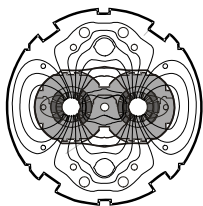


CERN

CH-1211 Geneva 23
Switzerland



The
**Large
Hadron
Collider**
project

LHC Project Document No.

LHC-AB-CO-xxxx rev 0.2

CERN Div./Group or Supplier/Contractor Document No.

AB-CO

EDMS Document No.

yyyyyy

Date: 13-MAR-08

Functional Requirements

LUMINOSITY MONITOR APPLICATION

Abstract

The requirements for the Luminosity Monitor application are listed, described and explained here.

Prepared by :

E. McCrory, Fermilab
E. Prebys, Fermilab
A. Ratti, Berkeley Lab

Checked by :

R. Assmann, AB/ABP
E. Bravin, AB/ABP
J-P. Koutchouk, AB/BI
M. Lamont AB/OP
J. Wenninger, AB/OP
F. Zimmerman, AB/ABP
D. McGinnis, Fermilab

Approved by:

P. Collier, AB/OP
J-J. Gras, AB/BI
H. Schmickler, AB/CO

Table of Contents

1. INTRODUCTION	4
1.1. BACKGROUND	4
2. DATA AND MEASUREMENTS THAT ALREADY EXIST	4
2.1. DATA TO BE OBTAINED FROM THE FESA CLASS.....	4
3. REQUIREMENTS	4
3.1. BASIC REQUIREMENTS	4
3.2. CONTROL REQUIREMENTS	5
3.3. OTHER REQUIREMENTS	5
4. COMMENTS	5
5. APPENDICES	5
6. FOOTNOTES	5

History of Changes

<i>Rev. No.</i>	<i>Date</i>	<i>Pages</i>	<i>Description of Changes</i>
0.1	2008-03-13	5	First draft

1. Introduction

Delivering luminosity is the “bottom line” for the AB Division during the Large Hadron Collider (LHC) era at CERN. Thus, it is crucial that there be a direct measurement of the luminosity at each interaction point (IP) in the LHC.

The device used for measuring the luminosity is called a luminometer.

This document presents the requirements for a high-level application for interfacing with the luminometers at the LHC.

1.1. Background

A simple description of the BRAN detectors can be found on the web.¹ Simply, there will be a pair of luminosity monitors at each of the four IP's that measure the flux of neutral particles that emanate from the IP in each direction. The rate of these particles is proportional to the luminosity. Achieving a relative reading of the luminosity should be easy. It is anticipated that the absolute luminosity at each of the BRAN detectors will be accurate to $\pm 1\%$.²

2. Data and Measurements that Already Exist

2.1. Data to Be Obtained from the FESA Class³

From the front end FESA class, considers the following to be the primary observables for this device:

- The relative luminosity: this quantity is proportional in an unknown but constant way to the actual luminosity; this implies insensitivity or correction of the detectors to the vertex position, background level,...; the proportionality constant may differ from IP to IP.
- The transverse separation of the two beams; this requires measuring luminosity while changing the beam-beam separation.
- The crossing angle, if the particle counters are granular.

Besides the interaction rates, the background to the experiments is another primary observable relevant to the machine optimization (beam-gas, beam-pipe).

3. Requirements

In this preliminary version of the requirements, we present the possible requirements for the high-level luminometer application.

3.1. Basic Requirements

1. Measurements needed by the luminometer:
 - 1.1. 1Hz graphical display of the luminosity averaged over all bunches.
 - 1.2. 1Hz display of the bunch-by-bunch luminosity
 - 1.3. The crossing angle at IP1 and IP5 (CMS and ATLAS).

- 1.4. The specific luminosity, that is, luminosity divided by X where X is one of the following
 - 1.4.1. Bunch intensity
 - 1.4.2. Bunch emittance
 - 1.4.3. Bunch length
- 1.5. Correlations for each of these measurements between and among the various luminometers, including the measurements from the experimental detectors.
- 1.6. Once per minute measurement of the luminosity lifetime.
- 1.7. Comparison of the luminometer data from the present store to earlier stores.
- 1.8. (?) Measurement of beam-beam effects. (?)

3.2. Control Requirements

Several aspect of the basic control of the luminometers shall be implemented. They are:

2. Place Holder no. 1
 - 2.1. Place Holder no. 2
 - 2.2. Place Holder no. 3
 - 2.2.1. Place holder no. 4

3.3. Other Requirements

3. Furthermore, the rest of the system shall:
 - 3.1. Alarm when the luminosity at ALICE exceeds the threshold.

4. Comments

Many of the measurements from the luminometers can be obtained directly from the front end through generic applications.

5. Appendices

6. Footnotes

¹ <http://ab-dep-bi-pm.web.cern.ch/ab-dep-bi-pm/?n=Activities.BRAN>

² http://ab-div.web.cern.ch/ab-div/Conferences/Chamonix/Chamx2006/PAPERS/EB_5_03-JP.pdf

³ <http://bdidev1.cern.ch/bdisoft/development/BDI-Domains/bdeyelids/bdeyelids.php?currentSelection=GI¤tInstrument=BRASCLHC¤tDomain=LHC>