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## Enhanced Electron Yield Measurements of Extremely Low-Conductivity High Yield Dielectrics

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*Utah State University*

JR Dennison  
*Utah State University*

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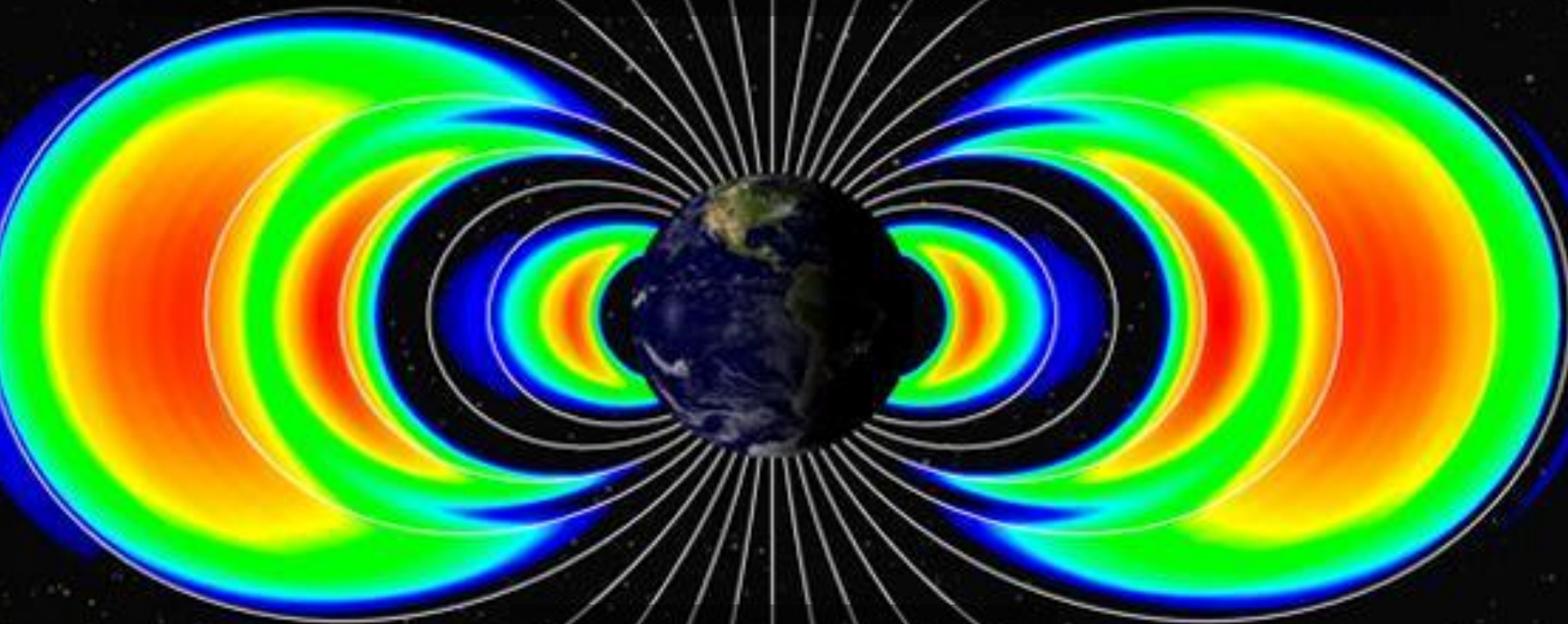
Christensen, Justin and Dennison, JR, "Enhanced Electron Yield Measurements of Extremely Low-Conductivity High Yield Dielectrics" (2015). American Physical Society Four Corner Section Meeting. *Presentations*. Paper 123.

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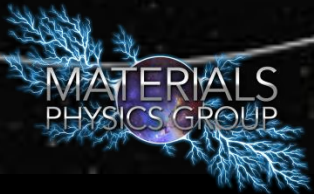
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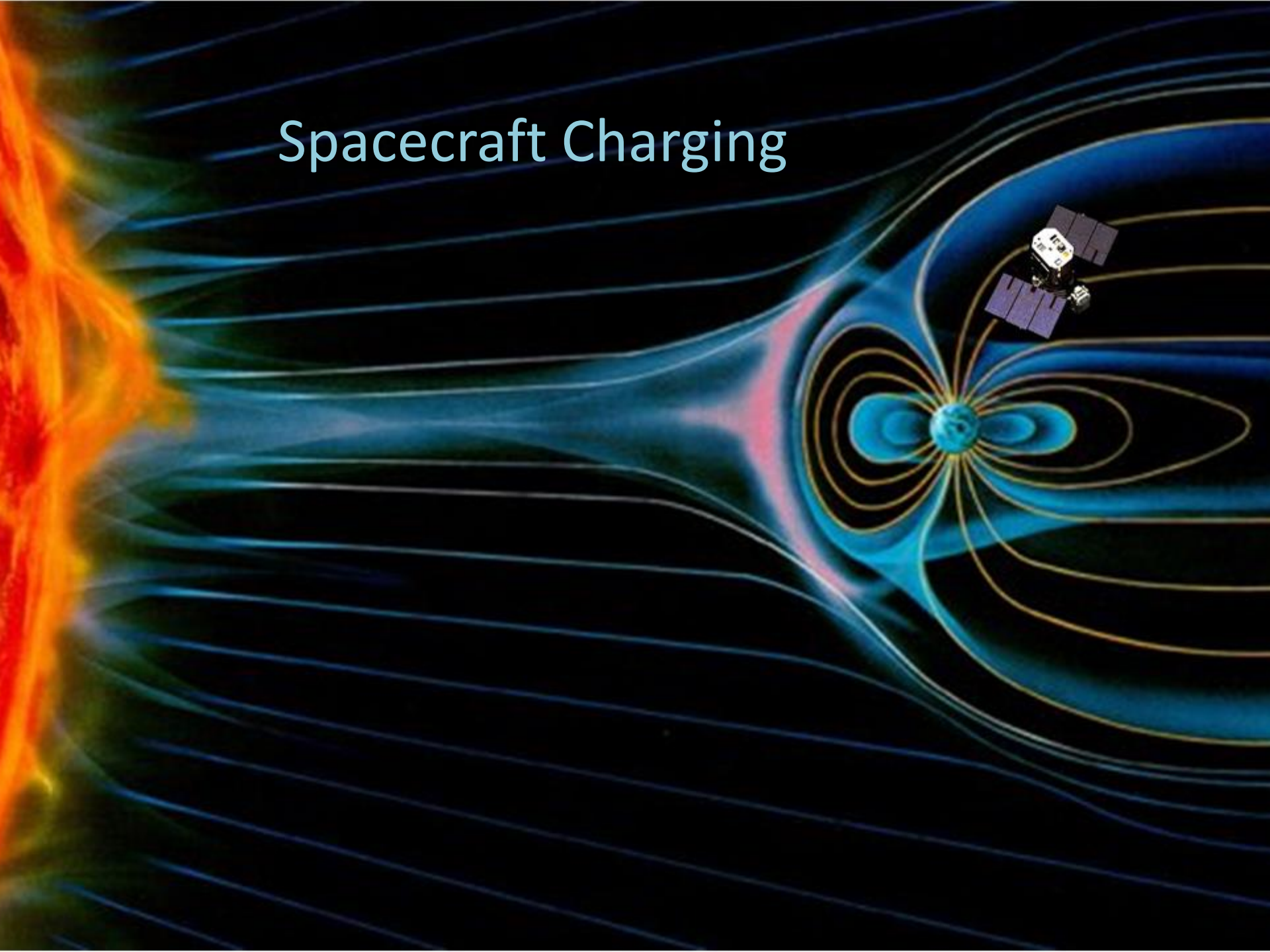
# Enhanced Electron Yield Measurements of Extremely Low-Conductivity High- Yield Dielectrics



Justin Christensen  
JR Dennison



# Spacecraft Charging

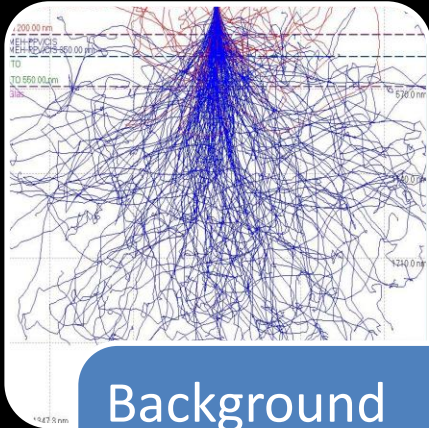




# Electron Microscopy

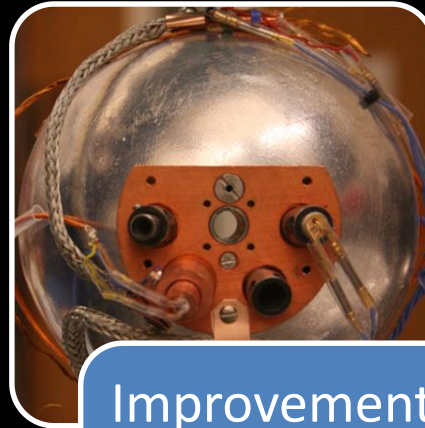


# Outline



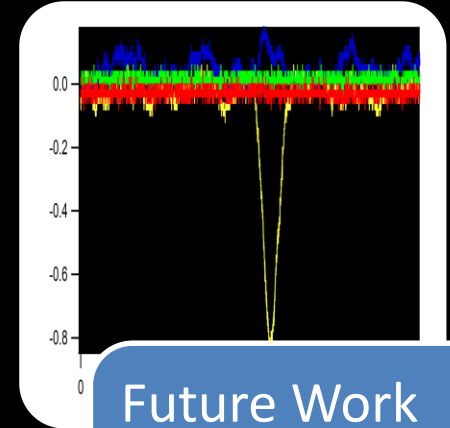
## Background

- What is Yield
- Measuring Yield
  - Conductors
  - Insulators



## Improvements

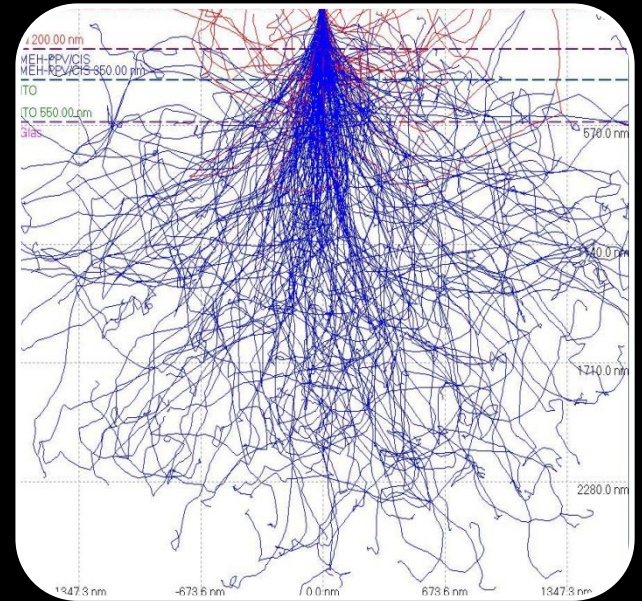
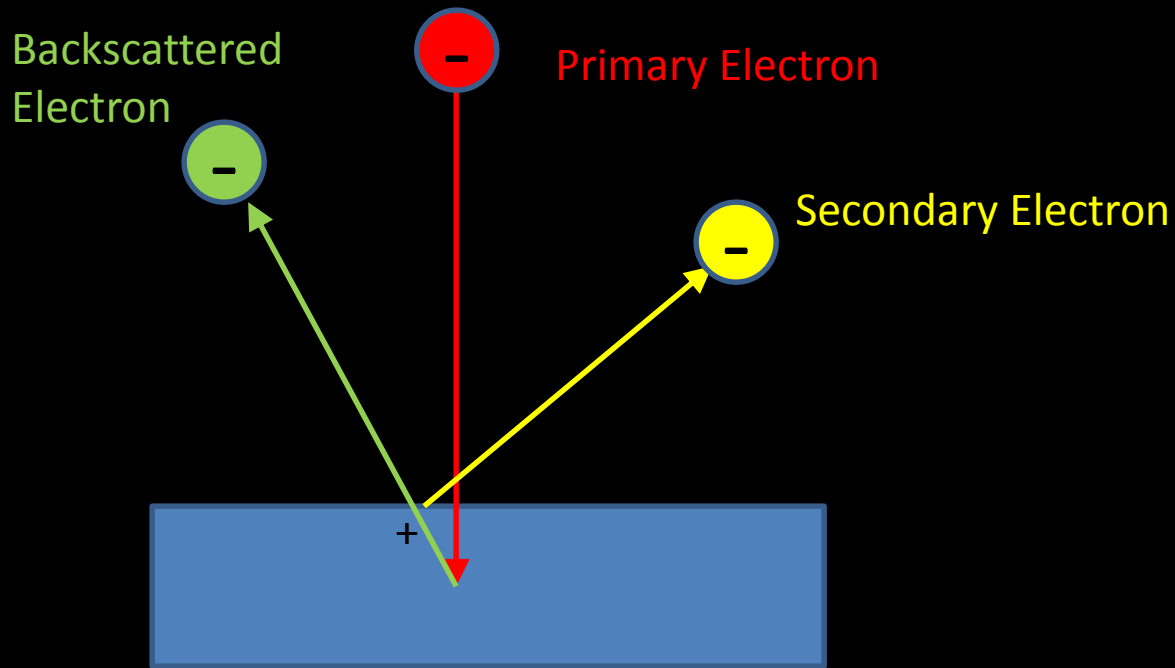
- Measurement
- Neutralization
- Analysis



## Future Work

- Verify Model
- Various Insulators

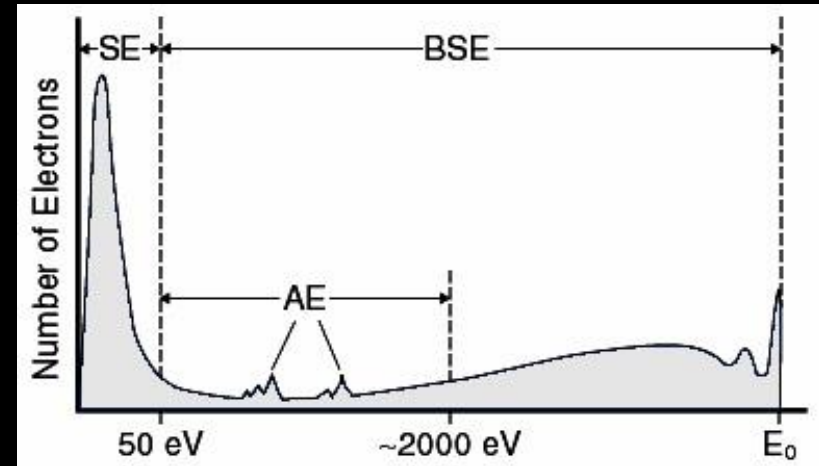
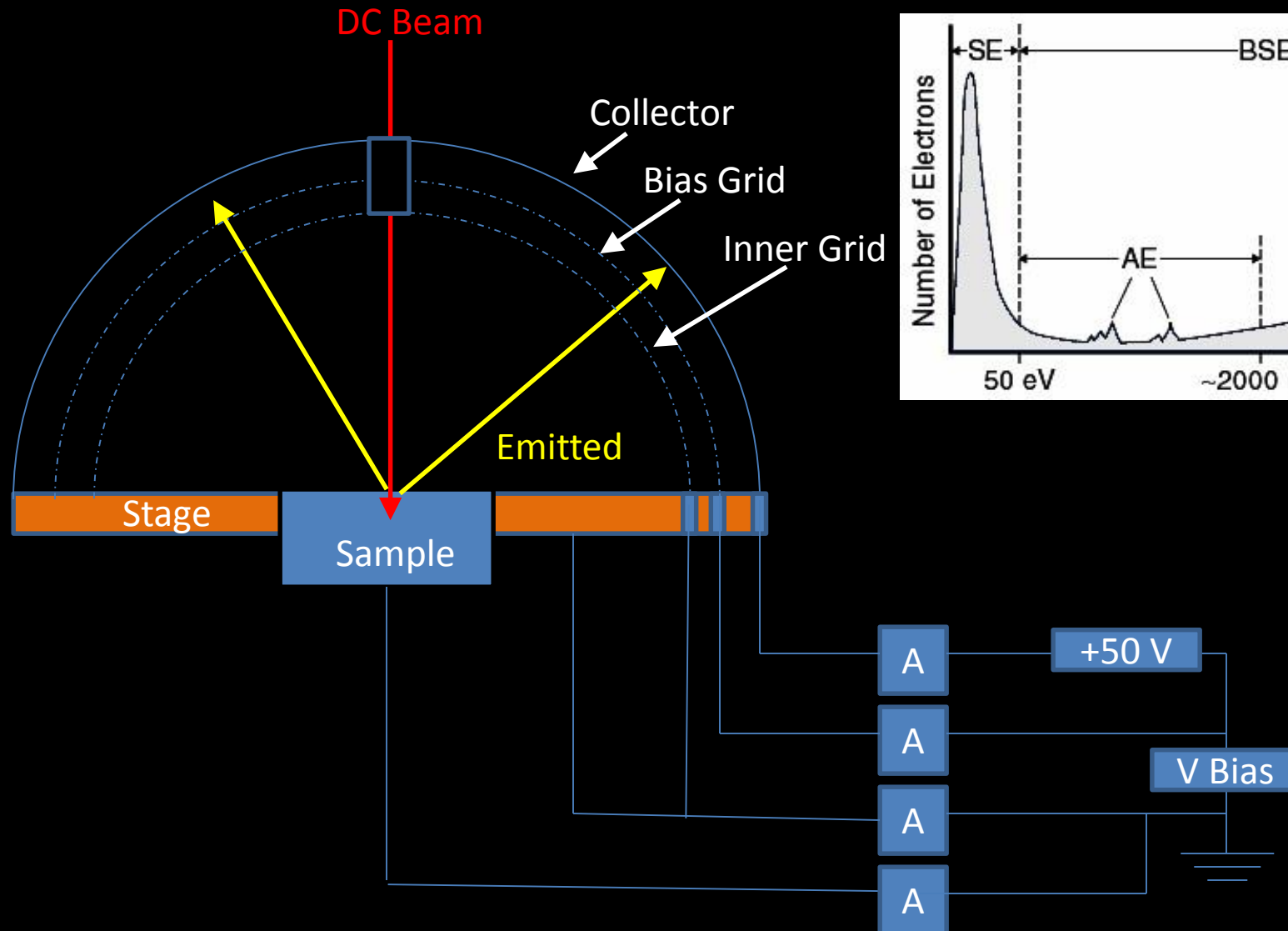
# What is Yield?



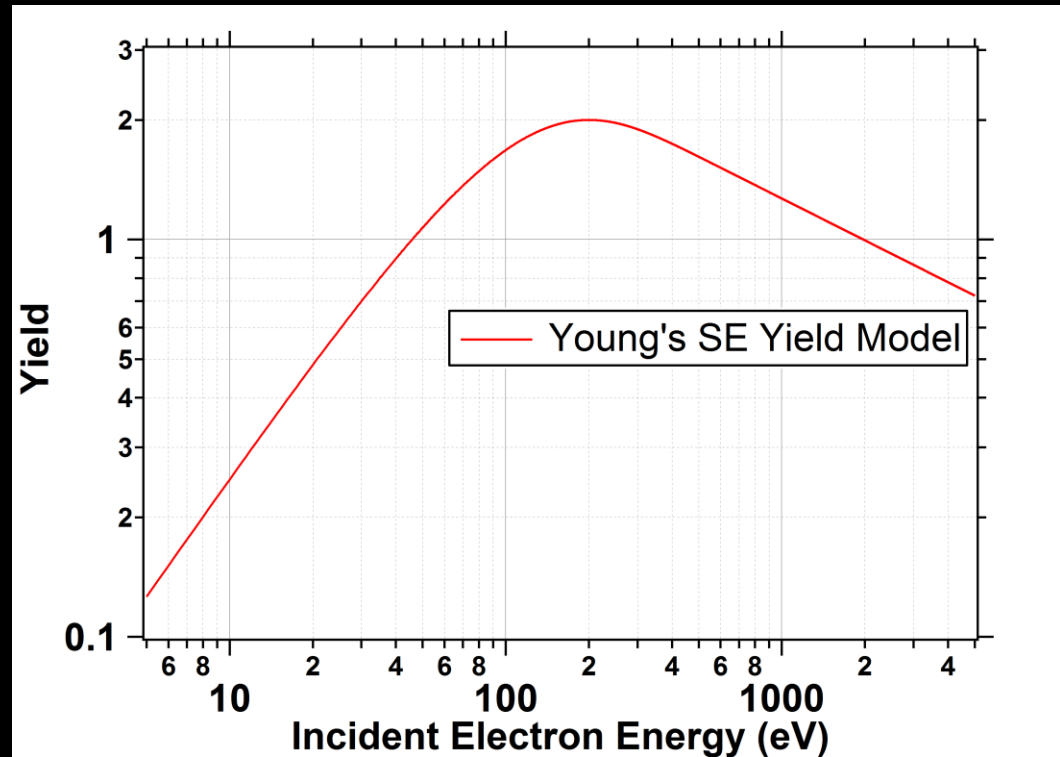
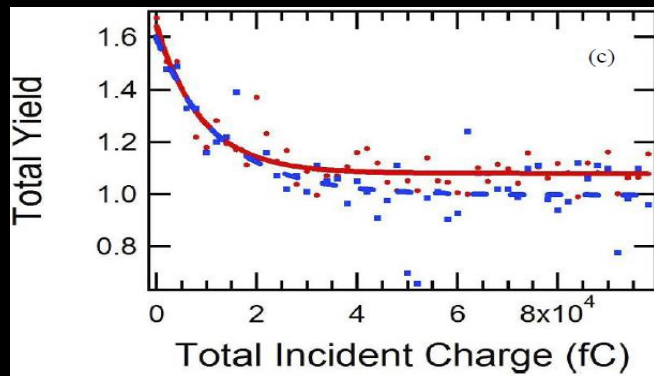
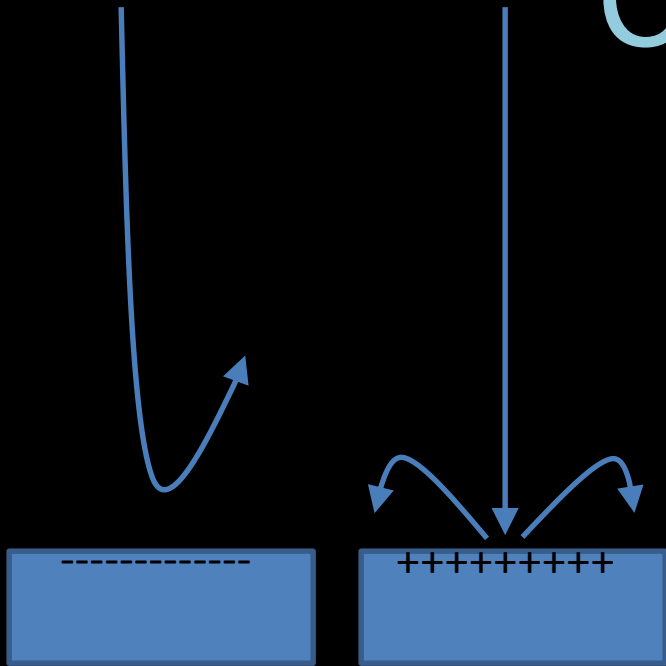
$$\sigma = \frac{\text{charge}_{emit}}{\text{charge}_{inc}}$$

Charge determined by “Yield”  
( $\sigma$ )

# Yield of conductors



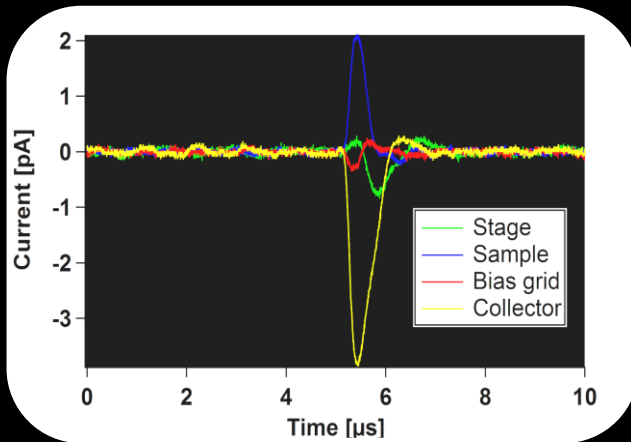
# Charging



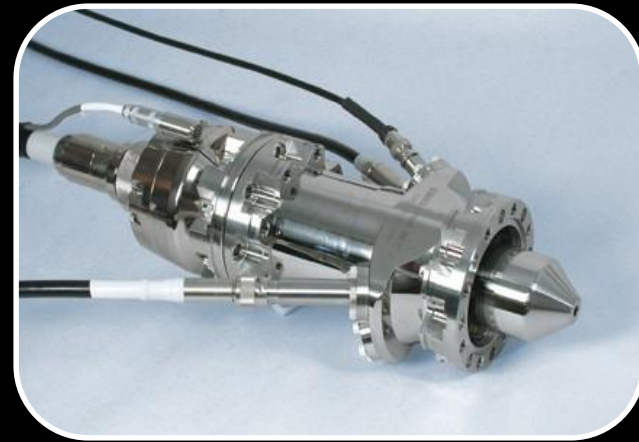


# How do we fix it?

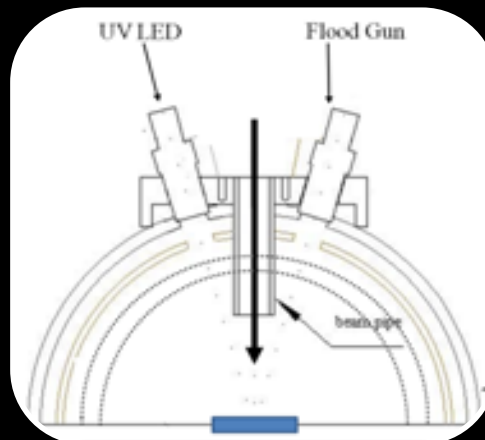
Fast Low-Current Measurement



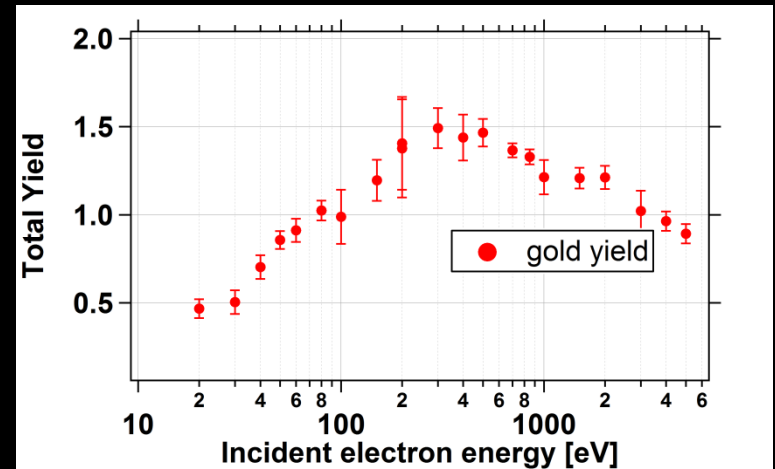
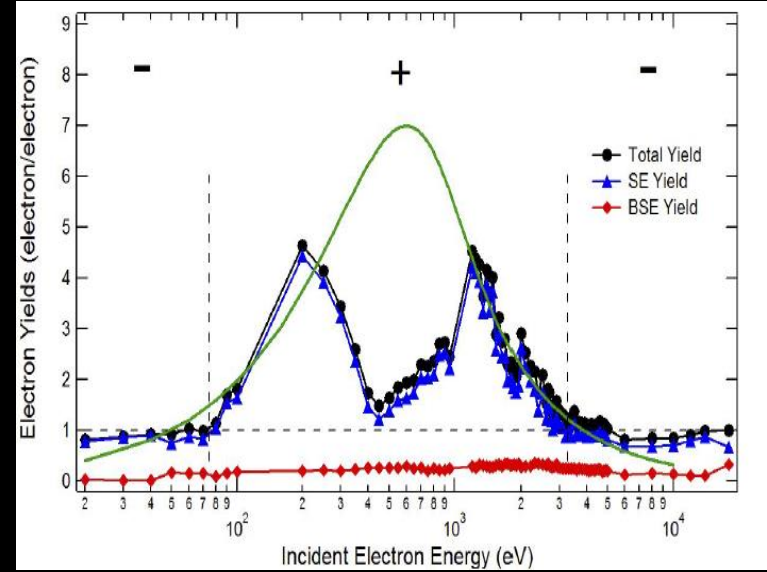
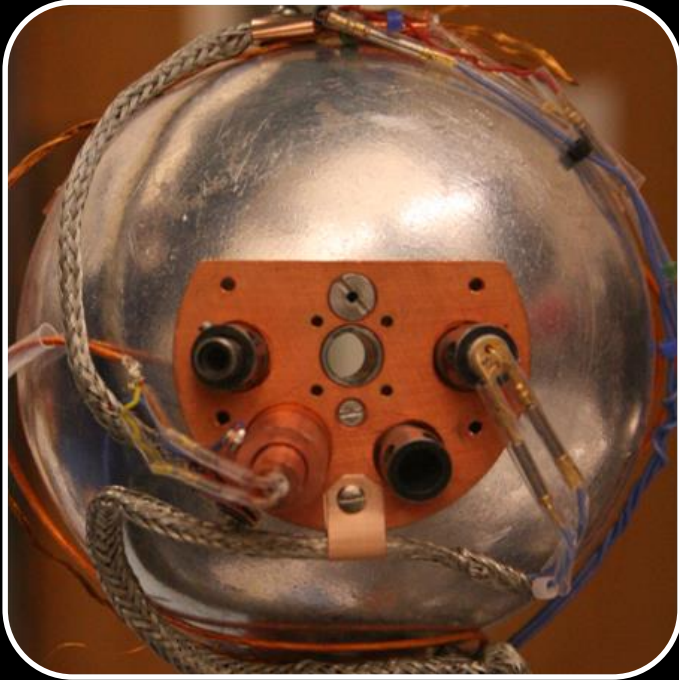
Pulsed Electron Beam



Charge Neutralization



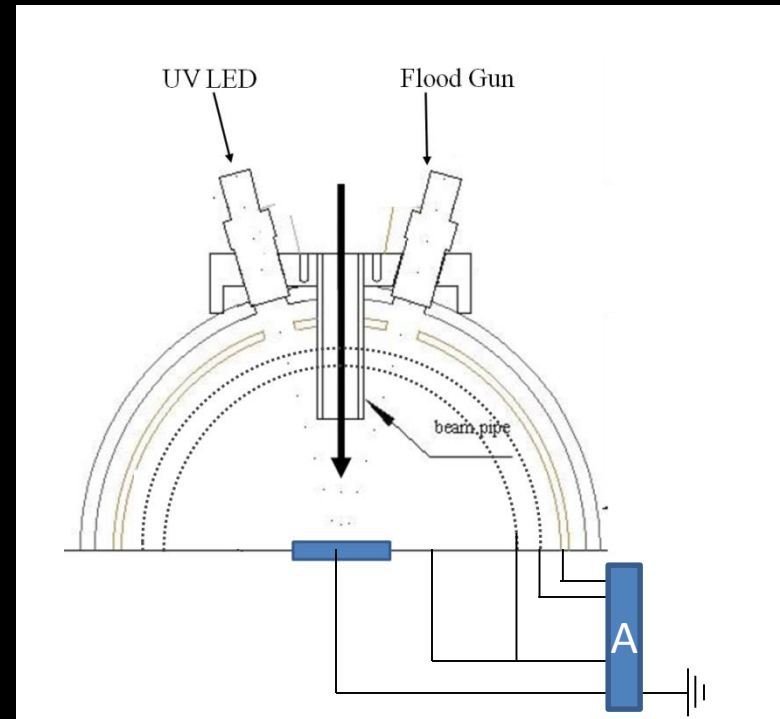
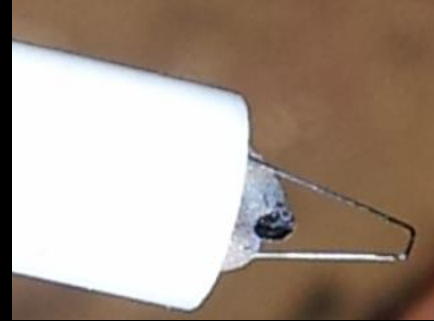
# It worked, kind of



# Improvements

## Problems

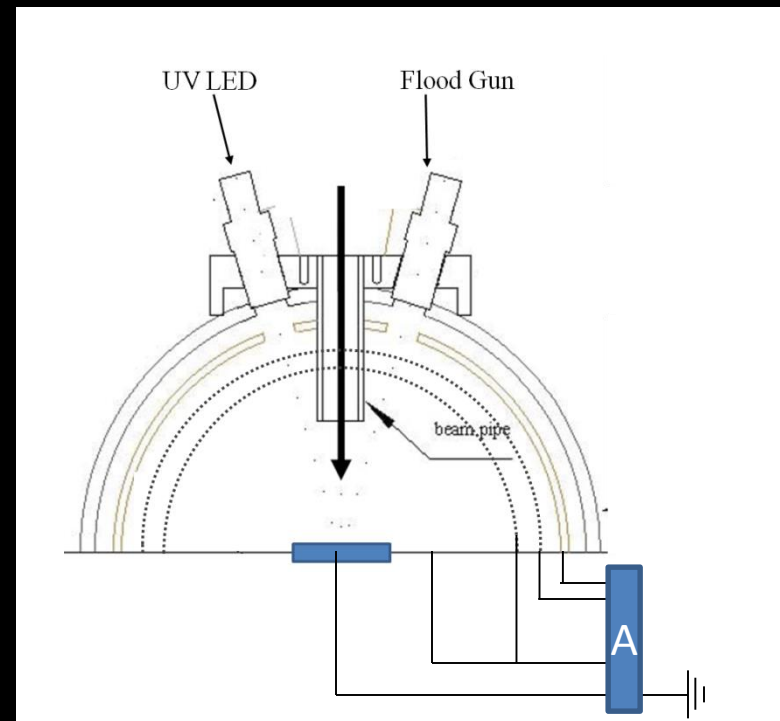
- Tungsten filament
- Grounded inner grid
- Flood gun, UVLED ground loops
- UVLED  $\sim 290$  nm, low intensity
- Emitted charge calculation



# Improvements

## Problems

- Tungsten filament
- Grounded inner grid
- Flood gun, UVLED ground loops
- UVLED  $\sim 290$  nm, low intensity
- Emitted charge calculation

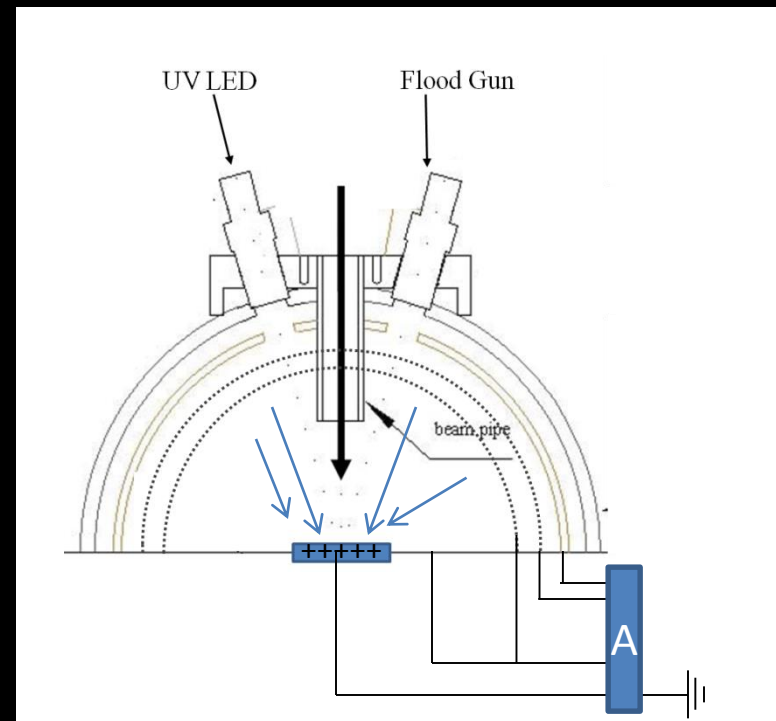
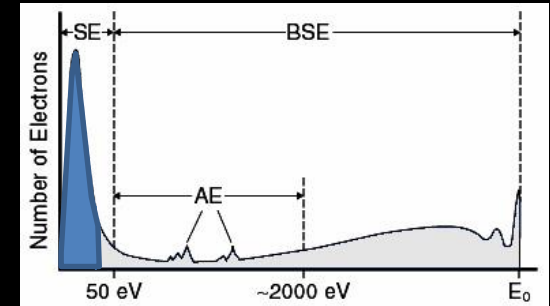




# Improvements

## Problems

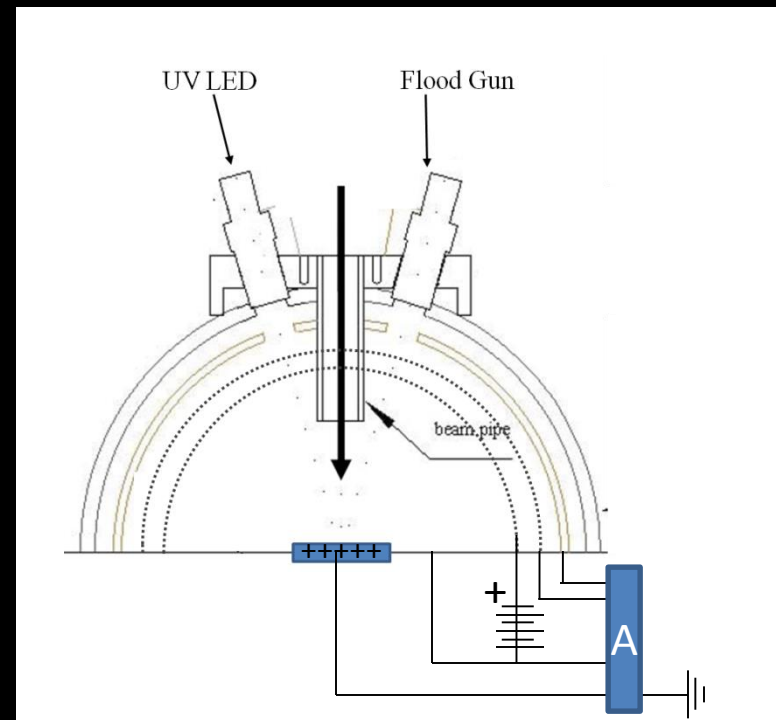
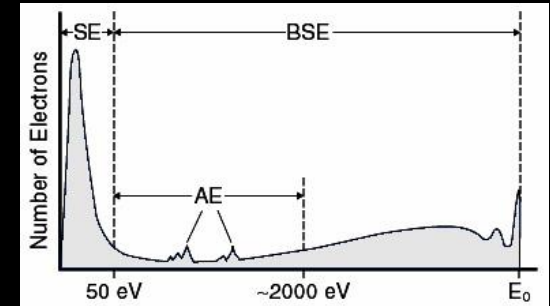
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# Improvements

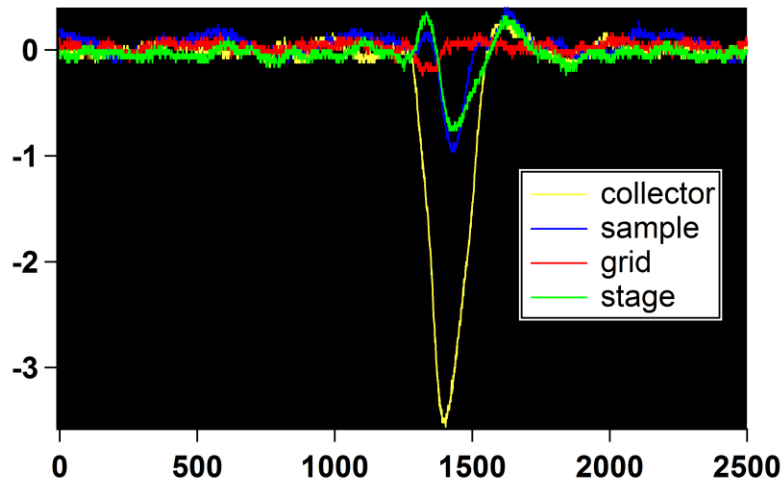
## Problems

- Tungsten filament
- Grounded inner grid
- Flood gun, UVLED ground loops
- UVLED  $\sim 290$  nm, low intensity
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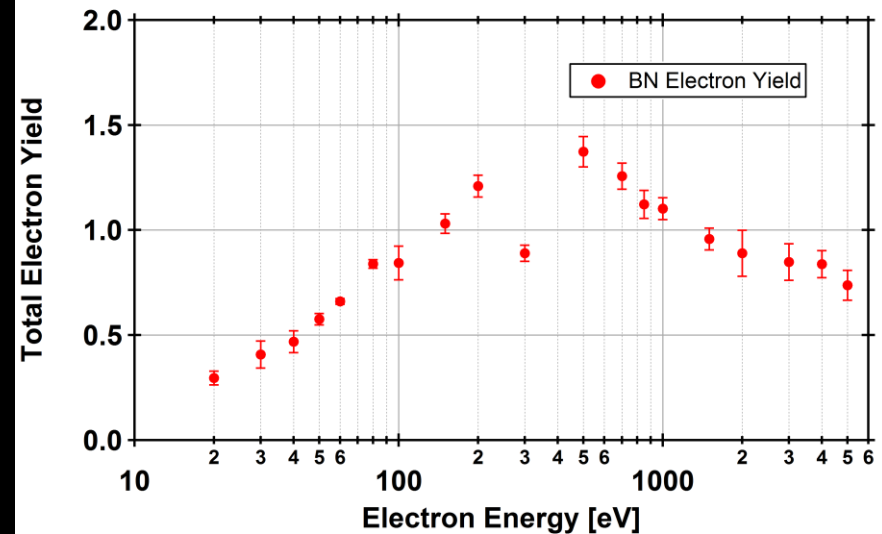


# Improvements

## Noise reduce

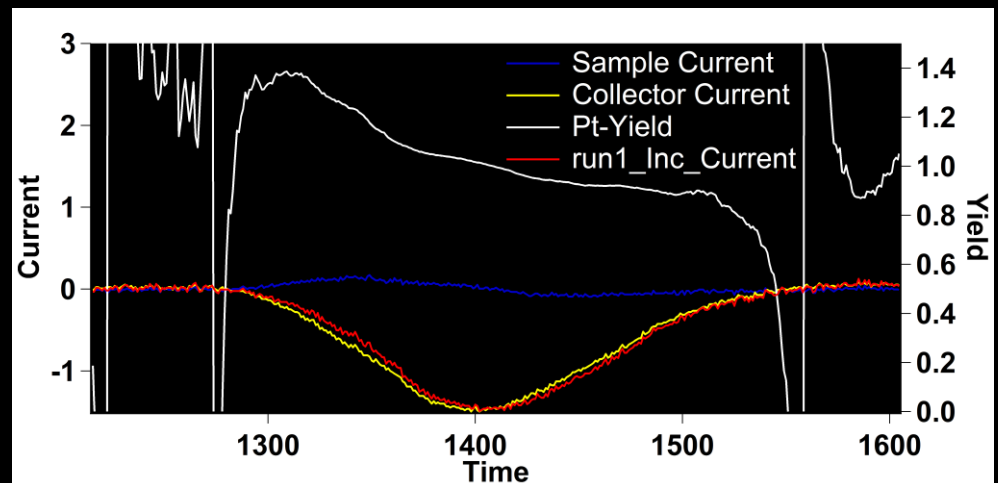
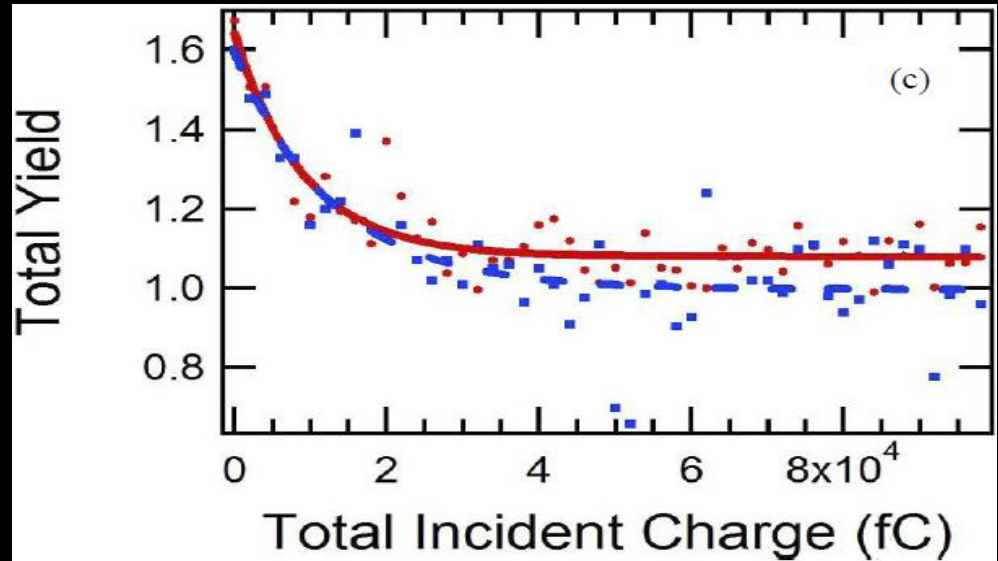


## Less charging



# Future Work

- Current analysis could show Yield changes in one pulse. (~1% of total pulse charge)
- Gold data should show no charging effects.
- Zero charge plateau.





# Conclusion

- Charge Neutralization
- Repeatable measurements
- Better analysis methods
- Lower signal-to-noise ratio



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