

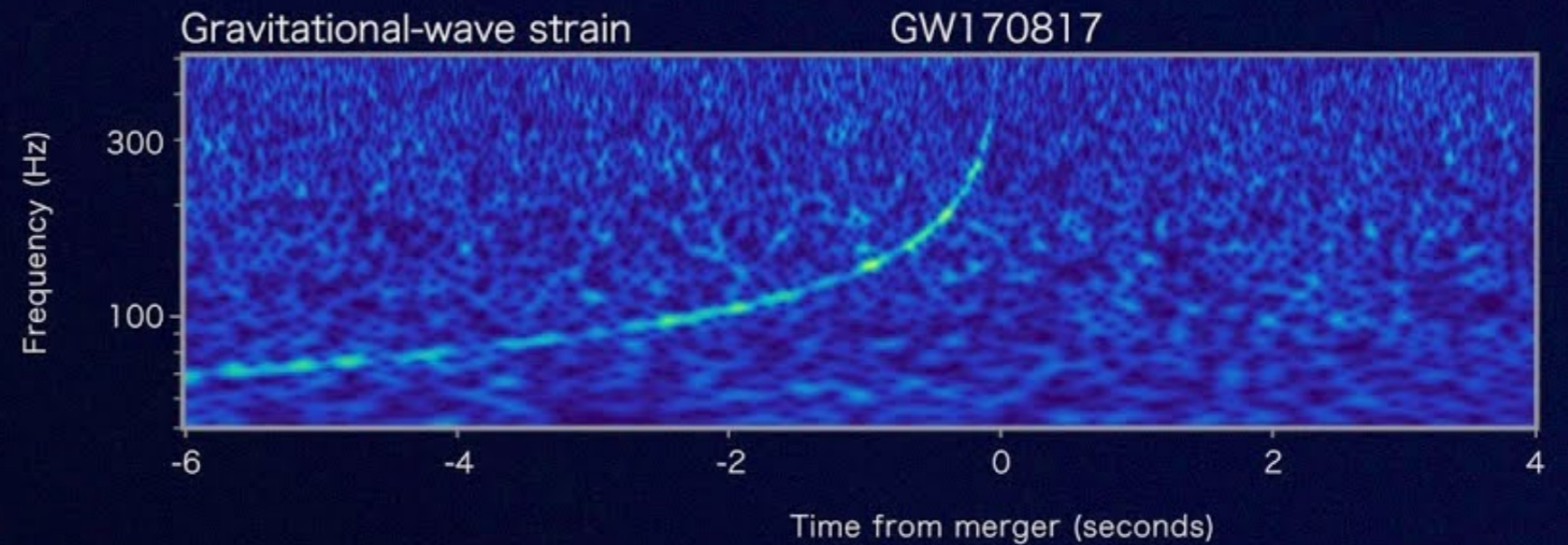
PHYS 391 - Day 13

Excess over
Background

Aug. 17, 2017



LIGO



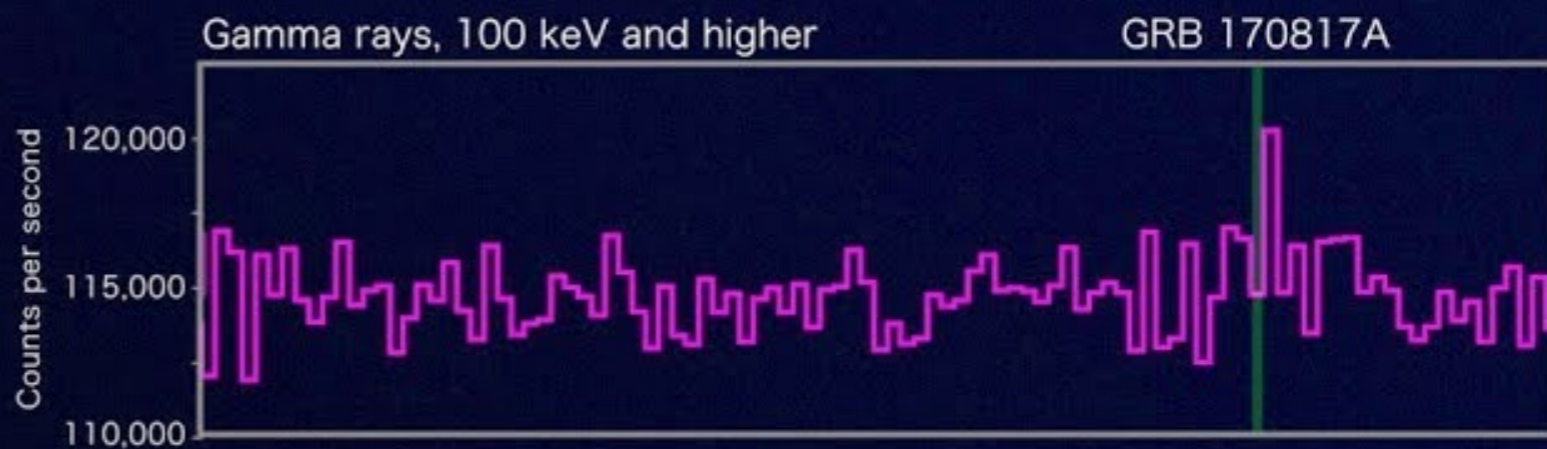
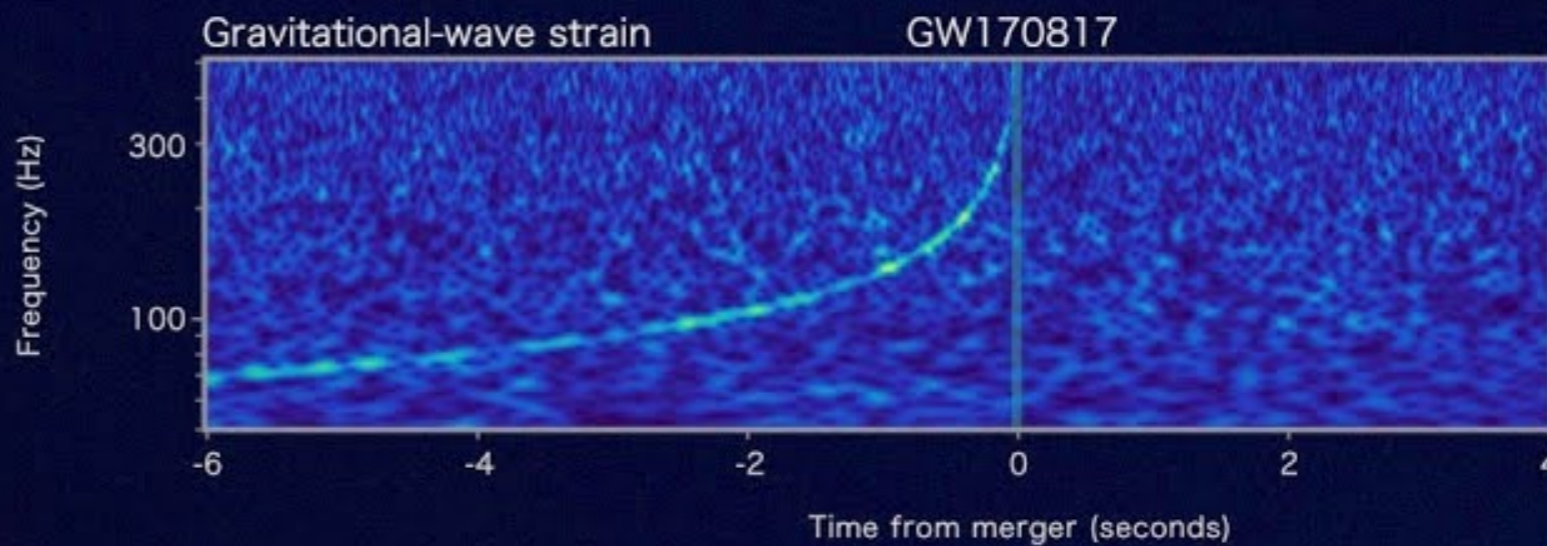
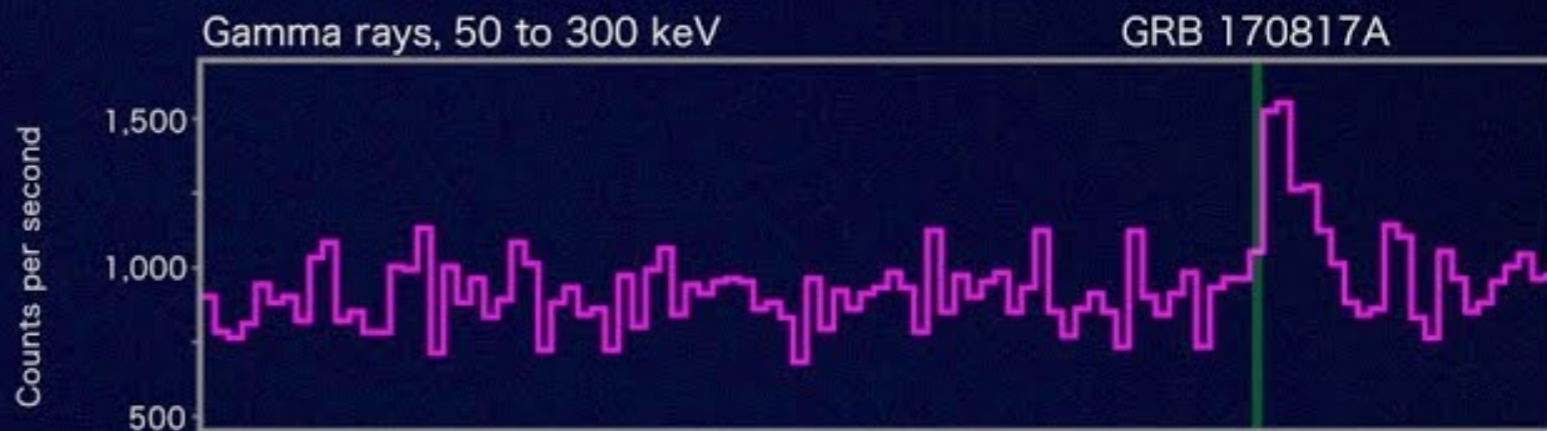
Fermi



LIGO-Virgo



INTEGRAL

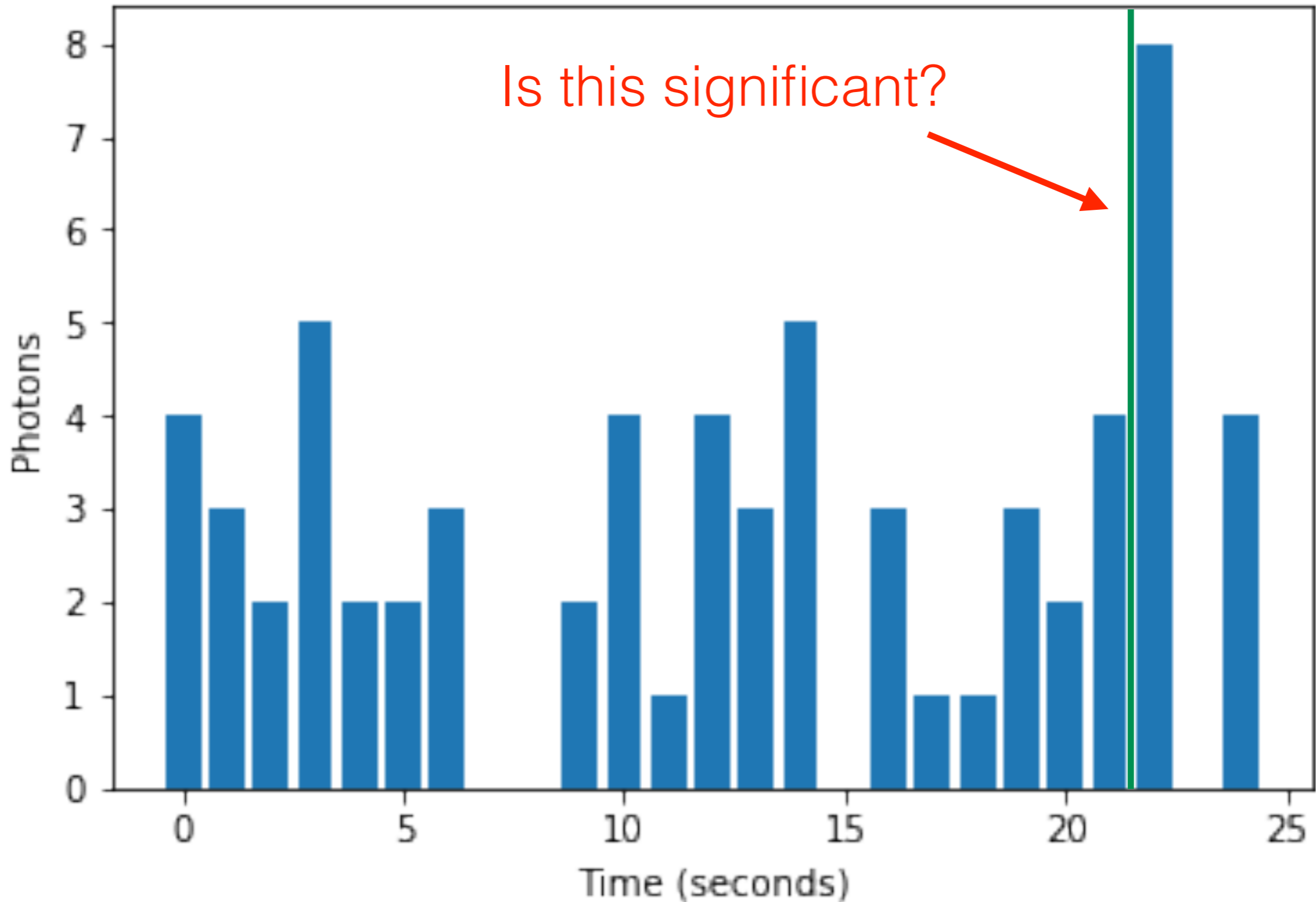


Excess over Background

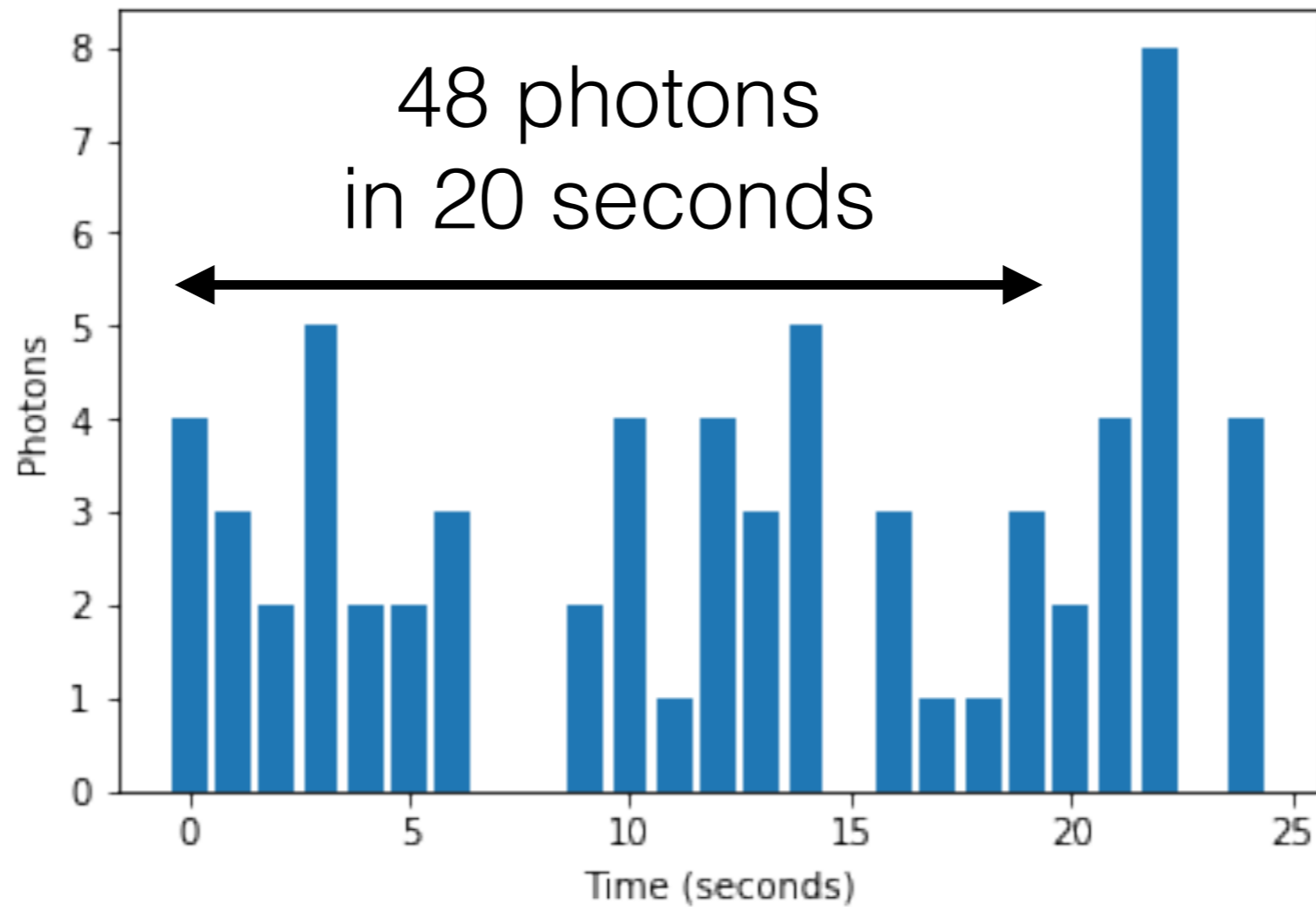
Hypothesis A: background-only
Hypothesis B: signal + background

Null hypothesis test: What is the probability to see this number of events or more from background only?

Fake Swift Data

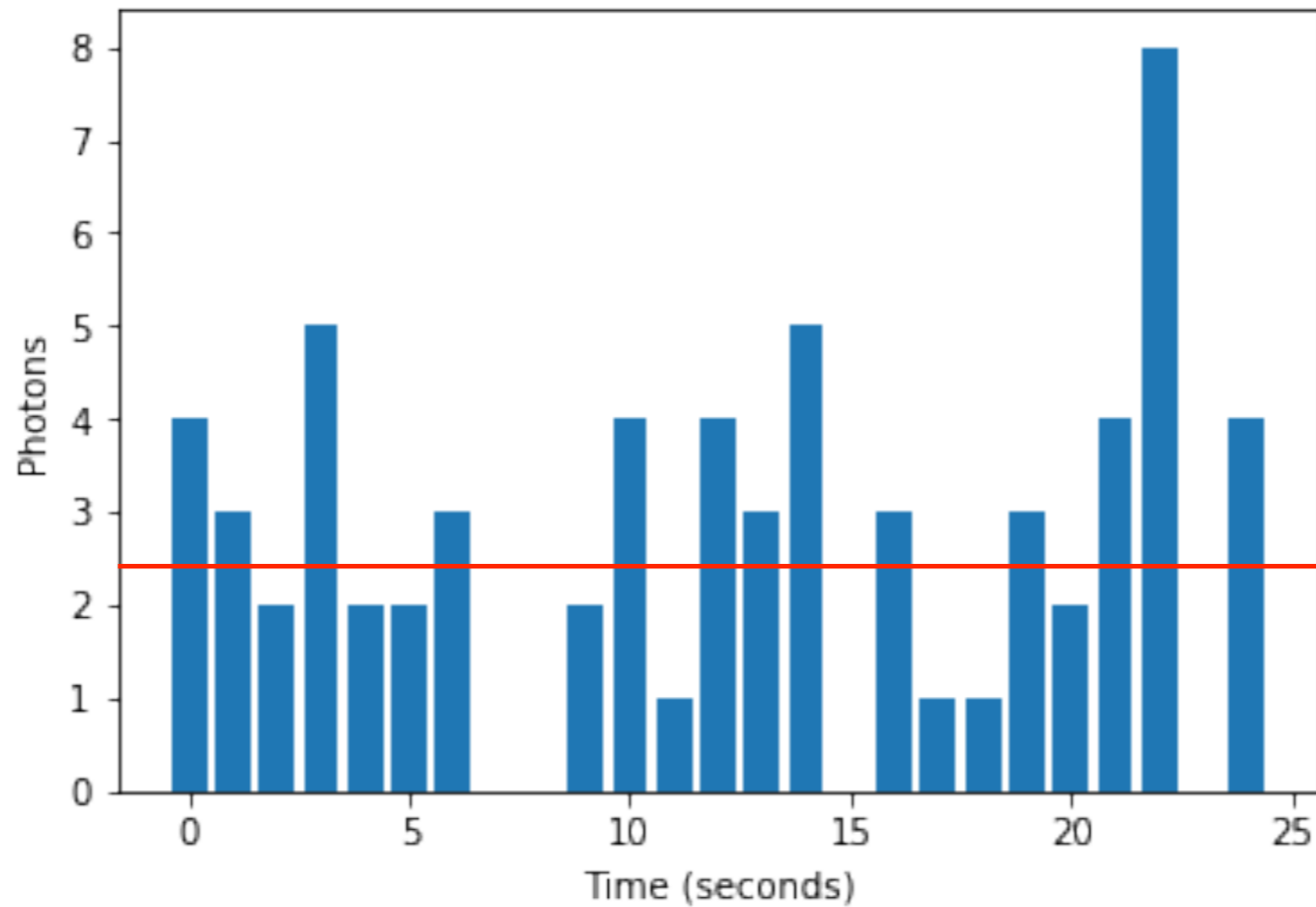


Fake Swift Data



What is R_{bgd} including uncertainty?

Fake Swift Data

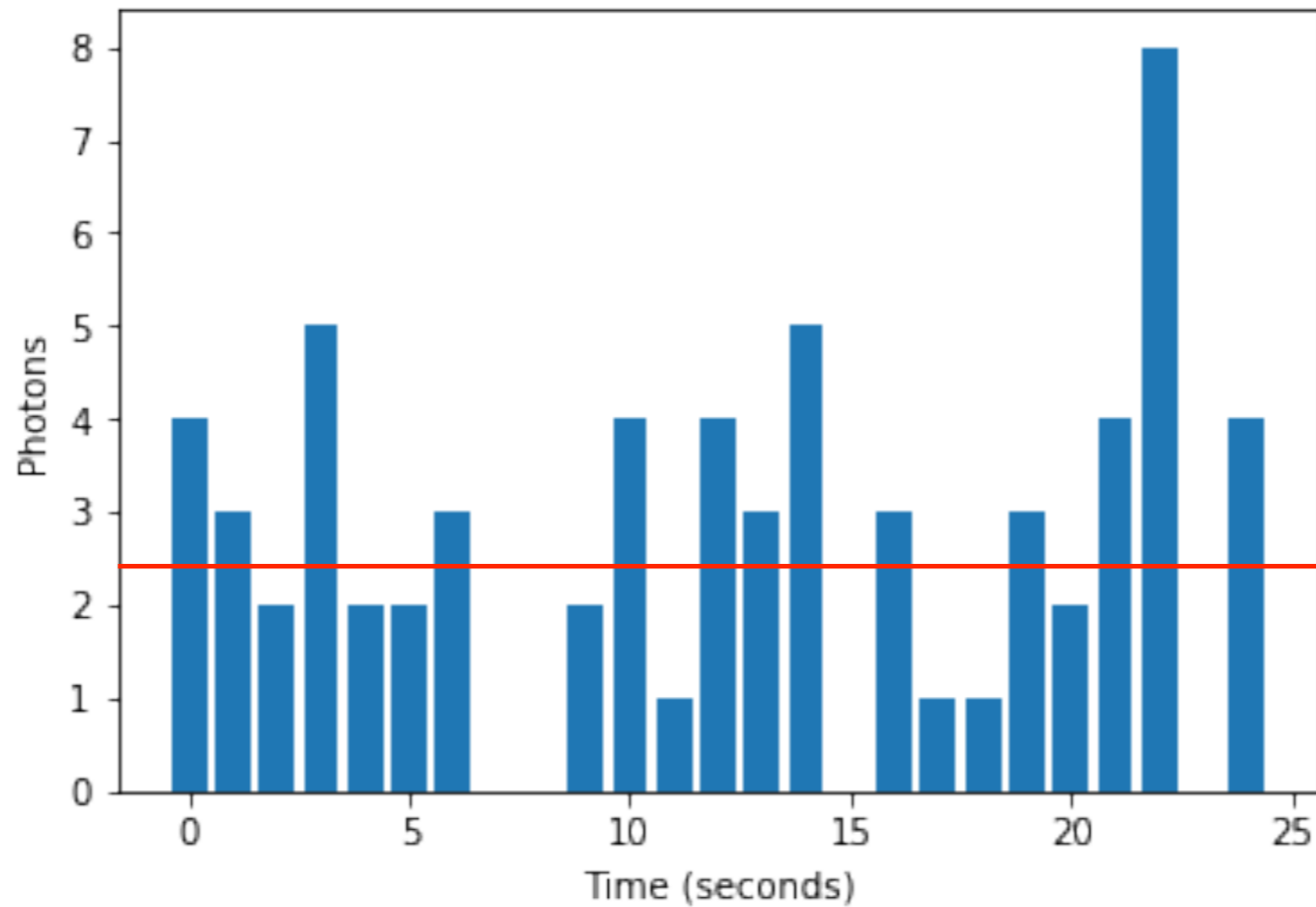


$$R_{\text{bgd}} = 2.4 \pm 0.3$$

$$R = N/\Delta t \Rightarrow \delta R = \delta N/\Delta t$$

$$\delta R = \sqrt{48} / 20$$

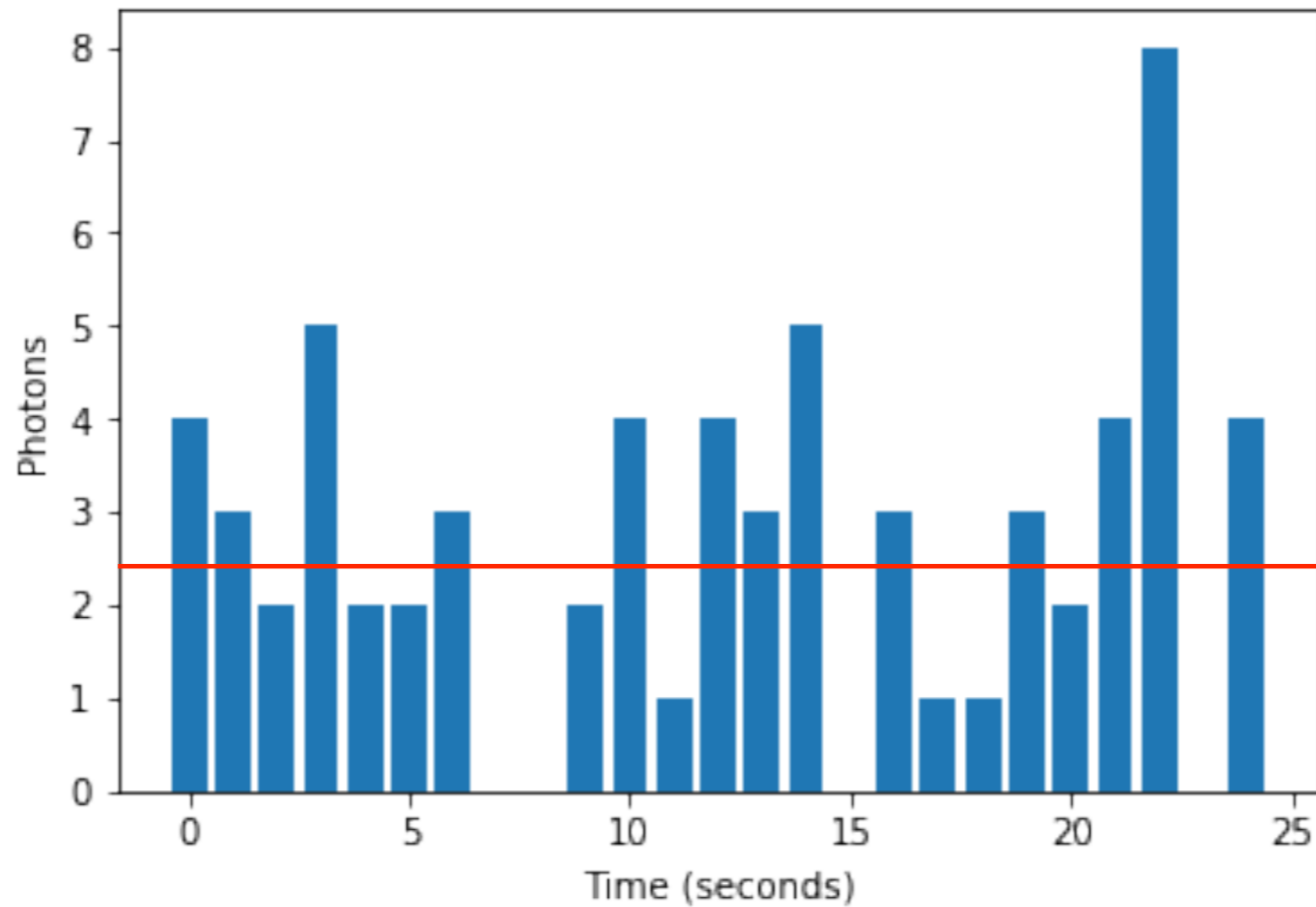
Fake Swift Data



$$R_{bgd} = 2.4$$

How do we find our null hypothesis P-value?

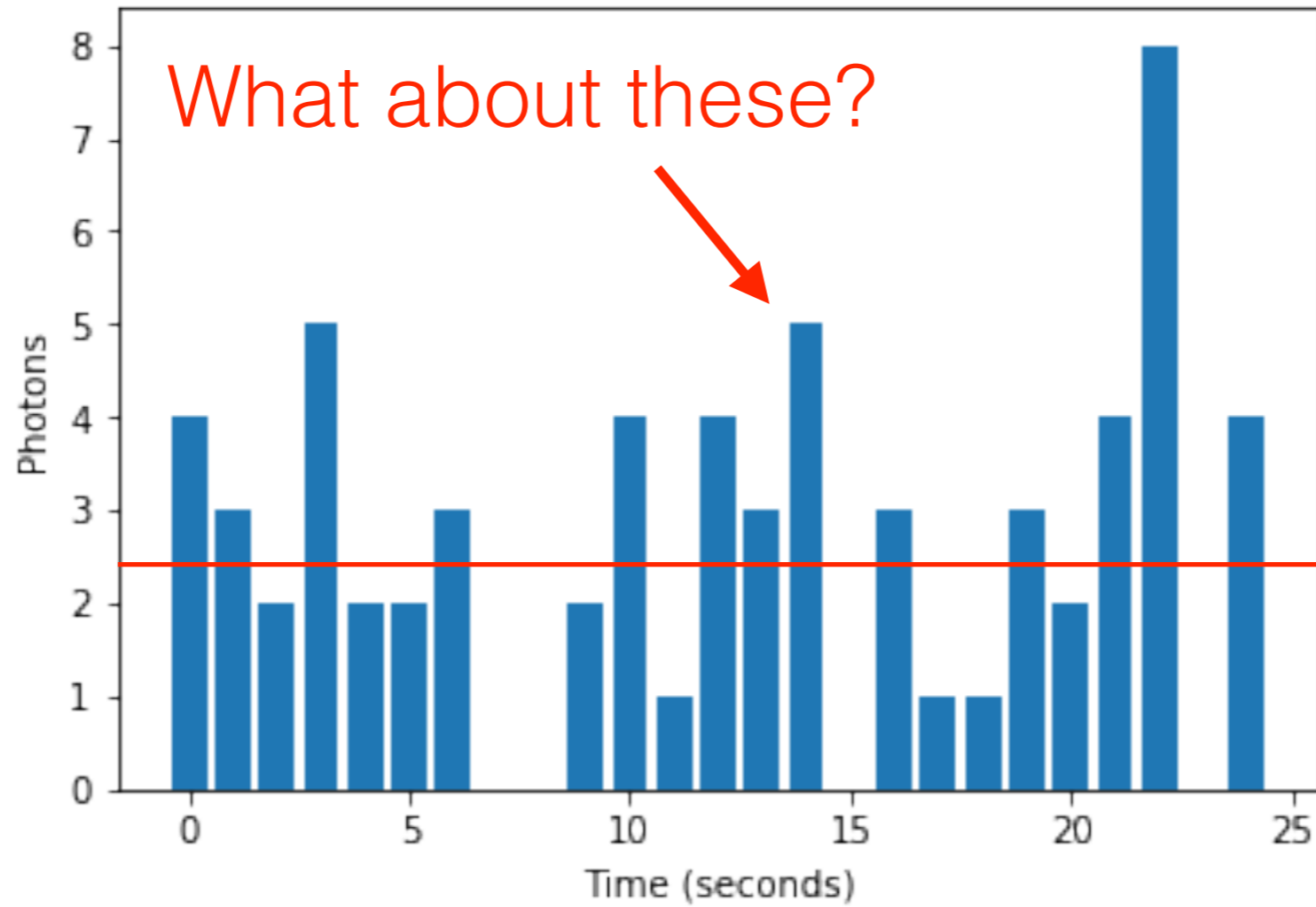
Fake Swift Data



$$R_{\text{bgd}} = 2.4$$

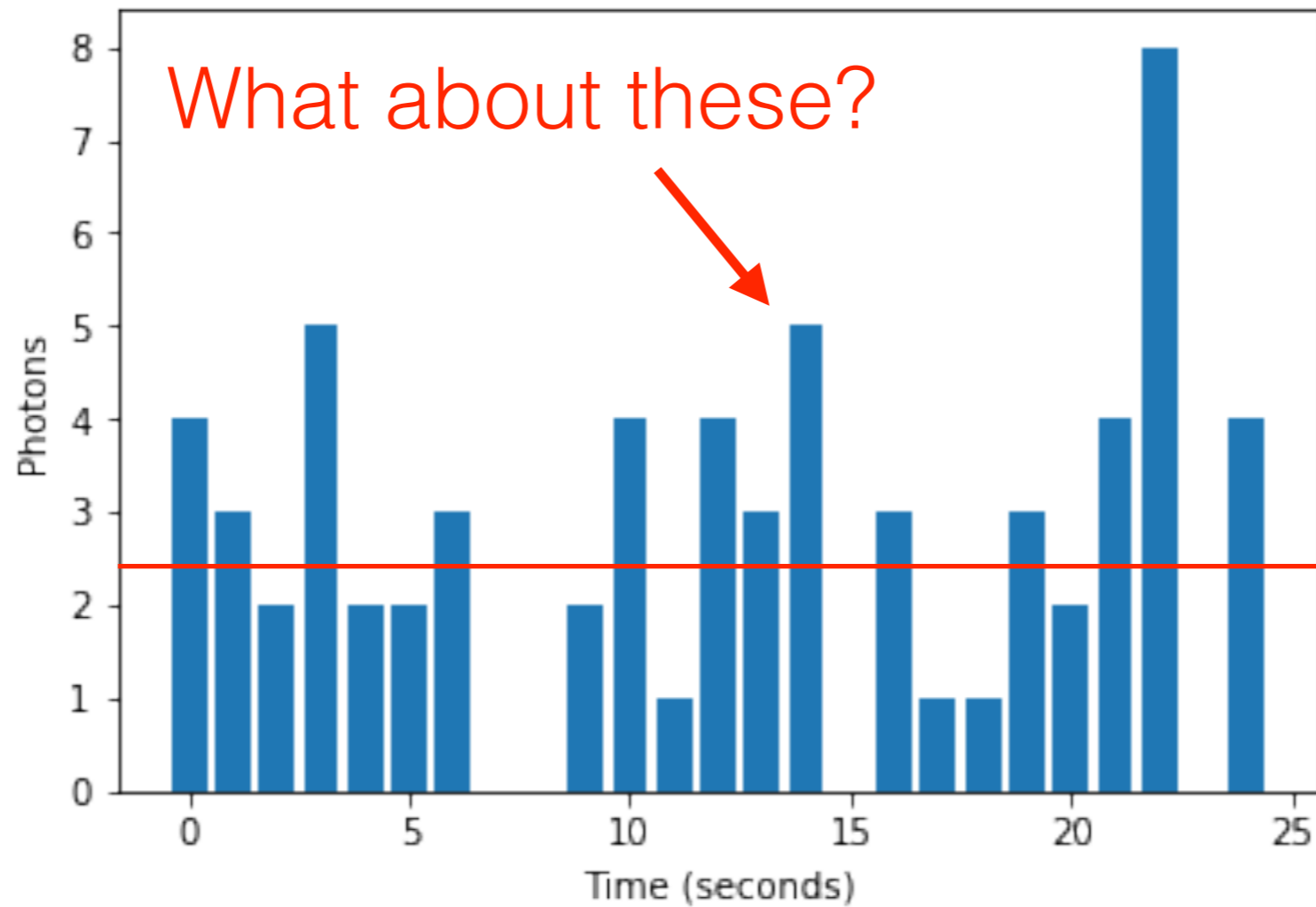
$P_{2.4}(v \geq 8) = 0.3\%$
or ~ 3 sigma in Gaussian prob.

Fake Swift Data



$$R_{\text{bgd}} = 2.4$$

Fake Swift Data



$$R_{\text{bgd}} = 2.4$$

$P_{2.4}(v \geq 5) = 9.6\%$, expect 2 in 20 trials