

Estimation of pile-up of n additional hits in time interval Δt at average rate r :

$$P(n) = \frac{(r\Delta t)^n \exp(-r\Delta t)}{n!}$$

For PANDA-MVD, hottest spot in strip detector (1st fw disc), maximum average peak rate is $r = 0.07 \mu\text{s}^{-1}$ in HL mode (Würschig 2010).

The pile-up probabilities for several ToT ranges (and dead times) are:

ToT range (bits)	dead time (μs)	pile-up probability		
		$P(n > 0)$	$P(n > 1)$ (percent)	$P(n > 2)$
7	0.83	5.6	0.16	0.003
8	1.65	10.9	0.62	0.02
9	3.3	20.6	2.3	0.17
10	6.6	37.0	7.9	1.2

Table 4.9.: Pile-up probabilities calculated for various ToT-ranges and multiplicities ($f_{ToT} = 155 \text{ MHz}$).

Estimation of the noise hit rates:

peaking time (ns)	f_{n0} (μs^{-1})	noise rate (s^{-1}) for threshold		
		$3\sigma_n$	$5\sigma_n$	$7\sigma_n$
50	2.89	32.1 k	10.8	$6.6 \cdot 10^{-5}$
100	1.44	16.0 k	5.4	$3.3 \cdot 10^{-5}$
150	0.96	10.7 k	3.6	$2.2 \cdot 10^{-5}$
200	0.72	8.0 k	2.7	$1.7 \cdot 10^{-5}$
250	0.58	6.4 k	2.2	$1.3 \cdot 10^{-5}$
300	0.48	5.3 k	1.8	$1.1 \cdot 10^{-5}$
500	0.29	3.2 k	1.1	$6.6 \cdot 10^{-6}$
1000	0.14	1.6 k	0.5	$3.3 \cdot 10^{-6}$