DATABASES

- LAYOUT
- FESA
- (MAD)
- LSA – CONTROLS
- MEASUREMENT
- LOGGING

Layout database

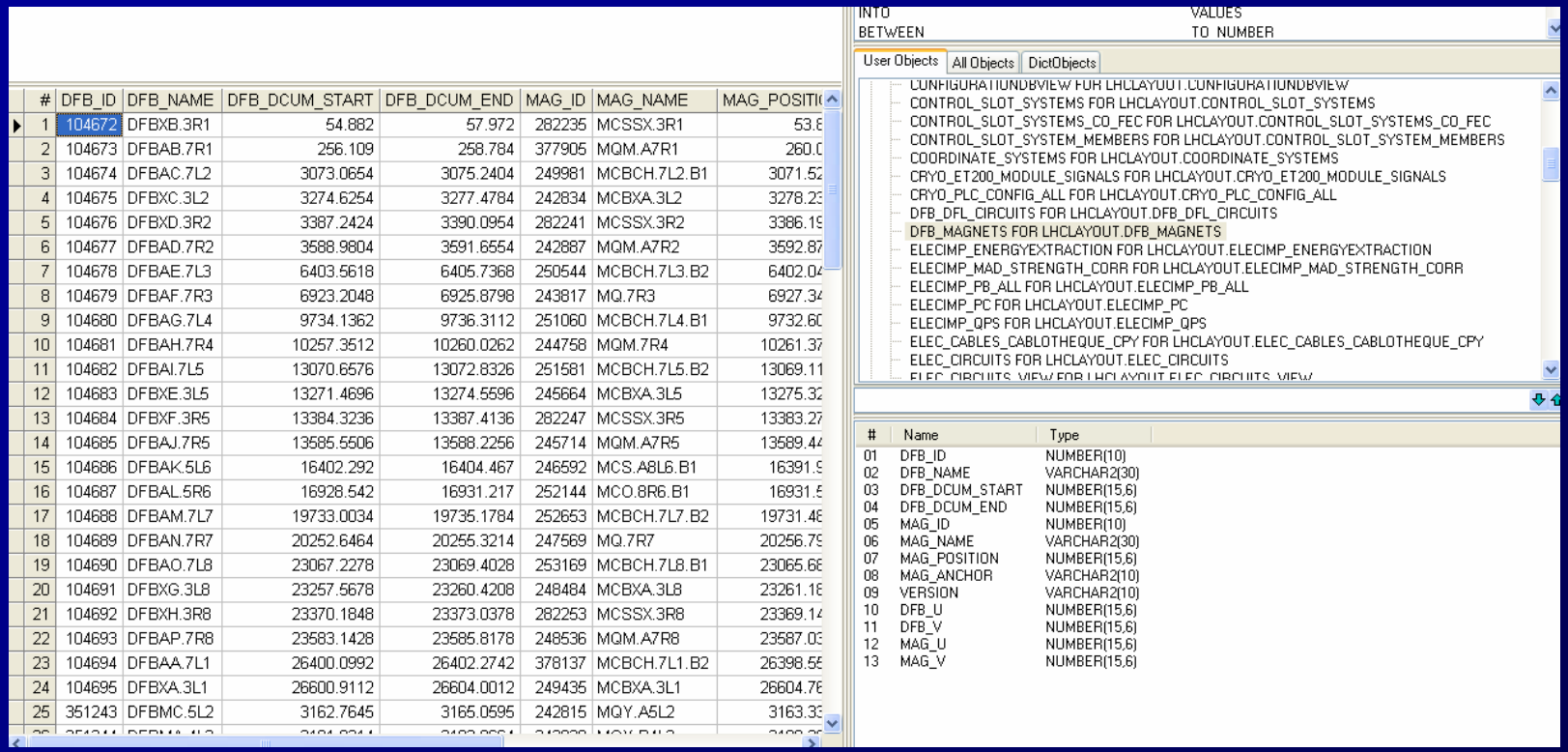
The **LHC Reference Database** is designed to store all data pertaining to the collider, its components, their **layout**, their manufacturing as a large unified tool.

Samy CHEMLI and team

It covers

Beam Instrumentation
Collimators and Aperture Limiters,
Cryomagnets and Warm Magnets,
Distribution Feed Boxes and Current Leads,
Injection and Beam Dumps,
Power Converters,
RF System,
Vacuum
Cables and Cable Trays,
Cooling and Ventilation,
Electronic racks,
Tunnel Cryogenic System
Monorail,
Space Reserved for Alignment,
Space Reserved for Transport,
Steel Structures,
Tunnel Geometry (floor height, local geometry, drain covers).

It is source number 1



#	DFB_ID	DFB_NAME	DFB_DCUM_START	DFB_DCUM_END	MAG_ID	MAG_NAME	MAG_POSITI
1	104672	DFBXB.3R1	54.882	57.972	282235	MCSSX.3R1	53.8
2	104673	DFBAB.7R1	256.109	258.784	377905	MQM.A7R1	260.0
3	104674	DFBAC.7L2	3073.0654	3075.2404	249981	MCBCH.7L2.B1	3071.52
4	104675	DFBXC.3L2	3274.6254	3277.4784	242834	MCBXA.3L2	3278.23
5	104676	DFBXD.3R2	3387.2424	3390.0954	282241	MCSSX.3R2	3386.19
6	104677	DFBAD.7R2	3588.9804	3591.6554	242887	MQM.A7R2	3592.87
7	104678	DFBAE.7L3	6403.5618	6405.7368	250544	MCBCH.7L3.B2	6402.04
8	104679	DFBAF.7R3	6923.2048	6925.8798	243817	MQ.7R3	6927.34
9	104680	DFBAG.7L4	9734.1362	9736.3112	251060	MCBCH.7L4.B1	9732.60
10	104681	DFBAH.7R4	10257.3512	10260.0262	244758	MQM.7R4	10261.37
11	104682	DFBAI.7L5	13070.6576	13072.8326	251581	MCBCH.7L5.B2	13069.11
12	104683	DFBXE.3L5	13271.4696	13274.5596	245664	MCBXA.3L5	13275.32
13	104684	DFBXF.3R5	13384.3236	13387.4136	282247	MCSSX.3R5	13383.27
14	104685	DFBAJ.7R5	13585.5506	13588.2256	245714	MQM.A7R5	13589.44
15	104686	DFBAK.5L6	16402.292	16404.467	246592	MCS.A8L6.B1	16391.9
16	104687	DFBAL.5R6	16928.542	16931.217	252144	MCO.8R6.B1	16931.5
17	104688	DFBAM.7L7	19733.0034	19735.1784	252653	MCBCH.7L7.B2	19731.48
18	104689	DFBAN.7R7	20252.6464	20255.3214	247569	MQ.7R7	20256.79
19	104690	DFBAO.7L8	23067.2278	23069.4028	253169	MCBCH.7L8.B1	23065.68
20	104691	DFBXG.3L8	23257.5678	23260.4208	248484	MCBXA.3L8	23261.18
21	104692	DFBXH.3R8	23370.1848	23373.0378	282253	MCSSX.3R8	23369.14
22	104693	DFBAP.7R8	23583.1428	23585.8178	248536	MQM.A7R8	23587.03
23	104694	DFBAA.7L1	26400.0992	26402.2742	378137	MCBCH.7L1.B2	26398.55
24	104695	DFBXA.3L1	26600.9112	26604.0012	249435	MCBXA.3L1	26604.78
25	351243	DFBMC.5L2	3162.7645	3165.0595	242815	MQY.A5L2	3163.33

INTO VALUES
BETWEEN TO_NUMBER

User Objects | All Objects | DictObjects

CONFIGURATIONDBVIEW FOR LHCLAYOUT.CONFIGURATIONDBVIEW
CONTROL_SLOT_SYSTEMS FOR LHCLAYOUT.CONTROL_SLOT_SYSTEMS
CONTROL_SLOT_SYSTEMS_CO_FEC FOR LHCLAYOUT.CONTROL_SLOT_SYSTEMS_CO_FEC
CONTROL_SLOT_SYSTEM_MEMBERS FOR LHCLAYOUT.CONTROL_SLOT_SYSTEM_MEMBERS
COORDINATE_SYSTEMS FOR LHCLAYOUT.COORDINATE_SYSTEMS
CRYO_ET200_MODULE_SIGNALS FOR LHCLAYOUT.CRYO_ET200_MODULE_SIGNALS
CRYO_PLC_CONFIG_ALL FOR LHCLAYOUT.CRYO_PLC_CONFIG_ALL
DFB_DFL_CIRCUITS FOR LHCLAYOUT.DFB_DFL_CIRCUITS
DFB_MAGNETS FOR LHCLAYOUT.DFB_MAGNETS
ELECIMP_ENERGYEXTRACTION FOR LHCLAYOUT.ELECIMP_ENERGYEXTRACTION
ELECIMP_MAD_STRENGTH_CORR FOR LHCLAYOUT.ELECIMP_MAD_STRENGTH_CORR
ELECIMP_PB_ALL FOR LHCLAYOUT.ELECIMP_PB_ALL
ELECIMP_PC FOR LHCLAYOUT.ELECIMP_PC
ELECIMP_QPS FOR LHCLAYOUT.ELECIMP_QPS
ELEC_CABLES_CABLOTHEQUE_CPY FOR LHCLAYOUT.ELEC_CABLES_CABLOTHEQUE_CPY
ELEC_CIRCUITS FOR LHCLAYOUT.ELEC_CIRCUITS
ELEC_CIRCUITS_VIEW FOR LHCLAYOUT.ELEC_CIRCUITS_VIEW

#	Name	Type
01	DFB_ID	NUMBER(10)
02	DFB_NAME	VARCHAR2(30)
03	DFB_DCUM_START	NUMBER(15,6)
04	DFB_DCUM_END	NUMBER(15,6)
05	MAG_ID	NUMBER(10)
06	MAG_NAME	VARCHAR2(30)
07	MAG_POSITION	NUMBER(15,6)
08	MAG_ANCHOR	VARCHAR2(10)
09	VERSION	VARCHAR2(10)
10	DFB_U	NUMBER(15,6)
11	DFB_V	NUMBER(15,6)
12	MAG_U	NUMBER(15,6)
13	MAG_V	NUMBER(15,6)

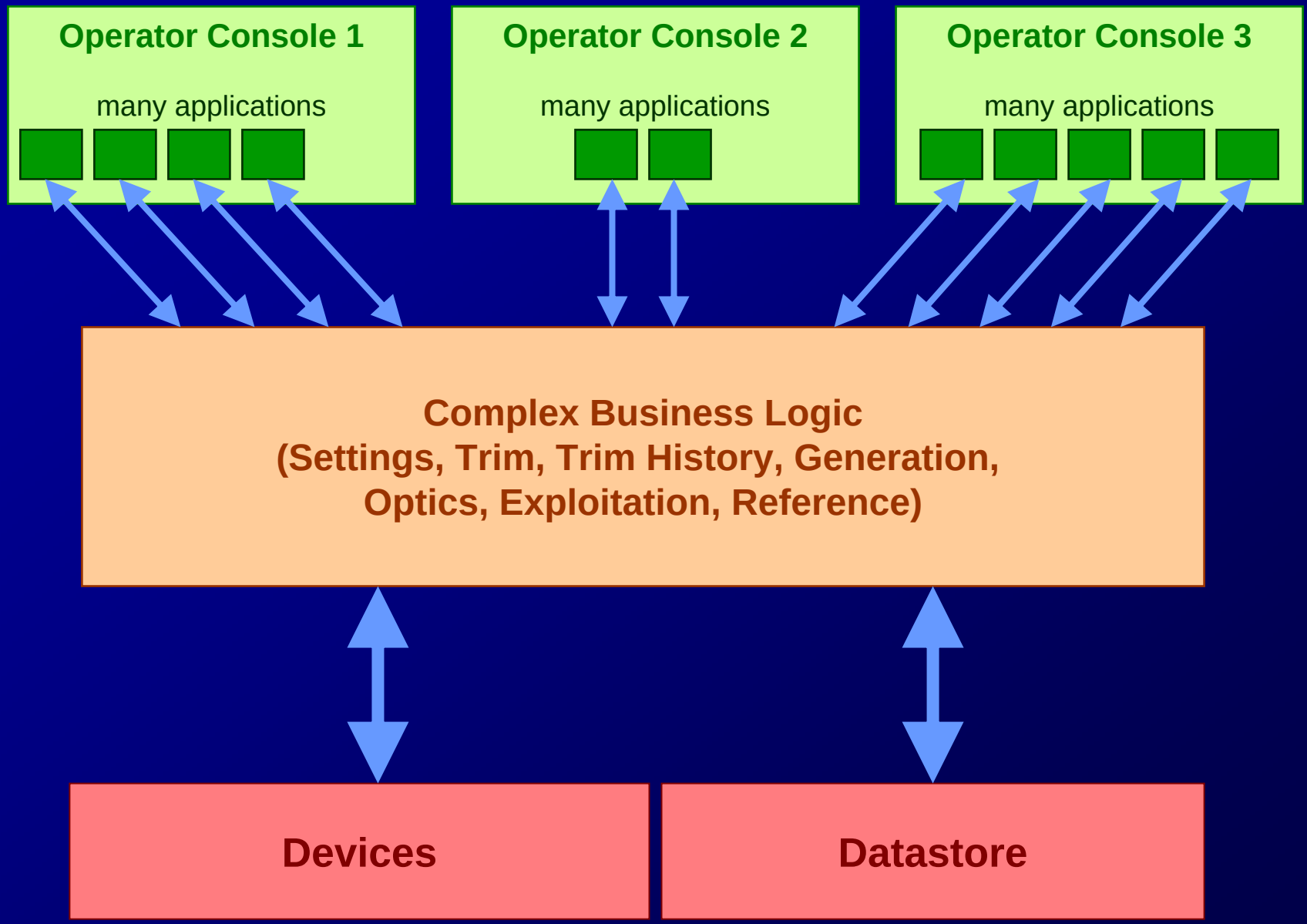
FESA

The source of all FESA devices and their properties.

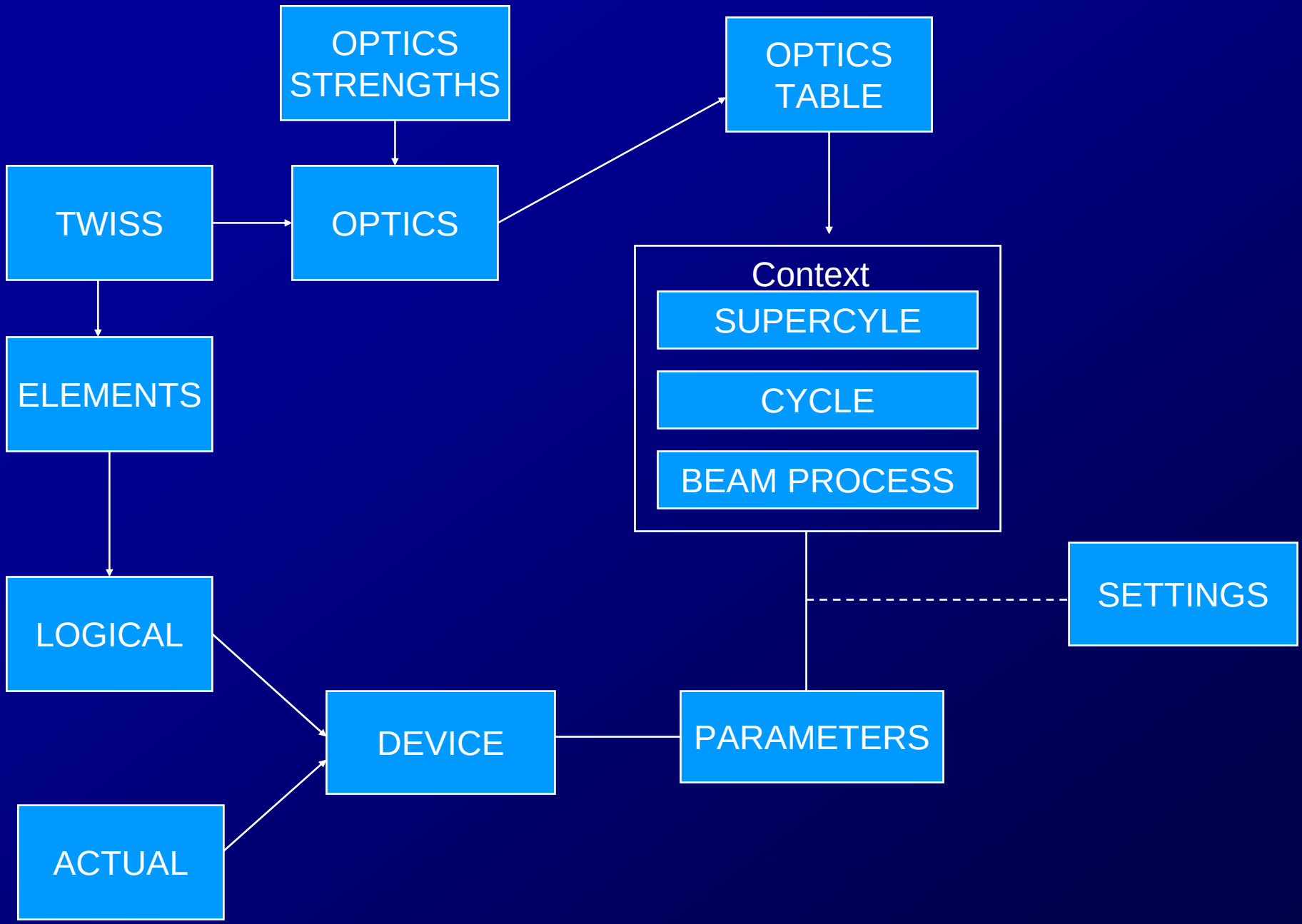
MAD

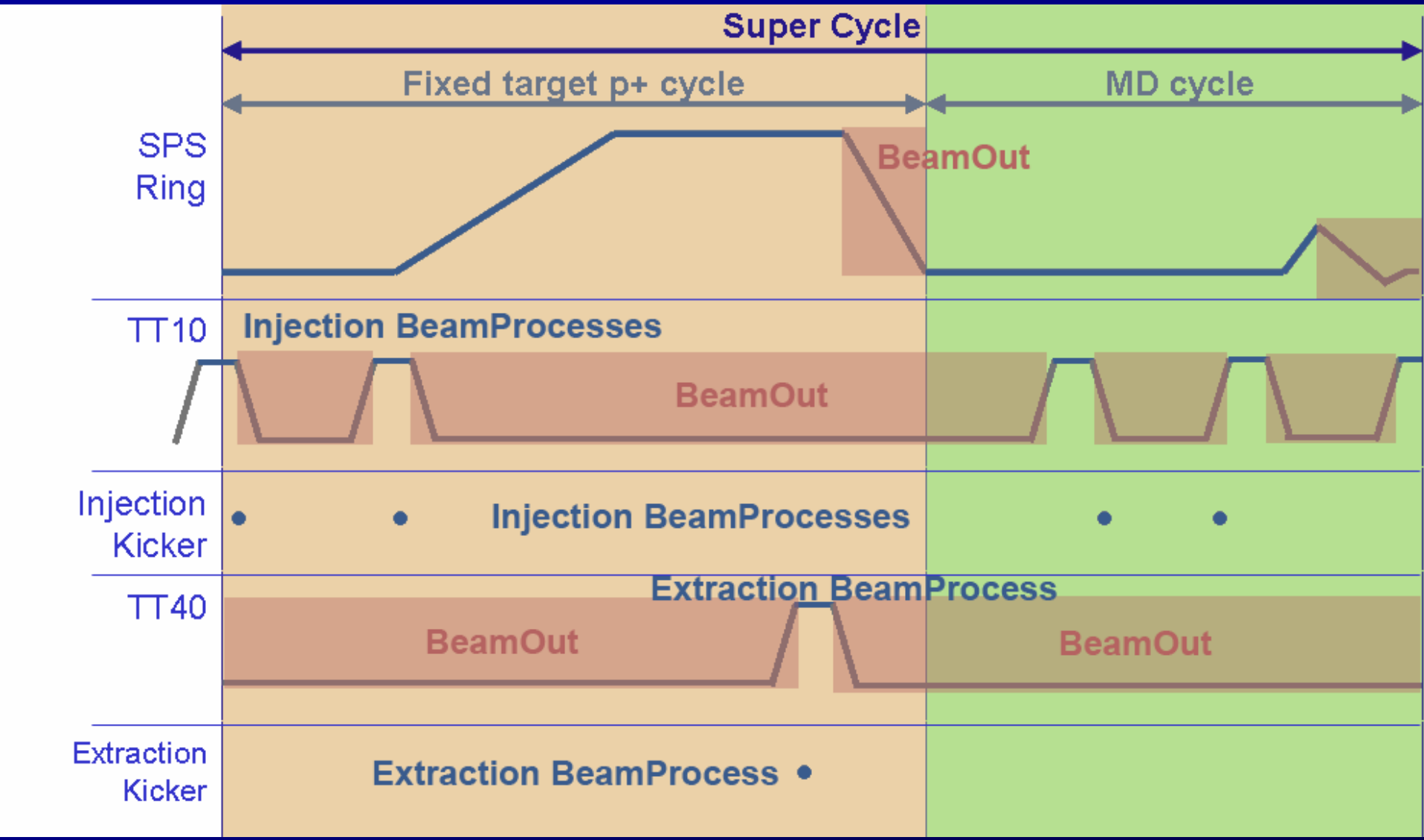
- MAD sequences defined on the layout database
- Use MAD output for element configuration our side
- Perl looping over MAD executions and uploading optics to database

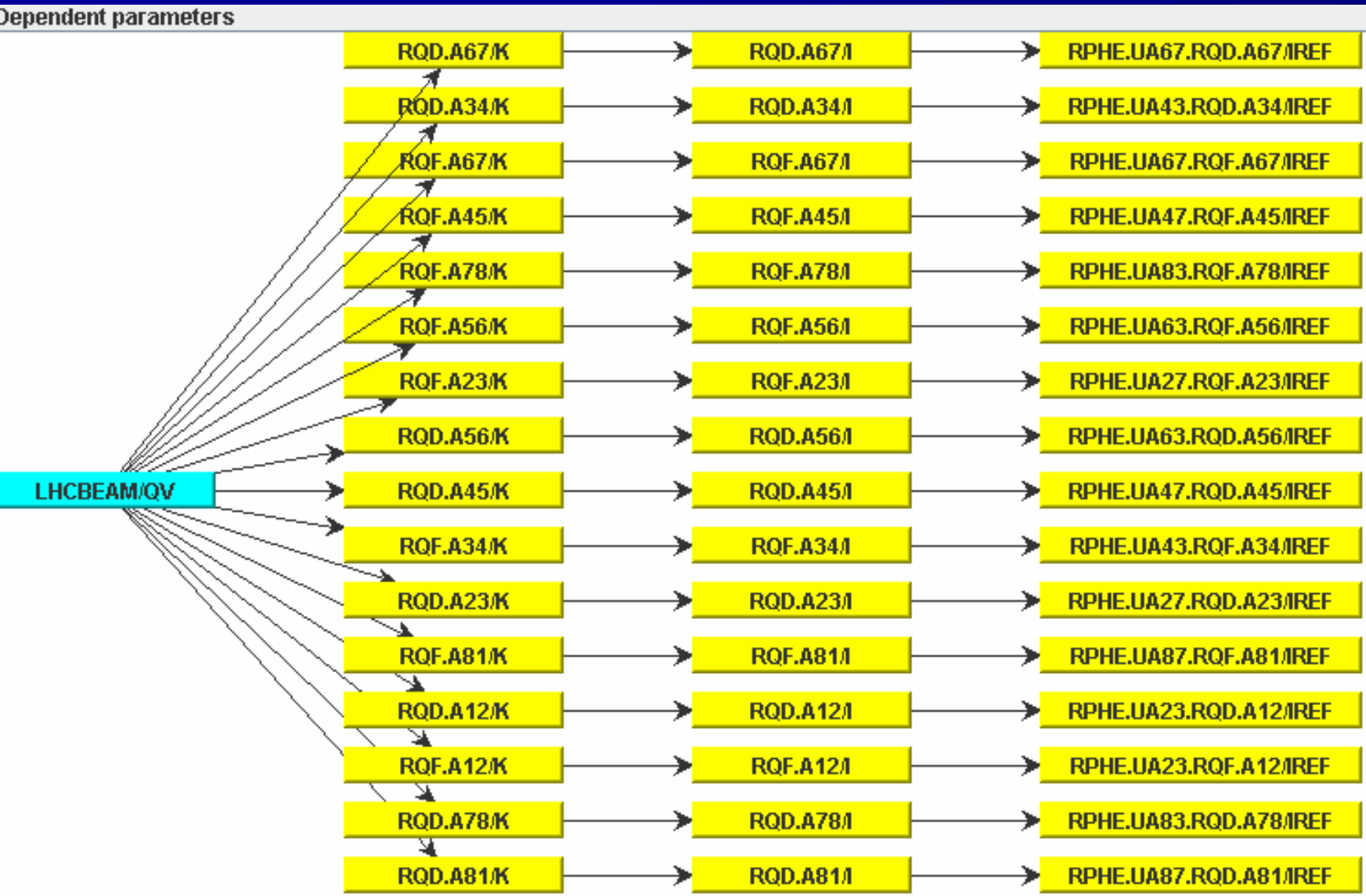
LSA overview

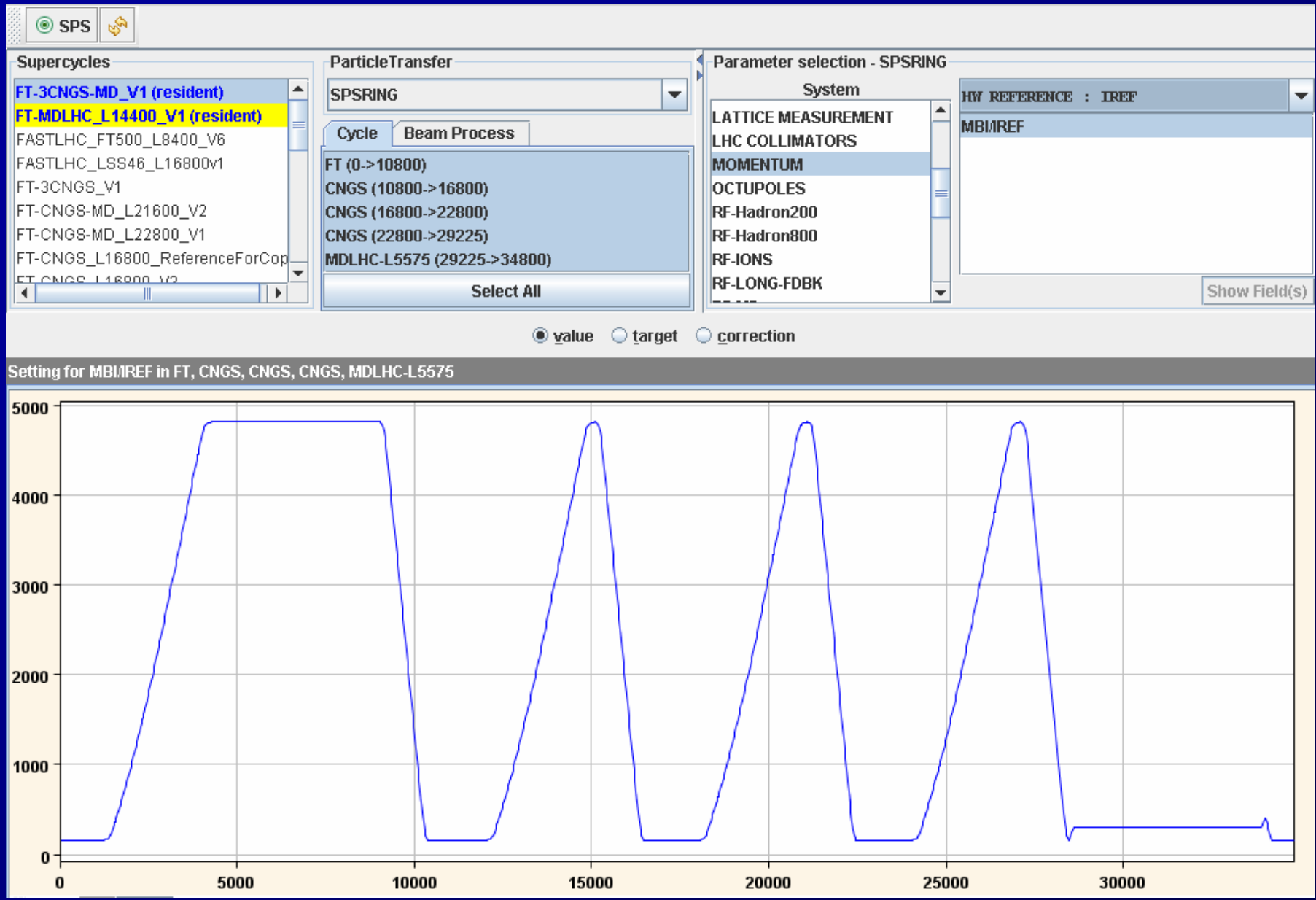

Operator Console 1
many applications
Operator Console 2
many applications
Operator Console 3
many applications
Complex Business Logic
(Settings, Trim, Trim History, Generation,
Optics, Exploitation, Reference)
Devices
Datastore

Few Important Concepts


OPTICS STRENGTHS
OPTICS TABLE
TWISS
OPTICS
Context
SUPERCYLE
CYCLE
BEAM PROCESS
ELEMENTS
SETTINGS
LOGICAL
DEVICE
PARAMETERS
ACTUAL

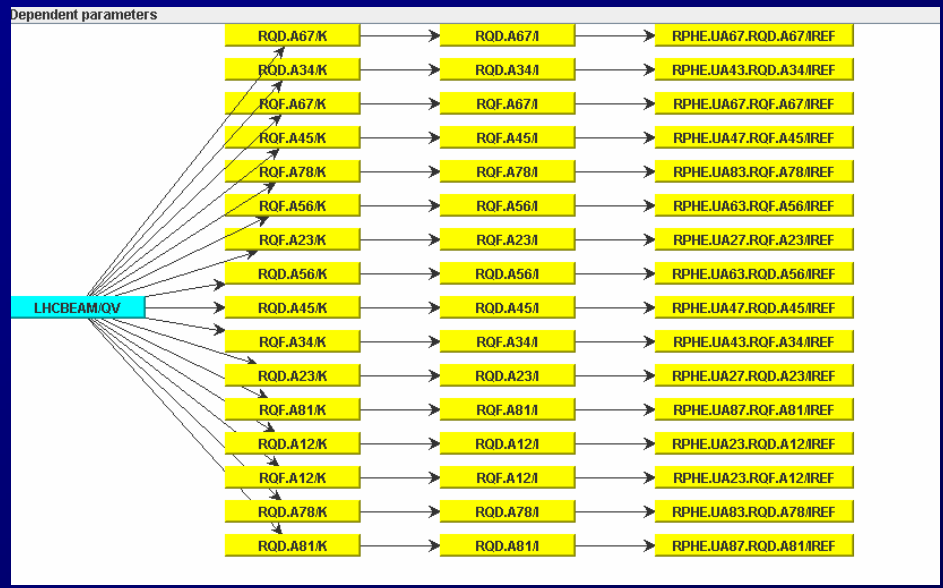

Super Cycle
Fixed target p+ cycle
MD cycle
SPS Ring
BeamOut
TT10
Injection BeamProcesses
BeamOut
Injection Kicker
Injection BeamProcesses
TT40
Extraction BeamProcess
BeamOut
BeamOut
Extraction Kicker
Extraction BeamProcess

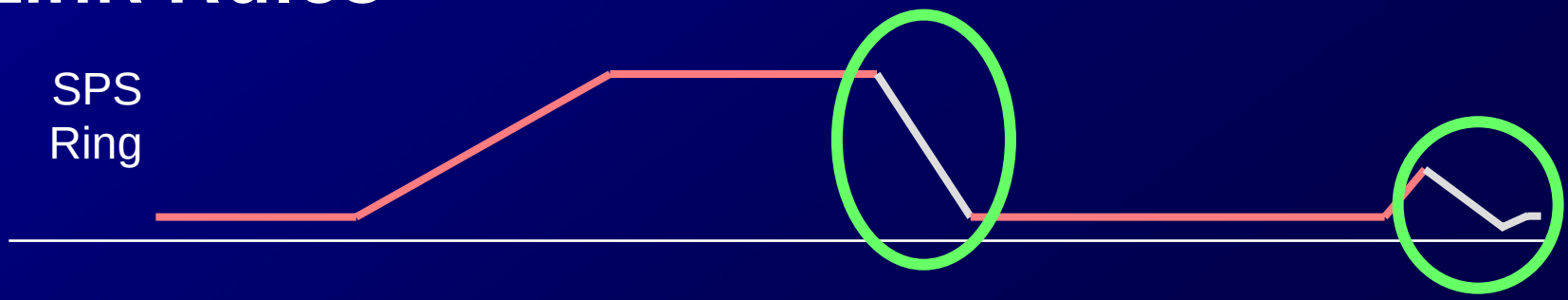

Dependent parameters
LHCBEAM/QV
RQD.A67/K
RQD.A34/K
RQF.A67/K
RQF.A45/K
RQF.A78/K
RQF.A56/K
RQF.A23/K
RQD.A56/K
RQD.A45/K
RQF.A34/K
RQD.A23/K
RQF.A81/K
RQD.A12/K
RQF.A12/K
RQD.A78/K
RQD.A81/K
RQD.A67/I
RQD.A34/I
RQF.A67/I
RQF.A45/I
RQF.A78/I
RQF.A56/I
RQF.A23/I
RQD.A56/I
RQD.A45/I
RQF.A34/I
RQD.A23/I
RQF.A81/I
RQD.A12/I
RQF.A12/I
RQD.A78/I
RQD.A81/I
RPHE.UA67.RQD.A67/IREF
RPHE.UA43.RQD.A34/IREF
RPHE.UA67.RQF.A67/IREF
RPHE.UA47.RQF.A45/IREF
RPHE.UA83.RQF.A78/IREF
RPHE.UA63.RQF.A56/IREF
RPHE.UA27.RQF.A23/IREF
RPHE.UA63.RQD.A56/IREF
RPHE.UA47.RQD.A45/IREF
RPHE.UA43.RQF.A34/IREF
RPHE.UA27.RQD.A23/IREF
RPHE.UA87.RQF.A81/IREF
RPHE.UA23.RQD.A12/IREF
RPHE.UA23.RQF.A12/IREF
RPHE.UA83.RQD.A78/IREF
RPHE.UA87.RQD.A81/IREF


SPS
Supercycles
FT-3CNGS-MD_V1 (resident)
FT-MDLHC_L14400_V1 (resident)
FASTLHC_FT500_L8400_V6
FASTLHC_LSS46_L16800v1
FT-3CNGS_V1
FT-CNGS-MD_L21600_V2
FT-CNGS-MD_L22800_V1
FT-CNGS_L16800_ReferenceForCop
ParticleTransfer
SPSRING
Cycle
Beam Process
FT (0->10800)
CNGS (10800->16800)
CNGS (16800->22800)
CNGS (22800->29225)
MDLHC-L5575 (29225->34800)
Select All
Parameter selection - SPSRING
System
LATTICE MEASUREMENT
LHC COLLIMATORS
MOMENTUM
OCTUPOLES
RF-Hadron200
RF-Hadron800
RF-IONS
RF-LONG-FDBK
HW REFERENCE : IREF
MBIMREF
Show Field(s)
value
target
correction
Setting for MBIMREF in FT, CNGS, CNGS, CNGS, MDLHC-L5575
5000
4000
3000
2000
1000
0
0
5000
10000
15000
20000
25000
30000

From Physics to Hardware Parameters

- Incorporation Rules
- Make Rules
- Link Rules

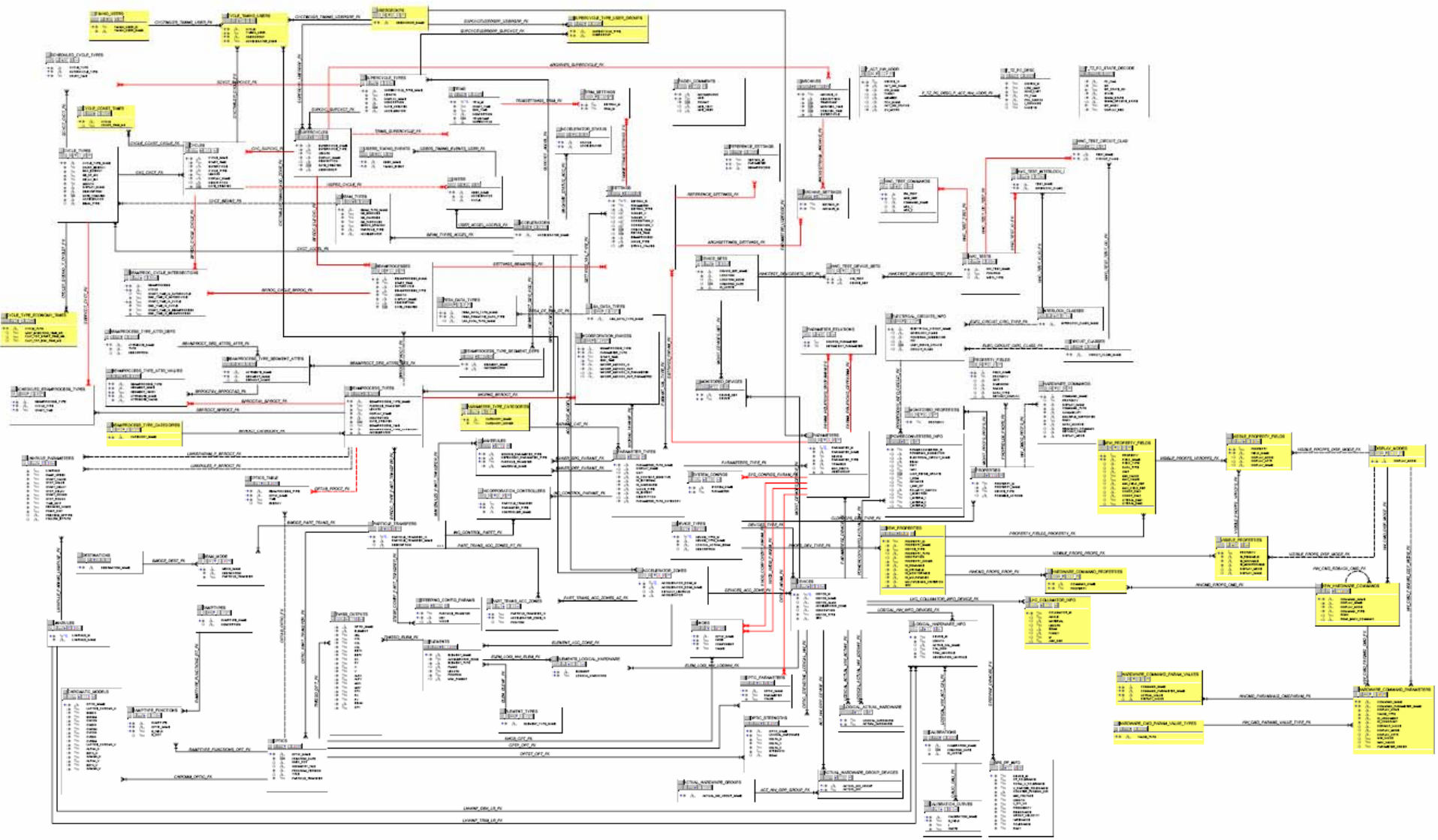




Brho2CurrMakeRule
Brho2MomentumMakeRule
BrhoDotGen2DepMakeRule
BrhoGen2DepMakeRule
Bucket2TotalMakeRule
Cn2KMakeRule
CNGSK2CurrMakeRule
Curr2cnMakeRule
ECK2CurrMakeRule
FED2ECKMakeRule
G2IMakeRule
GenerateMakeRule
K2CurrCalculator
K2CurrMakeRule
Knob2KMakeRule
Landau2KMakeRule
LEIRAdvanceMakeRule
LEIRCouple2KMakeRule
LEIREddy2006MakeRule
LEIREddyMakeRule
LEIRK2CurrMakeRule
LEIRK2CurrWithEddyMakerule
LEIRKnob2KMakeRule
Momentum2CurrMakeRule
NestedPowerConvertersMakeRule
NoOperationMakeRule
SimpleAdvanceMakeRule
SPSDamperGain2Digital
SPSKnob2KMakeRule
SPSRF200PartitionMakeRule
SPSRF800PhaseMakeRule
SPSRINGK2CurrMakeRule
Syfreq2NoiceCenterFreq
Total2DegreeMakeRule
Total2StablePhase
Total2SyPeriodMakeRule
Total2VoltageMakeRule
TripletMakeRule
UseSourceMakeRule
ConstantLinkRule
CrunchLinks
DEGAUSSLinkRule
Delay
ExtractionLinkRule
FOURPLinkRule
GIGOLinkRule
IncorporatingLinkRule
LEIRMainsLinkRule
LinkBuilder
LinkData
Linker
MULTPLinkRule
SEXLinkRule
SIXPLinkRule
SPSMainsDegaussLinkRule
SPSMainsLinkRule
SPSRingLinkRule
SPSTransferIminZeroLinkRule
SPSTransferLinkRule
THREEPLinkRule
TI8CNGSLinkRule
TI8LHCLinkRule
TWOPLinkRule

Data Model

- ~ 120 tables
- Many iterations
- Years of experience and experimentations
- Fruitful collaboration with CO/DM
- Strong asset



Ack: Chris Roderick

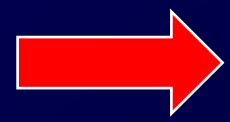
Database configuration is key

Rough Domain Breakdown

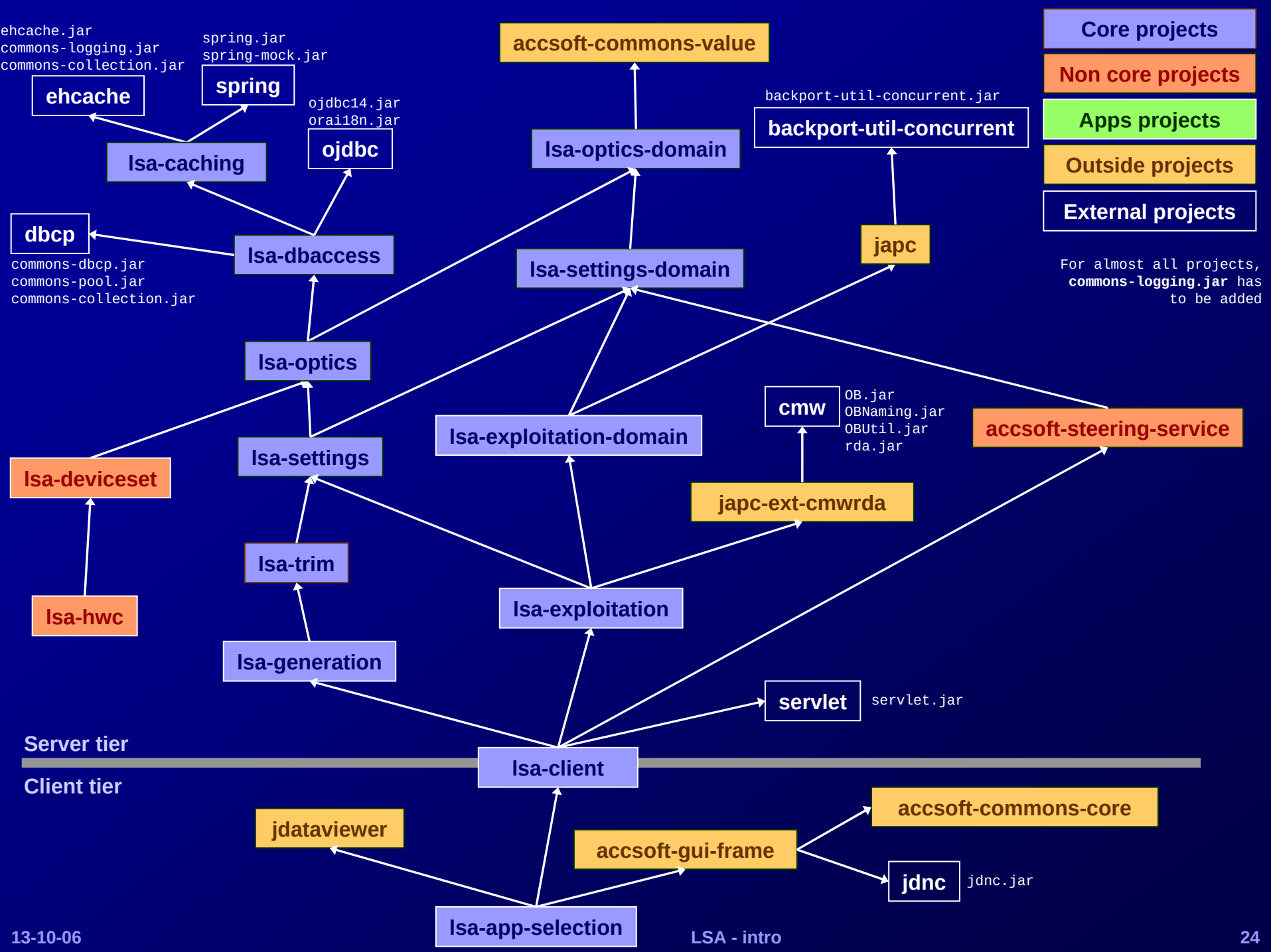
- Context configuration
- Optics
- Device/property configuration
- Parameter configuration
- Settings and trims
- Rules: make, link, incorporation

Core Software

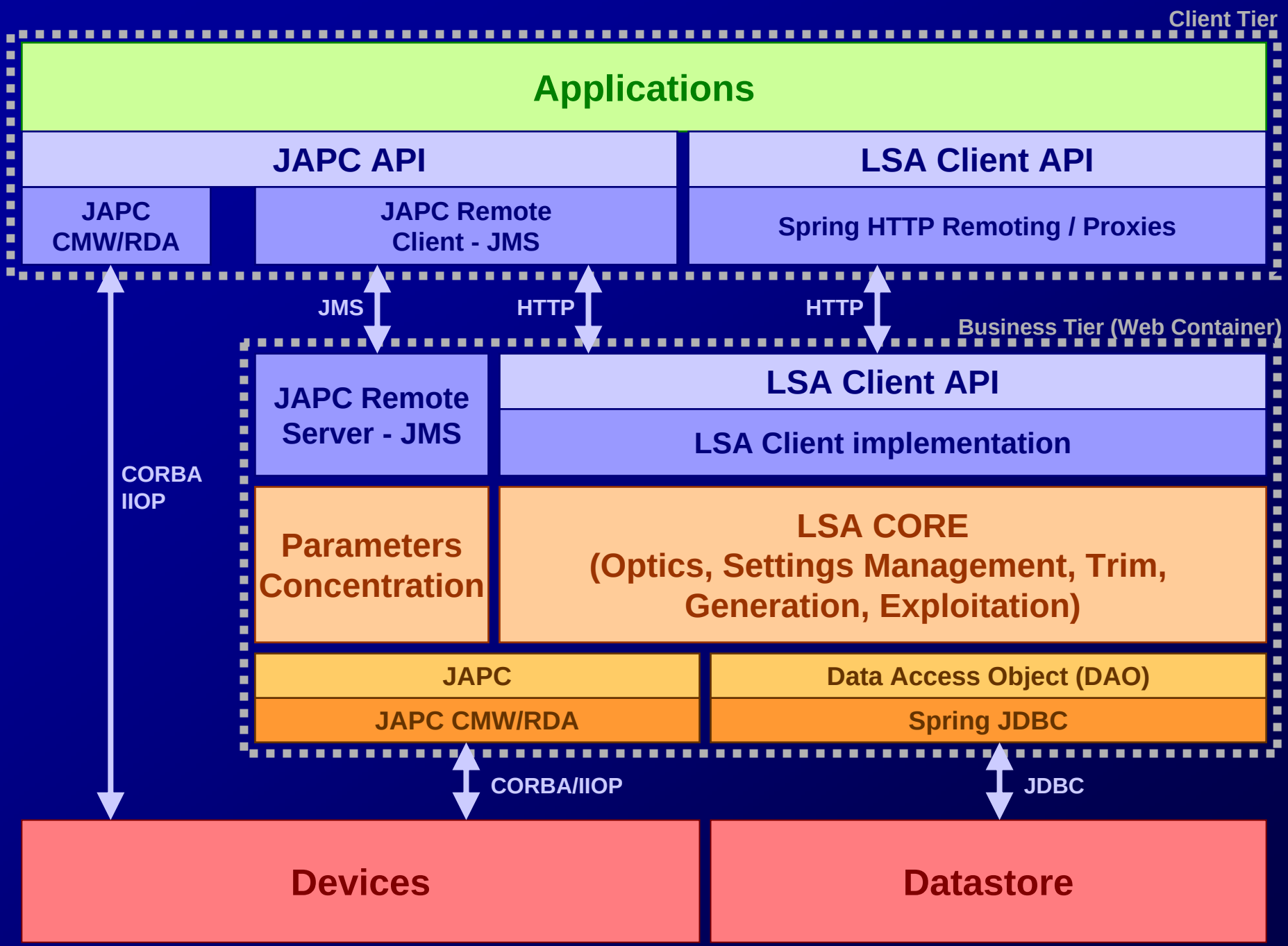
- Configuration and Optics
- Settings management
  - Operational, Critical and Expert
- Trim
- Settings Generation
- Exploitation
- Others Services



Modular


Core projects
Non core projects
Apps projects
Outside projects
External projects
For almost all projects, commons-logging.jar has to be added
ehcache.jar
commons-logging.jar
commons-collection.jar
ehcache
spring.jar
spring-mock.jar
spring
ojdbc14.jar
orai18n.jar
ojdbc
lsa-caching
accsoft-commons-value
lsa-optics-domain
backport-util-concurrent.jar
backport-util-concurrent
dbcp
commons-dbcp.jar
commons-pool.jar
commons-collection.jar
lsa-dbaccess
lsa-settings-domain
japc
lsa-optics
cmw
OB.jar
OBNaming.jar
OBUtil.jar
rda.jar
accsoft-steering-service
lsa-exploitation-domain
lsa-settings
lsa-deviceset
japc-ext-cmwrda
lsa-trim
lsa-hwc
lsa-exploitation
lsa-generation
servlet
servlet.jar
Server tier
Client tier
lsa-client
jdataviewer
accsoft-gui-frame
accsoft-commons-core
jdnc
jdnc.jar
lsa-app-selection

ARCHITECTURE


Client Tier
Applications
JAPC API
LSA Client API
JAPC CMW/RDA
JAPC Remote Client - JMS
Spring HTTP Remoting / Proxies
JMS
HTTP
HTTP
Business Tier (Web Container)
JAPC Remote Server - JMS
LSA Client API
LSA Client implementation
CORBA IIOP
Parameters Concentration
LSA CORE (Optics, Settings Management, Trim, Generation, Exploitation)
JAPC
Data Access Object (DAO)
JAPC CMW/RDA
Spring JDBC
CORBA/IIOP
JDBC
Devices
Datastore

MEASUREMENT DB

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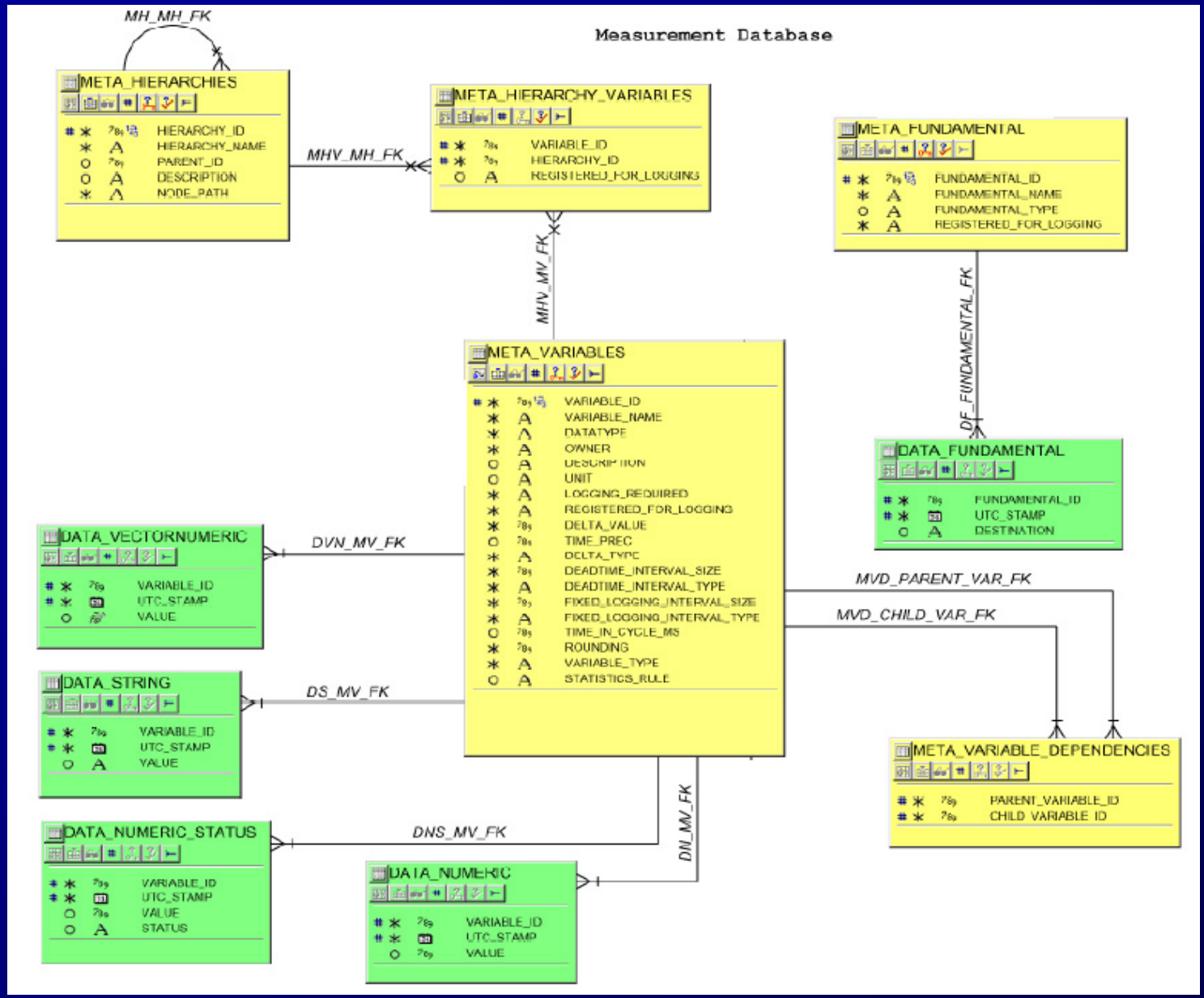
Measurement Database
MH_MH_FK
META_HIERARCHIES
HIERARCHY_ID
HIERARCHY_NAME
PARENT_ID
DESCRIPTION
NODE_PATH
MHV_MH_FK
META_HIERARCHY_VARIABLES
VARIABLE_ID
HIERARCHY_ID
REGISTERED_FOR_LOGGING
META_FUNDAMENTAL
FUNDAMENTAL_ID
FUNDAMENTAL_NAME
FUNDAMENTAL_TYPE
REGISTERED_FOR_LOGGING
MHV_MV_FK
DF_FUNDAMENTAL_FK
META_VARIABLES
VARIABLE_ID
VARIABLE_NAME
DATATYPE
OWNER
DESCRIPTION
UNIT
LOGGING_REQUIRED
REGISTERED_FOR_LOGGING
DELTA_VALUE
TIME_PREC
DELTA_TYPE
DEADTIME_INTERVAL_SIZE
DEADTIME_INTERVAL_TYPE
FIXED_LOGGING_INTERVAL_SIZE
FIXED_LOGGING_INTERVAL_TYPE
TIME_IN_CYCLE_MS
ROUNDING
VARIABLE_TYPE
STATISTICS_RULE
DATA_FUNDAMENTAL
FUNDAMENTAL_ID
UTC_STAMP
DESTINATION
DATA_VECTORNUMERIC
VARIABLE_ID
UTC_STAMP
VALUE
DVN_MV_FK
MVD_PARENT_VAR_FK
MVD_CHILD_VAR_FK
DATA_STRING
VARIABLE_ID
UTC_STAMP
VALUE
DS_MV_FK
META_VARIABLE_DEPENDENCIES
PARENT_VARIABLE_ID
CHILD_VARIABLE_ID
DATA_NUMERIC_STATUS
VARIABLE_ID
UTC_STAMP
VALUE
STATUS
DNS_MV_FK
DN_MV_FK
DATA_NUMERIC
VARIABLE_ID
UTC_STAMP
VALUE

Measurement database

- Basically a holding pen for the logging database
- Up to 7 days data
- Filter and reduce before transfer to logging database

Logging

- Dedicated database cluster (+1.5 Tbyte of disk space) on the production database LHCLOGDB.
- The LHC Logging Service is based on a 3-tier architecture; 2 machines are used to host the Application Server (middle) tier: ABJAS4 (a PC) and ABOFS1 (a Proliant HP), both with the Oracle Application Server installed and configured. In both AS, the dedicated OC4J containers “LHCLogging” are deployed
- Our clients implement an XML schema or use the Data Input API to submit their logging data to the service (as well as the meta data). This data loading chain is fully operational and in production, the Data Loading application on ABJAS4 takes care of the parsing and loading process.
- For Data Extraction, the web-deployed TIMBER interface allows users to get to selected logged variables, show them graphically and extract in file format.

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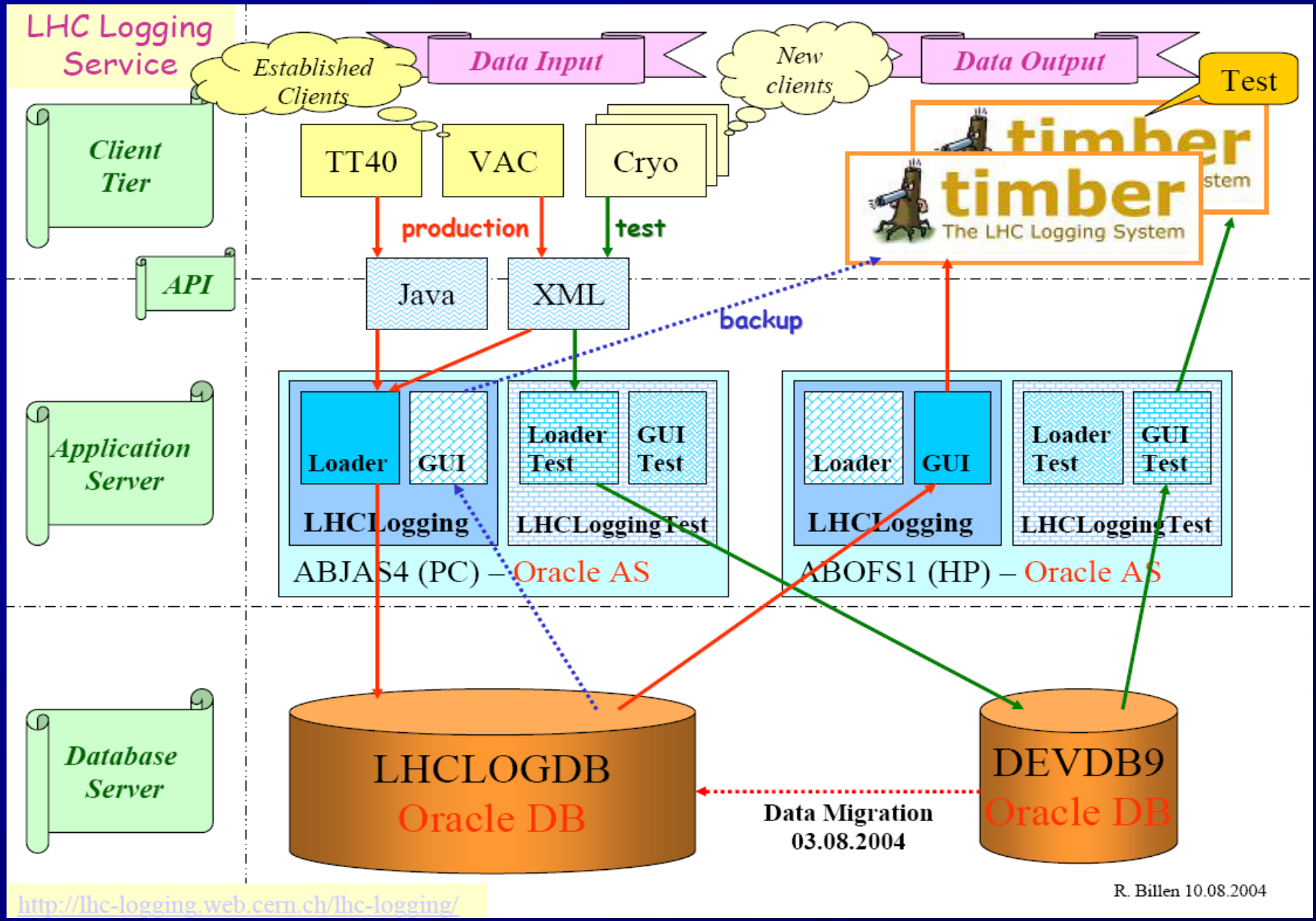
LHC Logging Service
Established Clients
Data Input
New clients
Data Output
Test
Client Tier
TT40
VAC
Cryo
production
test
timber
The LHC Logging System
API
Java
XML
backup
Application Server
Loader
GUI
Loader Test
GUI Test
LHCLogging
LHCLoggingTest
ABJAS4 (PC) – Oracle AS
ABOFS1 (HP) – Oracle AS
Database Server
LHCLOGDB
Oracle DB
Data Migration
03.08.2004
DEVDB9
Oracle DB
R. Billen 10.08.2004
http://lhc-logging.web.cern.ch/lhc-logging/

Conclusions

- Off-line databases feeding...
- LSA on-line
  - Well-developed data model which aims to be the sole repository for on-line control data
- Measurements and Logging in place
  - These are not a panacea