Following up on Wiser Rate Calculations

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The RL to be used in the Wiser code is not just the radiation length of the target, but is supposed to include an "internal radiation" factor that is tuned to reproduce data.

- for SLAC, $R_{int} \approx 5\%$
  for JLab 6 GeV, $R_{int} \approx 2\%$.
- Dave's 4.062% was an initial attempt to interpolate a typical value for 12 GeV.

Tanja provides her RL calculation:

$RL_{target} = 1.18\%$ (10 cm LH_2)
$+ 0.43\%$ (Al walls, 0.15 mm + 0.219 mm)
1.61%

$$R_{int} = \frac{1}{\pi} \ln\left(\frac{Q^2}{m_e^2} - 1\right) = \begin{cases} 4.86\% & \text{at } Q^2 = 3.0 \\ 4.29\% & \text{at } Q^2 = 0.5 \end{cases}$$

$R_{tot} = 5.9 - 6.5\%$.

→ this estimate dramatically over predicts the smallest angle rates

Using $R_{int} = 3.0\%$, $R_{tot} = 4.6\%$ gives much better agreement

Mean Ratio Obs/Pred = 1.15

→ see p. 23

13 Simona does analysis of SHMS quartz bar efficiency.

→ efficiency is good for e^-, π, drops off for protons on edges of focal plane

→ the issue appears to be when protons enter not at normal incidence, bar geometry does not allow proton Cherenkov cone to be efficiently captured by PMT.

- possibly the issue could be resolved by orienting the bars on an arc.
  Or, the bars could be replaced w/ plastic scintillator (would need to look at PID separation)

* For proton analysis, a hodoscope efficiency correction would have to be evaluated and applied

Ryan shows Weird Cointime peak 4ns to right of Main Reals peak

→ it appears that the 4ns peak also contains real $\pi^+ e^-$ COIN

→ Simond suggests to place focal plane cuts on HMS SHMS to see if it is caused by a PMT on edge with a bad β calibration due to bad statistics.

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Wiser Rate Calculations for 3.8, 4.9 GeV (hclog 3603590)

Continued from p.14:

→ I repeat the Wiser R.L. internal analysis for the observed SHMS rates at 3.8, 4.9 GeV.

→ Fortunately, the rates using $R_{int} = 3.0\%$, $R_{tot} = 4.61\%$ gives SHMS singles rates more than double the actual rate. Not surprisingly, much lower R_{int} are needed, consistent with previous JLab 4-6 GeV experience

→ For 3.8 GeV: $R_{int} = 0.4\%$, $R_{tot} = 2.01\%$ gives best fit
For 4.9 GeV: 0.7% 2.31%

shms-hadronrates-compare-3p8-4p9

P_shms	Theta_shms	RL=4.61% Wiser improved +charge rate at 70muA	RL=2.61% Wiser improved +charge rate (70uA)	RL=2.31% Wiser improved +charge rate (70uA)	RL=2.01% Wiser improved +charge rate (70uA)	Running current (muA)	SHADED Predicted rate at running current (kHz)	Observed (kHz)	Ratio (observed /predicted)
				Rates with 3.835 GeV beam					
2.583	6.79	2.74E+006	1.55E+006	1.38E+006	1.20E+006	24	410.4	340	0.83
2.583	6.79	2.74E+006	1.55E+006	1.38E+006	1.20E+006	32	547.2	473	0.86
2.583	9.79	1.37E+006	7.78E+005	6.88E+005	5.99E+005	40	342.3	325	0.95
2.583	9.79	1.37E+006	7.78E+005	6.88E+005	5.99E+005	50	427.9	400	0.93
				Rates with 4.933 GeV beam					
2.583	6.00	5.70E+006	3.23E+006	2.85E+006	2.48E+006	16	652.3	500	0.77
2.583	8.86	2.99E+006	1.69E+006	1.50E+006	9.28E+005	17.5	374.8	318	0.85
2.583	8.86	2.99E+006	1.69E+006	1.50E+006	9.28E+005	21.5	460.4	390	0.85
2.583	11.86	1.44E+006	8.17E+005	7.23E+005	6.29E+005	25.5	263.5	270	1.02
2.583	11.86	1.44E+006	8.17E+005	7.23E+005	6.29E+005	30.5	315.2	320	1.02
								MEAN	0.90

Wiser Improved = Subdivide focal plane into 10 bins instead of using only P_central
4.61% RL = RL_internal 3.0% + RL_target 1.61%
2.61% RL = RL_internal 1.0% + RL_target 1.61%
2.31% RL = RL_internal 0.7% + RL_target 1.61%
2.01% RL = RL_internal 0.4% + RL_target 1.61%