Update on JUNO Waveform Reconstruction

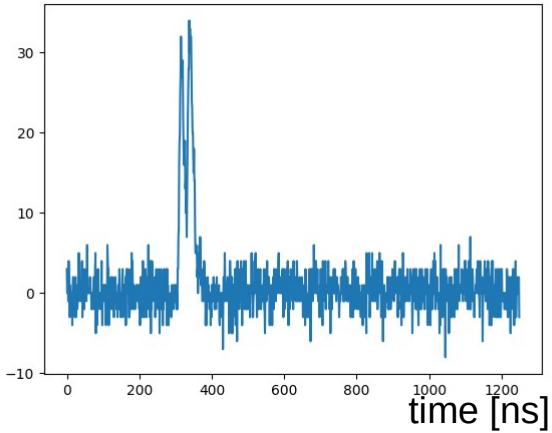
Michaela Schever

25th October 2022, EU-AM Collaboration Meeting

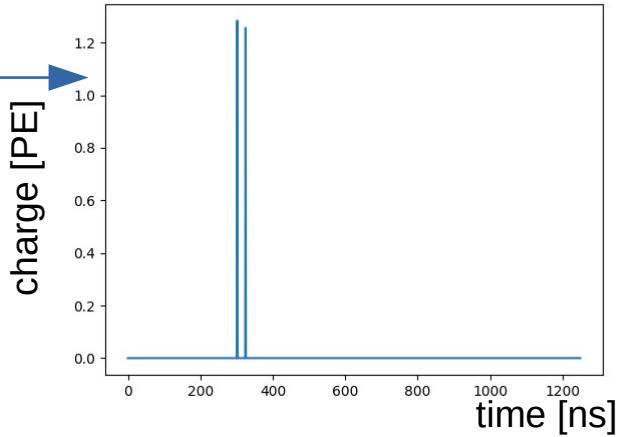
Outline

- Influence of different types of noise on the unfolding method

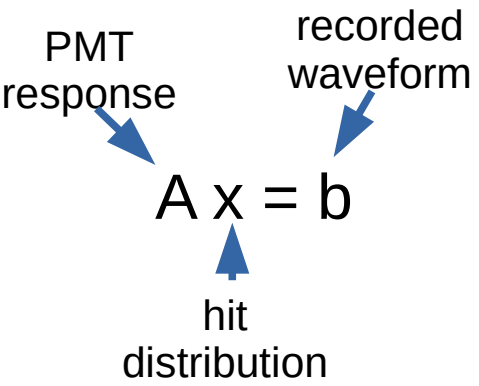
Principle of Unfolding



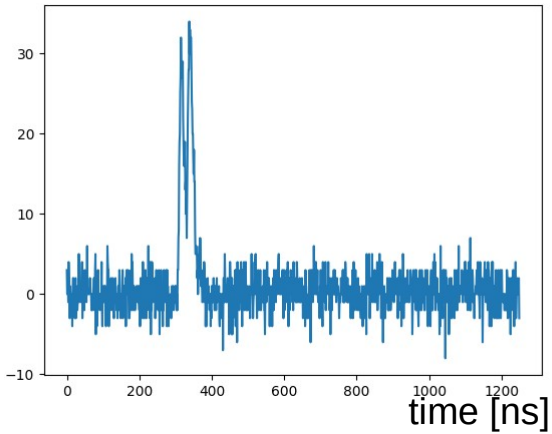
Simulated waveform



PE hit distribution



Principle of Unfolding



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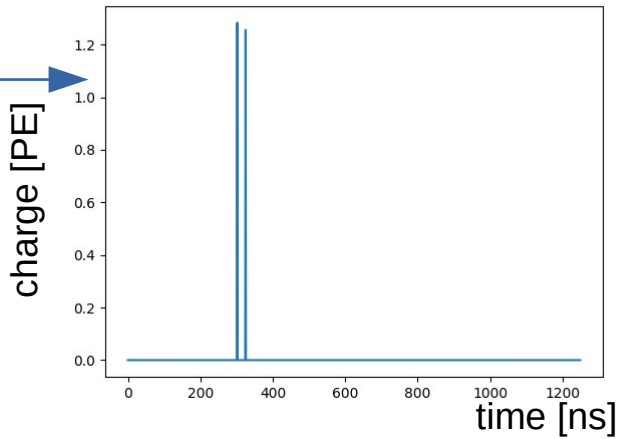
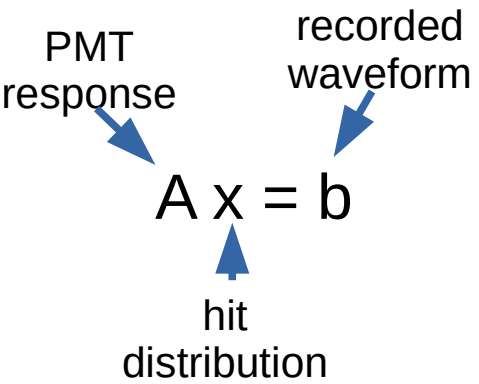
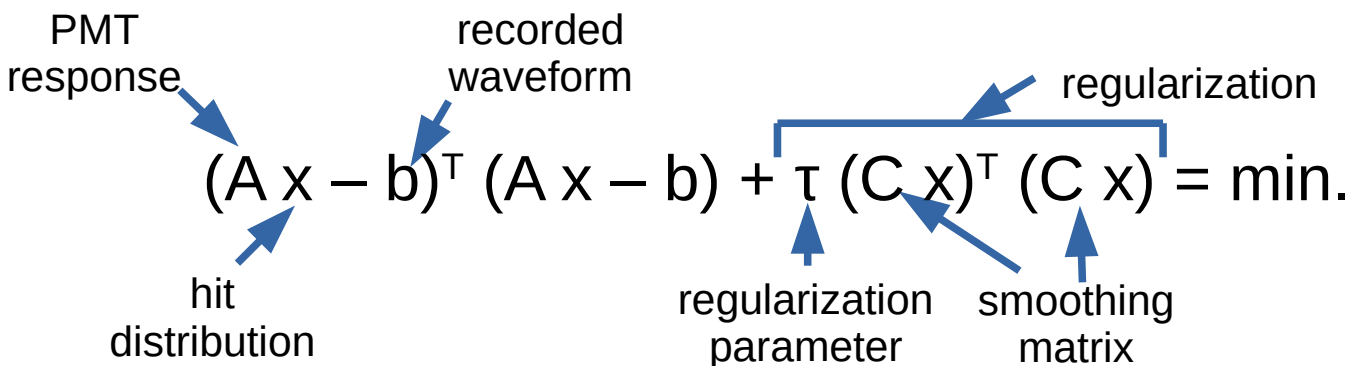


PE hit distribution

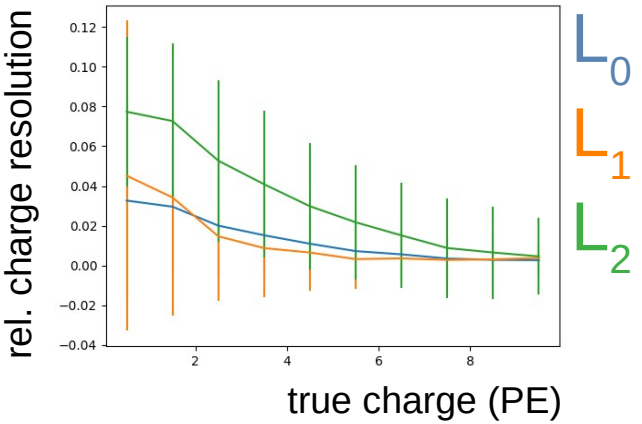


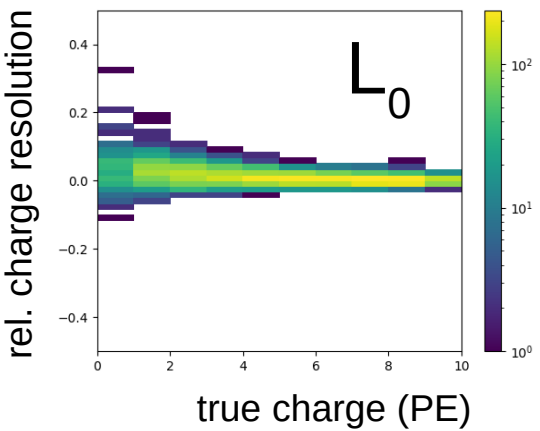


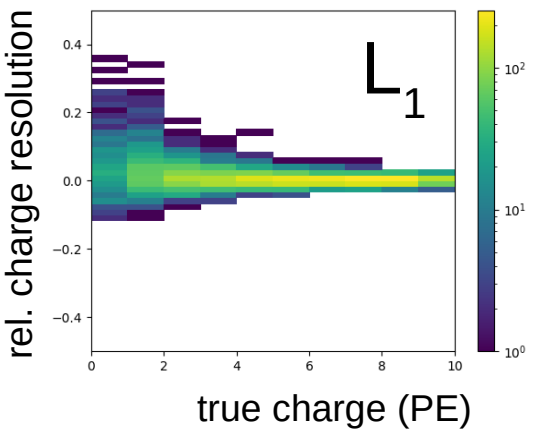
Charge reconstruction performance

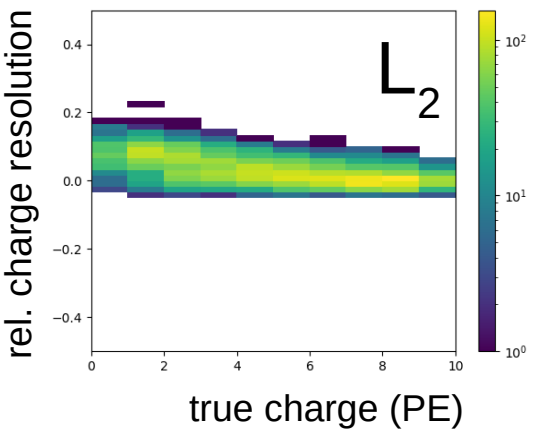
REMINDER

- Equivalent to deconvolution
- Use of unfolding for filter design
- Choices for regularization matrices:
  - L_0: unity matrix
  - L_1: minimize first derivative
  - L_2: minimize second derivative





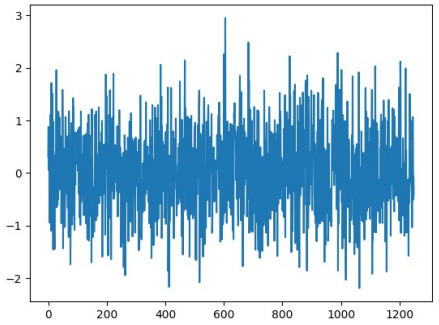


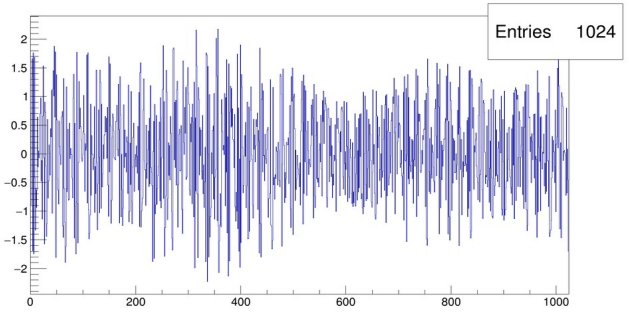


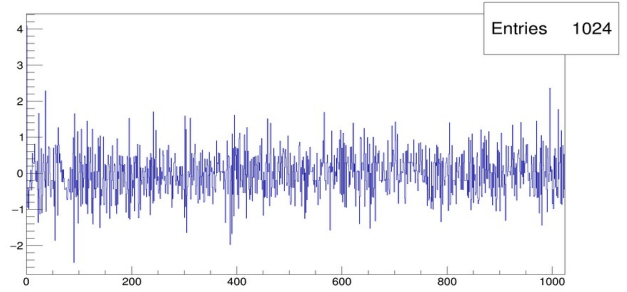
Different types of noise

- Different waveform reconstruction methods have been studied in anticipation of varying performances depending on the composition and strength of the noise

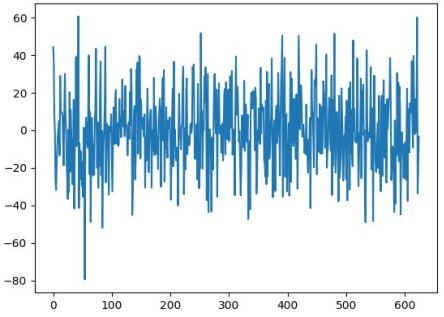
time

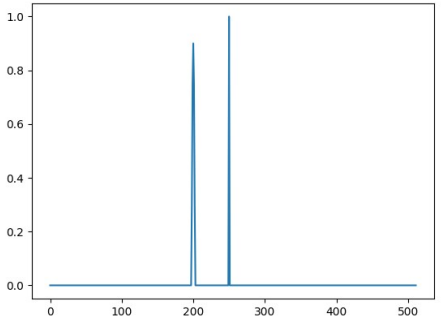


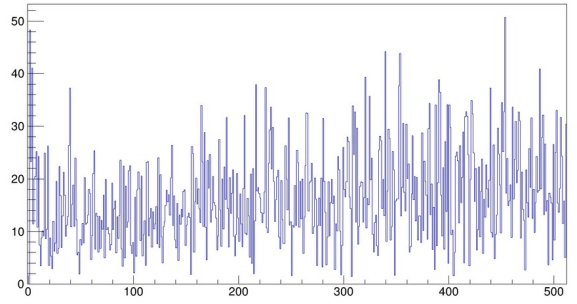




frequency







Simulated white noise

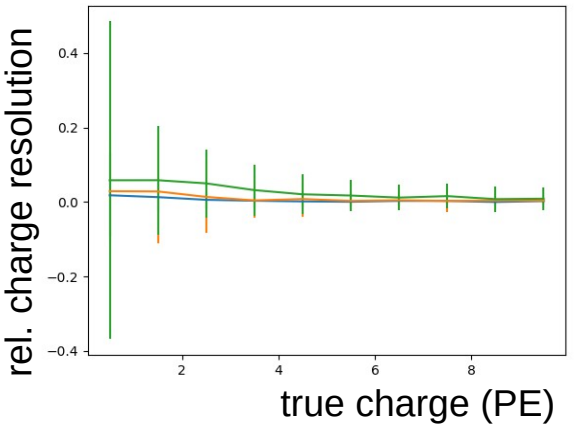
Noise of specific frequencies

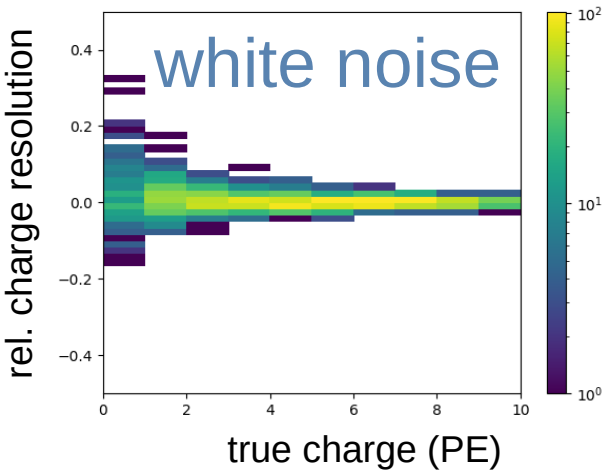
Noise measured at PMT testing site

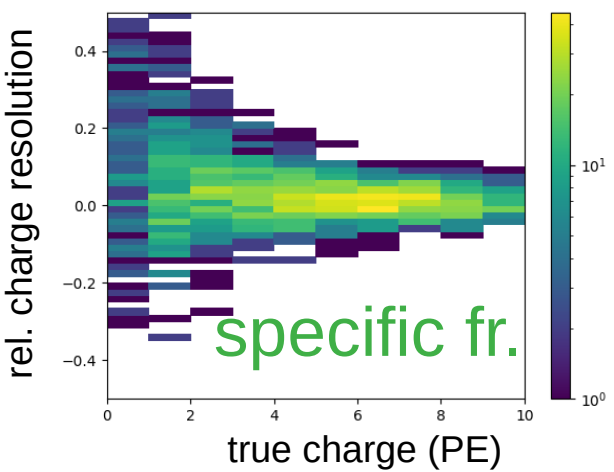
Charge reconstruction performance for different types of noise

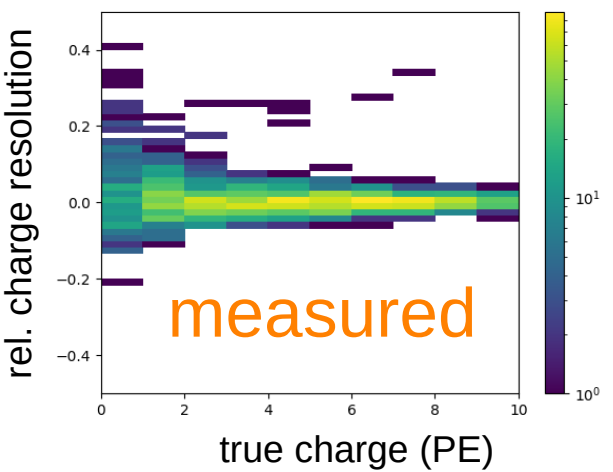
- Smoothing matrix: L_0 unity matrix
- Purely simulated white noise has best charge resolution
- Noise from PMT testing site only slightly worsens the charge resolution

white noise
measured
specific fr.









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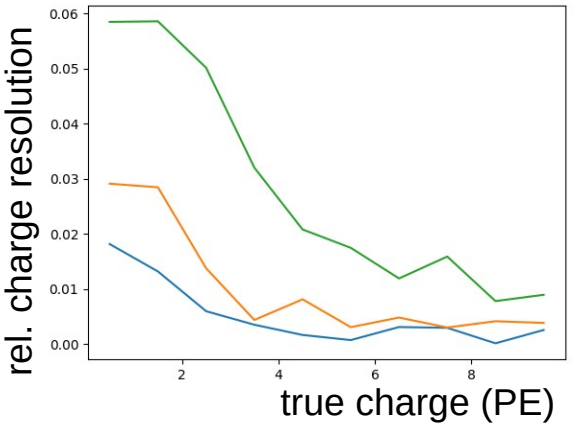

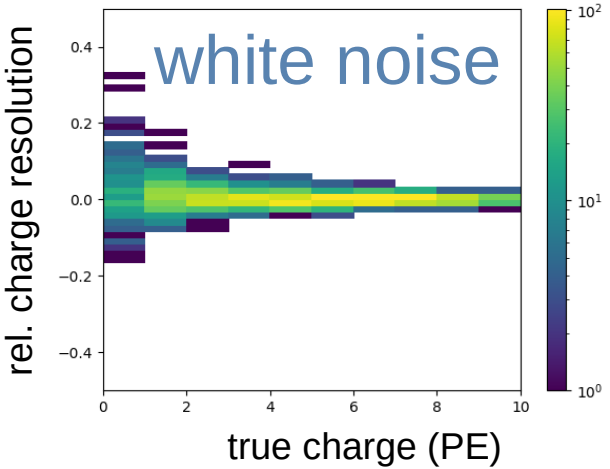

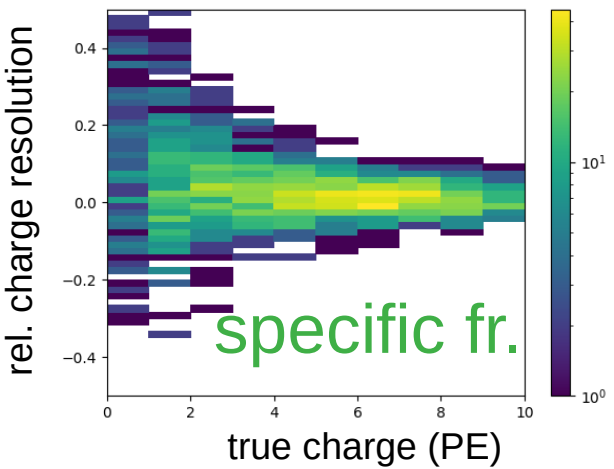

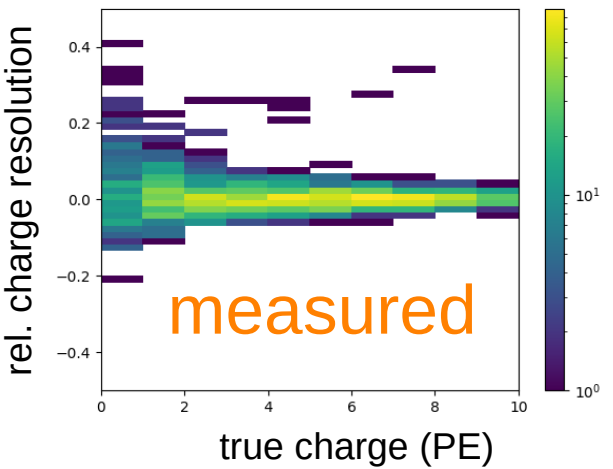

Conclusion

- Influence of different types of noise on charge reconstruction performance has been studied for Unfolding method
- Influence mostly for small NPE
- Noise measured at PMT testing site only slightly worsens charge reconstruction performance compared to simulated white noise
- Other waveform reconstruction methods need to be tested with different types of noise, too