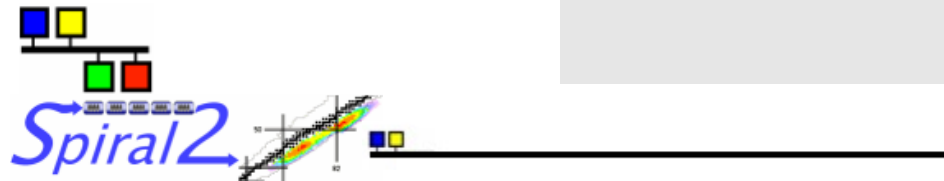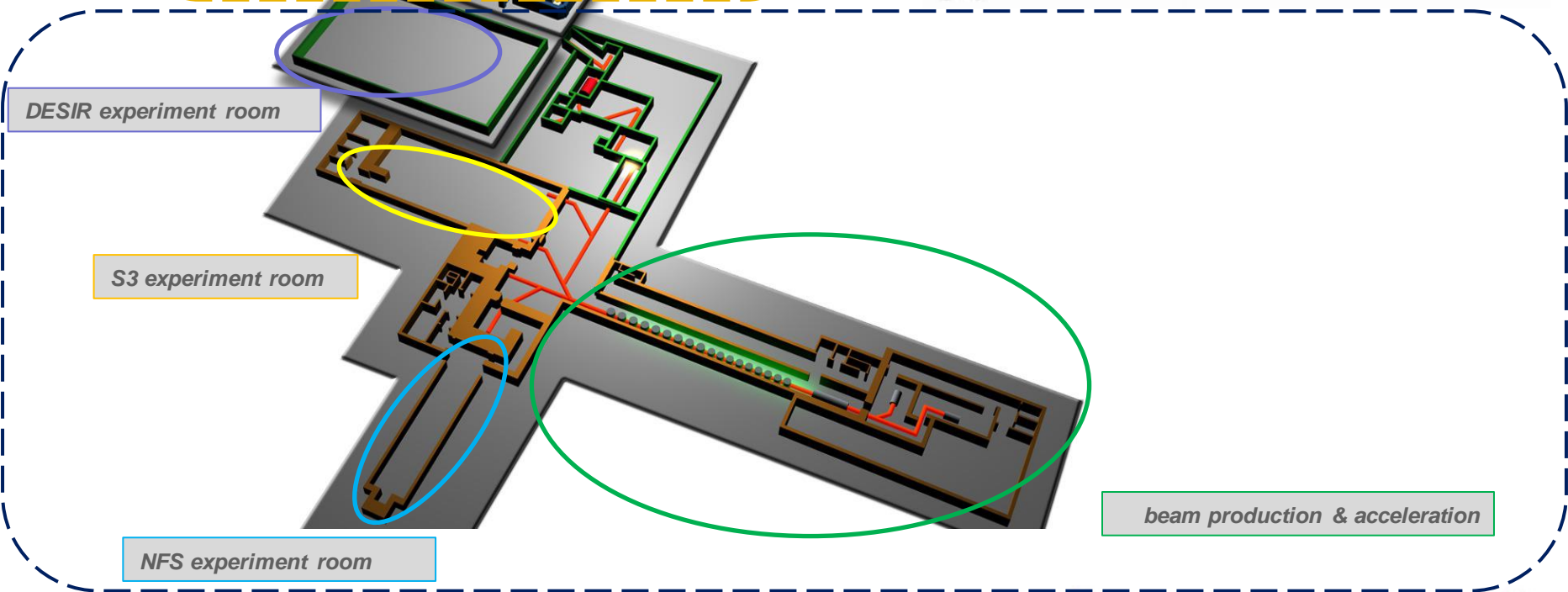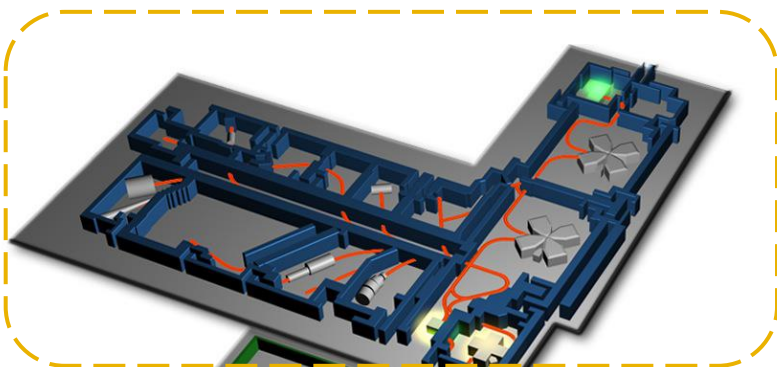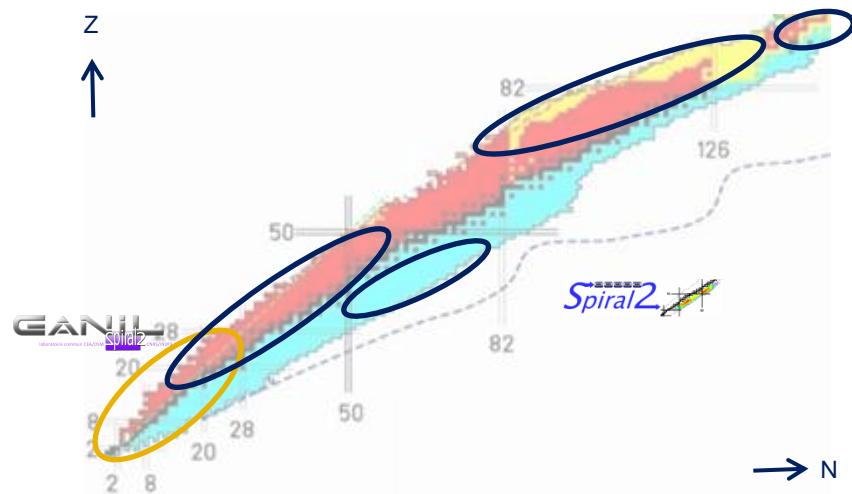# Setting the Spiral2 control system for the on-going commissioning

- Introduction
  - The Spiral2 project
  - Control system deliverables
  - Collaborations for the control system
- The Spiral2 control system
  - Infrastructure
  - Equipment configuration
  - Sources and beam lines controls
  - From RFQ to HEBT
  - GUIs environment
  - Software integration
- And now ?

DESIR experiment room

S3 experiment room

NFS experiment room

beam production & acceleration

Beam characteristics

	Q/A	I (mA)	Energy (Mev/u)	CW max beam power (KW)
Protons	1/1	5	2 - 33	165
Deuterons	1/2	5	2 - 20	**200**
Ions	1/3	1	2 - 14.5	45
Ions (option)	*1/6*	*1*	*2 - 8*	*48*

NFS

RFQ

Linac

S3

>1/3

>1/2

To RIB production

To DESIR room
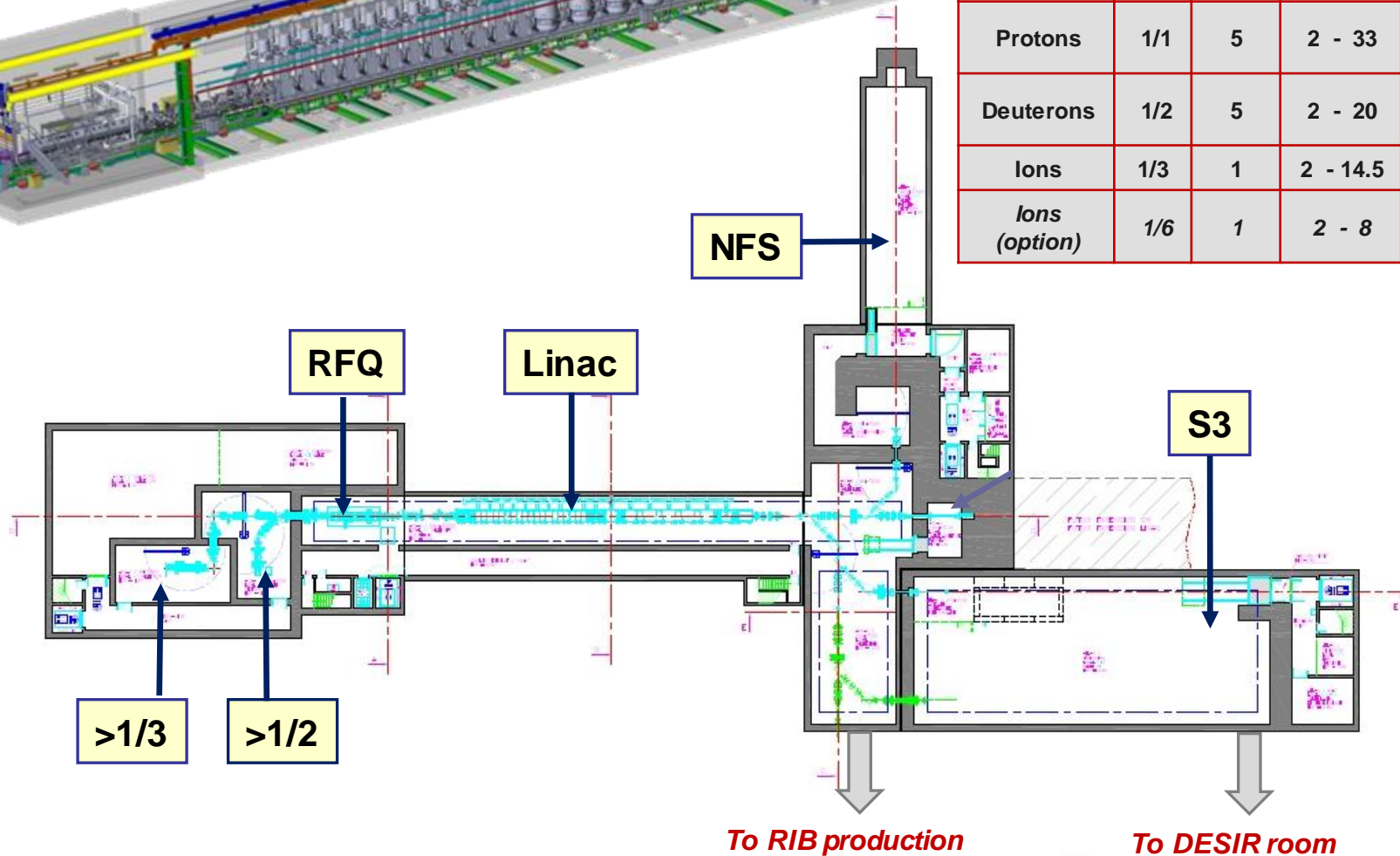
May 2011

October 2012

October 2014

LEBT1

RFQ

Linac tunnel

Cryomodules waiting for installation
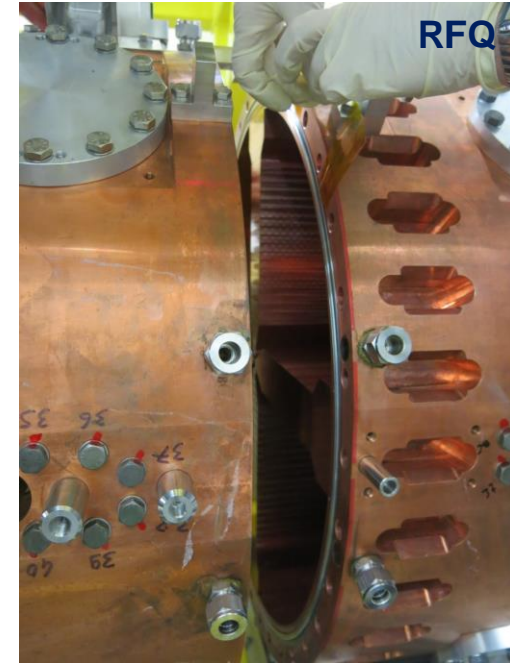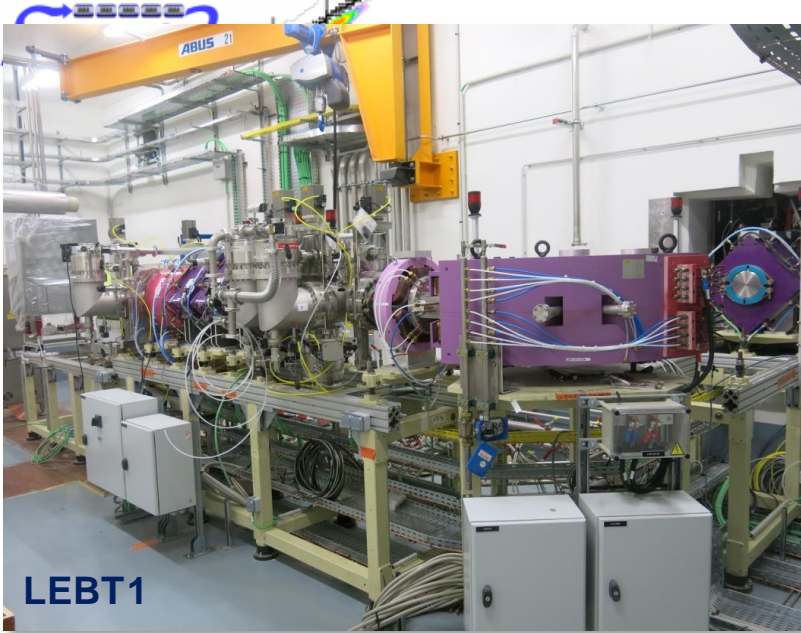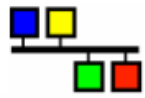
Work project for the PCD control room
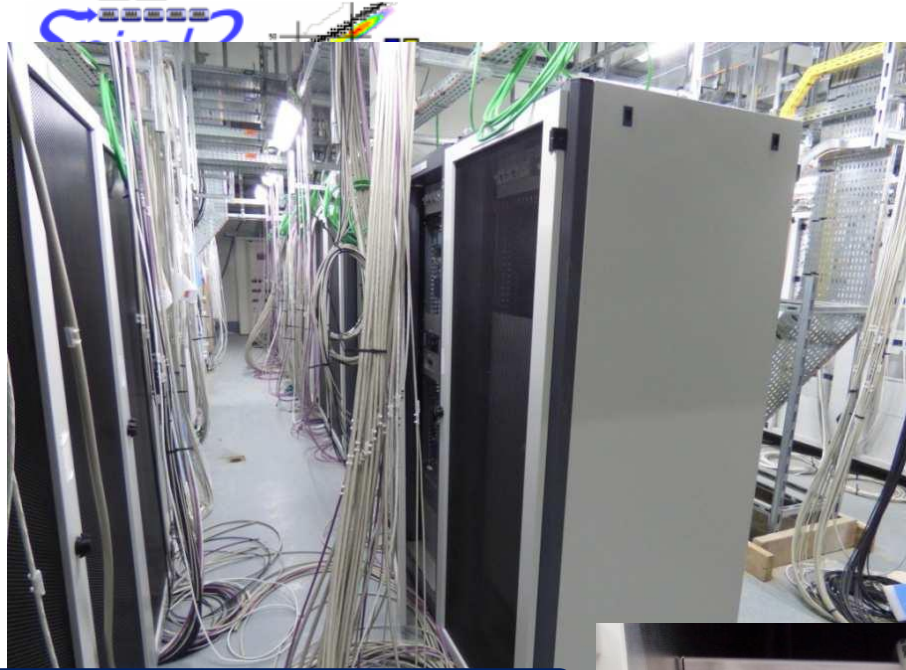
Racks installation & cabling

VME chassis installed waiting for the electrical switch-on and checks

Irfu
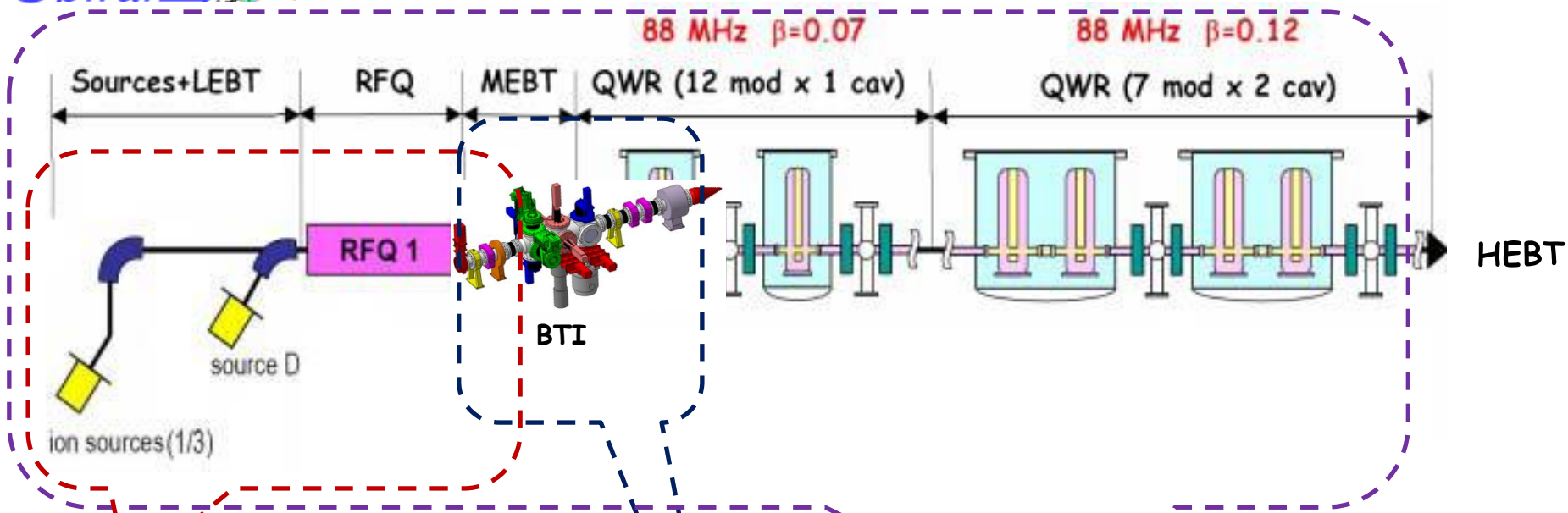
Injector controls
- *Ion source control*
- *Deuteron source control*

Epics distribution & repository

Equipment interfaces :
- *CFs, slits, ACCTs-DCCTs*
- *TOF, FCT, CFR*

LLRF

iPHC *Institut Pluridisciplinaire Hubert CURIEN STRASBOURG*

Equipment interfaces :
- *Emittancemeters*
- *BEMs*

BTI

GANIL *laboratoire commun CEA/DSM spiral2 CNI*

Global coordination

Equipment interfaces :
- *Power supplies*
- *Profilers, BLMs, BPMs*
- *RF*

Central services

High level applications

Databases

CSS distribution

SVN server

35 Synoptics

30 Tuning applications

10 Services

GUIs Epics tools

GUIs Java/Xal

Central services

Channel Access

20 IOCs

10 Drivers

IOC : VME (VxWorks)

I/O

IOC : Linux

Modbus/TCP

Power supplies

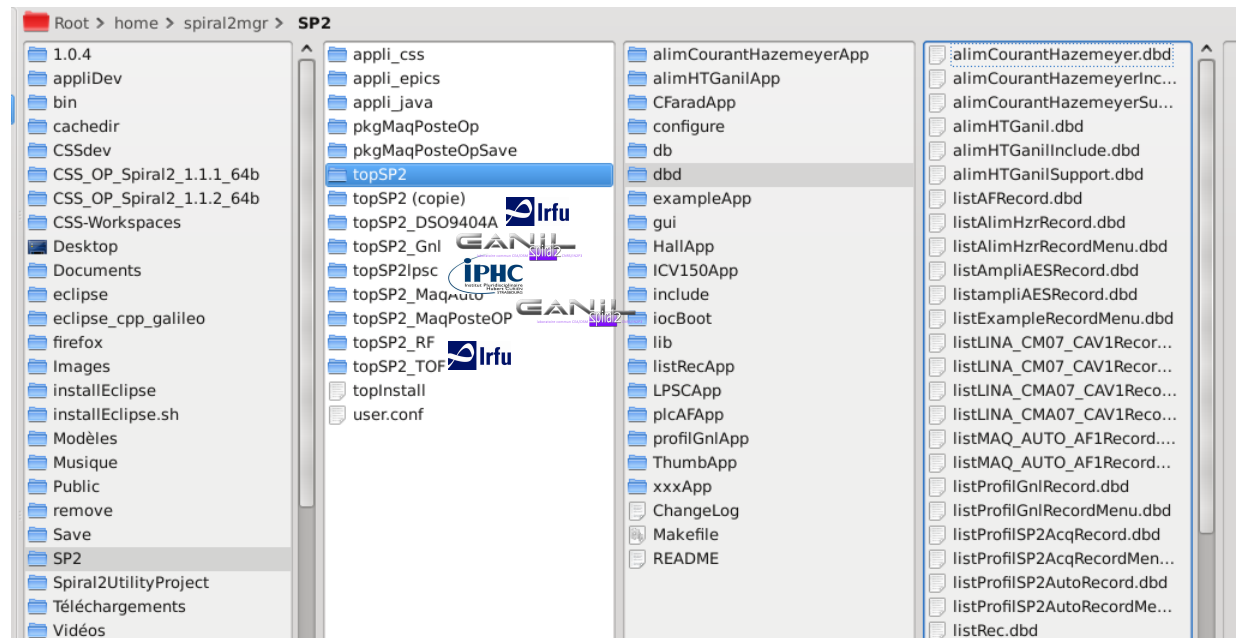**PLCs**

Profilers

RF amplifiers

~1500 equipment
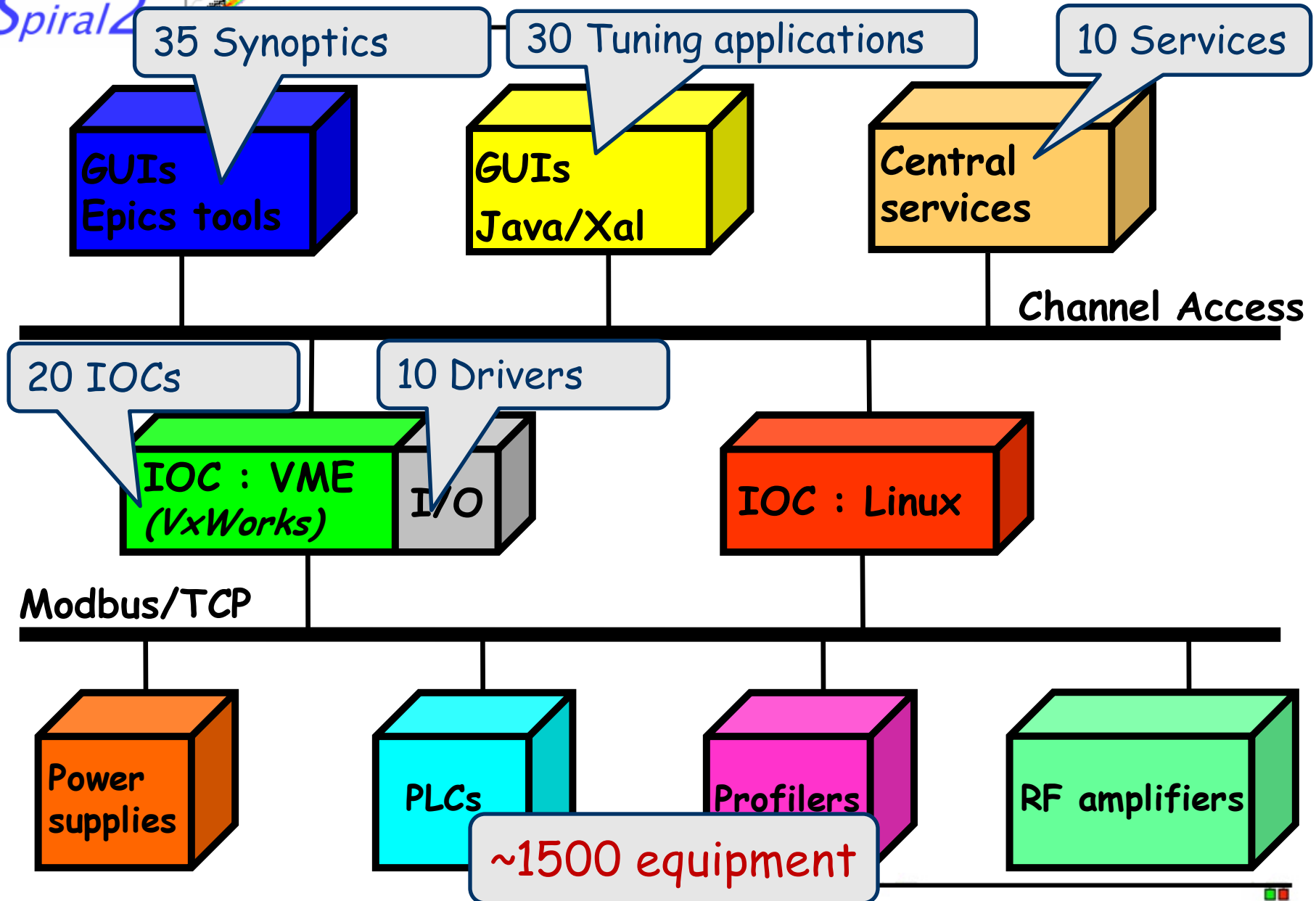
- Common Spiral2 development platform ("topSp2"):
  - Provided and maintained by Irfu
  - Shared by the three labs
  - Spiral2 version of the EPICS environment (development, operation)
- Rules and formalization
  - Interfaces between IOCs and GUIs
  - Files naming
  - Repository organization
  - For on-site integration
- Development hosted on a shared SVN server @Ganil

E-logbook

(commercial j5 product in use at Ganil)

Alarms handling

(in-house development shared Ganil/Spiral2)

Archiving system

(CSS)

GenIOC Software

Generates
- substitutions
- connections

IOC Configuration

Module APP

Module APP « PLC »

Genioc generation utility

Genauto generation utility

GUI

«Device configuration» database

Generates module APP

Developper module using VDCT

Developper

End user

- Add
- Remove
- Inhibit
- Configure Equipement

- Non Epics fields
  ⇨ IP, builder …

Value for non Epics fields
PLC address …

Off-line run preparation

On-line operation
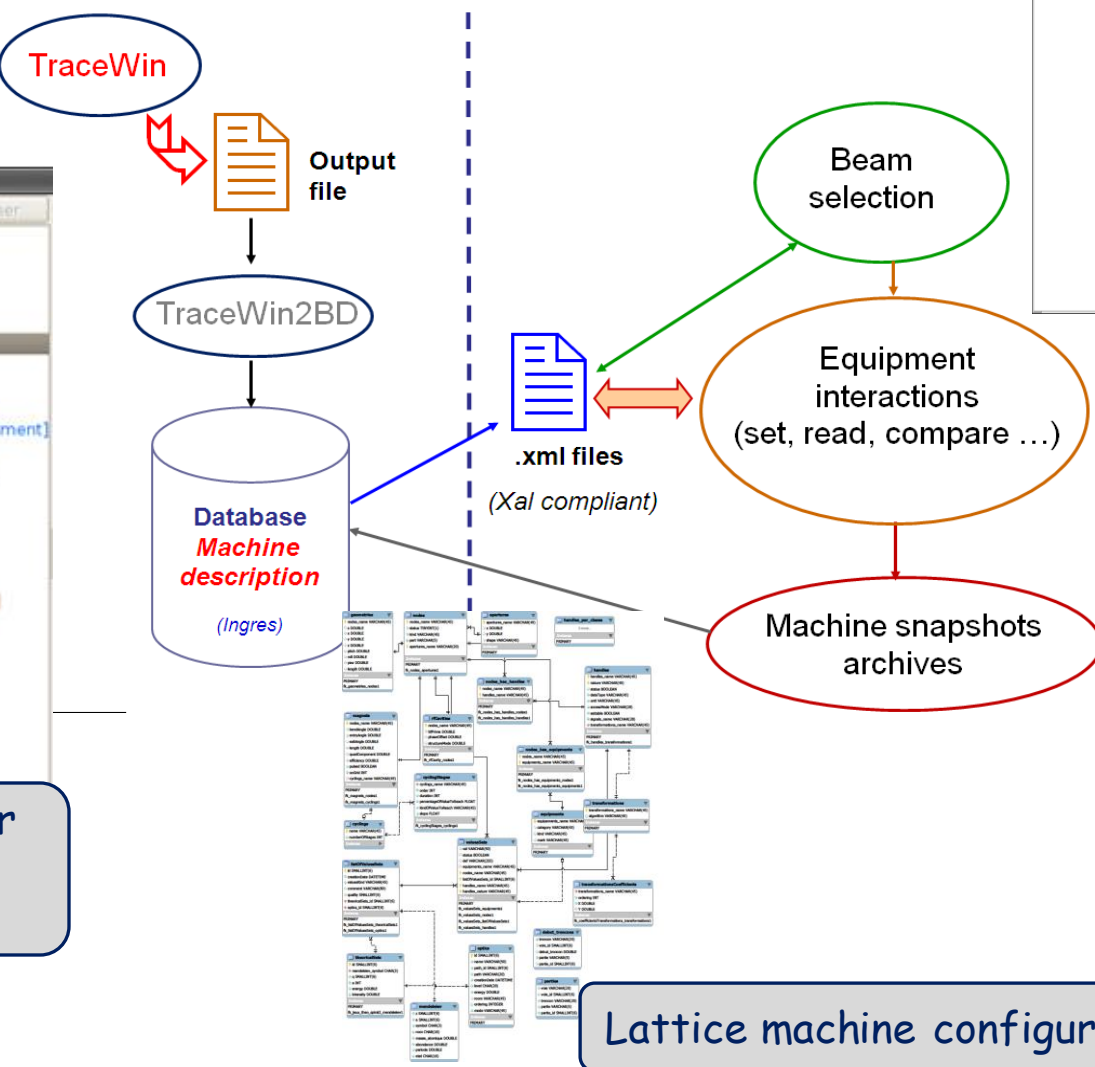
TraceWin

Output file

TraceWin2BD

Beam selection

.xml files

(Xal compliant)

Equipment interactions (set, read, compare …)

Database
Machine description

(Ingres)

Machine snapshots archives
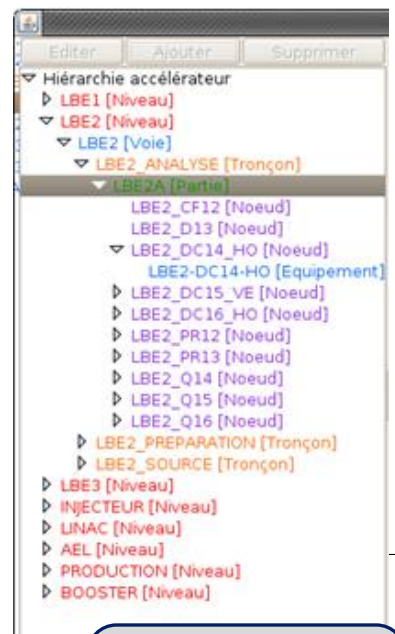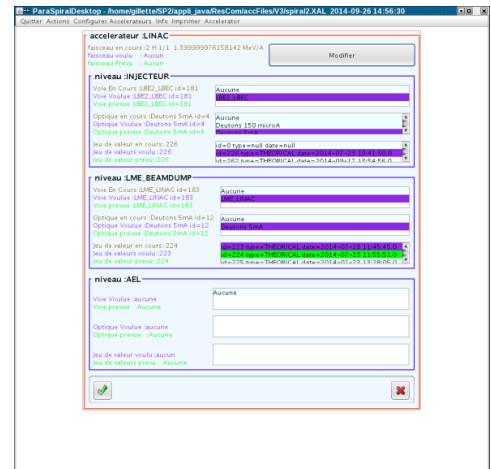
Accelerator hierarchy description

Lattice machine configuration database

Deuterons & LBE2/C :
Used and validated during
production tests @Saclay

Ions & LBE1 :
Different from the @Grenoble
control system ⇨ To be tested

Power supplies

Faraday Cups & ACCT-DCCT

Slits

Emittancemeters

Slow chopper
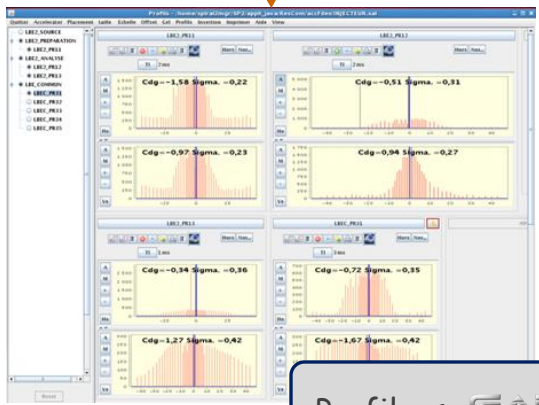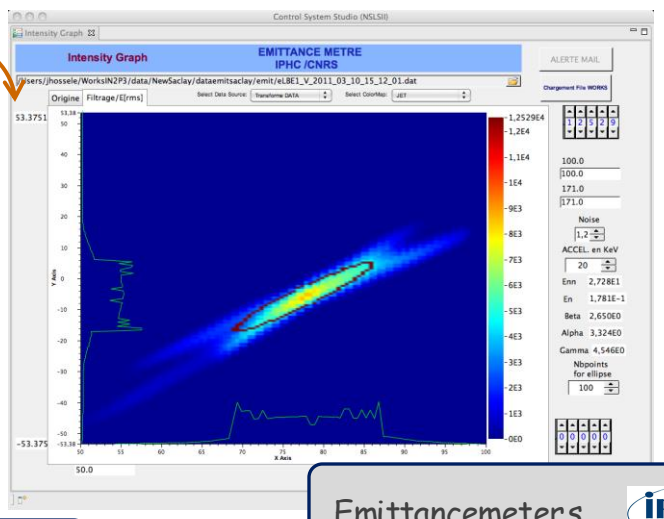
Profilers

From RFQ to HEBT : **Beam diagnostics**

Time Of Flight
Modbus-TCP & binary ADAS ICV 196
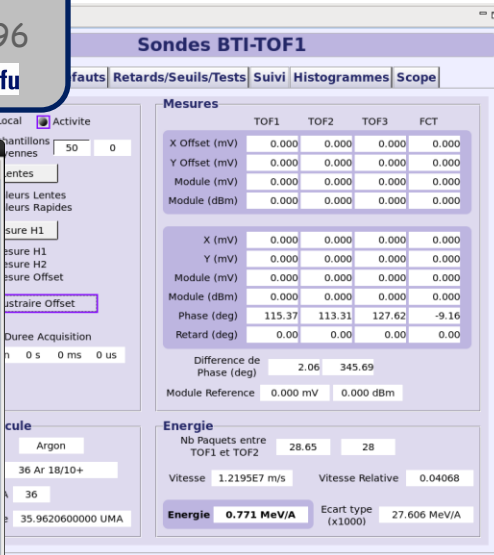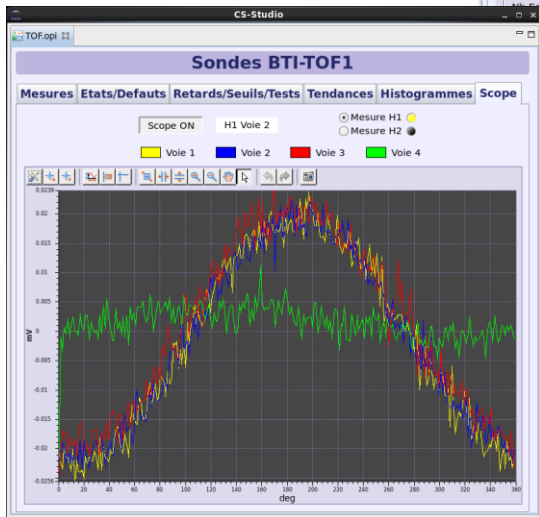
Fast Faraday Cup
Stream device
(Agilent Oscilloscope)
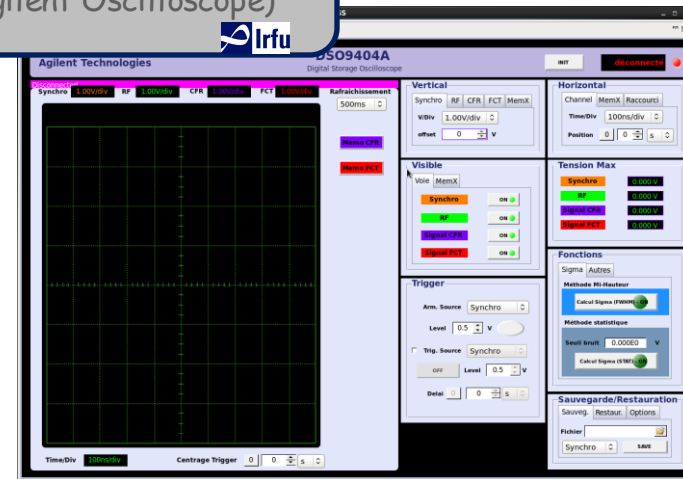
Beam Position Monitor
Specific VME 64 hardware and software
⇨ In progress

Beam Loss Monitor
Cosylab development for VME Caen 1495
⇨ June 2015

Beam Extension Monitor
NIM Multichannel Canberra Analyzer
⇨ Just starting

Spiral2

Objective

LHE1-ACCT11
LHE1-DCCT11
LHE1-TOF12
LHE1-TOF13
LHE1-PR11
LHE1-PR12

LHE2-Q101
LHE2-DCCT-HE
LHE2-VI11
LHE2-Q102
LHE2-FH11D & FH11G
LHE2-PR01
LHE2-Q103

LHE2-D11
LHE2-D11-COR
LHE1-PR13

LHE1-Q105
LHE1-DC12-VE
LHE1-Q106
LHE1-DC12-HO
LHE1-Q107

LHE1-PR14

LHE2-D12
LHE2-D12-COR
LHE2-PR201

LHE1-DI12
LHE1-VI12
LHE1-REG1
LHE1-VI13
LHE1-PR15

LHNFS-D11
LHNFS-D11-COR

LHNFS-Q11
LHNFS-DC1-VE
LHNFS-DC1-HO

LHE1-PR16

LHE1-Q108
LHE1-DC13-VE
LHE1-BLM13
LHE1-Q109
LHE1-DI13
LHE1-Q110
LHE1-DC13-HO
LHE1-Q111

LHE1-PR17

LHE1-DCCT12
LHE1-DCCT12

LHE1-VI14

LHE1-PR18

LHE1-BP11

BEAM DUMP

Salle n° 10

EPS classified device

FMEA required

WARNING

Limitation of the Linac beam dump activation

Implementation

I/Os
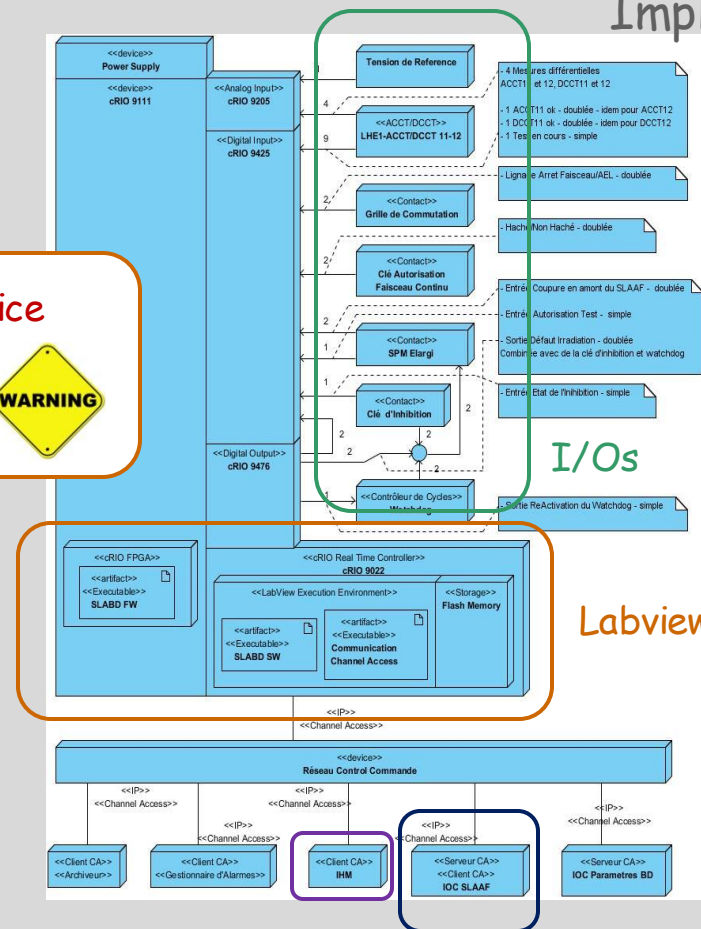
Labview cRIO device

EPICs IOC

Surveillance de l'activation de l'arret faisceau du linac spiral2

CSS/BOY GUI

- CSS/BOY suite adapted for Spiral2 (Ganil)
  - *Nb : former EDM screens developped at the beginning still there*
  - Contexts :
    - ✓ **CSSdev** : development
    - ✓ **CSSop** : operation
  - Widget library

- Available :
  - TOF / FCT-CFR interfaces, Emittance control & display, AES interface
- Under development
  - BTI GUI, Machine synoptics
- To be developped
  - Interlocks, Beam pulse control, Beam losses
- And many others to come …
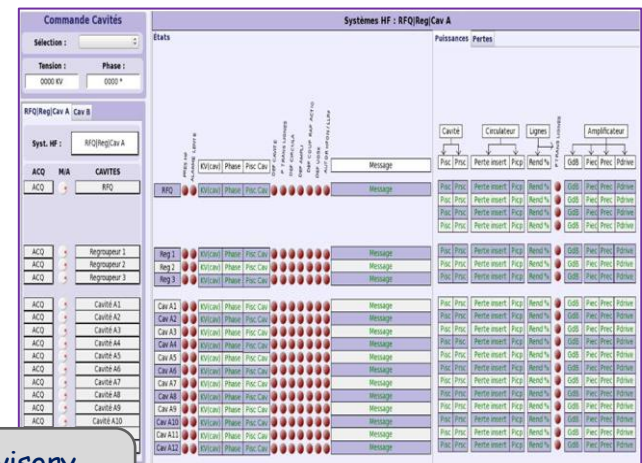
RF supervisory controls
(under evaluation)

- **Operator control environment : CSSop**
  - Implementation :
    - ✓ Perspectives limited to CSS runtime and data-browser
    - ✓ One unique workspace NFS mounted for all stations (Eclipse lock suppressed)
  - For operation :
    - ✓ No editing capability for no hazardous modifications
    - ✓ Light view : unused menus suppressed
    - ✓ One central and unique launcher for all applications : CSS, Java/XAL, EDM (+Ganil/Ada ones).

Lanceur

- Aide
- Alarmes et LogBook
- Equipements
  - Automates
  - Diagnostics
  - RF
    - AmpliAES
      - startAES.opi
    - AmpliRFQ
  - Hook.app
- Réglages
  - BTI
  - LBE1
  - LBE2
  - LBEC
  - LINAC
  - LME
  - Synoptiques
    - LBE1-Synoptic.opi
  - Transverses
- Suivis fil de l'eau
  - Ponctuels
  - Predefinis

Alarms (java)

Beam characteristics

e-logbook (j5)

Equipment (CSS)

Tuning (java)

Data Browser (CSS)

Launcher

Local   Synoptique LBE1   2013/07/22 09:08:05

AR-GT7-PC3   Reset Défaut

Defaut Manque Phase
Defaut Debit Eau Alim

Alimentation Delestee
Securite Filtre Strappee
Etat Constructeur
Puissance ON
Tensions Auxiliaires ON
Alimentation en Distance
Defaut Inverseur Polarite
Alimentation Prete
Regul en cours ou Pwr OF
Surveillance ON
Surveil Courant OK ou OF
Surveil Tension OK ou OF

Equipment

Spiral2

Optional displays

Alignment

Font size

Rotation

600	700

Palette

Graphics
Monitors
Controls
Others
Synoptic

- AcctDcct
- ArretFaisce...
- BPM
- CageFaraday
- CaviteA
- CaviteB
- Di
- Dipole
- EmitMetre
- Fente
- Groupeur
- Hacheur
- Hexapole
- Profil
- Qpole
- RFQ
- Scraper
- Solenoide

CageFaraday
######

CF11

######

Properties

Specifics Properties
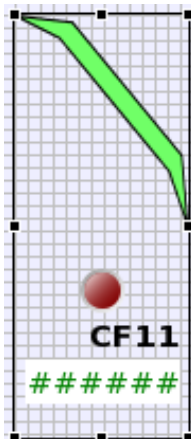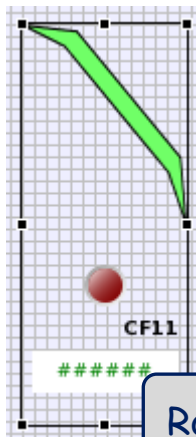
Property	Value
Basic	
Name	CageFaraday
Nom Court	☐ no
Widget Type	CageFaraday
Behavior	
Actions	no action
Enabled	☑ yes
Rules	ttached
Scripts	no script attached
Visible	☑ yes
Display	
Alignement Horizontale Nom	Center
Alignement Verticale Nom	Middle
Background Color	☐ (240,240,240)
Fond Transparent Partie Info	☐ no
Montrer Partie Info	☑ yes
Montrer Valeur	☑ yes
Position Partie Info	Droite
Rotation Image	Verticale
Taille de police	7
Tooltip	$(pv_name) / $(pv_va
Position	
Height	100
Width	164
X	588
Y	222

- **Development environment : CSSdev**
  - SPIRAL2 accelerator widget library
  - SPIRAL2 OPI templates automatically added in user's workspace :
    - ✓ Beam characteristics header
    - ✓ Launcher
    - ✓ Pydev added
    - ✓ SVN access added …
  - Common icons and pictures
  - Graphical common usage template
- **CSSdev & CSSop distribs' link :**
  - https://u.ganil-spiral2.eu/csssp2/
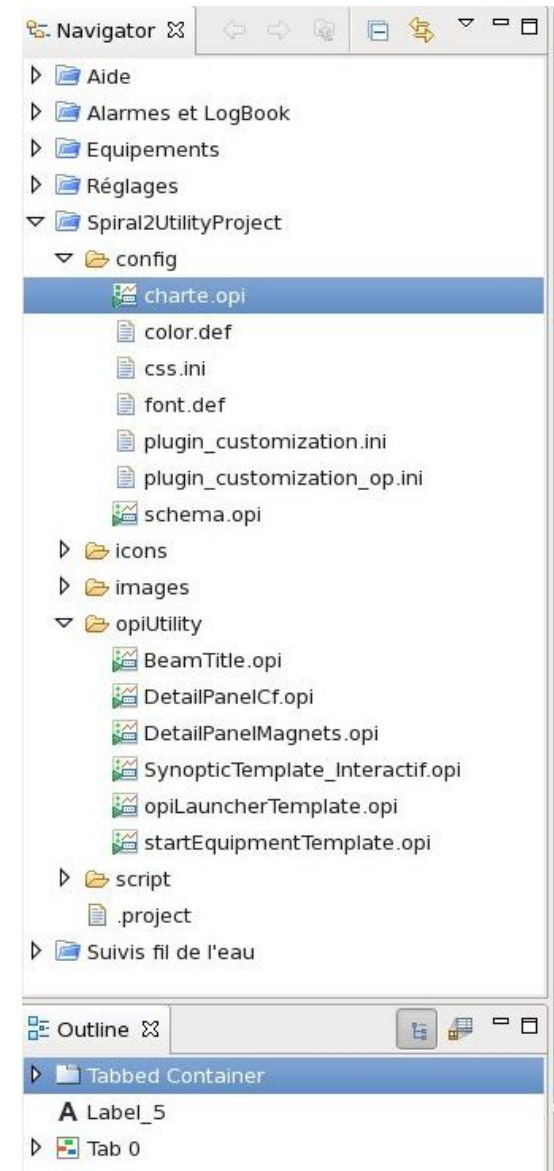
Environment

- Java programmation
- Derived from
  XAL framework (SNS)

Available

- Parameter management
- Optimization
- Emittance limitation
- Beam analysis
- Hook
- Beam profilers display

Under development

- Power raise

To be developped

- Cavity tuning
- MPS

Optimization
(tested @Saclay)

Emittance limitation
(tested @Saclay)

Cavity tuning
(simulation mode)
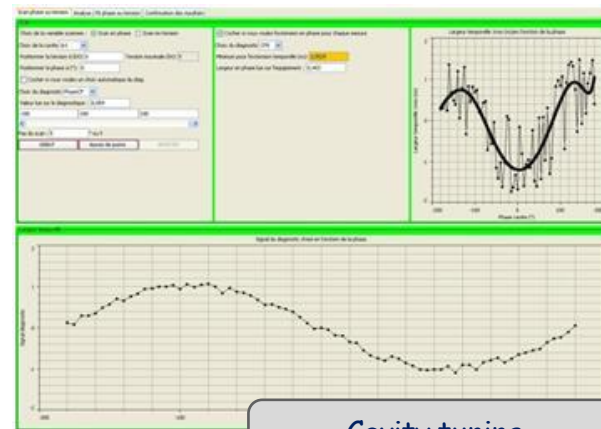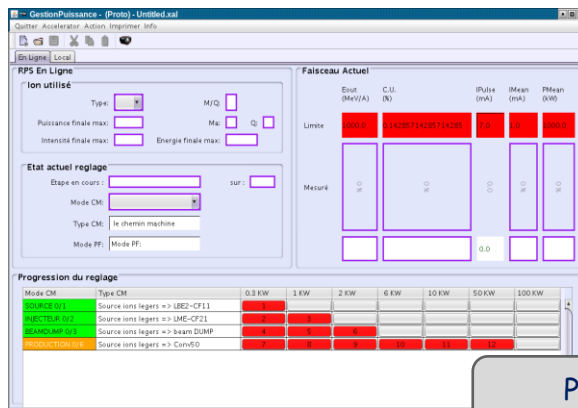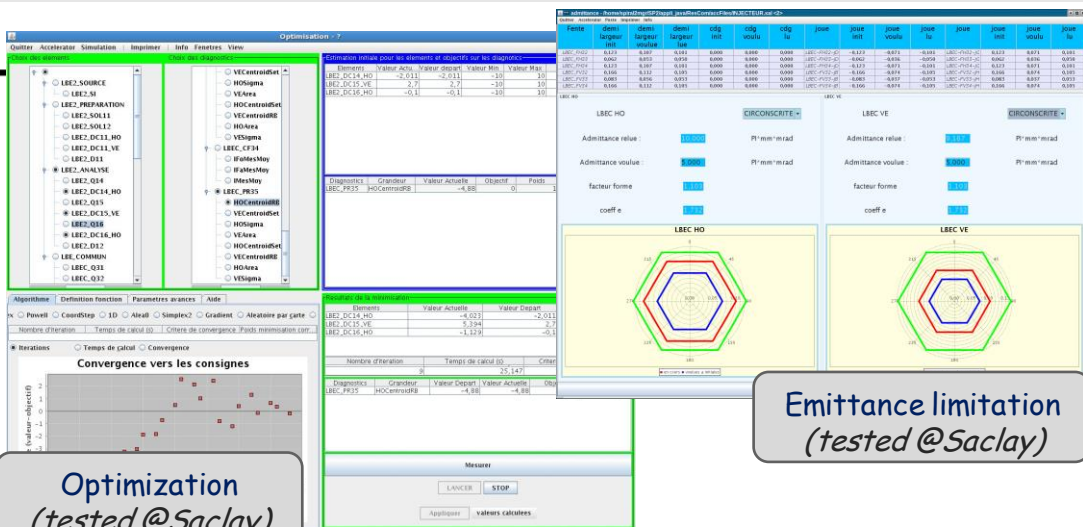
Power raise
(graphical design)

Integration mechanism

- Coherency check between
  - ✓ Software deliveries (through SVN)
  - ✓ Conventions & rules
- genIOC environment

Control system evolutions

- Identified items :
  - ✓ topSp2 repositories
    - ❑ Modules
    - ❑ Equipment
    - ❑ Alarms
  - ✓ CSS GUIs
  - ✓ Java applications
- Operation & maintenance modes
- Procedures
- Software tools & utilities

work flow diagram

Evolution type ?
- IOC
- Module
- Equipment conf.

Switch to maintenance mode

IOC or module creation /modification

Equipment configuration

Functionnal tests

Switch to operation mode
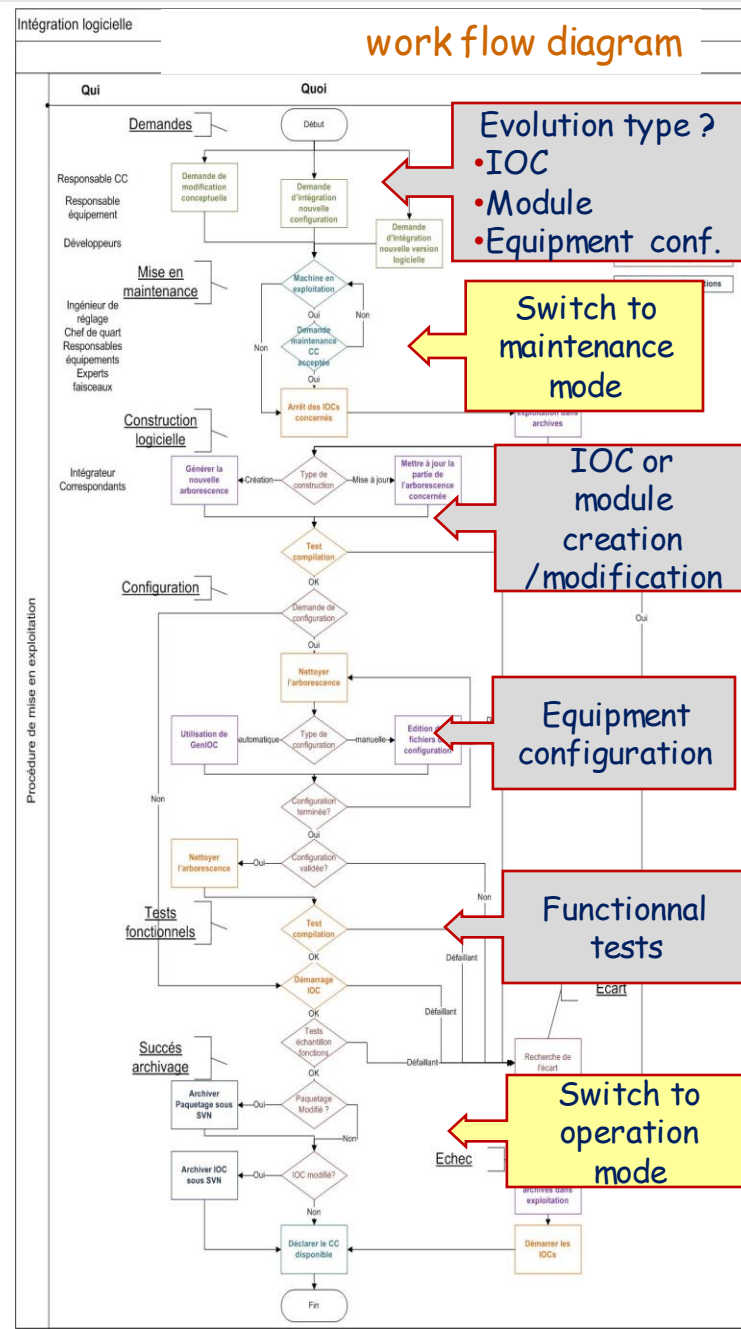
Sources + LEBTx 12/2014	RFQ + MEBT 05/2015	Linac + HEBT 09/2015

Milestones

- **Control system**
  - Software :
    - ✓ Infrastructure : ~ready for use
    - ✓ Integration of external developments on Ganil site : in progress

      Spiral2 project

      Ganil Accelerator Division
      Operation
      Technical groups
      ↳ *Control group*

  - Testing & commissioning
    - ✓ Sources & LEBTs :
      - ❑ Prior to software : installation, cabling and wiring tests
      - ❑ Control system tests possible when equipment declared available
    - ✓ From RFQ to HEBT :
      ~ expect to provide basic functionalities
  - Knowledge transfer : ?

  WORK IN PROGRESS
  SORRY FOR ANY
  INCONVENIENCE
  CAUSED

Thanks for your attention !

Irfu — Denis J.F., Gougnaud F., Lussignol Y. *(Gournay J.F.)*

iPHC — Graehling P., Hosselet J., Maazouzi C.

GANIL — Deroy J.C, Gillette P., Haquin C., Lécorché E., Lemaître E., Normand G., Patard C.H., Philippe L., Rozé J.F., Touchard D.

(Duneau P., Lermine P., Loyant J.M.)