

Beam-gas imaging vertex detector: kickoff meeting

Tuesday, October 30, 2012 at CERN

see <http://indico.cern.ch/conferenceDisplay.py?confId=213774>

* BGI/IPM: it was pointed out that the BGI chambers have to come out during LS1.

It was agreed to investigate the possibility to modify the chambers such as to make it compatible with the beam-gas vertexing method.

Note: At the position of the IPMs, β_x is about 350m, and β_y about 90m.

=> Mariusz (with Plamen, Massi): follow up on this. Contact Ray Veness.

Can the chamber be modified ? Thinner wall ? Al instead of SS ?

Angle of the wall ? (WF suppression!), etc.

Which of the two chambers (V or H) ? Which side of it ?

Other option: displace one pump and insert a new chamber ?

=> Giuseppe: provide pressure profile at BGIs (with gas injection).

* Prototype system: it was agreed that one should try to focus on a minimal setup and a specific use-case that could prove the value of such a device. This will help in the request for funds to build a full-scale device. It was suggested for example that the ability to measure the absolute beam sizes at all energies/intensities, and in particular during the ramp (even if averaged over all bunches) would be a strong addition to the existing transverse profile monitors. This prototype setup could be limited to a single ring and to a reduced acceptance.

NB: the ramp will take about 15 min to 6.5 TeV.

=> Bernd, Rhodri: specify more exactly the goals of the prototype system

=> Massi: investigate availability of prototype detectors

=> Plamen: simulate prototype detector with modified BGI, evaluate performance.

Toy MC, estimate the expected vertex resolution at 0.45 and 6.5 TeV.

* Full scale system:

- Specification: we need a specification. Attempt made in slides by MFL. This needs to be reviewed and corrected. What emittance range ? What statistical accuracy at which time intervals ? Which absolute precision ?

=> BI/Plamen: specify more exactly the goals of the full scale system for LHC

- Location:

o Must find the place with the smallest inner radius and largest beam size

o We need about 3-4 meters long space for the gas target and detectors

o Must consider the uncertainties on beta (optics) during the various beam modes. Until recently beta was determined from "nominal" LHC optics. Later moved to beta-beat measurements. Currently, uncertainty on emittance due to optics is about 10%. Effort ongoing to measure beta with K modulation which gives 10-20% difference wrt the results from beta-beat. It is believed that the beta-beat BPM-based method is limited by the local layout/properties of the BPMs.

o The beam-gas vertexing device should not be a "global aperture restriction".

At IR4: $d_{\text{pipe}} = 80\text{mm}$, β up to 400m, but BSRT mirror is at 20mm.

The standard tolerance is ~ 15 sigma at injection

Discuss possible solution for best place with collimation team (Stefano Redaelli)

An idea was suggested to increase beta during ramp so that the beam width does

not decrease as much. A possible place allowing such conditions would be near the IP of an experiment.

Another idea suggested: inject the gas in a dipole magnet and install the vertexing detector further downstream, so that the dipole field bends the charged particles out of the beam-pipe ... Complicates vertex reconstruction. To be thought through.

=> ABP/Gianluigi: Study of best location in the rings for final setup.

- Gas target: Cooling surfaces inside a vacuum chamber to increase the target thickness was used in various experiments (Hermes at HERA, many others at NIKHEF AmPS) and should be studied.

=> TE-VSC/Giuseppe & Adam Jeff: start thinking about possible target designs.

- Detector: two strategies could be followed, (a) recycle an existing detector (e.g. LHCb IT/TT in LS2) or (b) make a brand new detector.

=> Massi: investigate further the two options.

Question on detector sensors: is cooling to 0 C really necessary ?

Depends on radiation damage and on Signal/Noise one wants to achieve.

=> Plamen: Check leakage current and full-depletion voltage vs irradiation.

Estimate irradiation from beam-gas at IR4.

* Suggested presentations for next iteration:

- Outcome of investigations of BGI layout modifications in LS1 (Mariusz)

- Performance simulation of modified BGI layout with prototype detector (Plamen)

- Study of best location in the rings for final setup (Gianluigi)

o wish smallest inner radius and largest beam size

o need 3-4 meters long space for the gas target and detectors

o how well is the beta-function controlled/measured in the given location ?

(in the various beam modes)

- AOB...

* Organization:

- Next meeting date proposed: Friday morning 7 december

- A nickname must be found for this new device!

- egroup: for the time being, keep informal list of email of interested people, no egroup. If someone wants to join, please, tell us.

=> Bernd, Rhodri, Massi: meet to sort out administrative issues.