

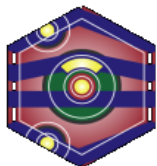
Onsen performance in May13 DESY Testbeam

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Special thanks to Florian Lütticke, Dima Levit, Carlos Marinas, Michael Ritzert, Mikhail Lemarenko, Benjamin Schwenker, Alan Campbell, ...

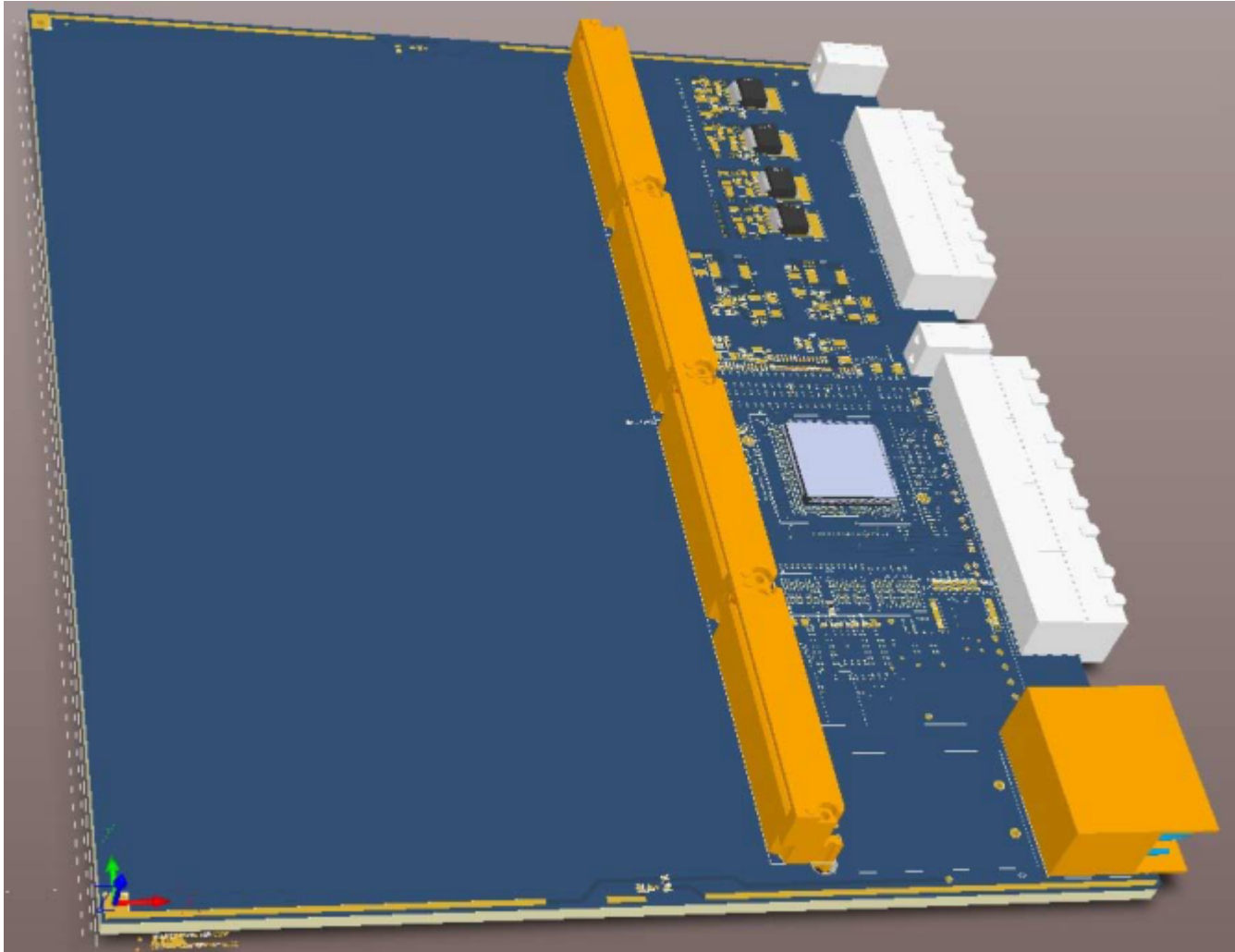
Ringberg DEPFET Workshop, June 12-15, 2013



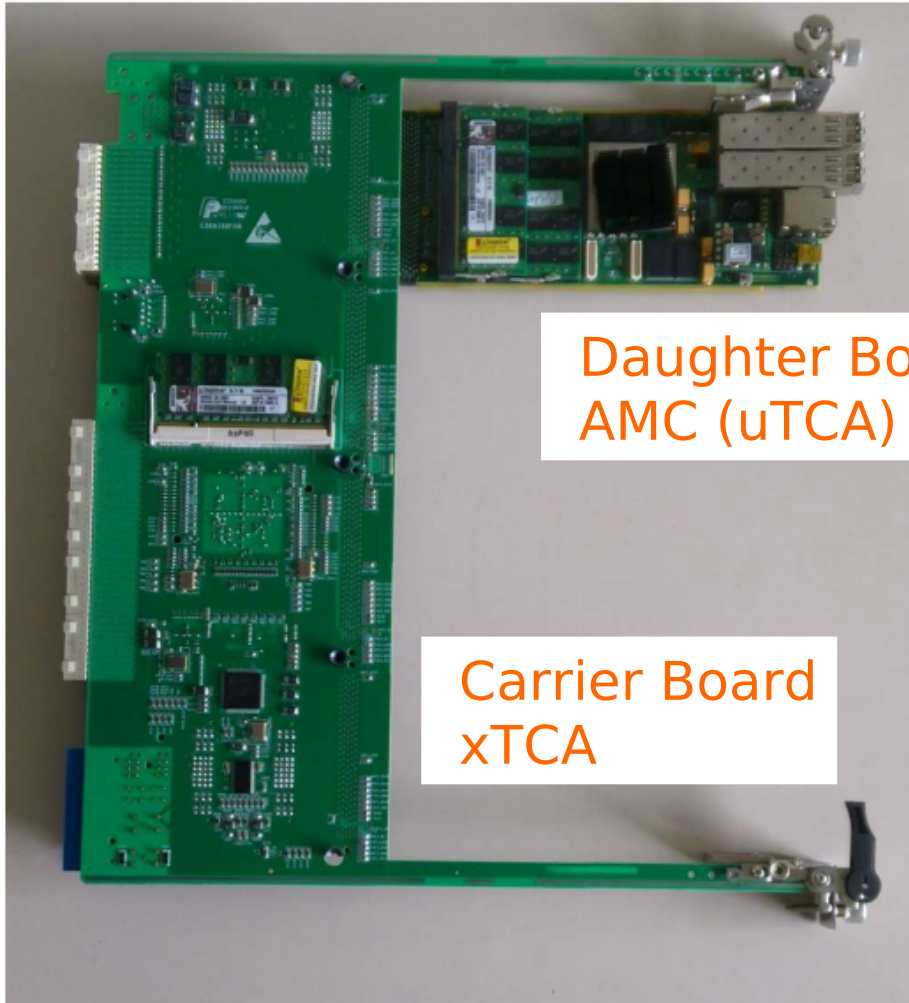
Bundesministerium
für Bildung
und Forschung

Compute Node Version #3

Carrier Board, xTCA compliant

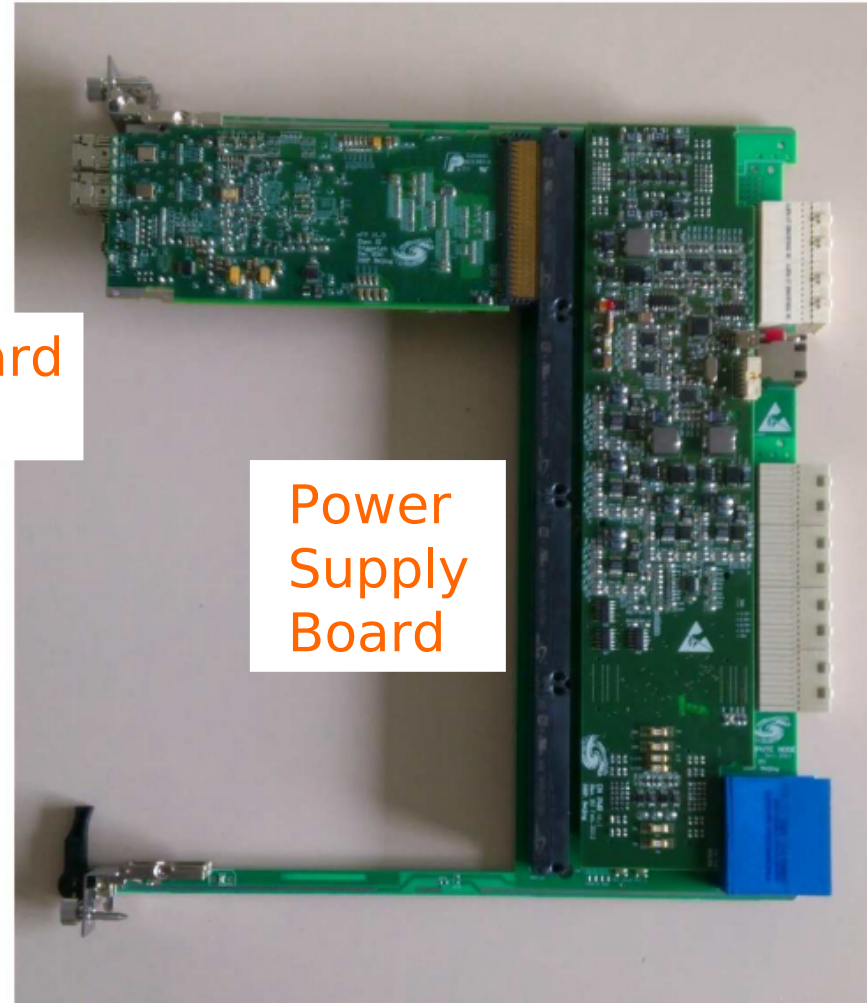


New (2012): ATCA Compute Node Version #3



Daughter Board
AMC (uTCA)

Carrier Board
xTCA



Power
Supply
Board

AMC Version 1.0



2 x 2 GB DDR2

Problem: DDR2 RAM only operable
with 200 MHz + 177 MHz

AMC Version 2.0



Problem: AMC-AMC connection
some RocketIO pins were routed to LVDS pins

AMC v3.2 arrived in Giessen March 12, 2013

64 MB Flash



4 x optical
6.5 Gbps

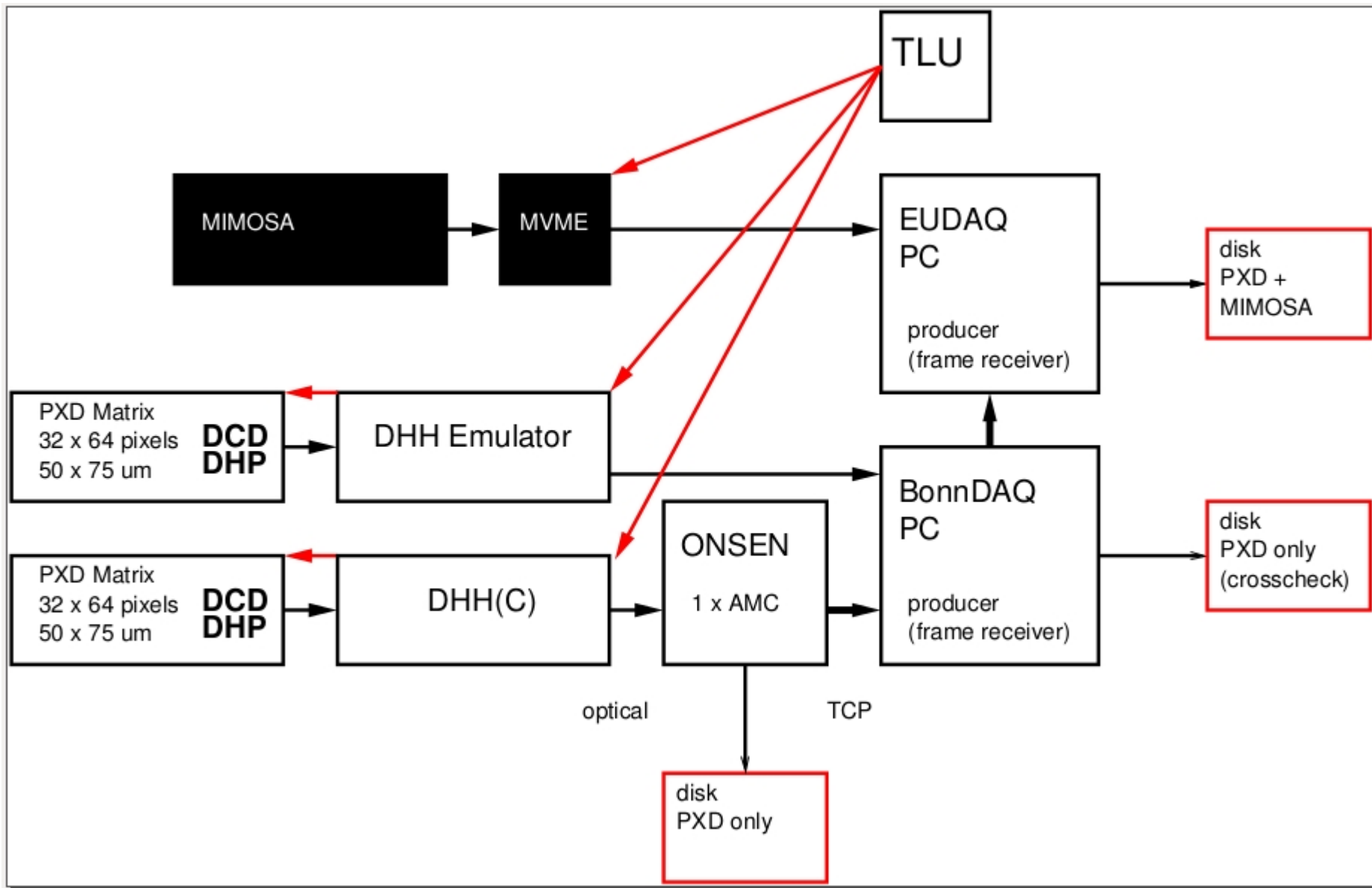
GbE (RJ45)

UART-to-USB

Connector
for MMC
(IPMI)

DC-DC converters
(12V → 3.3 V)

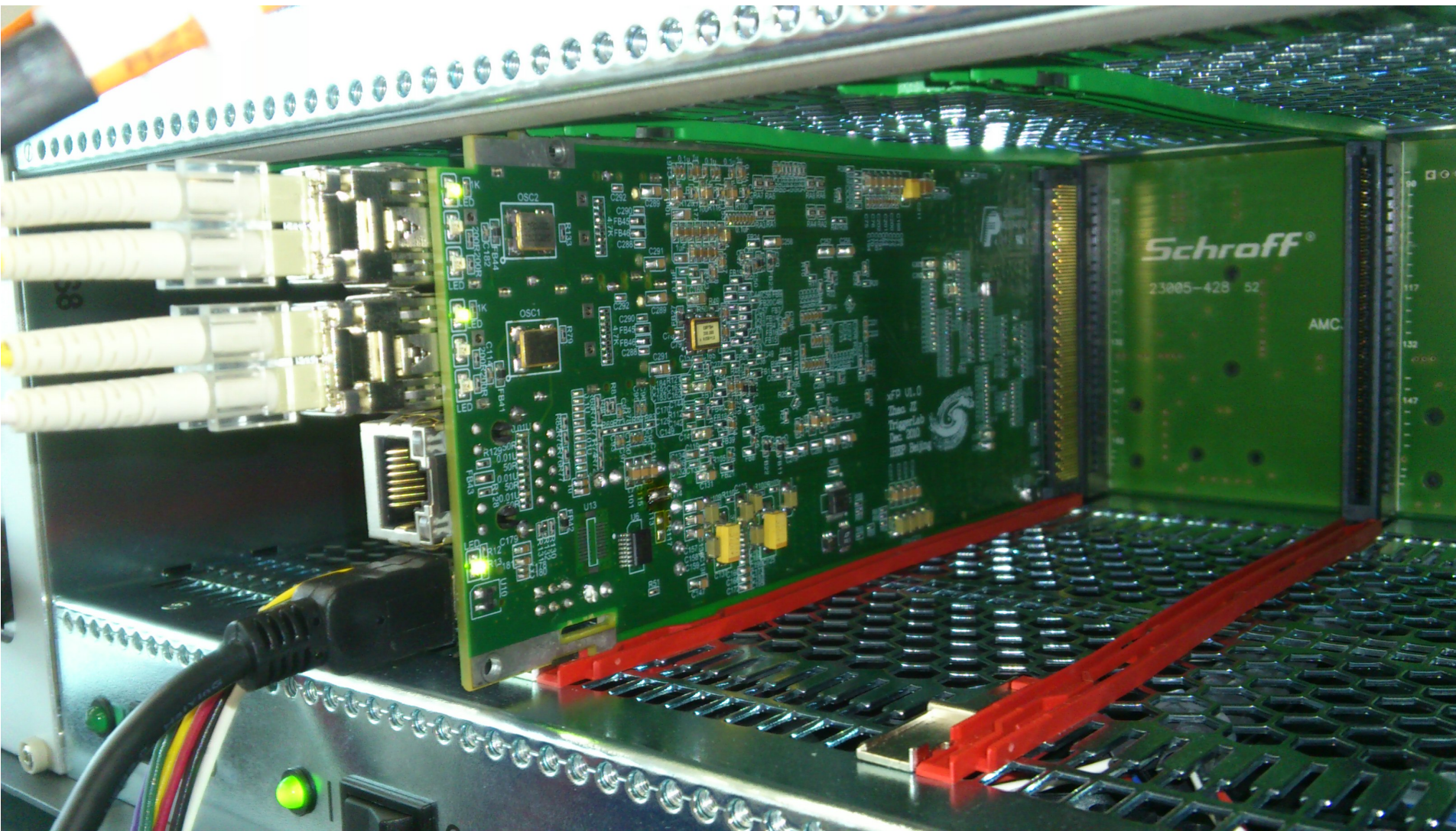
JTAG



Change by re-plug infiniband cable

ONSEN Setup in May13

- 1 uTCA Shelf (+ 1 spare)
- 1 AMC card (+ 1 spare)
This is the new AMC card v3.2
which arrived in Giessen in March 2013.
- No xTCA carrier board
- Aurora 3.125 Gbps on optical link
(not highspeed, because we didn't know
beforehand
if we have the speedgrade -11 FPGAs)
- No ROI selector



Differences between DHH+Onsen and DHH-Emulator System

- optical link, **L= 30 m** optical cable
- Buffer management was used !
256 kB buffer size x 4096 buffers
= 1 GB
- DATA WAS DUPLICATED - Writing data file
 - on ONSEN readout PC,
 - on BonnDAQ
 - on EUDAQ(at same time)

Why debugging required a few days

Issues for DHH+Onsen (alone)

- Non-Onsen issues
 - TLU latency
 - unknown mapping: trigger # → frame number
 - pedestal procedure is largely improvable
- Debugging of Onsen frame receiver in BonnDAQ
 - Requires nanosleep statements here and there in the code
 - multiple frames must be read for 1 trigger (because of non-clear TLU latency) with same trigger #
 - required debugging
- **DHP deserializer clock 160 MHz instead of 152.625 MHz**
lost 2 days by searching (why data seem wrong)
solution: Dima re-soldered DHH

ONSEN Hardware Issues

- Some problems already detected @ Bonn Test
 - problems with PowerPC when 2 AMC cards in 1 uTCA shelf configuration pins (on backplane) ?
 - 2nd memory bank off
only 1 bank (2 GB instead of 4 GB) operated at DESY test
→ as data size small, no problem
 - FPGA (Virtex-5 FX70T) almost full
issue: multi-port memory controller
- UDP and TCP frame receivers in BonnDAQ were both prepared
 - several issues: 32-bit alignment different, byte swap
 - UDP stalls after some time, origin of problem not found yet
 - for beamtest: siTCP
→ beamtest is also success for siTCP group at KEK
(thanks again to T. Uchida-san for support!)
- **FPGA re-boot almost not required**
4-5 days start/stop/re-start w/o re-upload bitstream
bitstream not changed during beam test
> very stable operation

DATA FORMAT

- Link to Dima's Document
http://aldebaran.hll.mpg.de/twiki/pub/DepfetInternal/DataHandlingHybrid/dataformats_testbeammay2013.pdf
 - Additional Onsen Header (to identify event boundaries easier)
4 x 32 bit, magic word
 - CHECKSUM by Dima (DHH) and Björn (Onsen)
software (not hardware), CRC32 variant
 - Data blocks:
 - RAW or DHP 0.2 format
1 event dump if detected on ONSEN (pedestal readback)
 - zero-suppressed yes/no
 - Unpacking routines still detect 3 problems
 - ghost frames: there is a trigger but no data
 - double 0xa0 headers (from DHH)
 - double trigger numbers (from DHH ?)
- we use workarounds, not completely solved yet

```
| cafe | babe |
|   | n |
| 0000 | 0000 |
| 0000 | 0000 |
```

-----/n

```
| trig[0:16] | DHH head | start of event frame
| time[0:16] | trig[17:31] |
| reserved | time[17:31] |
| crc      | crc      |
```

```
| cafe | babe |
|   | n |
| 0000 | 0000 |
| 0000 | 0000 |
```

```
| trig[0:16] | RF head | direct readout frame
```

```
| data | DHP head | DHP header
| data | data |
```

...

```
| data | data |
```

```
| crc | crc |
```

-----/n

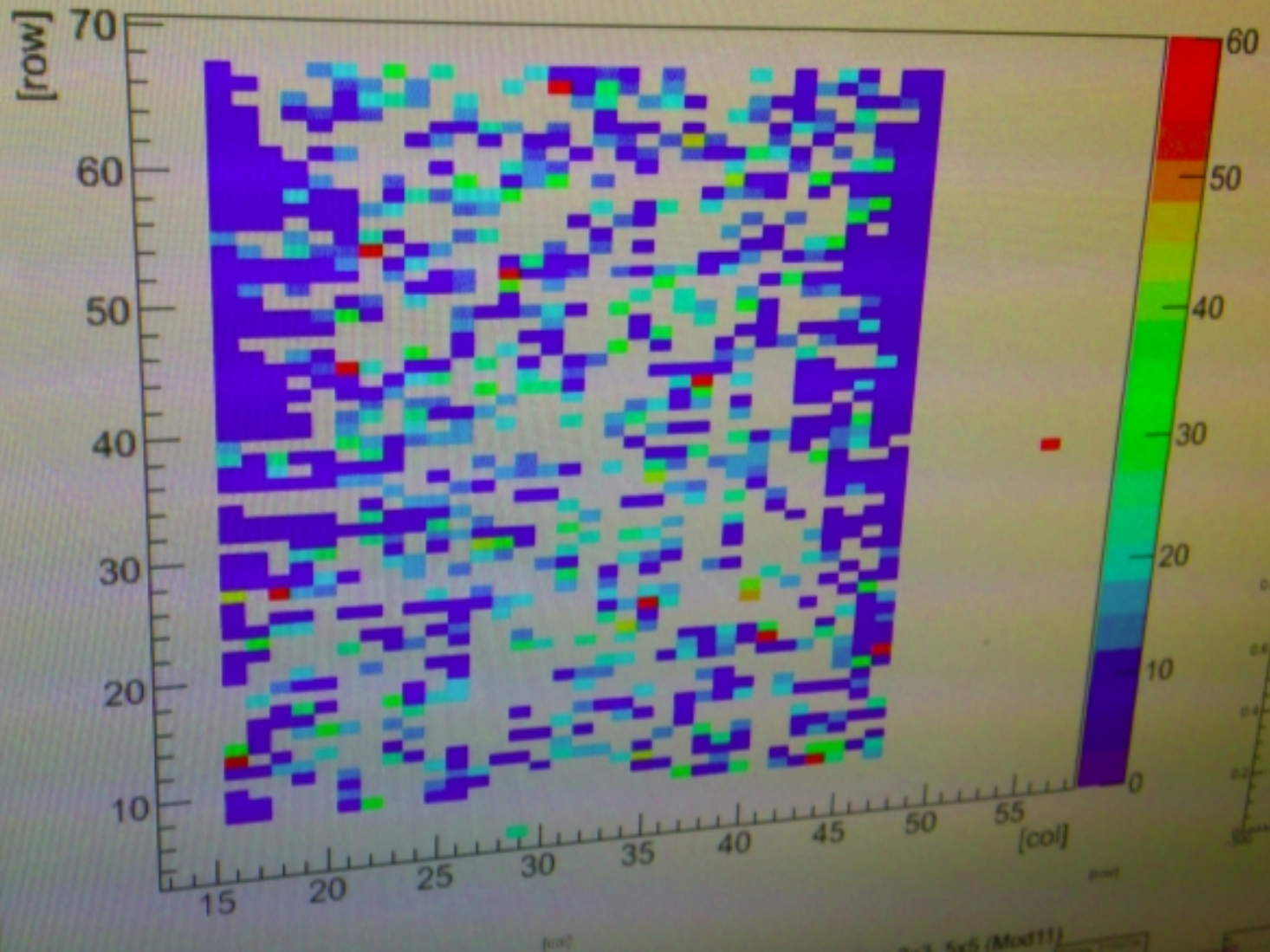
```
| cafe | babe |
|   | n |
| 0000 | 0000 |
| 0000 | 0000 |
```

```
| trig[0:16] | head | end of event frame
|   | n |
| err      | err |
| crc      | crc |
```





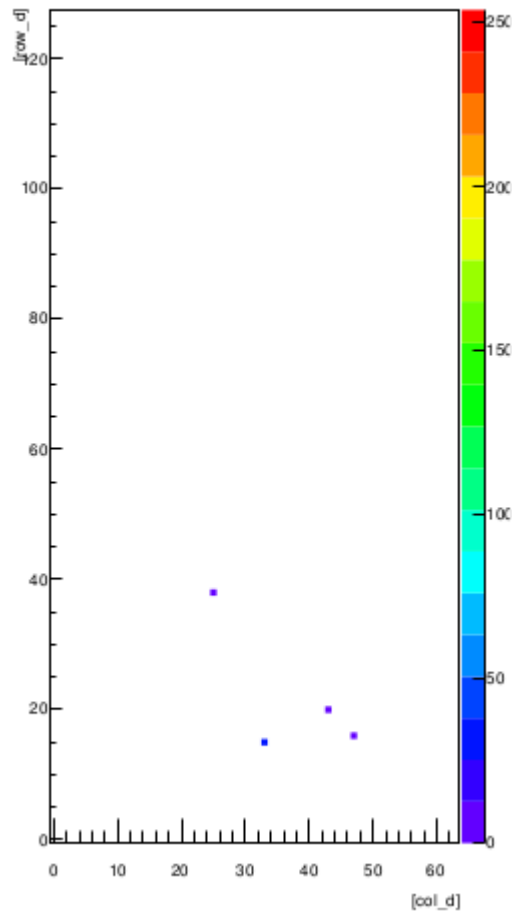

XY RAW (Mod11)



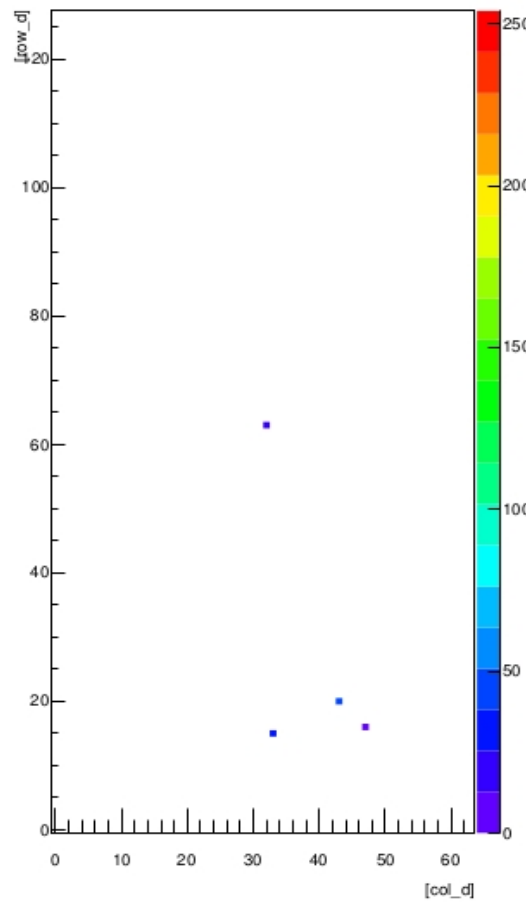
Seed and Clusters 3x3, 5x5 (Mod11)

Cluster Size 3x3, 5x5 (Mod11)

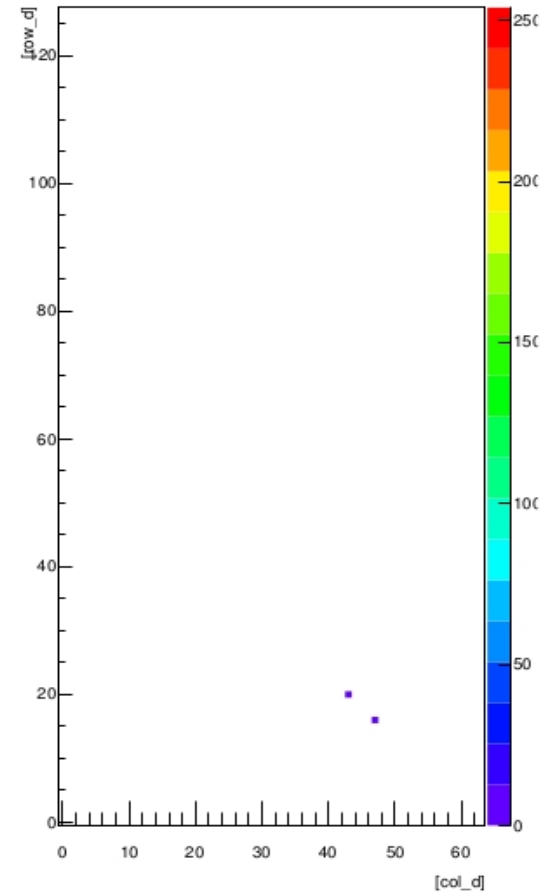
XY DCD (Mod11)



XY DCD (Mod11)



XY DCD (Mod11)





Results (1)

Long-term stable data taking

- 2 GeV e- beam
- 3mm Al target
- ~1620 Hz trigger rate
triggered by scintillator with TLU
- framerate 150 kHz (6.6 us frame length)
(this is 3x faster than design (50 kHz),
but possible because of smaller matrix)
- 8 frames per 1 trigger (set on DHH)
- DHH-Onsen optical links: Aurora 8B/10B 3.125 Gbps
- Onsen buffer management used w/ 256 kB buffer size
(i.e. larger than before to fit also a raw data frame inside)
- zero suppressed mode
- 200-300 kB/s sustained rate
- 54.878.580 events recorded
(in 1 single run, no stop inbetween)

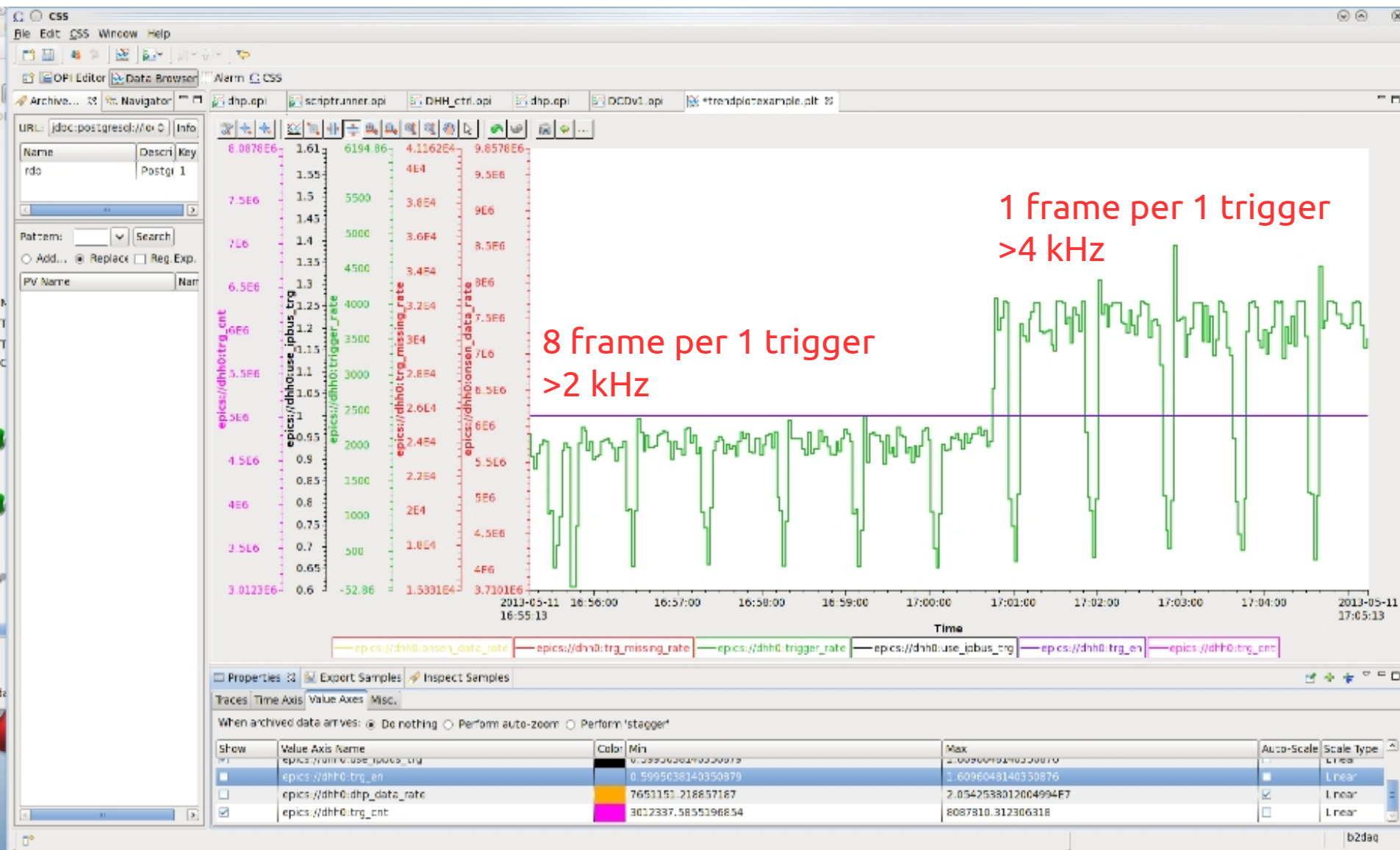
Results (2)

High rate test

- 2 GeV e- (maximum of particles/spill)
- 5 mm Cu target (thickest)
- ~4 kHz rate with DHH+ONSEN
stable for ~20 min

High rate test

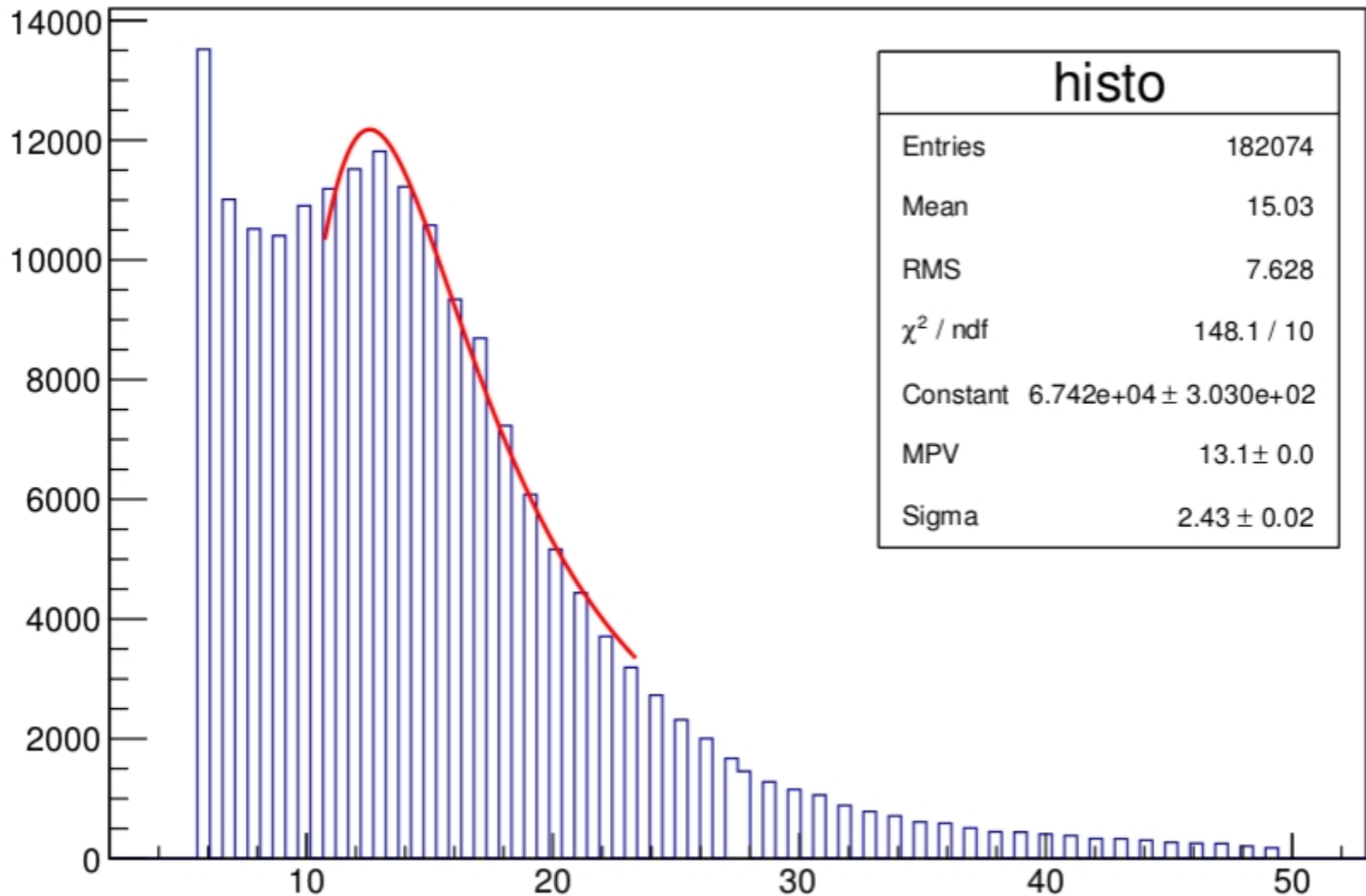
Screen Shot of DHH EPICS (by Dima, Michael R., Alan)



Total DHH+Onsen Collected Data

				DHP raw	DCE	Ghost	Start	End	DHP 0sup	CM	-
subfolder	file	size (byte)	frames	0	1	2	3	4	5	6	7
	data_20130510_100746	0	0								
	data_20130510_100816	0	0								
	data_20130510_100851	0	0								
	data_20130510_100951	0	0								
	data_20130510_103003	386815470	1142072	1		198822	335919	335643	271687		
	data_20130510_113342	38450826	755095	1		1983	191674	191437	370000		
	data_20130510_120837	18493628	369115				93436	93177	182502		
	data_20130510_122806	5855404	116852	1		1	29583	29480	57787		
	data_20130510_124022	97705402	1887522			1	478747	477467	931307		
	data_20130510_140558	8679318	26481				8742	8742	8997		
	data_20130510_141020	133799388	496014			32329	163946	163944	135795		
	data_20130510_142846	14883990	311131			11343	81519	81318	136951		
DESY_Test	data_20130511_093005	1201559488	20299895	4		3712775	5624972	5624783	5337361		
DESY_Test	data_20130511_125715	65470202	2107936	2		341563	583443	583430	599498		
DESY_Test	data_20130511_131347	521192970	17047245			3443558	5092850	5092662	3418175		
DESY_Test	data_20130511_162136	28857478	964927			258072	318164	318148	70543		
DESY_Test	data_20130511_165449	250454608	8438838	1		2478098	2802115	2802059	356565		
DESY_Test	data_20130511_171747	2277517870	75962750			19684401	24622905	24621992	7033452		
DESY_Test/BonnDAQ	Run182-000.dat	49753388	1286377			134305	426333	426333	299406		
DESY_Test/BonnDAQ	Run183-000.dat	159629228	4202201			47923	609029	609029	2936220		
DESY_Test/BonnDAQ	Run184-000.dat	174353024	4589319			40131	594487	594487	3360214		
DESY_Test/BonnDAQ	Run185-000.dat	164271040	4378057			58390	610751	610751	3098165		
DESY_Test/BonnDAQ	Run186-000.dat	179513252	4726376			38574	606712	606712	3474196		
DESY_Test/BonnDAQ	Run187-000.dat	4225856308	112470495			1816466	16035976	16035976	78582077		
DESY_Test/BonnDAQ	Run187-001.dat	4215866228	113394299			3490551	18533448	18533448	72836852		
DESY_Test/BonnDAQ	Run187-002.dat	3577876984	97218297			4675554	17830088	17830088	56882567		
DESY_Test/BonnDAQ	Run188-000.dat	15462400	423478			41289	95442	95447	191299		
DESY_Test/BonnDAQ	Run192-000.dat	71659520	1958628			388284	585970	585973	398401		
DESY_Test/BonnDAQ	Run193-000.dat	39588276	1083792			272297	350316	350316	110863		
DESY_Test/BonnDAQ	Run194-000.dat	75578604	2068167			497271	658412	658412	254072		
DESY_Test/BonnDAQ	Run195-000.dat	75470536	2067907			540814	675276	675276	176541		
DESY_Test/BonnDAQ	Run196-000.dat	78459804	2145180			459919	658625	658625	368011		
DESY_Test/BonnDAQ	Run197-000.dat	78763592	2153115			463669	663127	663127	363192		
DESY_Test/BonnDAQ	Run198-000.dat	78098396	2135483			471414	661701	661701	340667		
DESY_Test/BonnDAQ	Run199-000.dat	22356284	611361			118120	180153	180153	132935		
DESY_Test/BonnDAQ	Run200-000.dat	69664768	1903177	1		295330	519254	519254	569338		
DESY_Test/BonnDAQ	Run252-000.dat	61383452	1682771			447085	551703	551703	132280		
DESY_Test/BonnDAQ	Run253-000.dat	94806016	2592927			561563	804046	804046	423272		
DESY_Test	data_20130512_150845	19691584	650082			143428	211176	211155	84323		
DESY_Test	data_20130511_231148	60122457070	89615780			210535	18002442	17964609	53325664	36720	75810
DESY_Test	data_20130511_231148_1G	1073741824	1601125			2288	323474	322790	950848	809	916
	SUM BonnDAQ	363091407	1	0	14858949	61650849	61650857	224930568	0	0	0
	SUM netcat	129925873	10	0	30162946	40428015	40424282	18910620	0	0	0

ADC values (DHH+Onsen data)



5 hot pixels masked, no further processing

For Onsen Plans for Jan14 DESY Testbeam
see Talk on Saturday morning

THANKS.