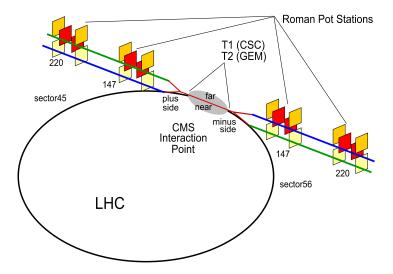


Fernando Lucas Rodríguez on behalf of the TOTEM collaboration fernando.lucas.rodriguez@cern.ch 3 December 2012

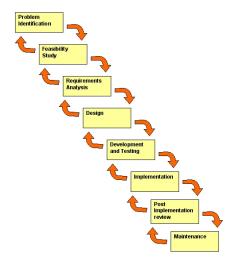




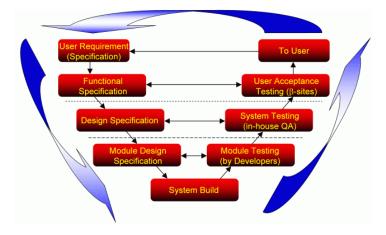
TOTEM introduction



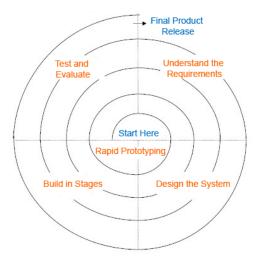
Waterfall software life-cycle model



V software life-cycle model

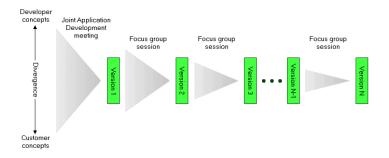


Iterative software life-cycle model



It is an incremental model

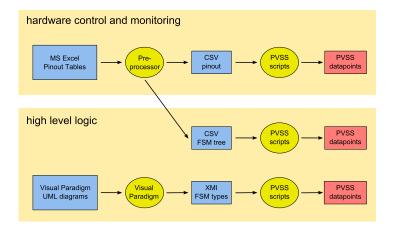
RAD software life-cycle model



Rapid Application Development

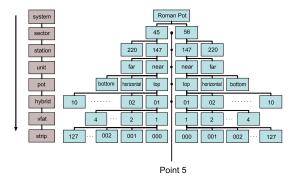
- Automated generation of some parts of the software
- It is an incremental model

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

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		12		12	12		20 20	8					BallowBorealbarr, 20,01	M. Profil Collocation
		12		12	12		34 17	*		2		•	Laboration and Art (Art)	1090040000am
		13		13	13	19190	19	- 00	σ	15			BallAvallare(13/P1,46,36,26	MURAURU CONTRACT
		13		13			20	_		29		•		
	-					088	212	-	-	-	-	-	-	-
		14		14	14		22	- 20		12				
	-						10	- 20	н			•	BJRANDHHANPT, 2N, 32	MJ96,40,000, HJH, Geo01
		15		15	15	PPICK	10	30	u	80 94		•	E.MbadharashAPT,3N;E	14,76,31,231,14,34,0482
	-						14	00 30	м					
		16		16	16		14	- 20		10		•	BARAGEDHIGHNPT, 20, 30	M./92,41,221,-1,-5,-54404
						1910	0	00	σ	2			EMMAARMAN (NPT), PC (8, 27	M. P. A. MILLIN, M. Margali
		B3 70710			8 8 8 8		24			27		•		
_		s manuface Bit P2P13A				088		-	-	-	-	-	-	-
		BD PRTM		a 1 e	0 0 0 4									
		aning Bas Sectors		н 1 4 -			1		н	30			BURGARDING APT, 20, 31	M_R_40,201_H_(0,00011
		1049 Bit 91773	0 0	0 1 4	5 5 5 4 5 6 6 4	HP1CK	20	30		u:		•	BallhadineeshAPT_2N_D	M./W./K./K./K./M./MK
		solvy Bit Score					2	*	×	99			DJM55xHISkine45APT_DA_SH	M.R.M.101.01.0000
		anity Bits Brands	1 1	8 1 4	4 4 4 4		24		н	30			BARAGERINA PT_20_38	M_R_01201_H_0_0MM

.

-	-					51.145	51.005	600 6058/4	FOR LINEARS	Ritabeter	00 April 10
		CC	ELMB	E LMBID	ELMB	ELMB CONNECTOR	ELMB CHANNEL	1	-	-	-
			BUS	(dec)	CHANNEL	PIN	POLARITY	0		0.MSAutowner45APT_2A_32	0030-002031200000
				()		FIN		0 00		BJMBAuttinite/BAPT_20_33	8(/%_0,00,7,9(OH65
								- 211		ELMANDHOLDAPT,2N,31	6(79)(0,220)936(Con65
					00	C1		00		0.465xelliamentshiP1_24_H	11.70.16.201.1.31.00064
								0	•	0.46Au89amer1A4P1,44,18,19	01.91.05.2014.04.741000
			09	17	01	C2	+	-	-	-	-
			00		00	C9		- 08		EMANDAMENT, N. N	14,76,8,20,9 (v,0=0)
					80	00		00 08	•	0.0554000000000000000000000000000000000	10.00.00.00.00.00.0000
					01	C10	+			EMEMORIEMANT, IN JR	8(59,40,00,3),N,0000
					01	010				ELMANAMENINA (20,31	64,769,68,200,9.34_Conditi
								Ch			
								(4) (4)		6.Mbbuillamer13APT_WUJU_21	ec./lp.,45,200, it.jp.,Tampi1
			_	_	_	_	_	-	-	-	-
								(4) (3)		EMMAARDONESS/PT_20_61	14(79)(8)(200)F_9(Con61
								C10 C25		DJMSHoulliamentshiPT_20C41	01/01/05/2018.00/00
	-							03		EMECURENCE/OPT_DV_C	0(/9,/0,00,7,0,000
	2							C24		ELMAnatheretAXP1_20_EL	64(76);81,220(P_9);Con64
			09	18	00	C1				0.464x88amer3A4P1_4X_81_23	M.R.A.BURACINE
			09	10	00	C9	+	-	-	-	-
	-		00			C2		_		ELMAnatherentityPT_2N_81	MURAUROUGHER
			09	18	01	62				DJMDburttisterbAvP1_24C48	M.Rp.45.201.H.M.GORD
	-		09	10	01	C10		_		B.MidwillionethAle7,20,31	M_96_40_001_H_00_00000
			09			010	+	Π		EMModReeEMP7,20(11	MURAL ROOM AND
			09			C3				Editoritaria(1)(PL, (C))(3)	w.fg.A.SH.m.M.Sorph
			09	18	02	03					
			09	10	02	C11	+	-	-	-	-
			00			011		_		BJBBARDHHMANPT, 2N JD	M(%)40(00),H(%)60601
			09			C4				EMUsalitates50P1,20,0	MURAL REPORT
			00	18	03	54				0.465x8567645491_24_54	M.Rp.45.231.00.00000
			09	.0	00	C12	+	_		EMAGENHEIMAPT, 2N (11	MUNU40301, MUNU60004
			03			012				Editoriane(13.91, at at 2	M.R.M.GRUND, Server
		1 1	BO PAPE			8 8 8 8 8 8 8	2 1 2				
			4 myordur 814 9371 - yier 818 9391 - 819 9391 - 819 9391	8 8 15 5 32 18 8 37 17 18,1,939 14 38 19 164	****			1	-	-	-
			aming EX SPLF	a a a a a a a a a a a a a a a a a a a		a a a a a	17 30 H M			B.MIANDOROANPT, 2N, 38	M_99_40_331_4_9_500011
			10.000 BEI (21.00	24 D 0			19 00 u ur	_		EMBAGERINANI, 20, 0	M.P.(.81,231, m.); GmB
			100% BEI 500%	10 10 10 10 14 14	1 1	0 0 0 4	2 00 H S	_		0.46AutometicANPT_2ALSt	M.R.A.10.4.10.0000
			aning BG 2020	24 H 34	7 H H 7 H		20 30 11 10	_	-	EMAndBookhAPT, 20, 31	MUNERAL STRUCTURE CONTROL

umu V	-	DCS hardware name	DCS logical name
		ELMB/bus09/elmb17/Al/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/Al/PT_2W_03	tot_Rp_45_147_fr_bt_Cool04
			Image: state of the s

umu V	 DCS hardware name	DCS logical name
	ELMB/bus09/elmb17/Al/PT_4W_00_01	tot_Rp_45_147_fr_bt_Temp01
	 Autom	ated _
	ELMB/bus09/elmb18/Al/PT_2W_00	tot_Rp_45_147_fr_bt_Cool01
	ELMB/bus09/elmb18/Al/PT_2W_01	tot_Rp_45_147_fr_bt_Cool02
	ELMB/bus09/elmb18/Al/PT_2W_02	tot_Rp_45_147_fr_bt_Cool03
	ELMB/bus09/elmb18/AI/PT_2W_03	tot_Rp_45_147_fr_bt_Cool04
		$\begin{array}{c c c c c c c c c c c c c c c c c c c $

FSM hierarchy tables

_			
L I	ogic name and FSM name		
E	kovil parent overside	PSM type: CU, DU or LU	PBS
4	8 C D E F G H		
10	Rp CM8_TOTEM	CU tot_Rp_Sv	E.03.01
	tot_Rp_Hv		
	tot_Rp_CeenModu01 tot_Rp_Lv	DU FwGaanBoardSY1527Rp	EU03U01
	tot Ro WienWats01	DU FwWienerVerathonRo	0.03.02
	tot Rp_WienMacs02 tot_Rp_WienMacs03	DU FwWienerMerathenRp	E.03.02
	tot_Rp_WenMateO3 tot_Rp_WenMateO4	DU FwWienerManthonRp DU FwWienerManthonRp	E.03.02 F 03.02
r		00141101010000000	0.03403
÷			E.03.03
ŗ	tot_Rp_Vme01_Fam11 tot_Rp_Vme02		E.03.03 E.03.03
÷			E,03,03
÷			E.03.03
	tot Rp_Cooling tot Rp_CoolPant	CU.so: RoCaV DU.PxCaVPaerDU	E.03,99
	tot Re CoePlantLoop01 tot Re CoePlantLoop02	DU FwCaVLogDU	E-03-09
	tot Rp CooPtantLoop02	DU FwCal/LoopDU	EU03405
	tat, Rp. CooPtantLoop03 tat, Rp. CooPtantLoop04	DU FwCar/LoopDU DU FwCar/LoopDU	E.03.09 E.03.05
	tot Ro CooPlantLocoloco01	DU FwGeVLoopDU	E.03.05
		DU FwCaVLogDU	E-03-06
	tol Ro CooPantLooploop03 tol Ro CooPantLooploop01	DU FwGahloopDU DU FwGahloopDU	EU03005
	tot Ro. Caribus	CU tor GeCan CU tor GeCanBus	
	to Pp_CanBus03 to Pp_CanBus09	CU tot_GeCarbus CU tot_GeCarbus	E.03.05.01 E.03.05.01
		CU tot_GatEmpNode	E.03.05.02
	to: Rp_Elmb10 to: Rp_Elmb10	CU to: GeEinshode CU to: GeEinsNode	EU0005.02 EU0005.02
	tot Rp Binb20	CU xx GeE Inthhote	E103-05-02
		CU tot: GeE Inthhote CU tot: GeE Inthhote	EU0309542 EU0305522
	to: Rp Ginte22 to: Rp Ginte23	CU to: GeE Inthhote CU to: GeE Inthhote	510005.02
	tot Po Elvicol	CU.tot GeEwishode CU.tot RpSide	
	tot Rp. 45 101 Rp. 45 223	CU.tot_RpStation CU.tot_RpStation	
	101 Ftp 45 220 (r tp 101 Ftp 45 220 (r tp DesTerep	CU tot RoPot	
r	tot_Rp_45_225_ft_tp_DeaTemp tot_Rp_45_225_ft_tp_Lvdt	DU tot_FwARpDos	E-03-09
÷	tet Ra 45 220 fr ta Rose	00.	E.03,08
r		DU:	E.03,08
٠	ter Rg 45 220 ft te MicrOut tet Rg 45 220 ft te Hv	DU: DU Fe/Geor/ChannelRoffy	E.03.08 E.03.01
	tet Re 45 220 fr te LyG	DU FwWienerMenthorGroupRp	E.03.02
		DU FwWienerMatathanChannel Rp	E.00.02
r	tot Rp 45 220 h to LvD tot Re 45 298 h to Toronti	DU FwWiererVerathorChannelRp DU	
÷	tel: Rp. 45, 230, fr. tp. Temp01 tel: Rp. 45, 230, fr. tp. CoeD1	DU:	0.03.05.03
÷	tel: Rg: 45, 220, ft to: Cooki2 tel: Rg: 45, 220, ft to: Cooki3	DU: DU:	E.03,05,03 E.03,05,03
÷	101 Fig. 45 220 ft to Cont04	00	
r	tel_Rg_45_220_ft_tg_Cod04 tel_Rg_45_220_ft_tg_Vec01	DU:	0.03.05.05
:	tot Ro. 45, 220 fr to: Rockaas	OU:	E.03.05.04 F.03.05.04
:	tot Rp 45 220 ft to RedCorp tot Rp 45 220 ft to RedBarn	DU:	EU0303.04
÷	tot, No. 45, 230, ft to, Radham tot Ro. 45, 230, ft to, Radhow tot, No. 45, 230, ft to, Radhow	00:	E-03-05-04
:	tot Rp 45 220 h to RedTemp	DU: DU	EU0005.04
÷	101 Rg 45 220 T 10 RodR 101 Rg 45 220 T 10 PR1	DU:	E-03-22
٠	100, Pp. 44, 230, P. to, Pith Tonuld 101, Pp. 44, 230, P. to, Pith Tonuld 101, Pp. 44, 230, P. to, Pith Tokold 101, Pp. 46, 230, Pp. 46, 230, Pp. 46, 230, Pp. 46, 200, Pp. 46	00	E.03.04
÷	tot Rp 45 220 ft to P101 Viel01	DU: DU:	E-03-04 E-03-04
:	tot Ro 45 220 fr to P101 Curt01	DU:	E203204
٠	10, Pp, 45, 230, F (p, F10, Temp01 10, Pp, 45, 230, F(p, F10, Vol01	DU:	5,03,04
:	tot_Rp_45_220_it_p_F102_Vot01 tot_Rp_45_220_it_p_F102_Cue01	DU:	E-03-04 E-03-04
1	tet Re 45 220 fr te P03	DU: DU	F/0.99
÷	tet Rp. 45, 220 h tp. P03 tot Rp. 45, 220 h to. P10, Temp01	DU:	E-03-04
:	tot_Rp_45_220_F_tp_F103_Vt401 tot_Rp_45_220_F_tp_F103_Cum01	DU: DU:	E.03.04 E.03.04
÷	tot Rp 45 220 P to P104	DU:	5,03,72

FSM hierarchy tables

	kpc name and PSM name parent overside A. B. C. D. C. H. F. H. O. N. parent overside M. PD CMB_TOTEM M. PD CMB_TOTEM	PSM type: CU, DU or CU to _ Rp_Sv	E.00/01	
logic name and FSM name level A B C D E F G H	parent override		FSM type: CU, DU or LU	PBS
# tol_Rp_45_ # tol_Rp_45_ # tol_Rp_45_ tol_Rp_45_ tol_Rp_45_ tol_Rp_45_ tol_Rp_45_ tol_Rp_45_ tol_Rp_45_ # tol_Rp_45_ # tol_Rp_45_ # tol_Rp_45_ # tol_Rp_45_ # tol_Rp_45_	220_fr_tp_DssTemp 220_fr_tp_Keso 220_fr_tp_Micrhn 220_fr_tp_HorCout 220_fr_tp_HV 220_fr_tp_LVA 220_fr_tp_LVA 220_fr_tp_LVA 220_fr_tp_LOU 220_fr_tp_LVA 220_fr_tp_CADLethin 220_fr_tp_COULethin 220_fr_tp_COOLECT		CU:ToIRpSv CU:ToIRpSide CU:ToIRpSide CU:ToIRpOnt DU:FwAIDssTemperature DU:ToIRpMotorPos DU:ToIRpMotorPos DU:ToIRpMotorPos DU:ToIRpMotorPos DU:ToIRpMotorPos DU:ToIRpMotorPos DU:FwWienerMarathonChanneITot DU:FwWienerMarathonChanneITot DU:FwWienerMarathonChanneITot DU:FwWienerMarathonChanneITot DU:FwWienerMarathonChanneITot DU:FwWientMartoITemperature DU:FwEimbAIToITemperature	E.03.01 E.03.99 E.03.99 E.03.99 E.03.09 E.03.09 E.03.08 E.03.08 E.03.08 E.03.08 E.03.08 E.03.01 E.03.01 E.03.02 E.03.02 E.03.02 E.03.02 E.03.05.03
# tot_Rp_45_2	220_fr_tp_CoolRightIn 220_fr_tp_CoolRightOut 220_fr_tp_Vacu01		DU:FwElmbAiTotTemperature DU:FwElmbAiTotTemperature DU:FwElmbAiTotVacuum	E.03.05.03 E.03.05.03 E.03.05.05
	 Multiple45_2201_51_01102_100001 Multiple45_2201_51_01103_01001 Multiple45_2201_51_01103_01001 Multiple45_2201_51_01102_0001 Multiple45_2201_51_01101 Multiple45_2201_52014001 Multiple45_2201_52014001 Multiple5220152014002_0001 Multiple5220152014001 Multiple5220152014001<!--</td--><td>DU: DU: DU: DU: DU: DU: DU: DU:</td><td>E.20234 E.20234 E.20234 E.20234 E.20234 E.20234 E.20234 E.20234 E.20234 E.20234</td><td></td>	DU: DU: DU: DU: DU: DU: DU: DU:	E.20234 E.20234 E.20234 E.20234 E.20234 E.20234 E.20234 E.20234 E.20234 E.20234	

FSM hierarchy tables

	logic tarme and F2M tarme panet counting A.1 B [C] 0 [C] 1 [C] 1 [C] 11 panet counting MR0_R_JW_ CMB_TOTEM M_R0_R_JW_ CMB_TOTEM	PSM type: CU, DU CU tot_Rp_Sv	E.00.01 E.00.92	
logic name and FSM name	parent override		FSM type: CU, DU or LU	PBS
# tot_Rp_45_2	20_fr_tp_DssTemp		CU:TotRpSv CU:TotRpStation CU:TotRpStation CU:TotRpUnit CU:TotRpPot DU:FwAiDbsTemperature DU:TotRpMotorPos DU:TotRpMotorPos	E.03.01 E.03.99 E.03.99 E.03.99 E.03.99 E.03.09 E.03.08 E.03.08
# tot_Rp_45_2 tot_Rp_45_2 tot_Rp_45_2 tot_Rp_45_2 tot_Rp_45_2 tot_Rp_45_2 # tot_Rp_45_2 # tot_Rp_45_2 # tot_Rp_45_2 # tot_Rp_45_2 # tot_Rp_45_2	20_fr_tp_MicrOut 20_fr_tp_Hv 20_fr_tp_LvG 20_fr_tp_LvG 20_fr_tp_Temp01 20_fr_tp_Temp01 20_fr_tp_CoolLeftIn 20_fr_tp_CoolLeftOut 20_fr_tp_CoolReftOut		DU-TottspMetorPos DU:FwCaenChannelRp DU:FwWienerMarathonChannelTot DU:FwWienerMarathonChannelTot DU:FwEinbAiTotTemperature DU:FwEinbAiTotTemperature DU:FwEinbAiTotTemperature DU:FwEinbAiTotTemperature	E.03.08 E.03.08 E.03.01 E.03.02 E.03.02 E.03.02 E.03.05.03 E.03.05.03 E.03.05.03 E.03.05.03 E.03.05.03
	20_fr_tp_CoolRightOut 20_fr_tp_Vacu01 H=n+totscoolset underscoolset underscoolset https://coolset/underscoolset/underscool https://coolset/underscoolset/under	DU: DU: DU: DU: DU: DU: DU: DU:	DU:FwEImbAiTotTemperature DU:FwEImbAiTotVacuum	E.03.05.03 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="TPEFSM" parameters="DU"/>
<column name="PBS" parameters="E03.01"/>
</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>
```

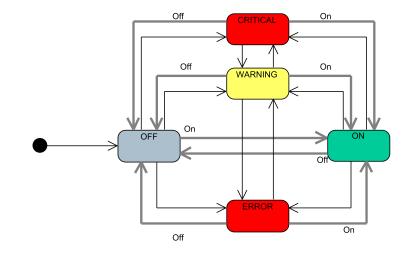
Preprocessor for the pinout and the FSM

Here View		
	Property	Value
Ihc_Energy	Name	CMS_TOTEM
Ihc_Physics	PBS	E.03.99
Ihc_Beta	Disabled	False
Ihc_Status	Calculated	False
i⊒-tot_Ge	Color	#FFC000
⊟-tot_Rp ⊟-tot Rp Hv	Count	1627
tot Rp CaenModu01	InformationChunk	16.00 Bytes
⊢-tot Rp Lv	Variation Probability	1
	VariationAccumulated	1
tot Rp WienMara02	ArchivingFrequency	00:05:00
tot Rp WienMara03	ArchivingNode	64.16 MBytes
tot_Rp_WienMara04	ArchivingAccumulated	138.68 GBytes
	ArchivingOverhead	16.00 Bytes
tot_Rp_Vme01_Temp	Readout Rate Frequency	00:00:00.5000000
tot_Rp_Vme01_Fan01	ReadoutRateNode	512.00 bits/s
□ tot_Rp_Vme02	Readout Rate Accumulated	1.08 Mbits/s
tot_Rp_Vme02_Temp	Readout RateOverhead	8.00 Bytes
tot_Rp_Vme02_Fan01	TimeSendResponse	00:00:00.1000000
i⊟ tot_Rp_Cooling	TimeSendCommand	00:00:00.1000000
tot_Rp_CoolPlant	TimeExecute	00:00:00.1000000
	TimeInternalUpdate	00:00:00.1000000

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.
- $\,\circ\,\,$ 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



- 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.

o 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.

			220			9.9N			147		45 Beam	2 < tot 9.81		or 56 B e	••• 1 14	,		08	56		22				
		FAB OFF	(ABN		NEAR	2523		FAR FROF •	1890	EY.	NEAR		_	NEAR FEOF •	199X		FAB FIDCE *	IDC		NEAR	09		FAR DEE 11		EDIT HY RECIPES HY RECIPE FSM STATE STANDBY Text. Rp. 0 V
	bor DE *	top Off *	bat CIT: 1	har Official	tap 295 r	bot 0.05 v	her FRROF*	bap FEOF*	bot RROF*	ber FREGE*	top RROF *	bat ERROF*	ber ERROF*	tap FROF*	bot FRFOF*	her SERGE*	tep RRCF *	bot RROF*	bar Officient	1000 0135 *	bet City i	her GTT 1	tap 0.65 ×	bot 0.00 r	HW RECEPE FSM STATE ON
1vA [V]	0.04	0.03	0.04	0.02	0.05	0.05	0.02	0.05	0.10	0.03	0.01	0.02	0.04	0.03	0.13 0.33 0.00	0.03	0.04	0.04	0.02	0.01	0.05	0.01	0.06	0.06	toRphtelock bean 1 bean 2 InectorPenik
	0.28 Con [V]	0.28	0.27 Opt [V] [A]	0.25	0.30 Rep [V]	0.00	0.04 Con [V]	0.04	0.04	0.04	0.04	0.04	0.32 Con [V]	0.22	0.29	0.33	0.30	0.29	0.33 Con [V]	0.01	0.25 (V] 500	0.33	0.33 Pep [V] [A]	0.21	UserPermit1
Rv [V] [μλ]	0.00	0.28	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.10	0.30	0	0.00	0.00	0	0.00	-UsePerni2 TRUE TRUE
TempO1 ["C] DowTemp ["C] CoolleftIn ["C]	-23.25 -22.94 -15.05 -25.03	-23.46 -22.95 -23.33	-23.06 -23.00 -24.42	-24.73 -22.85 -22.62 -24.52	-22.82 -23.12 -27.26	-24.12 -22.84 -25.53	-24.34 -24.92 -25.73	-25.42 -24.04	-25.65 -24.55 -22.00 -24.19	-23.63 -23.60 -23.67	-25.96 -19.77 -23.41	-24.05 -21.42 -25.16 -05.00	-21.70 -21.90 -15.68	-21.83 -21.41 -25.20	-22.90 -22.10 -16.92	-23.89 -23.01 -20.58	-25.00 -22.93 -22.60	-24.41 -23.54 -20.94	-23.77 -22.67 -28.92	-22.90 -23.30 -23.80	-24.97 -23.42 -24.47	-23.77 -23.13 -22.19	-24.84 -22.95 -23.88	-23.57 -23.25 -23.95	Pilation Penal Pilation TRUE
CoolLeftBut ("C) CoolRightIn ("C) CoolRightDut("C) RedTemp ("C)	-9.05 -23.71 18.55	-24.28 -20.36 -25.02 18.18	-20.81 -24.46 -25.16 17.21	-29.25 -27.05 16.31	-26.92 -23.66 -25.90 16.69	-26.33 -26.17 -26.65 16.05	-24.71 -25.01 -21.36 15.84	-21.83 -20.91 -18.59 16.05	-24.73 -23.77 15.46	-23.17 -24.60 -18.90 14.90	-22.33 -22.33 -23.71 18.10	-20.04 -20.09 13.99	-19.70 -17.30 -22.24 16.99	-24.27 -21.15 -19.40 16.28	-18.49 -20.13 -23.83 14.85	-24.16 -17.99 -22.55 16.69	-24.30 -21.04 -19.86 16.21	-16.90 -21.04 -17.35 15.51	-20.37 -27.04 -25.50 17.02	-27.67 -25.37 -25.24 16.96	-25.66 -25.24 -15.76	-25.75 -20.95 -25.49 16.61	-26.57 -25.13 -25.12 19.16	-27.50 -25.15 -25.03 17.07	MovementOvende Pit PALIZ DCS PALIZ
Verul [abar] leak [phar/s] Firani [abar]	28.21	27.78 +0.39	27.59 +0.55 225.54 /	26.95 +0.30	26.57	27.10	29.62	90.00 +0.01	29.19 +0.01 29.41 (29.41 +0.52 50.00	28.69	27.61	40.16	38.68	38.15 +0.20 38.53	37.37 +0.40 50.00	37.70 +0.42	38.78 +0.42	26.17	25.94	23.82 +0.00 30.43	25.26 +0.00 50.00	28.10	28.32	PI3 TRUE DCS TRUE
SPIn Sittone SPOut SPMotorPowerOn	TRUE TRUE TRUE TRUE	TRUE TRUE TRUE	TRUE TRUE TRUE TRUE	TRUE TRUE TRUE TRUE	NUSE TRUE TRUE	MALSZ 1932 1932 1932 1932 1932	TALIE TRUE TRUE TRUE	FALSE TRUE TRUE TRUE	TRUE TRUE TRUE TRUE	TRUE TRUE TRUE TRUE	TRUE TRUE TRUE	TRUE TRUE TRUE	TRUE TRUE	NALSZ 1932 1932 1932	FALSE TRUE TRUE TRUE	TRUE TRUE TRUE TRUE	TRUE TRUE TRUE TRUE	TRUE TRUE TRUE TRUE	TRUE TRUE TRUE	TRUE TRUE TRUE TRUE	INUE TRUE TRUE	NALSZ TRUE TRUE TRUE	MALSZ 1932 1932 1932 1932	FALSE TRUE TRUE TRUE	- ControlKays BypasisKey TRUE MotorCol TRUE
PrintiColligion Fosfetting (um) 1VDT (um)	+43000	+43000	-43000 -41507	+43000	+43000	-43000 -43775	+45782 +41749	+46012	-45079 -43233	+45454 +43375	+44999	-46022 -43507	+47000	+47000		+45772	+49001 +44182	-44999 -42913	+30000		-43000 -42000	+43000	+63000		totFESAState 2 totFESAInfoID 3
Motor (µm) Resolver (µm)	+40960 +40958	+40349 +40975	-41888 -41886	+40878 +40881	+41810	-41297 -43775	+39120 +41755	+43788	-40687 -43233	+43383		-41154 -43499	+40302 +43877	+42506 +42491	-42592	+40927 +41807	=43853 =44182	-40103 -43909	+411.48 +411.28	+40279	-42008 -41995	+41248	+41190 +41184	-41065	totFESAWarning 8 totFESAWarni/D 0
InsTructions [un] Instructions [un] Instinit [un] OutWarning [un]	+30000 +35000 +2450 +45000	+39000 +35000 +5250 +45000	-36000 -35000 -6030 -45000	+36000 +35000 +1650 +45000	+36000 +35000 +6700 +45000	-36000 -35000 -8630 -45000	+36000 +35000 +20000 +45000	+35000 +35000 +20000 +45000	-39000 -39000 -20000 -49000	+39000 +25000 +20000 +49000	+35000 +20000	-36000 -35000 -20000 -45000	+36000 +35000 +20000 +45000	+36000 +35000 +20000 +45000	-35000 -20000	+35000 +35000 +20000 +45000	+25000 +20000	-36000 -35000 -20000 -45000	+36000 +35000 +1690 +45000		-36000 -35000 -6230 -45000			-35000 -8020	-POStatus totPillafoID 0 totPillafoID 16384
OutCritical [um] SPState	+49000	+49000	-46000	+46000	+46000	-46000	+46000	+45000	-45000	+49000		-46000 D	+46000	+46000		+45000		-46000	+49000	+46000	-46000	+46000			-AlcoveTemp
Differing Differe	20	10	19	20	18,22	19,23	20	10	19	20	-	19	20	- 10	19	20	10	19	20	10	19	20	30	19	Sector46[%C] 25.72 Sector56[%C] 26.09
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a	S nm IIII		0,	_	S nm Ii		,		5 nn II	0/	+		inn —I	_	Ĺ.,	o ^{5 mm}				S mm Ii		_±	~ o	5 nn II	
-Color Legend - 650	-ERROR,	ORITICAL,	TRIPPED	YELLOW	- WWRN	NS LEGH	ELUE - OF	F OR/	NGE - R	AMP_UP/D		PURPLE	eusy <mark>legen</mark>	GRAY - D	IEAD, DISA	BLED, MARSK	60 0	.UE - 04	, STANDBY	GRED	- 0K,	ON NAC	ENTA -N	O DATA POI	

EDIT HV I HV RECIPE FSM: tot_T1 500 HV RECIPE FSM: tot_T1 2500	STATE STAI	VDBY 6	1-Ch1 4.30 1-Ch2 4.10 1-Ch3 4.80 1-Ch4 4.50 1-Ch5 4.60	Mh 3.80 Mh Mh 4.10 Mh Mh 4.00 Mh	61-Ch7 4 61-Ch8 4	.10 M .60 M .60 M	3.10 l/h 6 3.80 l/h 6 4.20 l/h 6	2-Ch1 4.30 M 2-Ch2 5.10 M 2-Ch3 5.00 M 2-Ch4 4.80 M 2-Ch5 4.80 M	3.70 l/h 4.60 l/h 4.20 l/h 3.90 l/h 4.60 l/h	62-Ch7 62-Ch8	5.30 Mh 5.20 Mh 4.10 Mh	5.00 M TotalFig 4.90 M Line1R- 4.60 M Line2R- 3.10 M Line3R- 3.90 M OutPre	atio 49.1 atio 40.1 atio 9.1	12 Mn 94 % Fl-n 01 % Fl-p 95 % Pr-r 9 bar Pr-;	l <u>1.09 M</u> h nn <u>2.54 bar</u>
		tot T1	mn	OFF	-	tot T1	1	OFF	*	tot T1		OFF	-		
tot T1 mn fr	_	OFF		1.1.T.1	_	OFF	_	tot T1 pl fr		NEE	_	tot T1 pl nr	_	OFF	
tot 11 mn rr		Unr		tot T1 mn nr		UFF	· ·	tot 11 pin- tot T1 pi fr-		UFF		tot i pinn 1 tot T1 pinn-	_	UFF	-
No. Content	Hy Para	ameters Si	et	Contraining of		ameters S	iet	Children Children	Hv Par	ameters Se	st	l wordson	Hv Par	ameters Se	e
	v0[V]	vMon[V]	iMon[µA]		v0[V]	vMon[V]	iMon[µA]		v0[V]	vMon[V]	Mon[µA]			vMon[V]	Mon[µA]
bt_HvA1	500	2	0.50	bt_HvA1	500	1	0.10	bt HvA1	500	0	0.10	bt_HvA1	500	1	0.20
bt HvA2	500	2	0.60	bt HyA2	500	Ö	0.20	bt HvA2	500	0	0.20	bt HvA2	500	2	0.20
bt HvA3	500	1	0.10	bt HyA3	500	1	0.10	bt_HvA3	500	ő	0.10	bt_HvA3	500	1	0.00
bt_HvA4	500	2	0.30	bt_HvA4	500	2	0.20	bt_HvA4	500	0	0.30	bt_HvA4	500	1	0.10
bt_HvAS	500	1	0.20	bt_HvA5	500	1	0.20	bt_HvA5	500	1	0.20	bt_HvA5	500	1	0.10
md_HvA1	500	1	0.20	md_HvA1	500	1	0.10	md_HvA1	500	0	0.10	md_HvA1	500	1	0.10
md_HvA2	500	1	0.10	md_HvA2	500	1	0.10	md_HvA2	500	0	0.00	md_HvA2	500	2	0.20
md_HvA3	500	2	0.60	md_HvA3	500	2	0.30	md_HvA3	500	0	0.20	md_HvA3	500	3	0.10
md_HvA4	500	1	0.10	md_HvA4	500	1	0.20	md_HvA4	500	0	0.00	md_HvA4	500	0	0.20
md_HvA5	500	2	0.20	md_HvA5	500	1	0.10	md_HvA5	500	1	0.10	md_HvA5	500	1	0.20
tp_HvA1	500	1	0.20	tp_HvA1	500	1	0.00	tp_HvA1	500	0	0.10	tp_HvA1	500	1	0.10
tp_HvA2	500	2	0.30	tp_HvA2	500	2	0.30	tp_HvA2	500	0	0.20	tp_HvA2	500	2	0.20
tp_HvA3	500	2	0.10	tp_HvA3	500	1	0.10	tp_HvA3	500	1	0.40	tp_HvA3	500	1	0.10
tp_HvA4	500	0	0.20	tp_HvA4	500	1	0.20	tp_HvA4	500	0	0.00	tp_HvA4	500	1	0.10
tp_HvA5	500	1	0.40	tp_HvA5	500	1	0.00	tp_HvA5	500	0	0.00	tp_HvA5	500	2	0.10
	Sense[V]	Fuses	Current[A]		Sense[V]	Fuses	Current[A]		Sense[V]	Fuses	Current[A]		Sense[V]	Fuses	Current[A]
LVDOHM	0.05		0.29	LVDOHM	0.03		0.26	LvDOHM	0.03		0.28	LVDOHM	0.02		0.27
Lv01A	0.02		0.27	Lv01A	0.09		0.30	Lv01A	0.05		0.32	Lv01A	0.02		0.28
Lv01D	0.04		0.28	Lv01D	0.02		0.24	Lv01D	0.02		0.32	Lv01D	0.05		0.29
Lv23BA	0.03	_	0.26	Lv23BA	0.03	_	0.23	Lv23BA	0.03		0.28	Lv23BA	0.03		0.33
Lv23BD	0.03		0.30	Lv23BD	0.03		0.19	Lv238D	0.04		0.27	Lv238D	0.04		0.27
Lv23MA	0.02		0.28	Lv23MA	0.05	_	0.21	Lv23MA	0.05	_	0.28	Lv23MA	0.04		0.27
Lv23MD	0.02		0.29	Lv23MD Lv23TA	0.05		0.19	Lv23MD Lv23TA	0.07		0.27	Lv23MD Lv23TA	0.06		0.32
Lv23TA			0.27								0.29	LV23TA			0.28
Lv23TD Lv45A	0.06		0.28	Lv23TD Lv45A	0.03		0.24	Lv23TD Lv45A	0.04		0.29	Lv231D Lv45A	0.04		0.29
LV45D	0.02		0.26	LV45A Lv45D	0.04		0.19	LV45A LV45D	0.01		0.27	LV45A LV45D	0.03		0.26
		8.70 °C	0.23				0.20				0.20			0 70 80	0.20
DssTempInne				DssTempInne		8.65 °C		DssTempInn		8.62 °C		DssTempInne		8.72 °C	
DssTempOute Temp01		8.70 °C 6.48 °C		DssTempOut Temp01		8.75 °C 6.83 °C		DssTempOut Temp01		18.75 °C 14.84 °C		DssTempOut Temp01		8.62 °C 4.79 °C	
Temp02		4.87 °C		Temp01 Temp02		5.91 °C		Temp01		14.84 °C		Temp01		4.79 °C	
Temp02		4.67 °C 8.30 °C		Temp02 Temp03		8.10 °C		Temp02		17.04 °C		Temp02		6.92 °C	
Temptos		0.00 0		icing005		0.00		long05		11.04		i cinpos		0.02 0	

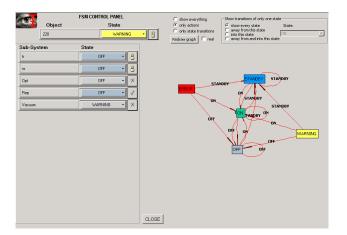
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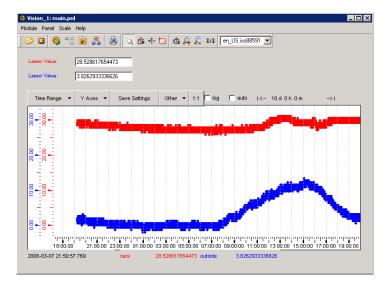
Alarms

Alarm S Print alarm	ns: 🖨	Acknowledgement	In dividual (Comm	urrent Alarms	t Time Range	NO USER
Alarm Filt Systems totem_dc totem_dc totem_dc totem_dc	s cs_01	Device Name[,Name,. Device Type *] Logical Name	Alarm Text	Global/Loc: Globa	
	ice DP eleme m_dcs_02:S7		Logical name tot_Rp_45_220_Vacuum_LimitAlarm		Dir. Value CAME 9999.00 mbar	Ack CAME Time Co *
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- TOT_gl_trg_rates					- globalTrigger-		-T2_rates		
TRIGGER NAME	RAW	FORK	PRESCALER	ENABLED		004	TRIGGER NAME	VALUE	rpRates147Trend
rp220_hor	65535	216	216	TRUE		-741	Trigger/tot_T2_mn_fr	0	rpRates220Trend
rp220_vert	65535	224	224	TRUE		201	Trigger/tot_T2_mn_nr	0	
rp220_cross	1305	1	0	FALSE	tot_Rp		Trigger/tot_T2_pl_fr	0	glTriggerTrend
rp147_hor	0	0	0	FALSE	TRIGGER NAME	VALUE	Trigger/tot_T2_pl_nr	0	
rp147_vert	0	0	0	FALSE	Trigger/tot_Rp_45_147_fr_bt	0	L		
rp147_cross	0	0	0	FALSE	Trigger/tot_Rp_45_147_fr_hr	0	-T1 rates-		
12	0	0	0	FALSE	Trigger/tot_Rp_45_147_fr_tp	0	TRIGGER NAME	VALUE	
t2_hm	0	0	0	FALSE	Trigger/tot_Rp_45_147_nr_bt	0	Trigger/tot_T1_mn_fr	0	
t1	0	0	0	FALSE	Trigger/tot_Rp_45_147_nr_hr	0	Trigger/tot_T1_mn_nr	0	
bc0	0	11223	64	FALSE	Trigger/tot_Rp_45_147_nr_tp	0	Trigger/tot_T1_pl_fr	0	
sd220	65535	289	0	FALSE	Trigger/tot_Rp_45_220_fr_bt	0	Trigger/tot_T1_pl_nr	0	
sd147	0	0	0	FALSE	Trigger/tot_Rp_45_220_fr_hr	0			
rp220_hr_cms	0	0	0	FALSE	Trigger/tot_Rp_45_220_fr_tp	0			
t2_cms	0	0	0	FALSE	Trigger/tot_Rp_45_220_nr_bt	0			
t1_t2_cms	0	0	0	FALSE	Trigger/tot_Rp_45_220_nr_hr	0			
cms	0	0	0	FALSE	Trigger/tot_Rp_45_220_nr_tp	0			
TOT_toCMS_trg_	- TOT_toCMS_trg_rates-				Trigger/tot_Rp_56_147_fr_bt	0			
TRIGGER NAME	RAW	FORK	PRESCALER	ENABLED	Trigger/tot_Rp_56_147_fr_hr	0			
rp220_hor	65535	216	216	FALSE	Trigger/tot_Rp_56_147_fr_tp	0			
rp220_vert	65535	224	224	FALSE	Trigger/tot_Rp_56_147_nr_bt	0			
rp220_cross	1305	1	0	FALSE	Trigger/tot_Rp_56_147_nr_hr	0			
rp147_hor	0	0	0	FALSE	Trigger/tot_Rp_56_147_nr_tp	0			
rp147_vert	0	0	0	FALSE	Trigger/tot_Rp_56_220_fr_bt	0			
rp147_cross	0	0	0	FALSE	Trigger/tot_Rp_56_220_fr_hr	0			
t2	0	0	0	FALSE	Trigger/tot_Rp_56_220_fr_tp	0			
t2_hm	0	0	0	FALSE	Trigger/tot_Rp_56_220_nr_bt	0			
ti	0	0	0	FALSE	Trigger/tot_Rp_56_220_nr_hr	0			
bc0	0	11223	64	FALSE	Trigger/tot_Rp_56_220_nr_tp	0			
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					







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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.



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