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

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 theses 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.

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