



Use of XAL at Spiral 2

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- What we had to do :
 - design java applications
 - ✓ to tune accelerators with different beams.
 - ✓ To control the accelerator devices.
 - with
 - ✓ a very small team of developpers.
 - ✓ No background of java and Epics.

- We need a magic wand => XAL

- What we are doing :
 - => definition of the accelerator tree.
 - => definition of the accelerator components.
 - => definition of the management of the values sets for tuning.
 - => writing first applications for supervising devices.



- Definition of the accelerator and the beam paths.

- ✓ Injector

- LBE1 => Ions 1/3.

- LBE2 => d,p

- LBE3 => Ions 1/6

} could be tuned « off line »

- ✓ Linac

- LME

- LINAC A

- LINAC B

- ✓ LHE

- NFS

- S3

- S3 N

- S3 S

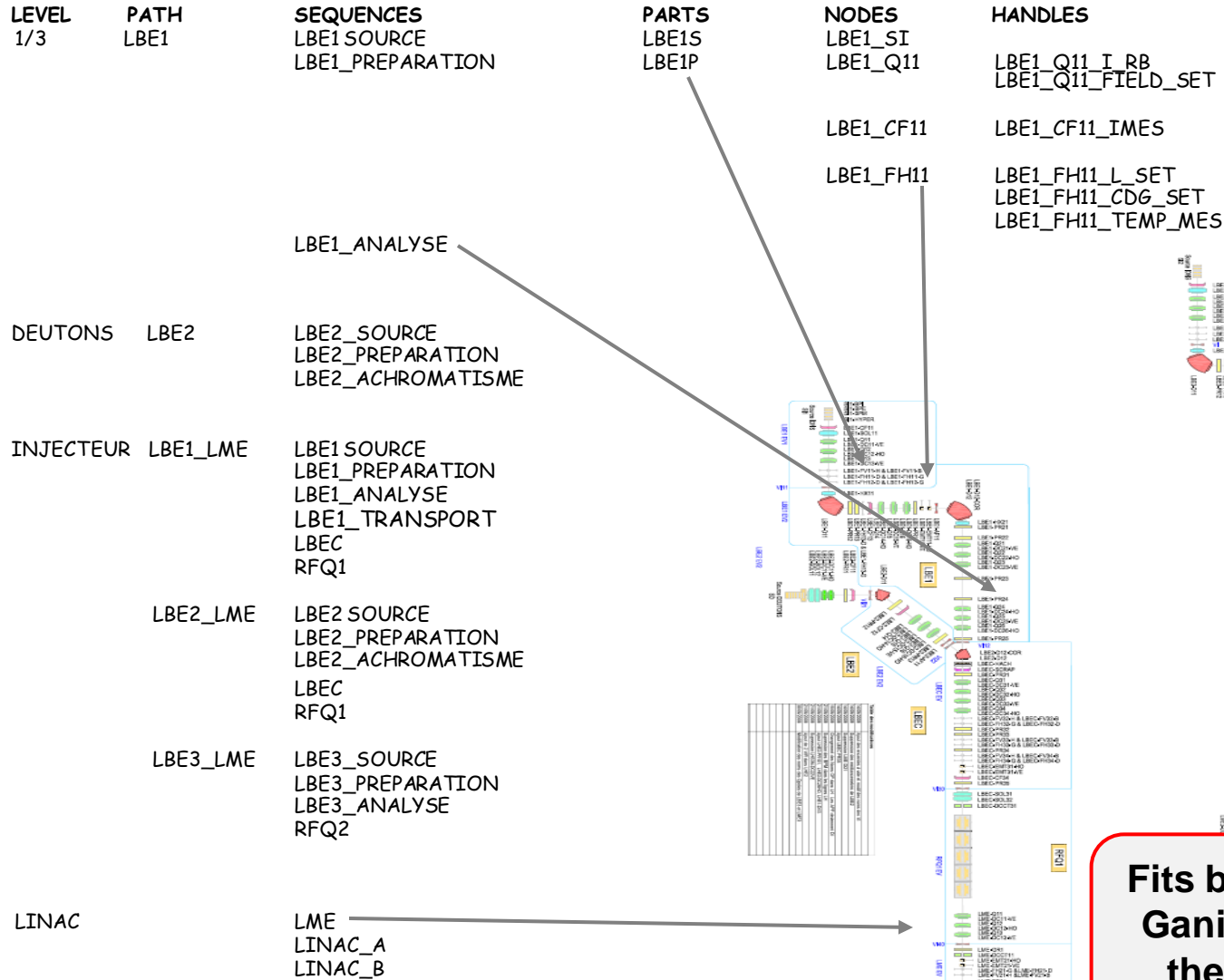
- Beam Dump

- Production

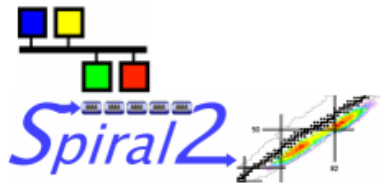
- Insertion in a database INGRES



Accelerator hierarchy within the database

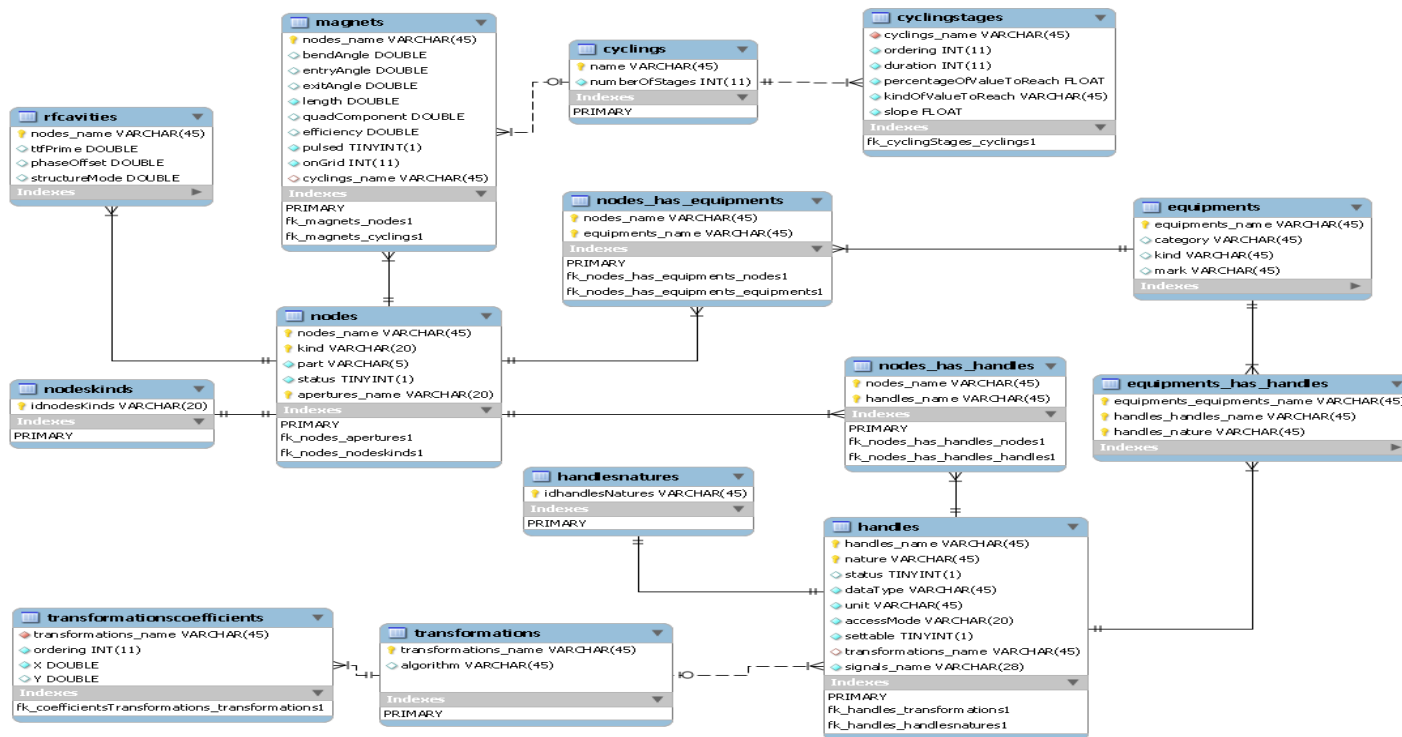


Fits both the existing Ganil approach and the Xal concepts



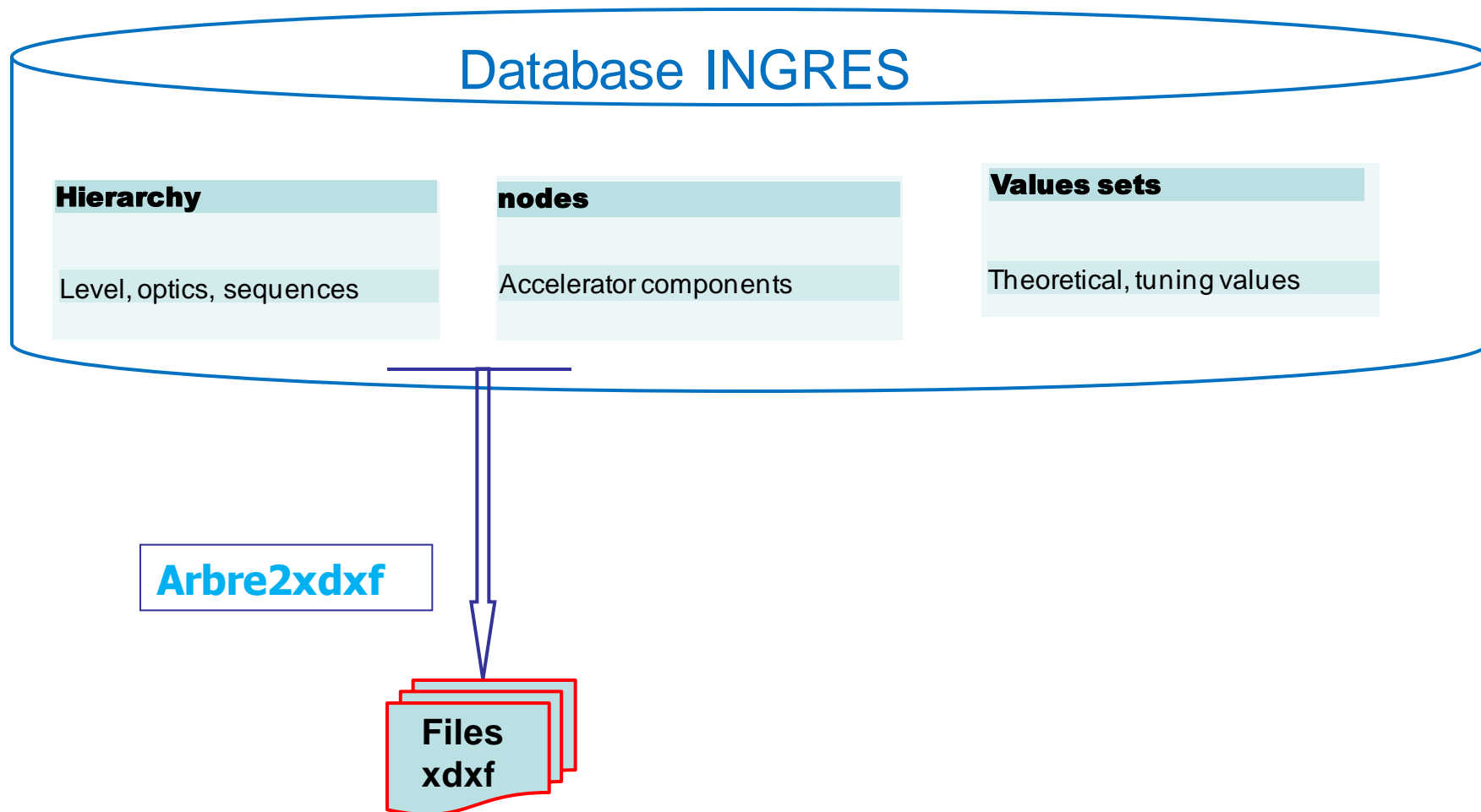
Definition of the nodes in the database

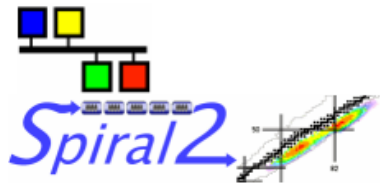
- Geometry.
- Handles.
- Specific values magnetic data, Hf ...
- Equipments(power supplies...).





Generation of the optics files





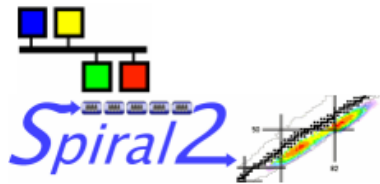
- **Arbre2xdxf** : software for automatic generation of XDXF files from database
 - Creates a new empty accelerator.
 - Reads the nodes ordered by sequences in the DB.
 - Populates the accelerator with the nodes created by **Spiral2AcceleratorNodeFactory** which from db
 - ✓ reads the alignment values.
 - ✓ reads the component values. (magnetBucket,rfBucket).
 - ✓ reads the handles and their transformations.
 - ✓ reads the equipments used by the node. (ps,...)
 - Populates the accelerator with the equipments by **bd2Eqpts** (powersupplies)
 - Writes the accelerator to a file.



```
<?xml version = '1.0' encoding = 'UTF-8'?>
<!DOCTYPE xdx SYSTEM "xdxf.dtd">
<xdxf date="08.21.2009" id="LBE1" ver="Beta">
  <sequence id="LBE1_ANALYSE" len="07.298" pos= " 2.7505" status="true" type="sequence">
    <attributes>
      <sequence predecessors = 'LBE1_PREPARATION' > />
    </attributes>
    <node id=" LBE1_D11" len="0.942478" pos="3.5205" status="true" type="DH">
      <attributes>
        <aperture shape="2" x="0.22" y="0.09"/>
        <align pitch="0.0" roll="0.0" yaw="0.0" x="3.5205" y="0.0" z="0.0" />
        <magnet bendAngle="-90.0" dfltMagFld="0.101824" dipoleEntrRotAngle="26.565"
          dipoleExitRotAngle="26.565" len="0.942478" polarity="1.0"/>
      </attributes>

      < ps main="LBE1-D11" trim="LBE1-D11-COR" />

      <channelsuite magnetsuite>
        <channel handle=« fieldRB" settable="false" signal="LBE1-D11-B:Champ" transform="LBE1-D11-B"
          <!-- gauge field measurement / bend axis field-->
          <transform name="LBE1-D11-B" nbcouples= " 2" type=" doubleNevilleInterpolation "
            " x0= " 500" x1="1000" y1= " 505.2" y2="1146.8" ,/>
        </channelsuite>
      </node>
```

Used to convert

- Field to current.
- Field measurement to field on axis of magnet.

```
<transform name="LBE1-D11"  
  nbcouples="6"  
  type="doubleNevilleInterpolation"  
  x0="0" x1="80" x2="90" x3="150" x4="200" x5="250"  
  y0="0" y1="1019" y2="1146.8" y3="1909" y4="2541.5" y5="3168.7"/>
```

- => modification
 - Signalsuite.java
 - TransformFactory
 - DataTransformFactory



Nodes & Devices

- Xal Nodes
 - Qpoles,bends,Rfcavities, ...
- Specific nodes
 - Slits.
 - TrimmedBend.
 - Deflectors (high voltage supply).
 - Bunchers.
 - Diagnostics ...
- Access to hardware devices of the accelerator.
 - Power supplies (current and high voltage).
 - Field probes (hall probes, mnr probes).
 - Motors .
 - Temperature probes.
 - Actuators.
- Common handles for accessing devices used by nodes
 - cmd
 - State
 - defaults



Beam diagnostics interface

Name	Interface	Progress
Faraday cup slow acq.	VME ICV150	To be validated
Faraday cup fast acq.	VME ICV178 & 108	First tests to be done
DCCT	VME ICV ...	Same as Faraday cups
ACCT	?	Under discussion
Profilers	Modbus / RTU	Prototype mid-2010
BLM Beam Losses Monitors	(↪ NIPNE) ?	To be defined
BPM Beam Position Monitors	(↪ BARC) Specific VME board	To be integrated
Time Of Flight (TOF)	Modbus / TCP	Under discussion
Packet length & FCT	Oscilloscope	Under discussion
Packet length (Linac)	?	?



Magnet Power supply Channels

```

<PS>
<main genre="HAZEMEYER" id="LBE1-D12" type="main">
<channelsuite name="« pssuite »">

  <channel handle="I" settable="false" signal="LBE1-D12:IAct"/>
  <channel handle="ISet" settable="true" signal="LBE1-D12:ICons"/>
  <channel handle="« fieldSet" settable="false" signal="LBE1-D12:ICons" transform="LBE1-D11"/>
  <channel handle="« psFieldRB" settable="false" signal="LBE1-D12:IAct" transform="LBE1-D11"/>

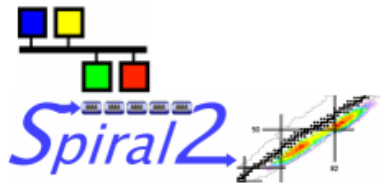
  <channel handle="RampeLocale" settable="false" signal="LBE1-D12:IRampLocal"/>
  <channel handle="Ready" settable="false" signal="LBE1-D12:Rdy"/>
  <channel handle="RampeStart" settable="true" signal="LBE1-D12:IRampStart"/>
  <channel handle="ButeeMax" settable="false" signal="LBE1-D12:IButeeMax"/>
  <channel handle="VMax" settable="false" signal="LBE1-D12:VMax"/>
  <channel handle="VMes" settable="false" signal="LBE1-D12:VMes"/>
  <channel handle="OnOff" settable="false" signal="LBE1-D12:OnOff"/>
  <channel handle="TypeAlim" settable="false" signal="LBE1-D12:TypeAlim"/>
  <channel handle="IMax" settable="false" signal="LBE1-D12:IMax"/>
  <channel handle="Ctrl" settable="false" signal="LBE1-D12:Ctrl"/>
  <channel handle="NoBusy" settable="false" signal="LBE1-D12:NoBusy"/>
  <channel handle="SlopeRb" settable="false" signal="LBE1-D12:IRampAct"/>
  <channel handle="SlopeSet" settable="true" signal="LBE1-D12:IRampCons"/>
  <channel handle="ButeeMin" settable="false" signal="LBE1-D12:IButeeMin"/>
  <channel handle="Pwr" settable="false" signal="LBE1-D12:Pwr"/>

  <channel handle="Cmd" settable="true" signal="LBE1-D12:Cmd"/>
  <channel handle="CmdsList" settable="false" signal="LBE1-D12:ProcessDynamicModbusTable.VALS"/>
  <channel handle="State" settable="false" signal="LBE1-D12:ProcessDynamicModbusTable.VALJ"/>
  <channel handle="StateDescOn" settable="false" signal="LBE1-D12:ProcessDynamicModbusTable.VALT"/>
  <channel handle="StateDescOff" settable="false" signal="LBE1-D12:ProcessDynamicModbusTable.VALU"/>
  <channel handle="DefaultsList" settable="false" signal="LBE1-D12:Defects.VALB"/>
  <channel handle="Defaults" settable="false" signal="LBE1-D12:Defects.VALA"/>
  <channel handle="DefaultsProcess" settable="true" signal="LBE1-D12:Defects.PROC"/>

  <transform name="LBE1-D11" nbcouples="6" type="doubleNevilleInterpolation" x0="0" x1="80" x2="90" x3="150" x4="200" x5="250" y0="0" y1="1019" y2="1146.8"
  y3="1909" y4="2541.5" y5="3168.7"/>
</channelsuite>
</main>
</PS>

```

equipment handles



Application Hook

Choice of ps

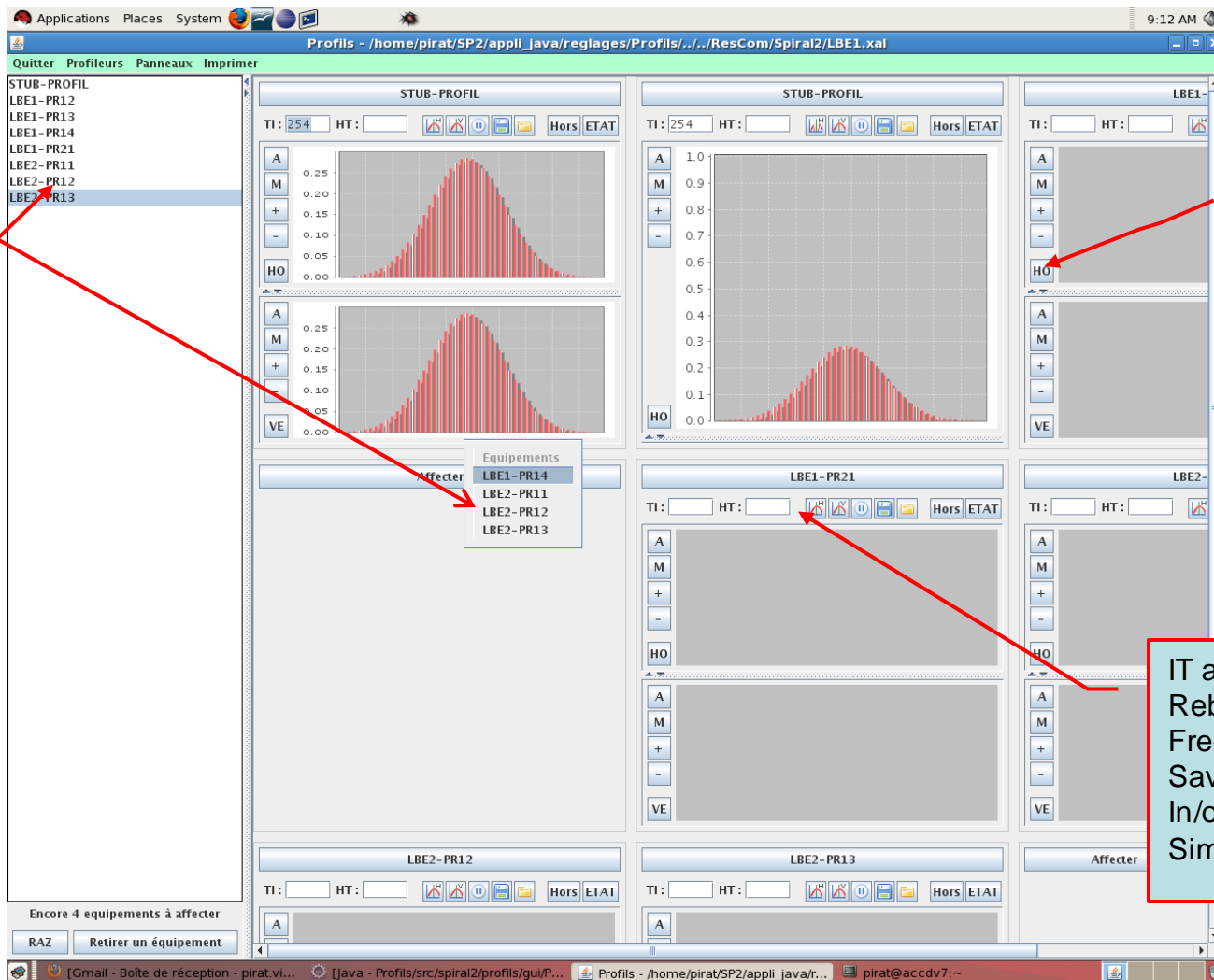
The screenshot shows the HookDesktop application window with a tree view on the left and a main control area on the right. The tree view lists various equipment under 'HAZEMEYER', including 'STUB-ALIM6', 'LBE2-DC11-HO', 'LBE2-D12-COR', 'LBE2-D12', 'LBE2-D11-COR', 'LBE1-SOL11', 'LBE1-SI-BP', 'LBE1-Q16', 'LBE1-Q15', 'LBE1-Q14', 'LBE1-Q13', 'LBE1-Q12', 'LBE1-Q11', 'LBE2-DC11-VE', 'LBE2-DC14-VE', 'LBE2-DC15-HO', 'STUB-ALIM5', 'STUB-ALIM4', 'STUB-ALIM3', 'STUB-ALIM2', 'STUB-ALIM1', 'LBE2-SOL12', 'LBE2-SOL11', 'LBE2-Q16', 'LBE2-Q15', 'LBE2-Q14', 'TST-ALIM1', 'LBE2-DC16-VE', 'LBE2-D11', 'LBE1-HX11', 'LBE1-DC14-VE', 'LBE2-SI-BP', 'LBE1-DC16-VE', 'LBE1-HX12', 'LBE1-DC12-VE', 'LBE1-DC15-HO', 'LBE1-DC11-HO', 'LBE1-D12-COR', 'LBE1-D12', 'LBE1-D11-COR', and 'LBE1-D11'. The main control area is divided into several panels for different power supplies: 'LIBERER0', 'LIBERER1', 'LIBERER3', 'AFFECTER2', 'AFFECTER4', and 'AFFECTER5'. Each panel shows a 'Consigne' (setpoint) value, a 'VAct' (actual voltage) value, an 'IAct' (actual current) value, and an 'ICons' (setpoint current) value. The 'LIBERER0' panel shows a 'Consigne' of 800.0 A and a 'VAct' of 76.0000 A. The 'LIBERER1' panel shows a 'Consigne' of 800.0 A and a 'VAct' of 76.0000 A. The 'LIBERER3' panel shows a 'Consigne' of 393.0 A and a 'VAct' of 73.0000 A. The 'AFFECTER2' panel shows a 'Consigne' of 800.0 A and a 'VAct' of 76.0000 A. The 'AFFECTER4' panel shows a 'Consigne' of 800.0 A and a 'VAct' of 76.0000 A. The 'AFFECTER5' panel shows a 'Consigne' of 800.0 A and a 'VAct' of 76.0000 A. A red box highlights the 'Choice of ps' text, with a red arrow pointing to the 'STUB-ALIM3' entry in the tree view.

low level access to devices : power supply control

Choice of beam profil

Scaling features
 A : automatic
 M : maxima
 + : increase
 - : decrease

IT and Ht values
 Rebuild Mode
 Freeze,
 Save/restore
 In/out state and cmd
 Simulation , Test Modes





Beam parameters management

Off-line preparation

TraceWin output file

TraceWin2BD

Spiral2 database

On-line use of the ParaSpiral2 application

Choice of a set of values

Interactions with equipment
(set, read, compare ...)

Configuration Archiving

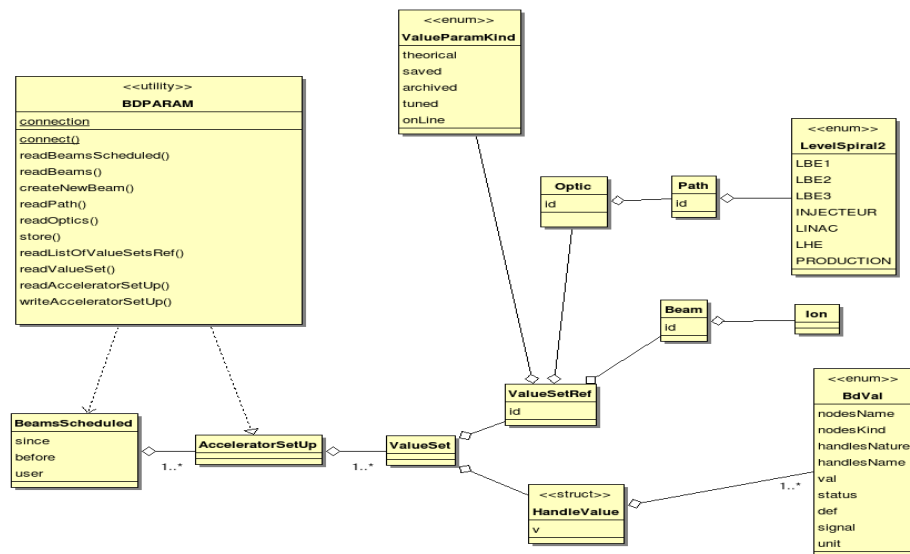
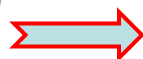
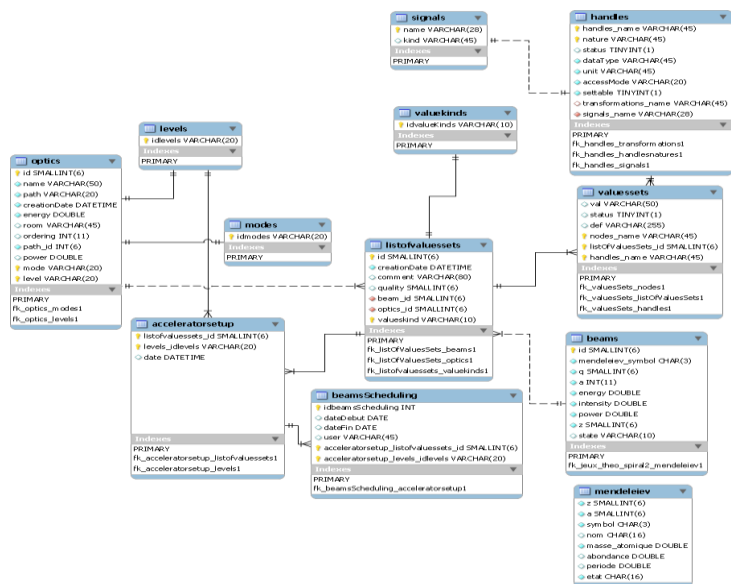
XAL (.xdxf) file

Arbre2xdxf



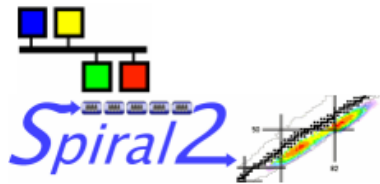
Values sets

Tracewin2Bd program reads theoreticals data created by the tracewin application and insert those into database tables



Data base tables

Java classes



The user can

- Choose
 - the ion beam.
 - the beam path, the beam optic from DB.
- Read theoretical, saved, archived or live values.
- Save values
 - For short term storage, selection by sequence.
 - For long term archiving, selection by beam path.
- Set values and restore them from DB
- Compare theoretical, saved, archived or live values..

- Change magnetic rigidity of the lines from theoretical, saved, archived or live values.

ParaSpiralDesktop

Quitter Changer Faisceau Equipements Configuration Impression Fenetres

/home/gillette/SP2/appli_java/commons/Paraspiral2/./././ResCom/Spiral2/LBE1.xal Faisceau de HE3+ 15MeV/A

Actions Impression

Racine

- LBE1_SOURCE
- LBE1_PREPARATION
- LBE1_ANALYSE
 - LBE1_D11
 - LBE1_PR12
 - LBE1_PR13
 - LBE1_FH13
 - LBE1_DC14_VE
 - LBE1_Q14
 - LBE1_DC15_HO
 - LBE1_Q15
 - LBE1_DC16_VE
 - LBE1_Q16
 - LBE1_PR14
 - LBE1_D12
 - LBE1_HX12
 - LBE1_PR21

READ pour Live

Nom	Type	Nature	Handle	Signal	Valeur	Unite	Default
LBE1_D11	DH	FIELD_TRIM_SET	LBE1_D11_FIELD_...	STUB-ALIM2:ICon...	26.1963920000...	G	
LBE1_D11	DH	I_RB	LBE1_D11_I_RB	STUB-ALIM1:IAct	200.0	A	
LBE1_D11	DH	I_TRIM_SET	LBE1_D11_I_TRI...	STUB-ALIM2:ICons	3.14	A	
LBE1_D11	DH	I_SET	LBE1_D11_I_SET	STUB-ALIM1:ICons	200.0	A	
LBE1_D11	DH	FIELD_SET	LBE1_D11_FIELD_...		2567.696392	G	valeur non calculee
LBE1_D11	DH	I_TRIM_RB	LBE1_D11_I_TRI...	STUB-ALIM2:IAct	3.14	A	
LBE1_D11	DH	FIELD_RB	LBE1_D11_FIELD_...	LBE1-D11-B:Cha...	0.0	G	ConnectionExcep...
LBE1_D11	DH	FIELD_BP_SET	LBE1_D11_FIELD_...	STUB-ALIM1:ICon...	2541.5	G	

READ => choisissez un jeu de valeurs stockee

Critere de tri

Faisceau	Voie	Type	Date
CARBONE => C ,A=12,Z=6,Q=1,I=5.5mA ,P=0.0W id=1	LBE1	stockee	2009-12-10 15:14:06
			2009-12-17 15:59:29

Annuler Valider

Fermer

test

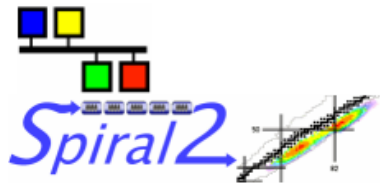
Element	Isotope	Charge
ACTINIUM => Ac	10 => MA=10.042618	1
ALUMINIUM => Al	11 => MA=11.026796226	2
AMERICIUM => Am	12 => MA=12.018613202	3
ANTIMOINE => Sb	13 => MA=13.005738584	4
ARGENT => Ag	14 => MA=14.003074005	5
ARGON => Ar	15 => MA=15.000108898	6
ARSENIC => As	16 => MA=16.006101417	7
ASTATINE => At	17 => MA=17.008449673	
AZOTE => N	18 => MA=18.014081827	
BARYLIUM => Ba	19 => MA=19.017026896	
BERKELIUM => Bk	20 => MA=20.023367295	
BERYLLIUM => Be	21 => MA=21.027087574	
BISMUTH => Bi	22 => MA=22.034440259	
BORE => B	23 => MA=23.04051	
BROME => Br	24 => MA=24.0505	
CADMIUM => Cd		
CALCIUM => Ca		
CALIFORNIUM => Cf		
CARBONE => C		
CERIUM => Ce		
CESIUM => Cs		
CHLORE => Cl		

Nom:AZOTE A:14 Q:7
 Symbol:N Masse atomique:14.003074005 Masse ionique:13.999233945623
 Z:7

Annuler Valider

Ion choice

Value Set Selection

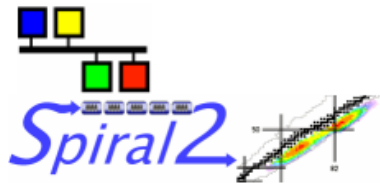


Conclusion

- Xal is mainly used, up to now, as a tool Box.
 - => we don't use modelisation.
 - => we don't have used bricks for building applications.

- Next steps
 - test the applications already written on the injection line LBE2 in Saclay
 - Write new applications or adapt existing ones
 - ✓ service applications
 - Launcher
 - Logging survey
 - Alarms
 - Elog
 - ✓ Tuning
 - general use applications. (scanning,knobs ...)
 - emittance limitation.
 - modelisation ?
 - tuning rf cavities
 - Energy management

- Xal is really what we were looking for and it will be a pleasure to share our code and applications.



*Congratulations to the XALteam
for the great work accomplished.*

Thank you for your attention.