

Proton Radiography User Manual

December 2019

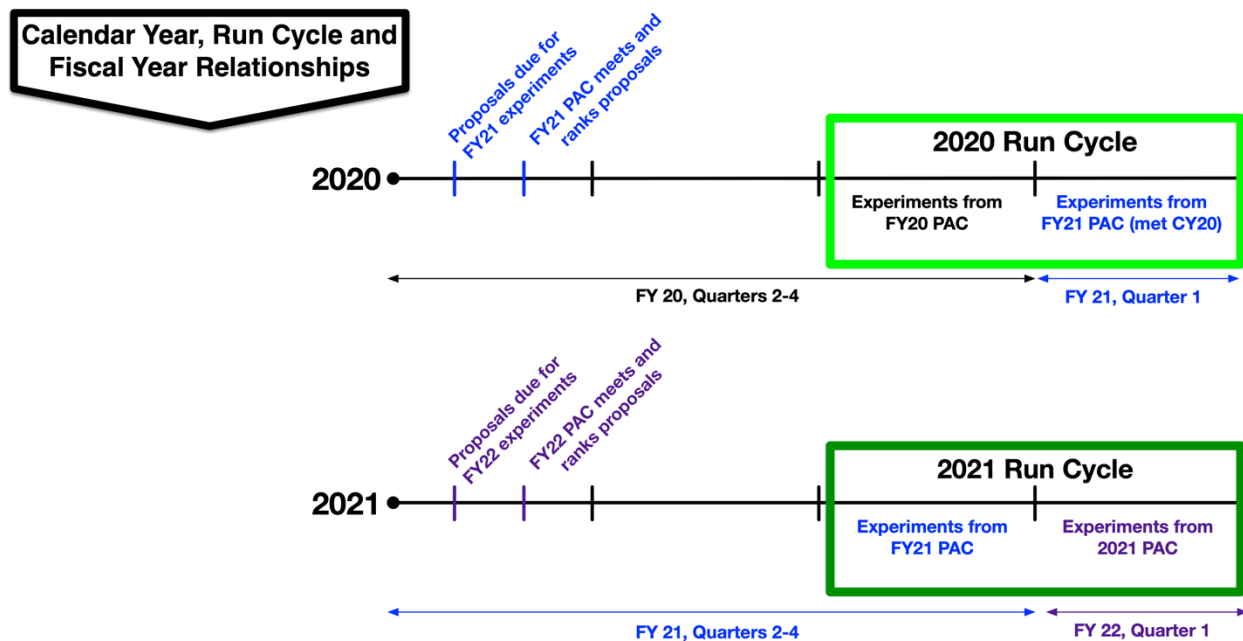
Welcome from the pRad Project Leader

Thank you for proposing experiments using proton radiography at LANSCE. We are looking forward to working with you. This manual serves as an introduction to the pRad team. We will work closely with you technically to give you the best experimental data possible. Please email me or any of the team members if you need help, have questions, or have suggestions. -Kathy Prestridge



Proposal Process & Timeline

The pRad proposal process calls for proposals early in the calendar year that will be scheduled for beam time in the next fiscal year. For example, proposals submitted in January 2020, if approved for experiments, will be scheduled for October-December 2020 or late June-September 2021. This is outlined in the graphic below.



When you receive your experiment scheduled dates, you will also receive feedback from the PAC review process, the name of your technical point of contact (POC), and instructions regarding training and registration. Your POC should be in touch with you well in advance of your shots to better understand safety and security issues and the experimental goals. The POC will answer questions about radiographic and other diagnostic capabilities and help you make a determination of what diagnostics you will use on your experiment.

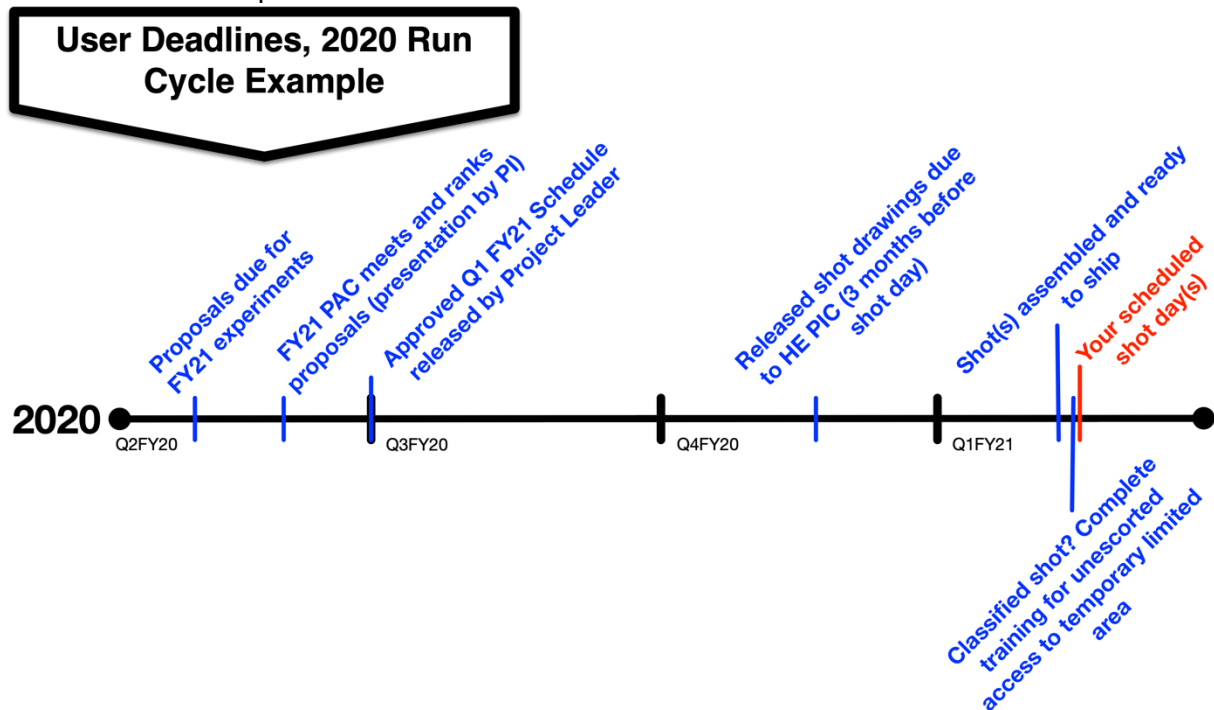
The facility operates within an authorization basis that has constraints on materials, explosives, and other hazardous activities. The experimental area operates under an Integrated Work

Document (IWD) that outlines the hazards of performing work. The assessment with your POC will determine whether or not your experiments fall within these existing controls. For experiments outside of the existing safety controls, there may be significant lead time associated with securing approvals to perform the experiments at LANSCE. So, if you have programmatic deadlines, please plan ahead!

High Explosive Experiments

Engineering Drawings

Moving high explosives to LANSCE requires special approvals. The High Explosives Operations Person in Charge (HE PIC) from J-3 (Mary Sandstrom) **requires completed technical drawings of your assembled shot 12 weeks (3 months) before your scheduled shot date**. There are some exceptions to this requirement, so contact Mary to see if your shot already has the required shipping paperwork. The drawings must include *all* of the materials that will ship with the HE and dimensions. Important deadlines for users are shown on the table below.



The full timeline for pRad shots is on the last page of this manual, “Shot Proposal to Execution.”

If the HE PIC does not have the drawings at the 12 week deadline, the Project Leader will be notified. The shots may have to be rescheduled, and it may be possible that beam time will not be available until the next run cycle.

Shot Assembly & Fiducials

There are limited assembly capabilities at Area C, so it is important that your shot is assembled and inspected off site to meet your build specifications. Shots can be assembled by J-3 at their makeup facilities, but all of the parts should be received at least one month before scheduled

shot days. If multiple shots are planned, please number the shots **in the order of priority to shoot**. If you already have an assembly numbering system that isn't in priority order, please add a new set of numbers, e.g., pRad 1, pRad 2, pRad 3...

If components of your shot must be assembled on site, please ensure that the team has instructions and build criteria. All assembly work must fall within the LANSCE safety basis. For on-site assemblies, it is helpful to have markings and fiducials on the setup to ensure the build is done correctly. Fiducials that mark the left and right side of the shot are also helpful. *It is the responsibility of the user to ensure that the shot is set up according to their specifications.* This can be done through final inspection and photographs before the shot enters the vessel. The pre-shot static radiographs can also be used for a final check. Work with your POC to determine the best focusing and alignment fiducials for your experiment.

Shot Execution & Optimization of Radiography

If you have calculations of your experiment that could be forward-modeled with a proton radiography simulator, please let your POC know. This information can be very helpful in deciding the correct beamline setup and focusing for the features of interest. In lieu of forward modeling, information about the time-dependent densities and materials that you would like to measure is important to convey to the POC. Your POC can also help you determine the shot timing. Shot timing is finalized on the day of the experiment.

For multiple experiments in a series, ensure that your POC knows the preferred shot sequence and diagnostics or conditioning for each experiment. Cooling and heating will add significant time to shot execution, usually taking two days total from initial receipt of the experiment to firing. Keep this in mind when prioritizing shots. PDV probes must be ordered in advance, and multiple probes take time to set up. This usually does not pose a significant delay to shot execution if the probe count is ≤ 16 , the standard number available at Area C.

What to Expect on Shot Day

On shot day(s), you should arrive at the Area C Counting House (CCH) by 9 a.m. for the Plan of the Day (POTD) meeting. There is limited cell service in the area, although a signal can often be found in the parking lot. There is no Wi-Fi, but if you have a LANL computer, you can connect to the yellow network (if authorized) using dynamic HCP. The main line at CCH is 505-667-3225. Non-LANL computers can be connected to the *wired* Guest Network, and a password can be issued by the User Office. Wireless networking may be available soon.

External Users will have a few steps to complete before they can come to CCH:

- Pick up your badge at the LANL Badge Office, TA 3 Building 261 if you are an external user or do not already have a DOE Badge.
- Pick up dosimetry at the LANSCE Visitor Center, TA 53 Building 1 Lobby if you do not already have a TLD and Lemon Badge and plan on going into the Dome.
- Take assigned training at the LANSCE Training Office TA 53 Building 1 Room B113 (external users only, internal users can complete training in UTrain)
- Stop by the User office to get a Guest Network password.

- Report to Area C. Upon arrival, check in with the Experimenter in Charge. You will be given an overview of the area by a team member.

Please keep in mind that CCH is not an office environment. If you need to have a meeting or make a lengthy phone call, please use building 898 (where the restrooms are located) just west of CCH. Building 898 has a lunch room with a fridge and microwave, network access, individual male and female restrooms, a shower, and a light lab space area. There is only stair access to 898, but there are accessible ground floor restrooms available at Staging Area A, so ask anyone to point those out to you if needed.

There is a pRad Beamline Status website located on one of the screens in CCH (prad-ops.lanl.gov) and available on the LANL yellow (internal) network. This lets you know who the EIC is, whether there is HE on site, and where we are in the flow of the work day. Shot setup is usually the longest part of the day. You will be allowed to come into the Dome to take pre-shot photos of your experiment if it is unclassified and you have a Laboratory approved camera. If you don't have an approved camera, please remind the EIC that you need photos, and they will take them using the pRad camera. The team also has a camera that can take pictures of classified assemblies. All pictures must be taken before the critical lift. This is also the time to inspect your experimental setup and make sure it meets your requirements.

Things for the PI to let people know at the 9 a.m. POTD meeting:

- The general goals of the experiment and what you want to measure
- Special setup issues with the experiment
- If you would like photos
- Inspection requirements before the shot goes in the vessel
- Any other concerns

Registration and User Agreement

All users who wish to be present for experiments must register with LANSCE. The pRad user office will send you an email asking you to register (<https://lems.lanl.gov>). Make sure you complete this step, since this is how you are assigned your required training.

External users (non-LANL employees) must have a valid User Agreement in place. The Non-proprietary (NPUA) or Proprietary User Agreement (PUA) needs to be established between institution of the user and LANSCE. (<https://lansce.lanl.gov/users/become-a-user/user-agreements.php>).

Foreign Nationals

If any visitors are not US citizens, a Foreign Visit Request must be submitted and approved for access to LANL. The User Office will submit the request with the information collected on the online registration form (<https://lems.lanl.gov>). Approvals of Foreign Visit Requests take **up to 60 days** from submission, so please work with the user office as soon as possible. We recommend not making non-refundable travel plans until the visit is approved.

Traveling to Los Alamos

Maps and directions to the Lab are at <https://www.lanl.gov/resources/maps.php>. A map of LANSCE is attached to the end of this manual.

Required Training & Dosimetry for Users

Users coming to the Area C who will go into the Line C hallway or Dome require a TLD (Thermo Luminescent Dosimeter) and TED (Track-Etch Dosimeter, a.k.a. Lemon Badge) that can be picked up at the LANSCE Visitor Desk. Some users may require access when the area is a Limited Area (requiring a security clearance). In that case, WQAS 11091 pRad TLA Unescorted Access will be assigned to you for additional training.

To have unescorted access to the pRad experimental area, you are required to take online training available via UTrain that can be accessed at the LANSCE training office. This training is assigned to you via the worker qualification and authorization system (WQAS) plan 5584. Some courses are available off site. The courses are in the following table.

Unescorted Access to Area C Dome	Course ID
TA-53 Facility Radiation Protection Requirements (FRPR)	21395
General Employee Radiological Training	3664
TA-53 Primary Beam Area Access (PBAA)	40394
LANSCE: Area C Hazard Overview for pRad Ops	33804
TA-53 Employees/Residents	201
pRad Required Equipment Review Training	45956
TA-53, MPF Sectors N and P Building Emergency Plan (available on extrain.lanl.gov)	21581

If you expect to perform experimental work at Area C, please speak with your technical POC at least 3 months in advance of your shot date, since extensive additional training is required for work on the P-25 pRad IWD. We expect that most users will not be performing hands-on, hazardous work in the experimental area.

Exit Process

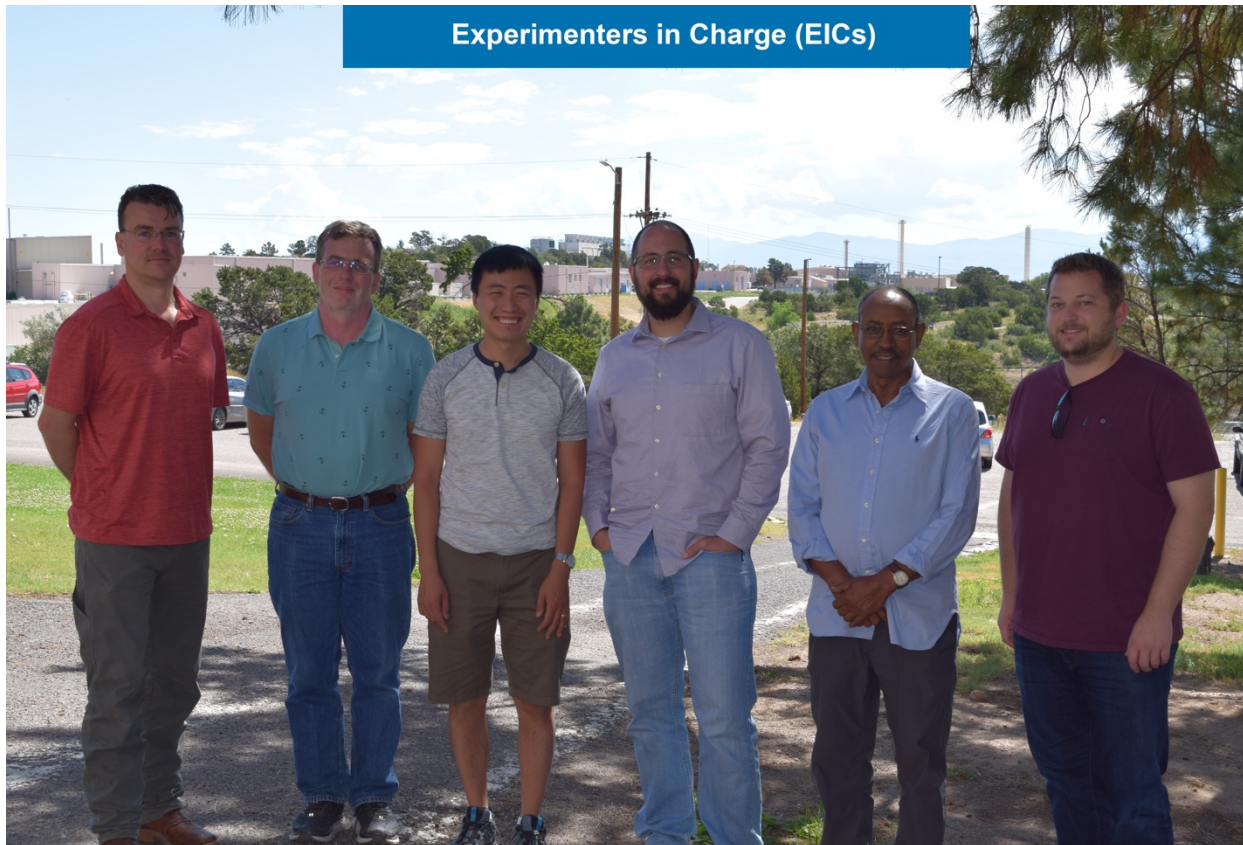
The pRad team needs your feedback for continuous improvement, and also as an NNSA user facility. So, please complete the user survey after your experiments! You will receive an email from the user office with the link. You are also welcome to send an email to any of the Team Leaders or the Project Leader with feedback. We will hold your comments in confidence while using them to improve the overall operations and user experience at pRad.

Experiment Report

You will receive a link to a report template (one pager with a quick highlight of what you accomplished). The LANSCE User Facility Director will use this to highlight pRad activities to our sponsors. Your completion of this brief report is very helpful to us. Thank you!



Levi Neukirch (P-25) Mary Sandstrom (J-3) Amy Tainter (P-25) Frank Cherne (M-9) Frans Trouw (P-23)



Josh Tybo Andy Saunders Zhaowen Tang Levi Neukirch Fesseha Mariam Carl Wilde

High Explosives Operations (J-3)



**(l-r) Matthew L. Davis Richard Uliano John Echave Ryan Vlietstra
Mary Sandstrom Devin Cardon Pamela Scott Jason DeVargas**

Diagnostics



Wil Meijer Levi Neukirch Dale Tupa Amy Tainter



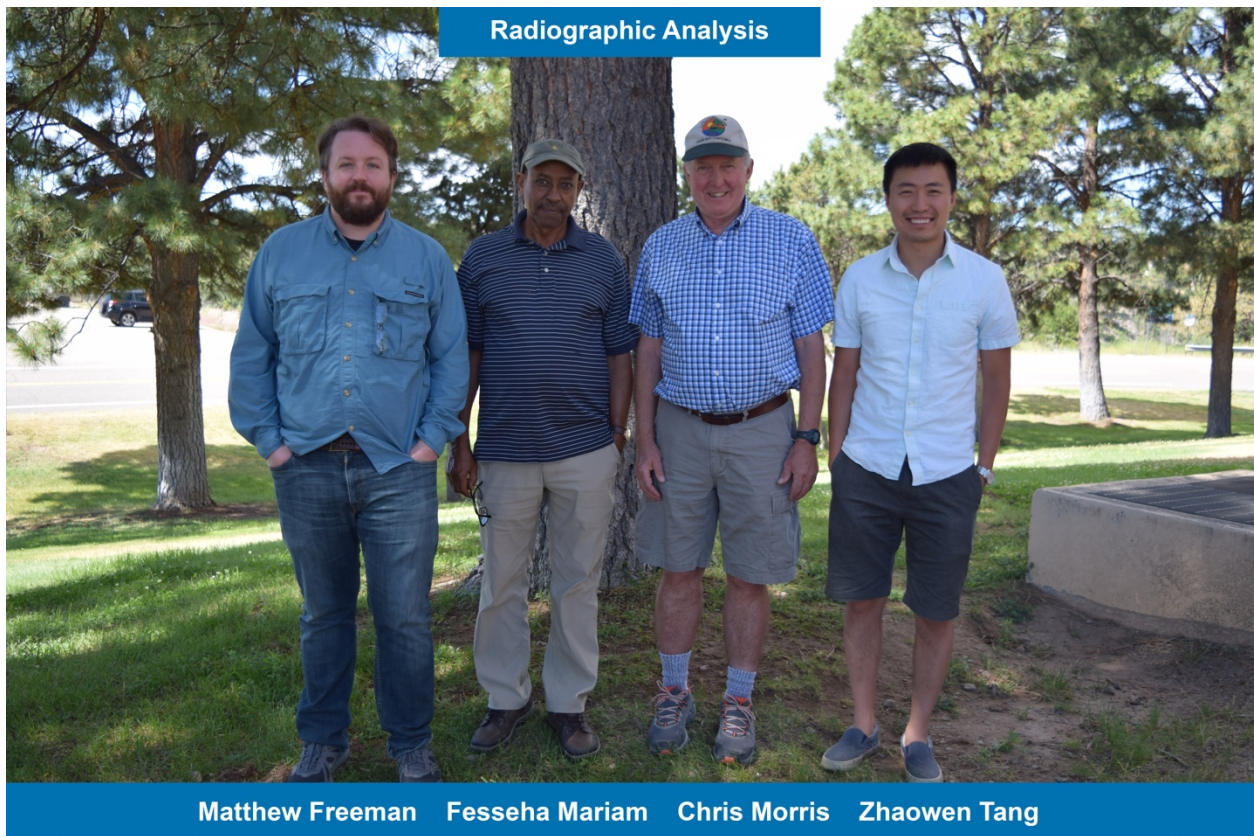
Anthony Sanchez Nicholas Lovato
Emily Rivera, Rayann Mora, Alexis Trujillo



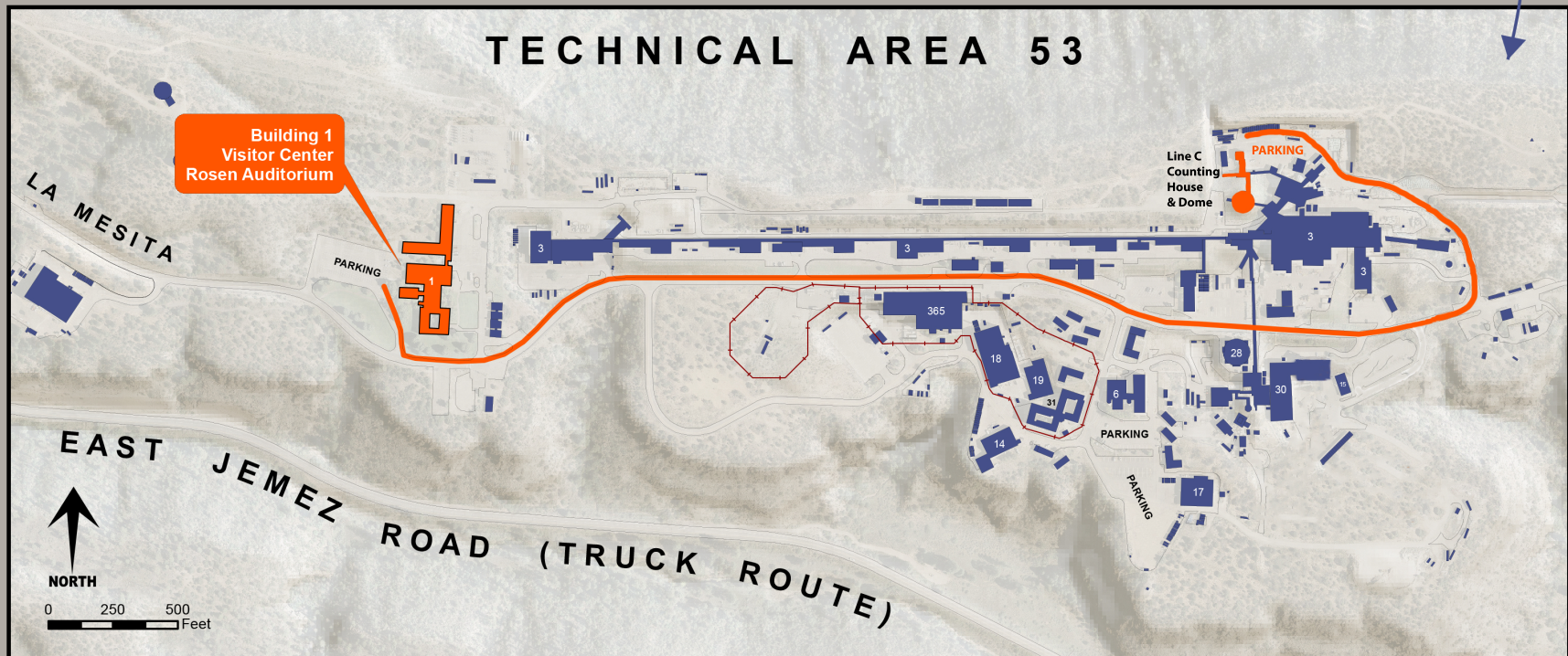
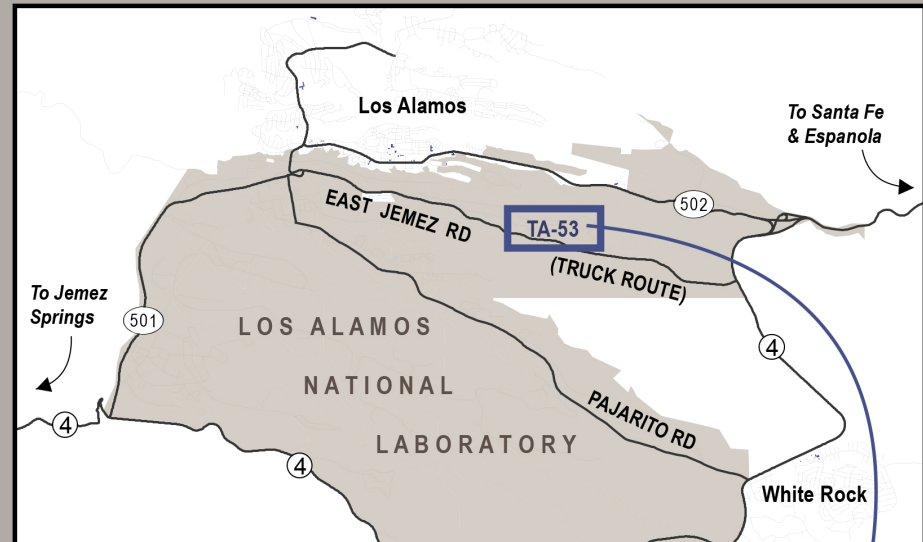
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LANSCE Los Alamos Neutron Science Center Technical Area 53





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