MLF Experimental Report	提出日 Date of Report
課題番号 Project No. 2013A0175 実験課題名 Title of experiment INVESTIGATION OF A UNCONVENTIONAL HYDROGEN GEOMETRIC EFFECT IN HYDROXYL SALTS CO2(OH)3CL AND CO2(OD)3CL 実験責任者名 Name of principal investigator X.G. Zheng 所属 Affiliation Saga University	装置責任者 Name of responsible person Y.Miyake 装置名 Name of Instrument/（BL No.） D1 実施日 Date of Experiment 2013. 5.16−2013.5. 18

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。（適宜、図表添付のこと）
Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

Co2(OD)3Cl in powder form

2. 実験方法及び結果（実験がうまくいかなかった場合、その理由を記述してください。）
Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

Hydroxyl salts of the type M2(OH)3X (X = Cl, Br or I) have been known for a long time. In recent years their magnetic properties became clear and they are known as “frustrated magnets” due to our research efforts. We further found that for $Co_2(OH)_3Cl$ and $Co_2(OH)_3Br$, which have the highest crystal symmetry in M2(OH)3X, their deuterated compounds $Co_2(OD)_3Cl$[Br] clearly showed ferroelectric response at exceptionally high temperatures. Therefore, we performed □SR experiments on $Co_2(OD)_3Cl$ to reveal the mechanism for this unconventional ferroelectric response, using the muon facilities of J-PARC. We observed a change in the dynamics of D atoms in $Co_2(OD)_3Cl$ through the nuclear field of D (Fig. 1).

2. 実験方法及び結果（つづき） Experimental method and results (continued)

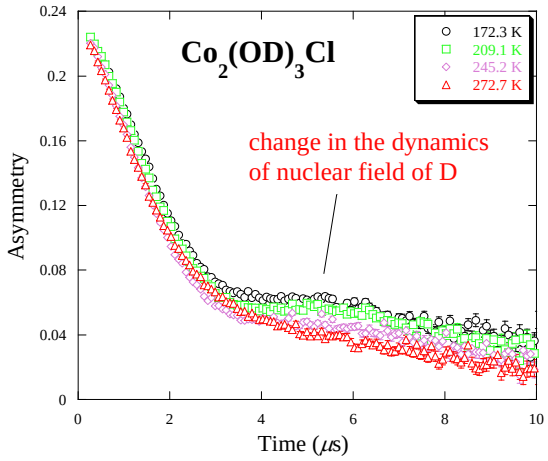

Fig. 1: Muon-spin-ralaxation spectra indicating a change in the dynamics of D atoms in $Co_2(OD)_3Cl$.

The asymmetry $a(t)$ of the muon-spin-ralaxation can be expressed by a combination of dynamic Kubo-Toyabe function and an exponential function. The dynamic Kubo-Toyabe function represents the contribution from the nuclear dipolar field of D atoms, and the exponential one accounts for the magnetic relaxation. field of the D atoms in $Co_2(OD)_3Cl$ shows a turning point at around the ferroelectric transition temperature T_E = 230 K (Fig. 2), suggesting that the hydrogen (D) dynamics plays a critical role in the ferroelectric response of $Co_2(OD)_3Cl$.

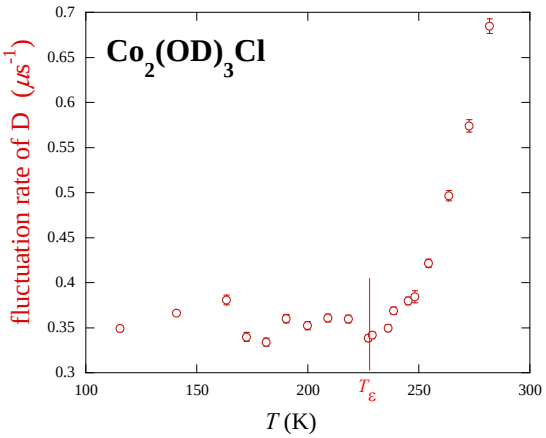

Fig.2: The analyzed fluctuation rate of the nuclear dipolar field of the D atoms in $Co_2(OD)_3Cl$.