multi-pin probe head connector
Custom written software in LabVIEW controls how the digitizer collects data during shots and then writes the data files. Sending the signal through custom connectors considerably contributes to noise levels. Floating coaxial feed-throughs should be used to transfer the signal between air and vacuum and any mechanical probe arm flanges.
Electrical Noise

Noise level: 0.2 V p-p

7 μs
1.2 V
• Data was continuously sampled during the shot at 60MHz with a high-speed digitizer.
• The observed count rates and pulses showed a clear dependence on the neutral beam power.
• The voltage signals are proportional to the particle’s initial energy deposited into the silicon surface barrier detector.
• Average peak height ~0.6V for 3MeV Proton and ~0.2V for a 1MeV Triton. The average peak width is ~100 - 500ns, depending on shaping parameters
• 0.8 MeV $^3$He ion would have an average height of ~0.15V (or less due to energy loss in foil)
• $^3$He could be identified so far
Peak Fitting

- A peak shape function from sampled peaks within each data channel.
- Sampled data are normalized to a maximum value of 1.
- Normalized data are fitted determining $C_1$ and $C_2$ fit.
- Groups of peaks fitted with:

$$S(t, t_0) = AV_N(t, t_0) + a_0 + a_1 t + a_2 t^2$$
Particle Rates: Beam pulses

- Criteria of good signals: ratio of fitted amplitude error to amplitude value
- Cut on ratio to suppress noise
- Histogram amplitudes for given time bin
- Proton and triton are mono energetic
- Integrate over time bin

Background noise

Triton
Proton

Histogram of Peak Values/Shot: 29958 channel: 3

Rate plot during 2 brief beam pulses

Shot : 29958/ channel: 3

Proton
Triton
Total