

xFLAG

Readout Interface and CMS Compliant Analysis of ROOTfiles with Database Output (non torna)

xml Files from LongTerm and ARCS Generator

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What is xFLAG?

- A program to create **correct** versions of the **xml** files to be uploaded into the Tracker **Production DataBase**
 - ARCS test
 - Long Term test
 - **for any kind of Tracker modules**
- xml templates by Valery Zhukov
 - <http://www-ekp.physik.uni-karlsruhe.de/~zhukov/Cms/database.html>
- Module Test analysis defined by the "Task Force"
 - a document is available (Version 1.4 23rd October 2003)
 - here **thresholds** and **tests** are defined
 - » http://hep.fi.infn.it/CMS/moduletest/tkwoct03/test_procedures.pdf



Where is xFLAG?

- Where to download **xFLAG**:
 - <http://hep.fi.infn.it/CMS/marchett/xFLAG>
 - Current version: **1.4.4**
- Six versions available
 - RedHat 7.2 with ROOT 3.03/09 compiled with gcc 2.96
 - standard Long Term PC
 - RedHat 8.0 with ROOT 4.00/02 compiled with gcc 3.2
 - RedHat CERN 7.3.4 (compiled with gcc 3.2) with ROOT 3.10/02 (stable version)
 - standard CERN, run on lxplus
 - Microsoft Windows 2000/XP with ROOT 4.00/03 compiled for cygwin
 - Microsoft Windows 2000/XP with ROOT 3.10/02 and ROOT 4.00/03 (win32gdk version)



How to use it?

- Edit the configuration file xFLAGrc

```
# AntaniX
# Global configuration for xFLAG

# Center tool_id (need for LT files)
202

# Full path of ARC config file:
./ARCconfig.txt

# Full path of LT config file:
./LTconfig.txt

# Fit LT profiles:
# 0 - don't fit
# 1 - fit
# This flag is ignored if LT version < 1.24
1

# Number of sensors
1

# List of ROOTfiles to be analyzed
file1.root
file2.root
file3.root
```

Center `tool_id` needed for LT files (the variable does not exist in LT ROOT files): if you don't have `tool_id` ask DB people for one

The path to your own ARC and LT cut files (the same used by Tony/Riccardo's macros)

Do calibration profiles fits for LT files (if you have not set `fitmode=2` in LT settings.xml)

Insert number of **sensors** (needed for module grading)

List of ROOT files (ARCS, LT)



Data Analysis

- xFLAG processes both ARCS and LT ROOT files from different software versions
 - automatic recognition of ARC and LT files
 - ARCS: versions 6.2 and 7.0
 - LT: versions 1.22, 1.23 and 1.24
 - ...and hopefully newer ones...
- Bad channels identification and flagging
 - the same analysis done by Tony/Riccardo's macros has been implemented in the code
 - bitwise OR of the flags resulting from the four APV modes
 - Noise analysis: badchped flag
 - Calibration analysis: badchcalprof flag
 - Pinhole test: badchpinhole flag



Noise Flags

- 1 sensor modules ARC

CM Sub. Noise [ADC ch]	Peak	Deconvolution	XML code
	ARC	ARC	badchped
Pinhole	<0.65	<1.00	2
Open	0.65÷0.65	1.00÷1.00	4
Open	0.65÷0.95	1.00÷1.30	8
Healthy	0.95÷1.45	1.30÷2.00	0
Noisy	>1.45	>2.00	16



Noise Flags

- 1 sensor modules LT

CM Sub. Noise [ADC ch]	Peak	Deconvolution	XML code
	LT	LT	badchped
Pinhole	<0.70	<1.15	2
Open	0.70÷0.70	1.15÷1.15	4
Open	0.70÷1.00	1.15÷1.40	8
Healthy	1.00÷1.65	1.40÷2.45	0
Noisy	>1.65	>2.45	16



Calibration Flags: Pulse Height



- 1 sensor modules ARC

Chip norm. Pulse Peak	Peak	Deconvolution	XML code
	ARC	ARC	badchcalprof
Low	$<(1-0.15)$	$<(1-0.20)$	2
Healthy	$0.85\div 1.15$	$0.80\div 1.20$	0
High	$>(1+0.15)$	$>(1+0.20)$	4



Calibration Flags: Pulse Height



- 1 sensor modules LT

Chip norm. Pulse Peak	Peak	Deconvolution	XML code
	LT	LT	badchcalprof
Low	$<(1-0.15)$	$<(1-0.20)$	2
Healthy	$0.85\div 1.15$	$0.80\div 1.20$	0
High	$>(1+0.15)$	$>(1+0.20)$	4



Calibration Flags: Peak Time



- 1 sensor modules ARC

Avg. Sub. Peak Time [ns]	Peak	Deconvolution	XML code
	ARC	ARC	badchcalprof
Pinhole	<-30	<-30	8
Open	$-30\div-30$	$-30\div-30$	16
Open	$-30\div-5$	$-30\div-3$	32
Healthy	$-5\div+5$	$-3\div+5$	0
Noisy	$>+5$	$>+5$	64



Calibration Flags: Peak Time



- 1 sensor modules LT

Avg. Sub. Peak Time [ns]	Peak	Deconvolution	XML code
	LT	LT	badchcalprof
Pinhole	<-30	<-30	8
Open	$-30\div-30$	$-30\div-30$	16
Open	$-30\div-5$	$-30\div-3$	32
Healthy	$-5\div+5$	$-3\div+5$	0
Noisy	$>+5$	$>+5$	64



Calibration Flags: PinHole



- 1 sensor modules ARC

max-min PulseHeight [ADC ch]	PeakInvOff	XML code
Healthy	<15	0
High	>15	2
Higher	>40	4



Final flag

- A final flag chflag is assigned to all the channels according to a fixed code resulting from all mandatory tests:

0	Healthy	OK
2.	OSO+	One Sensor Open (Pitch Adapter-Sensor)
4.	OSO-	likely One Sensor Open (PA-Sensor)
8.	TSO+	Two Sensors Open
16.	TSO-	likely Two Sensors Open
32.	MSO-	unidentified Open
64.	NOIS	Noisy
128.	SHT	Short
256.	PHL-	likely Pinhole
512.	PHL+	Pinhole
1024.	????	unidentified defect



BadChanList Flags



0 Healthy

- $\text{ped}=0 \text{ AND } \text{cal}=0 \text{ AND } \text{ph}=0$

2. OSO+

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

4. OSO-

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

8. TSO+

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

16. TSO-

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

32. MSO-

- $(\text{ped}=16 \text{ AND } \text{cal}=32) \text{ AND } \text{cal} \neq 2$
- $(\text{ped}=16 \text{ AND } \text{cal}=16) \text{ AND } \text{cal} \neq 2$
- $(\text{ped}=16 \text{ AND } \text{cal}=8) \text{ AND } \text{cal} \neq 2$
- $(\text{ped}=4 \text{ AND } \text{cal}=32) \text{ AND } \text{cal} \neq 2$
- $(\text{ped}=8 \text{ AND } \text{cal}=16) \text{ AND } \text{cal} \neq 2$

64.NOIS

- $\text{ped}=16 \text{ AND } \text{cal}=0 \text{ AND } \text{ph}=0$

128.SHT

- $\text{cal}=2 \text{ AND } \text{ped} \neq 0$
 - the selected channel and one of the ± 2 nearest neighbours

256.PHL-

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

512.PHL+

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

1024.????

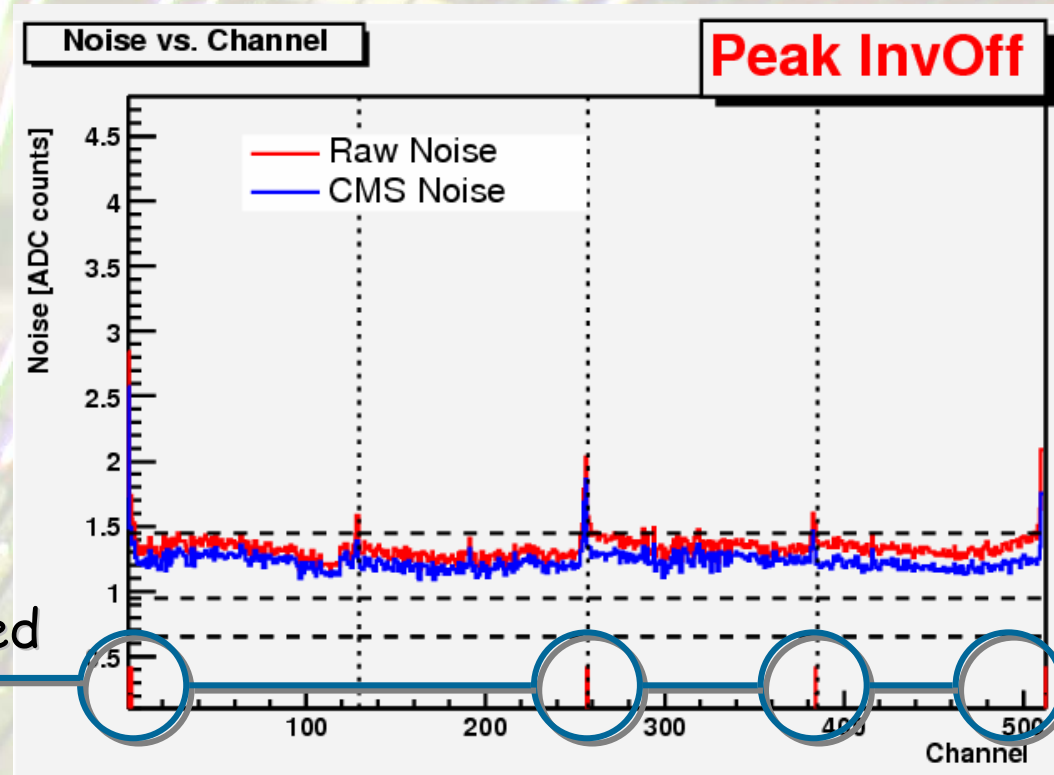
- $\text{ph}=4 \text{ AND } \text{ped}=16$
- all the other cases

Note: "=" means bitwise AND



More on bad channels...

- The final bad channel list is obtained excluding the chips edges and module edges channels if they are **noisy only** (final flag=64)
 - 4 APVs modules:
 - 1,2,128,129,256, 257,384,385,511,512
 - 6 APVs modules:
 - 1,2,128,129,256, 257,384,385,512, 513,640,641,767,768



These channels will not be included in the final bad channel list



ARCS bad channels



- The ARCS xml file contains one table only:
 - MODULBASIC
 - composed at least by the standard set of results as decided by the "Task Force"
 - » http://hep.fi.infn.it/CMS/moduletest/tkwoct03/test_procedures.pdf
 - Noise in all the four APV modes
 - Calibration profiles in all the four APV modes
 - Peak Amplitude, Peak Time
 - Pinhole test
 - IV curve
 - This is the base table used also for LT results
 - The bad channel list (BadChanList) is created according to the logical OR of the previous results (chflag)



Long Term bad channels

- At least three runs has to be recorded in LT xml:
 - MODULLTFIRST [MODULBASIC]
 - the first "warm" Record at +20°C
 - MODULLTCOLD [MODULBASIC]
 - the last "cold" Record at -20°C
 - MODULLTLAST [MODULBASIC]
 - the last "warm" Record at +20°C
- **Three independent bad channel lists are created**
- Final result of LT is summarized at the end of the xml file:
 - MODULLTSUMMARY
 - **A channel is identified as "bad" (LtBadChanList) according to the logical OR of the previous three tests results (chflag)**



ARCS software patches

- The software has been developed to cope with some changes due to the different ARCS and LT software releases
- Some patches have been added to comply with some software bugs found and corrected since Sep'03
 - ARCS versions before 7.0
 - a bug inside the Environment directory
 - TempHybDCU set to 0 [was not filled in ROOT files]
 - » temperature of DCU measured by DCU, adc [int]
 - TempHybNtsc properly filled [it was not in its place]
 - » hybrid temperature measured by DCU, adc [int]
 - Pinhole test leakage current Ipinhole set to 0 [not stored]
 - ARCS version 7.0 without the patched arcs_dll.dll library
 - if Header and Environment directories in Record1 are empty they are searched for in Record2
 - » a bug due to IV test done at first



LT software patches

- The calibration profile **CRRC** fitting function (Peak mode) was **incorrect** in **LT** sw releases **<1.24**
 - calibration subroutine as in Riccardo's LT analysis macro
- The valid calibration profile fit is ruled by fitmode tag in CalProfRunDescriptor in LT settings.xml file
 - **fitmode=2** [the default value is 0]
 - Peak Mode CRRC fit range: {PeakTime-40ns÷PeakTime+100ns}
 - Deconvolution Mode Gaussian fit range: {Peak Time±20ns}
- Calibration profiles fits are needed for module analysis
 - mandatory if LT sw version <1.24
 - ruled by xFLAGrc configuration file if LT sw version 1.24
 - number of fits to do: nModes x nChip x nChanPerChip
 - 4 APVs: 4x4x128=2048 fits
 - 6 APVs: 4x6x128=3072 fits



Module grading



- At the end of the analysis every module is graded according to the results of the tests
 - ARCS
 - MODULBASIC_val
 - LT
 - Three MODULBASIC_val
 - Final MODULLTSUMMARY_val
 - combination of the three LT results



Module grading scheme

- MODULBASIC_val
 - grade A: value="0"
 - NBadChan < 1%
 - grade AF: value="2"
 - NBadChan < 1% AND $I_{leak}(450V) > 5 \times I_{Sens}(450V)$
 - grade B: value="4"
 - $1\% < NBadChan < 2\%$
 - grade BF: value="8"
 - $1\% < NBadChan < 2\%$ AND $I_{leak}(450V) > 5 \times I_{Sens}(450V)$
 - grade C
 - NBadChan > 2%: value="-1"
 - $I_{leak}(450V) > N_{Sens} \times 10\mu A$: value="-2"
 - NBadChan > 2% AND $I_{leak} > N_{Sens} \times 10\mu A$: value="-4"



Module grading scheme

- Some qualification flags could be added "by hand" editing the xml file in presence of damaged modules
- **MODULBASIC_val**
 - **grade C**
 - No readout: value="-8"
 - Mechanical damages: value="-16"
 - Dismounted: value="-32"
 - Modules from September production (no stiffener): value="99"
 - this value has to be inserted by editing the xml file



Logfile



- A logfile is created at the end of the module analysis
 - [module number].txt
- It contains:
 - the bad channels list
 - the module grading
 - the cuts used for the analysis
- Look at this file to see if results are as expected



Tracker Production DataBase



- After having created the xml file **we tried** to upload it into the Tracker **Production DataBase**
- **We realised that the Module Test DB tables didn't exist in the Production DB!!!**
- We asked DB people to create them
- Thanks to the rapid intervention of DB people, now the Production DB is fully compliant with the xml template by Valery Zhukov
 - <http://www-ekp.physik.uni-karlsruhe.de/~zhukov/Cms/database.html>



The First Module

- The first test results on a TIB module were uploaded into the Tracker Production DataBase the 26th March 2004... **EVERYTHING WAS OK!!!**

Welcome to the CMS Tracker DataBase Navigator
 Connection Tracker Description Production Status Quality Control WorkStations Tables Windows Plug-ins Help

	Measurements:
MODVALIDATION_val	:0:
	Sub-Tests:
MODULBASIC	:0:

Add BM Del BM See BM SQL SQL

In: Modules Customize

TrkNavigator Version 2.02

Basic Object Information:

	Measurements:
MODLT_val	:0:
	Sub-Tests:
MODULLTSUMMARY	:0:
MODULLTFIRST	:0:
MODULLTCOLD	:0:
MODULLTLAST	:0:

MODLT (2)	:0:
L.T. Cold (2)	:0:
L.T. First (2)	:0:
L.T. Last (2)	:0:
ARC Validation (2)	:0:

connected to production DB



Modules are in Production DB!!!



Firenze TIB Module Production [14th April 2004]

Received	Bonded	ARC tested [OK]	ARC xml's into DataBase	LT tested [OK]	LT xml's into DataBase
78	78	78 [76]	58	69 [68]	54

74% of the ARC tested modules into the Tk Prod DB
A: 54 (93%)
B: 2 (3.5%)
C: 2 (3.5%)

78% of the LT tested modules into the Tk Prod DB
A: 52 (96%)
B: 1 (2%)
C: 1 (2%)

- Simone Paoletti released a new version of trkNavigator
 - version 2.02 2nd April 2004
 - <http://hep.fi.infn.it/CMS/testres/trkNavigator>



Conclusions

- Now it is possible to upload modules test results into the Tracker Production DataBase
- Correct versions of the xml files are created with **xFLAG** developed in Firenze by Cristiano Marchettini & Riccardo Ranieri
 - <http://hep.fi.infn.it/CMS/marchett/xFLAG>
 - » actual version 1.4.4 19th April 2004
- Perfect compatibility between DB Production tables and the xml template
- We have already started to upload all our test results into the Production DB



Where are ARCS/LT macros?



- New version of Tony/Riccardo's macros available
 - <http://hep.fi.infn.it/CMS/marchett>
 - rrARCS.cc
 - » with configuration files for 1 or 2 sensor modules
 - rrLT.cc
 - » with configuration files for 1 or 2 sensor modules
 - **version 3.1.0** 19th April 2004
 - **New features:**
 - automatic recognition of the number of the APVs
 - » code editing no more needed
 - border chip and border module channels are excluded from the bad channel summary if they are noisy only
 - » perfectly compatible with xFLAG analysis
 - a little bugfix in channel flagging with Inverter On
 - » necessary to flag shorts in LT analysis