

RD50 HV-CMOS Meeting

RD50-MPW4

How to DAQ

Bernhard Pilsl





Setup

- Get SD-card image from Cernbox .
- Get repositories ٠
 - Peary branch "RD50-MPW" _
 - **GUI**
- Read the README.md files .
- Compiling done by the usual bitbake . procedure (see Caribou manual)

General This device is intended to operate the RDSD-MPW3 chip by the CERN-RDSD HV-CMOS

How to Setup

In order to operate the RDSO_MFW3 device start Peary with 'pearycli < config.cfg RDSO_MPW3' on your Caribou system. The config should be generated by the designated GUI: <u>https://wilab.com.ch/vdSb.hc-mod/set/ware/vdSb.mpw3-out</u>

Additionally to those config files the "clock_configure" from clockgenerator folder needs to be copied on the Caribou system. This file is being parsed and used to configure the SIS345 clock on the Carboard

- We use the SIS70 clock generator of the Xilinx board. This clock by default is occupied by a "direct user input", in order to free this clock run "echo -n "1-005d" > /sys/bus/i2c/drivers/sil

Configuration files

Peary config file

The main Percy coding lifes fast by specifying it with the "<" options where calling "search". It specifies the initial waters of -Voltages where to within 100 so Callifold will be rates. The manuse are equal to the manus used in the PCS identificat and initially "contain" the value they are designed to, if you want you nevertheless can change them here. Keys with "__u" correspond to voltage theirs Specified in (V or defined with ") to compliance counter levels in (A). Chip registers: registers of the digital periphery eg. vptrim, vb(0,... (consult chip documentation for details)

Misc values like: I2C adress used by the chip, path to collbration_file, path to matrix_config file

Misc keys:

NIX. MKYNI 121, div: PMI bit operating ynten IIZ decks (eg. "(Mar)(2c-9") 122, div: PMI bit operating ynten IIZ decks (eg. "(Mar)(2c-9") 122, did: 122 dafress of the MMYN on the PGS (gan be specified via jurnee roeffig, USAS (eg. hath to dakk configuration file to be operating to the SSI24) via Silywark's "Cackbuilder Pm" software, needs the .cxv output style() matrix; .ccnillig: Path to matrix: config file - cuillig. Like: Path to Tim/CAC calibration file - exacties; Like: Path to a Mic cacharity device commands to be executed dar searcies; Like: Path to a Mic cacharity device commands to be executed dar leaser IC on the CaR-hoard (can be create

 exercise. Mer Path to a life containing device commanss to be exercise varies of the path to a life containing device commanss to be exercise varies of the reads with block's calculate block of the reads with block's calculate block of the reads with block's calculate the life contain life and the path block of the reads the path exercise of the path exercise of the reads the path exercise of the vor system yobates in the current imprementation through.
• Inj. 10: Tell IPGA to send the specified number of injections whenever a T0 signal is issued by the TLU during a start of a EUDAQ run. Can be used to test synchronization for testbeam setups.

Matrix config file

Additional custom configuration file not natively known by Peary, but only by our MPW3 device. It is generated by the CUI and castains a line for each not default configured point. May be empty if all points should be operated in the default way. The format is softwars (wind (cult) (masked) (e.g., rul) (e.g., b) (er., socie) (thirtinAU).

stooms: Down (cot) Initiating (or, m) (or,

If not specified / emoty default config will be applied to chip.

Calibration file

Additional outpont configuration film not natively known by Perry, but only by our MPV0 device, is the output of the outbare triac routine. It consists of 64 rows with a value's operated by ". These values define the tuned fitmiDAC value for all prioris. Early values has an implicit, pool address (you + namber of now in File, column + of the values is the current row). The values will be parsed and set for the trianDAC value if the pails is set to - 1/9 or trianDAC value from the config file.

If no calibration file is provided the trimDACS will be set to 7 for all pixels which are set to -1 in the matrix config file or to the forced value te -1.

GUI originally designed for the configuration and operation of the RDS0-MPW3

GUI config

As some point the GUI was generalized to be usable with any Peary device. This generalization made a config file (n. 500 the GUI manotatory. This config file (n. as either be specified with the ''<' command line option, if somehody provided your for the MDSLMMP users take at a lock to the ''mics' fields', therwhere a watcand by guide you through the process of config file when you start the GUI without '' or an involid config file for the first time. The path to the config file gets or the specified with the specified with the specified with the config file gets or the specified with the specified

Wizard

Make sure to run pearyd on

Usage Create Config

in the Config tab of the GUI check the radio button for to be. Especially the "Matrix" sub-tab in the should be of

If you want to store the generated config locally, you can simply enter a local path there. If you want to deploy the config to a remote Caribou system specify the path in the following way: ssh://=User_name>@=Caribou_IP>:<config_file_name>, eg: ssh://root@192.168.130.7:config.cfg

The username and the IP can also be specified with the following keys in the Gill config: - user - pears host - pears config This procedure will generate / deploy 2 files.

Theory Squeening life, with section of the section of the section in the CUI and the setup values for its registers / powers /
 Theory Squeening life, with section of the section

Each Peary device itself is now responsible to read and properly perform the intended actions in its co the generated file. The Peary style coeffig file can be processed easily with the _ coeffig GetT&y? Theth does not know anything about the matrix config file(format), this entirely has to be taken care of by th Take a look at the "FOIS-MEWY" device and see hew it is used in its MEWY, [this::ChipCoeffic:aparterior

Operate

The GUI further contains a Control tab which can be used to operate the configured Peary device u start ensure that **pearyd** is running on your Caribou system. This has to be done by the user manually with the peory e (optionally the port can be specified with the "o" command line option!.

uchane ingological programs and its particular basis of the system are upone. To come the devices you want to particular the device down bit at the black particular transmission of the system and the system are upone to the system and the system and the system particular transmission of the system are upone to the system and the system are system and the system and the particular transmission of the system are upone to the system and the system and

tend is doing





Jumper / DIP-Switch settings

- Default I2C address set to 0x41
 - Jumpers in picture set to this value
 - Can be changed in Peary config file (if needed)







DEMY O



GUI changes

- Interest by Caribou community lead to "generalization" of our GUI
- The GUI now needs a config file itself (specify with "-c")
 - Either you start GUI without providing any \rightarrow Wizard will help you set up one
 - For RD50-MPWx (x >= 3) you'll find one in rd50-mpw3-gui/misc/template_gui.json
- Commands also stored in config
 - No need for Get Commands anymore
- We now use *pearyd* executable
 - Runs more stable / less buggy than earlier hacky (*pearycli*-) SSH solution



AUSTRIAN ACADEMY OF SCIENCES



GUI config tab

Config

Power

1 calib file

3 en_freeze 4 execute file

5 i2c_addr

6 i2c_dev

7 inj t0

Control

Misc

2 config_si5345 clock_config.txt

key

Registers Matrix

value

calib base.txt

execute.txt

/dev/i2c-9 0

0x41

8 matrix config matrix config base.txt

- 1) Choose which device to configure
- 2) Set desired config options
 - DAC values in Power tab
 - I2C address,... in Misc tab
 - Chip registers in Registers tab
 - Matrix config by checking pixel checkboxes and alter values of mask, TDAC,... with inputs beneath
- 3) Deploy to Caribou system

Power Misc R		Registers	Matrix	
		power	U [V]	I_max [A]
1	ы		0.9	3
2	del_hi		0.7	3
3	del_lo		0.9	3
4	p1v3_vssa		1.3	3
5	p1v8_nw_ring		1.8	3
6	p1v8_vdd!		1.8	3
7	p1v8_vdda		1.8	3
8	p1v8_vddc		1.8	3
9	p1v8_vsensbus		5 1.8	3
10	p2v5d		2.5	3
11	p3v3_base		3.3	3
12	th		0.95	3



Po	wer	Misc	Re	gisters	Matri
		register		value	
1	con	reg_ts	ctrl	0x00	
2	con	f_reg_ts_	ini	0x00	
3	cu_e	trl		0x00	
4	en_	ext_ctrl		0x00	
5	en_:	ser_out_	dcol	0x00	
6	en_:	sfout_do	ol	0x00	
7	idle	0		0xfb	
8	idle	1		0xf7	
9	idle	2		0xf7	
10	idle	3		0xf7	
11	tx_c	trl		0x00	
12	vbft	0		0x26	
13	vblr			0x26	
14	vn			0x15	
15	vnft	0		0x12	
16	vnsi	ensbias		0x32	
17	vnst			0x2d	
18	vpb	ias		0x25	
19	vpc	omp		0x13	
20	votr	im		0x24	





GUI control tab

- 1) Choose device
- 2) Specify and connect to host
- 3) Power

AUSTRIAN ACADEMY OF SCIENCES

- 4) Configure
- 5) Choose command to execute
 - With proper arguments
- 6) Execute and observe output
- Alternatively use *pearycli* and not GUI to operate





Peary setup

- All commands available for MPW3 also available for MPW4
- Class RD50_MPW4Device inherits from RD50_MPW3Device
 - Differences:

AUSTRIAN CADEMY OF

- 1 DAC "p3v3" → "p1v8_vddp"
- 2 new registers "fei3_pulldn", "fei3_read"
- For available commands see doxygen documentation
 - Can be generated with *doxyfile* in "peary/devices/RD50_MPW3/docs/"

ny i iojeci	Channe - Flore			
ten Page Resider Pages Rom	nespaces - Casses - Fees -			
ibou::RD50 MPW3Dev	vice Class Reference			
tude <r050_rpw3bev1ce.hp< td=""><td>MPWIDevice</td><td></td><td></td><td></td></r050_rpw3bev1ce.hp<>	MPWIDevice			
				CaribouDevice-Cariboand Caribound-Name Dr
				eren,
				Condense MARY, MITTER Provide
				[rest
aboration diagram for caribou:RD1	50_MPW3Device:			Probabilities and and
				:Carboard, Have Litz regult 5
				reChipConfig CaribourRDS0_MPW3Device
				(ChipConfi)
blic Member Functions				
	8050_MPW3Device (const caribou: Configu	wtion config)		
wirtual void	Full configure () override Full configuration of the chip. More			
virtual pearyRewDate	getRawData () override Get raw data from FPGA FIFOS, called by Ca	ribou-producer, data packed in EUDAQ event. More		
virtual void	daqStart () overide			
wintual void	dagStop () override			
wittual void	Called by EUDAQ when a run is stopped. I powerUp () override			
	Power on Carboard LDOs and DACs accordin	g to the values in the config.		
and the	Switch off Carboard LDOs and DACs.			
virtual void	8 reset () override Reset the chip. Called by EUDAQ when reset	ing.		
void	powerStatusLog () Measure voltages, currents and power-const	umption of all supply voltages.		
void	E configureClocks ()			
void	configure sissivo, sis /0 and sissize cocks i sourve (uint22_t ninjectionPulses, double mi	In Xullink Gerp Fort NVolt, double max/Volt, double inc/Volt, const std::string &file)		
void	Record S-curve for full matrix. More 5 calibrateTdac (const uint32.1 niniections.co	nst double in/Volk.comst stid: string &outputFile.bool initTdac-true.bool maskFailed-failed		
	homogenize pixel response by setting trimDa	40 values through injections More		
100	Accumulate all hits for a given time and crea	te hitmap. More		
void	recordSpectrum (const uirt32_t time, const record a spectrum in the form of a ToT histo	indiating &file) gram More		
void	5 scanPhase (bool verbose+false) Scan the phase of the different clocks. More			
void	dec_eval (const std:string &output, dir, uint	12,1 ninjections, double minifalt, double manifolt, double voltinc)		
void	Breshold_eval (const std:string &output_dir	uint32,1 ninjections, double minWoltinj, double maxVoltinj, double voltincinj, double minWoltT	r, double maxifultThr, double voltin: Thr)	
void	20 scan to evaluate threshold behaviour by r s sest2 ()	scording multiple S-curves More		
void	5 inject (uint32,1 ninjections, double voltage, a Send injection pulses. More	ize_t dool, bool verbose=false)		
void	setting (const std.string &name, const std.:	itting &val)		
uint8,1	getileg (const std: string &name)			
void	weap back global chip-register. More d setThr (double voltage)			
	Manually set threshold. More			
voe	Manually set baseline. More			
sectors DetsMpw3: Pixelindex >	 maskNotryPtxets (long tShutter, uint32,1 noi mask noisy pixels More 	ieTh, inf.ferillons+1)		
void	ananualMaskNoisyPixel (long tShutter, uint2: manually perform a masking of noisy pixels	A traiseThe, int iterations) More		
bool	exportConfigs (const std: string &calib, const export configurations More	t and: string &matrix)		
void	# workOmPlogy (bool dolllork)			
	read out only more the pippy board HPO Mor	E		
scurve()				
void RD50_MPW3D	levice::scurve (uint32_t	ninjectionPulses,		
	double	minVolt,		
	double	maxVolt,		

Record S-curve for full matrix.

ers	
njectionPu	Ises Number of injection pulses
inVolt	Lower voltage-scan boundary
axVolt	Upper voltage-scan boundary
Volt	Increment of injection voltage for each date
e	Output file to write records to

const std::string & file

Masked pixels are being skipped