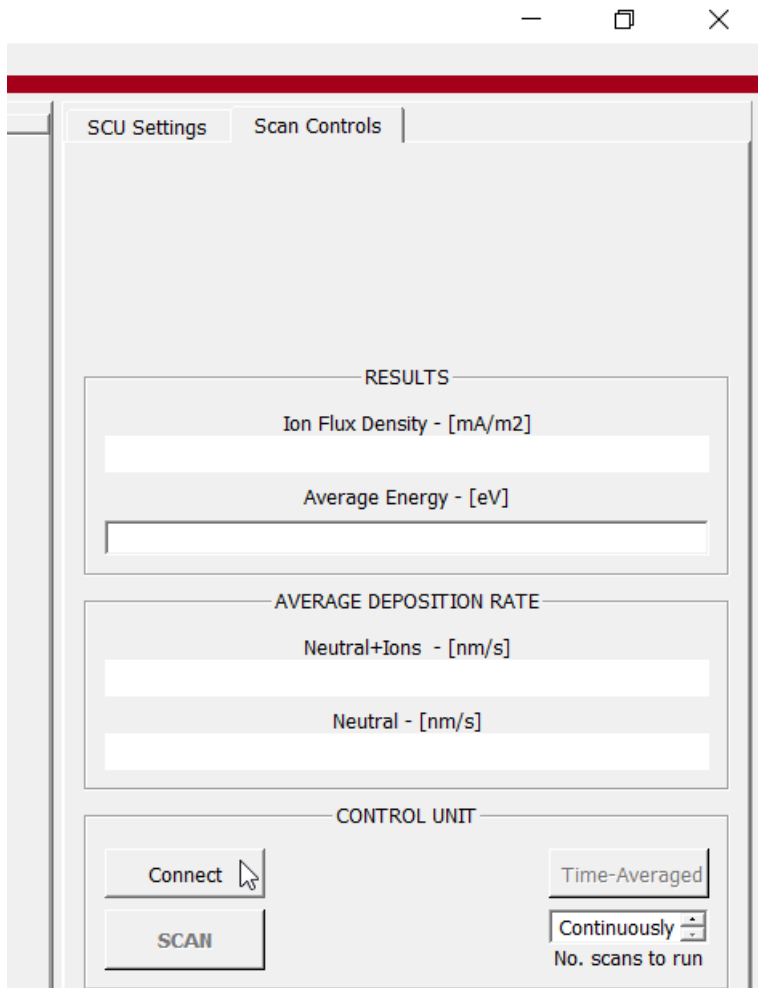


Quantum Quick Start Guide

support@impedans.com

Initial Connection

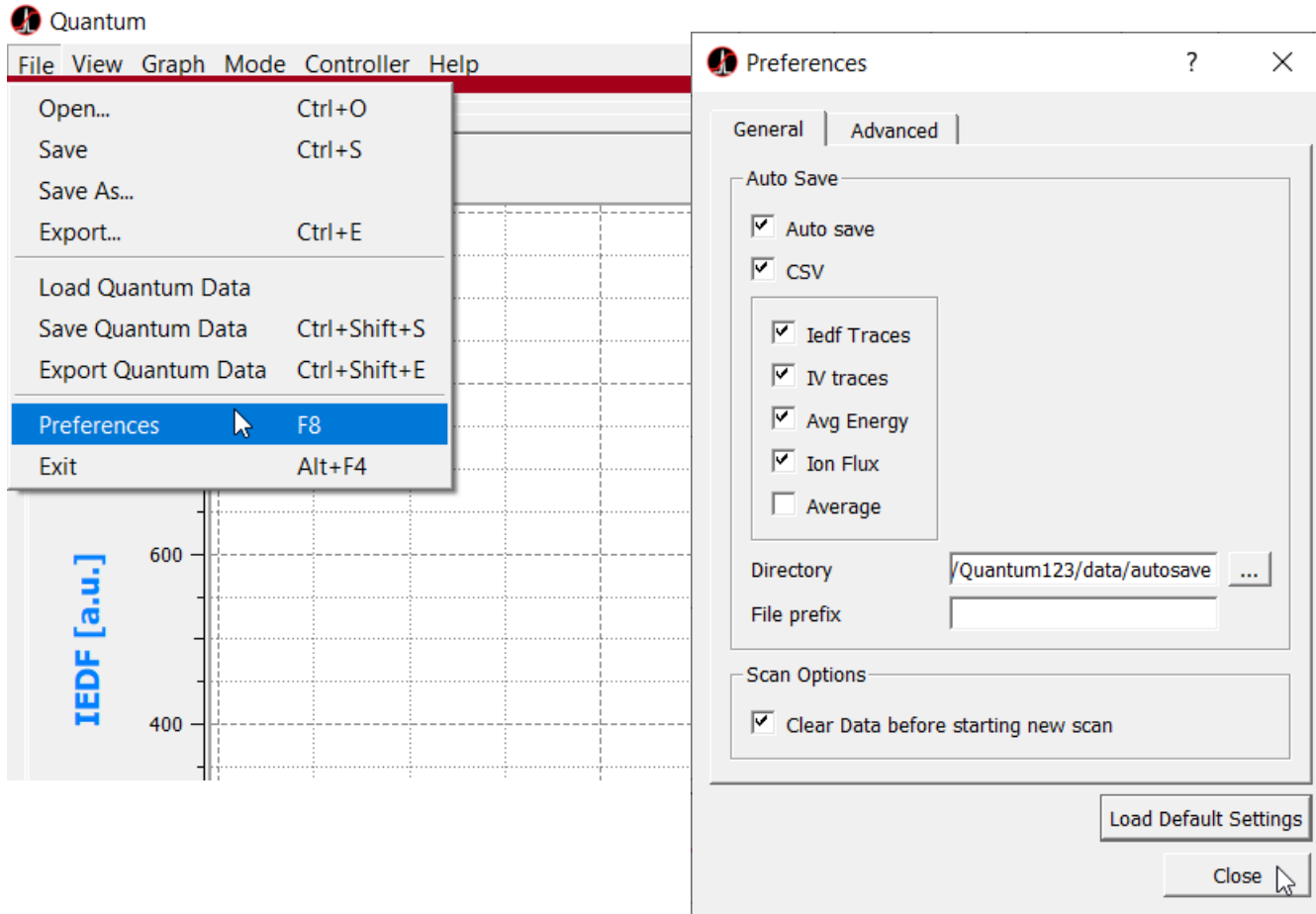


The initial hardware connections that must be made prior to the software connection is the power and USB to the control unit.

Once this is done then the software can be connected by clicking the 'Connect' button shown

Unless a particular number of scans are required it is recommended to set the No. of Scans to 'Continuously' by setting it to '1' then pressing the down button.

Preferences



Once connected its recommended that the Autosave set up through the preferences menu shown

Ensure that a directory is chosen that does not require administrator rights to save within (not within the installation directory) – recommend within Documents or on the Desktop.

Scan Setup – SCU Settings

The screenshot shows the SCU Settings software interface. It has two tabs: 'SCU Settings' and 'Scan Controls'. The 'DC BIAS VOLTAGE' section has two radio buttons: 'Measured' (selected) and 'User Defined'. The 'User Defined' option has a text box containing '0.0 [V]'. Below this is the 'PROCESS PARAMETERS' section with two spinners: 'Ion Energy Range' set to '60.0 [eV]' and 'Energy Resolution' set to '1.0 [eV]'. A button labeled 'Update Scan Parameters' is at the bottom right of this section. A second, identical 'PROCESS PARAMETERS' section is shown below, but with 'Ion Energy Range' set to '500.0 [eV]' and 'Energy Resolution' set to '5.0 [eV]'. A mouse cursor is pointing at the 'Update Scan Parameters' button in the second section.

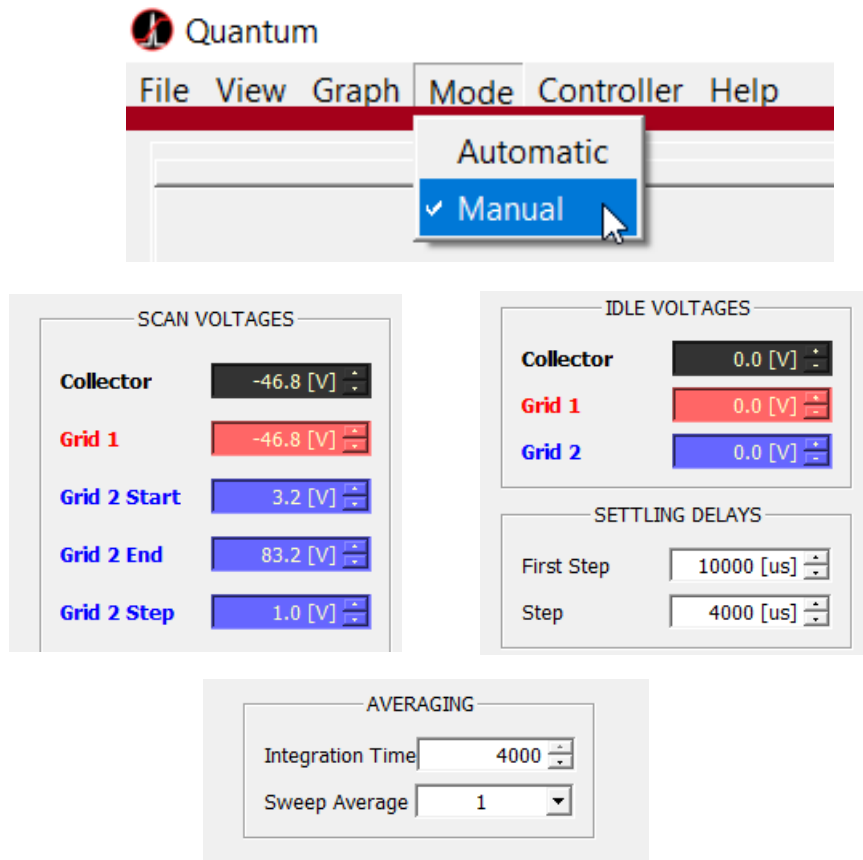
Select the measured DC Bias Voltage (Vdc) – Will update live when connected to a system.

Input the Ion Energy Range (60 V or 2x the Bias voltage whatever is greater).

Select the Energy Resolution (1 eV or 1% of the Ion Energy Range which ever is greater – To the nearest eV).

Ensure that anytime the Vdc, Energy Range or Energy resolution are changed that you click the 'Update Scan Parameters' button as these values will affect the RFEA voltages.

Scan Setup – Manual mode



To enter 'manual' mode select it in the Toolbar as shown.

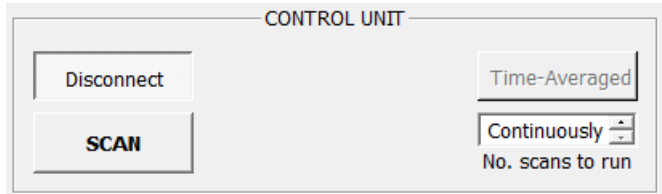
The 'Scan Voltages' are updated by the 'Update Scan Parameters' button from the previous slide.

Set the 'Settling Delays' as shown with the idle voltages left at 0.0 V.

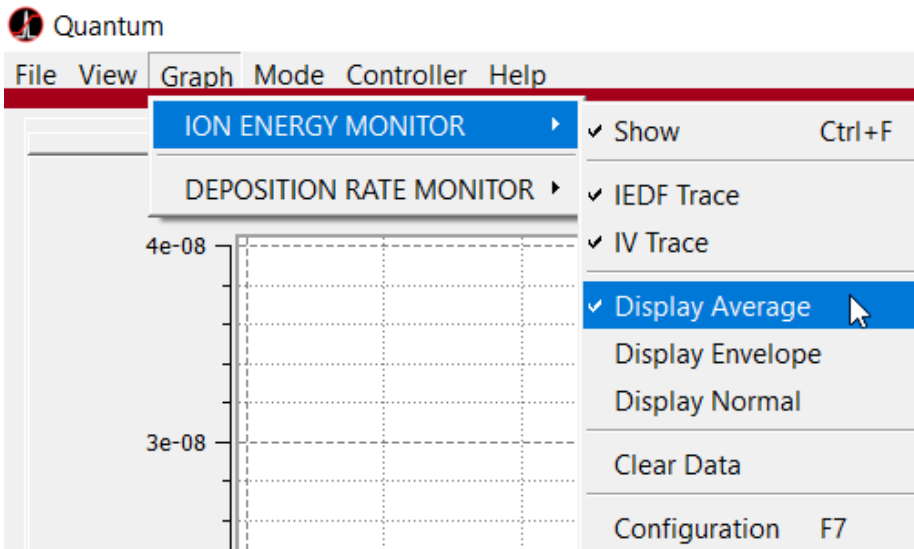
The integration time should be set to 4000 with the Sweep average set to 1.

The Flux constant is determined by the type of button being used (see end of document).

Graph Controls



Now the Scan can be started by pressing the 'Scan' button in the control unit box.



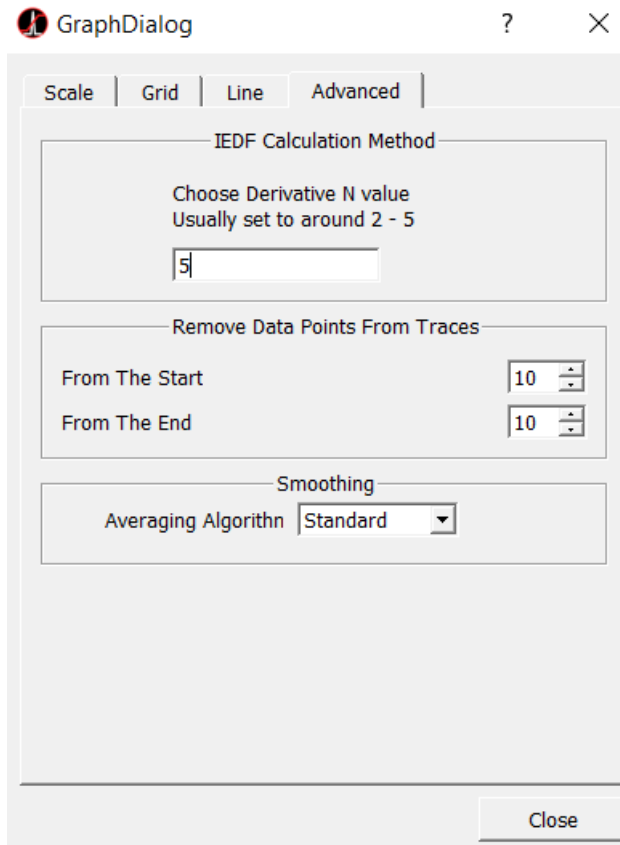
It is possible to alter what is shown in the graph – the recommended is to display both the IV trace and the IEDF in 'Average' mode as shown.

'Envelope' displays the last 32 scans which allows you to look at the overall stability of the plasma.

'Normal' displays just the last trace.

Configuration brings up the following interface

Graph Controls



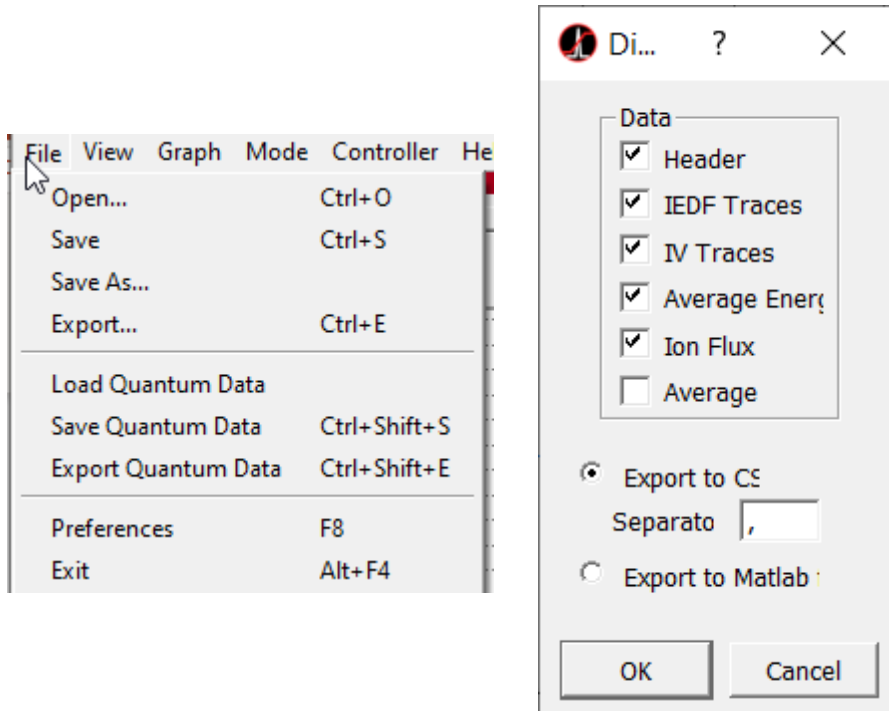
Under the 'Graph Dialog' navigate to the 'Advanced' tab.

Recommend that the IEDF calculation Method is set to at 5 – This determines how many points are used for the derivative – see the User manual for more details – 'Help' → 'Help'.

If needed the data can be cropped – this is particularly useful if there is a lot of noise at the start or end of the trace.

Leave the Smoothing to the 'Standard' algorithm (this is what is described in the user manual).

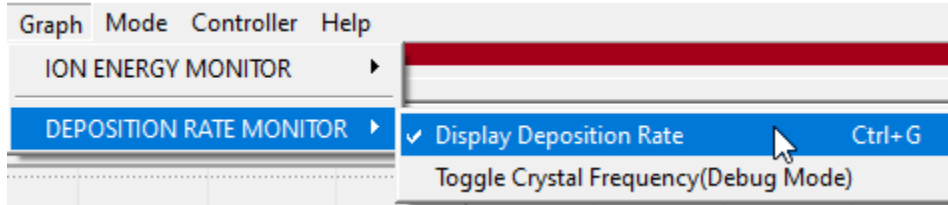
Scan Save/Export



Ensure to Save the scan (.sdf) as this is the native file format for the standard Ion energy monitor data (required for any diagnostics if a problem arises)

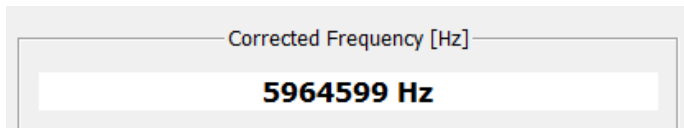
For access to the data you can export the data to a csv file with the ability to chose what data is exported as well as the separator used (, is not recommended for European computers)

Change to Deposition Mode



In order to measure the Deposition rate of the neutrals and ions, the graph must be changed to 'Deposition Rate Monitor' as shown.

This should be done after a Semion scan in order to understand the Ion energy distribution and set the appropriate blocking voltages.



If properly connected the Corrected Frequency should be around 5 or 6 MHz depending on the type of button.

Scan Voltages - Deposition Mode

SCAN VOLTAGES QC

Switch Time	100.0 [s]
Collector	-60.0 [V]
Grid 1	-60.0 [V]
Grid 2	80.0 [V]
Grid 3	-60.0[V]
Material Density	9.0 [g/cm3]

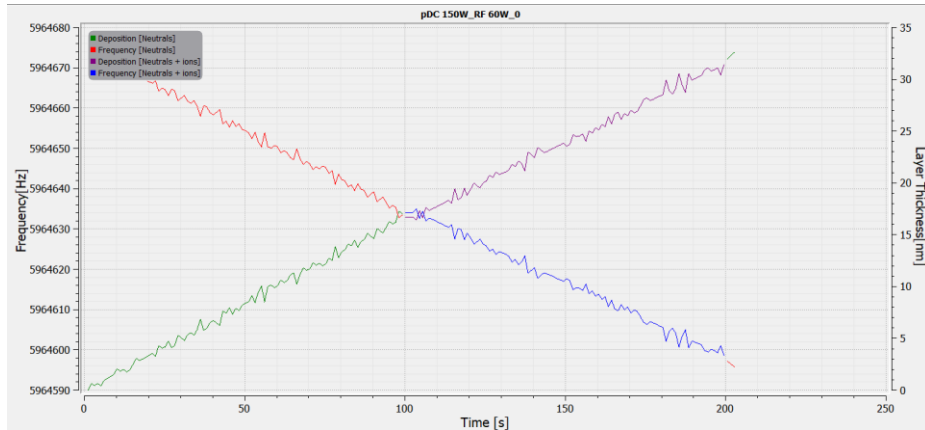
The switching voltage determines how long it averages for the deposition rate and will be determined by the expected rate

G1 and the collector should be: $V_{dc}-60\text{ V}$

G2 should be greater than the largest Ion energy seen in the 'Ion Energy Monitor' mode

The material density is determined by whatever is being deposited

Deposition Mode



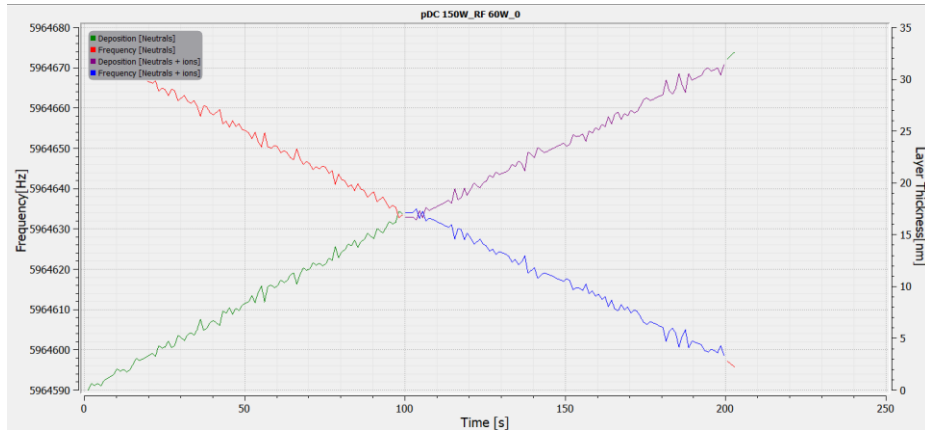
The frequency of the Quartz Crystal Microbalance (QCM) is shown in Red (during Neutrals only deposition) and Blue (Neutrals + Ions) and is plotted on the left hand axis (frequency) – It has a 1 Hz resolution.

Corrected Frequency [Hz]	
5964599 Hz	
AVERAGE DEPOSITION RATE	
Neutral+Ions - [nm/s]	0.148
Neutral - [nm/s]	0.173
CONTROL UNIT	
<input type="button" value="Disconnect"/>	<input type="button" value="Time-Averaged"/>
<input type="button" value="SCAN"/>	<input type="text" value="1"/> No. scans to run

The deposition is shown in Green (Neutrals only) and Purple (Neutrals and Ions) and plotted on the right hand axis (Total layer thickness)

On the right hand side is the calculation of the Deposition rate for the Neutrals and the Ions+Neutrals along with the current oscillation frequency for the QCM

Deposition Mode – Save Data



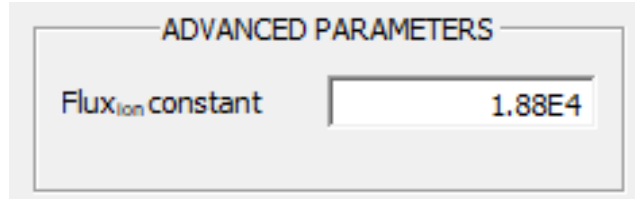
It is also recommended to manually save and export the data.

As with the 'Ion Energy Monitor' mode the save will be in the native Quantum deposition mode and is needed for any diagnostic purposes (can also reload the data, adjust the material density and recalculate the deposition rates if needed).

The Export will then be to csv for the user.

Corrected Frequency [Hz]	
5964599 Hz	
AVERAGE DEPOSITION RATE	
Neutral+Ions - [nm/s]	0.148
Neutral - [nm/s]	0.173
CONTROL UNIT	
<input type="button" value="Disconnect"/>	<input type="button" value="Time-Averaged"/>
<input type="button" value="SCAN"/>	<input type="text" value="1"/> No. scans to run

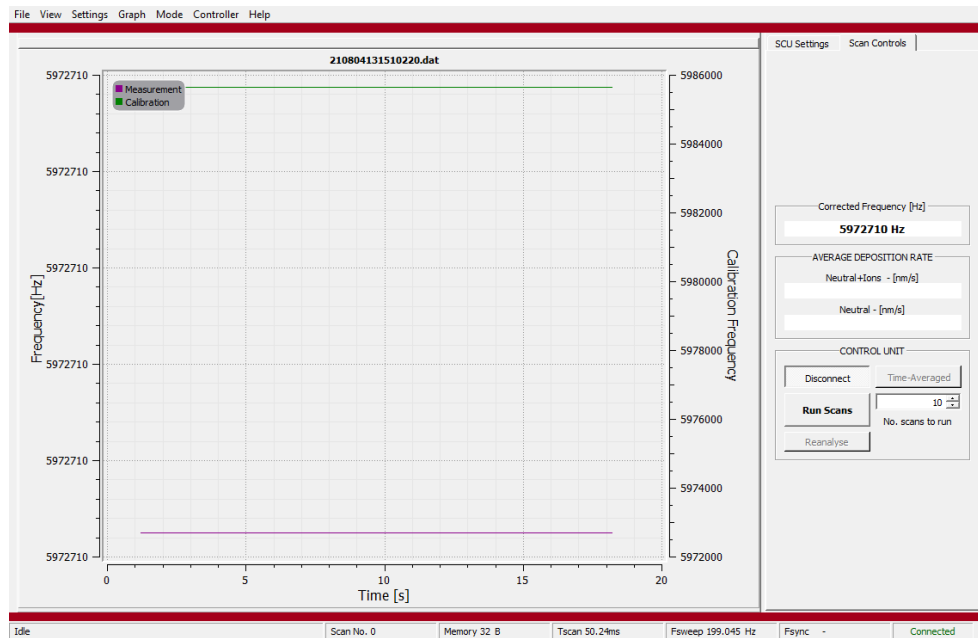
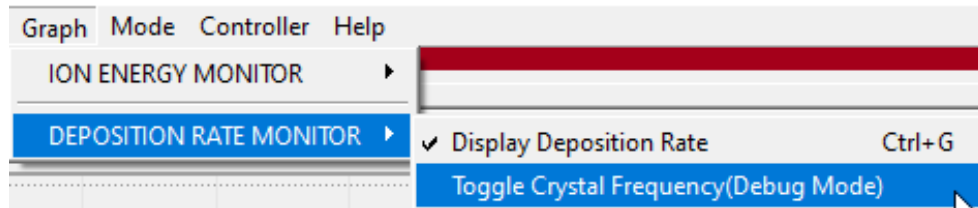
Flux Factors



There are 3 types of buttons available for the Quantum system with different flux factors based on the expected density of the plasma:

Low	5.73E+3
Standard	1.88E+4
High	1.70E+5

Startup tests



After connecting all hardware and connecting via the software, switch to Deposition mode

Set all voltages to zero and the switch time to be a suitably large number (i.e. at least 100s)

Run scan and then turn on the debug mode (as shown).

If the sensors are connected properly then you should get two flat lines as seen in the graph with the corrected frequency at around 5.9MHz (unless using special crystals for etching)

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