

Changes to Difference Case Tool in Simulator 20



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Presentation Overview

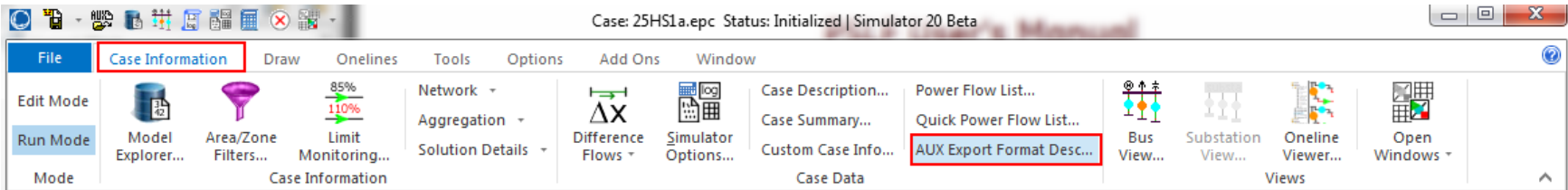


- Auxiliary Export Format Description
 - This is a feature we have had for many years that you may find useful
 - Added several hard-coded AUX Export Formats in Version 20
 - Useful in Difference Case Tool
- Changes to the Difference Case Tool
 - Change Model (to go with Present, Base, Difference)
 - 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



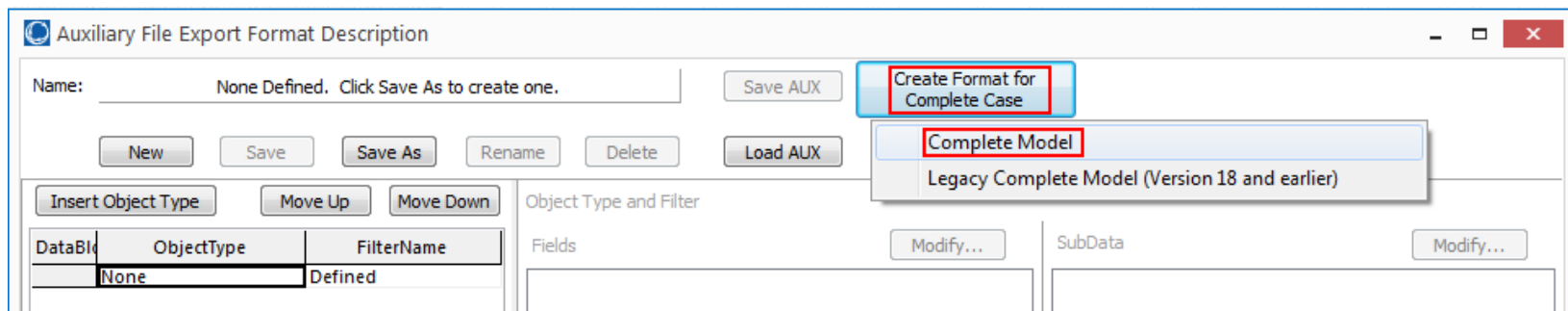
- Allows you to define a list of DATA sections you would like to write out to an Auxiliary File
 - Object Type: Specify type of object
 - Filter Name: specify which objects to write out data for
 - All, Selected, AreaZone
 - Name of an Advanced Filter
 - Fields: a list of all fields to be written for 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
 - <https://www.powerworld.com/WebHelp/#MainDocumentation HTML/Complete Case Auxiliary File Export Format Description.htm>
 - Several are done
 - Custom Info, Network Model, Contingency, Transient Models, Transient Models, Model Info



AUX Export Format Description: Network Model



Object
Types

Auxiliary File Export Format Description

Name: Network Model

Save AUX Create Format for Complete Case

New Save Save As Rename Delete Load AUX

Insert Object Type Move Up Move Down

Object Type	Filter Name
14 Bus	All
15 Generator	All
16 Reactive Capability	All
17 Load	All
18 Branch	BranchDeviceType notcontains 'Transformer'
19 Branch	BranchDeviceType = Transformer
20 3W Transformer	All
21 Multi-Section Line	All
22 Switched Shunt	ShuntMode <> 'Bus Shunt'
23 Switched Shunt	ShuntMode = 'Bus Shunt'
24 Line Shunt	All
25 DFACTS Correction	All
26 DFACTS	All
27 DC Transmission Line	All
28 Voltage Source Converter	All
29 Multi-Terminal DC Recorder	All
30 Multi-Terminal DC Bus	All
31 Multi-Terminal DC Converter	All
32 Multi-Terminal DC Transformer	All
33 Injection Group	All
34 Participation Point	All
35 Super Area	All

Create AUX File with Specified Format...

☒ Use Concise Variable Names and Auxiliary File Headers
☐ Use Consolidated Model

OK

Branch (BranchDeviceType notcontains 'Transformer')

Fields

Modify...

Number at From Bus : 8 : 0
Number at To Bus : 8 : 0
Circuit : -1 : -1
Topology\Branch Device Type : -1 : -1
Topology\Allow Consolidation of Branch : -1 : -1
Topology\Allow Open or Close Breakers : -1 : -1
Status : -1 : -1
Status (Normal) : -1 : -1
Bypassed\Bypassed or Not Bypassed : -1 : -1
Control\Metered Bus (for area or zone tie-lines) : -1 : -1
Impedance\R (series resistance) : 9 : 6
Impedance\X (series reactance) : 9 : 6
Impedance\B (shunt charging) : 9 : 6
Impedance\G (shunt conductance) : 9 : 6
Geography\Length, User Entered : 10 : 5
Limit Monitoring\Monitor Branch Flows : -1 : -1
Limit Monitoring\Limit Group : -1 : -1
Limit Monitoring\MVA Limits\Limit MVA A : 6 : 1
Limit Monitoring\MVA Limits\Limit MVA B : 6 : 1
Limit Monitoring\MVA Limits\Limit MVA C : 6 : 1
Limit Monitoring\MVA Limits\Limit MVA D : 6 : 1
Limit Monitoring\MVA Limits\Limit MVA E : 6 : 1
Limit Monitoring\MVA Limits\Limit MVA F : 6 : 1
Limit Monitoring\MVA Limits\Limit MVA G : 6 : 1
Limit Monitoring\MVA Limits\Limit MVA H : 6 : 1

Defaults for Exporting Fields

Total Digits 12
Dec Places 6

Fields for
selected
ObjectType

Filters

Impedance\X (series reactance) : 9 : 6

Field : Digits : Decimals

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
File Edit Format View Help
AuxFileExportFormatData (TotalDigits,DecimalPlaces,CaseInfoAuxDataFormat,ExpDescName)
{
12 6 "" "Network Model"
<SUBDATA DataBlockDescription>
  PWCaseInformation [Selected] [PWCaseHeader] ""
  DataMaintainer [Name Contact Phone Email Company Location DataMaintainerAssign] [] ""
  Owner [Number:8:0 Name DataMaintainerAssign] [] ""
  LoadModelGroup [Name LongName DataMaintainerAssign] [] ""
  Substation [Number:8:0 Name IDExtra Latitude:16:13 Longitude:16:12 DataMaintainerAssign DataMaintainerInheritBlock] [] ""
  XFCCorrection [Number Name DataMaintainerAssign Tap:0:12:6 Factor:0:12:6 Tap:1:12:6 Factor:1:12:6 Tap:2:12:6 Factor:2:12:6 Tap:3:12:6
  VoltageControlGroup [Name Status DataMaintainerAssign] [] ""
  Limit_Monitoring_Options_Value [Option Value] [] ""
  LimitSet [Name Disabled DataMaintainerAssign AmpMVA MonitorEnd BranchPercent:8:4 InterfacePercent:8:4 BranchRateSet InterfaceRateSet
  RatingSetNameBus [Name Header Description] [] ""
  RatingSetNameBranch [Name Header Description] [] ""
  RatingSetNameInterface [Name Header Description] [] ""
  RatingSetNameBusPair [Name Header Description] [] ""
  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 BAN
  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 EnforceMWL
  ReactiveCapability [BusNum:8:0 ID MW:10:5 MvarMax:10:5 MvarMin:10:5] [] ""
  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 DistStatus DistMWInput:10:5 DistMvarInput
  Branch [BusNumFrom:8:0 BusNumTo:8:0 Circuit BranchDeviceType ConsolidateAllow OpenOrCloseBreakersAllow Status StatusNormal ByPass Me
```


Using an AUX Export Format Description



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

```
Actual Export.aux - Notepad
File Edit Format View Help
79164 "1 " 9.28000 5.00000 -6.00000
79164 "1 " 10.00000 4.49000 -4.68000
79164 "1 " 11.45000 3.78000 -2.44000
79164 "1 " 11.97000 1.41000 -1.41000
79164 "1 " 12.10000 0.00000 0.00000
}
Load (BusNum,ID,Status,AGC,SMW,SMvar,IMW,IMvar,ZMW,ZMvar,DistStatus,DistMWInput,
DistMvarInput,Interruptible,MWMax,MWMin,LoadModelGroup,AreaNumber,ZoneNumber,
BANumber,OwnerNumber,EMSType,EMSID,DataMaintainerAssign,DataMaintainerInherit,
AllLabels)
{
10005 "1 " "Closed" "YES" 21.10157 1.99287 0.00000 0.00000 0.00000 0.00000 "Open" 0.00000 0.00000 "NO " 21.10157
10008 "TS" "Closed" "YES" 7.40000 2.43000 0.00000 0.00000 0.00000 0.00000 "Open" 0.00000 0.00000 "NO " 7.40000
10013 "1 " "Closed" "YES" 8.20714 -0.27384 0.00000 0.00000 0.00000 0.00000 "Open" 0.00000 0.00000 "NO " 8.20714
10015 "1 " "Closed" "YES" 3.81664 2.15916 0.00000 0.00000 0.00000 0.00000 "Open" 0.00000 0.00000 "NO " 3.81664
10017 "1 " "Closed" "YES" 4.86215 0.13237 0.00000 0.00000 0.00000 0.00000 "Open" 0.00000 0.00000 "NO " 4.86215
10020 "1 " "Closed" "YES" 21.81781 -2.27348 0.00000 0.00000 0.00000 0.00000 "Open" 0.00000 0.00000 "NO " 21.81781
10022 "1 " "Closed" "YES" 11.28303 3.29729 0.00000 0.00000 0.00000 0.00000 "Open" 0.00000 0.00000 "NO " 11.28303
10027 "1 " "Closed" "YES" 4.62299 -0.74862 0.00000 0.00000 0.00000 0.00000 "Open" 0.00000 0.00000 "NO " 4.62299
}
```

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,TopologyBusType,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,ZoneNumber: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,OwnerPerc4:6:3,OwnerNum5:5:0,OwnerPerc5:6:3,OwnerNum6:5:0,OwnerPerc6:6:3,OwnerNum7:5:0,OwnerPerc7:6:3,OwnerNum8:5:0,OwnerPerc8:6:3,EMSType,EMSID,DataMaintainerAssign,DataMaintainerInherit,AllLabels],[],All);
```

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

```
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,DistStatus,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],[],All);
```

- 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

Auxiliary File Export Format Description

Name: Network Model

Save AUX Create Format for Complete Case

New Save Save As Rename Delete Load AUX

Insert Object Type Move Up Move Down

DataBk	ObjectType	FilterName
1	Case Information	All
2	Data Maintainer	All
3	Owner	All
4	Model Group	All
5	Substation	All
6	Transformer Correction	All
7	Voltage Control Group	All
8	Limit Monitoring Option	All
9	Limit Set	All
10	Rating Set Name Bus	All
11	Rating Set Name Branch	All
12	Rating Set Name Interface	All
13	Rating Set Name BusPair	All
14	Bus	All
15	Generator	All
16	Reactive Capability	All
17	Load	All
18	Branch	BranchDeviceType notcontains 'Transformer'
19	Branch	BranchDeviceType = 'Transformer'
20	3W Transformer	All
21	Multi-Section Line	All
22	Switched Shunt	ShuntMode <> 'Bus Shunt'
23	Switched Shunt	ShuntMode = 'Bus Shunt'
24	Line Shunt	All
25	DFACTSCorrection	All
26	DFACTS	All
27	DC Transmission Line	All
28	Voltage Source Converter	All
29	Multi-Terminal DC Recorder	All
30	Multi-Terminal DC Bus	All
31	Multi-Terminal DC Converter	All
32	Multi-Terminal DC Transformer	All
33	Injection Group	All
34	Participation Point	All
35	Super Area	All
36	Area	All
37	Study MW Transactions	All
38	Balancing Authority	All
39	Zone	All
40	Interface	All
41	Interface Element	All
42	Nomogram	All
43	Sim Solution Options_V	All
44	Post Power Flow Actions	All
45	Post Power Flow Actions All	All

Bus (All)

Fields Modify...

SubData Modify...

Click on Modify... to add subdata

Number : 8 : 0
Name : -1 : -1
Voltage/kV Nominal : 8 : 4
Solution/Type Slack? : -1 : -1
Bus Shunt/Mvar - Nominal (B) : 10 : 5
Bus Shunt/MW - Nominal (G) : 10 : 5
Voltage/Per Unit Magnitude : 10 : 8
Voltage/Angle (degrees) : 11 : 7
Solution/DC Approximation Loss Multiplier : 8 : 6
Area/Number : 6 : 0
Zone/Number : 6 : 0
Balancing Authority/Number : 6 : 0
Owners/Number : 6 : 0
Substation/Number : 6 : 0
Limit Monitoring/Monitor Bus Voltage : -1 : -1
Limit Monitoring/Limit Group : -1 : -1
Limit Monitoring/Bus Specific Limits/Use Bus-Specific
Limit Monitoring/Bus Specific Limits/Low PU Volt A
Limit Monitoring/Bus Specific Limits/Low PU Volt B
Limit Monitoring/Bus Specific Limits/Low PU Volt C
Limit Monitoring/Bus Specific Limits/Low PU Volt D
Limit Monitoring/Bus Specific Limits/High PU Volt A
Limit Monitoring/Bus Specific Limits/High PU Volt B
Limit Monitoring/Bus Specific Limits/High PU Volt C
Limit Monitoring/Bus Specific Limits/High PU Volt D
Geography/Latitude : 16 : 13
Geography/Longitude : 16 : 12
Topology/Topology Bus Type : -1 : -1
Topology/Node Priority : 5 : 0
Topology/EMS Type : -1 : -1
Topology/EMS ID : -1 : -1
Data Maintainer/Name Assigned : -1 : -1
Data Maintainer/Inheritance Allowed : -1 : -1
Data Maintainer/Inheritance Block : -1 : -1
Labels/Labels All : -1 : -1

Defaults for Exporting Fields

Total Digits 12
Dec Places 6

Create AUX File with Specified Format...

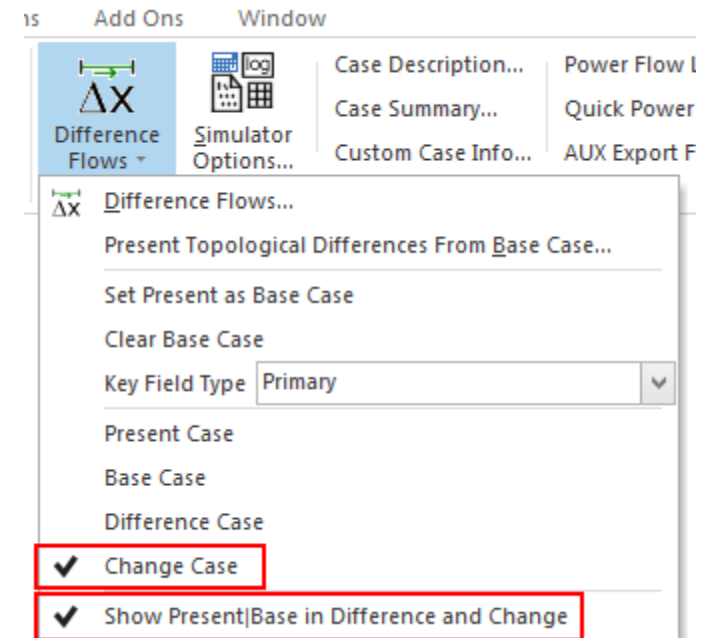
☒ Use Concise Variable Names and Auxiliary File Headers
☐ Use Consolidated Model

OK ? Help Cancel

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 Explorer: Generators

Explore Fields

- Branches Input (27)
- Branches State (27)
- Buses (22015)
- DC Transmission Lines (1)
- Generators (4257)
- Impedance Corrections (1)
- Line D-FACTS Devices (1)
- Line Shunts (229)
- Loads (10974)
- Mismatches (22015)
- Multi-Terminal DC Lines (1)
- Switched Shunts (1)
- Three-Winding Transformers (1)
- Transformer Contractions (1)
- Voltage Control Groups (1)
- VSC DC Transmissions (1)
- Aggregations
 - Areas (21)
 - Balancing Authorities (1)
 - Bus Pairs (1)
 - Data Maintainers (1)
 - Injection Groups (1)
 - Interfaces (70)
 - Islands (1)
 - Multi-Section Lines (1)

Open New Explorer

Generators Buses

	Number of Bus	ID	Status	Gen MW	Gen Mvar	Set Volt	AGC	AVR	Min MW	Max MW
3	10131	PV	Closed	2.57	0.00	0.00000	YES	NO	0.00	4.00
4	10189	1	Closed	40.00	-5.35	1.00500	YES	YES	0.00	42.00
5	10193	PV	Closed	0.02	0.00	0.00000	YES	NO	0.00	0.00
6	10197	PV	Closed	4.96	0.00	1.00000	YES	NO	0.00	7.60
7	10246	1	Closed Open	132.00	10.16	-0.00403	YES	YES	0.00	0.00
8	10261	1	Closed Open	44.00	2.26	0.00017	YES	YES	0.00	0.00
9	10262	1	Closed Open	43.00	2.13	0.00005	YES	YES	0.00	0.00
10	10263	1	Closed	0.00	-0.42	-0.00832	YES	YES	0.00	0.00
11	10264	PV	Closed	0.00	0.00	0.00000	YES	NO	0.00	0.00
12	10277	PV	Open Closed	0.00	0.00	0.00000	YES	NO	0.00	0.00
13	10318	1	Closed	0.00	-6.21	0.00000	YES	YES	0.00	0.00
14	10319	1	Closed	-6.00	-6.21	0.00000	YES	YES	0.00	0.00
15	10320	1	Closed	0.00	-9.32	0.00000	YES	YES	0.00	0.00
16	10321	1	Closed	-89.70	-9.32	0.00000	YES	YES	0.00	0.00
17	10394	1	Closed	0.00	-9.59	-0.00664	YES	YES	0.00	0.00
18	10395	1	Closed	0.00	-9.59	-0.00664	YES	YES	0.00	0.00
19	10396	1	Closed	0.00	-15.68	-0.00663	YES	YES	0.00	0.00
20	10471	PV	Closed	3.98	0.00	1.04300	YES	NO	0.00	6.10
21	10485	1	Closed	0.00	-6.04	-0.00266	YES	YES	0.00	0.00
22	10486	1	Closed	0.00	-6.03	-0.00262	YES	YES	0.00	0.00
23	10491	1	Closed Open	40.00	5.81	-0.05316	YES	YES	0.00	0.00
24	10492	1	Open	0.00	0.00	0.00000	YES	YES	0.00	0.00
25	10493	PV	Closed	1.26	0.00	0.00000	YES	NO	0.00	2.00
26	10903	1	Closed	0.00	-0.48	-0.00237	YES	YES	0.00	0.00
27	10909	1	Closed	0.00	3.32	0.00000	YES	YES	0.00	0.00
28	10933	1	Closed	0.00	0.00	0.00000	YES	NO	0.00	0.00

Change Case



Model Explorer: Generators

Explore Fields

- Branches Input (27)
- Branches State (27)
- Buses (22015)
- DC Transmission L
- Generators (4257)
- Impedance Correc
- Line D-FACTS Devi
- Line Shunts (229)
- Loads (10974)
- Mismatches (22015)
- Multi-Terminal DC
- Switched Shunts (
- Three-Winding Tra
- Transformer Contr
- Voltage Control G
- VSC DC Transmissi
- Aggregations
 - Areas (21)
 - Balancing Authori
 - Bus Pairs
 - Data Maintainers
 - Injection Groups
 - Interfaces (70)
 - Islands (1)
 - Multi-Section Line

Open New Explorer

Generators Buses

Records Geo Set Columns f(x)

	Number of Bus	ID	Status	Gen MW	Gen Mvar	Set Volt	AGC	AVR	Min MW	Max MW
3	10131	PV		5.87			YES			9.00
4	10189	1	Closed	40.00	-5.35	1.00500	YES	YES	0.00	42.00
5	10193	PV		5.22			YES			
6	10197	PV	Closed	4.96	0.00	1.00000	YES	NO	0.00	7.60
7	10246	1	Closed	132.00	10.16	1.02714	YES			
8	10261	1	Closed	44.00	2.26	1.00396	YES			
9	10262	1	Closed	43.00	2.13	1.00386	YES			
10	10263	1			4.01	1.00799				
11	10264	PV		1.30			YES			
12	10277	PV	Open							
13	10318	1			77.61					
14	10319	1		344.00	77.61		YES			
15	10320	1			116.41					
16	10321	1		404.28	116.41		YES			
17	10394	1			12.34	0.99955				
18	10395	1			12.34	0.99955				
19	10396	1			22.35	1.00023				
20	10471	PV	Closed	3.98	0.00	1.04300	YES	NO	0.00	6.10
21	10485	1			4.80	1.02368				
22	10486	1			13.74	1.03000				
23	10491	1	Closed	40.00	5.81	0.99684	YES			
24	10492	1								
25	10493	PV		4.56			YES			7.00
26	10903	1			10.94	1.02364				
27	10909	1			-17.27					
28	10933	1								

Difference Case (Present | Base)



Model Explorer: Generators

Explore

ExploreFields

Branches Input (27)

Branches State (27)

Buses (22015)

DC Transmission L

Generators (4257)

Impedance Correc

Line D-FACTS Devi

Line Shunts (229)

Loads (10974)

Mismatches (22015)

Multi-Terminal DC

Switched Shunts (1)

Three-Winding Tra

Transformer Contr

Voltage Control G

VSC DC Transmissi

Aggregations

Areas (21)

Balancing Authori

Bus Pairs

Data Maintainers

Injection Groups

Interfaces (70)

Islands (1)

Multi-Section Line

Open New Explorer

Generators

Buses

Records

Geo

Set

Columns

AWB

AWB

Sort

f(x)

	Number of Bus	ID	Status	Gen MW	Gen Mvar	Set Volt	AGC	AVR	Min MW	Max MW
3	10131	PV	Closed	5.87 3.30	0.00	1.00000	YES	NO	0.00	5.00
4	10189	1	Closed	40.00	-5.35	1.00500	YES	YES	0.00	42.00
5	10193	PV	Closed	5.22 5.20	0.00	1.00000	YES	NO	0.00	7.00
6	10197	PV	Closed	4.96	0.00	1.00000	YES	NO	0.00	7.60
7	10246	1	Closed Open	132.00 0.00	10.16 0.00	1.02714 1.03117	YES	YES	40.00	132.00
8	10261	1	Closed Open	44.00 0.00	2.26 0.00	1.00396 1.00379	YES	YES	0.00	44.00
9	10262	1	Closed Open	43.00 0.00	2.13 0.00	1.00386 1.00381	YES	YES	0.00	44.00
10	10263	1	Closed	66.00	4.01 4.43	1.00799 1.01631	YES	YES	0.00	67.00
11	10264	PV	Closed	1.30 1.30	0.00	1.00000	YES	NO	0.00	2.00
12	10277	PV	Open Closed	0.00	0.00	1.00000	YES	NO	0.00	0.75
13	10318	1	Closed	360.00	77.61 83.82	1.02900	YES	YES	0.00	373.00
14	10319	1	Closed	344.00 350.00	77.61 83.82	1.02900	YES	YES	0.00	373.00
15	10320	1	Closed	544.00	116.41 125.74	1.02900	YES	YES	0.00	544.00
16	10321	1	Closed	404.28 493.98	116.41 125.74	1.02900	YES	YES	0.00	544.00
17	10394	1	Closed	140.00	12.34 21.94	0.99955 1.00620	YES	YES	56.90	150.00
18	10395	1	Closed	140.00	12.34 21.94	0.99955 1.00620	YES	YES	56.90	150.00
19	10396	1	Closed	240.00	22.35 38.02	1.00023 1.00686	YES	YES	46.70	300.00
20	10471	PV	Closed	3.98	0.00	1.04300	YES	NO	0.00	6.10
21	10485	1	Closed	94.00	4.80 10.84	1.02368 1.02634	YES	YES	46.00	110.00
22	10486	1	Closed	141.00	13.74 19.76	1.03000 1.03262	YES	YES	75.00	149.00
23	10491	1	Closed Open	40.00 0.00	5.81 0.00	0.99684 1.05000	YES	YES	10.00	40.00
24	10492	1	Open	0.00	0.00	1.05000	YES	YES	10.00	40.00
25	10493	PV	Closed	4.56 3.30	0.00	1.00000	YES	NO	0.00	7.00 5.00
26	10903	1	Closed	143.00	10.94 11.42	1.02364 1.02601	YES	YES	0.00	143.00
27	10909	1	Closed	5.00	-17.27 -20.59	1.02600	YES	YES	0.00	102.00
28	10933	1	Closed	78.00	0.00	1.00000	YES	NO	0.00	100.00

Notice values like 116.41 | 125.74

Change Case (Present | Base)



Model Explorer: Generators

Explore Fields

- Branches Input (27)
- Branches State (27)
- Buses (22015)
- DC Transmission Lines (1)
- Generators (4257)
- Impedance Corrections (1)
- Line D-FACTS Devices (1)
- Line Shunts (229)
- Loads (10974)
- Mismatches (22015)
- Multi-Terminal DC Lines (1)
- Switched Shunts (1)
- Three-Winding Transformers (1)
- Transformer Controls (1)
- Voltage Control Groups (1)
- VSC DC Transmissions (1)
- Aggregations
 - Areas (21)
 - Balancing Authorities (1)
 - Bus Pairs (1)
 - Data Maintainers (1)
 - Injection Groups (1)
 - Interfaces (70)
 - Islands (1)
 - Multi-Section Lines (1)

Open New Explorer

Generators Buses

	Number of Bus	ID	Status	Gen MW	Gen Mvar	Set Volt	AGC	AVR	Min MW	Max MW
3	10131	PV		5.87 3.30						9.00 5.00
4	10189	1	Closed	40.00	-5.35	1.00500	YES	YES		42.00
5	10193	PV		5.22 5.20						
6	10197	PV	Closed	4.96		1.00000	YES	NO		7.60
7	10246	1	Closed Open	132.00 0.00	10.16 0.00	1.02714 1.03117				
8	10261	1	Closed Open	44.00 0.00	2.26 0.00	1.00396 1.00379				
9	10262	1	Closed Open	43.00 0.00	2.13 0.00	1.00386 1.00381				
10	10263	1			4.01 4.43	1.00799 1.01631				
11	10264	PV		1.30 1.30						
12	10277	PV	Open Closed							
13	10318	1			77.61 83.82					
14	10319	1		344.00 350.00	77.61 83.82					
15	10320	1			116.41 125.74					
16	10321	1		404.28 493.98	116.41 125.74					
17	10394	1			12.34 21.94	0.99955 1.00620				
18	10395	1			12.34 21.94	0.99955 1.00620				
19	10396	1			22.35 38.02	1.00023 1.00686				
20	10471	PV	Closed	3.98		1.04300	YES	NO		6.10
21	10485	1			4.80 10.84	1.02368 1.02634				
22	10486	1			13.74 19.76	1.03000 1.03262				
23	10491	1	Closed Open	40.00 0.00	5.81 0.00	0.99684 1.05000				
24	10492	1								
25	10493	PV		4.56 3.30						7.00 5.00
26	10903	1			10.94 11.42	1.02364 1.02601				
27	10909	1			-17.27 -20.59					
28	10933	1								

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 not the Base Case
- Light Green columns indicate field is not part of the base case comparison tool

Gen	BusNum(1<)	BusName (<)	ID(2B<)	Status (*<)	SensdValuedPinj	SensdValuedQinj	MW (<)
1	10097	10097	PV	Closed	0.000	0.000	5.93
2	10112	10112	PV		0.000	0.000	3.26 3.30
3	10131	10131	PV		0.000	0.000	5.87 3.30
4	10189	10189	1	Closed	0.000	0.000	40.00
5	10193	10193	PV		0.000	0.000	5.22 5.20
6	10197	10197	PV	Closed	0.000	0.000	4.96
7	10246	10246	1	Closed Open	0.000		132.00 0.00
8	10261	10261	1	Closed Open	0.000		44.00 0.00
9	10262	10262	1	Closed Open	0.000		43.00 0.00
10	10263	10263	1		0.000		
11	10264	10264	PV		0.000	0.000	1.30 1.30
12	10277	10277	PV	Open Closed	0.000	0.000	
13	10318	10318	1		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



Present Case Topological Differences from the Base Case

Summary

Difference Mode: ☒ Present ☐ Base ☐ Difference ☐ Change ☐ Show Present|Base in Difference and Change

Below is a summary of the comparison between the present case: 26hs1ae.epc and the base case: 25HS1a.epc saved from the Difference Flows Dialog.

Element Type	New	Removed	Both
Bus	1140	639	20875
Load	1583	1973	9391
Switched Shunt	457	319	2723
Generator	276	365	3981
Reactive Capability	1570	1163	3898
Branch	2071	1737	25350
Transformer Correction	4		27
Transformer	1141	681	8989
3W Transformer	138	36	564
Line Shunt	28	22	201
DC Transmission Line			4
Voltage Source Converter DC Link			
Multi-Terminal DC Record			2
Multi-Terminal DC Bus			8
Multi-Terminal DC Transmission			6
Multi-Terminal DC Converter			4
Voltage Control Group			

Element Type	New	Removed	Both
Area			21
Study MW Transactions	45	45	
Balancing Authority			1
Zone	4	2	468
Owner	11	4	508
Super Area			
Data Maintainer			
Interface	1	1	69
Interface Element	55	49	258
Bus Pair			
Injection Group			
Participation Point			
Substation			
Multi-Section Line	69	102	183
Model Group			
Nomogram			
Limit Set			1
Rating Set Name Branch			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

Save and Send Option

All Lists

☐ Use Area/Zone Filters when saving to Auxiliary File

Send To Excel Save To Text File Save To EPC File

Save To Aux File Load Aux File

Close

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



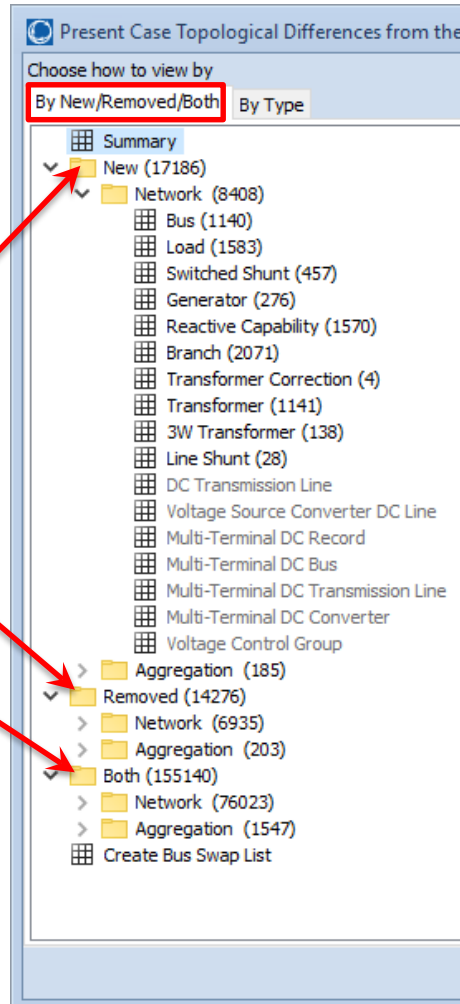
- Storage of Values to Base Case
 - Adding many new fields for storage in the Base Case for use in the Difference Case Tool
 - All fields that are part of the AUX Export “Network Model” are included now
 - Also is now much easier for PowerWorld to add additional fields for comparison in the Difference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

More Object Types, More Ways to Navigate

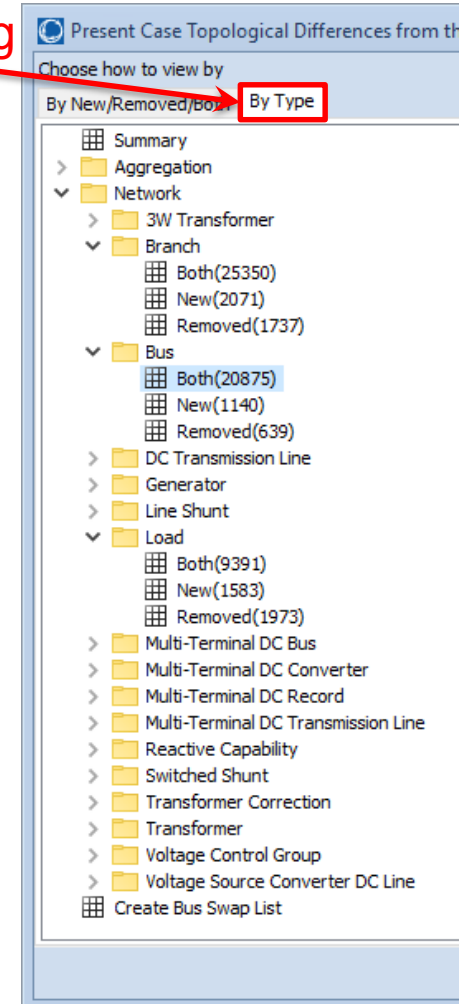


Primary
Grouping

- New
- Removed
- Both



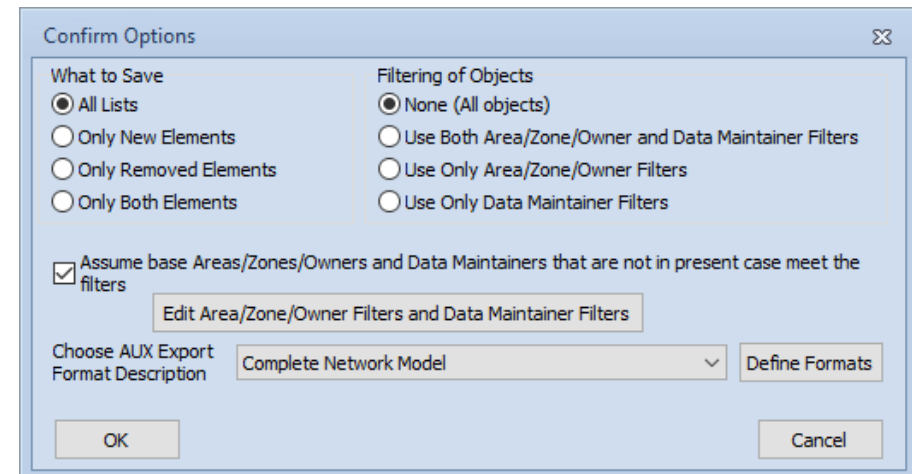
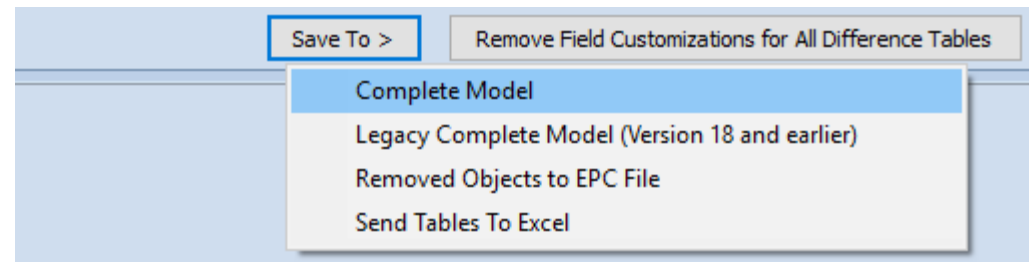
Primary Grouping
By Type



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



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

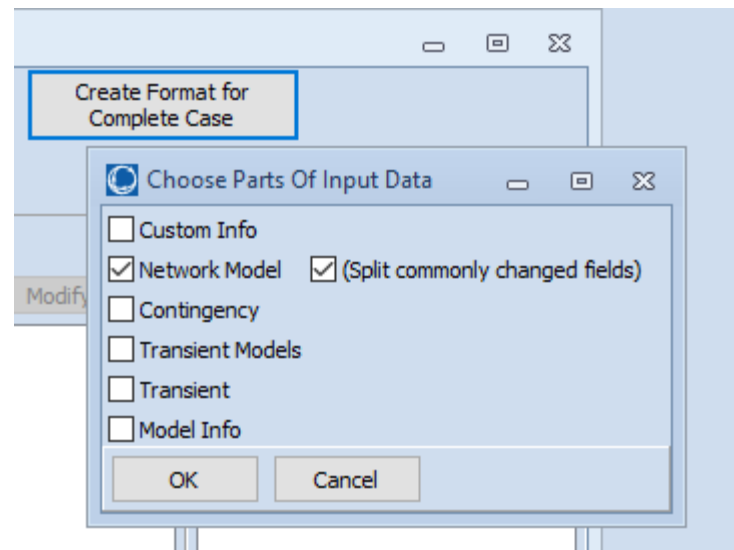


- Conversion AUX file does not include “BOTH” records for which all entries are either blank or “_same_”
- Blank or “_same_” values throughout indicate no change
- All values that are part of the AUX File Export Format “Network Model” are now supported by the Difference Case Tool

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

Name: Network Model

Save AUX Create Format for Complete Case

New Save Save As Rename Delete Load AUX

Insert Object Type Move Up Move Down

	Object Type	Filter Name
12	Rating Set Name Interface	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
20	Load	All

Create AUX File with Specified Format...

☒ Use Concise Variable Names and Auxiliary File Headers
☐ Use Consolidated Model

Generator (All)

Fields Modify...

Number of Bus : 8 : 0
ID : -1 : -1
Status : -1 : -1
Regulated Bus\Setpoint Voltage : 7 : 5
MW Output\AGC : -1 : -1
MW Output\Participation Factor : 10 : 5
MW Output\MW Set Point : 10 : 5
Mvar Output\AVR : -1 : -1
Mvar Output\Mvar Set Point : 10 : 5

SubData Modify...

Click on Modify... to add subdata

Defaults for Exporting Fields Total Digits 12 Dec Places 6

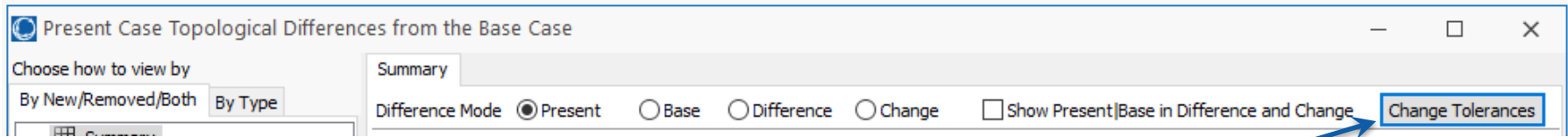
OK ? Help Cancel

Change Mode Tolerances

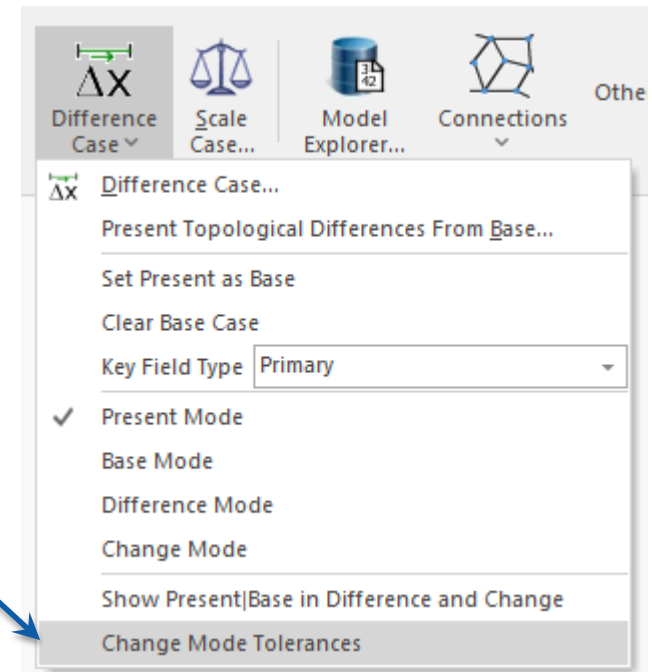


- Allows the user to specify what is considered a significant change when reporting that an object has changed between the Present and Base case
- This only affects the objects and values reported when in Change Mode

Change Mode Tolerances



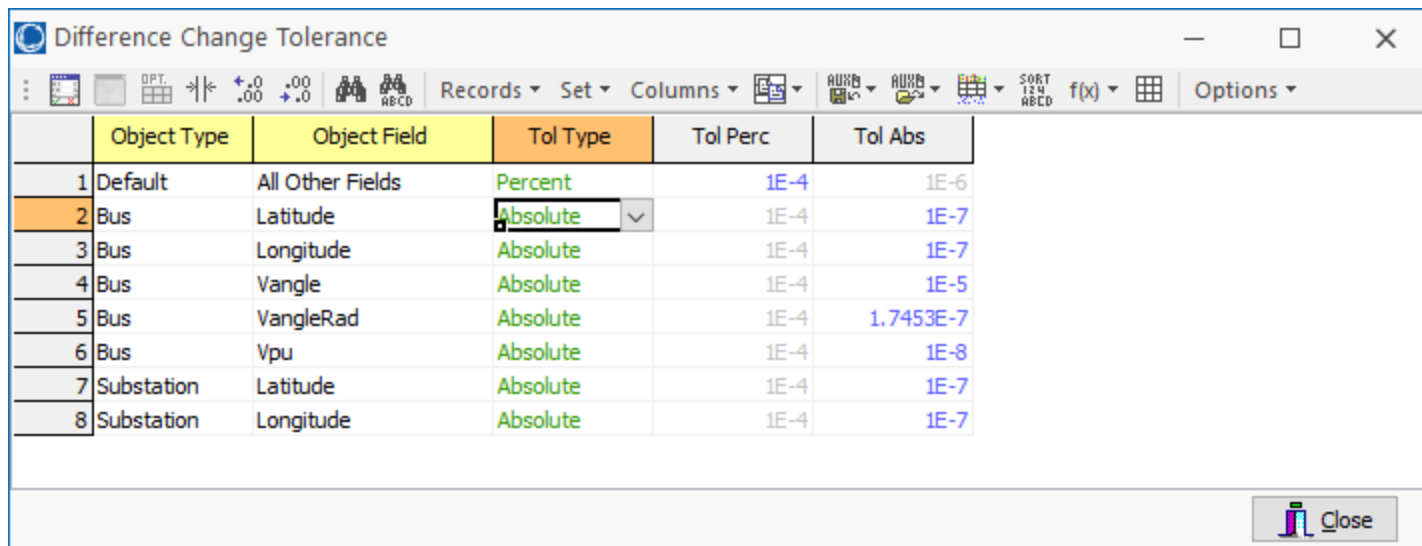
Access the case information display of all tolerances from the Present Topological Differences from Base Case dialog or the Difference Case dropdown menu



Change Mode Tolerances



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



	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

Change Mode Tolerances



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

PU Volt	Volt (kV)	Angle (Deg)	Load MW
1.05000		7.64	
1.04000		4.36	
0.98500	136.354	0.00	
1.00			
1.00			
1.04			

Set Difference Change Tolerance

Show Dialog...

Show Data View

DiffChangeTolerance 'Bus' 'Vpu'

Find DiffChangeTolerance 'Bus' 'Vpu'

ObjectType Bus

ObjectField Vpu

TolType Absolute

TolPerc 1E-4

TolAbs 1E-8

Close Options



Change Mode Tolerance



- TolType

- Absolute

- Change is considered based on the absolute value of the Present – Base
 - $|Present - Base| \geq TolAbs$

- 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

$$\left[(|Base| \geq 1 \times 10^{-6}) \text{ AND } \left(\left| \frac{Present - Base}{Base} \right| \geq \frac{TolPerc}{100} \right) \right] \text{ OR } \left[(|Base| < 1 \times 10^{-6}) \text{ AND } (|Present - Base| \geq 1 \times 10^{-6}) \right]$$

Change Mode Tolerance



- TolType

- Perc OR Abs

- Change is considered based on whether the value meets either the TolPerc or TolAbs constraint

$$\left[(|Present - Base| \geq TotalAbs) \right] OR \left[(|Base| \geq 1 \times 10^{-6}) AND \left(\left| \frac{Present - Base}{Base} \right| \geq \frac{TolPerc}{100} \right) \right]$$

- Perc AND Abs

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

$$\left[(|Present - Base| \geq TotalAbs) \right] AND \left[(|Base| < 1 \times 10^{-6}) OR \left(\left| \frac{Present - Base}{Base} \right| \geq \frac{TolPerc}{100} \right) \right]$$