

# PHOTOLUMINESCENCE DYNAMICS OF GaAs/AlGaAs CORE-SHELL NANOWIRES

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# Materials for 1-D Devices

- Why look at semiconductor nanowires?

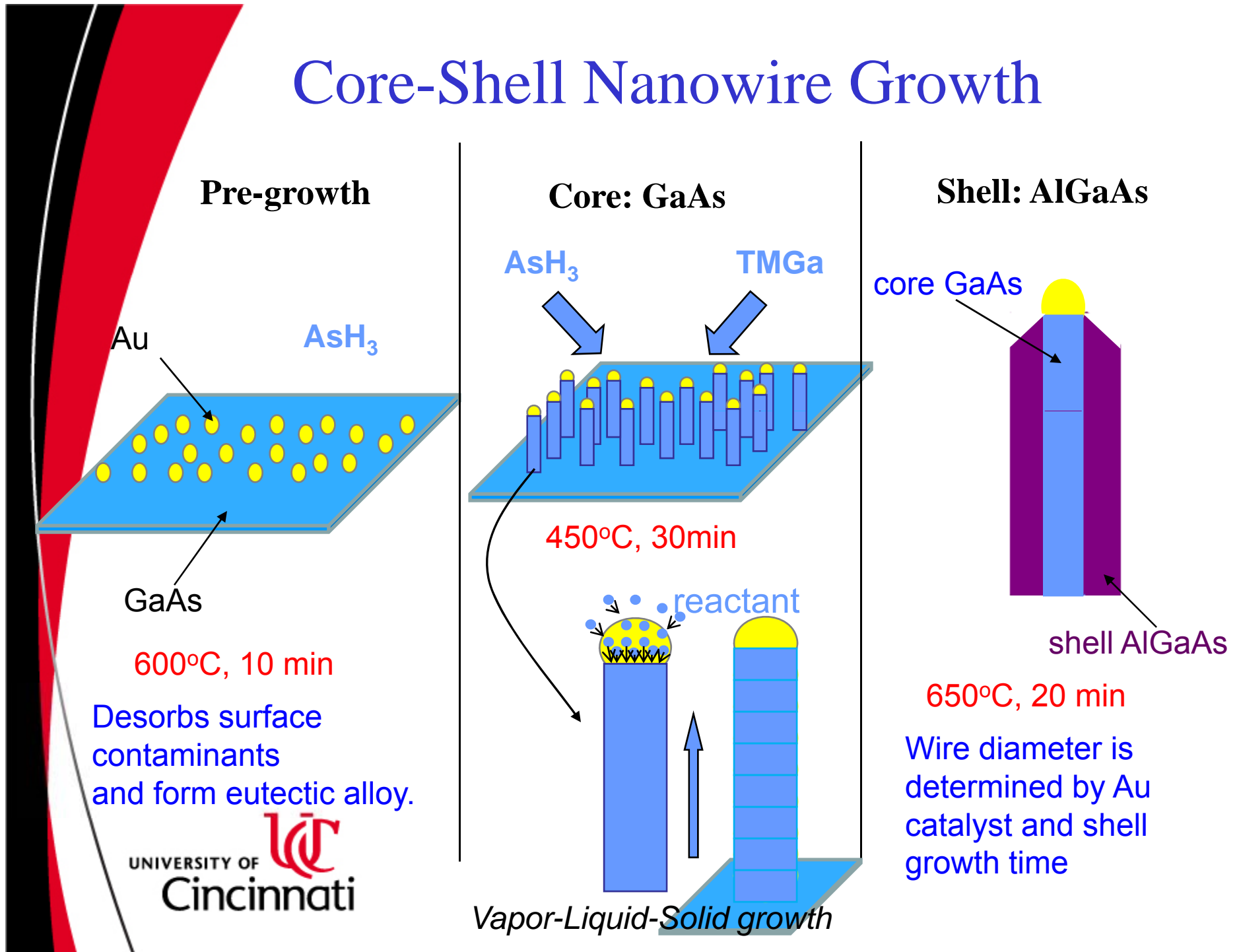
## Applications

- Sensor development
- LED and Nanowire lasers
- Photo detectors
- Single electron devices

*All depend on  
material quality*

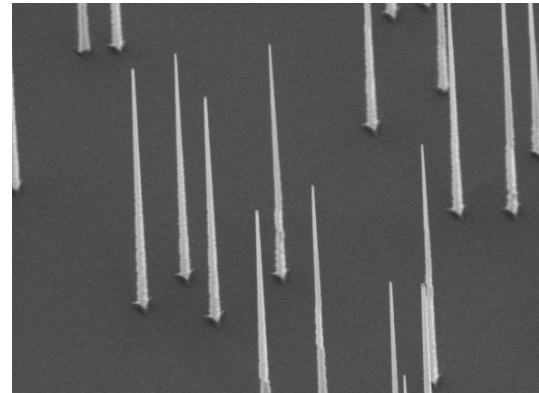


# Core-Shell Nanowire Growth

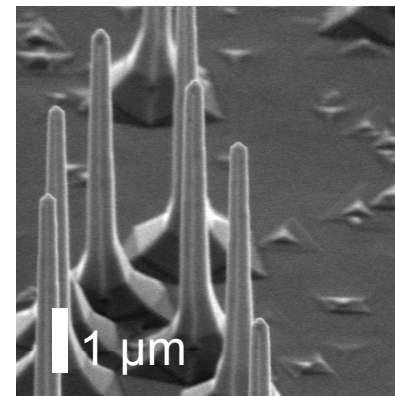


# SEM of GaAs/AlGaAs grown at 450 C

GaAs  
core

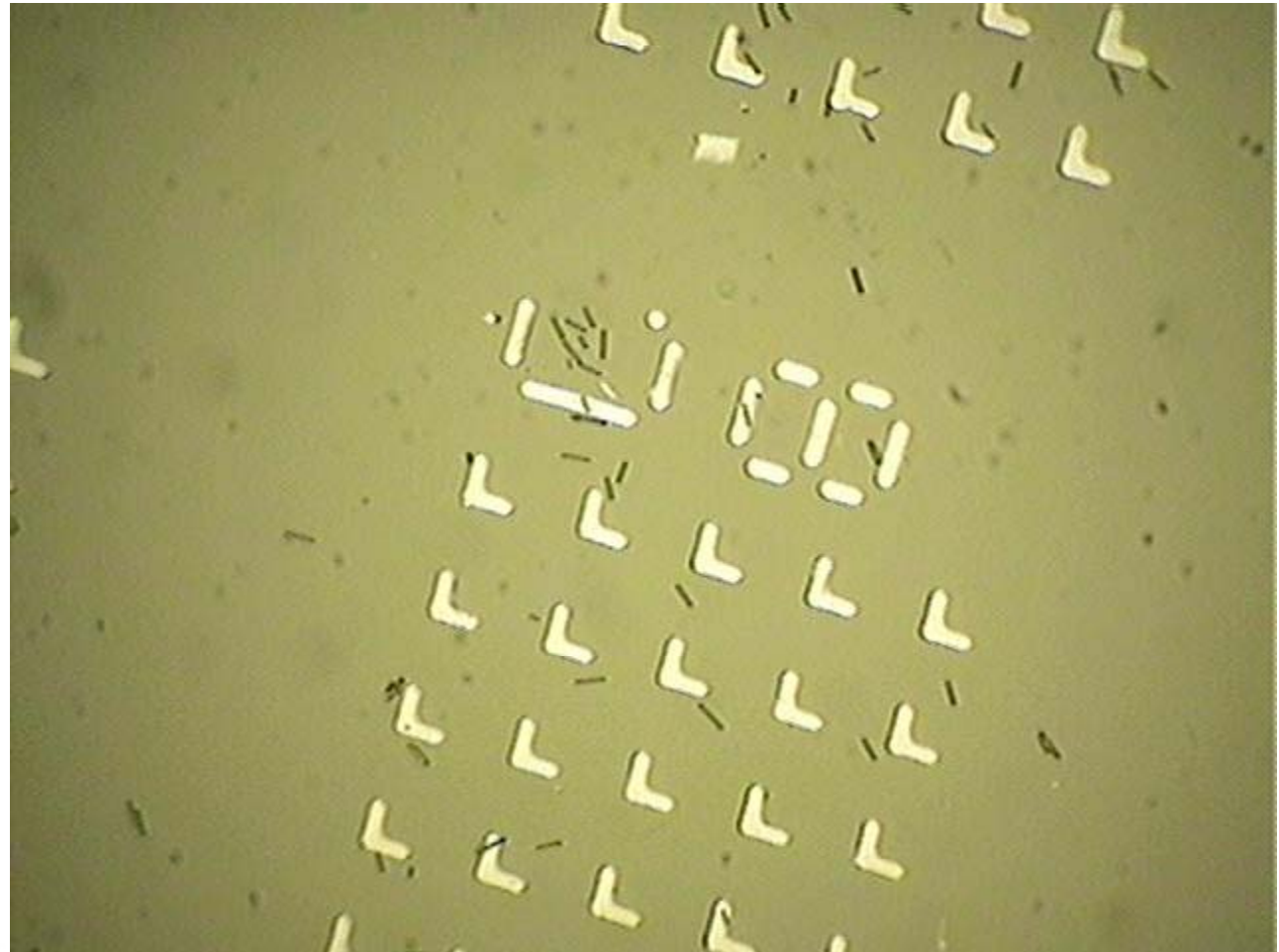


GaAs/AlGaAs  
core-shell

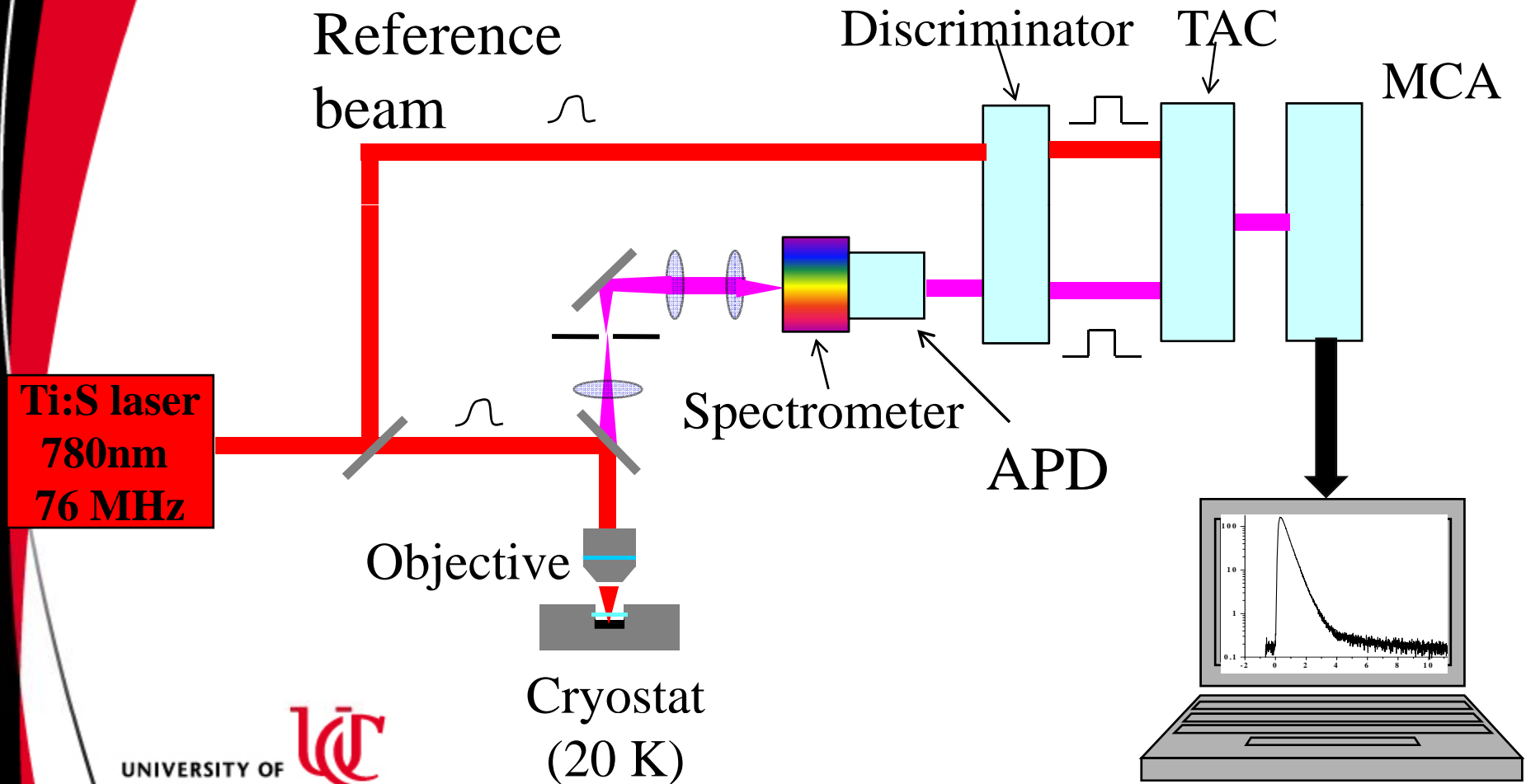


# Sample Preparation

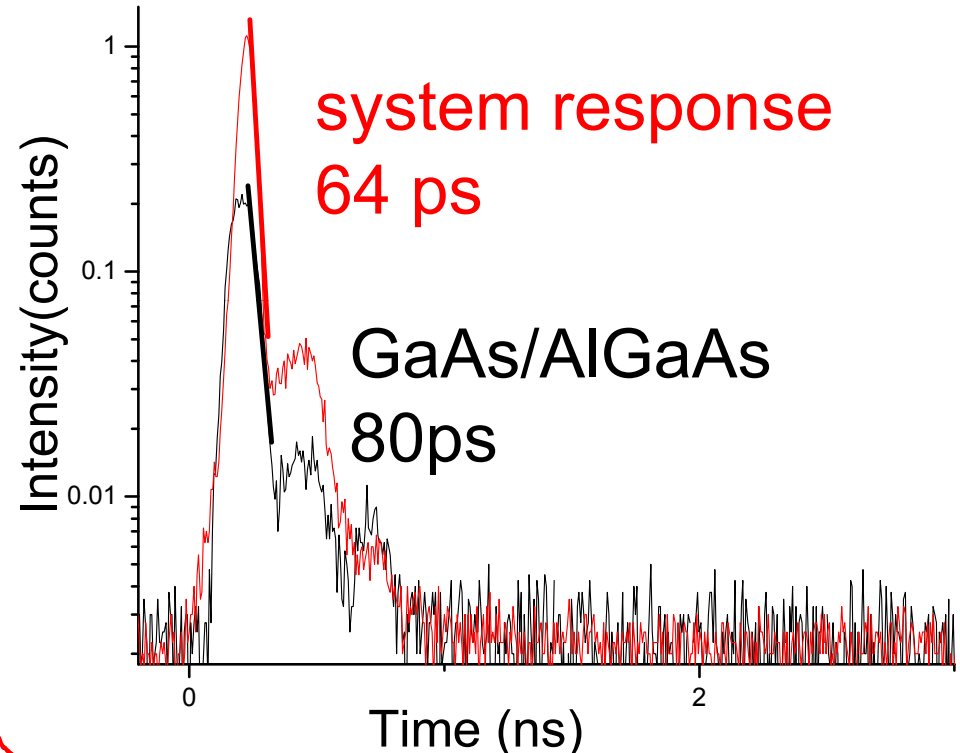
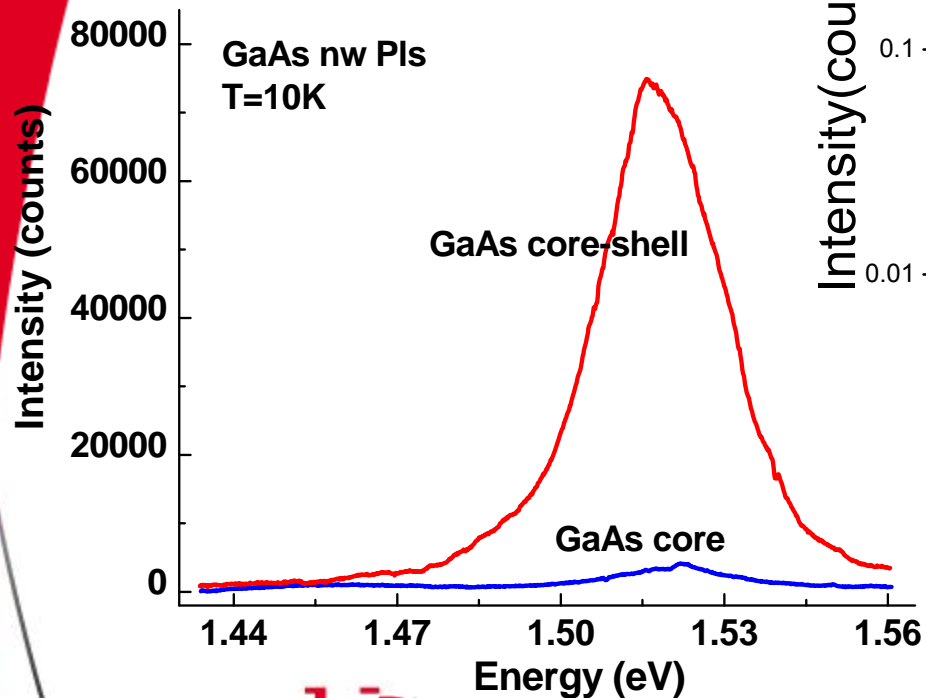
## Mechanical transformation



# Experimental Setup



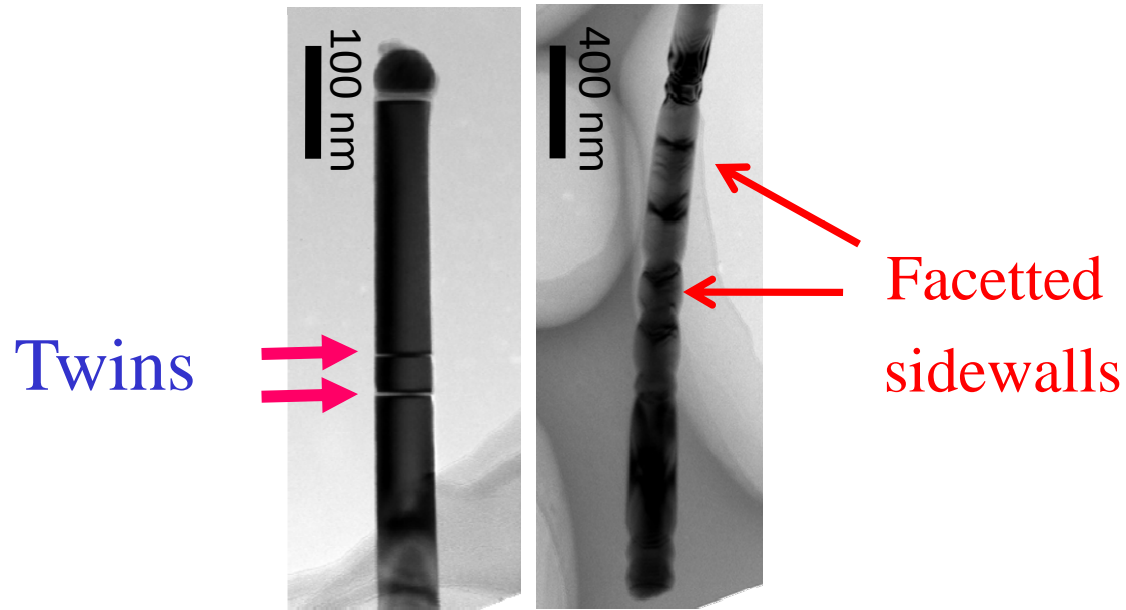
# Short lifetimes, low Quantum Efficiency



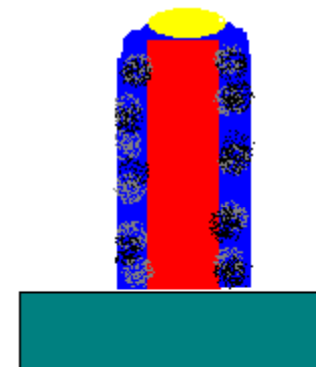
Shell increases QE, but lifetime is still short.

# Possible Causes

- TEM of GaAs core



- Oxidation of AlGaAs Shell

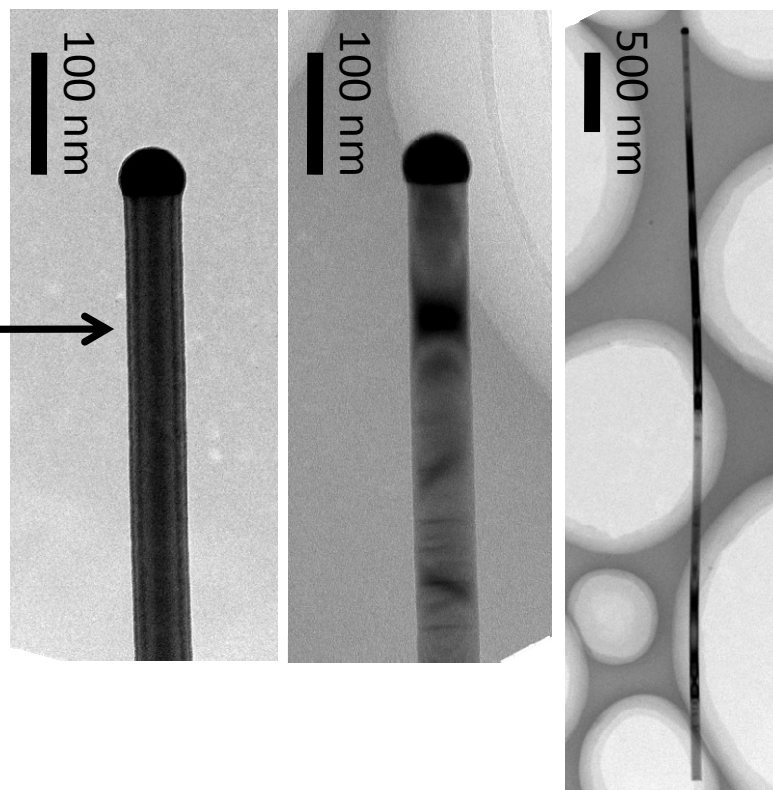




# A New Growth Procedure

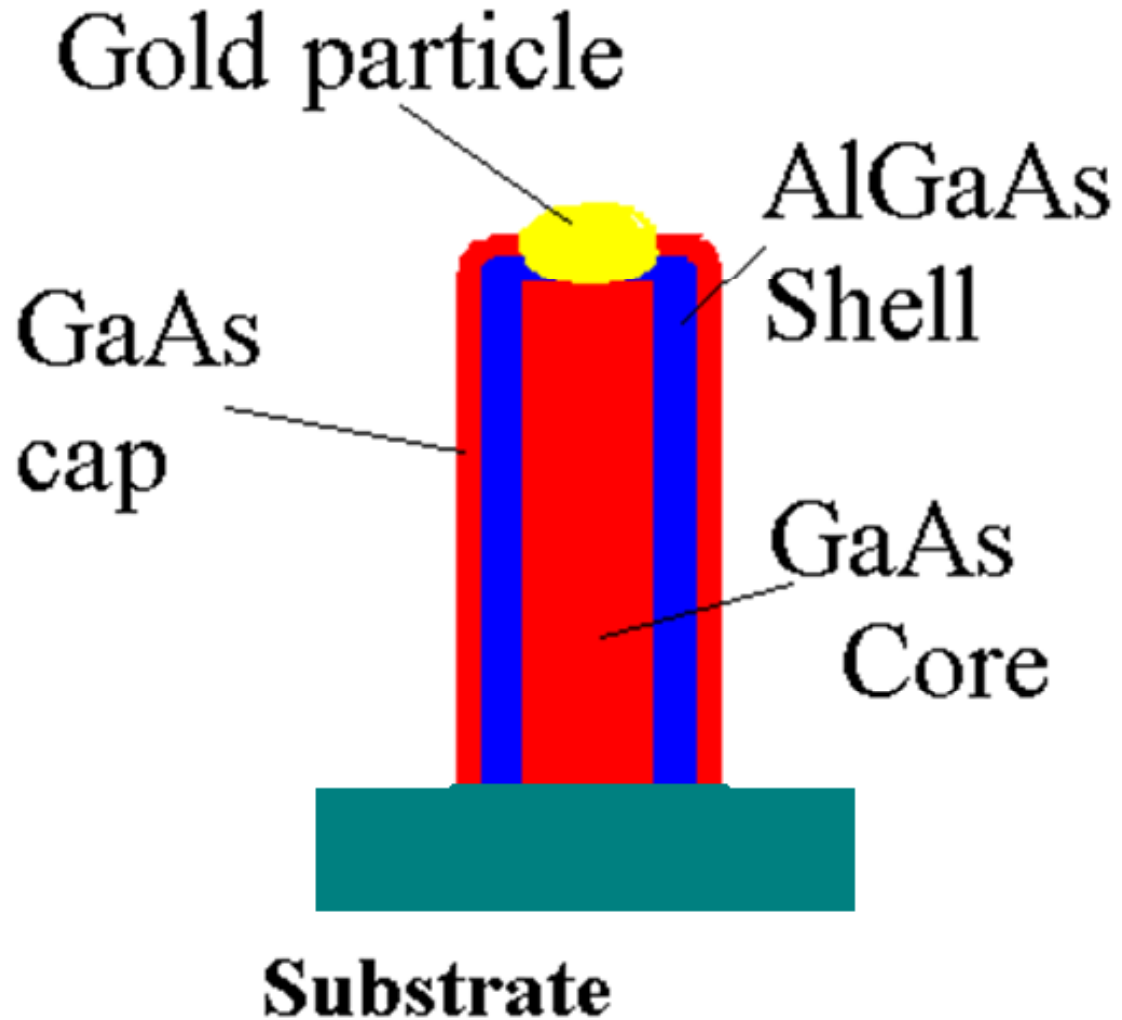
- Two-temperature growth

No twin defects !

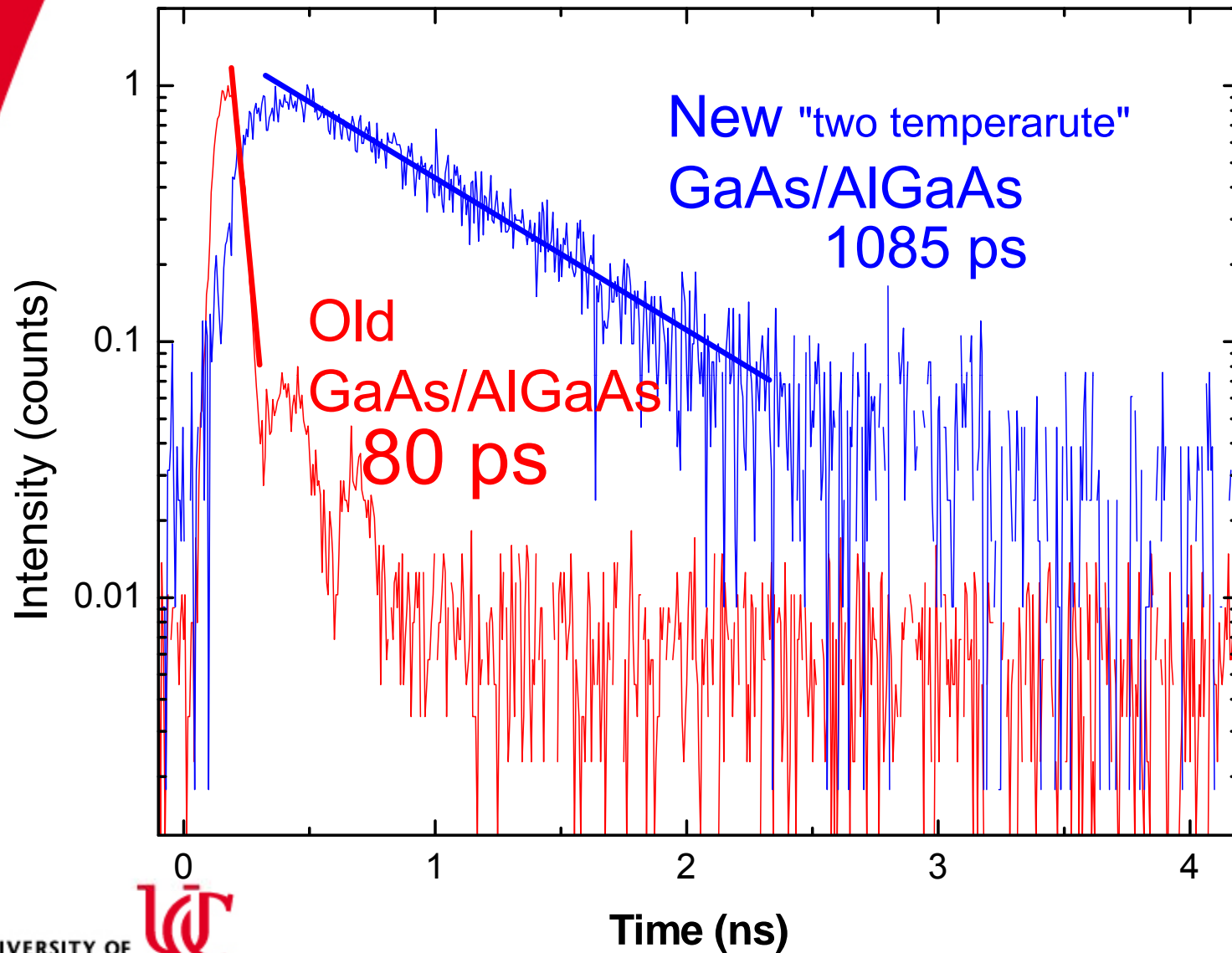


# A second change

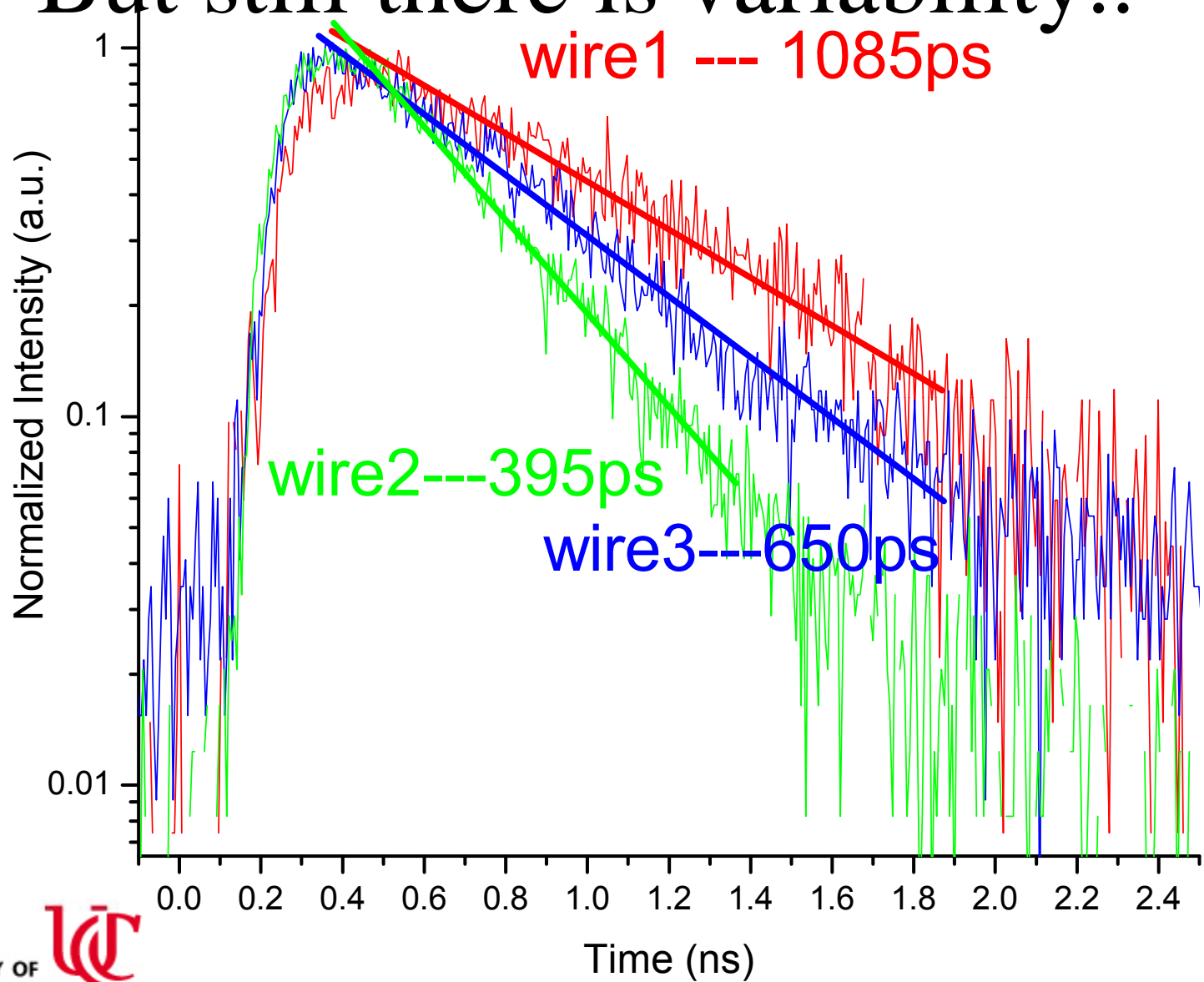
- Add 5nm GaAs cap ...eliminates oxidation.



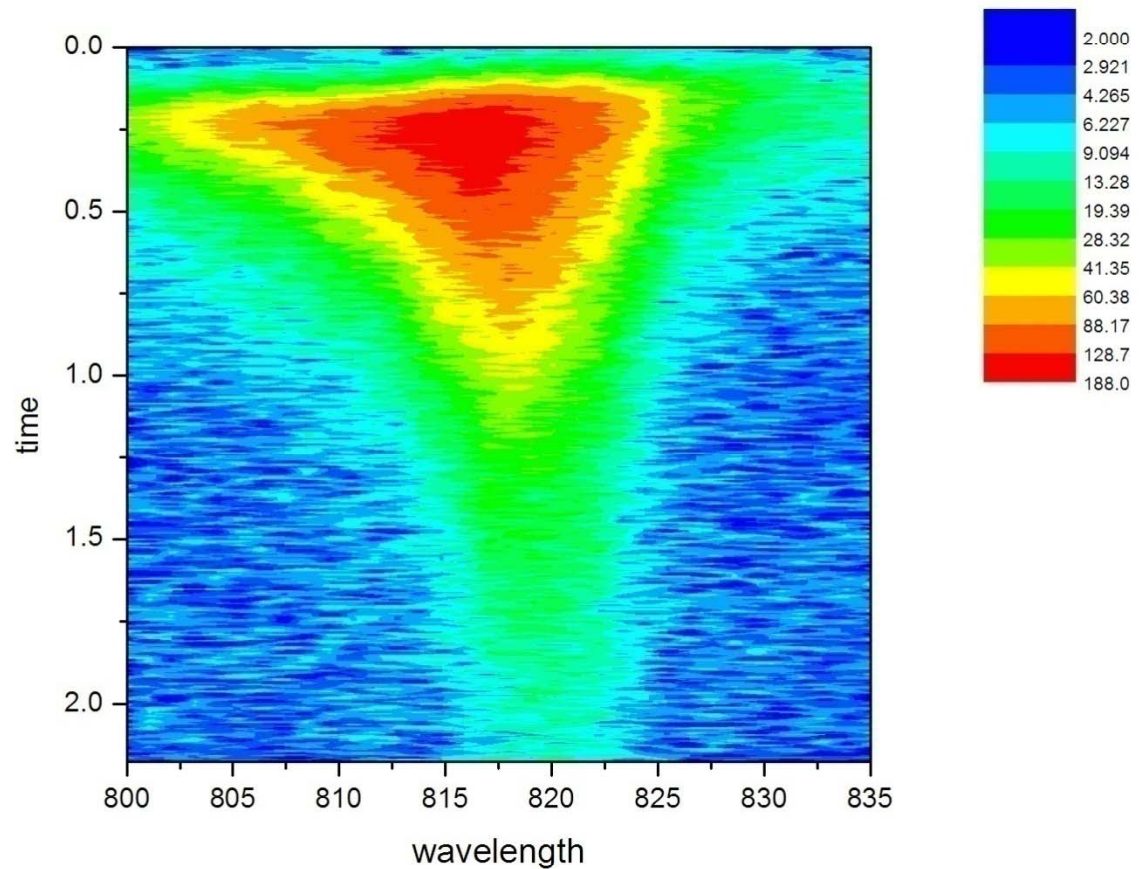
# New growth .... Long lifetimes



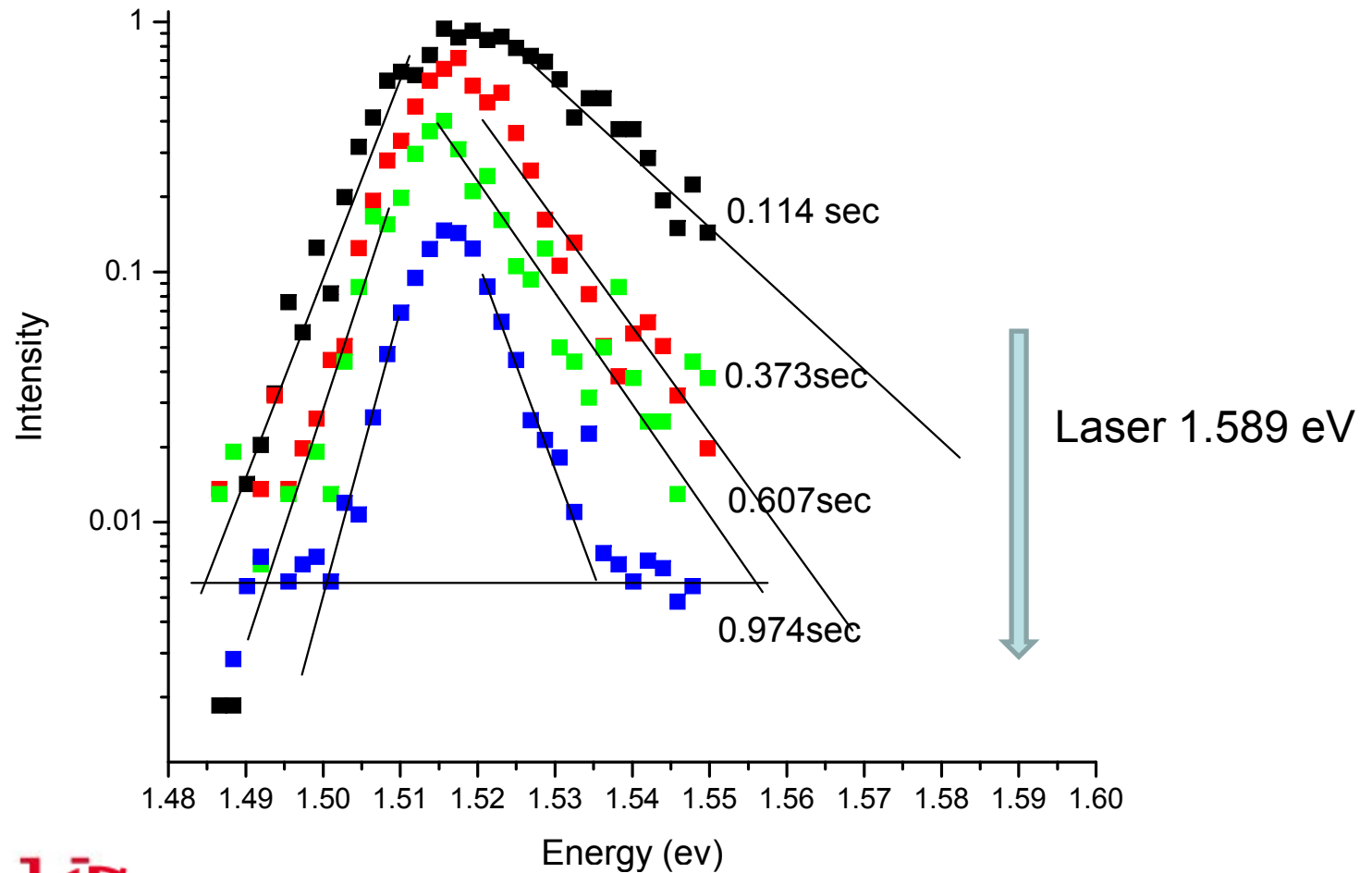
# But still there is variability..



# Time-resolved Spectral map of a single wire



# Electron-hole plasma to exciton PL





# Summary

- New growth method yields
  - Minimizes tapering
- Exhibits high quantum efficiency with a very long exciton lifetime ranging from 0.4 to 1.2 ns at 20 K.
- This will lead us to find electron Hole Plasma under high power pulsed excitation.