Summer Student
Project Charter

Program Name: Searching for and placing limits on the gamma-ray emission from CHIME/FRBs using Swift/BAT GUANO

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Version: 1.0

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PURPOSE

The Project Charter formally authorizes a project or project phase and documents the initial requirements that will satisfy the stakeholder's needs and expectations. It outlines the known program scope, schedule, cost, resources, and the key assumptions and constraints that are needed to formally commission the project teams to start.

Document History

Ver.	Date	Author	Change History
1.0	2022-04-22	Paul Scholz and Ziggy Pleunis	Initial version

1 PROGRAM OVERVIEW

1.1 Description

- Our collaborators at Swift have been automatically dumping the Swift/BAT time-tagged event buffer using the GUANO system triggered by our VOEvents. BAT data is available for > 500 CHIME/FRB events. There is baseband data for a large fraction of the events (VOEvents and baseband callbacks have the same trigger criteria). We can therefore use baseband localizations in the analysis. In the summer project, the student will develop an end-to-end workflow to search for gamma-ray counterparts in the BAT data. To perform this analysis there are steps needed involving both CHIME/FRB and Swift/BAT data.

1.2 Requestor(s)

- Paul Scholz, Ziggy Pleunis

1.3 Stakeholders

Stakeholder	Project Role(s)	Description
Paul Scholz, Ziggy Pleunis	Supervisors	Paul and Ziggy will provide daily supervision to the summer student.
Aaron Tohuvavohu	External Collaborator	Aaron will provide advice on how to perform the BAT analysis.

1.4 Data Plan

- Swift/BAT data are publicly available and downloadable from the HEASARC archive. Swift provides a python API to query GUANO triggers and download the data for each trigger.
- The baseband data sets need for this project will be available either on the on-site archiver or on CANFAR. The student will access and process the baseband data preferably at CANFAR using already available baseband-analysis tools.

1.5 Scientific Benefits

- The project will provide a workflow for searching for and placing limits on the gamma-ray emission from CHIME FRBs.
- The workflow can be extended to the full sample (> 500 events) which will be the widest (in terms of sources) and deepest (in terms of sensitivity to 15-150 keV gamma-rays) search for gamma-ray counterparts to FRBs.

2 CONSTRAINTS, ASSUMPTIONS, AND DEPENDENCIES

2.1 Assumptions

- Baseband localizations will either be available for events or supercomputing resources (on-site or CANFAR) will be available for student to perform the baseband pipeline processing with help from supervisors.

2.2 Dependencies:

- Some support from Swift/BAT experts on BAT data analysis.

3 SCOPE & SCHEDULE

3.1 In Scope

- Collect an inventory of available Swift/BAT and CHIME/FRB baseband data
- Select a small test set of events on which to develop workflow.
- Run and verify baseband localization for test set using the CHIME/FRB baseband pipeline on CANFAR.
- Using baseband position and mask-weighted BAT images, create source light-curves for each test set event.
- Place limits on gamma-ray emission using light curves and BAT effective area towards the source location.
- Provide well-documented code for the above workflow on CHIME/FRB github.
- Write up a report on the above workflow so that others can apply it to future events.
- Time permitting: Apply workflow to a wider set of events than the test set.

3.2 Out of Scope

- Applying analysis to all CHIME/FRB events with GUANO dumps.
- Preparation of a scientific manuscript on the search and limits.

3.3 Program Success Criteria and High-Level Deliverables:

- Search performed and limits placed for a set of baseband-localized FRBs.
- Well-documented code for the workflow.
- Written report on the workflow.

3.4 Schedule Estimates

- Week 1-2: Specifications, familiarize with CHIME/FRB collaboration, code standards, project board, github repositories.
- Week 3-4: Familiarization with baseband localization pipeline and outputs.
- Week 5-6: Familiarization with Swift BAT masked-weighted imaging and light curve extraction.
- Week 7: Specification of how to combine CHIME/FRB and Swift BAT information into a limit on gamma-ray emission. Definition of test set events.
- Week 8-11: Development and refinement of workflow though application to a test set of events.
- Week 12-13: Streamlining of workflow through lessons learned from test set, documentation of code.
- Week 14: Submit final code for review.
- Week 15: Document and presentation.