Since we are talking about timing resolution, here are uncertainties I can think of that can affect the timing resolution…

|  |  |  |
| --- | --- | --- |
| **Source** | **Issue** | **Resolution** |
| Electron bunch length | Electrons strike foil at different times | < 1 ps |
| Electron energy spread | Electrons are travelling at different (max) velocity, w/  (+/-100keV over < 50 cm) | < 0.7 ps |
| Scintillation light rise time | Electrons deposit energy and scintillation light occurs (NE102A used); ignore pulse width | <0.9 ns\*  (maybe 2-3ns if transit time included) ??? |
| Foil effects | Single- scattering on average shorter pathlength than double-  (<2 cm over 50 cm) | <70 ps |
| Electronic resolution | Timing jitter in any of the chain of fan-out, discriminators | From model spec |
| TDC resolution | Limiting bin size resolution of electronics | From model spec |
| RF Jitter | Resolution of the LLRF used to trigger laser and DAQ  (<0.5 deg @ 499 MHz) | <3 ps |
| Divide by circuit jitter | Resolution of the zero-crossing circuit providing laser or RF trigger | From model spec |
| TOTAL resolution | Contribution of all factors |  |

\* NUCLEAR INSTRUMENTS AND METHODS 158 (1979) 1-31 ; (~) NORTH-HOLLAND PUBLISHING CO. STATUS OF TIMING WITH PLASTIC SCINTILLATION DETECTORS

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