# Determining event start times in GlueX

Craig Bookwalter

Sept 23, 2009

Some numbers

## From the design report v4, low intensity

- Beam current: 300 nA
- Total flux: $1.9 \times 10^8$ photons/s
- Tagged photon flux on target: $10^7$ photons/s
- Hadronic rate in DAQ: 1.4 kHz
- Accidental rate in DAQ: 7.3 kHz
- Trigger window size: 100 ns
- start counter/tagger coincidence window: 15 ns

More numbers for low intensity

## per bucket

- $300nA \times 1.6022 \times 10^{19} e/C = 4.81 \times 10^{12} e/s$
- $\frac{4.81 \times 10^{12} e/s}{5 \times 10^{8} 2 nsbunches/s} \approx$ 10000 e/bucket
- Radiator thickness$\times$ e/bucket = 0.38 $\gamma$/bucket
- 0.38 $\gamma$/bucket $\times$ 14% in coherent peak $\times$ 37.5% tagging efficiency = 0.02 tagged coherent peak $\gamma$ per bucket
- 50 buckets per trigger window $\times$ 0.02 = 1 tagged photon in coherent peak per event window

algorithm w/ start counter

1. group start counter hits in time (+/- 2 ns)
2. beginning with the largest group:
   1. average over times of hits, and for each hit in the tagger:
      1. propogate the photon in time to the event vertex (if available) or center of target
      2. retain the difference between photon arrival time and average st time
3. the photon with the arrival time closest to the average st times is selected as the trigger photon, and the event start time is set to the accelerator RF time propogated to the event vertex/center of target

high intensity numbers

## From the design report v4, high intensity

- Beam current: 3 $\mu$A
- Total flux: $1.9 \times 10^9$ photons/s
- Tagged photon flux on target: $10^8$ photons/s
- Hadronic rate in DAQ: 1.4 kHz
- Accidental rate in DAQ: 7.3 kHz
- Trigger window size: 100 ns (?)
- start counter likely not available
- following previous logic, expect 10 tagged photons in coherent peak per event window

algorithm w/o start counter

1. grab vectors of FCAL clusters
2. for each cluster in FCAL:
   1. grab associated TOF hit and associated track
   2. calculate $\beta$ via $p_{hit-based}/E_{FCAL}$ ?
   3. propogate tracks from TOF back to target along path length
3. grab vectors of BCAL clusters
   1. grab associated CDC track
   2. calculate $\beta$ via $p_{hit-based}/E_{BCAL}$ ?
   3. propogate tracks back from BCAL (?) to target along path length
4. attempt to group BCAL/FCAL cluster vertex times
   - by time? (+/- 2ns prob. too optimistic)
   - by vertex position?
5. largest group of tracks wins – use their average vtx time to select a photon in the tagger?

wishlist

- timing simulations – beam buckets w/ RF time, tagger, etc

beef? questions / comments / flames / etc