



## Sandia National Laboratories Pulsed Power Sciences

### Call for Proposals Package for the Z Facility Fundamental Science Program for the Period July 1, 2024 to June 30, 2026

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## Part 1: Shot Opportunity Description

### **A. Background**

The Z facility includes a megajoule-class pulsed power accelerator at Sandia National Laboratories (SNL) that, after more than twenty years, has grown into a multifaceted experimental resource; see, for example, the recent review article in *Physics of Plasmas* [D.B. Sinars et al., *Phys. Plasmas* **27**, 070501 (2020)]. The Z accelerator produces intense x-rays and magnetic fields useful for experiments in fundamental high-energy-density science. The Z Petawatt and Z Beamlet lasers are used as diagnostics on the Z accelerator and as stand-alone experimental facilities. Approximately 10% of the Z shots allocated – around 14 shots/year – will be designated for fundamental science during the period 7/1/2024 to 6/30/2026. SNL researchers are available for

scientific collaboration and for assistance with user experiments. Principal Investigators are strongly encouraged to collaborate with SNL staff members; for each proposal utilizing the Z accelerator an ‘SNL accelerator scientist’ will be assigned to assist experimental planning and execution.

This call for proposals offers opportunities for U.S. University, Business, and National Laboratory Scientists to perform experiments in high-energy-density (HED) physics, including inertial confinement fusion (ICF), laboratory astrophysics, properties of materials under HED conditions, etc. For a broad review of HED physics, see the National Research Council report, “Frontiers in High Energy Density Physics: The X-Games of Contemporary Science” (copyright 2003, National Academy Press, Washington, DC). Many of the physics regimes outlined in this report are accessible using the Z facility.

For information about the Z facility, the solicitation process, and/or Z accelerator scientists who will assist in experimental planning and execution, please contact:

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## **B. Solicitation Schedule**

<b>Event</b>	<b>Target Date</b>
Call for proposals	June 15, 2023
Proposals due (via <b>.docx, .rtf, or .pdf</b> format)	<b>September 15, 2023</b>
Distribution of shots to projects	December 15, 2023
Experiments conducted	July 1, 2024 through June 30, 2026

The (unclassified) proposals must be received in full by close of business on September 15, 2023 at Sandia National Laboratories at the following email address: [zproposals@sandia.gov](mailto:zproposals@sandia.gov)

### ***C. Z Fundamental Science Program Purpose and Objectives***

The primary purpose of the Z Fundamental Science Program is to provide access to NNSA's Z accelerator for HED experiments. The specific objectives of the program are to provide access to the Z accelerator and its diagnostics to a broad community of academic, industrial, and national laboratory research interests, for use:

1. as tools for conducting fundamental research in HED science, and
2. in providing research experience necessary to maintain and grow the HED community, especially through involvement of researchers from academia.

### ***D. Technical Scope and Research Areas***

The research tools and resources of the Z facility are available to scientists for state-of-the-art fundamental research in HED physics, which is taken to include, but is not limited to: hydrodynamics, properties of materials under extreme conditions, laboratory astrophysics, advanced ignition concepts, fundamental HED physics, biology, and chemistry.

Fundamental research is defined as research directed toward increased knowledge in a particular field of science. The primary aim of fundamental research is deeper knowledge or understanding of the subject matter under study, rather than immediate application of that knowledge.

## **Part 2: Shot Allocation Information**

### ***A. Type of Award Instrument***

Sandia National Laboratories' Z facility will provide:

1. experimental time;
2. basic power feed hardware;
3. load assemblies and most targets; and
4. standard diagnostics\*.

### ***B. Anticipated Experiment Size***

We encourage projects utilizing the Z accelerator in the range of 2 to 3 shots per calendar year.

### ***C. Expected Number of Experiments***

A total of approximately 14 shots will be scheduled over a 2-year period in CY2024, CY2025, and CY2026 for this proposal call. We anticipate including 3 to 4 project proposals for this call.

### ***D. Period of Performance***

This proposal announcement is for Z facility shot requests from July 1, 2024 to June 30, 2026.

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\* For diagnostic information please request a copy of the Z Diagnostic Update (SAND2022-10451C) from mdknuds@sandia.gov

## Part 3: Eligibility Information

### A. Eligible Applicants

The objective of this proposal announcement is to make experimental time available, on a competitive basis, for use of the unique resources of the Sandia Z facility by Principal Investigators (PIs) who are members of the teaching/research faculty of a U.S. university or academic institution, employees of U.S.-based companies, or members of one of the five principal U.S. laboratories participating in the HED program (currently LANL, LLNL, SNL, NRL, and UR/LLE). SNL must be notified of any foreign nationals involved in the proposed work. There may be some restrictions on participation by foreign nationals.

Note that Principal Investigators who have been awarded experimental time on Z through the CY22 Call for Proposals (including ride-along time and proof-of-principle opportunities) for the award period of July 1, 2023 through June 30, 2025 are not eligible for this call.

## Part 4: Application and Submission Information

### A. Content and Form of Application

#### 1. Cover Page/Proposal Summary

The first page of the proposal shall be the completed Proposal Summary Form, included in Appendix A of this announcement. If the project requires extraordinary support beyond the normal support for a Z experiment, such requirements and the source of such support must be identified.

#### 2. Project Narrative

The Project Narrative must not exceed 12 pages, including narrative cover page, table of contents, charts, graphs, maps, photographs, and/or other pictorial presentations, when printed using standard 8.5" by 11" paper with 1-inch margins (top, bottom, left, and right) with font not smaller than 11 point. **EVALUATORS WILL ONLY REVIEW THE NUMBER OF PAGES SPECIFIED IN THE PRECEDING SENTENCE.** Do not include any Internet addresses (URLs) that provide information necessary to review the application – any information contained in such sites will not be reviewed.

The Project Narrative must include:

#### (1) Narrative Cover Page: The narrative cover page must include:

- a. the name and type of organization;
- b. the project title;
- c. the technical points of contact for the proposal, including the names, titles, addresses, telephone and facsimile numbers, and electronic mail addresses; and
- d. a statement that the proposal is an application for experimental time on the Z facility, including the Principal Investigator's name, telephone number, facsimile number, electronic mail address, and institution.

- (2) Project Objectives: This section should provide a clear, concise statement of the specific objectives/aims of the proposed project.
- (3) Merit Review Criteria Discussion: This section should be formatted to address each of the merit review criteria and sub-criteria listed in Part 5A below. Provide sufficient information so that reviewers will be able to evaluate the application in accordance with these merit review criteria.
- (4) Relevance and Outcomes/Impacts: This section should explain the relevance of the proposed work to the objectives in the program announcement and the expected outcomes and/or impacts.

### 3. Appendices

The following information is to be included as appendices to the Project Narrative. These appendices will not count against the Project Narrative page limitation.

Appendix A: Project Management Plan: This appendix should identify the activities/tasks to be performed, a time schedule for the accomplishment of the activities/tasks, and the expected dates for the release of outcomes. Applicants may use their own project management system to provide this information. This plan should identify any decision points and go/no-go decision criteria. Successful applicants must use this project timetable format to report progress variances.

Appendix B: Bibliography and References Cited: This appendix should provide a list of all references cited in the Project Narrative. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address, if available electronically. Include only bibliographic citations. Applicants should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the application.

Appendix C: Facilities and Other Resources: This information is used to assess the capability of the organizational resources, including sub-awardee resources, available to perform the proposed work. Identify the facilities to be used (laboratory, office, laser, etc.) at each performance site listed. If appropriate, indicate their capacities and pertinent resources that are directly applicable to the proposed work. Describe other resources available to the project (such as machine shop, electronic shop, etc.) and the extent to which they would be available to the project.

Appendix D: Experimental Requirements: This appendix should contain information on the technical requirements necessary to complete a successful experiment. Please provide the Z facility with the most detailed information possible. In particular, please include:

- a. diagnostics requirements, including both standard and new diagnostics;
- b. Z accelerator configuration, including Marx charge voltage, desired current, pulse length, pre-pulse suppression, and estimated pulse shape;

- c. load and target hardware requirements (include diagram of target concepts – a PowerPoint or scanned, hand-drawn sketch is acceptable); and
- d. Environment, Safety, and Health hazards such as beryllium, lithium, heavy metals, gases, explosives, *etc.* **Safety is of utmost importance at the Z facility – please describe any material or process that can pose a hazard to the operations staff or to the facility.**

Appendix E: Roles of Collaborators/Participants: This appendix should provide concise information on collaboration with SNL scientists or scientists at other institutions who are required to conduct the proposed work. Also include official institutional confirmation of the acceptance of such collaborations, as appropriate. For multi-organizational or multi-investigator projects, describe the roles and responsibilities for each of the participants/investigators, provide business agreements between the applicant and participants, and describe how the various efforts will be integrated and managed.

Appendix F: Evaluation Phase: This appendix must include a plan and metrics to be used to assess the success of the project.

Appendix G: Biographical Sketch: This appendix should provide a biographical sketch for the project director/principal investigator (PD/PI) and each senior/key person listed. The biographical information for each person must not exceed 2 pages when printed on 8.5” by 11” paper with 1-inch margins (top, bottom, left, and right) with font not smaller than 11 point. The biographical information must include:

- a. Education and Training: Undergraduate, graduate, and postdoctoral training, including institution, major/area, degree obtained, and year.
- b. Research and Professional Experience: Beginning with the current position, list in chronological order professional/academic positions with a brief description.
- c. Publications: Provide a list of up to 10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address, if available electronically. Patents, copyrights, and software systems developed may be provided in addition to, or substituted for, publications.
- d. Synergistic Activities: List no more than 5 professional and scholarly activities related to the proposed work.

## ***B. Submission Dates and Times***

Proposals must be received in full by close of business on **September 15, 2023**. Proposals received after this deadline will not be reviewed or considered for an experimental series during this proposal cycle. Proposals must be submitted via e-mail in **.docx, .rtf, or .pdf format** at the following email address: [zproposals@sandia.gov](mailto:zproposals@sandia.gov)

Confirmation of receipt will be provided.

## **Part 5: Application Review Information**

### ***A. Criteria***

#### **1. Initial Review Criteria**

Prior to a comprehensive merit evaluation, an initial review will be held to determine that:

- (1) the applicant is eligible;
- (2) the information required by the announcement has been submitted;
- (3) all mandatory requirements are satisfied; and
- (4) the proposed project is responsive to the objectives of the shot opportunity announcement.

#### **2. Merit Review Criteria**

Proposal packages will be technically evaluated based on four general scientific/technical criteria:

- (1) the scientific and technical soundness, quality of the proposed method/approach, and the feasibility/likelihood of accomplishment of the stated objective;
- (2) the overall scientific/technical merit of the project and its relevance and prospective contribution to its field of research;
- (3) the competence, experience, and past performance of the applicant, principal investigator and/or key personnel; and
- (4) the demands of the project in terms of resource requirements (equipment, shot time, etc.) and/or other requirements (facility hardware modifications, component development, etc.) vis-à-vis competing demands.

### ***B. Review and Selection Process***

The Z-facility conducts a review of the proposal packages with respect to resource requirements and operational feasibility.

An independent, non-conflicted, peer review panel of knowledgeable scientists will undertake a technical review of all submitted proposal packages.

The Z Facility Director, in consultation with the Pulsed Power Center Director and the Z Facility Science Advisory Committee, will determine the final Z schedule with the goal of maximizing the overall quality of work and impact within the bounds of available resources.

### ***C. Anticipated Notice of Selection and Award Dates***

We expect that the Principal Investigators of successful proposals will be notified by December 15, 2023 for experiments to be conducted starting July 1, 2024.



## Part 6: Z Facility Contacts

For information about the Z facility, the solicitation process, and/or the Z accelerator scientists who will assist in experimental execution, please contact:

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## **Appendix A**

# **Sandia National Laboratories Z Facility Fundamental Science Program Proposal Package Template for the period July 1, 2024 – June 30, 2026**

PID #:

Expected Shot Rate:

## Fundamental Science Program July 1, 2024 to June 30, 2026

<b>Title of project proposal:</b>	
<b>Principal Investigator &amp; Co-PI: (Name, Phone, Email, Institution)</b>	
<b>Sandia accelerator scientist</b>	
<b>Experiment type:</b>	(Ex. hydrodynamics, properties of materials under extreme conditions, laboratory astrophysics, advanced ignition concepts, magnetized plasma physics, fundamental HED physics...)
<b>Summary of experimental objectives:</b>	
<b>Experimental approach:</b>	
<b>Experimental weeks and expected shots/week:</b>	Total experimental weeks: Expected shots/week: If more than one experimental series, weeks by quarter: CY2024 Q3: Q4: CY2025 Q1: Q2: Q3: Q4: CY2026 Q1: Q2:
<b>Pulsed power parameters required</b> (e.g., Marx charge voltage, desired current, pulse length, pre-pulse suppression, pulse shape type, etc.)	
<b>Special considerations (ES&amp;H, security):</b>	Highlight use of beryllium, heavy metals, gases, explosives, ride-along experiments on Z, STAR, THOR, or DICE:
<b>Sandia-supplied diagnostics required:</b>	
<b>Type and number of targets/samples including spares and a <u>diagram of each type in project narrative:</u></b>	
<b>Specific user-supplied equipment required</b> (targets, diagnostics, samples, etc.):	

## Appendix B

### Formal Policy for Z Fundamental Science “Lost” Shots

The Z accelerator is a large-scale, industrial research facility, and as such can be prone to unexpected interruptions in operation. These interruptions can last from one day (in the case of a minor problem associated with load hardware or supporting equipment, such as the overhead crane), to several weeks (in the case of an unplanned stack rebuild). Such interruptions result in the need to reorganize the shot schedule; this is done by the Z Facility Director, in consultation with the Pulsed Power Center Director and the various programmatic stakeholders. Reorganization of the schedule may result in postponement of scheduled experiments; in some cases, this postponement may be indefinite (i.e. the shot does not immediately return to the new schedule). Furthermore, there is always a small, but finite probability of power flow problems associated with large-scale, localized current loss (i.e. an arc or “zinger”) which could compromise the quality of an experiment and/or problems with diagnostics resulting in loss of data. In any of these cases, one may consider the experiment as a “lost” shot. This document serves as the formal policy for managing “lost” shots experienced by individual Z Fundamental Science (ZFS) projects.

#### **A. Z Fundamental Science Director Shots**

Approximately 10% of the total shot time allocated to the ZFS Program – namely 1-2 shots per year, or 2-4 shots per proposal cycle – will be reserved as ZFS Director shots. These shots can be used, at the discretion of the ZFS Director, to either:

1. replace “lost” shots (see below) experienced by individual ZFS projects; or
2. award additional shots to individual ZFS projects.

#### **B. “Lost” Shots Due to Schedule Change**

In the event that a ZFS project experiences a “lost” shot due to an unforeseen schedule change for already built hardware (i.e. the shot is postponed indefinitely), every effort will be made to try and identify a suitable opportunity to reinsert the “lost” shot onto the Z schedule; this may require the “lost” shot be rescheduled during the following calendar year. In the event several ZFS experiments are postponed, particularly near the end of a proposal period, the subsequent call for proposals may be delayed in order to accommodate scheduling of postponed ZFS experiments.

#### **C. “Lost” Shots Due to Unmet Experimental Objectives**

In the event that a ZFS project experiences a “lost” shot due to unmet experimental objectives stemming from issues related to power flow, incorrect Z accelerator configuration, failed diagnostics, etc., the ZFS Director will consider replacement of the “lost” shot with one of the ZFS Director shots. However, we stress that this will be on a case by case basis and replacement is not guaranteed.