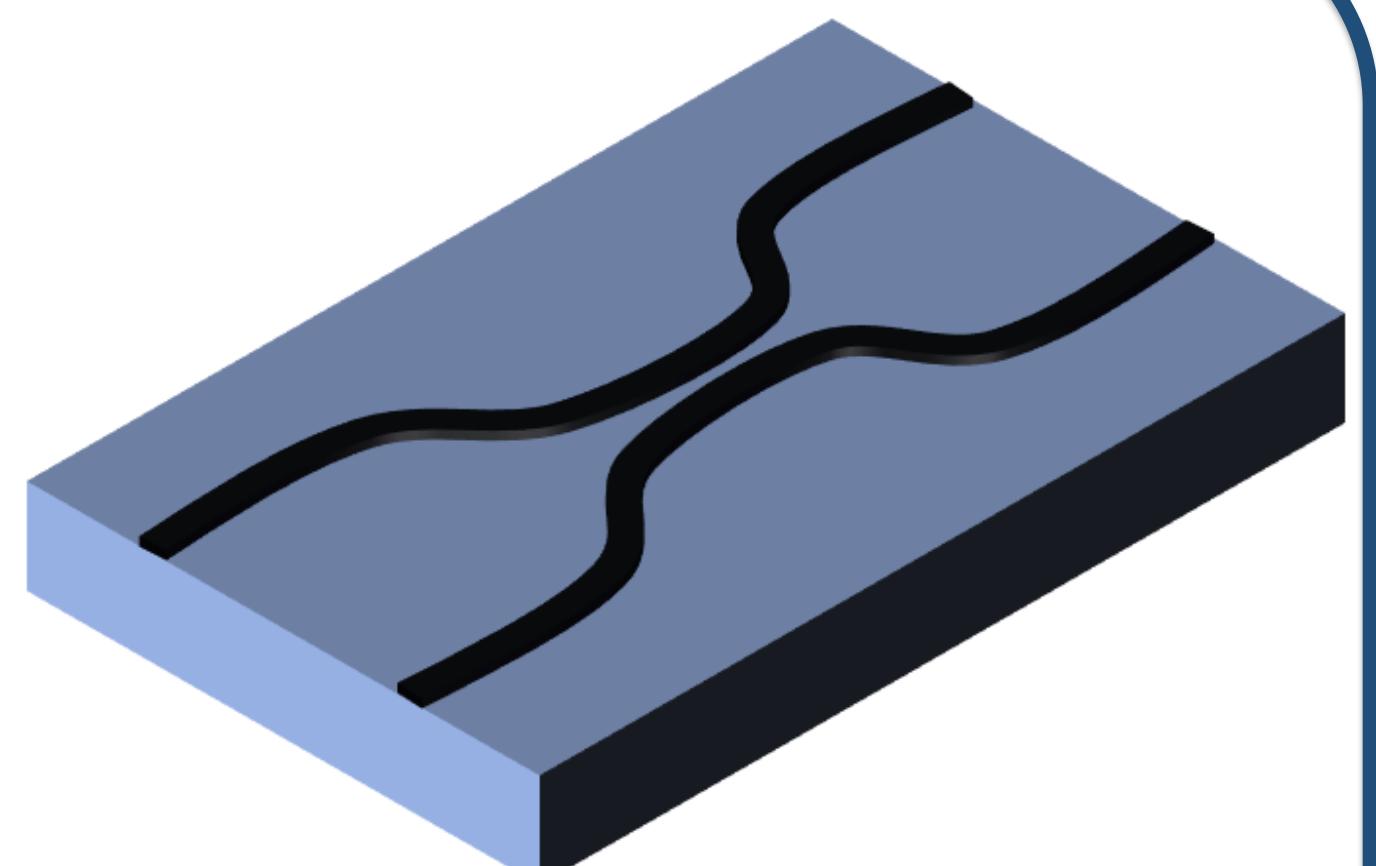
## 3) Experimental Setup



## 4) Directional Coupler

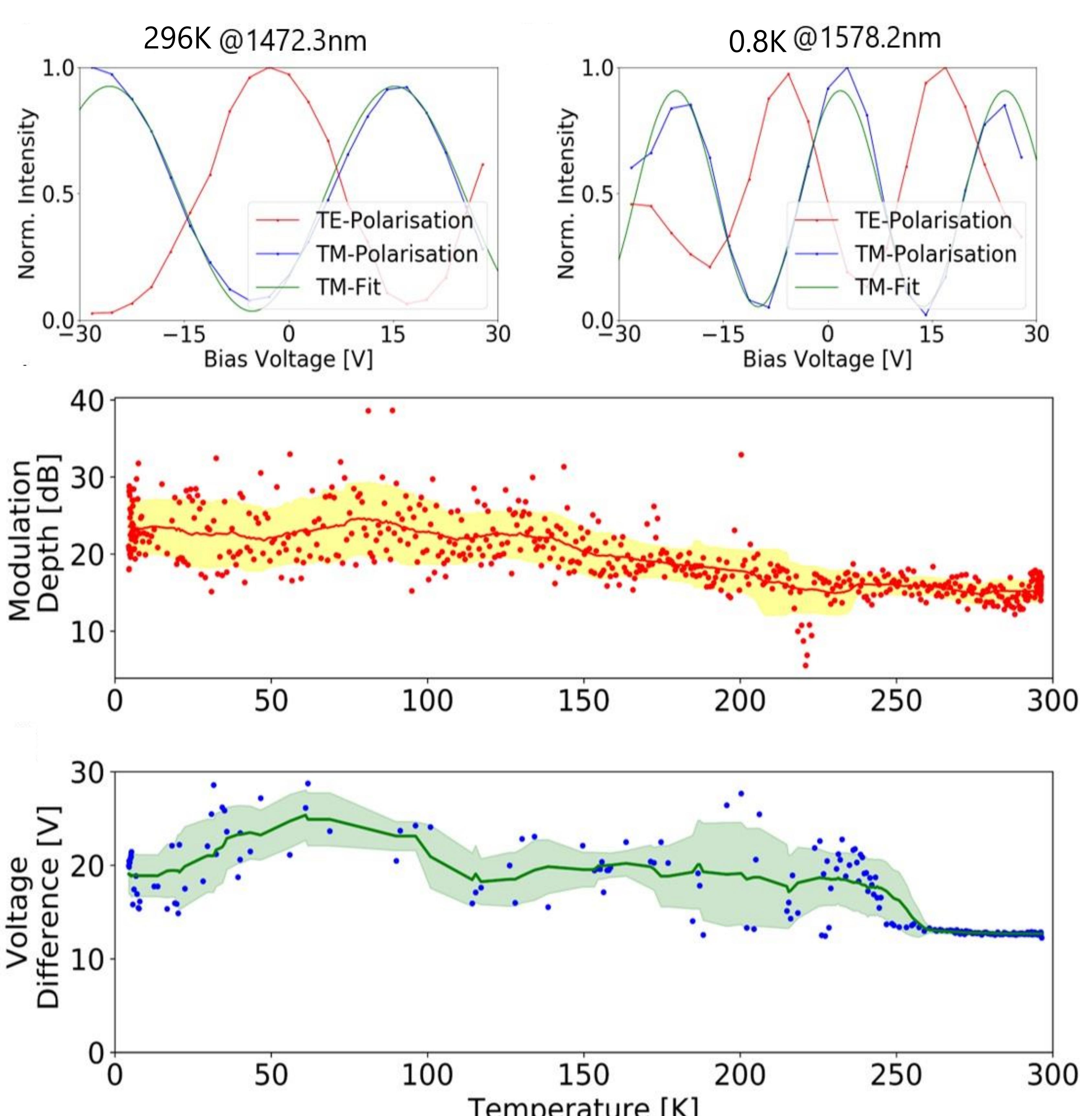
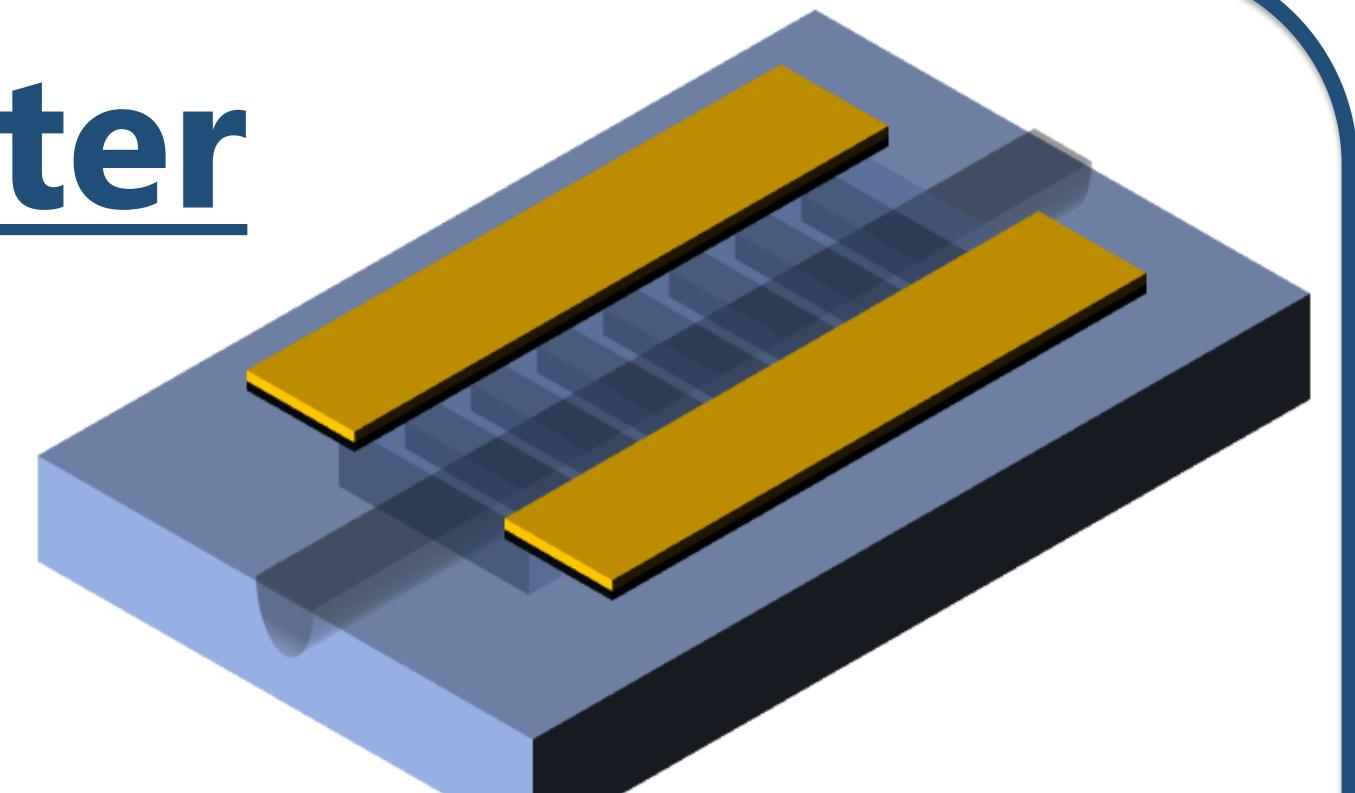
splitting ratio:

- 52±2.5% @300K
- 55±2.5 % @22K



## 5) Polarisation Converter

- 23dB modulation depth
- 43% fibre-to-fibre transmission



## References

1. P. Sharapova et al, New J. Phys. **19**, 123009 (2017)
2. J.P. Höpker et al, APL Photonics **4**, (2019)
3. S. C. Abrahams, The Institution of Electrical Engineers, London, (1989)

