Software Injection Tests on Deepclean

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Injection Dataset - White Gaussian channel

- Generate the white Gaussian channel
- Apply Butterworth band pass filter: 100 ~ 150 Hz
- White Gaussian Strain amplitude: \(2 \times 10^{-20}\)
- White Gaussian PEM amplitude: \(8 \times 10^{-3}\)
Injection Dataset - Sine wave injection

- Inject sine wave with frequency: **125** Hz
- Injection lasts for **300 seconds**.
- Strain amplitude: **2e−21**
- PEM amplitude: **8e−3 Pa**
- No phase shift between Strain and PEM injection.
Background Strain
Background PEM
Injected Sine Wave: 125 Hz
Injected Sine Wave: 125 Hz
Injected Strain: 125 Hz
Injected PEM: 125 Hz
Strain ASD: Background and Injection

![Graph showing Strain ASD: Background and Injection](image-url)
PEM ASD: Background and Injection

![Graph showing ASD for Background and Injection at 125 Hz](image-url)
Dataset Properties

- GPS time to train: 1275891680 (480 seconds)
- GPS time to clean: 1275891680 (320 seconds)
- Strain channel: K1:CAL-CS_PROC_C00_STRAIN_GAUSSIAN
- PEM channel: K1:PEM_GAUSSIAN
- Sampling rate: 4096 Hz
- Bandpass filter: 120 ~ 130 Hz
  - 10 Hz wide, centered at the injected frequency
- Epochs: 20
- Loss function setup:
  - $J_{\text{asd}} = 1$, $J_{\text{mse}} = 0$
  - $J_{\text{asd}} = 0$, $J_{\text{mse}} = 1$
  - $J_{\text{asd}} = 0.5$, $J_{\text{mse}} = 0.5$
\[ J = 1 \times J_{\text{asd}} + 0 \times J_{\text{mse}} \]
Predicted Strain: 125 Hz
ASD: Predicted Strain

Train Data ASD: Predicted Strain (125 Hz)
ASD: Raw and Cleaned Strain

Train Data ASD: Raw Strain and Cleaned Strain (125 Hz)
\[ J = 0 \times J_{\text{asd}} + 1 \times J_{\text{mse}} \]
Predicted Strain: 125 Hz
ASD: Predicted Strain

Train Data ASD: Predicted Strain (125 Hz)
ASD: Raw and Cleaned Strain
\[ J = 0.5 \times J_{\text{asd}} + 0.5 \times J_{\text{mse}} \]
ASD: Predicted Strain

Train Data ASD: Predicted Strain (125 Hz)
ASD: Raw and Cleaned Strain

Train Data ASD: Raw Strain and Cleaned Strain (125 Hz)
Summary

- We prepared the 300 seconds long single-frequency injection to white Gaussian strain and white Gaussian PEM background.
- We have shown the training and cleaning of the 125 Hz injection.
- How do we avoid the effect of the line removed on other frequencies besides the frequency we want to subtract?
- How do we setup the DeepClean or similar model be applied in 04?