Operating Manual for UK-B Electrical Tests

Dave Charlton
Version 0.4
24 May 2002

The main reference document for SCT electrical tests is *Electrical Tests of SCT Hybrids and Modules*, by Peter Phillips and Lars Eklund, available from http://hepwww.rl.ac.uk/atlas-sct/documents/Electrical_Tests.htm. This should be consulted for details of the test sequences, and the acceptance/defect criteria.

Hybrid and Module tests

As discussed in the UK-B site qualification document *Outline of UK-B Module QA Activities*, electrical tests of ASIC-stuffed hybrids are performed primarily in Birmingham with an acceptance test at RAL, whereas tests of modules are performed at the three university test sites, Birmingham, Cambridge and QMUL. Two types of tests are performed on both hybrids and modules – room temperature tests and long-term tests (LTTs). The long-term tests of hybrids and modules differ in two significant respects: the hybrid long-term test lasts (at least in the first part of production) for 100h and is run at elevated temperature, whereas the module long-term test is run for 24h cold.

The standard Mustard test system set-up should be used for all these tests, including a CLOAC to provide 100kHz triggers for the noise-occupancy tests if possible. It is recommended that test VME systems be left powered on during production, or at least only powered on or off with no hybrids/modules attached.

Hybrid Set-up

Hybrids are tested electrically in Birmingham on their production jigs. These are attached to water-cooled cooling blocks. Hybrid jigs must have the upper cover in place before testing commences. Support cards are attached to the patch card affixed to the hybrid jigs. The VME crate should be switched on, but the LV and HV power should be off, before connecting the support cards/cables to the hybrids.

The hybrid test set-up is identical for room temperature and long-term tests.

Module Set-up

Modules in old-style QMW module boxes can be connected directly to cooling water and N_2 if running a room temperature test. For the long-term test, N_2 should be flowed through the module box for some time before cooling down, and during the cooling procedure, and throughout the test and subsequent warm-up.

Modules in the new QMUL module box must be attached to a cooling plate before testing. N_2 should be flowed through the box as for the old-style boxes.

Test sequence names

Names have been devised to describe the standard test sequences for hybrids and modules, which are used in indexing the results for later analysis/storage/web display. The sequences defined are:

- Hybrid_Initial: the first test of a hybrid after ASIC attach (Birmingham)
- Hybrid_Longterm: hybrid long term test (Birmingham)
- Hybrid_Completion: the first test after the pitch adaptor is bonded (Birmingham)
- Hybrid_Reception: post-shipping hybrid acceptance test (RAL)
- Module_Initial: the first test after the hybrid is bonded (RAL)
- Module_Completed: completed module test (RAL)
- Module_Reception: post-shipping test (universities)
- Module_Longterm: module long term test (universities)
- Subsequent retests after any of these tests are denoted as Hybrid_Initial_Retest1, Hybrid_Initial_Retest2, Module_Longterm_Retest1 etc.

These sequence names are needed only when storing the results of the tests, and follow a UK-B convention. New sequence names may be defined in future.

Running the tests on hybrids or modules

1. Install devices to be tested as described above.

2. For a module room temperature test, start the N_2 flowing gently.

3. Turn on cooling.

   - For room temperature tests the chiller temperature should be set so as to obtain a hybrid thermistor sensed temperature within 3C of 25C.
   - For the hybrid long-term test (warm) it should be set to obtain a hybrid temperature of 37C. Care must be taken to avoid condensation on cooling pipes or blocks.
   - For the module long-term test (cold), the test is run in a cold environment (freezer or environmental chamber). Before cooling, dry the module box cooling channel. N_2 should be flowed through the module box before and during cooling at a reasonably high rate. The environment temperature is set to give a hybrid thermistor temperature of 0C. The next steps can be performed as the module is cooling, as far as step 8. Wait for the hybrid thermistors to reach 0C before starting the long-term test.

4. Check the `st_system_config.dat` defines the correct modules / hybrids.

5. In the same directory, check that the .det files exist, or that there is a default.det file, for the hybrids/modules in question. Check that .trim and .mask files do not exist, unless they are specifically required.

6. Start sctdaq.

7. Check that the hybrid power has come on. If it has not, try "LV recovery" from the main menu (can be repeated if it does not work first time, but only up to ten times).

8. Check the hybrid temperature and currents via DCSQuery.

9. If you have installed new cables, run the "Set Stream Delay" scan. This produces two integer values per hybrid/module (one per link), given as "optimum" in the printout. These values are loaded after the test, but may also be recorded for future use by changing the d0 and d1 values in the system config file.

10. For a module test, switch off the LV power to the hybrid, and wait for the hybrid thermistor temperatures to stabilise at around 20C (this may require the cooling water temperature to be raised, or for the cooling water to be temporarily stopped). Then do an I-V Curve. This will leave the HV on after the test. Switch the LV on.

11. Start the appropriate test sequence. For a characterisation test use a scope to do the hard-reset test.

12. The other tests in the sequence run on without intervention. For hybrids the typical length of a characterisation sequence from here on is about 60 minutes per hybrid, slightly longer for modules. This can vary (upwards!) quite a lot if there are noisy channels on the device, so be patient. For a six hybrid or module test, a characterisation can therefore take most of the day. The long-term test currently takes 100h(hybrids)/24h(modules), although this should be reduced with experience.

13. Keep an eye on the test while it is running, for program crashes.

14. When the test sequence has completed, shut down sctdaq via the "Exit" menu button. Confirm in the Rint window: type y (usually it gives you an error the first time: click on Exit again and type y again, and the system will shut down). Do **not** stop root using ".q" as this does **not** turn off the LV or HV power.

15. When sctdaq has exited, check that the LV and HV power lights are all off. If they are not, restart sctdaq and immediately "Exit". This should turn the power off cleanly.

16. Switch off the cooling. For the module long-term test care must be taken to keep the module in a N_2 environment until it reaches room temperature, to avoid any danger of condensation.

17. Disconnect devices under test.

18. Test sequence results may be analysed using perl scripts. The test sequence name (see above) is needed for these. Test results and root files should be archived and backed up, respectively.