

# Increasing the data rate of a photon-starved optical communication system that uses a low-rate detector array

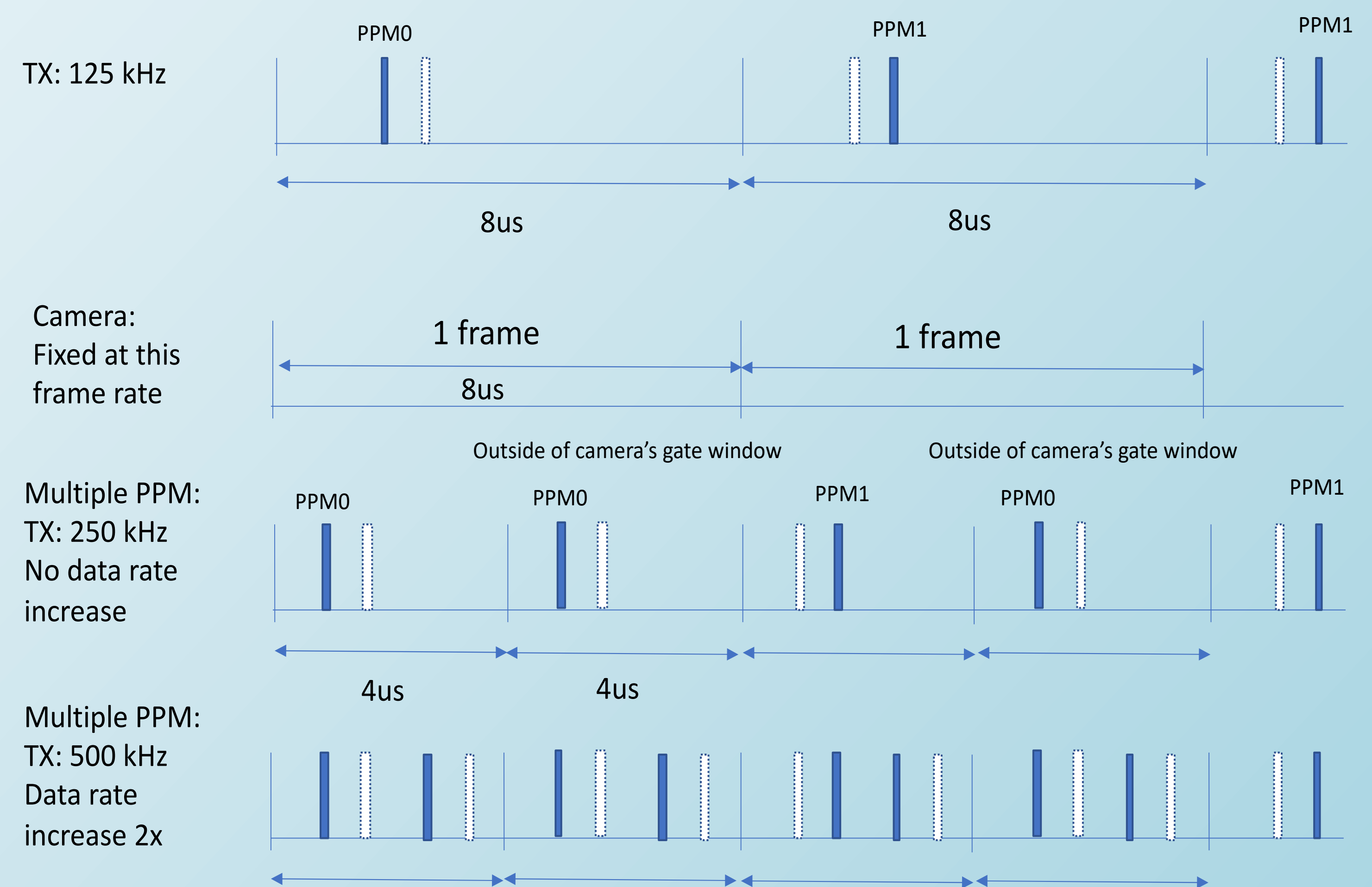
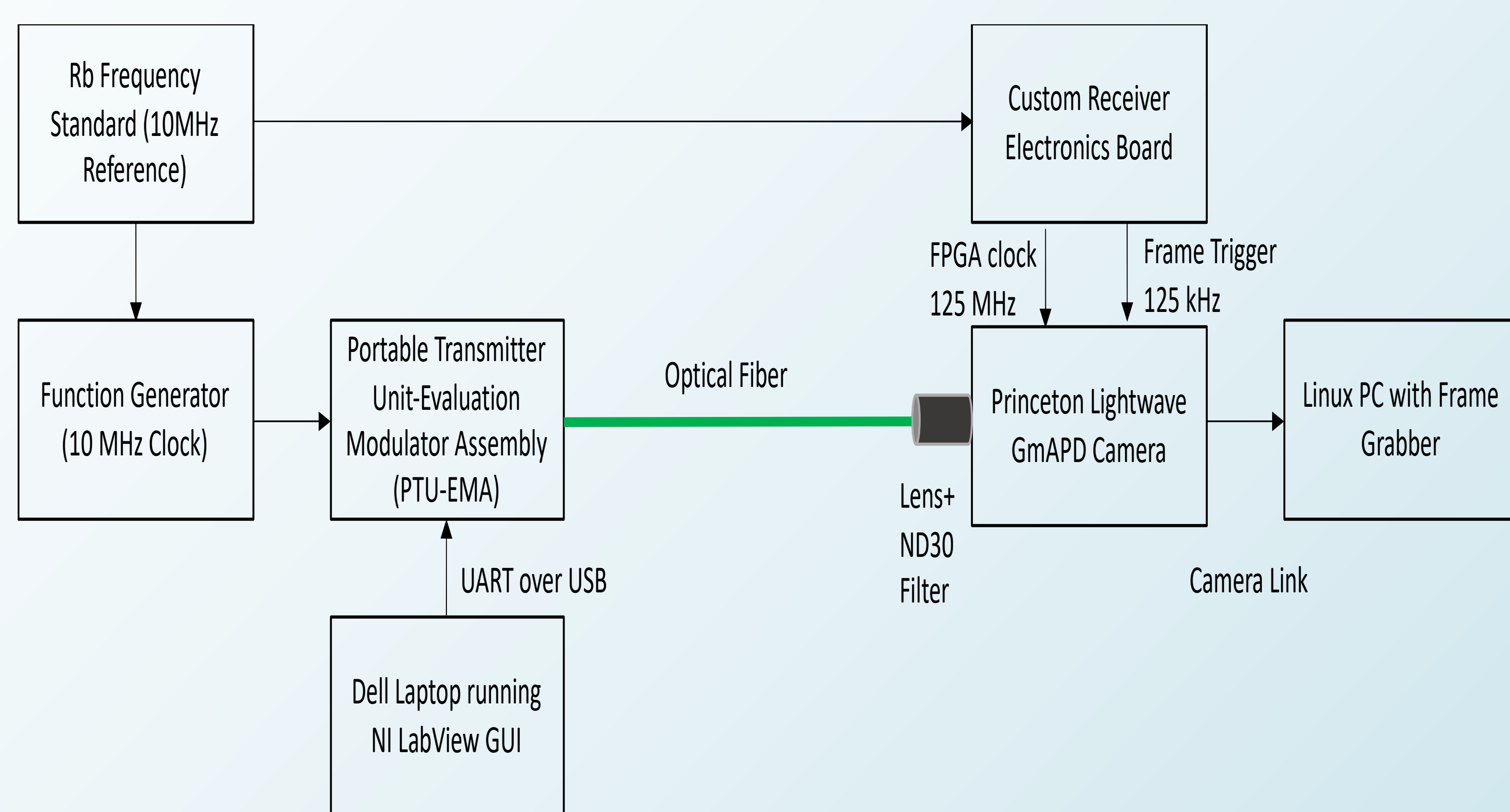
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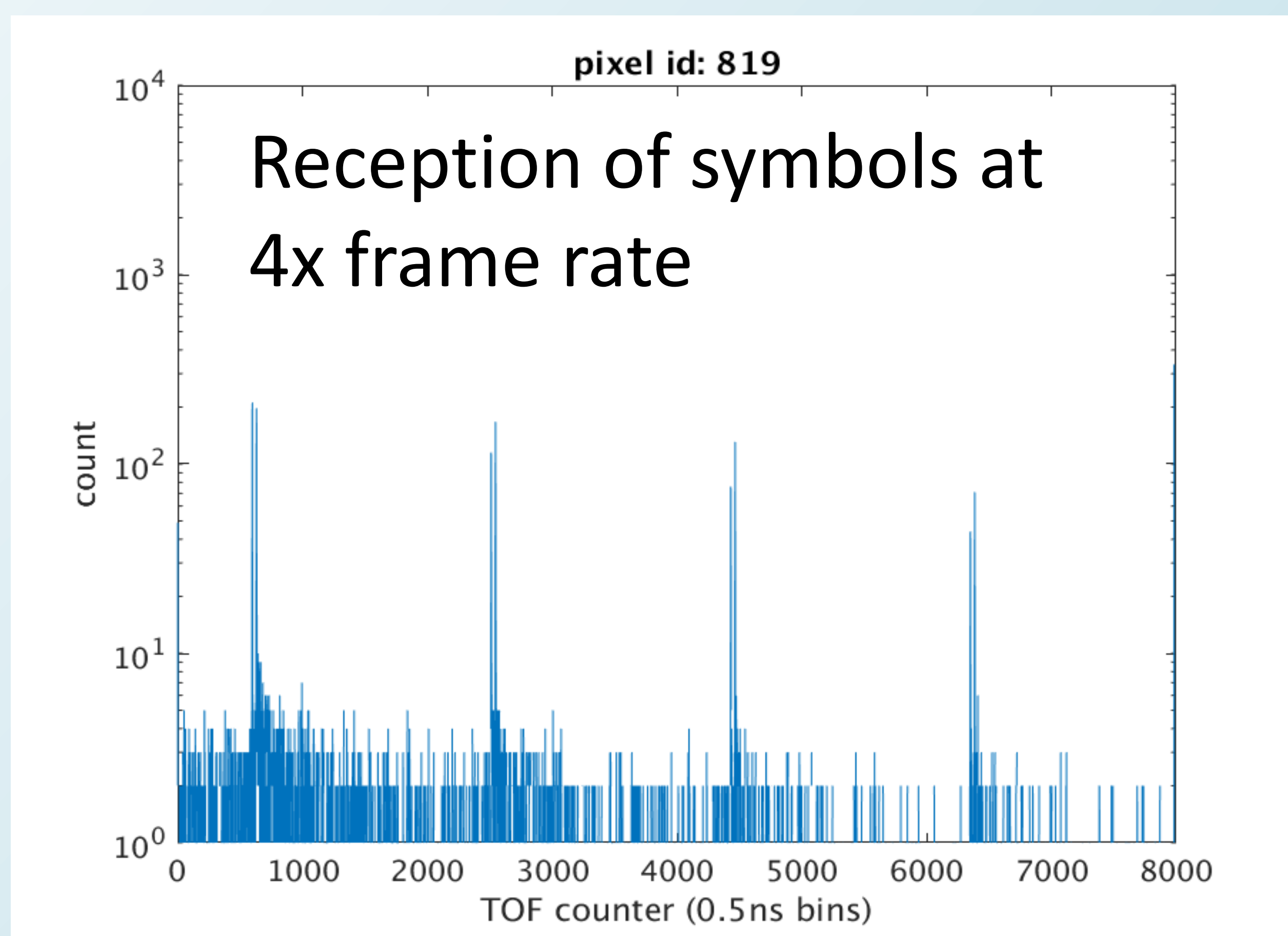
## I Abstract

Using hardware at hand with minimal modifications, we demonstrated optical communication at a data rate higher than the camera's temporal frame rate  $R_f$  using a new modulation scheme we call multi-ppm.

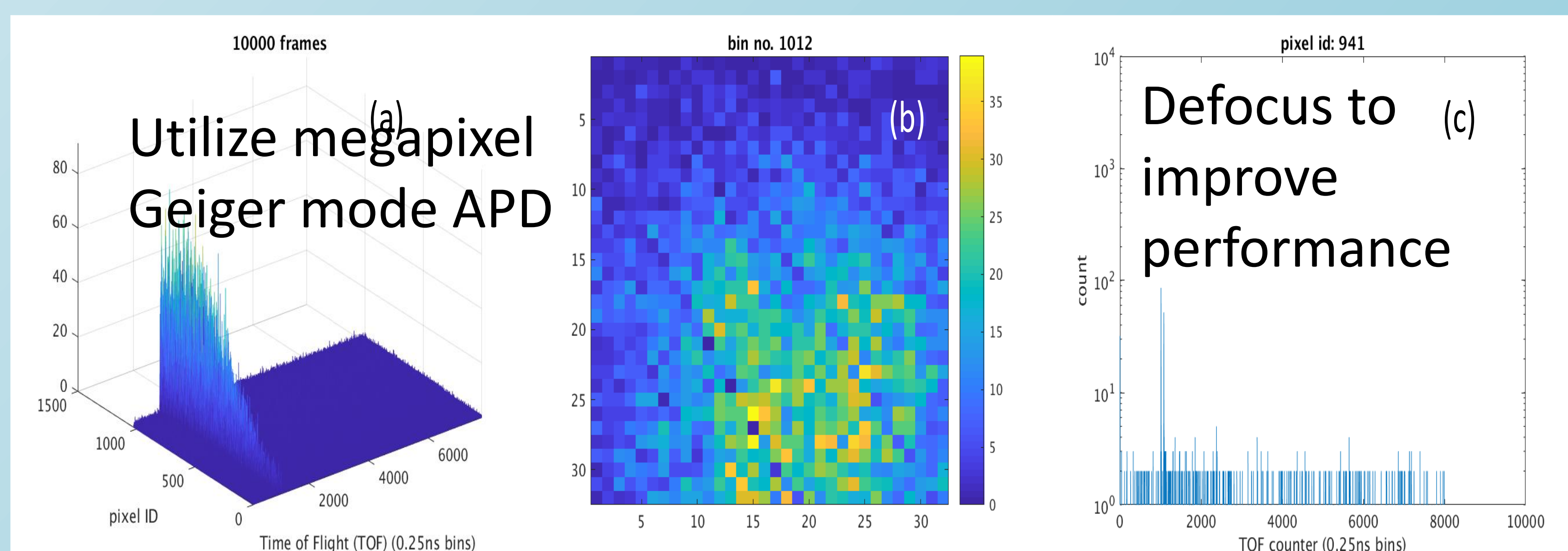
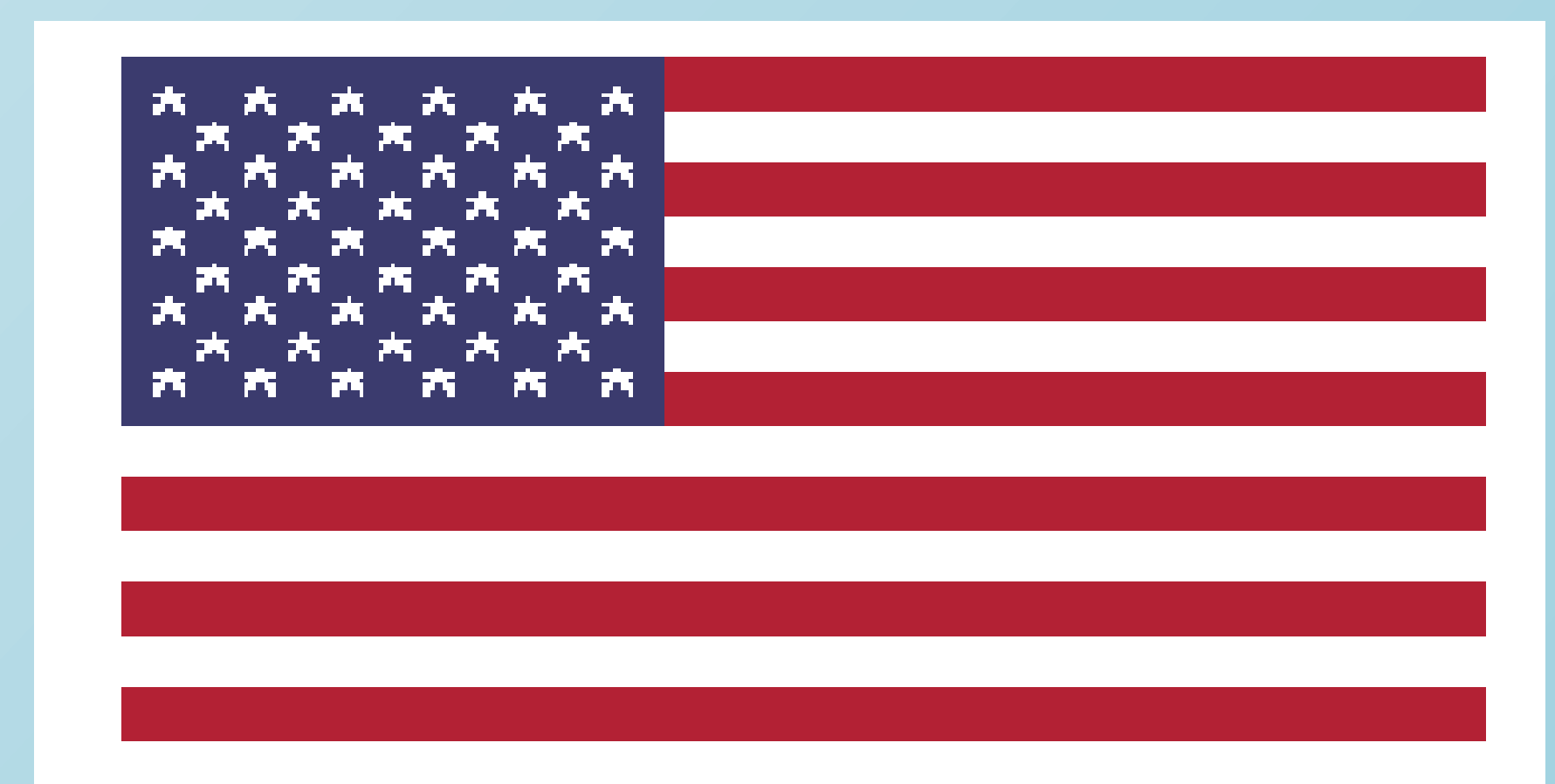
## II Experimental Setup



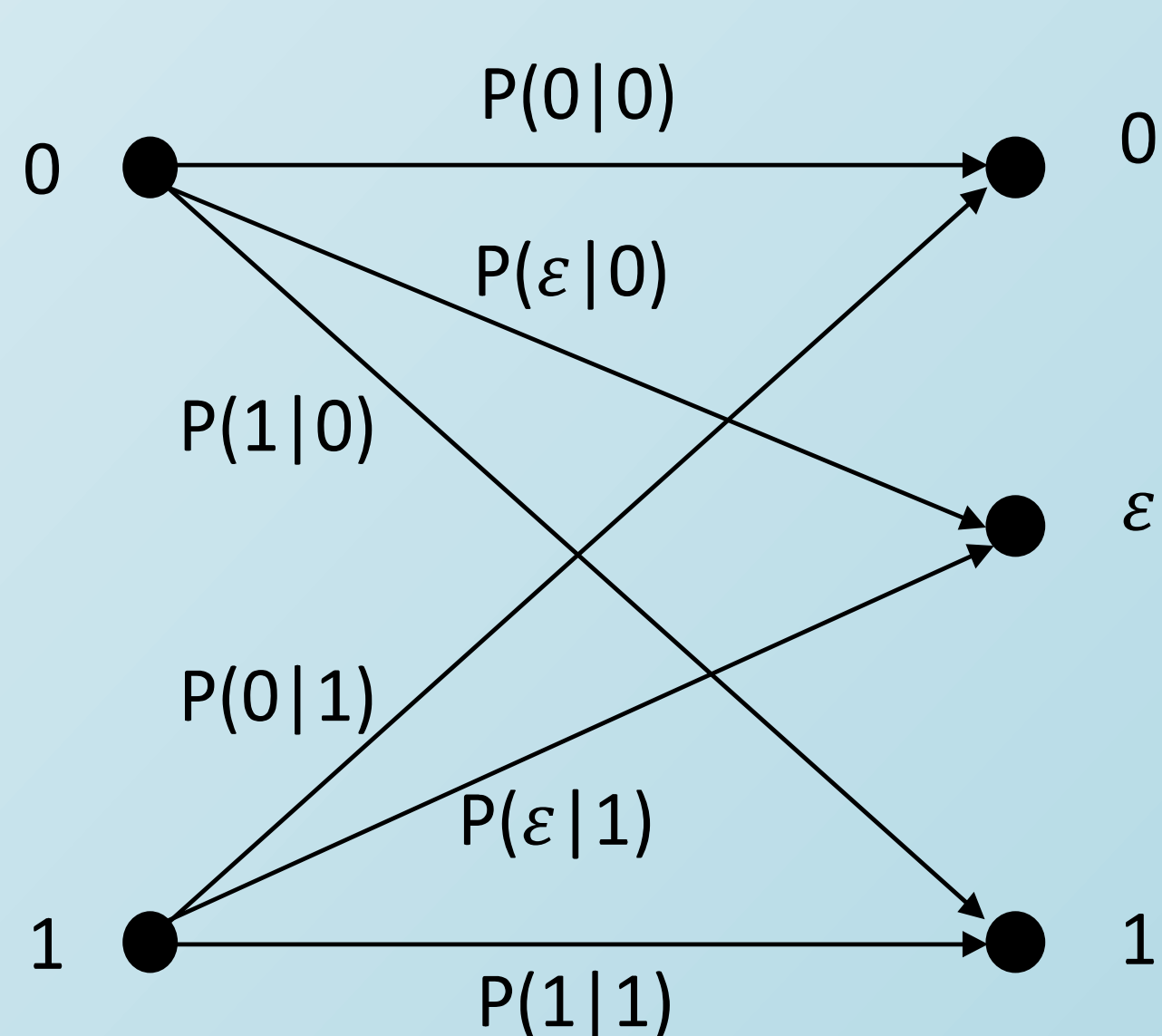
## III Results



Error-Free transmission of test image (US Flag)



## IV Theoretical Modeling



Use max pixel only			
TX bias	692	680	692
Range gate extension	1	2	4
Bin size (ns)	0.25	0.5	1
Gate window (us)	2	4	8
$P(0 0)$	0.2316	0.0124	0.1977
$P(\epsilon 0)$	0.7662	0.9873	0.7987
$P(1 0)$	0.0023	3.45e-4	0.0036
$P(0 1)$	3.15e-4	1.45e-4	3.62e-4
$P(\epsilon 1)$	0.7686	0.9877	0.8035
$P(1 1)$	0.2311	0.0121	0.1962

Multi-PPM is competitive with M-ary PPM in regime of high channel losses, low background noise

