

Proposing an experiment at IOTA/FAST

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INTRODUCTION

The Integrable Optics Test Accelerator (IOTA) and its injector, the Fermilab Accelerator Science and Technology (FAST) superconducting electron linac, are facilities dedicated to research and education in beam physics and accelerator technology [1, 2]. Current areas of research include the dynamics and control of hadron beams with strong self fields for high-energy physics; the experimental demonstration of nonlinear integrable optics; stochastic beam cooling at optical frequencies; magnetized beams for electron cooling; quantum properties of radiation from single electrons; beam dynamics in superconducting cavities; advanced beam diagnostics; and others.

This document is meant to help Fermilab scientists and engineers and their external collaborators in the process of proposing and carrying out experiments at IOTA/FAST.

PROPOSAL PREPARATION AND REVIEW

The IOTA/FAST Scientific Committee (ISC) evaluates experimental proposals and, together with the Fermilab Directorate, establishes research priorities for the facility. Current members of the committee are listed in Appendix A. The procedures outlined in this document are designed to achieve the following objectives:

- Encourage a vibrant scientific program
- Establish fair and transparent resource and schedule priorities
- Ensure that adequate internal and external resources are allocated to each project
- Document the research done at the facility
- Develop a straightforward proposal evaluation process to serve a facility that, by its nature, must accommodate frequent apparatus modifications and several experiments operating in parallel

Experiments are proposed by Fermilab researchers or by external collaborators from laboratories, universities, industry, etc. Each experiment designates a Spokesperson or Principal Investigator (PI) and, optionally, a Deputy Spokesperson or co-PI. If neither the Spokesperson or the Deputy Spokesperson is a Fermilab employee, a Fermilab Liaison is identified. Before starting experimental work, external members of all experiments register as Fermilab users in the FAST/IOTA Collaboration, which serves as a general umbrella organization for administrative purposes.

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Beam time at IOTA/FAST is divided into ‘runs.’ The first commissioning and experimental run (Run 1) took place between August 2018 and April 2019. It is expected that there will be a couple of runs each year, each lasting a few months, spaced by shutdown periods for maintenance and installation of equipment.

Proposals can be submitted any time. The ISC meets about once a month to discuss and evaluate the proposals. During a run, if necessary, the ISC may meet more frequently to ensure that experiments are scheduled as soon as possible. The ISC maintains a web site with resources related to the proposal submission process and with the list of current experiments [3].

The proposal process is divided into three main phases, described below.

A. Preliminary Discussions and Letter of Intent

Researchers discuss the project with interested parties and with Fermilab staff.

A letter of intent describing the proposed research is sent by e-mail to one of the members of the ISC. The letter of intent is in the form of a short document, from a few paragraphs up to 4 pages in length.

B. Proposal Preparation and Submission

The formal proposal is a detailed written document describing the scientific and technical aspects of the experiment.

The proposal contains at least the following elements: title, personnel, scientific goals, beam conditions, experimental methods and apparatus, required equipment and services, experimental plan and proposed schedule, funding sources. A proposal template can be found on the ISC web site [3].

The written proposal is submitted by e-mail to a member of the ISC. The committee and the spokesperson also schedule an oral presentation to discuss the proposal.

C. Scientific and Technical Reviews

The *scientific review* is carried out by the ISC. The main evaluation criterion is scientific merit, as defined, for instance, by current literature, support of independent experts or relevance to the Fermilab program. For prioritization and scheduling purposes, the ISC also considers other factors, such as alignment with current priorities and compatibility with the existing apparatus.

The *technical review* includes safety, feasibility, availability of internal and external resources, schedule, and the impact on other projects. It is coordinated by the Head of the FAST Facility Department, with input from relevant Departments (safety, mechanical and electrical engineering, instrumentation, cryogenics, controls, etc.).

The outcome of the reviews is approval, deferral, or rejection.

If the proposal is rejected, the spokesperson is notified in writing of the decision and of the reasons for it.

Proposals may be deferred if there are unanswered questions or in cases when the project may benefit from an extension of the preparatory phase.

Approved experiments are included in the experimental program and in the schedule of facility operations. Installation, beam time and decommissioning are coordinated by the spokesperson with the Head of the FAST Facility Department and with the IOTA/FAST Run Coordinator.

DOCUMENTATION AND COMMUNICATION

Approved experiments document and communicate their progress and results to the ISC and to the community. At a minimum, the spokesperson and collaborators:

- Maintain a web site with links to documents, pictures, data, computer code, internal notes, papers, etc. Support is available to set up the system at Fermilab through Redmine if the experiment chooses to do so.
- Present brief and regular oral status updates. During the run, experiments that received beam time give a 10-minute presentation at the IOTA/FAST Friday group meetings every two weeks.
- Publish results as soon as possible after the end of the run. Publication may be in the form of peer-reviewed journal papers, conference proceedings contributions, Fermilab Technical Memos or Physics Notes, internal reports in the Accelerator Division Beams-doc database, or a combination of these. At least one written report is published within 6 months of the end of the run.

Appendix A: Members of the IOTA/FAST Scientific Committee

Current members of the committee are

- Giulio Stancari (chair), Head of the Accelerator Research Department, stancari@fnal.gov;
- Dan Broemmelsiek, Head of the FAST Facility Department, broemmel@fnal.gov;
- Alexander Valishev, Head of the Accelerator Science and Technology Sector, valishev@fnal.gov.

It is expected that the committee will be expanded to include scientists outside Fermilab. In addition, the committee occasionally consults external experts, depending on the scope of the proposed experiments.

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- [1] S. Antipov et al., IOTA (Integrable Optics Test Accelerator): Facility and Experimental Beam Physics Program, [JINST 12, T03002 \(2017\)](#).
- [2] General information on the IOTA/FAST facility can be found at fast.fnal.gov.
- [3] The web page of the IOTA/FAST Scientific Committee is cdcv.sfnal.gov/redmine/projects/ifsc/wiki.