# **DEVELOPMENT OF POST-MORTEM VIEWER FOR THE TAIWAN PHOTON SOURCE**

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#### ABSTRACT

The Taiwan Photon Source (TPS) is a 3-GeV third-generation synchrotron light source located in Hsinchu, Taiwan. The postmortem (PM) system is act as an important tool to diagnostic the cause of trip events caused by beam loss. A MATLAB-based and webbased viewer were developed to plot and view the each event to understand the cause and effect of the event. The post-mortem viewer architecture and implementation were presented in this report.

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### **DATA STORAGE SERVER AND VIEWER**

#### **SYSTEM DESCRIPTION**

- The architecture of the TPS PM system is shown in Fig. 1.
- The system includes the beam trip detector, EPICS embedded standalone data recorders, data storage server and viewer.
- The main system features are the following: generate a trigger signal to data recorders when the stored beam current is lost abnormally; record relevant signals to server when a beam trip occurs; view the report from the GUI tool or web browser to analyze each event for cause and effect.
- The flow char of the save program is shown in



Fig. 1: Schematic layout of the TPS PM system.





*Fig. 5: Plot page of vacuum interlock event.* 



Fig. 8: Demonstrations of the data cursor and dual cursors functions. The data sampling point will be displayed, when the x-axis is zoom in into a certain level.

Fig. 6: Kicker waveforms during spontaneous fired kickers K1, K3, and K4 while the K2 is misfired causing a beam trip.



Fig. 2: Flow char of the save program.

#### **POST-MORTEM VIEWER GUI**

#### **PM Viewer**

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- The PM Viewer GUI is designed to list and plot beam trip events and the graphic user interface is developed with the Matlab's GUI-building tool as shown in Fig. 3.
- It can list the beam trip event with a simple note and provide a signal list check box to select for display the desired data, which can be downloaded from the server using the FTP protocol.
- The flow char of the plot function is shown in Fig. 4.
- Figure 5 shows that the vacuum interlock is active during 400 mA operation. The RF system is shut down within a few milliseconds. Finally, the BPM position interlock is active.
- Some kickers were unexpectedly fired without system trigger signal, causing an instant loss of the electron beam, as shown in Fig. 6.
- A customized toolbar can provide simple data adjustment functions as shown in Fig. 7.



#### Web-based Viewer

- The web-based viewer of the beam trip report is designed to list and view beam trip events. The main developed is by the page Python/Django tool with SQLite database as shown in Fig. 9.
- As shown in Fig. 10, the report is generated from the report generator immediately or from the PM Viewer GUI later (regenerate).
- The report contains the information including the timestamp of the trip event, note, beam current, kicker waveforms, subsystem interlock waveforms, history of the beam current, and machine parameters. This web-based interface is useful to quickly review a trip event by any device through the web browser.

*Fig. 4: Flow char of the plot function.* Fig. 7: Text description of the illustration toolbar.

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e Name gnals	TPS Post-r	nortem (Beam Tri -28 13:15:34.760447	p) Report List		
	Timestamp 🔻	Note 🗠	Beam Current	Report Link 🗠	Created At 🗠
	20170927-200504	[K1&K3&K4 Spontaneous fire]	301.50 mA to -0.25 mA	http://172.18.0.40/static/20170927-200504.html	09/27/2017 11:04 p
	20170926-134731	[K1&K3&K4 Spontaneous fire]	301.69 mA to -0.27 mA	http://172.18.0.40/static/20170926-134731.html	09/26/2017 2:25 p.
	20170926-060359	[Kicker Dump Beam]	120.32 mA to 104.10 mA	http://172.18.0.40/static/20170926-060359.html	09/26/2017 2:48 p.
	20170926-051210	[Kicker Dump Beam]	30.35 mA to -0.18 mA	http://172.18.0.40/static/20170926-051210.html	09/26/2017 5:13 a.
	20170926-031355	[Kicker Dump Beam]	29.36 mA to 16.64 mA	http://172.18.0.40/static/20170926-031355.html	09/26/2017 3:14 a.
	20170926-024011	[POS ILK Active]	30.40 mA to -0.17 mA	http://172.18.0.40/static/20170926-024011.html	09/26/2017 2:41 a
	20170925-085858	[Kicker Dump Beam]	150.09 mA to 137.92 mA	http://172.18.0.40/static/20170925-085858.html	09/25/2017 8:59 a
	20170925-005856	[Kicker Dump Beam]	121.44 mA to 104.09 mA	http://172.18.0.40/static/20170925-005856.html	09/25/2017 12:59
	20170924-225323	[Kicker Dump Beam]	47.64 mA to 35.41 mA	http://172.18.0.40/static/20170924-225323.html	09/24/2017 10:54
	20170924-220230	[SRF Trip]	219.06 mA to -0.23 mA	http://172.18.0.40/static/20170924-220230.html	09/24/2017 10:03
	20170924-181323	[SRF Trip]	104.87 mA to -0.23 mA	http://172.18.0.40/static/20170924-181323.html	09/24/2017 6:14 p
Delete Not Jpdate Signals	20170924-175602	[SRF Trip]	109.05 mA to -0.23 mA	http://172.18.0.40/static/20170924-175602.html	09/24/2017 5:56 p
	20170924-174636	[SRF Trip]	280.33 mA to -0.24 mA	http://172.18.0.40/static/20170924-174636.html	09/24/2017 5:47 p
	20170924-100407	-	125.37 mA to 105.39 mA	http://172.18.0.40/static/20170924-100407.html	09/24/2017 11:26
	20170924-011107	K2 & K3 WF Abnormal	299.96 mA to -0.25 mA	http://172.18.0.40/static/20170924-011107.html	09/26/2017 9:57 a
	20170922-194313	-	262.94 mA to 262.94 mA	http://172.18.0.40/static/20170922-194313.html	09/22/2017 7:44 p
	20170920-075657	[POS ILK Active]	301.49 mA to -0.28 mA	http://172.18.0.40/static/20170920-075657.html	09/20/2017 7:57 a
	20170918-220427	[Kicker Dump Beam]	88.01 mA to 67.61 mA	http://172.18.0.40/static/20170918-220427.html	09/18/2017 10:05
	20170918-174307	[Kicker Dump Beam]	259.60 mA to 238.15 mA	http://172.18.0.40/static/20170918-174307.html	09/18/2017 5:43 p
	20170918-160519	[SRF Trip]	150.14 mA to -0.23 mA	http://172.18.0.40/static/20170918-160519.html	09/18/2017 4:06 p

Fig. 9: Web interface of TPS beam trip report list.

SR-PS-INJ-K3:getHV = 8.010000228882 (20170927-20052) SR-PS-INJ-K4:getHV = 7.915999889374 (20170927-200521 T560:getADelay = 176928 (20170926-050116) T560:getBDelay 176932 (20170926-050116) T560:getCDelay = 177072 (20170926-050116 T560:getDDelay = 177011 0926-051720) 0 (20170926-050010) TI-INJ-PROC:setBunchMode TI-INJ-PROC:setBeamCurrentTopupHi = 0012207 (20170926-141102) I-INJ-PROC:setBeamCurrentTopupLo = 300 (20170926-141058) TI-INJ-PROC:setBucketAddress = 330 (20170927-200504) TI-INJ-PROC:setBucketAddressStart 100 (20170926-060412) TI-INJ-PROC:setBucketAddressStep = 10 (20170926-060413) TI-INJ-PROC:setBucketAddressLast 600 (20170926-060412) TI-INJ-PROC:getTrig-LI-SYS = 1 (20170927-200521) TI-INJ-PROC:getTrig-BR-SYS = 1 (20170927-200521) 0 (20170927-200521 TI-INJ-PROC:getTrig-BR-INJ : TI-INJ-PROC:getTrig-BR-EXT = 0 (20170927-200521) TI-INJ-PROC:getTrig-SR-SEPTUM 0 (20170927-200521 TI-INJ-PROC:getTrig-SR-KICKER : 0 (20170927-200521 SR-SAF-MPS:CIA03-X33-X48-Latch.B4 0 (20170927-200521 SR-SAF-MPS:CIA05-X33-X48-Latch.B4 = 0 (20170927-200521) SR-SAF-MPS:CIA11-X33-X48-Latch.B4 = 0 (20170927-200521 SR-SAF-MPS:CIA12-X33-X48-Latch.B4 = 0 (20170927-200521) SR-SAF-MPS:CIA13-X33-X48-Latch.B3 = 0 (20170927-200521 SR-SAF-MPS:CIA13-X33-X48-Latch.B4 = 0 (20170927-200521) SR-SAF-MPS:CIA21-X33-X48-Latch.B4 = 0 (20170927-200521) SR-SAF-MPS:CIA23-X33-X48-Latch.B4 = (20170927-200521)  $= = = = = = = = = \lambda_{larm}$  List = = = = = = = = = ()TPS-ALM-LIST:list0 = 2017/09/26 06:23:22 BFM stdLim Fault (20170926-062323 TPS-ALM-LIST:list1 = 2017/09/27 20:05:05 Stop Injection (20170927-200506) TPS-ALM-LIST:list2 = 2017/09/27 20:05:07 SR-RF2-LLRF Fault (20170927-200508 TPS-ALM-LIST:list3 = (20170925-17281 TPS-ALM-LIST:list4 = (20170925-17281 TPS-ALM-LIST:list5 = (20170925-172815 TPS-ALM-LIST:list6 = (20170925-172815 TPS-ALM-LIST:list7 = (20170925-17281 TPS-ALM-LIST:list8 = (20170925-172815 TPS-ALM-LIST:list9 = (20170925-172815 TPS-ALM-LIST:list10 = (20170925-172815 TPS-ALM-LIST:list11 = (20170925-172815 TPS-ALM-LIST:list12 = (20170925-172815 TPS-ALM-LIST:list13 = (20170925-172815 TPS-ALM-LIST:list14 = (20170925-172815 TPS-ALM-LIST:list15 = (20170925-172815 TPS-ALM-LIST:list16 = (20170925-172815 TPS-ALM-LIST:list17 = (20170925-172815 TPS-ALM-LIST:list18 = (20170925-172815 TPS-ALM-LIST:list19 = (20170925-172815 TPS-ALM-LIST:list20 = (20170925-172815 TPS-ALM-LIST:list21 = (20170925-172815 TPS-ALM-LIST:list22 = (20170925-172815 TPS-ALM-LIST:list23 = (20170925-172815 TPS-ALM-LIST:list24 = (20170925-172815

Fig. 10: Web page of beam trip report.

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