Test Stand Status

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University of Colorado, Boulder

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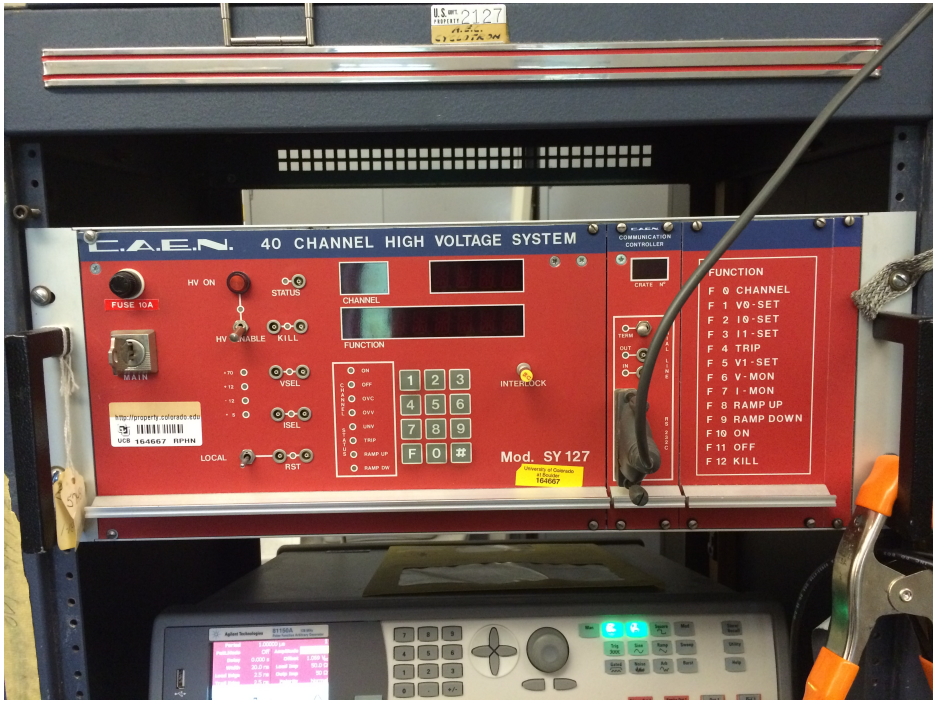
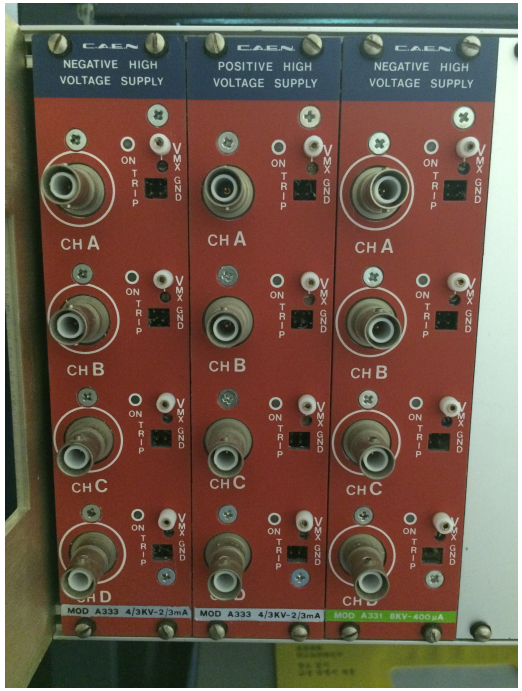
Part 1—high voltage supplies and preparing for cosmics

CAEN SY127

Our primary HV supply is an early '90s CAEN SY127
We have 3 modules on the back, a negative bias A331 (working), a negative bias A333 (not working), and a positive bias A333 (seems to be working...)

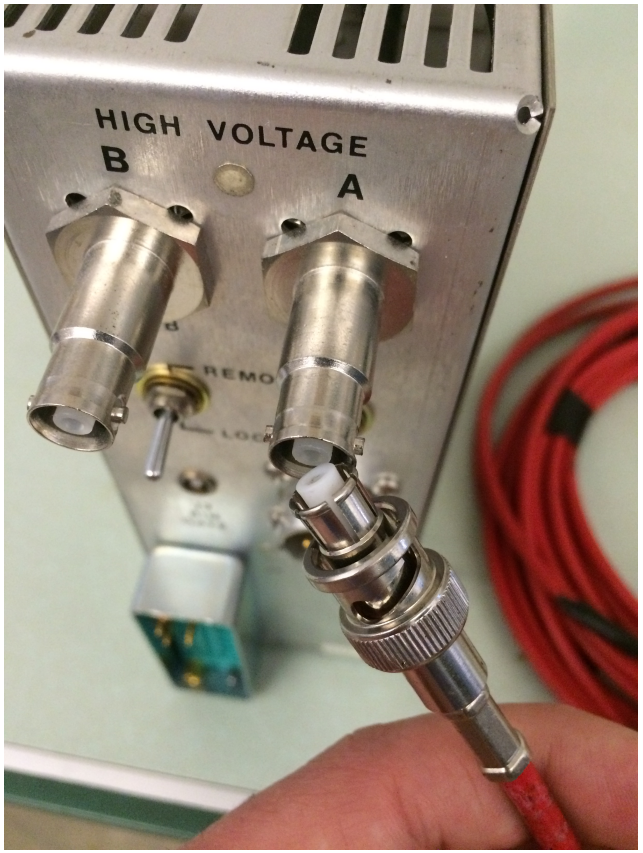




Unfortunately, we need a negative bias supply with high current (2–3 mA), and only the A333 has the right specs...

Bertan 380N

We also have an old Beran 380N laying around...



We're not sure if it supplies enough current, but it has the wrong HV jacks
Question to the audience: do all Bertans have these jacks, or does it depend on the model/voltage?

CAEN N1470

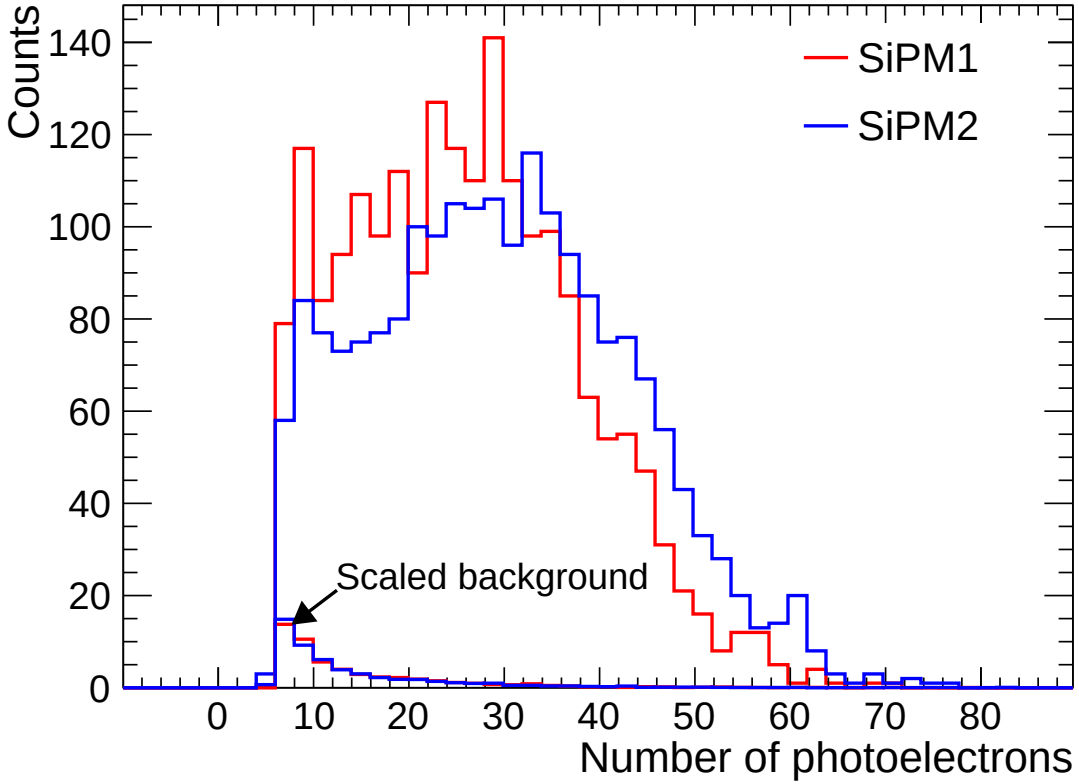
We have borrowed a CAEN N1470 from the particle physics group

The unit is very nice and has the specs we need, but we can't keep it forever
We've requested a quote from CAEN for a new one

Part 2—looking at the distributions from the source

Establishing consistency - Source scans

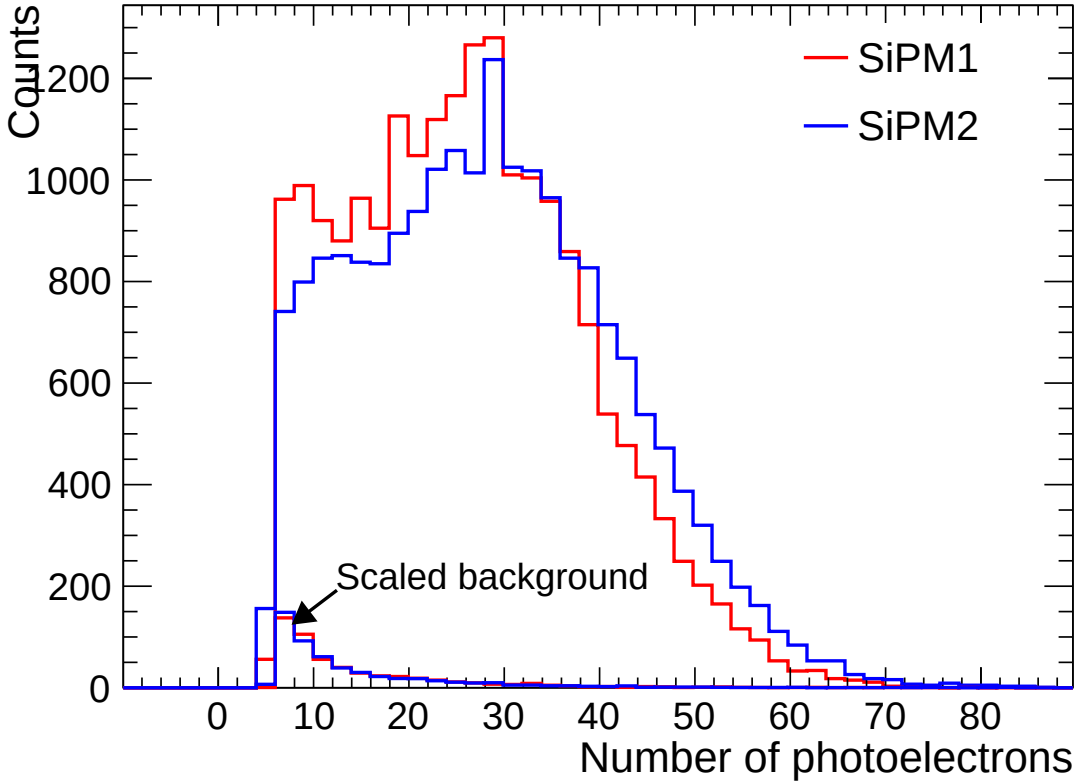
Distribution of Foreground and Background



Event count: 2,000
Foreground rate: 1038 Hz
Background rate: 27 Hz
Background percentage: 2.6%

Establishing consistency - Source scans

Distribution of Foreground and Background



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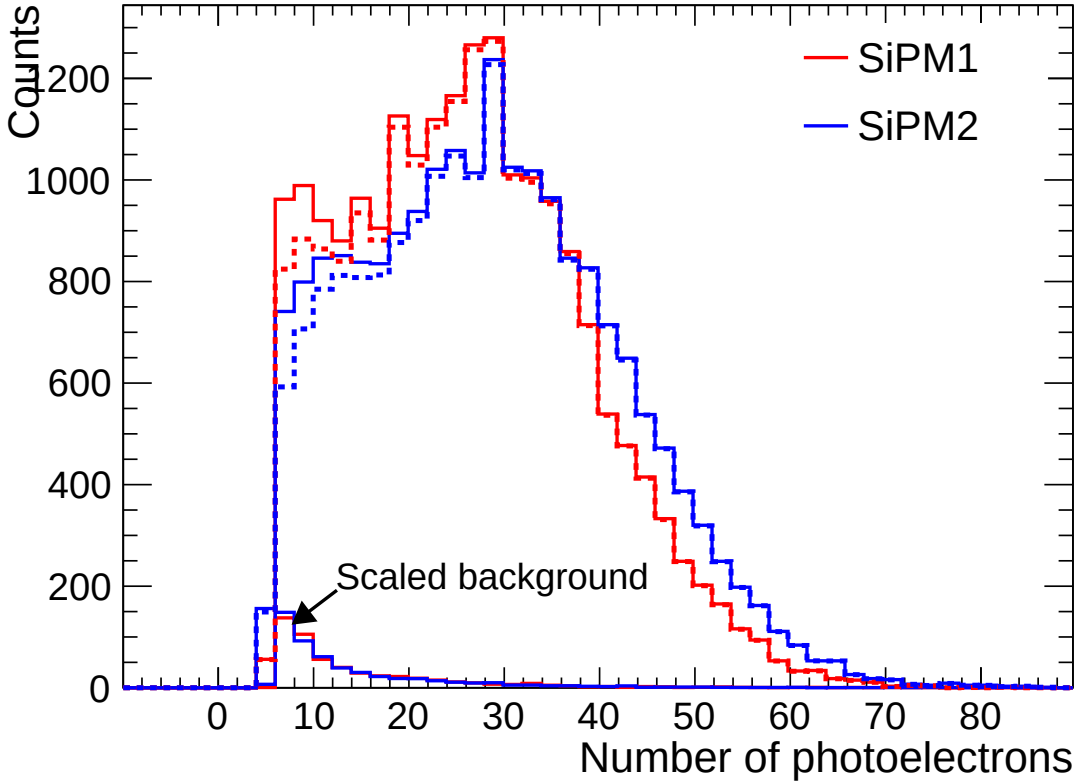
Background rate: 27 Hz
Background percentage: 2.6%

Establishing consistency - Source scans

Distribution of Foreground and Background



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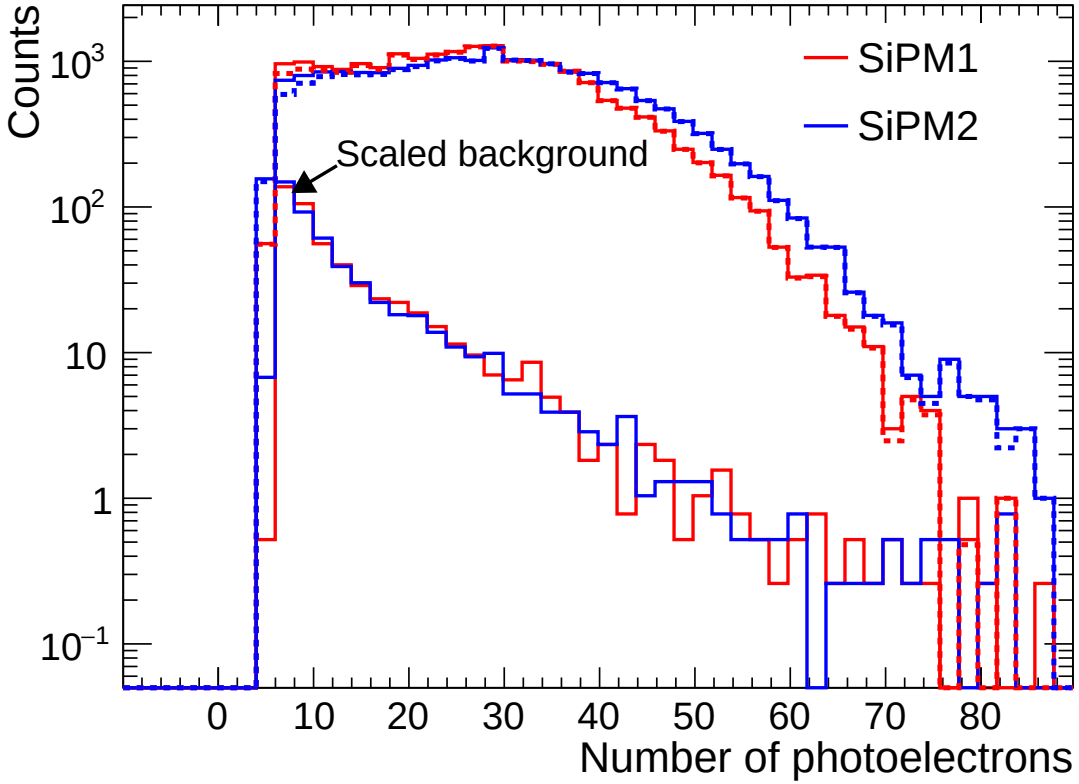
Background rate: 27 Hz
Background percentage: 2.6%

Establishing consistency - Source scans

Distribution of Foreground and Background



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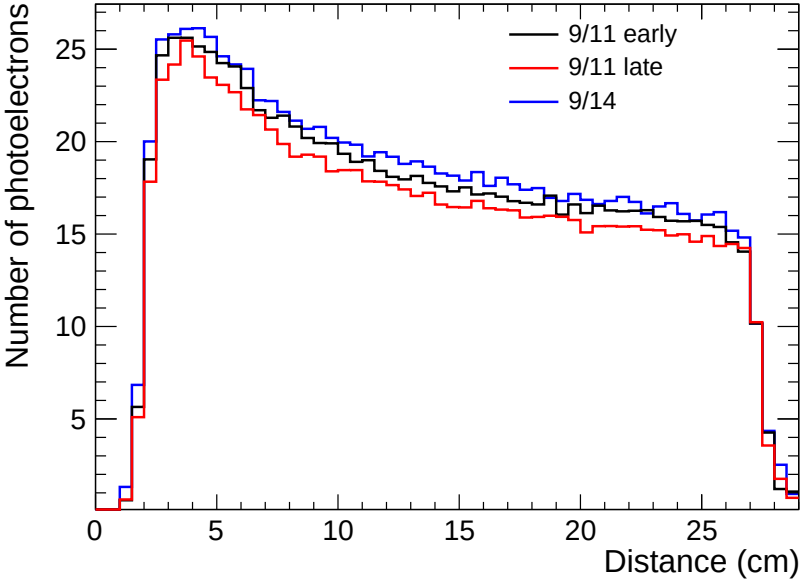
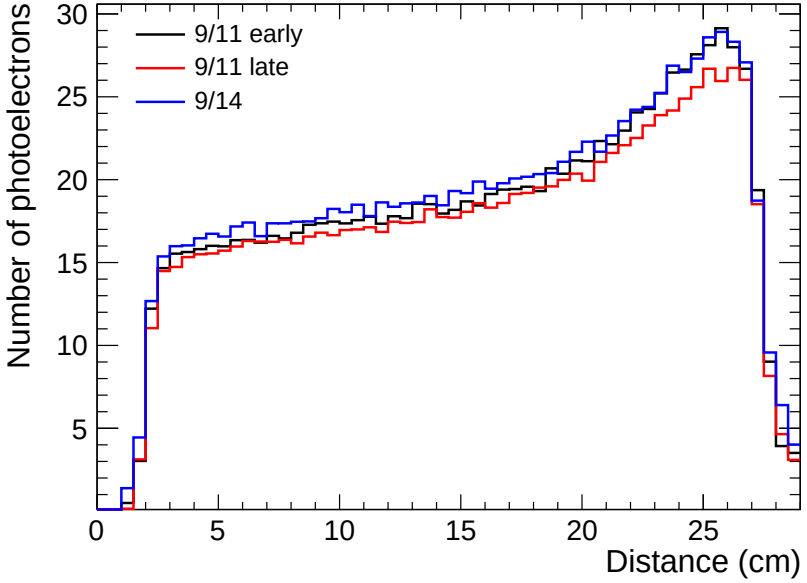
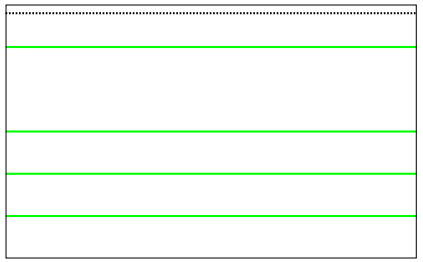
Part 3—establishing consistency in source scans

Establishing consistency - Source scans

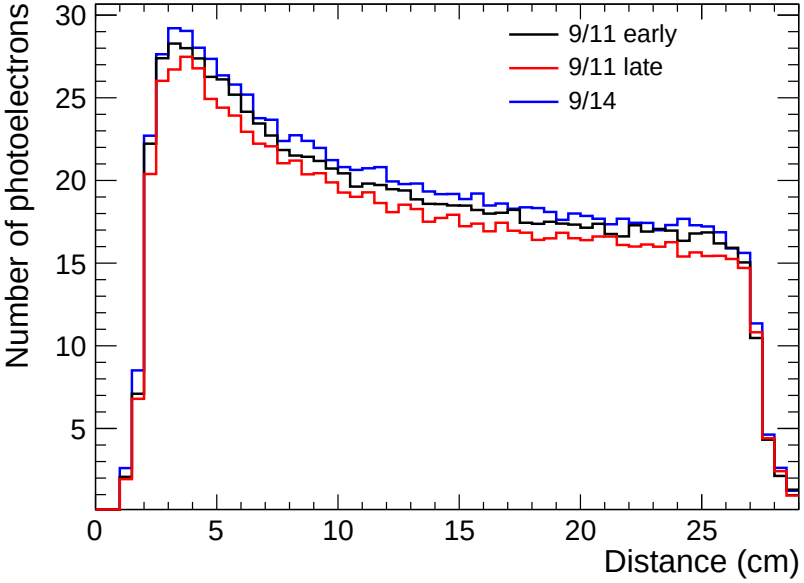


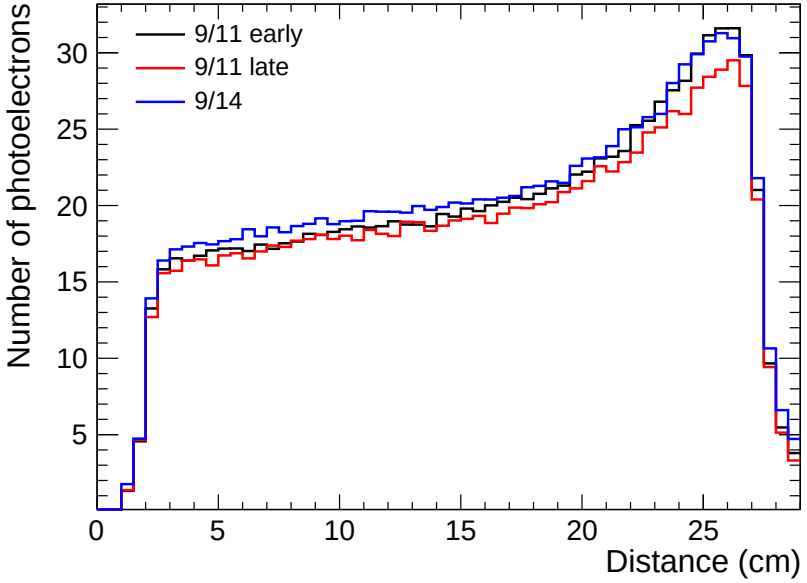


Projection 0, -2.0 cm from fiber

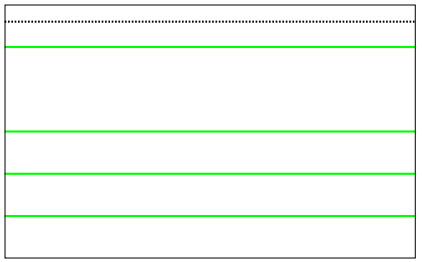


Establishing consistency - Source scans

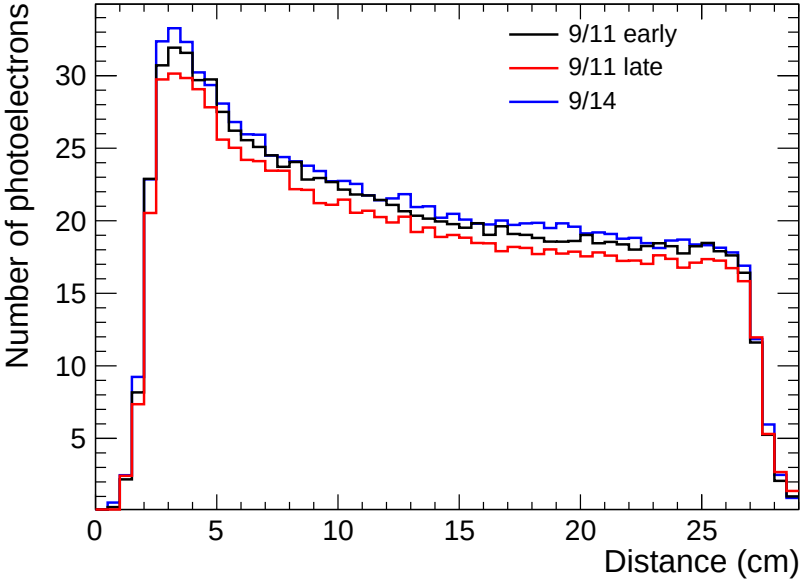


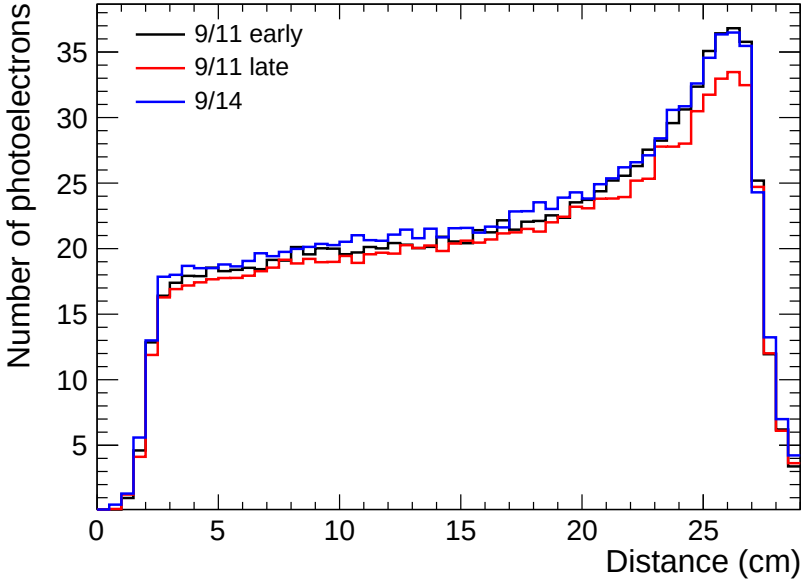


Projection 1, -1.5 cm from fiber



Establishing consistency - Source scans





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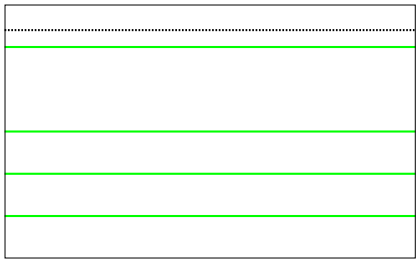
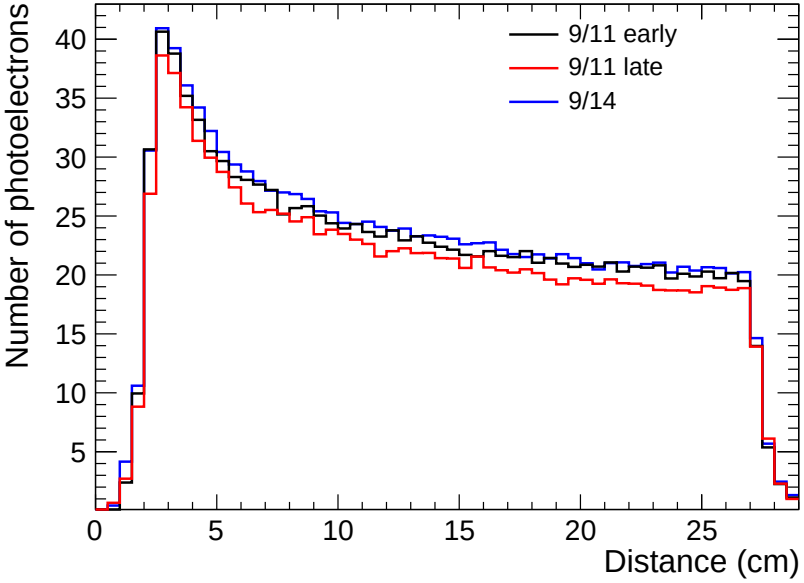
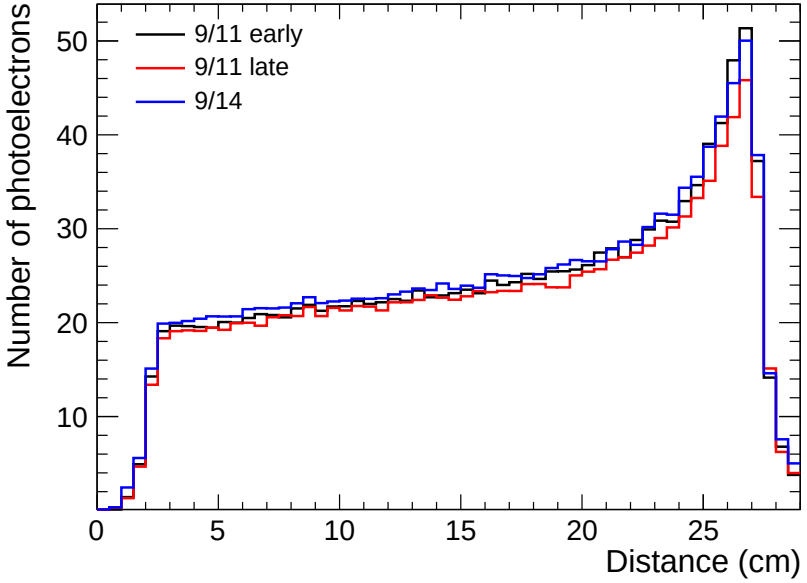
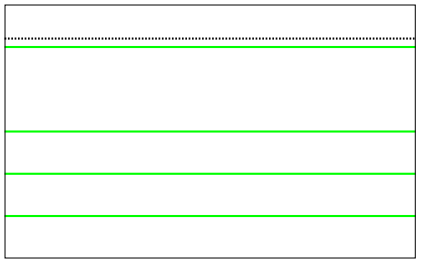


Establishing consistency - Source scans

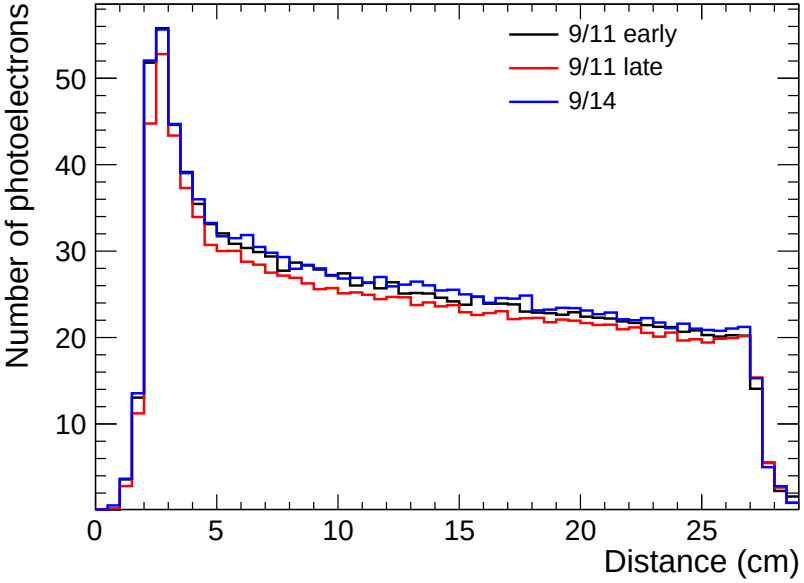


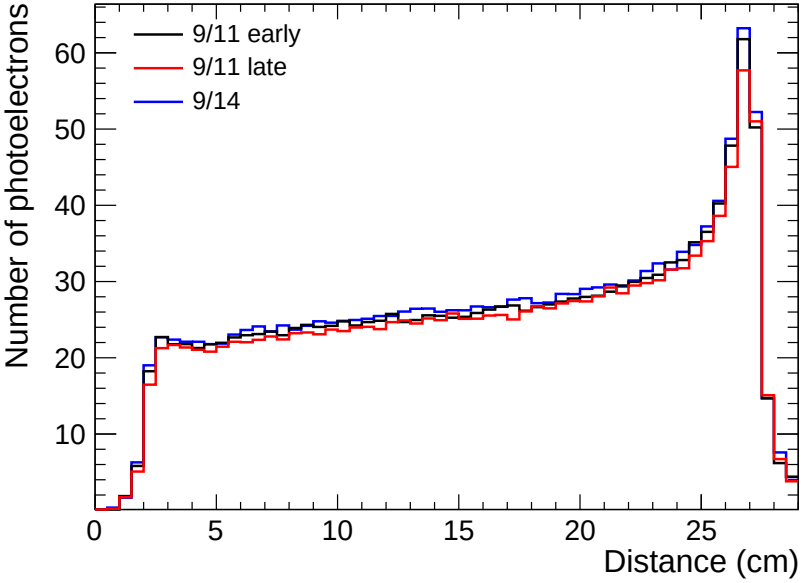


Projection 3, -0.5 cm from fiber

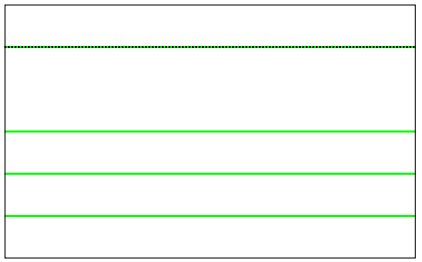


Establishing consistency - Source scans

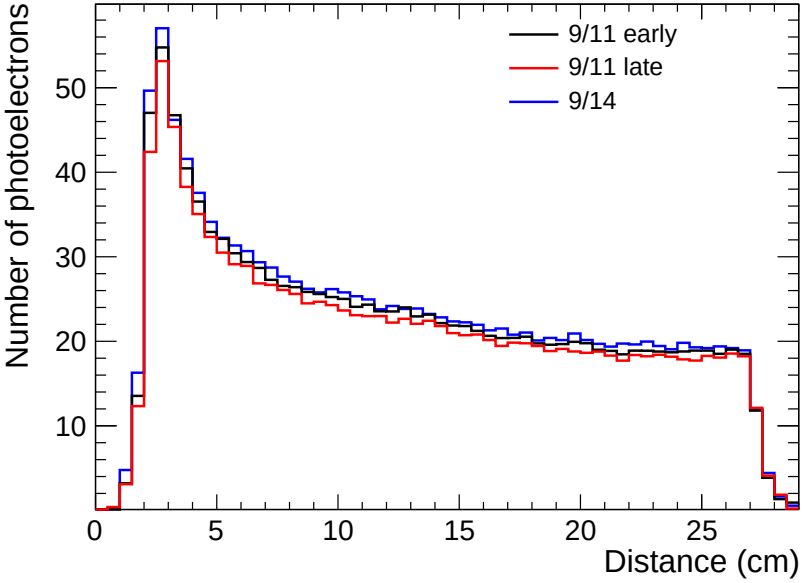


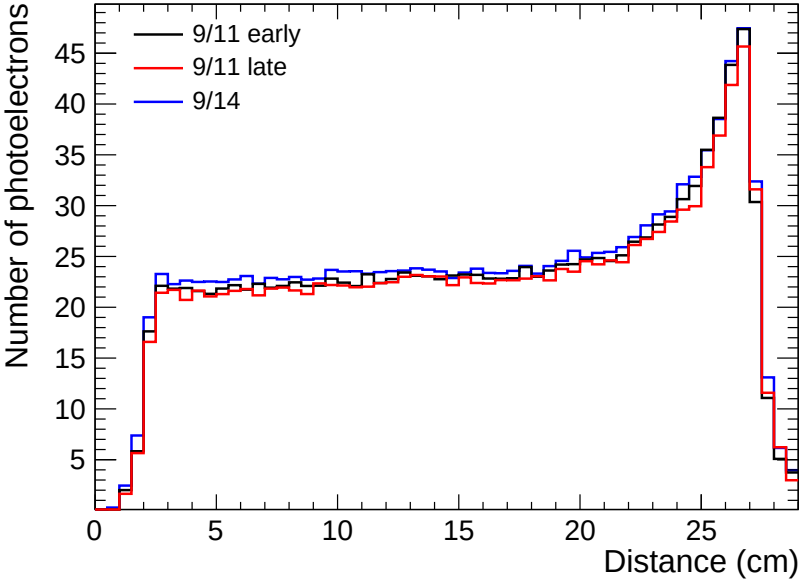


Projection 4, 0.0 cm from fiber

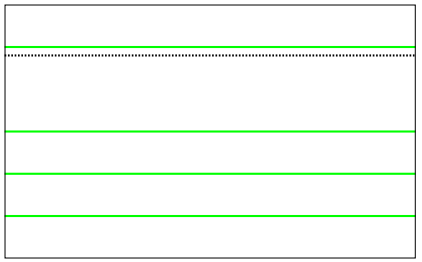


Establishing consistency - Source scans

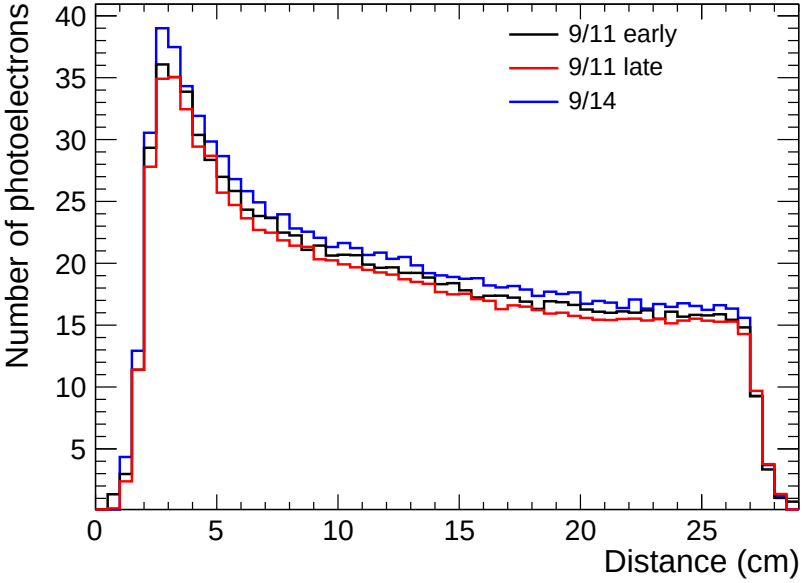


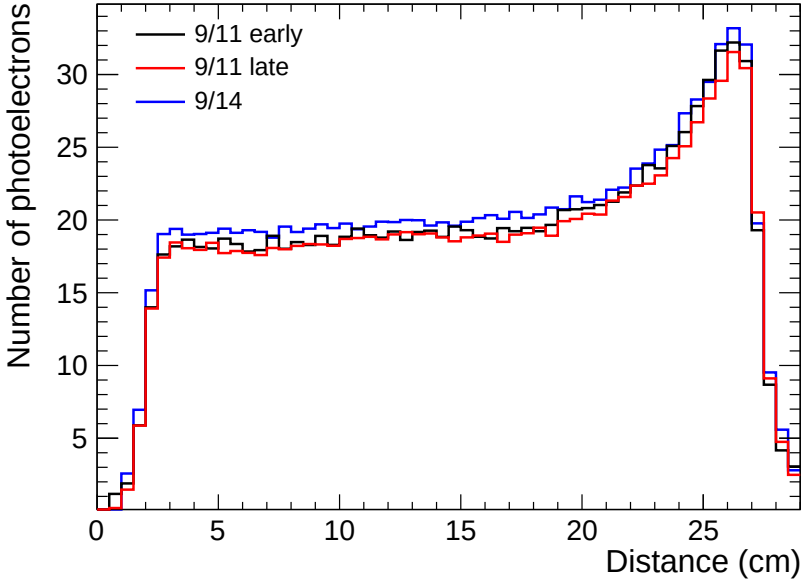


Projection 5, 0.5 cm from fiber

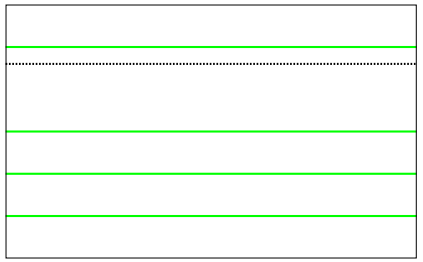


Establishing consistency - Source scans

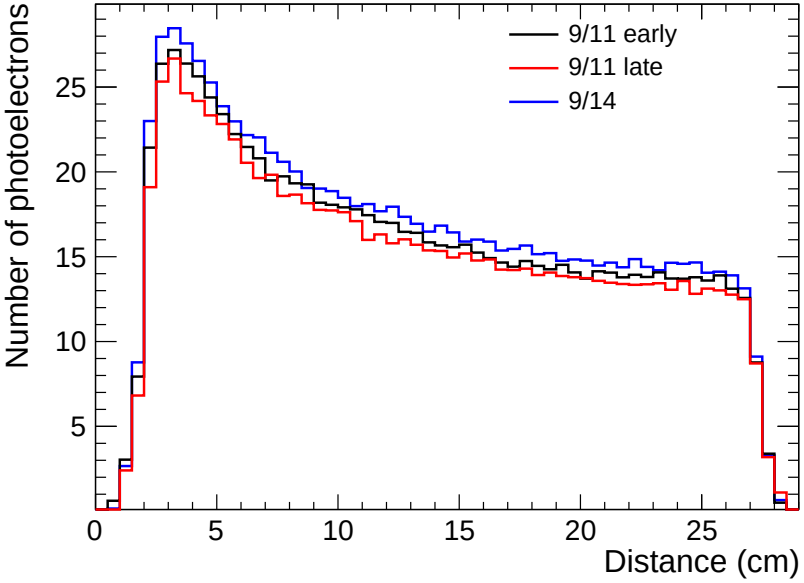


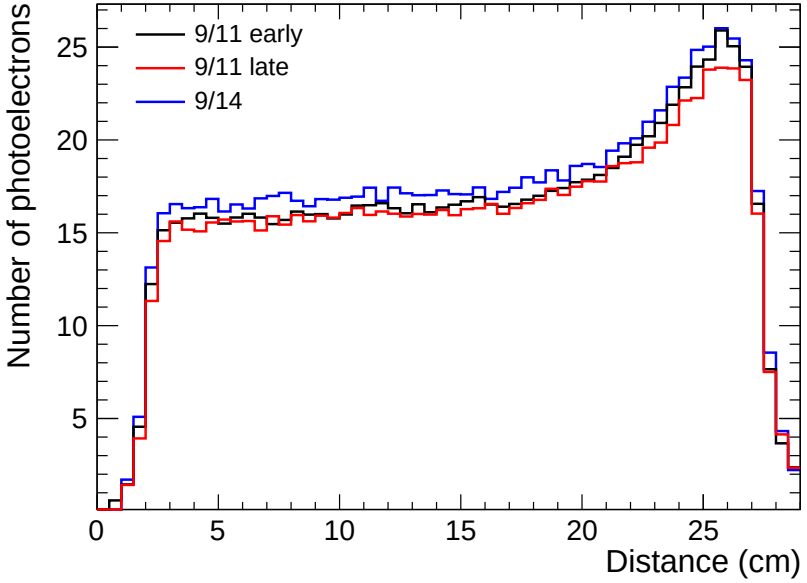


Projection 6, 1.0 cm from fiber

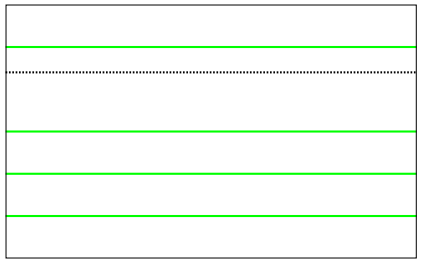


Establishing consistency - Source scans

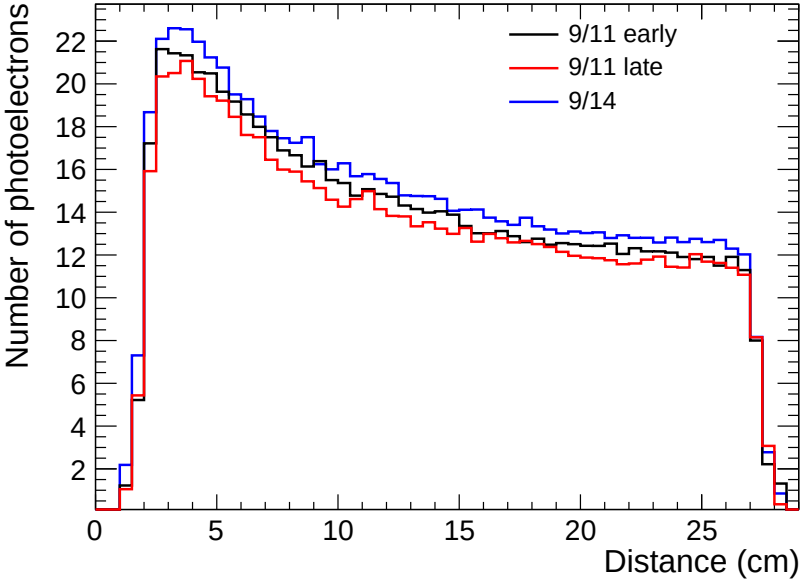


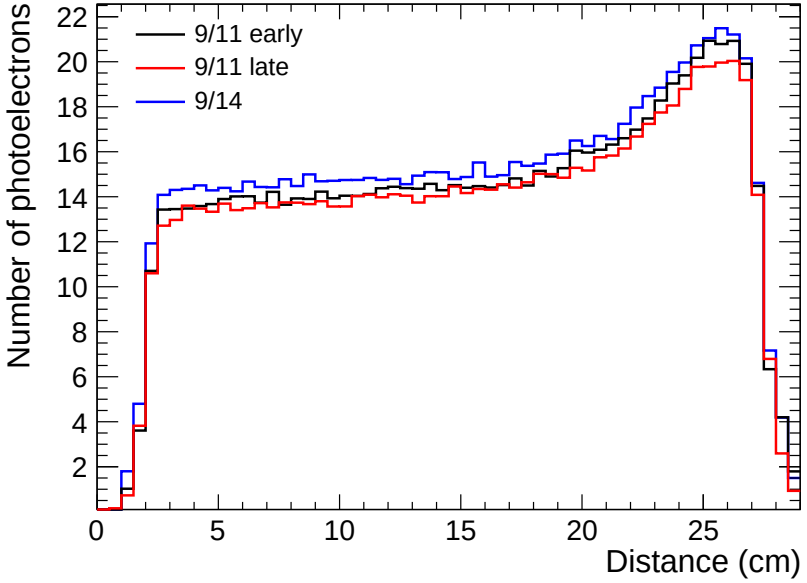


Projection 7, 1.5 cm from fiber

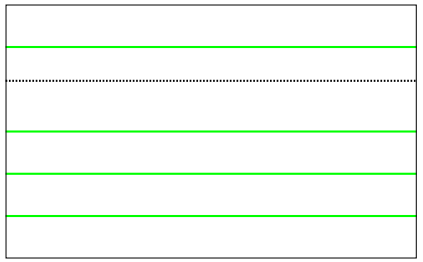


Establishing consistency - Source scans





Projection 8, 2.0 cm from fiber



Part 4—light yield modeling

2-component light yield modeling

Looking at the light yield from each SiPM separately, we can do a simple 2-component model (core+cladding)

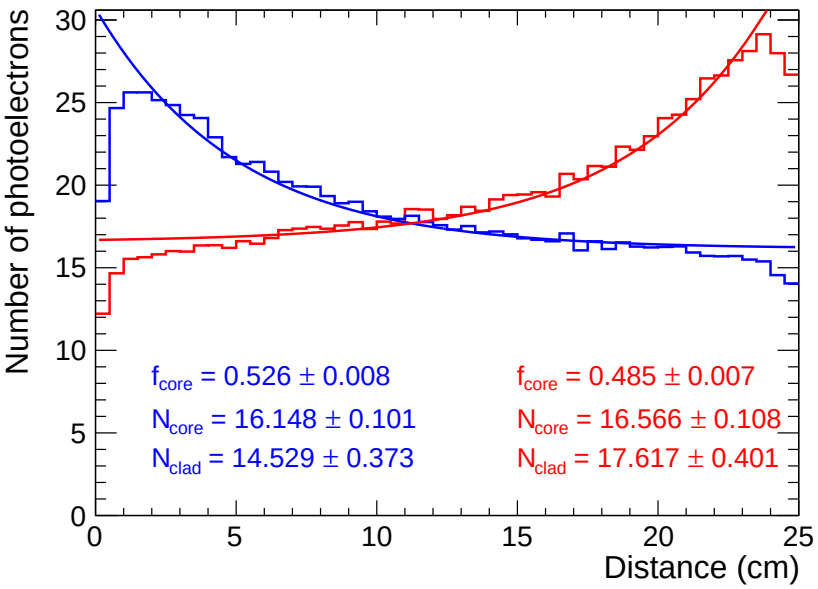
- Let Y_1 denote the total light yield in photoelectrons in SiPM1, and similarly for SiPM2 (Y_2)
- Let N_{core} denote the light in the core, and similarly for N_{clad}, resulting in $Y_1 = N_{\text{core}} + N_{\text{clad}}$
- Let λ_{core} denote the attenuation length in the core (3.5 m for Y11 non S-type), and similarly for λ_{clad} (estimated to be 5 cm)
- We can model the total light yield in SiPM1 as $Y_1 = N_{\text{core}} e^{-x/\lambda_{\text{core}}} + N_{\text{clad}} e^{-x/\lambda_{\text{clad}}}$
- Similarly, and taking into account the local coordinate system where L is the length of the panel, we can estimate the total light yield in SiPM2 as $Y_2 = N_{\text{core}} e^{(x-L)/\lambda_{\text{core}}} + N_{\text{clad}} e^{(x-L)/\lambda_{\text{clad}}}$

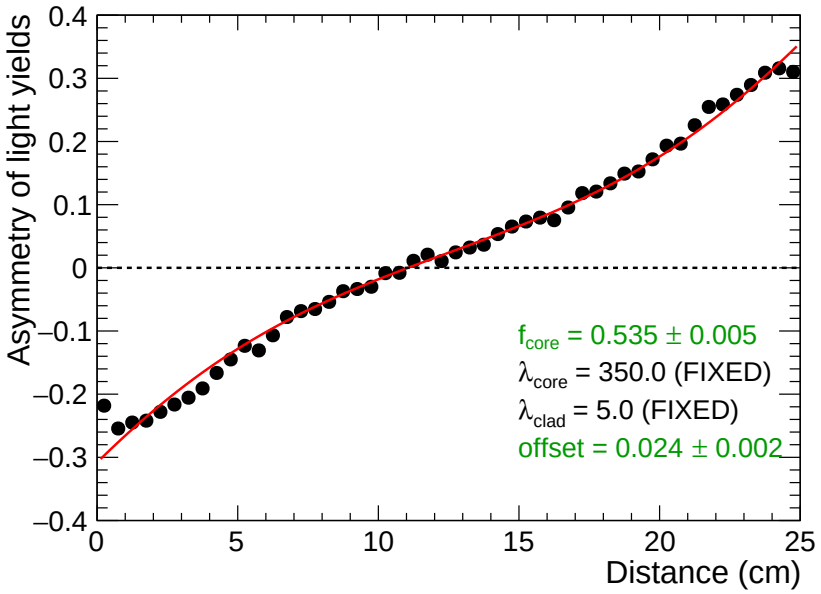
2-component light yield modeling

Looking at the light yield from each SiPM separately, we can do a simple 2-component model (core+cladding)

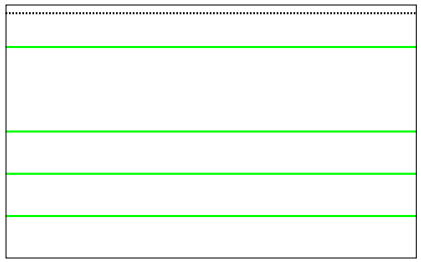
- We define the core fraction with the relation $N_{\text{core}} = f_{\text{core}} Y_1$
- This gives by definition $N_{\text{clad}} = (1 - f_{\text{core}}) Y_1$
- We define the asymmetry as $A = (Y_2 - Y_1)/(Y_2 + Y_1)$ which allows us to cancel the Ns and rewrite the light yields as
  $Y_1 = f_{\text{core}} e^{-x/\lambda_{\text{core}}} + (1 - f_{\text{core}}) e^{-x/\lambda_{\text{clad}}}$
  $Y_2 = f_{\text{core}} e^{(x-L)/\lambda_{\text{core}}} + (1 - f_{\text{core}}) e^{(x-L)/\lambda_{\text{clad}}}$

2-component lightyield

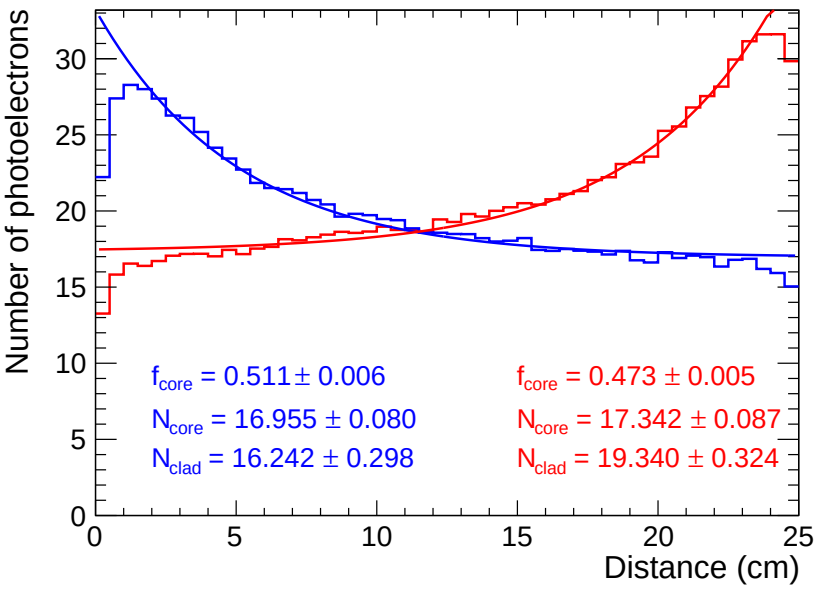


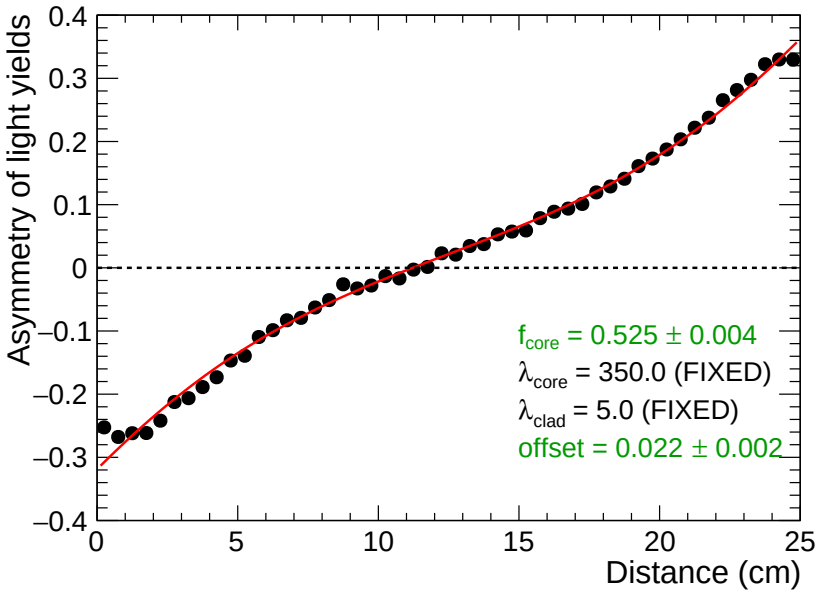


Projection 0, -2.0 cm from fiber

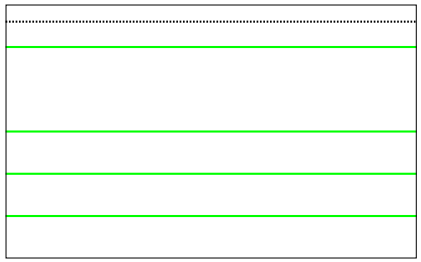


2-component lightyield

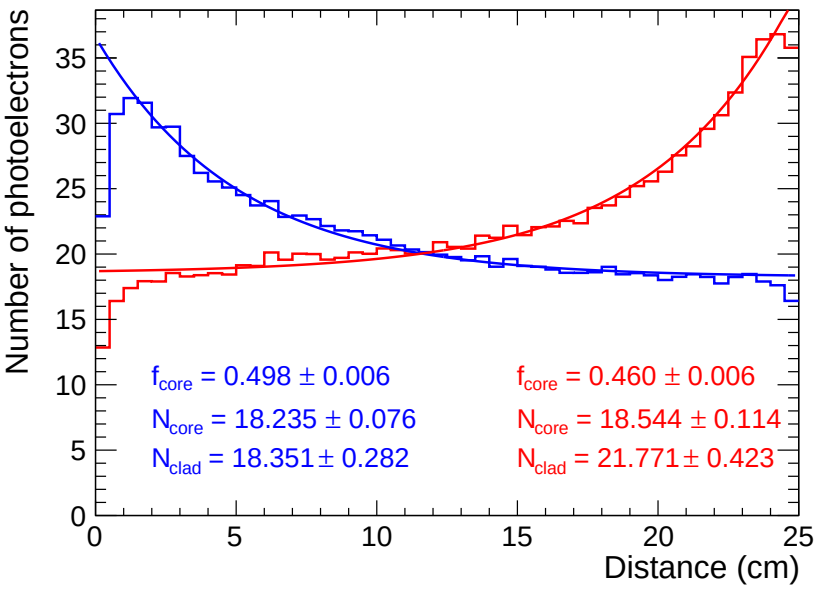


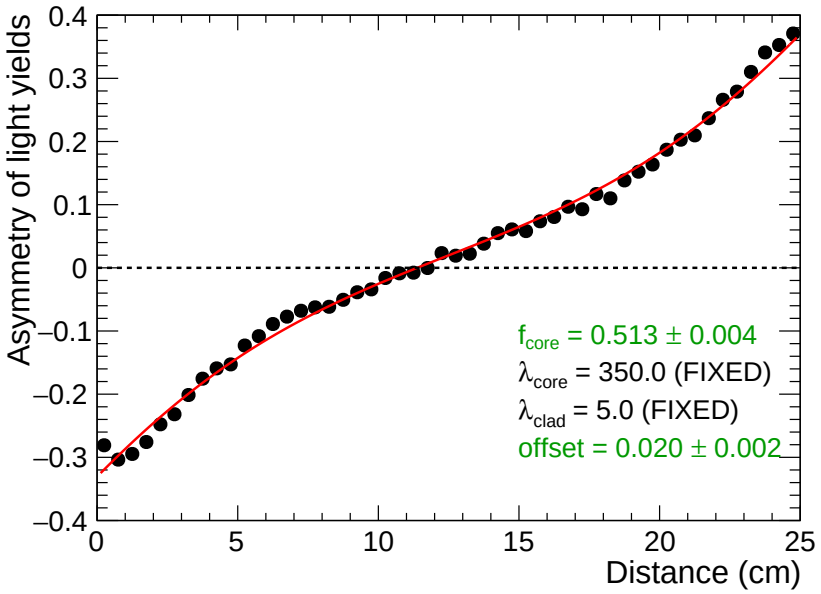


Projection 1, -1.5 cm from fiber

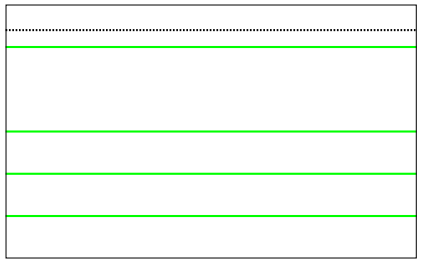


2-component lightyield

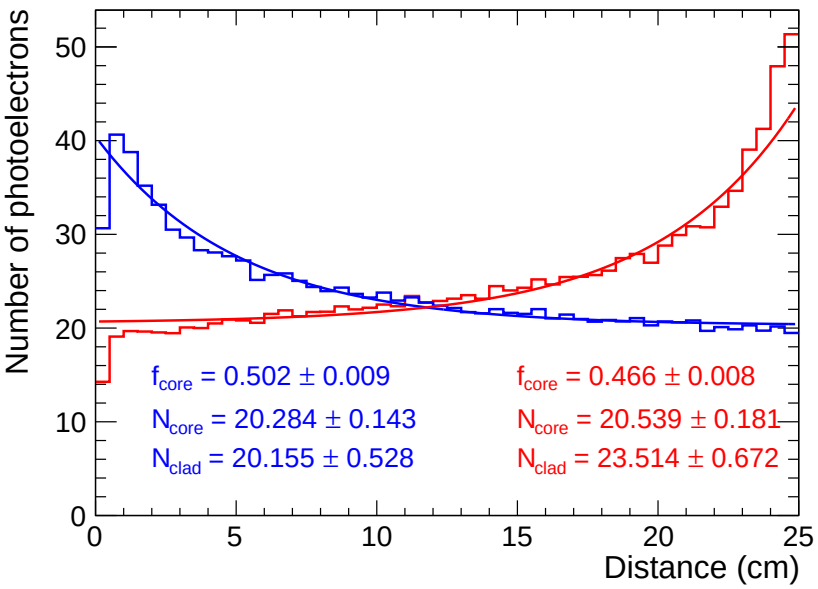


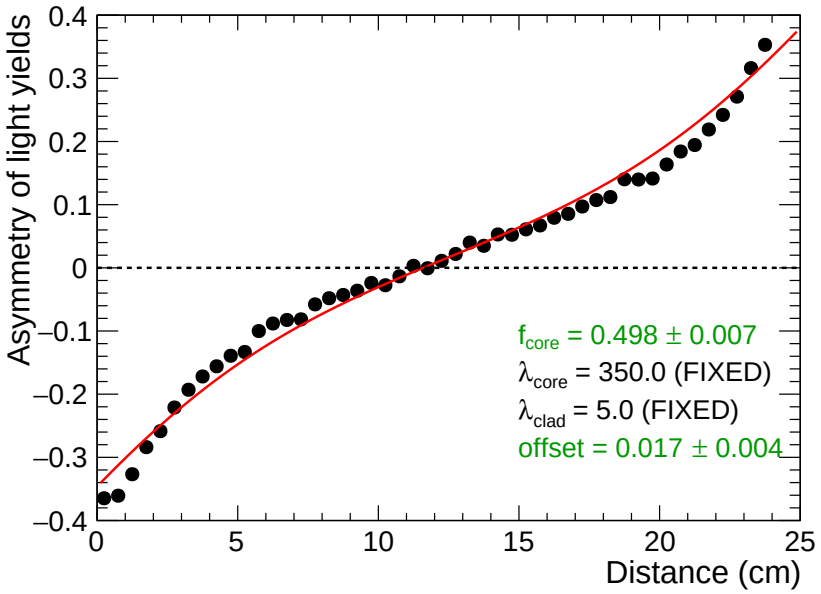


Projection 2, -1.0 cm from fiber

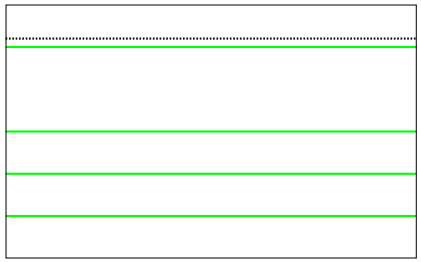


2-component lightyield

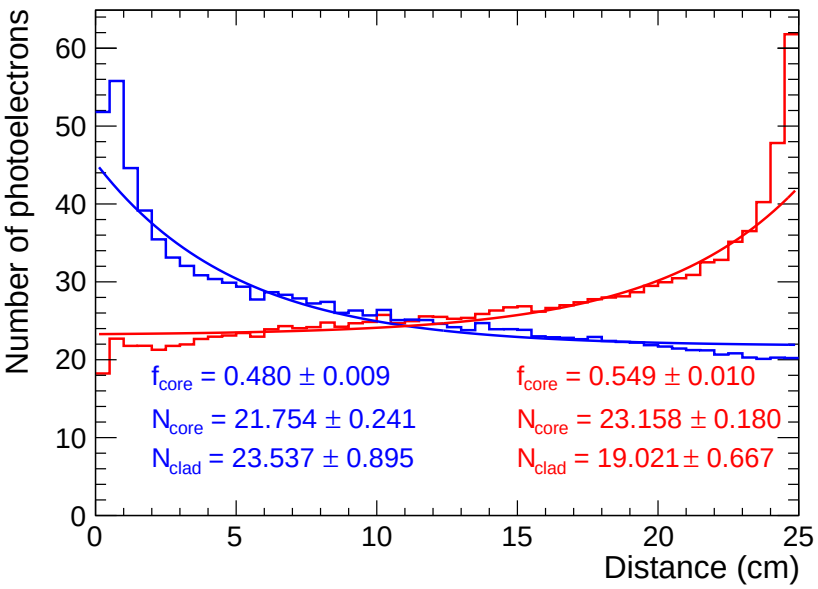


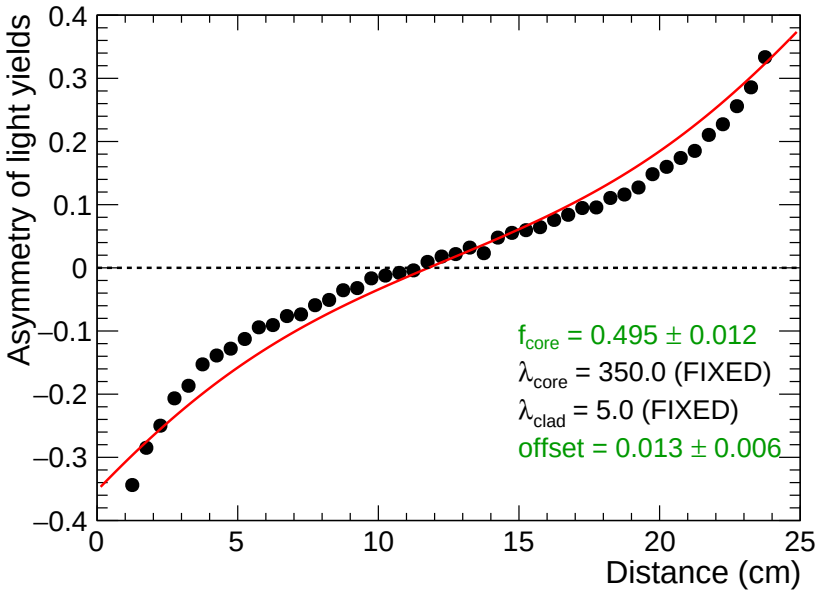


Projection 3, -0.5 cm from fiber

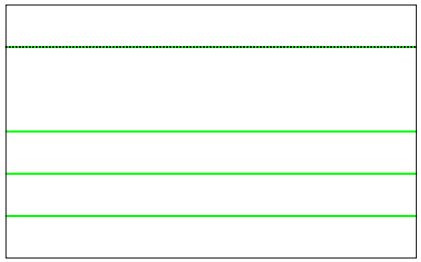


2-component lightyield

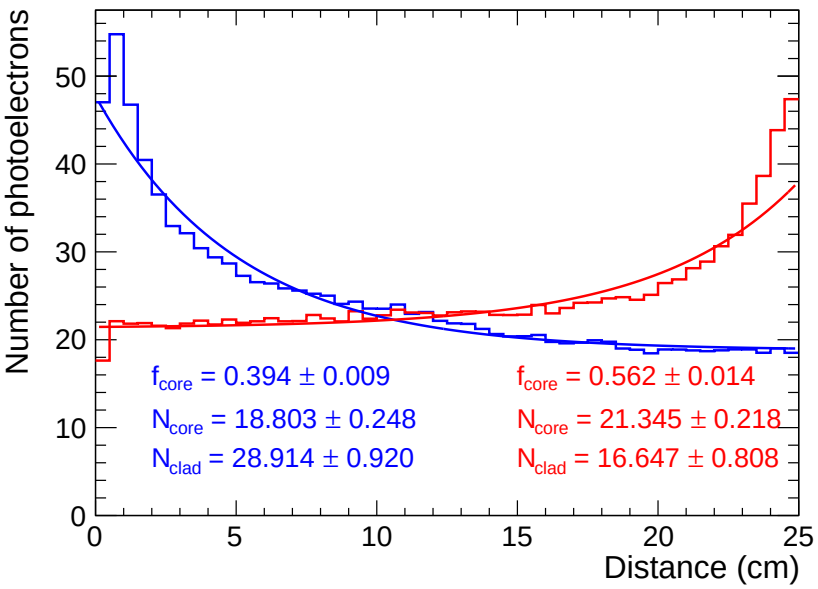


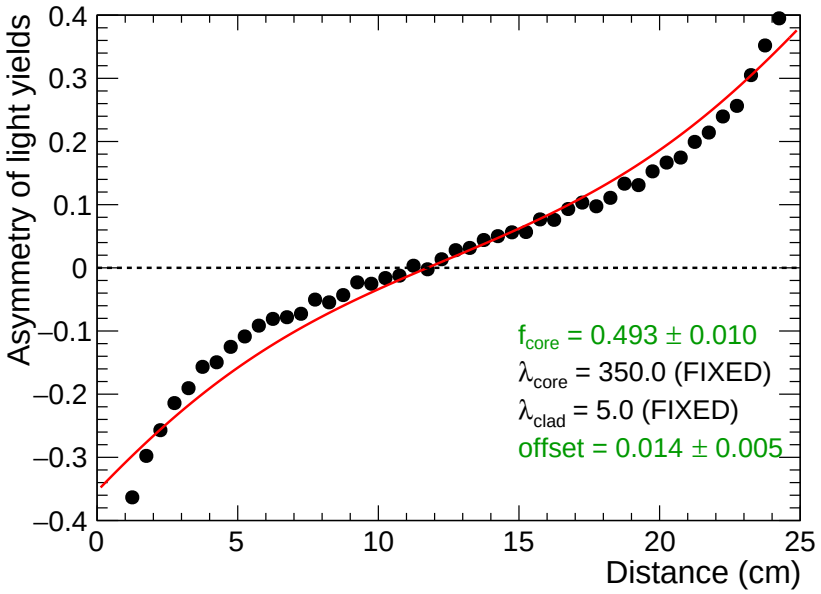


Projection 4, 0.0 cm from fiber

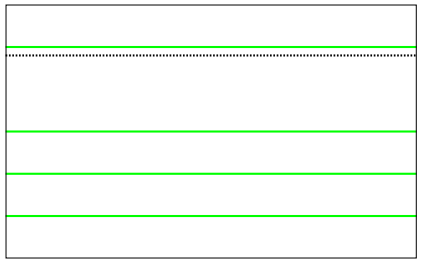


2-component lightyield

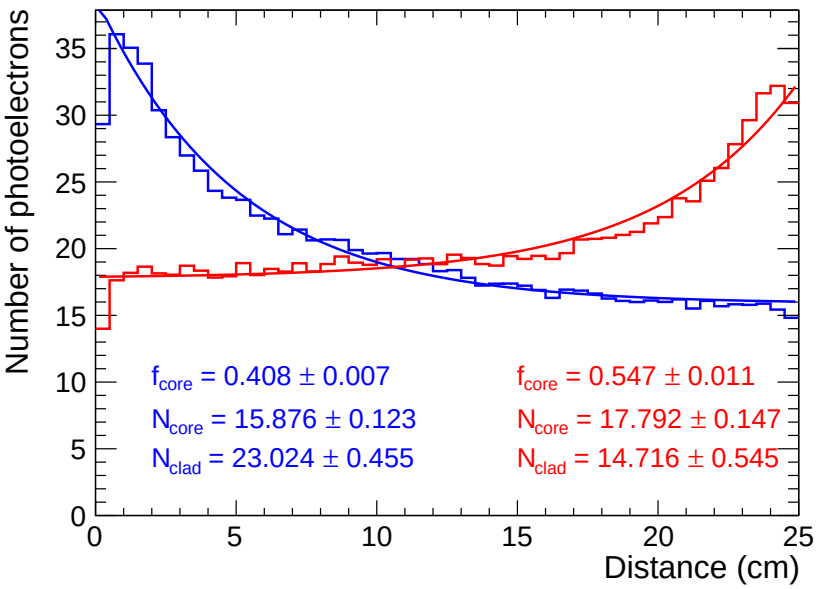


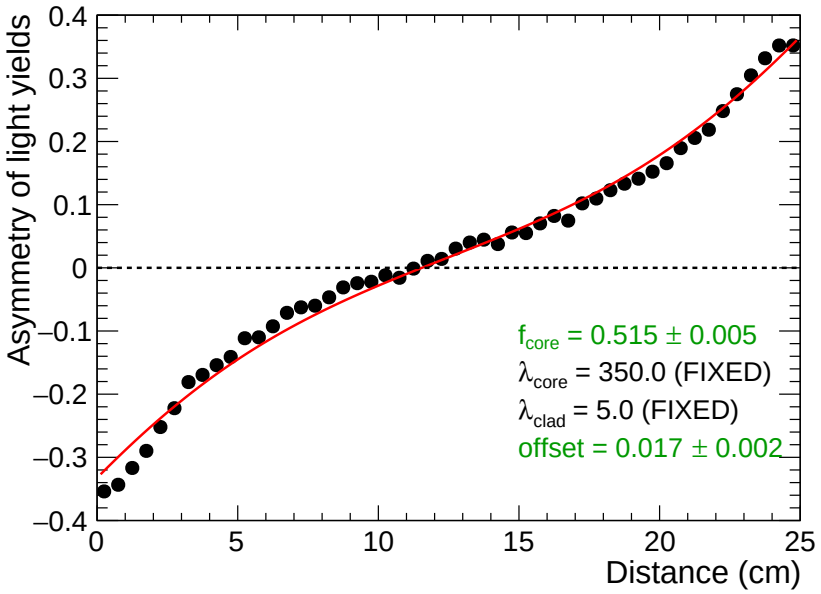


Projection 5, 0.5 cm from fiber

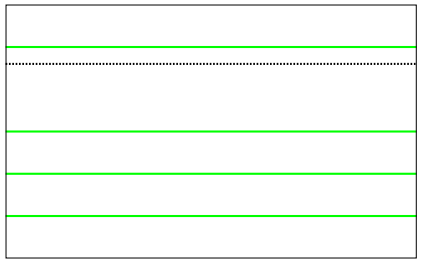


2-component lightyield

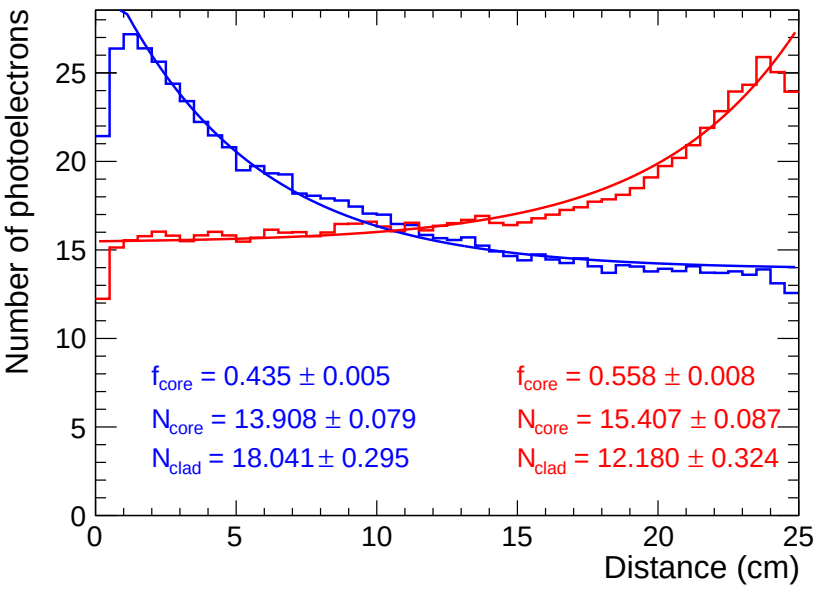


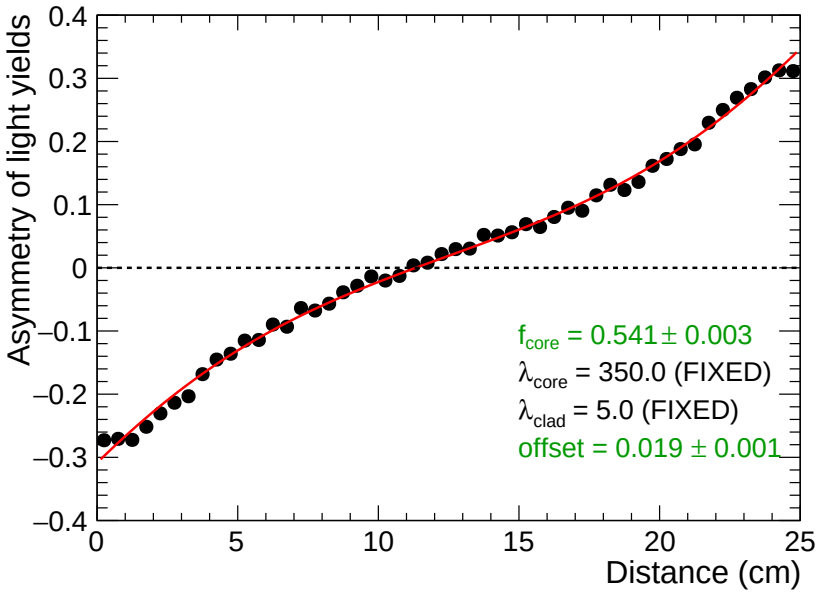


Projection 6, 1.0 cm from fiber

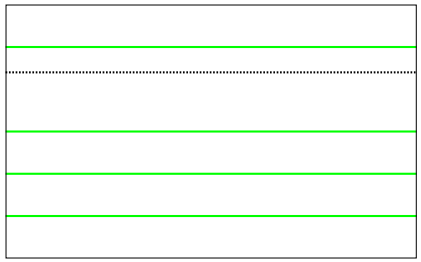


2-component lightyield

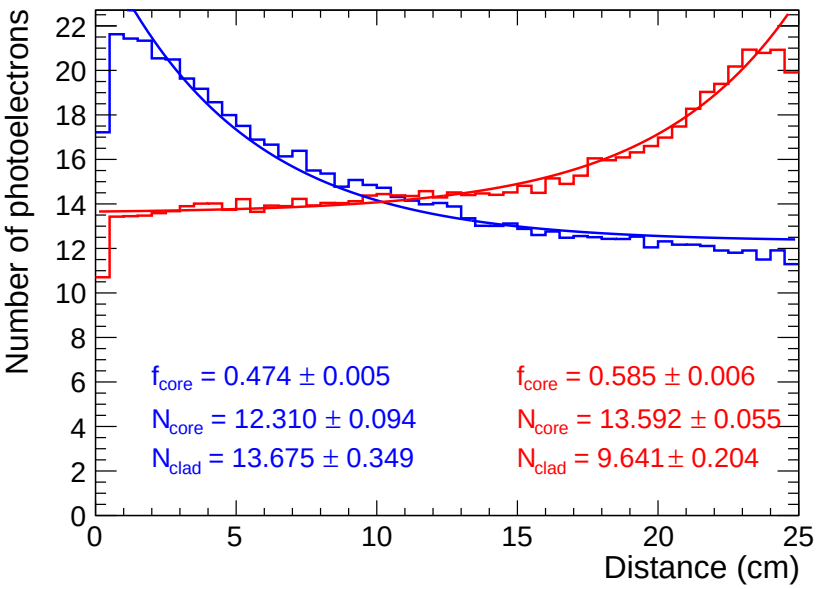


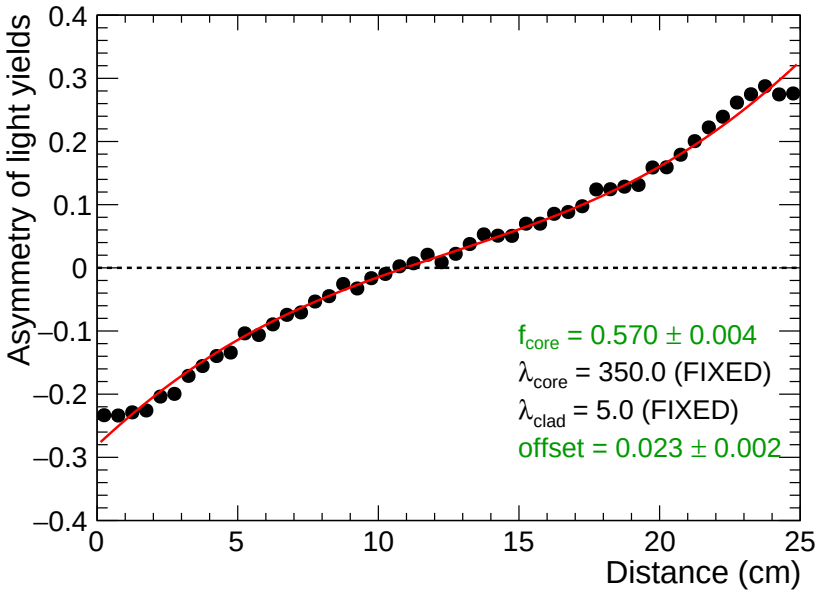


Projection 7, 1.5 cm from fiber

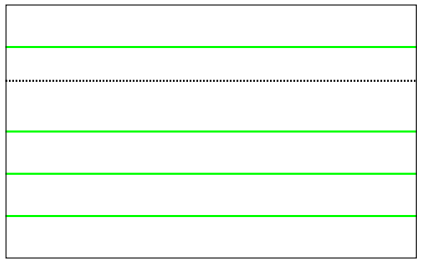


2-component lightyield



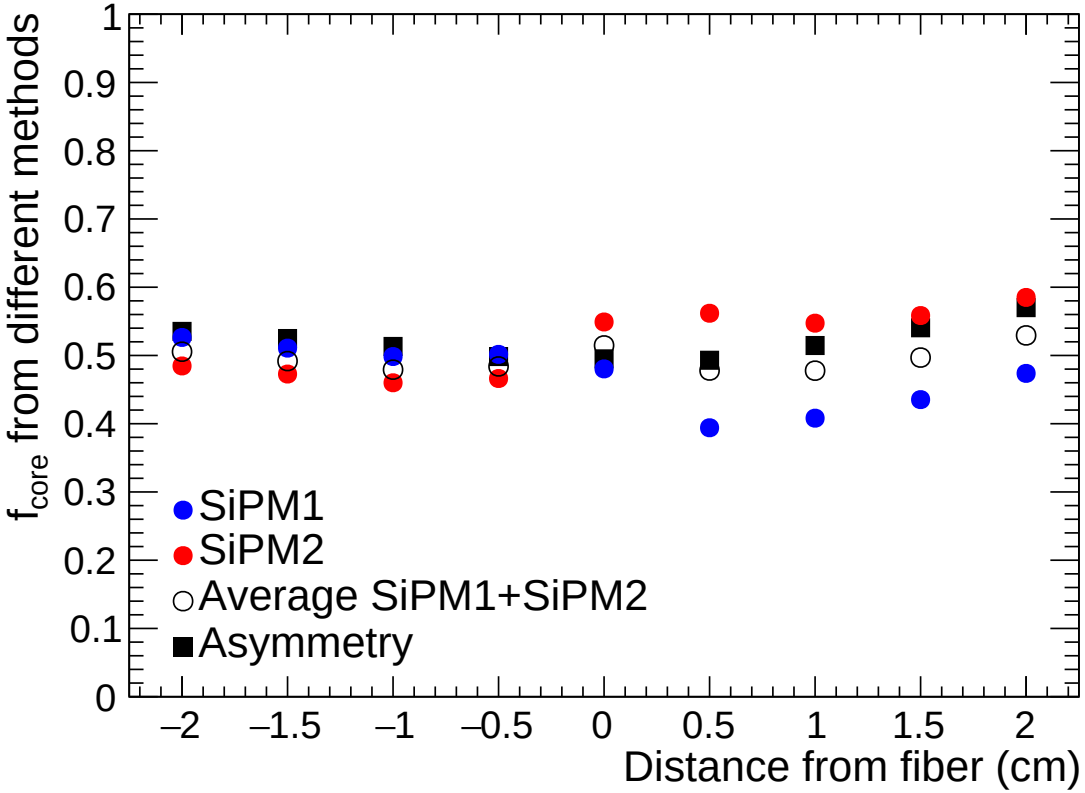


Projection 8, 2.0 cm from fiber



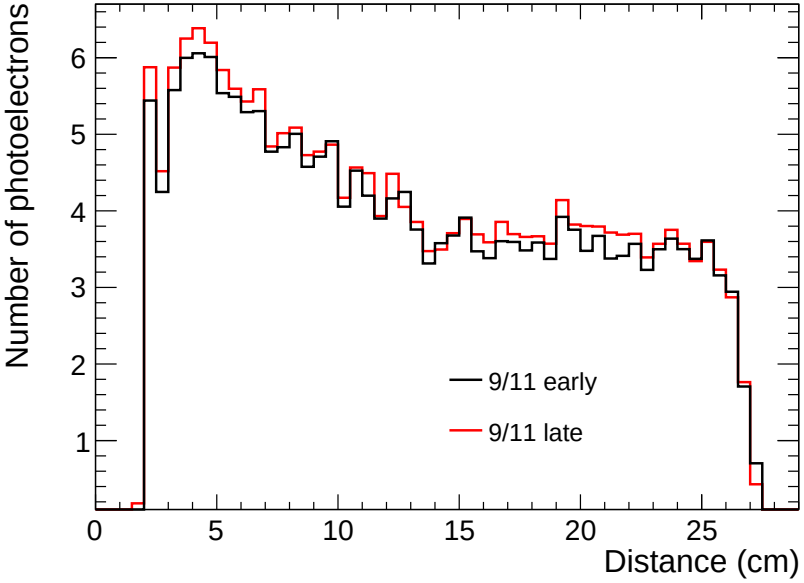
2-component lightyield

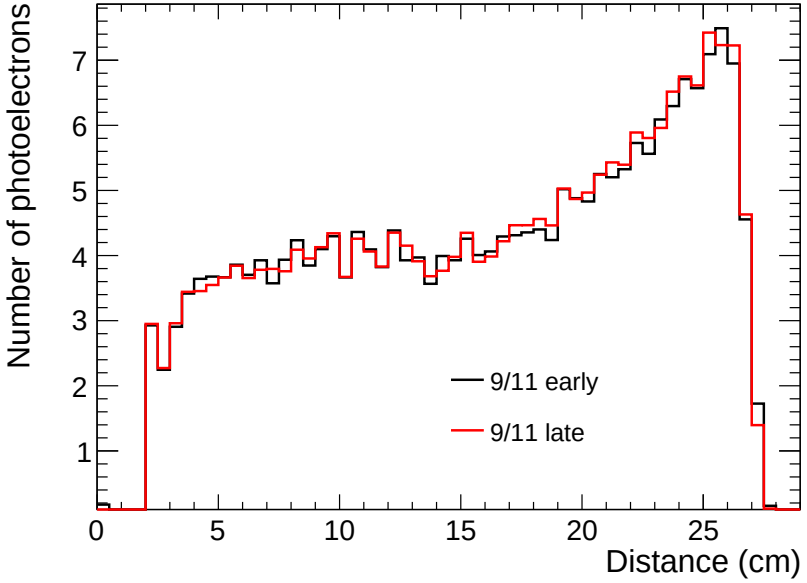
Comparison of projections



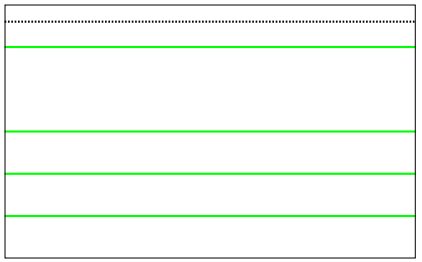
Part 5—Parts 3 and 4 but with LED scans

Establishing consistency - LED scans

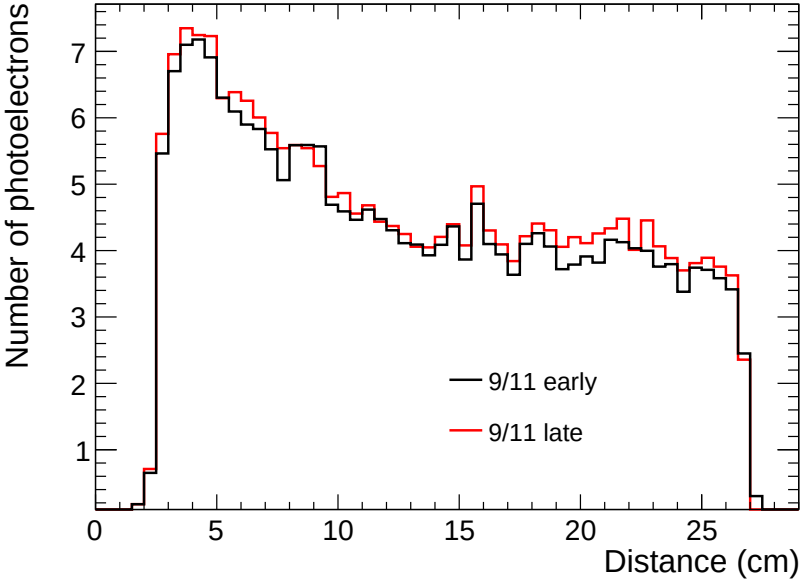


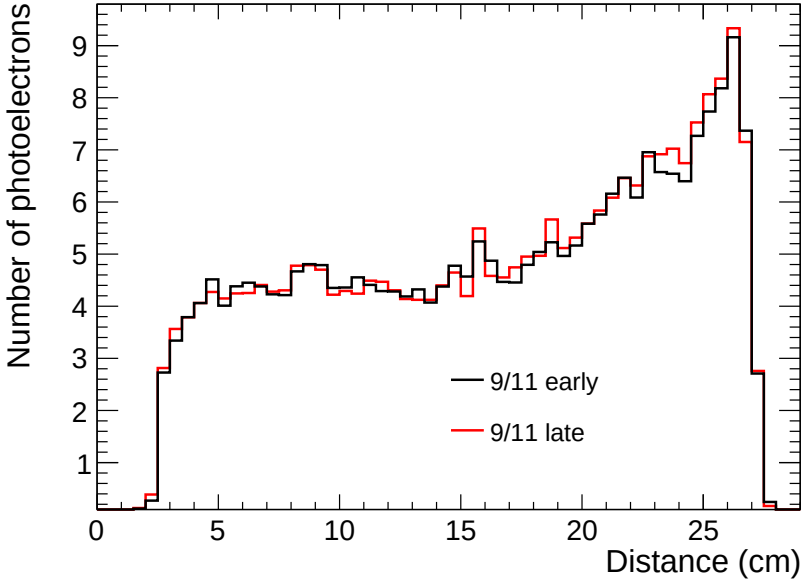


Projection 0, -1.5 cm from fiber

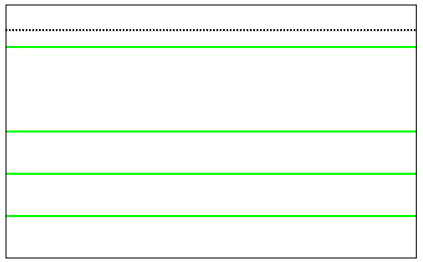


Establishing consistency - LED scans

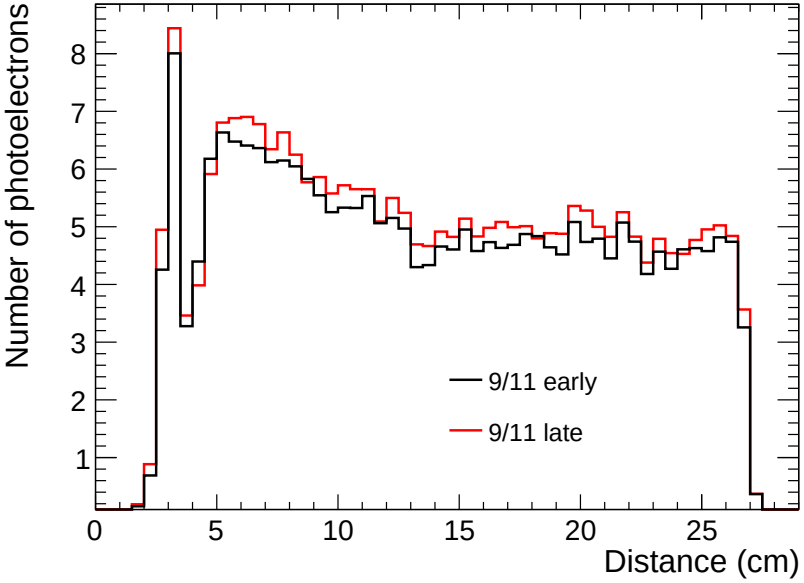


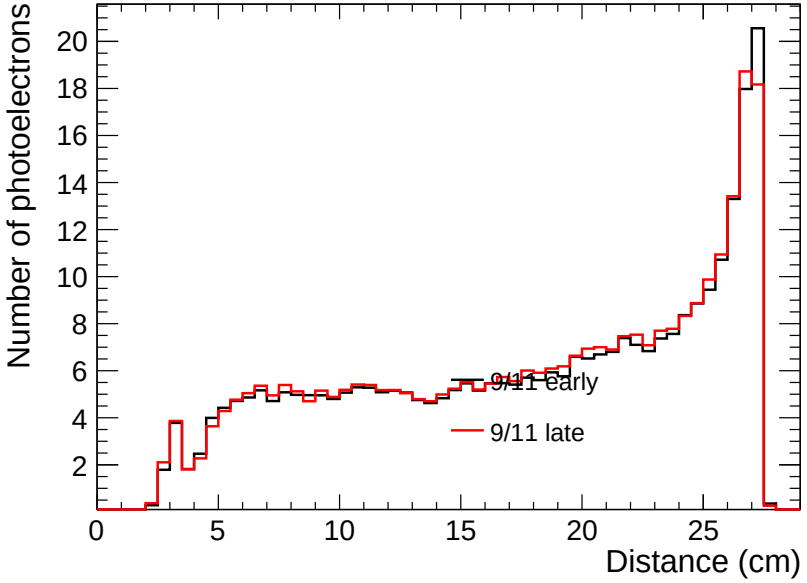


Projection 1, -1.0 cm from fiber

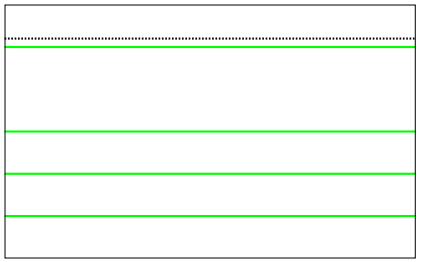


Establishing consistency - LED scans

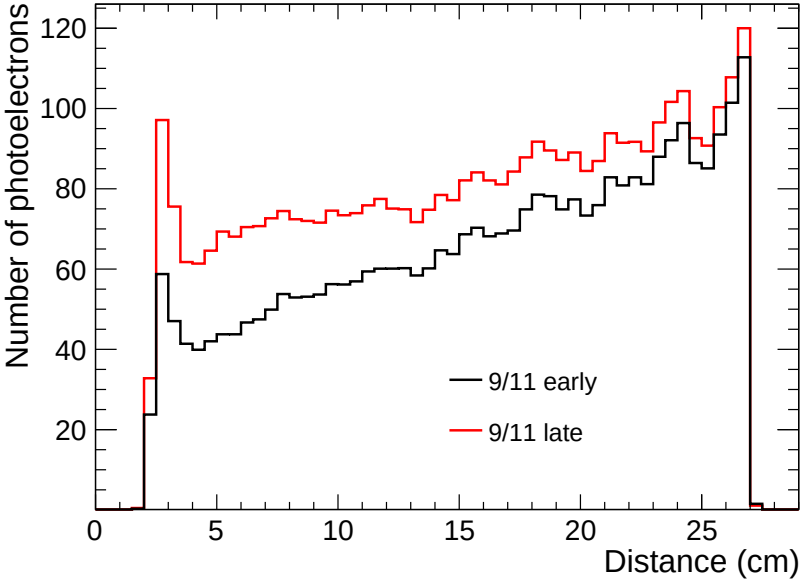


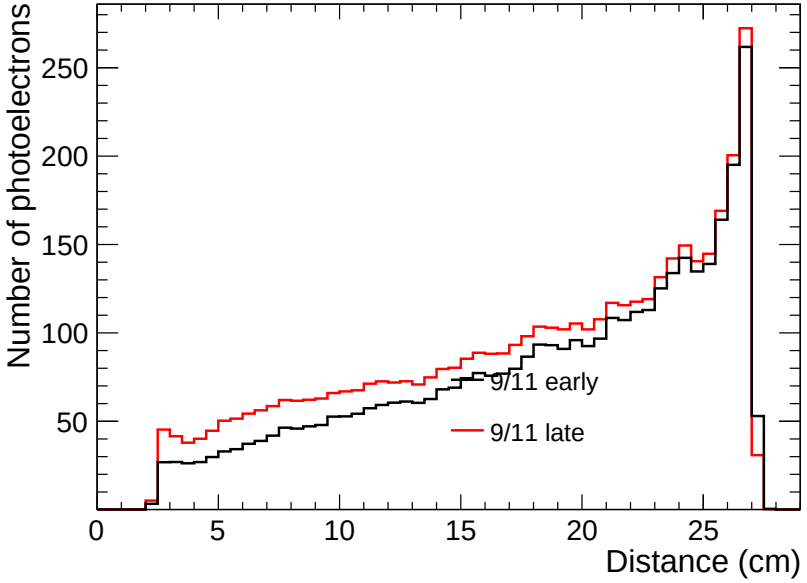


Projection 2, -0.5 cm from fiber

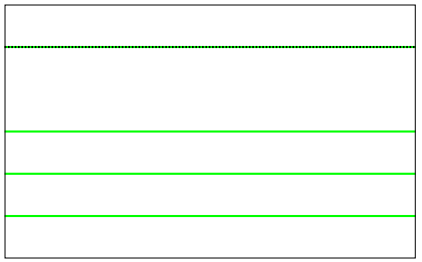


Establishing consistency - LED scans

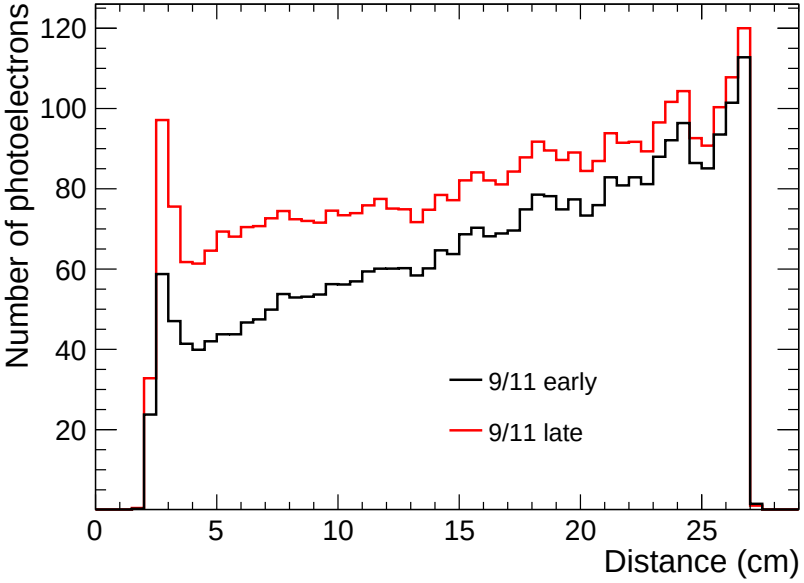


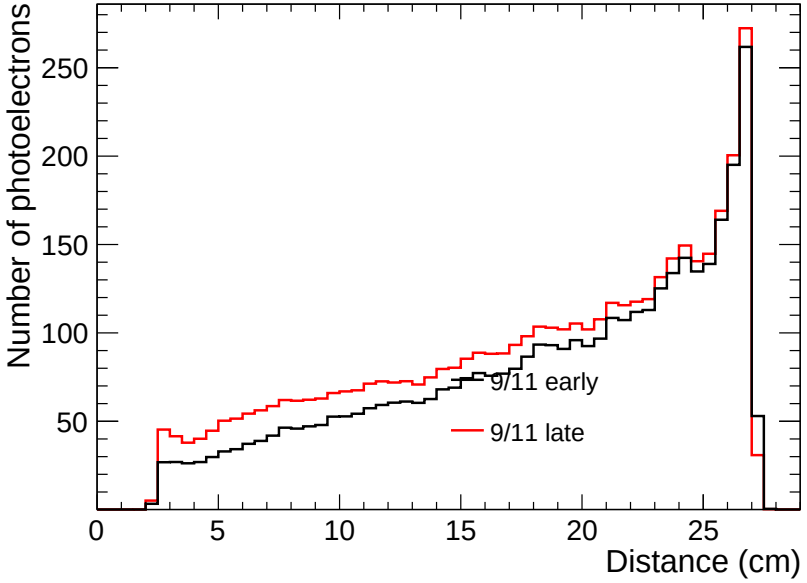


Projection 3, 0.0 cm from fiber

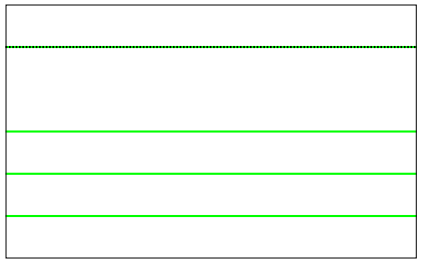


Establishing consistency - LED scans

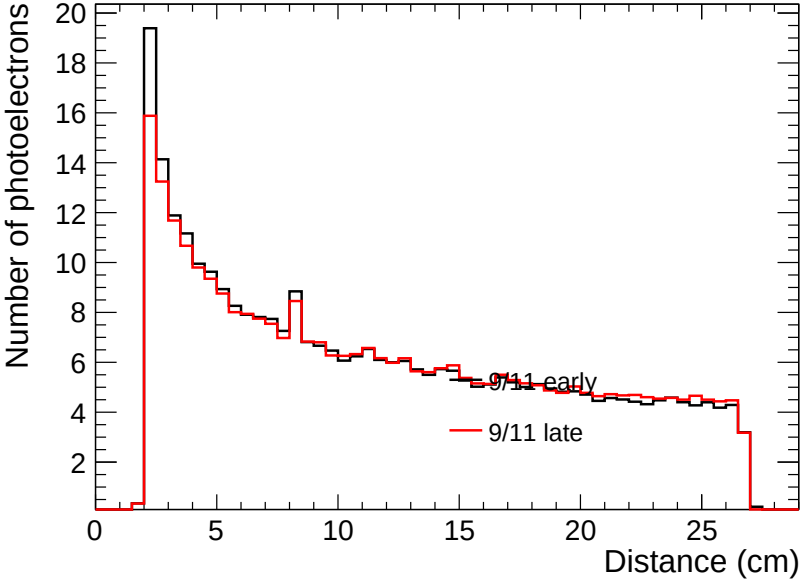


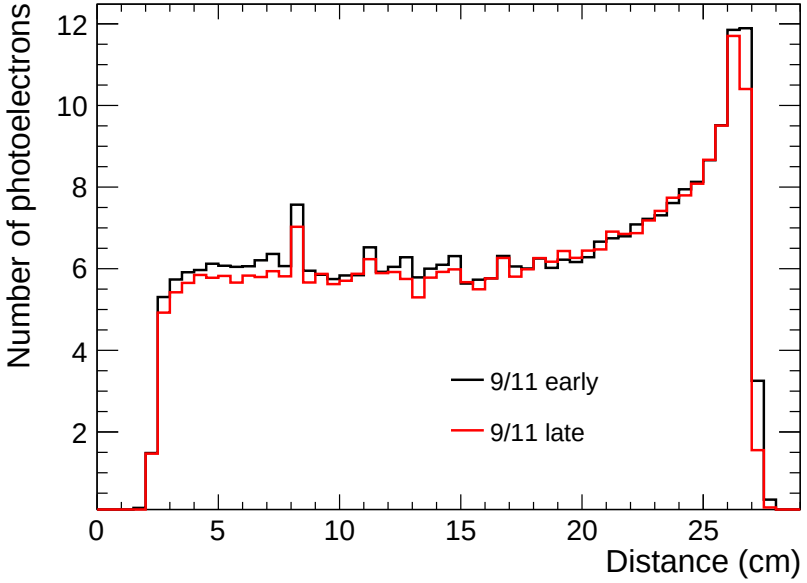


LED scans with coated panel are **very** sensitive to alignment

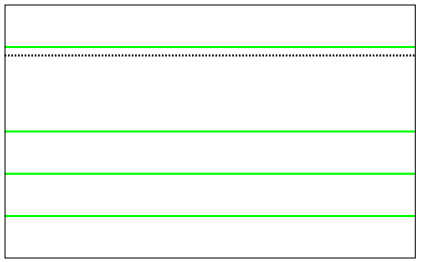


Establishing consistency - LED scans

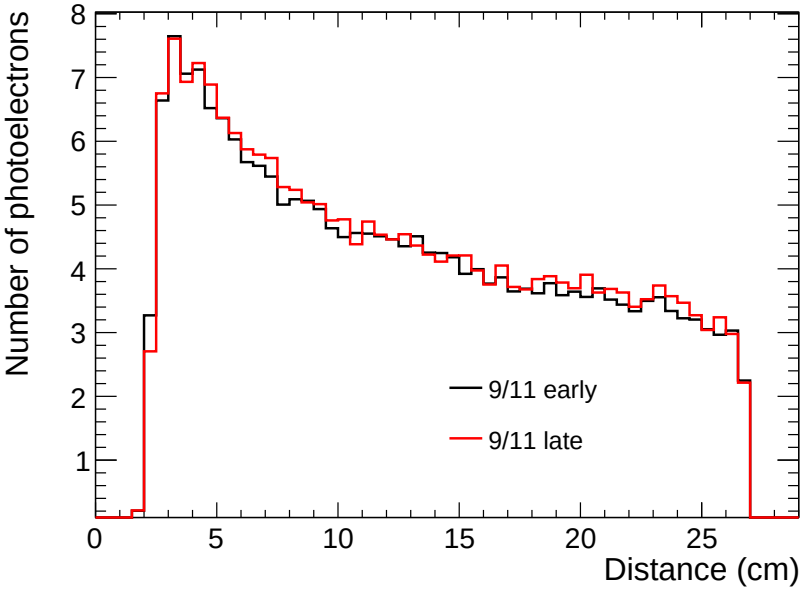


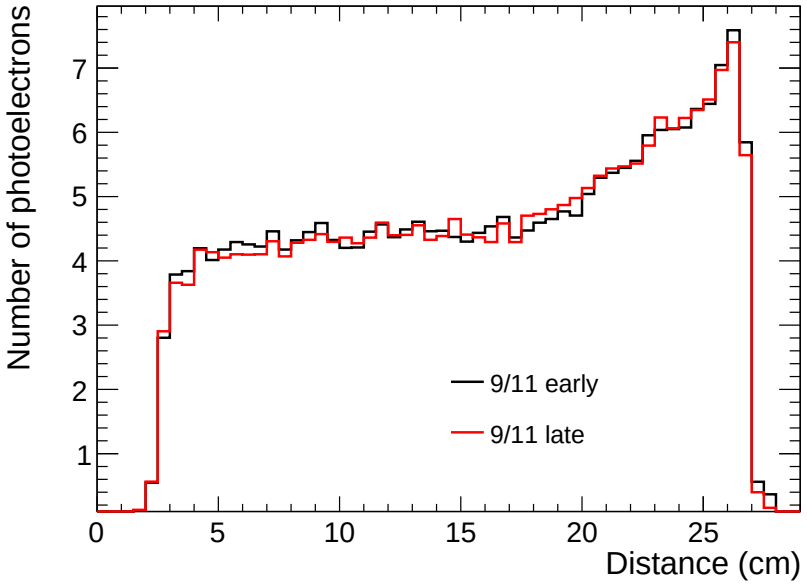


Projection 4, 0.5 cm from fiber

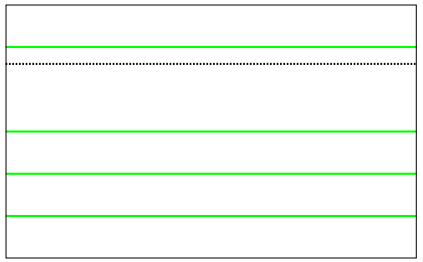


Establishing consistency - LED scans

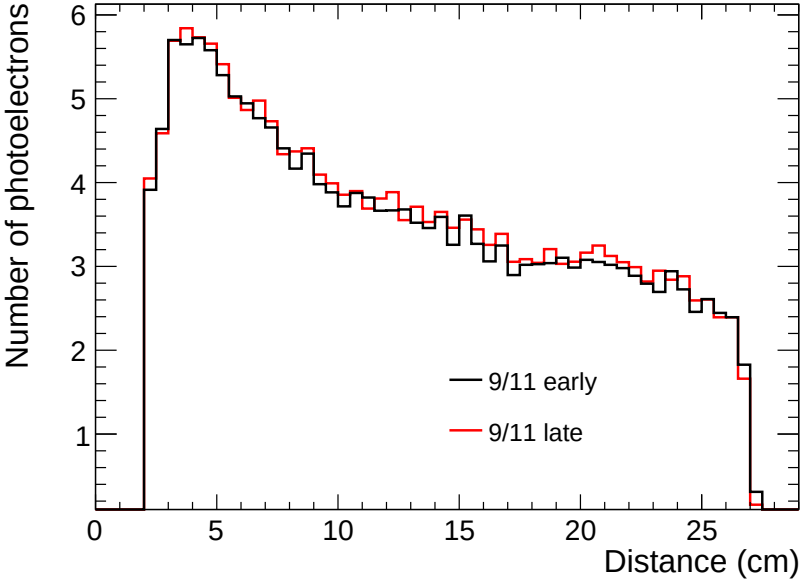


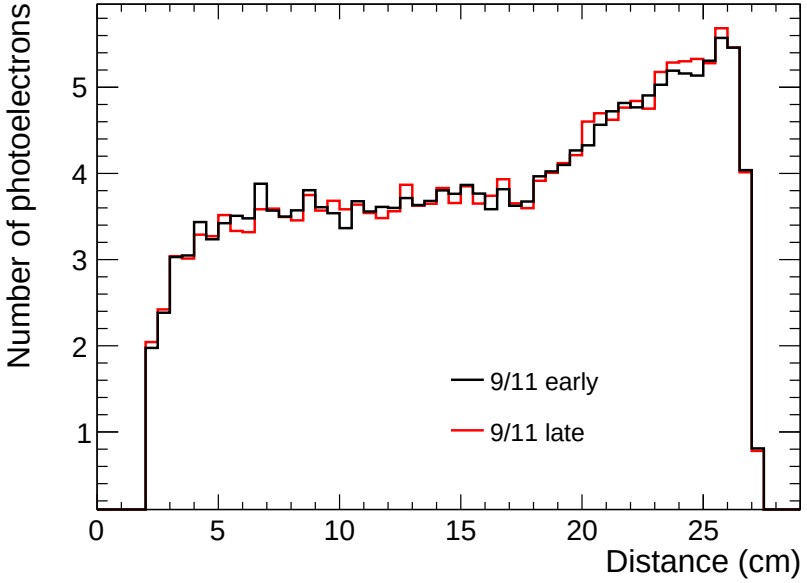


Projection 5, 1.0 cm from fiber

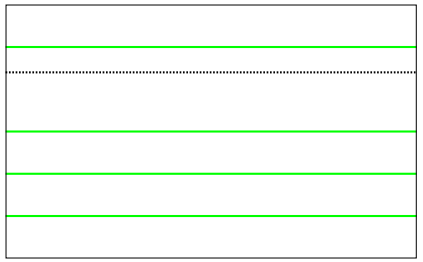


Establishing consistency - LED scans

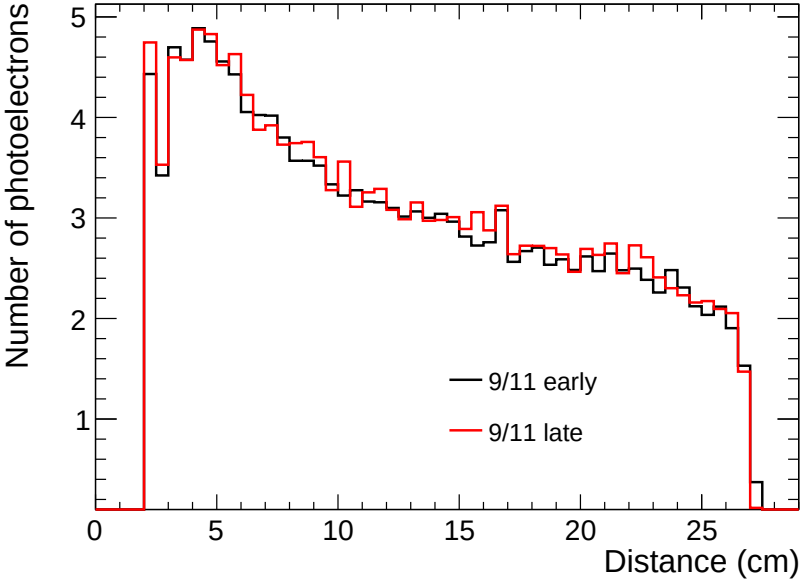


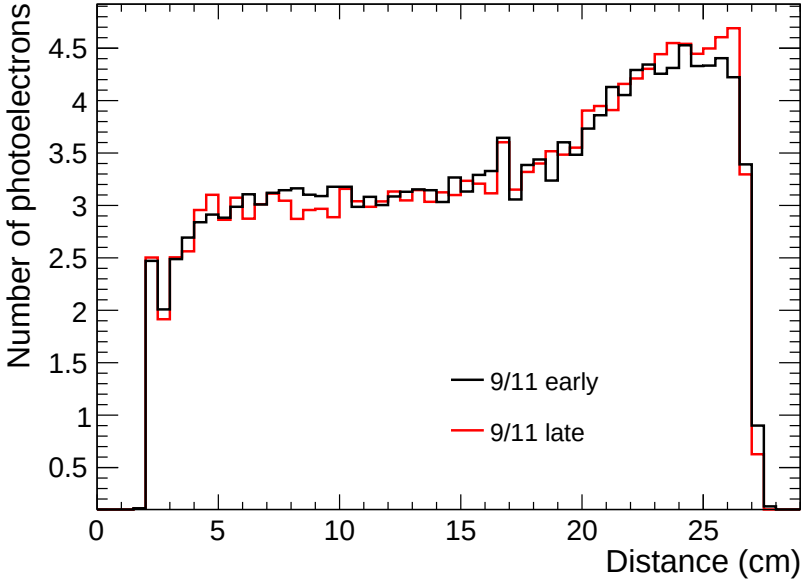


Projection 6, 1.5 cm from fiber

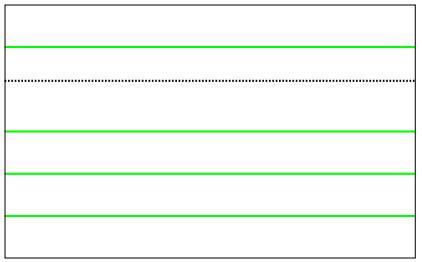


Establishing consistency - LED scans

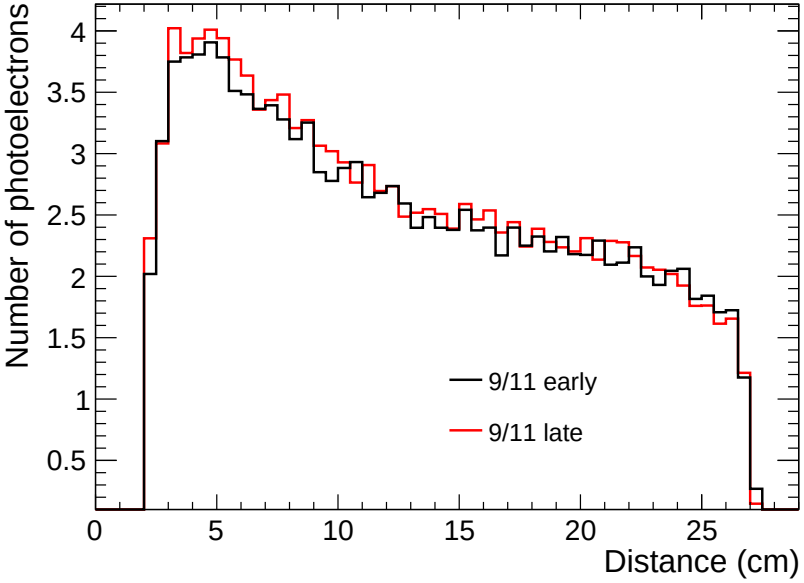


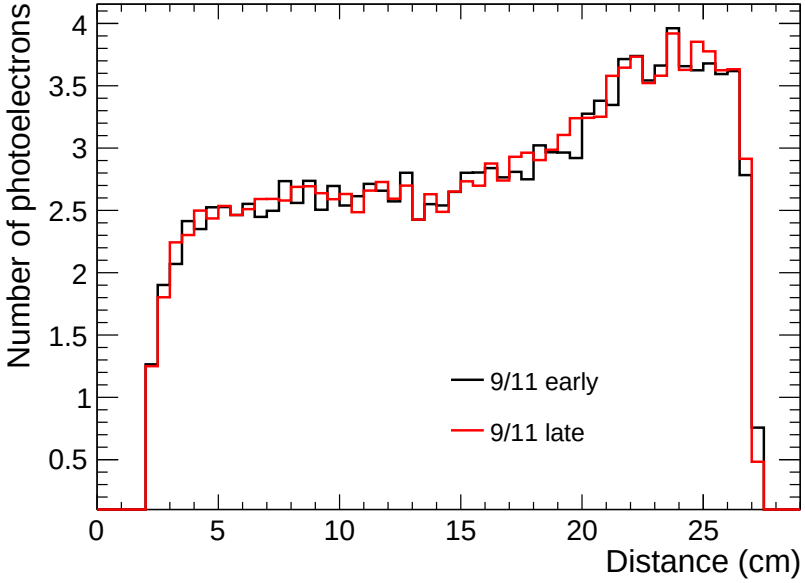


Projection 7, 2.0 cm from fiber

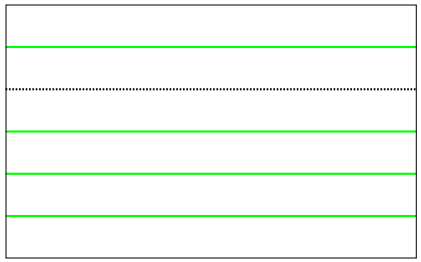


Establishing consistency - LED scans

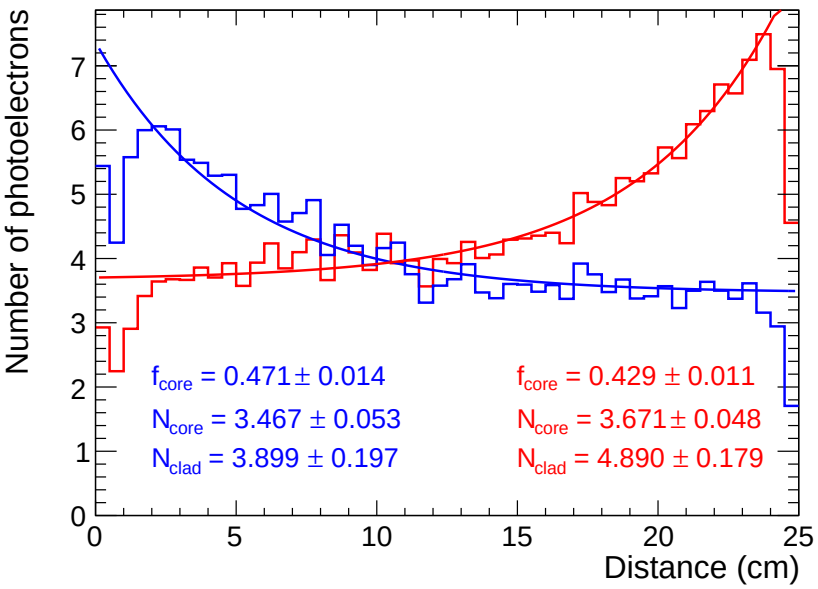


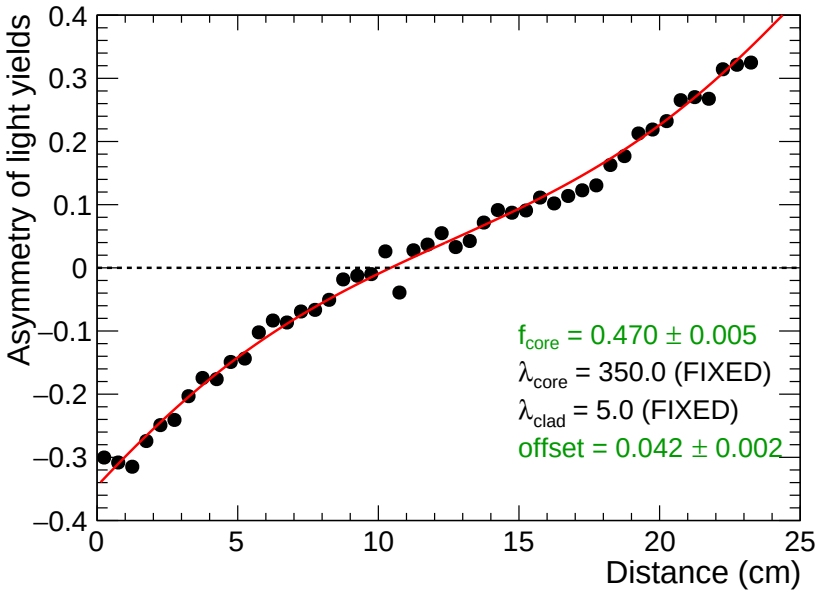


Projection 8, 2.5 cm from fiber

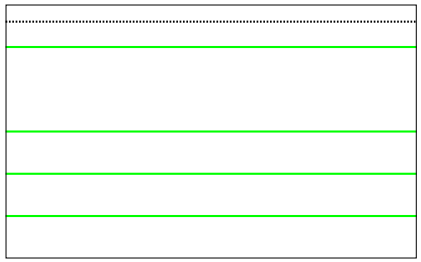


2-component lightyield

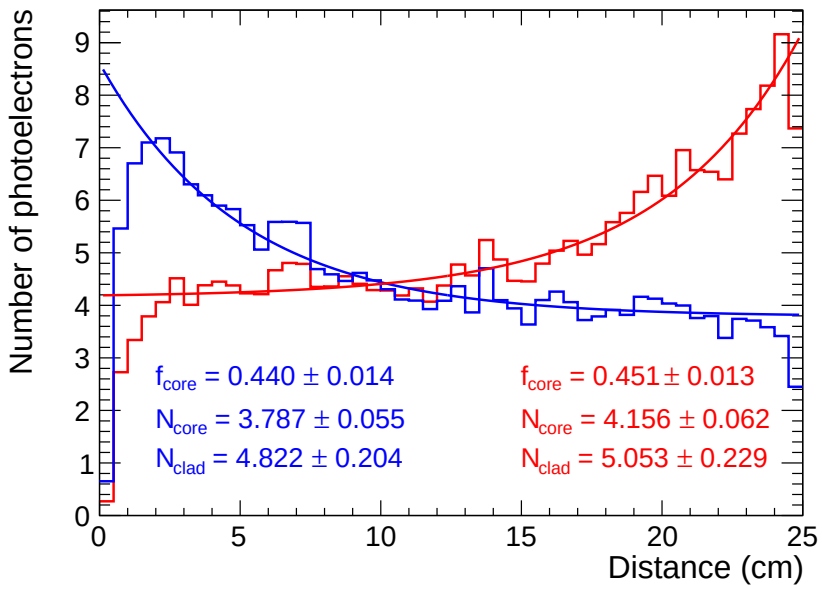


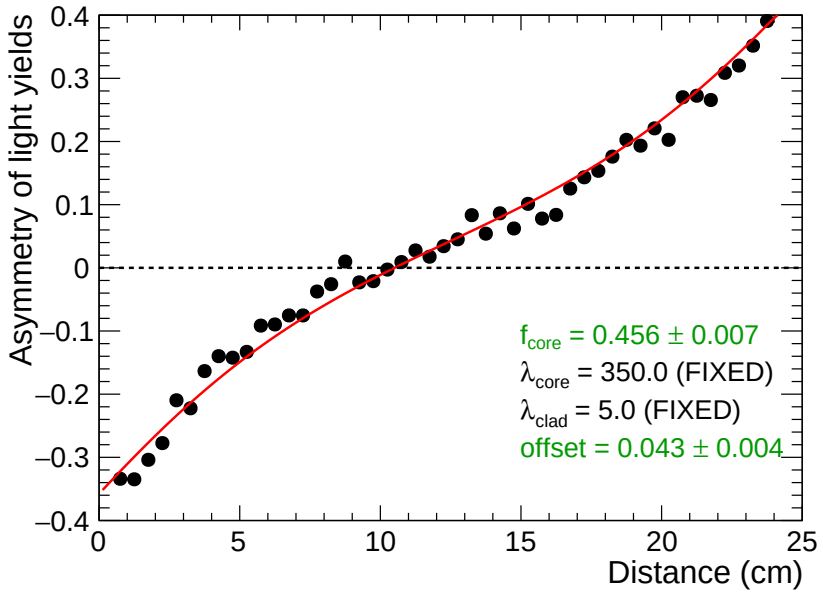


Projection 0, -1.5 cm from fiber

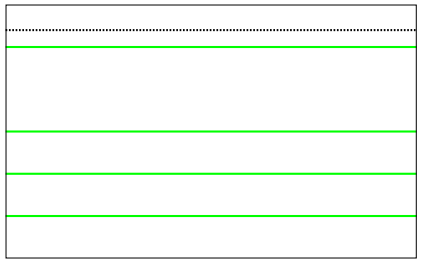


2-component lightyield

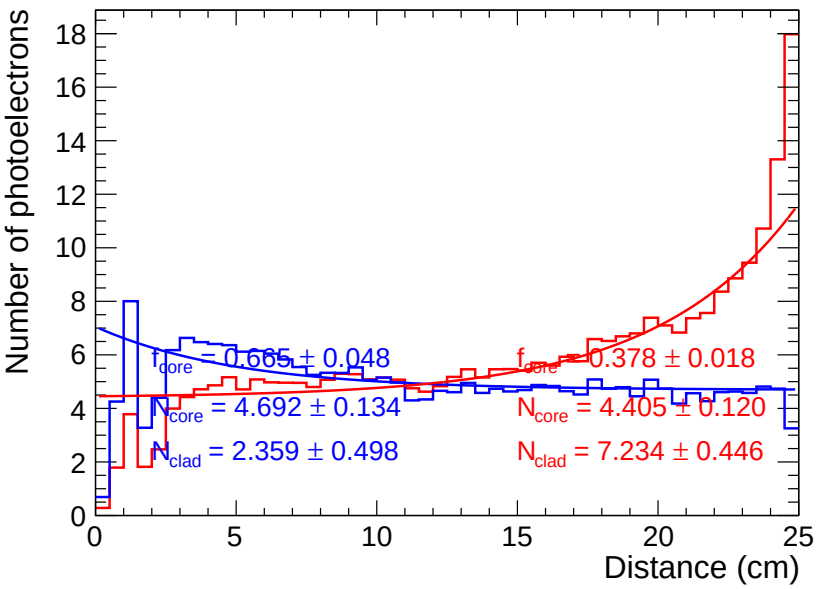


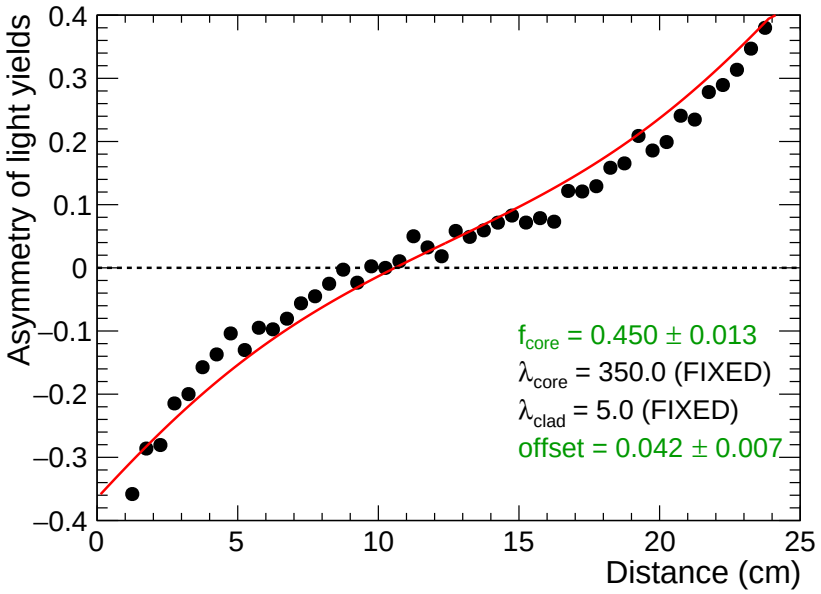


Projection 1, -1.0 cm from fiber

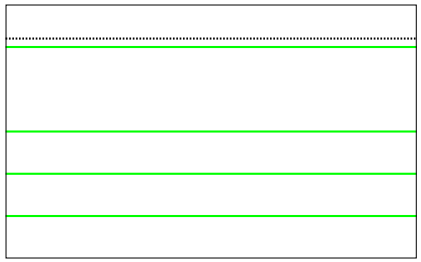


2-component lightyield

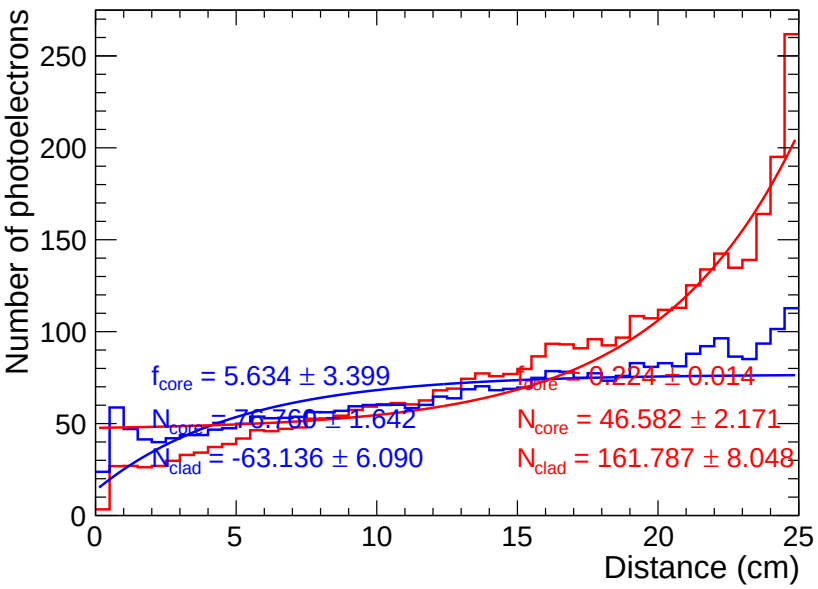


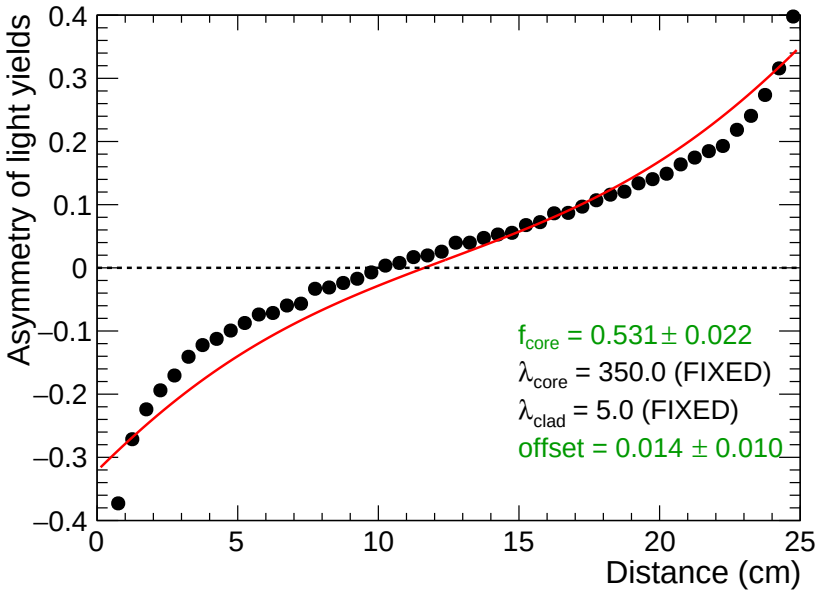


Projection 2, -0.5 cm from fiber

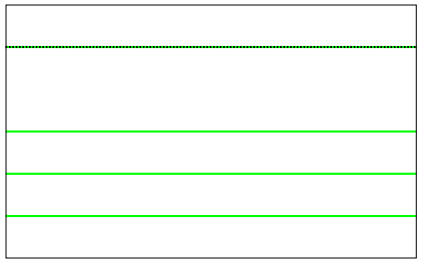


2-component lightyield

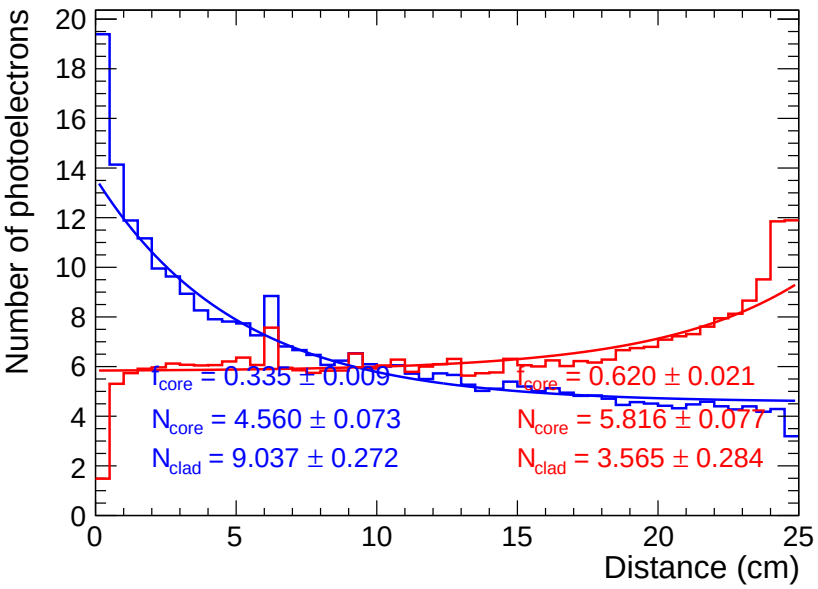


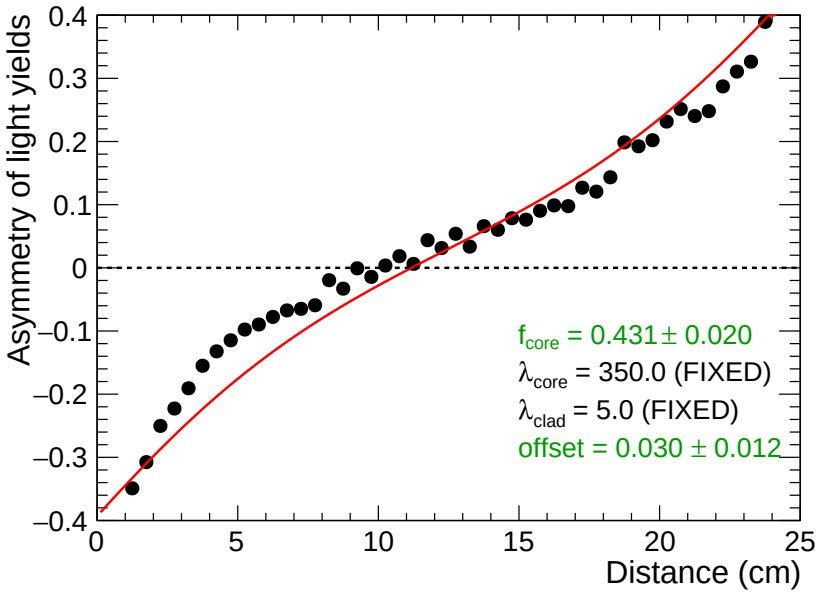


Projection 3, 0.0 cm from fiber

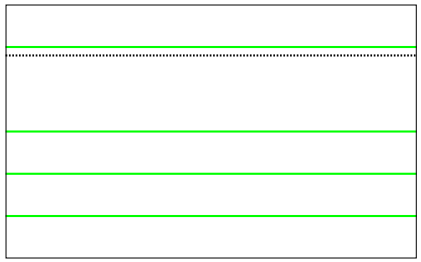


2-component lightyield

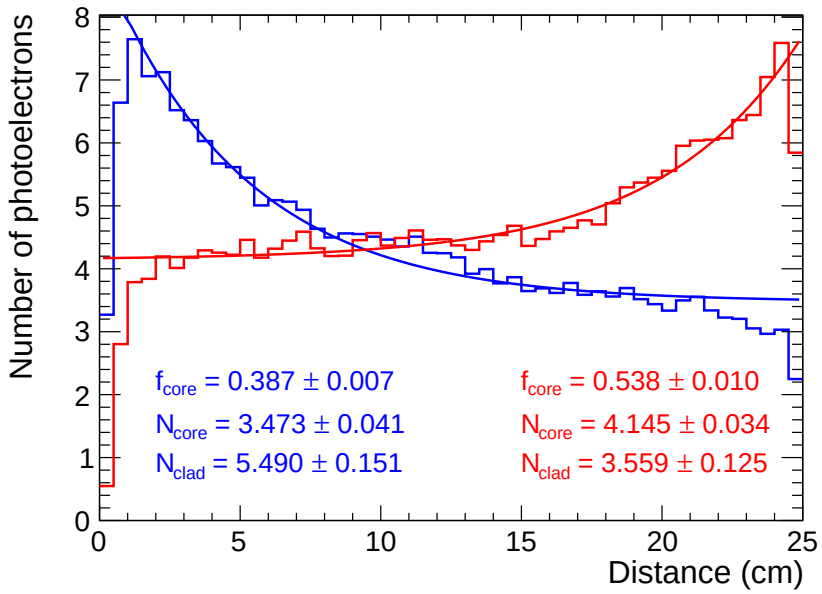


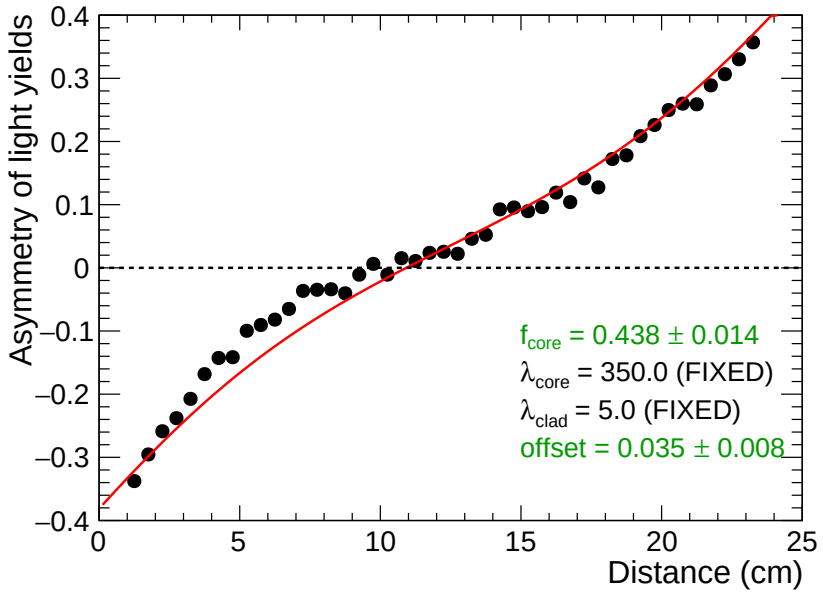


Projection 4, 0.5 cm from fiber

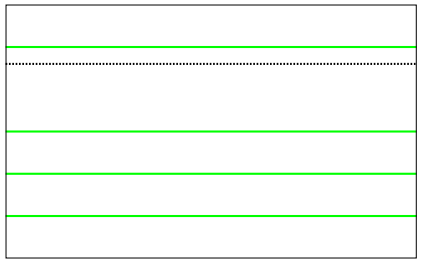


2-component lightyield

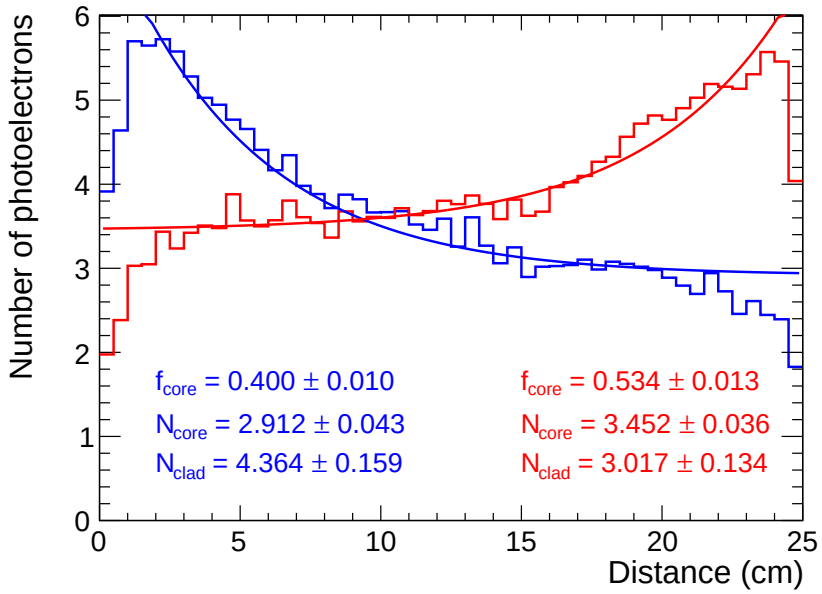


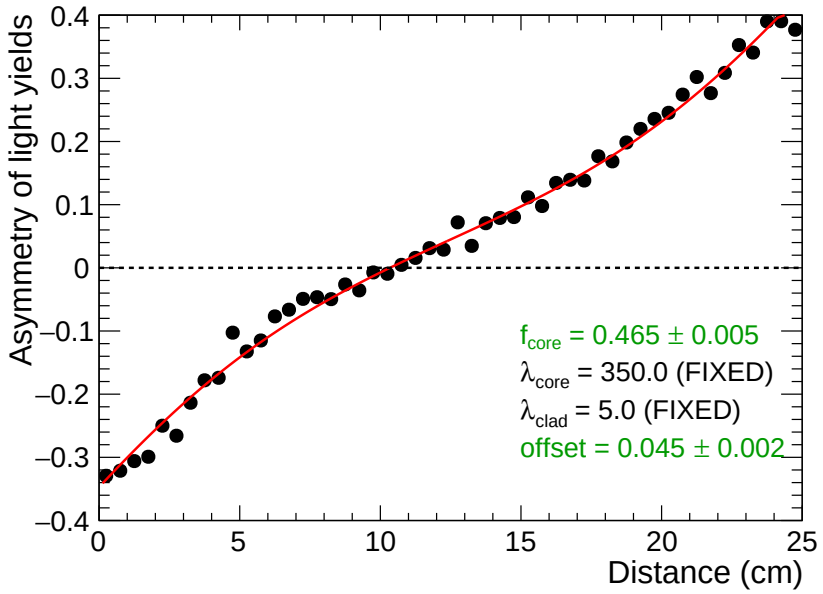


Projection 5, 1.0 cm from fiber

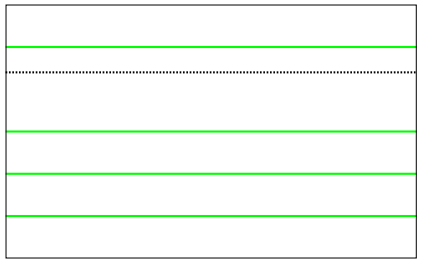


2-component lightyield

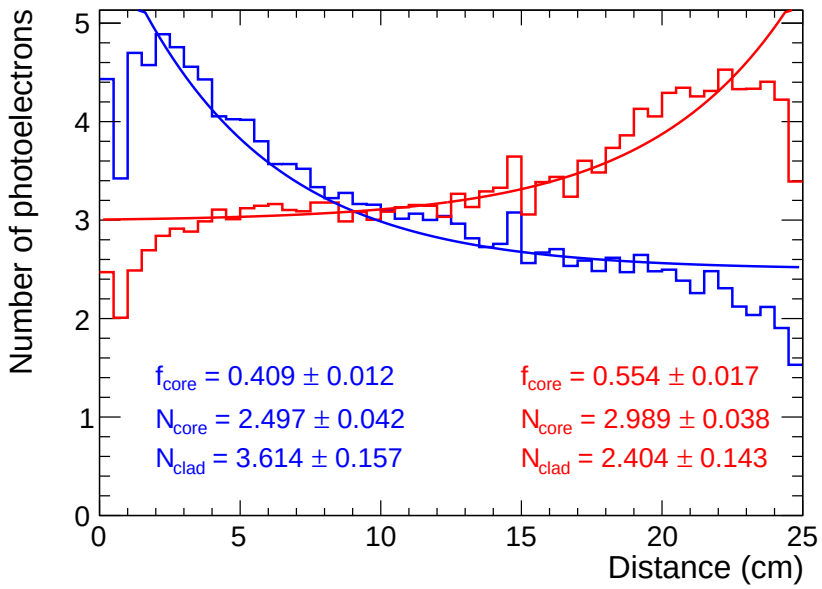


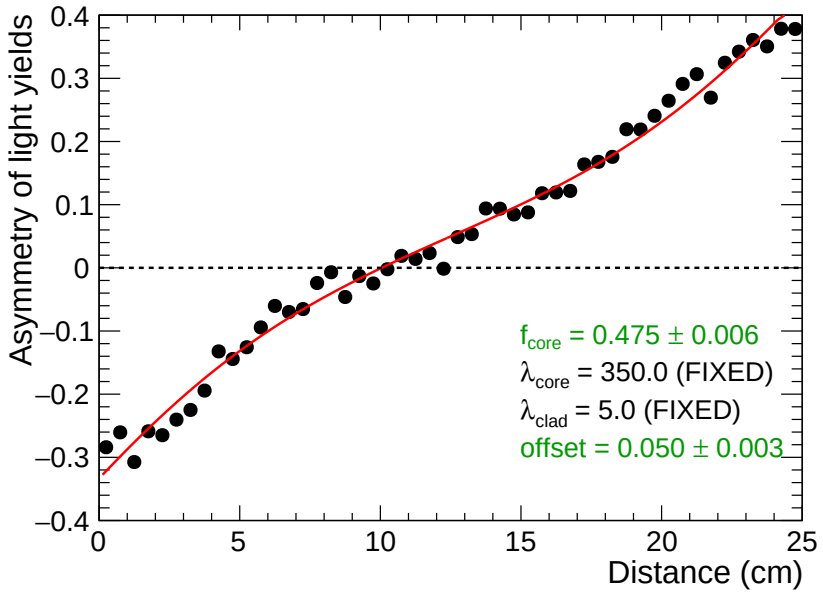


Projection 6, 1.5 cm from fiber

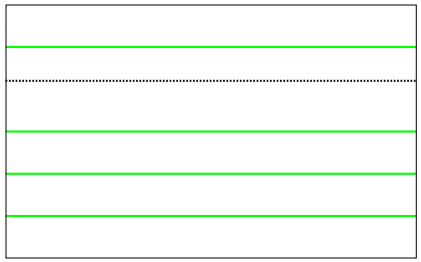


2-component lightyield

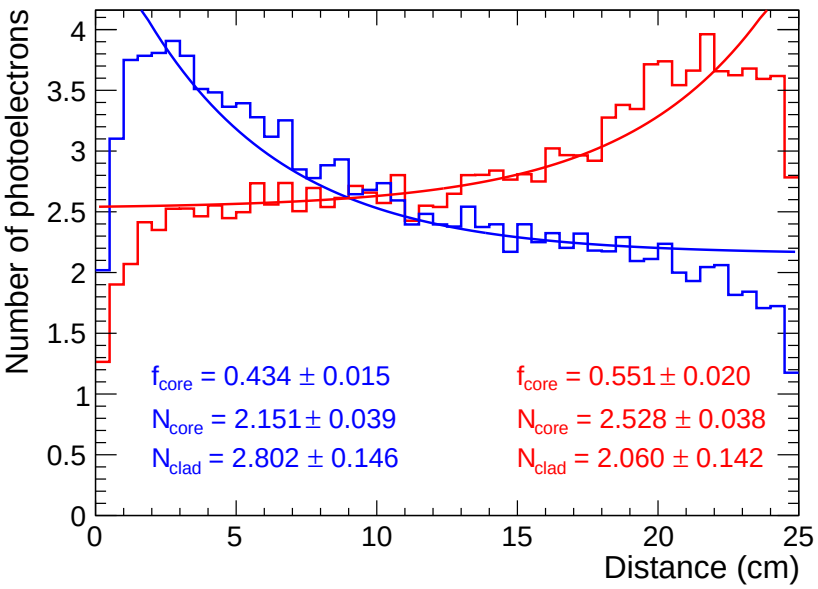


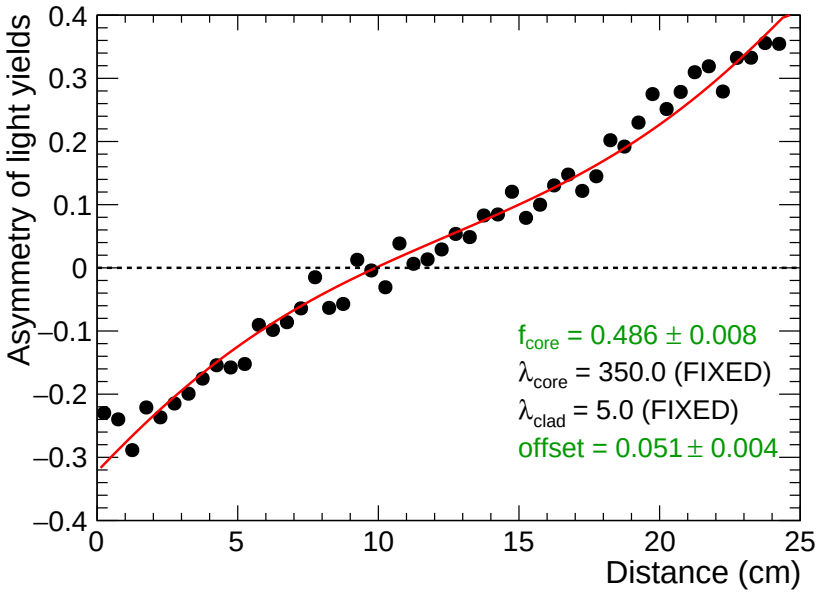


Projection 7, 2.0 cm from fiber

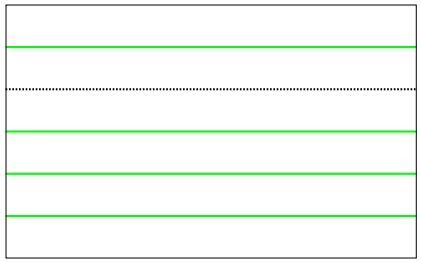


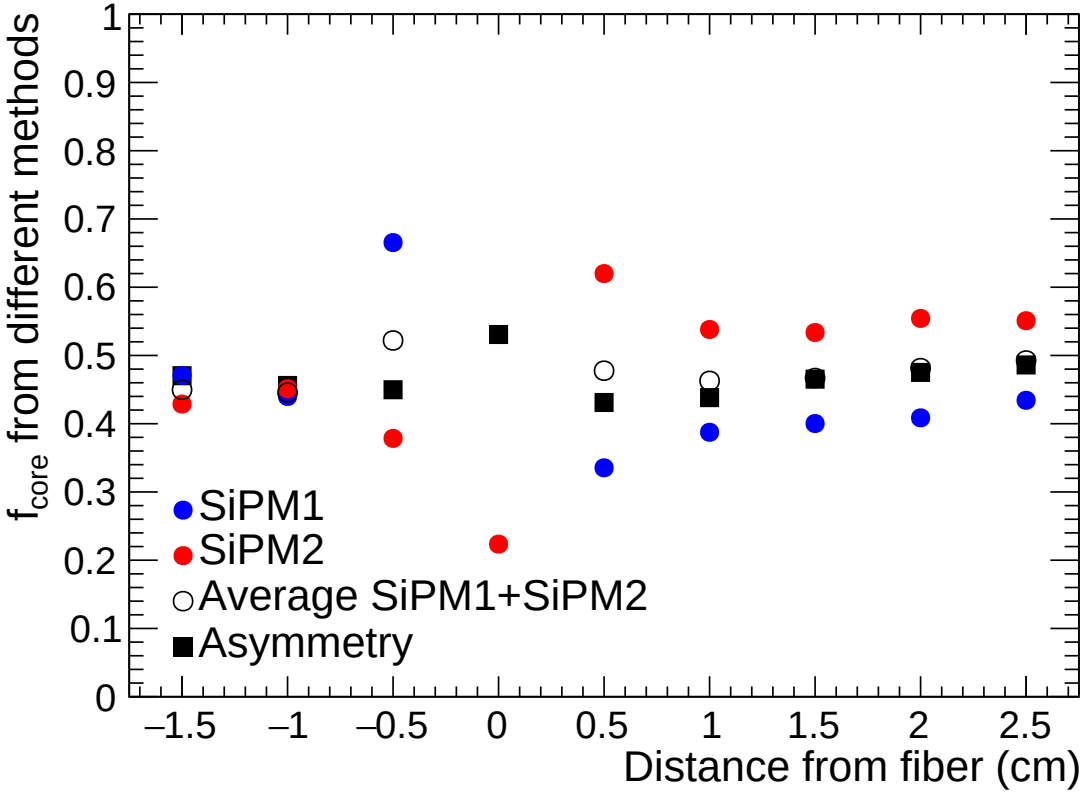
2-component lightyield





Projection 8, 2.5 cm from fiber



2-component lightyield

Comparison of projections