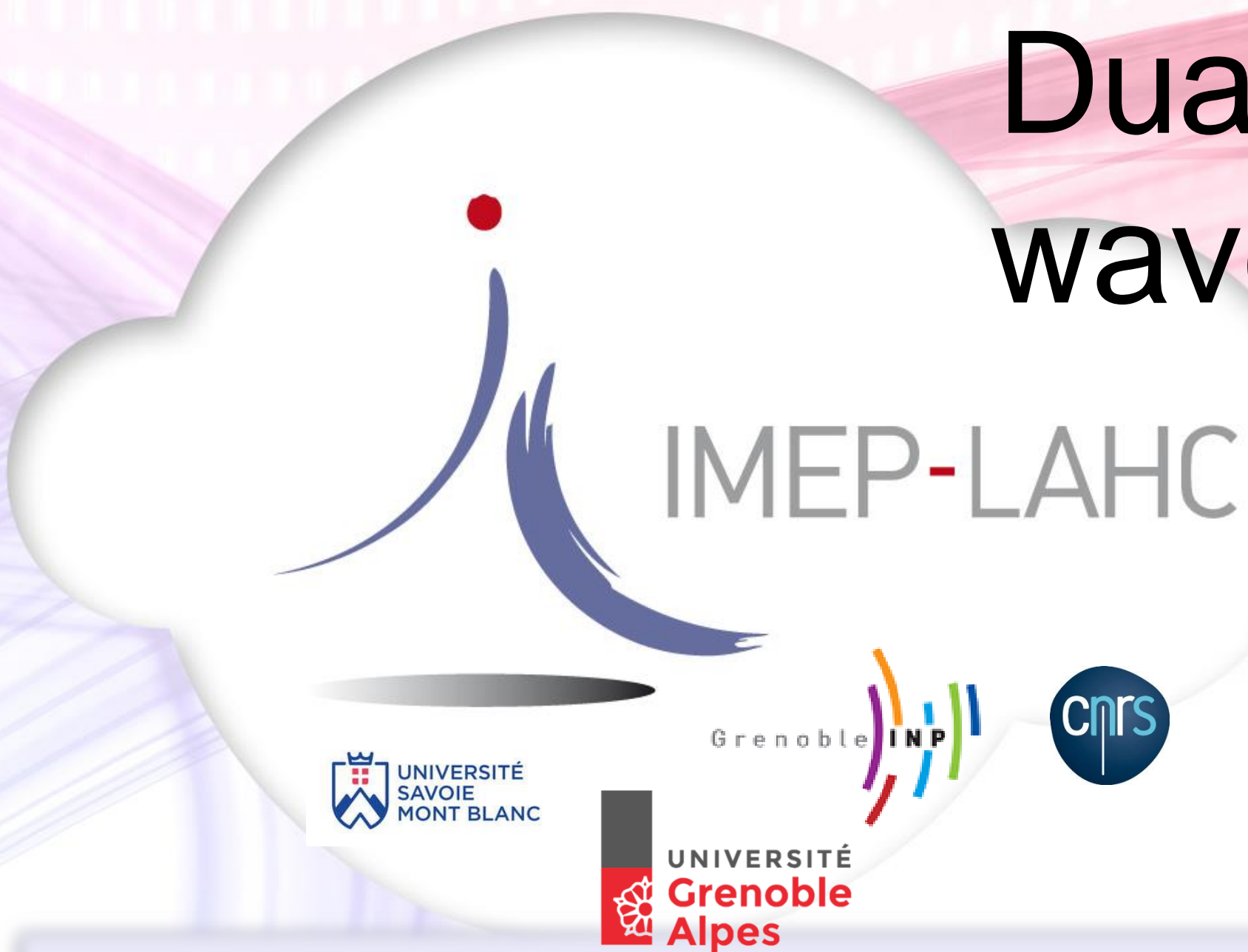


Dual wavelength Y-junction glass integrated waveguides for mm-wave carrier generation



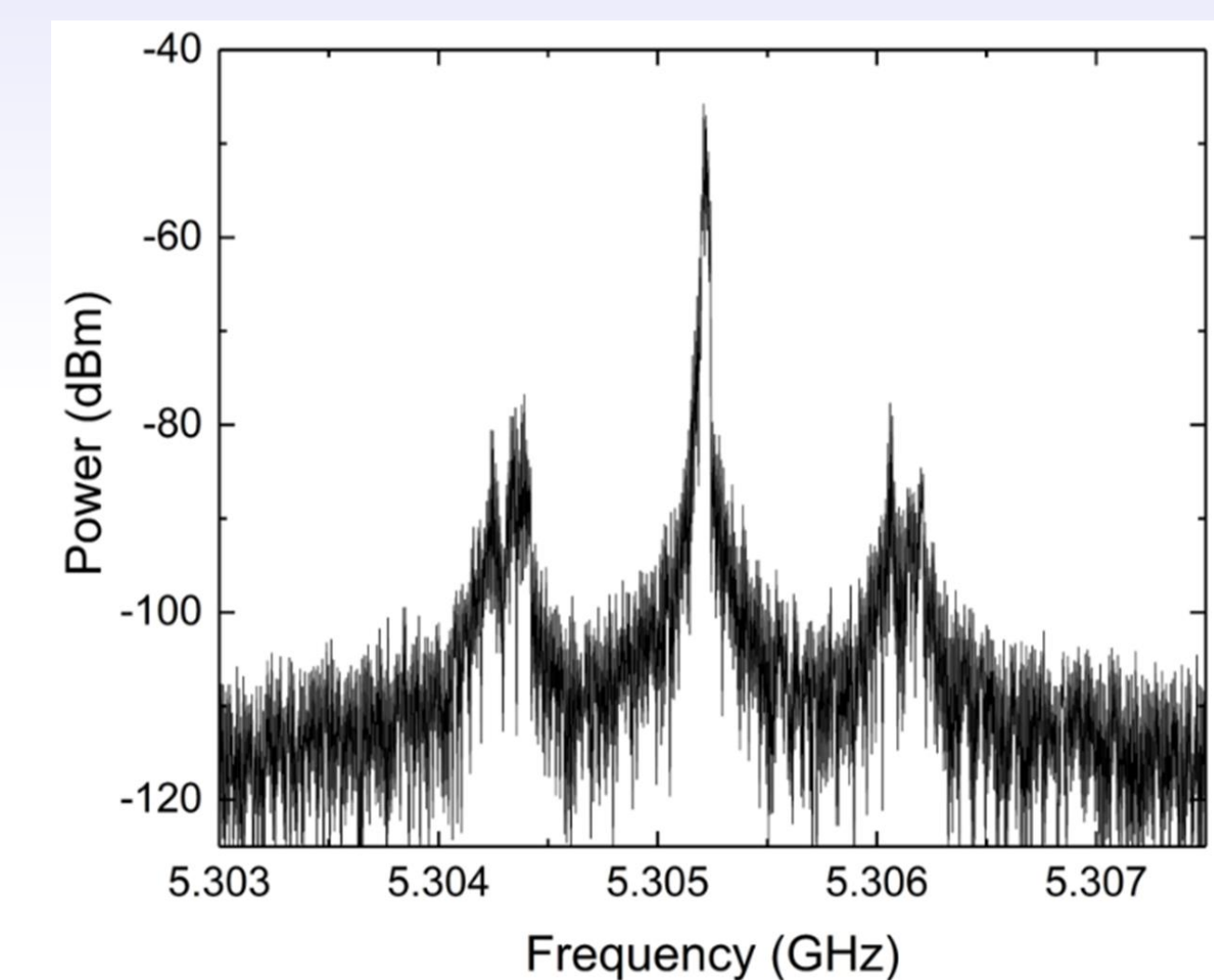
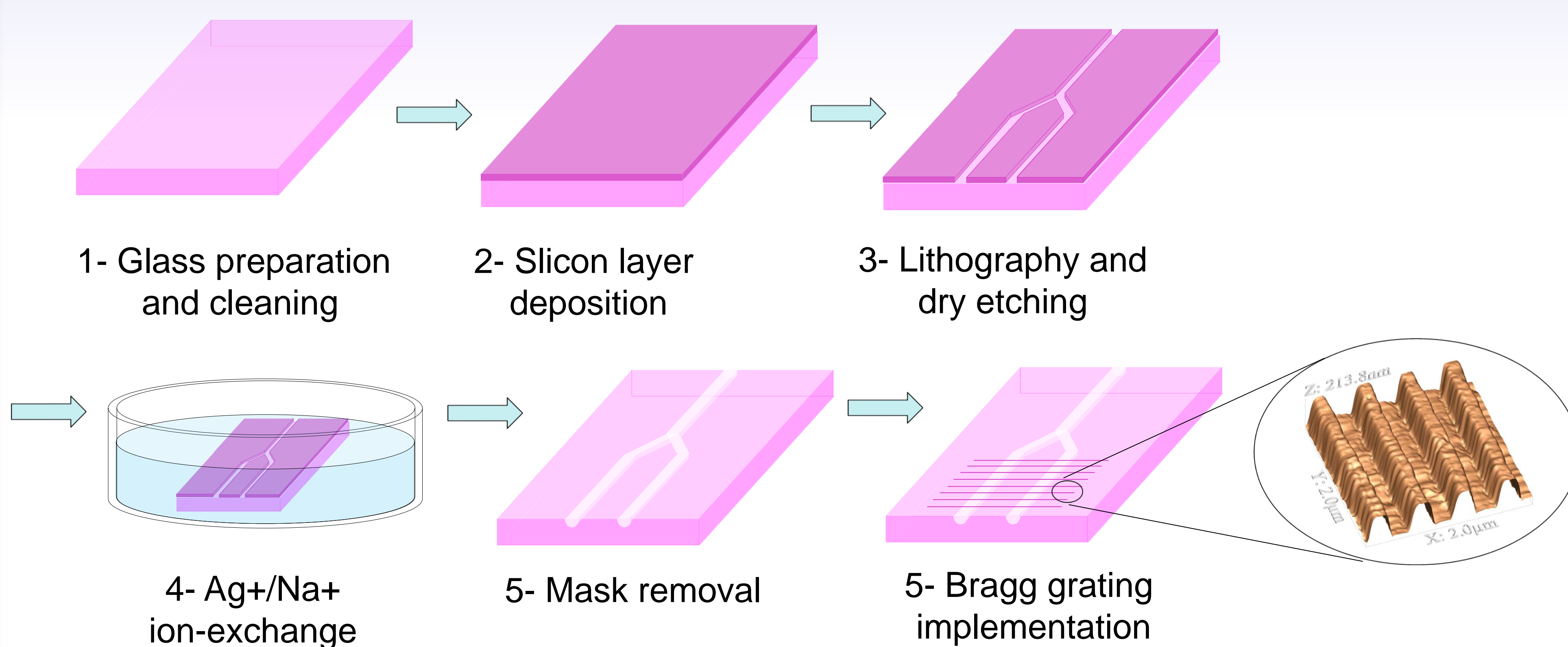
Nisrine Arab, Julien Poëtte, Lionel Bastard and Jean-Emmanuel Broquin
 Institut de Microélectronique, Electromagnétisme et Photonique (IMEP-LAHC),
 MINATEC – 3 parvis Louis Néel, B.P. 257, 38016 Grenoble, France
 E-mail: julien.poette@grenoble-inp.fr

Introduction and problem statement

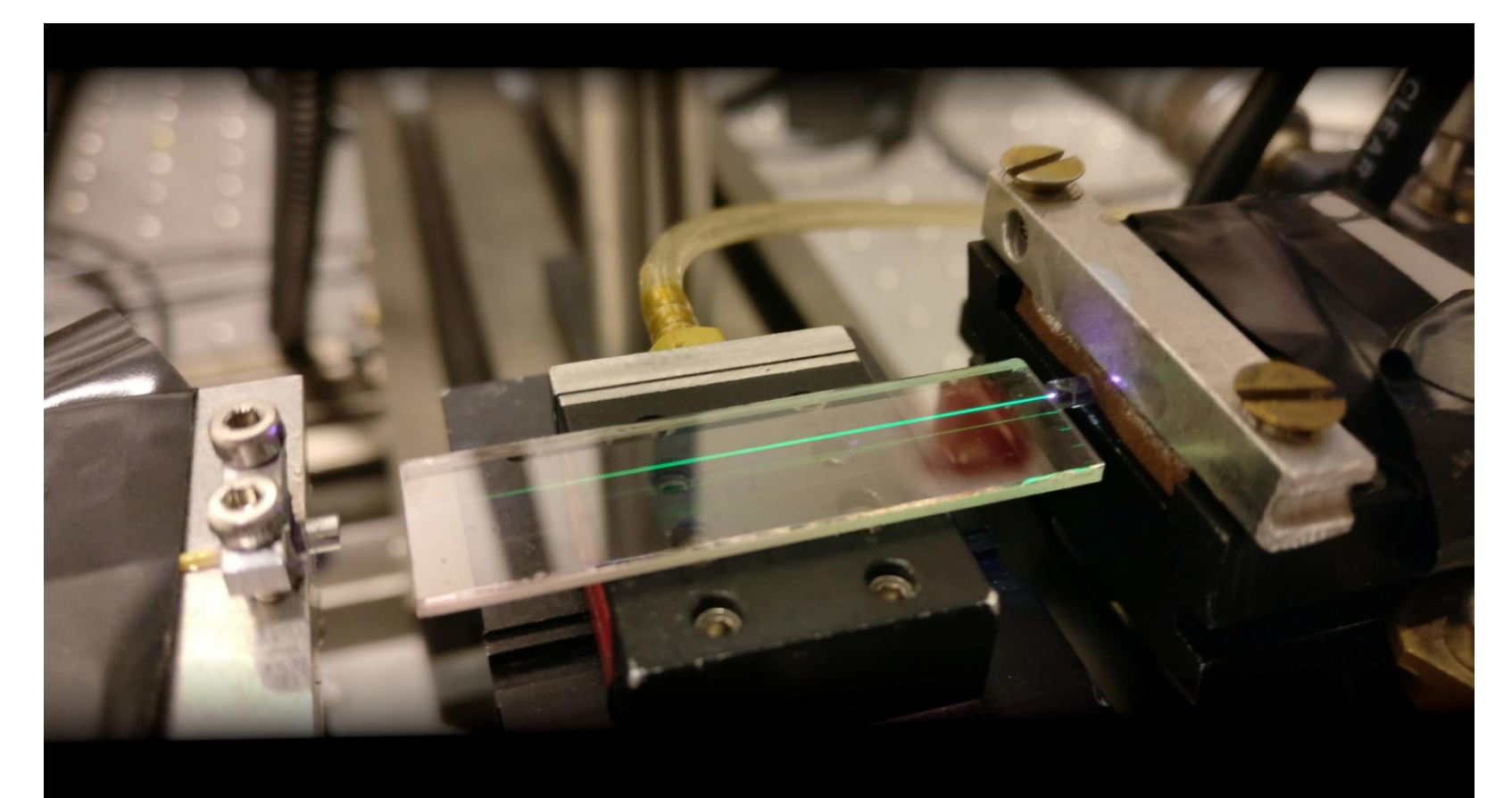
During the last two decades, an impressive growth in the demand for communication systems at high data rates has been observed. To overcome the congestion at low frequencies, researches are focused at the generation of millimeter wave (mm-wave) (30GHz-300GHz) frequency band. One of the techniques of mm-wave generation, is the heterodyning of single mode lasers. The use of DFB lasers on glass allows the generation of stable high frequencies with narrow linewidths. Our work is focused on the design, fabrication and characterization of DFB lasers on glass for millimeter wave generation using heterodyning technique. In this poster, we present our work on Y-junction DFB lasers.

Dual Wavelength Structures

Fabrication process



Spectrum of a 1.3 kHz linewidth electrical carrier generated at 5.3 GHz



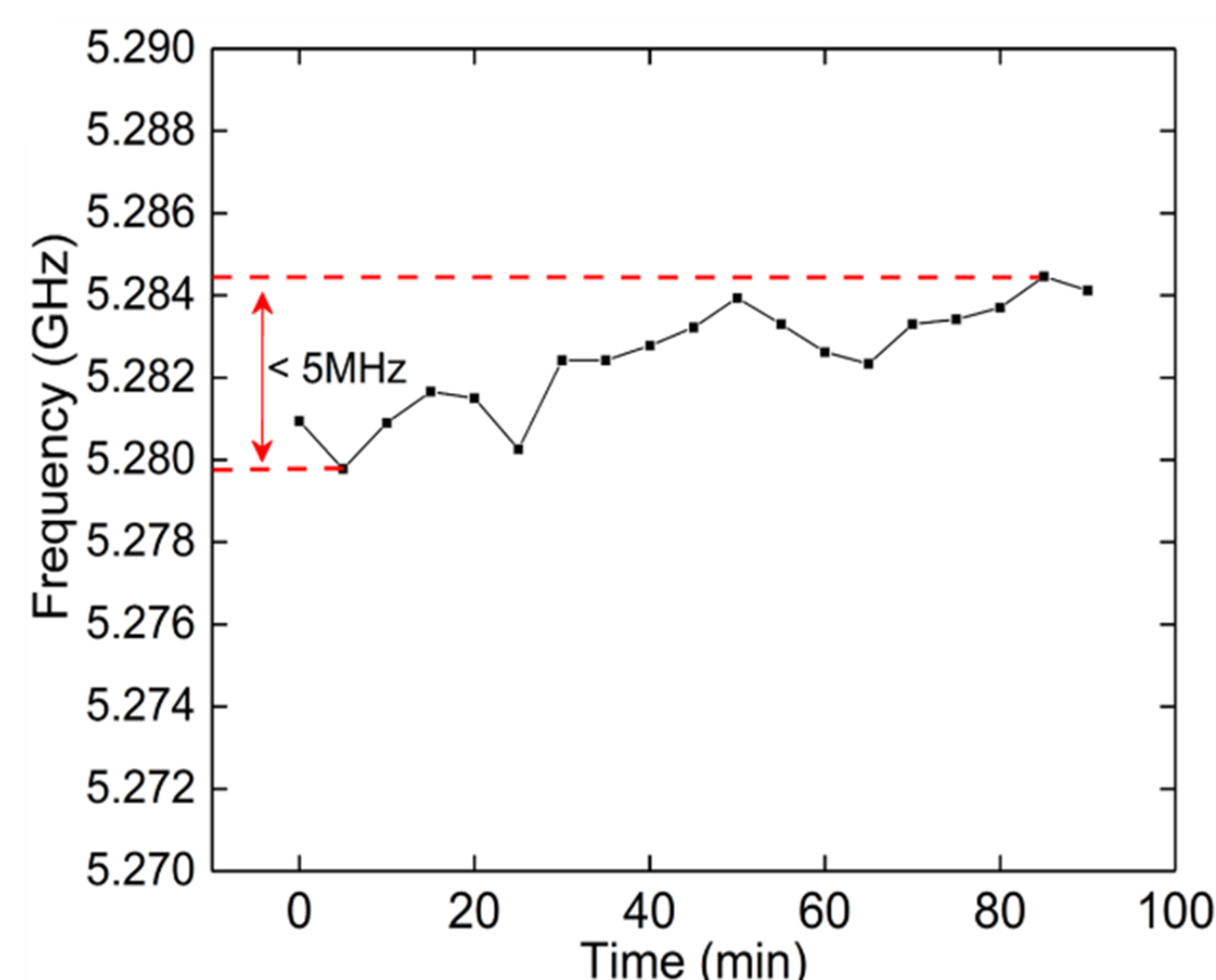
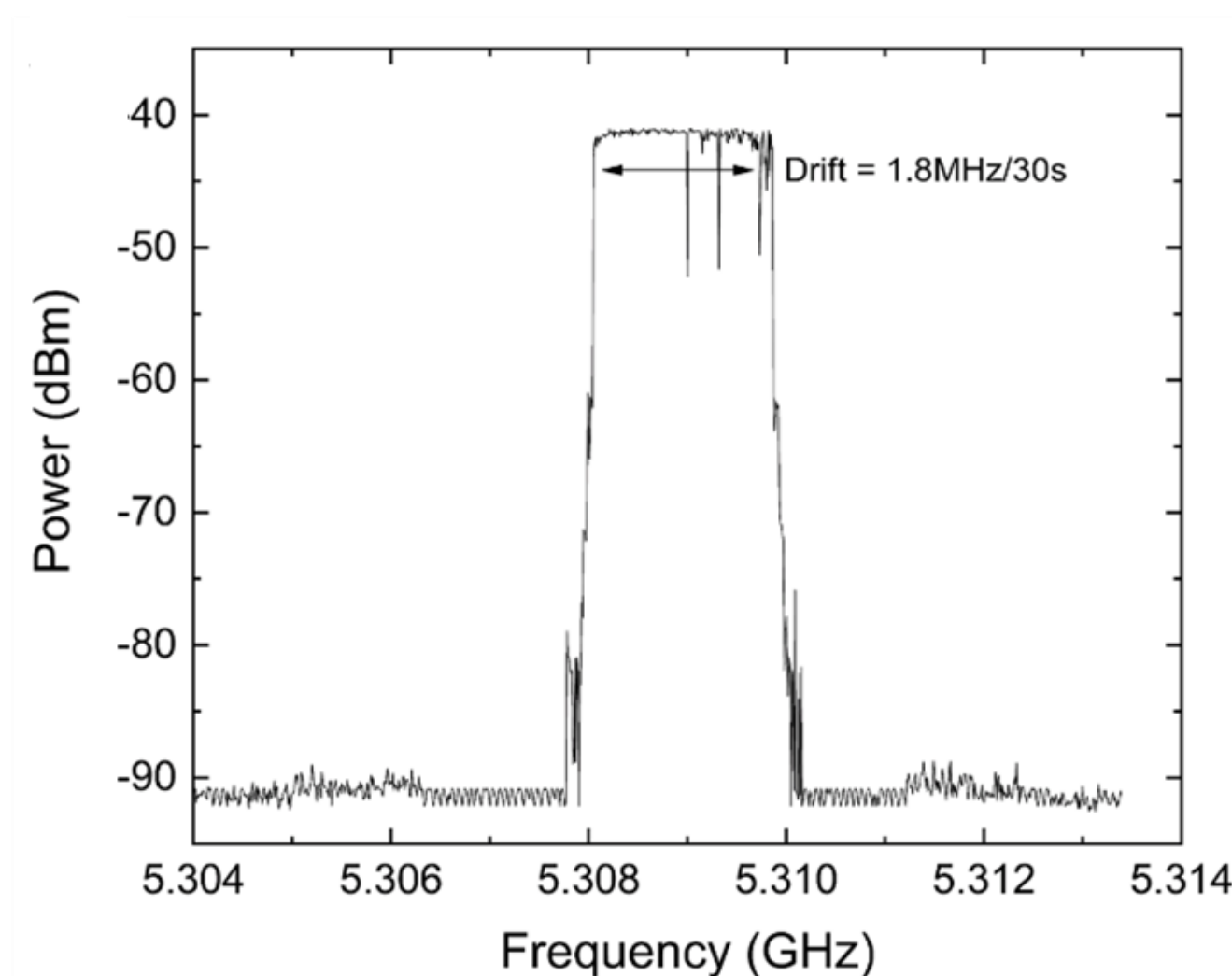
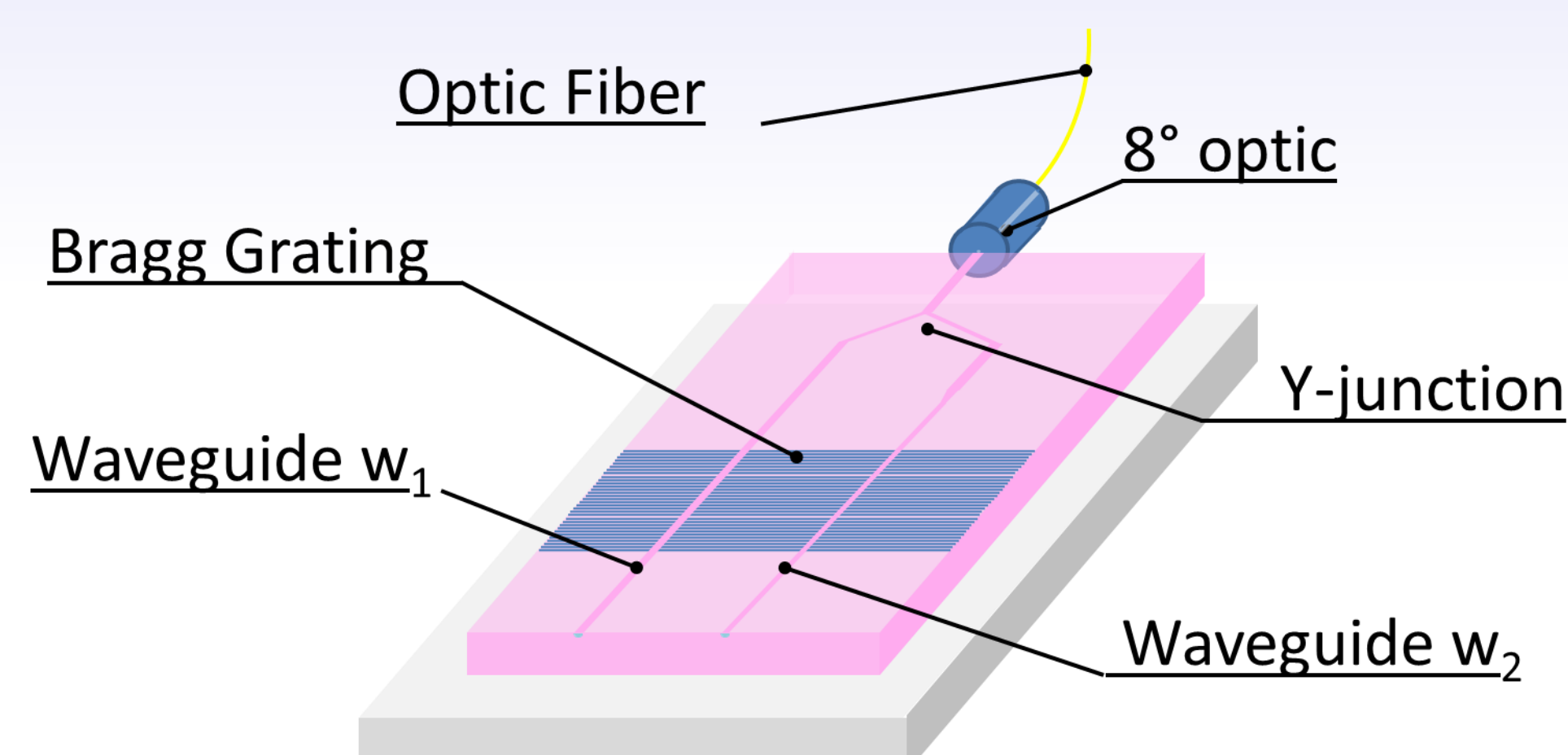
Example of a fabricated structure on the characterization bench

- The beating frequency corresponds to the difference of the optical frequencies.
- Each laser emission wavelength depends on the grating pitch Λ and the guided mode effective index n_{eff} .
 - Technological parameters are identical for the two output waveguides except for waveguide widths, which are accurately controlled by the mask apertures and set to 9.3 μm and 9.4 μm . These slightly different aperture widths entail different effective indices

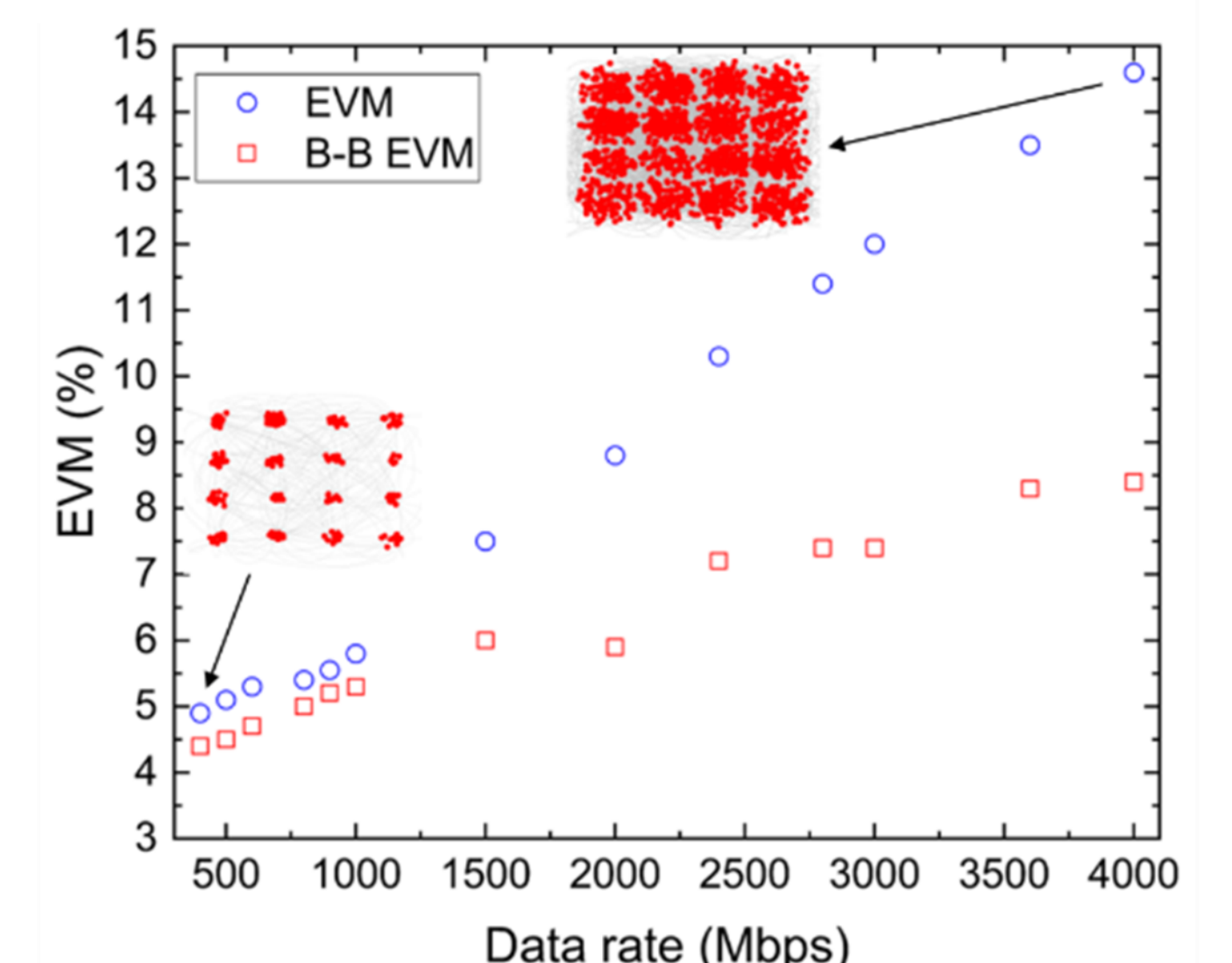
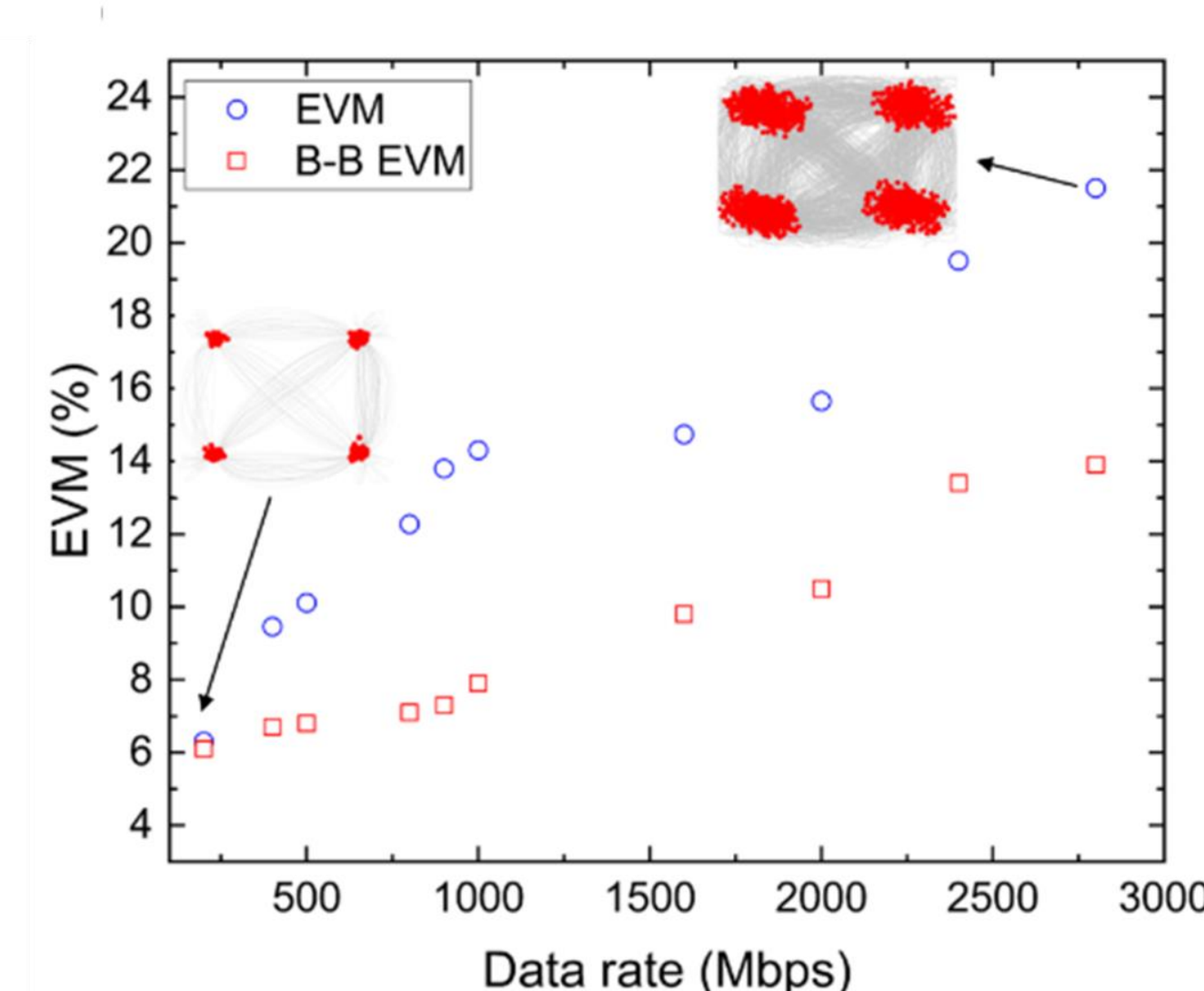
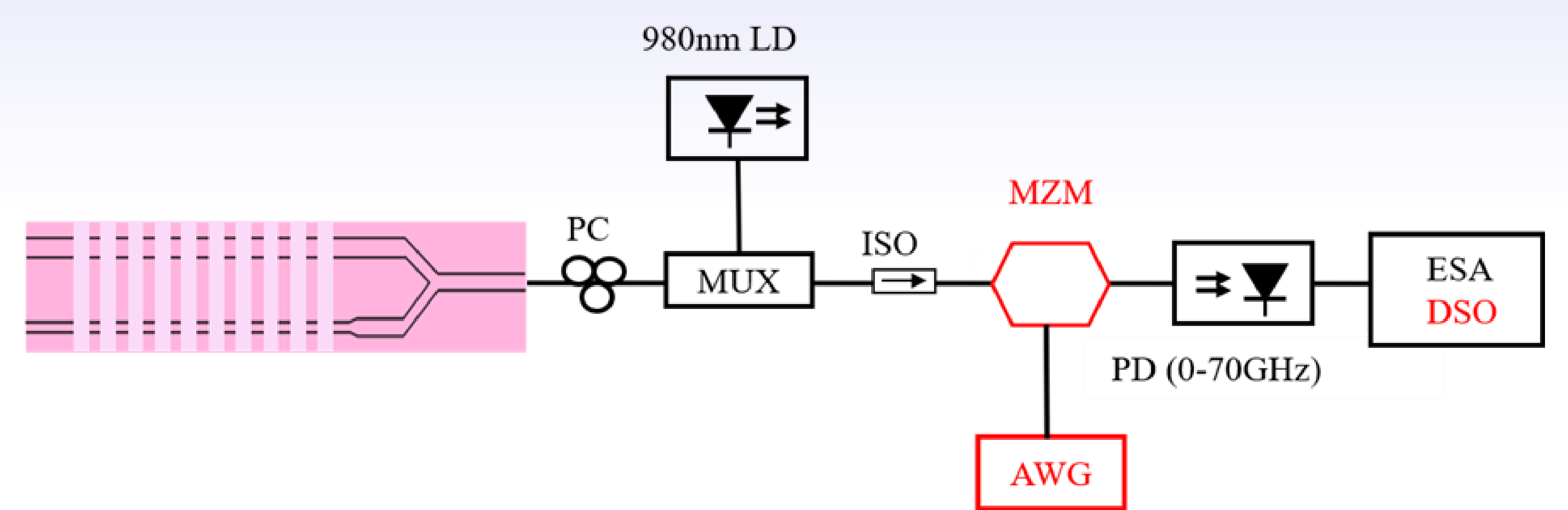
$$f = \frac{c(\lambda_2 - \lambda_1)}{\lambda_1 \lambda_2}$$

$$\lambda_i = 2\Lambda_i n_{eff,i}$$

Mm-wave Generation and Characterization



Even without any thermal control, the integrated structure demonstrates stable frequency generation: the drift is less than 1.8 MHz over 30s (left), and less than 5 MHz over 90 min (right).



The structure has been successfully used in a communication system to demonstrate its performances. QPSK(left) and 16QAM(right) modulation formats have been successfully transmitted with data rates up to 4 Gbps

VI. Conclusion and perspectives

Integrated optical structures on glass based on the ion-exchange technology demonstrates the generation of a narrow linewidth radio-frequency carrier by optical heterodyning. Thanks to the outstanding spectral performances of the optical signals, having an optical linewidth in the kHz range and an optical power of several mW, the radio frequency generation can be obtained using very simple setups while showing an ultra stable operation without the need for thermal control or electrical feedback. The demonstration of this structure employed as a carrier source in a communication system validates their performances based on standards requirement and highlights the interest of this technology.