Workshop on Electronics for physics experiments and applications @INFN

Report of Contributions

https://agenda.infn.it/e/Workshop-INFN-Elettronica-5-6marzo-Torino

Contribution ID: **2** Type: **Talk**

Performance of nanoscale CMOS analog front-end circuits in extreme radiation environments

Wednesday, 5 March 2025 14:00 (35 minutes)

Primary author: RE, Valerio

Presenter: RE, Valerio

Session Classification: Operation in extreme environment

Contribution ID: **3** Type: **Talk**

Total Ionizing Dose effects at ultra high doses: a comparison between planar and FinFET technologies

Wednesday, 5 March 2025 14:35 (25 minutes)

In High-Energy physics applications, electronic devices will experience ever-increasing radiation doses. The forthcoming increase of the luminosity of the Large Hadron Collider (LHC) at CERN will require electronics to be able to withstand ultrahigh total ionizing dose (TID) levels up to 1 Grad(SiO2). For this reason, research on the TID response of modern technologies at ultrahigh doses has been receiving increasing attention in recent years in the HEP community. This paper reviews recent studies on TID effects on two modern commercial technologies: 28nm planar CMOS and 16nm FinFET technology. DC measurements provide insights into degradation mechanisms affecting oxide structures, including gate oxide, shallow trench isolation (STI), and spacers. The influence of transistor geometry and bias conditions during irradiation is analyzed, with emphasis on the mechanisms driving parameter degradation. Similarities and differences between the two technologies are highlighted.

Keywords: radiation effects; Total Ionizing Dose (TID); Metal–oxide semiconductor (MOS) transistors; FinFET

Primary author: MATTIAZZO, Serena

Presenter: MATTIAZZO, Serena

Session Classification: Operation in extreme environment

Contribution ID: **4** Type: **not specified**

Registration and Welcome lunch

Wednesday, 5 March 2025 12:00 (1h 45m)

Session Classification: Welcome Greetings

Contribution ID: **5** Type: **not specified**

Opening Remarks by Institutional Representatives

Wednesday, 5 March 2025 13:45 (15 minutes)

Alberto Quaranta, Marco Maggiora, Angelo Rivetti

Session Classification: Welcome Greetings

Contribution ID: **6** Type: **Talk**

On-line Testing and Healing Permanent Radiation Effects in Reconfigurable Systems

Wednesday, 5 March 2025 15:00 (25 minutes)

Primary author: STERPONE, Luca

Presenter: STERPONE, Luca

Session Classification: Operation in extreme environment

Contribution ID: **7** Type: **Talk**

Radiation-hardened embedded FPGA for applications in high-energy physics

Wednesday, 5 March 2025 15:25 (20 minutes)

Primary author: FRONTINI, Luca

Presenter: FRONTINI, Luca

Session Classification: Operation in extreme environment

Contribution ID: **8** Type: **Talk**

Very low noise transimpedance amplifiers to readout SiPMs at cryogenic temperature

Wednesday, 5 March 2025 16:15 (25 minutes)

Primary author: GOTTI, Claudio

Presenter: GOTTI, Claudio

Session Classification: Operation in extreme environment

Contribution ID: **9** Type: **Talk**

From lab to orbit: an overview of the IXPE readout electronics design

Wednesday, 5 March 2025 17:05 (25 minutes)

Primary author: MINUTI, Massimo

Presenter: MINUTI, Massimo

Session Classification: Operation in extreme environment

Contribution ID: **10** Type: **Talk**

Low-Power Front-End Electronics chip design for the LITE_SLPD experiment in space applications

Wednesday, 5 March 2025 16:40 (25 minutes)

Primary author: BADONI, Davide

Presenter: BADONI, Davide

Session Classification: Operation in extreme environment

Contribution ID: **11** Type: **Talk**

Cold electronics for Martian and lunar exploration. Threats, opportunities and technological challengies

Wednesday, 5 March 2025 17:30 (25 minutes)

Primary author: ZERILLI, Luca

Presenter: ZERILLI, Luca

Session Classification: Operation in extreme environment

Contribution ID: **12** Type: **not specified**

Roundtable Discussion: Q&A and Insights

Wednesday, 5 March 2025 17:55 (35 minutes)

Session Classification: Operation in extreme environment

Contribution ID: **13** Type: **Talk**

The challenges of large ASIC integration and verification: the RD53 experience

Thursday, 6 March 2025 09:15 (25 minutes)

Primary author: LODDO, Flavio

Presenter: LODDO, Flavio

Session Classification: Integration challenges - 1

Contribution ID: **14** Type: **Talk**

FEROCE and the journey of data from the detector to the computing farm

Thursday, 6 March 2025 09:40 (25 minutes)

Primary author: TRIOSSI, Andrea

Presenter: TRIOSSI, Andrea

Session Classification: Integration challenges - 1

Contribution ID: **15** Type: **Talk**

APE Router: an IP enabling low-latency packet communications for FPGA-based distributed processing.

Thursday, 6 March 2025 10:05 (25 minutes)

Primary author: LO CICERO, Francesca

Presenter: LO CICERO, Francesca

Session Classification: Integration challenges - 1

Contribution ID: **16** Type: **Talk**

AI Engine Technology in AMD Devices

Thursday, 6 March 2025 11:00 (25 minutes)

Primary authors: BAGNI, Daniele; GUASTI, Giovanni

Presenters: BAGNI, Daniele; GUASTI, Giovanni

Session Classification: Integration challenges - 2

Contribution ID: **17** Type: **Talk**

High speed serial links and radiation tolerant serdes devices for TTC distribution and DAQ in future HEP experiments

Thursday, 6 March 2025 11:25 (25 minutes)

Primary author: MAGAZZÙ, Guido

Presenter: MAGAZZÙ, Guido

Session Classification: Integration challenges - 2

Contribution ID: **18** Type: **Talk**

ARCADIA FDMAPS development with LFoundry 110 nm CIS

Thursday, 6 March 2025 11:50 (25 minutes)

Primary author: MANDURRINO, Marco

Presenter: MANDURRINO, Marco

Session Classification: Integration challenges - 2

Contribution ID: **19** Type: **not specified**

Roundtable Discussion: Q&A and Insights

Thursday, 6 March 2025 12:15 (30 minutes)

Session Classification: Integration challenges - 2

Contribution ID: **20** Type: **Talk**

Sensors and electronics for extreme timing at extreme rates

Thursday, 6 March 2025 14:00 (25 minutes)

Primary author: LAI, Adriano

Presenter: LAI, Adriano

Session Classification: Solutions for fast timing and high frequency

Contribution ID: **21** Type: **Talk**

Monolith Picosecond Avalanche Detector

Thursday, 6 March 2025 14:25 (25 minutes)

Primary author: KUGATHASAN, Thanushan

Presenter: KUGATHASAN, Thanushan

Session Classification: Solutions for fast timing and high frequency

Contribution ID: **22** Type: **Talk**

High resolution timing applications from the LGAD side

Thursday, 6 March 2025 14:50 (25 minutes)

Primary author: CARTIGLIA, Nicolo

Presenter: CARTIGLIA, Nicolo

Session Classification: Solutions for fast timing and high frequency

Contribution ID: **23** Type: **Talk**

Development of monolithic LGADs in 110nm CMOS: overview and perspectives

Thursday, 6 March 2025 15:15 (25 minutes)

Presenter: PANCHERI, Lucio (University of Trento)

Session Classification: Solutions for fast timing and high frequency

Contribution ID: **24** Type: **Talk**

A flexible electronics and DAQ system for the Timepix4 and Medipix4 ASICs

Thursday, 6 March 2025 16:20 (25 minutes)

Primary author: BIESUZ, Nicolò

Presenter: BIESUZ, Nicolò

Session Classification: Solutions for fast timing and high frequency

Contribution ID: **25** Type: **Talk**

The dRICH data acquisition system for ePIC: a general overview

Thursday, 6 March 2025 16:45 (25 minutes)

Primary author: FALCHIERI, Davide

Presenter: FALCHIERI, Davide

Session Classification: Solutions for fast timing and high frequency

Contribution ID: **26** Type: **Talk**

Monolithic (ASPIDES) and hybrid (ADA_5D) approach to the readout of avalanche diodes in high dynamic range applications

Thursday, 6 March 2025 17:10 (25 minutes)

Primary author: RATTI, Lodovico

Presenter: RATTI, Lodovico

Session Classification: Solutions for fast timing and high frequency

Contribution ID: **27** Type: **Talk**

CMOS SPAD Arrays for Quantum Imaging: Opportunities and Challenges

Friday, 7 March 2025 09:40 (25 minutes)

Primary author: GANDOLA, Massimo

Presenter: GANDOLA, Massimo

Session Classification: Future (Electronics for Quantum Technologies (Single Photon Detection), gravitational wave detection (Einstein Telescope), and Real-Time Artificial Intelligence

Contribution ID: **28** Type: **Talk**

Electronic system for the control and readout of superconducting quantum bit

Friday, 7 March 2025 08:50 (25 minutes)

Primary author: GIACHERO, Andrea

Presenter: GIACHERO, Andrea

Session Classification: Future (Electronics for Quantum Technologies (Single Photon Detection), gravitational wave detection (Einstein Telescope), and Real-Time Artificial Intelligence

Contribution ID: **29** Type: **Talk**

Next-Generation Control Systems for European Gravitational Waves Detectors

Friday, 7 March 2025 11:05 (25 minutes)

Primary author: GENNAI, Alberto

Presenter: GENNAI, Alberto

Session Classification: Future (Electronics for Quantum Technologies (Single Photon Detection), gravitational wave detection (Einstein Telescope), and Real-Time Artificial Intelligence

Contribution ID: **30** Type: **Talk**

Low Latency Data Acquisition for Future Gravitational Waves Detectors

Friday, 7 March 2025 11:30 (25 minutes)

Primary author: PROSPERI, Paolo

Presenter: PROSPERI, Paolo

Session Classification: Future (Electronics for Quantum Technologies (Single Photon Detection), gravitational wave detection (Einstein Telescope), and Real-Time Artificial Intelligence

Contribution ID: **31** Type: **Talk**

Memristor-CMOS Synergy –Innovating Circuit Configurations for In-memory Computing

Friday, 7 March 2025 11:55 (25 minutes)

Primary author: BOCCI, Valerio

Presenter: BOCCI, Valerio

Session Classification: Future (Electronics for Quantum Technologies (Single Photon Detection), gravitational wave detection (Einstein Telescope), and Real-Time Artificial Intelligence

Contribution ID: **32** Type: **Talk**

Exploring Novel Neuromorphic Computing Architectures with a Multi-Node FPGA System

Friday, 7 March 2025 12:20 (25 minutes)

Primary author: PERTICAROLI, Pierpaolo

Presenter: PERTICAROLI, Pierpaolo

Session Classification: Future (Electronics for Quantum Technologies (Single Photon Detection), gravitational wave detection (Einstein Telescope), and Real-Time Artificial Intelligence

Contribution ID: **33** Type: **Talk**

New ASICs for medical imaging with embedded machine learning capability

Friday, 7 March 2025 12:45 (25 minutes)

Primary author: FIORINI, Carlo

Presenter: FIORINI, Carlo

Session Classification: Future (Electronics for Quantum Technologies (Single Photon Detection), gravitational wave detection (Einstein Telescope), and Real-Time Artificial Intelligence

Contribution ID: **37** Type: **not specified**

Roundtable Discussion: Q&A and Insight

Thursday, 6 March 2025 17:35 (30 minutes)

Session Classification: Solutions for fast timing and high frequency

Contribution ID: **38** Type: **Talk**

The RETINA project: from R&D to integration in the DAQ of LHCb

Thursday, 6 March 2025 08:50 (25 minutes)

Presenter: LAZZARI, Federico (Istituto Nazionale di Fisica Nucleare)

Session Classification: Integration challenges - 1

Contribution ID: **39** Type: **not specified**

The RETINA project: from R&D to integration in the DAQ of LHCb

Session Classification: Integration challenges - 1

Contribution ID: **41** Type: **not specified**

TBC ”Electronics for controlling multiple Qbits”

Friday, 7 March 2025 09:15 (25 minutes)

Presenter: DE DOMINICIS, Francesco (Istituto Nazionale di Fisica Nucleare)

Session Classification: Future (Electronics for Quantum Technologies (Single Photon Detection), gravitational wave detection (Einstein Telescope), and Real-Time Artificial Intelligence

Contribution ID: **42** Type: **Talk**

TID mechanisms on nanoscale CMOS technologies

In High-Energy physics applications, electronic devices will experience ever-increasing radiation doses. The forthcoming increase of the luminosity of the Large Hadron Collider (LHC) at CERN will require electronics to be able to withstand ultrahigh total ionizing dose (TID) levels up to 1 Grad(SiO2). For this reason, research on the TID response of modern technologies at ultrahigh doses has been receiving increasing attention in recent years in the HEP community. This paper reviews recent studies on TID effects on two modern commercial technologies: 28nm planar CMOS and 16nm FinFET technology. DC measurements provide insights into degradation mechanisms affecting oxide structures, including gate oxide, shallow trench isolation (STI), and spacers. The influence of transistor geometry and bias conditions during irradiation is analyzed, with emphasis on the mechanisms driving parameter degradation. Similarities and differences between the two technologies are highlighted.

Keywords: radiation effects; Total Ionizing Dose (TID); Metal–oxide semiconductor (MOS) transistors; FinFET

Primary author: MATTIAZZO, Serena (Università di Padova e INFN PD)

Presenter: MATTIAZZO, Serena (Università di Padova e INFN PD)

Session Classification: Operation in extreme environment

Contribution ID: **43** Type: **Talk**

Very low noise transimpedance amplifiers to readout SiPMs at cryogenic temperature

Several next-generation experiments will use SiPMs cooled to very low temperatures. The DUNE experiment will use large arrays of SiPMs to detect scintillation light produced in liquid argon (90 K) by neutrino interactions. Each channel will require single photon sensitivity with a total photosensitive area of tens of cm^2, read out with a single amplifier. Due to the low source impedance, with a total capacitance of 50-100 nF, an amplifier with very low voltage (series) noise is required, capable of operating reliably in liquid argon for decades of data acquisition, while consuming less than 1 mA per channel. The LHCb Upgrade II RICH detectors will use SiPMs to detect Cherenkov photons for particle identification. Due to the high neutron fluence, up to a few 10^{13} cm^{-2}, cooling to low temperature, most likely to liquid nitrogen (77 K), will be the only way to ensure single photon sensitivity over the lifetime of the experiment. A time resolution of less than 100 ps RMS will be required, which in turn will require SiPMs to be characterised by an amplifier with very low voltage noise, wide bandwidth and low jitter. This talk will describe two transimpedance amplifier designs that meet the above requirements, both based on a SiGe HBT as the input device, followed by different operational amplifiers, both forming closed-loop configurations.

Primary authors: CARNITI, Paolo (Istituto Nazionale di Fisica Nucleare); GOTTI, Claudio (Istituto Nazionale di Fisica Nucleare); PESSINA, Gianluigi Ezio (Istituto Nazionale di Fisica Nucleare); TROTTA, Davide (Istituto Nazionale di Fisica Nucleare)

Presenter: GOTTI, Claudio (Istituto Nazionale di Fisica Nucleare)

Session Classification: Operation in extreme environment

Contribution ID: **44** Type: **not specified**

TBD

Friday, 7 March 2025 10:05 (25 minutes)

Presenter: CACCIA, Massimo

Session Classification: Future (Electronics for Quantum Technologies (Single Photon Detection), gravitational wave detection (Einstein Telescope), and Real-Time Artificial Intelligence