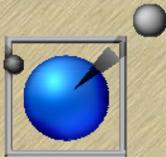


High Dynamic Range Current Measurements With Machine Protection

NEUTRON SCIENCES

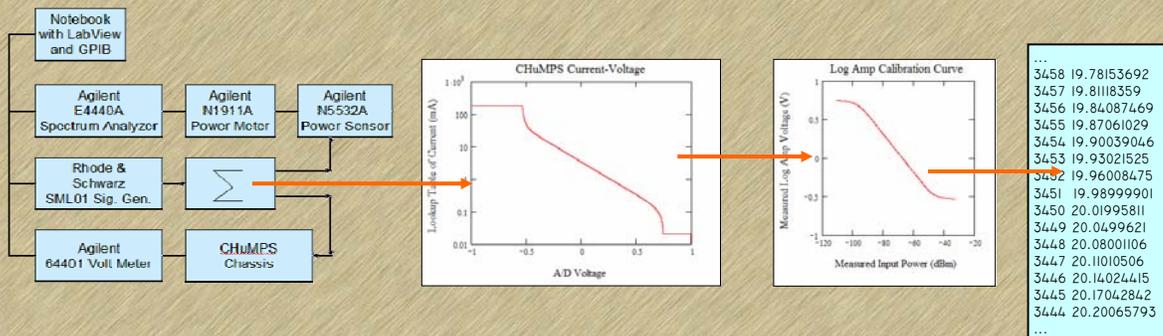


Abstract

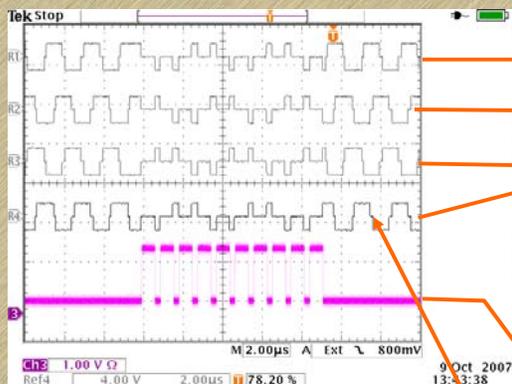
At the SNS a beam current measurement technique, called CHuMPS (Chopper Machine Protection System) has been developed that is fast, has a large dynamic range, and is droop free. Combined with the LEBT (Low Energy Beam Transport) chopper controller, a beam in gap measurement is possible that can accurately measure the beam in the chopper gaps. The beam in gap measurement can then provide machine protection in the case of chopper failure.

Dynamic range is achieved by using an LNA, a 50 dB range log amplifier, a 14 bit A/D, and optimum scaling. The scaling is about 225 counts/dB. The on screen display resolution is the same even when the waveform display is zoomed in on the gaps.

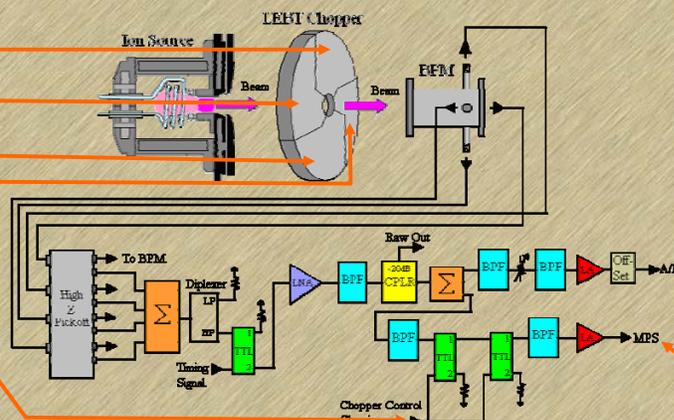
Automatic calibration system.



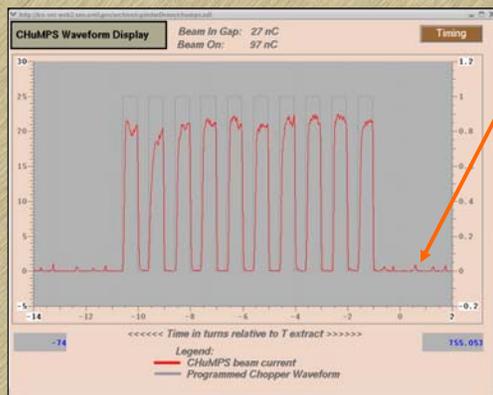
Block Diagram of Installed CHuMPS.



Chopper Control Waveforms.



The calibration table is used directly to convert A/D counts to equivalent current in an EPICs waveform PV.



CHuMPS displayed Waveform.

During the gaps and outside of the macro pulse the beam is deflected sequentially to four different positions. Ripple on baseline is chopper switching islands created when a pair of vanes is changing polarity and only the other pair of vanes is deflecting the beam. CHuMPS can detect a weak switch and trip MPS on failure.

The MPS channel is blanked during the injected mini-pulses. The threshold detector only sees current when the beam current is expected to be zero. Anything above 3 mA trips the machine.

