LCLS Machine Protection System at SLAC

- Overview
- Hardware
- Communication
- System Configuration
- MPS Logic
- User Interface

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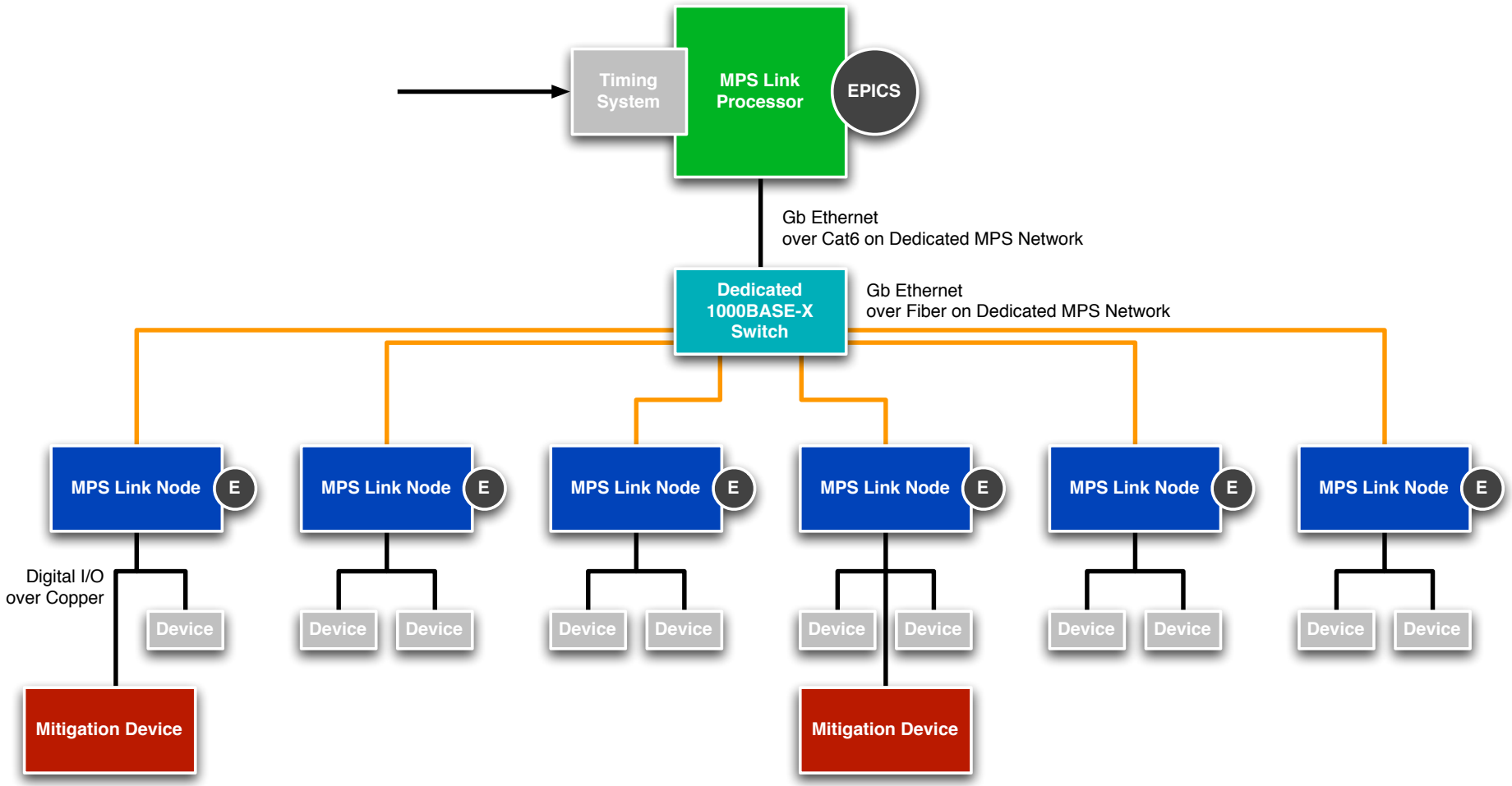
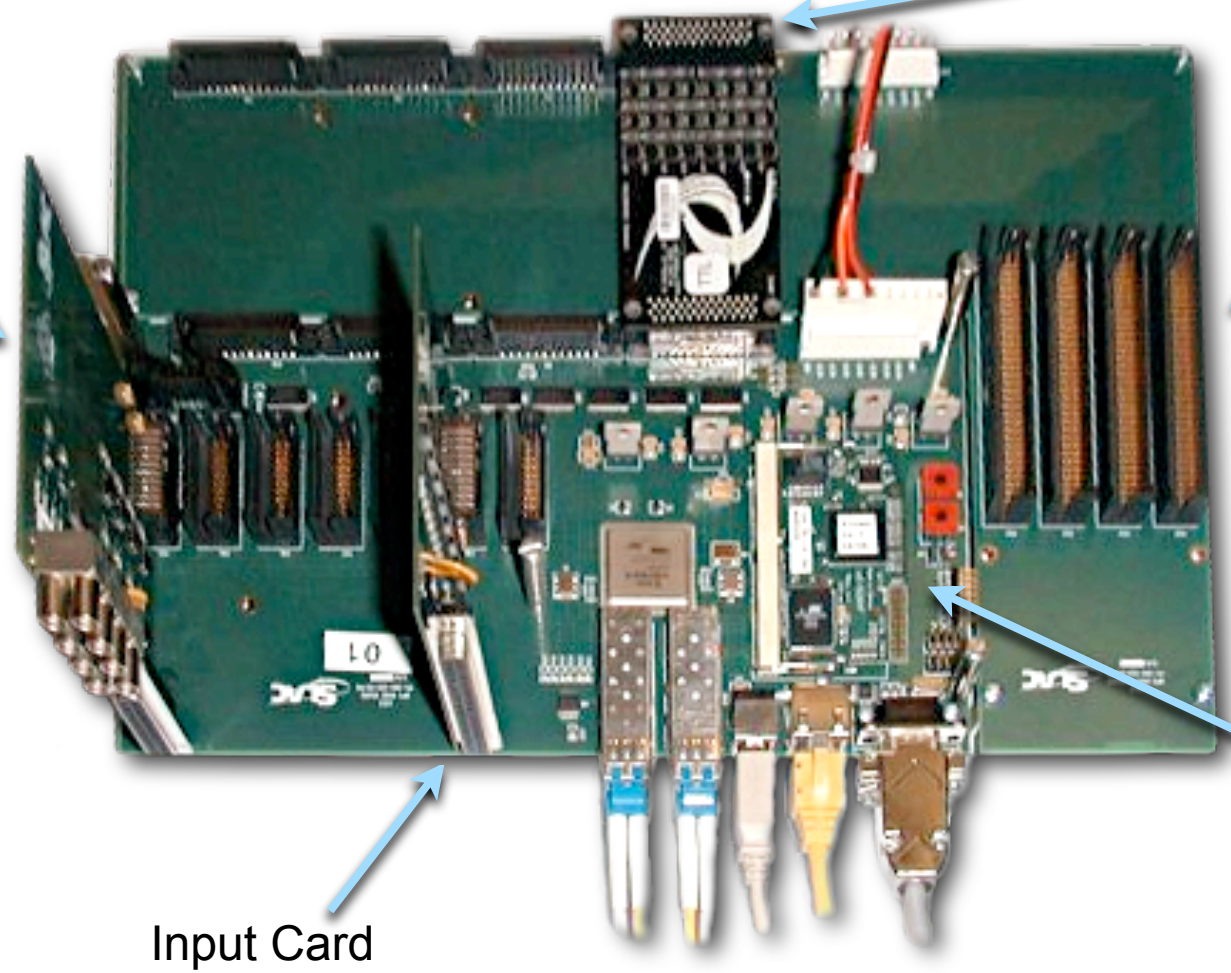
LCLS MPS Overview



MPS Link Node



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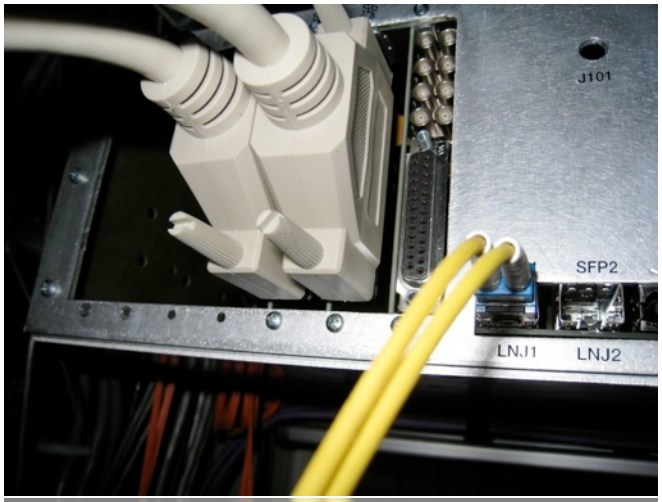
Link Node

- Ninety-six digital inputs
- Eight SSR outputs
- Four TTL trigger inputs
- Four TTL trigger outputs
- Eight analog inputs for each SLAC QADC IndustryPack Module
- Two Rocket IO transceivers (one for GbE)
- Serial connections with USB 1.1 and RS-232

Link Node

KA20-03
NOTICE
QUADS LGPS

LCLS MPS LINK NODE
384-202
+24V
+12V
-12V
+5V


J101
SFP2
LNJ1
LNJ2

Link Processor

Motorola MVME 6100 "Link Processor"
Micro-Research Finland PMC-EVR-200
and Cisco GbE Switches

Communication

- Link Processor
  - EPICS communication uses MVME 6100's first GbE interface and BSD network stack
  - MPS/Link Node communication uses second GbE interface and Till Straumann's real-time protocol stack (RTS)
  - RTS provides deterministic communication
  - UDP/IP protocols allow familiar development, easy testing, standard hardware and software tools

Communication

- Link Node
  - Arcturus uC5282's 100BASE-TX interface used for EPICS communication
    - Configuration of Link Node at startup
    - Device input thresholds and debounce times
  - High-speed GbE MPS communication using FPGA's RocketIO/fiber SFP transceiver

System Configuration

- Configuration and MPS Logic file editors
- SQLite file format
- Python export modules

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MPS Configuration 2009-04-22.mps

All

- Link Nodes
- Link Node Cards
- Link Node Channels
- External PVs
- Devices
- Faults
- Racks
- PV Components

Type	Name	PV	Z Position	Device Area
Link Node Channel	BLM_UND1_3321_LOS...	BLM:UND1:3321	0	UND1
Link Node Channel	FAST_VLV_OPEN_LI28	VVFS:LI28:1	0	LI28
Link Node Channel	BLM_UND1_1421_LOS...	BLM:UND1:1421	0	UND1
Link Node Channel	FLT_20_6_TRP	KLYS:LI20:61	0	IN20
Link Node Channel	HVPS_UND1_2621_HIGH	HVPS:UND1:2621	2.00	Undulator
Link Node Channel	BLM_UND1_3021_PED_H	BLM:UND1:3021	0	UND1
Link Node Channel	BLM_UND1_3320_LOS...	BLM:UND1:3320	0	UND1
Link Node Channel	BLM_UND1_1821_LOS...	BLM:UND1:1821	0	UND1
Link Node Channel	BLM_2220_B30L	BLM:UND1:2221	1.00	Undulator
External EPICS F...	LION404	MPS:MCC0:LION404	0	MCC
Link Node Channel	BLM_UND1_221_PED_H	BLM:UND1:221	0	UND1
Link Node Channel	SLOW_VLV_OPEN_LI30	VVPG:LI30:1	0	LI30
Link Node Channel	BYKIK_THRESHOLD_U...	KICK:LTU0:320	3.00	LTU

Name: BLM_UND1_3021_LOSS_L
Device Area: UND1
PV Device: BLM
Position X: 0.00
PV Area: UND1
Position Y: 0.00
PV Position: 3021
Position Z: 0.00
Type: Link Node Channel
Link N...hannel: 37 (B921-2225) BLM C

MPS Configuration Editor

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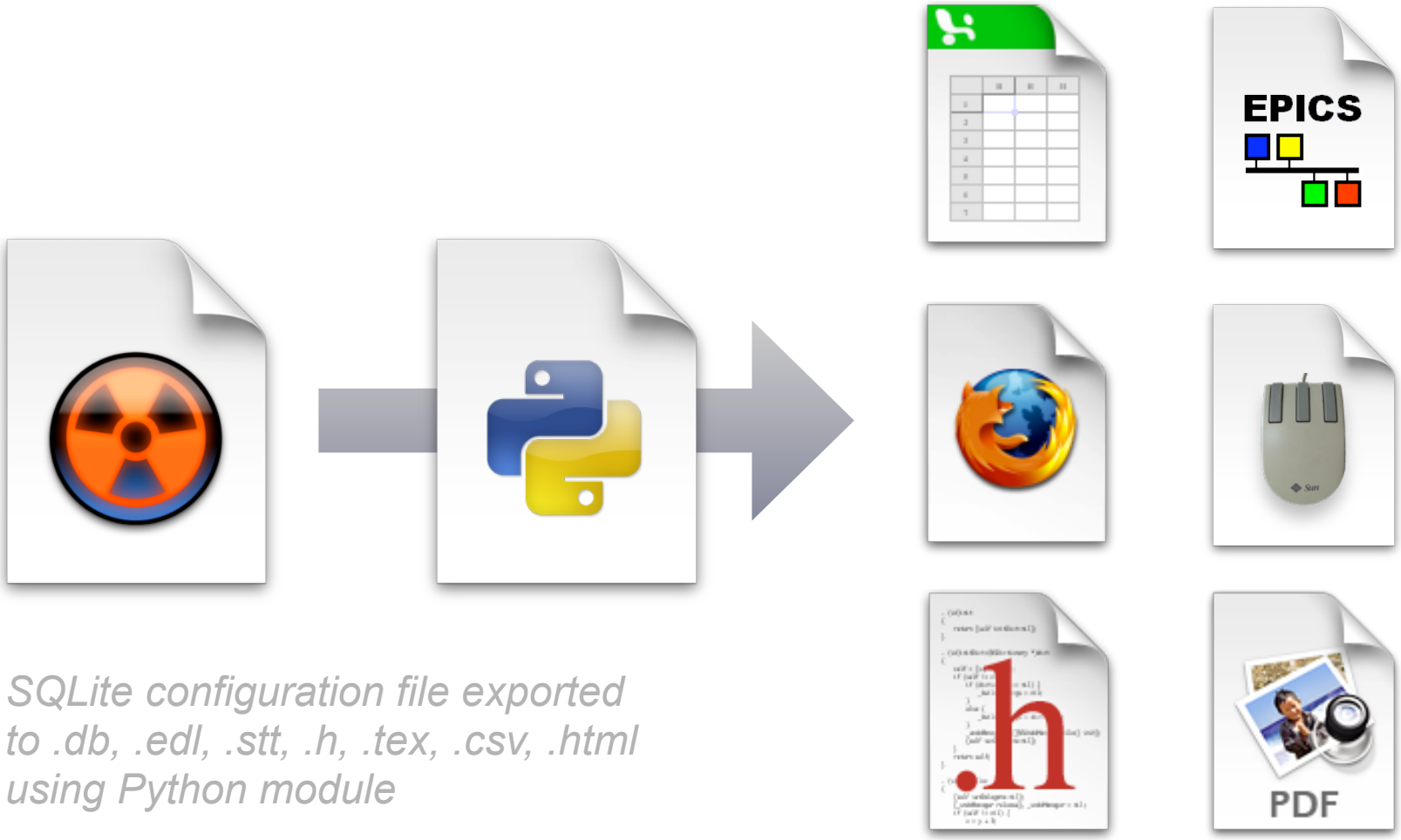
Configuration Control



SQLite configuration file exported to .db, .edl, .stt, .h, .tex, .csv, .html using Python module

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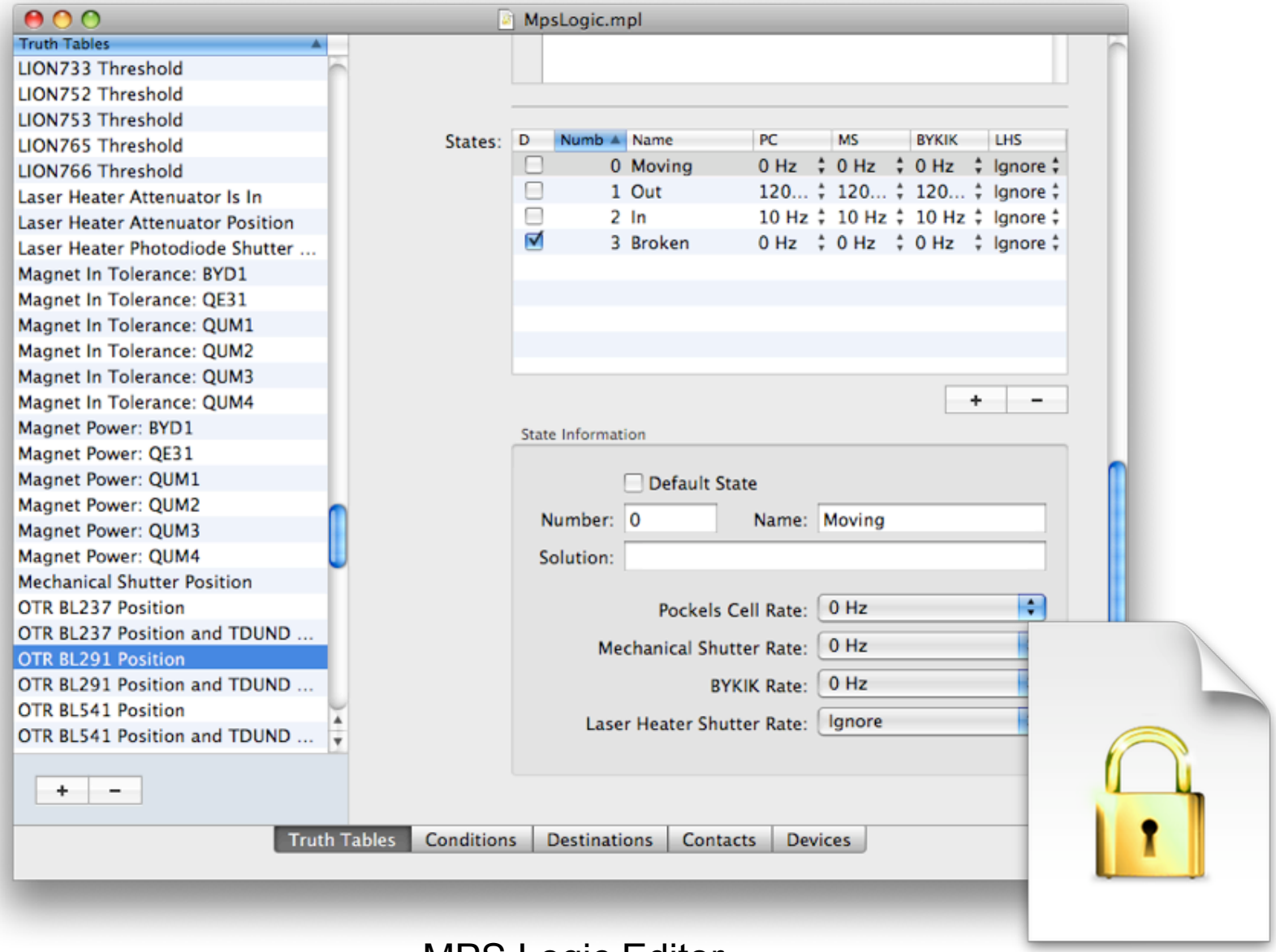
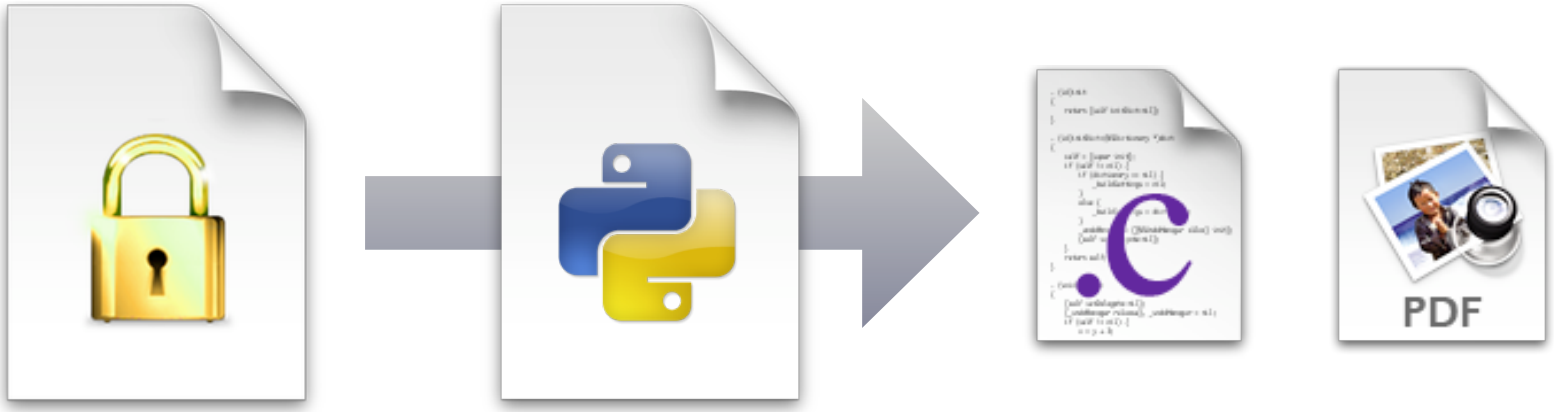


MPS Logic Editor

MPS Logic



SQLite MPS Logic file exported to .c and .tex using Python module

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MPS Logic Documentation

6.13 OTRH2 Moving/Broken

Name	*B*	*A*	PC	MS	BYKIK	LHS
Moving	F	F	0 Hz	0 Hz	0 Hz	0 Hz
Broken	T	T	0 Hz	0 Hz	0 Hz	0 Hz

Where
A = OTRH2_OUT_LIMIT_STATE,
B = OTRH2_IN_LIMIT_STATE

6.14 TDUND Position

Name	*B*	*A*	PC	MS	BYKIK	LHS
Moving	F	F	0 Hz	0 Hz	0 Hz	–
Out	F	T	–	–	–	–
In	T	F	–	–	10 Hz	–
Broken	T	T	0 Hz	0 Hz	0 Hz	–

Where
A = TDUND_OUT_POSITION,
B = TDUND_IN_POSITION

6.15 VACFS LTU1 102 Position

Name	*A*	PC	MS	BYKIK	LHS
Not Out	F	0 Hz	0 Hz	0 Hz	–
Out	T	120 Hz	120 Hz	120 Hz	–

Where
A = VACFS_LTU1_102_STATE

6.16 VACV DMP 100 Position

Name	*A*	PC	MS	BYKIK	LHS
Not Out	F	0 Hz	0 Hz	0 Hz	–
Out	T	120 Hz	120 Hz	120 Hz	–

Where
A = VACV_DMP_100_STATE

6.14 TDUND Position

Name	*B*	*A*	PC	MS	B
Moving	F	F	0 Hz	0 Hz	0
Out	F	T	–	–	
In	T	F	–	–	10
Broken	T	T	0 Hz	0 Hz	0

Where
A = TDUND_OUT_POSITION,
B = TDUND_IN_POSITION

MPS User Interface

MpsGui Beta [Built 2009-04-23] Summary

Pockels Cell	Mechanical Shutter	BYKIK	Laser Heater
MPS Rate Limits			
120 Hz	120 Hz	120 Hz	120 Hz
Requested Beam Rates			
10.0	N/A	N/A	
Actual Beam Rates			
10.0	10.0	10.0	

Name	State	Min Rate	Pockels Cell	Mech Shutter	BYKI
BLM Argonne Heartbeat (LN32)	OK	120 Hz	120 Hz	120 Hz	120
BLM Argonne Heartbeat (LN33)	OK	120 Hz	120 Hz	120 Hz	120
BLM Argonne Heartbeat (LN35)	OK	120 Hz	120 Hz	120 Hz	120
BLM Argonne Heartbeat (LN36)	OK	120 Hz	120 Hz	120 Hz	120
BLM Argonne Heartbeat (LN37)	OK	120 Hz	120 Hz	120 Hz	120
BLM HVPS LTU1 762	OK	120 Hz	120 Hz	120 Hz	120
BLM HVPS UND1 120	OK	120 Hz	120 Hz	120 Hz	120
BLM HVPS UND1 1720	OK	120 Hz	120 Hz	120 Hz	120
BLM HVPS UND1 2221	OK	120 Hz	120 Hz	120 Hz	120

Bypassed Faults

Exp Date	PV
06/08 18:19:57	BEND:BSY0:41:STATE
06/08 18:23:18	BLM:LTU1:722:LOSS_H

Summary / Faults / Logic / History / CUD

MpsGui Beta [Built 2009-04-23] Logic

Name	State	Min Rate	Pockels Cell	Mech Shutter	BYKIK	Heater Shutter
BPM Summary (19-27)	OK	120 Hz	120 Hz	120 Hz	120 Hz	--
BPM Summary (28-36)	OK	120 Hz	120 Hz	120 Hz	120 Hz	--
BYKIK 30 Hz Abort Trigger	OK	120 Hz	120 Hz	120 Hz	120 Hz	--
BYKIK 30 Hz Standby Trigger	OK	120 Hz	120 Hz	120 Hz	120 Hz	--
BYKIK Readback Signal	OK	120 Hz	120 Hz	120 Hz	120 Hz	--
Beam Finder Wires Inserted Count	No BFWs In	120 Hz	120 Hz	120 Hz	120 Hz	--
LION404 Threshold	OK	120 Hz	120 Hz	120 Hz	120 Hz	--
LION405 Threshold	OK	120 Hz	120 Hz	120 Hz	120 Hz	--
LION504 Threshold	OK	120 Hz	120 Hz	120 Hz	120 Hz	--
LION505 Threshold	OK	120 Hz	120 Hz	120 Hz	120 Hz	--
LION584 Threshold	OK	120 Hz	120 Hz	120 Hz	120 Hz	--
LION585 Threshold	OK	120 Hz	120 Hz	120 Hz	120 Hz	--
LION716 Threshold	OK	120 Hz	120 Hz	120 Hz	120 Hz	--

Selection Details

Name: BYKIK Readback Signal
Current State: BYKIK Readback Signal
Solution:

Truth Table

State	Min Rate	Pockels Cell	Mech Shutter	BYKIK	Heater Shutter
Under Threshold	0 Hz	0 Hz	0 Hz	0 Hz	--
Over Threshold	0 Hz	0 Hz	0 Hz	0 Hz	--
OK	120 Hz	120 Hz	120 Hz	120 Hz	--
Broken	0 Hz	0 Hz	0 Hz	0 Hz	--

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Summary / Faults / Logic / History / CUD