

Techplots generation for gm/Id Methodology using Cadence Virtuoso

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Creating New Library/Cellview

- Follow this document to create a new schematic

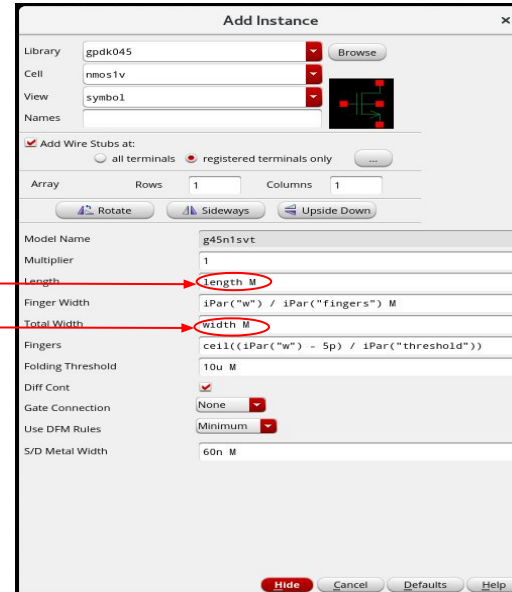
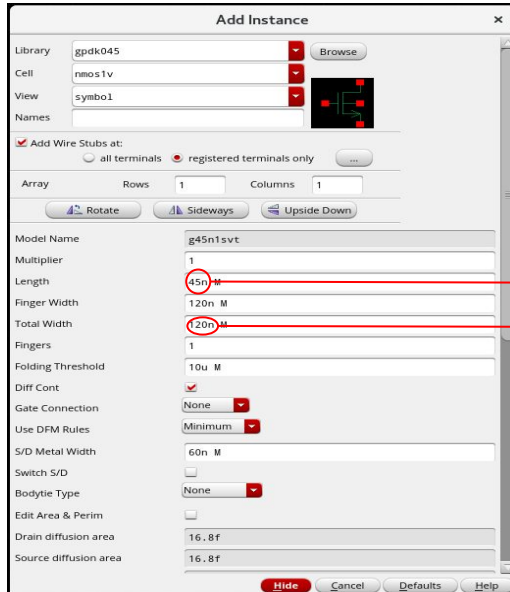
[\(Lecture-9\) VL502 Lab Simulation Exercise Tutorial.pdf](#)

- While creating the Library attach the pdks that you are going to work with
- If you're working in a pre-existing library by creating a new cellview you can add the necessary pdks in the ADE L by clicking this icon

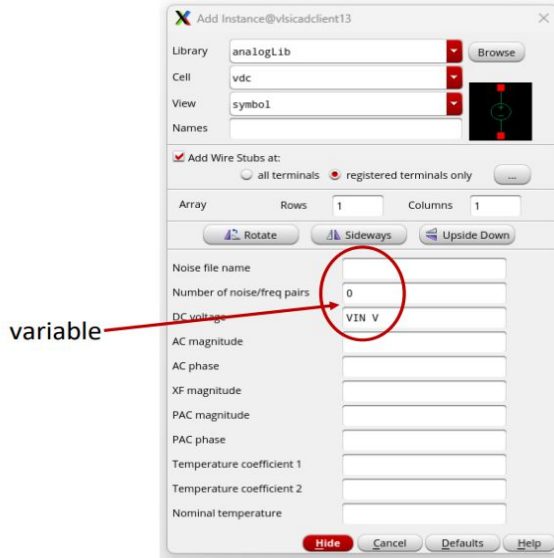


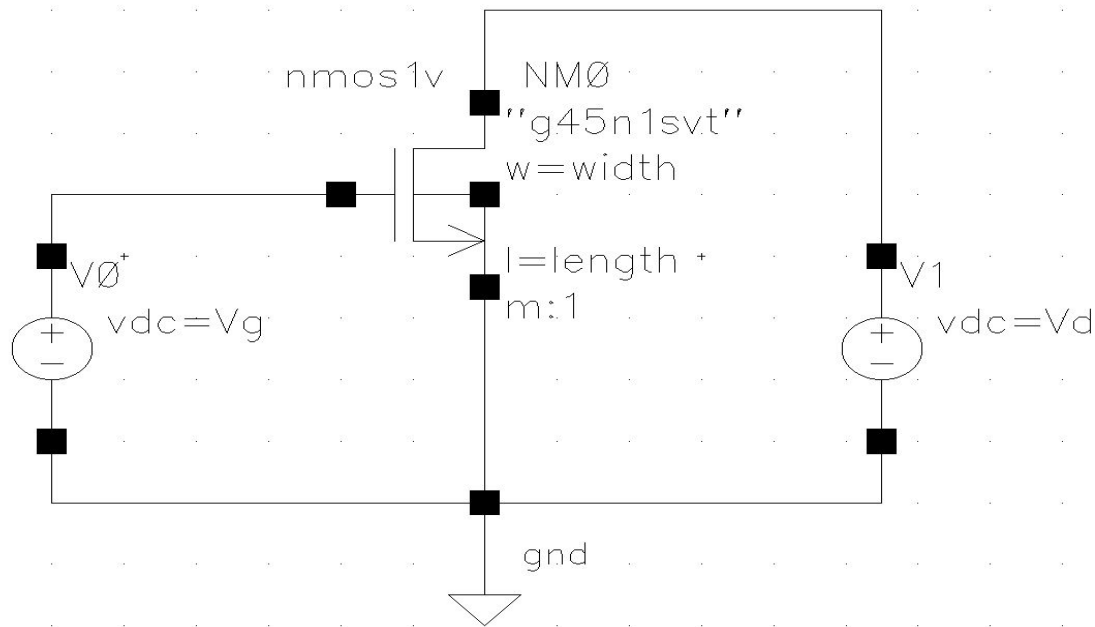
Creating New Schematic

- To make the schematic click i to add the necessary circuit elements.
- While selecting the nmos/pmos make the length and width of nmos/pmos as variables respectively



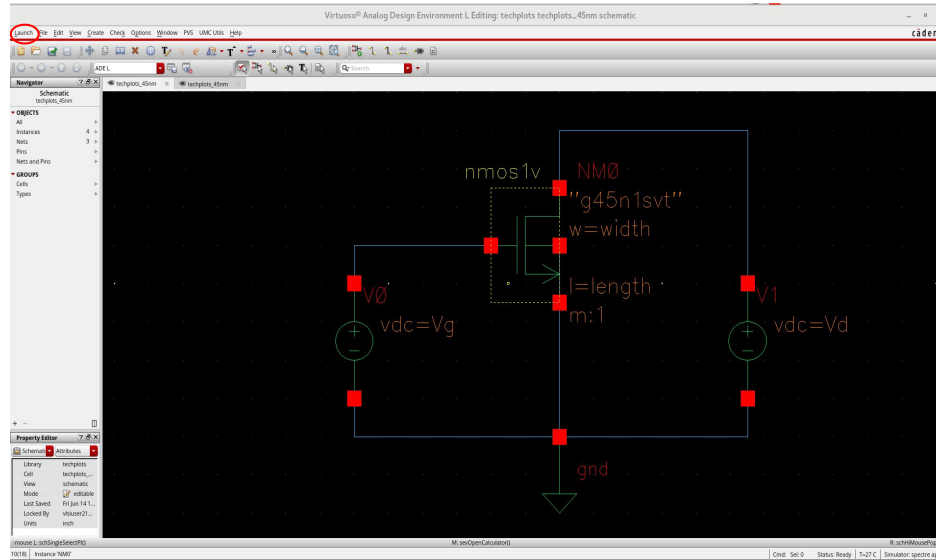
- And also instantiate the necessary DC voltage and ground ,make the DC voltages as variables.

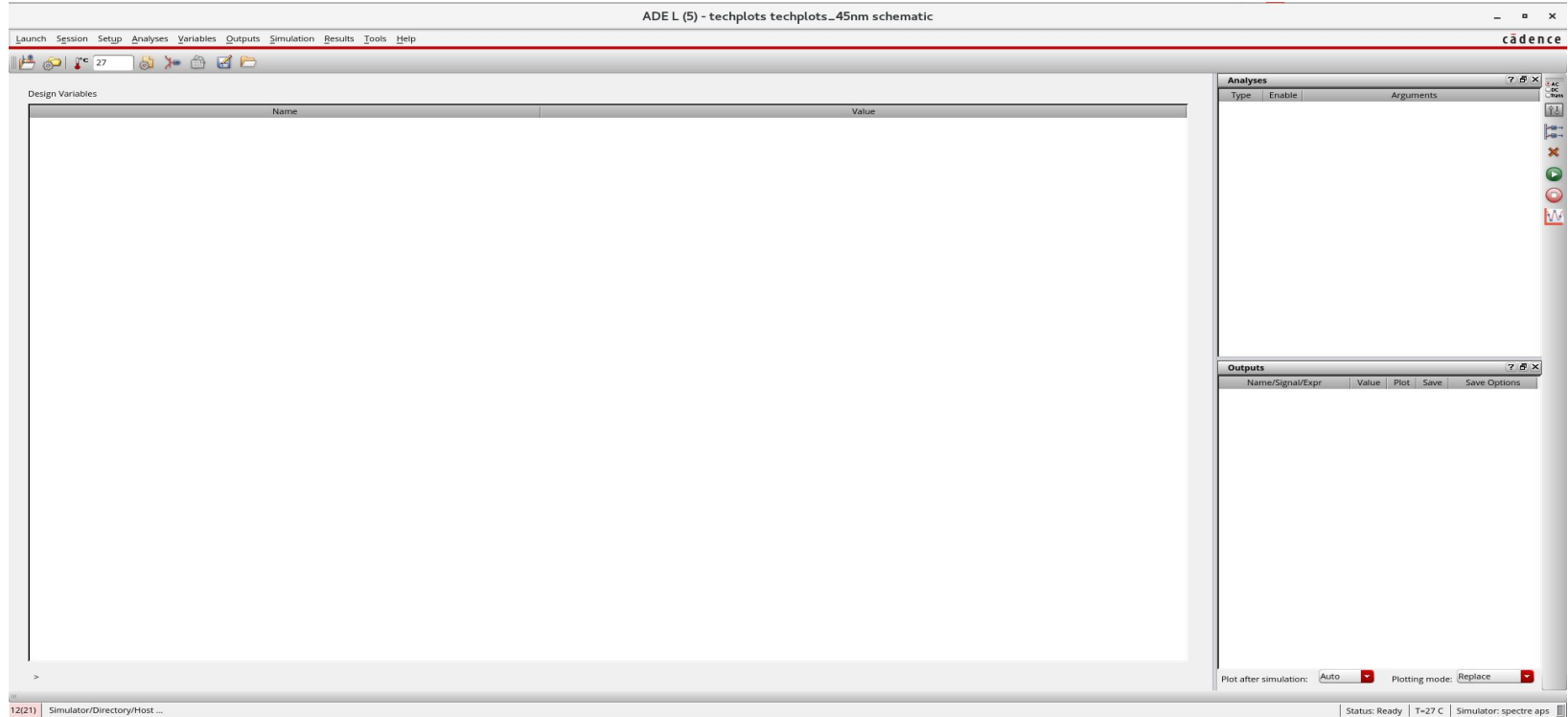




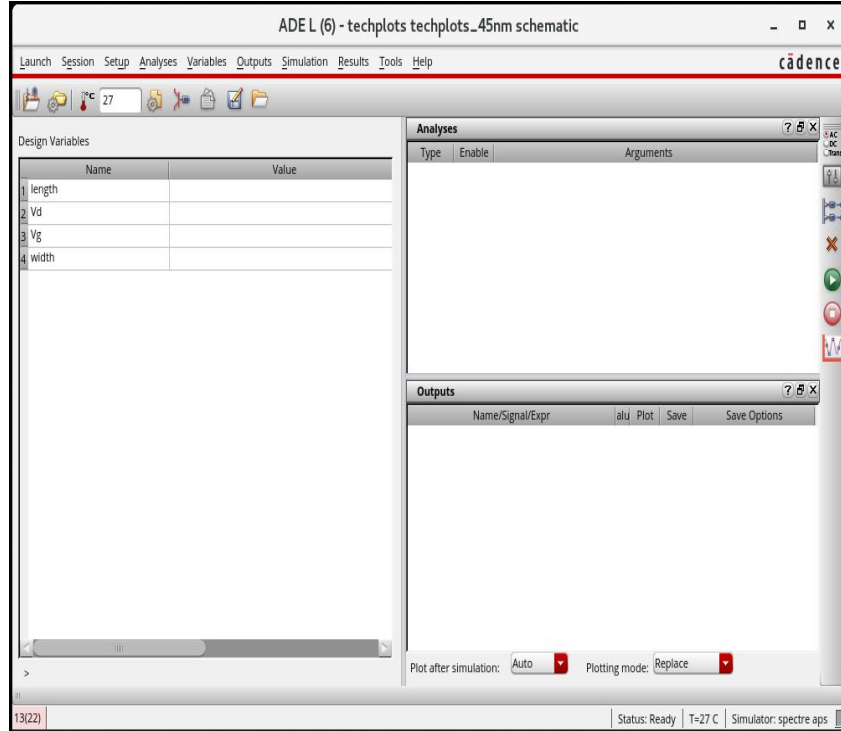
Launching ADE L

- Click on launch in the schematic editor window and then select ADE L to open the ADE L window.

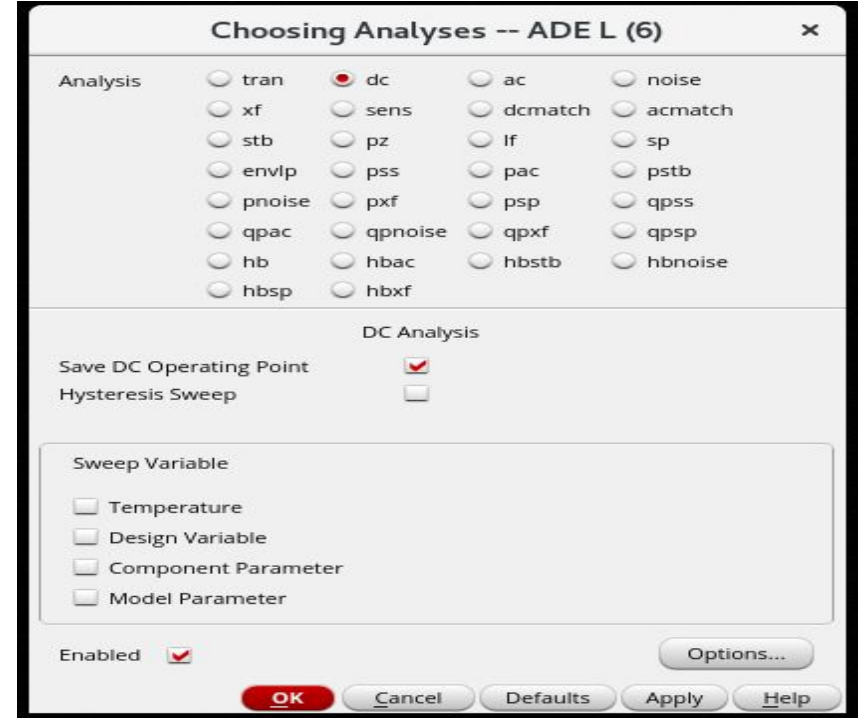




Loading variables to ADEL

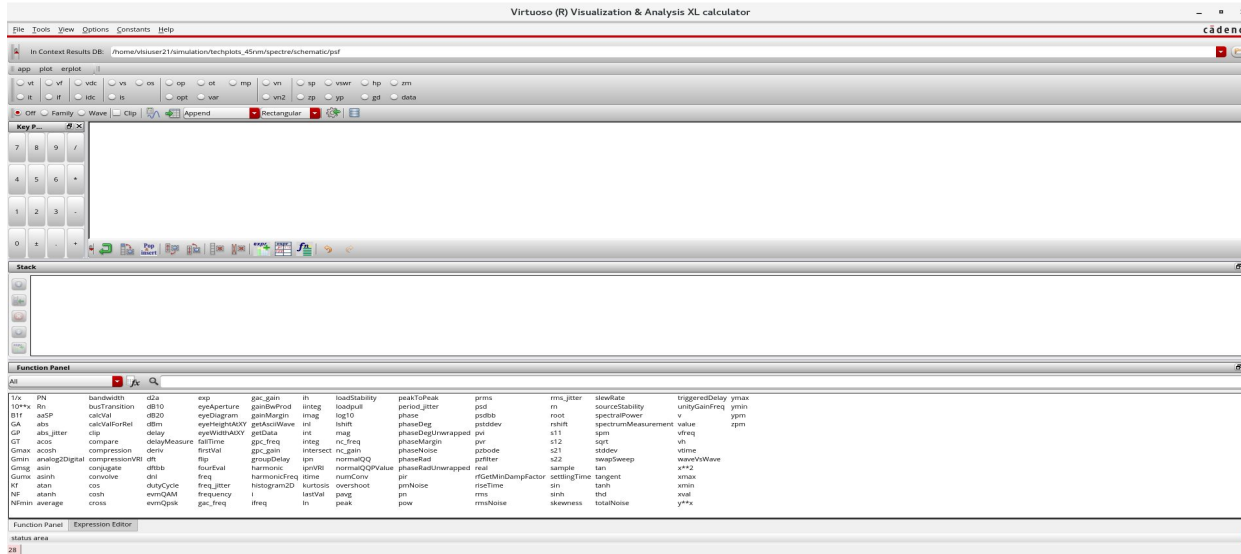


Choosing Analyses

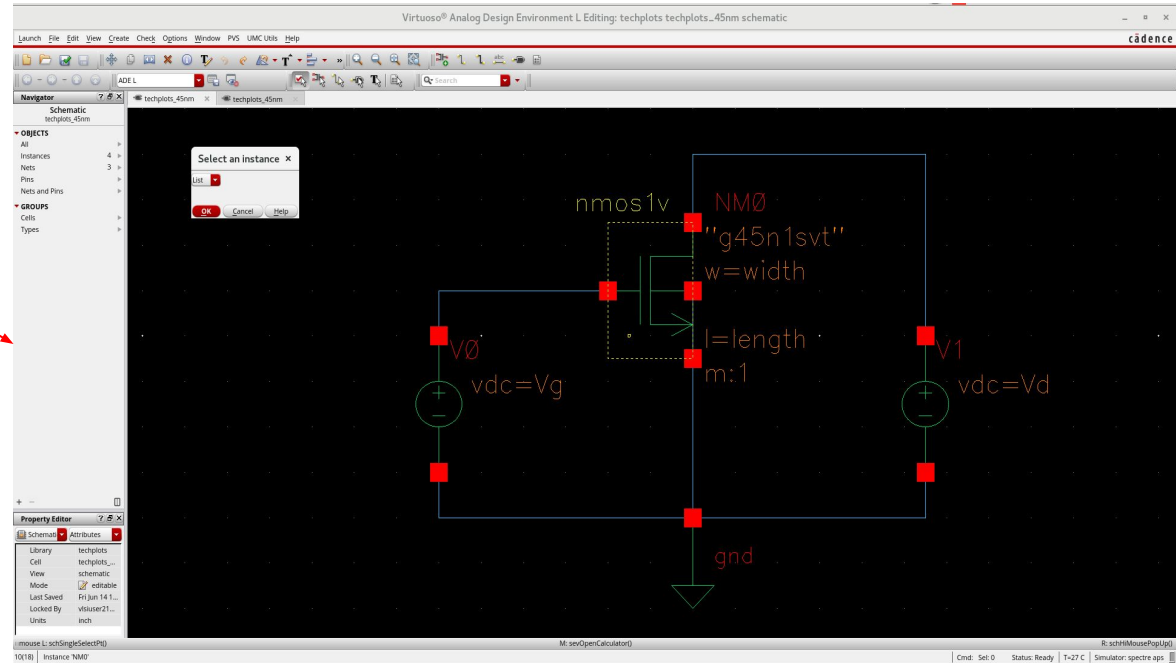


Calculator and Output Expressions

- After choosing the analyses click on the run simulation 
- In the ADE L window click on tools select calculator



- Click on the op in the calculator window and after the select the instance which is the nmos/pmos to add the necessary operating points to the ADE L



Virtuoso (R) Visualization & Analysis XL calculator

File Tools View Options Constants Help

In Context Results DB: /home/vsiuser21/simulation/techplots_45nm/spectre/schematic/psf

app plot erplot

vt vf vdc vs os op ot mp vn sp vswr hp zm
it if idc is opt var vn2 zp yp gd data

Off Family Wave Clip Append Rectangular

Key P... $OS/NM0, gm$

Click the icon the expression will get added to the ADE L

Stack

Function Panel

All

1/x	PN	bandwidth	d2a	exp	gac_gain	lh	loadStability	peakToPeak	prms	rms_jitter	slewRate	triggeredDelay	ymin
10**x	Rn	busTransition	dB10	eyeAperture	gainBWProd	iinteg	period_jitter	psd	m	sourceStability	unityGainFreq	ymax	
B1f	asp	calcVal	dB20	eyeDiagram	gainMargin	imag	phase	psdbb	root	spectralPower	v	ypm	
GA	abs	calcValForRel	dBm	eyeHeightADXY	getAsciWave	lshift	phaseDeg	psddev	rshift	spectrumMeasurement	value	zpm	
GP	abs_jitter	clip	delay	eyeWidthADXY	getData	int	phaseDegUnwrapped	pvi	s11	spm	vfreq		
GT	acos	compare	delayMeasure	fallTime	gpc_freq	integ	phaseMargin	pvr	s12	sqr	vh		
Gmax	acosh	compression	deriv	firstVal	gpc_gain	intersect	phaseNoise	pzbode	s21	stddev	vtime		
Gmin	alog2Digital	compressionVRI	dft	flip	groupDelay	ipn	normalQQ	pzfilter	s22	swapSweep	waveVsWave		
Gmsg	asin	conjugate	dftbb	fourEval	harmonic	ipnVRI	normalQQPValue	real	sample	tan	x**2		
Gumx	asinh	convolve	dnl	freq	harmonicFreq	itime	numConv	phaseRadUnwrapped	settlingTime	tangent	xmax		
Kf	atan	cos	dutyCycle	freq_jitter	histogram2D	kurtosis	overshoot	pmNoise	riseTime	sin	xmin		
NF	atanh	cosh	evmQAM	frequency	i	lastVal	pavg	pn	rms	sinh	xval		
NFmin	average	cross	evmQpsk	gac_freq	ifreq	ln	peak	pow	rmsNoise	skewness	totalNoise	y**x	

Function Panel Expression Editor

status area

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ADE L (6) - techplots techplots_45nm schematic

Launch Session Setup Analyses Variables Outputs Simulation Results Tools Help

27

Design Variables

	Name	Value
1	length	45n
2	Vd	400m
3	Vg	1
4	width	180n

Analyses

Type	Enable	Arguments
1 dc	<input checked="" type="checkbox"/>	t

Outputs

Name/Signal/Expr	alu	Plot	Save	Save Options
1 OP("/NM0" "gm")		<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Plot after simulation: Auto Plotting mode: Replace

13(22) Edit Variables ... Status: Ready T=27 C Simulator: spectre aps

- Following the same steps add the remaining operating points in the ADE L

ADE L (6) - techplots techplots_45nm schematic

Launch Session Setup Analyses Variables Outputs Simulation Results Tools Help

27

Design Variables

	Name	Value
1	length	45n
2	Vd	400m
3	Vg	1
4	width	180n

Analyses

Type	Enable	Arguments
1 dc	<input checked="" type="checkbox"/>	t

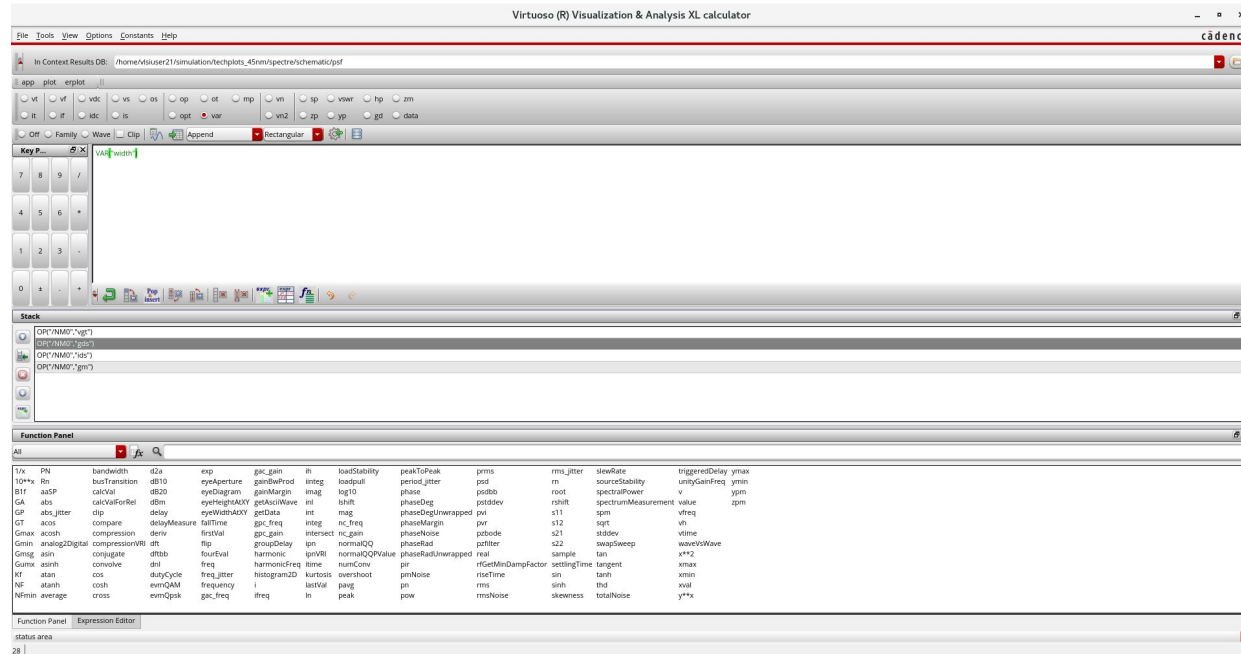
Outputs

	Name/Signal/Expr	alu	Plot	Save	Save Options
1	OP("/NM0" "gm")		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2	OP("/NM0" "ids")		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3	OP("/NM0" "gds")		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4	OP("/NM0" "vgst")		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5	OP("/NM0" "ft")		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6	(OP("/NM0" "gm") / OP("/NM0" "ids"))		<input checked="" type="checkbox"/>	<input type="checkbox"/>	

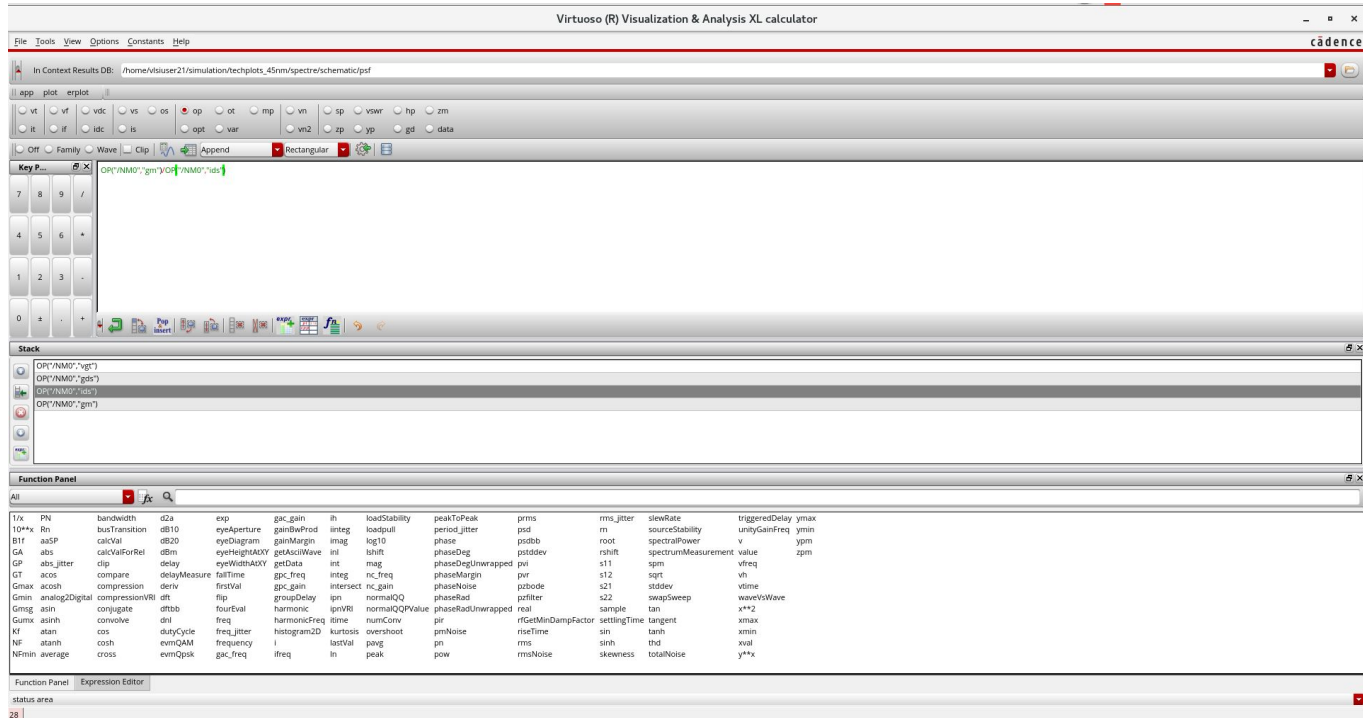
Plot after simulation: Auto ☒ Plotting mode: Replace ☒

13(22) Stop Status: Ready T=27 C Simulator: spectre aps

- Click on var in the calculator and then select the nmos as the instance after that select the width in the drop down menu.



- Make the gm/Id , gm/gds , Id/W expressions in the calculator and add them to the ADE L



ADE L (6) - techplots techplots_45nm schematic

Launch Session Setup Analyses Variables Outputs Simulation Results Tools Help

27

Design Variables

	Name	Value
1	length	45n
2	Vd	400m
3	Vg	1
4	width	180n

Analyses

Type	Enable	Arguments
1 dc	<input checked="" type="checkbox"/>	t

Outputs

Name/Signal/Expr	Alt	Plot	Save	Save Options
1 OP("/NM0" "gm")		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2 OP("/NM0" "ids")		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3 OP("/NM0" "gds")		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4 OP("/NM0" "vgst")		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5 OP("/NM0" "ft")		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6 VAR("width")		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
7 (OP("/NM0" "gm") / OP("/NM0" "ids"))		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
8 (OP("/NM0" "gm") / OP("/NM0" "gds"))		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
9 (OP("/NM0" "ids") / VAR("width"))		<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Plot after simulation: Auto Plotting mode: Replace

13(22) Choose Analyses ...

Status: Ready T=27 C Simulator: spectre aps

- Click on *waveVsWave* in the functional panel in the calculator and fill the xtrace and ytrace with the appropriate expressions to generate the plots.

Function Panel

All

fx

1/x	PN	bandwidth	d2a	exp	gac_gain	ih	loadStability	peakToPeak	prms	rms_jitter	slewRate	triggeredDelay	ymin
10**x	Rn	busTransition	dB10	eyeAperture	gainBwProd	iinteg	loadpull	period_jitter	psd	rn	sourceStability	unityGainFreq	ymin
B1f	aaSP	calcVal	dB20	eyeDiagram	gainMargin	imag	log10	phase	psdbb	root	spectralPower	v	ypm
GA	abs	calcValForRel	dBm	eyeHeightAtXY	getAsciiWave	inl	lshift	phaseDeg	pstddev	rshift	spectrumMeasurement	value	zpm
GP	abs_jitter	clip	delay	eyeWidthAtXY	getData	int	mag	phaseDegUnwrapped	pvi	s11	spm	vfreq	
GT	acos	compare	delayMeasure	fallTime	gpc_freq	integ	nc_freq	phaseMargin	pvr	s12	sqr	vh	
Gmax	acosh	compression	deriv	firstVal	gpc_gain	intersect	nc_gain	phaseNoise	pzbode	s21	stddev	ytime	
Gmin	analog2Digital	compressionVRI	dft	flip	groupDelay	ipn	normalQQ	phaseRad	pzfilter	s22	swapSweep	waveVsWave	
Gmsg	asin	conjugate	dftbb	fourEval	harmonic	ipnVRI	normalQQPValue	phaseRadUnwrapped	real	sample	tan	x**2	
Gumx	asinh	convolve	dnl	freq	harmonicFreq	itime	numConv	pir	rfGetMinDampFactor	settlingTime	tangent	xmax	
Kf	atan	cos	dutyCycle	freq_jitter	histogram2D	kurtosis	overshoot	pmNoise	riseTime	sin	tanh	xmin	
NF	atanh	cosh	evmQAM	frequency	i	lastVal	pavg	pn	rms	sinh	thd	xval	
NFmin	average	cross	evmQpsk	gac_freq	ifreq	ln	peak	pow	rmsNoise	skewness	totalNoise	y**x	

Function Panel

Expression Editor

status area

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- Now add these expressions to the ADE L

ADE L (6) - techplots techplots_45nm schematic

Launch Session Setup Analyses Variables Outputs Simulation Results Tools Help

27

Design Variables

Name	Value
length	45n
Vd	400m
Vg	1
width	180n

Analyses

Type	Enable	Arguments
dc	<input checked="" type="checkbox"/>	t

Outputs

Name/Signal/Expr	Value	Plot	Save	Save Option
OP("NM0" "gm")	waves	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
OP("NM0" "ids")	waves	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
OP("NM0" "gds")	waves	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
OP("NM0" "vgt")	waves	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
VAR("width")	waves	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
(OP("NM0" "gm") / OP("NM0" "ids"))	waves	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
(OP("NM0" "gm") / OP("NM0" "gds"))	waves	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
(OP("NM0" "ids") / VAR("width"))	waves	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
waveVsWave(7x OP("NM0" "vgt") 7y (OP("NM0" "gm") / OP("NM0" "ids")))	waves	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
waveVsWave(7x (OP("NM0" "gm") / OP("NM0" "ids")) 7y (OP("NM0" "gm") / OP("NM0" "gds")))	waves	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
waveVsWave(7x (OP("NM0" "gm") / OP("NM0" "ids")) 7y (OP("NM0" "ids") / VAR("width")))	waves	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

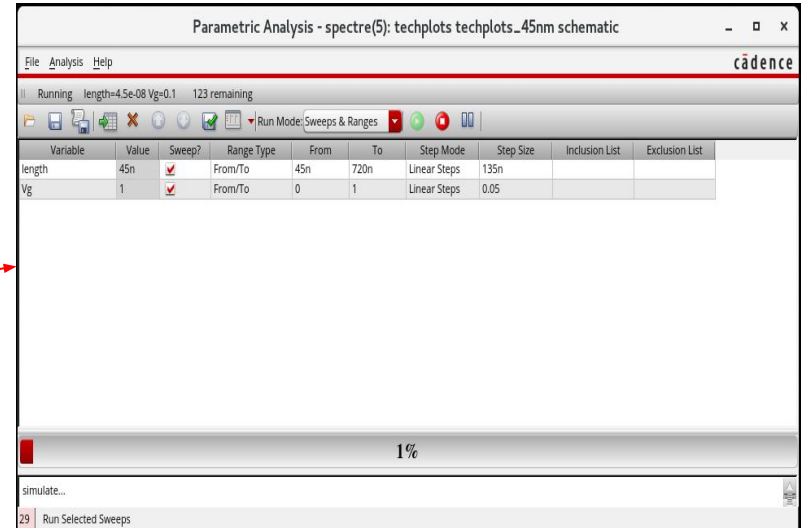
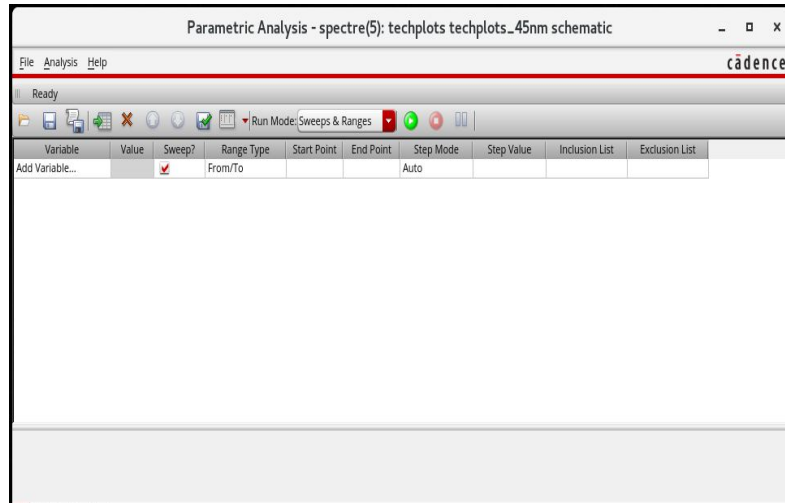
> Results in /home/visuser21/simulation/techplots_45nm/spectre/schematic

Plot after simulation: Auto Plotting mode: Replace

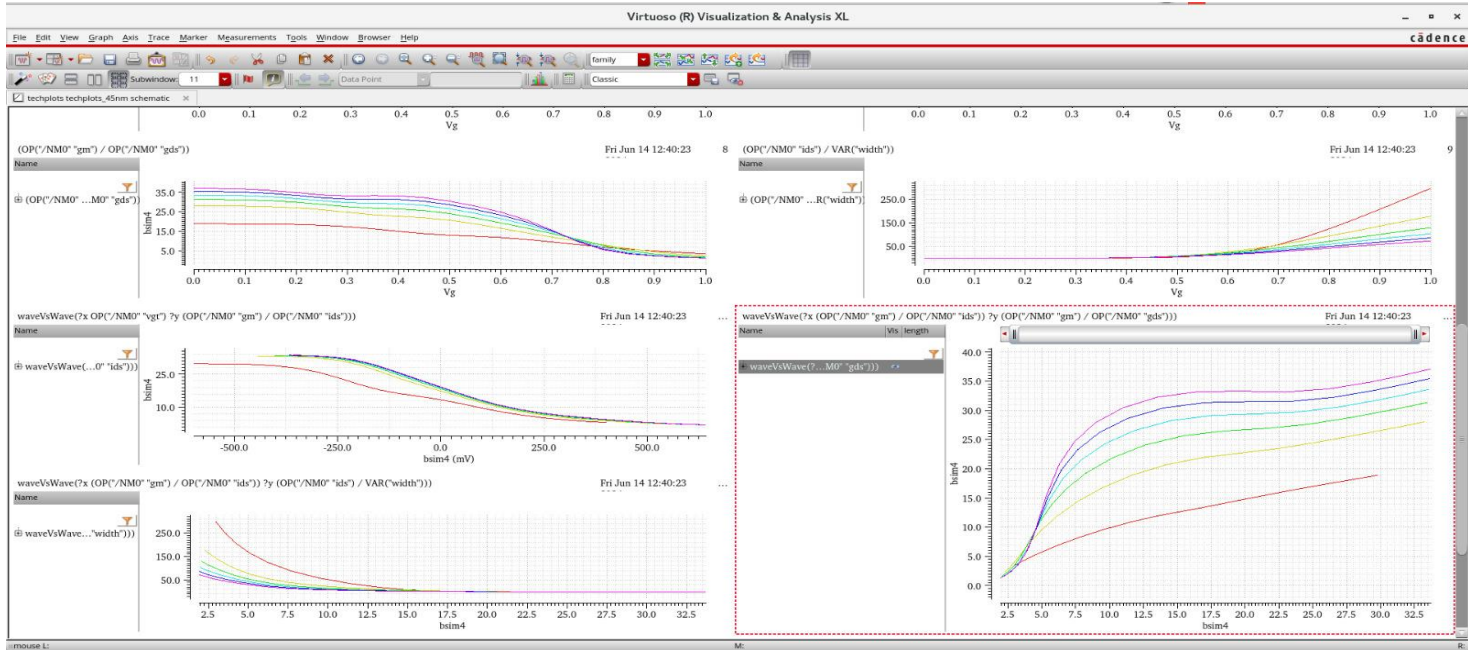
13(22) Choose Design ... Status: Ready T=27 C. Simulator: spectre aps

Parametrization

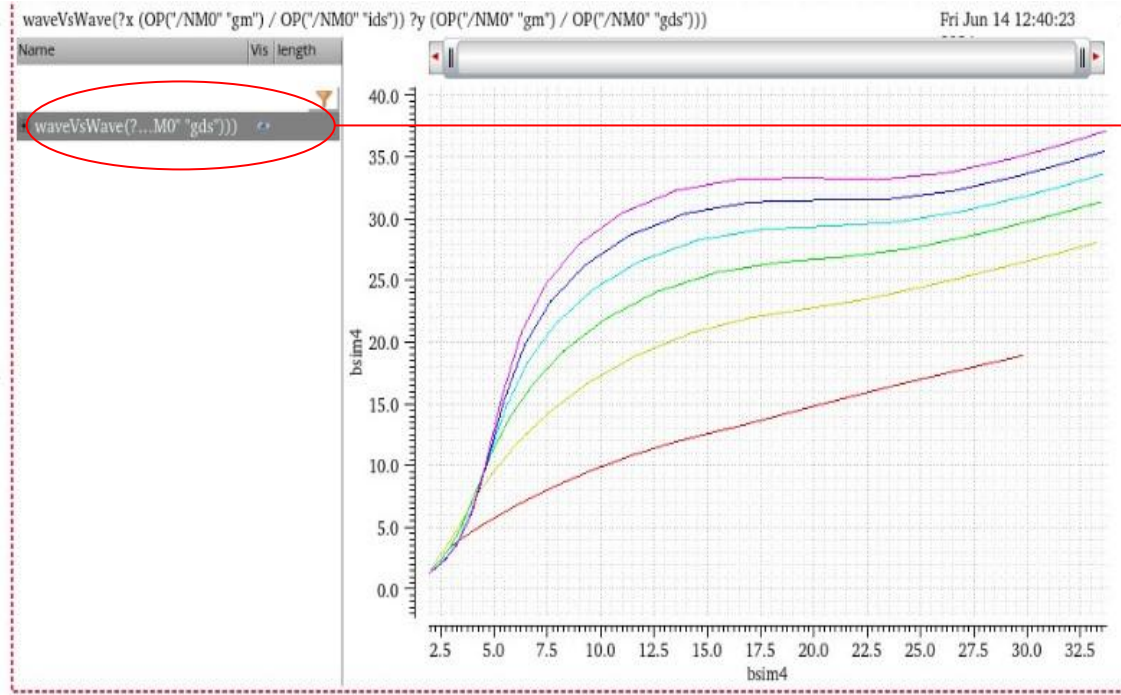
- After adding all the required expressions in the ADE L ,now click on tools in the ADE L and select parametric analysis and parametrize the required Variables and click on run.



- After the completion of parametrization a new window will gets opened with the plots for the expressions which are there in the ADE L



To get the .csv file



Right click on it and
then select
move>new table

Virtuoso (R) Visualization & Analysis XL Table

File Edit View Tools Help

cadence

waveVsWaveTx(OP/NM0"gm") / OPL...

	bsim4	waveV...e-08	bsim4	waveVsW...8e-07	bsim4	waveVsW...15e-07	bsim4	waveVsW...5e-07	bsim4	waveVsW...85e-07	bsim4	waveVsW...2e-07
1	29.75	18.90	33.24	28.06	33.46	31.37	33.53	33.58	33.62	35.45	33.69	37.09
2	29.71	18.88	33.15	28.02	33.32	31.31	33.35	33.50	33.40	35.35	33.45	36.97
3	29.61	18.85	32.93	27.93	32.97	31.15	32.90	33.28	32.87	35.08	32.85	36.66
4	29.37	18.76	32.31	27.62	32.11	30.71	31.85	32.74	31.67	34.46	31.53	35.96
5	28.80	18.52	31.12	27.07	30.49	29.96	29.94	31.85	29.55	33.45	29.24	34.86
6	27.77	18.11	28.99	26.13	27.86	28.81	27.08	30.65	26.55	32.25	26.15	33.68
7	25.98	17.40	25.89	24.80	24.61	27.62	23.84	29.71	23.31	31.54	22.91	33.16
8	23.36	16.32	22.57	23.53	21.45	26.90	20.72	29.40	20.18	31.49	19.75	33.30
9	20.38	15.00	19.66	22.70	18.45	26.49	17.61	29.16	17.01	31.34	16.55	33.22
10	17.85	13.83	16.94	21.96	15.43	25.66	14.54	28.26	13.95	30.42	13.52	32.28
11	16.11	13.05	14.17	20.72	12.58	24.06	11.80	26.55	11.31	28.64	10.96	30.45
12	14.79	12.50	11.53	18.84	10.17	21.86	9.580	24.23	9.224	26.22	8.966	27.95
13	13.32	11.84	9.285	16.58	8.273	19.33	7.877	21.52	7.633	23.31	7.448	24.83
14	11.49	10.86	7.523	14.26	6.828	16.68	6.578	18.45	6.417	19.78	6.285	20.85
15	9.505	9.587	6.174	12.04	5.717	13.90	5.566	14.85	5.453	15.28	5.353	15.59
16	7.707	8.236	5.143	9.972	4.839	10.93	4.729	10.60	4.632	10.06	4.545	9.757
17	6.231	6.970	4.336	8.025	4.109	7.818	3.990	6.635	3.886	5.899	3.807	5.588
18	5.080	5.868	3.681	6.180	3.471	5.155	3.326	4.082	3.229	3.615	3.174	3.441
19	4.199	4.941	3.131	4.530	2.921	3.401	2.793	2.710	2.713	2.444	2.663	2.349
20	3.521	4.170	2.660	3.242	2.464	2.372	2.356	1.944	2.293	1.784	2.255	1.727
21	2.992	3.527	2.263	2.354	2.093	1.752	2.005	1.475	1.955	1.369	1.925	1.332

37 | Trace: (OP/NM0"gm") / OP/NM0"gdsc" (length=315e-07); Context: /home/vsuser21/simulation/techplots_45nm/

Click on save to get .csv file

- This document contains all the plots that are generated using gpd45nm technology node using Cadence Virtuoso.

[Nmos_45nm.pdf](#)

Thank You