

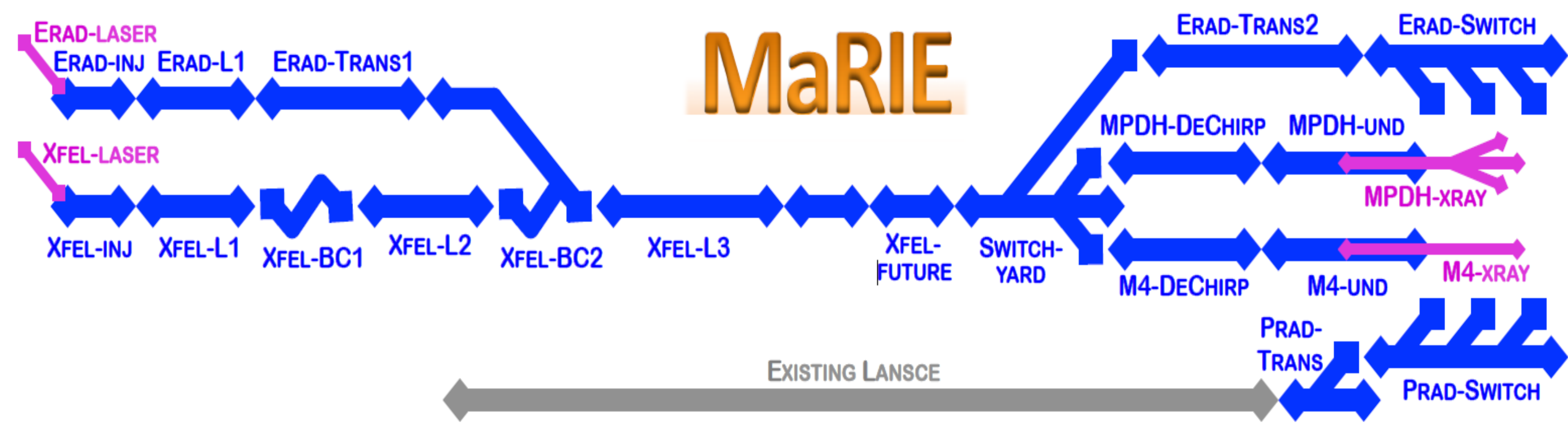
MARIE – INSTRUMENTATION & CONTROL SYSTEM DESIGN STATUS AND OPTIONS*



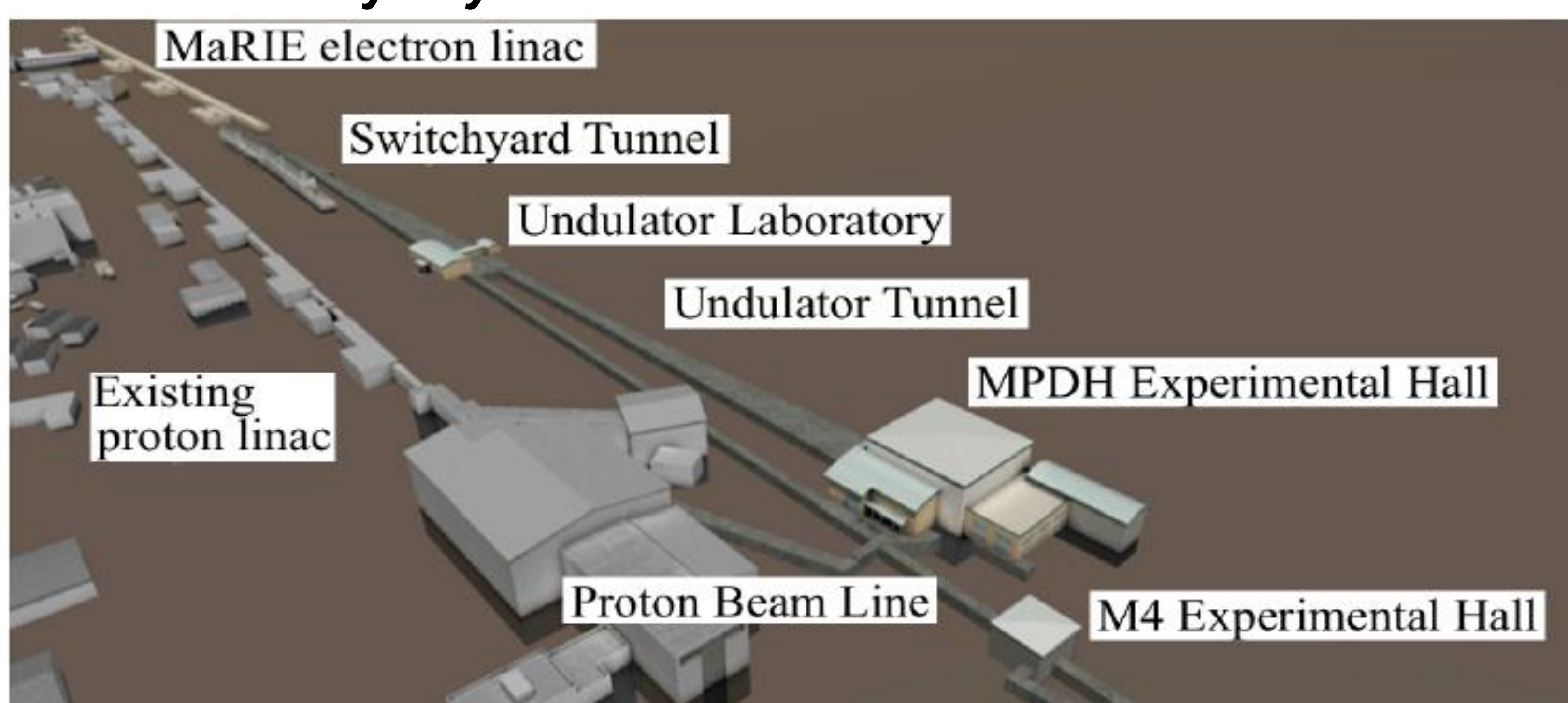
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MaRIE: Matter-Radiation Interactions in Extreme

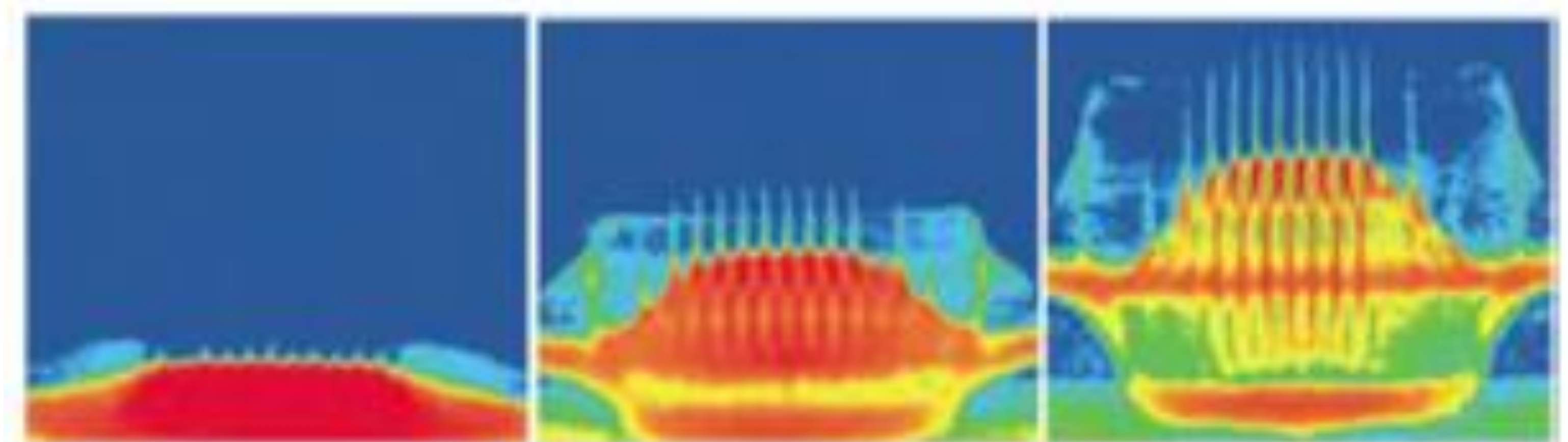
Los Alamos National Laboratory (LANL) has defined a flagship science facility Matter-Radiation Interactions in Extremes (MaRIE) that builds on the existing Los Alamos Neutron Science Center (LANSCE). The MaRIE facility will include a 12 GeV linac to provide a suite of measurement designed to investigate the performance limits of materials in extreme environments. One of MaRIE's most powerful tools will be the ability to multiplex an X-ray FEL, electron, and proton radiography onto a target material to study dynamic events as they develop. The existing LANSCE proton linac will be used to provide proton radiography (pRad).



MaRIE Facility Layout



pRad Capability



Using the LANSCE proton beam allows for multiple images taken at a wide range of intervals, capturing a movie of the event where the frames may be spaced from one second to 10⁻⁷ seconds apart.

MaRIE Control System Turnkey Subsystem

The scope of the MaRIE project likely requires a multilab collaboration with other facilities that have expertise in many of the systems required for MaRIE. Similarities between MaRIE and other XFEL facilities exist. The expectation is that some of these systems could be delivered by these facilities as turnkey subsystems.

The pros of using a turnkey system include:

- One responsible supplier will provide all the project management and become the single interface to the host facility. This frees the host facility from dealing with many individual contractors to achieve the same result.
- Suppliers most likely have already developed control system solution for a particular subsystem which could save the design / engineering cost.
- Turnkey system providers (subject matter experts) often have a better understanding of what is required to make a system work which in turn increases the cost certainty for the project.
- When working with one responsible authority, one would expect to have one warranty to secure the quality and craftsmanship of the subsystems to be delivered.

The cons of using a turnkey system include:

- Having a single responsible supplier usually means a higher management fee for this type of service which could be equivalent to hiring independent consultant(s) or a permanent staff
- Most likely the turnkey system needs to be integrated into one holistic control system which may require extensive integration work.
- In-house personal need likely extensive training due to the lack of being involved during the engineering design phase.
- Higher maintenance cost due to the possible wide variety of hardware and software solutions used across the host facility for different turnkey systems.
- Timely response to pending problems may be difficult due to lack of on-site subject matter experts.
- Reduced opportunity to develop in-house capabilities and knowhow that could be beneficial for future projects.

For a turnkey system several things should be kept in mind in order to avoid any difficulties down the road.

- Be mindful about changing interface in the future as the facility goes through its lifecycle stages.
- Insist on having access to all system documentation and software. Proprietary implementation may lead to the inability to make required changes in the future.
- Require the use of industry standards whenever practical which will make upgrading and interfacing easier in the future.
- Like other control systems, turnkey systems should be designed with a modular upgrade path.
- Test early, test often. Take advantage of prototypes, simulators, emulators, and any other way to let everyone involved get an early look at the system. Make sure tests prove that the supplier satisfies the requirements

