



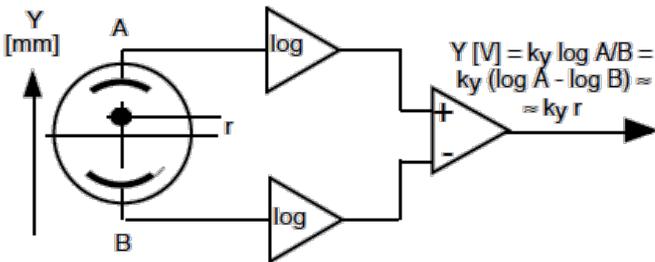
S-band / L-band Beam Position Measurement Electronics

For linacs, microtrons and transfer lines
Single bunch, macropulse and CW
Beam charge dynamic range > 1000

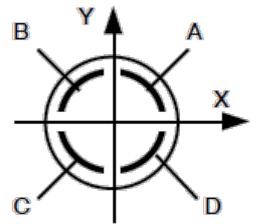
Operating principle

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

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.



Signal processing

Signals from the pickups are stretched to produce bursts. This is essential to measure the single pass of a bunch. Four parallel logarithmic amplifiers detect the burst envelopes.

Amplifiers' response is log of amplitude. Logs of opposite pickups are subtracted. If pickups are rotated, axes are translated to obtain X and Y positions. The process is all-analog, wideband.

Front-end Filter / Amplifier FEFA

One Front-end Filter / Amplifier is required for every BPM pickup electrode. It is tuned to the beam RF or a harmonic and powered by the S-BPM module via the coaxial cable linking them together. S-BPM FEFA must be installed close to the BPM pickup block, i.e. within 1 m.



MANUFACTURER

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Specifications

Operating frequencies	2.856 GHz and 2.999 GHz. For L-band, all filter frequencies are made to order
Inputs	One per pickup, SMA 50 Ω Possibility to configure for orthogonal or rotated pickups
Outputs	X and Y: -2 V...0...+2 V 40 mA max Sum of logs: 0...+2 V 40 mA max
X and Y gain	1.5 V corresponds 1/2 of aperture radius for orthogonal pickups 1.0 V corresponds to 1/2 of aperture radius for rotated pickups
Beam intensity position dependence	
On center	Near zero.
Off-center	Worst case when beam is 6 dB off center (e.g. ±7 mm in a 20 mm radius aperture): ±3 %
Temperature drift	0.6×10^{-3} of aperture per degree, e.g. 25 μm/K in 20 mm radius aperture
Trigger output	> 10 ns trigger after single bunch
Power supply	+15 V, < 300 mA; -15 V < 300 mA

Order codes

S-FEFA/xxxMHz	Front-end Filter / Amplifier Operating frequency xxxMHz One unit for each pickup electrode
S-BPM	S-band / L-band plug-in module

On-board factory-installed options:

S-BPM-SH	Sample and Hold on X and Y outputs
S-BPM-TRG	Beam Trigger, built-in
S-BPM-SUM	Sum of log (A,B,C,D)

Accessories:

BPM-RFC/xx	RF-chassis, ≤16 stations 19" rack-mountable 3U-high EMI-RFI-shielded chassis for 100~245 V 50~60 Hz mains power
BPM-KIT	Table-top test kit 100~245 V 50~60 Hz 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

Modes of operation

Track-Continuous

Advised for CW beams or macropulses longer than 1 μs	
No trigger needed	
Output bandwidth	5 MHz
Resolution in function of input power (per input):	
-5 dBm to -30 dBm	1/10'000 of aperture radius
-30 dBm to -50 dBm	1/2'000 of aperture radius
-50 dBm to -60 dBm	1/660 of aperture radius

Sample & Hold

Advised for single pulse or macropulses shorter than 1 μs	
Requires LR-BPM-SH option	
Requires trigger (built-in or external)	
Processing time	~450 ns
Hold time	≤ 100 ms
Pulses rep. rate	Up to 2 MHz
Resolution in function of input power (per input):	
-5 dBm to -20 dBm	1/200 of aperture radius
-20 dBm to -40 dBm	1/100 of aperture radius

Track & Hold

Advised for single pulse or macropulses shorter than 50 ns	
Requires LR-BPM-SH option	
Requires trigger (built-in or external)	
Processing time	~110 ns
Hold time	~70 ns
Pulses rep. rate	Up to 5 MHz
Resolution in function of input power (per input):	
-5 dBm to -20 dBm	1/200 of aperture radius
-20 dBm to -40 dBm	1/100 of aperture radius

Packaging

S-BPM module is 3U-high x 160mm shielded Euromodule; 20-mm wide.

Interchangeable / plug-compatible with other Bergoz Instrumentation's BPM modules.

S-BPM can be installed in same chassis as LR-BPM, BB-BPM and MX-BPM for mixed application.

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