

# Interface Electronics

Peter Göttlicher

DESY, October 5<sup>th</sup>, 2010

- > Updates to interface electronics
- > Ideas for the backplane
- > Summary



## Two cables/quadrant:

>Ethernet cable: TCP/IP

> Clock cable: RJ45

- Bunch clock: 4.5MHz

  - Jump at “ pre-warning for train” for ASIC and ADC

- System clock: 99MHz continues:  $ADC\_clk < 49.5MS/s$  or less

  - Continues running

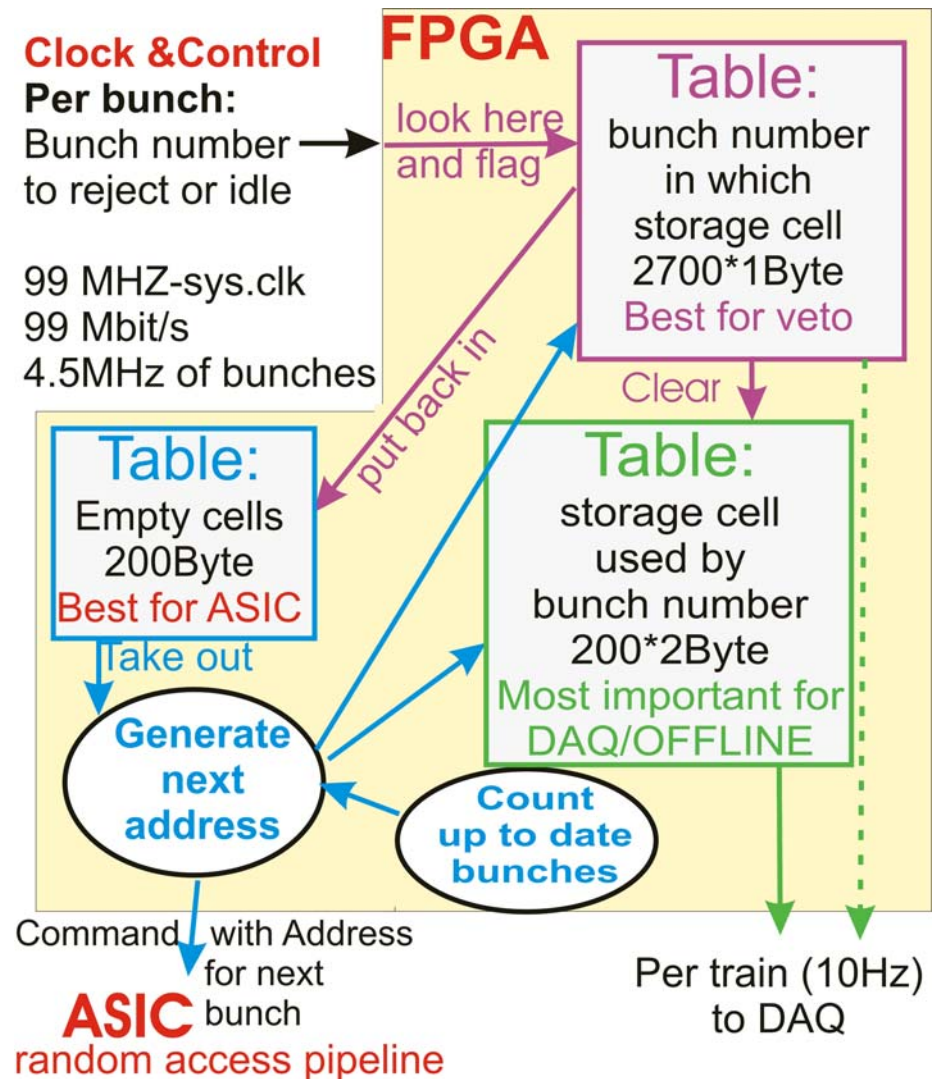
- Telegrams (train start & veto): allows 22bits/bunch

- Status as return from detector head to C&C

**Galvanic isolation** at driver side

# News to interface: Reject from and to

- > Received from C&C
- > Configured to ASIC with a CLK: 99MHz or 198MHz or ? needs
  - table free\_cells
- > Backend needs
  - bunch\_nr(cell)
- > Internal reject needs
  - cell(bunch\_nr)
  - Optional also to backend

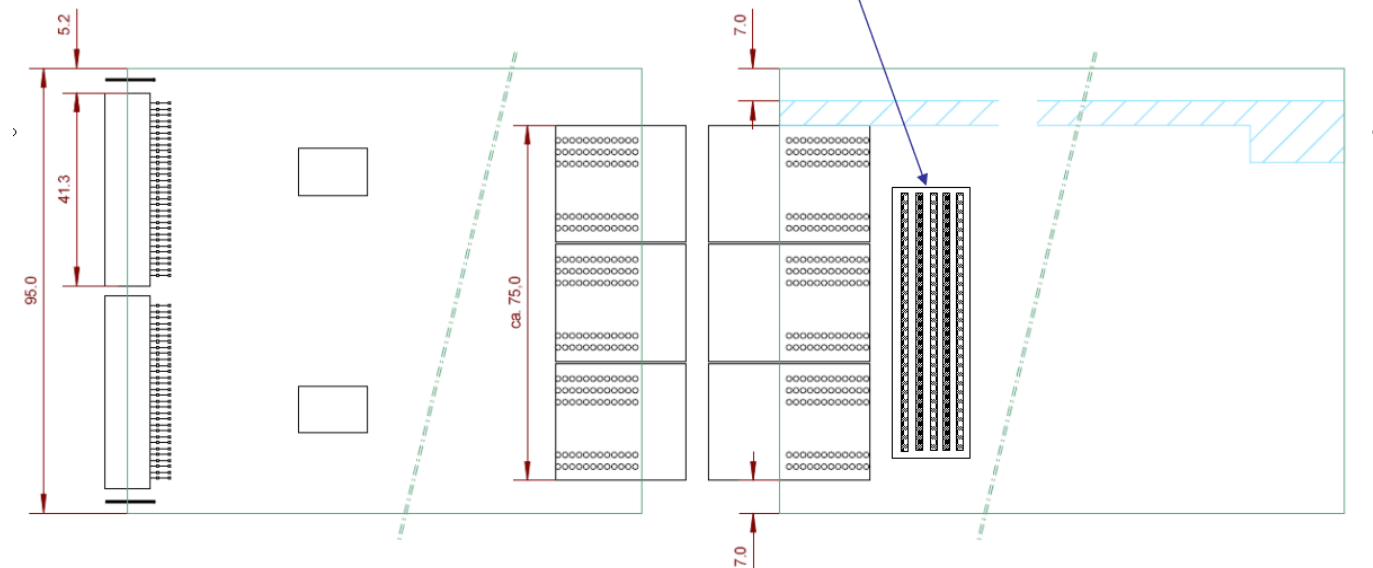
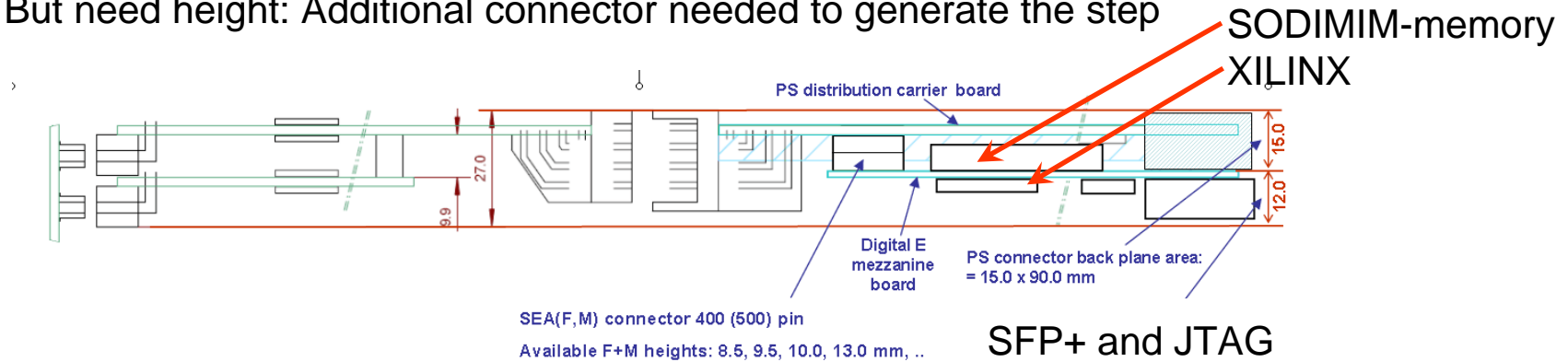


# News to interface: Layout

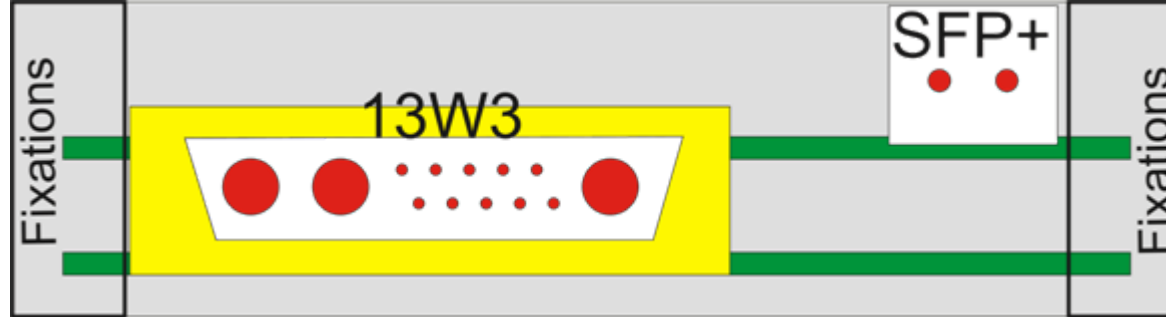
## Layout of digital part:

- > Length ~25-30cm (analogue part the same)
- > Layout around XILINX need RAM on opposite side
- > Memory market: SODIMM modules much better than chips

But need height: Additional connector needed to generate the step



# News on Interface: Layout



27mm x 104mm

- > Power for analogue part via power pins: need < 10A, specs: 20A(40A)  
straight to wires
- > Power for digital part: via 3+2 pins specs: 2A/pin or 5A/pin  
angled into PCB
- > Option to return for sensing: but more complex cables. (5 pins)
- > SFP+ for the high speed data transfer (bi-directional fibres)
- > Remaining space with priorities:
  - JTAG
  - LED'sPCB's don't need to go to the end: More space than in the drawing

# News on the Interface: Powering

## Powering via external supply, regulator in detector head

Resistors in supply chain.

Component	resistivity	number	length	cross section	resistor
ZRMET	50mΩ, 15mΩ	12, 6			1.6mΩ
PCB / Cu-bar	17mΩ mm <sup>2</sup> /m		0.3m	4mm <sup>2</sup>	1.3mΩ
sub-D-Combo	< 1mΩ	1			1.0mΩ
cable	17mΩ mm <sup>2</sup> /m		5m	2.5mm <sup>2</sup>	34. mΩ
connector-supply	????				
<b>sum</b>					<b>40 mΩ</b>

Dominant is cable

Current: <8A  
Two directions



Voltage drop: 0.64 V  
Power loss: 5 W

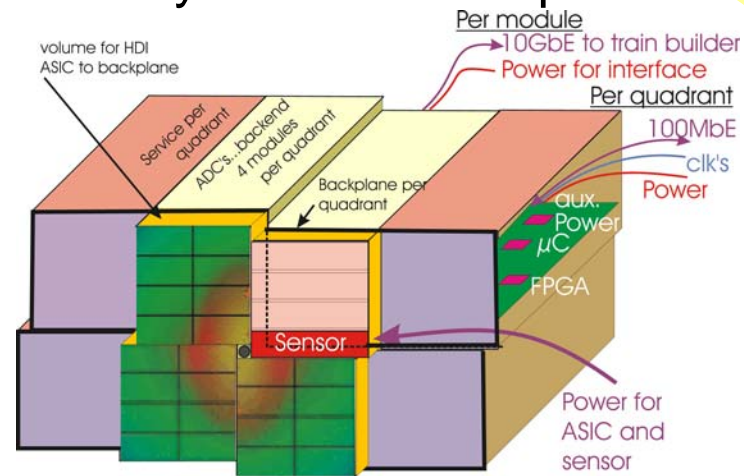
### Tolerable losses:

- > External good quality power supply for analogue is possible
- > Less effort/space for DC/DC and filtering in analogue, NOT ZERO
- > Digital need many voltages: DC/DC converter:  
Filter in detector head, good quality on supply side
- > Cable 5 x 2.5mm<sup>2</sup>: 12mm outer diameter: Sub-D-combo
- > If sense, than parallel thinner cable into same connector.

# Backplane: Connector issues

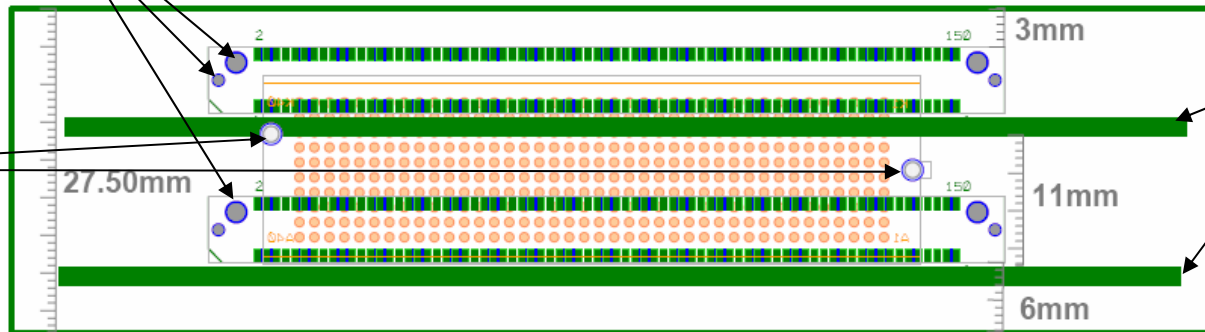
Nothing discussed with responsible for PCB in vacuum

- > Look into solution to get the signals away from the backplane direction of ASIC/HDI
- > Possible:  
SEAM-40-01-L-10-2-RA  
SEAF-40-04-S-10-2-A-K



Holes of interface side connectors

Holes of ASIC/HDI side connectors



Position of the two analogue PCB's of interface

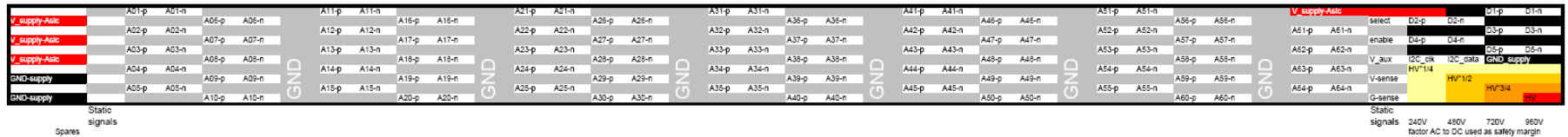
- **400 pin connector** and not 500 pin avoids complexity of blind holes  
Option under investigation
- We need **vacuum tightness**, micro-via's from both sides
- **bottom distance** fits to connector analogue-digital-part: Everything behind sensor region





# Backplane: Connector issues

The connector as a whole: Details on next slides: 40 x 10 pins , 100Ω



power,  
spare

Analogues , surrounded  
to GND or slow-signals

HV, power,  
digital control

- > 5 differential pairs for ASIC-control , spare region: up-to-date status?
- > Slow control of PCB in vacuum via I2C+auxiliary power enable to allow an easy power-off select as an option
- > HV and power (one voltage) included, might ease the assembly comments? Up-to-date current: 10 pins\*2A
- > GND definition somewhere in the vacuum:
  - GND and GND\_supply as different signals
  - GND and V with sense return
  - Power and HV supplie(s)/module



# Backplane: Connector issues

GND	A51-p	A51-n	GND	V supply-Asic				
				A56-p	A56-n		select	
	A52-p	A52-n				A81-p	A81-n	
				A57-p	A57-n			enable
	A53-p	A53-n				A82-p	A82-n	
				A58-p	A58-n			V_aux
	A54-p	A54-n				A83-p	A83-n	
				A59-p	A59-n			V-sense
	A55-p	A55-n				A84-p	A84-n	
				A60-p	A60-n			G-sense
						Static signals		

## Analogue differential pairs:

- > Surrounded by GND
- > Only diagonal neighbour: here 500 pin offers more safety-margin
- > Sometimes “static signals” on the diagonal

# Backplane: Connector issues

	A01-p
V_supply-Asic	
	A02-p
V_supply-Asic	
	A03-p
V_supply-Asic	
	A04-p
GND-supply	
	A05-p
GND-supply	

Static  
signals

Spares

V_supply-Asic			D1-p	D1-n
	select	D2-p	D2-n	
A01-p	A01-n		D3-p	D3-n
	enable	D4-p	D4-n	
A02-p	A02-n		D5-p	D5-n
	V_aux	I2C_clk	I2C_data	GND supply
A03-p	A03-n	HV*1/4		
	V-sense	HV*1/2		
A04-p	A04-n	HV*3/4		HV
	G-sense			

GND

Static  
signals

240V    480V    720V    980V  
factor AC to DC used as safety margin

## 5 differential pairs,

more on other end of connector, if needed

- > Surrounded by GND or power
- > Only diagonal neighbour
- > Sometimes “static signals” beside

**POWER and GND** supply at edge to allow larger vias

**HV**: stepped to stay within connector defining 240V-AC + safety margin

# Backplane: Powering for ASIC

Quantitatives for drops  
between quadrant-control and vacuum

Component	resistivity	number	length	cross section	resistor
bonding					
HDI					
PCB in vacuum	17mΩ mm <sup>2</sup> /m				
connector to backplane	<17.1mΩ	10			1.7 mΩ
backplane/Cu-bar	17mΩ mm <sup>2</sup> /m		0.4m	6mm <sup>2</sup>	1.1 mΩ
connector side-board					~ mΩ
side board, w/o copper bar	17mΩ mm <sup>2</sup> /m		<0.2m	4 x 35μm x 5mm = 0.7mm <sup>2</sup>	5 mΩ
<b>sum</b>					<b>~10 mΩ</b>

Possible positions for voltage regulators

Voltage regulators  
at quadrant to  
compensate cable  
+  
in vacuum with  
minimized  
drop and heat  
+  
floating supply in  
rack

2 directions ,

$I_{\max}, I_{\text{switched}} ? \dots \dots \dots 0.5\text{A} / \text{ASIC} \Rightarrow 8\text{A} \quad \Rightarrow \quad 160\text{mV}$



# Summary

- > Details are updated: Keep every thing behind sensor
- > No contact to design of the PCB in vacuum, ... proposal, no decisions
- > Powering with reasonable losses in the cables

