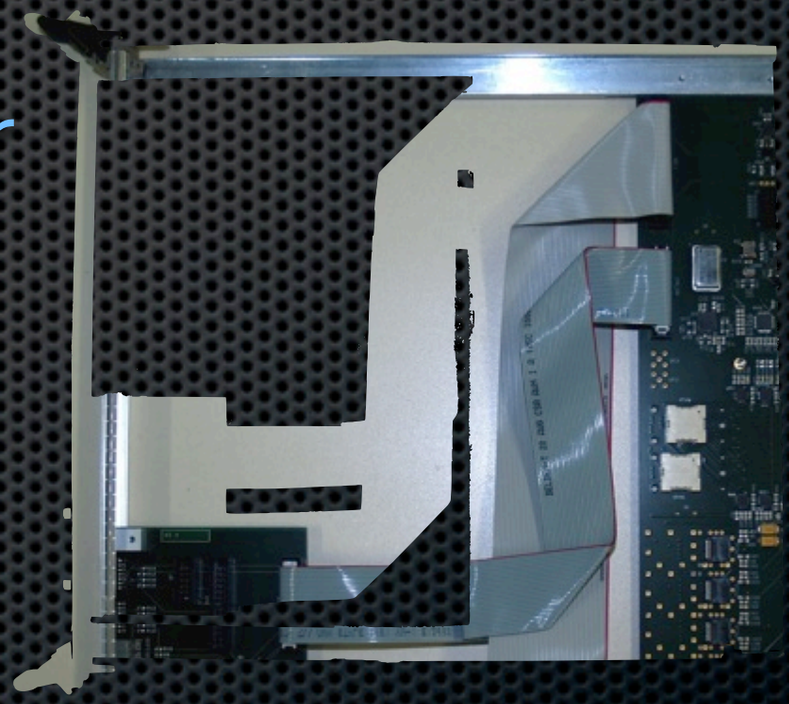
CP/JEP backplane speed tests

Level-1 Calorimeter Trigger
Joint Meeting
Mainz, 30 June 2009



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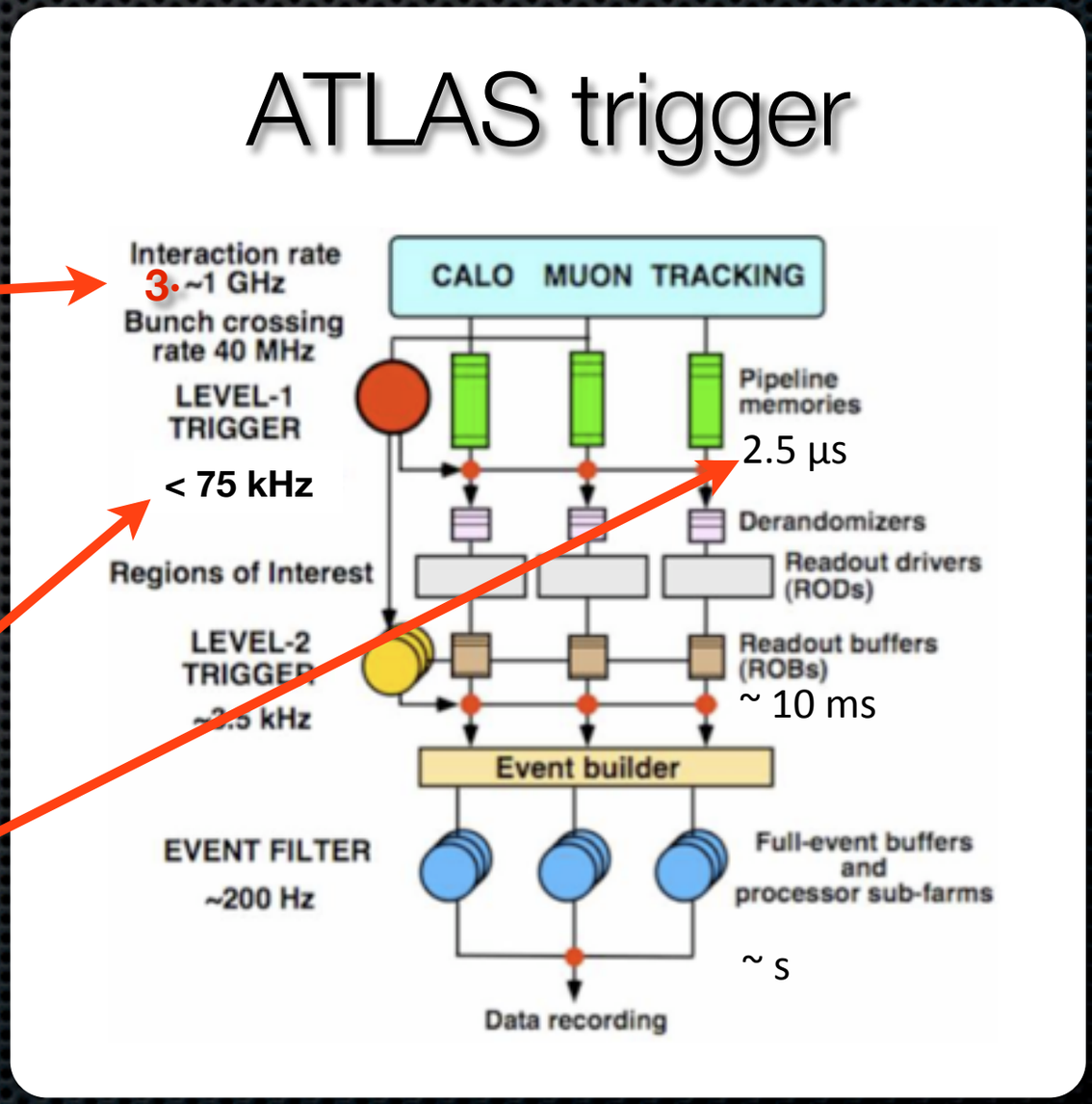
Motivation

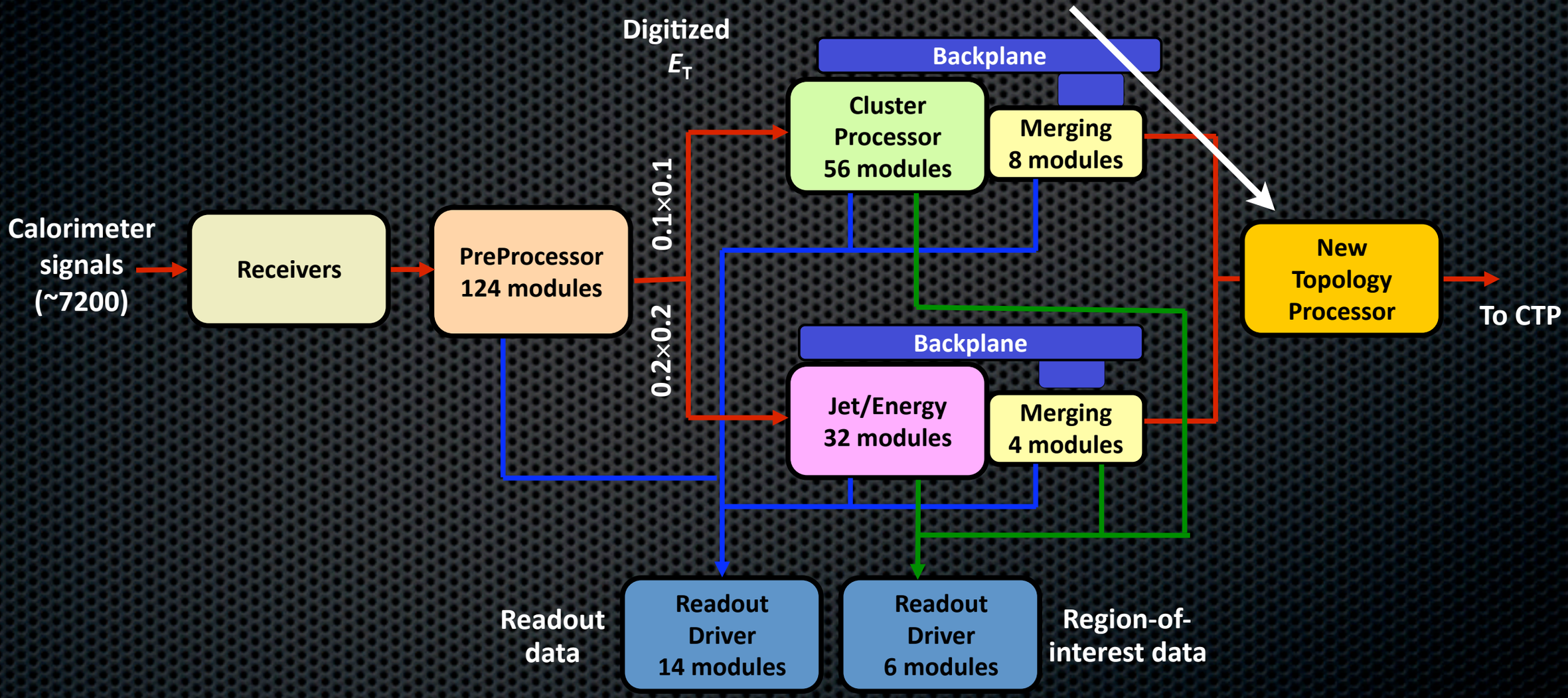
SLHC phase 1:

- increase in luminosity by a factor of ~3
- pile-up: ~60 events per bunch crossing
- Level-1 latency and output trigger rate doesn‘t increase
- **challenge for Level-1**



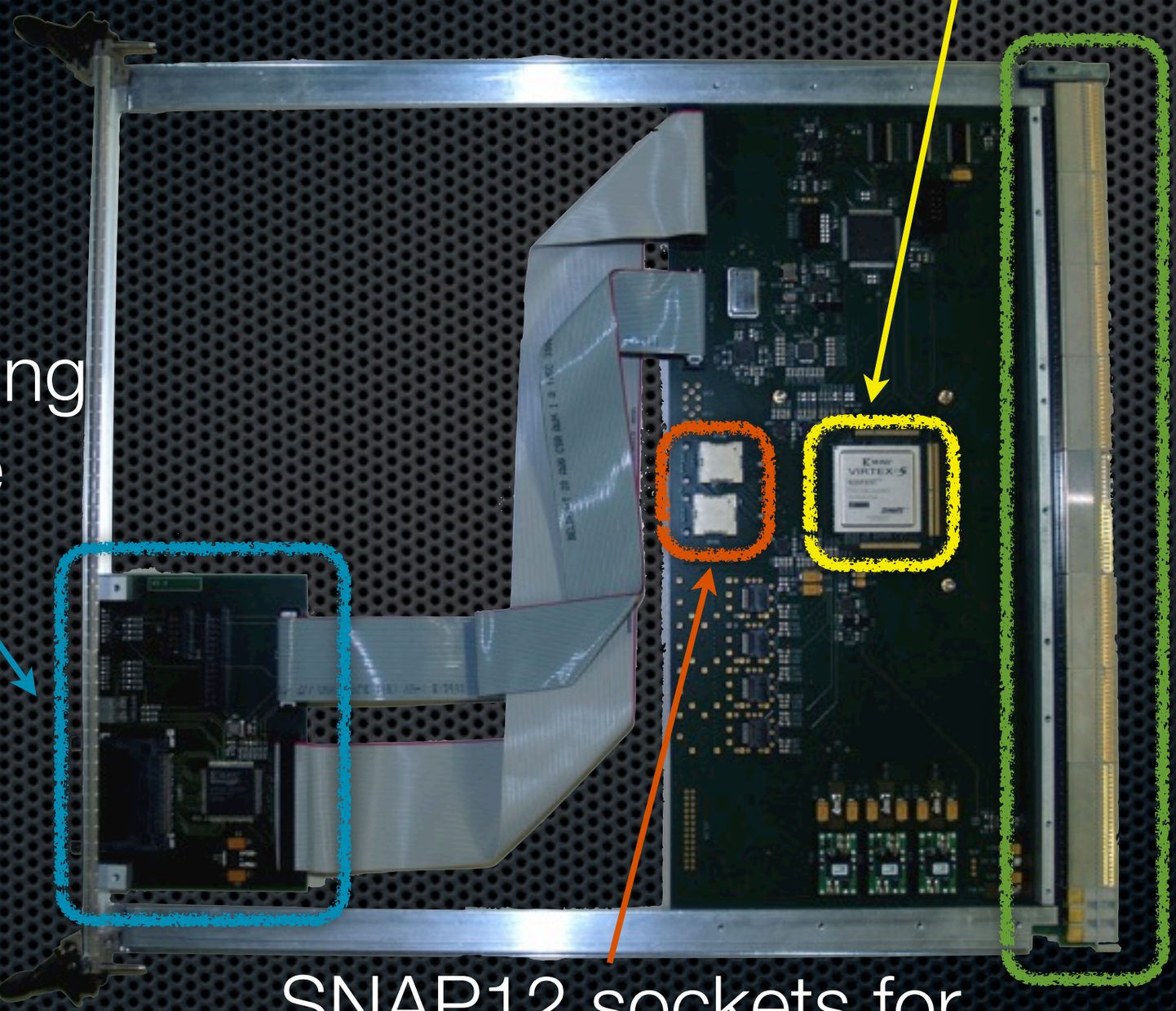
L1Calo upgrade szenario

- Idea: add topological processor to Level-1

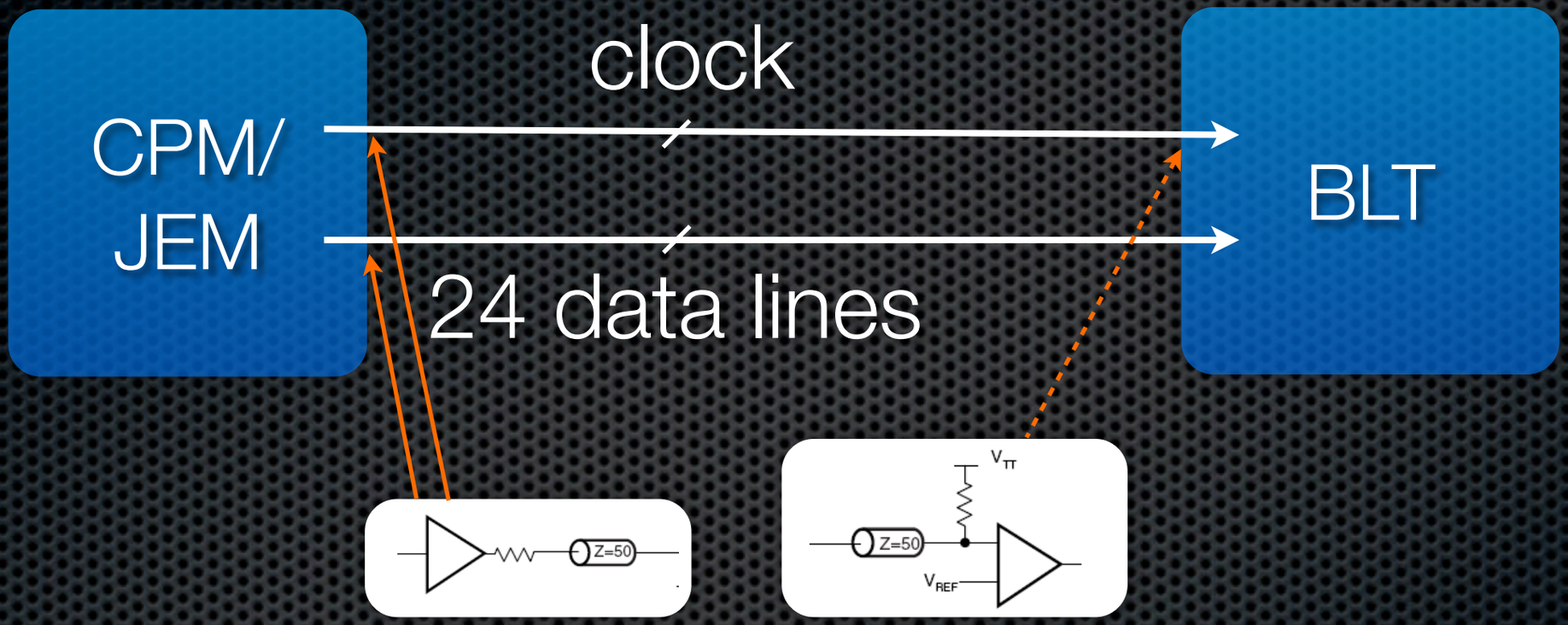


- **check for extra bandwidth on CP/JEP backplane**
  (currently: 40 Mbit/s, i.e. 50 bits per CPM/JEM per BC)

The backplane and link tester (BLT)



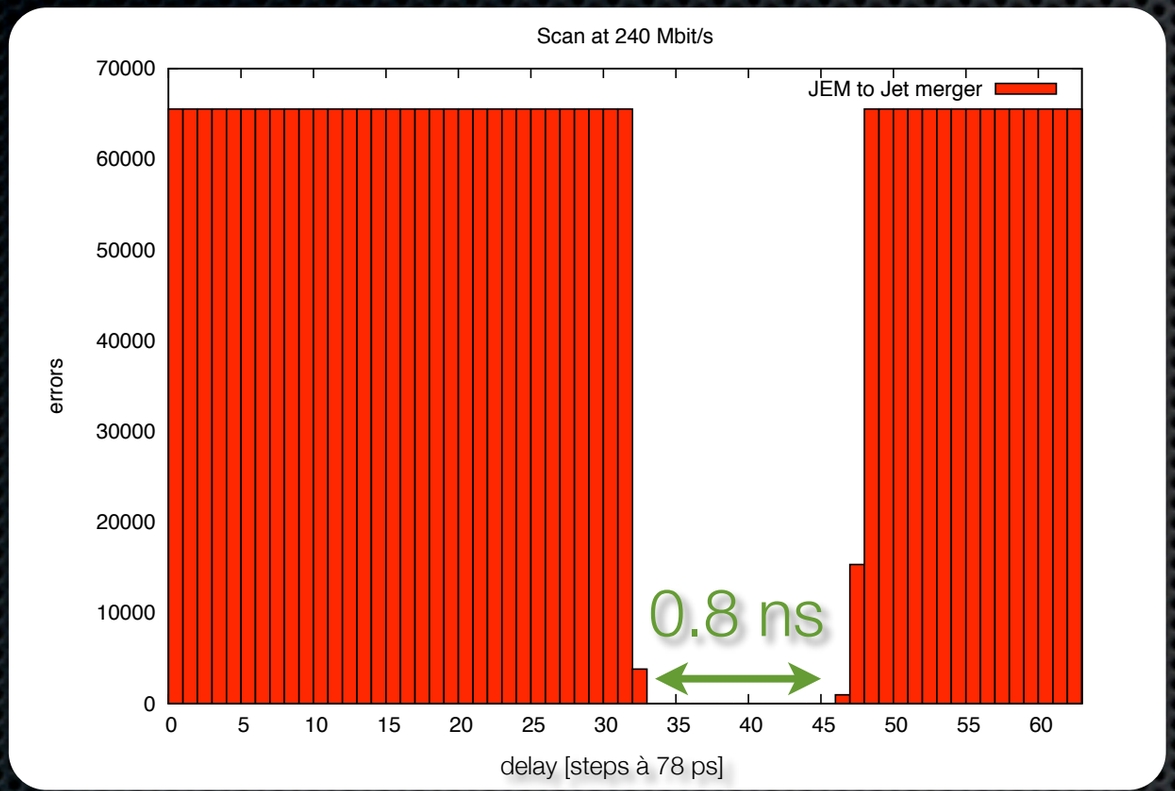
Transmission and test setup

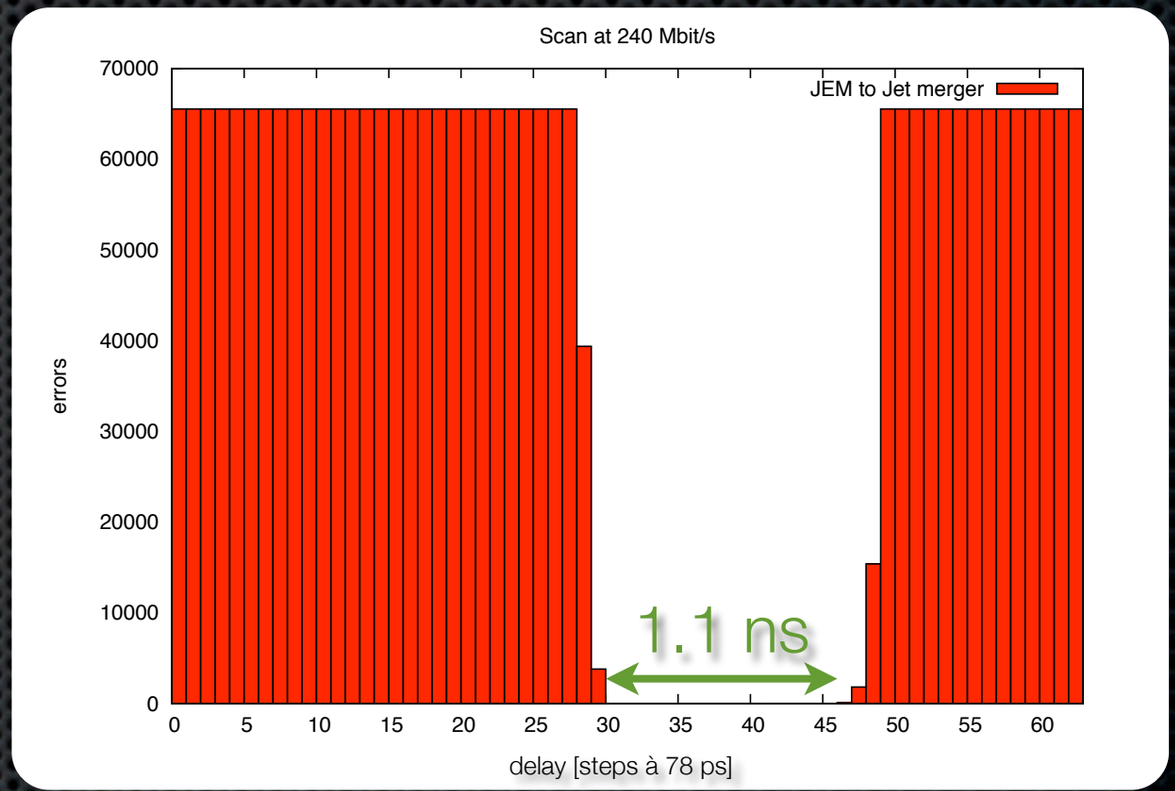


- bit 0: forwarded clock
- bits 1-23: shifted, serialised 16-bit counter (JEMs)/shifted PRBS (CPMs)
- bit 24: odd parity --> check for parity

- all lines 50Ω source terminated
- possibility of additional parallel termination at sink (BLT), but not possible for all lines (heat!)

Parallel terminated clock line

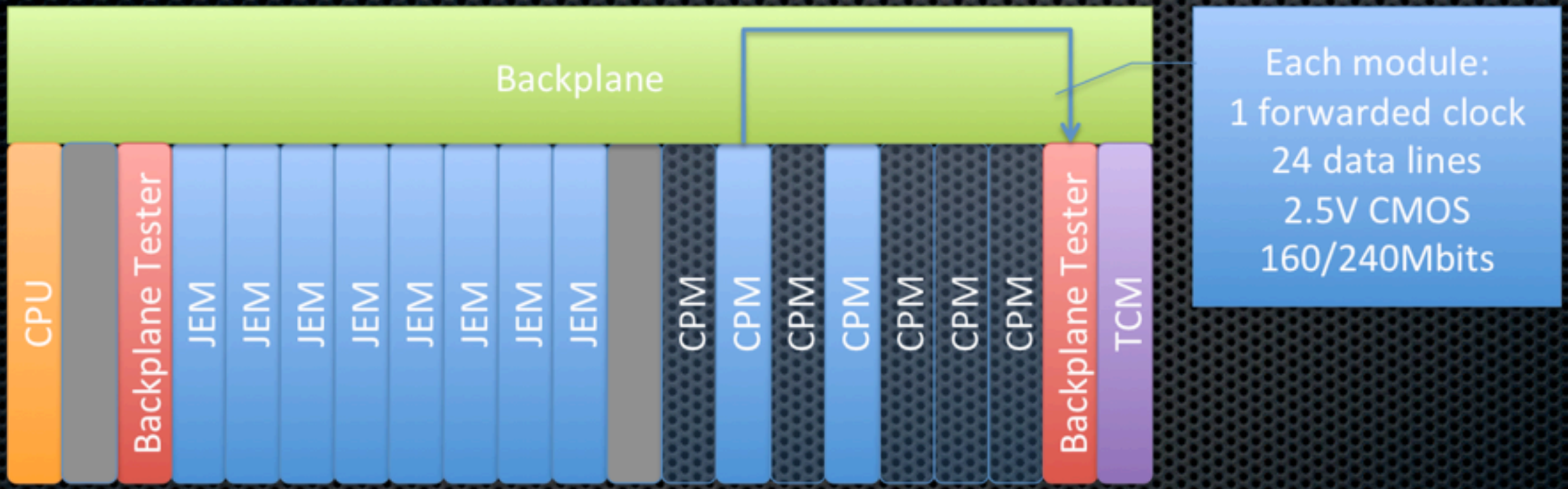




- significant improvement with terminated clock line

➡ use parallel termination for all clock lines

Testsetup at CERN testrig



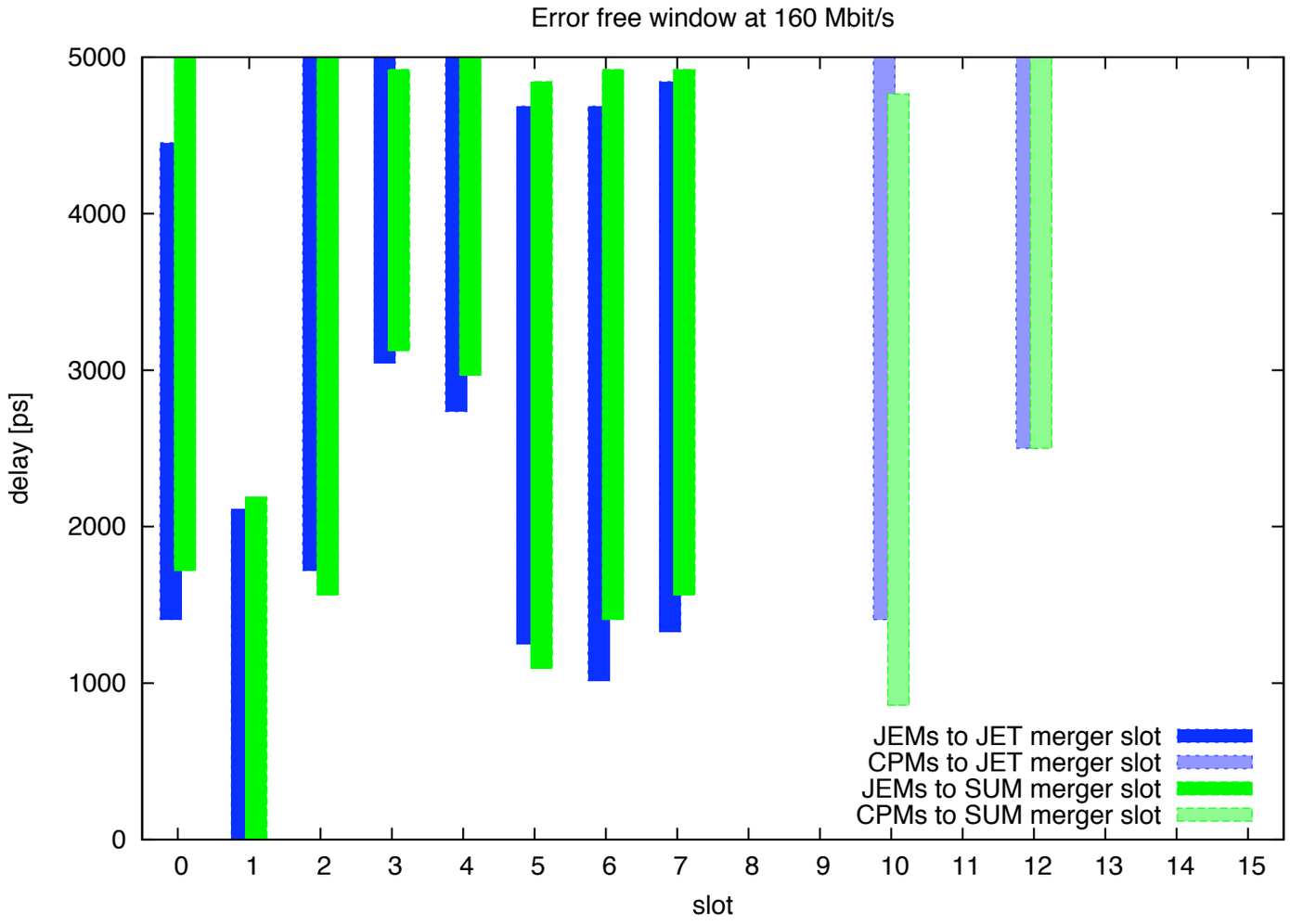
- Max. 8 JEMs and 2 CPMs were possible due to power oscillations
- the JEMs/CPMs generate a test pattern with 160 Mbit/s (240 Mbit/s)
- the backplane test module receives data and check for parity

→the bit errors are calculated and an error counter can be read out via VME

→phase correction of clock and data lines controlled via VME

- additional VME-traffic to check for crosstalk

Results at 160 Mbit/s



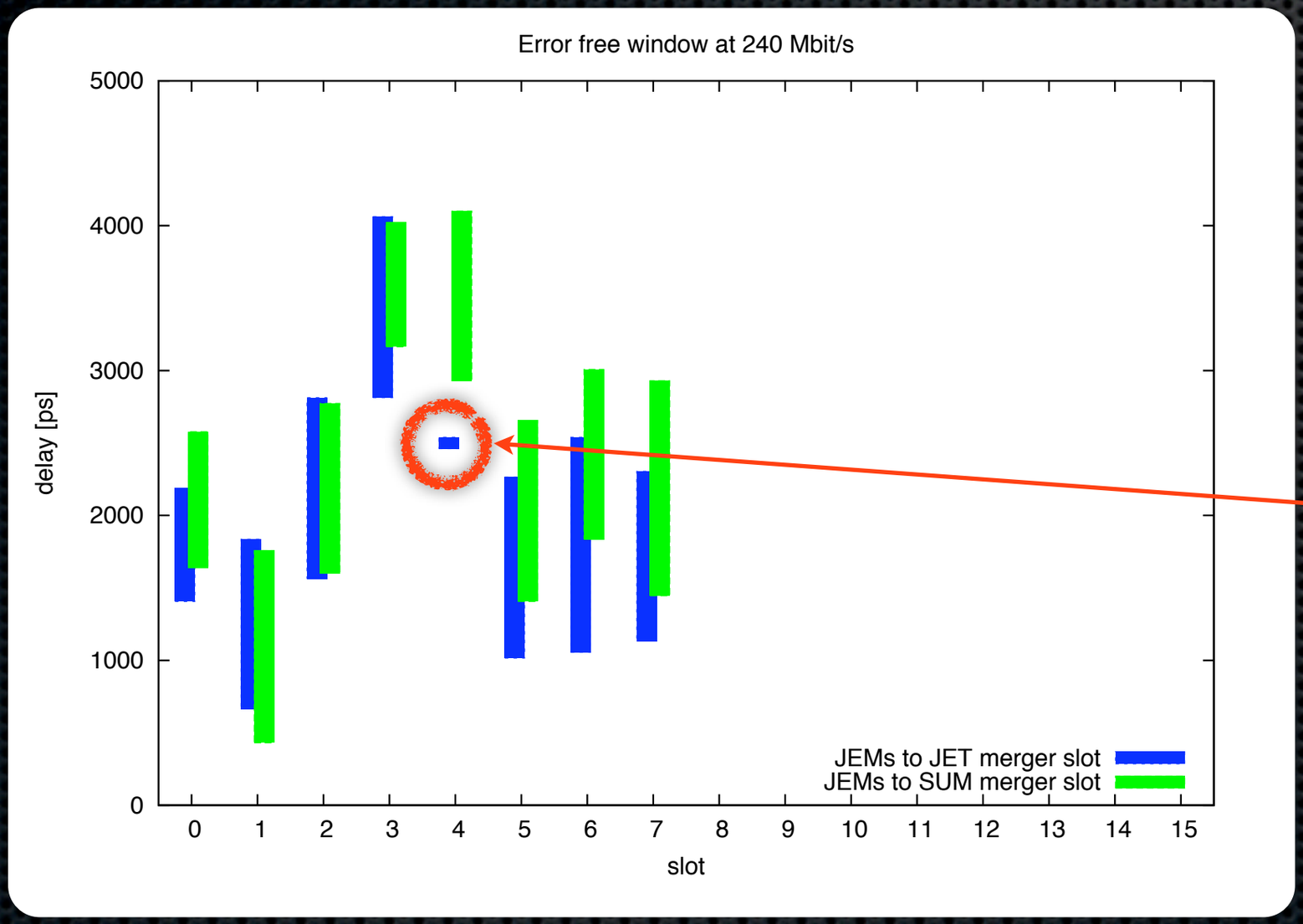
Window size for JEMs
to JET merger slot:
•2.0-3.7ns (3.0-3.7ns)
to SUM merger slot:
•2.1-3.5ns (3.3-3.5ns)

Window size for CPMs
to JET merger slot:
•2.5-3.6ns (3.6ns)
to SUM merger slot:
•2.5-3.9ns (3.9ns)

No errors:
BERT < $2 \cdot 10^{-14}$

160 Mbit/s seems to be possible without any problems

Results at 240 Mbit/s



Window size for JEMs to JET merger slot:
- 0.6-1.3 ns
  (slot 4: 0.0 ns)

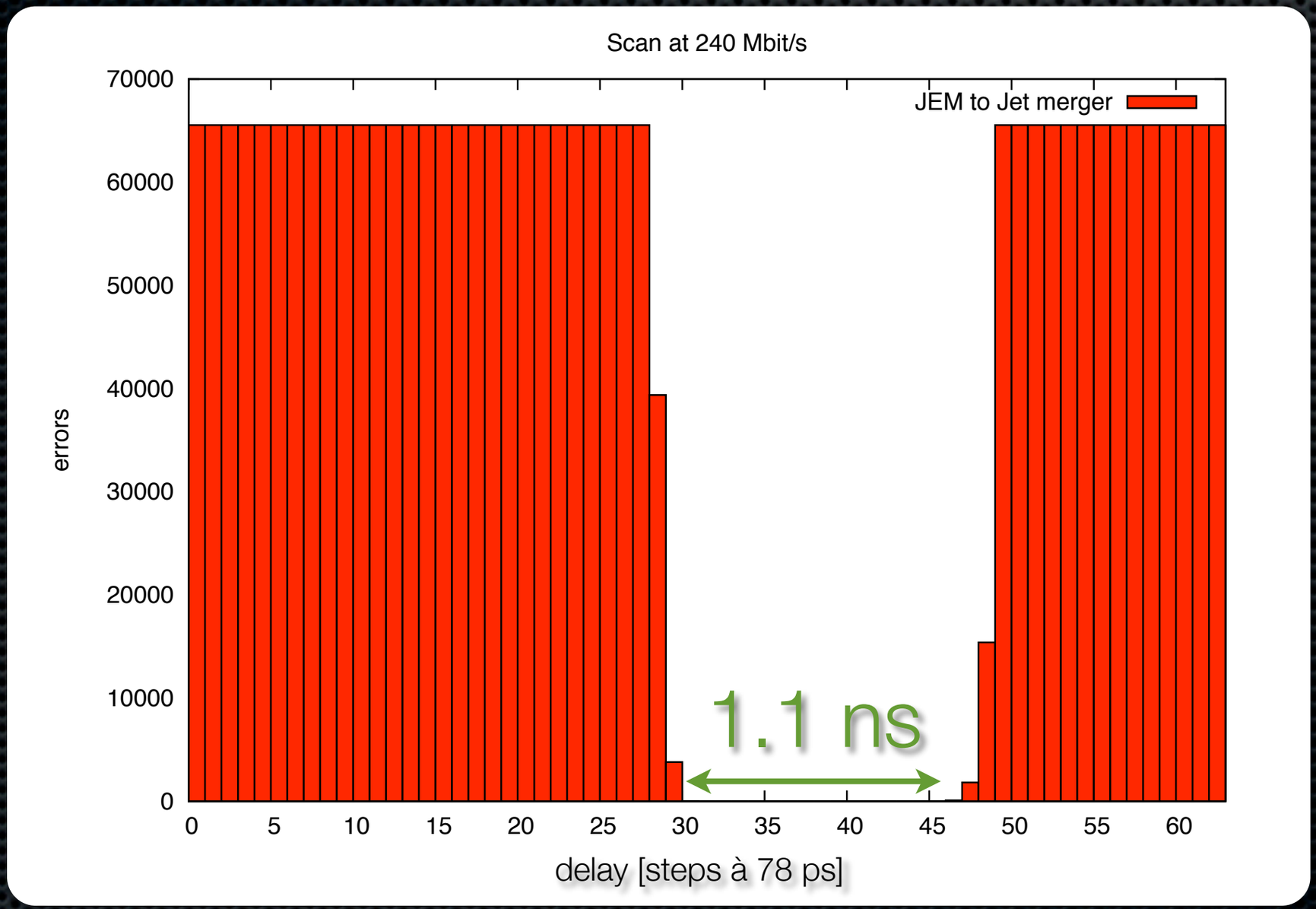
to SUM merger slot:
- 0.9-1.5 ns

Slot 4, JET side:
BERT > $5 \cdot 10^{-8}$

Other slots no errors:
BERT < 10^{-12}

240 Mbit/s possible, but what's with slot 4

Slot 4 measurements at Mainz test rig



- everything seems to be okay

➡maybe some problem with the JEM at CERN

Summary and conclusion

- for the JEMs datarates upto 240 Mbit/s seem to be possible to transmit over the backplane

➡ 6 x data --> 300 bits per JEM and BC

- for the CPMs datarates upto 160 Mbit/s are possible

➡ 4 x data --> 200 bits per CPM and BC