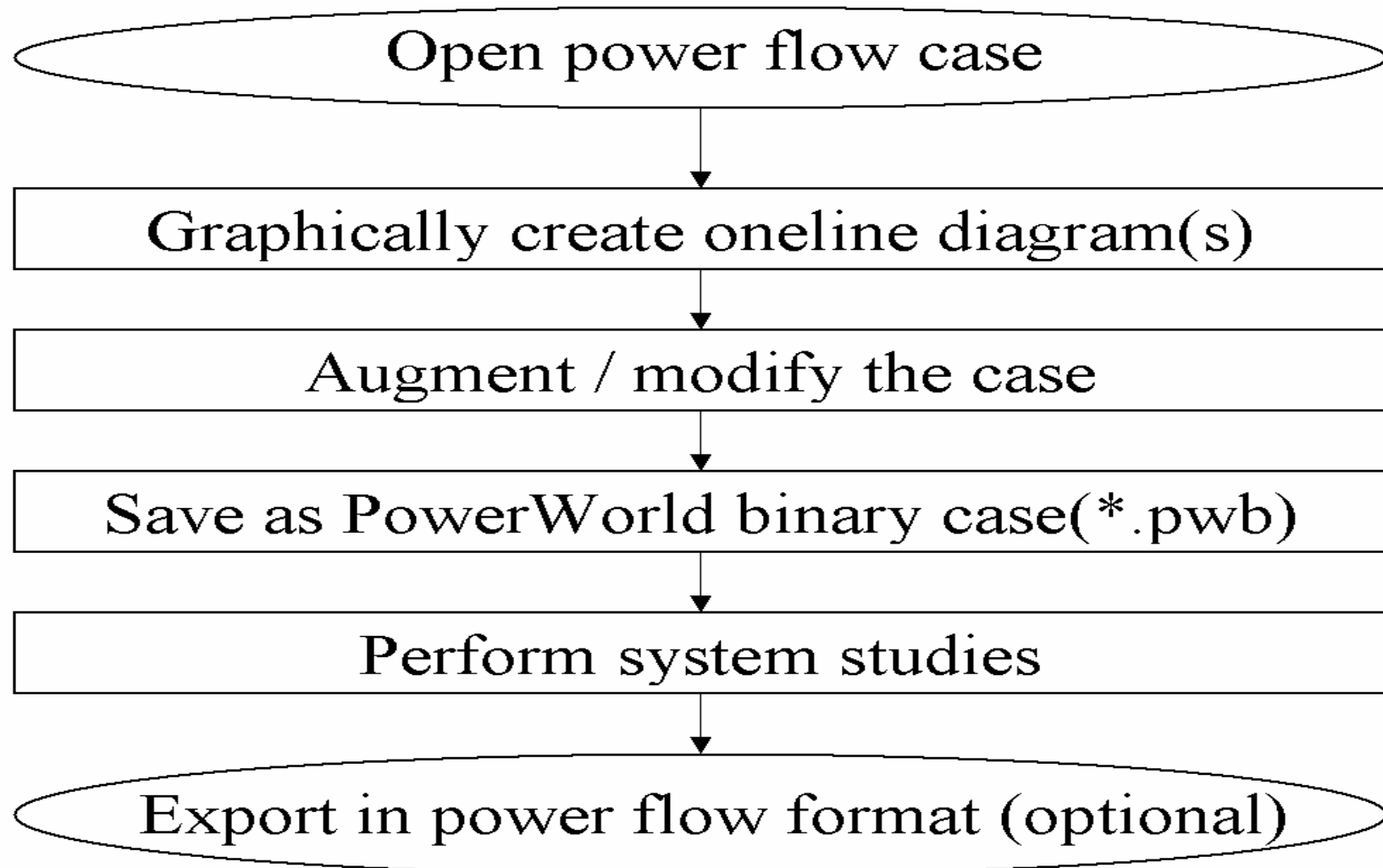# Editing and Analyzing an Existing Power Flow Case

- PowerWorld cases can be easily created from existing text-based power flow cases stored in the following formats:
  - PTI RAW version 23 - 30
    - Used with public cases
      - FERC 715 cases
      - NERC MMWG
      - Files obtained from ISOs and Market Operators
  - GE PSLF text format (EPC version 15.X)
    - Also used with some public cases

Power Flow Data

- Provides static model of power system
- For some studies this model is sufficient
- For other studies model needs to be augmented
  - Generator cost information
  - Reactive capability curve
  - PowerWorld Simulator case options
  - Interface definitions
  - Injection group definitions
  - Contingency Definitions
  - Etc… and Much more

Existing Case Flow Chart

Open power flow case

↓

Graphically create oneline diagram(s)

↓

Augment / modify the case

↓

Save as PowerWorld binary case(*.pwb)

↓

Perform system studies

↓

Export in power flow format (optional)

Display/Model Relationships

- Single system model
- Power flow data is subset of system model
- Text case information displays always provided.
- Multiple onelines can be created, and can be used with different cases

Display/Model Relationships

PowerWorld User

Busview One-line

One-line Diagram

One-line Diagram

Case Information Displays

PowerWorld Simulator Case

Power Flow Data
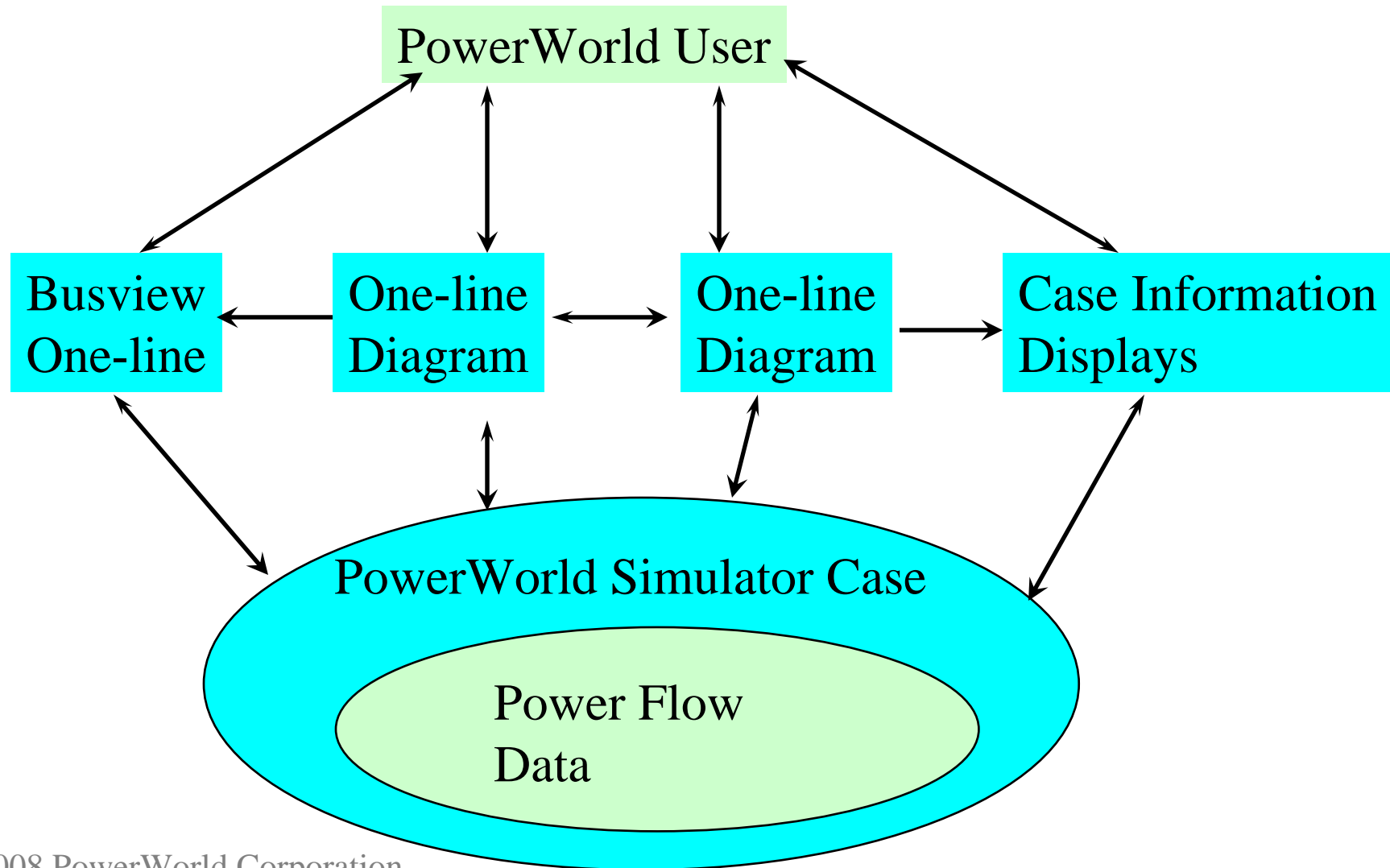
Display/Model Relationships

- Relationship between oneline objects and system model is NOT a one-to-one mapping
  - multiple oneline objects can be linked to the same model object
- This is a more powerful approach, but introduces ambiguity when deleting objects
  - delete just the oneline display object
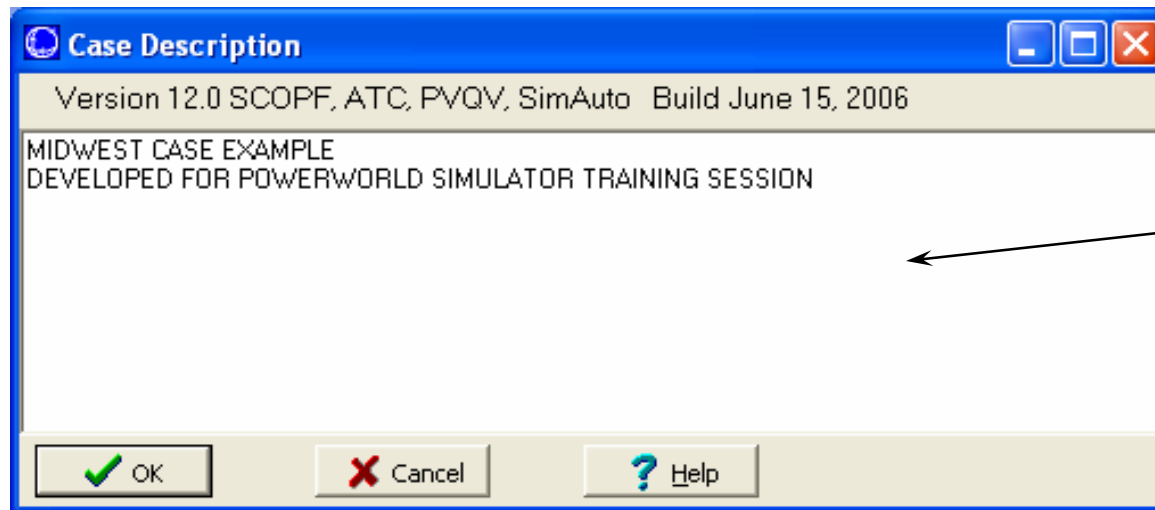 - delete oneline display object and model object

Midwest Example

- Example: build a oneline for 10,452 bus Midwest case saved in PTI version 24 format.

- Click the **Application Button** to open the **Application Menu** and choose **Open Case** to view open dialog

    – In **Files of type** select *PTI Raw Data (.raw)*

    – open case **Midwest.raw**

- When prompted to create a oneline; select **Yes**.

Case Information Displays

- Provide text-based view of the case

- Select **Case Information** ribbon tab → **Case Description** to view an enterable description of the case

PTI format allows 2 lines; PWB format allows unlimited number

Case Summary Dialog

Summary of total case Load, shunts, and generation

List of slack buses

NOTE: There are no changeable fields on this dialog

Select for Help, or press F1 key

Area/Zone/Owner Filters

- Allow filtering of most case information display by area, zones, or owners.
  - This is particularly useful for large cases.
- Select **Case Information** ribbon tab → **Area/Zone Filters**, or use case information toolbar button.
  - Left-click on column labels to sort.
- Set all areas to *No* except for area IP.
  - Right-click on the **Shown** Column and choose **Toggle All No**
  - Scroll down to area IP. Change *No* to *Yes* in the **Shown** column by double clicking on the cell.

Area/Zone/Owner Filters

View areas, zones, or owners

Left click on labels to sort

Double-click to change the area's display filter status

Total number of buses in the area

Minimum and maximum bus numbers in area

Area/Zone/Owner Filters

Set all Area/Zone/Owners to "Yes"　　　Close

| Areas | Zones | Owners |

	Number	Name	Shown	# of Buses	Min Bus Num	Max Bus Num
1	25	PJM500	YES	53	1	9929
2	26	PENELEC	YES	478	201	9837
3	27	METED	YES	250	1151	1743
4	28	JCP&L	YES	690	2101	2943
5	29	PP&L	YES	367	3051	9930
6	30	PECO	YES	393	4001	9911
7	31	PSE&G	YES	255	4951	9907
8	32	BG&E	YES	468	5901	6846
9	33	PEPCO	YES	194	7001	7266
10	34	AE	YES	426	7701	8714
11	35	DP&L	YES	460	8800	9864
12	130	AECI	NO	387	96001	97291
13	131	BCA	NO	7	99900	99906

Power Flow List

- Shows complete power flow information for all buses with **Area/Zone/Owner Filter** set to *Yes*.

- To display use **Case Information** ribbon tab → **Power Flow List**.

- Display has its own local menu. To view right click anywhere on the list.

Power Flow List

Local Menu of Power Flow List

Quick Power Flow List

- Similar to Power Flow List, except list can be used to show flow at individual or a set of buses
- To display use **Case Information** ribbon tab ➔ **Quick Power Flow List**.
- Enter number or range of numbers of buses to view
- Double-click to move to desired bus, or right-click for information.
- Area/Zone/Owner filters are not used.

Quick Power Flow List

Clears the list

Enter either a single bus, a set of buses separated by commas, or a range of buses

Quick Power Flow List for Current Case

Bus Number 32353, 32370-32371   Show Buses   Clear List   Print   Close

```
BUS 32353 ADM NRTH 138.0    MW      Mvar       MVA      % 0.9995 -13.88   57 IP
 LOAD 1                    133.44   69.67     150.5
 TO 32352 OREANA    1 -187.47   -68.52     199.6   49
 TO 32352 OREANA    2 -167.32   -62.43     178.6   44
 TO 32370 CATERPIL  1  166.24    40.19     171.0   42
 TO 32371 FARIESPK  1   55.06    20.59      58.8   24
Mismatch                   0.04    0.49

BUS 32370 CATERPIL 138.0    MW      Mvar       MVA      % 0.9980 -14.13   57 IP
 LOAD 1                     11.79   10.09      15.5
 TO 32353 ADM NRTH  1 -166.18   -39.50     170.8   42
 TO 32364 N 27TH    1  154.43    29.88     157.3   39
Mismatch                  -0.04   -0.48

BUS 32371 FARIESPK 138.0    MW      Mvar       MVA      % 0.9979 -14.05   57 IP
 LOAD 1                     52.70   12.51      54.2
 TO 32353 ADM NRTH  1  -55.03   -20.57      58.8   24
 TO 32372 MT ZION   1    2.35     8.18       8.5    4
```

Format is similar to Power Flow List

Circuit identifier *99* indicates an equivalent line

New buses appear at the end of the list

Bus View

- Designed to replace Quick Power Flow List
  - Easier to use
  - Much more powerful approach
  - Allows user to navigate through buses like web pages
- To Display use **Onlines** ribbon tab → **Bus View**
- Auto-generates oneline diagrams at each bus, one at a time, showing all devices connected to bus and all flows.
- Operations just like other oneline diagrams in Simulator

Bus View Oneline

Back and forward buttons
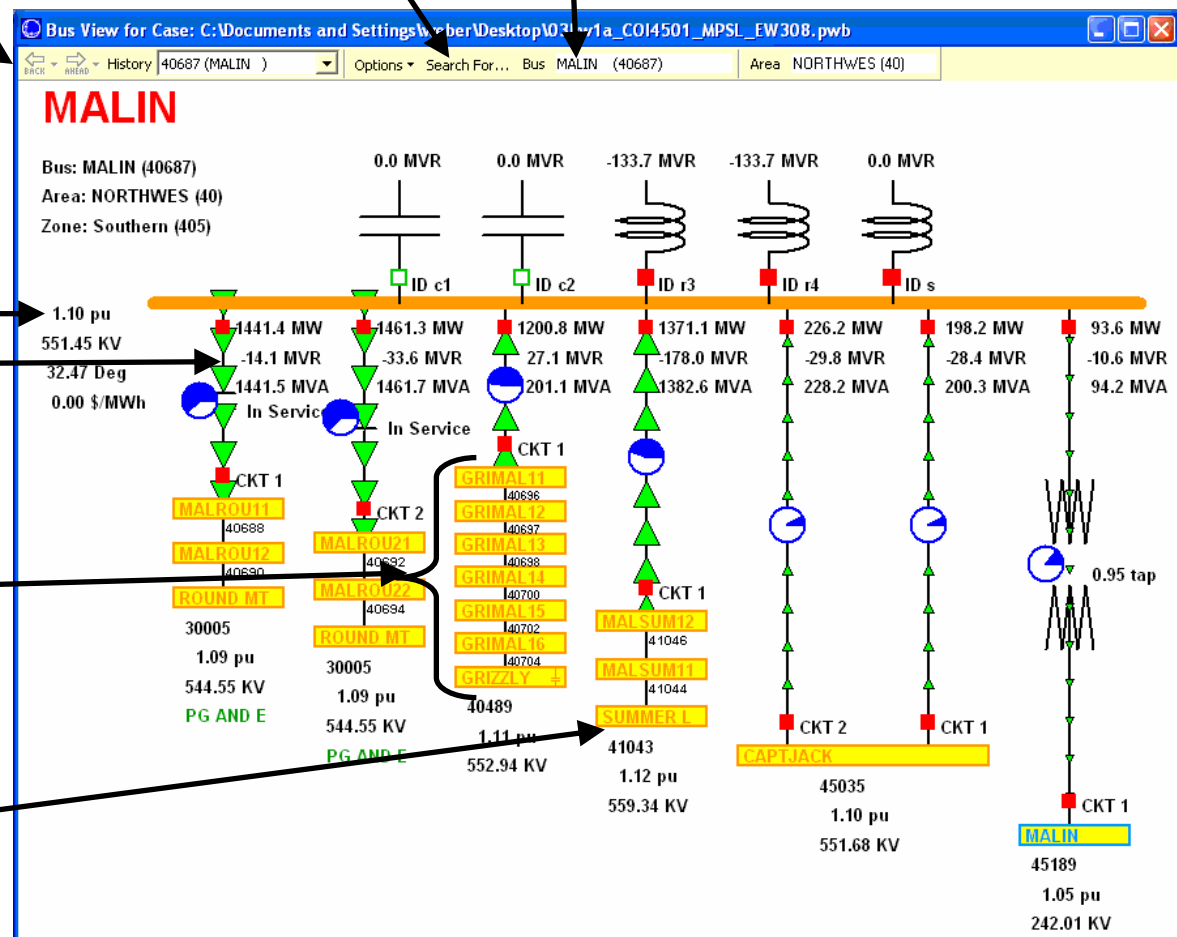
Click Search For… to find a bus

Enter a name or number in Bus to go to a bus

Bus and Flow information

Serial buses are shown automatically

Click on links to jump to new bus

I2-17

Bus View Oneline

Colors are determined by the default drawing values

COULEES1

Bus: COULEES1 (41356)
Area: NORTHWES (40)
Zone: Central (403)

1.04 pu
240.01 KV
88.67 Deg
0.00 $/MWh

112.8 MW
-20.9 MVR
114.7 MVA

232.1 MW
-1.7 MVR
232.1 MVA

88.5 MW
32.9 MVR
94.4 MVA

83.1 MW
3.2 MVR
83.2 MVA

51.8 MW
26.6 MVR
58.2 MVA

402.0 MW
-40.1 MVR
404.0 MVA

CKT 1

0.99 tap

0.99 tap

COLUMBIA
40261
1.04 pu
239.95 KV

CKT 1

POTHOLES
40851
1.03 pu
235.95 KV

CKT 1

COULEES2
41357
1.04 pu
240.00 KV

CKT 3

BELCOU31
41359

BELL SO
40090
1.04 pu
239.10 KV

CKT 1

COULEE
40281
1.05 pu
120.39 KV

CKT 1

COUL0105
41770
1.04 pu
14.34 KV

COLCOV11
40304
VANTAGE
41111
COULEES3
41358
ANC LK T
46001
MCKENZIE
46809
ROCKYRH2
46832
COLUMBIA
40259

MIDWAYB1
41346
MAE VL T
46043
POTHOLES
40849

COULEE
40287
COULEE
40285
WESTBPA2
41276
COULEES3
41358
ROCKYFD
46156
COUL0606
41771
COUL1010
41772

BELL BPA
40091
BELL MI
40088
ADDBEL11
40092
BELLAN11
40626
BEACON N
48025
BEACON S
48031

BELCOU11
40282
KELLER T
41222
COUL2GRD
46150
NILLES C
47067

Symbols show locations of generators, loads, shunts

Right-click on elements for information
Left-click on circuit breaker to open/close

I2-18

Bus View Oneline:
Click Options > to reveal

- Number of Tiers – specify 1 or 2
- Show Hints
  - As you move your cursor over an object it will show information
- Show Serial Buses
  - Buses that are in series will be cascaded
- Show Equivalent Lines
  - Change to hide/show equivalent lines
- Represent Multi Section Line Objects
  - Show endpoints of MS Lines without intermediate buses
- Open Multiple Bus views
  - Specify whether to create a new Bus View when a new one is requested.
  - Choosing Prompt means you will be prompted each time
- Include Field Labels
  - A description of what each field is will be shown.
- Change Bus Link Color
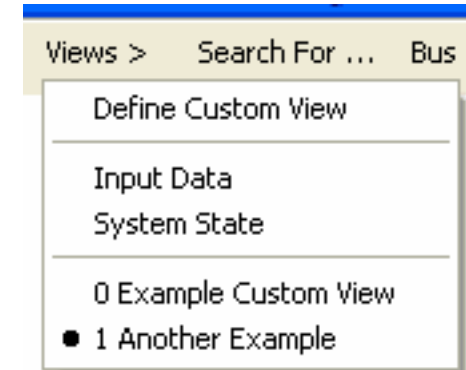 - The fill color of the bus links can be changed
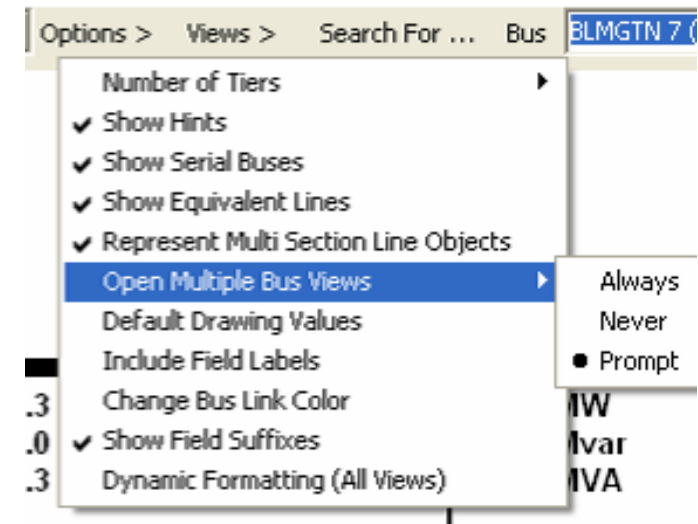
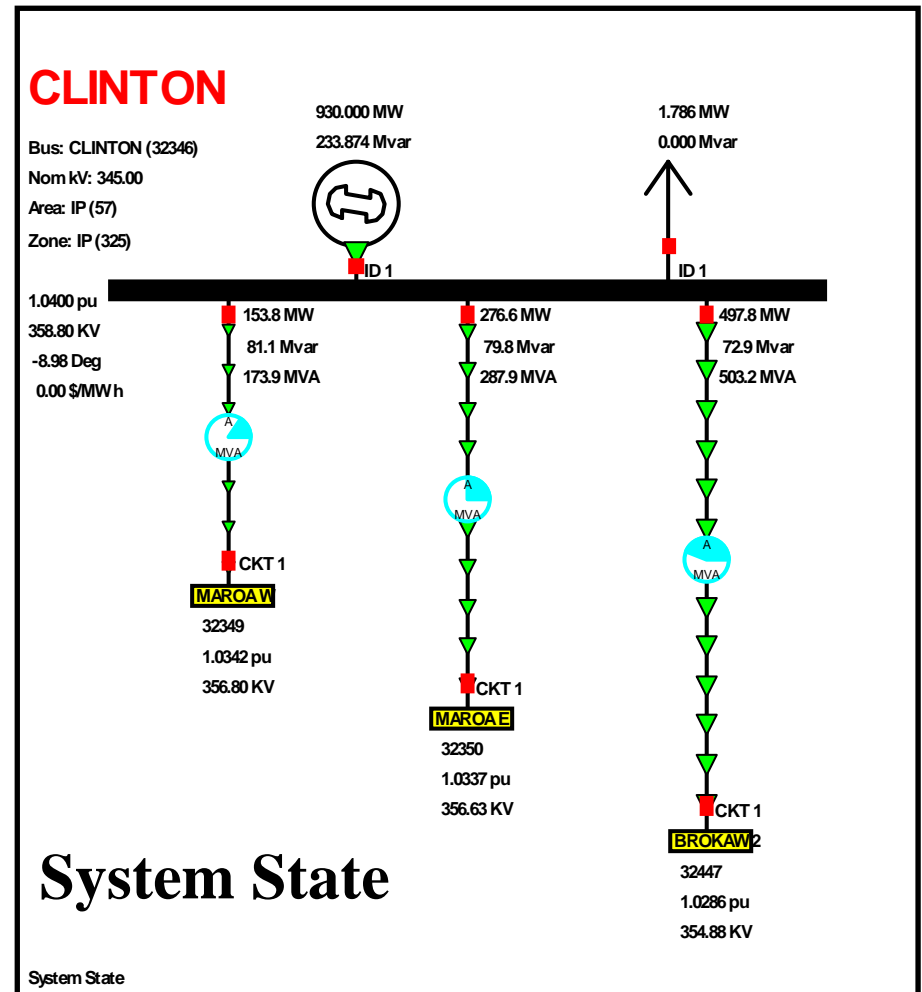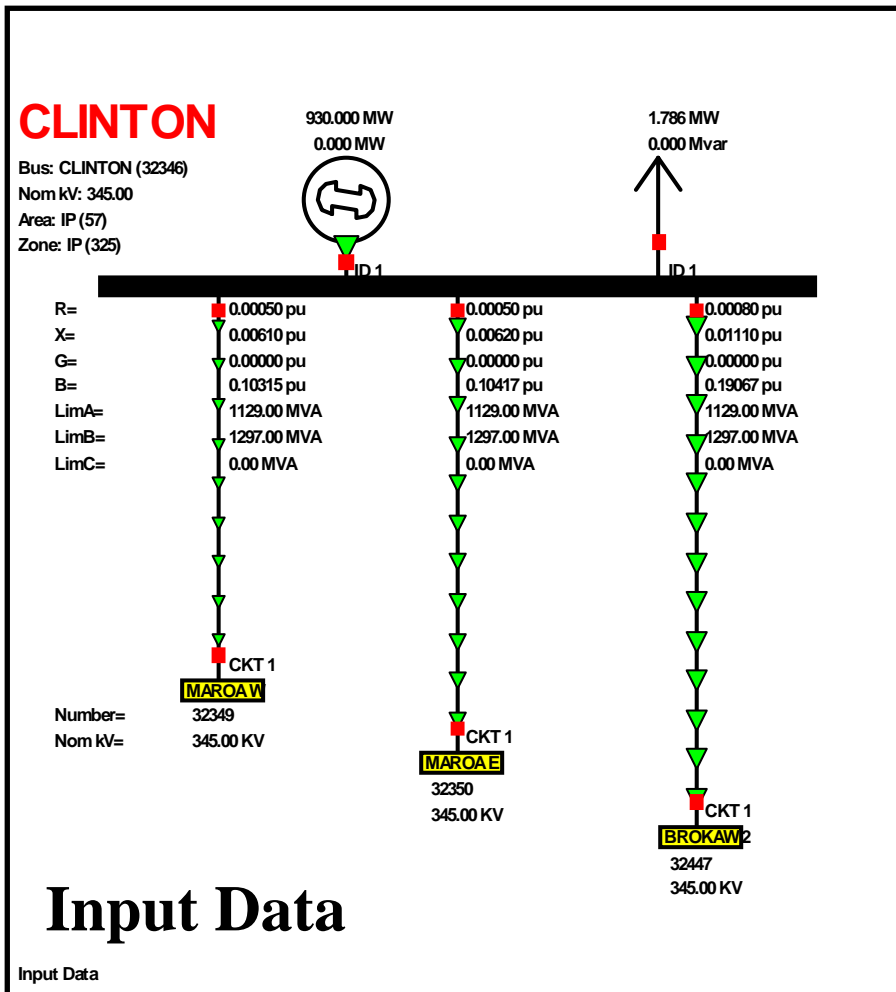# Bus View Oneline
Click Views > to reveal

- **Define Custom View**
  - Will discuss next
- **Input Data – pre-defined view**
  - Shows information related to input parameters
- **System State – pre-defined view**
  - Shows information about the system state
- **If Custom Views are defined, they will appear at the bottom of this list**

Bus Views:
Input Data and System State

Input Data

CLINTON

Bus: CLINTON (32346)
Nom kV: 345.00
Area: IP (57)
Zone: IP (325)

930.000 MW
0.000 MW

1.786 MW
0.000 Mvar

ID 1

ID 1

R=	0.00050 pu	0.00050 pu	0.00080 pu
X=	0.00610 pu	0.00620 pu	0.01110 pu
G=	0.00000 pu	0.00000 pu	0.00000 pu
B=	0.10315 pu	0.10417 pu	0.19067 pu
LimA=	1129.00 MVA	1129.00 MVA	1129.00 MVA
LimB=	1297.00 MVA	1297.00 MVA	1297.00 MVA
LimC=	0.00 MVA	0.00 MVA	0.00 MVA

CKT 1
MAROA W

Number= 32349
Nom kV= 345.00 KV

CKT 1
MAROA E
32350
345.00 KV

CKT 1
BROKAW 2
32447
345.00 KV

Input Data

System State

CLINTON

Bus: CLINTON (32346)
Nom kV: 345.00
Area: IP (57)
Zone: IP (325)

930.000 MW
233.874 Mvar

1.786 MW
0.000 Mvar

ID 1

ID 1

1.0400 pu
358.80 KV
-8.98 Deg
0.00 $/MWh

153.8 MW
81.1 Mvar
173.9 MVA

276.6 MW
79.8 Mvar
287.9 MVA

497.8 MW
72.9 Mvar
503.2 MVA

A MVA

A MVA

A MVA

CKT 1
MAROA W
32349
1.0342 pu
356.80 KV

CKT 1
MAROA E
32350
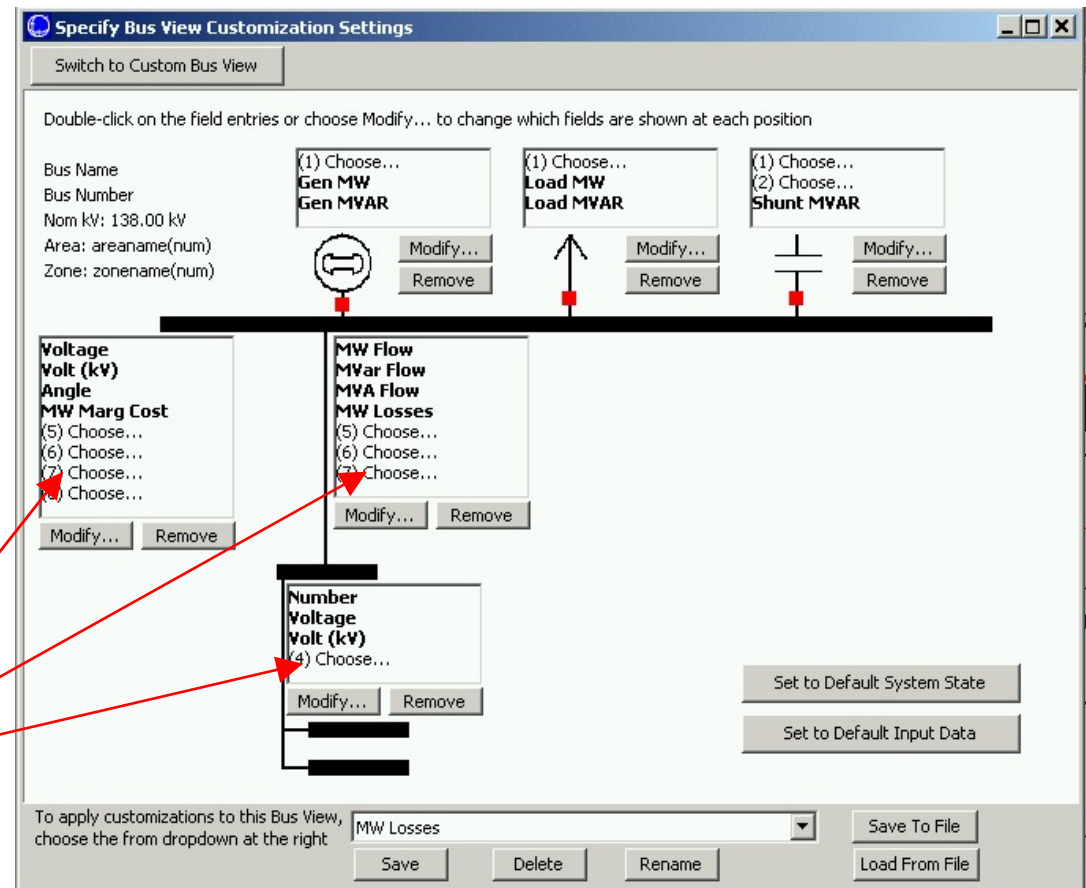1.0337 pu
356.63 KV

CKT 1
BROKAW 2
32447
1.0286 pu
354.88 KV

System State

Custom Bus View

- Add custom fields to bus view oneline

- Select **Views** → **Define Custom View** from bus view oneline

Add new object fields to certain positions

Solving the Case

- Show the Message Log to view iterations.
- To perform a single power flow solution, click the **Single Solution** button on the **Tools** ribbon tab.
  - mode is automatically switched to **Run**
  - system has initial mismatches because of voltage truncation in *.raw file
  - case should converge within several iterations

Building Onelines

- Case can be modified from text case information displays: we'll return to those in the next section
- Much easier to visualize results using a oneline diagram.
- Oneline only needs to be created for the desired portion of the system.
  - Simulator always models the ENTIRE system in calculations.
  - For larger system, the oneline diagrams normally only show a portion of the system
- Simulator will automatically link to existing power system model.

Building Onelines

- While in Edit Mode, Simulator includes the ability to automatically insert
  - U.S. state and county borders
  - Canadian Province borders
  - Central American Country borders.
- Select **Draw** ribbon tab → **Auto Insert** → **Borders**
  - Select **Options** tab. Adjust line color and thickness if desired.
  - Select the borders and map projection (under the respective tab). Click **OK**.

Map Projection

- Simulator supports two projections for representing earth in two-dimensional space
  - Simple conic
    - Suitable for North America only
    - Latitude lines are curved; longitude lines are radial
  - Mercator
    - Latitude lines are straight, form rectangles with longitude lines
- Once a projection is selected for a oneline, it should be used for all mapping and GIS functions so that objects are drawn in proper relation to one another
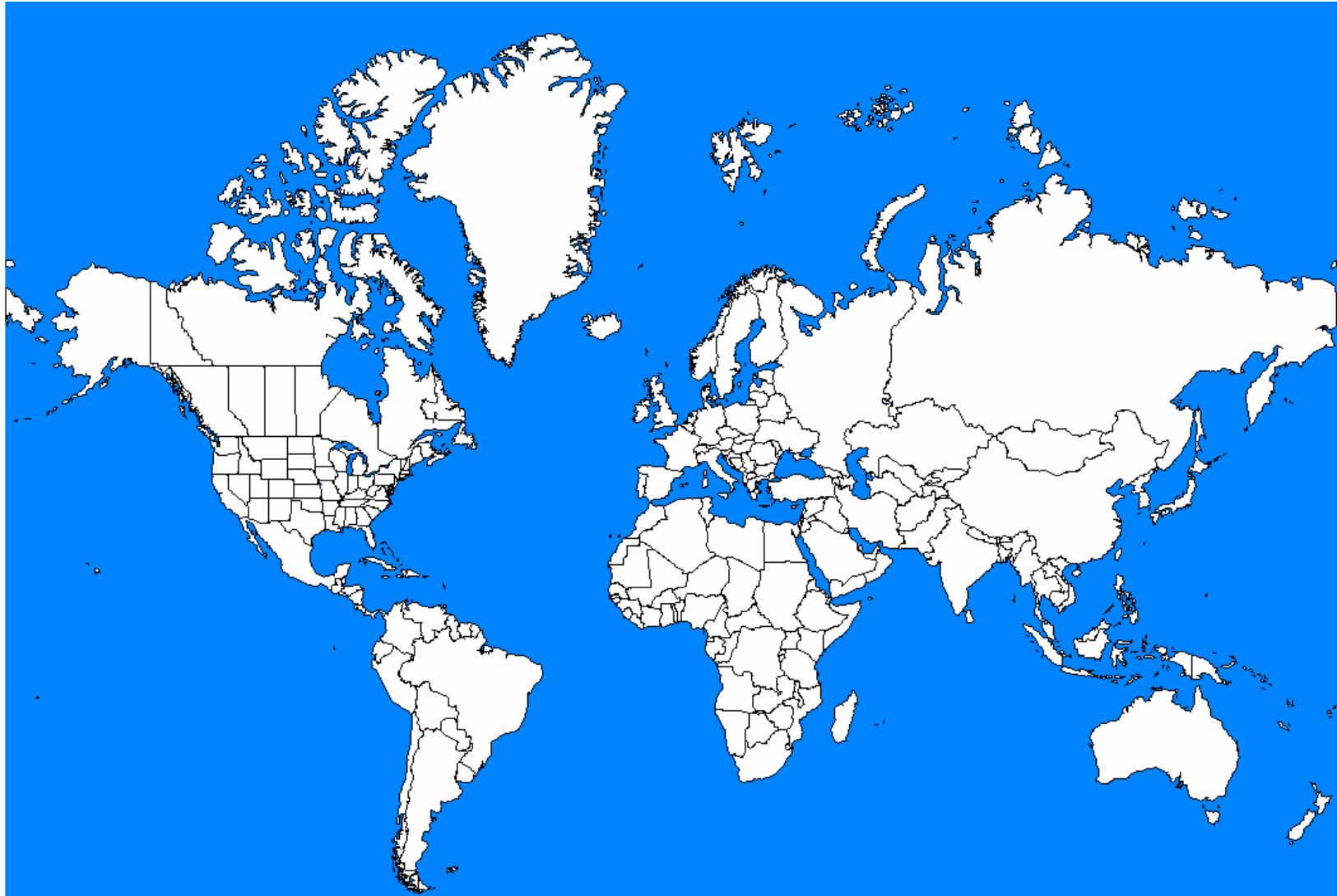
Built-In Geographic Borders

Built-In Geographic Borders:
With US Counties
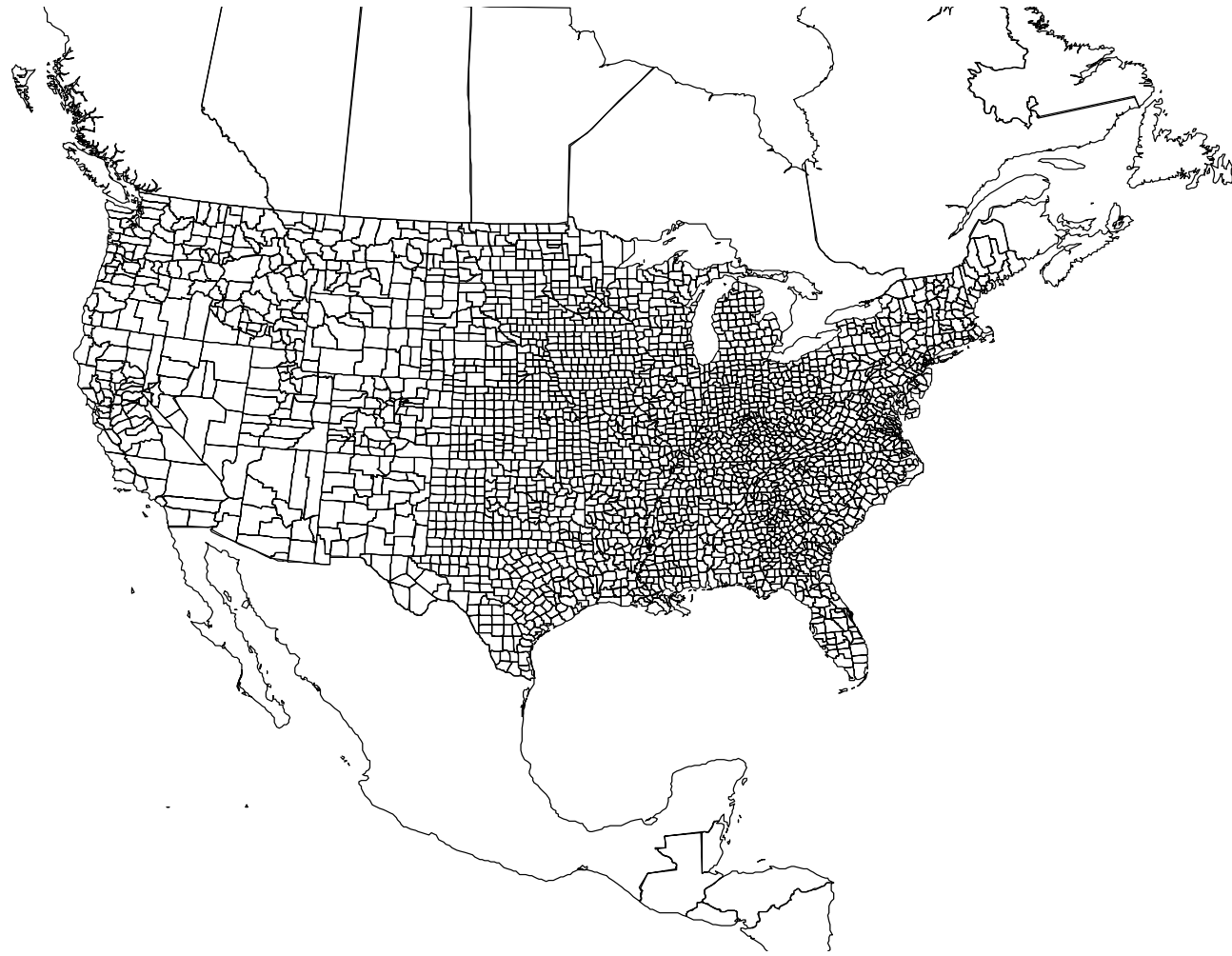
Built-In Geographic Borders: Entire World

I2-29

Building Onelines

- Zoom in to 100%, approximately centered on Central Illinois

- Show the **Bus View**, moving it towards the bottom of the screen; show bus 32353 (ADM NRTH).

- Select **Draw** → **Network** → **Bus**

- Click on the oneline towards the top center

  – for **Bus Number** enter 32353

  – select **Find by Number** to view bus info; then select **OK** to place the bus

Building Onelines

- Repeat this procedure, entering buses 32370 and 32371.

- Save your case using the default PWB format. The oneline is saved separately as a PWD file.

- Oneline should look similar to the following

Oneline Showing Three Buses
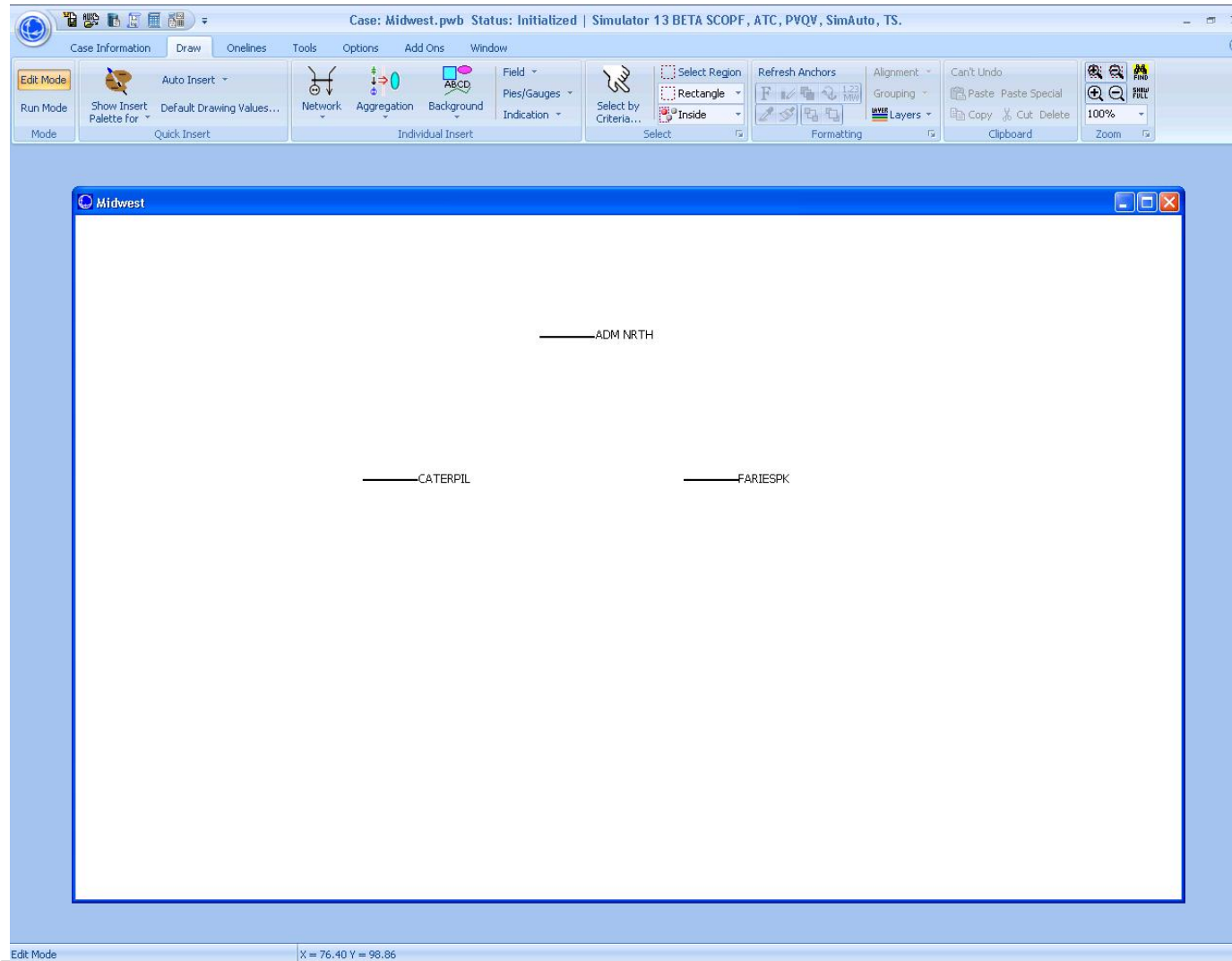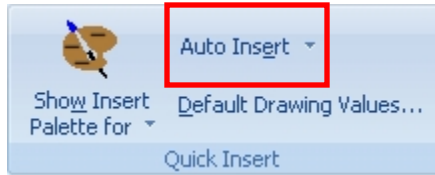
Automatic Line Insertion

- Lines between buses can be inserted manually.

- It is easier to use automatic line insertion.

- Select **Draw → Auto Insert → Lines**

  - select default options

  - click **OK**

  - lines joining buses are automatically added, optionally with circuit breakers and pie charts

Automatic Line Insertions

Automatic Insertion of Transmission Lines

Minimum KV Level [0] Default Drawing Values

☑ Insert Text Fields
☑ Insert Equivalenced Objects
☐ Use Only Selected Buses/Substations
☐ Insert Pie Chart for Lines with no Limit and Bus Ties
☑ Insert Multi Section Lines

Identifying Bus Ties

Maximum P.U. Impedance for Bus Ties [0.00010]
☑ Do not insert stubs for bus ties
☑ Only insert a single circuit breaker

✓ OK   ✗ Cancel   ? Help

Set a minimum kV level of lines to be inserted

Click here to open the Default Drawing Values dialog to set default line values

Set options for branches with very low impedance

Automatic Load, Generator, and Shunt Insertion

- Loads can be inserted manually using **Draw → Network → Load**

- Easier to use automatic load insertion

- Select **Draw → Auto Insert → Loads**
  - Select default options
  - Click **OK** to automatically add loads to displayed buses

- Automatic Generator and Switched Shunt Insertion is also available

Auto Insert Loads

Panning and Zooming

- ## Select **Onelines** Ribbon

- ## Keyboard Shortcuts
  - Pan
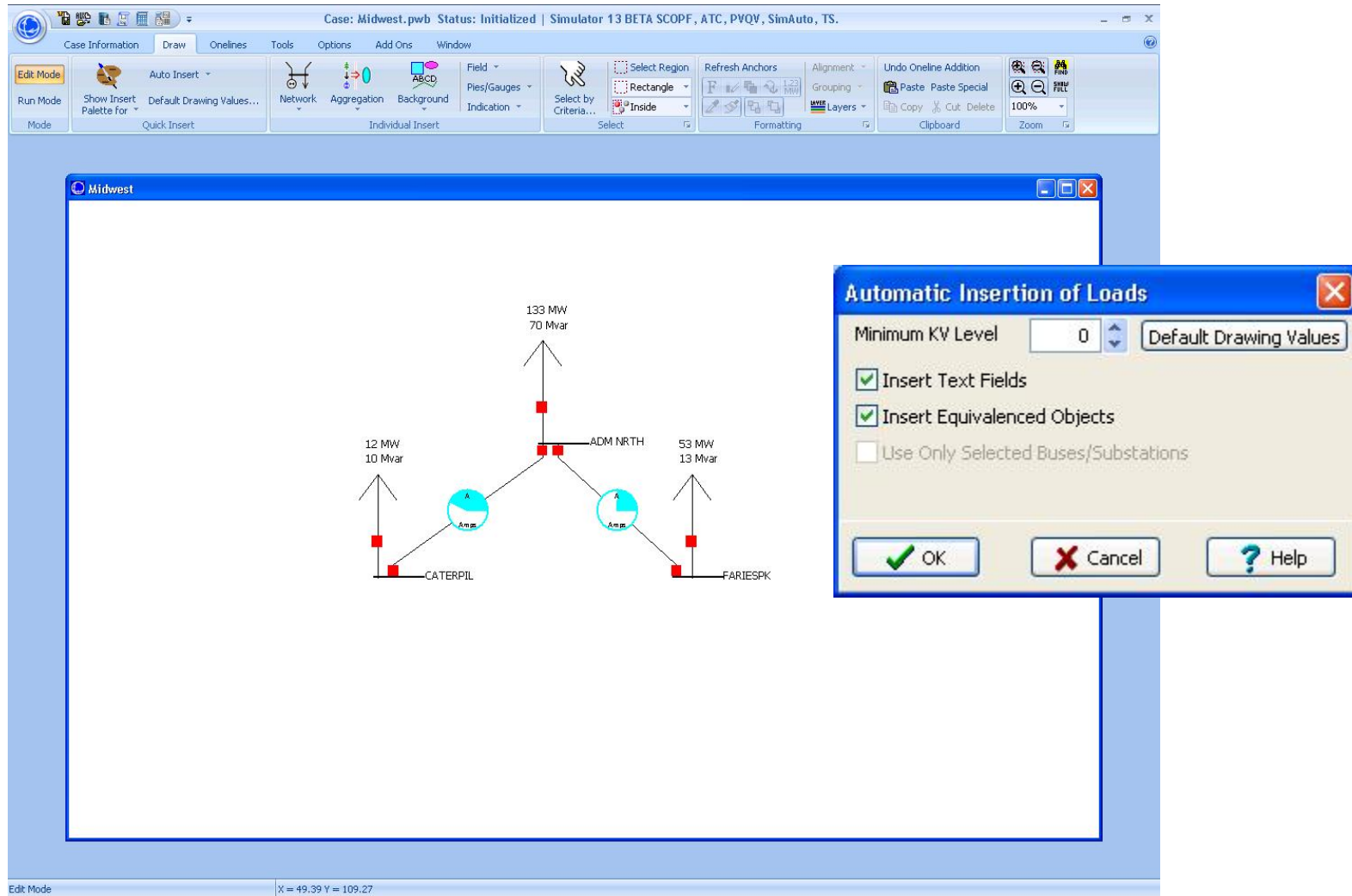   - Arrow Keys (up, down, left, right)
    - Home, End, Page Up, Page Down (larger steps)
  - Zoom-in: Ctrl + **Up** Arrow, Ctrl-Page **Up** (larger steps)
  - Zoom-out: Ctrl + **Down** Arrow, Ctrl-Page **Down** (larger steps)

- ## Keyboard/Mouse Combinations
  - Zoom-in: Ctrl-Alt + **Left** Mouse Drag a Region
  - Zoom-out: Ctrl-Alt + **Right** Mouse Drag a Region
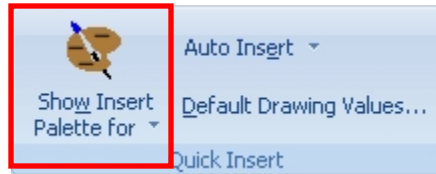
Bus Palette

- Pan down and enter buses 32364 and 32372 using the Bus Palette tool.
    - select **Draw → Show Insert Palette For → Buses**
    - select a displayed bus to see its displayed and undisplayed neighbors
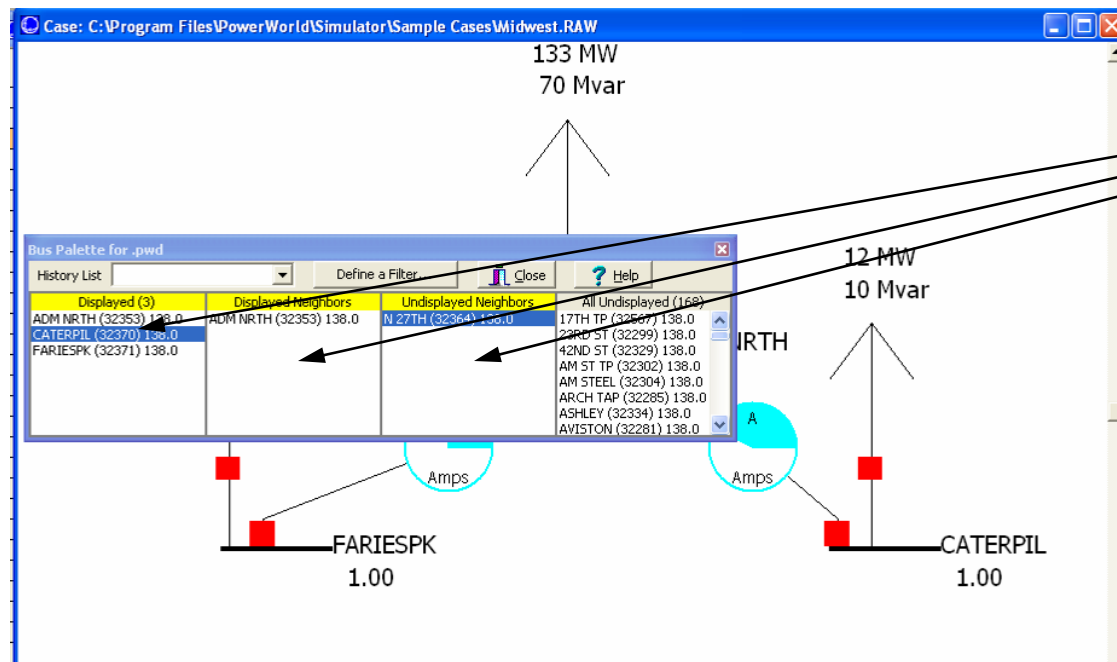
Select displayed bus; see displayed and undisplayed neighbors

Automatically insert undisplayed buses by dragging from the palette to the oneline

Bus Palette

- Add buses 32364 and 32372
  - select Caterpil 138 bus, drag N 27th 138 to oneline under bus 32370
  - select Fariespk 138 bus, drag Mt Zion 138 to oneline under bus 32371

- Insert transmission lines by selecting **Draw → Auto Insert → Lines**

Zooming Portion of Oneline
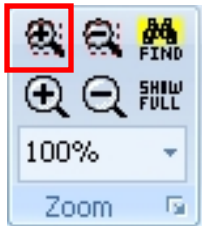
- To zoom into a specified portion of the one-line, select **Zoom In on Area** in the Zoom Toolbar.

- Click and drag the mouse to define the zoom area.

- Release left button to zoom.

Showing Entire One-line

- To view the entire oneline, click the **Show Full** button on toolbar.

- Zooming level and screen center is immediately changed so all objects on the oneline are visible.

Adding Background

- To show static background line on the one-line, select **Draw → Background → Background Line**
  - click to start the background line and to add segments.
  - double click to end
- Use **Draw → Line/Fill** to fill in the background. For this example the background shows Clinton Lake.

Decatur 138 kV Oneline

Equivalent lines have no limit and hence would not have a pie chart
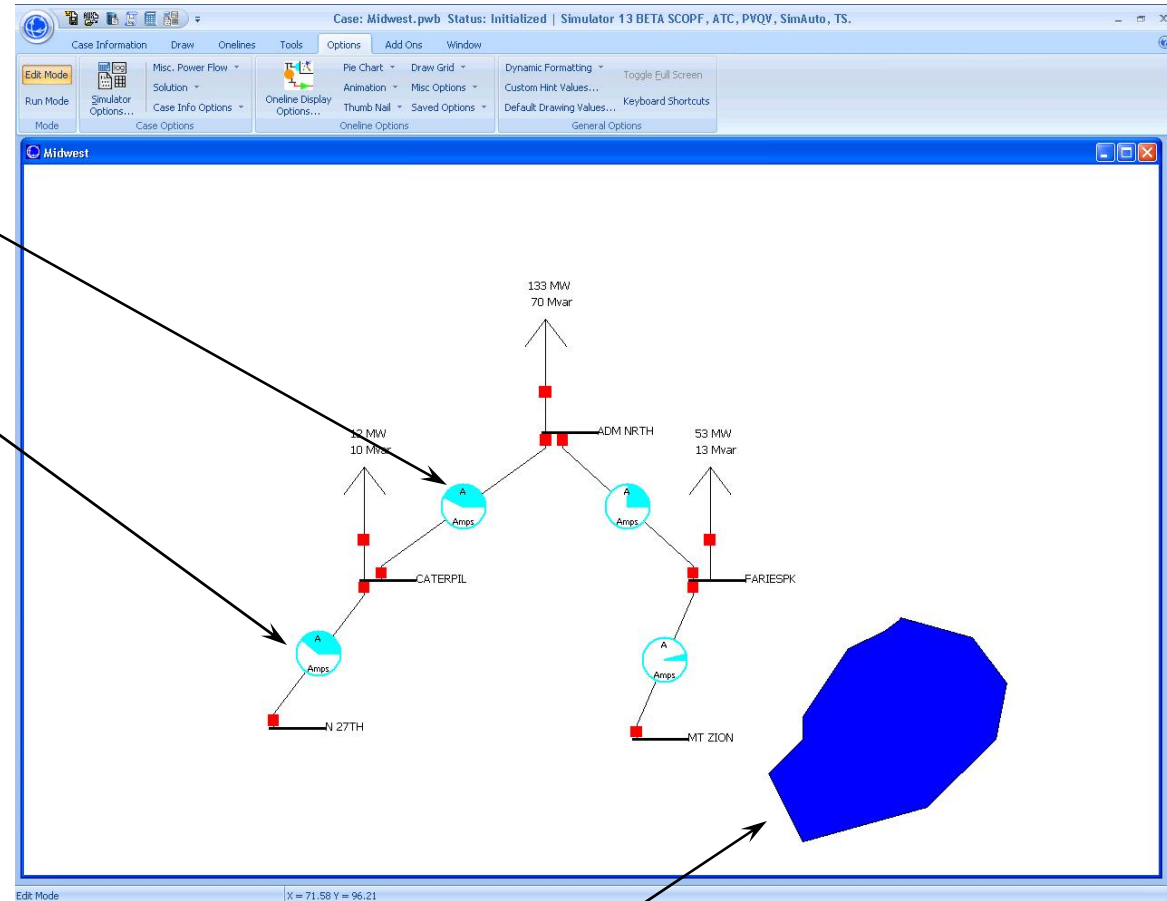
Clinton Lake, shown in blue

Simulating the Case
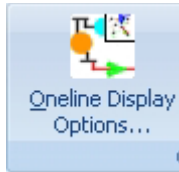
- To show animated flows, again use the Oneline Display Options dialog (select **Onelines → Oneline Display Options**).

- Save your case.

- Go to Run Mode and select **Tools → Play**. If all worked fine, congratulations! You are simulating a 10,452 bus case.

Run-time Object Dialogs

- Pause the Simulation

- To view/modify parameters for any oneline object, right-click on the object.

- Many of these parameters can be modified, with the results taken into account when the simulation is resumed.

Oneline Local Menu

- Right clicking on an empty portion of the oneline displays its local menu. The local menu is used to

  - print the oneline

  - save entire screen to file as a bitmap

  - copy/save oneline in Windows metafile format, which is more versatile than a bitmap

  - apply case or oneline template

Oneline Local Menu

- find buses on the oneline
- Pan/Zoom Control
- show Oneline Display Options; this display is used to customize the appearance of the oneline
- display the Area Information dialog for the closest bus to the cursor (covered in a later section)
- Edit screen layers and show layers
- perform contouring (covered in a later section)

Oneline Local Menu

- view difference flows (covered in a later section)

- toggle flow visualization; switch between displaying actual flows and PTDF flows (covered in a later section)

- save/edit/delete view

- go to view
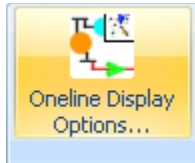
Oneline Display Options:
Display Options Page

Another Slide explains

Covered in later section

Options for visualizing out-of-service elements

Flow fields specify a near and far bus. This implies a direction, so a negative sign is normally displayed for flows in the opposite direction. Check this box to NOT show the negative sign.

Oneline Display Options

Select Option Category
- Animated Flows
- Display Object Options
- Display Options
- Geography/Coordinates
- Grid/Highlight Unlinked
- Memo
- Pie Charts/Gauges
- Substations
- ThumbNail View

Display Options

Display Detail
- ● Complete
- ○ Moderate
- ○ Minimal
- ○ Custom [Set...]

Emphasize Specific Objects
- ☐ Do Emphasis [Emphasis Filter]
  - Emphasis Amount
  - A little ———————— A lot

Background Color
- [____] [Change]
- ☐ Set as Default Background

- ☑ Use Absolute Values for MW Line Flows
- ☐ Use Absolute Values for Mvar Line Flows
- ☐ Use Absolute Values for Interface MW Flows
- ☑ Enable Mouse Wheel Zooming (All Onelines)
- ☐ Show Oneline Hints (All Onelines)

[Edit Oneline Browsing Path]
(These settings apply to all onelines)

Visualizing out-of-service elements
(These settings apply to all onelines)
- ☐ Draw an 'X' through off-line generators
- ☐ Use dashed lines
- ☐ Blink   Blinking options
  - Interval [1.0] sec
  - Color [____] [Change]

[✓ OK] [Apply] [Save Options to Case...] [✗ Cancel] [? Help]

Display Object Options:
General Options

Oneline Display Options...

Choose where to show circuit breakers

Show selected field inside generator

Oneline Display Options

Select Option Category
- Animated Flows
- Display Object Options
- Display Options
- Geography/Coordinates
- Grid/Highlight Unlinked
- Memo
- Pie Charts/Gauges
- Substations
- ThumbNail View

Display Object Options
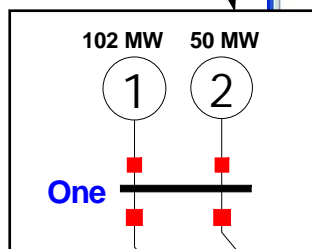
General Options (All) | Circuit Breakers

Percent of Injection Group/Owner object height used by name: 33.33

Generator, Load, and Switched Shunt Display Objects

Display Circuit Breakers in Generators, Loads and Switched Shunts

Display breakers on...
- ☑ Loads
- ☑ Generators
- ☑ Switched Shunts

Generator Display Objects

☑ Display Rotors in Generators

Change in Gen Rotor Angle per Refresh (degrees): 0

Show Field Inside Generator

No Field | Find... | Digits 4 | Decimals 0

Relative Font Size Small ———————— Large

☑ Dynamically decrease the font size so that the field fits inside generator

Multi-Section Line Display Objects

Intermediate Bus Rotation Angle: 10

Intermediate Bus Relative Size: 1.00

Bus Field Voltage Option
- ⦿ Voltage in Per Unit
- ○ Voltage in kV

Note: Only for Bus Fields

✓ OK | Apply | Save Options to Case... | ✗ Cancel | ? Help

Each time the display refreshes, the generators "rotor" will rotate this amount

Change appearance of MS Line intermediate buses, relative to end buses

Only affects Bus Voltage Fields

102 MW 50 MW

1   2

One
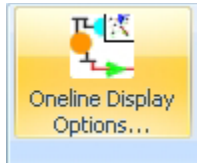
Display Object Options:
Circuit Breakers

Choose outline and fill color for normally open and normally closed circuit breakers

Choose the circuit breaker shape
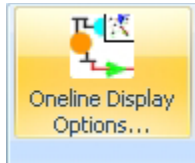
Display Options Tab:
Set Custom Detail

- **Display Detail**
  - Complete: show everything
  - Moderate: remove pie charts and line fields
  - Minimal: remove pie charts and all fields except those associated with generators, loads, or shunts
  - Custom Detail: opens the Select by Criteria dialog (pictured) to specify a custom display detail by area, zone, layer, and other criteria
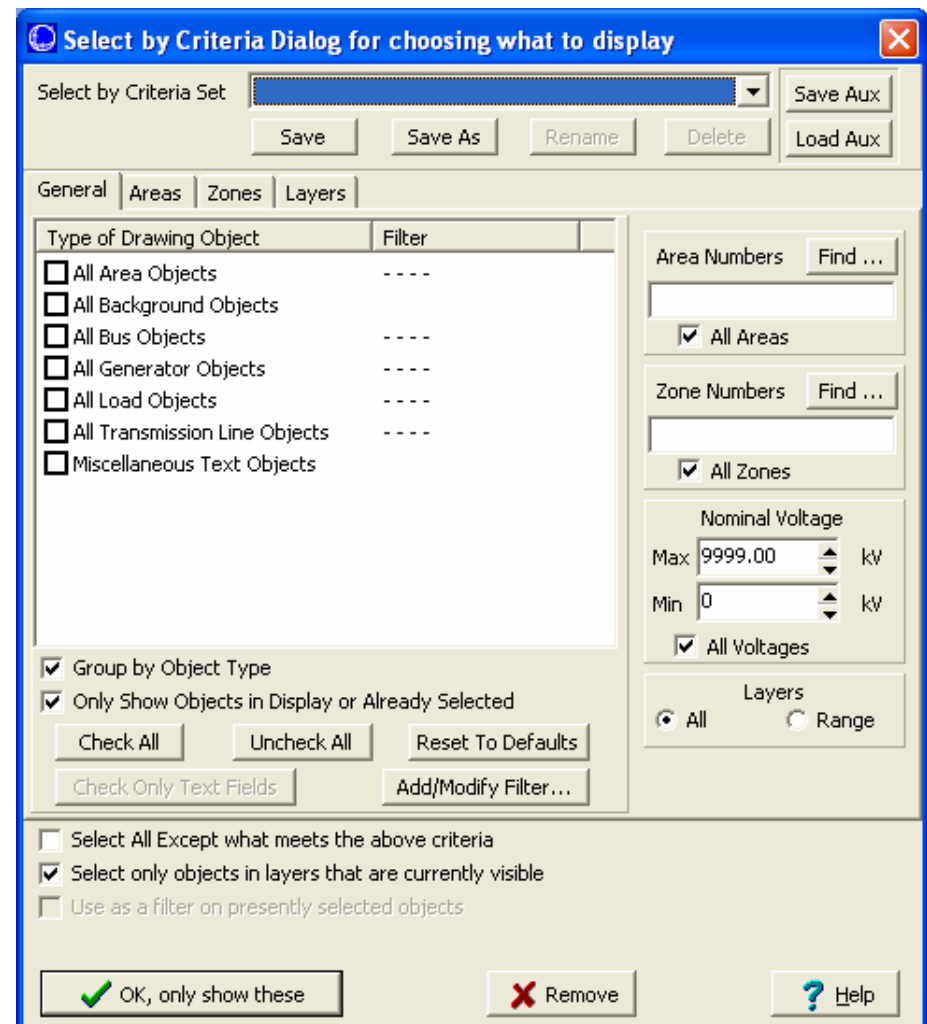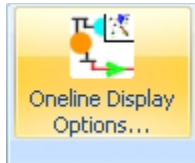
Oneline Display Options:
Pie Charts/Gauges Page

Pie chart percentage based on

Separate options for lines and interfaces

Default styles for Generator, LTC, and Shunt and user defined styles (Used with pie chart/gauges other than lines and interfaces)

Gauge value based on

Line flows are different at each end of the line, this specifies to always using Limiting Flow

Limiting Flow is normally the higher value, but this can be changed in the Limit Monitoring Settings

When values are higher than this percent, the number will appear inside the pie chart

Display percentages in gauge instead of unit values

Specifies the colors and scales of pie charts when values are higher than the percentage breakpoint.

Oneline Display Options

Select Option Category
- Animated Flows
- Display Object Options
- Display Options
- Geography/Coordinates
- Memo
- Movie
- Pie Charts/Gauges
- ThumbNail View

Pie Charts/Gauges

☑ Show Pie Charts/Gauges in Run Mode
☑ Only Show Pie Charts/Gauges if relevant data exists

Lines | Interfaces | Pie Chart/Gauge Styles | General Options (All)

Pie Chart Style
- ○ Total power (MVA)   ○ Amp, Transf. MVA
- ○ Real power (MW)   ○ Max % Load Cont.
- ○ Reactive pwr (Mvar)   ○ PTDF

☑ Always Use Limiting Flow

Gauge Style
- ○ Total power (MVA)   ● Amp, Transf. MVA
- ○ Real power (MW)   ○ Max % Load Cont.
- ○ Reactive pwr (Mvar)   ○ PTDF

☐ Display Gauge Values in Percent

Color, Size, and Percentage

MVA | MW | Mvar | Amp | CTG | PTDF | Open Parameters

Show Value Percent   80.0

Normal Size Scalar   1.0

Normal Color   [blue]

☑ Use Discrete Map
Warning/Limit Scalars and Colors

Percent	Scalar	Color
80.00	1.50	[orange]
100.00	2.00	[red]

☐ Make normal color the same as the line to which the pie chart or gauge is anchored (if any)

☐ Only Apply Warning/Limit Colors And Resizing to Monitored Elements

✓ OK | Apply | Save Options to Case... | ✗ Cancel | ? Help
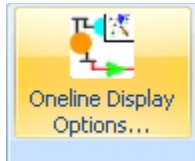
Oneline Display Options:
Pie Charts/Gauges Page, Lines Tab

Sub tabs allow separate breakpoints for different measurement types

| MVA | MW | Mvar | Amp | CTG | PTDF | Open Parameters |

☑ Use Same Settings From MVA

Use same settings as MVA measurements

Show Value Percent   80.0

☑ Use Discrete Map
Warning/Limit Scalars and Colors

Percent	Scalar	Color
80.0	1.50	33023
100.00	2.00	255

Normal Size Scalar   1.0

Normal Color

☐ Make normal color the same as the line to which the pie chart or gauge is anchored (if any)

☐ Only Apply Warning/Limit Colors And Resizing to Monitored Elements

| MVA | MW | Mvar | Amp | CTG | PTDF | Open Parameters |

Special formatting options for open lines

☑ Special Formatting for Open Devices

☑ Do Not Scale Normally Open Devices

☑ Use Special Open Background Color

Open Size Scalar   1.0

Open Background Color   [Change]

Open Border Width   3

Open Border Color   [Change]

☑ Draw "X" symbol on pie chart

Open Symbol Color   [Change]

☐ Make normal color the same as the line to which the pie chart or gauge is anchored (if any)

☐ Only Apply Warning/Limit Colors And Resizing to Monitored Elements

Oneline Display Options:
Pie Charts Page, General Options Tab

Show current limit set (selected in limit monitoring settings)

Show what is being measured

Internal pie chart background fill

Text font size relative to pie chart size

Highest zoom level for resizing

Minimum font size in the pie chart

These options only apply to Line and Interface pie chart/gauges
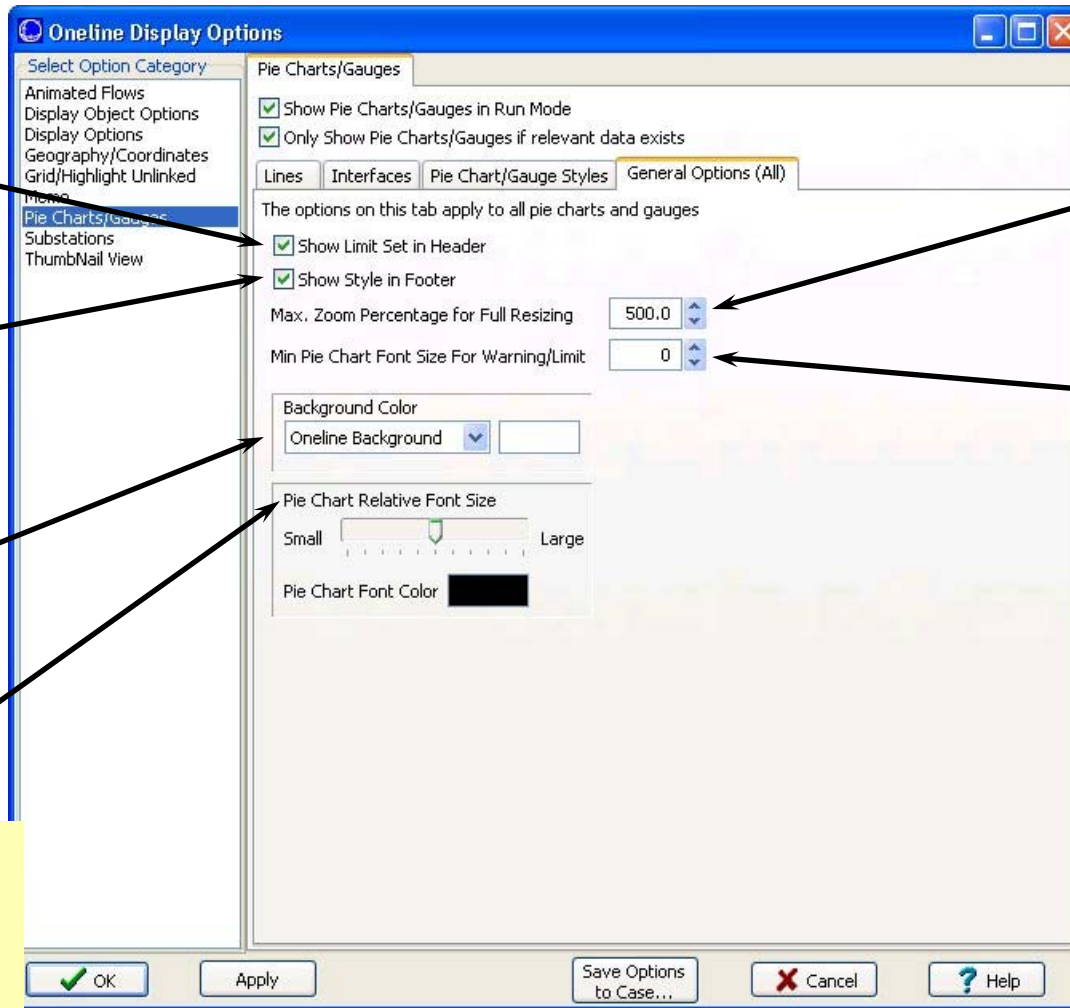
Oneline Display Options

Select Option Category
- Animated Flows
- Display Object Options
- Display Options
- Geography/Coordinates
- Grid/Highlight Unlinked
- Memo
- Pie Charts/Gauges
- Substations
- ThumbNail View

Pie Charts/Gauges

☑ Show Pie Charts/Gauges in Run Mode
☑ Only Show Pie Charts/Gauges if relevant data exists

| Lines | Interfaces | Pie Chart/Gauge Styles | General Options (All) |

The options on this tab apply to all pie charts and gauges

☑ Show Limit Set in Header
☑ Show Style in Footer

Max. Zoom Percentage for Full Resizing   500.0

Min Pie Chart Font Size For Warning/Limit   0

Background Color
Oneline Background

Pie Chart Relative Font Size
Small   Large

Pie Chart Font Color ▮

✔ OK   Apply   Save Options to Case...   ✖ Cancel   ? Help

Pie Charts Options Ribbon
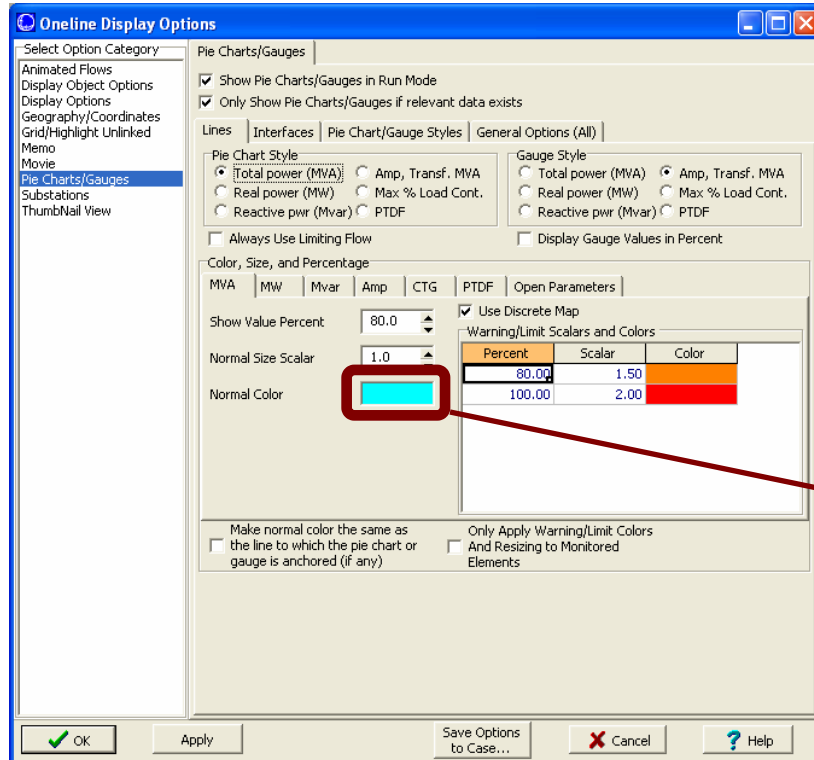
Click **Options** → **Pie Chart** to reveal
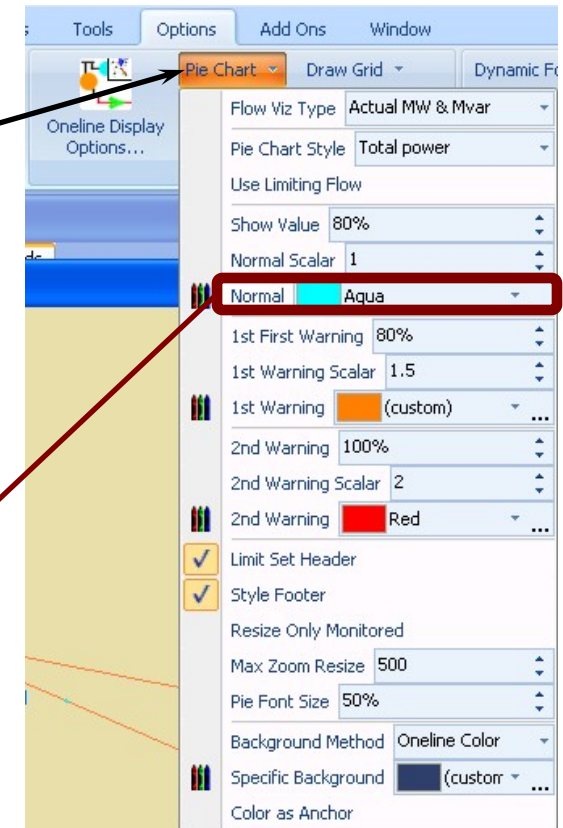
Same Setting

Background and Pie Chart Color Example

Warning Percent = 60
Warning Color = Orange
Warning Scalar = 1.5

Background Color for
Oneline = Yellow

68%

50%

79%

Normal Color = Blue
Normal Scalar = 1.0

Show Value Percent = 45

Limit Percent = 70
Limit Color = Red
Limit Scalar = 2.0

Pie Chart Background
Color = White
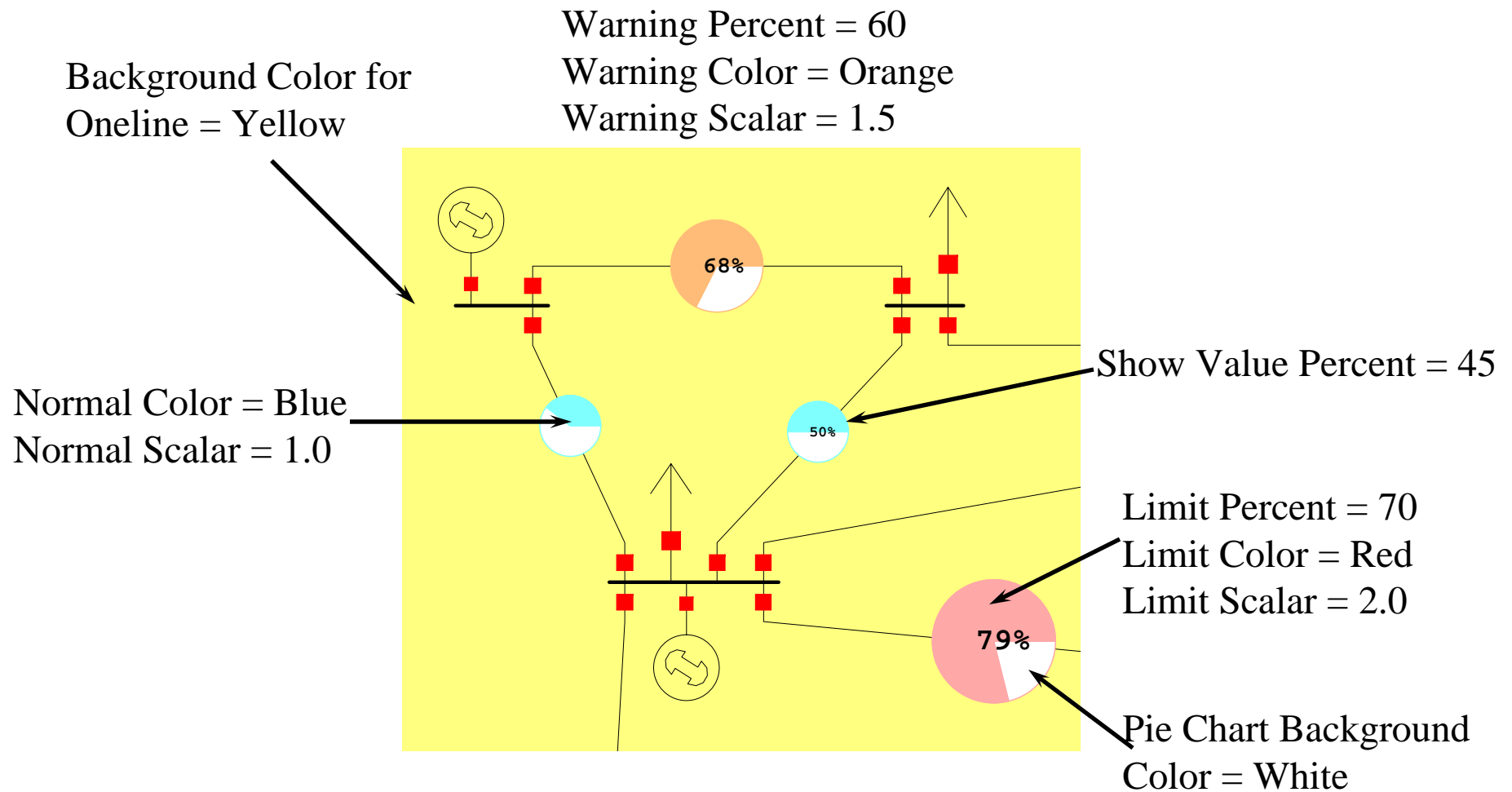
Oneline Display Options: Animated Flows Page

Show Animated Flows

Select Objects

Click this button to initialize the arrows to reasonable numbers

Density and Size of Arrows

Make Arrows move

Flows are based on these values

Parameters used when Animating Size. See the next slide for more info.

Symbol used to show flows. Almost always use Arrows.

Change to make flows move faster

Oneline Display Options

Select Option Category
- Animated Flows
- Display Object Options
- Display Options
- Geography/Coordinates
- Grid/Highlight Unlinked
- Memo
- Movie
- Pie Charts/Gauges
- Substations
- ThumbNail View

Animated Flows

☑ Show Flow Symbols

Show Flows On
- ☑ Branches ☑ Shunts
- ☑ Loads ☑ Generators

☑ Animate

☑ Scale Speed of Flow

☑ Scale Size of Flow

Base Flow Scaling on
- ⦿ Actual MW Power Flow
- ○ Actual Mvar Power Flow
- ○ Actual MW & Mvar Power Flow
- ○ PTDF Percentage Flows
- ○ Actual MW & PTDF Flows
- ○ Custom Float 1

Reset Animated Flow Offsets

Flow Size and Scaling Options

Set Size, Density, and Reference Values for this oneline

Size 10.0

Density 10.00

Scaling Based on
- ⦿ Actual Flow
- ○ Percent Flow

Maximum Zoom Level to Scale Size 200

☑ Maintain Density above Maximum Zoom Level

Minimum Size in Pixels for In-service Elements 0

Reference Values for Scaling

Max Line Flow 300

Max Load Value 300

Max Generator Value 300

Custom Float 1 Value 100.0

Flow Appearance Options

Symbol Shape
- ⦿ Arrows ○ Squares
- ○ Circles ○ Triangles

Animation Rate

Slower ———— Faster

Symbol Fill Color
- Actual MW [green] PTDF Color [black]
- Actual Mvar [blue] PTDF Counter Flow [black]
- Fault P.U Amps [black] Custom Float 1 [purple]

☑ Use Fill Color ☑ Show PTDF Counter Flow

✓ OK | Apply | Save Options to Case... | ✗ Cancel | ? Help

How do these parameters affect the Arrow Size and Spacing

- Arrow Size
  - Arrow Size when NOT Animating Size

    $$\text{ArrowArea} \sim \text{Size}$$

  - Arrow Size when Animating Size
    - Actual Flow
      $$\text{ArrowArea} \sim \text{Size} * \left(\frac{\text{FlowOnElement}}{\text{FlowReference}} \right)$$
      - Actual flows higher than 2 times the FlowReference will not appear larger than a flow 2 times the FlowReference
    - Percent Flow $\text{ArrowArea} \sim \text{Size} * \text{ElementPercentageFlow}$

- Arrow Spacing
  $$\text{ArrowSpacing} \sim \frac{1}{\text{Density}}$$

Click the button **Automatically Set Size, Density, and Parameters for this oneline** to get values that look reasonable for your oneline

Example Variable Flow Size
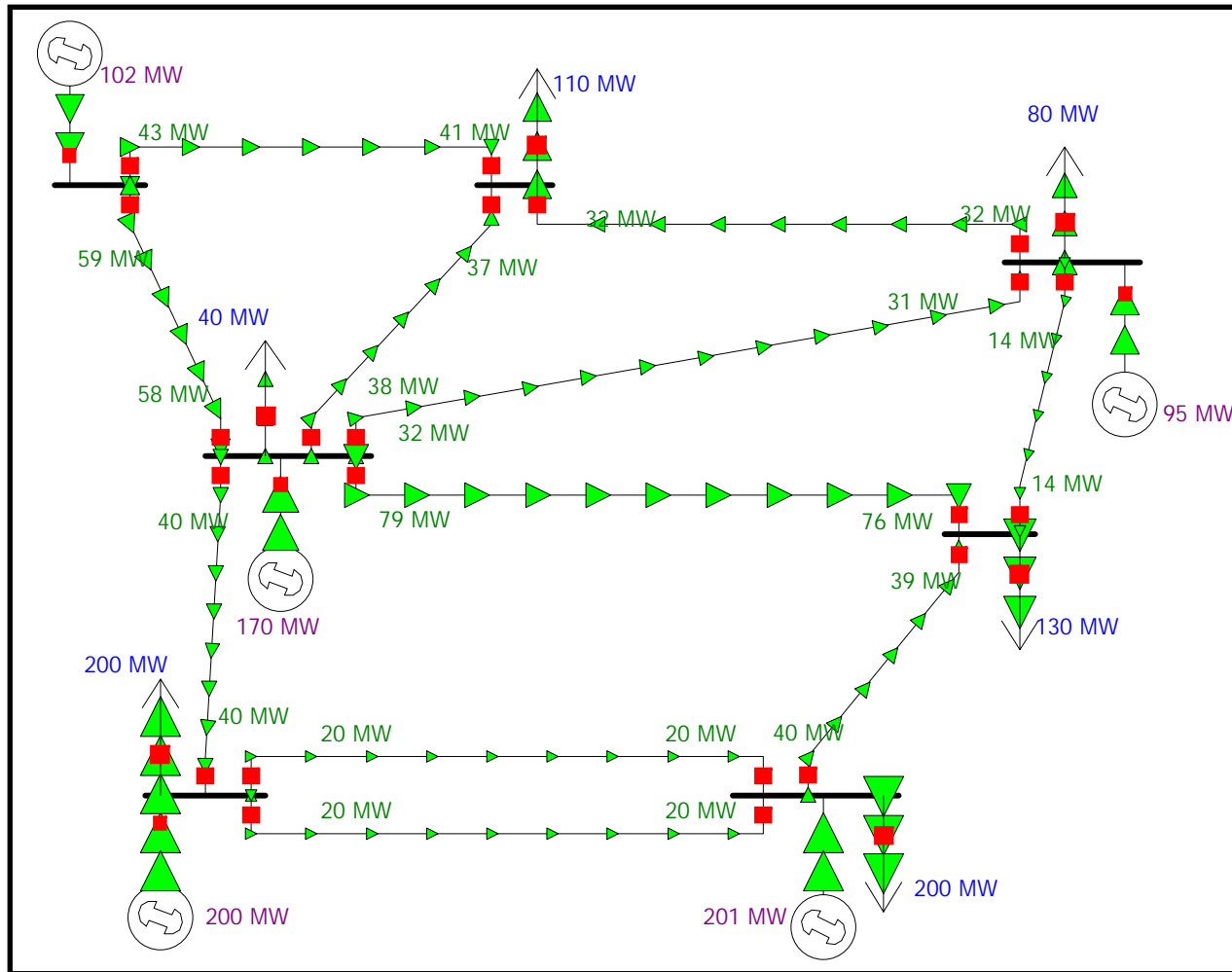
Animate Size = TRUE
Reference Size = 200 MVA

Animated Flow Options Ribbon

- Notice that all the settings on the dialog are available
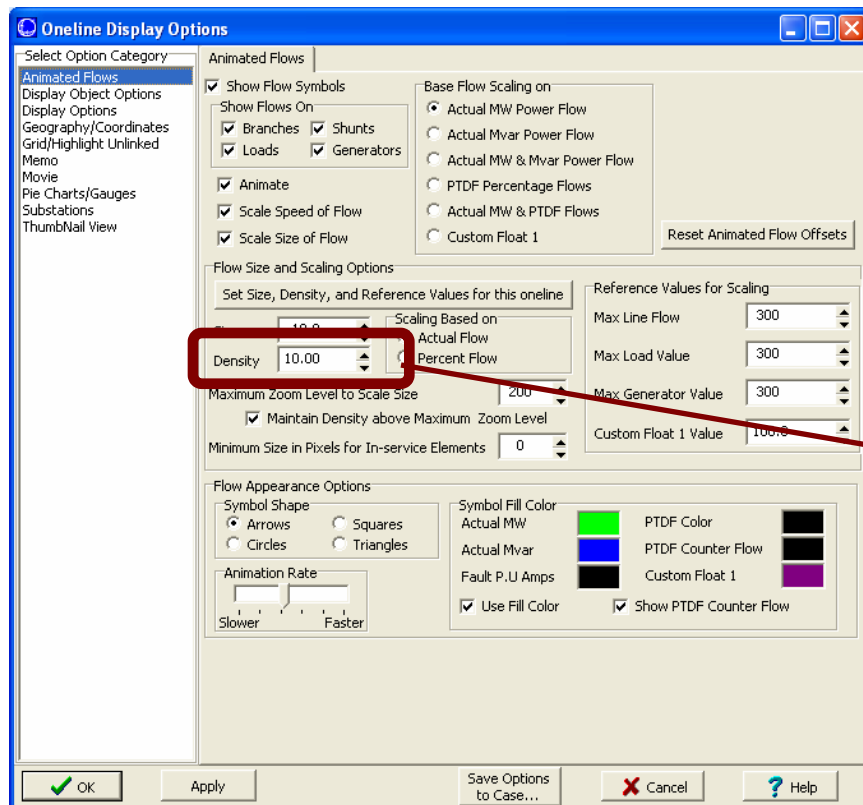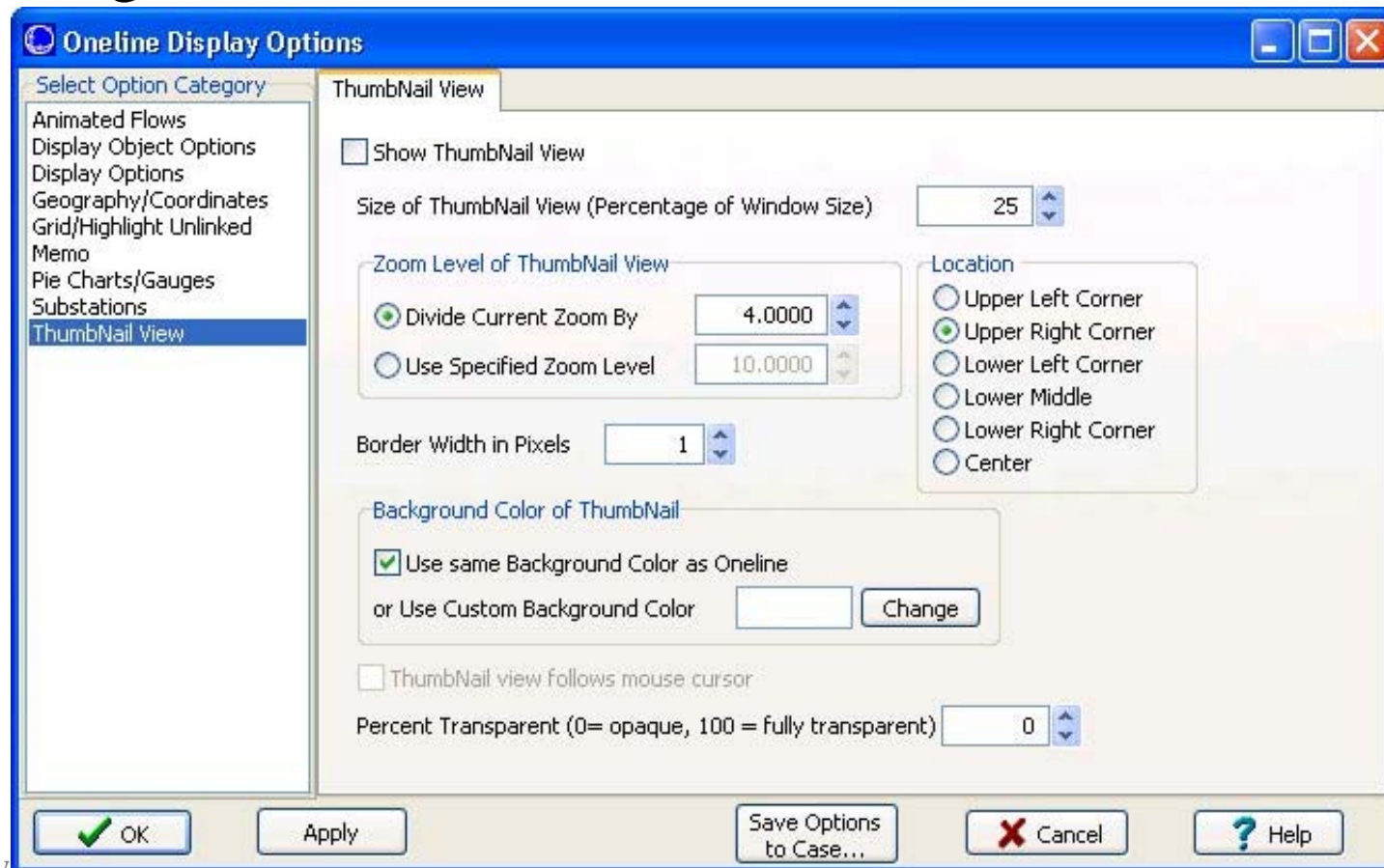
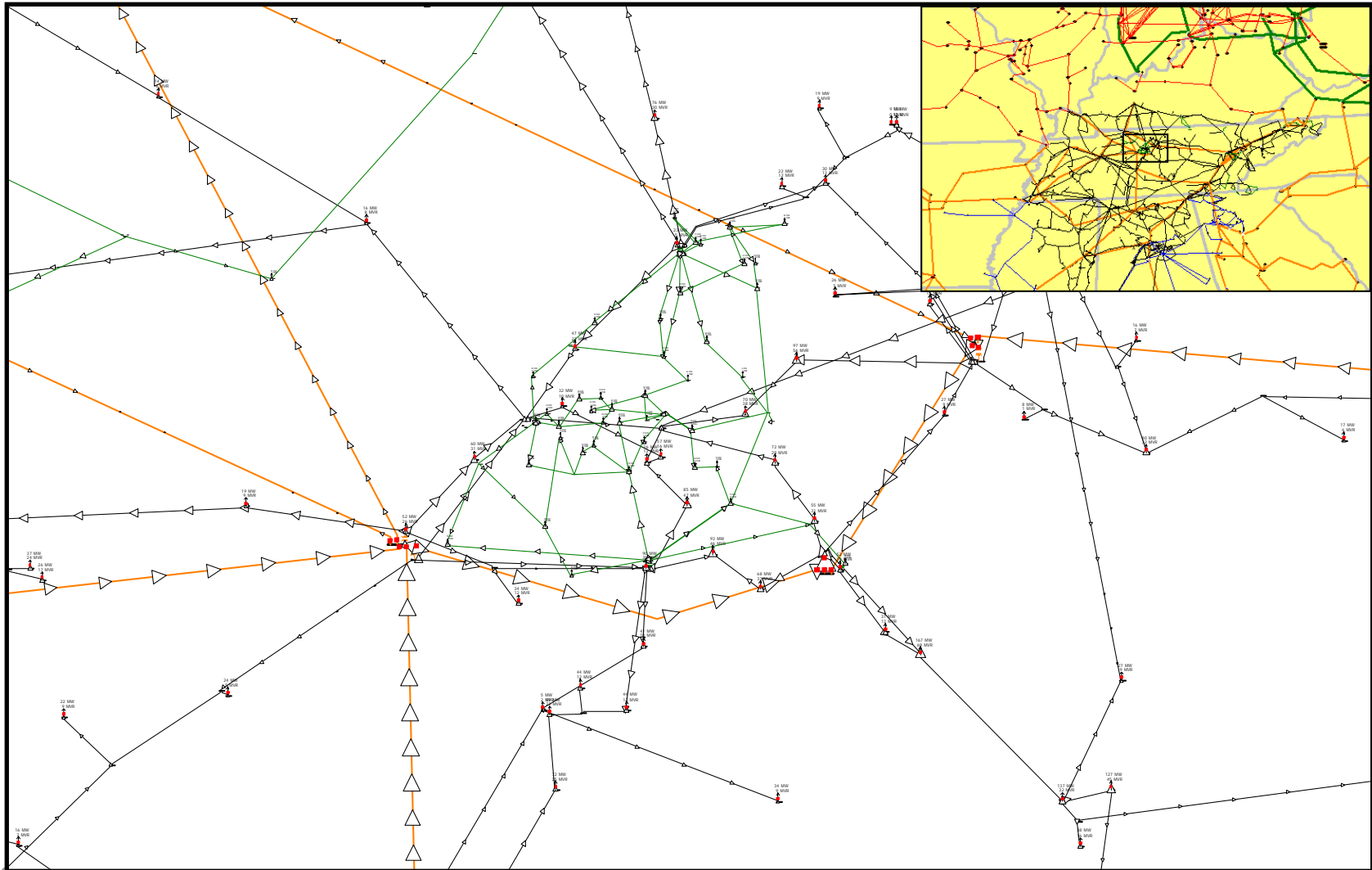Click **Options** → **Animation** to reveal

Same Setting
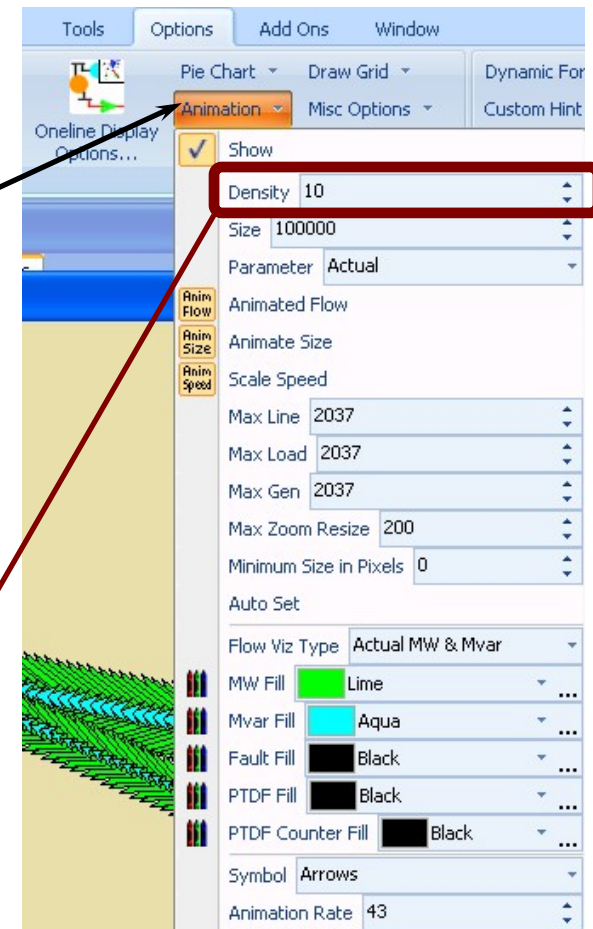
Oneline Display Options: Thumbnail View Page

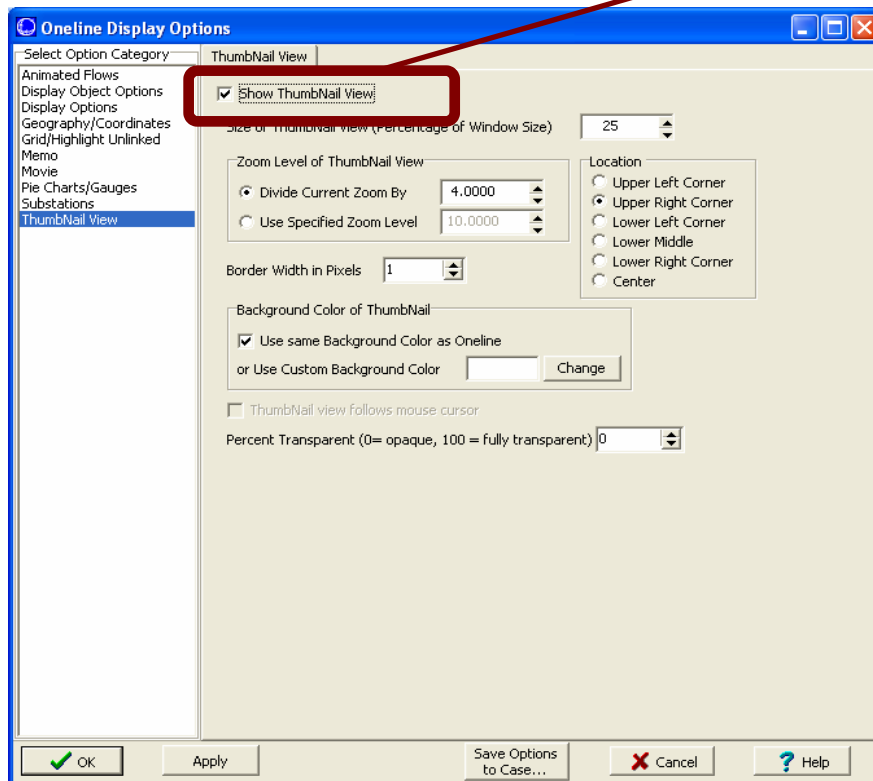- Use to show an overview window for the oneline diagram.
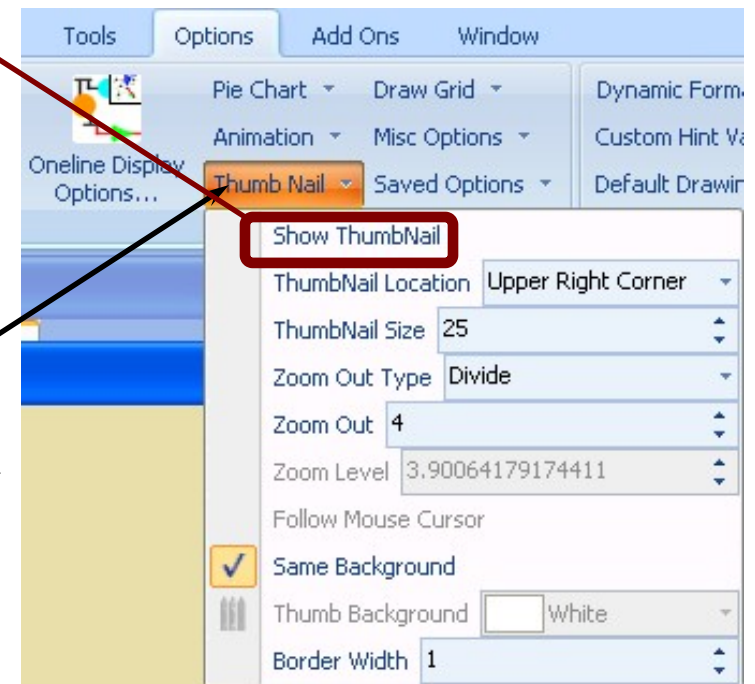
Thumbnail Example

Thumbnail View Options Toolbar

- Right Click in the toolbar region and Choose the ThumbNail View Options Toolbar to make it visible if needed
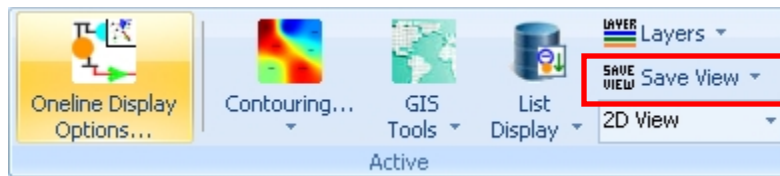- Notice that all the settings on the dialog are available

Same Setting

Click
Options →
Thumb Nail
to reveal

Saving Views

- Save favorite settings of oneline locations and zoom levels
  - right-click, save/edit/delete view, or toolbar button
  - identified by a specified name
  - accept current settings, or specify your own
- Quickly move around the oneline by using the list of saved views
  - right-click, go to view, or toolbar dropdown list

Finding Buses on Onelines

- On large onelines, sometimes it is time consuming to find a particular bus. Rather, you can use the **Find Object on Oneline** option from the local-menu.

- This displays the Zoom, Pan and Find Objects dialog.

Finding Buses on Onelines

- To find a particular bus
    - set **Object Type** to *Buses*
    - use advanced search engine to locate the desired bus by number or name
    - select **Pan to Object on Oneline** to center the oneline on the specified bus
- Find does not change the current zoom level, unless **Auto-Zoom when Panning** is checked.

Start from An Existing Oneline with a New Power System Case

- You've already put together a detailed oneline of your system and it matches up with a case you use

- A year later, a new power system case is created and you want to make sure it matches up with your oneline

  – System elements are reconfigured

  – Bus numberings change

  – More detail or less detail in the case

Integrating an old Oneline with a new Case

- Open the new power system case
- Choose **Open Oneline** from the **Application Button** to open up your old oneline
- Now, find out if all the elements on the oneline are still linked up with the case
- Choose **Onelines → List Display → Unlinked Display Objects**
  - This gives you a list of display objects that have no corresponding data in the case

Fixing a Few Unlinked Oneline Objects

- "Few" may mean less than 500
  - If Bus 101 were removed in case at right there would be 17 unlinked objects created by this!

- If only have a few, easiest process is to
  - Delete unlinked all objects
  - Fix up the areas on the oneline affected

Bus 102

404.0 MW   -81.3 MVR

700.00 MW   **Bus 101**
1.03 pu

160.6 MW   5.3 MVR

0.99 pu   **Bus 103**
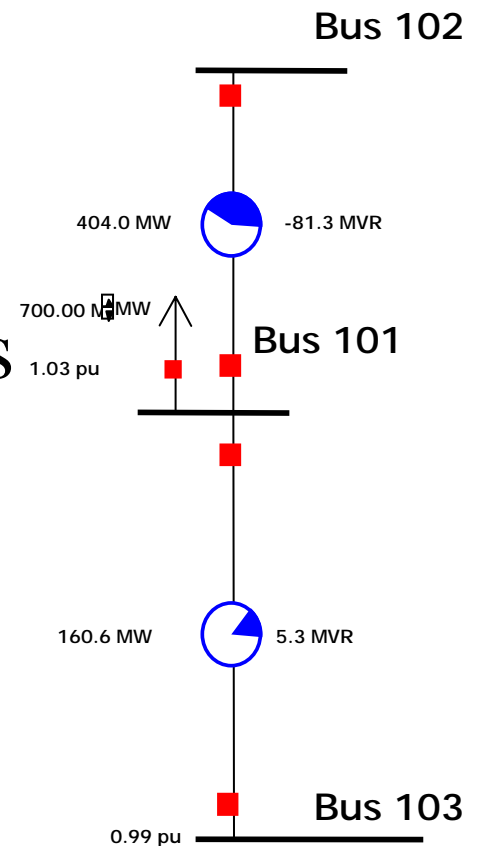
Fixed A Lot of Unlinked Objects: Bus Renumbering

- If you have a lot of unlinked objects, then the case bus numberings have probably changed

- Best option is to attempt to "renumber" the buses on the oneline

Bus Renumbering

- Open the old oneline with the OLD CASE
- In Edit Mode, choose **Tools → Renumber → Renumber Buses**
- Select **Load Only Buses on Oneline** and press the **Setup Bus Swap List** button
- Right Click on the table and choose **Save As → Auxiliary File…**
  - Select a name such as (oldscheme.aux)
- Close Renumber Buses dialog

Bus Renumbering (cont)

- Open the NEW CASE and the old oneline
- Choose **Tools → Renumber → Renumber Buses**
- Select **Freshen Current Oneline** and specify the file you saved (oldscheme.aux)
- Click the **Setup Swap List** Button
  - Simulator will match the old numbering scheme used in the oneline with elements in the new case by BUS NAME and KV.
  - Tie breakers will use the BUS AREA NAME
  - If it still can't figure it out, it puts in both options

Bus Renumbering (cont)

- Go through the new list and make sure you want to swap as they are listed

- Change the **Swap?** field for those you want to switch

- When you've selected what you want to swap, click **Change Bus Numbers** at the bottom of the form

- NOTE: It will take a long time to renumber a big oneline

Integrated Bus Renumbering

- When saving a diagram (*.pwd) file, Simulator automatically includes a table inside this file which stores data necessary to do the renumbering routine
- This allows you to perform the renumbering automatically when you open the diagram
  – Choose **Open Oneline** from the Application Button
  – Change **Files of type** to *Oneline Display File (Name_KV linking)*
  – Choose the file to open
- This automatically renumbers the diagram.
  – BE CAREFUL. If the case does not have unique "name-nominal kV" values this can cause incorrect linking.

One-line Diagrams for FERC 715

- Our affiliate, Energy Visuals, provides geographic-based one-line diagrams as a subscription service
  - Updated annually
  - Let them worry about bus renumbering!
- +1 (217) 398-8035, Tim Born
- http://www.energyvisuals.com
- Energy Visuals also provides generator cost models for use with Optimal Power Flow (OPF)