UUB Charge and Peak histograms

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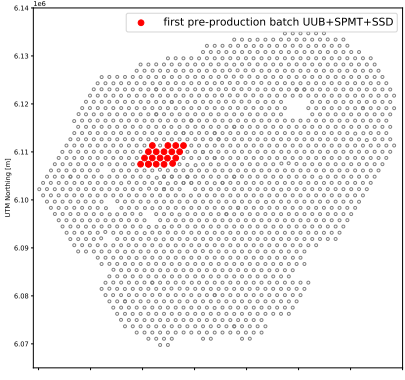
- Station studied: 863 1222 1219 1211 1740 1743 1221 1223 1217 1747 1741 1745 1818 1851 1729 1735 1746 1819 1791
- Data from CDAS.
- Software CDAS, pre-production version.



Let's assume a muon pulse as exponential function:
$P(t) = P_{\max} \exp(-t/\tau)$.

So, the peak takes a value of $P_{\max}$, and the integral (A) takes $P_{\max}\tau$.

This means an AoP of τ.

In a digitalized scenario, the $P(t)$ takes values each Δt, which means that the $P_{\max}$ will be a value between $P(ts)$ and $P(ts + \Delta t)$, where ts is the time at which the signal starting.

Let's say that peak is at ts, then
$P(ts) = P_{\max} \exp(-ts/\tau)$.

For the integral:
$A = \Delta t \sum_{n=1}^{n=\infty} P_{\max} \exp - \frac{ts+n\Delta t}{\tau}$
$A = P_{\max} \exp^{-ts/\tau} \frac{\Delta t}{1-e^{-\Delta t/\tau}}$

Therefore, we expected an AoP of $\mathrm{AoP} = \frac{\Delta t}{1-e^{-\Delta t/\tau}}$.

If Δt goes to zero, so $\mathrm{AoP} = \tau$

For UB, AoP takes:

$$(\mathrm{AoP})^{\mathrm{UB}} = \frac{25\,\mathrm{ns}}{1-e^{-25/\tau}}$$

and for UUB,

$$(\mathrm{AoP})^{\mathrm{UUB}} = \frac{8.33\,\mathrm{ns}}{1-e^{-8.33/\tau}}$$

So, $\frac{(\mathrm{AoP})^{\mathrm{UB}}}{(\mathrm{AoP})^{\mathrm{UUB}}} = \frac{25\,\mathrm{ns}\left(1-e^{-8.33/\tau}\right)}{8.33\,\mathrm{ns}\left(1-e^{-25/\tau}\right)}$

$$\frac{(\mathrm{AoP})^{\mathrm{UB}}}{(\mathrm{AoP})^{\mathrm{UUB}}} = 3\frac{\left(1-e^{-8.33/\tau}\right)}{\left(1-e^{-25/\tau}\right)}$$

Assuming a $\tau = 50$ ns:

$$\frac{(\mathrm{AoP})^{\mathrm{UB}}}{(\mathrm{AoP})^{\mathrm{UUB}}} = 3\frac{0.15}{0.39} = 1.17$$

$$(\mathrm{AoP})^{\mathrm{UB}} = 1.17\,(\mathrm{AoP})^{\mathrm{UUB}}$$