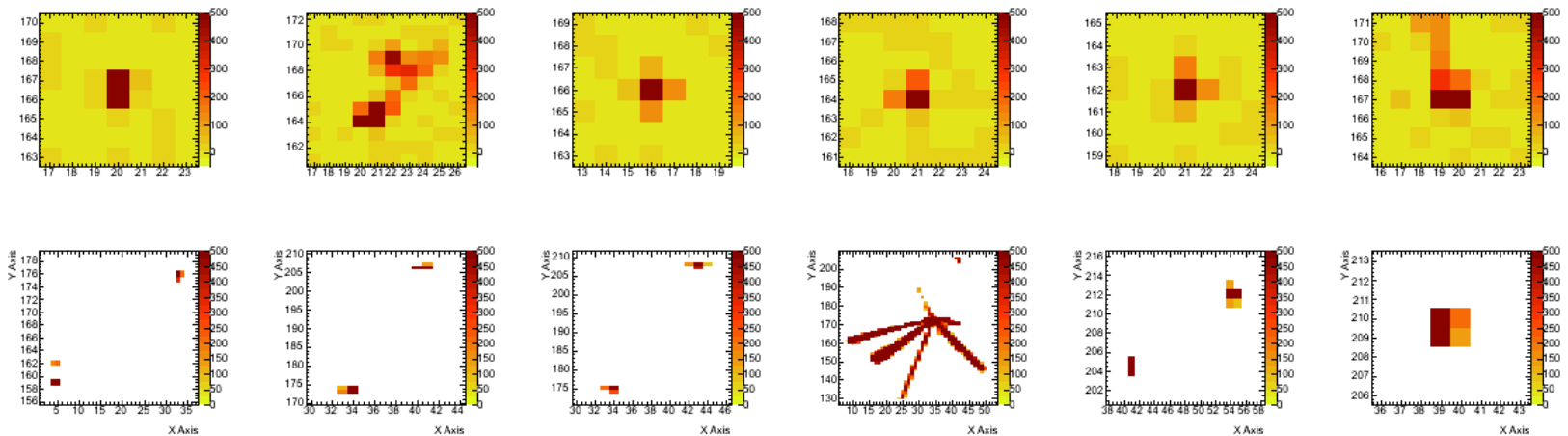


# DEPFET TB 2010/2011



## DEPFET TB 2010/2011

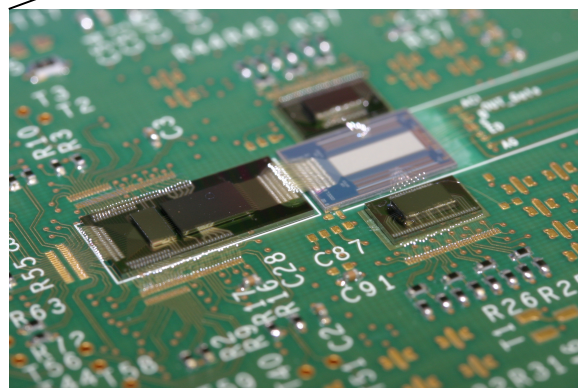
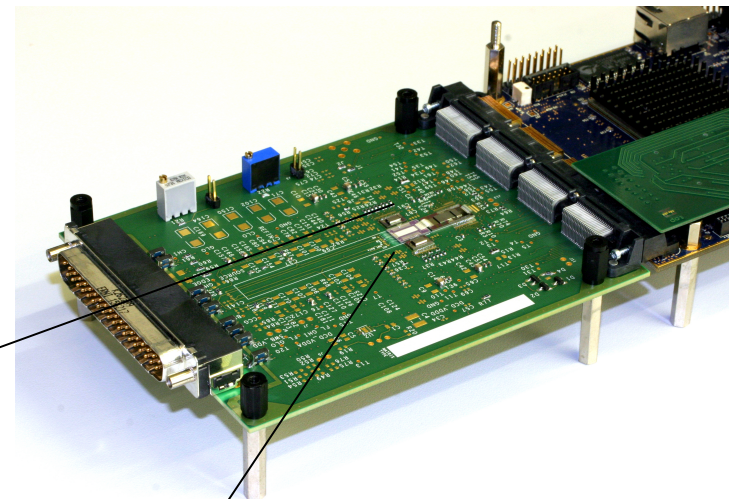
7<sup>th</sup> DEPFET workshop, Ringberg castle  
– May 10<sup>th</sup> 2011 -

Marcel Vos, IFIC Valencia

# Some history: TB2010

## DCDB-based PXD5 DUT (on hybrid 4.1)

- **(Nearly) full-speed read out** row rate/nominal  $\sim 3$ , compared to several orders of magnitude with previous system)
- **Relevant pedestals, common mode** but custom power supplies, cables, no dynamic offset correction



# SPS Operation

Period 6 2010 Oct 21 to Nov 22

Schedule Issue date: 15-April-2010

Version 2.0

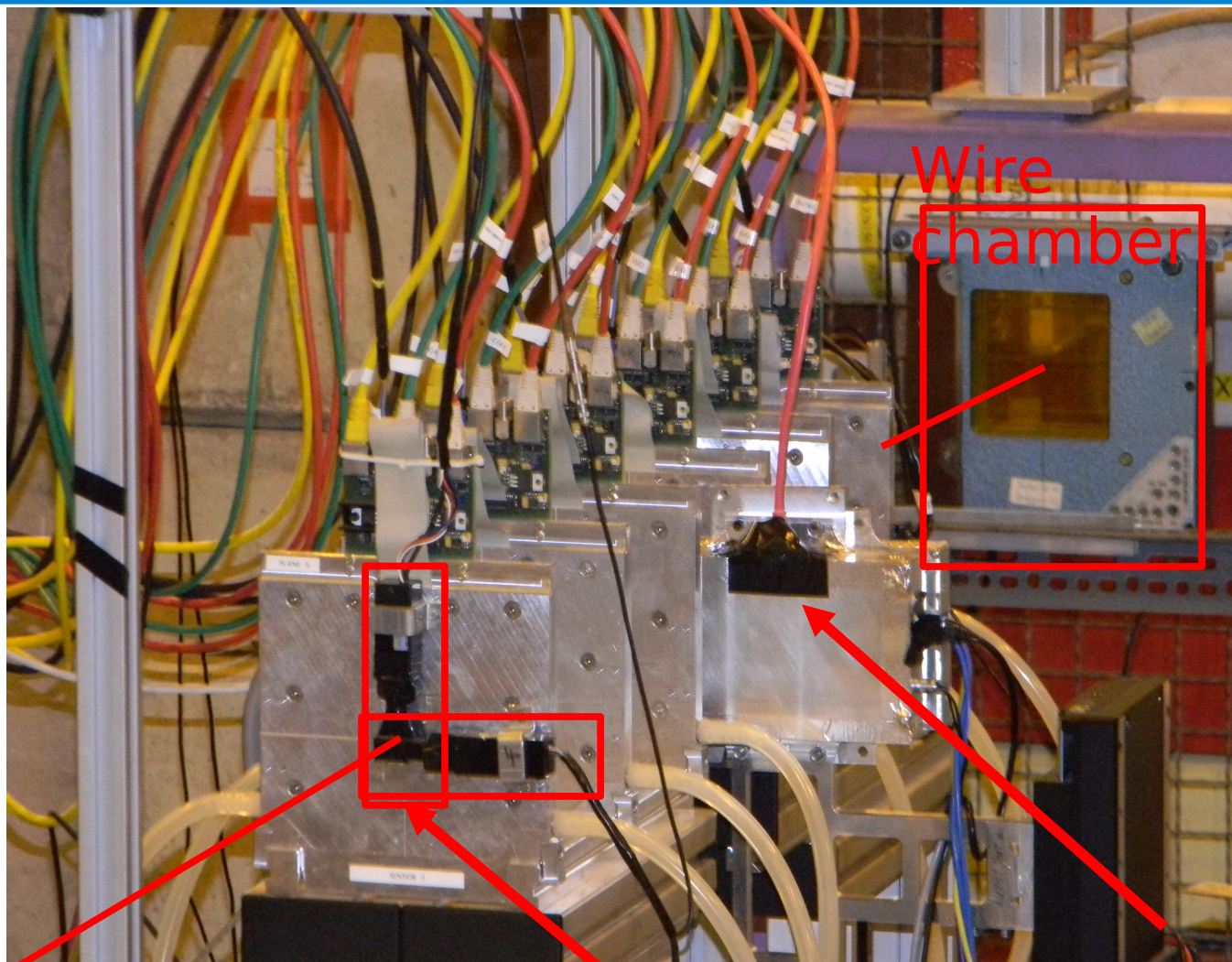
(colour code: purple (dark) – scheduling meeting, light green (light) – weekend or holiday)

<div><div>Thu 21 Oct</div><div>Fri 22 Oct</div><div>Sat 23 Oct</div><div>Sun 24 Oct</div><div>Mon 25 W443</div><div>Tue 26 Oct</div><div>Wed 27 Oct</div><div>Thu 28 Oct</div><div>Fri 29 Oct</div><div>Sat 30 Oct</div><div>Sun 31 Oct</div><div>Mon 1 W444</div><div>Tue 2 Nov</div><div>Wed 3 Nov</div><div>Thu 4 Nov</div><div>Fri 5 Nov</div><div>Sat 6 Nov</div><div>Sun 7 Nov</div><div>Mon 8 W445</div><div>Tue 9 Nov</div><div>Wed 10 Nov</div><div>Thu 11 Nov</div><div>Fri 12 Nov</div><div>Sat 13 Nov</div><div>Sun 14 Nov</div><div>Mon 15 W446</div><div>Tue 16 Nov</div><div>Wed 17 Nov</div><div>Thu 18 Nov</div><div>Fri 19 Nov</div><div>Sat 20 Nov</div><div>Sun 21 W447</div><div>Mon 22 Nov</div></div>																																		
Machine <div>816</div> WED MD																																		
NORTH AREA	T2 -H2	8h Z Fodor	NA61 phys	8h A Malinin	CREAM H2B	8h Z Fodor	NA61 test	8h P Luukka	CMS-SiBT	8h L Tkachev	NUCLEON																							
	T2 -H4			8h M Alfonsi	RD51	8h A di Mauro	ALICE-VHMPID	8h A di Mauro	ALICE-SPD	8h A Singovski	CMS-ECAL																							
	T4 -H6	8h CMOSILC APIX		8h H Wilkens		MMEGAS AIBL H6A/B	8h SavoyNavarro	SiLCRD H6B	8h M Vos	DEPFET H6B																								
	T4 -H8	8h ATLAS-3DSi		8h H Wilkens		ATLAS-STGC	8h H Wilkens		ATLAS-MDTROM H8B																									
	T4 -P0																																	
	T6 -M2	8h G Mallot																																
	-CNGS	8h Neutrinos																																
CNGS																																		
For further Information contact the SPS/PS-Coordinator																																		
<div>Remarks</div> <div>SPS/PS-Coordinator: Horst Breuker E-mail: SPS.Coordinator@cern.ch phone: 73777 (ext. +41 22 767 3777) mobile: 164212 (ext. +41 76 487 4212) - No further remarks</div>																																		

TB2010, our beam period: 15-21 November

Last slot of the season, after SiLC, EUDET telescope requested

# TB setup



Wire chamber

SPS H6  
beam  
line

Scintillator  
triggers

DEPFET DUT



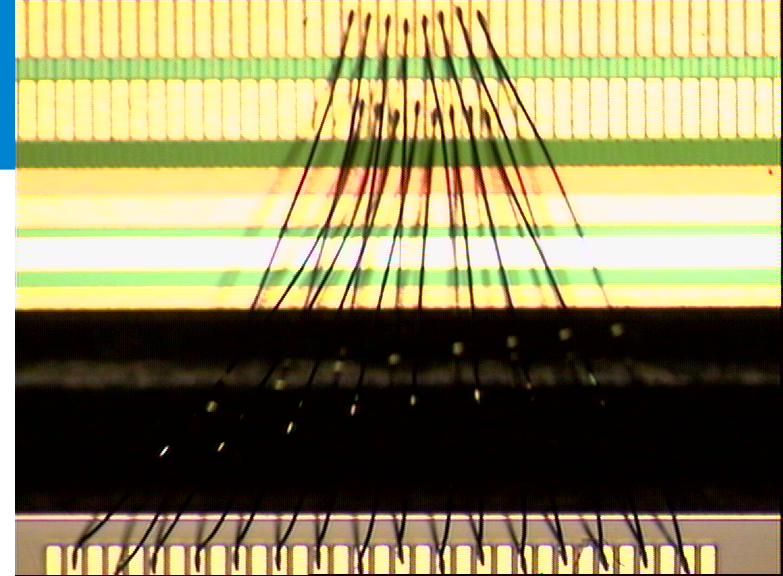
# TB2010: with some hindsight

SwitcherB operated successfully during TB2010,

- after two SwitcherB chips died on first hybrid 4.1 (one after brief period with life signs)

Bonding errors lead to inefficient and undefined sequence

- data not usable



DCD Pedestal spread over 2/3 of dynamic range

- subtraction DACs not yet available... will be there for next TB!!!
- Source for offset current subtraction too weak → gate on voltage must be too low.

DCD pedestal variations

- Variations with time of a few counts observed due to temperature drift
- otherwise stable to within

DCD noise:

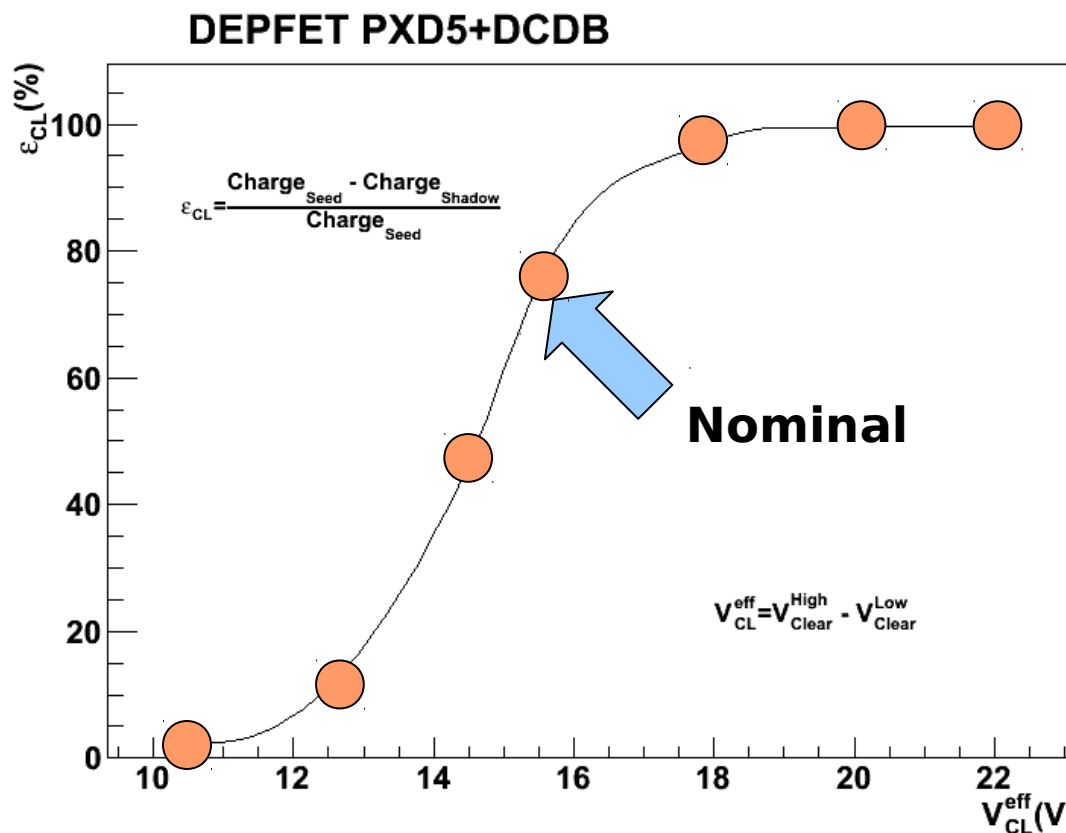
- 0.8 LSB noise before TB and in H6 when run with same parameters in TB

DCD ADC response:

- instabilities in fraction of ADCs confirmed by more detailed studies

**Jochen's talk yesterday: this module is now behaving nicely. I wish we had a few more!**

Trailing frames – a new feature of the DAQ developed by Sergey and team for TB2010 – allow unambiguous measurement of signal remaining (or not) after applying clear voltage. Source data taken by Christian Koffmane at MPI after repair.



# SPS Operation

Period 3 2011 Jul 5 to Aug 9

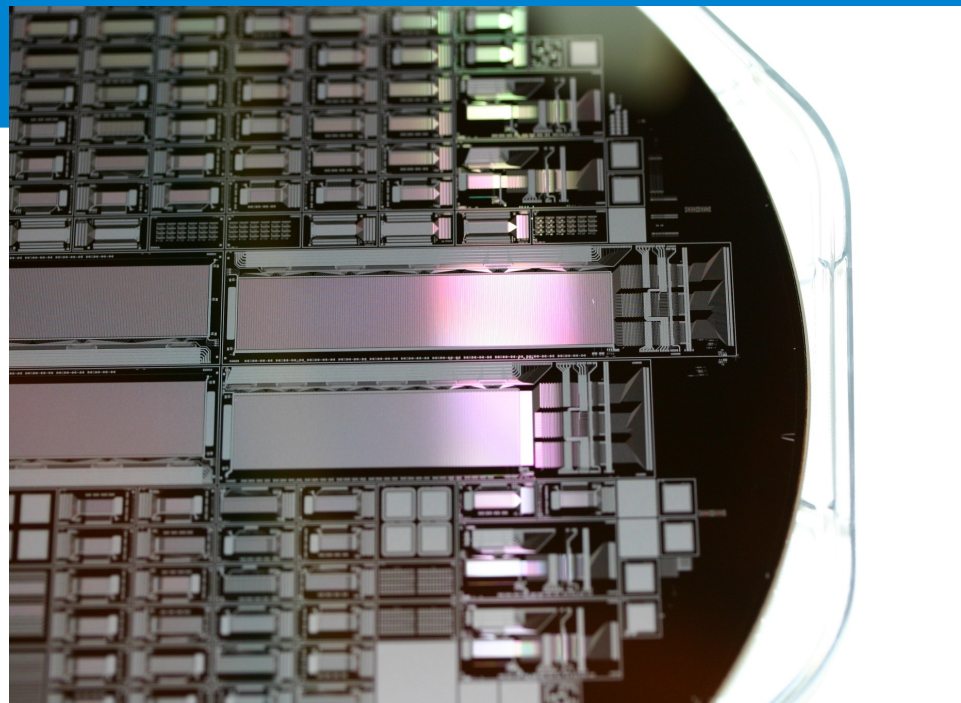
Schedule issue date: 18-Apr-2011

Version 1.0

(colour code: purple (dark) = scheduling meeting , light green (light) = weekend or holiday)

		Tue 5 Jul	Wed 6 Jul	Thu 7 Jul	Fri 8 Jul	Sat 9 Jul	Sun 10 Jul	Mon 11 Jul	Tue 12 Jul	Wed 13 Jul	Thu 14 Jul	Fri 15 Jul	Sat 16 Jul	Sun 17 Jul	Mon 18 Jul	Tue 19 Jul	Wed 20 Jul	Thu 21 Jul	Fri 22 Jul	Sat 23 Jul	Sun 24 Jul	Mon 25 Jul	Tue 26 Jul	Wed 27 Jul	Thu 28 Jul	Fri 29 Jul	Sat 30 Jul	Sun 31 Jul	Mon 1 Aug	Tue 2 Aug	Wed 3 Aug	Thu 4 Aug	Fri 5 Aug	Sat 6 Aug	Sun 7 Aug	Mon 8 Aug	Tue 9 Aug				
Machine		8h WED MD										8h BIG MD																													
NORTH AREA	T2 -H2	8h S Spanier CMS-PLT Magnet										8h D Lazic CMS-CALO										8h Z Fodor NA61-Protons proton																			
	T2 -H4	8h M Prest PHOTAG										8h M Brugger H4IRRAD										8h A Singovski CMS-ECAL LHCb										8h M Cherdevill C-MMEGAS									
	T4 -H6	8h M Vos Kagan DEPFET RD42										8h H Wilkens APPS AMMEGAS										8h H Wilkens A-ALIBAVA										8h Wilkens Kagan ABCM RD42									
	T4 -H8	8h M Bozzo TOTEM										8h P Peschi Casse CALICE-RD50										8h R Wigmans DREAM										8h Thomas Wilken ICb AMDT AsTGC									
	T4 -P0																																								
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TB2011, beam period suggested by CERN: 5-12 July  
 Known to clash with B2GM, known to be challenging!  
 SPS coordinator is aware of this. Need to clarify whether we  
 want to delay by several months.



## DCDB module

- full-speed or at least high speed read-out
- live with V1 features (ADC issues, offset correction, see next slide).

## PXD6 module

- mm<sup>2</sup> ILC design → first thin DEPFET, comparison with previous results
- mm<sup>2</sup> Belle-II design → resolution, digitizer validation
- full-length ladder → final demonstrator



## DUTs - continued

### PXD5/DCDB module (golden module)

- was in TB2010
- from Jochen's talk, the PXD5 module we had in 2010 looks ready for a TB!
- This module has a Switcher problem that prevents it from running full-speed

### PXD6/DCDB module (platinum module)

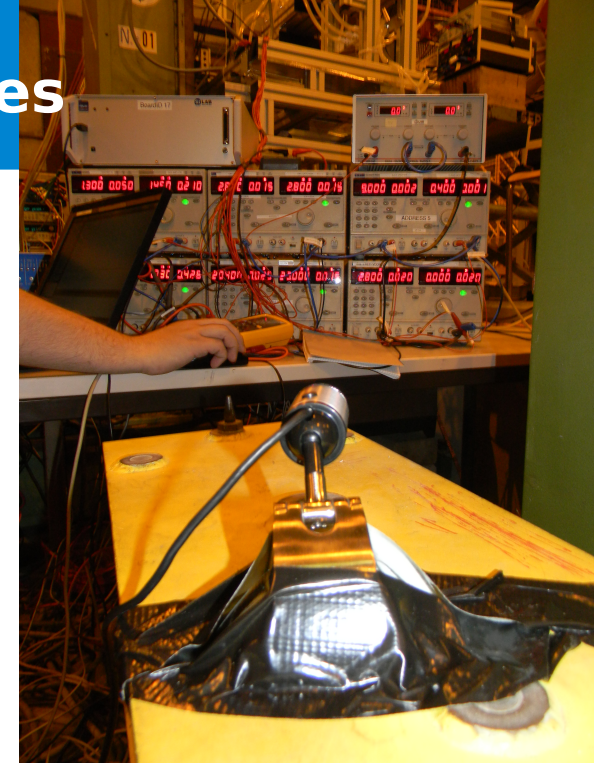
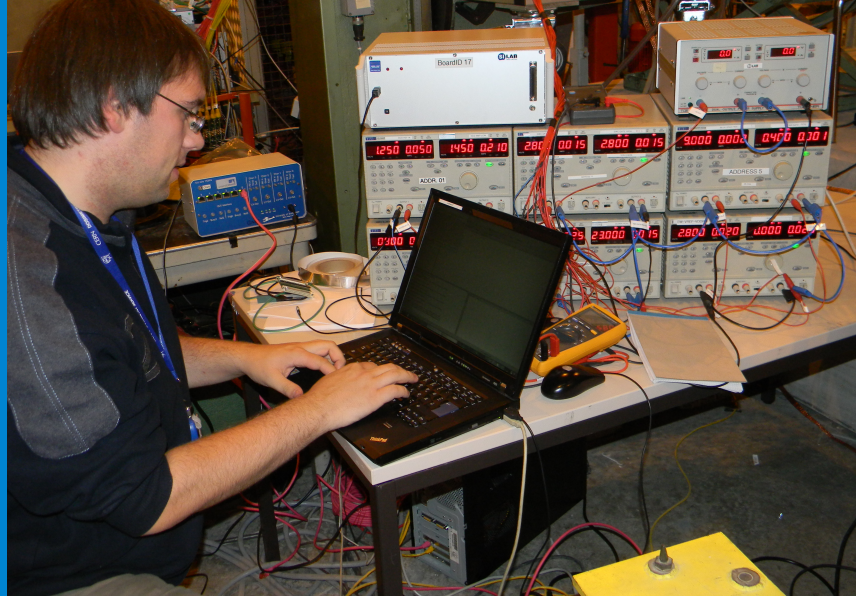
- seems perfect

...

- Any DCDBv1 module has limited offset correction current and will have to be run with a GATE ON voltage that is sub-optimal  $\rightarrow g_q$  will be too low
- Test chip hard to use in TB. DCDBv2 expected in October.

*Is reading out with CURO going to be any easier than reading out DCDB?  
Or possible at all?*

# Power supplies



## Power supplies 2010:

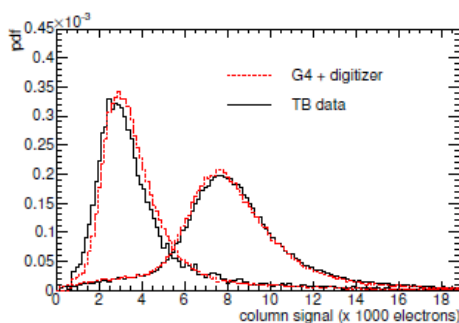
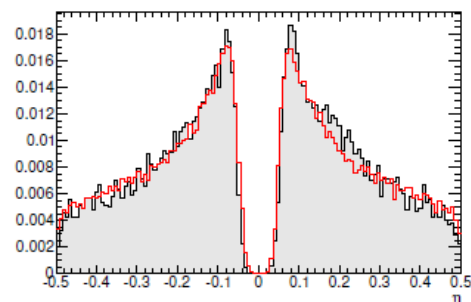
- Semi-automated start-up sequence
- Remote control & monitoring

## Power supplies 2011:

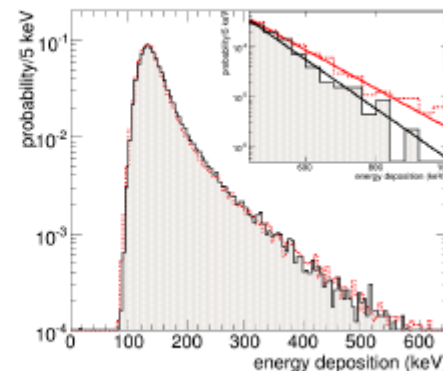
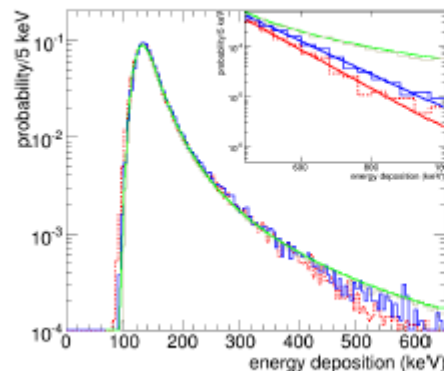
- prototype system available and debugged?
- Question in this direction from Stefan Rummel.

# Digitizer validation

## Charge sharing

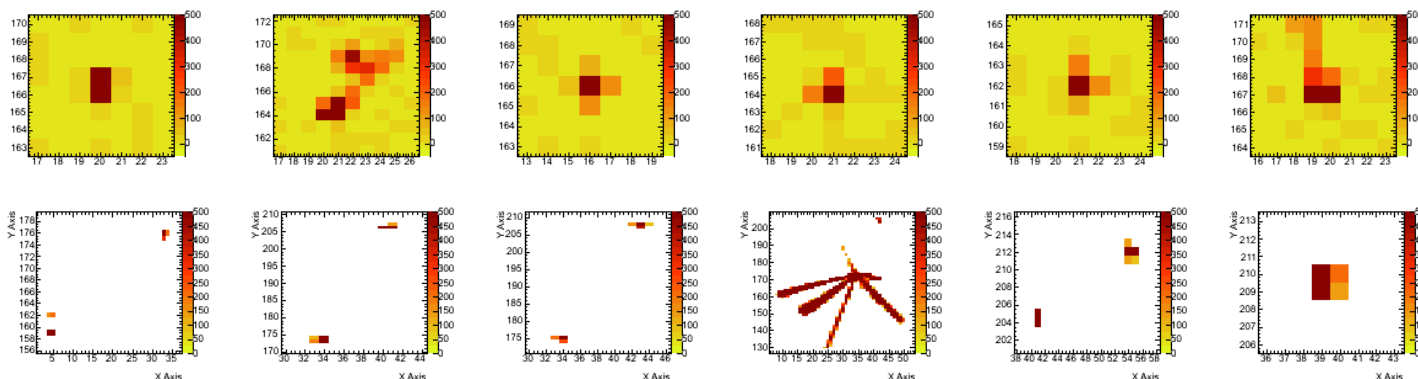


## FLUKA/GEANT4/Bichsel



## Impact of digitization

A lot of material exists on ILC-type design allows for very precise characterization of Si-based detector response. Must validate the digitizer used for physics studies. Repeat with BASF?



$\delta$ -electrons

Nuclear interactions

# Conclusions

## **TB2010: development of new tools, debugging of new system**

- *Several developments still ongoing: DCDB yield, two-bit DAC...*
- *TB data now abandoned, but TB-like analysis of source data after DUT repair provides interesting results.*

## **TB2011: demonstrator of thin Belle-II design DEPFET sensor with high-speed read-out**

- *Not just (or even primarily) to convince the outside world we are able to build the best detector ever; this is an important test of the full system performance. Important feedback we should have as early ASAP.*
- *Not to be done in a rush, with something that's not carefully characterized. But, we want to be able to raise an alarm signal before submitting new sensor design. Stick to July or delay until September/October?*

## **More issues:**

Power supplies: when?

Digitizer validation: use BASF set-up to reproduce old results