

# Post Mortem, Logging and AccTesting

JC Garnier on behalf of TE-MPE-MS

# Control System Upgrade Strategy for LS2

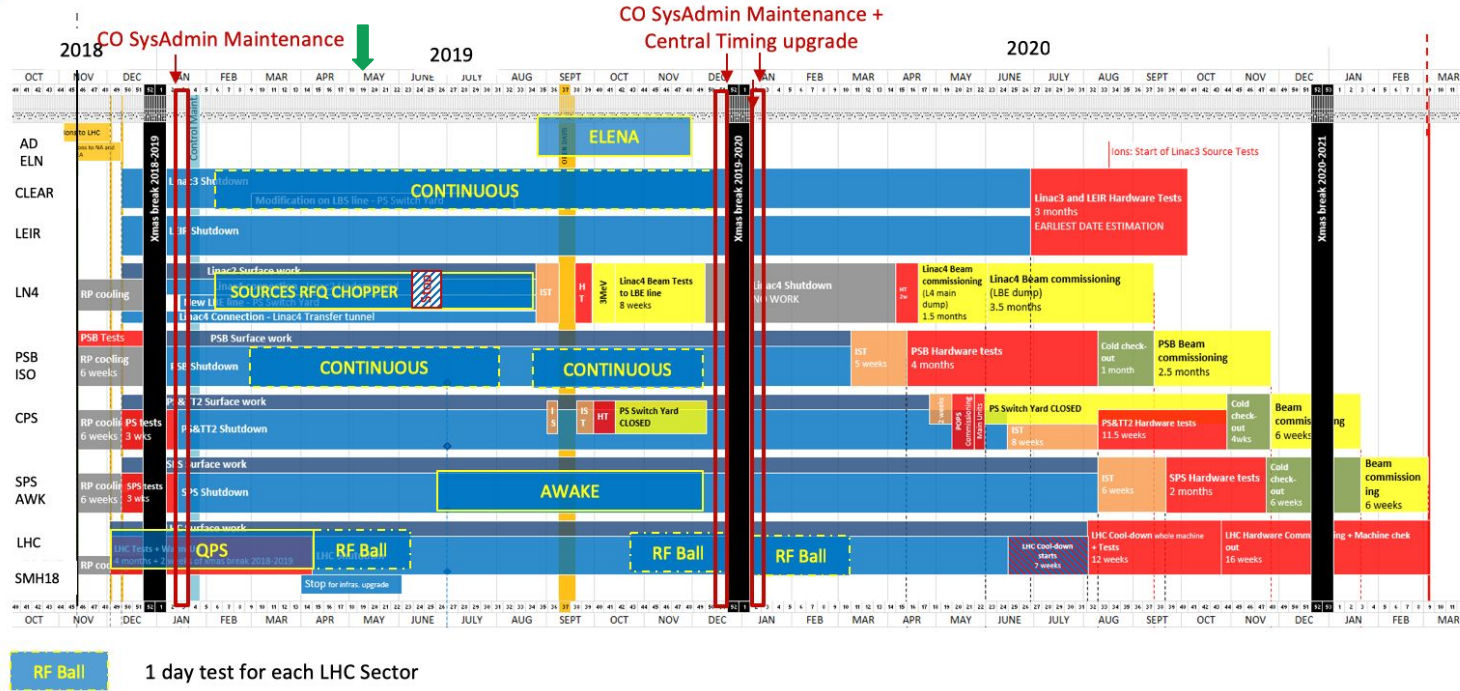
- Early release of LS2 Baseline in January 2019 to fix interfaces (APIs) at the beginning of LS2 and allow developers to adapt
- Baseline = set of controls products and services released together as coherent controls stack. It offers long-term support (until LHC Run 3) w/o requiring modifications due to backward-incompatible changes
- 3 more Baseline Releases distributed until end 2020

LS2 Baseline	LIN4-BEAM Tests Baseline	End-LS2-INJ Baseline	End-LS2-LHC Baseline
14 Jan 2019	17 Jun 2019	13 Jan 2020	29 Jun 2020

- Long Shutdowns seems as opportunity to make necessary breaking changes

## Controls Requirements in LS2 MASTER Planning

EDMS 1687788



# Control System Before/After LS2

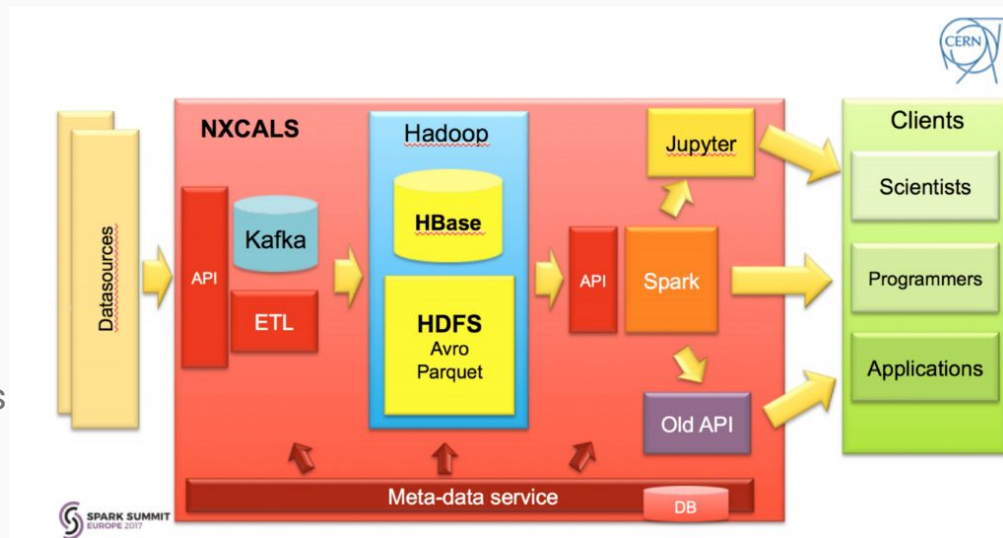
Before	After
SLC5 32b	CC7 64b
DGII or Encore VME drivers	Edge VME driver
C++ 98/03	C++ 11
FESA3 v5	FESA3 v7 or 8
RDA2 + RDA3	RDA3
CALS	NXCALS
PM / RDA2	PM / RDA3 / NXCALS

- End of Life during LS2 for RDA2/FESA2/GM/SLEQUIP/32 bit OS
- WorldFIP upgrades (new MasterFIP) and NanoFIP introduction
- MENA25 boards in addition to MENA20
- Numerous changes in Java ecosystem  
<https://wikis.cern.ch/display/DVTL/Java+LS2+Changes>
  - Is Java 11 coming?

Run 3 will use an entirely new and upgraded control system

# From CALS to NXCALS

- Move from Oracle
- Rely on standard Lambda architecture and standard technologies
  - Balances real-time and batch performance
  - Horizontal scalability
- Better sending analysis jobs to Spark rather than extracting data to analyse locally
  - Second use case supported for backward compability with all clients already extracting data



# NXCALS subscriptions

- Easy definition by the user
- Health checks

CIBX-400.LN4.CH		✘	CIBM	LN4	LastTimingCycle	LN4.USER.ALL	✔	CYCLE	lastCycleName	acc-logging-team	01-01-1970 1:00 am	VALIDATION_IN_ERROR	cern.japc.core.Subscrip	29-04-2019 10:23 am
CIBX-400.LN4.CH		✘	CIBM	LN4	LastTimingCycle	LN4.USER.ALL	✔	CYCLE	microseconds	acc-logging-team	01-01-1970 1:00 am	VALIDATION_IN_ERROR	cern.japc.core.Subscrip	29-04-2019 10:23 am
CIBX-400.LN4.CH		✘	CIBM	LN4	LastTimingCycle	LN4.USER.ALL	✔	CYCLE	monitorStatus	acc-logging-team	01-01-1970 1:00 am	VALIDATION_IN_ERROR	cern.japc.core.Subscrip	29-04-2019 10:23 am
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CIBX-400.LN4.CH		✘	CIBM	LN4	LastTimingCycle	LN4.USER.ALL	✔	CYCLE	visibility	acc-logging-team	01-01-1970 1:00 am	VALIDATION_IN_ERROR	cern.japc.core.Subscrip	29-04-2019 10:23 am
CIBX-400.LN4.CH		✘	CIBM	LN4	LastTimingCycle	LN4.USER.ALL	✔	CYCLE	lastCycleLength	acc-logging-team	01-01-1970 1:00 am	VALIDATION_IN_ERROR	cern.japc.core.Subscrip	29-04-2019 10:23 am
CIBX-400.LN4.CH		✘	CIBM	LN4	LastTimingCycle	LN4.USER.ALL	✔	CYCLE	controlStatus	acc-logging-team	01-01-1970 1:00 am	VALIDATION_IN_ERROR	cern.japc.core.Subscrip	29-04-2019 10:23 am
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CIBX-400.LN4.CH		✘	CIBM	LN4	LastTimingCycle	LN4.USER.ALL	✔	CYCLE	details	acc-logging-team	01-01-1970 1:00 am	VALIDATION_IN_ERROR	cern.japc.core.Subscrip	29-04-2019 10:23 am
CIBX-400.LN4.CH.PUB (5)														
CIBX-400.LN4.RF (11)														
CIBX-400.LN4.RF		✘	CIBM	LN4	LastTimingCycle	LN4.USER.ALL	✔	CYCLE	subtype	acc-logging-team	26-04-2019 4:21 am	VALIDATION_OK		26-04-2019 4:21 am
CIBX-400.LN4.RF		✘	CIBM	LN4	LastTimingCycle	LN4.USER.ALL	✔	CYCLE	details	acc-logging-team	26-04-2019 4:21 am	VALIDATION_OK		26-04-2019 4:21 am
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## Error message

cern.japc.core.SubscriptionProblemException: Cannot start monitoring on CIBM.400.LN4.L4T/LastTimingCycle (Server 'CIBM.cfv-400-cib14t14z' is down or unreachable)

✘ Discard

Copy

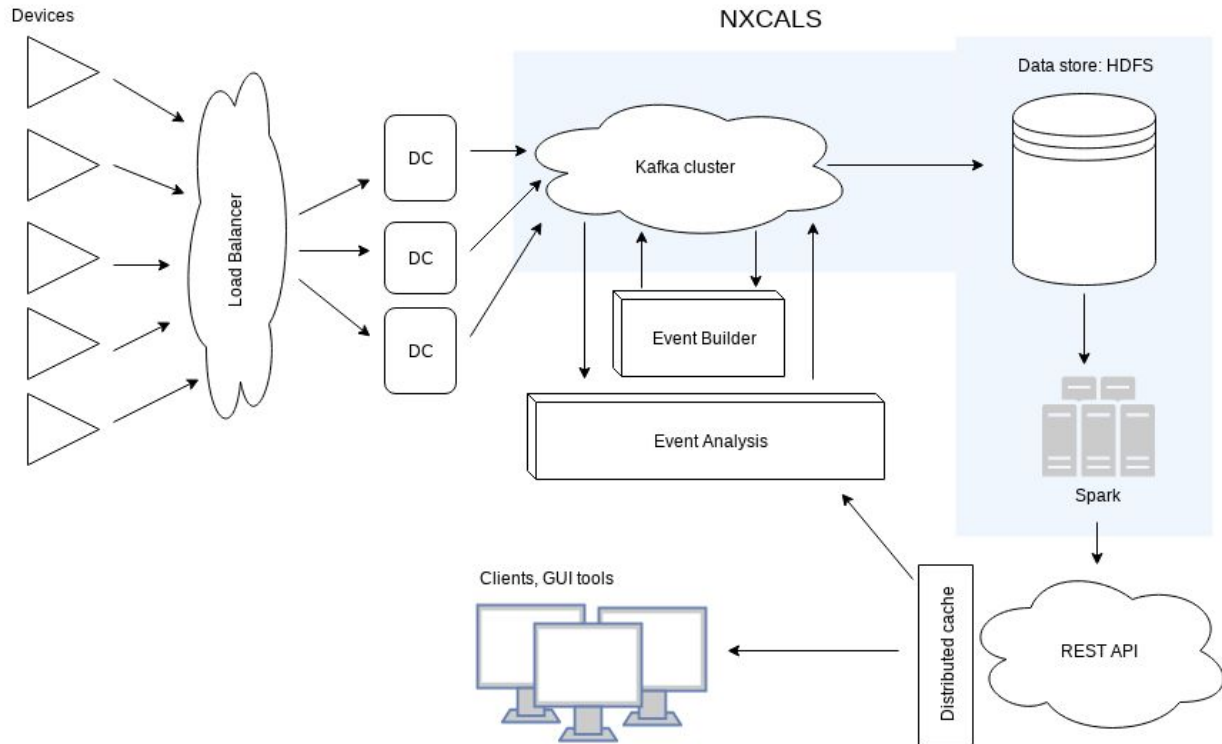
- NXCALS operational and used in parallel to CALS
- CALS will be discontinued once the following criterias have been satisfied:
  - All required historical data from CALS are in NXCALS
  - Backward compatible Java client API has been provided
  - New Timber is available in production
  - The data extraction performance is comparable with CALS
- Timber will be ported to NXCALS
  - Based on Web
- Easy analysis made possible with SWAN project
- NXCALS takes advantage of early adopters to identify shortcomings





# PM in NXCALS

# New PM Architecture



- NXCALs adopted technologies very promising for Post Mortem
- APIs
  - Backward compatible REST API for any languages
  - Backward compatible Java API to minimize impact on existing client applications
- First iteration focused on data extraction
  - Then later enable Spark analysis

- Built-in partitioning
- Better throughput in comparison to other brokers
- Persistence of data
- Replication
- Low latency
- Scalable

"a system optimized for writing"



- It does not affect your resources - you can execute Spark queries on dedicated spark cluster
- It is fast - Spark will divide your query into jobs and execute them in parallel (if possible)
- It is easy to write - you can use Scala with Spark-Shell, Python with PySpark or Java using NXCALS client library
- Issue with latency before data is available for reading
  - Problem for fast use cases like XPOC, IQC and SPSQC
  - Actively working to solve this issue

The screenshot shows the PM Web interface with the following search filters:

- Time filter type: Time range
- Time unit: Date/time (local time)
- Start date (dd/mm/yy...): 29/11/2018
- Start time (hh:mm:ss)\*: 02:00:15 PM
- End Date (dd/mm/yy...): 30/11/2018
- End time (hh:mm:ss)\*: 02:00:15 PM
- System (optional):

The table below shows the event data:

Timestamp ↑	System	Class	Source
Thu Nov 29 2018 - 15:34:29.487363525	PME	GPM1	PM.BE-PM1
Thu Nov 29 2018 - 15:34:29.487363525	PME	GPM1	PM.BE-PM1
Thu Nov 29 2018 - 15:34:29.488000000	PME	XPOC_B2	PM.BE-PM1
Thu Nov 29 2018 - 15:34:29.488000000	PME	XPOC_B1	PM.BE-PM1
Thu Nov 29 2018 - 15:45:42.280238525	PME	POW	PM.BE-PM1
Thu Nov 29 2018 - 15:45:42.280238525	PME	POW	PM.BE-PM1
Thu Nov 29 2018 - 19:04:46.285000000	PME	IQC_B1	PM.BE-PM1
Thu Nov 29 2018 - 19:05:48.685000000	PME	IQC_B2	PM.BE-PM1
Thu Nov 29 2018 - 19:06:51.085000000	PME	IQC_B1	PM.BE-PM1
Thu Nov 29 2018 - 19:07:53.485000000	PME	IQC_B2	PM.BE-PM1
Thu Nov 29 2018 - 19:13:05.485000000	PME	IQC_B2	PM.BE-PM1
Thu Nov 29 2018 - 19:24:16.285000000	PME	IQC_B1	PM.BE-PM1

The screenshot shows the raw entry data and names and values sections:

Multiple datapoints with same header data found, select result: Result 1

### Raw Entry Data

NAME	VALUE
pmDataSource	{ "system": "PME", "clazz": "GPM1", "source": "PM.BE-PM1", "wildcard": false }
pmEventStamp	1543502069487363525
pmAnalysisFlags	INCOMPLETE,INTERESTING XPOC,INTERESTING GPM,NORMAL,INTERESTING BEAM,IN...
sender	pmowner@cs-ccr-pm1.cern.ch
version	1.1
rawDataQualifier	UNTESTED

### Names and Values

Search name

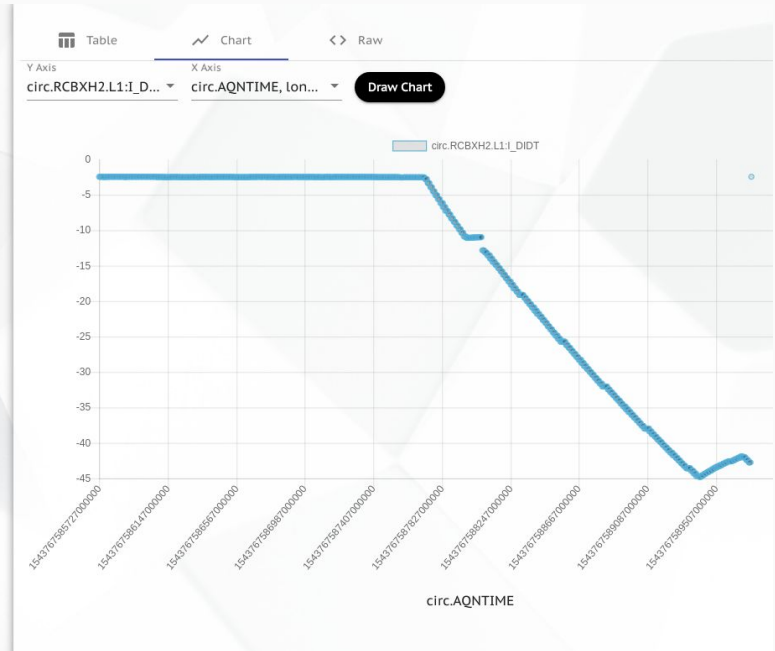
NAME	TYPE	VALUE
windowPreTime	long	100
globalId	String	pre-efcb200e812ce1ea--57f0c6d0-166cef362b0--7fff-154350206953700...
timeRemaining	long	589
eventType	String	GLOBAL
localId	long	1543502069488488525
collectionTimeout	long	720
pmAnalysisResultDesc...	String	<html>Global dump triggered by HX.PM1-CT timing event.  Inc...
startTime	long	1543502069490496000
windowPostTime	long	800

Time filter type: **Time range** | Time unit: **Date/time (local time)** | Start date (dd/mm/yy...): **02/12/2018** | Start time (hh:mm:ss)\*: **04:55:35 PM** | End Date (dd/mm/yy...): **03/12/2018** | **Search** | **Clear**

End time (hh:mm:ss)\*: **04:55:35 PM** | **System (optional): QPS** | **Class (optional):** | **Allow duplicates:**

**Hide Filters**

Timestamp ↑	System	Class	Source
Sun Dec 02 2018 - 17:19:47.727000000	QPS	DQAMGNA	RCBXH2.L1
Sun Dec 02 2018 - 17:19:47.728000000	QPS	DQAMGNA	RCBXH2.L1
Sun Dec 02 2018 - 22:46:39.187000000	QPS	DQAMGNA	RCBXH2.L1
Sun Dec 02 2018 - 22:46:39.188000000	QPS	DQAMGNA	RCBXH2.L1
Mon Dec 03 2018 - 00:42:19.611000000	QPS	DQAMCNMB_PMSTD	272.DT8.AG_01
Mon Dec 03 2018 - 00:42:19.612000000	QPS	DQAMCNMB_PMHSU	272.DT8.AG_01
Mon Dec 03 2018 - 00:42:19.613000000	QPS	DQAMCNMB_PMSTD	272.DT8.AG_01
Mon Dec 03 2018 - 05:08:14.423000000	QPS	DQAMSN600	UJ33.RQ6.L3B2
Mon Dec 03 2018 - 05:08:14.430000000	QPS	DQAMGNA	RQ6.L3B2



- Operational PM Analysis Framework (aka PMA)
  - No changes planned
  - Uses a backward compatible interface to the PM storage
  - Future step
    - Use Spark capabilities to analyse data rather than keep extracting them to analyse them locally
- LabVIEW Tools
  - Adapted to the REST API
- No support for FGC buffer decoding in Post Mortem anymore
  - Dumped self described data directly

- NXCALS should be able to store the necessary amount of data (2TB/week at the moment)
  - Provided that the necessary storage and computing resources are financed, and with an adequate clean-up policy to be implemented
- New use cases coming
  - Larger amount of data per SPS cycle, how large?
- Desire to interlock next cycles in case of error, what's the time constraint for analysis?
- How's the NXCALS latency impacting SPSQC?



# Recommissioning with AccTesting

- Adapt to new baseline
- Test driven PM Event builder to improve Powering test analysis
  - Improve communication between AccTesting and PMEA
  - Reduce cross-talk between tests
- Better integration between the back-end components
  - PMEA, AccTesting, HWC Sequencer
    - And also MoIR and PMA
- Better integration with PMEA for the users
  - Not using 2 GUIs anymore
- Plan to support BIS and WIC commissioning with AccTesting and MoIR (a modular remote execution and debugging framework)

# Software Upgrades and Validation + Powering and Protection Testbed

- Run 3 will use the same process as in Run 2
  - Registered in Control Change web service ([asm.cern.ch/cc](http://asm.cern.ch/cc))
  - Discussed with OP to evaluate their impact and the need for a CCR
  - Reviewed with all other Software Upgrades and scheduled accordingly
  - Tested in CCC with (as close as possible) operational conditions prior to deployment at a specific time slot
- Powering and Machine Protection Testbed
  - Rely on GPN and BE-CO's TestBed environment
  - Validate full vertical slice with hardware, firmware, low-level control, Configuration DB, AccTesting, LSA coming soon

- Control System LS2 Baseline should be ready for LN4 LBE Run by end of June 2019
  - Opportunity to validate core BE-CO products in operation
- NXCALS is already operational
- Post Mortem is on track for the Global, Powering
  - Solution under study for the XPOC, IQC and SPSQC over the summer
- Priorities to be defined as a function of available resources...