



PLATFORM FOR THE ACCELERATED REALIZATION,
ANALYSIS & DISCOVERY OF INTERFACE MATERIALS

Policies and Procedures

V 1.1

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Lynn Rathbun, Ph.D

Assistant Platform Director

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Note to Self

The audience for this Policies and Procedures document is both the PARADIM Staff and PARADIM users. It establishes general policies on how PARADIM will be operated and what each group can expect. It establishes management's expectations.

This is different than but related to the Strategic Plan which must be submitted to NSF.

PARADIM Policies and Procedures

1.0 Introduction

PARADIM (**P**latform for the **A**ccelerated **R**ealization, **A**nalysis, and **D**iscovery of **I**nterface **M**aterials) is one of two **Materials Innovation Platforms**, a new type of research and user facility program funded by the National Science Foundation. Specifically, the Materials Innovation Platforms were established as the centerpiece of a new effort to return dominance in the discovery of new materials to the US. PARADIM's specific mission is the discovery of **new materials for electronics** through a complete **materials-by-design** process. PARADIM is managed out of Cornell University, with user facilities at Cornell University, Johns Hopkins University, and Clark Atlanta University, and in-house research activities at Cornell and Princeton. PARADIM is part of the national Materials Genome Initiative (MGI).

Creating new materials, by design rather than by serendipity, is accomplished in PARADIM through a synergistic set of user facilities dedicated to theory, synthesis, and characterization. The materials-by-design loop at the heart of PARADIM accelerates the pace at which new crystalline materials with unprecedented properties are designed, realized experimentally, and measured.

PARADIM was established in March 2016. Some facilities were available shortly thereafter; other facilities as described below will be available later in 2017. For current information of facilities status, please refer to the PARADIM web site (www.paradim.org). This document contains the initial operational policies of PARADIM. We expect, however, that these policies will grow and evolve and new facilities come on line and new operational issues are raised.

2.0 Scope and Purpose

PARADIM facilities are dedicated to discovery of **novel inorganic electronic materials and interfaces** through a materials-by-design process. PARADIM combines state-of-the-art equipment for growth, theory, and characterization, expert staff for user support, and a complementary in-house research program for advancing **Interface Quantum Materials for Next-Generation Electronics/Sensors**. It is expected that most requests for PARADIM use will involve the development of novel electronic materials and interfaces, although PARADIM has some very limited flexibility for truly novel out-of-scope activities.

PARADIM is a materials-by-design platform. Successful user proposals are expected to make full use of iterative design loops involving the three aspects of PARADIM resources—materials growth, characterization, and simulation/theory—to develop and understand new electronic materials. PARADIM growth facilities include both bulk crystal and thin film growth. These capabilities are all available at PARADIM, but users are free to use some facilities elsewhere for particular steps as well to complete the design loop.

Specific PARADIM user facilities are detailed below. All PARADIM user facilities are open to all via a reviewed proposal process. Likewise, all access is regulated by this proposal process. Most of this document refers to the policies and procedures for administering the user program and for user interaction with the user facilities.

3.0 PARADIM Facilities

PARADIM is a distributed research platform with user support operations at three different universities and at least six different laboratories. The policies described herein apply to the use of following PARADIM and PARADIM affiliated facilities.

- Cornell University
 - Stand-alone CVD facilities (staff use for growth of “standard” samples via established recipes) (available 1Q 2017)
 - Integrated MOCVD/MBE/ARPES thin film facility (available 3Q 2017)
 - Electron microscopy facilities at the Cornell Center for Materials Research (currently available) (*affiliated resource*)
 - Other characterization facilities at the Cornell Center for Materials Research (currently available) (*affiliated resource*)
 - Fabrication facilities at the Cornell Nanoscale Facility (currently available) (*affiliated resource*)
- Johns Hopkins University
 - PARADIM bulk crystal growth laboratory (3Q 2016)
 - Other bulk crystal growth and preparation facilities of the Institute for Quantum Materials at JHU (currently available) (*affiliated resource*)
 - Sample preparation and characterization instruments at JHU central facilities (currently available) (*affiliated resource*)
- Clark Atlanta University
 - Computation (currently available with future expansion)

Details on the status and capabilities of the PARADIM equipment set are available on the PARADIM web site.

4.0 Definitions

4.1 Types of Institutions

PARADIM was established to serve the materials-by-design community in the US. In the interests of promoting broad technology development and intellectual interactions, PARADIM facilities are, however, open to users from around the world under specific conditions. Specific PARADIM policies and associated modes of interaction, however, vary by type of institution. **For this purpose, institution type will be determined by the affiliation of the Principal Investigator.** The following types of institutions are recognized.

- **US Academic:** Non-profit, degree granting academic institutions located in the United States. Within the US Academic category, the following sub-categories are recognized and used in some of PARADIM's policies
 - **R1 Institutions:** Carnegie classification of Doctoral Institutions: Highest Research Activity, the 115 largest US academic Research universities¹.
 - **Non-R1 Institutions:** All other US Academic institutions (other Doctoral Institutions and all Masters and Baccalaureate level institutions).
 - **MSI:** Minority serving institutions. Institutions serving a large population of underrepresented minorities, as defined by the Department of Education.² These would include Historically Black and Tribal serving institutions, among others.
- **Foreign Academic:** Non-profit, degree granting educational institutions located outside the US.
- **Government (U.S):** U.S. federal research laboratories and U.S. state operated laboratories
- **Non-profit research facilities:** Non-degree granting, non-government research institutes or foundations.
- **Industrial (foreign and domestic):** All other types of non-educational institutions

For simplicity, we may refer to Industrial projects as **Proprietary Projects** and all others as **Non-Proprietary Projects**.

4.2 Types of Projects

It is expected that users will interact with PARADIM in a variety of ways. The following types of interactions are recognized by PARADIM.

- **Equipment (Lab) Access (including computation):** PARADIM facilities are user facilities and it is expected that **Equipment Access** will be the most common type of project. All PARADIM equipment resources will be available to users via a proposal process described below. All equipment access project proposals will be externally reviewed. Staff support is included with equipment access. Users may work directly with staff, or after sufficient training, work independently from staff.
- **Standard Samples:** PARADIM seeks to develop new electronic materials and to make these new materials available to the broad research community. It is expected that new materials will be developed by outside users, by PARADIM internal researchers, and by PARADIM staff. Original grown samples will always belong to the user; PARADIM will not keep or distribute archival samples (see Data Management Plan). However, once new materials have been grown for non-

¹ https://en.wikipedia.org/wiki/List_of_research_universities_in_the_United_States

² <https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html>

proprietary projects and the results published in the literature (or the project has been abandoned), PARADIM may use these recipes to make material available to others--for confirmation of results, for further materials characterization, or for fabrication of devices and structures using the new materials. The PARADIM web site will contain a listing of the standard materials available upon request. Researchers can have standard samples grown by PARADIM staff by submission of a **Standard Sample Request Proposal**. These proposals will not be externally reviewed but will be evaluated by PARADIM management and staff. Quantities may be limited at the discretion of management. It is expected that the original material developer will, at a minimum, be acknowledged in any publication (see Acknowledgements Section).

- **Data:** As detailed in the PARADIM Data Management Plan, after publication or upon project abandonment, original growth and characterization data from non-proprietary (academic, government, and non-profit) projects must be made available to the research community. PARADIM will defer to the PI to make data supporting particular publications available through the data management protocols of his/her institution and funding source. Once results from a project are published, additional growth and characterization data collected by PARADIM will be available, according to the PARADIM data management plan. PARADIM will work with PIs to protect their interests in original publication while honoring PARADIM's commitment to NSF and the community to make original data accessible. Generally, data made available by PARADIM will be made available under a Creative commons BY-SA ³ or similar license.
- **Codes:** Computational codes and computational resources developed by PARADIM staff or internal researchers will be made available for use on other computational resources under an open source license. It is expected that these will be downloadable from the PARADIM web site via a simple registration process. Generally, codes will be made available under a Creative Commons BY-SA-NC ⁴ or similar license.
- **Collaboration and Sponsored Research:** PARADIM is a user facility and it is the intention that all resources be available on a user basis, i.e., without the requirement to collaborate with PARADIM staff or associated university faculty. We expect this to be the dominant mode of interaction. In some cases, however, collaboration may be necessary or desirable to meet the user's technical goals. Informal collaboration with PARADIM staff or associated faculty MAY be arranged at the discretion of the user. It is expected that users will address these situations proactively before extensive interaction. In addition, as common with all universities, more structured (and compensated) collaborations may be set up via the Sponsored Programs mechanism to interact directly with faculty and/or students. This later may be particularly appropriate for companies that wish to more strictly define intellectual property issues. Such sponsored agreements would be used to clearly spell out IP issues and staff/student

³ Creative commons BY-SA; Share (alike) and adapt, with attribution. <https://creativecommons.org/licenses/by-sa/2.0/>

⁴ Creative Commons BY-SA-NC <https://creativecommons.org/licenses/by-nc-sa/2.0/>

compensation issues. Again, we emphasize that such agreements are not necessary to access the standard PARADIM user resources.

4.3 Roles

Associated with each project are a multitude of different people. The following roles are recognized.

- **Principal Investigator (PI):** There is one Principal Investigator per proposal. Generally the institution type is determined by the affiliation of the PI. For an academic project, the PI would be the lead Professor or other academically titled senior research staff with university PI status. For an industrial project, it would be the lead scientist in charge of the project. Collaborative proposals between academia and industry will be treated as a special situation on a case-by-case basis.
- **Direct Users:** Persons who actually use PARADIM resources, first hand. In general, these would be students or scientists who work for the PI. These can be on-site or remote (computation). Also known as Laboratory Users.
- **PARADIM User Facility Staff:** PARADIM employs a number of senior technical staff at the research associate level. PARADIM staff are responsible for maintenance of equipment, development of processes, and direct support of users. At the user's discretion, they can act either in the role of instructor or in the role of collaborator.
- **PARADIM Faculty and Students:** PARADIM associated faculty and their students are merely users of the PARADIM facilities like any other users. Users interact with the PARADIM staff not with faculty or their research groups. Extensive interaction with faculty or their research groups would in the form of an optional collaboration and may include a normal sponsored research agreement. Both are outside the scope of the PARADIM user program.
- **Other Users and Collaborators:** In many cases, the materials developed in PARADIM will be part of further experiments by persons other than the direct users, e.g., other students in the research group doing characterization or student/faculty collaborators at other institutions. These persons fall within the "universe" of impact of PARADIM; PARADIM will seek to count and document these persons for reporting to NSF.

PARADIM asks for identity of prospective users and prospective collaborators at proposal submission. Additional users and collaborators may be added by the PI at any time by contacting the Assistant Platform Director or via the annual reports.

4.4 Project Classification

NSF has set limits on the use of PARADIM by various classes of users.

- **PARADIM In-House Research:** Research by students, faculty, and staff directly supported by PARADIM as part of its in-house research program. Presently, the scope of this in-house research is limited to **Interface Quantum Materials for Next-Generation Electronics/Sensors**.
- **Other Research from PARADIM institutions:** Research projects from faculty at Cornell University, Johns Hopkins University, and Clark Atlanta University who are not part of the PARADIM supported internal research activity (**Interface Quantum Materials for Next-Generation Electronics/Sensors**).
- **External Projects:** Research projects not associated with PARADIM institutions.

Usage of major PARADIM resources (time used and number of users) within these classifications will be reported to NSF annually.

4.5 Types of Interaction

- **User mode:** PARADIM is a user facility and it is the intention that most interactions be in the User Mode. PARADIM staff are tasked with helping and instructing; they do not generally seek to directly insert themselves into the research. In this mode, there is no additional charge for staff support. We generally would not describe this as “collaboration.”
- **Informal Collaboration with Staff:** For some projects, it may be necessary/desirable for the PARADIM staff to become more intellectually involved with a project, making original contributions rather than simple instruction. This is the point where, for academic projects, the staff member would be considered as a co-author. It is incumbent upon users to clarify their relation to the PARADIM research staff at the beginning of each project and as it progresses.
- **Faculty collaborations and Sponsored Research:** The faculty and research groups associated with PARADIM are not part of the user program and are not generally involved with users. Users may engage with faculty research groups on a mutually agreeable basis either as informal collaboration or via a sponsored program mechanism. Again, this should not be necessary to access PARADIM equipment, but only to engage in collaborative research. A sponsored contract may also be used to formalize the “informal collaboration with staff” to assure that IP is more tightly protected. This would generally involve direct charging of staff costs. This is beyond the user mode of interaction. It is mentioned here for completeness, but should not be considered necessary or even common.

5.0 User Access Model and Proposal Process

5.1 Facility (equipment) Access Proposals

5.1.1 Proposal Process

All access to PARADIM facilities is via a brief proposal process. A proposal packet consists of

- Cover Sheet (see appendix)
- 2 page technical proposal, plus references

- PI CV

Proposals should address the following

- The scientific opportunity, approach, and significance
- Prior experience of the PI research team in this area; results of prior PARADIM work (if any)
- Appropriateness for PARADIM facilities
- Alignment of the science with PARADIM's technical focus (materials for the next generation of electronics)
- Methods and metrics for assessing material quality and implementation of a Materials-by-Design methodology

The most successful proposals will take significant advantage of PARADIM by implementing a closed loop **Materials-by-Design** process involving theory, growth, and characterization to develop **electronic materials**. The manner in which this will be accomplished should be clearly discussed in the proposal.

If preliminary discussions have been conducted with PARADIM scientists regarding technical feasibility and resource requirements for the project (highly recommended), please reference these discussions.

Proposal packages should be submitted by email, as attachments in pdftm or Wordtm format, to proposal-paradim@cornell.edu. Receipt will be acknowledged within 1 working day.

5.1.2 Proposal Review

All PARADIM user proposals will be externally reviewed. PARADIM has assembled a committed group of more than 20 prominent senior scientists in the fields of crystal and thin film growth, characterization, and computational materials science, all well-known materials innovators external to the universities that constitute PARADIM. All proposals will be reviewed by at least 3 members of the PARADIM User Proposal Review Committee

Proposals will be evaluated according to the following criteria.

- Scientific merit and potential impact
- Experience and capability of proposing research team
- Suitability for PARADIM resources
- Alignment with PARADIM's scientific focus on **Electronic Materials by Design**
- Implementation of the Materials-by-Design process

Proposals will be rated as a single score on a scale of 1(low) to 5(high) based on the reviewer's assessment *vis a vis* the review criteria.

It is our expectation that the review process will be completed within 8 weeks of proposal submission. Reviews will be returned to the PI.

Highly reviewed proposals will be forwarded to the Director of User Programs for allocation of time on the appropriate resources. Awards of time will be based upon merit, as determined by the review process, and by the availability and capability of the equipment resources.

The Director of User Programs will seek advice from PARADIM technical staff on a reasonable time allocation for each project, given the equipment availability, capabilities, and the perceived difficulty of the proposed work. Since the focus is on growing and characterizing new materials, the amount of time and other resources necessary may not always be clear at the onset. At the Director's discretion, allocation may consist of a primary allocation and a conditional supplemental allocation, to be used at the facility directors' discretion based on success of initial work and the promise of additional effort.

Proposals are good for one year, or until the resource allocation is consumed. At that point, the PI may submit another proposal for additional resources based on the accomplishments with the initial allocation. Such follow-on proposals will be judged according to their prior accomplishments.

In order to meet the objective of building a broad community of materials innovators, preference may be given to new researchers and researchers from outside the major research universities (so called non-R1 institutions including MSIs).

Proposers are encouraged to take advantage of the full range of PARADIM resources to complete a iterative Materials-by-Design process. Proposals should include a request for ALL resources which might be necessary (i.e., theory, synthesis, and characterization). **Any later request for substantial additional resources will require a new proposal and review.**

A flow chart of the proposal and review process is available as an appendix.

5.1.3 Scheduling

Once a proposal is approved, individual users identified in the proposal may apply for laboratory access and scheduling at particular approved facilities. Specific time slots will be assigned by management at each facility at their sole discretion. Scheduling will be based upon tool availability, prior commitments, and materials compatibility issues. Facility managers will communicate scheduled allocations as well as used time to the Assistant Platform Director on a regular basis for tracking.

The entire allocation of time need not be scheduled at once. In fact, it is likely preferable that it be broken up so that later experiments can be impacted by preliminary experiments and characterization. PARADIM staff will attempt to be flexible and likewise expect users to be as flexible as possible to maximize tool use and availability in cases of equipment failure, materials availability, and unexpected results.

Users are expected to make every effort to actually use all time as it is scheduled to avoid wasting resources. Actual cancellation policies will vary by laboratory.

Issues with scheduling individual facilities should be brought to the attention of the Associate Platform Director or the Assistant Platform Director.

5.2 Standard Samples

Users may request standard samples via a simplified proposal process. Standard Samples are recreations of materials previously grown and optimized in PARADIM user facilities. They will be grown by PARADIM

staff using the original archived sample preparation recipes and will be characterized as appropriate. Standard Sample proposals will not be externally reviewed, but will be reviewed by PARADIM staff for appropriateness.

6.0 Safety and Facility Access

Safety is paramount in PARADIM facilities. Users should be aware that these are multi-user facilities accommodating multiple users with a variety of skill levels from external laboratories with a variety of laboratory cultures. As such, certain activities which might be acceptable in an individual faculty lab are not permitted in PARADIM facilities. The laboratory use rules exist to establish a common set of expectations and to protect the users, staff, and equipment. It is the user's responsibility to know and follow all facility rules.

As PARADIM consists of at least 6 different laboratories at 3 different universities, laboratory rules and standard practice may in fact vary across PARADIM. Individual facility policies and individual instrument policies procedures are included in this policy by reference. This policy describes only the general overall principles. Users must be aware of and follow the safety policies of each specific facility and the direction of facility staff.

6.1 Laboratory Orientation and Training

Users will be assigned login/access credentials for appropriate laboratories and scheduled for laboratory orientation and safety training. Each laboratory/university will have specific safety and laboratory orientation training, In addition, each instrument will have specific operational training. Usage of the laboratory and equipment will be restricted until training and orientation have been successfully completed. At the discretion of PARADIM staff, users may be granted either "supervised access," "daytime access," or "unattended access," i.e., 24 hours per day, 7 days per week (24x7). The access status provided by PARADIM staff may change over time as a user gains experience and familiarity with the usage of the equipment in a particular PARADIM laboratory; access may also be downgraded.

General laboratory procedures will be posted at each laboratory site and reviewed with each user as part of the safety orientation process.

6.2 Equipment Access and Training

PARADIM employs senior technical staff to maintain equipment, develop processes, train users, and assist users with their processing/characterization needs. Ultimate authority over each facility rests with the Facility Director and the associated technical staff. The exact mode of user support will vary depending on the complexity of the instrument and the level of expertise of the user. Similarly, the mode of operation of each instrument will vary (e.g., 24x7, daytime only, daytime only with staff, etc.). The Assistant Platform Director will keep a database of users and level of access. For the most part, we expect PARADIM to be a participatory facility, with users either directly using the resources themselves, or by staff working in close cooperation with the users.

Users will be required to receive training on each specific instrument. Training is the sole responsibility of the PARADIM staff. **Training by other students or training on similar instruments at a users' home university or another facility is not sufficient to gain approved access.** Users may be required to receive follow-up safety training or retrain on specific instruments if inactive for more than 1 year or at the discretion of PARADIM staff. Facility managers will maintain a database of users and training received.

Each major instrument will have a user manual which contains basic operation procedures. The user manual is for reference only; it is not a replacement for required training. In some cases, video or interactive media may be used for training.

Trained users are authorized to use the equipment in the manner described, in particular, loading samples and operating within the prescribed parameters. Users are expressly forbidden to operate equipment for purposes other than intended and instructed, to operate outside of prescribed operational parameters, or to adjust, modify, or fix anything. Such issues will be treated as equipment abuse and result in temporary or permanent loss of access. All equipment issues must be reported to staff immediately, using the means recommended during training.

Each major instrument will have a reservation calendar; reservation policies will vary between laboratories. All PARADIM equipment will have some form of user log for recording usage. Most PARADIM equipment will have computerized sign-on for access control and automatic data/recipe logging. Log-in credentials are for your personal use only; they must not be shared with others. For those instruments not so equipped, users are required to 1) access only those instruments they have been specifically trained on and authorized to use, 2) log all time accurately, and 3) record all experimental conditions accurately in the system log. Failure to accurately log equipment use will result in denial of future access.

6.3 Materials and Chemical Restrictions.

Users must disclose all chemicals and materials they intend to use in PARADIM facilities (growth materials, cleaning materials, substrates, prior films, etc.) to cognizant PARADIM staff. For safety and contamination reasons, PARADIM will restrict the use of certain chemicals and elements. Each laboratory and each experimental tool will have a list of allowed and disallowed materials. All materials should be considered DISALLOWED until specifically approved for a specific laboratory/tool. New materials MAY be approved on a limited use basis (specific time/instrument/user) or on a more permanent general basis at the discretion of PARADIM laboratory staff. Materials Data Sheets will be required for all new chemical/element requests; a library of Materials Data Sheets for all approved materials will be maintained by each PARADIM facility.

Users should be aware that shipping of chemical materials (including carrying in personal vehicles) in and out of facilities is restricted by many University and DOT regulations. Such materials shall not be shipped or brought to PARADIM facilities prior to written approval by cognizant PARADIM facility staff. Facility staff will supervise materials or chemicals entering the facilities.

6.4 Travel and Accommodations

Generally, housing and travel to PARADIM facilities is at user expense, with one exception. Users from non-R1 US academic institutions (R2, R3, and all Masters and Baccalaureate level institutions) are eligible for travel support (airfare, food, and housing) as part of the PARADIM award. Details and logistics will be made available upon project approval

Facilities will assist users in finding appropriate accommodations for their stay. In some cases, special lower than market cost housing is available near campus.

6.5 University Conduct Policies

6.5.1 Information Technology

PARADIM users will be granted guest access to network and computer facilities at PARADIM sites as necessary. Each university associated with PARADIM has policies covering appropriate use and security of IT resources. Prohibited activities include, among others, unauthorized access to computers, unauthorized network use, copyright violations, spam email, violation of license terms, and sharing of logins and passwords.

The relevant IT policies of PARADIM universities are included here by reference⁵. Violation of university IT policies can result in loss of access to PARADIM or all university facilities.

6.5.2 Harassment, Bias, and Discrimination

Users and staff are required to treat each other with respect and in a professional manner. PARADIM will not tolerate harassment, discrimination, or anti-social behavior of any kind, between users or between users and staff. Incidents should be reported to the facility director and/or the PARADIM Associate Director. Discipline will be at the sole discretion of the PARADIM Facility Director and be consistent with university policies. University policies are included here by reference.⁶

6.5.3 Ethics and Responsible Conduct of Research

As members of the respective university communities, PARADIM expects all users, staff, and students to adhere to the highest standards of ethical conduct and responsible conduct of research. This includes financial and scientific fraud, plagiarism, proper attribution, authorship, etc. Each university has extensive policies which are referenced in Appendix 4. Failure to adhere to these policies can result in exclusion from PARADIM and the university.

6.6 Enforcement

Access to PARADIM facilities may be revoked at any time. Program and facility staff and university staff retain the right to deny future access for a limited or extended time, to any user who violates this policy or any general university policy.

⁵ Johns Hopkins University: <http://it.jhu.edu/policies/>

Cornell University: https://www.dfa.cornell.edu/sites/default/files/vol5_1.pdf

⁶ https://www.jhu.edu/assets/uploads/2014/09/equity_civility_respect.pdf

http://www.cau.edu/compliance-office/_includes/files/2-4-0-code-of-ethical-conduct.pdf

Failure to follow safety and operational protocols and rules will result in expulsion of the user or termination of all access for all users under the approved project, or both, at the sole discretion of PARADIM management.

7.0 Project Management

7.1 User Fee Policy

7.1.1 US Academic Projects:

PARADIM resources are free of charge to U.S. Academic and US Government Users. In addition, travel support to use PARADIM user facilities will be available to users from non-R1 universities. As appropriate to individual proposals, successful US academic projects will be allocated 1) specific periods of time, free of charge, on PARADIM controlled instruments, and 2) time allocation for use of affiliated facilities (e.g., CCMR and CNF) for work necessary under the approved statement of work. PARADIM will pay the fees in these associated facilities, corresponding to the allocated time. Note, the allocation is for work directly within the proposed scope of work. In particular, time allocations at CCMR and CNF may not be used for unrelated fabrication and characterization activities. Compliance will be monitored by the Assistant Platform Director.

As a condition of use, PARADIM US academic and government users are expected to publish the results of their work (via journal or conference) in a timely manner and make the supporting data/processes publicly available as described in the PARADIM data management plan.

7.1.2 Industry Projects:

Industry users will be charged for access on a fee-for-service basis (by the day or hour); their results, however, will not be made publically available by PARADIM and they are under no obligation to publish their results. NSF regulations require that facilities such as PARADIM cannot undercut commercially available services, where they exist. Charges will be billed monthly in the following month, by each specific laboratory. Fee-for-service users are expected to put a Purchase Order in place to cover anticipated charges. For these purposes each facility operates independently so multiple purchase orders may be required.

Theory Facility Support	\$500/day
Thin Film-MBE	\$2500/day
Thin Film-ARPES	\$2000/day
Thin Film-MOCVD	\$2000/day
Thin Film-Stand alone MODVD	\$1500/day
Thin Films-Training Only	\$500/day
Bulk Crystal Facility	\$2500/day
CNF and CCMR Affiliated Resources	Established rates

- Microscopy services and other CCMR and CNF service will be billed at the standard Industrial Rates charged by CCMR and CNF (generally hourly).

- As described elsewhere, there is no additional charge for normal staff instruction and support.

7.1.3 Non-profit research facilities and non-US Academic institutions.

Projects from these institutions will be charged for access at an intermediate rate to assure cost recovery. Reduced rate projects must commit to publishing their results and the supporting data must be made publically available as described below.

7.1.4 Charges for Substrates and Special Materials

As part of the no-charge usage allocation for **US Academic and Government Users**, PARADIM will provide at no charge most materials and substrates necessary for the project. PARADIM does, however, reserve the right to charge for unusually expensive/exotic or unusually large amounts/numbers of source materials and substrates. For foreign, non-profit, and Industrial users, standard materials charges will be built into the equipment rates; Additional charges will be made for exotic materials and substrates. In all cases, these additional charges will be disclosed in advance. Users may bring their own samples , subject to Safety review.

7.3 Publications and Presentations

7.3.1 Expectation of Publication

To fulfil its mission of expanding the rate at which new electronic materials are discovered, it is imperative that results of PARADIM research be widely distributed. As a condition of free or reduced cost usage, **all free and reduced rate users are expected to publish their results** in a timely manner (via conference or journal). PARADIM recognizes that the research is not complete as soon as a sample is grown or characterized. During this extended data collection and analysis period, projects will be considered “ongoing”. After one year in “ongoing” status, PARADIM will begin to inquire whether a project has been abandoned with no expectation of publication or whether analysis continues. Failure to publish from prior usage could have an effect on future PARADIM proposal evaluations.

7.3.2 Authorship and Collaboration

PARADIM operates under a user facility model. It is not necessary or routine to collaborate with PARADIM associated faculty to have access to PARADIM facilities; neither is it necessary to collaborate with PARADIM technical staff to have access to PARADIM facilities. Assisting users with technical instruction and equipment support is part of the job description of each PARADIM staff member. That being said, PARADIM staff are highly skilled scientists with years of experience. As such, it can be highly beneficial to collaborate with PARADIM staff to achieve your Materials-by-Design goals.

The parameters of such collaboration should be discussed ahead of time with PARADIM staff. It is expected that PARADIM staff will be included as authors on publications **to which they make a significant intellectual contribution**. Please see discussion in section 7.5 (patents) as it is governed by similar principles.

Additional discussion of authorship practices and responsibilities can be found in the *APS Guidelines for Professional Conduct*.⁷

7.3.3 Notification and Submission

PIs shall promptly notify PARADIM management (within 30 days) of each publication and conference presentation based on PARADIM samples. An on-line portal will be developed to aid in this notification. Notification should include PARADIM project number, full citation, and URL/DOI, when applicable. At that time, the PI and management will agree upon the plan, mode, and time table for data release under the Data Management plan.

7.3.4 Acknowledgement

As a condition of access for all users, the use of PARADIM facilities and resources must be acknowledged in each publication and presentation. **It is imperative that the acknowledgement include both PARADIM by name and the NSF award number;** this is an NSF requirement. Failure to properly acknowledge PARADIM may adversely impact future access to PARADIM facilities

Written acknowledgements should be substantially similar to the following. Similar acknowledgements should be included in each conference presentation.

(I will deal with formatting this gap later)

⁷ http://www.aps.org/policy/statements/02_2.cfm

7.3.4.1 Standard acknowledgement for laboratory use

The materials (*grown/characterized/used*) in this paper were (*grown/characterized*) using PARADIM (paradim.cornell.edu) resources at (*Cornell University/Johns Hopkins University/Clark Atlanta University*). PARADIM is supported by the National Science Foundation as a Materials Innovation Platform under Cooperative Agreement *DMR-1539918*.

7.3.4.2 Standard acknowledgement for “standard samples”

The material used in this study was provided as a standard material by PARADIM (www.PARADIM.org), an NSF supported Materials Innovation Platform. The original recipe for this material was developed by (*original user name*) (*publication citation*). PARADIM is supported by the National Science Foundation under Cooperative Agreement *DMR-1539918*.

7.3.4.3 Standard acknowledgement for “Data Only”

The work is based, in part, upon extended analysis of data gathered by (*original PARADIM user*) using PARADIM (www.paradim.org) and made available through the PARADIM data management plan. (*citation for prior publication if appropriate*). PARADIM is supported by the National Science Foundation as a Materials Innovation Platform under Cooperative Agreement *DMR-1539918*

7.3.4.4 Standard acknowledgement for “Codes”

The (*name*) computational code used in this work was developed by (*named PARADIM Staff*) (*or students*) and made available under the PARADIM user program (paradim.cornell.edu). PARADIM is a Materials Innovation Platform supported by the National Science Foundation under Cooperative Agreement *DMR-1539918*

7.3.4.5 Acknowledgement in General Public Media

To the extent under the user’s control, substantially similar acknowledgements of PARADIM should be included in press releases and general public communications (TV, web, newspaper).

7.3.4.6 Staff Acknowledgement

If PARADIM staff are not co-authors on a publication, PARADIM staff who supported the effort should, *at a minimum*, be acknowledged by name and contribution in all publications.

7.4 Patents and Intellectual Property

Simply, intellectual property belongs to the inventor and the inventor’s institution. That does not change due to the use of PARADIM’s or any other institution’s facilities. PARADIM and its associated institutions make no claim to the intellectual property of PARADIM users based solely upon their use of PARADIM user facilities. (We do expect, at a minimum, however, for the use of PARADIM facilities to be properly acknowledged. See acknowledgement policy above.)

That being said, PARADIM user facilities are highly complex and proper usage is heavily dependent upon assistance from PARADIM staff. To the extent that this involves only simple equipment instruction, such interaction has no effect on intellectual property. On the other hand, PARADIM staff are highly skilled

and experienced scientists who can and often will contribute intellectually to a project by lending their expertise and experience in more than an instructional manner. In such cases, it is both appropriate and expected that the contributions of PARADIM staff (and hence their institutions) be acknowledged via co-authorship of papers or co-inventors in patents.

Examples: A user growing a crystal of a new material XYO_3 in PARADIM on his own is solely a user-IP-event, even after basic instruction by PARADIM staff. A PARADIM staff member growing a crystal of a new material XYO_3 for a user is likely a joint PARADIM-User-IP-event. And a crystal of XYO_3 whose growth was enabled by a novel technique introduced by PARADIM staff or under novel experimental conditions developed by PARADIM staff is definitely a joint PARADIM-User-IP-event.

While we can be flexible about the mode of interaction between users and staff, we cannot be flexible about the fundamental principles of intellectual property ownership. Users who are concerned about the ownership of intellectual property are expected to explore the situation with facility managers and technical staff, and if necessary place appropriate limits on the extent of staff interaction/support that they are comfortable with, **prior to undertaking experiments**. Alternatively, users may seek to control intellectual property via a Sponsored Research Program contract, whereby, in exchange for staff compensation and other support, special IP treatment is specified. PARADIM management will be happy to assist with these arrangements.

PARADIM staff are bound by IP agreements with their respective universities (not with PARADIM itself). Both PARADIM management and appropriate individual PARADIM staff members must be notified promptly in cases where patents or patent disclosures involving PARADIM staff are contemplated.

7.5 Project Status and Termination

Time allocations under successful PARADIM user proposals are good for 12 calendar months. At the end of 12 months, or when the allocation is fully used, the PI may submit a follow on proposal, which will be reviewed in the same manner as the original proposal, with consideration of the results obtained to date. Even after actual PARADIM use is complete, we would expect that a project would continue for some period of time, as samples are characterized and data analyzed and papers written. During this time, PARADIM will consider the project “ongoing” until the principal results are published or the project is specifically terminated or abandoned by the PI.

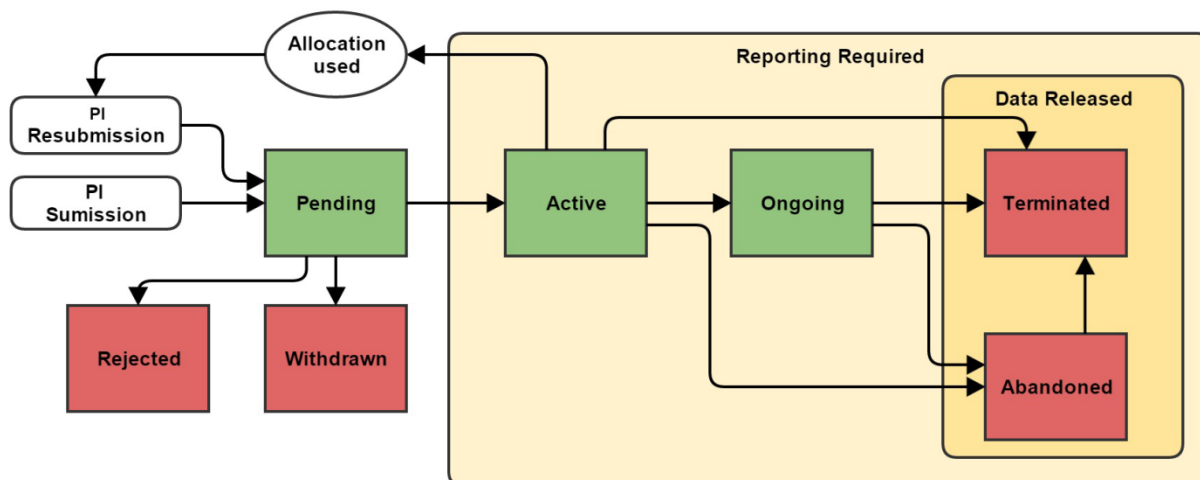
Over their lifetime, proposals/projects will be categorized as follows.

- **Pending:** Proposal Under review
- **Rejected:** No time allocated due to low reviews, or inappropriate for PARADIM resources
- **Withdrawn:** Withdrawn by PI prior to use
- **Active:** An approved proposal with time allocated; actively engaged in (or scheduled for) PARADIM use.

- **Ongoing:** i.e. Active Post-use; ongoing data analysis and publication preparation; no longer actively using PARADIM resources but activity continues elsewhere.
- **Abandoned:** Projects with no current PARADIM activity and no progress towards publication.
- **Terminated:** Closed at PI request or by management after abandonment.

Note, termination of a project does not relieve the PI of responsibility of reporting. A final report will be due upon **Abandonment** or **Termination**.

PARADIM Project Status Flow Chart



PARADIM management will query “Ongoing” projects at least annually to determine those which should be moved into the “Abandoned” category. With the exception of full rate industrial projects, all data in PARADIM’s possession related to abandoned and terminated projects will be made public according to the PARADIM Data Management Plan.

Projects may be terminated or withdrawn at any time by contacting the Assistant Platform Director. A final report will be due upon termination or abandonment.

7.6 Technical Reporting

PARADIM must report to NSF on its activities and the activities of its users. There are both major annual reports of all activity and technical accomplishments, and monthly highlights of specific activity. All ongoing and recently completed projects will be required to submit an annual progress report as well as research highlights upon request by PARADIM management. These reports will consist, at a minimum, of accomplishments, plans and resulting publications. Selected highlights will, with the user’s permission and acknowledgement, be posted on the PARADIM web site or used in other promotional material.

Failure to submit reports will adversely affect future access.

7.2 Confidentiality

7.2.1 Confidentiality of Proposals and Ongoing Projects

The content of proposals (including proposal titles and the identity of the PI/institution) will be held confidential within the PARADIM community (Management, Technical Staff and User Proposal Review Committee). Title and PI identity may, however, be disclosed to the National Science Foundation, external review committees, and the PARADIM External Advisory Board as part of the normal reporting process. In addition, a summary of projects (Titles, PI and affiliation, and time allocation) will be part of the abridged public annual report to NSF as required by the PARADIM Cooperative Agreement. For approved proposals, PI and user names may appear on equipment schedules/usage logs on site, but such information will not be otherwise disseminated.

7.2.2 Confidentiality of Experimental Data

In most cases, PARADIM staff will retain copies of all experimental run conditions for each growth tool for archival purposes. This data will remain confidential as long as a project is Active or Ongoing. As detailed in the Data Management plan, for non-proprietary projects, this run data will be made publicly available upon publication, abandonment, or termination (Academic, government, and non-profit projects only).

It is inevitable that PARADIM staff will be exposed to the experimental data of many users. In many cases they will be collaborators with users on multiple projects, some of them for related materials. In this environment, it is impractical to sign non-disclosure agreements. PARADIM policy is to not share private process information with other users.

7.2.2.1 US Academic, non-US academic, and non-profit projects

Data related to not yet published results will remain confidential as long as the project is Active or Ongoing. Data supporting published results will be made publicly available according to the data management plan, generally at the time of first publication. A commitment to publish results and share data is implicit in the acceptance of free use of PARADIM facilities. Abandoned data (unpublished data associated with abandoned projects) will be released at the discretion of PARADIM management, in accordance with the PARADIM Data Management Plan.

7.2.2.2 Industrial Pprojects

Industrial projects pay full cost recovery for their use of PARADIM facilities. This entitles them to keep all data confidential. There is no general requirement for publicly sharing data for these projects.

7.2.3 Non disclosure Agreements

PARADIM staff, working within the user program, do not sign non-disclosure agreements (NDAs). Our policies regarding confidentiality are clear, but it impractical to embody them in NDAs with multiple users. Users requiring NDAs should work through the sponsored programs structure to define a more structured interaction to suit their needs.

7.2.3 Confidentiality Summary

Proposal Status	Confidentiality of proposal	Confidentiality of Title/PI	Data Confidentiality (non-proprietary projects)	Data Confidentiality (proprietary projects)
Pending	Yes	Annual Report only	N/A	N/A
Rejected	Yes	Annual Report only	N/A	N/A
Withdrawn	Yes	Annual Report only	N/A	N/A
Active	Yes	Annual Report only	Private until publication	Private
Ongoing	Yes	Annual Report only	Private until publication	Private
Abandoned	Yes	Annual Report only	Public	Private
Terminated	Yes	Annual Report only	Public	Private

7.7 Data Management

The full Data Management Policy is under development. It will be guided, however, by the following principals.

- PARADIM will archive all experimental data in private access storage directories, accessible only by staff and the user. A standard naming convention will be used, and all data will be accompanied by descriptive metadata.
- As a condition of free or reduced rate use, data from completed, abandoned, and/or published projects will be made publically available. (See status section 7.6)
- Data for industrial (full rate) projects belongs solely to the user and will not be made public or otherwise shared.
- PARADIM will work with other national efforts within the Materials Genome Initiative to assure that data is cataloged and searchable by the community.

7.8 Summary of Project Fees and Requirements

Project Type	Fees for equipment	Fees for staff support	Substrates and materials	Publication Required	Data Public
US Academic	Free	Free	Generally free	Yes	Yes
Government	Free	Free	Generally free	Yes	Yes
Foreign Academic	Reduced	Built in	Generally built in	Yes	Yes
Non Profit	Reduced	Built in	Generally built in	Yes	Yes
Industry	Full	Built in	Generally built in	No	No

8.0 Community of Users

8.1 Promoting Collaboration and Information Exchange

PARADIM seeks to develop a vibrant community of materials designers in the United States. This includes academic, industrial, and government participants. While active participation in this community is optional the community as a whole will benefit from sharing of data, techniques, and applications. PARADIM will deploy a WIKI, social media, web content, videos, seminars/webinars, and other IT and non-IT resources to facilitate user communication and sharing of best practices. PARADIM will not share user information without permission, but encourages open dialog between users.

To assist in building a community of users, PARADIM has a corps of **Idea Ambassadors**, faculty associated with PARADIM who have agreed to promote PARADIM to particular technical communities. The Idea Ambassadors can assist potential users in refining ideas and in some cases in forming collaborative teams with other potential users. The Idea Ambassadors can be contacted via the PARADIM web site.

8.2 Support for Diversity

PARADIM seeks to help create a vibrant and diverse community of materials designers. To this end, special considerations during review and resource allocation will be given to researchers from minority serving institutions(MSI) and other institutions outside the major research universities (so called non-R1 institutions)(see definitions in section 4.1). Proposals for samples or laboratory use as well as participation in summer schools and other educational activities from these groups and institutions are encouraged. To assist in evaluating PARADIM's diversity efforts, voluntary demographic information will be solicited from PIs, users, and collaborators, as part of the proposal and annual report process.

Details of PARADIM's activities in relation to creating a diverse community of users can be found in the PARADIM Diversity Plan, available on request.

Travel support for laboratory usage and participation in summer schools for participants from non-R1 academic institutions is available. Please contact the Assistant Platform Director for details.

8.3 Education and Outreach

PARADIM maintains a strong education program to support the Materials-by-Design Community. Two 1 week summer schools will be conducted each summer, one at Cornell University and one at Johns Hopkins University. These programs are Interactive including both lectures and hands on activities. Lectures will be recorded and available via the PARADIM web site.

9.0 In-House Research Program

In addition to its user program, the platform supports an internal research program focused on **Interface Quantum Materials for Next-Generation Electronics/Sensors**. The in-house research program contributes to the technology base of PARADIM and, in particular, is meant to establish PARADIM as a world leader in **Interface Quantum Materials for Next-Generation Electronics/Sensors**. PARADIM

supports graduate students and postdocs who work as a unified team to advance the field. PARADIM in-house researchers have no special access to PARADIM facilities; requests for access from in-house research project proposals are reviewed by the same external review team as outside user projects. Some in-house research may also be done on non-PARADIM facilities. The results of the in-house research program are made available through the standard academic publishing mechanism.

In order to attract the highest quality staff, the senior technical staff (Research Associates) of PARADIM are allowed and encouraged to spend up to 20% of their time on their own research programs using PARADIM resources. Again, they must write a proposal to PARADIM which will be reviewed externally. As part of the in-house research program, this research will be limited to the area of Interface Quantum Materials for Next-Generation Electronics/Sensors.

In-house research projects have no special scheduling or allocation priority over other user projects.

Appendices

Appendix 1: User Program Management

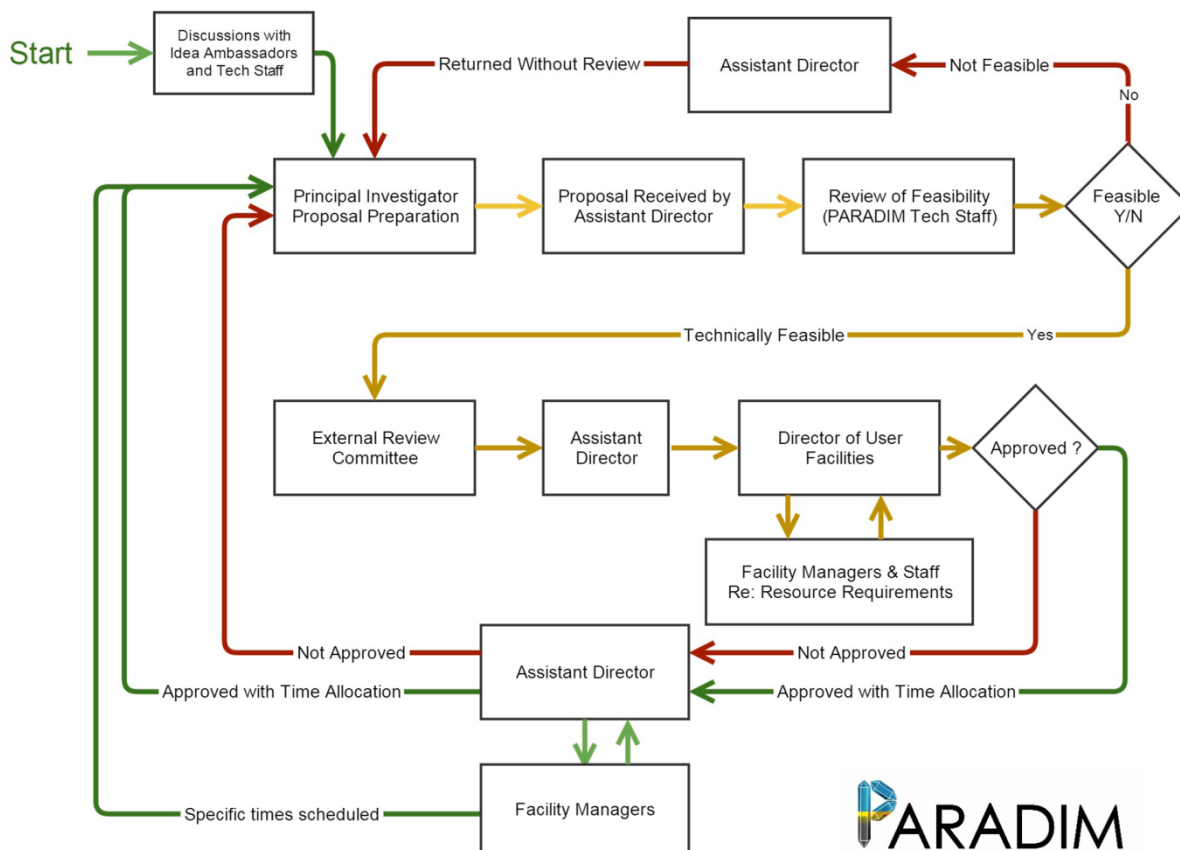
Platform Director:	Prof. Darrell Schlom, schlom@cornell.edu
Associate Platform Director-User Program:	Don Tennant, dmt34@cornell.edu
Assistant Platform Director-User Program:	Lynn Rathbun, Ph.D., LCR2@cornell.edu
Director of User Facilities:	Prof. David Muller, dm24@cornell.edu
Director of Bulk Crystal Facility	Prof. Tyrel McQueen, mcqueen@jhu.edu
Director of Electron Microscopy Facilities	Prof. Lena Kourkoutis, lena.f.kourkoutis@Cornell.edu
Director of Theory User Facility	Prof. Xiao-Qian (Larry) Wang, xwang@cau.edu

General inquiries about the user program should be directed to the Assistant Platform Director at LCR2@cornell.edu.

Inquiries about technical capabilities should be directed to the Director of the appropriate facility.

Appendix 2: User Proposal Flow chart

PARADIM User Proposal Flow Chart



Appendix 3: Proposal Review Form

The following form is used by reviewers. Completed forms will be returned to the PI upon review.

	Reference # _____ (PARADIM use only)
Project PI: <i>completed by PARADIM</i> _____	
Project Title <i>completed by PARADIM</i> _____	
Date sent for Review <i>completed by PARADIM</i> _____	Date to be returned <i>completed by PARADIM</i> _____

PARADIM Proposal Review Form

I certify that I have NO Conflict of Interest with this proposal YES No *click to set
If N, return to PARADIM immediately*

Conflict of Interest situations, per NSF guidelines. 1) Present or past Ph.D. Student or Advisor, 2) collaboration within the last 48 months, 3) co-editor within the last 24 months, 4) Any other circumstance where impartiality could be questioned. Reviewers are expected to self-disclose conflict of interest situations, and furthermore are expected to not disclose and benefit from non-public information.

Review Criteria <ul style="list-style-type: none">• Scientific merit and potential impact• Experience and capability of proposing research group• Suitability for PARADIM Resources• Alignment with PARADIM's scientific focus of New Interface Materials by Design• Implementation of the Materials by Design process	Overall Scoring <ul style="list-style-type: none">5 Proposal is of high quality and must be given high priority4 Proposal is of good quality and access should be granted3 Proposal is acceptable and access should be granted at PARADIM's discretion2 Proposal has minimal merit and access should be low priority; marginal scope; marginal equipment match1 Proposal has little merit and access should not be granted; out of scope; not suitable for available resources
--	---

Overall Score: _____ (5=highest)

This form will be returned to Proposer without modification.

Review Comments:

Box will expand as necessary onto next page

Save with original file name and return by email to Rebecca Vliet at RLC12@cornell.edu

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Appendix 4: Related Policy Documents

NSF

- **NSF User Facility Policy**
<http://www.nsf.gov/pubs/1998/iin122/iin122.txt>

User Agreements

- **Johns Hopkins University User agreement**
https://sites.coecis.cornell.edu/paradim/files/2016/03/PARADIM-JHU_User_Agreement-1rym0wx.pdf
- **PARADIM/Cornell combined outside User Agreement**
http://dev-paradim.pantheonsite.io/sites/default/files/2018-07/PARADIM-External_user_agreement_07202018.pdf

Lab Safety

- **Cornell General Safety Policy**
https://www.dfa.cornell.edu/sites/default/files/policy/vol8_6_0.pdf
- **Cornell Chemical Hygiene Plan**
<https://sp.ehs.cornell.edu/lab-research-safety/laboratory-safety-manual/Pages/index.aspx>
- **Johns Hopkins University Safety Policy**
<https://paradim.jhu.edu/users/safety/hse-safety.php>

Code of Conduct, Ethics, Responsible Conduct of Research, etc

As de facto members of the respective university communities, PARADIM users, students, and staff are expected to adhere to the relevant codes of conduct.

- **Cornell Campus Code of Conduct**
http://assembly.cornell.edu/uploads/Elections/Campus_Code_of_Conduct.pdf
- **Cornell Academic Integrity Policy**
<http://www.theuniversityfaculty.cornell.edu/AcadInteg/code.html>
- **Essential Guide to Academic Integrity at Cornell**
<https://cornell-classic.univcomm.cornell.edu/provost/docs/0814-academic-integrity.pdf>
- **Cornell Responsible Conduct of Research**
<https://www.oria.cornell.edu/rcr/>
- **APS Guidelines for Professional Conduct (re: authorship)**
http://www.aps.org/policy/statements/02_2.cfm
- **Clark Atlanta Responsible Conduct of Research Policy**
http://www.cau.edu/research-sponsored-programs/_includes/files/rcr-researchmisconductpolicy.pdf
- **Clark Atlanta Code of Ethical Conduct (includes IT policies)**
http://www.cau.edu/compliance-office/_includes/files/2-4-0-code-of-ethical-conduct.pdf
- **Johns Hopkins University Anti-harrassment Policy**
http://web.jhu.edu/administration/jhuoie/equity_compliance/antiharassment_policy.html