New Randoms Correction Techniques on the Gen II System

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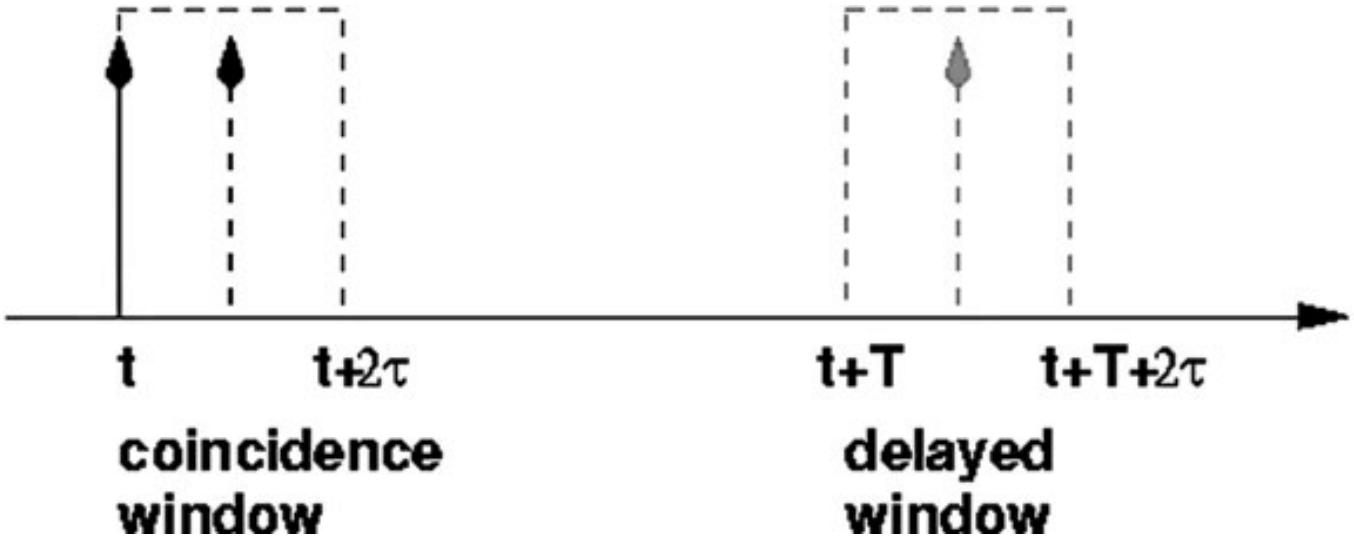
Randoms Correction

- How many of the coincidences measured on a certain LOR are 'random coincidences?'
- We use this information to advise image reconstruction.

Methods

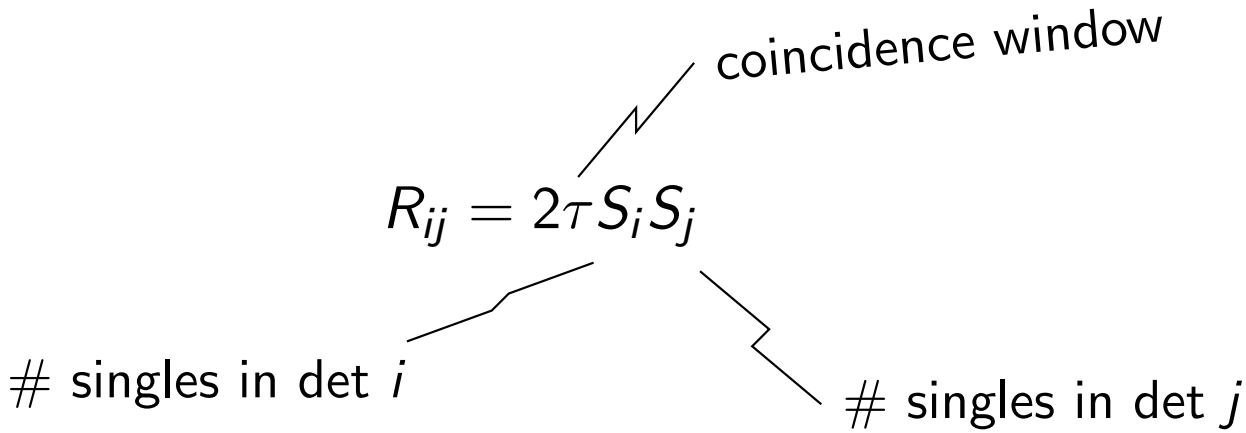
- Delayed-Window (DW)
- Singles-Rate (SR)
- Singles-Prompts (SP) - 2016, new to our group
- Singles-Prompts with Multiple Coincidence Correction - new

Delayed-Window (DW)



- Every time you open a prompt window, also open a delayed window.
- A count in the DW = random coincidence on that LOR.
- Currently implemented on hardware.

Singles-Rate (SR)



- Estimates random coincidences from # singles counts.
- Requires singles acquisition.

Singles-Prompts (SR)

$$R_{ij}^{SP} = \frac{2\tau e^{-(\lambda+S)\tau}}{(1-2\lambda\tau)^2}$$

Radius, Area, and Volume Equations

$$r(h) = \begin{cases} 1.1 & 0 \leq h < 2 \\ 5.9164 - 6.02984h + 2.52828h^2 - 0.418985h^3 + & \\ 0.03203h^4 - 0.000943h^5 & 2 < h < 9.5 \\ 5.5 & h \geq 9.5 \end{cases}$$

The area and volume equations could then be easily derived via integral.

Height and Exhaust Speed Equation

- Used Newton's method to solve for $h(V(m))$.
- Then we could solve for u

$$u = -\rho\sqrt{\frac{2(\rho g h - P_{atm} + P_0(1 + \frac{m_0 - \rho V(h)}{V_0 \rho})^{-\gamma}}{\rho(1 - (\frac{A_n}{A_h})^2)}}$$

Conclusion

- The rocket model did seem to match experiment quite well for masses and pressures in the middle range, but did seem to break down when the water level was too low or too high, as well as when the pressure was really low.
- One clear weakness of the experiment was that we didn't account for the rocket's horizontal motion and how that might have caused error. We felt like the math was too complicated given that the Bv^2 drag term made decomposing the velocity tedious.
- The horizontal angles made it really hard to tell what was experimental error and what wasn't.

Future Work

- Work on a mathematical model to properly deal with diagonal launches.
- Work on a model to better correct for large angle discrepancies with the camera recording.
- More trials.
- Better fins for stability so drag measurements more useful.

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