PID summary

J. Va'vra

SuperB collaboration meeting in London, 2011

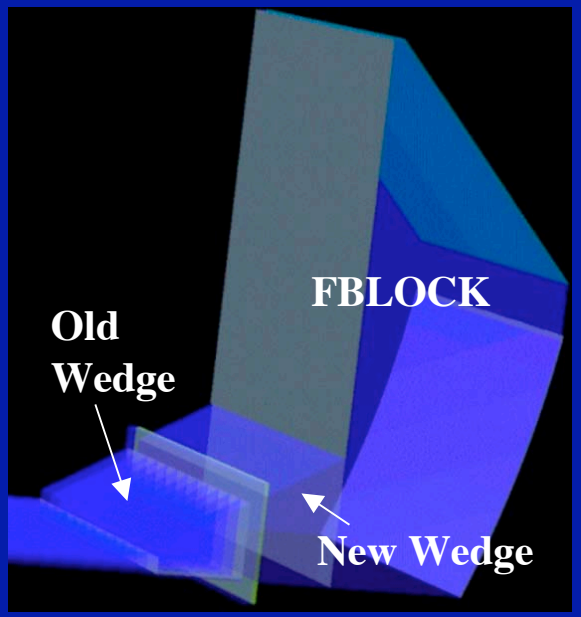
Speakers

- **Barrel FDIRC**
  - **Jerry Va'vra: "Update on FDIRC prototype"**
  - **Christophe Beigbeder: "Barrel electronics status"**
  - **Jerry Va'vra: "Comment on charge sharing with H-8500"**
  - **Eugeniy Kravchenko:** "Investigation of PMT ageing in Novosibirsk"
  - **Gabriele Simi: "Initial experience with PMT+electronics test setup in Padova"**
- **Forward PID**
  - **no talk presented this time**
- **TDR assignments**

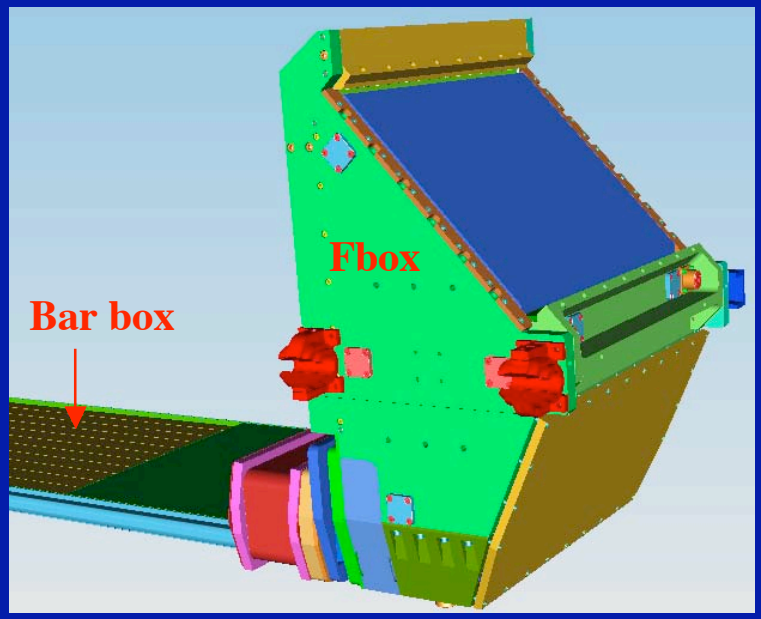
FDIRC: Definitions of names

(For newcomers)

Photon camera optics:



FDIRC camera mechanics:

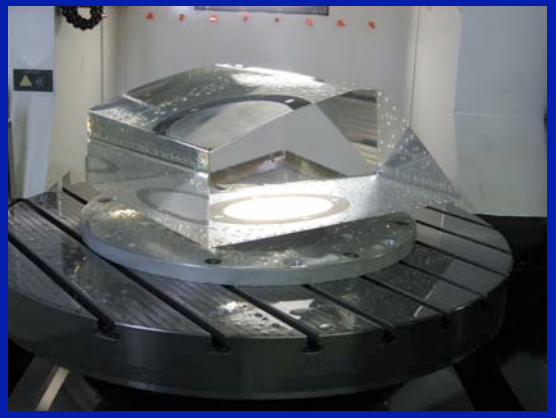


FBLOCK and New Wedge

J. Va'vra

- **Polishing of the new Wedge is finished. It is being delivered to SLAC.**
- **FBLOCK polishing will be finished by the end of September. Then it will go to the plating company to produce two mirror surfaces. We will get it sometimes in October.**
- **The shape of the new optical pieces will be measured with a digital arm owned by the alignment group at SLAC.**

FBLOCK after machining its shape:



FBLOCK on x-y polishing table:

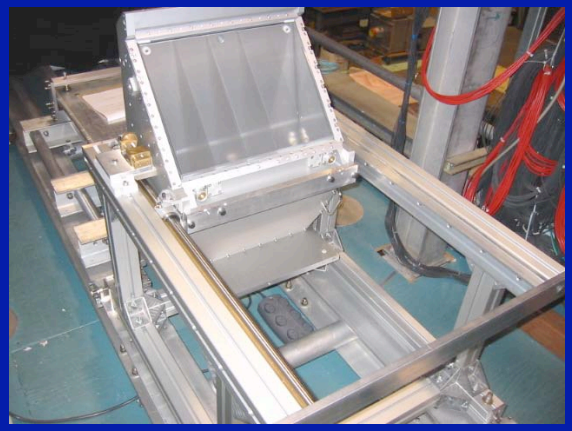
Fbox and its support in CRT

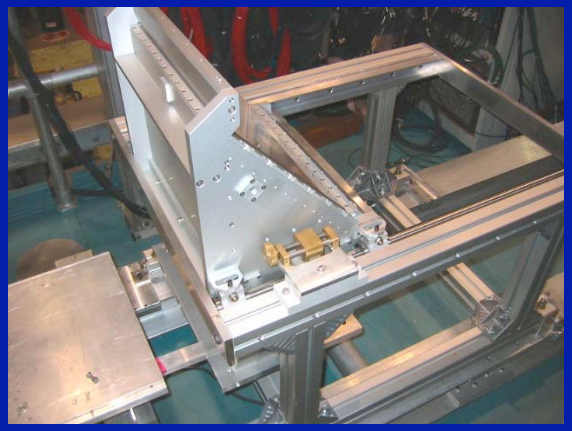
Massimo Benettoni, Nicola Mazziotta, and technicians from Padova & Bari

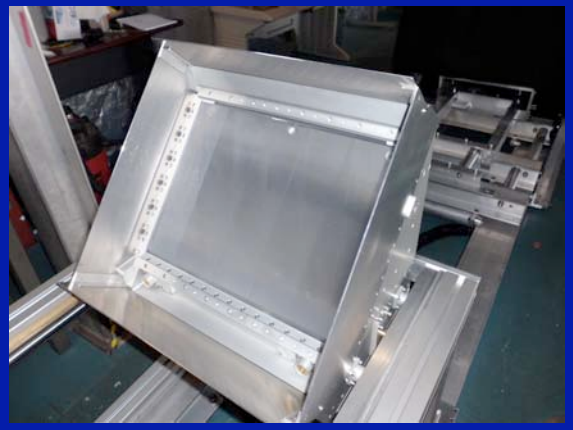
- **Fbox and its support was finished in Padova and Bari.**
- **The parts are at SLAC.**

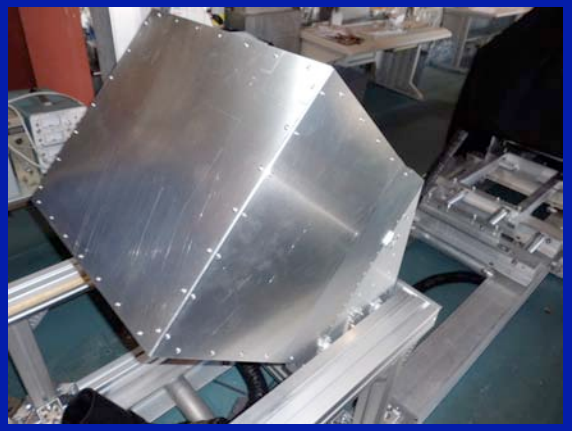
Mechanical trial test of Fbox in CRT

M. McCulloch and J. Va'vra





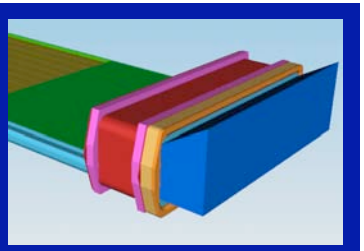




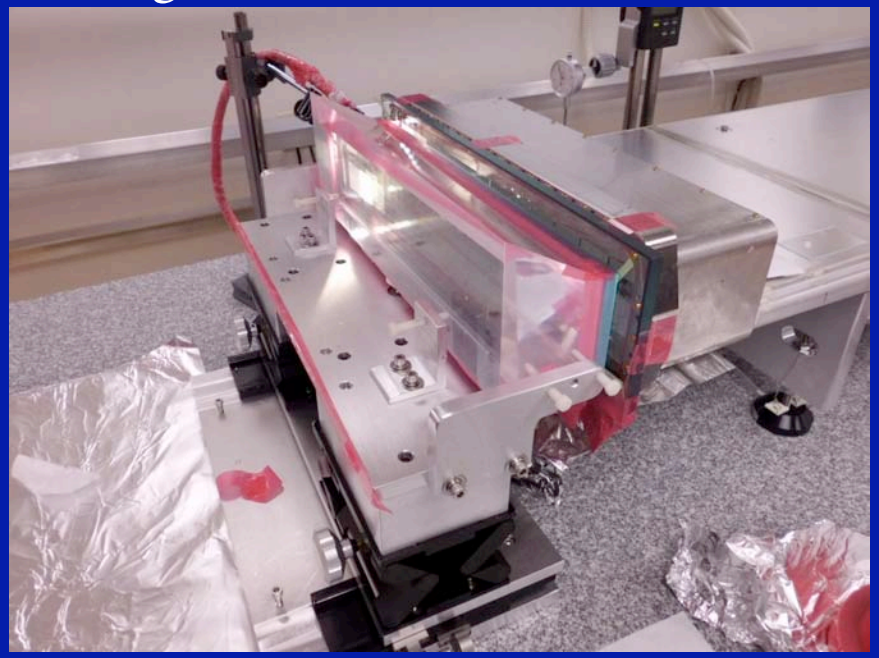
- **Fbox and its support was successfully trial fitted into the CRT stand.**
- **Right now we working detector holder, electronics shield, air cooling, cable entry.**

Test of bar box - wedge gluing

M. McCulloch and J. Va'vra



Gluing fixture:

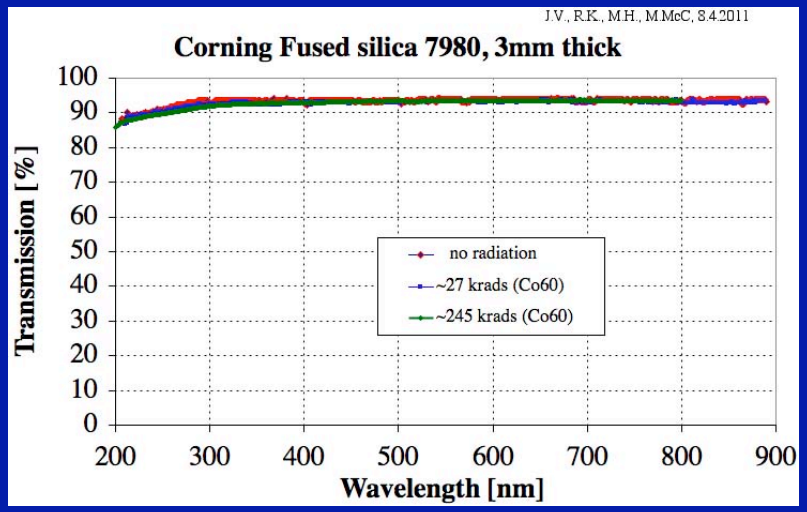


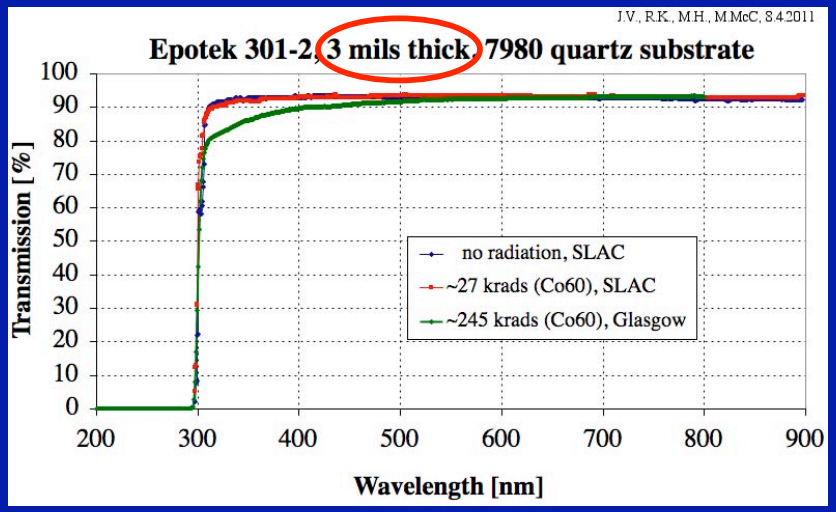
Trial test of large area gluing:

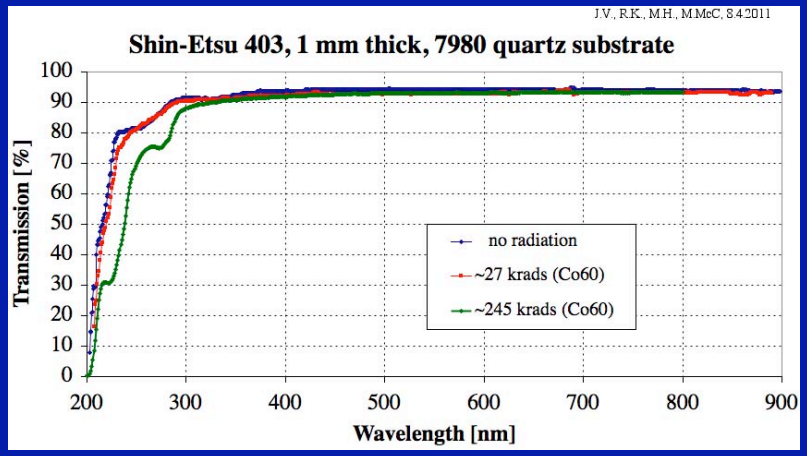
- **Use Epotek 301-2 for this coupling.**
- **Gluing procedure works well. No bubbles.**

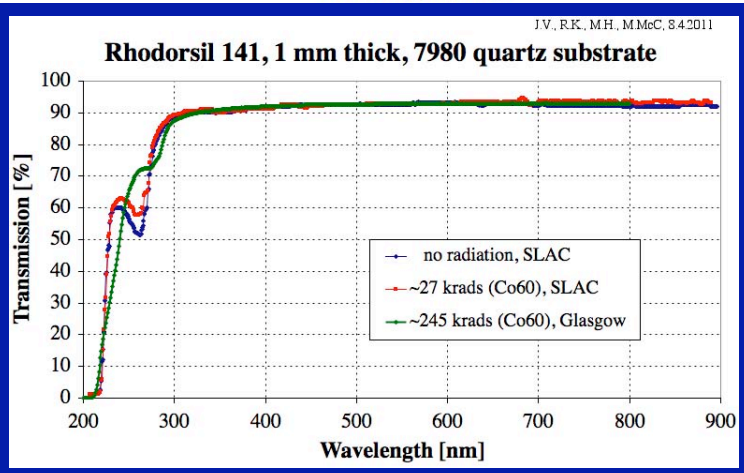
Transmission =f(radiation dose) up to ~250krads

J. Va'vra





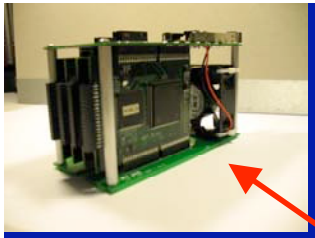


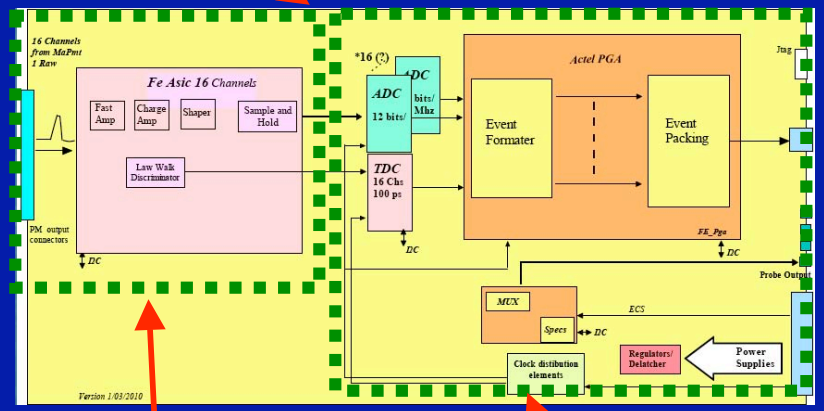


- **Bottom line: Corning 7980 Fused Silica and RTVs are OK, Epotek-302-1 is the worst.**
- **Epotek 301-2 OK up to ~250 krads.**

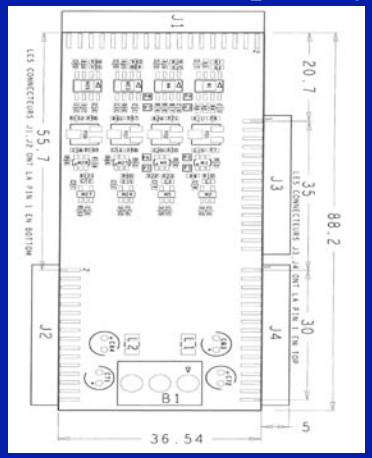
Barrel electronics status

Christophe Beigbeder

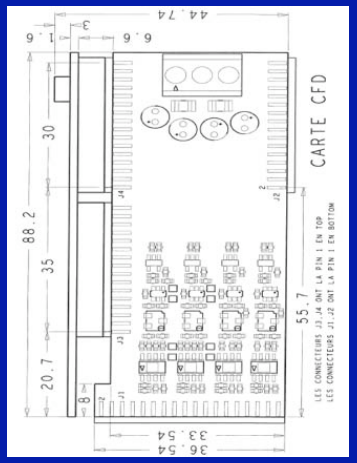




Front-end board prototype:



Motherboard:



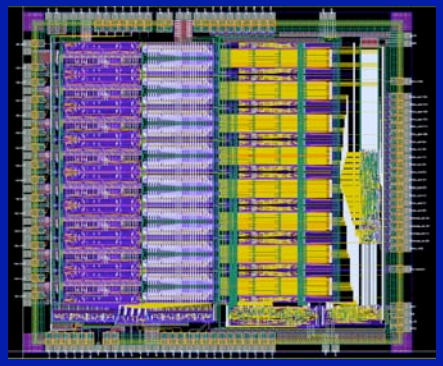
Front-end board:

- A prototype test board allowing to test 3 diff. CFD algorithms
- ASIC-based amplifier
- JV: **Do we need an adjustable amp. gain for every channel ?**

Motherboard:

- TDC & ADC
- Data packing
- Communication interface
- SCAT chip

SCAT chip:

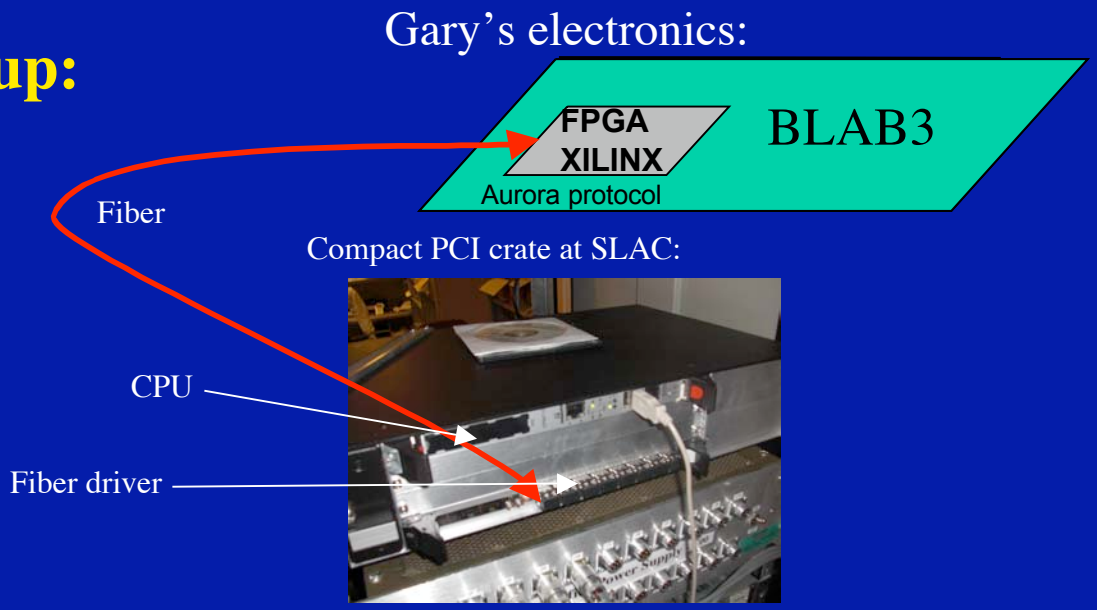


- **Front-end board should be available by the end of this year.**
- **SCAT chip will be submitted in November.**
- **Motherboard design will start soon, will be available in 6 months.**

Barrel electronics status: communication

Christophe Beigbeder

SLAC CRT & scanning setup:

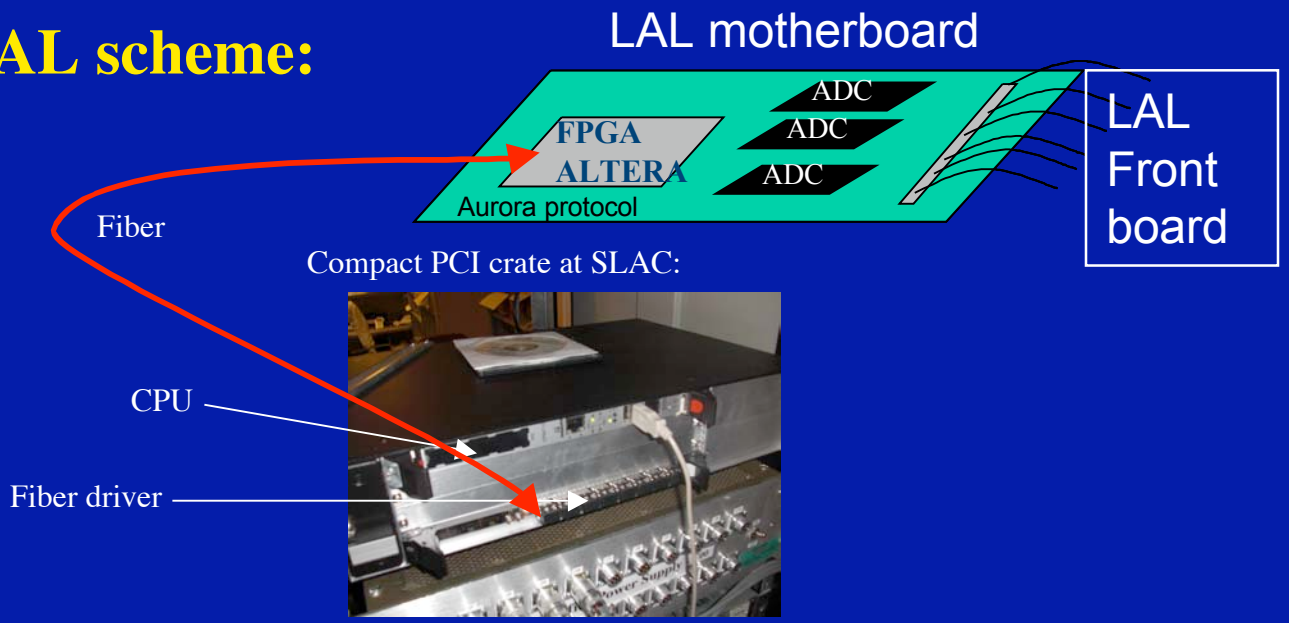


- **Problem with Gary's solution:**
  - Fiber driver are not available, but Gary can provide the artwork to make boards.
  - One cannot develop a new electronics outside of SLAC
  - LAL engineers do not use XILING chip
  - SLAC solution might appear a bit more expensive

Barrel electronics status: communication

Christophe Beigbeder

One possible LAL scheme:



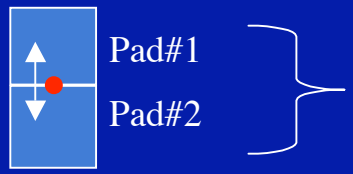
- **Five options for communication protocol:**

1. LAL: ALTERA chip with a specific firmware developed in Taiwan, and some new software development, "Aurora protocol", Cost: crate, board, PC.
2. LAL, etc.: ALTERA chip with two new firmware and two limited software developments, "Fiber channel protocol", Cost: IP, crate, board, PC.
3. LAL, Padova: A2818 CAEN board in PC, ALTERA chip with a specific new firmware and PC-based DAQ software developments, "Conet 1 or 2 protocol", Cost: IP, crate, board, PC.
4. LAL, Padova: MXI express board in PC, ALTERA chip with new firmware and PC-based DAQ software developments, "Ethernet protocol", Cost: IP, crate, board, PC.

- **Whatever the solution, SLAC CRT & scanning setup will be supported !**

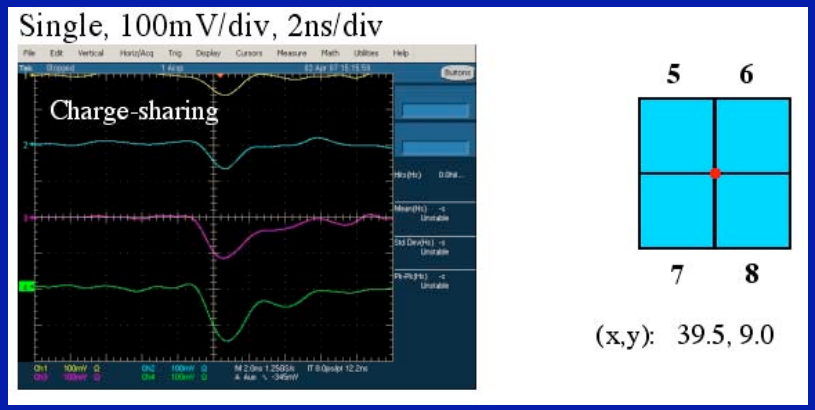
Comments on charge sharing with H-8500

J. Va'vra

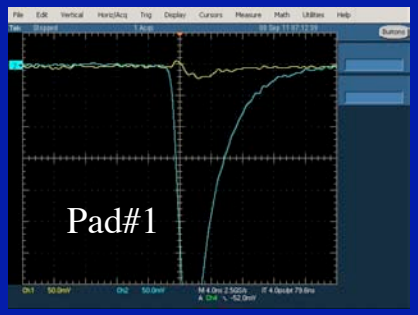


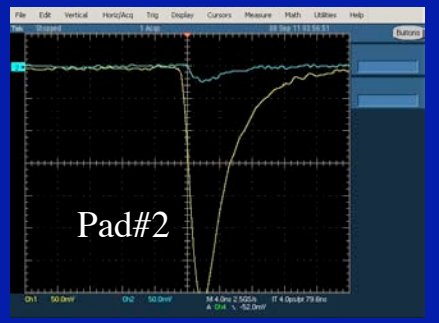
Maximum charge sharing position

Burle MCP: charge sharing works

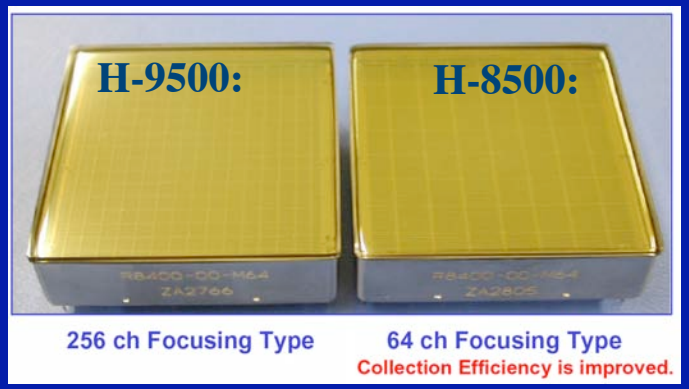


H-8500: charge sharing does not work

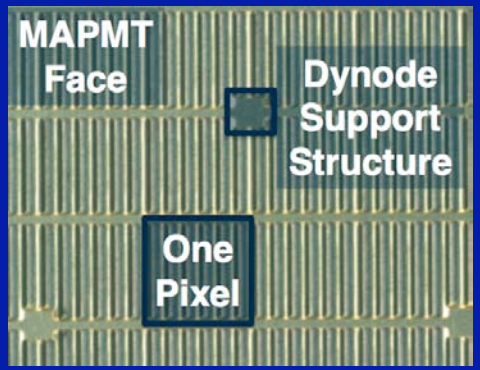




Hamamatsu Multi-anode electrode structure:



H-8500 front electrode detail:

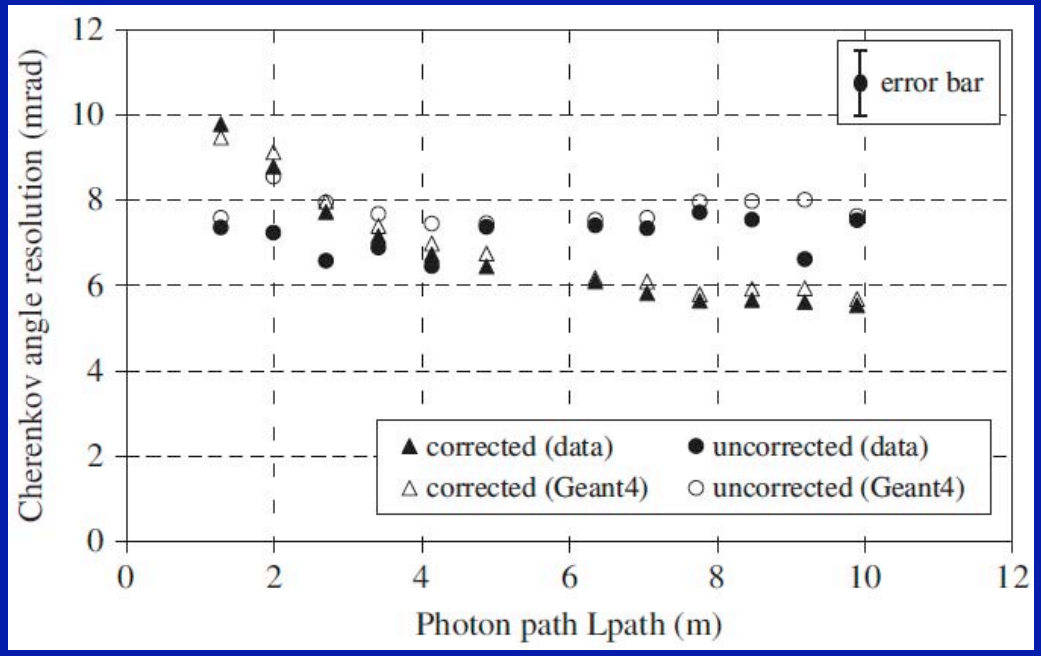


- **Notice a little entrance electrode around each pad boundary. In my opinion, this deflects photoelectrons away from the pad boundary, which reduces the charge sharing.**

1-st FDIRC prototype in the ESA test beam

J. Benitez, D.W.G.S. Leith, G. Mazaheri, B.N. Ratcliff, J. Schwiening,
J. Va'vra, L.L. Ruckman, G.S. Varner, NIM A 595 (2008) 104

H-9500 with 3 mm x 12 mm pixels:



Corrected for chromatic errors

Note:
In this prototype we did not have the DIRC wedge

- **One can see that with the chromatic correction the performance with 3mm x 12mm pixels is superB.**
- **If we adopt H-9500 with 3mm x 12mm pixels, we would have 64 pixels/tube.**

Present FDIRC predicted performance

Doug Roberts, SuperB workshop, Annecy, 2010

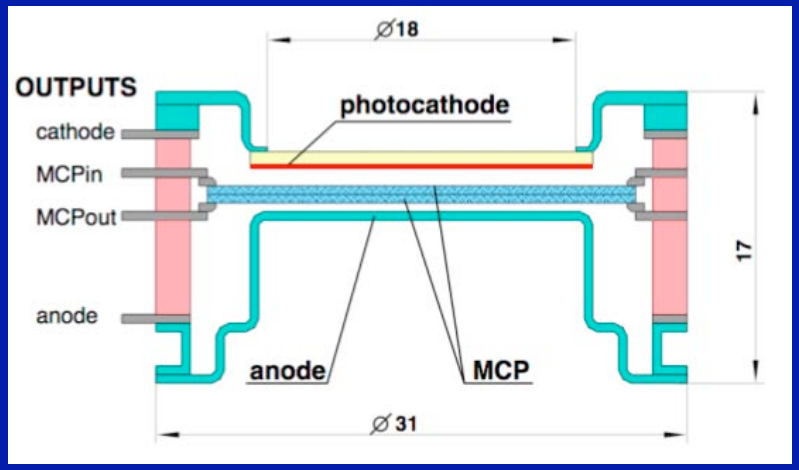
Table 1: FDIRC performance simulation by Geant 4 MC.

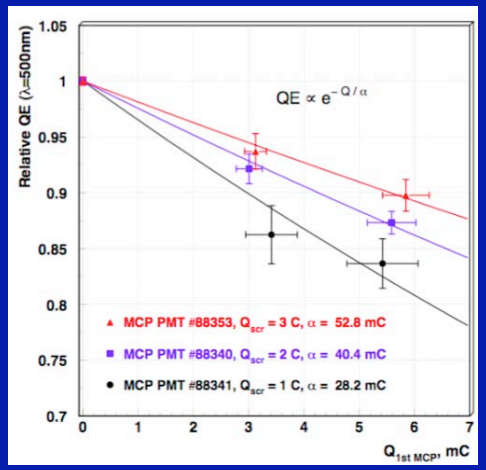
Design	Option	θ_c resolution [mrad]
1	FDIRC with 3 mm x 12 mm pixels with a micro-wedge	8.1
2	FDIRC with 3 mm x 12 mm pixels & no micro-wedge	8.8
3	FDIRC with 6 mm x 12 mm pixels with a micro-wedge	9.0
4	FDIRC with 6 mm x 12 mm pixels & no micro-wedge	9.6

- **The most conservative decision, which is a design #4, would give the same performance as the BaBar DIRC (~9.6 mrads for di-muons).**
- **However, one should point out that FDIRC will correct out the chromatic error by timing, which would reduce the error by 0.5-1 mrads.**
- **If we reduce the pixel size in y-direction by the charge sharing we gain. The question is how much, and is the improvement worth the effort ?**

QE aging of MCP tubes in Novosibirsk

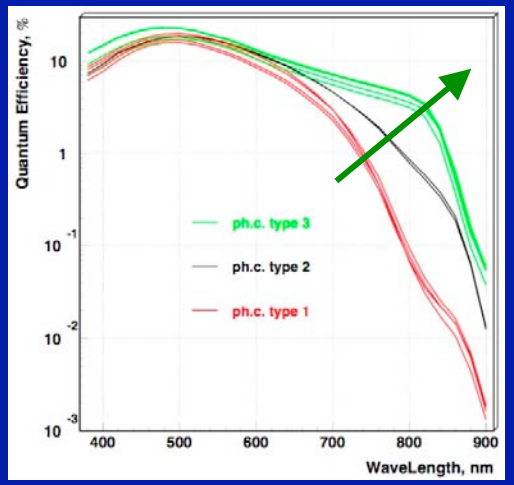
E. Kravchenko (reporting on work of A. Barnyakov: NDIP11, Lyon, 2011)

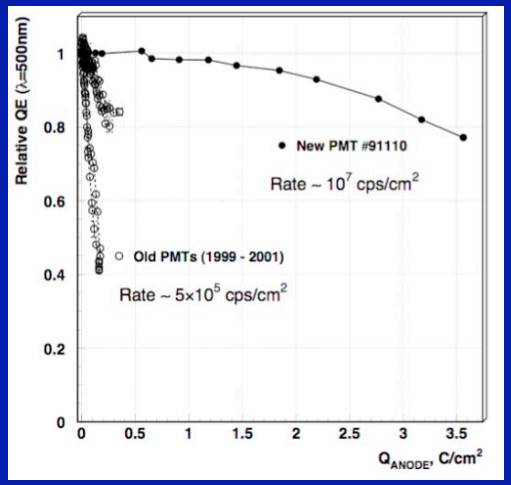




Better scrubbing:
3x better vacuum =>
2x slower QE aging

Photocathode coating:
Coat the multi-alkali photocathode with a Cs-based protective layer to improve QE in the red region, which then improves the aging overall





Final result:
Lifetime improved by an order of magnitude !!!

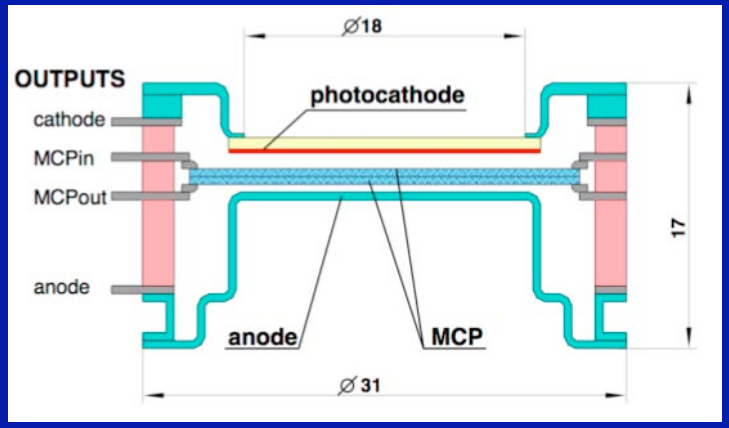
No foils

- **QE aging is caused by ion bombardment of the photocathode.**
- **Ion bombardment affects the red region of QE first.**

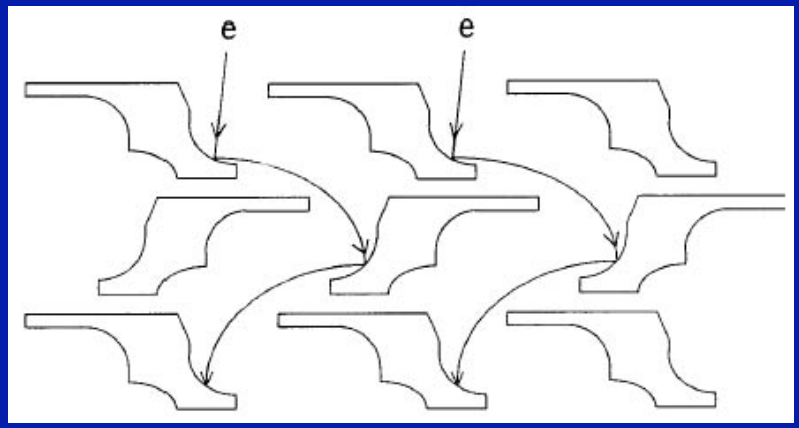
My comment to MCP vs. MaPMT aging

J. Va'vra

MCP's photocathode is directly opened to ions:



MaPMT's photocathode is shielded from ions:

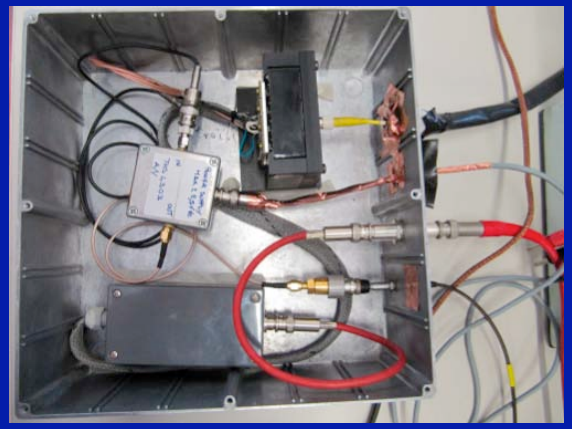


- **Hamamatsu took great care to design the dynode structure to prevent ions from hitting the photocathode. Every dynode shields ions, and there are 12 dynodes in the structure.**
- **MCP structure is vulnerable to this problem, and therefore one has to work hard to invent various tricks (foils, scrubbing, photocathode protection, etc.)**
- **I would expect that the MaPMT aging is similar to the classical PMT aging, such as what we have observed on tubes in DIRC.**
- **But it should be checked with H-8500, of course.**

Initial experience with PMT+electronics test setup in Padova

Gabriele Simi

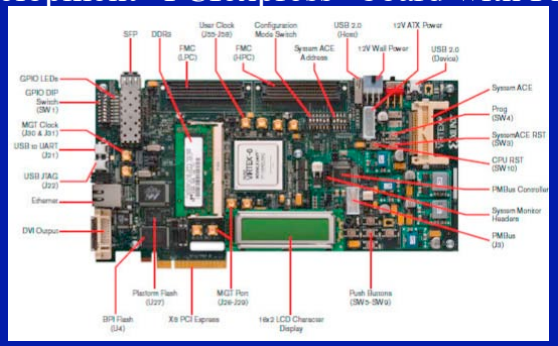
1. Present effort



- **Test setup with Burle MCP and H-8500**
- **CAEN waveform digitizer**

2. Future possibility

Development "PCIexpress" board with FPGA:



- **Xylinx ML605 with 8 optical links**
- **BLAB3 or French electronics.**

Conclusion

- **A clear progress on FDIRC prototype thanks to work of people in Padova, Bari and SLAC.**
- **BLAB3 electronics will be available in January 2012 (the 1-st unit for testing in the SLAC scanning setup in October, 2011).**
- **LAL electronics will be available in March 2012.**
- **We are not yet settled on the electronics communication protocol between PC & motherboard.**
- **Conclusion on the charge sharing with H-8500: it does not work, thus we cannot reduce the pixel size by the charge interpolation. If we want to reach the best test beam θ_c resolution results with the 1-st FDIRC prototype, we would have to go to 3mm x 12mm pixels of H-9500. Thinking….**
- **We have seen interesting MCP aging results from Novosibirsk.**
- **A new effort in Padova to understand H-8500 & MCP.**