Measurement of the $pd\mu$ fusion cycle parameters in the solid H/D mixture

M. Filipowicz$^a$, V.M. Bystritsky$^b$, V.V. Gerasimov$^b$ and J. Woźniak$^c$

$^a$ Faculty of Fuels and Energy, AGH University of Science and Technology, PL-30059 Krakow, Poland

$^b$ Laboratory of Nuclear Problems, Joint Institute for Nuclear Research, Dubna 141980, Russia

$^c$ Faculty of Physics and Applied Computer Science, AGH University of Science and Technology, PL-30059 Krakow, Poland

The final results of the $\mu$CF kinetics experimental study in solid hydrogen-deuterium mixtures (H/D) at temperature 3 K are presented. The experiment E742 has been carried out on the meson facility TRIUMF(Canada). Four exposures were performed at different deuterium concentration in H/D mixture: $c_d = 0.0005, 0.02, 0.15$ and 0.75. The simultaneous analysis of the measured time distributions of 5.5 MeV $\gamma$-quanta and 5.3 MeV conversion muons from nuclear fusion in $pd\mu$ molecule allowed to extract the values of the $\mu$CF chain parameters in H/D mixture: the fusion partial rates for different nuclear spin states of the $pd\mu$ molecule and the $pd\mu$ molecule formation rate. The experimental data fitting procedure has been done by two ways: using only the analytical formulae described the kinetics of $\mu$CF processes in H/D mixture and the detailed Monte-Carlo simulation of the whole experiment. The results ($pd\mu$ formation rate, $pd$ fusion rates in different nuclear spin states of $pd\mu$ molecule ($S = 1/2$; $S = 3/2$)) with gamma and conversion muon production obtained by these two methods are consistent with each other and confirm the existence of the Wolfenstein – Gershtein effect. There is a 20 - 30% difference between the final results and our previous data reported on the Ascona $\mu$CF Conference.