Contingency Combination Analysis

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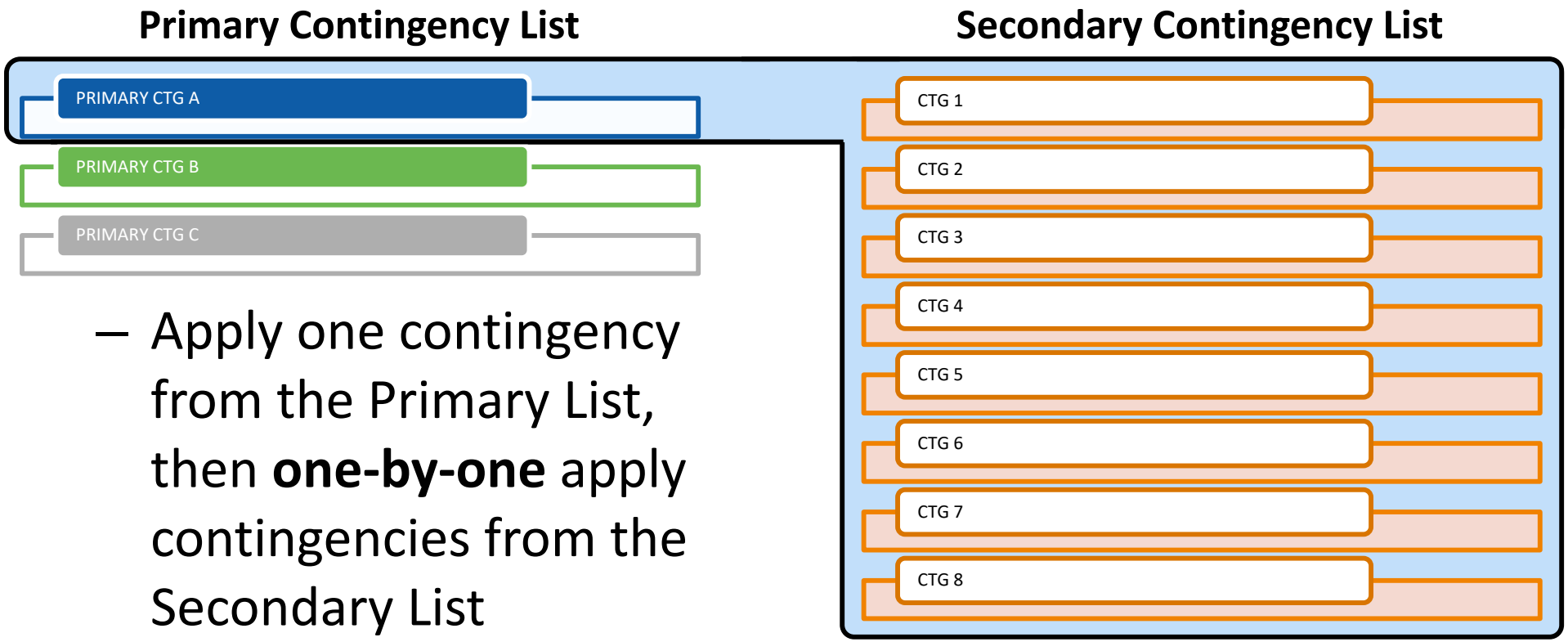
Contingency Analysis

- Contingency Combination Tool, a.k.a. N-1-1 contingencies



  - Apply one contingency from the Primary List, then **one-by-one** apply contingencies from the Secondary List

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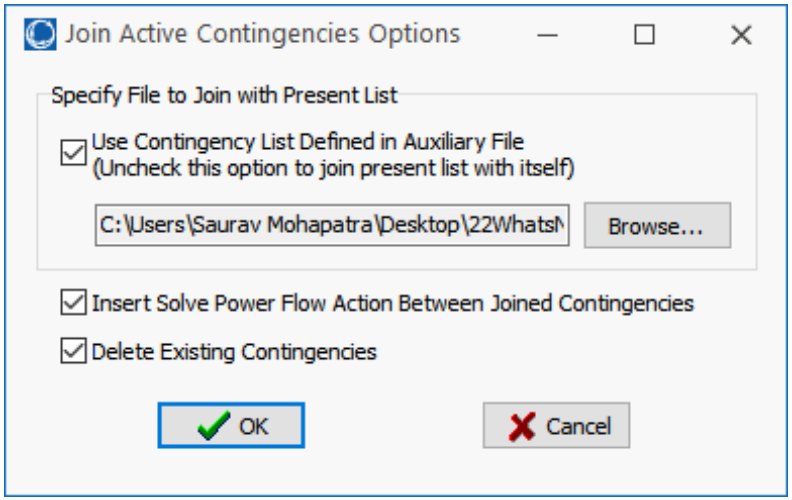
Contingency Analysis

- Without the combination tool possible to do N-1-1, but each combination needs to be defined
- With n contingencies
  - Join with existing contingencies : $\binom{n}{2}$
  - Join with another list of m contingencies: $m \times n$

Side note:
if $n = 10{,}000$
$\binom{n}{2}$= 49,995,000

- With combination tool all combinations are not explicitly defined
- Requires less computer memory and easier to maintain lists



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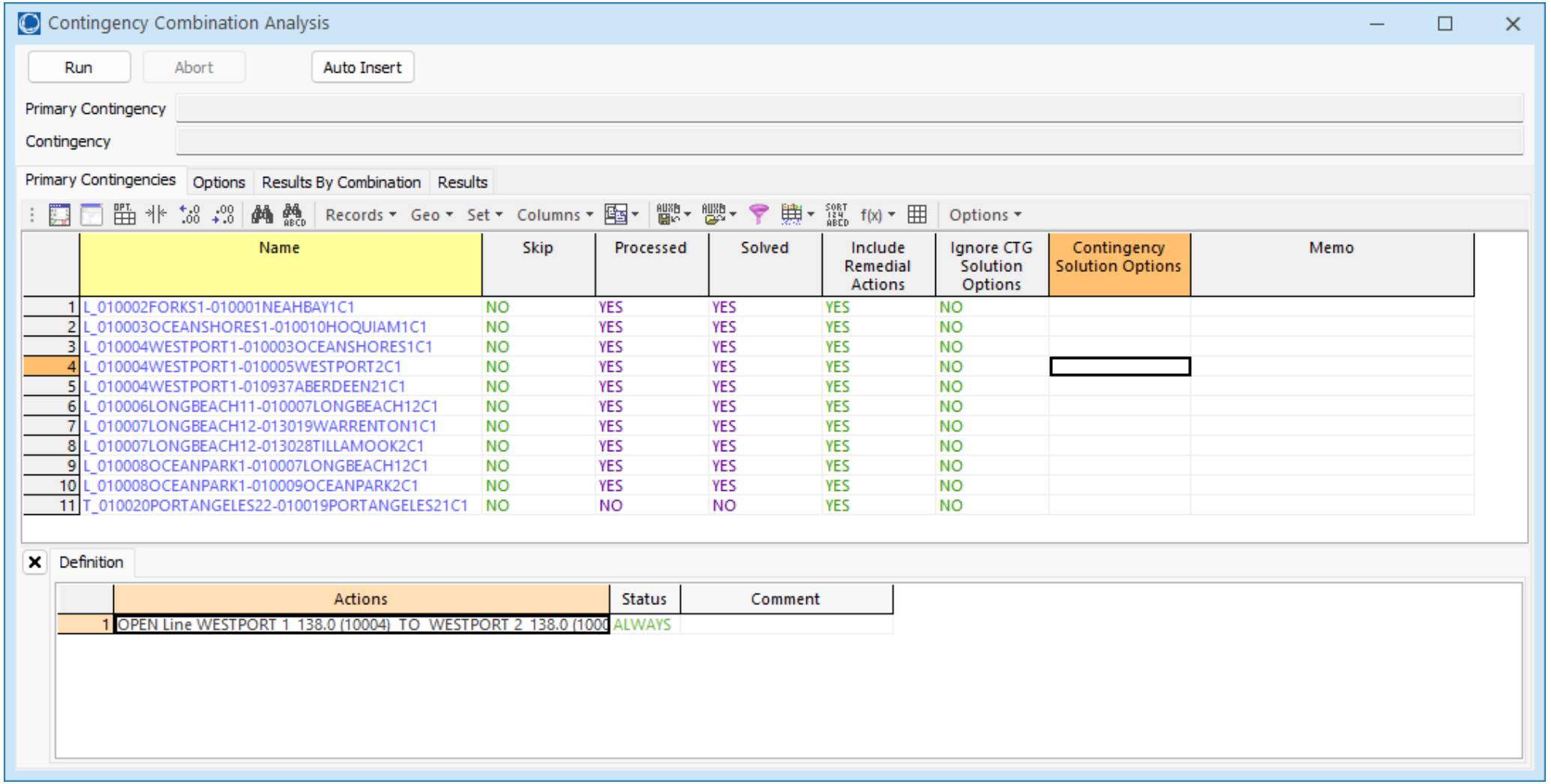
CTG Combo Analysis

Contingency Combination Analysis Tool



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Defining Contingencies

- Primary contingency list is defined with Contingency Combination Analysis tool
  - Object Names
    - **`ContingencyPrimary`**
    - **`ContingencyPrimaryElement`**
- Secondary contingency list is defined with the Contingency Analysis tool
  - i.e., the regular contingencies we have always had
    - *No new object in the data structure for "secondary contingency"*
    - When we say "Secondary Contingency", we mean the object **`Contingency`**
  - Object Names
    - **`Contingency`**
    - **`ContingencyElement`**

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Creating Primary Contingencies

- Manually create using **Insert** option in Primary Contingencies case information display
- **Auto Insert** using button on Contingency Combination Analysis dialog
- Convert Secondary contingencies to Primary contingencies using **Insert Special → Convert into Primary Contingencies** option on Contingency case information display

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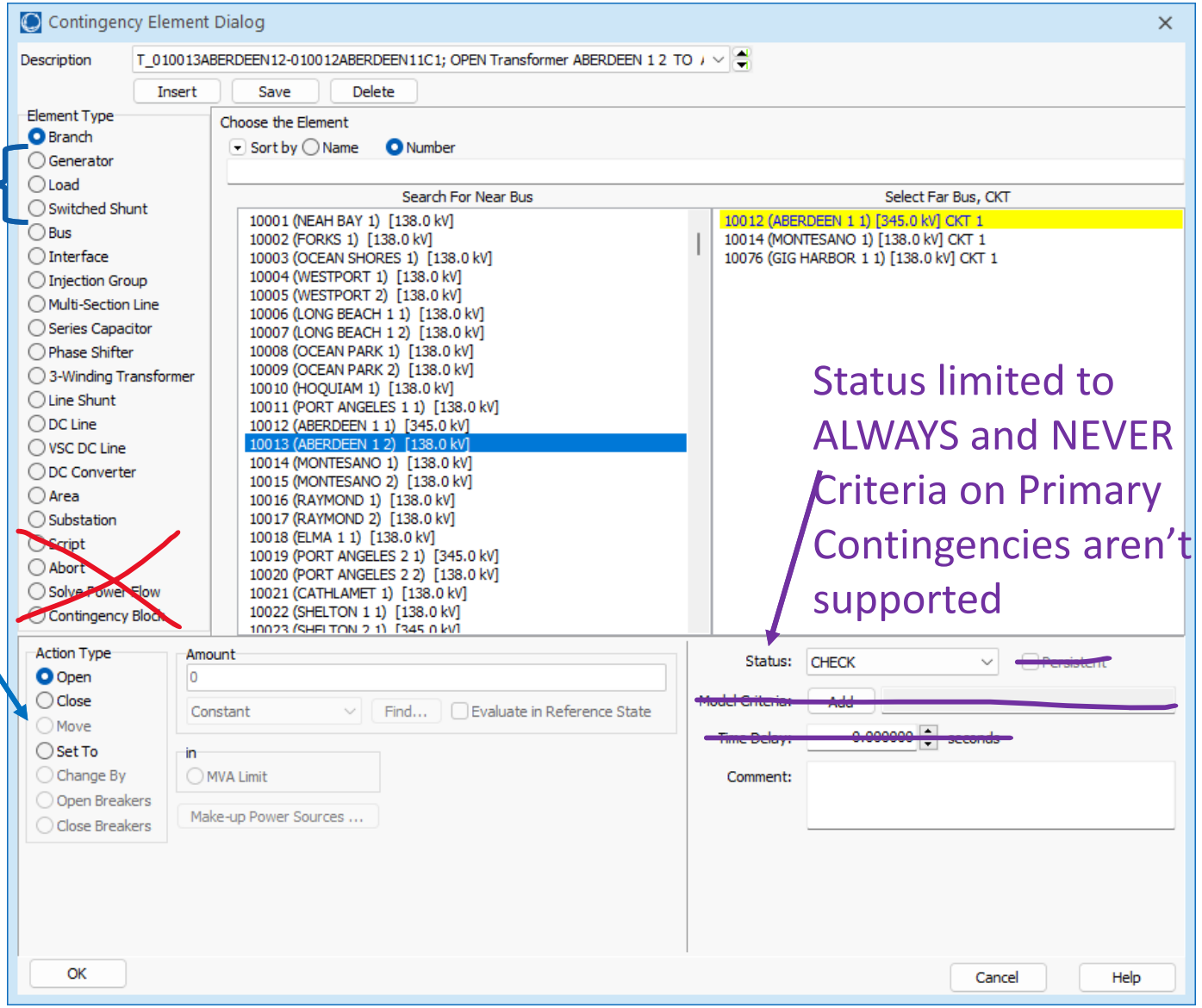
Differences Between Primary and Secondary CTG Element Definitions

Generators, Loads, and Switched Shunts do not allow Move actions

<u>Not Supported:</u>
Script, Abort, SolvePowerFlow, ContingencyBlock



Status limited to ALWAYS and NEVER Criteria on Primary Contingencies aren't supported

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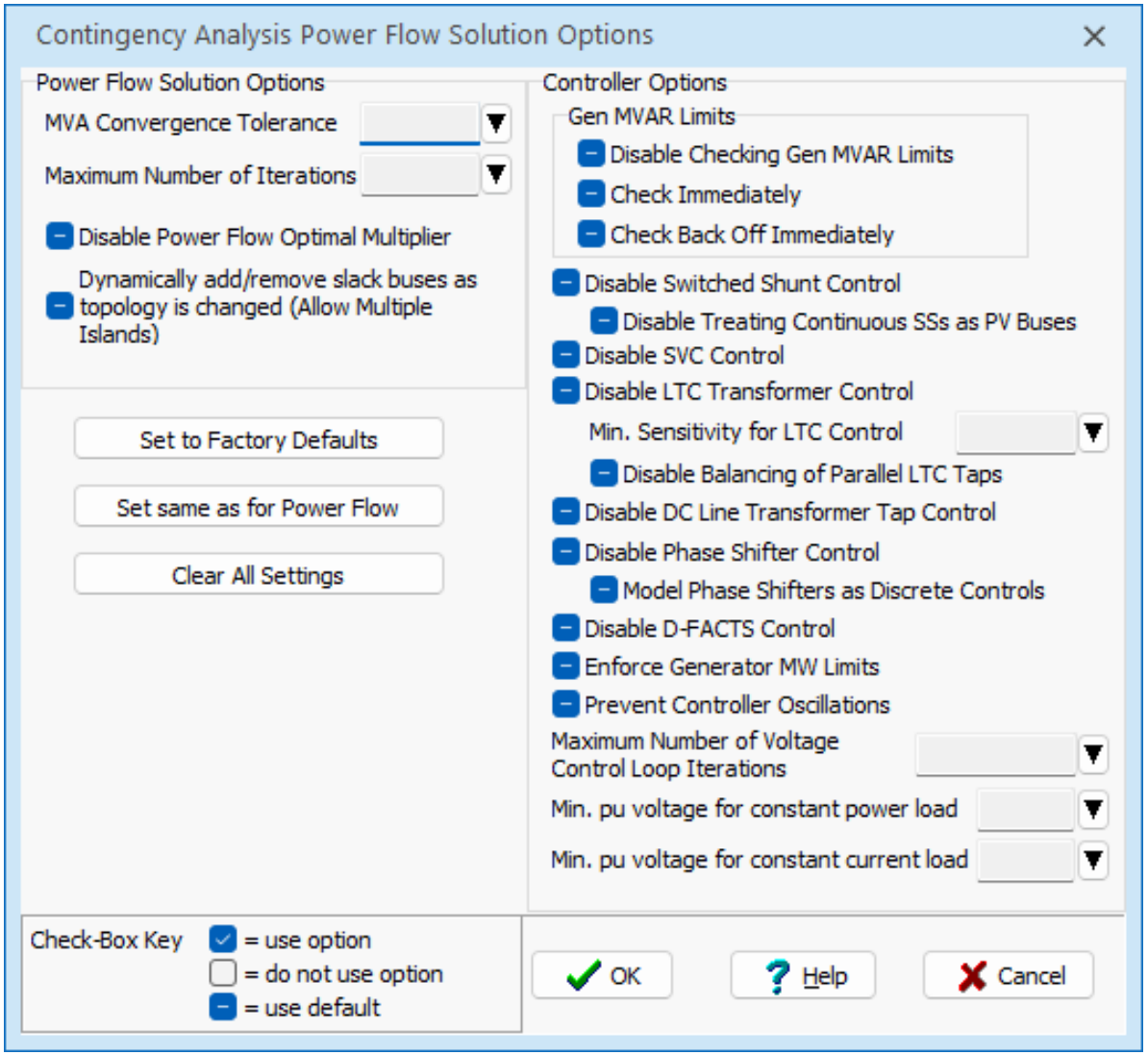
Contingency Solution Options

- Power flow related options that can be changed at various points in the combination analysis
- Allow primary contingencies to be solved with different automatic controls than the secondary contingencies



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Contingency Solution Options

- If specific options are not defined at a given level, the options at the previous level are used by default
- Five levels at which options can be defined
  1. (Secondary) Contingency Specific Options
  2. Contingency Analysis Options
  3. Primary Contingency Specific Options (new)
  4. Contingency Combination Analysis Options (new)
  5. General Power Flow Solution Options

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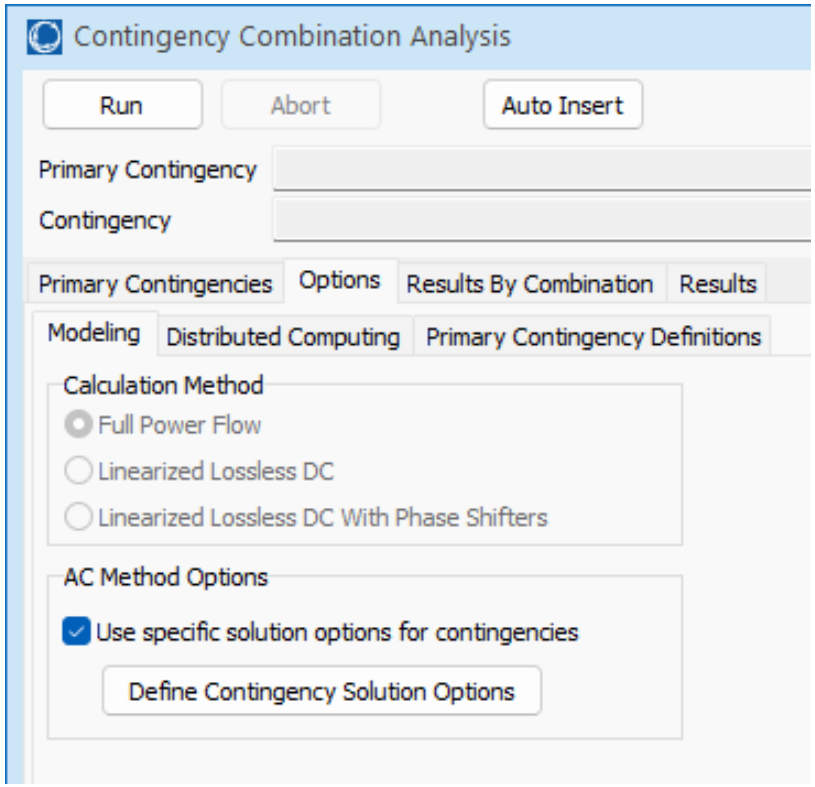
Analysis Options
Primary Contingency Options

- Options specific to the Primary contingency found on the **Modeling→Options** page of the Contingency Combination Analysis dialog
- Primary contingency can only be solved using the full ac power flow
- Specific solution options defined here are level 4 in the hierarchy of solution options



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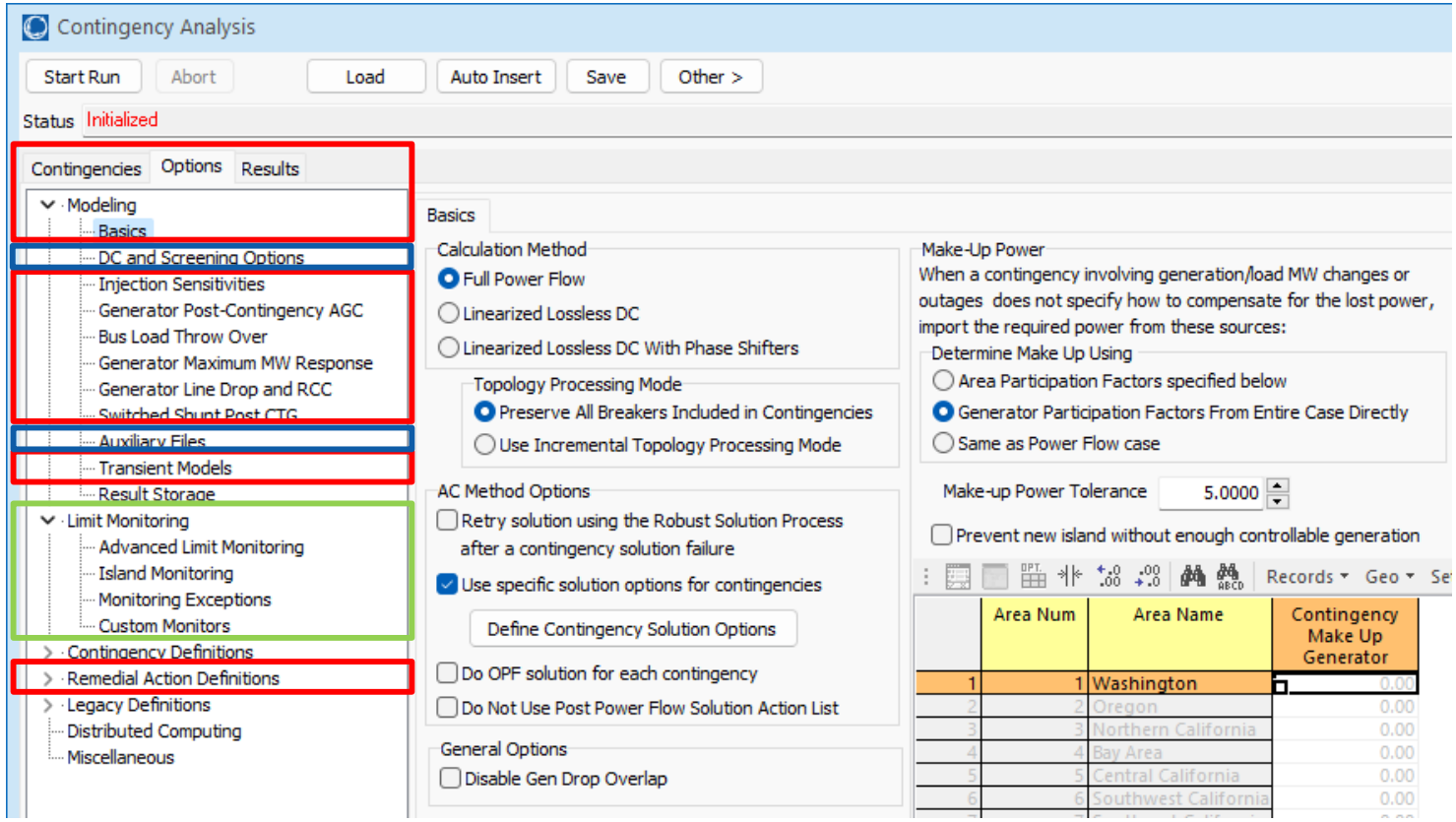
Analysis Options
Primary and Secondary CTG Options

- Options specified on the Contingency Analysis dialog are applicable based on the color coding, with a few exceptions
  - **Calculation Method** and **Specific Solution Options** are only used with the Secondary contingency because the Primary contingency has its own settings for these
  - There are a few options that are not used for either contingency (detailed on next slide)



Applicable to both Primary and Secondary contingencies

Applicable only to Secondary contingencies

Recorded after both the Primary and Secondary contingency are applied

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Analysis Options
Exceptions

- Retry solution using the Robust Solution Process after a contingency solution failure is never used
- OPF solution for each contingency is never used
- Post Power Flow Solution Action List is always ignored
- Result Storage options are always ignored

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Remedial Actions

- Use the **Include Remedial Actions** field to enable/disable remedial actions with Primary and Secondary contingencies
- Remedial action applied for a Primary contingency cannot be applied again for a Secondary contingency

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Violations and Results

- Violations, Injection Sensitivities, and summary results are recorded after the Secondary contingency has been solved
- For conciseness, What Occurred lists Primary and Secondary contingencies separately for a given combination
- To determine violations that occur only for a Primary contingency, create a Secondary contingency with no actions
- Any Advanced Limit Monitoring relative to the *base case* is relative to the system state prior to the Primary contingency being applied

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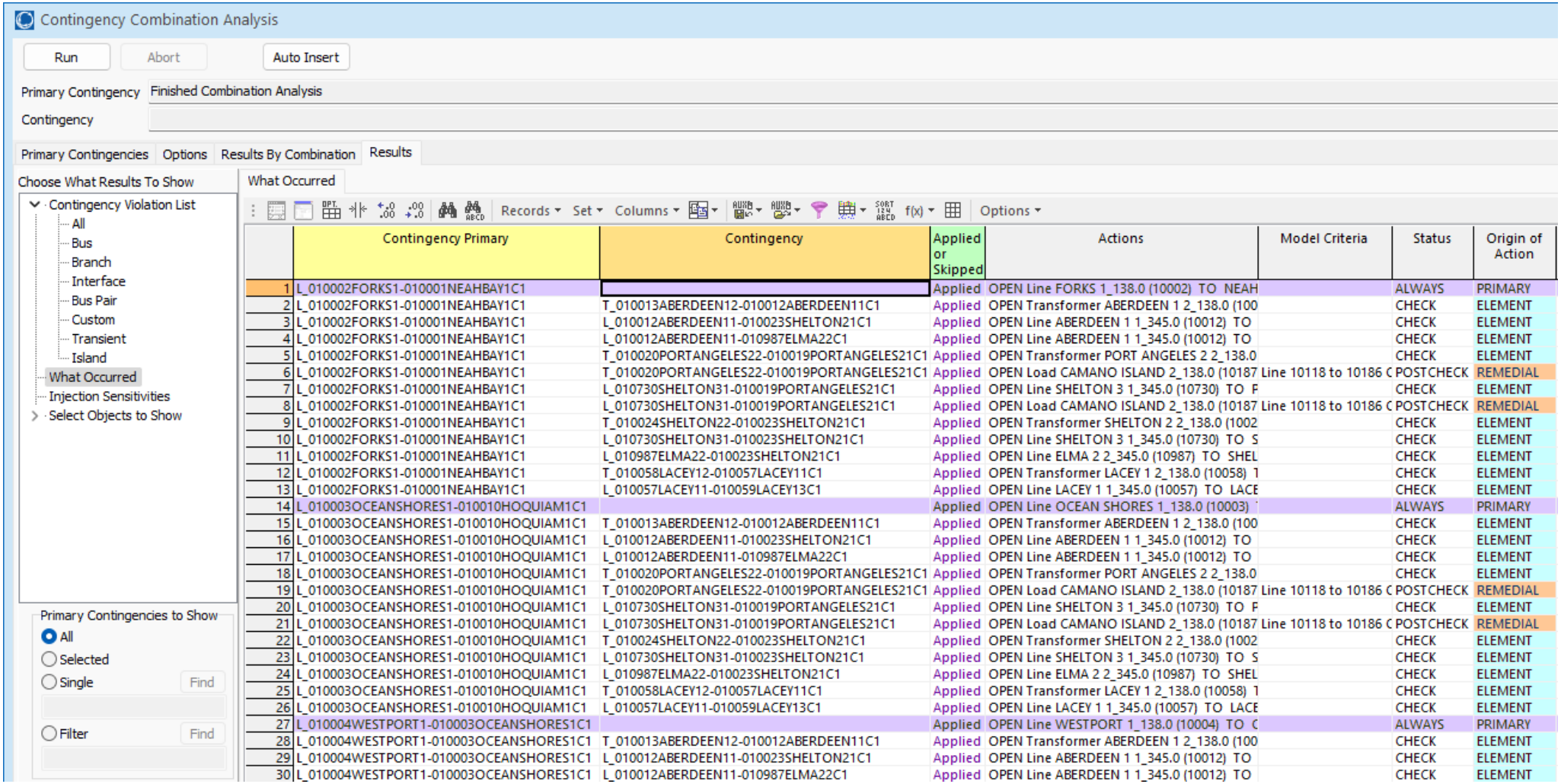
What Occurred

Purple highlighting indicates what actions occurred for the Primary contingency. These actions should be combined with the actions of each pair for the same Primary to obtain the full listing of what occurred for a combination of Primary and Secondary contingency.



	Contingency Primary	Contingency	Applied or Skipped	Actions	Model Criteria	Status	Origin of Action
1	L_010002FORKS1-010001NEAHBAY1C1		Applied	OPEN Line FORKS 1_138.0 (10002) TO NEAH		ALWAYS	PRIMARY
2	L_010002FORKS1-010001NEAHBAY1C1	T_010013ABERDEEN12-010012ABERDEEN11C1	Applied	OPEN Transformer ABERDEEN 1 2_138.0 (100		CHECK	ELEMENT
3	L_010002FORKS1-010001NEAHBAY1C1	L_010012ABERDEEN11-010023SHELTON21C1	Applied	OPEN Line ABERDEEN 1 1_345.0 (10012) TO		CHECK	ELEMENT
4	L_010002FORKS1-010001NEAHBAY1C1	L_010012ABERDEEN11-010987ELMA22C1	Applied	OPEN Line ABERDEEN 1 1_345.0 (10012) TO		CHECK	ELEMENT
5	L_010002FORKS1-010001NEAHBAY1C1	T_010020PORTANGELES22-010019PORTANGELES21C1	Applied	OPEN Transformer PORT ANGELES 2 2_138.0		CHECK	ELEMENT
6	L_010002FORKS1-010001NEAHBAY1C1	T_010020PORTANGELES22-010019PORTANGELES21C1	Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 C	POSTCHECK	REMEDIAL
7	L_010002FORKS1-010001NEAHBAY1C1	L_010730SHELTON31-010019PORTANGELES21C1	Applied	OPEN Line SHELTON 3 1_345.0 (10730) TO F		CHECK	ELEMENT
8	L_010002FORKS1-010001NEAHBAY1C1	L_010730SHELTON31-010019PORTANGELES21C1	Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 C	POSTCHECK	REMEDIAL
9	L_010002FORKS1-010001NEAHBAY1C1	T_010024SHELTON22-010023SHELTON21C1	Applied	OPEN Transformer SHELTON 2 2_138.0 (1002		CHECK	ELEMENT
10	L_010002FORKS1-010001NEAHBAY1C1	L_010730SHELTON31-010023SHELTON21C1	Applied	OPEN Line SHELTON 3 1_345.0 (10730) TO S		CHECK	ELEMENT
11	L_010002FORKS1-010001NEAHBAY1C1	L_010987ELMA22-010023SHELTON21C1	Applied	OPEN Line ELMA 2 2_345.0 (10987) TO SHEL		CHECK	ELEMENT
12	L_010002FORKS1-010001NEAHBAY1C1	T_010058LACEY12-010057LACEY11C1	Applied	OPEN Transformer LACEY 1 2_138.0 (10058) T		CHECK	ELEMENT
13	L_010002FORKS1-010001NEAHBAY1C1	L_010057LACEY11-010059LACEY13C1	Applied	OPEN Line LACEY 1 1_345.0 (10057) TO LACE		CHECK	ELEMENT
14	L_010003OCEANSHORES1-010010HOQUIAM1C1		Applied	OPEN Line OCEAN SHORES 1_138.0 (10003) T		ALWAYS	PRIMARY
15	L_010003OCEANSHORES1-010010HOQUIAM1C1	T_010013ABERDEEN12-010012ABERDEEN11C1	Applied	OPEN Transformer ABERDEEN 1 2_138.0 (100		CHECK	ELEMENT
16	L_010003OCEANSHORES1-010010HOQUIAM1C1	L_010012ABERDEEN11-010023SHELTON21C1	Applied	OPEN Line ABERDEEN 1 1_345.0 (10012) TO		CHECK	ELEMENT
17	L_010003OCEANSHORES1-010010HOQUIAM1C1	L_010012ABERDEEN11-010987ELMA22C1	Applied	OPEN Line ABERDEEN 1 1_345.0 (10012) TO		CHECK	ELEMENT
18	L_010003OCEANSHORES1-010010HOQUIAM1C1	T_010020PORTANGELES22-010019PORTANGELES21C1	Applied	OPEN Transformer PORT ANGELES 2 2_138.0		CHECK	ELEMENT
19	L_010003OCEANSHORES1-010010HOQUIAM1C1	T_010020PORTANGELES22-010019PORTANGELES21C1	Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 C	POSTCHECK	REMEDIAL
20	L_010003OCEANSHORES1-010010HOQUIAM1C1	L_010730SHELTON31-010019PORTANGELES21C1	Applied	OPEN Line SHELTON 3 1_345.0 (10730) TO F		CHECK	ELEMENT
21	L_010003OCEANSHORES1-010010HOQUIAM1C1	L_010730SHELTON31-010019PORTANGELES21C1	Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 C	POSTCHECK	REMEDIAL
22	L_010003OCEANSHORES1-010010HOQUIAM1C1	T_010024SHELTON22-010023SHELTON21C1	Applied	OPEN Transformer SHELTON 2 2_138.0 (1002		CHECK	ELEMENT
23	L_010003OCEANSHORES1-010010HOQUIAM1C1	L_010730SHELTON31-010023SHELTON21C1	Applied	OPEN Line SHELTON 3 1_345.0 (10730) TO S		CHECK	ELEMENT
24	L_010003OCEANSHORES1-010010HOQUIAM1C1	L_010987ELMA22-010023SHELTON21C1	Applied	OPEN Line ELMA 2 2_345.0 (10987) TO SHEL		CHECK	ELEMENT
25	L_010003OCEANSHORES1-010010HOQUIAM1C1	T_010058LACEY12-010057LACEY11C1	Applied	OPEN Transformer LACEY 1 2_138.0 (10058) T		CHECK	ELEMENT
26	L_010003OCEANSHORES1-010010HOQUIAM1C1	L_010057LACEY11-010059LACEY13C1	Applied	OPEN Line LACEY 1 1_345.0 (10057) TO LACE		CHECK	ELEMENT
27	L_010004WESTPORT1-010003OCEANSHORES1C1		Applied	OPEN Line WESTPORT 1_138.0 (10004) TO C		ALWAYS	PRIMARY
28	L_010004WESTPORT1-010003OCEANSHORES1C1	T_010013ABERDEEN12-010012ABERDEEN11C1	Applied	OPEN Transformer ABERDEEN 1 2_138.0 (100		CHECK	ELEMENT
29	L_010004WESTPORT1-010003OCEANSHORES1C1	L_010012ABERDEEN11-010023SHELTON21C1	Applied	OPEN Line ABERDEEN 1 1_345.0 (10012) TO		CHECK	ELEMENT
30	L_010004WESTPORT1-010003OCEANSHORES1C1	L_010012ABERDEEN11-010987ELMA22C1	Applied	OPEN Line ABERDEEN 1 1_345.0 (10012) TO		CHECK	ELEMENT

What Occurred and Remedial Actions

Remedial action applied with the Primary contingency

What Occurred

Records ▾ Set ▾ Columns ▾ f(x) ▾ Options ▾

	Contingency Primary	Contingency	Applied or Skipped	Actions	Model Criteria	Status	Origin of Action	Brief What Occurred	Com
1	T_010020PORTANGELES22-010019PORTANGELES21C1		Applied	OPEN Transformer PORT ANGELES 2 2_138.0		ALWAYS	PRIMARY	Opened flow of	
2	T_010020PORTANGELES22-010019PORTANGELES21C1		Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 Overloaded	POSTCHECK	REMEDIAL	Opened 37.59 M	
3	T_010020PORTANGELES22-010019PORTANGELES21C1	T_010013ABERDEEN12-010012ABERDEEN11C1	Applied	OPEN Transformer ABERDEEN 1 2_138.0 (100		CHECK	ELEMENT		
4	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010012ABERDEEN11-010023SHELTON21C1	Applied	OPEN Line ABERDEEN 1 1_345.0 (10012) TO		CHECK	ELEMENT		
5	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010012ABERDEEN11-010987ELMA22C1	Applied	OPEN Line ABERDEEN 1 1_345.0 (10012) TO		CHECK	ELEMENT		
6	T_010020PORTANGELES22-010019PORTANGELES21C1	T_010020PORTANGELES22-010019PORTANGELES21C1	Applied	OPEN Transformer PORT ANGELES 2 2_138.0		CHECK	ELEMENT		
7	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010730SHELTON31-010019PORTANGELES21C1	Applied	OPEN Line SHELTON 3 1_345.0 (10730) TO F		CHECK	ELEMENT		
8	T_010020PORTANGELES22-010019PORTANGELES21C1	T_010024SHELTON22-010023SHELTON21C1	Applied	OPEN Transformer SHELTON 2 2_138.0 (1002		CHECK	ELEMENT		
9	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010730SHELTON31-010023SHELTON21C1	Applied	OPEN Line SHELTON 3 1_345.0 (10730) TO S		CHECK	ELEMENT		
10	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010987ELMA22-010023SHELTON21C1	Applied	OPEN Line ELMA 2 2_345.0 (10987) TO SHEL		CHECK	ELEMENT		
11	T_010020PORTANGELES22-010019PORTANGELES21C1	T_010058LACEY12-010057LACEY11C1	Applied	OPEN Transformer LACEY 1 2_138.0 (10058) 1		CHECK	ELEMENT		
12	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010057LACEY11-010059LACEY13C1	Applied	OPEN Line LACEY 1 1_345.0 (10057) TO LACE		CHECK	ELEMENT		

Remedial actions disabled with Primary contingency results in RAS applied with Secondary

What Occurred

Records ▾ Set ▾ Columns ▾ f(x) ▾ Options ▾

	Contingency Primary	Contingency	Applied or Skipped	Actions	Model Criteria	Status	Origin of Action	Brief What Occurred
1	T_010020PORTANGELES22-010019PORTANGELES21C1		Applied	OPEN Transformer PORT ANGELES 2 2_138.0		ALWAYS	PRIMARY	Opened flow of
2	T_010020PORTANGELES22-010019PORTANGELES21C1	No Actions	Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 Overloaded	POSTCHECK	REMEDIAL	
3	T_010020PORTANGELES22-010019PORTANGELES21C1	T_010013ABERDEEN12-010012ABERDEEN11C1	Applied	OPEN Transformer ABERDEEN 1 2_138.0 (100		CHECK	ELEMENT	
4	T_010020PORTANGELES22-010019PORTANGELES21C1	T_010013ABERDEEN12-010012ABERDEEN11C1	Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 Overloaded	POSTCHECK	REMEDIAL	
5	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010012ABERDEEN11-010023SHELTON21C1	Applied	OPEN Line ABERDEEN 1 1_345.0 (10012) TO		CHECK	ELEMENT	
6	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010012ABERDEEN11-010023SHELTON21C1	Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 Overloaded	POSTCHECK	REMEDIAL	
7	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010012ABERDEEN11-010987ELMA22C1	Applied	OPEN Line ABERDEEN 1 1_345.0 (10012) TO		CHECK	ELEMENT	
8	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010012ABERDEEN11-010987ELMA22C1	Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 Overloaded	POSTCHECK	REMEDIAL	
9	T_010020PORTANGELES22-010019PORTANGELES21C1	T_010020PORTANGELES22-010019PORTANGELES21C1	Applied	OPEN Transformer PORT ANGELES 2 2_138.0		CHECK	ELEMENT	
10	T_010020PORTANGELES22-010019PORTANGELES21C1	T_010020PORTANGELES22-010019PORTANGELES21C1	Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 Overloaded	POSTCHECK	REMEDIAL	
11	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010730SHELTON31-010019PORTANGELES21C1	Applied	OPEN Line SHELTON 3 1_345.0 (10730) TO F		CHECK	ELEMENT	
12	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010730SHELTON31-010019PORTANGELES21C1	Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 Overloaded	POSTCHECK	REMEDIAL	
13	T_010020PORTANGELES22-010019PORTANGELES21C1	T_010024SHELTON22-010023SHELTON21C1	Applied	OPEN Transformer SHELTON 2 2_138.0 (1002		CHECK	ELEMENT	
14	T_010020PORTANGELES22-010019PORTANGELES21C1	T_010024SHELTON22-010023SHELTON21C1	Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 Overloaded	POSTCHECK	REMEDIAL	
15	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010730SHELTON31-010023SHELTON21C1	Applied	OPEN Line SHELTON 3 1_345.0 (10730) TO S		CHECK	ELEMENT	
16	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010730SHELTON31-010023SHELTON21C1	Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 Overloaded	POSTCHECK	REMEDIAL	
17	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010987ELMA22-010023SHELTON21C1	Applied	OPEN Line ELMA 2 2_345.0 (10987) TO SHEL		CHECK	ELEMENT	
18	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010987ELMA22-010023SHELTON21C1	Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 Overloaded	POSTCHECK	REMEDIAL	
19	T_010020PORTANGELES22-010019PORTANGELES21C1	T_010058LACEY12-010057LACEY11C1	Applied	OPEN Transformer LACEY 1 2_138.0 (10058) 1		CHECK	ELEMENT	
20	T_010020PORTANGELES22-010019PORTANGELES21C1	T_010058LACEY12-010057LACEY11C1	Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 Overloaded	POSTCHECK	REMEDIAL	
21	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010057LACEY11-010059LACEY13C1	Applied	OPEN Line LACEY 1 1_345.0 (10057) TO LACE		CHECK	ELEMENT	
22	T_010020PORTANGELES22-010019PORTANGELES21C1	L_010057LACEY11-010059LACEY13C1	Applied	OPEN Load CAMANO ISLAND 2_138.0 (10187	Line 10118 to 10186 Overloaded	POSTCHECK	REMEDIAL	

Results By Combination

- Similar to the results shown on the Contingencies tab on the Contingency Analysis dialog for a regular contingency run
- For each combination of Primary and Secondary contingency, summary information is provided along with a list of Violations and What Occurred

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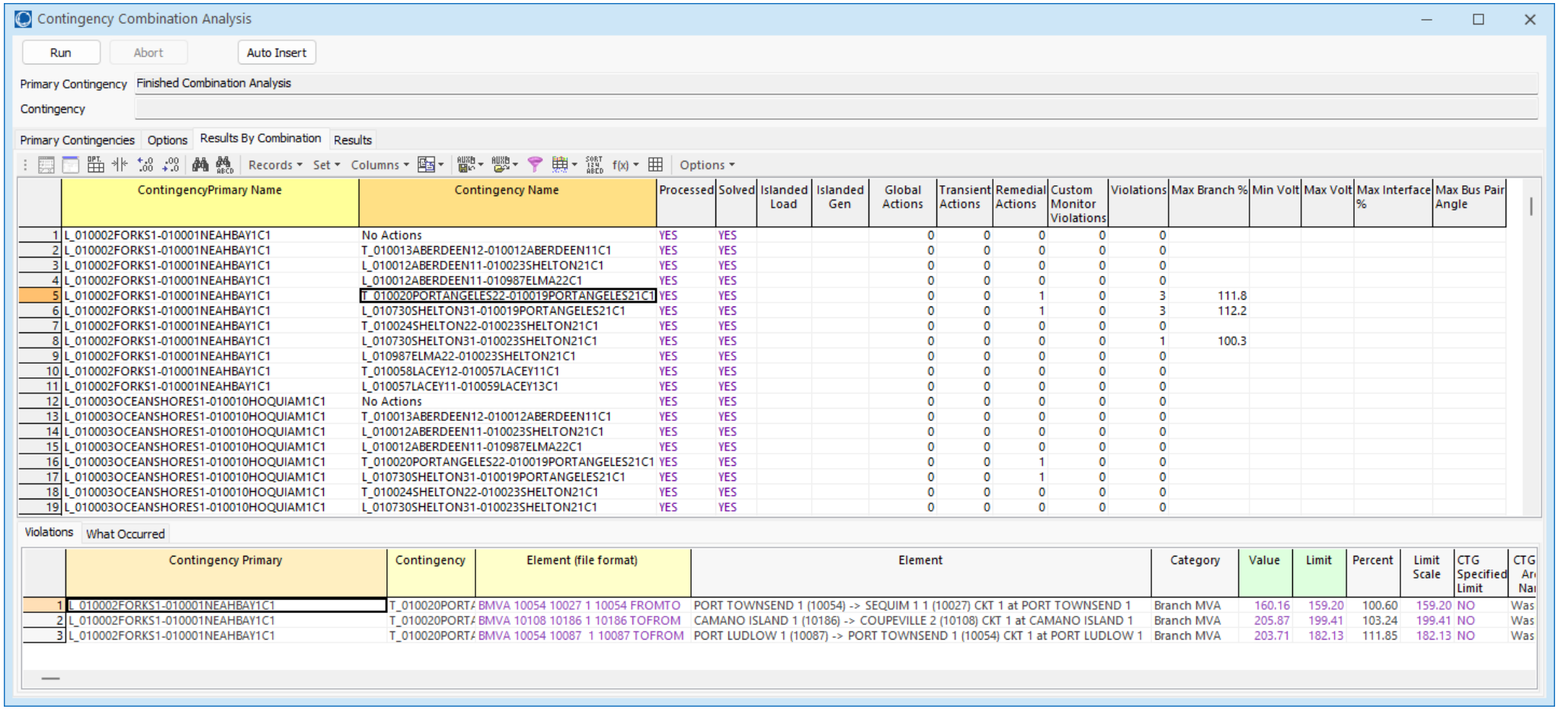
Results By Combination



	ContingencyPrimary Name	Contingency Name	Processed	Solved	Islanded Load	Islanded Gen	Global Actions	Transient Actions	Remedial Actions	Custom Monitor Violations	Violations	Max Branch %	Min Volt	Max Volt	Max Interface %	Max Bus Pair Angle
1	L_010002FORKS1-010001NEAHBAY1C1	No Actions	YES	YES			0	0	0	0	0					
2	L_010002FORKS1-010001NEAHBAY1C1	T_010013ABERDEEN12-010012ABERDEEN11C1	YES	YES			0	0	0	0	0					
3	L_010002FORKS1-010001NEAHBAY1C1	L_010012ABERDEEN11-010023SHELTON21C1	YES	YES			0	0	0	0	0					
4	L_010002FORKS1-010001NEAHBAY1C1	L_010012ABERDEEN11-010987ELMA22C1	YES	YES			0	0	0	0	0					
5	L_010002FORKS1-010001NEAHBAY1C1	T_010020PORTANGELES22-010019PORTANGELES21C1	YES	YES			0	0	1	0	3	111.8				
6	L_010002FORKS1-010001NEAHBAY1C1	L_010730SHELTON31-010019PORTANGELES21C1	YES	YES			0	0	1	0	3	112.2				
7	L_010002FORKS1-010001NEAHBAY1C1	T_010024SHELTON22-010023SHELTON21C1	YES	YES			0	0	0	0	0					
8	L_010002FORKS1-010001NEAHBAY1C1	L_010730SHELTON31-010023SHELTON21C1	YES	YES			0	0	0	0	1	100.3				
9	L_010002FORKS1-010001NEAHBAY1C1	L_010987ELMA22-010023SHELTON21C1	YES	YES			0	0	0	0	0					
10	L_010002FORKS1-010001NEAHBAY1C1	T_010058LACEY12-010057LACEY11C1	YES	YES			0	0	0	0	0					
11	L_010002FORKS1-010001NEAHBAY1C1	L_010057LACEY11-010059LACEY13C1	YES	YES			0	0	0	0	0					
12	L_010003OCEANSHORES1-010010HOQUIAM1C1	No Actions	YES	YES			0	0	0	0	0					
13	L_010003OCEANSHORES1-010010HOQUIAM1C1	T_010013ABERDEEN12-010012ABERDEEN11C1	YES	YES			0	0	0	0	0					
14	L_010003OCEANSHORES1-010010HOQUIAM1C1	L_010012ABERDEEN11-010023SHELTON21C1	YES	YES			0	0	0	0	0					
15	L_010003OCEANSHORES1-010010HOQUIAM1C1	L_010012ABERDEEN11-010987ELMA22C1	YES	YES			0	0	0	0	0					
16	L_010003OCEANSHORES1-010010HOQUIAM1C1	T_010020PORTANGELES22-010019PORTANGELES21C1	YES	YES			0	0	1	0	0					
17	L_010003OCEANSHORES1-010010HOQUIAM1C1	L_010730SHELTON31-010019PORTANGELES21C1	YES	YES			0	0	1	0	0					
18	L_010003OCEANSHORES1-010010HOQUIAM1C1	T_010024SHELTON22-010023SHELTON21C1	YES	YES			0	0	0	0	0					
19	L_010003OCEANSHORES1-010010HOQUIAM1C1	L_010730SHELTON31-010023SHELTON21C1	YES	YES			0	0	0	0	0					

Violations | What Occurred

	Contingency Primary	Contingency	Element (file format)	Element	Category	Value	Limit	Percent	Limit Scale	CTG Specified Limit	CTG Ar Na
1	L_010002FORKS1-010001NEAHBAY1C1	T_010020PORTA	BMVA 10054 10027 1 10054 FROMTO	PORT TOWNSEND 1 (10054) -> SEQUIM 1 1 (10027) CKT 1 at PORT TOWNSEND 1	Branch MVA	160.16	159.20	100.60	159.20	NO	Was
2	L_010002FORKS1-010001NEAHBAY1C1	T_010020PORTA	BMVA 10108 10186 1 10186 TOFROM	CAMANO ISLAND 1 (10186) -> COUPEVILLE 2 (10108) CKT 1 at CAMANO ISLAND 1	Branch MVA	205.87	199.41	103.24	199.41	NO	Was
3	L_010002FORKS1-010001NEAHBAY1C1	T_010020PORTA	BMVA 10054 10087 1 10087 TOFROM	PORT LUDLOW 1 (10087) -> PORT TOWNSEND 1 (10054) CKT 1 at PORT LUDLOW 1	Branch MVA	203.71	182.13	111.85	182.13	NO	Was

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Results and Filtering

- The Results tab on the Contingency Combination Analysis dialog has options to easily filter Violation, What Occurred, and Injection Sensitivity results
- Various filtering options exist
  - Advanced Filter on the CTGComboViolation, CTGComboWhatOccurred, or CTGComboViolationInjSens objects
  - Type of object that is violated and limited to filtered objects of that type
  - Primary Contingency
  - Secondary Contingency

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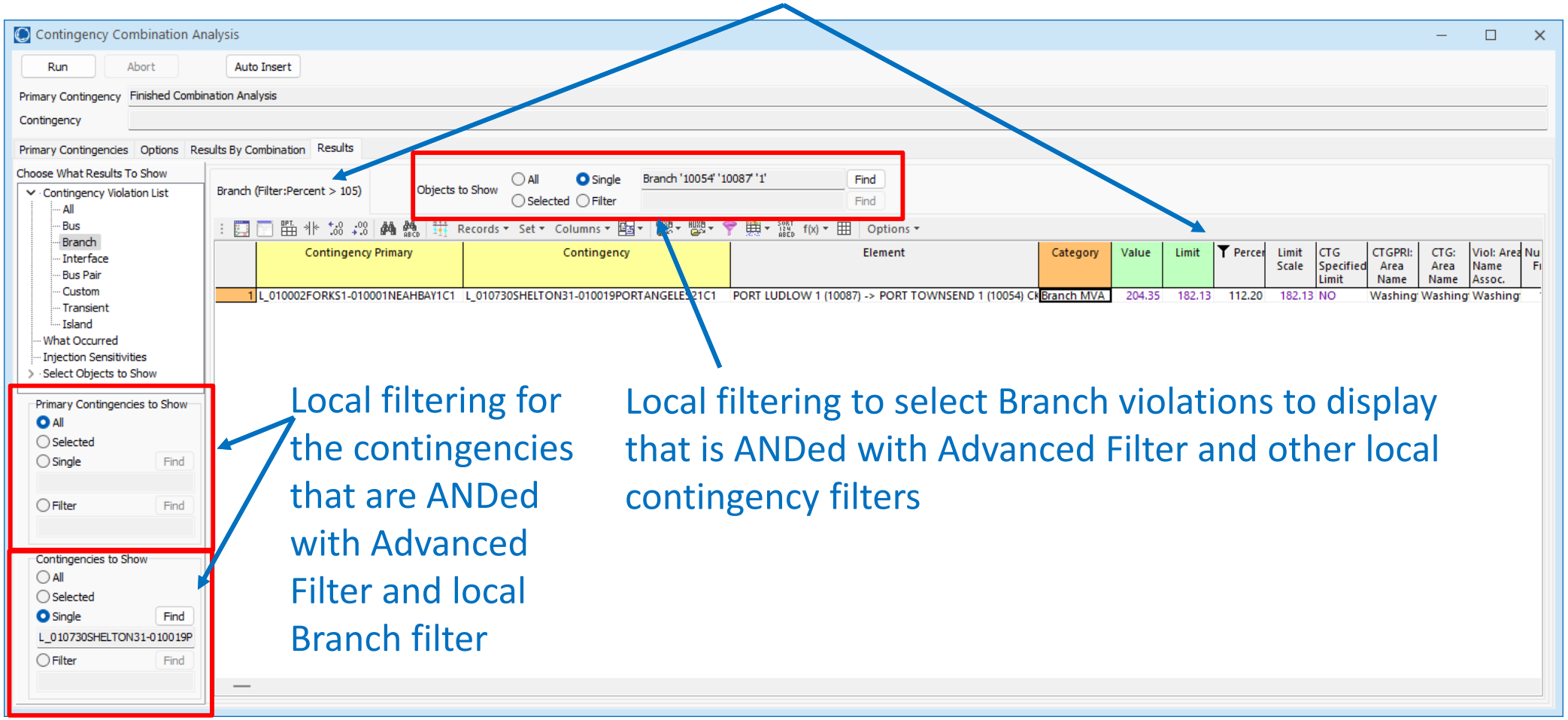
Results and Filtering

Advanced Filter applied to CTGComboViolation object for fields that result from the violation



Local filtering for the contingencies that are ANDed with Advanced Filter and local Branch filter

Local filtering to select Branch violations to display that is ANDed with Advanced Filter and other local contingency filters

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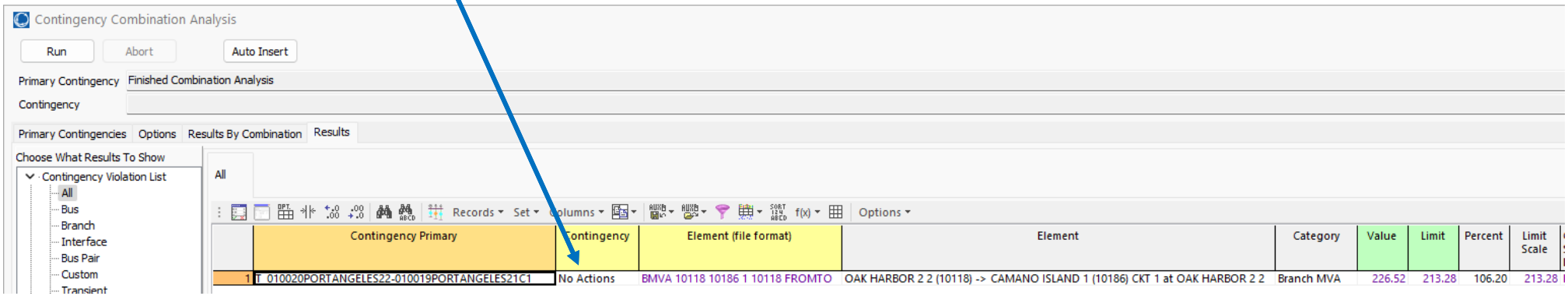
Violations for Primary Only

- Violations are recorded after the Primary AND Secondary have been implemented
- To see violations for only the Primary contingency, create a Secondary contingency that has no actions



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Coordination of Contingency Analysis and Contingency Combo Analysis

- When running Combo Analysis, all regular contingency analysis results are deleted automatically
- PowerWorld prevents you from running Contingency Combo Analysis if regular Contingency Analysis is running (and vice versa)
  - This makes no sense anyway

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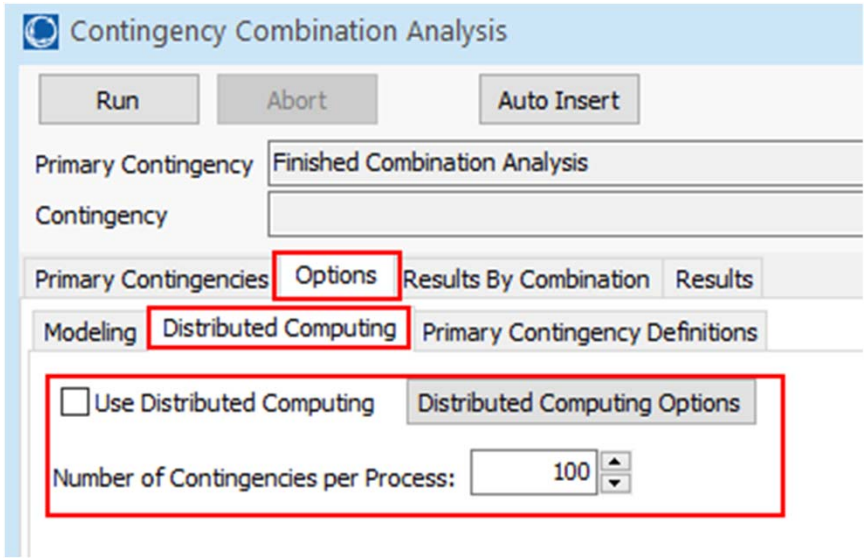
Distributed Computing

- Distributed Computing is available for this tool
  - Each distributed process handles
    - 1 Primary Contingency
    - User specified number of Contingencies



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