Data acquisition software and Simulation progress

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February 3, 2011

Plan

1. Introduction

2. Online DAQ Status
   - LDA Integration
   - Process control an User Interface
   - Configuration DataBase

3. Online DAQ futur developments
   - Slow Control
   - Online Analysis

4. Simulation status (R.Han)

Introduction

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Simulation status

- m^3 simulation
- Beam test validation of the simulation

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Low Level driver

- Driver developped at LLR (D.Decotigny,N.Roche)
- SLC5 installation tested successfully at IPN
- Firmware development ongoing (Slow control OK, HR2 R/O soon)

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- XDAQ integration of LDA driver
- First prototype tested. Waiting for new firmware to complete the integration

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Integration in the Event Builder (L.M)

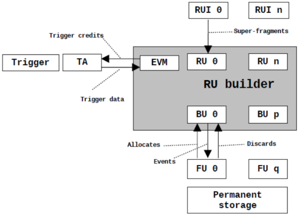
- New LDACollector for multi-dif readout
- File-based LDAEmulator
- Performances test

Reminder:The CMS Event Builder

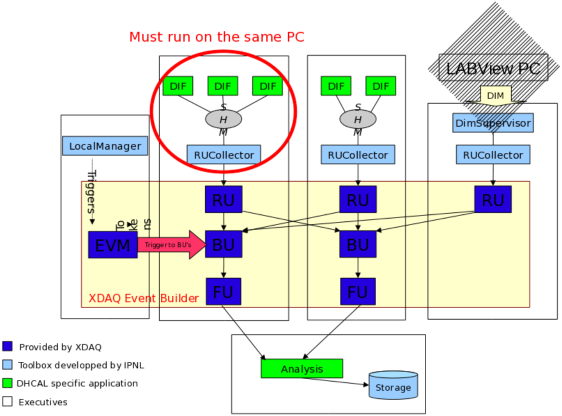
See http://cms-ru-builder.web.cern.ch/cms-ru-builder/RUBUILDER_G_V1_6_0.doc

Aysnchronous collection of data source corresponding to the same trigger.

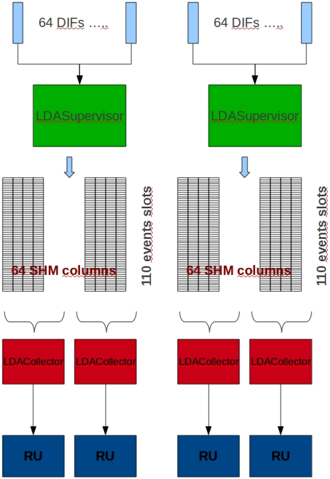
- One trigger is seen
- Each *Readout*U*nit*I*nput* collects its fragments and pushes it to the RU
- The T*riggerAccepter* sends trigger data to the EV*ent*M*anager*
- The **EVM** sends an event Id to the **B***uilder***U***nit* that will request its first buffer to each **RU** and build the event
- The event is sent to the registered **F***ilter***U***nit* that can make data coherence checks, analysis and data storage



Reminder: The USB DIF case



The LDA Readout case



The LDAEmulator

Goal

1. Application generating up to 64 DIF events blocks
2. Realistic data : Read from data file

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Implementation

- XDAQ application reading cosmic test data file and duplicating DIF blocks in 64 DIFs
- New share memory structure to handle up to 64 DIFs
- Flexible RU interface: LDACollector handling 1 to 64 DIFs Shm columns

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Performances

- 2 LDAEmulators on 2 PCs, 2x2 LDACollectors, 4 RU-BU-FU
- 7 DIFs (TOMUVOL data) duplicated 9 times on each PCs
- Stable running: 800 Hz, 230 Mb/s

Process Control

Job Control

- XDAQ daemon started at boot time
- Instantiate or kill XDAQ process on request
- SOAP controlled

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User Control: Python package using SOAP messages

- Parsing of the configuration file
- XDAQ process control (executives creation/destruction)
- Parameters and State Machine control
- Full access to histograms (XML messages+ PyROOT package)

Graphical User interface

Technical

PyQt package interfacing the python package written to control process. Monitoring ROOT histograms are accessible via a simplified browser and ROOT Canvas are created allowing data manipulation (Fit,rebin...)

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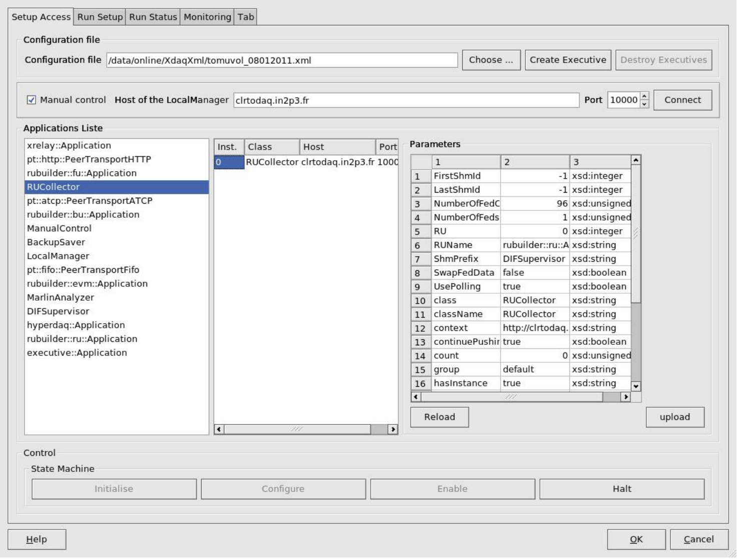
Deployment and Access

- Python-Root-PyQt (3) has to be installed (PyQt4 will allow x-platform installation)
- Remote access behind firewall using SOCKS
- Possibility to connect to a running DAQ
- Usual web access still available

Setup Access



Configuration file

Configuration file /data/online/XdaqXml/tomuvol_08012011.xml

☑ Manual control Host of the LocalManager clrtodaq.in2p3.fr Port 10000

Applications Liste

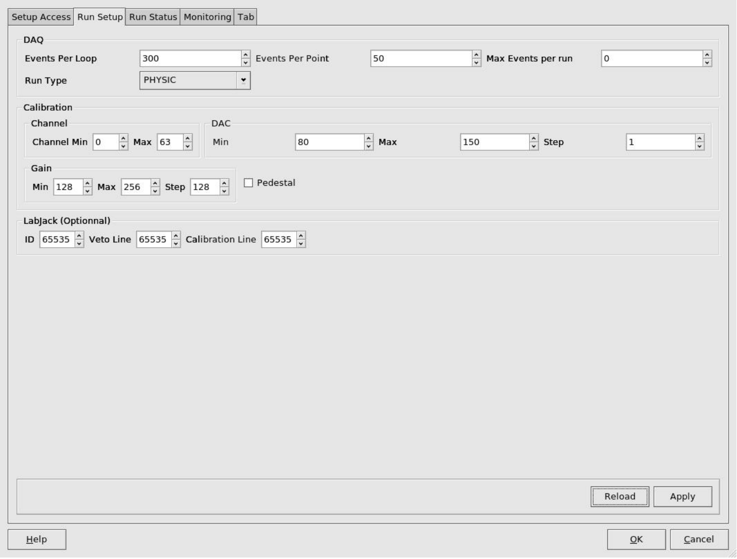
- xrelay::Application
- pt::http::PeerTransportHTTP
- rubuilder::fu::Application
- RUCollector
- pt::atcp::PeerTransportATCP
- rubuilder::bu::Application
- ManualControl
- BackupSaver
- LocalManager
- pt::fifo::PeerTransportFifo
- rubuilder::evm::Application
- MarlinAnalyzer
- DIFSupervisor
- hyperdaq::Application
- rubuilder::ru::Application
- executive::Application

Inst.	Class	Host	Port
0	RUCollector	clrtodaq.in2p3.fr	1000

Parameters

	1	2	3
1	FirstShmId	-1	xsd:integer
2	LastShmId	-1	xsd:integer
3	NumberOfFedC	96	xsd:unsigned
4	NumberOfFeds	1	xsd:unsigned
5	RU	0	xsd:integer
6	RUName	rubuilder::ru::A	xsd:string
7	ShmPrefix	DIFSupervisor	xsd:string
8	SwapFedData	false	xsd:boolean
9	UsePolling	true	xsd:boolean
10	class	RUCollector	xsd:string
11	className	RUCollector	xsd:string
12	context	http://clrtodaq.	xsd:string
13	continuePushir	true	xsd:boolean
14	count	0	xsd:unsigned
15	group	default	xsd:string
16	hasInstance	true	xsd:string

Run Settings



DAQ

Events Per Loop 300
Events Per Point 50
Max Events per run 0
Run Type PHYSIC

Calibration

Channel
Channel Min 0 Max 63

DAC
Min 80 Max 150 Step 1

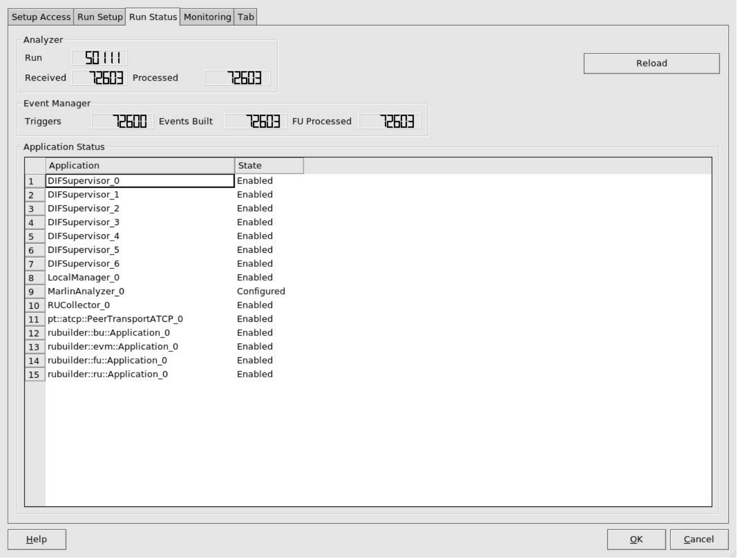
Gain
Min 128 Max 256 Step 128

☐ Pedestal

LabJack (Optionnal)

ID 65535 Veto Line 65535 Calibration Line 65535

Run Status



Analyzer

Run 50111

Received 72603 Processed 72603

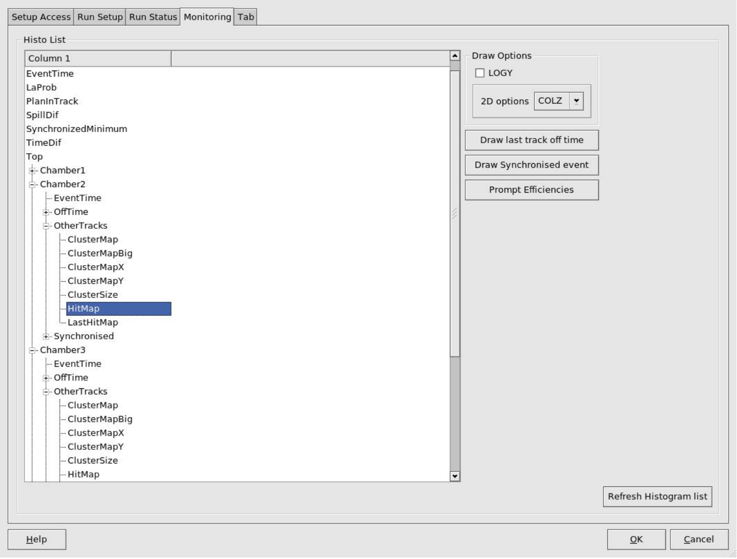
Event Manager

Triggers 72600 Events Built 72603 FU Processed 72603

Application Status

	Application	State
1	DIFSupervisor_0	Enabled
2	DIFSupervisor_1	Enabled
3	DIFSupervisor_2	Enabled
4	DIFSupervisor_3	Enabled
5	DIFSupervisor_4	Enabled
6	DIFSupervisor_5	Enabled
7	DIFSupervisor_6	Enabled
8	LocalManager_0	Enabled
9	MarlinAnalyzer_0	Configured
10	RUCollector_0	Enabled
11	pt::atcp::PeerTransportATCP_0	Enabled
12	rubuilder::bu::Application_0	Enabled
13	rubuilder::evm::Application_0	Enabled
14	rubuilder::fu::Application_0	Enabled
15	rubuilder::ru::Application_0	Enabled

Monitoring

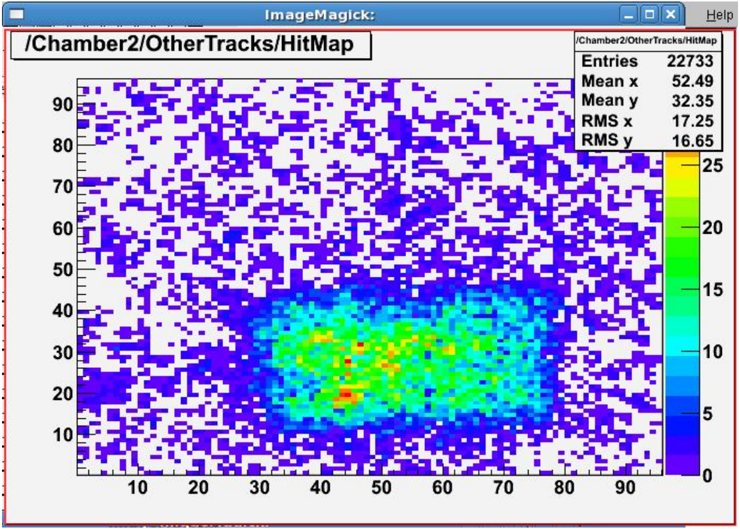


☐ LOGY

2D options COLZ

```
EventTime
LaProb
PlanInTrack
SpillDif
SynchronizedMinimum
TimeDif
Top
  + Chamber1
  - Chamber2
      EventTime
    + OffTime
    - OtherTracks
        ClusterMap
        ClusterMapBig
        ClusterMapX
        ClusterMapY
        ClusterSize
        HitMap
        LastHitMap
    + Synchronised
  - Chamber3
      EventTime
    + OffTime
    - OtherTracks
        ClusterMap
        ClusterMapBig
        ClusterMapX
        ClusterMapY
        ClusterSize
        HitMap
```

ROOT Access


ImageMagick:
Help
/Chamber2/OtherTracks/HitMap
/Chamber2/OtherTracks/HitMap
Entries 22733
Mean x 52.49
Mean y 32.35
RMS x 17.25
RMS y 16.65
90
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15
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5
0

DataBase: Two steps development

Currently, SQLITE

- Simplified schema with global versionning
- File based , easy backup
- Tools to populate and update (C,python) or browse (SQLITE browser extension in Firefox) the DB
- Interface in XDAQ done

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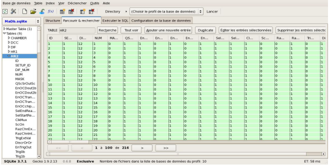

ID	SE...	DI...	NUM	MA...	QS...	En...	En...	En...	En...	En...	Sel...	Sel...	Cl...	Sc...	Ra...	Ra...	Tri...	Di
1	1	12	1	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
2	1	12	2	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
3	1	12	3	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
4	1	12	4	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
5	1	12	5	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
6	1	12	6	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
7	1	12	7	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
8	1	12	8	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
9	1	12	9	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
10	1	12	10	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
11	1	12	11	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
12	1	12	12	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
13	1	12	13	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
14	1	12	14	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
15	1	12	15	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
16	1	12	16	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
17	1	12	17	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
18	1	12	18	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
19	1	12	19	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
20	1	12	20	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
21	1	12	21	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
22	1	12	22	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1

SQLite 3.7.1 Gecko 1.9.2.13 0.6.8 Exclusive Nombre de fichiers dans la liste de bases de données du profil: 10 ET: 58 ms

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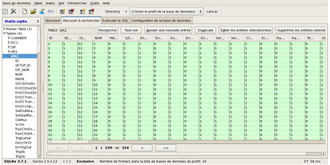

TABLE HR2

ID	SE...	DI...	NUM	MA...	QS...	En...	En...	En...	En...	En...	Sel...	Sel...	Cl...	Sc...	Ra...	Ra...	Tri...	Di
1	1	12	1	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
2	1	12	2	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
3	1	12	3	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
4	1	12	4	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
5	1	12	5	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
6	1	12	6	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
7	1	12	7	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
8	1	12	8	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
9	1	12	9	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
10	1	12	10	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
11	1	12	11	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
12	1	12	12	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
13	1	12	13	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
14	1	12	14	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
15	1	12	15	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
16	1	12	16	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
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21	1	12	21	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1
22	1	12	22	0	1	1	0	1	0	1	1	1	1	0	0	1	0	1

1 à 100 de 216

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Final version:ORACLE (G.Beaulieu)

- Keep full history (versions) of all parameters sets
- Multi-partitions
- Run database
- Interface to XDAQ via sqlite generated file

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Slow Control: Hardware foreseen

Low Voltage

ZUP power supplies 6V - 200 A. RS232 & RS485 remote control

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High Voltage

ISEG DC-DC 10kV modules. Baseline with DC input + home made DAC/ADC ethernet board. CAN bus driven modules also available

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P,T,H

Meteo station readout via USB ADC

Software solution

Existing software

Existing C/C++ programs to access any of the baseline hardware. No remote control developped yet.

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Slow Control: Future developments

- Interface the current drivers in a distributed framework: DIM -PVSS/LabView interfaces- or XDAQ
- Add configuration table (at least for HV) in the configuration database
- Define a minimal condition database to store monitoring data

Analysis: Current Status and issues

Data Storage

- All Filter Unit's provide their data to one *MarlinAnalyzer* responsible for data formatting and monitoring
- Two data collections stored: *RU_XDAQ* (raw) and *DHCALRawHits*
- All noise frames kept: Possible huge data size

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Monitoring

- One unique monitoring processs (*MarlinAnalyzer*) handling all events
- Large number of Histograms per chamber: well-suited for few chambers beam test or comsic data taking. Not scalable at m^3 level

Hints for the m^3 beamtests

Data Storage (March 2011)

- Distributed *MarlinAnalyzer's* on all PC's. Run file splitted.
- Keep in separate files raw data and **good**, i.e synchronised, hits

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Monitoring and Event Display (LLR+IPNL May 2011)

- Keep only DAQ related monitoring histograms in the *MarlinAnalyzer*
- Build a (non-XDAQ) publish-subscribe mechanism in the *MalinAnalyzer* to distribute events on request
- Independant monitoring MARLIN process requesting events
- Possible DRUID event display using the same mechanism

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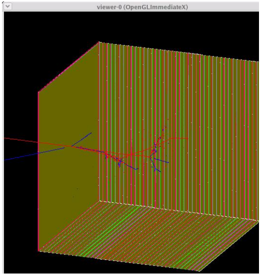
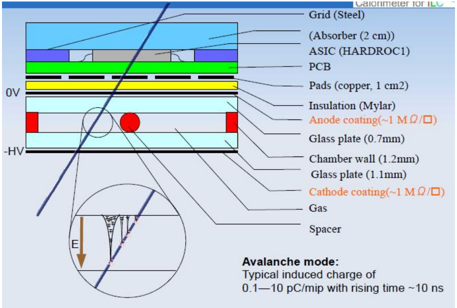
Geant4 Based Prototype Simulation

Why

1. Simulate the performance of the SDHCAL GRPC and validate using beam test data (Including dead zones and edge effects, Obtaining the same efficiency and multiplicity as for data)
2. Perform the digitization of SDHCAL in Mokka model
3. Prepare adding the prototype model to ILC software





Avalanche mode:
Typical induced charge of
0.1—10 pC/mip with rising time ~10 ns

Cosmic Ray Charge Spectrum

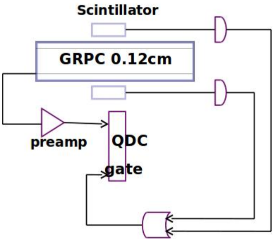


Figure: Charge Spectrum Cosmic Test Set Up. 64 Channels, trigger area smaller than Channel area.Analog readout

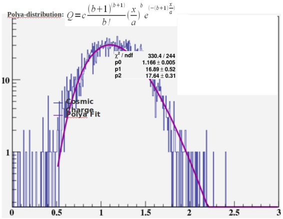
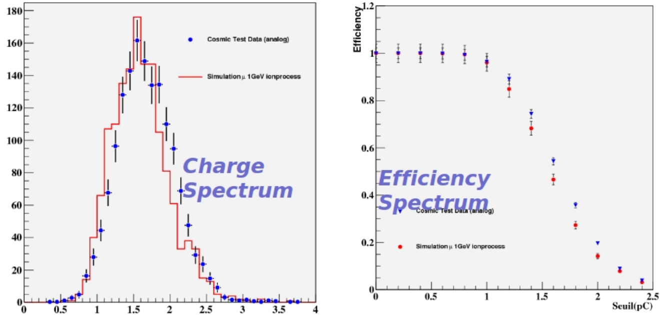


Figure: Avalanche signal charge spectrum in pC (Cosmic Ray)

Simulation Charge Spectrum

In prototype simulation : 10GeV mu, the parameters are got from Polya fitting

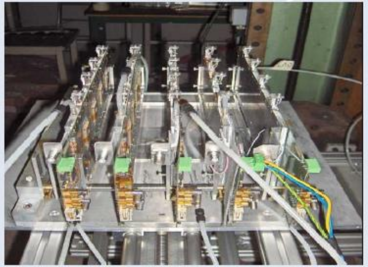


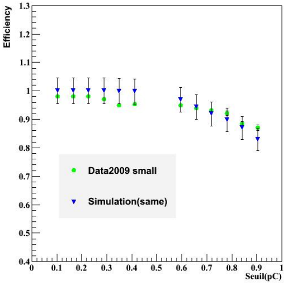
Notice! Plot show the average induced charge spectrum for all pads, it is more important to know the induced charge distribution on each pad, especially for pad multiplicity calculation.

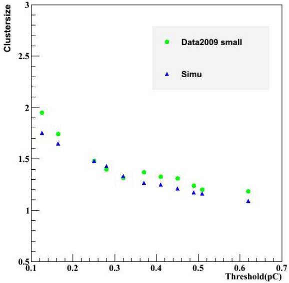
Small RPC's beam test data

Measurement

Compare Efficicency and cluster size with real data







Future

Digitization

Check process with different angle of incoming cosmic data

Simulation

Improve simulation for multipe particles going through one cell with test beam data