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Displacement damage induced by electrons in CMOS Single-Photon Avalanche Diodes.

Ponticelli E., Di Capua F., Campajola M.
Dipartimento di Fisica "Ettore Pancini", Università degli Studi di Napoli "Federico II", Italia

This work investigated the degradation induced to 150-nm Single-Photon Avalanche Diodes (SPADs) by 2 MeV electrons. The great relevance of studying radiation damage on SPADs comes from their wide use in many areas that include high radiation fields, such as space applications or high-energy physics. In this work, the radiation-induced damage effects were investigated through a Dark Count Rate (DCR) behavior analysis. Different architectures of CMOS SPADs, both in terms of structural parameters and geometrical configuration, were tested. Despite electrons being light particles, the work was focused on Displacement Damage, which has been slightly investigated in literature for these particles. Displacement Damage results in reticular defects that lead to a DCR increase by mostly thermal causes in most linear-region operating devices; the study revealed an interesting behavior of DCR as a function both of absorbed dose and applied voltage, suggesting a strong relevance of tunneling contribution to noise in a peculiar way for Geiger-Mode devices such as SPADs, alongside the thermal one.

Cryogenic vacuum behavior of porous materials of interest for future accelerators.

Angelucci M., Spallino L., Cimino R.
Laboratori Nazionali di Frascati, LNF-INFN I-00044 Frascati, Italy

The properties of vacuum components at cryogenic temperature represent a crucial aspect to assure accelerator's best performances. These are not only intrinsic to each surface but also to the residual gas physisorbed on the walls and to the many interactions such surfaces will undergo during operation. Here we report on our study about the effects induced by temperature fluctuations and electron irradiation on a class of porous materials which are potential candidates of future accelerators. The results will be useful to predict the gas quantity delivered in cryogenic vacuum from porous surfaces.

Il progetto REMIX: Research on Emerging Medical radIonuclides from the X-sections.

Pupillo G. ([1]), Barbaro F. ([2])([3]), Campostrini M. ([1]), Canton L. ([3]), Carante M.P. ([2])([5]), Cazzola E. ([6]), Cisternino S. ([1])([4]), Colombi A. ([2])([5]), De Dominicis L. ([1])([4]), De Nardo L. ([3])([4]), Esposito J. ([1]), Fontana A. ([5]), Groppi F. ([7]), Manenti S. ([7]), Petra Martini ([1]), Melendez-Alafort L. ([1])([8]), Mou L. ([1]), Rigato V. ([1]), Sciacca G. ([1])([4])
([1]) *Istituto Nazionale di Fisica Nucleare - Laboratori Nazionali di Legnaro, INFN-LNL*
([2]) *Università di Pavia*
([3]) *INFN - Sezione di Padova, INFN-PD*
([4]) *Università di Padova*
([5]) *INFN - Sezione di Pavia, INFN-PV*
([6]) *Ospedale Sacro Cuore Don Calabria, Negrar, VR*
([7]) *Università di Milano e INFN - Sezione di Milano, INFN-MI*
([8]) *Istituto Oncologico Veneto, IOV-IRCCS*

Lo scopo del progetto REMIX è studiare la produzione con acceleratori di Sc-47 ed alcuni radionuclidi del terbio: Tb-149, Tb-152, Tb-155 e Tb-161. Tali radionuclidi hanno caratteristiche ideali per essere utilizzati nella teranostica di diversi tumori, dato che possono svolgere un'azione sia diagnostica che terapeutica. Il progetto REMIX, finanziato dall'INFN

per gli anni 2021–2023 e svolto all'interno del programma di ricerca LARAMED presso i Laboratori Nazionali di Legnaro, vede la collaborazione di varie sezioni (LNL, PD, PV e MI) e la collaborazione dell'Ospedale Sacro Cuore Don Calabria (Negrar, VR) e dell'Istituto Oncologico Veneto (IOV). L'obiettivo è la misura presso il centro di ricerca ARRONAX (Nantes, Francia) di diverse sezioni d'urto, del confronto dei dati sperimentali con i risultati della modellistica nucleare e del calcolo della dose per alcuni radiofarmaci, considerando le radiazioni emesse sia dal radionuclide di riferimento che dagli eventuali isotopi contaminanti.

Compact Raman setup to measure natural gas composition.

Cocola L., Melison F., Poletto L.
CNR IFN UOS Padova, Italia

It is here presented a multi-gas analyzer using Raman spectroscopy for the in-line measurement of composition and heating value of natural gas. The system consists of: 1) a high-power lighting-grade multimode laser diode; 2) a gas cell rated for operation up to 7 bar pressure; 3) a custom-designed lens-based f/2.8 spectrometer with a CMOS camera as high-sensitivity and low-noise focal-plane array. The system is intended to be operated in a wide range of temperatures, from −20 °C to 50 °C. The use of a multimode laser diode gives Raman spectra that are broadened and drifting with temperature. Custom image processing and fitting software cope for these effects and give gas composition once calibration spectra have been acquired. The method has been validated against the single components (such as methane and other alkanes, nitrogen, oxygen, carbon dioxide, hydrogen) and tested with certified gas mixtures simulating the concentration levels commonly found during field operation on natural gas. The method can be considered as a competitor of most available non-analytical techniques for the determination of the heating value and complementary to gaschromatography.

Il progetto europeo BLEMAB: La radiografia muonica come strumento di *imaging* in ambito industriale.

Borselli D. ([1])([2]), Ambrosino F. ([3])([4]), Andreetto P. ([5]), Bonechi L. ([1]), Bonomi G. ([6])([7]), Bottai S. ([1]), Buhles T. ([8]), Calliari I. ([9]), Checchia P. ([5]), Chiarotti U. ([10]), Cialdai C. ([1]), Ciaranfi R. ([1]), Cimmino L. ([3])([4]), Ciulli V. ([1])([11]), D'Alessandro R. ([1])([11]), D'Errico M. ([2])([3]), Ferretti R. ([12]), Finke F. ([8]), Franzen A. ([8]), Glaser B. ([13]), Gonzi S. ([1])([11]), Liu Y. ([13]), Lorenzon A. ([5])([14]), Masone V. ([4]), Nechyporuk O. ([15]), Pezzato L. ([9]), Rangavittal B.V. ([13]), Ressegotti D. ([16]), Saracino G. ([3])([4]), Sauerwald J. ([9]), Starodubtsev O. ([1]), Viliani L. ([1])
([1]) *INFN, Florence, Italy*
([2]) *Department of Physics and Geology, University of Perugia, Perugia, Italy*
([3]) *Physics Department "Ettore Pancini", University of Naples Federico II, Naples, Italy*
([4]) *INFN, Naples, Italy*
([5]) *INFN, Padua, Italy*
([6]) *Department of Mechanical and Industrial Engineering, University of Brescia, Brescia, Italy*
([7]) *INFN, Pavia, Italy*
([8]) *Ironmaking Department/ArcelorMittal Bremen GmbH, Bremen, Germany*
([9]) *Department of Industrial Engineering, University of Padua, Padua,Italy*
([10]) *Rina Consulting - Centro Sviluppo Materiali SpA, Rome, Italy*
([11]) *Department of Physics and Astronomy, University of Florence, Florence, Italy*
([12]) *Rina Consulting - Centro Sviluppo Materiali SpA, Terni, Italy*
([13]) *KTH Royal Institute of Technology, Stockholm, Sweden*
([14]) *Department of Physics and Astronomy, University of Padua, Padua, Italy*