

SY 120 BPM Electronics Measurements

The Switchyard (SY) 120 beam lines uses the SY style resonant BPMs and associated electronics. The SY BPM electronics modules contain two sections, a "slow" with section, with high gain and filtered input, designed for spill lengths of 20 seconds, and a "fast" low gain un-filtered section designed for spill lengths of 1.5msec. The electronics can be externally gated to switch between these two sections. This electronics was designed for Tev fixed Target intensities of $1E12$ protons.

The SY style BPM are located in the P1, P2, P3 as well as the SY and pre-target areas. The spill lengths in these beam lines, under various accelerator operating modes and test beams, can range from $.57 \mu\text{-sec}$, for single turn extraction of 30 bunches to 3.8 seconds when extraction coincides with Numi beam extraction. Recent spill length has been near $.5$ seconds, by multiple turn partial extractions of 30 to 84 MI batches. RF signal strength from the detector will change in proportion to the intensity level and the spill length.

Several tests and measurements were done with the SY Resonant BPM electronics to study and understand the performance and sensitivity to the number of batches in the Main Injector.

These test were done on the BPM electronics "slow section". A 53 MHz signal gated at the MI revolution rate of $11 \mu\text{-sec}$, and with RF burst duty factor range of 5% to 100% was used to simulate extracted beam.

These measurements checked several areas of performance important for the SY-120 application. Three of the tests preformed are described as follows.

1. The maximum RF Input Power at 100% Duty Factor (DF), vs. Intensity Output before an internal component reaches saturation or a clipping level. The Charts in Fig 1 shows saturation or clipping at an input power level of -71 dBm This test was done at a 100% Duty Factor (DF) at 53.1 Mhz, using test setup No. 1.
2. The RF input power level in relation to RF input Duty Factor. With the input power adjusted to maintain a constant intensity output, equal to the 100 % DF power level. This was done three different reference power levels. Charts in Fig. 2 thru Fig 4 show the results and the exponential curve produced. This test was done using test setup No. 2.
3. The Intensity and Position outputs (volts) in relation to the RF input pulse Width DF, and with the Input Power adjusted to maintain a constant output level equal to the 100 % DF power level. The input power was set at approximately -85 dB to ensure that no saturation would occur at the 100% DF setting. The Chart in Fig. 7 shows that the electronics is capable of measuring position and intensity accurately, with DF ranging from 100% down to 5%. This test was done using test setup No. 4.

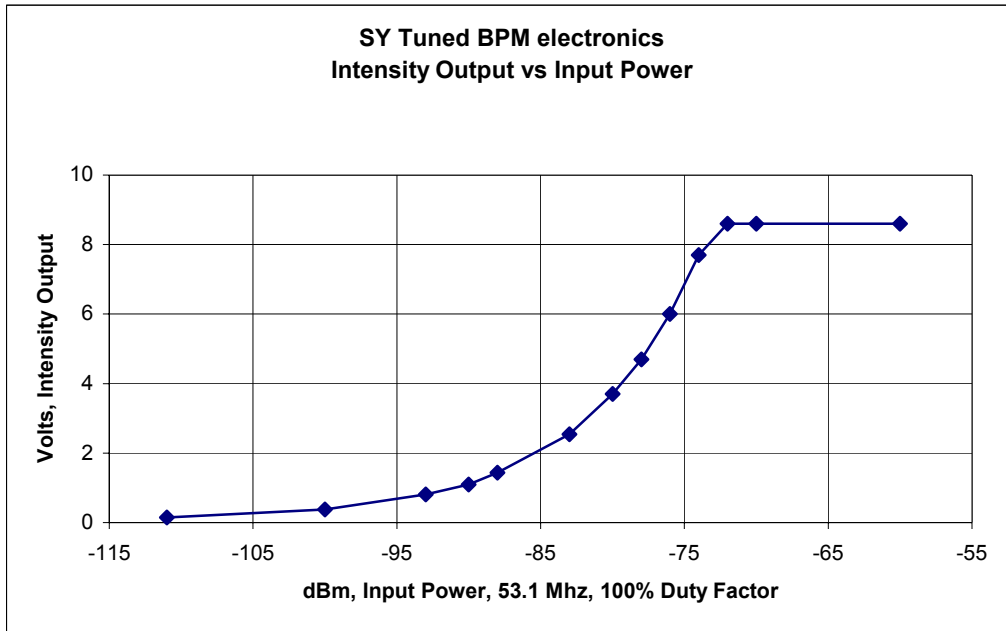


Fig. 1

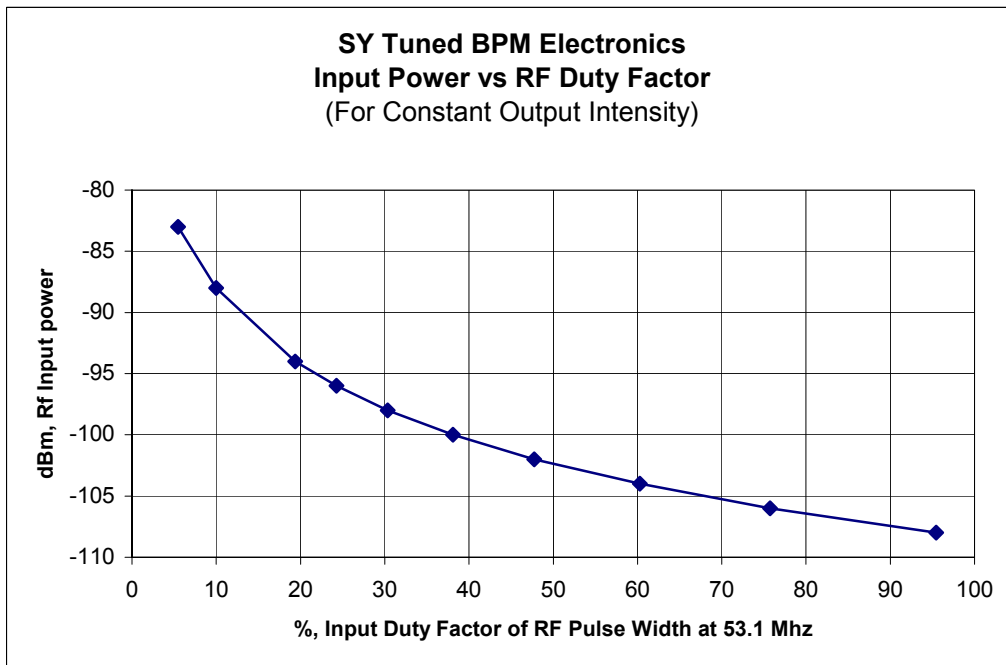


Fig. 2

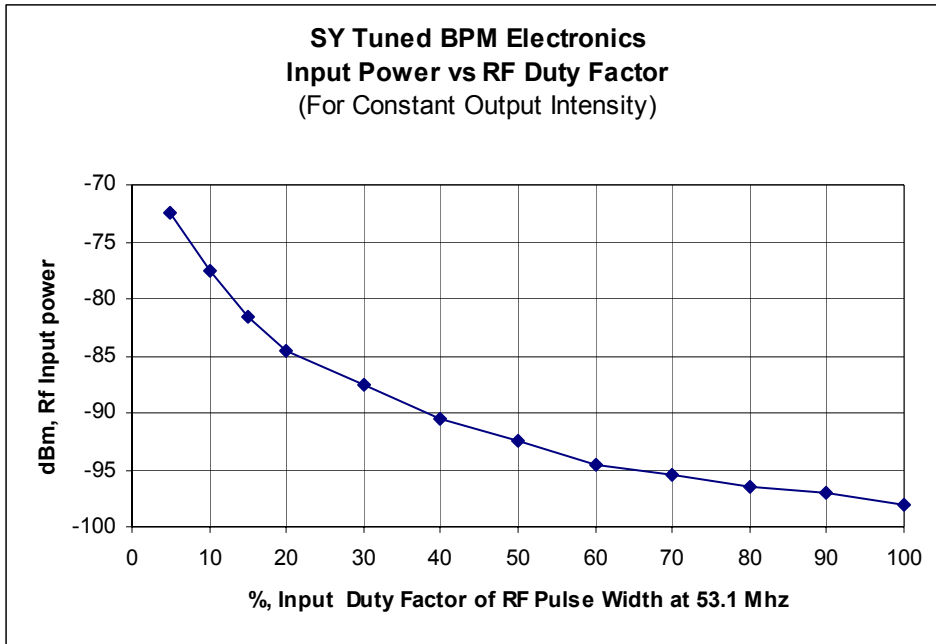


Fig. 3

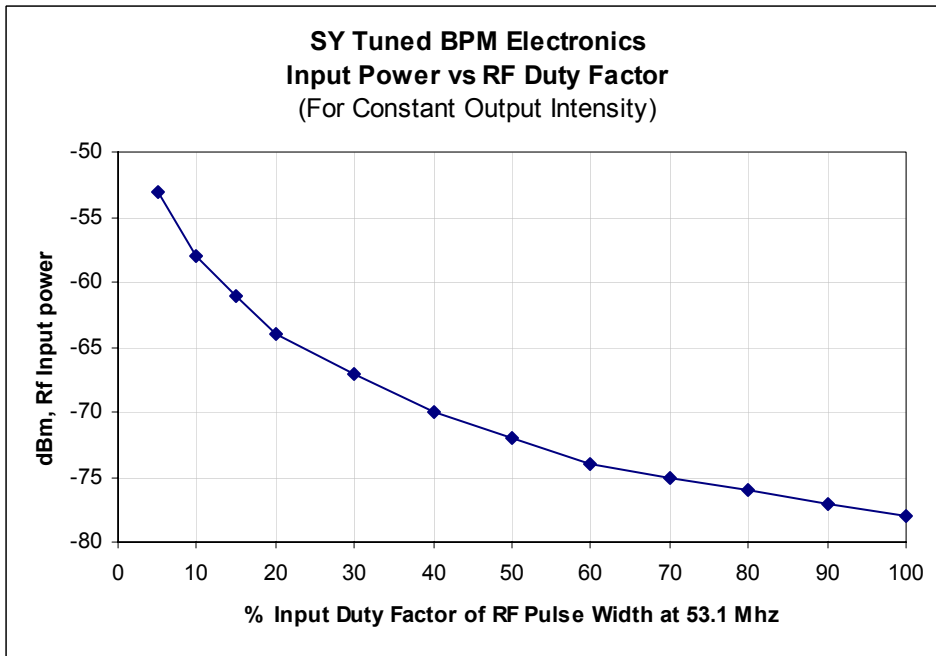


Fig. 4

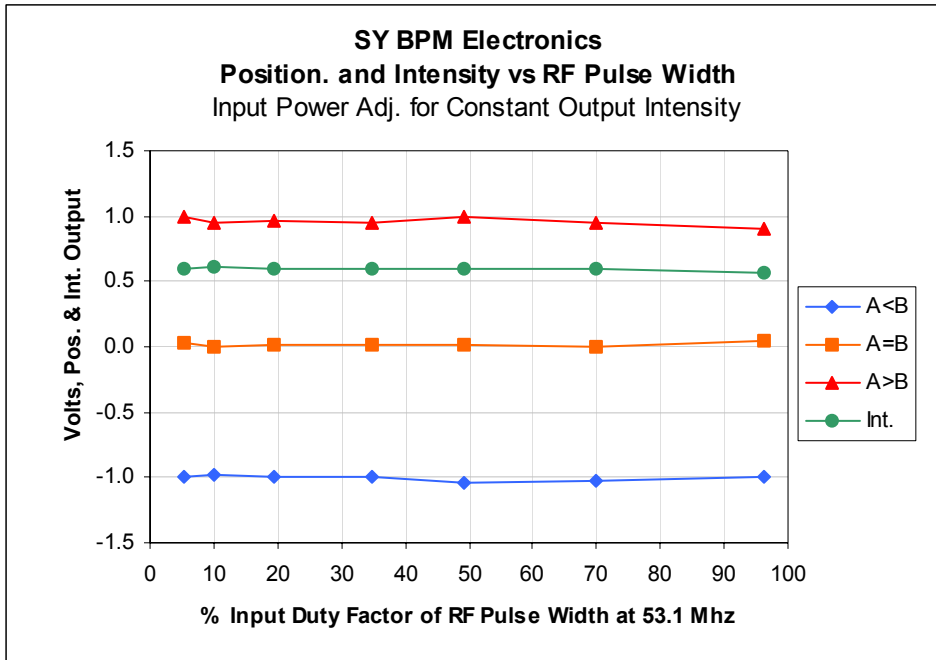
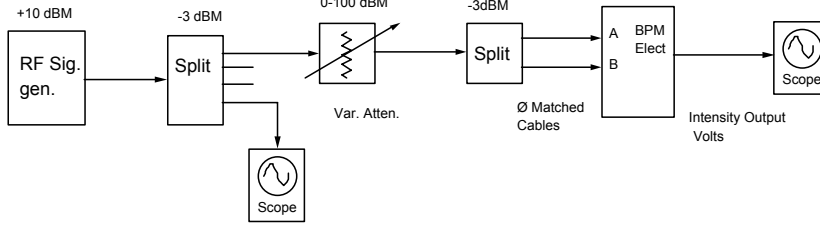


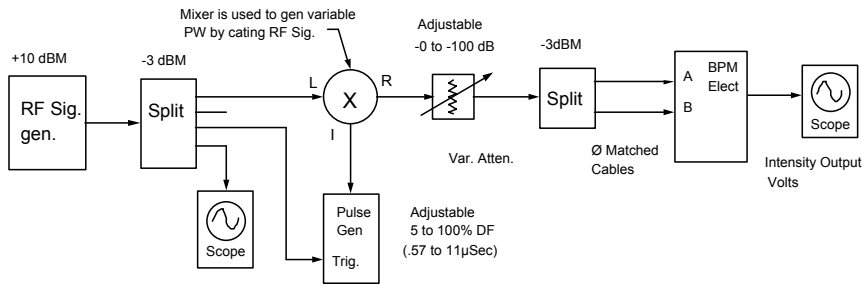
Fig. 5

SY120 BPM Electronics Test Setups

Jim Fitzgerald, John Seraphin
Cad Redraw of Originals from 12/20/04



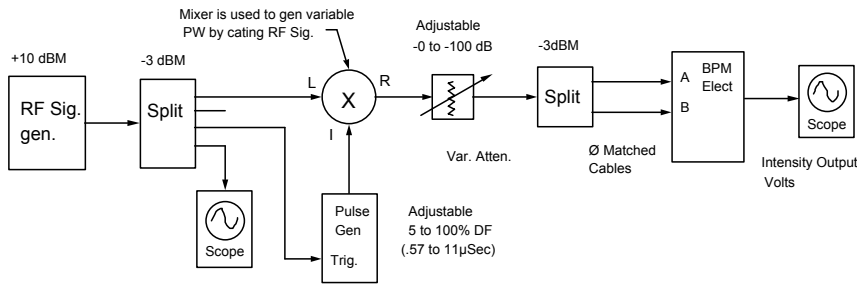
SY BPM Electronics, Test Setup No. 1



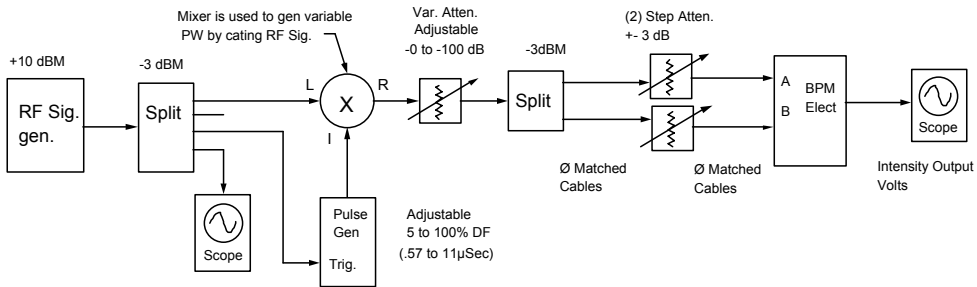
SY BPM Electronics, Test Setup No. 2

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SY BPM Electronics, Test Setup No. 3



SY BPM Electronics, Test Setup No. 4