

# How to run Autograin on the NanoSIMS

Frank Gyngard

9/21/09

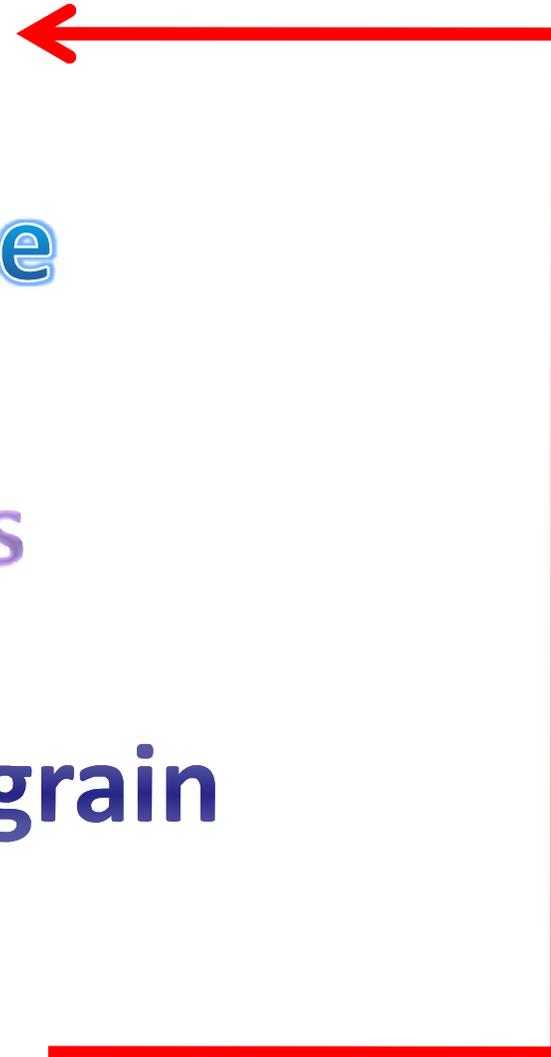
**Pre-sputter**

**Take an Image**

**Define Particles**

**Measure each grain**

**Move Stage**



# Setup the following:

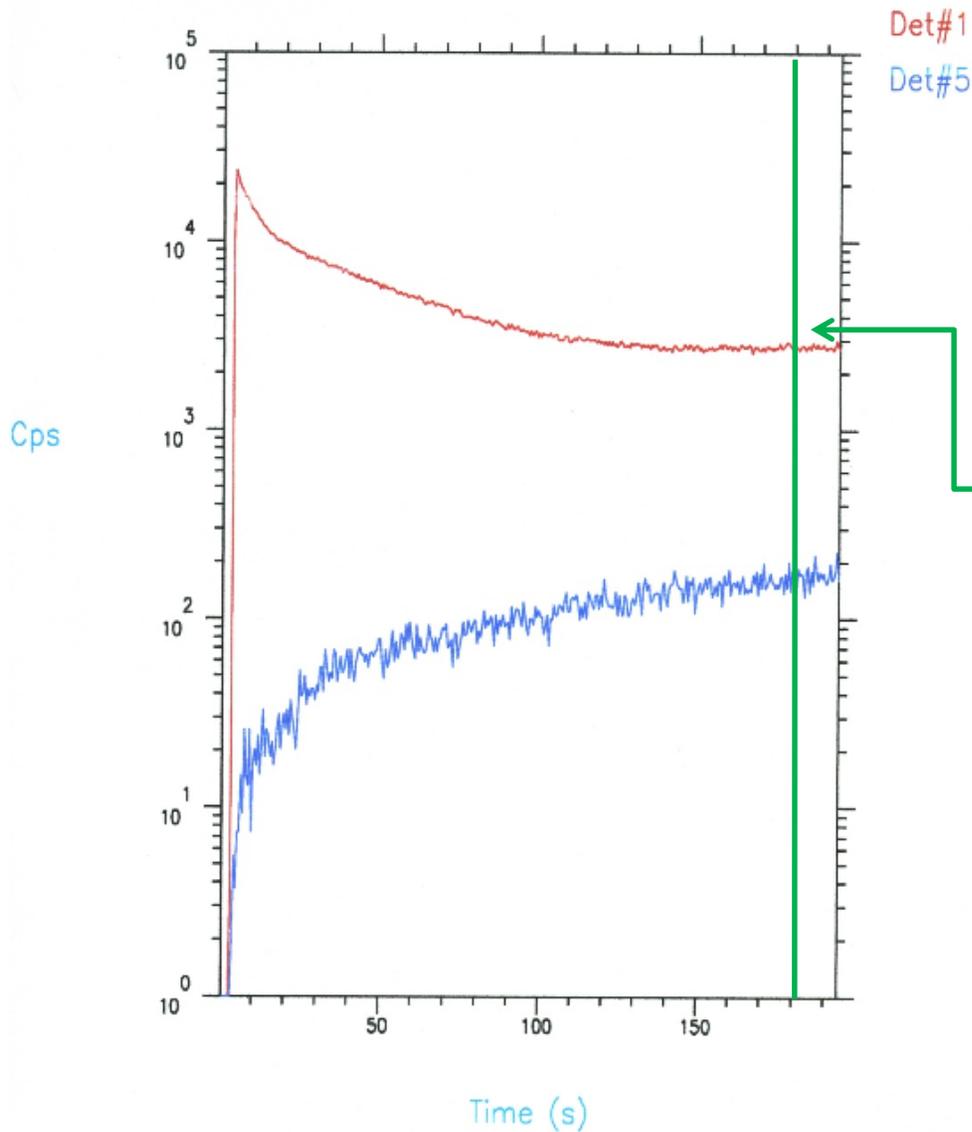
1. Create a prespinner image file
2. Setup and run grain mode image
3. Start IDL & test the grain mode image
4. Run at least 1 grain mode isotope measurement on a defined particle
5. Load both the prespinner image file and the isotope measurement file into chain mode
6. Setup up Chain Mode and pray it works

# Create prespitter image file:

1. Get high beam current: Larger D1; increase L0 and L1; or some combination

## Create prespitter image file:

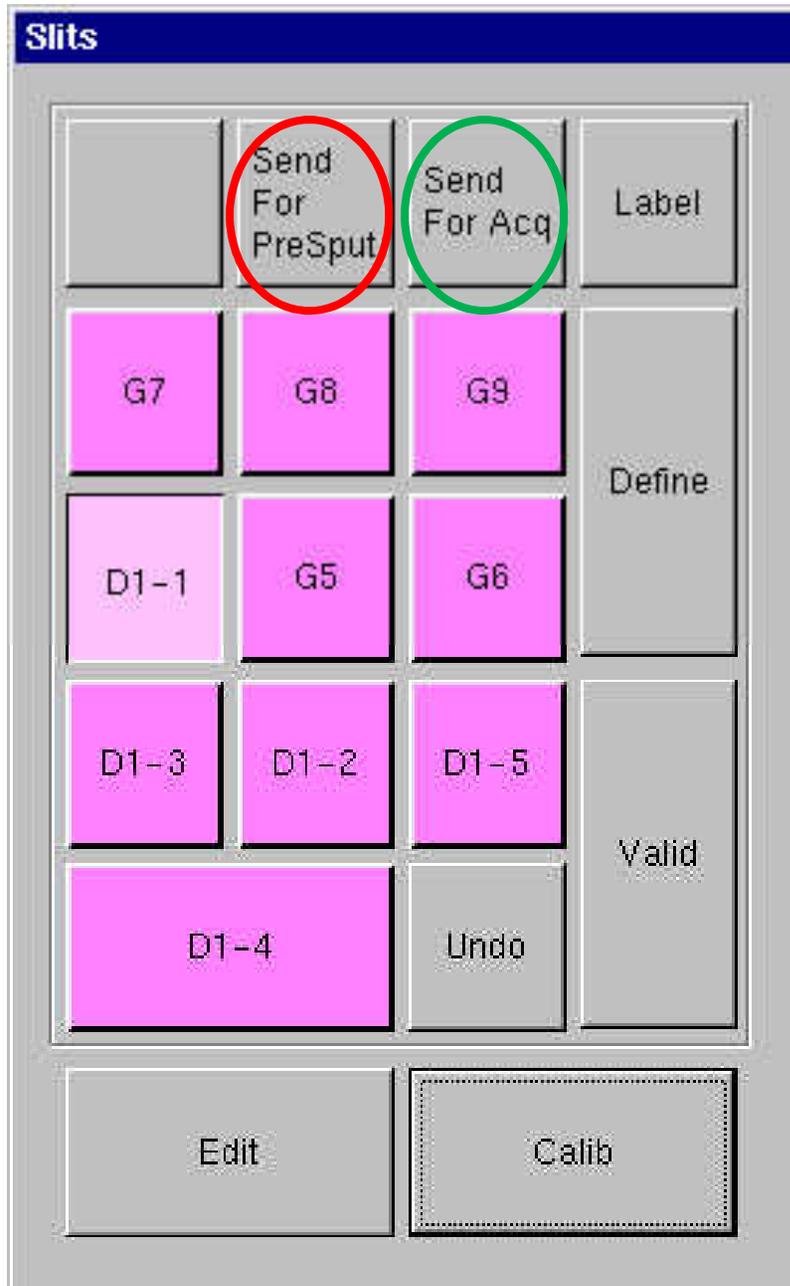
1. Get high beam current: Larger D1; increase L0 and L1; or some combination
2. Run **Beam Stability** on pristine area similar to actual measurement place till signal stabilizes



Presputter with high beam for about this long (~180s in this case)

## Create prespitter image file:

1. Get high beam current: Larger D1; increase L0 and L1; or some combination
2. Run **Beam Stability** on pristine area similar to actual measurement place till signal stabilizes
3. Setup presets for prespitter and acquisition



# Presets

1. **Presputter**: Should contain both lens & slit settings for your high beam. Set ALL EM HVs to ZERO (add them by clicking *Define* if not available)
2. **Acquisition**: Should contain actual measurement settings for the grain mode image and isotope files. Set all EM HVs back to original values.

## Create prespitter image file:

1. Get high beam current: Larger D1; increase L0 and L1; or some combination
2. Run **Beam Stability** on pristine area similar to actual measurement place till signal stabilizes
3. Setup presets for prespitter and acquisition
4. Setup typical image measurement: 256x256, **100 $\mu$ s/pix** (or something similar), turn on presputtering & adjust # of cycles to match amount you want to prespitter

Load... Save Save as... New Data Inc.: No  
 Sample ID :  
 Matrix ID :  
 Total analysis time: 0s Time finished : 14:02  
 Meas. number: 1

Lens preset : None  
 Slit preset : None

Pre-sputtering: No Yes

Nb cycles: 1 Raster size (um): 20.0  
 Time: 65.5 s  
 Lens preset : rrent [125pA] More...  
 Slit preset : None More...

Raster size (um): 20.0  
 Real size (um): 20.0  
 Comment :

GO Analysis type selection  
 acquisition

Working Frame  
 Width : 256 Height : 256  
 Scanning frame  
 Start Col : 1 Start Row : 1  
 Width : 256 Height : 256

Working\_Frame 256 x 256  
 Scanning\_Frame 256 x 256

Magnetic Field List  
 B1 1331.065  
 Ct/px (us) : 1000 Ct/fr (s) : 65.536  
 Offset (V) : 0.00

Print results after acquisition

Centering

Base Line	Detector List	N	Id	Species Symbol	a.m.u.	Radius
	FC				15.231	377.560
	Tr1	160			16.000	386.972
	Tr2	180			17.999	410.435
	Tr3	28Si			28.001	511.922
	Tr4	29Si			29.001	520.983
	Tr5	30Si			30.001	529.886
	ES			Electron Scanning Image		

Adjust to be your presputter time

Make sure it has your presets!

Change to:  
~100µs/pix

# Setup Grain Mode image file:

The image shows two software windows side-by-side. The left window is titled 'RIMS-ORG1d-2-OSI-redone\_47.im' and contains various settings for image acquisition, including 'Sample ID', 'Matrix ID', 'Total analysis time', 'Time finished', 'Meas. number', 'Lens preset', 'Slit preset', 'Pre-sputtering', 'Raster size (um)', 'Real size (um)', and a 'Comment' field. A purple oval highlights the 'M>Y0...' and 'M<V0...' buttons. The right window is titled 'Nanosims 50 - GRAIN MODE - IMAGE' and shows 'Working Frame' and 'Scanning frame' dimensions (256 x 256), 'Magnetic Field List' (B1 1331.065), 'Ct/px (u.s): 1000', 'Offset (V): 0.00', and a 'Detector List' table. A red circle highlights the 'Offset (V): 0.00' field. A purple arrow points from the 'M>Y0...' button to the 'Offset (V): 0.00' field, and a red arrow points from the 'GO' button to the 'Offset (V): 0.00' field.

Base Line	Detector List	N	Id	Species Symbol	a.m.u.	Radius
	FC				15.231	377.560
Tr1	160				16.000	386.972
Tr2	180				17.999	410.435
Tr3	285i				28.001	511.922
Tr4	295i				29.001	520.983
Tr5	305i				30.001	529.886
ES	Electron Scanning Image					

Adjust for total time of image acquisition you want. **NOTE:** in grain mode you can't increase the # of frames!

Make sure it has your presets!

## Start & run IDL:

1. Right click on desktop & click on:  
*Files -> Programs -> Shell Tool*
2. Type: `idl -vm=/space/ims/frankg/autograin.sav`

# Start & run IDL:



```
shelltool - /bin/csh
laotzu.wustl.edu:~/space/ims>idl -vm=/space/ims/frankg/autograin.sav
```

A terminal window titled "shelltool - /bin/csh" showing a shell prompt at "laotzu.wustl.edu:~/space/ims>". The command "idl -vm=/space/ims/frankg/autograin.sav" has been entered and is followed by a black cursor block.

## Start & run IDL:

1. Right click on desktop& click on:  
*Files -> Programs -> Shell Tool*
2. Type: `idl -vm =/space/ims/frankg/autograin.sav`
3. Click anywhere on Splash Screen

# IDL<sup>VM</sup>

## The IDL Virtual Machine™

Distribution Platform for IDL Applications

[click to continue](#)

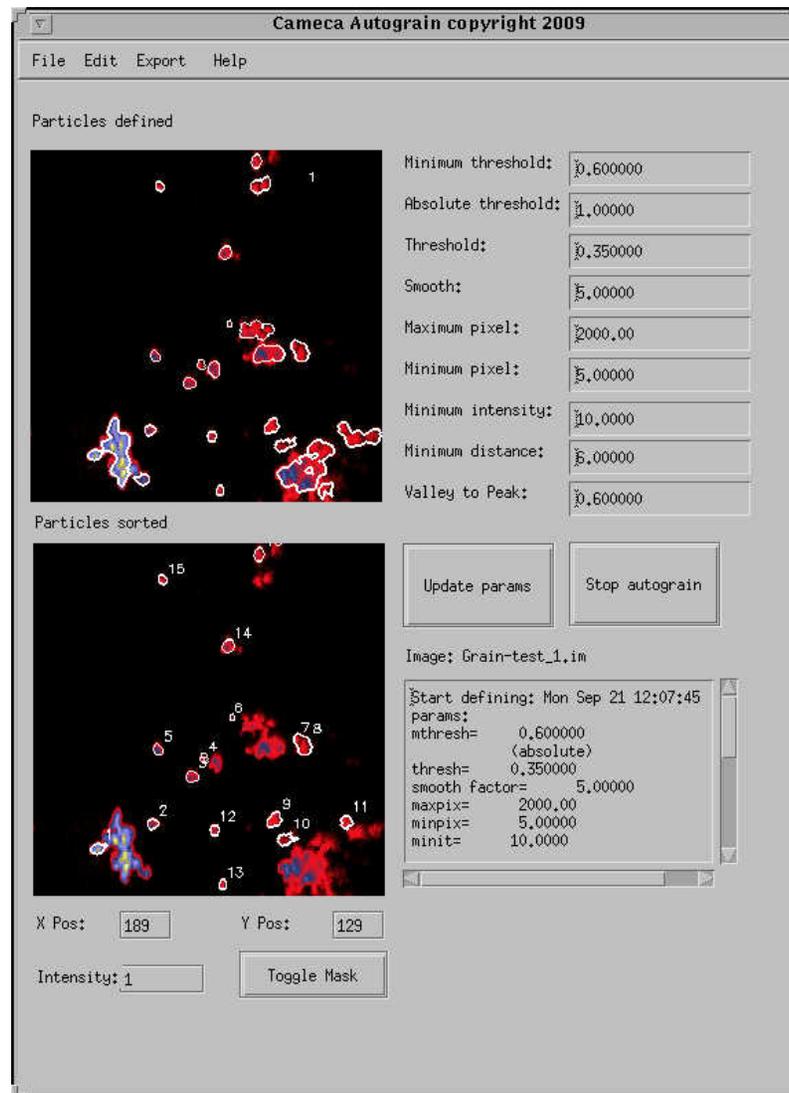
*Upgrade to a development version of IDL and:*

- interactively explore your data in the IDL environment
- develop cross-platform applications for distribution
- test custom data analysis algorithms

*Find out more at [www.rsinc.com/IDL](http://www.rsinc.com/IDL)*

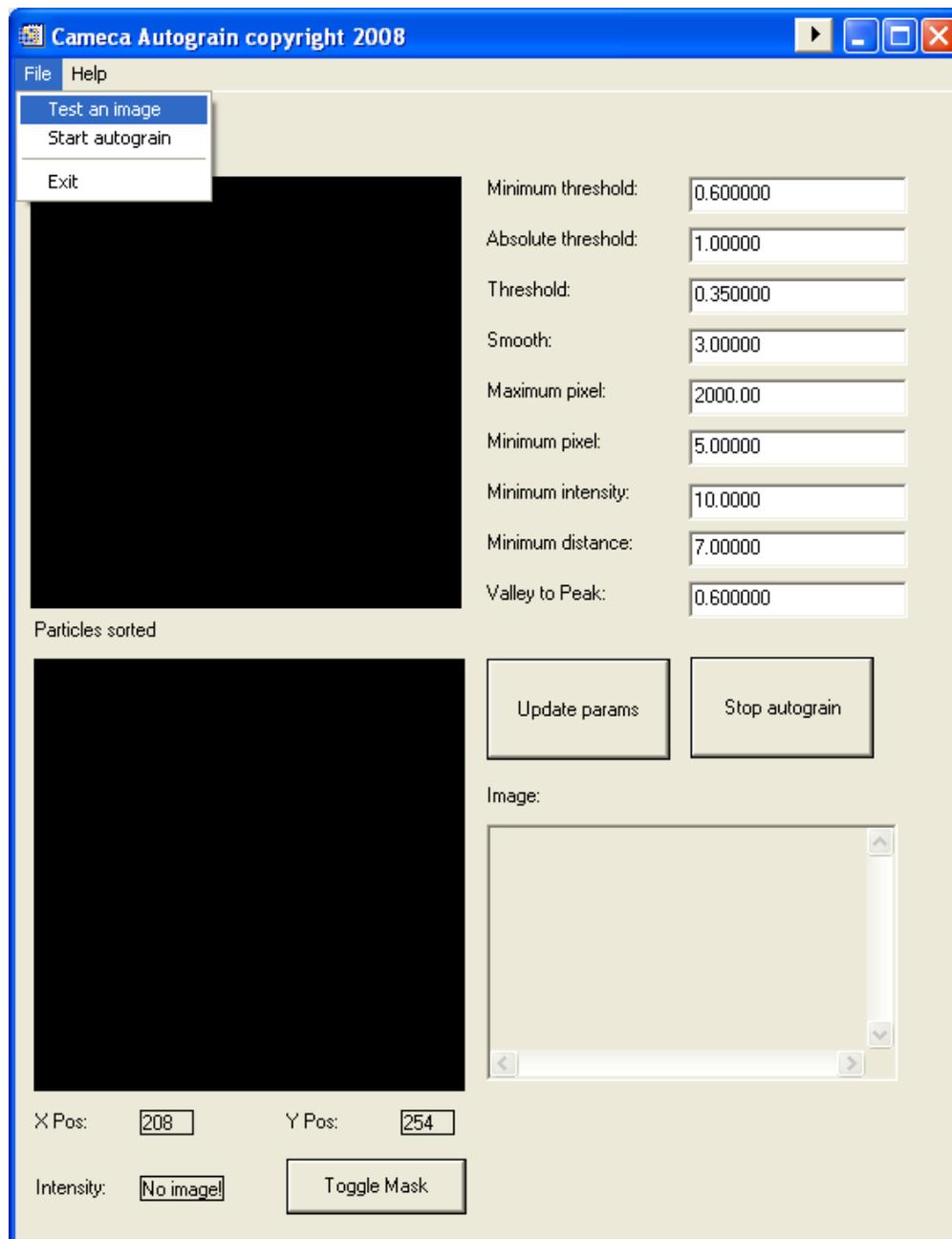
# RSI

# Start & run IDL:



## Start & run IDL:

1. Right click on desktop& click on:  
*Files -> Programs -> Shell Tool*
2. Type: `idl -vm =/space/ims/frankg/autograin.sav`
3. Click on Splash Screen
4. Once the Grain Mode image has finished, test it in the autograin program:  
*File -> Test an image*



## Start & run IDL:

1. Right click on desktop & click on:  
*Files -> Programs -> Shell Tool*
2. Type: `idl -vm =/space/ims/frankg/autograin.sav`
3. Click on Splash Screen
4. Once the Grain Mode image has finished, test it in the autograin program:  
*File -> Test an image*
6. Once finished, start autograin by going to:  
*File -> Start autograin*

# Setup Grain Mode isotope file:

The screenshot shows two windows from the Nanosims 50 software. The left window, titled "Measurement Conditions - NSIMS: 11 Feb08\_52\_1.is", contains various parameters for the measurement. The right window, titled "Nanosims 50 - GRAIN MODE - ISOTOPES", shows the grain mode configuration. A red arrow points from the "Nb cycles" field in the left window to the "Ct/px (us)" field in the right window. A purple circle highlights the "Auto Grain" mode button, and a red circle highlights the "Ct/px (us)" field.

**Measurement Conditions - NSIMS: 11 Feb08\_52\_1.is**

Load... Save Save as... New Data inc.: No

Sample ID :  
Matrix ID :

Meas. nb: 100

Block number: 10  
Meas. per block: 10  
Rejection at (sigma): 2

Lens preset: None  
Slit preset: None

Pre-sputtering: No Yes

~~Nb cycles: 1 Raster size (um): 20.0  
Time: 65.5 s  
Lens preset: Element [125pA]  
Slit preset: None~~

Raster size (um): 20.0

Comment :

Analysis type selection

**Nanosims 50 - GRAIN MODE - ISOTOPES**

Scanning mode: No Yes Mode: Graphic Semi Graphic **Auto Grain**

Magnetic Field List

B1 1331.065

Ct/px (us): 1000  
Offset (V): 0.00

Print results after acquisition

Centering

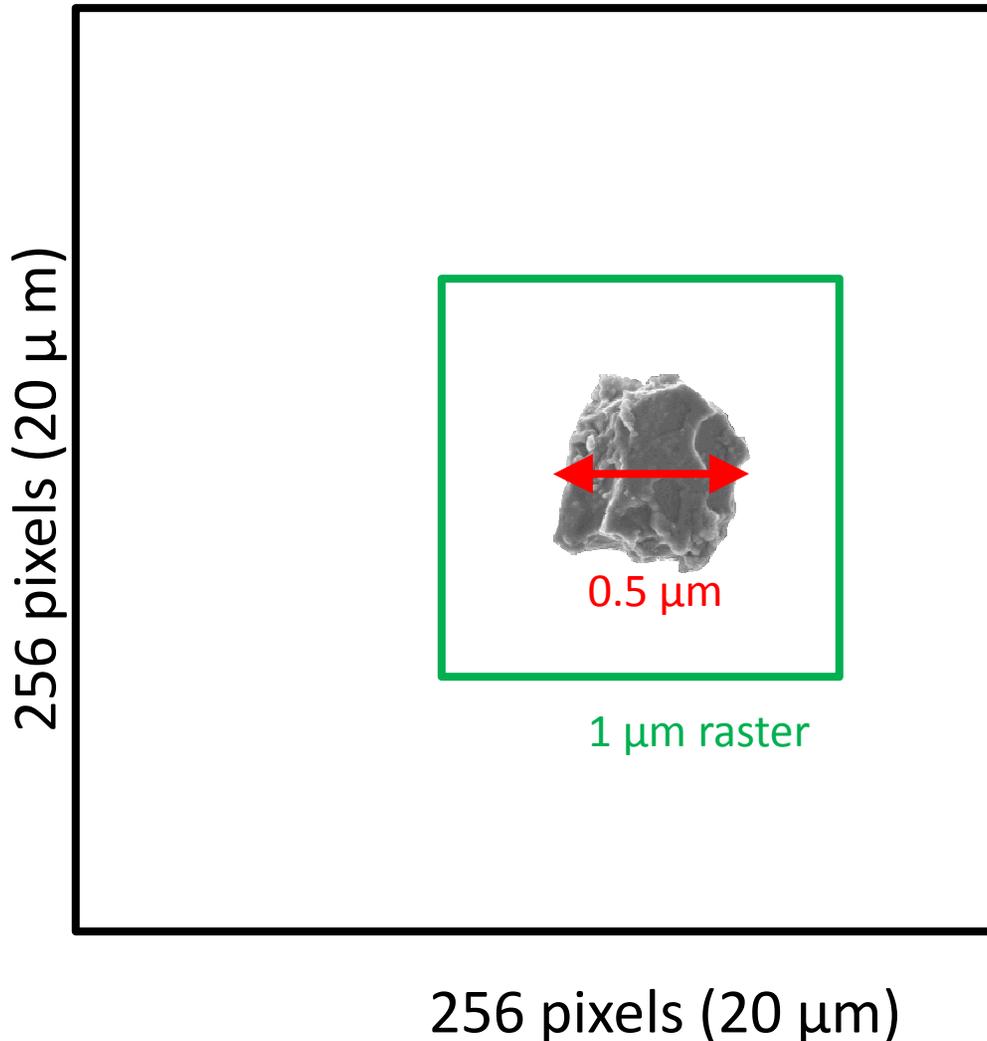
SIBC

Ratios

Base Line	Detector N	Detector Id	Species Symbol	a.m.u.	Radius	Ref. Peak Num.
			FC	15.231	377.560	
	Tr1	16O		16.000	386.972	
	Tr2	18O		17.999	410.435	
	Tr3	28Si		28.001	511.922	
	Tr4	29Si		29.001	520.983	
	Tr5	30Si		30.001	529.886	

Adjust for approximate amount of total measurement time you want. **NOTE:** actual time will depend on size (in pixels) of grain defined

# How many $\mu\text{s}/\text{pix}$ ?



The software calculates a raster size roughly twice the grain diameter.

For a 0.5  $\mu\text{m}$  grain, this leads to a raster size of 1  $\mu\text{m}$  (12.8 pixels in this example).

Total number of pixels =  $12.8^2 = 164$ .

For counting time of 1000  $\mu\text{s}/\text{pixel}$ , acquisition time per cycle = 164 ms

For 10 blocks of 10 cycles = 16.4s.  
Probably way too short.

**NOTE:** Some grains may be smaller, some may larger. Optimize counting time per pixel to achieve sufficient statistics for the size of the average grain.

# Setup Chain Mode:

1. Click *Add...* to make a second line.
2. With first line selected, click  and select your prespinner file (e.g., prespinner.im)
3. With second line selected, click  and select your grain mode isotope file ONLY (e.g., grain\_mode.is). The grain mode image file associated with it will be automatically loaded too
4. Click on the snake () movement scheme and click *Chain all* button and put in parameters

# Setup Chain Mode:

Chained Analysis – new4.cha.dir/morespace/data/frankg/11 Feb08

Load... Save Save as... New file Ion : Cs+

#	Sample name	Matrix	Stage pos	Analysis type	File name	Time schedule	Status
1	pregrid1		200 : 4470	Image nano	pregrid1@2.im	02'10''	edited
2	grid1		200 : 4470	Grain Mode	grid1@2.im	05'33''	edited
3	grid1		200 : 4470	Grain Mode	grid1@2_mg_y.is	01'46''	edited

Total chained analysis time (mn) : 09'29"

Delete all Delete Add Chain All

Sample name : pregrid1 Matrix : \_\_\_\_\_

Stage Move :  Nb : 1 

File name : pregrid1@2

Measurement conditions : dir : /morespace/data/frankg/11 Feb08

Edit MC Load... presputter-125pA.im Snap

START STOP ABORT

SHOW ACQ  Analysis type selection

1

4

2 - 3

# Setup Chain Mode:

Chained Analysis – new4.cha.dir/morespace/data/frankg/11Feb08 (edited)

Ion : Cs+

#	Sample name	Matrix	Stage pos	Analysis type	File name	Time schedule	Status
1: 4	pregrid1		200 : -4470	Image nano	pregrid1@..._i.m	08'40 ✓	edited
2	grid1		200 : -4470	Grain Mode	grid1#2.i.m	05'33 ✓	edited
3	grid1		200 : -4470	Grain Mode	grid1#2_mg_y.1s	01'46 ✓	edited

Total chained analysis time (mn) : 15'59"

Chain All

Stage Move :

dX : 25 x 1  
dY : -25 x 5

Nb : 1

# Future Improvements: IDL

1. Increase general software stability
2. Add ability to define grains to measure based on isotopic ratios
3. Add a log file that records/exports everything: all variables, file names, actions taken, etc
4. Add export of images with raster boxes overlaid
5. Better optimize the sorting algorithm for grains that are too close to each other.
6. Enhance cross-platform compatibility

# Future Improvements: Cameca

1. Allow dynamic measurement termination
2. Allow multiple frames in the grain mode image
3. Create a more streamlined/integrated incorporation of grain mode into chain mode
4. Fix the quiriness of the measurement presets

# Technical stuff

## DIRECTORY AND FILE INFORMATION

Here is a list of the directory and files used for communication:

/space/ims/data/raw_ima/	Directory for communication files
.AutoGrainIsOn	File saying IDL software is on and running
.AutoGrainImage	2 line text file: 1st line flag (0 or 1) whether image is done being acquired, 2 <sup>nd</sup> line is full path of image for IDL to analyze
.AutoGrainList	Text file list of grains to analyze
.AutoGrainDPPARS	Text file list of particle definition parameters
.AutoGrainResults	Text results file that is displayed in the result window
.AutoGrainCompleted	Text file IDL creates when it is done creating the grainlist file

## GRAIN DEFINITION PARAMETERS

The following is a table of what the particle definition parameters mean. It is best to just play around with them for a given image to see what effect they have.

Minimum threshold	minimum intensity pixel must have to be considered a center of a particle
Absolute threshold	if equal 1 then minimum threshold is absolute value, otherwise it is fraction of maximum image intensity
Threshold	pixels > threshold*maximum intensity are included in particle
Smooth	images smoothed by this amount before defining
Maximum Pixel	maximum number of pixels allowed in a particle
Minimum Pixel	minimum number of pixels allowed in a particle
Minimum Intensity	minimum intensity for pixel to be included in particle
Minimum Distance	minimum radius between adjacent grains
Valley to peak	valley to peak intensity ratio allowed of adjacent grains