MQS41970 NIS-Elements Galvo Scanner License

Summary

The NIS-Elements Galvo Scanner license enables control of a Laser Scanner attachment used for ROI laser stimulation, activation, bleaching, ablation and cutting experiments. Other names used for this module are ‘XY Galvo’ or ‘Galvo XY’. The attachment mounts to the LAPP port of an inverted microscope and has two galvano motor mirror scanners to quickly move a laser beam across the center of the field-of-view. NIS-Elements controls the position of both mirrors through two analog output lines of a NIDAQ board. The laser is switched on/off synchronized with the ROI scanning.

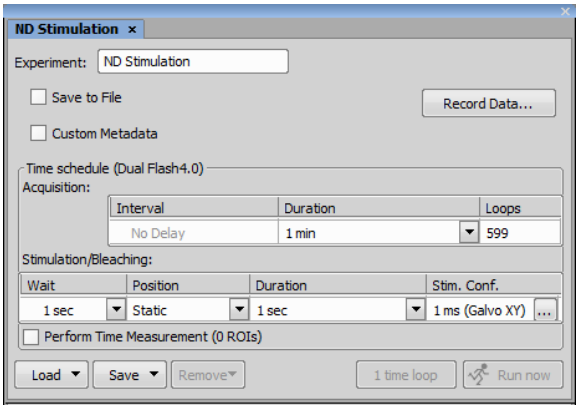
Requirements

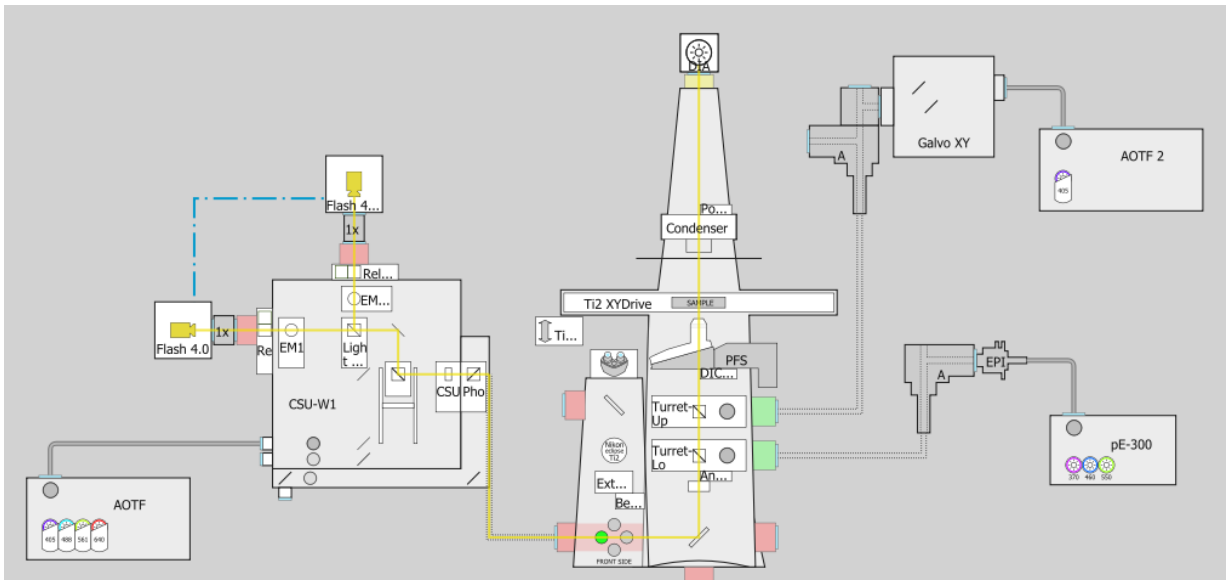
The MQS41970 Galvo XY license requires:
- NIS-Elements AR
- MQS42560 NIS 6D
- MQS41930 NIS Wavelength Switcher
- a galvano motor XY laser scanner adapter such as the Opti-Microscan (OMS).
- a NIDAQ controlled laser
- 2 triggered AO outputs on **the same NIDAQ board** for the X and Y mirrors of the scanner
- optionally 1 extra NIDAQ triggered output line on the same board + 2 Real-Time TTL Inputs for accurate timing event recording (requires license MQS41940 NIS TTL Analog I/O)

Hardware Configurations

Dedicated stimulation laser

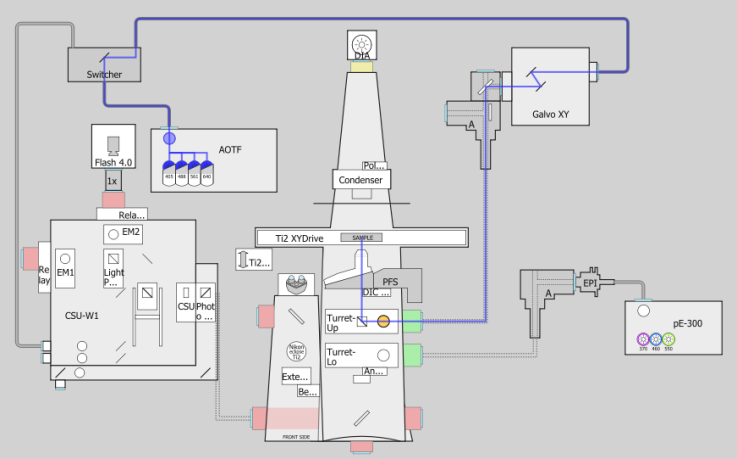
A typical configuration has the Galvo XY scanner mounted to the Ti2 top-layer and has a dedicated fiber coupled laser. The advantage of this configuration is that acquisition and stimulation can be executed simultaneously. This requires a dedicated filter cube in the top turret. When the imaging protocol includes triggered acquisition or illumination sequence, the imaging laser bed must be controlled by a different NIDAQ board.

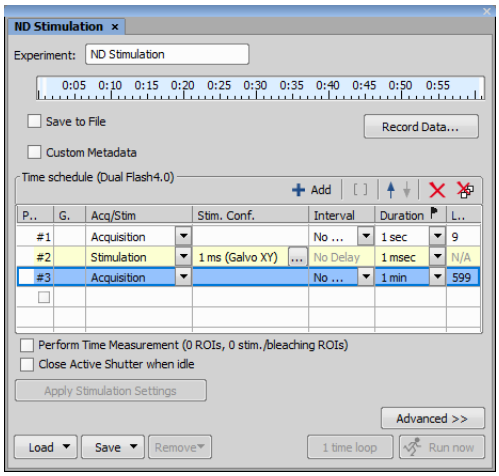




Shared laser bed

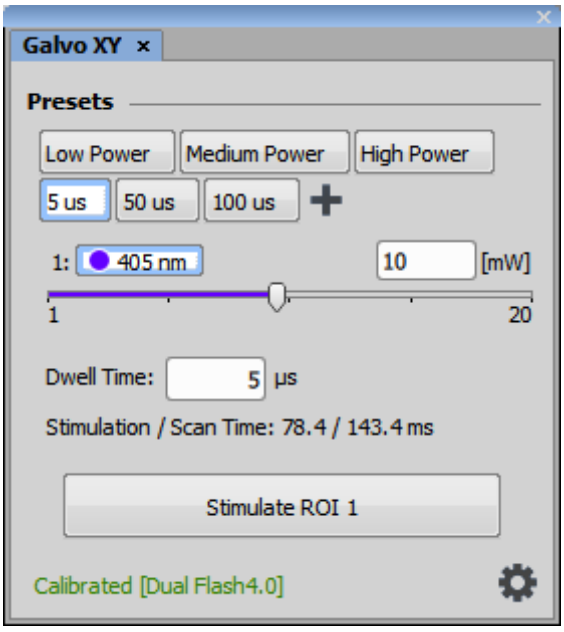
When one laser bed used is used for both imaging and stimulation, only sequential stimulation is possible. The scheme of such a configuration includes a fiber switcher, which is usually a built-in feature of the laser bed.





Galvo XY Panel

The Galvo XY panel is used to select which laser lines are used, the power of each line and the time (‘Dwell Time’) that every pixel in the stimulation ROI is illuminated. These settings can be stored in a ‘Preset’ (also called ‘Stimulation Configuration’).

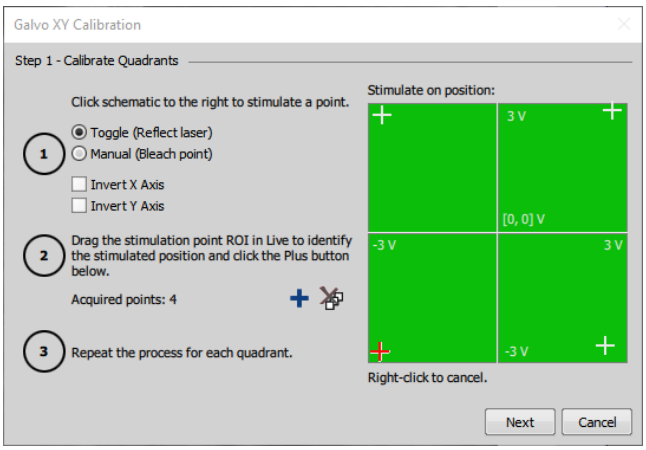


On a captured or frozen image, one or more Region of Interests (ROIs) are drawn to define the area to be stimulated. Next each ROI is assigned to one of the Galvo XY Presets or to the ‘current Configuration’.

The activation can be started manually by pressing the ‘Stimulate’ button. This performs the stimulation on all ROIs associated with the current Preset. To activate one ROI only, press on the Stimulate button next to the ROI.

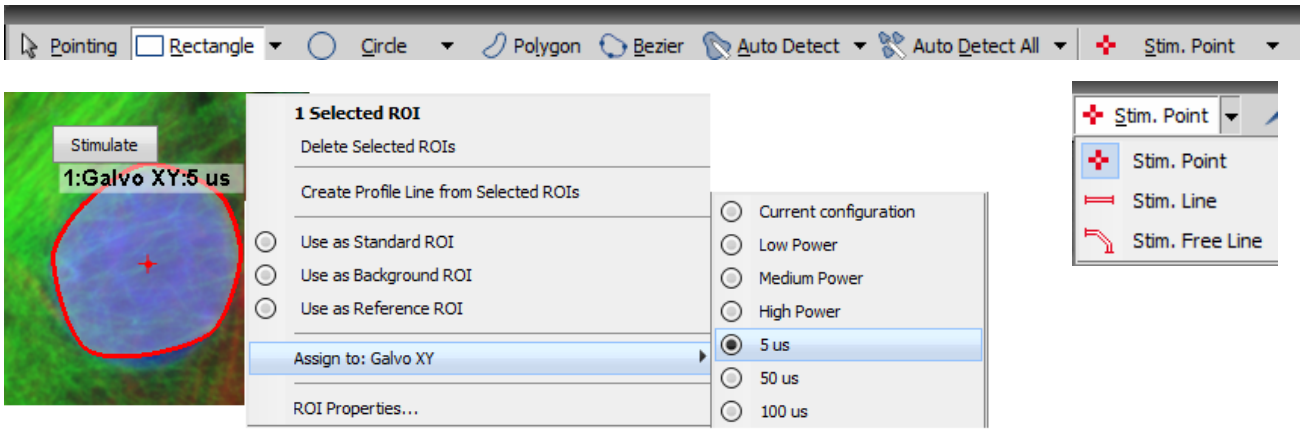
Calibration

The position of the mirrors is calibrated manually in four quadrants of the field-of-view. Both a reflection and a bleaching calibration slide can be used. Add at least one calibration point in every quadrant, preferably in the outer corners. After adding a calibration point, move the point ROI in the live image to the laser spot and press the blue + button to store the calibration.

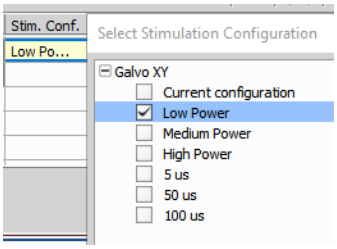


Stimulation ROIs

All standard ROIs can be assigned to a stimulation Preset. In the live and frozen image, the ROI editor adds 3 dedicated stimulation ROI shapes: ‘Stim. Point’, ‘Stim. Line’ and ‘Stim. Free Line’.



In the stimulation experiment definition, one or more Presets are selected and how many times they should be scanned. The selected Presets are scanned sequentially.

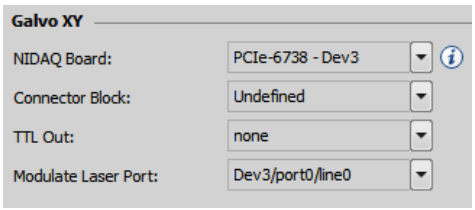


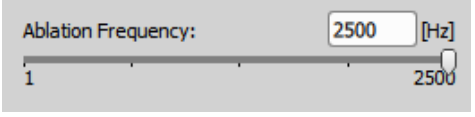
During stimulation, the mirrors will be scanned over a the smallest rectangular area that encloses each ROI. The laser will be switched on when the spot is inside the ROI. The laser spot moves along the positions of the pixels of the image on which the ROI was defined and will stay at each position for the specified ‘Dwell Time’. To ensure smooth illumination, diameter of the laser spot must be larger than the pixel size of the image on which the ROIs are defined.

Most ROI types can be combined with the exception of the Stimulation Point type. Stimulation Point ROIs can only be combined with other Stimulation Points.

Ablation

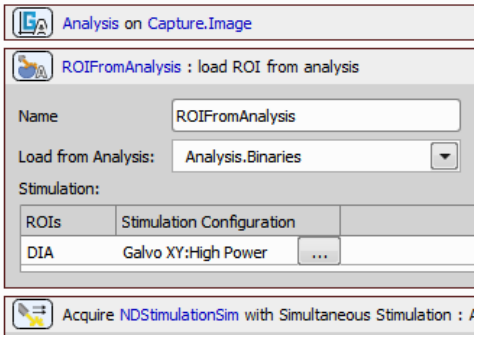
Ablation experiments uses a pulsed laser. If the laser controller cannot tune the pulse frequency, NIS can generate pulse triggers on the laser TTL on/off line. The laser controller should be configured to generate one laser pulse per TTL pulse. Maximum ablation frequency defaults to 2500 Hz. A custom maximum up to 100 kHz can be defined in the registry. Higher frequencies will result in a larger NIDAQ wavetable which will slightly delay the start of the stimulation.
HKEY_LOCAL_MACHINE\SOFTWARE\Laboratory Imaging\Misc\GalvoXY\MaximumAblationFrequency





Jobs

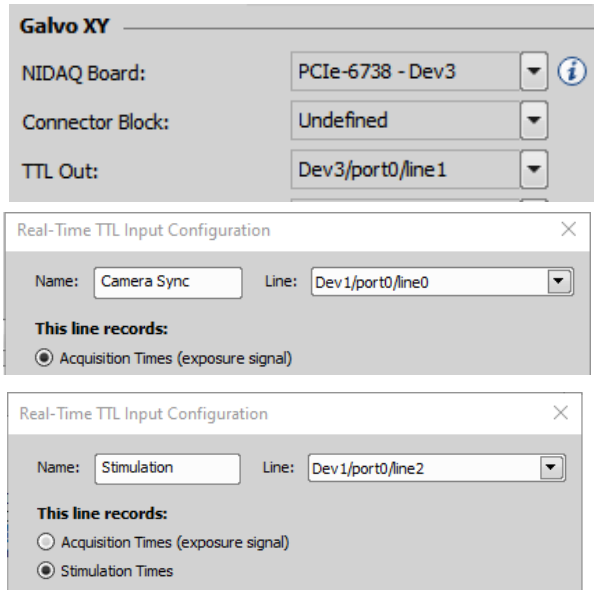
The Jobs experiment builder features the tasks ‘Sequential Stimulation’ and ‘Simultaneous Stimulation. These tasks can be used to embed stimulation experiments in to the experiment. For each point in a point loop different ROIs can be defined or loaded from an Analysis Task. Jobs requires license MQS43020 NIS-A Bundle Jobs.

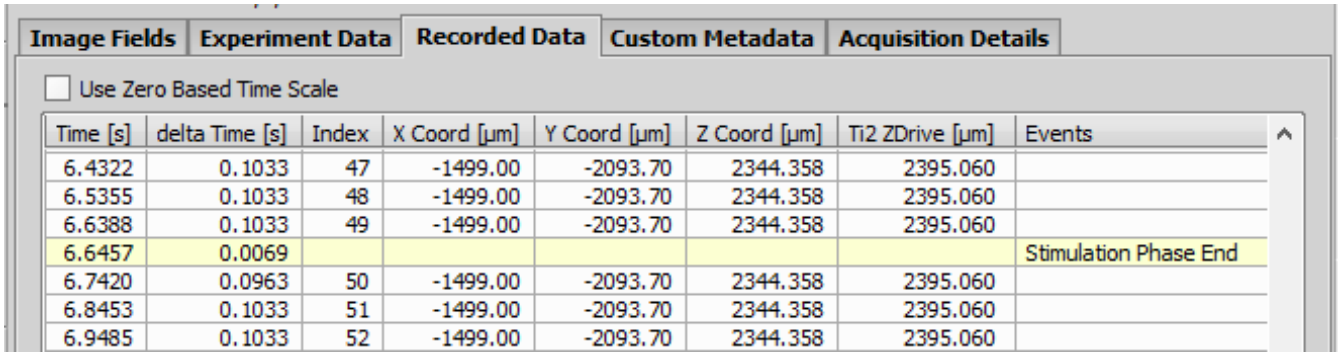


Recording timing events

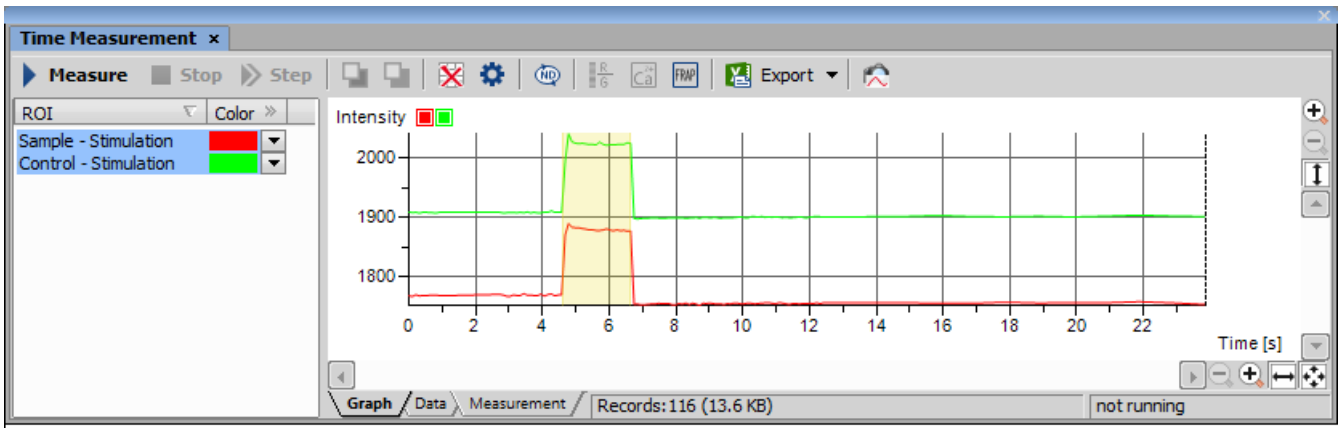
To correlate the captured time-series with the start and stop of the stimulation, the Galvo XY module can output a TTL pulse on a ‘TTL Out’ line. To record this pulse, license MQS41940 TTL Analog I/O and two NIDAQ Real-Time Input lines are required.

The camera frame sync signal and the Galvo XY ‘TTL Out’ signal are connected to two ‘Real-Time TTL Input’ ports of a NIDAQ board. The camera trigger sync pulses are used as hardware time-stamps for the captured images, the Galvo XY ‘TTL Out’ pulse is recorded as the ‘Stimulation Begin/End’ events.





Time [s]	delta Time [s]	Index	X Coord [µm]	Y Coord [µm]	Z Coord [µm]	Ti2 ZDrive [µm]	Events
6.4322	0.1033	47	-1499.00	-2093.70	2344.358	2395.060	
6.5355	0.1033	48	-1499.00	-2093.70	2344.358	2395.060	
6.6388	0.1033	49	-1499.00	-2093.70	2344.358	2395.060	
6.6457	0.0069						Stimulation Phase End
6.7420	0.0963	50	-1499.00	-2093.70	2344.358	2395.060	
6.8453	0.1033	51	-1499.00	-2093.70	2344.358	2395.060	
6.9485	0.1033	52	-1499.00	-2093.70	2344.358	2395.060	



NIDAQ hardware

The following combinations of NIDAQ board and BNC breakout terminals are common:

1x MHX00546 NI PCIe-6321 & 1x shielded cable
1x MXS52200 NI 6321/6323 Trigger breakout box
BNC terminals: 2x PFI, 2x triggered Analog Out and 8x triggered/real-time TTL
screw terminals: +6x PFI/TTL and +8x TTL

1x MHX00545 NI PCIe-6323 & 2x shielded cables
2x MXS52200 NI 6321/6323 Trigger breakout box
BNC terminals: 2x PFI, 4x triggered Analog Out and 18x triggered/real-time TTL
screw terminals: +6x PFI/TTL, +8x TTL and +14 triggered/real-time TTL

1x MHX00552 NI PCIe-6738
1x MHX00554 NI SHC68-68-EPM 2m Cable
1x MXST0012 Ubob42 NIDAQ Ultimate Breakout Box wired for 6738
BNC terminals: 8x PFI/TTL, 32x triggered Analog Out and 2x triggered/real-time TTL

When two NIDAQ cards are needed and only one PCIe slot is available, a PXI chassis can be used.

Features

View | *Acquistion Controls* | *Galvo XY; Applications* | *Define/Run Sequential Stimulation*; *Applications* | *Define/Run Simultaneous Stimultion;*
With Jobs license: *Jobs Sequential Stimulation Task; Jobs Simultaneous Stimulation Task;*

Information

Product Code:	MQS41970 NIS-D XY Galvo
Plug-in for:	NIS-AR
Required:	MQS42560 NIS-A 6D
	MQS41930 NIS Wavelength Switcher
Related Plug-ins:	MQS41940 NIS TTL/Analog IO
	MQS43020 NIS-A Bundle Jobs

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