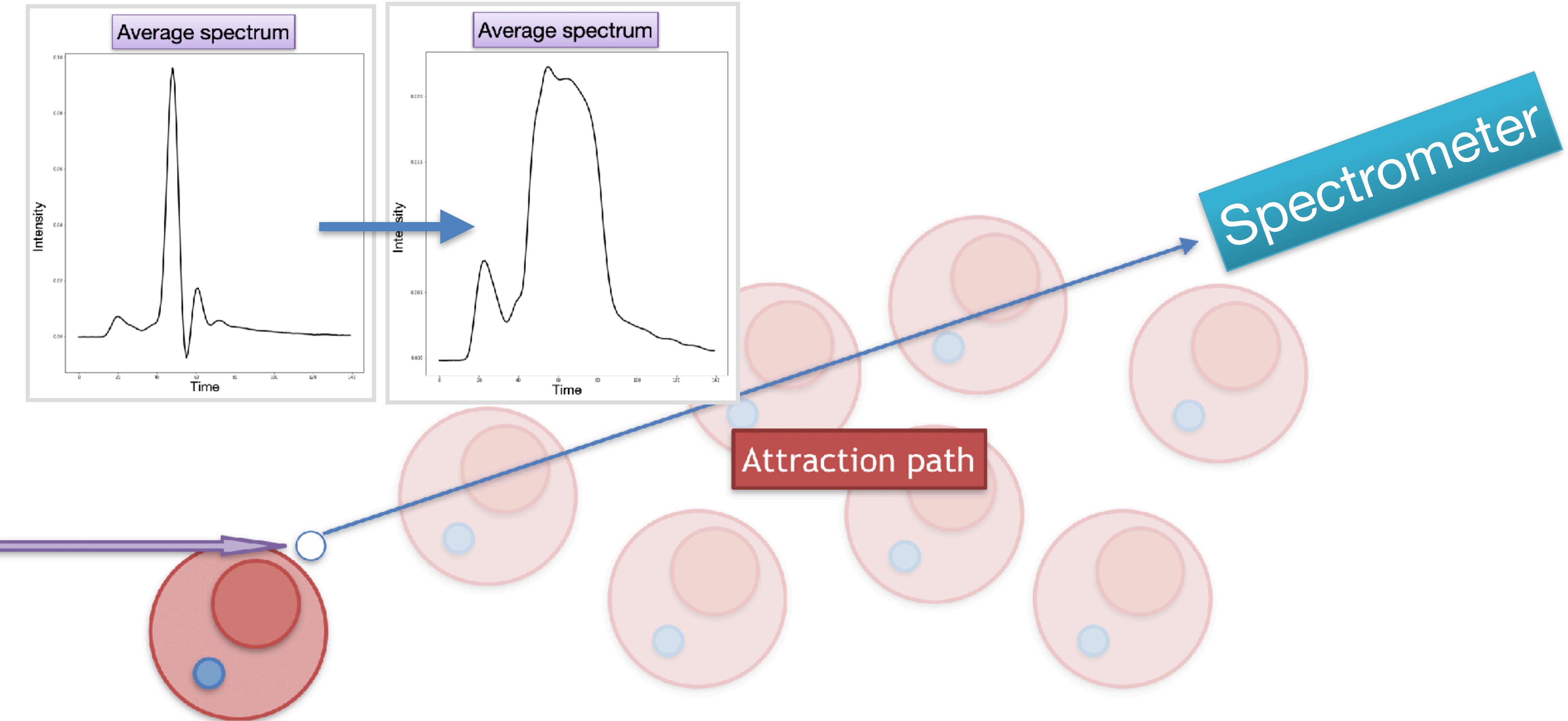
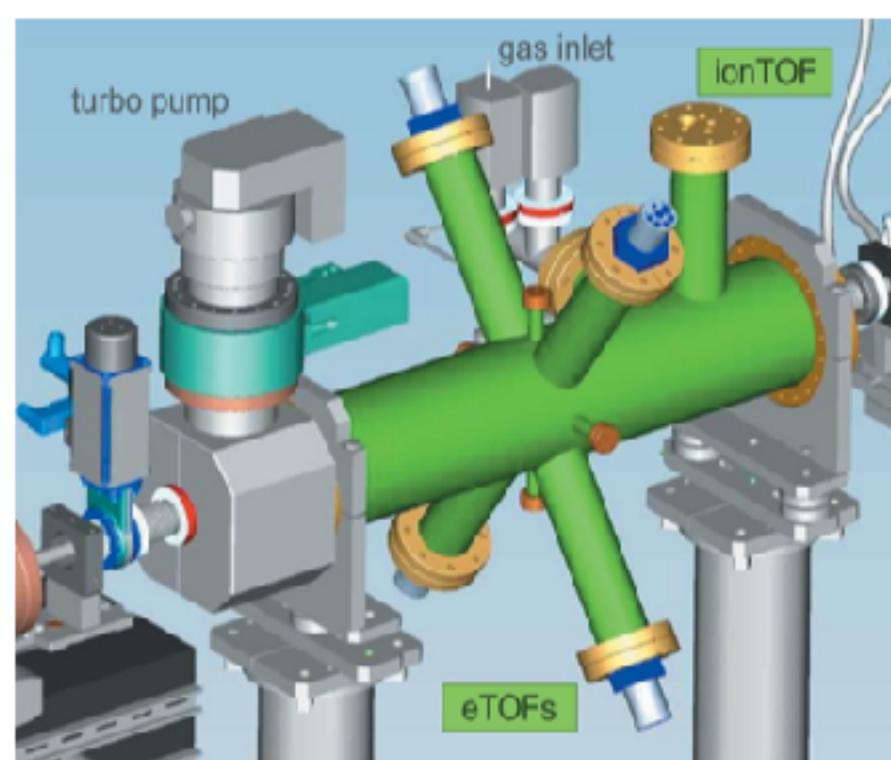
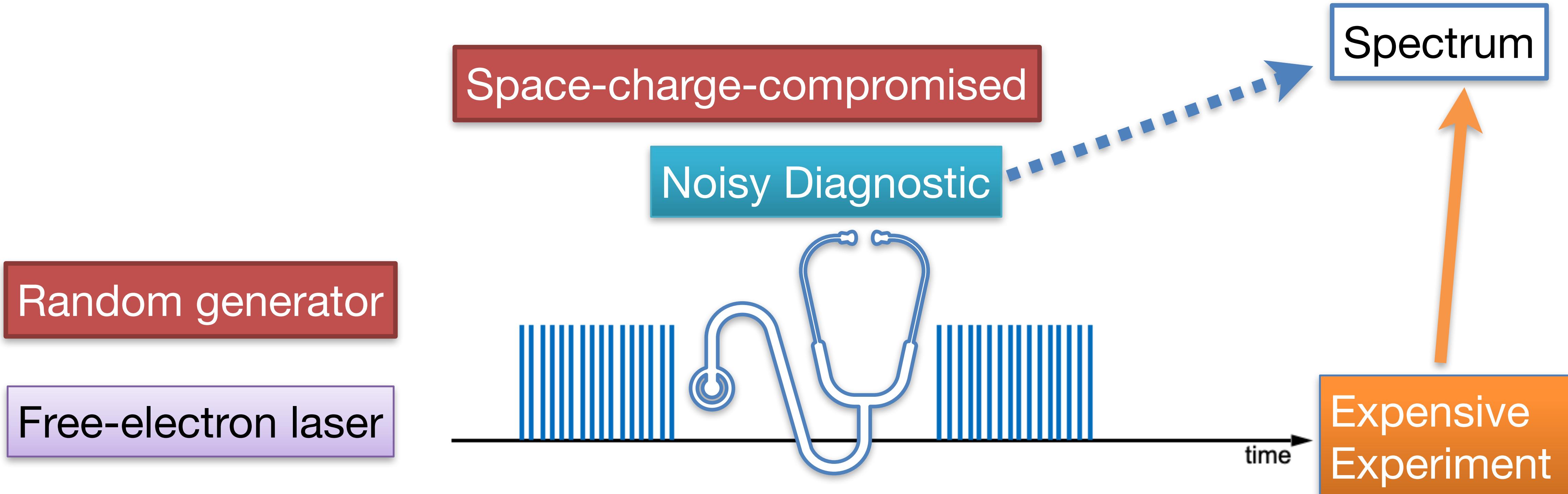


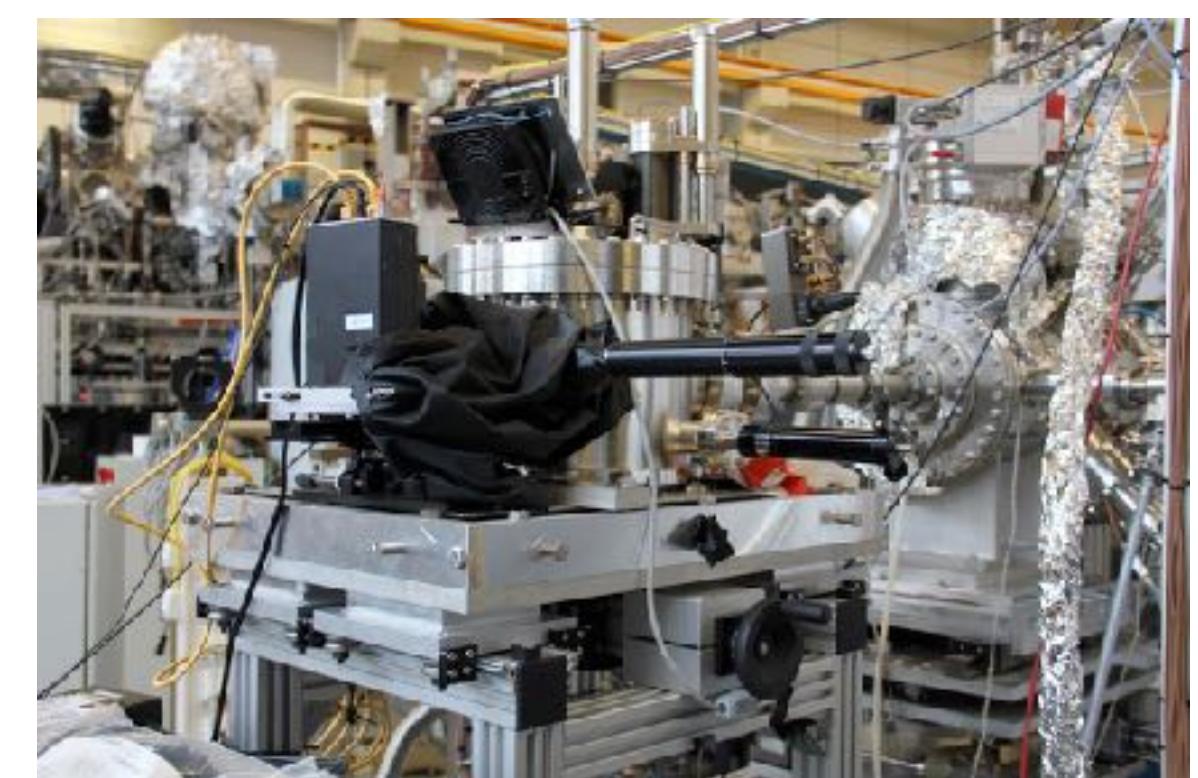
# Project D: Space-Charge-O-Meter

Gregor Hartmann, 2020-08-10, HZB Summer School 2020

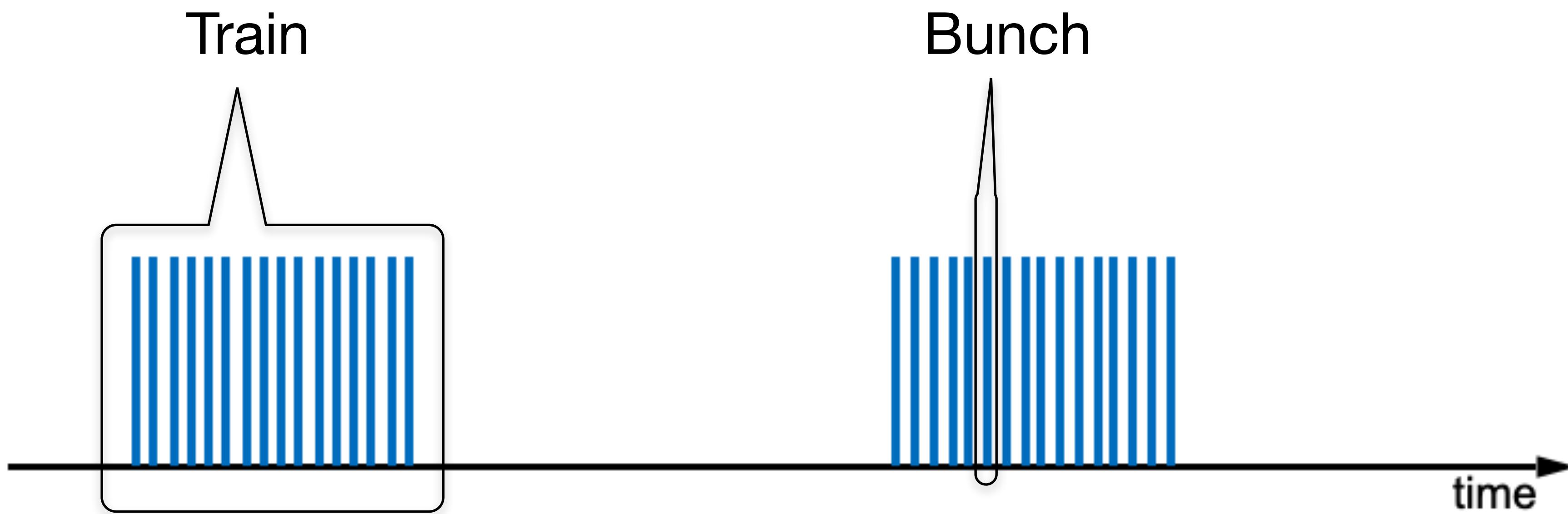




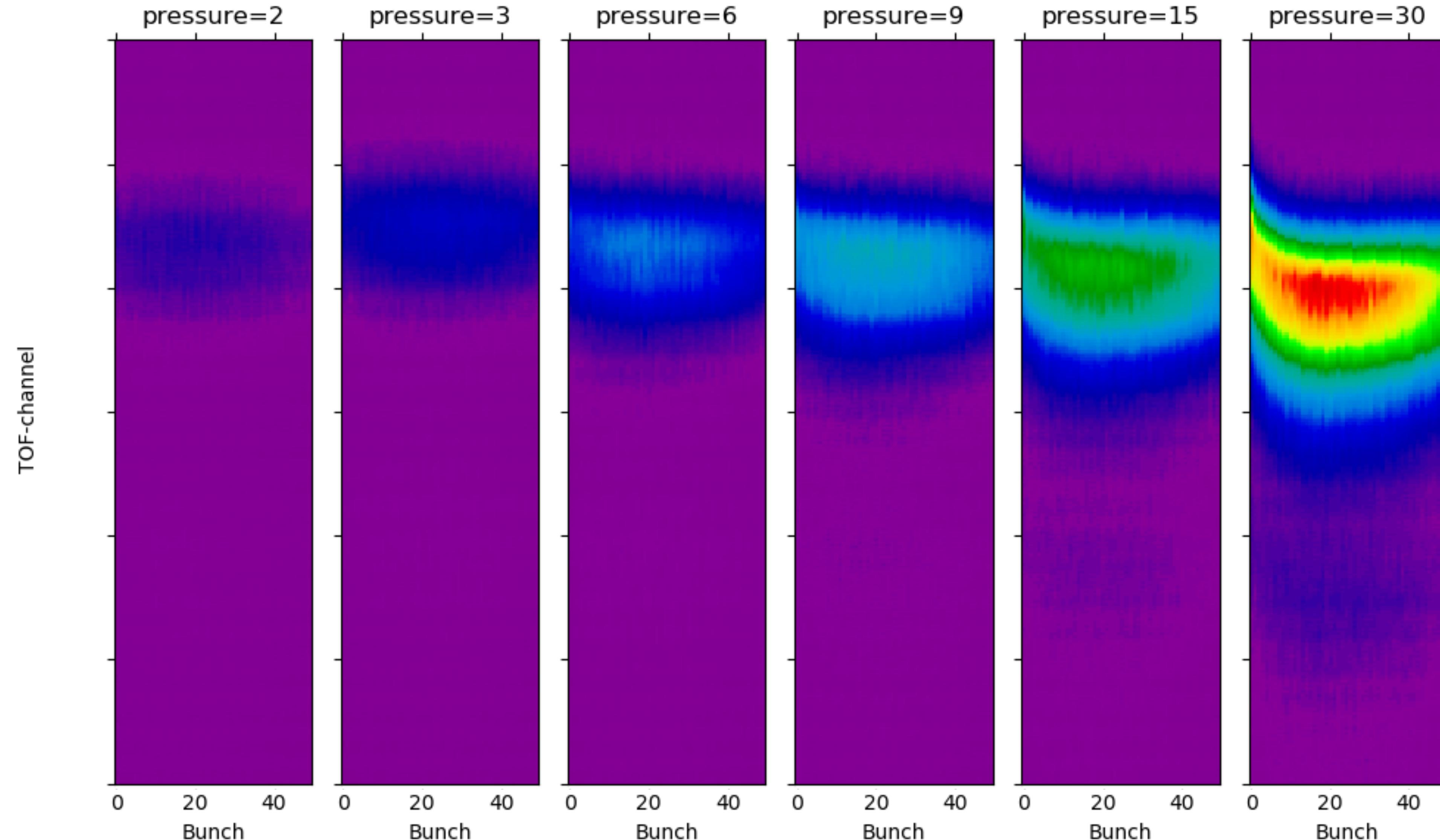
GOTTHARD spectrometer  
behind PES experiment  
@ FLASH (BL2), Steffen  
Palutke



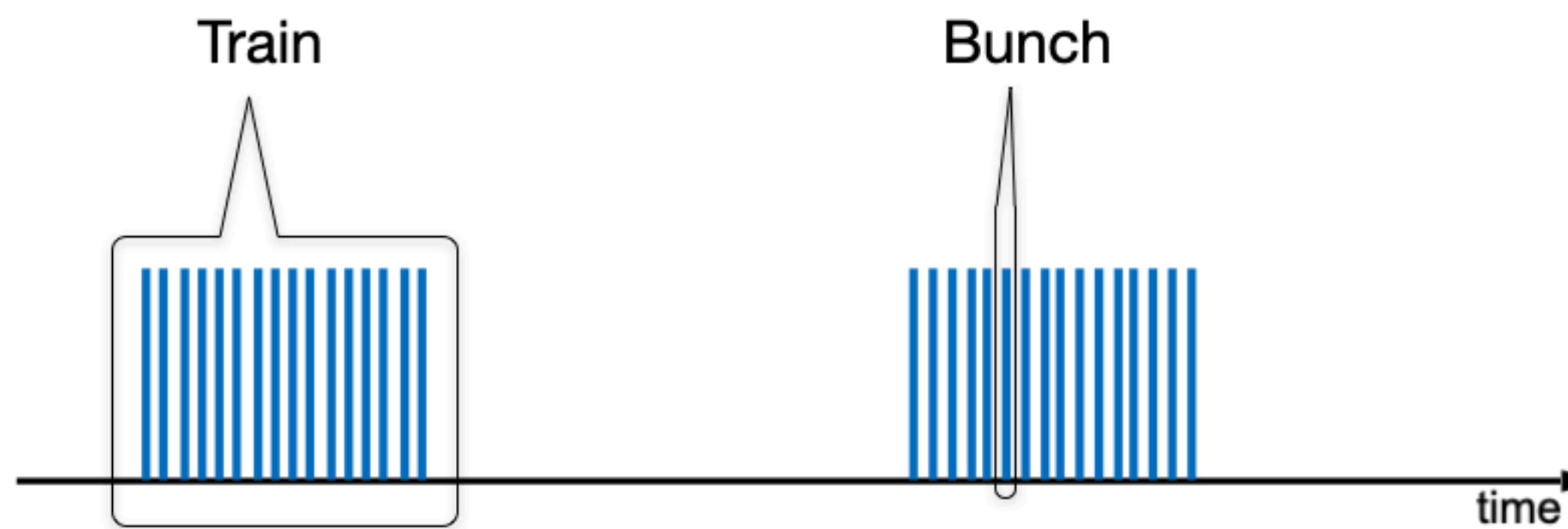
# HOW AN FEL SHOOTS



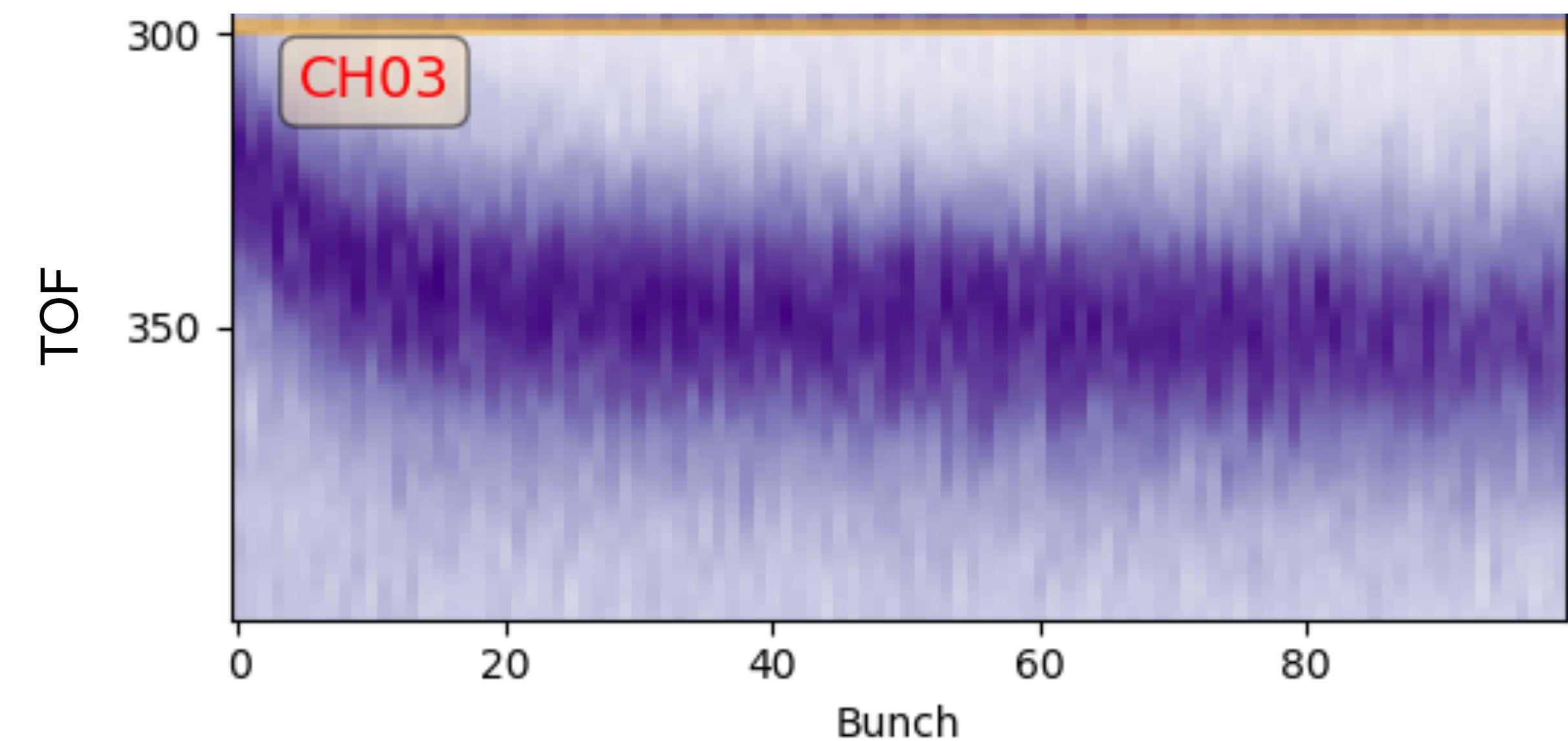
# SLOWING DOWN ELECTRONS



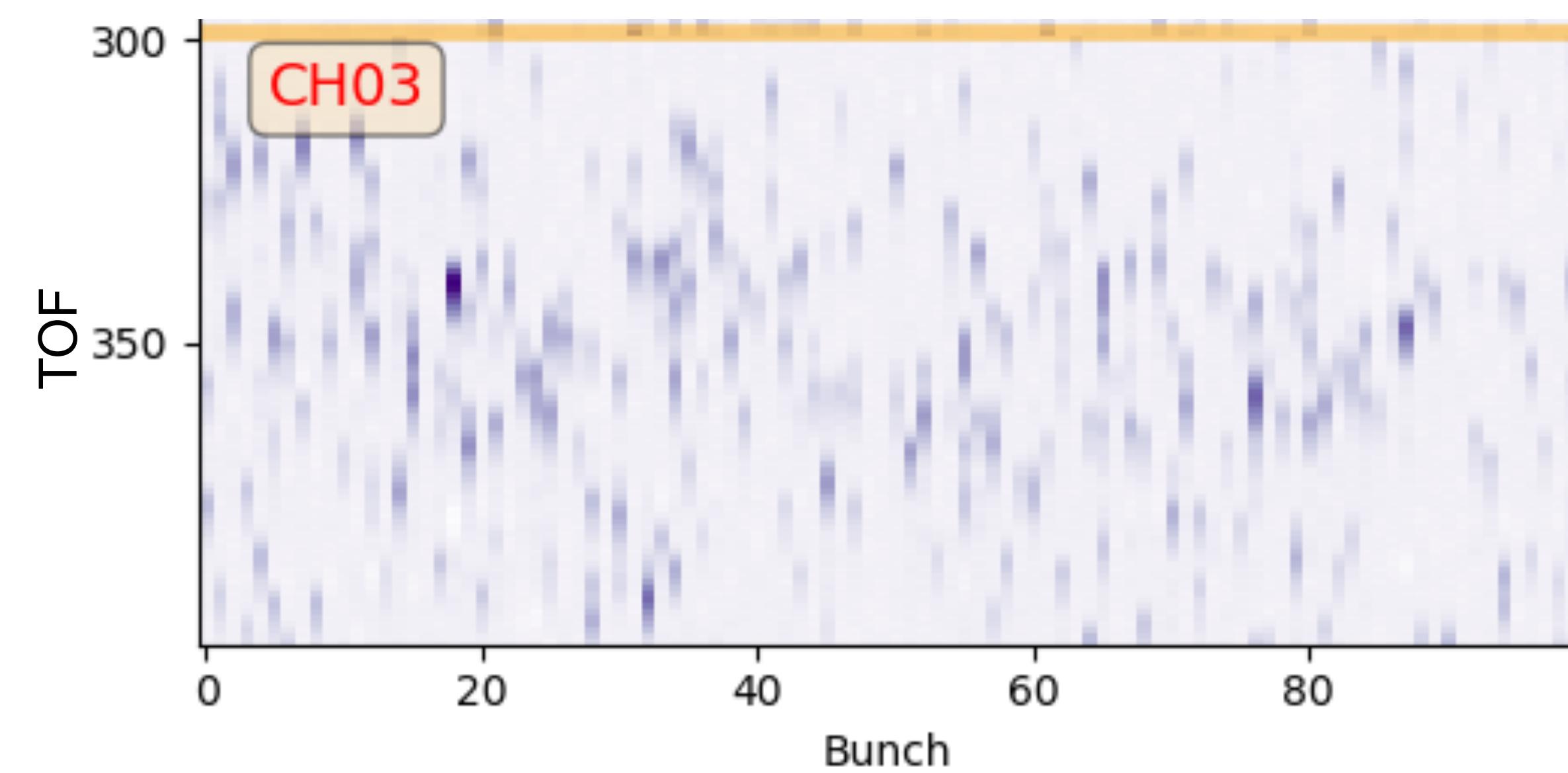
# AVERAGE VS. SINGLE SHOT

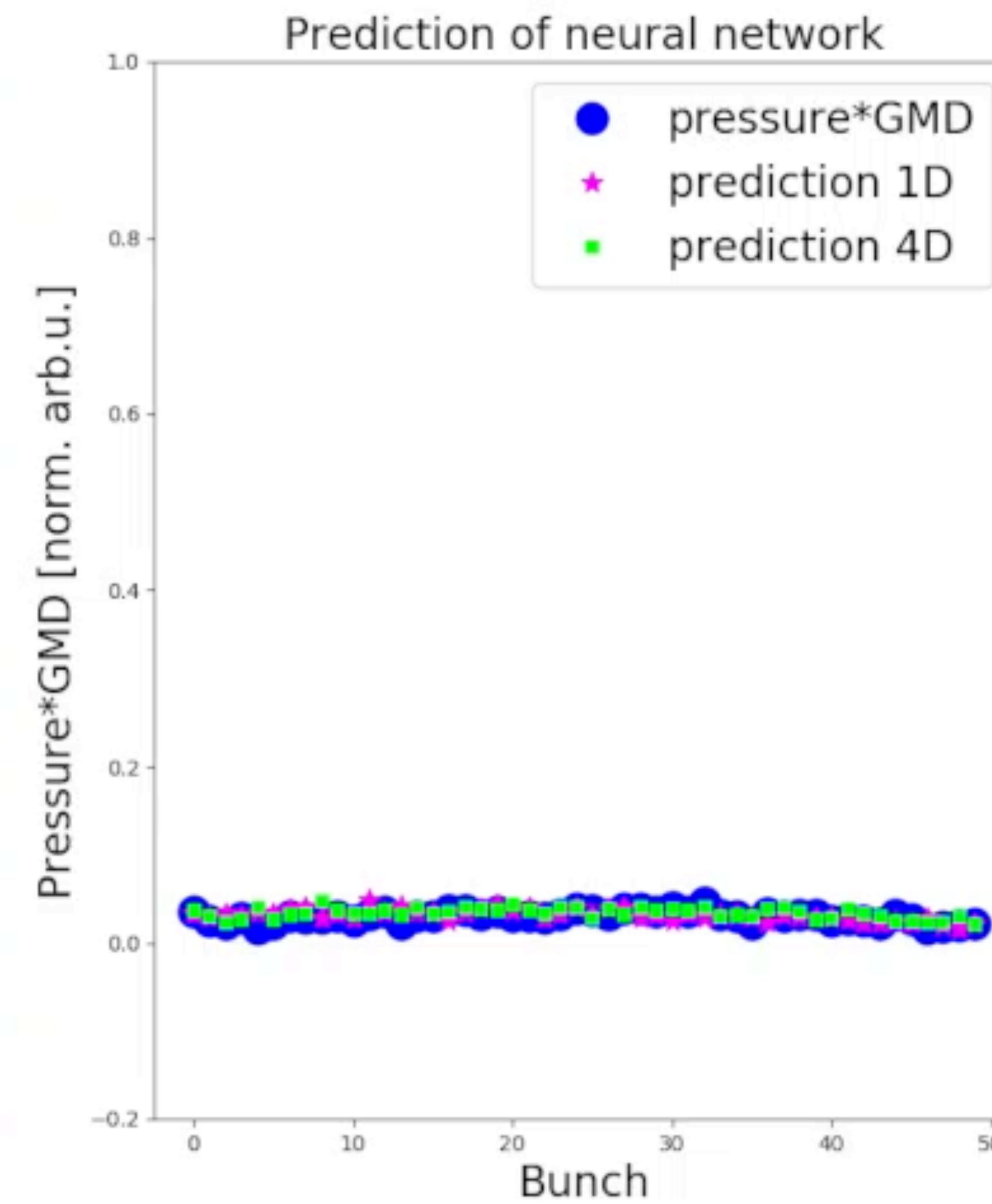
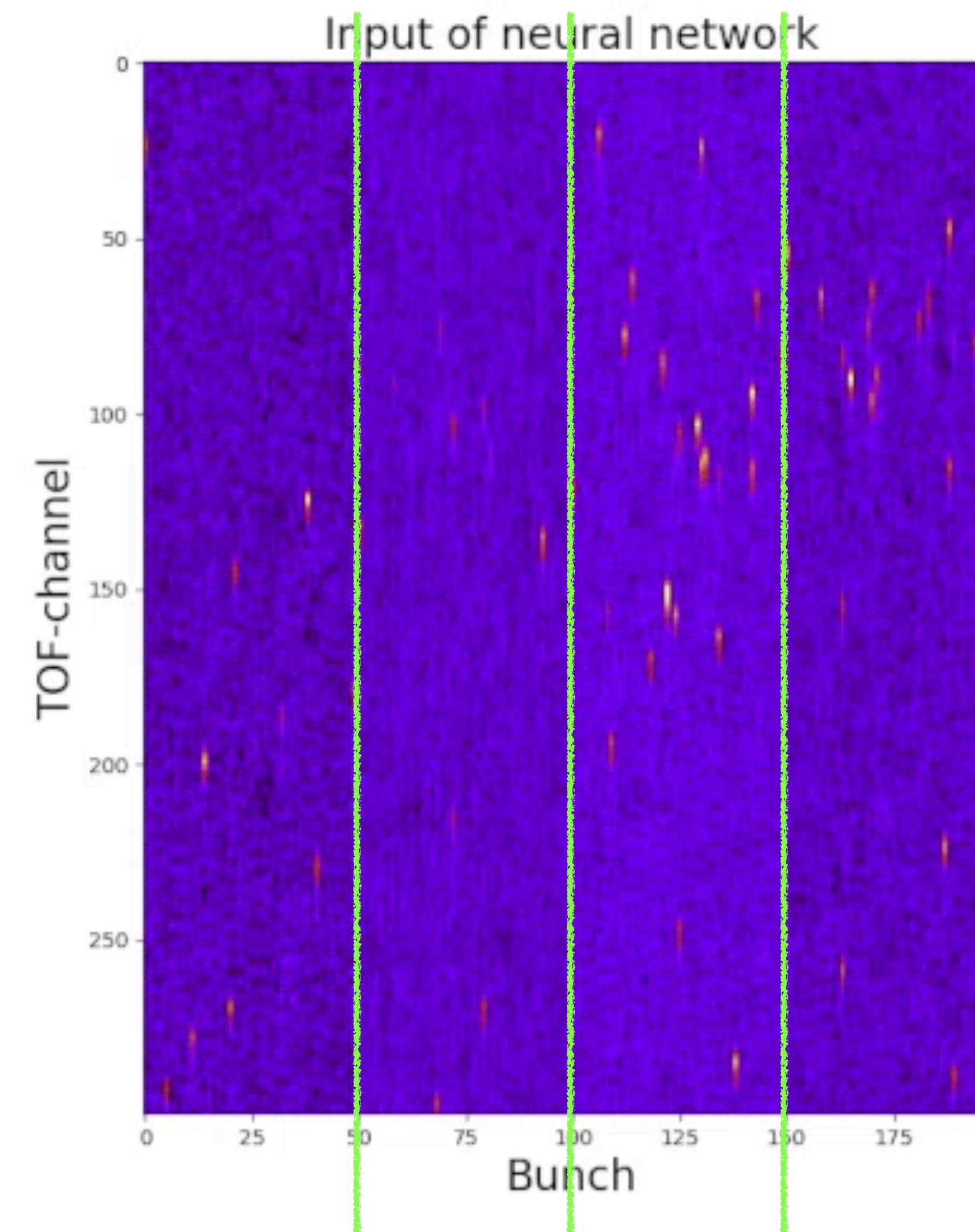


Average 1k shots

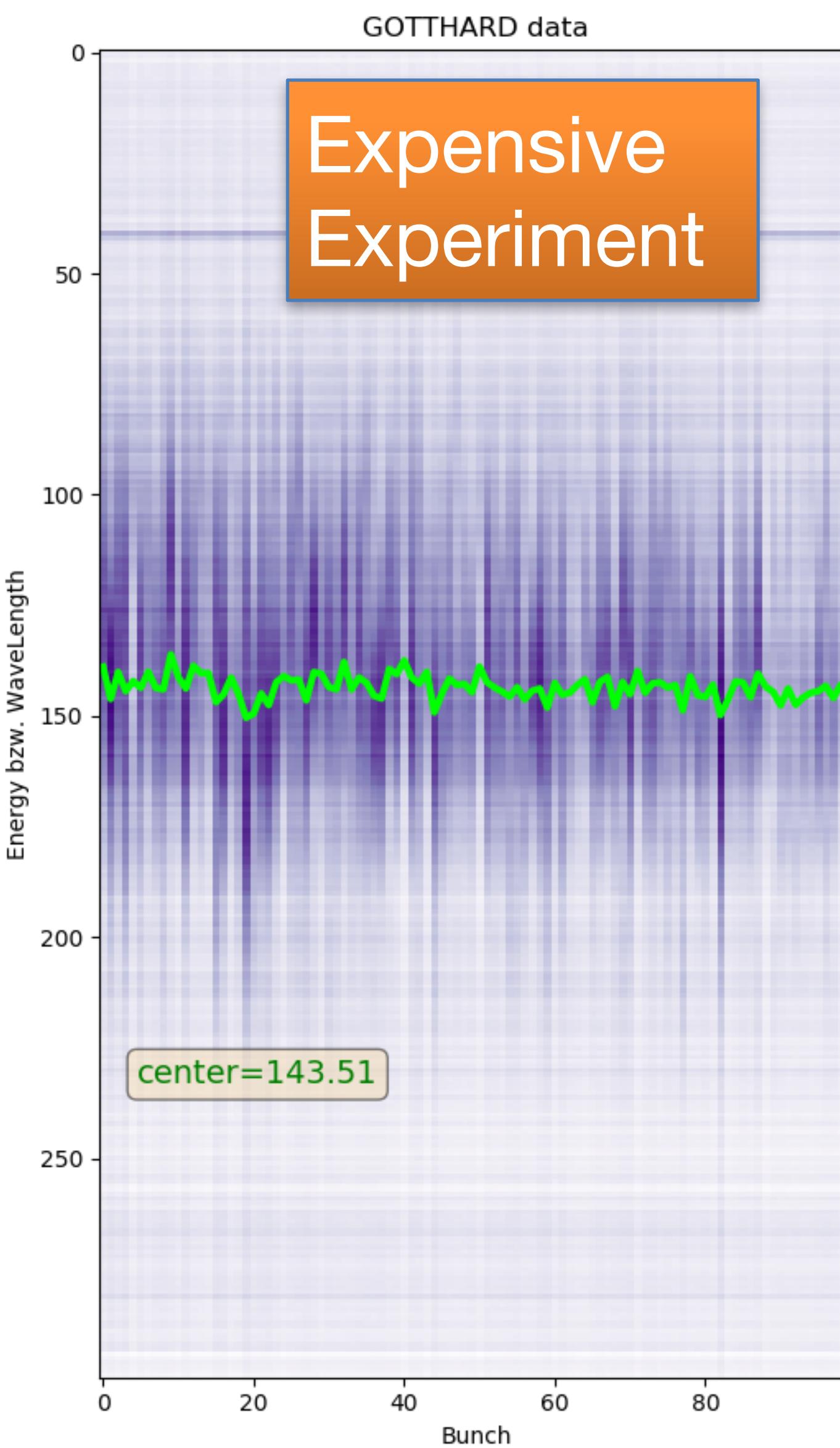
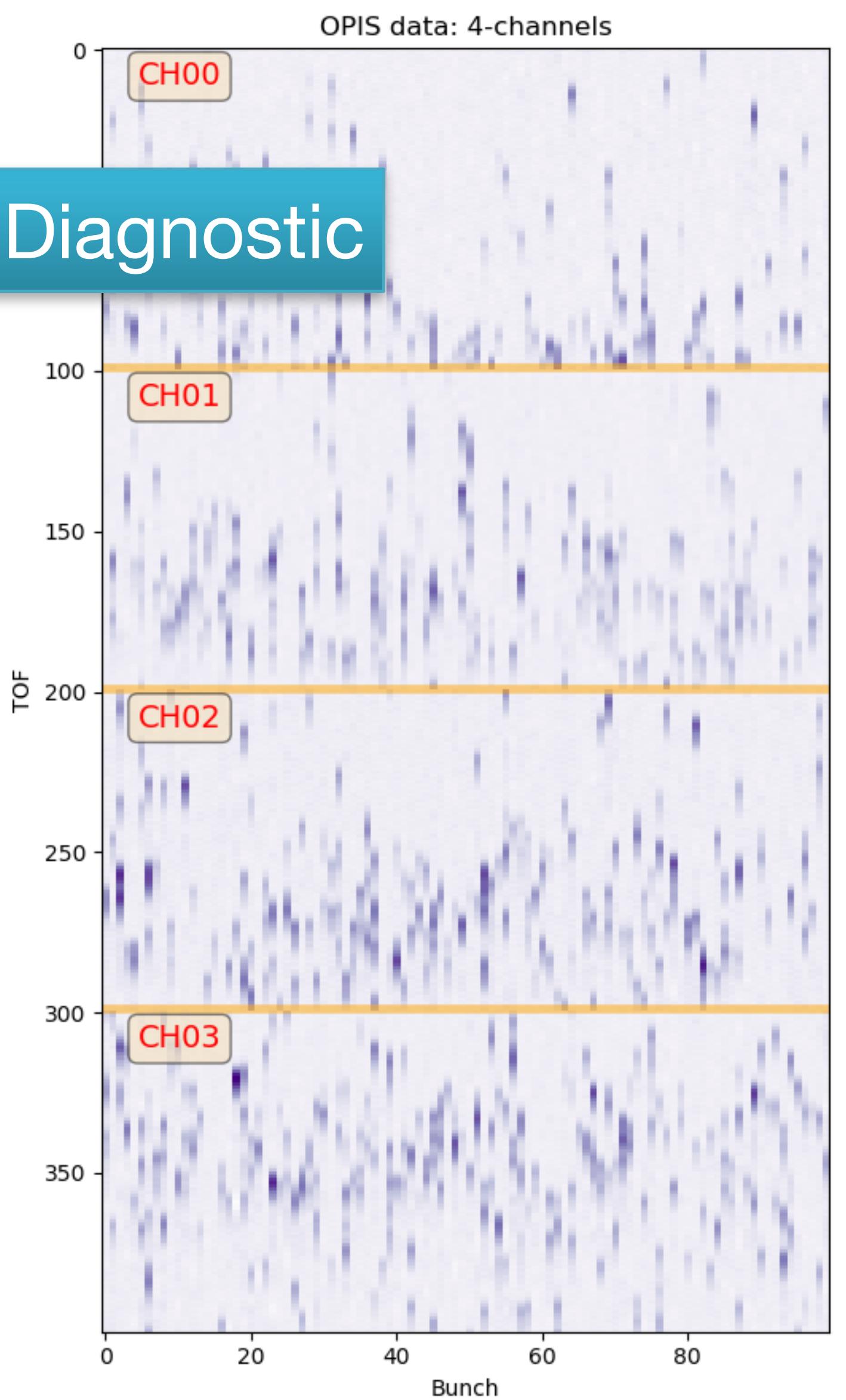


Single shot data



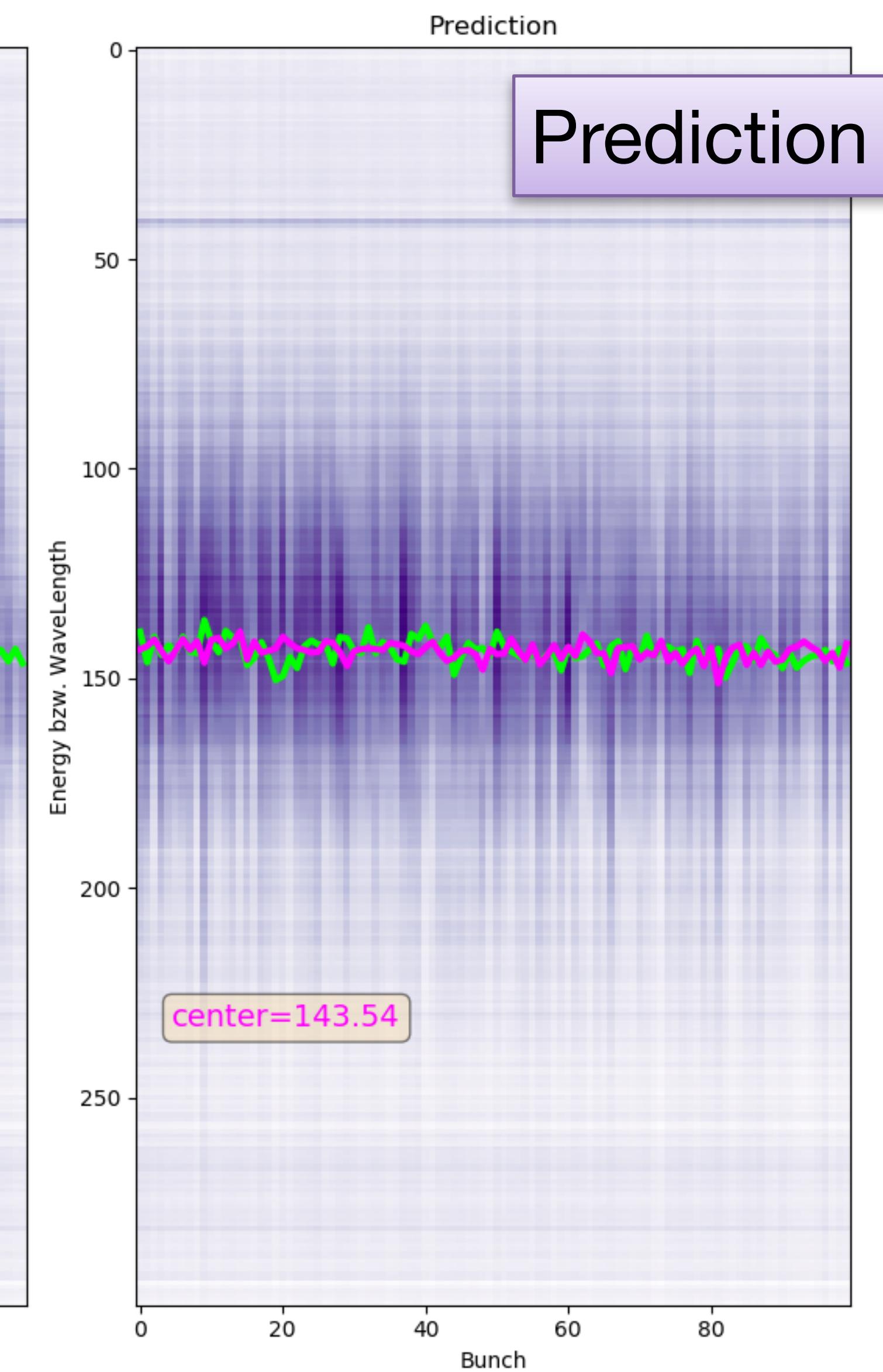
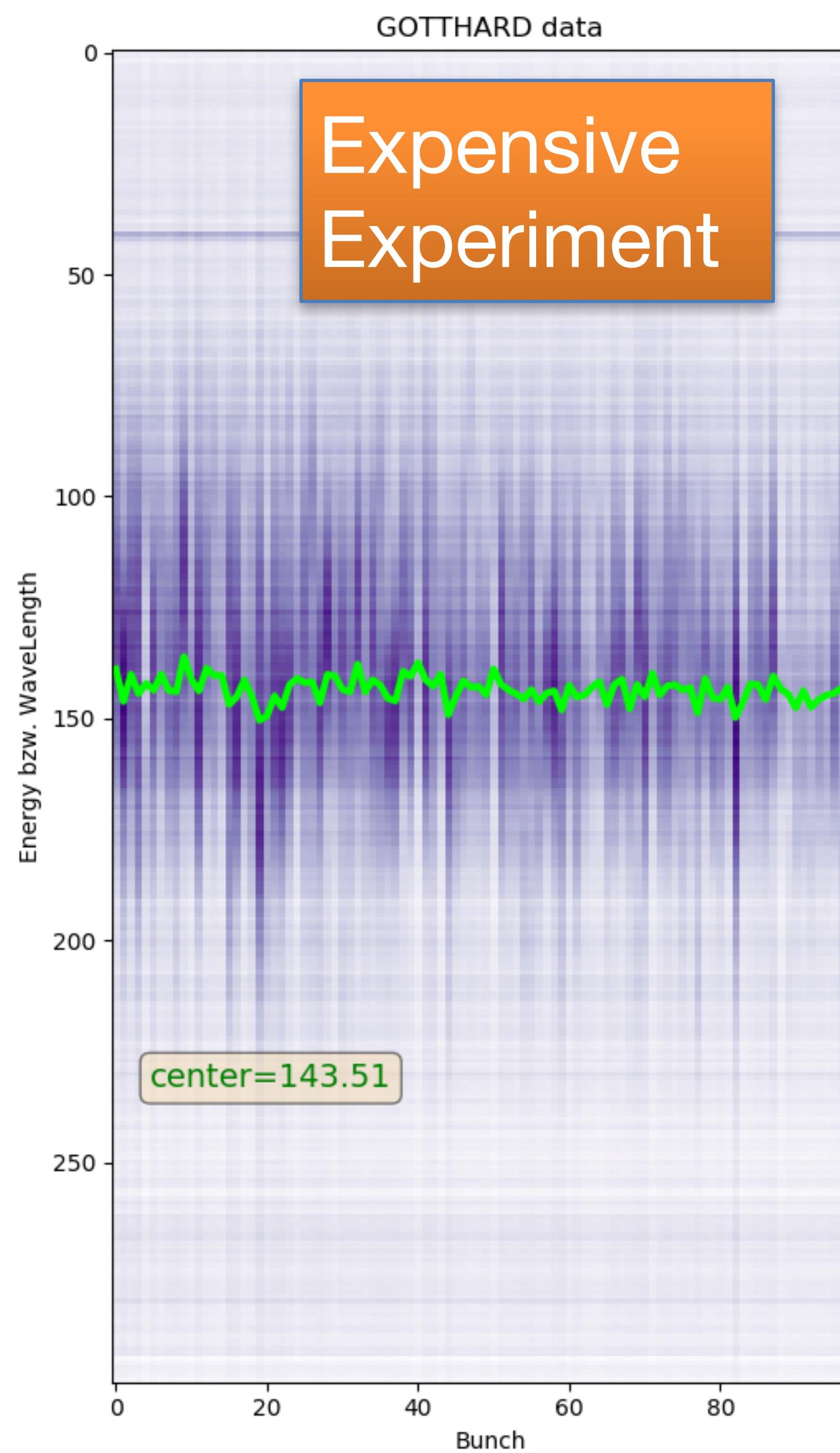
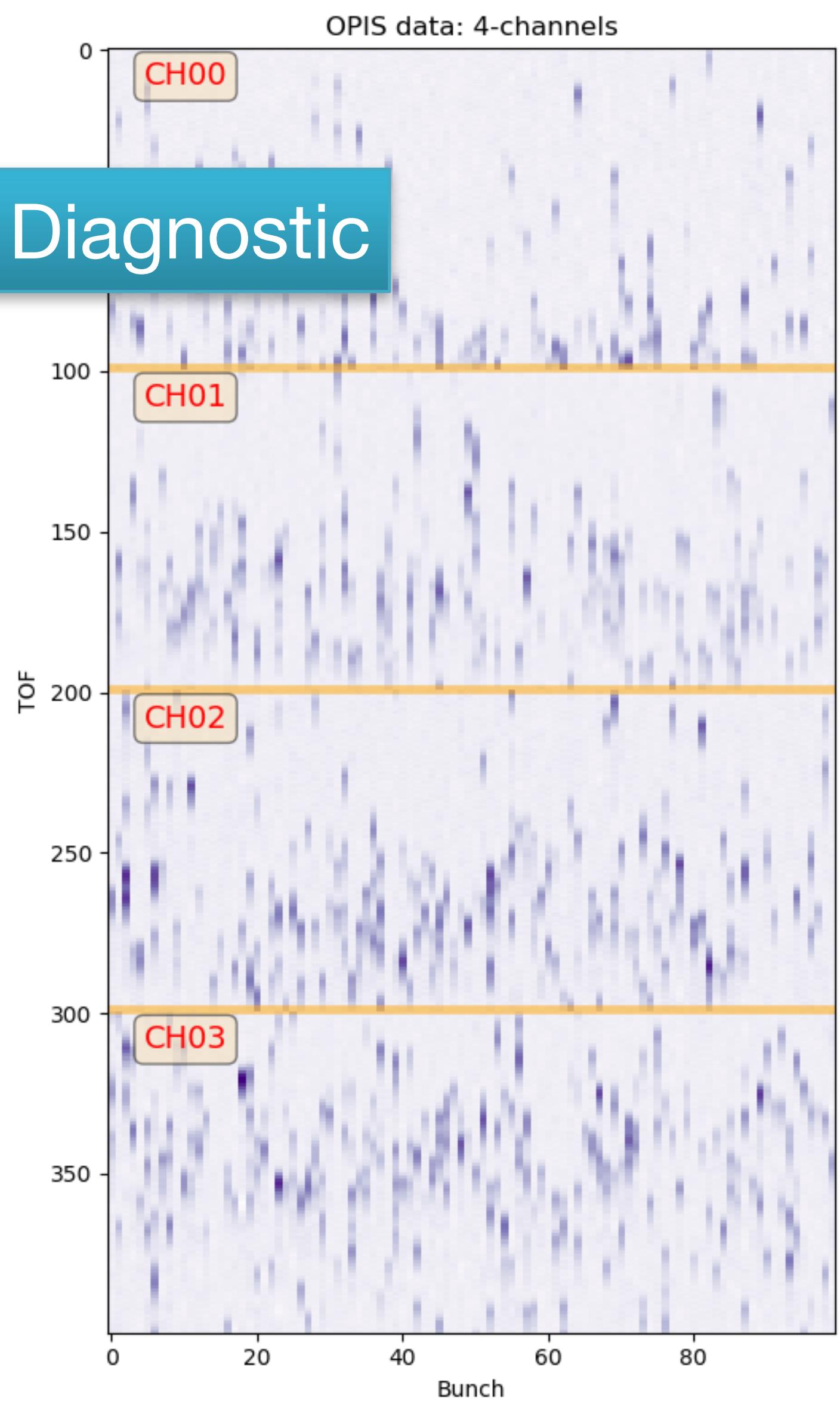


Noisy Diagnostic

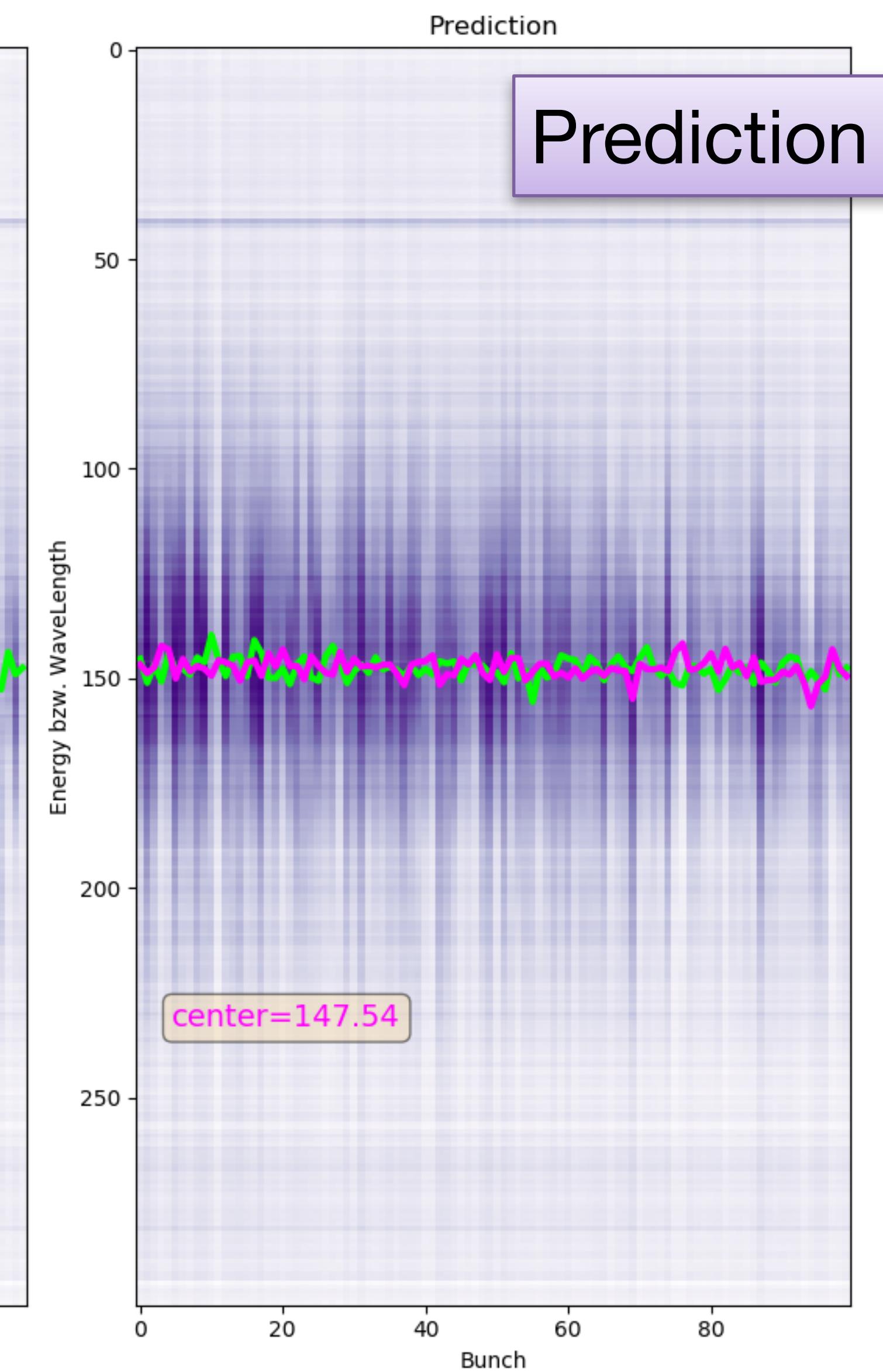
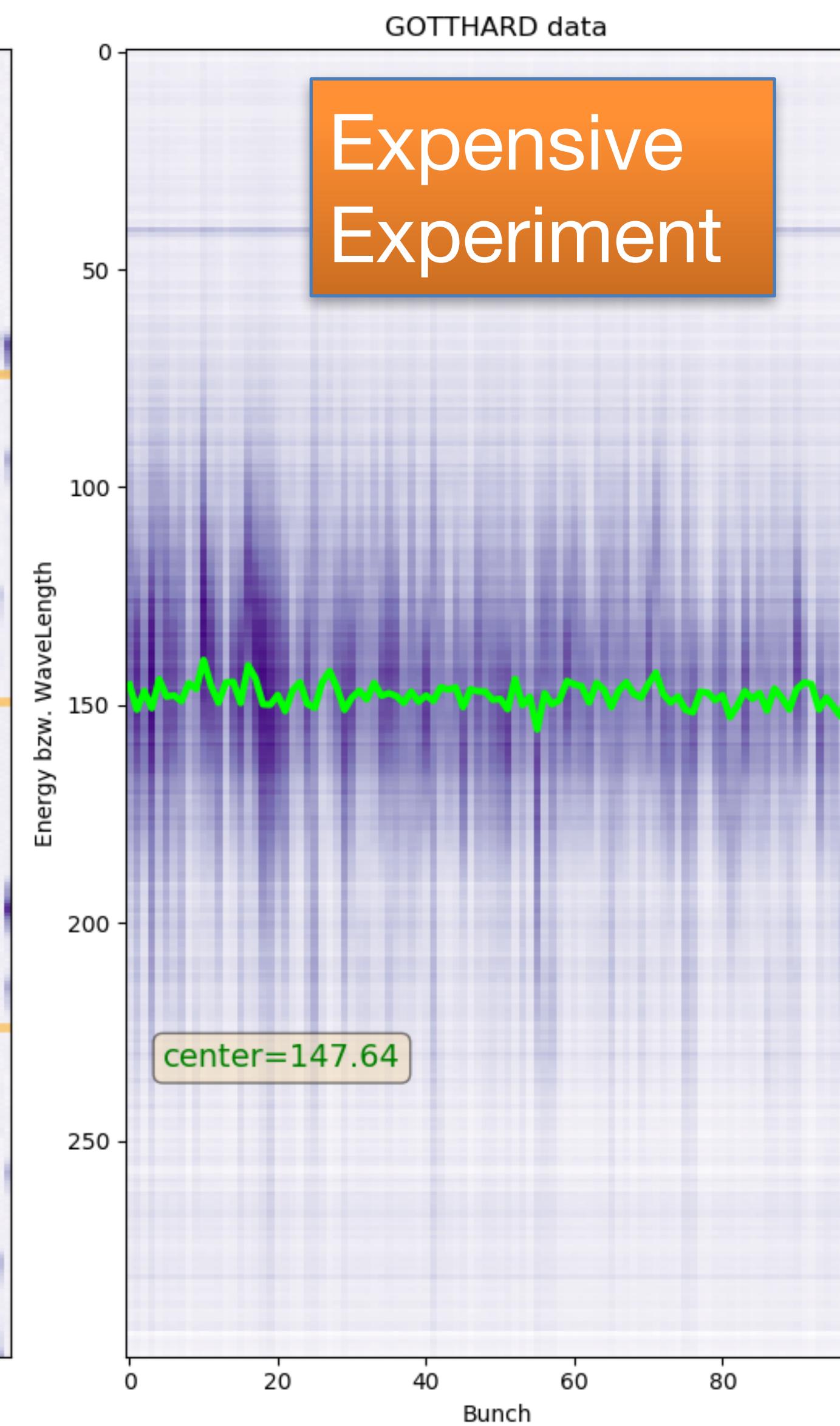
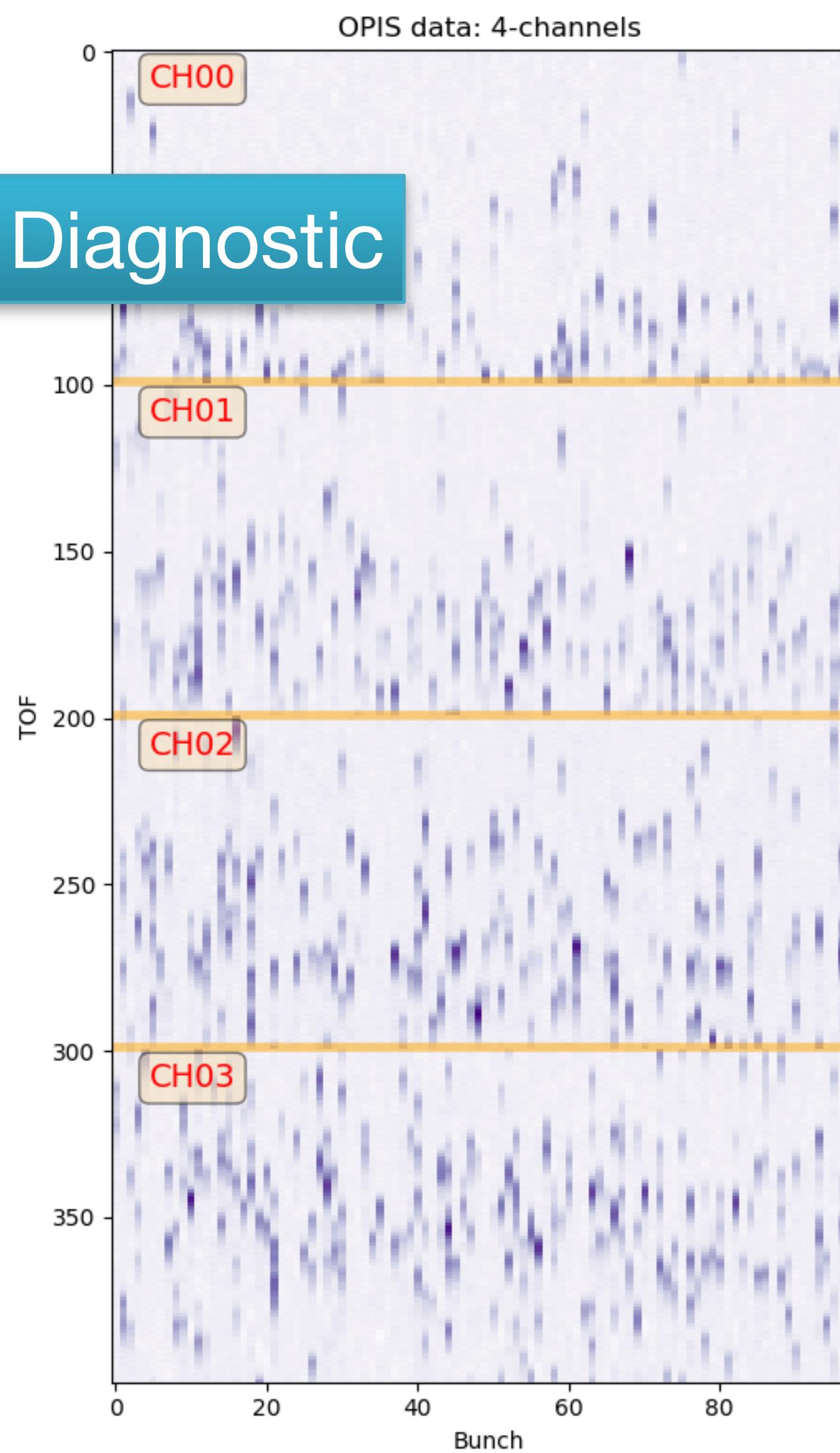


$$\text{com} = \frac{\sum_i (X_i \cdot Y_i)}{\sum_i X_i}$$

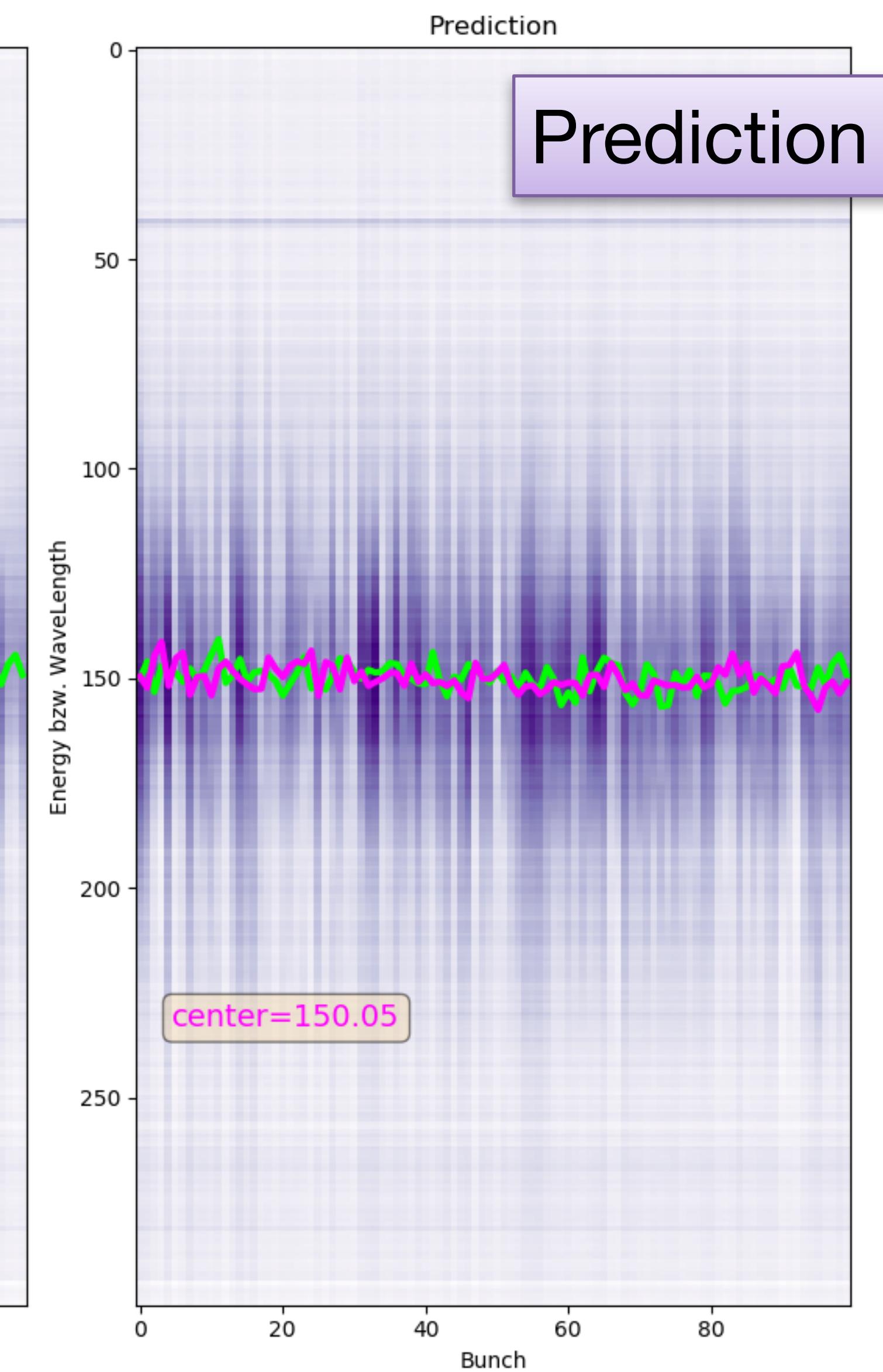
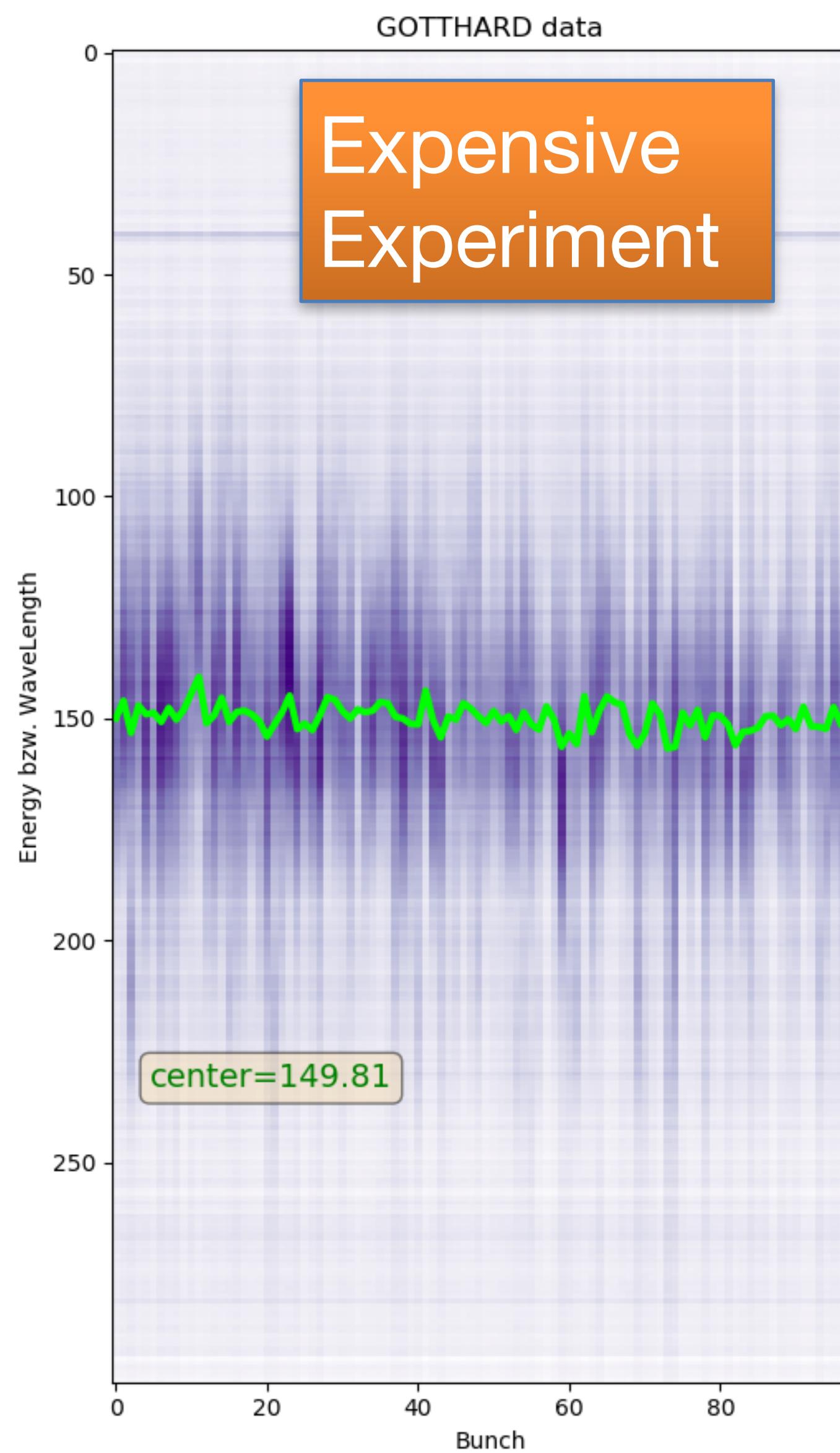
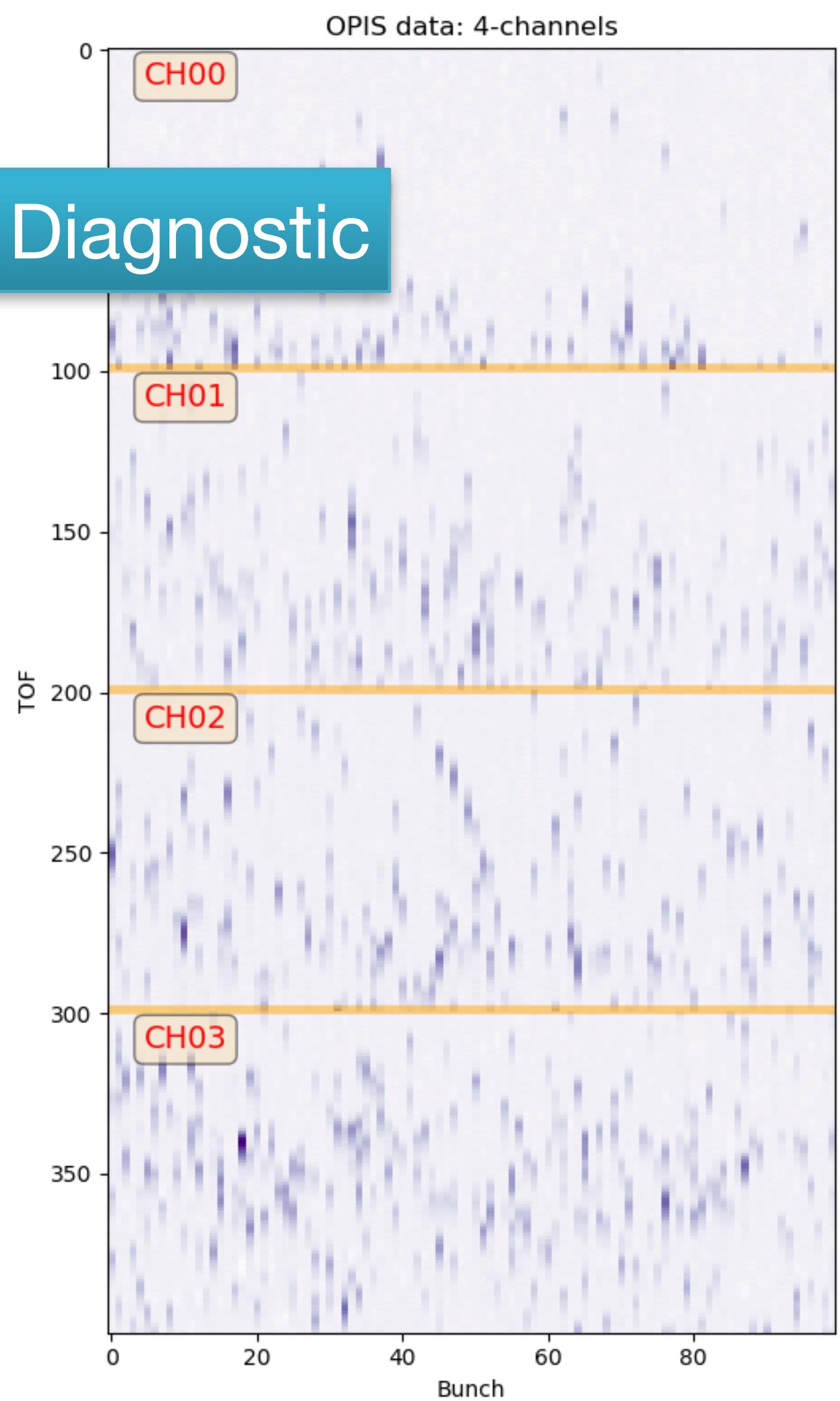
Noisy Diagnostic

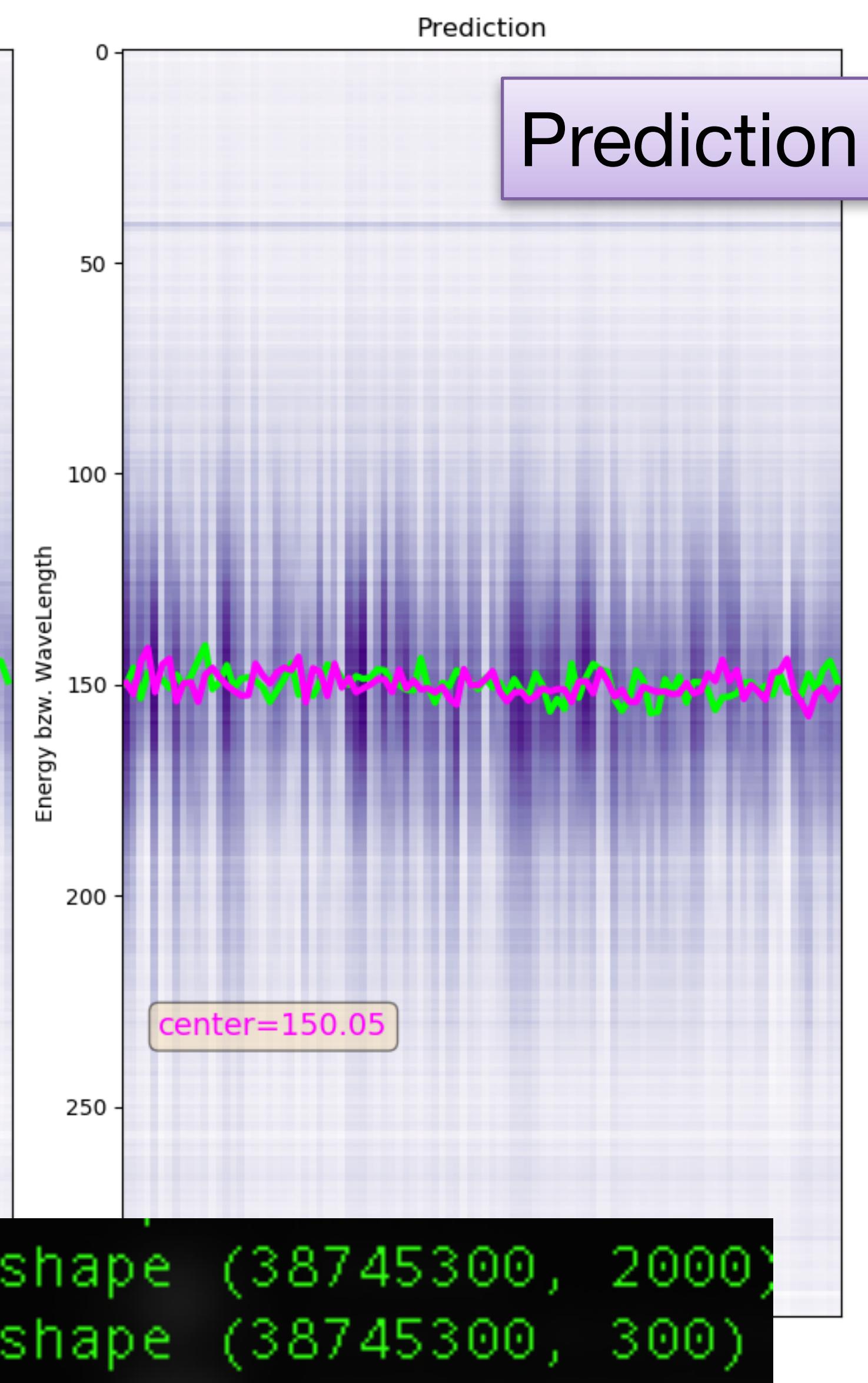
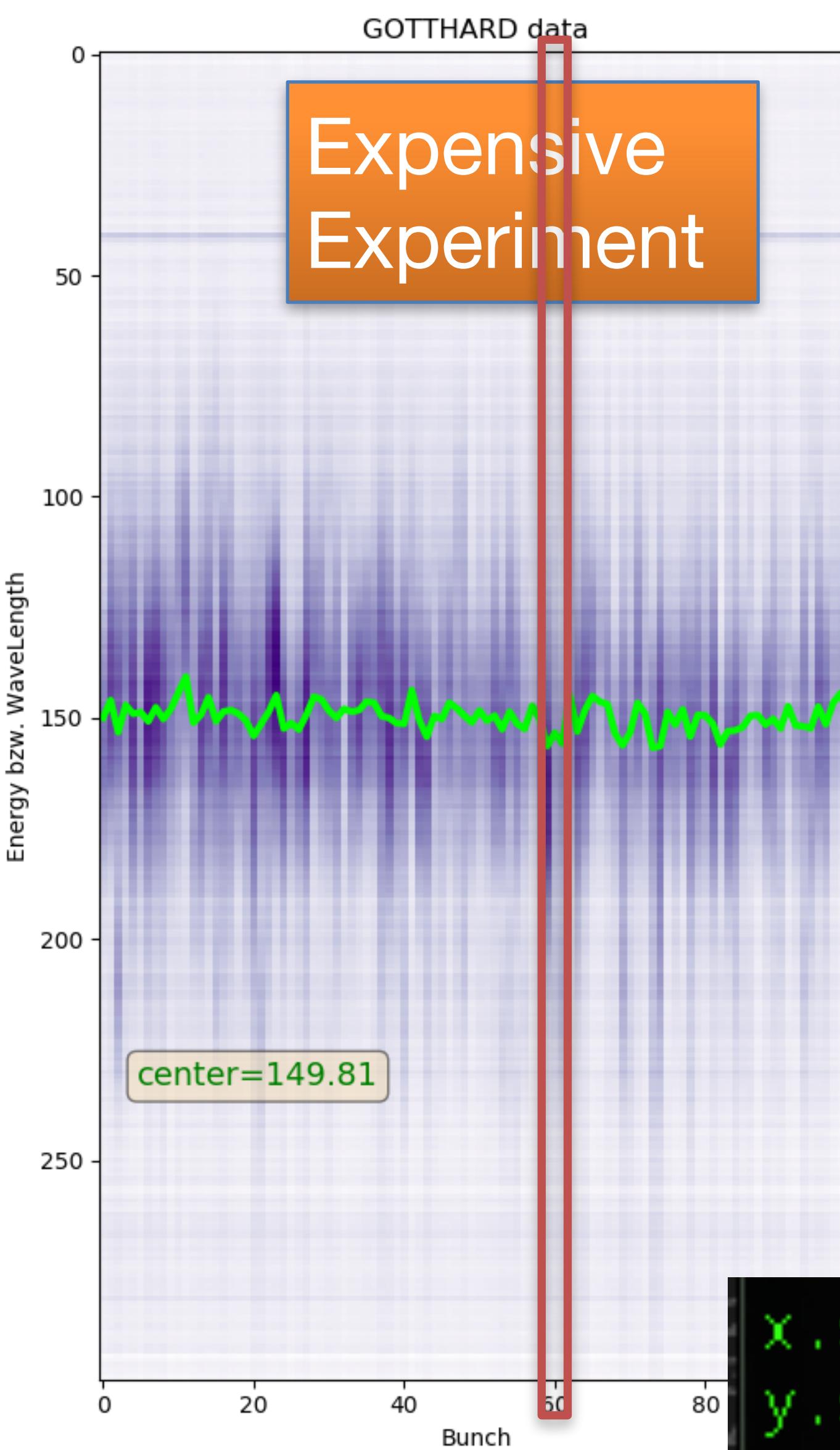
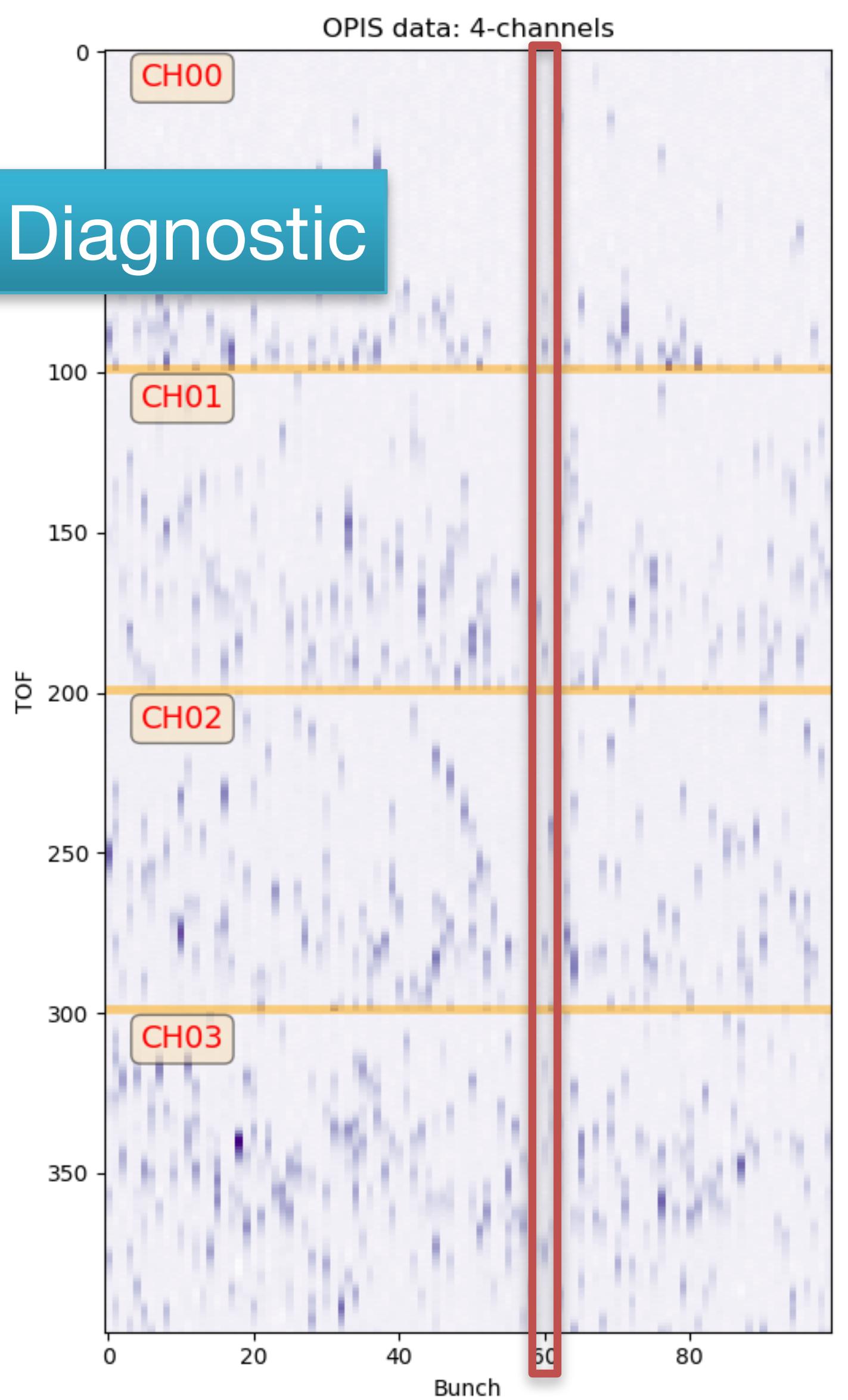


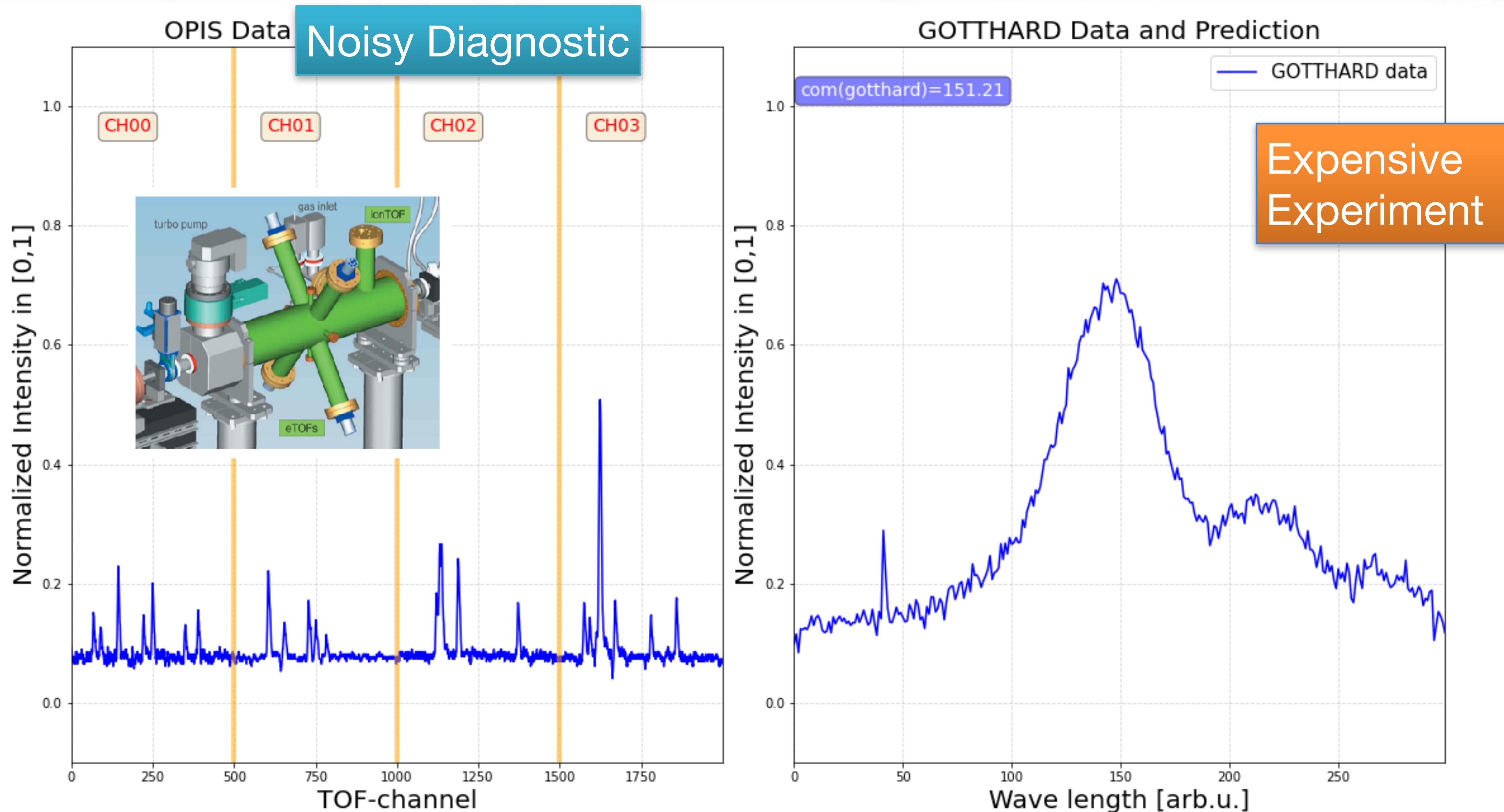
Noisy Diagnostic

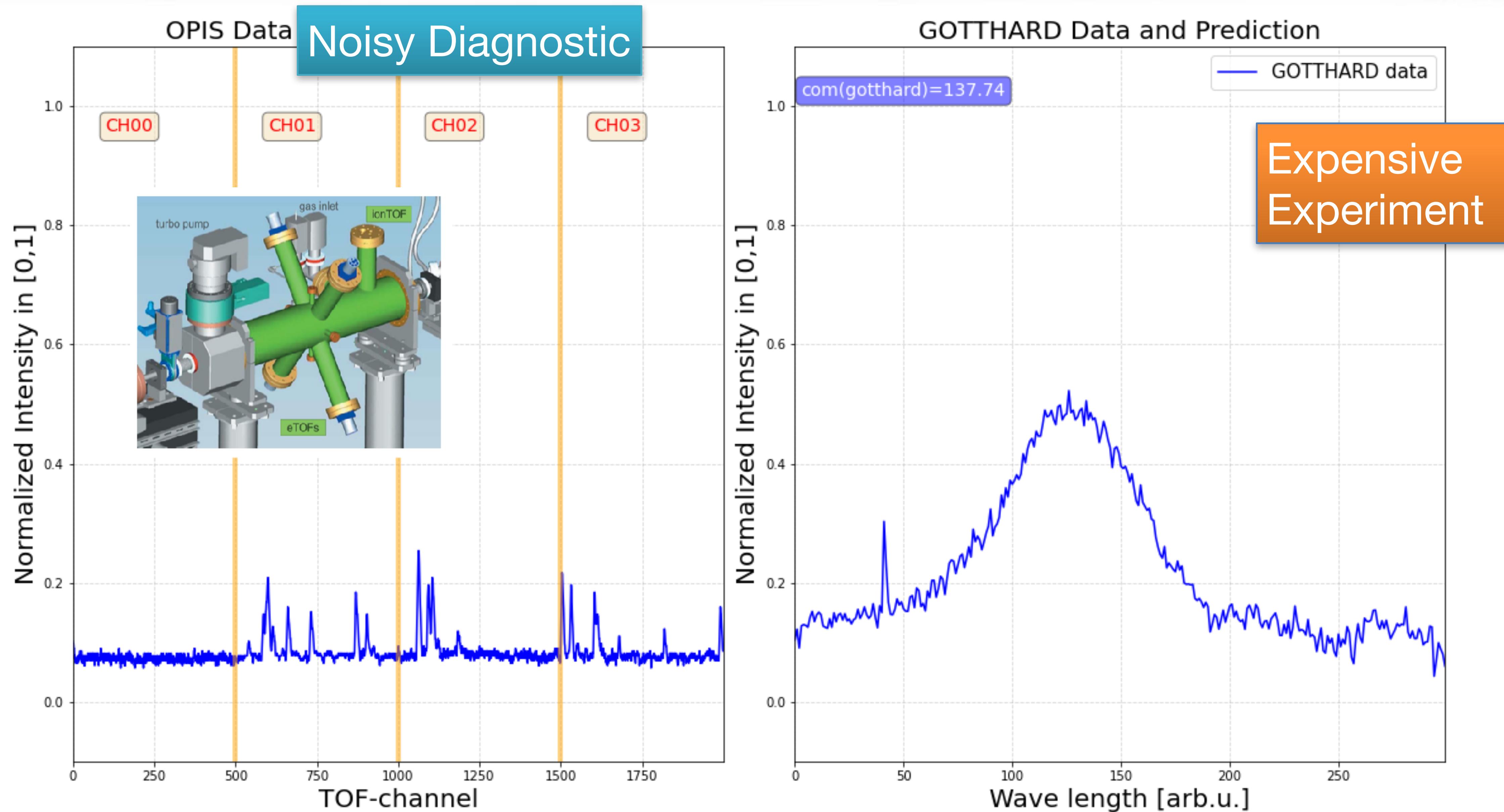


Noisy Diagnostic

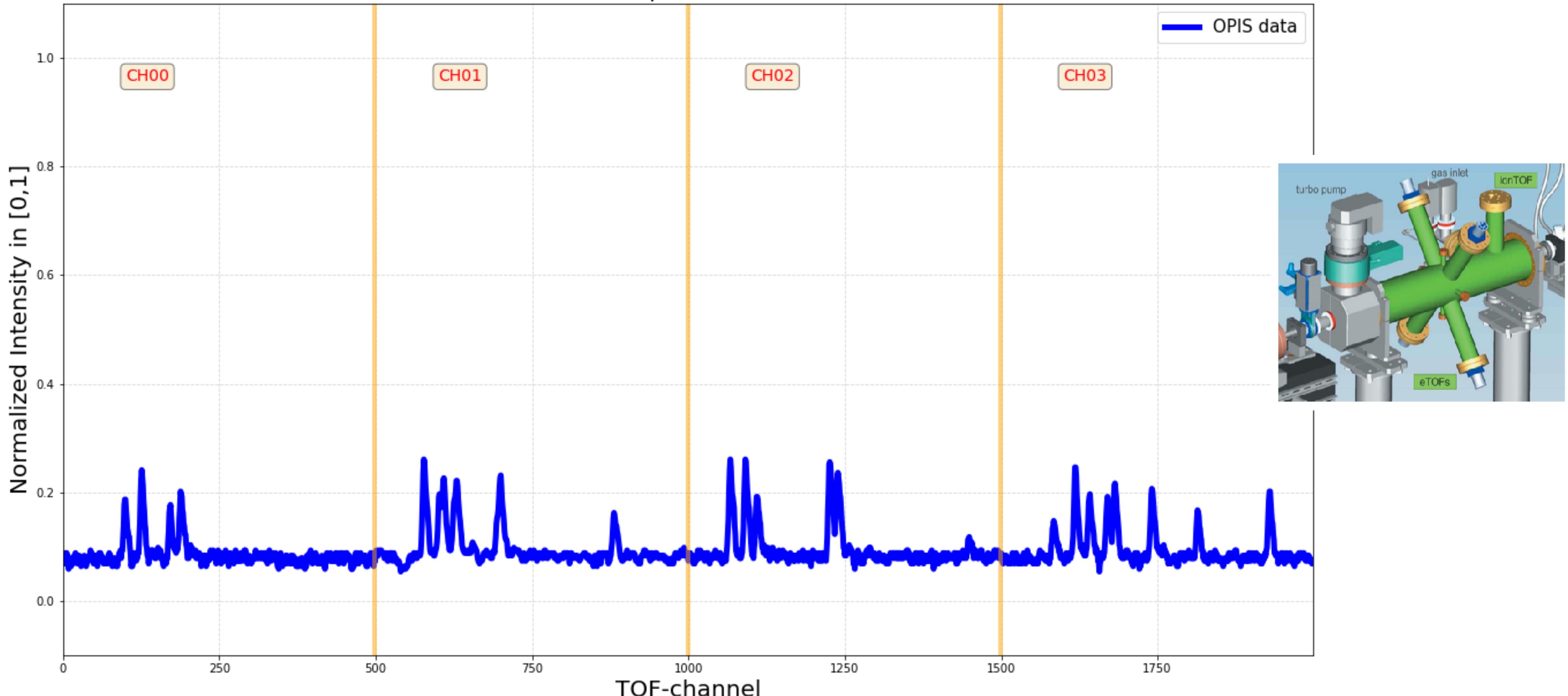


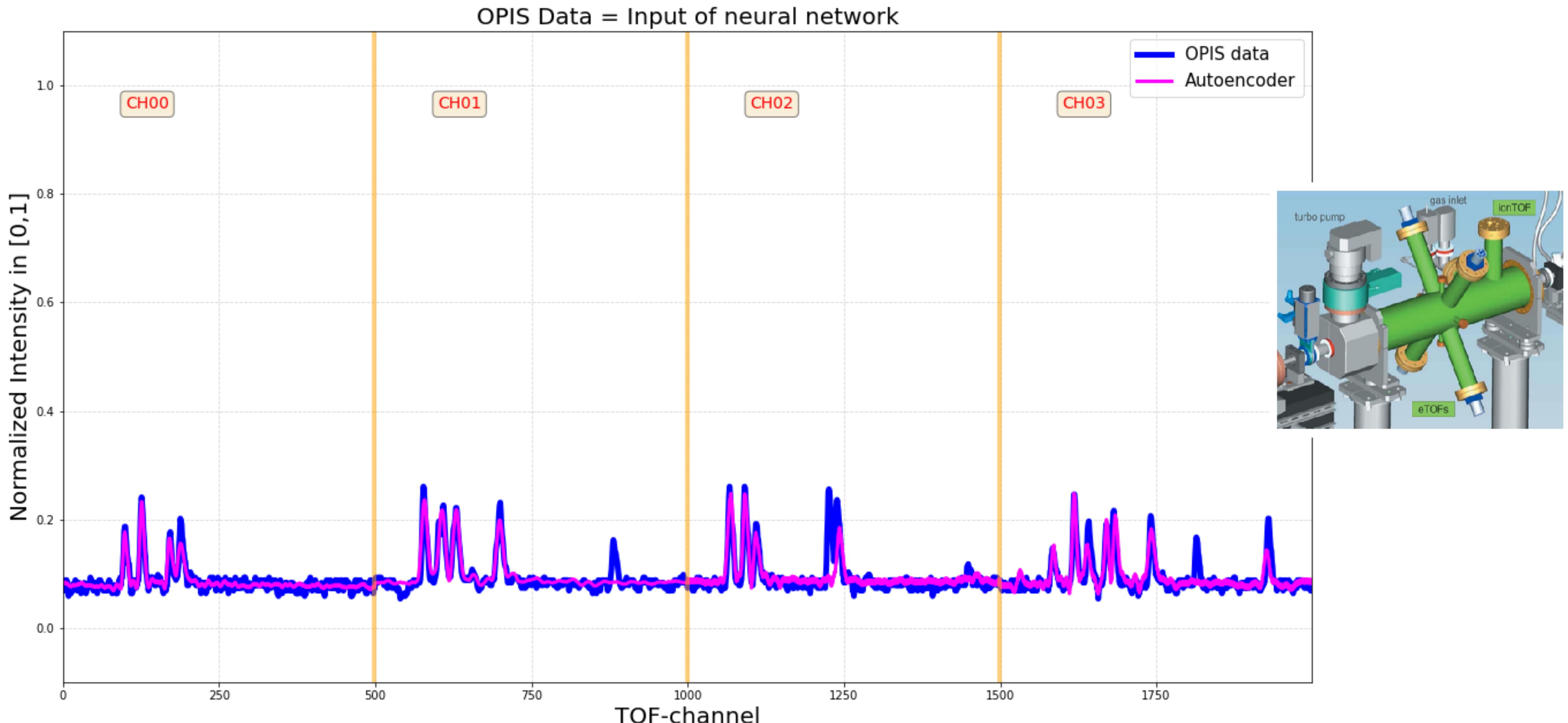
**Noisy Diagnostic**



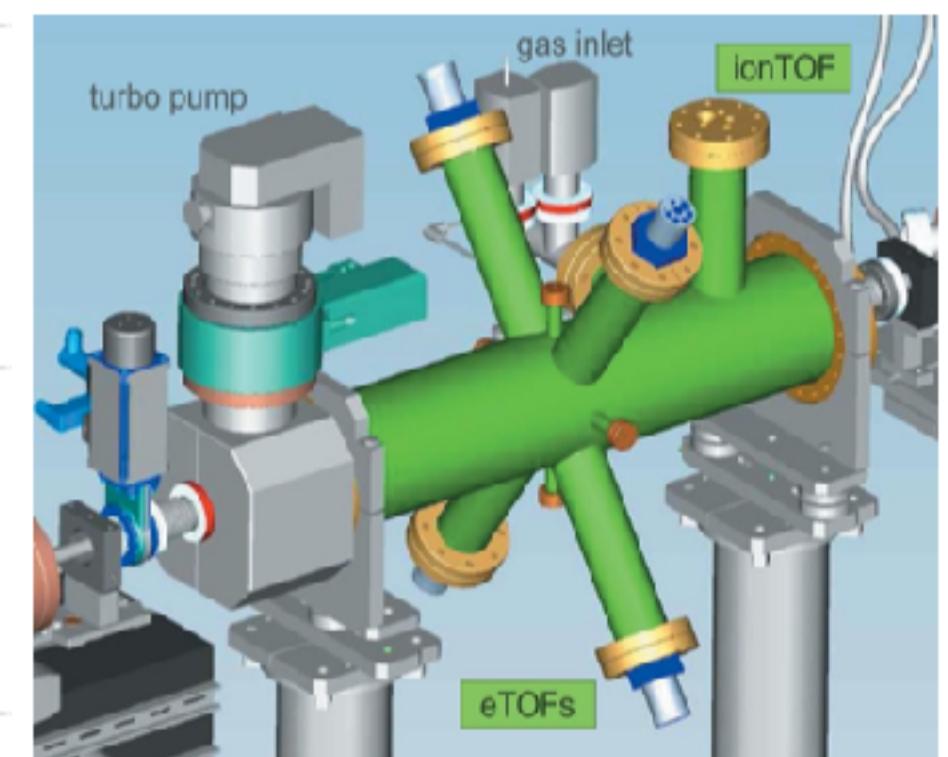
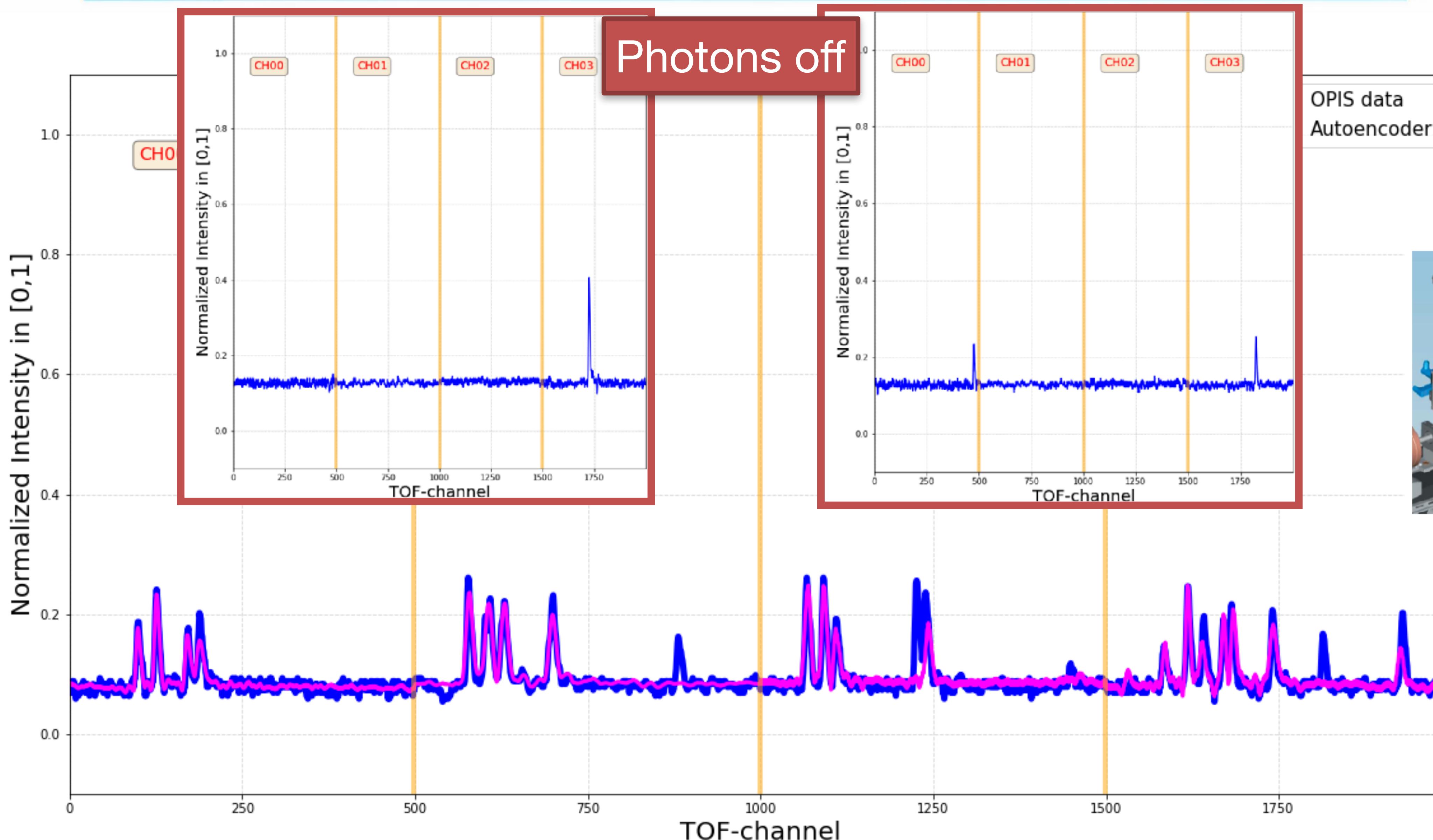


OPIS Data = Input of neural network

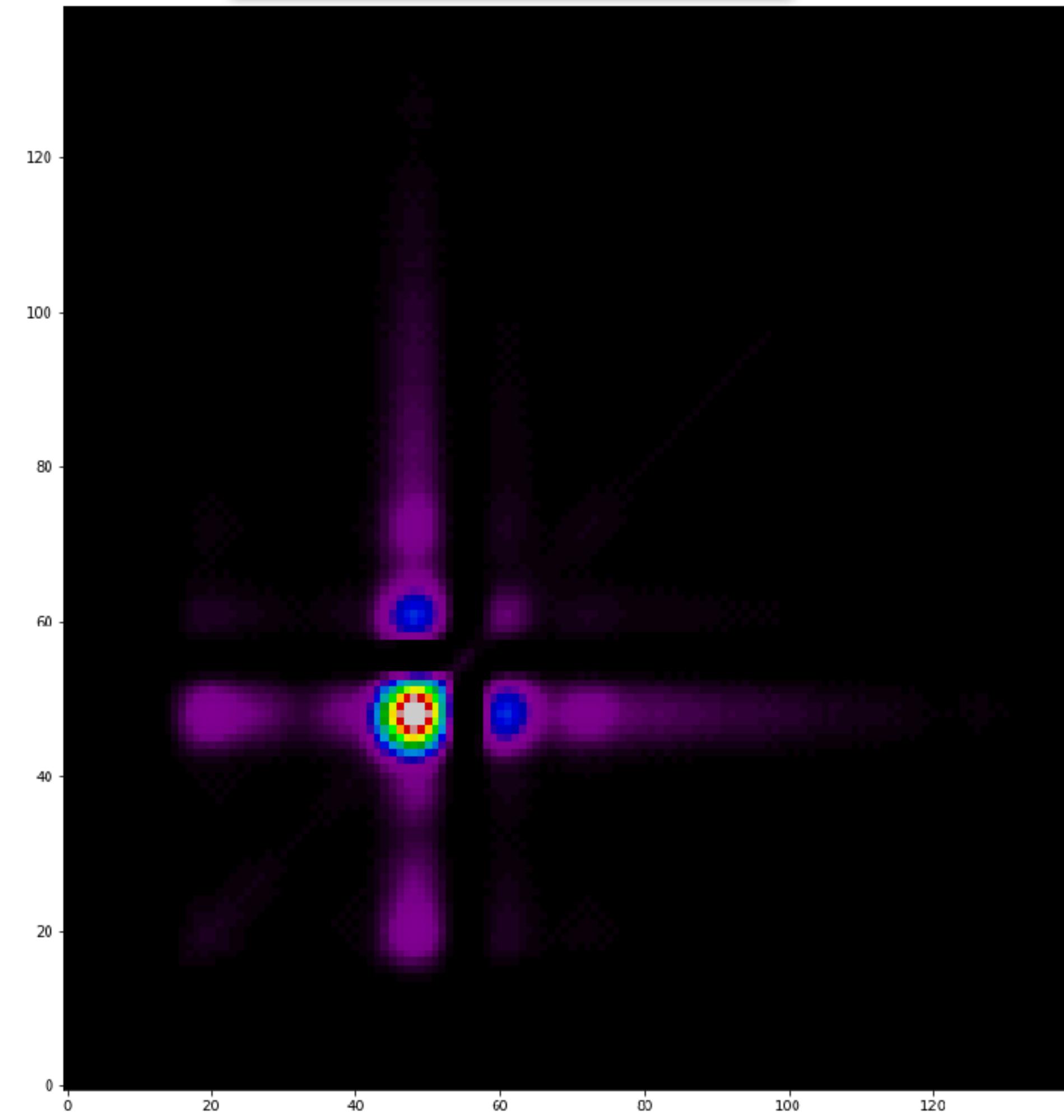




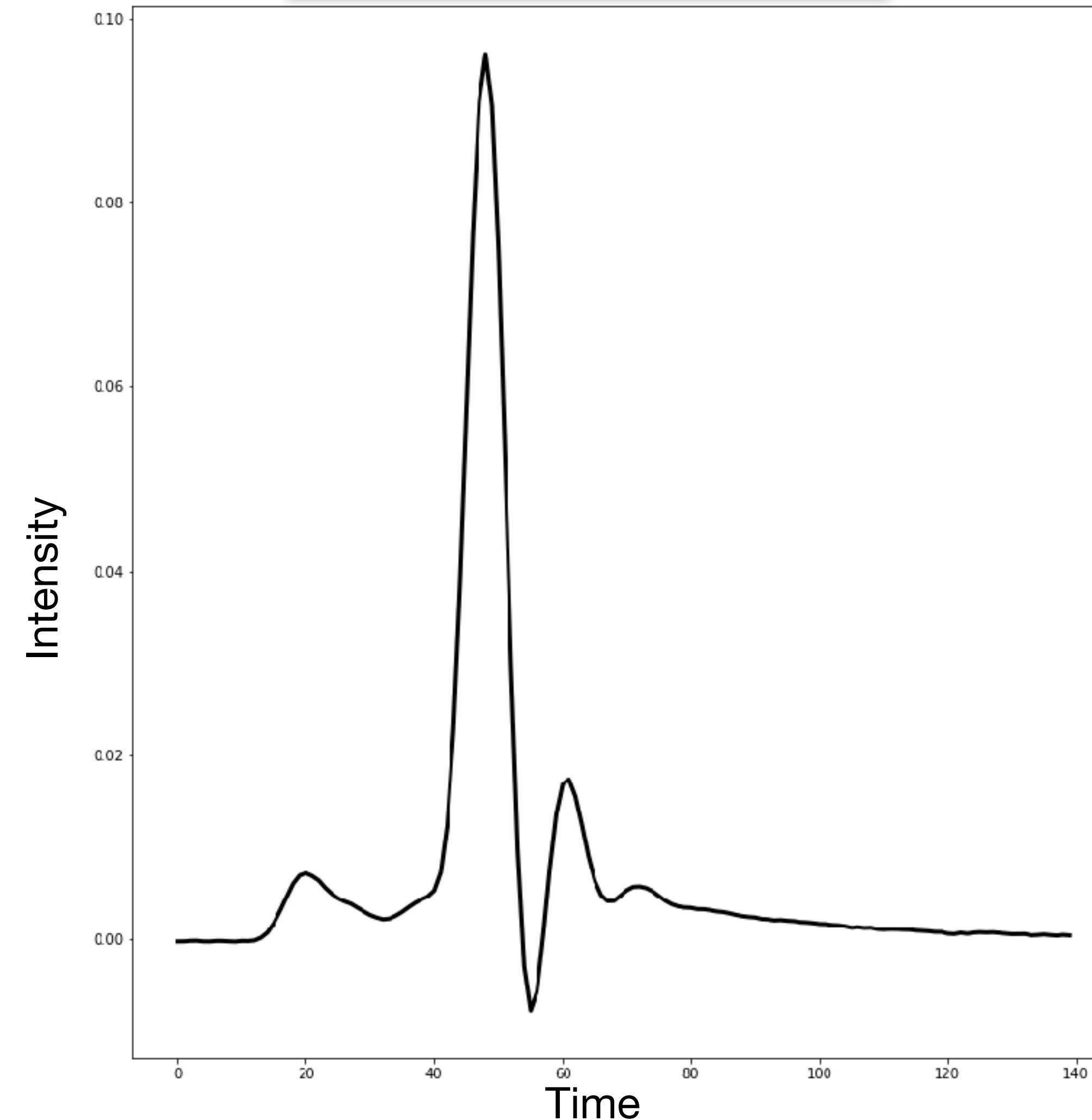
# RAW OPIS DATA THROUGH AUTOENCODER



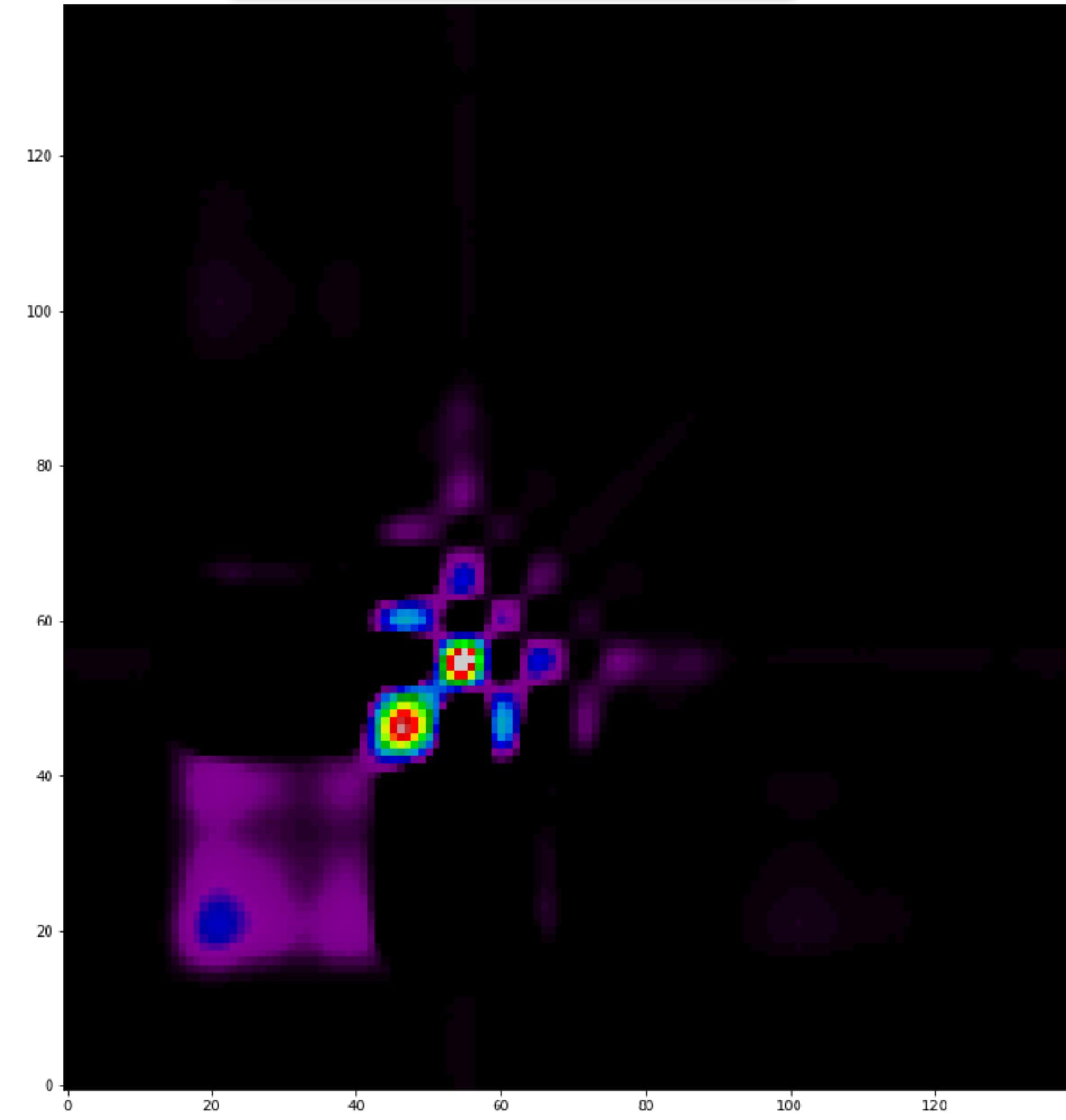
## Covariance Map



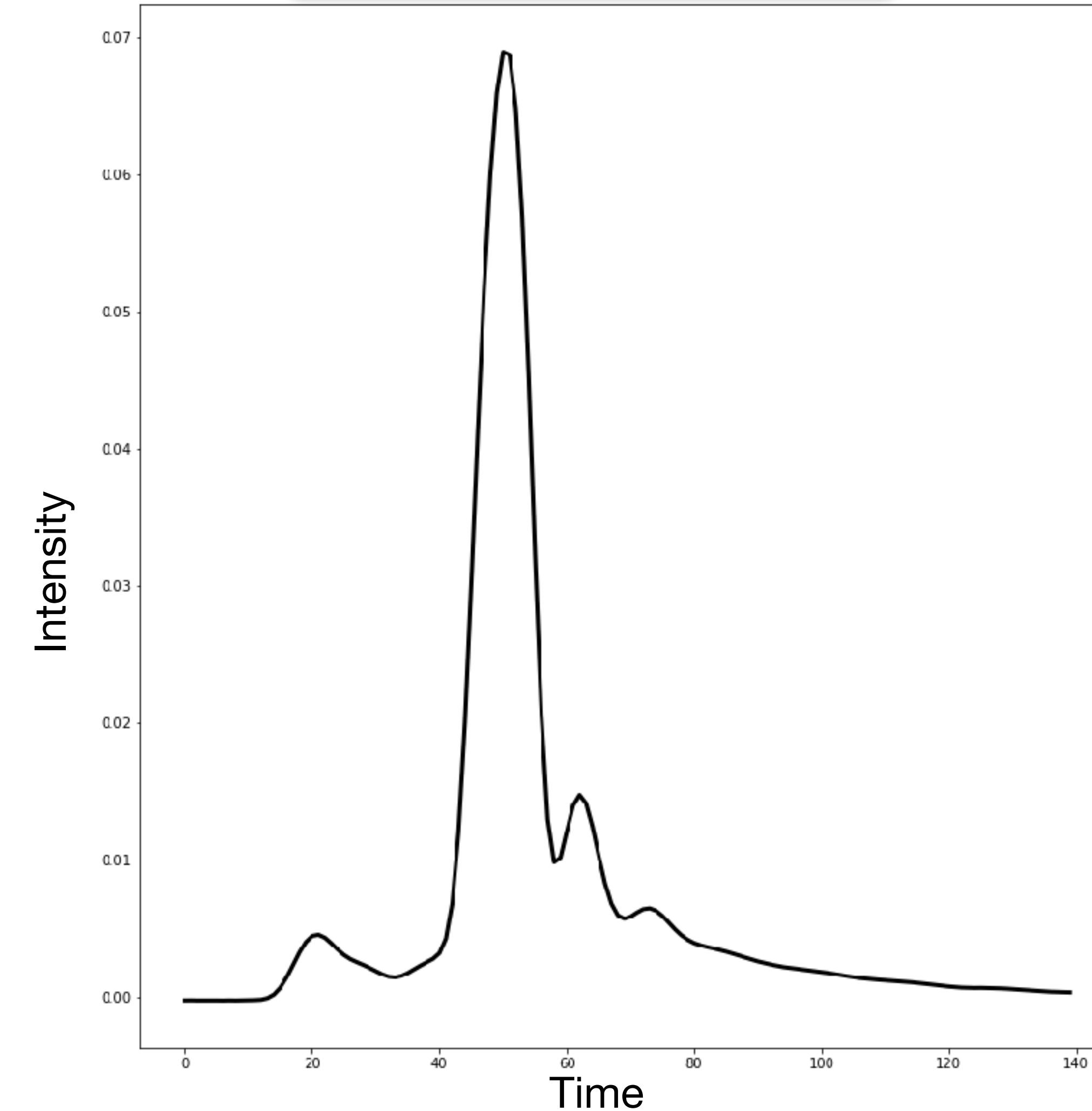
## Average spectrum



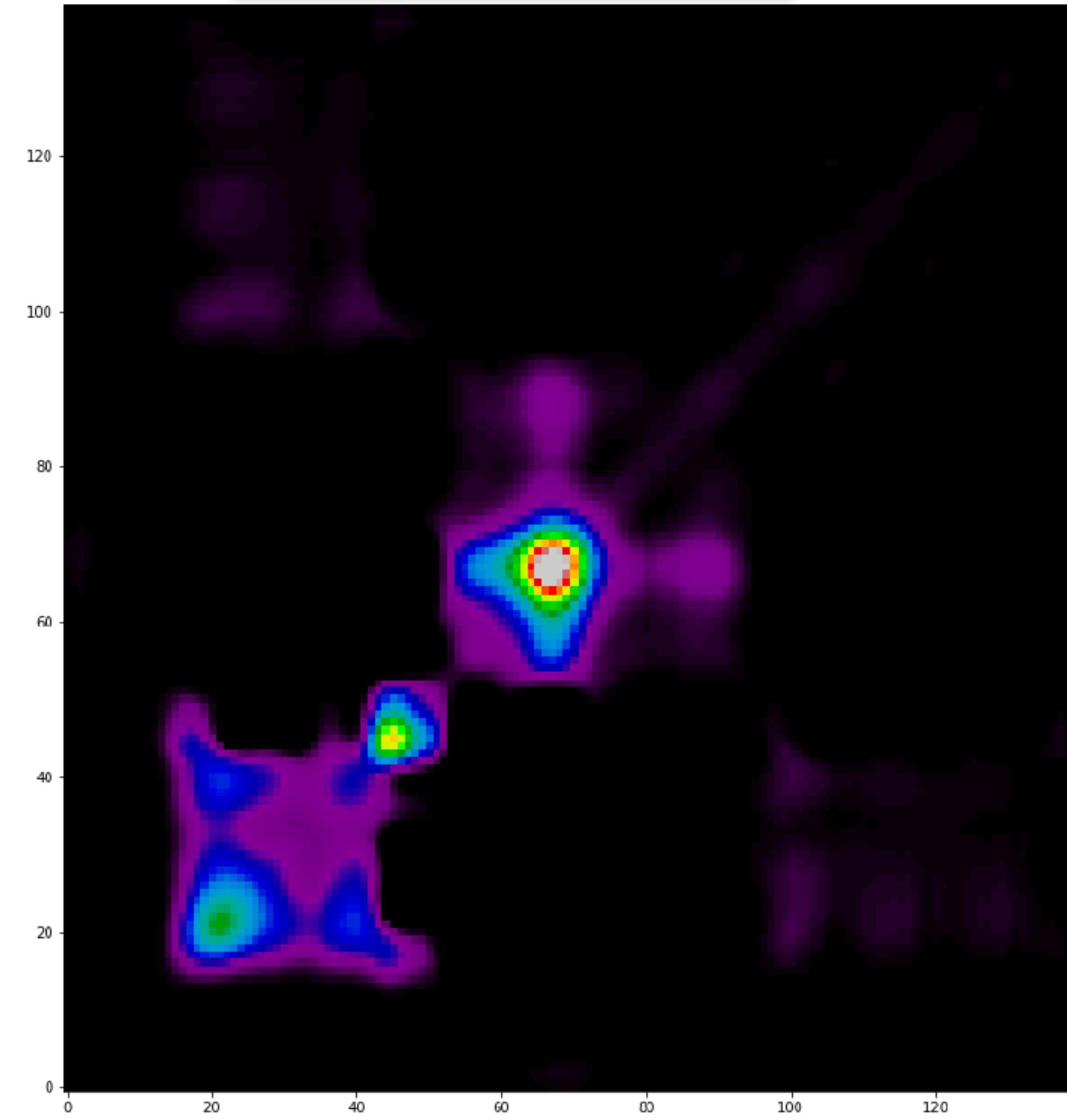
## Covariance Map



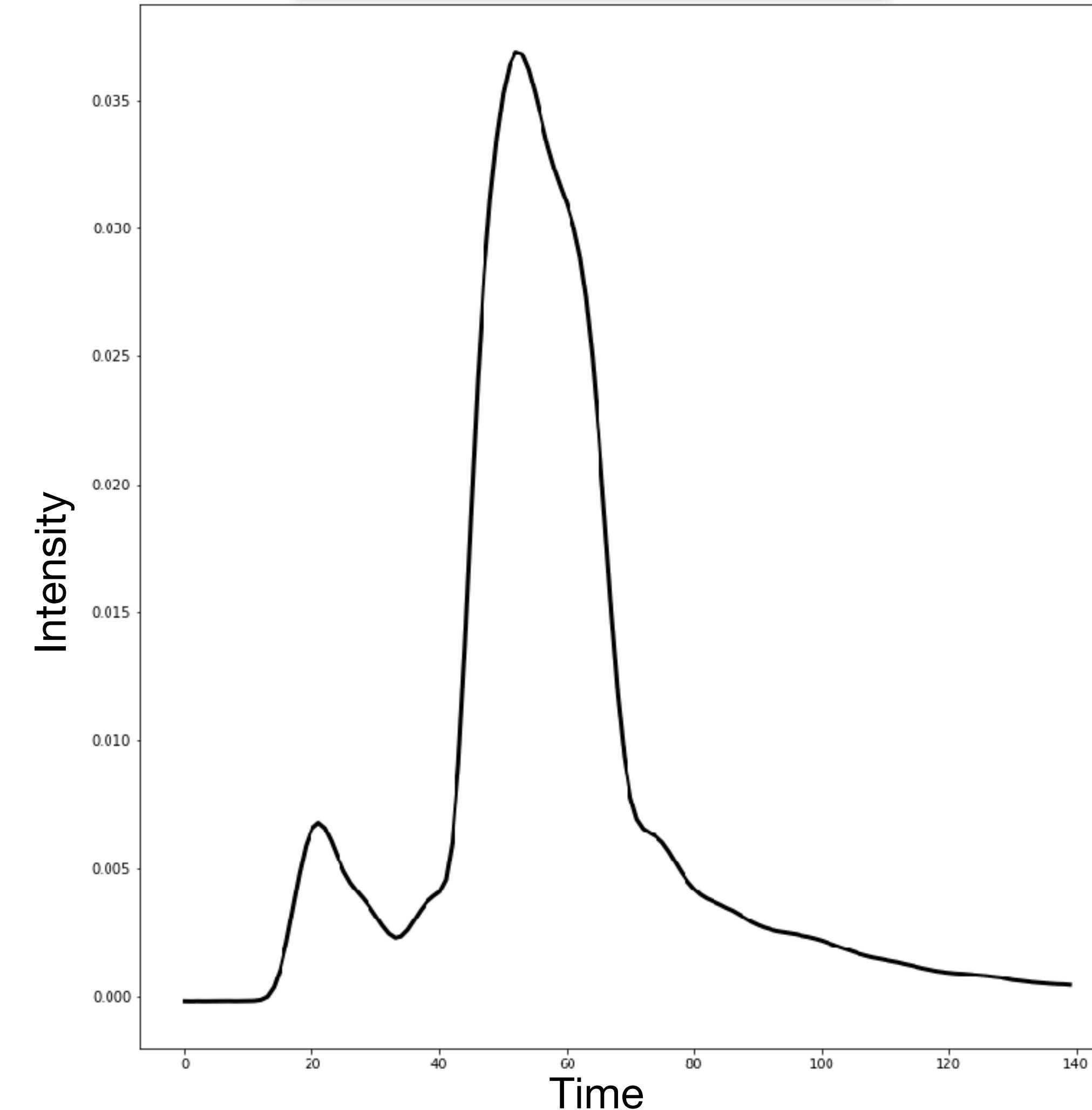
## Average spectrum



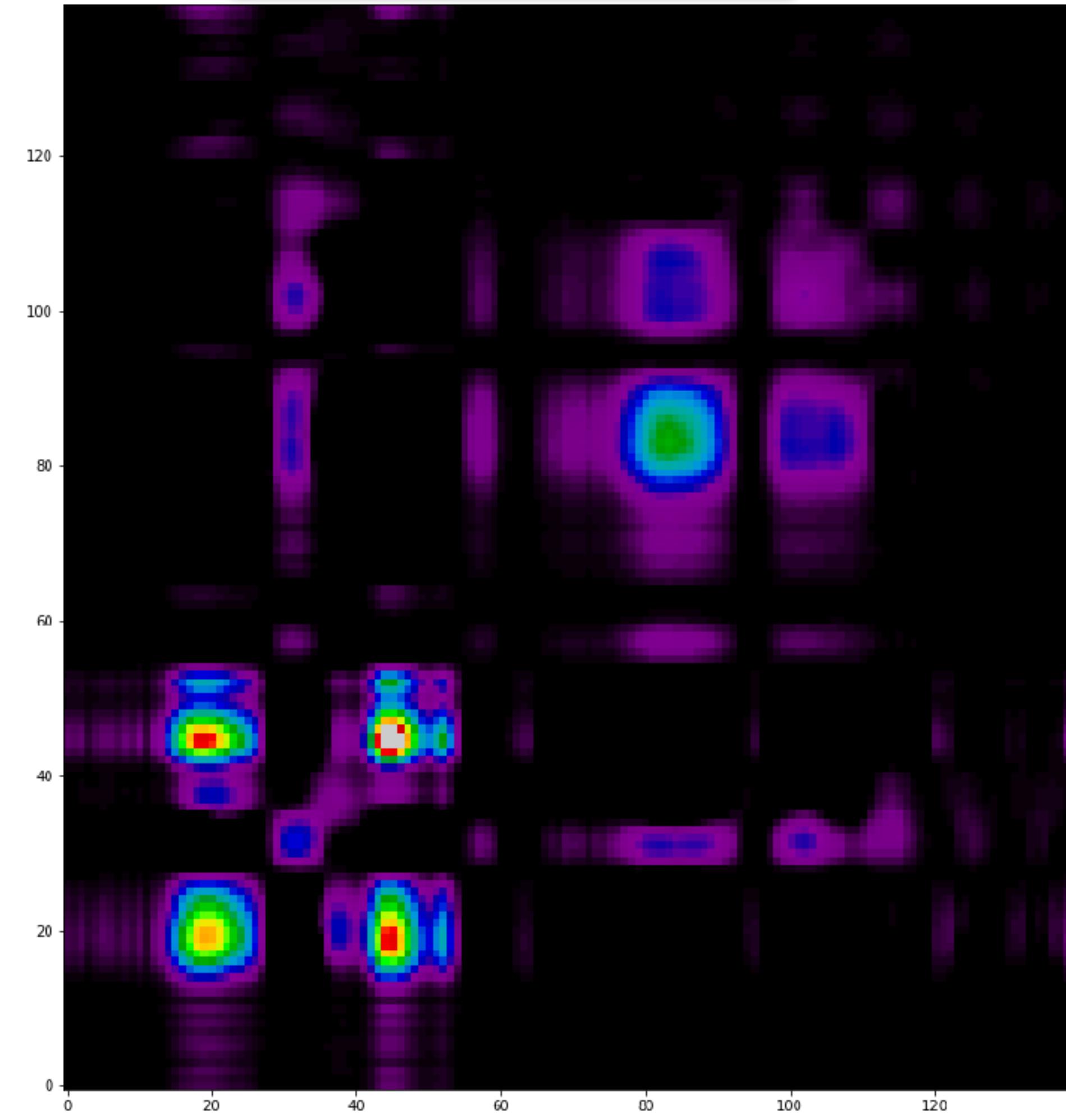
## Covariance Map



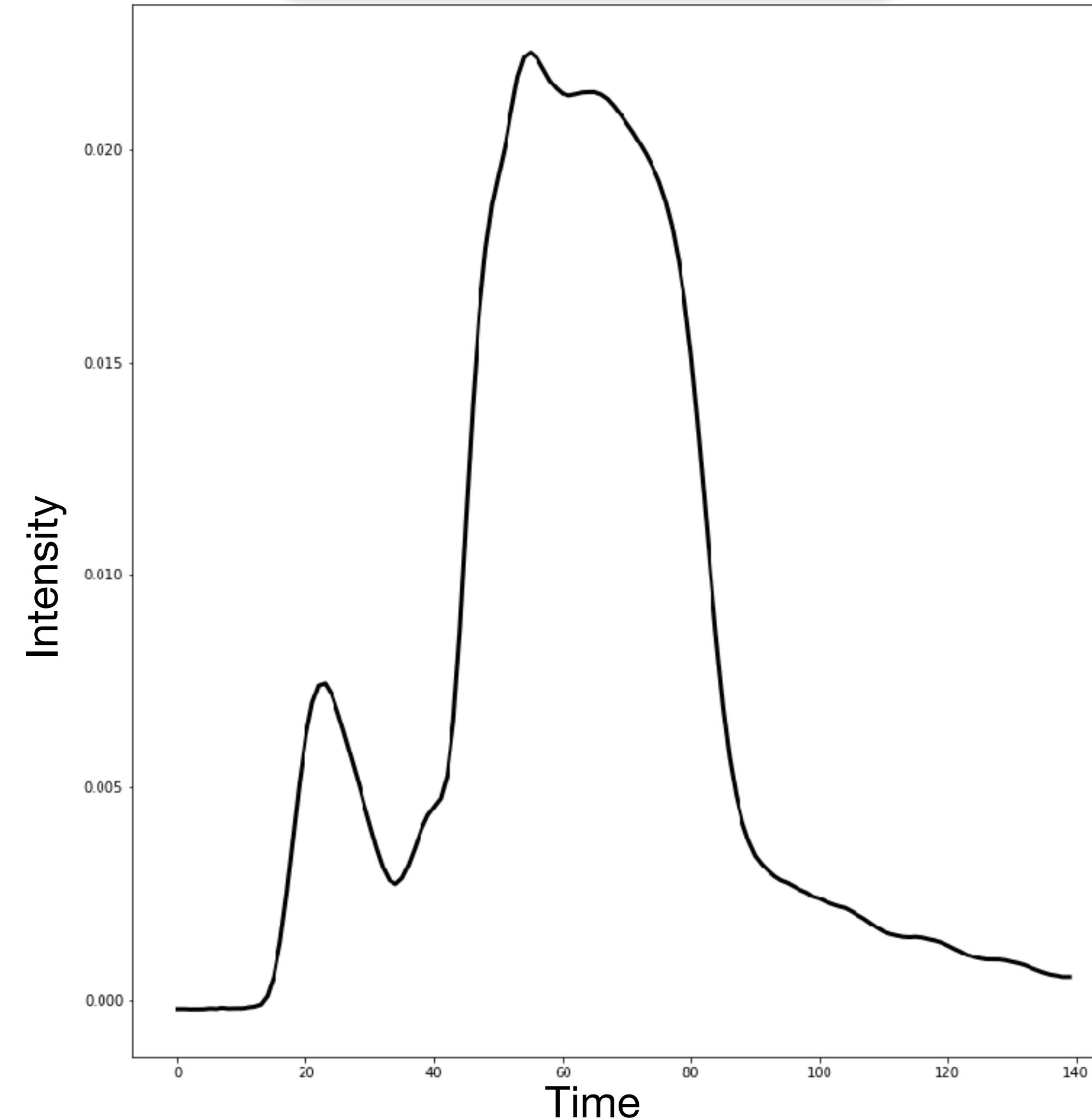
## Average spectrum



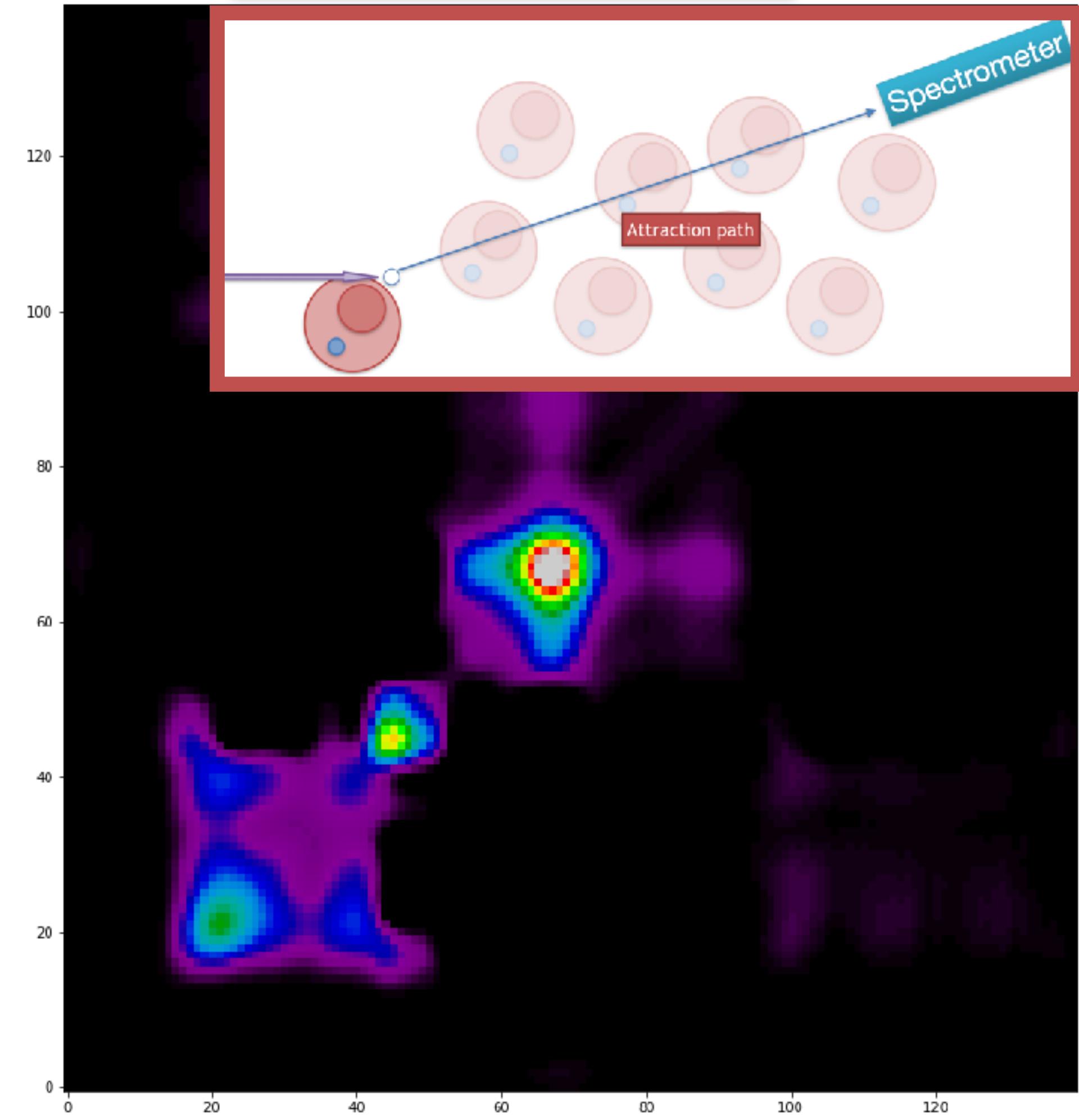
Covariance Map



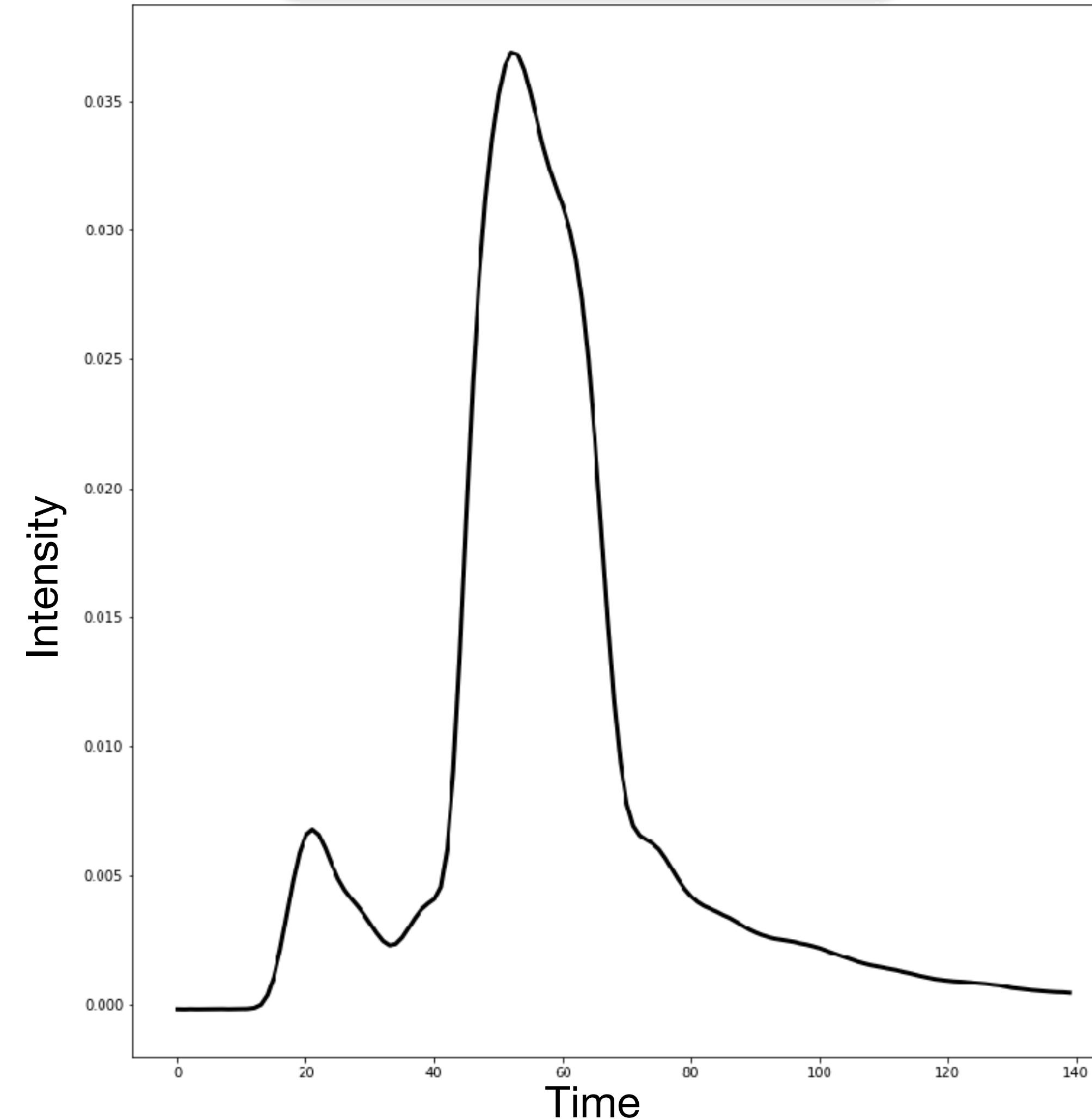
Average spectrum

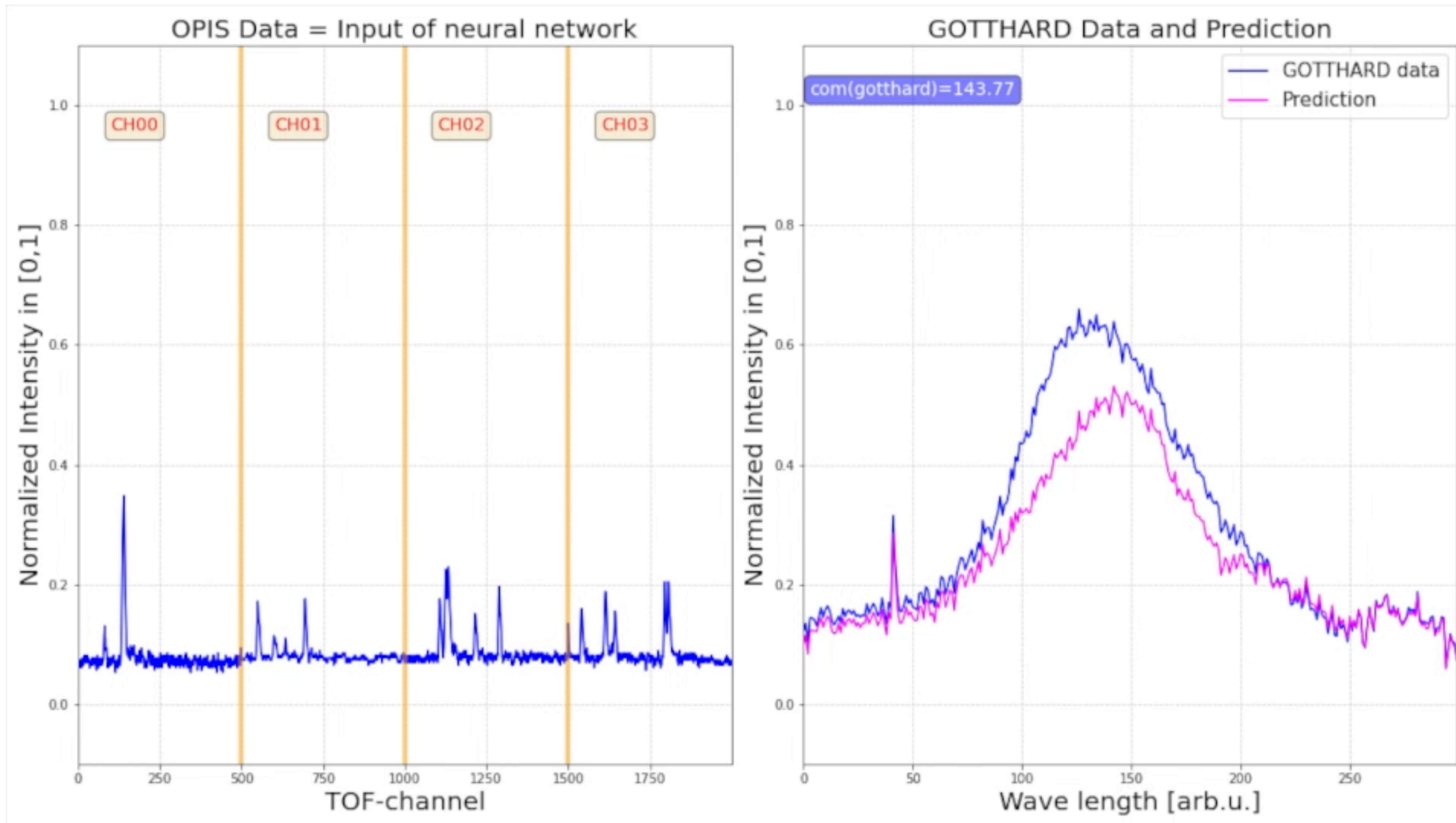


## Covariance Map



## Average spectrum





- How strong can we compress the data in the **bottleneck**?
- **Stacked AEs?**
- **Disentangled Variational AEs?**
- How much **training data**?
- From **latent space / bottleneck** to GOTTHARD
- From **OPIS** to GOTTHARD
- **Certainty** of the predictions