**Introduction**

The direct measurement of mass spectra and energy distributions for mass-identified positive and negative ions arriving at target surfaces in plasma reactors has produced useful information. The measurements have been, in the great majority of cases, of the time-averaged distributions even when the applied power to the plasma has been pulsed.

Time-resolved data particularly during initiation and decay of pulsed plasmas would be advantageous. To facilitate such studies we have incorporated a Multi-Channel Scalar (MCS) device into the ion detector system of a Hiden EQP instrument.

**Example Data**

As examples of the new capabilities of the EQP instrument we show below data obtained for plasmas in a parallel-plate reactor operated using argon as the test gas and with power supplied from either a 25 kHz AC supply or from an RF supply at 13.6 MHz repetitively gated using a square-wave envelope from a signal generator at frequencies of around 500 Hz.

**Summary**

- Multi-Channel Scalar device fitted to the ion detector system of the EQP
- 50 ns time resolution
- Data shows initiation and decay of features in the ion energy spectra that were not possible to obtain with time averaged data

**Figure 1** shows a typical variation with time of the energy distribution for Ar⁺ ions at 50 mTorr pressure in a 20 kHz plasma. The energy scans were made at intervals of 200 nsec.

For the gated RF plasmas, again using argon as the test gas, the ion energy distributions had considerably more structure. A typical family of IED scans for Ar⁺ ions is shown in **Figure 2** for a 25 Watt plasma at 35 mTorr. The data show in particular how the number of ions with high energy arriving at the sampling orifice of the EQP decays rapidly as the plasma becomes established.