The BN Samples as Targets for Studies of Nuclear Reactions on Nitrogen: $^{14}N(p,d)^{13}N$ at Proton Energies Used in Hadrontherapy

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Abstract. The BN samples, prepared in UNIPRESS by sintering BN powder at 1000ºC under 7.7 GPa pressure, or available commercially from Saint-Gobain, were successfully used as nuclear targets irradiated simultaneously with proton beam of initial energy equal to 58 MeV. The reaction $^{14}N(p,d)^{13}N$ was studied through the measurement of β^+ decay of ^{13}N, leading to the emission of two 511 keV annihilation γ-quanta measured in $LaBr_3$:Ce scintillation detectors. The ^{13}N nucleus cannot be formed with proton on any boron isotope (A=10 or 11). A stack of BN targets was simultaneously irradiated, so the relative beam intensity was stable. Decay spectroscopy of 511 keV line (single and coincidence) was applied, allowing to disentangle β^+ decays of ^{13}N and ^{11}C (produced in $^{14}N(p,\alpha)$ and $^{11}B(p,n)$ reactions) with relative intensities determined with 3% precision.