11.07.2023

(Problems with) MMC Data Fits

Reminder

- Spectral lines described by Voigtian

$$V(x;\sigma,\gamma) = (G * L)(x) = \int G(\tau)L(x-\tau)d\tau$$

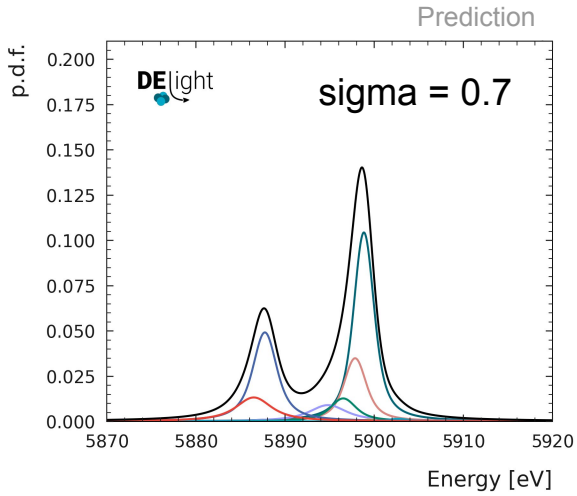
$$G(x;\sigma) = \frac{e^{-x^2/(2\sigma^2)}}{\sigma\sqrt{2\pi}}$$ ← Detector

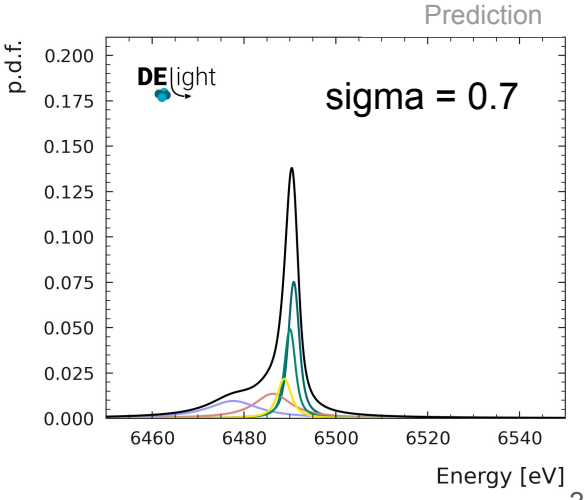
$$L(x;\gamma) = \frac{\gamma}{\pi(x^2+\gamma^2)}.$$ ← Source

No analytic solution, but good approximations exist

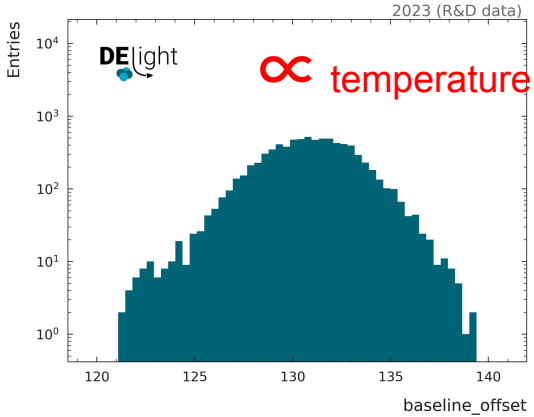
PDF = ka * Sum($V^i_{K\alpha}$) + (1-ka) * Sum($V^i_{K\beta}$) , ka = rel. intensity

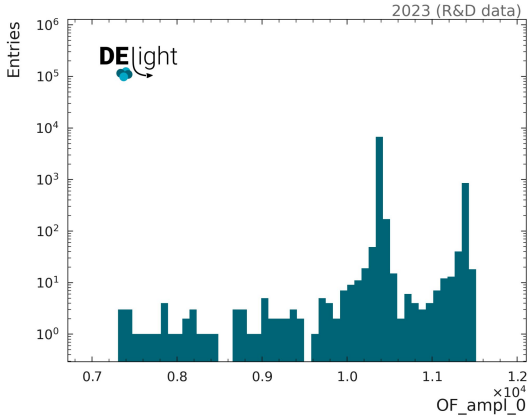
- Here I present the current status and things I've tried to estimate and improve the resolution

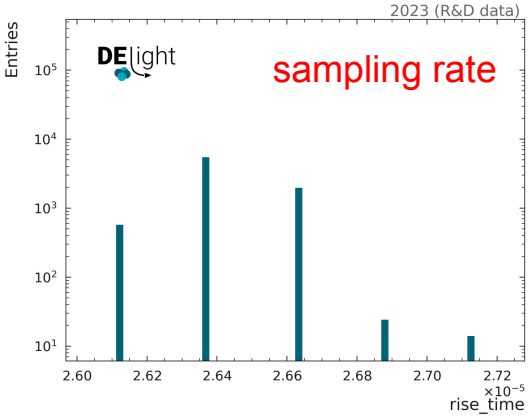


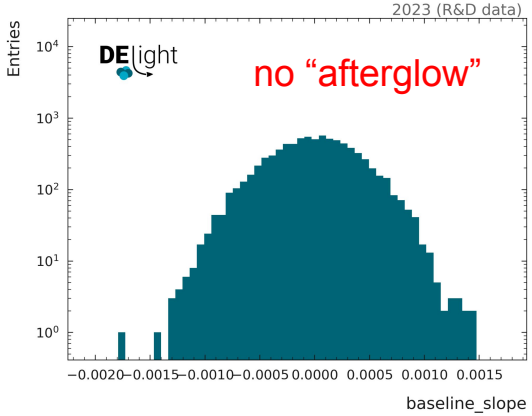


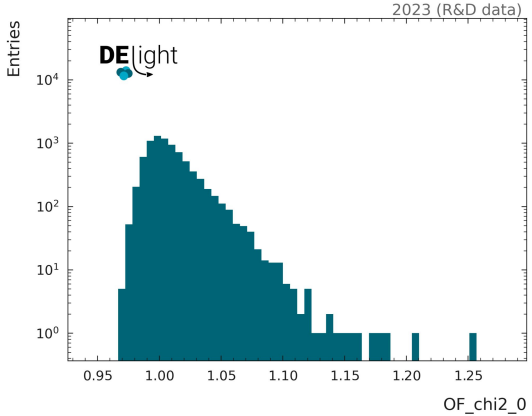
Data after Cleaning + Optimal Filtering

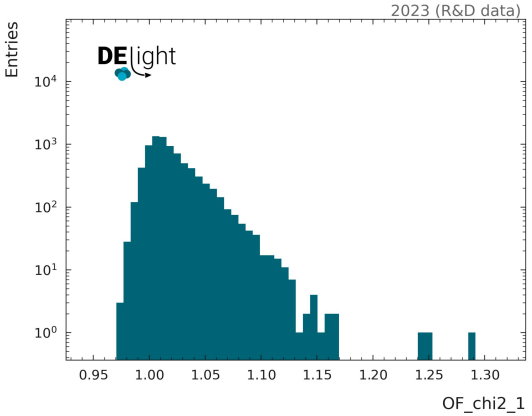






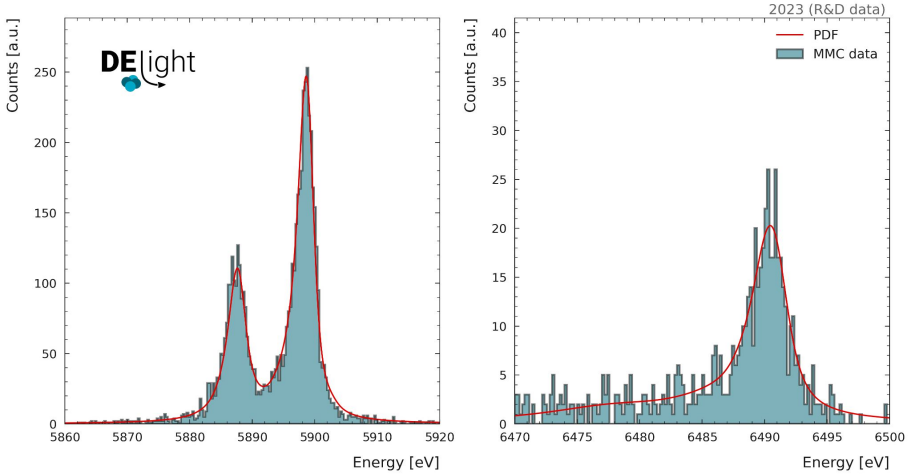


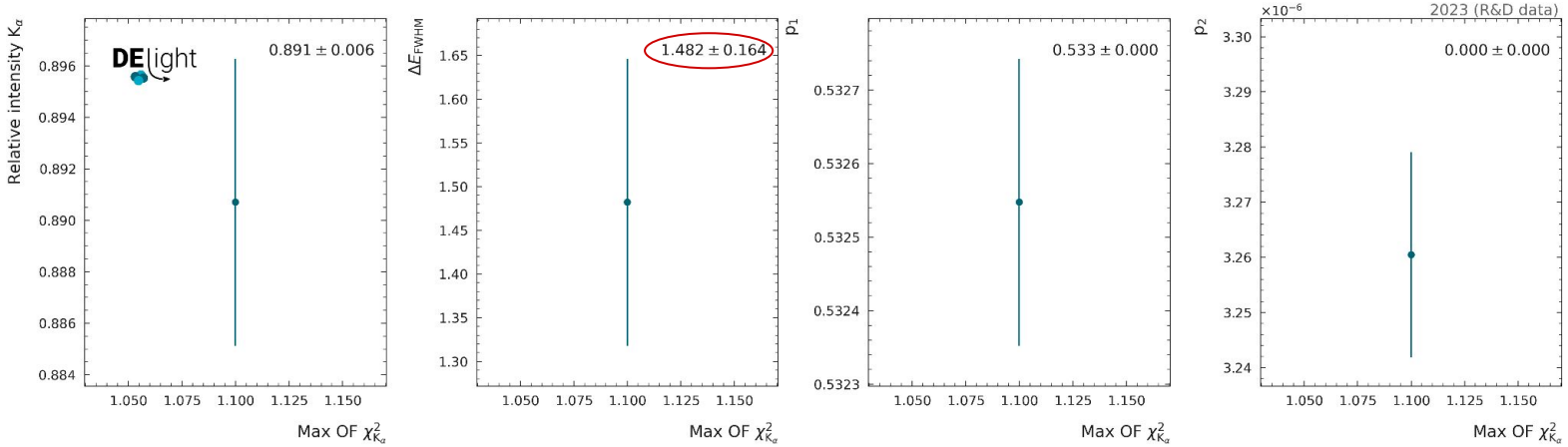




Fitting the full range

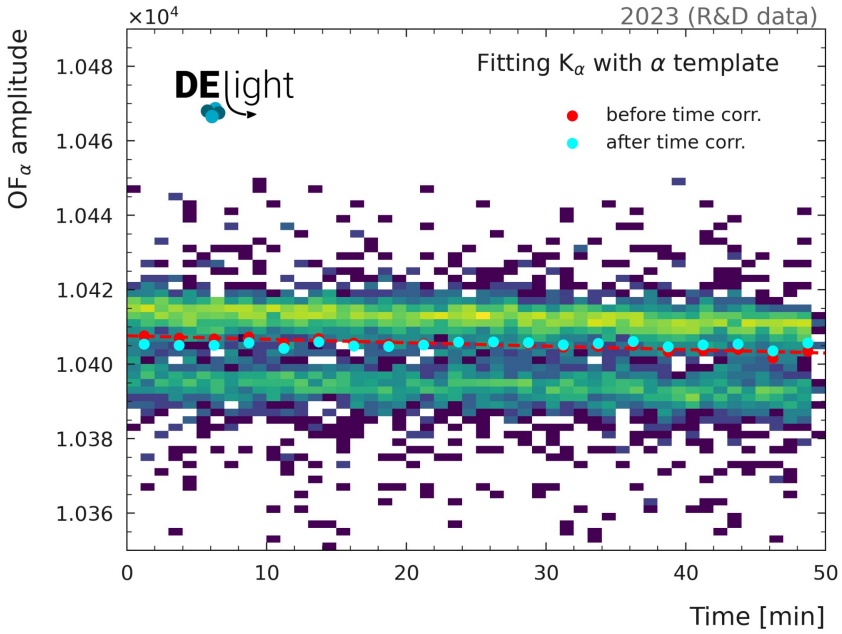
- $E = p_0 + p_1 x + p_2 x^2 + p_3 x^3$, x = ampl
- Resolution: 1.48 GeV
- Marginal improvement over last time (1.49 eV) coming from outlier cleaning
- Referred to as “default” hereafter

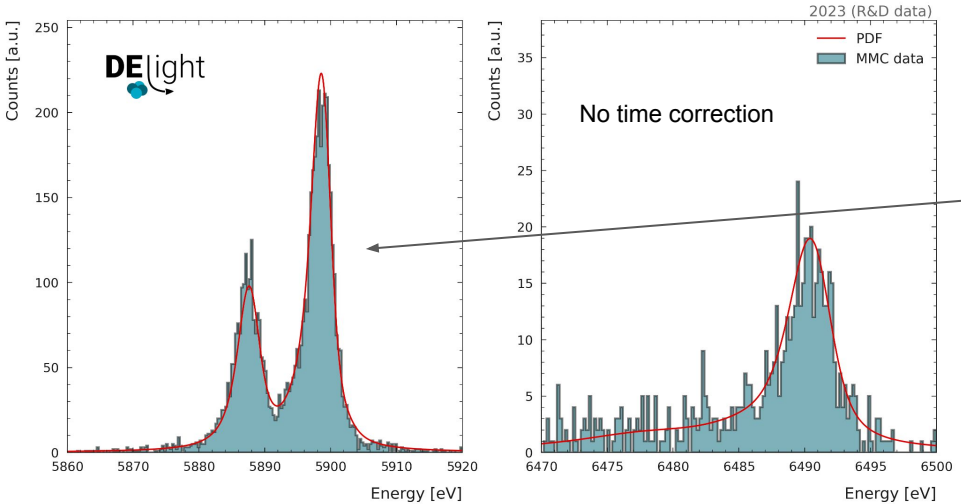




Time correction

- The default has a time-dependent correction of the fitted amplitudes based on the mean of the trend
- Correction derived on K_{α}, but applied also to K_{β}

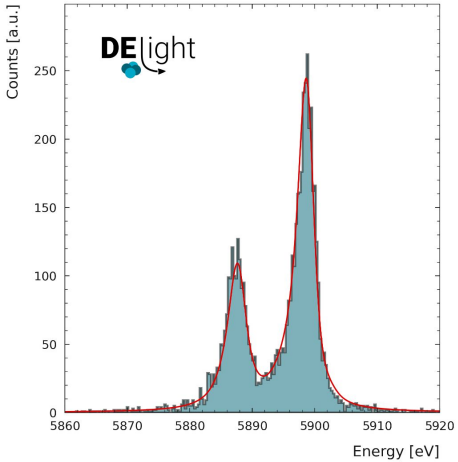




No time correction clearly adverse effect on fit (2.18 eV)

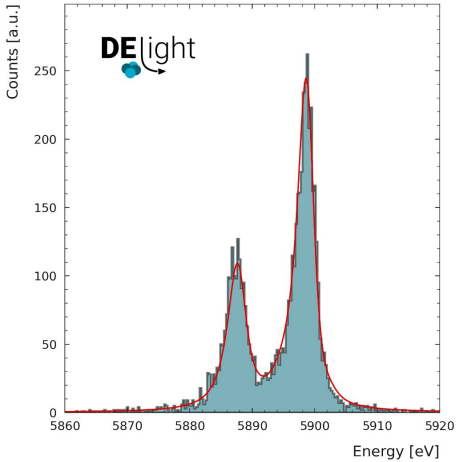
Masking the K_β line

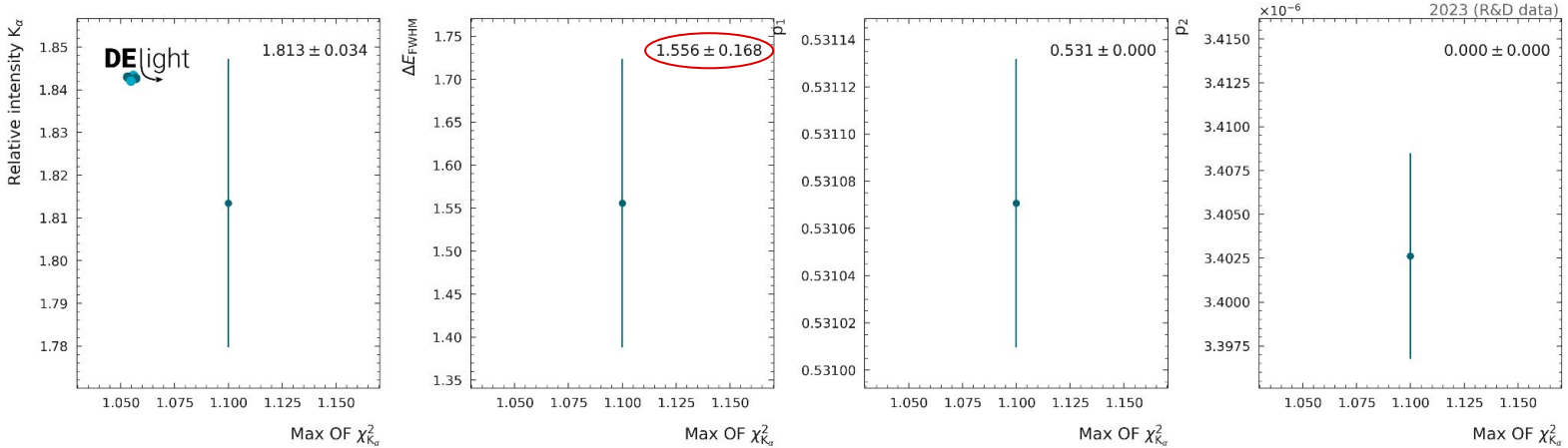
- Only considering the K_α lines
- Idea: chemical composition of K_β source may be different and the spectra off
- Fit not converging when removing K_β term from PDF
- Used full PDF and just masked events in K_β region



Masking the K_β line

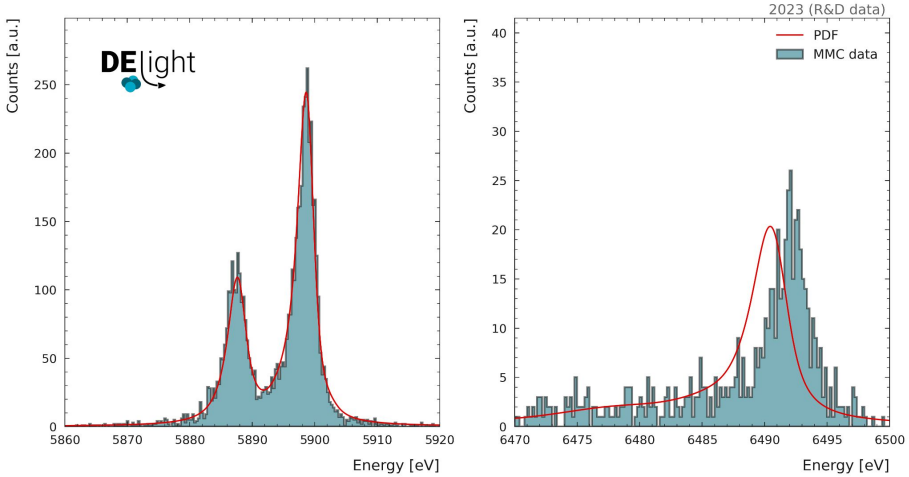
- Degraded resolution extracted compared to fit on full range

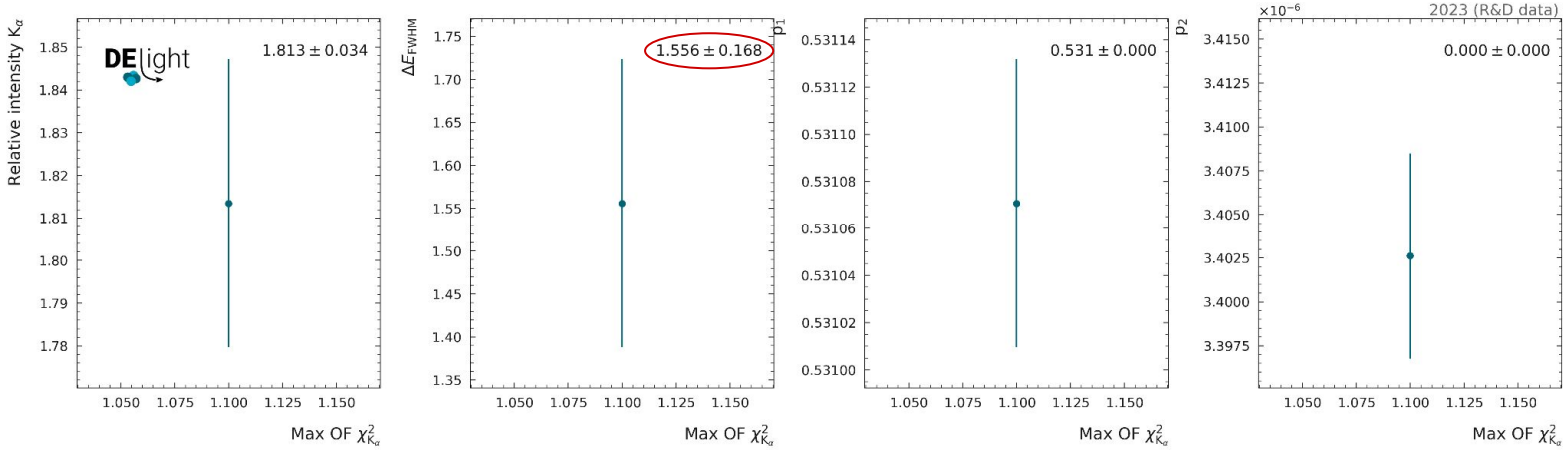




Masking the K_β line

- Slightly degraded resolution extracted compared to fit on full range
- Clearly, estimate off for K_β as no constraints at high energies



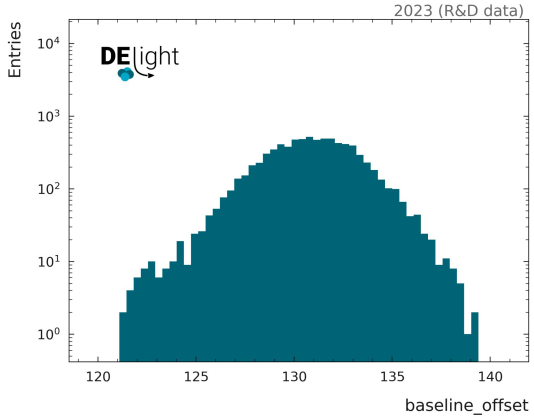


Some fits that did not converge (yet)

- Anything with RooFit
- Only considering the K_α traces + just the K_α PDF term
- Parametrizing (as polynomial) the detector resolution
  - Sigma_0 → sigma = sigma_0 + sigma_1*x
- 3rd order polynomial for x → E
  - Currently a 2nd order polynomial is used

Temperature dependence

- Temperature hiding in the baseline offset
- We expect to see an amplitude dependence on the temperature, but how strong is it?



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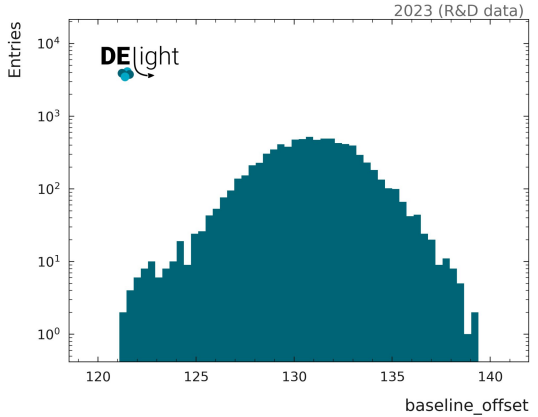
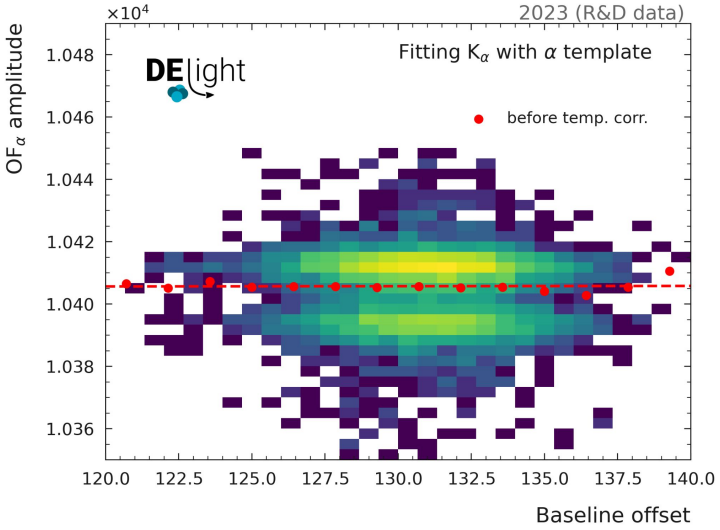
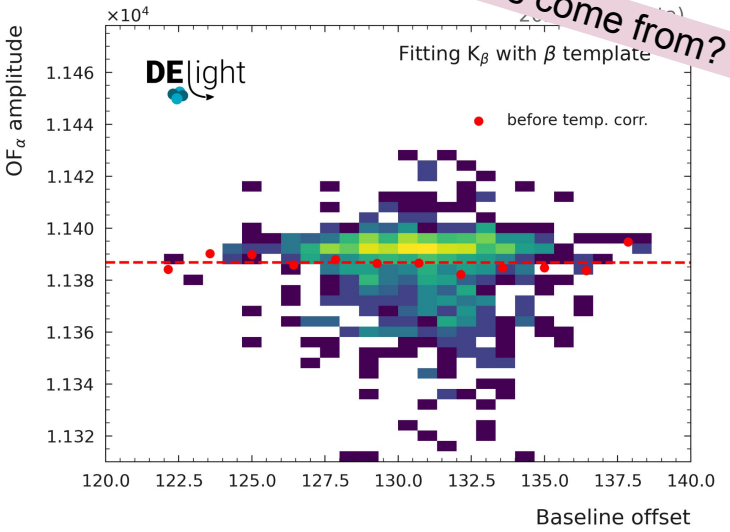
- ~ sinusodial dependence?



Where does this come from? Ideas?





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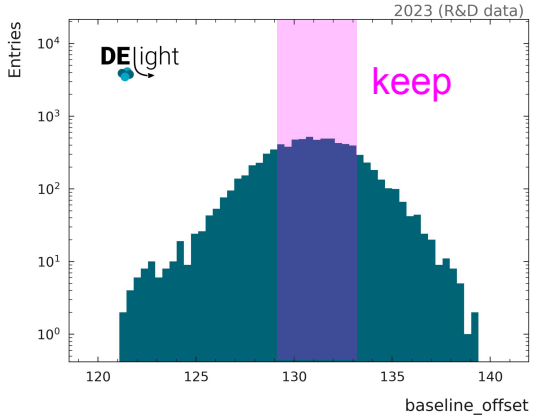

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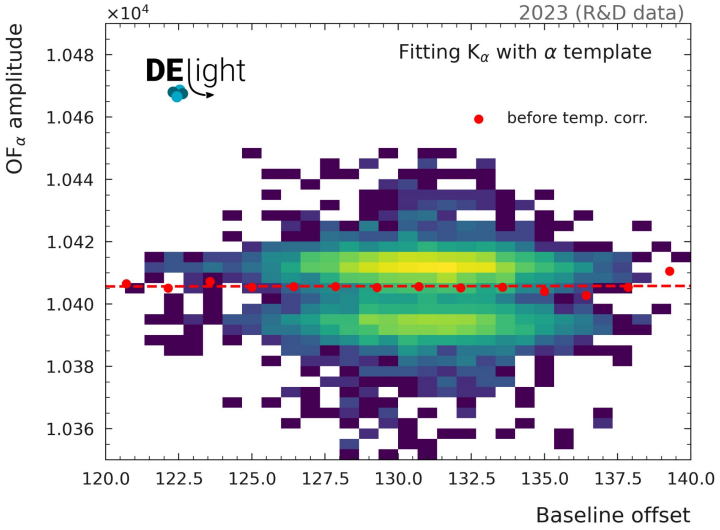
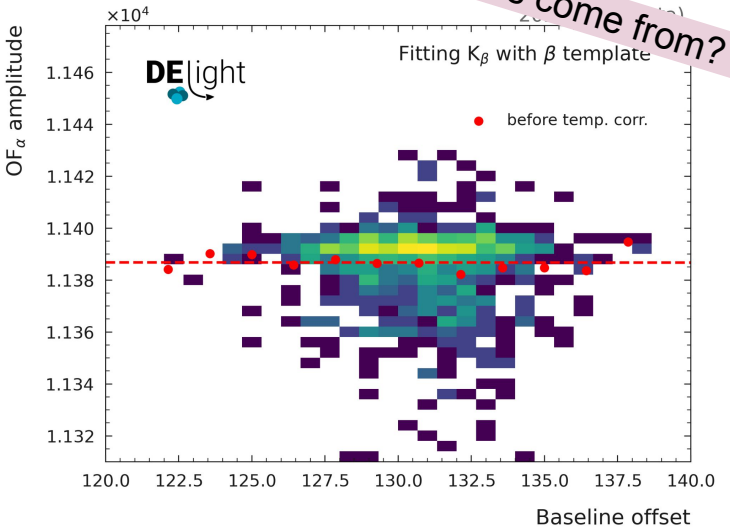
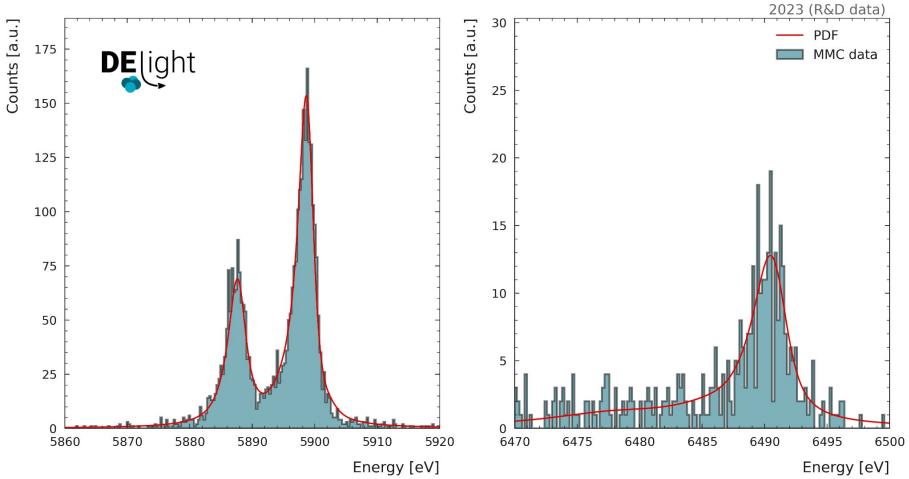
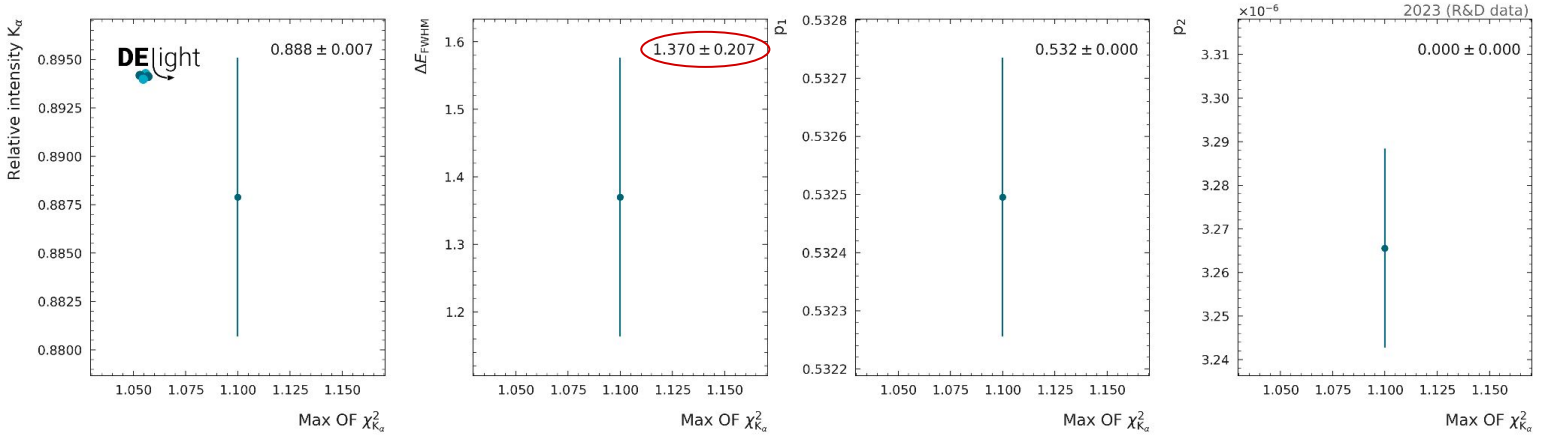




Last slide

- Removing all events with t =]129,133[
- Much improved resolution (within unc)
- Asks for closer inspection of temperature effects & correction





Backup

Overview

- Run 0: masking beta region
- Run 1: default
- Run 2: no time correction
- Run 3: time correction + correction offset shift
- Run 4: Beta 1 time correction for Kbeta region
- Run 5: Run 3 + Run 4
- Run 6: Run 4 + temperature correction
- Run 7: temperature correction
- Run 8: temperature selection via skim.config
- Run 9: flip sigma and aw_ij