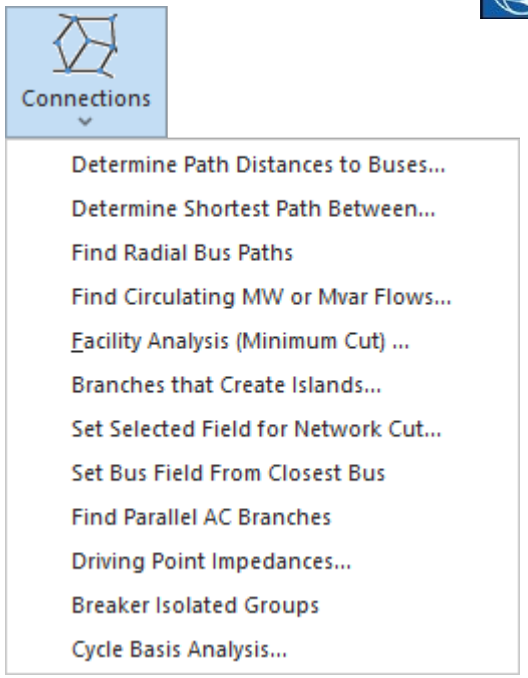
PowerWorld Simulator: Tools Connections Menu

PowerWorld Simulator Users Group

June 18, 2025

Jamie Weber, Director of Software Development



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Future Events: Series of Webinars

https://www.powerworld.com/training/client-meetings

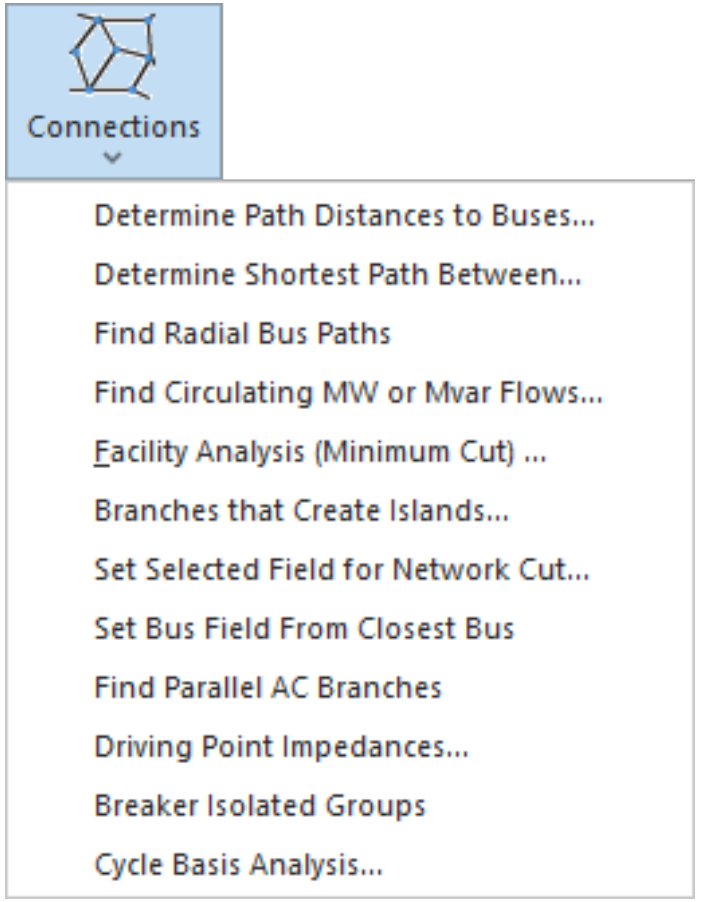
1. Title: What is New in PowerWorld Simulator 24
   Date and Time: May 20, 2025, 3:00 pm Central Time (UTC -5)
   Presenter: James Weber
2. Title: Historic Event Geomagnetic Disturbance (GMD) Analysis in PowerWorld Simulator
   Date and Time: May 28, 2025, 3:00 pm Central Time (UTC -5)
   Presenter: Scott Dahman
3. Title: PowerWorld Simulator Geographic Regions and Routes
   Date and Time: June 11, 2025, 3:00 PM Central Time (UTC -5)
   Presenter: Thomas Overbye

4. Title: PowerWorld Simulator Connection Menu Tools
   Date and Time: June 18, 2025, 2:00 pm Central Time (UTC -5)
   Presenter: James Weber

5. Title: PowerWorld Simulator Integration with EPRI GICHarm
   Date and Time: June 24, 2025, 3:00 pm Central Time (UTC -5)
   Presenter: Thomas Overbye
   Register here

Connections Tools: Revisit all of these Tools!

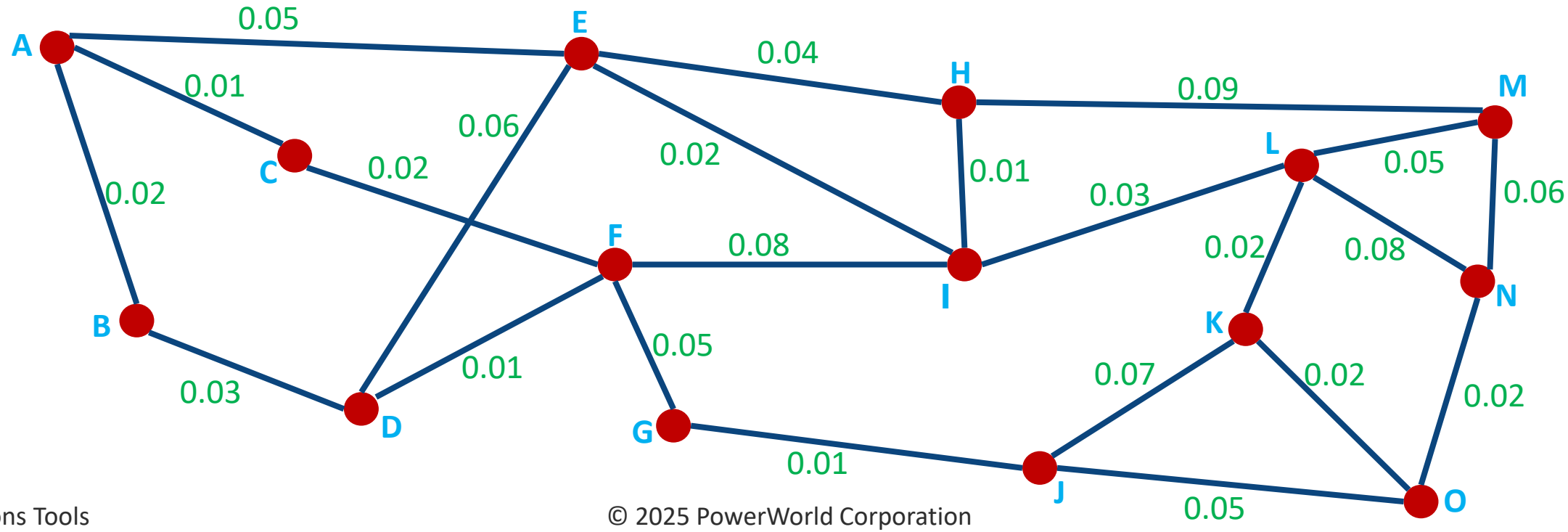
- Connection Menu tools
  - Calculations treat the transmission network as a mathematical “Graph”
    - Vertex of the Graph = Bus or Node of our Network
    - Edges of the Graph = Branch of our Network
    - Weights of the Graph are varied in the tools
      - Length of Branch
      - Series X reactance
      - Series Z impedance



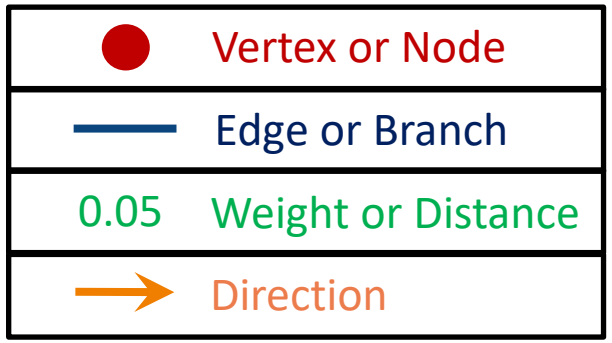
Graph: Vertex, Edge, Weight
Undirected Graph: Weights have no direction

Vertex or Node	
Edge or Branch	
0.05	Weight or Distance

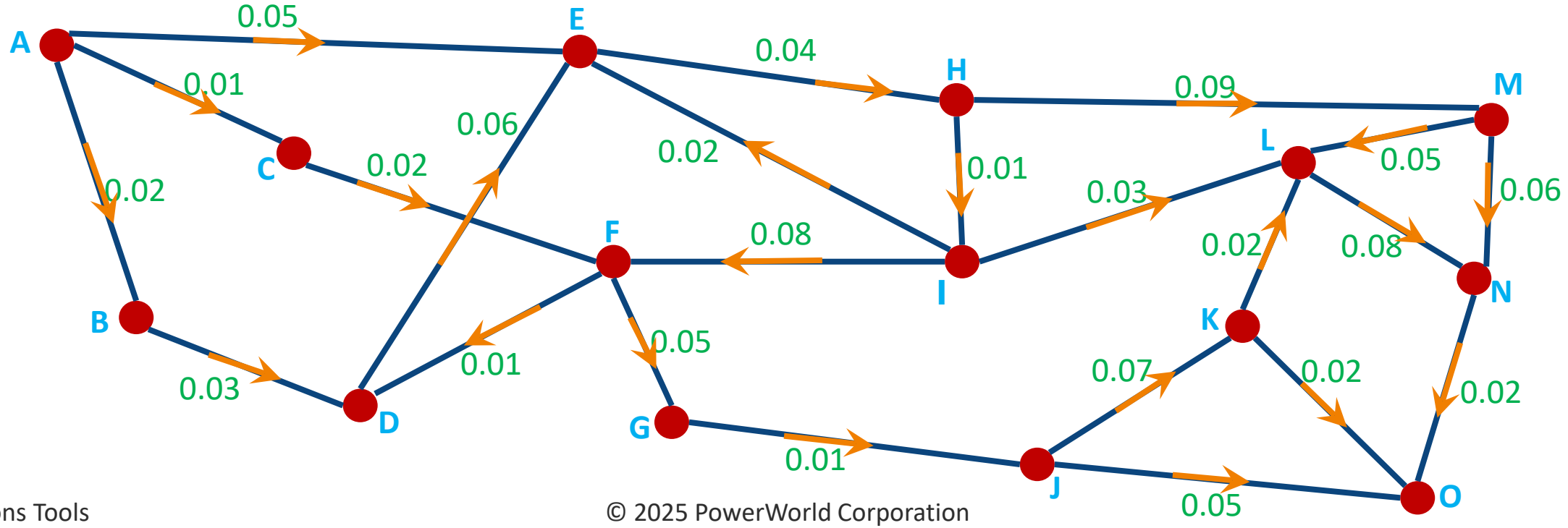
For a few Connection Tools, the Distance Measure is an Option



Graph: Vertex, Edge, Weight
Directed Graph: Weights have Direction

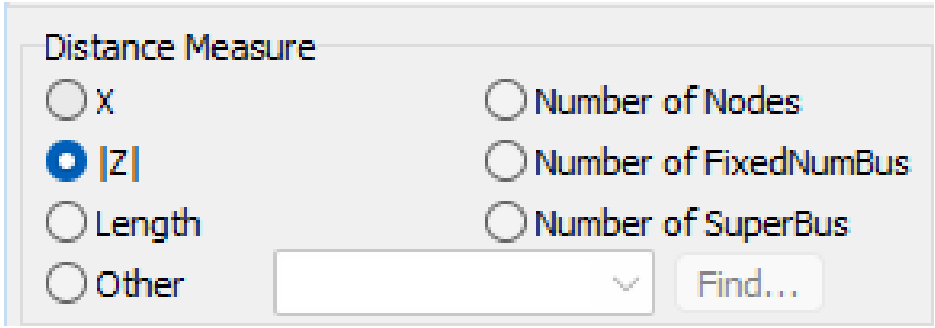


Find Circulating MW or Mvar Flows

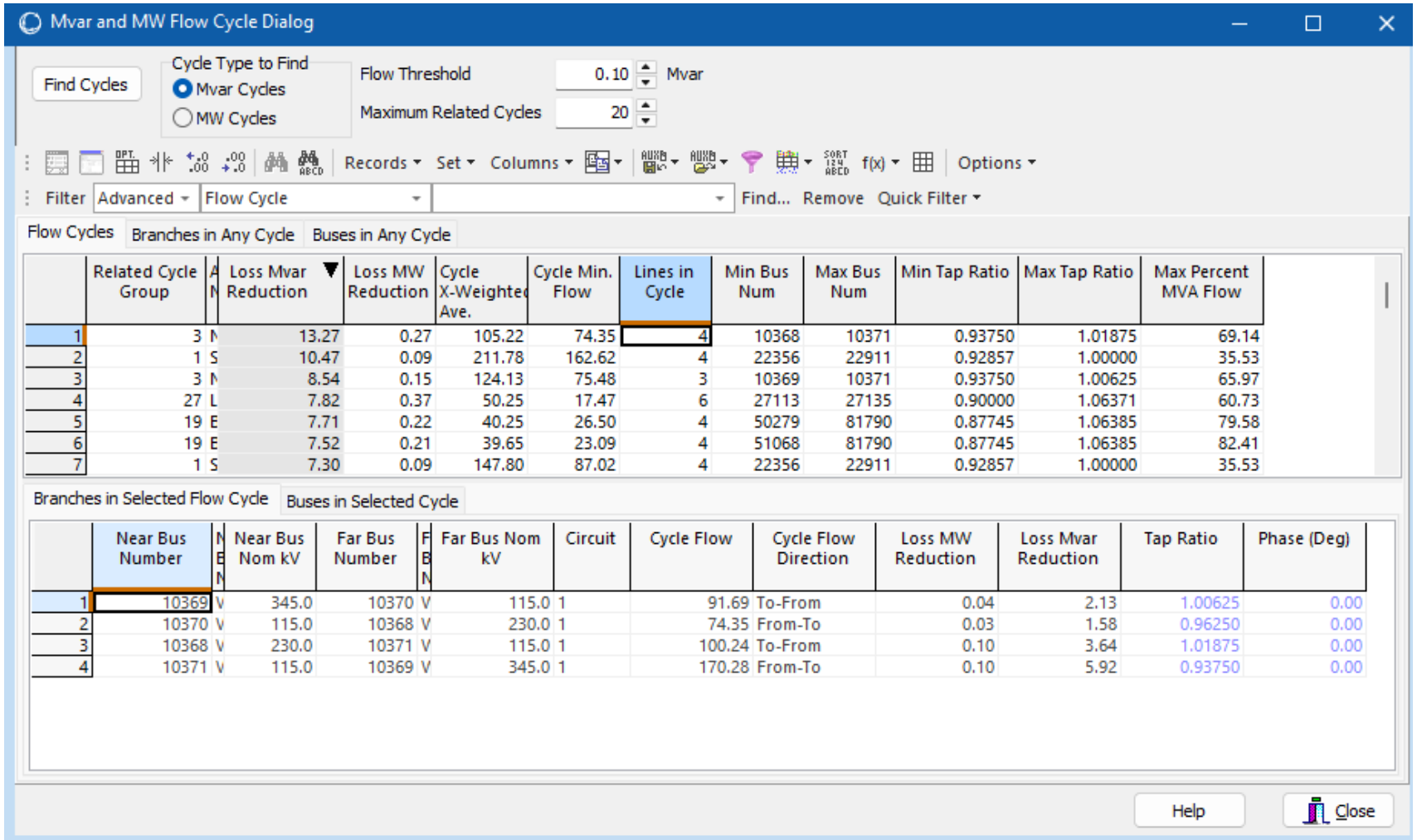


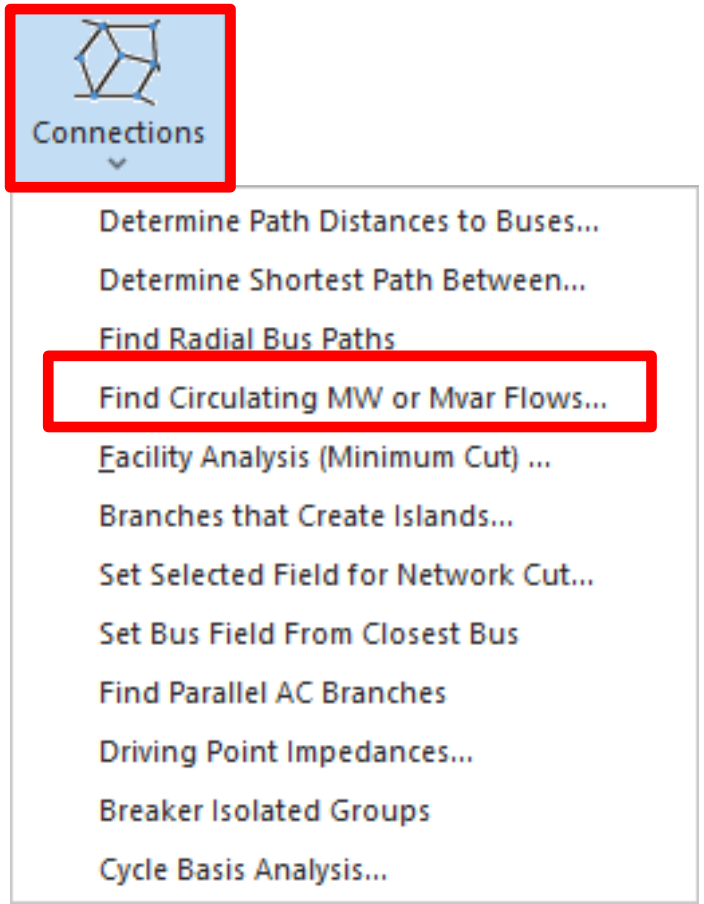
Distance Measure Choices

- A few calculations require a user-input to specify what Distance Measurement should be used for a path distance
  - Determine Path Distance to Buses
  - Determine Shorted Path Between
  - Set Bus Field From Closest Bus
- **Distance Measure Choices**
  - **X** : use the series X impedance (some calculations require positive lengths)
  - **|Z|** : use the series Z impedance
  - **Length** : use the Branch object field Length (this is often not populated though)
  - **Other** : specify your own field to use (such as a custom integer or float)
  - **Number of Nodes** : every branch is assumed to have the same distance measure
  - **Number of FixedNumBus**
    - Branches between same FixedNumBus have a measurement of 0 and other branches are 1
  - **Number of SuperBus**
    - Branches between same SuperBus have a measurement of 0 and other branches are 1



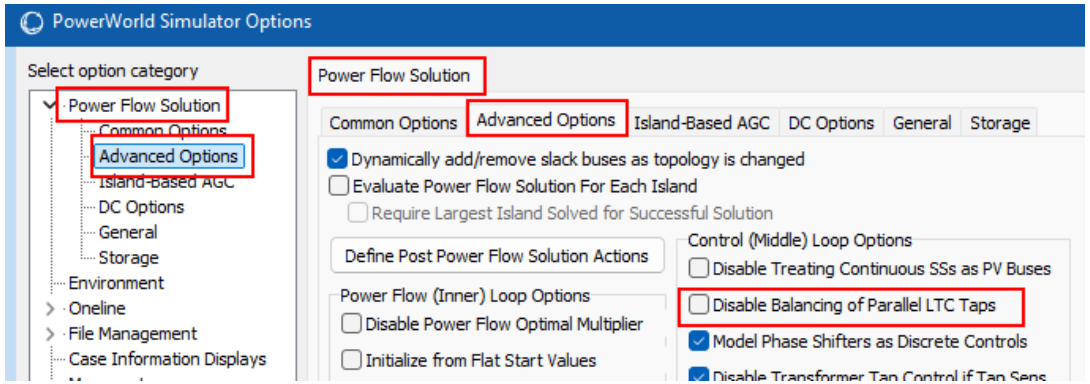
Tools, Connections, Find Circulating MW or Mvar Flows





Connections Tools: Circulating Mvars

- Usually, these represent small input data mistakes
- Mostly they are unbalanced tap ratios on parallel paths
  - PowerWorld Simulator automatically detects more obvious mistakes like parallel taps between “ZBR Bus Groups”.
    - Means multiple transformers share the same group of buses connected by low impedance branches as terminals
    - This is what “tap balancing” tools
    - Tap Balancing catches the obvious errors
    - Sometimes the network topologies are more complicated (Mvar Cycles can find these)

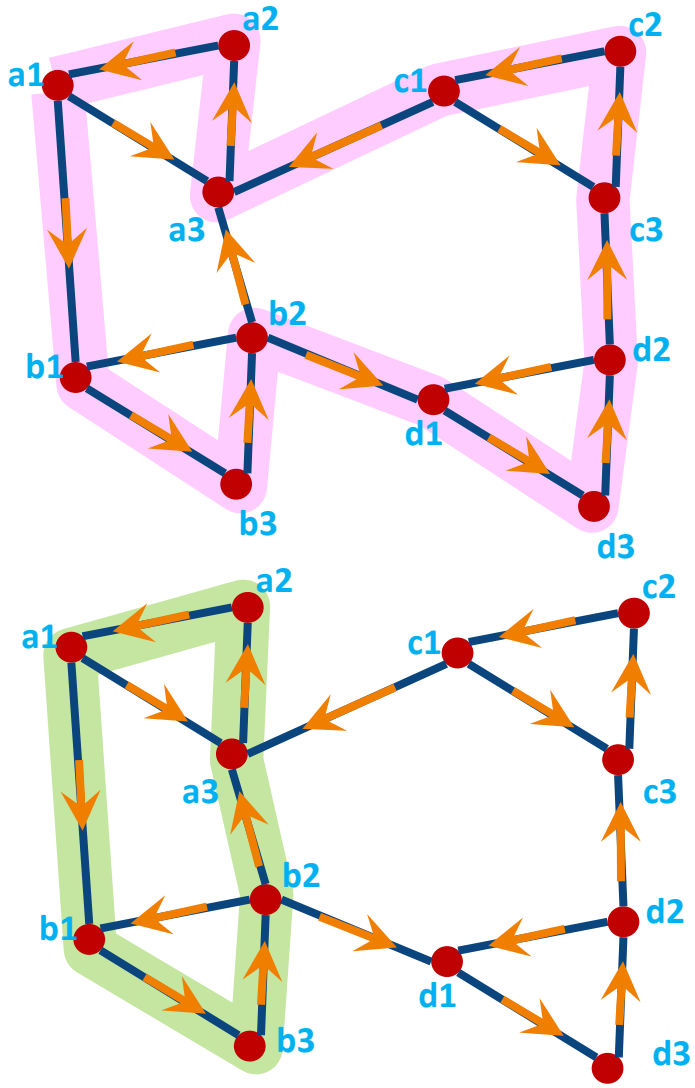


Tools, Connections, Find Circulating MW or Mvar Flows

- Represents the power system as a directed graph: MW and Mvar flows have a flow direction
- Terminology
  - **Flow Cycle** = a series of transmission branches with positive flows that can be traversed to form a loop
  - **Flow Threshold** = Any flow with an absolute value less than this is ignored
  - **Related Cycles** = a pair of cycles are called related if both cycles can reach each other by a series of positive flow
    - These then create more large cycles with various combinations of smaller flow cycles. In a real power system this can result in potentially millions of combinations of cycles
    - PowerWorld has an input parameter for **Maximum Related Cycles** to prevent the presentation to you of too many results
      - Mathematicians call these *Strongly Connected Components*
      - PowerWorld will present you with the related cycles that have the largest minimum flow

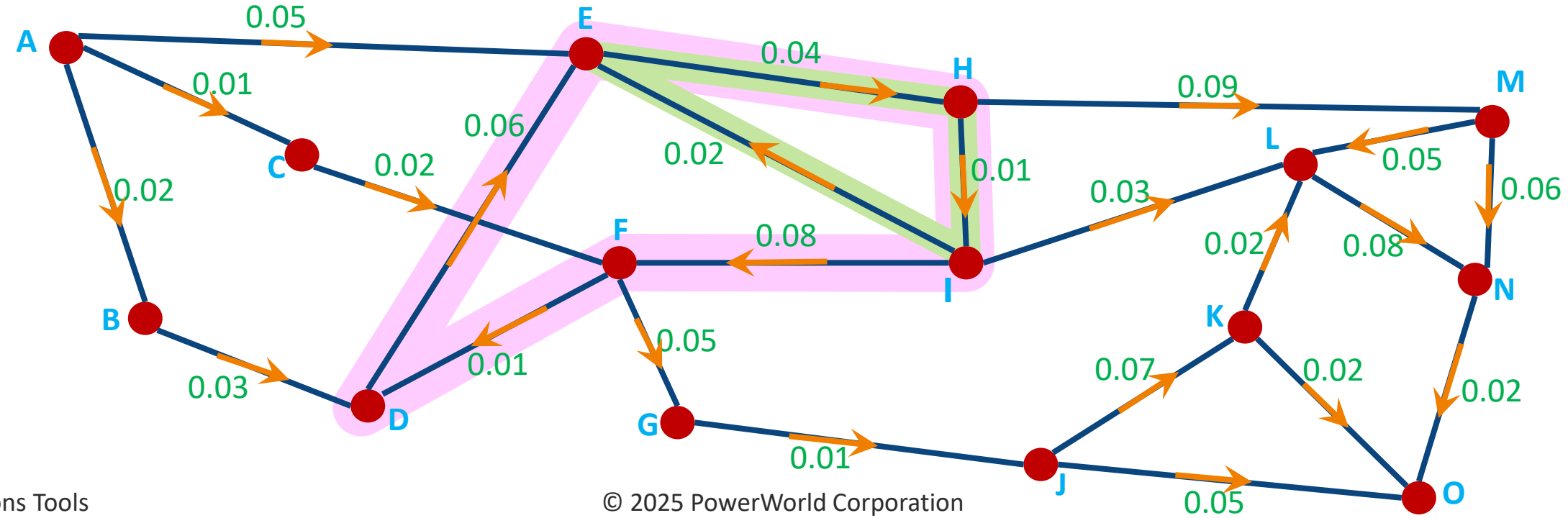
Related Cycles: The Count of Flow Cycles gets very large

- a3,a2,a1
- b3,b2,b1
- c3,c2,c1
- d3,d2,d1
- a3,a2,a1,b1,b3,b2,d1,d3,d2,c3,c2,c1,a3
- a3,a2,a1,b1,b3,b2,a3
- And many, many more
- Mathematicians call this a “Strongly Connected Graph” meaning each vertex can be reach from all other vertices
  - PowerWorld calls them Related Cycles



Find Circulating MW or Mvar Flows These are operating on a Directed Graph

- There are 2 “Flow Cycles” in the Graph Below
- E → H → I → E and E → H → I → F → D → E
- These 2 flow cycles are Related

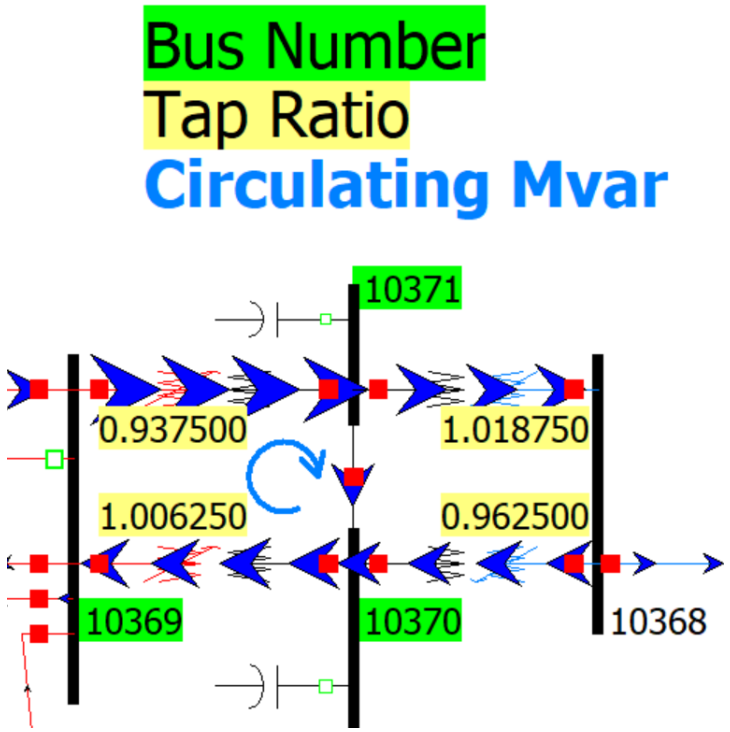


Causes of Flow Cycles in Power System Network Model

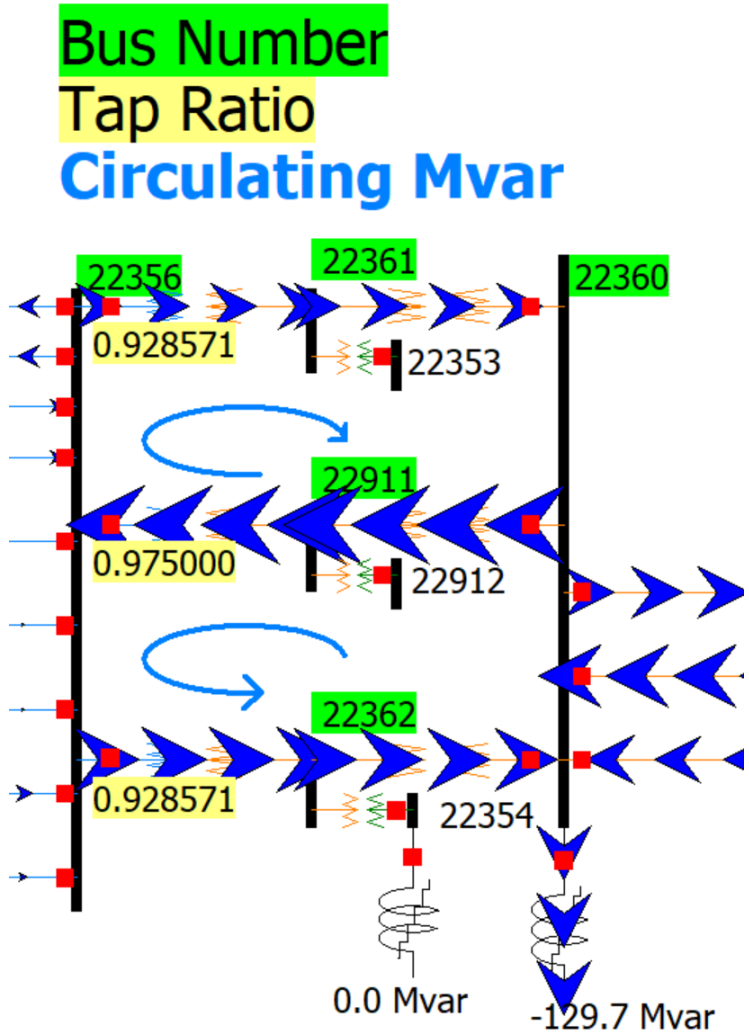
- We do not expect to see any flow cycles in a power system, but a few things can cause these cycles
- MW and Mvar Flow Cycles will occur for parallel paths between buses with
  - One path has a positive series X impedance
  - One path has a negative series X impedance
  - So parallel paths where one path has a series capacitor
    - Normally you do not see this because a series capacitors in series with another branch with a series X larger in magnitude than the series cap
    - Lines are not more than 100% compensated!
    - You might see a small positive impedance representing a switching device that bypasses the series cap and is parallel with it → those show up as both MW and Mvar cycles, but the flow is very small so ignore them
- Mvar Flow Cycles: Unbalanced Transformer Tap Ratios
  - This is a very common reason
  - We would recommend the use of this tool to fix these in your power system models
- MW Flow cycles: Unbalanced transformer phase shifts
  - This is a very rare occurrence, but also possible

Mvar Cycle Examples: Almost always unbalanced tap ratios

- DataCheckExample.pwb
- Mvar cycles



Notice the Blue arrows are going in a circle



Flow Cycle Results

	Related Cycle Group	A N	Loss Mvar Reduction	Loss MW Reduction	Cycle X-Weighted Ave.	Cycle Min. Flow	Lines in Cycle	Min Bus Num	Max Bus Num	Min Tap Ratio	Max Tap Ratio	Max Percent MVA Flow
1	3	N	13.27	0.27	105.22	74.35	4	10368	10371	0.93750	1.01875	69.14
2	1	S	10.47	0.09	211.78	162.62	4	22356	22911	0.92857	1.00000	35.53
3	3	N	8.54	0.15	124.13	75.48	3	10369	10371	0.93750	1.00625	65.97

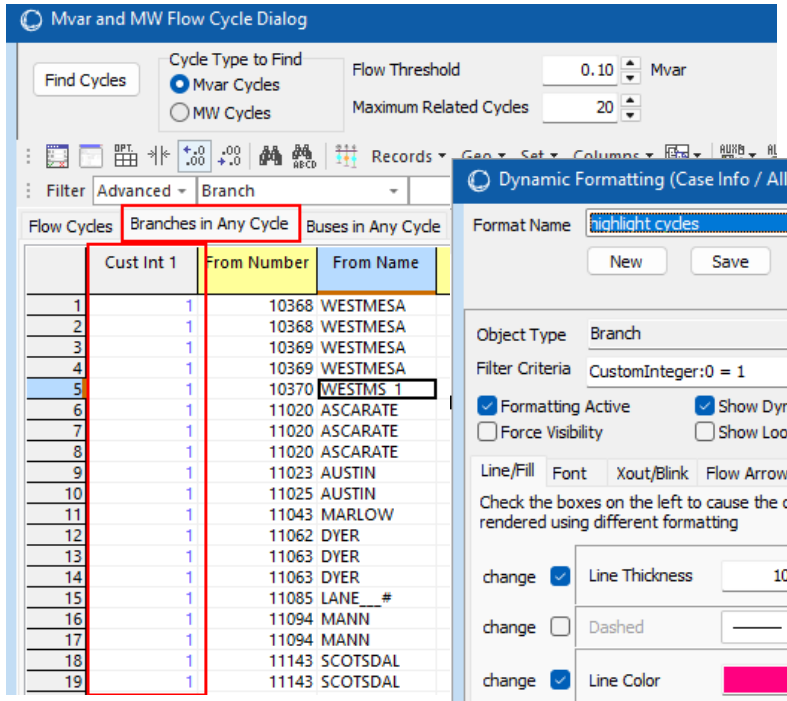
Default Column	Description of Default Column
Related Cycle Group	Cycles with the same integer are related
Area Names	Names of the Areas of Buses in the Flow Cycle
Loss Mvar Reduction	An estimate of how much the Mvar loss on all branches in the cycle will be reduced if the flow cycle is reduced by the X-Weighted average flow
Cycle X-Weighted Ave	Weighted Average flow in the cycle (weighted by the Series X)
Cycle Min Flow	The minimum flow on any branch in the flow cycle
Lines in Cycle	Number of branches in the cycle
Min and Max Bus Num	Minimum and maximum Bus Number in the flow cycle
Min and Max Tap Ratio	The minimum and maximum transformer tap ratio for a transformer branch in this cycle. These are normally the cause of these cycles

Visualizing Results

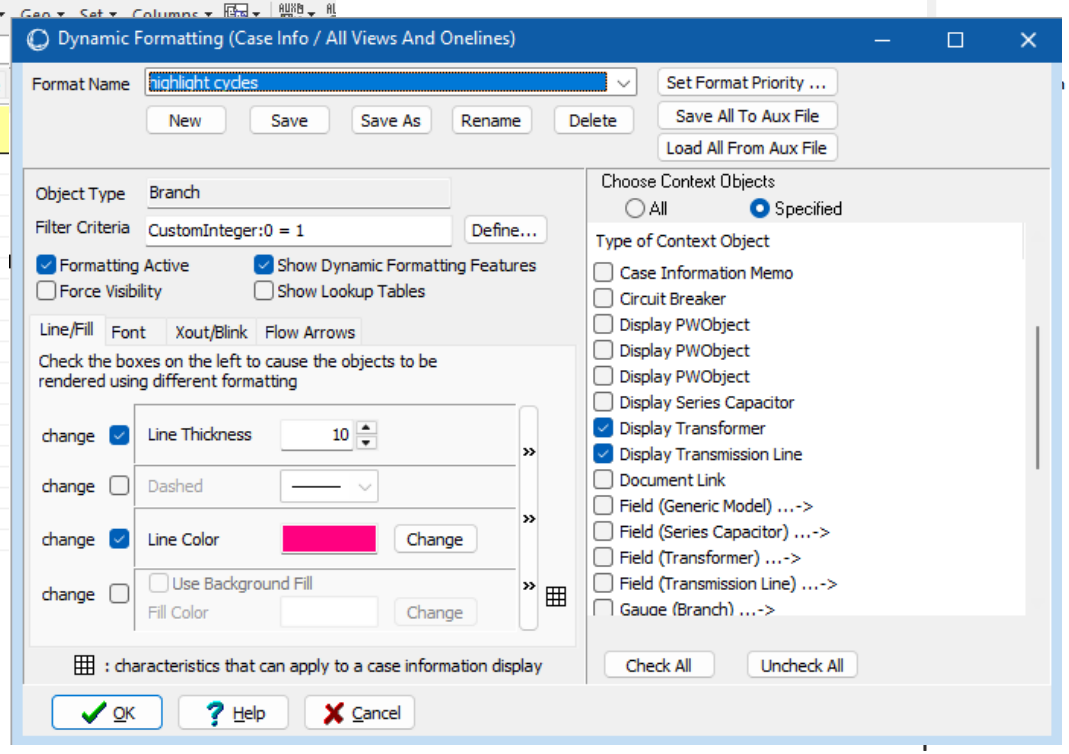
- Use the Branches in Any Cycle and Buses in Any Cycle tab to set a parameter (for example a “Custom Float”
- Use the Parameter to select and format branches on a oneline
- Use the parameter to create a Dynamic Formatting
  - Set Custom Integer = 1 for all branches in a cycle
  - Set Dynamic Formatting to highlight transformers and transmission line display objects on all ones if CustomInteger = 1
  - Show the Bus View and bus 70320 in DataCheckExamples

Visualizing Results of Cycle Flows

Branches in Any Cycle Custom Int



Dynamic Formatting



Bus View Highlighted

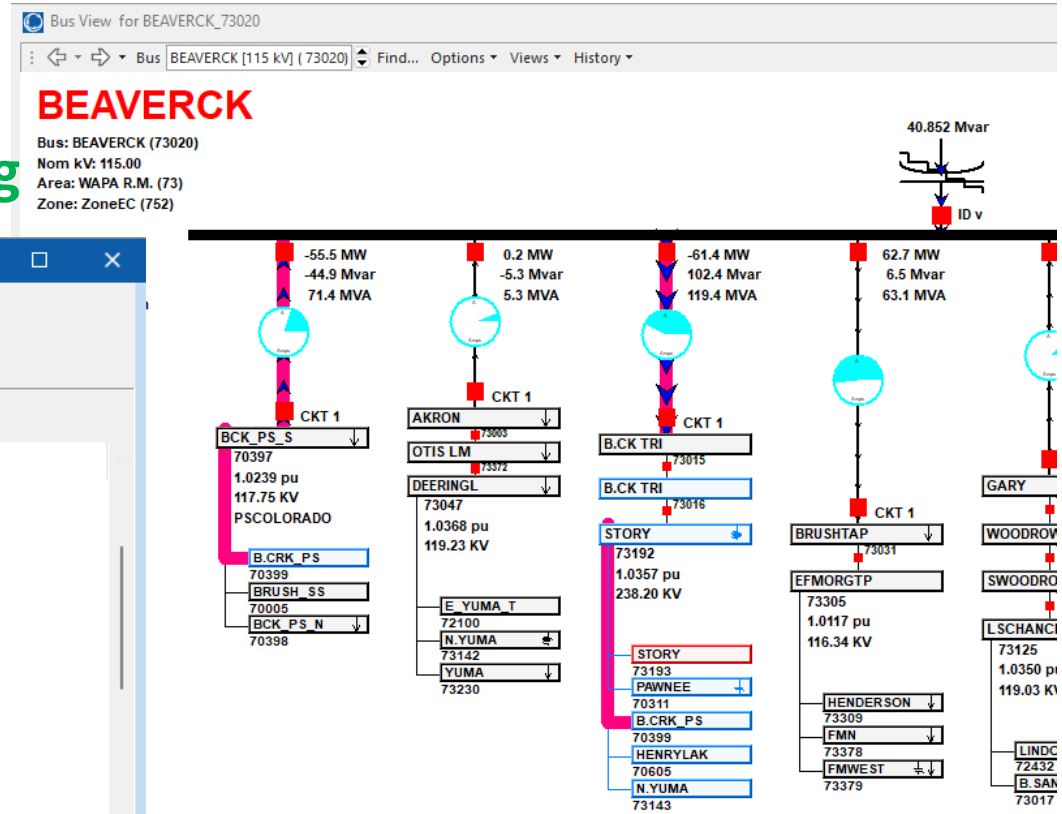
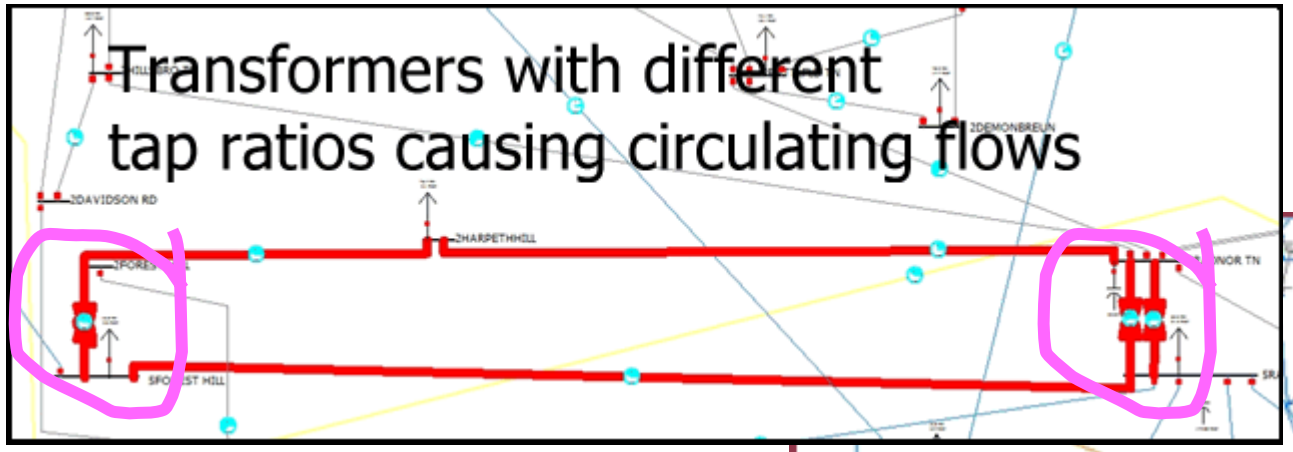
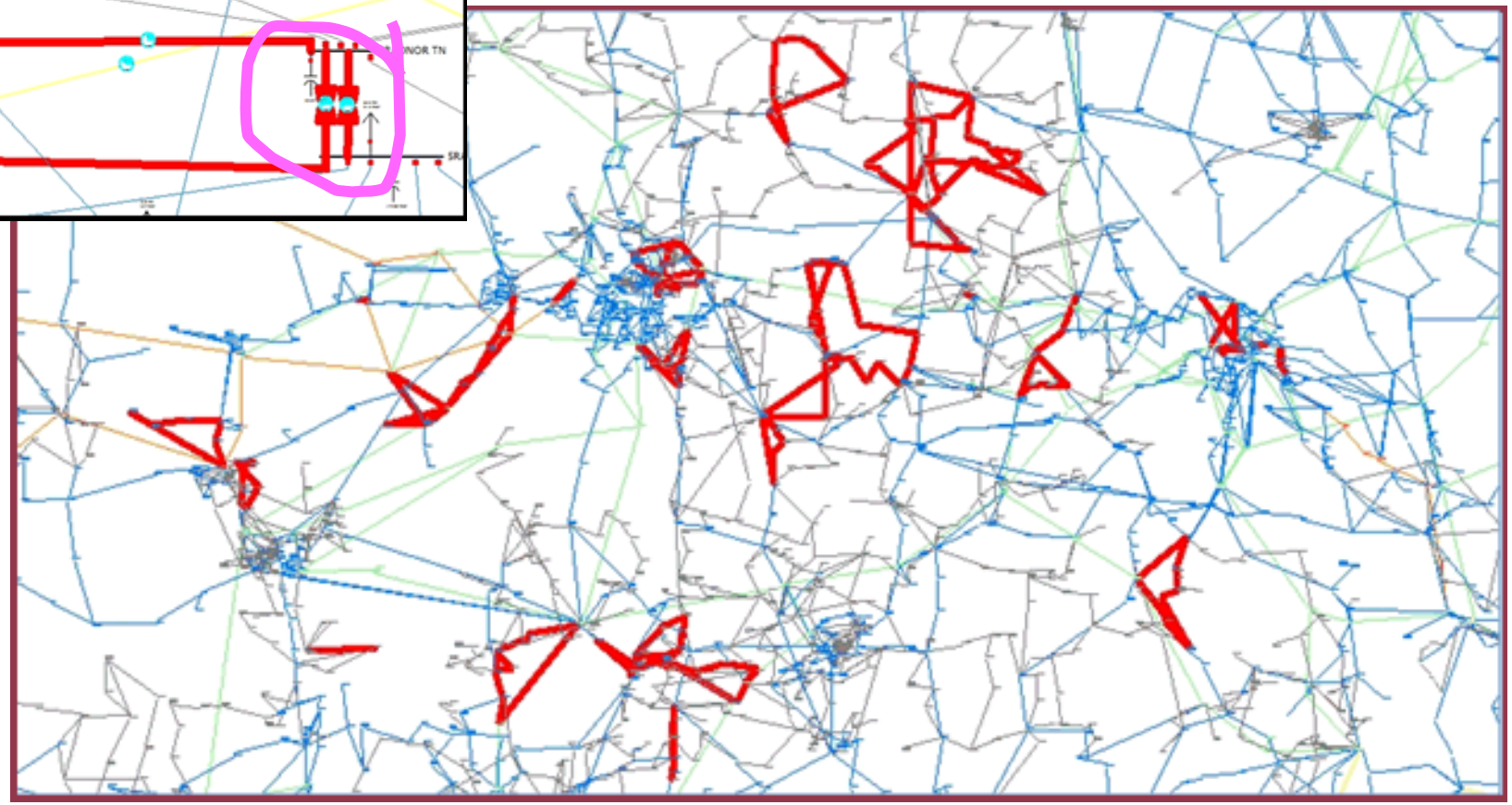


Image of old example

Visualizing Results of Cycle Flows

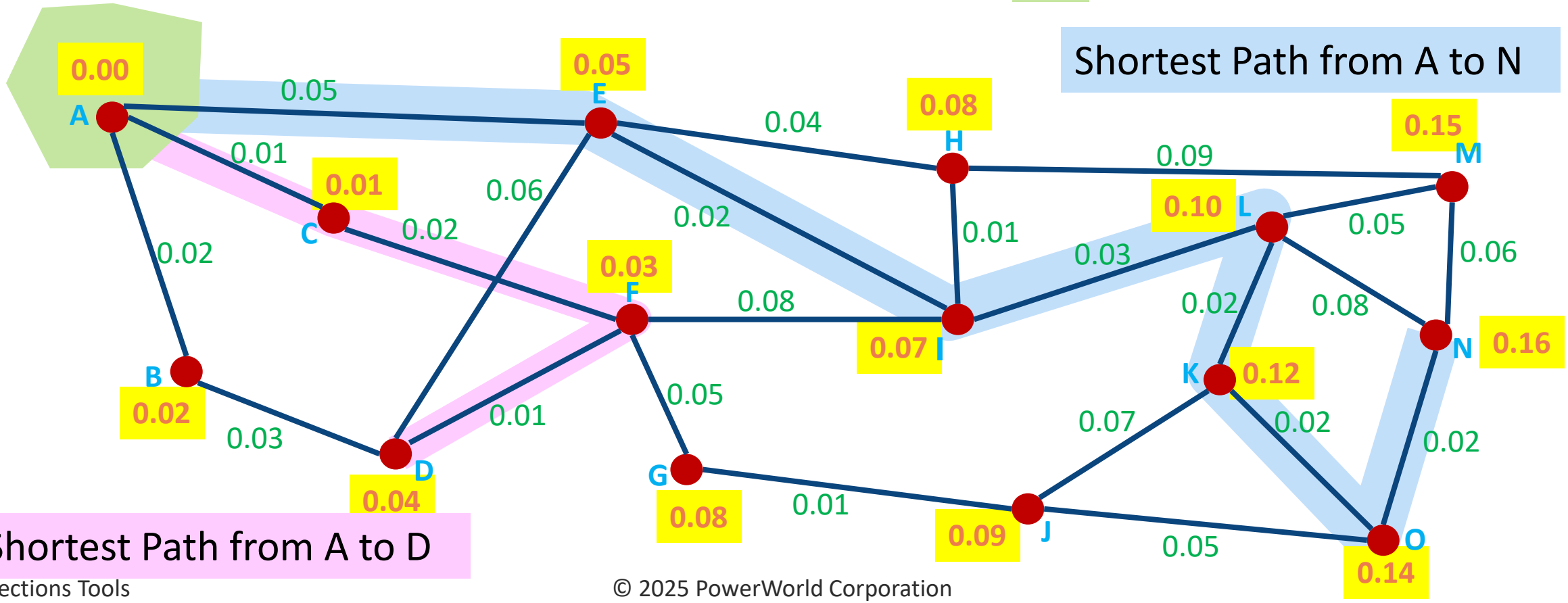


Not directly parallel, but they are nearby in a parallel configuration

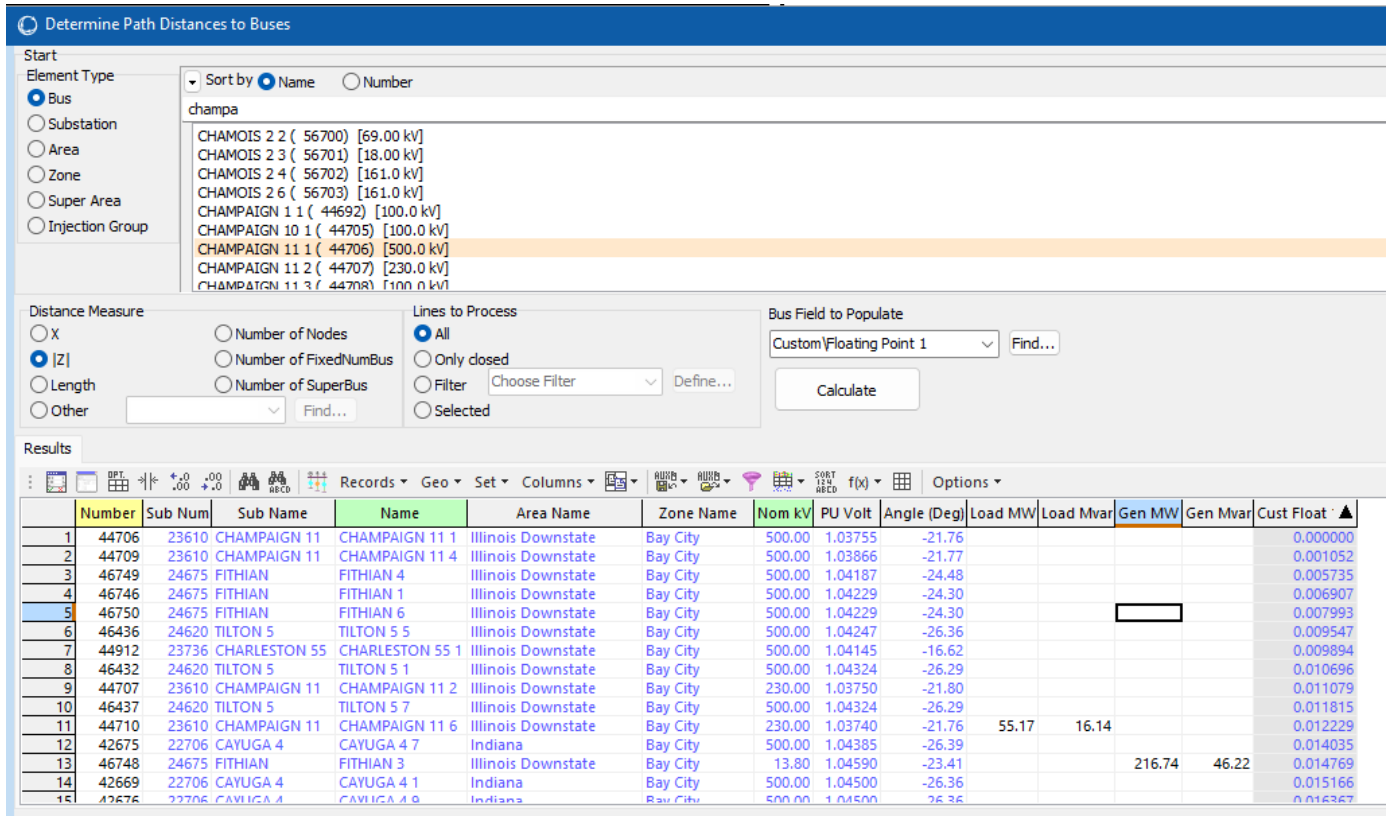


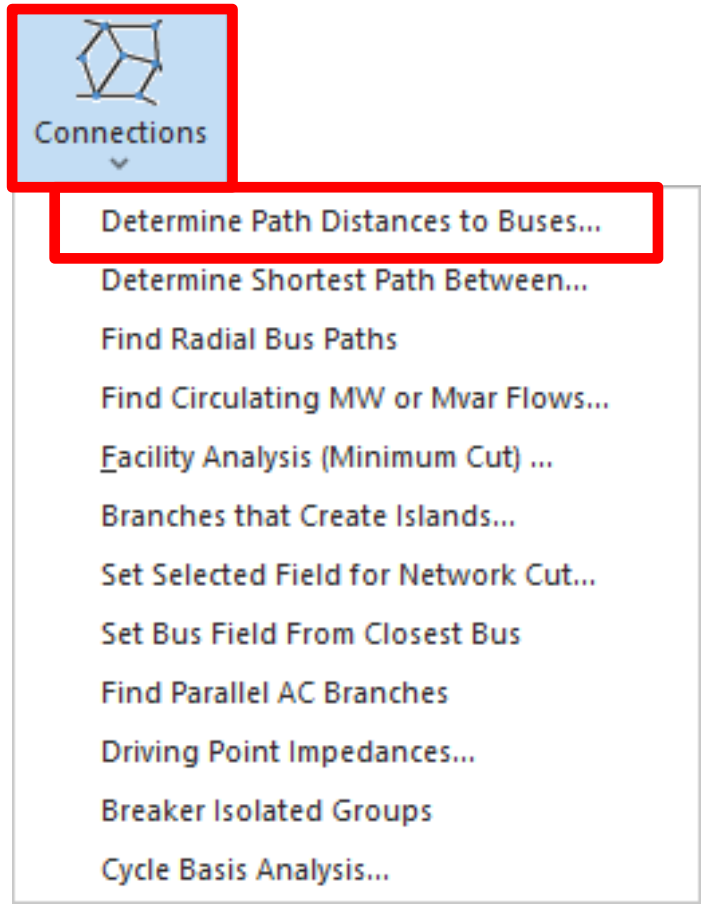
Determine Path Distances to Buses

- Choose a Start: Point A in this example
- Calculation will populate a field with the yellow numbers showing the summation of the distances for the shortest path between each point and the Start

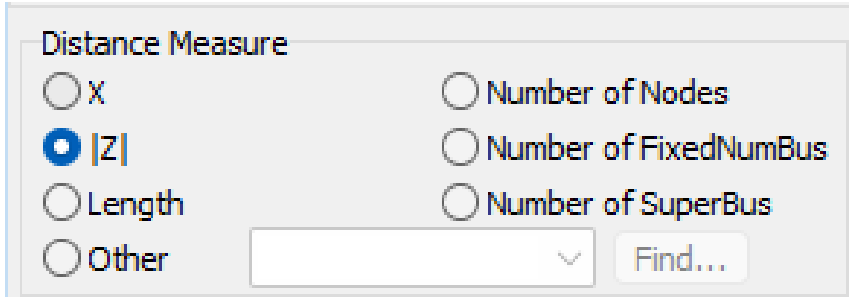


Connection Menu: Determine Path Distances to Buses





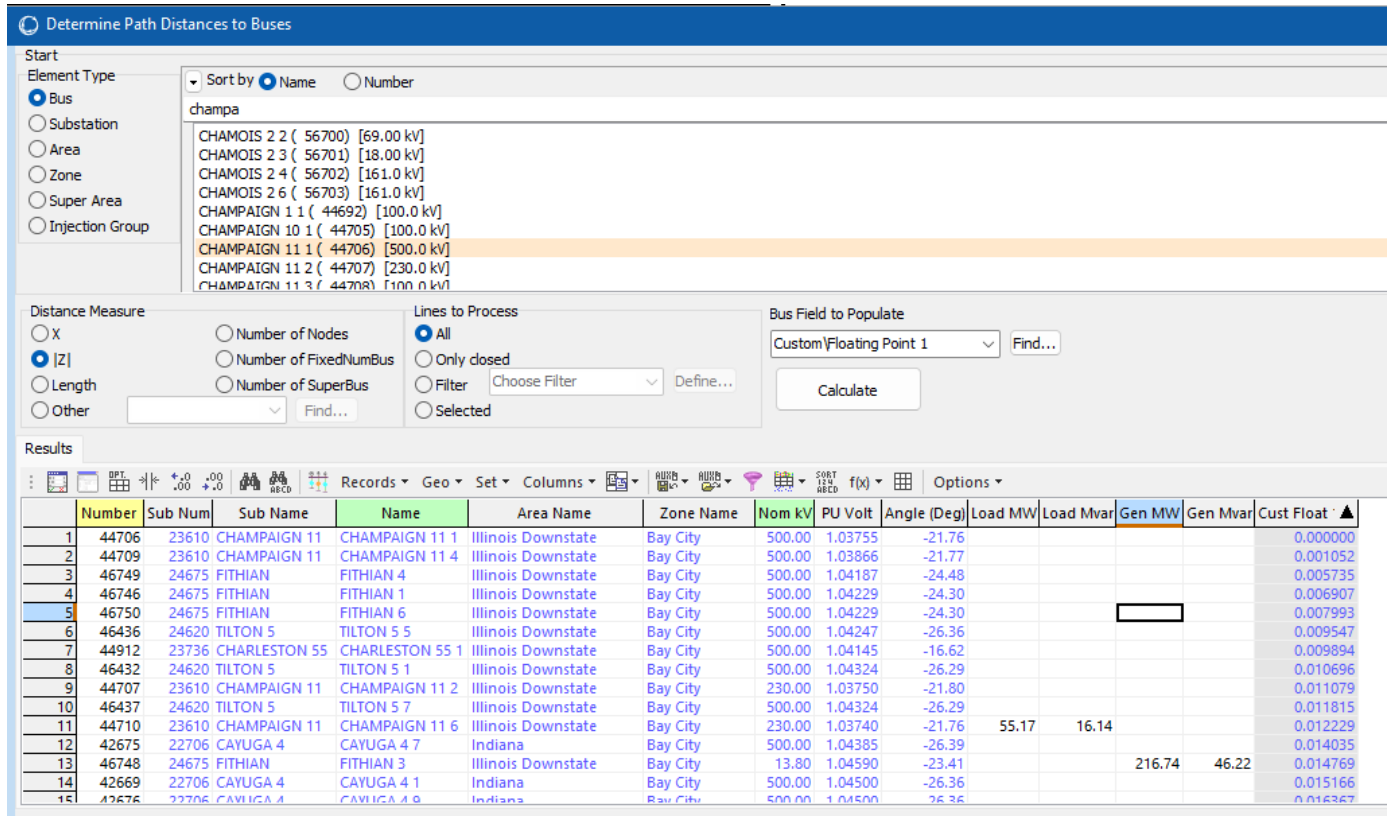
Distance Measure Choices (Reminder from earlier slide)



- **Distance Measure Choices**
  - **X** : use the series X impedance (some calculations require positive lengths)
  - **|Z|** : use the series Z impedance
  - **Length** : use the Branch object field Length (this is often not populated though)
  - **Other** : specify your own field to use (such as a custom integer or float)
  - **Number of Nodes** : every branch is assumed to have the same distance measure
  - **Number of FixedNumBus**
    - Branches between same FixedNumBus have a measurement of 0 and other branches are 1
  - **Number of SuperBus**
    - Branches between same SuperBus have a measurement of 0 and other branches are 1

Determine Path Distances to Buses

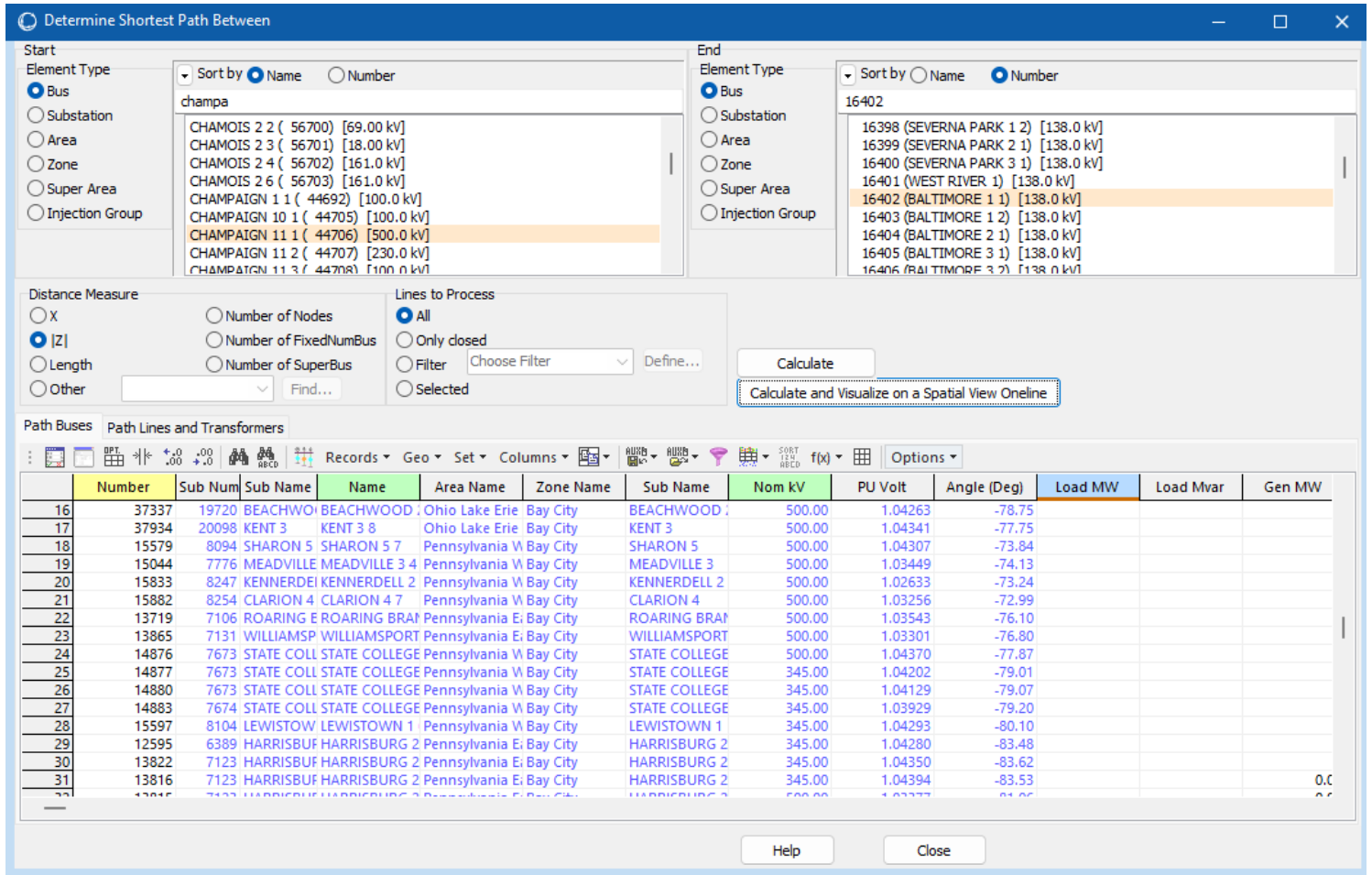
- Choose a Start Element: All buses in the Start have distance = 0.000
- Distance Measure
  - Specify the numeric value used for branch distance
- Lines to Process
  - Lines not meeting this selection will be ignored
  - (treated as infinite distance)
- Bus Field To Populate
  - Result of calculation will be placed in this field

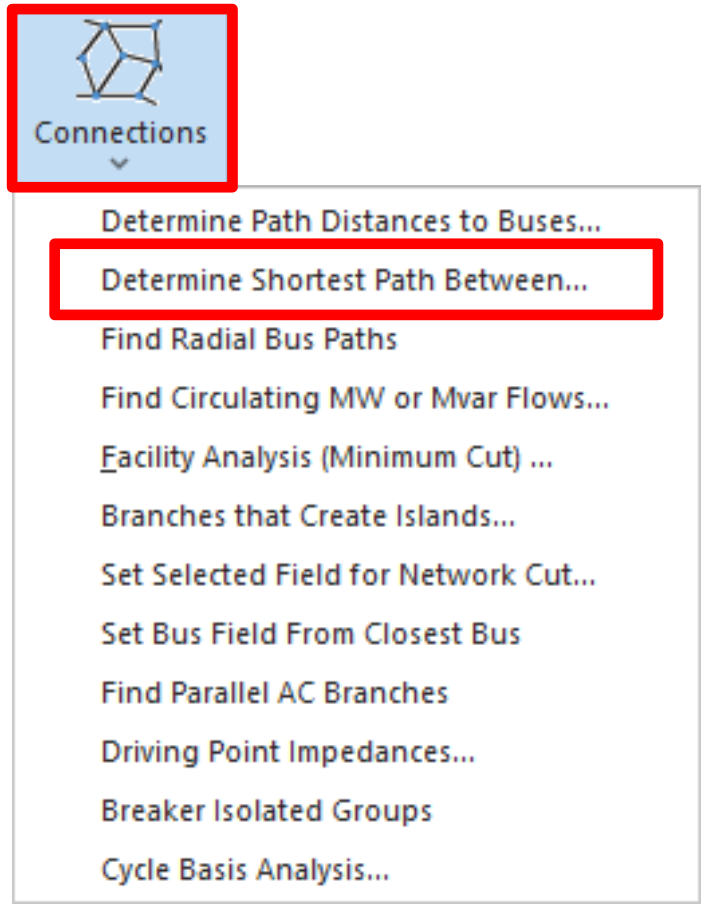


Uses of Determine Path Distances to Buses

- Generator Interconnection Study or a Large Load Integration Study
  - More detailed Limit Monitoring Settings
    - Toggle the Monitor (YES/NO) field for branches and buses that are nearby the point of interconnection or integration
  - Contingency Analysis
    - Auto-insertion of contingencies of branches that are nearby the new facility

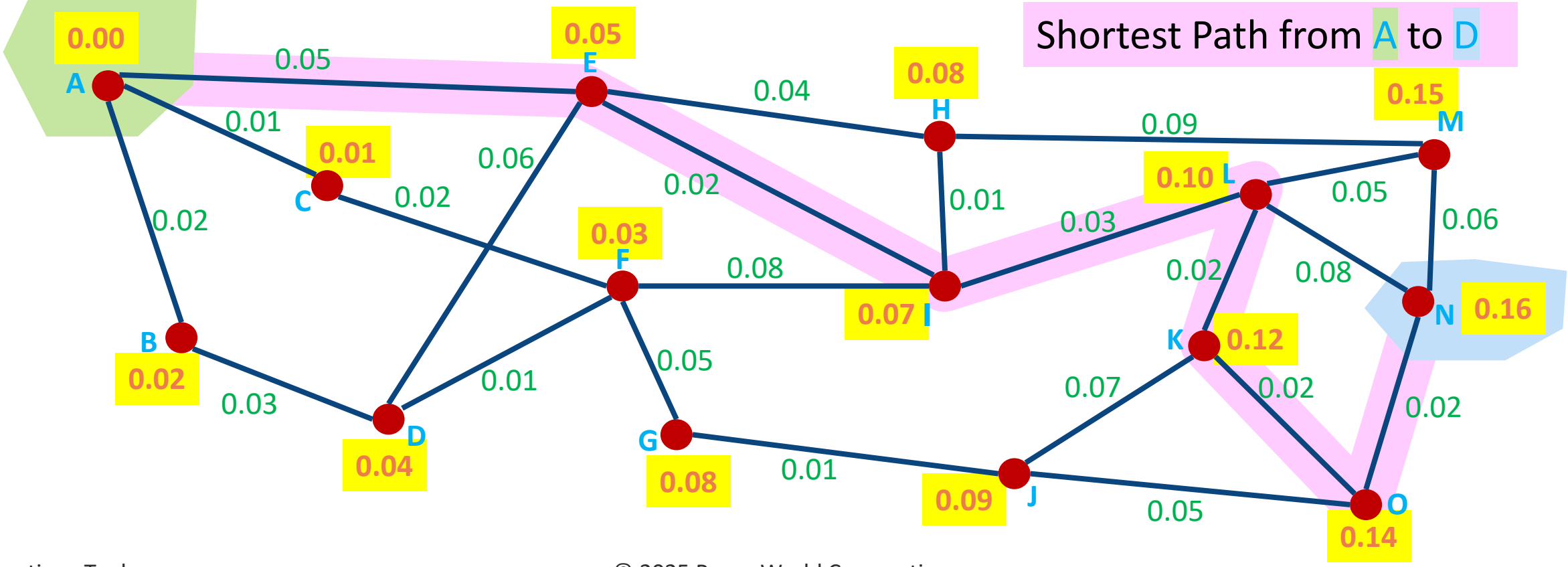
Connection Menu: Determine Shortest Path Between





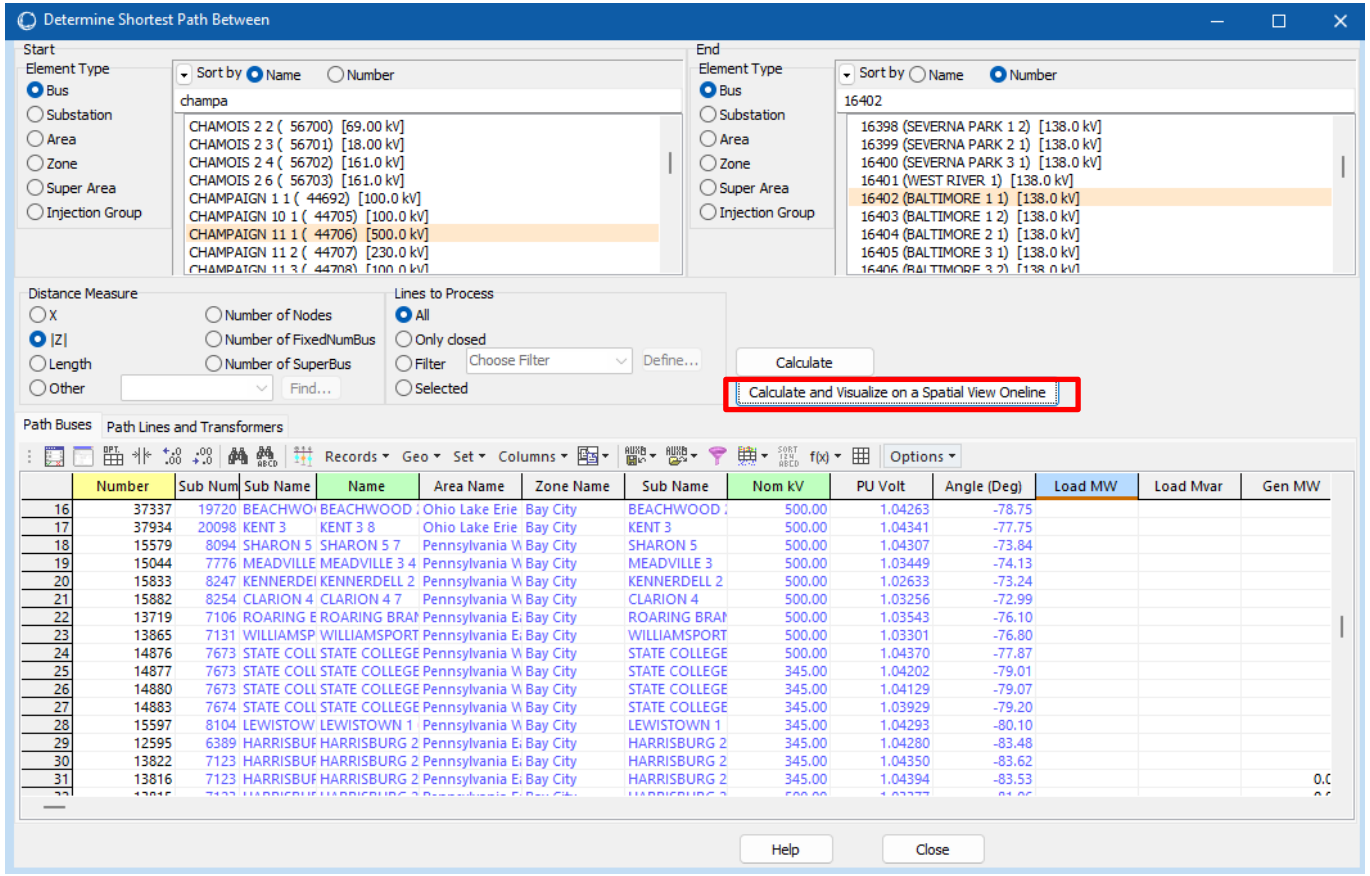
Related Calculation: Determine Shortest Path Between

- Example: Start= Point A and End = Point N
- Result will give you the path Buses and the Path Lines/Transformers

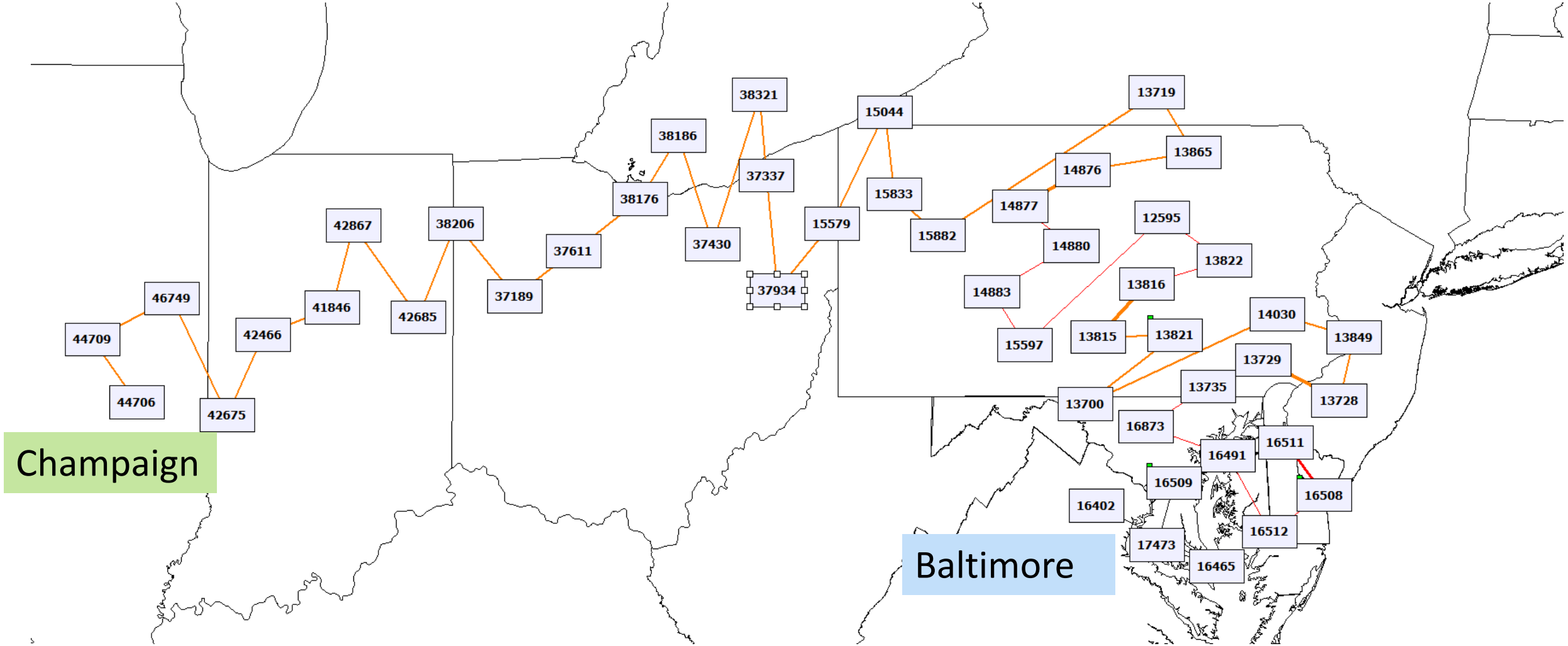


Related Calculation: Determine Shortest Path Between

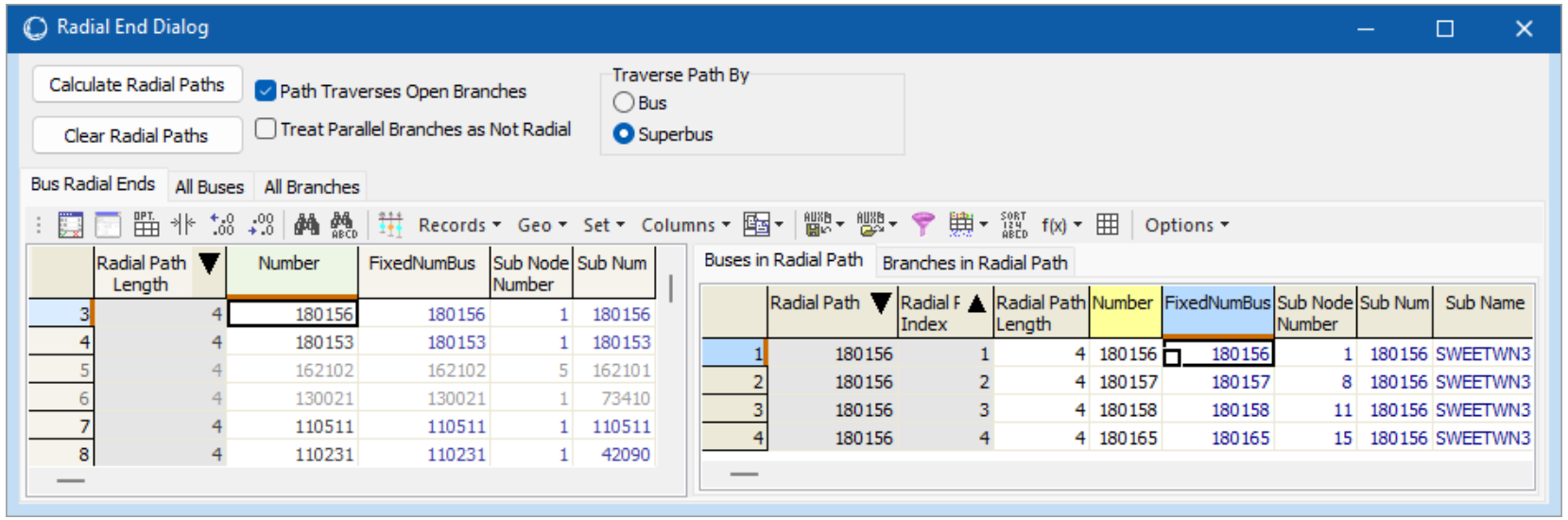
- Choose **Start** and **End**
- Choose **Distance Measure**
- Choose **Lines to Process**
- Result is two lists
  - Path Buses
  - Path Lines and Transformers
- If case has Geography **Calculate and Visualize on a Spatial View Oneline**

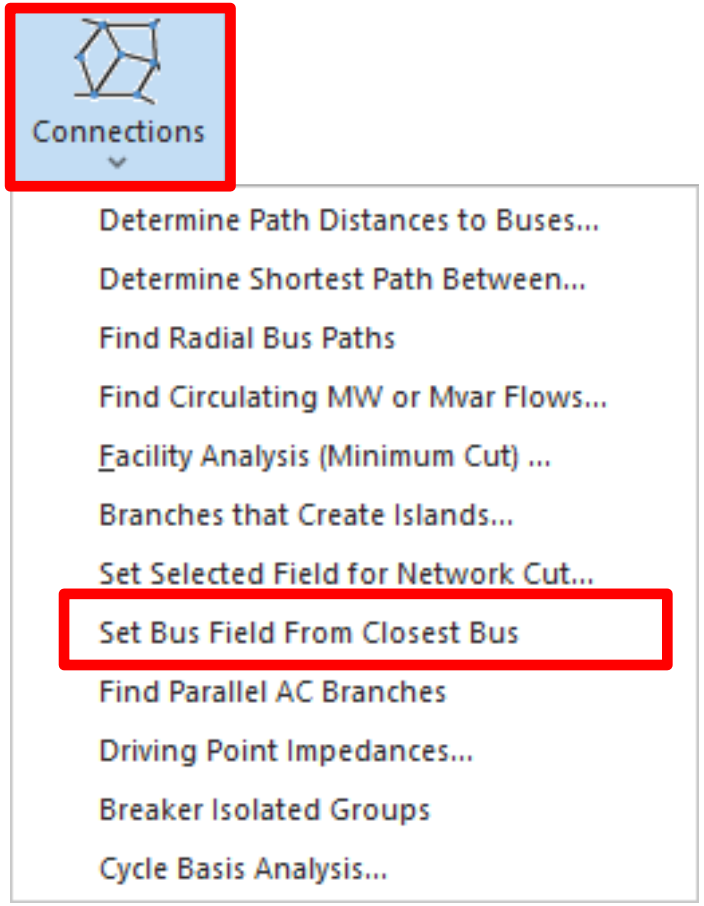


Visualize on a Spatial View Oneline



New Connection Tool: Set Bus Field From Closest Bust

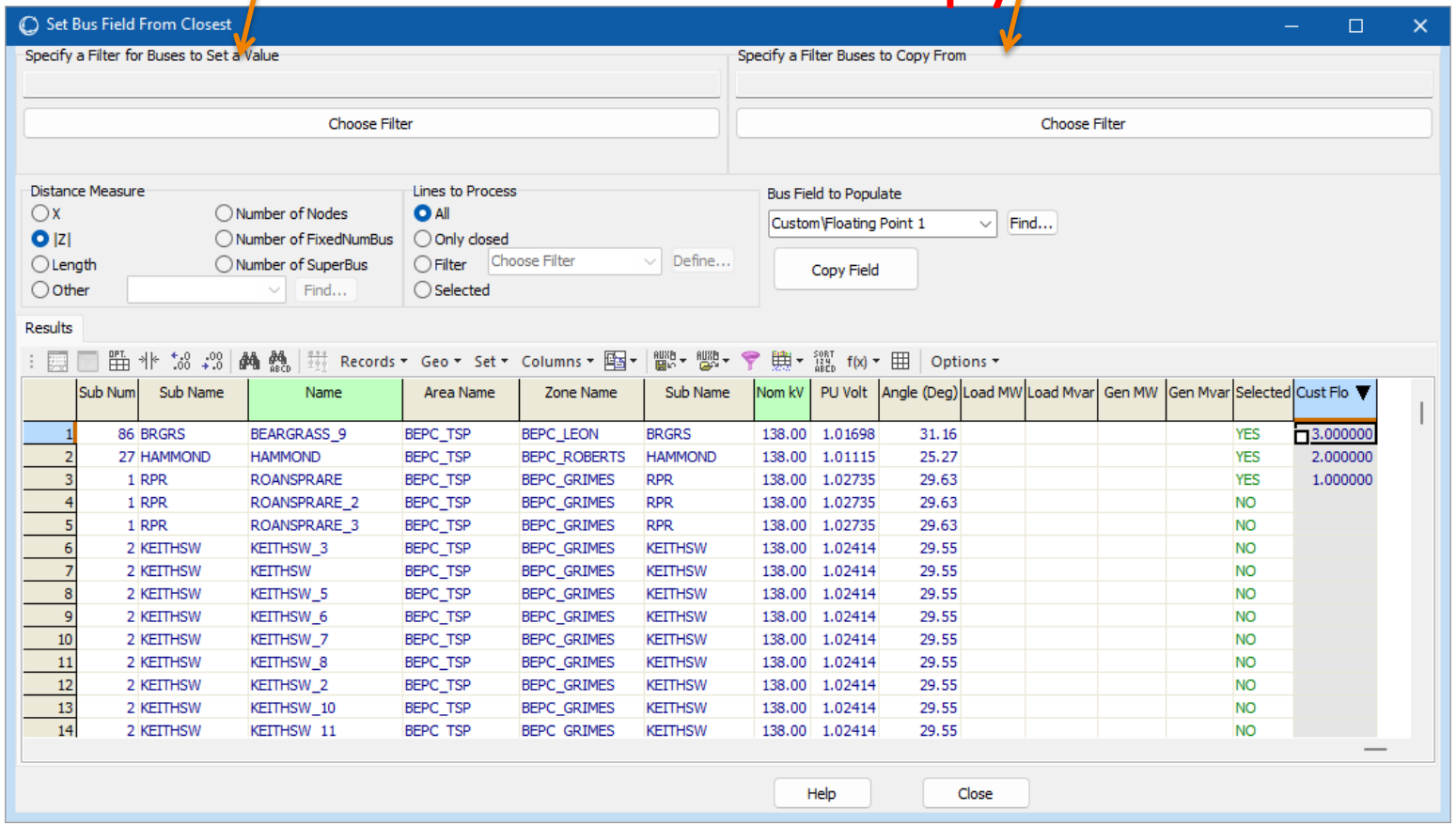




New Connection Tool: Set Bus Field from Closest Bus

Choose Buses to "Set To"

Choose Buses to "Copy From"

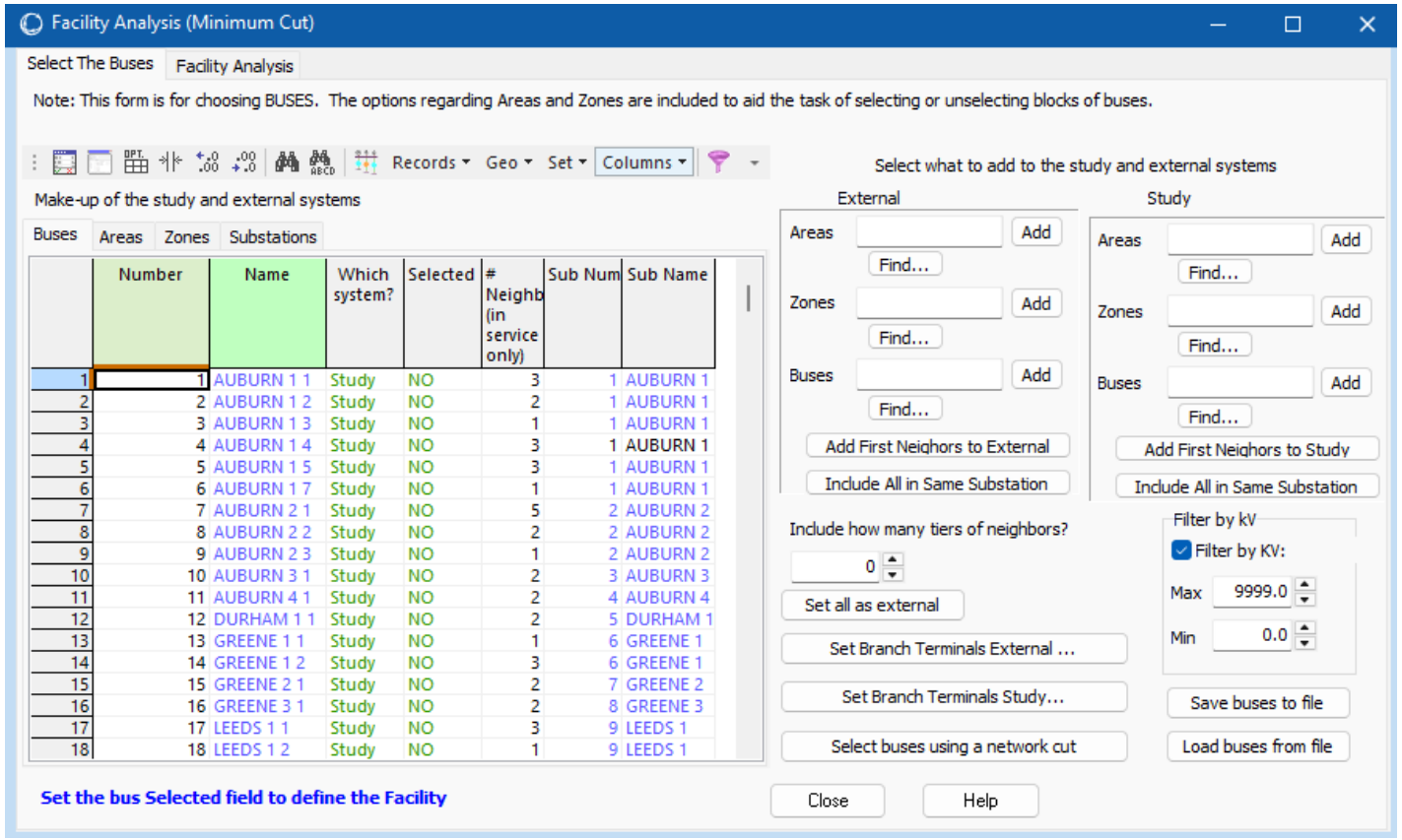


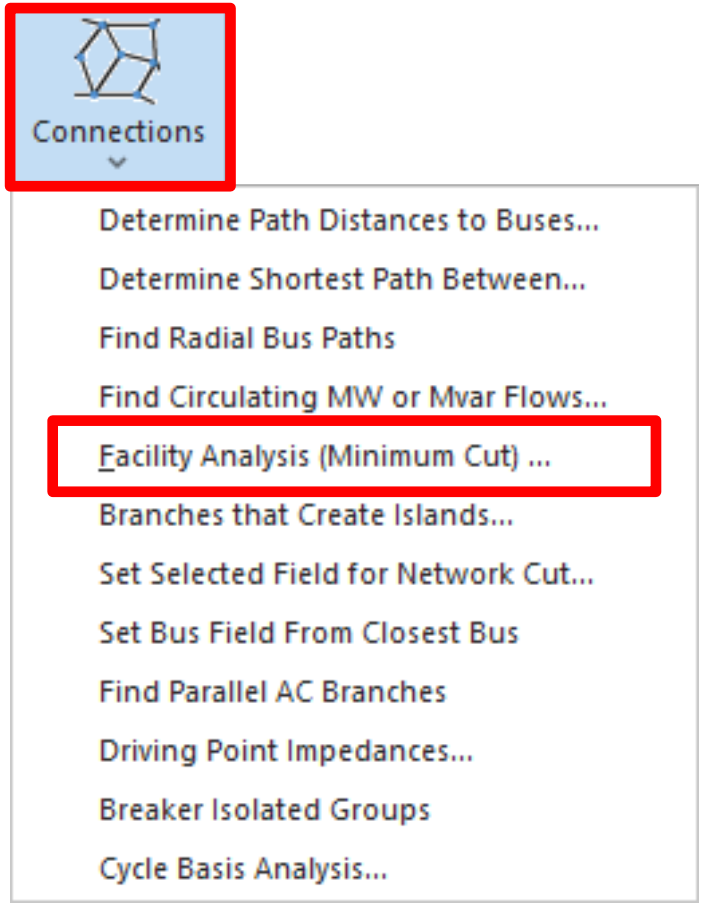
Script command For SetBusFieldFromClosest

- SetBusFieldFromClosest(variablename, BusFilterSetTo, BusFilterFromThese, BranchFilterTraverse, BranchDistMeas);
  - VariableName: specified which field to copy between Bus objects
  - BusFilterTo: name of Filter specified buses to “Copy To”
  - BusFilterFromThese: name of filter of bus from which to copy
  - BranchFilterTranverse: specify which branches to traverse in the search
  - BranchDistMeas: X, Z, Length, Nodes, FixedNumBus, SuperBus, or Variablename (set how to measure distance)

```
SetBusFieldFromClosest(SubNumber,"SubNumber IsBlank","SubNumber NotIsBlank",All,Z);
```

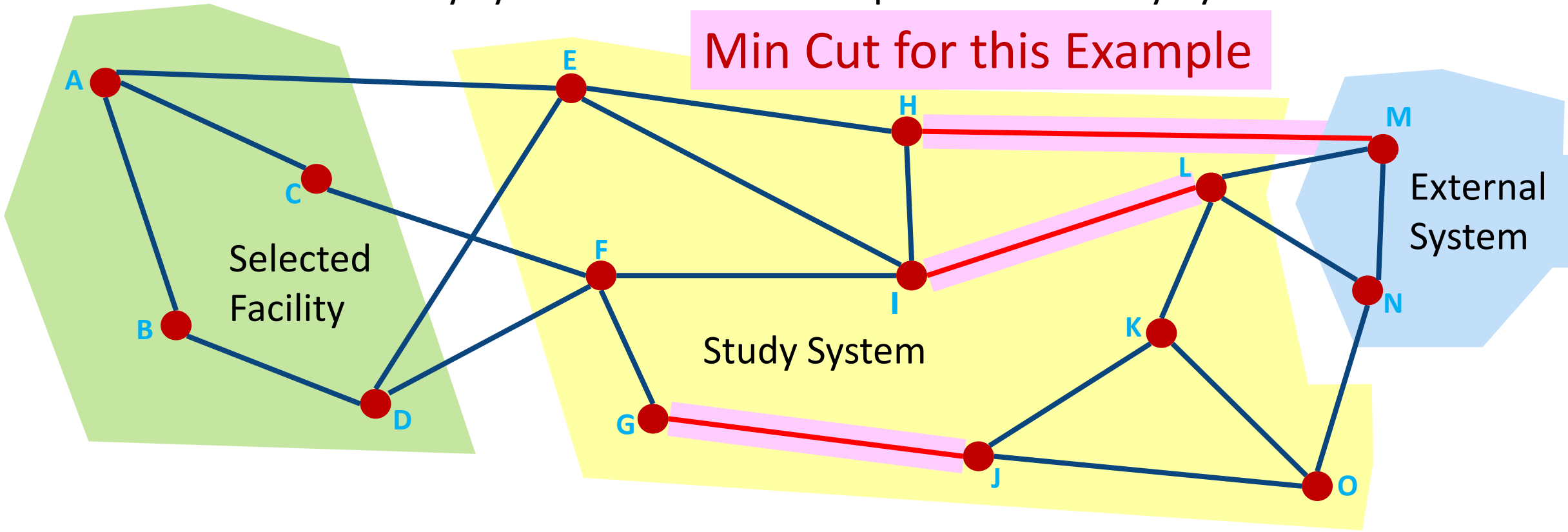
Connection Menu: Facility Analysis (Minimum Cut)





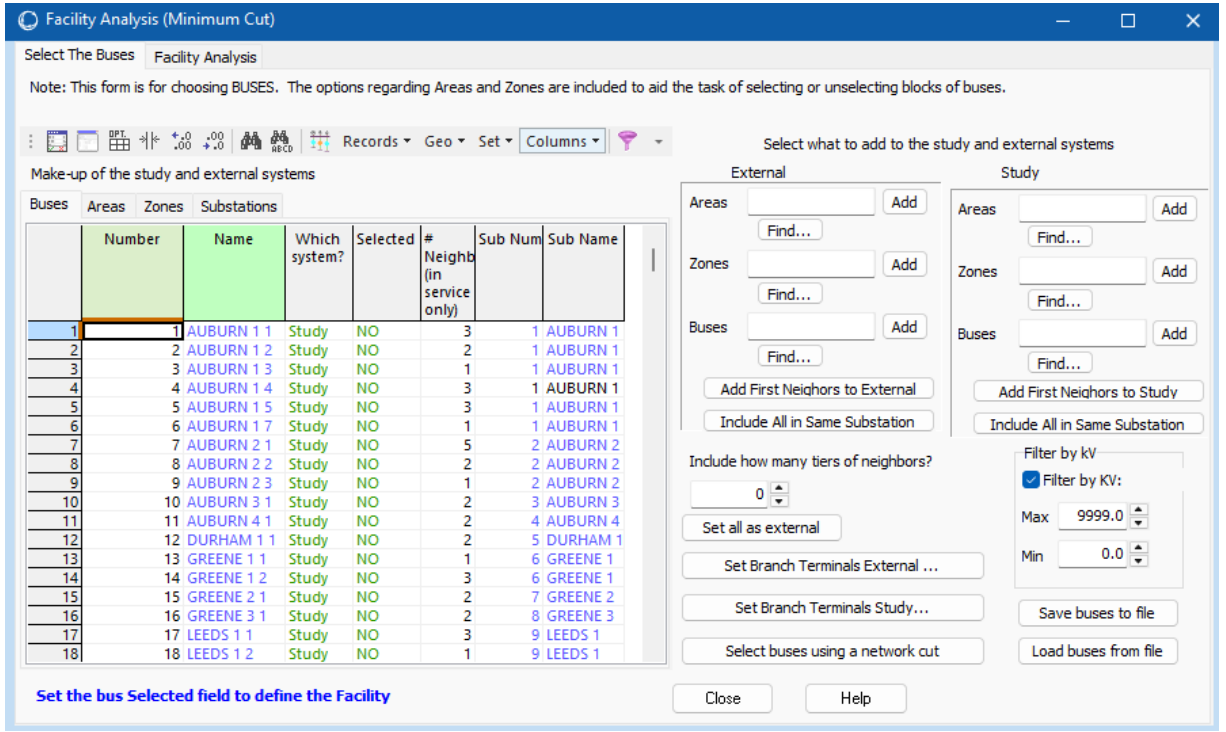
Facility Analysis (Minimum Cut)

- Find the minimum number of branches in the Study System that when removed will disconnect the Selected Facility from the External System
- Note: Tie-lines to Study system are considered part of the Study System



Facility Analysis (Minimum Cut) Dialog

- Specify Buses in the Facility
  - Selected = YES
- Specify Buses in External System
  - Which System?
  - Equiv = External
- Study System is then Buses with
  - (Selected = NO)
    AND
    (Equiv = Study)
- Dialog is built on top of the old Equivalencing dialog



Facility Analysis (Minimum Cut) Dialog: Example on Conus82.pwb

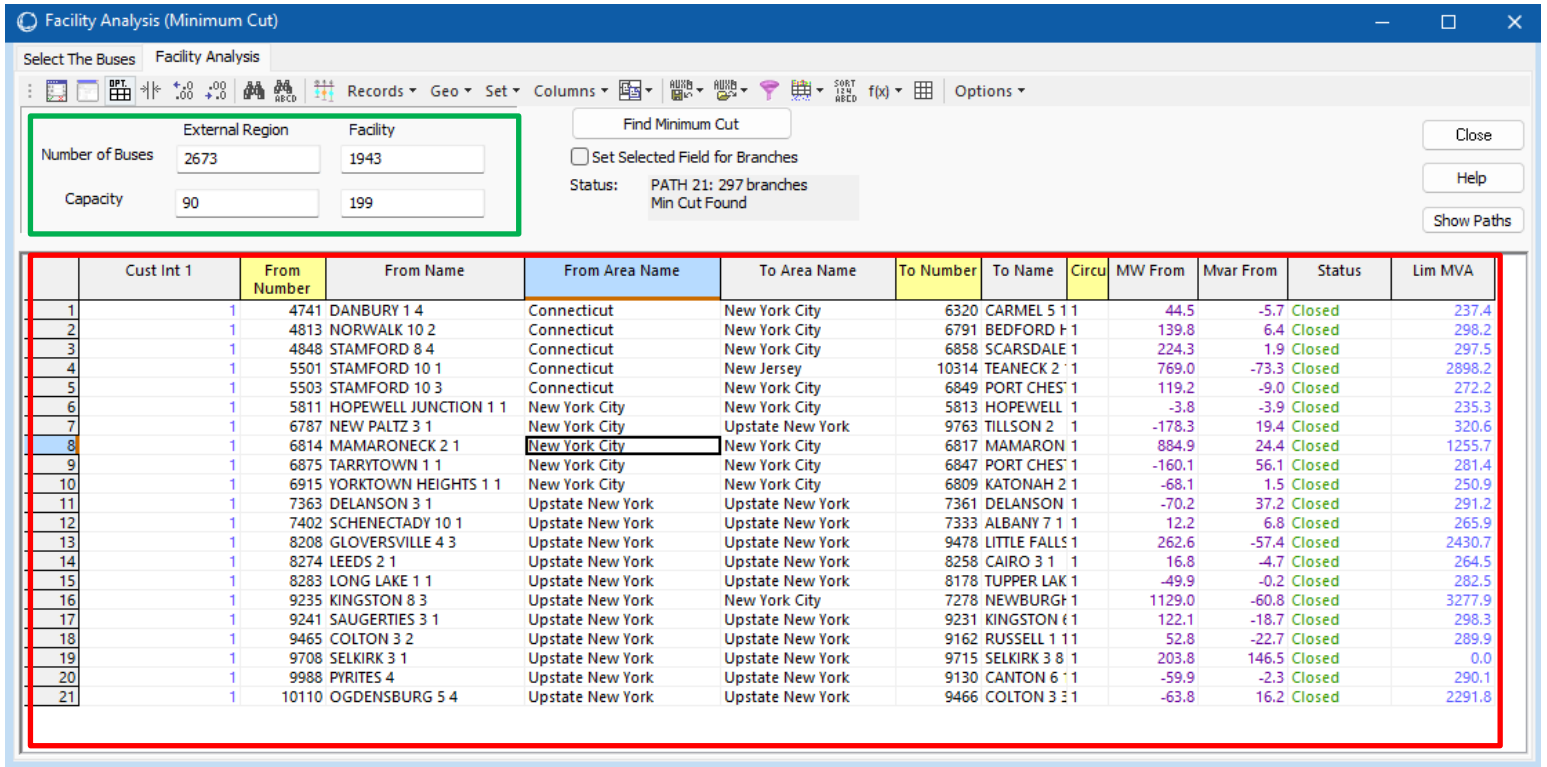
- Selected = YES: Define the Facility
  - Areas 33 (Indiana)
- Which System = External : Define the part of the system you would like the facility to be disconnected from
  - Areas 1, 2, 3 (Maine, New Hampshire, Vermont)
- Facility Analysis
  - Go to this tab to do the Minimum Cut Calculation

Facility Analysis (Minimum Cut) Dialog: Example on Conus82.pwb

- Shows the Number of Buses in the External and Facility
- Capacity = Count of branches connecting each to the study system

List of Branches representing the minimum cut

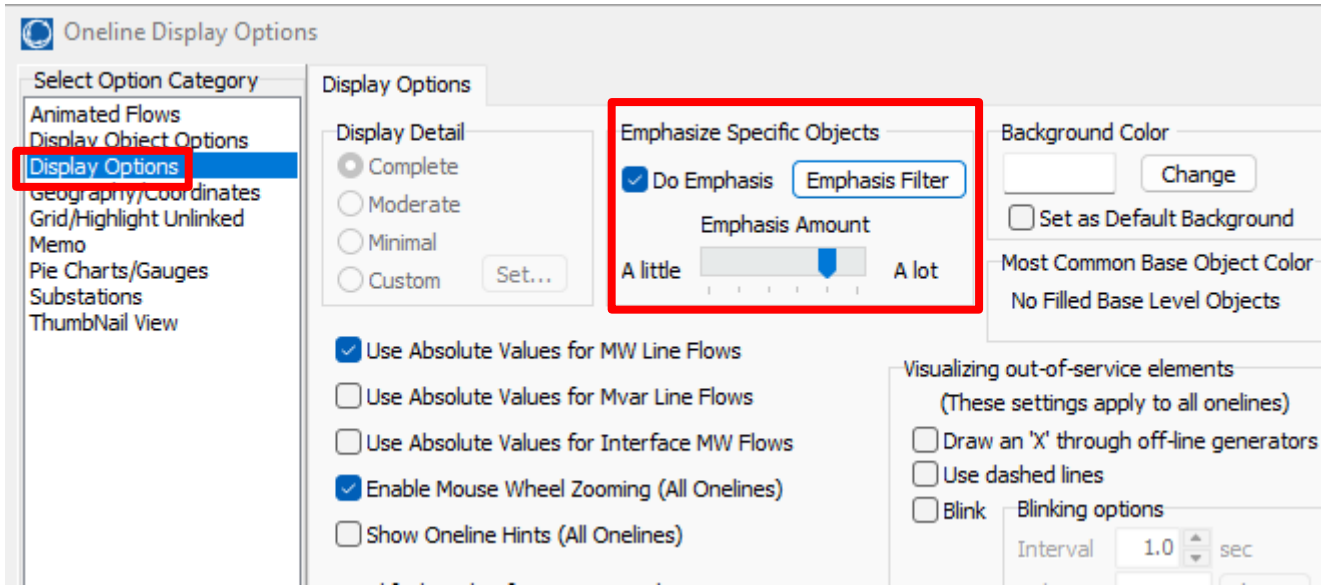
(Added Custom Integer column to populate with a 1)

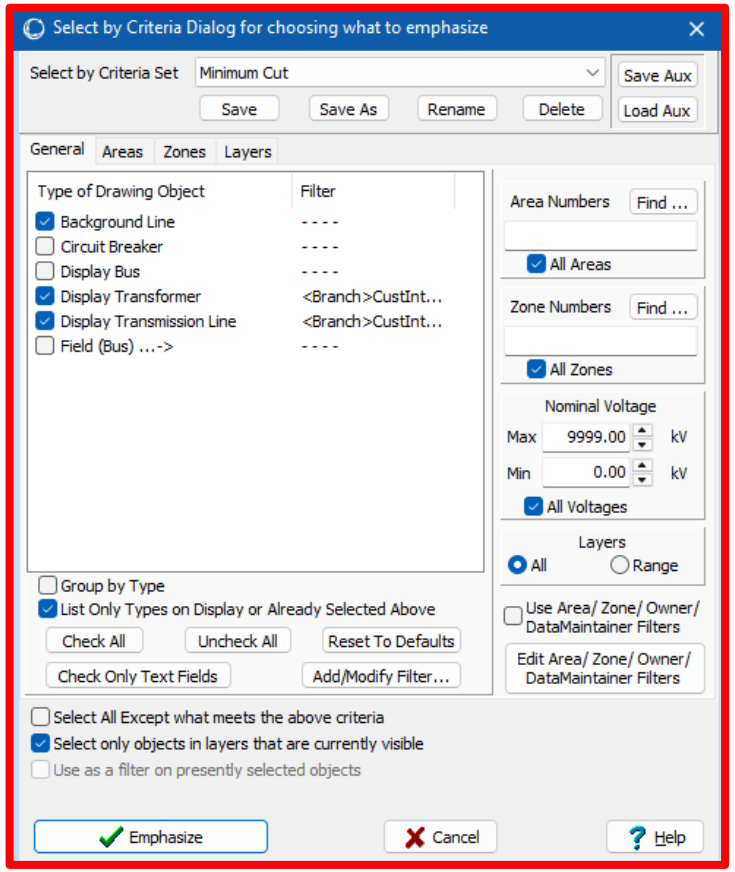


	Cust Int 1	From Number	From Name	From Area Name	To Area Name	To Number	To Name	Circu	MW From	Mvar From	Status	Lim MVA
1	1	4741	DANBURY 1 4	Connecticut	New York City	6320	CARMEL 5 1	1	44.5	-5.7	Closed	237.4
2	1	4813	NORWALK 10 2	Connecticut	New York City	6791	BEDFORD H	1	139.8	6.4	Closed	298.2
3	1	4848	STAMFORD 8 4	Connecticut	New York City	6858	SCARSDALE	1	224.3	1.9	Closed	297.5
4	1	5501	STAMFORD 10 1	Connecticut	New Jersey	10314	TEANECK 2	1	769.0	-73.3	Closed	2898.2
5	1	5503	STAMFORD 10 3	Connecticut	New York City	6849	PORT CHES	1	119.2	-9.0	Closed	272.2
6	1	5811	HOPEWELL JUNCTION 1 1	New York City	New York City	5813	HOPEWELL	1	-3.8	-3.9	Closed	235.3
7	1	6787	NEW PALTZ 3 1	New York City	Upstate New York	9763	TILLSON 2	1	-178.3	19.4	Closed	320.6
8	1	6814	MAMARONECK 2 1	New York City	New York City	6817	MAMARON	1	884.9	24.4	Closed	1255.7
9	1	6875	TARRYTOWN 1 1	New York City	New York City	6847	PORT CHES	1	-160.1	56.1	Closed	281.4
10	1	6915	YORKTOWN HEIGHTS 1 1	New York City	New York City	6809	KATONAH 2	1	-68.1	1.5	Closed	250.9
11	1	7363	DELANSON 3 1	Upstate New York	Upstate New York	7361	DELANSON	1	-70.2	37.2	Closed	291.2
12	1	7402	SCHENECTADY 10 1	Upstate New York	Upstate New York	7333	ALBANY 7 1	1	12.2	6.8	Closed	265.9
13	1	8208	GLOVERSVILLE 4 3	Upstate New York	Upstate New York	9478	LITTLE FALLS	1	262.6	-57.4	Closed	2430.7
14	1	8274	LEEDS 2 1	Upstate New York	Upstate New York	8258	CAIRO 3 1	1	16.8	-4.7	Closed	264.5
15	1	8283	LONG LAKE 1 1	Upstate New York	Upstate New York	8178	TUPPER LAK	1	-49.9	-0.2	Closed	282.5
16	1	9235	KINGSTON 8 3	Upstate New York	New York City	7278	NEWBURGH	1	1129.0	-60.8	Closed	3277.9
17	1	9241	SAUGERTIES 3 1	Upstate New York	Upstate New York	9231	KINGSTON (	1	122.1	-18.7	Closed	298.3
18	1	9465	COLTON 3 2	Upstate New York	Upstate New York	9162	RUSSELL 1	1	52.8	-22.7	Closed	289.9
19	1	9708	SELKIRK 3 1	Upstate New York	Upstate New York	9715	SELKIRK 3 8	1	203.8	146.5	Closed	0.0
20	1	9988	PYRITES 4	Upstate New York	Upstate New York	9130	CANTON 6	1	-59.9	-2.3	Closed	290.1
21	1	10110	OGDENSBURG 5 4	Upstate New York	Upstate New York	9466	COLTON 3 3	1	-63.8	16.2	Closed	2291.8

Visualization of Minimum Cut

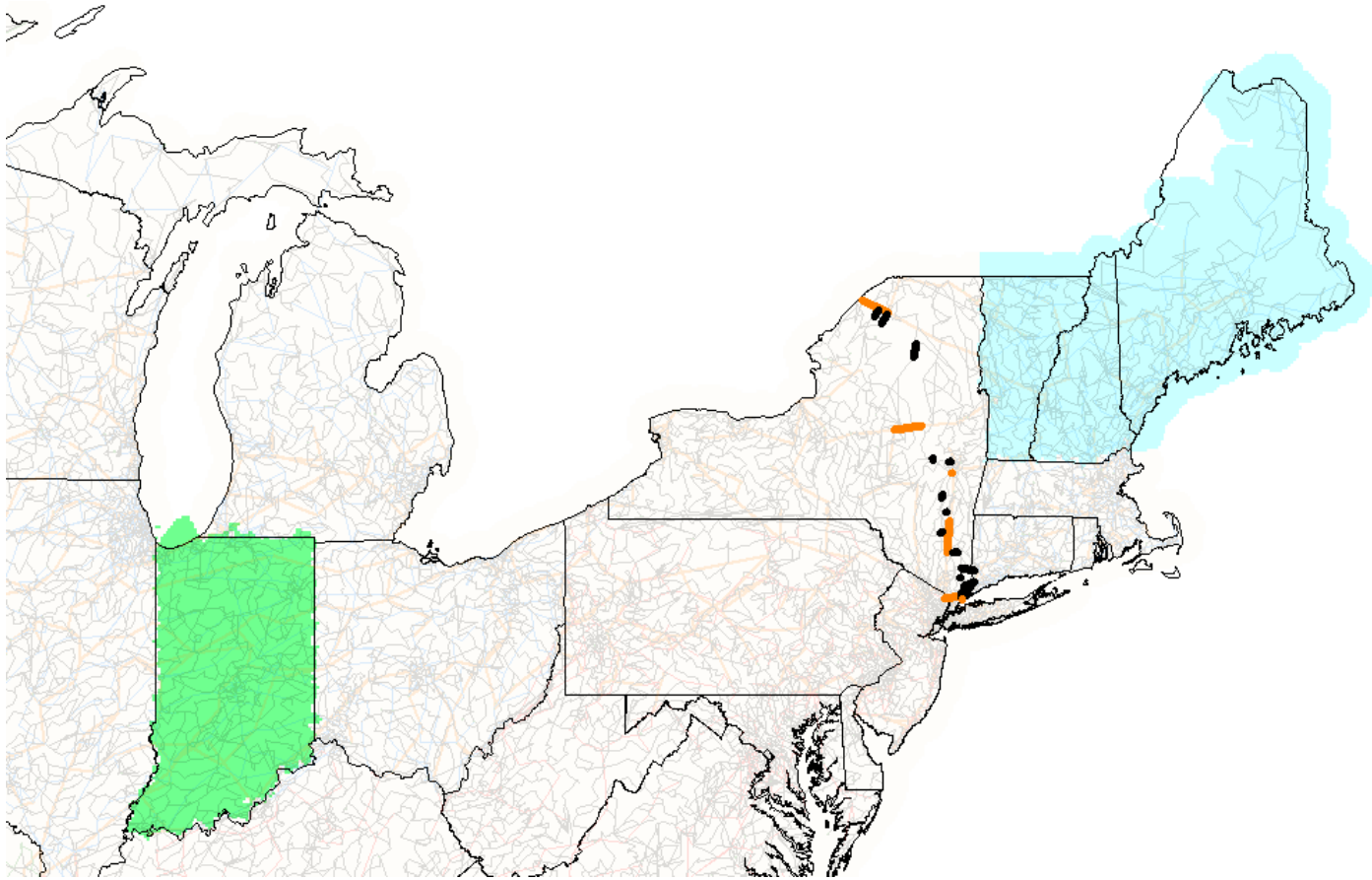
- Change the Custom Integer for each branch in the minimum Cust to 1 (shown on previous slide)
- Use Emphasis Filter in Oneline Options



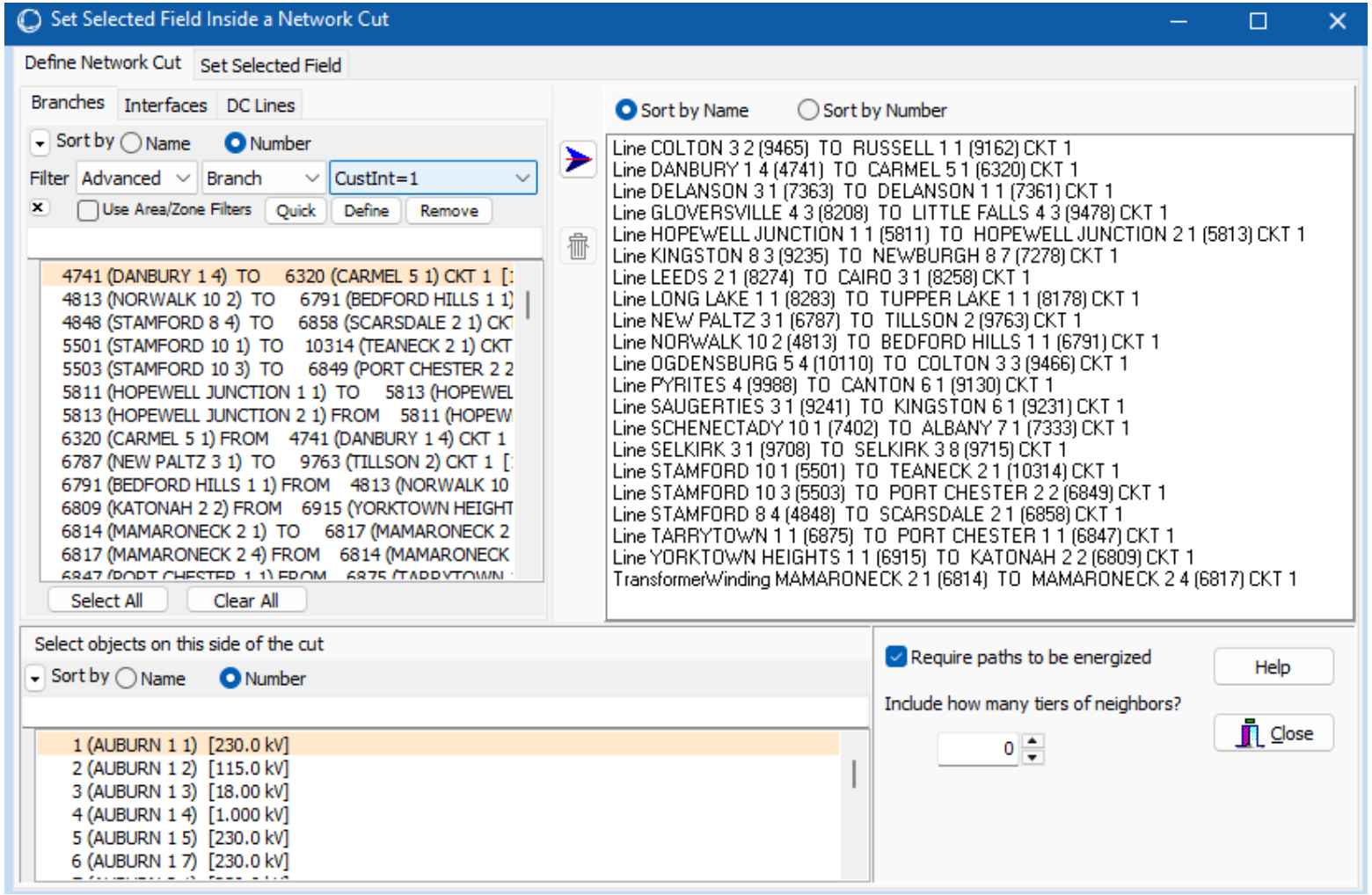


Visualization of Minimum Cut

- Also use Select By Criteria to Select Branch ins the cut
- Format to make line have large thickness so we can see them
- Use Contouring to highlight area 1-3 in Blue and Area 33 in Green

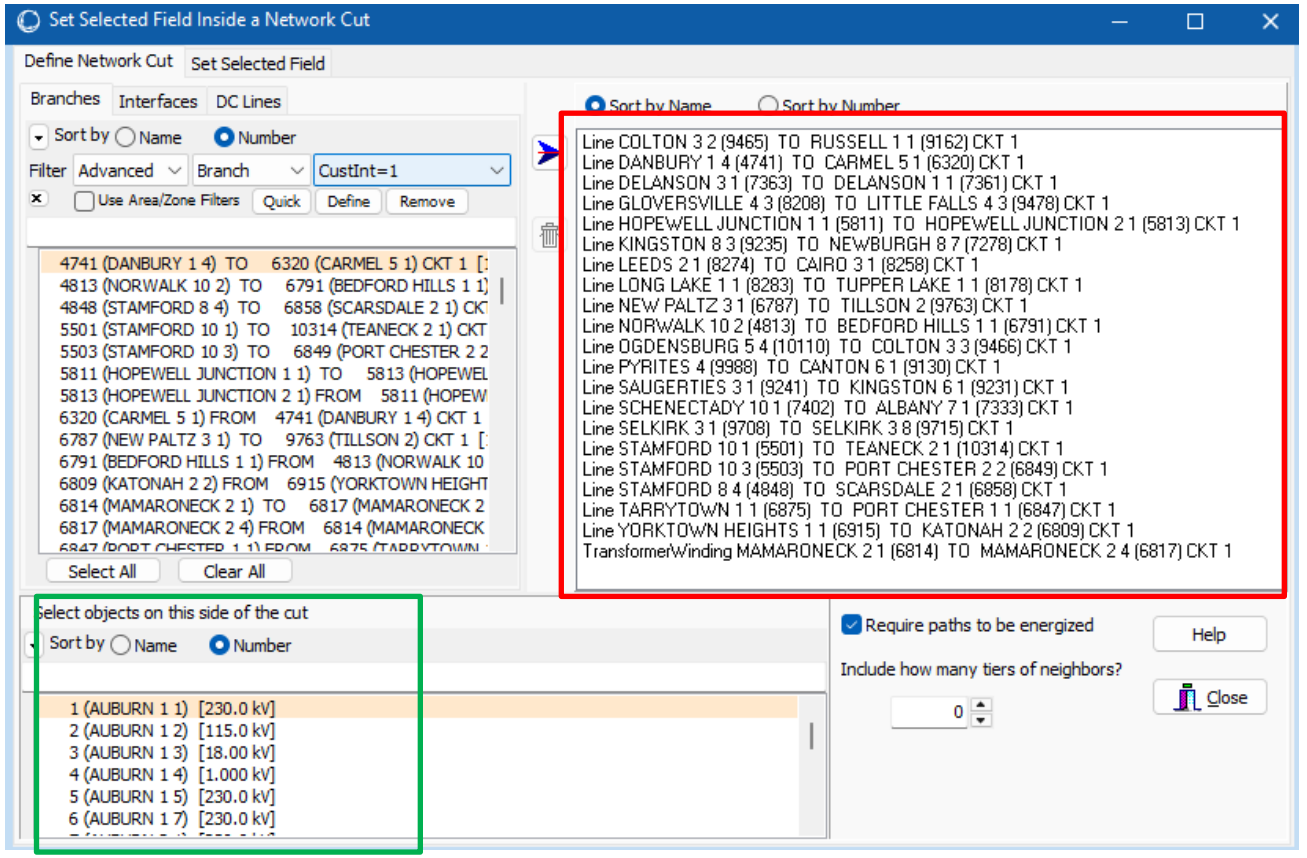


Connections Menu: Set Selected Field for Network Cut



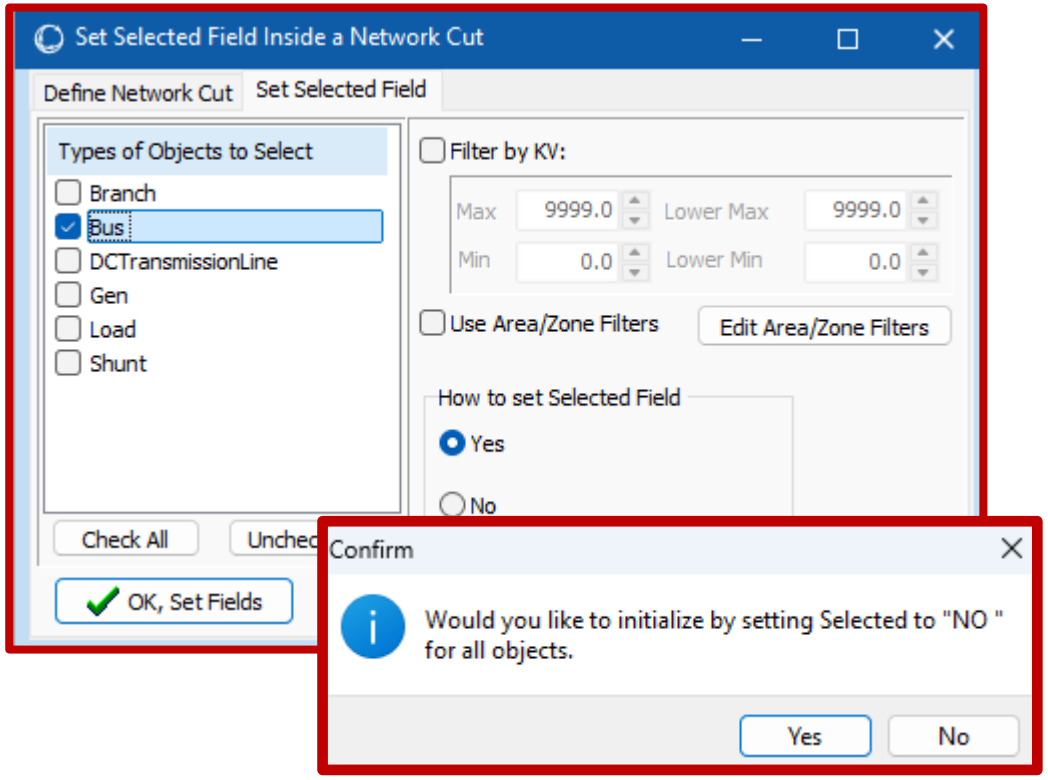
Set Selected For Network Cut: Define Network Cut

- Assumes you know what the network cut is ahead of time
- Input to tool
  - Specify the list of branches and interfaces that will cut the system into two parts
  - Specify a bus on the inside of the cut.
  - Then go to Set Selected Field tab

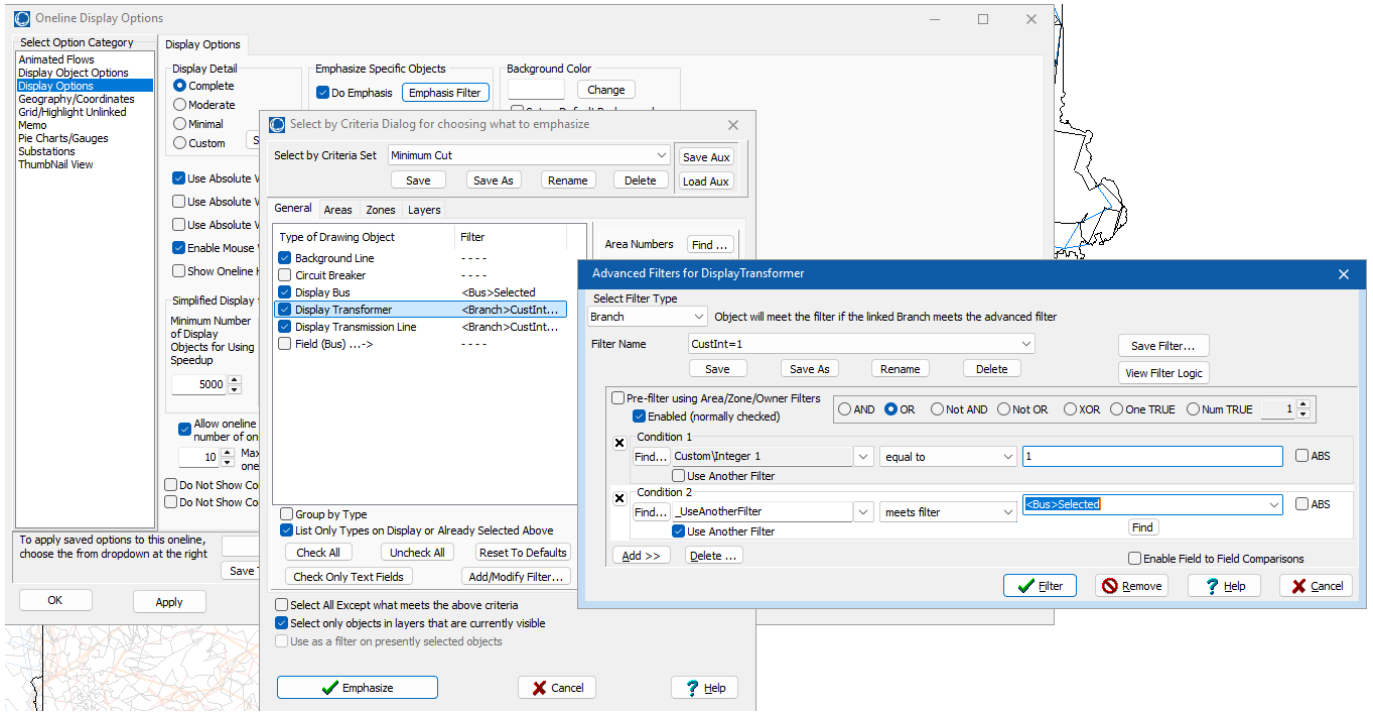


Most support questions on this tool are because a complete network cut has not actually been specified. Make sure it really is a cut

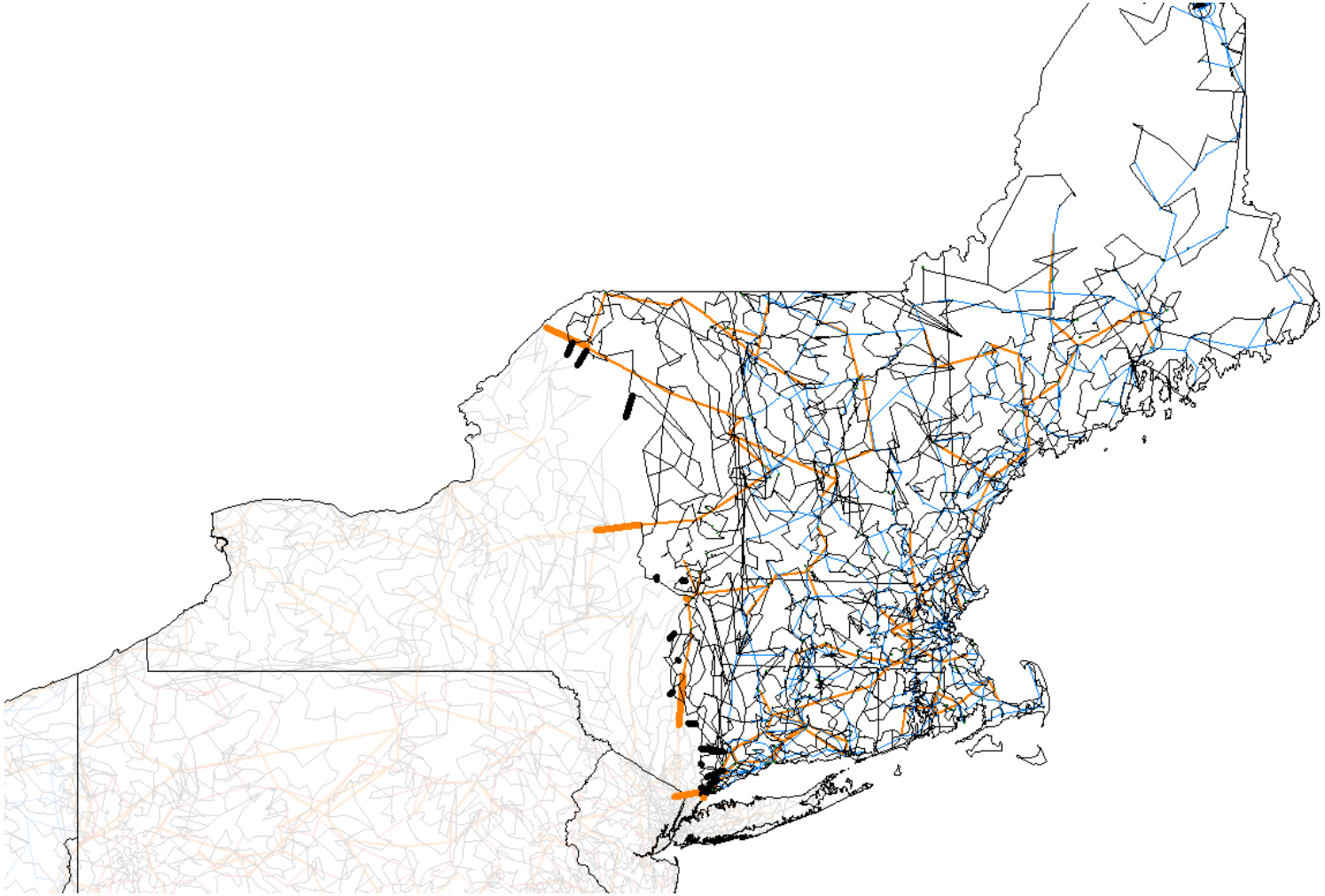
Set Selected For Network Cut: Define Network Cut



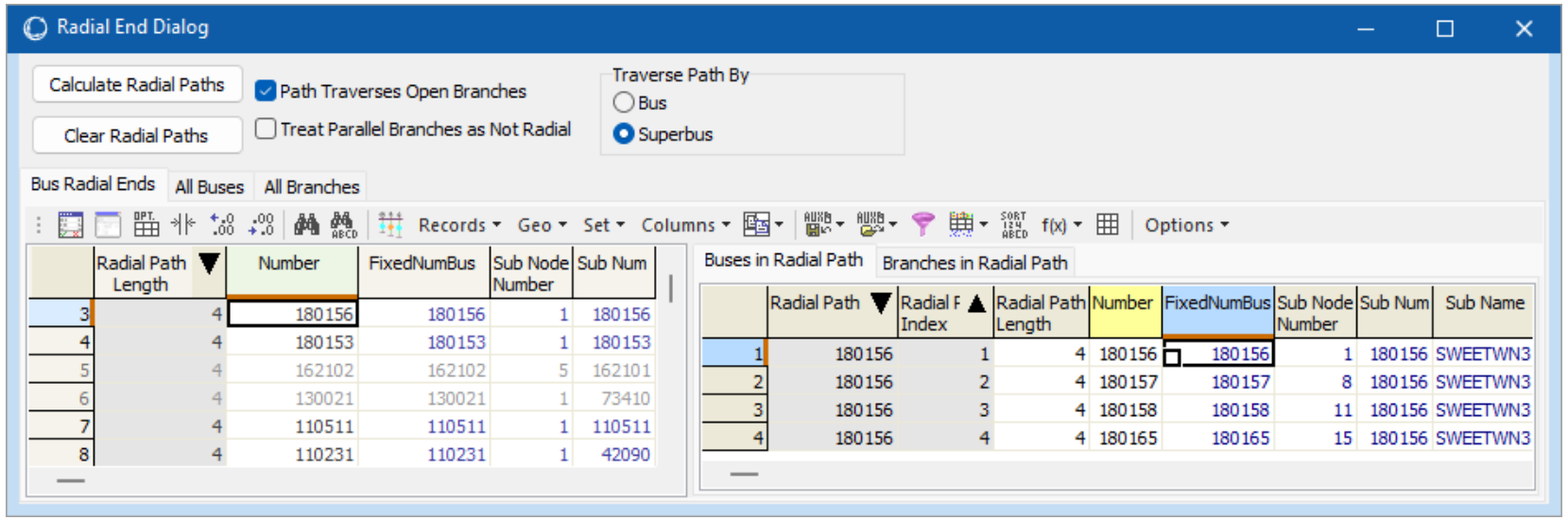
- Modify Emphasis Filter to emphasize branches that are Selected also)

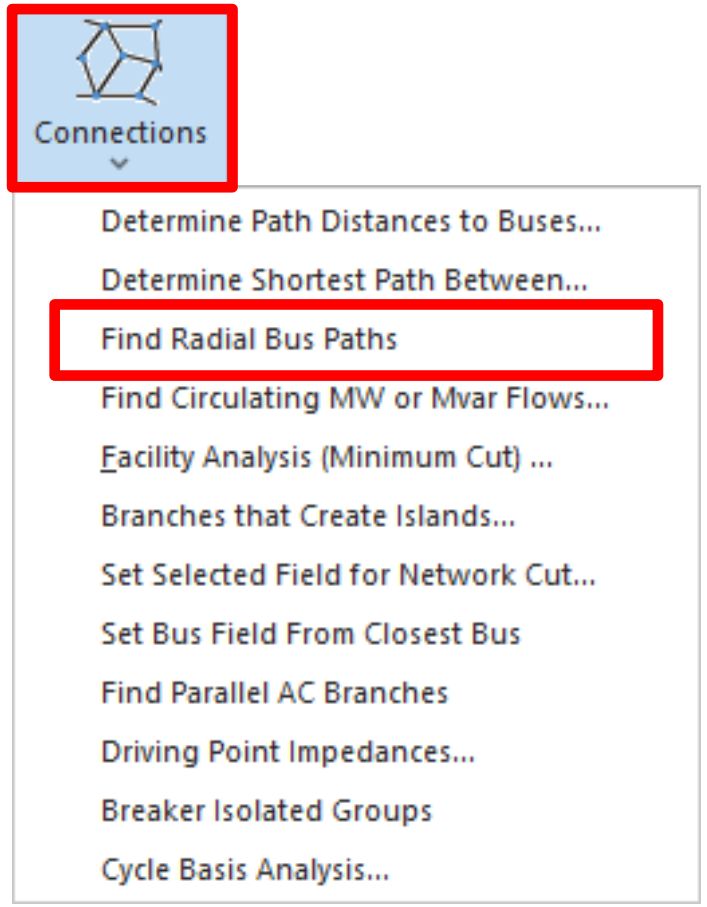


Visualization of the portion of the system that is cut by the Minimum Cut



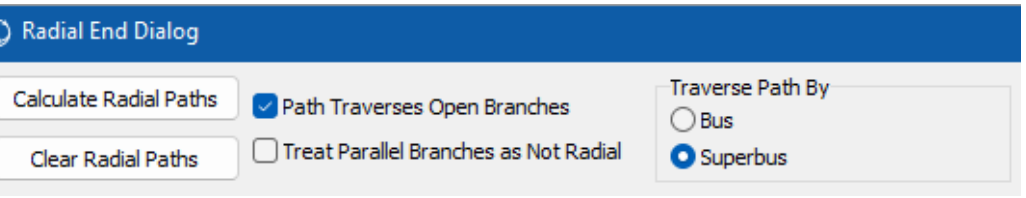
New Connection Tool: Find Radial Bus Paths

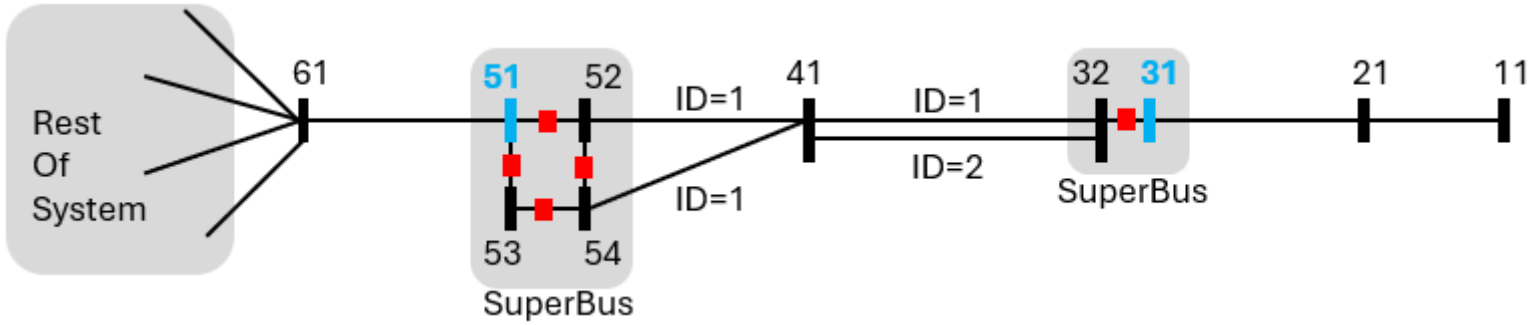




New Connection Tool: Find Radial Bus Paths

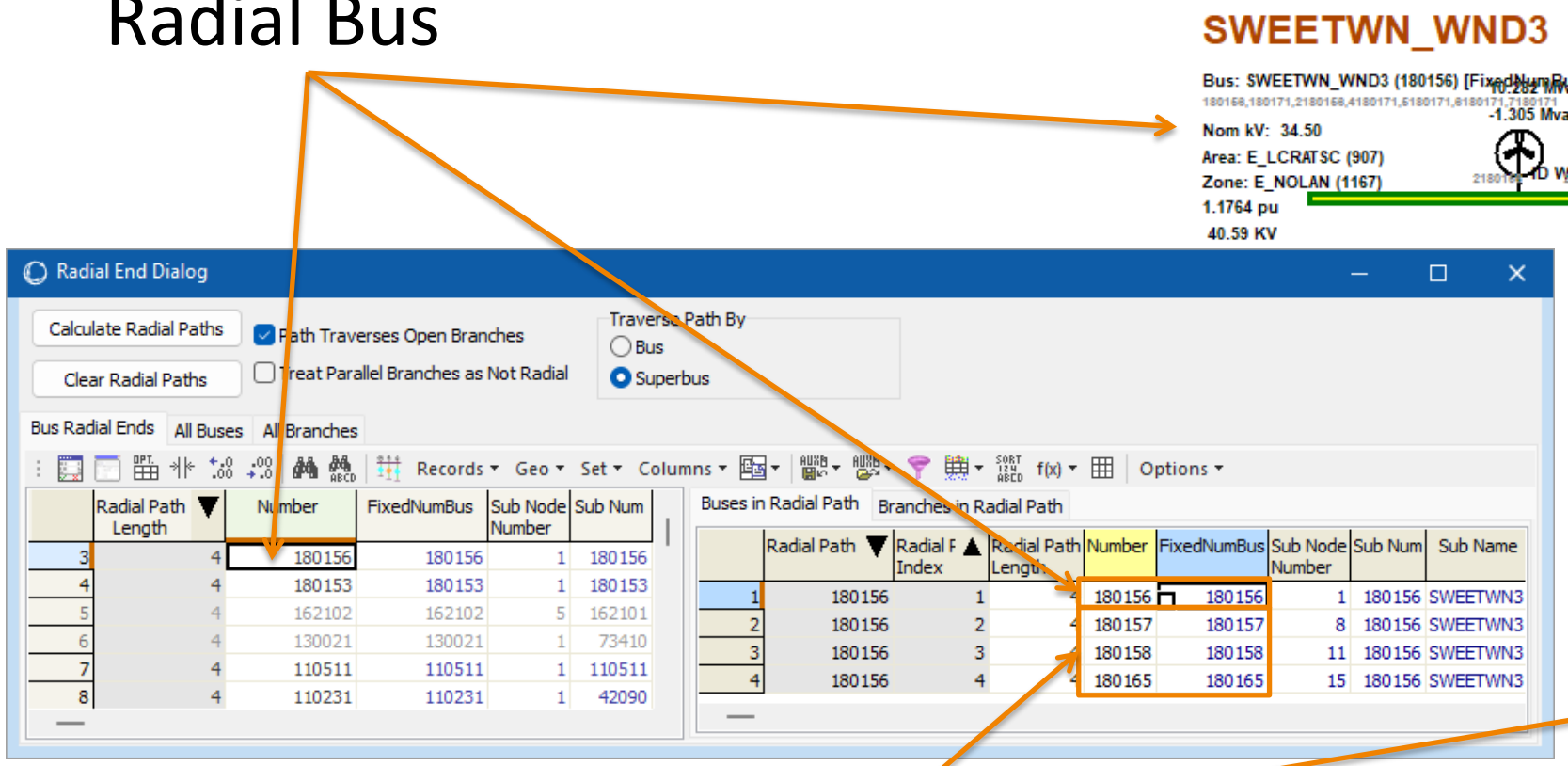
- Options
  - Traverse Open Branches
  - Treat directly parallel branches as Not Radial
  - Traverse path by Bus or SuperBus
- Identifies groups of buses that form radial paths and the branches that connect them
- In this example, grouped by Superbus, Superbus 11 is the radial bus, and 11, 21, 31, 41, 51, and 61 lie on the radial path

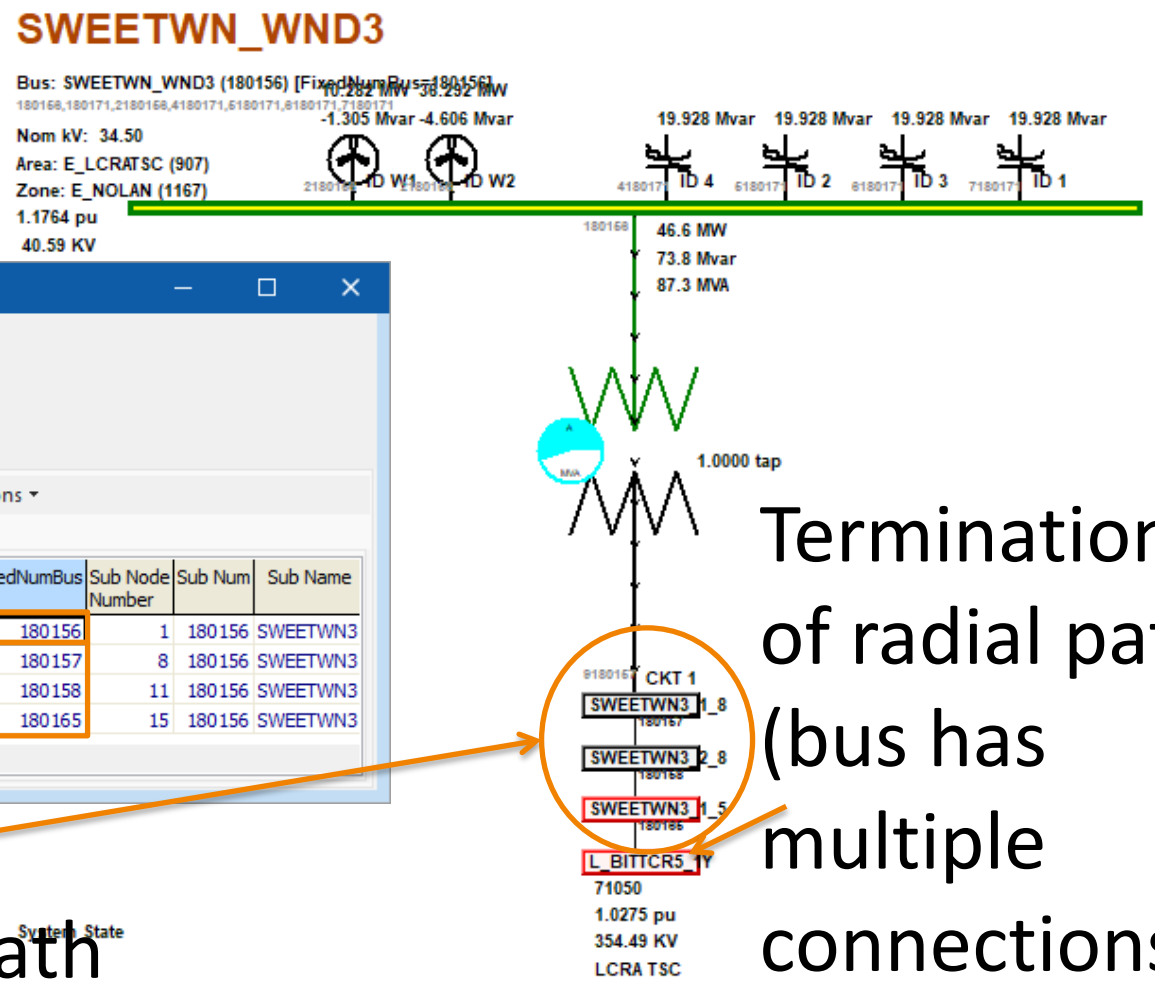




Find Radial Bus Paths

Radial Bus

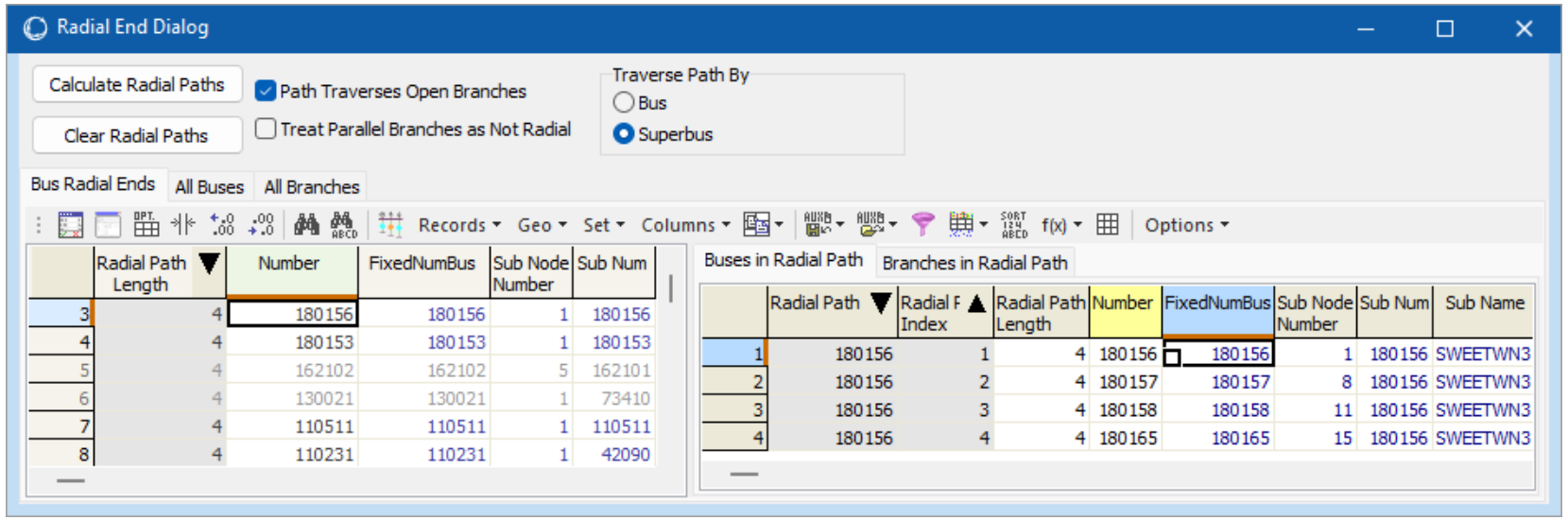




Other Buses on Radial Path

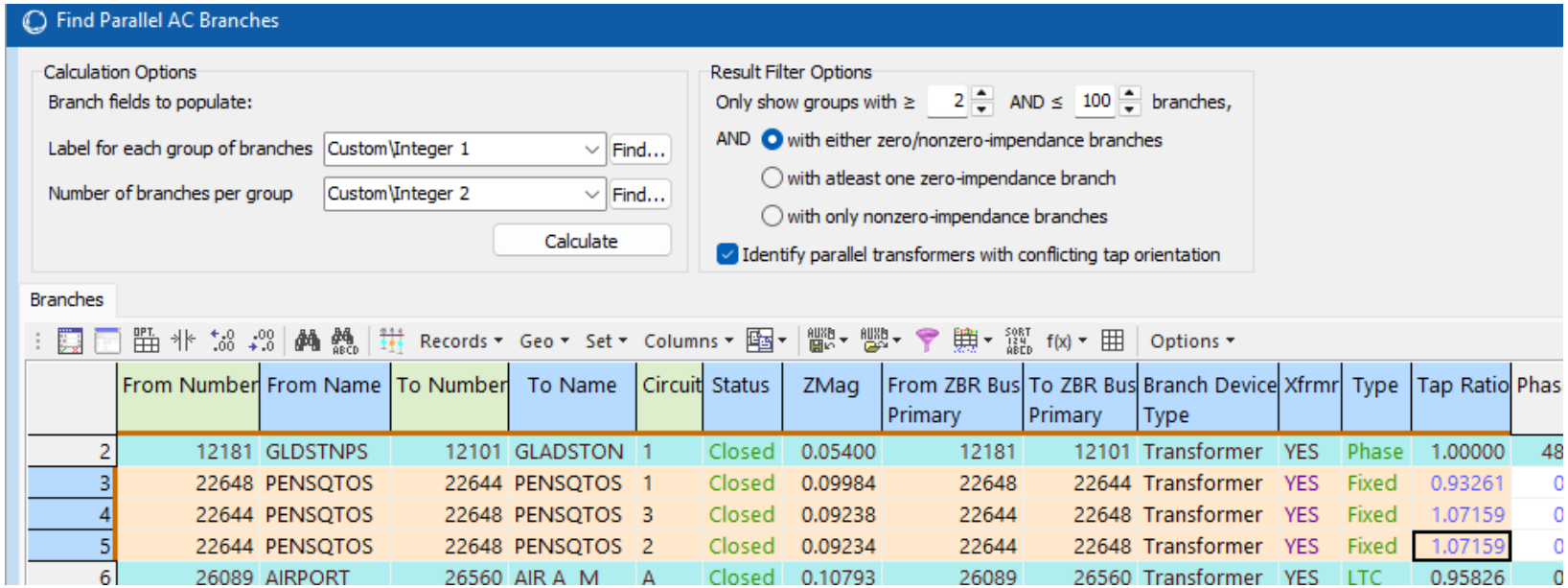
Termination of radial path (bus has multiple connections)

Connections Menu: Find Parallel AC Branches



More Existing Tools: Find Parallel AC Branches

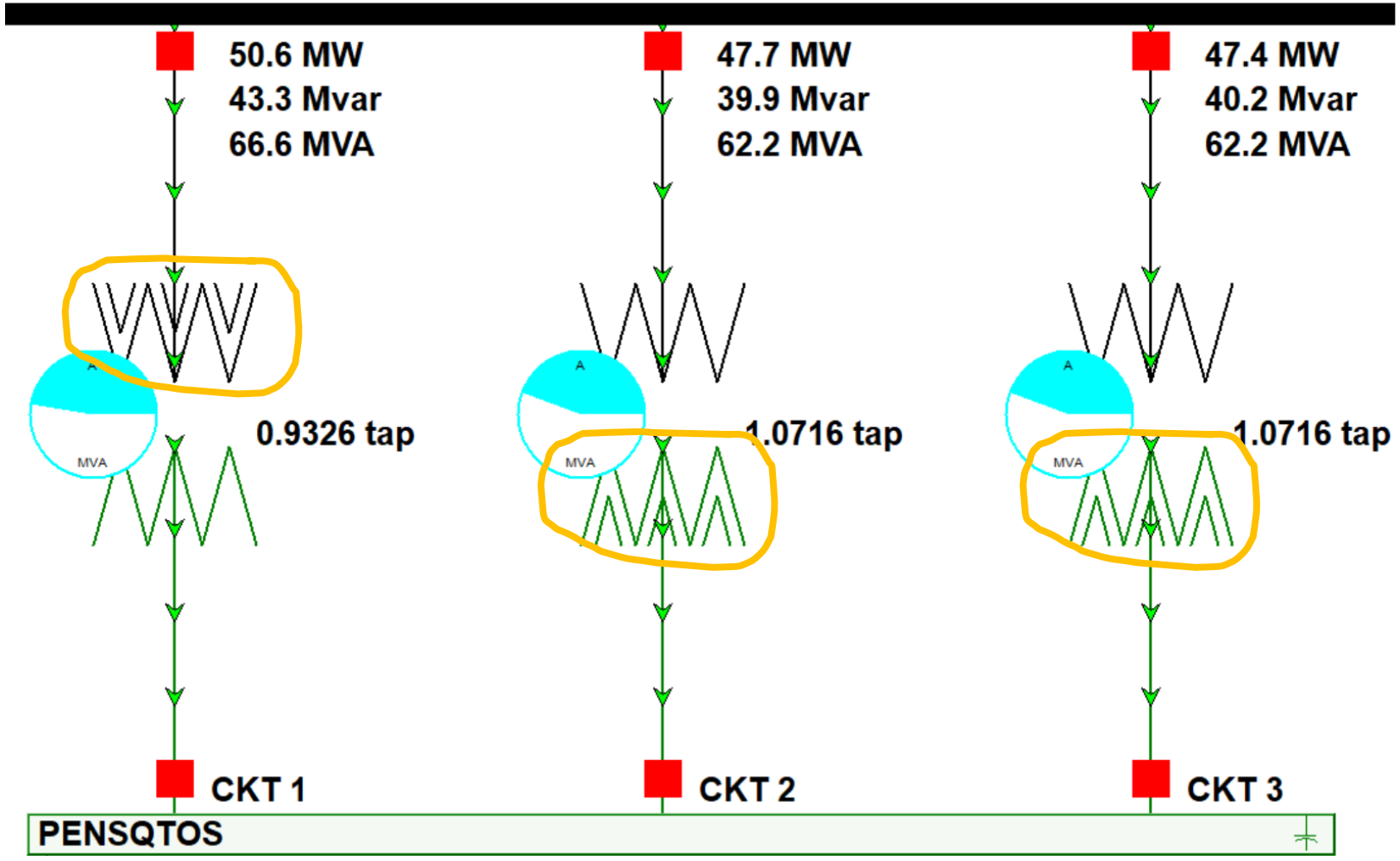
- Good for finding parallel transformers with “from/to” bus terminals flipped. Makes coordinating transformer taps confusing
- Buses 22648 and 22644 are 3 parallel transformers, but from/to bus designations are flipped
  - Tap ratios are 1.07159 and 0.93261
  - Yes… Balanced…
  - But confusing
    - You should flip these from/to



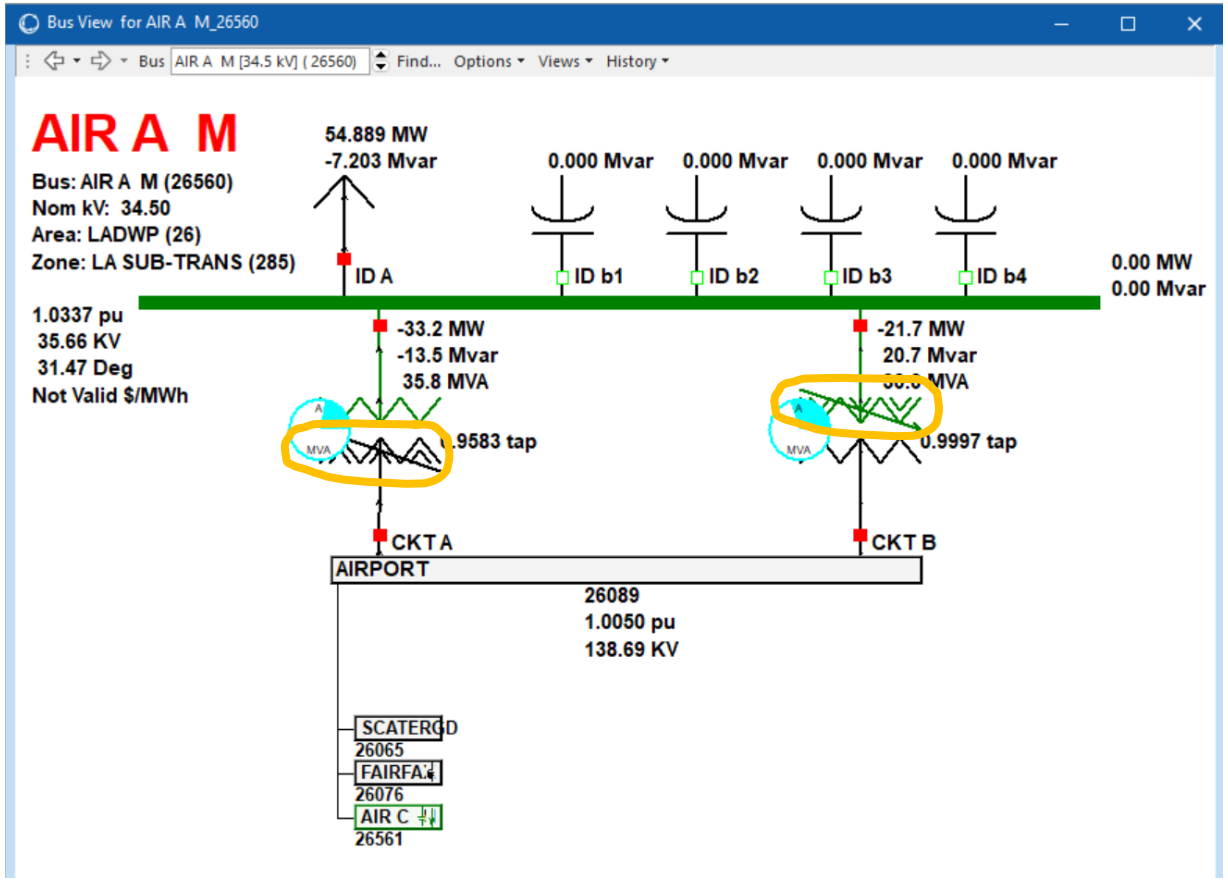
	From Number	From Name	To Number	To Name	Circuit	Status	ZMag	From ZBR Bus Primary	To ZBR Bus Primary	Branch Device Type	Xfrmr	Type	Tap Ratio	Phas
2	12181	GLDSTNPS	12101	GLADSTON	1	Closed	0.05400	12181	12101	Transformer	YES	Phase	1.00000	48
3	22648	PENSQTOS	22644	PENSQTOS	1	Closed	0.09984	22648	22644	Transformer	YES	Fixed	0.93261	0
4	22644	PENSQTOS	22648	PENSQTOS	3	Closed	0.09238	22644	22648	Transformer	YES	Fixed	1.07159	0
5	22644	PENSQTOS	22648	PENSQTOS	2	Closed	0.09234	22644	22648	Transformer	YES	Fixed	1.07159	0
6	26089	AIRPORT	26560	AIR A_M	A	Closed	0.10793	26089	26560	Transformer	YES	LTC	0.95826	0

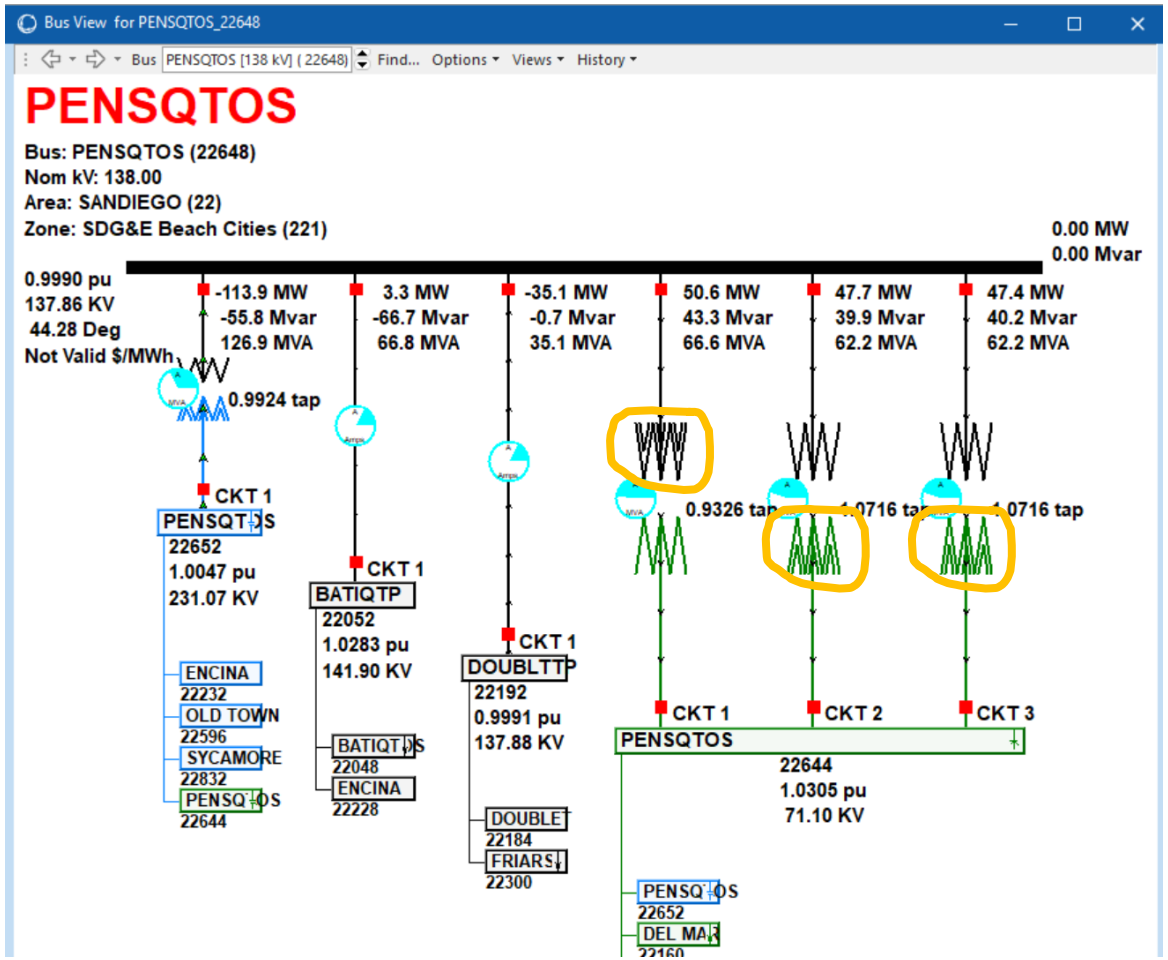
New Transformer Winding Symbol Indicates the Variable Tap side (from bus)

- Double lines represent the From Bus (Variable Tap side)

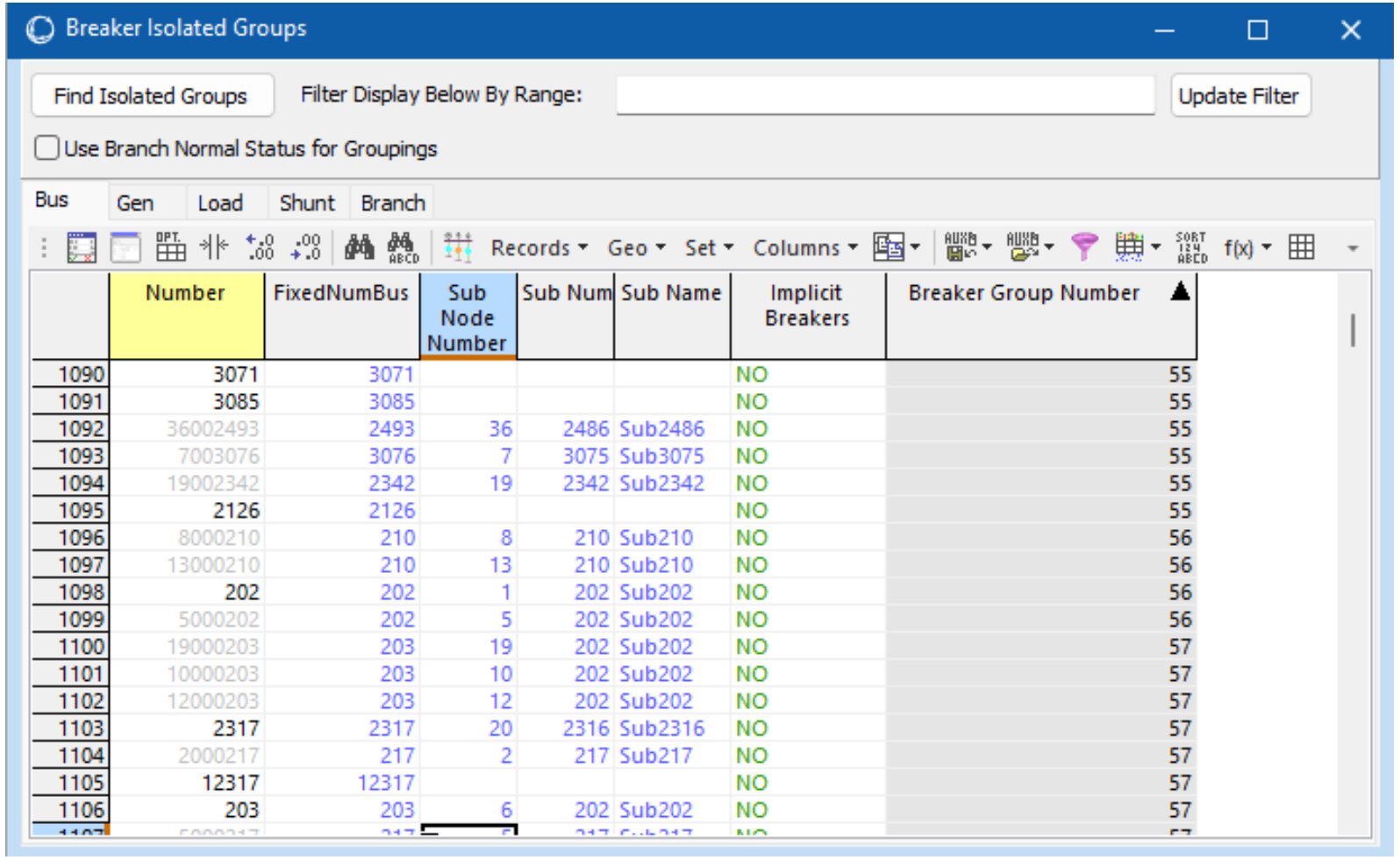


Parallel Transformer with From/To Bus Numbers flipped from each other

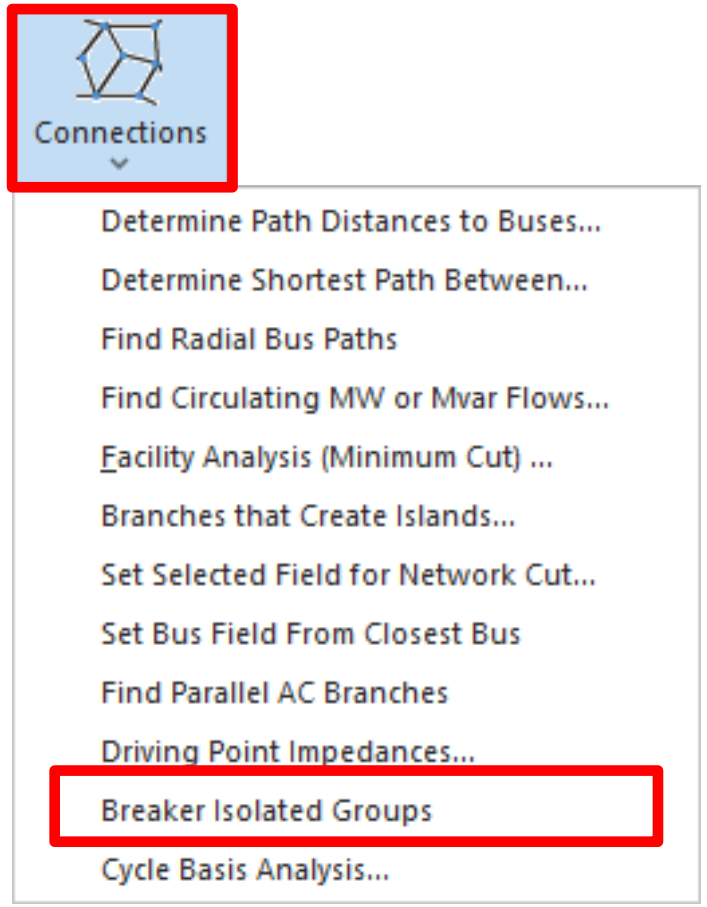




Connections Menu: Breaker Isolated Groups



	Number	FixedNumBus	Sub Node Number	Sub Num	Sub Name	Implicit Breakers	Breaker Group Number
1090	3071	3071				NO	55
1091	3085	3085				NO	55
1092	36002493	2493	36	2486	Sub2486	NO	55
1093	7003076	3076	7	3075	Sub3075	NO	55
1094	19002342	2342	19	2342	Sub2342	NO	55
1095	2126	2126				NO	55
1096	8000210	210	8	210	Sub210	NO	56
1097	13000210	210	13	210	Sub210	NO	56
1098	202	202	1	202	Sub202	NO	56
1099	5000202	202	5	202	Sub202	NO	56
1100	19000203	203	19	202	Sub202	NO	57
1101	10000203	203	10	202	Sub202	NO	57
1102	12000203	203	12	202	Sub202	NO	57
1103	2317	2317	20	2316	Sub2316	NO	57
1104	2000217	217	2	217	Sub217	NO	57
1105	12317	12317				NO	57
1106	203	203	6	202	Sub202	NO	57

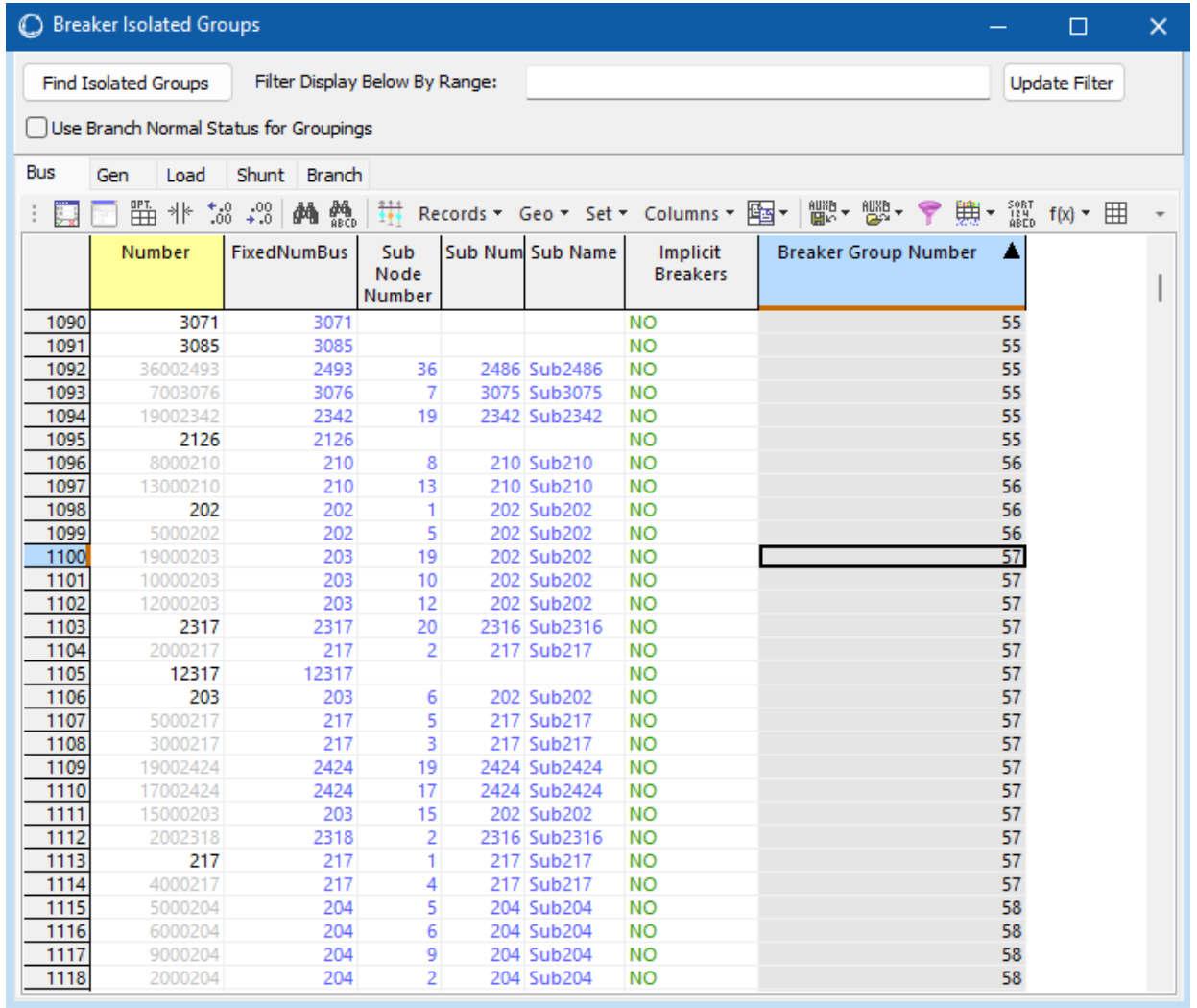


Connections Menu: Breaker Isolated Groups

- Can be used with a Full-Topology Model
  - All the breakers/disconnects and other switching devices are in the model
  - Algorithm will look for groups of buses and their connected devices that are isolated by opening the same group of switching devices
- Alternative, populate the bus field called “Implicit Breakers” (YES or NO)
  - YES means every branch connected to this bus is assumed to have switching devices at a bus end which is marked Implicit Breakers = YES
  - Similar search algorithm

Breaker Isolated Groups: Just Click **Find Isolated Groups**

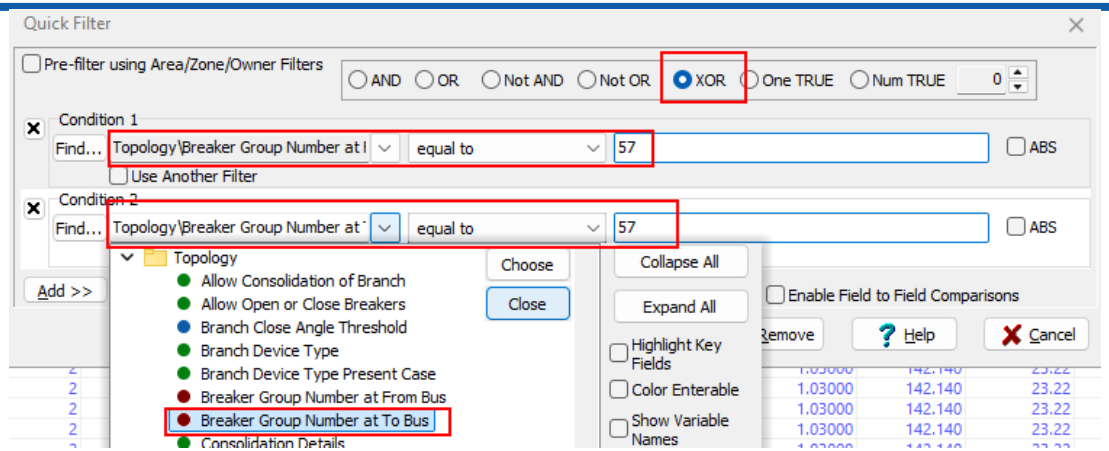
- Bus Breaker Group Number Integer will be populated with an integer
  - Buses that are grouped together have the same integer
  - Generators, Loads, Shunt shows a column with Breaker Group Number
  - Branches table will show the from and to bus integer

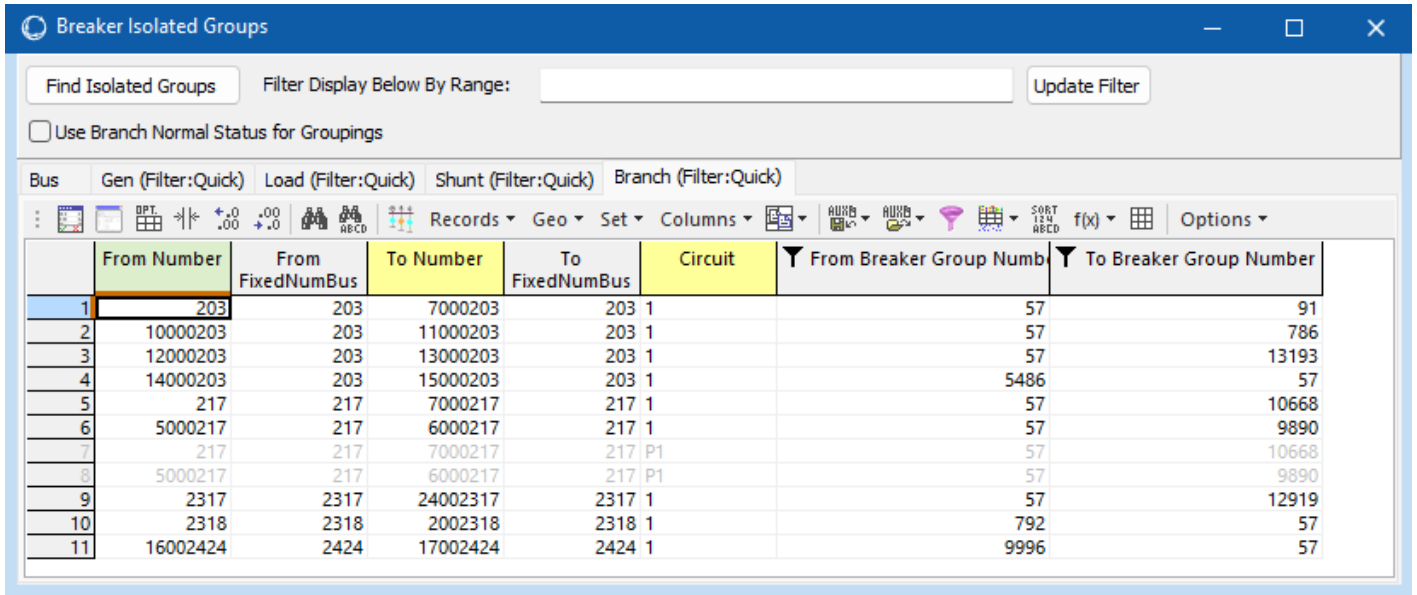


	Number	FixedNumBus	Sub Node Number	Sub Num	Sub Name	Implicit Breakers	Breaker Group Number
1090	3071	3071				NO	55
1091	3085	3085				NO	55
1092	36002493	2493	36	2486	Sub2486	NO	55
1093	7003076	3076	7	3075	Sub3075	NO	55
1094	19002342	2342	19	2342	Sub2342	NO	55
1095	2126	2126				NO	55
1096	8000210	210	8	210	Sub210	NO	56
1097	13000210	210	13	210	Sub210	NO	56
1098	202	202	1	202	Sub202	NO	56
1099	5000202	202	5	202	Sub202	NO	56
1100	19000203	203	19	202	Sub202	NO	57
1101	10000203	203	10	202	Sub202	NO	57
1102	12000203	203	12	202	Sub202	NO	57
1103	2317	2317	20	2316	Sub2316	NO	57
1104	2000217	217	2	217	Sub217	NO	57
1105	12317	12317				NO	57
1106	203	203	6	202	Sub202	NO	57
1107	5000217	217	5	217	Sub217	NO	57
1108	3000217	217	3	217	Sub217	NO	57
1109	19002424	2424	19	2424	Sub2424	NO	57
1110	17002424	2424	17	2424	Sub2424	NO	57
1111	15000203	203	15	202	Sub202	NO	57
1112	2002318	2318	2	2316	Sub2316	NO	57
1113	217	217	1	217	Sub217	NO	57
1114	4000217	217	4	217	Sub217	NO	57
1115	5000204	204	5	204	Sub204	NO	58
1116	6000204	204	6	204	Sub204	NO	58
1117	9000204	204	9	204	Sub204	NO	58
1118	2000204	204	2	204	Sub204	NO	58

Showing the Branches that Isolate a Group

- Filter Branch table to show the logical XOR of the From/To Breaker Group Number being equal to the integer group number of interest
  - This gives only the branches that will create an isolated group
- These are the switching devices that will isolate this group





	From Number	From FixedNumBus	To Number	To FixedNumBus	Circuit	From Breaker Group Numb	To Breaker Group Number
1	203	203	7000203	203	1	57	91
2	10000203	203	11000203	203	1	57	786
3	12000203	203	13000203	203	1	57	13193
4	14000203	203	15000203	203	1	5486	57
5	217	217	7000217	217	1	57	10668
6	5000217	217	6000217	217	1	57	9890
7	217	217	7000217	217	P1	57	10668
8	5000217	217	6000217	217	P1	57	9890
9	2317	2317	24002317	2317	1	57	12919
10	2318	2318	2002318	2318	1	792	57
11	16002424	2424	17002424	2424	1	9996	57

Connections Tools Summary

- There are a lot of different tools
- Some are new features
- Others have been in PowerWorld Simulator a long time
- We have not traditionally covered these in a training session due to limited time

- Make good use of them, and the visualization tools that go with them

In-Person PowerWorld Simulator Training Sept 30 – Oct 2: ERCOT, Austin, Texas

- September 30 – October 2: PowerWorld Training hosted by ERCOT in Austin, Texas
  - Agenda (registration is done for each day, so attend a few days or all 5 days) https://www.powerworld.com/files/TrainingAgendaERCOT202509.pdf
    - Tuesday: OPF, LMP Markets, Contingency Analysis, SCOPF
    - Tuesday: Advanced OPF, Case Info, Auxiliary Files, OPF automation
    - Wednesday: Transient Stability
  - Location/Time
    - Location: ERCOT, 8000 Metropolis Drive Austin, Texas 78744
    - 8:30 AM start time each day. Ends 4:30 or 4:45 PM
  - https://www.powerworld.com/training/training-calendar
- We are looking forward to it!