



Contribution ID: 2

Type: **not specified**

## **Machine protection at the Jefferson Lab 1MW CEBAF electron accelerator**

*Wednesday 6 June 2012 10:50 (30 minutes)*

Jefferson Lab accelerators include the 1MW CEBAF electron machine as well as the high intensity Free Electron Laser. Borrowing risk management practices from the military, aerospace and chemical processing industries, Jefferson Lab manages a graded approach to identify and manage risk presented by beam operations. Constraints are then incorporated in to system level requirements across multiple subsystems. This talk will describe the engineering transition of the Jefferson Lab CEBAF and FEL accelerator machine protection systems to a risk based systems engineering approach. The approach addresses the traditional goals of maximum machine availability, minimal short and long term damage, and configurability. In addition, a systems engineering approach also addresses enabling and supporting processes like project management, controls infrastructure, personnel competency, and long term system effectiveness. We will conclude with a brief look at ongoing work to integrate the systems, software, and cyber security assurance practices.

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**Session Classification:** Introduction; Machine protection, experience and challenges