

# OVERVIEW OF LCLS-II PROJECT STATUS AT FERMILAB\*

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## Scope/Status

Fermilab's scope of work includes supplying

- Nineteen 1.3 GHz cryomodules
- Three 3.9 GHz cryomodules
- Cryogenic distribution system (CDS) components.

Current status:

- Built & tested eighteen 1.3 GHz cryomodules
- Delivered to SLAC nine 1.3 GHz cryomodules (total from both JLab & Fermilab delivered is sixteen) and all CDS components
- Starting work on 3.9 GHz string assembly

## Key Lesson Learned

- Schedule compression - most impactful project constraint
  - Upper management, including funding agencies, need to analyse risk of their decisions to compress time
- Develop culture of Work Planning and Control (WPC) early and establish acceptance at all levels
- Monitor off-normal work and assure risks are properly analysed
- Avoid single points of failure (people or equipment)

Choose the type of collaboration desired early in project:

- Build interactions that reinforce that philosophy
- Host lab is responsible for the machine - must be skilled in SRF technology/take responsibility for solving problems
- Establish organization that matches required SRF knowledge

## Design/Assembly Lessons Learned

- Create design teams to eliminate single point failure
- Form working groups to solve major problems
- Design to avoid sole source vendor situation
  - Monitor vendor closely
- Define amount and timing of documentation early in project
- Monitor non-conformance at all stages
- Do not stop R&D too early
- Optimize value of prototype

## Transportation Lessons Learned

- Assure root cause of any failure is fully addressed
- Provide independent review of transport scheme
- Short test runs are necessary but not sufficient
- Analyse risks/quantify motions even at expense of time delay

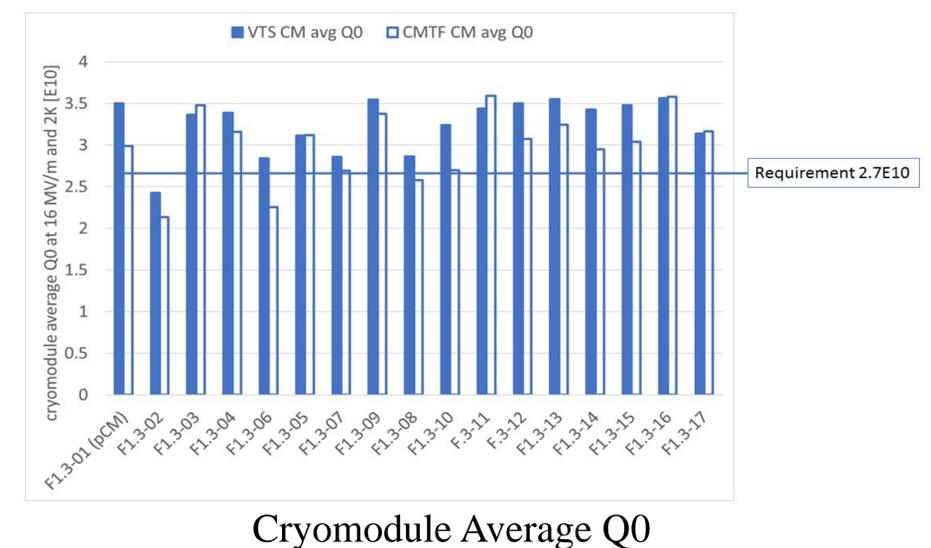
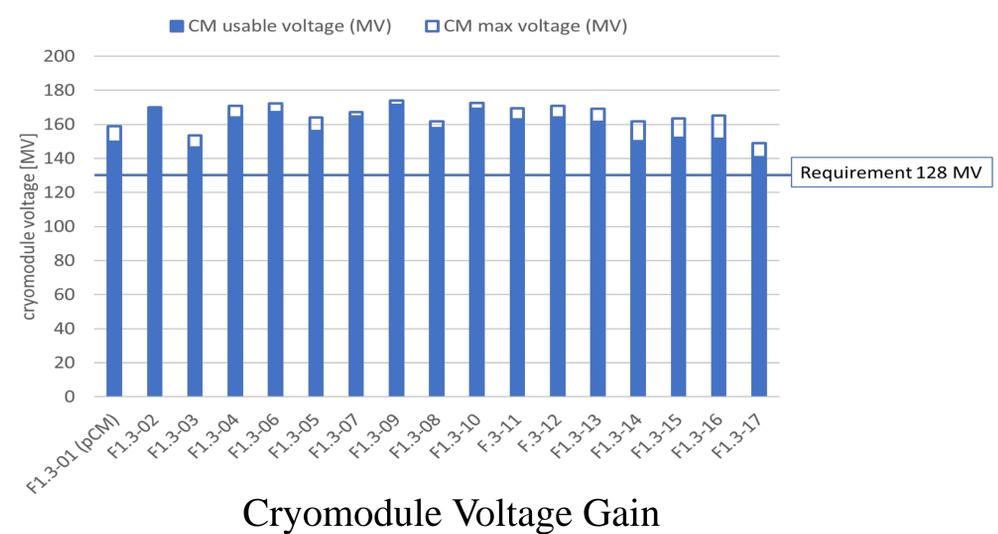
## CDS Lessons Learned (Design & Build Contracts)

- Follow system engineering process throughout the work
- Provide reference design and detailed specifications
- Perform formal reviews with issue tracking
- Implement structured vendor oversight, including assistance with technical problems resolution.
- Conduct factory acceptance testing at the vendor

## Results

Fermilab tested cryomodules only

- Average usable energy gain/cryomodule: 159 MV (spec. is 128 MV)
- Average Q0 for cavities: 3 E10 (spec. is 2.7 E10)
- JLab has similar results



## Testing Lessons Learned

- Plan additional time for first few cryomodule tests
- Assume learning curve on most tasks including mechanical installation and removal from the test stand
- Dedicated test facility, with redundancy, helps maintain schedule
- Develop detailed test plan even if it will change.
- Establish testing shift coverage early
- Match cryogenic parameters of accelerator (cryogenic inlet conditions and cooldown rate)