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Test Stands for readout of Run2b DØ silicon detectors

Essentially the same type of test stands will be used for all the electrical tests performed on the readout hybrids and the detector modules. These test stands are based on the Stand Alone Sequencer Board (SASeq), which are developed at Fermilab. These SASeq based test stands were successfully used in Run2A. They are developed independently from the full D0 readout system, and are relatively cheap which allows us to replicate them in large quantities and distribute them at various locations at Fermilab and at remote institutions. The two-channel SASeq board is a self-contained data acquisition card designed to interface to the SVX chips. Its basic function is to control the SVX chip for data acquisition, collect the SVX data when a data cycle was requested, and to relay the data to the processor in the crate. To achieve the planned rate of testing we plan to set up 4 different types of SASeq based test stations:

1. Two hybrid burn-in stations (16 channels each) for burn-in of hybrids
2. Two module burn-in stations (32 channels each) for burn-in of detector modules
3. Eleven 1-Saseq stations (one channel each) for fast functionality test, debugging of modules and QA tests, with 6 stations at Fermilab and 5 at remote institutions;
4. Two 3-Saseq stations (6 channels each) for simultaneous read out of up to 6 modules during assembly of staves and stave mounting in the final support structure

Each Module burn-in station consists of two Cooling Racks and a VME Rack between them. Each Hybrid burn-in station consists of a Shelve Rack and VME Rack. We plan to reutilize the two racks that were used in Run-2A as Shelve Racks with small changes concerning the electrical parts.

The base hardware unit for the burn-in stations is shown in Fig.1.The Burn-in Crate configuration for module burn-in is shown in Fig.2. It consists of a VME crate that contains a Bit-3 VME controller card, sixteen SASeqs, a scanning 12-bit 64 channel analog-to-digital converter board (VMIVME-3113A) for temperature measurement, and a master vertical interconnect board for high voltage crate control. High voltage supply sources are located in a separate VME crate.

The HV VME crate for the burn-in stations contains four VME 4877PS Motherboards and a slave vertical interconnect board for high voltage crate control. Every Motherboard carries eight HV pods. Thus, the HV crate provides 32 independent voltages for silicon detector biasing and supports monitoring of the detector currents. The 4877PS Motherboard allows the voltage to be set from 0 to 5000 V, with a maximum current of 2mA per channel. To ensure the safe operation of the burn-in stations, the over-voltage hardware protection of the HV supply will be set to 300 V.

The interface between the hybrids and the SASeq is provided in Run-2B by a circuit board dubbed the Purple Card. It is the functional analogue of the Interface Card and Connector Adapter Module used in Run2A. The Purple Card is located close to the device under test inside the Cooling Rack. Every Purple Card has two independent channels and is used as a bi-directional interconnect between the SASeq and the Hybrid through the Digital Jumper Cable (DJC). The board contains the logic to control the power of the SVX chip as well as the HV. The board also prepares the data for the temperature measurement. All low voltages are fused on the Purple Card. The Card is equipped with test points and LED's to monitor the functionality and provide diagnostic capabilities if they require servicing.

Each SASeq is connected to a Purple Card by a 10 foot long 50-conductor cable with impedance of 82 Ohms. Three low voltage power supplies are used to supply the two operating voltages (AVDD, DVDD) needed by the SVX chips and to supply the voltage to power the Purple Card. Low Voltage Distribution wire Buses are located on the side of each Cooling Rack or Shelve Rack and are used for the distribution of the SVX power and the Purple Card power for each of the sixteen Cards.

The Hybrid burn-in station and the Module burn-in station only differ in two aspects, which are the High Voltage crate and the cooling system. The Module burn-in stations need a separate VME crate to house the high voltage modules to bias the detectors, which is not needed for the Hybrid burn-in stations. For the one-SASeq and three-SASeq test stations the HV module is located in the same VME crate as the SASeq. The second aspect in which they differ is the cooling. The Module burn-in stations are outfitted with a cooling system to operate the detectors at low temperature. Up to 16 detectors are placed on 8 shelves inside a Cooling Rack that is thermally isolated. The chiller temperature is set to 5C, and the detectors will run at temperatures between 10C and 15C, depending on the number of chips on the HDI and on the water flow rate. Each detector module is placed on a custom made, 17 x 3.5 inch aluminum Cooling Plate (Fig.3), designed to accept any kind of Module. Every Cooling Plate is equipped with a pipe for cooling water and special holes to provide nitrogen flow through the storage box that encloses the device under test. Two Cooling Plates together with the Purple Card and signal cables are placed on plywood board. This board, called the Slider Plate, is equipped with sliders to simplify loading and unloading of the devices under test (Fig.4). Plywood is chosen because it is a cheap, thermally non-conductive material that helps minimize possible risk of condensation on surfaces inside the Cooling Rack. Every Slider Plate has its own water and nitrogen pipe.

A control panel attached to the rack side provides control of the water and gas flow. One chiller supplies two control panels. A software based interlock system monitors the temperature on each device and shuts off the power in the event the temperature exceeds 50C, to avoid melting of the epoxy used in detector assembly.

We have ordered 60 additional Saseq boards; these will be tested at remote institutions following the procedures outlined in (MIKE UTES WEB PAGE). Additional HV parts

are being ordered for use in the test stands. They will be used in the detector when production is finished. The Purple card is currently being designed; first prototypes are expected in Spring 2002. A floor plan of the burn-in stations in the Sidet Lab AB-bridge is shown in Fig.5

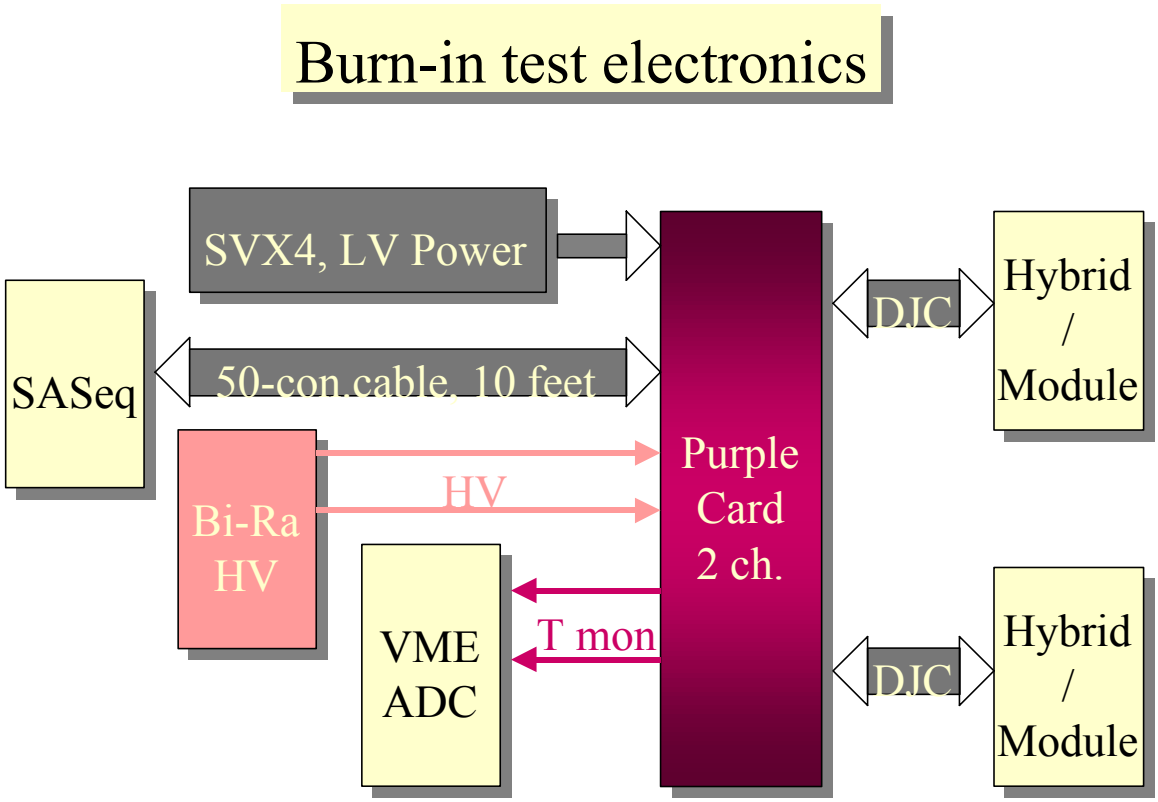


Fig.1. Base unit of the Burn-in test electronics.

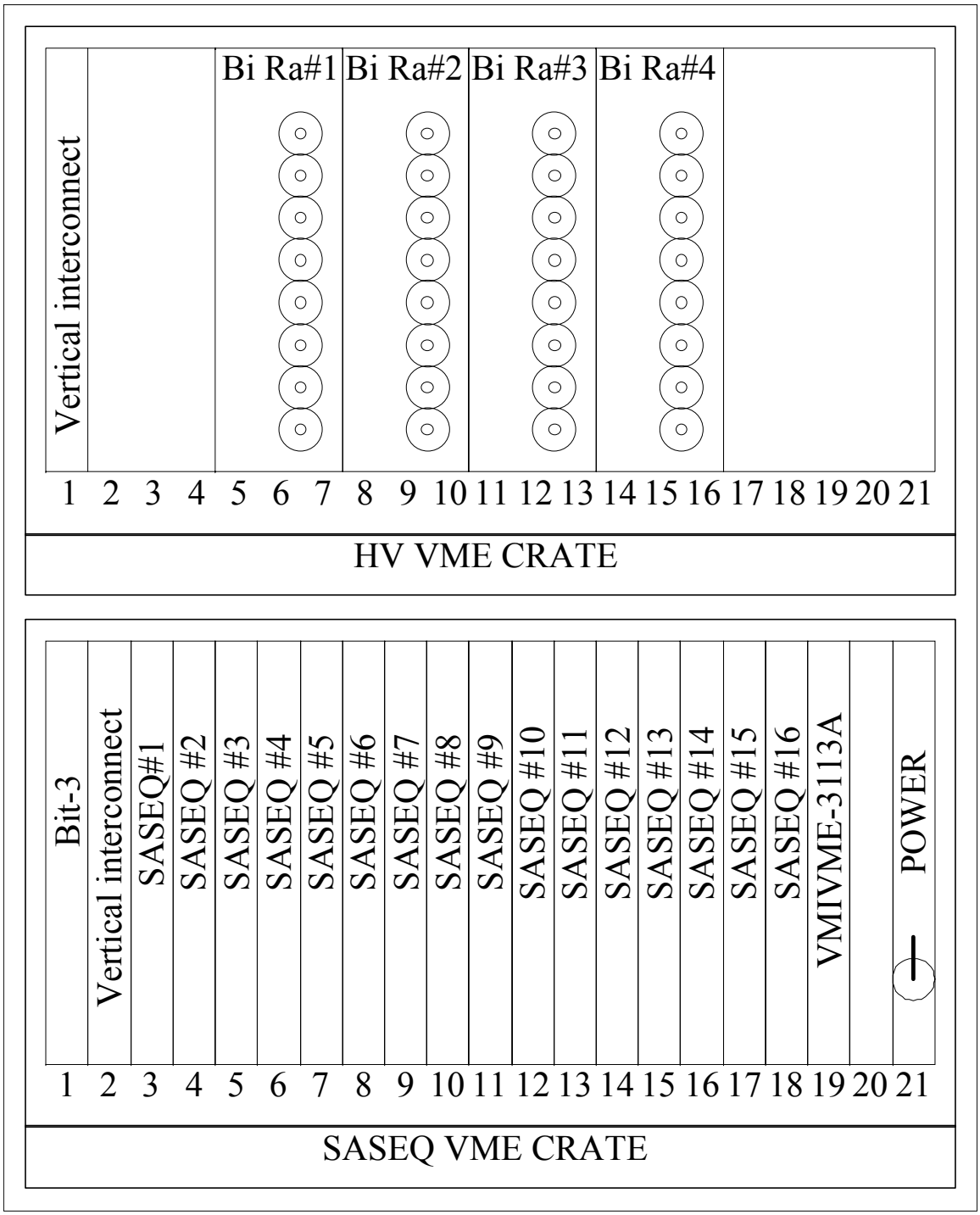
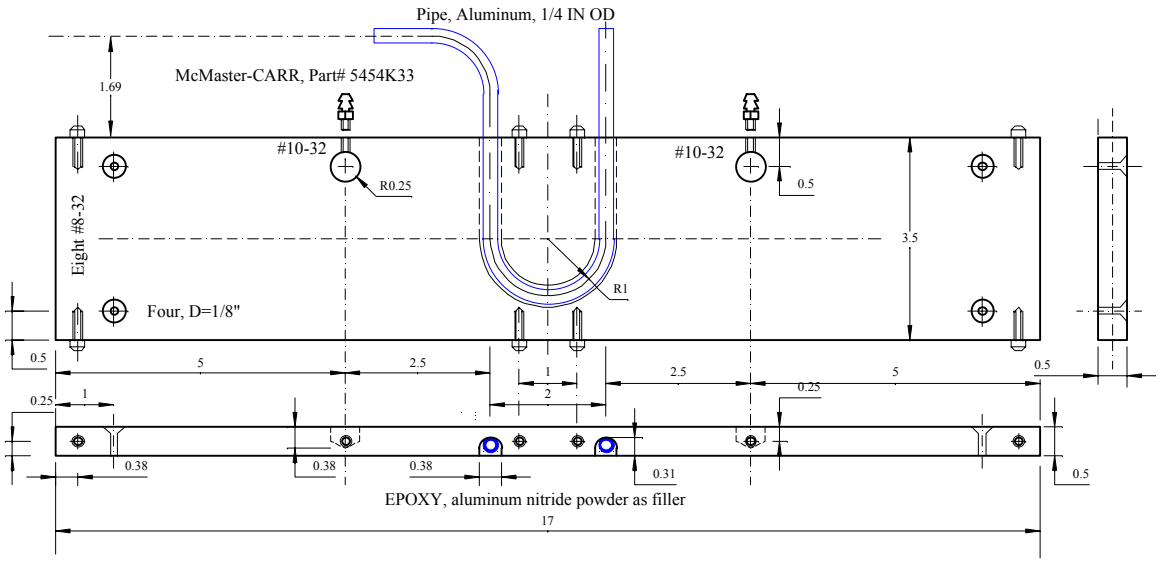


Fig.2. Burn-in test crates.



BURN-IN TEST Cooling Plate.
ALUMINUM, 17 x 3.5 x 0.5 INCH

Fig.3. Cooling Plate.

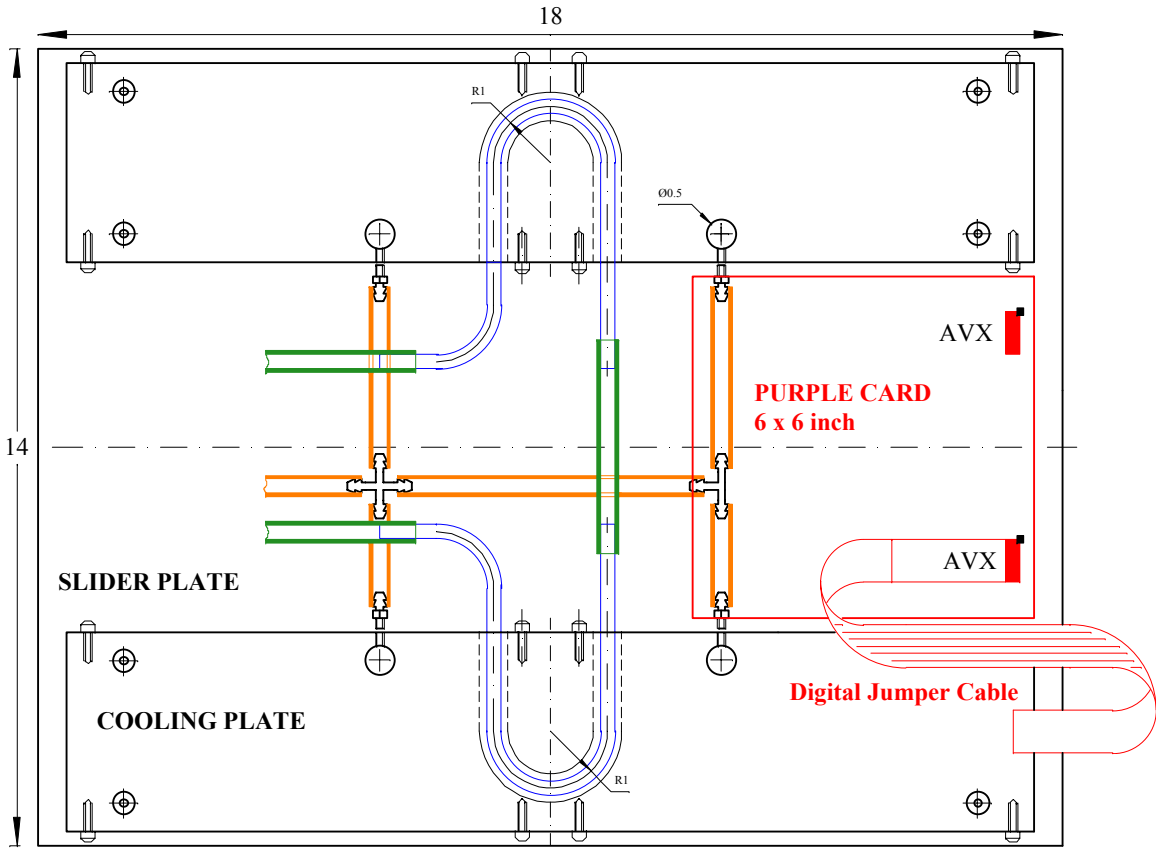


Fig.4. Slider plate

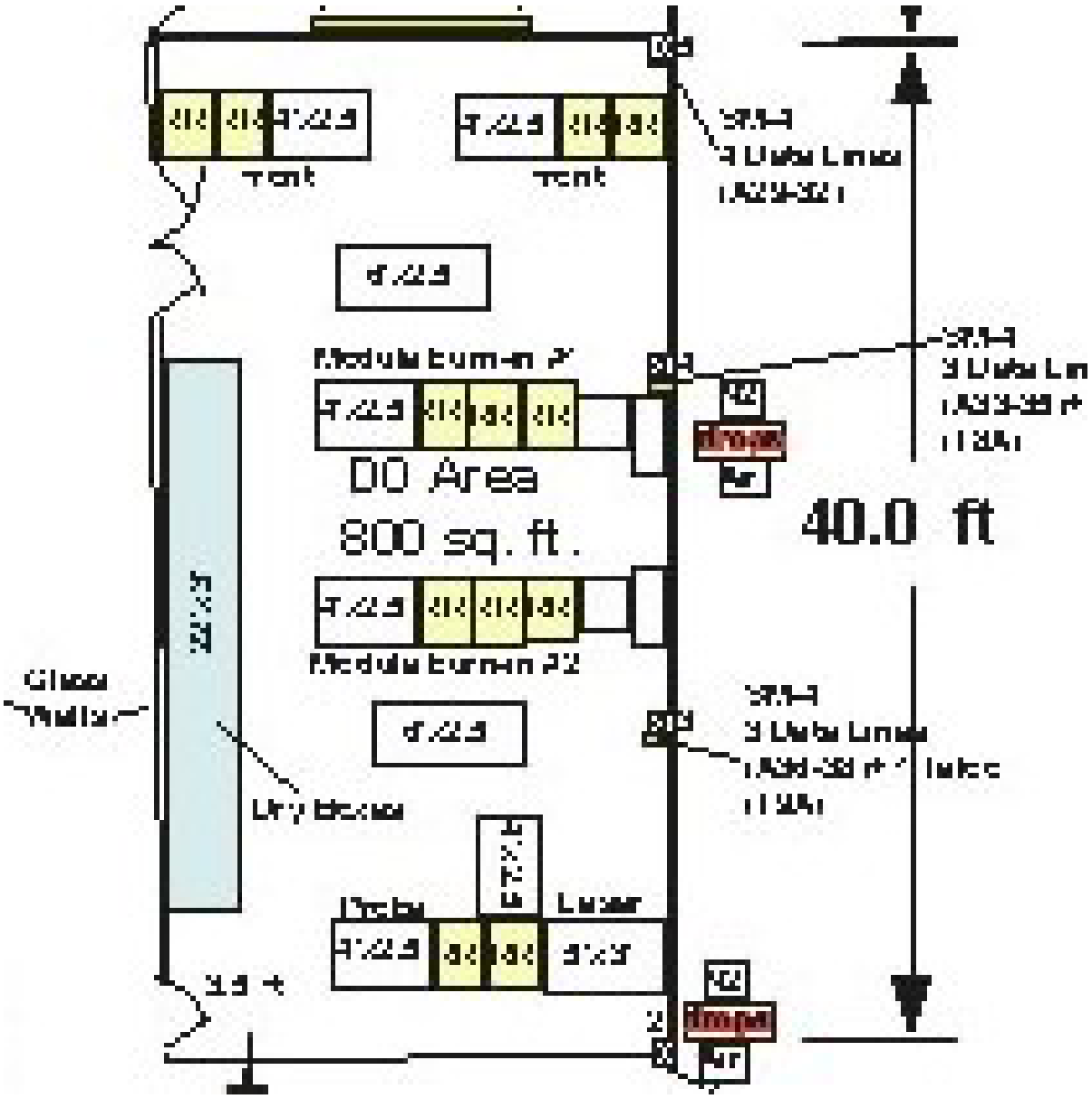


Fig. 5 Layout of burn-in stations and QA stations in the New SiDet Lab AB Bridge