

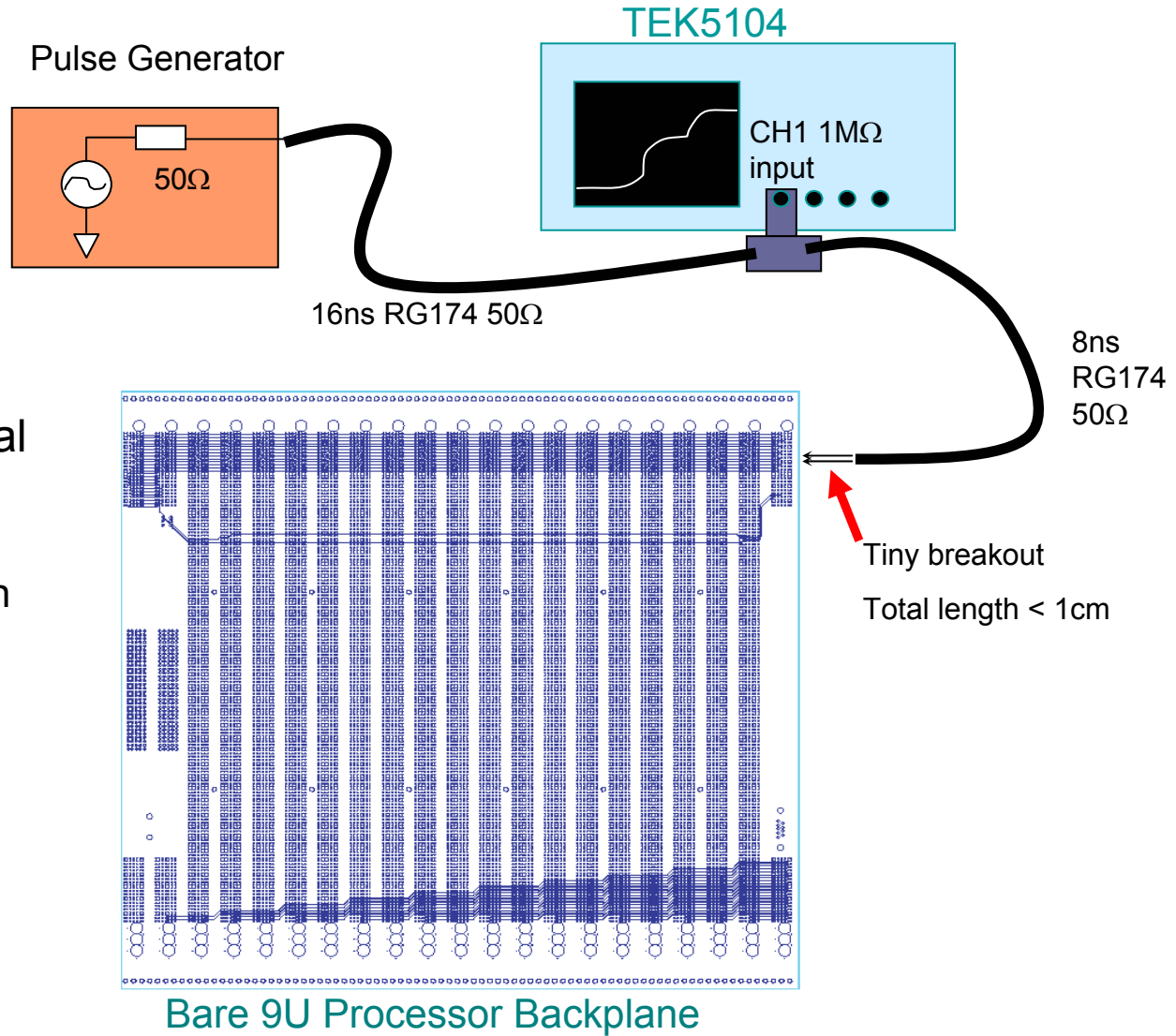


ATLAS T1

# Processor Backplane Impedance Tests

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ATLAS L1 Calorimeter Trigger Joint Meeting, RAL  
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# Test Setup

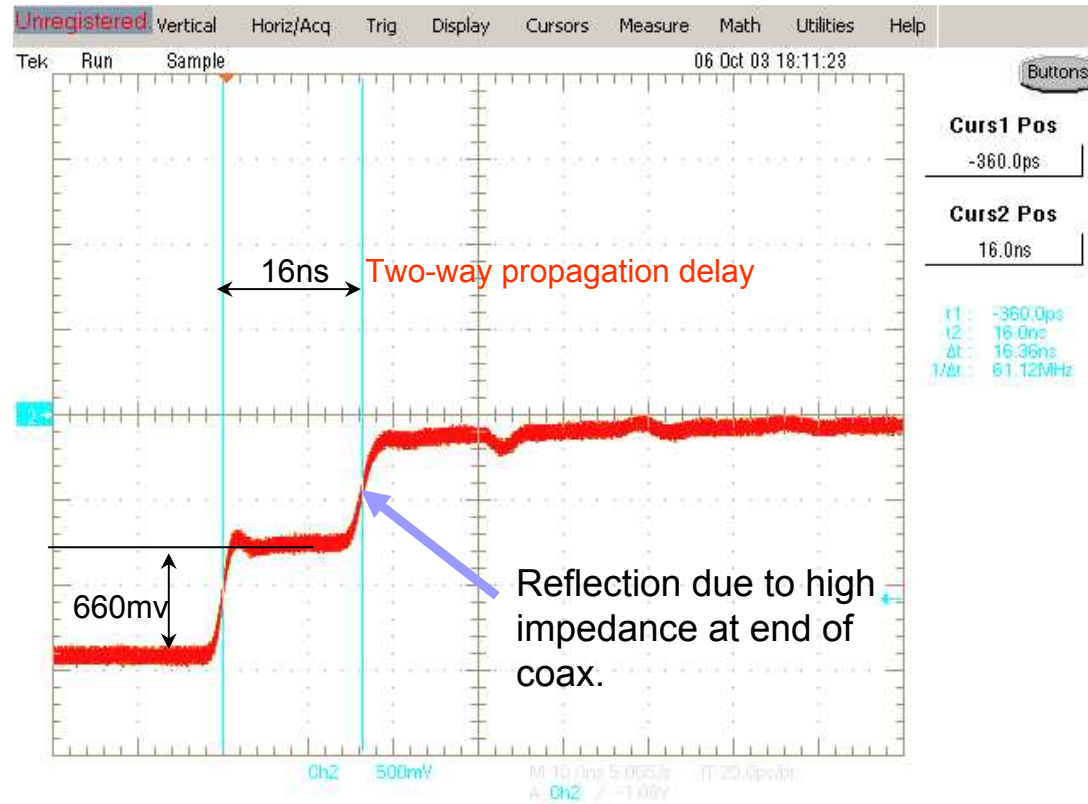


- Test Principal
  - Time Domain Reflection

# Test Pulse Shape on Scope



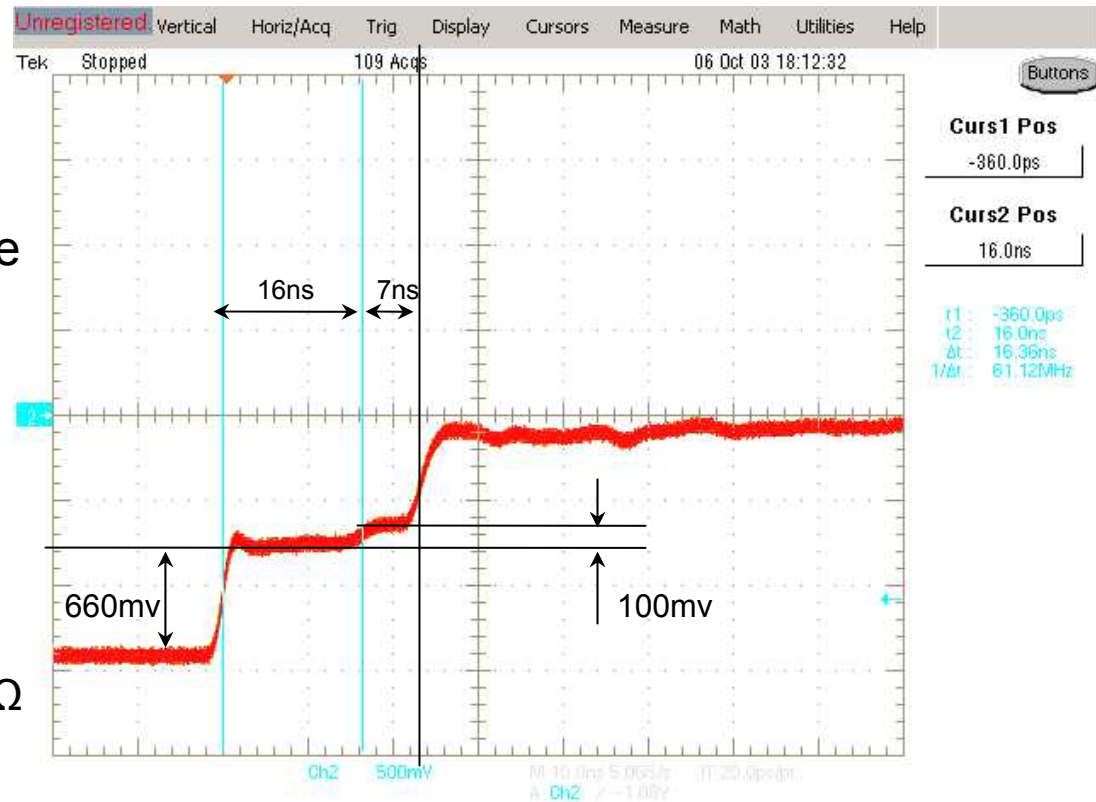
- Rise Time
  - 2.2ns
- The Breakout is left open.



# Merge signal trace impedance



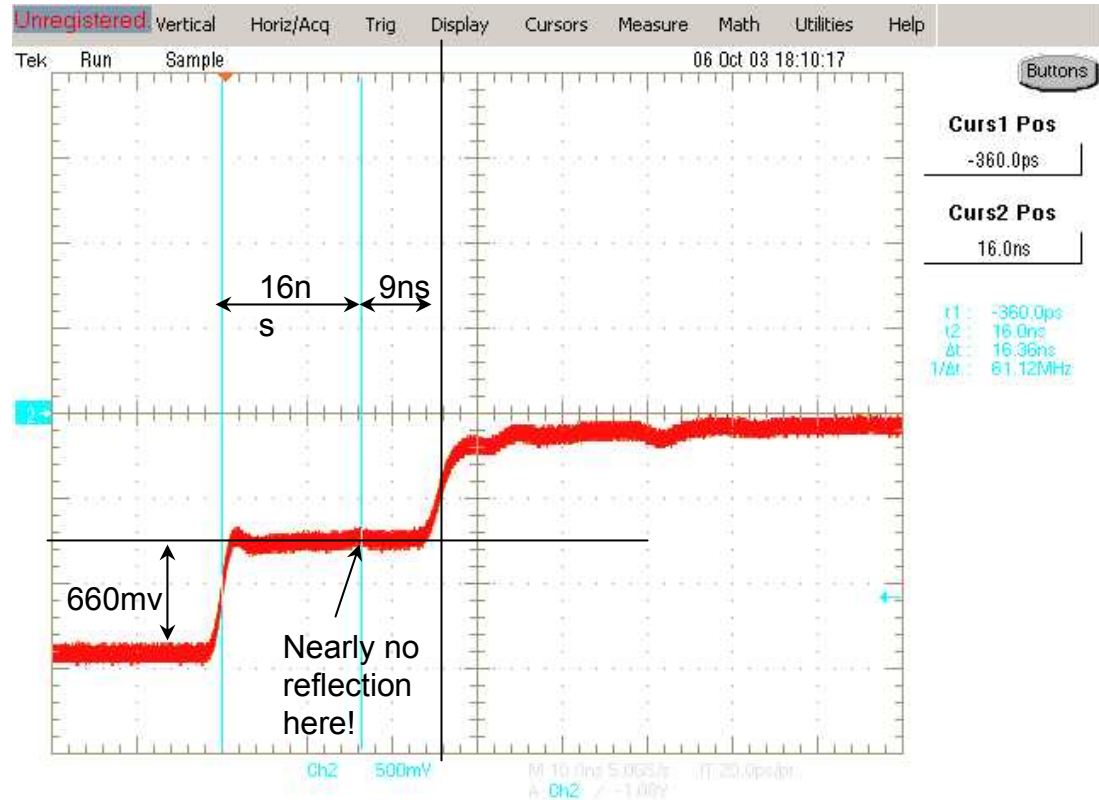
- SMM0 of CPM/JEM  
15 slot
- Longest merging line propagation delay
  - 3.5ns
- Reflection  $\rho$ 
  - $100/660=15\%$
- Trace Impedance
  - $Z_{\text{coax}}*(1+\rho)/(1-\rho)$
  - $1.35Z_{\text{coax}} \sim 67.5\Omega$



# VME-- Signal Trace Impedance



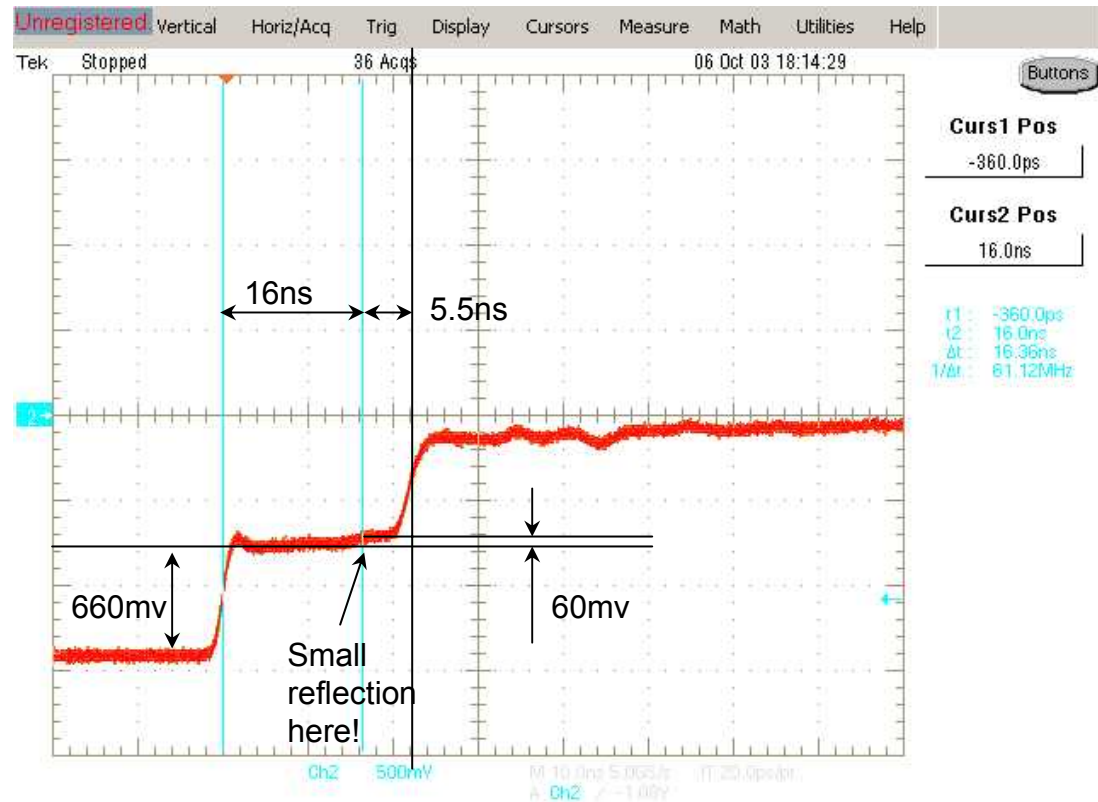
- VMED00 pin of TCM slot
- Longest VME-- signal propagation delay
  - 4.5ns
- Nearly no Reflection
- Trace Impedance
  - $\sim 50\Omega$



# TTC Signal Trace Impedance



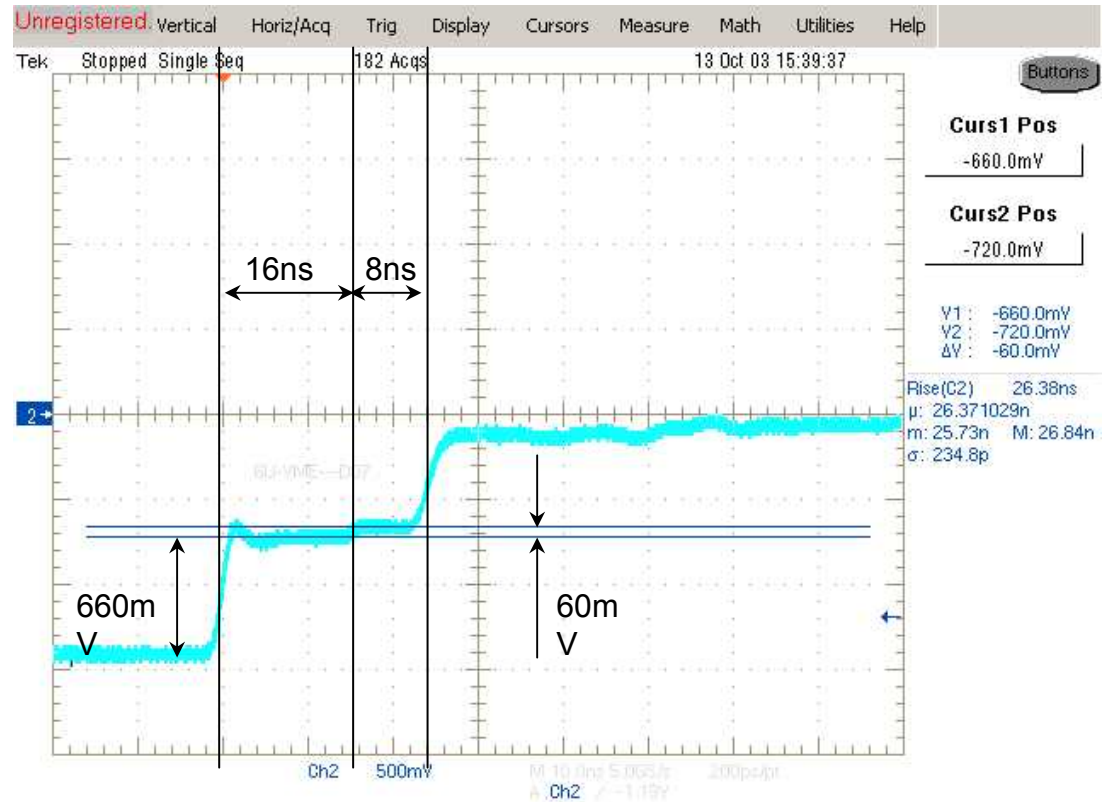
- TTC+ pin of CPM/JEM 1 slot
- Longest TTC line propagation delay
  - 2.75ns
- Reflection  $\rho$ 
  - $60/660=9\%$
- Trace Impedance
  - $Z_{\text{coax}}*(1+\rho)/(1-\rho)$
  - $1.20Z_{\text{coax}} \sim 60\Omega$



# Standard 6U VME Backplane Impedance



- D07 pin of slot 21
- Longest propagation delay
  - 4ns
- Reflection  $\rho$ 
  - $60/660=9\%$
- Trace Impedance
  - $Z_{\text{coax}} \cdot (1+\rho)/(1-\rho)$
  - $1.20Z_{\text{coax}} \sim 60\Omega$





- The single-ended signal (e.g.. merging line) trace impedance on PB ( $67.5\Omega$ ) is  $\sim 10\%$  higher than its specification ( $60\Omega$ ).
  - Corresponding  $\sim 5\%$  reflection
- The connectors and plated-through holes on the VME-- bus trace cause its impedance to drop by  $\sim 25\%$  ( $67.5\Omega \rightarrow 50\Omega$ ).
- The VME-- bus trace impedance on PB is  $\sim 50$  ohms, which conforms to VME specification. From signal integrity perspective, VME-- buses on PB should be able to work reliably.



- VME-- signal trace width on PB is only 6 thousandth, which is much narrower than a standard 6U VME backplane.
- Current-carrying capacity
  - 6-thousandth-wide trace of 1-oz copper (1.35 thousandth): ~400mA
- VME interface driver: ~64mA
- One method to increase the trace width while remaining its impedance higher than 50 ohms
  - Cut the copper area over the VME-- buses on top and bottom chassis ground planes

