**Motivation**

With the Radioactive Ion Beam Factory (RIBF) at RIKEN being on the cusp to deliver the world’s most intense RI beams, a new γ-ray detection array is required to exploit the new experimental possibilities coming along with it. The material LaBr3(Ce) possesses an unprecedentedly high intrinsic energy resolution for scintillators of 2 % (FWHM) at 1332.5 keV and an excellent time resolution below 500 ps and is therefore well suited for high-resolution in-beam γ-ray experiments at relativistic energies. To minimize Doppler effects, the total array will comprise of up to one thousand individual crystals. The array will be placed around the secondary target area of the large acceptance fragment separator BigRIPS. Alternatively, the array can be used in a different configuration for stopped beam, delayed γ-ray decay experiments.

**Objectives and considerations**

- Construct a 4rt LaBr3 fast beam γ-ray detection array of up to 1000 detectors with an optimized geometry for RIBF energies of v/c = 0.6.
- Energy resolution of less than 3 % (FWHM) at Ev = 1332.5 keV and Ebeam = 100 MeV/u.
- Full energy peak efficiency (FEP) of 40 %.
- Simple detector geometry for a maximum of flexibility and to allow for an easy reconfiguration of the array for stopped beam experiments.
- In the first instance, the uncompleted array can be used in addition to a modified DALI2 array*.

**Configuration for fast beam experiments**

- 960 LaBr3 detectors.
- Arranged in a configuration that keeps the same Doppler broadening due to the detectors’ opening angle for all polar angles at v/c = 0.6.
- 15 x 40 x 80 mm³ crystal size.
- Simulations are performed with a 0.5 mm thick Al housing.

**Configuration for stopped beam experiments**

- 960 LaBr3 detectors in a simple boxed shaped geometry.
- 15 x 40 x 80 mm³ crystal size.
- 12 cm distance to target.
- Simulations performed with Al housings of 0, 0.5 and 1.0 mm thickness.
- ≈ 85 % solid angle coverage.
- High granularity is kept for high energetic γ-rays.

**Simulated exemplary experiments**

- 25 particles per second ¹²⁴Sn beam at secondary target.
- Secondary target thickness of 500 mg/cm² Au.
- \( B(E2; 0^+ \rightarrow 2^+ ) = 0.044 \text{ e}^2\text{b}^2 \) from shell model calculations.
- 5 days beam on target.

- 50 implanted ¹³⁰Cd isomers.
- \( 2^+ \) \( 4^+ \) \( 6^+ \) \( 8^+ \) at the limits.

**Conclusions**

- The LaBr3 array in a configuration of 960 detectors with the dimensions of 15 x 40 x 80 mm³ fulfills the set requirements on energy resolution and photopeak efficiency at the relativistic secondary beam energies of the RIBF.
- The high granularity and efficiency of the array make it a powerful tool to study Y-γ angular correlations.
- Only few implanted isomers are necessary to reconstruct level schemes. Therefore, the array is a dedicated equipment for the spectroscopy of very weakly produced isomers.