ASDBLR 01 Test amplifier User Guide March 7, 2002

An ASDBLR fabricated in September, 2002 (ASDBLR01) has been mounted on a modified TB3 board and installed in an aluminum enclosure. Two channels of discriminator output and one channel of analog output are available.

The Track and TR Threshold are set through separate 'Lemo' connectors on the output side of the box. Power and control voltages are provided through a 10 pin connector. A grounding pin is provided for the shield of the ten conductor cable.

Mapping of labeled "LEMO connector" signals:

INPUTS		OUTPUTS	
		Discriminator	Analog
INPUT1	→	OUT1	Mon
INPUT2	→	OUT2	XX

THR_TR → Voltage for TR Threshold (High Impedance)
THR_D → Voltage input for Track threshold (High Impedance)

High rate operation

Due to the use of HF transformers to convert the differential outputs to single ended signals, a different arrangement is needed for high rate testing. It is not unreasonable to consider rewiring the box to send the differential outputs into the available "Lemo" connectors for either the discriminator or the analog outputs. The Analog outputs require termination into low impedance (~50Ω) at ~3V. Digital outputs should be terminated into 0V.

Power and Control Board.

Input Requirements:

+V, -V and Gnd provided with "Banana plug" connectors.
Input voltage should be between 5 and 15V. Current ~200mA
Adjustable, regulated voltage is provided to the ASDBLR chip. (set to ±3V)

Table 1 Jumper Block (X = not shipped connected O = jumpered pair)

	JUMPER BLOCK			
Function	+3	control	-3	
ADJ		O	O	+3 for max Shaping Amplitude
XESEL		X		NO Jmp → Xenon +3 → Ar gas
BLR_BIAS		X	X	NO Jmp → Normal -3
EN_SH	X	X	X	+3 → route shaper to mon output
EN_BLR	O	O	X	+3 → route BLR to mon output

** Do not simultaneously send Shaper and BLR to monitor output.

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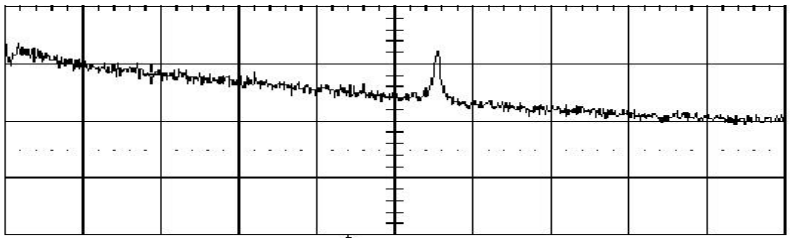
Bench tests at Penn

We have used the charge injector network provided by Anatoli Romaniouk to mimic the time development of the xenon pulse in the straw.

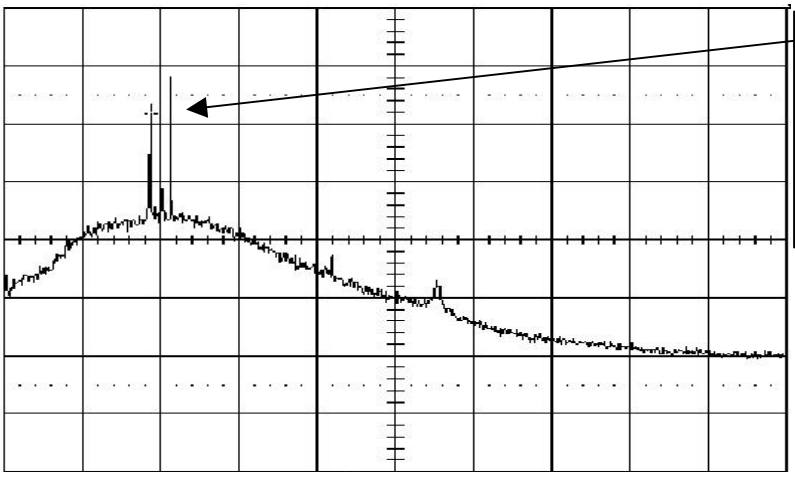
Power Spectrum at analog monitor point using Scope Average FFT

It is critical to reference the control voltage board to the same reference potential as the Amplifier box.



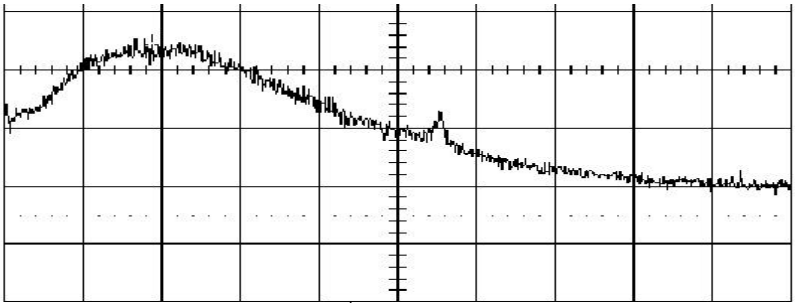
Power off -92dbm at 93MHz

Demonstrates Scope Associated noise.



Power on -75dbm at 93MHz
This is one of many local FM radio Transmitter frequencies.

Control board is floating.



Power on -84 dbm 93MHz

Power / Control board and Test amp connected to a common reference conductor. " Ground plane"

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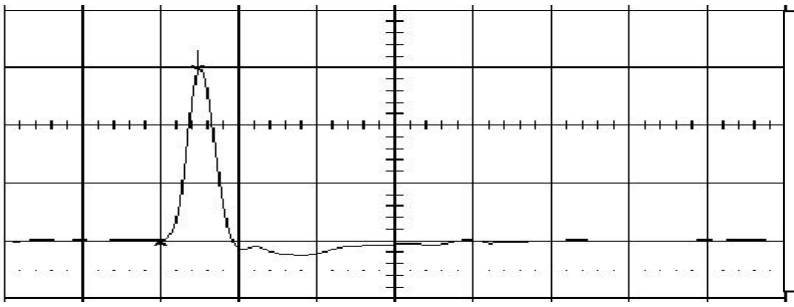
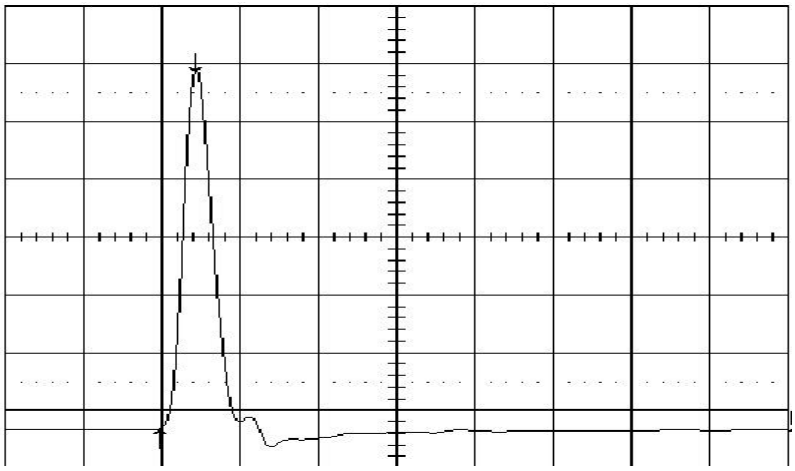
Response to Xenon Charge injector input



BLR at monitor output.

3.1fC injected charge
5.9mV output, 5ns 0-peak

2mV X 10s/ box
Averaged response



BLR at monitor output.

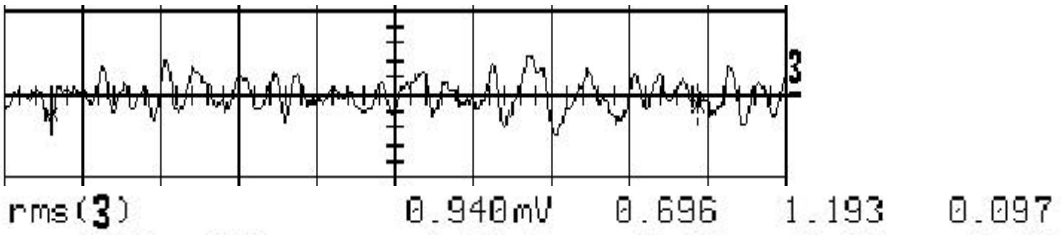
31.2fC injected charge
61mV output, 5ns 0-peak

10mV X 10s/ box
Averaged response

Note - The use of a Transformer to convert from the ASDBLR differential output to a single ended cable results in an AC coupling with time constant L/R ~100μH/50Ω ≈ 2μs . An overshoot can be expected that has only to do with the output coupling transformer.

Conversion factor for Analog monitor output is ~2mV per fC

Single Sweep RMS noise at BLR output (.94mV)

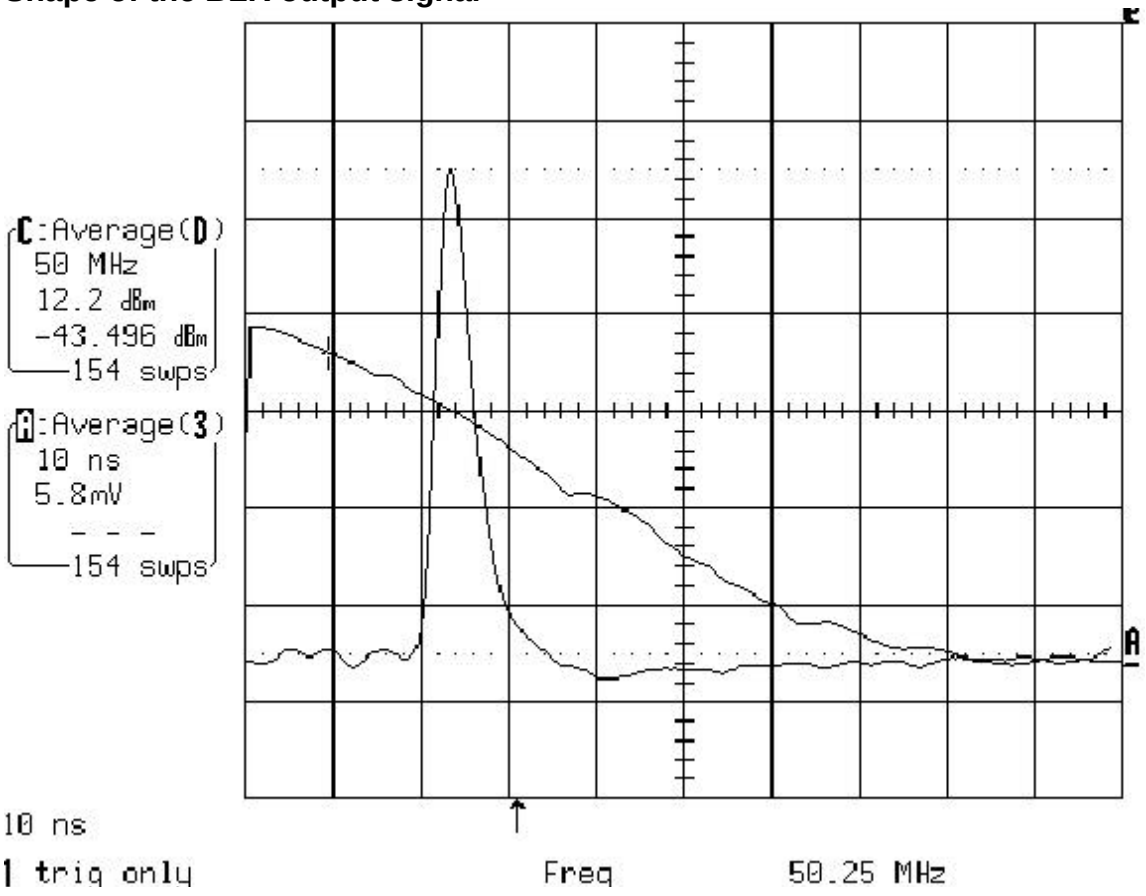


The RMS noise is measured at the Analog monitor output. It does not change appreciably as the sweep time varies from 80ns (shown above) to 1.6us.

Noise Calibration = .94mV / (2mV / fC) * 6250e/fC = 2937e
Input capacitance = 10pF for pulser + connect + Tb3 board + Twisted pair cable
≈ 15pF

The peaking time at the monitor output is 5ns. Additional shaping in the comparator increases the peaking time to 7.5ns. Since "series" noise dominates this measurement is reasonable to estimate that the noise at the comparator input is reduced by the square root of 5ns/7.5ns. Doing this the estimated noise at the comparator input is 2400e.

Shape of the BLR output signal

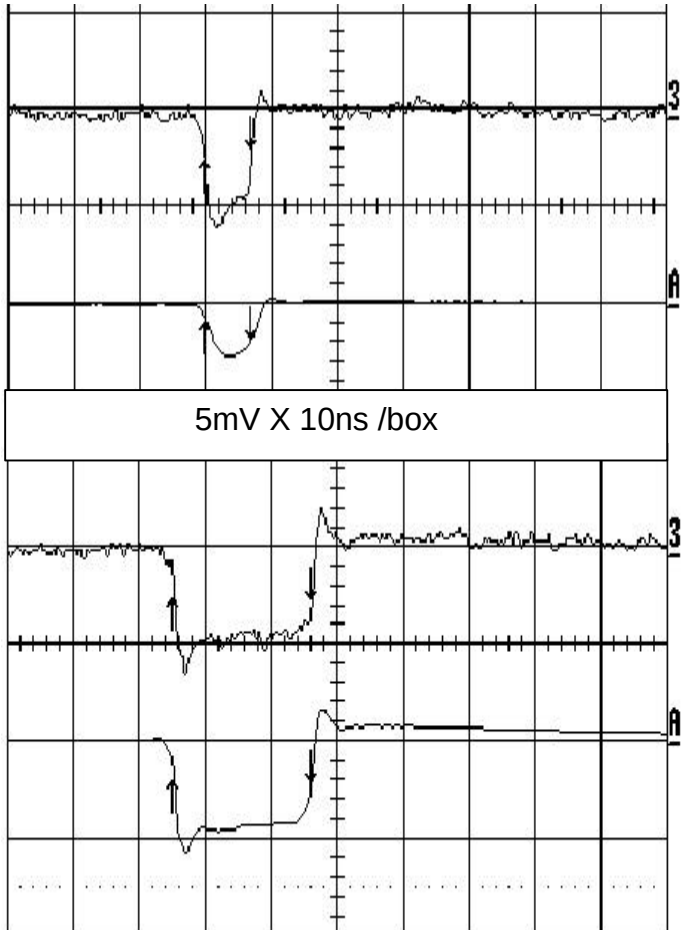


An FFT of the output signal shows the 3db bandwidth of the signal is ~ 50MHz and that there are no particularly disturbing features in the spectrum.

Note that a "Penn" version of the Xenon charge injector was used here to avoid a "kink" in the output waveform that seems to be injected by the Anatoli version pulser. One difference is that a larger attenuation is used in the the Penn charge injector.

Digital Outputs

The Discriminator output has a minimum width of about 6ns.



5mV X 10ns /box

2fC input at 2fC threshold

Single, “at (2fC) threshold” output

Averaged response at 50% threshold

2fC input Threshold with 100fC input

Single output

Averaged response

Δt = 20.9ns

Table 2 Threshold Calibration

Track (Low)		Tr (High)	
Input Charge	50% Threshold		50% Threshold
2 fC	465 mV	10fC	191 mV
3.1fC	607mV	31fC	458mV
5fC	767mV	100fC	1006mV

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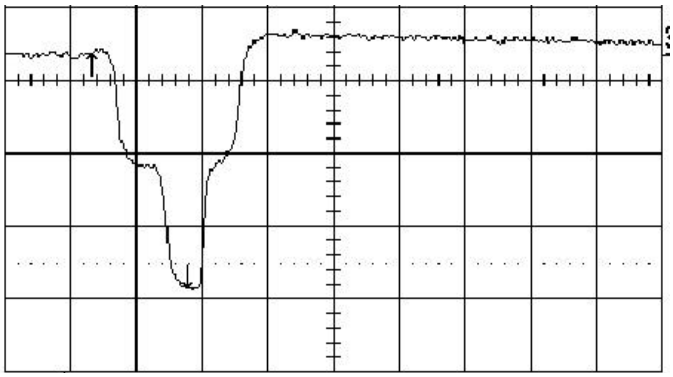
The outputs shown above are with the design current of ~200μA sent into a coupling transformer to change the signal from differential to single ended. The output current has been increased to ~ 700μA to allow easier measurement of the discriminator.



Ternary output with increased current for Test amplifier.

ΔV = 65mV for two level output.

The high level threshold is set to ~30fC and an "at threshold signal triggers the outputs.

The test amp seems to be stable at a 2fC threshold even when stimulated by a large input pulse.

Response at 2fC threshold to a 100fC input signal.