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BOOK OF ABSTRACT

Editors

Flavio Seno
University of Padova

Davide Valenti
University of Palermo

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Dipartimento di Fisica e Chimica

#505 - Gel dosimeters for medical physics applications

Francesco d'Errico (I) - Yale University

Other Authors: Luigi Lazzeri (Università di Pisa), Mario Mariani (Politecnico di Milano), Daniele Dondi (Università degli Studi di Pavia), Maurizio Marrale (Università degli Studi di Palermo), Paolo Randaccio (Università degli Studi di Cagliari), Giancarlo D'Agostino (Istituto Nazionale di Ricerca Metrologica)

Gel dosimeters for three-dimensional mapping of radiotherapy doses were introduced at Yale University in the mid-1980's. Soon after, R&D in this field also started in Italy. Early work was done at the Istituto Superiore di Sanità, and at the Universities of Pisa and Milan. Several institutes now collaborate on this topic with support from the Italian Ministry for University and Research (MIUR) through Grant PRIN SNALEM2010 "Development and application of new materials for ionizing radiation dosimetry". This presentation describes this research, which aims at developing new formulations of hydrogel matrices with improved characteristics of stability, sensitivity and spatial resolution compared to those of earlier Fricke-gel and polymer-gel systems. An additional goal of our research is the simplification of the manufacturing processes in order to facilitate the diffusion of this technology and its transition from the bench to the bedside.

#506 - Hadrontherapy: from the conventional modality to the laser-driven approach

GIACOMO CUTTONE (I) - Laboratori Nazionali del Sud, INFN

Other Authors: GAP Cirrone, F Romano, F Schillaci, V Scuderi, G Candiano, V Marchese, G Larosa, G Milluzzo, R Leanza, G Petringa, A Tramontana (Laboratori Nazionali del Sud, INFN; Via S sofia 63, Catania, Italy)

External radiation treatments coupled to (on-line and off-line) imaging techniques with hadron beams represent, nowadays, the frontier of conformational radiotherapy for tumor treatments and one of the best clinical approach for the battle against cancer. Today, more than 40 hadrontherapy centers are active around the world and about 40 are planned to be realized in the next five years.

Nevertheless, the large-scale adoption of hadrontherapy centers is strongly limited by the complexity and cost of these facilities.

In this context, laser-accelerated ion beams represent a fascinating alternative in the field of non-conventional acceleration techniques. The INFN ELIMED (ELI-Beamlines MEDical and multidisciplinary applications) project aims to demonstrate the potential medical applicability of optically accelerated proton beams.

In this work we will present the status of the art of the clinical dosimetry with proton beams as well as the future challenges that the laser-driven beams reserve in this field.

Design, development and characterization of beam transport, selection and dosimetric devices for high-energy laser-driven proton beams will be also presented.

#507 - Innovative approaches in the dosimetry of laser-driven proton beams for future hadrontherapy applications

Renata Leanza - INFN

Other Authors: G.A.P. Cirrone¹, F. Romano¹, V. Scuderi^{1,2}, A. Amato¹, L. Andò¹, A. Attili³, M. Borgesi⁴, G. Candiano¹, L. Cosentino¹, M. Costa¹, G. Cuttone¹, G. De Luca¹, D. Doria⁴, G. Gallo¹, G. Korn², R. Leanza^{1,6}, M. Maggiore⁵, R. Manna¹, V. Marchese¹, D. Margarone², A. Maugeri¹, G. Milluzzo^{1,6}, A. Musumarra¹, L. Pandola¹, G. Petringa^{1,6}, S. Pulvirentil¹, D. Rifuggiato¹, D. Rizzo¹, S. Salamone¹, F. Schillaci¹, M. Sedita¹, A. Seminaro¹, A. Tramontana^{1,6}, B. Trovato¹, C. Vaglini¹ 1 Istituto Nazionale di Fisica Nucleare, Laboratori Nazionali del Sud, Via Santa Sofia 62, Catania, Italy 2 Department of Experimental Program at ELI-Beamlines, Institute of Physics of the ASCR, ELI-Beamlines project, Na Slovance 2, Prague, Czech Republic 3 Istituto Nazionale di Fisica Nucleare, Sezione di Torino, Via P. Giuria 1, Torino, Italy 4 Centre of Plasma Physics, School of Mathematics and Physics, The Queen's University of Belfast, United Kingdom of Great Britain 5 Istituto Nazionale di Fisica Nucleare, Laboratori Nazionali di Legnaro, Viale dell'Università 2, Legnaro (Pd), Italy 6 Università di Catania, Dipartimento di Fisica e Astronomia, Via S. Sofia 64, Catania, Italy

Over the last decades, charged particle acceleration using ultra-intense and ultra-short laser pulses has been one of the most attractive topics in the relativistic laser-plasma interaction research. Actually, one of the most challenging ideas consists on using laser-target interaction as a source of high-energy ions for medical applications. In this framework, the purpose of the international ELIMED network consists on demonstrating that laser-driven high-energy proton beams can be used for multidisciplinary applications investigating, particularly, new approaches in the hadron-therapy field.

We started to design a beam transport line prototype that allow the focalization and selection of the accelerated particles able to deliver laser-generated proton beams with optimized properties suitable for multidisciplinary applications.

Furthermore, a Faraday cup (FC) prototype for absolute dosimetry has been designed and realized and preliminary tests have been performed with conventional proton beams at LNS-INFN, and with laser-driven beams at the PALS laser facility in Prague and at the TARANIS laser facility in Belfast.

In this contribution, the design and development of the dosimetric prototypes developed will be discussed. Moreover, preliminary results obtained at the mentioned facilities will be presented.