gnavigator quick reference guide

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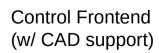
2024-12-02, version 1

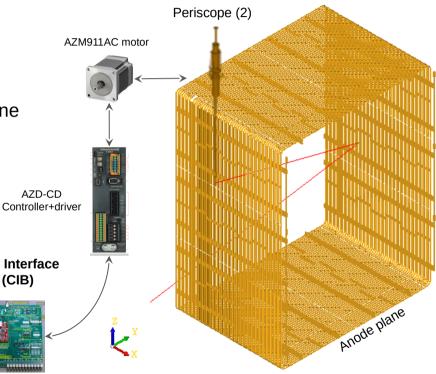
gnavigator

Frontend to **control** the **periscope and laser**, guiding the beam through the **Field Cage** while **avoiding sensitive areas**:

- Uses directly the existing CAD drawings;
 - Based on OpenCascade (CE) libraries;
- Able to identify the part being hit and determine the reflected beam direction.
- Offsets can be corrected based on reference shots (e.g. PIN diodes)
- All actions (e.g. periscopes status, periscope movements) are made through the CIB.

Calibration Interface Board (CIB)





(screenshot from the control frontend)

gnavigator: at CERN np04-iols-srv-01 (1)

gnavigator is installed on np04-iols-srv-01, to run it follow the steps:

- 1) If connecting to **np04-iols-srv-01** via SSH, include the -X flag to enable X11 forwarding: ssh -X user@np04-iols-srv-01
- From either the remote or local terminal console, if it doesn't already exist, create a working directory (e.g., mkdir laser).
- 3) Inside your working directory:
 - A) Execute **gnavigator-P1** to launch **gnavigator** configured for the <u>P1 laser periscope</u>;
 - B) Execute **gnavigator-P2** to launch **gnavigator** configured for the <u>P2 laser periscope</u>;
- 4) the gnavigator-[P1|P2] command creates a default configuration file (config_per[1|2].json) inside the working directory and links the default config.json to config_per[1|2].json, respectively;
- Subsequent calls to gnavigator-[P1|P2] inside the same working directory will not recreate the correspondent configuration files; Instead, they will just re-link config.json to config_per[1|2].json, as appropriated;
 - A) The **config_per[1|2].json** files can be modified locally to reflect each user's preferences. These configuration files are only created automatically if not existing).

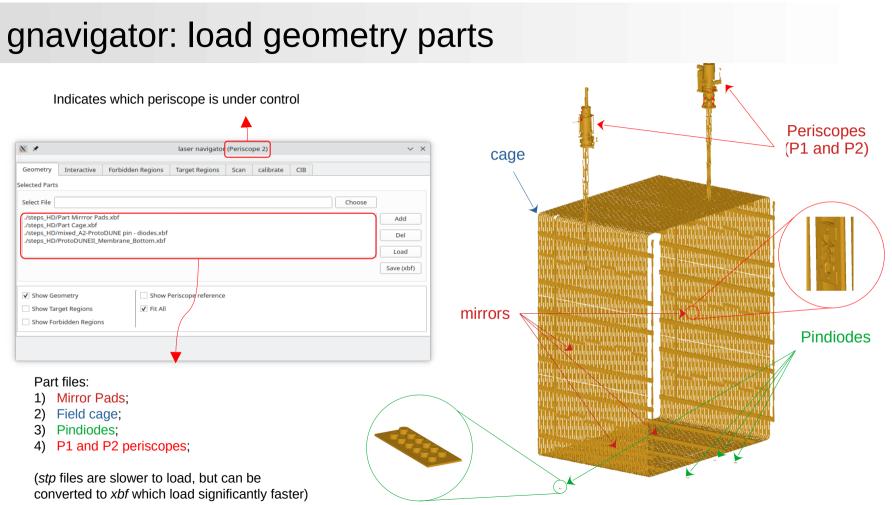
gnavigator: at CERN np04-iols-srv-01 (2)

Alternatively, users can use a VNC session for better interaction with the GUI. Detailed instructions can be found here: https://twiki.cern.ch/twiki/bin/view/Main/VNCCONNECTIONS

Yet another option is to take advantage of ssh tunneling to start VNC directly at **np04-iols-srv-01**:

- ssh into np04-iols-srv-01 and use the above instruction to set a VNC password and start a VNC server inside a screen session: vncserver :ff -localhost -name iols-Session [-autokill] -geometry 1920x1080 (ff is a number between 00 and 99 – see tunnel below)
- From you local machine open a ssh tunnel through lxplus:
 - (auto)ssh -L9999:localhost:59ff -J user@lxplus.cern.ch user@np04-iols-srv-01
- Use your VNC client to connect to localhost:9999 from you local machine.
- User the instruction on the previous slide to start **gnavigator**.

The latest approach ensures that **gnavigator** continues to run even if the internet connection fails, ans provides a smooth interaction with the GUI.



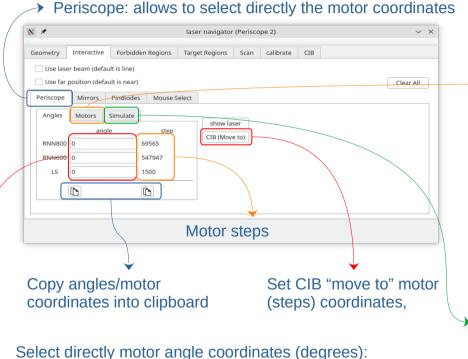
gnavigator: Interacting with the geometry

Use the mouse to interact with the loaded geometry:

- Click and hold the middle mouse button and move the mouse up|down|left|right to rotate the geometry;
- Click the middle mouse button to center that point on the drawing canvas;
- Rotate the mouse wheel to zoom in out the geometry over the center point of the geometry;
- In the Interactive → Mouse Select tab Ctrl + Click the right mouse button to select the coordinates of the clicked point

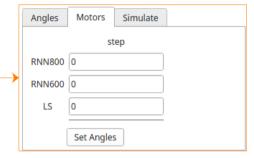
(Note: when the connection is remote using X11 forwarding, any change in the geometry display can take a few seconds to update/refresh)

gnavigator: Interactive targeting (1)



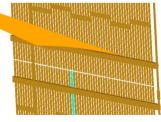
 correspondent motor steps are only updated after clicking "show laser".

Select directly motor coordinates



Quick simulation of laser movement (Do not calculate reflections neither check against forbidden regions)

Angles	Motors	Simulat	e	
	step i	min		step max
RNN800	0		0	
RNN600	0		0	
LS	0		0	
	Simulate			



(RNN800 movement)

gnavigator: Interactive targeting (2)

pad 3

pad 4

mirror 3

mirror 4

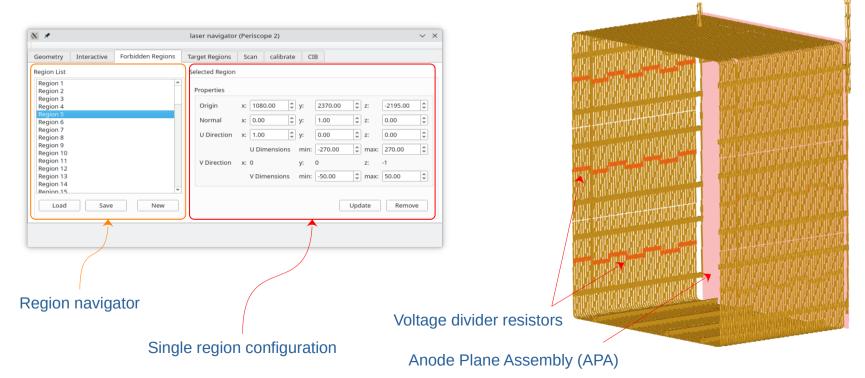
mirror 5

*	laser navigator (Periscope 2)	~ ×		Select coor	dinates	using mouse clicks
eometry Interactive Fork	vidden Regions Target Regions Scan calibrate CIB			Periscope Mirrors	Pindiodes Mou	use Select
Use laser beam (default is lin	_			Mouse Selection (Ctrl+Rig	ht Button) C	ptions
Use far position (default is no		Clear All		Coordinates		Fire On-Click
Periscope Mirrors Pindio				x (mm):		Open Window with coordinates
Angles Motors Simula	show laser)	y (mm):		Fill Periscope (a1,a2,a3)
RNN800 0	step CIB (Move to)			z (mm):		Uses Fixed a1 (Periscope Tab)
RNN600 0	547947			Þ		
LS 0	1500					
				\searrow		
/				\sum		
			Periscope Mirrors Pindiodes	Mouse Select		
Selec	t coordinates for 1 or more mirrors		Calibration Piodes			
Perioren	Mirrors Pindiodes Mouse Select		Pindiode Pad: Pad Pi	ndiode:		
Periscope			🗌 pad 1 📃 Pin	diode 1 Pindiode 5	Pindiode 9	
Mirror Pa			🗌 pad 2 📃 Pin	diode 2 Pindiode 6	Pindiode 1	0
pad 1	mirror 1 (central)			diode 3 Pindiode 7	Pindiode 1	
D pad 2	mirror 2		pad 4 Pin	diode 4 Pindiode 8	Pindiode 1	2

Select coordinates for 1 or more pindiodes

gnavigator: forbidden regions

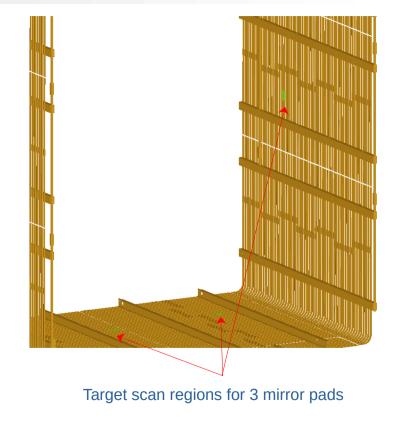
Define regions we **forbid** the laser to hit either directly or after a reflection:



gnavigator: target regions

Define regions we want to target during a scan:

🐹 🗶 laser navigator (Periscope 2) $\sim \times$ Forbidden Regions Target Regions Scan calibrate CIB Geometry Interactive **Region List** Selected Region Region Region 2 Properties ✓ Region 3 ‡ у: ‡ z: Origin x: 1379.00 1465.00 -3290.00 **‡** у: ‡ z: 0.00 1.00 0.00 Normal X: U Direction 0.00 0.00 🗘 z: 1.00 X: max: 70.00 U Dimensions step: 10.00 1 min: -70.00 0 V Direction X: 1 V: 0 Z: V Dimensions step: 10.00 min: -50.00 max: 50.00 Load Save New Update Remove **Region navigator** Single region configuration



gnavigator: scan and calibrate

Perform a scan:

<u>x</u> ×			laser navigator	(Perisco	pe 2)		~ >
Geometry	Interactive	Forbidden Regions	Target Regions	Scan	calibrate	CIB	
Model Scan							
🖌 Scan O	nly target selec	ted regions	Show Laser	beams (A	II OK)		
Check I	Reflections agai	inst forbidden Regions	Show Laser	lines			
✓ Overric	le existing scan	data	✓ Show good	laser line	s		
Show I	nterest Region	Source	✓ Show good	laser line	s with a refle	ection	
Show N	lear Interest To	ol (latest scan only!)	Show laser	lines obso	ured/hiting	directly a forbidd	den region
Show F	ar Interest Tool	(latest scan only!)	Show laser	lines hitin	g directly a f	forbidden region	after reflection
Show N	lear Interest Re	gions (latest scan only!)	Scan R	efine Ang	le 10.00	-	
Show F	ar Interest Reg	ions (latest scan only!)	Scan G	ranularity	0.50	\$	
							scan

Calculate the motor coordinates (RNN800, RNN600 and LS) for the target points defined for each of the **target regions**:

- a) Considers the transversal profile of the laser beam;
- b) Find the coordinates with best clearance when going through the field cage;
- c) Avoids forbidden regions (direct and reflection hits);

Calibrate motor offsets:

Geometry	Interactive	Forbi	dden Regions	Т	arget Re	egions	Scan	calibrat	e CIB				
it Range					_	-	Minimizati	ion Parar	neters				
motor	min		max		nbi	ns	mot	or	Start		conv. min	cont. f	act
RNN800	-50000	-	50000	-	20	\$	RNN8	800	D	\$	0.50	\$ 0.90	1
RNN600	-50000	-	50000	-	20	\$	RNN	500	0	\$	0.50	\$ 0.90	
LS	-50000	*	50000	*	20	\$	LS		0	-	0.50	\$ 0.90	4
/alues												Radius 5	;
pindiode,3,4	-> 86996,5842 -> 86996,5843 -> 86996,5840	64,135	15				Load						
pindiode,3,7 pindiode,3,8	 -> 86996,5840 -> 86996,5840 1 -> 86996,584 	24,135 24,135	33 13				Save						
pinaioae,s, i	1 -> 80330,384	120,13	400				Calibrat	e					

Calculate the motor offsets (RNN800, RNN600 and LS) from a list of target coordinates:

- a) Supports (x,y,z) coordinates for the laser hit position;
- b) Supports naming (i.e. mirror, pindiode) of the laser hit;

CIB (1): Monitoring

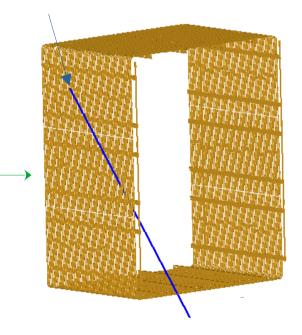
(dis)connect from/to CIB server (different servers for P1,P2,...)

X 🗶				laser na	vigato	or (Periscope 2)		~ ×
Geometry	Interactive	Forbidden	Regions	Target Re	gions	Scan calibrate	СІВ	
Monitor	Control Ext	tra						
Disconne	ect opc.tcp://loo	calhost:4841)——					
	Property		Va	alue	^		7] : Failed to connect to se	
13 LS1.LST/	AGE.current_pos	ition_mo	16124				7] : Failed to connect to se 7] : Fail to connect to CIB	rver.
14 LS1.LSTA	AGE.state		offline			[2024-12-02 14:54:5	1] : Successfully connected	
15 LS1.PM1	.average_readi	ng	9.6e-05			[2024-12-02 14:54:5	1] : Connected to server ar	nd started monitoring.
16 LS1.PM1	.energy_readin	g	9.6e-05					
17 LS1.PM1	.state		offline					
18 LS1.RNN	1600.current_po	sition_cib	610041					
19 LS1.RNN	1600.current_po	sition_m	610041					
	600.state		offline		-	4		•

- [RNN800, RNN600, LS] motor positions and status,
- Shutters status;
- DAC threshold;
- etc

(values are updated every second)

laser direction indicator: provides a visual indication of the direction the laser/periscope is pointing, independently of the actual laser status (e.g offline, warming)



CIB (2): Control

∞ *	laser navigator (Periscope 2) V X	
Geometry Monitor	Interactive Forbidden Regions Target Regions Scan calibrate CIB Control Extra Single Point Scan	to the CIB servelse is control command from
Send Co		Loads and NOT edit
X ★ Geometry Monitor	Iaser navigator (Periscope 2) V X Interactive Forbidden Regions Target Regions Scan calibrate CIB Control Extra Extra Extra Extra Extra	Direction of a (up/down)
Config	Single Point Scan	If selected, fi
Mov X X	laser navigator (Periscope 2)	Move the pe coordinates) tab Interacti
Geometry Monitor Config Sence	Interactive Forbidden Regions Target Regions Scan calibrate CIB Control Extra Single Point Scan	Send the scan I The scan posit regions.
Save	Save to a json file / show	v at the CAD the sc

IMPORTANT: multiple clients can be connected simultaneously to the CIB server for monitoring and control. Make sure no one else is **controlling** the laser before sending **ANY** laser command from your gnavigator instance.

Loads and send a configuration file (json) to the CIB. Do
 NOT edit the config file without consulting a CIB expert!

Direction of approach to the new position (up/down)

If selected, fire the laser the chosen number of times at the new position. Not checked against forbidden regions!

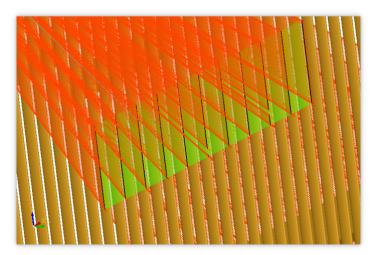
Move the periscope to a new position (motor coordinates). The position can be filled from the tab **Interactive > Periscope**

Send the scan loaded/available from the tab **target regions**. The scan positions are checked against forbidden regions.

Save to a json file / show at the CAD the scan traces as will be sent to the CIB (usefull for debug)

CIB (3): Extra

Geometry Interactive Forbidden Regions Target Regions Scan calibrate CIB Monitor Control Extra plot triggers Load	Monitor Control Extra	Monitor Control Extra	🐹 🗶			laser navigator	(Perisco	pe 2)			~ ×
Monitor Control Extra	Monitor Control Extra	Monitor Control Extra	Geometry	Intoractivo	Forbiddon Pagions	Target Regions	Scap	calibrato	CIR		
						larget Regions	Scan	Calibrate	CID		
plot triggers Load	plot triggers Load	plot triggers Load								 	
			plot trigge	rs							Load



Loads a text file containing the actual trigger positions (motor coordinates) and show them at the CAD (see examples):

timestamp;rnn800;rnn600;LS

.....



Send feedback on your user experience and report bugs/issues:

- slack: @Francisco Neves
- email: neves@lip.coimbra.pt