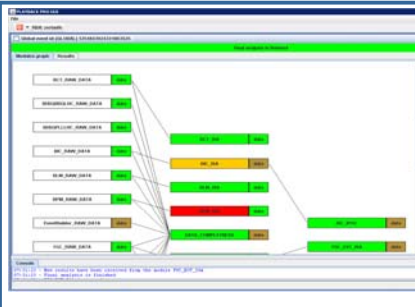


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Abstract

The LHC with its unprecedented complexity and criticality of beam operation will need thorough analysis of data taken from systems such as power converters, interlocks and beam instrumentation during events like magnet quenches and beam loss. The causes of beam aborts or in the worst case equipment damage have to be revealed to improve operational procedures and protection systems. The correct functioning of the protection systems with their required redundancy has to be verified after each event. Post mortem analysis software for the control room has been prepared with automated analysis packages in view of the large number of systems and data volume. The chosen implementation has been a multi-level analysis framework, allowing for automated analysis and qualification of a beam dump events based on expert provided analysis modules.

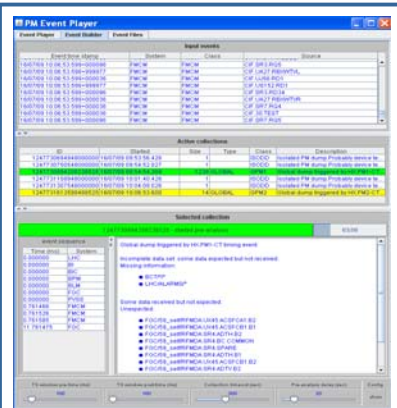
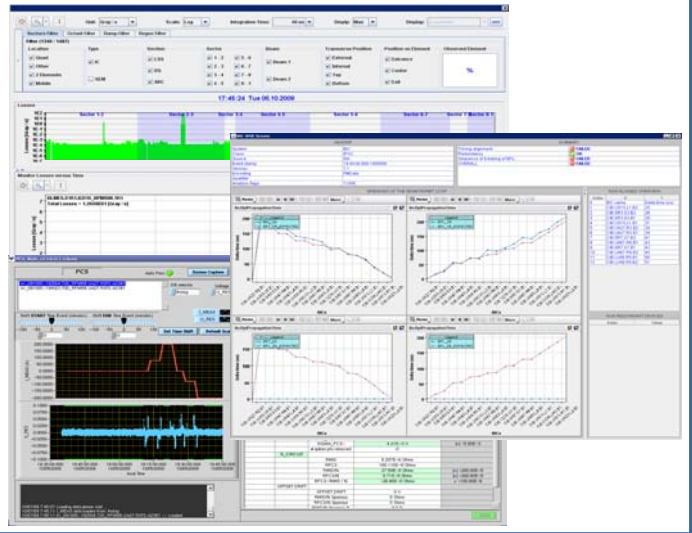


PMA Scheduler

Based on event type, a predefined configuration of analysis will be scheduled for execution. Status and dependencies of analysis modules will be monitored throughout the analysis session and according bookkeeping of errors is provided.

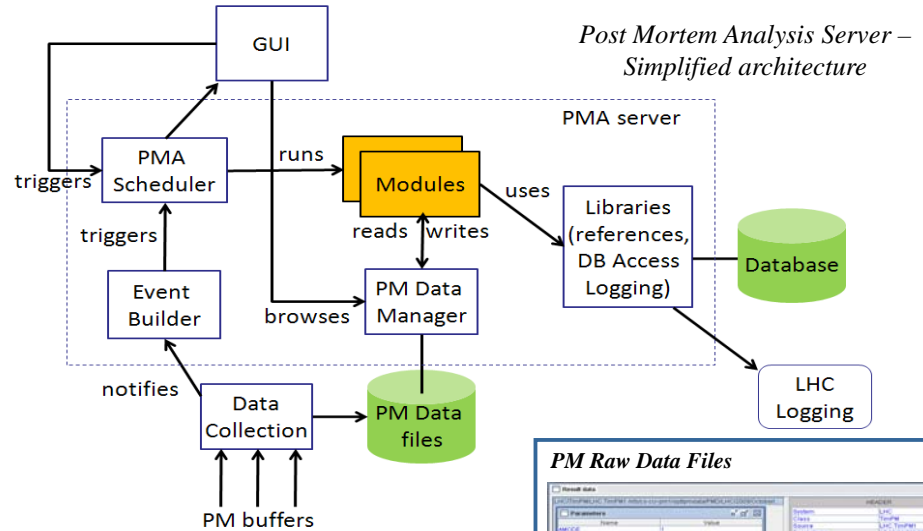
GUI and Analysis Modules

Numerous analysis modules for magnet powering, beam losses and orbit, machine protection, etc.. have been implemented for commissioning and later operation (using different programming languages) and were integrated into the Analysis Framework.

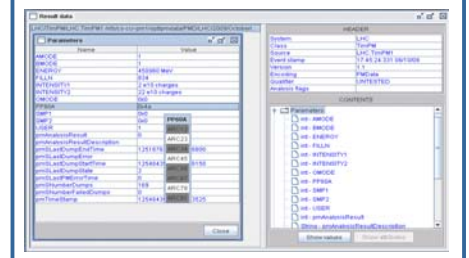


Event Building

Based on pattern recognition in the incoming PM data stream. Multiple event builders might run in parallel and provide event details to framework for detailed analysis.



PM Raw Data Files



FR Server Name	Status	First Connection Time	Last Status Change	Last Dump	Number of Dumps
PM BCT-MAN	connected	230909 12 32 48 39 2	0601009 17 45 26 272		4
PM BCT-SPARE	connected	230909 12 32 48 39 2			0
PM BI-MAN	connected	230909 12 32 48 165	0601009 17 45 45 110		8
PM BI-SPARE	connected	230909 12 34 33 265			0
PM BIC-MAN	connected	230909 12 34 08 351	0601009 17 45 26 138		30
PM BIC-SPARE	connected	230909 12 34 08 36 3			0
PM BEL-MAN	connected	230909 12 34 08 28 2	0601009 17 46 11 835		24
PM BEL-M-SPARE	connected	230909 12 34 03 291			0
PM BFM-MAN	connected	230909 12 33 48 48 3	0601009 17 45 26 684		84
PM BFM-SPARE	connected	230909 12 33 48 21 2			0
PM COLLECTOR	connected	230909 12 33 53 88 3	0701009 01 24 26 391		20
PM COLLC-MAN	connected	230909 12 33 48 428	0601009 14 45 26 045		71
PM COLLC-SPARE	connected	230909 12 34 13 48 1			0
PM FOC-MAN	connected	230909 12 33 48 00 3	0701009 07 37 40 410		4380
PM FOC-SPARE	connected	230909 12 33 48 05 5			0
PM FMC-MAN	connected	230909 12 34 13 48 1	0601009 17 45 30 009		2554
PM FMC-SPARE	connected	230909 12 33 48 48 3			0
PM LEOB-MAN	connected	230909 12 34 18 57 3	0501009 22 39 32 356	0501009 22 38 43 519	12044
PM LEOB-SPARE	connected	230909 12 33 48 56 3	0501009 22 39 13 876		0
PM LHC-MAN	connected	230909 12 34 38 68 1	0601009 17 45 55 601		109
PM LHC-SPARE	connected	230909 12 33 48 67 1			0
PM LHC-EX-MAN	connected	230909 12 33 48 93 3			0
PM LHC-EX-SPARE	connected	230909 12 34 13 48 1			0
PM PVS-MAN	connected	230909 12 33 48 00 3	0601009 17 45 55 233		11
PM PVS-SPARE	connected	230909 12 34 23 68 1			0
PM QPS-MAN	connected	230909 12 33 56 00 8	0701009 07 38 46 231		36811
PM QPS-SPARE	connected	230909 12 33 48 109	230909 12 33 54 580		1

Post Mortem Data Collection

Relies on redundant hardware infrastructure with main and spare collection servers for each client system. Diagnostic and Monitoring tools supervise the functioning of the system and assure coherency of the redundant data storage.

Conclusions

Parts of the LHC Post Mortem System have been extensively exercised during the Hardware Commissioning period of the LHC and valuable experience with equipment systems for magnet powering and the analysis of related data could be gathered. The territory of beam related data is however rather unexplored, and initial operation of the LHC machine will be an important period for the PM system to further tune analysis modules and progress in the understanding of possible correlated failures and their identification. After the initial validation of the system it will become a more and more important challenge to provide tools to compare the results of different beam dump events against each other. The main goal will be the identification of similar fault scenarios and to establish a knowledge database of possible failure scenarios and their detection based on the provided Post Mortem data.