

# Robust Microfabricated Surface Ion Traps with Arbitrary Geometries

SAND2011-4486C

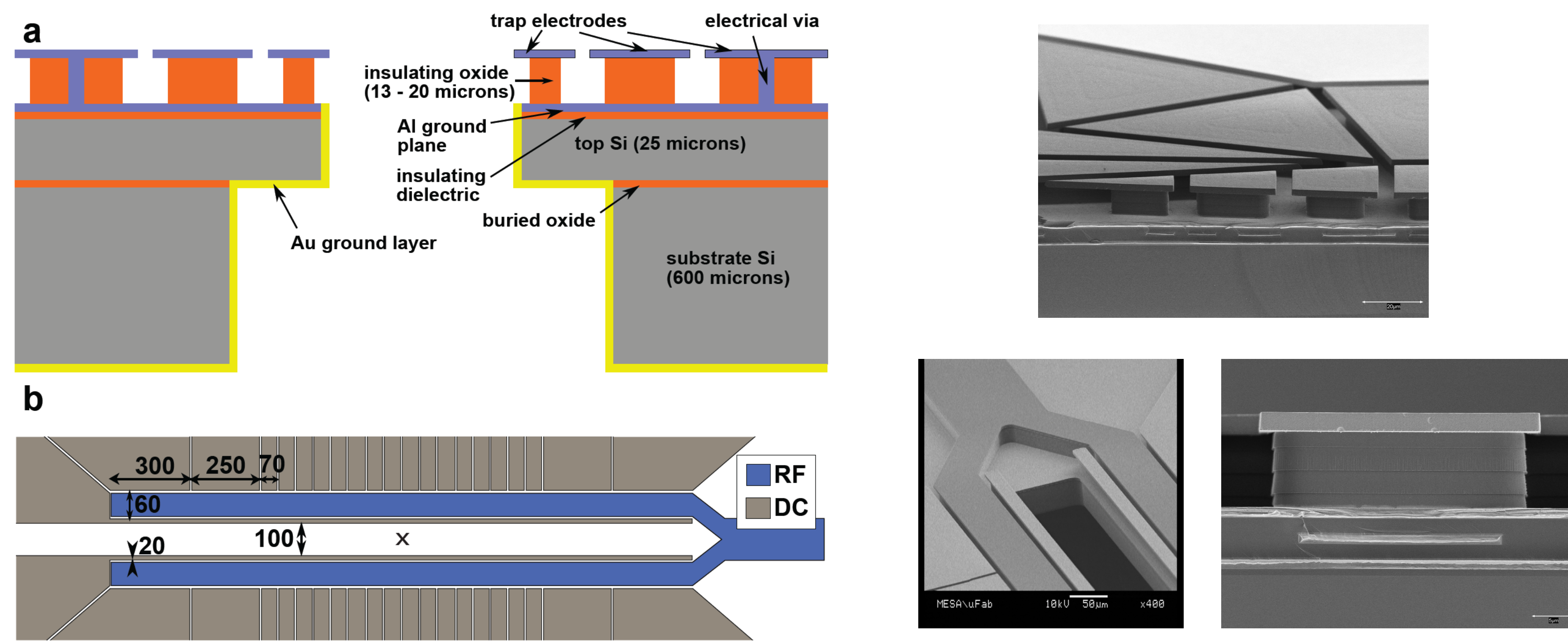


IARPA



D. L. Moehring, T. A. Barrick, F. Benito, M. G. Blain, A. A. Cruz-Cabrera, A. R. Ellis, L. Fang, K. M. Fortier, R. A. Haltli, C. Highstrete, S. A. Kemme, T. L. Lindgren, M. E. Smith, J. Sterk, J. E. Stevens, D. Stick, B. Tabakov, C. P. Tigges, M. Descour  
Sandia National Laboratories, PO Box 5800, Albuquerque, NM 87185

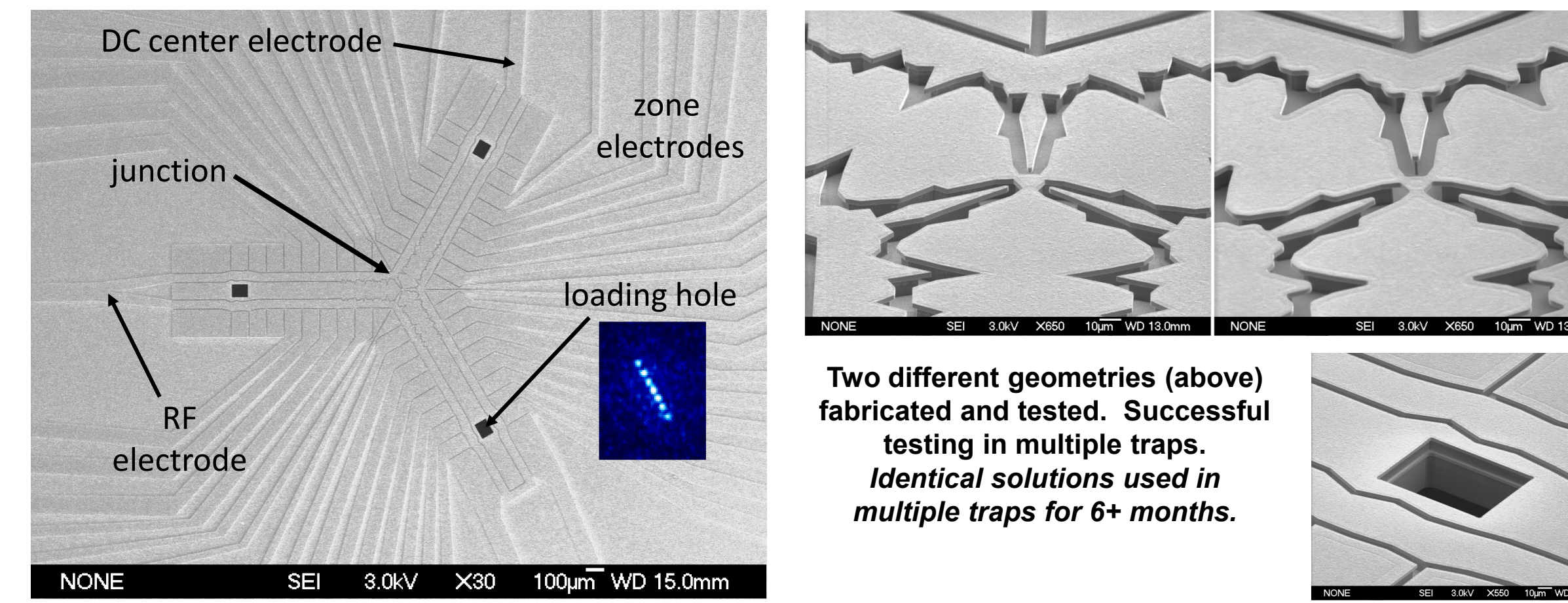
## Surface Electrode Ion Microtrap Fabrication



D. Stick, et al. Demonstration of a Microfabricated Surface Electrode Ion Trap, [arXiv:1008.0990v1] (2010).

## Junction Surface Ion Traps: Design, Fabrication, and Testing

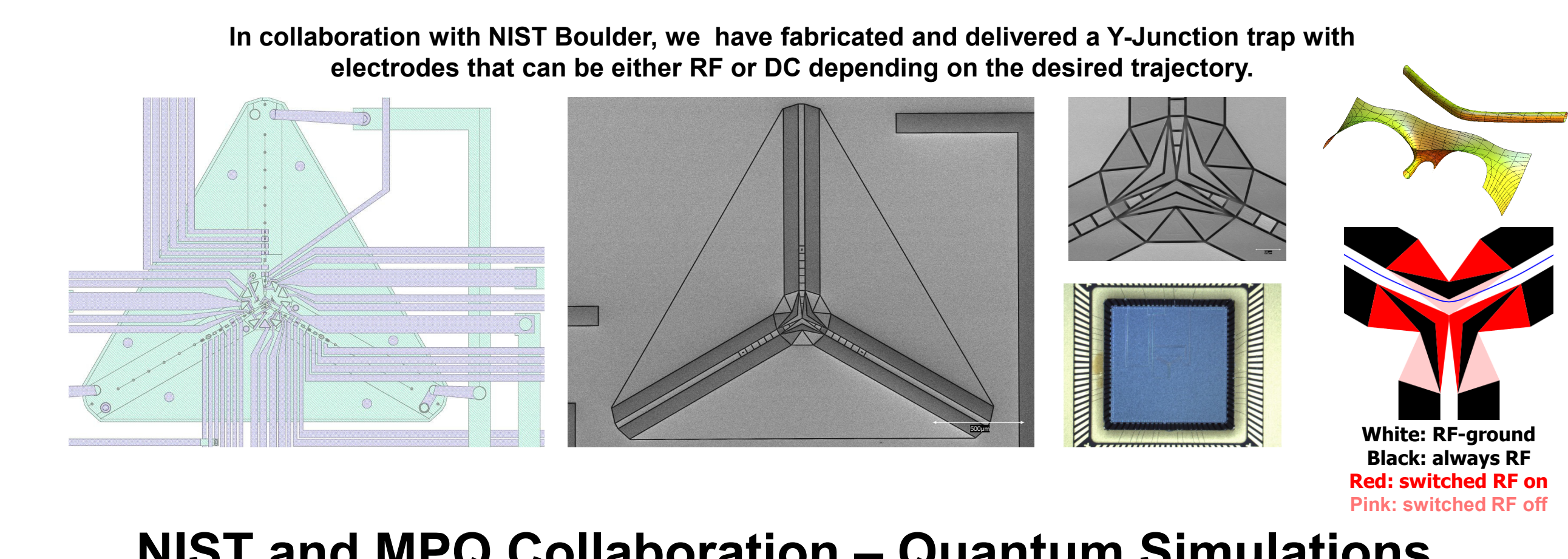
### Original Y-Trap Junction Design



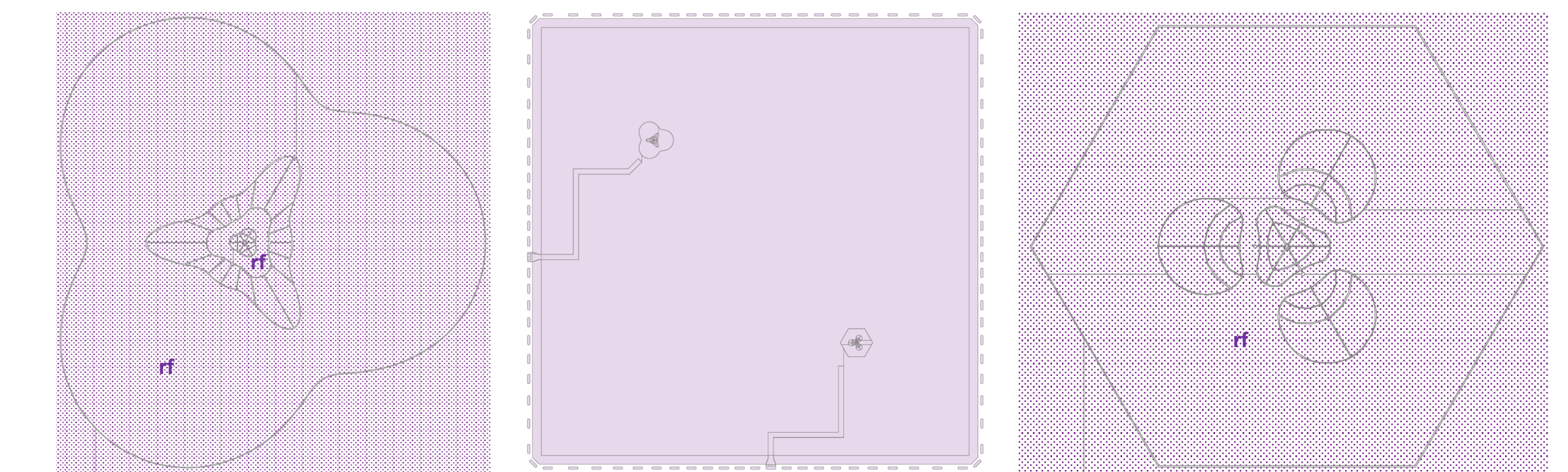
Left: reflection ion-height measurement. Right: Junction shuttling image.  $10^6$  junction shuttles without ion loss. Total travel of 1.5 km at 1 meter/second.

Successful Junction shuttling also at Georgia Tech campus group of Ken Brown. Successful junction shuttling was performed with identical voltage solution used also at Sandia.

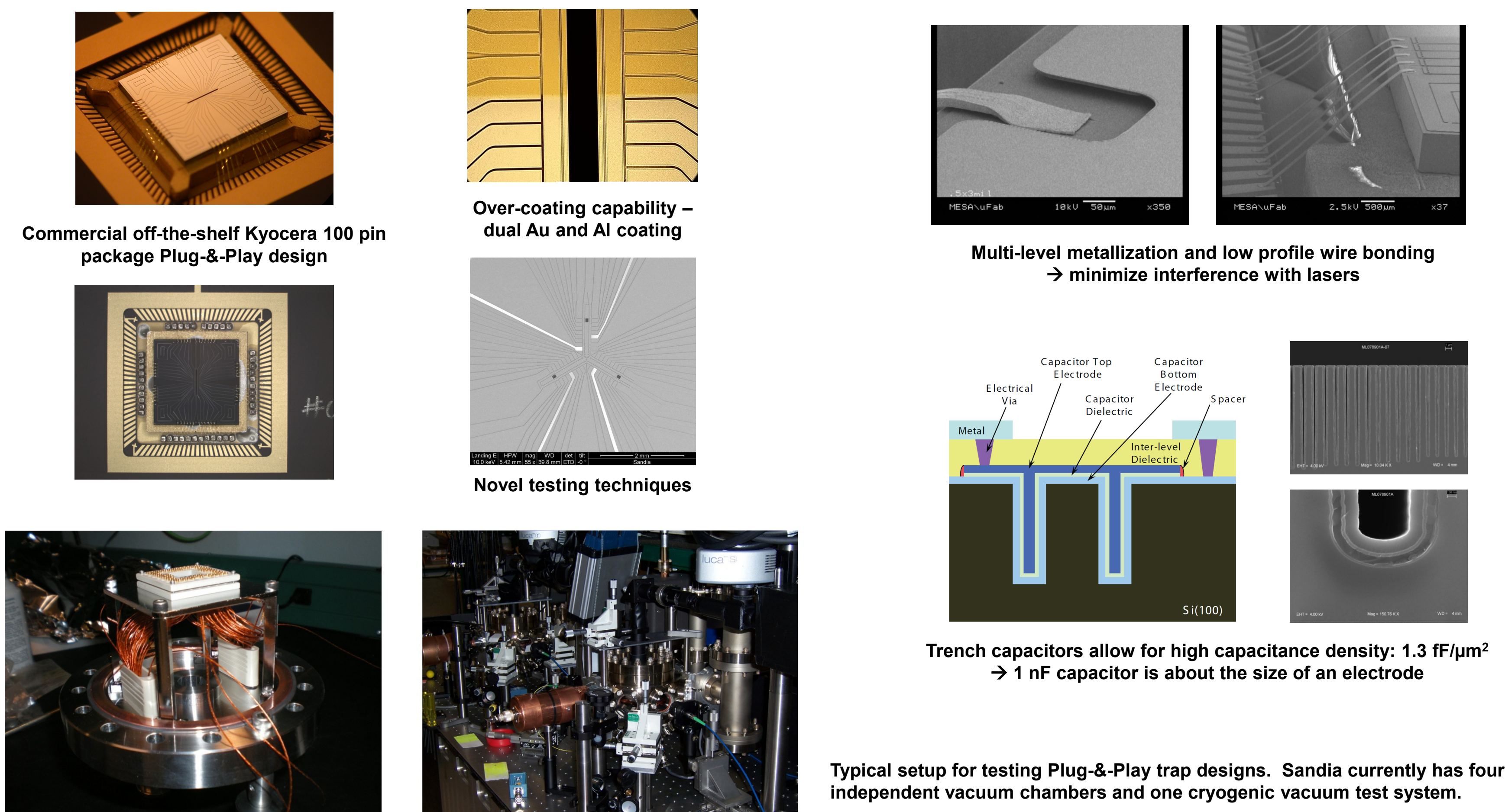
### Y-Junction with RF Switchable Electrodes



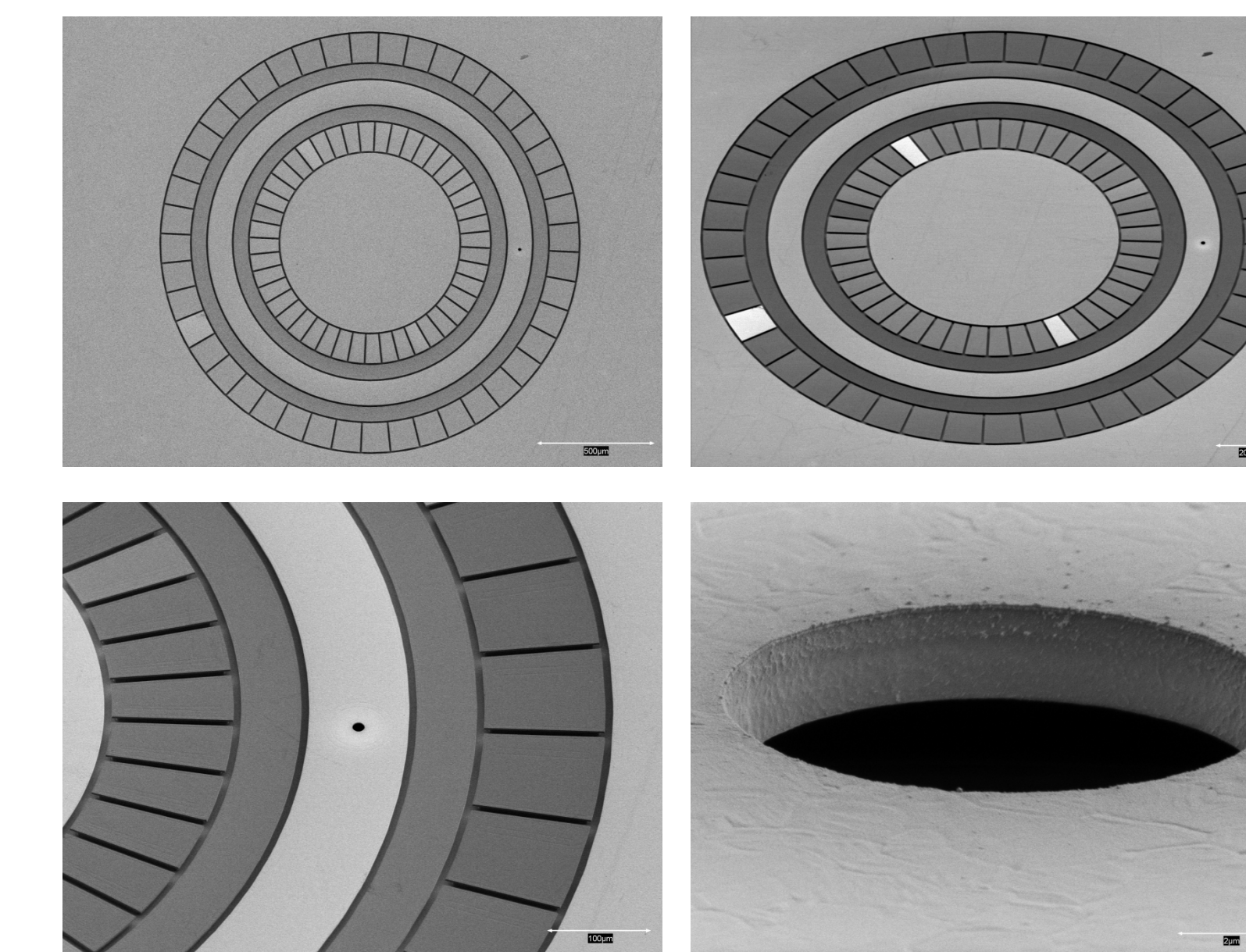
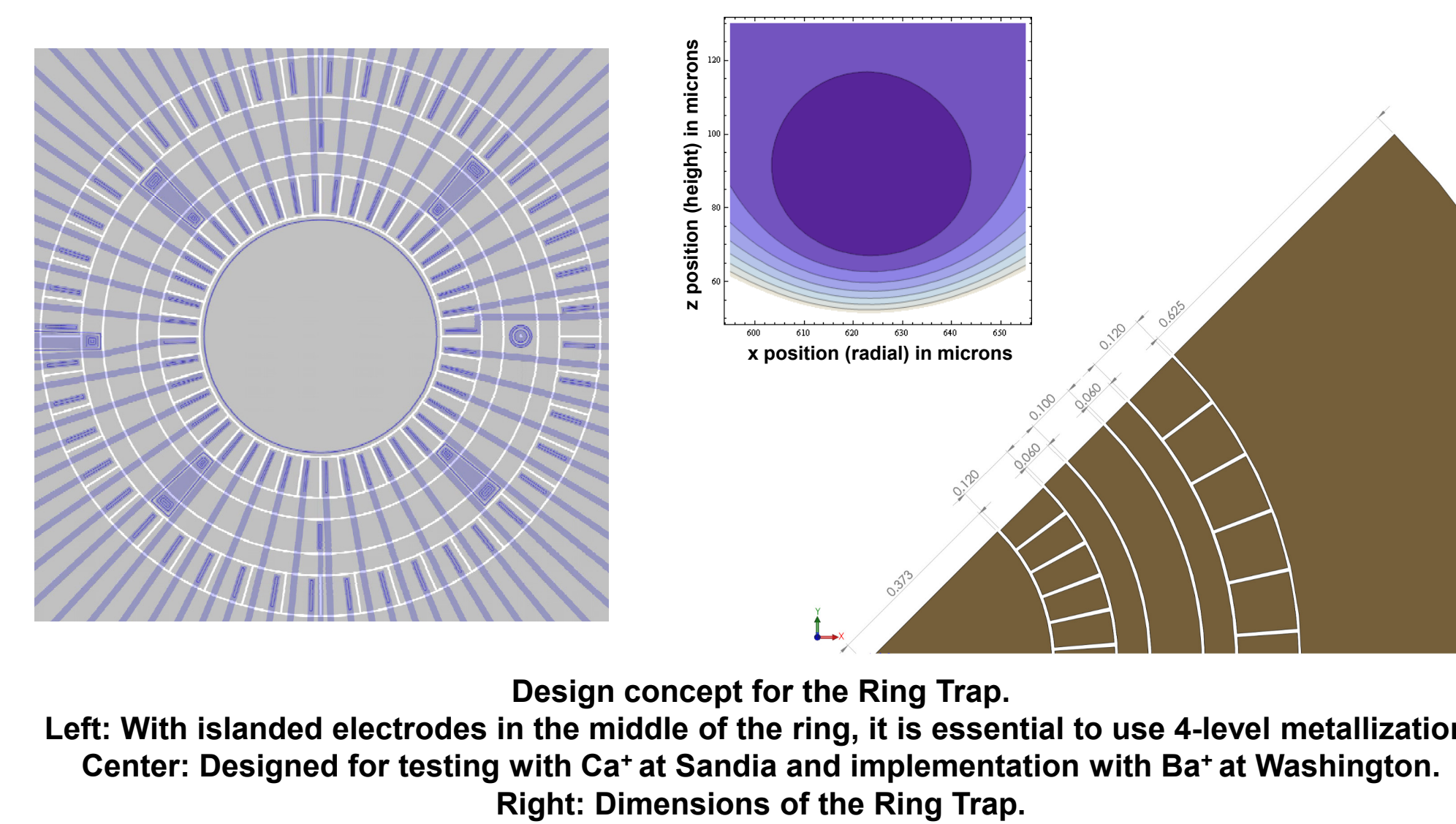
### NIST and MPQ Collaboration – Quantum Simulations



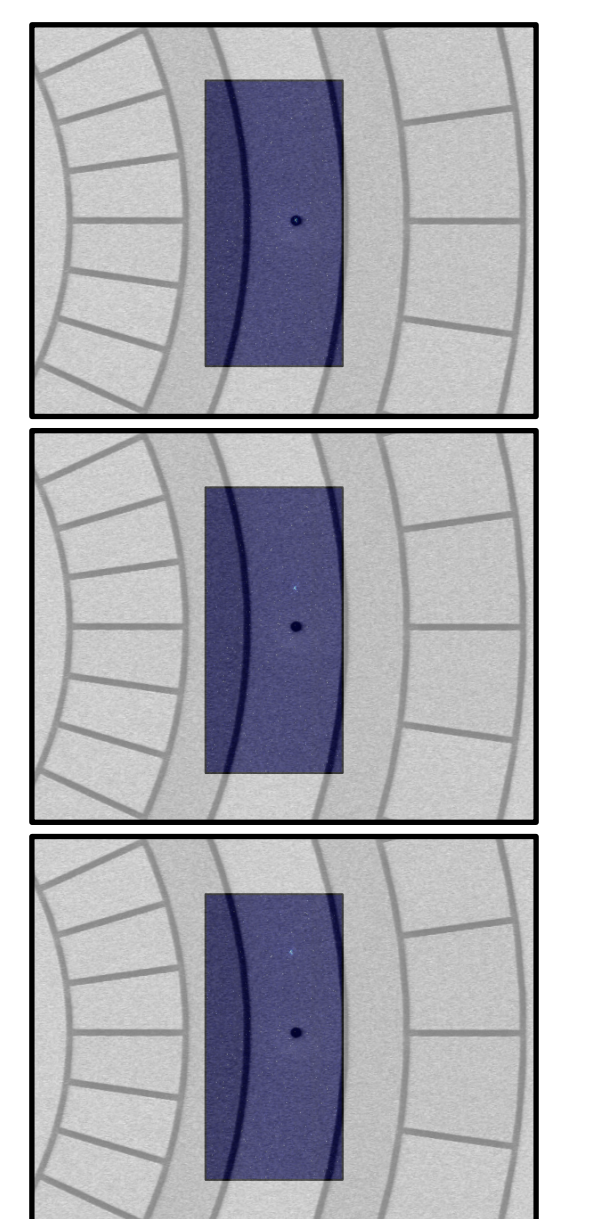
## Ion Trap Packaging & Integrated Capacitors



## Ring Trap

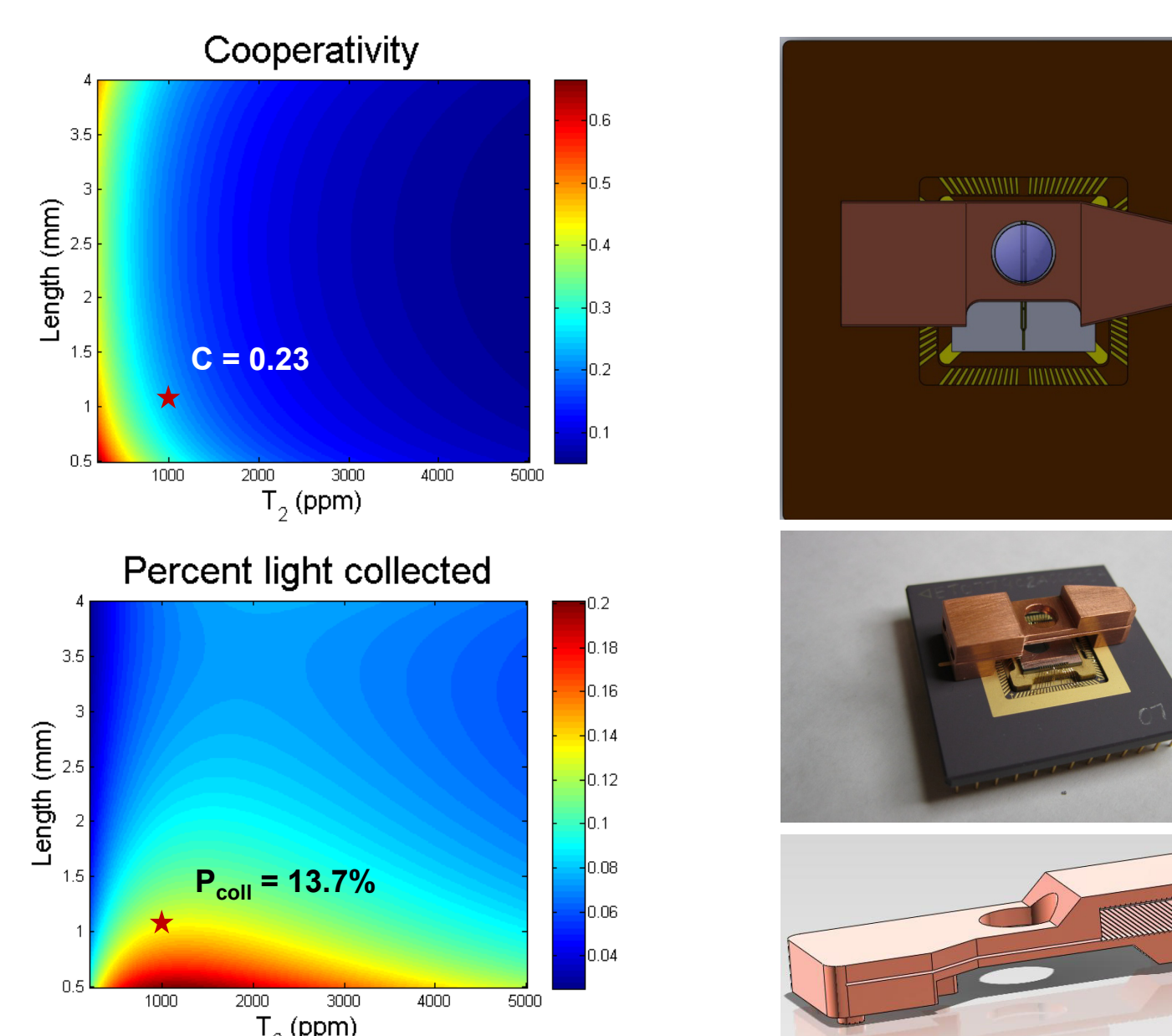
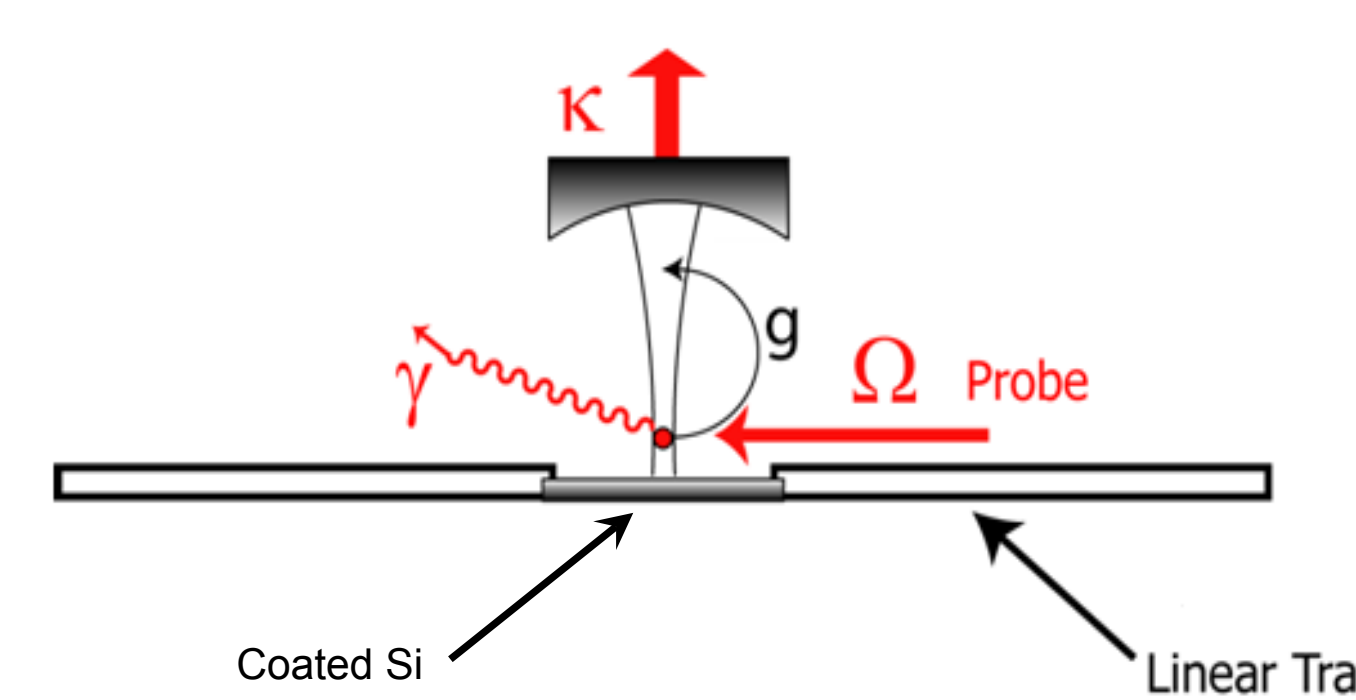


Successful trapping & shuttling on first attempt. 1000s of complete loops completed

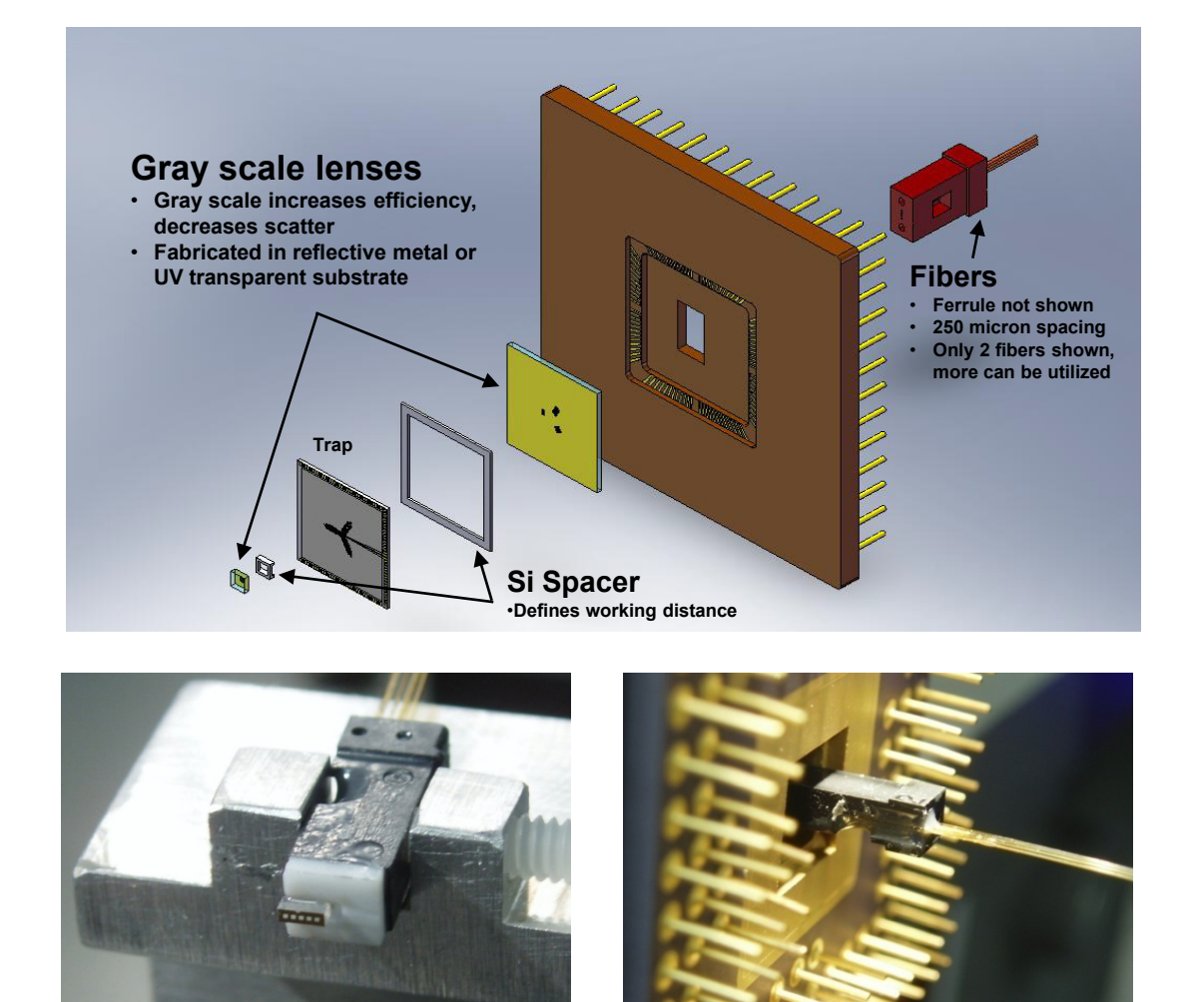
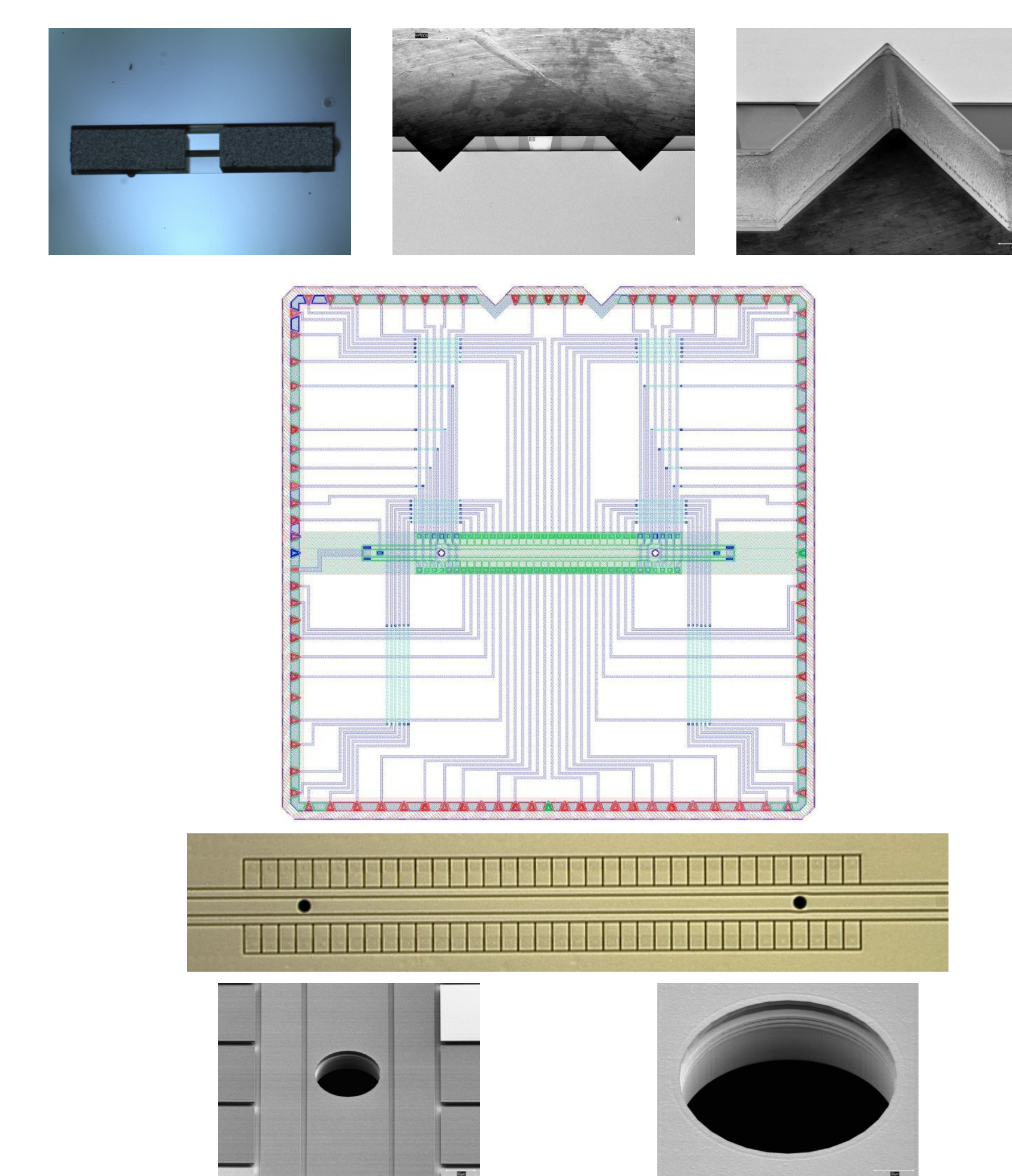


## Cavity QED and Integrated Optics

### Cavity QED-Integrated Microfabricated Surface Ion Trap



### New Linear Trap Design and Fabrication



Trapping & shuttling successful in Sandia Linear Trap with identical voltage solutions as in a trap without integrated optics, despite dielectric proximity of ~200 microns. G. R. Brady, et al., Applied Physics B (2011).

## Linear Trap Results and Collaborations

