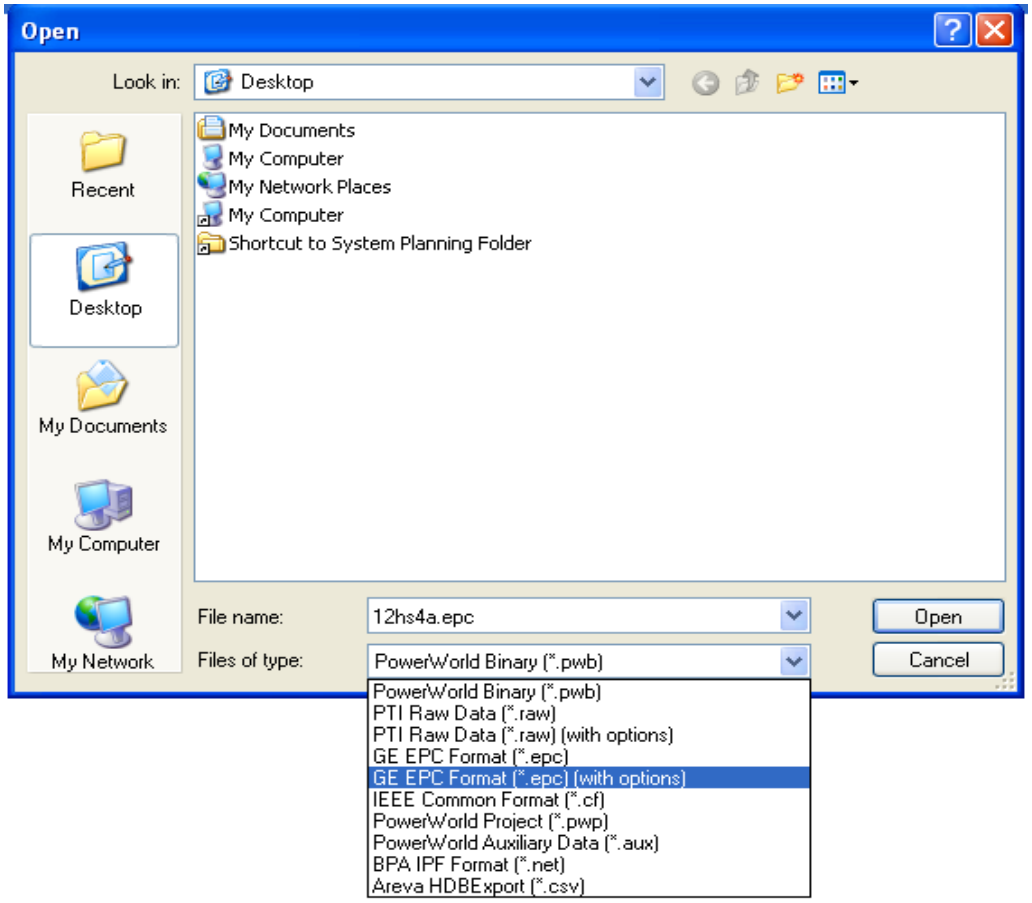
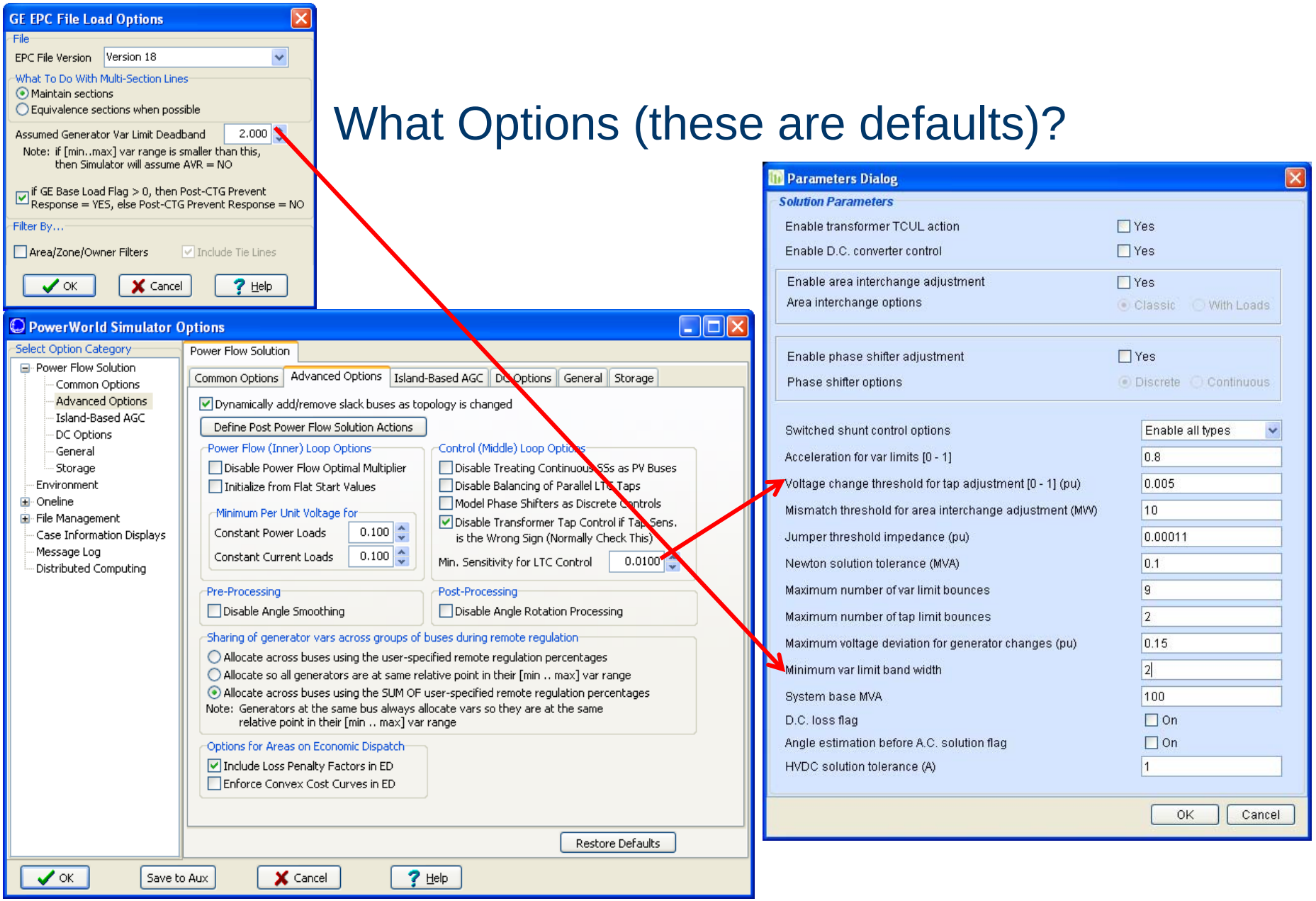
Reading a GE PSLF *.epc into PWS

Tracy Rolstad
Avista System Planning
WECC PWSUG, 14 March 2012

Open Case, Select <GE EPC format (with options)>

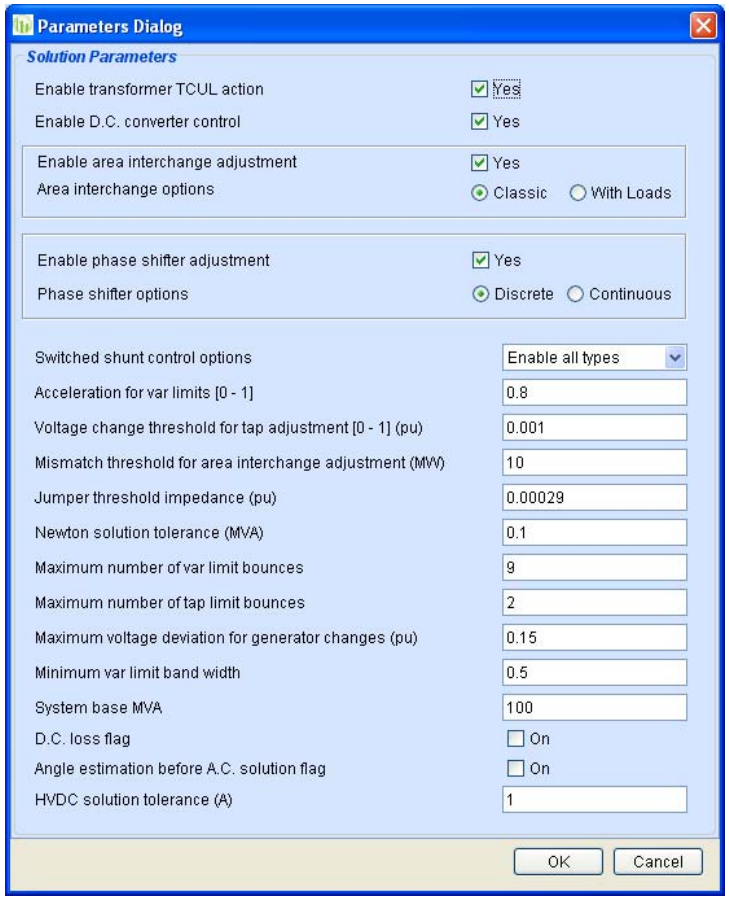


What Options (these are defaults)?

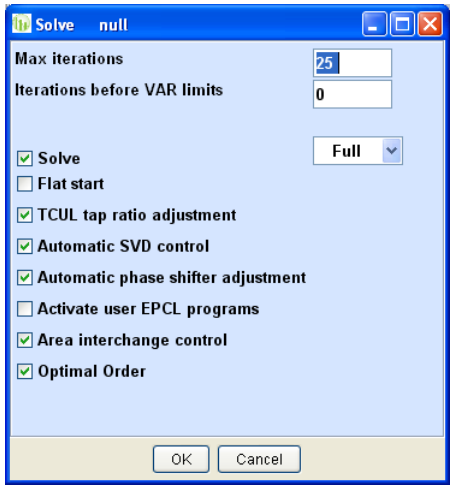


Start with GE

- Nothing is sacred about the GE defaults. Change them!



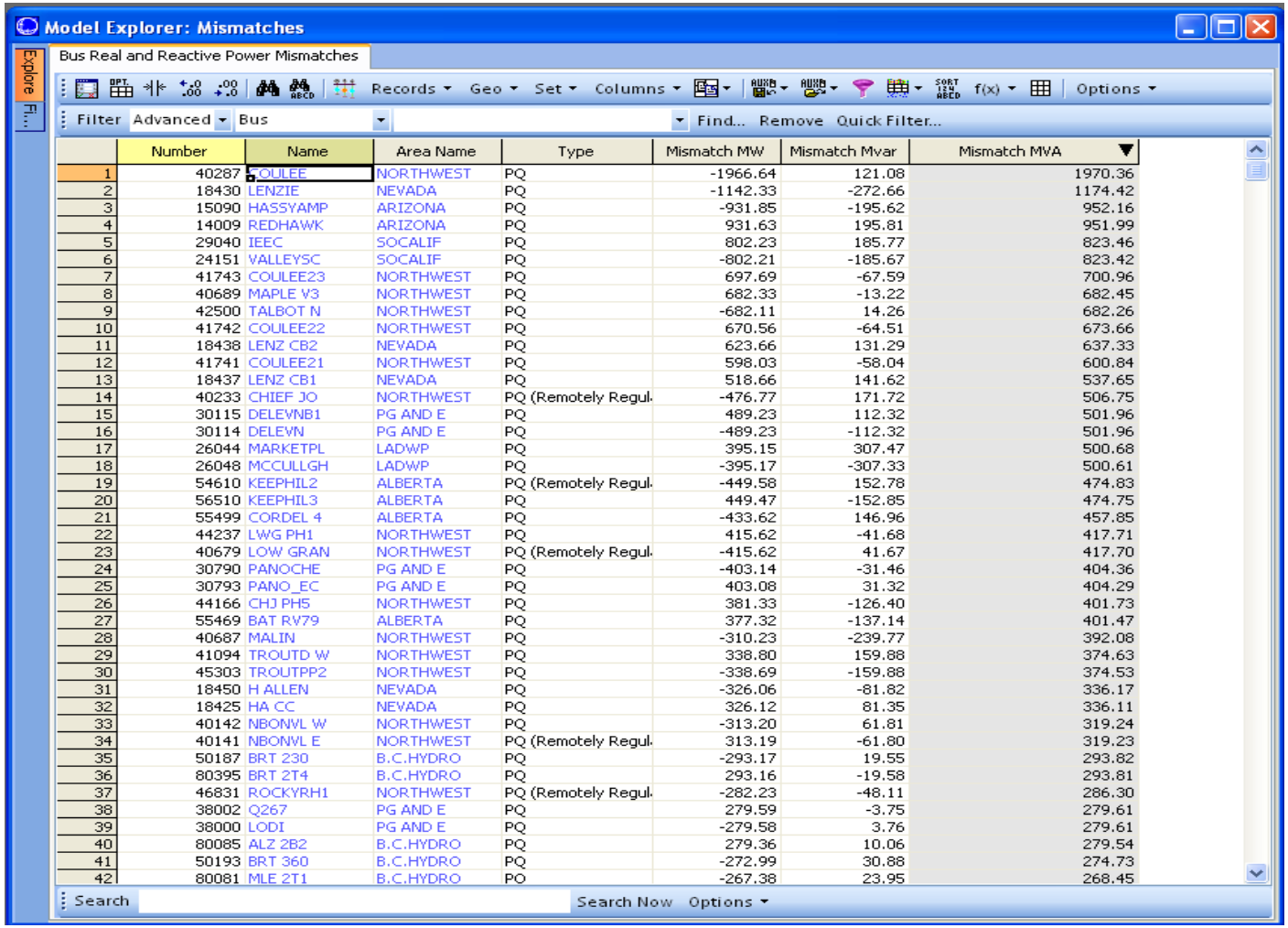
- Solve the case, multiple times…
- GE uses an ***estimated*** mismatch
- So, solve in GE three times or so
- Save the solved case as an *.epc file



Read into PWS and Solve

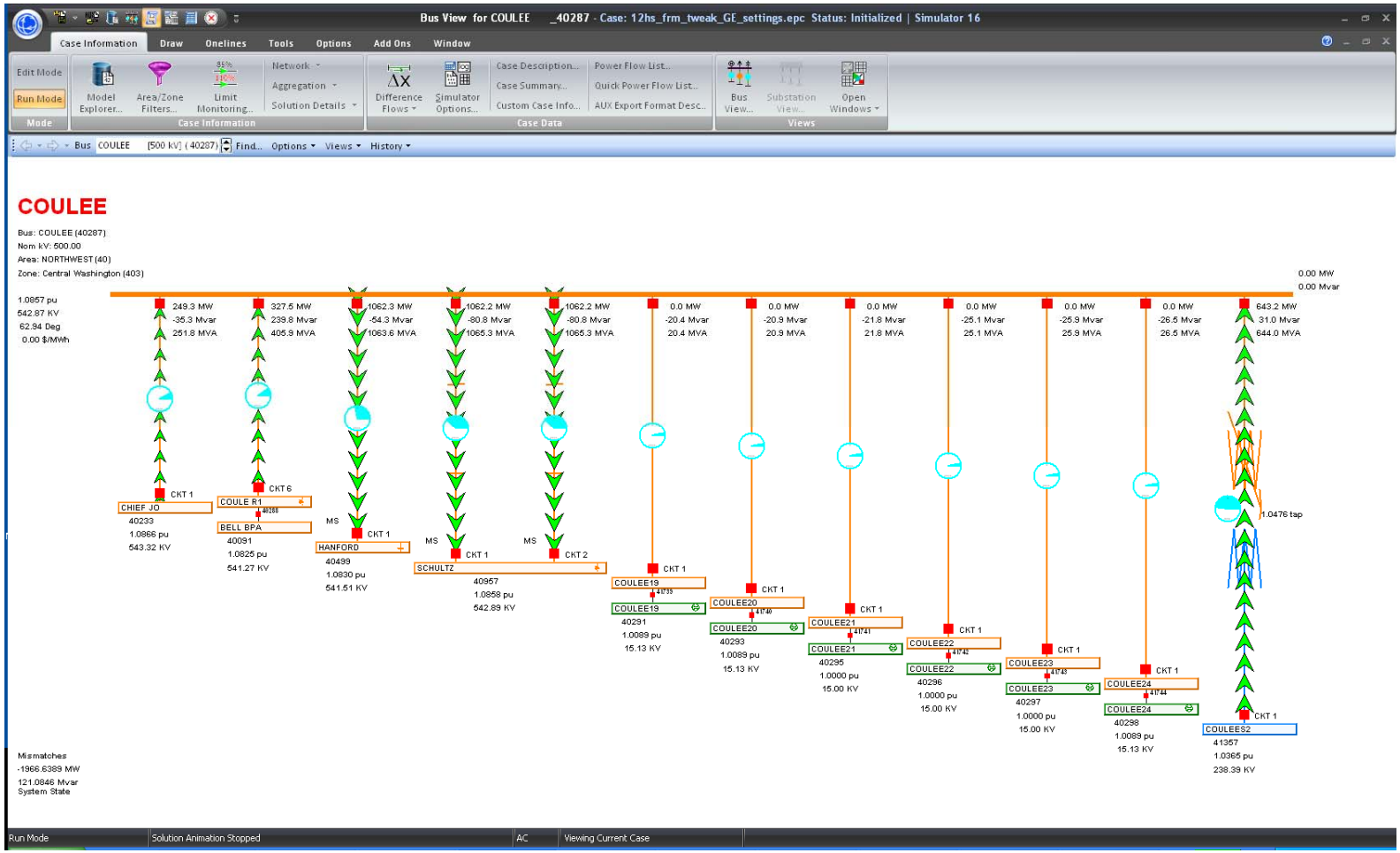
- Read in case, note mismatches, understand them
- Lock all controls down, solve in PWS (set gen voltage control)
  - Check Interface flows against GE…
    - GE allows double counting the same line
      - PWS does NOT allow double counting
- Note Mismatch resolution in log
  - PWS Zero Impedance Line is very, very small
    - GE uses X=0.00029 (0.725 ohms @ 500 kV)
    - PWS uses X=0.00001 (0.025 ohms @ 500 kV)

Mismatch Table

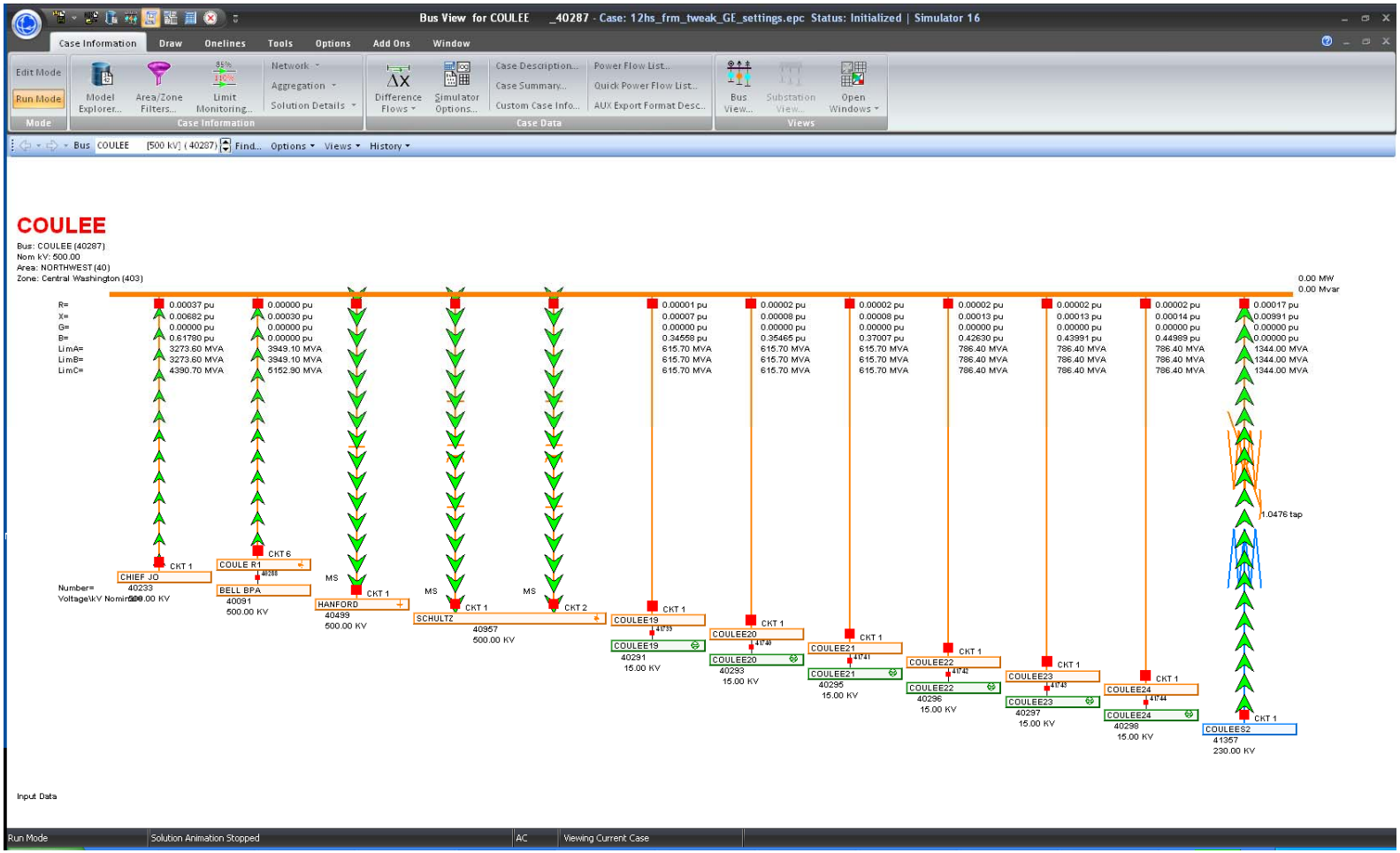


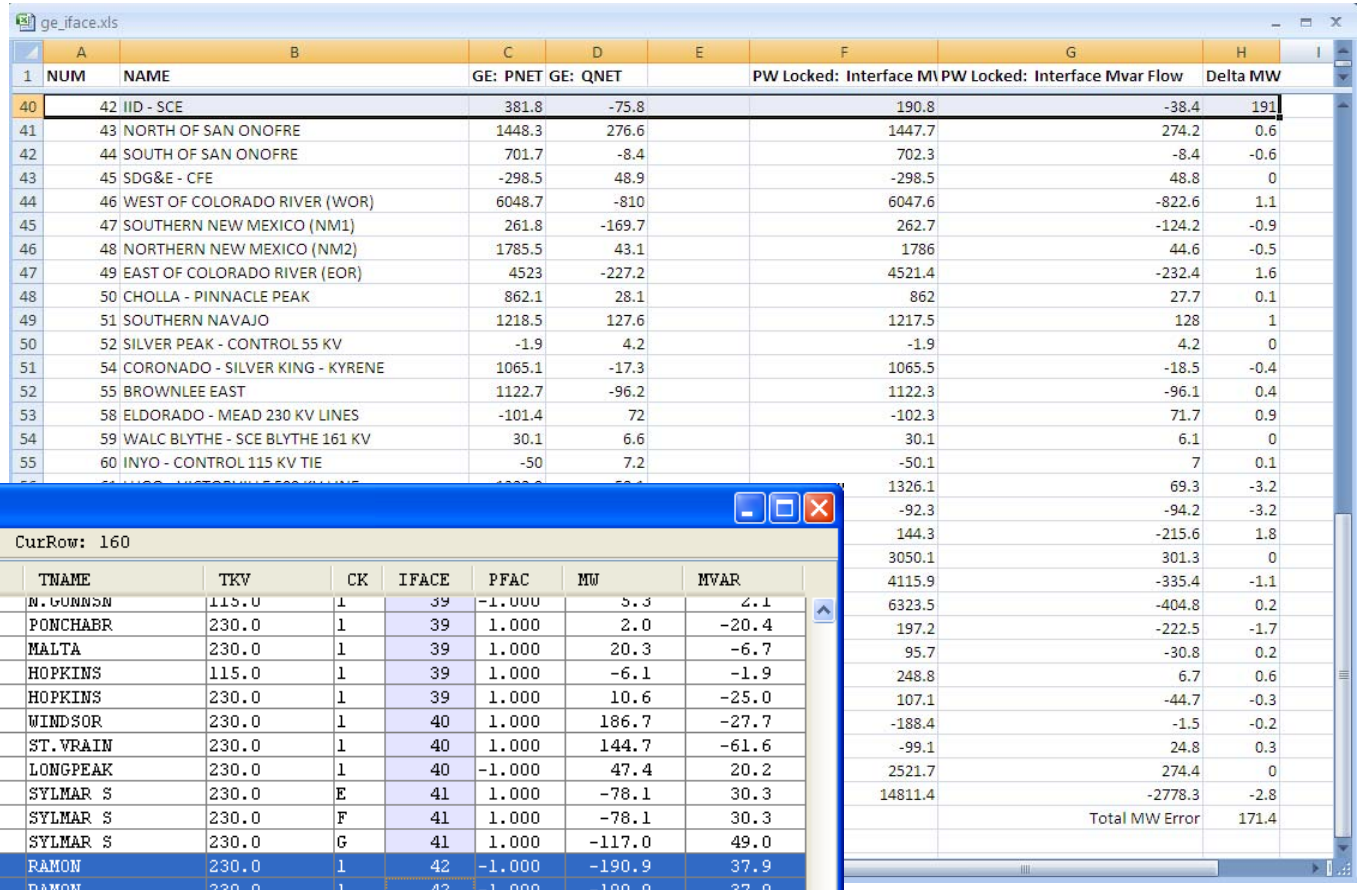
	Number	Name	Area Name	Type	Mismatch MW	Mismatch Mvar	Mismatch MVA
1	40287	COULEE	NORTHWEST	PQ	-1966.64	121.08	1970.36
2	18430	LENZIE	NEVADA	PQ	-1142.33	-272.66	1174.42
3	15090	HASSYAMP	ARIZONA	PQ	-931.85	-195.62	952.16
4	14009	REDHAWK	ARIZONA	PQ	931.63	195.81	951.99
5	29040	IEEC	SOCALIF	PQ	802.23	185.77	823.46
6	24151	VALLEYSC	SOCALIF	PQ	-802.21	-185.67	823.42
7	41743	COULEE23	NORTHWEST	PQ	697.69	-67.59	700.96
8	40689	MAPLE V3	NORTHWEST	PQ	682.33	-13.22	682.45
9	42500	TALBOT N	NORTHWEST	PQ	-682.11	14.26	682.26
10	41742	COULEE22	NORTHWEST	PQ	670.56	-64.51	673.66
11	18438	LENZ CB2	NEVADA	PQ	623.66	131.29	637.33
12	41741	COULEE21	NORTHWEST	PQ	598.03	-58.04	600.84
13	18437	LENZ CB1	NEVADA	PQ	518.66	141.62	537.65
14	40233	CHIEF JO	NORTHWEST	PQ (Remotely Regul	-476.77	171.72	506.75
15	30115	DELEVNB1	PG AND E	PQ	489.23	112.32	501.96
16	30114	DELEVN	PG AND E	PQ	-489.23	-112.32	501.96
17	26044	MARKETPL	LADWP	PQ	395.15	307.47	500.68
18	26048	MCCULLGH	LADWP	PQ	-395.17	-307.33	500.61
19	54610	KEEPHIL2	ALBERTA	PQ (Remotely Regul	-449.58	152.78	474.83
20	56510	KEEPHIL3	ALBERTA	PQ	449.47	-152.85	474.75
21	55499	CORDEL 4	ALBERTA	PQ	-433.62	146.96	457.85
22	44237	LWG PH1	NORTHWEST	PQ	415.62	-41.68	417.71
23	40679	LOW GRAN	NORTHWEST	PQ (Remotely Regul	-415.62	41.67	417.70
24	30790	PANOCHE	PG AND E	PQ	-403.14	-31.46	404.36
25	30793	PANO_EC	PG AND E	PQ	403.08	31.32	404.29
26	44166	CHJ PH5	NORTHWEST	PQ	381.33	-126.40	401.73
27	55469	BAT RV79	ALBERTA	PQ	377.32	-137.14	401.47
28	40687	MALIN	NORTHWEST	PQ	-310.23	-239.77	392.08
29	41094	TROUTD W	NORTHWEST	PQ	338.80	159.88	374.63
30	45303	TROUTPP2	NORTHWEST	PQ	-338.69	-159.88	374.53
31	18450	H ALLEN	NEVADA	PQ	-326.06	-81.82	336.17
32	18425	HA CC	NEVADA	PQ	326.12	81.35	336.11
33	40142	NBONVL W	NORTHWEST	PQ	-313.20	61.81	319.24
34	40141	NBONVL E	NORTHWEST	PQ (Remotely Regul	313.19	-61.80	319.23
35	50187	BRT 230	B.C.HYDRO	PQ	-293.17	19.55	293.82
36	80395	BRT 2T4	B.C.HYDRO	PQ	293.16	-19.58	293.81
37	46831	ROCKYRH1	NORTHWEST	PQ (Remotely Regul	-282.23	-48.11	286.30
38	38002	Q267	PG AND E	PQ	279.59	-3.75	279.61
39	38000	LODI	PG AND E	PQ	-279.58	3.76	279.61
40	80085	ALZ 2B2	B.C.HYDRO	PQ	279.36	10.06	279.54
41	50193	BRT 360	B.C.HYDRO	PQ	-272.99	30.88	274.73
42	80081	MLE 2T1	B.C.HYDRO	PQ	-267.38	23.95	268.45

Mismatches in State Variable View



Mismatches in Input Data View





ge_iface.xls

	A	B	C	D	E	F	G	H	I
1	NUM	NAME	GE: PNET	GE: QNET		PW Locked: Interface MW	PW Locked: Interface Mvar Flow	Delta MW	
40	42	IID - SCE	381.8	-75.8		190.8	-38.4	191	
41	43	NORTH OF SAN ONOFRE	1448.3	276.6		1447.7	274.2	0.6	
42	44	SOUTH OF SAN ONOFRE	701.7	-8.4		702.3	-8.4	-0.6	
43	45	SDG&E - CFE	-298.5	48.9		-298.5	48.8	0	
44	46	WEST OF COLORADO RIVER (WOR)	6048.7	-810		6047.6	-822.6	1.1	
45	47	SOUTHERN NEW MEXICO (NM1)	261.8	-169.7		262.7	-124.2	-0.9	
46	48	NORTHERN NEW MEXICO (NM2)	1785.5	43.1		1786	44.6	-0.5	
47	49	EAST OF COLORADO RIVER (EOR)	4523	-227.2		4521.4	-232.4	1.6	
48	50	CHOLLA - PINNACLE PEAK	862.1	28.1		862	27.7	0.1	
49	51	SOUTHERN NAVAJO	1218.5	127.6		1217.5	128	1	
50	52	SILVER PEAK - CONTROL 55 KV	-1.9	4.2		-1.9	4.2	0	
51	54	CORONADO - SILVER KING - KYRENE	1065.1	-17.3		1065.5	-18.5	-0.4	
52	55	BROWNLEE EAST	1122.7	-96.2		1122.3	-96.1	0.4	
53	58	ELDORADO - MEAD 230 KV LINES	-101.4	72		-102.3	71.7	0.9	
54	59	WALC BLYTHE - SCE BLYTHE 161 KV	30.1	6.6		30.1	6.1	0	
55	60	INYO - CONTROL 115 KV TIE	-50	7.2		-50.1	7	0.1	
						1326.1	69.3	-3.2	
						-92.3	-94.2	-3.2	
						144.3	-215.6	1.8	
						3050.1	301.3	0	
						4115.9	-335.4	-1.1	
						6323.5	-404.8	0.2	
						197.2	-222.5	-1.7	
						95.7	-30.8	0.2	
						248.8	6.7	0.6	
						107.1	-44.7	-0.3	
						-188.4	-1.5	-0.2	
						-99.1	24.8	0.3	
						2521.7	274.4	0	
						14811.4	-2778.3	-2.8	
							Total MW Error	171.4	

Table bface [Last: 281 , Max: 5000]

Table Options Help CurRow: 160

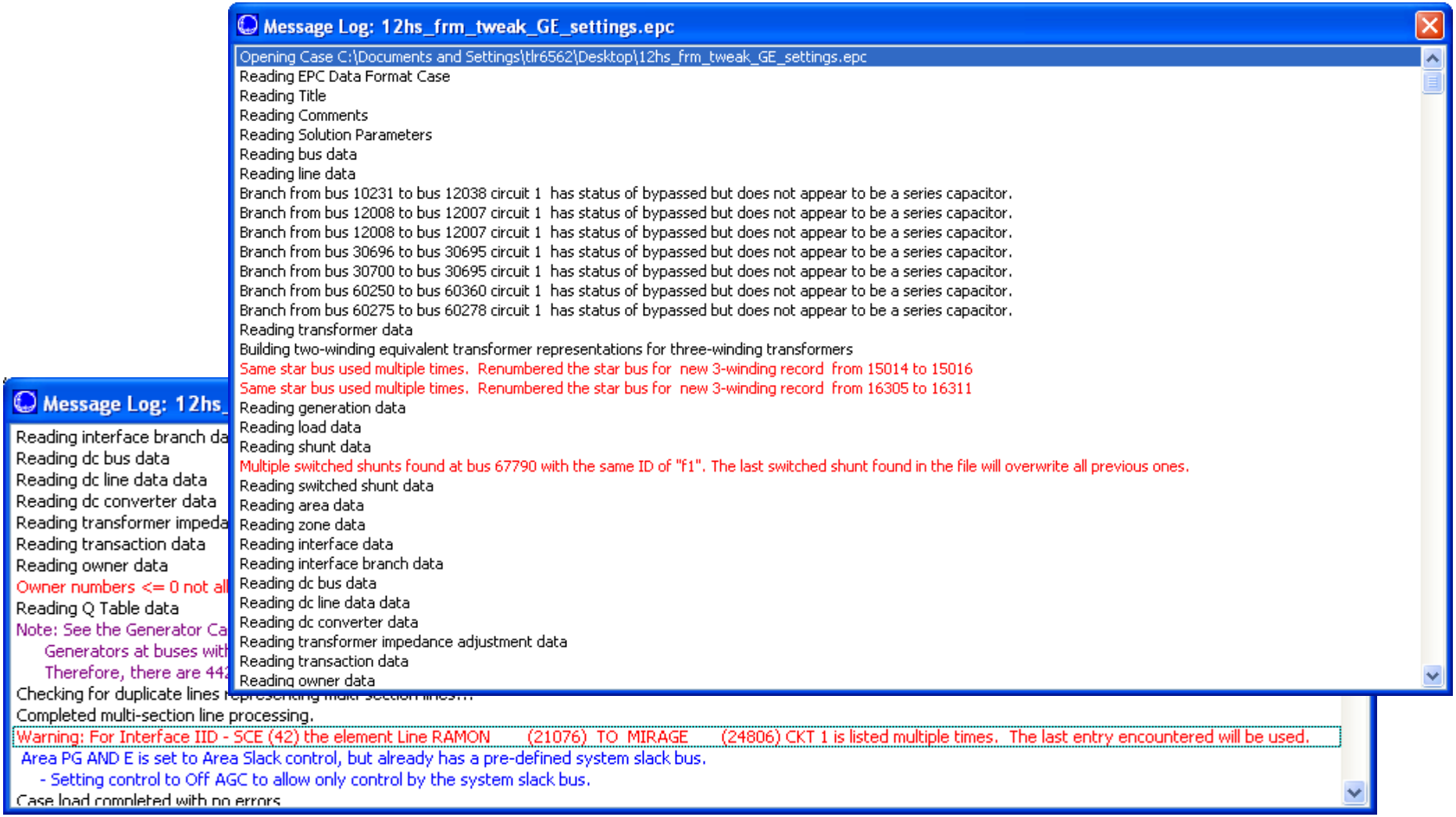
FROM	FNAME	FKV	TO	TNAME	TKV	CK	IFACE	PFAC	MW	MVAR
70327	PONCHA	115.0	79196	N.GUNNSN	115.0	1	39	-1.000	5.3	2.1
79021	CURECANT	230.0	79054	PONCHABR	230.0	1	39	1.000	2.0	-20.4
79004	BASALT	230.0	70274	MALTA	230.0	1	39	1.000	20.3	-6.7
79003	BASALT	115.0	70231	HOPKINS	115.0	1	39	1.000	-6.1	-1.9
70358	RIFLE_PS	230.0	70232	HOPKINS	230.0	1	39	1.000	10.6	-25.0
73011	AULT	230.0	70474	WINDSOR	230.0	1	40	1.000	186.7	-27.7
70471	WELD_PS	230.0	70410	ST.VRAIN	230.0	1	40	1.000	144.7	-61.6
70410	ST.VRAIN	230.0	73116	LONGPEAK	230.0	1	40	-1.000	47.4	20.2
26094	SYLMARLA	230.0	24147	SYLMAR S	230.0	E	41	1.000	-78.1	30.3
26094	SYLMARLA	230.0	24147	SYLMAR S	230.0	F	41	1.000	-78.1	30.3
26094	SYLMARLA	230.0	24147	SYLMAR S	230.0	G	41	1.000	-117.0	49.0
24806	MIRAGE	230.0	21076	RAMON	230.0	1	42	-1.000	-190.9	37.9
24806	MIRAGE	230.0	21076	RAMON	230.0	1	42	-1.000	-190.9	37.9
24131	S.ONOFRE	230.0	24134	SANTIAGO	230.0	1	43	1.000	508.9	91.1
24131	S.ONOFRE	230.0	24134	SANTIAGO	230.0	2	43	1.000	508.9	91.1
24131	S.ONOFRE	230.0	25654	VIEJOSC	230.0	1	43	1.000	271.6	36.7
24131	S.ONOFRE	230.0	24137	SERRANO	230.0	1	43	1.000	158.7	57.7
24131	S.ONOFRE	230.0	22716	SANLUSRY	230.0	1	44	1.000	123.1	-26.6
24131	S.ONOFRE	230.0	22716	SANLUSRY	230.0	2	44	1.000	90.6	-16.2
24131	S.ONOFRE	230.0	22716	SANLUSRY	230.0	3	44	1.000	87.7	-15.9
24131	S.ONOFRE	230.0	22844	TALEGA	230.0	1	44	1.000	200.2	25.2
24131	S.ONOFRE	230.0	22844	TALEGA	230.0	2	44	1.000	200.2	25.2
20118	ROA-230	230.0	22356	IMPRLVLY	230.0	1	45	1.000	-485.3	53.1
20149	TJI-230	230.0	22609	OTAYMESA	230.0	1	45	1.000	186.8	-4.3
24042	ELDORDO	500.0	24086	LUGO	500.0	1	46	1.000	687.6	-40.5
24041	ELDORDO	230.0	24627	CIMA	230.0	1	46	1.000	48.4	-15.2
24041	ELDORDO	230.0	24219	RTSGAH	230.0	2	46	1.000	39.2	-15.9

find fill insert delete scan recEd print colTot sort origVal refresh done

After Fixing GE Bface Error

- Errors after removing extra BFACE entry
  - Total MW Error (i.e. sum) = -19.5
  - Max MW Error = 3.7 (North to South California, Path 24)
  - Min MW Error = -4

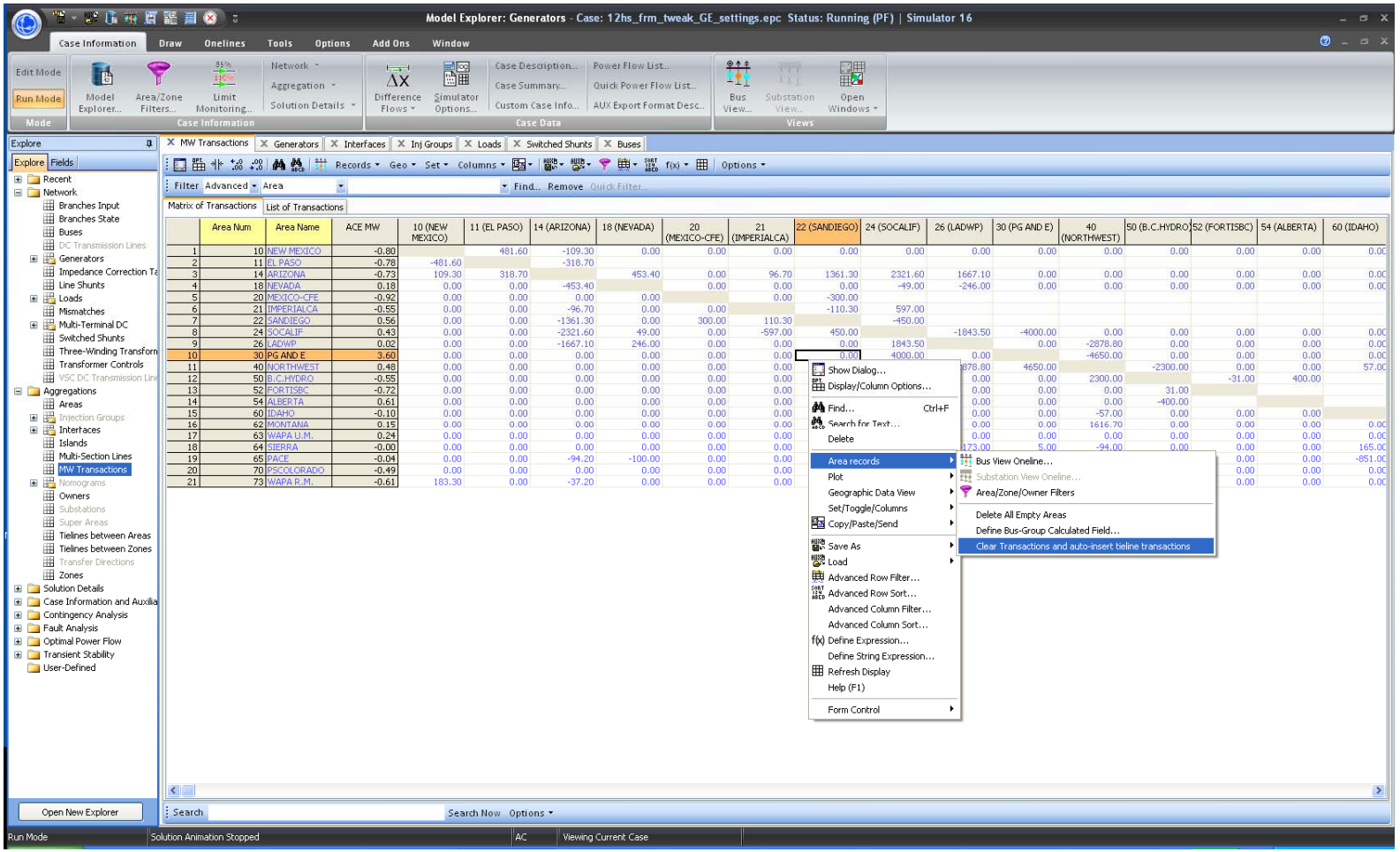
Read the Log, Understand and Take Action



Read into PWS and Solve

- Unlock all controls, solve in PWS
  - Check log for AGC movement
    - May need to “Zero out transactions”
      - If GE transaction table isn’t manually updated by WECC staff
  - Check Interface flows against GE…
    - Should get pretty much the same answer on path flows
  - Check for multiple islands

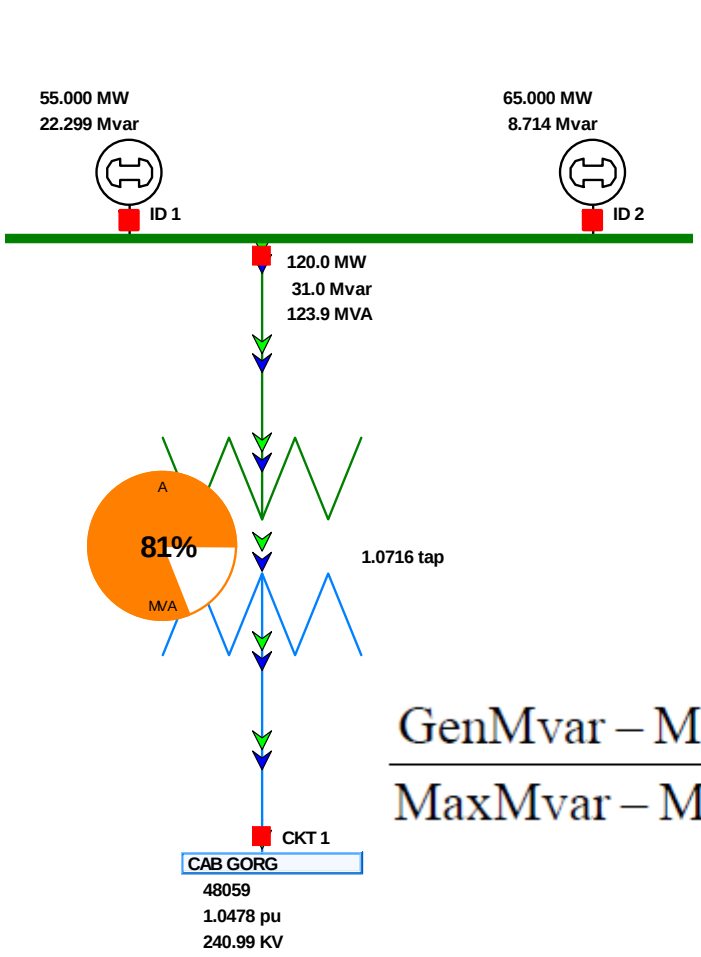
Zeroing Out Transactions

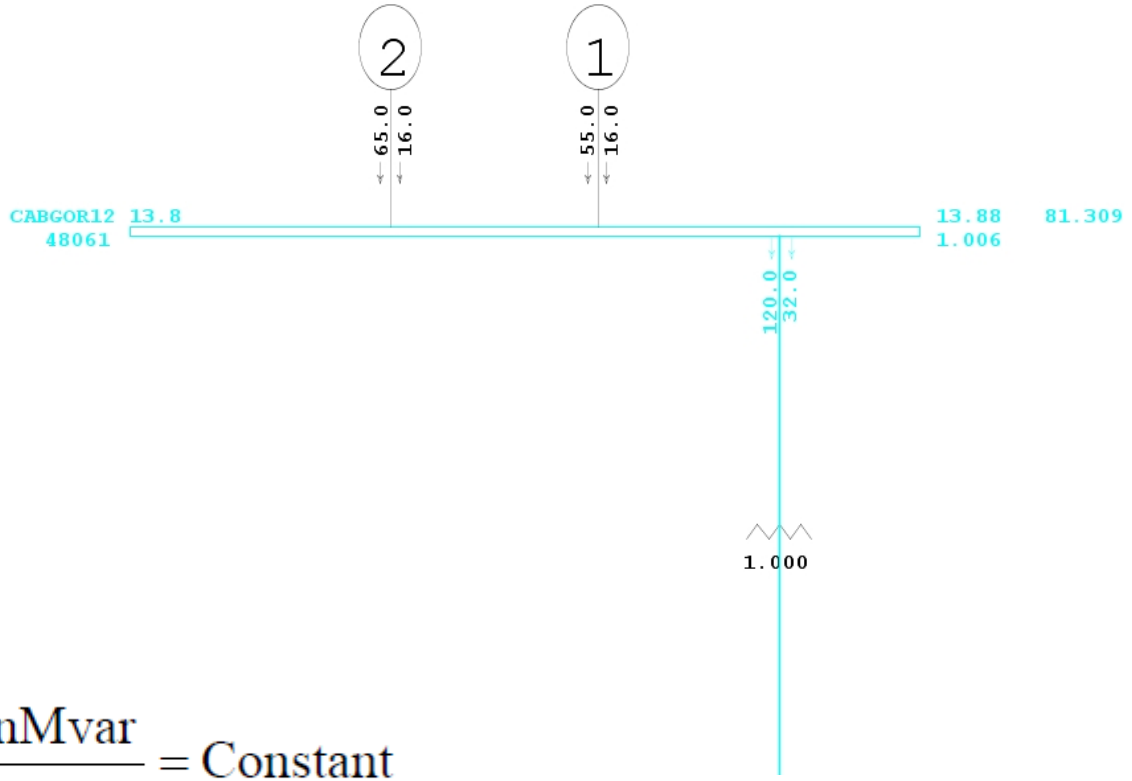


Voltage Control for Generators

- Allocate across buses using the user-specified remote regulation percentages. This option is what is used by default and most closely matches the sharing seen in ***RAW*** files.
- Allocate so all generators are at same relative point in their [min .. max] var range. This option most closely matches the sharing seen in a few EMS solutions PowerWorld has seen.
- Allocate across buses using the SUM OF user-specified remote regulation percentages. This option most closely matches the sharing seen in ***EPC*** files.
- ***Note: Generators at the same bus always allocate vars so they are at the same relative point in their [min…max] range***

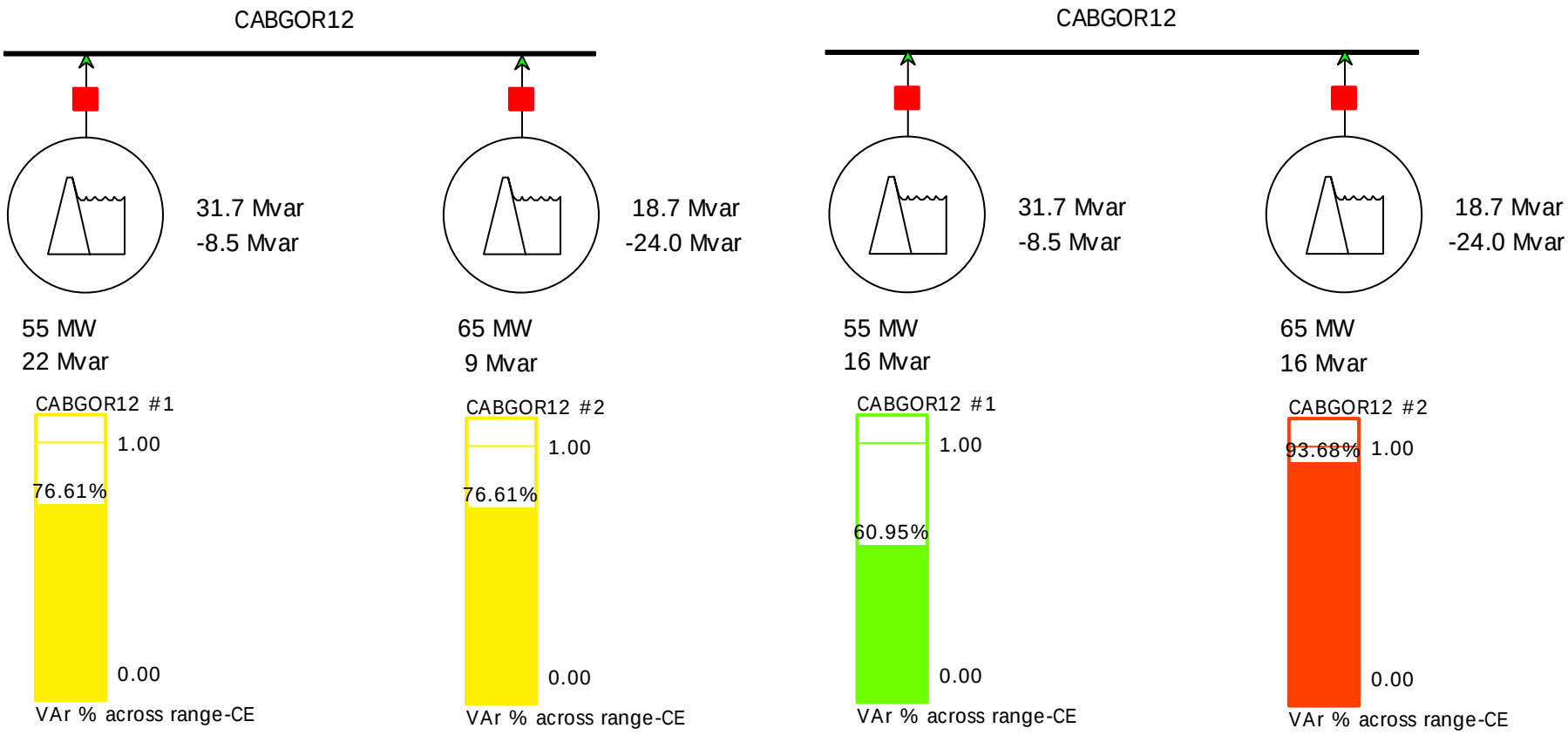
Var Sharing



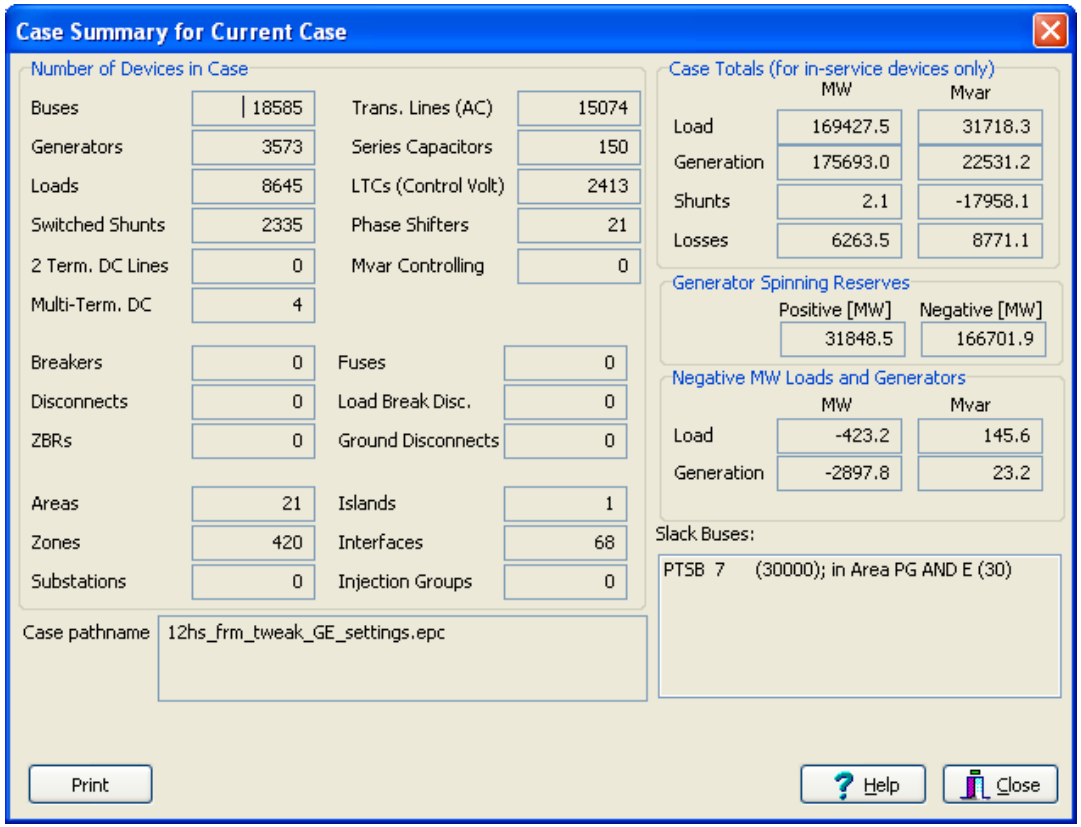


$$\frac{\text{GenMvar} - \text{MinMvar}}{\text{MaxMvar} - \text{MinMvar}} = \text{Constant}$$

Comparing PWS to GE VAr “Answer”



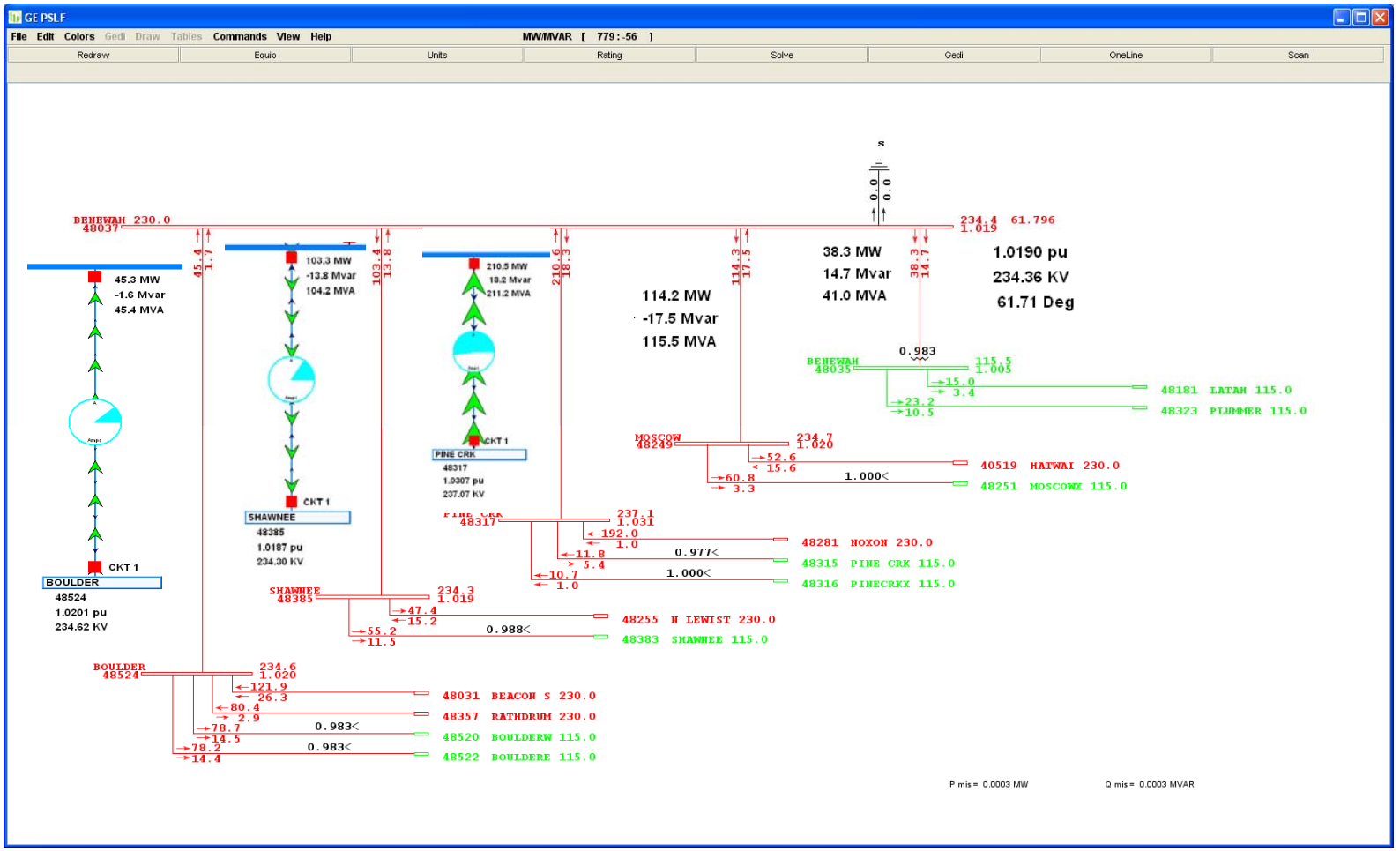
Check Case Summary and Slack Bus Generator



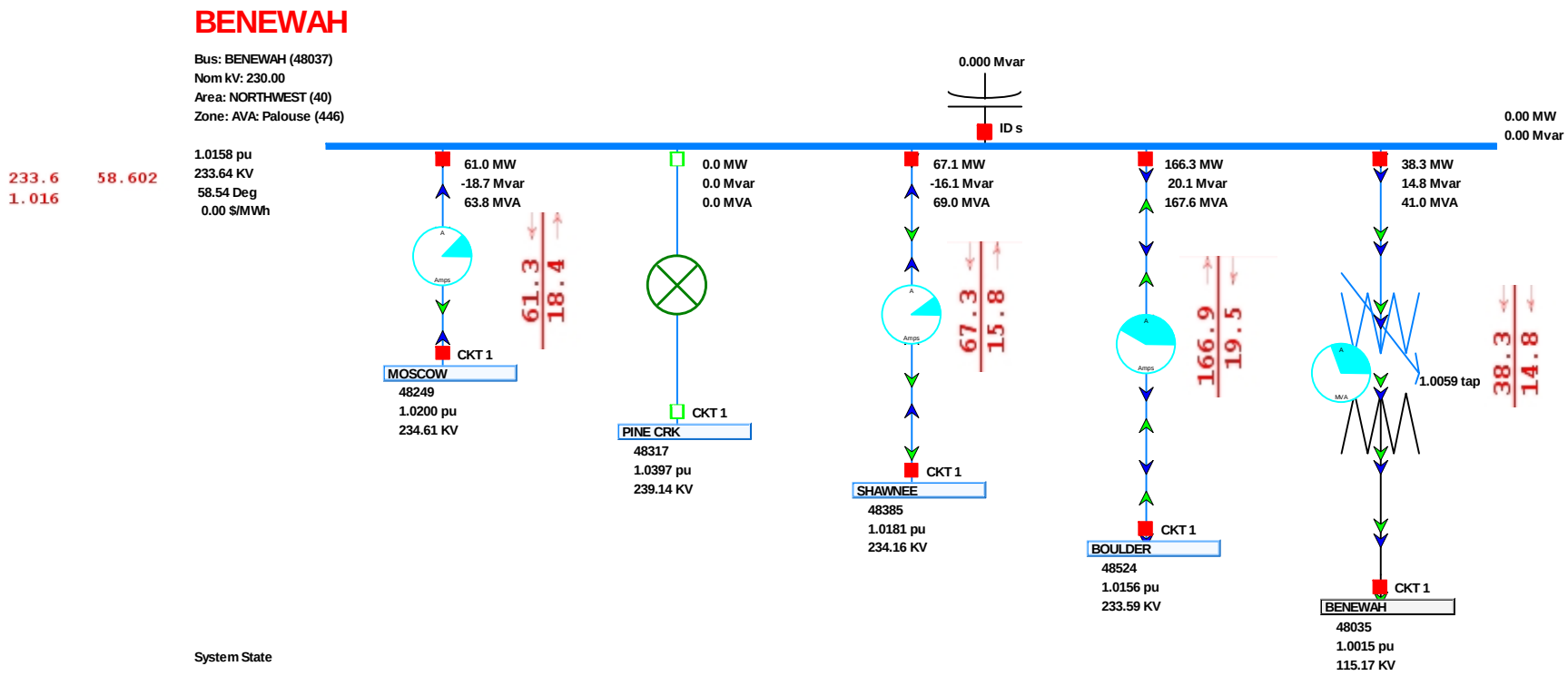
Quantity	GE	PWS
Load MW	169427.5	169427.5
Gen MW	175697.1	175693.0
Losses MW	6269.8	6263.5
Buses count	18205	18585
Load MVAr	31767.3 (t_area)	31718.3
Load MVAr*	32291.53	31718.3
Slack MW	538.0	543.01

* Summed directly from load record

Look for Places to Establish “Test Flows”



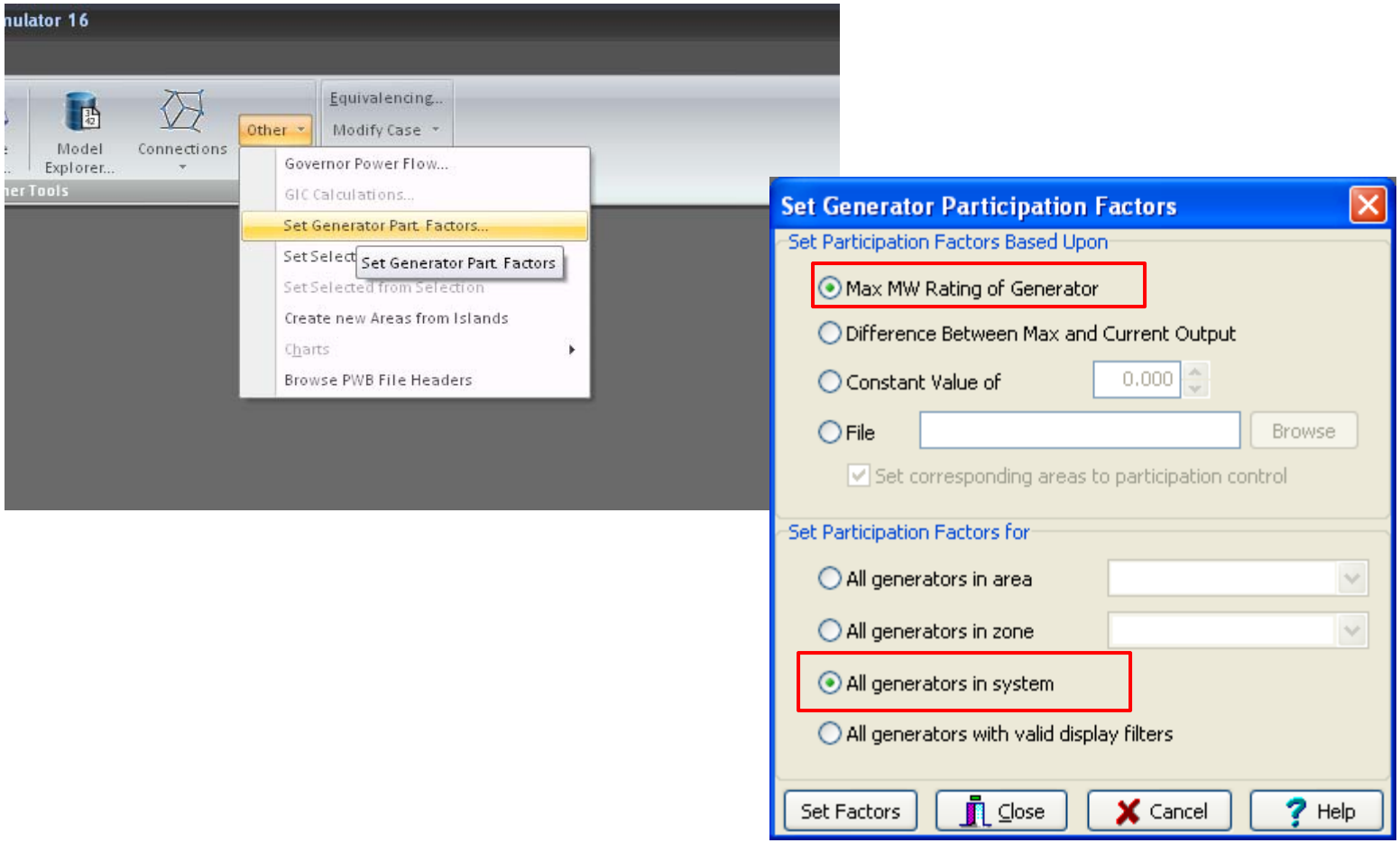
Check Performance in Contingent Environment

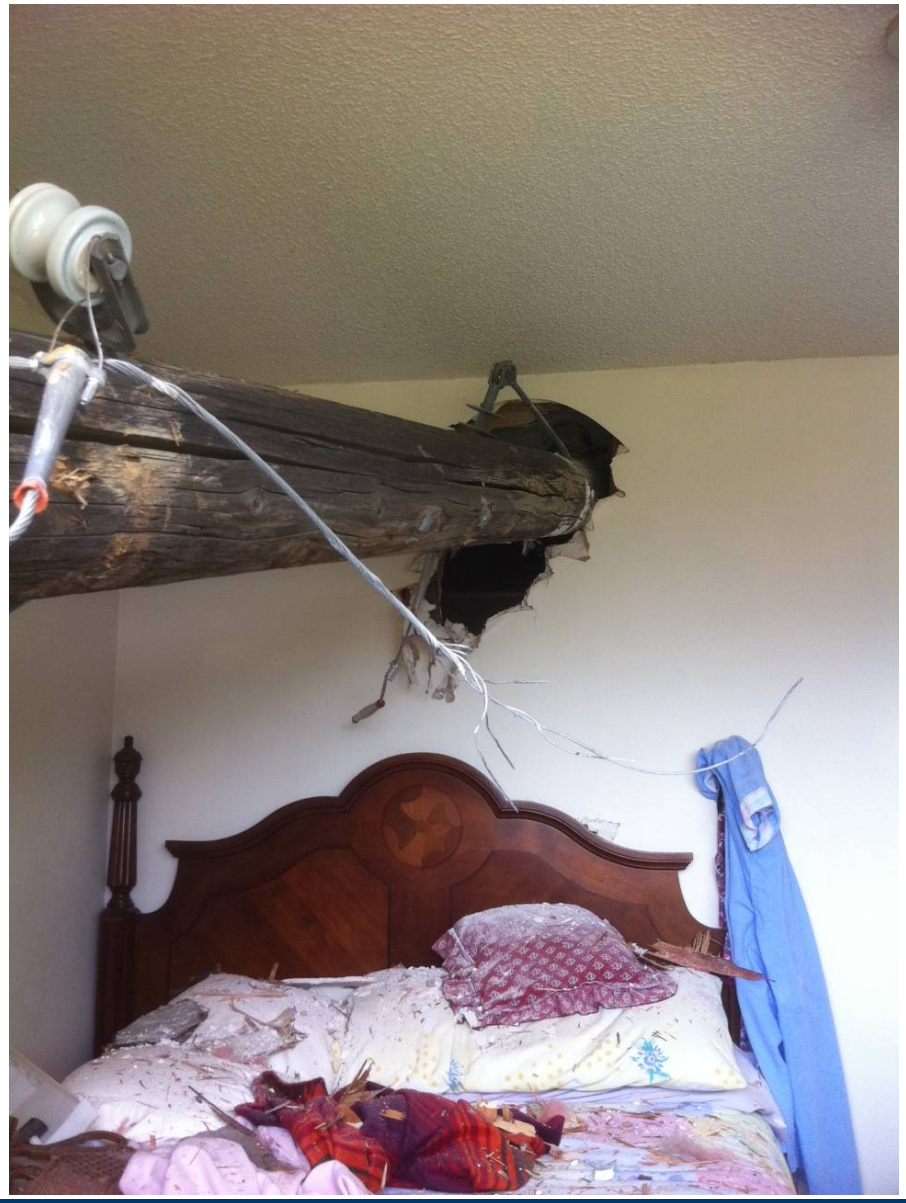


Participation Factor Note (Added Post Meeting)

- During the second WECC PWS Users Group we noticed that PWS was parsing the Gen MVA field of the *.epc file and setting Participation Factors on that field. In many cases this value is merely set to 100 MVA (for example the large units located in the third power house at Grand Coulee).
- Users should be alert to this behavior and manually set Participation Factors to be based on Pmax
  - Typically setting Participation Factors to Pmax is the desired setting for dispatching make-up power during contingency analysis, etc.

Setting Participation Factors



Questions?

- PWS will provide similar, but not exact results when compared to GE (or PTI)
- Heuristics abound…
  - What is “right?” Good reason to use multiple tools
- VAr dispatch of generation has an impact, especially on the initialization point for transient stability
- Zero impedance line representations have some impact
- Recommendation
  - Presume that both software provide reasonably accurate ***possible*** solution points
  - **Take five minutes to understand the case read!!!**