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Optimization of a table-top synchrotron light source for radiological applications

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Within the Seventh Framework Programme (FP7) of the European Commission, a three-year project named LABSYNC has been recently funded with the aim of designing a complete small facility around the MIRRORCLE light source, a laboratory sized commercial synchrotron developed in Japan [1]. The Medical Physics group of Ferrara University is one of the seven partners of the LABSYNC consortium. Within the project, we will be responsible for the design of an X-ray imaging beamline for diagnostic and therapy applications owing to the broad experience in the physics of diagnostic radiology acquired through the years, in particular for the application of synchrotron radiation to mammography and the development of tunable quasi-monochromatic x-ray beams.
Preliminary investigations have confirmed the potential of small-scale synchrotron light sources for medical imaging applications. Indeed, Monte Carlo simulations have demonstrated that x-ray beams generated by the interaction of MeV electrons with target materials of diagnostic interest are far more intense than those generated by conventional x-ray tubes [2]. Furthermore, significant improvement in x-ray beam monochromaticity can be achieved by viewing the x-ray emission from a direction orthogonal or antiparallel to that of the incident electron beam. Since the energy range involved is significantly beyond the diagnostic range an optimization of x-ray detector characteristics is also desirable.
Finally, if electron beams with energies of about 20 MeV will be available then also monochromatic X-rays produced by Parametric X-ray Radiation might be tested.

[1] http://www.kuleuven.be/labsync/
[2] M. Marziani et al "Optimization of radiography applications using x-ray beams emitted by compact accelerators.", Med. Phys. 36, 2009.

Please submit a short bio (max 1500 characters)

Mauro Gambaccini graduated in Physics at the University of Ferrara in 1977. From November 2002 he is Full Professor with the Physics Department at the University of Ferrara. His research is devoted to the physics of medical imaging with attention to the processes of image formation, detection and manipulation in both x- and gamma- rays. To this aim he has led projects involving research groups from various universities. He has also led research groups in experiments carried out in synchrotron radiation facilities like Frascati (ADONE), Trieste (ELETTRA) and Grenoble (ESRF). He is currently involved in two projects for the development of novel monochromatic x-ray sources: BEATS (INFN project to use inverse Compton scattering) and LABSYNC (European project to use a compact synchrotron light source). He is author and co-author of more than 90 publications in peer-reviewed journals. He has attended various national and international conferences as invited speaker. He is fellow of the Italian Association of Medical Physics (AIFM) and the Italian Society of Physics (SIF). Member of the Physics in Radiology committee for the ECR in 2002. Secretary of the ETP committee within the European Federation of Organizations for Medical Physics (EFOMP). Member of the International Advisory Board of the scientific journal Physics in Medicine and Biology. Member of the Research Council of Ferrara University. Lecturer at the Italian School of "Senologia"directed by Prof. U. Veronesi.

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