GRETINA Service Level Description

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Prepared by

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X _Dirk Weisshaar (signature)_

Dirk Weisshaar
Senior Research Physicist
Signed by: weisshaa

Reviewed by

12/2/2020

X _Alexandra Gade (signature)_

Alexandra Gade
Professor of Physics
Signed by: gade

Approved by

12/2/2020

X _Georg Bollen (signature)_

Georg Bollen
Experimental Systems Division Director
Signed by: bollen

Concurred

12/2/2020

X _Jill Beryman (signature)_

Jill Beryman
Manager for User Relations
Signed by: berrymaj

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Revision History

Revision	Issued	Changes
R001	2 December 2020	Original issue

Authorizing Document

None.

Authorized Documents

None.

Authorized Committees and Boards

None.

Named Program Roles

None.

1   Objective

This documents describes the level of service FRIB will be able to provide for the operation of GRETINA and for user support for experiments.

2   Abbreviations

ANL: Argonne National Laboratory

DAQ: Data-Acquisition System

GEANT: GEometry ANd Tracking (simulation code)

GRETINA: Gamma-Ray Energy Tracking In-beam Nuclear Array

LBNL: Lawrence Berkeley National Laboratory

SLD: Service Level Description

3   GRETINA Overview

GRETINA consists of twelve gamma-ray tracking modules, each one housing four high-purity, 36-fold segmented Ge crystals, totaling 48 detectors and 1776 high-resolution channels. A detailed study of the in-beam performance of GRETINA can be found in *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, Volume 847, 187-198 (2017)*. The source-efficiency curve from this publication scaled to twelve modules can be used for estimating the in-beam efficiency of GRETINA with four modules placed at 58º and the remaining eight at 90º. In this particular configuration, the impact of the Lorentz boost on the efficiency is small. For more elaborate estimates the GEANT-based simulation code UCGretina is available, see http://gretina.lbl.gov.

4   Standard Configuration

4.1 Physical Configuration

4.1.1 Frame mechanics and detector positions

The GRETINA frame consists of two solid Al hemispheres with 21 positions for the GRETINA detector modules. The table below gives the available detector angles (beam axis with respect to the axis of the detector module) and number of available slots at each angle. Please note that detectors at ring 5 are NOT available when GRETINA is set up in front of the S800 spectrograph, as those positions are blocked by the 6 inch diameter beam pipe needed for in-flight separated beams.

RING	ANGLE	SLOTS	REMARK
2	58º	4	
3	90º	8	
4	122º	4	
5	148º	5	Not available at the S800

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Both hemispheres can be moved perpendicular with respect to the beam axis and allow access to the target chamber area.

4.1.2 Target chamber

For experiments with fast beam, a standard target chamber with corresponding vacuum system is available. The chamber is a cylindrical, thin-walled Al beam pipe of 6 inch diameter. The standard target size is 50mm x 50mm. Targets are typically glued to a support ring and placed on a low-mass cradle. The cradle is inserted into the target chamber using a precision stick. Targets have to be provided by the experimenter.

4.2 Operational Features

Experimenters can request a specific configuration of the 12 gamma-ray tracking modules over the 21 available mounting positions in the hemispheres.
The dynamic range of the front-end electronics is fixed at 10MeV for the segment channels. The central contacts are converted in four energy ranges, 2MeV, 5MeV, 10MeV and 30MeV and all ranges are recorded in the data stream simultaneously.
Energy thresholds are typically set at 50-80keV.

4.3 Electronics and Data Acquisition

GRETINA is read out using a fully digital electronics and data acquisition system developed by LBNL and ANL. A software interface will be available which sends time-stamped data from NSCL DAQ based devices (such as the S800 spectrograph) to the GRETINA DAQ. Events will be built by the GRETINA DAQ. GRETINA data comprises of the energy and timing of each hit segment and core electrode and the energy deposition and spatial coordinates of each interaction point obtained from the signal decomposition algorithm.

4.4 Analysis Software and Tools

A software interface will allow access to event-built data from the GRETINA DAQ. Online analysis software based on the SpecTcl framework will be made available to monitor the experiments online. Online event correlation between S800 particle data and Doppler-corrected gamma rays measured with GRETINA will be available. The same software can also access event data stored on disk and enables off-line sorting.

5   Instrument Support Level

5.1 Device Scientist Support

FRIB provides support of GRETINA by a device scientist. Setup of the instrument will be coordinated by the device scientist. On-site support is normally available from 9 a.m. to 5 p.m. on working days. On-call support for critical technical assistance during the experiment outside of the normal working hours can be requested by contacting the operator in charge (OIC), who will then contact the device scientist on call.

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5.2   Additional Support

Prior to the experiment training will be provided by the device scientist for operating the GRETINA DAQ, using the online analysis software, and performing source calibration measurements. The training offered covers:

- Start/Stop of data runs
- Analysis of online and offline data using the SpecTcl-based software
- Typical diagnostic checks for monitoring the performance of GRETINA
- Procedure to hand over beam to operators
- Procedure to accept beam back from operators
- Procedure to access and secure the experimental area

On request, experimenters can be trained to open and close the array. If the target chamber as described in 4.1.2 is used, experimenters can be trained in operating the vacuum system of the target chamber and in changing targets. Approval from the device scientist is required to be allowed to perform those tasks after successful training.

Changing of detector configurations is a major task and any change to a setup other than requested in the proposal shall be communicated to the device scientist and stated in the spokesperson questionnaire. Changes of detector configurations outside the scope of the questionnaire will be subject to schedule and resource limitations.

Users are welcome to participate in the installation phase and should contact the device scientist to coordinate schedules. For experiments using additional equipment not supported by this SLD (e.g. the plunger target system), the spokesperson should contact the device scientist for coordination of the set-up.

A USB docking station will be available to copy the experiment data on user-provided hard discs. These data may include raw data (detector waveform data) which are routinely taken in experiments with low or medium count rate. Raw data allows to re-run the signal decomposition process. Raw data is not regarded as production data and will not be copied by the IT department after close-out of the experiment for hand-over to the user. No software is provided to analyze these raw data.

6   Additional instrument support for GRETINA not covered in this SLD

Any request for support not covered in this SLD should be submitted to the FRIB Manager of User Relations prior to the submission of an experiment proposal for pre-approval.

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