



Manual Q1 2017

Confidential

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## Confidential

## 1. Software overview



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legen New Sample		Presets Show block blag		AC
	SNAP GRAB	Prepare Run Scrip	ot QUIT	Image ; FOV = 41.01mm X 32.12mm
	25W1		27.9 VS (μm) 3.549 magn. 705.8 SDD 198.9 SOD	
Tube Motors	Camera Scan	Image Program	Sample Extra	
Main Advanced	Statistics			
XWT-120-TCNF High Power Target power Move to default pos	Tube Focus Mode Output mode	10 Emissio 0 Emissio	current act (μA) in current (μA) in current act (μA) ie current act(μA) Filter	Please enterviser D - re and password User name
	Adjust Filament	OK	Tube status Filament status	Password
Autocenter kV	Autocenter all	ОК	Autocenter status	
		CLOSED	Interlock status	
Reset tube		0.000001	Vacuum level	
	н	ALT		OK Cancel
				○         Image: August and Augus
	_		< ) <sup>^</sup>	

## Main software window

The main software window is divided into 4 parts:

	/		
s	4		

#### Function area

In the function area gives you easy access the most common scanner controls for the X-ray tube, detector and motor stages. It also enables you to prepare and execute scan scripts.

## 2

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#### Setting area

The settings area contains the several tabs with more detailed settings for all components of the system (X-ray tube(s), detector(s) and motors) and additional functions for controlling the system.

## 1. Software overview



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	) 11	,		2
XRAY OFF	SNAP GRAB	Prepare Run Scrip	t QUIT	Image ; FOV = 41.01mm X 32.12mm
	HW25W1		27.9 VS (μm) 3.549 magn. 705.8 SDD 198.9 SOD	
Tube Motors	s Camera Scan	Image Program	Sample Extra	
Main Advance	d Statistics			
XWT-120-TCNF High Power Target power Move to default p	Focus Mode	10 Emissio 0 Emissio	surrent act (μA) n current (μA) n current act (μA) e current act(μA) Filter	Please entenuser part = and password
	Start Warmup	LimitedOpFilAdj	Tube status	
	Adjust Filament	ОК	Filament status	Password
Autocenter kV	Autocenter all	ОК	Autocenter status	
		CLOSED	Interlock status	
Reset tube		0.000001	Vacuum level	OK Cancel
	н	ALT		
				○         1470x1152 0.47X 161.00 (0,819)         0         65535         ☑AUTO

## Main software window

The main software window is divided into 4 parts:



#### Image area

In the image area the data captured by the detector can be displayed and additional tools for image enhancement and positioning are available.

## 4

#### Toolbar

In the toolbar addition functions are available for login into the software, setting info about the sample or hardware filters that are placed in the system and system specific Add-on tools can be selected

## 2. Getting started



🛂 Acquila		- 0	$\times$
Logon New Sample New Filter Add-ons Presets Show Block Diagr	am Exit		
🖷 间 II			A
XRAY OFF SNAP GRAB Prepare Run Scrip	t QUIT	Image ; FOV = 41.01mm X 32.12mm	
High Power         Pocus Mode         10         Emissio           Target power         Output mode         0         Emissio           00         Apertur         00         Apertur		Logon — I X	
Move to default pos	Filter	Please enter user name and password User name	
Start Warmup LimitedOpFilAdj	Tube status		
Adjust Filament OK	Filament status	Password	
Autocenter kV Autocenter all OK	Autocenter status		
CLOSED	Interlock status		
Reset tube 0.000001	Vacuum level		
		OK Cancel	
HALT		D C 0 1470x1152 0.47X 161.00 (0,819)	то

## Logon

When the software is started, it will be necessary to logon. This is mainly to avoid unintended use of the system, but it also defines the level of the user. The software has different levels (from Developer to Operator) with different permission for each level. The selected user also defines the default

folders for storing the data

By entering the username and password you will be able to control the scanner and the function window will become accessible.

User name		
Password		

## 2. Getting started



🛂 Acquila				-	
Logon New Sample New Fi	ilter Add-ons	Presets Show Block Diagr	am Exit		<b>?</b> A
•••					<u></u>
XRAY OFF	GRAB	Prepare Run Scrip	t QUIT	Image; FOV = 41.01mm X 32.12mm	
0.0     W act       Tube     Motors     Came       Main     Advanced     Statist       XWT-120-TCNF     Image: Came       High Power     Image: Came	averages era Scan	0.1 Target o 0 Target o 10 Emissio 0 Emissio	27.9         VS (μm)           3.549         magn.           705.8         SDD           198.9         SOD           isample         Extra           urrent (μA)         urrent act (μA)           n current act (μA)         a current act (μA)	Logon - C X	
			Filter	Uşer name	
	start Warmup	LimitedOpFilAdj	Tube status	Password	
	djust Filament	ОК	Filament status	Password	
Autocenter kV A	Autocenter all	ОК	Autocenter status		
<b>D</b> (1)		CLOSED	Interlock status		
Reset tube		0.000001	Vacuum level	OK Cancel	
	H/	LLT			
				▶         ●         □         1470x1152 0.47X 161.00 (0,819)         0         ↓         65535         ▶	

## X-ray tube warmup

When the system has been inactive for more then 5 hours, a warmup of the X-ray tube is due. During warm-up the tube will gradually increase the kV and current to avoid arcing.

A warmup can be performed in the Settings Area in the Tube tab by clicking the Start Warmup button. A popup window lets you move the detector back to avoid damaging the detector. The warmup procedure automatically starts the X-ray tube and usually takes about half an hour.

ibe Motors	Camera Scan	Image	Prog	ram	Sample	Extra
Main Advanced	Statistics					
XWT-120-TCNF	✓ Tube		0.1	Target	t current (µ	A)
High Power	Focus Mode		-0	Target	t current ad	:t (μΑ)
-			10	Emiss	ion current	: (μΑ)
Target power	<ul> <li>Output mode</li> </ul>		0	Emission current act (µA)		act (µA)
Move to default pos			0.0	Aperti	ure current	act(µA)
				1		
Nove to default pos				1		
Nove to default pos					Filter	
Move to default pos	Start Warmup	imitedOp	FilAdj		Filter Tube st	atus
Move to default pos	Start Warmup Adjust Filament	.imitedOpl	FilAdj			
Autocenter kV		· · ·	FilAdj		Tube st	nt status
	Adjust Filament	ОК	FilAdj		Tube st	nt status nter status

## 2. Getting started

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70.0 kV

5.0 w

Tube

Main

0.0 kV act

0.0 W act

XWT-120-TCNF

High Powe

Target power

Move to default pos

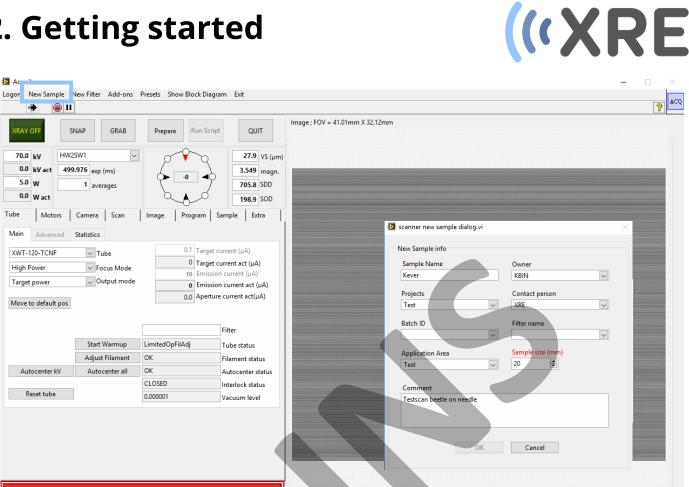
Autocenter kV

Reset tube

Advanced

SNAP

HW2SW1



#### HALT

#### New sample

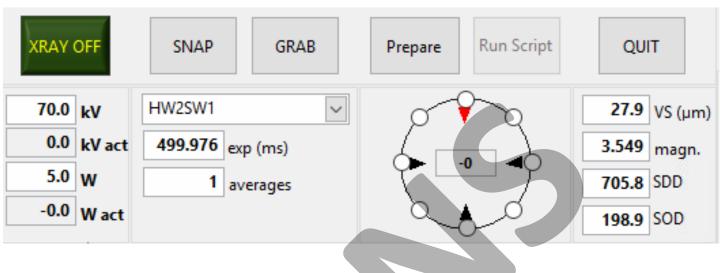
When a new sample is placed in the scanner it is advised to fill in the information about the sampled. By clicking the New Sample button in the toolbar a new window is displayed in which sample parameters can be added.

The Sample size (mm) parameter is shown in red and is the most important parameter, as it determines the safety limits of the motor stages in the system. This parameter refers to the total sample diameter: sample + anything that is around the sample (sample holder, cell, container, ...).

Sample Name Kever		Owner KBIN	~
			•
Projects		Contact person	
Test	$\sim$	XRE	$\sim$
Batch ID		Filter name	
	$\sim$		~
Application Area		Sample size (mm)	
Test	$\sim$	20 🖨	
Comment			
Testscan beetle on ne	edle		

65535 AUTO

# («XRE

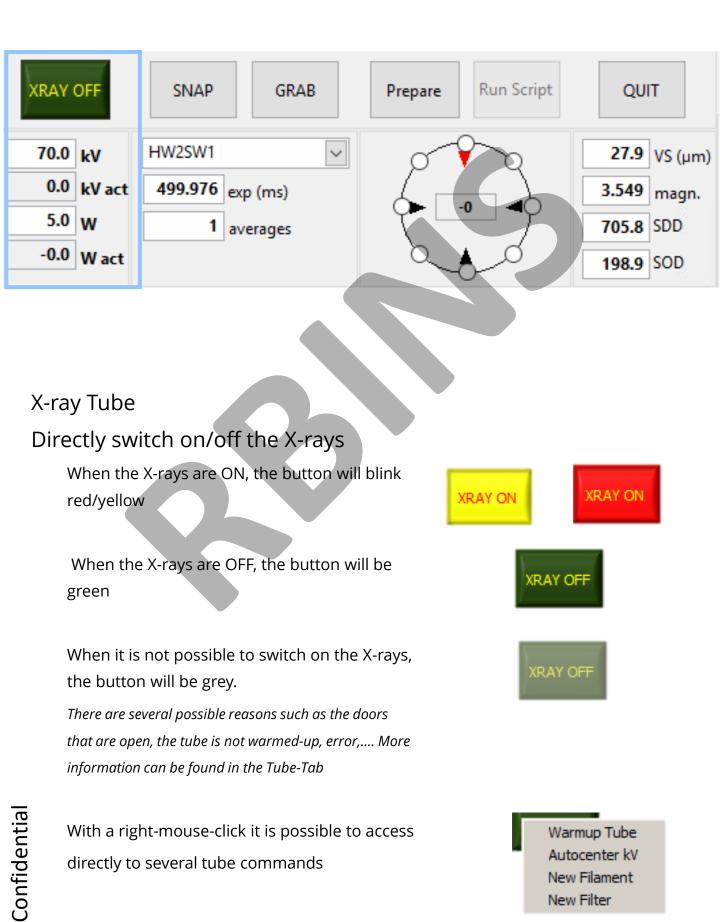


## Function area:

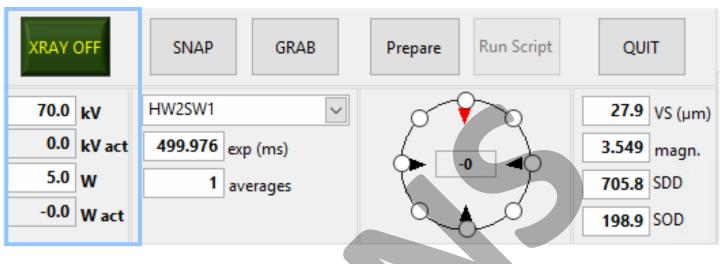
In the function area you are able to:

- Directly switch on/off the X-rays and change the kV or Power
- Take one radiography or grab continuously and change the detector settings such as the binning mode, exposure time and averaging
- Rotate to a pre-defined set of angles (0°, 45°, 90°,...) and move the sample with the micro-positioner
- View and alter the SDD (Source to Detector Distance), SOD (Source to Object Distance and the voxel size (VS).
   SDD and SOD are in mm, VS is in µm!
- Prepare and run a script
- Quit the software in a proper way









## X-ray Tube

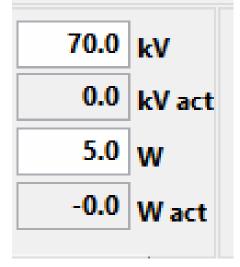
## Change the kV or Power

The source voltage can be changed using the *kV* indicator. The actual kV level of the source is shown in the *kV act* indicator.

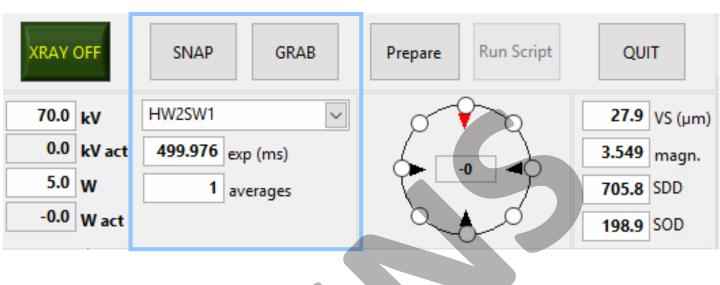
The source power can be changed using the *W* indicator. The actual power level of the source is shown in the *W* act indicator.

More information can be found on the *Tube* Tab.





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## Detector

#### SNAP

Takes one radiography.

## GRAB

Continuously takes radiographs. With the right-mouse button it is possible to activate the auto-save function and set a delay between consecutive saved files.

## Binning

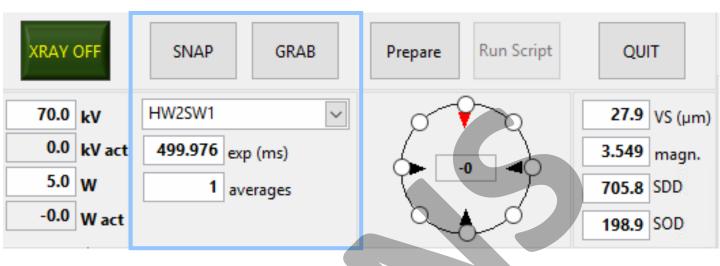
In the drop-down menu it is possible to select the binning and mode of the detector.

Detector binning is used to limit the amount of data or increase the SNR-ratio of an image. In binning, several pixels are grouped together as if they were one pixel, the value of the binned pixel is the average of the group.

SNAP	GRAB
HW2SW1	$\sim$
HW1SW1	
HW2SW1	
HW1SW2	
HW2SW2	
HW1SW4	

A detector of for example 1000 x 1000 pixels can be binned by a factor of 2, resulting in a 500 x 500 image. Each pixel of this image is the average of four original pixels, which is a SNR of 4 times.

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## Detector

## Binning

The detector can be binned in hardware (HW), which will typically also result in a faster readout, or in software (SW).

Combinations of both are also possible.

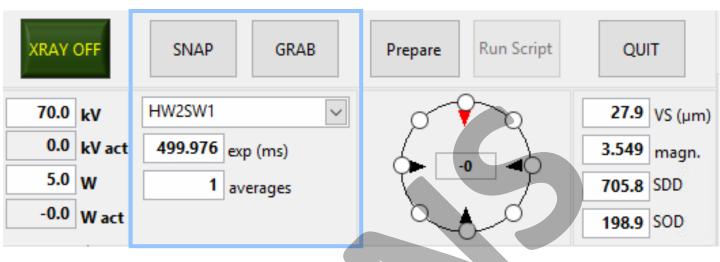
Examples:

Mode HW2SW1 is hardware binning 2 and software binning 1 which results in a final binning of 2.

Mode HW2SW2 is hardware binning 2 and software binning 2 which results in a final binning of 4.

SNAP	GRAB
HW2SW1	~
HW1SW1	
HW2SW1	
HW1SW2	
HW2SW2	
HW1SW4	
	a i Scall - I

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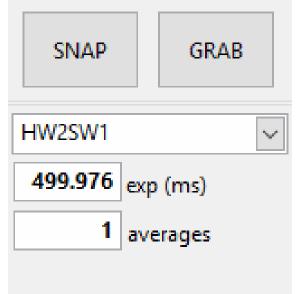
## Detector

#### Exposure time

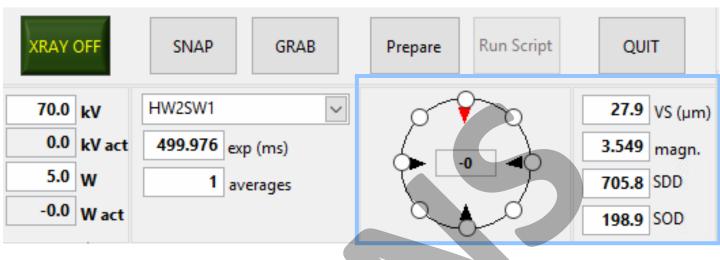
The exposure time will automatically limit itself to the smallest possible exposure time if a lower value is input. Higher exposure timings will result in a better SNR but it is important to make sure the detector is not saturated!

#### Averages

Averaging is another method to increase the SNR when the sensor becomes saturated. When the averaging number is higher than 1 and an image is taken, the subsequent improved images will be displayed and the last image is the result of the total number of averages.



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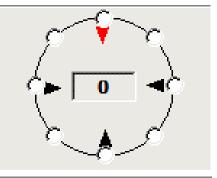
## Motor Positioning

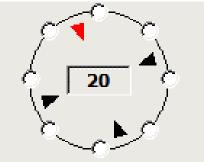
## Rotation

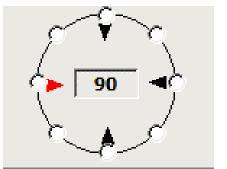
The indicator in the middle of the circle reflects the actual angle of the rotation stage. The red arrow shows with which position on the circle this corresponds.

The dots can be used to rotate to predefined positions (0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°). This is mainly useful during alignment of the sample.

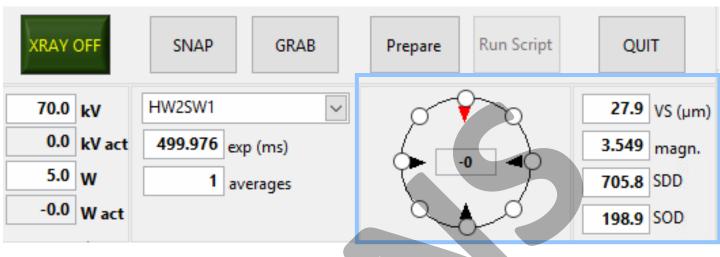
If a X-Y micro-positioner is installed, the black arrows can be used to move the sample in the indicated direction. Since the arrows also rotate, the direction of movement corresponds with the image in the image area.







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## Motor Positioning

## Magnification

The SOD (Source-to-Object-Distance) is the calibrated distance in mm between the spot of the X-ray source and the centre of the rotation stage.

The SDD (Source-to-Detector-Distance) is the calibrated distance in mm between the spot of the X-ray source and the centre of the detector.

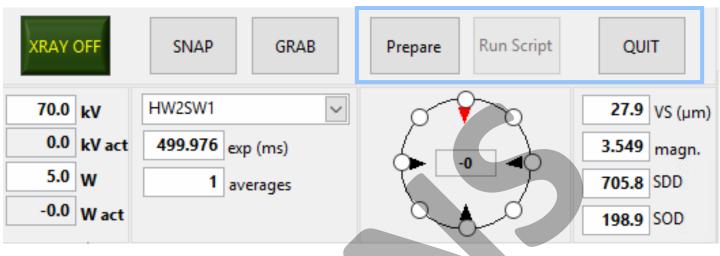
The magnification is the ratio between SDD/SOD.

The VS (voxel size) is the pixel size of the detector divided by the magnification in  $\mu$ m.

27.9 VS (μm) 3.549 magn. 705.8 SDD 198.9 SOD

These indicators can also be used as an input and the system will be moved to change the positions accordingly. A warning message will be prompted to confirm the movement

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## Preparing and running the CT script

#### Prepare

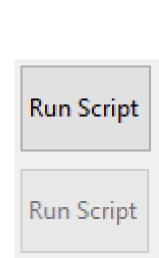
When all settings are OK and you want to start a CT-scan, you can use the prepare button to generate a CT-script. More info in the preparescript section (5). During a CT-scan the prepare button will change to a pause button that can be used to pause a script.

#### **Run Script**

When a script has been prepared, you can run the script using this button. When the script is running this button can also be used to stop a script. If there is no script available, the button will be greyed-out

## QUIT

This button has to be used to properly stop the software.



OUIT

Prepare

Tube	Motors	Camera	Scan	Ima	ige 🛛	Prog	ram	Sample	Extra	
Main	Advanced	Statistics								
XWT-12	20-TCNF	∼ Tul	be	[		0.1	Targe	t current (	μΑ)	
High Pr	ower	For	us Mode	[		-0	Targe	et current a	ct (µA)	
High Power		Focus Mode				10	Emis	Emission current (µA)		
Target	power	√ Ou	tput mode	[		0	Emis	sion curren	it act (μA)	
	default pos			[		0.0	Apert	ure curren	t act(µA)	
								Filter		
		Start V	Varmup	Limi	tedOpFi	lAdj		Tube s	tatus	
		Adjust	Filament	OK				Filame	nt status	
Auto	ocenter kV	Autoc	enter all	OK				Autoce	enter status	
		_		CLO	SED			Interlo	ck status	
Re	set tube			0.000	0001			Vacuu	m level	

## Tube

Depending on the selected output mode the corresponding input is enabled (emission current, target current or target power). The preferred output mode is **target power** and is displayed in the Function area.

Depending on the size of the sample and the desired resolution the focus mode can be selected.

Identical to the target power and KV, both the desired and the actual values are given and can be used as input if the mode is selected. The aperture current should be low

Main	Advanced	Statistics	
XWT-1	20-TCNF	V Tube	
High P	ower	- Focus Mode	
Target	power	🗸 Output mode	2

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High Power	- Focus Mode
High Power	Output mode
Microfocus	
Nanofocus	

0.1	Target current (µA)
-0	Target current act (µA)
10	Emission current (µA)
0	Emission current act (µA)
0.0	Aperture current act(µA)

4. The Set	tings	area	a				(X	R	E
Tube Motors	Camera 3	Scan	lmage	Program	Sample	Extra			
Main Advanced	Statistics								
XWT-120-TCNF High Power Target power Move to default pos	✓ Tube ✓ Focus	Mode		-0 Targe 10 Emiss 0 Emiss	t current (µ t current ac ion current ion current ure current	tt (μΑ) : (μΑ) : act (μΑ)			
	Start Wa	rmup	LimitedOpF	FilAdj	Tube sta	atus			
	Adjust Fila	ament	ОК		Filamen	nt status			
Autocenter kV	Autocent	ter all	ОК		Autocer	nter status			
Reset tube			CLOSED 0.000001		Interloc Vacuum				

## Tube

When a filter is changed, the according one should be selected from this list. In this way, the used filter will be logged or can be used as a preset. The filter can also be changed with a right-mouse-click on the X-RAY button. The available filters can be changed in the settings.ini file.

	Start Warmup	LimitedOpFilAdj	Tube status				
The current status of the tube is	shown here.						
The button on the left can be use	ed to start a						
warm-up. During warm-up the t	warm-up. During warm-up the tube will						
gradually increase the kV and cu	rrent to avoid						
arcing. This procedure should b	pe repeated						
often and might be mandatory	y before the						
X-rays can be switched on.							

Filter

4. Tl	he Set	ttings are	a ((XRE	
Tube	Motors	Camera Scan	Image Program Sample Extra	
Main	Advanced	Statistics		
High Po Target (		✓ Tube ✓ Focus Mode ✓ Output mode	0.1       Target current (μA)         -0       Target current act (μA)         10       Emission current (μA)         0       Emission current act (μA)         0.0       Aperture current act(μA)         Filter	
		Start Warmup	LimitedOpFilAdj Tube status	
		Adjust Filament	OK Filament status	
Auto	ocenter kV	Autocenter all	OK Autocenter status	
			CLOSED Interlock status	
Re	set tube		0.000001 Vacuum level	

Tube		Adjust Filament	ОК	Filament status
The stat	tus of the filament is	shown here and it		
is also p	ossible to perform a	a filament adjust.		
During	this procedure the tu	ube will look for		
the opti	mal filament setting	s to avoid		
unnece	ssary usage of the fil	ament. Especially		
when a	new filament is ins	stalled it is		
import	ant to perform fila	ment adjust very		
freque	ntly (every 4h is adv	vised).		
	Autocenter kV	Autocenter all	ОК	Autocenter status
The cen	tering of the focusin	ig is important to		
get goo	d resolution images.	Centering should		
be perf	ormed regularly. It is	possible to		
autocer	ntre at a specific kV o	or to centre for all		
kV.				
The stat	tus of the interlock a	nd the vacuum	CLOSED	Interlock status
can be i	nspected here		0.000001	Vacuum level
The stat	ghas occurred, it is p	ossible to reset	Reset tube	
	-		Reset tube	

the tube

4. Tl	he Set	ttings are	a ((XRE	
Tube	Motors	Camera Scan	Image Program Sample Extra	
Main	Advanced	Statistics		
High Po Target (		✓ Tube ✓ Focus Mode ✓ Output mode	0.1       Target current (μA)         -0       Target current act (μA)         10       Emission current (μA)         0       Emission current act (μA)         0.0       Aperture current act(μA)         Filter	
		Start Warmup	LimitedOpFilAdj Tube status	
		Adjust Filament	OK Filament status	
Auto	ocenter kV	Autocenter all	OK Autocenter status	
			CLOSED Interlock status	
Re	set tube		0.000001 Vacuum level	

Tube		Adjust Filament	ОК	Filament status
The stat	tus of the filament is	shown here and it		
is also p	ossible to perform a	a filament adjust.		
During	this procedure the tu	ube will look for		
the opti	mal filament setting	s to avoid		
unnece	ssary usage of the fil	ament. Especially		
when a	new filament is ins	stalled it is		
import	ant to perform fila	ment adjust very		
freque	ntly (every 4h is adv	vised).		
	Autocenter kV	Autocenter all	ОК	Autocenter status
The cen	tering of the focusin	ig is important to		
get goo	d resolution images.	Centering should		
be perf	ormed regularly. It is	possible to		
autocer	ntre at a specific kV o	or to centre for all		
kV.				
The stat	tus of the interlock a	nd the vacuum	CLOSED	Interlock status
can be i	nspected here		0.000001	Vacuum level
The stat	ghas occurred, it is p	ossible to reset	Reset tube	
	-		Reset tube	

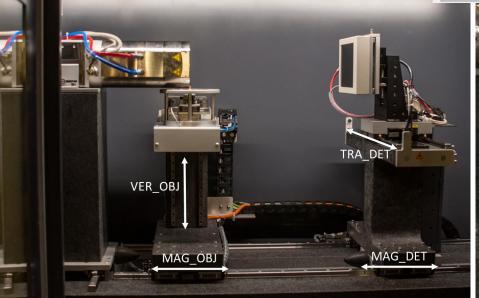
the tube

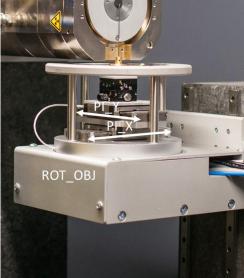
#### 4. The Settings area («XRE Motors Scan Tube Camera Image Program Sample Extra v motors ver\_obj move rel + 166.4189 position (mm) move abs 0 mm 100 previous position move rel back enable disable 40 mm/s set speed mm/s/s set accel. 20 move to ref. reference all lower limit 0 Move to preset reset set limits 235 upper limit Pl\_step size PI\_Y\_+ 0.001 10 ÷ PI\_X\_+ 10 PI\_X\_reset piezo 0,0 PI\_Y\_-Autocenter sample with piezo initialise component Motor Status

## Motors

Each available axis can be selected from this drop-down menu. When the axis is selected, the current settings are refreshed.

ver_obj 🗸 🗸	motors
ver_obj	
mag_obj	
tra_det	position
mag_det	
rot_obj	previous
PI_X	
PI_Y	mm/s





Camera Scan

Motors

Tube



1						
ver_obj	$\sim$	motors				
			move rel +			
move abs	166.4189	position (mm)	0 mm			
back	100	previous position	move rel -			
set speed	40	mm/s	enable	disable		
set accel.	20	mm/s/s	move to ref.	reference all		
set limits	0	lower limit	Move to preset	reset		
Section	235	upper limit				
				PI_step size		
		PI_Y_+				
reset piezo	PI_X	0,0 PI_X_+	0.001	10 ≑	10	
		PI_Y	Autoce	enter sample with	piezo	
initialise compon	ent			Mo	itor Status	

Image Program Sample Extra

#### Motors

In the position indicator, a new motor position value can be inserted, with the 'move absolute' button, the selected axis will move to the new position. For safety reasons, the current value will be refreshed if the move absolute button is not pressed after a new position is inserted.

In the relative movement input window a value can be inserted and with the 'move relative' buttons a relative movement is performed in either pos. or neg. direction.

The motor position shown here are actual motor position and not the calibrated SOD, SDD or other.

move abs	166.4189	position (mm)
back	100	previous position

move rel +				
0	mm			
move re	el -			

#### 4. The Settings area Tube Motors Camera Scan Program Sample Extra Image ver\_obj motors move rel + 166.4189 position (mm) 0 move abs mm 100 previous position move rel back disable enable 40 mm/s set speed mm/s/s 20 reference all set accel. move to ref. 0 lower limit Move to preset reset set limits 235 upper limit Pl\_step size PI\_Y\_+ 0.001 10 PI\_X\_+ 10 ÷ PI\_X\_reset piezo 0,0 PI\_Y\_-Autocenter sample with piezo initialise component Motor Status

## Motors

Speed and acceleration can be changed here.

For safety reasons, the range of absolute movement is limited with an upper and lower value. If necessary, the range can be adjusted. If a permanent change has to be performed, the limits can be found in the .ini file of the component.

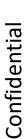
Movement of a certain axis can be enabled or disabled with these buttons. When the software is restarted, the axis will be enable again.

set speed	40	mm/s
set accel.	20	mm/s/s
and Kurdan	0	lower limit
set limits	235	upper limit



#### 4. The Settings area Tube Motors Camera Scan Program Sample Extra Image ver\_obj motors move rel + 166.4189 move abs position (mm) 0 mm 100 previous position move rel back disable enable 40 set speed mm/s 20 mm/s/s reference all set accel. move to ref. 0 lower limit Move to preset reset set limits 235 upper limit Pl\_step size PI\_Y\_+ 0.001 10 PI\_X\_+ 10 ÷ PI\_X\_-0,0 reset piezo PI\_Y\_-Autocenter sample with piezo initialise component Motor Status **Motors** After a power failure or when estimated necessary, it is possible to perform a reference all referencing of the motor stages. Either one or move to ref. all stages at once can be referenced. **Be very** Move to preset reset careful to follow the instructions as referencing is potentially dangerous if an object is still in place. Pl\_step size PI\_Y\_+





Movements and travel ranges of the X-Y micro-positioner on the rotation stage can be adjusted here. It is preferred to use the arrows in the function area to move the micro-positioning

stage.

mera am_horizontal ♀ 2 Binning value 1 number of frames xcam_vertical xcam_horizontal 0.0495 original pixel size (mm) y_start 0 ♀ ROI Select ROI 0 ♀ ROI x_start 0 ♀ 2940 ♀ x_end Reset ROI 2304 ♀ y_end OV Extended FOV orizontal Hor stretch EFOV_central position ♀ EFOV positions tra_det 0 ♀ 0 ♀ 0 ♀ 0 ♀ 0 ♀ 0 ♀ 0 ♀ 0 ♀ 0 ♀ 0		
Tube Motors Camera Scan Image	Program Sample Extra	
xcam_vertical xcam_horizontal     0.0495     original pi       y_start     0     ROI       Set ROI     0     ROI       x_start     0     x_end	ixel size (mm) Move to default position	
Extended FOV       Horizontal Hor stretch       1       1       1       0	tra_det 0 ver_det tra_det 0 ver_det	

#### Camera

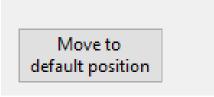
The desired camera or camera-orientation can be selected from this drop-down list.

The binning and mode of the camera can be selected in the function area. With the chosen mode, the total binning value, the effective pixel size and the original pixel size are indicated here.

The camera can be moved to it's default position (if applicable when several detectors or detector X-Z is available) using this button.

$\sim$
L







ube N V:\scans\ma	Motors   arijn	Camera	.		mage	1	gram		output p	Extra ath	'I	
s	tart 00:00	0:00 tir	me busy		rem	aining			expected progress			
component	comman	d	argume	ents				FDB	wait?		~	
scanner	set outpu	ut path	V:\scan	s\marijn					ACK			
scanner	set samp		@4			DKBIN	DTe		ACK			
camera	set mode		mode1						ACK			
camera	set expos	ure	499.976	135					ACK			
camera	set numb	per of fra	r 1						ACK			
camera	set numb	per of ave	= 1						ACK			
camera	set ROI		0 0 2940 2304						ACK			
ver_obj	move ab:	solute	0.000000					ACK				
tube	xrayoff							ACK				
scanner	pause		2000.00	0000					ACK			
camera	take imag	ge							ACK			
camera	set numb	per of ave	22						ACK			
camera	take imag	ge							ACK			
camera	save ima	qe	V:\scan	s\marijn	\di0000	.tif			ACK			
camera	set numb	per of ave	: 1						ACK			
tube	xrayon								ACK			
tube	REPEAT U	UNTIL TR							ACK			
scanner	pause		5000.00						ACK			
ver_obj	move ab	solute	0.00000	0					ACK			
camera	take imag	•							ACK			
camera	set numb	per of ave	= 44						ACK		×	

#### Scan

In the scan tab, the script and information about the script is displayed. Once a script has been prepared and accepted, a copy of the script is present in this tab.

It is subdivided into several columns: 'component' for which component the command is addressed to 'command' which command is send 'argument' for the parameter of the command 'FDB' for the type of feedback that is requested

'wait' for explicit longer wait-times before time-out.

When the script is running, in the column next to 'wait', the exact execution time of that command is shown. Once the script is finished it will save a copy (script\_executed.txt) of the executed script with the execution timings. It is possible to make changes to the script but these changes will not be saved in the original script, only in the executed script.



Tube   I	Motors Camera	Scan	Image	Program	ו   s	ample	Extra		
V:\scans\m	arijn					output p	ath		
	start 00:00:00 tin	ne busy	remair	nina		expected			
						progress	(1 of 1)		
					50.0		( ,		
component	t command	arguments			FDB	wait?		$\Delta \parallel$	
scanner	set output path	V:\scans\mari	in			ACK			
scanner	set sample info	@4 EKeve	er 🛛 Test 🖸	IKBIN DTe	2	ACK			
camera	set mode	mode1				ACK			
camera	set exposure	499.976135				ACK			
camera	set number of fran	1				ACK			
camera	set number of ave	1		ACK					
camera	set ROI	0 0 2940 2304	ACK						
ver_obj	move absolute	0.000000				ACK			
tube	xrayoff					ACK			
scanner	pause	2000.000000				ACK			
camera	take image					ACK			
camera	set number of ave	22				ACK			
camera	take image					ACK			
camera	save image	V:\scans\mari	in\di0000.tif	f		ACK			
camera	set number of ave	1				ACK			
tube	xrayon					ACK			
tube	REPEAT UNTIL TR					ACK			
scanner	pause	5000.000000				ACK			
ver_obj	move absolute	0.000000				ACK			
camera	take image					ACK			
camera	set number of ave	44				ACK		~	
<							>		

## Scan

The output path is the folder into which all

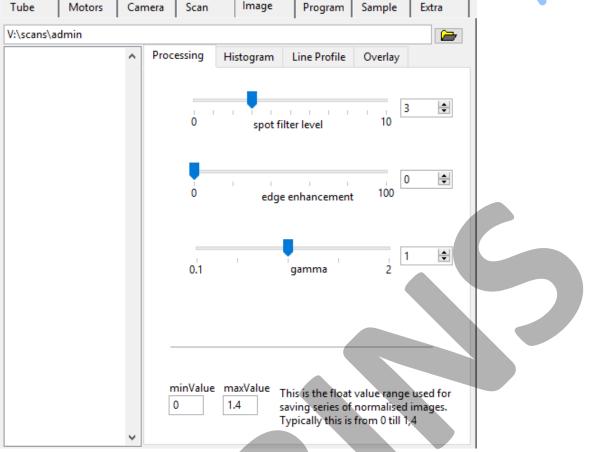
data is saved

V:\scans\marijn		output path
start 00:00:00 time busy	remaining	expected
		progress (1 of 1)
		-

The progress of the current script can be followed here.

If there are multiple scripts, the status of that progress is indicated with numbers next to the progress bar.





#### Image

The image tab is for image processing and image optimization.

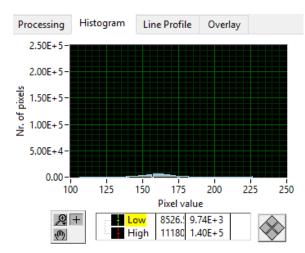
## Processing

In the processing tab the displayed image can be optimized by removing spots in the image, enhancing edges and changing the gamma.

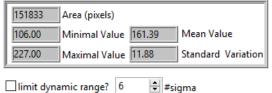
## Histogram

Confidentia

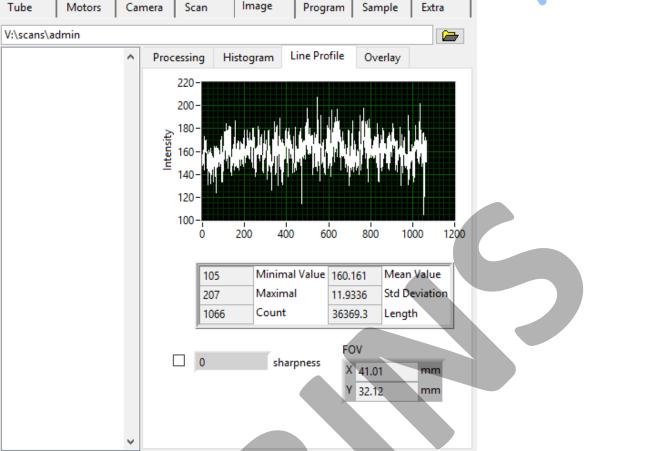
The histogram tab displays the histogram of the current image. Numerical details of the grey value distribution in the image is also provided.



Histogram cluster







#### Image

The image tab is for image processing and image optimization.

## Line Profile

If a line is drawn on the displayed image, the grey values along that line are shown in the line profile tab. Further details about the grey values and the length of the line are provided below the profile.

## Overlay

Text can be overlaid on the radiographs using the overlay tab

rocessing	Histogram	Line Profile	Overlay	
overla	y info?			
Text	Color			
custom	text			
Horizont	al Alignment			
Horizont Left	al Alignment	~		
	Outline?	<b>▼</b>		
Left Shadow? OFF/C	Outline?	₩ N		

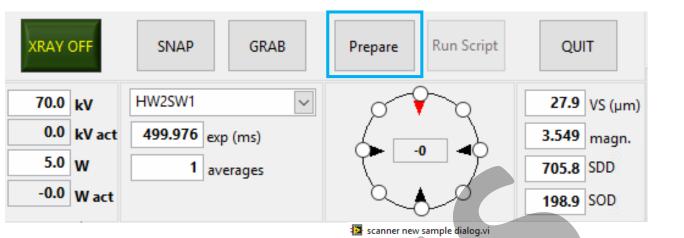


Tube	ube Motors Ca		Scan	Image	Program	Sample	Extra	
Sample								
Kever		Sar	nple Name					
Test			plication Area					
KBIN		Ow	ner					
Testscar	n beetle on n	eedle Co	mment					
		Ci-r	e (mm)					
20								
XRE	XRE		ntact person					
			n ID					
		Bat	ch ID					
Test		Pro	ject					

## Sample

When the sample information Is filled in using the New Sample button in the toolbar, this information in displayed in the Sample tab.





## Prepare

A scan script can be generated by clicking the prepare button in the function area.

When prepare is clicked, the new sample dialog is displayed, in which the sample information like sample name, owner and project can be altered or edited.

The OK button is greyed out and only becomes active when the sample name and sample size are entered.

	3.349 magn.
	705.8 SDD
	198.9 SOD
scanner new sample dialog.vi	×
New Sample info	
Sample Name	Owner
Kever	KBIN
Projects XRE	Contact person XRE
Batch ID	Filter name
Application Area	Sample size (mm)
Test	2 <b>0</b>
Comment Testscan beetle on needle	
ОК	Cancel



# Script\_generator\_selection\_dialog.vi Select script type Script type Smooth scan XRE Smooth 4D scan XRE Calibrate with spheres XRE Stacked scan XRE Step and shoot XRE Step and shoot XRE Smooth scan 4D back and forward

## Prepare

When the sample information is entered, the Script type needs to be selected. Numerous acquisition scripts are available.

The standard acquisition scripts are Smooth scan and Step and shoot, in which Smooth scan is the fastest option.

More advanced scripts for scanning elongated samples, dynamic acquisitions and calibration scans can also be selected.



#### 🔯 script\_generator smooth.vi

Ger	neral	Sample Info	Camera	Scan sp	ecific	Motors	Other	In preparation	n	Accepted scri	ots						
F	Path							component	con	nmand	arg1		arg2	wait mode	timeout	duration	^
•	V:\scan	s\marijn															
	<sup>‡</sup> project 2205	L . I	File base nan scan_	ne	angula 0.1633	r interval 39	]										
	f offset		# pre flat fiel 44	d images 🜲	# post f	flat field ir ‡	nages										
	otal pro 2205	jections 韋															
								<								>	~
Ge	nerate s	script	Accept		Clear		Cancel	Load scrip	at	Save script	15234.2 a	ppr. required di	sk space (MB)				_
								Load scrip		Jave script							

#### Prepare

After selecting the Script type, the script generator window for that type is shown

#### General

In the general tab the path where the images will be stored can be selected and the File basename chosen.

The number of projections for a full rotation can be entered and the minimum amount of projections is equal to the amount of pixels in the horizontal direction of the projection.

A number of correction images can be selected before and /or after the scan.

The total number of projections is also shown and the can differ from the #projections/360° if the rotation angle is altered.

General	Sample Info	Camera	Scan sp	ecific	Motors	Other	
Path	ns\marijn						,
2205	t images #	ile base nam scan_ f pre flat field 44		0.1633	ir interval 39 flat field im	nages	
total pro 2205	ojections						



#### 😰 script\_generator smooth.vi

ieneral S	Sample Info	Camera	Scan specific	Motors	Other	In preparatio	Accepted sc	ripts					
						component	command	arg1	arg2	wait mode	timeout	duration	^
	Update samp	ole info				r							
Kever		Sample	Name										
Test		Applica	ation Area										
KBIN		Owner											
Testscan	beetle on need	le Comm	ent										
									-				
		_											
20		Size (m											
XRE			t person										
		Scan ID											
		Batch I											
XRE		Project											
													~
Generate sc	ript A	ccept	Clear		Cancel	<						>	_
						Load scrip	ot Save scrip	t 15234.2 appr	: required disk space (MB)				

## Prepare

#### Sample Info

The information about the sample is shown in the Sample Info tab and this data can be updated.

#### Camera

In the camera tab the detector settings like binning and ROI are shown and the integration time and number of averages can still be optimized.

#### 🔯 script\_generator smooth.vi General Sample Info Camera Scan specific Motors Other Imaging mode HW2SW1 $\sim$ Integration time (ms) 499.976 ÷ Number of averages ÷ 1 readout time (ms) 0 ÷ ROI y\_start 0 x\_start x\_end 0 2940 2304 y\_end



neral	Sample Info	Camera	Scan specific	Motors	Other	In preparation	Accepted scr	pts					
∕Goto	eral Sample Info Camera Scan specific Motors Other Goto reference after scan					component	command	arg1	arg2	wait mode	timeout	duration	1
						·							
nerate	script	Accept	Clear		Cancel	<						)	>
reruce.	in the second	- ceepe	cicui		cuncer	Load scrip	t Save script	15234.2 appr. required	disk space (MB)				

## Prepare

## Scan specific

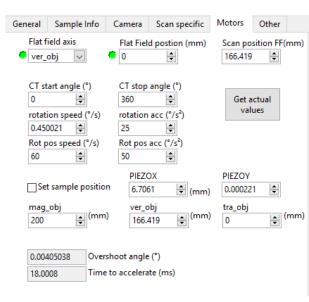
The scan specific tab shows specific options depending on the selected scan script.

#### Motors

In the motors tab the flat field position or the calibration image without the sample in the beam, can be optimized.

The start and stop angle can be altered and the rotation speed and accelerations can be changed is desired.

*Set sample position* makes it possible to enter specific positions of the sample for the scan .





#### 📴 script\_generator smooth.vi

General	Sample Info	Camera	Scan specific	Motors	Other	In preparation	Accepted scripts	S						
pause before DI (s)					component	command	arg1		arg2	wait mode	timeout	duration	^	
2	-	Refresh	tube before sca	n		scanner	set output path	V:\scans\marijn			ACK			
nause be		Filamer	at adjust before	can		scanner	set sample info	@4 EKever	DTest DKBI		ACK			
5			-			camera	set mode	mode1			ACK			
-				an		camera	set exposure	499.976135			ACK			
· · · · · · · · · · · · · · · · · · ·		# prescan				camera	set number of fram	1			ACK			
0		0	÷			camera	set number of avera	1			ACK			
	✓ Referenc	e images ev	ery			camera	set ROI	0 0 2940 2304			ACK			
□ Add v	isual image					ver_obj	move absolute	0.000000			ACK			
Add visual image						tube	xrayoff				ACK			
					scanner	pause	2000.000000			ACK				
ACK wait mode for rotation				camera	take image				ACK					
		_				camera	set number of avera	22			ACK			
ACK		🔟 wait mo	de for take imag	e		camera	take image				ACK			
ACK	ause before IO (s) Filament adjust before scan ause before scan (s) # prescan projections D Reference images every Add visual image ACK S wait mode for save image ACK S wait mode for rotation ACK S wait mode for ver_obj	camera	save image	V:\scans\marijn\	di0000.tif		ACK							
ACK	CK wait mode for ver_obj camera save image V:\scans\m camera set number of aver: 1		1			ACK								
Ren						tube	xrayon				ACK			
						tube	REPEAT UNTIL TRU				ACK			
						scanner	pause	5000.000000			ACK			
						ver_obj	move absolute	0.000000			ACK			
						camera	take image				ACK			
						camera	set number of avera	44			ACK			~
						<							>	
Generate	script	Accept	Clear		Cancel					c space (MB)				

#### Prepare

#### Other

In the other tab the tube can be refreshed and focused, the pause between specific steps in the script can be altered and prescan projections can be acquired.

#### Generate script

If all parameters are selected the script can be generated. Clicking *Generate script* displays all the steps of the script. This scan script can be cleared or even canceled, but can also be saved.

Existing scripts can also be loaded using the *Load script* button.



General	Sample Info	Camera	Scan specific	Motors	Other	In preparation	Accepted scrip	ts			
pause be	fore DI (s)	_				Scripts					
2						Output Path	, ,		Sample		
-	ause before IO (s) Filament adjust before scan					V:\scans\m			Kever	Sample Name	-
5	ause before scan (s) # prescan projections				v.\scans\m	ign -		Test	Application Are	ea	
·								KBIN	Owner		
0	Reference	0	×								
		e images ev	ery						Testscan beetle on needle	Comment	
Add v	isual image										
ACK		wait mode for save image									
ACK		wait mode for rotation									
ACK						12		×	20	Size (mm)	
ACK		🔄 wait mo	de for ver_obj			-			XRE	Contact person	
						Do you want to prepare another script? XRE Contact person Scan ID					
						Yes	No				
						Tes				Batch ID	
						script out			XRE	Project	
						component			t.		
								argum			^
Generate	script	Accept	Clear		Cancel	scanner	set output path set sample info	V:\scai @4	ns\marijn DKever DTest DKBIN DT	estecan heatle o	
Generate	senpe	Accept	cicui		curren	camera	set mode	mode		esiscan beene o	'
						camera	set exposure	499.97			
						camera	set number of f	ram 1			
						camera	set number of a				
						camera	set ROI	0 0 294			
					ver_obj	move absolute	0.0000	00		$\sim$	

## Prepare

## Accept

When clicking the accept button, the script is stored and the options window *Do you want to prepare another script*? Is shown.

When selecting *Yes*, you are redirected to the main software window.

When selecting *No*, an additional script can be generated with other settings or with another sample position.

## Run Script

Confidential

The Run script button in the function area f the main window is no longer greyed out and clicking this button starts the scan. The progress of the scan can be monitored in the Scan tab of the settings area.

