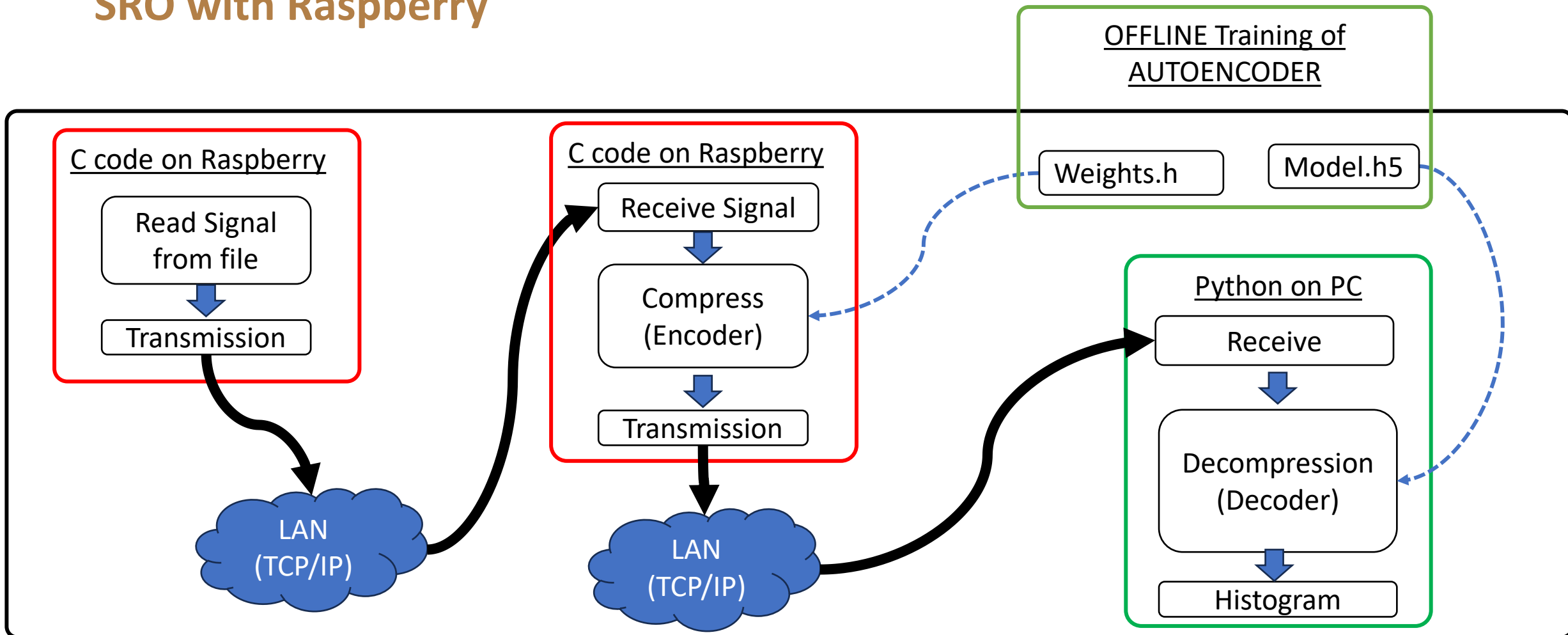
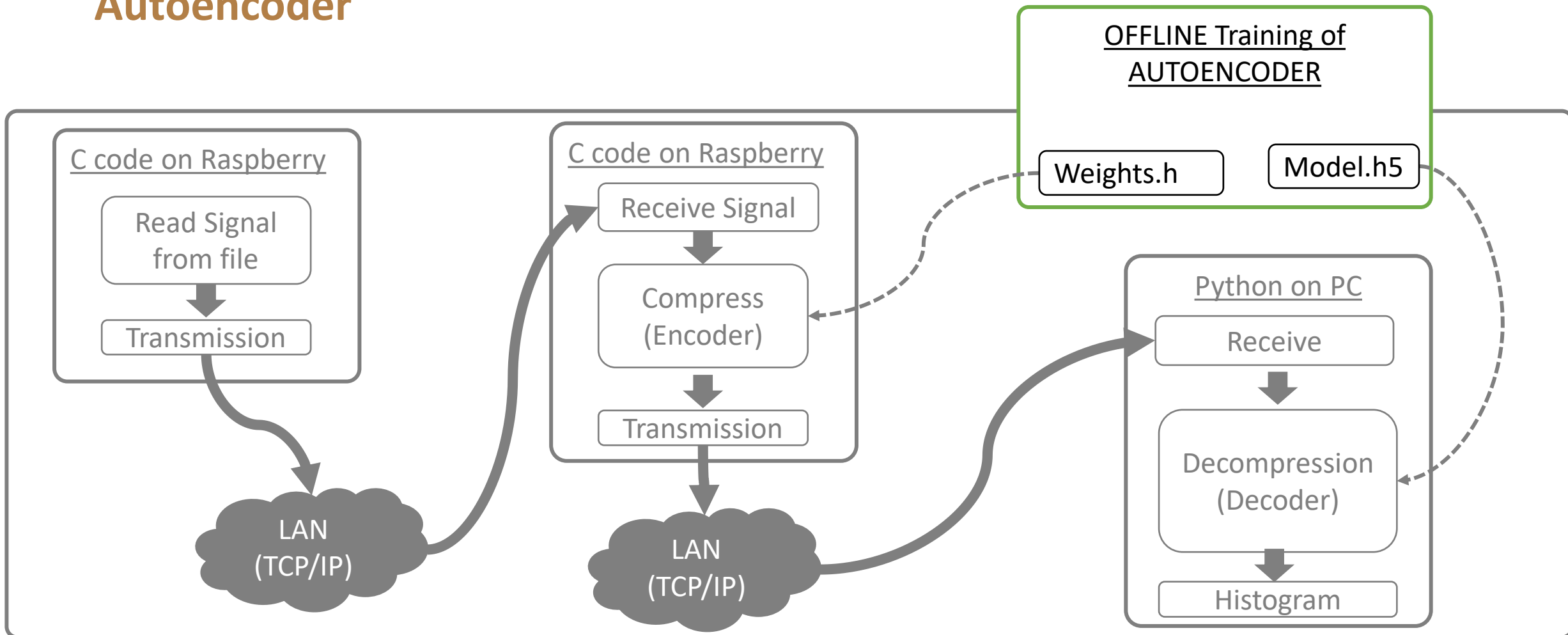


SRO with Raspberry



Autoencoder



Autoencoder

Machine Learning Algorithm

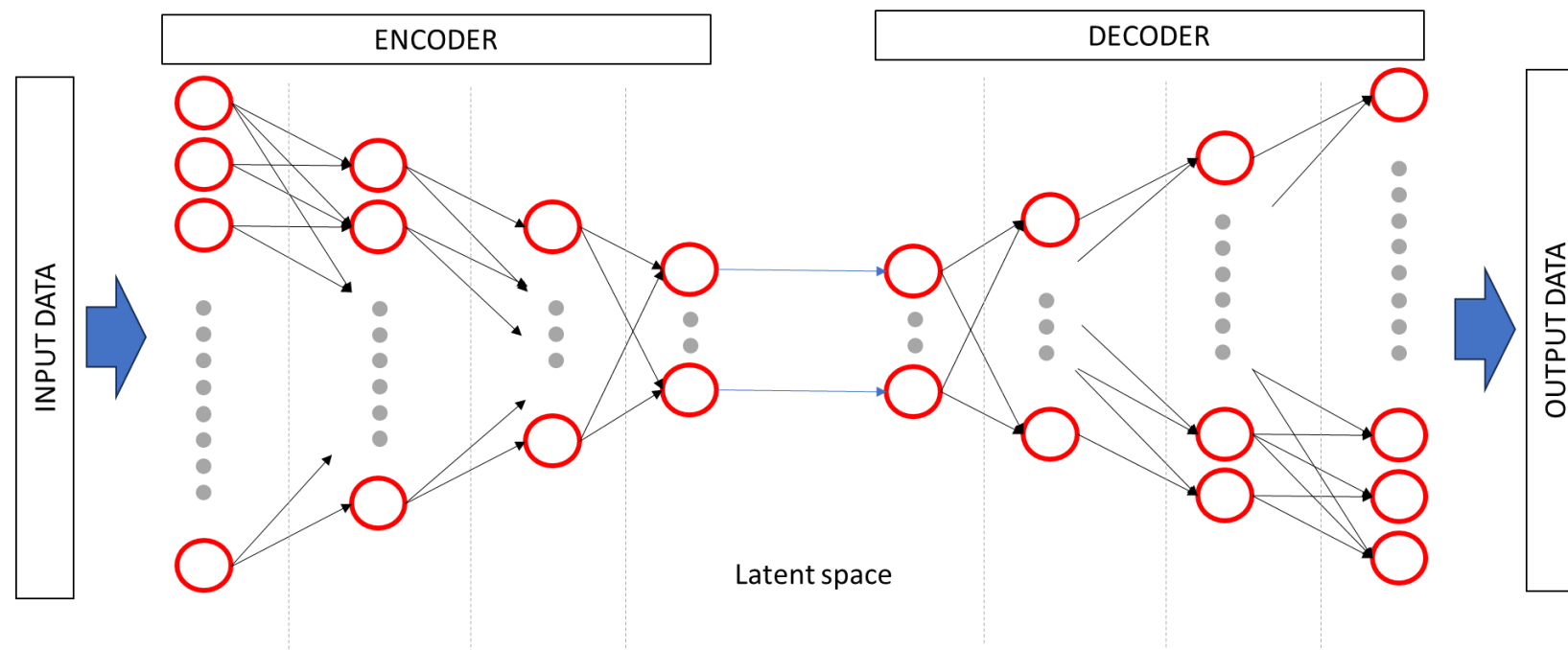
Artificial Neural Network

Unsupervised learning

Dimensionality reduction

Composed of two function:

- encoding
- decoding

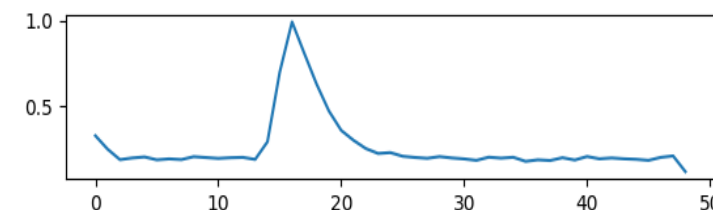
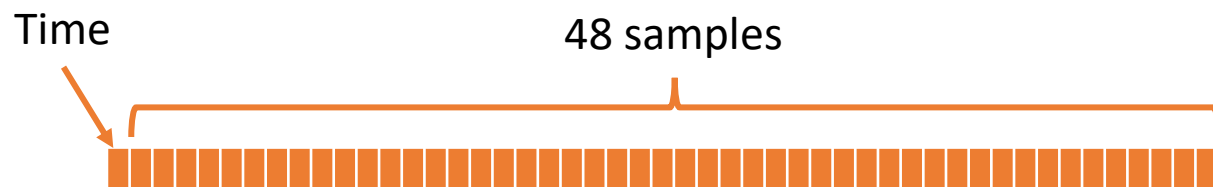


FULLY CONNECTED AUTOENCODER WITH DENSE LAYER

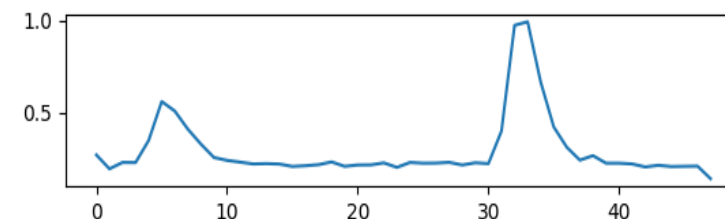
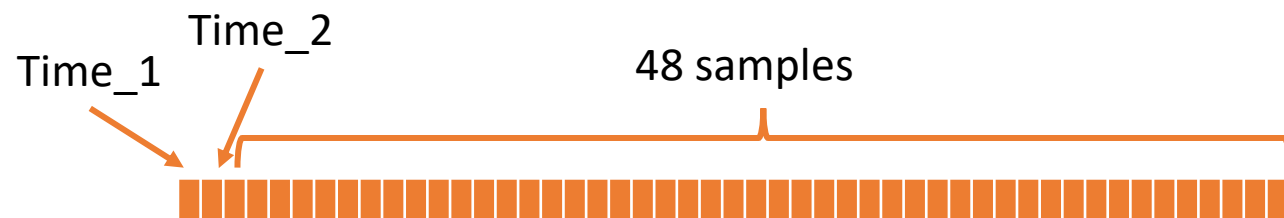
Autoencoder Training: Input Data

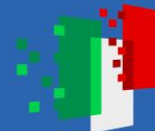
Two files of signals from Gagik's Database

Single Pulse Signals



Double Pulse Signals





Autoencoder Training: Autoencoder Model

```

class Autoencoder(tf.keras.Model):
    def __init__(self, Neurons):
        super(Autoencoder, self).__init__(INPUT_SHAPE)

        self.encoder = []

        for i in range(0, len(Neurons), 1):
            if i == 0:
                self.encoder.append(layers.Dense(Neurons[i], activation="relu", input_shape=(INPUT_SHAPE,)))
            else:
                self.encoder.append(layers.Dense(Neurons[i], activation="relu"))
        for i in reversed(range(0, len(Neurons), 1)):
            self.encoder.append(layers.Dense(Neurons[i], activation='relu'))
        self.encoder.append(layers.Dense(INPUT_SHAPE))

```

First Layer with same dimension of signal sample number

Variable number of layer with variable number of neurons

Variable number of layer with variable number of neurons

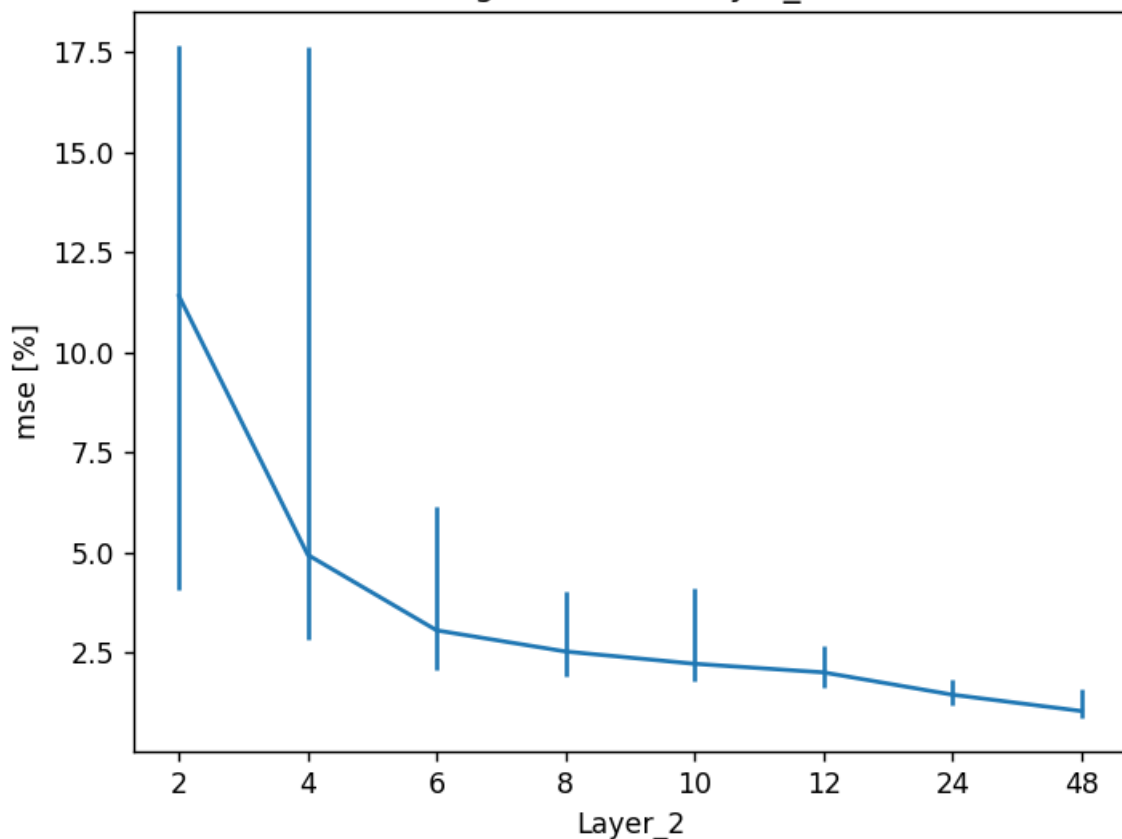
Output layer with the same dimension of input

Flexible model allows to explore and test different configuration

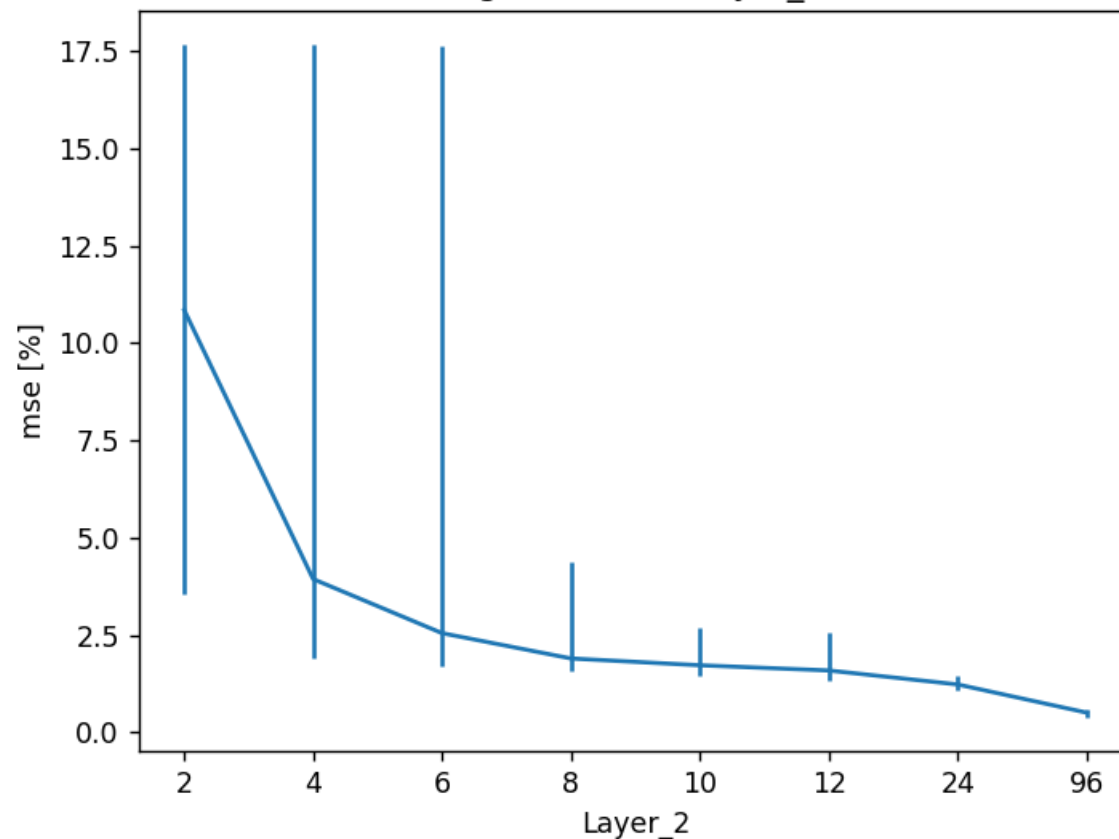
	Encoder
	Decoder

Autoencoder Training: Training results with different configuration

BestSingleLoss with Layer_1 = 48

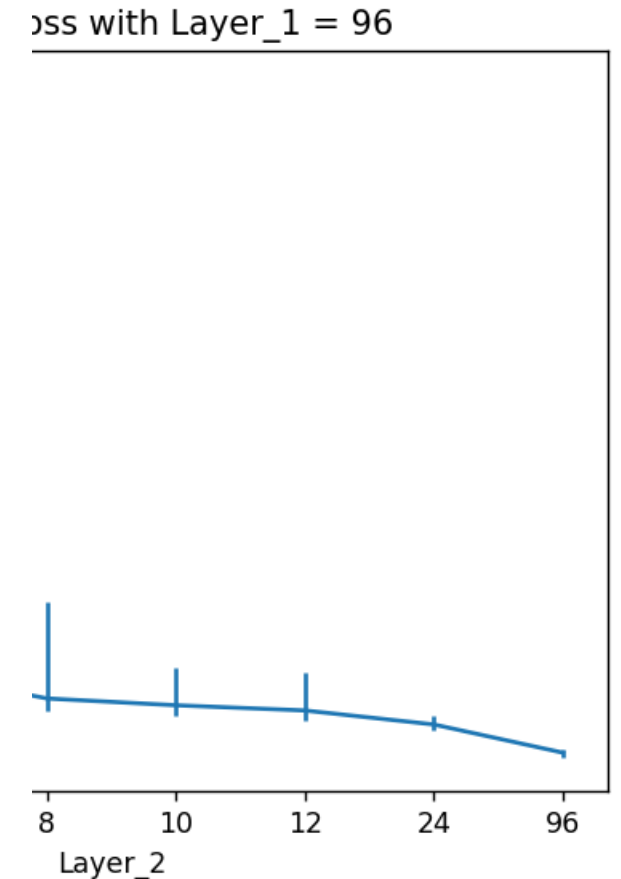
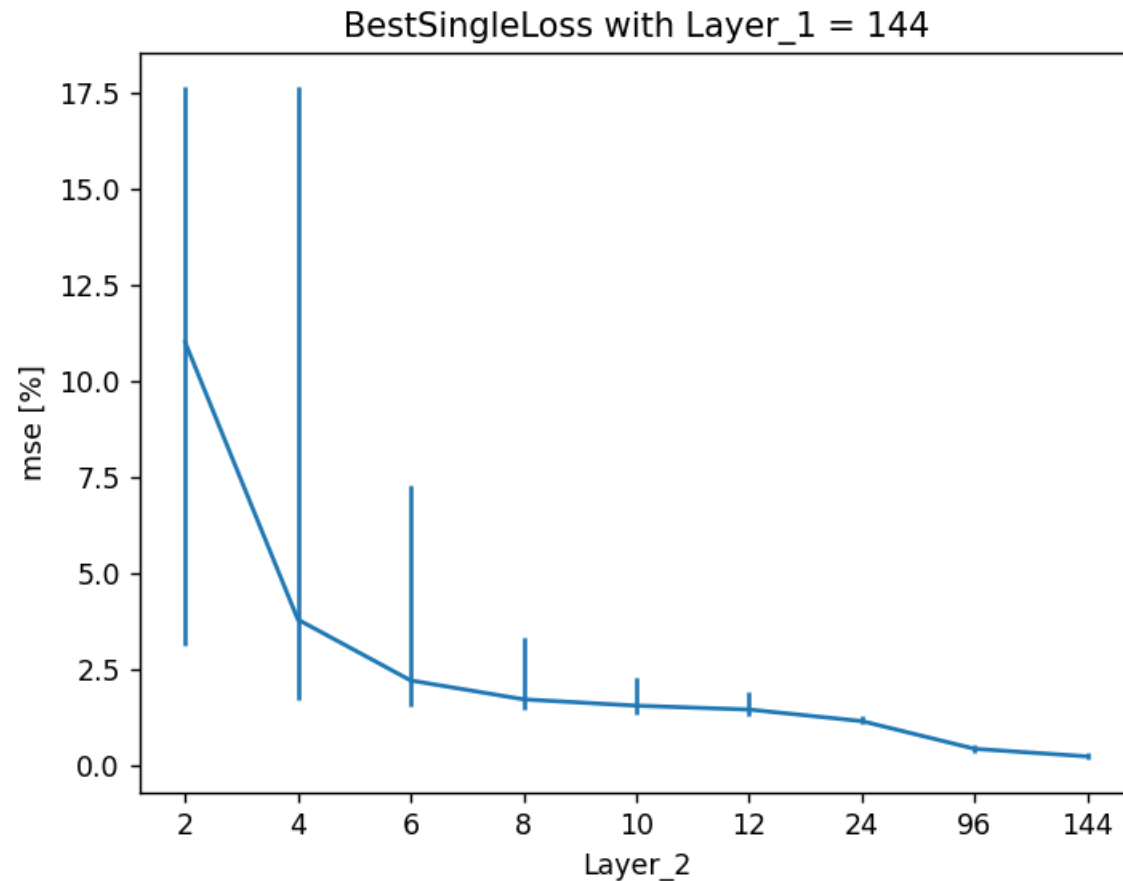
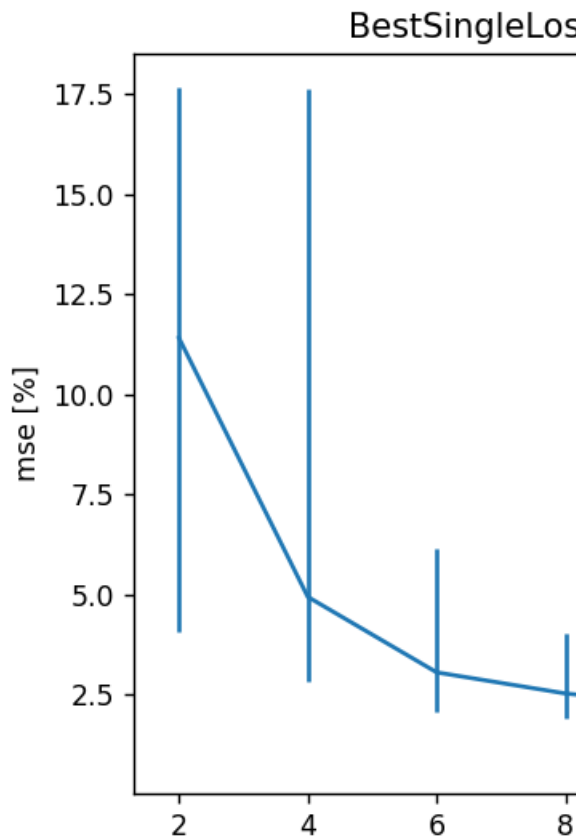


BestSingleLoss with Layer_1 = 96





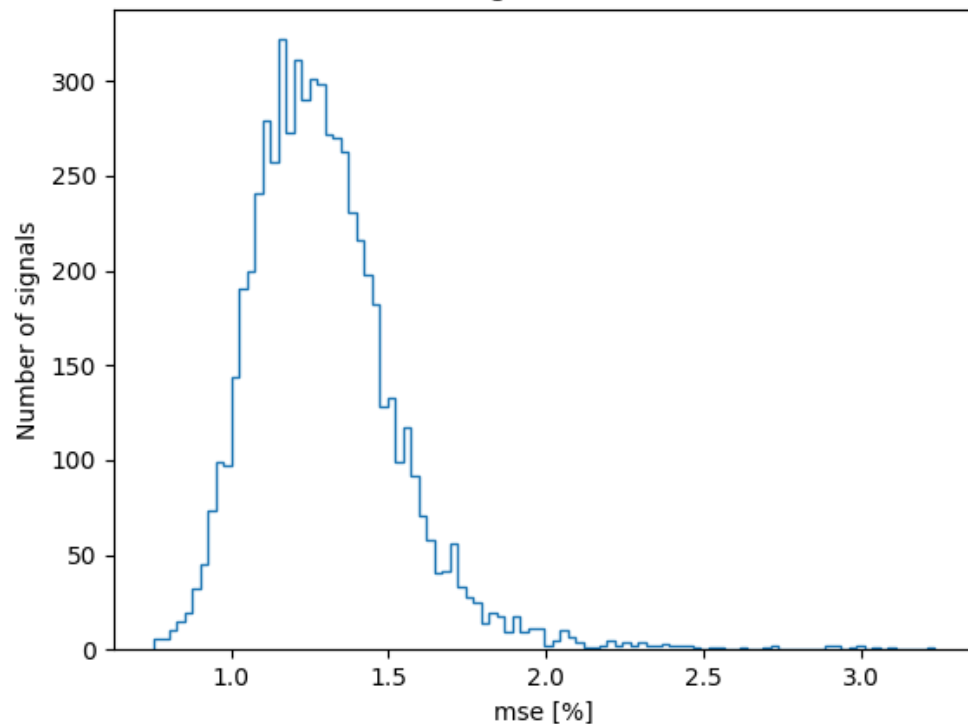
Autoencoder Training: Training results with different configuration



Autoencoder Training: Test results with 96-12 configuration

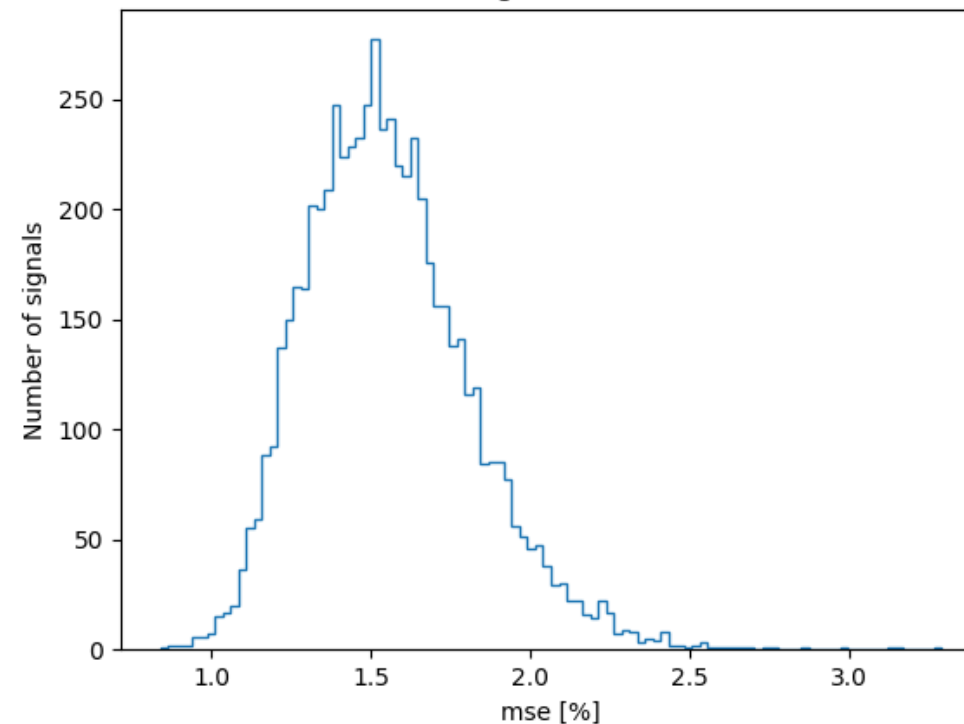
Single Pulse

Histogram of mse



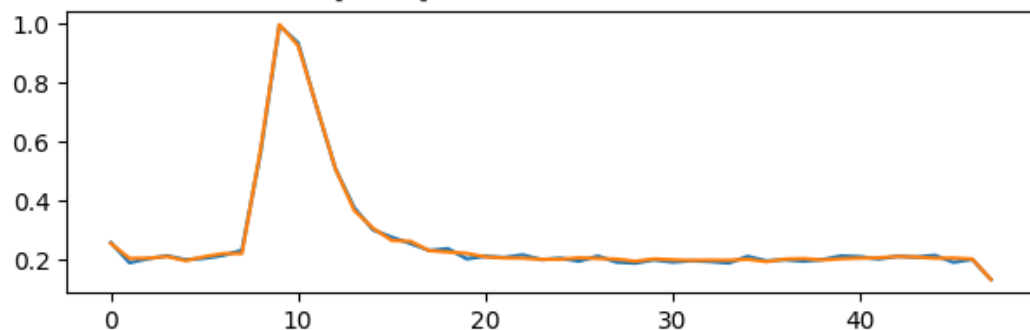
Double Pulse

Histogram of mse



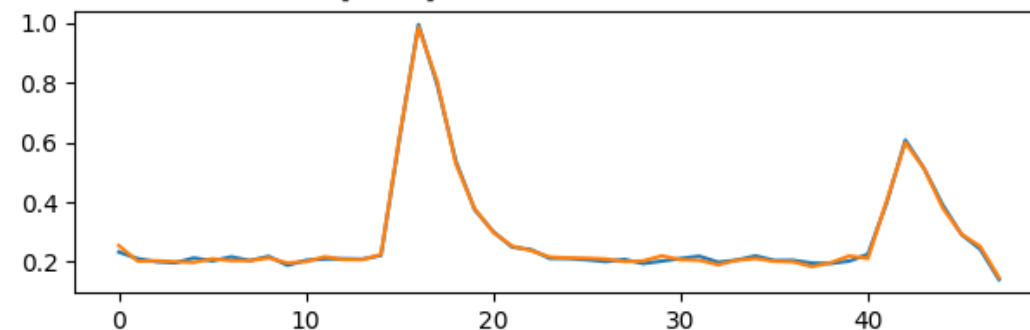
Autoencoder Training: Test results with 96-12 configuration

Mse[5999] = 0.7513767268707775 %

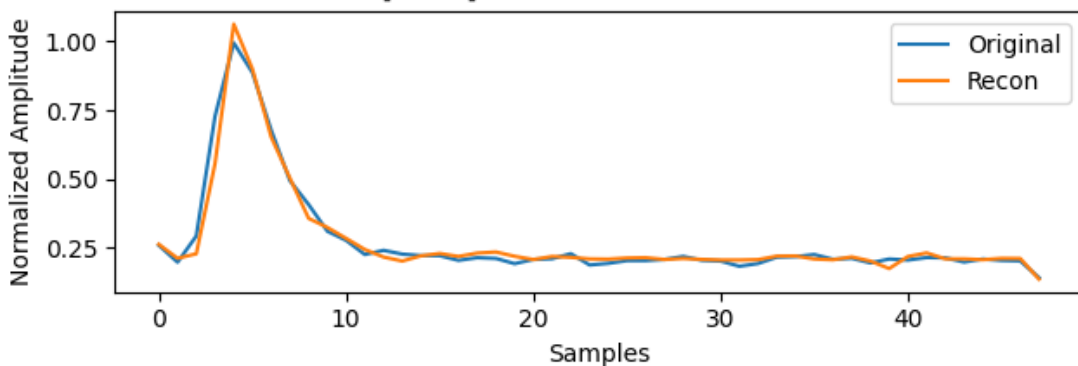


BEST

Mse[3198] = 0.8393174851318557 %

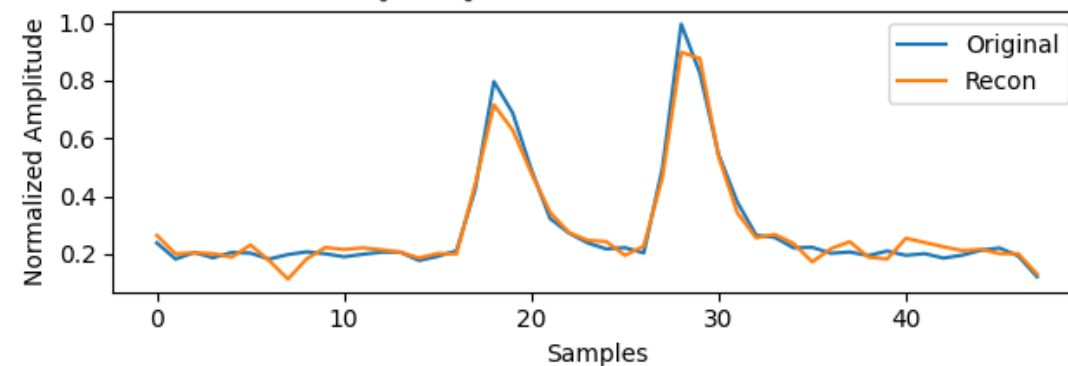


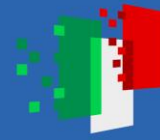
Mse[5631] = 3.2345875404039965 %



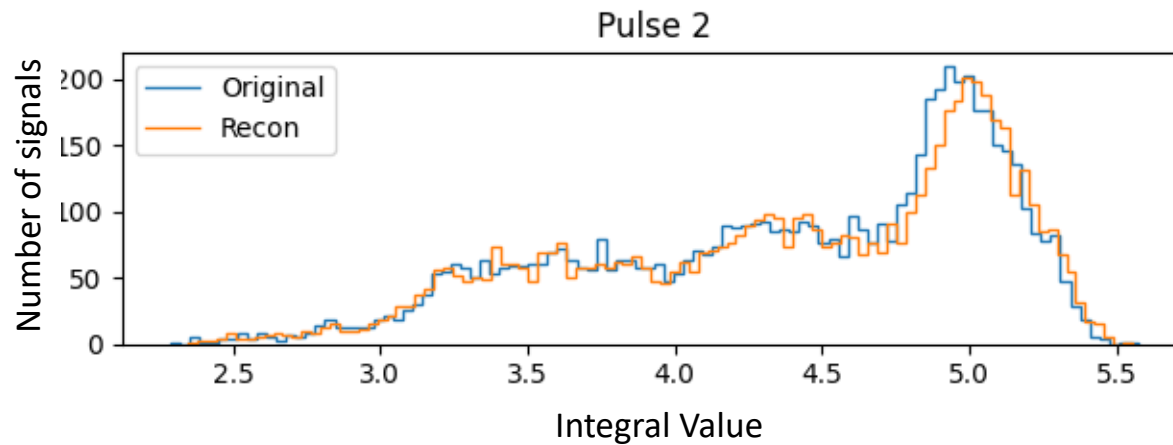
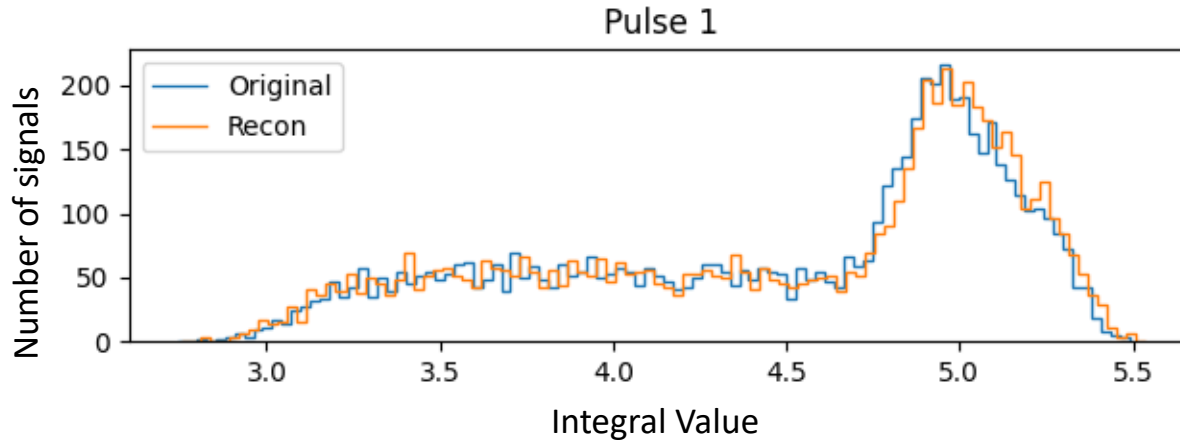
WORST

Mse[1528] = 3.2883887533937854 %





Autoencoder Training: Test results 96-12 configuration



MSE computed on
integral of each test
pulses



Autoencoder Training: Test results

