

A BEAM POSITION MONITOR SYSTEM FOR BEAM TRANSPORT LINE (BTL) AT THE PLS

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Abstract

Electron Linac at the Pohang Accelerator Laboratory (PAL) has been operated continuously as full energy for storage ring, 2.0-GeV since 1994 Dec. and 2.5-GeV since 2002 Oct. At the BTL, BCM (Beam Current Monitor), BLM (Beam Loss Monitor) and BPRM (Beam Profile Monitor) are used for beam operation. Current BPM of the BTL is installed at the one location (BTL start location). This BPM is chamber length 160 mm, strip-line length 120 mm. As long strip-line length and chamber structure this BPM is not suitable diagnostic of beam from pick-up signal. Therefore new a BPM make short length strip-line type BPM (strip-line length: 36 mm) to PLS BTL and electrical tested. These test result are using BPM fabrication for BTL installation. And BTL BPMs are will using orbit correction at PLS normal beam operation This paper is described design concept, test results and data acquisition system of the PLS BTL BPM.

INTRODUCTION

Electron Linac at the Pohang Accelerator Laboratory (PAL) has been operated continuously as full energy for storage ring, 2.0-GeV since 1994 Dec. and 2.5-GeV since 2002 Oct Pohang Accelerator Laboratory (PAL) finished. The linac is consists of 12 klystron-modulator systems, 11 pulse compressors, 44 accelerating columns. Preinjector section of the linac has a 1-ns, 80 kV, 2 A thermionic electron gun, a prebuncher, and a buncher. After passing through the preinjector section, the beam is compressed to three micro-bunches. Operation frequency of the linac is 2,856 MHz [1]. There are 13 Beam Current Monitor (BCM) and 12 Beam Profile Monitor (BPRM) for diagnostics in the PLS linac and BTL. There are also two beam analysing stations in the linac. There are 44 Beam Loss Monitor (BLM) in the linac and 12 unit in the BTL. The delivery ratio of the beam current depends mainly on the beam optics. Currently, beam current delivery ratio is more than 60% in the linac and 90% in the BTL [2].

BEAM POSITION MONITOR (BPM)

Stabilized beam injection is demanded constant beam from linac to storage ring (SR). Therefore beam energy and optics are very important. Three BPMs are installed linac end, BTL start and beam analysing station#3 at the linac and BTL. Currently BPM beam monitoring was not use at the PLS Linac operation.

Currently installed BPMs (strip-line length 120mm)

A conventional strip-line type BPM was designed with a $\pi/2$ rotational symmetry. The total length of chamber is 160 mm, length of strip-line is 120 mm and diameter of strip-line to line is 40 mm. The angular width of the electrode is 52 degree in order to avoid a strong electromagnetic coupling between the neighboring electrodes. A 50 Ω N-type vacuum feed-through is connected to the upstream side of each electrode, while downstream ends are short-circuited to the chamber (Fig 1). Installation locations of these BPM are linac end, BTL start and beam analysing station#3 (Fig 2.).

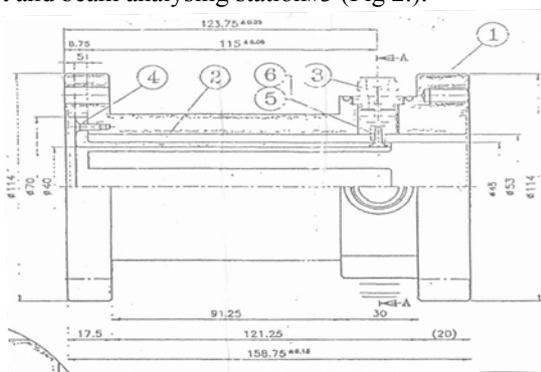


Figure 1: Strip-line length 120 mm BPM .

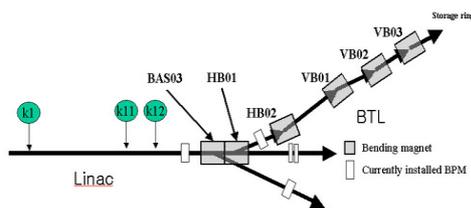


Figure 2: BPM(strip-line length 120 mm) installation location.

New BPM (strip-line length 36mm)

A conventional strip-line type BPM was designed with a $\pi/2$ rotational symmetry. The total length of chamber is 75 mm, length of strip-line is 36 mm and diameter of strip-line to line is 40 mm. The angular width of the electrode is 52 degree in order to avoid a strong electromagnetic coupling between the neighboring electrodes. A 50 Ω SMA-type vacuum feed-through is connected to the upstream side of each electrode, while downstream ends are short-circuited to the chamber. This

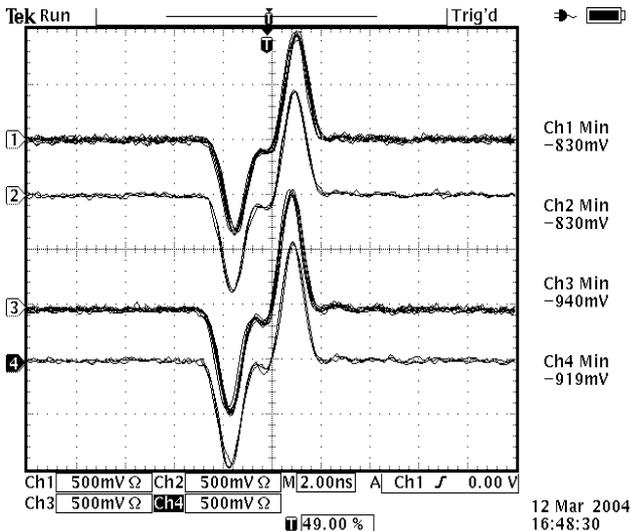


Figure 7: Signal of 120mm length strip-line BPM pickup ('A', 'B', 'C', and 'D' at the linac end.)

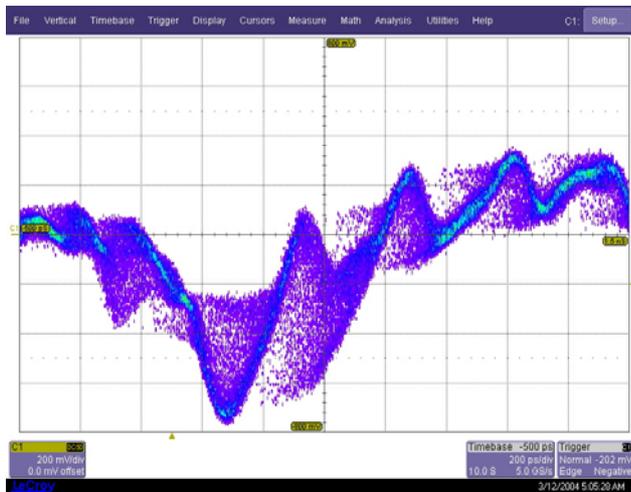


Figure 8: Signal of 36 mm length strip-line BPM pickup 'A' at the linac dump.

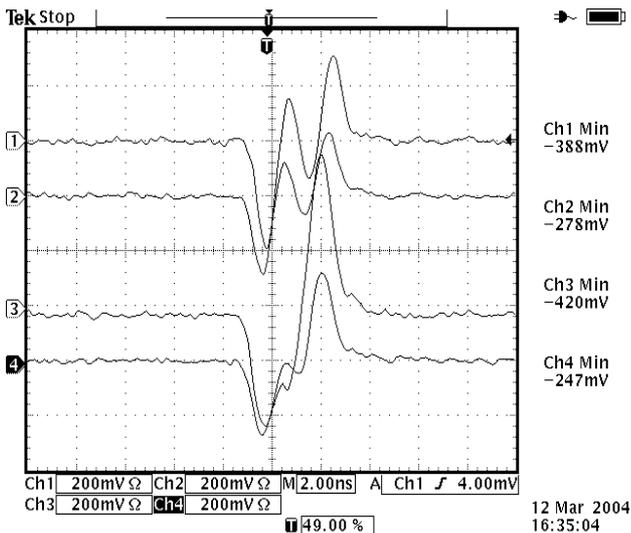


Figure 9: Signal of 36 mm length strip-line BPM pickup ('A', 'B', 'C', and 'D' at the linac dump.)

PLS BTL BPM installation plan

The BTL provides a dispersion-free, focus beam that is matched to the displaced storage ring acceptance. The BTL consists of three major section : linac-side section, horizontal section, and vertical section. Horizontal section is send by 20 degree from the direction of the linac. Two 10 degree bending magnet and one quadrupole between them are use to form an achromatic section so there is no horizontal dispersion beyond this section. There are 10 quadrupole in the dispersion free space. The vertical section is made of three vertical bending magnets and a lambertson magnet, so all the bnding is taken place in the vertical plane. The bending angle of these magnets is 8 degree. The two magnets are formed an achromatic section like the horizontal section with one quadrupole. Another achromatic section is by the labbertson magnet and nearest vertical bending magnet. In the latter case, two quadrupoles are used instead of one. There are four quadrupoles placed in the dispersion-free space in the vertical section [3]. We are going to install the BTL BPMs at Oct. 2004 summer shutdown period. The minimum number of installation is ten strip-line type BPM. Structure of the BPM selected 120 mm length strip-line, cylinder type chamber shape, and SMA-R feed-through. BPM electronics is adopted "log-ratio BPM board" of berogoz company for data acquisition. Future these BPMs will use for linac energy feedback system and BTL beam optics correction

SUMMARY

We are fabrication and test for PLS BTL BPM installation. Finally BPM of the BTL is adopted strip-line type, length if the strip-line is 120mm, chamber shape is cylinder type and feedthrough will use SMA-R type. This BPM will install at the Oct. 2004, use for linac energy feedback system and BTL optic correction through data acquisition system.

REFERENCE

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- [3] "Design Report of Pohng Light Source (revised ed.)," Pohang Accelerator Laboratory, 1992