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# WBS1.2.3 CCD Reports and Data Analysis

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Julia Campa  
IEEC Barcelona



# Current Status of Data Analysis

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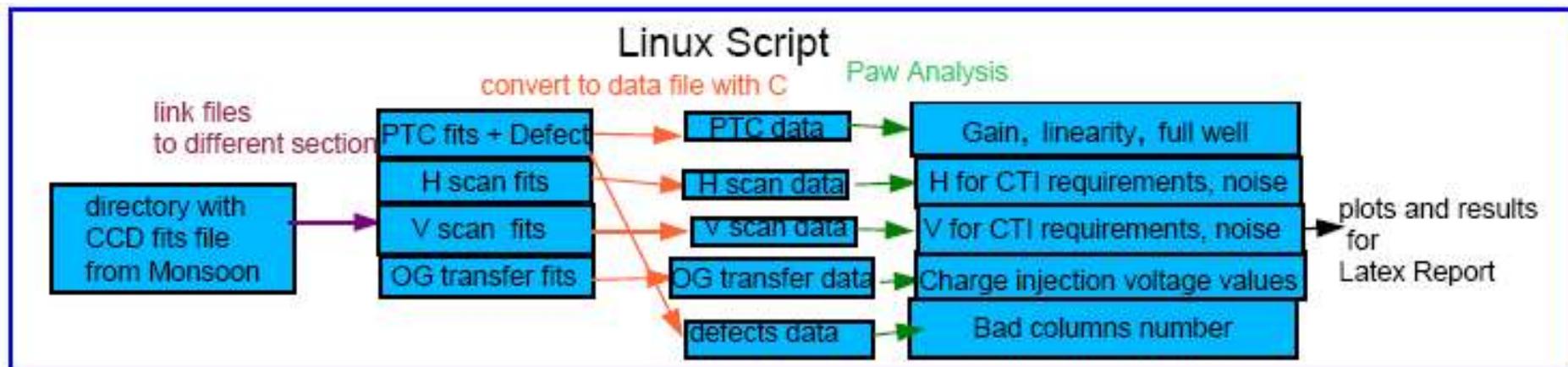
- Two steps for an initial CCD Test ([FNAL-1](#)):
  - After an automated data taking is done for a device at FNAL the data are archived in the FNAL DES cluster to be analysed
- Analysis of data CCD test and report:
  - non-FNAL collaborators (Barcelona) make the analysis via Kerberos or Crypto card
  - 470 FITS of 600 (22GB) are used for the automated analysis and the reports. The rest are used for Time Scan studies



# Analysis procedure

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- A Linux script selects the FITS files from the tested device name directory and distribute them to be analysed in different sections
- Run the programs to read the FITS files in a selected pixel area per section
  - A C program with **CFITSIO** library *converts FITS file into a text file with the ADU value of the pixels*
- Data analysis with **PAW** programs
- Reports with **Latex** using plots and values generated with Paw
- 3 sizes of CCD in the automated analysis require the same programs with parameters different like over scan areas, row and columns number.





# Analysis procedure

- Every image has a log file to identify it (test date, cube number, CCD ID, exposure time, temperature, etc)
- Always the data taking test is made in the same order to automate the analysis
  - Fits files used for data analysis:

Sections	FITS file number required
I.Photo Transfer Curve(Gain)+Linearity +Full Well	156
II.Horizontal Clock Scan	80
III.Vertical Clock Scan	80
IV.Output Gate transfer curve	154
V.Defective Columns	1 (flat from section 1)
<b>TOTAL</b>	<b>470</b>



# Reports Overview

- In the first page there is an overview with the ID CCD and analysis results table

## CCD ID:

Device ID	109001-3-1
Package ID	rb-24-02
Lot	1 A
Package	Picture Frame
Type	Back Illuminated
Size	2048X4096
Thickness	250 microns
Operator	Juan Estrada
Analysis	Julia Campa

## Analysis Results:

	Right Amplifier (RH)	Left Amplifier (LH)
Gain (ADU/e)	1.41	1.41
Full Well (e)	>130000	>130000
Non Linearity <1%	Yes	Yes
Min. Horizontal Clock for CTI requirements H+ (1,2,3) (V)	6.5	8.5
Max. Horizontal Clock for CTI requirements H- (1,2,3) (V)	-4	-4
Minimum Output Gate (V) for Vref = -12 V to prevent charge injection	3	3
RMS	10	10

Min. Vertical Clock for CTI requirements V+(1,2,3)(V)	7
Max. Vertical Clock for CTI requirements V- (1,2,3) (V)	-3
Dark Current (e/hr/pixel)	
Light Bulbs number	2
Bad columns number	16



# Reports Overview

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- There are five sections in the CCD Reports:
  - *I Photo Transfer Curve* : 6 plots  
PTC Plot, Mean as function of exp time and linearity for U and L amplifier
  - *(II) X-Ray Exposure* to obtain the Gain in some cases: 1plot  
Distribution of charge
  - *II H Clock Scan* : 12 plots  
*II.A H+* / *II.B H-* : transition to serial over scan ,CTI and noise for H+/H- values for U and L amplifier
  - *III V Clock Scan*: 6 plots  
*III.A V+* / *III.B V-* : transition to parallel over scan ,CTI and noise for V+ /V- values
  - *IV OG Transfer*: 2 plots  
Mean as a function of  $V_{og}$  for different values of  $V_{ref}$  for U and L amplifier
  - *V Defects*: 2 plots  
Deviation from local average (  $5 \sigma$  deviation ) to detect bad columns  
10 column average as function of column for the complete CCD



# Reports Overview

- With [FNAL-2](#) test will include more sections:
  - QE studies
    - › QE versus temperature
    - › QE versus wavelength
  - Dark counts versus temperature



# Individual CCD Test

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- Required time for one full individual CCD test :

## FNAL-1:

- CCD taking data test at FNAL : 1 overnight
- CCD data analysis and report at Barcelona : half day (run programs + evaluate the results)

## FNAL-2:

- if device pass FNAL-1 then : 3 or 4 days per detailed study  
(QE measurement, temperature studies, flatness, cooling maintained )

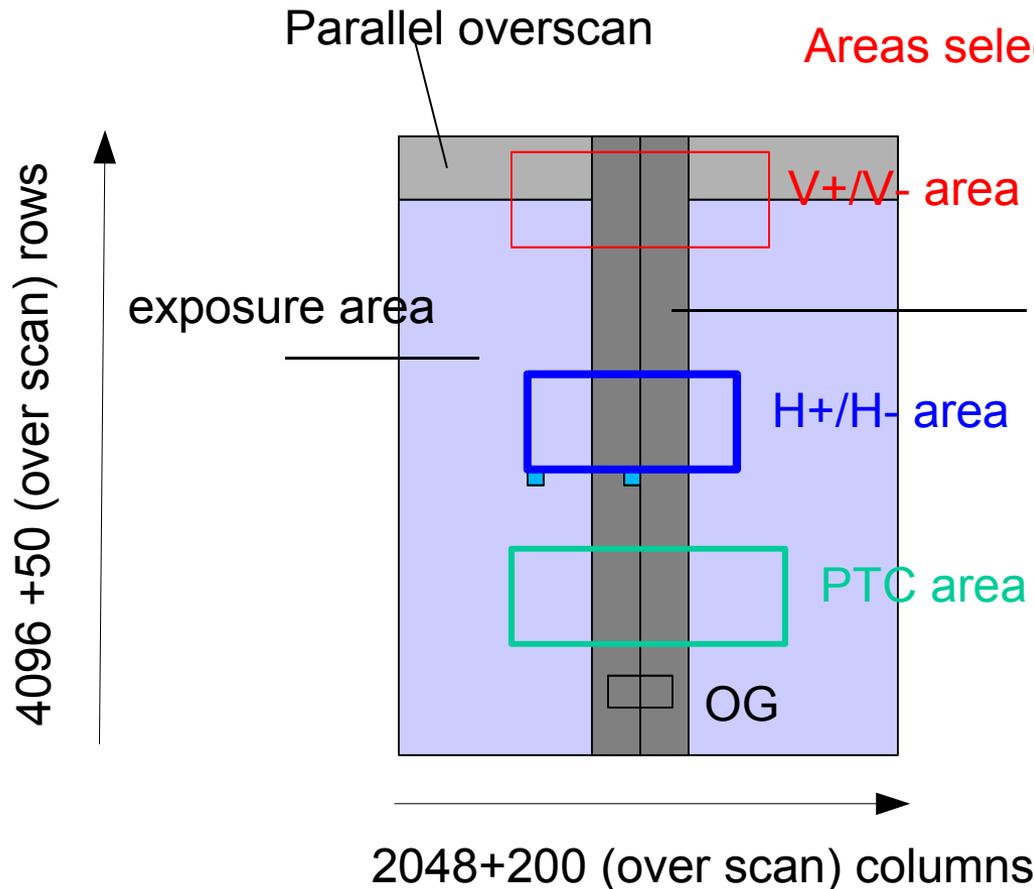
**Total time:** 4 or 5 days

- Manpower:
  - Nowadays Barcelona is analysing the data test (one person)
  - During 2007 one or two non-FNAL Collaborator of Barcelona will analyse the test data
  - During **Production** test (2008/2009) two non- Fnal collaborators (CTIO and Barcelona) will analyse the test data



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# Pixels area selected (back slides)



Areas selected for a 4K X 2 K CCD

Serial over scan

- For bad columns the complete CCD is selected.