Torrent Readiness Review

Manufacturing & Test

Manufacturing Overview

- It starts with an order…..
  - Orders are turned into customer specifications by the detector engineer assigned to the order.
  - The customer specifications are entered into the Torrent configuration tools (Torrent sysConfig).
  - The configuration tools then generate the basic system configuration files needed to build and run a Torrent DHE system. These files become part of the configuration documentation deliverable.
  - Any additional system information goes into the configuration documentation.
  - Hardware is assembled, configured, and tested per the configuration documentation package.
- The result is a configured Torrent DHE system ready to be integrated to a detector by a detector engineer.

Manufacturing - DHE Hardware Receiving

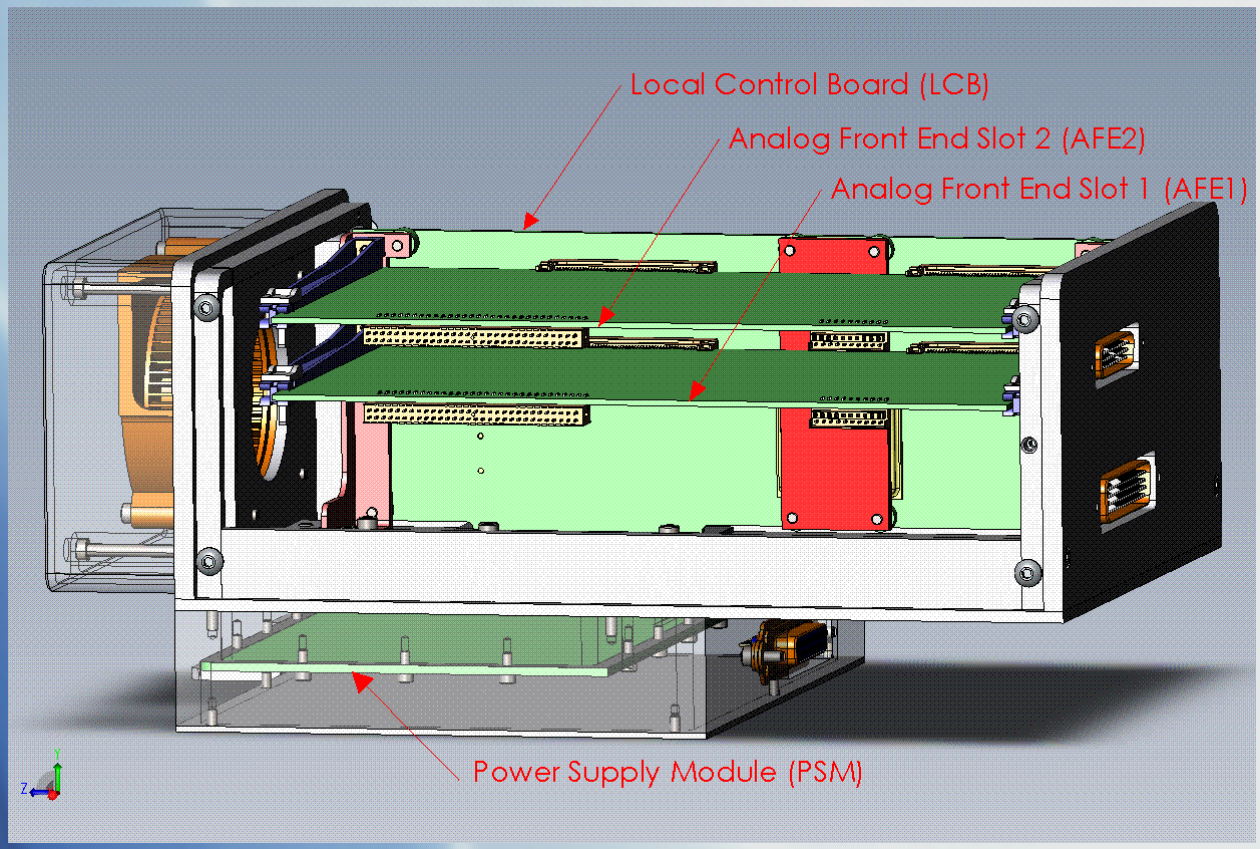
- The hardware to assemble a completed Torrent DHE consists of the electronics printed circuit boards, flex cables, and the mechanical housings for the circuit board assemblies.
  - Parts will be ordered to build multiple systems in order to minimize setup and other recurring fees.
  - Mechanical parts will be lot sampled for fit, form, and function upon receipt and then placed into inventory.
  - Electronics assemblies will be inspected according to existing incoming receiving procedures and placed into inventory.
  - Electronics assembly receiving procedures include visual inspection and power supply impedance checks.
  - Discrepant material is documented and returned to vendor for resolution. *The exception being minor rework to circuit boards.*

Manufacturing - DHE Mechanical housing subassemblies

- Mechanical parts will be assembled ready to have the electronics installed into them.
  - The controllers will be assembled “ready for PCB’s and flex cables” and placed into inventory.
  - The generic transition module’s (TSM) will be assembled “ready for PCB’s, wiring, and Dewar interface” and placed into inventory.
  - Custom transition modules will not be pre-assembled. They will be assembled on an order by order basis.

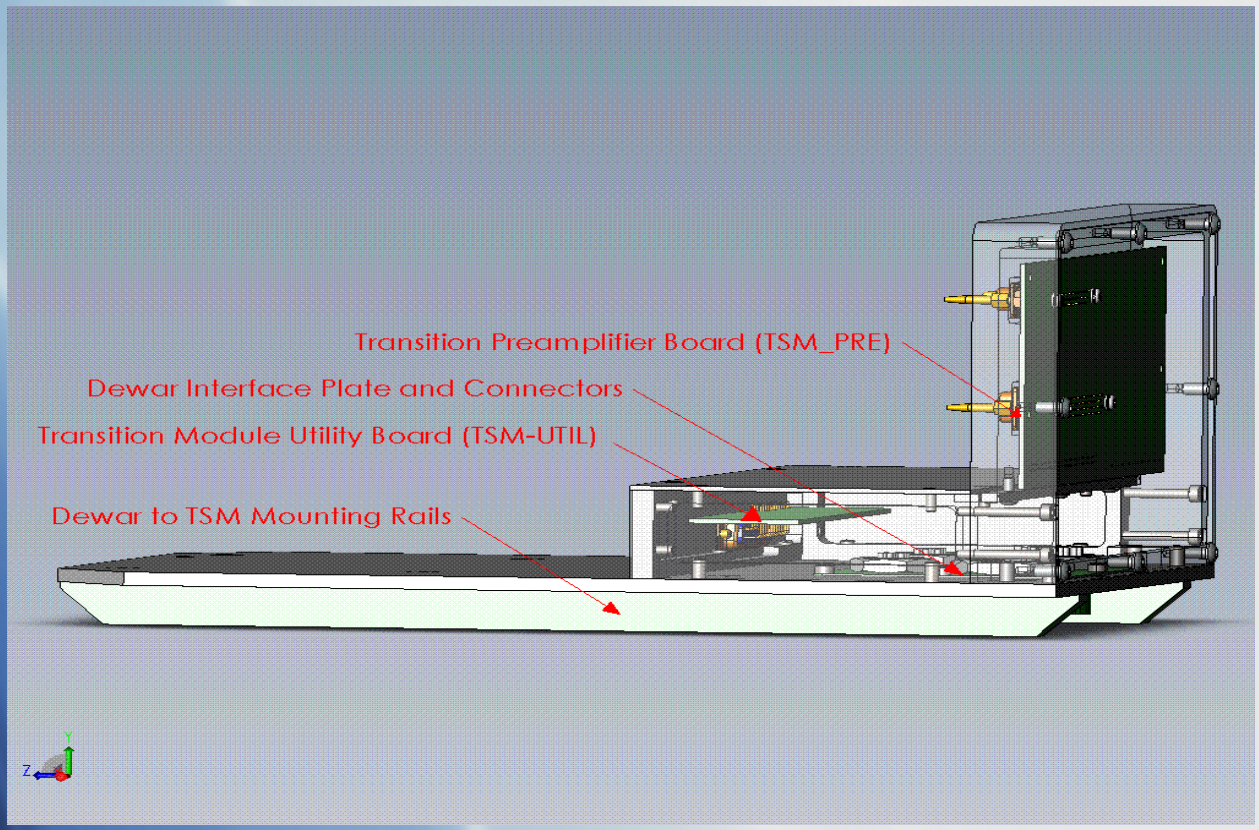
Manufacturing - DHE Hardware

Torrent Controller Unit



Manufacturing - DHE Hardware

Generic Torrent Transition Module (TSM)



Manufacturing - DHE Electronics Hardware

- PCB's are tested on the Torrent test fixture prior to becoming eligible for integration into a Torrent DHE system.
- Flex cables are pre-assembled in house and are also tested on the Torrent test fixture.
- All electronics hardware that has passed testing is returned to inventory.
- Electronics hardware that fails test will be kept in a diagnostic loop out of inventory until repaired and passed or deemed as scrap and replaced.

Manufacturing - DHE Hardware Assembly

- Configured and tested circuit boards and flex cables are installed into the controller mechanical subassemblies.
- Once a controller is assembled it is tested on the Torrent test fixture.
- The transition module Dewar specific wiring and Dewar specific interface are assembled.
- The controller is then mated to the transition module.
- Together they are a Torrent DHE which is ready for integration to a detector.

Test Overview

- The Torrent test concept is based on an automated test screen with test operator interaction.
- The Torrent test software will be developed in the LabView graphical programming language.
- The Torrent test hardware will consist of a custom designed test fixture and a USB 2.0 capable PAN computer with a fiber interface.

Test - Concept

- Machine based semi-automated test execution that requires test operator interaction and oversight.
- Test step pass/fail results will be determined by measured values conforming to an acceptance window which guarantees consistent screening results.
- Acceptance windows will be determined statistically during test development.
- Failures must be acknowledged by the test operator in order to continue the subtest.
- Acknowledged failures will be documented in the test report preventing a false pass result.
- Programmed parts such as FPGA eeproms and calibration eeproms are programmed during test.

Test - Software Design

- The initial GUI will allow the selection of an assembly subtest.
- The available subtests will be:
  - PSM test
  - LCB test (requires FPGA eeprom firmware programming)
  - Mezzanine test
  - CCD AFE test (requires calibration eeprom programming)
  - IR AFE test (requires calibration eeprom programming)
  - Generic Pre-Amp test
  - Utility board test
  - Flex cable test
  - Controller system test

Test - Software Design

- Once an assembly subtest is chosen, instructions for configuring the test fixture and resident boards are to be displayed.
- The test operator will then make the necessary configuration changes to the fixture and install the unit under test (UUT).
- The subtest can then be executed.
  - Should a subtest step fail, a pop-up window describing the specific details of the failure will appear.
  - The test operator can then choose to abort the test, loop on the failure for diagnostics, or acknowledge the failure and continue the subtest.

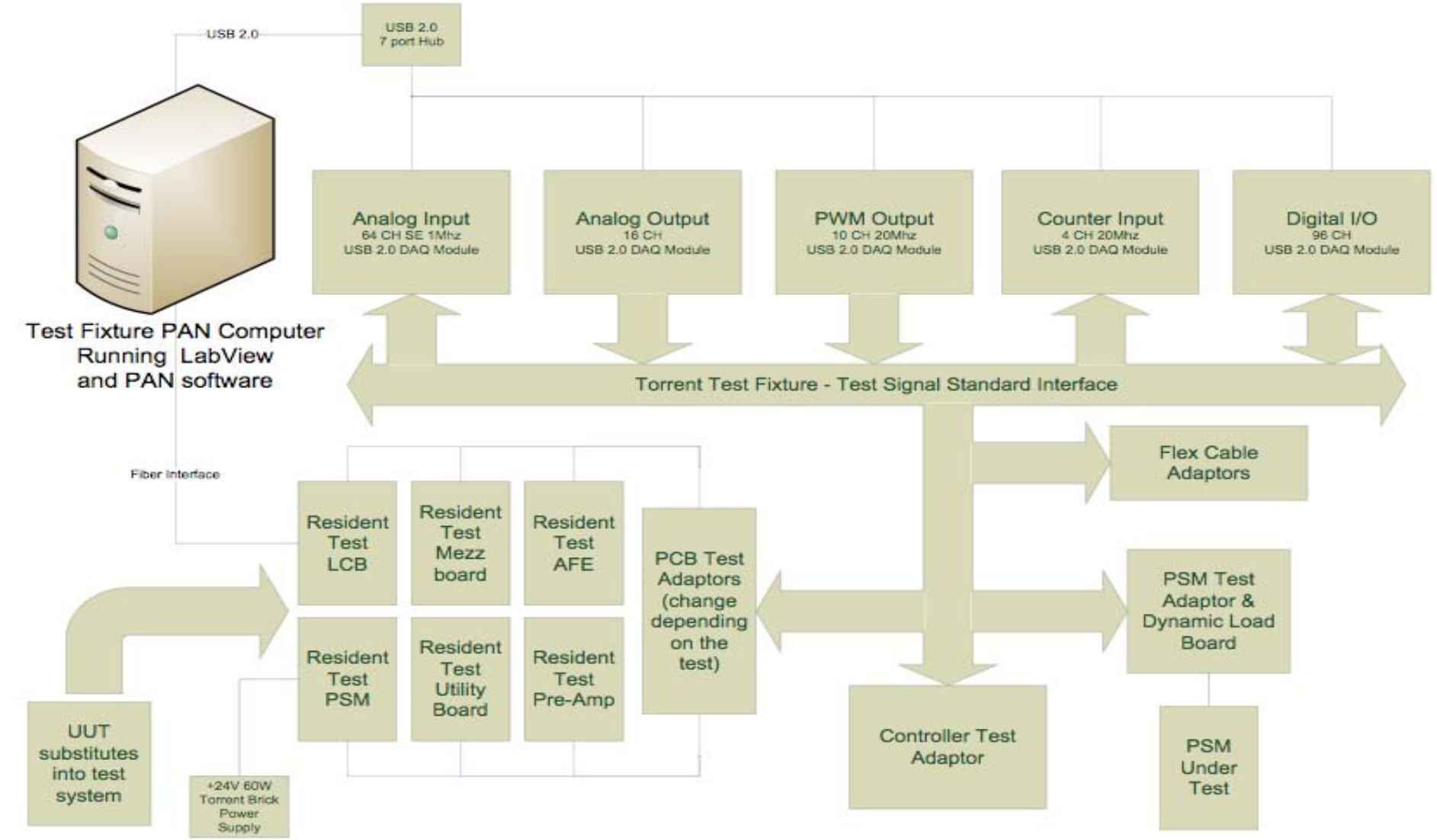
Test - Software Design

- Upon successful completion of a subtest the program will save the test report data file and return to the initial GUI.
- The operator can then choose to exit or continue testing.
- The test report data file is considered a documentation deliverable with the system.
- Certain subtests will also produce and program eeprom calibration data, which will be saved as an eeprom mirror file. These mirror files are also a system deliverable.
- All documentation deliverables will be uniquely archived on an NOAO server.

Test Fixture Design

- The test fixture is configurable depending on which assembly is being tested.
  - Configurations are: PSM test, LCB test, Mezzanine test, AFE CCD test, AFE IR test, Generic Pre-Amp test, Utility board test, Flex cable test, and Controller test.
- All but the Controller test will use some combination of “resident” test boards.
- Each configuration requires an adapter/load board and specific UUT interface cables.
- A resident 24Vdc “brick” provides system power.

Test - Fixture Design Block Diagram



Test development and cost

- The estimated development time for the Torrent test fixture is five to six man months.
- Hardware costs for the test development are estimated to be around $20K
- Includes USB acquisition modules, custom test load boards, adapters, and resident test boards.
- Development software costs are estimated to be $4.3K.
- There is a manual fallback for testing should the development not be completed before the first system order.
  - The manual fallback adds in considerable test time to the manufacturing process.

Torrent Sparing

- At least one spare controller is recommended to be on hand at the observatory.
- Failed controllers would be returned to Tucson for troubleshooting and repair.
- In the event of a failure an on hand controller could be pre-shipped in order to ensure sparing at the observatory.
- An option to the above would be that observatories could build their own Torrent test fixture and diagnose or repair controller failures on site.