P. Schacht, 15.10.99

EST Problems: Status 15.10.99

HV Problems during testbeam runs June-September

- CF01: EST2 L2 $\Rightarrow$ disconnected
- CF01: EST1 L2 $\Rightarrow$ hospital at 1400 $\Rightarrow$ disconnected 8.7.99.
- CR18: EST1 L4 $\Rightarrow$ disconnected 14.7.99.
- CR19: EST1 L4 $\Rightarrow$ disconnected 14.7.99.
- CF17: EST2 L2 $\Rightarrow$ disconnected 19.7.99.

In total: 5 HV problems out of 480 boards:
$\Rightarrow$ stable operation until end of runs 3.9.99.
$\Rightarrow$ data quality: perfectly OK

Immediate actions taken

- LPI: redo warm longterm HV tests at 3 kV rather than 2.5 kV
- MPI: add 15 min. HV test at 3.0 kV
  do cold tests (2) with 10/20 EST boards (without HV)
- TRIUMF: restart warm longterm HV tests at 3 kV
  start cold tests

$\Rightarrow$: Suspicion: Pinhole problem?
Kapton has NOT been tested for pinholes at the russian producer in contrast to the previous russian producer (which went bankrupt). $\Rightarrow$: Action: Preparation of large scale (288 boards) cold test at CERN, using Dupont kapton material (80 % of total amount of kapton to be used for EST production)

Situation after warming up in September

- from 192 HV tested EST boards: 55 failed!
- ⇒ Action: CR18, CR19, CR21 back to MPI for disassembling

Findings after disassembling CR18, CR19, CR21

The EST boards have tears at the 2 outermost tierod holes or at the innermost tierod hole, all oriented towards the outside. The tears extend partially thru the 2 mm HV guard zone (kapton + glue) until the CLK layers. The shorts are then at the edge of the 2 CLK layers (side A and B).
But: No other effects (e.g. pinholes) have been observed. Also no shorts in LAr gaps! ⇒ QC during stacking is OK!

Conclusion: The difference in shrinkage (N2 temperature) between the Cu plates and the EST board is larger than forseen (elliptic holes, except for positioning holes), acceptable shrinkage is 4 mm (as observed in module 0 (TRIUMF) EST boards).

First Analysis of EST Problems at MPI and TRIUMF

- Positioning of outermost and innermost tierod holes: For few boards these positions have been compared with the related Padboard holes. Offsets of about 0.5 mm have been observed, but opposite at the 2 holes. This reduces the critical distance by about 1 mm.
- The holes have been cut and not punched as in module 0. The rips have a tendency to start at a knick (polygon rather than circle). The tolerances are larger.

Two types of EST boards have been produced:

- A
  Color: orange
  kapton thickness: 60-63 micron
  kapton+glue (both sides) thickness: 105 micron
  total board thickness: 160-175 micron
  glue:difficult to remove
  Tears: extend up to the CLK layer
  board shrinkage with respect to Cu: $8.3 \pm 0.3\,mm$
- B
  Color: yellow-orange
  kapton thickness: 75 micron
  kapton+glue (both sides) thickness: 90-95 micron
  total board thickness: 145 micron

glue:more easy to remove (acetone)
Tears: less, do normally not extend up to the CLK layer
board shrinkage with respect to Cu: $5.7 - 6.1 \pm 0.3\,mm$

All boards without HV problems are of type B
The glue (which is thicker in A) may be part of the shrinkage problem

Presently Proposed Scenario to Resume EST Production

- Measure shrinkage of new LPI EST boards (Dupont kapton).
- Modify elliptic holes in CLK and kapton for new situation (new SRD)
- Get punching tool of proper geometry to LPI, so all CLK foils available at LPI and the kapton can be punched (new geometry).
- Restart EST production at TRIUMF to close the EST production gap as fast as possible.
- Restart EST production at LPI
- Test first 100 EST boards at each site for thermal shrinkage
- Test LPI and TRIUMF boards at test beam (june 2000), inspect boards after this run (i.e.disassemble partially 2 modules)