Xe doping analysis update: statistics on Fast Component

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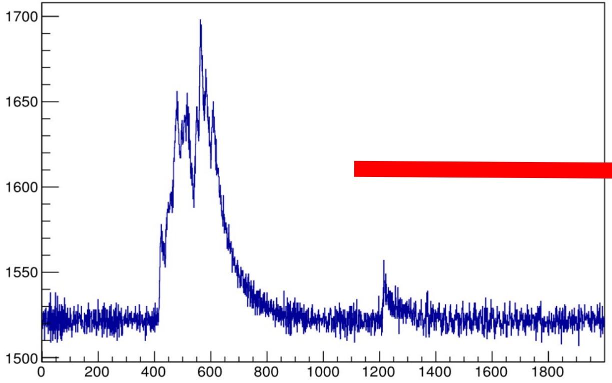
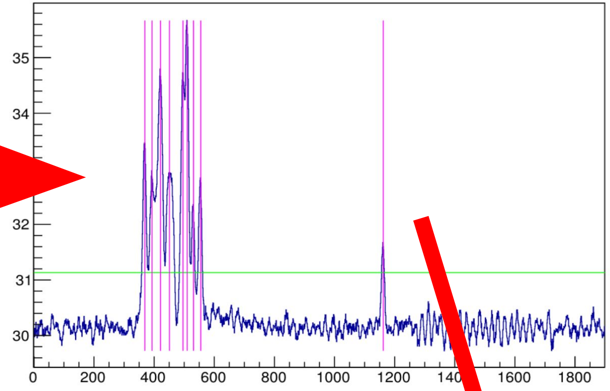
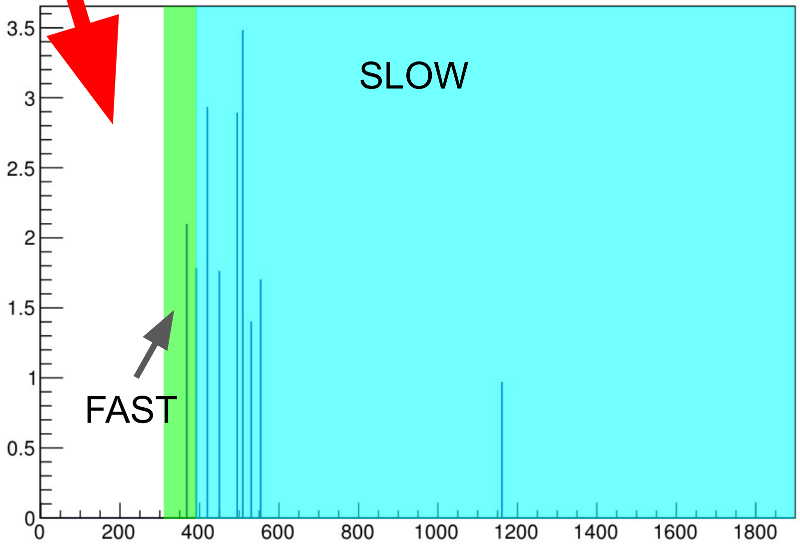
Defining fast & slow light yield

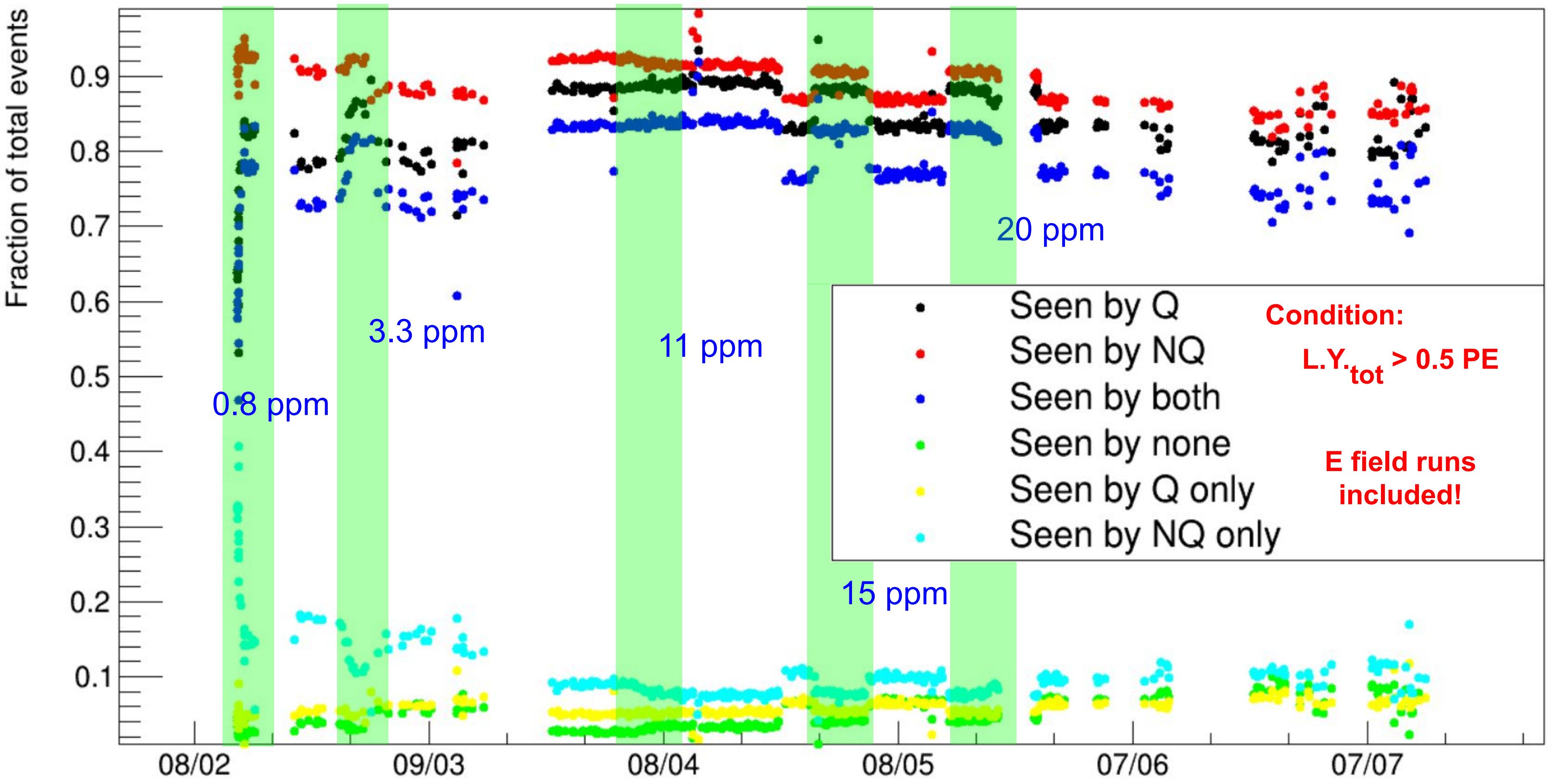




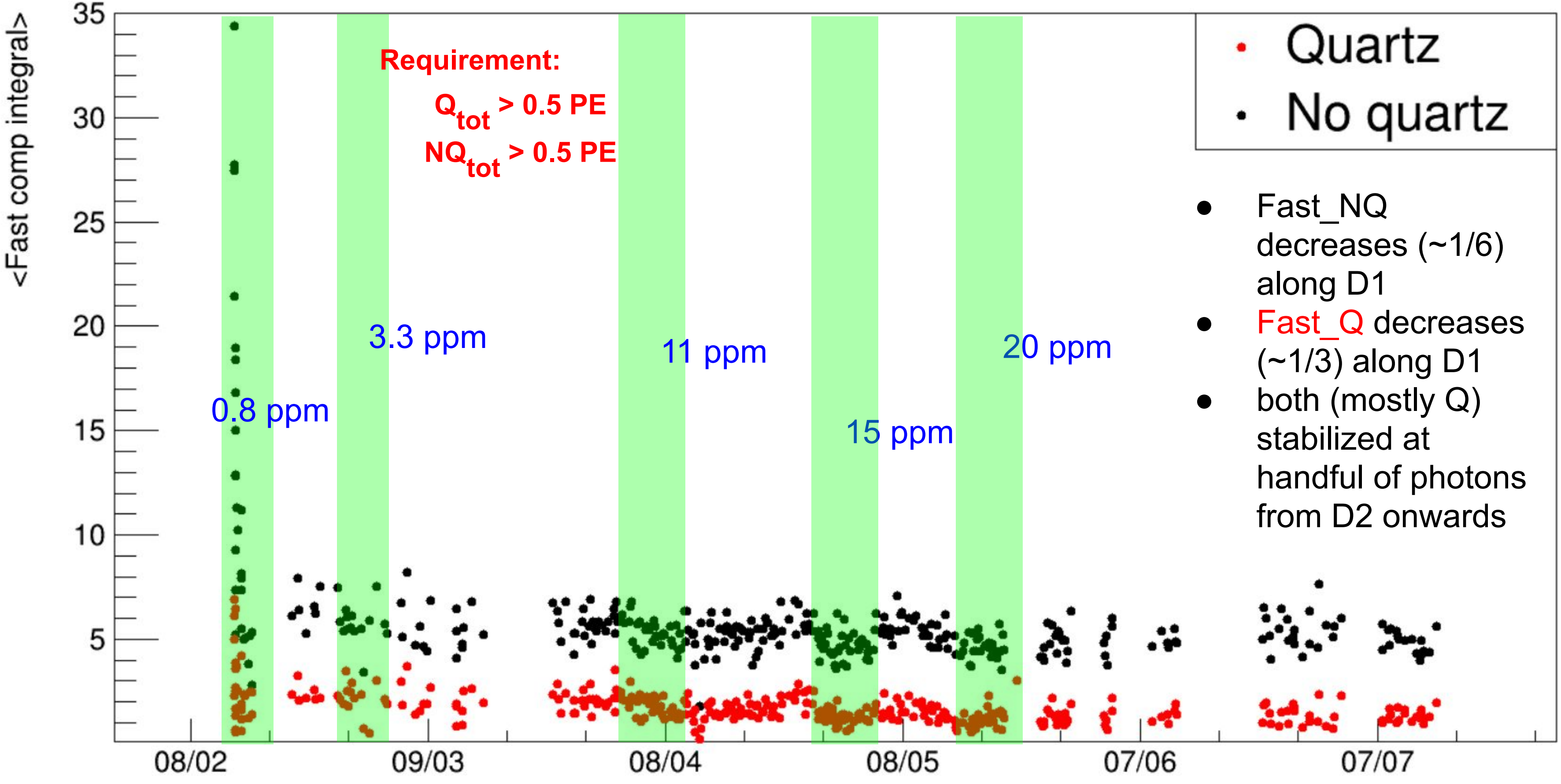
- FIR filter analysis gives access to photon arrival times on an event-by-event basis (time resolution ~10 ns)
- LY of the fast and slow components can be studied separately & event-by-event ($\rightarrow$ statistics)
- $L.Y._{\mathbf{tot}} = \sum P.H.$ $(t \geq \text{trig time})$
- $L.Y._{\mathbf{fast}} = \sum P.H.$ $(\text{trig time} \leq t < \text{trig time} + 10 \text{ tick})$
- $L.Y._{\mathbf{slow}} = \sum P.H.$ $(t \geq \text{trig time} + 10 \text{ tick})$



Time survey of Q & NQ detection efficiency

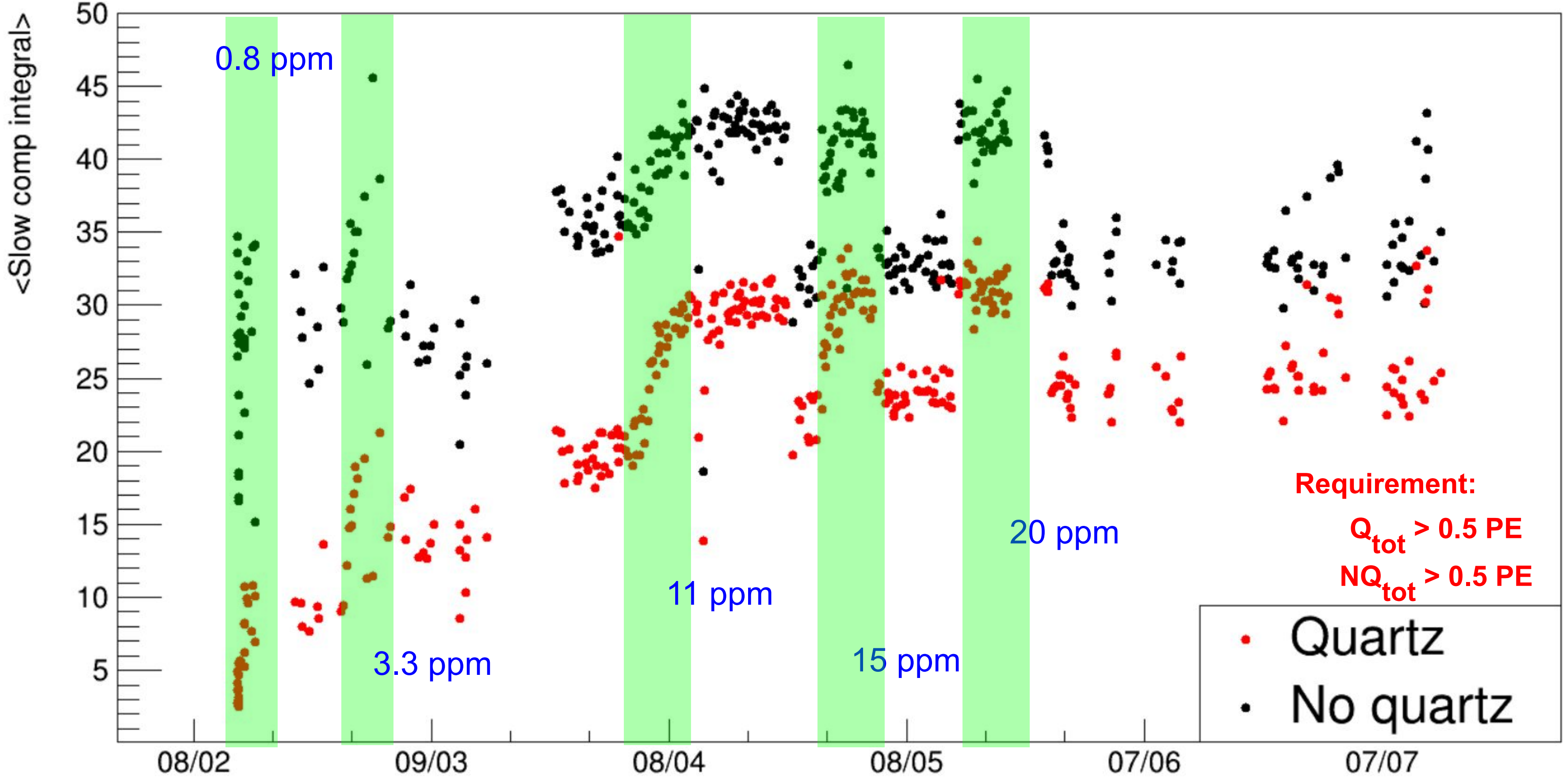


Time survey of $\langle LY_{fast} \rangle$

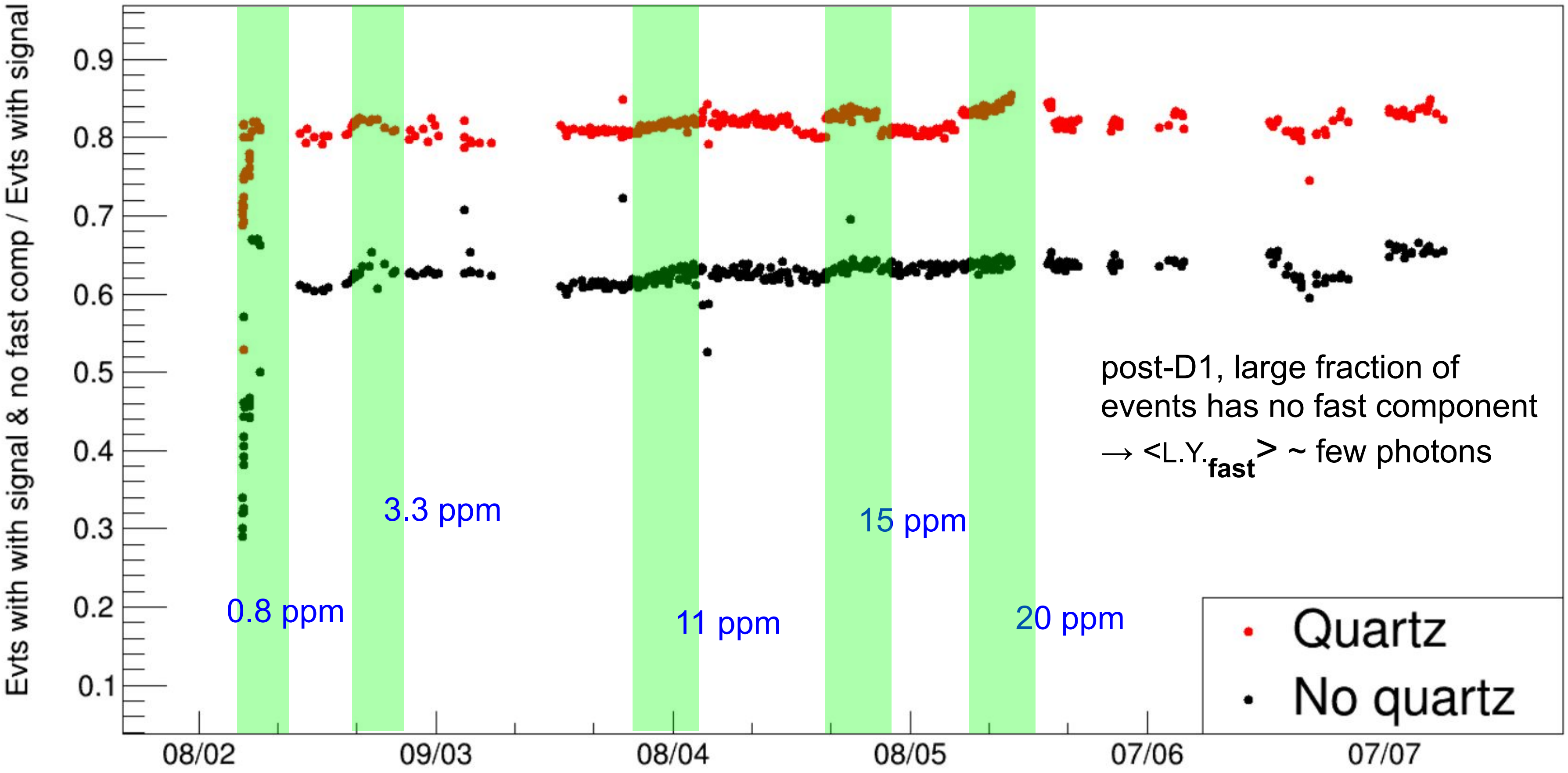


- Fast_NQ decreases (~1/6) along D1
- Fast_Q decreases (~1/3) along D1
- both (mostly Q) stabilized at handful of photons from D2 onwards

Time survey of <LY_{slow}>

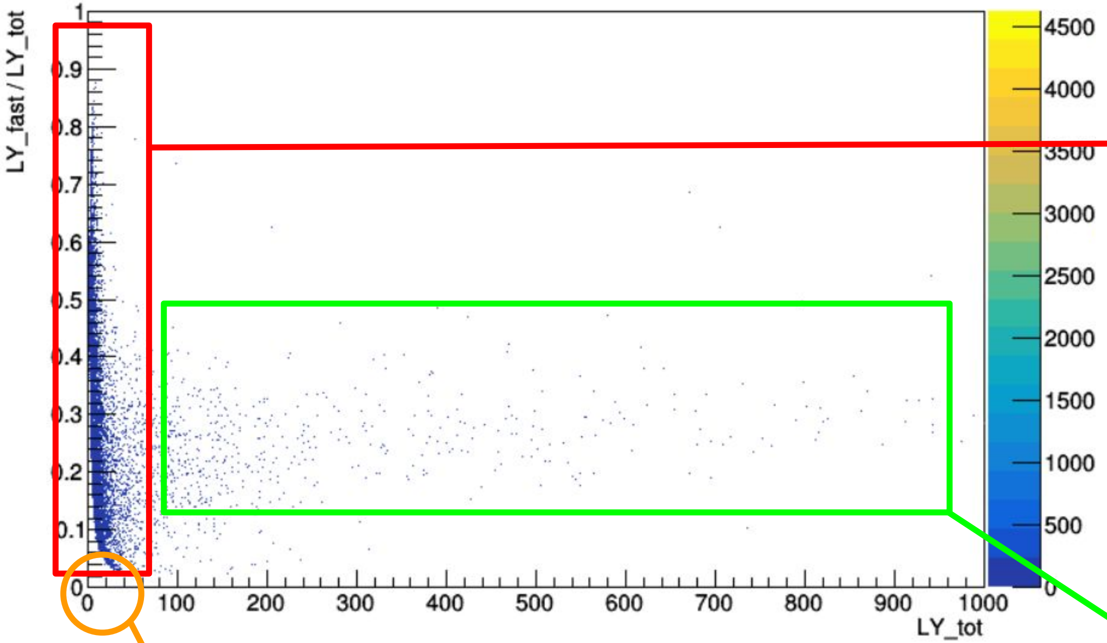


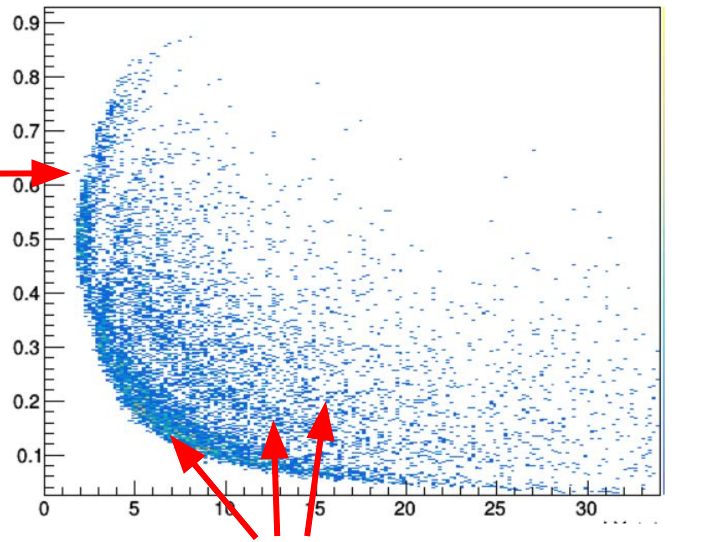
Time survey of events showing no Fast Light



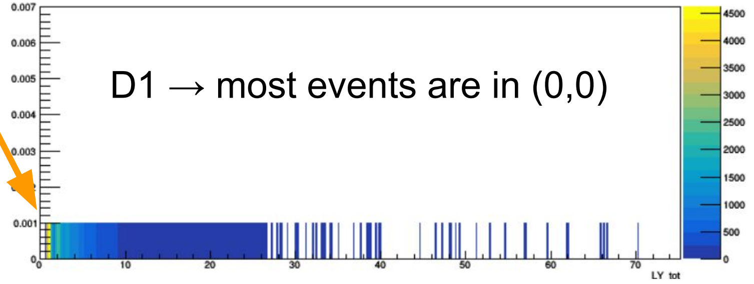
post-D1, large fraction of events has no fast component → <L.Y.$_{fast}$> ~ few photons

Fast fraction vs total LY : Q - post D1





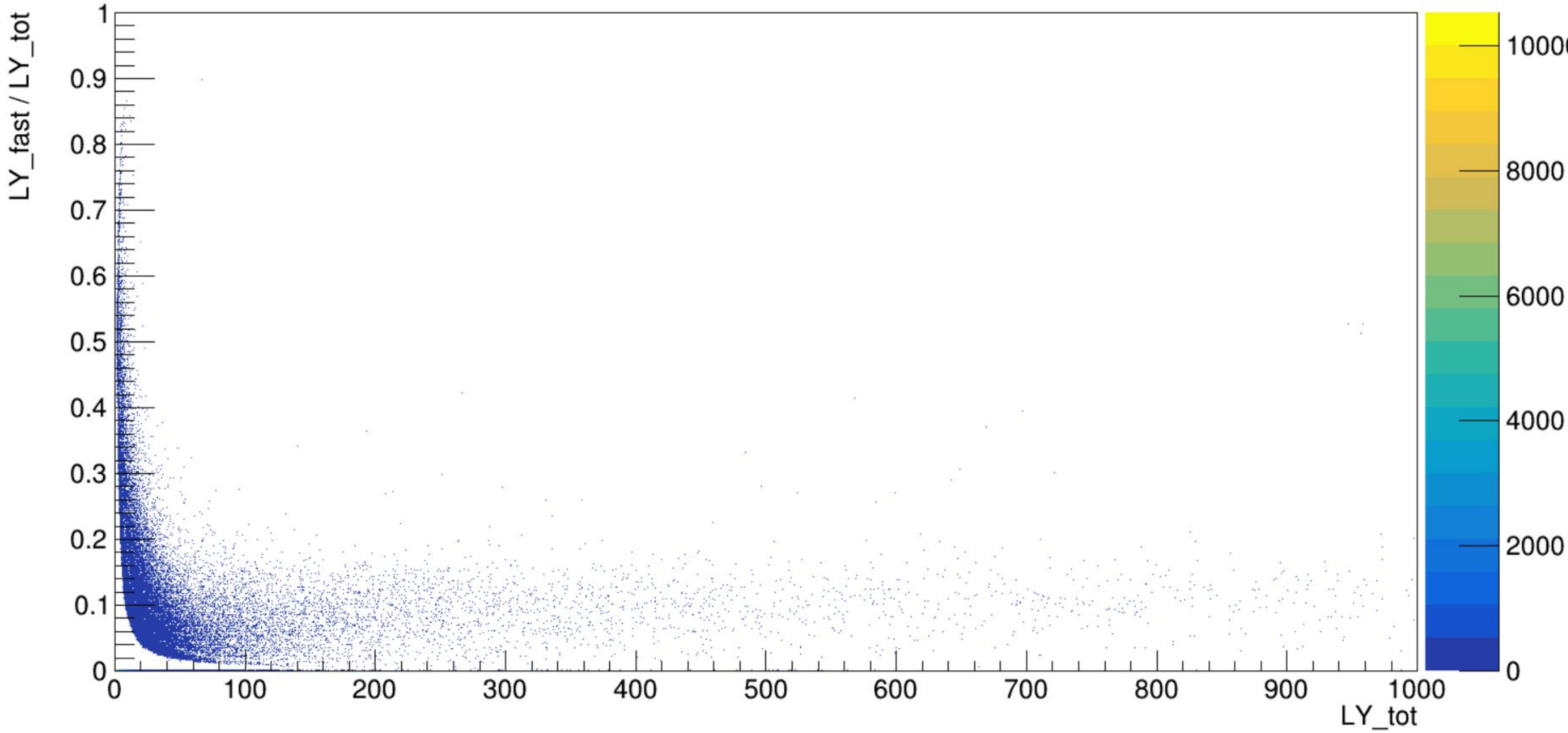
each (approximate) hyperbole corresponds to 1, 2, 3… PE in the fast comp



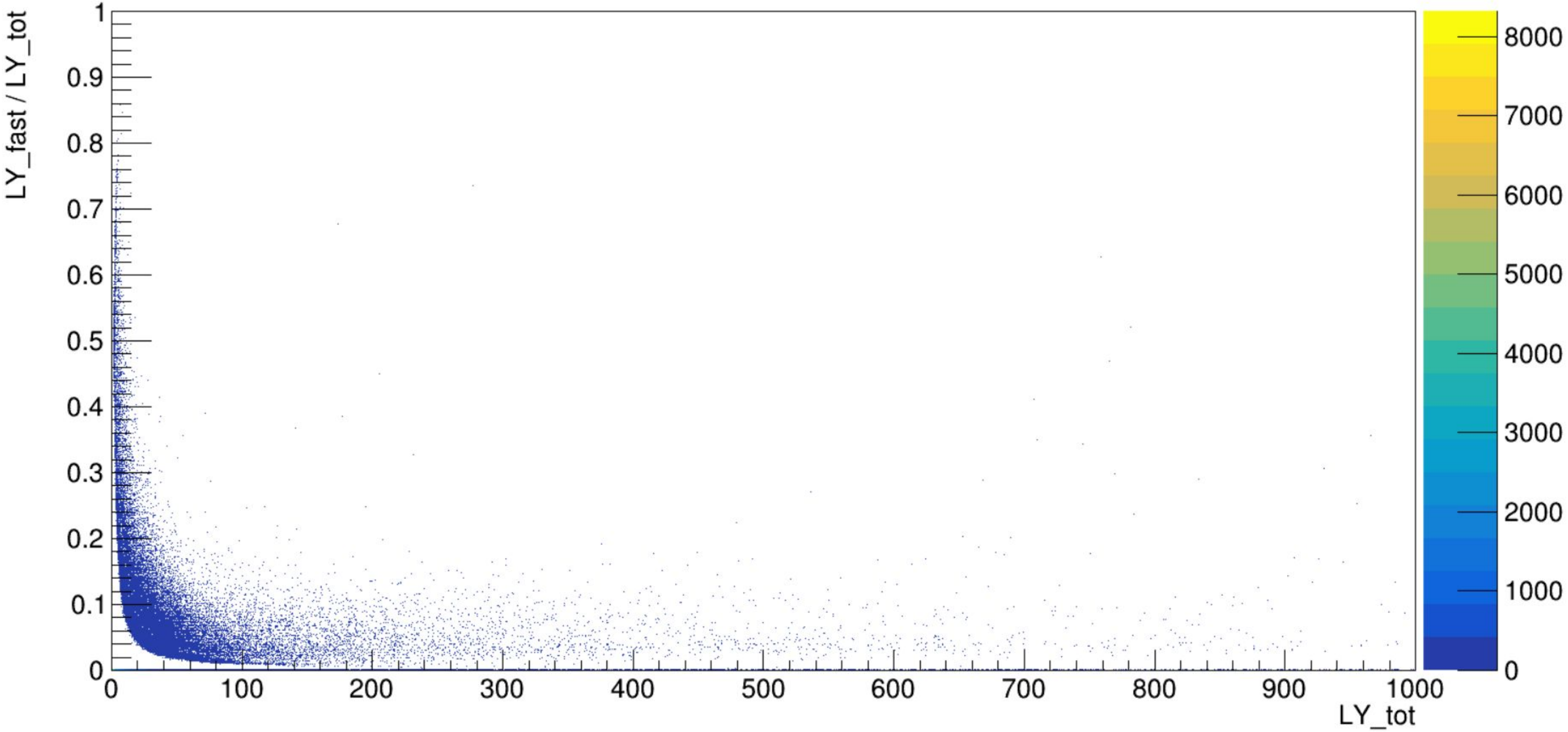
D1 → most events are in (0,0)

events with many photons have a fast fraction of ~ 0.2-0.3
otherwise fast fraction uniformly ranges between (0.1,0.5)

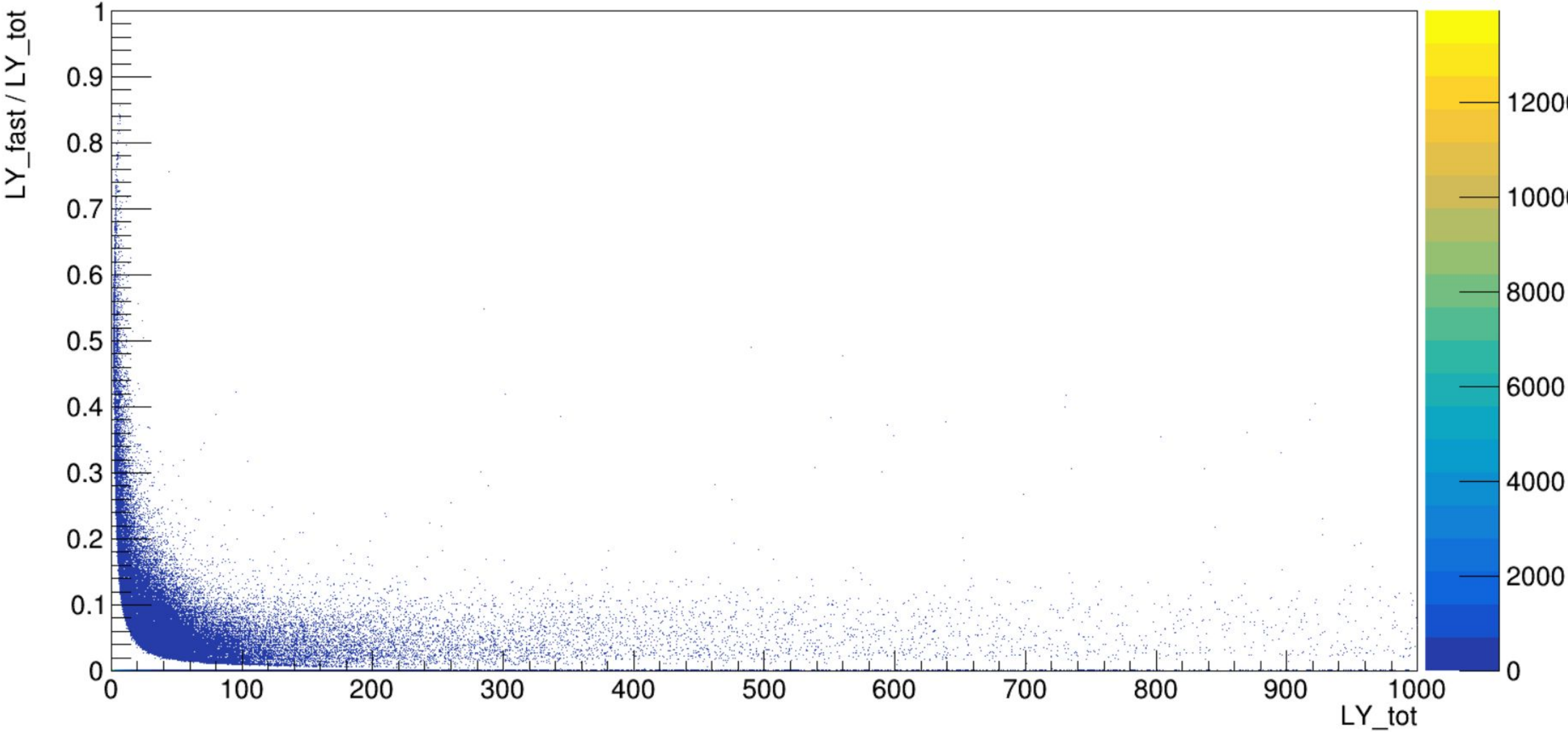
Fast fraction vs total LY : Q - post D2



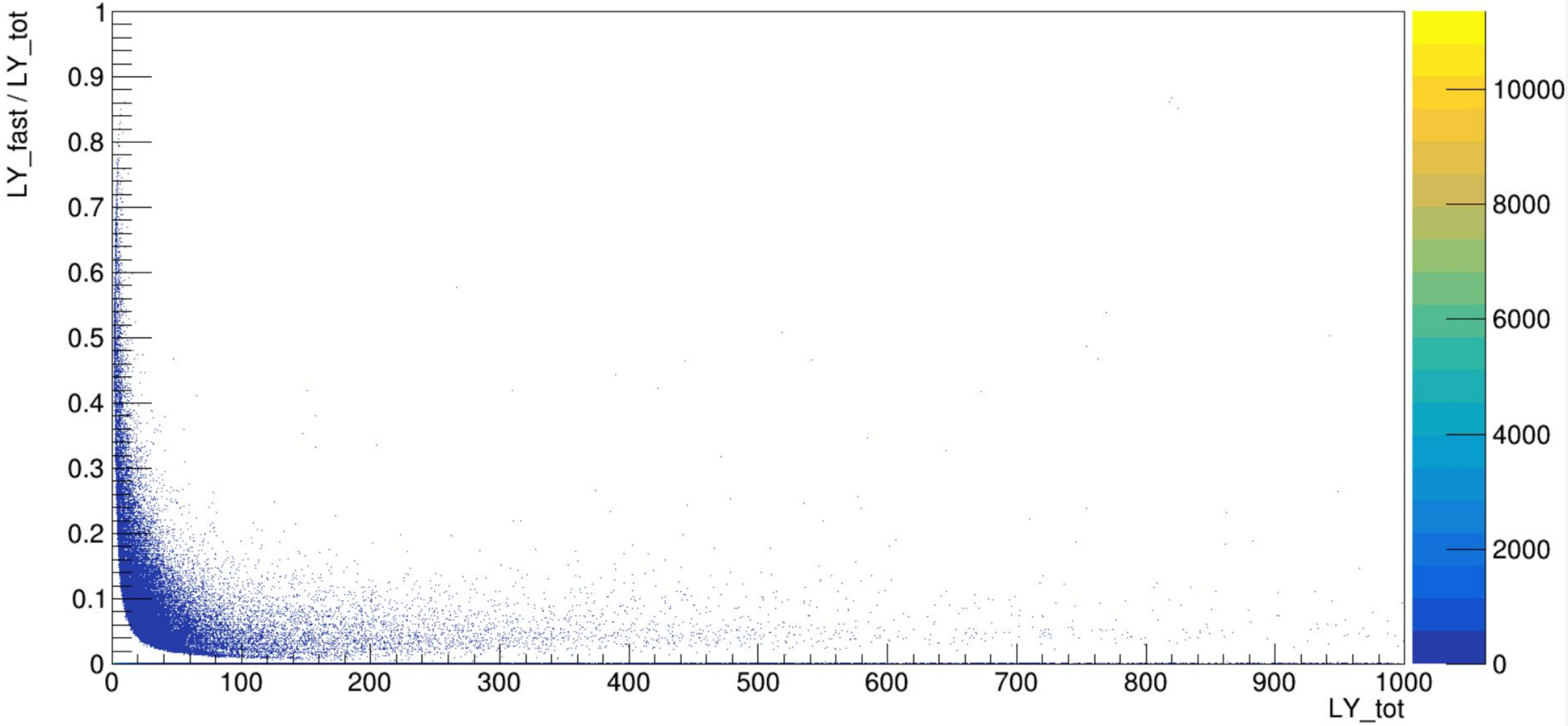
Fast fraction vs total LY : Q - post D3



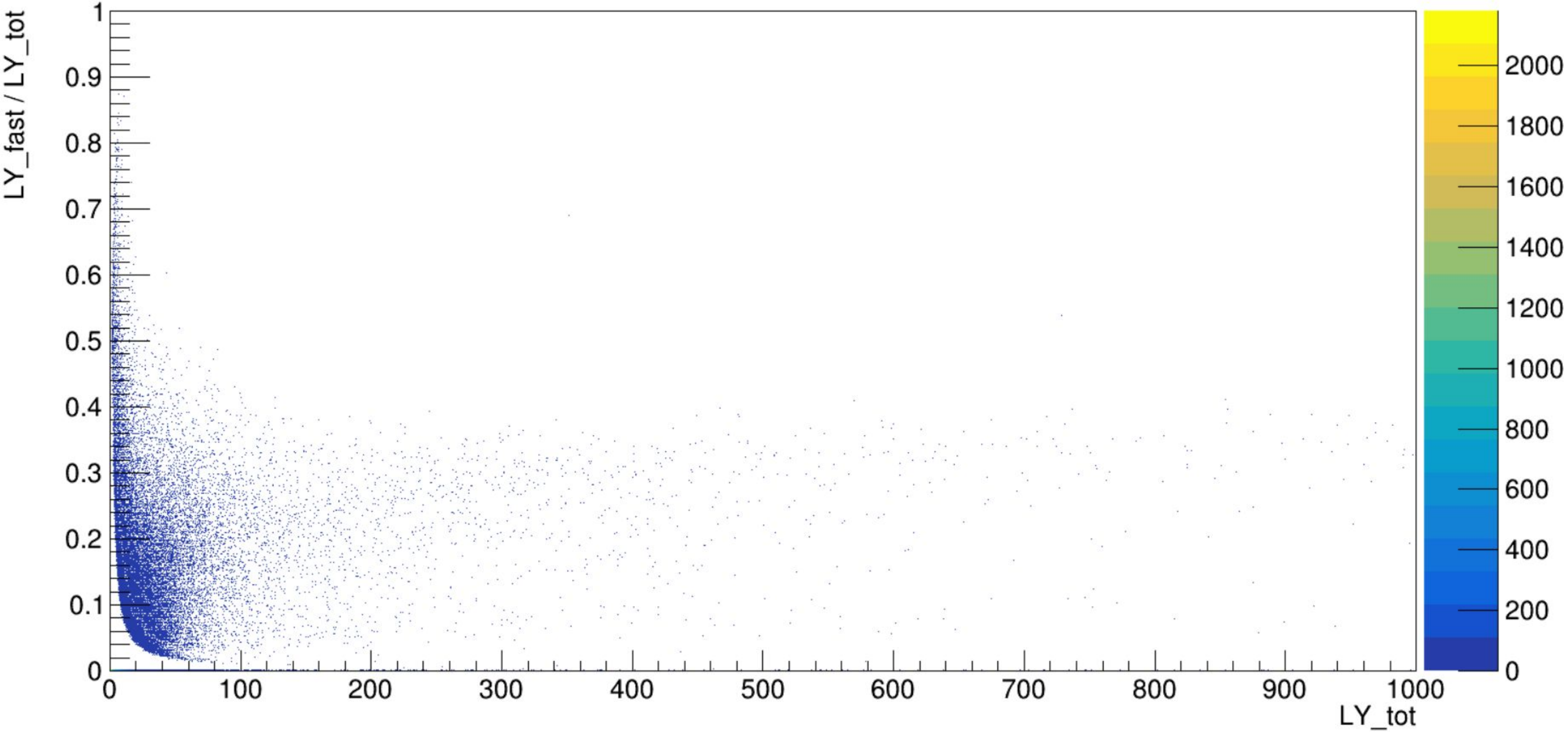
Fast fraction vs total LY : Q - post D4



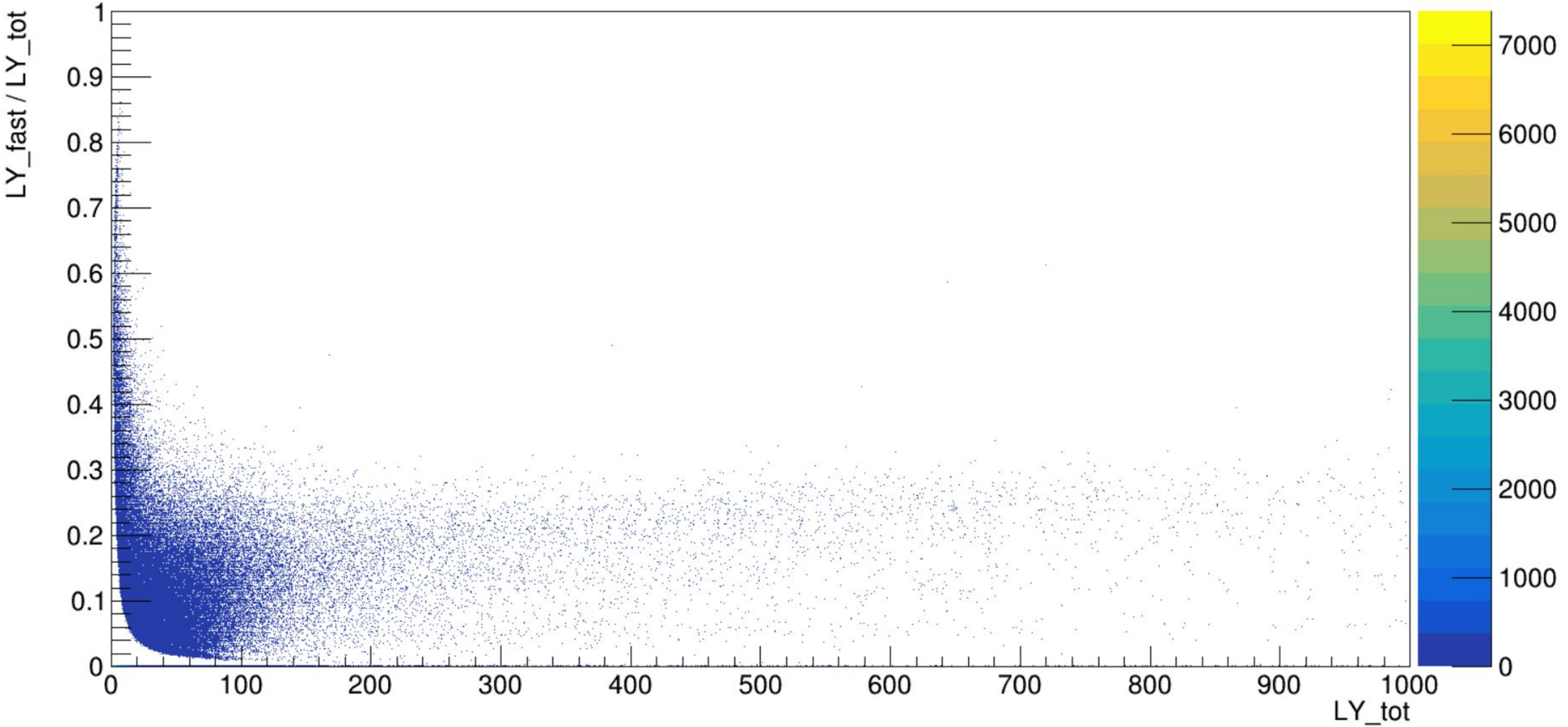
Fast fraction vs total LY : Q - post D5



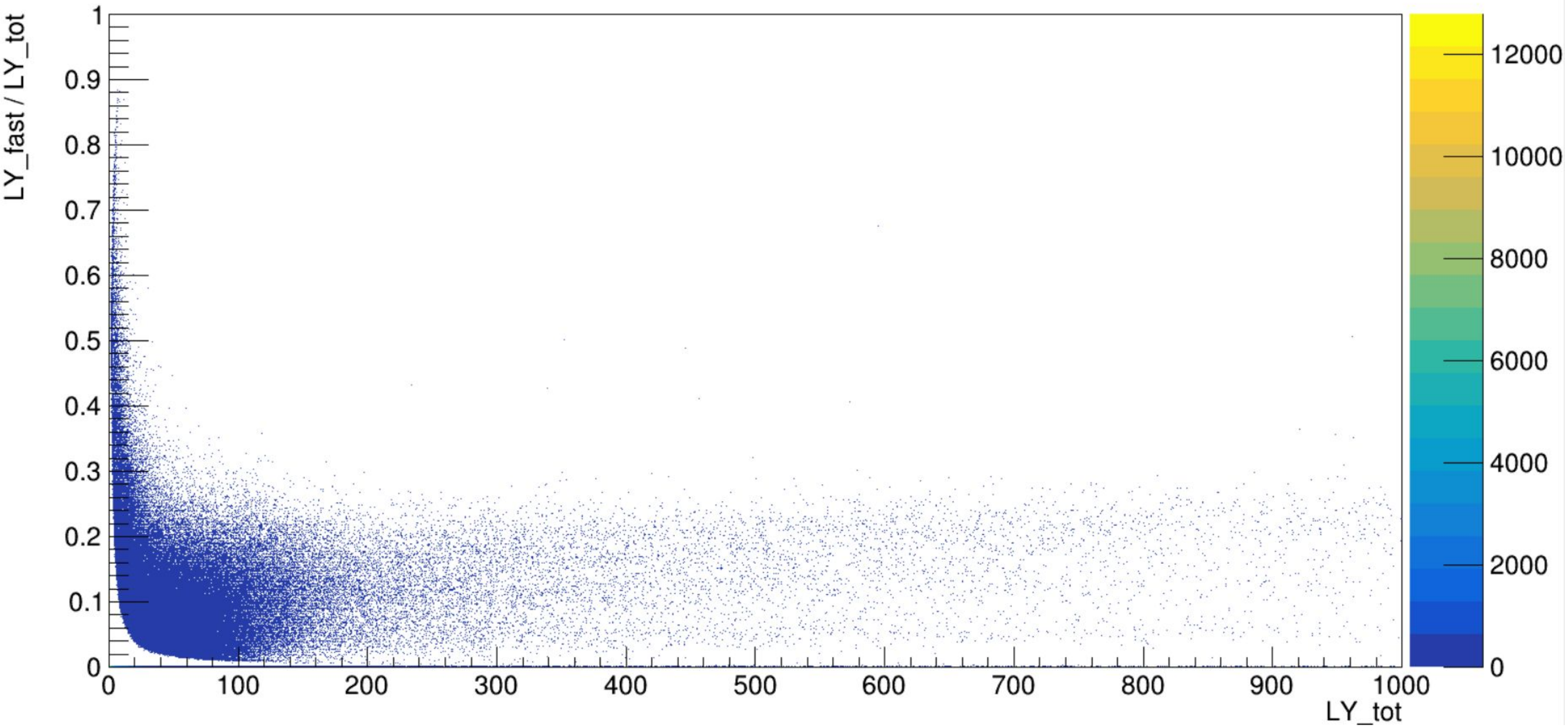
Fast fraction vs total LY : NQ - post D1



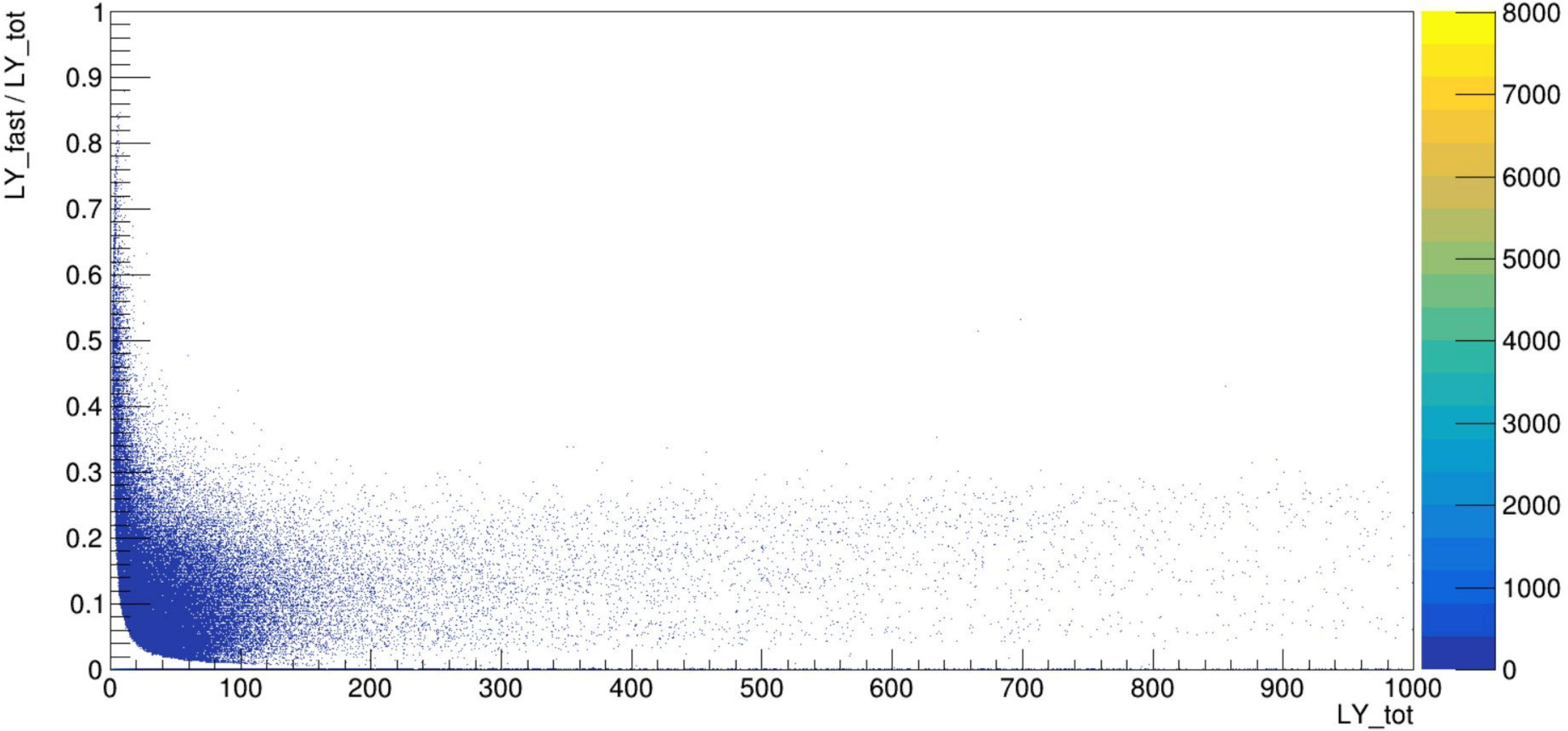
Fast fraction vs total LY : NQ - post D2



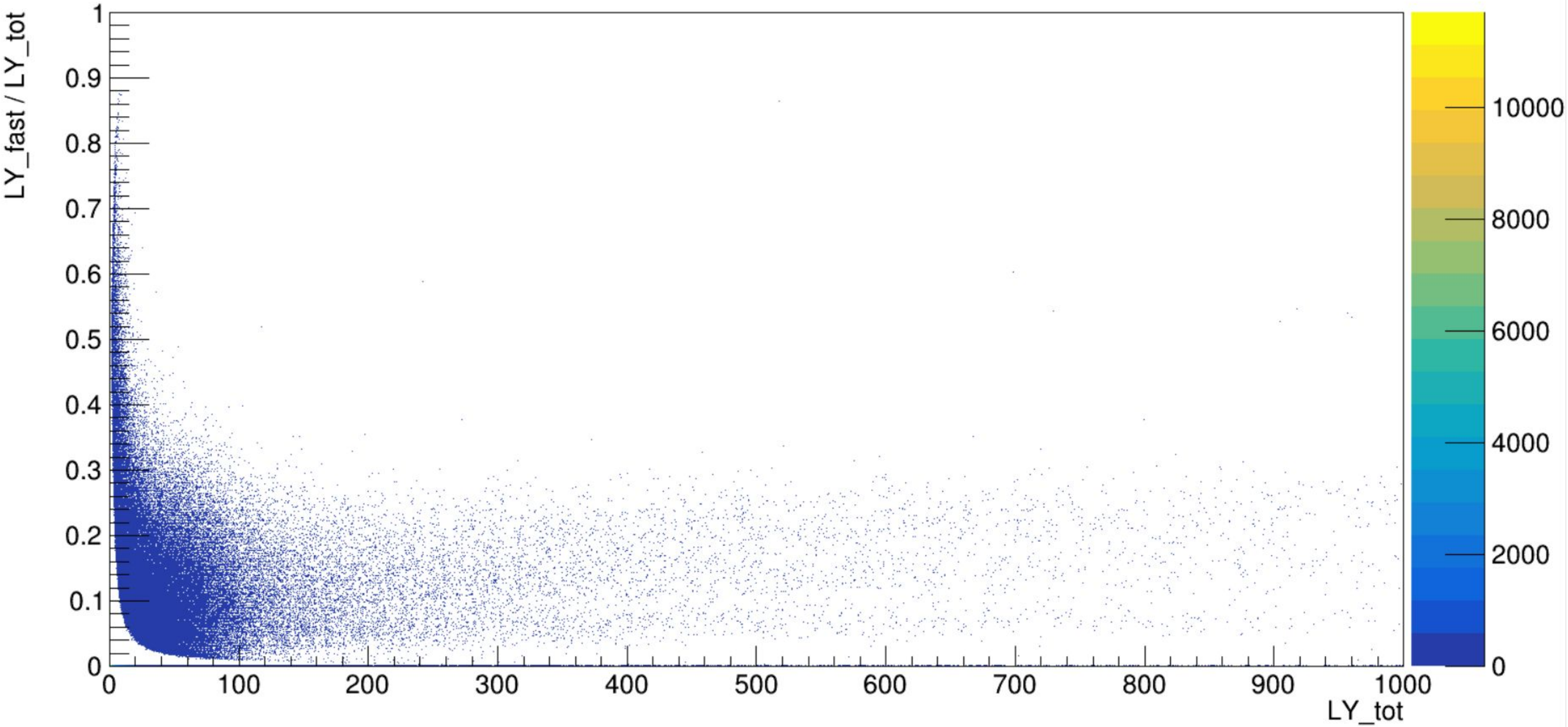
Fast fraction vs total LY : NQ - post D3



Fast fraction vs total LY : NQ - post D4

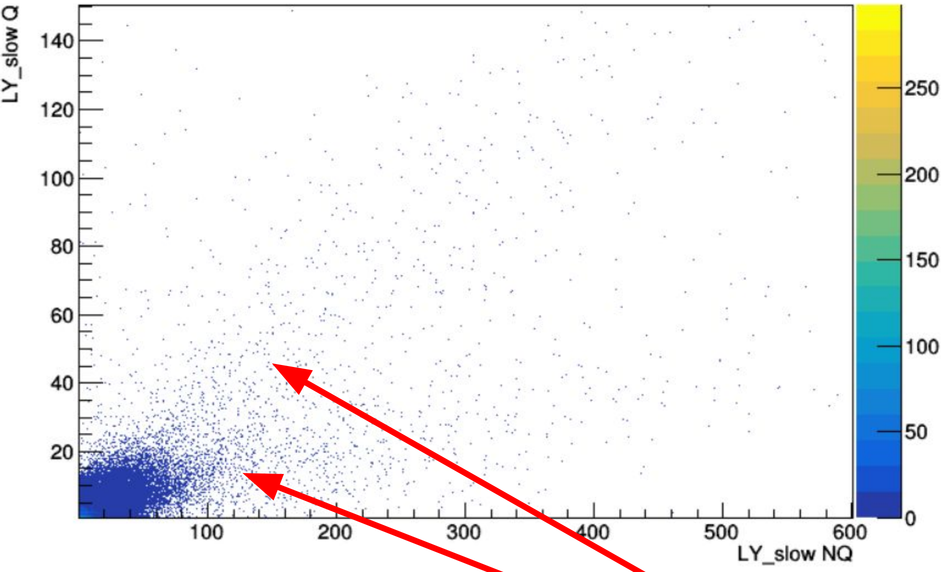


Fast fraction vs total LY : NQ - post D5

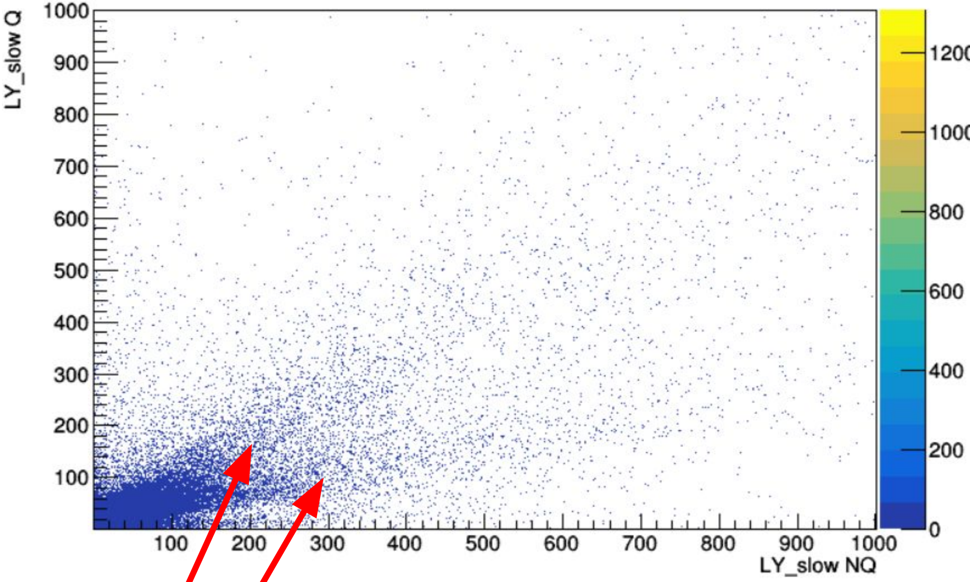


LY slow - Q vs NQ

Dope 1



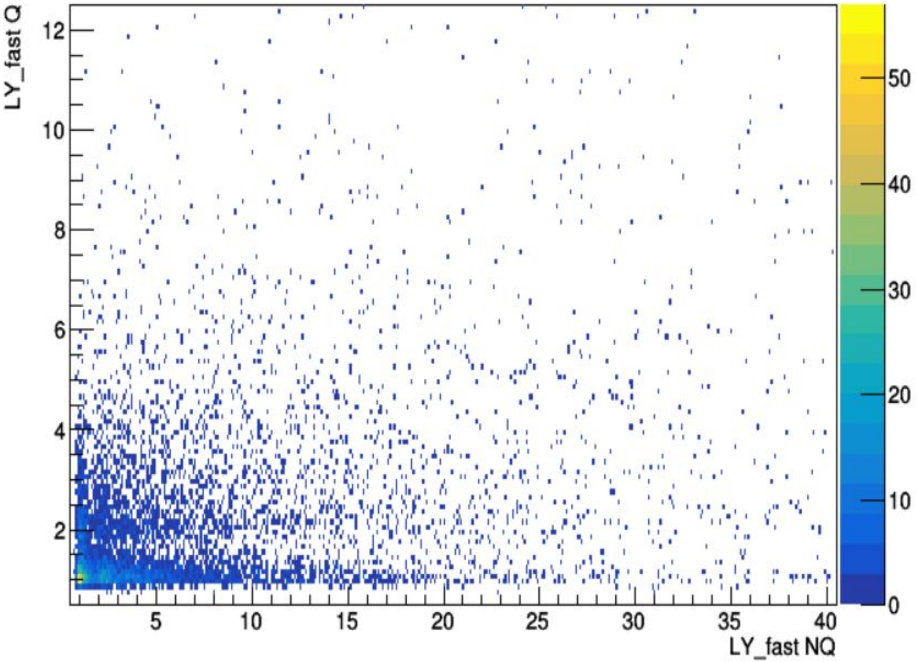
Dope 5



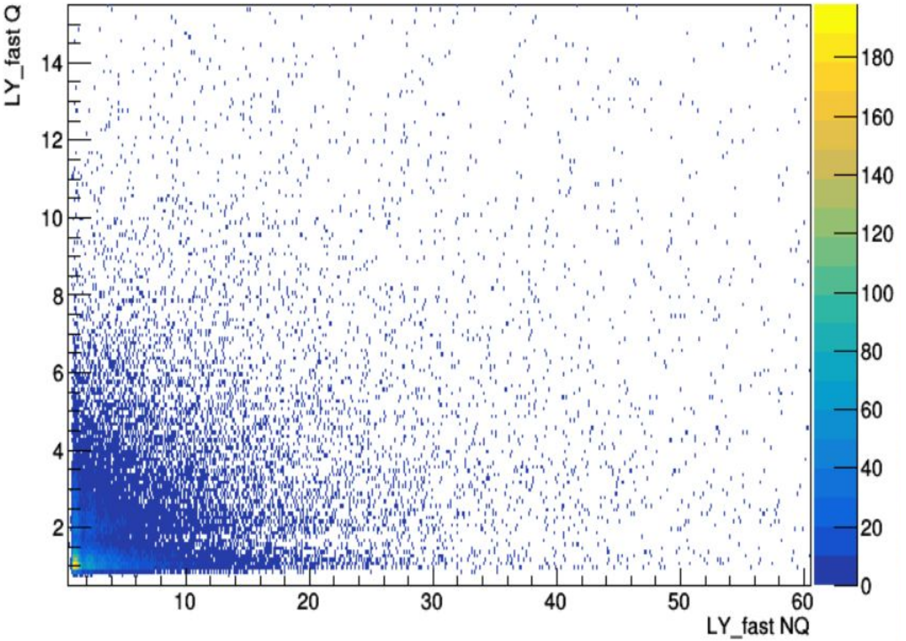
previously observed “lobes

LY fast - Q vs NQ

Dope 1



Dope 5



Fast component shows no apparent sign of the “lobes”

Conclusions

- In the very first runs of D1: <Fast_NQ> 35 ; <Fast_Q> ~ 7 → Fast_NQ/Fast_Q ~ 5
- Along D1,
  - Light Detection Efficiency of Q (ε_Q), increases from ~55% to ~80%.
  - Fast_Q decreases down to an average of few photons per event
    <Fast_NQ> 6 ; <Fast_Q> ~ 2 → Fast_NQ/Fast_Q ~ 3
- further doping increases the fraction of events with no fast component, but still ~50% of total Q events have Fast_Q
- In Q, fraction of fast light decreases with doping: from ~ uniform distribution between ~0.1-0.5 to <0.2 for Q (determination of the 90% population tbd)
- In NQ less evident trend (determination of the 90% population tbd)
- previously observed lobes visible in the slow component, absent in the fast
- The few photons (~2) observed in 50% of Q events may be generated inside the XA (WLS plate and/or Cerenkov in quartz/dichroic filters, or in LAr contained in the XA): in this hypothesis the Q_fast should be considered as an “offset” to the total light (hence subtracted)