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SAND2020-10771C

Measurement of two-dimensional distribution of electric fields in collisional environments.

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73rd Annual Gaseous Electronics Conference
Virtual Poster Session
Tuesday, October 6, 2020

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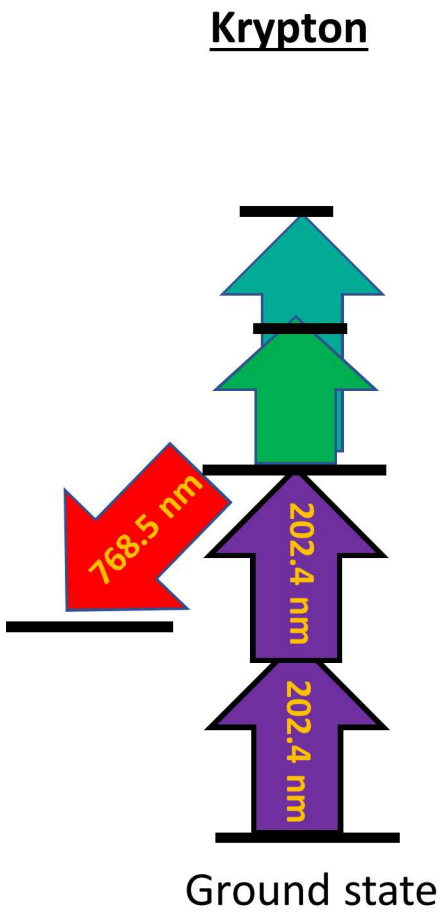
(Slide 1)

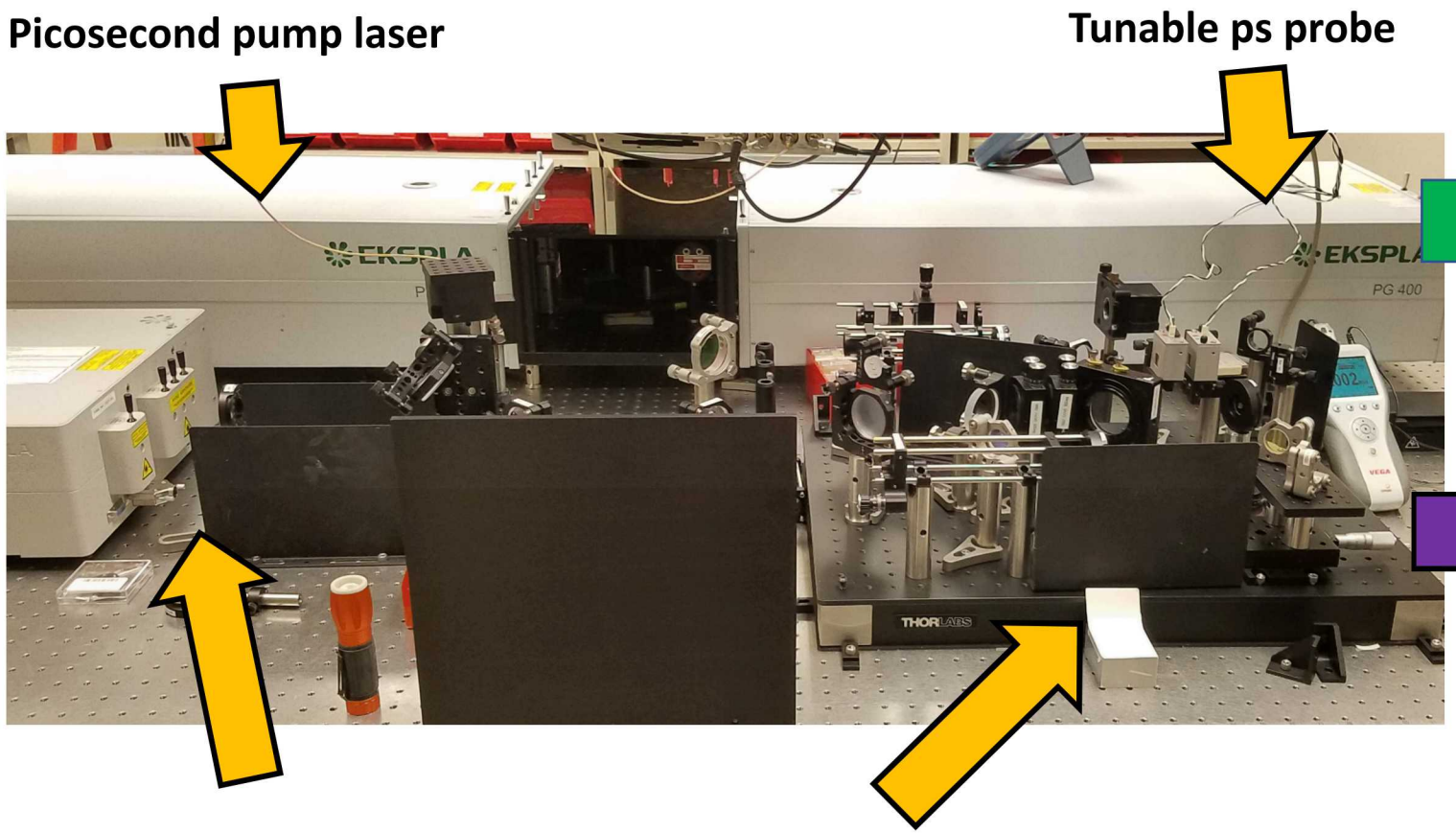
Introduction

- In this presentation, we describe pump-probe method to measure electric fields in highly collisional environments
  - Based on laser-induced fluorescence dip (LIF-dip) spectroscopy
  - Two-photon picosecond excitation to access ground state before, during and after plasma generation
  - Tunable picosecond probe to interrogate mixing of Rydberg states before excitation relaxes
  - Monitor a depletion (dip) in the fluorescence due to redistribution of excited state



(Slide 2)

Picosecond Pump-Probe System



Picosecond pump laser

Tunable ps probe

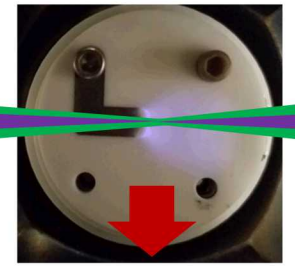
Seed laser

Seeded OPA for DUV pump

Long-wave pass mirror

Cylindrical Lens

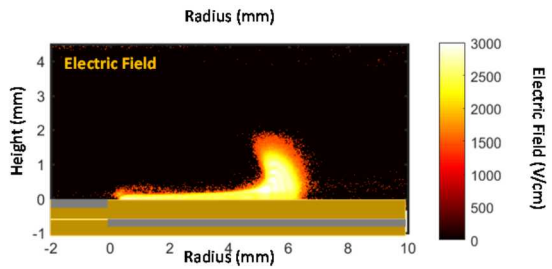
Plasma



Imaged LIF

Interference Filter

Gated Intensified CCD



Key pieces of hardware assembled and proof of principle demonstrated

(Slide 3)

Implementation of LIF-DIP Method

520 – 560 nm
25 ps, 200 μJ

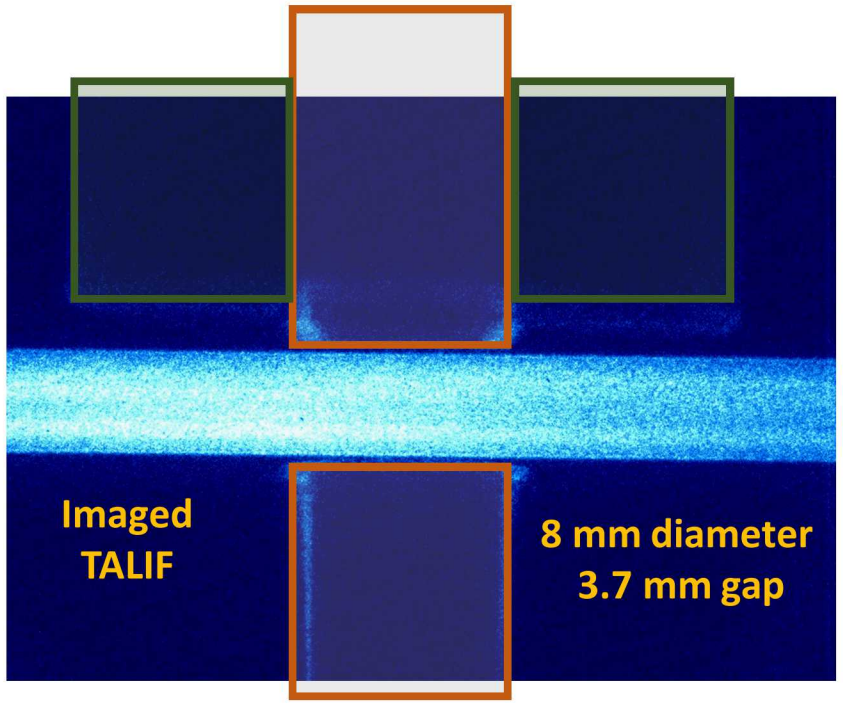
202.4 nm
20 ps, 20 μJ

Probe

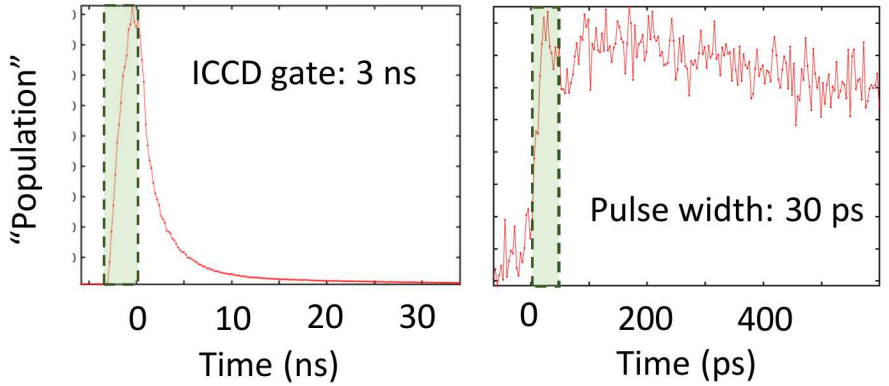
Pump

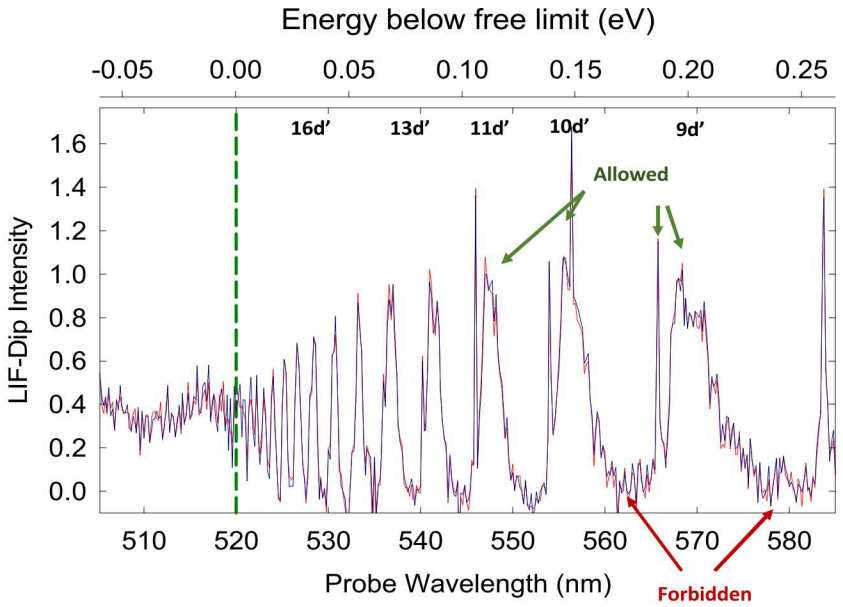
- 50 to 500 ps separation

Anode (Biased)



Cathode (Grounded)

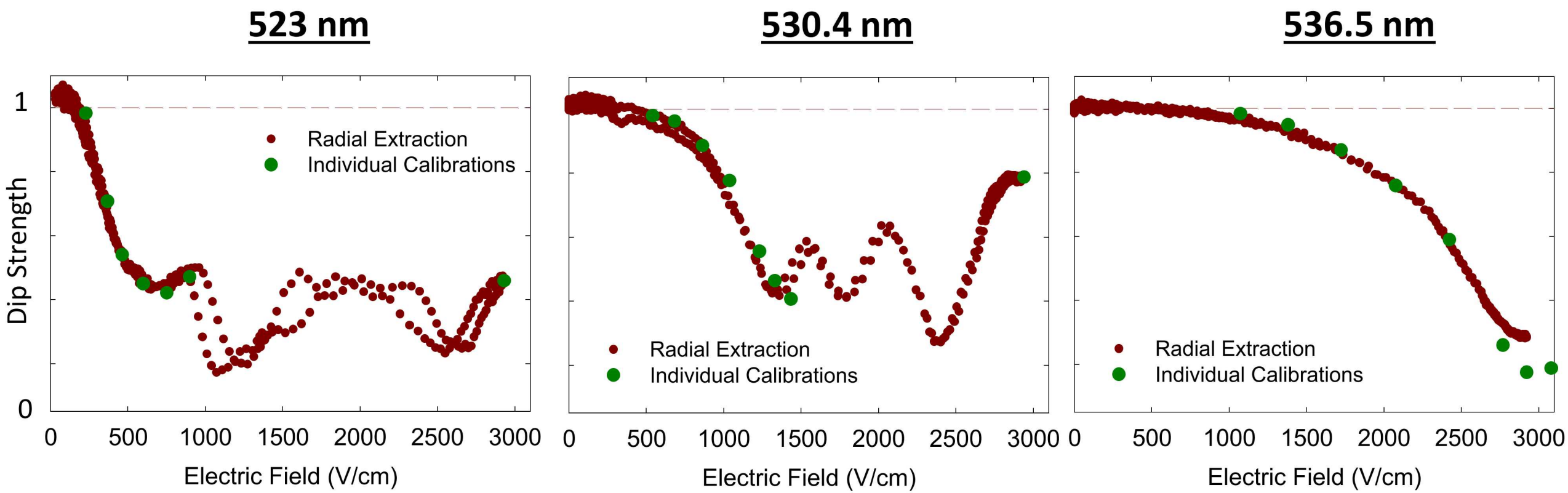




TALIF-Dip is interrogated temporally and spectrally

(Slide 4)

Representative Electric Field Calibrations

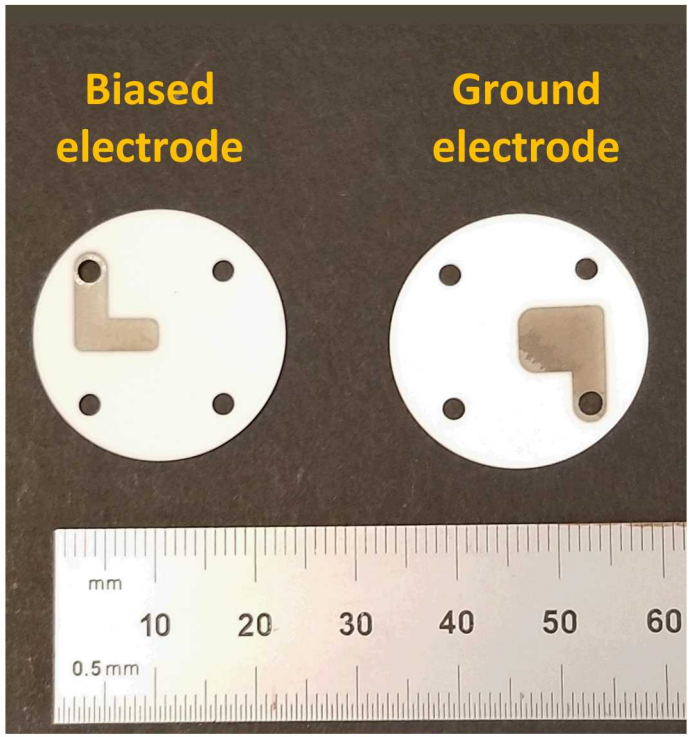


Normalized TALIF-Dip intensities are used to assess magnitude of electric fields

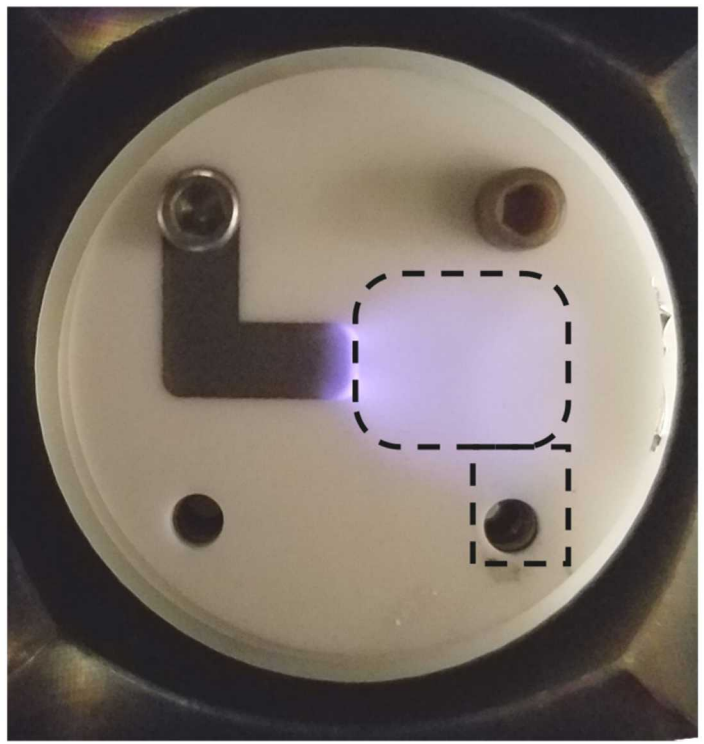
(Slide 5)

Surface Ionization wave Setup and Demonstration

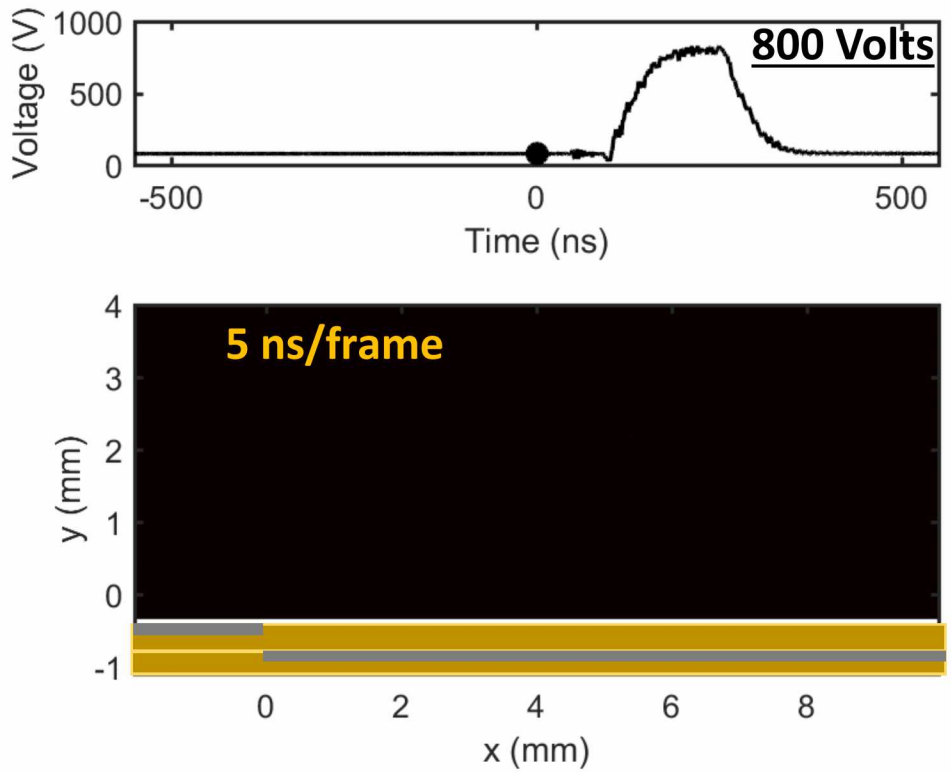
Individual electrodes



200 Torr He (5% Kr) Plasma

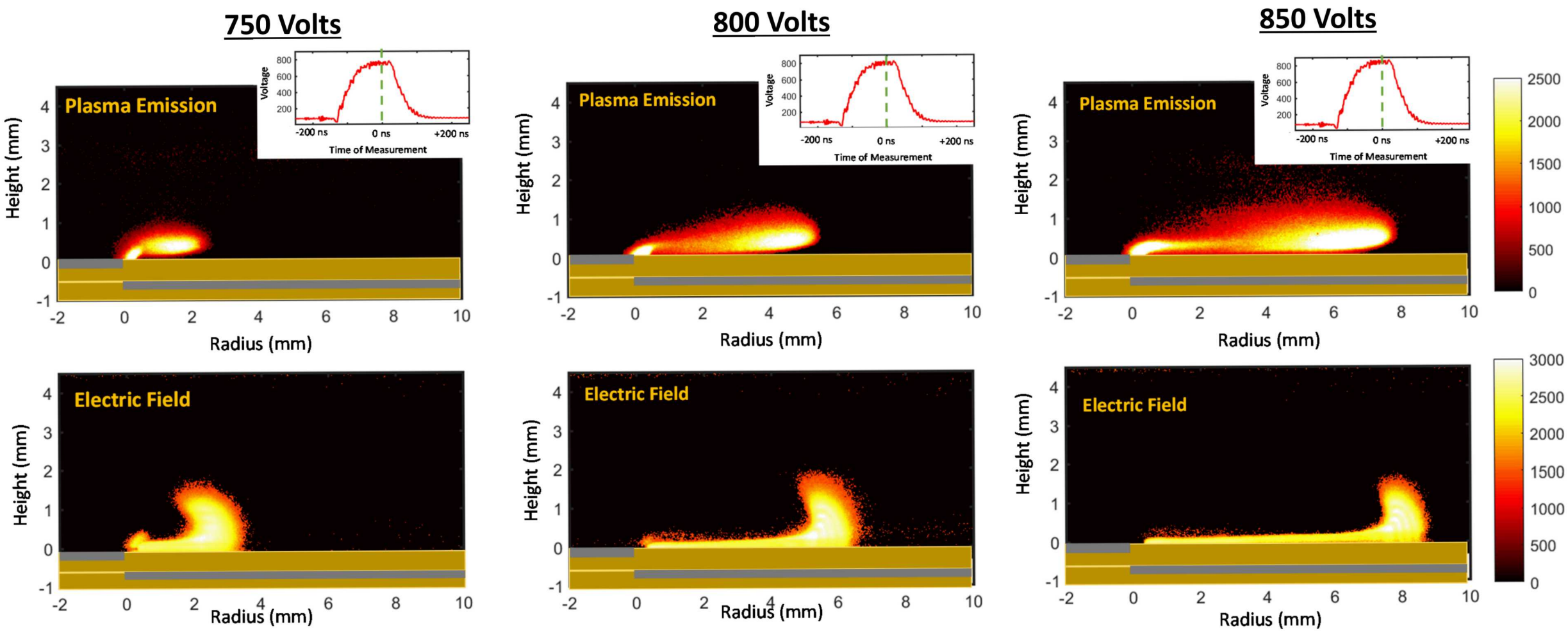


Animated Surface IW



Planar discharge is good testbed for planar TALIF and provides good access to sheaths formed at surface

Structure of Ionization Wave



Summary

- Electric Field detection has partial successes
  - Ability to spatially resolve electric fields.
  - Have good handle on lower <3 kV/cm fields
- More work needs to be done with the method
  - Ensure that technique produces unique results
  - Target and calibrate higher electric fields

This material is based upon work supported by the U.S. Department of Energy, Office of Science, Office of Fusion Energy Sciences under contract number DE-NA0003525. This research used resources of the Low Temperature Plasma Research Facility at Sandia National Laboratories, which is a collaborative research facility supported by the U.S. Department of Energy, Office of Science, Office of Fusion Energy Sciences.

Auxiliary

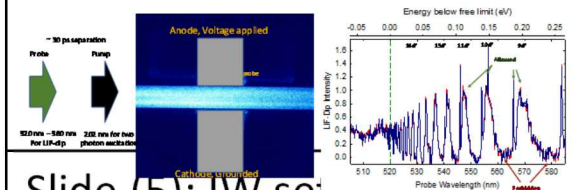
General panel layout

Title Bar

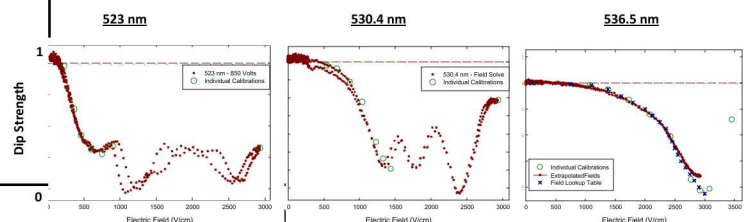
Slide (1): Introduction

Slide (2): Setup – discussion of ps-ps pump-probe, laser generation, timing

Slide (3): Calibration setup



Slide (4): Key Calibration trends



Slide (5): IW setup

Slide (6): IW Results

Slide (7): Conclusions and outlook