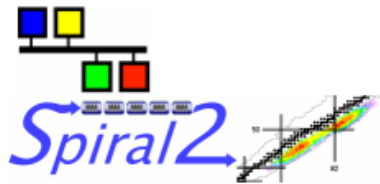




# The Spiral2 Control System progress towards the commissioning phase



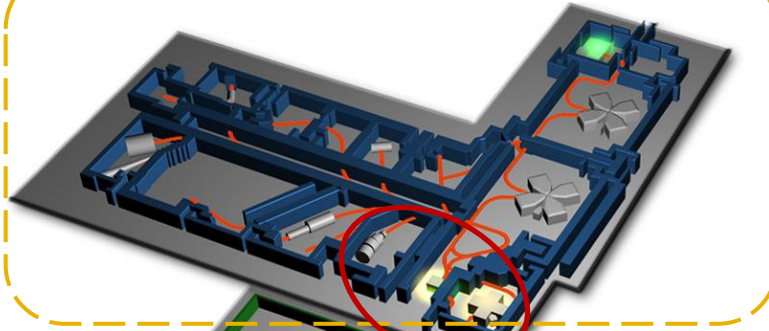


# Spiral2 : a new Rare Ion Beam facility

*Beam Characteristics at Linac exit*

	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

Existing GANIL facility



SPIRAL2 facility

DESIR experiment room

S3 experiment room :  
Super Separator Spectrometer

NFS experiment room  
Neutron For Science

Phase 2 : RIB production : under design

Spiral2 Accelerator :  
2 ions sources, RFQ, superconducting Linac



# Building progress : From building to ...

The Finishing touch is ongoing





# Building progress : ... process installation

- Process installation in parallel with the building

- Low Energy Beam lines installation started end-2012



**July 2013:  
mechanical frame and quadrupoles in place**



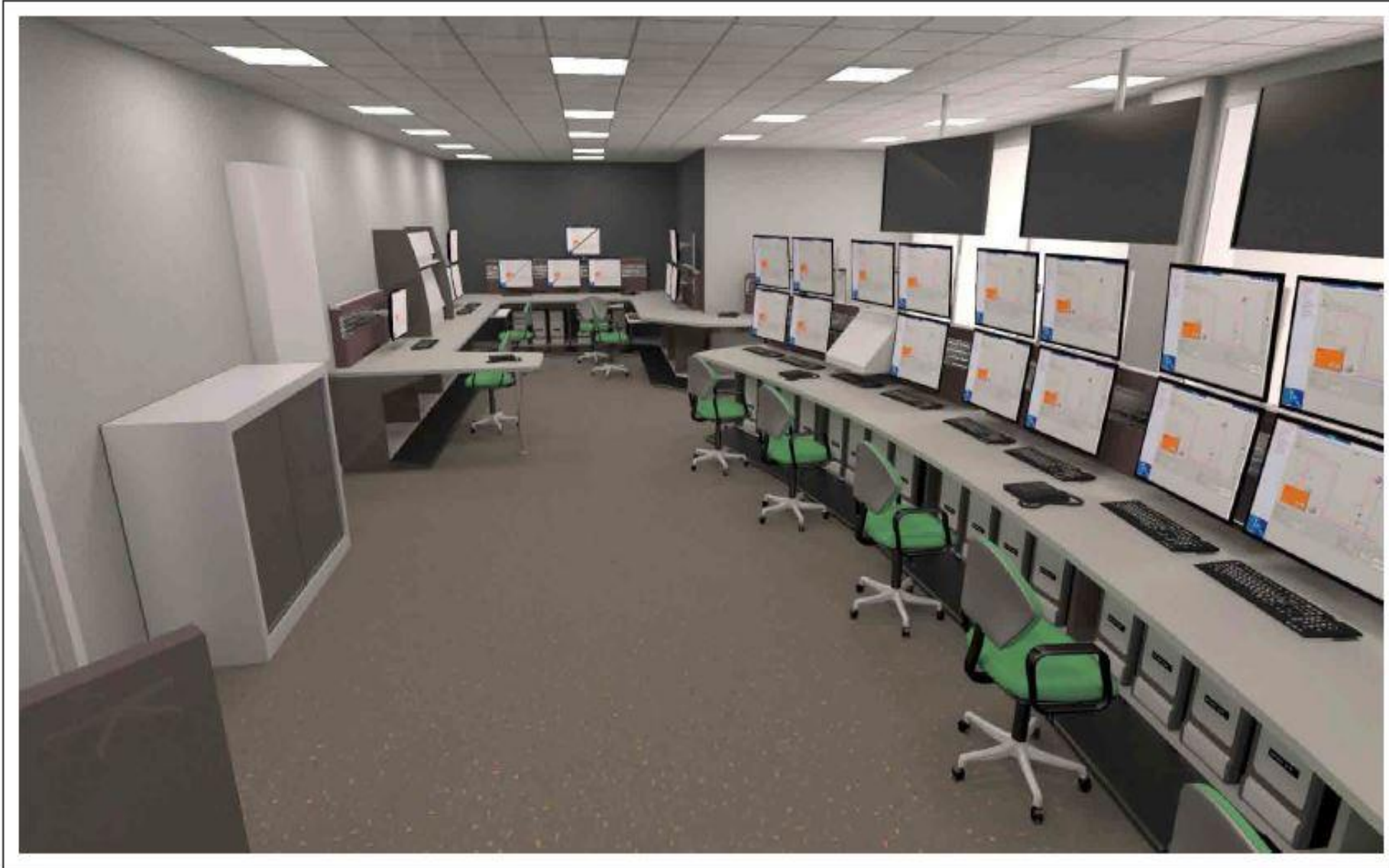
- Linac installation just started



**July 2013: mechanical frame in place**

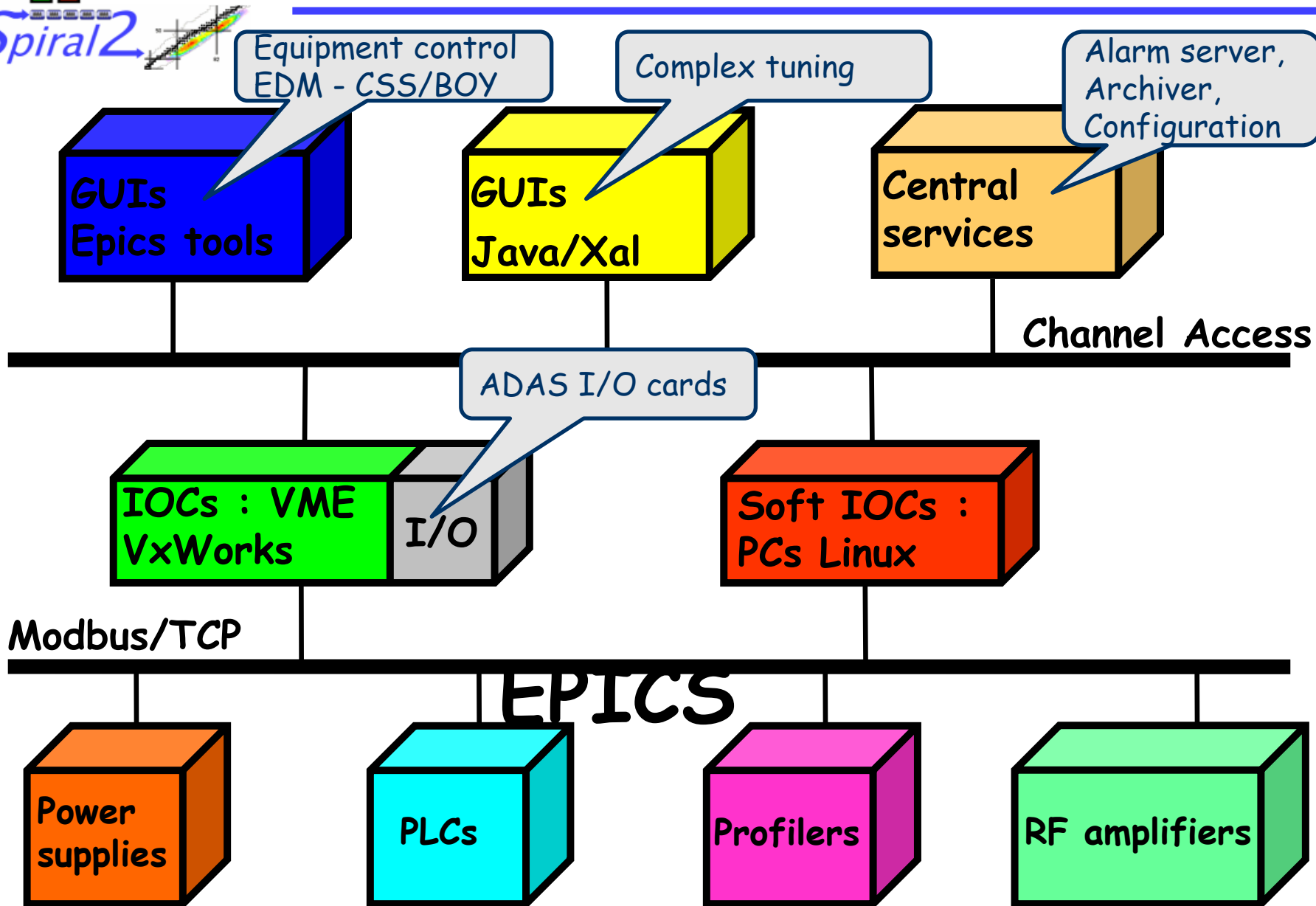


**Cryogenic-modules installed soon**

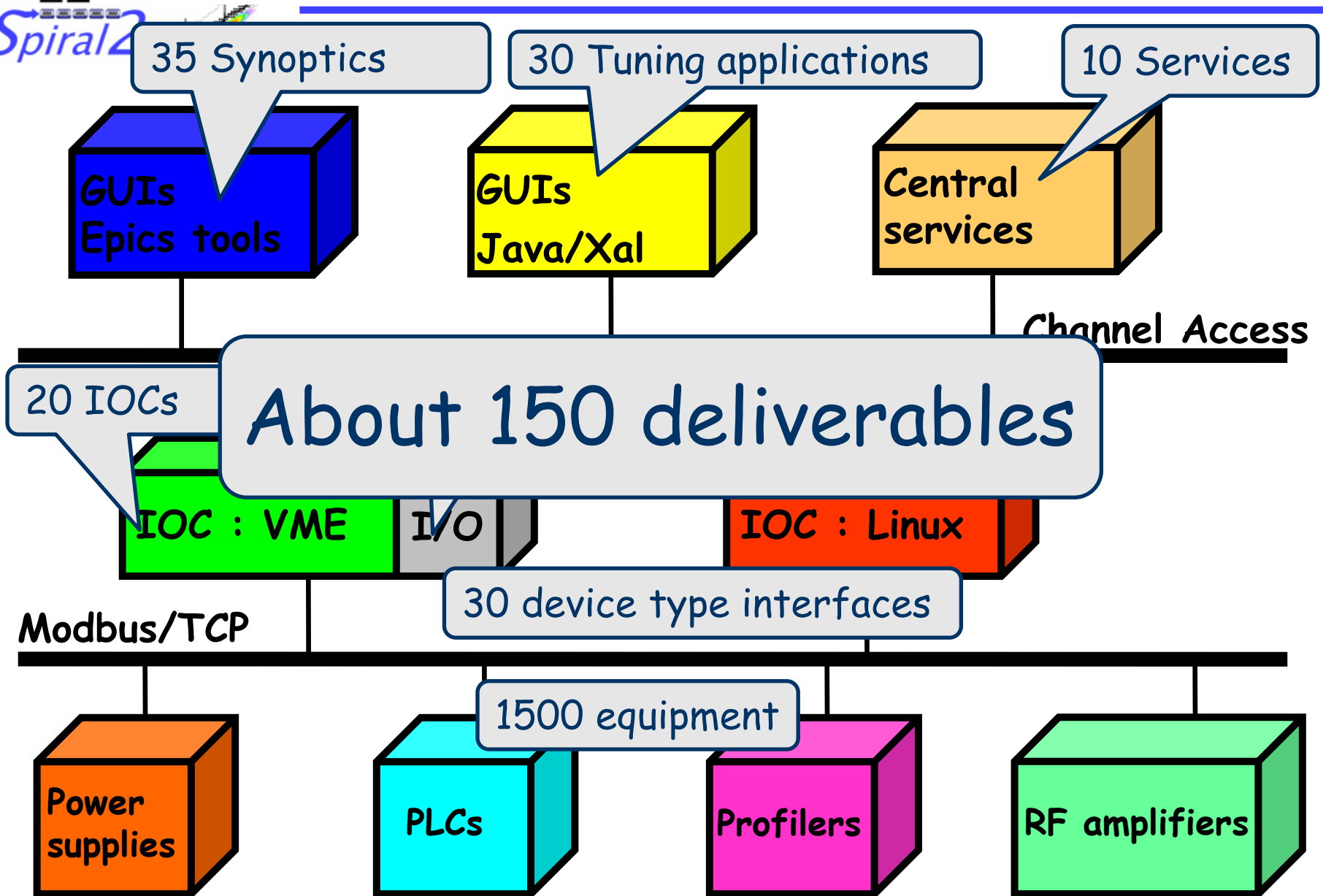




# Control System Architecture



# Control System Deliverables







Work Package	Low Level RF		Beam dump activity limiter		Beam Lost Monitor	
	IRFU		GANIL		IFIN-HH	
Responsible	IRFU		GANIL		IFIN-HH	
	Dev. With & by	Hardware choices	Dev. With & by	Hardware choices	Dev. With & by	Hardware choices
CPU	EPICS/ IRFU	MVME 5500	EPICS/ Labvie w/GANIL	NI CRio	EPICS/ GANIL	MVME 5500
FPGA	IRFU	IRFU	GANIL	NI 9022	Cosylab	CAEN V1495
I-O	IRFU	IRFU	GANIL	NI 9205 9425	IFIN-HH	CAEN V1495



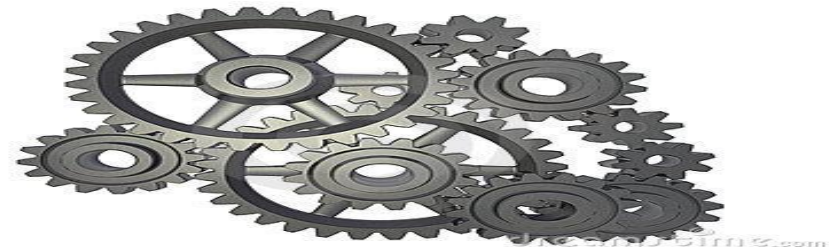
- Collaboration between IRFU, IPHC and GANIL institutes
- Coordination under responsibility of GANIL
- 3 teams
  - Average of 7 men/year since 2007





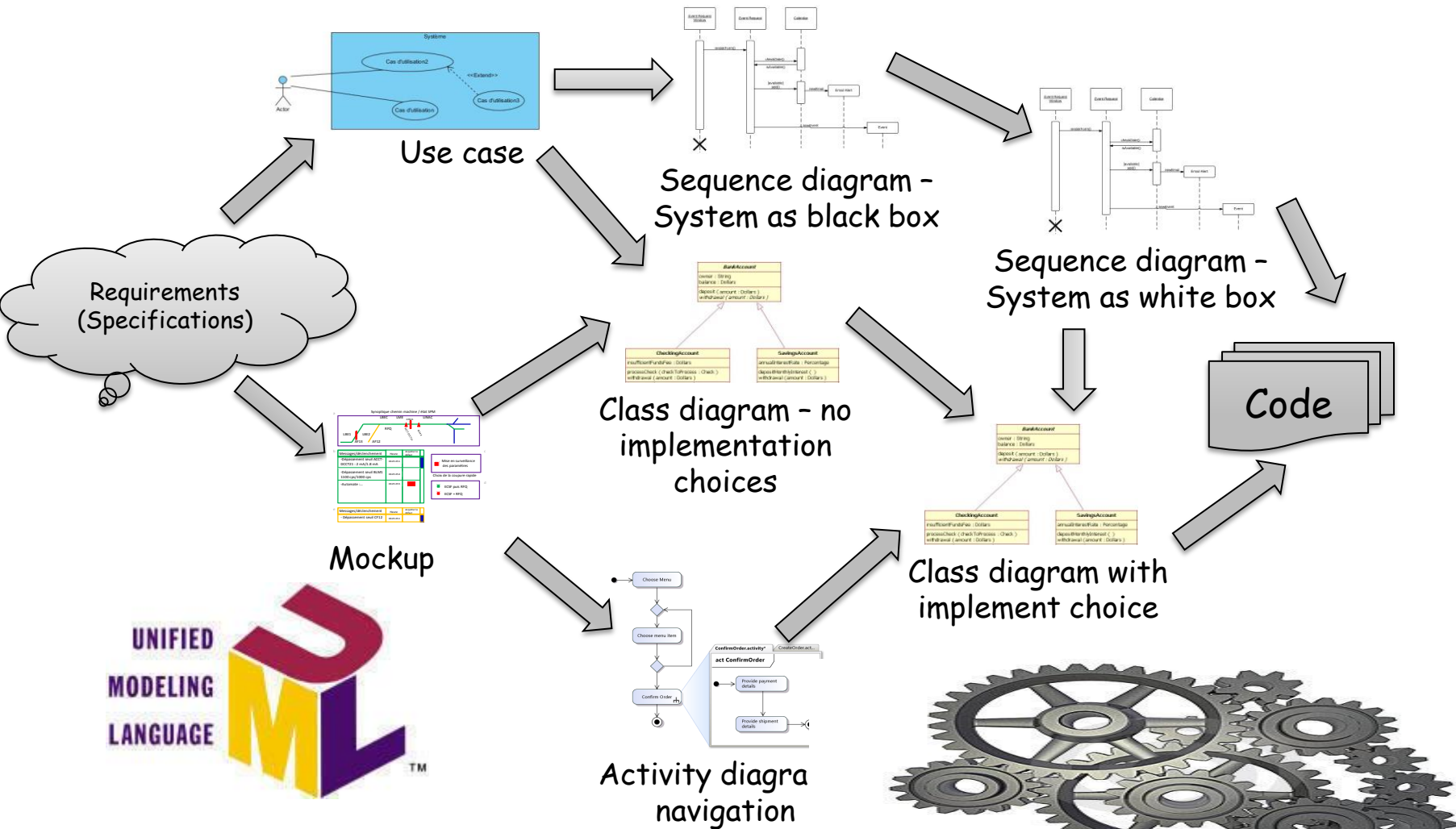
## ▪ Working organization

- Common Spiral2 development platform:
  - ✓ Common EPICS distribution
  - ✓ With the same VxWorks kernel
  - ✓ And Spiral2 version of the EPICS development environment
- Rules and Formalization
  - ✓ **Standardized** interface between EPICS records and GUIs
- Development shared via SVN repository





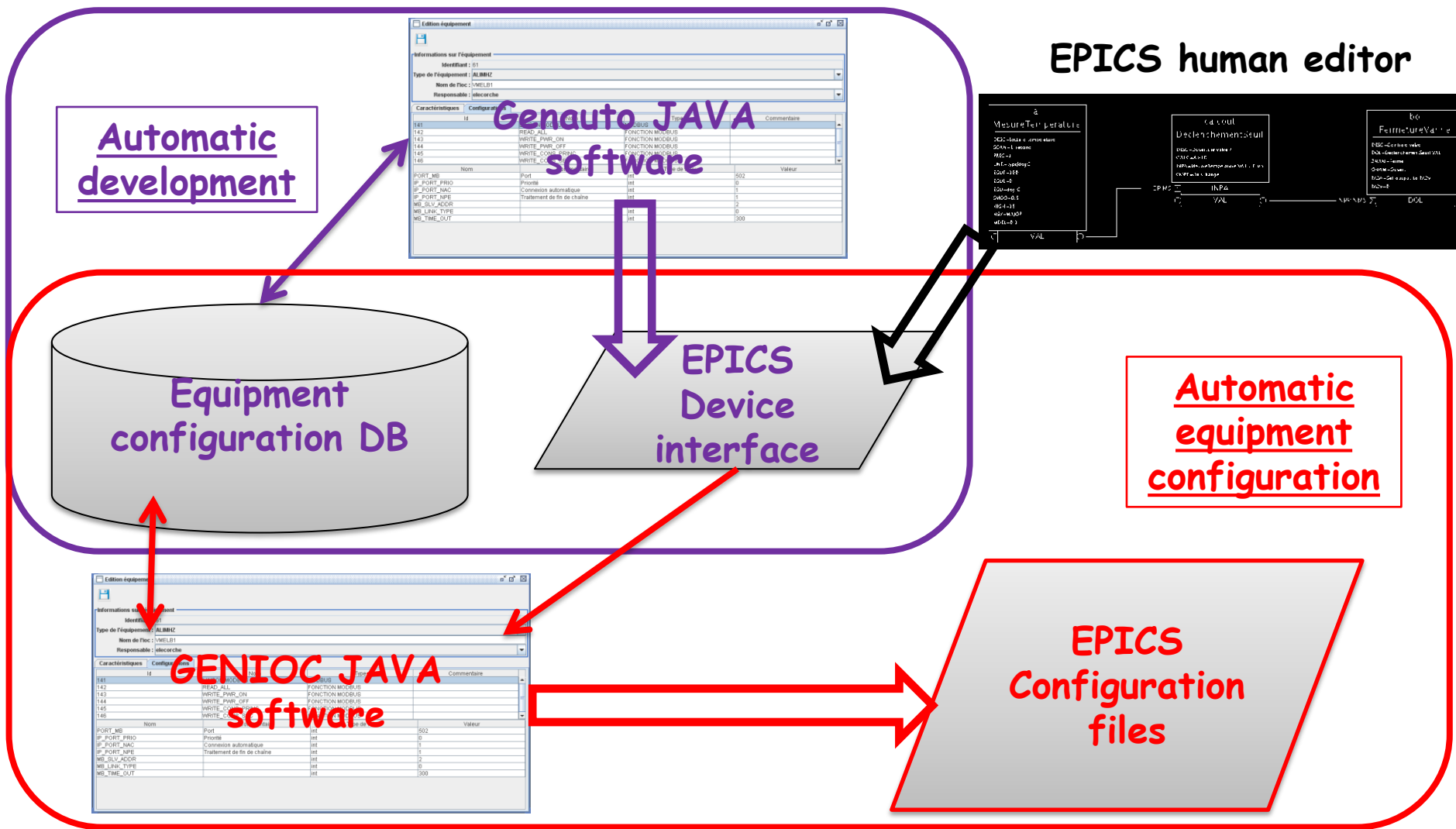
## Specification template for module documentation





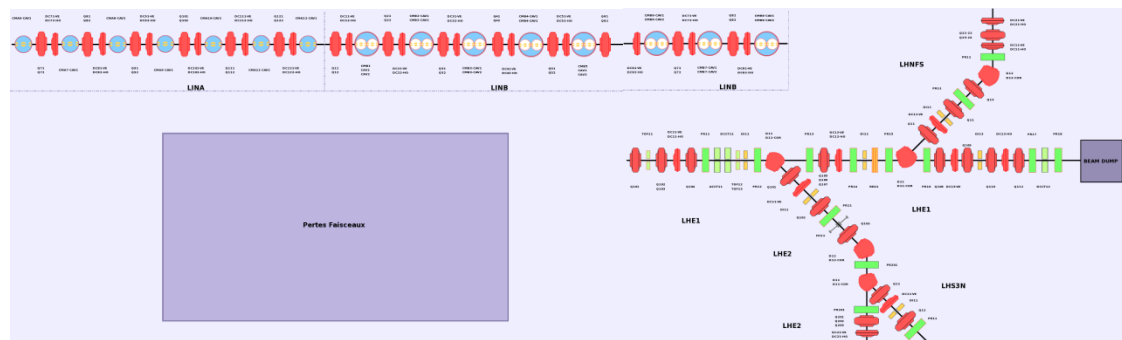
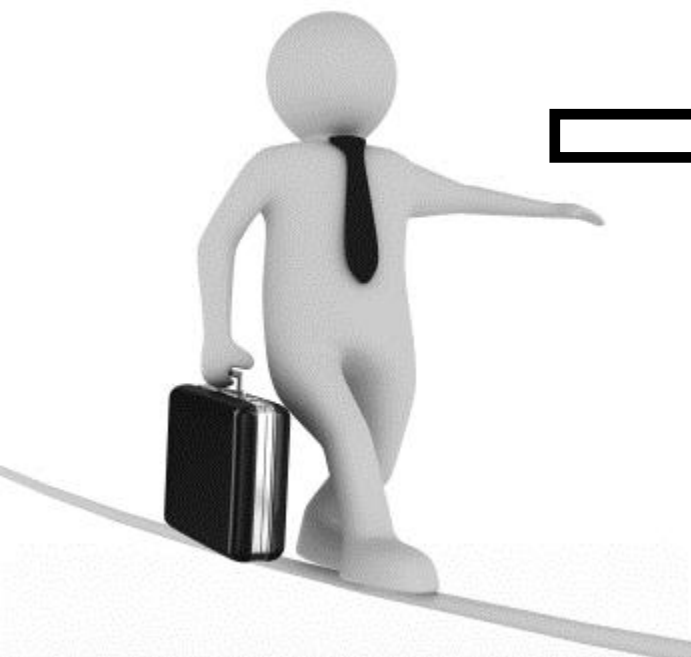
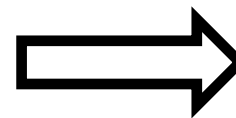
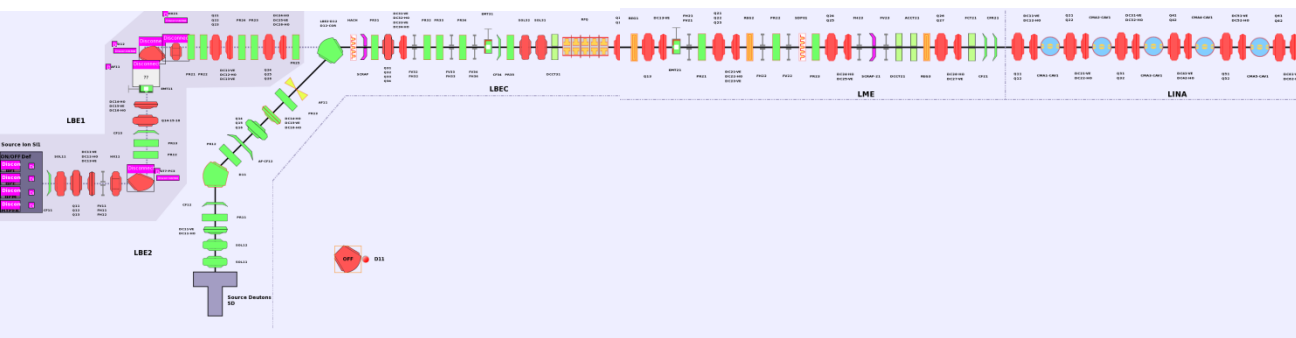
# Automatic IOCs development & configuration

- Epics IOCs automatically generated from SVN and equipment relational database.





- Supervision on EPICS CSS/BOY : Control System Studio editor





# Xal Graphical User interface

**Regroupeur - ?**

Tableau de bord Scan phase ou tension Analyse / fit phase ou tension

Choix de la variable scannée:  Scan en phase  Scan en tension  Cocher si vous positionner la tension  dV  100000 Tension maximale

Choix du diagnostic: TOF1

Valeur lue sur le diagnostic: 0,026

Pas du scan: 1  ou V

Largeur temporelle

Signal

Signal diagnostic

Choix des éléments

- LBE2\_SOURCE
- LBE2\_SI
- LBE2\_PREPARATION
  - LBE2\_SOL11
  - LBE2\_SOL12
  - LBE2\_DC11\_HO
  - LBE2\_DC11\_VE
  - LBE2\_D11
- LBE2\_ANALYSE
  - LBE2\_Q14
  - LBE2\_DC14\_HO
  - LBE2\_Q15
  - LBE2\_DC15\_VE
  - LBE2\_Q16
  - LBE2\_DC16\_HO
  - LBE2\_D12
- LBE\_COMMUN
  - LBEQ\_Q31
  - LBEQ\_Q32

**GestionPuissance - (Proto) - Untitled.xal**

Quitter Accelerator Action Imprimer Info

En Ligne Local

**RPS En Ligne**

Ion utilisé

Type:  M/Q:

Puissance finale max:  Ma:  Q:

Intensité finale max:  Energie finale max:

**Faisceau Actuel**

	Eout (MeV/A)	C.U. (%)	IPulse (mA)	IMean (mA)	PMean (kW)
Limite	1000.0	0.14285714285714285	7.0	1.0	1000.0
Mesuré	% 0	% 0	0.0	% 0	% 0

Etat actuel réglage

Etape en cours:  sur:

Mode CM:

Type CM: le chemin machine

Mode PF: Mode PF:

**Progression du réglage**

Mode CM	Type CM	0.3 kW	1 kW	2 kW	6 kW	10 kW	50 kW	100 kW
SOURCE 0/1	Source ions legers => LBE2-CF11	1						
INJECTEUR 0/2	Source ions legers => LME-CF21	2	3					
BEAMDUMP 0/3	Source ions legers => beam DUMP	4	5	6				
PRODUCTION 0/6	Source ions legers => Conv50	7	8	9	10	11	12	

Algorithme Definition fonction Parametres avances Aide

Powell  CoordStep  1D  Alea0  Simplex2  Gradient  Aleatoire par garte

Nombre d'iteration Temps de calcul (s) Critere de convergence Poids minimisation corr...

Iterations  Temps de calcul  Convergence

**Convergence vers les consignes**

Critere (valeur-objectif)

Iterations

■ HOCentroidRB

**Resultats de la minimization**

Elements	Valeur Actuelle	Valeur Depart	Ecart A
LBE2_DC14_HO	-4,023	-2,011	-2,013
LBE2_DC15_VE	5,394	2,7	2,694
LBE2_DC16_HO	-1,129	-0,1	-1,029

		Nombre d'iteration	Temps de calcul (s)	Critere de convergence
		9	25,147	17,956

Diagnostics	Grandeur	Valeur Depart	Valeur Actuelle	Objectif	Ecart mm
LBEQ_PR35	HOCentroidRB	-4,88	-4,88	-0,547	-0,547

Mesurer

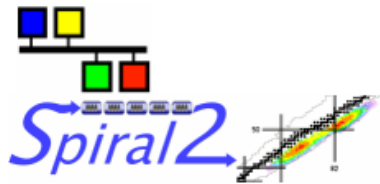
LANCER STOP

Appliquer valeurs calculees

$$P_{failure} = \sum_{c=0}^{2k} P_{up of size c exists} = \sum_{c=0}^{2k} \frac{2k!}{(2k-c)! c!} \frac{(2k-c)!}{2k!} = \sum_{c=0}^{2k} \frac{1}{c!} = H_{2k} - H_k$$

$$\leq \int_k^{2k} \frac{1}{x} dx = \ln 2k - \ln k = \ln 2$$

Process = 1 - P<sub>failure</sub> ≥ 1 - ln 2 ≈ 0.30



# Development Status

- Sources/Low energy beam lines validated during tests performed in Grenoble & Saclay in the past 4 years
  - Ions Sources control
  - 3 first VME IOCs configured
  - Developments required not only for low energy beam lines
    - ✓ Power supply, Faraday cups, Slits, Beam profiler
  - Central Services
  - Commissioning will start mid-2014
- Important developments are still on going ...
  - Beam Loss Monitors, Cavity tuning, Vacuum and many others
  - ... must be available end 2014







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Thank you for your attention !