Integration and test of ALICE SPD readout chain

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OUTLINE

System overview
Optical power margins
Total dose and SEU test
Test Beam

System Overview

The ALICE SPD



Inner radius: 3.9cm
Outer radius: 7.6cm
Length: ~28cm (sensitive area)
Number of channels: 9.8*10⁶
Pixel dimension: 50μmx400μm

ALICE SPD

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120 half-staves in total

•Each half-stave has 10 pixel chips (~82*10³ channels)

•Each half-stave is readout by a Multi Chip Module

Multi layer flex Kapton interconnection structure



Optical links for the clock, slow control and data signals <u>from</u> the control room
Optical link for the readout data <u>to</u> the control room
Available space for the active components: 45mmx11mm

The ALICE SPD



2 MCMs (half-staves) each Link-Rx

3 Link-Rx card each Router (6 half-staves)

20 Router cards (120 half_staves)

Optical Power Margins

The MCM



G-Link communication



The Solution



Measured Improvement
 The margin on the optical power for the signals coming from the control room is now <u>7dB</u>

The margin on the G-Link communication optical power is more than <u>8dB</u>

G-link jitter from 16ps down to 10-11ps

We will receive end of September MCMs with the "swapped" configuration

Total Dose and SEU Tests

Total Dose Test

ALICE level: 250krad in 10 years

Test level: 1Mrad using 10KeV X-rays

Total Dose Test Result

The GOL was already qualified for higher doses

No changes due to the total dose have been observed in the Digital Pilot

A shift of the Band Gap voltage reference was observed in the Analog Pilot

SEU test

58MeV proton beam

 Integrated Flux: 3.5*10¹² protons/cm²
 Total dose: 497.5Krad

40*10^6 full speed acquisitions performed

Periodic check of the configuration registers



Test results

No changes in the configuration's registers were detected

4 SEU where detected during the acquisitions:

- 1 flipped bit in the read-out data
- 3 loss of lock synchronization

Analysis of the results

SEU in the configuration registers: 0

Total number of SEU: 4

SEU/Integrated-Flux: (11.5±5.8)*10⁻⁹ cm²

Test Beam

Test beam setup



Test beam setup



Test beam software



Conclusions

The noise margins on the optical communication (7dB and 8dB) assure a reliable link between the control room and the on detector electronics

The on detector readout electronics have been proven radiation tolerant from total dose and SEU point of view

A full read-out chain prototype was used in test beam 2003