

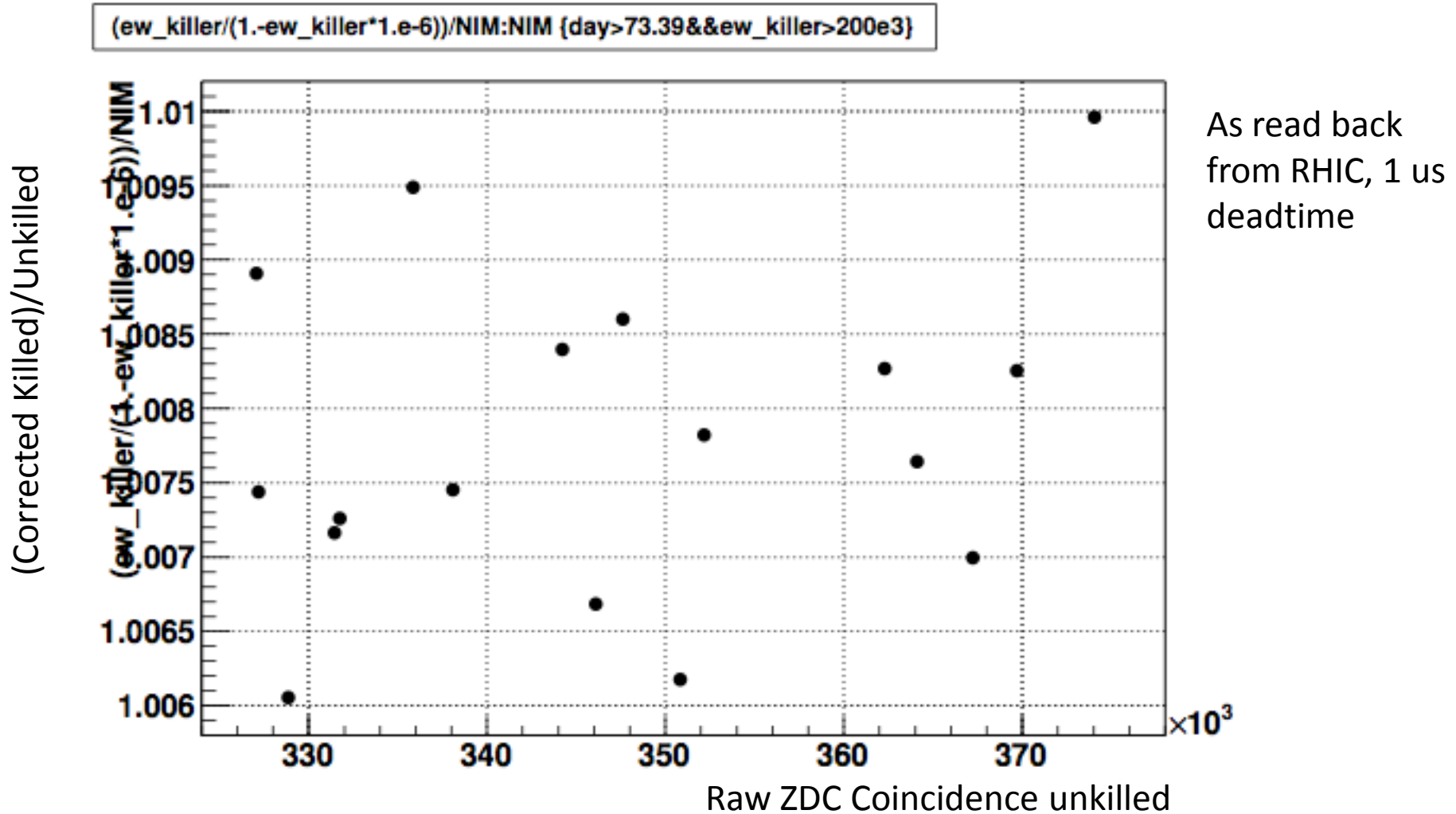
STAR ZDC (and ZDC at high rates in general)

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Killer Bits

- Two flavors: with “killer bit” (non-updating deadtime) and without
 - Killer bit kills afterpulsing in heavy ions. Afterpulsing not a problem in pp, but...
 - At high rates, killer bit decreases rates substantially
 - Formula: $\text{Real} = \text{killed} / (1 - \text{killed} * \text{deadtime})$
 - E.g. for 1 us deadtime, 0.5 MHz killed = 1 MHz real
 - Believe PHENIX = 400 ns deadtime, 0.714 MHz killed = 1 MHz real. Large correction at current singles rates.
- This year: deadtime is user settable. Currently (as of March 14) at 1 us, like last years. Did a scan, formula works to within a few percent.
 - N.B. Issues with signal to C-AD before March 14. Ghosting in killer bit, and inadvertently set to 0.1 us

Killer bit correction good to few percent



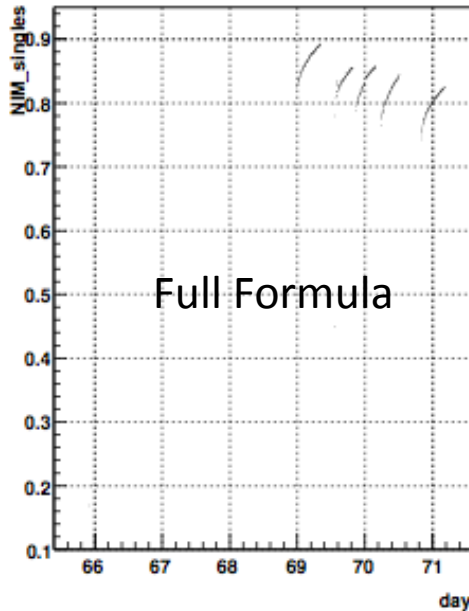
Signal routing

- ZDC East w/o killer: `sisscalер_6a_star_2`
- ZDC West w/o killer: `sisscalер_6a_star_1`
- ZDC Coin w/o killer: `sisscalер_6a_star_3`
- ZDC East w/ killer: not currently connected, but will show up at `sisscalер_6a_star_6`
- ZDC West w/ killer: not currently connected, but will show up at `sisscalер_6a_star_5`
- ZDC Coinc. w/ killer: `sisscalер_6a_star_16`

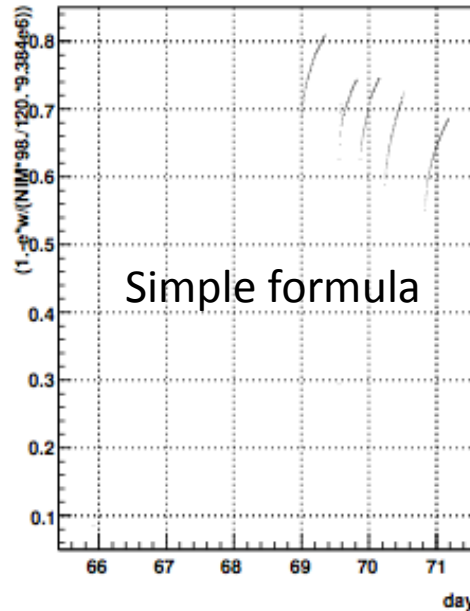
Singles/Doubles Corrections

- Since singles rates are \sim MHz, cannot ignore clocking of the beam. Significant probability of more than one hit in a single crossing, needs to be accounted for.
 - Simple (ignoring clocking) formula:
 - $\text{Real} = EW - (E*W)/\text{clock}$
 - Full formula
 - $\text{Real} = -\text{clock} * \ln(1 - (EW - E*W)/\text{clock}) / (\text{clock} + EW - E*W)$
 - Differences are very significant at current rates
 - Added complication of killer bits. STAR internally uses only non-killed data for correction. PHENIX?
- NOTE: this formula assumes uniform population bunch-by-bunch. STAR actually does the final correction bunch-by-bunch, but not possible in real time or in RHIC scalars.

NIM_singles:day {NIM>100e3}

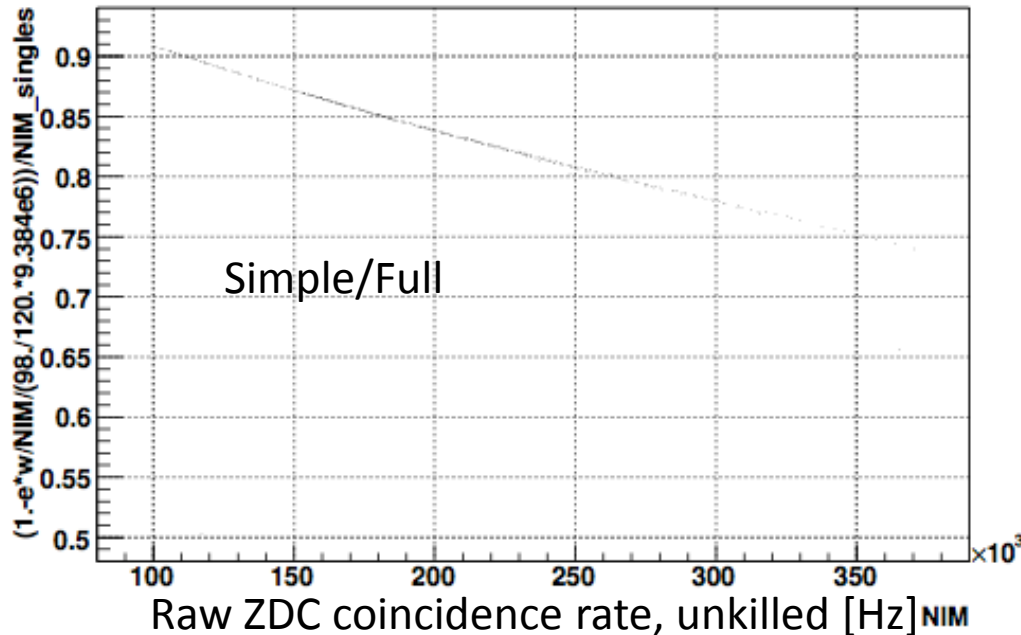


$(1.-e^*w\{NIM^*98./120.*9.384e6\}):day \{NIM>100e3\}$

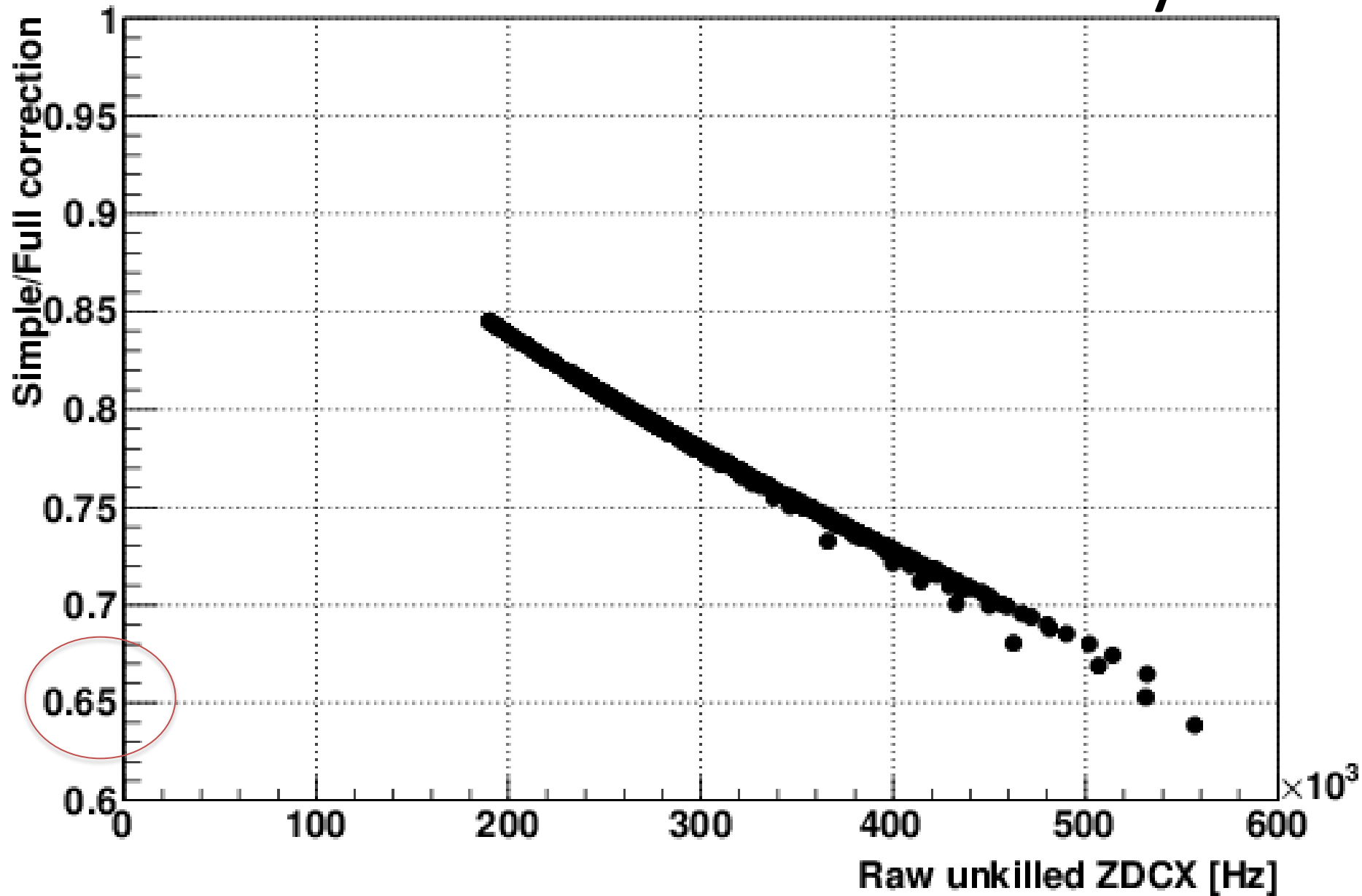


With wrong correction formula, will underestimate instantaneous luminosity by large amount

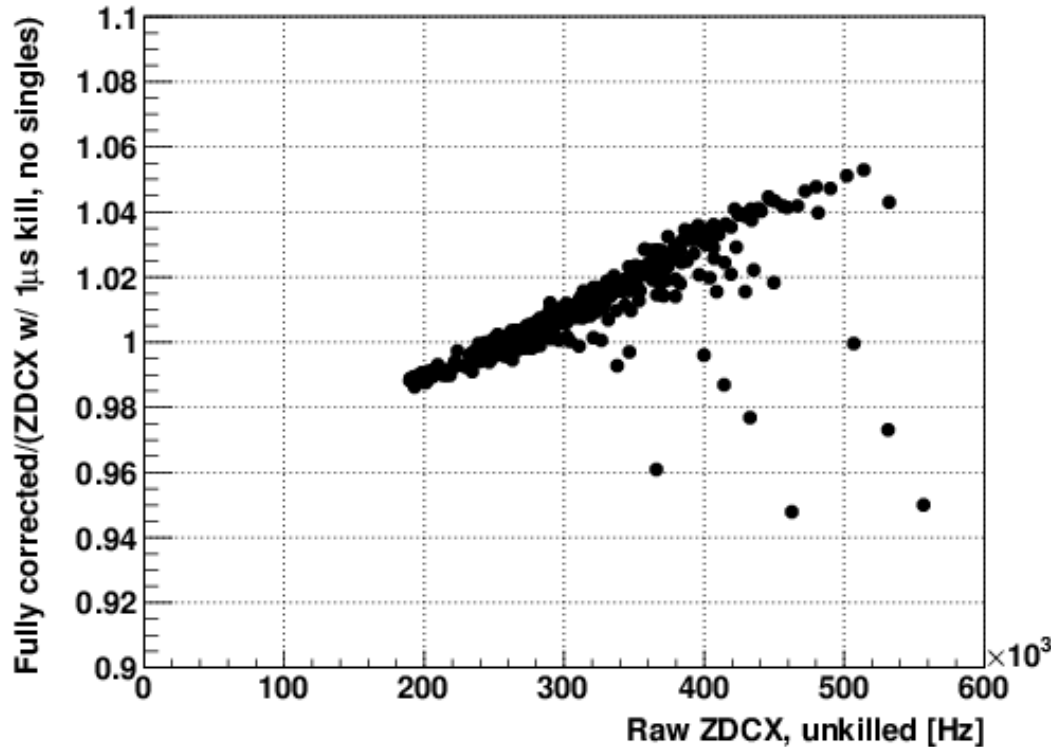
$(1.-e^*w\{NIM/(98./120.*9.384e6)\})/NIM_singles:NIM \{NIM>100e3\}$



Underestimate of Luminosity



Accidental cancellation



By pure accident, ZDC coincidence w/ 1 us dead, no singles correction = Real ZDC coincidence after full correction, to within +/- 5%