3/4/98
B.Baldin

Note on MFC/TFC timing

This note describes a few aspects of Muon Fanout Card (MFC) and Trigger Fanout Card (TFC) timing issues. It is necessary to understand relative timing for all the elements of the muon system in order to design and set it up properly. Typical diagram of the muon system timing is presented in **Figure 1**. MFC is a source of all timing signals for the entire Geographical Section (GS). Possible inputs to the MFC are TFW timing, internal sequencer and TFC timing. TFC timing can be synchronized to the TFW timing or be independent. The goal for the TFC design is to minimize setting changes when switching from TFW timing to TFC timing and back. Expected difference between TWF and TFC timing relative to the beam is equal to the propagation delay from MFC to TFC and back. Timing adjustment delays in front-ends can compensate this difference. **Figure 1** assumes no difference between timing sources mentioned above.

Timing sequence generated by MFC arrives at front-end (FE) location after *Cable delay 1* that includes cable delay between MCH and FE and, also, FE beam adjustment delay. At this point timing is synchronized to the beam. When event occurs, event data is stored in the FE pipeline and also trigger signal is send up to the MCH to signal TFC that event needs to be readout. In our example this happens at crossing number six. (see FE timing in **Figure 1**). The trigger signal will be delayed by *Cable delay 2* while it is propagating to the TFC location. TFC will have an internal adjustment delay to compensate for big FE pipeline delay set to the Level 1 decision time. The TFC internal delay will eliminate re-adjustment of the pipelines when timing is switched to the TFC timing. The delay will have fine settings 0 to 7 in 53 MHz steps and coarse settings 0 to 4.8 μS in 53/7 MHz steps. The delay settings have to be adjusted that way, that setup and hold for logic generating L1 Accept signal associated with the trigger are fully satisfied. L1 Accept signal arriving at the FE location will have to meet data flowing out of the pipelines at delayed crossing number six, if all the settings are correct. The data will then be registered and transferred to the MCH via standard muon data interface. Observing **Figure 1**, one can derive simple equations describing relationship between different settings.

$$P_{min} = T_{cab1} + T_{cab2}\,, \qquad (1)$$

where P is pipeline delay, T_{cab1} and T_{cab2} are cable delays.

$$D = P - (T_{cab1} + T_{cab2})\,, \qquad (2)$$

where D is TFC delay and the other members are the same as in equation (1).

$$\Delta X = X_{TFC} - (T_{cab1} + T_{cab2})\,, \qquad (3)$$

where ΔX is crossing counter offset necessary to generate correct crossing number for L1 Accept, X_{TFC} is TFC crossing number at the time of trigger arrival, and the other members are the same as in equation (1).

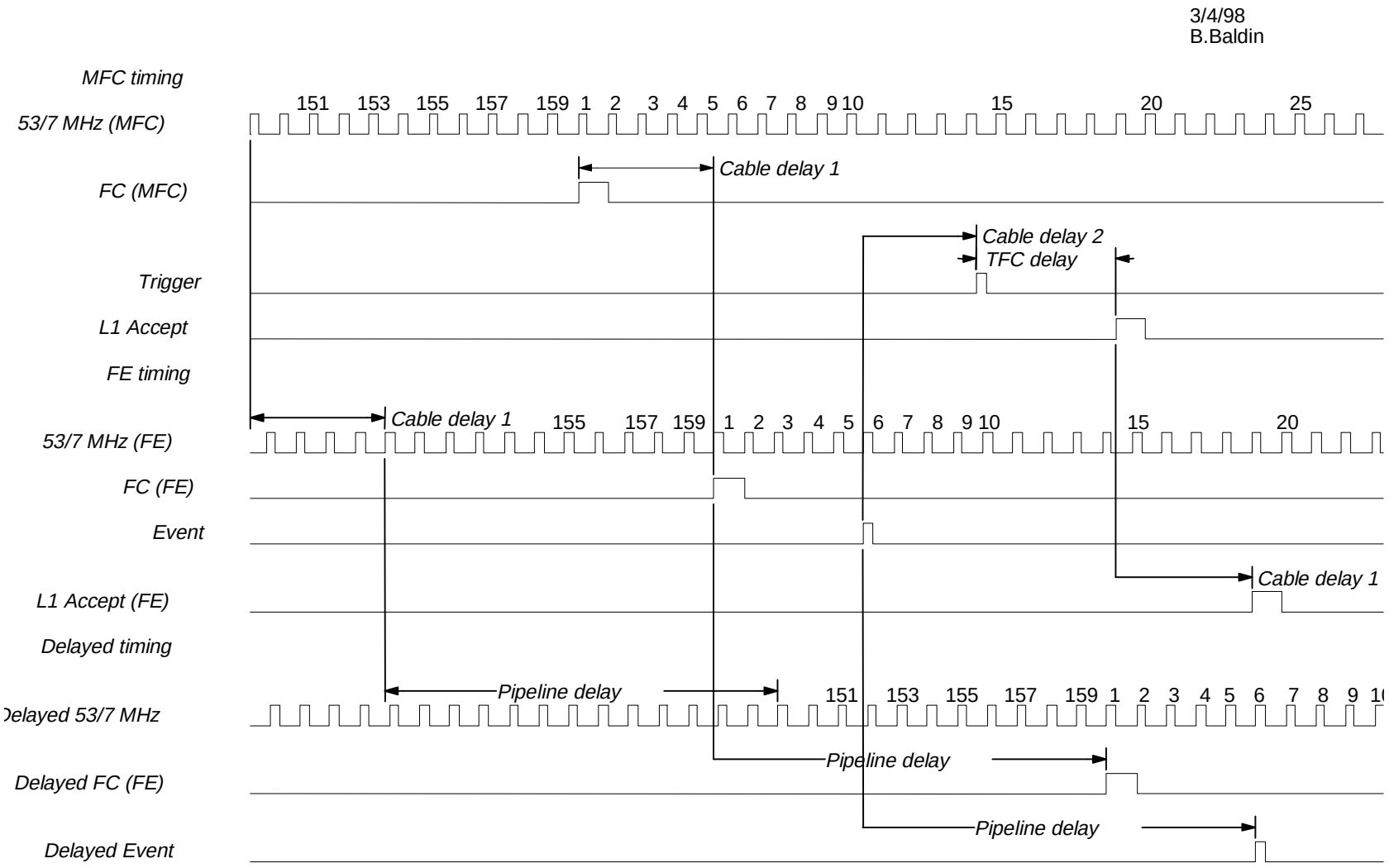

Figure 1. Muon System Timing Diagram.