

Study of Decreasing PMT Quantum Efficiency

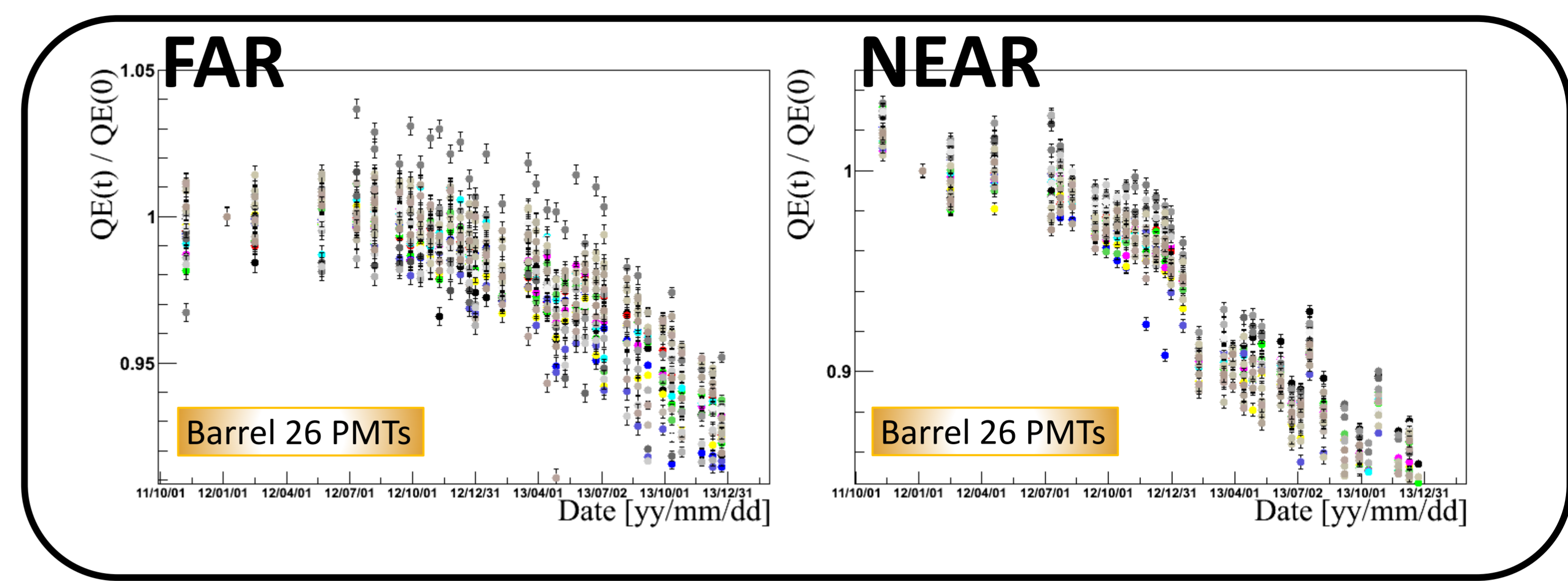
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for RENO Collaboration

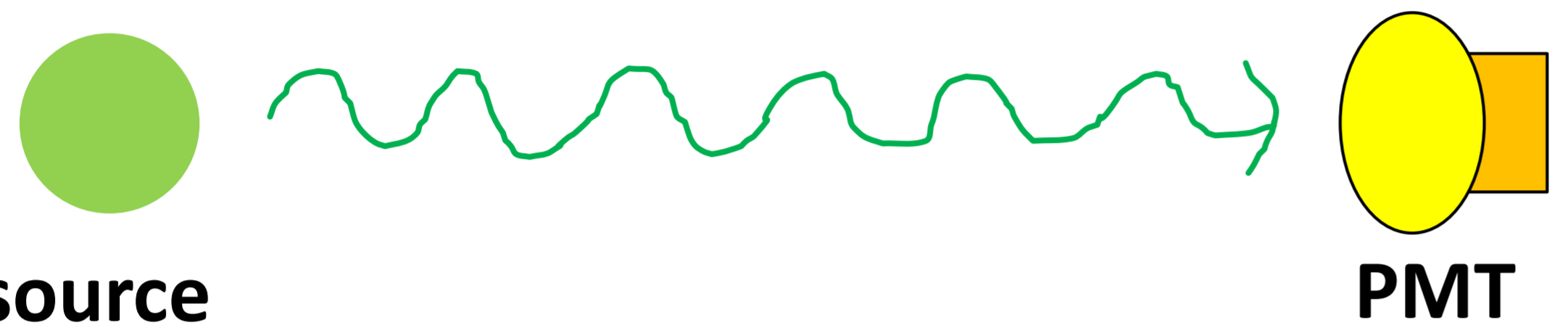


Motivation

Monitoring detector stability including PMT properties using radioactive sources
 → Observed decrease of PMT quantum efficiency (QE)



Probing PMT QE by Hit Rate



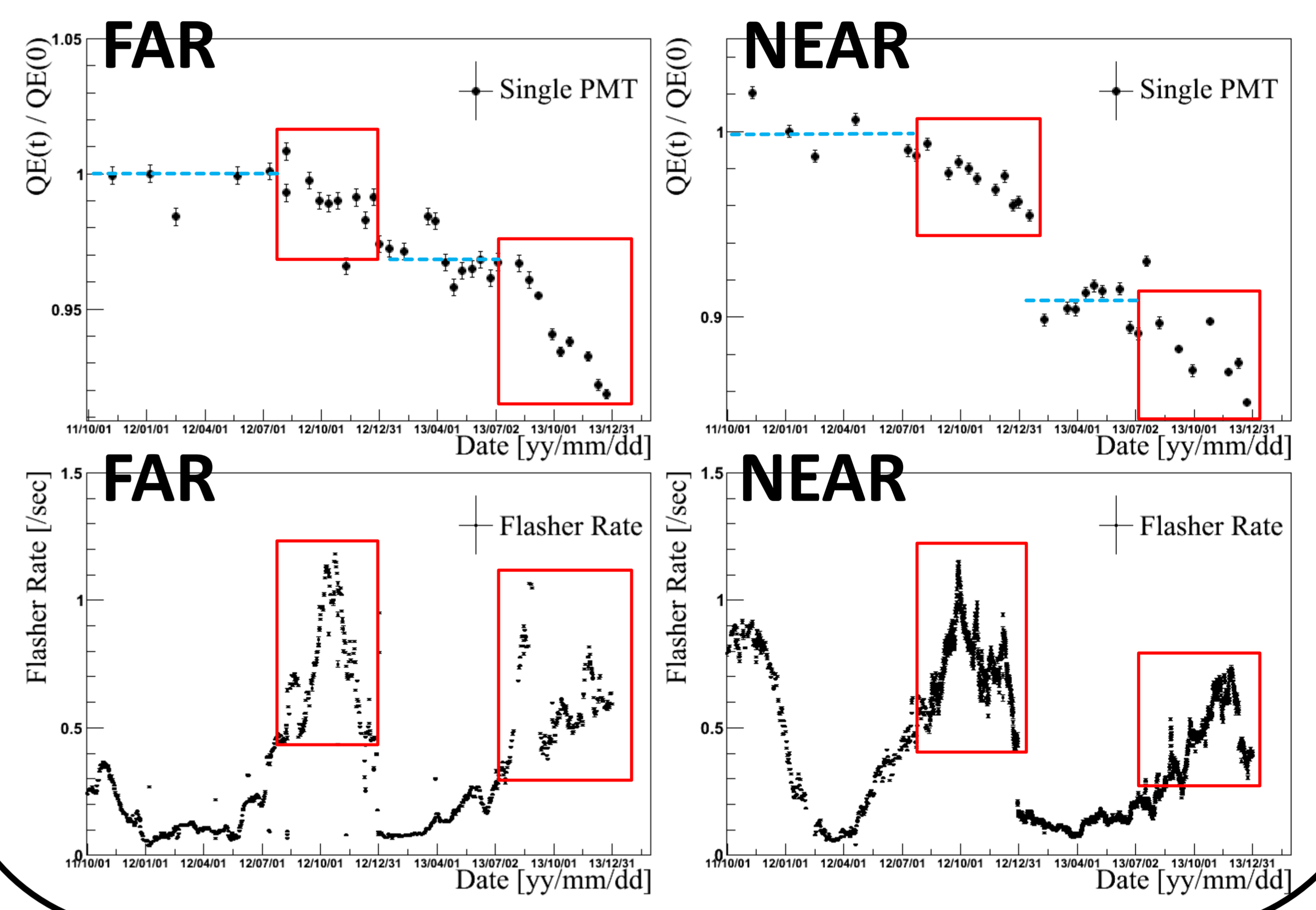
Hit Rate \propto (PMT QE & Gain)
 \otimes (Optical Properties)
 \otimes (Source Activity)

Negligible temporal-change (Gain correction & stable GdLS)

$$PMT\ QE \propto \frac{Hit\ Rate}{Source\ Activity} \Rightarrow \frac{QE(t)}{QE(0)} = \frac{H(t)}{H(0)\exp(-\frac{t}{\tau})}$$

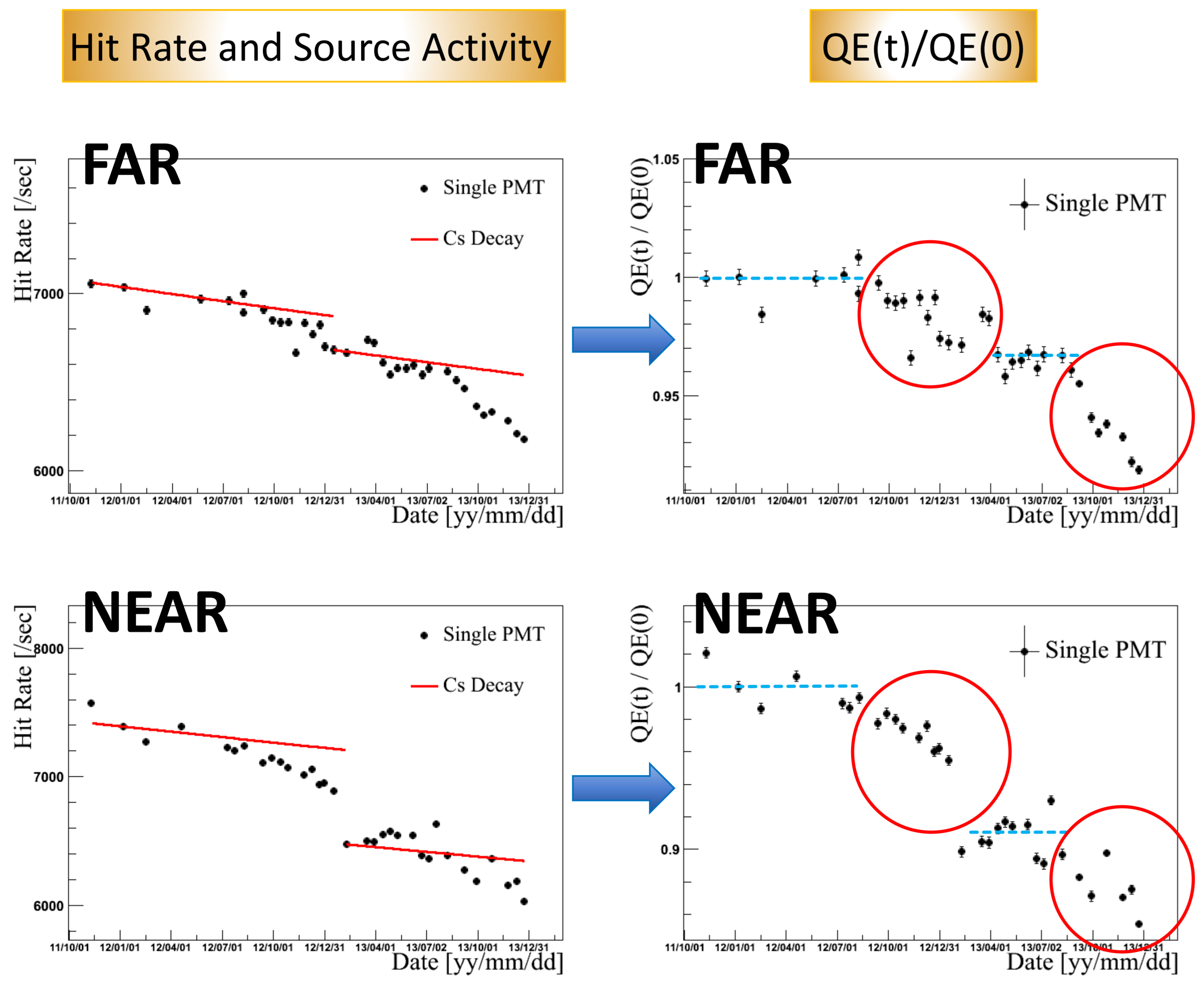
Cause of PMT QE Decrease

PMT QE decrease seems to be correlated with high PMT-flasher rate



Observed Decrease of PMT QE

^{137}Cs source : 0.662 MeV , $\tau = 43.53$ yr
 → 80% single-photoelectron hit PMTs in an event

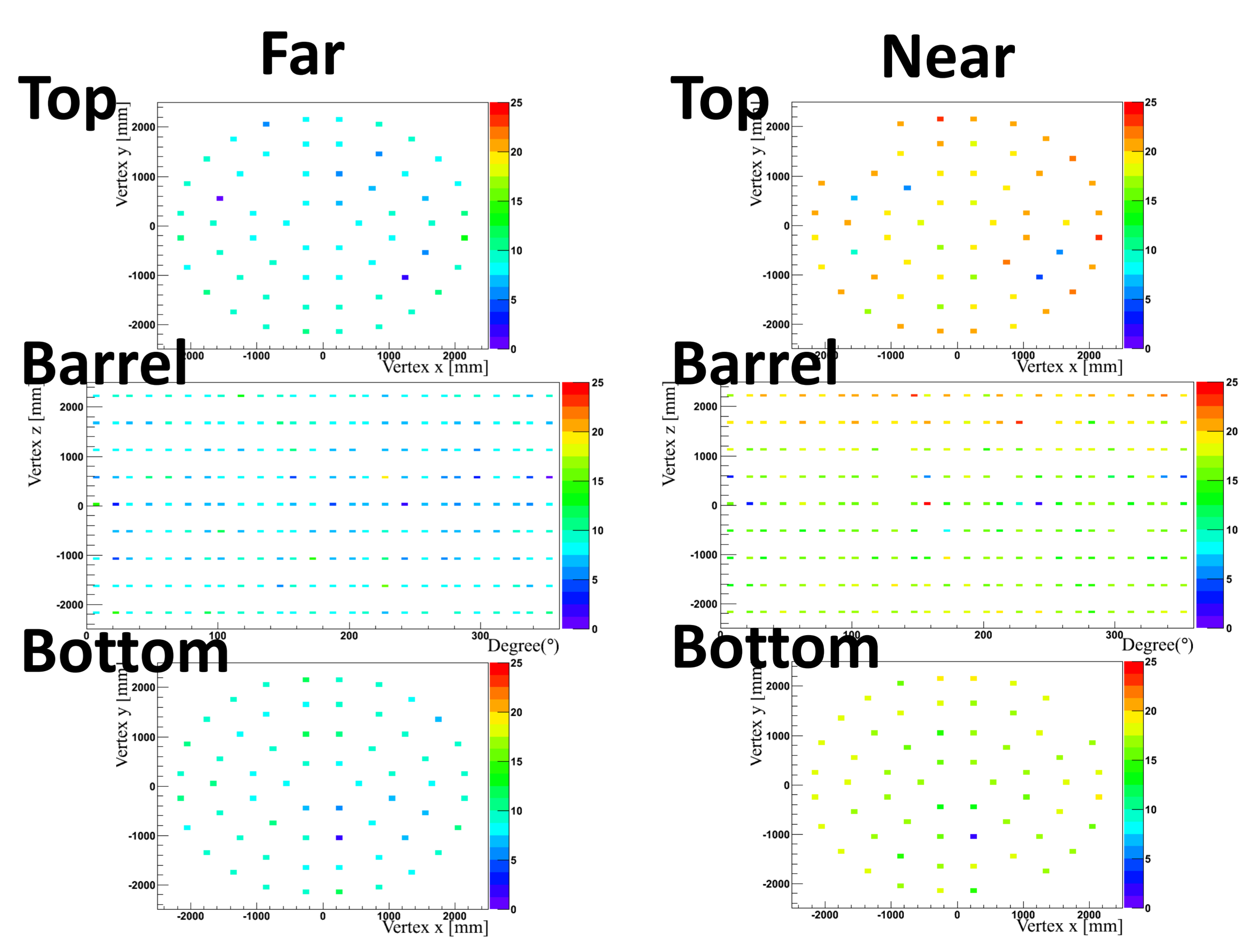


→ Find decrease of PMT hit rate, and therefore decrease of PMT QE

Measured PMT QE Decrease

$$PMT\ QE\ Decrease = 100 * \left(1 - \frac{QE(t)}{QE(0)}\right)$$

	Far	Near
Avg. QE decrease for all PMTs	8.34 ± 0.11 (%)	17.72 ± 0.19 (%)



Decrease of PMT QE → Near > Far