DIII-D National Fusion Facility Guidance Document	**Title:** Developing New Research/Project Proposals	
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	Process Owner: DIII-D Deputy Director	
	DIII-D Director Approval: RJ Buttery	

REVISION HISTORY

Rev.	Date	Description
A	August 4, 2021	initial release

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ACRONYMS

Acronym	Description
E&P	Engineering and Projects
FTE	Full Time Equivalent
GA-MFE	General Atomics, Magnetic Fusion Energy group
GB	Gigabyte
Hz	Hertz
PVR	Physics Validation Review

GLOSSARY

Term	Description
All DIII-D List	A communications list that includes the widest possible set of DIII-D personnel. The technical implementation of this List may change over time, e.g., an email distribution.
DIII-D Cyber Access	The application and approval process by which personnel are given access to DIII-D data and other resources, thereby becoming users of the facility. See https://fusion.gat.com/global/computing
SharePoint	Internal web application used to facilitate communication and documentation across the DIII-D team. Accessible at https://fusionga.sharepoint.com/

1. PURPOSE AND SCOPE

This guidance document describes the process of developing a new research concept or other project proposal within the DIII-D program. Details concerning the Physics Validation Review represent a procedure to be followed.

1.1. New Concepts or Project Proposals

As used in this document, a “new research concept or project proposal” is any research activity that requires non-incidental hardware investment or labor contribution from DIII-D Operations staff. The typical threshold for the incidental resource level is that the amount falls within the base budgets of the DIII-D program.

1.2. Definition of the Physics Validation Review (PVR)

The PVR is the process by which the DIII-D team defines the research scope and feasibility of a proposed project, including both scientific and engineering issues. Any new research concept or project proposal, as defined in Section 1.1, requires a PVR in order to be considered for implementation. At the close of the PVR process, the proposal should be specified such that the following information has been vetted by the wider team through a PVR Meeting:

- research goals and relevance to fusion or program development
- definition of the scientific scope is sufficient to meet research goals
- engineering feasibility design
- information concerning scientific benefit is suitable to inform a resource allocation decision from the DIII-D Director

1.3. PVR Role in Project Development

A diagram of the project proposal and/or new concept development process is shown in Figure 1. The Final PVR Report, along with the presentation and support materials it summarizes, serve as a proposal for consideration by the DIII-D Director. Following the closure of a PVR, a decision to proceed with the proposal causes a transition into project management. DIII-D project management procedures are described in forthcoming documents.

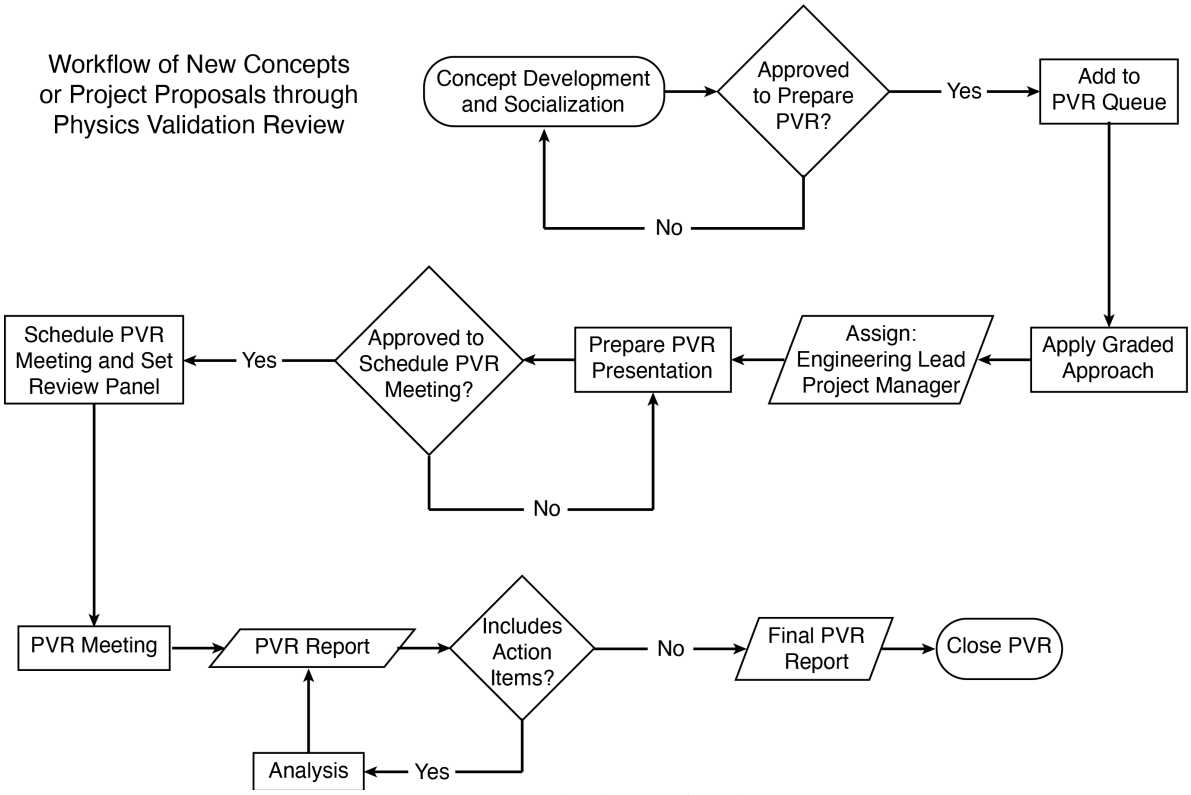

Figure 1: Project development flowchart.

2. APPLICABLE REFERENCE DOCUMENTS

2.1. PVR SharePoint Site

All team-wide information concerning PVRs, including process documentation and proposal statuses, are stored in a dedicated DIII-D SharePoint site at,
https://fusionga.sharepoint.com/sites/PhysicsValidationReview

The PVR SharePoint site is open to the entire DIII-D team.

2.2. PVR Status Form

The PVR Status Form serves as the single documentation point for the PVR process of any project. It includes notes and action items resulting from any PVR Meetings. At the closing of the PVR, this form is provided to the DIII-D Director and recorded for the team on the PVR SharePoint site.

The template of this form is available on the PVR SharePoint site at,
https://fusionga.sharepoint.com/:w:/s/PhysicsValidationReview/EWMLSvumIWtMmYxC2UGwS7YBFsz_7Z5Va-RnTnS1pzTi0Q?e=R4BRnc

2.3. Graded Approach Categorization Guidelines

This document provides a series of quantitative guidelines that are used to categorize projects. The resulting categorization of a project is then used to determine the requirements during all phases of project execution.

This document is available on the DIII-D SharePoint site at,
https://fusionga.sharepoint.com/:x:/s/PhysicsValidationReview/EdC_T4HVE21NngTnYFH5fSoB3oGAXLtp6Eoj70oa1E2e9g?e=Kqd1Fq

2.4. Project Folder

Materials related to each proposed PVR is stored in a dedicated folder within the PVR SharePoint Site. The PVR Status Form, PVR Meeting presentations, and any auxiliary materials are stored within this folder.

3. ROLES AND RESPONSIBILITIES

3.1. Proposer

The Proposer is the lead representative of the proposal across the PVR process. The Proposer interacts with other personnel to develop the proposal as required for the PVR.

3.2. PVR Chairperson

Initial point of contact for Proposers to register a proposal for PVR. Leads the graded approach assessment and identifies other responsible personnel as required. Chairs the PVR meeting and prepares record for archiving. The DIII-D Deputy Director either serves as the PVR Chairperson or assigns the role for all PVRs.

3.3. Engineering Lead

If determined necessary through the graded approach classification, then the Engineering Lead is assigned by the DIII-D Deputy Director. This person oversees the feasibility design that is included in the PVR.

3.4. Project Manager

If determined necessary through the graded approach classification, then the Project Manager is assigned by the DIII-D Deputy Director. This person oversees the planning of activities related to the proposal while ensuring that the work performed remains on schedule and within budget.

4. PROCESS DESCRIPTION

4.1. Concept Development and Socialization

The DIII-D program provides limited resources for socializing and developing new concepts and project proposals without requiring unique or specific approvals. It is important that such ideas be developed and submitted to the appropriate funding agency opportunities, wherein those proposals are technically reviewed. Within the DIII-D program, such ideas may be circulated and developed through the following venues (information concerning how to participate is provided to all DIII-D Cyber Access users),

- presentations made during the DIII-D Friday Science, Engineering, and Technology meeting
- participation in the Physics Topical Areas of the Experimental Science group

4.2. Placing a Proposal into the PVR Queue

The preparation and execution of a PVR requires appreciable labor from across the DIII-D team. The content of a PVR includes both physics and engineering design, requiring that a dedicated labor allocation be provided. The Proposer will contact the DIII-D Deputy Director to describe the project and request admission into the PVR queue. Once admitted, the DIII-D Deputy Director assigns the PVR Chairperson and adds the project to the queue as documented on the PVR SharePoint site.

4.3. Project Categorization According to Graded Approach

After admitting a proposal to the PVR queue, the PVR Chairperson will categorize the proposal according to the graded approach process outlined in Graded Approach Categorization Guidelines. Through this categorization, it will be determined whether the proposal requires dedicated Engineering Lead and Project Manager leading up to the PVR meeting. Based on the estimated scale of the project, and the known technical needs, some portions of the PVR presentation may be waived. Any waivers or special requirements for the proposal will be noted on the PVR Status Form under the Proposal Information section.

The graded approach is performed anew when proposals transition to a project execution phase. In that instance, the categorization determines a set of project management requirements.

4.4. Preparation of the PVR Presentation

Unless otherwise noted in the PVR Status Form, each PVR presentation must include the following sections.

4.4.1. Executive Summary

The first two slides, following the title slide, of the presentation should provide the following summary information,

- Key physics goals enabled by the project
- New capabilities available to the DIII-D team following project completion
- Summary of technical and engineering challenges
- Summary of program resources required by the project (cost and schedule)
- Summary of impacts on existing or in-progress systems

4.4.2. Elucidation of Research Goals

The research goals should be specified, and these may be called out as either directly related to the DIII-D program or the development of fusion energy more generally. It is not necessarily the case that DIII-D management will give equal weight to each type of goal. Past progress and research that motivates the new project should be presented. Finally, and regardless of whether the goal is already contained within DIII-D programmatic plans, the benefit of the project to the DIII-D program should be stated. This may include the key program achievements that the project would enable.

4.4.3. Unbounded Physics Specification

This section presents the physics specifications required to achieve the project goals, completely devoid of any engineering or technical limitation. Based on the previously stated physics goals, this section presents the required target regime and measurements, and the ways in which those data are used to achieve the goals. Measurement parameters need to include the field itself along with the accuracy, resolution (time and space), and precision. It is not required that existing techniques and capabilities are suitable to creating these regimes or performing these measurements.

The unbounded physics specification serves as a useful input when evaluating possible future facility improvements. This information may frequently describe impactful research avenues that are presently unobtainable due to engineering and/or technology constraints. Future technological advances may change the feasibility and/or cost of obtaining this unbounded specification. It is therefore advantageous to the program to document the ideal, or unbounded, physics specification of the various concepts that are proposed.

4.4.4. Initial Engineering and Technical Assessment

Following on the Unbounded Physics Specification, an initial engineering and technical assessment provides context for how the project may realistically be implemented at DIII-D. Engineering limitations should be described such that the difference between the unbounded needs and the potentially realizable parameters and measurements are known.

An engineering feasibility design should be presented. The level of technical detail should allow for the early identification of major conflicts across the facility. This includes, but is not limited to, requirements related to tokamak access (ports, personnel access, etc.), auxiliary systems, measurement needs, data storage, computing capability, and modeling availability.

This section must be approved by the Engineering Lead. The PVR Status Form documents this section, following the PVR Meeting, by recording an answer to the following question, “is there high confidence that the initial engineering assessment identifies the most important issues to address in any following design stage?”

4.4.5. Bounded Physics Specification

The Bounded Physics Specification presents the parameter regimes, measurements, and other pertinent requirements as proposed for implementation. These should be presented as technically feasible versions of the ideal specifications presented in the Unbounded section. Including both the unbounded and the bounded physics specifications allows the program to document the ideal (unbounded) and the realistically achievable (bounded).

Each proposed technique, e.g., measurement or plasma heating method, should be presented with the following context:

- Previous experimental work (not limited to tokamak implementations) that either demonstrates the validity of the approach or suggests a research avenue to develop it
- Modeling results that provide expected performance of this technique in the targeted DIII-D scenarios or plasma regimes

These techniques should be described by the following characteristics:

- Perturbation or input to the plasma, e.g., 2 MW of injected power
- Parameter to be measured, e.g., ion temperature
- Spatial extent, e.g., major radius from 1.6 to 2.2 m
- Temporal extent, e.g., during 2 – 4 second pulses of radiofrequency system
- Resolution, both spatial and temporal, e.g., 1 cm, 1 MHz
- Data storage requirement, e.g., 3 GB/shot or 1 Hz continuous monitoring

Where possible, each characteristic of a given measurement should be categorized according to the following indicators of importance:

- Essential: least demanding specification that allows for achieving the project goals, but at the highest risk of not achieving project goals
- Important: moderately demanding specification that improves the likelihood of achieving project goals (reduces risk), but at increased resource needs

- Desired: most demanding specification that greatly improves the likelihood of achieving the project goals with a commensurate increase in required resources and potential impacts on existing systems

The PVR Status Form documents this section, following the PVR Meeting, by recording answers to the questions:

- Is the Bounded Physics Specification sufficient to meet the Research Goals?
- Are the classifications of Essential, Important, and Desired appropriate?

4.4.6. Pre-conceptual Design for Implementation

This section details how the Bounded Physics Specification might be implemented within DIII-D. Implementation should be considered as an integration of the project into the wider DIII-D program. The following elements must be included:

- Scale of Project Cost: rough order of magnitude estimate. A refined engineering assessment based on the Bounded Physics Specification would contribute to this classification.
- Schedule: rough order of magnitude estimate. Should identify significant resources that limit the implementation time frame, e.g., length of vent(s) required to perform installation or a pre-install vent required for scoping or test fits of prototypes or the time to obtain needed hardware.
- Usage Level: rough estimate. Include either the number of experiments per year or the number of potential run days for which the resulting project system(s) is proposed to be utilized. Additional information may include examples of how the outputs from this proposed system can be useful in database studies.
- Modeling Support: rough estimate. The level of modeling or analysis support that is required to realize the stated project goals, e.g., amount of synthetic diagnostic work required to process measurements. This is provided in terms of the number of annual full time equivalents (FTE).
- Impacts on Existing Systems: rough estimate. List possible conflicts with other tokamak systems, including the proposed port assignments or other tokamak connections required by the proposed project (initial assessments of resources required to resolve conflicts should be included in the Scale of Project Cost). Describe any increases in rate of data storage or computing power needs.

The PVR Status Form documents this section, following the PVR Meeting, by recording an answer to the question, “is it highly likely that consequential impacts on existing DIII-D systems have been identified at the correct scale?”

4.4.7. Concluding Remarks

The conclusion of the PVR presentation should describe any relevant issues not treated by the prescribed sections.

4.5. PVR Meeting

4.5.1. Approval to Schedule the PVR Meeting

Once the Proposer and their team considers the PVR presentation ready for review, they will submit the slides to the PVR Chairperson. Within two weeks of receipt, the PVR Chairperson will provide feedback to the Proposer. This feedback will include any missing or insufficient information from

the presentation. Once the PVR Chairperson confirms the presentation satisfies the requirements of a PVR, then the proposal is approved to proceed with team review.

4.5.2. Scheduling and Review Panel Selection

Table 1 lists the required invitees and corresponding targeted minimum attendance for a PVR meeting. A selection from this group, determined by the PVR Chairperson, serves as the review panel for the PVR meeting. Each invitee has the option of sending a delegate. The PVR Chairperson records the review panel members on the PVR Status Form.

The Proposer will provide a list of team members to be added to the invite list. Additional relevant personnel may be identified by the PVR Chairperson. The PVR Chairperson will identify the first available time slot that best accommodates the required invitees. Once a time slot is identified, a review invitation will be sent to the required invitees, including the All DIII-D List.

All PVRs are open to the entire DIII-D team. The DIII-D Team at Large is invited to the PVR Meeting, but no attendance is required outside of that detailed in Table 1.

Group	Members to Invite	Targeted Minimum Attendance
DIII-D Directorate	Director	One of Group
	Assistant Director	
	Deputy Director	
Operations	Operations Director	One of Group
	Deputy Director of Operations	
	Head of Tokamak Operations	
Engineering	Chief Engineer	One of Group
	Engineering and Projects (E&P) Representative	
Experimental Science	Director of Exp. Sci.	Three of Group
	Deputy Director of Exp. Sci.	
	Burning Plasma Physics Leader	
	Integrated Plasma Scenarios Leader	
	Edge & Boundary Physics Leader	
Diagnostics	Diagnostic Coordinator	All
Computing	Computing Working Group Leader	All
GA-MFE Leaders	Director of Computers, Diagnostics, and Technologies	Two of Group
	Director of Theory and Computational Science	
	Computer Systems and Science Leader	
Proposing Team	Proposer	Proposer
	Proposer-identified Team Members	
DIII-D Team at Large	All DIII-D List	N/A

Table 1: Required DIII-D invitees of the PVR meeting.

4.5.3. Presentation

The PVR meeting will commence at the announced time. The PVR Chairperson will introduce the Proposer and team and provide any introductory remarks that provide context for the ensuing discussion. The Proposer, or their delegate, will then be given the floor to present. Different members of the team may present various portions of the material.

Any of the attendees may ask a question at any time during the presentation. The PVR Chairperson and Proposer will adjust this option as necessary to ensure progress in the delivery of the presentation. Notes will be taken by the PVR Chairperson, and any other participant notes can be collected following the meeting.

After the presentation is complete, the PVR Chairperson will open the floor for further questions, comments, and discussion. Issues that require further clarity should be noted.

Once the Proposer and PVR Chairperson have determined that the review has generated the relevant input, then the PVR Chairperson will close the meeting.

4.6. Closing of the PVR

4.6.1. Post-presentation Report and Actions

Following the presentation, the PVR Chairperson will document the proceedings in the PVR Status Form. This form will include any action items that resulted from the presentation. An action item may result from any of the following:

- Insufficient justification for a proposal claim, e.g., physics argument, measurement specification, or impact on existing systems
- Missing information, e.g., relevant system was not considered for impacts by the proposal
- Insufficient input from the wider DIII-D team, e.g., a relevant Physics Area was not represented in the discussions surrounding the proposal (these discussions should occur prior to the PVR meeting)

The PVR Status Form will be distributed through the PVR SharePoint site within two weeks of the PVR Meeting.

As the Proposer and team address action items, the documentation of those efforts will be performed by the PVR Chairperson creating revisions to the PVR Status Form. The Proposer and PVR Chairperson will also document input from relevant personnel concerning when an action item is considered to have been resolved.

In addressing the action items, the Proposer and PVR Chairperson may determine that another PVR Meeting is required. Any additional PVR Meetings will be setup as detailed in Section 4.5.

4.6.2. Final PVR Report

Once all actions items are considered resolved, then the PVR Chairperson will create the final revision of the PVR Status Form. This completed PVR Status Form serves as the final report and will be distributed through the PVR SharePoint Site. The availability of the final report will be announced to the All DIII-D List and the DIII-D Director. The PVR is considered closed at this point.

5. PROGRESSION FOLLOWING CLOSURE OF THE PVR

Once the PVR is closed, the proposed project enters a review by the DIII-D Director. If the decision is to proceed with execution of the proposal, then it will enter into a project management phase dictated according to GA-MFE and DIII-D procedures. The closing of a PVR is not an approval to execute the proposal.