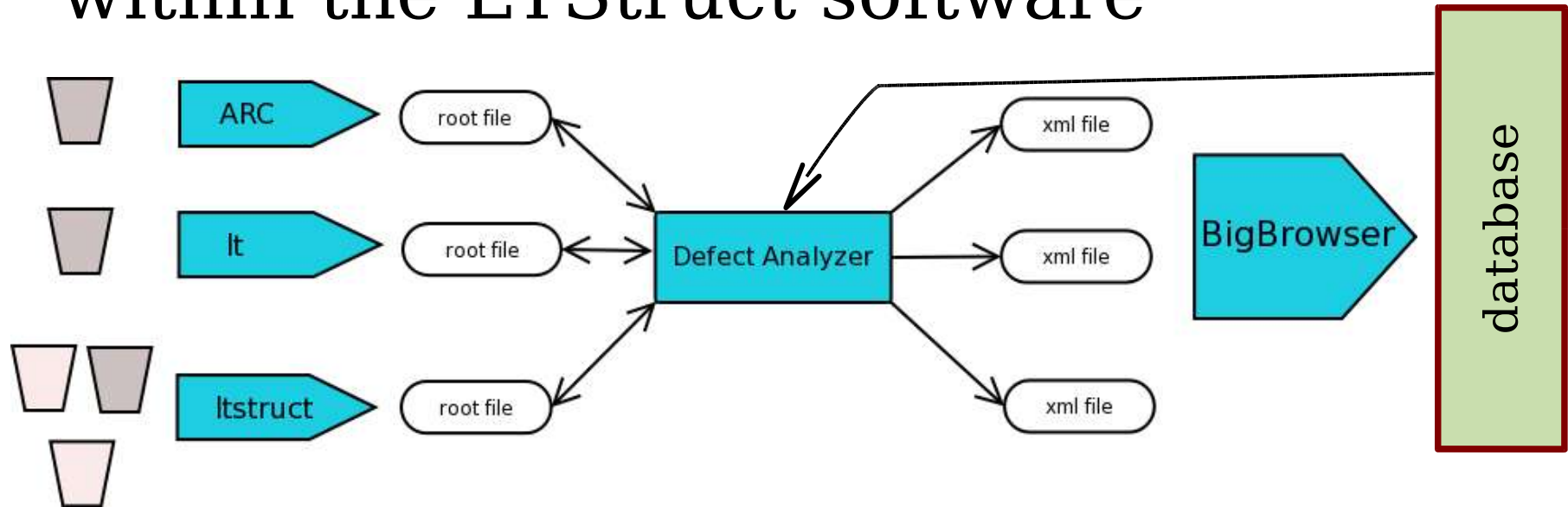

Defect Analyzer Package

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- Presentation
- Features
- Usage
- Future

Last CMS week

- Defect Analyzer package developed within the LTStruct software



- Tool for module qualification fully compliant with construction database
- Tool to perform complex offline analysis with an interactive histogramming

Features: Qualification

- Module qualification
 - ARC
 - LT module tests
 - **LT for structures**
 - Creates defect channels flags, status variable according to algorithm and cuts defined by the task force group
 - Write informations in the same root file
 - Results in :
 - Ascci summary
 - Post-script summary plots
 - XML format °∈ Database
 - Agreement with xFLAG

Features: Qualification [Flow]

Channel defect
analysis (next slide)

Tests flagging

Badchped	Badchcal	Badchpin
0 Healthy	Healthy	Healthy
2 Low noise	PulseHeight min	High
4 TS unbounded	PulseHeight max	Higher
8 OS Unbound	PeakTime Low	
16 High noise	PeakTime TS	
32 Low pedestal	PeakTime OS	
64 High pedestal	PeakTime High	

Channel flagging

Bad Channel Flag
0 Healthy
2 OSO+
4 OSO-
8 TSO+
16 TSO-
32 MSO-
64 NOIS
128 SHT
256 PHL-
512 PHL+
1024 Unkn

OR 3 records (LT)

OR 3 records/modules (LTStruct)

Module grading

Module grade		
0	A	Nbad < 1%
2	AF	A + Ileak > 5.ISens
4	B	1% < Nbad < 2%
8	BF	B + Ileak > 5.ISens
-1	C	Nbad > 2%
-2	C	Ileak > Imax
-4	C	(-1) + (-2)

Features: Qualification [Algorithmic]



BadCharList Flags



0 **Healthy**

$pac=0 \text{ AND } cal=0 \text{ AND } ph=0$

2. **OSQ+**

$(pac=8 \text{ AND } cal=32) \text{ AND } cal \neq 2$

3. **OSQ**

$(pac=8 \text{ OR } cal=32) \text{ AND } cal \neq 2$

4. **TSQ+**

$(pac=4 \text{ AND } cal=16) \text{ AND } cal \neq 2$

5. **TSQ**

$(pac=4 \text{ AND } cal=16) \text{ AND } cal \neq 2$

6. **MSQ**

$(pac=16 \text{ AND } cal=32) \text{ AND } cal \neq 2$

$(pac=16 \text{ AND } cal=16) \text{ AND } cal \neq 2$

$(pac=16 \text{ AND } cal=8) \text{ AND } cal \neq 2$

$(pac=4 \text{ AND } cal=32) \text{ AND } cal \neq 2$

$(pac=8 \text{ AND } cal=16) \text{ AND } cal \neq 2$

1. **NQS**

$pac=16 \text{ AND } cal=0 \text{ AND } ph=0$

2. **SHT**

$cal=2 \text{ AND } pac \neq 0$

– the selected channel and one of the ± 2 nearest neighbours

3. **FHL-**

$pac=8 \text{ AND } cal=8 \text{ AND } cal=2$

$ph=4$

4. **FHL+**

$ph=4 \text{ AND } pac=2 \text{ AND } cal=8$

5. **????**

$ph=4 \text{ AND } pac=16$

all the other cases

Note "=" means bitwise AND

Usage: Installation

- Informations on

<http://neukerma.home.cern.ch/neukerma/DefAna/DefAna.html>

- Installation and upgrade

- via cvs

- With an installation script

http://neukerma.home.cern.ch/neukerma/DefAna/scripts/defana_inst.bash

- Running

- Standard long term pc

- Cern Redhat 7.3.3, debian

- Programs

- TestModuleAnalyzer

- TestModLtAnalyzer

- mainAnalyzer

Features: ARC test analysis

- **TestModuleAnalyzer** program

- Command line program

- Usage:

```
% TestModuleAnalyzer -rootin f.root [-recnr <rnb>]  
[-settings <set>]
```

- rnb: Record number

- set: either ARCS_TIB or xml file.

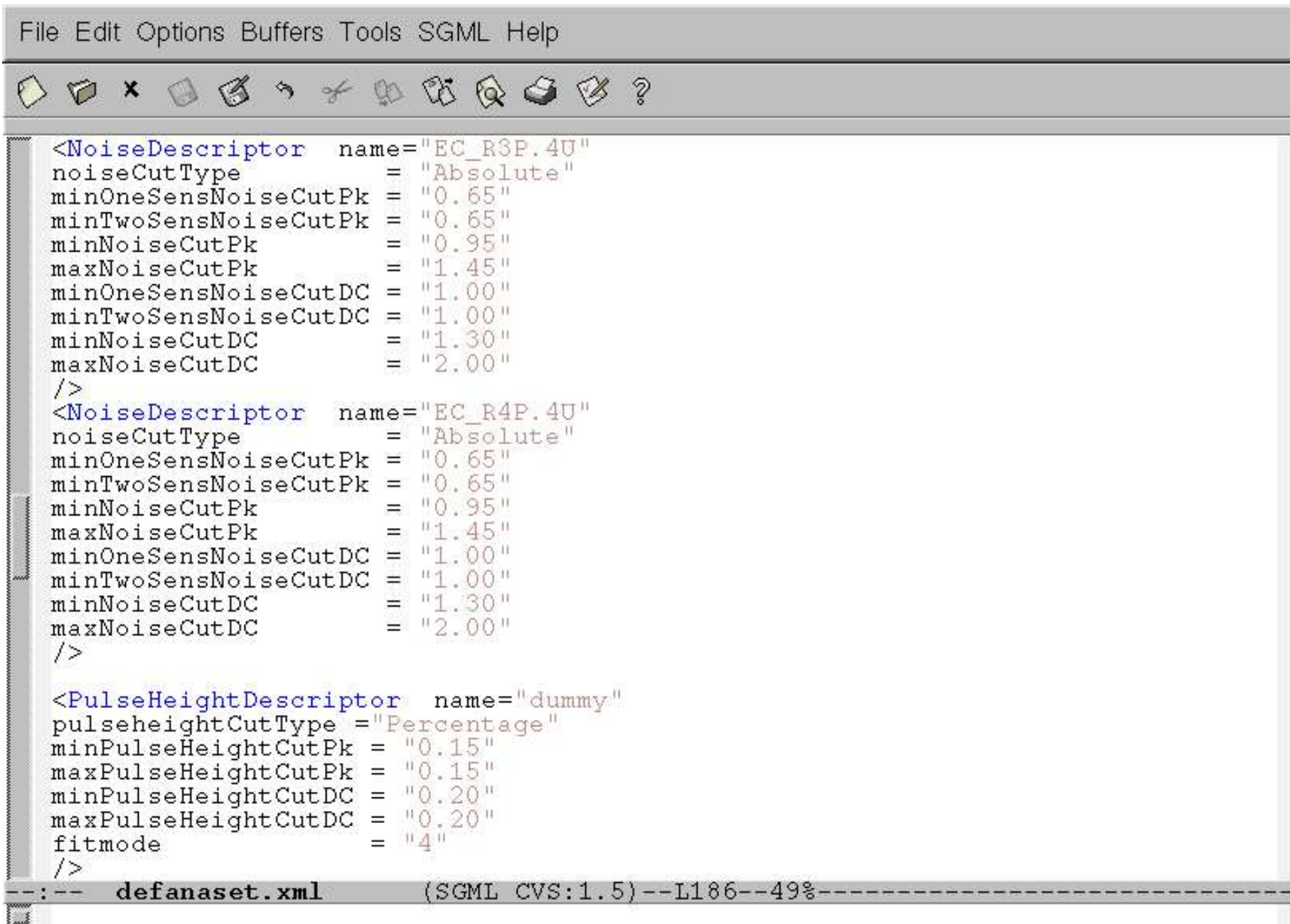
- Output:

- 302xxx_modvalidation2_ok.xml

- Summary plots (Noise, pedestal, Pulse, Pinhole)

- Summary ascci files for each apv mode

Features: ARC test analysis [settings]

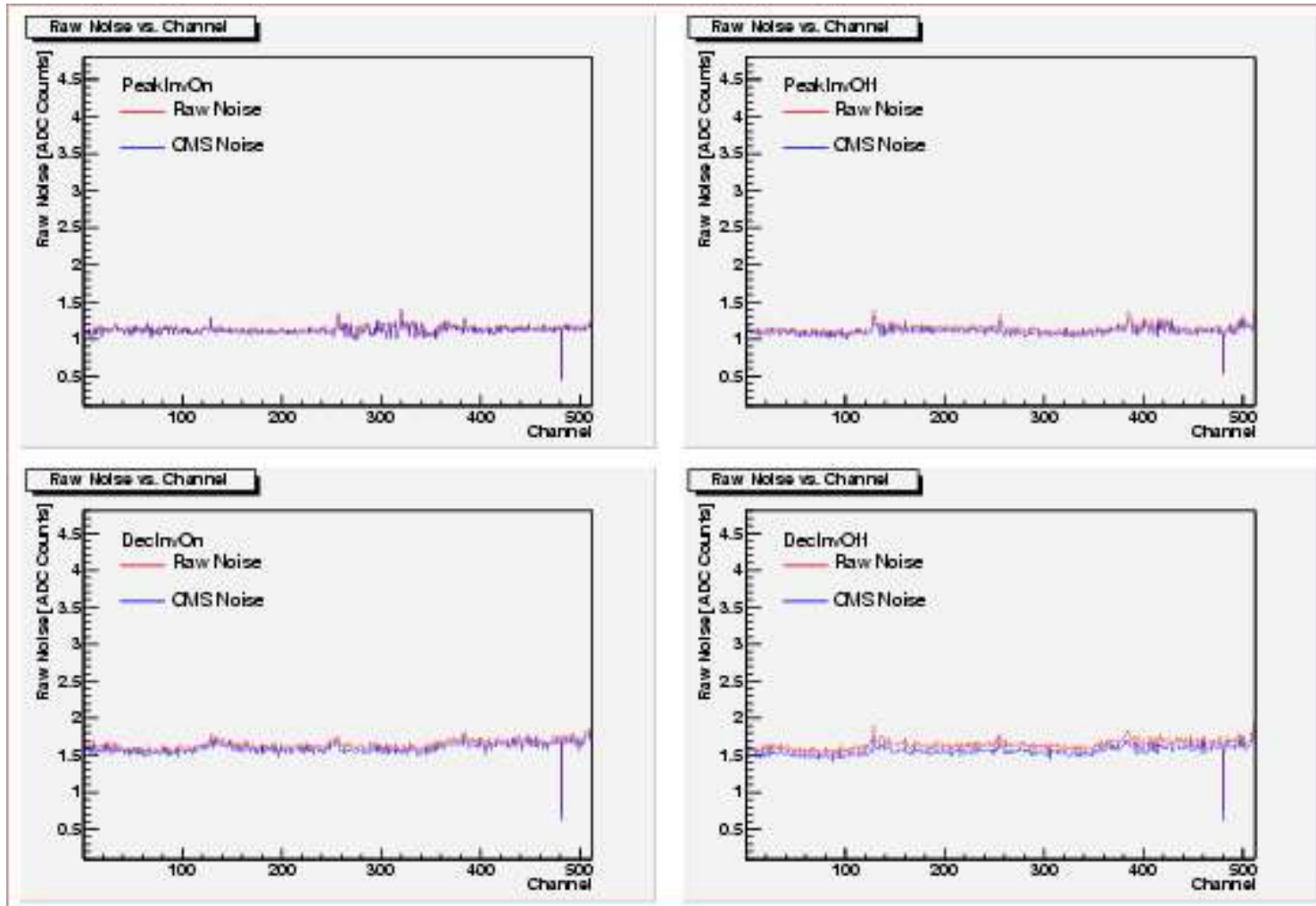


The screenshot shows a window titled "defanaset.xml" with a menu bar (File, Edit, Options, Buffers, Tools, SGML, Help) and a toolbar. The main area contains XML code for three descriptors:

```
<NoiseDescriptor name="EC_R3P.4U"  
  noiseCutType = "Absolute"  
  minOneSensNoiseCutPk = "0.65"  
  minTwoSensNoiseCutPk = "0.65"  
  minNoiseCutPk = "0.95"  
  maxNoiseCutPk = "1.45"  
  minOneSensNoiseCutDC = "1.00"  
  minTwoSensNoiseCutDC = "1.00"  
  minNoiseCutDC = "1.30"  
  maxNoiseCutDC = "2.00"  
>  
<NoiseDescriptor name="EC_R4P.4U"  
  noiseCutType = "Absolute"  
  minOneSensNoiseCutPk = "0.65"  
  minTwoSensNoiseCutPk = "0.65"  
  minNoiseCutPk = "0.95"  
  maxNoiseCutPk = "1.45"  
  minOneSensNoiseCutDC = "1.00"  
  minTwoSensNoiseCutDC = "1.00"  
  minNoiseCutDC = "1.30"  
  maxNoiseCutDC = "2.00"  
>  
<PulseHeightDescriptor name="dummy"  
  pulseheightCutType = "Percentage"  
  minPulseHeightCutPk = "0.15"  
  maxPulseHeightCutPk = "0.15"  
  minPulseHeightCutDC = "0.20"  
  maxPulseHeightCutDC = "0.20"  
  fitmode = "4"  
>
```

At the bottom of the window, the status bar shows: "--:-- defanaset.xml (SGML CVS:1.5)--L186--49%--"

Features: ARC test analysis [Histos]



hNoise_302xxx_Recy.eps

Features: ARC test analysis [xFLAG comp.]

- General comparison with xFLAG 1.5.1
 - XML file order
 - Few environment variables
 - TempSensNtsc1,2, Ileak units different, AvgcalApinhole, Ipinhole set to 252 in xFLAG, Inverted sign avgCalA for Invert. on.
 - (MSO-) logic seems to be **different**
 - Badchped does not contains pedestal info in xFLAG

Features: ARC test analysis [xFLAG comp.]

- Comparison with xFLAG1.5.1

Module	Test center	Nbadch	Flags	Qualif.	DefAna
30200020035153	Firenze	4	265 64, 266 64, 270 64, 272	-1	Same
30200020035168	Firenze	10	33 64, 41 64, 125 64, 228 64, 254 64, 255 64, 320 64, 481 64, 493 64, 496 64	4	Same
30200020035281	Firenze	3	3 64, 719 64, 720 1060	0	Diff
30200020035293	Catania	3	1 256, 632 4, 697 4	0	Diff
30200020035356	Catania	1	481 256	0	Diff

ALL problems related to MSO-

Channels Flags:

2 : open pa-sensor
4 : likely open pa-sensor
8 : open sensor-sensor
16 : likely open sensor-sensor
32 : open unknown
64 : noisy
128 : short
256 : lowleakpinhole
512 : high leak pinhole
1024 : unknown

Modules Grading:

0 : A
2 : AF
4 : B
8 : BF
-1 : Nbad>2%
-2 : Ileak>Imax
-4 : (-1).AND.(-2)

Features: LT test analysis

- **TestModLtAnalyzer** program

- Command line program

- Usage:

```
% TestModLtAnalyzer -rootin f.root [-fitmode <mf>]
[-settings <set>]
```

- mf: fit procedure flag

- set: either LT_TIB or xml file.

- Output:

- 302xxx_modlt2_ok.xml

- Summary plots / record

- Summary files / record / apvmode

Features: LT test analysis [xFLAG comp.]

- General comparison with xFLAG 1.5.1
 - XML file order
 - Few environment variables
 - **StatusSensors** not filled in xFLAG, **ApvModeCal** not filled in DefAna, **CalA** is the fitted one in DefAna, **Timeit** in min in DefAna
 - Badchped does not contains pedestal info in xFLAG
 - MSO- Logic
 - Pulse Shape fitting could be unstable.
Need an agreement on fitting procedure.

Features: LT test analysis [xFLAG comp.]

- Comparison with xFLAG 1.5.1

Module	Test center	Nbadch	Flags	Qualif.	DefAna
30200020035153	Firenze	0		0	Same
30200020035168	Firenze	0		0	Same
30200020035281	Firenze	1	720 4	0	Diff
30200020035293	Catania	4	1 1024, 631 64, 632 4, 697 4	0	Diff
30200020035356	Catania	1	481 1024	0	Same

ALL problems related to MSO-

Channels Flags:

2 : open pa-sensor
4 : likely open pa-sensor
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512 : high leak pinhole
1024 : unknown

Module Grading:

0 : A
2 : AF
4 : B
8 : BF
-1 : Nbad>2%
-2 : Ileak>Imax
-4 : (-1).AND.(-2)

with an **OR** of the 3 records

Features: mainAnalyzer

```
[xdaq@petal-cms test]$ mainAnalyzer -h  
[mainAnalyzer] ... enter  
Default data path: /home/xdaq/DefAna/data/
```

Usage example :

```
mainAnalyzer -rootin file.root [-recnr x -settings setfile] [-comp 'file1.root file2.root ...' -rec '1 2 3...' -objname 'histname']
```

options:

-rootin :the rootfile

LtStruct root file name must be of the form: reslt_S_XXXXXXXXXX.root

LtMod root file name must be of the form: reslt_M_XXXXXXXXXX.root

ARC root file name must be of the form: XXXXXXXXXXXXX.root)

where XXXXXXXXX is the module id number

-recnr :number of record containing valid info (only for ARC root file)

Optional, otherwise last record in file will be taken as valid

-settings : cuts settings file to be used

Optional, otherwise default file will be used

-comp :Comparison mode. Compares histogram objname in:

"different records for the same file file1.root (more than 1 value is given in -rec=)

Example: mainAnalyzer -comp reslt_M_30200020035266.root -rec '18 19' -objname DecInvOn/Noise/RawNoise

"different files for the same record -rec (just one value is given in -rec=)

Example: mainAnalyzer -comp './data/30200020035266.root reslt_M_30200020035266.root' -rec '1 19' -objname DecInvOn/Noise/RawNoise

First record number is for file1.root. Second record number is for file2.root,...

NOTE: if comparison mode is requested, mainAnalyzer is oblivious to -rootin entry

===== EXPERT MODE=====

mainAnalyzer -expert

Demo of DBase parameters comparison using DbClient class

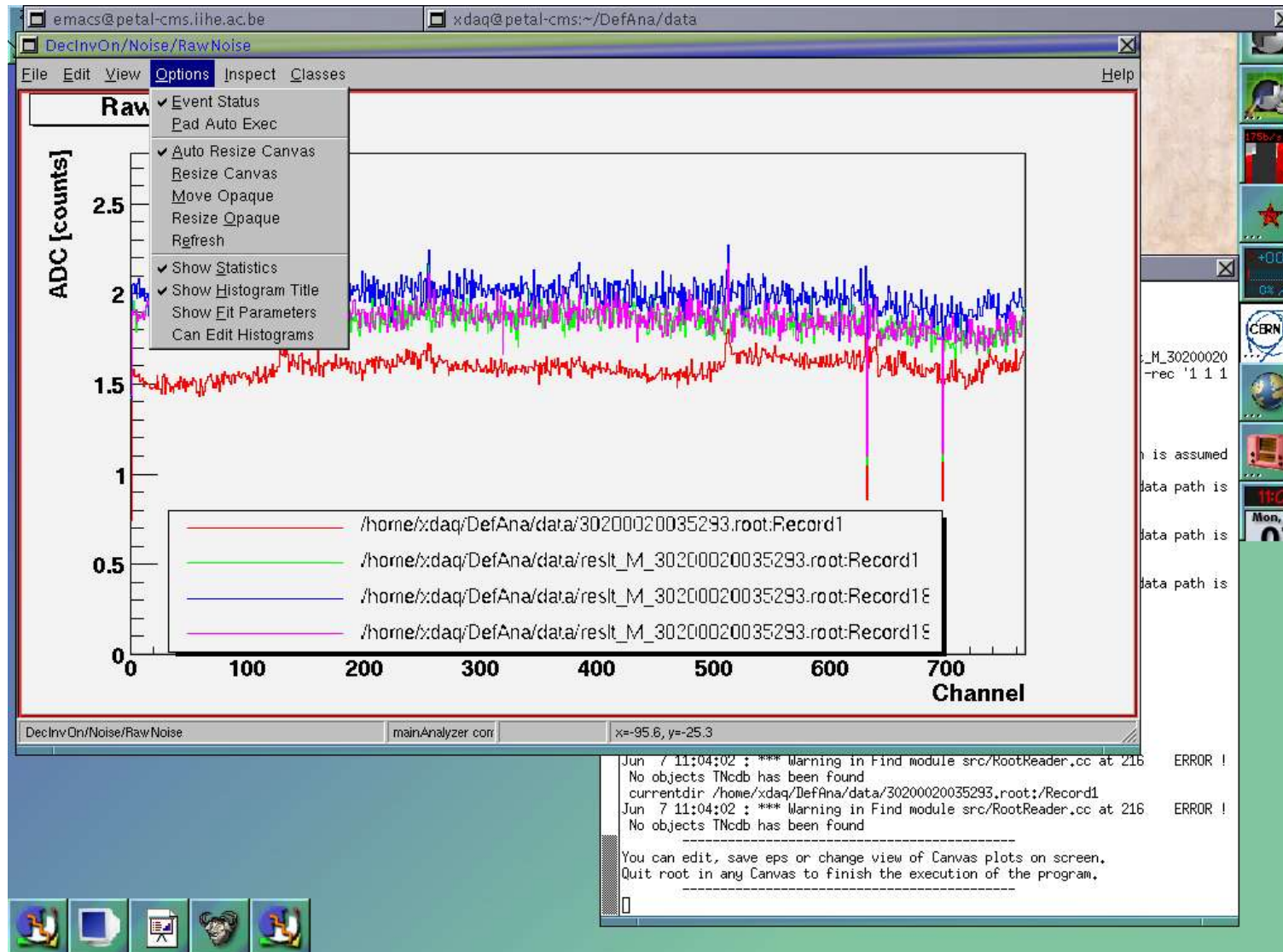
For details see code in:

\$DEFANAHOME/src/DefectAnalyzer/test/src/mainAnalyzer.cpp

```
[xdaq@petal-cms test]$ █
```

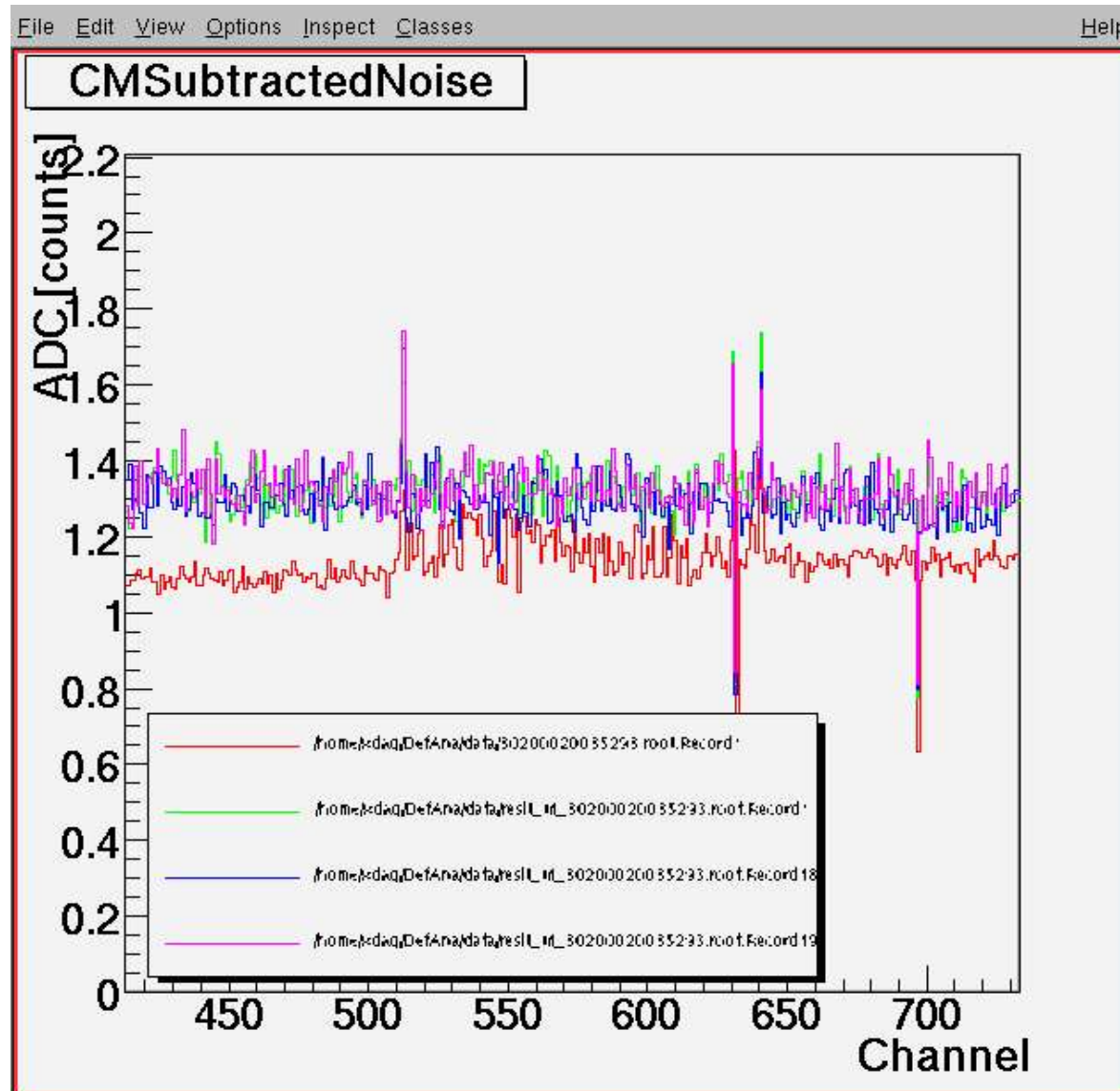
Features: mainAnalyzer [comparison mode]

- Data sets comparison: ARC vs LT



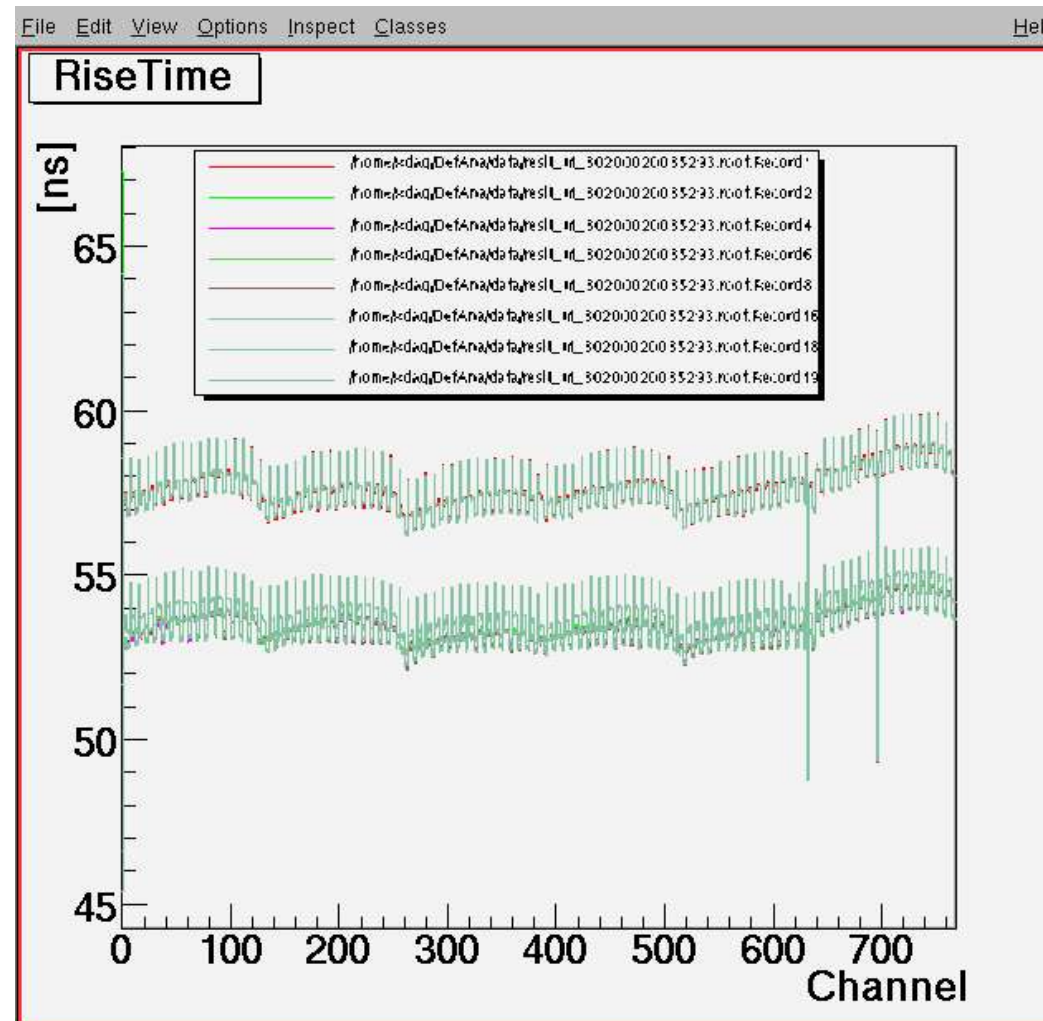
Features: mainAnalyzer [comparison mode]

- Allow to zoom on histograms



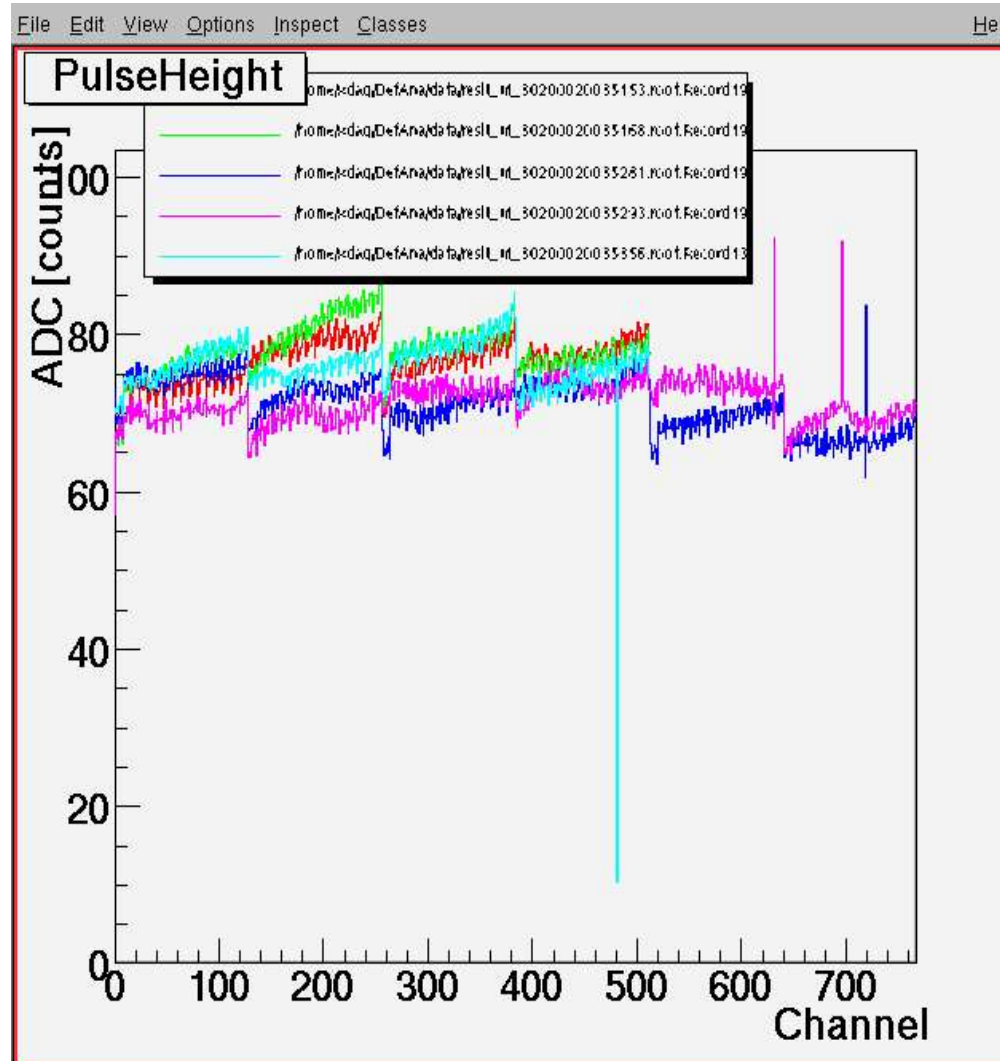
Features: mainAnalyzer [comparison mode]

- Comparisons of records for one module



Features: mainAnalyzer [comparison mode]

- Comparison for several modules



Features: mainAnalyzer [dB client]

- DbClient mode
 - Get information from dB
 - DCUId, modId
 - Bad channels list
 - IV, Noise, PulseHeight ...
- Next
 - Improve the user interface
 - Write some examples
 - ...

Features: mainAnalyzer [dB client]

The terminal window displays the following content:

```
Connecting to DB to retrieve info, please be patient
Mod_type for module Id: 30200020035049 is: 1.2.4.1

-----
New query
Size = 5
Element [0] = Objects contained in
Element [1] = 30200020035049
Element [2] = object, object_id
Element [3] = object_assembly
Element [4] = container_id

-----
Connecting to DB to retrieve info, please be patient
Module 30200020035049 contains:
SEN with Id: 30220230400706
HYB with Id: 30216681602040

-----
New query
Size = 6
Element [0] = IV curve for
Element [1] = 30211234387903
Element [2] = voltage_v, i_tot_na
Element [3] = ivtest_1_sen_
Element [4] = object_id
Element [5] = and status = 'reference'

-----
Connecting to DB to retrieve info, please be patient
VOLTAGE_V  I_TOT_NA
50,0000    2543
100,0000   2730,8
150,0000   2824,4
200,0000   2882,8
250,0000   2906
300,0000   2939,7
350,0000   3056,8
400,0000   3546,2
450,0000   4977,9
500,0000   7563,2
550,0000   10939,5

-----
New query
Size = 6
Element [0] = DCU Id for Mod Id
Element [1] = 30200020035049
Element [2] = FHIT_et_dcu_id
Element [3] = object_assembly OA, fhitmeasurement_1_hyb_ FHIT
Element [4] = OA.container_id
```

The graph window, titled "CALPAPION", displays a plot of AD [counts] versus Channel. The y-axis ranges from 650 to 1050, and the x-axis ranges from 0 to 700. Two data series are shown: a red line representing data from a file path and a green line representing data from a database table. The green line shows a significant peak around channel 200, reaching approximately 1000 counts, while the red line remains relatively flat around 850-900 counts.

Conclusion

- Defect Analyzer package is a tool fully integrated within the LTStruct software framework which allow:
 - The module qualification
 - Extensive analysis
- Some analysis skeletons are already available
 - More will come (for cuts tuning)
 - Already useful for building dedicated analysis
- Petals/Rods qualification in progress
- Integration within the LTStruct gui as a button or scenario