

Module Test Working Group

CERN 28 Sep 2000

- L. Demaria Laser and backplane tests: experience in Torino
- L. Mirabito The final hardware proposal
- S. Tkaczyk Experience with silicon detectors in Fermilab:
 questions and answers.
 (the title is my best guess. Marco)
- ALL:
- Finalizing the preliminary list of tests to be done on modules.
- Defining where these tests have to be done.
- Comments on the drafts on module test and burn-in.

The Framework

- EDR: 15 NOVEMBER 2000.
 - We must pass EDR for Module Testing and Q.A.
- *In less than **ONE MONTH** from now we have to:*
 - *make a proposal,*
 - *go through TPO,*
 - *present the proposal at the 25 Oct. Tracker Meeting,*
 - *then finally go to Oct. TIB for approval.*
- EDR is intended for final production, nothing to do with M200
-Let's go fast and smoothly !

A Possible Proposal for Testing during Production

- Optimization to get the “minimum” number of different tests
- Reduce complexity and duration of tests
- Make a clear flow of operations
- Detail (among us) which test, where, how many times, how long
- Define the hardware needed

Test Definitions

- The tests aim mainly to verify CONNECTIONS and only to lesser extent PERFORMANCE
- FAST TEST = LV power on, send W/R commands via I2C, then measure:
currents, pedestals, channel noise, both in peak and deconvolution with fully automated procedure, in clean room, humidity controlled.
- Readout errors in frame header will be signaled automatically by the system.
- Use default values for APV as given by APV experts

Test Definitions cont'd

- “B” TEST = FAST TEST + Back-plane pulse readout
- “C” TEST = FAST TEST + a 2 point internal calibration (1 and 3 MIPs)
- “L” TEST = FAST TEST + Readout signal generated from infrared light pulse
- “T” TEST = FAST TEST + Thermal cycling
- “I” TEST = FAST TEST + I-V curve
- “V” TEST = FAST TEST + Vbias variations

What is needed beforehand....

- **A fully qualified APV25 !**

From the tracker electronics System Meeting on 19-20 Sep:

- APV25-S1 performance is optimal, yield is very high
- 84% of the chips passed all tests
- Only a small number were damaged during dicing (tests performed on ~ 500 chips)
- Good results from first irradiation tests and SEU
- Test list: digital functionality, I2C, power supply currents, pipeline pedestals, gain, analog output pedestals
- Production tests on wafer
- **NO MEASUREMENT OF NOISE**

More on APV25 requirements

- RAL people could make plans to investigate “early mortality” (if any)?
- **We absolutely need more information, statistically significant, about this issue**

Testing at Hybrid Centers

(From U. Goerlach July presentation)

Functionality Tests during Production (*Tests carried out by the manufacturer*):

Power consumption
(in standard I2C configuration)

I2C control (R/W cycles ca 100-1000)

Read-out test:

correct response to T1, reset and cal_request

analogue differential output levels

For IB: I2C and power lines for opto-hybrid

⇒ *simple, compact and portable set-up*

In Strasbourg verify performances (deeper) on samples

Hybrids at CERN

- Fast test upon arrival
- Bond Pitch Adapter
- Fast test after bonding
- Some burn-in to be defined (?)
- “C” test
- Qualified hybrid
- Write DAQ to results to DB

Last steps must be done with a “qualification setup”, because this is a possible starting point to write in DB numbers that will be compared during module’s life.

Testing at Gantry Centers

Bari Brussels Lyon Perugia Wien USA

- Optical inspection upon arrival
- Fast test
- Assembling on the gantry
- Optical inspection
- Fast test
- Packaging

(The I-V curve of the sensors could be useful in case of problems, but it is not foreseen at this stage. Problems with the equipment needed to do that. Risk/benefit high!)

Testing at Bonding Centers

Aachen Bari Firenze Karlsruhe Padova Pisa Strasbourg
Torino USA Wien Zurich

Before bonding:

Optical inspection (microscope), **FAST TEST**

After bonding:

Tests of the Bondings according to Alan's WG prescriptions;

"I" TEST;

Thermal cycling, +20 °C to -20 °C, power OFF

"B" TEST,

"V" TEST,

"L" TEST.

Testing at Bonding Centers cont'd

- Module qualified
- Write to DB; from now on we **MUST** have the test setup directly interfaced to DB
- **No possibility for the operator to write into DB if some parameters are not the “standard common ones”.**

Testing at Burn/Cool in Centers

Aachen* Brussels Karlsruhe Lyon* Louvain Pisa* Strasbourg
USA* Wien Zurich

- Many variables to be kept under control during repeated thermal cycles, ranging from +20 °C to -15 °C:

LV currents, APV performance, DCU, I-Vbias, Vbreak,
I vs. time, I vs. Temperature (see draft for details).

- Interlocks always active on crucial parameters (I, T, humidity etc.).

Testing at Burn/Cool in Centers cont'd

- Cooling: needed absolutely, but it is still unclear if it can be similar to the final one.
- We are not going to test the thermal properties of our modules: that must be studied very carefully BEFORE, so as to ensure thermal exchange will be enough to cool down even the most irradiated detectors. (Is it a weak point?)
- SNR measurements only on sample basis (if at all possible)
- What we should not do: thermal cycles for finding APV failures

Testing at Burn/Cool in Centers cont'd

- **FAST TEST**
- **“T” TEST** -Thermal cycle 1 (or more if available) modules with copper analog connection

In Integration Centers

- **FAST TEST**
- **“T” TEST** -Thermal cycle PETAL or ROD with optical analog connection

Shells and disks: do the same

Hardware

- Each production step, from hybrid to full integration, will have specific hardware needs
- One of the tasks of MTWG is to find out common setups for common needs
- As a first approximation we have identified 2 possible DAQ setups:
 - 1: for Hybrid centers (and industry) and Gantry centers
 - 2: for Bonding, Burn in and Integration centers (qualification)

Number 2 must have capabilities to read more modules at the same time, connected in CMS scheme, and to be interfaced to climatic chambers for burn in.

Hardware cont'd

- Aachen proposal = Type 1
- Lyon proposal = Type 2
- Estimated number of setups to be installed:
 - 10-15 of type 1
 - 16-20 of type 2
- **During production, for compatibility reasons, and for quality assurance all the qualification setups must be identical**
- Comparison of results and traceability of failures are at the highest priority

Remarks

- We will learn a lot with Milestone 200 production, and we will refine our testing strategy
- We will try to circulate our draft on testing procedures as soon as possible
- We are now aiming at the best approximation with present knowledge