Surface dependence for laser - induced target current by plastic materials

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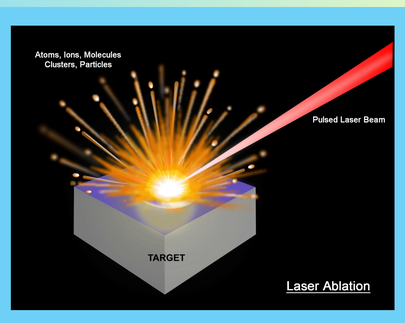
Motivations

Correlation between target current and particle beams

- Beam diagnostics
- Tuning parameters
- Various applications in several fields

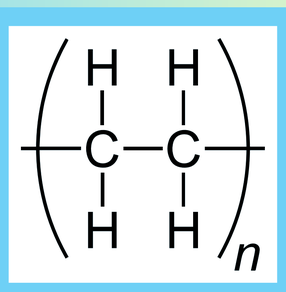
Basic Concepts



Laser ablation

- High intensity laser striking a material
- Target vaporization
- Reflected radiation absorbed by vapor
- Creation and expansion of plasma

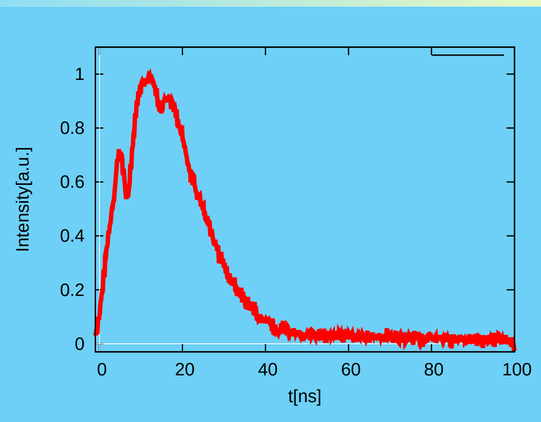
Material



UHMWPE

- Already used in many applications
- Arranged in discs with different sizes

Laser beam



- KrF excimer laser
- $\lambda = 248$ nm
- Pulse FWHM ≈ 23 ns

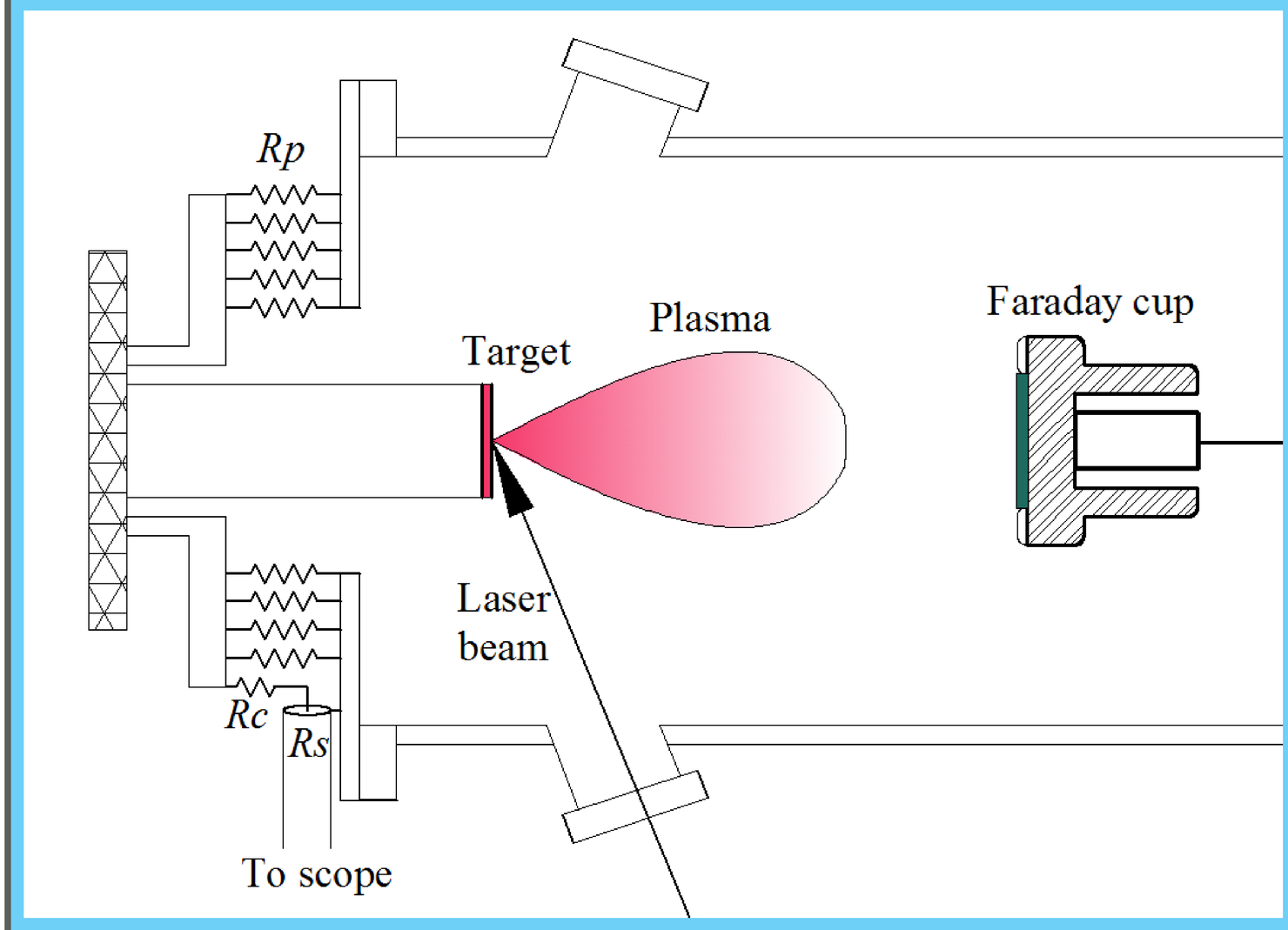
References

[1] J. Krása, D. Delle Side, E. Giuffreda, V. Nassisi, *Characteristics of target polarization by laser ablation*, *Laser Part. Beams* **33** (2015), 601-605.

For the Future

- Further geometry target manipulations (Thickness?)
- Target current modeling
- Slow - motion of ps and fs lasers?

Setup

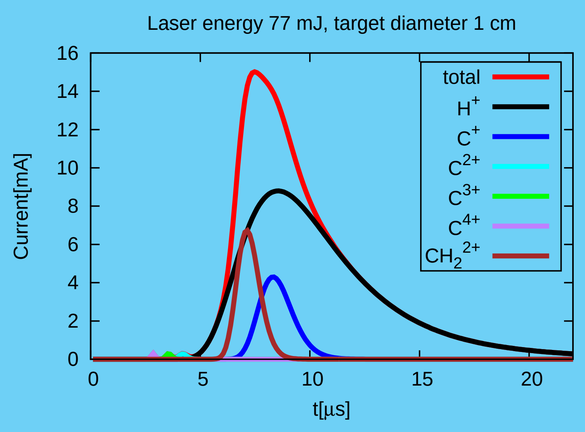


- Laser beam striking the target at 70^o with respect to the surface normal
- Target connected through the metallic holder by $R_p/10$
- Resistors arrays R_p measuring the current flowing to the ground

Current analysis

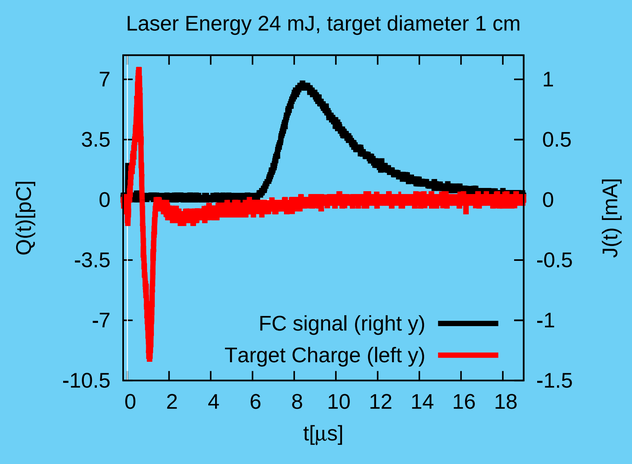
Time of Flight signal analysis

$$S(L,T) = \frac{L^2}{t^5} \sum_i S_{i,0} \exp\left[-\frac{m_i}{2k_B T_{KL,i}} \left(\frac{L}{t} - u_{CM,i} \right)^2 \right]$$



- Laser energy is not able to ionize C with high charge states
- Presence of protons and CH_2^{2+} ions

Surface charge overview

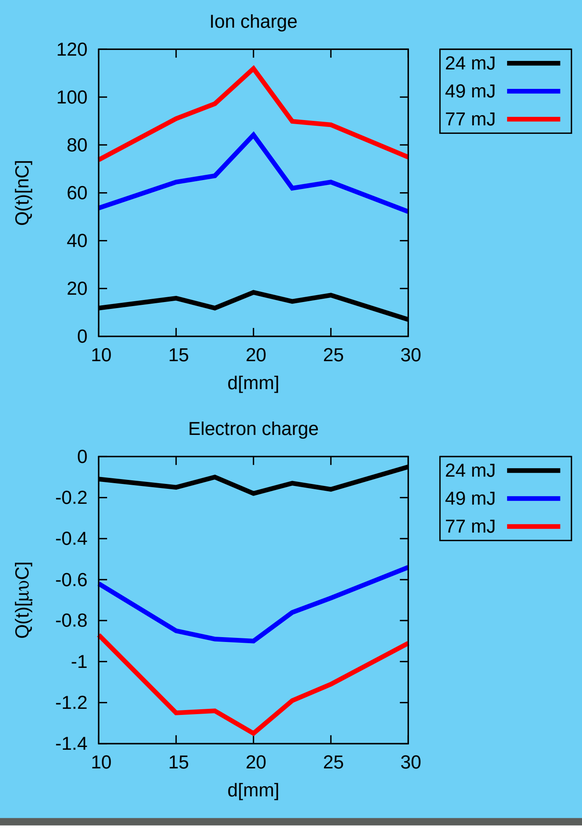


- Target charge $Q_T(t) = C_T V_T(t)$
- Correlation between plasma expansion and target polarization

Charge analysis

Total charge versus target diameter d

"'Anomalous"' behavior when the target size equals the holder size



Ion front characterization