UNICORN Systems

TSC CTDS

TSC
Transmission System Operator
Security Cooperation

01 June 2014

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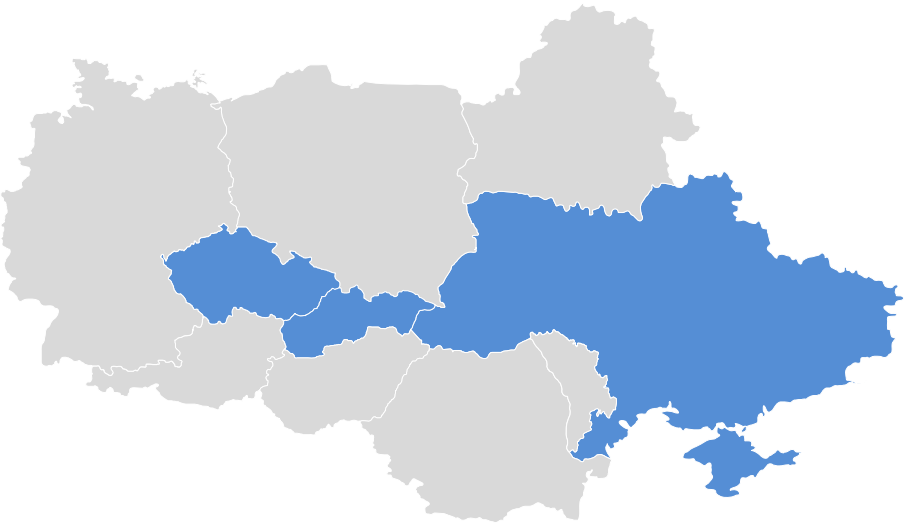
Agenda

- About Unicorn Systems
- TSC initiative introduction
- CTDS application introduction

Unicorn Systems

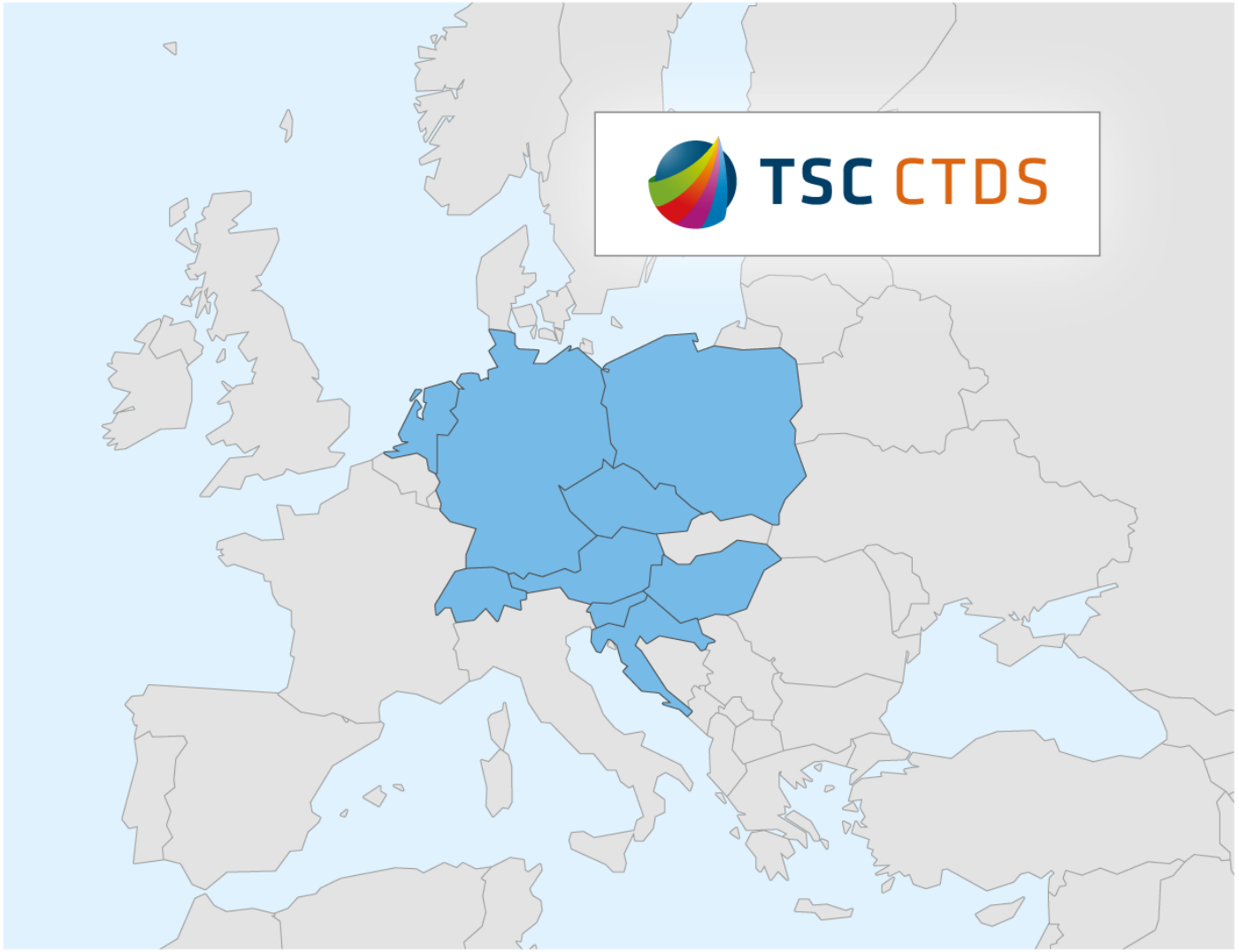
- Largest Czech ICT vendor, founded in 1990
  - 6 development centers; branch offices in the CR, SR, and Ukraine
- Total turnover for 2012 amounted to 56.6 mil. EUR, of which 24 % came from energy and utilities
- 900+ employees, about 200 of them working in energy and utilities
- First energy project completed in 1999
  - Special focus on system and market operators
- Out-of-the-box products and custom software development
- Strong technological background
- Large international projects



TSC Initiative

- TSC = Transmission System Operator Security Cooperation
- Increase security of supply through intensified regional cooperation based on a Cooperation Platform and common remedial actions
  - Processes and definitions for operational forecast data (DACF/IDCF)
  - A unique merged dataset (based on individual TSO datasets) as input for grid security calculations
  - Execution of grid security calculations and provision of results
  - Definition of additional individual studies on the Cooperation
  - Platform on the basis of the unique merged dataset
  - Common daily evaluation of security calculation results, identification and coordination of remedial actions
  - Coordinated procedures in case of critical grid situations and remedial actions
- Joint office in Munich (opened 25. 10. 2013)
- More on the web http://www.tso-security-cooperation.eu/

TSC Members



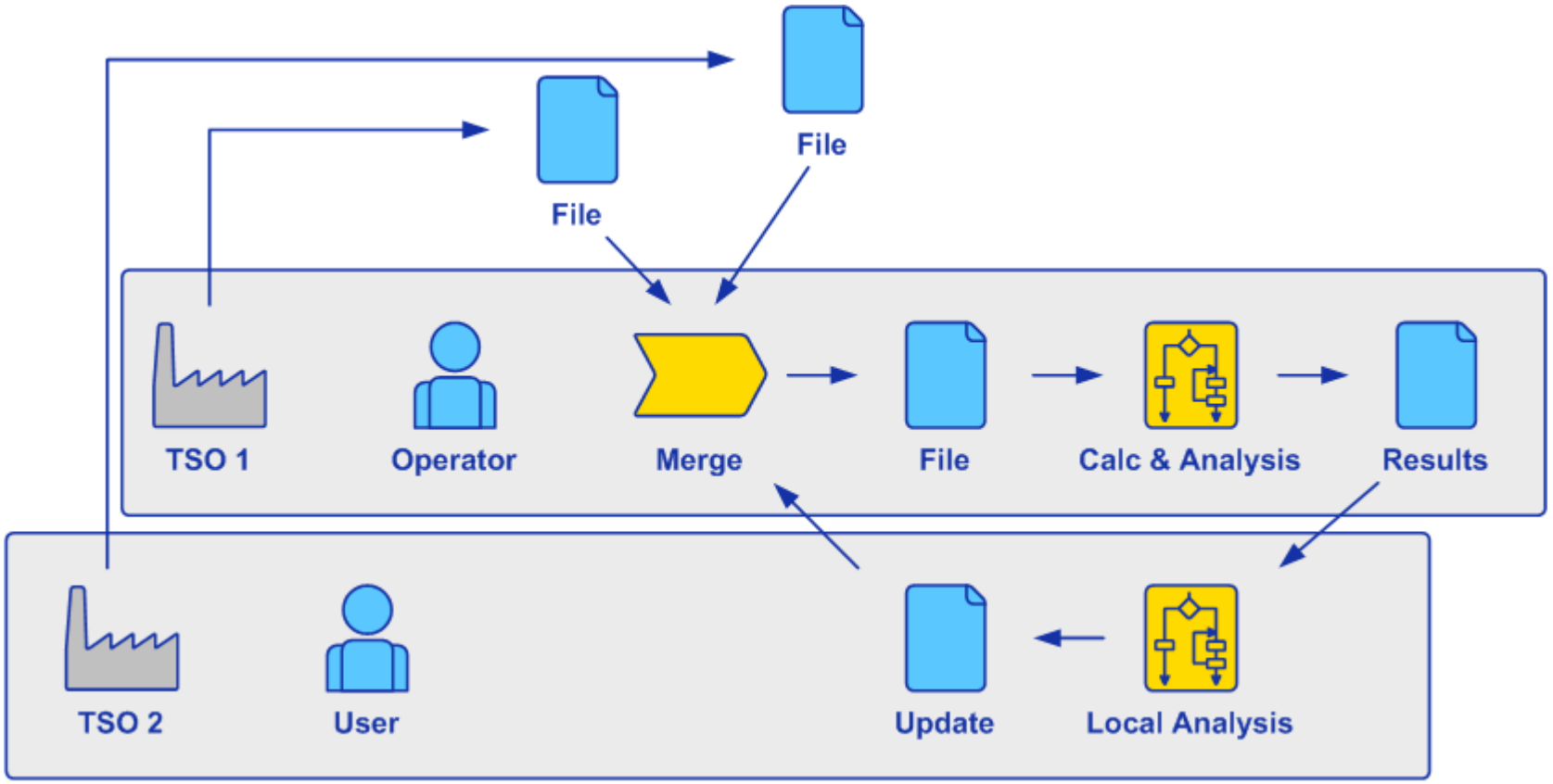
- 50Hertz (DE)
- Amprion (DE)
- APG (AT)
- ČEPS (CZ)
- ELES (SI)
- Energinet (DK)
- HOPS (HR)
- MAVIR (HU)
- PSEO (PL)
- Tennet (NL)
- Tennet (DE)
- Transnet BW (DE)
- Swissgrid (CH)

Covering area with more than 165 million European citizens in the heart of Europe

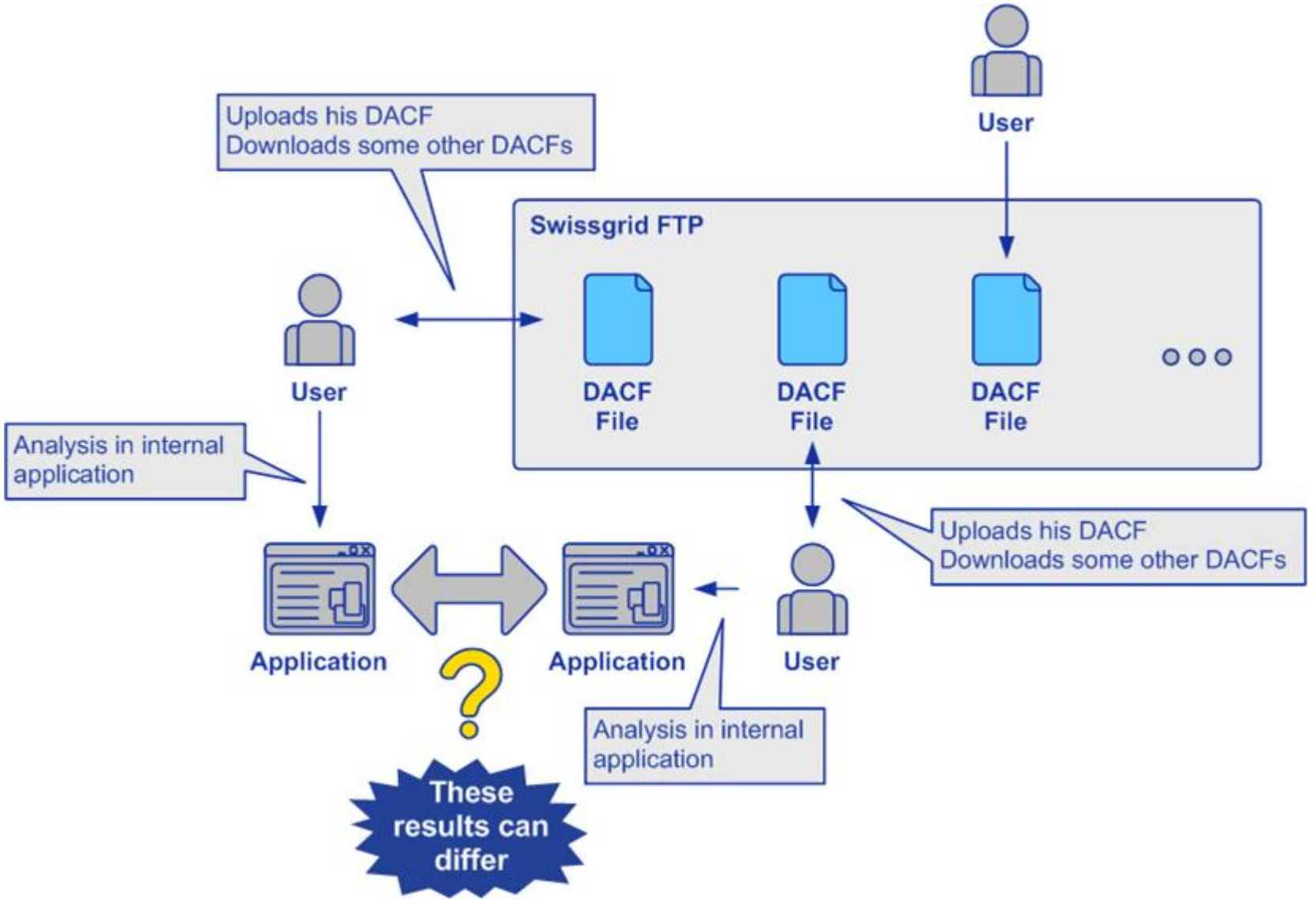
CTDS

- Common Tool for Data exchange and Security assessments
- Represents main TSC cooperation platform
- Key requirements:
  - Receiving - receiving operational forecast data from all participating TSOs and adjacent (non-participating) TSOs
    - 25 individuals models for all 24 hours of next day (i.e. 600 a day)
    - Intraday updates, every hour, one hour before real-time, for the remaining hours of the day
  - Merging - Merging input data into a unique dataset being the input for grid security calculations
    - 8000 busses and 12000 branches
  - Calculations – grid security computation (N/N-1)
    - 6500 contingency cases simulated for each hour, computed within 20 minutes
  - Studies – for further analysis over the common merged model
  - Integration platform for other functional modules

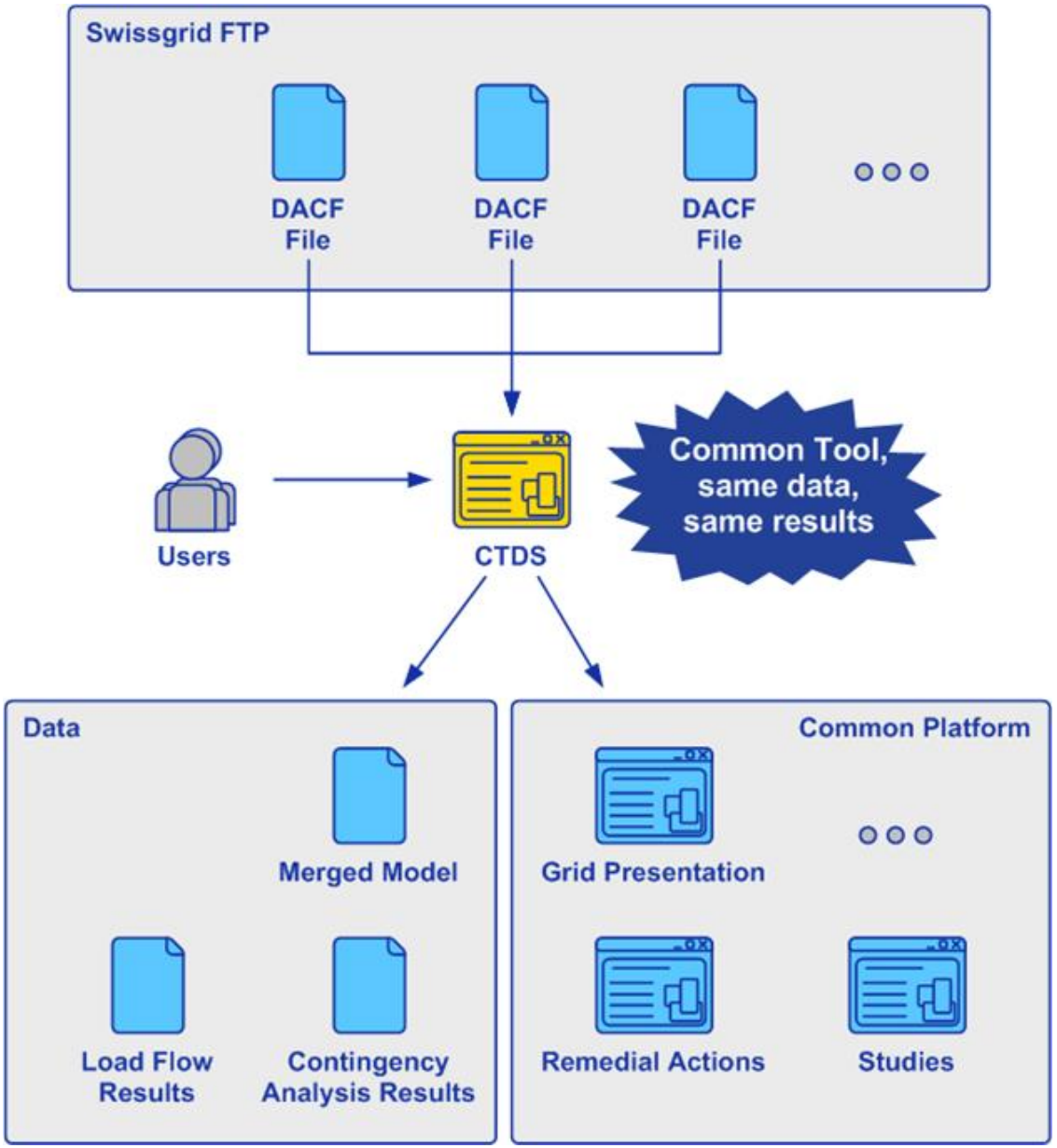
CTDS „Big Picture“



DACF process before CTDS



DACF process with CTDS

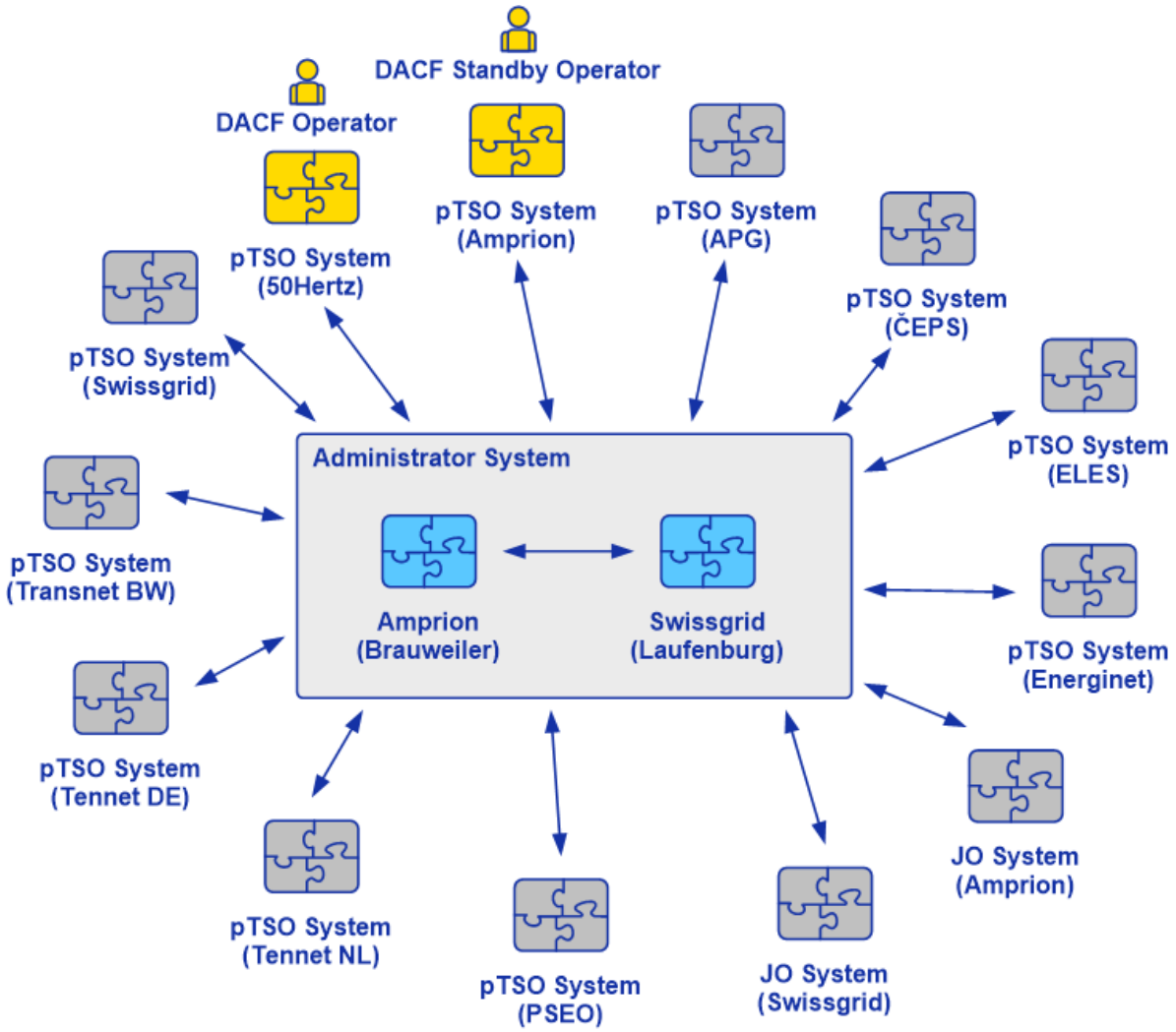


Goals of CTDS

- Avoiding risks in Central Europe
- Secure operation of interconnected grids
- Meeting cooperation requirements of European legislature

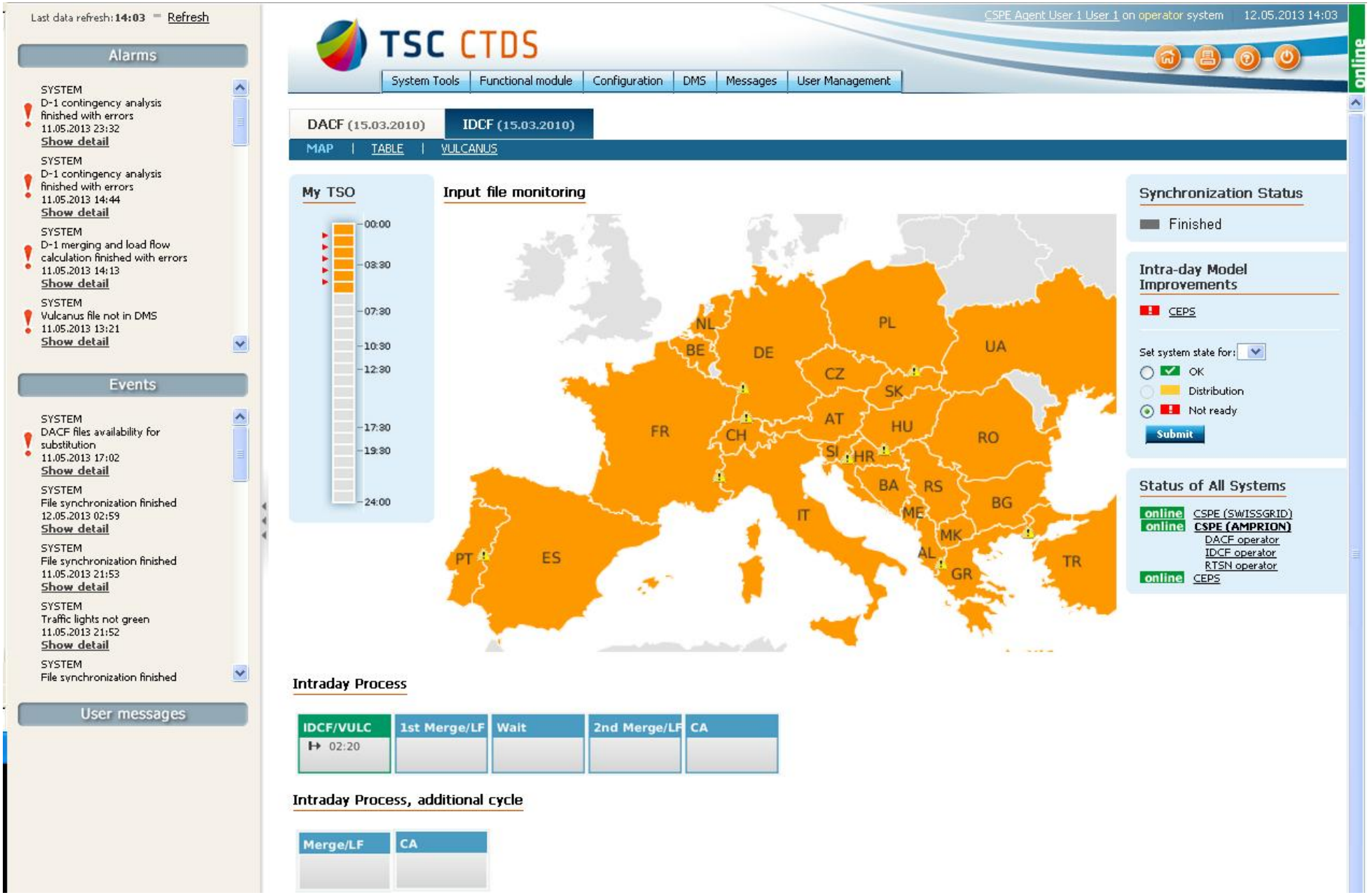
- No misunderstandings – all TSOs can work with the same data and same analytical results
- Extension current DACF process to intraday level
- Handling of unexpected major changes in flows
- Faster alerting of TSOs and coordination of remedial actions
- Possibility to simulate impact of changes on complete grid model
- Secure and decentralized solution

Decentralized Solution

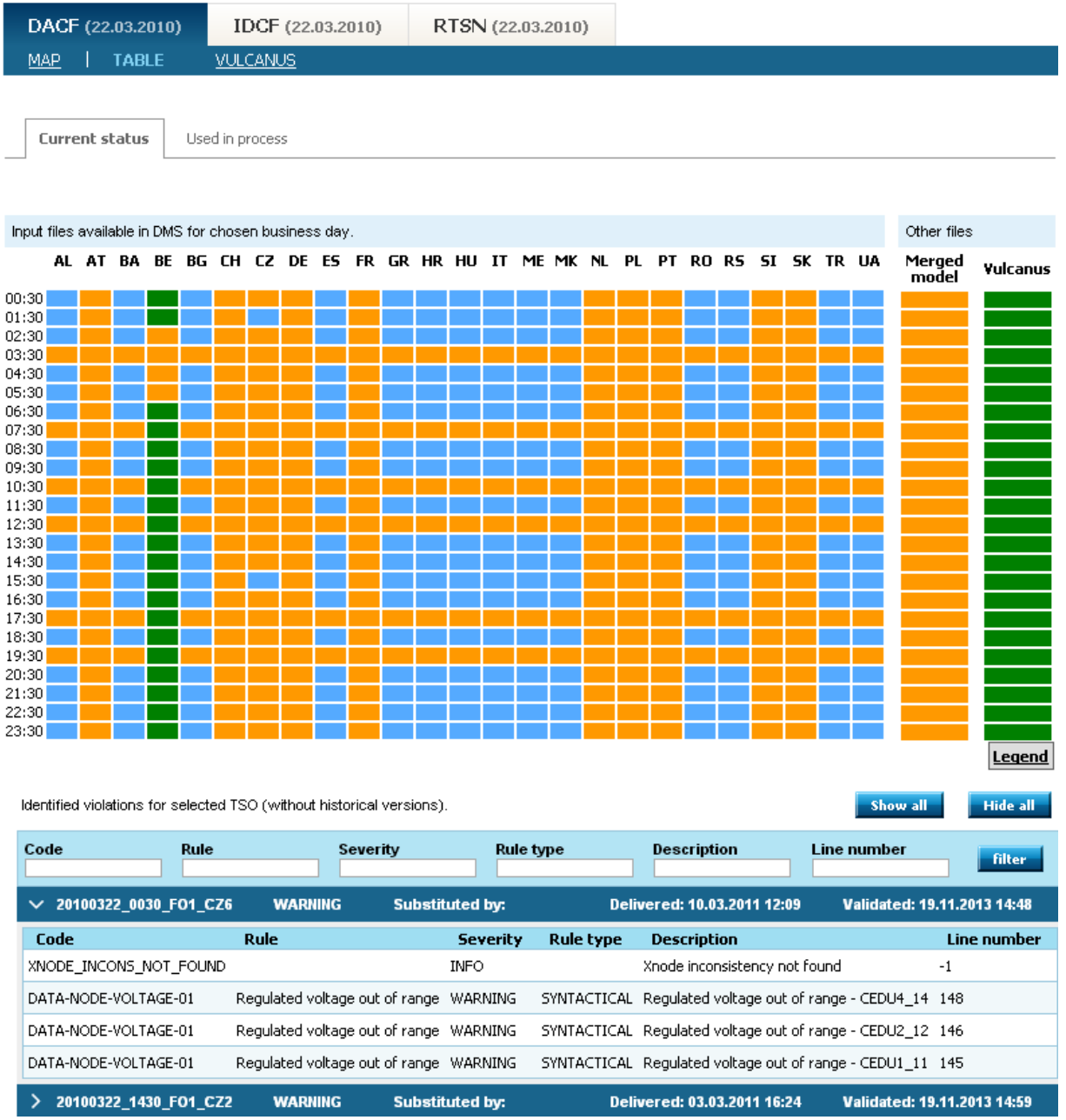


- CTDS User/Operator system installation at each participating TSO
- Administrator sites installations at two hosting sites
  - Active / Passive
  - Reliable data repository and central management – shared data
- Systems interconnected via Electronic Highway using Energy Communication Platform (ECP)

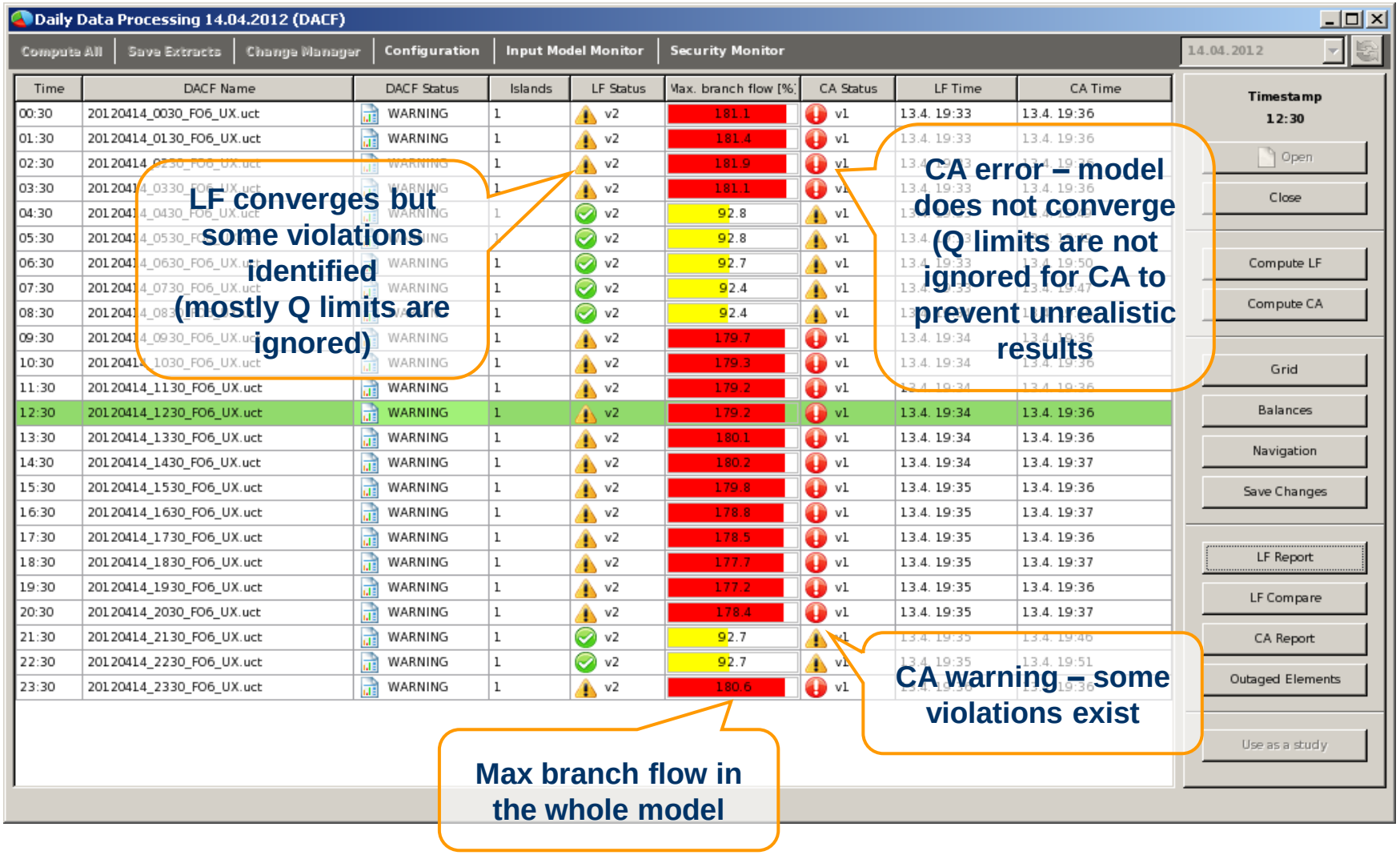
Main Page



Input Files Monitoring

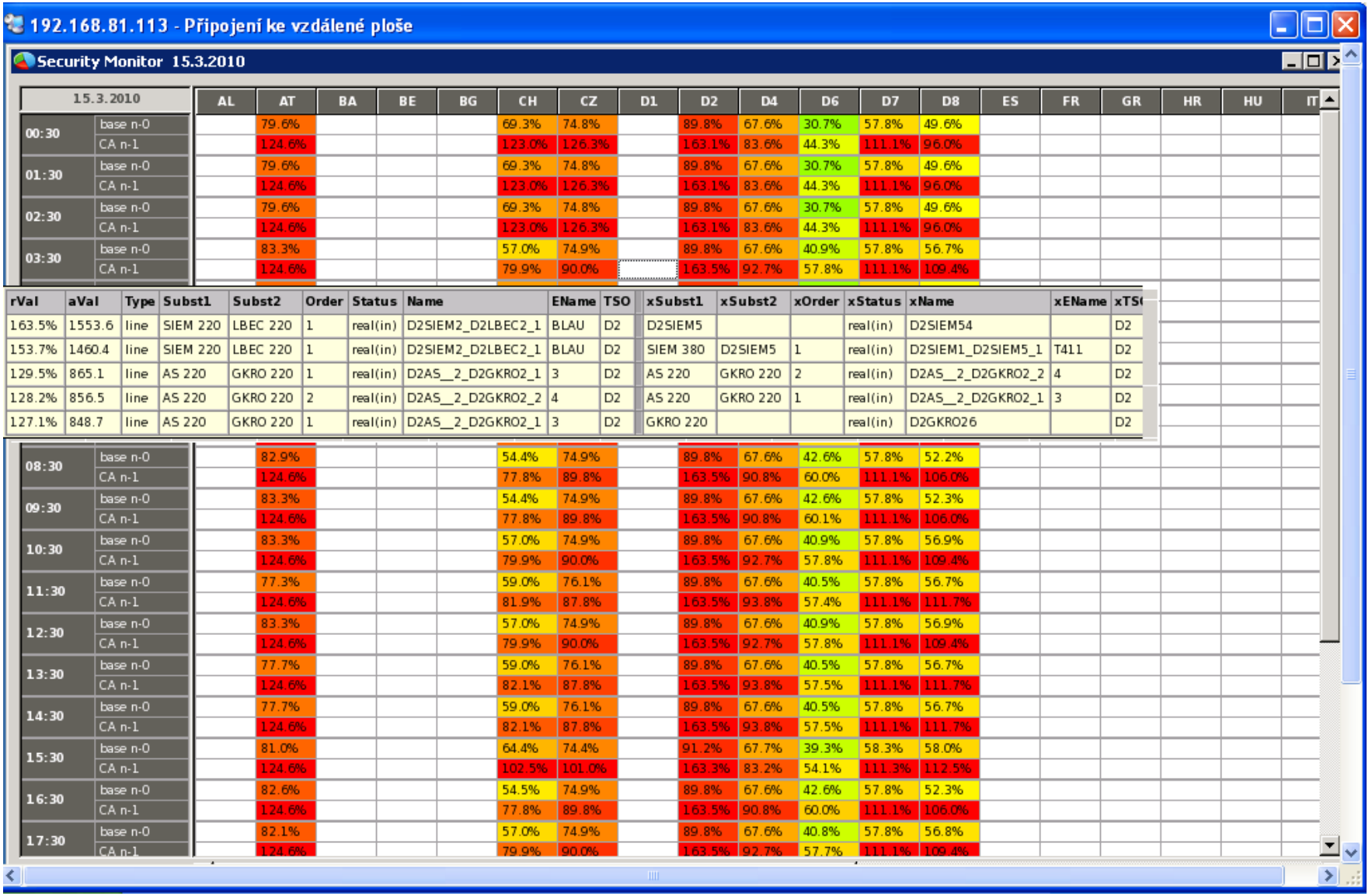


LF/CA Overview



Time	DACF Name	DACF Status	Islands	LF Status	Max. branch flow [%]	CA Status	LF Time	CA Time
00:30	20120414_0030_FO6_UX.uct	WARNING	1	v2	181.1	v1	13.4. 19:33	13.4. 19:36
01:30	20120414_0130_FO6_UX.uct	WARNING	1	v2	181.4	v1	13.4. 19:33	13.4. 19:36
02:30	20120414_0230_FO6_UX.uct	WARNING	1	v2	181.9	v1	13.4. 19:33	13.4. 19:36
03:30	20120414_0330_FO6_UX.uct	WARNING	1	v2	181.1	v1	13.4. 19:33	13.4. 19:36
04:30	20120414_0430_FO6_UX.uct	WARNING	1	v2	92.8	v1	13.4. 19:33	13.4. 19:47
05:30	20120414_0530_FO6_UX.uct	WARNING	1	v2	92.8	v1	13.4. 19:33	13.4. 19:47
06:30	20120414_0630_FO6_UX.uct	WARNING	1	v2	92.7	v1	13.4. 19:33	13.4. 19:50
07:30	20120414_0730_FO6_UX.uct	WARNING	1	v2	92.4	v1	13.4. 19:33	13.4. 19:47
08:30	20120414_0830_FO6_UX.uct	WARNING	1	v2	92.4	v1	13.4. 19:33	13.4. 19:47
09:30	20120414_0930_FO6_UX.uct	WARNING	1	v2	179.7	v1	13.4. 19:34	13.4. 19:36
10:30	20120414_1030_FO6_UX.uct	WARNING	1	v2	179.3	v1	13.4. 19:34	13.4. 19:36
11:30	20120414_1130_FO6_UX.uct	WARNING	1	v2	179.2	v1	13.4. 19:34	13.4. 19:36
12:30	20120414_1230_FO6_UX.uct	WARNING	1	v2	179.2	v1	13.4. 19:34	13.4. 19:36
13:30	20120414_1330_FO6_UX.uct	WARNING	1	v2	180.1	v1	13.4. 19:34	13.4. 19:36
14:30	20120414_1430_FO6_UX.uct	WARNING	1	v2	180.2	v1	13.4. 19:34	13.4. 19:37
15:30	20120414_1530_FO6_UX.uct	WARNING	1	v2	179.8	v1	13.4. 19:35	13.4. 19:36
16:30	20120414_1630_FO6_UX.uct	WARNING	1	v2	178.8	v1	13.4. 19:35	13.4. 19:37
17:30	20120414_1730_FO6_UX.uct	WARNING	1	v2	178.5	v1	13.4. 19:35	13.4. 19:36
18:30	20120414_1830_FO6_UX.uct	WARNING	1	v2	177.7	v1	13.4. 19:35	13.4. 19:37
19:30	20120414_1930_FO6_UX.uct	WARNING	1	v2	177.2	v1	13.4. 19:35	13.4. 19:36
20:30	20120414_2030_FO6_UX.uct	WARNING	1	v2	178.4	v1	13.4. 19:35	13.4. 19:37
21:30	20120414_2130_FO6_UX.uct	WARNING	1	v2	92.7	v1	13.4. 19:35	13.4. 19:46
22:30	20120414_2230_FO6_UX.uct	WARNING	1	v2	92.7	v1	13.4. 19:35	13.4. 19:51
23:30	20120414_2330_FO6_UX.uct	WARNING	1	v2	180.6	v1	13.4. 19:35	13.4. 19:36

Security Report

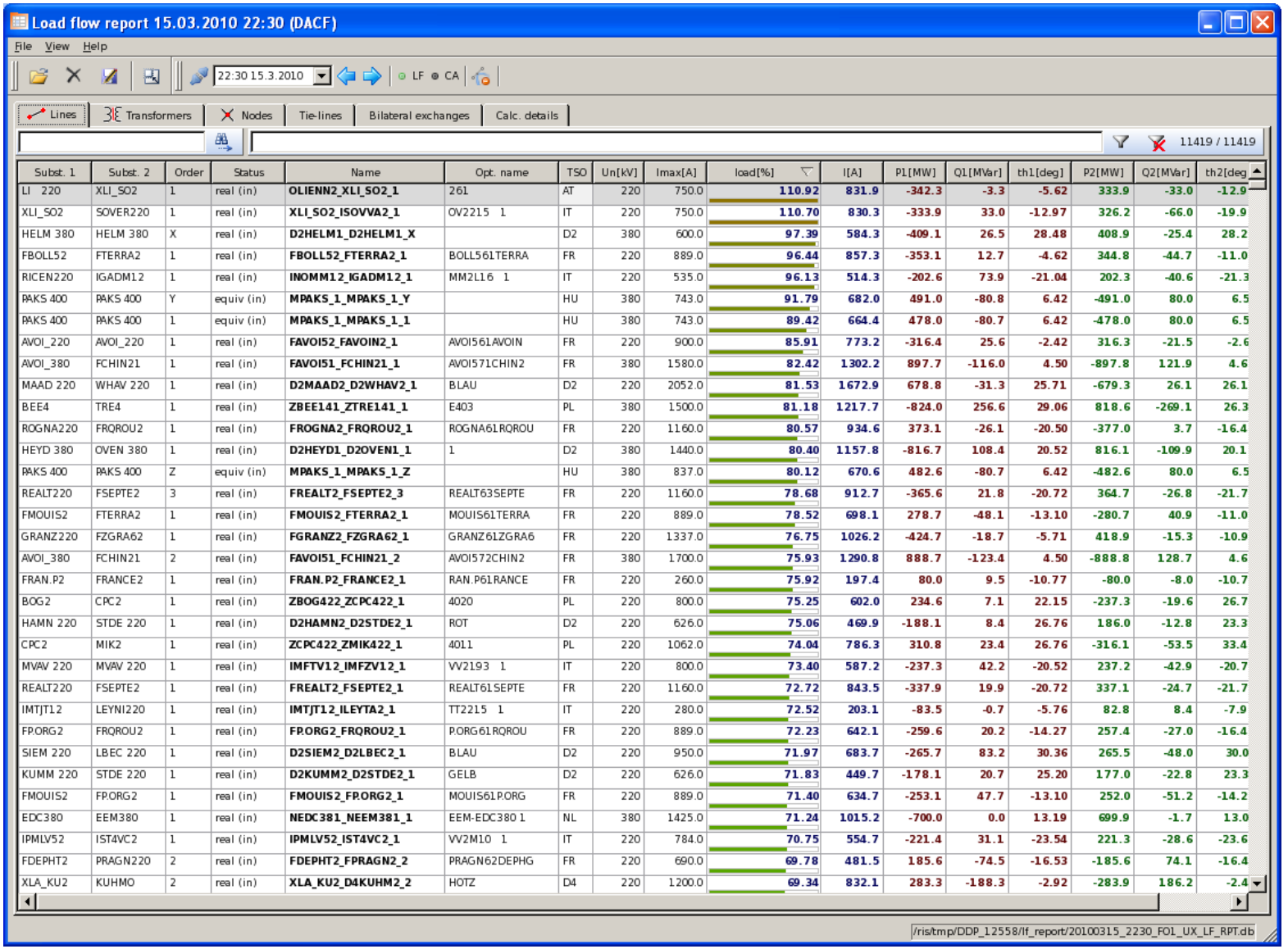


15.3.2010		AL	AT	BA	BE	BG	CH	CZ	D1	D2	D4	D6	D7	D8	ES	FR	GR	HR	HU	IT
00:30	base n-0		79.6%				69.3%	74.8%		89.8%	67.6%	30.7%	57.8%	49.6%						
	CA n-1		124.6%				123.0%	126.3%		163.1%	83.6%	44.3%	111.1%	96.0%						
01:30	base n-0		79.6%				69.3%	74.8%		89.8%	67.6%	30.7%	57.8%	49.6%						
	CA n-1		124.6%				123.0%	126.3%		163.1%	83.6%	44.3%	111.1%	96.0%						
02:30	base n-0		79.6%				69.3%	74.8%		89.8%	67.6%	30.7%	57.8%	49.6%						
	CA n-1		124.6%				123.0%	126.3%		163.1%	83.6%	44.3%	111.1%	96.0%						
03:30	base n-0		83.3%				57.0%	74.9%		89.8%	67.6%	40.9%	57.8%	56.7%						
	CA n-1		124.6%				79.9%	90.0%		163.5%	92.7%	57.8%	111.1%	109.4%						

rVal	aVal	Type	Subst1	Subst2	Order	Status	Name	EName	TSO	xSubst1	xSubst2	xOrder	xStatus	xName	xEName	xTS
163.5%	1553.6	line	SIEM 220	LBEC 220	1	real(in)	D2SIEM2_D2LBEC2_1	BLAU	D2	D2SIEM5			real(in)	D2SIEM54		D2
153.7%	1460.4	line	SIEM 220	LBEC 220	1	real(in)	D2SIEM2_D2LBEC2_1	BLAU	D2	SIEM 380	D2SIEM5	1	real(in)	D2SIEM1_D2SIEM5_1	T411	D2
129.5%	865.1	line	AS 220	GKRO 220	1	real(in)	D2AS__2_D2GKRO2_1	3	D2	AS 220	GKRO 220	2	real(in)	D2AS__2_D2GKRO2_2	4	D2
128.2%	856.5	line	AS 220	GKRO 220	2	real(in)	D2AS__2_D2GKRO2_2	4	D2	AS 220	GKRO 220	1	real(in)	D2AS__2_D2GKRO2_1	3	D2
127.1%	848.7	line	AS 220	GKRO 220	1	real(in)	D2AS__2_D2GKRO2_1	3	D2	GKRO 220			real(in)	D2GKRO26		D2

08:30	base n-0		82.9%				54.4%	74.9%		89.8%	67.6%	42.6%	57.8%	52.2%						
	CA n-1		124.6%				77.8%	89.8%		163.5%	90.8%	60.0%	111.1%	106.0%						
09:30	base n-0		83.3%				54.4%	74.9%		89.8%	67.6%	42.6%	57.8%	52.3%						
	CA n-1		124.6%				77.8%	89.8%		163.5%	90.8%	60.1%	111.1%	106.0%						
10:30	base n-0		83.3%				57.0%	74.9%		89.8%	67.6%	40.9%	57.8%	56.9%						
	CA n-1		124.6%				79.9%	90.0%		163.5%	92.7%	57.8%	111.1%	109.4%						
11:30	base n-0		77.3%				59.0%	76.1%		89.8%	67.6%	40.5%	57.8%	56.7%						
	CA n-1		124.6%				81.9%	87.8%		163.5%	93.8%	57.4%	111.1%	111.7%						
12:30	base n-0		83.3%				57.0%	74.9%		89.8%	67.6%	40.9%	57.8%	56.9%						
	CA n-1		124.6%				79.9%	90.0%		163.5%	92.7%	57.8%	111.1%	109.4%						
13:30	base n-0		77.7%				59.0%	76.1%		89.8%	67.6%	40.5%	57.8%	56.7%						
	CA n-1		124.6%				82.1%	87.8%		163.5%	93.8%	57.5%	111.1%	111.7%						
14:30	base n-0		77.7%				59.0%	76.1%		89.8%	67.6%	40.5%	57.8%	56.7%						
	CA n-1		124.6%				82.1%	87.8%		163.5%	93.8%	57.5%	111.1%	111.7%						
15:30	base n-0		81.0%				64.4%	74.4%		91.2%	67.7%	39.3%	58.3%	58.0%						
	CA n-1		124.6%				102.5%	101.0%		163.3%	83.2%	54.1%	111.3%	112.5%						
16:30	base n-0		82.6%				54.5%	74.9%		89.8%	67.6%	42.6%	57.8%	52.3%						
	CA n-1		124.6%				77.8%	89.8%		163.5%	90.8%	60.0%	111.1%	106.0%						
17:30	base n-0		82.1%				57.0%	74.9%		89.8%	67.6%	40.8%	57.8%	56.8%						
	CA n-1		124.6%				79.9%	90.0%		163.5%	92.7%	57.7%	111.1%	109.4%						

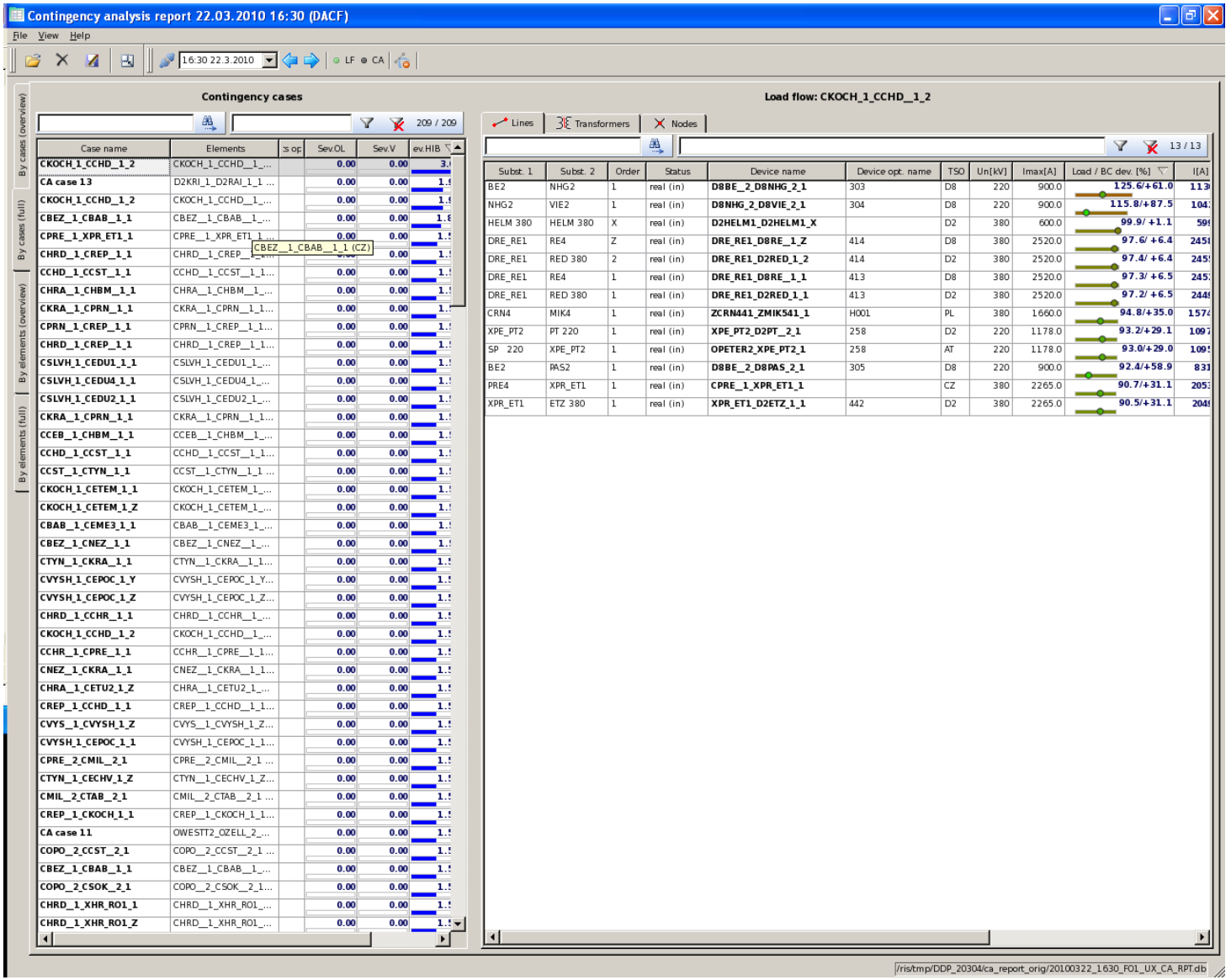
Load Flow Results



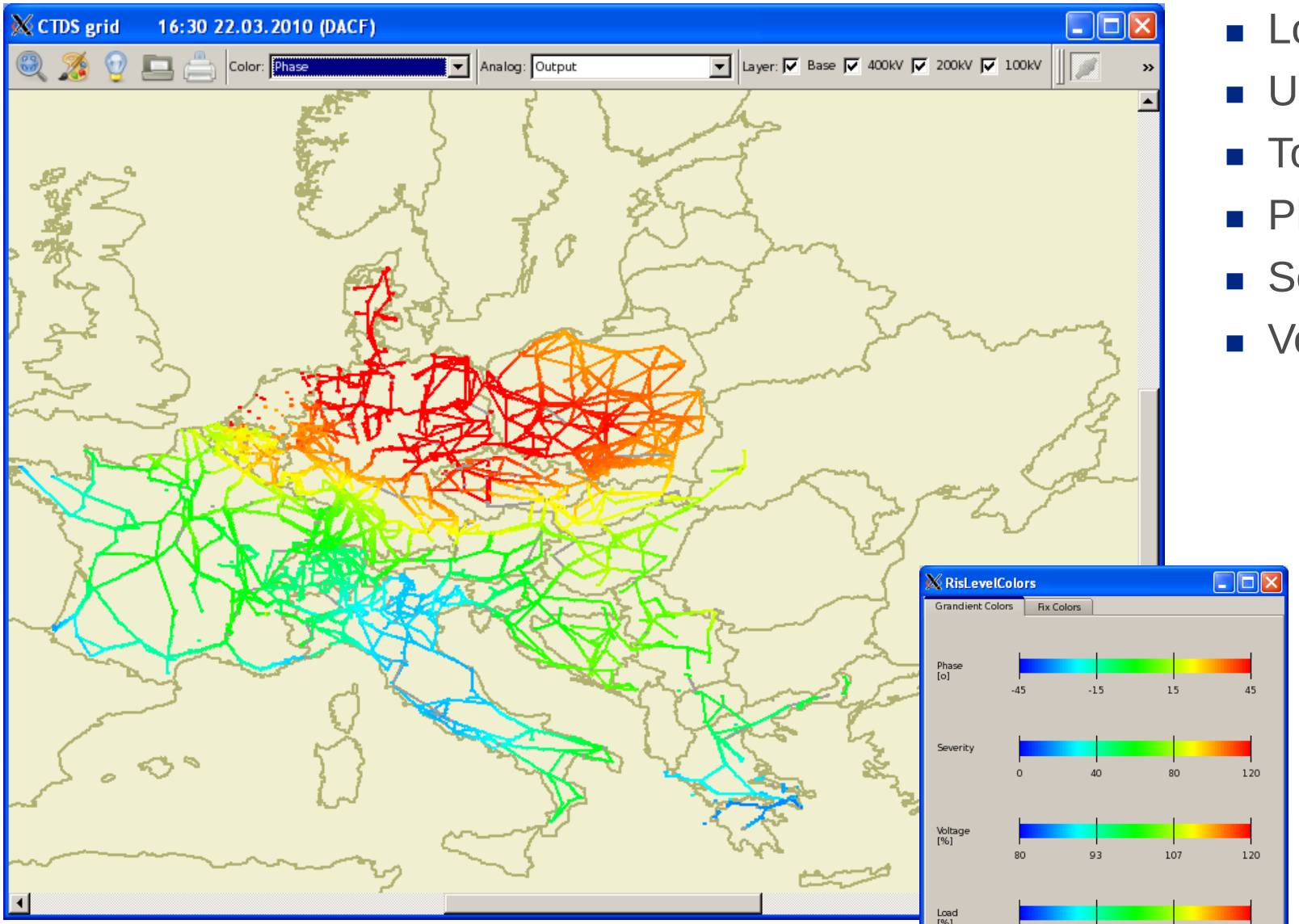
Subst. 1	Subst. 2	Order	Status	Name	Opt. name	TSO	Un[kV]	Imax[A]	load[%]	I[A]	P1[MW]	Q1[MVar]	th1[deg]	P2[MW]	Q2[MVar]	th2[deg
LI 220	XLI_SO2	1	real (in)	**OLIENN2_XLI_SO2_1**	261	AT	220	750.0	110.92	831.9	-342.3	-3.3	-5.62	333.9	-33.0	-12.9
XLI_SO2	SOVER220	1	real (in)	**XLI_SO2_ISOVVA2_1**	OV2215 1	IT	220	750.0	110.70	830.3	-333.9	33.0	-12.97	326.2	-66.0	-19.9
HELM 380	HELM 380	X	real (in)	**D2HELM1_D2HELM1_X**		D2	380	600.0	97.39	584.3	-409.1	26.5	28.48	408.9	-25.4	28.2
FBOLL52	FTERRA2	1	real (in)	**FBOLL52_FTERRA2_1**	BOLL561TERRA	FR	220	889.0	96.44	857.3	-353.1	12.7	-4.62	344.8	-44.7	-11.0
RICEN220	IGADM12	1	real (in)	**INOMM12_IGADM12_1**	MM2L16 1	IT	220	535.0	96.13	514.3	-202.6	73.9	-21.04	202.3	-40.6	-21.3
PAKS 400	PAKS 400	Y	equiv (in)	**MPAKS_1_MPAKS_1_Y**		HU	380	743.0	91.79	682.0	491.0	-80.8	6.42	-491.0	80.0	6.5
PAKS 400	PAKS 400	1	equiv (in)	**MPAKS_1_MPAKS_1_1**		HU	380	743.0	89.42	664.4	478.0	-80.7	6.42	-478.0	80.0	6.5
AVOI_220	AVOI_220	1	real (in)	**FAVOI52_FAVOIN2_1**	AVOI561AVOIN	FR	220	900.0	85.91	773.2	-316.4	25.6	-2.42	316.3	-21.5	-2.6
AVOI_380	FCHIN21	1	real (in)	**FAVOI51_FCHIN21_1**	AVOI571CHIN2	FR	380	1580.0	82.42	1302.2	897.7	-116.0	4.50	-897.8	121.9	4.6
MAAD 220	WHAV 220	1	real (in)	**D2MAAD2_D2WHAV2_1**	B.LAU	D2	220	2052.0	81.53	1672.9	678.8	-31.3	25.71	-679.3	26.1	26.1
BEE4	TRE4	1	real (in)	**ZBEE141_ZTRE141_1**	E403	PL	380	1500.0	81.18	1217.7	-824.0	256.6	29.06	818.6	-269.1	26.3
ROGNA220	FRQROU2	1	real (in)	**FROGNA2_FRQROU2_1**	ROGNA61RQROU	FR	220	1160.0	80.57	934.6	373.1	-26.1	-20.50	-377.0	3.7	-16.4
HEYD 380	OVEN 380	1	real (in)	**D2HEYD1_D2OVEN1_1**	1	D2	380	1440.0	80.40	1157.8	-816.7	108.4	20.52	816.1	-109.9	20.1
PAKS 400	PAKS 400	Z	equiv (in)	**MPAKS_1_MPAKS_1_Z**		HU	380	837.0	80.12	670.6	482.6	-80.7	6.42	-482.6	80.0	6.5
REALT220	FSEPTE2	3	real (in)	**FREALT2_FSEPTE2_3**	REALT63SEPTE	FR	220	1160.0	78.68	912.7	-365.6	21.8	-20.72	364.7	-26.8	-21.7
FMOUIS2	FTERRA2	1	real (in)	**FMOUIS2_FTERRA2_1**	MOUIS61TERRA	FR	220	889.0	78.52	698.1	278.7	-48.1	-13.10	-280.7	40.9	-11.0
GRANZ220	FZGRA62	1	real (in)	**FGRANZ2_FZGRA62_1**	GRANZ61ZGRA6	FR	220	1337.0	76.75	1026.2	-424.7	-18.7	-5.71	418.9	-15.3	-10.9
AVOI_380	FCHIN21	2	real (in)	**FAVOI51_FCHIN21_2**	AVOI572CHIN2	FR	380	1700.0	75.93	1290.8	888.7	-123.4	4.50	-888.8	128.7	4.6
FRAN.P2	FRANCE2	1	real (in)	**FRAN.P2_FRANCE2_1**	RAN.P61RANCE	FR	220	260.0	75.92	197.4	80.0	9.5	-10.77	-80.0	-8.0	-10.7
BOG2	CPC2	1	real (in)	**ZBOG422_ZCPC422_1**	4020	PL	220	800.0	75.25	602.0	234.6	7.1	22.15	-237.3	-19.6	26.7
HAMN 220	STDE 220	1	real (in)	**D2HAMN2_D2STDE2_1**	ROT	D2	220	626.0	75.06	469.9	-188.1	8.4	26.76	186.0	-12.8	23.3
CPC2	MIK2	1	real (in)	**ZCPC422_ZMIK422_1**	4011	PL	220	1062.0	74.04	786.3	310.8	23.4	26.76	-316.1	-53.5	33.4
MVAV 220	MVAV 220	1	real (in)	**IMFTV12_IMFZV12_1**	VV2193 1	IT	220	800.0	73.40	587.2	-237.3	42.2	-20.52	237.2	-42.9	-20.7
REALT220	FSEPTE2	1	real (in)	**FREALT2_FSEPTE2_1**	REALT61SEPTE	FR	220	1160.0	72.72	843.5	-337.9	19.9	-20.72	337.1	-24.7	-21.7
IMTJT12	LEYNI220	1	real (in)	**IMTJT12_ILEYTA2_1**	TT2215 1	IT	220	280.0	72.52	203.1	-83.5	-0.7	-5.76	82.8	8.4	-7.9
FP.ORG2	FRQROU2	1	real (in)	**FP.ORG2_FRQROU2_1**	P.ORG61RQROU	FR	220	889.0	72.23	642.1	-259.6	20.2	-14.27	257.4	-27.0	-16.4
SIEM 220	LBEC 220	1	real (in)	**D2SIEM2_D2LBEC2_1**	B.LAU	D2	220	950.0	71.97	683.7	-265.7	83.2	30.36	265.5	-48.0	30.0
KUMM 220	STDE 220	1	real (in)	**D2KUMM2_D2STDE2_1**	GELB	D2	220	626.0	71.83	449.7	-178.1	20.7	25.20	177.0	-22.8	23.3
FMOUIS2	FP.ORG2	1	real (in)	**FMOUIS2_FP.ORG2_1**	MOUIS61P.ORG	FR	220	889.0	71.40	634.7	-253.1	47.7	-13.10	252.0	-51.2	-14.2
EDC380	EEM380	1	real (in)	**NEDC381_NEEM381_1**	EEM-EDC380 1	NL	380	1425.0	71.24	1015.2	-700.0	0.0	13.19	699.9	-1.7	13.0
IPMLV52	IST4VC2	1	real (in)	**IPMLV52_IST4VC2_1**	VV2M10 1	IT	220	784.0	70.75	554.7	-221.4	31.1	-23.54	221.3	-28.6	-23.6
FDEPHT2	PRAGN220	2	real (in)	**FDEPHT2_FPRAGN2_2**	PRAGN62DEPHG	FR	220	690.0	69.78	481.5	185.6	-74.5	-16.53	-185.6	74.1	-16.4
XLA_KU2	KUHMO	2	real (in)	**XLA_KU2_D4KUHM2_2**	HOTZ	D4	220	1200.0	69.34	832.1	283.3	-188.3	-2.92	-283.9	186.2	-2.4

/ris/tmp/DDP_12558/lf_report/20100315_2230_FO1_UX_LF_RPT.db

Contingency Analysis Results

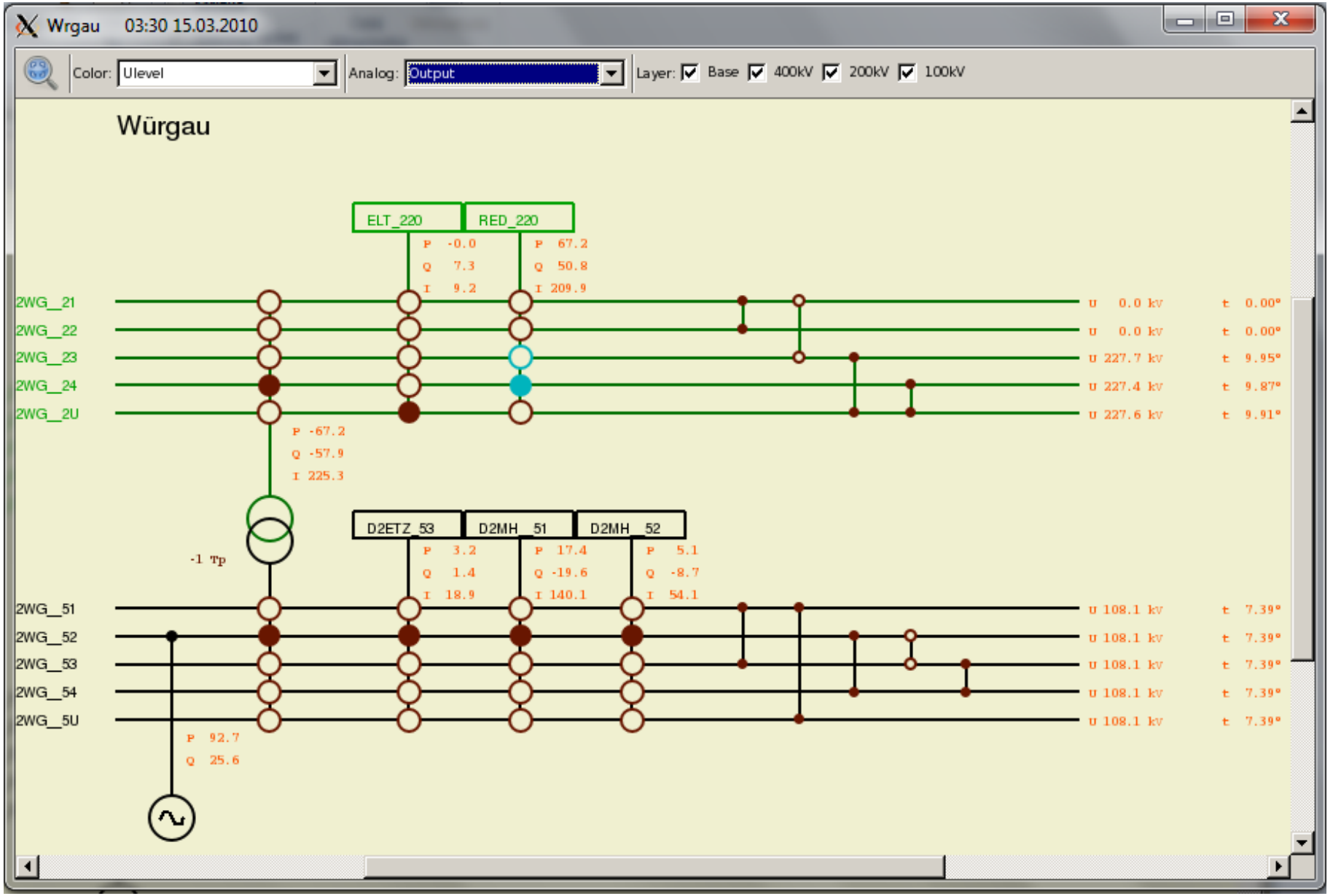


Geographical Presentation



- Load
- Ulevel
- Topology
- Phase angle
- Severity index
- Voltage

Substation Detail

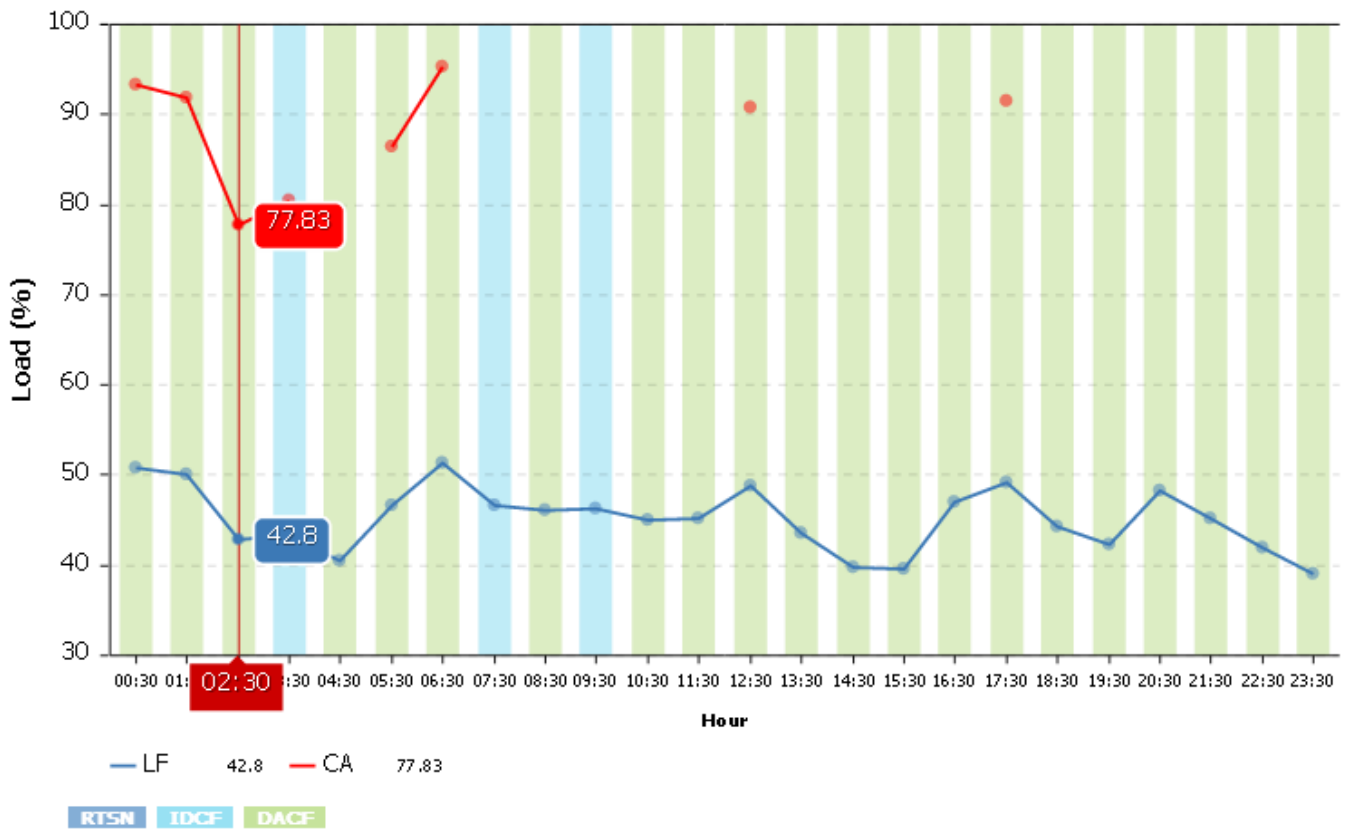


Trend Analysis

Trend Analysis For A Day

Date 22.03.2010 Display Configuration

Trend overview



Detailed information about the worst LF and CA result

Load Flow

Load %	42.8
S2	
Type	
Substation1	CPRE__22
Substation2	CVIT__21
Order	1
Status	0
Name	CPRE__2_CVIT__2_1
EName	
TSO	CZ

Contingency Analysis

Affected Element	
Load %	77.83
S2	
Type	
Substation1	CPRE__22
Substation2	CVIT__21
Order	1
Status	0
Name	CPRE__2_CVIT__2_1
EName	
TSO	CZ
Contingency Case	
Substation1	CPRE__21
Substation2	CVIT__22
Order	2
Status	0
Name	CPRE__2_CVIT__2_2
EName	
TSO	CZ

Trend table

		00:30		01:30		02:30		03:30		04:30		05:30		06:30		07:30		08:30		09:30		10:30		11:30		12:30		13:30		14:
List of Elements	Optional names	LF	CA	LF	CA	LF	CA	LF	CA	LF	CA	LF	CA	LF	CA	LF	CA	LF	CA	LF	CA	LF	CA	LF	CA	LF	CA	LF
CPRE__2_CVIT__2_1		50.78	93.23	50.07	91.88	42.8	77.83	38.79		37.83		39.44		43.67		44.88		46.15		46.24		42.03		41.7		42.19		43.56		39.7
CVIT__2_CHRA__2_1		18.47		18.06		39.58		43.37	80.49	40.53		46.66	86.49	51.31	95.31	46.69		43.09		46.08		45.04		45.23		48.75	90.84	41.47		25.1