

## HighFinesse Tutorial

# HighFinesse Analog PID Option (1 or 2 Channels): Laser Control

HighFinesse Tutorial  $\cdot$  Analog PID 1 or 2  $\cdot$  9-2024 This document provides general information only and may be subject to change at any time without prior notice.

### Overview

## How to ...

## ... set up the HighFinesse Analog PID Option (1 or 2 channels): Laser Control

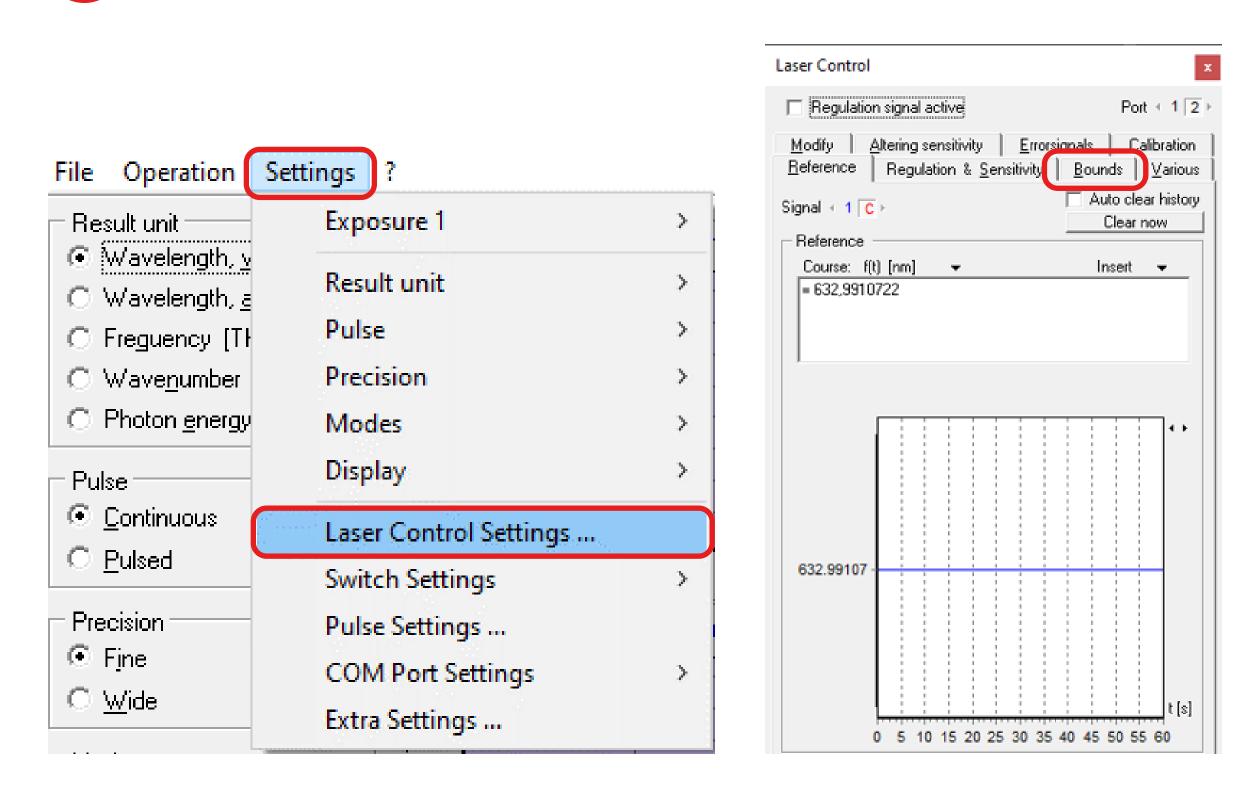
The analog output at the wavelength meter will provide up to  $\pm 4$  V. This tutorial is intended to give you a brief overview of how to configure the HighFinesse laser control settings. The tutorial does not replace reading the manual. Make sure you have read and understood it (especially section 3.5) before you start the regulation. Setting voltage bounds incorrectly might cause damage to your laser.

Here we assume that the laser is already successfully connected with a fiber to the wavelength meter. If you have any questions about that refer to the quickstart guide "HighFinesse Wavelength Meter".

### Further information

Quick Start Guide HighFinesse Wavelength Meter

https://www.highfinesse.com /en /support /quick-start-guide.html

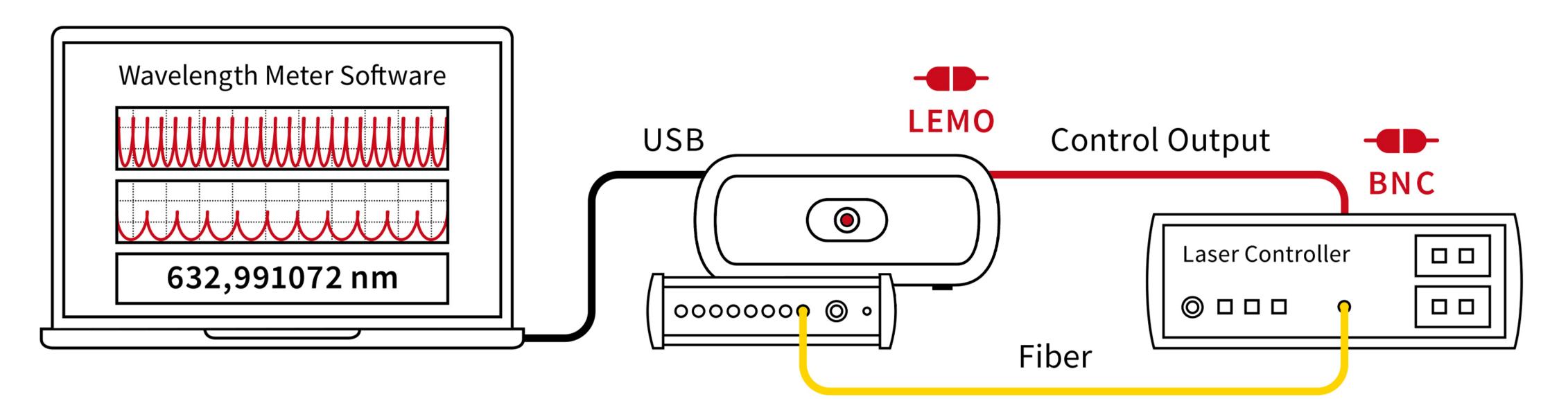


**Start the software** and set the **voltage bounds in the Laser Control Menu** such that you can exclude a damage to your laser and make sure the output range is suitable (e.g. as defined by a mode-hope-free scanning range).

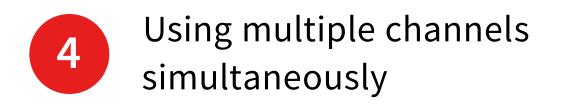
Laser Control         □ Regulation signal active       Port          Modify       Altering sensitivity       Errorsignals       Calibra <u>M</u> eference       Regulation & Sensitivity       Bounds       Val         □ Signal bounds       [mV]	x
<u>M</u> odify <u>Altering sensitivity Errorsignals</u> <u>Calibra</u> <u>R</u> eference Regulation & <u>S</u> ensitivity <u>B</u> ounds <u>V</u> a	
<u>Reference</u> Regulation & <u>Sensitivity</u> <u>Bounds</u> <u>Va</u>	1 <mark>2</mark> ⊦
	ation
Minimum -4096 + Maximum 4096 +	
<ul> <li>Adjust reference midway (0.0 mV)</li> <li>Adjust reference at 0 mV</li> </ul>	
<ul> <li>Behaviour on exceeding bounds</li> <li>Only cut at signal bounds</li> <li>Output errorvalue [mV] at min2800 at max3200 at min.</li> </ul>	
Maximum shot-per-shot change [mV]	

2

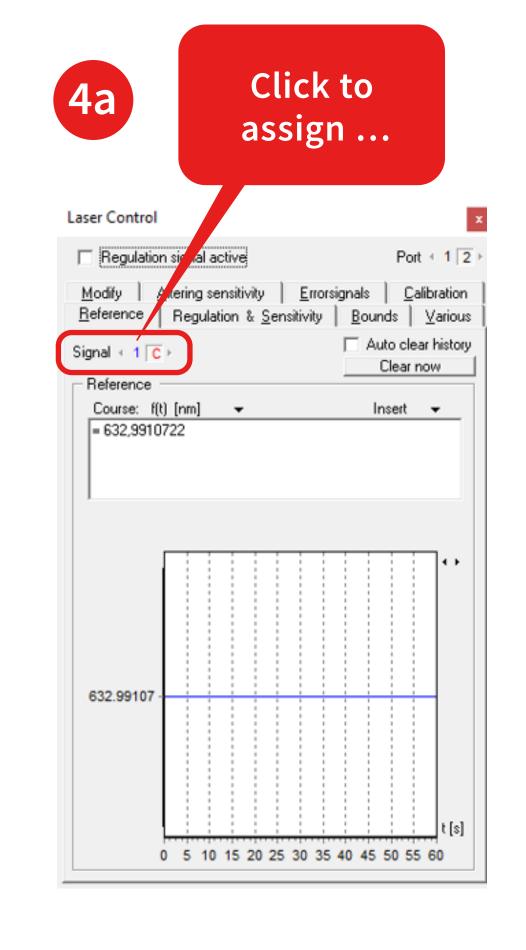
Move to the **frame bounds** to **enter them correctly.** 



**Connect the voltage output of the wavelength meter** to the **input at the laser** (minimum impedance at the laser input 10 kOhm).



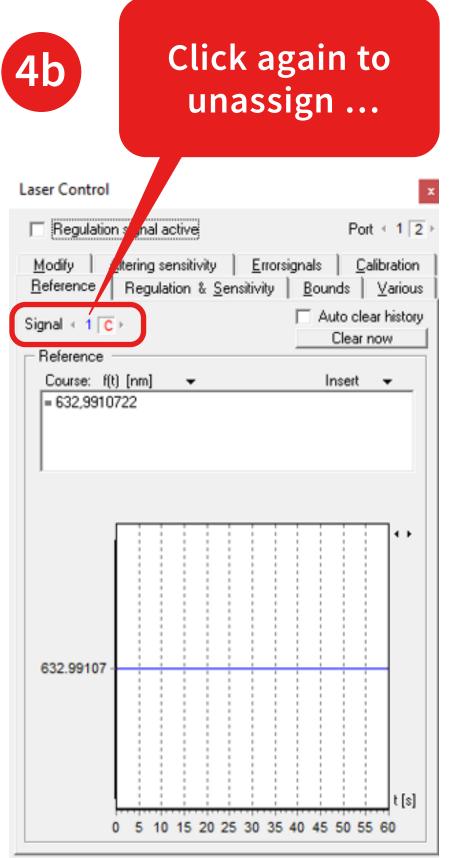
Laser Control													x
☐ Regulation	n sign	al ad	stive	1967						F	ort	←1 2	Þ
Modify A													
Signal 🗧 🕇 🔽	Þ.							Г		uto d Clea		r history ow	1
- Reference - Course: f(t = 632,9910		]	·					_		nser		•	
632.99107 -												t [s]	
	) 5	10	15	20	25	30	35	40	45	50	55	60	



Choose the port where the voltage will be put out by clicking on the black numbers.

to the port.

Then click on one of the colored numbers to assign the switch signal



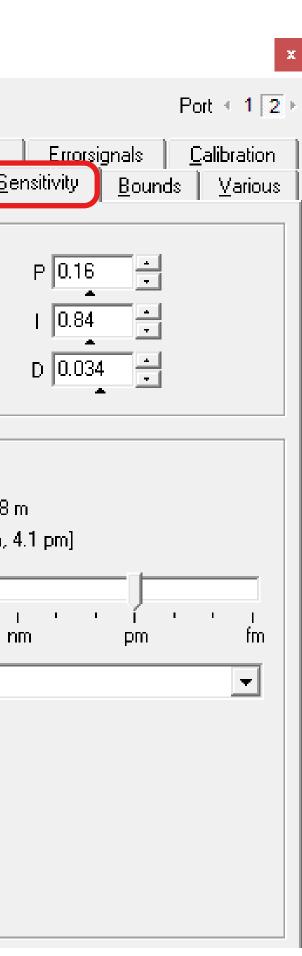
You can unassign it by clicking on the same number again. In the example the Switch signal C is assigned to port 2.

### Laser Control

Regulation signal active
<u>M</u> odify <u>Altering sensitivity</u> <u>R</u> eference Regulation & <u>S</u>
Regulation
Constant dt dt [s] 0.010
Use t <sub>a</sub> in I and D
t <sub>a</sub> [s] 0.020
_ Sensitivity
Actual sensitivity: 1 V/pm
Min. resolution: 125 e-18
Deviation range: [-4.1 pm,
1.00 ≛ ∨ / ▼
Polarity Positive

Use the **PIDSim2 Tool** to simulate good starting parameters.

Alternatively, you can set PID parameters manually in the laser control settings/frame: **"Regulation & Sensitivity".** 





## Start the PIDSim2 application located in the path ...

Installation Path of the Wavelength Meter Software \Tools \PIDSim2.exe

... and make sure you can measure.

7	7a PIDSim2 Settings
General Measurement count 200 Time / Measurement [s] 0.020 Laser 1 / Amplification 1	General Measurement count 200 ↓ Time / Measurement [s] 0.020 ↓ Response count 2 ↓ VOut minimum [V] 0.000 ↓ VOut maximum [V] 4.096 ↓ VOut resolution [mV] 0.500 ↓ Synchronize f and r Laser 1 / Amplification ↓ 1.00 ↓ V / pm ↓ ↓ 0 V Wavelength 632.991075 ↓ ↓
Clicking on the <b>small black triangle</b> will enable more settings.	Now you can <b>make your setting</b> for simulation.

gs

## Measurement count:

number of points in the simulation.

## Time/Measurement [s]:

get this live from the wavelength meter by clicking on the red dot and confirm by clicking on the checkmark.

## **Response Count:**

2 for single channel, 1 for multichannel measurements.

## Set the minimum and maximum output

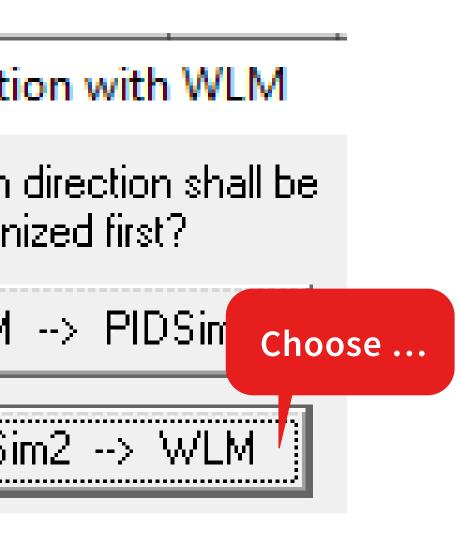
according to your system (voltage bounds set in 1.).

Set the **resolution** to obtain a realistic simulation of your system.

8 Show more settings	<b>8</b> a
Regulation f(t) [nm]	Connect
<ul> <li>= 632,9910722</li> <li>✓ ta [s] P 0.25 ↔</li> <li>0.040 ↔ I 1.00 ↔</li> <li>Auto TPID D 0.060 ↔</li> <li>Clear history on range exceed Sensitivity</li> </ul>	In which synchror WLM PIDS
t 1.00 ÷ V / pm ▼ Synchronize WLM	Choose to <b>s</b> <b>PIDSim2</b> in
	Choose <b>PID</b>

The tool can be used as a **pure** simulation tool or synchronized to the wavelength meter software running in parallel.

Sim --> WLM. You can alternatively also transfer all settings you have made from the wavelength meter to the PIDsim2 tool. you would like to adjust.



synchronize the the section regulation.



Regulation —	<b></b>
f(t)	[nm]
= 632,9910722	
🔽 ta [s]	P 0.20
0.040	1.00
Auto TPID	D 0.060
🔲 Clear history o	on range exceed
Sen:	sitiviti 🔹
+ 1.00 ÷	
Release WLN	Port 1

After that set the port that

## Amplification settings

Collection points per cycle 900

Upper voltage border [mV] 1250

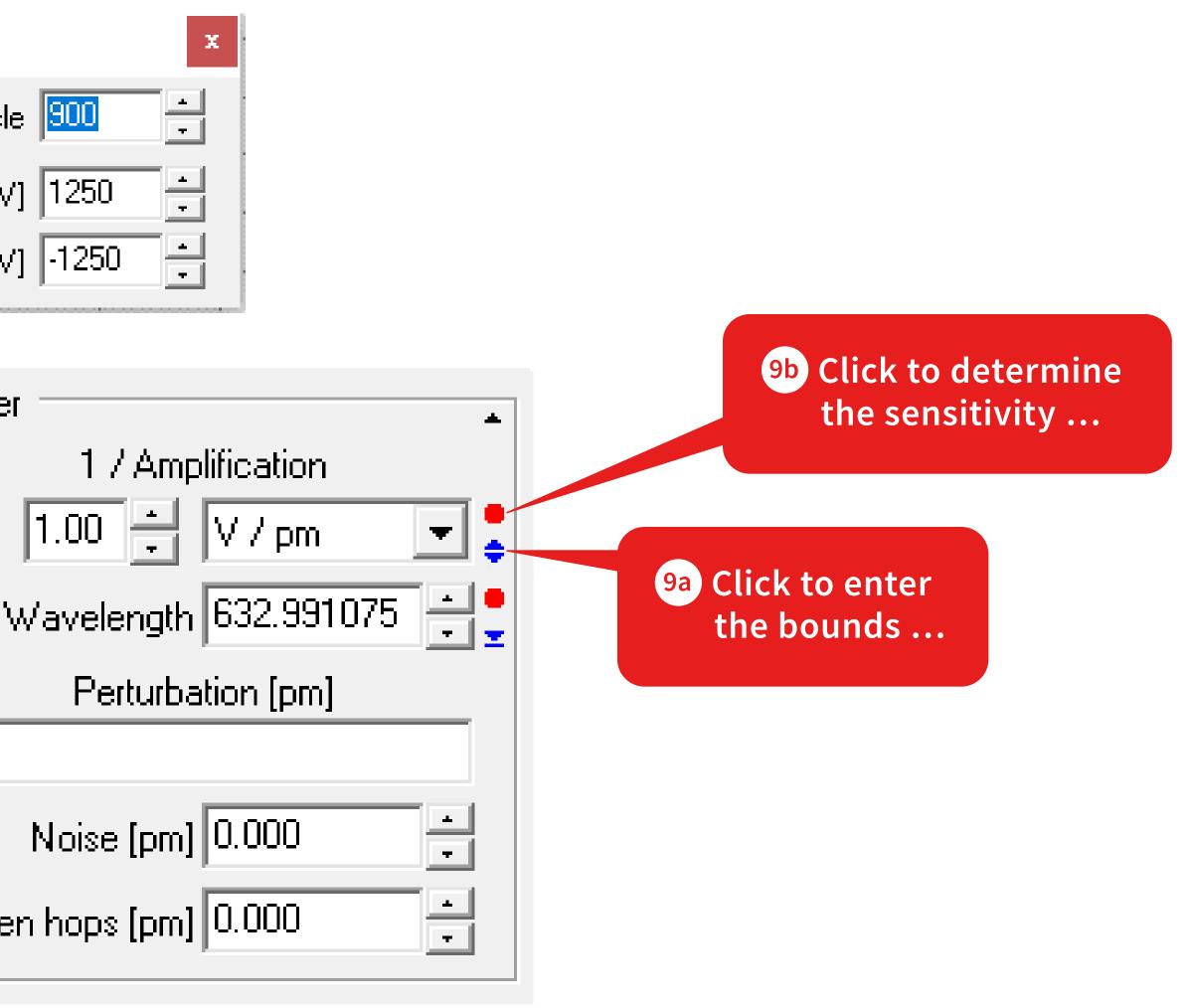
Lower voltage border [mV] -1250

Click on the blue triangles to enter the bounds (range should be smaller or equal to the bounds in 1.) and number of collection points used for calculation.

Then click on the red dot <sup>9b</sup> to automatically determine the sensitivity. Once this is determined transfer the result to the frame "Regulation" and enter it as the "Sensitivity" of the laser.

**Caution:** this will vary the output voltage, so a safe choice for the bounds is important.

<b>.</b>
3





### Reference Voltage

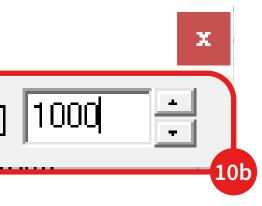
Reference Voltage [mV] 1000

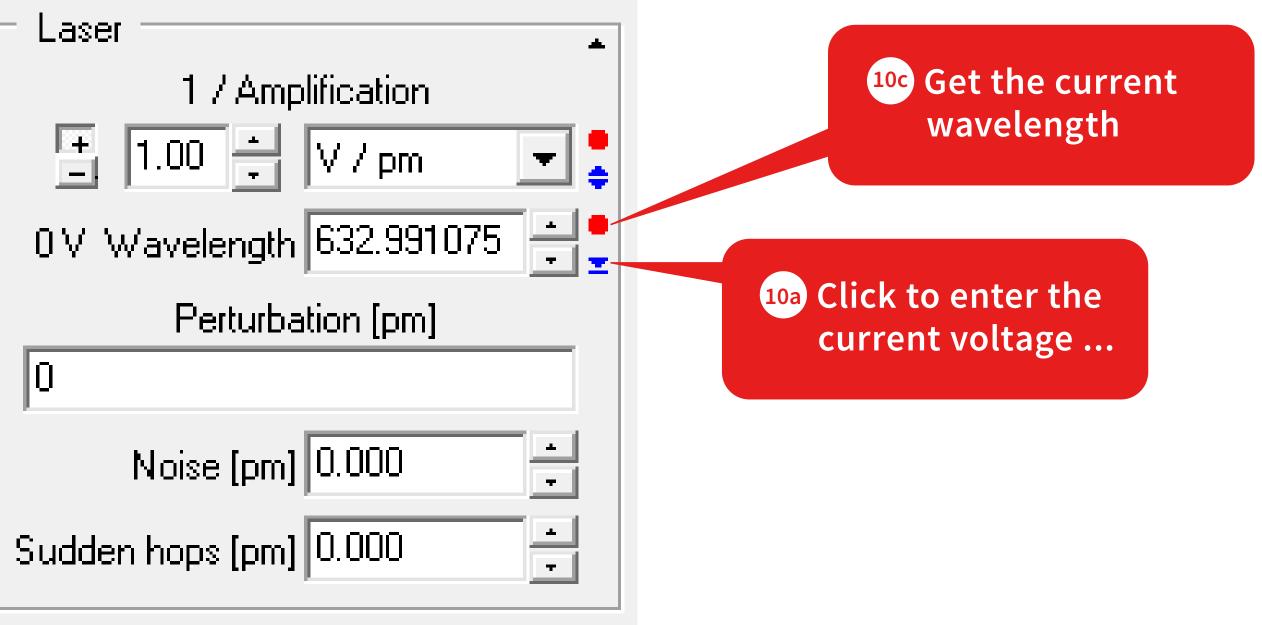
Laser 0

Click on the **blue triangle** 10a.

Enter the **current voltage** 10b.

Get the corresponding wavelenth by clicking on the red dot 100.







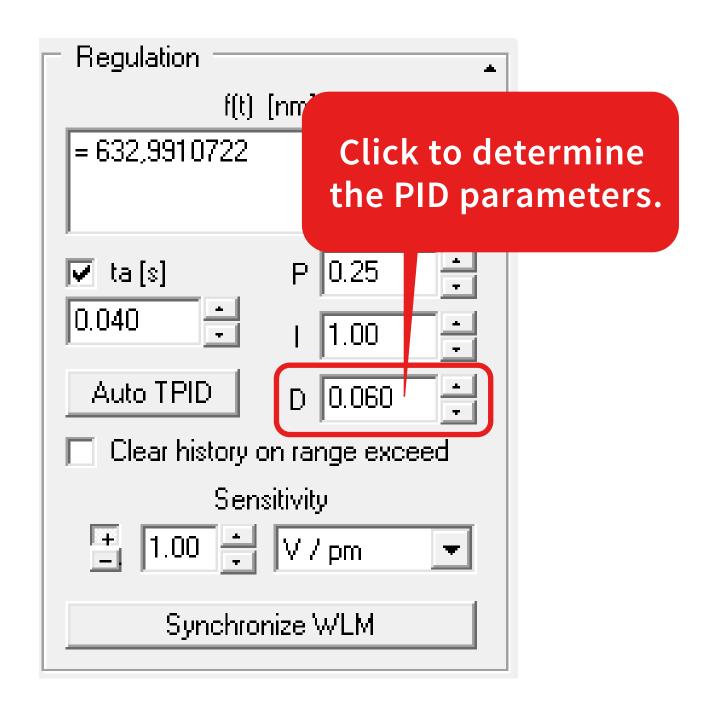
Regulation								
fít) [nm]								
= 632,9910722								
✓ ta [s] P 0.25								
0.040								
Auto TPID D 0.060								
Clear history on range exceed								
Sensitivity								
+     1.00     +     ∨ / pm								
Synchronize WLM								

<b>11a</b>
Regulation
f(t) [nm]
= 632,9910722
🔽 ta [s] 🛛 P 0.25 🚔
0.040
Auto TPID D 0.060
Clear history on range exceed
Sensitivity
1.00 🗧 V / pm 💌
Synchronize WLM

Enter a target wavelength or a function.

In this example the laser should be **stabilized at 632.9910722 nm.** 





Press "Auto TPID" to determine the
PID parameters. Finally, you can close
the PIDSim2. Now the system should
be ready for a test.



Laser Control														x
Regulatio	in s	ign	al ac	stive	taket						F	ort	< <b>1</b> ]	2 ⊦
Modify <u>R</u> eference	<u> </u>		-									6	bratior ⊻ariou	
Signal + 1	F F										ito d Clea		r histor ow	y _
Reference	_													
Course: f	_			Ŧ						lr	nser	t	•	
= 632,9910	J72	2												
632.99107													••	
	0	5	10	15	20	25	30	35	40	45	50	55	t [s]	

For this start the Regulation.

You can optimize the regulation further by using the LongTerm application and minimizing possible unwanted effects by altering the PID parameters.





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