New York ISO
Independent System Operator

CENTRAL EAST STABILITY LIMIT ANALYSIS FOR OUTAGE CONDITIONS (CE-23)

A Report by the
New York Independent System Operator

April 2023

Executive Summary

This study was conducted to examine the stability limits for the Central East interface to determine the impact of construction of the Princetown 345 kV substation and other associated equipment built as part of the Segment A and Segment B projects, as well as the Leeds-Hurley smart wire project. The study covers the impact of transmission upgrades from the Segment A and Segment B projects, up to and including the Princetown – New Scotland (361 and 362) 345 kV lines, the Knickerbocker 345 kV substation, the Knickerbocker series compensation path to Pleasant Valley 345 kV, and the Van Wagner 345 kV substation. The Central East interface is defined in Table 2 and illustrated in Figure 1.

This analysis was focused on the impact of the previously stated upgrades on the line outages surrounding the new Princetown substation, including the Princetown – New Scotland (55, 361, 362) 345 kV lines and the Princetown – Gordon Road (371) 345 kV line. The existing limits for all lines in service conditions and all other outage conditions not explicitly stated in this report have been confirmed and remain in effect. A future comprehensive analysis will be conducted for the full completion of the Segment A&B project, accounting for the Edic-Princetown (351 and 352) 345 kV lines and the Dover PAR.

Sensitivities were examined for various operation levels of the Knickerbocker series compensation and the Leeds – Hurley smart wire. Neither the Knickerbocker series compensation at any of its operation levels nor the status of the Leeds-Hurley smart wire was found to cause a degradation of any limits found in this report.

The limits recommended in this report are based on a stable system response at the highest transfer level tested. There were no instances of any system or unit instability observed.

It is recommended that the Central East stability transfer limits be updated as reported in Table 1.

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Summary of Proposed Limits

The proposed new line outage limit revisions and the magnitude of the changes are presented in Table 1, below:

Princetown - New Scotland (55) 345 kV Out-of-Service																		
Oswego	Sithe	Marcy StatCom O/S									Marcy StatCom I/S								
		SVCs I/S			One SVC O/S			Both SVCs O/S			SVCs I/S			One SVC O/S			Both SVCs O/S		
		Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta
3	5	2350	2750	400	2350	2750	400	2400	2800	400	2450	2850	400	2450	2850	400	2450	2850	400
3	3	2200	2550	350	2200	2550	350	2250	2600	350	2400	2650	250	2400	2700	300	2400	2700	300
3	0	1950	2450	500	2000	2450	450	2000	2450	450	2150	2500	350	2150	2550	400	2200	2550	350
2	5	2350	2650	300	2350	2650	300	2400	2650	250	2400	2700	300	2400	2700	300	2400	2700	300
2	3	2150	2550	400	2150	2550	400	2200	2600	400	2350	2600	250	2350	2600	250	2350	2600	250
2	0	1800	2450	650	1850	2450	600	1850	2500	650	2100	2500	400	2100	2550	450	2150	2550	400

Princetown - New Scotland (361 or 362) 345 kV Out-of-Service																		
Oswego	Sithe	Marcy StatCom O/S									Marcy StatCom I/S								
		SVCs I/S			One SVC O/S			Both SVCs O/S			SVCs I/S			One SVC O/S			Both SVCs O/S		
		Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta
3	5	0	2750	2750	0	2750	2750	0	2800	2800	0	2850	2850	0	2850	2850	0	2850	2850
3	3	0	2550	2550	0	2550	2550	0	2600	2600	0	2650	2650	0	2700	2700	0	2700	2700
3	0	0	2450	2450	0	2450	2450	0	2450	2450	0	2500	2500	0	2550	2550	0	2550	2550
2	5	0	2650	2650	0	2650	2650	0	2650	2650	0	2700	2700	0	2700	2700	0	2700	2700
2	3	0	2550	2550	0	2550	2550	0	2600	2600	0	2600	2600	0	2600	2600	0	2600	2600
2	0	0	2450	2450	0	2450	2450	0	2500	2500	0	2500	2500	0	2550	2550	0	2550	2550

Princetown – Gordon Road (371) 345 kV Out-of-Service																		
Oswego	Sithe	Marcy StatCom O/S									Marcy StatCom I/S								
		SVCs I/S			One SVC O/S			Both SVCs O/S			SVCs I/S			One SVC O/S			Both SVCs O/S		
		Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta
3	5	0	2450	2450	0	2500	2500	0	2500	2500	0	2600	2600	0	2600	2600	0	2600	2600
3	3	0	2400	2400	0	2400	2400	0	2400	2400	0	2500	2500	0	2550	2550	0	2550	2550
3	0	0	2000	2000	0	2000	2000	0	2000	2000	0	2400	2400	0	2450	2450	0	2450	2450
2	5	0	2400	2400	0	2450	2450	0	2450	2450	0	2450	2450	0	2500	2500	0	2500	2500
2	3	0	2350	2350	0	2350	2350	0	2350	2350	0	2400	2400	0	2400	2400	0	2400	2400
2	0	0	2000	2000	0	2000	2000	0	2000	2000	0	2250	2250	0	2250	2250	0	2250	2250

Table 1: Proposed New Line Outage Limit Revisions

Introduction

This study serves as a review of Central East stability limits for the Segment A and Segment B projects commissioning. A limited selection of outage conditions (Princetown – New Scotland (55), Princetown – New Scotland (361/362), and Princetown – Gordon Road (371)) had new limits developed, while other outage conditions previously tested for Central East had their existing limits validated. Sensitivities regarding the status of the Knickerbocker series capacitor path and the Leeds-Hurley smart wire were examined and found to cause no degradations to Central East limits.

This study provides recommendations to update the Central East stability transfer limits for outage conditions as per Table 1.

System Operating Limit Methodology

The "NYSRC Reliability Rules for Planning and Operating the New York State Power System" (NYSRC Reliability Rules) provides the methodology for developing System Operating Limits (SOLs) within the NYISO Reliability Coordinator Area. NYSRC Reliability Rules require compliance with all North American Electric Reliability Corporation (NERC) Standards and Northeast Power Coordinating Council (NPCC) Standards and Criteria. Rule C.1 of the NYSRC Reliability Rules sets forth the contingencies to be evaluated and the performance requirements to be applied in developing SOLs. Rule C.1 also incorporates NYISO Transmission Planning Guideline #3-1, the "Guideline for Stability Analysis and Determination of Stability-Based Transfer Limits" found in Attachment H to the NYISO "Transmission Expansion and Interconnection Manual."

Interface Summary

The new Central East interface definition is given below in Table 4 and illustrated in Figure 1.

Central East		
Mohawk Valley (Zone E) – Capital (Zone F)		
Name	**Line ID**	**Voltage (kV)**
Edic-Gordon Rd.*	14	345
Marcy-New Scotland*	18	345
East Springfield-Inghams*	7-942	115
Inghams PAR*	PAR	115
Inghams Bus Tie*	R81	115
North (Zone D) – ISONE (Zone N)		
*Plattsburgh-Sand Bar	PV20	115

* Indicates the metered end of the circuit

Table 2. Central East Interface Definition

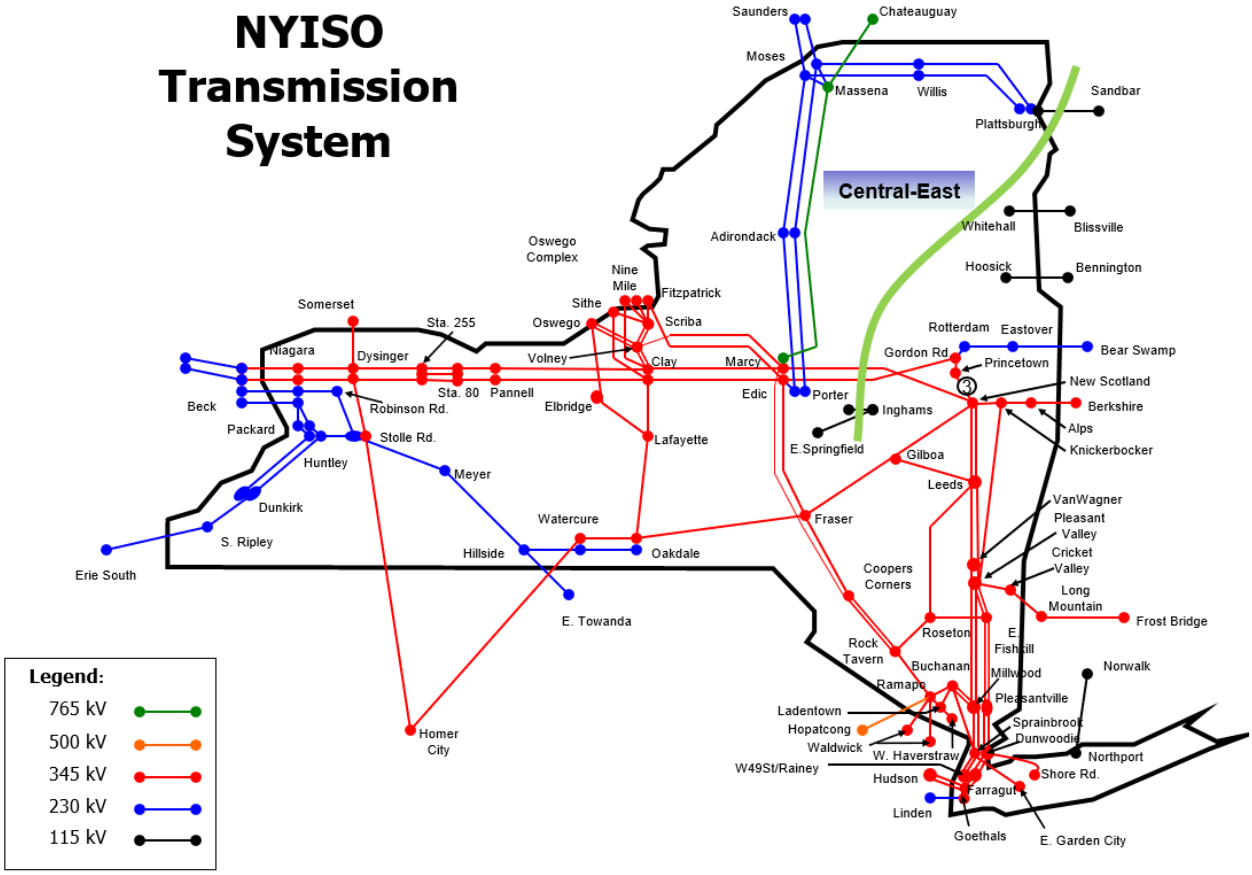

Figure 1. NYCA Transmission System Interface (Central East inset)

System Representation and Transfer Case Development

The analysis was based on the 2022 NYISO Dynamics Base Case, which was developed from the 2022 MMWG Dynamics Base Case with the NYISO representation updated to reflect the results of the NYISO 2022 Summer Operating Study. The Summer 2022 Operating Study was updated to include the summer 2023 network configuration of the Segment A and Segment B projects, including the additions of the Princetown 345 kV substation, the new Princetown-New Scotland 345 kV lines (361 and 362), the Knickerbocker 345 kV substation, the Knickerbocker series compensation connection to Pleasant Valley 345 kV, the Van Wagner 345 kV substation, which taps the 345 kV lines of Leeds – Pleasant Valley (91) and Athens – Pleasant Valley (92). The Leeds-Hurley smart wire, replacing existing equipment on the Leeds – Hurley (301) 345 kV line, was also placed in service for this analysis.

The base case model includes:

- the NYISO Transmission Operator area;
- all Transmission Operator areas contiguous with NYISO;
- all system elements modeled as in-service;
- all generation represented;
- phase shifters in the regulating mode;
- the NYISO Load Forecast;
- transmission facility additions and retirements;
- generation facility additions and retirements;
- Remedial Action Scheme (RAS) models currently existing or projected for implementation within the studied time horizon;
- series compensation for each line at the expected operating level; and
- facility ratings as provided by the Transmission Owner and Generator Owner

Central East transfers were developed from generation shifts between IESO and NYISO West (Zone A) through Central (Zone C) to Capital (Zone F), and ISO New England. The base case was established with a high transfer on Dysinger East (> 2900 MW), Moses South (> 2700 MW) and NY-ISO-NE (>1500 MW).

The units included in the Oswego Complex are Nine Mile 1, Nine Mile 2, Fitzpatrick, Oswego 5 and Oswego 6. When this report refers to Oswego units, it is referring to these units. The large combined cycle

plant in the Oswego area is referred to as Sithe and is accounted for separately.

This study was performed with Chateauguay HVDC terminals taken out-of-service with the Chateauguay transfers maintained with the Beauharnois units, and the Marcy South Series Compensation was modeled out-of-service. When the Fraser SVC, Leeds SVC and Marcy FACTs were modeled in-service, the base case load flow were solved with the SVCs/FACTs set to minimum (0MVAr) output by adjusting their respective voltage schedules in the pre-contingency case.

This study placed the Knickerbocker series compensation in service at 50% compensation and placed the Leeds-Hurley smart wire in service. Sensitivities were examined for various operation levels of the Knickerbocker series compensation and the Leeds – Hurley smart wire. Neither the Knickerbocker series compensation at any of its operation levels nor the status of the Leeds-Hurley smart wire was found to cause a degradation of any limits found in this report.

Tested Contingencies

Ninety-one (91) contingencies were tested for Central East transfer case scenario. Table 3 provides the identification and description of these contingencies.

Table 3.

Contingencies Applied for Evaluating Central East Stability Transfer Limits

#	ID	Description
1	CE02	3PH-NC@MARCY345 – L/O MARCY-N.SCOTLAND (UNS-18) W/RCL
2	CE03_AC-SEGA_SUM2023	SLG-STK@EDIC345 (BKR R935) – L/O EDIC-GORDON ROAD #14 / BKUP CLR FE1
3	CE05	3PH-NC@EDIC345 – L/O EDIC-MARCY UE1-7
4	CE06	3PH-NC@MARCY345 – L/O EDIC-MARCY (UE1-7)
5	CE07	LLG@MARCY/EDIC - L/O MARCY-COOPERS (UCC2-41) & EDIC-FRASER (EF24-40) DCT
6	CE07AR	LLG@MARCY/EDIC - L/O MARCY-COOPERS (UCC2-41) & EDIC-FRASER (EF24-40) DCT W/RCL
7	CE08	LLG@COOPERS - L/O MARCY-COOPERS (UCC2-41)/FRASER-COOPERS (FCC33) DCT
8	CE08AR	LLG@COOPERS – L/O MARCY-COOPERS (UCC2-41)/FRASER-COOPERS (FCC33) DCT W/RCL
9	CE09_AC-SEGA_SUM2022	SLG-STK@EDIC345kV – L/O FITZ-EDIC #FE-1/BKUP CLR#14
10	CE10	SLG-STK@MARCY345 (BKR3308) – L/O MARCY-N.SCOT (UNS-18)
11	CE11	SLG-STK@FRASER345 (BKR B1/3562) – L/O FRASER-GILBOA (GF-5)
12	CE12_AC-SEGA_SUM2023	3PH-NC@GORDON ROAD345 – L/O EDIC-GORDON ROAD #14 W/H.S RCL
13	CE13	3PH-NC@VOLNEY345 – L/O VOLNEY-MARCY (VU-19)

14	CE14	3PH-NC@MARCY345 – L/O VOLNEY-MARCY (VU-19)
15	CE15	SLG-STK@MARCY345(BKR 3108) – L/O VOLNEY-MARCY (VU-19) / BKUP CLR#UE1-7
16	CE16	SLG-STK@EDIC345 (BKR R915) – L/O EDIC-FRASER (EF24-40) / BKUP CLR#2-15
17	CE17	SLG-STK@MARCY(BKR 3208)- L/O MARCY-COOPERS(UCC2-41)
18	CE18AR-UC30AR	LLG@ROCK – L/O CPV (DOLSON) - ROCK TAVERN DCT W/ RCL
19	CE18-UC30	LLG@ROCK – L/O CPV (DOLSON) - ROCK TAVERN DCT
20	CE19	LLG@COOPERS – L/O COOPERS CORNERS- CPV_VALY(DOLSON) DCT
21	CE19AR	LLG@COOPERS – L/O COOPERS CORNERS-CPV_VALY(DOLSON) DCT W/ RCL
22	CE20	SLG-STK@EDIC345 (BKR R70) – L/O EDIC-MARCY UE1-7/ BKUP CLR EDIC T4 (WithT2 Moved)
23	CE21	SLG-STK@FRASER – L/O FRASER-COOPERS 33 / BKUP CLR#32@OAKDALE
24	CE21OAK	TEXT, SLG-STK@FRASER – L/O FRASER-COOPERS 33 / BKUP CLR#32@OAKDALE
25	CE22	3PH-NC@EDIC345 – L/O EDIC-FRASER EF-24/40
26	CE22AR	3PH-NC@EDIC345 – L/O EDIC-FRASER EF-24/40 W/RCL@FRASER
27	CE23	LLG@FRASER – L/O MARCY-COOPERS(UCC2-41)/EDIC-FRASER(EF24-40) DCT
28	CE23AR	LLG@FRASER – L/O MARCY-COOPERS(UCC2-41)/EDIC-FRASER(EF24-40) DCT W/RCL
29	CE24	3PH-NC@FRASER – L/O FRASER-COOPERS CORNERS FCC-33
30	CE24AR	3PH-NC@FRASER – L/O FRASER-COOPERS CORNERS FCC-33 W/RCL
31	CE25	3PH-NC@COOPERS – L/O FRASER-COOPERS CORNERS FCC-33
32	CE25AR	3PH-NC@COOPERS – L/O FRASER-COOPERS CORNERS FCC-33 W/RCL
33	CE26	3PH-NC@COOPERS – L/O MARCY-COOPERS CORNERS UCC-2/41
34	CE26AR	3PH-NC@COOPERS – L/O MARCY-COOPERS CORNERS UCC-2/41 W/RCL
35	CE27	3PH-NC@COOPERS – L/O COOPERS CORNERS- ROCK TAVERN CCRT-34
36	CE27AR	3PH-NC@COOPERS – L/O COOPERS CORNERS-ROCK TAVERN CCRT-34 W/RCL
37	CE28	3PH-NC@COOPERS – L/O COOPERS CORNERS-CPV_VALY(DOLSON) CCRT-42
38	CE28AR	3PH-NC@COOPERS – L/O COOPERS CORNERS-CPV_VALY(DOLSON) CCRT-42 W/RCL
39	CE29	3PH-NC@CPV – L/O CPV_VALY(DOLSON AVE)- ROCK TAV DART-44
40	CE30	3PH-NC@ROCK – L/O ROCK TAVERN-CPV_VALY (DOLSON AVE) DART-44
41	CE32	3PH-NC@FRASER – L/O EDIC - FRASER EF-24/40
42	CE32AR	3PH-NC@FRASER – L/O EDIC - FRASER EF-24/40 W/RCL
43	CE33	3PH-NC@FITZ – L/O EDIC - FITZPATRICK FE-1
44	CE34	3PH-NC@SCRIBA 345kV JA FITZP-SCRIBA #10 NORMALLY CLEARED

45	CE35	3PH-NC@JA FITZP 345kV JA FITZP-SCRIBA #10 NORMALLY CLEARED
46	CE36	SLG--STK@SCRIBA345 (BKR R100)/SCRIBA-FITZ #10/ BKUP CLR SCRIBA 345-SCRIBA 115 XFMR
47	CE37_NM2-L23	3PH@Nine Mile 2 on line 23 from Nine Mile 2 to Scriba with failure of A Package Protection - Using conservative B Package clearing times
48	CE99	SLG-STK@SCRIBA345 (BKR R935) – L/O SCRIBA-VOLNEY 21 / BKUP CLR FITZ-SCRIBA #10
49	NYPA02	3PH-NC@MOSES230 – L/O MOSES-ADIR W/NO REJ.
50	NYPA150	LLG@MOSES230 – L/O MOSES-ST.LAWRENCE L33/34P DCT W/NO REJ
51	NE01	3PH-NC@SEABROOK345 – L/O SEABROOK G1
52	NE03	L/O PHASE II INTERCONNECTION W/O FAULT (N-1)
53	P1-2-F14_3PH_KNKBKR_ALPS	3PH fault at KNICKERBOCKER on KNICKERBOCKER - ALPS 345kV CKT 1
54	P1-2-F15_3PH_ALPS_KNKBKR	3PH fault at ALPS on ALPS - KNICKERBOCKER 345kV CKT 1
55	P1-2-F20_3PH_KNKBKR_PLSVLY	3PH fault at KNICKERBOCKER on KNICKERBOCKER - PLEASANT VALLEY 345kV CKT 1
56	P1-2-F21_3PH_PLSVLY_KNKBKR	3PH fault at PLEASANT VALLEY on PLEASANT VALLEY - KNICKERBOCKER 345kV CKT 1
57	P1-2-F31_3PH_NSCOT77-KNKBKR	3PH fault at N.SCOT77 on N.SCOT77 - KNICKERBOCKER 345kV CKT 1
58	P1-2-F32_3PH_KNKBKR_NSCOT77	3PH fault at KNICKERBOCKER on N.SCOT77 - KNICKERBOCKER 345kV CKT 1
59	P4-2-F13_SLG_KNKBKR_NSCOT_#4_POST	SLG fault at KNICKERBOCKER on KNICKERBOCKER - NEW SCOTLAND 345kV CKT 1 W/ STUCK BRK #4
60	P4-2-F13_SLG_KNKBKR_NSCOT_#7_POST	SLG fault at KNICKERBOCKER on KNICKERBOCKER - NEW SCOTLAND 345kV CKT 1 W/ STUCK BRK #7
61	P4-2-F14_SLG_KNKBKR_ALPS_#5_POST	SLG fault at KNICKERBOCKER on KNICKERBOCKER - ALPS 345kV CKT 1 W/ STUCK BRK #5
62	P4-2-F14_SLG_KNKBKR_ALPS_#7_POST	SLG fault at KNICKERBOCKER on KNICKERBOCKER - ALPS 345kV CKT 1 W/ STUCK BRK #7
63	P4-2-F15_SLG_ALPS_KNKBKR_#R2	SLG fault at ALPS on ALPS - KNICKERBOCKER 345kV CKT 1 W/ BRK# R2 STUCK
64	P4-2-F20_SLG_KNKBKR_PLSVLY_#4_POST	SLG fault at KNICKERBOCKER on KNICKERBOCKER - PLEASANT VALLEY 345kV CKT 1 W/ STUCK BRK #4
65	P4-2-F20_SLG_KNKBKR_PLSVLY_#5_POST	SLG fault at KNICKERBOCKER on KNICKERBOCKER - PLEASANT VALLEY 345kV CKT 1 W/ STUCK BRK #5
66	P4-2-F21_1PH_PLSVLY_KNKBKR_#RNS3	1PH fault at PLEASANT VALLEY on PLEASANT VALLEY - KNICKERBOCKER 345kV CKT 1 W/ BRK# RNS3 STUCK
67	P4-2-F31_SLG_NSCOT_KNKBKR_#R2	3PH fault at N.SCOT77 on N.SCOT77 - KNICKERBOCKER 345kV line with stuck BRK#R2, Q542+Q543
68	P7_F1_KNKBKR-PLSVLY_FTORNG-VLKN	Double Circuit Tower Contingency on Knickerbocker-Pleasant Valley 345kV and Fort Orange-Valkin 115kV lines
69	P7_F5_KNKBKR-PLSVLY_ADMML-CHRCHTWN	Double Circuit Tower Contingency on Knickerbocker-Pleasant Valley 345kV and ADM Milling-Churchtown 115kV lines
70	P7_F6_KNKBKR-PLSVLY_CHRCHTWN-BLSTRS	Double Circuit Tower Contingency on Knickerbocker-Pleasant Valley 345kV and Churchtown-Blue Stores 115kV lines
71	P7_F8_KNKBKR-PLSVLY_MLN-PLSVLY	Double Circuit Tower Contingency on Knickerbocker-Pleasant Valley 345kV and Blue Milan-Pleasant Valley 115kV lines

72	SA01_Q556	SLG-STK@EDIC345 (BKR R915) – L/O EDIC-FRASER (EF24-40) / BKUP CLR#2-15
73	SA02_Q556_SUM2023	SLG-STK@N.SCOTLAND 345kV (BKR R55) – L/O N.SCOTLAND-PRINCETOWN
74	SA03_Q556_SUM2023	3PH-NC@EDIC345 – L/O EDIC-GORDON_ROAD
75	SA04_Q556_SUM2023	3PH-NC@GORDON ROAD345 – L/O EDIC-GORDON ROAD
76	SA05_Q556_SUM2023	3PH-NC@NSCOT345 – L/O PRINCETOWN-N.SCOT W/H.S RCL
77	SA06_Q556_SUM2023	3PH-NC@PRINCETOWN – L/O N.SCOT - PRINCETOWN W/RCL
78	SA07_Q556_SUM2022	3PH-NCN.SCOTLON.SCOT-LEEDS93WHSRCL
79	SA08_Q556_SUM2032	SLG-STK@GORDON ROAD 345 (BKR 2) – L/O EDIC - GORDON ROAD
80	SA09_Q556_SUM2023	SLG-STK@GORDON ROAD (BKR 5) – L/O PRINCETOWN - GORDON ROAD
81	SA10_Q556_SUM2023	SLG-STK@EDIC345 (BKR R140) – L/O EDIC-GORDON ROAD
82	SA14_Q556_SUM2023	SLG-STK@PRINCETOWN (BKR 2) – L/O GORDON_ROAD-PRINCETOWN
83	SA15_Q556_SUM2023	3PH-NC@GORDON ROAD – L/O EDIC-GORDON ROAD
84	SA16_Q556_SUM2023	3PH-NC@PRINCETOWN – L/O PRINCETOWN-GORDON ROAD
85	SA17_Q556_SUM2023	3PH-NC@PRINCETOWN – L/O PRINCETOWN-N.SCOTLAND 66
86	SA18_Q556_SUM2023	3PH-NC@PRINCETOWN – L/O PRINCETOWN - N.SCOT
87	SA19_Q556_SUM2023	SLG-STK@N. SCOTLAND 66 345kV (BKR R361) – L/O N.SCOTLAND - PRINCETOWN
88	SA20_Q556_SUM2023	3PH-NC@GORDON ROAD – L/O PRINCETOWN-GORDON ROAD
89	SA21_Q556_SUM2023	3PH-NC@N.SCOTLAND 66 – L/O PRINCETOWN-N.SCOTLAND 66
90	SA22_Q556_SUM2023	3PH-NC@N.SCOT 77– L/O PRINCETOWN - N.SCOT
91	SA23_Q556_SUM2023	LLG-DCT@PRINCETOWN – L/O PRINCETOWN - N.SCOT66 (361) & PRINCETOWN - N.SCOT (362)

All Central East contingencies listed on Table 3 (Contingencies Applied for Evaluating Central East Stability Transfer Limits) were tested for the 2 Oswego units and 3 Oswego units in-service scenarios, with 0, 3 and 5 Sithe units in-service for Marcy StatCom sensitivity with both Leeds and Fraser SVCs in-service.

The most severe contingency related to Central East stability is CE99, a single line to ground fault at Scriba 345 kV which results in the loss of Scriba – Volney (21) 345 kV and the back-up clearing of the Fitzpatrick – Scriba (FS-10) 345 kV line. Other contingencies that merit monitoring on Central East are CE06, CE09_AC-SegAB_SUM2022, CE36, and SA01_Q556. Contingency CE06 deals with a 3-phase fault at Marcy 345 kV, CE09_AC-SegAB_SUM2022 with a single line to ground fault at Edic 345 kV and loss of Fitzpatrick-Edic 345 kV, CE36 with a single line to ground fault at Scriba 345 kV, and SA01_Q556 with a single line to ground fault at Edic 345 kV and loss of Edic-Fraser 345 kV.

Monitored Elements

In order to assess system stability response for the Central East power transfer scenarios including contingencies, the following parameters were monitored and analyzed:

- generators' angles, power outputs, terminal voltages, and speeds in the following areas/zones (West, Central, Capital, North); and
- bus voltages and frequencies around Central East, Moses South, Dysinger East and NYISO-ISO-NE interfaces.

The recommended limits in this report are all based on stable system response at the highest transfer level tested. There were no instances of any system or unit instability observed in any of the simulations.

Discussion

General Comments

Angle and Voltage Monitoring

Machine angles and bus voltages were employed in this analysis as the key indicators of system stability. The discussions that follow include representative plots of generation unit angle response for illustration purposes. Similar plots are included in the appendix for all simulations conducted. The recommended limits in this report are all based on stable system response at the highest transfer level tested. There were no instances of any system or unit instability observed in any of the simulations.

Central East Stability Limit with Line Outages

Princetown – New Scotland (55) 345 kV Out-of-Service Stability Limit Results

Stability limit results for the outage of Princetown - New Scotland (55) 345 kV cases are found in Table 4 below:

Princetown - New Scotland (55) 345 kV Out-of-Service																		
Oswego	Sithe	Marcy StatCom O/S								Marcy StatCom I/S								
		SVCs I/S			One SVC O/S			Both SVCs O/S			SVCs I/S			One SVC O/S			Both SVCs O/S		
		Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta
3	5	2350	2750	400	2350	2750	400	2400	2800	400	2450	2850	400	2450	2850	400	2450	2850	400
3	3	2200	2550	350	2200	2550	350	2250	2600	350	2400	2650	250	2400	2700	300	2400	2700	300
3	0	1950	2450	500	2000	2450	450	2000	2450	450	2150	2500	350	2150	2550	400	2200	2550	350
2	5	2350	2650	300	2350	2650	300	2400	2650	250	2400	2700	300	2400	2700	300	2400	2700	300
2	3	2150	2550	400	2150	2550	400	2200	2600	400	2350	2600	250	2350	2600	250	2350	2600	250
2	0	1800	2450	650	1850	2450	600	1850	2500	650	2100	2500	400	2100	2550	450	2150	2550	400

Table 4: Updates to Princetown - New Scotland (55) 345 kV Outage Stability Limits

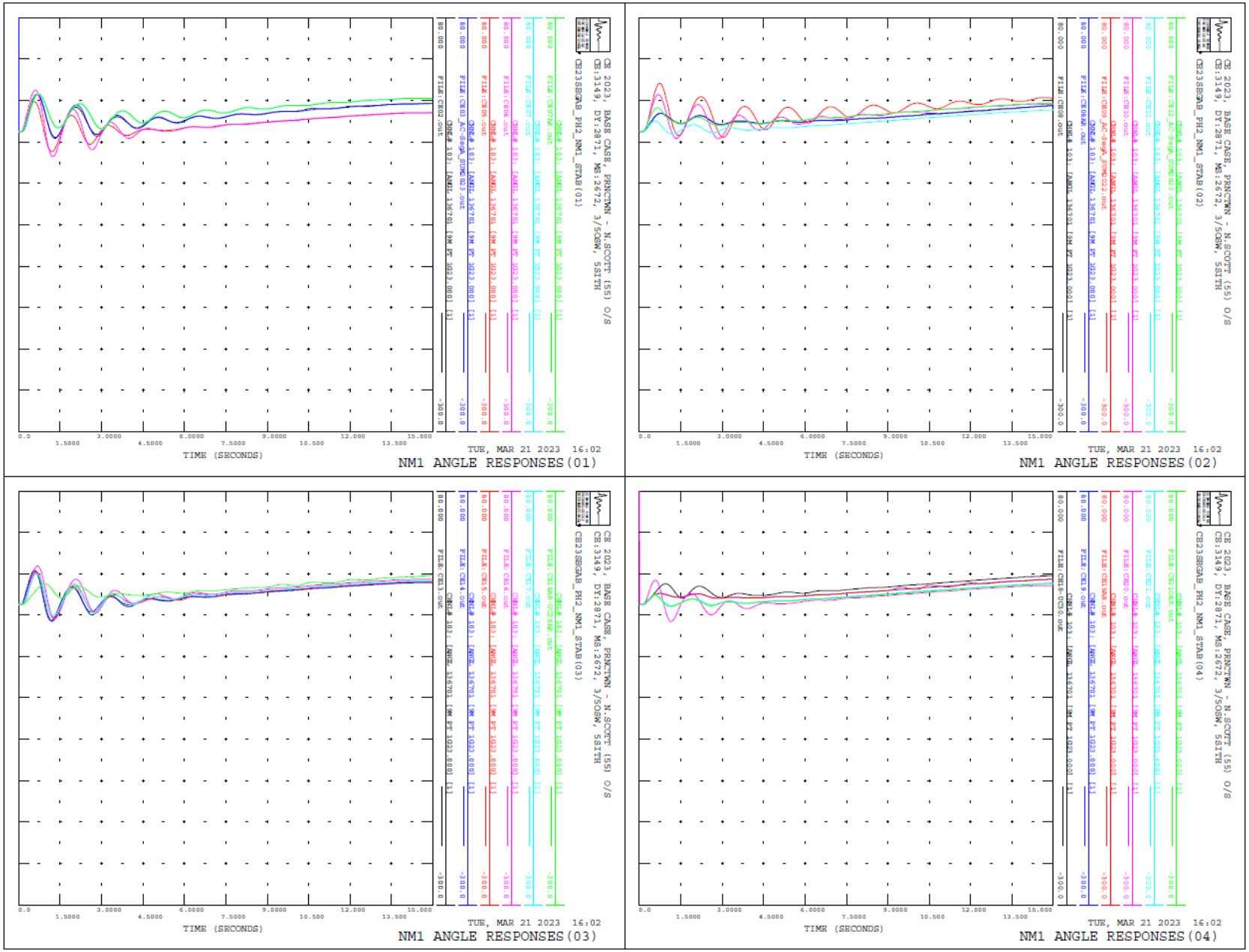

Figure 2a. Nine Mile 1 Angles in Case 55 OS, 3 Oswego, 5 Sithe, Marcy StatCom and SVCs In-Service Contingency Responses (01-04)

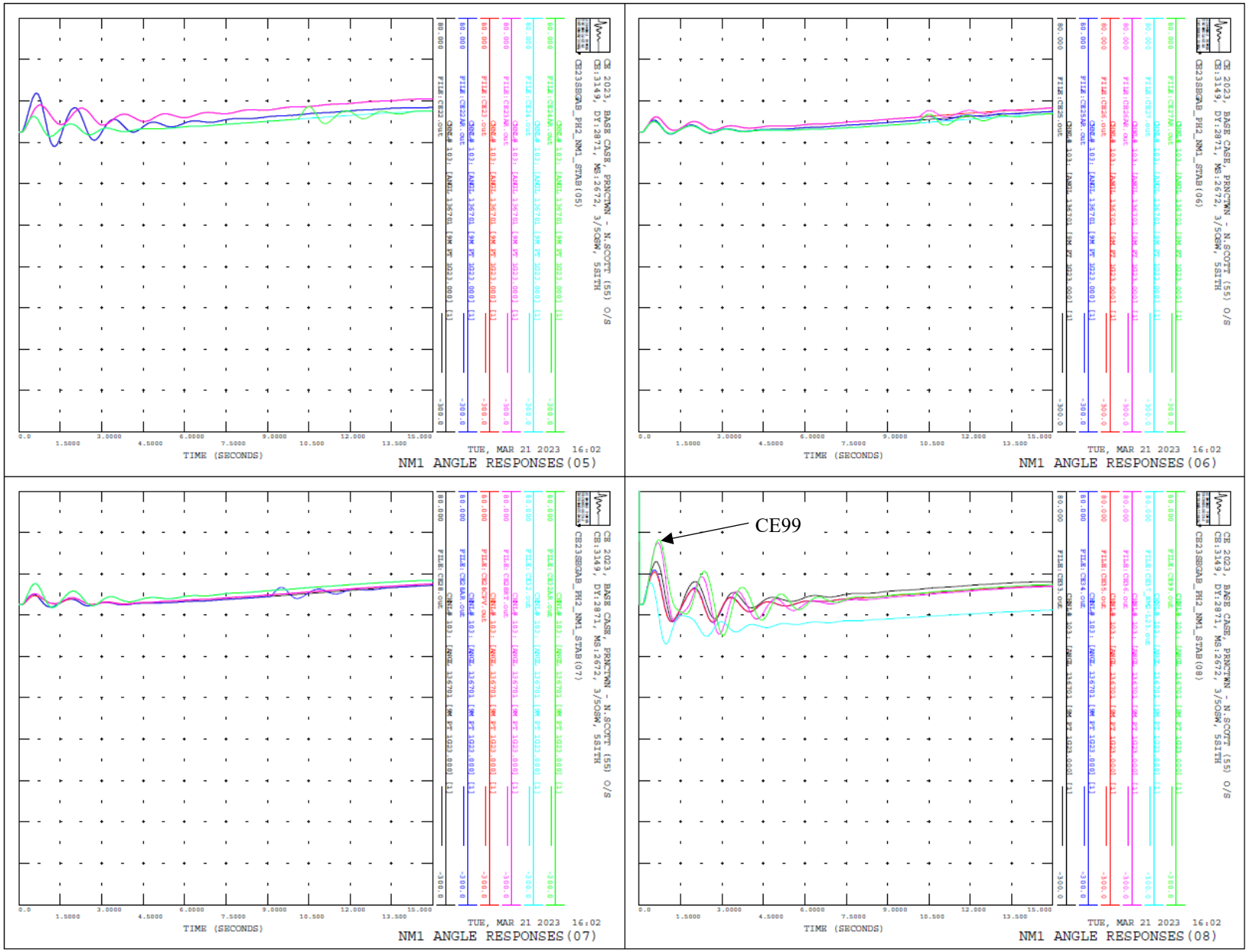

Figure 2b. Nine Mile 1 Angles in Case 55 OS, 3 Oswego, 5 Sithe, Marcy StatCom and SVCs In-Service Contingency Responses (05-08)

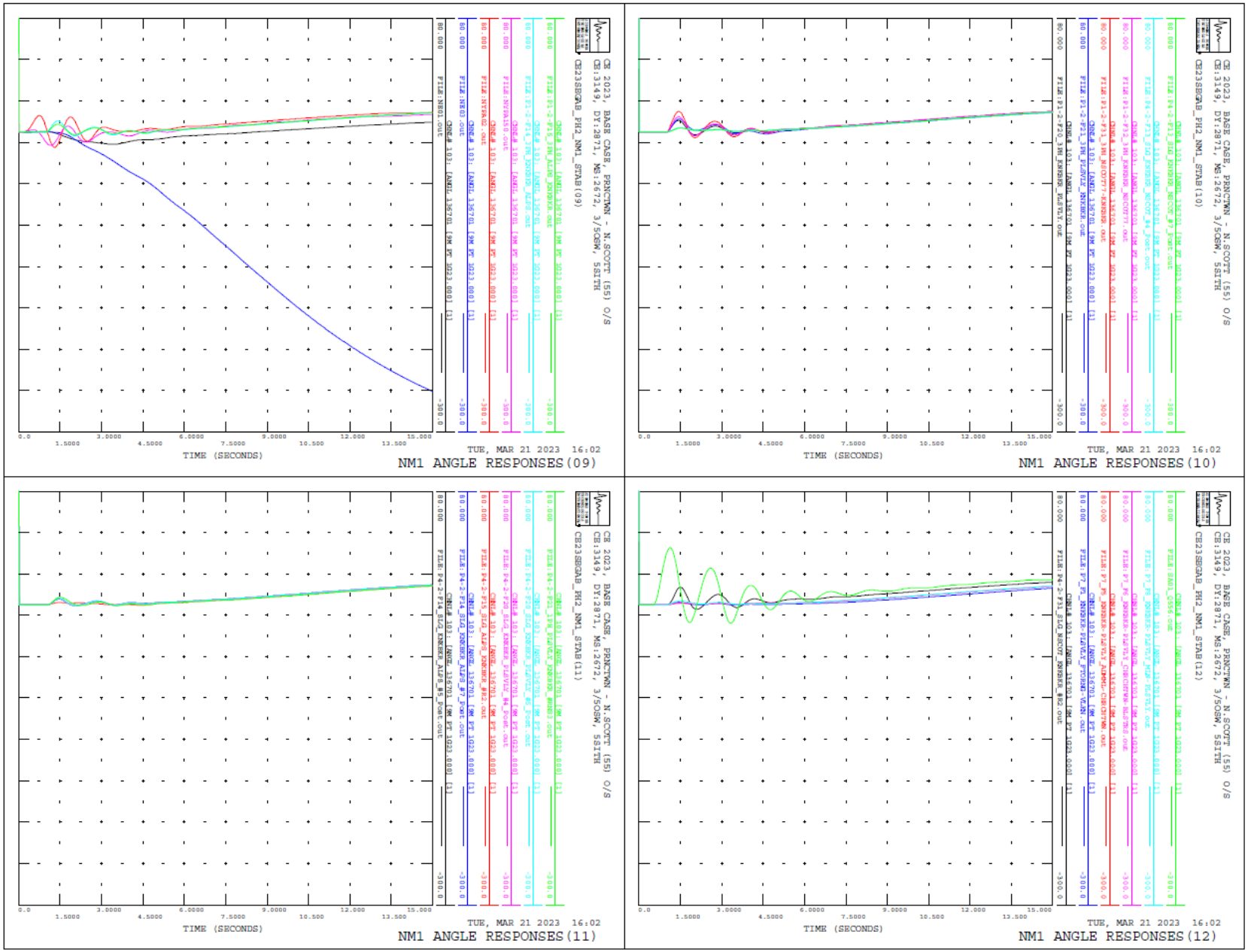

Figure 2c. Nine Mile 1 Angles in Case 55 OS, 3 Oswego, 5 Sithe, Marcy StatCom and SVCs In-Service Contingency Responses (09-12)

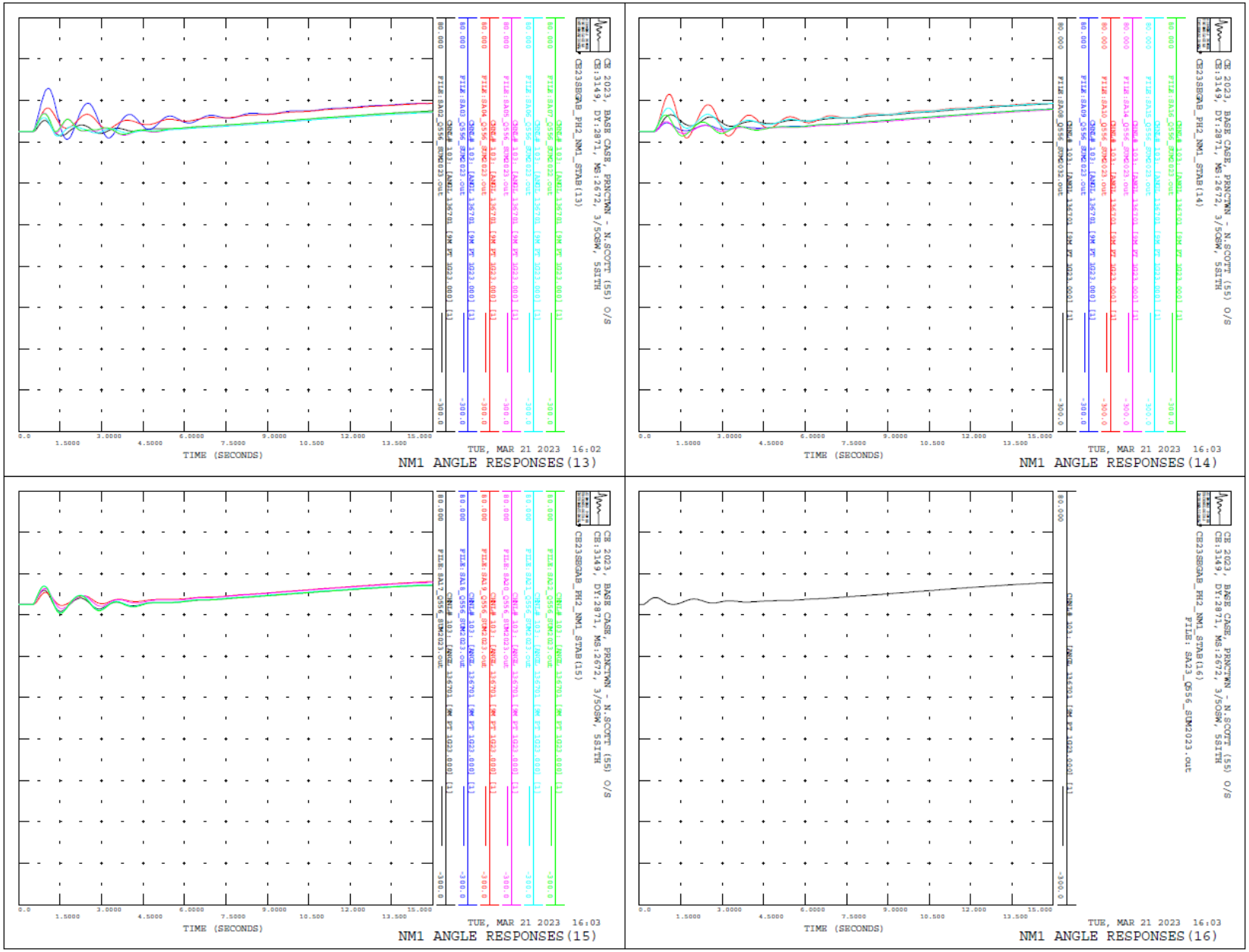

Figure 2c. Nine Mile 1 Angles in Case 55 OS, 3 Oswego, 5 Sithe, Marcy StatCom and SVCs In-Service Contingency Responses (13-16)

All Central East contingencies listed on Table 3 Contingencies Applied for Evaluating Central East Stability Transfer Limits were tested for the 3 Oswego scenario with 5 Sithe, Marcy StatCom and both SVCs in-service with Princetown – New Scotland (55) 345 kV line out-of-service. The contingencies that resulted in the largest oscillation of machine angles or caused instability were employed to determine all the proposed limits presented on Table 4 Updates to Princetown – New Scotland (55) 345 kV outage Stability Limits.

The most severe contingency related to Central East stability is CE99, a single line to ground fault at Scriba 345 kV which results in the loss of Scriba – Volney (21) 345 kV and the back-up clearing of the Fitzpatrick – Scriba (FS-10) 345 kV line.

The left graph in Figure 5 below shows six angle responses: Fitzpatrick, Nine Mile 1, Moses and Gilboa to show the impact on major generators near the Central East interface, along with Niagara and Roseton to show the broader impact of CE99 on the NYCA. The right graph in Figure 5 also shows the voltage response at major buses near the interface, Marcy 345 kV, Edic 345 kV, Fitzpatrick 345 kV and Leeds 345 kV, as well as Niagara 345 kV and Rock Tavern 345 kV to show the broader impact of CE99.

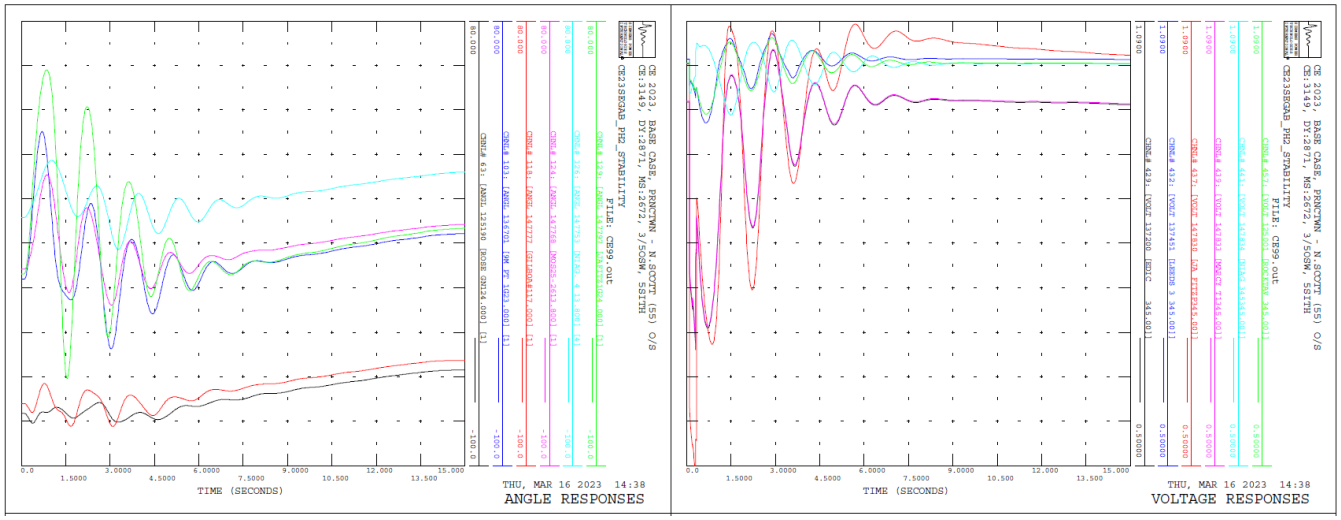

Figure 5: Case 55 OS, 3 Oswego, 5 Sithe, Marcy StatCom and SVCs In-Service with Contingency CE99 Angle/Voltage Plot

Princetown – New Scotland (361 or 362) 345 kV Out-of-Service Stability Limit Results

Stability limit results for the outage of Princetown - New Scotland (361 or 362) 345 kV cases are found in Table 5 below:

Princetown - New Scotland (361 or 362) 345 kV Out-of-Service																		
Oswego	Sithe	Marcy StatCom O/S									Marcy StatCom I/S								
		SVCs I/S			One SVC O/S			Both SVCs O/S			SVCs I/S			One SVC O/S			Both SVCs O/S		
		Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta
3	5	0	2750	2750	0	2750	2750	0	2800	2800	0	2850	2850	0	2850	2850	0	2850	2850
3	3	0	2550	2550	0	2550	2550	0	2600	2600	0	2650	2650	0	2700	2700	0	2700	2700
3	0	0	2450	2450	0	2450	2450	0	2450	2450	0	2500	2500	0	2550	2550	0	2550	2550
2	5	0	2650	2650	0	2650	2650	0	2650	2650	0	2700	2700	0	2700	2700	0	2700	2700
2	3	0	2550	2550	0	2550	2550	0	2600	2600	0	2600	2600	0	2600	2600	0	2600	2600
2	0	0	2450	2450	0	2450	2450	0	2500	2500	0	2500	2500	0	2550	2550	0	2550	2550

Table 5: Updates to Princetown - New Scotland (361 or 362) 345 kV Outage Stability Limits

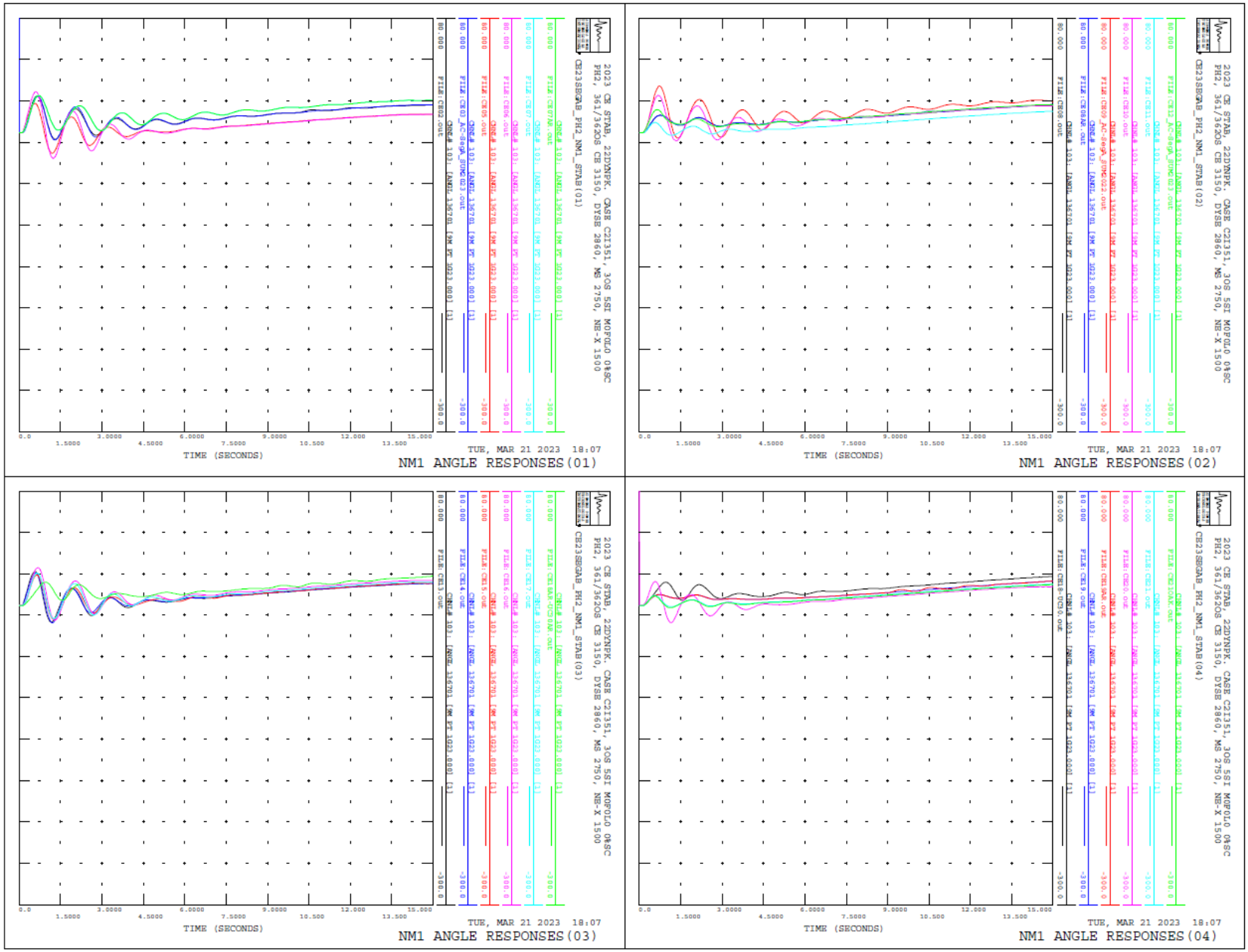

Figure 3a. Nine Mile 1 Angles in Case 361 OS, 3 Oswego, 5 Sithe, Marcy StatCom and SVCs In-Service Contingency Responses (01-04)

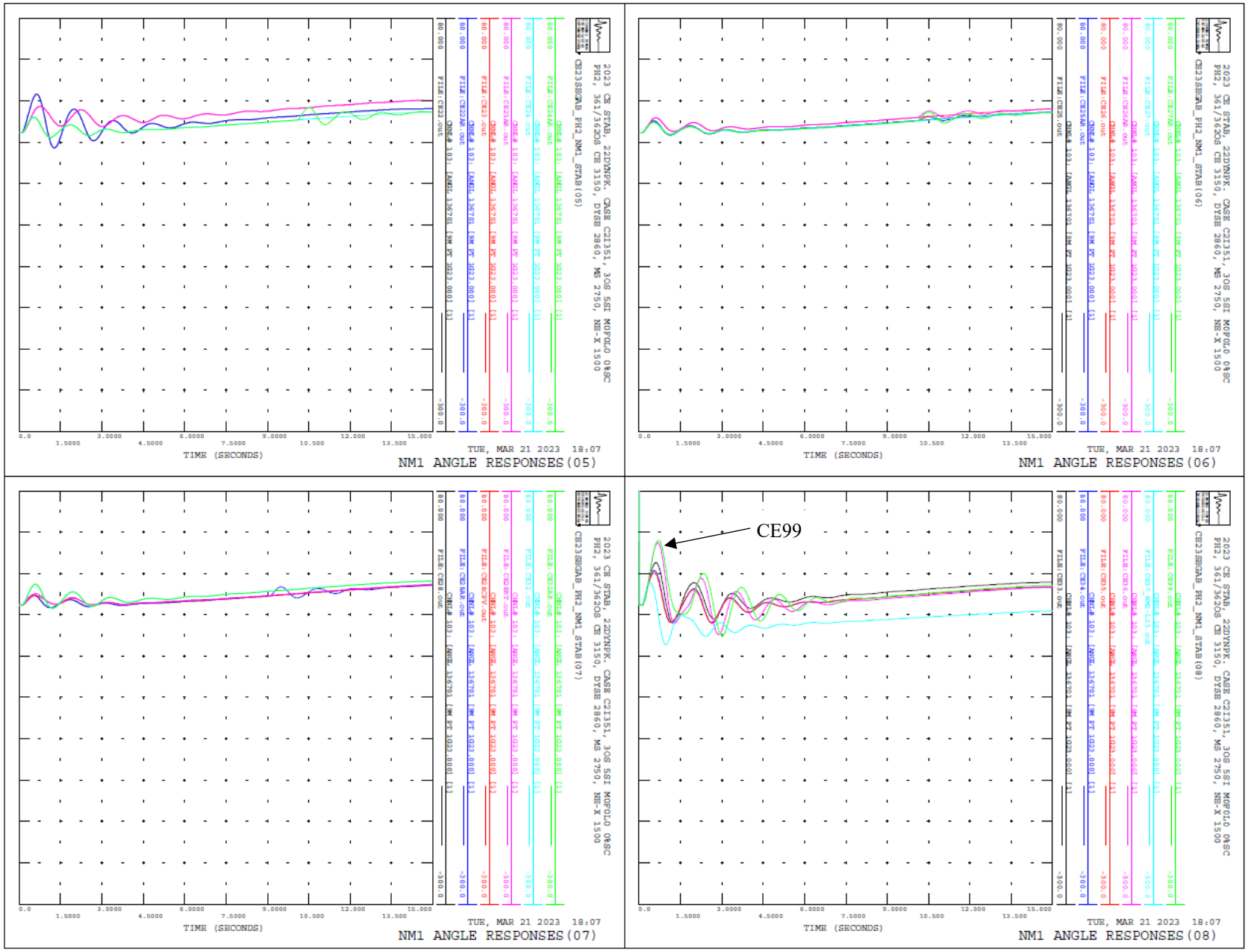

Figure 3b. Nine Mile 1 Angles in Case 361 OS, 3 Oswego, 5 Sithe, Marcy StatCom and SVCs In-Service Contingency Responses (05-08)

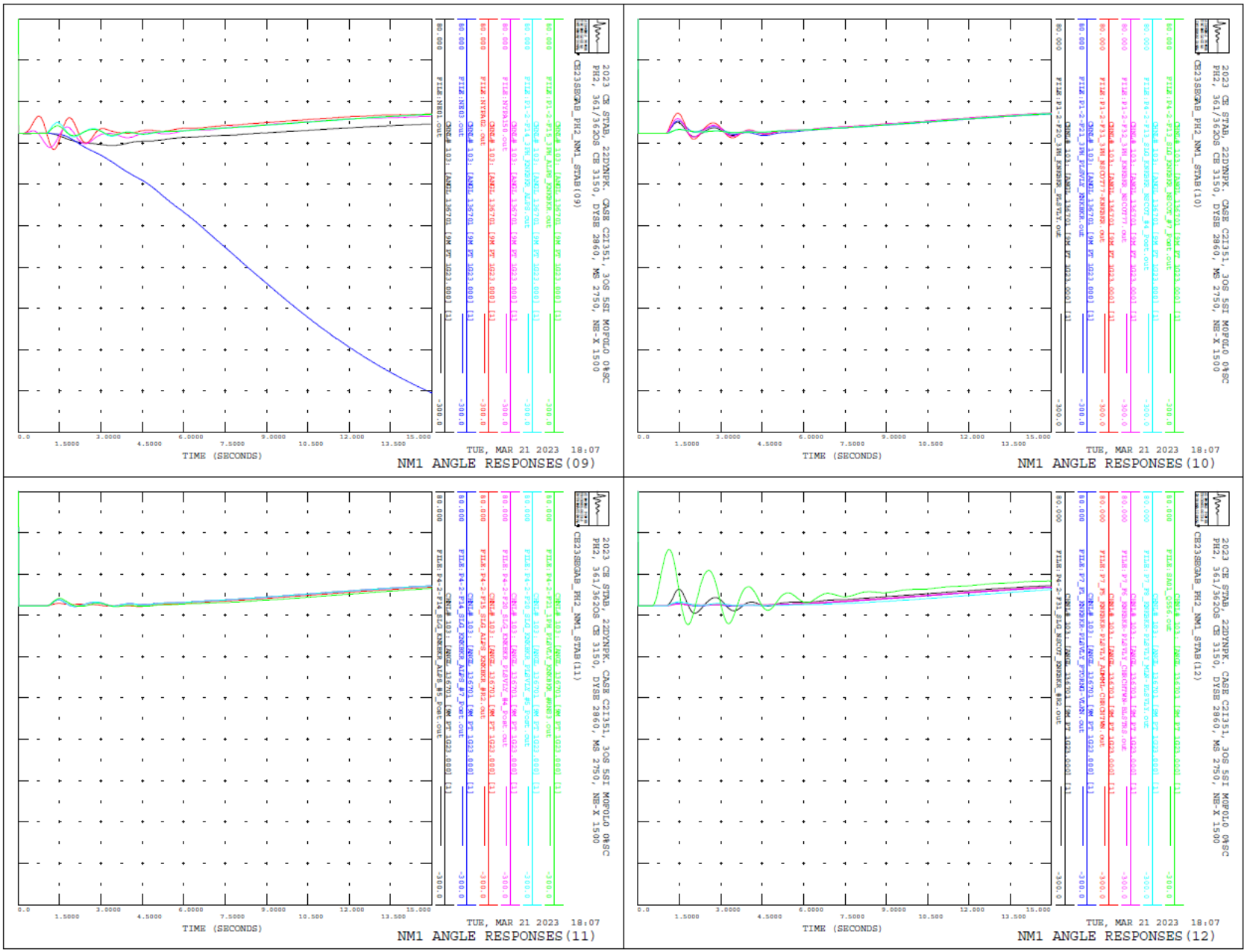

Figure 3c. Nine Mile 1 Angles in Case 361 OS, 3 Oswego, 5 Sithe, Marcy StatCom and SVCs In-Service Contingency Responses (09-12)

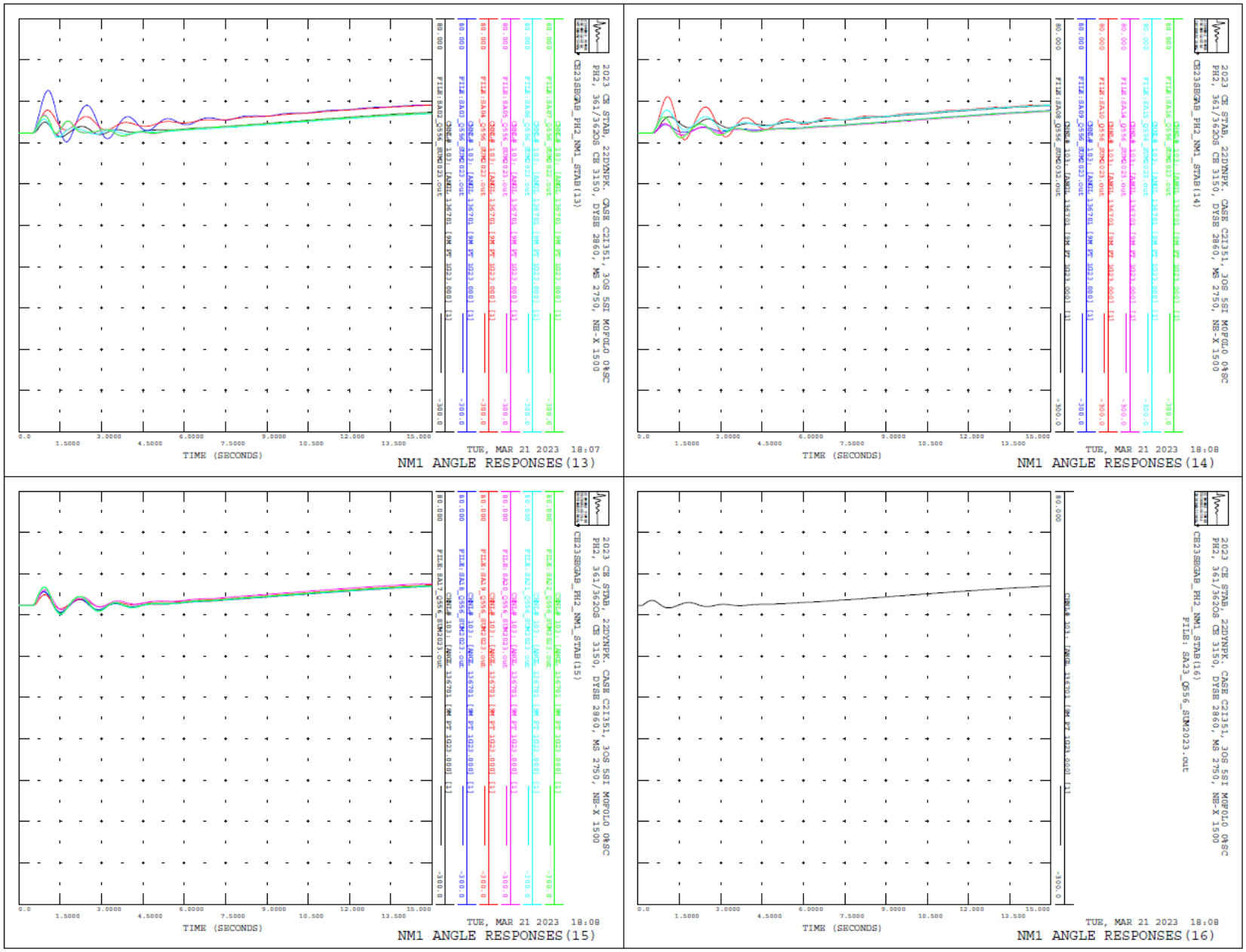

Figure 3d. Nine Mile 1 Angles in Case 361 OS, 3 Oswego, 5 Sithe, Marcy StatCom and SVCs In-Service Contingency Responses (13-16)

All Central East contingencies listed on Table 3 Contingencies Applied for Evaluating Central East Stability Transfer Limits were tested for the 3 Oswego scenario with 5 Sithe, Marcy StatCom and both SVCs in-service with Princetown – New Scotland (361) 345 kV line out-of-service. The contingencies that resulted in the largest oscillation of machine angles or caused instability were employed to determine all the proposed limits presented on Table 5 Princetown – New Scotland (361) 345 kV Outage Stability Limits.

The most severe contingency related to Central East stability is CE99, a single line to ground fault at Scriba 345 kV which results in the loss of Scriba – Volney (21) 345 kV and the back-up clearing of the Fitzpatrick – Scriba (FS-10) 345 kV line.

The left graph in Figure 5 below shows six angle responses: Fitzpatrick, Nine Mile 1, Moses and Gilboa to show the impact on major generators near the Central East interface, along with Niagara and Roseton to show the broader impact of CE99 on the NYCA. The right graph in Figure 5 also shows the voltage response at major buses near the interface, Marcy 345 kV, Edic 345 kV, Fitzpatrick 345 kV and Leeds 345 kV, as well as Niagara 345 kV and Rock Tavern 345 kV to show the broader impact of CE99.

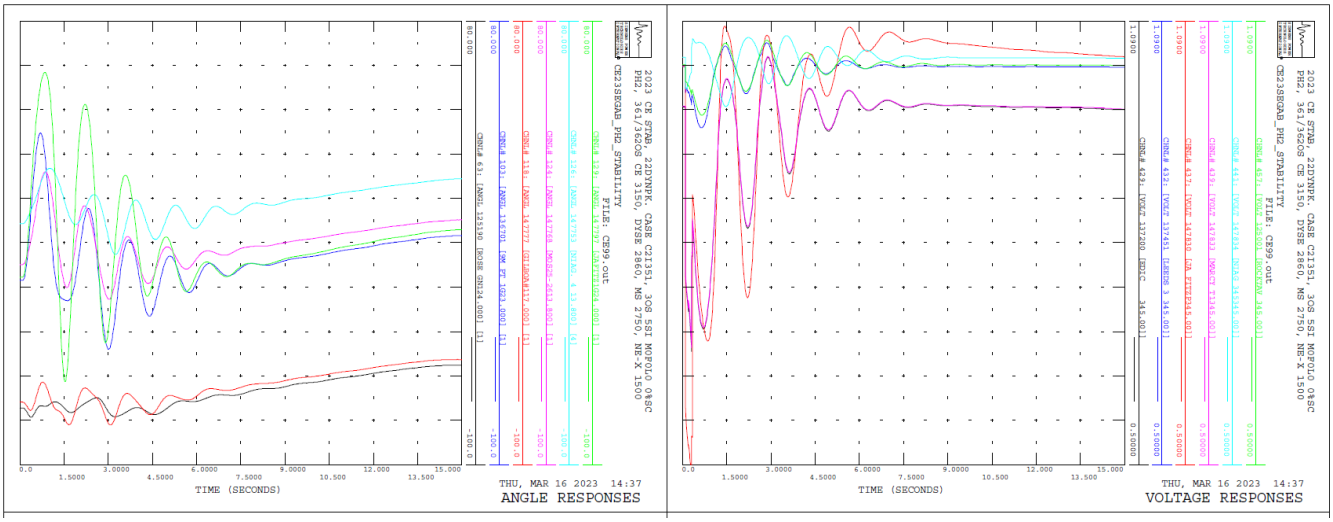

Figure 4: Case 361 OS, 3 Oswego, 5 Sithe, Marcy StatCom and SVCs In-Service with Contingency CE99 Angle/Voltage Plot

Princetown – Gordon Road (371) 345 kV Out-of-Service Stability Limit Results

Stability limit results for the outage of Princetown – Gordon Road (371) 345 kV cases are found in Table 6 below:

Princetown – Gordon Road (371) 345 kV Out-of-Service																		
Oswego	Sithe	Marcy StatCom O/S									Marcy StatCom I/S								
		SVCs I/S			One SVC O/S			Both SVCs O/S			SVCs I/S			One SVC O/S			Both SVCs O/S		
		Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta	Current	Tested	Delta
3	5	0	2450	2450	0	2500	2500	0	2500	2500	0	2600	2600	0	2600	2600	0	2600	2600
3	3	0	2400	2400	0	2400	2400	0	2400	2400	0	2500	2500	0	2550	2550	0	2550	2550
3	0	0	2000	2000	0	2000	2000	0	2000	2000	0	2400	2400	0	2450	2450	0	2450	2450
2	5	0	2400	2400	0	2450	2450	0	2450	2450	0	2450	2450	0	2500	2500	0	2500	2500
2	3	0	2350	2350	0	2350	2350	0	2350	2350	0	2400	2400	0	2400	2400	0	2400	2400
2	0	0	2000	2000	0	2000	2000	0	2000	2000	0	2250	2250	0	2250	2250	0	2250	2250

Table 6: Updates to Princetown – Gordon Road (371) 345 kV outage Stability Limits

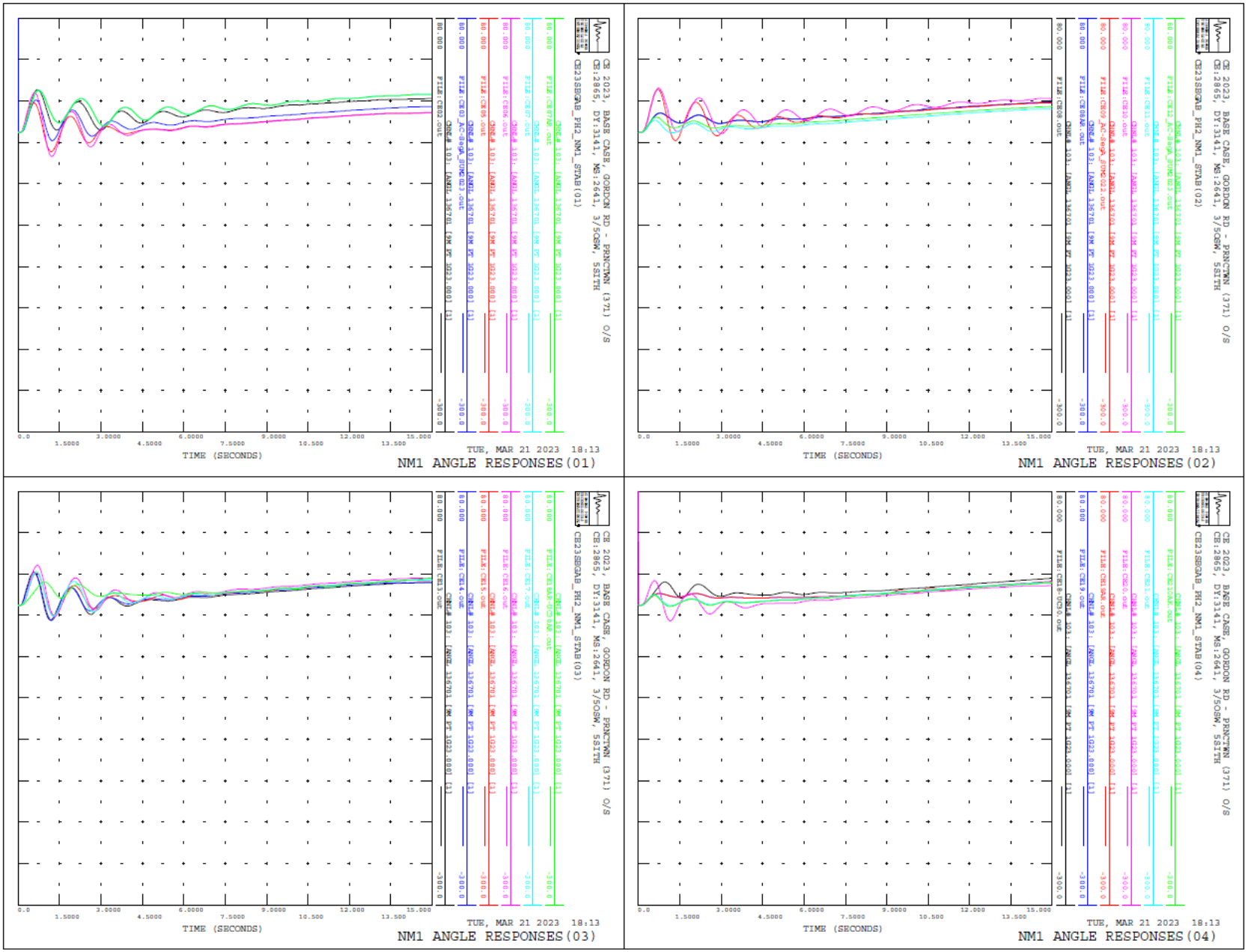

Figure 4a. Nine Mile 1 Angles in Case 371 OS, 3 Oswego, 5 Sithe, Marcy StatCom and SVCs In-Service Contingency Responses (01-04)

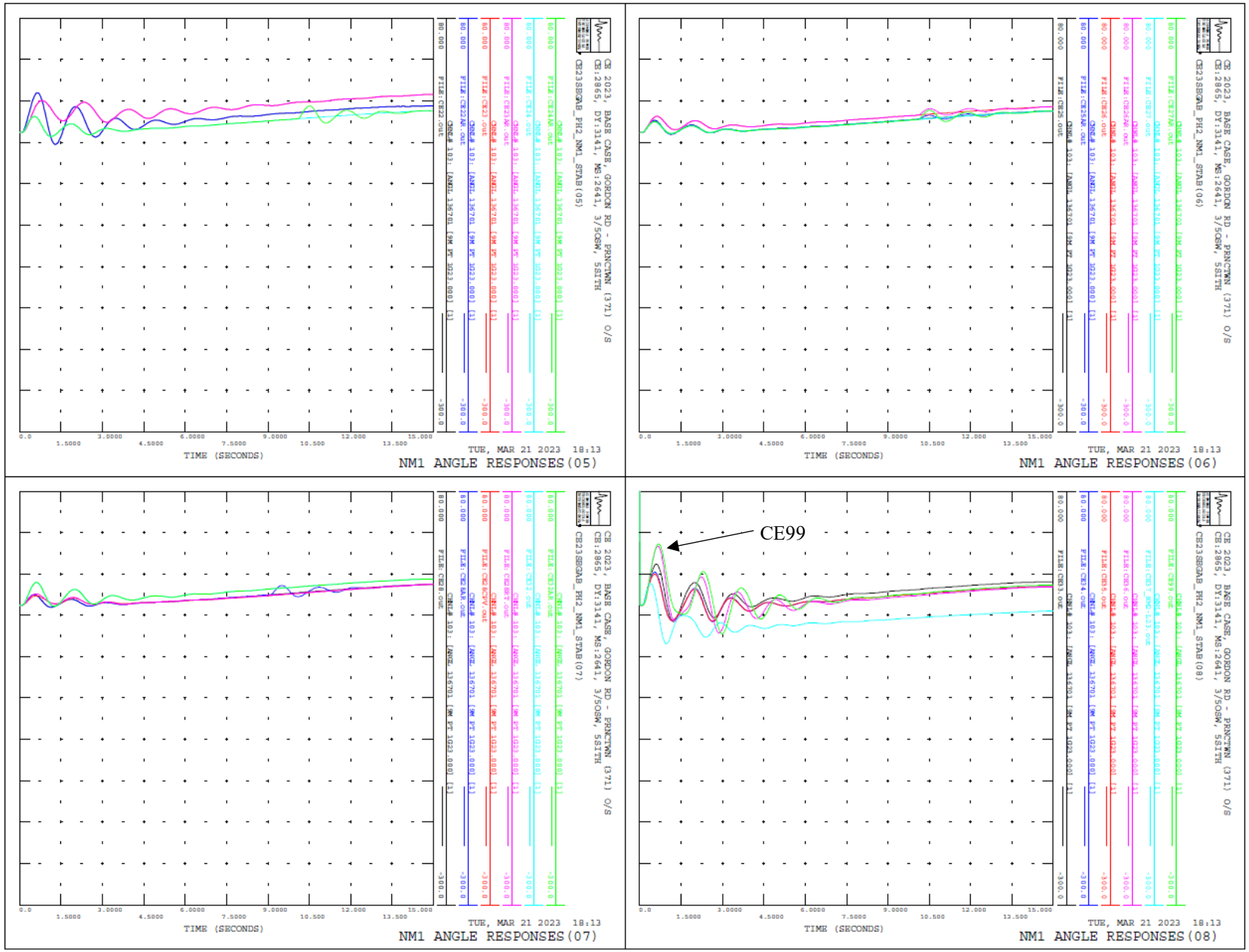

Figure 4b. Nine Mile 1 Angles in Case 371 OS, 3 Oswego, 5 Sithe, Marcy StatCom and SVCs In-Service Contingency Responses (05-08)

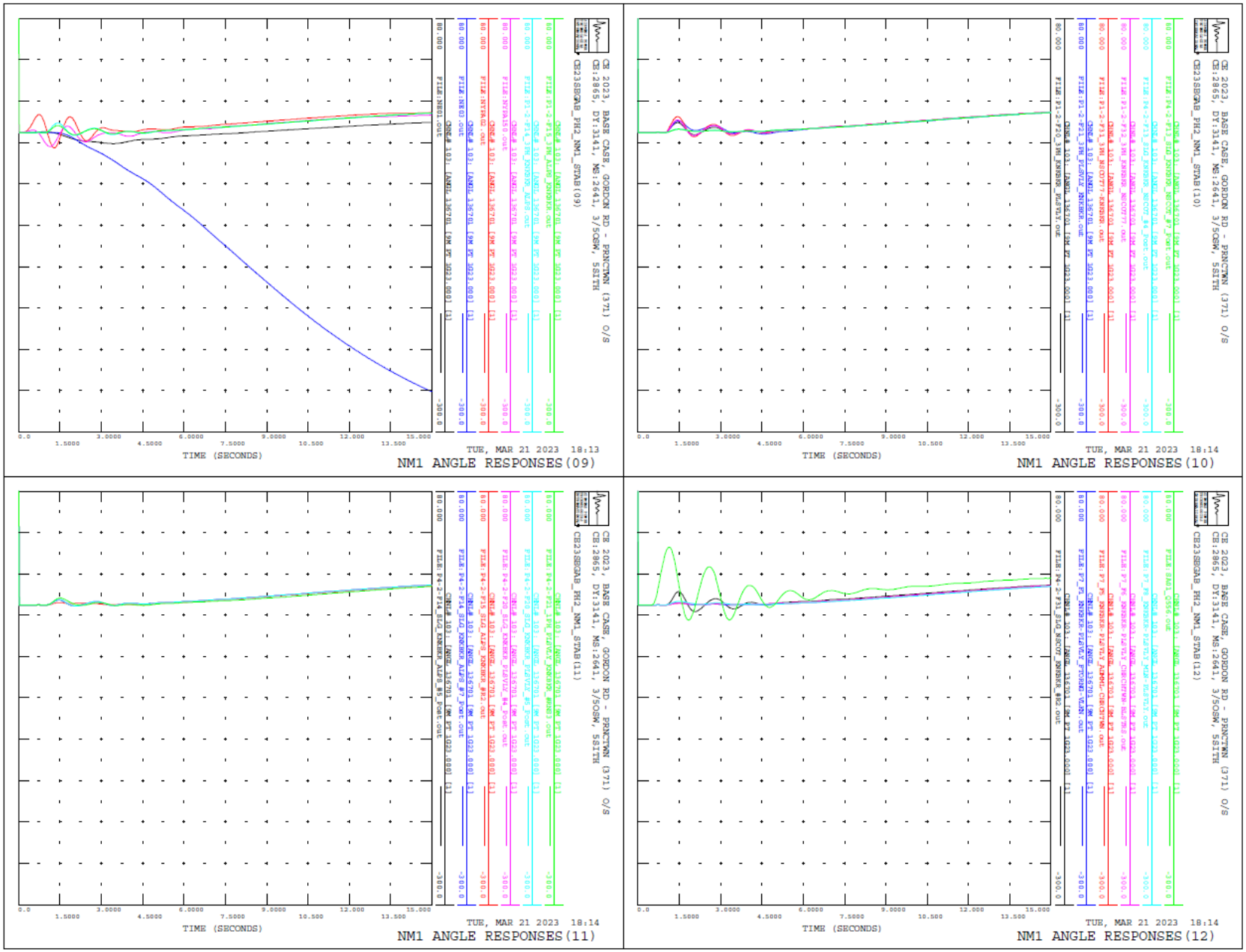

Figure 4c. Nine Mile 1 Angles in Case 371 OS, 3 Oswego, 5 Sithe, Marcy StatCom and SVCs In-Service Contingency Responses (09-12)

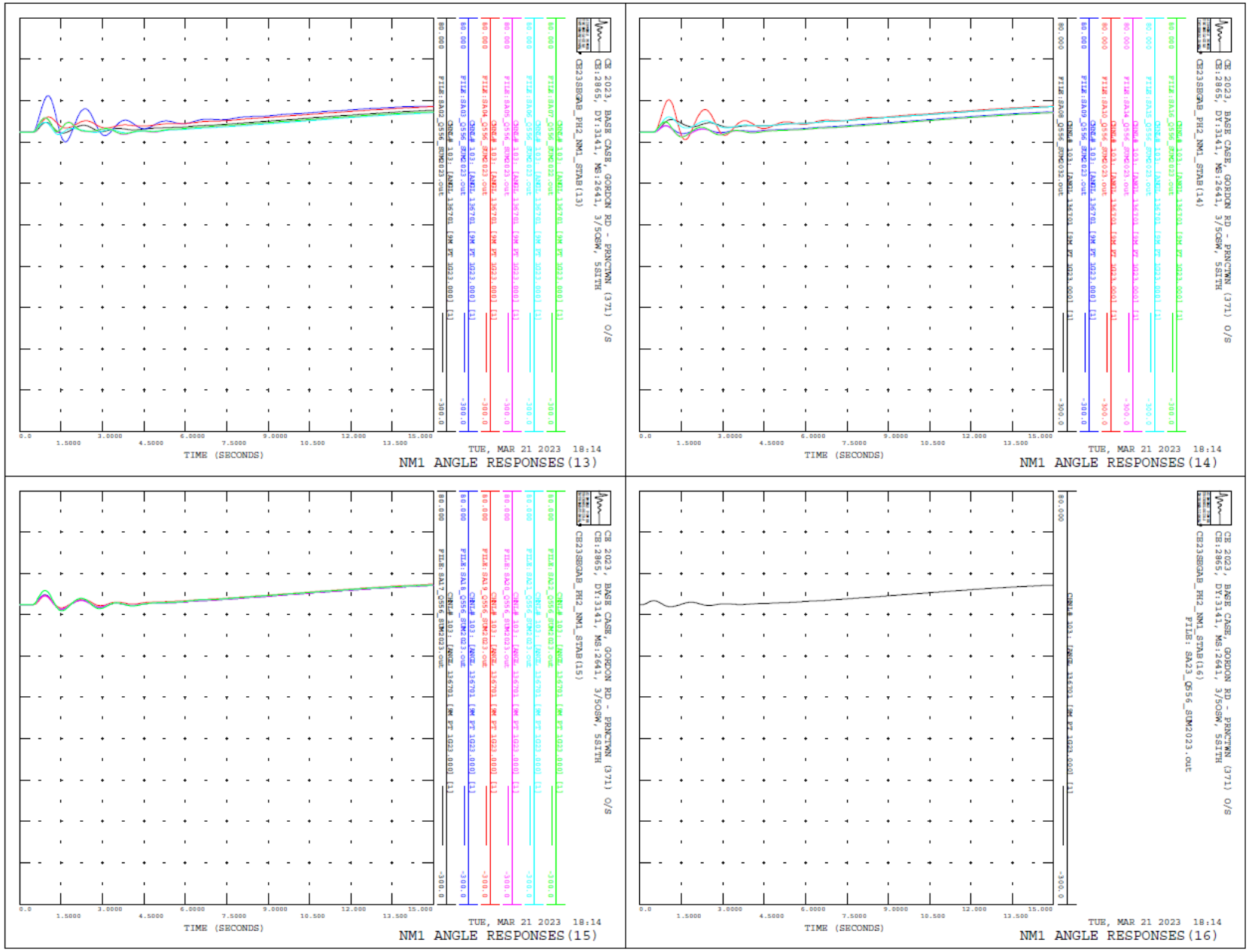

Figure 4d. Nine Mile 1 Angles in Case 371 OS, 3 Oswego, 5 Sithe, Marcy StatCom and SVCs In-Service Contingency Responses (13-16)

All Central East contingencies listed on Table 3 Contingencies Applied for Evaluating Central East Stability Transfer Limits were tested for the 3 Oswego scenario with 5 Sithe, Marcy StatCom and both SVCs in-service with Princetown – Gordon Road (371) 345 kV line out-of-service. The contingencies that resulted in the largest oscillation of machine angles or caused instability were employed to determine all the proposed limits presented on Table 6 Updates to Princetown – Gordon Road (371) 345 kV outage Stability Limits.

The most severe contingency related to Central East stability is CE99, a single line to ground fault at Scriba 345 kV which results in the loss of Scriba – Volney (21) 345 kV and the back-up clearing of the Fitzpatrick – Scriba (FS-10) 345 kV line.

The left graph in Figure 5 below shows six angle responses: Fitzpatrick, Nine Mile 1, Moses and Gilboa to show the impact on major generators near the Central East interface, along with Niagara and Roseton to show the broader impact of CE99 on the NYCA. The right graph in Figure 5 also shows the voltage response at major buses near the interface, Marcy 345 kV, Edic 345 kV, Fitzpatrick 345 kV and Leeds 345 kV, as well as Niagara 345 kV and Rock Tavern 345 kV to show the broader impact of CE99.

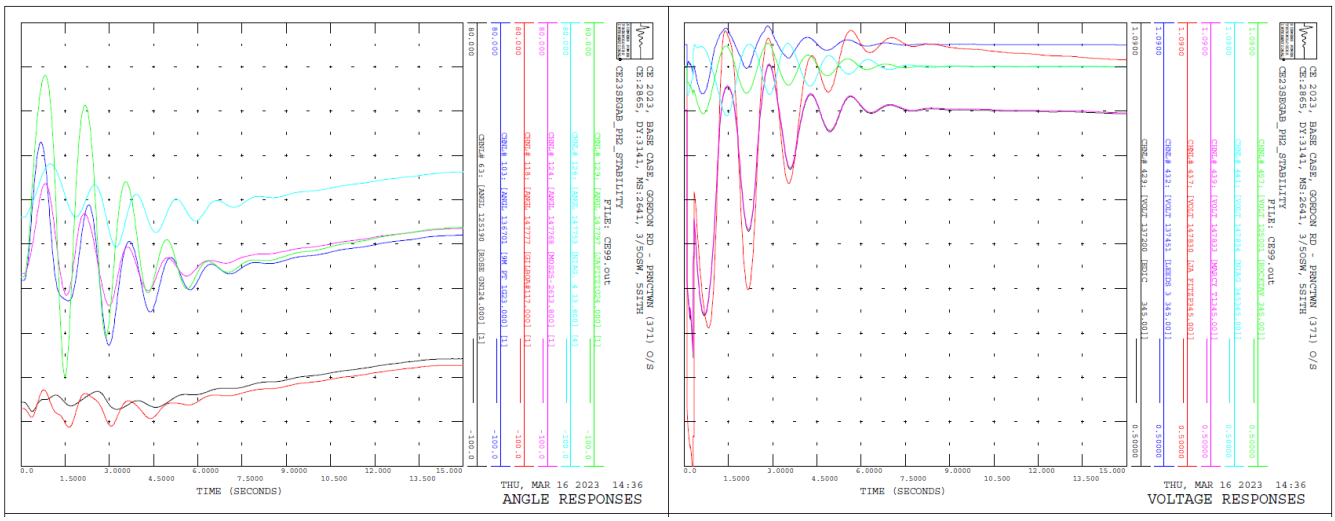

Figure 5: Case 371 OS, 3 Oswego, 5 Sithe, Marcy StatCom and SVCs In-Service with Contingency CE99 Angle/Voltage Plot