

## Connecting ESL Lasers to a Nu Instruments Vitesse ICP-TOF-MS

### Introduction

These instructions cover the physical connection of an ESL imageGEO193, imageBIO266 or ESLFemto laser ablation system to the torch of the Vitesse and the automation of data collection using TV Tuner for supported laser ablation systems. TV Tuner has been developed to automatically optimize system gas flows and the sample-cup spacing for minimum single pulse response and thus rapid imaging when using ICP-TOF-MS. In addition to achieving fast washout, TV Tuner can be used to confirm single pulse widths (matrix check) or optimize for lowest signal noise and thus highest precision.

Systems supported: ESL lasers fitted with electronics capable of producing TOF triggers and using AV2 version 1.5.1.33 and higher.

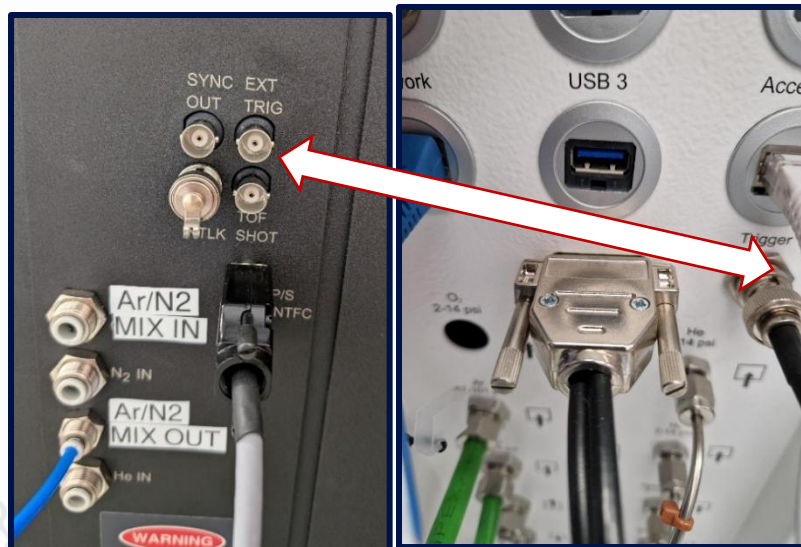
NB: This document was written for use with Codaq for Vitesse v2.1.8607. Laser systems using higher versions of software than listed above, may have functionalities added which make them no longer compatible with Codaq. If issues are found, please contact [lasersupport@icpms.com](mailto:lasersupport@icpms.com) for assistance.

### Connection of Trigger and Communication Cables

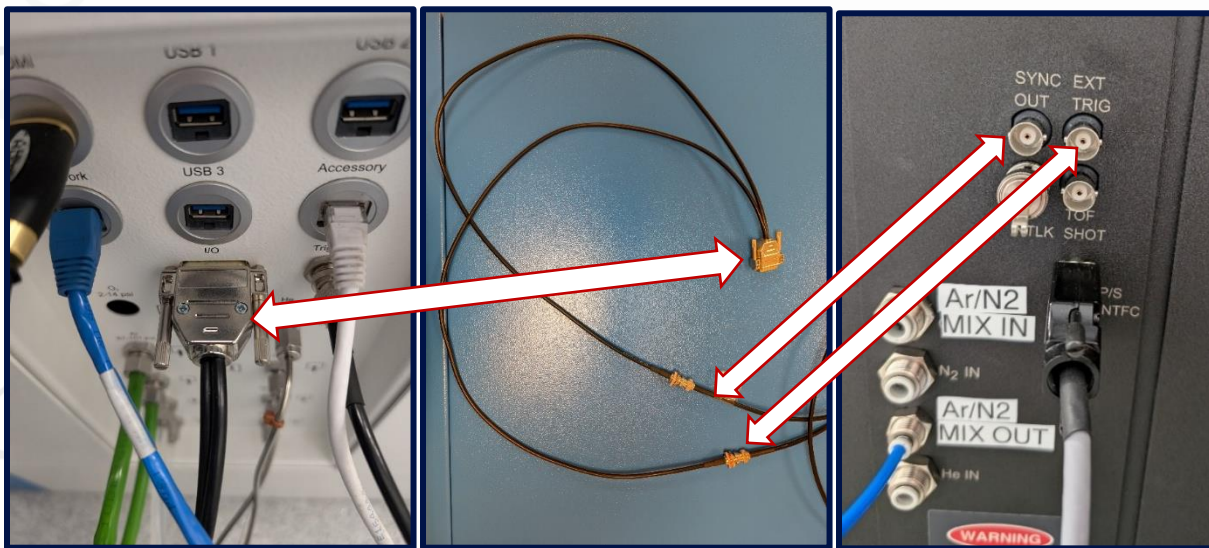
A TOF Shot trigger (signal corresponding to every laser shot) is required by the Vitesse to define individual pulse data in combination with meta data for image construction. This is achieved using a series of BNC connections and a network connection.

Ensure the laser system provides individual trigger signal for each shot of the laser; this can be confirmed by the TOF Shot BNC connector on the rear of the instrument. Older instruments will require hardware upgrades to enable this triggering mechanism, please contact [lasersupport@icpms.com](mailto:lasersupport@icpms.com) for advice.

- Connect the "TOF Shot" at the rear of the laser to the "Trigger" at the rear of the Vitesse via the provided BNC cable.



- For TV Tuner you will require the cable containing the 15-pin d-connector and 2 x BNC connectors. Plug the 15-pin d-connector to the I/O port of the Vitesse.
  - Connect the BNC labeled "Trigger" to the "EXT TRIG" of the laser
  - Connect the BNC labeled "Other" or "Sync" to the "SYNC OUT" of the laser
  - If you do not have the 15-pin d-connector then contact [Nu.VitesseService@Ametek.com](mailto:Nu.VitesseService@Ametek.com) for support. Alternatively, a cable can be configured as detailed: <https://iolite.xyz/docs/tvtuner-docs/index.html>



- Connect the ethernet port of the Vitesse to that at the rear of the laser.

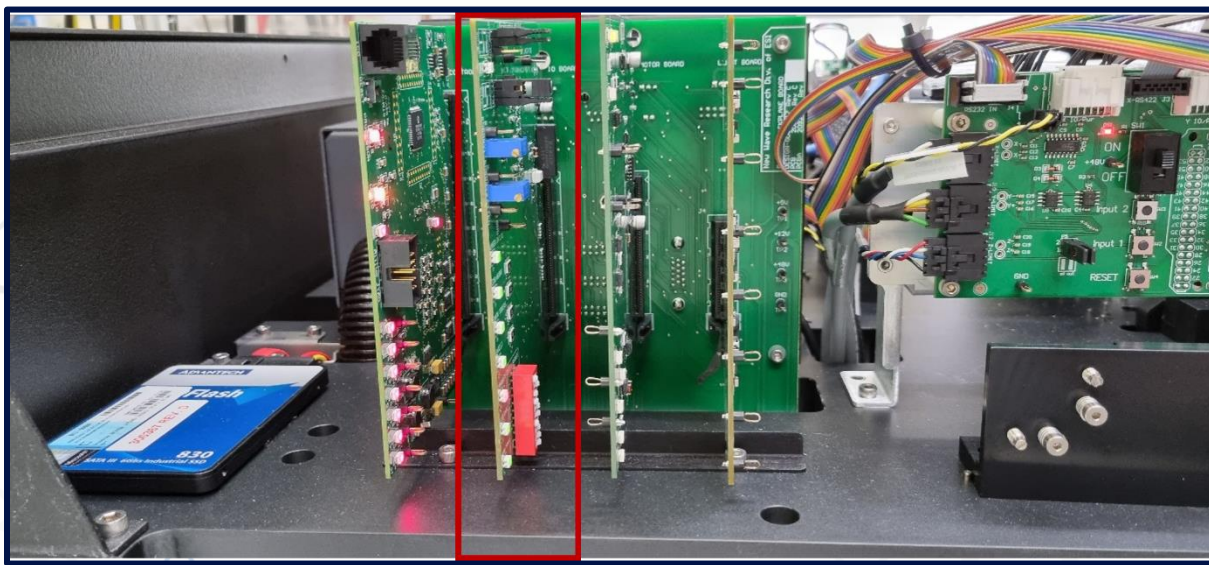


## Configure Communication

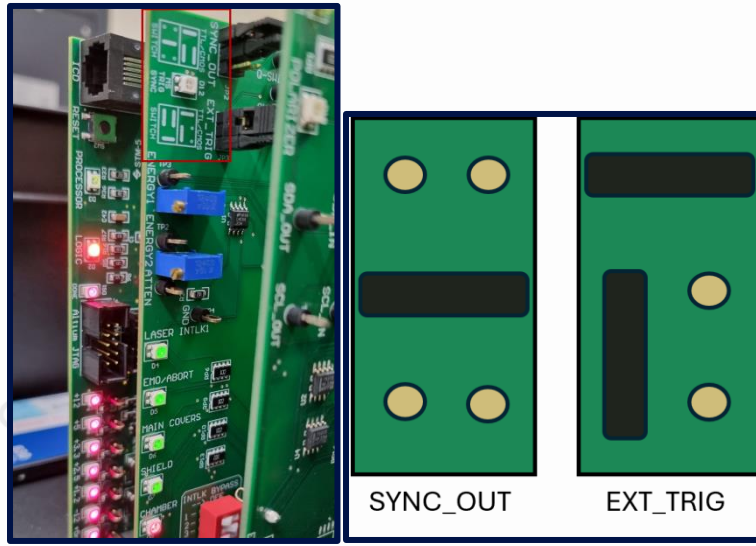
### Laser

#### Jumper settings

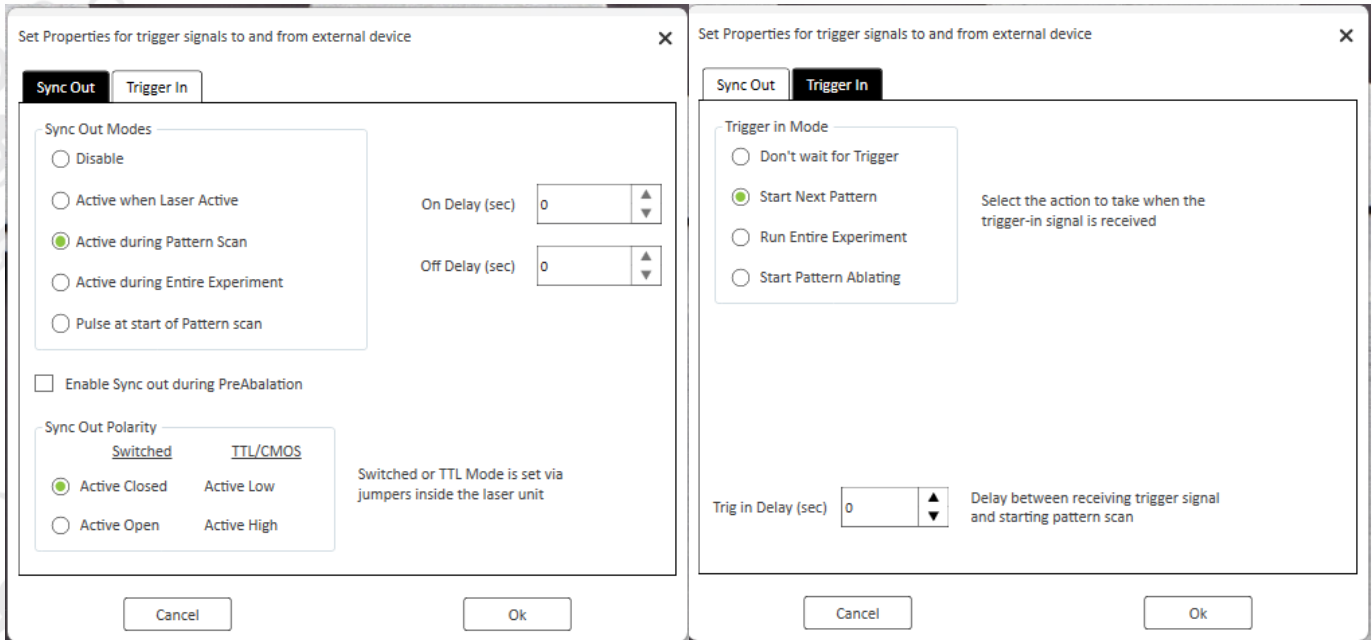
There are two hardware trigger jumpers that must be set correctly for each ICP type. These are normally set by the Service Engineer on installation. The jumpers are located on the I/O board located under the top main cover of the laser system. To gain access to the I/O board the system should first be fully powered down, and the top main cover slid back, then rotated to expose the boards on the left rear of the system. Care must be taken not to disturb the optics / camera and electrical systems under this cover. The I/O board is located on the left-hand side of the top deck of the system, see Figure 2 and Figure 3.



Both the SYNC\_OUT and EXT\_TRIG jumpers should be set to TTL. This is done by physically moving the jumpers according to the diagrams given below



Configure triggering within ActiveView2 as pictured below:



Set the IP address of the laser to [192.168.10.10](http://192.168.10.10).

### Nu Vitesse

To configure Codaq software for laser automation:

1. Configure the IP of the Vitesse as a fixed with address [192.168.10.20](http://192.168.10.20).

2. Edit the Settings.ini file located in C:\CoDaq Config\Configuration on the PC embedded in the Vitesse.
  - a. Look for a section headed [Laser] and ensure that it is set as NWR for ESL laser systems.
3. Look for the file labelled Laser.ini in the same directory as the Settings.ini. If it does not exist, create a text file with that name and ensure that the text below is added.

[Laser]

LaserSystemId = NWR

[NWR]

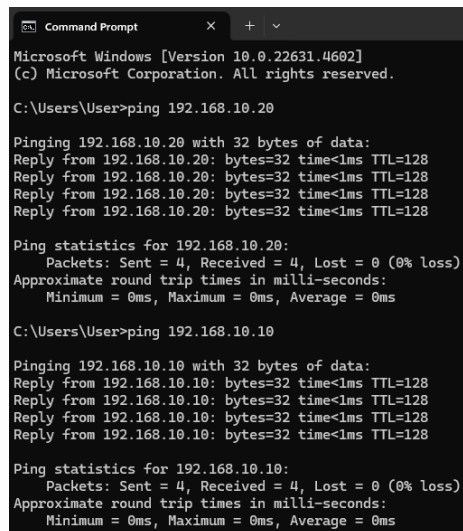
IPAddress=192.168.10.10

PortNumber=1234

## Establishing Communication

Network communication can be confirmed by pinging each system from the different PCs. Open the respective cmd window and enter the following commands on each instrument PC:

- "Ping 192.168.10.20" from the laser PC to confirm networking to the Vitesse PC.
- "Ping 192.168.10.10" from the Vitesse PC to confirm networking to the Laser PC.



```
Microsoft Windows [Version 10.0.22631.4602]
(c) Microsoft Corporation. All rights reserved.

C:\Users\User>ping 192.168.10.20

Pinging 192.168.10.20 with 32 bytes of data:
Reply from 192.168.10.20: bytes=32 time<1ms TTL=128
Reply from 192.168.10.20: bytes=32 time<1ms TTL=128
Reply from 192.168.10.20: bytes=32 time<1ms TTL=128
Reply from 192.168.10.20: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.10.20:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\User>ping 192.168.10.10

Pinging 192.168.10.10 with 32 bytes of data:
Reply from 192.168.10.10: bytes=32 time<1ms TTL=128
Reply from 192.168.10.10: bytes=32 time<1ms TTL=128
Reply from 192.168.10.10: bytes=32 time<1ms TTL=128
Reply from 192.168.10.10: bytes=32 time<1ms TTL=128

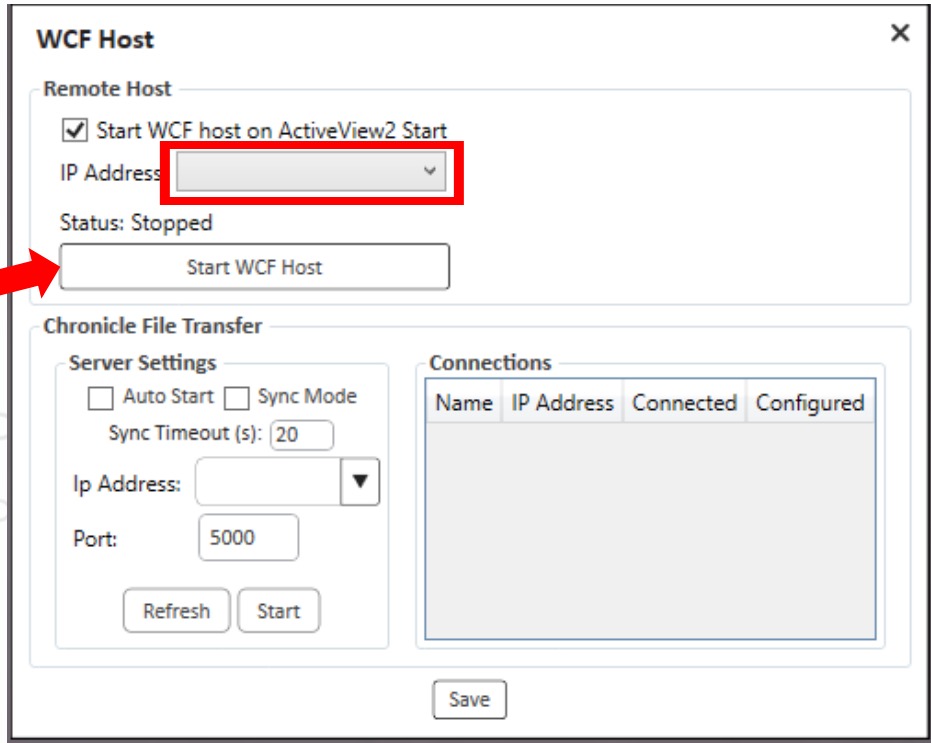
Ping statistics for 192.168.10.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Open the WCF window within ActiveView2 (via the settings window), select the IP address from the drop down menu and click "Start WCF Host". The WCF can be set to start on ActiveView2 start up using the check box.

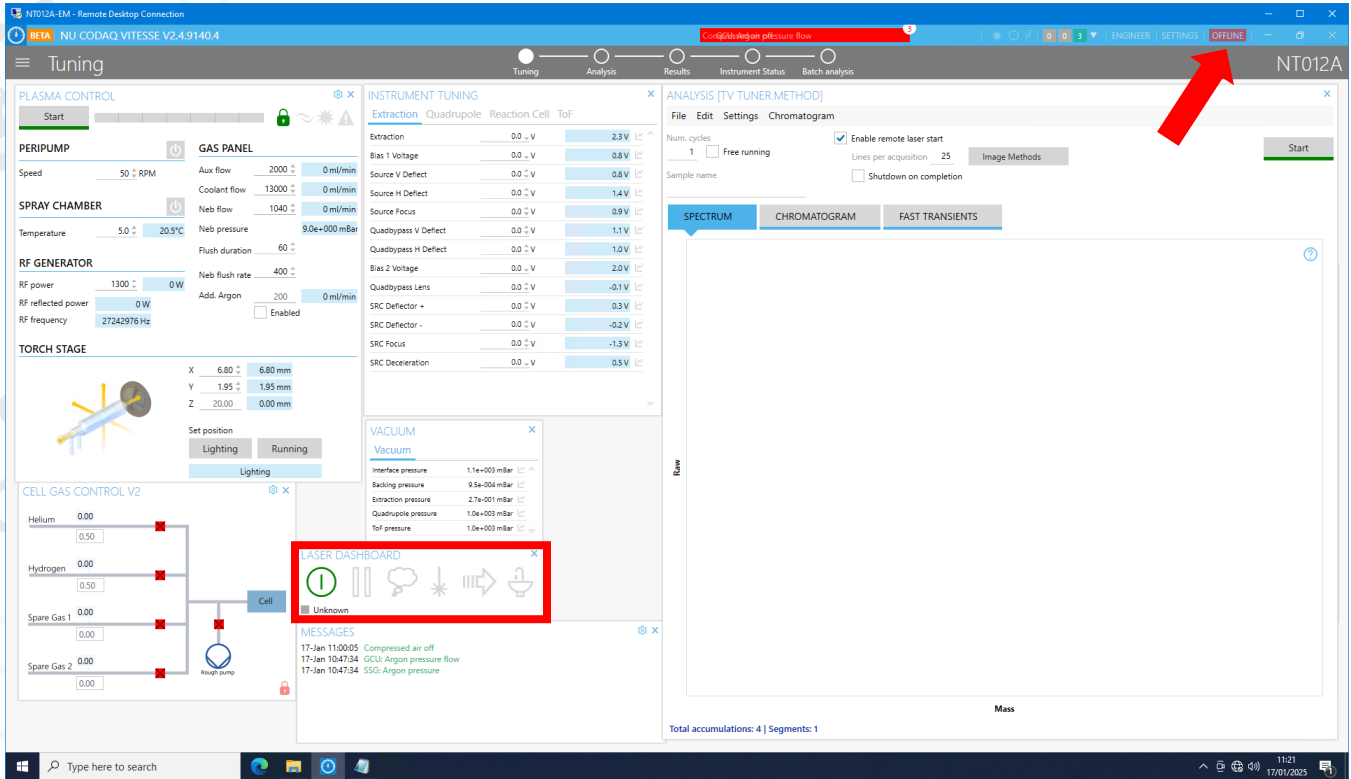


**Elemental Scientific**

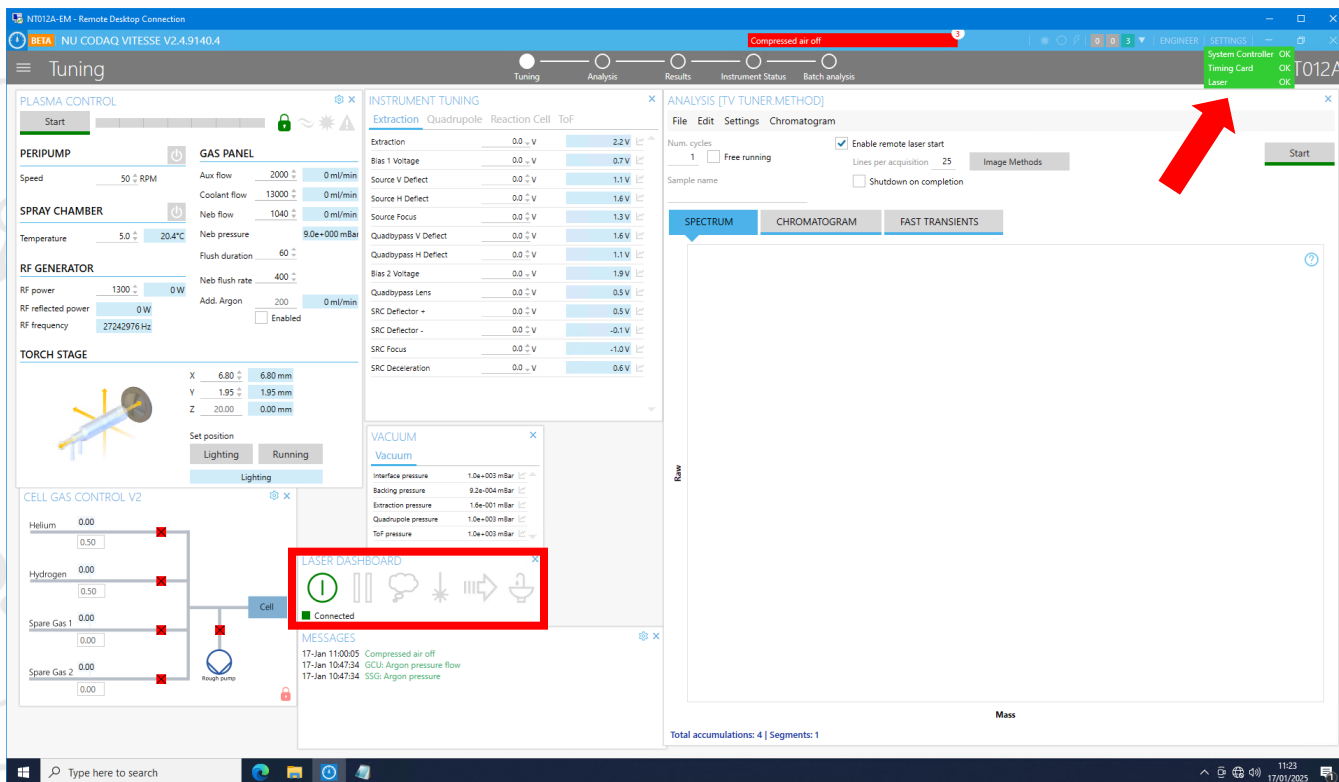
**LASERS**



Communication can be confirmed in Nu Instruments CoDAQ software.



CoDAQ window – laser offline



### CoDAQ window – laser online

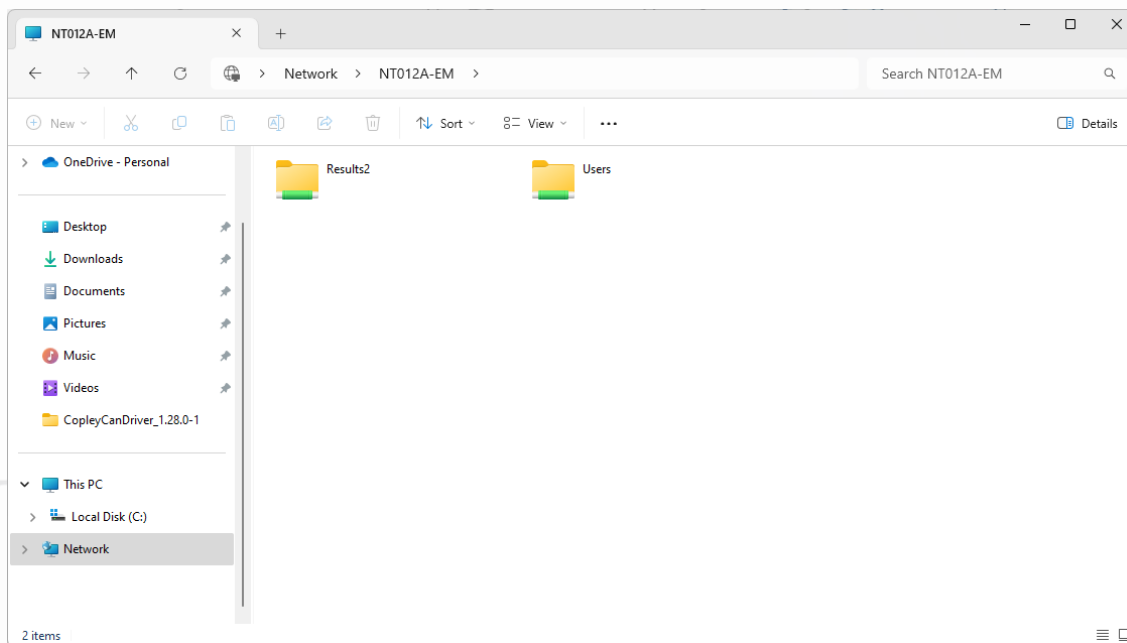
Communication can be confirmed by plotting a scan line in ActiveView2 and retrieving the scan line properties/name within CoDAQ.

### Map Directory for TV Tuner File Retrieval

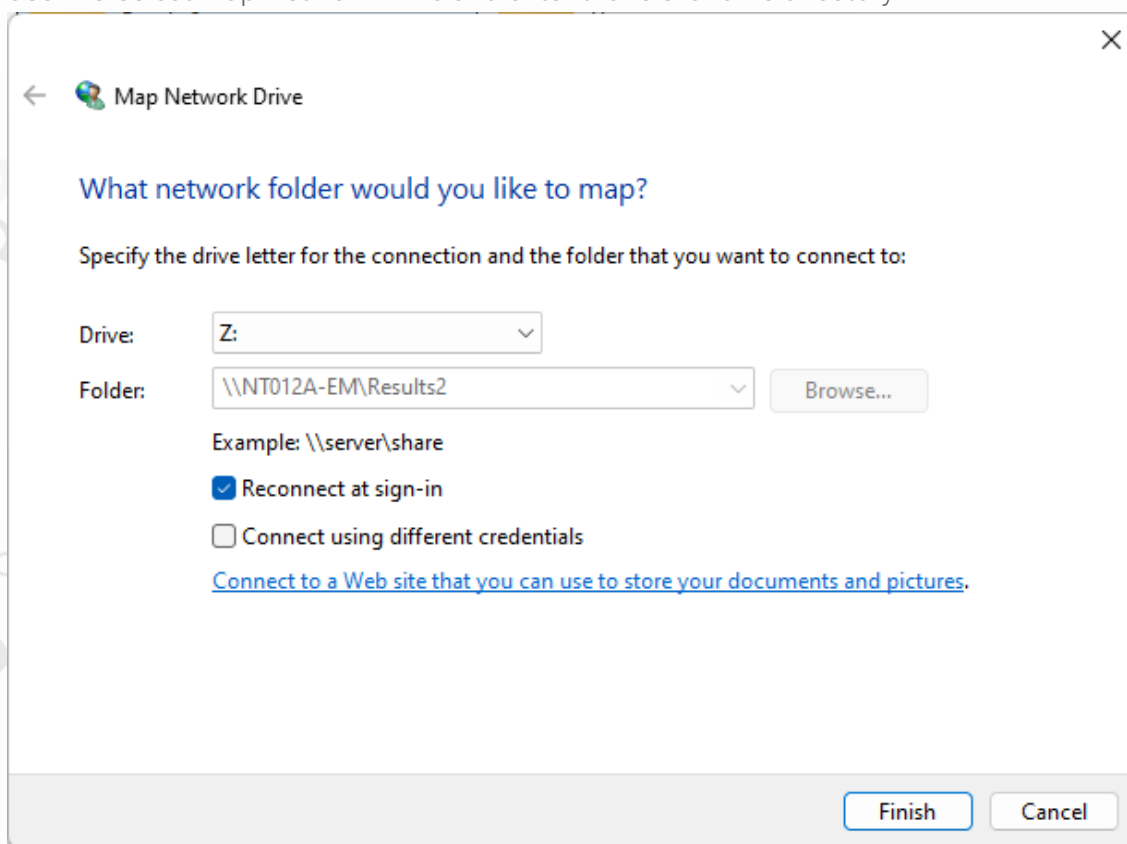
On the laser PC you will need to map the Vitesse data file directory to automatically retrieve transient signals for processing by TV Tuner.

- Confirm the directory on the Vitesse PC. This is usually named NTXXX-EMResults2, where XXX is your instrument number, in the example below the instrument number is 012A.





- On the laser PC select Map Network Drive and enter the relevant file directory

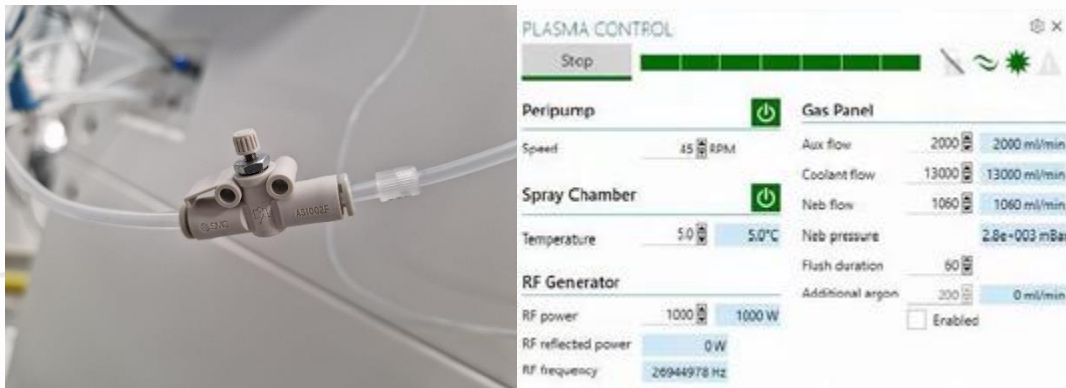


Vitesse Ar Makeup Gas (Nebulizer Gas) – Setting the Back Pressure



The Vitesse Ar nebulizer gas is designed to operate with a back pressure (typically provided by a nebulizer). The back pressure allows a more precise control of the flows and without a back pressure, it is possible for large changes in flow to occur too quickly which can extinguish the plasma.

For use with a laser ablation system, a flow restrictor can be added to the 4mm pipe for the nebulizer gas line. Insert the restrictor (provided by Nu Instruments) in the line as shown in the picture. When setting up for the first time, turn on the nebulizer gas by clicking on the Peristaltic pump On/Off button in CoDAQ:



Set the nebulizer flow to 1500 mL/min and then adjust the flow restrictor until the back pressure is approximately 2000mBar. The locking nut on the flow restrictor can then be used to lock the valve in place.

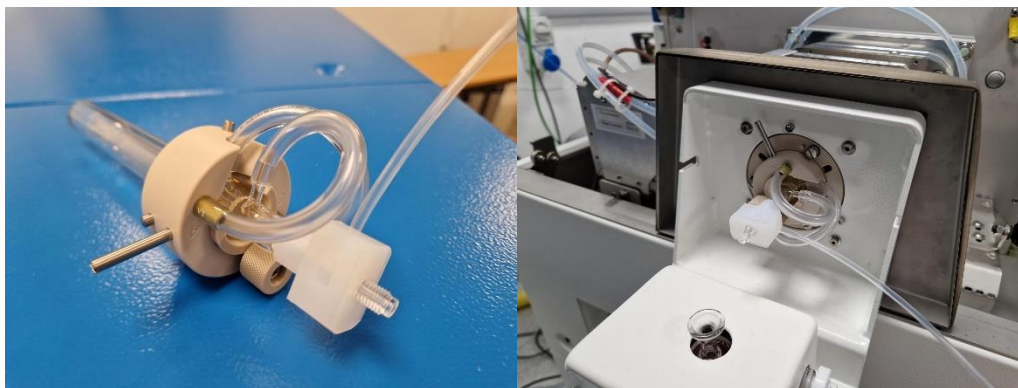
NOTE: The additional gas line is designed to work with almost zero back pressure so care must be taken that only the nebulizer line is restricted. If the alternative gas mass flow controller is connected to allow addition of nitrogen, this mass flow controller will work either with or without a back pressure.

## Connecting the DCI and to the Vitesse ICP Torch

Refer to the DCI installation guide.

In brief, replace the standard Nu Instruments torch with the ESL DCI2 torch. For fast washout ensure the laser and torch of the ICP-TOF-MS are as close as physically possible, whilst avoiding sharp bends in the connecting PEEK tubing. Long lengths and/or bends in the tubing will significantly affect particle transport and thus increase washout/single pulse response performance.





## Installing and Launching TV Tuner

### Install Prerequisites

Ensure you have a working installation of iolite v4 (v4.9.0 or later) on the laser control PC.

### Install the TVTuner Add-In

Obtain the TVTuner add-in installer file from the [iolite online store](#).

Run the installer on your AV2 computer.

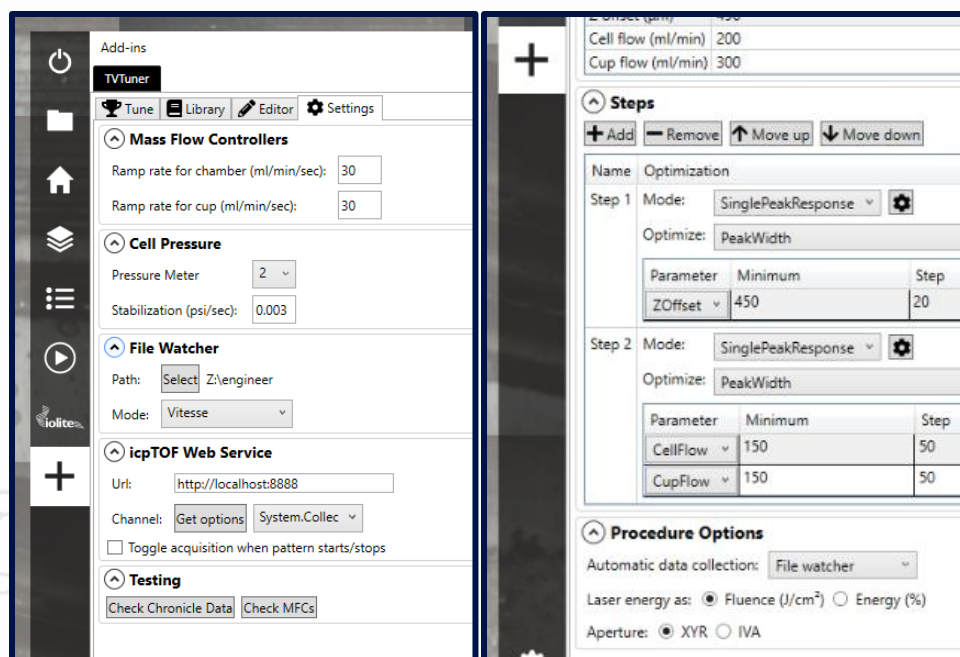
You can find documentation regarding the use of TV Tuner here: <https://iolite.xyz/docs/tvtuner-docs/index.html>

Launch the laser software (AV2). Click the configuration “cog” icon at the bottom of the screen: Settings --> Add-Ins --> Load TVTuner to load the TVTuner add-in.

In the settings tab configure for the Nu Instruments Vitesse, set the file watcher as follows:

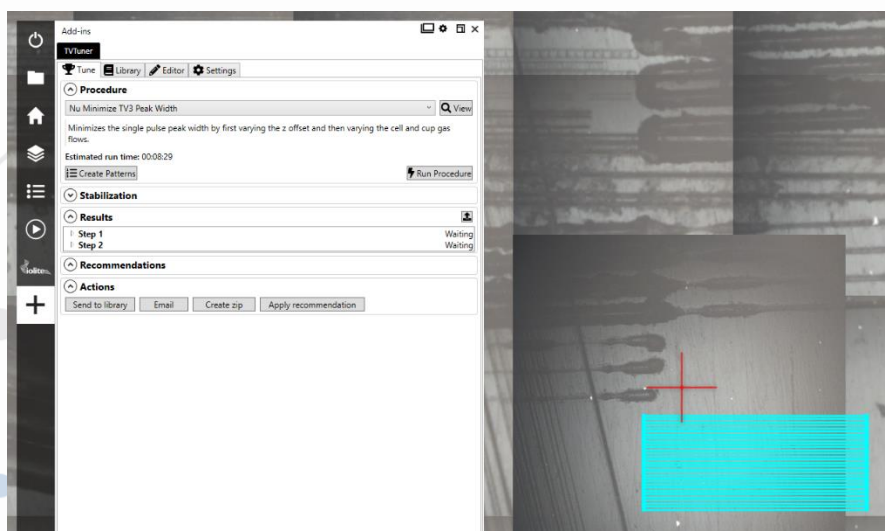
- Mode – Vitesse
- Path – your previously mapped directory e.g. Z\NTXXX-EM\Results2
- Mass – select an appropriate mass to monitor e.g. U238

In the editor tab configure for automatic data collection via “File Watcher”.

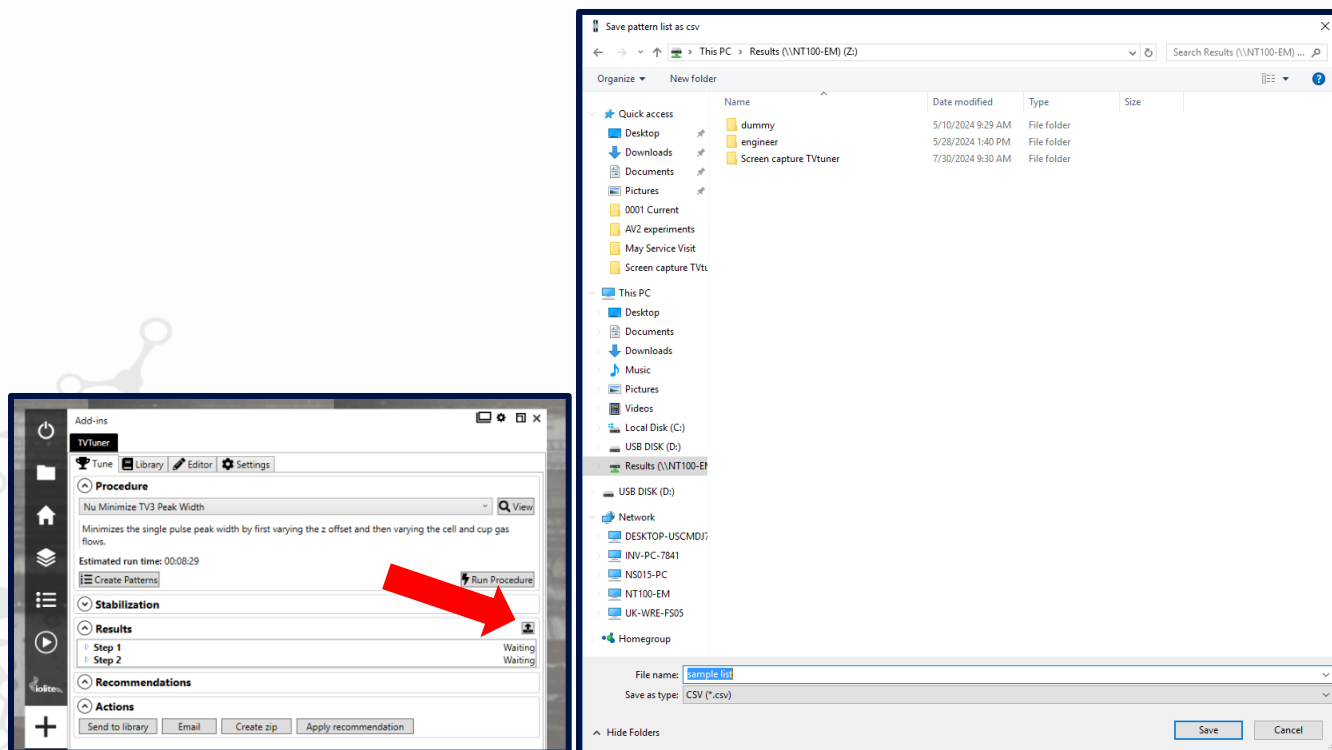


## Configure Optimisation Patterns in ActiveView2 and CoDAQ

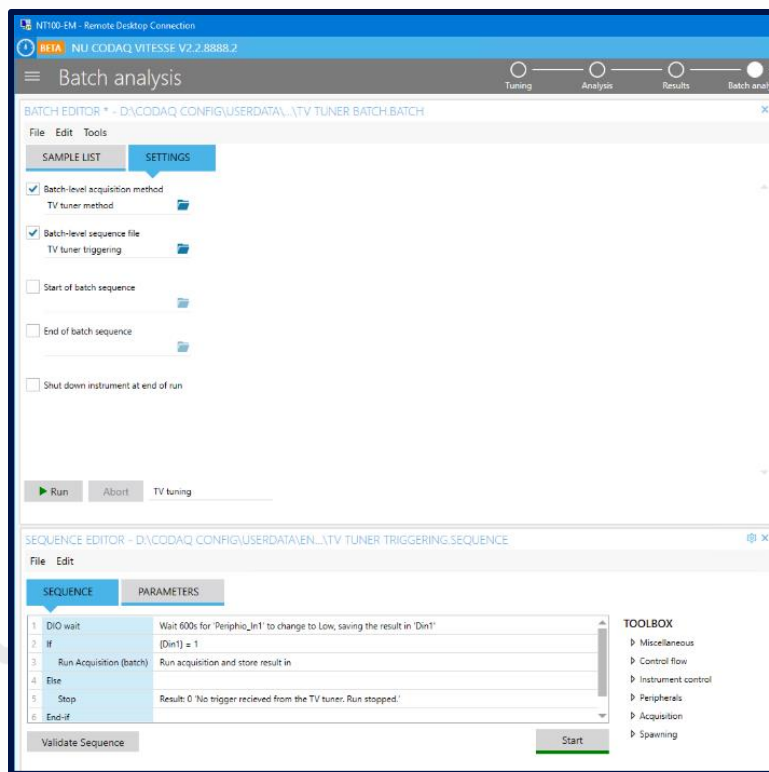
1. Select the "Minimize TV3 Peak Width" procedure within TV Tuner. This procedure will sequentially optimize the sample-cup distance and both the chamber and cup gases.
2. Ensure the spot size is set to 5  $\mu\text{m}$ , laser energy to 3 J/cm<sup>2</sup> and repetition rate to 10 Hz.
3. Focus on a clear area of NIST SRM 612 glass and select "Create Patterns" to automatically generate a list of patterns with varying sample-cup distance and helium gas flows. Ensure the ablation area is clear and free of previous ablation sites. For best results ensure the sample is polished and in focus.



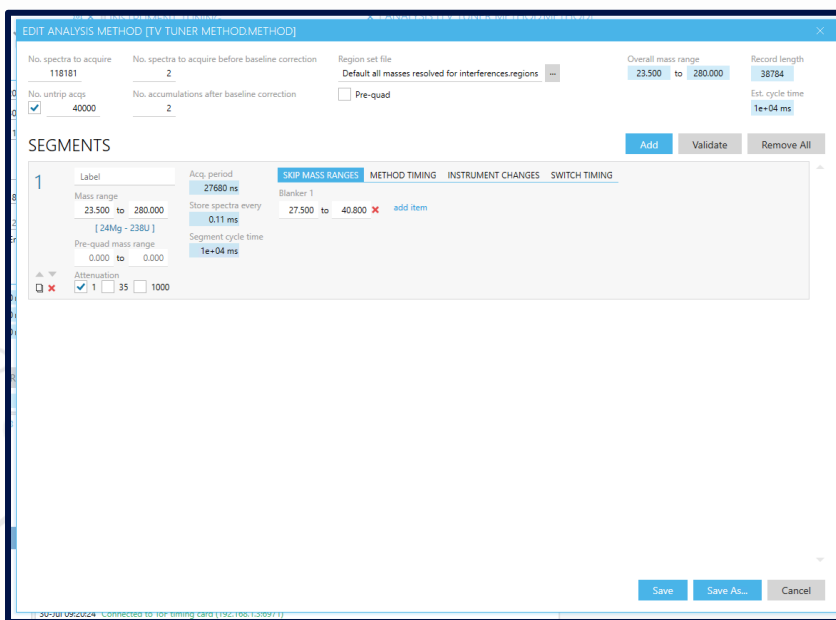
- The automatically generated pattern list will then need to be exported and can be saved to the previously mapped drive for import into CoDAQ.



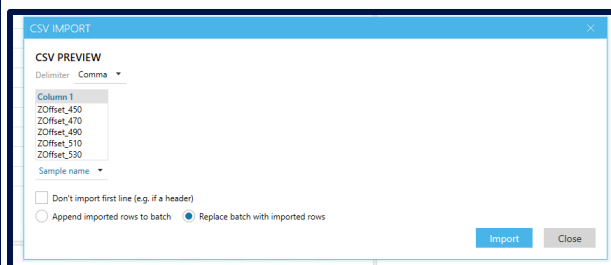
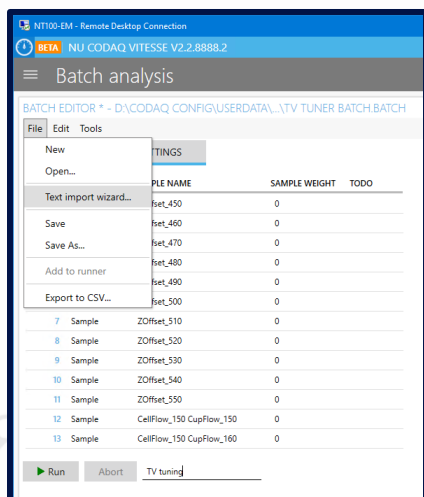
- Nu Instrument's CoDAQ software will then need to be configured to run in batch analysis using the supplied .batch, .method and . sequence files.
  - The Sequence needs to be set as follows:



b. A suggested method is as follows:



c. Import the previously created sample list (from the TV Tuner patterns:



- d. Set the Vitesse running by selecting "Start". The ICPMS will then wait for the laser.
- e. Select "Run Procedure" on the TV Tuner Tune window.