The probability that n photons were created in at time t_i is

$$P(n_i) = \text{Poisson}(n|_i NY(t_i)dt_i) \tag{1}$$

The probability that $\{\text{PMT}_a, ...\text{PMT}_z\}$ will create $\{n_{ai}, ...n_{zi}\}$ PEs is

$$P(n_{ai}, ..n_{zi}) = \sum_n \text{Poisson}(n_i|NY_i dt_i) \prod_c \text{Binom}(n_{ci}|Q_c, n_i) \tag{2}$$

The probability that $\{n_{ai}, ...n_{zi}\}$ PEs will be resolved in $\{\text{PMT}_a, ...\text{PMT}_z\}$ due to PMT jitter and misalignment is

$$P(n_{ai}, ..n_{zi}) = \sum_{n_j, j} \text{Poisson}(n_j|NY_j dt_j) \prod_c \text{Binom}\left(n_{ci}|Q_c dt_i \frac{e^{-(i-j-T_c)^2/(2\sigma_c^2)}}{\sqrt{2\pi}\sigma_c}, n_j\right) \tag{3}$$

P alignment

$$\begin{aligned} P_0(n_{a0}, ..n_{z0}) &= \sum_j \prod_{k<j} P(0_{ak}..0_{zk}) P(n_{aj}, ..n_{zj}) \\ P_0(n_{ai}, ..n_{zi}) &= \sum_j \prod_{k<j} P(0_{ak}..0_{zk}) \left(1 - P(0_{ak}..0_{zk})\right) P(n_{aj+i}, ..n_{zj+i}) \end{aligned} \tag{4}$$

For individual PMT

$$\begin{aligned} P_0(n_{a0}) &= \sum_j \prod_{k<j} P(0_{ak}..0_{zk}) \sum_{n_{bj}} .. \sum_{n_{zj}} P(n_{aj}, ..n_{zj}) = \\ &\sum_j \prod_{k<j} P(0_{ak}..0_{zk}) \sum_{n_l, l} \text{Poisson}(n_l|NY_l dt_l) \text{Binom}\left(n_{aj}|Q_a dt_j \frac{e^{-(j-l-T_a)^2/(2\sigma_a^2)}}{\sqrt{2\pi}\sigma_a}, n_l\right) \\ P_0(n_{ai}) &= \sum_j \prod_{k<j} P(0_{ak}..0_{zk}) \left(1 - P(0_{aj}..0_{zj})\right) \sum_{n_{bj+i}} .. \sum_{n_{zj+i}} P(n_{aj+i}, ..n_{zj+i}) = \\ &\sum_j \prod_{k<j} P(0_{ak}..0_{zk}) \left(1 - P(0_{aj}..0_{zj})\right) \sum_{n_l, l} \text{Poisson}(n_l|NY_l dt_l) \cdot \\ &\text{Binom}\left(n_{ai+j}|Q_a dt_{i+j} \frac{e^{-(i+j-l-T_a)^2/(2\sigma_a^2)}}{\sqrt{2\pi}\sigma_a}, n_l\right) \end{aligned} \tag{5}$$