PID summary

- Barrel PID
- Forward PID

J. Va'vra, SLAC

Barrel PID

FDIRC progress

(SLAC, Maryland, Hawaii, Orsay, Padova)

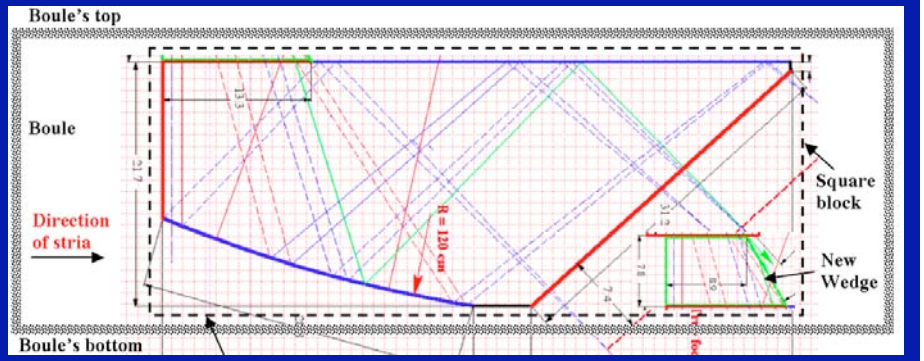
- **New FDIRC optics ordered.**
- **FDIRC mechanical design for the CRT test is in progress.**
- **Optical coupling of the new optics to bar box.**
- **Update on the final SuperB electronics.**
- **Time table for FDIRC tests in CRT**

FBLOCK for CRT test ordered

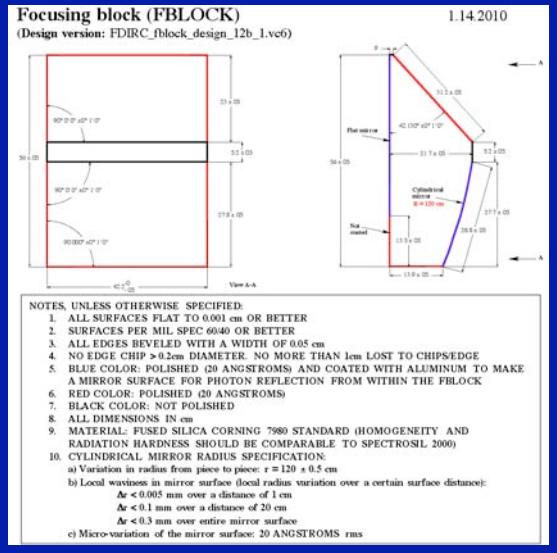
J. Va'vra

At the end we will have 3 FBLOCKs out of a single boule like this:

Orientation of FBLOCKs within the boule:



- **The raw material has been ordered. The expected delivery in middle of November.**



Focusing block (FBLOCK) 1.14.2010

(Design version: FDIRC_fblock_design_12b_1.ve6)

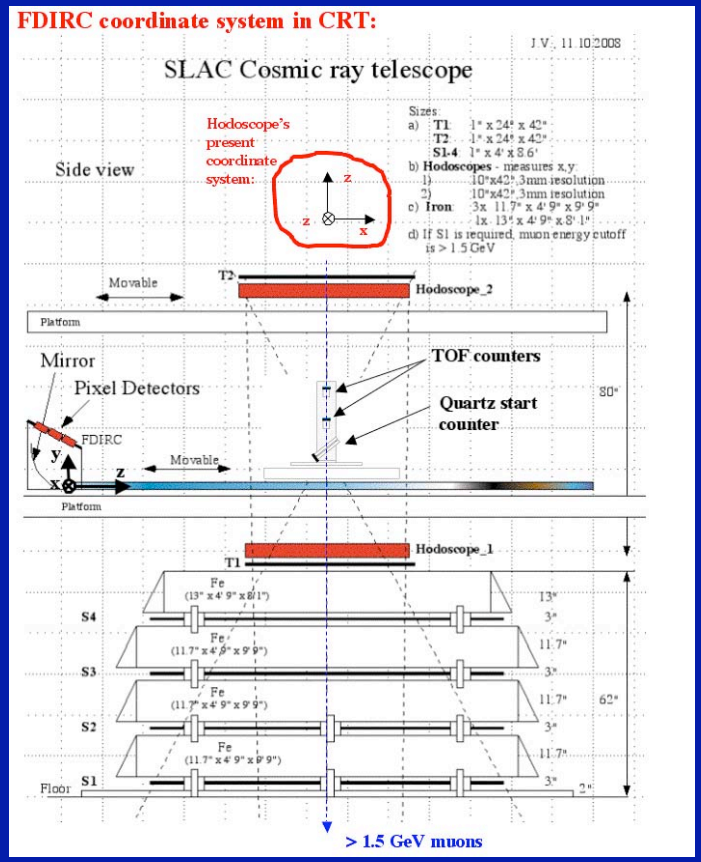
NOTES, UNLESS OTHERWISE SPECIFIED:

1. ALL SURFACES FLAT TO 0.001 cm OR BETTER
2. SURFACES PER MIL SPEC 60/40 OR BETTER
3. ALL EDGES BEVELED WITH A WIDTH OF 0.05 cm
4. NO EDGE CHIP > 0.2cm DIAMETER. NO MORE THAN 1cm LOST TO CHIPS/EDGE
5. BLUE COLOR: POLISHED (20 ANGSTROMS) AND COATED WITH ALUMINUM TO MAKE A MIRROR SURFACE FOR PHOTON REFLECTION FROM WITHIN THE FBLOCK
6. RED COLOR: POLISHED (20 ANGSTROMS)
7. BLACK COLOR: NOT POLISHED
8. ALL DIMENSIONS IN cm
9. MATERIAL: FUSED SILICA CORNING 7980 STANDARD (HOMOGENEITY AND RADIATION HARDNESS SHOULD BE COMPARABLE TO SPECTROSIL 2000)
10. CYLINDRICAL MIRROR RADIUS SPECIFICATION:
    a) Variation in radius from piece to piece: r = 120 ± 0.5 cm
    b) Local waviness in mirror surface (local radius variation over a certain surface distance):
       Δr < 0.005 mm over a distance of 1 cm
       Δr < 0.1 mm over a distance of 20 cm
       Δr < 0.3 mm over entire mirror surface
    c) Micro-variation of the mirror surface: 20 ANGSTROMS rms

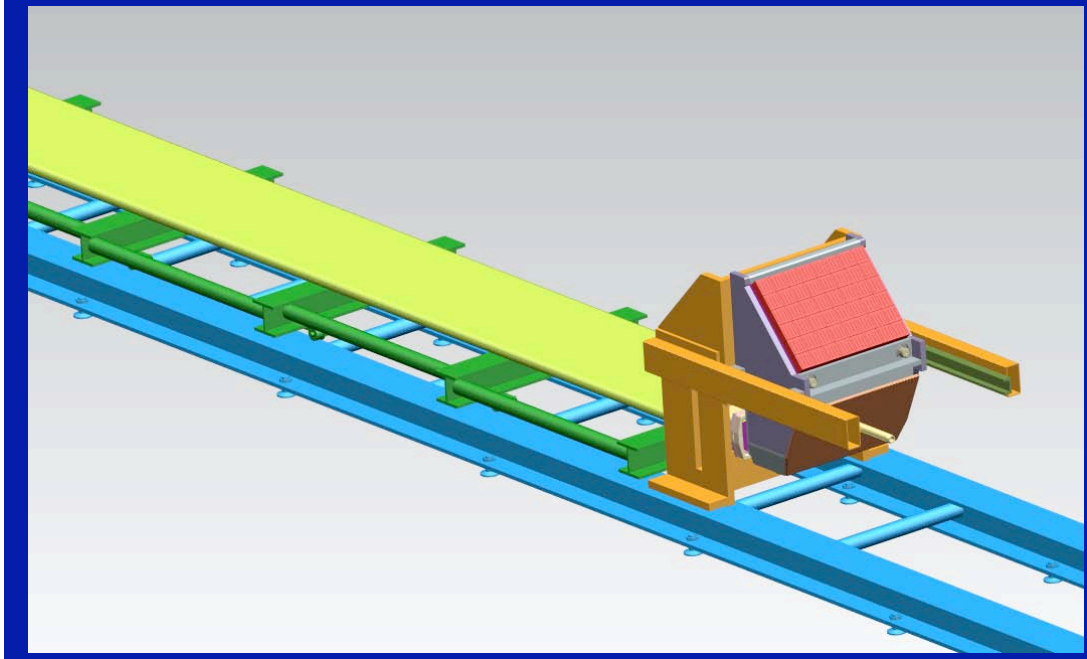
- **Bids to machine and polish the FBLOCK launched. 6 companies are involved in bidding.**
- **Expected delivery: Feb. 2011**

Mechanics for the FDIRC in CRT

M. Benettoni with input from J. Va'vra



Massimo's FBLOCK support concept in CRT:

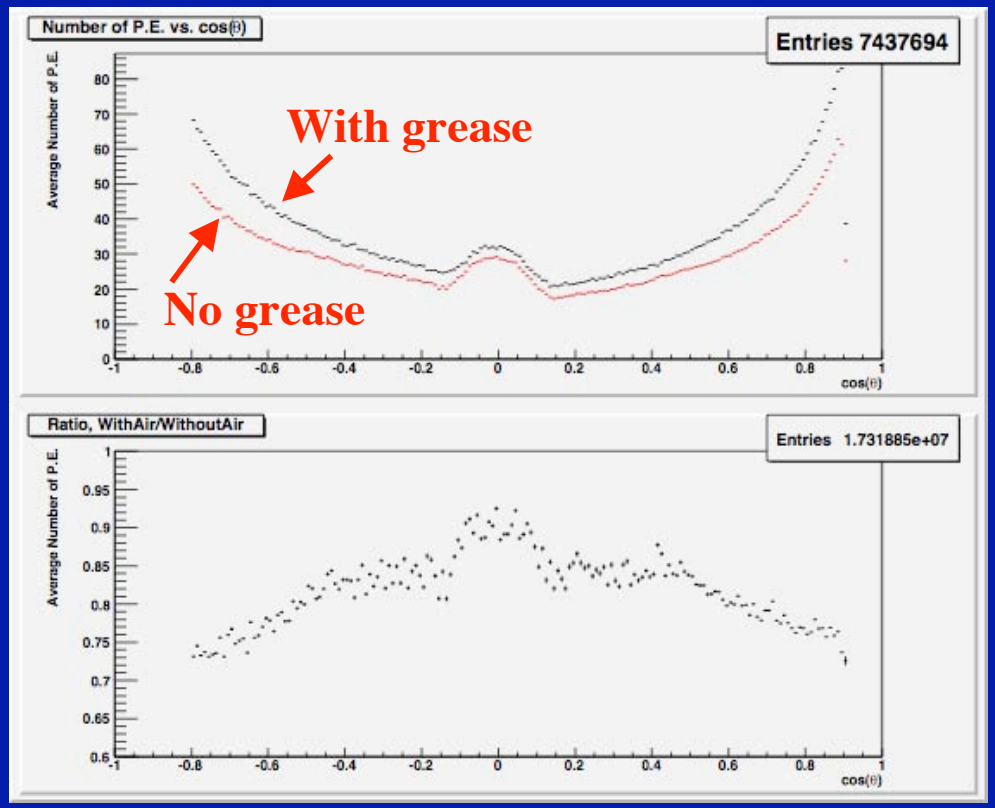


- **The design process for CRT setup has started.**
- **A number of details still to be solved in detail: (a) RTV coupling between FBLOCK and bar box, (b) removal of PMTs (if we grease), (c) size of motherboard, (d) laser calibration, (e) gas sealing, (f) material choice, (g) electronics cooling, etc.**
- **Will use initially the BLAB3 digitizer.**

Optical coupling: grease vs. air

D. Roberts

MC simulation:



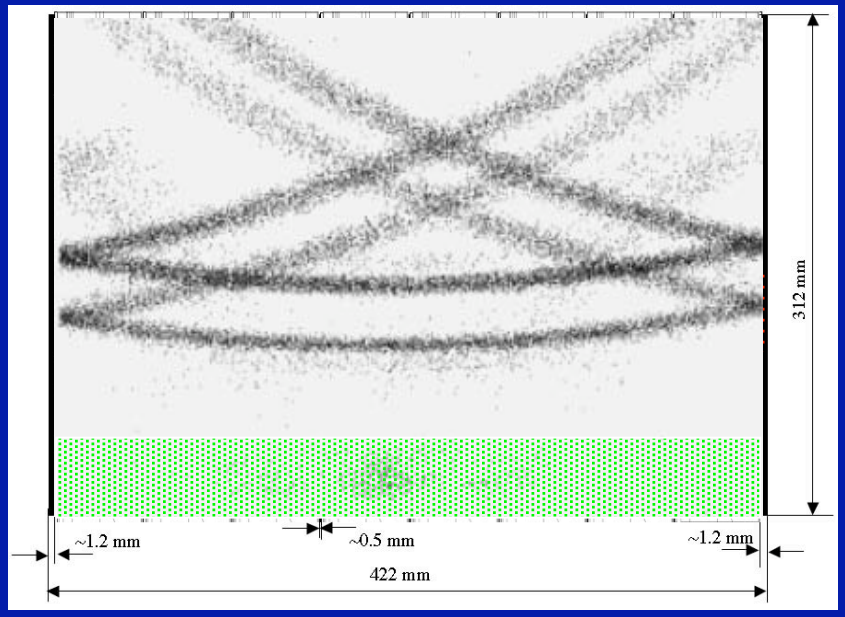
- **Loss of photoelectrons: 8-25% as one goes from the center to the wing.**
- **On the other hand, photons near the Cherenkov wing have worse angular resolution. Should really compare θ_c resolutions for 2 cases.**

Electronics coupling to FBLOCK in CRT

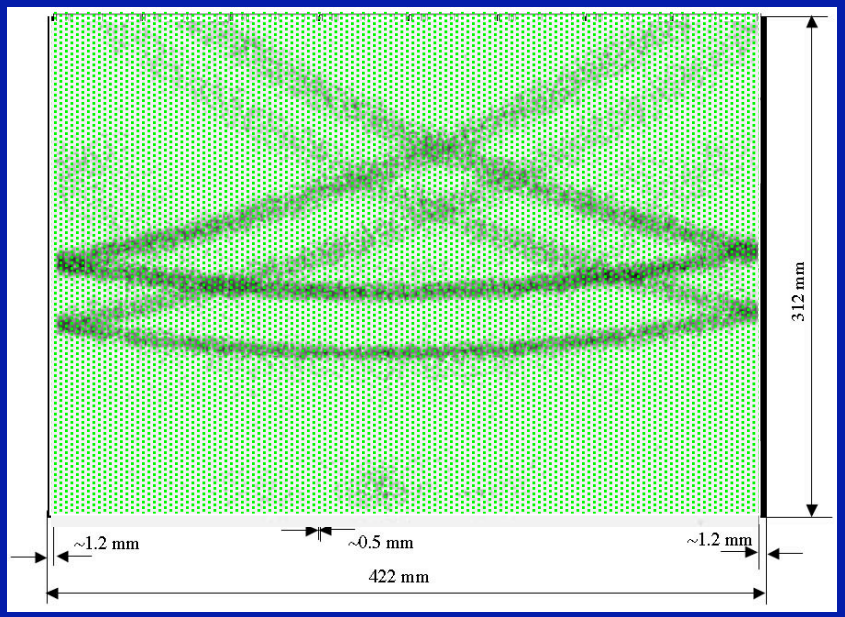
Christophe Beigdeger, Massimo Benettoni and J. Va'vra

Detector plane:

(a)



(b)



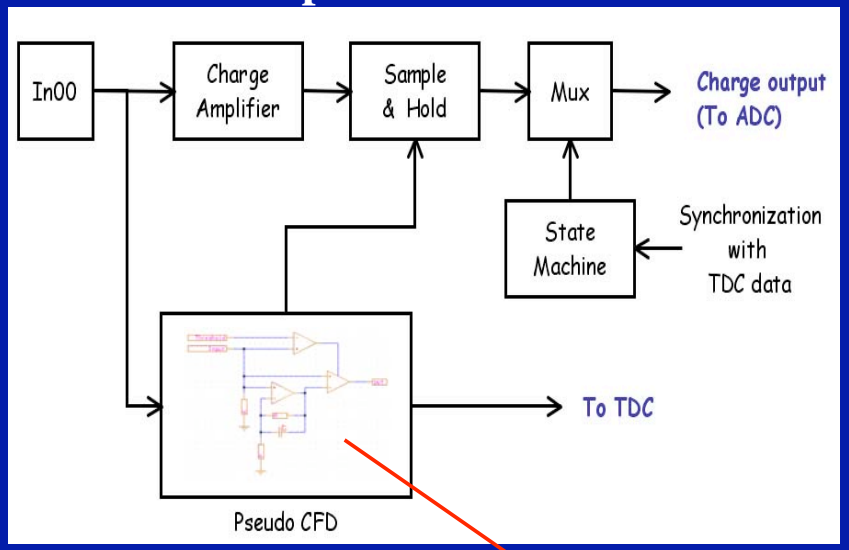
- **Two motherboard options were discussed:**
  - (a) Small one for 8 detectors, or (b) Large one for 48 detectors.
- **Detectors are plugged into the motherboard first. The board provides the alignment.**
- **From a maintenance point of view, it seems to me, that it is difficult to apply the grease or RTV optical coupling between the detectors and FBLOCK. <u>Need testing.</u>**

Ring: $\theta_{dip}=88^{o}$, $\phi=90^{o}$
(Doug Roberts)

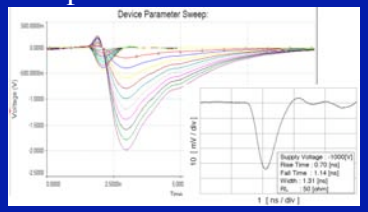
Barrel electronics: front-end chip & TDC

Herve Lebbolo & V. Tocut, and Christophe Beigbeder, LAL

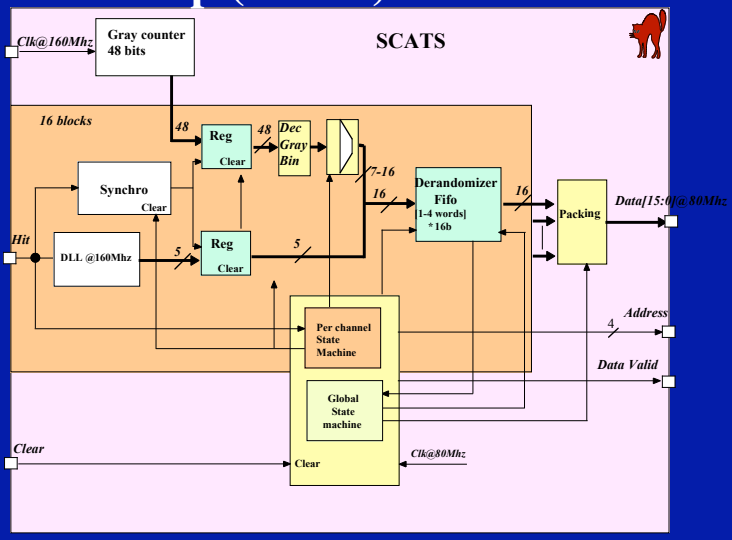
Front-end chip:



Spice simulation:



TDC chip (SCAT):



- **Time measurement:**
  - σ ~100ps resolution / photon
  - 1 MHz max background rate / pixel
  - 50ns double pulse resolution min
- **ADC measurement**
  - 8-10 bit (?)
  - allows PMT monitoring & improves the θ_c resolution by doing the charge sharing between pixels; needs calibration.

- **TDC parameters:**
  - resolution: 70ps/count
  - linearity:
  - dead time at the input: 50ns
  - maximum rate (all chan. fired): 5MHz/channel
  - maximum rate (1 chan. fired): 20MHz/channel
  - trigger latency: 4μs

FDIRC R&D schedule

- **Raw quartz finished:** **Nov. 17, 2010**
- **FBLOCK optics finished:** **Feb. 15, 2011**
- **Mechanical & optical tests with FBLOCK:** **Feb.-March 2011**
- **Glue tests:** **Jan.-Feb., 2011**
- **Mechanical support:** **Feb.-March, 2011**
- **Decision on the detector coupling to quartz:** **March 2011**
- **Detectors installation:** **May, 2011**
- **Final detector motherboard:** **March 2011**
- **Electronics installation:** **May-June, 2011**
- **Laser calibration:** **May 2011**
- **Common DAQ system:** **March-May, 2011**
- **Start running in CRT:** **Summer 2011**

Forward PID

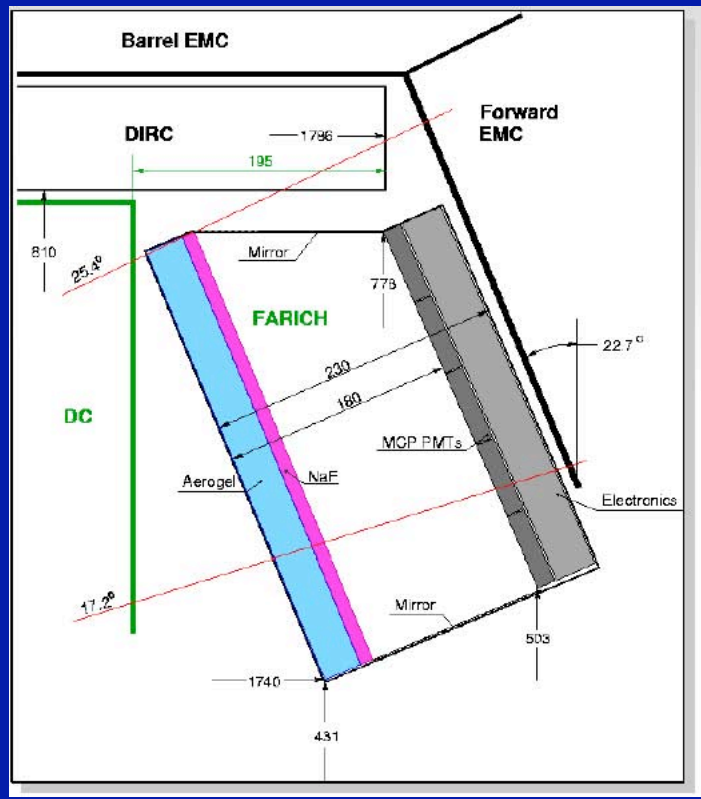
Forward PID progress

(LAL, Novosibirsk, SLAC)

- **FARICH.**
- **Low cost pixilated TOF.**
- **DIRC-like TOF.**

FARICH for SuperB

Alexei Kononov



- Expansion gap ~180 mm
- 312 Photonis XP85012 MCP PMTs
- 3-layer focusing aerogel n_{max} =1.07, 40mm thickness
- NaF 5mm thickness

Material budget (X/X_0)

Aerogel	4%
NaF	4%
MCP PMT	10%
Support, electronics, etc	8%
Total	**26%**

- **Monte Carlo: π/K better than 8σ for momenta 0.6 - 4 GeV/c.**
- **Would like to use the same electronics as Barrel DIRC.**
- **Test beam is in preparation at Budker Inst.**
- **Presently testing SiPMTs detectors.**

Simple pixilated TOF counter with σ ~ 100ps

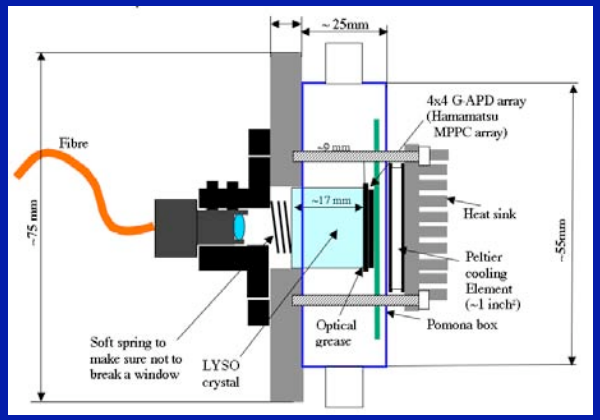
(G-APD ≡ SiPMT)

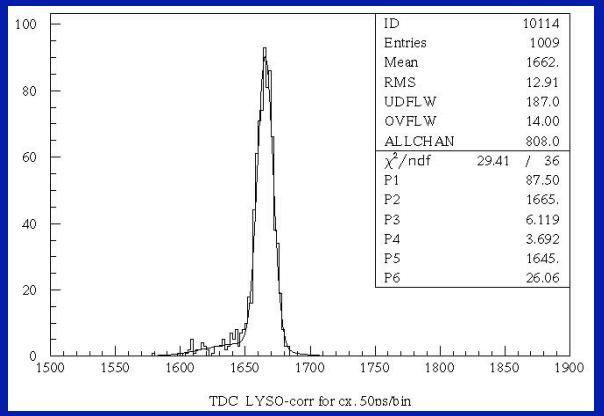
Jerry Va'vra

- 1.7cm-long **LYSO + MCP-PMT**: **σ < 103 ps**
- 1cm-long **Quartz + G-APD** (4x4 array @-70.9V): **σ < 164 ps**
- 1.7cm-long **LYSO + G-APD** (4x4 array @-70.9V): **σ < 132 ps**
- 1"-long **Scintillator + G-APD** (4x4 array @-70.9V): **σ < 134 ps**
- 1"-long **Scintillator + mesh-PMT**: **σ < 214 ps**

Preliminary

LYSO + G-APD (4x4 array): $\sigma \sim \sqrt{\sigma^2_{LYSO} - \sigma^2_{Start}} < \sqrt{(152^2 - 76^2)} < 132$ ps



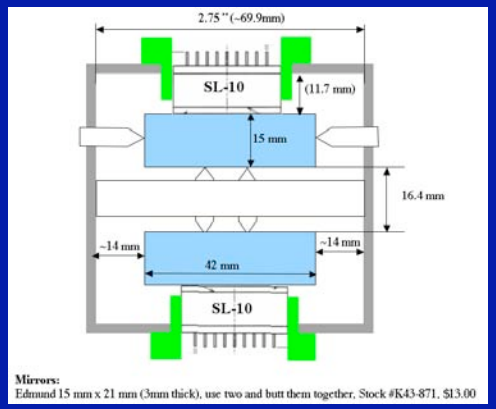


- **To obtain these results one has to use CRT 3D tracking, ADC corrections, E > 1.5 GeV**
- **Can we just glue G-APD array to LYSO crystals from front and be done with TOF ?**

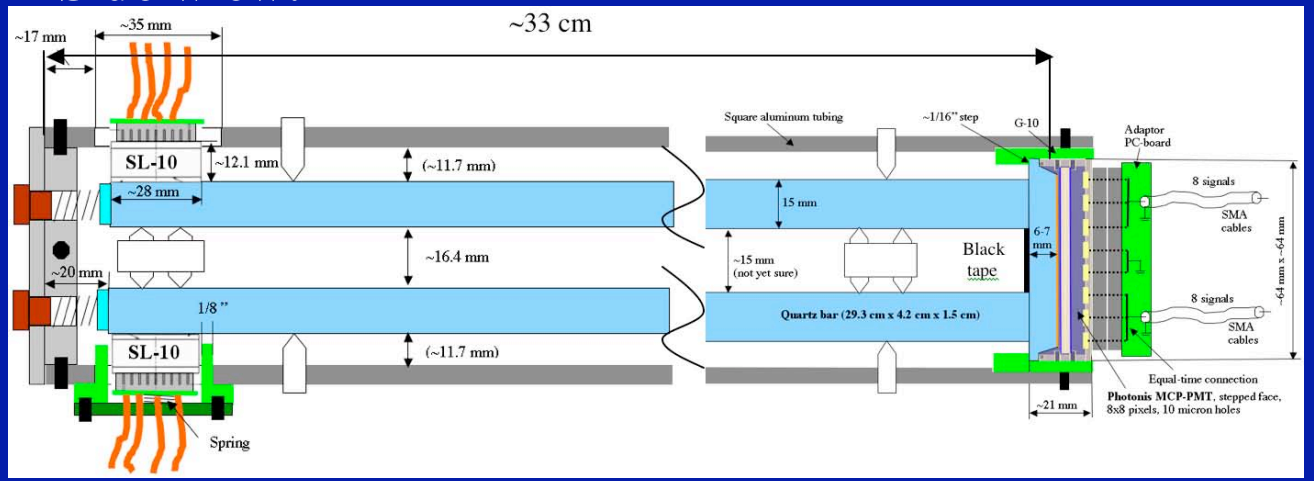
DIRC-like TOF counter design

Jerry Va'vra (detector design), Matt McCulloch (making parts)

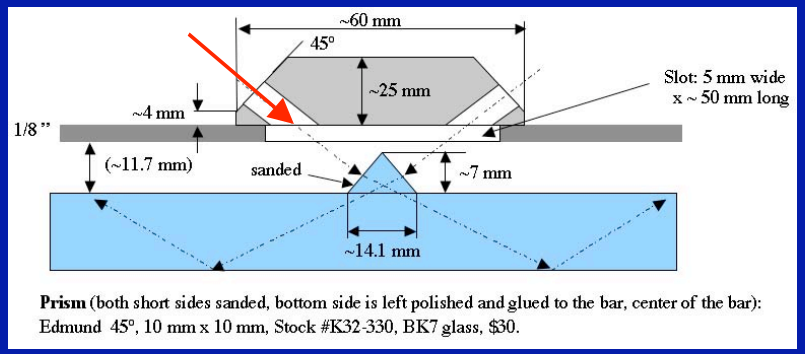
Front view:



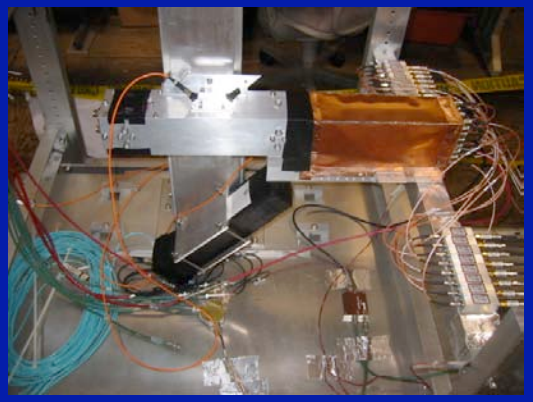
Side wiew:



Laser entry:



Setup in CRT:

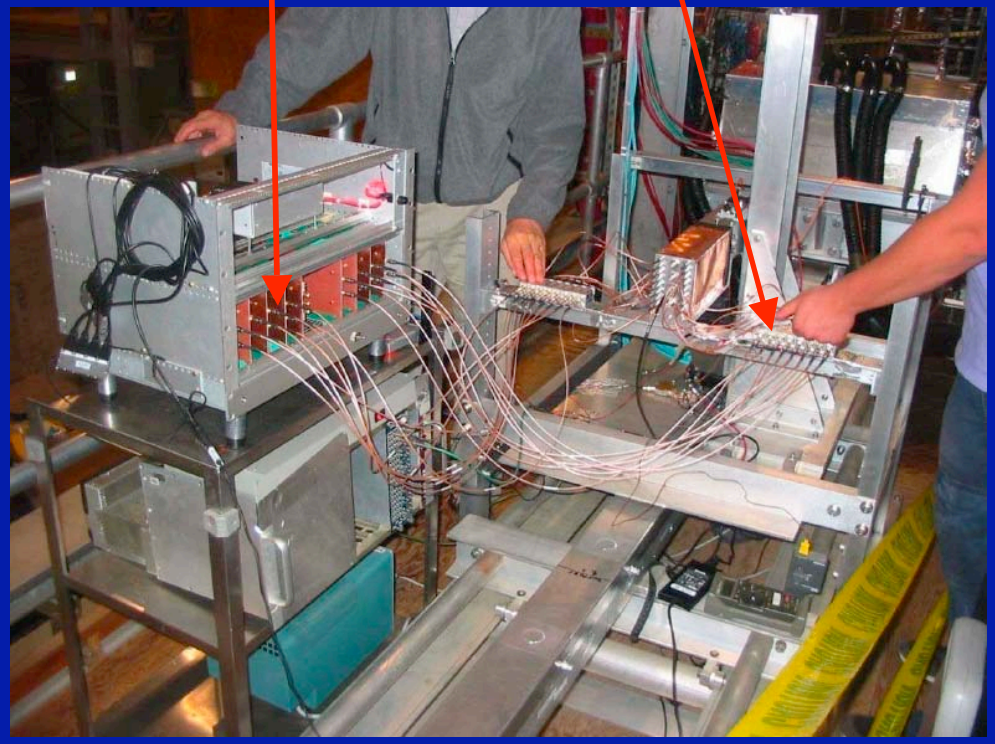


- **One end is instrumented with a Photonis stepped-face MCP-PMT. The other end with HPK SL-10 would come later. That end has mirrors.**

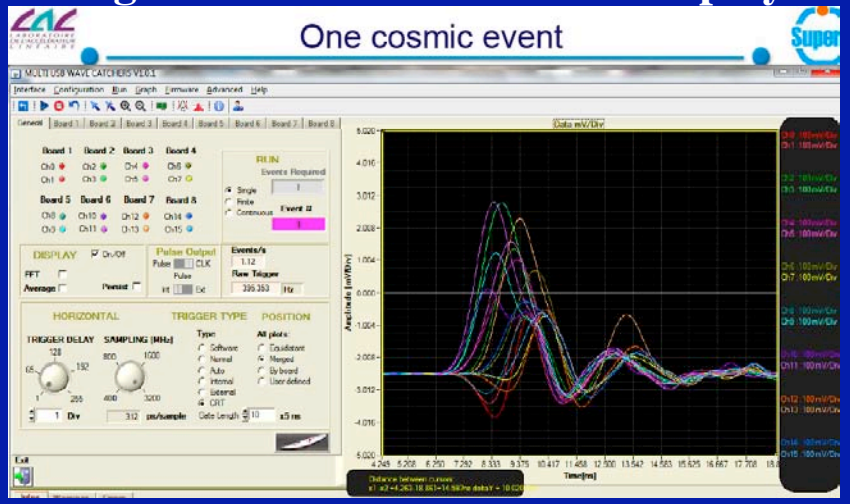
DIRC-like TOF counter electronics

Dominique Breton & Jihane Di Bello (electronics & software)

WaveCatcher electronics **Miteg 1GHz BW amp.**



A single muon event in on-line display:

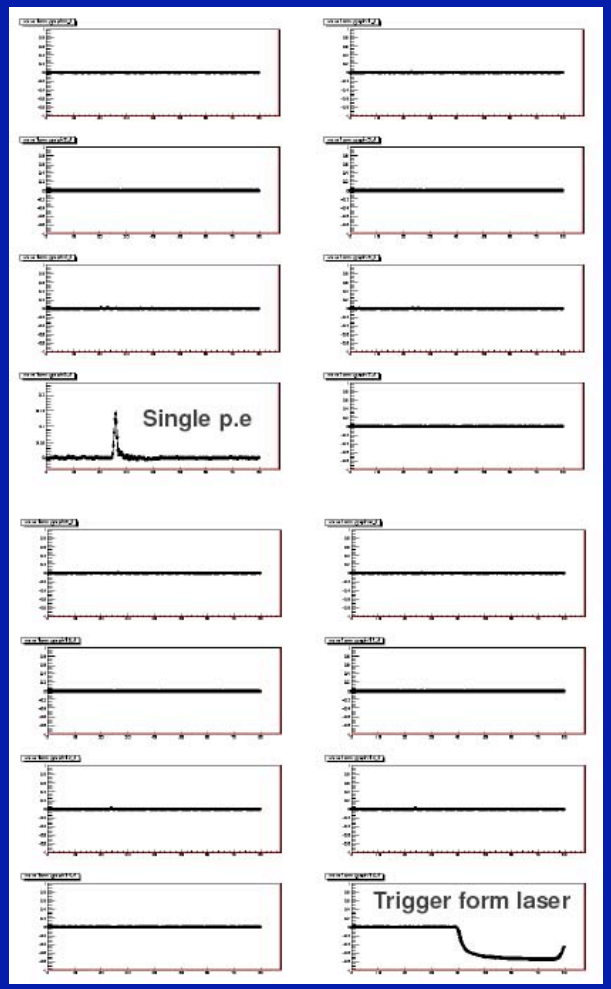


- **16 channels of WaveCatcher waveform digitizing electronics.**
- **Electronics and on-line software works very well.**
- **To reduce the MCP pad-to-pad cross-talk use 530MHz BW low pass filters.**

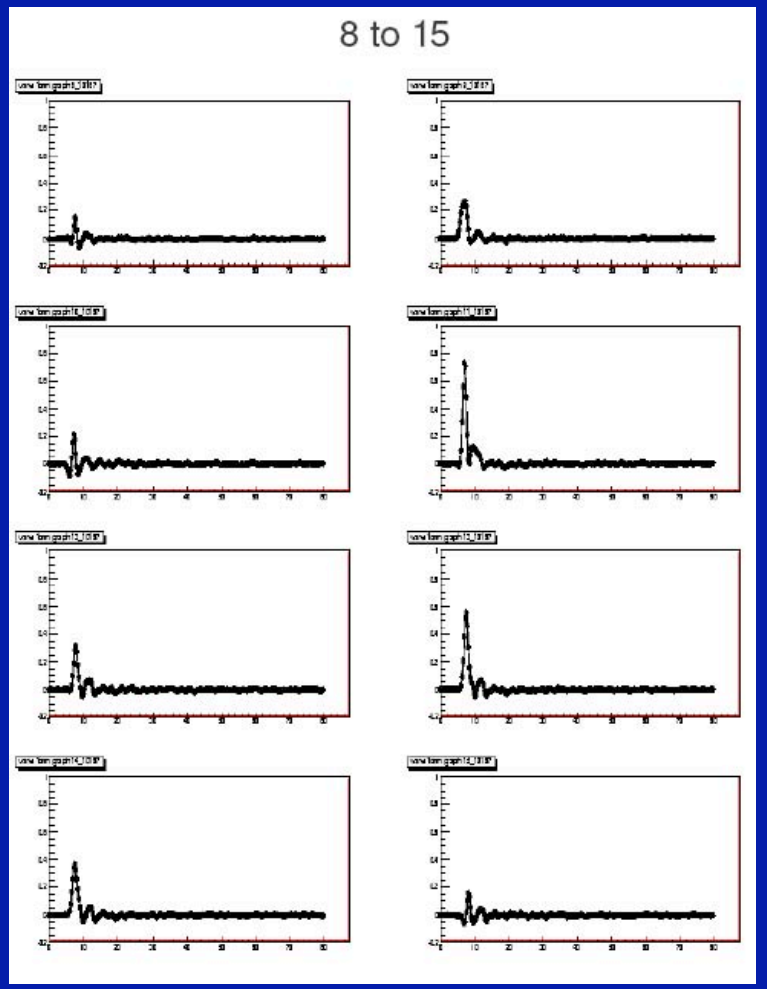
DIRC-like TOF data analysis

Leonid Burmistrov

Laser event:



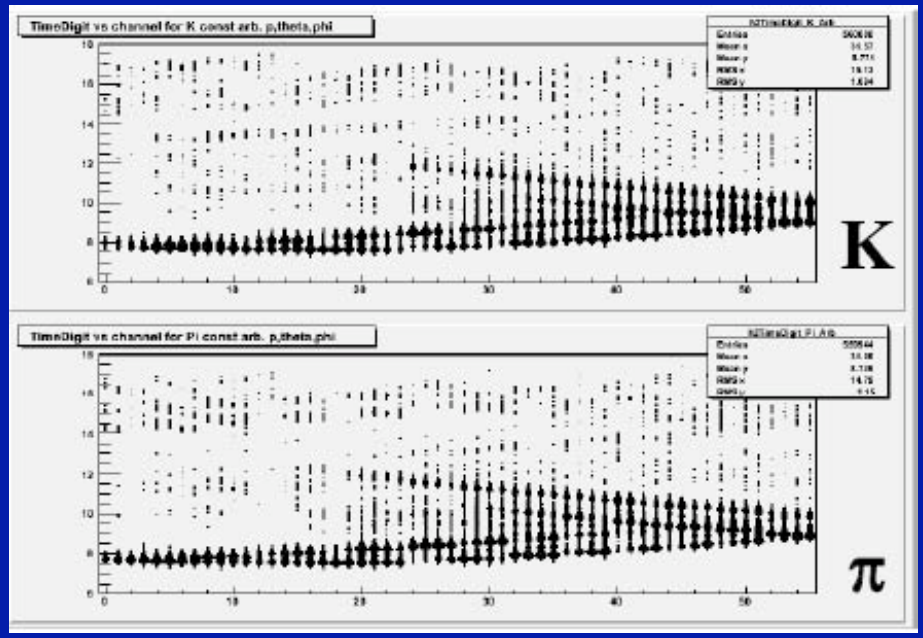
Muon event:



- **Ready for analysis with CRT tracking.**

DIRC-like TOF reconstruction analysis

Nicolas Arnaud



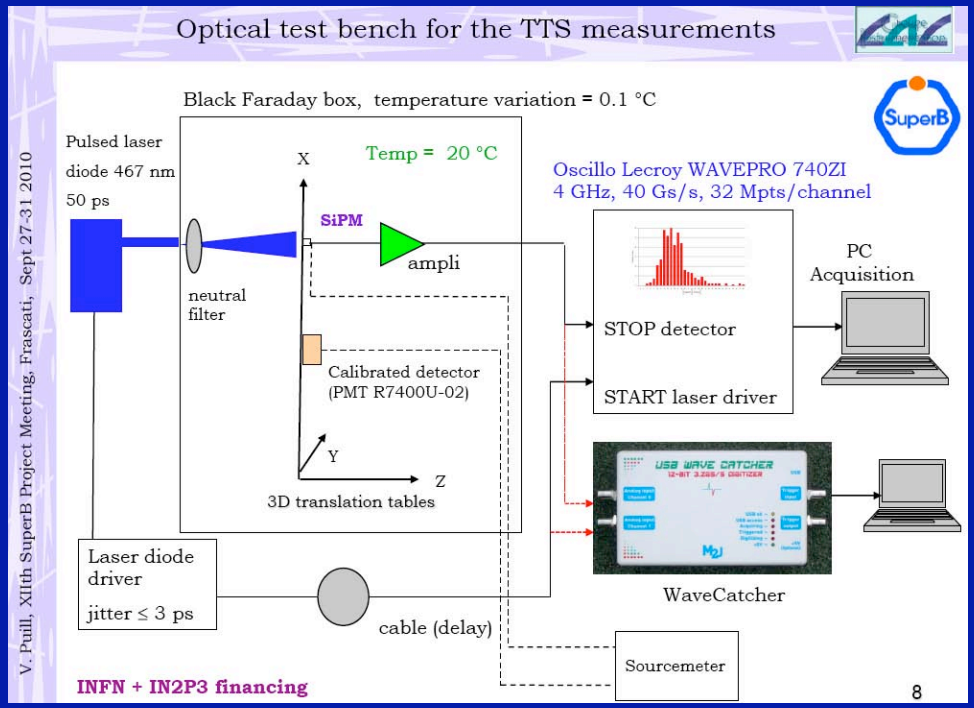
- **The data are represented in the "x-time" plane.**
- **For each track one can create a prediction of pattern for π and K's.**
- **One can then form a likelihood L_π and L_K for a given track.**
- **The software seems to be working.**

Test bench setup at LAL

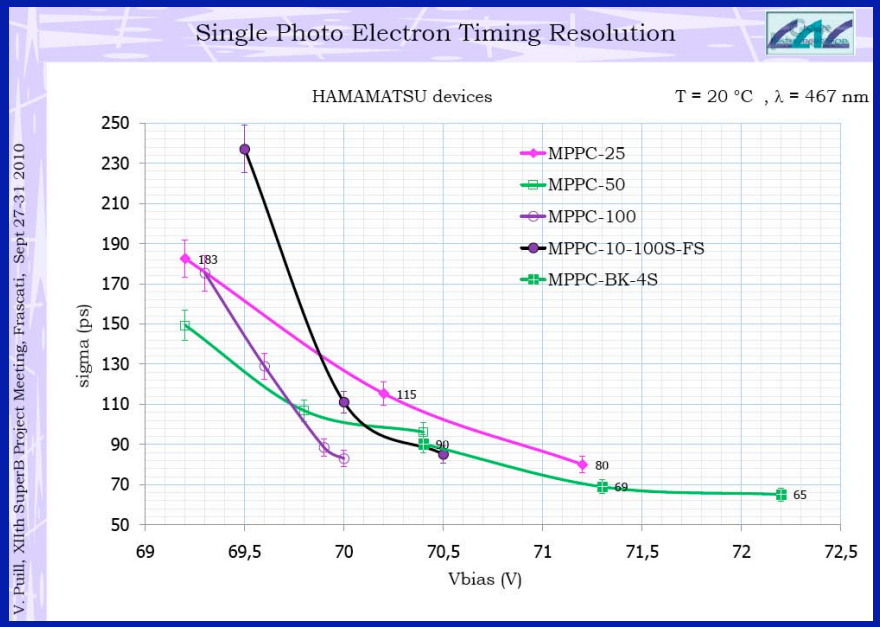
(G-APD ≡ SiPMT)

Veronique Puill

Test setup to test photon detectors:



TTS resolution = f(V_{bias}):



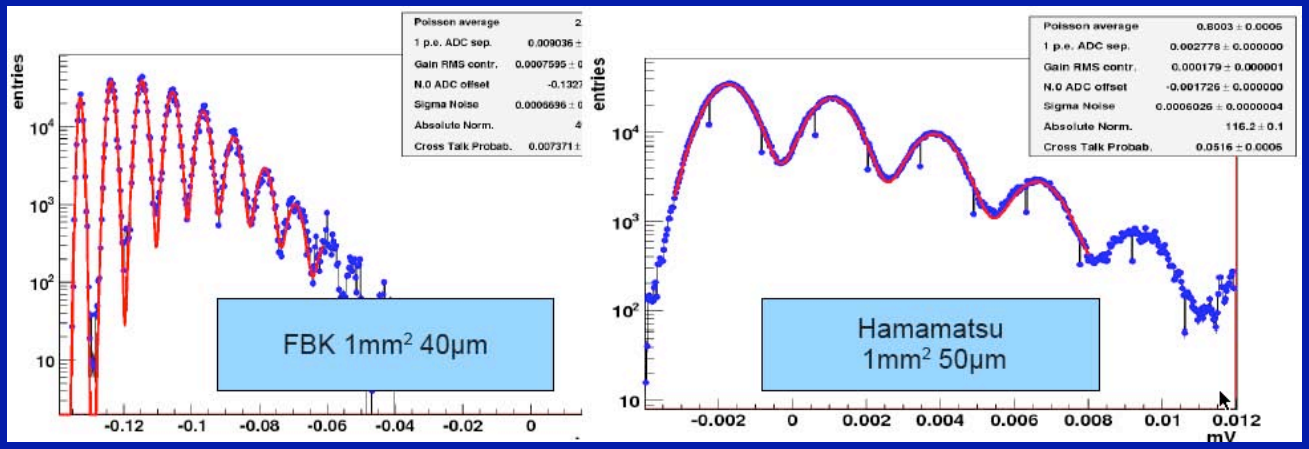
- **Created a temperature-controlled setup to test SiPMT detectors.**
- **Created the optical test setup to test photon detectors.**
- **Measured the TTS timing resolution of several SiPMT devices.**

SiPMT gain and aging tests

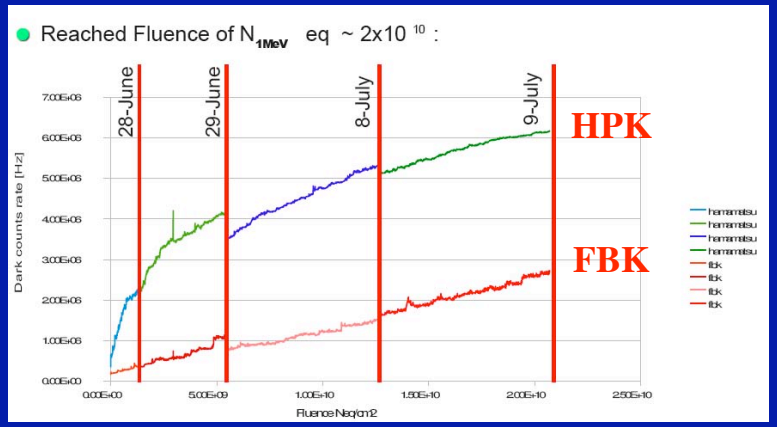
(G-APD ≡ SiPMT)

Enrico Feltresi

Gain study:



Dark noise increase after a neutron damage:



- **Gain parameterization of HPK, FBK SiPMTs.**
- **Performed radiation damage tests with neutrons at T = 20°C.**
- **Developed a low cost PS for SiPMTs (76V max, 4mA, operates from 2.7-11V, small chip 4mm²).**