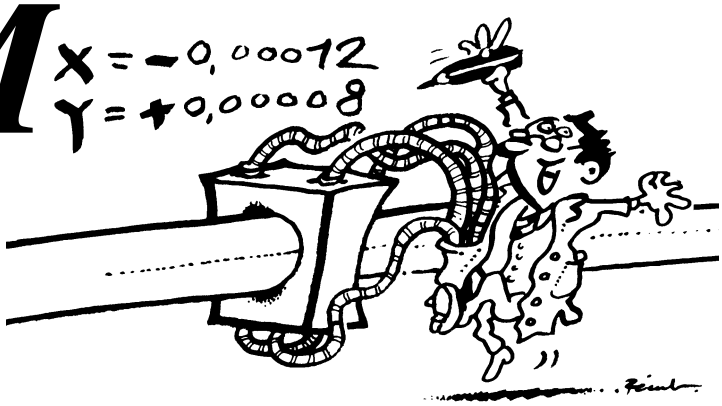
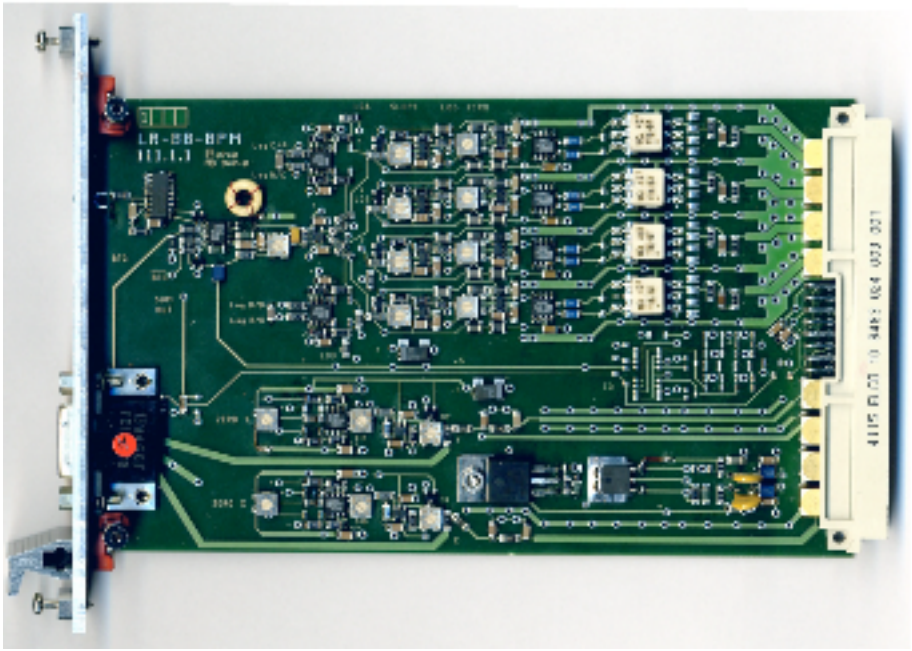
BB-BPM

BaseBand Beam Position Monitor



Designed for cancer therapy synchrotrons
Ideal for heavy ion synchrotrons
Tracks the beam during the energy ramp
Handles >70 dB beam intensity range



The BaseBand BPM is a log amplifier-based beam position monitor. It operates from 1 to 11 MHz.

Output signals are analog voltages: X&Y narrowband outputs for close orbit measurement: ±2V

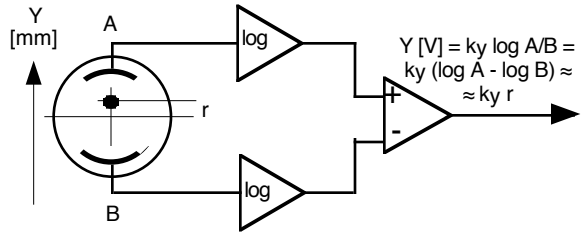
X&Y wideband outputs for machine study, to see orbit changes or instabilities during the ramp: ±2V

Cable length matching not required: pickup signals don't need to be in phase.

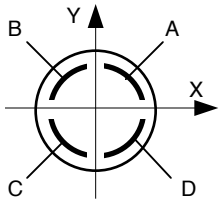
BB-BPM may be custom-built on daughter card for installation on user's FPGA/DSP mother boards.

Operating principle

Based on the pioneering work of Robert E. Shafer at Los Alamos Laboratory, the Log-Ratio BPM derives beam position from logarithm of the ratio of opposite pickup signals: Log(A/B).



Position measured by this method is more linear, over a wider range, than difference-over-sum.



The position of the beam from rotated pickups is obtained by axes translation to the vertical resp. horizontal plane by wideband analog circuits.

Input sensitivity

BB-BPM requires -70 dBm minimum signal at its 50-ohm inputs.

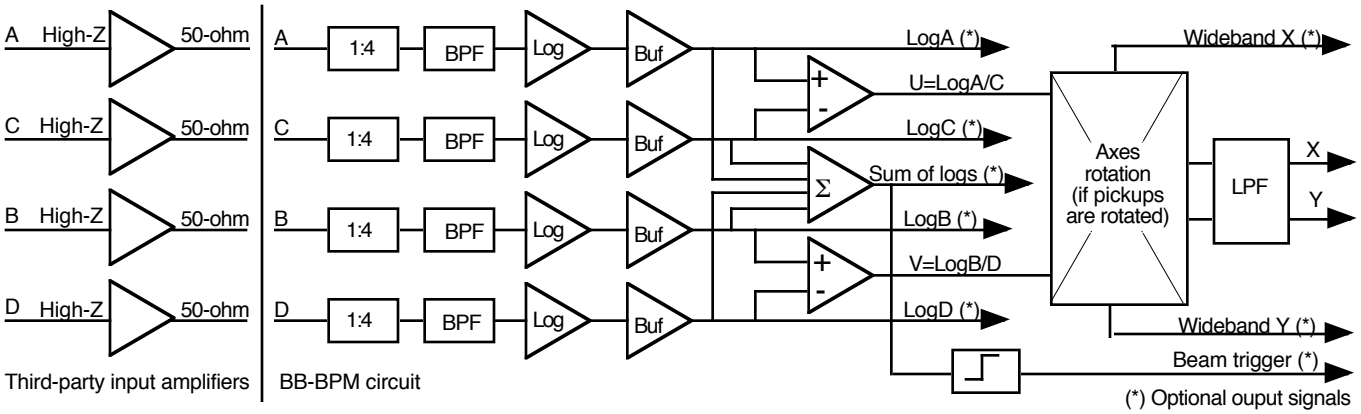
Typical ion accelerator beam position stripline or shoe box pickups must be measured in a high-impedance load. An amplifier with high-impedance input is therefore required for each pickup.

It is preferable to install the preamplifiers near the pickups, to minimize RF interference effects on the coaxial cables.

GSI in Darmstadt use 40dB preamps from German company Femto. Kyoto cancer facility use preamps from Japanese maker NF.

v.2.0

Block diagram



Specifications

Measures X&Y position of a continuous beam ramped in the 1 MHz to 11 MHz range.

Beam intensity range	> 70 dB
Frequency range	1 to 11 MHz, or narrrower range
Input signal	-70dBm to 0dBm operating range
Outputs	Narrow band X and Y (0...200 Hz): -2V...0...+2V, 40mA max, for high-Z load Wideband X and Y (0...5MHz): -2V...0...+2V, 40mA max, 50-ohm output
Optional outputs	Sum of logs: 0...+2V, 40mA max LogA, LogB, LogC and LogD Beam Trigger
X and Y gains	1.5V = 1/2 of radius for orthogonal pickups 1.0V = 1/2 of radius for rotated pickups
Output noise	Narrowband output for -70dBm input signal: <$2x10^{-3}$ radius, e.g. <200 um in 100 mm radius Wideband output for -70dBm input signal: <2% radius, e.g. <2 mm in 100 mm radius
Beam intensity position dependence	
On center	Near zero.
Off-center	±3%, worst case when difference between input signals is 6dB
Temperature drift	pickup radius/3300 per degree, e.g. 30um/K in 100 mm radius
Power supply	+ 8...15V, <300 mA; – 8...15V, <300 mA

Packaging

BB-BPM module is 3U-high x 160mm shielded Euromodule, 20-mm wide. Interchangeable / plug-compatible with Bergoz Instrumentation BPM modules. Baseband, Log-ratio and multiplexed BPMs can be installed in same chassis for mixed applications.

BB-BPM can be supplied as a custom-built daughter card for user installation on FPGA/DSP mother boards.

BB-BPM module was developed by Alexander Kalinin
Later redesigned by Sebastien Artinian .
Based on Robert E. Shafer original concept.

Ordering information

BB-BPM-	BB-BPM plug-in module
-xx-xxMHz	Operating frequency range (pls. specify)

On-board factory-installed options:

BB-BPM-TRG	Beam Trigger
BB-BPM-SUM	Sum of log (A,B,C,D)
BB-BPM-ABCD	Direct Log(A,B,C,D) wideband outputs

Accessories:

BPM-RFC/xx	RF-chassis, xx≤16 stations 19" rack-mountable 3U-high EMI-RFI-shielded chassis for 100~240V 50~60Hz mains power, features up to 16 stations for any mix of BaseBand-BPM or Multiplexed BPM.
BPM-KIT	Tabletop test kit. 100~240V 50~60Hz powered kit. Pickup inputs on SMAs. Outputs on BNCs and DB15.
BPM-XTD	Module extender card.
BPM-SERV/RF	RF service module. Passive module. Brings the pickup signals from the back connectors to front panel BNCs.

Distributors

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Instrumentation