SSD – Status

ITS Upgrade meeting – 4 October 2010

1. Detector Status
2. Stability
3. SSD spare components
4. Mortality rate
5. High rate capabilities

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**SSD status in 2010**

- Not operable half-ladders: 6/144

- Active modules: 1557/1698 \(\approx 91.7\%\)
  - The non-active modules:
    - belong to disabled half-ladders
    - are not operable due to configuration problems
    - are masked due to noisy areas

- Active channels in active modules: \(\approx 98.5\%\)
  - The non-active channels:
    - noisy
    - no gain
    - open

- Overall efficiency \(\approx 90.3\%\)
**SSD stability in 2010: Bad Modules**

*Time evolution: Mar-Sept 2010*

**Bad modules vs time**

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**Inactive modules**

- very stable conditions
- exceptions:
  - 1 half-ladder excluded in 6 runs (126073 → 126093) due to temporary high bias current issue
- increase of noise causes the temporary masking of a few units

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**Bad modules**

- Bad p-Sides on Layer6: 105
- Bad n-Sides on Layer6: 69
- Bad p-Sides on Layer5: 48
- Bad n-Sides on Layer5: 34

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+ 4 half-modules not configurable anymore → excluded from acquisition
SSD stability in 2010: Bad Channels

Time evolution: Mar-Sept 2010

- Bad Channel %
  - good stability during 2010 except for 6 runs 126073 → 126093 (1 ladder temporary off)
  - n-side very stable deviations < 0.05 %
  - p-side Lay6: humidity dependence in Sintef modules (relative humidity > 16% causes high noise on p-side)
  - p-side generally more variable due to the thresholds for bad tagging

Bad Channel % distribution

- Bad p-Side channels in Lay6: 11.1 %
- Bad n-Side channels in Lay6: 9.9 %
- Bad p-Side channels in Lay5: 8.6 %
- Bad n-Side channels in Lay5: 7.9 %
SSD stability in 2010: average Noise

Time evolution: Mar-Sept 2010

- Average Noise distribution

R.H. > 40% ~0-15 June (from run 123500)

- p-side & n-side: humidity effects
  (relative humidity > 30% causes high noise and excess of bias current -> dangerous for SSD)

- R.H. stably < 30% since end of July thanks to:
  - Geneva region weather conditions
  - some improvements in ventilation system
Present SSD - mortality rate in 2010

- recovered half-ladders: + 1/144 (lower bias current)
- not operable half-ladders: - 0/144
- not configurable half-modules: - 4/(1698*2)

- CAEN PS channels:
  - HV: - 2/(144*2)
  - LV: - 1/144

- FEROM read-out electronics:
  - Link module (9ch): - 1

✓ power cycling limited → system stability increased

Present SSD - planned modifications

- new ITS ventilation machine (define specs)
- CAEN boards to reduce Common Mode (under study)
- review of the interlock chain in HV boards
Present SSD: spare components

- CAEN power-supplies:
  - Main Frame: 1 (1)
  - 48V: 4 (5)
  - LV boards (1ch): 8 (144)
  - HV-Positive (12ch): 2 (12)
  - HV-Negative (12ch): 2 (12)
  - branch-controller: 1

- FEROM read-out electronics:
  - 2 fully equipped half-FEROM sets (9AD+1Link)
  - 3 Link modules
  - 2 watercooled VMEcrate

- JTAG box: 1

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Not usable on present SSD

- 4 layer6 ladders
- 2 layer5 ladders }
  replacement is risky!

- some modules
- thousands of HAL25 front-end chips, untested
High rate acquisition performance

Main Rate limitations:
- Present firmware busy time = 265 μs
  - 100ns read-out clock → 160 μs for digitization
  - amplifier discharging time
  - FEROM data correction
- DDL/LDC back-pressure

To be tested at HI-like occupancy

After a first look:
- HI high mult. → 1.5% occupancy → Dead time OK up to 800Hz
Conclusions

✔ SSD status:
  • overall efficiency: 90%
  • active fraction: 92%
  • good channels in active part: 98.5%

✔ Good stability: same configuration from March to October
  • except for 6 runs

✔ Lost components in 2010
  • 4 half-modules
  • 3 PS channels
  • 1 FEROM Link Module

✔ Spare components: full sets available

✔ Acquisition rate limitations
Backup
SSD General layout

- 1,700 modules,
- 20,400 chips, >5m²
- 2.6 * 10⁶ analogue channels

Sensor → FEE

EndCap

ITS-SSD:
layer 5: 34Lx22M=748Mod
layer 6: 38Lx25M=950Mod

CF supports 'cones'
Water cooling

FEROM

8 SSD racks outside magnet

DAQ

50 cm
144 EndCaps

25 m

200 m