

Report on Module Test

Marco Meschini
INFN Firenze



Monitoring Quality from DB

♣ Summary table from Mod test web page (hep.fi.infn.it/CMS/moduletest/wg.html)

Module Test Monitor (Results from Tracker DB)

21 October 2005	TIB	TOB	TEC	Total
ARC Tested Modules	2260	2964	3185	8409
Good Modules	2227	2941	3124	8292
Bad Modules	33	23	61	117
Bad Strip % on Good Modules	0.08	0.10	0.12	0.10
LT Tested Modules	2118	2723	940	5781
Good Modules	2111	2719	934	5764
Bad Modules	7	4	6	17

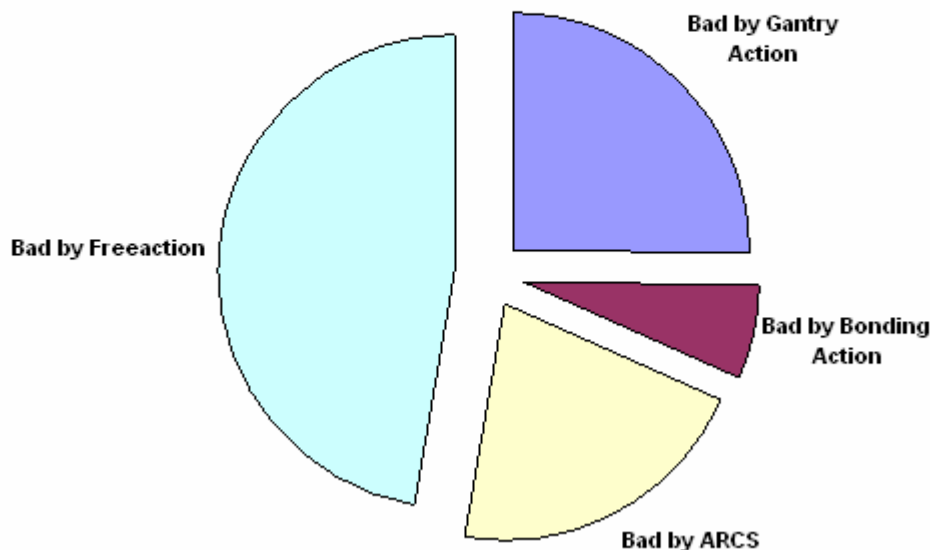
♣ Data in this table refer only to Module Test (ARC & LT) results! Faulty modules for reason outside Mod Test do not appear here

ARC test
TOB yield 99.2%
TIB yield 98.5%
TEC yield 98.1%

Modules are set faulty in the TrackerDB because...



Distribution of Faulty Modules (from TrackerDB)
Total Number of faulty Moduls: 207



TEC Analysis in agreement with module test monitor

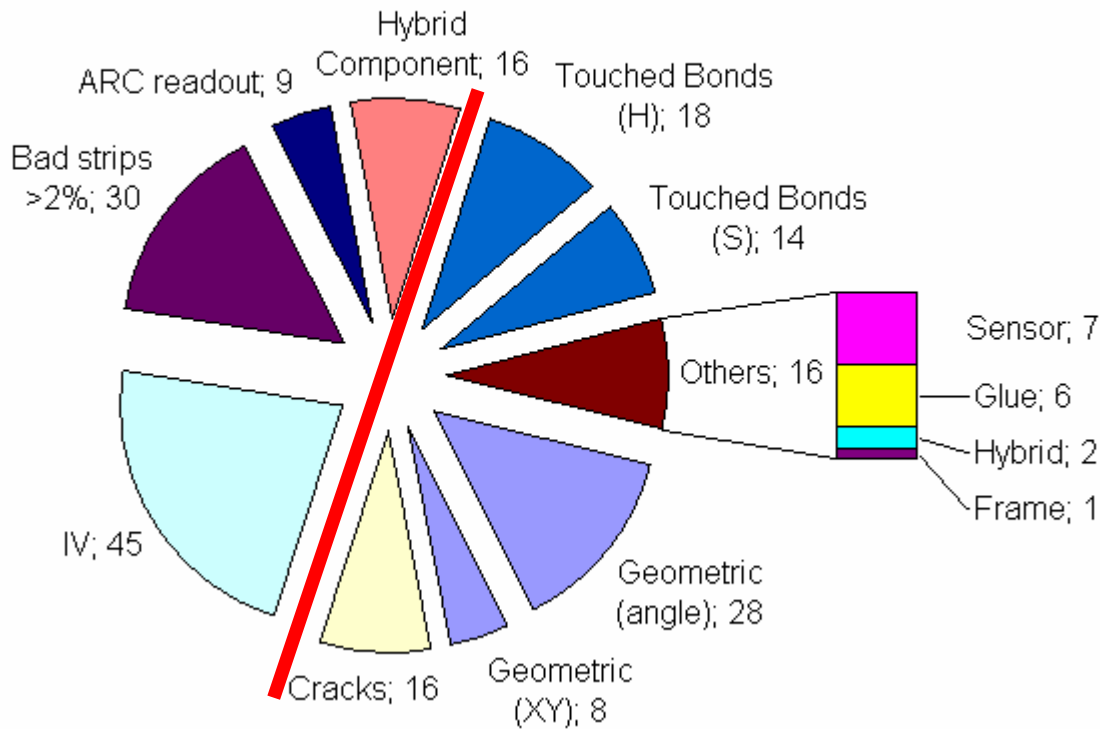
- Most Modules are set to “faulty” by a *Special action*
- Reason for the faultyness is obscured
- Vienna made an effort to better understand these problems

See also: Stephan Hänsel, CMS Week September 05, TEC meeting, “Module Production Yield and Analysis of faulty modules”

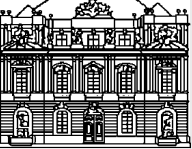
Distribution of Problems



Distribution of Problems (from localDB)

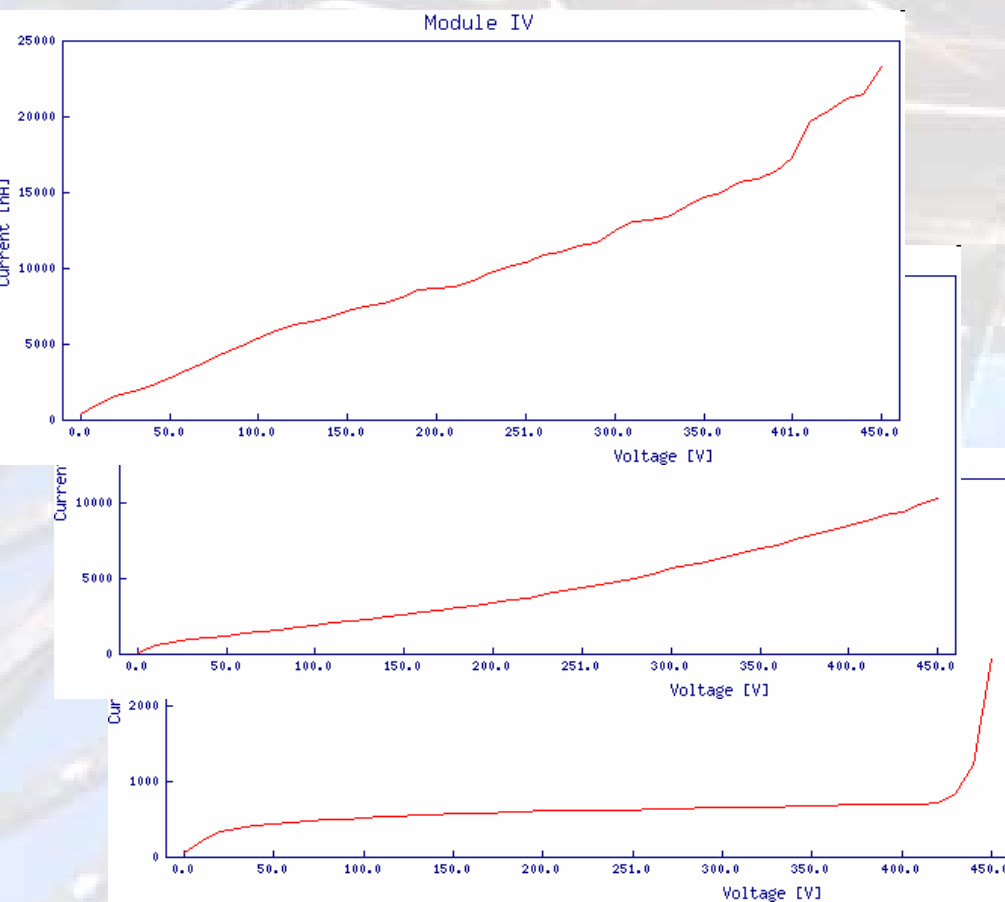


- Most Problems should be recognized by ARCS
- Some problems may also be related to wrong storage of the sensor (humidity – IV)
- Communication problems between the ARC Board and the Hybrid may encourage wrong test results (too many bad strips, readout problems)



IV Problems (HPK Sensors)

(Or How to Recover...)



Whenever you see IV curves like that on a Module with HPK Sensors:

1. Suspect it to be a humidity problem → Put it in a dry environment (10% -15%) for at least 48h.
2. Retest it
3. If the IV is still bad, take care to do the right TrackerDB action, see next slides.
4. Send it to Vienna. If you do not have the time to do the drying and the retests, you can send them directly to Vienna.

I agree on drying procedure, but then make a final test around 30-35% RH to minimize future troubles during integration, commissioning and also final TK operation

Note: Alignment Sensors are exceedingly sensitive on humidity!

Why?...



...is it so important to keep information in TrackerDB up-to-date?

We have to assess the amount of spare parts to place reorders **NOW!**

For each Module we have to decide **NOW!** if it is good for the Tracker (“*valid*”) or not (“*faulty*”).

So AACHEN-REPAIR (and VIENNA for IVs) is the latest possible place where this decision **must be made.**

We cannot afford to lose modules because they are kept at an Institute for dubious reasons.

In the end it may still be necessary to go back to the faulty modules and **select the best ones** to be put in the Tracker for the lack of “*valid*” ones.

Selecting the best of the “*faulty*” modules can only be done, if the data in the TrackerDB is **valid** and **verbose.**

Be careful also on modules which have not passed ARC test at first time: are they weaker than others? Use TComment field in xml



More on Central TK Database

Data quality is crucial: during integration we rely on data from DB!

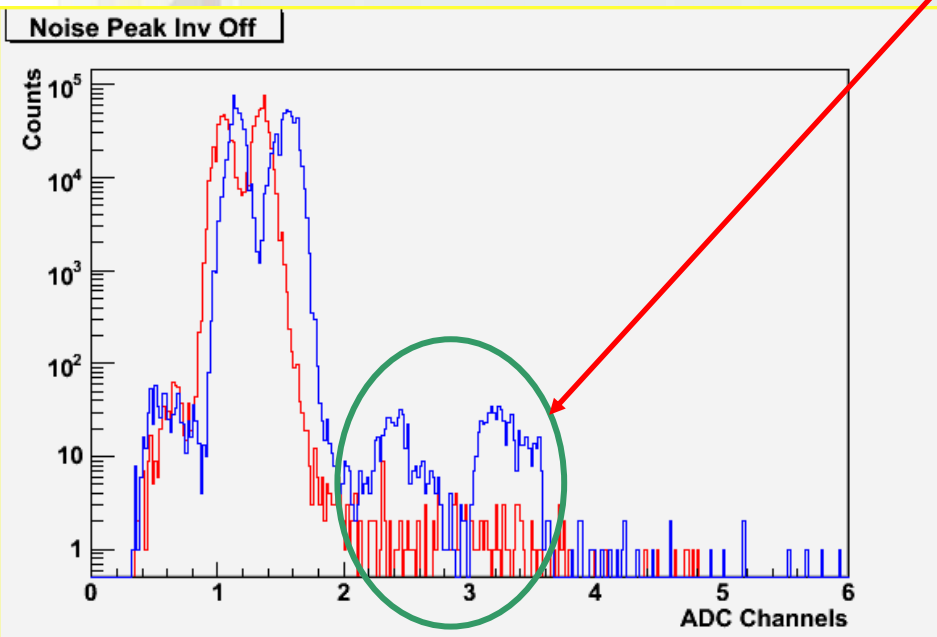
- ♣ Upload data to DB as soon as you can: modules are not really “done” until everybody can find final results with BigBrowser
- ♣ DO NOT upload “wrong” data, but if you do it, then upload new “corrected” data immediately
- ♣ BE CAREFUL when you perform full tests with FAULTY modules: info in DB **MUST** reflect the real defect and not “derived” ones. Example: modules tested at ~ 0 Volt must not be flagged for “noisy strips”, while it is a $V_{\text{breakdown}}$ defect



An example of (not good) data uploaded to DB

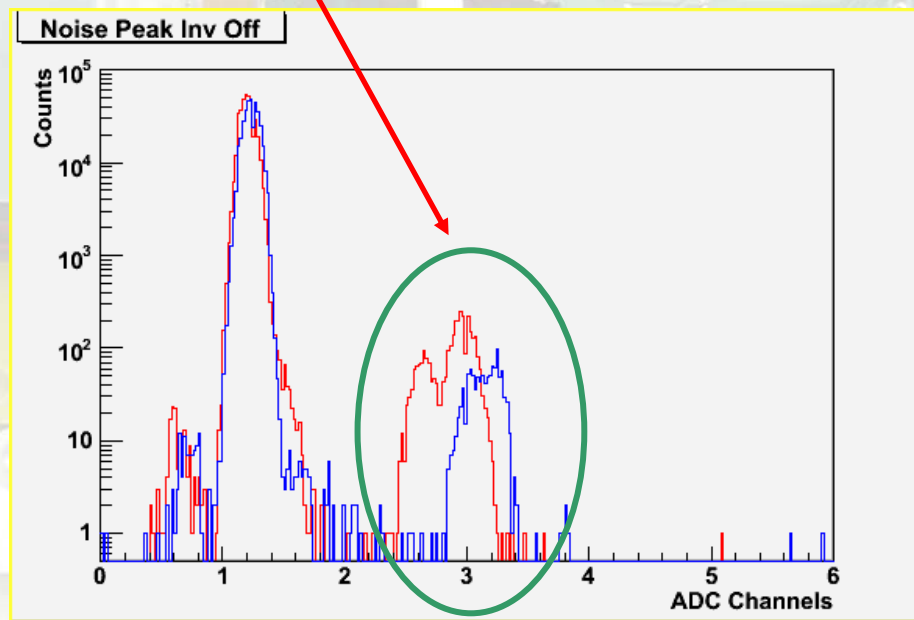
These data should not go into DB!

TEC noise in ARC



Blue 4 APVs modules
Red 6 APVs modules

TIB noise in ARC





ARCS Testing Results

ARCS testing is proceeding very smoothly at both sites

Tests take ~20 minutes and are completely automated

- 1 technician can run 3 stands simultaneously
 - Not sustainable for an extended period of time

We are over halfway through module production in US!!!

- 55% of TOB finished
- 41% of US TEC finished

	Cumulative			% A or B
	A	B	F	
L12pu	180	0	1	99.45%
L12pd	297	0	0	100.00%
L12su	128	1	3	97.73%
L12sd	75	0	0	100.00%
L34p	789	4	9	98.88%
L56p	1371	5	13	99.06%
R5N	155	1	4	97.50%
R5S	172	0	1	99.42%
R6	309	0	0	100.00%
R7	165	0	1	99.40%
Total	3641	11	32	99.13%



ARC Module Testing Throughput and Potential Bottlenecks

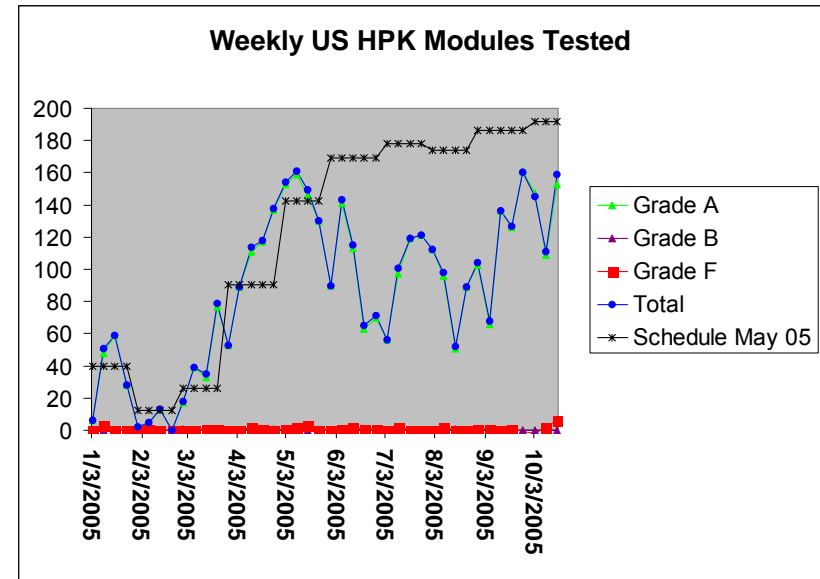
With current equipment, UCSB can test 50-60 modules per day and FNAL can test 60-70 modules per day

- UCSB has tested 150 modules in one week (45 in one day)

These rates easily exceed the needs of high rate module production even with the additional testing needed for retrofitting TOB modules

Equipment failure is the only potential bottleneck for module testing

- Again, we do not have spare ARCS equipment
 - If there was a failure, we would still be able to keep up with production.





LT Testing

We have LT tested almost all of the modules produced in the US

With about half of the total production tested, we find only a 0.09% failure rate during LT tests

We want to go to sampling LT testing of modules (10 modules/day/site)

- modules will be thermal tested during rod and petal testing
- We will target modules that have faults already or have had bonding repairs
- Going to sampling frees valuable manpower for other tasks, providing much needed help for rod production.

	Cumulative		% Pass
	Pass	Fail	
L12pu	127	0	100.00%
L12pd	213	0	100.00%
L12su	92	0	100.00%
L12sd	68	0	100.00%
L34p	785	2	99.75%
L56p	1356	1	99.93%
R5N	153	0	100.00%
R5S	143	0	100.00%
R6	226	0	100.00%
R7	129	0	100.00%
Total	3292	3	99.91%

Proposal is accepted by MTWG, provided all modules will be LT tested in rods



LT Module Testing Potential Bottlenecks

Equipment failure is the only potential bottleneck for LT modules testing

- We have obtained spare infrastructure like chillers, power supplies, etc...

But we are still waiting for valuable DAQ spares. This lack of spares is a potential bottleneck for both module and rod LT testing

As already stated, spare parts (ARC and LT) availability is out of Module Test control. This can still be a major cause of DELAYS

Spares we still need:

- 2 TSC spares
- 3 TPO (1 for UCR, 2 spares)
- 2 FEC spares sent back for repairs
- About 20 TEC hybrid-to-utri adaptor boards (only needed when FNAL goes into production)



ARC TIB from DB

Center	Total	Bad	Bad Ch % OGM	Bad Ch	IV	Both	Other
Bari	293	7	0.06	4	3		
Catania	210	0	0.11				
Firenze	289	7	0.08	2	3		2
Padova	614	6	0.10	3	2	1	
Pisa	619	12	0.08	4	4	4	
Torino	235	1	0.04	1			
Total	2260	33	0.08	14	12	5	2

Including TID 2775

Bad channels on good modules

- ♣ 1 mech damage
- ♣ 1 dismantled to I.C.