ALCT Technical Status

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• ALCT2001 status
• Test stand
• TMB-ALCT-CFEB test
• Conclusion
ALCT2001 Boards

Main board for 384-channel type

Power, computer connectors

80 MHz SCSI outputs (to Trigger Motherboard)

Delay/ buffer ASICs, 2:1 bus multiplexors (other side)

Input signal connectors

Analog section: test pulse generator, AFEB power, ADCs, DACs (other side)

Xilinx mezzanine card
ALCT Functions

1. Inputs discriminated signals from AFEB front-end boards, provides AFEB support:
   - Distributes power, shut-down, test pulse signals.
   - Sets and reads back discriminator thresholds.
   - Monitors board currents, voltages, and temperature.

2. Delay/translator ASIC on input does time alignment with bunch crossings.

3. Searches for muon patterns in anode signals. If found, sends information to trigger motherboard.

4. Records input and output signals at 40 MHz in case of level 1 trigger.
ALCT Status

- ALCT is the CSC anode trigger and readout board (anode local charged track).
- ALCT2001 is in pre-production.
- Minor modifications to ALCT2001.
- Have 288- and 672-channel board.
- 6 672-channel boards send out for assembly end of this week.
- Layout for mezz board for Virtex 2 chip finished. (maybe used by TMB. Additional inputs and outputs)
- ALCTs: 30  Mezz: 40
ALCT Status

• Small mistakes in layout to fix (1 wrong capacitor and 1 missing connection)
• 6 delay chips replaced
• Replaced 1 multiplexer
• Some shorts between inputs and outputs
• 3 mezz boards broken. (Missing connections)
• For assembly of more ALCT and mezz boards still two components missing. (voltage reference 1.2 V, Xilinx EPROM).
ALCT status

• Tried out diverse manufacture companies (Problem with bubbles for mezz board)
• Found problem with company. Different production company.
• Problems with assembly. First 10 boards had a lot of problems. Next 20 much better.
• Try another assembly company. Send the 6 672-channel boards there.
• Iatsura finished files for all types of boards and sent them to the assembly companies for quotations.
ALCT Test Procedure

• Complete test of the ALCT board and mezz board. (Documented and on the web)
• It tests complete functionality of ALCT and mezz board.
• Includes manual test of the delay chips. (To improve). This test step itself could damage the delay chips.
• Burn-in ALCT board and mezz board for two days at 70 C with power on. Repeat all tests after burning.
• Use students to help with the testing. At moment 2, thinking of hiring 2 more.
• It takes 5 days to test 8 boards if not too many problems occur.
• Could be much faster if manual testing could be reduced or replaced.
Problems encountered

• Change 1 multiplexer. Not working.
• The main problem found was related to the delays chips.
• After testing the last 8 ALCT boards 6 delay chips had to be replaced and several connections re-soldered:
  • Shorts between two inputs. (1 delay chip)
  • Wrong input resistance for inputs (2 delay chips)
  • 1 broken delay chip.
  • Delays too small (2 delay chips) compared to setting
• To investigate delay chip failure three boards were powered for 9 days at room temperature. No additional failures were seen.
Test stand
Testing Delay ASICs
Test firmware

- Use firmware developed by Zhmakin.
- Depending on the test 3 different test firmware have to be downloaded.
- Presently the delay chips have to be tested manually. Cycle minimum and maximum delay and check with oscilloscope for 24 chips times 16 channels.
- Zhmakin working on automatic procedure for testing delay chips. Would improve test. Having help in Florida from other two PNPI engineers and Madorsky.
- Zhmakin is working on combining the diverse test firmware into one.
- The firmware needs to be modified to also test the 288- and 672-channel boards.
- In moment it takes 2 hours of hard work to test completely one board.
ALCT programs

• Barashko wrote testing program. It uses JTAG to communicate with the firmware developed by Zhmakin.
• It controls the Virtex and Spartan functions.
• Supplied the required libraries for the slow control functions to Stasko. (Implemented into DAQ code). Madorsky supplied the library for the Virtex functions.
• Still to implement fully automatic delay test (?) and speed up other tests.
ALCT Test Program

ALCT Test Program (Ver. 0.1.8.6)

Setup | Firmware | Slow Control | Delay Chips | Test Board RFQ | Stability | Script Engine

Communication

Drivers
- LPT Driver
- JTAS Driver

LPT #: 1

Select X/Blaster Channel
- Virtex Programming
- Set Chain

to JTAG < - - - > to PC

Manual JTAG Commands

IR
- Value in Hex: 0000
- Length, bits: 13

DR
- Value in Hex: 0000
- Length, bits: 32

Reset

ID Codes
- Read All IDs
- Virtex 600
- Delete

Mezzanine Board Type

10:11:20 AM > IR- > 13 bits: Value 0x0000
10:11:20 AM > IR- > 13 bits: Value 0x0501
10:11:25 AM > IR- > 13 bits: Value 0x0FF
10:11:26 AM > IR- > 13 bits: Value 0x0501
10:11:27 AM > DR- > 32 bits: Value 0x00000000
10:11:27 AM > DR- > 32 bits: Value 0x21460126

Set Virtex Programming Chain

# | Test Type | Status

Martin von der Mey, Emu Meeting in Florida, April 2002
ALCT-TMB Testing

- Standalone bench tests
- Radiation tests
- Cosmic ray tests
- ALCT-TMB test
TMB-ALCT-CFEB Test
• Using DYNATEM to communicate from a Linux PC to the VME crate.

• New software has been written to control TMB functions using socket connections. Needs to be improved. (OSU) Maybe it is necessary to agree to one protocol (?)

• Injected patterns into the delay lines of the ALCT using self triggering. Injected patterns into the CFEBs.

• Found maybe problems with the PHOS4-chips again. CCB uses them for delaying the clocks.

• Looked at the results on TMB side. It depended on how the CCB PHOS4-chips powered up in respect to the TMB PHOS4-chips.

• Next step is to write the software to decode the data coming to the TMB from ALCT and CFEB and check the data. (OSU?)
Conclusions

- ALCT2001 in pre-production.
- Test is running well. Hiring more students to perform testing.
- Waiting for improvements in test procedure including test of delay chips. Reduce manual testing.
- Sent 4 ALCT boards to Florida.
- 8 ALCT boards and 5 mezz boards ready to ship.
- 5 ALCT boards and 5 mezz boards ready for burning. (pre-test)
- Test including TMB/ALCT/CFEB works well. Found small problems.
- For start of full production ALCTs we are waiting for feedback from FAST sites.