EDMS: 2227422

Review of HL-LHC Alignment and Internal Metrology (WP15.4)

Mandate of the review:

The main objective is to review the alignment solutions foreseen for HL-LHC, with a focus on the internal metrology, the monitoring of inner triplet cold masses and crab cavities inside their cryostat and full remote alignment systems.

Scope of the review:

The scope of this review is:

- To examine the soundness of the proposed solutions individually and as a global system;
- To verify that all requirements from equipment owners and machine operation are duly covered;
- To check that the interfaces between WP15.4 and the other WPs are clear;
- To check the readiness of the solutions proposed and evaluate the associated risk if any;
- To evaluate the related test plan, acceptance criteria and the overall schedule;
- To examine the procurement strategy, identifying possible risks;
- To put in evidence possible integration issues and safety aspects.

Members of the Review Panel:

Georg Gassner (SLAC, Chairman)
Johannes Prenting (DESY)
Jean-Philippe Tock (CERN)
Jorg Wenninger (CERN)

Scientific secretary: Mark Jones

Dates and Place:

26 August, 27 August and 28 August morning (2019) at CERN in room 30-7-018

Program:

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The program is on two days and a half organized as follows

Day 1:

Introduction
- Welcome **(O. Brüning) 15'**
- Introduction of WP15.4, sub-WPs, activities, context **(H. Mainaud Durand) 30'**

Internal metrology
- Introduction to Frequency Scanning Interferometry (FSI) systems **(M. Sosin) 30'**
- FSI qualification and results **(V. Rude) 30'**
- FSI choices and next steps **(H. Mainaud Durand) 20'**

Visit of dipole test + visit of 181 low beta string

Fiducialisation aspects
- Specific case of crab cavities **(V. Rude) 20'**
- Internal metrology/fiducialisation on other HL-LHC components **(P. Bestmann) 30'**
- Strategy of magnetic measurements at warm, at cold. **(E.Todesco) 20'**

Alignment systems and Full Remote Alignment (FRA)
- What we can do as movement of single elements without impacting the machine aperture and what is the advantage for the machine of the remote alignment **(R. De Maria) 10'**
- Vacuum: review of limitations in moving the components under vacuum and cold **(V.Baglin) 10'**
- Cryo: review of the limitations in moving the components under vacuum and **cold (S. Claudet) 10'**
- RF including crabs: review of the limitations in moving the components under vacuum and cold **(R. Calaga) 10'**
- BI requirements **(T. Lefevre) 10'**
- Long Straight Sections lay-out **(M. Amparo) 15'**
- FRA and Matching Sections optimization **(P. Fessia) 15'**
- FRA functional specification and interfaces **(H. Mainaud Durand) 20'**

Day 2:
Alignment systems and Full Remote Alignment (FRA)
- Radiations to Electronics considerations **(R. Garcia Alia) 10'**
- Radio Protection considerations **(C. Ardorisio) 10'**
- Safety considerations **(C. Gaignant) 10'**
- Machine protection and operational aspects **(D. Wollmann) 15'**

- Adjustment:
    - Jacks requirements and motorization strategy **(H. Mainaud Durand) 20'**

- Jacks: consolidation and procurement strategy **(V. Parma) 20'**
- 5DOF/6DOF Platform **(M. Sosin) 30'**
- Motors control/command **(P. Peronnard) 20'**
- System reliability and radiation hardness / maintainability **(M. Sosin) 20'**

- Determination of the position:
  - Requirements & solutions, status of integration **(A. Herty) 30'**
  - Status of developments (cWPS, iHLS, inclinometer, sensors data acquisition) **(M. Sosin) 30'**
  - Algorithm and uncertainty of measurements **(V. Rude) 20'**
  - Status of automatic platform measurements **(H. Mainaud Durand) 20'**
- What is foreseen on string test **(A. Herty) 20'**
- Summary of schedule foreseen for each WP, resources and material **(H. Mainaud Durand) 30'**

Day 3:

- Closed session: additional questions, preparation of the conclusions
- Conclusions & feedback from reviewers