SiLC DAQ

EUDET Meeting 2010

Alexandre CHARPY & LPNHE team

Goal

Conducted by LPNHE:

- Research baseline: wafer 6”-8”, 200µm of thickness, pitch of 50 µm, transparency ~70%, active edge
- Testing of the SiTr130 prototype and VA1' chip

Edgless with SOI technology

VTT- Juha Kallopuska

Manufacturing achievement:

- edgeless & pixels sensors, 6” wafer, 50 µm pitch

HPK designed by Vienna w/wo surface treatment of silicon wafers(Santander)

→ 50µm pitch, 320µm of thickness
→ ~ 20% transmittance
→ Alignment System (IFCA) using an infra-red laser in labs & tests beam

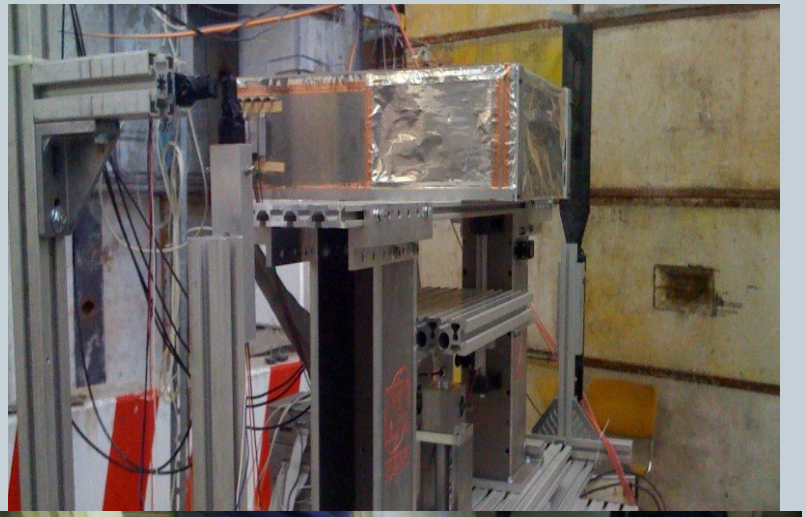
Edgeless planar strips

FBK-irst-U. Trento/INFN - Gian Franco Dalla Betta

- Prototyped sensors 2.5x5cm^2 (Trento & LPNHE)
- full characterization at Lab followed by beam test & HPK comparison

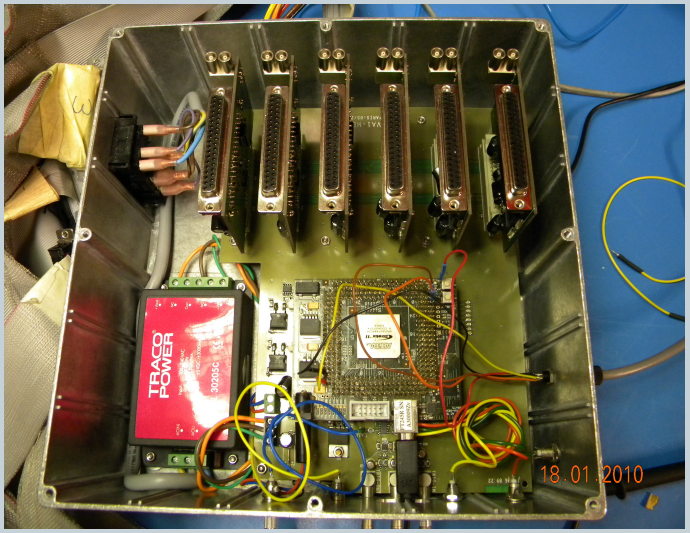
2010 Setup

- Standalone telescope, with five silicon sensors layers: until 2048 channels active strips/modules
- Intented to be easily integrated to a test beam
  - High customization
  - All Electronic features In One “AlteraBox”
  - Main functionalities (Peaking Time, Laser Alignment etc…)



DAQ Hardware

- Evolutive DAQ Hardware ToolKit (EUDET deliverable)
  - Adapted to both: VA1 (référence) prototypes SiTr-130 and next, mix mode (VA1+SiTr chips)
  - USB/FPGA interface with microtcontroler
  - TTL/NIM for triggering and laser alignement
  - AlteraBox chaining
  - Power supplied embedded
  - Need to integrate the TLU ?



Faster serial Interface:

- Ethernet

Development toward the final DAQ design for ILD → link with the mechanical constraint

Data Acquisition System software Narval

Acquisition requirement:

- Increasing of the data size management
- Addressing of the data
- On-line control
- High Flexibility

Narval is the main frame (ADA-oriented) https://forge.in2p3.fr/projects

→ module programming: ADA/C/C++

→ *Can be easily connected to any global DAQ software → what is needed ?*

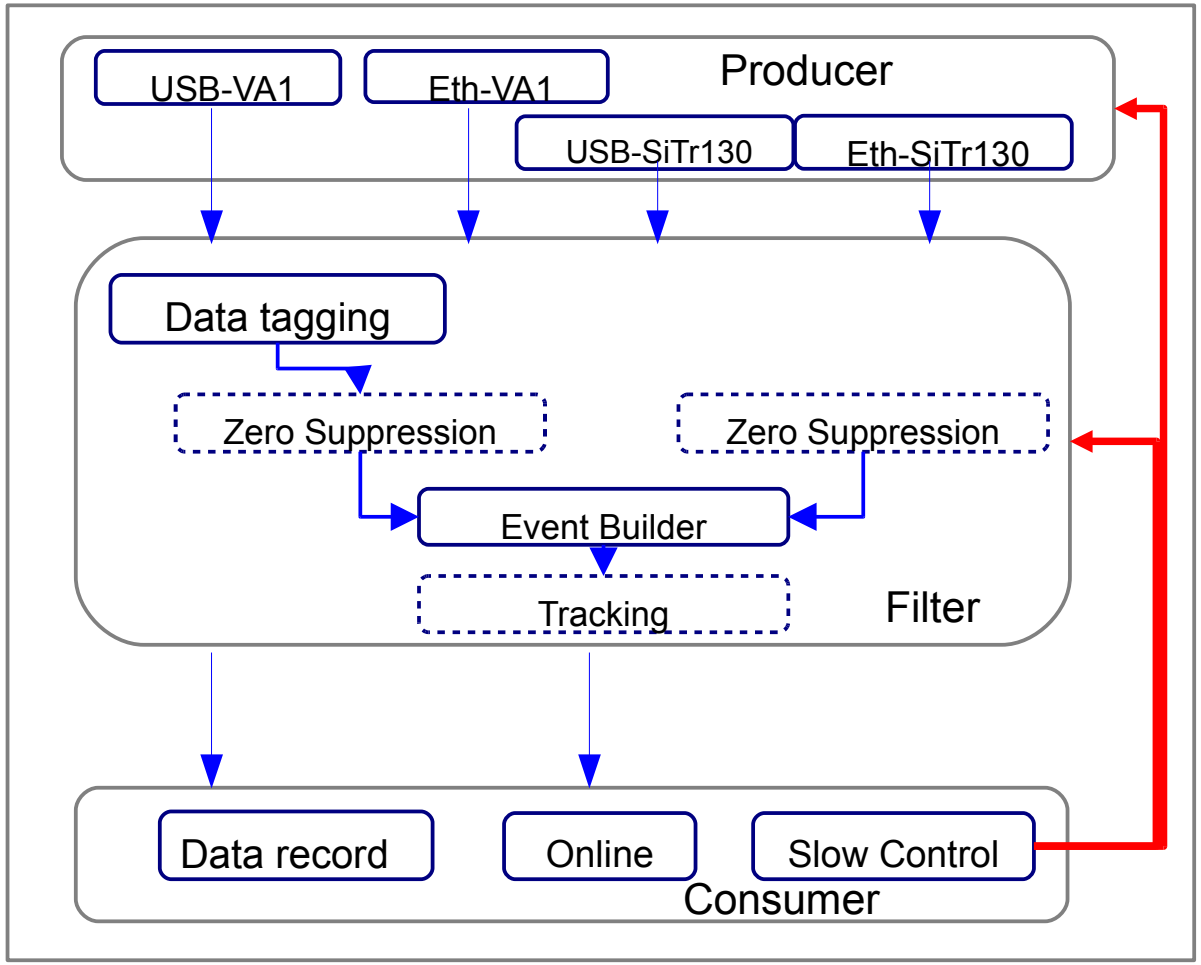
→ *Can easily include another DAQ system*

→ *ENX for the slow Control*

FPGA system is handled by a full VHDL software package

Data Acquisition System software
Narval

Master: Narval as a linux server



- Three basic actors:
  → Producers
  → Filters
  → Consumers
  (could be created)

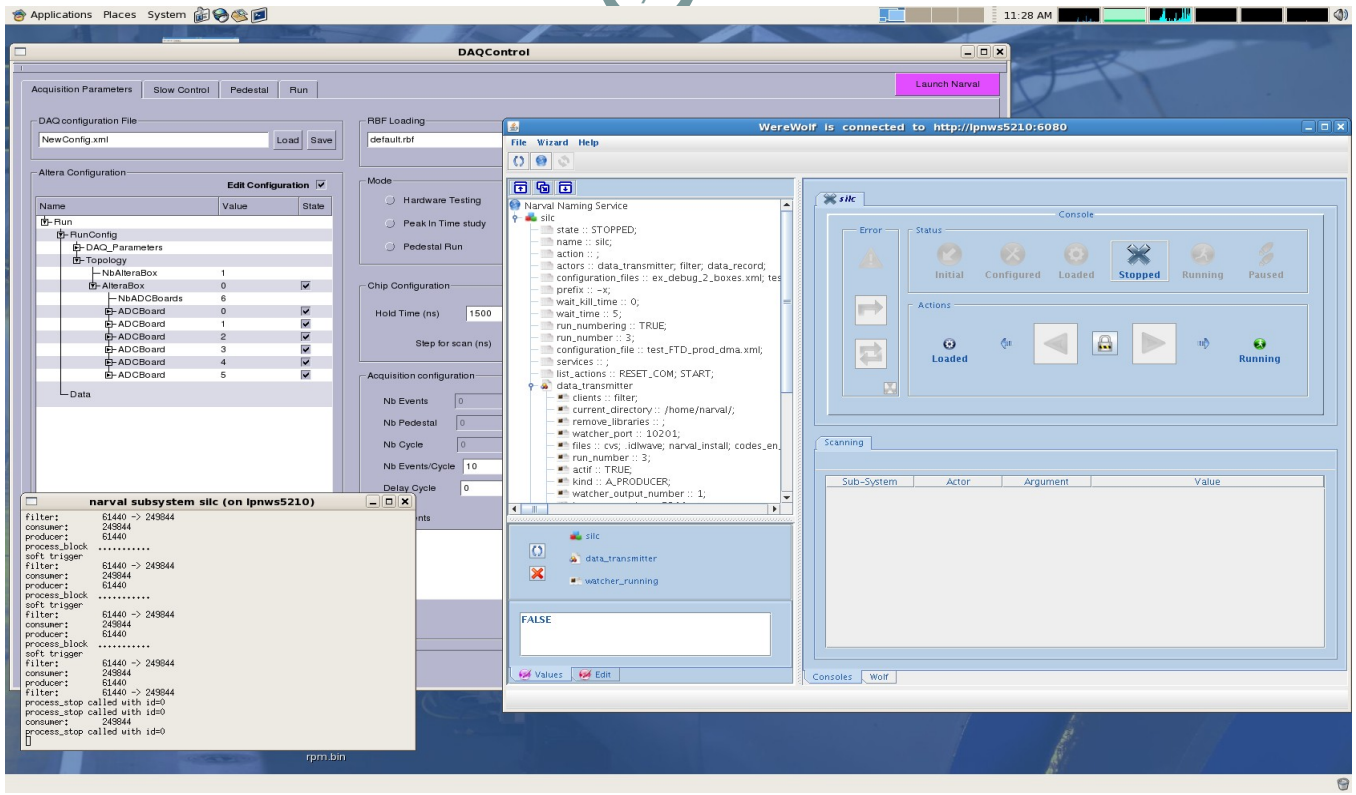
- Dedicated libraries in C/C++/ADA95

- High flexibility with very simple scripts & xml files

Raw Data format for combined test beam ?

LPNHE
Laboratoire de
Physique Nucléaire
et des Hautes Energies

Data Acquisition System
Software



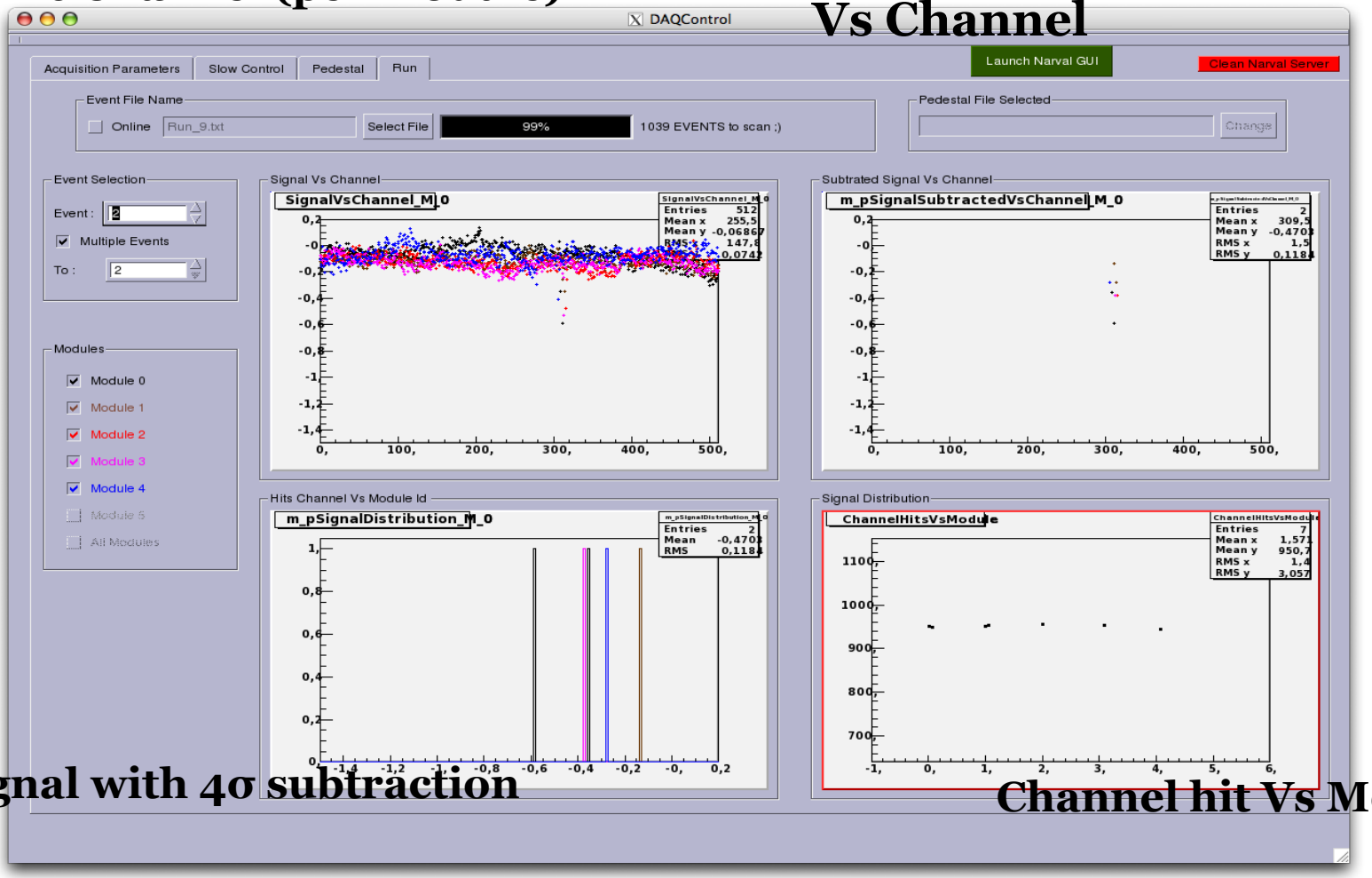
- **Narval Control**
- **Configuration and online:**
  - QTRoot → developped @ LPNHE for SiLC
  - DAQ Configuration, Basic Analysis, Online

Next evolution: web interface

Online Monitoring

Signal vs Channel (per module)

Signal with subtracted pedestal Vs Channel

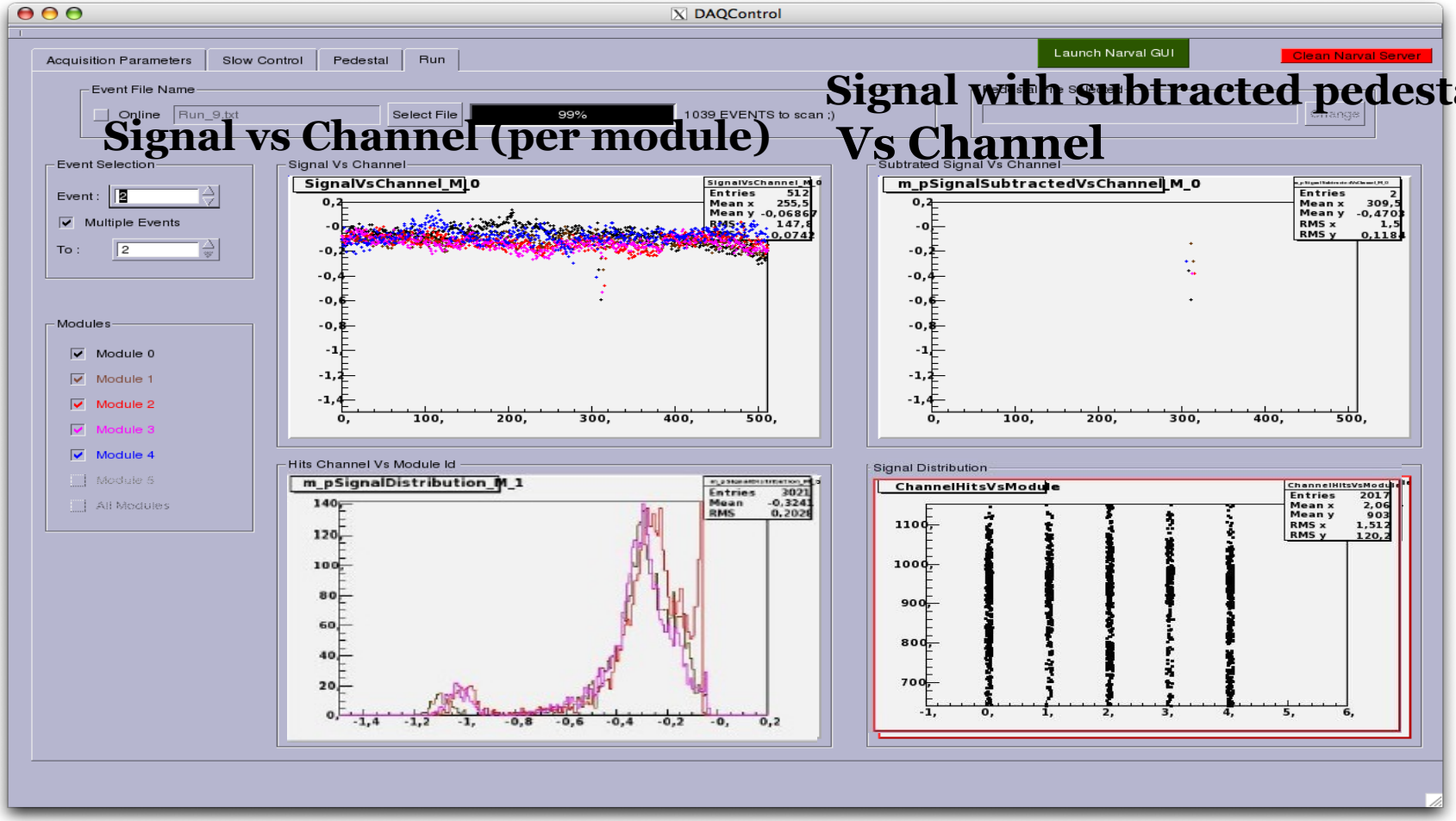


Signal with 4σ subtraction

Channel hit Vs Module

LPNHE
Laboratoire de
Physique Nucléaire
et des Hautes Energies

Online Monitoring
Cumulated events



Signal vs Channel (per module)

Signal with subtracted pedestal Vs Channel

Signal with 4σ subtraction

Channel hit Vs Module

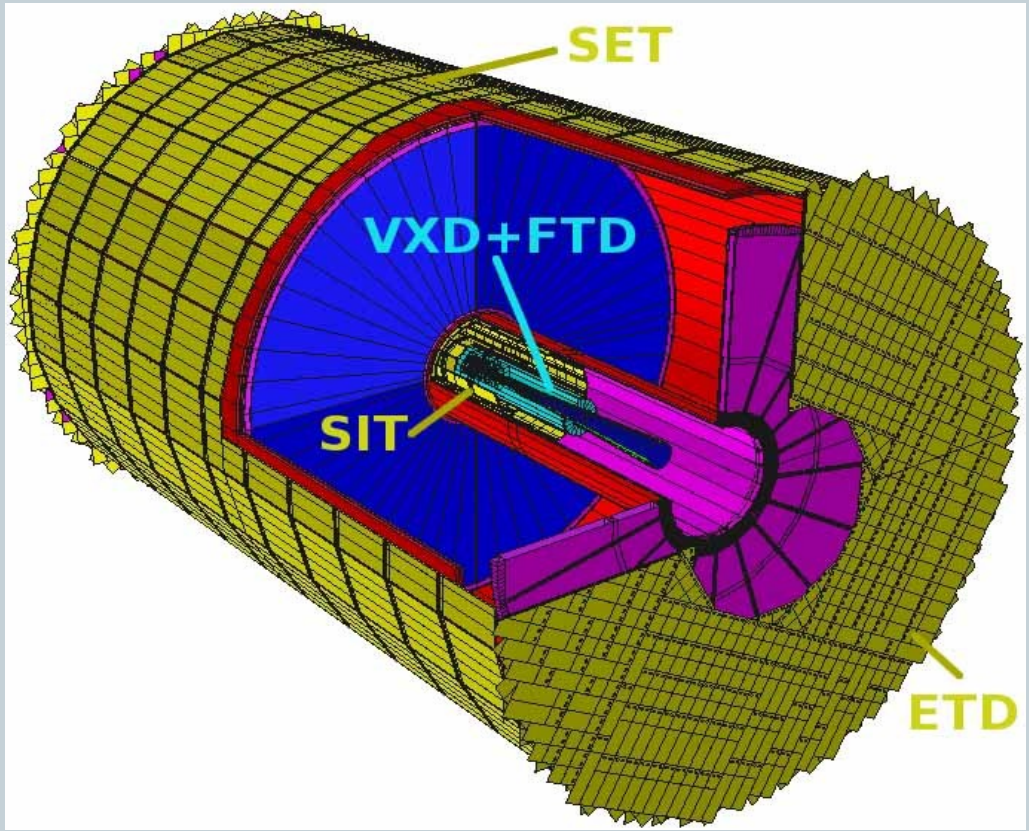
⇒Alternative in progress based on « Midas » (cf. Diego Terront)

MIDAS experiment "Pibeta"			Wed Apr 12 12:33:03 2000		
Start ODB CNAF Messages ELog Alarms Programs Config Help					
Trigger settings Rates Ratios Chambers PID Handbook WebCam Accelerator					
Run #30160	Stopped	Alarms: Off	Restart: Yes	Data dir: /data	
Start: Wed Apr 12 07:50:46 2000			Stop: Wed Apr 12 08:27:26 2000		
Equipment	**FE Node**	**Events**	**Event rate[/s]**	**Data rate[kB/s]**	**Analyzed**
Trigger	Trigger Frontend@pc812	22029	0.0	0.0	100.0%
Scaler	Trigger Frontend@pc812	217	0.0	0.0	100.0%
HV	SC Frontend@pc809.psi.ch	0	0.0	0.0	0.0%
Environment	SC Frontend@pc809.psi.ch	0	0.0	0.0	0.0%
Chamber	Trigger Frontend@pc812	38	0.0	0.0	100.0%
Beamline	SC Frontend@pc809.psi.ch	0	0.0	0.0	0.0%
Channel		**Active**	**Events**	**MB written**	**GB total**
0 run30160.mid		Yes	22362	32.440	31.286
Lazy Destination		**Progress**	**File Name**	**Speed [kb/s]**	**Total**
psarchive		100 %	run30158.mid	773.9	3.3 %
Lazy Label		**Progress**	**File Name**	**# Files**	**Total**
2000-2		100 %	run30158.mid	44	45.5 %
11:01:44 [ODBEdit2] Program ODBEdit2 on host pc2106 stopped					
ODBEdit [pc2106]		Lazy_FTP [pc2106]		Lazy_Tape [pc2106]	
Logger [pc2106]		ODBEdit1 [pc2106]		mhttpd [pc2106]	
Analyzer [pc2106]		Trigger Frontend [pc812]		SC Frontend [pc809.psi.ch]	

- Generic acquisition system for little & middle size experiments .
- Known for years at TRIUMF and PSI
- Easily portable for any operating system (embedded systems included)
- Include a « slow control » system, on-line database and an « history system »
- Tests in progress with this system for being used during November tests and a future embedded system.

VHDL software is slightly modified for processing data from new front-end cards in November(cf. Marc Dhellot)

Prospect for 2012
The Silicon Envelope of ILD



Detailed design
GEANT4 simulation both in MOKKA & ILCROOT
(here) & mechanical design (CATIA) in progress

Total number of modules:

500 (SIT) + 2500 (SET) + 2000 (ETDs)

5000 modules of 1792 channels

Total number of channels:

10^6 (SIT) + $5x10^6$ (SET) + $4x10^6$ (2 ETD)

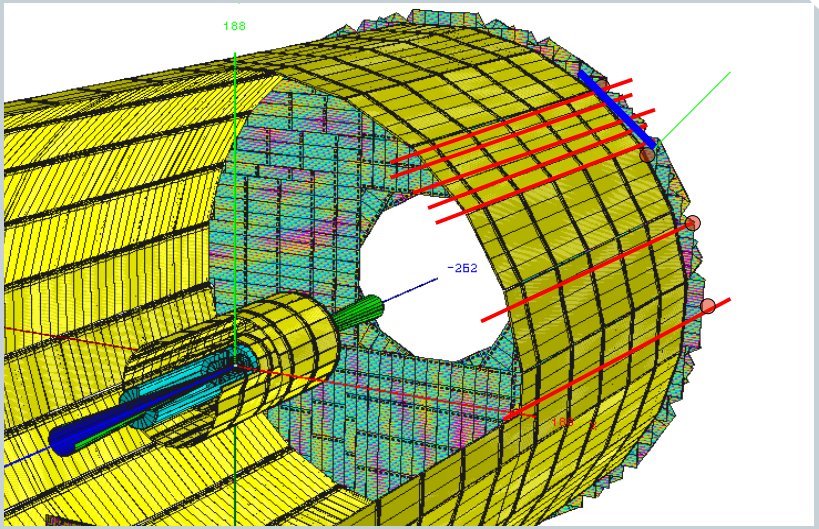
$10 x 10^6$ channels

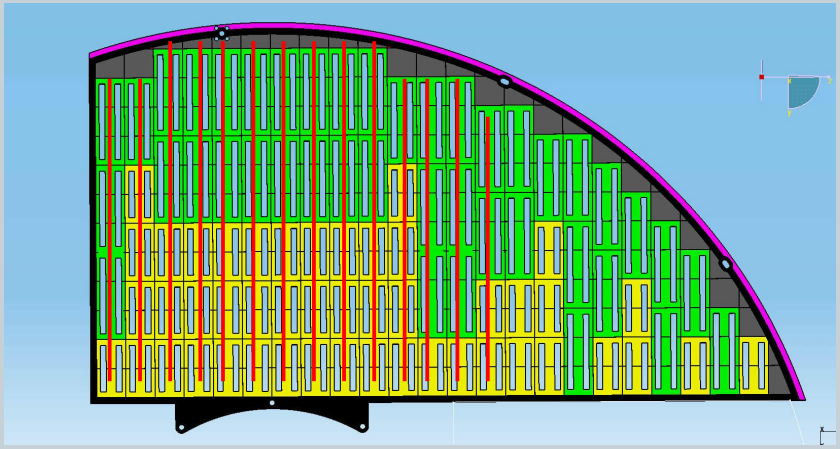
~5.12 Gbytes

Component	Layer #	# modules	# sensors/ module	# channels	Total surface m2
SIT1	1st layer	33	3	66.000	0.9
	2nd layer	99	1	198.000	0.9
SIT2	1st layer	90	3	180.000	2.7
	2nd layer	270	1	540.000	2.7
SET	1st layer	1260	5	2.520.000	55.2
	2nd layer	1260	5	2.520.000	55.2
ETD_F	X or U or V	82/quad =328/layer =984/ETD	2 or 3 or possibly 4	2.000.000	30
ETD_B	idem	idem	idem	idem	30

LPNHE
Laboratoire de
Physique Nucléaire
et des Hautes Energies

Prospect for 2012
The Silicon Envelope of ILD





- On the “module”:
Chaining of 14 SiTR130-128

- “Super Module”:
Chaining the adjacent ladders toward a level 1 concentrator

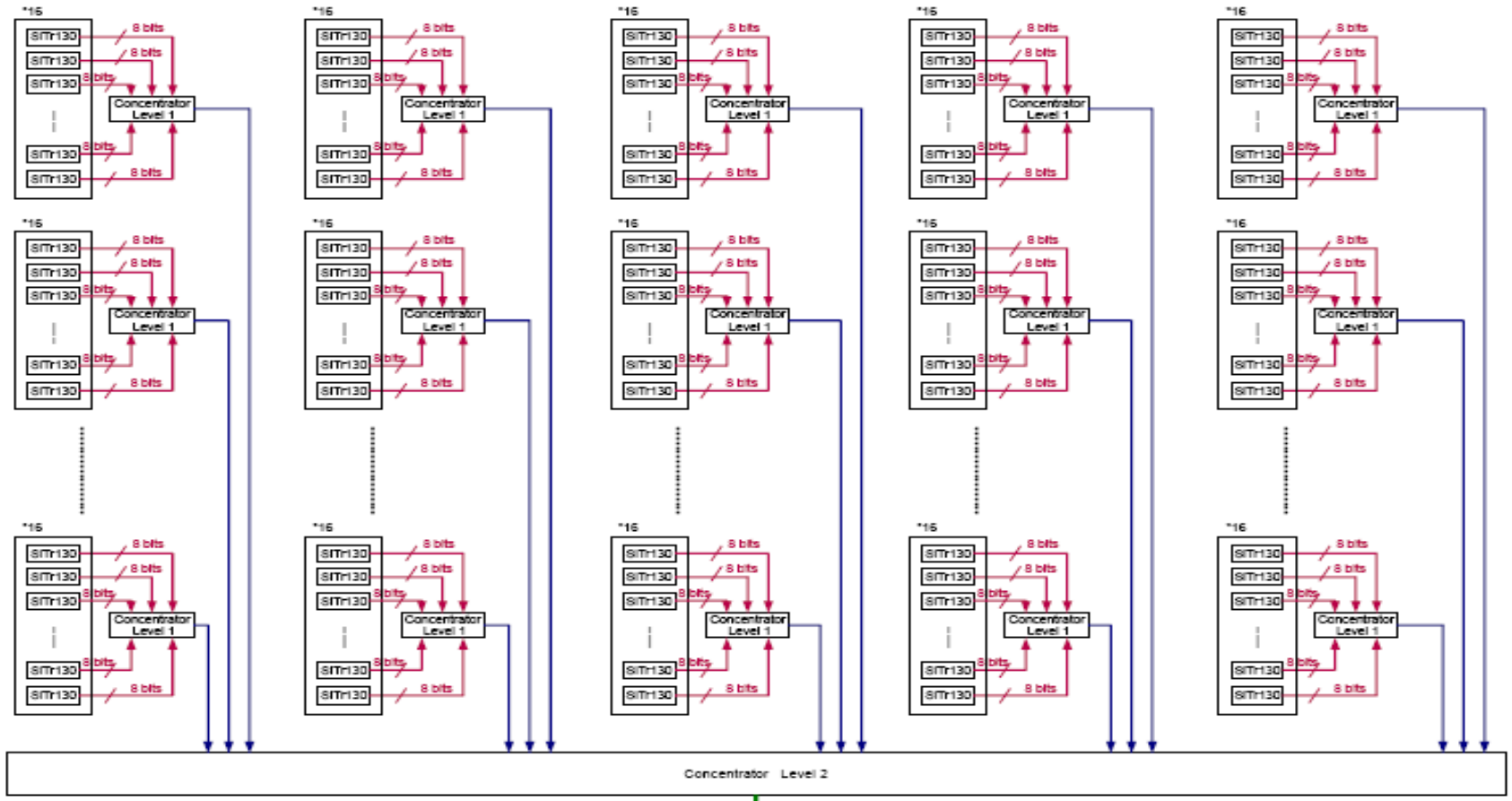
- Half cylinder (“Detector Element”):
Level 1 concentrator (toward level 2 ?)

- Toward the global Silicon DAQ system by Optical fibers

- Send to Global DAQ system

Depending on the final requirements

Next Version



Preliminary study: micro-FPGA BGA on board

Thanks for your intention