

## Gradient Team (DRAFT)

### Team Members:

Ken Baggett - Team Leader, Trent Allison(EES), Rama Bachimanchi(EES), Tomasz Plawski (EES), Mike Drury(SRF), Bob Legg(SRF), Michael McCaughan(Operations), Clyde Mounts(EES), Nusair Hasan(Cryo), Jonathan Creel(Cryo), Jay Benesch (Ops), Adam Carpenter(OPS-SystemAdministration)

### Auxiliary Members:

Krystina Serafini (HR), Rhonda Barbosa (HR)

### Stakeholders:

Jonathan Creel, Arne Freyberger, Andrew Hutton, Andrew Kimber, Will Oren, Tony Reilly

### Team Charter

The CEBAF acceleration system was designed to provide 1090 MeV/linac with sufficient overhead to maintain operability throughout run periods. Currently, CEBAF is not able to reach this expectation with acceptable trip rates but is operating stably at 1050 MeV/linac (2.1 GeV/pass). The Physics division expectation is that the accelerator will maintain a minimum of 2.1 GeV/pass through Fall 2018. However, losses (klystron failures, field emission, etc.) cause CEBAF gradient capabilities to decline at roughly 1.2MeV/week of operations which, if not mitigated, will prevent the program from meeting this goal.

To meet the lab's requirements, the Team is authorized to evaluate all aspects of the cryomodules, RF, and cryogenics to stabilize and improve the existing acceleration system. This includes identifying crucial tasks, and assigning them to groups to be executed, to optimize operating conditions for the C20, C50, and C100 systems. Stakeholders will review the task-lists and provide guidance and prioritization as needed. Based on the lab's current funding, procurement costs must be minimized and labor resources utilized efficiently. Specific goals include:

1. Quantify the baseline capabilities of each of the C-20, C-50, and C-100 systems circa Fall 2016 beam operations
  - a. Develop a weekly Gradient Performance report that captures the operating gradients, downtimes and FSD by module type/linac, and energy reach available to Operations for the previous week of operations and trend plots over the course of the run period. Include in the weekly report recommendations for RF recovery periods and quantifiable improvements with known causes.
  - b. Assume ownership of the "Energy Reach" plot/data that is presently generated by Arne Freyberger. Work with Arne and appropriate software/web developers to generate a web-based resource as the home of the "Energy Reach" plot and weekly reports developed for charge 1a.
2. Document the historical operational performance capabilities of the C-100 modules from the 2012 104MeV fully loaded beam demonstration to present.

- a. Develop a test plan to reevaluate the same module under the same test condition parameter to further understand and quantify CEBAF's C-100 performance losses and execute the plan.
3. Document the current capabilities of the C-100 acceleration system and detail operational limitations that require additional engineering beyond the gradient team's scope. Provide feedback to applicable departments for incorporation in future design projects.
4. Develop a plan to maintain 2.1+ GeV/pass with an acceptable trip rate (as required to achieve 80% availability, <5 trips/hour/linac expected) through Fall of 2018. [Deliverable 3/17]
  - a. Required margin is 60MeV/linac for observed losses and bypass of a C-20/C-50
  - b. Preferred margin is 100MeV/linac, to bypass a C-100
  - c. Tasks will align with strategic plans of the Long Range LINAC PIT to meet the energy reach goal of 2.2 GeV/pass with >80% availability.
5. Provide tactical plans for Summer SAD acceleration system improvements by March of each year to allow time for stakeholder evaluation and resource allocation prior to the start of the downs.

The focus of the Team should be to optimize the existing hardware, but the Team may also suggest hardware changes to improve performance. The Team is authorized to marshal additional support to augment the team, when necessary, by working through the stakeholders. The Team will meet twice monthly and report to stakeholders on the evolving state of the system.

**Reference:**

A. Freyberger, "Establishing CEBAF Energy for the FY17 Physics Program", 29 MAR 16.