Electron spectrometer progress

Cockcroft Institute, 13 March 2018

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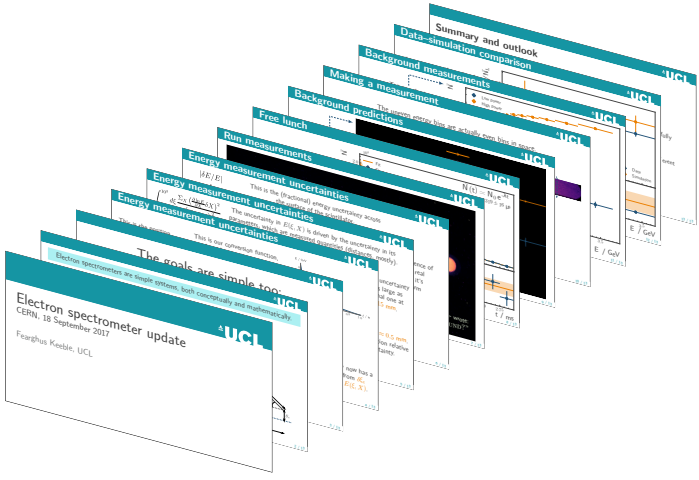
I. Gorgisyan, S. Mazzoni; CERN

Previously...


Summary and outlook
Data–simulation comparison
Background measurements
Making a measurement
Background predictions
Free lunch
Run measurements
Energy measurement uncertainties
Energy measurement uncertainties
Energy measurement uncertainties
The goals are simple too:
Electron spectrometer update
CERN, 18 September 2017
Fearghus Keeble, UCL

Previously...

UCL

The goals are simple too:

See e^-.

Say what E_e is.

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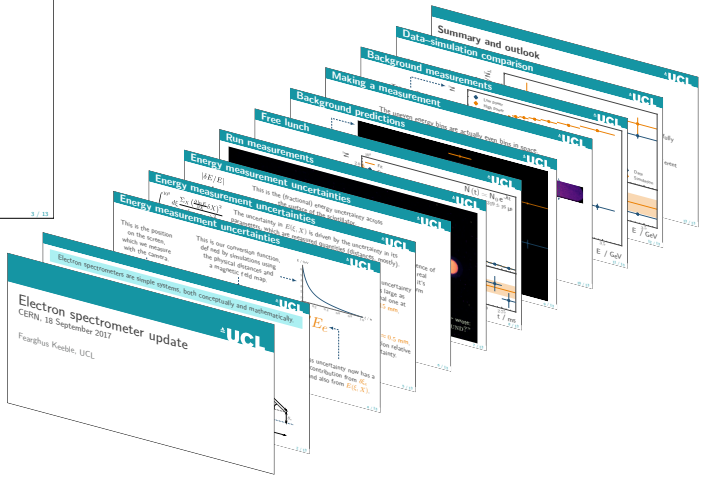
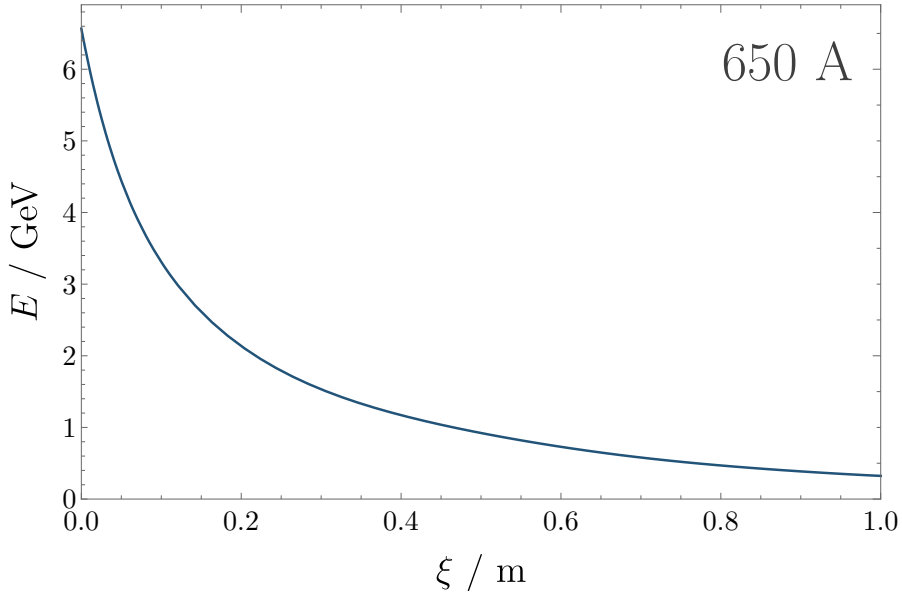


Erratum



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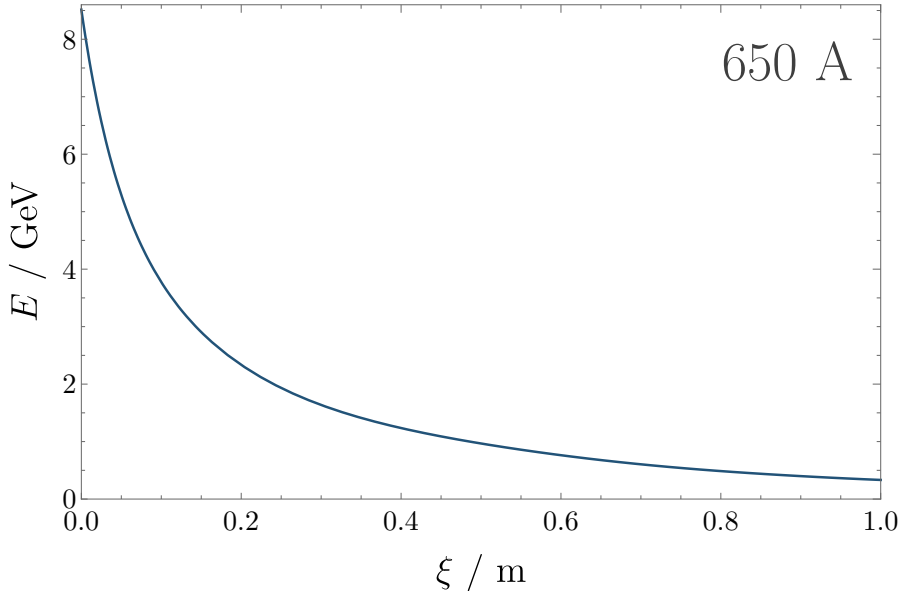
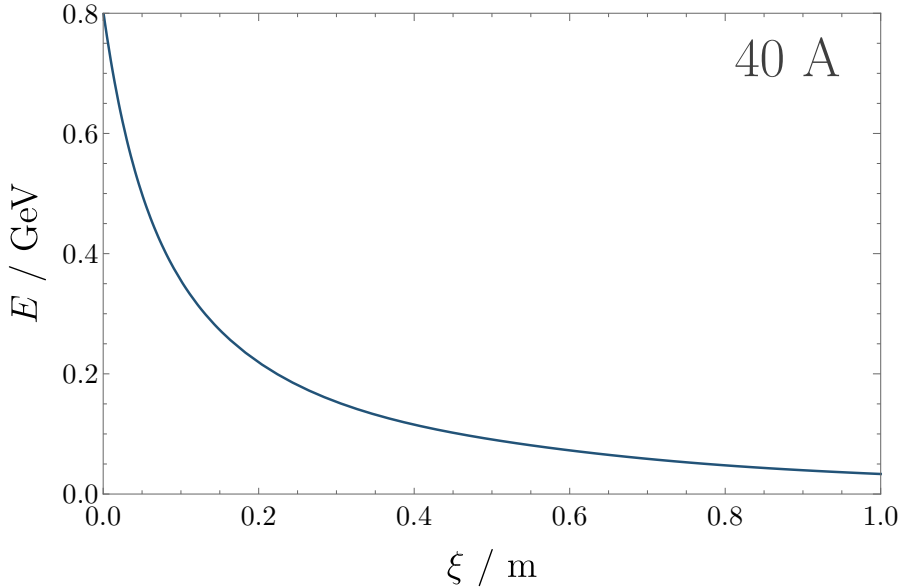
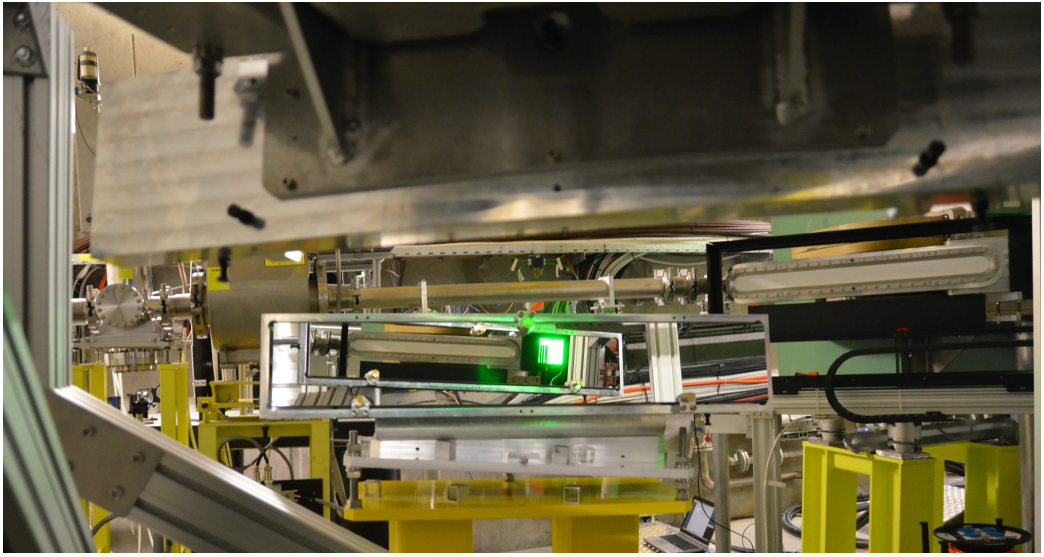


Erratum



Mirror installation



Calibration at CLEAR

UCL

We spent November 27–28 at CLEAR having a first look at the charge calibration of our scintillator.

Thanks to the team at CLEAR for their help with this work.

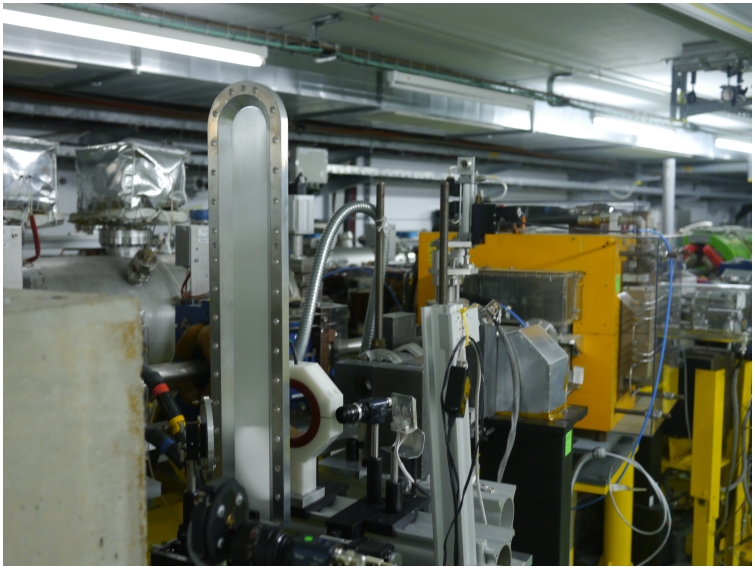


Photo courtesy of Kyrre Sjøbæk

Calibration at CLEAR

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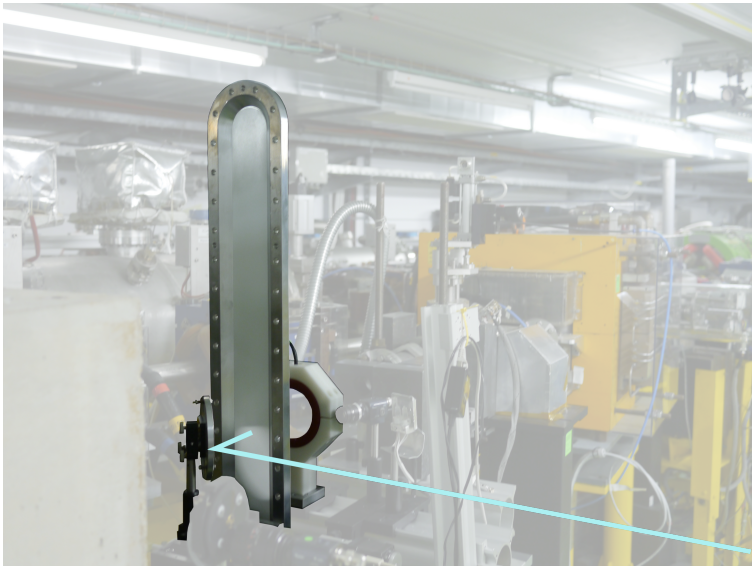
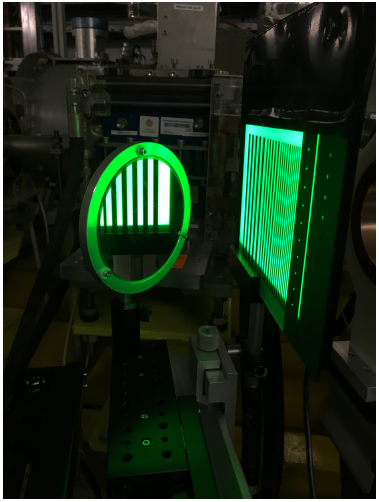
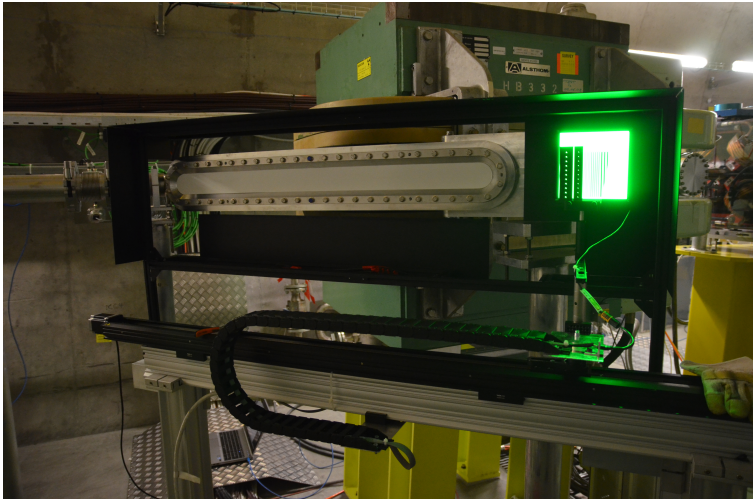


Photo courtesy of Kyrre Sjøbæk

Calibration at CLEAR



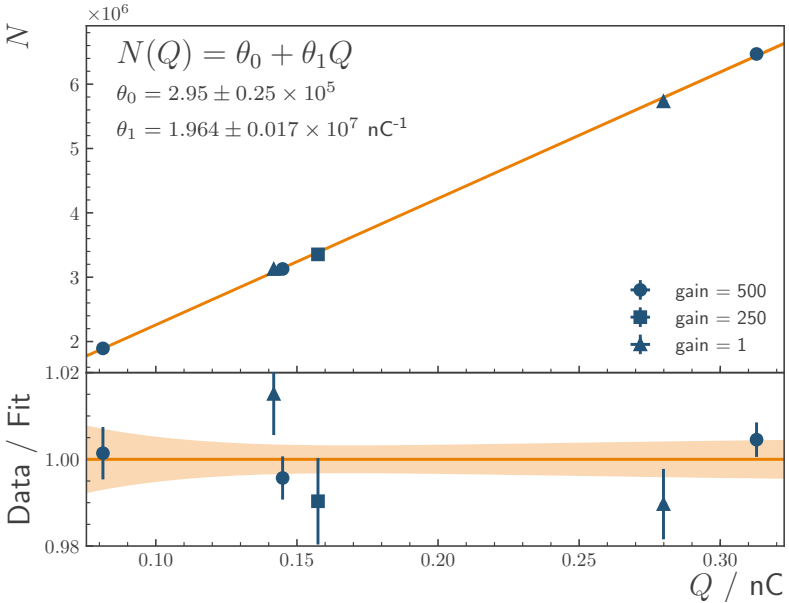


CLEAR signal

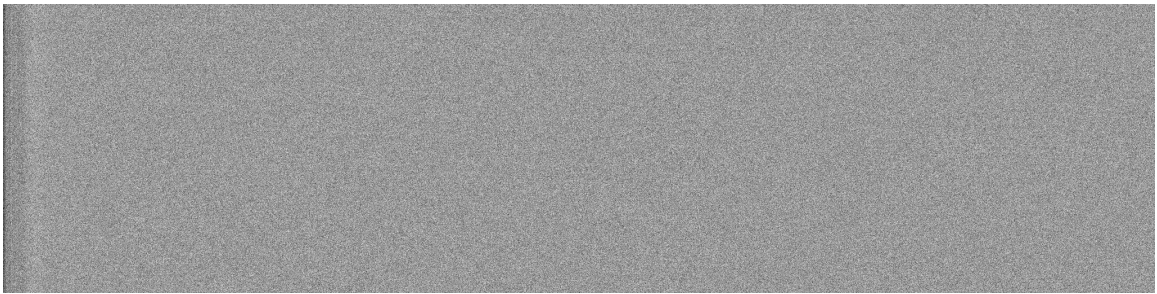
Since we're well away from the saturation region, our response is well fitted by a straight line.

The non-zero intercept is mysterious but we will redo this measurement with some more care later this month.

The correction from this data to our December data is to increase it by ~ 100.



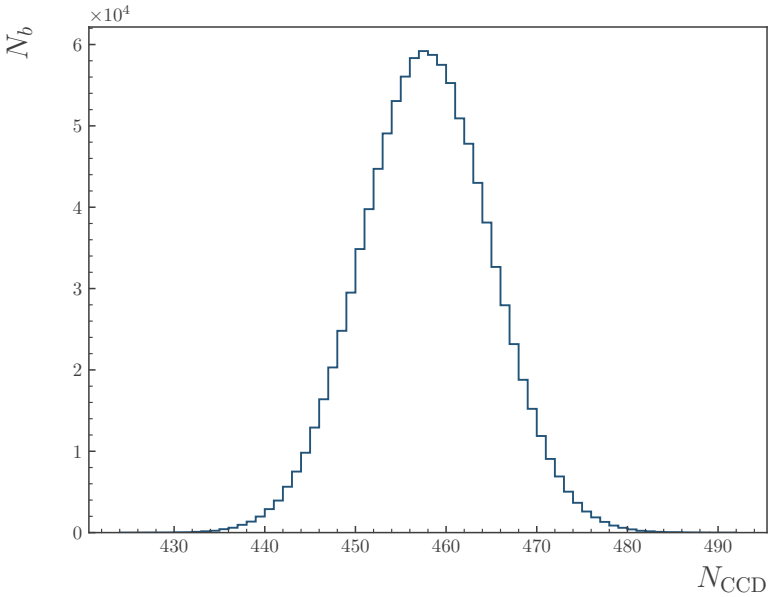
Camera background images



Here we have a dark image from the camera (the lens cap is on).What we see is mostly readout noise, dark current etc.

Camera background

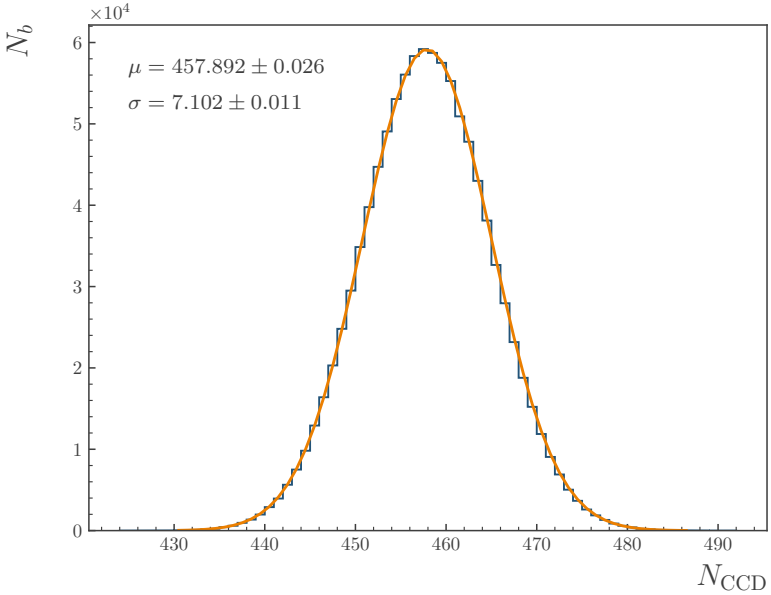
We histogram the $\sim 10^6$ CCD counts.



Camera background

We histogram the $\sim 10^6$ CCD counts.

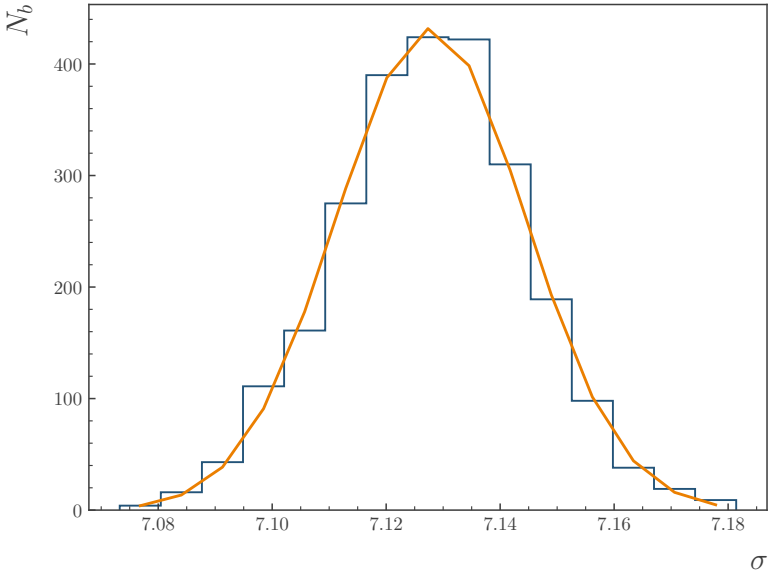
Now we do this, say, 500 times and histogram the fit parameters.



Camera background

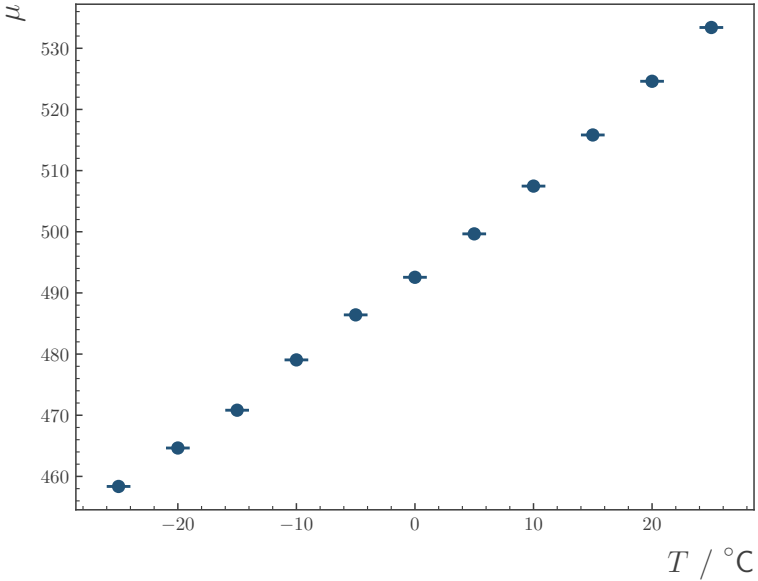
Fit another Gaussian over each of the fit parameters and you have the parameter value and width.

Do this for a range of temperatures.



Camera background

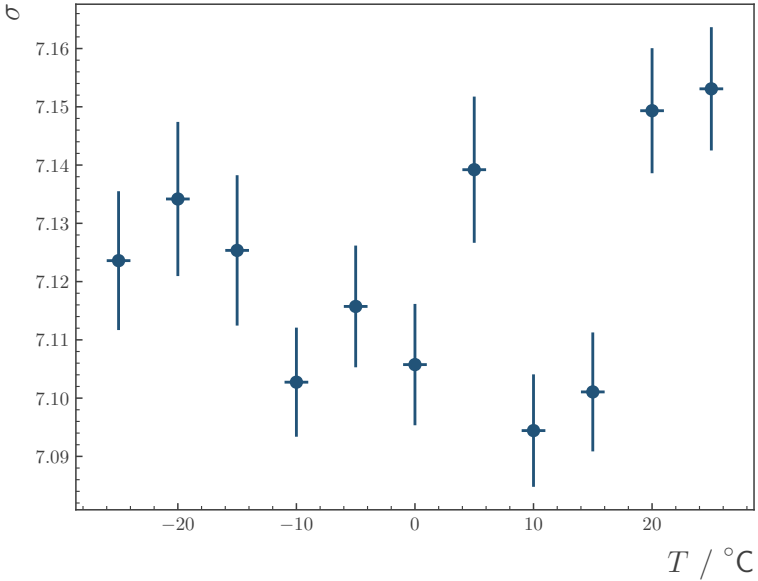
We find the mean variation with temperature is somewhat linear.



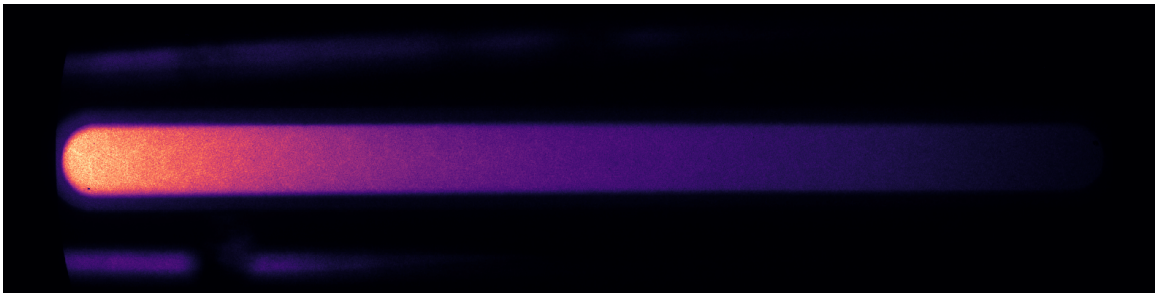
Camera background

The standard deviation doesn't seem to have a simple variation with temperature.

This doesn't really matter too much, the point is the variation is very small.



AWAKE background images



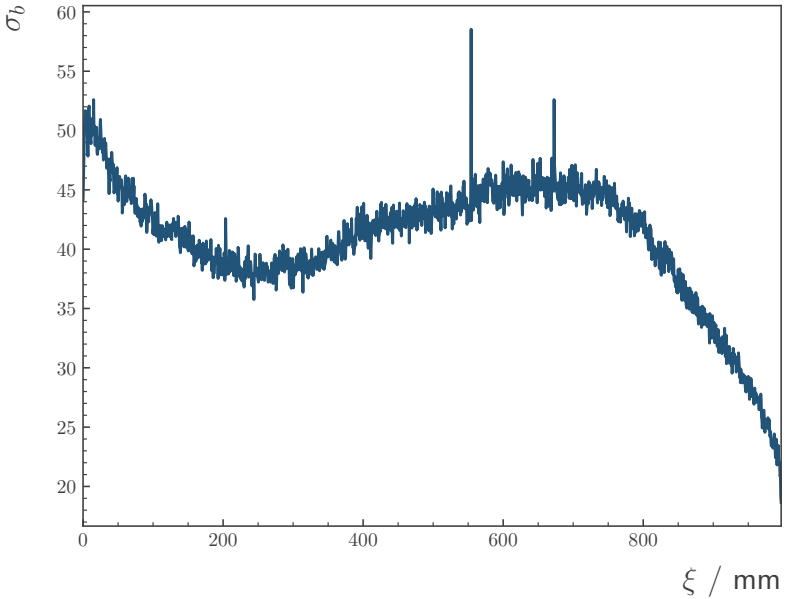
This is what we really see during the experiment.

AWAKE background

Background pixel standard deviation across the screen (assuming vertical uniformity) at a plasma density $\sim 2\times10^{14}$ cm^{-3}.

This is considerably lower than we anticipated. In general, our irreducible background noise is ~ 35 counts.

Note that the shape and values are influenced by the vignetting.



Upgrades

- Change the trigger.
  - This is really the only thing that matters.
- ~~Improve the alignment to reduce vignetting.~~
  - Characterise our resolution.
- ~~Reduce the ambient light.~~
  - ~~It's not clear to me that this will help that much with the noise.~~
- ~~Install our chiller to reduce the dark current.~~
  - ~~Again, it's not clear that this actually reduces the dark current standard deviation.~~
- Redo the calibration at CLEAR.
  - More data, lower charge, scans in the beam energy, size, trajectory.
- Fix a few outstanding issues with the DAQ.
  - Logging of the magnet currents.
  - Our "CameraAcq" property was not acquired properly.