

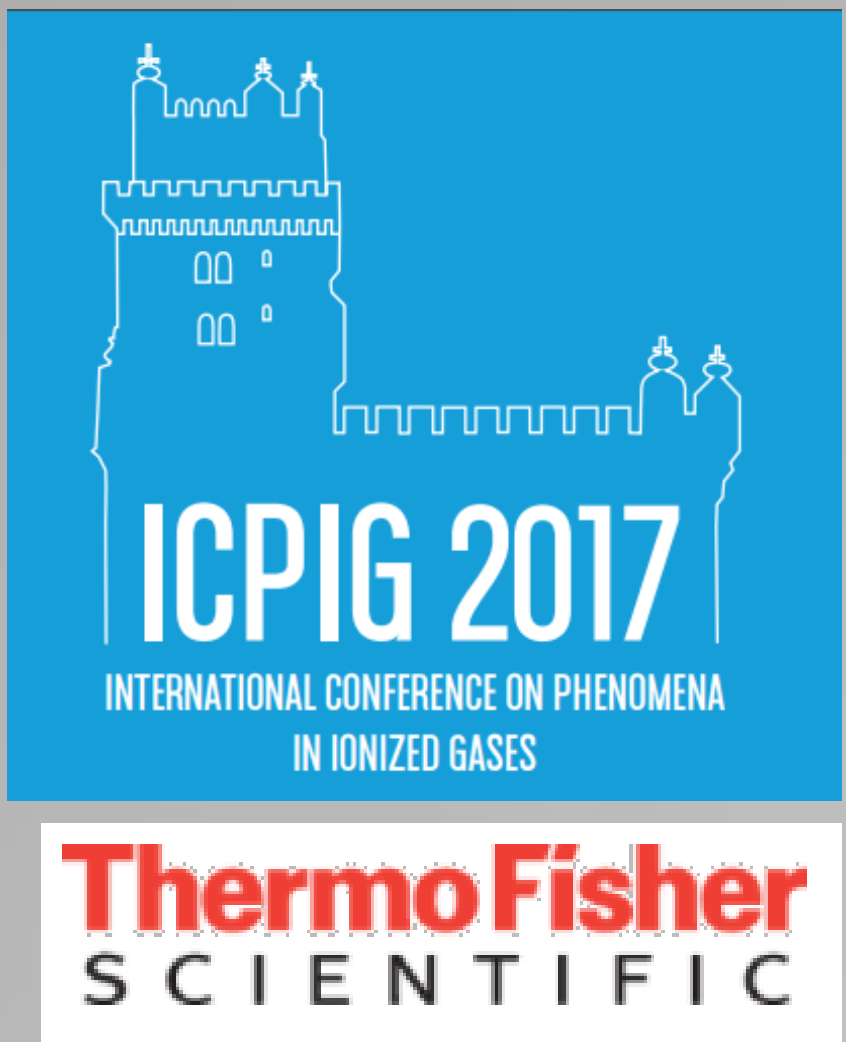
Comparison of two electric field measurement methods for a kHz microsecond atmospheric pressure plasma jet

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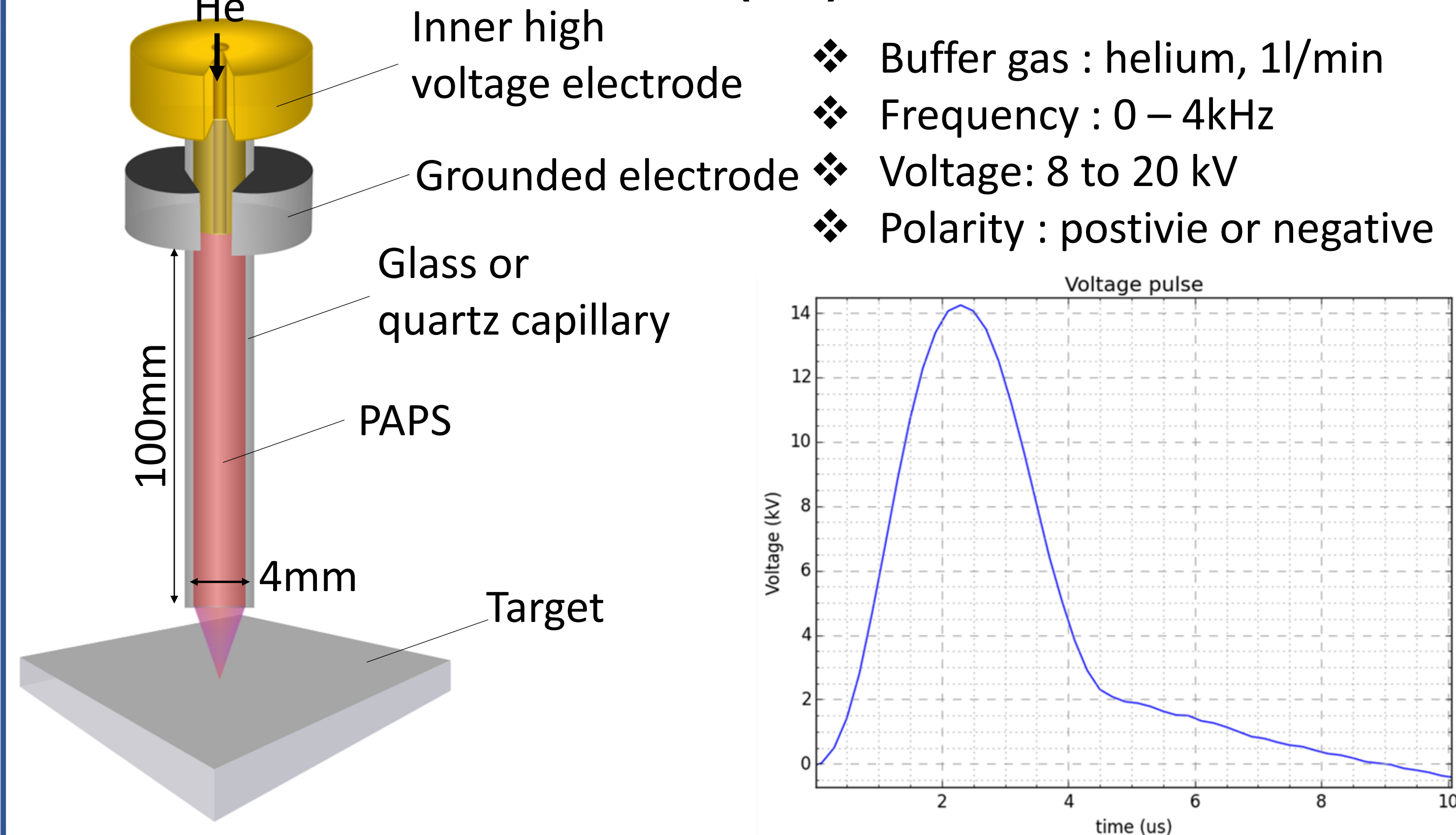


Introduction

Atmospheric pressure plasma jet have been studied because of the wide range of applications they offer, especially in biomedical fields. These jets consist in an ionisation wave which propagates into a rare gas. Behind it, a column of plasma connected with high voltage electrodes exists for several microsecond. All of it is called pulsed atmospheric pressure streams (PAPS). This study deals with transient electric fields resulting of these PAPS measured with two methods :

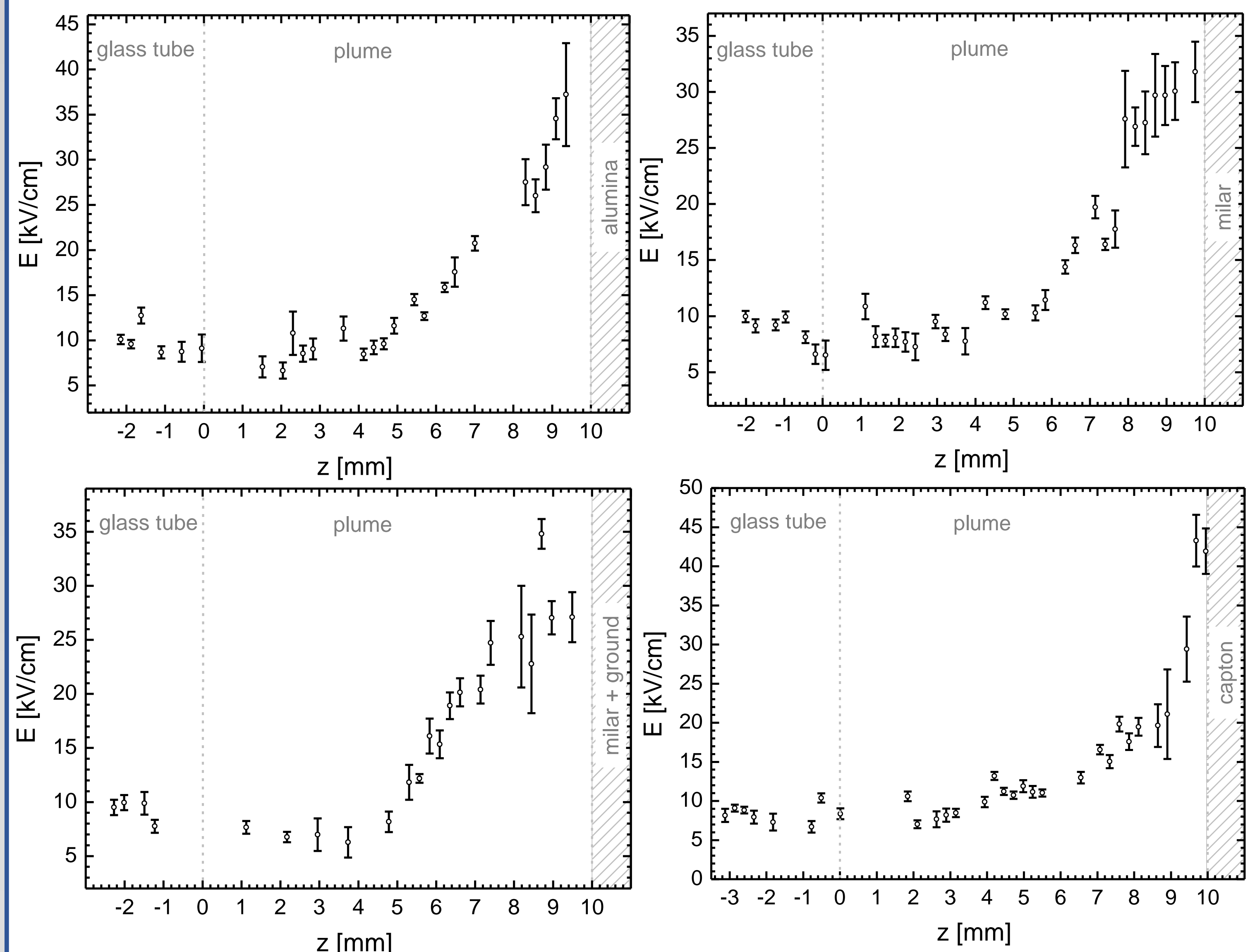
- An **electro-optic sensor** based on the Pockels effect [1]
- Emission spectroscopy of He 1 line at 492.19 using its **Stark polarization** dependence.

Plasma source: Plasma Gun (PG)

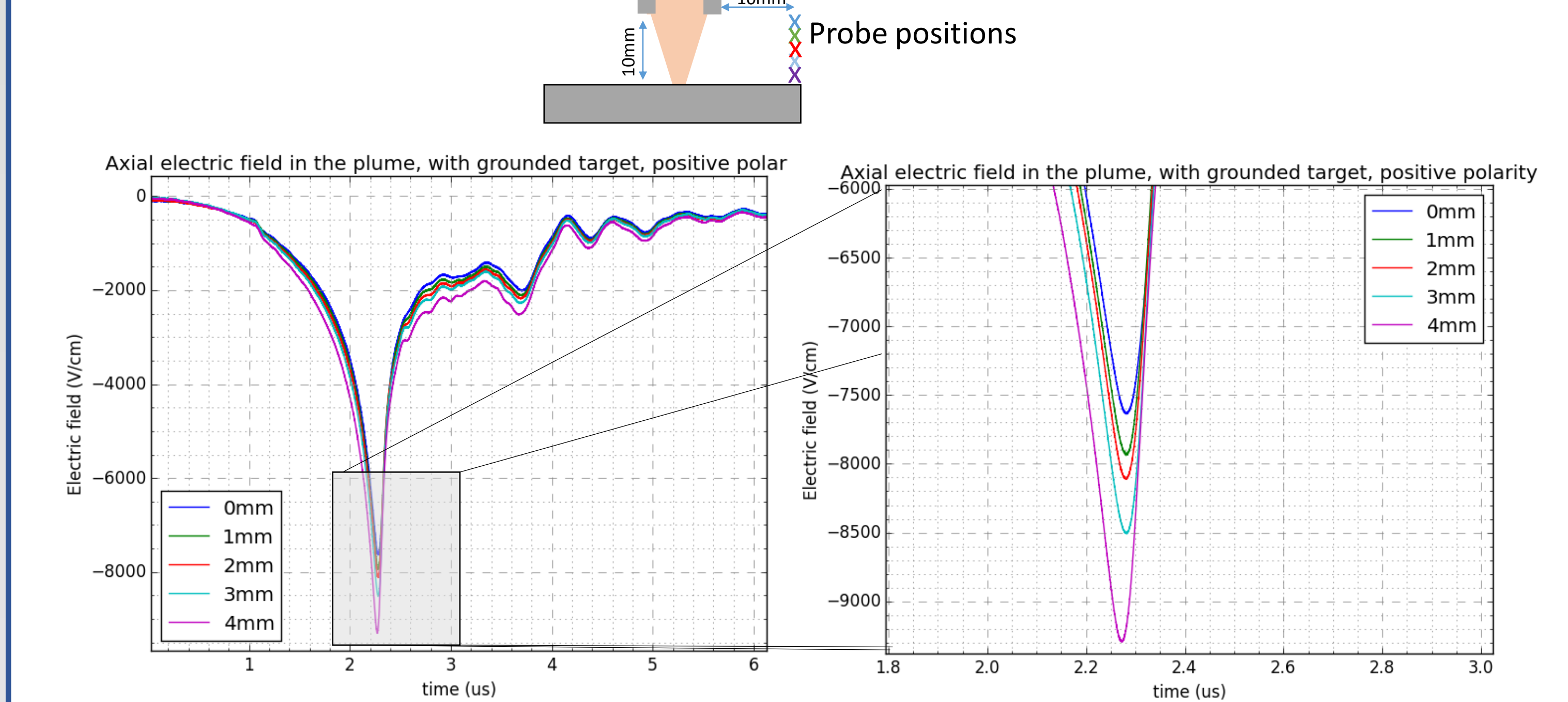


E-field in the plume according to different targets

Operating PG with: 1l/min He, 2kHz, 14 kV, positive polarity
- With spectroscopy



- With the EO-probe



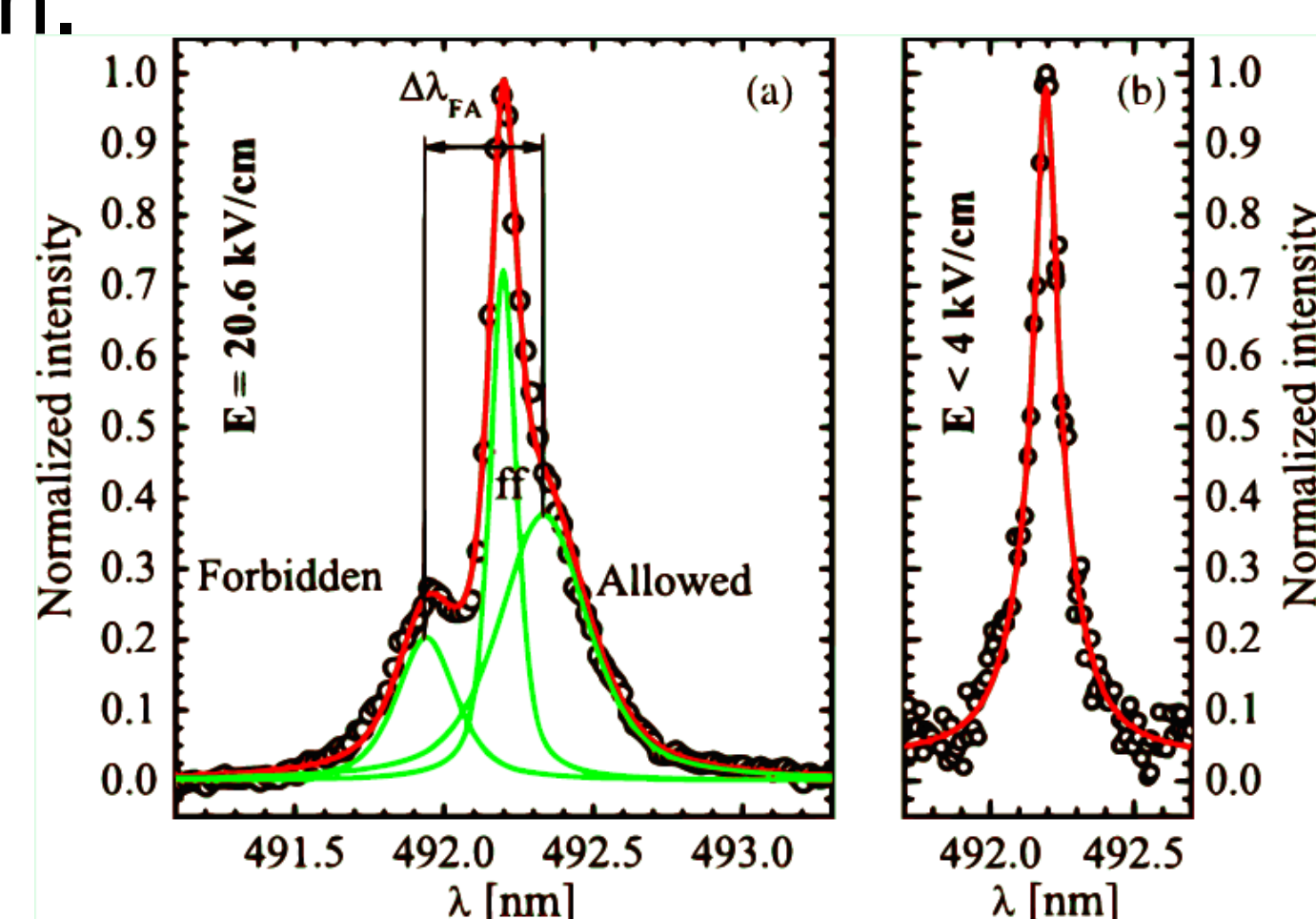
Electro-optic probe

- ❖ Electro-optic sensor
 - Pockels effect
 - BSO crystal (1.8mm*1.0mm)
- ❖ Transient E-field
 - 50 kHz to 40 GHz
 - 10 V.cm⁻¹ to 100 kV.cm⁻¹
- ❖ 1 E-field component measure
- ❖ Good time resolution but intrusive in the plume.



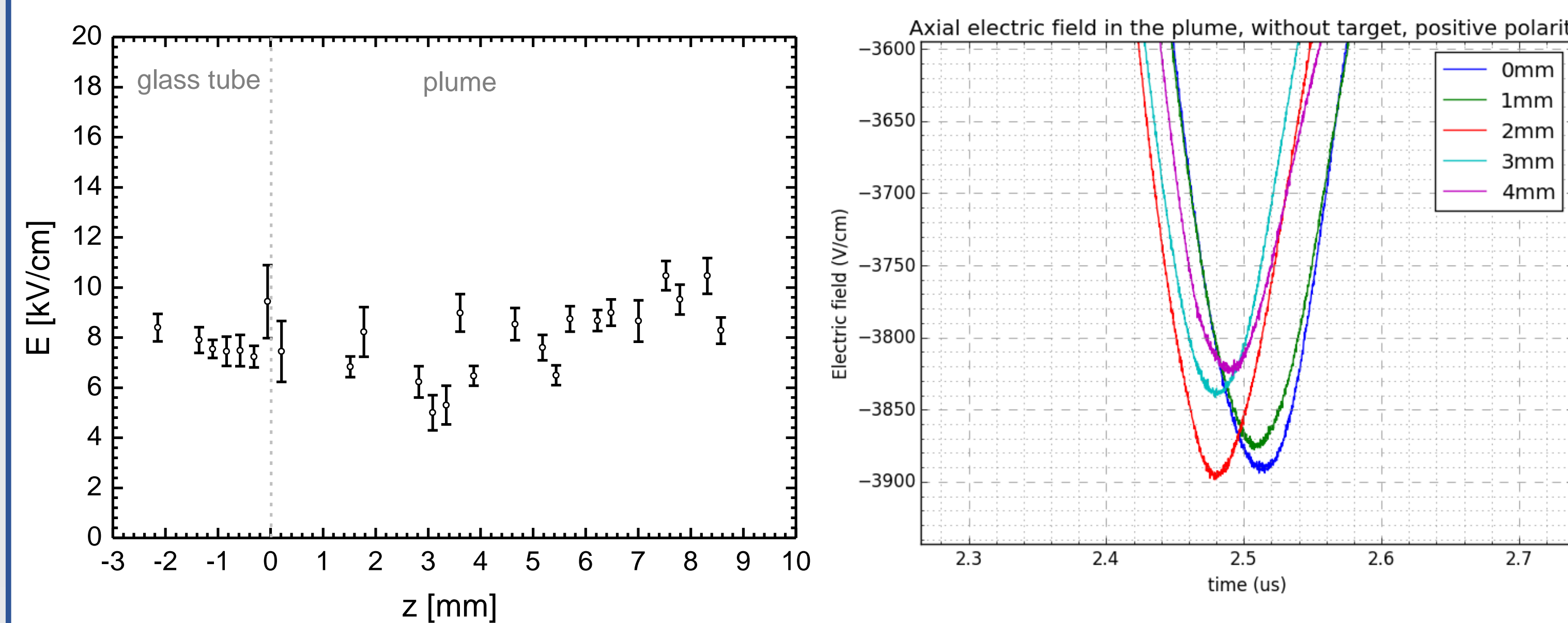
π-polarization Stark He 1

- ❖ Optical emission spectroscopy technique: non intrusive
- ❖ π-polarization Stark : splitting and shifting of the allowed and forbidden counterpart transitions of He 1 (492.19nm) depend on the light polarization.
- ❖ Time and space resolved.
- ❖ Threshold of ~4 kV.cm⁻¹



π-polarized spectrum of the He 1 at 492.19nm in a plasma jet [4]

E-field without target, positive polarity



Concluding remarks

- Both methods are complementary and in good agreement
- E-field increases in the plume when a target is present.
- The EO probe overestimates the E-field when in direct contact with the plasma.

Acknowledgments

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References

- [1] Gaborit, G et al., *IEEE Trans. Plasma Sci.* 42(5), 1265-1273 may (2014)
- [2] Kuraica, M. M. and Konjevic, N, *Appl. Phys Lett.* 70(12), 1521 (1997)
- [3] Sretenovic, G. B., and al. *Journal of Physics D: Applied Physics* 47 (10), 102001 (2014)