

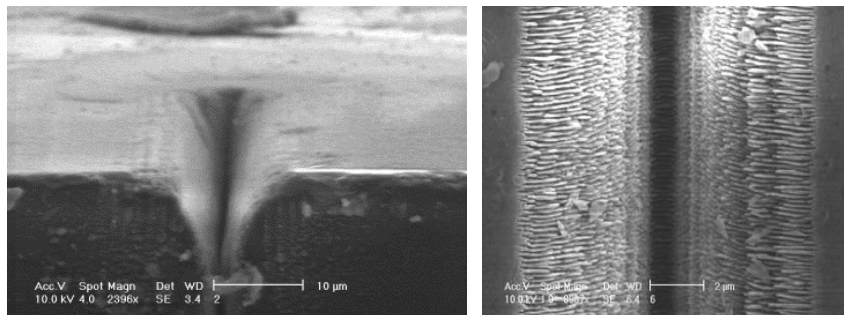
ULTRAFAST NONLINEAR OPTICS GROUP – Research activities

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Starting from Nonlinear Optics, we contributed in merging expertise from the ultrafast, spatial soliton-and-pattern and linear optics communities, which boosted the growth of the "space-time" light localization investigation. The research currently outlines nonlinear conical waves as the best candidate for a comprehensive understanding of ultra-short and intense pulse propagation inside transparent dielectrics, and for a number of relevant applications including parametric generation, creation of long and stable plasma channels, laser micro-fabrication.

1) Laser beam shaping and application to laser microfabrication

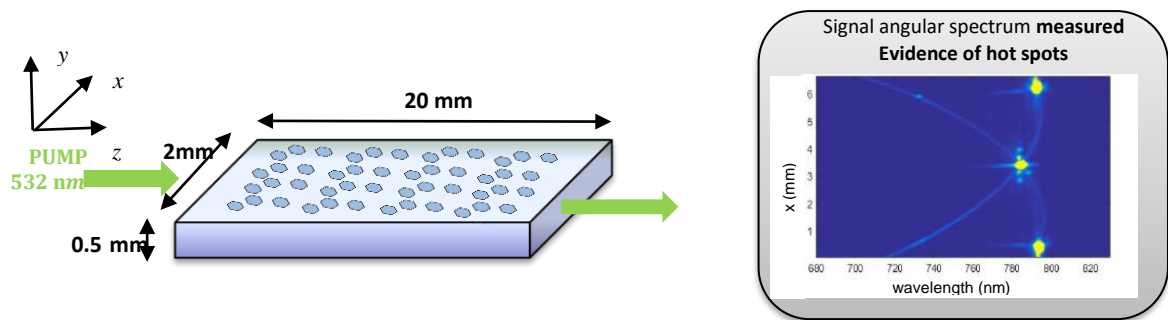
- Laser micromachining of transparent materials by means of Bessel beams: waveguides and high aspect-ratio channel generations in different materials; laser machining for surface functionalization
- Laser surface micromachining of diamond for microfluidics and biosensing applications (collaboration with Prof. Ramponi and Dr. Eaton, IFN-CNR Milano)
- Cutting and drilling of glass and transparent materials for technological applications (Collaboration with Altechna Ltd. Vilnius)
- Study of the dynamics of the fabrication process- collaboration with group of Dr. Couairon (Ecole Polytechnique of Paris)



Microchannels on diamond surface

2) Engineering of quantum states of light in parametric processes

- Parametric down conversion and generation of entangled states of light in the mesoscopic regime (high intensity) in periodically poled crystals
- Pump beam shaping and application to nonlinear parametric processes in bulk crystals
- Characterization of the spatio-temporal coherence and correlation properties of the superfluorescent radiation, and multimode entanglement



Collaboration with the Quantum Optics group of Dr. Alessandra Gatti and Dr. E. Brambilla (IFN-CNR, Insubria University).