Nabity System

UPDATES:

- Kathryn McGill (CNF Fellow)
- Walk-through

As of 10/19/16 (though truly from 2013-2014 during MoS2 work):

Chip Spinning:

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- 1. spin 4% 495 @ 3000 rpm, 1000 ramp, 60 s (resist will be ~150 nm thick) • bake @ 170 °C for 15 min
- 2. spin 2% 950 @ 3000 rpm, 1000 ramp, 60 s (resist will be ~50 nm thick)
 bake @ 170 °C for 15 min

(develop in 1:3 MIBK:IPA - see below - & lift-off in 1:1 methylene chloride:acetone) E-beam Writing on the Nabity

- 1. Measure the current in pA for all apertures you are going to use (typically, 10 µm ap => 30-40 pA & 60 µm ap => ~1000+ pA)
- 2. Parameters common to all run files (including alignment):
 - a. gun @ 20 kV
 - b. 900 magnification
 - c. general params:
 - Non-stop writing mode yes
 - Disable automated stage control no
 - Disable digital SEM control no
 - Disable x-y focus mode yes
 - Enable global rotation correction no
- 1. alignment windows:
 - counts of 15
 - center-to-center spacing 50 nm
 - line spacing of 50 nm
- 2. pattern writing of fine features:
 - 10 µm aperture (set in Supra system, not Nabity system)
 - continuous write
 - center-to-center spacing 5 nm
 - line spacing of 5 nm
 - 300 µC/cm² area dose
- 3. pattern writing of large features:
 - 60 µm aperture (set in Supra system, not Nabity system)
 - continuous write
 - center-to-center spacing 30 nm
 - line spacing of 30 nm
 - 500 µC/cm² area dose

*see screenshots below

Development

• 45 sec in 1:3 MIBK:IPA (shake chip back-and-forth in soln) & quench in IPA; N2 dry

Walk-through

step 1 - copy gds file into this directory:

					x
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Organize 🔻 Include in	library 🔻 Share with 💌 Burn	New folder		:≡ ▼ 🔟	0
🛠 Favorites	Name	Date modified	Туре	Size	*
Desktop	chip_4_01_spot2.gds	7/13/2012 5:24 PM	GDS File	4 KB	
bownloads	chip_4_01_spot10.gds	7/13/2012 7:34 PM	GDS File	4 KB	
📃 Recent Places	chip_4_06_spot1.gds	7/17/2012 8:42 PM	GDS File	4 KB	
	chip_4_06_spot2.gds	7/17/2012 8:42 PM	GDS File	4 KB	
詞 Libraries	chip_4_06_spot3.gds	7/17/2012 8:42 PM	GDS File	4 KB	
Documents	chip01_graphene-layer.gds	6/22/2012 5:00 PM	GDS File	2 KB	
🎝 Music	CHIP2.gds	4/4/2011 10:21 PM	GDS File	10 KB	
NPGS	CHIP2V3.gds	4/6/2011 1:15 AM	GDS File	4 KB	
Pictures	Chip03_June21_graphene.gds	6/26/2012 8:02 PM	GDS File	2 KB	
🛃 Videos	Chip03_June21_metal-line.gds	6/22/2012 4:53 PM	GDS File	4 KB	
_	Chip03_patch.gds	7/2/2012 10:37 AM	GDS File	2 KB	
🖳 Computer	CHIP3.gds	4/4/2011 7:10 PM	GDS File	8 KB	
🏭 OS (C:)	Chip04_06-21_metal-line.gds	6/21/2012 2:06 PM	GDS File	4 KB	
	Chip04_patch.gds	7/2/2012 10:54 AM	GDS File	4 KB	
辑 Network	Chip04-graphene_layer.gds	6/26/2012 5:32 PM	GDS File	2 KB	
-	CHIP6_L1.gds	4/16/2012 12:47 AM	GDS File	6 KB	
	CHIP6_L2.gds	4/18/2012 8:02 PM	GDS File	4 KB	
	CHIP6_L3.gds	5/8/2012 4:55 PM	GDS File	4 KB	
	CHIP7_L1.gds	4/16/2012 12:45 AM	GDS File	8 KB	
	CLID7 L2 add	A /19 /2012 7,50 DM	GDC Eila	1 VD	Ŧ
638 items					

step 2 - right click to convert gds to dc2:

_	ern Generation	System - Project: Daron			
File Project Op	tions Comm	ands Help			
- Custom Commands	;	Current Project Directory		<u>– D</u> isplay F	File Types
Process R	un File	C:\NPGS\Projects\Daton\	•		ern Files 🔻
Bun File B	Editor			Jean acc	
Show Bu	in File	File Name	Туре	Size	Time and Date 🔺
5100010	-	Prochip_4_06_spot2.dc2	DesignCAD	5,490	07-20-2012 10:
DesignCAD	Express	Chip_4_06_spot3.dc2	DesignCAD	4,544	07-17-2012 21:
Estimate To	tal Time	Prochip_4_06_spot1.dc2	DesignCAD	3,939	07-17-2012 21:
Simulate V	Vriting	chip_4_06_spot3 ada	GDS2 file	4,096	07-17-2012 20:
		Convert to DC2	GDS2 file	4,096	07-17-2012 20:
KUICK Me - Us	ser Notes>	rhip_4_06_spot1.gds	GDS2 file	4,096	07-17-2012 20:
NPGS Ma	anual	<mark>₽</mark> chip_4_01_spot10.dc2	DesignCAD	5,580	07-13-2012 19:
Run Files	DC2 Files	chip_4_01_spot10.gds	GDS2 file	4,096	07-13-2012 19:
LastBun log	Project log	Chip_4_01_spot2.dc2	DesignCAD	5,858	07-13-2012 17:
		<mark>P⊿</mark> chip_4_01_spot1.dc2	DesignCAD	3,856	07-13-2012 17:
Set WD=6.0	Read WD	□ alignment-contact_test.dc2	DesignCAD	4,777	07-13-2012 17:
Do Backlash	Backlash Off	hip_4_01_spot2.gds	GDS2 file	4,096	07-13-2012 17:
NPGS Mode	SEM Mode	hip_4_01_spot1.gds	GDS2 file	2,048	07-13-2012 17:
		lignment-contact_test.gds	GDS2 file	4,096	07-13-2012 17:
DAC (0,0)	AC (+10,+10)	<mark>₽</mark> device_contacts_2writes.dc2	DesignCAD	5,312	07-12-2012 15:
Сору То	Copy From	device_contacts_1write.dc2	DesignCAD	4,959	07-12-2012 15:
View Text File	Blank Screen	device_contacts_2writes.gds	GDS2 file	4,096	07-12-2012 14:
		device_contacts_1 write.gds	GDS2 file	4,096	07-12-2012 14:
Auto Logging M	lode	Provide the second seco	DesignCAD	49,106	07-10-2012 19:
Exposure Scale	1 000	Exposure_Array_DesignCAD_multi.gds	GDS2 file	24,576	07-10-2012 19:
Beam Current	1.000	kathryntest.dc2	DesignCAD	2,816	07-09-2012 19: 🔻
		•			•
chip_4_06_spot	3.gds				N?

step 2.1 - change drawing unit size to 1 and press convert:

(GDSII Pattern Co	nversion			
	File to Convert:	chip_4_06_spot3.	gds		
l	<u>O</u> utput File:	chip_4_06_spot3.	dc2		
	Options:				
	<u>D</u> esign CAD Co	lor Mode: ignCAD Color to M SII Layer # as De: SII DataType/Box	atch Assigne signCAD Colo Type as Des	ed GDSII Layer # or in Layer = 1 ignCAD Color	
	DesignCAD Dr.	awing <u>U</u> nit Size:			
	Line Type Scale (for Filled Polygons):				
	Error Checking Mode: Normal Mode Verbose Mode Save to File: gds_out.txt 				
	Cor	wert	Cano	el	

step 3 - right click on new dc2 file and select DesignCAD Express:

Nanometer Pa	attern Generatio	n System - Project: Daron			
File Project (Options Comn	ands Help			
Custom Commar	nds	Current Project Directory		<u>– D</u> isplay F	ïle Types
Process	Run File	C:\NPGS\Projects\Daron\	-	Design	AD Files 👻
Bun Fi	le Editor			1	
Show I	Run File	File Name	Туре	Size	Time and Date 🔺
DeviewCd	DEveryon	Chip_4_01_spot1_screenshot.dc2	DesignCAD	2,461	07-20-2012 11:
Designua	U Express	<mark>₽</mark> ° chip_4_06_spot2.dc2	DesignCAD	5,490	07-20-2012 10:
Estimate	Total Time	Chip_4_06_spot3.dc2	DesignCAD	4,544	07-17-2012 21:
Simulate	e Writing	Page chip_4_06_spot1.dc DesignCAD Express	nCAD	3,939	07-17-2012 21:
Click Me -	Liser Notes>	Chip_4_01_spot10.d Run File Editor	nCAD	5,580	07-13-2012 19:
	0.561140(632	Provide the second sec	nCAD	5,858	07-13-2012 17:
NPGS	Manual	Page chip_4_01_spot1.dc view Text File	nCAD	3,856	07-13-2012 17:
Run Files	DC2 Files	alignment-contact_test.dc2	DesignCAD	4,777	07-13-2012 17:
LastRun.log	Proiect.log	device_contacts_2writes.dc2	DesignCAD	5,312	07-12-2012 15:
C-11/D C 0	Deedly/D	device_contacts_1write.dc2	DesignCAD	4,959	07-12-2012 15:
	Read WD	Exposure_Array_DesignCAD_multi.dc2	DesignCAD	49,106	07-10-2012 19:
Do Backlash	Backlash Off	kathryntest.dc2	DesignCAD	2,816	07-09-2012 19:
NPGS Mode	SEM Mode	Exposure_Array_L-Edit_single_data0_2.dc2	DesignCAD	1,285	07-09-2012 19:
	DAC (+10 +10)	Exposure_Array_DesignCAD_single.dc2	DesignCAD	1,285	07-09-2012 18:
	0.5	Exposure_Array_DesignCAD_single_2.dc2	DesignCAD	1,285	07-09-2012 18:
Copy Io	Copy From	Exposure_Array_DesignCAD_single_2_data0.dc2	DesignCAD	1,285	07-09-2012 18:
View Text File	Blank Screen	Exposure_Array_DesignCAD_single_3_data0.dc2	DesignCAD	1,285	07-09-2012 18:
- Auto Longing	- Mada	Exposure_Array_AutoCAD_single_data0_2.dc2	DesignCAD	1,303	07-09-2012 17:
Auto Logging	g mode	Exposure_Array_AutoCAD_single_data0.dc2	DesignCAD	1,368	07-09-2012 17:
Exposure Sc	ale 1.000	Exposure_Array_DesignCAD_single_data0.dc2	DesignCAD	1,285	07-09-2012 17:
Beam Curre	ent	Exposure_Array_AutoCAD_single_data1.dc2	DesignCAD	1,368	07-09-2012 17: 👻
					4
chip_4_06_sp	ot3.dc2				N?

step 3.1 - click NPGS - setdump



step 3.1.1 - the dump point is green:



step 3.2 - click NPGS - MaxMag:



step 3.3 - click NPGS - save - exit when done - then re-open to double check dump existence:



step 4 - right click on dc2 - choose run file editor:

Nanometer Pa	attern Generatio	System - Project: Daron			_ D X
File Project C	Options Comm	ands Help			
- Custom Comman	ıds	Current Project Directory		– <u>D</u> isplay P	ile Types
Process	Run File	C:\NPGS\Projects\Daron\	-	DesignC	AD Files 👻
Run Fil	le Editor	,			
Show F	Run File	File Name	Туре	Size	Time and Date 🔺
DesignCá		Chip_4_06_spot3.dc2	DesignCAD	4,541	07-20-2012 11:
Designar	D Express	Chip_4_01_spot1_screet DesignCAD Express	CAD	2,461	07-20-2012 11:
Estimate	Fotal Time	2° chip_4_06_spot2.dc2 Run File Editor	DAD	5,490	07-20-2012 10:
Simulate	e Writing	Chip_4_06_spot1.dc2	DAD	3,939	07-17-2012 21:
<click -<="" me="" td=""><td>Leer Notes></td><td>Chip_4_01_spot10.dc</td><td>DAD</td><td>5,580</td><td>07-13-2012 19:</td></click>	Leer Notes>	Chip_4_01_spot10.dc	DAD	5,580	07-13-2012 19:
	User notes/	2° chip_4_01_spot2.dc2	DesignCAD	5,858	07-13-2012 17:
NPGS	Manual	2º chip_4_01_spot1.dc2	DesignCAD	3,856	07-13-2012 17:
Run Files	DC2 Files	2º alignment-contact_test.dc2	DesignCAD	4,777	07-13-2012 17:
LastBun.log	Project.log	2º device_contacts_2writes.dc2	DesignCAD	5,312	07-12-2012 15:
Cathyle C.O.	Deedly/D	2º device_contacts_1 write.dc2	DesignCAD	4,959	07-12-2012 15:
Set WD=6.0	Read WD	2º Exposure_Array_DesignCAD_multi.dc2	DesignCAD	49,106	07-10-2012 19:
Do Backlash	Backlash Off	<mark>₽</mark> kathryntest.dc2	DesignCAD	2,816	07-09-2012 19:
NPGS Mode	SEM Mode	2 Exposure_Array_L-Edit_single_data0_2.dc2	DesignCAD	1,285	07-09-2012 19:
	DAC (+10 +10)	2º Exposure_Array_DesignCAD_single.dc2	DesignCAD	1,285	07-09-2012 18:
DAC (0,0)	DAC (+10,+10)	2º Exposure_Array_DesignCAD_single_2.dc2	DesignCAD	1,285	07-09-2012 18:
Сору То	Copy From	Prosure_Array_DesignCAD_single_2_data0.dc2	DesignCAD	1,285	07-09-2012 18:
View Text File	Blank Screen	Provide the second state of the second state o	DesignCAD	1,285	07-09-2012 18:
		2.dc2 Exposure_Array_AutoCAD_single_data0_2.dc2	DesignCAD	1,303	07-09-2012 17:
Auto Logging) Mode	2º Exposure_Array_AutoCAD_single_data0.dc2	DesignCAD	1,368	07-09-2012 17:
Exposure Sc	ale 1 000	2º Exposure_Array_DesignCAD_single_data0.dc2	DesignCAD	1,285	07-09-2012 17:
Beam Curre	nt	2º Exposure_Array_AutoCAD_single_data1.dc2	DesignCAD	1,368	07-09-2012 17: 🔻
		· · · · · · · · · · · · · · · · · · ·			- · · ·
chip_4_06_spo	ot3.dc2				NY

step 4.1 - for fine contacts process 2 entities - set params as shown - pattern name is name of dc2 file:

NPGS Run File Editor - Project: Daron File: NoName	
File Edit Help	
Entity Entries	Highlighted Entity Data
Number of entities to process	Non-Stop Writing ModeYes
Allow Advanced Modes Yes 🗾	Disable Automated Stage Control No
1. Entity Type Alignment 💽	Disable Digital SEM Control
Alignment Mode Manual 📃	Disable X-Y-Focus Mode
Pattern Name	Disable Automated Beam Reading Yes 💌 💌
Number of times to repeat pattern	Time Between Readings (Minutes) 20.0
XY Move to Pattern Center (µm,µm) 0,0	Check Beam Reading Before
2. Entity Type Pattern 💌	Enable Global Rotation Correction No
Pattern Name	Offset for Stage Rotation Adjustment 1,0
Number of times to repeat pattern	Offset for Stage Matrix (Optional)
XY Move to Pattern Center (μm,μm) 0,0	
Insert Entity Cut Entity Copy Entity Paste Entity	Set <u>D</u> oses P <u>rint S</u> ave E <u>x</u> it
Up to 5000 Entities can be created using the Run File Editor.	You can now save changes.

step 4.2 - 1st entity is alignment - set params as shown - insert measured beam current in pA:

NPGS Run File Editor - Project: Daron File: NoName	
File Edit Help	
Entity Entries	Highlighted Entity Data
Number of entities to process 2	Layer 1
Allow Advanced Modes Yes 💌	Origin Offset (x,y) (μm,μm) 0,0
1. Entity Type Alignment	Magnification
Alignment Mode Manual 💌	Center-to-Center Distance (nm) 50.86
Pattern Name	Line Spacing
Number of times to repeat pattern	Configuration Parameter
XY Move to Pattern Center (μm,μm) 0,0	Measured Beam Current
2. Entity Type Pattern	Dwell: Color 1 🗆 Counts 15
Pattern Name	Layer 2Window
Number of times to repeat pattern	Origin Offset (x,y) (μm,μm) 0,0
XY Move to Pattern Center (μm,μm) 0,0	Magnification
	Center-to-Center Distance (nm) 50.86
	Line Spacing
	Configuration Parameter
	Measured Beam Current
	Dwell: Color 1
	Layer 3
	Origin Offset (x,y) (μm,μm) 0,0
	Magnification
	Center-to-Center Distance (nm) 50.86
	Line Spacing
	· · · · · · · · · · · · · · · · · · ·
Insert Entity Cut Entity Copy Entity Paste Entity	Set Doses Print Save Exit
Layer 1: Measured Beam Current limits: 1.0 < X < 10000000.0	You can now save changes.

step 4.2.1 - skip all non alignment layers:

NPGS Run File Editor - Project: Daron File: NoName

File Edit Help			
Entity Entries	Highlighted Entity Data		
Number of entities to process	Dwell: Color 1		
Allow Advanced Modes Yes 💌	Layer 4		
1. Entity Type Alignment 💌	Origin Offset (x,y) (μm,μm) 0,0		
Alignment Mode Manual 💌	Magnification		
Pattern Name	Center-to-Center Distance (nm) 50.86		
Number of times to repeat pattern	Line Spacing (nm) 50.86		
XY Move to Pattern Center (μm,μm) 0,0	Configuration Parameter		
2. Entity Type Pattern 💌	Measured Beam Current		
Pattern Name	Dwell: Color 1 Counts 15		
Number of times to repeat pattern	Layer 6		
XY Move to Pattern Center (μm,μm) 0,0	Origin Offset (x,y) (μm,μm) 0,0		
	Magnification		
	Center-to-Center Distance (nm) 50.86		
	Line Spacing (nm) 50.86		
	Configuration Parameter		
	Measured Beam Current		
	Dwell: Color 1 🗖 Counts 15		
	Layer 7Skip 💌		
	Origin Offset (x,y) (μm,μm) 0,0		
	Magnification		
	Center-to-Center Distance		
	·		
Insert Entity Cut Entity Copy Entity Paste Entity	Set Doses Print Save Exit		
Layer 6: Select the appropriate setting for each layer in the pattern. You can now save changes.			

step 4.3 - 2nd entity for fine contacts - skip all alignment layers - change line to area dose:

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	~

File Edit Help	
Entity Entries	Highlighted Entity Data
Number of entities to process 2	Layer 4Skip 🗾 📥
Allow Advanced Modes Yes 💌	Origin Offset (x,y) (μm,μm) 0,0
1. Entity Type Alignment 💌	Magnification
Alignment Mode Manual 💌	Center-to-Center Distance (nm) 18.31
Pattern Name	Line Spacing
Number of times to repeat pattern	Configuration Parameter
XY Move to Pattern Center (μm,μm) 0,0	Measured Beam Current (pA) 10.0
2. Entity Type Pattern	Multiple Pass Mode Disable
Pattern Name	Dwell: Color 1 ■
Number of times to repeat pattern	Line Dose (nC/cm) 1.30
XY Move to Pattern Center (μm,μm) 0,0	Layer 6Continuous
	Origin Offset (x,y) (μm,μm) 0,0
	Magnification
	Center-to-Center Distance (nm) 5.09
	Line Spacing
	Configuration Parameter
	Measured Beam Current (pA) 10.0
	Multiple Pass Mode Disable 🗾 💌
	Dwell: Color 1 🔲
	Line Dose (nC/cm) 1.29997 📃 🗨
	Layer 7
	Point
Insert Entity Cut Entity Copy Entity Paste Entity	Set <u>D</u> oses P <u>r</u> int <u>S</u> ave E <u>x</u> it
Layer 6: Area Dose limits: 0.00001 < X < 100000000.00	You can now save changes.

step 4.3.1 - enter params as shown - same for each layer! - skip contact pad layer - remember to update measured current

NPGS Run File Editor - Project: Daron File: NoName			_ D _ X	
File Edit Help				
Entity Entries	- Highlighted Entity Da	ata		
Number of entities to process 2	Layer 6		🔜 Continuous 🔄 💆	1
Allow Advanced Modes Yes 💌	Origin Offset (x,y)	μm,μ	.m) 0,0	
1. Entity Type Alignment	Magnification		900	
Alignment Mode Manual 💌	Center-to-Center Dist	tance(n	m) 5.09	
Pattern Name	Line Spacing		m) 5.09	
Number of times to repeat pattern	Configuration Parame	eter	1	
XY Move to Pattern Center (μm,μm) 0,0	Measured Beam Cur	rent	_λ Α) <mark>10.0</mark>	
2. Entity Type Pattern	Multiple Pass Mode .		Disable 📃 💌	
Pattern Name	Dwell: Color 1 🗖		ec) 7.761	
Number of times to repeat pattern	Area Dose	(μC/cr	m²) 300.00 📃 💌	
XY Move to Pattern Center (μm,μm) 0,0	Layer 7		Continuous 🛛 💌	
	Origin Offset (x,y)	(µm,µ	.m) 0,0	
	Magnification		900	
	Center-to-Center Dist	tance(n	m) 5.09	
	Line Spacing		m) 5.09	
	Configuration Parame	eter	1	
	Measured Beam Cur	rent	A) 10.0	
	Multiple Pass Mode .		Disable 💌	
	Dwell: Color 1 🔳		ec) 7.761	
	Area Dose	(μC/cr	m²) 300.00 💌	
	Layer 8		Skip 🔽 –	
Insert Entity Cut Entity Copy Entity Paste Entity	Set <u>D</u> oses	P <u>r</u> int <u>S</u> ar	ve E <u>x</u> it	
Layer 6: Measured Beam Current limits: 1.0 < X < 10000000.0		You can now save cha	anges.	?

step 4.4 - save run file - extension RF6 - and exit:

NPGS Run File Editor - Project: Daron File: NoName	
File Edit Help	
Entity Entries	Highlighted Entity Data
Number of entities to process 2	Area Dose
Allow Advanced Modes Yes	Layer 7Continuous
1. Entity Type Alignment	Origin Offset (x,y) (μm,μm) 0,0
Alignment Mode Manual	Magnification
Pattern Name chip_4_06_spot3	Center-to-Center Distance (nm) 5.09
Number of times to repeat pattern	Line Spacing (nm) 5.09
XY Move to Pattern Center (μm,μm) 0,0	Configuration Parameter
2. Entity Type Pattern	Measured Beam Current (pA) 10.0
Pattern Name chip_4_06_spot3	Multiple Pass Mode
Number of times to repeat pattern	Dwell: Color 1 ■
XY Move to Pattern Center (μm,μm) 0,0	Area Dose μC/cm²) 300.00 💌
Carry Due File	2 × 12
Save: Run File	
File Name	Type Size Time and I
0324TR_CHIP1.RF6	Run file 1,516 04-07-201 😑 35
0324TR_CHIP2_TG.RF6	Run file 1,508 04-07-201 86
0324TRCHIP5.RF6	Run file 1,507 04-12-201
0324TRCHIP5TG.RF6	Run file 1,318 04-14-201
033011.RF6	Run file 1,286 03-30-201
033011SIDOSE.RF6	Run file 520 04-04-201 able 💌
033011SIDOSE_2.RF6	Run file 530 04-05-201
033111_1.RF6	Run file 1,119 04-04-201 0 🔽
033111_2.RF6	Run file 959 04-05-201
040511.RF6	Run tile 829 04-05-201
Insert Entity 040511_2.RF6	Run file 1,108 04-05-201
Layer 6: Measured Beau 200 U4U511RERUN.RF6	Run file 823 04-06-201
400011_A1.RF6	Hun file 1,304 04-08-201
	Run file 1,311 04-08-201
Eile Name: chip_4_06_spot3_fine_breakou	uts.RF6 <u>S</u> ave Cancel
生気し	

step 5 - find run file - right click - process run file:

File Project Options Commands Display File Types Process Run File Run File Editor Run File Editor Run File Ru	Nanometer Pa	ttern Generatio	n System - Project: Daron	-		_ _ ×
Custom Commands Display File Types Process Run File Run File Editor Show Run File Immediate Street DesignCAD Express C:MPGS VProjects/Daron/ Estimate Total Time Show Run File Simulate Writing Chip. 4, 06, spot1_contact_pads. RF Process Run File Cick Me - User Notes> Chip. 4, 06, spot2_contact_pads. RF Process Run File Cick Me - User Notes> Chip. 4, 06, spot2_contact_pads. RF Process Run File Cick Me - User Notes> Chip. 4, 06, spot2_contact_pads. RF Show Run File 769 07:20:2012 10; Run Files DC2 Files Chip. 4, 06, spot2_contact.pads. RF Show Run File 769 07:20:2012 10; Run Files DC2 Files Chip. 4, 06, spot2_breakouts. RF6 Show Run File 77:70:71:2012 21; Run Files DC2 Files Chip. 4, 01, spot1_contact_pads. RF6 Run file 771 07:15:2012 19; Set WD=6.0 Read WD Chip. 4, 01, spot1_contact_pads. RF6 Run file 771 07:15:2012 19; De Backlash Backlash Off Nofile 771 07:15:2012 19; alignment-contact_lest_contact_pads. RF6 Run file 1,479 07:13:	File Project C	ptions Comn	nands Help			
Process Run File Run File Editor Run File Editor Run File Show Run File Type Size Time and Date DesignCAD Express File Name Type Size Time and Date Estimate Total Time Chip. 4_05_spot3_contact_pads. RF Process Run File 769 07-20-2012 10 File Rame Simulate Writing Chip. 4_06_spot3_contact_pads. RF Run File Editor 769 07-20-2012 10 File Rame Click Me - User Notes> Chip. 4_06_spot3_contact_pads. RF Run File Editor 769 07-20-2012 10 File Rame/Copy Run Files DC2 Files Chip. 4_06_spot3_breakouts. RF6 Run File 1.479 07.17-2012 21: NPGS Manual DC2 Files Chip. 4_01_spot1_contact_pads. RF6 Run file 7107-15-2012 19: Run Files DC2 Files Chip. 4_01_spot1_contact_pads. RF6 Run file 77107-2012 21: Backlash Backlash Diff Or 1.52012 19: Chip. 4_01_spot1_contact_pads. RF6 Run file 77107-152012 19: Backlash Backlash Diff Descus RF6 Run file 770 07-152012 19: 20: 20: 20: 20: 20:	Custom Commands Display File Types					
Run File Editor File Name Type Size Time and Date Show Run File chip. 4. 06_spot3_cine_breakouts.Rf Process Run File 768 07-20-2012 10. DesignCAD Express chip. 4. 06_spot3_contact_pads.Rf Process Run File 768 07-20-2012 10. Estimate Total Time chip. 4. 06_spot3_contact_pads.Rf Run File Editor 769 07-20-2012 10. Simulate Writing chip. 4. 06_spot3_contact_pads.Rf Run File Editor 769 07-20-2012 10. Click Me - User Notes> chip. 4. 06_spot3_contact_pads.Rf Run File 1.479 07-17-2012 21. NPGS Manual chip. 4. 06_spot3_contact_pads.RF6 Run File 1.485 07-17-2012 21. Run File DC2 Files chip. 4. 01_spot10_contact_pads.RF6 Run file 717-2012 21. Run File DC2 Files chip. 4. 01_spot10_contact_pads.RF6 Run file 771 07-15-2012 19. Set WD=60 Read WD Schip.4.01_spot10_contact_pads.RF6 Run file 771 07-15-2012 19. Do Backlash Backlash Diff chip.4.01_spot1_contact_pads.RF6 Run file 1.479 07-13-2012 17. DAC (0.0) DAC (+0.1.9101 <td>Process</td> <td>Run File</td> <td>C:\NBCC\Breinste\Deren</td> <td colspan="3"></td>	Process	Run File	C:\NBCC\Breinste\Deren			
Tige Size Time and Date Show Run File Chip, 4, 06, spol3, fine, breakouts, Rfs Process Run File 1,479 07-20-2012 11: DesignCAD Express Chip, 4, 06, spol3, contact_pads, Rf Process Run File 768 07-20-2012 10: Estimate Total Time Chip, 4, 06, spol3, contact_pads, Rf Run File Editor 769 07-20-2012 10: Simulate Writing Chip, 4, 06, spol3, contact_pads, Rf Run File Editor 769 07-20-2012 10: Click Me - User Notes> Chip, 4, 06, spol3, breakouts, RF6 Run File 1,479 07-17-2012 21: NPGS Manual Chip, 4, 06, spol2, breakouts, RF6 Print Run File 1,483 07-17-2012 21: Run File D 2 Chip, 4, 01, spol10, contact_pads, RF6 Run file 771 07-15-2012 19: LastRun.log Project.log Chip, 4, 01, spol10, contact_pads, RF6 Run file 771 07-15-2012 19: Set WD=60 Read WD Salignment-contact_test_contact_pads, RF6 Run file 1,479 07-13-2012 19: D B Backlash Backlash Off Bank Screen Chip, 4, 01, spol1_breakouts, RF6 Run file 1,479 07-13-2012 17: D AC (0,0) DAC (Bup Fil	e Editor	C. WEDS FOJECTS DAION		Inunnie	
Show Hun File1 (1)0.03 spoil1 (1)0.03 spoil1 (1)0.03 spoil1 (1)0.03 spoil1 (1)0.03 spoil0.03 spoil			File Name	Tupe	Size	Time and Date
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Estimate Total Timechip, 4_06_spot3_contact_pads.RFRun File Editor76907-20-2012 10Simulate Writingchip, 4_06_spot3_contact_pads.RFShow Run File1,47907-17-2012 21:Click Me · User Notes>chip, 4_06_spot3_breakouts.RF6Print Run File1,48507-17-2012 21:NPGS Manualchip, 4_06_spot3_breakouts.RF6Rename/Copy1,48307-17-2012 21:Run FilesDC2 Fileschip, 4_01_spot1_breakouts.RF6Rename/Copy1,48307-17-2012 21:LastRun logProject.logchip, 4_01_spot1_contact_pads.RF6Run file77107-15-2012 19:Set WD=6.0Read WDchip, 4_01_spot1_contact_pads.RF6Run file77107-15-2012 19:Do BacklashBacklash OffChip, 4_01_spot1_breakouts.RF6Run file77807-13-2012 19:NPGS ModeSEM ModeChip, 4_01_spot1_breakouts.RF6Run file1,47007-13-2012 19:Do BacklashBacklash OffChip, 4_01_spot1_breakouts.RF6Run file1,47007-13-2012 19:Copy ToCopy FromCopy FromChip, 4_01_spot1_breakouts.RF6Run file1,47007-13-2012 17:Mevice_contacts_1wite.RF6Run file1,00007-12-2012 17:07-13-2012 17:07-13-2012 17:Mevice_contacts_1wite.RF6Run file1,00007-12-2012 17:07-10-2012 10:07-13-2012 17:ModeChip,4_01_spot1_hreakouts.RF6Run file1,00007-12-2012 17:07-10-2012 10:ModeChip,4_01_spot1_hreakouts.RF6Run file1,000 <td>DesignCA</td> <td>D Express</td> <td>chip 4 06 spot1 contact pads.RF</td> <td>Process Run File</td> <td>768</td> <td>07-20-2012 10: =</td>	DesignCA	D Express	chip 4 06 spot1 contact pads.RF	Process Run File	768	07-20-2012 10: =
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Click Me - User Notes>chip_4_06_spot3_breakouts.RF6Print Run FileNPGS Manualchip_4_06_spot3_breakouts.RF6Print Run FileNPGS ManualChip_4_06_spot3_breakouts.RF6Rename/CopyRun FilesDC2 FilesLastRun.logProject.logSet WD=6.0Read WDDo BacklashBacklash OffNPGS ModeSEM ModeDo BacklashBacklash OffNPGS ModeSEM ModeCopy ToCopy FromView Text FileBlank ScreenView Text FileBlank ScreenAuto Logging ModeExposure Scale1.000Beam Current10.00	Simulate	e Writing	chip_4_06_spot2_contact_pads.RF	Show Pup File	769	07-20-2012 10:
NPGS Manualchip_4_06_spot2_breakouts.RF6Print Run File1,48507-17-2012 21:Run FilesDC2 Fileschip_4_06_spot1_breakouts.RF6Rename/Copy1,48307-17-2012 21:LastRun.logProject.logchip_4_01_spot1_contact_pads.RF6Run file77107-15-2012 19:Set WD=6.0Read WDchip_4_01_spot1_contact_pads.RF6Run file77107-15-2012 19:Do BacklashBacklash Offchip_4_01_spot1_contact_pads.RF6Run file77807-15-2012 19:Do BacklashBacklash Offchip_4_01_spot1_breakouts.RF6Run file1,47007-13-2012 19:Do BacklashBacklash Offchip_4_01_spot1_breakouts.RF6Run file1,47007-13-2012 19:Do BacklashBacklash Offchip_4_01_spot1_breakouts.RF6Run file1,47007-13-2012 19:DAC (0,0)DAC (+10,+10)chip_4_01_spot1_breakouts.RF6Run file1,47907-13-2012 17:DAC (0,0)DAC (+10,+10)chip_4_01_spot1_breakouts.RF6Run file1,49707-13-2012 17:DAC (0,0)DAC (+10,+10)chip_4_01_spot1_kRF6Run file1,00607-11-2012 17:View Text FileBlank Screendevice_contacts_2writes.RF6Run file1,09607-11-2012 10:View Text FileBlank Screen1,000chip_4_1.RF6Run file1,09607-11-2012 10:Mater Scale1,000chip_4_0.00chip_4_1.RF6Run file2,08407-11-2012 10:Mater Scale1,000chip_4_0.00chip_4_1.RF6Run	Click Mo. J	Lear Natao	🔤 chip_4_06_spot3_breakouts.RF6	Show Kun Pile	1,479	07-17-2012 21:
NPGS ManualChip_4_06_spot1_breakouts.RF6Rename/Copy1,48307-17-2012 21:Run FilesDC2 FilesChip_4_01_spot10_contact_pads.RF6Run file77207-15-2012 19:LastRun.logProject.logChip_4_01_spot2_contact_pads.RF6Run file77107-15-2012 19:Set WD=6.0Read WDChip_4_01_spot1_contact_pads.RF6Run file77107-15-2012 19:Do BacklashBacklash OffChip_4_01_spot1_contact_pads.RF6Run file77807-15-2012 19:Do BacklashBacklash OffChip_4_01_spot1_breakouts.RF6Run file1,47007-13-2012 19:DAC (0,0)DAC (+10,+10)Chip_4_01_spot2_breakouts.RF6Run file1,47807-13-2012 17:DAC (0,0)DAC (+10,+10)Chip_4_01_spot1_breakouts.RF6Run file1,49707-13-2012 17:Copy ToCopy FromCopy FromChip_4_01_spot1_breakouts.RF6Run file1,49707-13-2012 17:View Text FileBlank Screen1,000Chip-dose2_Exposure_Array.RF6Run file1,09607-12-2012 16:Chip-dose2_Exposure_Array_V3.RF6Run file1,09607-11-2012 20:exposure_array_v3.RF6Run file71707-06-2012 01:exposure_array_v3.RF6Run file71707-06-2012 00:IIIIIIIIIIIIIII	Click Me-	User Notes>	🔄 🏧 chip_4_06_spot2_breakouts.RF6	Print Run File	1,485	07-17-2012 21:
Run Files DC2 Files Chip_4_01_spot10_contact_pads.RF6 Run me 772 07-15-2012 19: LastRun.log Project.log chip_4_01_spot2_contact_pads.RF6 Run file 771 07-15-2012 19: Set WD=6.0 Read WD chip_4_01_spot1_contact_pads.RF6 Run file 771 07-15-2012 19: Do Backlash Backlash Off chip_4_01_spot1_contact_pads.RF6 Run file 778 07-15-2012 19: Do Backlash Backlash Off chip_4_01_spot1_contact_pads.RF6 Run file 778 07-15-2012 19: NPGS Mode SEM Mode chip_4_01_spot1_breakouts.RF6 Run file 1,470 07-13-2012 17: DAC (0.0) DAC (+10,+10) chip_4_01_spot1_breakouts.RF6 Run file 1,479 07-13-2012 17: Copy To Copy From chip_4_01_spot1_breakouts.RF6 Run file 1,497 07-13-2012 17: View Text File Blank Screen device_contacts_test_breakouts.RF6 Run file 1,010 07-12-2012 17: Auto Logging Mode chip_14_spot_1.RF6 Run file 1,000 07-12-2012 16: chip_214_spot_1.RF6	NPGS I	Manual	chip_4_06_spot1_breakouts.RF6	Rename/Copy	1,483	07-17-2012 21:
LastRun.logProject.logSet WD=6.0Read WDSet WD=6.0Read WDRead WDSet WD=6.0Read WDRead WD<	Run Files	DC2 Files	chip_4_01_spot10_contact_pads.RF6	Hun file	772	07-15-2012 19:
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Oct in 0 oneIndex in 0Do BacklashBacklash OffDo BacklashBacklash OffNPGS ModeSEM ModeDAC (0.0)DAC (+10,+10)Copy ToCopy FromView Text FileBlank Screen✓ Auto Logging ModeExposure Scale1.000Beam Current10.00Item Current10.00Item Current10.00	Set WD=6.0	Bead WD	chip_4_01_spot1_contact_pads.RF6	Run file	771	07-15-2012 19:
Do Backlash Backlash Uff NPGS Mode SEM Mode DAC (0.0) DAC (+10,+10) Copy To Copy From View Text File Blank Screen ✓ Auto Logging Mode 1,000 Exposure Scale 1,000 Beam Current 10.00		D U LOW	alignment-contact_test_contact_pads.	RF6 Run file	778	07-15-2012 19:
NPGS Mode SEM Mode 1,478 07-13-2012 17: DAC (0,0) DAC (+10,+10) chip_4_01_spot1_breakouts.RF6 Run file 1,469 07-13-2012 17: Copy To Copy From copy From device_contacts_test_breakouts.RF6 Run file 1,497 07-13-2012 17: View Text File Blank Screen device_contacts_2writes.RF6 Run file 1,096 07-12-2012 17: ✓ Auto Logging Mode device_contacts_1write.RF6 Run file 1,096 07-11-2012 20: ✓ Auto Logging Mode Chip-dose2_Exposure_Array.RF6 Run file 1,696 07-11-2012 16: Exposure Scale 1.000 10.00 10.00 mile 77 07-06-2012 01:	Do Backlash	Backlash Uff	Chip_4_U1_spot1U_breakouts.HF6	Bun file	1,470	07-13-2012 19:
DAC (0,0) DAC (+10,+10) Copy To Copy From View Text File Blank Screen ✓ Auto Logging Mode 1,000 Exposure Scale 1,000 Beam Current 10,00	NPGS Mode	SEM Mode	Sector Chip_4_U1_spot2_breakouts.RF6	Run file	1,478	07-13-2012 17:
Copy To Copy From View Text File Blank Screen ✓ Auto Logging Mode Chip-dose2_Exposure_Array.RF6 Exposure Scale 1.000 Beam Current 10.00	DAC (0,0)	DAC (+10,+10)	Chip_4_01_spot1_breakouts.hF6	Run file	1,463	07-13-2012 17:
View Text File Blank Screen ✓ Auto Logging Mode Image: Scale 1.000 Exposure Scale 1.000 Image: Scale 1.000 Beam Current 10.00 Image: Scale 1.000	Сору То	Copy From	device contacts 2writes BE6	Bun file	1,437	07-13-2012 17:
View Fext file blank öddeaff Auto Logging Mode Schip2_14_spot_1.RF6 Exposure Scale 1.000 Beam Current 10.00	View Text File	Blank Screen	device_contacts_1write_BE6	Bun file	1,001	07-12-2012 16
Auto Logging Mode Chip-dose2_Exposure_Array.RF6 Run file 2,084 07-11-2012 16: Exposure Scale 1.000 exposure_array_v2.RF6 Run file 717 07-06-2012 01: Beam Current 10.00 III III III III		Didnk Screen	chip2 14 spot 1.8F6	Run file	1.696	07-11-2012 20:
Exposure Scale 1.000 Run file 717 07-06-2012 01: Beam Current 10.00 exposure_array_v3.RF6 Run file 728 07-06-2012 00:	🛛 🔽 Auto Logging	Mode	Chip-dose2 Exposure Array.RF6	Run file	2,084	07-11-2012 16:
Exposure Scale 1.000 Beam Current 10.00			exposure_array_v2.RF6	Run file	717	07-06-2012 01:
	Page Current		exposure_array_v3.RF6	Run file	728	07-06-2012 00: 👻
	Beam Current 10.00					
chip_4_06_spot3_fine_breakouts.rf6 = #0.NonStop-AutoStage-DigitalSEM(SCOPE), #1.Align:chip_4_06_s 隆	chip_4_06_spc	t3_fine_brea	akouts.rf6 = #0.NonStop-AutoSta	ge-DigitalSEM(SCOPE), #3	L.Align:c	hip_4_06_s 🎦

step 5.1 - click continue - the writing will start!

in do manda	LI ISTE COID /L US SOOFL DESKOURS RES	BUD NA	1.48	
Log File Editor - P	roject Daron File: Pg_Log_Pre.sys			×
File Help				
<pre-writing log<="" td=""><td>g File></td><td></td><td></td><td>_</td></pre-writing>	g File>			_
Sample Informati	ion			
Sample #1	Sample/Wafer ID			
none	Secondary ID			
Si3N4	 Substrate 			
950k PMMA	Resist (Top Layer)			
150-200nm	Resist Thickness			
Not Used	Resist (Bottom Layer)			-
Not Used	Resist Thickness			
Microscope Setti	ings			
20kV 🔻	Accelerating Voltage (kV)			
7	Gun Bias			
2.2	Filament Current (A)			
60	Emission Current (µA)			
100				
		Save & Continue	Co <u>n</u> tinue	<u>Cancel Exposure</u>
Sample/Wafer ID			No Change	23

step 6 - set up contact pad exposure - use these params:

NPGS Run File Editor - Project: Daron File: NoName		
File Edit Help	Highlighted Entity Data	
Number of entities to process	Non-Stop Writing Mode	Yes 🔻
Allow Advanced Modes	Disable Automated Stage Control	No
1. Entity Type	Disable Digital SEM Control	No 💌
Pattern Name	Disable X-Y-Focus Mode	Yes 🔽
Number of times to repeat pattern	Disable Automated Beam Reading	Yes 🔽
XY Move to Pattern Center (μm,μm) 0,0	Time Between Readings (Mi	nutes) 20.0
	Check Beam Reading Before	1
	Enable Global Rotation Correction	No 💌
	Offset for Stage Rotation Adjustment	1,0
	Offset for Stage Matrix	tional)
Insert Entity Cut Entity Copy Entity Paste Entity	Set <u>D</u> oses P <u>r</u> int	<u>S</u> ave E <u>x</u> it
The SEM driver is defined in Pg_Cmnd.sys.	You can now save	changes.

step 6.1 - skip all but contact pad layer - enter params - remember to update measured current - proceed as before:

NPGS Run File Editor - Project: Daron File: NoName	
File Edit Help	ľ
Entity Entries	Highlighted Entity Data
Number of entities to process 1	Line Dose (nC/cm) 1.30 🗾 📥
Allow Advanced Modes Yes 💌	Layer 7Skip 🔽
1. Entity Type Pattern 💌	Origin Offset (x,y) (μm,μm) 0,0
Pattern Name chip_4_06_spot3	Magnification
Number of times to repeat pattern	Center-to-Center Distance (nm) 32.04
XY Move to Pattern Center (μm,μm) 0,0	Line Spacing
	Configuration Parameter
	Measured Beam Current
	Multiple Pass Mode Disable 💌
	Dwell: Color 1 🔳
	Line Dose (nC/cm) 1.30 💌
	Layer 8
	Origin Offset (x,y) (μm,μm) 0,0
	Magnification
	Center-to-Center Distance (nm) 30.52
	Line Spacing
	Configuration Parameter
	Measured Beam Current
	Multiple Pass Mode Disable 💌
	Dwell: Color 1 🔲
	Area Dose
Insert Entity Cut Entity Copy Entity Paste Entity	Set <u>D</u> oses P <u>r</u> int <u>S</u> ave E <u>x</u> it
Layer 8: Measured Beam Current limits: 1.0 < X < 10000000.0	You can now save changes.