**12 GeV Upgrade**

**SYSTEM REQUIREMENTS DOCUMENT**

***Upgrade Hall B***

***CLAS12***

**Version 1.2**

**August 9, 2010**

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***Upgrade Hall B***

APPROVALS

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REVISION LOG

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| **Version No.** | **Description of the Changes Made** | **Revision Date** |
| 1.0 | Original | September 2007 |
| 1.1 | Reviewed, unchanged | June 2008 |
| 1.2 | Updated Physics APM to Glenn Young on approval page | August 2010 |
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ACRONYMS

AC Alternating current

ALARA As low as reasonably achievable

CEBAF Continuous Electron Beam Accelerator Facility

CHL Central Helium Liquefier

CLAS CEBAF Large Acceptance Spectrometer

CLAS12 CEBAF Large Acceptance Spectrometer for 12 GeV Upgrade

DAQ Data Acquisition

DI Deionized

DOE Department of Energy

DX Direct Expansion

EH&S Environment, Health and Safety

fpm Feet per minute

FPC Fundamental Power Coupler

ft Feet

HEPA High-efficiency particulate air

HOM Higher-Order Mode

Hz Hertz

I&C/S Instrumentation and Controls/Safety

ID Internal diameter

in Inch(es)

JLab Thomas Jefferson National Accelerator Facility

kV kilovolt

kW kilowatt

LCC Life-cycle cost

Linac Linear accelerator

LLRF Low level radio frequency

MHz Megahertz

NFPA National Fire Protection Association

ODH Oxygen Deficiency Hazard

PPS Personnel Protection System

psf Pounds per square foot

psi Pounds per square inch

QCD Quantum Chromodynamics

rf/RF Radio frequency

SBC Standard Building Code

SF Square feet

SRD System requirements document

SRF Superconducting Radio Frequency

TBD To be determined

UL Underwriters Laboratories

UPS Uninterruptible power supply

WBS Work Breakdown Structure

12 GeV Upgrade

**SYSTEM REQUIREMENTS DOCUMENT  
*Hall B***

# Project Mission

The 12 GeV CEBAF Upgrade will increase the available energy of the facility from 6 GeV to 12 GeV, and add to its experimental capabilities in order to more fully explore the nature of non-perturbative QCD as manifested in the nucleus plus potentially solving the riddle of quark confinement.

# System Role

The thrust of the science program with the CLAS12 detector in Hall B in conjunction with the 12 GeV CEBAF accelerator is the study of nucleons and nuclei through exclusive, semi-inclusive and inclusive processes. This will provide new insights into the nucleon dynamics at the elementary quark and gluon level and allow development of a more complete description of the nucleon interior. Major associated upgrades include upgrades to the CLAS forward detector based on new superconducting Torus magnet and the new central detector based on a superconducting solenoid magnet.

# System Requirements

The Hall B System shall meet the following requirements:

* Capability to receive 11 GeV polarized electron beam,
* Capability to run at Luminosities of 1035 cm-2sec-1,
* Capability of operation with a longitudinally polarized target,
* Capability to detect the forward-going high momentum particles from 5 - 35 degrees,
* Capability to detect the recoil baryons at large angles (> 45 degrees), and
* Large momentum range for the separation of electrons, pions, kaons and protons.

The safety of personnel and equipment will be implemented in all phases of the CLAS12 detector upgrade, R&D, design and construction.

# Required Interfaces

The Hall B System has functional interfaces with the following systems:

* Beam Transport,
* Cryogenics,
* Instrumentation and Controls/Safety (I&C/S), and
* Site Utilities.

# References

1. The Science and Experimental Equipment for The 12 GeV Upgrade of CEBAF (2007 Update from the Document Originally Prepared for the April 2005 DOE Science Review).
2. Hall B 12 GeV Upgrade Technical Design Report, version 4, 2008.