	Report of the PRR of ATLAS Muon End Cap Alignment System	
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PRODUCTION READINESS REVIEW OF THE MUON END CAP ALIGNMENT SYSTEM

Brandeis University, 10th and 11th January 2003

The reviewers acknowledge the amount of technical work based on extensive and successful R&D work that the teams have performed. The different subsystems with their individual components have reached a state of maturity based on prototyping, testing and analysis. There still some areas of concern, which will have to be picked up at a later stage.

The team specifically requested the green light for ordering of fully equipped alignment bars, the BCAMs, and the LWDAQs. Thus the reviewers recommend ordering of the first 16 alignment bars fully equipped (including some adjustment possibility for the mid- EI line) and tested as well as BCAMs, multiplexers, heads, LWDAQs, etc. shall go into production subject to a formal electronics review as defined in the ATLAS Electronics Coordination by U.S.

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Distribution: EB Members, TC Members, All Participants mentioned in §2 of the Agenda.

PRR of ATLAS Muon End Cap Alignment System			Page 2 of 2
ATC-RM-ER-00xx	<i>Created: 14-Jan-03</i>	<i>Modified:</i>	<i>Rev. No.: 1</i>

1. Introduction

The Production Readiness Review of the ATLAS Muon End Cap Alignment System Spectrometer, specifically the alignment bars, the BCAMs, and the LWDAQ was held at Brandeis University on the 10th and 11th January 2003. The scope and content of this review as well as agenda and names of participants were defined separately in document ATC-RM-ET-0023.

The reviewers thank the End Cap (EC) Alignment team for the amount of documentation prepared for this review, as well as the patient guidance through the complex material combined with the instructional description of their equipment in the laboratory. Through the documentation and the talks, the extensive, detailed and successful R&D that the team has performed became evident. The different subsystems with their individual components and teams have reached a state of maturity based on prototyping, testing and analysis.

The reviewers understood that both radiation hardness and grounding/noise issues have been looked at thoroughly but nevertheless request that these subjects are reviewed and formally documented and closed (see also 2.2)

The overall assembly of the Small and Big Wheels and integration issues of the EC muon system on which finally also the alignment systems heavily depends is still evolving and needs very careful evaluation of the error budget as well as monitoring by the alignment team. The nomination of a dedicated "End Cap Muon Integration Physicist" at CERN with appropriate engineering support is needed to help in solving problems and finding viable solutions. A charge for this physicist should be worked out with the Muon Project Leader and the End Cap Muon Group.

For all alignment bars and other hardware a last thorough counter checking against "environment", frames, chambers, services, attachments, etc. is required.

2. Comments and Recommendations

2.1. PRR items:

The team specifically requested the green light for ordering of fully equipped alignment bars, the BCAMs, and the LWDAQs. Thus the reviewers recommend:

- 2.1.1 Ordering of the first 16 alignment bars fully equipped and tested. For the support of mid- EI BCAM an (at least) 10 mm shimming possibility should be built in. The full release of the remaining short and the 32 long bars, for which a simple and cost effective solution of production must also be found, shall take place once the experience gathered on that first series has fully been exploited. This release of the following bars will be done by the formal approval of the Muon Project Leader, the End Cap Muon Physicist, the Muon Project Engineer, and the appropriate TC members.
- 2.1.2 The mechanical items containing electronics should be ordered of course in sizeable numbers to allow cost effective machining orders and they present no risk at this stage of the project.
- 2.1.3 The BCAMs, multiplexers, heads, LWDAQs, etc. shall go into production subject to a formal electronics review as defined in the ATLAS Electronics Coordination by U.S. ATLAS members to take place within a month or so. The preparation for the review must include for example a full list of requirements for each component, all a clear and documented production plan and QA plan, a list of all the information to be transmitted to ATLAS, and radiation tolerance certification.
- 2.1.4 The reviewer propose also that in order to minimize the number of cables that go out of the detector in to USA15, the Alignment group investigate seriously the possibility of adding an additional Multiplexing stage in the readout. TC requests that the system present its solution during the formal electronics review (see 2.2)
- 2.1.5 The azimuthal corridors should be included in layout Q so they can go through the approval procedure.
- 2.1.6 The dynamic range of the proximity sensors (not part of this review) is considered worrisome in particular for the Big Wheel, where they have to provide information of chamber positions with respect to the alignment in both the sector assembly and in the final Big Wheel integration. GM

2.2 Some General Comments

- 2.2.1 The assembly drawings of all chambers must contain and show details and positions of all on chamber alignment elements (including electric connection boxes with their correct position and orientations).
- 2.2.2 Archive urgently on CDD at least those drawings of subassemblies, which will go into series production.
- 2.2.3 Systematize your approach on QA issues for all components (without going into heavy formalism). At least randomly re-check the measurements of whatever checking the vendor has already done in your current contract.
- 2.2.4 Analyze the error budget for all of the End Cap Muon system.
- 2.2.5 The Committee recommends azimuthal channels to be considered in order to avoid interference with these paths.