Changes to Difference Case Tool in Simulator 20



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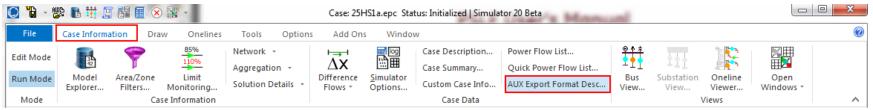
Presentation Overview



- Auxiliary Export Format Description
 - This is a feature we have had for many years that you may find useful
 - Added several hard-coded AUX Export Formats in Version 20
 - Useful in Difference Case Tool
- Changes to the Difference Case Tool
 - Change Model (to go with Present, Base, Difference)
 - Integrated throughout the user interface
 - Expanded the list of fields that are stored in the Base Case
- Upgraded the "Present Topological Differences from Base Case" Dialog

AUX Export Format Description: Built-In "Complete Case" descriptions

- Auxiliary File Export Format Descriptions have been around a long time
 - First implement in about 2006 in Simulator Version 13
 - Available under Case Information tab
 - AUX Export Format Desc...



In Version 20 we have added several hard-coded versions of these

Review: Auxiliary File Export Format Descriptions



- Allows you to define a list of DATA sections you would like to write out to an Auxiliary File
 - Object Type: Specify type of object
 - Filter Name: specify which objects to write out data for
 - All, Selected, AreaZone
 - Name of an Advanced Filter
 - Fields: a list of all fields to be written for this object
 - SubData: a list of sub-data sections to write for each object
- Uses of "AUX Export Formats"
 - Concise way to export the same data every time
 - These can then be used in Difference Case Tool as well
 - Script command to invoke saving all this information
 - SaveDataUsingExportFormat("filename", filetype, "FormatName");

New in Version 20: "Formats for Complete Case"



- Drop-down available on the Auxiliary File Export Format Description
 - <u>https://www.powerworld.com/WebHelp/#MainDo</u>
 <u>cumentation_HTML/Complete Case Auxiliary File</u>
 <u>Export Format Description.htm</u>
 - Several are done
 - Custom Info, Network Model, Contingency, Transient Models, Transient Models, Model Info

Name:	None Defined. Click Save As to	o create one.	Save AUX	Create Format for Complete Case	
Nev Insert Object		Rename Delete Object Type and Filter	Load AUX	Complete Model Legacy Complete Model (Version 18 and	earlier)
DataBle None	ObjectType FilterName Defined	Fields		Modify SubData	Modify

AUX Export Format Description: Network Model

	O Auxiliary File Export Format Description	- 8 %	
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Object	Object Type Filter Name	Fields Modify	Fields for
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	18 Branch BranchDeviceType notcontains 'Transforme '	Topology Allow Consolidation of Branch : -1 : -1 Topology Allow Open or Close Breakers : -1 : -1	ObjectType
	20 3W Transformer All	Status : -1 : -1	
	21 Multi-Section Line All 22 Switched Shunt ShuntMode <> 'Bus Shunt'	Status (Normal) : -1 : -1 Bypassed\ByPassed or Not Bypassed : -1 : -1	
	23 Switched Shunt ShuntMode = 'Bus Shunt' 24 Line Shunt All	Control/Metered Bus (for area or zone tie-lines) : -1 : -1 Impedance/R (series resistance) : 9 : 6	
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	28 Voltage Source Converte All 29 Multi-Terminal DC Recor All	Limit Monitoring Monitor Branch Flows : -1 : -1	
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	35 Super Area All	Limit Monitoring WVA Limits Limit MVA F : 6 : 1 Limit Monitoring WVA Limits Limit MVA G : 6 : 1	
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			1
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Click Modify to change the Fields

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Storing the Definition of an AUX Export Format Description

 This is weird: store description of an AUX Export Format in an Auxiliary File

Click the Save AUX button in upper right

AUX Export Definition.aux - Notepad	—		\times
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Using an AUX Export Format Description



• On the dialog you can click the button Create **AUX File with Specified Format**

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Original Use for AUX Export Formats



• Container for defining your own formats

• You might have a script that has a bunch of SaveData() commands

SaveData("c:\temp\MyFile.aux",AUXDEF,Bus,[Number:8:0,Name,NomkV:8:4,Slack,NomB:10:5,NomG:10:5,Vpu:10:8,Vangle:11:7,DCLossMultiplier:8: 6,AreaNumber:6:0,ZoneNumber:6:0,BANumber:6:0,OwnerNumber:6:0,SubNumber:6:0,Monitor,LimitSet,UseSpecificLimits,LimitLowA:8:6,LimitLowB: 8:6,LimitLowC:8:6,LimitLowD:8:6,LimitHighA:8:6,LimitHighB:8:6,LimitHighC:8:6,LimitHighD:8:6,Latitude:16:13,Longitude:16:12,TopologyBus Type,Priority:5:0,EMSType,EMSID,DataMaintainerAssign,DataMaintainerInherit,DataMaintainerInheritBlock,AllLabels],[],All);

SaveData("c:\temp\MyFile.aux",AUXDEF,Gen,[BusNum:8:0,ID,Status,VoltSet:7:5,RegBusNum:8:0,RegFactor:9:5,AGC,PartFact:10:5,MWSetPoint:10:5,MWMax:10:5,MWMin:10:5,EnforceMWLimit,AVR,MvarSetPoint:10:5,MvarMax:10:5,MvarMin:10:5,UseCapCurve,WindContMode,WindContModePF:8:6,UseLineDrop,Rcomp:8:6,Xcomp:8:6,MVABase:8:4,GenR:8:6,GenX:8:6,StepR:8:6,StepX:8:6,StepTap:8:6,GovRespLimit,UnitTypeCode,AreaNumber:6:0,Z oneNumber:6:0,BANumber:6:0,OwnerNum1:5:0,OwnerPerc1:7:3,OwnerNum2:5:0,OwnerPerc2:6:3,OwnerNum3:5:0,OwnerPerc3:6:3,OwnerNum4:5:0,OwnerPerc6:6:3,OwnerNum7:5:0,OwnerPerc7:6:3,OwnerNum8:5:0,OwnerPerc8:6:3,EMSType,E MSID,DataMaintainerInherit,AllLabels],[]);

SaveData("c:\temp\MyFile.aux",AUXDEF,ReactiveCapability,[BusNum:8:0,ID,MW:10:5,MvarMax:10:5,MvarMin:10:5],[]);

SaveData("c:\temp\MyFile.aux",AUXDEF,Load,[BusNum:8:0,ID,Status,AGC,SMW:10:5,SMvar:10:5,IMW:10:5,IMvar:10:5,ZMW:10:5,ZMvar:10:5,DistSt atus,DistMWInput:10:5,DistMvarInput:10:5,Interruptible,MWMax:10:5,MWMin:10:5,LoadModelGroup,AreaNumber:6:0,ZoneNumber:6:0,BANumber:6:0, OwnerNumber:6:0,EMSType,EMSID,DataMaintainerAssign,DataMaintainerInherit,AllLabels],[]);

• Replace this with command referring to Format

SaveDataUsingExportFormat("filename", filetype, "FormatName");

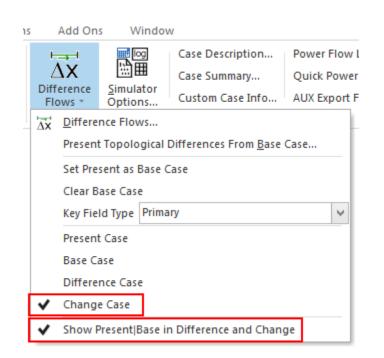
AUX Export Format Complete Case: Network Model

• This is the same set of objects that are going to be available for comparison using the **Difference** Case Tool

New Save As Rename Delete Load AUX DbjectType FilterName But (AI) Case Information AII AII Owner AII AII Owner AII Model Group But (AI) Subtation AII Model Group But (AI) Subtation AII Model Group But (AI) Subtation AII Bas Shurt/Ww -Normal (B): 10: 5 Bas Shurt/Ww -Normal (B): 10: 5 Subtation AII Bas Shurt/Ww -Normal (B): 10: 5 Bas Shurt/Ww -Normal (B): 10: 5 Subtation AII Bas Shurt/Ww -Normal (B): 10: 5 Bas Shurt/Ww -Normal (B): 10: 5 Subtation Chapton AII Bas Shurt/Ww -Normal (B): 10: 5 Bas Shurt/Ww -Normal (B): 10: 5 Subtation Chapton AII Bas Shurt/Ww -Normal (B): 10: 5 Bas Shurt/Ww -Normal (B): 10: 5 Subtation Chapton AII Bas Shurt/Ww -Normal (B): 10: 5 Bas Shurt/Ww -Normal (B): 10: 5 Subtation Chapton AII Bas Shurt/Ww -Normal (B): 10: 5 Bas Shurt/Ww -Normal (B): 10: 5 Subtation Chapton AII Bas Shurt/Ww -Normal (B): 10: 5 Bas Shurt/Ww -Normal (B): 10: 5 Subtation AII Bas Shurt/Ww -Normal (B): 10: 5		Network Model	•	Save AUX Create Format for Complete Case		
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Create AUX File with Specified Format						
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User Interface Changes

- Difference Case Tool modes
 - Present Case, Base Case, Difference Case
 - New: Change Case
 - Only shows values which are different between the two cases
 - If values are the same they will either show a blank or "_same_" (for fields which blank means something)
 - New Option
 - Show Present | Base in Difference and Change



Difference Case

💽 Model E	Explorer: Generators											-		23
Explore	Ļ	X Gen	erators 🗙	В	uses									
Explore	Fields	1 🛄 🛙	***	•.00	.00 .0 ₩ ₩	Records •	Geo 👻 Set 👻 🤇	Columns 👻 🛅 👻	AUX® Constant	• AUXD	🌱 🏥 👻 SORT JE 4 ABED f(X)	• 🆽		•
	Branches Input (2: A Branches State (27		Number of Bus	ID	Status	Gen MW	Gen Mvar	Set Volt	AGC	AVR	Min MW	Max M	w	^
	Buses (22015)	3	10131	PV	Closed	2.57	0.00	0.00000	YES	NO	0.00		4.00	
	DC Transmission L	4	10189	1	Closed	40.00	-5.35	1.00500	YES	YES	0.00		42.00	
> 💾	Generators (4257)	5	10193	PV	Closed	0.02	0.00	0.00000	YES	NO	0.00		0.00	
Ħ	Impedance Correc	6	10197	PV	Closed	4.96	0.00	1.00000	YES	NO	0.00		7.60	
> 🖪	Line D-FACTS Devi	7	10246		Closed Open	132.00	10.16		YES	YES	0.00		0.00	
	Line Shunts (229)	8	10261		Closed Open	44.00	2.26				0.00		0.00	
	Loads (10974)	9	10262		Closed Open	43.00	2.13				0.00		0.00	
		10	10263		Closed	0.00	-0.42				0.00		0.00	
	Mismatches (2201!	11	10264		Closed	0.00	0.00				0.00		0.00	
	Multi-Terminal DC	12	10277		Open Closed	0.00	0.00				0.00		0.00	
	Switched Shunts (13	10318		Closed	0.00	-6.21				0.00		0.00	
	Three-Winding Tra	14	10319		Closed	-6.00	-6.21				0.00		0.00	
	Transformer Contr	15	10320		Closed	0.00	-9.32				0.00		0.00	
> 🖪	Voltage Control G	16	10321		Closed	-89.70	-9.32				0.00		0.00	
	VSC DC Transmissi	17	10394		Closed	0.00	-9.59				0.00		0.00	
	gregations	18	10395		Closed	0.00	-9.59				0.00		0.00	
		19	10396		Closed	0.00	-15.68				0.00		0.00	
		20	10471		Closed	3.98	0.00				0.00		6.10	
	Balancing Authori	21	10485		Closed	0.00	-6.04				0.00		0.00	
	Bus Pairs	22	10486		Closed	0.00	-6.03				0.00		0.00	
	Data Maintainers	23	10491		Closed Open	40.00	5.81				0.00		0.00	
> 🖽	Injection Groups	24	10492		Open	0.00	0.00				0.00		0.00	
	Interfaces (70)	25 26	10493		Closed	1.26	0.00				0.00		2.00	
	Islands (1)	20	10903 10909		Closed Closed	0.00	-0.48 3.32				0.00		0.00	
		27	10909		Closed	0.00	0.00				0.00		0.00	
0	n New Eveloper	20	10955		Closed	0.00	0.00			NO	0.00		0.00	
Ope	en New Explorer	<											>	
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Change Case

OMD Model Explorer: Generators										_		23
Explore 무	× Genera	ators 🗙 B	uses									
Explore Fields	: 📴 🖂	₩T. * * 1 00	.00 🏘 🙀	👫 Records 🕶	Geo 🔹 Set 🍷 C	olumns 👻 📴 👻	AUX® . Bio	• AUXB •	🌱 🏥 🕶 Sort 124 ABED	f(x) ▼ 🗄	₿	-
	Nu Bu	umber of ID IS	Status	Gen MW	Gen Mvar	Set Volt	AGC	AVR	Min MW	Ma	x MW	^
Buses (22015)	3	10131 PV		5.87			YES				9.00	
DC Transmission L	4	10189 1 10193 PV	Closed	40.00 5.22	-5.35	1.00500	YES	YES	0.0	0	42.00	
Generators (4257) Impedance Correc		10195 PV	Closed	4.96	0.00	1.00000		NO	0.0	0	7.60	
Impedance Correc Impedance Correc	7	10246 1	Closed	132.00	10.16	1.02714			0.0		1100	1
Line Shunts (229)	8	10261 1	Closed	44.00	2.26	1.00396	YES					
> H Loads (10974)	9	10262 1	Closed	43.00	2.13	1.00386	YES					
Mismatches (2201!	10	10263 1			4.01	1.00799						-
> H Multi-Terminal DC	11	10264 PV	0.000	1.30			YES					-
Switched Shunts (12	10277 PV 10318 1	Open		77.61							-
Three-Winding Tra	14	10319 1		344.00	77.61		YES					
Transformer Contr	15	10320 1			116.41							
> P Voltage Control G	16	10321 1		404.28	116.41		YES					
VSC DC Transmissi	17	10394 1			12.34	0.99955						_
✓ Aggregations	18 19	10395 1 10396 1			12.34 22.35	0.99955						-
Areas (21)	20	10396 T	Closed	3.98	0.00	1.04300	VES	NO	0.0	0	6.10	
Balancing Authori	21	10485 1	closed	5,50	4.80	1.02368	100	NO	0.0	-	0.10	1
Bus Pairs	22	10486 1			13.74	1.03000						
Data Maintainers	23	10491 1	Closed	40.00	5.81	0.99684	YES					
> 🖪 Injection Groups	24	10492 1										
> 💾 Interfaces (70)	25	10493 PV		4.56	10.04		YES				7.00	2
Islands (1)	26	10903 1 10909 1			10.94 -17.27	1.02364						-
	28	10933 1			-17121							v
Open New Explorer	< 1	10005 1						1		1	>	

Difference Case (Present|Base)

plore	Р	× Gen	erators X Bu	uses													
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	Branches Input (2: A Branches State (27		Number of ID Bus	Status	Gen M\	N	Gen M	var	Set V	olt	AGC	AVR	N	/lin MW		Max M	w
	Buses (22015)	3	10131 PV	Closed	5.87	3.30		0.00		1.00000	YES	NO		0	.00	9.00	5.00
	DC Transmission L	4	10189 1	Closed		40.00		-5.35	1	.00500	YES	YES		0	.00		42.00
-> 💾	Generators (4257)	5	10193 PV	Closed	5.22	5.20		0.00		1.00000	YES	NO		0	.00		7.00
Ħ	Impedance Correc	6	10197 PV	Closed		4.96		0.00	1	00000	YES	NO		0	.00		7.60
> 🖪	Line D-FACTS Devi	7	10246 1	Closed Open	132.00	0.00	10.16	0.00	1.02714	1.03117	YES	YES			.00		132.00
Ē	Line Shunts (229)	8	10261 1	Closed Open	44.00	0.00	2.26	0.00	1.00396	1.00379	YES	YES			.00		44.00
> 🖪	Loads (10974)	9	10262 1	Closed Open	43.00	0.00	2.13		1.00386						.00		44.00
	· · · ·	10	10263 1	Closed		66.00	4.01		1.00799						.00		67.00
III	Mismatches (2201!	11		Closed	1.30	1.30		0.00		1.00000					.00		2.00
> 💾	Multi-Terminal DC	12	10277 PV	Open Closed		0.00		0.00		1.00000					.00		0.75
	Switched Shunts (13	10318 1	Closed		60.00	77.61			1.02900					.00		373.00
	Three-Winding Tra	14	10319 1	Closed	344.00 3		77.61			1.02900					.00		373.00
Ħ	Transformer Contr	15	10320 1	Closed		44.00	116.41			1.02900					.00		544.00
> 🖪	Voltage Control G	16	10321 1	Closed	404.28 4		116.41			1.02900					.00		544.00
	~	17	10394 1	Closed		40.00			0.99955						.90		150.00
		18	10395 1	Closed		40.00			0.99955						.90		150.00
	gregations	19	10396 1	Closed	2	40.00	22.35		1.00023					46			300.00
		20		Closed		3.98		0.00		.04300					.00		6.10
	Balancing Authori	21	10485 1	Closed		94.00	4.80		1.02368					46			110.00
	Bus Pairs	22	10486 1	Closed		41.00	13.74		1.03000					75			149.00
	Data Maintainers	23	10491 1	Closed Open	40.00	0.00	5.81		0.99684						.00		40.00
> 🖽	Injection Groups	24	10492 1	Open		0.00		0.00		1.05000					.00		40.00
	Interfaces (70)	25		Closed		3.30	10.01	0.00		1.00000					.00		5.00
		26	10903 1	Closed	1	43.00			1.02364						.00		143.00
		27	10909 1	Closed		5.00	-17.27			1.02600					.00		102.00
	en New Explorer	28	10933 1	Closed		78.00		0.00		1.00000	TES	NO			.00		100.00

Notice values like 116.41 | 125.74

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Change Case (Present | Base)



plore	Р	🛪 Gen	erators 🗙	B	ises										
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Ē	Branches Input (2: 🔺 Branches State (27		Number of Bus	ID	Status	Gen M	w	Gen M	var	Set Volt	AG	AVR	Min MW	Max N	1W
	Buses (22015)	3	10131				3.30							9.00	5.00
	DC Transmission L	4	10189		Closed		40.00		-5.35	1.00	00 YES	YES			42.00
	Generators (4257)	5	10193			5.22	5.20								
	Impedance Correc	6			Closed	422.001	4.96	10.10			00 YES	NO			7.60
	Line D-FACTS Devi	- / 8	10246 10261		Closed Open	132.00	0.00	10.16		1.02714 1.03					
	Line Shunts (229)	9	10261		Closed Open Closed Open	44.00	0.00	2.26		1.00396 1.00					
> 🖪	Loads (10974)	10	10262		closedjopen	45.00	0.00			1.00799 1.01					
	Mismatches (2201!	11	10264			1.30	1.30	4,011		1007351 1101					
> 🖪	Multi-Terminal DC	12	10277	PV	Open Closed										
Ħ	Switched Shunts (13	10318	1				77.61	83.82						
	Three-Winding Tra	14	10319			344.00	350.00	77.61	83.82						
Ī	Transformer Contr	15	10320					116.41					b		
	Voltage Control G	16	10321			404.28 4	493.98	116.41							
	VSC DC Transmissi	17	10394 10395							0.99955 1.00					
Aac	regations	10	10395							0.99955 1.00					
	Areas (21)	20			Closed		3.981	100	30.02		001 YES	NO			6.10
	Balancing Authori	21	10485				212.2	4.80	10.84	1.02368 1.02					0.10
	Bus Pairs	22	10486	1						1.03000 1.03					
	Data Maintainers	23	10491		Closed Open	40.00	0.00	5.81	0.00	0.99684 1.05	000				
	Injection Groups	24	10492												
	Interfaces (70)	25	10493			4.56	3.30							7.00	5.00
	Islands (1)	26	10903							1.02364 1.02	601				
		27 28	10909 10933					-17.27	-20.59						

Notice blanks and values like 116.41 | 125.74

Colors for Rows and Columns



- Light Orange rows shows objects that are in the Present Case but <u>not the Base Case</u>
- Light Green columns indicate field is not part of the base case comparison tool

Gen	BusNum ^(1 <)	BusName (<) I	D(2B<)	Status (*<)	SensdValuedPinj	SensdValuedQin	MW	(<)
1	10097	AL CONTRACT F	PV	Closed	0.000	0.000		5.93
2	10112	Coloradore F	PV		0.000	0.000	3.26	3.30
3	10131	PROFESSION F	PV		0.000	0.000	5.87]	3.30
4	10189	un 1007 1	L	Closed	0.000			40.00
5	10193	neurogrameth P	PV		0.000	0.000	5.22	5.20
6	10197	remain participant	PV	Closed	0.000	0.000		4.96
7	10246	HALL BRANCHINE 1	L	Closed Open	0.000		132.00	0.00
8	10261	and 4 (1)	L	Closed Open	0.000		44.00	0.00
9	10262	1	L	Closed Open	0.000		43.00	0.00
10	10263	Ann 1	L		0.000			
11	10264	Annual P	PV		0.000	0.000	1.30	1.30
12	10277	F	PV	Open Closed	0.000	0.000		
13	10318	1000000, 000 1	L		0.000			

Change Mode: Treatment of Unchanged Values



- For most values, unchanged values will appear as a BLANK
- For some fields, however, a blank value (depicted as "") means something
 - Geographic Latitude and Longitude

Base Case	Present Case	Difference Case	Change Case
80	120	40	120
	120	120	120
80	80	0	"_same_"
80		-80	



Many Updates in Present Case Topological Difference from Base Case

Network (8408) Present (35) Pagregation (135) Show Present (Base in Difference and Change Below is a summary of the comparison between the present case: 26hstae.epc saved from the Difference Flows Dialog. Image: Comparison between the present case: 26hstae.epc saved from the Difference Flows Dialog. Agregation (203) Element Type New Removed Both Difference Flows Dialog. Image: Comparison between the present case: 26hstae.epc saved from the Difference Flows Dialog. Work (75023) Element Type New Removed Both Load (3931) Element Type New Removed Both Load (3931) Biss (20875) Element Type New Removed Both Load (3931) Study MW Transactions 45 Biss (20875) Element Type (New Removed Both Load (3931) Study MW Transactions 45 45 Biss (20875) Element Type (New Removed Both Load (3931) Element Type (New Removed Both Load (3931) Study MW Transactions 45 45 Biss (20875) Element Type (New Removed Both Load (3931) Farea (114 4 4 4 Banch (23350) Element Type (New Removed Both Load (3388) Owner (114 4 5 4 2 468 Barnch (25350) Transformer (S64) Incerface Element (55 4 2 4 4	Summary	Summary							
Aggregation (155) moved (7138) Hetwork (6935) Aggregation (203) th (77571)Below is a summary of the comparison between the present case: 25HS Ia.epc and the base case: 25HS Ia.epc saved from the Difference Flows Dialog.Network (76023) the base (20875) till Load (9391)Element TypeNewRemovedBoth Aggregation (203)Bus (20875) till Load (9391) till cad (9391)Element TypeNewRemovedBoth Aggregation (2778)Berneh (2728) till Generator (3981) till Reactive Capability (3898) till ransformer (Greetion 42763653981 2071Branch (2530) till Line Shunt (201) till Line Shunt (201) till Los Source Converter till Multi-Terminal DC Record (till Multi-Terminal DC Record (till Multi-Terminal DC Converter till Multi-Terminal DC Converter427Multi-Terminal DC Converter till Multi-Terminal DC Converter till Aggregation (1547) eate Bus Swap ListControl Group2Multi-Terminal DC Converter till Aggregation (1547) eate Bus Swap ListMulti-Terminal DC Converter4Multi-Terminal DC Converter till Control Group42Multi-Terminal DC Converter till Converter42Multi-Terminal DC Converter till Converter44Multi-Terminal DC Converter till Converter44Multi-Te	New (8593)	Difference Mode	Base	e 🔘 Diffe	rence 🔘	Change Show Present Bas	e in Differe	ence and Cha	ange
Element Type New Removed Both Element Type New Removed Both IN betwork (75023) III Bus (20875) III Cad (3931) Study MW Transactions 45 45 III Load (3931) Switched Shunt (2723) Generator (3981) Switched Shunt (2723) Generator (2881) 1570 1163 38981 III ransformer Correction (287) Transformer Correction (277) Transformer (5898) Transformer (564) III cad (3930) Suith 681 9889 III Load (201) III Shunt (201) Element Type New Removed Read 0 0 III Line Shunt (201) III Shunt (201) DC Transmission Line (4) Voltage Source Converter I IO C Transmission Line (7) 4 2 201 Data Maintainer 1 65 IIII Multi-Terminal DC Rocord (1) Line Shunt (201) DC Transmission Line (4) 4 4 1 65 IIII Multi-Terminal DC Cocord (1) Line Shunt (201) DC Transmission Line (4) 4 4 1 65 IIII Multi-Terminal DC Cocord (1) Line Shunt (10) Cocord (10) 28 22 201 1 65 IIII Multi-Terminal DC Cocord (200)<	 ▷ Aggregation (185) □ Removed (7138) ▷ ○ Network (6935) 	between the present case: 26hs and the base case: 25HS 1a.epc	lae.epc						
Image: Bus (20875) Image: Bu	Both (77571)	Element Type	New	Removed	Both	Element Type	New	Removed	Both
Image: Control Group Load 1353 1973 9391 Study MW Transactions 45 45 Image: Control Group Switched Shunt (2723) Generator (3931) Genera		Bus	1140	639	20875	Area			21
Switched Shunt (2723)Switched Shunt4573192723Balancing AuthorityIIGenerator (3981)Generator (3981)Generator (2981)Generator (2981)Cone42468Reactive Capability (3898)Branch (25350)Branch (25350)Branch (25350)Super Area114508If Transformer (8989)Transformer Correction (27Transformer Correction (27Transformer 11416818989Interface11669If With-Terminal DC Transmission LineDC Transmission Line422Data Maintainer11659With-Terminal DC Record (CMulti-Terminal DC Record (CMulti-Terminal DC Record (CMulti-Terminal DC Converter DC I11669102183Multi-Terminal DC Converter42Aggregation (1547)Multi-Terminal DC Converter411669102183Aggregation (1547)Voltage Control GroupInterface11669102183Multi-Terminal DC Converter444116116116Voltage Control GroupInterface11669102183Multi-Terminal DC Converter4444444Voltage Control GroupInterface11669102183Multi-Terminal DC Converter44444444Voltage Control GroupInterface1116		Load	1583	1973	9391	Study MW Transactions	45	45	
Image: Construct (398.1)Generator (398.1)Generator (398.1)Construct (398.1) <td></td> <td>Switched Shunt</td> <td>457</td> <td>319</td> <td>2723</td> <td>Balancing Authority</td> <td></td> <td></td> <td>1</td>		Switched Shunt	457	319	2723	Balancing Authority			1
Image: Reactive Capability (3898)Reactive Capability (3898)Super AreaIII 4508III Transformer Correction (27)Transformer (564)ITransformer 1146818989Interface II 16969258III DC Transmission Line (4)Voltage Source Converter DC ITransmission Line (4)Voltage Source Converter DC IInjection GroupInjection Capability (388)Injection Capab		Generator	276	365	3981	Zone	4	2	468
Branch (25350) Branch (25350) Branch (25350) Super Area Image: Control Group (27) Transformer Correction (27) Transformer Correction (27) Transformer Correction (27) Transformer Correction (27) Transformer (6898) Multi Transformer (564) Transmission Line (4) Multi Terminal DC Record (28) Multi Terminal DC Converter (28) Multi Terminal DC Converte		Reactive Capability	1570	1163	3898	Owner	11	. 4	508
Transformer (8989)Transformer (8989)Interface116533W Transformer (564)JW Transformer13836564Interface Element5549258J DC Transmission Line (4)Voltage Source Converter IDC Transmission Line411653Wulti-Terminal DC Record (7)Multi-Terminal DC Record (7)Multi-Terminal DC Record2Substation11653Multi-Terminal DC Bus (8)Multi-Terminal DC Converter02Substation11653Multi-Terminal DC Converter4Multi-Section Line69102183Aggregation (1547)Notage Control Group4Nomogram11653Aggregation (1547)Voltage Control Group4Nomogram11653Rating Set Name Bus4Rating Set Name Bus411653Rating Set Name Bus111653111Rating Set Name Interface1511111Rating Set Name Bus11111111Rating Set Name Interface11111111111111111111111111111111111111111111<		Branch	2071	1737	25350	Super Area			
W Transformer (564) W Transformer (564) Uine Shunt (201) DC Transmission Line (4) W Voltage Source Converter I Multi-Terminal DC Record (2) Multi-Terminal DC Rus (8) Multi-Terminal DC Record (2) Multi-Terminal DC Converter Voltage Control Group Aggregation (1547) Multi-Terminal DC Converter Voltage Control Group Voltage Control Group Aggregation (1547) Voltage Control Group Rating Set Name Bus 4 Rating Set Name Interface 15	Transformer Correction (27	Transformer Correction	4		27	Data Maintainer			
Line Shunt (201) Internate Definition 55 55 55 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155		Transformer	1141	681	8989	Interface	1	. 1	69
DC Transmission Line (4) Unreshuft 28 22 201 bus Pain Dus Pain Wilti-Terminal DC Record (2) DC Transmission Line 4 Participation Point 1 Multi-Terminal DC Bus (8) Multi-Terminal DC Record 2 Multi-Section Line 69 102 183 Multi-Terminal DC Converter Multi-Terminal DC Converter 4 Multi-Section Line 69 102 183 Multi-Terminal DC Converter 4 Nomogram 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		3W Transformer	138	36	564	Interface Element	55	49	258
Woltage Source Converter I DC Transmission Line 4 Injection Group Multi-Terminal DC Record (C) Multi-Terminal DC Record 2 Multi-Terminal DC Bus (8) Multi-Terminal DC Rus 8 Multi-Terminal DC Converter 4 Multi-Section Line 69 102 183 Multi-Terminal DC Converter 4 Multi-Section Line 69 102 183 Multi-Terminal DC Converter 4 Nomogram 1 1 Voltage Control Group Voltage Control Group 10 183 10 10 183 Aggregation (1547) Multi-Terminal DC Group 4 Nomogram 10 10 10 reate Bus Swap List Voltage Control Group 4 Nating Set Name Bus 4 4 Rating Set Name Bus 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 <td< td=""><td></td><td>Line Shunt</td><td>28</td><td>22</td><td>201</td><td>Bus Pair</td><td></td><td></td><td></td></td<>		Line Shunt	28	22	201	Bus Pair			
Image: Multi-Terminal DC Record (: Voltage Source Converter DC L Participation Point Image: Multi-Terminal DC Bus (8) Multi-Terminal DC Record 2 Image: Multi-Terminal DC Converter Multi-Terminal DC Converter 6 Image: Voltage Control Group Multi-Terminal DC Converter 4 Voltage Control Group Multi-Terminal DC Converter 4 Voltage Control Group Voltage Control Group Nomogram Voltage Control Group Imit Set 10 Rating Set Name Bus 4 Rating Set Name Interface 15		DC Transmission Line			4	Injection Group			
Image: Multi-Terminal DC Bus (8) Multi-Terminal DC Record 2 Substation Image: Multi-Terminal DC Transmission Multi-Terminal DC Converter Multi-		Voltage Source Converter DC L				Participation Point			
Multi-Terminal DC Transmission 6 Multi-Terminal DC Converter 4 Aggregation (1547) Multi-Terminal DC Converter 4 Voltage Control Group 4 Voltage Control Group 4 Voltage Control Group 4 Value Control Group 4 Rating Set Name Bus 4 Rating Set Name Interface 15	Multi-Terminal DC Bus (8)	Multi-Terminal DC Record			2	Substation			
Multi-Terminal DC Converter 4 Nomogram Limit Set 1 Voltage Control Group Voltage Control Group 1 Rating Set Name Branch 1 1 Rating Set Name Bus Rating Set Name Bus 4 Rating Set Name Interface 4 1		Multi-Terminal DC Bus			8	Multi-Section Line	69	102	183
Aggregation (1547) reate Bus Swap List Voltage Control Group Volta		Multi-Terminal DC Transmission			6	Model Group			
reate Bus Swap List Rating Set Name Branch 15 Rating Set Name Bus 24 Rating Set Name BusPair 24 Rating Set Name Interface 15		Multi-Terminal DC Converter			4	Nomogram			
Rating Set Name Branch 15 Rating Set Name Bus 4 Rating Set Name BusPair 4 Rating Set Name Interface 15		Voltage Control Group				Limit Set			1
Rating Set Name BusPair 4 Rating Set Name Interface 15	j Greate bus Swap List					Rating Set Name Branch			15
Rating Set Name Interface 15						Rating Set Name Bus			4
						Rating Set Name BusPair			4
						Rating Set Name Interface			15
Assume base case Areas/Zones which are not in present case meet the Area/Zone Filters		Voltage Control Group	nes which	are not in p		Limit Set Rating Set Name Branch Rating Set Name Bus Rating Set Name BusPair Rating Set Name Interface			
		Save and Send Option							
Save and Send Option		All Lists	-			Send To Excel Save to Tex	kt File	Save To E	PC File
	4	Use Area/Zone Filters when	saving to	Auxiliary Fil		ave To Aux File	File		



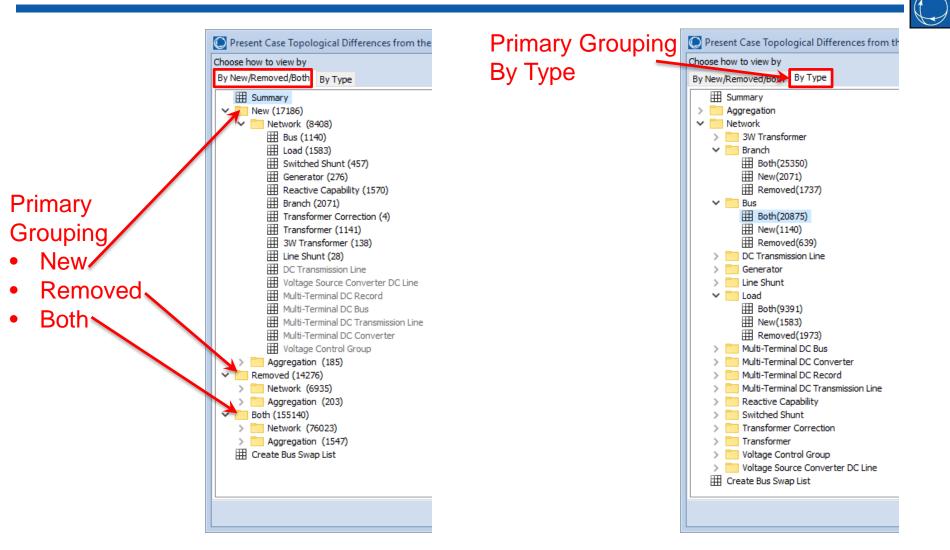
Difference Case Tool Updates in Version 20

- Topological Differences Tool
 - More flexibility in the user interface for the Topological Differences tool
 - Added support for all object types that define what we would call the "Network Model"
 - Added Case Info Customizations for all case information displays used with the Difference Case tool dialog (and a button to clear all of them!)
 - Data Maintainer Filtering works with this now
 - Removed Objects now supports Owner filtering as well (previously it was only Area and Zone)

Difference Case Tool Updates in Version 20

- **C**----
- Storage of Values to Base Case
 - Adding many new fields for storage in the Base
 Case for use in the Difference Case Tool
 - All fields that are part of the AUX Export "Network Model" are included now
 - Also is now much easier for PowerWorld to add additional <u>fields</u> for comparison in the Difference Case Tool

More Object Types, More Ways to Navigate



Option to Save to AUX File: Complete Model

- Save To >
 - Complete Model
- Opens the dialog
 - Choose What to Save
 - Filter by Area/Zone/Owner and/or Data Maintainer
 - If desired, choose an AUX
 Export Format Description

Save To > Remove Field Customizations for All Difference Table	s			
Complete Model				
Legacy Complete Model (Version 18 and earlier)				
Removed Objects to EPC File				
Send Tables To Excel				

Confirm Options	23
What to Save All Lists Only New Elements Only Removed Elements Only Both Elements	Filtering of Objects None (All objects) Use Both Area/Zone/Owner and Data Maintainer Filters Use Only Area/Zone/Owner Filters Use Only Data Maintainer Filters
[™] filters	rs and Data Maintainers that are not in present case meet the Filters and Data Maintainer Filters
Choose AUX Export Format Description	work Model V Define Formats
ОК	Cancel

Options to Save to AUX File: Custom AUX Export Format



- New
 - User-specified AUX export format is used to specify object types and fields to include
 - Any fields that are required when creating new objects will automatically be included
- Removed
 - User-specified AUX export format is used to specify the object types to include
- Both
 - User-specified AUX export format is used to specify object types and fields to include

New Script Command DiffFlowWriteCompleteModel()



- DiffFlowWriteCompleteModel("filename", AppendFile, SaveAdded, SaveRemoved, SaveBoth, KeyFields, "ExportFormat", UseAreaZone, UseDataMain, AssumeBaseMeet)
 - "filename" name of the file such as c:\mypath\filename.aux
 - AppendFile = YES or NO
 - SaveAdded, SaveRemoved, and SaveBoth = YES or NO to indicate which parts of the comparison to save to AUX file
 - Keyfields = Primary or Secondary to indicate which key fields to use
 - "ExportFormat" = the name of an Auxiliary File Export Format Description you want to use when exporting
 - UseAreaZone and UseDataMain YES or NO to indicate whether to only write objects that meet the Area/Zone/Owner or the DataMaintainer display filters
 - AssumeBaseMeet = YES or NO to indicate how objects that were in the base case but are NOT in the present case should be treated with regarding the UseAreaZone and UseDataMain options

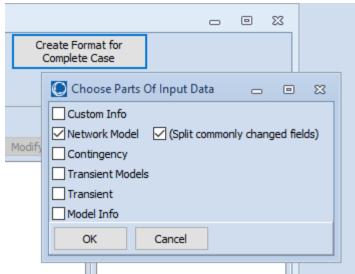
Now, saving out truly creates an AUX file that converts the cases

- Conversion AUX file does not include "BOTH" records for which all entries are either blank or "_same_"
- Blank or "_same_" values throughout indicate no change
- All values that are part of the AUX File Export Format "Network Model" are now supported by the Difference Case Tool

Saving the changes between two cases



- Present Topological Differences actually uses slightly modified "Network Model" AUX Format
- It automatically splits the fields into "commonly changed field" and those that don't normally change



See Duplicate Object Types



 Example: Fields below for a generator are commonly changing fields

Auxiliary File Export Format Description					-		23
Name: Network Model	~	ave AUX	te Format for nplete Case				
New Save Save As Rena	me	Delete	oad AUX				
Insert Object Type Move Up Move Down		Generator (All)					
Object Type Filter Name	^	Fields	Modify	SubData	Modi	fy	
12 Rating Set Name Interfac All 13 Rating Set Name BusPair All 14 Bus All 15 Bus All 16 Generator All 17 Generator All 18 Reactive Capability All 19 Load All 201 oad All 201 oad All 201 oad All Use Concise Variable Names and Auxiliary File Headers Use Consolidated Model	~	Exporting	int Voltage : 7 : 5 : -1 tion Factor : 10 : 5 Point : 10 : 5 1 : -1	Click on Modify	to add sub	odata	
✓ ОК ? Неір		X Car	ncel				



- Allows the user to specify what is considered a significant change when reporting that an object has changed between the Present and Base case
- This only affects the objects and values reported when in Change Mode

Present Case Topological Different Choose how to view by By New/Removed/Both By Type	Summary Difference Mode Present) Base		() Change	Show P	resent Base in D	ifference and Cha	ange Change 1] ×
Access the case info tolerances from the Differences from Ba Difference Case dro	ormation displ Present Topo ise Case dialog	ay of logic	f all cal		L Differ Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case Case	ence Scale Case	Model Explorer gical Difference Base Primary	Connections	Othe
				\mathbf{i}		hange Mode			_
						how Present E		ice and Change	



Case information display of all change mode tolerances will show separate defaults for particular fields that require more precision than overall defaults

. ** ∰ <u> </u>	•.0 •00 ♠ ♣ ♣ Re	cords + Set + Co	olumns 👻 🖭 👻		▼ SORT 124 ABED f(x) ▼	otions 🝷	
Object Type	Object Field	Tol Type	Tol Perc	Tol Abs			
1 Default	All Other Fields	Percent	1E-4	1E-6			
2 Bus	Latitude	Absolute 🗸 🗸	1E-4	1E-7			
3 Bus	Longitude	Absolute	1E-4	1E-7			
4 Bus	Vangle	Absolute	1E-4	1E-5			
5 Bus	VangleRad	Absolute	1E-4	1.7453E-7			
6 Bus	Vpu	Absolute	1E-4	1E-8			
7 Substation	Latitude	Absolute	1E-4	1E-7			
8 Substation	Longitude	Absolute	1E-4	1E-7			





Access the dialog to specify tolerances for a particular object type and field by right clicking on the field while in Change Mode

	💽 DiffChangeTolerance 'Bus' 'Vpu' — 🗆 🗙
	Find DiffChangeTolerance 'Bus' 'Vpu'
	ObjectType Bus
	ObjectField Vpu
PU Volt Volt (kV) Angle (Deg) Load MW	TolType Absolute ~
1.05000 7.64 1.04000 4.36	TolPerc 1E-4
0.98500 105 054 0.00	TolAbs 1E-8
1.00 Set Difference Change Tolerance	
1.00 Show Dialog	
1.04 Show Data View	
	Close Options

- TolType
 - Absolute
 - Change is considered based on the absolute value of the Present – Base
 - $|Present Base| \ge TolAbs$
 - Percent
 - Percent change from the base case value is used to determine if the value has changed
 - Actual check is done as follows to take into account a base case value that may be very small

 $\left[(|Base| \ge 1x10^{-6}) AND \left(\left| \frac{Present-Base}{Base} \right| \ge \frac{TolPerc}{100} \right) \right] OR \\ \left[(|Base| < 1x10^{-6}) AND \left(|Present - Base| \ge 1x10^{-6} \right) \right]$

- TolType
 - Perc OR Abs
 - Change is considered based on whether the value meets either the TolPerc or TolAbs constraint

 $\begin{bmatrix} (|Present - Base| \ge TotalAbs) \end{bmatrix} OR \\ \begin{bmatrix} (|Base| \ge 1x10^{-6}) AND \left(\left| \frac{Present - Base}{Base} \right| \ge \frac{TolPerc}{100} \right) \end{bmatrix}$

- Perc AND Abs
 - Change is considered based on whether the value meets both the TolPerc and TolAbs constraint

$$\begin{bmatrix} (|Present - Base| \ge TotalAbs) \end{bmatrix} AND \\ \begin{bmatrix} (|Base| < 1x10^{-6}) OR \left(\left| \frac{Present - Base}{Base} \right| \ge \frac{TolPerc}{100} \right) \end{bmatrix}$$