Synchronization of Detector Signals with LHC Clock  
(T.Y. Ling, 11/6/98)

• Make use of the LHC Bunch Crossing structure

LHC Bunch Structure
**EMU Timing Diagram**

Muon generated at IR

Anode amp/shaped pulse

Anode discrim output pulse

$\tau_{\text{DET}}$  350 ns (?)  Anode LCT

Cathode amp/shaped pulse

Cathode LCT  485 ns

3 $\mu$s  Lev-1 Accept

Read LCT data anode bits into FIFO

Read cathode data into FIFO

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After making channel-to-channel time alignment, we expect the spread in $t_{\text{DET}}$ to be:

$$\Delta t_{\text{DET}}$$

(for 3rd or 4th arrival out of 6 wire layers)
• **Determine the detector-LHC phase difference**
  - Take data with LHC beam-on
  - Readout *anode LCT bunch crossing number* whenever LCT trigger fires
  - Plot *anode LCT bunch crossing number* and compare with master LHC bunch crossing structure

![Diagram showing LHC bunch crossing numbers and anode LCT bunch crossing numbers](image-url)
• Data can be sharpened by fine phase adjustment
Estimate Length of calibration run

- Assume 1 kHz LCT rate per chamber @ $10^{34}\text{cm}^{-2}\text{s}^{-1}$.
- Fill histogram of 3564 bins, 50 evts/bin, takes about 3 min.
- At $10^{32}$ lumi, length of run $\sim 300$ min or 5 hours!
- No need to go full LHC cycle, since sub-structure repeats 12 time per cycle. Length of run $\sim 25$ min @ $10^{32}\text{cm}^{-2}\text{s}^{-1}$. 