Minutes of the 17th Collimation Upgrade Specification Meeting, 25th of January 2013

Participants: C. Adorisio (CA), A. Bertarelli (AB), R. Bruce (RB), P. Hermes (PH), J. Jowett (JJ), M. Karppinen (MK), L. Lari (LL), A. Marsili (AM) (scientific secretary), D. Mirarchi (DM), V. Parma (VP), D. Ramos (DR), S. Redaelli (SR) (chairman), A. Rossi (AR), M. Schaumann (MS), R. Schicker (RS), D. Smekens (DS).
Remote: R. J. Barlow (RJB) (Huddersfield University), T. Markiewicz (TM).

Indico event here.

1 Update on concept for ALICE detectors in the DS collimator: Tagging of Pb-ions in ALICE (R. Schicker)

Slides are available here.

1.1 Summary of the presentation

RS gave the different goals of the future ALICE detector in the DS collimator, and presented two different concepts for this detector. This presentation has also been given at the Alice upgrade meeting.

The Pb ions undergo interactions in IP2 which produce ions with different masses and charges, hence different magnetic rigidities. Each type of ion behaves as a separate secondary beam. The upgrade of Pb-beam intensity requires DS collimators in cold section of LHC dipole magnets, to intercept different secondary beams.

The detector would see a signal proportional to the charge of the ion, and would measure its position. RS presented the different production mechanisms for single and multiple pair production, and the extra correction from QED. RS then presented a list of QED–related topics that didn't attract attention recently.

Then, the first concept of a 2–dimensional detector was presented, which would detect Pb^{80+} and Pb^{81+} ions. It could detect the positions, the time of flight, and also have a Cerenkov radiator. The total length would be less than 25 cm. This detector would have multiple tracks (pixels).

SR asked why the detector is doubled; it is to measure the resolution on the number of mass Z. JJ asked if there is an estimate on the ion fragmentation; the ions have so much momentum that they would go through anyway. SR asked if this detector would be installed on only one side of the beam; it is the case, since the interesting secondary beam is in this case the Pb^{81+}. SR asked if this would also be helpful for protons; apparently not, since the secondary beams would be on the other side of the orbit. SR pointed out that this detector might be installed in the collimator tank, for longitudinal space issues.

In case a length of 25 com is too much, RS presented another shorter detector concept, this time with a gas detector, for a total length of $\simeq 10$ cm. The readout would be segmented longitudinally and horizontally (the Pb^{80+} and Pb^{81+} secondary beams are separated horizontally). The read-out of the gas detector would be at the top or bottom to separate these two beams. It would also include two position detectors to reconstruct tracks and get rid of eventual back-scattering particles from the collimator. The detector would need a vessel

to contain the gas, in a solid material that could go directly in the vacuum. The detector would sit at roughly 6 mm from the beam, which corresponds to $\simeq 16\,\sigma$ at this location.

In conclusion, the project has advanced well, and two detector concept were presented. The choice will mainly depend on the longitudinal space available.

1.2 Discussion

JJ asked if the measure of the cross–section is also proportional to the charge of the ion, and might then perturbed the measure. RS answered that they have a way to measure purely electromagnetic processes: coincidence measurements.

SR asked if these proposals have been accepted by the ALICE upgrade forum. RS answered that since these proposals are just made, there has been no answer yet.

2 Longitudinal integration of a cold collimator (D. Ramos)

Slides are available in pptx and pdf.

2.1 Summary of the presentation

DR presented the two solutions considered to integrate a collimator in the LHC cryostat: moving magnets, and replacing the current magnets by shorter magnets with a higher field.

In the first case, the best choice would be a 4.5–m long warm collimator. The design was started in 2010, aiming for an installation during LS1. However, the cold/warm transitions would require longitudinal space. The design of a cold collimator, which would be placed in the cryostat, would have many advantages: avoiding to move several magnets, and possibly a shorter installation and more compact cross section.

DR showed that the more promising case would be to have the collimator in between the two new high–field magnets, instead of have the two magnets next to each other. The new cold case covers between collimator and magnets would save space. The total collimator length would be 1.48 m. The pumping equipment would be in the tank.

Bellows would be needed to make replacement easier. A plug for RF ball would also be needed. Gate valves would be used to join with the beam pipe in the magnets. The bellows could be optimized, but the total length would still be around 13 m. With standard components, the length is 37 mm too long; with optimized components (if feasible), there would be a spare 31 mm.

In conclusion, the cold design does not seem to solve as many issues as expected, especially not the main one: the transversal space needed. It would also add several new limitations, such as the need for machine warm-up for intervention. In addition, the design hasn't been started, and will need a lot of R&D.

If the collimator is in the middle of the current MB.A10, then the Pb^{80+} secondary beam would not be intercepted. This is OK for protection, but not for the ALICE detector.

2.2 Discussion

During this meeting, it was decided to dismiss cold collimation option as possible implementation in LS2.

AR suggested that some space could be gained if the full range of the bellows is not needed: they could be installed "half closed".

AB pointed out that there is an additional element: the insulation layers for the cold design would add more volume in the transverse direction than in the warm case.