BB-BPM

BaseBand Beam Position Monitor
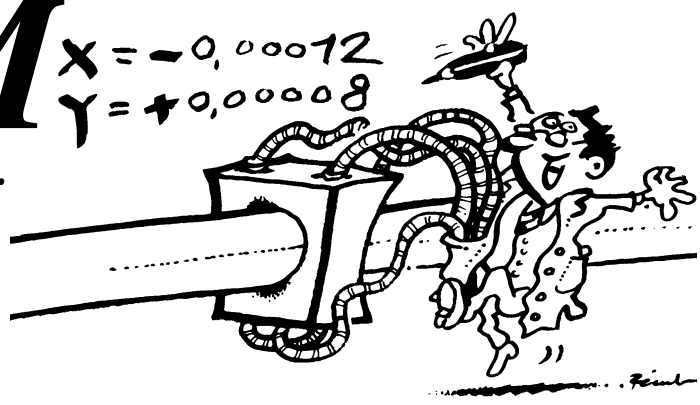
Designed for cancer therapy synchrotrons

Ideal for heavy ion synchrotrons

Tracks the beam during the energy ramp

The BaseBand BPM is a beam position monitor with high-impedance front-end amplifiers designed for stripline or shoebox BPM pickups. It operates from 0.7 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 is not required: pickup signals don't need to be in phase.

Front-end amplifiers are powered via the RF signal coaxial cables.
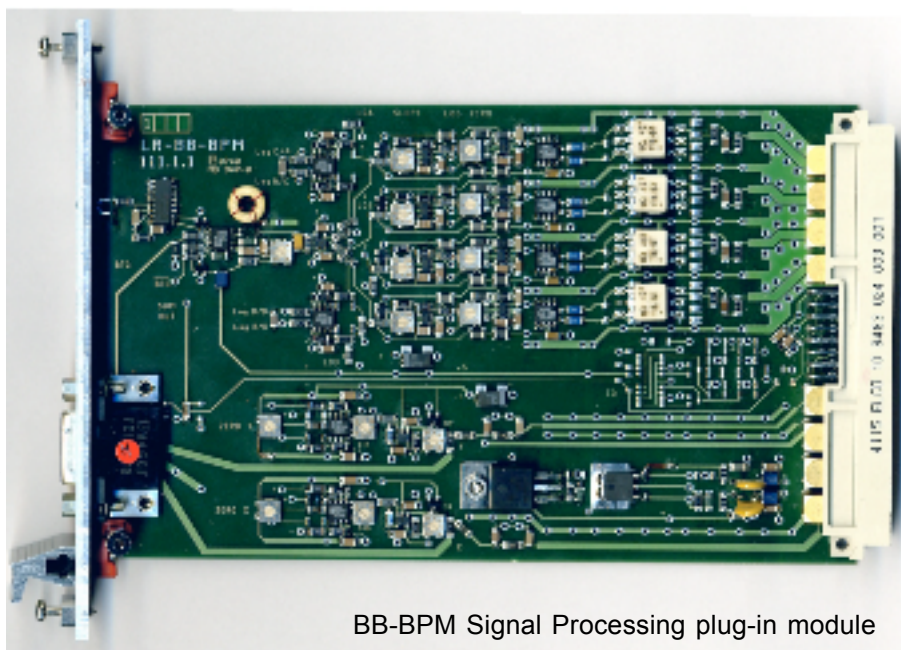
BB-BPM Signal Processing plug-in module

Front-end Filter & Amplifier BB-FEFA

Four BB-FEFA are required for each BB-BPM plug-in module; one per pickup. BB-FEFA was specifically developed to measure low-intensity ion beams. Its high input impedance collects a maximum of signal from stripline or shoebox pickups.

BB-FEFA input consists of parallel FET transistors in cascode with a bipolar transistor. This design features noise equivalent to the thermal noise of 50 ohms at 156°K.
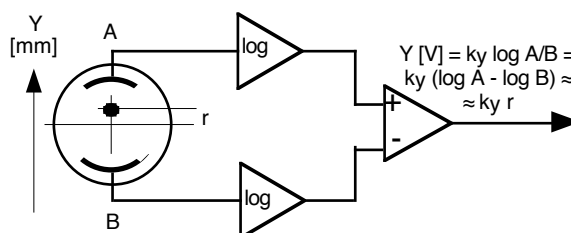
It is powered from the BB-BPM plug-in module via the coaxial cable. It is best to install it close to the pickups.
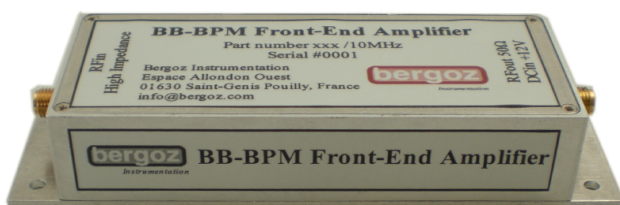
BB-FEFA Front-end Filter & Amplifier

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).

$$Y [V] = ky \log A/B = ky (\log A - \log B) \approx \approx ky \ r$$

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

BB-BPM module was developed by Alexander Kalinin and later redesigned by Sebastien Artinian. It is based on Robert E. Shafer original concept.

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Block diagram
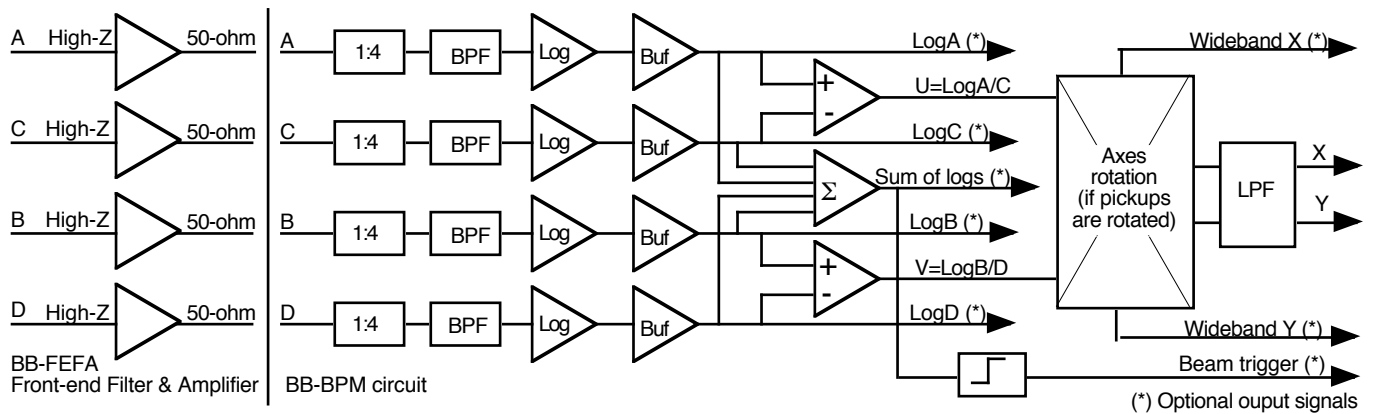
Specifications

Measures X&Y position of a continuous beam ramped in the 0.7 MHz to 11 MHz range.

Beam intensity range	> 110 dB
Frequency range	0.7 to 11 MHz
Input signal	-130dBm to -20dBm operating range
Outputs	Narrowband X and Y (0...200 Hz): -2V...0...+2V, 40mA max., for high-impedance readout.
	Wideband X and Y (0...5MHz): -2V...0...+2V, 40mA max, for 50-ohm readout.
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
Input noise	156°K temperature noise at BB-FEFA input
Output noise	Narrowband output: <0.1% of pickup radius e.g. 100um rms in 100 mm radius.
	Wideband output:<1% pickup radius. e.g. 1mm rms in 100 mm radius.
Temperature drift	300 ppm/K of pickup radius/ e.g. 30u3m/K in 100 mm radius
Power supply	+/- 8V, <10W including 4 x BB-FEFA

Dimensions

BB-BPM is 3U-high x 160mm shielded Euromodule, 20-mm wide.
BB-FEFA is a shielded metal box with four 3-mm mounting holes.
BPM-RFC is a 19" x 3U-high chassis.

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Ordering information

Distributors

Manufacturer

bergoz

Instrumentation