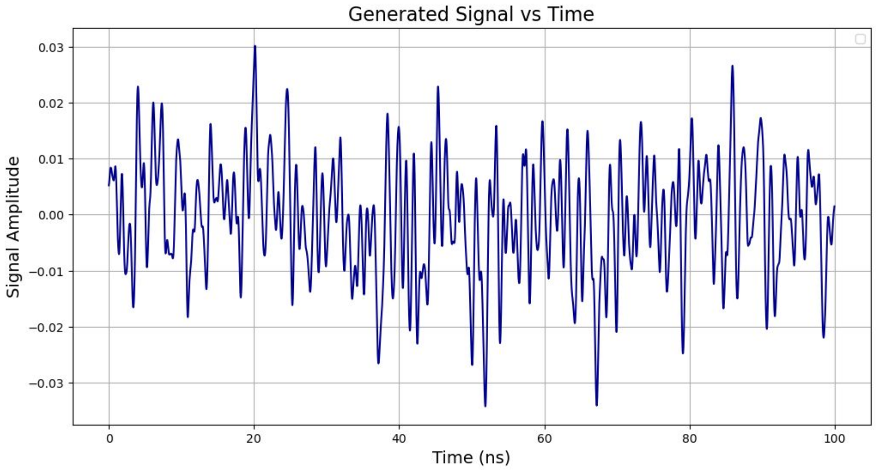
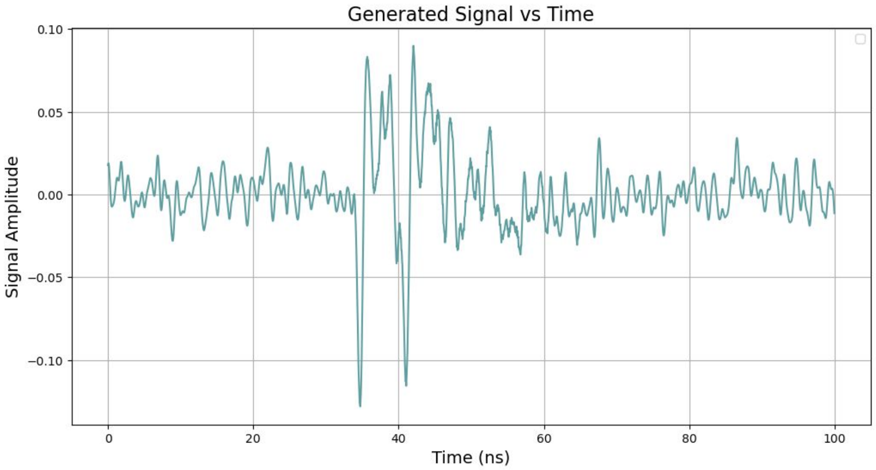
Question: Where is the photon?





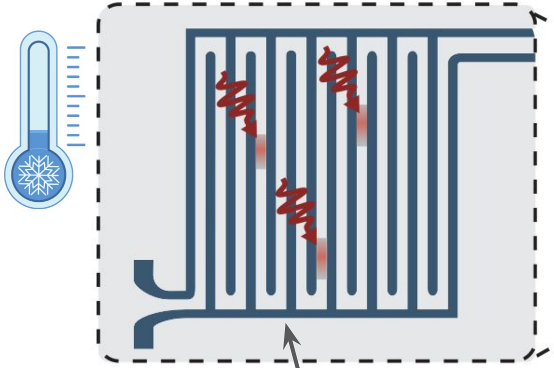
Binary Classification: a thing of the past

– New Achievements in Photon detection –

Hao Tang, Xiaotian Yang, David Ullrich

(Quick) Physical Background

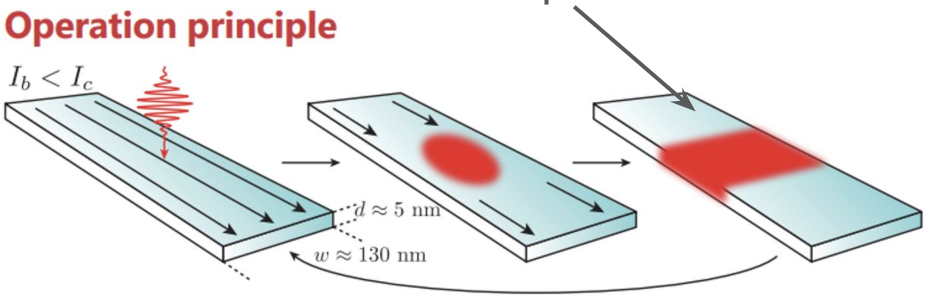
Setup:



Superconducting nanowire

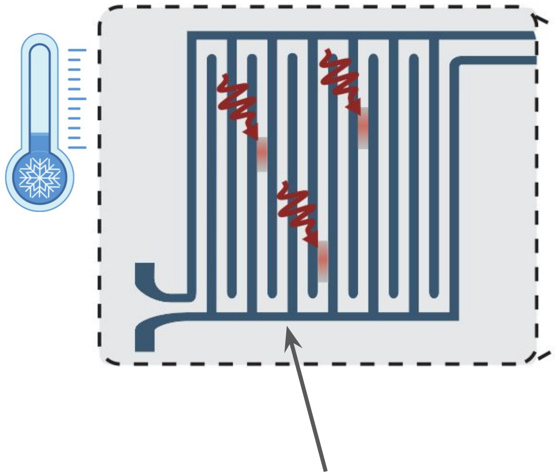
Principle:

Hotspot effect



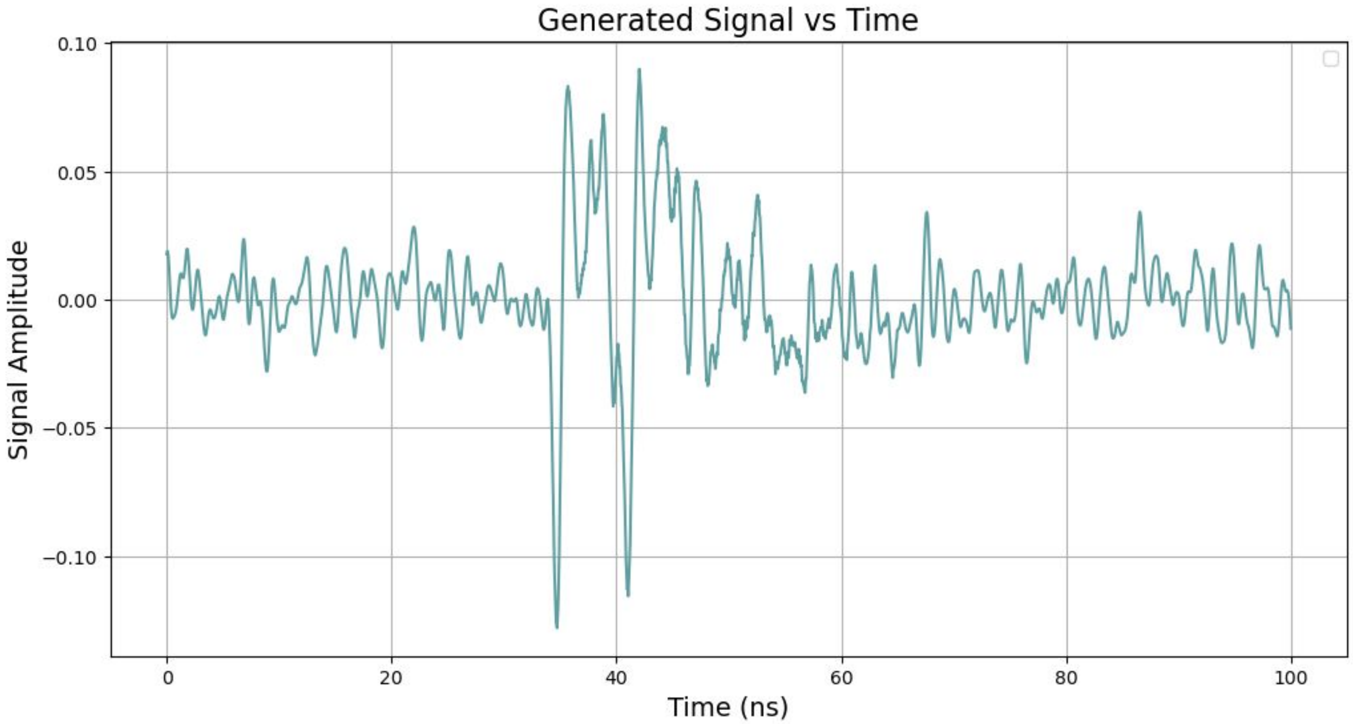
(Quick) Physical Background

Setup:

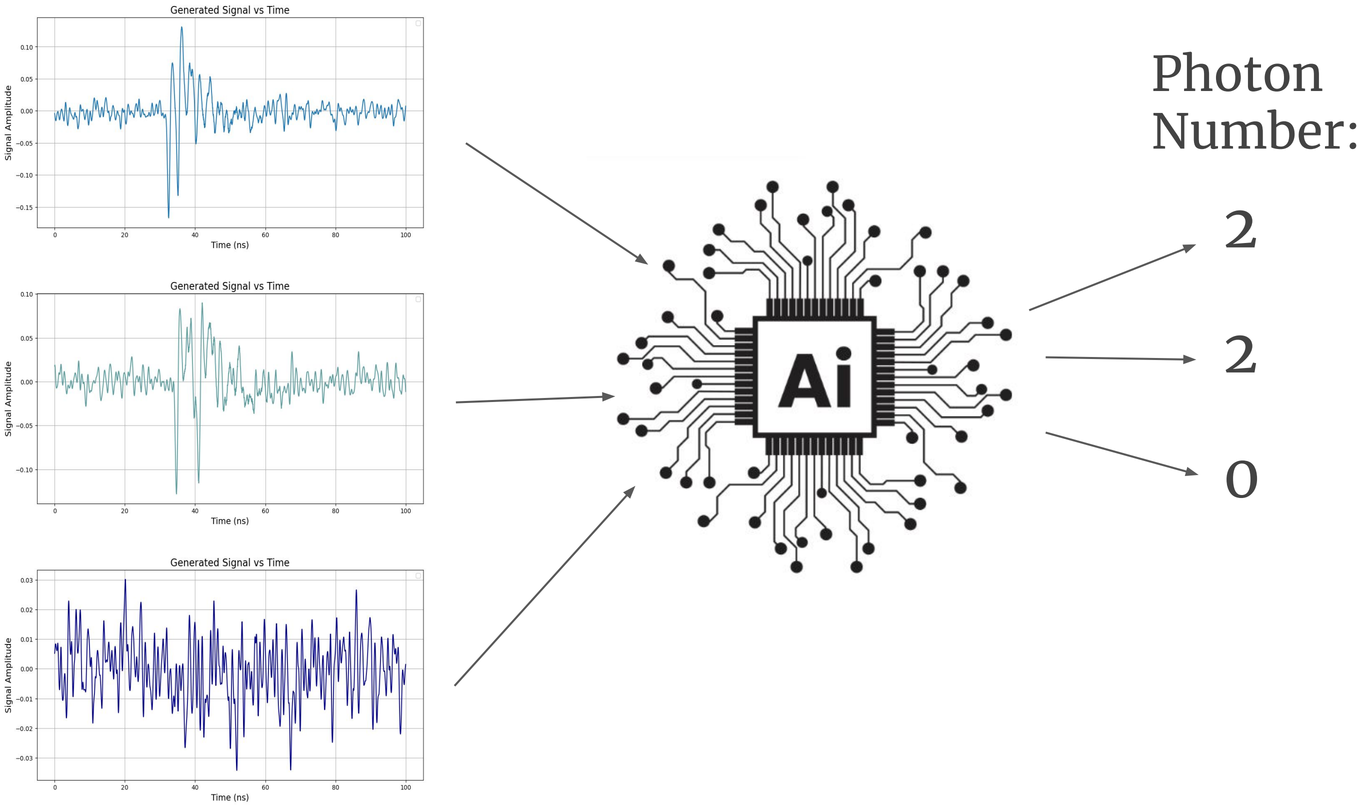


Superconducting nanowire

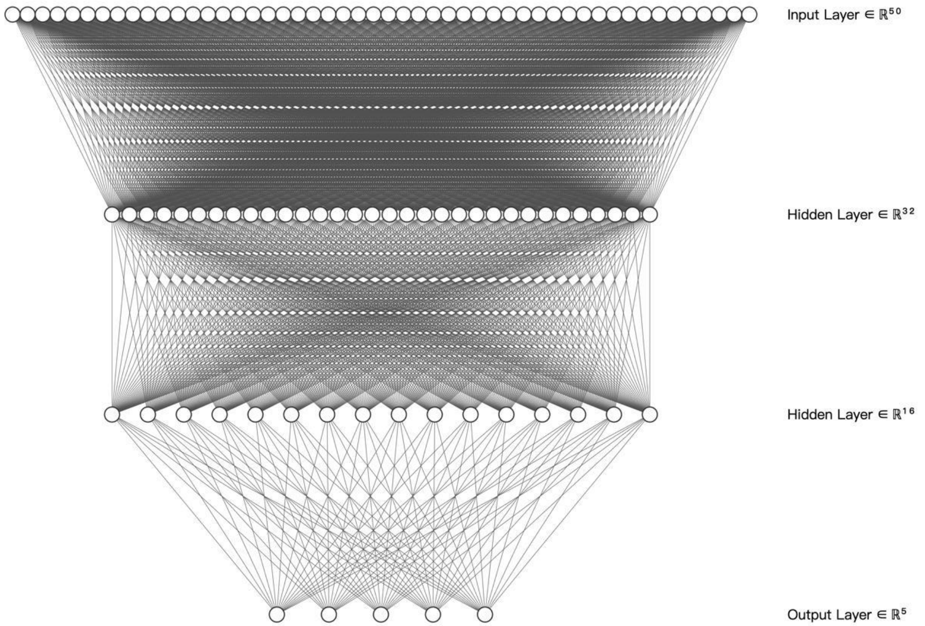
BUT: Ambiguous Output



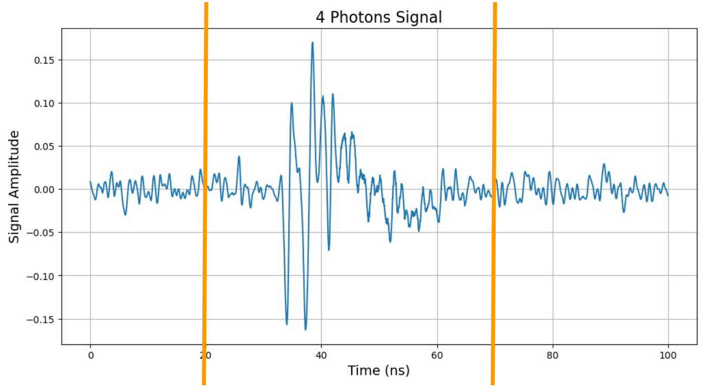
Machine Learning Solution



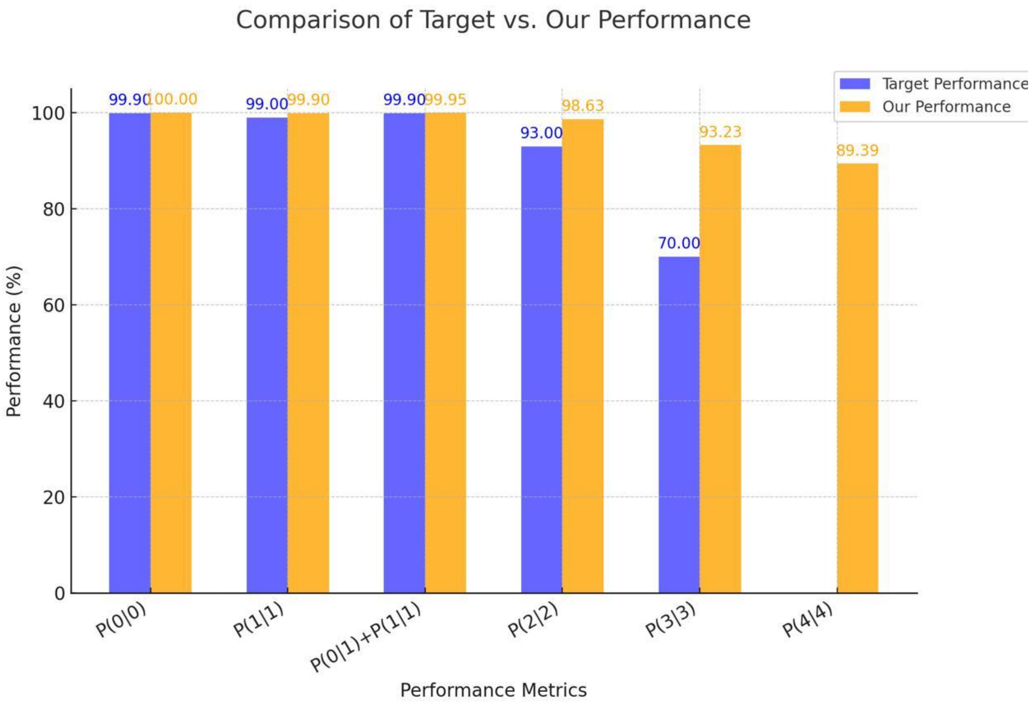
Key facts on the used Model



- Fully connected feedforward model
- Cut out noise on both sides
- 3.5% of max. workload of the FPGA

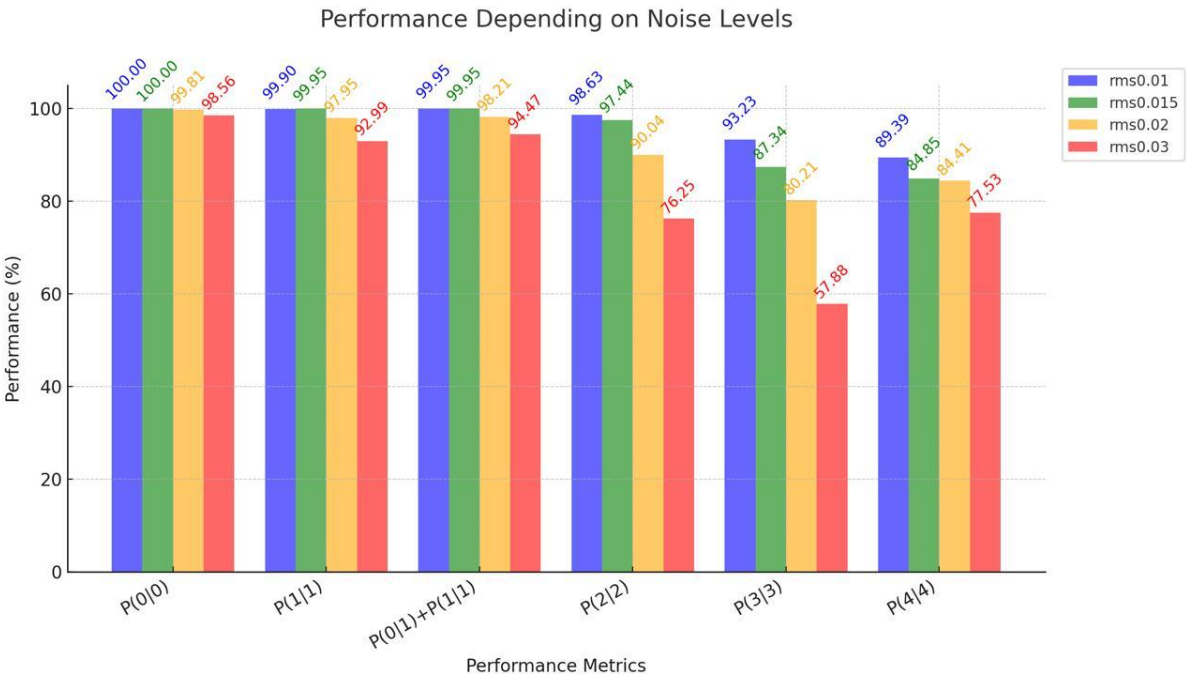


Performance of the Model

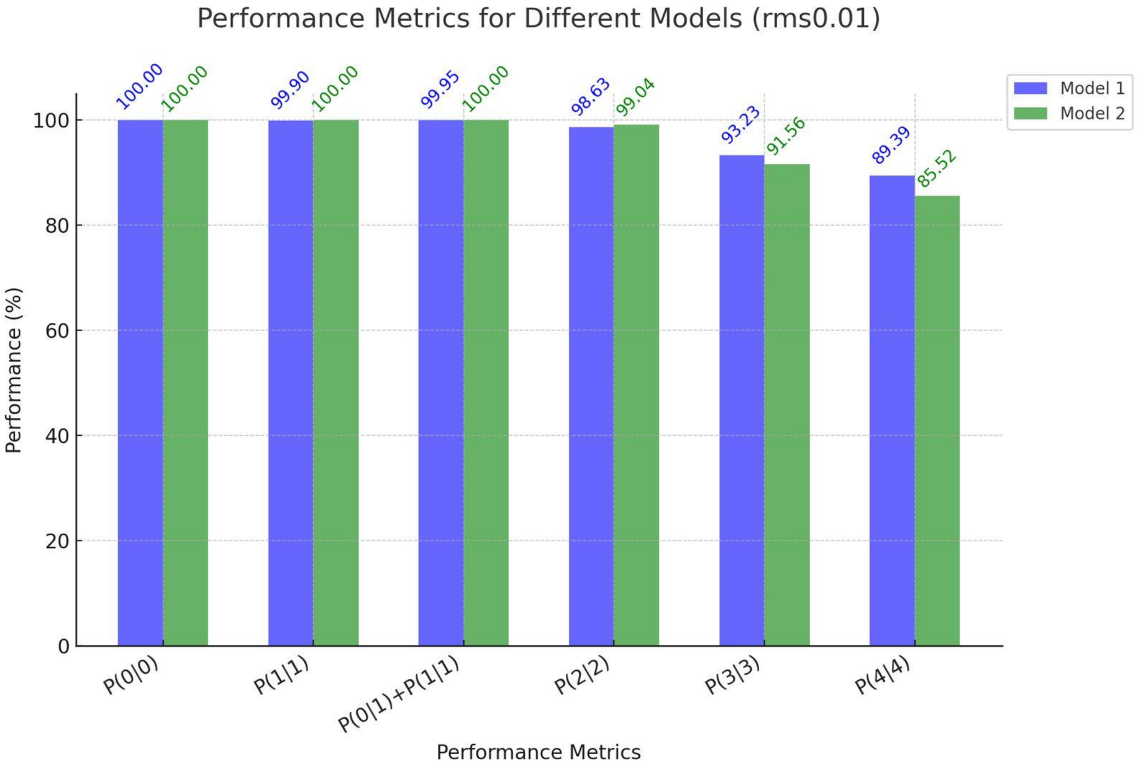


Rms = 10dB
(Noise Level)

Performance for Different Noise Levels

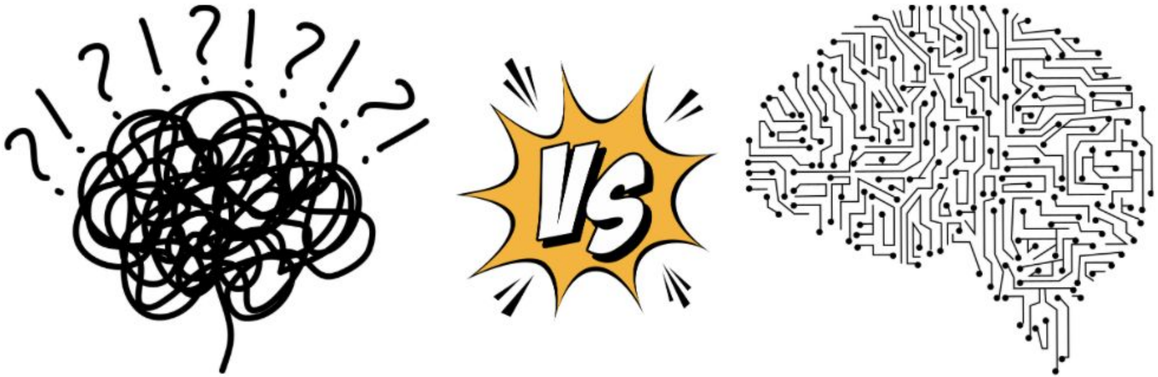


Training Data With More Noise

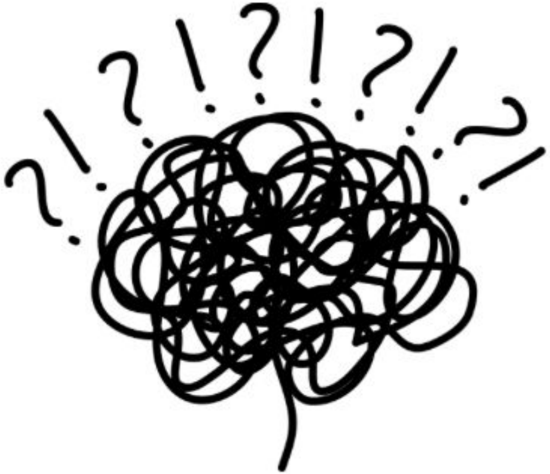


Question:

Is Machine Learning really the best way to go?

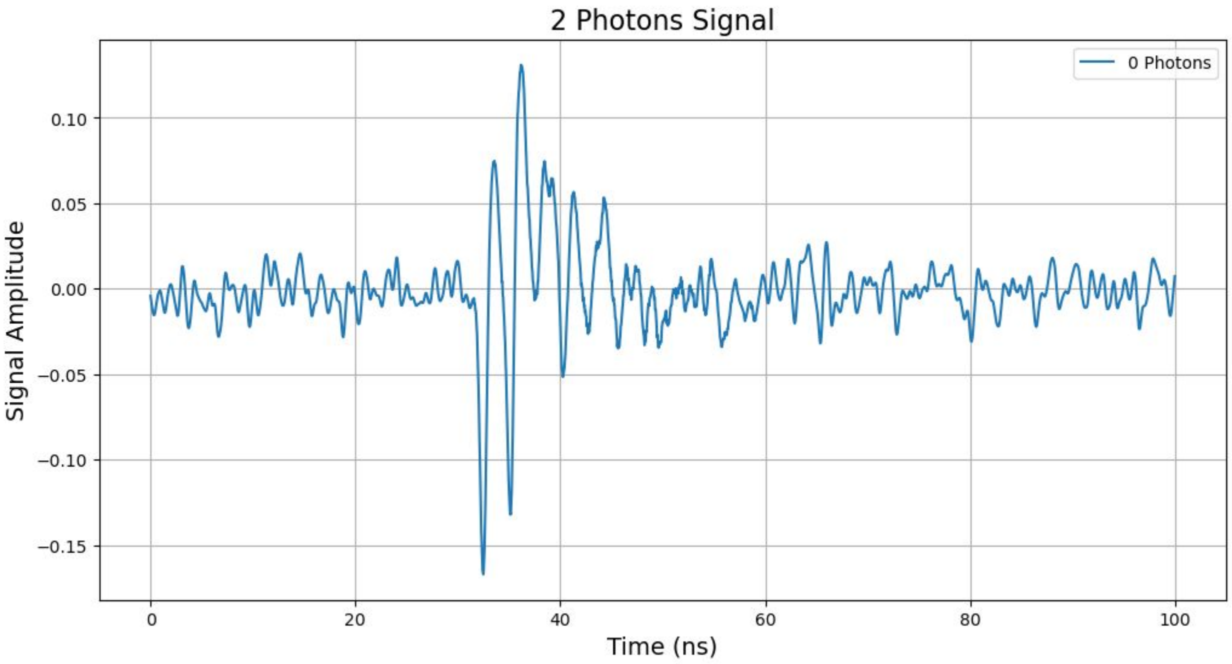


Human vs. Machine



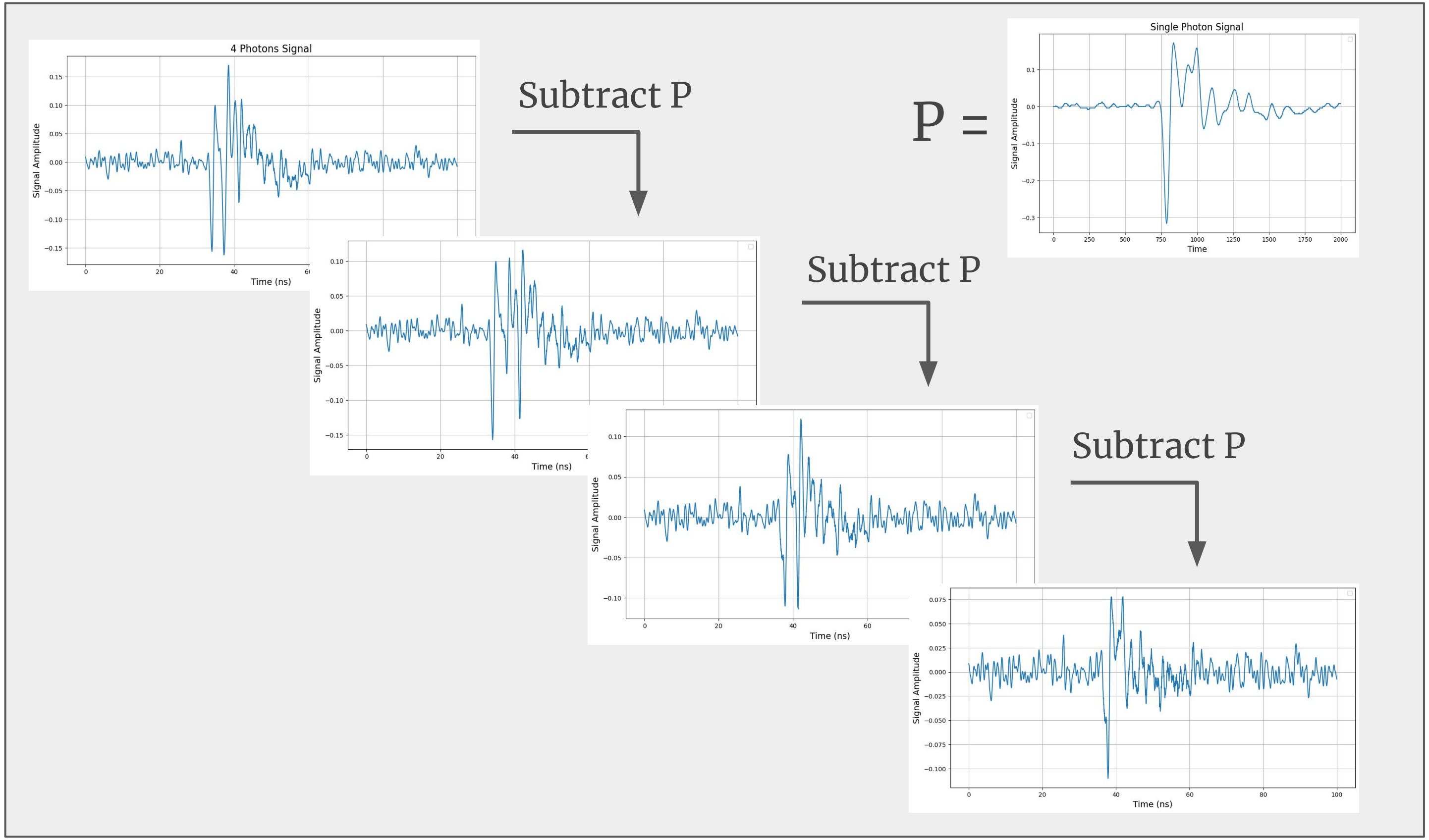
Idea

2 Photon Signal =



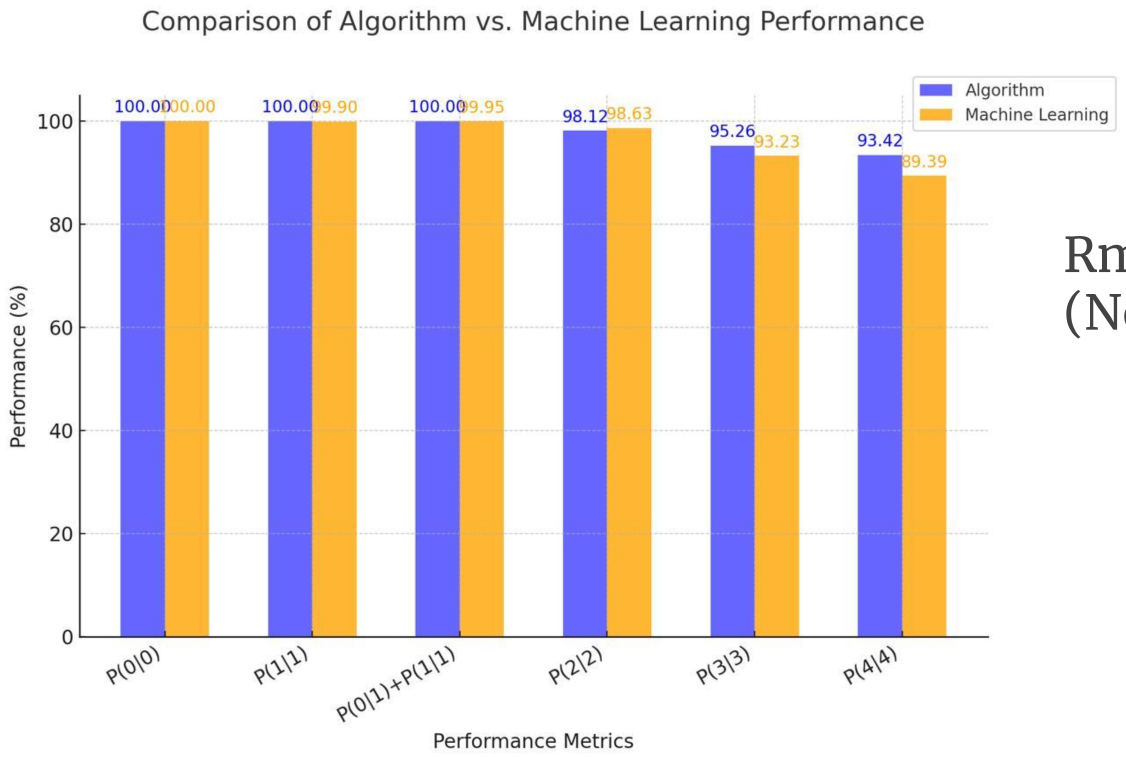
Iconic Peak

Algorithm



4 Photons Signal
Subtract P
P =
Single Photon Signal
Subtract P
Subtract P
Signal Amplitude
Time (ns)
Time

Comparing to Previous Results



Rms = 10 db
(Noise Level)

Key Message(s)

- We can resolve the actual photon number from the detector data to a *very high* accuracy
- To further optimise, it is useful to *also* further understand the underlying physics