



# RPC Trigger Progress Report

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for  
Bari, Helsinki, Lappeenranta, Warsaw*

*CMS Electronics and Tridas Week  
Trigger Meeting  
CERN, November 9, 2004*



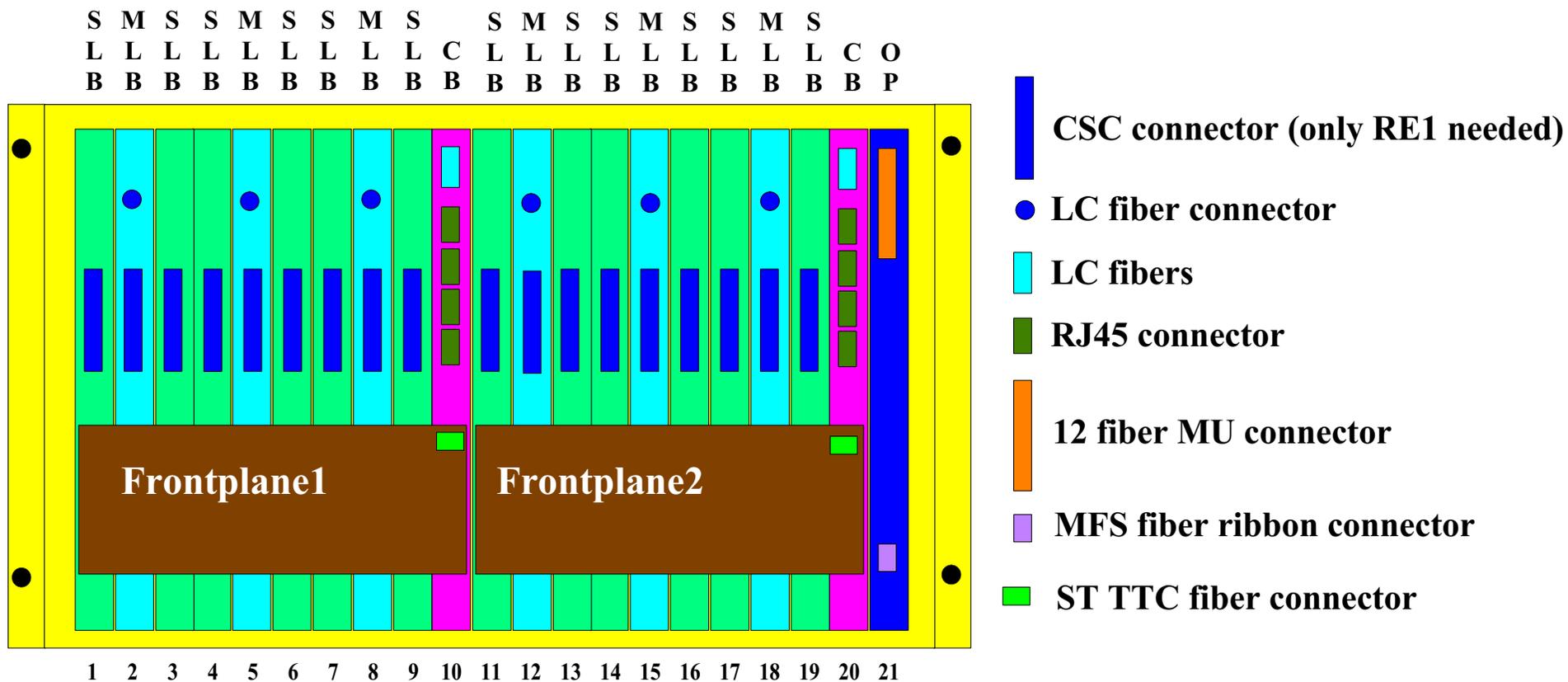
- \* **UXC55 RPC Trigger Electronics**
- \* **USC55 RPC Trigger Electronics**
- \* **milestones**



# UXC RPC Trigger Electronics - Link System



## Link Box (Euro crate) - 124 needed





# UXC RPC Trigger Electronics - Link System



## Inventory of Link System

	MLB	SLB	CB	BP	FP	LBox
full system	684	1124	248	124	246	124
staged system	444	788	192	96	192	96

MLB - Master Link Board
SLB - Slave Link Board
CB - Control Board
BP - Backplane Board
FP - Frontplane Board
LBox - Euro Link Box

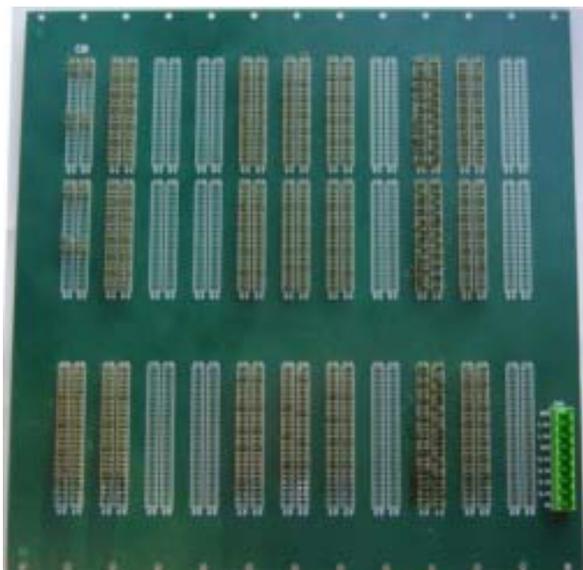
staged - w/o re11, re5, re4; re1, re2, re3 for eta<1.6



# UXC RPC Trigger Electronics - Link System



Set of LBox boards tested June(CERN), July(Bari), October 2004 (CERN)  
(thanks to Bari and Endcap RPC teams for their support !)



**BP**  
(one per LBox needed)



**LB**  
(~16 per LBox needed)



**CB**  
(2 per LBox needed)

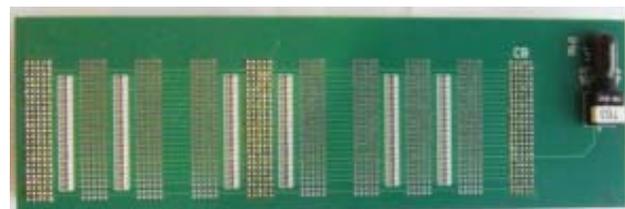


**PO**  
(needed one per each  
~six LBox)

(LB - Link Board - it can be configured as MLB or SLB)

Oct2004 Link system BeamTests web page:

<http://pccms9.igf.fuw.edu.pl/users/tb/CMS/Oct2004BeamTests/>



**FP** (2 per LBox needed)



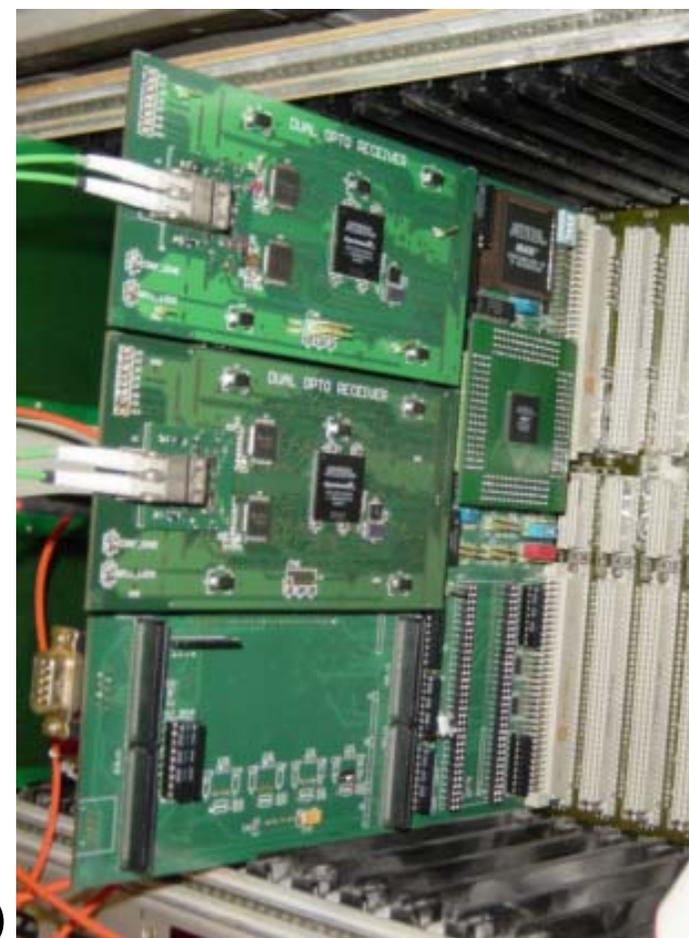
# UXC RPC Trigger Electronics - Link System



2004 Synch tests (1)



Set of 4 LBs, 1 CB + DCS chain to optical FEC



**Splitter Board + Optorec Board  
(TB receiver used: opto rec, deser, FPGA)**



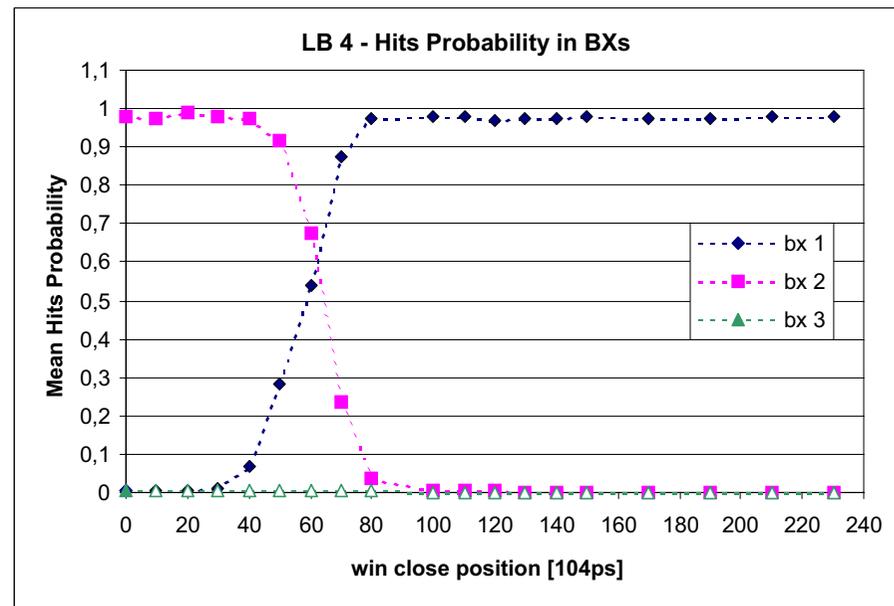
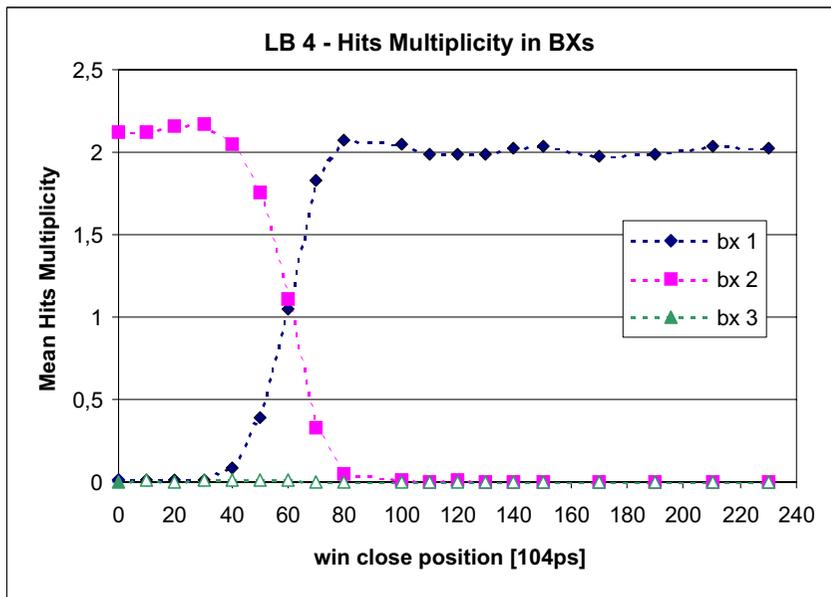
# UXC RPC Trigger Electronics - Link System



2004 Synch tests (2) - in H2 with endcap RPC chambers

Synchronisation Window analysis with LB diagnostics and DCS optical chain

## Endcap RPCs



Very good timing behaviour



# UXC RPC Trigger Electronics - Link System



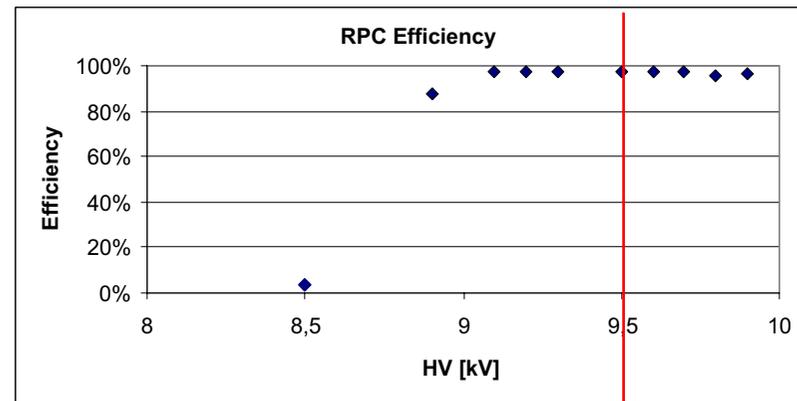
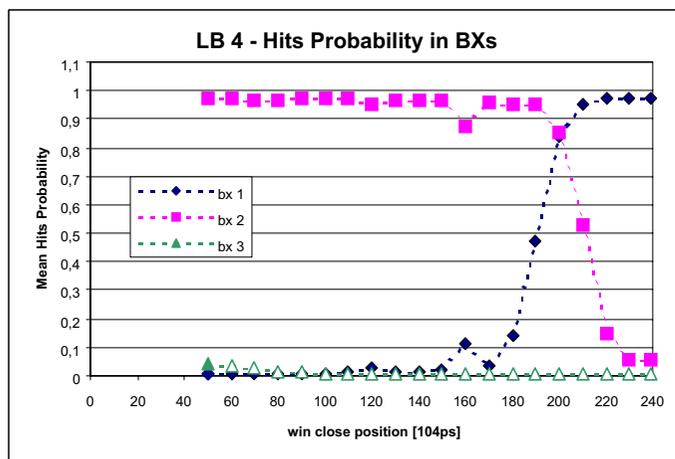
## 2004 Synch tests (3) - in GIF with barrel RPC chambers

Synchronisation window analysis with LB diagnostics and DCS optical chain

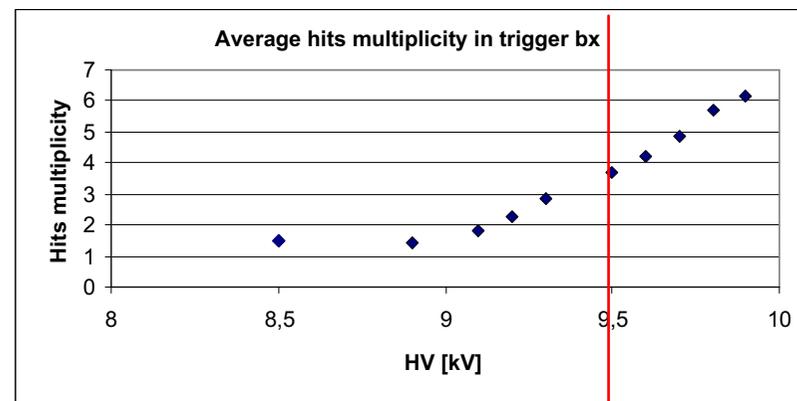
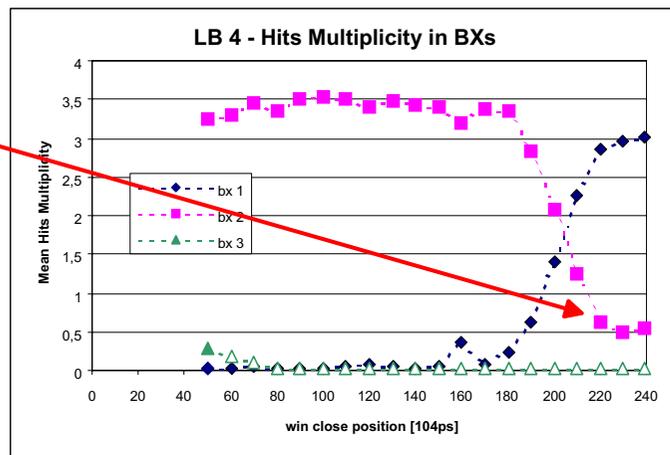
### Explanation:

HV=9.5kV much above working point, large clusters with tails in next BX

### Barrel RPCs



10% hits found in next BX

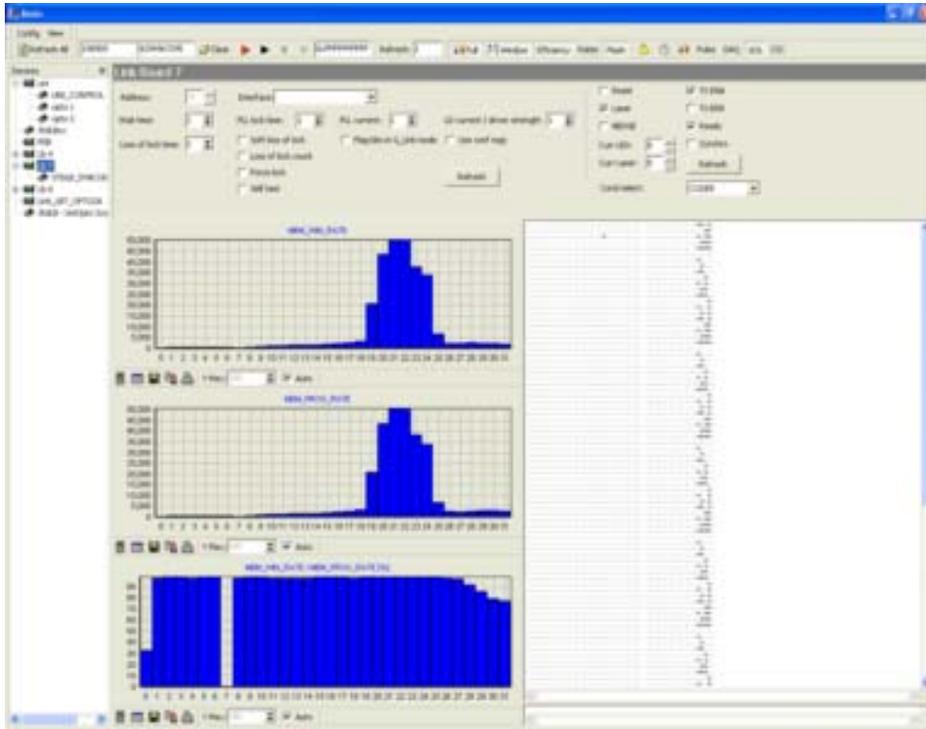




# UXC RPC Trigger Electronics - Link System

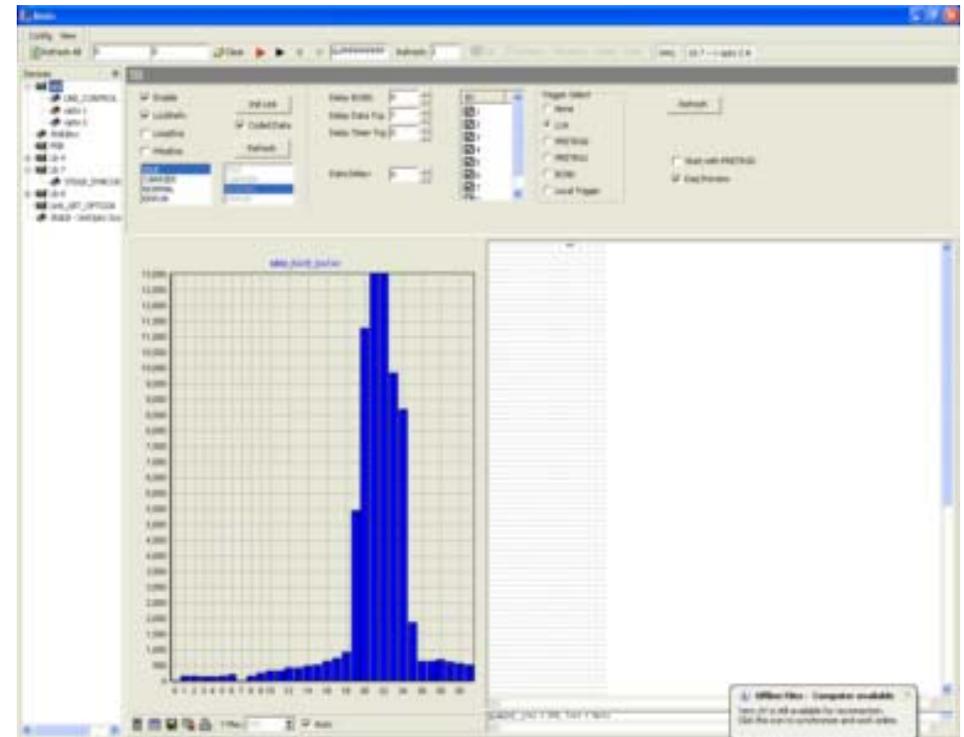


2004 Synch tests (4) - on H2 with CSC



Beam muons seen on LB diagnostics

Beam muons seen after long fiber transmission on Optorec Board (TB receiver used: opto rec, deser, FPGA) no difference in data streams!





# UXC RPC Trigger Electronics - Link System



## 2004 Synch tests (5) - on H2 with CSC



Cable connection to the CSC TMB Board

\* TMB readout and LB readout see the same data and BXN numbers!

**but** differences in RPC data positioning in TMB and LB pipeline - to be understood

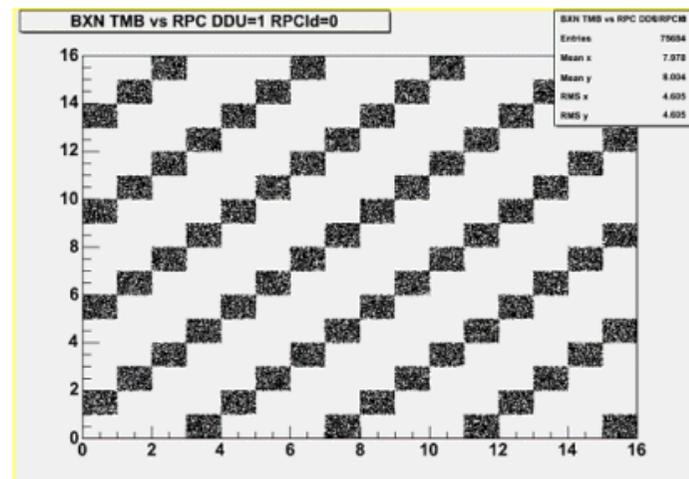
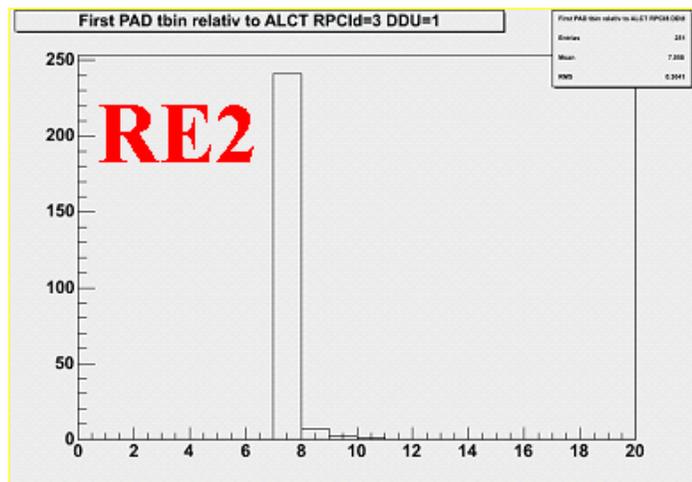
(Karol Bunkowski's analysis of CSC data)

Jay Hauser analysis ->

and conclusion:

- RPC Link Board to RAT-TMB data transmission worked well

...



[http://www.physics.ucla.edu/~hauser/tb04/0410\\_rpc\\_rat.ppt](http://www.physics.ucla.edu/~hauser/tb04/0410_rpc_rat.ppt)



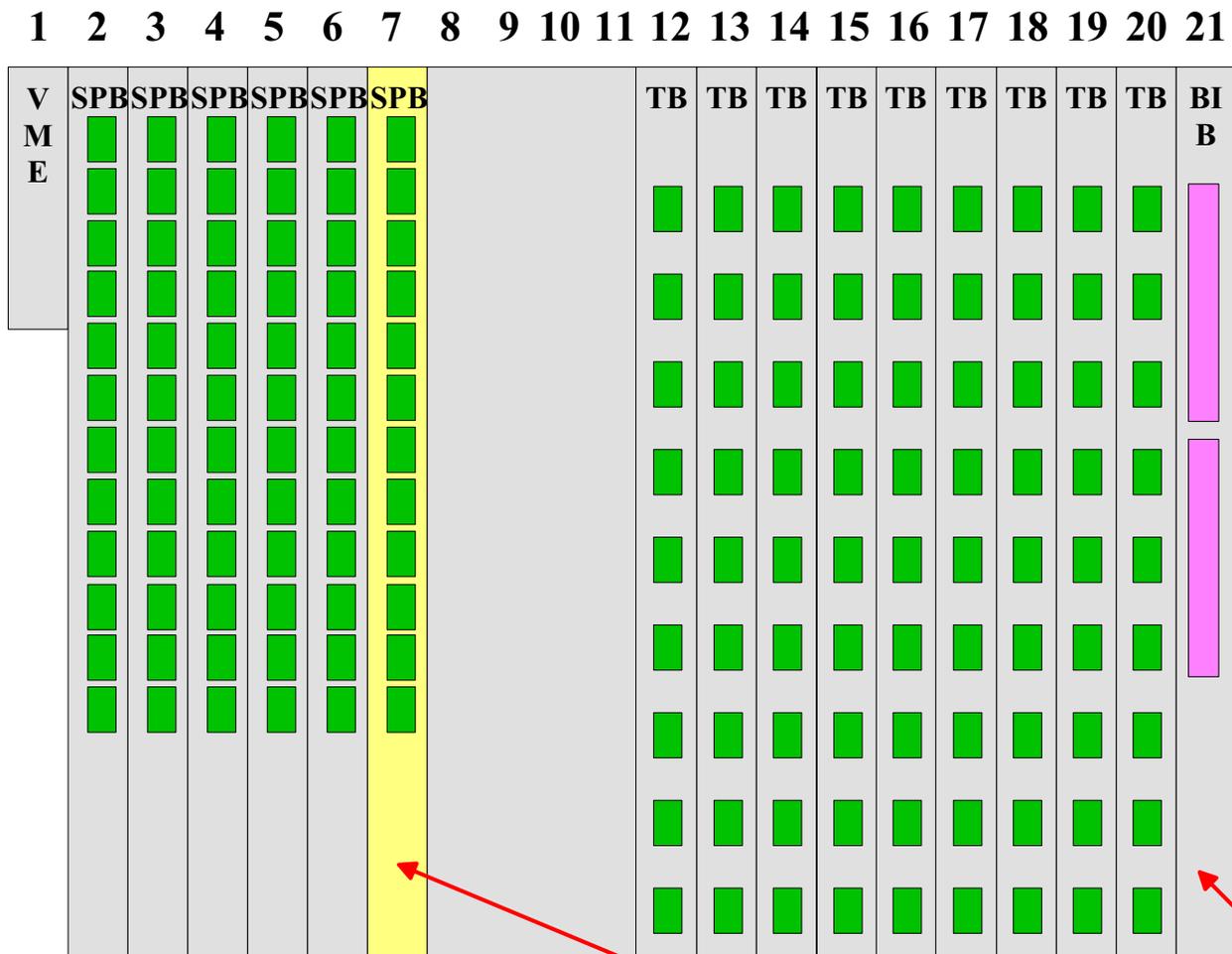
# UXC RPC Trigger Electronics - Link System



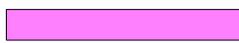
- \* **Synch tests show that Link System can go to preproduction phase**  
-> the design is being transferred to Lappeenranta
- \* **Synch test 2004 version docs - web page:**  
*[http://pccms9.igf.fuw.edu.pl/users/tb/CMS/Link\\_System/working\\_design\\_2004\\_tests/](http://pccms9.igf.fuw.edu.pl/users/tb/CMS/Link_System/working_design_2004_tests/)*
- \* **Schematics revision made and ready for preproduction - web page**  
*[http://pccms9.igf.fuw.edu.pl/users/tb/CMS/Link\\_System/preproduction/](http://pccms9.igf.fuw.edu.pl/users/tb/CMS/Link_System/preproduction/)*
- \* **Two full (16 LBs) crates needed for February 2005**  
**(commissioning of Barrel, Endcap RPCs) - preproduction version**



# USC RPC Trigger Electronics - Trigger Crate



 dual Honeywell LC opto connector

 SCSI connector

spare SPB

Backplane VME Interface and Trigger Crate sorter connectors



# USC RPC Trigger Electronics



## USC RPC Trigger Electronics - Inventory

	<b>per Crate</b>	<b>Total</b>	<b>Comments</b>
<b>Trigger Crate</b>		<b>12</b>	
<b>Splitter Board</b>	<b>5</b>	<b>60</b>	
<b>Trigger Board</b>	<b>9</b>	<b>108</b>	
<b>Backplane Interface Board</b>	<b>1</b>	<b>12</b>	
<b>Backplane</b>	<b>1</b>	<b>12</b>	
<b>Vme Controller</b>	<b>1</b>	<b>12</b>	
<b>Sorter Crate</b>		<b>1</b>	
<b>Splitter Board</b>	<b>3</b>	<b>3</b>	
<b>Readout Concentrator Board</b>	<b>3</b>	<b>3</b>	<b>Ecal DCC</b>
<b>DCS Board</b>	<b>3</b>	<b>3</b>	<b>Tracker CCS</b>



# USC RPC Trigger Electronics - Splitter Boards



	RPC(all)	HO	Total
Quad Splitter	192	24	216
Dual Splitter	420	60	480

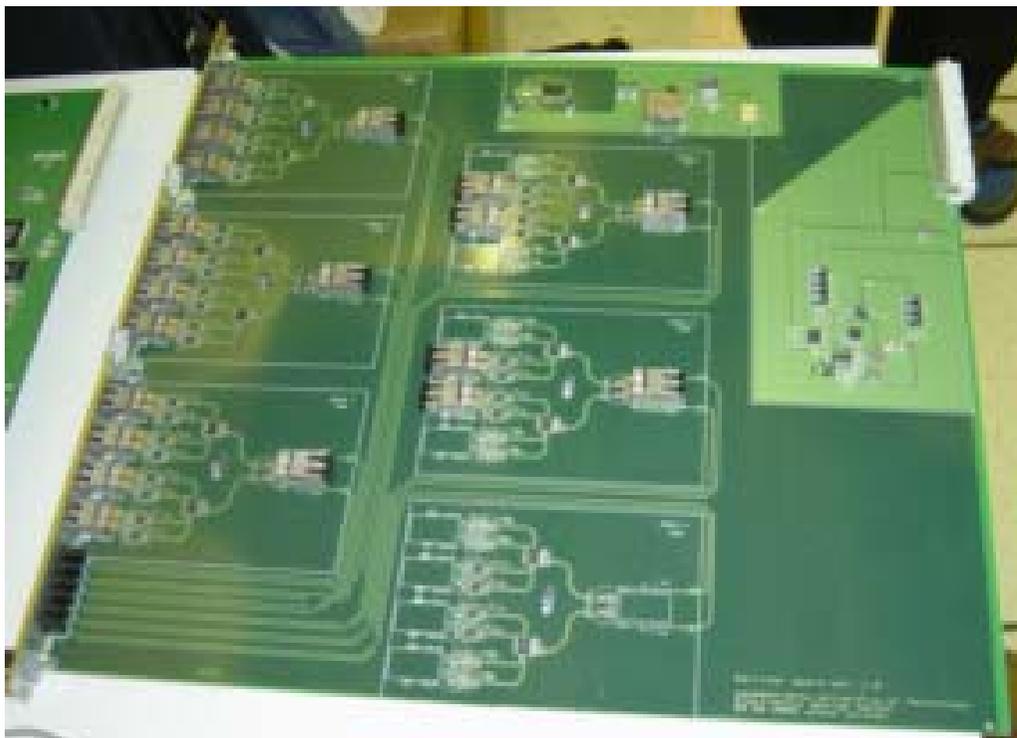
**Splitters Board (SPB) = 4 quad + 8 dual splitters**

**60 + spares (9) SPBs needed**

**(5 SPBs per RPC Trigger Crate)**



# USC RPC Trigger Electronics - Splitter Boards



**Preproduction SPB tested and  
successfully used  
during 2004 Synch tests**

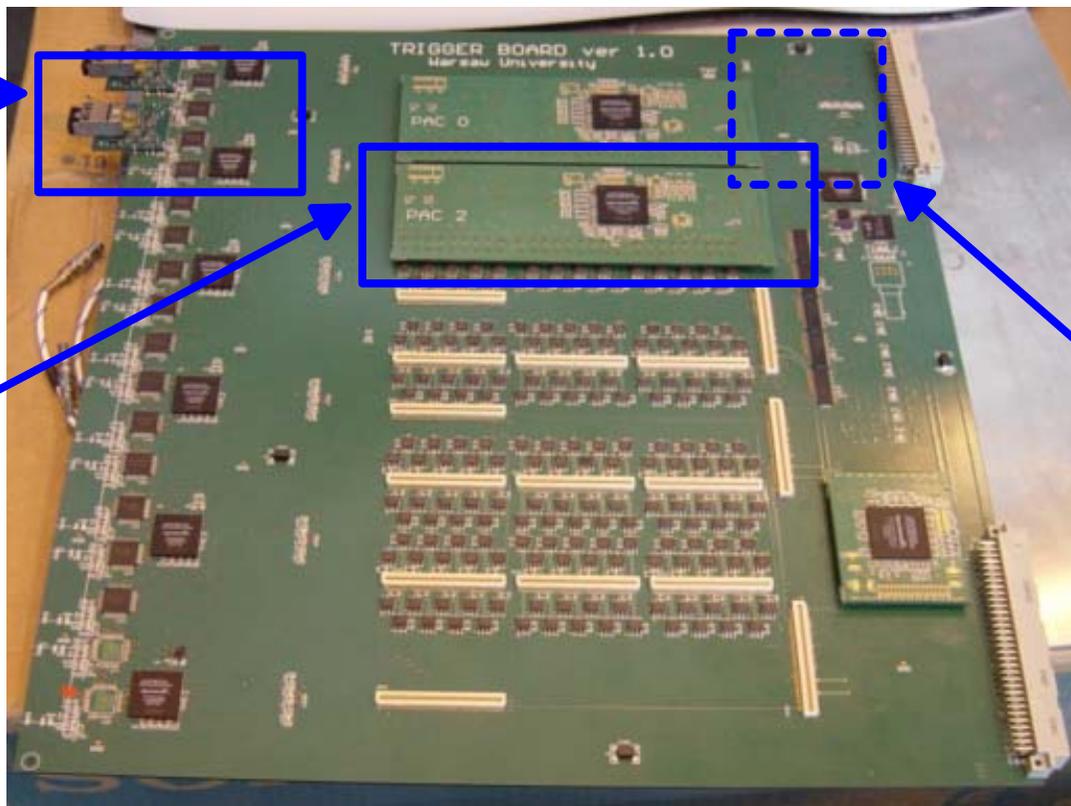
**Ready for production**



# USC RPC Trigger Electronics - Trigger Boards



optical input  
(custom receiver,  
TLk 2501. FPGA)  
- tested on Optorec  
board  
PAC mezzanine

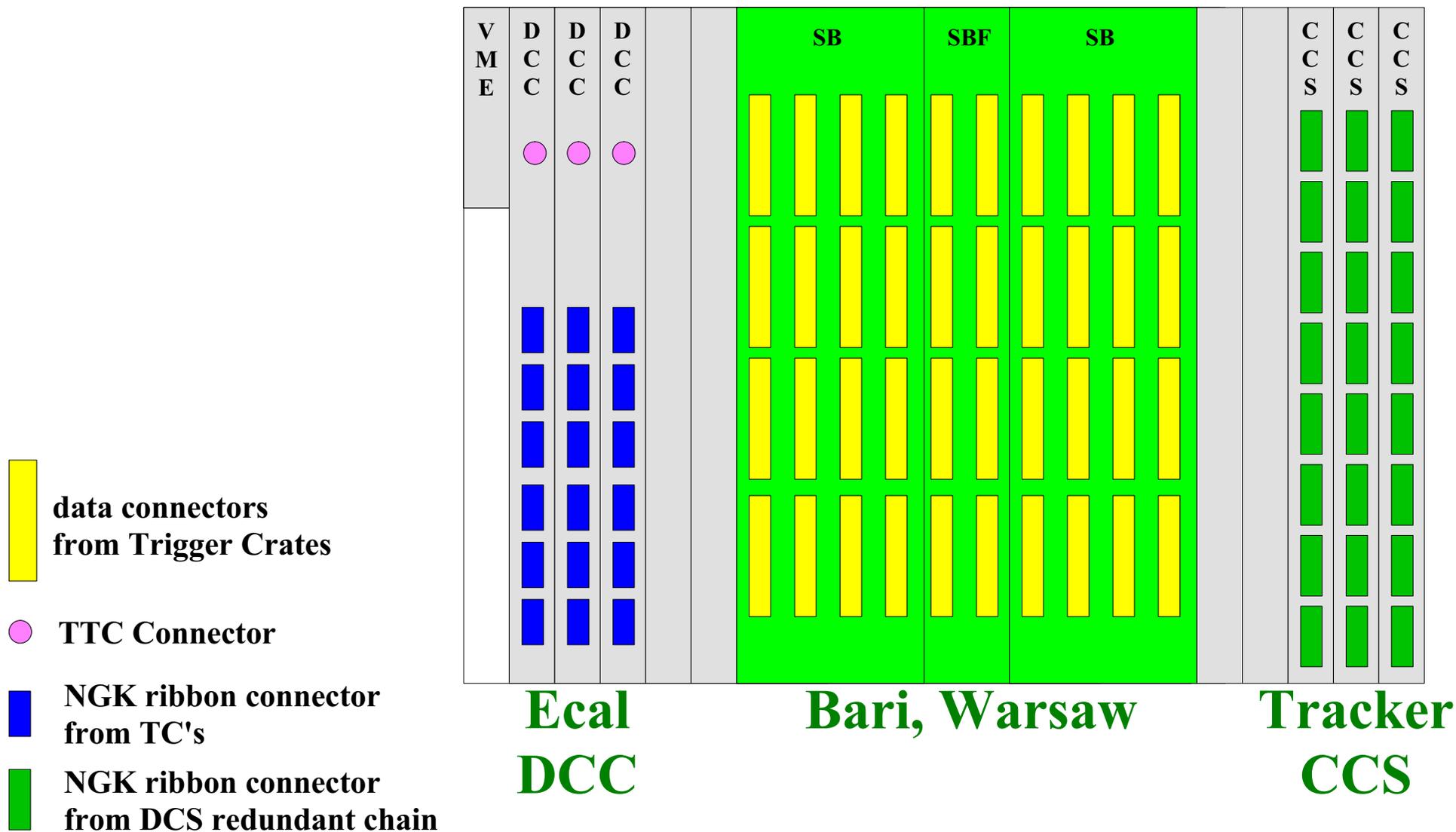


VME mezzanine  
(on other side)  
- tested

TB, PAC mezzanine - under tests  
(an mistake with docking connectors for VME mezzanine occurred - new VME  
mezzanine will be delivered today)

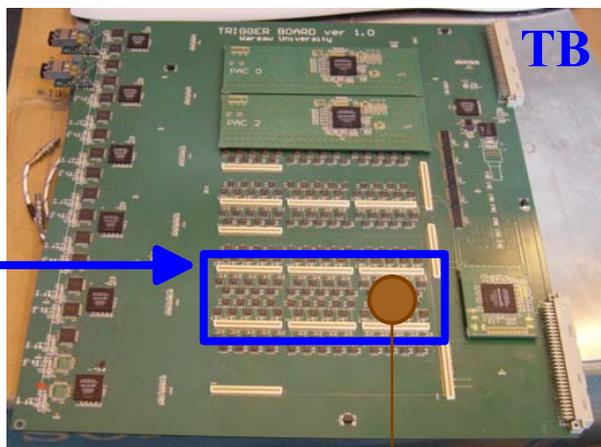


# USC RPC Trigger Electronics - Sorter Crate

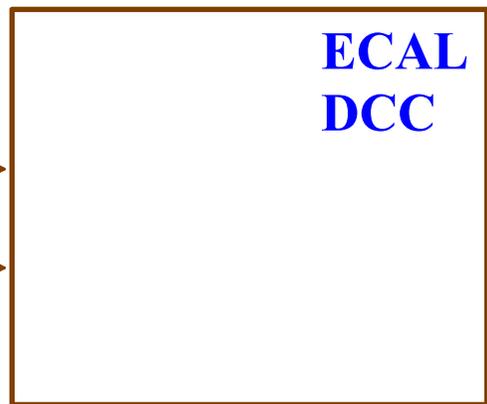




# USC RPC Trigger Electronics - Readout



Readout mezzanine with **GOH** - firmware is being designed

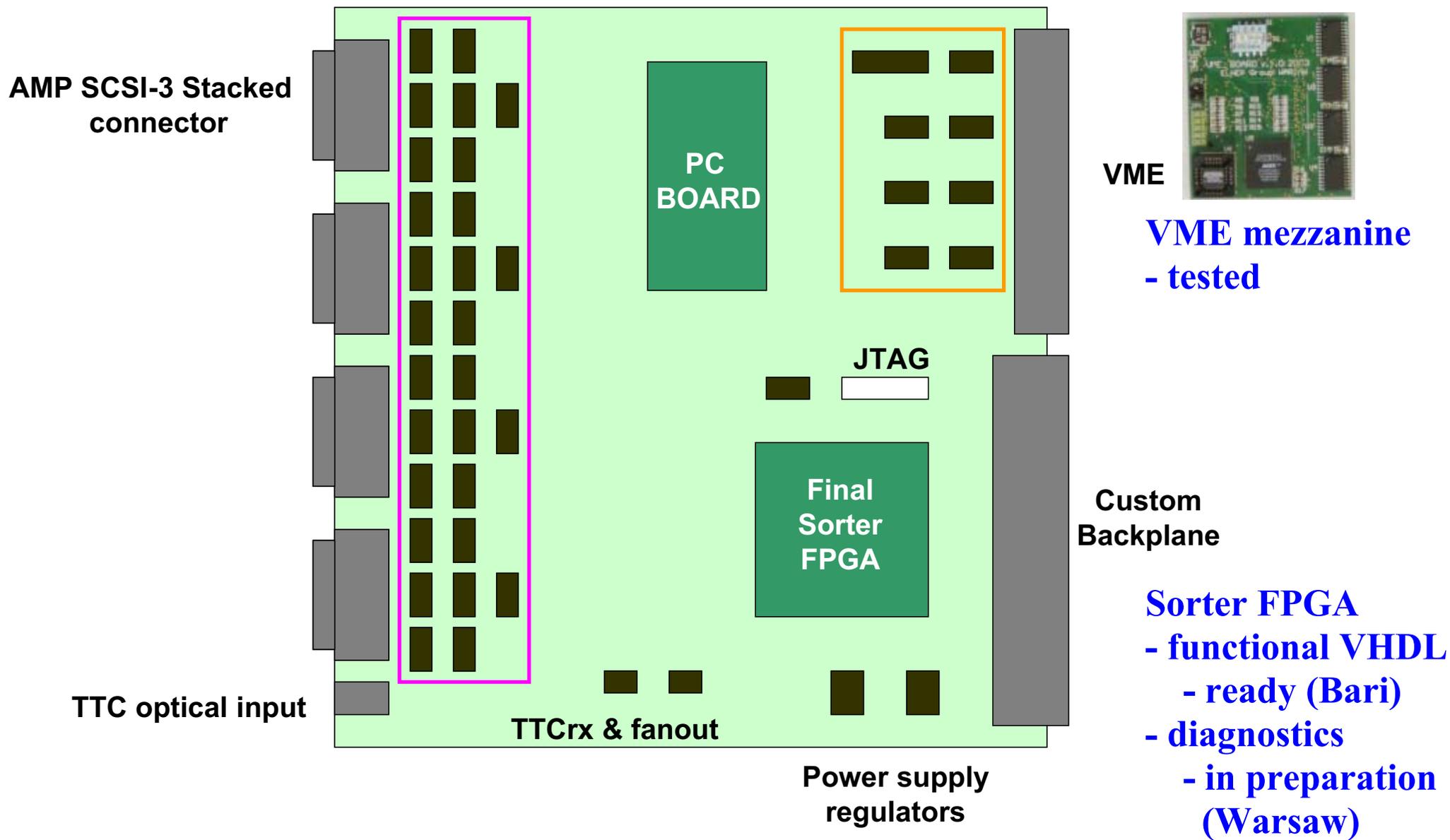


Participation in Ecal DCC firmware design  
Event Merger/Builder

Slink tests last October



# USC RPC Trigger Electronics - Sorter





# RPC Trigger Milestones



	<i>item</i>	<i>milestone</i>	<i>date</i>	<i>comment</i>
RPC	<b>Link Board</b>	<b>Production start</b>	<b>Sep-03</b>	<b>delayed Jan-05</b>
RPC	<b>Trigger Bd</b>	<b>PPP done</b>	<b>Dec-03</b>	<b>delayed Apr-04</b>
RPC	<b>Sorter Bd</b>	<b>Design done</b>	<b>Aug-03</b>	<b>delayed Jul-04</b>
RPC	<b>R/O Bd</b>	<b>PPP done</b>	<b>Dec-04</b>	<b>included on TB</b>
RPC	<b>Trigger Crate</b>	<b>Proto done</b>	<b>Feb-03</b>	<b>delayed Apr-04</b>
RPC	<b>Link Board</b>	<b>Production done</b>	<b>Mar-04</b>	<b>delayed Aug-05</b>
RPC	<b>Trigger Bd</b>	<b>Production start</b>	<b>Jun-04</b>	<b>delayed Sep-04</b>
RPC	<b>Splitter Bd</b>	<b>Production start</b>	<b>Oct-04</b>	
RPC	<b>System</b>	<b>System test (2crates)</b>	<b>Mar-05</b>	
RPC	<b>Trigger Bd</b>	<b>Produced &amp; tested</b>	<b>Dec-05</b>	
RPC	<b>R/O Bd</b>	<b>Produced &amp; tested</b>	<b>Dec-05</b>	<b>included on TB</b>
RPC	<b>Trigger Crate</b>	<b>Produced &amp; tested</b>	<b>Dec-05</b>	
RPC	<b>Sorter Bd</b>	<b>Produced &amp; tested</b>	<b>Dec-05</b>	