BIG.BROTHER

TOTEM DCS - Detector Control System

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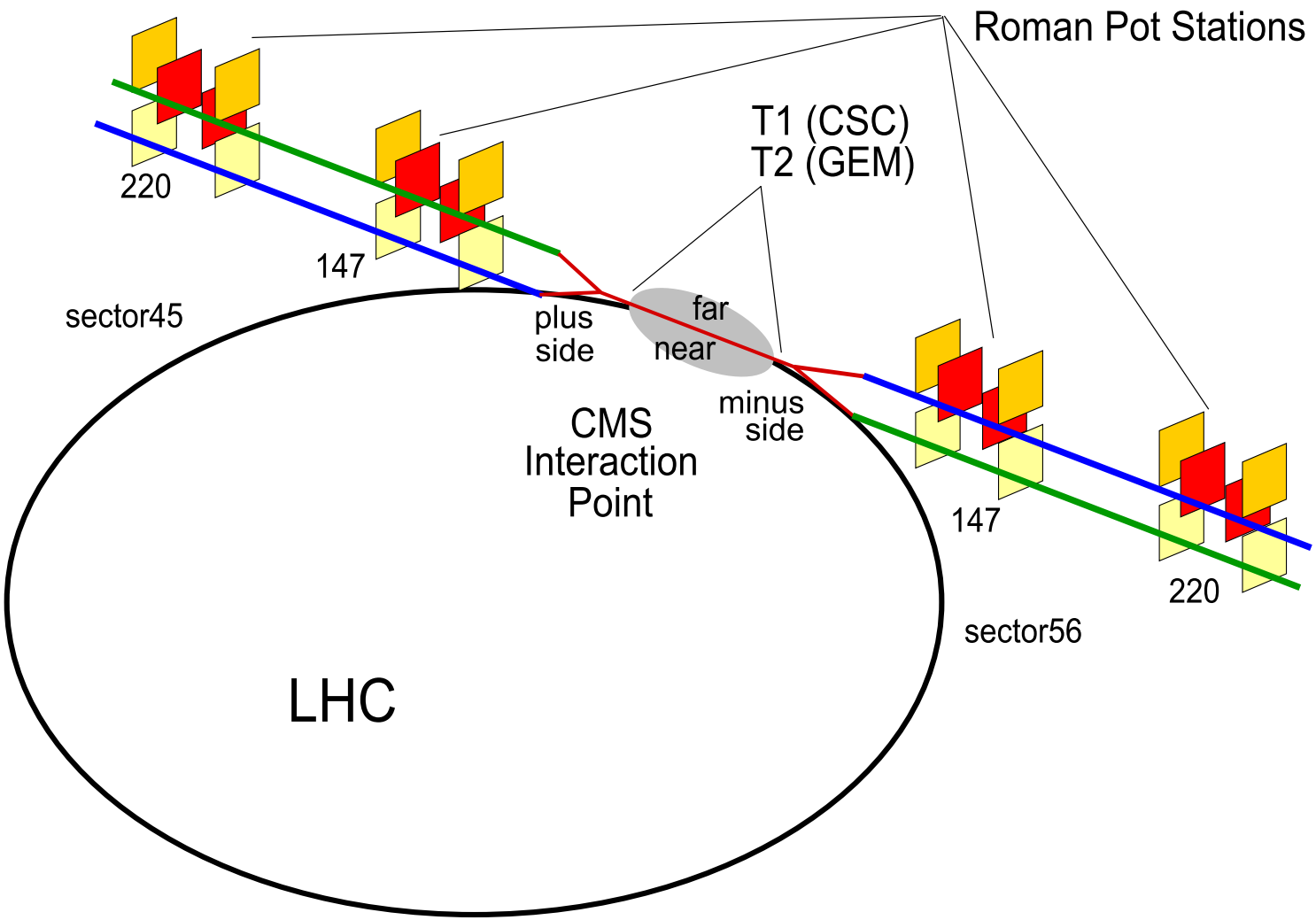
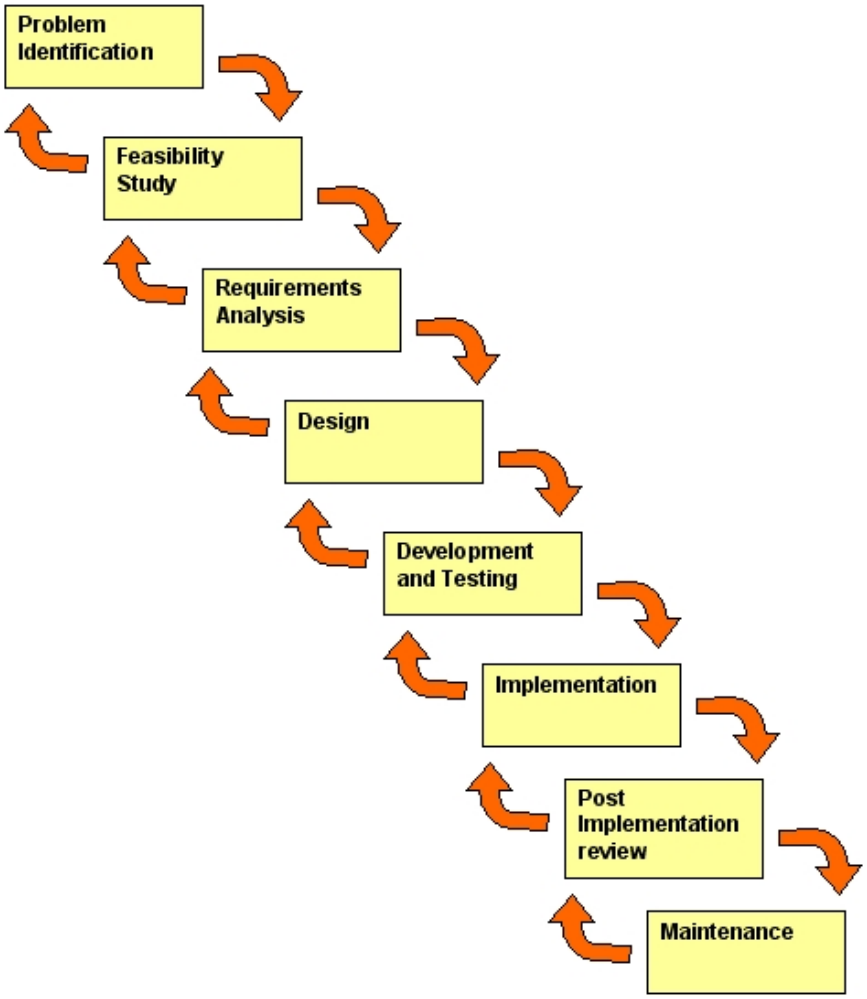
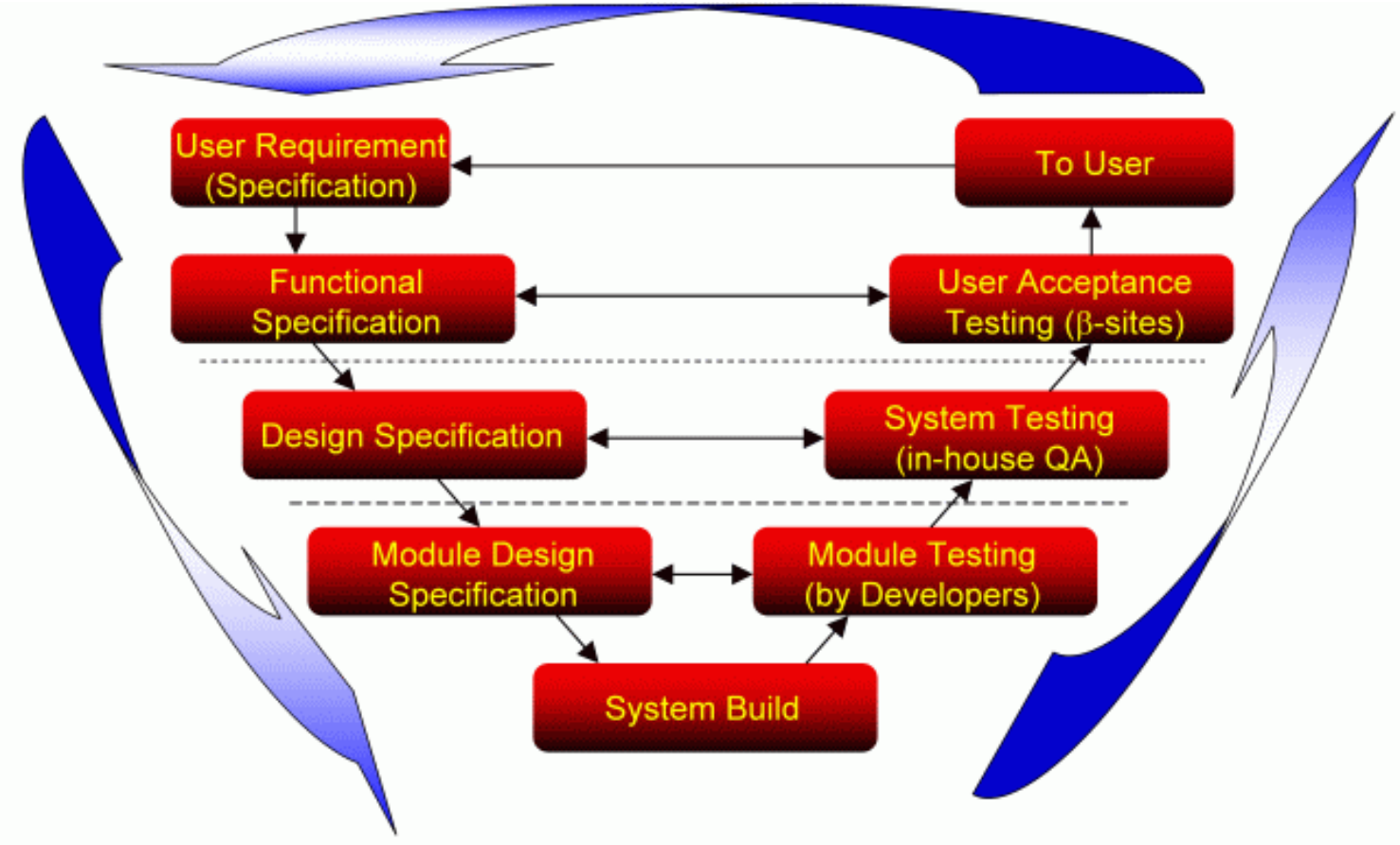
TOTEM introduction



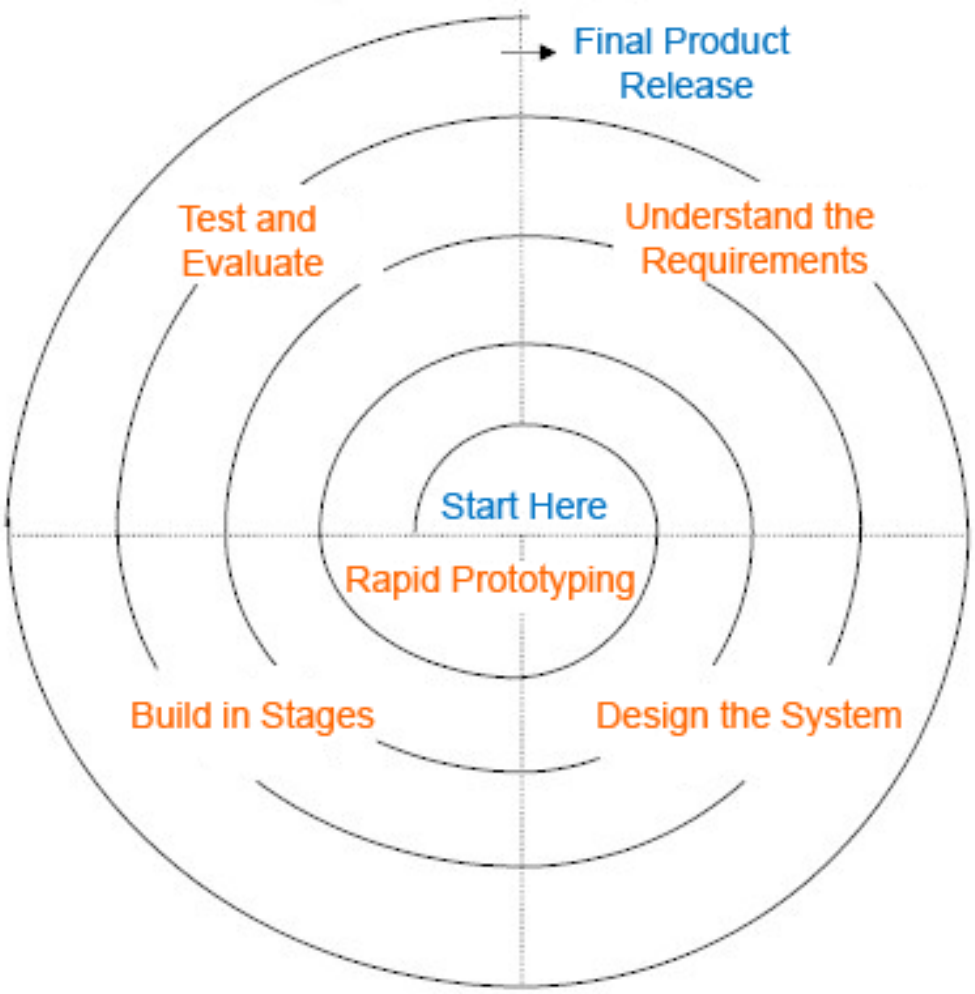
Waterfall software life-cycle model



V software life-cycle model

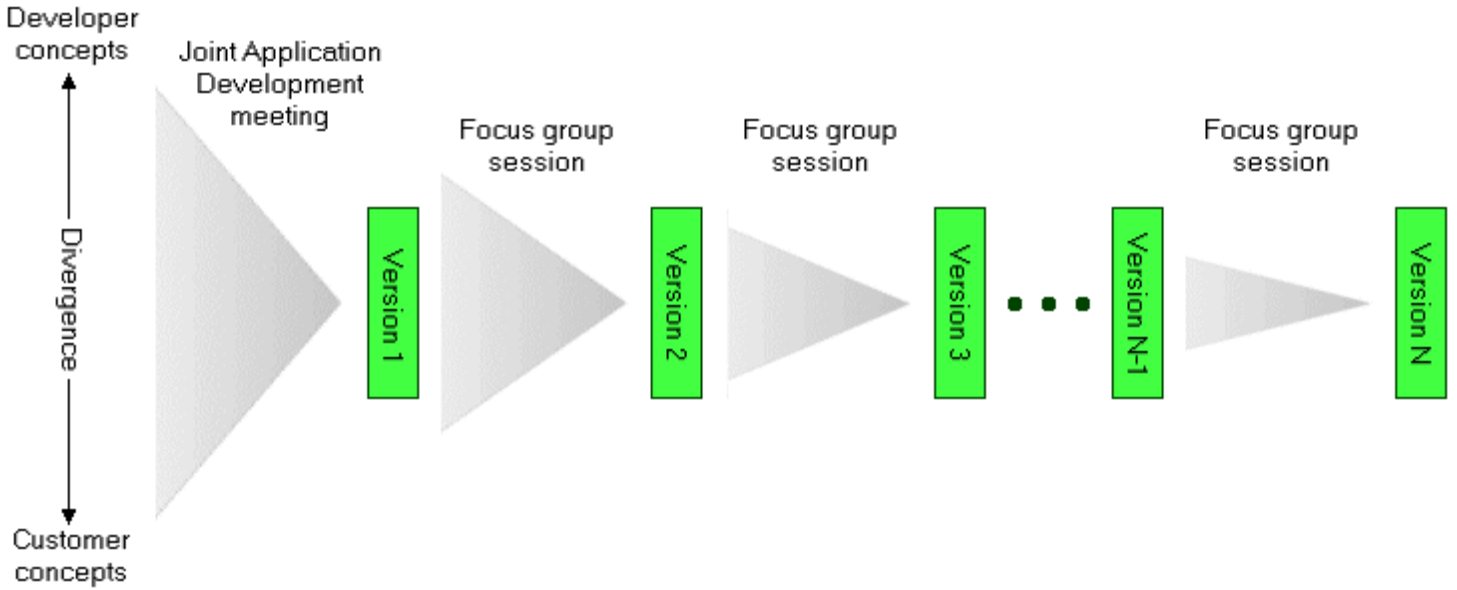


Iterative software life-cycle model



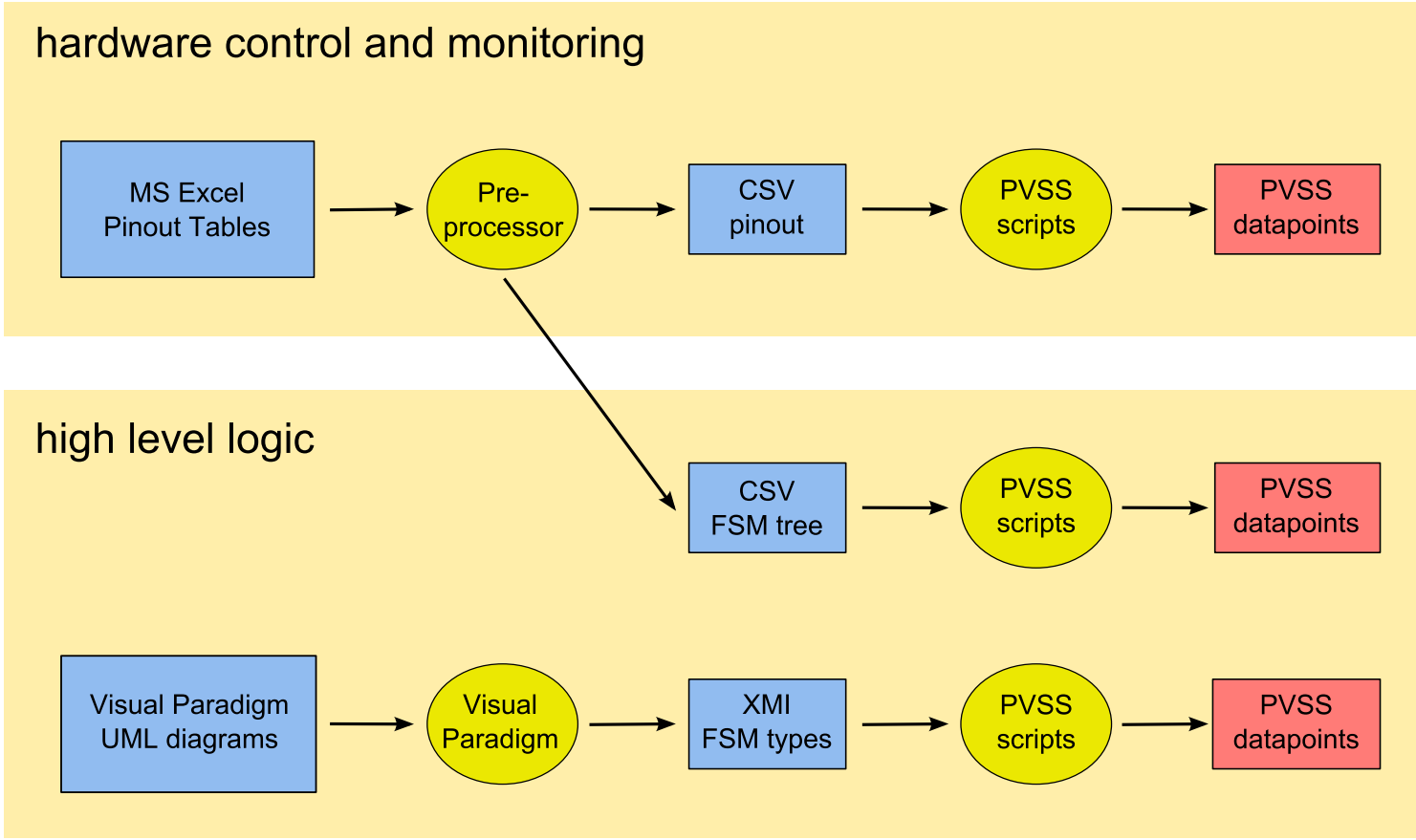
- It is an incremental model

RAD software life-cycle model



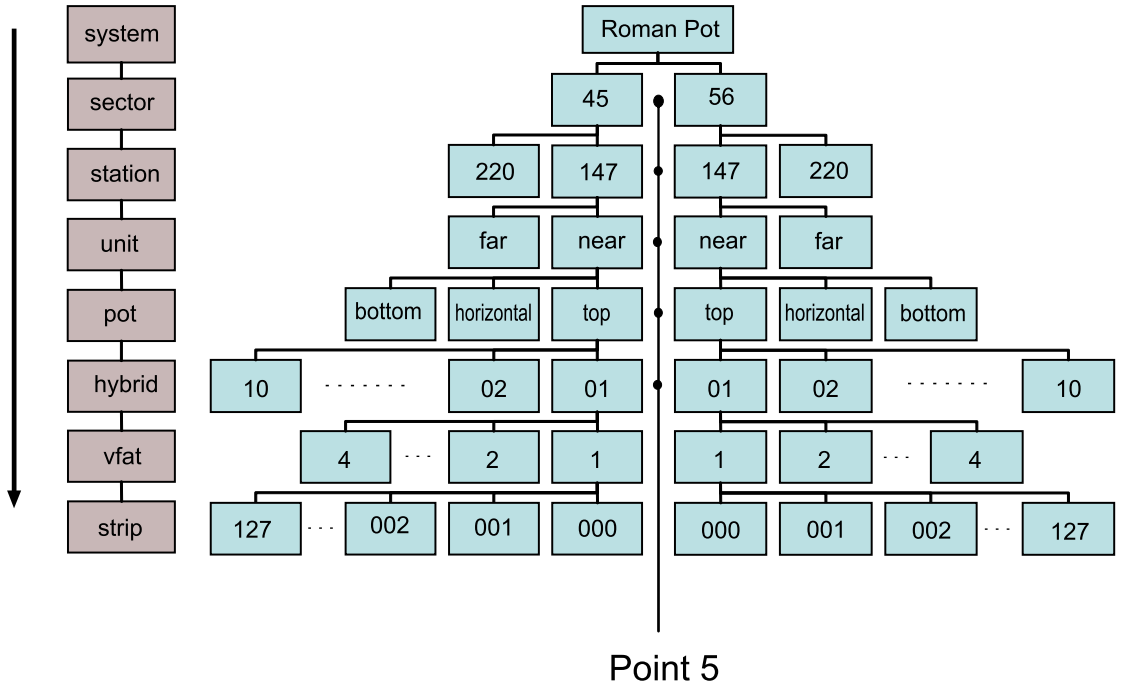
- Rapid Application Development
- Automated generation of some parts of the software
- It is an incremental model

Development process



The automation tools help in the steps between the blue and red blocks.

PBS and Naming Scheme



- *rp_45_147_fr_tp_02_004*
- It is possible to build a Backus-Naur Form (BNF) grammar
- Its opens the possibility for using heuristics based on the names

Pinout formalization in Excel Tables

SECTOR	STATION	UNIT	POT	FUNCTION	RPMB PAD	RPMB SIGNAL NAME	RPMB CONNECTOR PIN	19 PINS CONNECTOR IN SHORT CABLE	SHORT CABLE	SHORT CABLE WIRE NUMBER	19 PINS CONNECTOR IN SHORT CABLE	19 PINS CONNECTOR IN PATCH PANNEL	PATCH PANNEL	48 PINS CONNECTOR IN PATCH PANNEL	48 PINS CONNECTOR IN LONG CABLE	LONG CABLE	WIRE NUMBER	48 PINS CONNECTOR IN LONG CABLE	48 PINS CONNECTOR	FLAT CABLE ID	FLAT CABLE POS	ELMB BUS	ELMB ID (dec)	ELMB CHANNEL	ELMB CONNECTOR PIN	ELMB CHANNEL POLARITY	DCS hardware name	DCS logical name
45	220	1r	5t		B53	P5PT1A	04	04	TR.1_SP11 NE48 04, 21, 52, 150 2	?	04	04	?	04	04	TR.1_SP1	04	04	04	DSS	DSS	—	—	—	—	—	—	—
				temperature plane	B54	P3PT2B	05	05		?	05	05	?	05	05		05	05	05										
					B55	P3PT2A	06	06		?	06	06	?	06	06		06	06	06										
					B56	P3PT1B	07	07		?	07	07	?	07	07		07	07	07										
					B57	P3PT1A	08	08		?	08	08	?	08	08		08	08	08										
				temperature cooling	B58	SP1PT1A	09	09		?	09	09	?	09	09		09	09	09	RPTC3	01	09	18	32	C1		ELMB/bus09/elmb18/AI/PT_2W_32	tot_Rp_45_220_fr_bt_Cool01
					B59	SP1PT1B	10	10		?	10	10	?	10	10		10	10	10		02	09			C9	+		
				temperature cooling	B60	SP1PT2A	11	11		?	11	11	?	11	11		11	11	11		03	09	18	33	C2		ELMB/bus09/elmb18/AI/PT_2W_33	tot_Rp_45_220_fr_bt_Cool02
					B61	SP1PT2B	12	12		?	12	12	?	12	12		12	12	12		04	09			C10	+		
				temperature cooling	B62	SP2PT1A	13	13		?	13	13	?	13	13		13	13	13		05	09	18	34	C3		ELMB/bus09/elmb18/AI/PT_2W_34	tot_Rp_45_220_fr_bt_Cool03
					B63	SP2PT1B	14	14		?	14	14	?	14	14		14	14	14		06	09			C11	+		
				temperature cooling	B64	SP2PT2A	15	15		?	15	15	?	15	15		15	15	15		07	09	18	35	C4		ELMB/bus09/elmb18/AI/PT_2W_35	tot_Rp_45_220_fr_bt_Cool04
					B65	SP2PT2B	16	16		?	16	16	?	16	16		16	16	16		08	09			C12	+		
			4t		B50	P8PT2B	01	01	TR.1_SP12 NE48 04, 21, 52, 150 2	?	01	01	?	17	17		17	17	17	RPTP2	05	09	17	18	C3		ELMB/bus09/elmb17/AI/PT_4W_18_19	tot_ R p_45_220_fr_hr_Temp01
				temperature plane	B51	P8PT2A	02	02		?	02	02	?	18	18		18	18	18		07			19	C4	+		
					B52	P8PT1B	03	03		?	03	03	?	19	19		19	19	19		06			18	C11			
					B53	P8PT1A	04	04		?	04	04	?	20	20		20	20	20		08			19	C12	+		
				temperature plane	B54	P3PT2B	05	05		?	05	05	?	21	21		21	21	21	DSS	DSS	—	—	—	—	—	—	—
					B55	P3PT2A	06	06		?	06	06	?	22	22		22	22	22										
					B56	P3PT1B	07	07		?	07	07	?	23	23		23	23	23										
					B57	P3PT1A	08	08		?	08	08	?	24	24		24	24	24										
				temperature cooling	B58	SP1PT1A	09	09		?	09	09	?	25	25		25	25	25	RPTC3	09	09	18	36	C5		ELMB/bus09/elmb18/AI/PT_2W_36	tot_ Rp_45_220_fr_hr_Cool01
					B59	SP1PT1B	10	10		?	10	10	?	26	26		26	26	26		10	09			C13	+		
				temperature cooling	B60	SP1PT2A	11	11		?	11	11	?	27	27		27	27	27		11	09	18	37	C6		ELMB/bus09/elmb18/AI/PT_2W_37	tot_Rp_45_220_fr_hr_Cool02
					B61	SP1PT2B	12	12		?	12	12	?	28	28		28	28	28		12	09			C14	+		
				temperature cooling	B62	SP2PT1A	13	13		?	13	13	?	29	29		29	29	29		13	09	18	38	C7		ELMB/bus09/elmb18/AI/PT_2W_38	tot_Rp_45_220_fr_hr_Cool03
					B63	SP2 PT 1B	14	14		?	14	14	?	30	30		30	30	30		14	09			C15	+		
				temperature cooling	B64	SP2PT2A	15	15		?	15	15	?	31	31		31	31	31		15	09	18	39	C8		ELMB/bus09/elmb18/AI/PT_2W_39	tot_Rp_45_220_fr_hr_Cool04
					B65	SP2PT2B	16	16		?	16	16	?	32	32		32	32	32		16	09			C16	+		
			1p		B50	P8PT2B	01	01	TR.1_SP13 NE48 04, 21, 52, 150 2	?	01	01	?	33	33		33	33	33		09				20	C5			
				temperature plane	B51	P8PT2A	02	02		?	02	02	?	34	34		34	34	34	RPTP2	11	09	17	21	C6	+	ELMB/bus09/elmb17/AI/PT_4W_20_21	tot_Rp_45_220_ fr_tp_Temp01
					B52	P8PT1B	03	03		?	03	03	?	35	35		35	35	35		10			20	C13			
					B53	P8PT1A	04	04		?	04	04	?	36	36		36	36	36		12			21	C14	+		
				temperature plane	B54	P3PT2B	05	05		?	05	05	?	37	37		37	37	37	DSS	DSS	—	—	—	—	—	—	—
					B55	P3PT2A	06	06		?	06	06	?	38	38		38	38	38										
					B56	P3PT1B	07	07		?	07	07	?	39	39		39	39	39										
					B57	P3PT1A	08	08		?	08	08	?	40	40		40	40	40										
				temperature cooling	B58	SP1PT1A	09	09		?	09	09	?	41	41		41	41	41	RPTC3	17	09	18	40	C17		ELMB/bus09/elmb18/AI/PT_2W_40	tot_Rp_45_220_fr_tp_Cool01
					B59	SP1PT1B	10	10		?	10	10	?	42	42		42	42	42		18	09			C25	+		
				temperature cooling	B60	SP1PT2A	11	11		?	11	11	?	43	43		43	43	43		19	09	18	41	C18		ELMB/bus09/elmb18/AI/PT_2W_41	tot_Rp_45_220_fr_tp_Cool02
					B61	SP1PT2B	12	12		?	12	12	?	44	44		44	44	44		20	09			C26	+		
				temperature cooling	B62	SP2PT1A	13	13		?	13	13	?	45	45		45	45	45		21	09	18	42	C19		ELMB/bus09/elmb18/AI/PT_2W_42	tot_Rp_45_220_fr_tp_Cool03
					B63	SP2PT1B	14	14		?	14	14	?	46	46		46	46	46		22	09			C27	+		
				temperature cooling	B64	SP2PT2A	15	15		?	15	15	?	47	47		47	47	47		23	09	18	43	C20		ELMB/bus09/elmb18/AI/PT_2W_43	tot_Rp_45_220_fr_tp_Cool04
					B65	SP2PT2B	16	16		?	16	16	?	48	48		48	48	48		24	09			C28	+		
		nr	5t		B50	P8PT2B	01	01	TR.1_SP21 NE48 04, 21, 52, 150 2	?	01	01	?	01	01	TR.1_SP1	01	01	01	RPTP2	13	09	17	22			ELMB/bus09/elmb17/AI/PT_4W_22_23	tot_Rp_45_220_nr_bt_Temp01
				temperature plane	B51	P8PT2A	02	02		?	02	02	?	02	02		02	02	02		15			23		+		
					B52	P8PT1B	03	03		?	03	03	?	03	03		03	03	03		14			22				
					B53	P8PT1A	04	04		?	04	04	?	04	04		04	04	04		16			23		+		
				temperature plane	B54	P3PT2B	05	05		?	05	05	?	05	05		05	05	05	DSS	DSS	—	—	—	—	—	—	—
					B55	P3PT2A	06	06		?	06	06	?	06	06		06	06	06										
					B56	P3PT1B	07	07		?	07	07	?	07	07		07	07	07										
					B57	P3PT1A	08	08		?	08	08	?	08	08		08	08	08										
				temperature cooling	B58	SP1PT1A	09	09		?	09	09	?	09	09		09	09	09	RPTC4	01	09	18	48			ELMB/bus09/elmb18/AI/PT_2W_48	tot_Rp_45_220_nr_bt_Cool01
					B59	SP1PT1B	10	10		?	10	10	?	10	10		10	10	10		02	09				+		
				temperature cooling	B60	SP1PT2A	11	11		?	11	11	?	11	11		11	11	11		03	09	18	49			ELMB/bus09/elmb18/AI/PT_2W_49	tot_Rp_45_220_nr_bt_Cool02
					B61	SP1PT2B	12	12		?	12	12	?	12	12		12	12	12		04	09				+		
				temperature cooling	B62	SP2PT1A	13	13		?	13	13	?	13	13		13	13	13		05	09	18	50			ELMB/bus09/elmb18/AI/PT_2W_50	tot_Rp_45_220_nr_bt_Cool03
					B63	SP2PT1B	14	14		?	14	14	?	14	14		14	14	14		06	09				+		
				temperature cooling	B64	SP2PT2A	15	15		?	15	15	?	15	15		15	15	15		07	09	18	51			ELMB/bus09/elmb18/AI/PT_2W_51	tot_Rp_45_220_nr_bt_Cool04
					B65	SP2PT2B	16	16		?	16	16	?	16	16		16	16	16		08	09				+		
			4t		B50	P8PT2B	01	01	TR.1_SP22 NE48 04, 21, 52, 150 2	?	01	01	?	17	17		17	17	17	RPTP2	17			24					
				temperature plane	B51	P8PT2A	02	02		?	02	02	?	18	18		18	18	18		19	09	17	25		+	ELMB/bus09/elmb17/AI/PT_4W_24_25	tot_Rp_45_220_nr_hr_Temp01
					B52	P8PT1B	03	03		?	03	03	?	19	19		19	19	19		18			24				
					B53	P8PT1A	04	04		?	04	04	?	20	20		20	20	20		20			25		+		
				temperature plane	B54	P3PT2B	05	05		?	05	05	?	21	21		21	21	21	DSS	DSS	—	—	—	—	—	—	—
					B55	P3PT2A	06	06		?	06	06	?	22	22		22	22	22										
					B56	P3PT1B	07	07		?	07	07	?	23	23		23	23	23										
					B57	P3PT1A	08	08		?	08	08	?	24	24		24	24	24										
				temperature cooling	B58	SP1PT1A	09	09		?	09	09	?	25	25		25	25	25	RPTC4	09	09	18	52			ELMB/bus09/elmb18/AI/PT_2W_52	tot_Rp_45_220_nr_hr_Cool01
					B59	SP1PT1B	10	10		?	10	10	?	26	26		26	26	26		10	09				+		
				temperature cooling	B60	SP1PT2A	11	11		?	11	11	?	27	27		27	27	27		11	09	18	53			ELMB/bus09/elmb18/AI/PT_2W_53	tot_Rp_45_220_nr_hr_Cool02
					B61	SP1PT2B	12	12		?	12	12	?	28	28		28	28	28		12	09				+		
				temperature cooling	B62	SP2PT1A	13	13		?	13	13	?	29	29		29	29	29		13	09	18	54			ELMB/bus09/elmb18/AI/PT_2W_54	tot_Rp_45_220_nr_hr_Cool03
					B63	SP2PT1B	14	14		?	14	14	?	30	30		30	30	30		14	09				+		
				temperature cooling	B64	SP2PT2A	15	15		?	15	15	?	31	31		31	31	31		15	09	18	55			ELMB/bus09/elmb18/AI/PT_2W_55	tot_Rp_45_220_nr_hr_Cool04
					B65	SP2PT2B	16	16		?	16	16	?	32	32		32	32	32		16	09				+		
			1p		B50	P8PT2B	01	01	TR.1_SP23 NE48 04, 21, 52, 150 2	?	01	01	?	33	33		33	33	33		21			26					
				temperature plane	B51	P8PT2A	02	02		?	02	02	?	34	34		34	34	34	RPTP2	23	09	17	27		+	ELMB/bus09/elmb17/AI/PT_4W_26_27	tot_Rp_45_220_nr_tp_Temp01
					B52	P8PT1B	03	03		?	03	03	?	35	35		35	35	35		22			26				
					B53	P8PT1A	04	04		?	04	04	?	36	36		36	36	36		24			27		+		
				temperature plane	B54	P3PT2B	05	05		?	05	05	?	37	37		37	37	37	DSS	DSS	—	—	—	—	—	—	—
					B55	P3PT2A	06	06		?	06	06	?	38	38		38	38	38										
					B56	P3PT1B	07	07		?	07	07	?	39	39		39	39	39										
					B57	P3PT1A	08	08		?	08	08	?	40	40		40	40	40										
				temperature cooling	B58	SP1PT1A	09	09		?	09	09	?	41	41		41	41	41	RPTC4	17	09	18	56			ELMB/bus09/elmb18/AI/PT_2W_56	tot_Rp_45_220_nr_tp_Cool01
					B59	SP1PT1B	10	10		?	10	10	?	42	42		42	42	42		18	09				+		
				temperature cooling	B60	SP1PT2A	11	11		?	11	11	?	43	43		43	43	43		19	09	18	57			ELMB/bus09/elmb18/AI/PT_2W_57	tot_Rp_45_220_nr_tp_Cool02
					B61	SP1PT2B	12	12		?	12	12	?	44	44		44	44	44		20	09				+		
				temperature cooling	B62	SP2PT1A	13	13		?	13	13	?	45	45		45	45	45		21	09	18	58			ELMB/bus09/elmb18/AI/PT_2W_58	tot_Rp_45_220_nr_tp_Cool03
					B63	SP2PT1B	14	14		?	14	14	?	46	46		46	46	46		22	09				+		
				temperature cooling	B64	SP2PT2A	15	15		?	15	15	?	47	47		47	47	47		23	09	18	59			ELMB/bus09/elmb18/AI/PT_2W_59	tot_Rp_45_220_nr_tp_Cool04
					B65	SP2PT2B	16	16		?	16	16	?	48	48		48	48	48		24	09				+		

Pinout formalization in Excel Tables

RPMB PAD	RPMB SIGNAL NAME	RPMB CONNECTOR PIN
B50	P8PT2B	01
B51	P8PT2A	02
B52	P 8 PT1B	03
B53	P8PT1A	04
B54	P3PT2B	05
B55	P3PT2A	06
B56	P3PT1B	07
B57	P3PT1A	08
B58	SP1PT1A	09
B59	SP1PT1B	10
B60	SP1PT2A	11
B61	SP1PT2B	12
B62	SP2PT1A	13
B63	SP2PT1B	14
B64	SP2PT2A	15
B65	SP2 PT 2B	16

SECTOR	STAT											
45		2 2 0	1 p	plane	B52	P8PT1B	03	03	TR.1_SP23 NE48 04. 21. 52. 150 2	?	03	03	?
					B53	P8PT1A	04	04		?	04	04	?
					B54	P3PT2B	05	05		?	05	05	?
				temperature	B55	P3PT2A	06	06		?	06	06	?
				plane	B56	P3PT1B	07	07		?	07	07	?
					B57	P3PT1A	08	08		?	08	08	?
				temperature	B58	SP1PT1A	09	09		?	09	09	?
				cooling	B59	SP1PT1B	10	10		?	10	10	?
				temperature	B60	SP1PT2A	11	11		?	11	11	?
				cooling	B61	SP1PT2B	12	12		?	12	12	?
				temperature	B62	SP2PT1A	13	13		?	13	13	?
				cooling	B63	SP2PT1B	14	14		?	14	14	?
				temperature	B64	SP2PT2A	15	15		?	15	15	?
				cooling	B65	SP2PT2B	16	16		?	16	16	?

48 PINS CONNECTOR IN PATCH PANNEL	48 PINS CONNECTOR IN LONG CABLE	LONG CABLE	WIRE NUMBER	48 PINS CONNECTOR IN LONG CABLE	48 PINS CONNECTOR	FLAT CABLE ID	FLAT CABLE POS	ELMB BUS	ELMB ID (dec)	ELMB CHANNEL	ELMB CONNECTOR PIN	ELMB CHANNEL POLARITY	DCS hardware name	DCS logical name
04	04		04	04	04		04			17	C10	+		
05	05		05	05	05	DSS	DSS	—	—	—	—	—	—	—
06	06		06	06	06									
07	07		07	07	07									
08	08		08	08	08									
09	09		09	09	09	RPTC3	01	09	18	32	C1		ELMB/bus09/elmb18/AI/PT_2W_32	tot_Rp_45_220_fr_bt_Cool01
10	10		10	10	10		02	09			C9	+		
11	11		11	11	11		03	09	18	33	C2		ELMB/bus09/elmb18/AI/PT_2W_33	tot_Rp_45_220_fr_bt_Cool02
12	12		12	12	12		04	09			C10	+		
13	13		13	13	13		05	09	18	34	C3		ELMB/bus09/elmb18/AI/PT_2W_34	tot_Rp_45_220_fr_bt_Cool03
14	14		14	14	14		06	09			C11	+		
15	15		15	15	15		07	09	18	35	C4		ELMB/bus09/elmb18/AI/PT_2W_35	tot_Rp_45_220_fr_bt_Cool04
16	16		16	16	16		08	09			C12	+		
17	17		17	17	17	RPTP2	05	09	17	18	C3		ELMB/bus09/elmb17/AI/PT_4W_18_19	tot_ R p_45_220_fr_hr_Temp01
18	18		18	18	18		07			19	C4	+		
19	19		19	19	19		06			18	C11			
20	20		20	20	20		08			19	C12	+		
21	21		21	21	21	DSS	DSS	—	—	—	—	—	—	—
22	22		22	22	22									
23	23		23	23	23									
24	24	TR.1_SP1	24	24	24									
25	25		25	25	25	RPTC3	09	09	18	36	C5		ELMB/bus09/elmb18/AI/PT_2W_36	tot_ Rp_45_220_fr_hr_Cool01
26	26		26	26	26		10	09			C13	+		
27	27		27	27	27		11	09	18	37	C6		ELMB/bus09/elmb18/AI/PT_2W_37	tot_Rp_45_220_fr_hr_Cool02
28	28		28	28	28		12	09			C14	+		
29	29		29	29	29		13	09	18	38	C7		ELMB/bus09/elmb18/AI/PT_2W_38	tot_Rp_45_220_fr_hr_Cool03
30	30		30	30	30		14	09			C15	+		
31	31		31	31	31		15	09	18	39	C8		ELMB/bus09/elmb18/AI/PT_2W_39	tot_Rp_45_220_fr_hr_Cool04
32	32		32	32	32		16	09			C16	+		
33	33		33	33	33	RPTP2	09	09	17	20	C5		ELMB/bus09/elmb17/AI/PT_4W_20_21	tot_Rp_45_220_ fr_tp_Temp01
34	34		34	34	34		11			21	C6	+		
35	35		35	35	35		10			20	C13			
36	36		36	36	36		12			21	C14	+		
37	37		37	37	37	DSS	DSS	—	—	—	—	—	—	—
38	38		38	38	38									
39	39		39	39	39									
40	40		40	40	40									
41	41		41	41	41	RPTC3	17	09	18	40	C17		ELMB/bus09/elmb18/AI/PT_2W_40	tot_Rp_45_220_fr_ tp_Cool01
42	42		42	42	42		18	09			C25	+		
43	43		43	43	43		19	09	18	41	C18		ELMB/bus09/elmb18/AI/PT_2W_41	tot_Rp_45_220_fr_tp_Cool02
44	44		44	44	44		20	09			C26	+		
45	45		45	45	45		21	09	18	42	C19		ELMB/bus09/elmb18/AI/PT_2W_42	tot_Rp_45_220_fr_tp_Cool03
46	46		46	46	46		22	09			C27	+		
47	47		47	47	47		23	09	18	43	C20		ELMB/bus09/elmb18/AI/PT_2W_43	tot_Rp_45_220_fr_ tp_Cool04
48	48		48	48	48		24	09			C28	+		
01	01		01	01	01	RPTP2	13	09	17	22			ELMB/bus09/elmb17/AI/PT_4W_22_23	tot_Rp_45_220_nr_bt_Temp01
02	02		02	02	02		15			23		+		
03	03		03	03	03		14			22				
04	04		04	04	04		16			23		+		
05	05		05	05	05	DSS	DSS	—	—	—	—	—	—	—
06	06		06	06	06									
07	07		07	07	07									
08	08		08	08	08									
09	09		09	09	09	RPTC4	01	09	18	48			ELMB/bus09/elmb18/AI/PT_2W_48	tot_Rp_45_220_nr_bt_Cool01
10	10		10	10	10		02	09				+		
11	11		11	11	11		03	09	18	49			ELMB/bus09/elmb18/AI/PT_2W_49	tot_Rp_45_220_nr_bt_Cool02
12	12		12	12	12		04	09				+		
13	13		13	13	13		05	09	18	50			ELMB/bus09/elmb18/AI/PT_2W_50	tot_Rp_45_220_nr_bt_Cool03
14	14		14	14	14		06	09				+		
15	15		15	15	15		07	09	18	51			ELMB/bus09/elmb18/AI/PT_2W_51	tot_Rp_45_220_nr_bt_Cool04
16	16		16	16	16		08	09				+		
17	17		17	17	17	RPTP2	17	09	17	24			ELMB/bus09/elmb17/AI/PT_4W_24_25	tot_Rp_45_220_nr_hr_Temp01
18	18		18	18	18		19			25		+		
19	19		19	19	19		18			24				
20	20		20	20	20		20			25		+		
21	21		21	21	21	DSS	DSS	—	—	—	—	—	—	—
22	22		22	22	22									
23	23		23	23	23									
24	24	TR.1_SP1	24	24	24									
25	25		25	25	25	RPTC4	09	09	18	52			ELMB/bus09/elmb18/AI/PT_2W_52	tot_Rp_45_220_nr_hr_Cool01
26	26		26	26	26		10	09				+		
27	27		27	27	27		11	09	18	53			ELMB/bus09/elmb18/AI/PT_2W_53	tot_Rp_45_220_nr_hr_Cool02
28	28		28	28	28		12	09				+		
29	29		29	29	29		13	09	18	54			ELMB/bus09/elmb18/AI/PT_2W_54	tot_Rp_45_220_nr_hr_Cool03
30	30		30	30	30		14	09				+		
31	31		31	31	31		15	09	18	55			ELMB/bus09/elmb18/AI/PT_2W_55	tot_Rp_45_220_nr_hr_Cool04
32	32		32	32	32		16	09				+		
33	33		33	33	33	RPTP2	21	09	17	26			ELMB/bus09/elmb17/AI/PT_4W_26_27	tot_Rp_45_220_nr_tp_Temp01
34	34		34	34	34		23			27		+		
35	35		35	35	35		22			26				
36	36		36	36	36		24			27		+		
37	37		37	37	37	DSS	DSS	—	—	—	—	—	—	—
38	38		38	38	38									
39	39		39	39	39									
40	40		40	40	40									
41	41		41	41	41	RPTC4	17	09	18	56			ELMB/bus09/elmb18/AI/PT_2W_56	tot_Rp_45_220_nr_tp_Cool01
42	42		42	42	42		18	09				+		
43	43		43	43	43		19	09	18	57			ELMB/bus09/elmb18/AI/PT_2W_57	tot_Rp_45_220_nr_tp_Cool02
44	44		44	44	44		20	09				+		
45	45		45	45	45		21	09	18	58			ELMB/bus09/elmb18/AI/PT_2W_58	tot_Rp_45_220_nr_tp_Cool03
46	46		46	46	46		22	09				+		
47	47		47	47	47		23	09	18	59			ELMB/bus09/elmb18/AI/PT_2W_59	tot_Rp_45_220_nr_tp_Cool04
48	48		48	48	48		24	09				+		

Pinout formalization in Excel Tables

48 PINS CONNECTOR IN LONG CABLE	LONG CABLE	WIRE NUMBER	48 PINS CONNECTOR IN LONG CABLE
01		01	01
02		02	02
03		03	03
04		04	04
05		05	05
06		06	06
07		07	07
08		08	08
09		09	09
10		10	10
11		11	11
12		12	12
13		13	13
14		14	14
15		15	15
16		16	16

plane	B52	P8PT1B	03	03	TR.1_SP23 NE48 04. 21. 52. 150 2	?	03	03	?	35	35		35	35	35
	B53	P8PT1A	04	04		?	04	04	?	36	36		36	36	36
temperature plane	B54	P3PT2B	05	05		?	05	05	?	37	37		37	37	37
	B55	P3PT2A	06	06		?	06	06	?	38	38		38	38	38
	B56	P3PT1B	07	07		?	07	07	?	39	39		39	39	39
	B57	P3PT1A	08	08		?	08	08	?	40	40		40	40	40
temperature cooling	B58	SP1PT1A	09	09		?	09	09	?	41	41		41	41	41
	B59	SP1PT1B	10	10		?	10	10	?	42	42		42	42	42
temperature cooling	B60	SP1PT2A	11	11		?	11	11	?	43	43		43	43	43
	B61	SP1PT2B	12	12		?	12	12	?	44	44		44	44	44
temperature cooling	B62	SP2PT1A	13	13		?	13	13	?	45	45		45	45	45
	B63	SP2PT1B	14	14		?	14	14	?	46	46		46	46	46
temperature cooling	B64	SP2PT2A	15	15		?	15	15	?	47	47		47	47	47
	B65	SP2PT2B	16	16		?	16	16	?	48	48		48	48	48

FLAT CABLE ID	FLAT CABLE POS	ELMB BUS	ELMB ID (dec)	ELMB CHANNEL	ELMB CONNECTOR PIN	ELMB CHANNEL POLARITY	DCS hardware name	DCS logical name
	04			17	C10	+		
DSS	DSS	–	–	–	–	–	–	–
RPTC3	01	09	18	32	C1		ELMB/bus09/elmb18/AI/PT_2W_32	tot_Rp_45_220_fr_bt_Cool01
	02	09			C9	+		
	03	09	18	33	C2		ELMB/bus09/elmb18/AI/PT_2W_33	tot_Rp_45_220_fr_bt_Cool02
	04	09			C10	+		
	05	09	18	34	C3		ELMB/bus09/elmb18/AI/PT_2W_34	tot_Rp_45_220_fr_bt_Cool03
	06	09			C11	+		
	07	09	18	35	C4		ELMB/bus09/elmb18/AI/PT_2W_35	tot_Rp_45_220_fr_bt_Cool04
	08	09			C12	+		
RPTP2	05	09	17	18	C3		ELMB/bus09/elmb17/AI/PT_4W_18_19	tot_ R p_45_220_fr_hr_Temp01
	07			19	C4	+		
	06			18	C11			
	08			19	C12	+		
DSS	DSS	–	–	–	–	–	–	–
RPTC3	09	09	18	36	C5		ELMB/bus09/elmb18/AI/PT_2W_36	tot_ Rp_45_220_fr_hr_Cool01
	10	09			C13	+		
	11	09	18	37	C6		ELMB/bus09/elmb18/AI/PT_2W_37	tot_Rp_45_220_fr_hr_Cool02
	12	09			C14	+		
	13	09	18	38	C7		ELMB/bus09/elmb18/AI/PT_2W_38	tot_Rp_45_220_fr_hr_Cool03
	14	09			C15	+		
	15	09	18	39	C8		ELMB/bus09/elmb18/AI/PT_2W_39	tot_Rp_45_220_fr_hr_Cool04
	16	09			C16	+		
RPTP2	09	09	17	20	C5		ELMB/bus09/elmb17/AI/PT_4W_20_21	tot_Rp_45_220_ fr_tp_Temp01
	11			21	C6	+		
	10			20	C13			
	12			21	C14	+		
DSS	DSS	–	–	–	–	–	–	–
RPTC3	17	09	18	40	C17		ELMB/bus09/elmb18/AI/PT_2W_40	tot_Rp_45_220_fr_ tp_Cool01
	18	09			C25	+		
	19	09	18	41	C18		ELMB/bus09/elmb18/AI/PT_2W_41	tot_Rp_45_220_fr_tp_Cool02
	20	09			C26	+		
	21	09	18	42	C19		ELMB/bus09/elmb18/AI/PT_2W_42	tot_Rp_45_220_fr_tp_Cool03
	22	09			C27	+		
	23	09	18	43	C20		ELMB/bus09/elmb18/AI/PT_2W_43	tot_Rp_45_220_fr_ tp_Cool04
	24	09			C28	+		
RPTP2	13	09	17	22			ELMB/bus09/elmb17/AI/PT_4W_22_23	tot_Rp_45_220_nr_bt_Temp01
	15			23		+		
	14			22				
	16			23		+		
DSS	DSS	–	–	–	–	–	–	–
RPTC4	01	09	18	48			ELMB/bus09/elmb18/AI/PT_2W_48	tot_Rp_45_220_nr_bt_Cool01
	02	09				+		
	03	09	18	49			ELMB/bus09/elmb18/AI/PT_2W_49	tot_Rp_45_220_nr_bt_Cool02
	04	09				+		
	05	09	18	50			ELMB/bus09/elmb18/AI/PT_2W_50	tot_Rp_45_220_nr_bt_Cool03
	06	09				+		
	07	09	18	51			ELMB/bus09/elmb18/AI/PT_2W_51	tot_Rp_45_220_nr_bt_Cool04
	08	09				+		
RPTP2	17	09	17	24			ELMB/bus09/elmb17/AI/PT_4W_24_25	tot_Rp_45_220_nr_hr_Temp01
	19			25		+		
	18			24				
	20			25		+		
DSS	DSS	–	–	–	–	–	–	–
RPTC4	09	09	18	52			ELMB/bus09/elmb18/AI/PT_2W_52	tot_Rp_45_220_nr_hr_Cool01
	10	09				+		
	11	09	18	53			ELMB/bus09/elmb18/AI/PT_2W_53	tot_Rp_45_220_nr_hr_Cool02
	12	09				+		
	13	09	18	54			ELMB/bus09/elmb18/AI/PT_2W_54	tot_Rp_45_220_nr_hr_Cool03
	14	09				+		
	15	09	18	55			ELMB/bus09/elmb18/AI/PT_2W_55	tot_Rp_45_220_nr_hr_Cool04
	16	09				+		
RPTP2	21	09	17	26			ELMB/bus09/elmb17/AI/PT_4W_26_27	tot_Rp_45_220_nr_tp_Temp01
	23			27		+		
	22			26				
	24			27		+		
DSS	DSS	–	–	–	–	–	–	–
RPTC4	17	09	18	56			ELMB/bus09/elmb18/AI/PT_2W_56	tot_Rp_45_220_nr_tp_Cool01
	18	09				+		
	19	09	18	57			ELMB/bus09/elmb18/AI/PT_2W_57	tot_Rp_45_220_nr_tp_Cool02
	20	09				+		
	21	09	18	58			ELMB/bus09/elmb18/AI/PT_2W_58	tot_Rp_45_220_nr_tp_Cool03
	22	09				+		
	23	09	18	59			ELMB/bus09/elmb18/AI/PT_2W_59	tot_Rp_45_220_nr_tp_Cool04
	24	09				+		

Pinout formalization in Excel Tables

CC	ELMB BUS	E LMBID (dec)	ELMB CHANNEL	ELMB CONNECTOR PIN	ELMB CHANNEL POLARITY
	09	17	00	C1	
			01	C2	+
			00	C9	
			01	C10	+
	—	—	—	—	—
	09	18	00	C1	
	09			C9	+
	09	18	01	C2	
	09			C10	+
	09	18	02	C3	
	09			C11	+
	09	18	03	C4	
	09			C12	+

ELMB NECTOR PIN	ELMB CHANNEL POLARITY	DCS hardware name	DCS logical name
C10	+		
—	—	—	—
C1		ELMB/bus09/elmb18/AI/PT_2W_32	tot_Rp_45_220_fr_bt_Cool01
C9	+		
C2		ELMB/bus09/elmb18/AI/PT_2W_33	tot_Rp_45_220_fr_bt_Cool02
C10	+		
C3		ELMB/bus09/elmb18/AI/PT_2W_34	tot_Rp_45_220_fr_bt_Cool03
C11	+		
C4		ELMB/bus09/elmb18/AI/PT_2W_35	tot_Rp_45_220_fr_bt_Cool04
C12	+		
C3			
C4	+	ELMB/bus09/elmb17/AI/PT_4W_18_19	tot_ R p_45_220_fr_hr_Temp01
C11			
C12	+		
—	—	—	—
C5		ELMB/bus09/elmb18/AI/PT_2W_36	tot_ Rp_45_220_fr_hr_Cool01
C13	+		
C6		ELMB/bus09/elmb18/AI/PT_2W_37	tot_Rp_45_220_fr_hr_Cool02
C14	+		
C7		ELMB/bus09/elmb18/AI/PT_2W_38	tot_Rp_45_220_fr_hr_Cool03
C15	+		
C8		ELMB/bus09/elmb18/AI/PT_2W_39	tot_Rp_45_220_fr_hr_Cool04
C16	+		
C5			
C6	+	ELMB/bus09/elmb17/AI/PT_4W_20_21	tot_Rp_45_220_ fr_tp_Temp01
C13			
C14	+		
—	—	—	—
C17		ELMB/bus09/elmb18/AI/PT_2W_40	tot_Rp_45_220_fr_ tp_Cool01
C25	+		
C18		ELMB/bus09/elmb18/AI/PT_2W_41	tot_Rp_45_220_fr_tp_Cool02
C26	+		
C19		ELMB/bus09/elmb18/AI/PT_2W_42	tot_Rp_45_220_fr_tp_Cool03
C27	+		
C20		ELMB/bus09/elmb18/AI/PT_2W_43	tot_Rp_45_220_fr_ tp_Cool04
C28	+		
	+	ELMB/bus09/elmb17/AI/PT_4W_22_23	tot_Rp_45_220_nr_bt_Temp01
	+		
—	—	—	—
		ELMB/bus09/elmb18/AI/PT_2W_48	tot_Rp_45_220_nr_bt_Cool01
	+		
		ELMB/bus09/elmb18/AI/PT_2W_49	tot_Rp_45_220_nr_bt_Cool02
	+		
		ELMB/bus09/elmb18/AI/PT_2W_50	tot_Rp_45_220_nr_bt_Cool03
	+		
		ELMB/bus09/elmb18/AI/PT_2W_51	tot_Rp_45_220_nr_bt_Cool04
	+		
	+	ELMB/bus09/elmb17/AI/PT_4W_24_25	tot_Rp_45_220_nr_hr_Temp01
	+		
—	—	—	—
		ELMB/bus09/elmb18/AI/PT_2W_52	tot_Rp_45_220_nr_hr_Cool01
	+		
		ELMB/bus09/elmb18/AI/PT_2W_53	tot_Rp_45_220_nr_hr_Cool02
	+		
		ELMB/bus09/elmb18/AI/PT_2W_54	tot_Rp_45_220_nr_hr_Cool03
	+		
		ELMB/bus09/elmb18/AI/PT_2W_55	tot_Rp_45_220_nr_hr_Cool04
	+		
	+	ELMB/bus09/elmb17/AI/PT_4W_26_27	tot_Rp_45_220_nr_tp_Temp01
	+		
—	—	—	—
		ELMB/bus09/elmb18/AI/PT_2W_56	tot_Rp_45_220_nr_tp_Cool01
	+		
		ELMB/bus09/elmb18/AI/PT_2W_57	tot_Rp_45_220_nr_tp_Cool02
	+		
		ELMB/bus09/elmb18/AI/PT_2W_58	tot_Rp_45_220_nr_tp_Cool03
	+		
		ELMB/bus09/elmb18/AI/PT_2W_59	tot_Rp_45_220_nr_tp_Cool04

Pinout formalization in Excel Tables

DCS hardware name	DCS logical name
ELMB/bus09/elmb17/AI/PT_4W_00_01	tot_Rp_45_147_fr_bt_Temp01
—	—
ELMB/bus09/elmb18/AI/PT_2W_00	tot_Rp_ 45_147_fr_bt_Cool01
ELMB/bus09/elmb18/AI/PT_2W_01	tot_Rp_ 45_147_fr_bt_Cool02
ELMB/bus09/elmb18/AI/PT_2W_02	tot_Rp_ 45_147_fr_bt_Cool03
ELMB/bus09/elmb18/AI/PT_2W_03	tot_Rp_ 45_147_fr_bt_Cool04

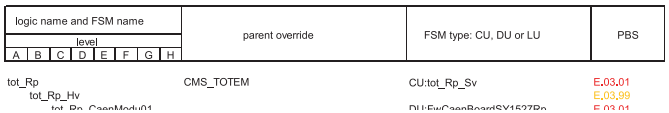
Pinout formalization in Excel Tables

DCS hardware name	DCS logical name
ELMB/bus09/elmb17/AI/PT_4W_00_01	tot_Rp_45_147_fr_bt_Temp01
_Automated _	
ELMB/bus09/elmb18/AI/PT_2W_00	tot_Rp_ 45_147_fr_bt_Cool01
ELMB/bus09/elmb18/AI/PT_2W_01	tot_Rp_ 45_147_fr_bt_Cool02
ELMB/bus09/elmb18/AI/PT_2W_02	tot_Rp_ 45_147_fr_bt_Cool03
ELMB/bus09/elmb18/AI/PT_2W_03	tot_Rp_ 45_147_fr_bt_Cool04

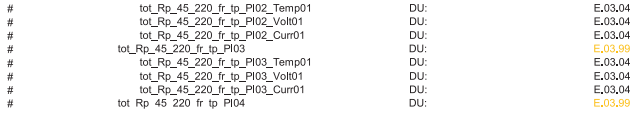
FSM hierarchy tables

logic name and FSM name (level A B C D E F G H)	parent override	FSM type: CU, DU or LU	PBS
tot_Rp	CMS_TOTEM	CU:tot_Rp_Sv	E.03.01
tot_Rp_Hv			E.03.99
tot_Rp_CaenModu01		DU:FwCaenBoardSY1527Rp	E.03.01
tot_Rp_Lv			E.03.99
tot_Rp_WienMara01		DU:FwWienerMarathonRp	E.03.02
tot_Rp_WienMara02		DU:FwWienerMarathonRp	E.03.02
tot_Rp_WienMara03		DU:FwWienerMarathonRp	E.03.02
tot_Rp_WienMara04		DU:FwWienerMarathonRp	E.03.02
# tot_Rp_Vme01			E.03.03
# tot_Rp_Vme01_Temp			E.03.03
# tot_Rp_Vme01_Fan01			E.03.03
# tot_Rp_Vme02			E.03.03
# tot_Rp_Vme02_Temp			E.03.03
# tot_Rp_Vme02_Fan01			E.03.03
tot_Rp_Cooling		CU:tot_RpCaV	E.03.99
tot_Rp_CoolPlant		DU:FwCaVPlantDU	E.03.06
tot_Rp_CoolPlantLoop01		DU:FwCaVLoopDU	E.03.06
tot_Rp_CoolPlantLoop02		DU:FwCaVLoopDU	E.03.06
tot_Rp_CoolPlantLoop03		DU:FwCaVLoopDU	E.03.06
tot_Rp_CoolPlantLoop04		DU:FwCaVLoopDU	E.03.06
tot_Rp_CoolPlantLooploop01		DU:FwCaVLoopDU	E.03.06
tot_Rp_CoolPlantLooploop02		DU:FwCaVLoopDU	E.03.06
tot_Rp_CoolPlantLooploop03		DU:FwCaVLoopDU	E.03.06
tot_Rp_CoolPlantLooploop04		DU:FwCaVLoopDU	E.03.06
tot_Rp_Environment		CU:tot_GeEnvironment	E.03.99
tot_Rp_CanBus		CU:tot_GeCan	E.03.99
tot_Rp_CanBus08		CU:tot_GeCanBus	E.03.05.01
tot_Rp_CanBus09		CU:tot_GeCanBus	E.03.05.01
tot_Rp_Elmb		CU:tot_GeElmb	E.03.99
tot_Rp_Elmb17		CU:tot_GeElmbNode	E.03.05.02
tot_Rp_Elmb18		CU:tot_GeElmbNode	E.03.05.02
tot_Rp_Elmb19		CU:tot_GeElmbNode	E.03.05.02
tot_Rp_Elmb20		CU:tot_GeElmbNode	E.03.05.02
tot_Rp_Elmb21		CU:tot_GeElmbNode	E.03.05.02
tot_Rp_Elmb22		CU:tot_GeElmbNode	E.03.05.02
tot_Rp_Elmb23		CU:tot_GeElmbNode	E.03.05.02
tot_Rp_Elmb24		CU:tot_GeElmbNode	E.03.05.02
tot_Rp_45		CU:tot_RpSide	E.03.99
tot_Rp_45_220		CU:tot_RpStation	E.03.99
tot_Rp_45_220_fr		CU:tot_RpUnit	E.03.99
tot_Rp_45_220_fr_tp		CU:tot_RpPot	E.03.99
tot_Rp_45_220_fr_tp_DssTemp		DU:tot_FwAiRpDss	E.03.09
# tot_Rp_45_220_fr_tp_Lvdt		DU:	E.03.08
# tot_Rp_45_220_fr_tp_Reso		DU:	E.03.08
# tot_Rp_45_220_fr_tp_MicrIn		DU:	E.03.08
# tot_Rp_45_220_fr_tp_MicrOut		DU:	E.03.08
tot_Rp_45_220_fr_tp_Hv		DU:FwCaenChannelRpHv	E.03.01
tot_Rp_45_220_fr_tp_LvG		DU:FwWienerMarathonGroupRp	E.03.02
tot_Rp_45_220_fr_tp_LvA		DU:FwWienerMarathonChannelRp	E.03.02
tot_Rp_45_220_fr_tp_LvD		DU:FwWienerMarathonChannelRp	E.03.02
# tot_Rp_45_220_fr_tp_Temp01		DU:	E.03.05.03
# tot_Rp_45_220_fr_tp_Cool01		DU:	E.03.05.03
# tot_Rp_45_220_fr_tp_Cool02		DU:	E.03.05.03
# tot_Rp_45_220_fr_tp_Cool03		DU:	E.03.05.03
# tot_Rp_45_220_fr_tp_Cool04		DU:	E.03.05.03
# tot_Rp_45_220_fr_tp_Vacc01		DU:	E.03.05.05
# tot_Rp_45_220_fr_tp_RadLaas		DU:	E.03.05.04
# tot_Rp_45_220_fr_tp_RadCmrp		DU:	E.03.05.04
# tot_Rp_45_220_fr_tp_RadRem		DU:	E.03.05.04
# tot_Rp_45_220_fr_tp_RadBpw		DU:	E.03.05.04
# tot_Rp_45_220_fr_tp_RadTemp		DU:	E.03.05.04
# tot_Rp_45_220_fr_tp_RadRl		DU:	E.03.05.04
# tot_Rp_45_220_fr_tp_Pl01		DU:	E.03.99
# tot_Rp_45_220_fr_tp_Pl01_Temp01		DU:	E.03.04
# tot_Rp_45_220_fr_tp_Pl01_Volt01		DU:	E.03.04
# tot_Rp_45_220_fr_tp_Pl01_Curr01		DU:	E.03.04
# tot_Rp_45_220_fr_tp_Pl02		DU:	E.03.99
# tot_Rp_45_220_fr_tp_Pl02_Temp01		DU:	E.03.04
# tot_Rp_45_220_fr_tp_Pl02_Volt01		DU:	E.03.04
# tot_Rp_45_220_fr_tp_Pl02_Curr01		DU:	E.03.04
# tot_Rp_45_220_fr_tp_Pl03		DU:	E.03.99
# tot_Rp_45_220_fr_tp_Pl03_Temp01		DU:	E.03.04
# tot_Rp_45_220_fr_tp_Pl03_Volt01		DU:	E.03.04
# tot_Rp_45_220_fr_tp_Pl03_Curr01		DU:	E.03.04
# tot_Rp_45_220_fr_tp_Pl04		DU:	E.03.99

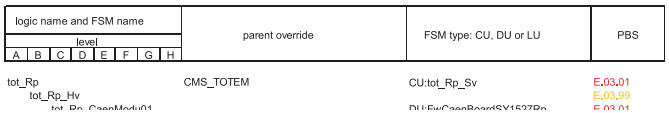
FSM hierarchy tables



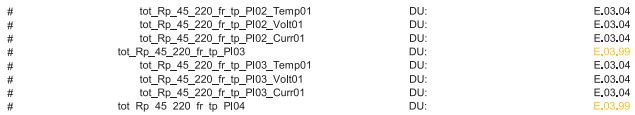
logic name and FSM name								parent override	FSM type: CU, DU or LU	PBS
level										
A	B	C	D	E	F	G	H			
tot_Rp								CMS_TOTEM	CU:TotRpSv	E.03.01
	tot_Rp_45								CU:TotRpSide	E.03.99
		tot_Rp_45_220							CU:TotRpStation	E.03.99
			tot_Rp_45_220_fr						CU:TotRpUnit	E.03.99
				tot_Rp_45_220_fr_tp					CU:TotRpPot	E.03.99
					tot_Rp_45_220_fr_tp_DssTemp				DU:FwAiDssTemperature	E.03.09
#					tot_Rp_45_220_fr_tp_Lvdt				DU:TotRpMotorPos	E.03.08
#					tot_Rp_45_220_fr_tp_Reso				DU:TotRpMotorPos	E.03.08
#					tot_Rp_45_220_fr_tp_MicrIn				DU:TotRpMotorPos	E.03.08
#					tot_Rp_45_220_fr_tp_MicrOut				DU:TotRpMotorPos	E.03.08
					tot_Rp_45_220_fr_tp_Hv				DU:FwCaenChannelRp	E.03.01
					tot_Rp_45_220_fr_tp_LvG				DU:FwWienerMarathonGroupTot	E.03.02
					tot_Rp_45_220_fr_tp_LvA				DU:FwWienerMarathonChannelTot	E.03.02
					tot_Rp_45_220_fr_tp_LvD				DU:FwWienerMarathonChannelTot	E.03.02
#					tot_Rp_45_220_fr_tp_Temp01				DU:FwElmbAiTotTemperature	E.03.05.03
#					tot_Rp_45_220_fr_tp_CoolLeftIn				DU:FwElmbAiTotTemperature	E.03.05.03
#					tot_Rp_45_220_fr_tp_CoolLeftOut				DU:FwElmbAiTotTemperature	E.03.05.03
#					tot_Rp_45_220_fr_tp_CoolRightIn				DU:FwElmbAiTotTemperature	E.03.05.03
#					tot_Rp_45_220_fr_tp_CoolRightOut				DU:FwElmbAiTotTemperature	E.03.05.03
#					tot_Rp_45_220_fr_tp_Vacu01				DU:FwElmbAiTotVacuum	E.03.05.05



FSM hierarchy tables



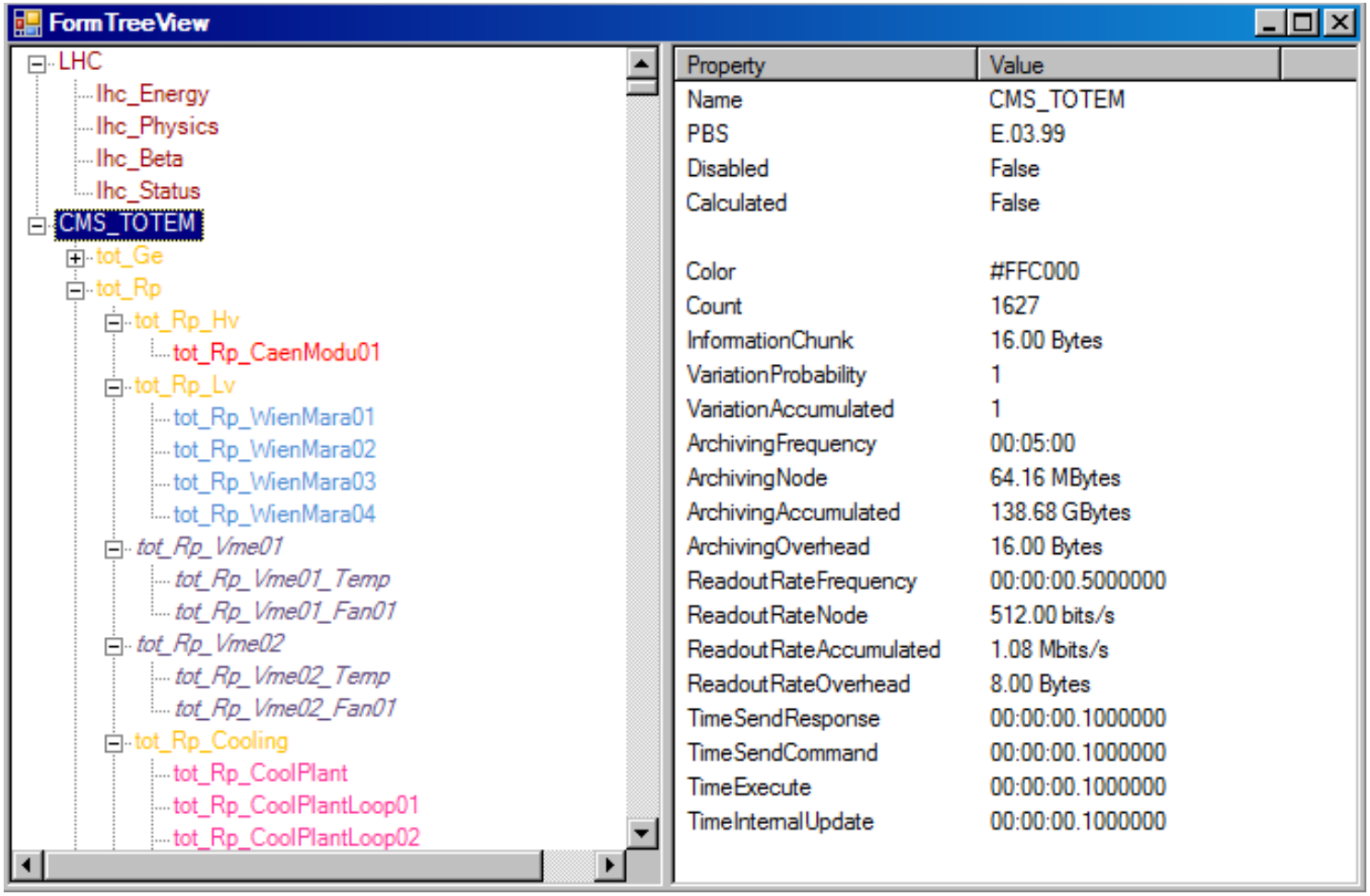
logic name and FSM name								parent override	FSM type: CU, DU or LU	PBS
level										
A	B	C	D	E	F	G	H			
tot_Rp								CMS_TOTEM	CU:TotRpSv	E.03.01
	tot_Rp_45								CU:TotRpSide	E.03.99
		tot_Rp_45_220							CU:TotRpStation	E.03.99
			tot_Rp_45_220_fr						CU:TotRpUnit	E.03.99
				tot_Rp_45_220_fr_tp					CU:TotRpPot	E.03.99
					tot_Rp_45_220_fr_tp_DssTemp				DU:FwAiDssTemperature	E.03.09
#					tot_Rp_45_220_fr_tp_Lvdt				DU:TotRpMotorPos	E.03.08
#					tot_Rp_45_220_fr_tp_Retro				DU:TotRpMotorPos	E.03.08
#					tot_Rp_45_220_fr_tp_MicIn				DU:TotRpMotorPos	E.03.08
#					tot_Rp_45_220_fr_tp_MicrOut				DU:TotRpMotorPos	E.03.08
					tot_Rp_45_220_fr_tp_Hv				DU:FwCaenChannelRp	E.03.01
					tot_Rp_45_220_fr_tp_LvG				DU:FwWienerMarathonGroupTot	E.03.02
					tot_Rp_45_220_fr_tp_LvA				DU:FwWienerMarathonChannelTot	E.03.02
					tot_Rp_45_220_fr_tp_LvD				DU:FwWienerMarathonChannelTot	E.03.02
#					tot_Rp_45_220_fr_tp_Temp01				DU:FwElmbAiTotTemperature	E.03.05.03
#					tot_Rp_45_220_fr_tp_CoolLeftIn				DU:FwElmbAiTotTemperature	E.03.05.03
#					tot_Rp_45_220_fr_tp_CoolLeftOut				DU:FwElmbAiTotTemperature	E.03.05.03
#					tot_Rp_45_220_fr_tp_CoolRightIn				DU:FwElmbAiTotTemperature	E.03.05.03
#					tot_Rp_45_220_fr_tp_CoolRightOut				DU:FwElmbAiTotTemperature	E.03.05.03
#					tot_Rp_45_220_fr_tp_Vacu01				DU:FwElmbAiTotVacuum	E.03.05.05



Heuristics

```
<PVSSrule>
<key name="FUNCTION" filter="^HV$"/>
<column name="DCS hardware name" parameters="'CAEN/' % CRATE ID % '/board' % CRATE BOARD (dec) % '/channel' % CRATE
BOARD CHANNEL"/>
<column name="DCS logic name" parameters="HIERARCHY BASE NAME % '_' % 'Hv'"/>
<column name="TYPEFSM" parameters="'DU'"/>
<column name="PBS" parameters="'E.03.01'"/>
</PVSSrule>

<PVSSrule>
<key name="FUNCTION" filter="^HV$"/>
<key name="SYSTEM" filter="^tot_Rp$"/>
<column name="TYPEPVSS" parameters="'FwCaenChannelRp'"/>
</PVSSrule>

<PVSSrule>
<key name="FUNCTION" filter="^HV$"/>
<key name="SYSTEM" filter="^tot_T1$"/>
<column name="TYPEPVSS" parameters="'FwCaenChannelT1'"/>
</PVSSrule>


<PVSSrule>

<key name="FUNCTION" filter="^HV$"/>

<key name="SYSTEM" filter="^tot_T2$"/>

<column name="TYPEPVSS" parameters="'FwCaenChannelT2'"/>

</PVSSrule>
```

Preprocessor for the pinout and the FSM

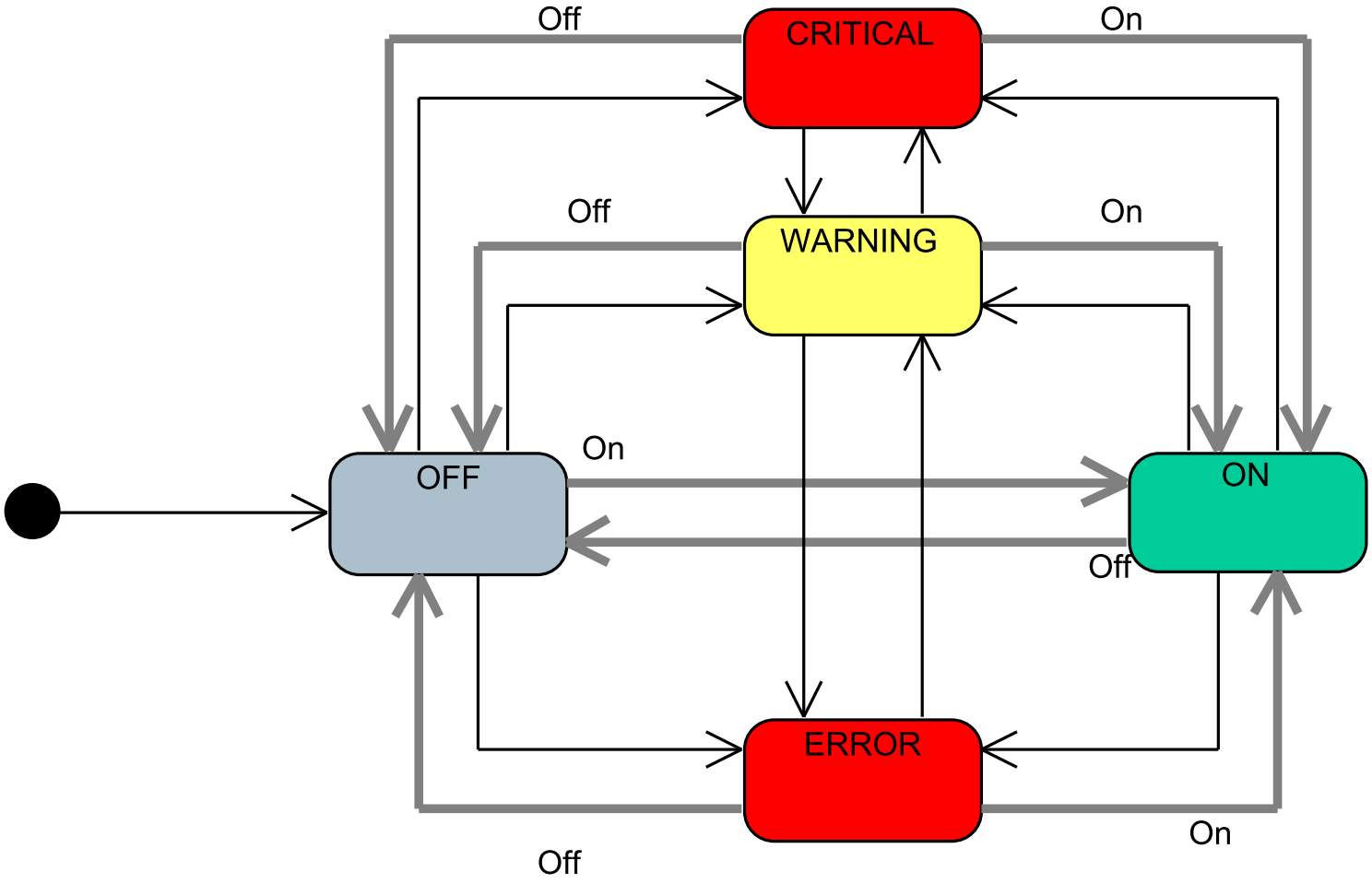


Preprocessor for the pinout and the FSM

It has eight steps and two outputs:

- Parse and clean the MS Excel tables.
- Add additional columns in the tables with a set of heuristics.
- Validate the logic names using a BNF grammar.
- Export into CSV the expanded pinout tables.
- Generate the FSM hierarchy by removing suffixes from the logic name.
- Add extra attributes in the FSM hierarchy such as PBS, FSM type,... with another set of heuristics.
- Export into CSV the FSM hierarchy.
- Execute correspondent algorithms for the information exchange calculations.

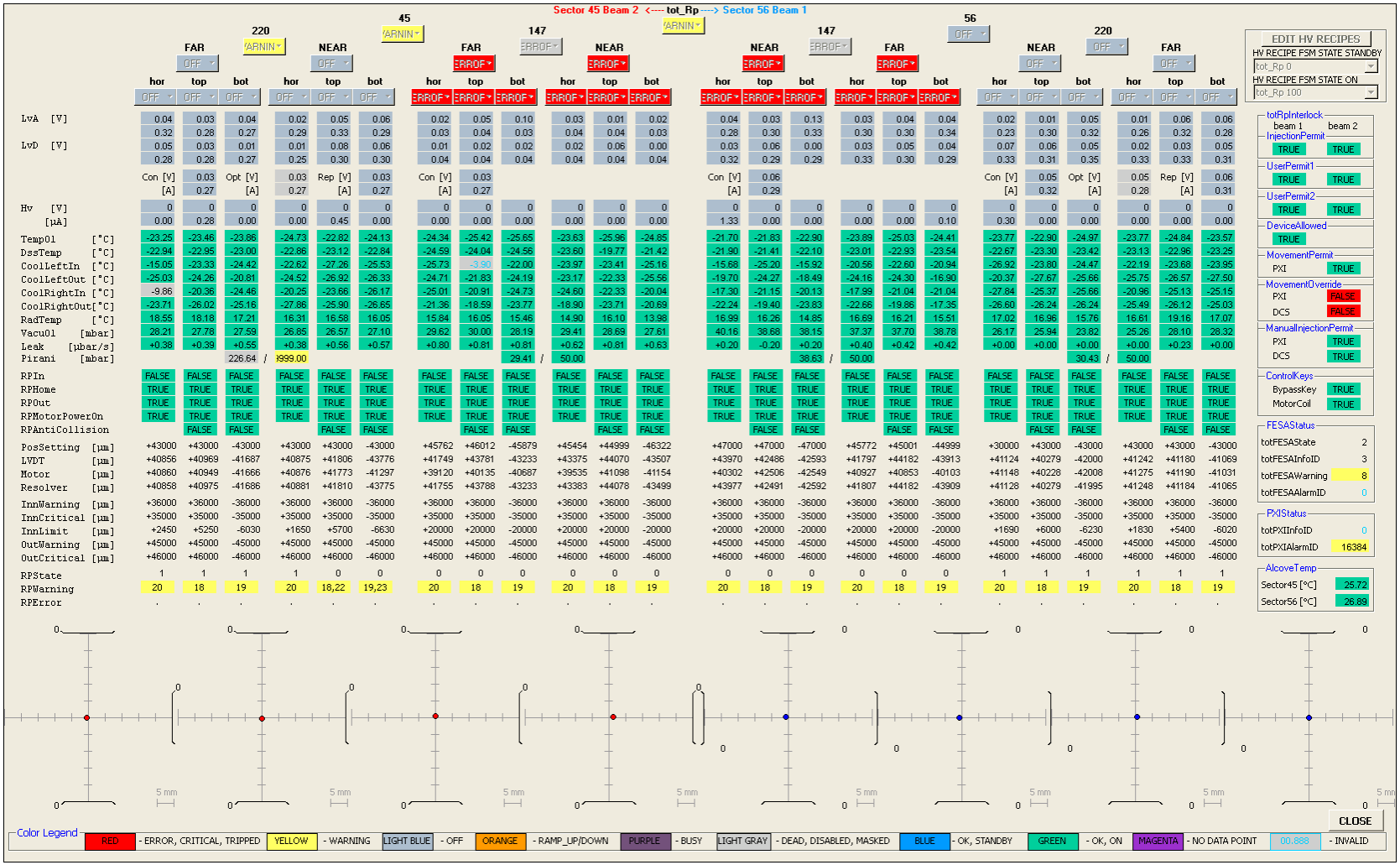
FSM types

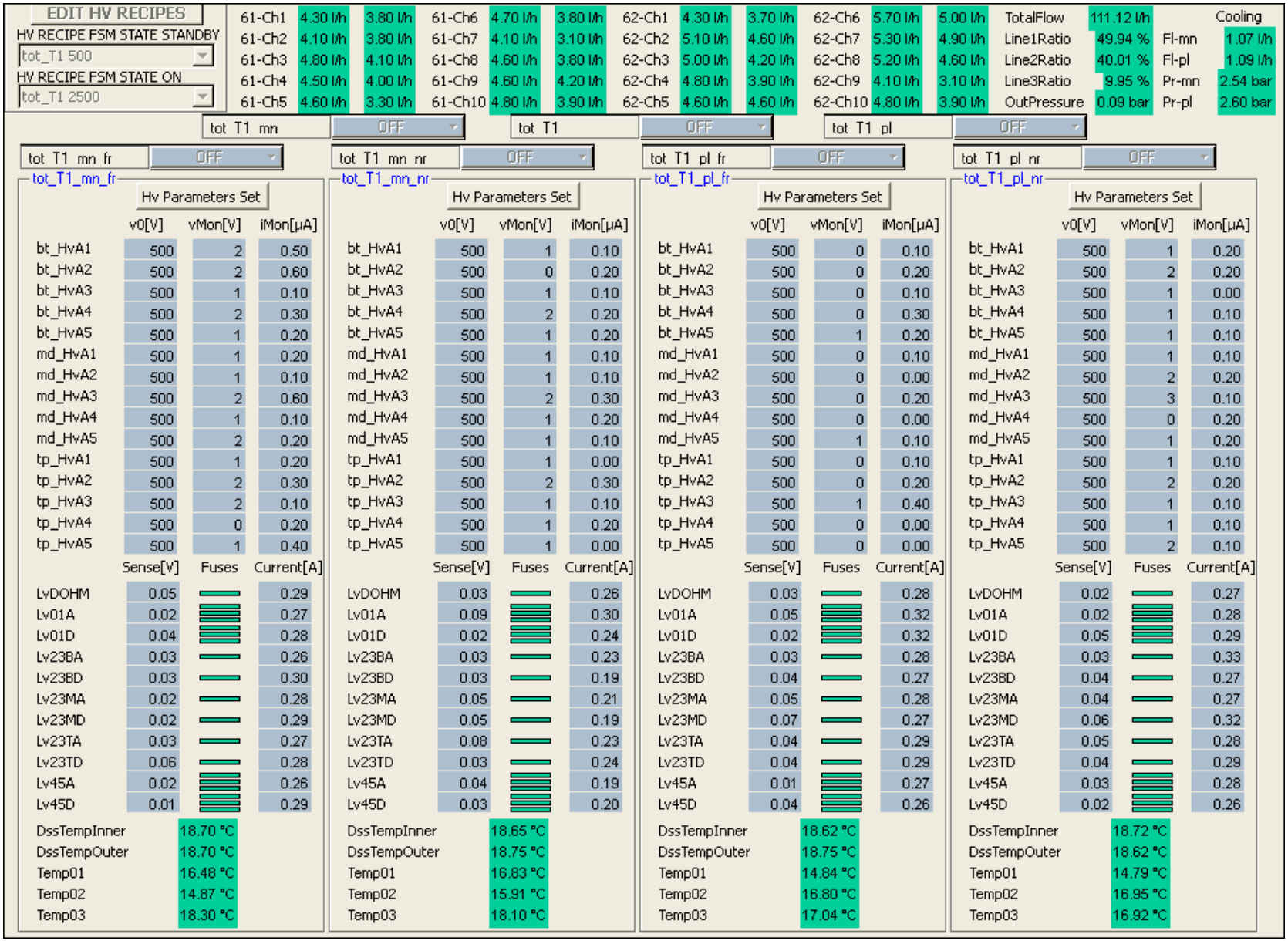


FSM types

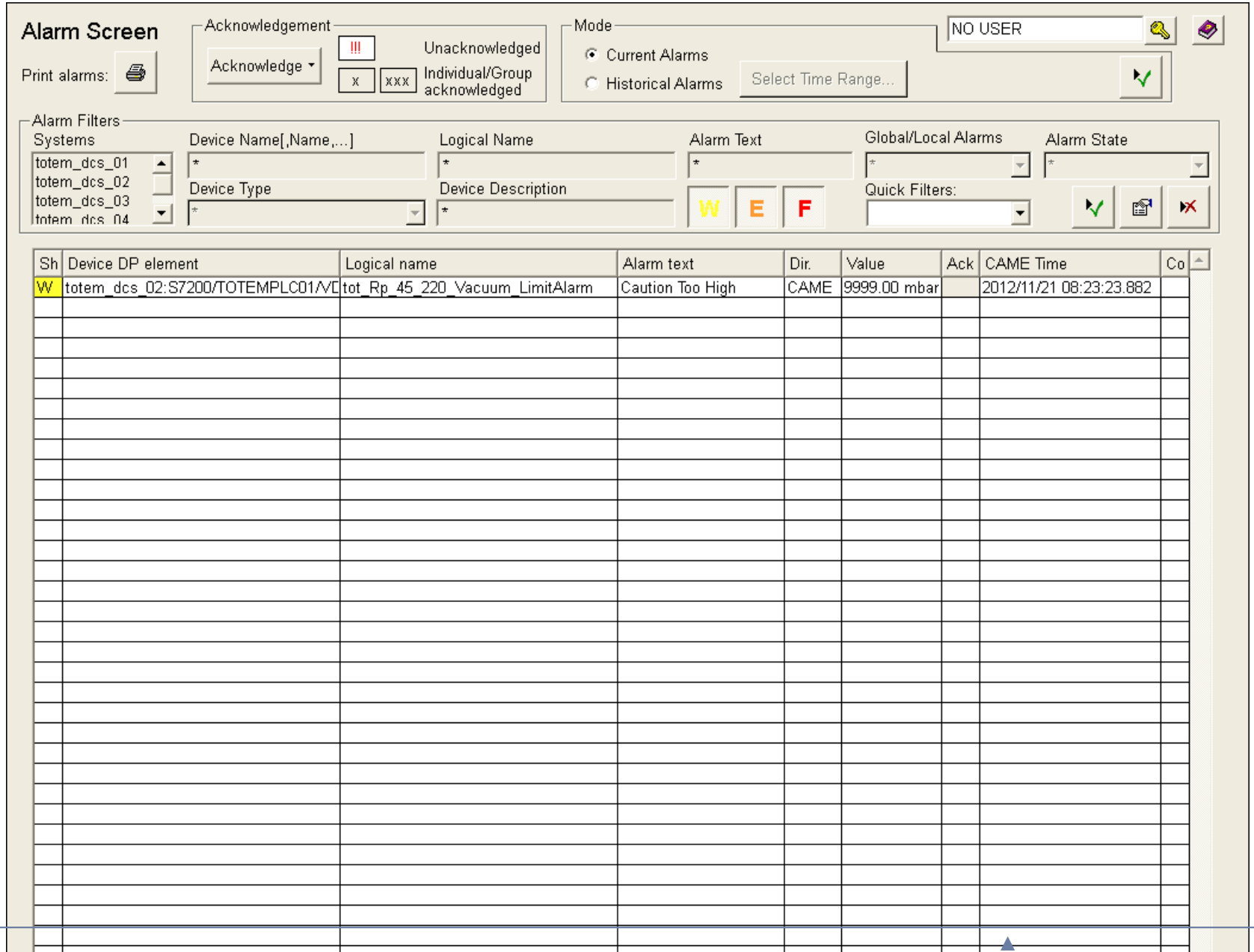
- Those UML diagrams are developed with the tool 'Visual Paradigm for UML'. In a second step they are converted into XMI (based on XML) with the same tool. Later the XMI file is parsed within PVSS, and it generates inside PVSS the FSM types as defined by the JCOP framework.
- The transition arrows are of two types:
  - **Gray, thick and labelled**
    They represent the commands of the FSM type. The label is the 'command' name and the transition is triggered manually by the operator or by FSM internal logic.
  - **Black, thin and unlabelled**
    They represent autonomous transitions in the system. They take place without the DCS intervention as response of changes in the internal status of the hardware.
- A special BUSY (not shown in the UML diagram) state is introduced when converting from UML into PVSS. Its main purpose is that the operator notices that there is a transition in progress or there is not a 'stable' situation.

Roman Pots

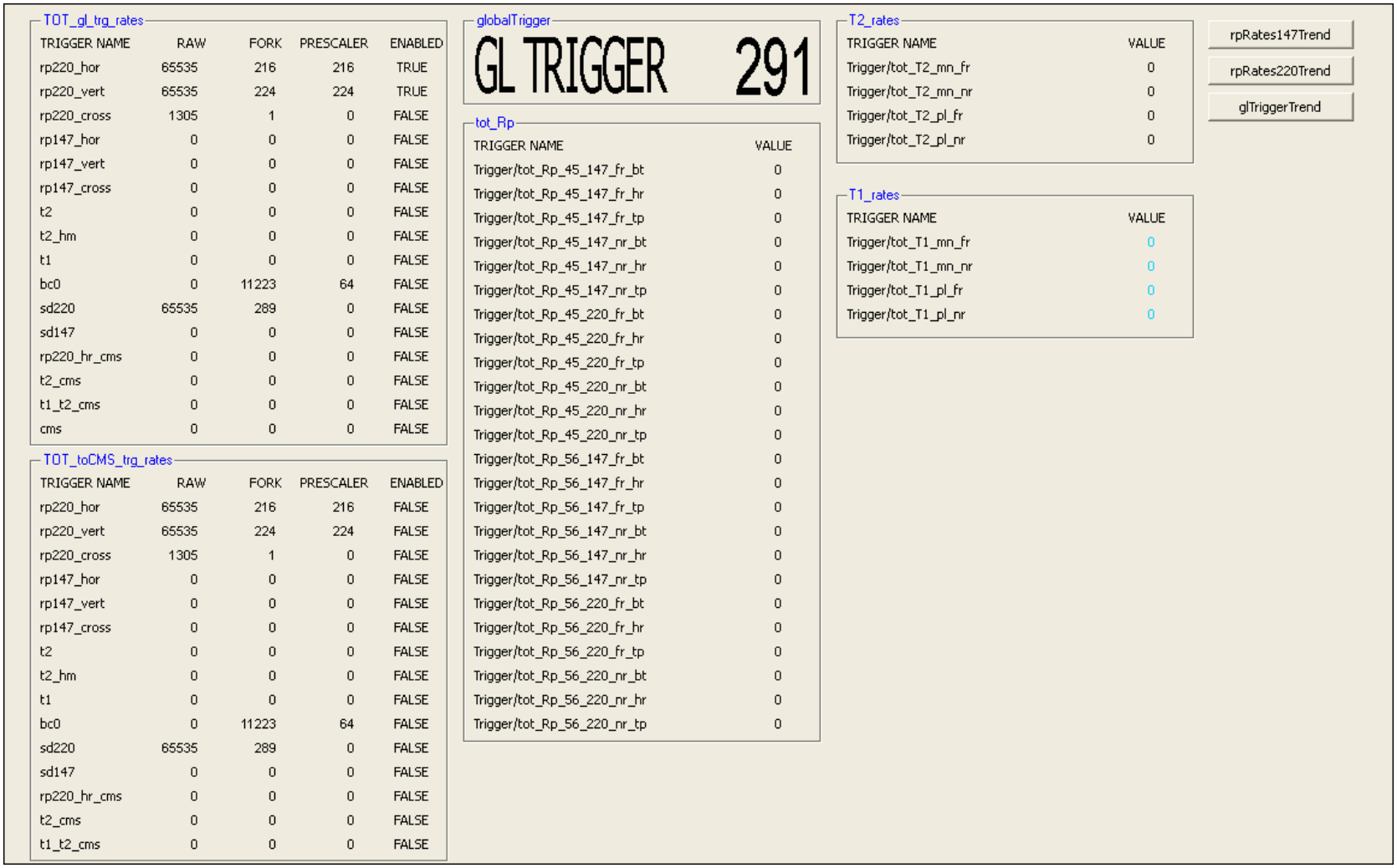

Sector 45 Beam 2 <---- tot_Rp ----> Sector 56 Beam 1
45
220
147
147
220
56
FAR
NEAR
EDIT HV RECIPES
HV RECIPE FSM STATE STANDBY
HV RECIPE FSM STATE ON
totRpInterlock
beam 1
beam 2
InjectionPermit
UserPermit1
UserPermit2
DeviceAllowed
MovementPermit
MovementOverride
ManualInjectionPermit
ControlKeys
BypassKey
MotorCoil
FESAStatus
totFESAState
totFESAInfoID
totFESAWarning
totFESAAlarmID
PXIStatus
totPXIInfoID
totPXIAlarmID
AlcoveTemp
Sector45 [°C]
Sector56 [°C]
5 mm
CLOSE
Color Legend
RED - ERROR, CRITICAL, TRIPPED
YELLOW - WARNING
LIGHT BLUE - OFF
ORANGE - RAMP_UP/DOWN
PURPLE - BUSY
LIGHT GRAY - DEAD, DISABLED, MASKED
BLUE - OK, STANDBY
GREEN - OK, ON
MAGENTA - NO DATA POINT
00.888 - INVALID


EDIT HV RECIPES
HV RECIPE FSM STATE STANDBY
tot_T1 500
HV RECIPE FSM STATE ON
tot_T1 2500
61-Ch1 4.30 l/h 3.80 l/h
61-Ch2 4.10 l/h 3.80 l/h
61-Ch3 4.80 l/h 4.10 l/h
61-Ch4 4.50 l/h 4.00 l/h
61-Ch5 4.60 l/h 3.30 l/h
61-Ch6 4.70 l/h 3.80 l/h
61-Ch7 4.10 l/h 3.10 l/h
61-Ch8 4.60 l/h 3.80 l/h
61-Ch9 4.60 l/h 4.20 l/h
61-Ch10 4.80 l/h 3.90 l/h
62-Ch1 4.30 l/h 3.70 l/h
62-Ch2 5.10 l/h 4.60 l/h
62-Ch3 5.00 l/h 4.20 l/h
62-Ch4 4.80 l/h 3.90 l/h
62-Ch5 4.60 l/h 4.60 l/h
62-Ch6 5.70 l/h 5.00 l/h
62-Ch7 5.30 l/h 4.90 l/h
62-Ch8 5.20 l/h 4.60 l/h
62-Ch9 4.10 l/h 3.10 l/h
62-Ch10 4.80 l/h 3.90 l/h
TotalFlow 111.12 l/h
Line1Ratio 49.94 %
Line2Ratio 40.01 %
Line3Ratio 9.95 %
OutPressure 0.09 bar
Cooling
Fl-mn 1.07 l/h
Fl-pl 1.09 l/h
Pr-mn 2.54 bar
Pr-pl 2.60 bar
tot T1 mn OFF
tot T1 OFF
tot T1 pl OFF
tot T1 mn fr OFF
tot T1 mn nr OFF
tot T1 pl fr OFF
tot T1 pl nr OFF
tot_T1_mn_fr
tot_T1_mn_nr
tot_T1_pl_fr
tot_T1_pl_nr
Hv Parameters Set
v0[V] vMon[V] iMon[µA]
bt_HvA1 500 2 0.50
bt_HvA2 500 2 0.60
bt_HvA3 500 1 0.10
bt_HvA4 500 2 0.30
bt_HvA5 500 1 0.20
md_HvA1 500 1 0.20
md_HvA2 500 1 0.10
md_HvA3 500 2 0.60
md_HvA4 500 1 0.10
md_HvA5 500 2 0.20
tp_HvA1 500 1 0.20
tp_HvA2 500 2 0.30
tp_HvA3 500 2 0.10
tp_HvA4 500 0 0.20
tp_HvA5 500 1 0.40
Sense[V] Fuses Current[A]
LvDOHM 0.05 0.29
Lv01A 0.02 0.27
Lv01D 0.04 0.28
Lv23BA 0.03 0.26
Lv23BD 0.03 0.30
Lv23MA 0.02 0.28
Lv23MD 0.02 0.29
Lv23TA 0.03 0.27
Lv23TD 0.06 0.28
Lv45A 0.02 0.26
Lv45D 0.01 0.29
DssTempInner 18.70 °C
DssTempOuter 18.70 °C
Temp01 16.48 °C
Temp02 14.87 °C
Temp03 18.30 °C
bt_HvA1 500 1 0.10
bt_HvA2 500 0 0.20
bt_HvA3 500 1 0.10
bt_HvA4 500 2 0.20
bt_HvA5 500 1 0.20
md_HvA1 500 1 0.10
md_HvA2 500 1 0.10
md_HvA3 500 2 0.30
md_HvA4 500 1 0.20
md_HvA5 500 1 0.10
tp_HvA1 500 1 0.00
tp_HvA2 500 2 0.30
tp_HvA3 500 1 0.10
tp_HvA4 500 1 0.20
tp_HvA5 500 1 0.00
Sense[V] Fuses Current[A]
LvDOHM 0.03 0.26
Lv01A 0.09 0.30
Lv01D 0.02 0.24
Lv23BA 0.03 0.23
Lv23BD 0.03 0.19
Lv23MA 0.05 0.21
Lv23MD 0.05 0.19
Lv23TA 0.08 0.23
Lv23TD 0.03 0.24
Lv45A 0.04 0.19
Lv45D 0.03 0.20
DssTempInner 18.65 °C
DssTempOuter 18.75 °C
Temp01 16.83 °C
Temp02 15.91 °C
Temp03 18.10 °C
bt_HvA1 500 0 0.10
bt_HvA2 500 0 0.20
bt_HvA3 500 0 0.10
bt_HvA4 500 0 0.30
bt_HvA5 500 1 0.20
md_HvA1 500 0 0.10
md_HvA2 500 0 0.00
md_HvA3 500 0 0.20
md_HvA4 500 0 0.00
md_HvA5 500 1 0.10
tp_HvA1 500 0 0.10
tp_HvA2 500 0 0.20
tp_HvA3 500 1 0.40
tp_HvA4 500 0 0.00
tp_HvA5 500 0 0.00
Sense[V] Fuses Current[A]
LvDOHM 0.03 0.28
Lv01A 0.05 0.32
Lv01D 0.02 0.32
Lv23BA 0.03 0.28
Lv23BD 0.04 0.27
Lv23MA 0.05 0.28
Lv23MD 0.07 0.27
Lv23TA 0.04 0.29
Lv23TD 0.04 0.29
Lv45A 0.01 0.27
Lv45D 0.04 0.26
DssTempInner 18.62 °C
DssTempOuter 18.75 °C
Temp01 14.84 °C
Temp02 16.80 °C
Temp03 17.04 °C
bt_HvA1 500 1 0.20
bt_HvA2 500 2 0.20
bt_HvA3 500 1 0.00
bt_HvA4 500 1 0.10
bt_HvA5 500 1 0.10
md_HvA1 500 1 0.10
md_HvA2 500 2 0.20
md_HvA3 500 3 0.10
md_HvA4 500 0 0.20
md_HvA5 500 1 0.20
tp_HvA1 500 1 0.10
tp_HvA2 500 2 0.20
tp_HvA3 500 1 0.10
tp_HvA4 500 1 0.10
tp_HvA5 500 2 0.10
Sense[V] Fuses Current[A]
LvDOHM 0.02 0.27
Lv01A 0.02 0.28
Lv01D 0.05 0.29
Lv23BA 0.03 0.33
Lv23BD 0.04 0.27
Lv23MA 0.04 0.27
Lv23MD 0.06 0.32
Lv23TA 0.05 0.28
Lv23TD 0.04 0.29
Lv45A 0.03 0.28
Lv45D 0.02 0.26
DssTempInner 18.72 °C
DssTempOuter 18.62 °C
Temp01 14.79 °C
Temp02 16.95 °C
Temp03 16.92 °C

Alarms


Alarm Screen
Print alarms:
Acknowledgement
Acknowledge
!!!
Unacknowledged
x
xxx
Individual/Group acknowledged
Mode
Current Alarms
Historical Alarms
Select Time Range...
NO USER
Alarm Filters
Systems
totem_dcs_01
totem_dcs_02
totem_dcs_03
totem_dcs_04
Device Name[,Name,...]
Logical Name
Alarm Text
Global/Local Alarms
Alarm State
Device Type
Device Description
W
E
F
Quick Filters:
Sh
Device DP element
Logical name
Alarm text
Dir.
Value
Ack
CAME Time
Co
W
totem_dcs_02:S7200/TOTEMPLC01/VD
tot_Rp_45_220_Vacuum_LimitAlarm
Caution Too High
CAME
9999.00 mbar
2012/11/21 08:23:23.882

Trigger



TOT_gl_trg_rates

TRIGGER NAME	RAW	FORK	PRESCALER	ENABLED
rp220_hor	65535	216	216	TRUE
rp220_vert	65535	224	224	TRUE
rp220_cross	1305	1	0	FALSE
rp147_hor	0	0	0	FALSE
rp147_vert	0	0	0	FALSE
rp147_cross	0	0	0	FALSE
t2	0	0	0	FALSE
t2_hm	0	0	0	FALSE
t1	0	0	0	FALSE
bc0	0	11223	64	FALSE
sd220	65535	289	0	FALSE
sd147	0	0	0	FALSE
rp220_hr_cms	0	0	0	FALSE
t2_cms	0	0	0	FALSE
t1_t2_cms	0	0	0	FALSE
cms	0	0	0	FALSE

TOT_toCMS_trg_rates

TRIGGER NAME	RAW	FORK	PRESCALER	ENABLED
rp220_hor	65535	216	216	FALSE
rp220_vert	65535	224	224	FALSE
rp220_cross	1305	1	0	FALSE
rp147_hor	0	0	0	FALSE
rp147_vert	0	0	0	FALSE
rp147_cross	0	0	0	FALSE
t2	0	0	0	FALSE
t2_hm	0	0	0	FALSE
t1	0	0	0	FALSE
bc0	0	11223	64	FALSE
sd220	65535	289	0	FALSE
sd147	0	0	0	FALSE
rp220_hr_cms	0	0	0	FALSE
t2_cms	0	0	0	FALSE
t1_t2_cms	0	0	0	FALSE

globalTrigger

GL TRIGGER 291

tot_Rp

TRIGGER NAME	VALUE
Trigger/tot_Rp_45_147_fr_bt	0
Trigger/tot_Rp_45_147_fr_hr	0
Trigger/tot_Rp_45_147_fr_tp	0
Trigger/tot_Rp_45_147_nr_bt	0
Trigger/tot_Rp_45_147_nr_hr	0
Trigger/tot_Rp_45_147_nr_tp	0
Trigger/tot_Rp_45_220_fr_bt	0
Trigger/tot_Rp_45_220_fr_hr	0
Trigger/tot_Rp_45_220_fr_tp	0
Trigger/tot_Rp_45_220_nr_bt	0
Trigger/tot_Rp_45_220_nr_hr	0
Trigger/tot_Rp_45_220_nr_tp	0
Trigger/tot_Rp_56_147_fr_bt	0
Trigger/tot_Rp_56_147_fr_hr	0
Trigger/tot_Rp_56_147_fr_tp	0
Trigger/tot_Rp_56_147_nr_bt	0
Trigger/tot_Rp_56_147_nr_hr	0
Trigger/tot_Rp_56_147_nr_tp	0
Trigger/tot_Rp_56_220_fr_bt	0
Trigger/tot_Rp_56_220_fr_hr	0
Trigger/tot_Rp_56_220_fr_tp	0
Trigger/tot_Rp_56_220_nr_bt	0
Trigger/tot_Rp_56_220_nr_hr	0
Trigger/tot_Rp_56_220_nr_tp	0

T2_rates

TRIGGER NAME	VALUE
Trigger/tot_T2_mn_fr	0
Trigger/tot_T2_mn_nr	0
Trigger/tot_T2_pl_fr	0
Trigger/tot_T2_pl_nr	0

T1_rates

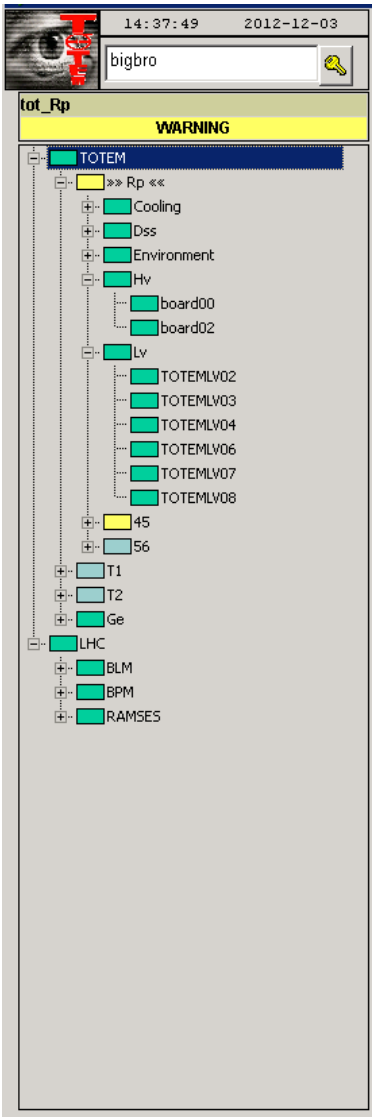
TRIGGER NAME	VALUE
Trigger/tot_T1_mn_fr	0
Trigger/tot_T1_mn_nr	0
Trigger/tot_T1_pl_fr	0
Trigger/tot_T1_pl_nr	0

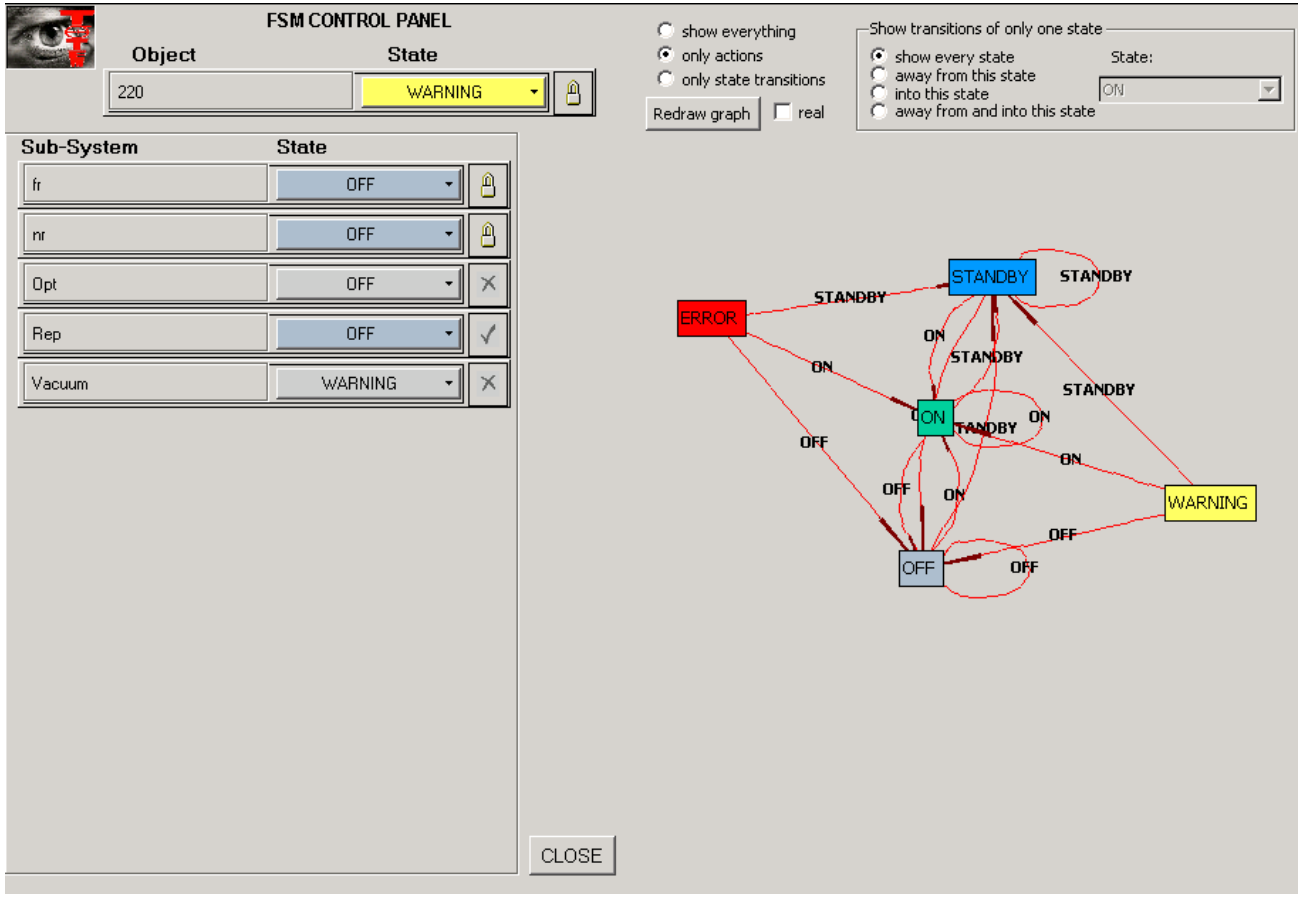
rpRates147Trend

rpRates220Trend

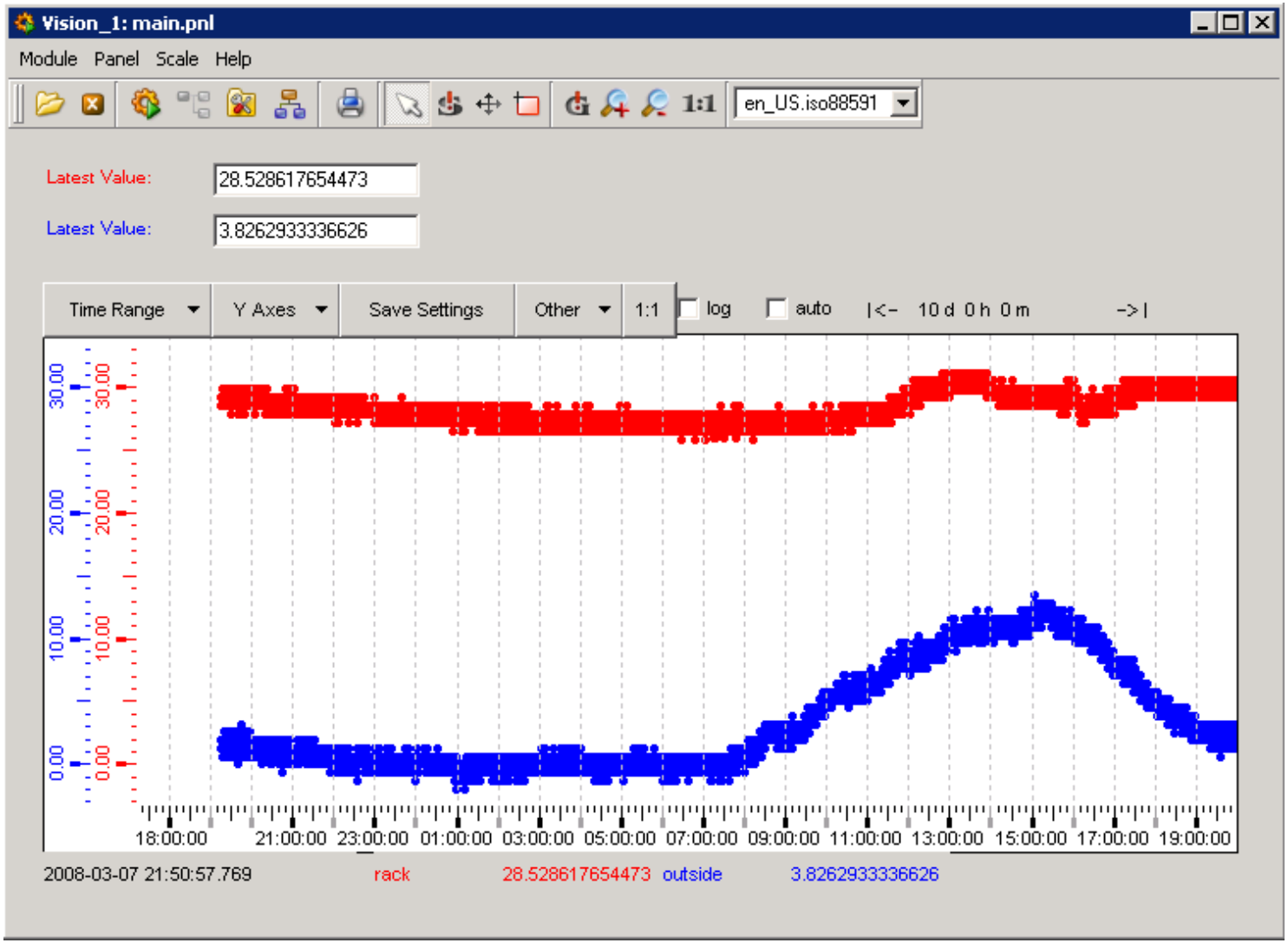
glTriggerTrend

FSM commands





Plotting


Vision_1: main.pnl
Module Panel Scale Help
en_US.iso88591
Latest Value:
28.528617654473
Latest Value:
3.8262933336626
Time Range
Y Axes
Save Settings
Other
1:1
log
auto
|<- 10 d 0 h 0 m ->|
30.00
20.00
10.00
0.00
18:00:00 21:00:00 23:00:00 01:00:00 03:00:00 05:00:00 07:00:00 09:00:00 11:00:00 13:00:00 15:00:00 17:00:00 19:00:00
2008-03-07 21:50:57.769
rack
28.528617654473
outside
3.8262933336626

Conclusions

- Those automation tools and scripts make the DCS developments and maintenance much faster than usual. If considering 1 as the effort of developing the DCS for a detector, the effort of this whole system is 1.50...1.75, but the cost of adapting to a detector is 0.25. Building two detectors was the break-even. The control system for the rest of detectors comes 'free'.

- Even more important is the confidence of what is agreed in the table is really implemented in the final system.

- The detector experts that provide the requirements can inspect the human readable representations of the pinout tables and UML diagrams.

- The system can be ported to another platform just porting the final step of the process.

Questions

References

- F. Lucas Rodríguez, 'Design, Development and Verification of the Detector Control System for the TOTEM experiment at the CERN LHC'
- G. Anelli, G. Antchev, P. Aspell, *et al.*, 'The TOTEM experiment at the CERN Large Hadron Collider,' *Journal of Instrumentation*, vol. 3, pp. 1–113, Aug. 2008, ISSN: 1748-0221. DOI: 10.1088/1748-0221/3/08/S08007. [Online]. Available: http://iopscience.iop.org/1748-0221/3/08/S08007
- M. Albrow, G. Antchev, M. Arneodo, *et al.*, *Prospects for diffractive and forward physics at the LHC*, , CERN/LHCC 2006-039/G-124, Dec. 21, 2006. [Online]. Available: http://cdsweb.cern.ch/record/1005180/files/lhcc-2006-039.pdf
- V. Berardi, M. G. Catanesi, E. Radicioni, *et al.*, *TOTEM: Technical Design Report*, CERN-LHCC-2004-002, Jan. 2004