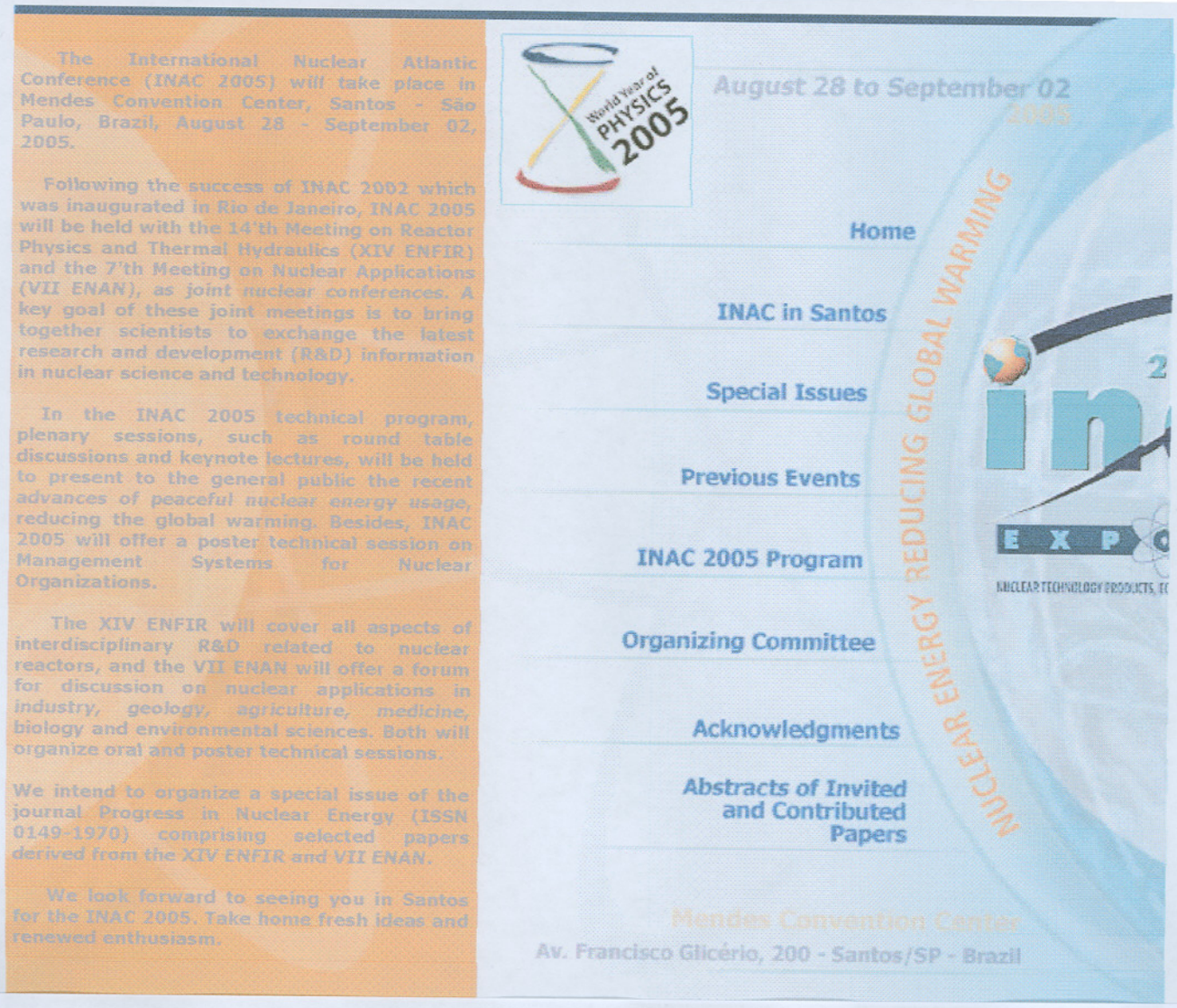

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MONTE CARLO SIMULATION OF X-RAY SPECTRA IN DIAGNOSTIC RADIOLOGY AND MAMMOGRAPHY USING GEANT4

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ABSTRACT

The open-source object-oriented toolkit GEANT4 was used to simulate x-ray spectra in diagnostic radiology and mammography. The simulations were performed using different combinations of target, filters and tube voltages. All the relevant physical processes were included in the calculations: Compton scattering, photoelectric effect, Rayleigh scattering, bremsstrahlung and ionization. The analyzed energy range is from 10 keV to 150 keV. Both Penelope and Low Energy physical models included in the Low Energy extensions of GEANT4 toolkit were used in this work. Range cuts for electron and gamma were set to 500 nm and 3000 nm, respectively. The simulated x-ray spectra using both physics models were compared with calculated spectra generated by the IPEM report number 78. Results show good agreement for the bremsstrahlung intensity for the spectra with tube voltages 40 kV, 100 kV and 150 kV, while the bremsstrahlung intensity is larger for the simulated spectra with 25 kV and 30 kV. Simulated characteristic peaks present lower intensities all spectra. These discrepancies should be related with the ionization process and/or the atomic relaxation implemented in the code. The cross section tables for electrons used in the simulations should be checked.