STATUS REPORT ON SACLAY HIGH INTENSITY PROTON INJECTOR PROJECT (I P H I)

D. BOGARD, P. MATTEI : CEA-DSM-DAPNIA-SEA, Saclay, France.

U. BOTHNER : CNRS-IN2P3-IPN, Orsay, France

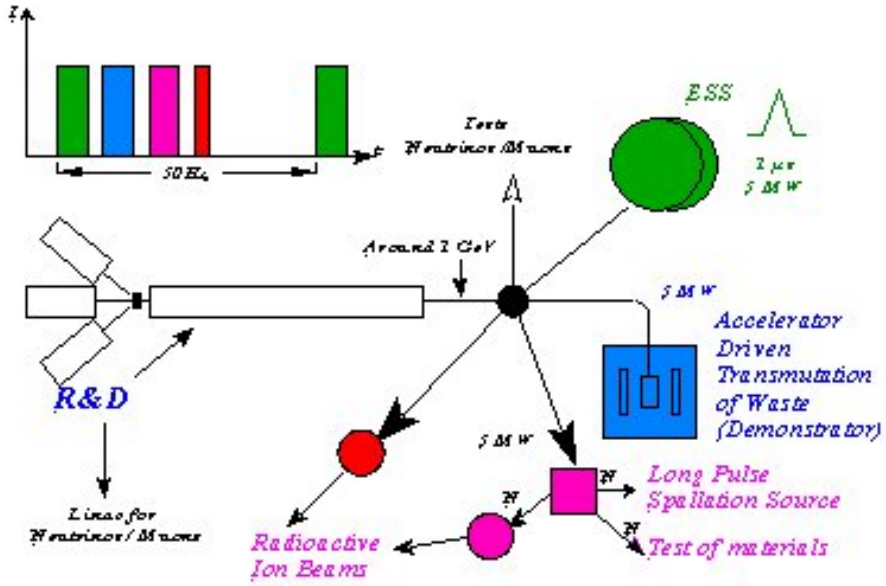
IPHI STATUS

- IPHI PROJECT
- SILHI & LEBT
- Software /Hardware choices
- Evolution

IPHI STATUS

♦ **IPHI PROJECT** (Injector of Protons with High Intensity) :

- Low energy demonstrator for **H**igh-**P**ower **P**roton **A**ccelerators.
- **HPPA** are needed by : Hybrid systems, Spallation neutron sources, Production of radioactive ion beams, Injectors for muon/neutrinos facilities, Production of fissile material and irradiation facilities, …
- All these applications require same type of accelerator.
- Beam power 5-10 MW, final energy around 1 GeV.



Choice of LINAC accelerators :

- Low Energy (< 20 MeV) : main goal is to manage space-charge forces.
  ⇒ Construction and test of a linac front end prototype
- High Energy (>100 MeV) : maximum limitation of structure activation induced by lost particles.

IPHI STATUS

IPHI is composed of :

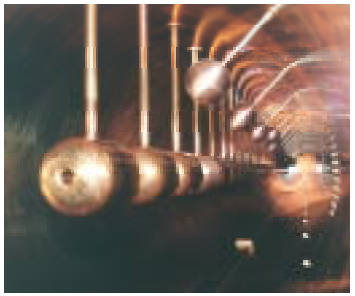
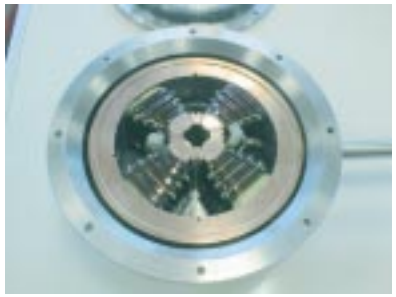
- SILHI (High-Intensity Light Ion Source) : W=95 keV, I>=100 mA proton
- LEBT with diagnostics to measure, optimize and match the beam
- RFQ cavity : W=5 MeV
- Matching section with quadrupoles and buncher cavities
- DTL tank : W=10 MeV
- Beam Line Diagnostics to measure beam characteristics up to 100 mA

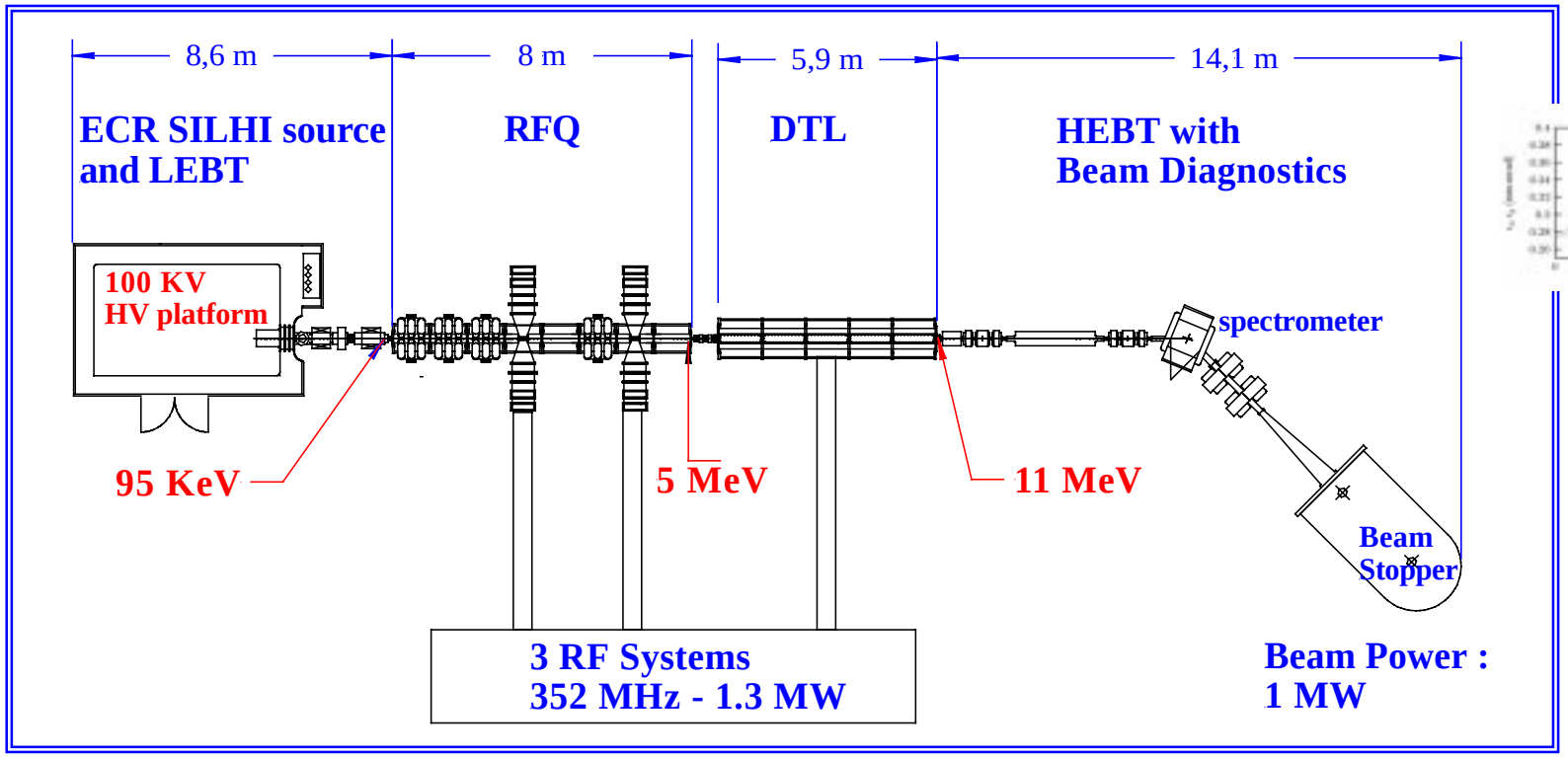
IPHI is designed for maximum beam of 100 mA
(first step is to produce a continuous beam)

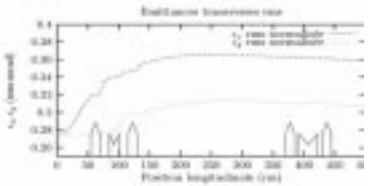
IPHI construction must prove that required performances can be obtained :

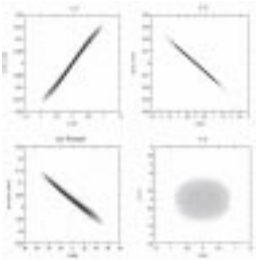
- Control of beam intensity
- Reliability
- High availability

IPHI STATUS

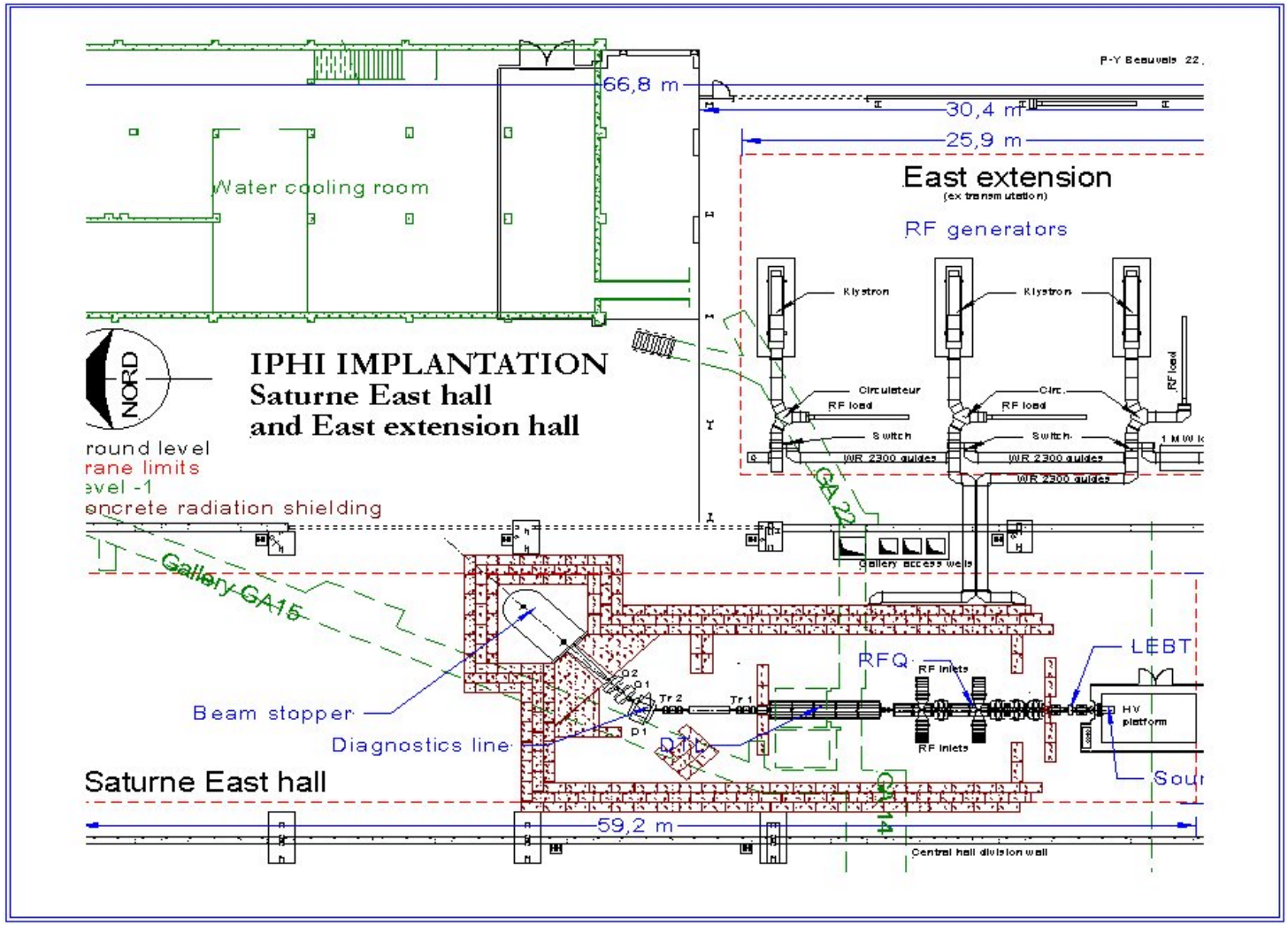






Commisariat à l'Energie Atomique, CEA-Saclay
DSM/DAPNIA/SEA bât. 706, 91191 GIF-sur-Yvette cedex
Daniel BOGARD, Pierre MATTEI – EPICS Collaboration Meeting 8-10 May 2001 at PSI, Switzerland

IPHI STATUS

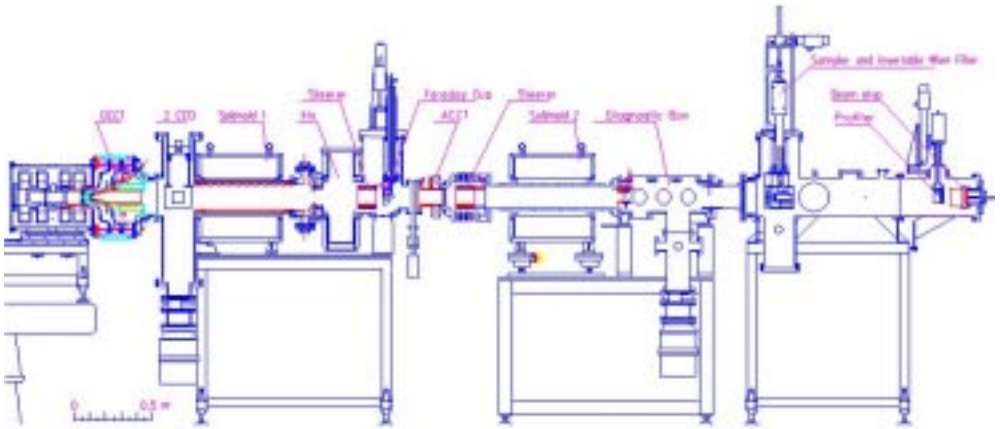


P-Y Beauvais 22
66,8 m
30,4 m
25,9 m
East extension
(ex transmutation)
RF generators
Water cooling room
Klystron
Klystron
Circulateur
RF load
Circ.
RF load
Switch
Switch
WR 2300 guides
WR 2300 guides
WR 2300 guides
RF load
NORD
IPHI IMPLANTATION
Saturne East hall
and East extension hall
round level
rane limits
evel -1
oncrete radiation shielding
GA 22
Gallery access wells
Gallery GA15
RFQ
RF inlets
RF inlets
LEBT
HV platform
Beam stopper
Diagnostics line
Tr 2
Tr 1
D1
D1L
Saturne East hall
59,2 m
Central hall division wall

IPHI STATUS

♦ SILHI (High-Intensity Ligth Ion Source)

- ECR proton & deuteron source located on a high voltage platform :
  - Produce a 95 keV beam (>100mA) with proton fraction higher than 85%.
  - Low Energy Beam Transport to analyze beam characteristics.



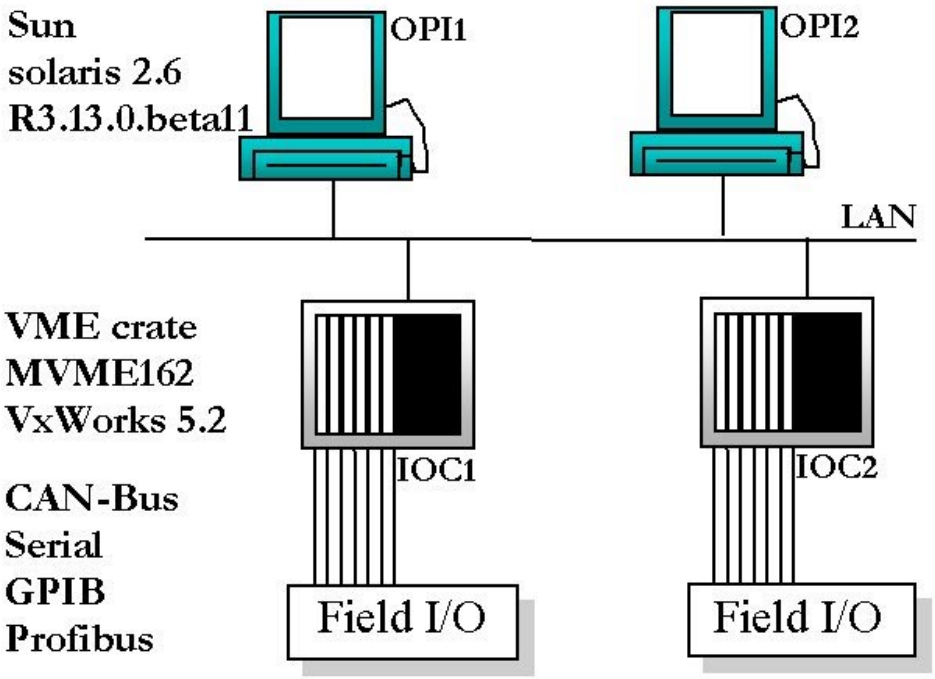
- Runs at nominal conditions for several months.
- CW and pulsed mode
- High availability (>99% during a week working)
- First deuteron beam in May.

IPHI STATUS

SILHI Parameters	Requests	8 mm Extraction	9 mm Extraction
Energy [keV]	95	95	95
Intermediate Electrode [kV]	65	48	57
Proton Current [mA]	100	111	100.
Total Current [mA]	110	126	125.
Proton Fraction [%]	> 90	88	80
Current Density [mA/cm²]	140	243	190
RF Forward Power [W]	1200	800	1000
Duty Factor [%]	100	100	100
H_2 Gas Flow [sccm]	< 10	~2.0	~5.3
BEAM NOISE RMS [%]	1	±0.5	±1
rms normalized emittance [π.mm.mrad]	0.2	0.11 @ 75 mA	0.21 @ 97 mA

IPHI STATUS

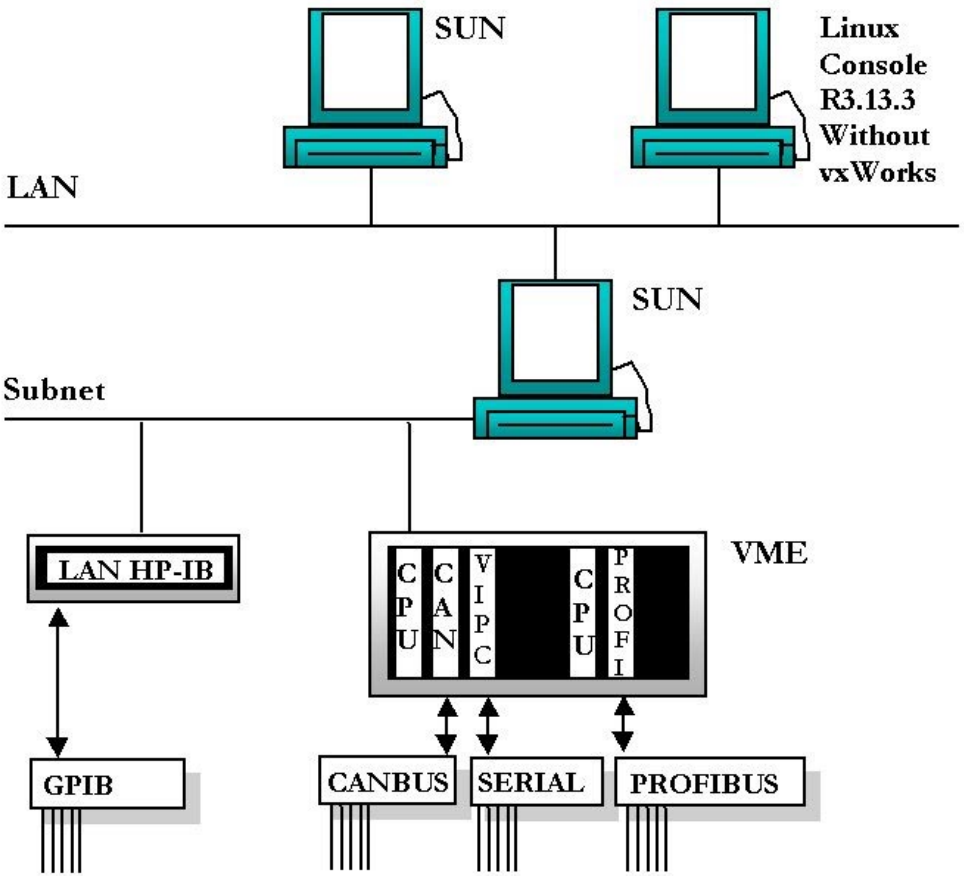
♦ Software/Hardware Choices



- SILHI & LEBT run under OS9 since 1996.
- Project team decides to move to EPICS in 1998.
- First steps (after LA training) middle of 1999
- SILHI & LEBT now controlled by EPICS (december 2000)

IPHI STATUS

Actual Configuration



Control room

VME crate

HP-IB module

IPHI STATUS

Devices & Drivers

- *CANBUS*

  Package from BESSY II - Control of power supplies.

- *SERIAL*

  drvAscii by Allan HONEY
  drvIpac by Andrew JOHNSON
  tyGSoctal by P. McGEHEE
  Control of power supplies, RF, gas flow controller… through NI FieldPoint modules.

- *GPIB*

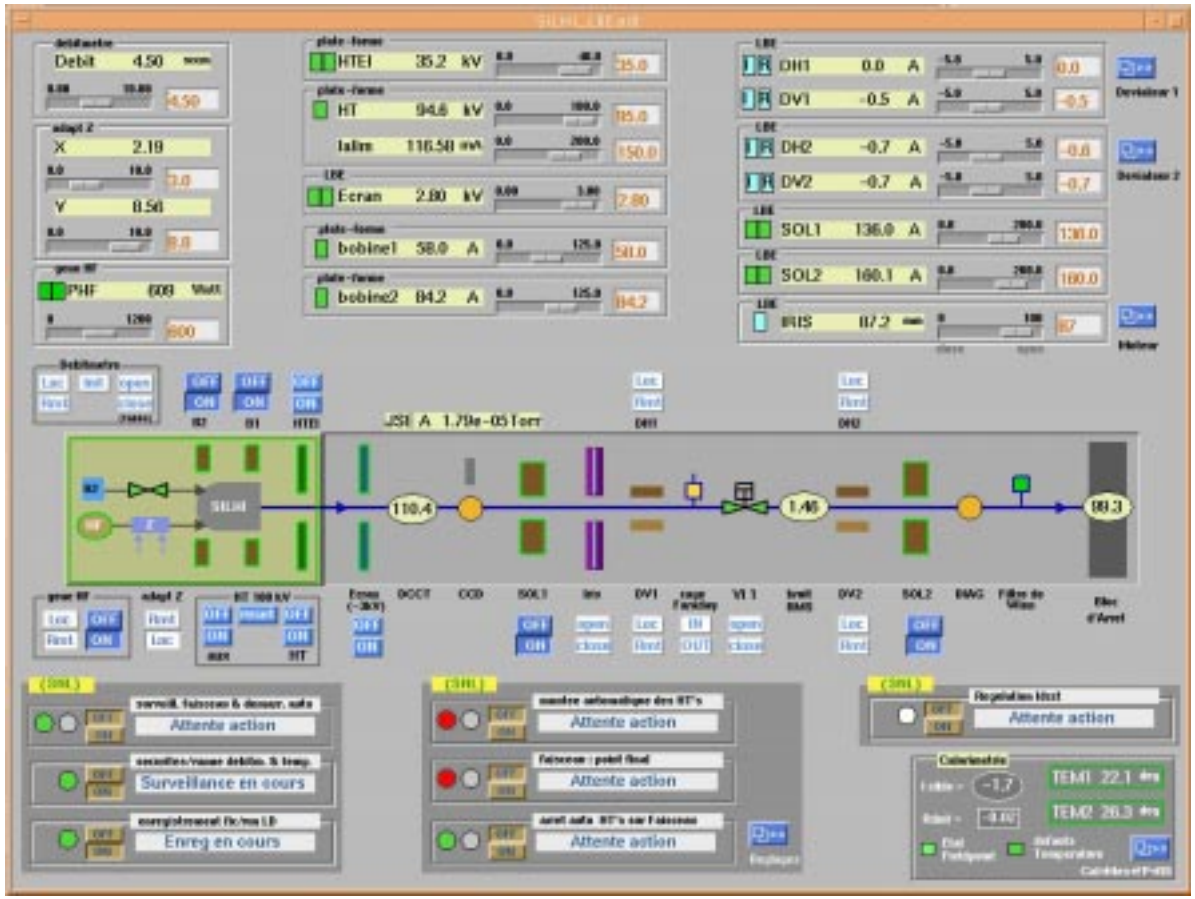
  drvLanGpib by Benjamin FRANKSEN
  Control of power supplies, stepper motors and scopes.

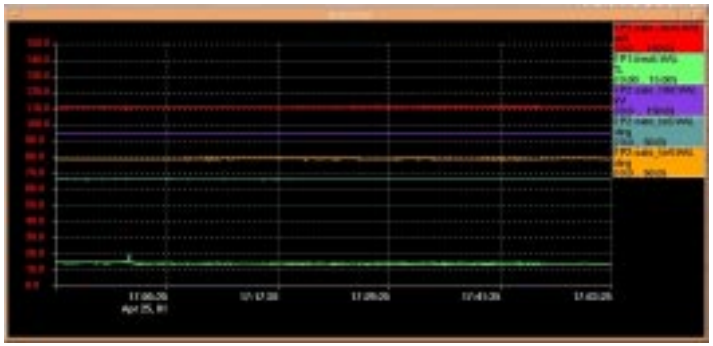
- *PROFIBUS*

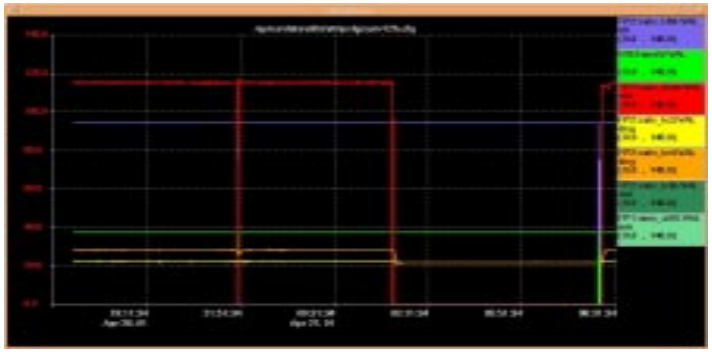
  Package from DESY
  Control of 2 SIEMENS PLCs' (vaccum & interlocks).

IPHI STATUS

EPICS Tools : Mainly MEDM & StripTool



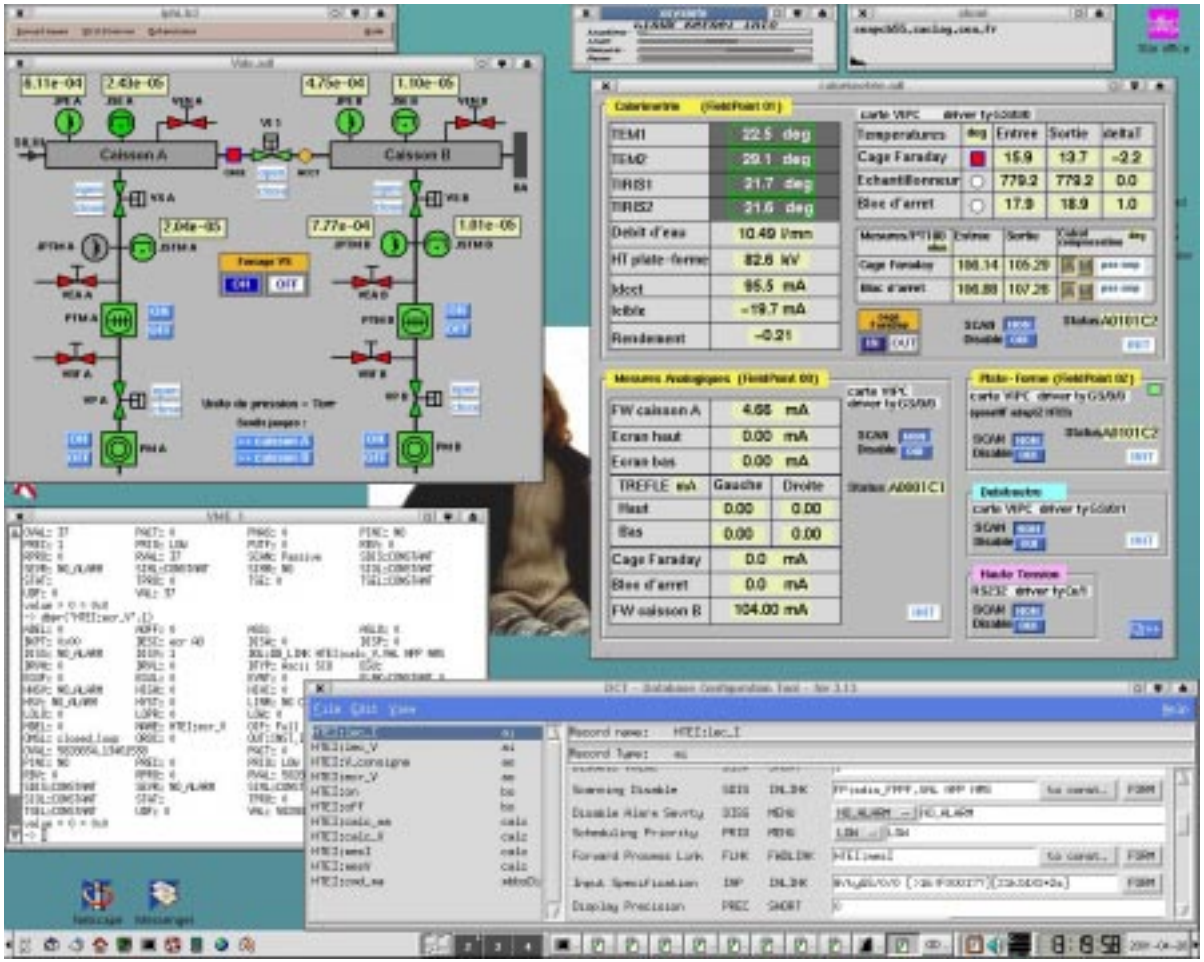




IPHI STATUS

LINUX as a console : Mandrake 7.2 & EPICS R3.13.3

SILHI Vacuum control screen



FieldPoint Measurements screen

VxWorks console

EPICS Parameters

SILHI + LEBT	IOC 1 (CANBUS-GPIB-SERIAL)	IOC 2 (PROFIBUS)
Devices	35	22
PVs	140	60
Records	470	240

IPHI STATUS

♦ Evolution

- **RFQ/HEBT : RF, Cooling, Vaccum, Diagnostics systems need new Hardware & Software :**
  - **Workstation(s) with R3.13.4 or R3.14.x.**
  - **Controllers : new MVME162 or powerPC with TORNADO II.**
  - **PLCs (SIEMENS S7/300) : from Profibus to TCP/IP (PSI solution).**
  - **VXI & DSP : RF / HEBT systems, using EPICS or LabView CA-Client.**
  - **Pulsed beam ⇒Synchronous data acquisition – VME modules or "home made" solution.**