

Review of LCLS-II cryomodule shipping.

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Charge for the review:

1) Assess the shipping system design and implementation,

Is the design of the LCLS-II CM shipping system adequate to protect the cryomodule from transportvibration generated motion? Are the primary internal resonances, (i.e. resonances most likely to cause damage), properly restrained and / or damped? Is the system immune to temperature fluctuations such as those expected any time of the year along the route from Jlab / Fermilab to SLAC? Are the shipping restraint installation-procedures fully developed and adequate to ensure correct installation? Is the instrumentation (logger) scheme well developed? Are logger up-load and interpretation criteria (GO/NO-GO) meaningful and understood?

2) Examine evidence showing performance to date (success and failure), and

Is the project-team's interpretation of shipping-failure events (chiefly the loss of beamline vacuum F1.306) justified by the facts? Are there possible failure-modes that have been overlooked?

3) Determine whether the proposed improvements are adequate and reduce risks acceptably.

Are the proposed restraint improvements and updated instrumentation workable and likely to be effective? Are there potential risks associated with the deployment of these improvements?

4) Advise the project team on a route-survey procedure.

Please note the recently held DoE OPA review concluded with a recommendation (SC7) to hold a CM shipping review. This review serves to respond to that recommendation.