UNIVERSIDAD DE MÁLAGA

Fs-Time Resolved Microscopy as a tool for monitoring laser-matter interaction

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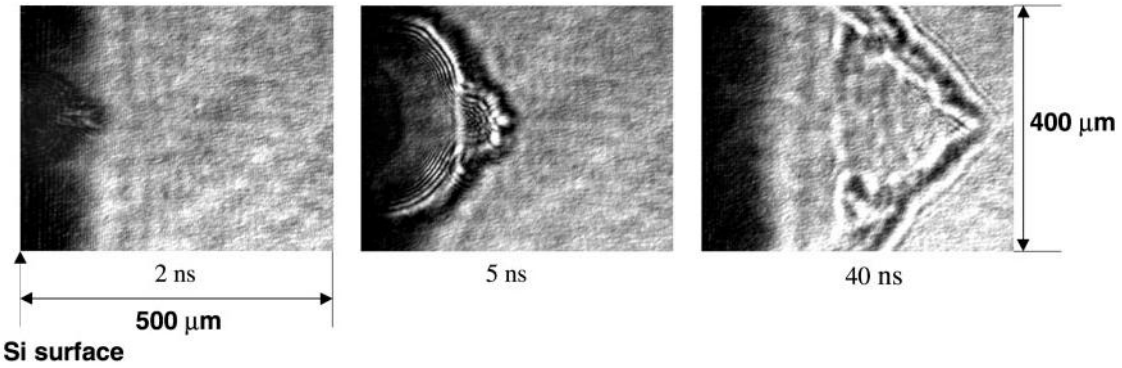
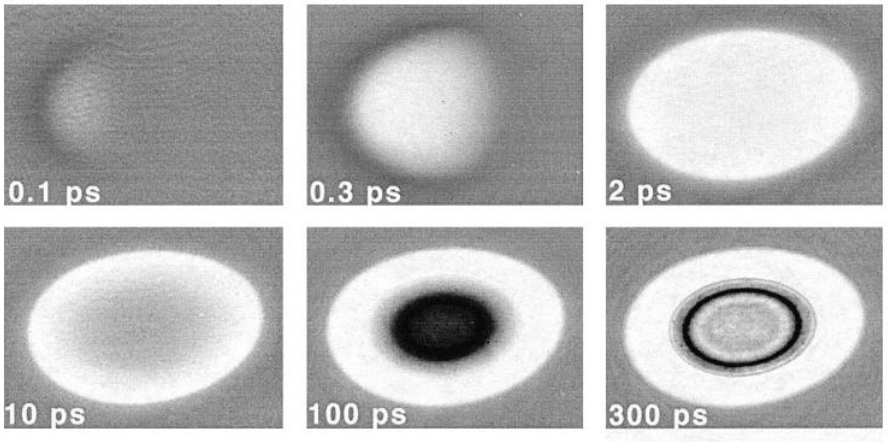


Russo et al. Appl. Phys. A 69 (Suppl.) S887-S894 (1999)

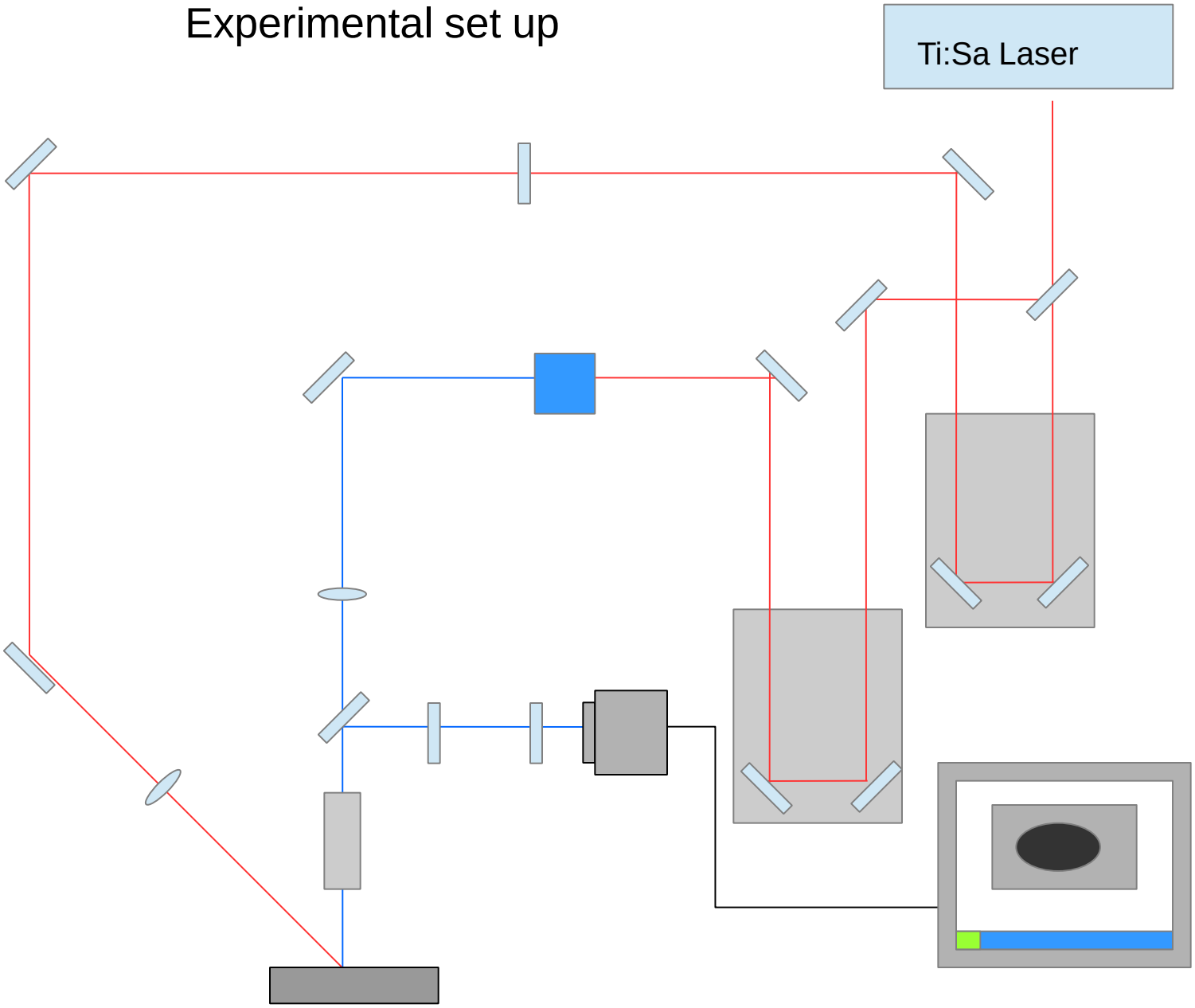
Antecedents:

- Shadowgraphy
- Time resolved microscopy applied below and slightly above the ablation threshold

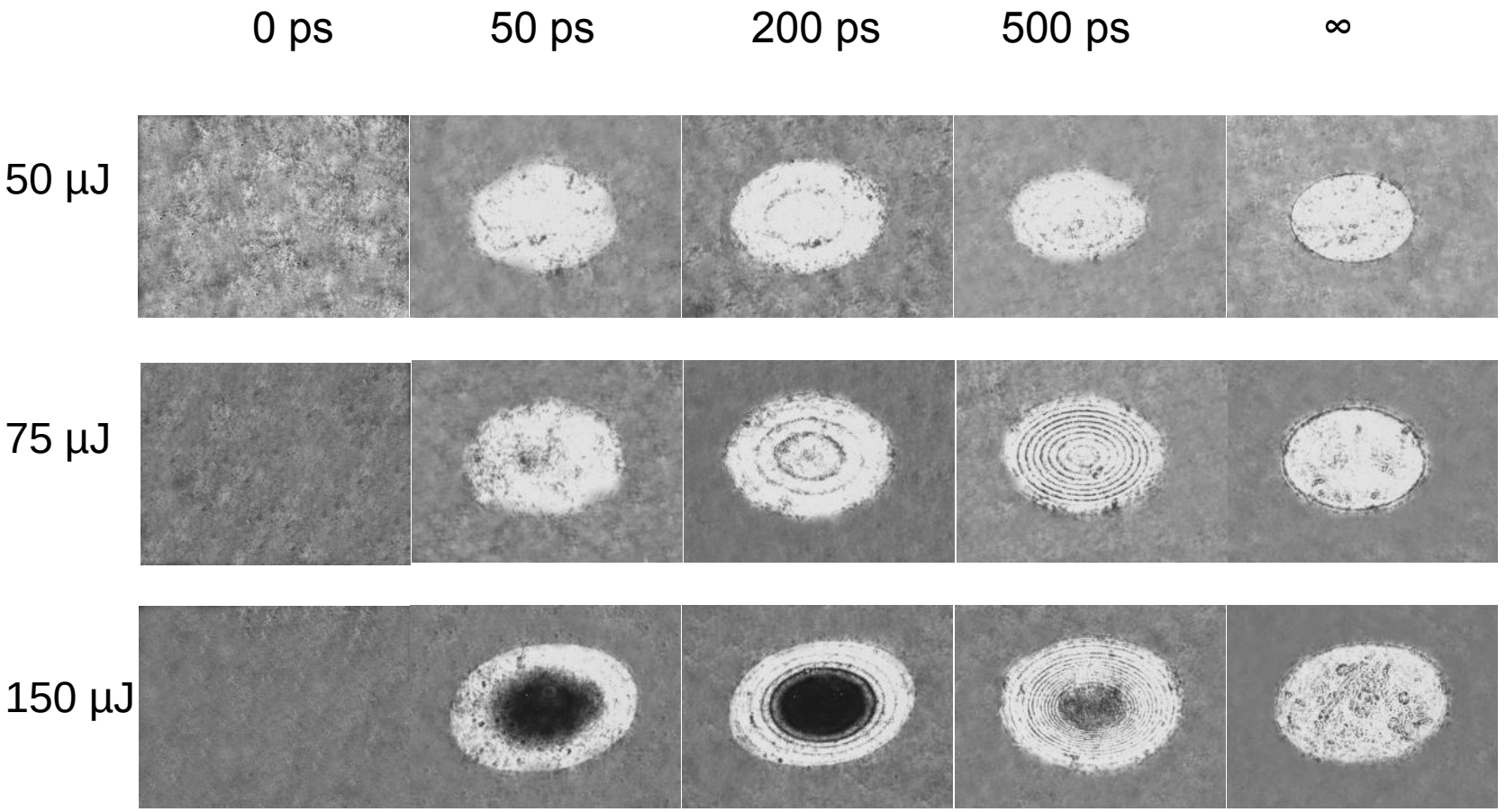


Von der Linde et al. Appl. Sur. Sci. 154-155 1-10 (2000)

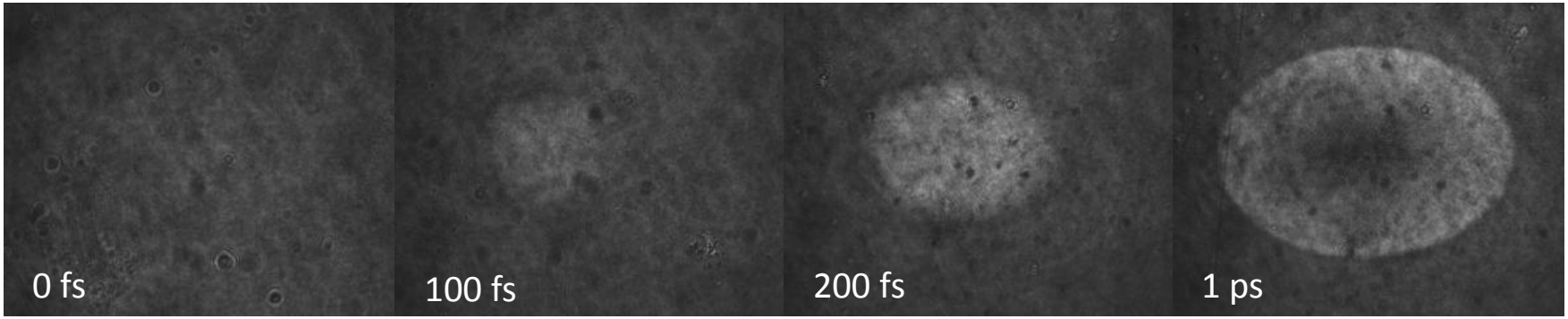
Experimental set up

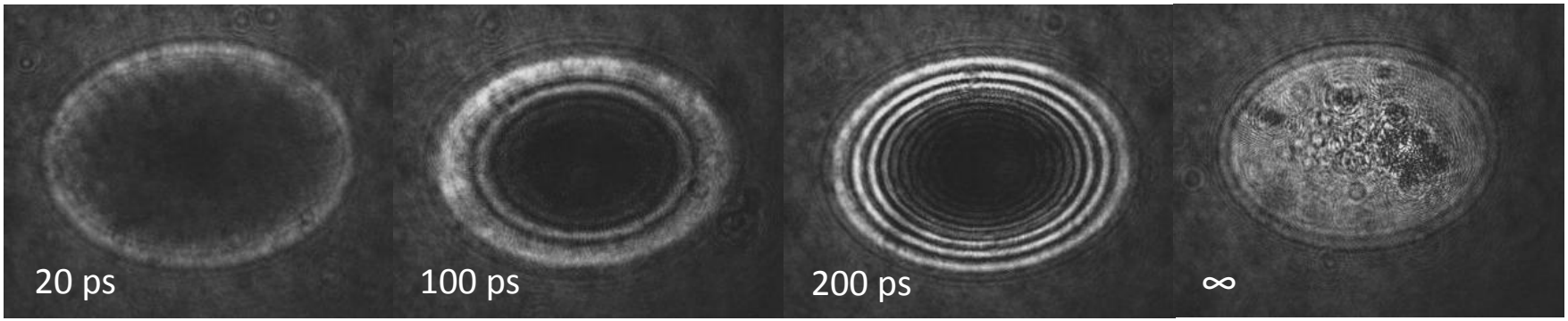


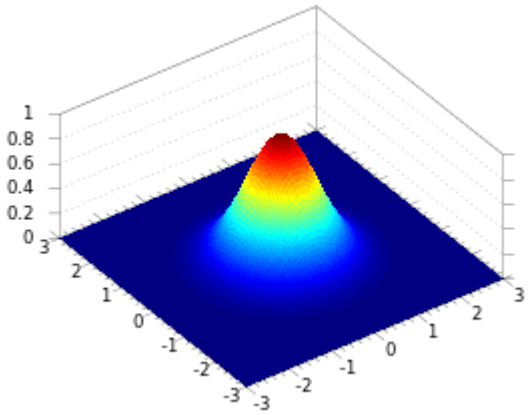
Temporal evolution vs. Energy



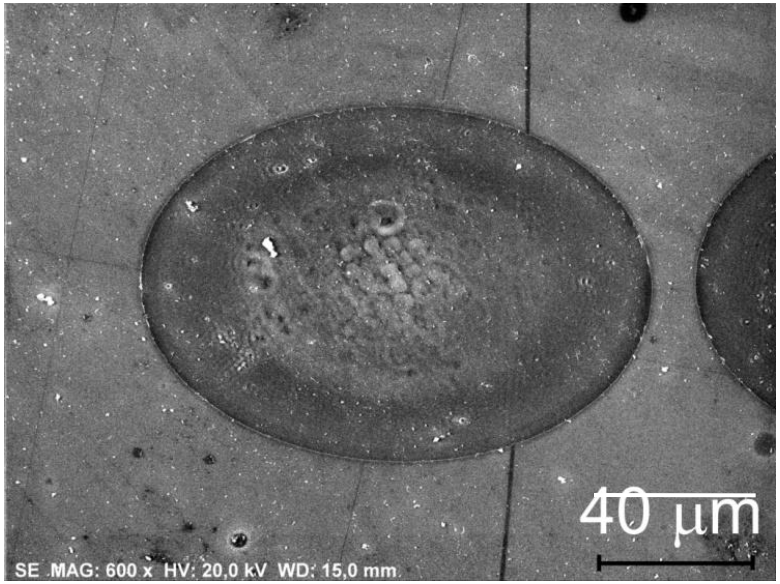
The earliest stages of fs laser-matter interaction





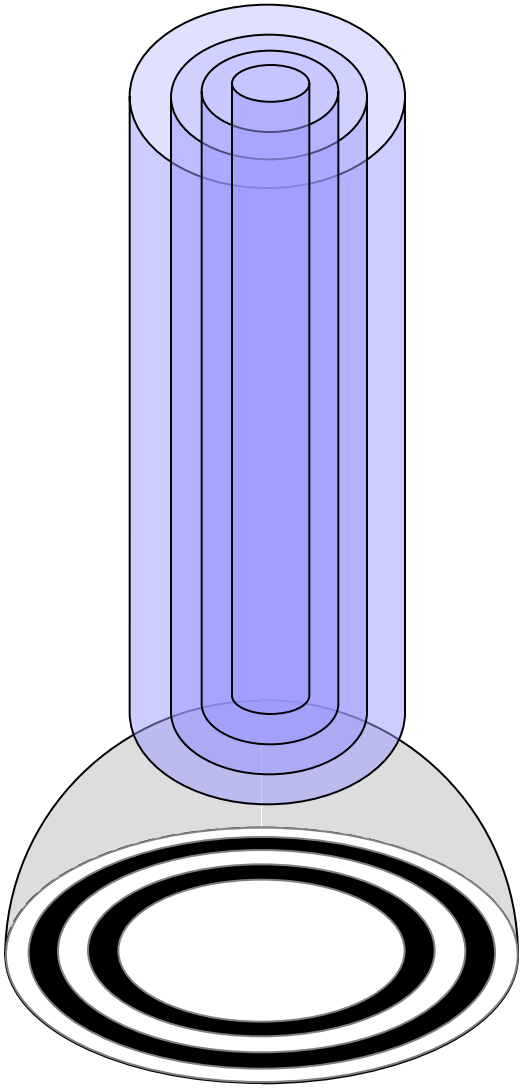


Gaussian profile:
Not all the irradiated target area receives the same fluence

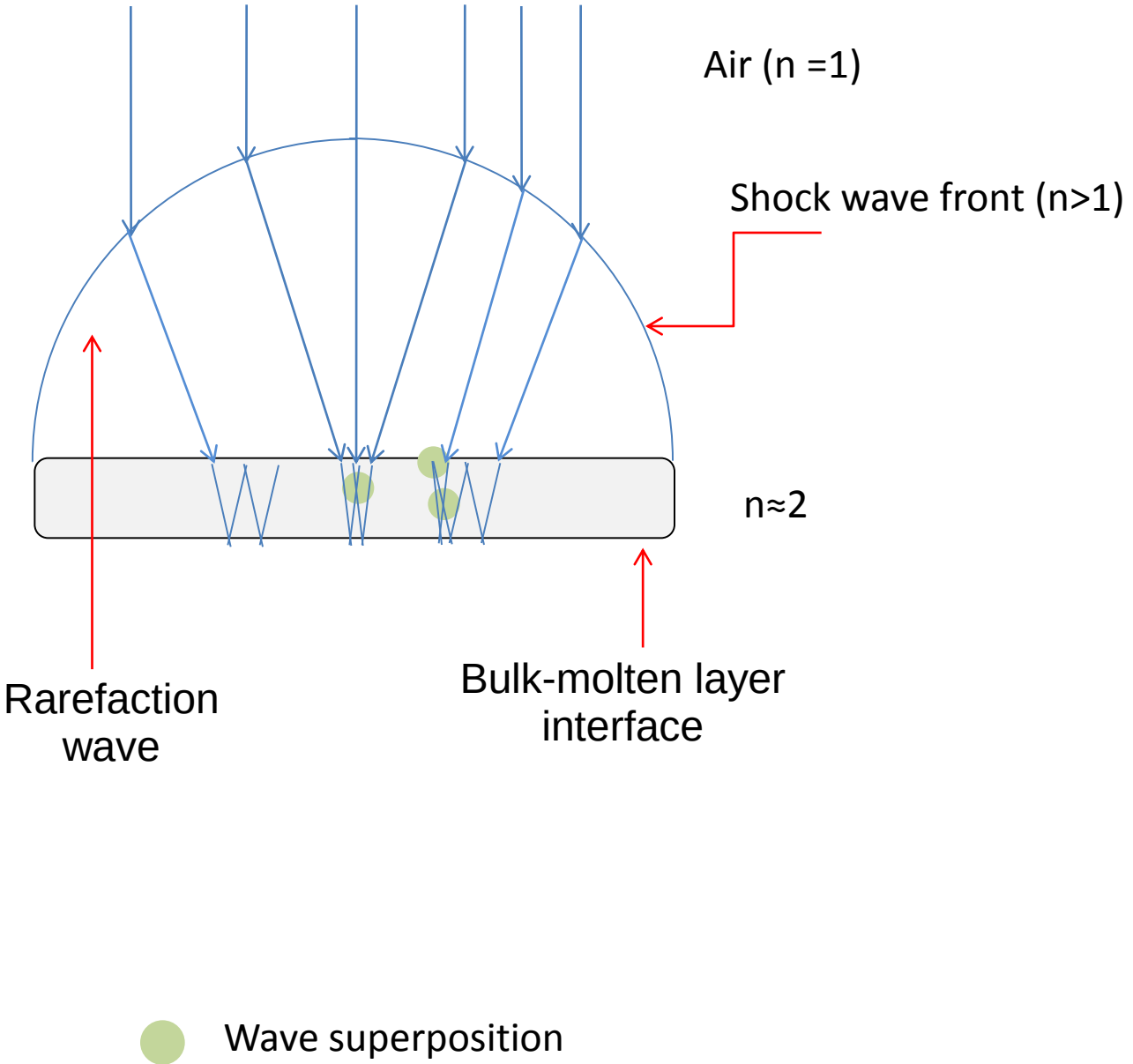


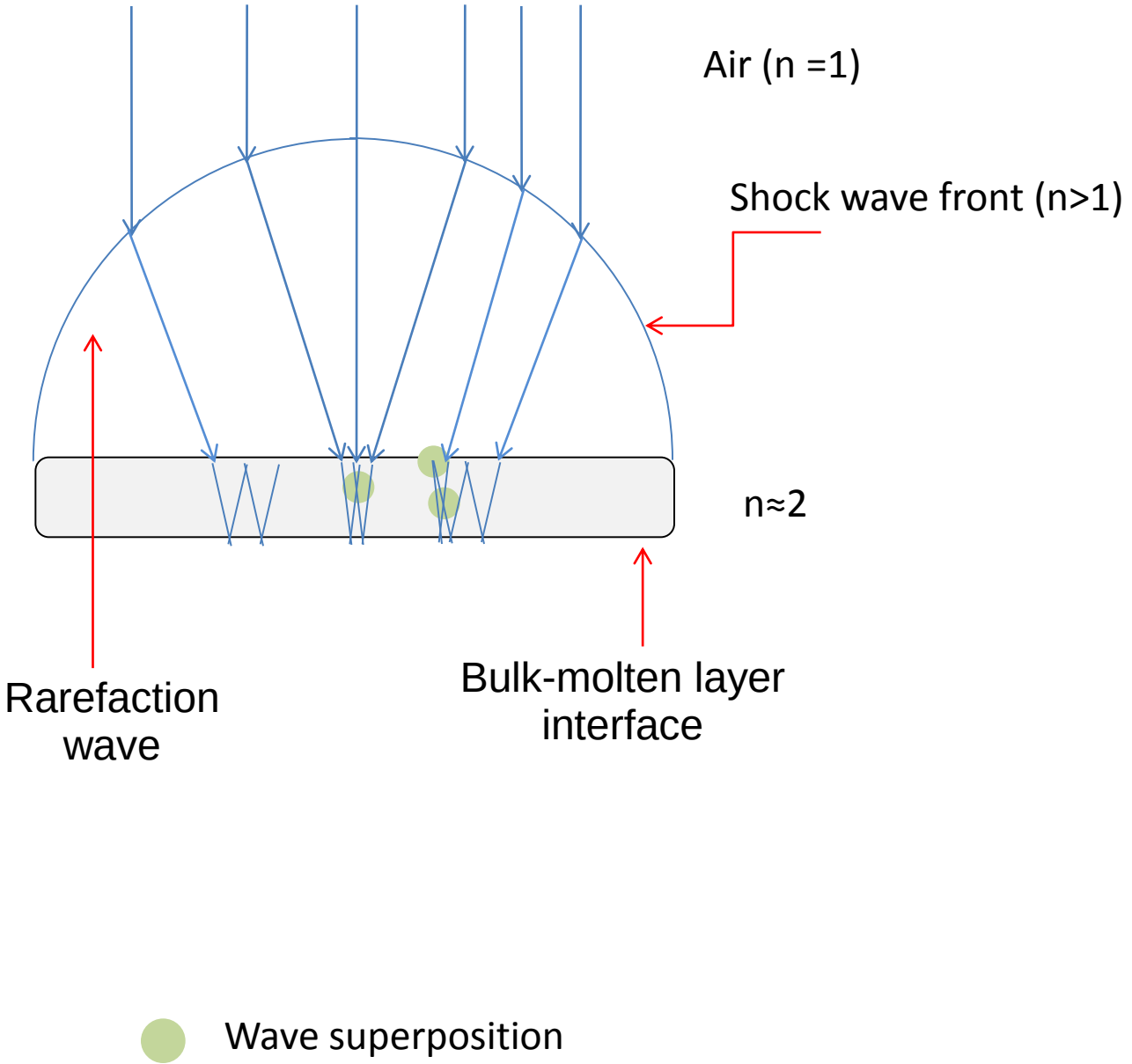
Different effects on targets according to the profile simmetry

Dynamic Newton rings

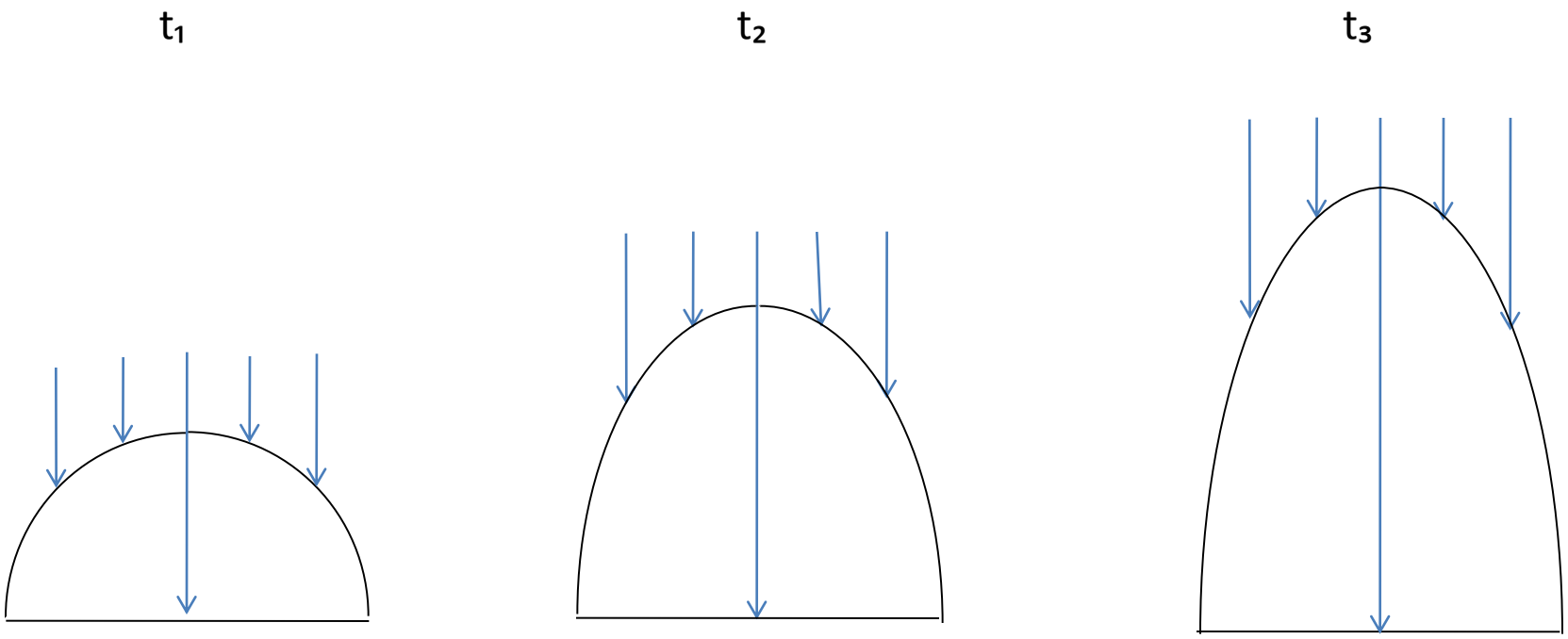


Interferences are produced by wave superposition, reflected between the molten layer and the rarefaction wave (ablation front). As the system presents radial simmetry due to the pump beam profile, the fringe pattern produced by the laser-matter interaction with the system with the probe beam will be Newton rings

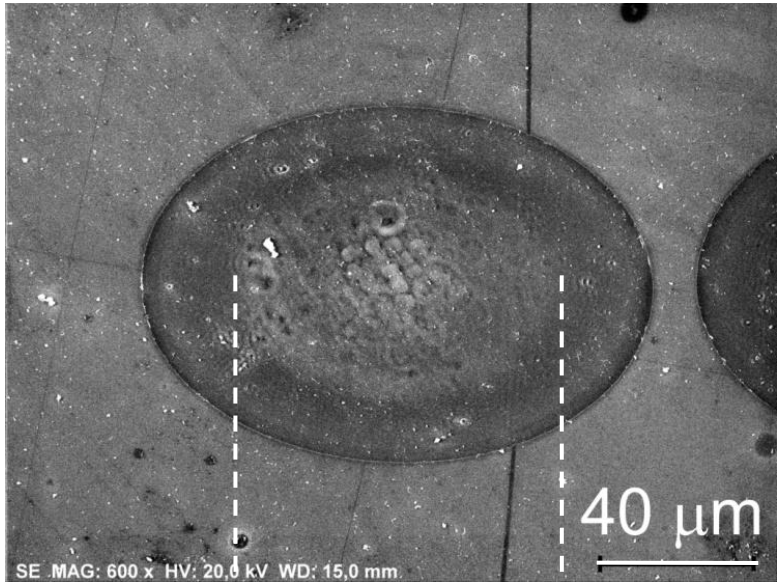

Air (n =1)
Shock wave front (n>1)
n≈2
Rarefaction wave
Bulk-molten layer interface
Wave superposition

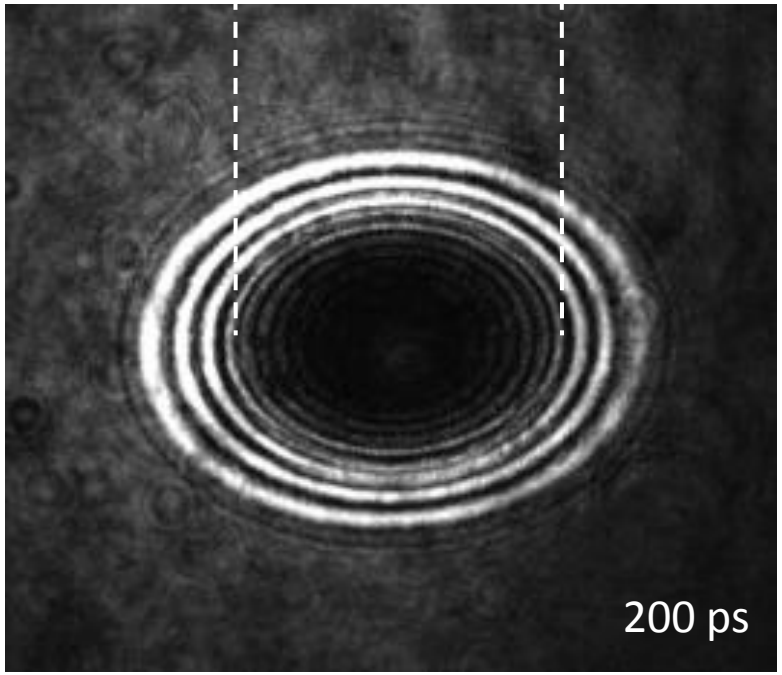

Air (n =1)
Shock wave front (n>1)
n≈2
Rarefaction wave
Bulk-molten layer interface
Wave superposition

Why do they move?



As the rarfaction wave expands, its curvature is varying, so, the beam incidence will vary which involves the “movement” of the Newton rings





Fringe visibility

$$V = \frac{I_M - I_m}{I_M + I_m}$$

Ideal conditions: V=1

Radial contrast decrease

Strong absorption in the central zone

Conclusions

- This technique can be used for improving the related acquisition parameters in plasma analysis
- Fast area of interest selection, as the target can be monitorized in real time and sample or debris defects and border effects can be avoided
- Focusing and defocusing of the target is can be controlled

Acknoledgements

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- Química Láser Group
- UIMP
- Ministerio de Economía y Competitividad, proyecto CTQ2011-24433 and Programa de Formación de Personal Investigador (FPI)..