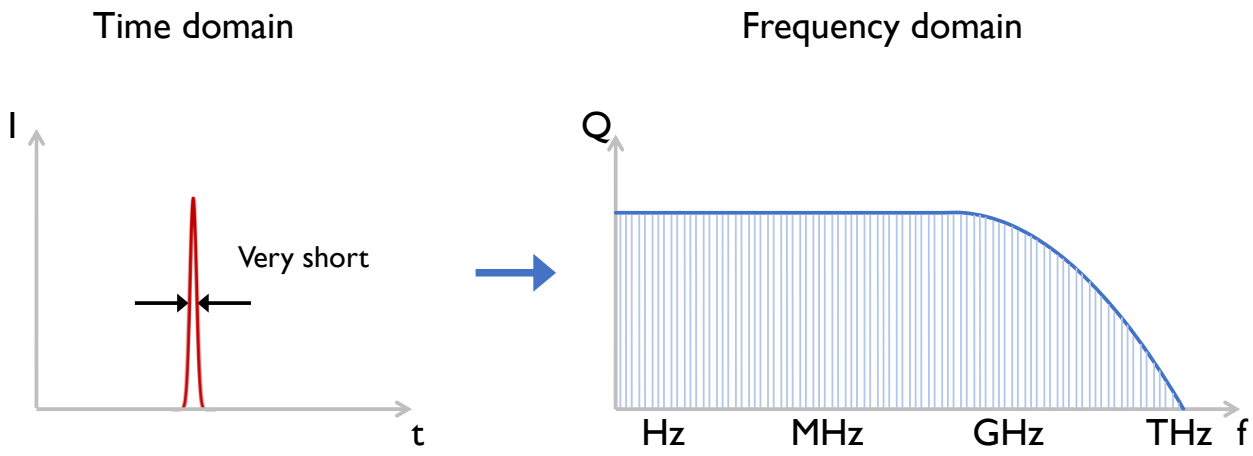
156 rue du Mont Rond
Espace Allondon Ouest
01630 Saint Genis Pouilly, France

Tel: +33 450 42 66 42
Fax: +33 450 42 66 43
Email: info@bergoz.com

Turbo-ICT & BCM-RF-E principle

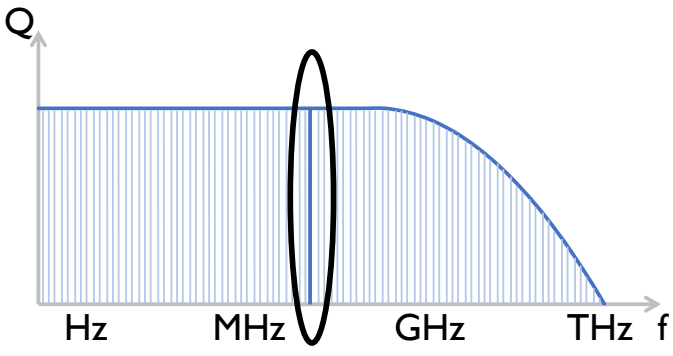
Rev. 1.0

A very short pulse can be considered a quasi-Dirac pulse. Its spectrum looks like the plot below:



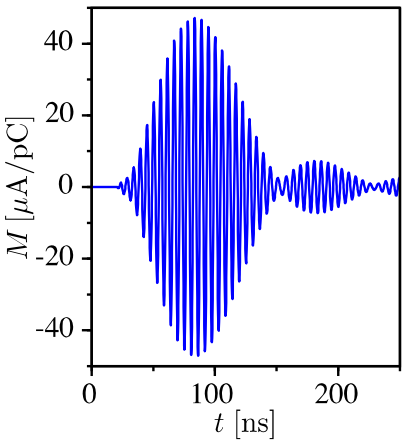
The flat top is present until some hundreds of MHz or even further depending on the input pulse length. The flat top value is equal to the charge of the pulse. Hence, by measuring the spectral amplitude within this part of the spectrum, the pulse charge can be found.

Using a bandpass filter is the best way to select one spectral ray.
Usually, the Turbo-ICT uses a bandpass filter at 180MHz with a bandwidth of about 15MHz.
The filter is directly installed in a small box attached to the sensor.



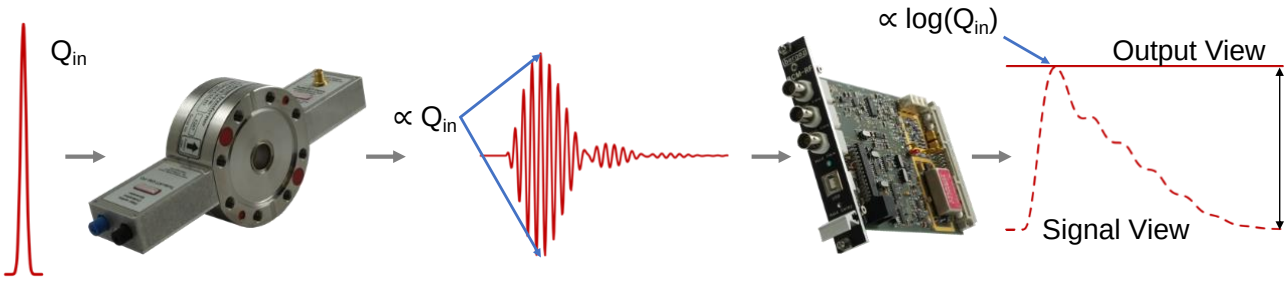
Bandpass filter at 180 MHz

After bandpass filtering, the time-domain signal looks similar to the one below:



This resonance is then processed by the BCM-RF-E:

1) A logarithmic amplifier is used to get the logarithmic envelope (see picture below). The envelope's apex is logarithmically proportional to the pulse charge.
2) A Track-and-Hold circuit tracks the envelope and holds its output voltage when triggered
3) The BCM-RF-E provides a DC voltage corresponding to the Track-and Hold signal.



The BCM-RF-E output signal is a voltage logarithmically proportional to the input pulse charge. A reverse transfer function is needed to find the pulse charge from the output voltage. The reverse transfer function is equal to:

$$Q_{\text{in}} = Q_{\text{cal}} \times 10^{\left(\frac{U_{\text{BCM-RF}}}{U_{\text{cal}}}\right)}$$

The calibration constants U_{cal} and Q_{cal} are factory-measured and provided in a Calibration Report. They are also saved in the BCM-RF-E PIC microcontroller. U_{cal} is measured in Volts and Q_{cal} is measured in pico-Coulombs.