EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Status Report to the ISOLDE and Neutron Time-of-Flight Committee

Determination of the B(E3,0 $^+$ ->3 $^-$) strength in the octupole-correlated nuclei 142,144Ba using Coulomb excitation

28/09/2016

```
M. Scheck<sup>1</sup>, D.T. Joss<sup>2</sup>, A. Andreyev<sup>3</sup>, C. Barton<sup>3</sup>, A. Blazhev<sup>4</sup>, S. Bönig<sup>5</sup>, P.A. Butler<sup>2</sup>, J. Cederkäll<sup>6</sup>,
D. Cline<sup>7</sup>, T.E. Cocolios<sup>8</sup>, M. Danchev<sup>9</sup>, P. Van Duppen<sup>10</sup>, L.P. Gaffney<sup>10</sup>, R. Gernhäuser<sup>11</sup>, K. Gladniski<sup>9</sup>,
A. Görgen<sup>12</sup>, T. Grahn<sup>13,14</sup>, P.T. Greenlees<sup>13,14</sup>, M. Guttormsen<sup>12</sup>, A. Jungclaus<sup>15</sup>, K. Hadynska-Klek<sup>16</sup>,
A. Hayes<sup>7</sup>, R.-D. Herzberg<sup>2</sup>, M. Huyse<sup>10</sup>, A. Ignatov<sup>5</sup>, T. Ilieva<sup>5</sup>, J. Iwanicki<sup>16</sup>, D.G. Jenkins<sup>3</sup>, J. Jolie<sup>4</sup>, R. Julin<sup>13</sup>,
N. Kesteloot<sup>10</sup>, T. Kröll<sup>5</sup>, R. Krücken<sup>11</sup>, E. Kwan<sup>17</sup>, A.-C. Larsen<sup>12</sup>, M.T. McEllistrem<sup>18</sup>, K. Moschner<sup>4</sup>,
D. Mücher<sup>11</sup>, P. Napiorkowski<sup>16</sup>, K. Nowak<sup>11</sup>, G. O'Neill<sup>2</sup>, R.D. Page<sup>2</sup>, J. Pakarinen<sup>13,14</sup>, D. Pietak<sup>16</sup>,
P. Rahkila<sup>13,14</sup>,G. Rainovski<sup>9</sup>, P. Reiter<sup>4</sup>, M. von Schmid<sup>5</sup>, M. Seidlitz<sup>4</sup>, S. Siem<sup>12</sup>, G.S. Simpson<sup>1</sup>, J. Srebrny<sup>16</sup>,
P. Thirolf<sup>19</sup>, M. Thürauf<sup>5</sup>, D. Voulot<sup>8</sup>, R. Wadsworth<sup>3</sup>, N. Warr<sup>4</sup>, F. Wenander<sup>8</sup>, K. Wimmer<sup>20</sup>,
K. Wrzosek-Lipska<sup>16</sup>, C.Y. Wu<sup>17</sup>, S.W. Yates<sup>18</sup>, and M. Zielinska<sup>21</sup>
1 University of the West of Scotland
2 University of Liverpool
3 University of York
4 University of Cologne
5 TU Darmstadt
6 Lund University
7 University of Rochester
8 CERN-ISOLDE
9 Sofia University
10 KU Leuven
11 TU München
12 University of Oslo
13 University of Jyväskylä
14 Helsinki Institute of Physics
15 Institudo de Estructura de la Materia Madrid
16 HIL University of Warsaw
17 Lawrence Livermore National Laboratory
18 University of Kentucky
19 LMU München
20 Central Michigan University
21 CEA Saclay
                               Spokesperson(s): M.Scheck (marcus.scheck@uws.ac.uk)
```

D.T.Joss (dtj@ns.ph.liv.ac.uk) Local contact: E.Rapisarda (elisa.rapisarda@cern.ch) Status Report as requested in the minutes of the INTC meeting #43, concerning document: CERN-INTC-2012-047, INTC-P-348 (Experiment IS553)

In the minutes of the INTC meeting #43 the 33 shifts requested in order to fulfill the physics aims as stated in the proposal were recommended under the condition that a Status Report is presented, clarifying whether the measurements will have been performed elsewhere.

An attempt to measure the B(E3,0+ \rightarrow 3⁻) excitation strength in ¹⁴⁴Ba using Coulomb excitation employing a combined setup of CARIBU, ATLAS, CHICO II., and GRETINA at Argonne National Laboratory was conducted in 2014.

Due to low statistics and considerable level of contamination (see Fig. below), the extracted B(E3) transition probability has a large uncertainty, 48^{+25}_{-34} W.u. [1]. This value does not distinguish between the predictions of available theories. The low statistics was due to the low beam intensity ($\approx 8 \times 10^3$ nuclei/s), which will be exceeded by at least one order of magnitude by HIE-ISOLDE ($\approx 2 \times 10^5$ nuclei/s). To the best of our knowledge [2] no further attempts are intended at the moment.

Hence, in order to obtain a precise value for this crucial quantity with less than 15% relative error, it is mandatory to perform the experiment as proposed. We, herewith request the 33 shifts as outlined in the proposal.

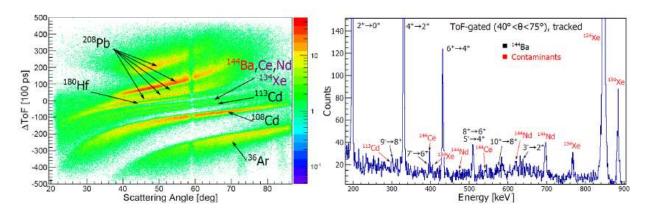


Figure 1: Left side, Time-of-flight versus scattering angle plot used for particle identification, which shows the various beam contaminations. Right side: 144 Ba on 208 Pb Coulomb-excitation γ -ray spectrum extracted using ToF gating and an angular range of 40-75°. Obviously, the crucial peak of the $3^- \rightarrow 2^+$ transition at 638 keV is weakly emerging above the background and additionally obscured by a peak belonging to a transition of 144 Nd. Courtesy of C.Y. Wu and B. Bucher.

- [1] B. Bucher et al., Phys. Rev. Lett. 116, 112503 (2016)
- [S] S. Zhu, private communication