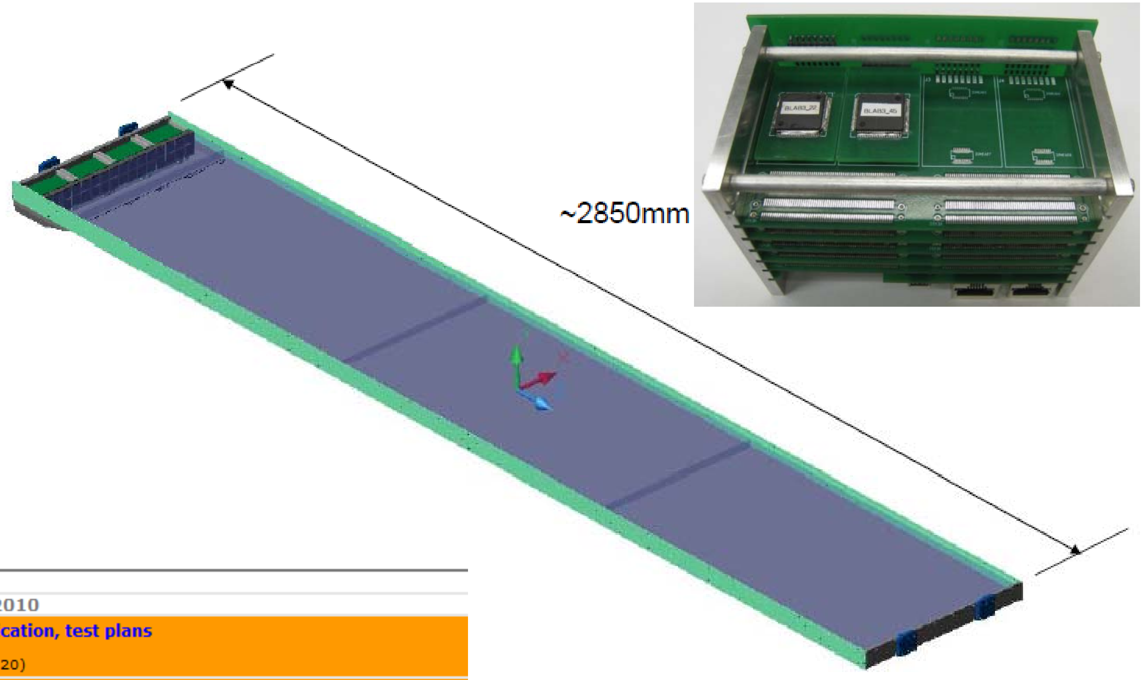
Barrel PID Summary

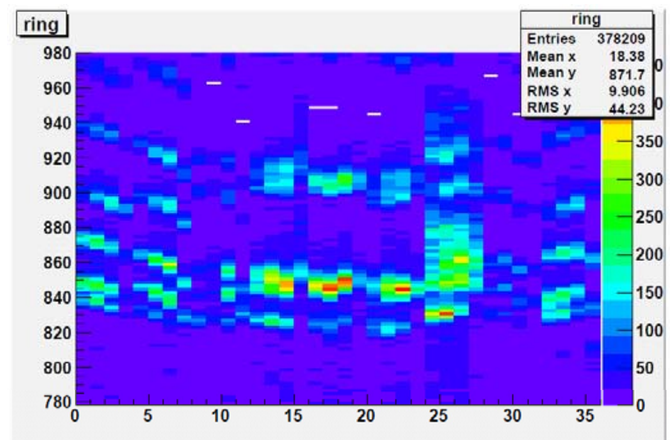
- Hard to summarize



Contribution List | Time Table

Friday, 19 November 2010

09:00	[127] Update on Zygo prototype fabrication, test plans by Alan SCHWARTZ (Seminar Hall: 09:00 - 09:20)
	[128] Electronics update [Hawaii] by K. NISHIMURA (University of Hawaii) (Seminar Hall: 09:20 - 09:40)
	[129] Mechanics update [Hawaii] by Marc ROSEN (University of Hawaii) (Seminar Hall: 09:40 - 10:00)
10:00	[130] New FDIRC development, experience from BaBar DIRC, FDIRC prototype, and extrapolations for SuperB/Belle-II by J. VAVRA (SLAC) (Seminar Hall: 10:00 - 10:45)
	[131] Discussion: Background, Rates, and Issues (Seminar Hall: 10:45 - 11:00)
11:00	[132] Update on Quartz radiator thickness by T. MORI (Nagoya) (Seminar Hall: 11:00 - 11:30)
	[133] Beam Test quick Results and status of MCP-PMT by K. INAMI (Nagoya) (Seminar Hall: 11:30 - 12:00)
12:00	[134] Update on full G4 simulation by Marko PETRIC (Ljubljana) (Seminar Hall: 12:00 - 12:15)
	[135] Reconstruction update by Marko STARIC (Ljubljana) (Seminar Hall: 12:15 - 12:30)



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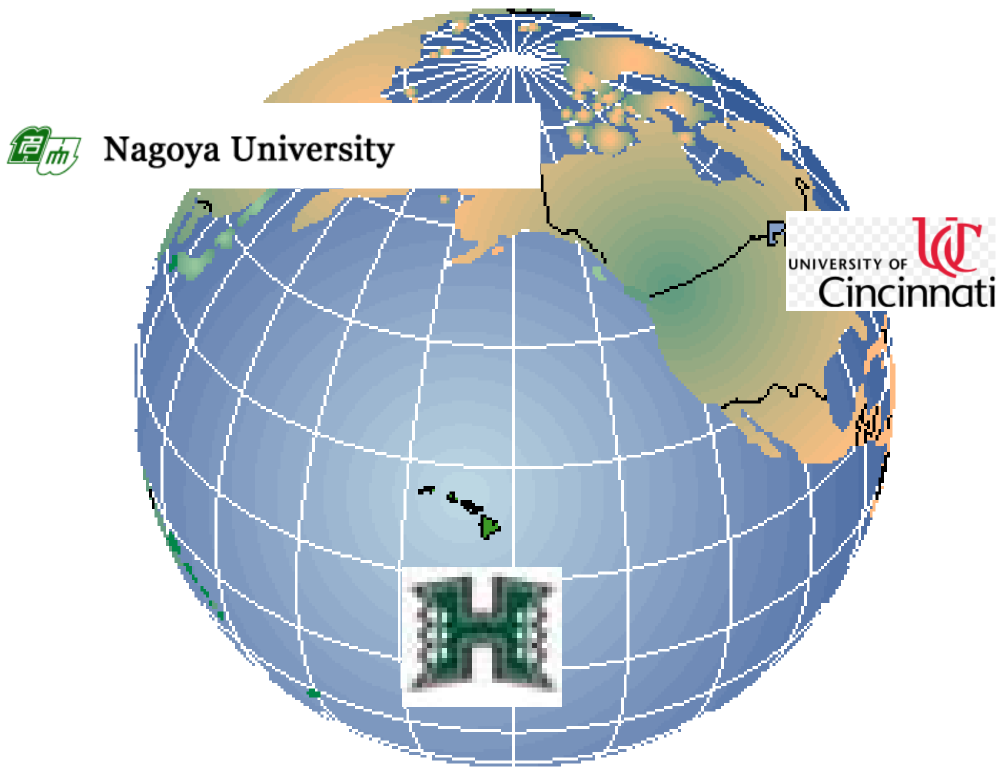
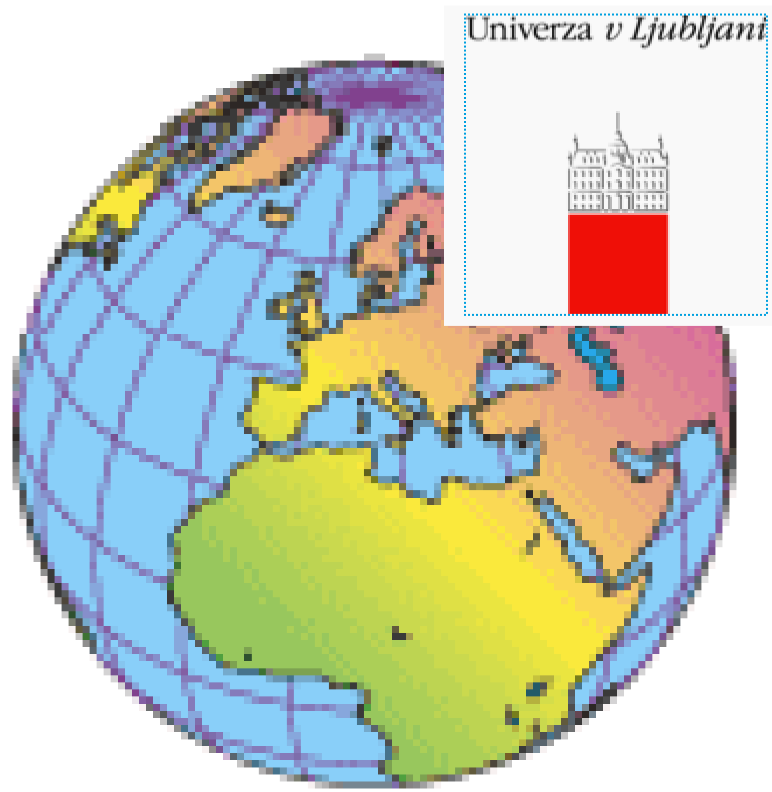
2 comments:

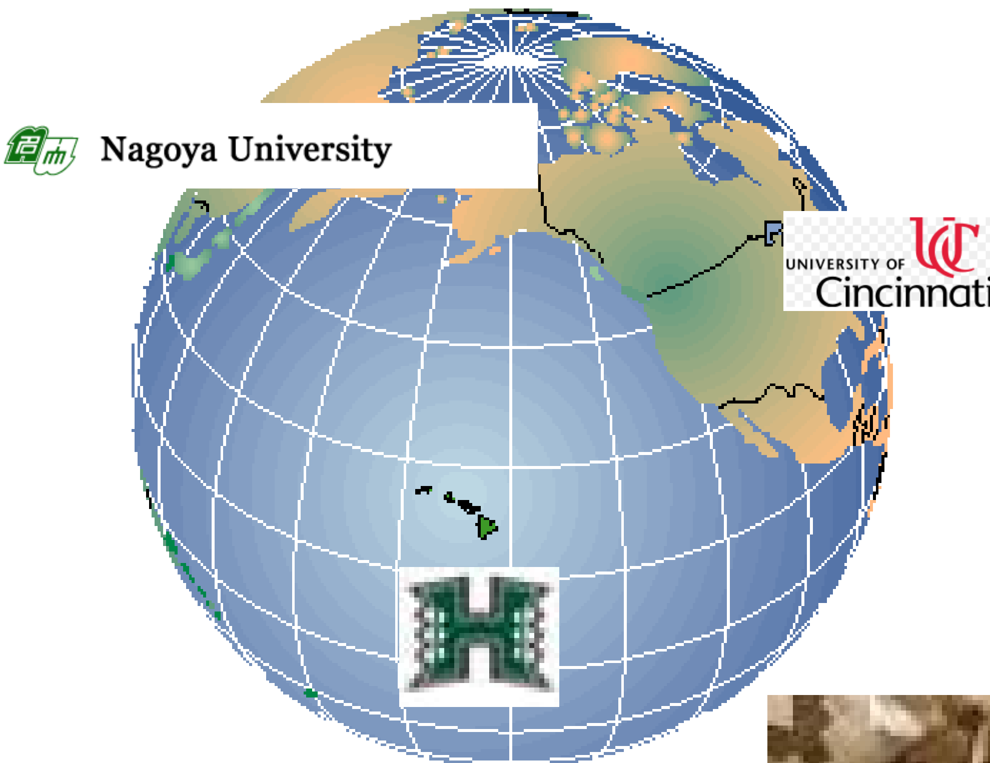
- Too busy as usual
- Special presentation today

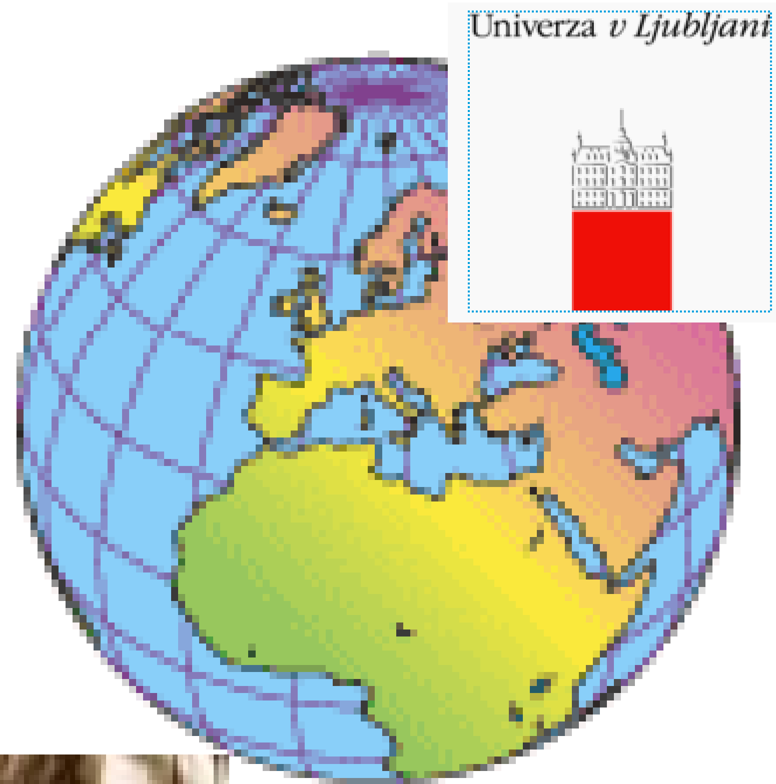
- The sun never sets…





- It’s always the middle of the night somewhere….





- For real discussion…

PID special meeting at Hawaii

from **Friday 03 September 2010 (09:00)**
to **Saturday 04 September 2010 (20:00)**
Pacific/Honolulu

Friday 03 September 2010 | Saturday 04 September 2010 |

Friday 03 September 2010

top

09:00	Introduction and Welcome (05') (Slides)	G. Varner (Hawaii)

09:05->*12:05* B-PID General items

09:05	Quartz bar thickness (15') (Slides)	K. Inami (Nagoya)
09:20	Quartz vendor updates (20') (Slides)	A. Schwartz (Cincinnati)
09:40	TOP software status (20') (Slides)	Marko Petric (*Ljubljana*)
10:00	break (15')	
10:15	Beam test availability at J-PARC (15') (Slides)	K. Inami (Nagoya)
10:30	Beam test availability at CERN (15') (Slides)	P. Krizan (Ljubljana)
10:45	Beam test system overview and readiness (15') (Slides)	
11:00	Discussion on beam test readiness (1h00')	

13:30->*17:00* B-PID Details of beam test preparations

And can summarize some of this today

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2 comments:

- Too busy as usual
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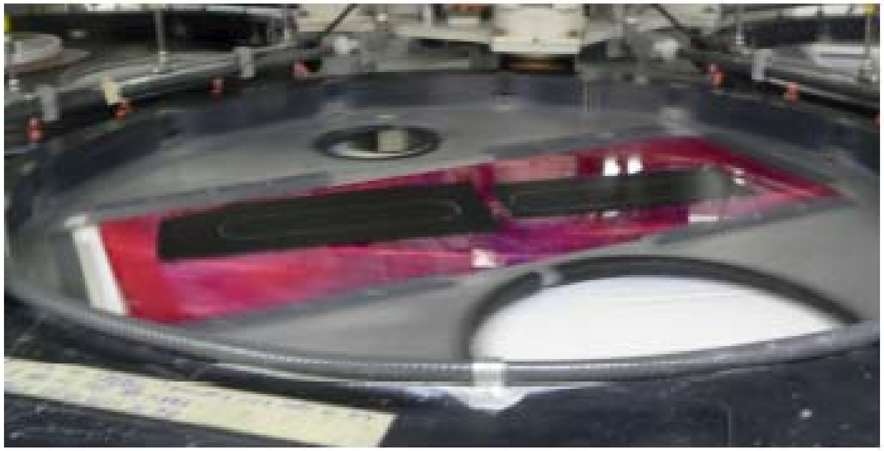
Zygo Quartz prototype

First Zygo bar

- In April 2010 we ordered one bar of dimensions 20 x 45 x 120 cm^3. Material is Corning 7980.
- Polishing the six sides requires three different polishing setups. The 20x45 cm^2 bar ends are especially challenging.
- Current status: all required tooling/jigging has been fabricated, setup, and tested. Have prepared and polished a test part "with great results." Our bar has been machined, ground, and the two large faces polished to spec. They are now setting up to begin polishing the two 1200x20 cm^2 edges. No problems have occurred thus far, and they are on schedule for a "late January" delivery.

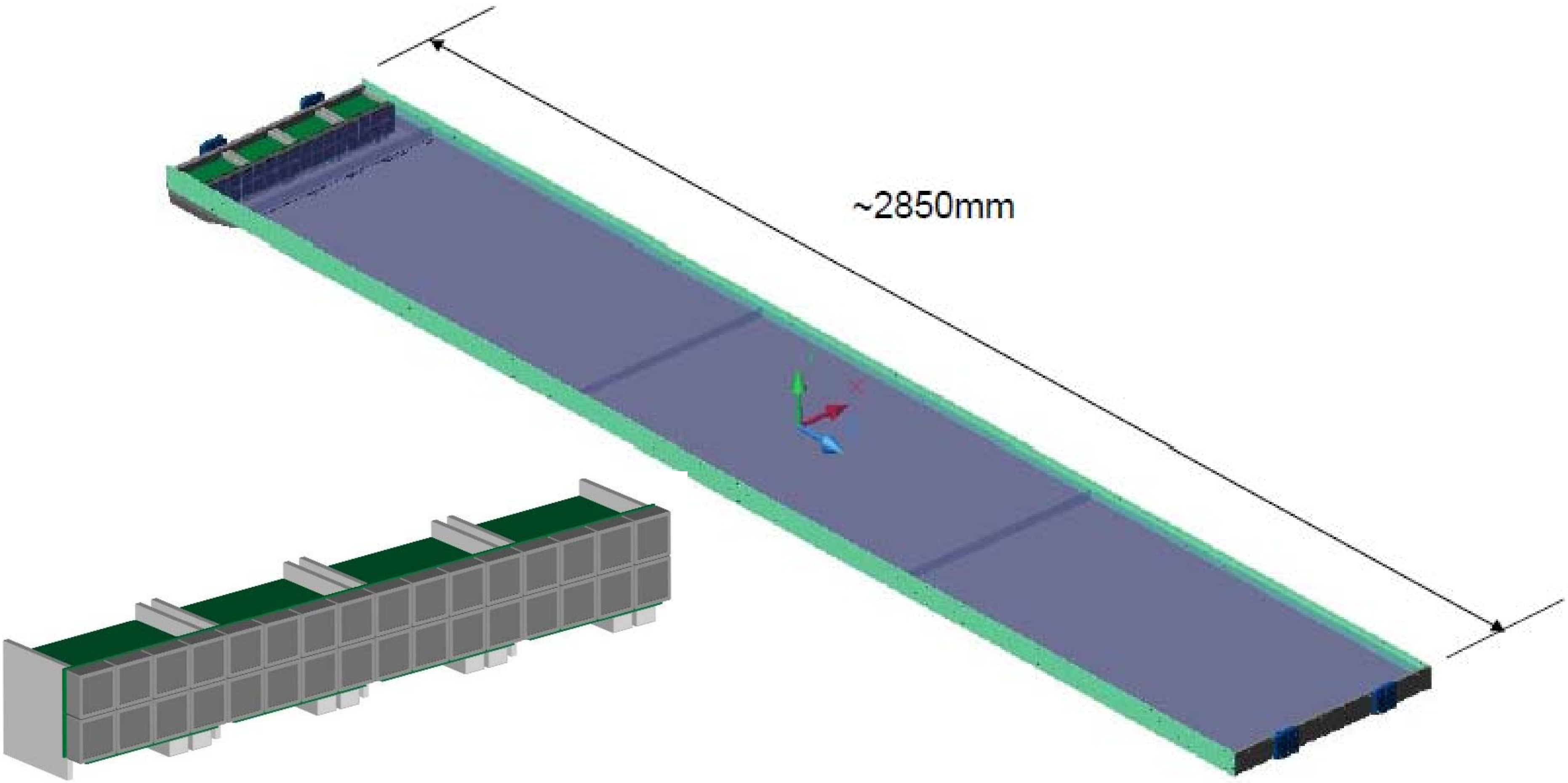
Our bar on the large polisher:



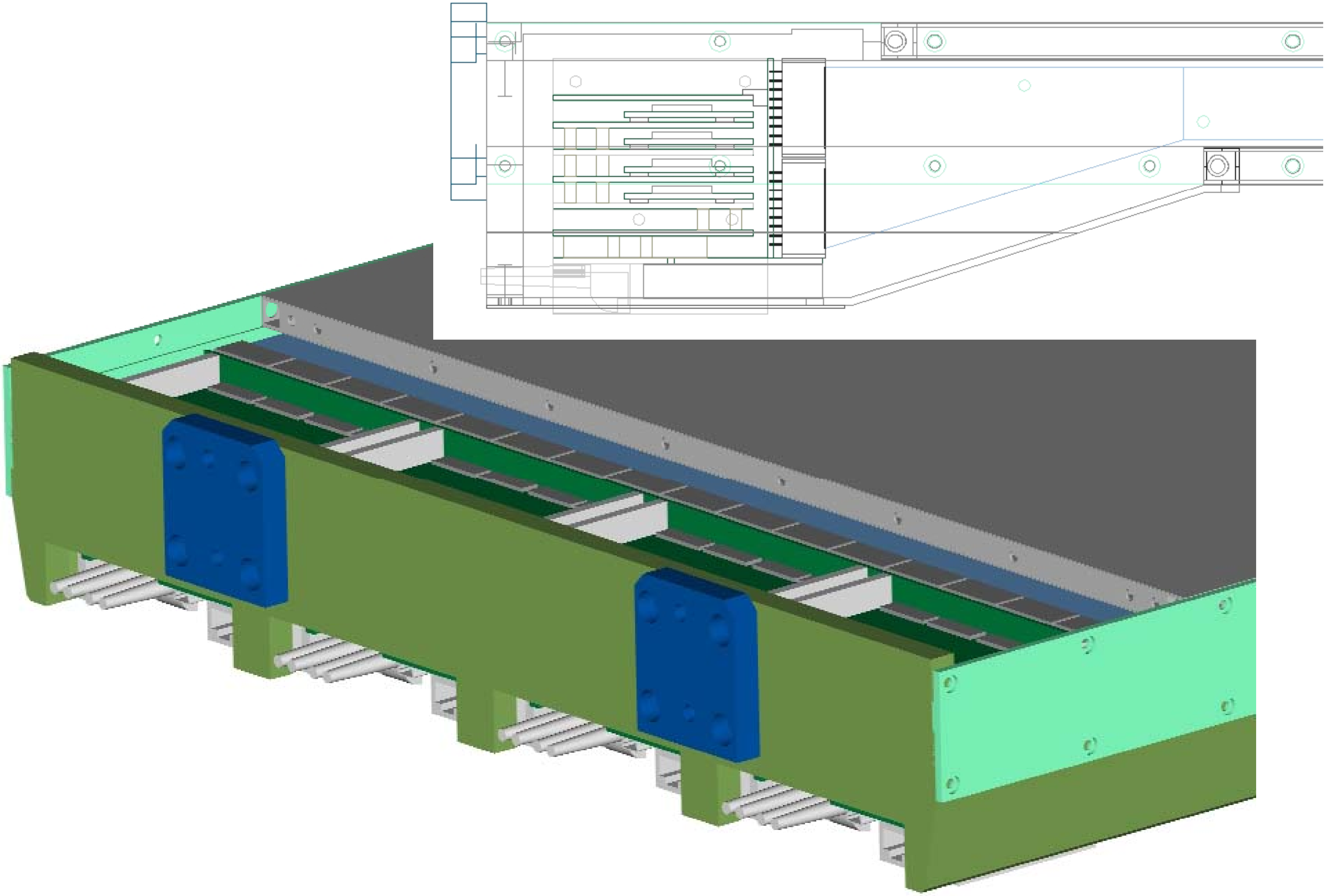
Mechanical Update – M. Rosen (Hawai'i)

bPID Electro Mechanical Update:

- Complete counter module (without top panels)



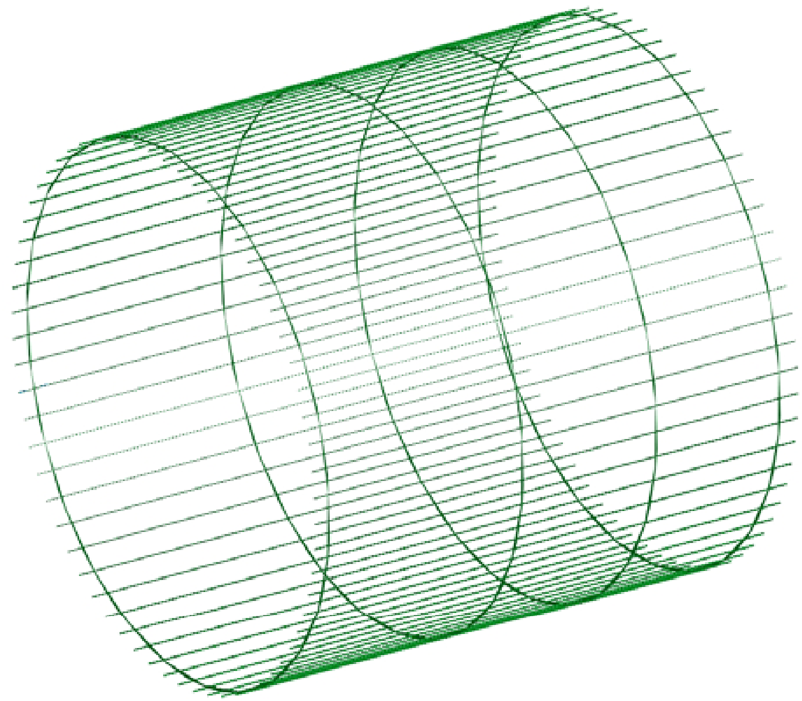
Detailed engineering drawings

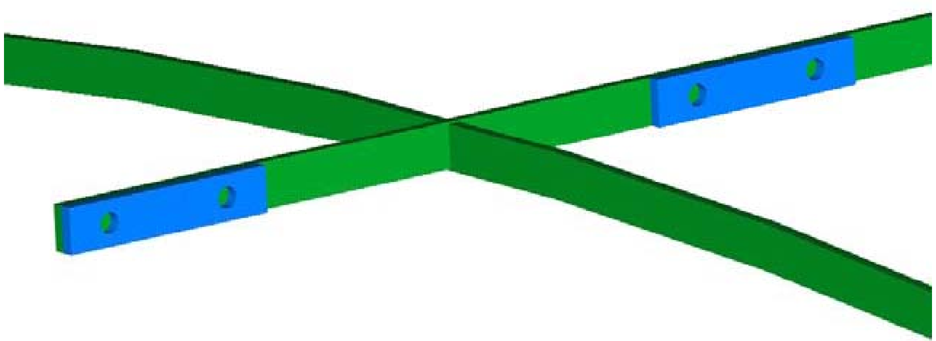


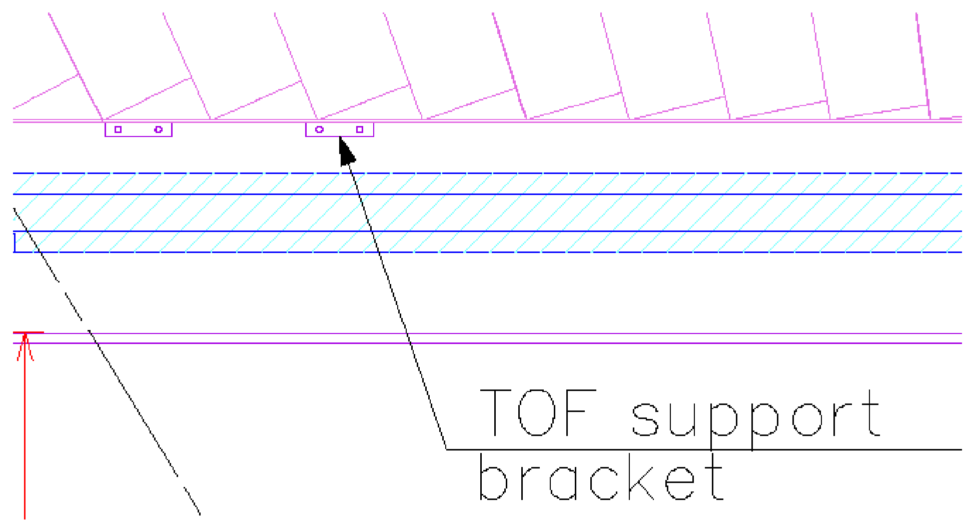
Mechanical Issues – M. Rosen (Hawai'i)

Summary of Current Belle and Belle II Inner Detector Loads

Current Belle	Mass (kg)	Support Method
TOF	960	tabs on inner ECL cylinder
BACC	500	fwd & bkwd bECL flanges
CDC	330	fwd & bkwd BECL flanges
Total Mass	1790	
Belle II		
bPID: 2cm	1100	ECL cylinder + bECL flanges
(bPID: 3cm)	(1500)	ECL cylinder + bECL flanges
CDC	600	bECL flanges
Total Mass	1700/2cm bar	
(Total Mass)	(2100/3cm bar)	



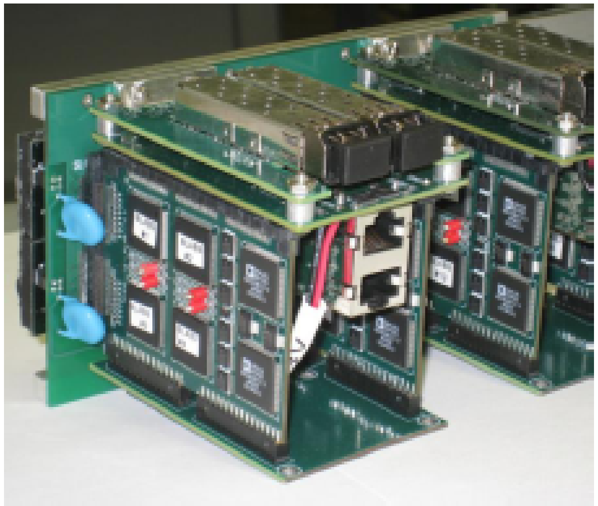


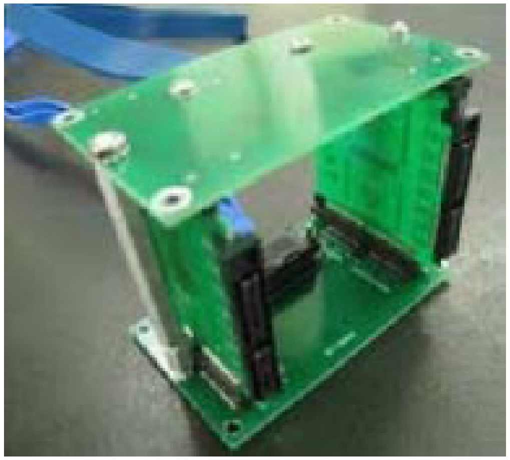


Readout Electronics – K. Nishimura (Hawai'i)

Disadvantages of Existing Board Stack

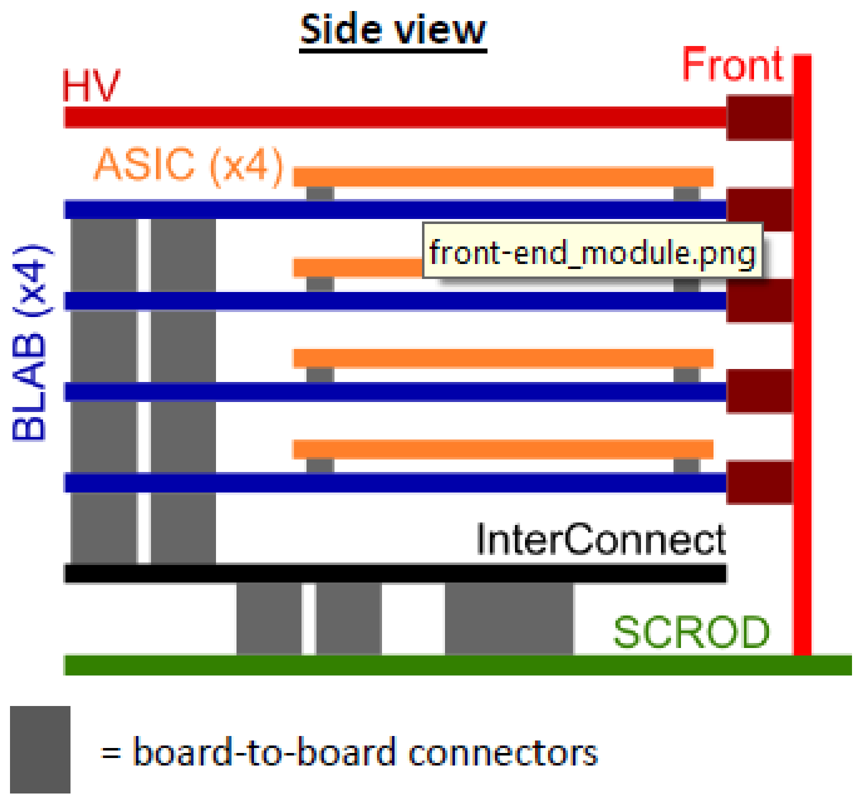
- BLAB3 issues:
  - Replacement requires re-soldering.
  - Calibration requires a front board adapter to inject test signals.
- Firmware issues:
  - No on-board clock: need clock distribution to test any firmware.
  - Fiberoptic readout only: need back-end working to verify any data out.
- Size issues:
  - Significant amount of wasted space.
  - Existing modules (top right) are too big for Belle II.
  - Split module (lower right) where transceivers are separated from digitizers might meet size restrictions, but this is untested and may not preserve signal fidelity.





K. Nishimura (Hawai'i)

New Front-end Board Stack



Front
- Connects HV board to PMTs
- Connects PMT output to ASIC input

HV
- High voltage components for PMTs
- Cooling for high voltage components

Standard Control, Read-Out, Data (SCROD)
- FPGA (ASIC control)
  - Virtex4, Spartan6
- 2 Fiber transceivers
- 2 RJ45
  - Clock Distribution
  - LVDS (JTAG)
- Mini USB – for easy bench testing

Digitizer Boards (BLAB)
- Carrier card for ASICs
  - 4 ASIC daughter cards per carrier
- ASIC in-situ testing components
  - e.g., pulser for channel checks

ASIC
- 1 BLAB3 per card
- DACs

Interconnect Board
- Connects SCROD & BLAB
  -Layout of connectors are forced to be unique because of size constraints
- Power regulation/distribution

K. Nishimura (Hawai'i)

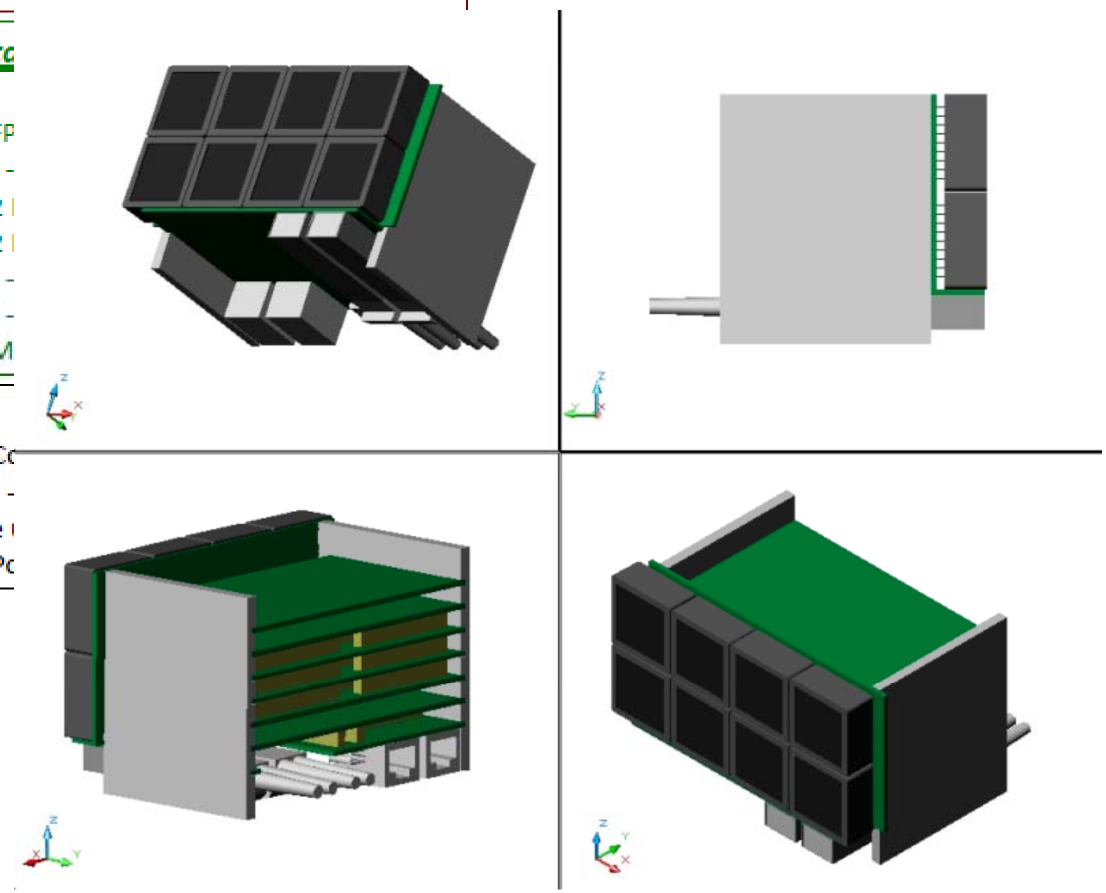
New Front-end Board Stack

Mechanical Mockup – Isometric View

Front
- Connects HV board to PMTs
- Connects PMT output to ASIC input

HV
- High voltage components for PMTs
- Cooling for high voltage components

Sta
- FP
  - -
- 2
- 2
  - -
  - -
- M



Digitizer Boards (BLAB)
- Carrier card for ASICs
  - 4 ASIC daughter cards per carrier
- ASIC in-situ testing components
  - e.g., pulser for channel checks

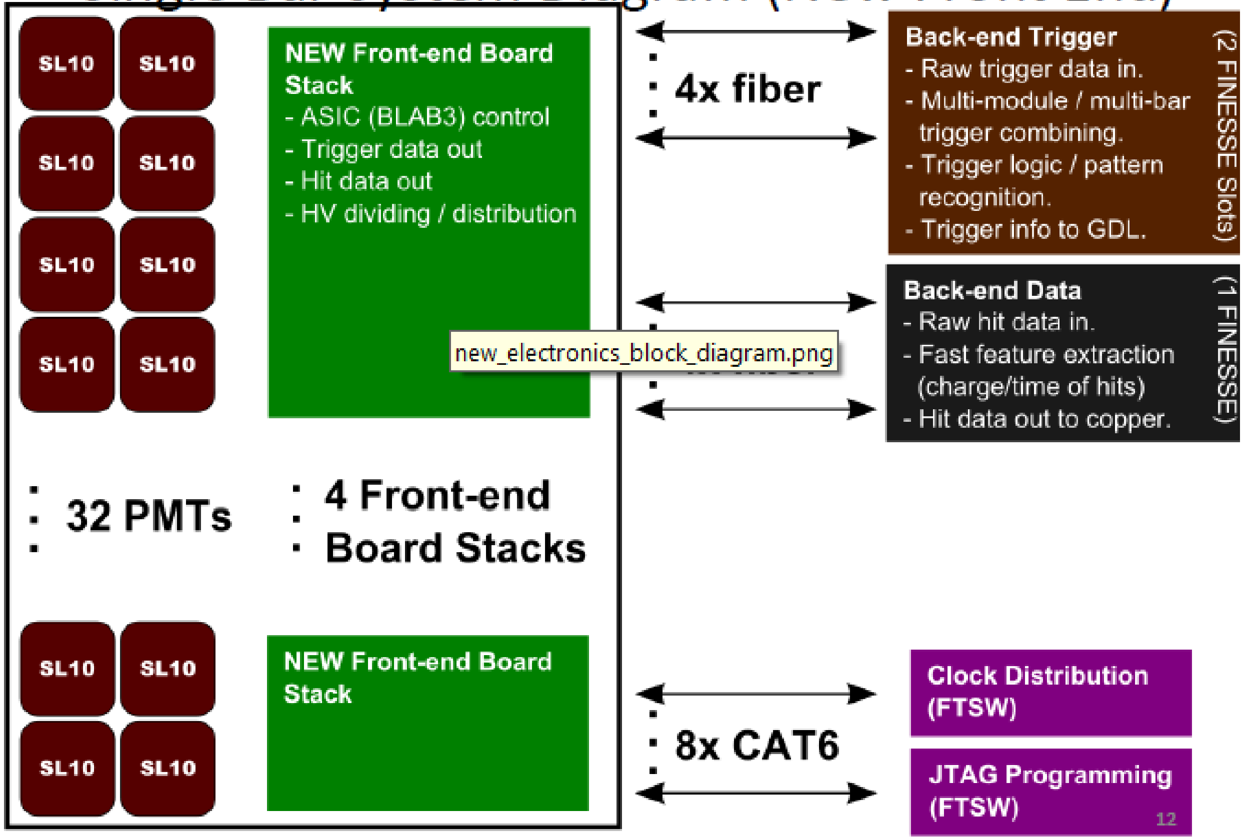
ASIC
- 1 BLAB3B per card
- DACs for bias voltages

- Co
  - -

be

- Po

Single Bar System Diagram (New Front End)



- Remaining system pieces are being developed/tested.

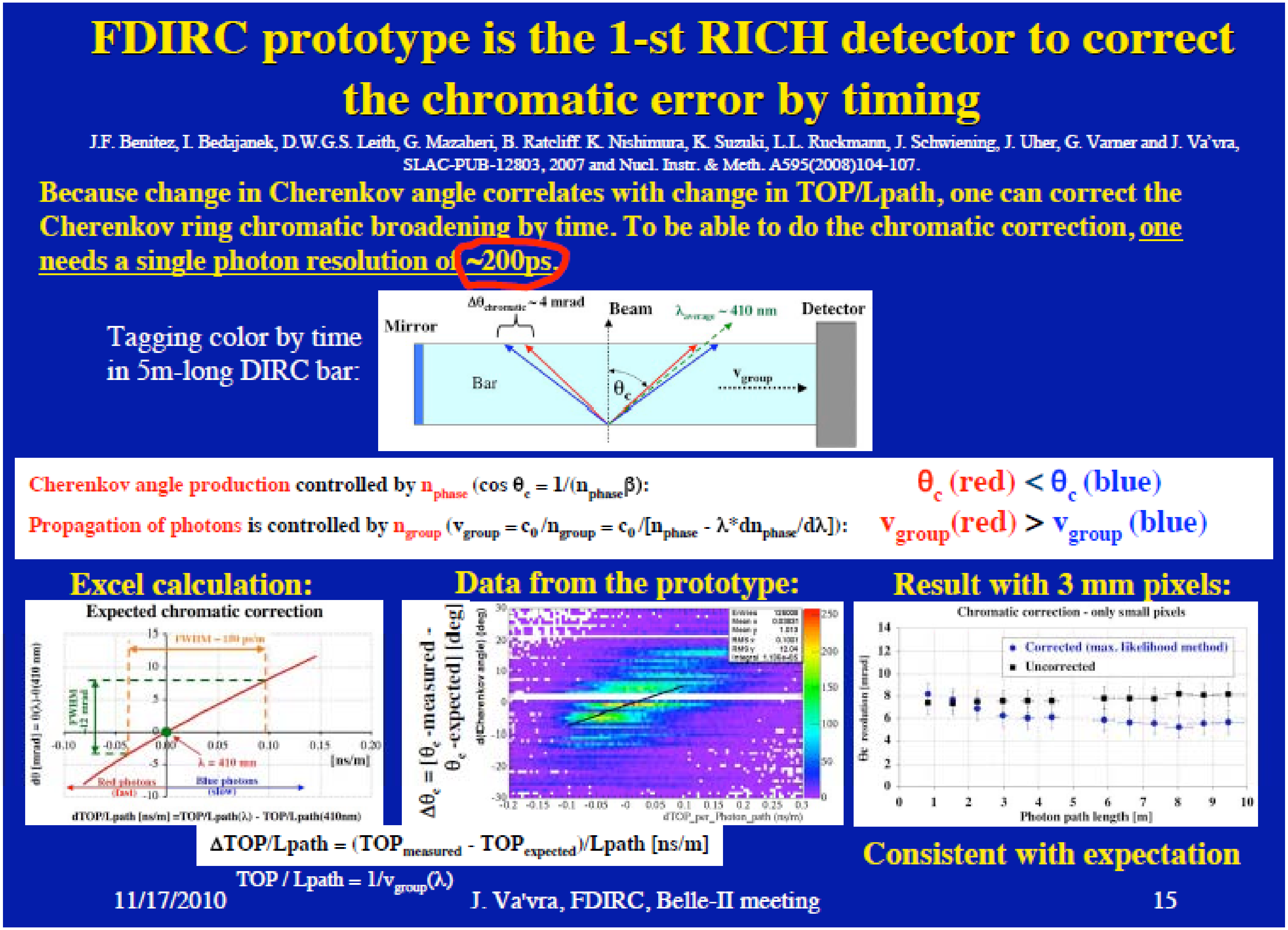
–Changes to front-end don’t significantly impact other elements (actually require fewer numbers of boards on back-end).

- Calibration studies in Hawaii are ongoing in preparation for the arrival of the next round of ASICs.

New FDIRC development, experience from BaBar DIRC, FDIRC prototype, and extrapolations for SuperB/Belle-II

J. Va'vra, SLAC

A wealth of knowledge presented…

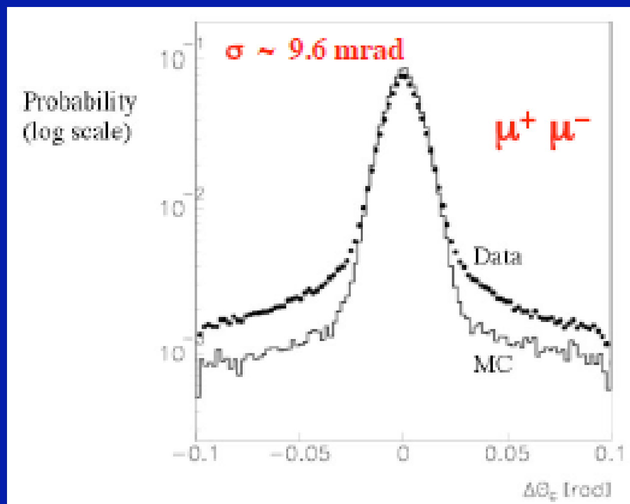


Focus on issues raised:

BaBar: tail in the θ_c distribution

J. Va'vra, B. Ratcliff

BaBar DIRC data vs MC:



← K. Yarritu, S Spanier and J. Va'vra: DIRC Note #141, 2001:
(http://www.slac.stanford.edu/~jjv/activity/dirc/DIRC_Note_141.pdf)

Combinatorial background is removed by requiring that a photon lies closest to the expected Cherenkov angle and arrival time. The remaining background under the signal peak contributes up to 15%. Only ~ 60% of the background level is presently explained by the BaBar DIRC Monte Carlo.

Note: based on this work, glue reflections and δ-rays are in the BaBar MC

- **Cherenkov distribution has two components: (a) narrow, and (b) wide. This is observed at BaBar, but also in CRT tests. Some contribution to the tail comes from ambiguity overlaps, δ-rays, glue reflections, etc. Generally only ~60% of the tail is explained by BaBar MC. This is NOT presently understood (!!):**
  - We did a special experimental test, which showed that the tail cannot be explained by δ-rays (DIRC note #141,2001).
  - There are three candidates to explain it: (a) quartz sub-surface damage when polishing, (b) photons re-scatter when entering a glue joint at grazing angles, and (c) photons scatter when propagating through a long path in quartz, (d) or ???.

Blair's comment: The tail may be a more serious issue for the TOP counter than to FDIRC. You should do a beam test with a full size bar with all glue joints in the problem, probing all track angles, and simulate the realistic background by adding extra "fake" events on top of a single real event.

Expected rates: FDIRC vs TOP counter

J. Va'vra, Scaling from Belle-I Aerogel data (I. Idachi provided update on 11/18/2010)

SL-10 MCP-PMT predicted rates in TOP counter:

Lumi	Polar angle Theta [deg]	Number of PMTs per one quartz block	Bar box volume [cm^3]	Bckg scaling with L	Rate in one SL-10 [MHz]	Pixel rate [kHz]	Total dose [C/cm^2 per 10 years]
10^{36}	35-130°	30	~2.4×10^4	25 x	~1.0	~63	~8

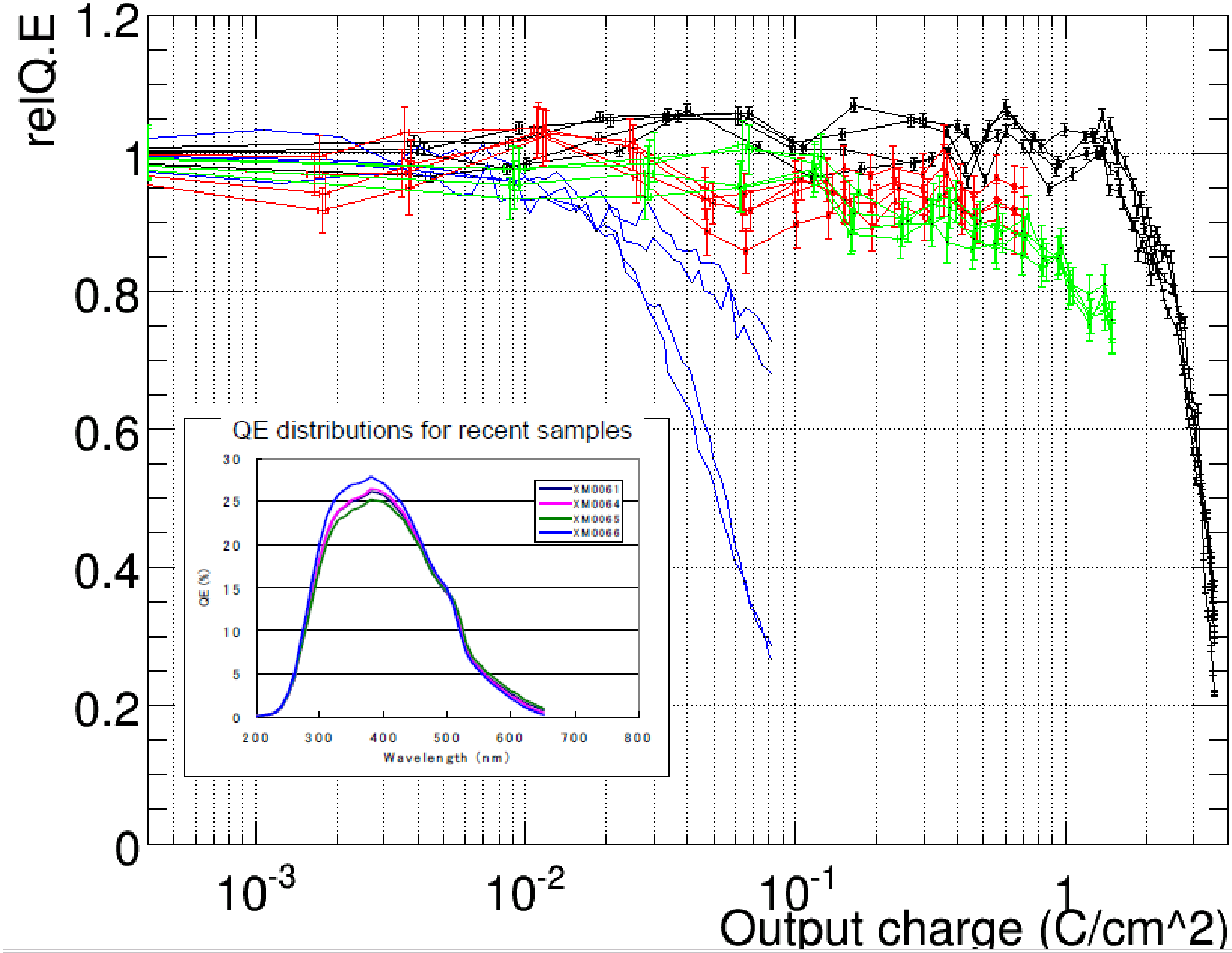
(numbers worked out for a 1-bar solution)

H-8500 MaPMT predicted rates in FDIRC:

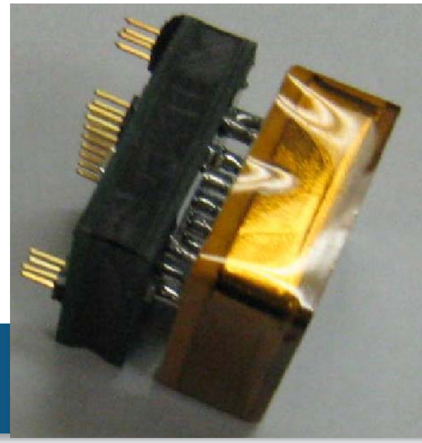
Lumi	Polar angle Theta [deg]	Number of PMTs per one FBLOCK	Bar box volume [cm^3]	Bckg scaling with L	Rate in one H-8500 MaPMT [MHz]	Double-pixel rate [kHz]	Total dose [C/cm^2 per 10 years]
10^{36}	35-130°	48	~2.6×10^4	25 x	~0.94	~29	~1

- Still many factors uncertain: (a) collection efficiency of background photons, (c) calculated for a total integrated luminosity of 200 ab^{-1}, need only 50 (Peter Krizan's comment), etc.
- However, starting from the same assumtions, FDIRC detectors have ~ 2-3x smaller pixel rate, and 8-10x smaller total charge dose/cm^2 compared to the TOP counter's detectors.

Inami-san – update on MCP PMT procurement



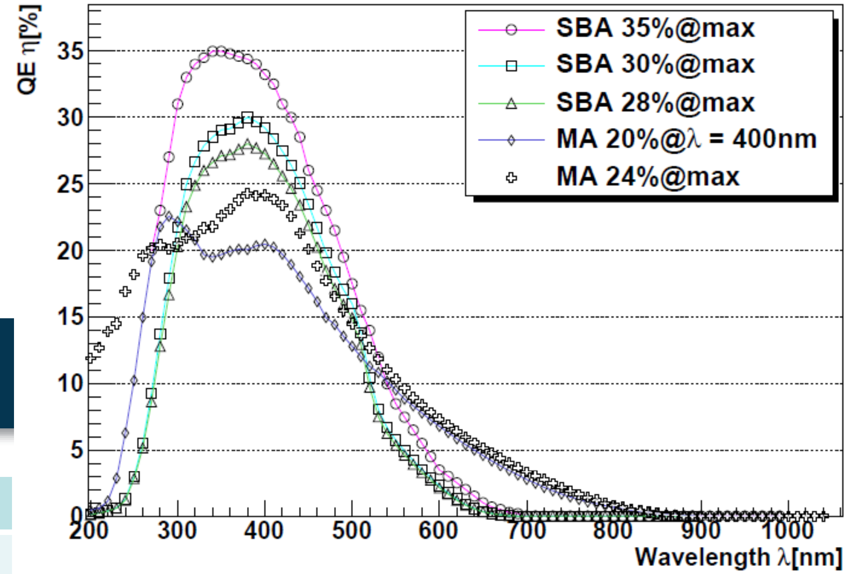
Inami-san – update on MCP PMT procurement

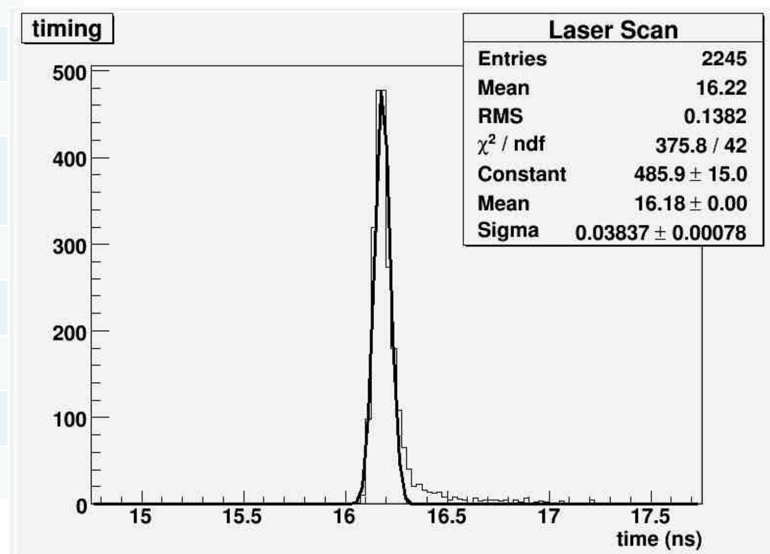


Specification

Item	Value	
Photocathode	Bialkali (28% at max.)	
Photocathode area	22 x 22	mm
Window material	Synthetic silica	
Window thickness	1.5	mm
MCP layer	2 (Al protection on 2nd MCP)	
MCP channel diameter	10	µm
Anode	4 x 4 ch	
Anode size	5.275 x 5.275	mm
Anode gap	0.3	mm
External size (without pin)	27.6 x 27.6 x 13.1	mm

+α for HV shield



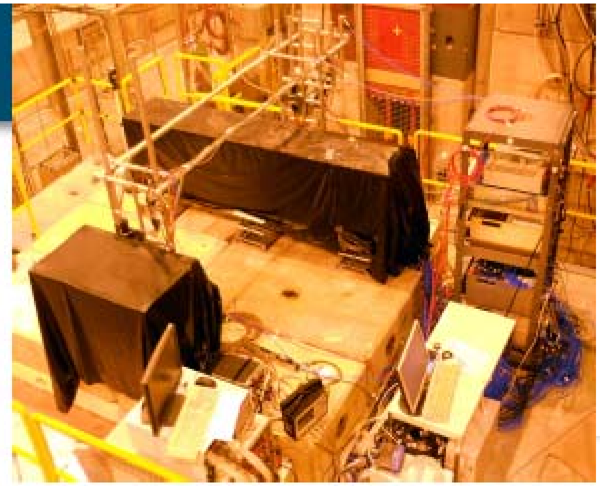


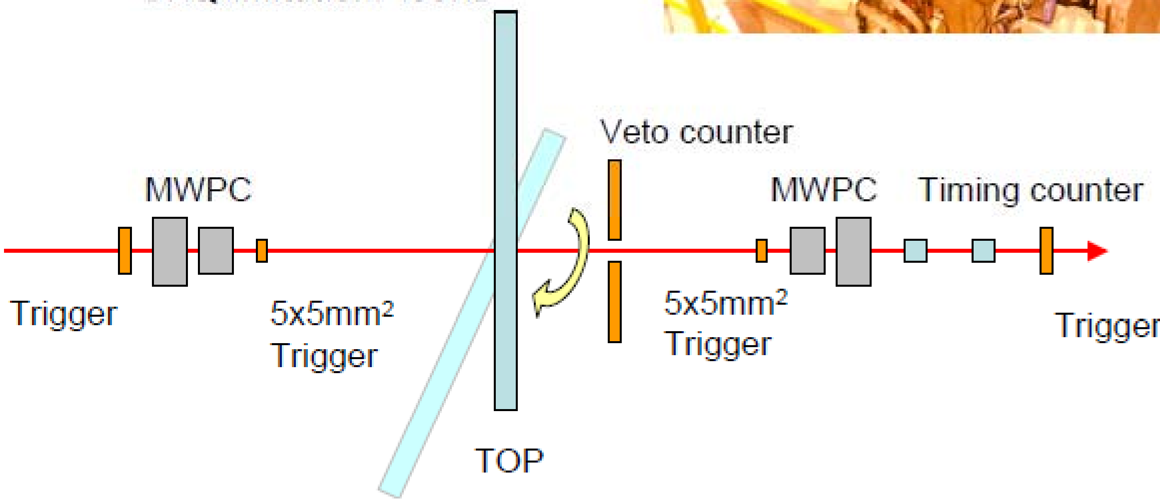
σ ~ 38.4 ps

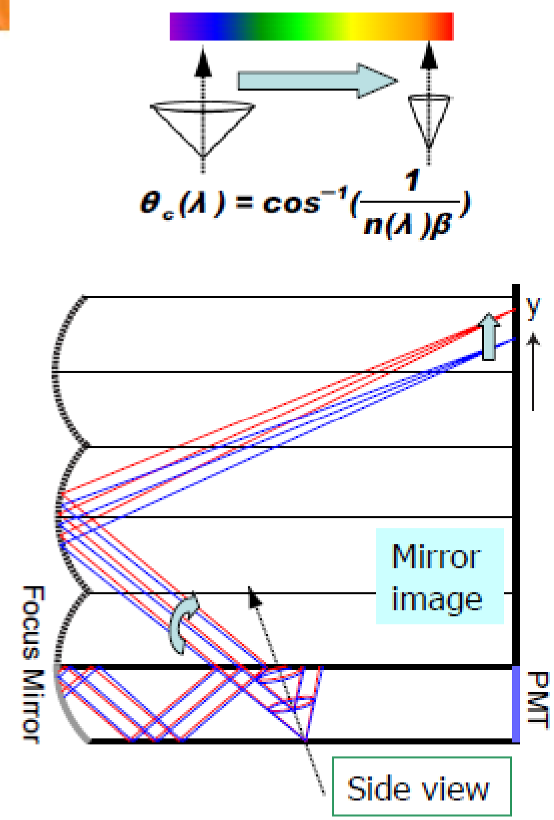
Inami-san – beam test of fwd mirror at CERN

Set up

- CERN SPS T4-H6B
  - +120GeV
  - Nov. 8 – 15
  - DAQ rate: ~45Hz in average
    - DAQ limitation: 450Hz

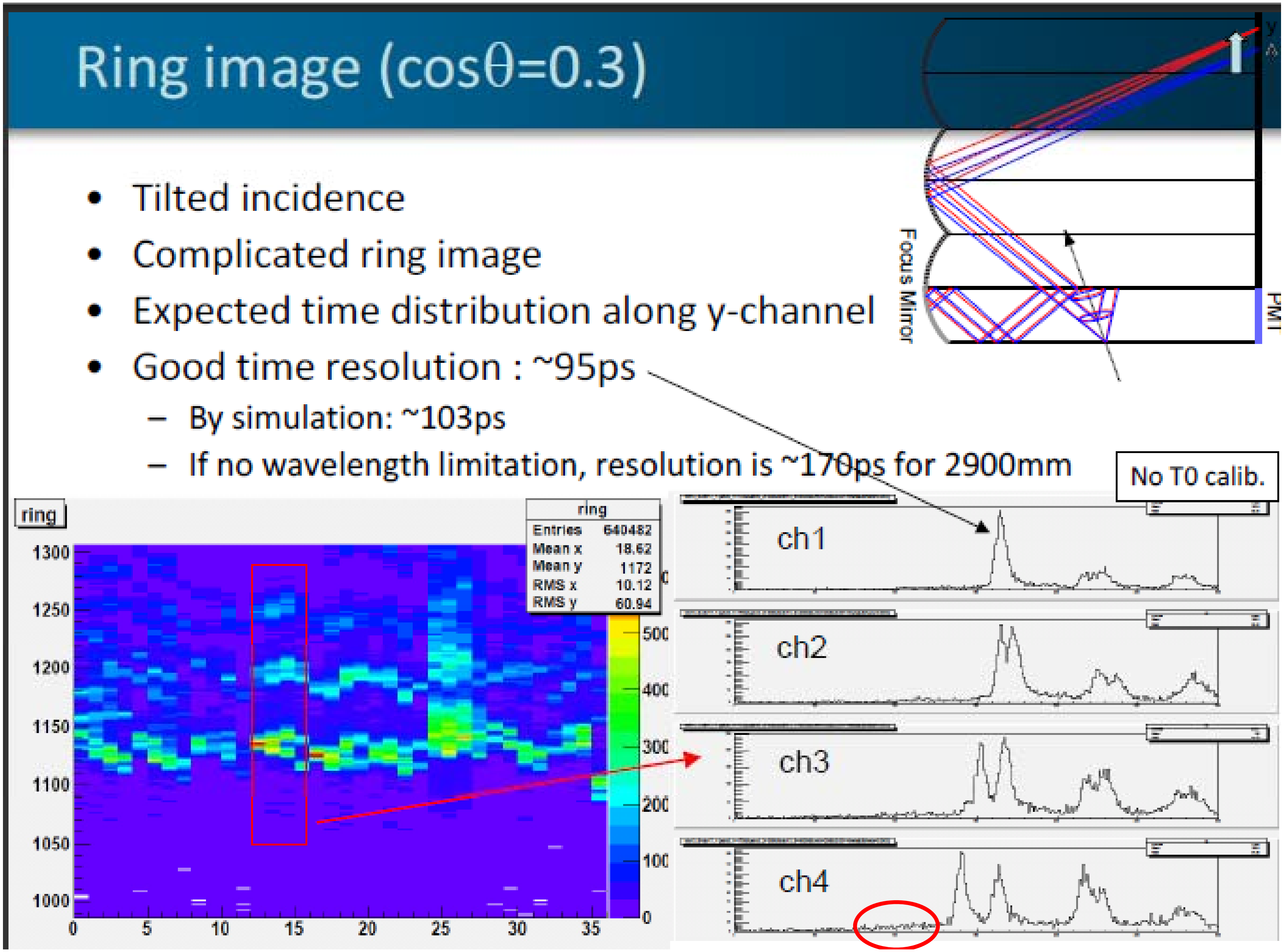






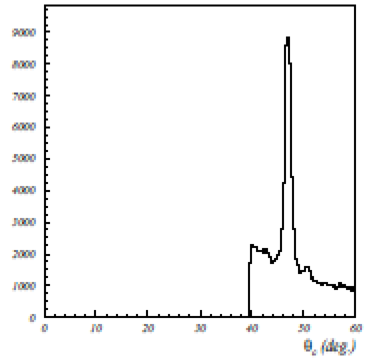
Data just collected…

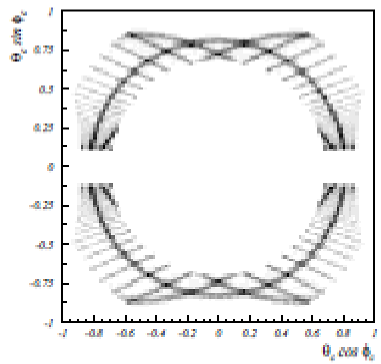
Detailed analysis to follow



Ideas for improved analysis – Marko Staric

- To reduce ambiguities:
  - total reflection requirement ($|k_{x(y)}| < \sqrt{1 - 1/n^2}$)
  - limitation in Cerenkov angle ($\theta_c < 60^0$)





19-Nov-2010
VII B2GM

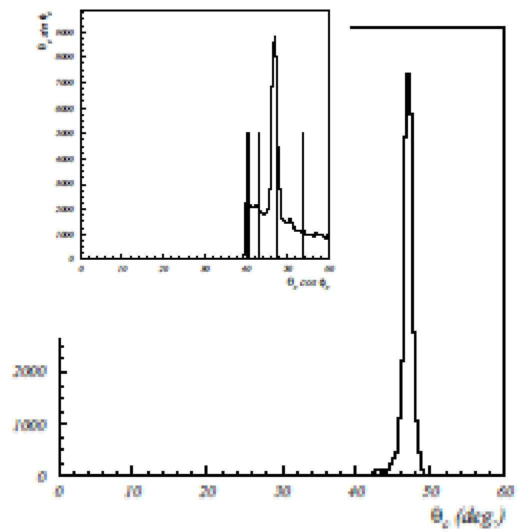
Reconstruction of Cerenkov ring from TOP data (page 4)

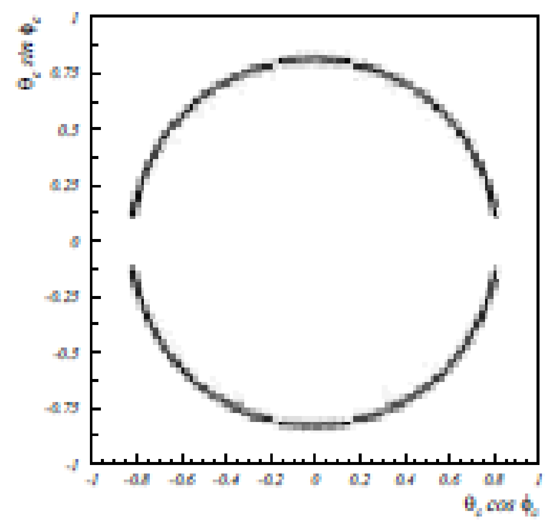
Marko Starič
Institut Jožef Stefan, Ljubljana, Slovenia

1. start with $w_k = 1$: fill cerenkov histogram
2. assign new weights to n ambiguous solutions

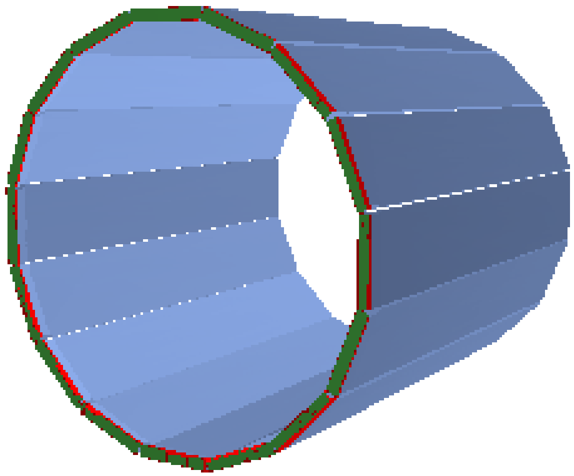
$$w_k = \frac{h(\theta_c^k)}{\sum_{i=1}^{n} h(\theta_c^i)}$$

3. fill (new) cerenkov histogram with w_k
4. repeat steps 2 and 3 till procedure converges (usually 10-20 iterations needed)
5. use the solution with the largest weight

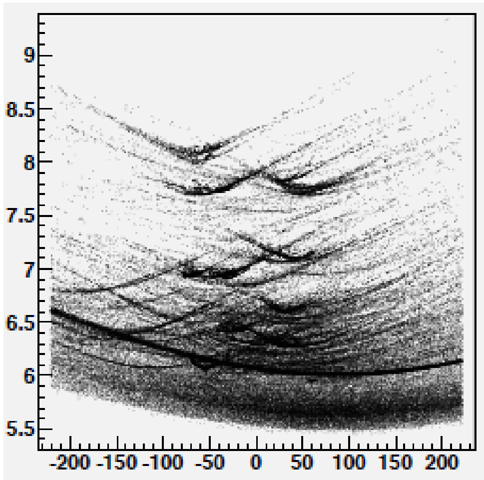




Full GEANT4 – a work in progress (M. Petric)



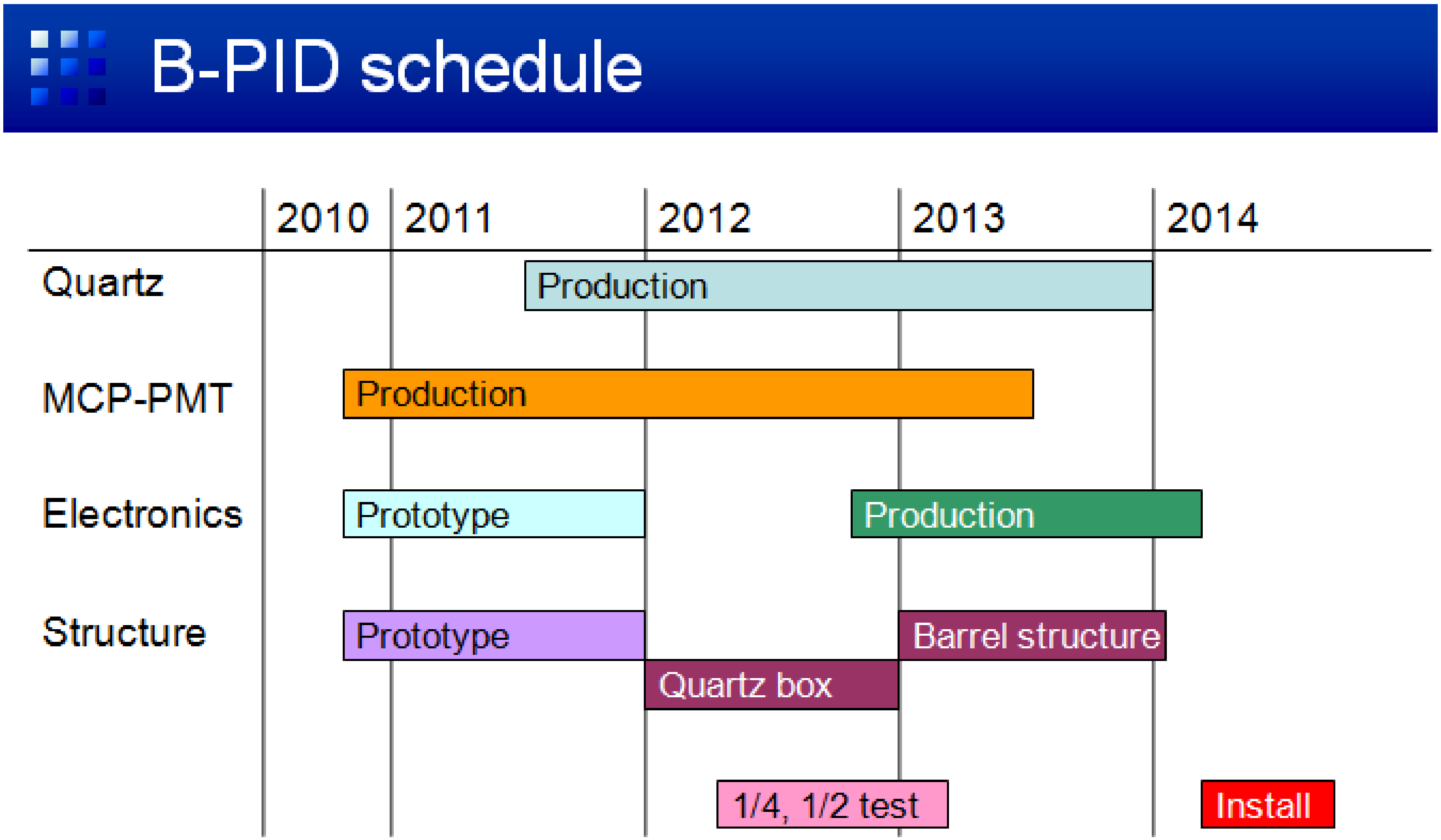
- Testing of simulation
  - bug tracing
- Histogram t vs. x(detector plane) of 10.000 π^+ hitting the same spot in the quartz
- $\rightarrow$ wrong $\rightarrow$ bug
- Simulations with L. Šantelj optics extension working, have to fix bug



quartz+PMTs without support structure

- We have "working"(bug) version of TOP simulation
- Cannot upload simulation to SVN because of missing optics in basf2!
- Digitisation of signal done for needs of simulation testing, easily converted to other format
- Have to add spherical mirror (minor fix)
- Have to add Q.E. of PMTs
- Have to include correction for imperfect quartz edge (not completely rectangular)

Schedule update



Progress since last B2GM

- Plausible configuration for electronics that fits

- 2nd "Dedicated PID" meeting:
  - Ideas presented that have come to fruition
  - Coordination of efforts, mechanical issues

- Beam test data of forward mirror

- Zygo bar prototype

Open issues

- Prototype test of full-sized counter

- Support/loading of the ECL support structure:
  - Sufficient rigidity (100um deflection)
  - How to actually fabricate?

- Demonstration of PMT TTS-limited timing with monolithic readout electronics

- Schedule resource driven

Summary

- Good progress, much to be done
- Some immediate homework:
  - Check non/wide-gaussian tails in data/MC
  - Quartz background rates/total PC charge
- Challenge to meet updated schedule
- Schedule resource driven

Back-up slides

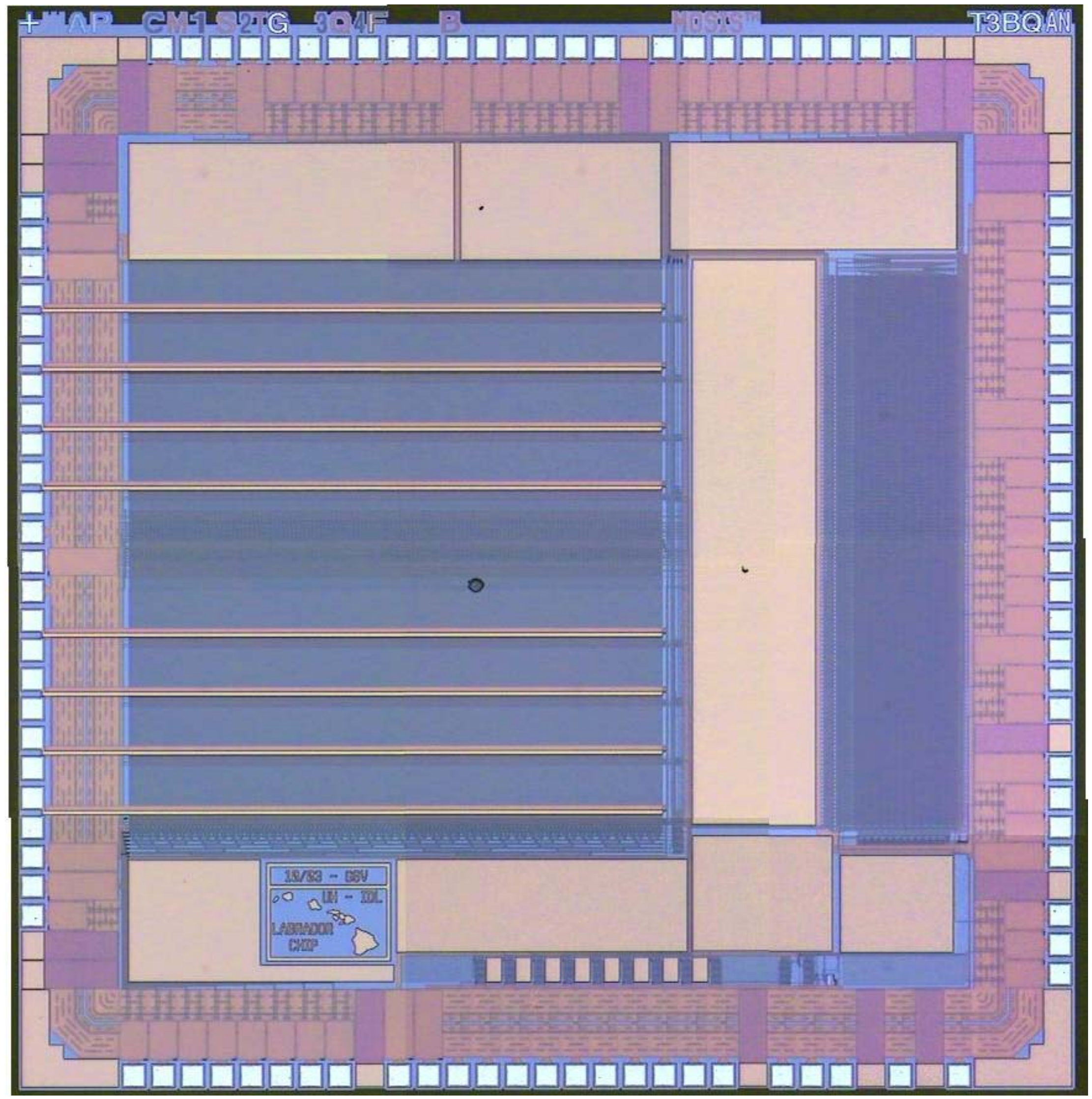
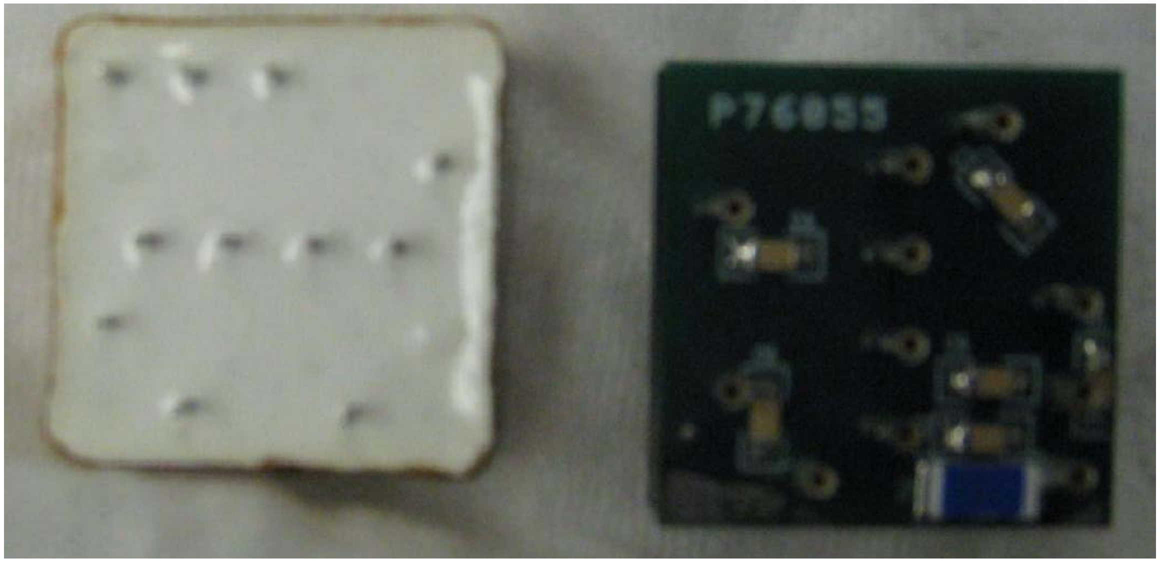
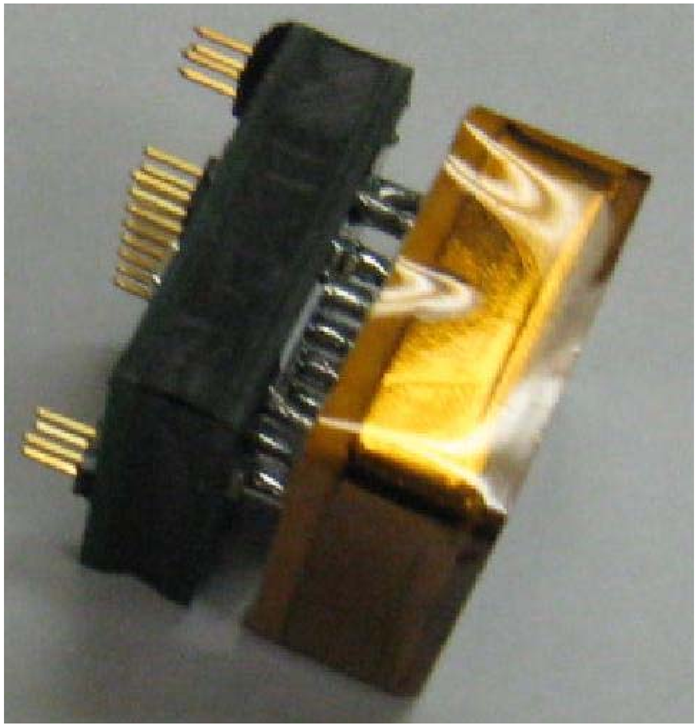


Photo-detector: Hamamatsu SL-10

- Micro-channel Plate:
  - Operates in 1.5T B-field
  - <50ps single photon timing
- Multi-pixel (4x4 anode pads)
- Enhanced Lifetime (Al protection layer)
- Interesting mechanical challenges (PMT case at HV)

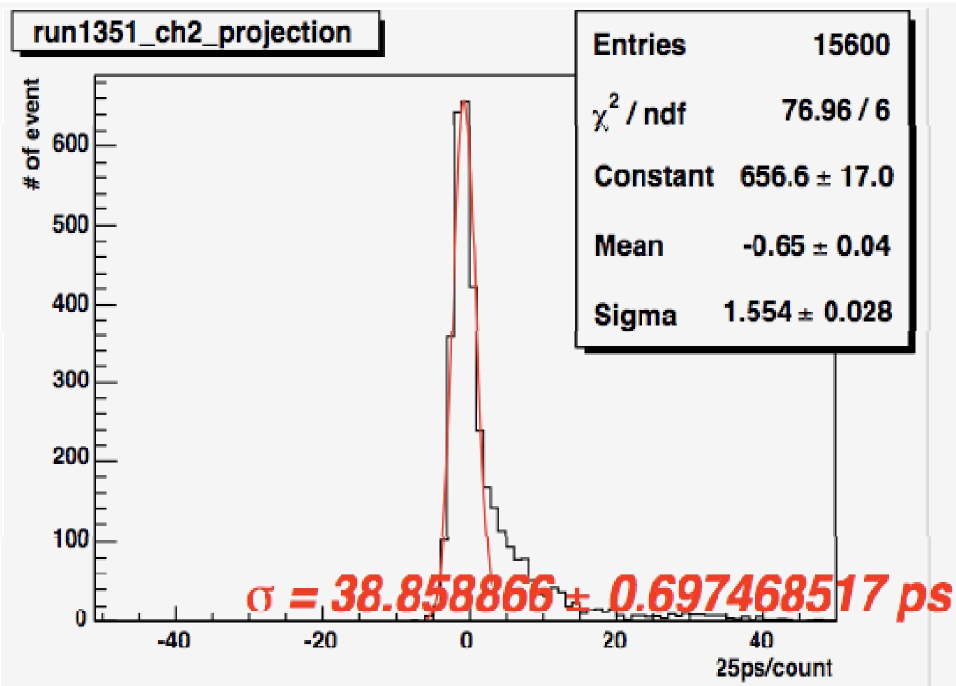


Approximately 1” x 1”

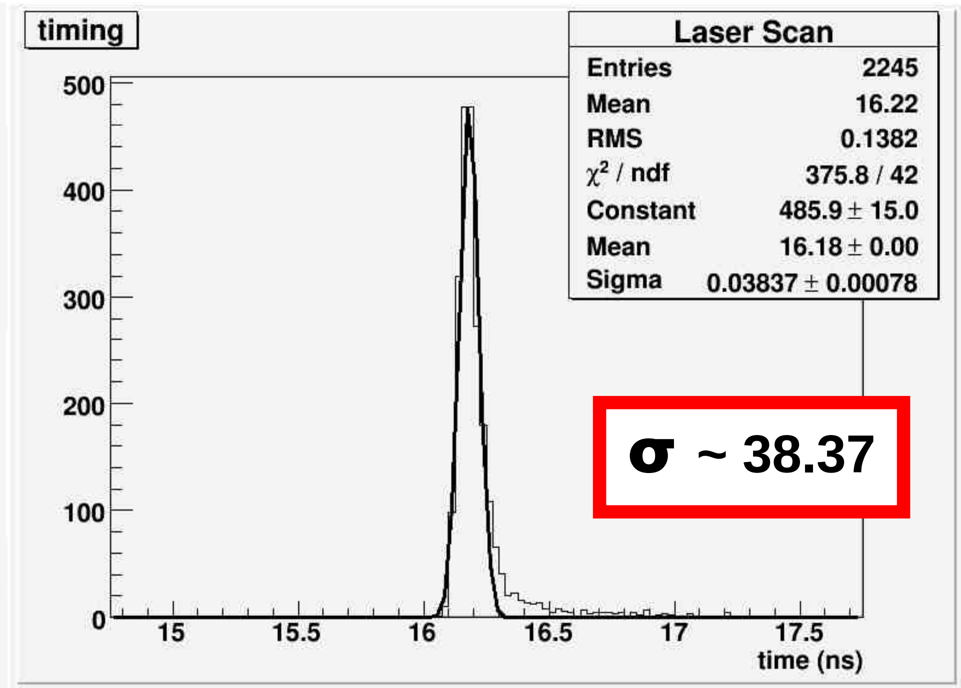


SL-10 Timing Performance

Nagoya



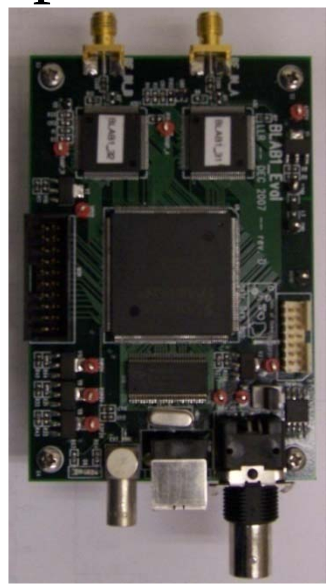
Hawai'i

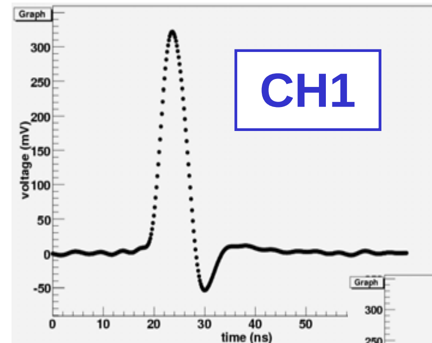


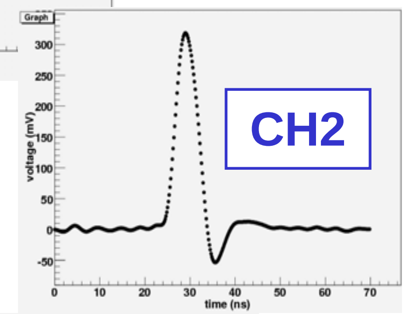
- Nagoya = constant fraction discriminator + CAMAC ADC/TDC
- Hawai'i = waveform sampling + feature extraction

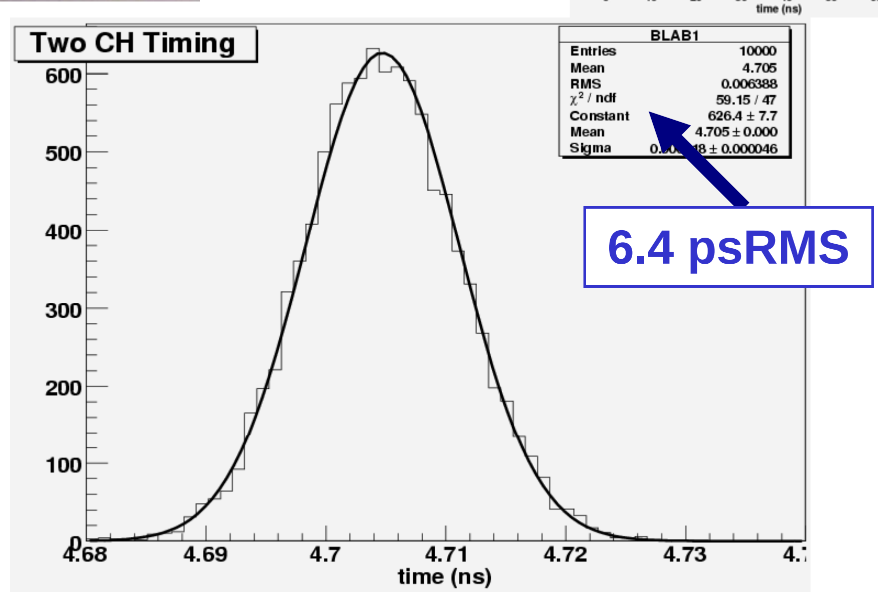
High speed Waveform sampling
“oscilloscope on a chip”

- Comparable performance to best CFD + HPTDC
- MUCH lower power, no need for huge cable plant!
- Using full samples reduces the impact of noise
- Photodetector limited





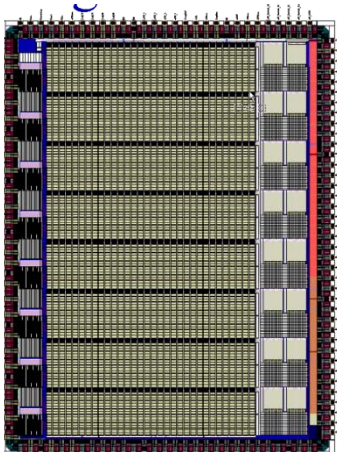




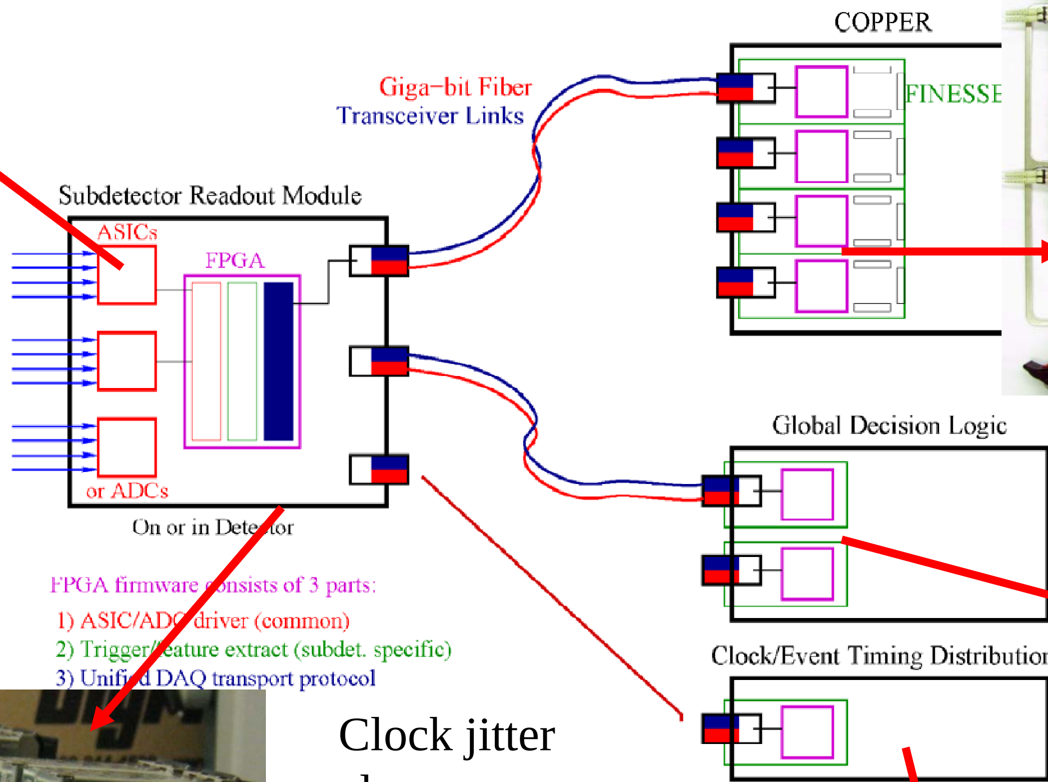
NIM **A602** (2009) 438

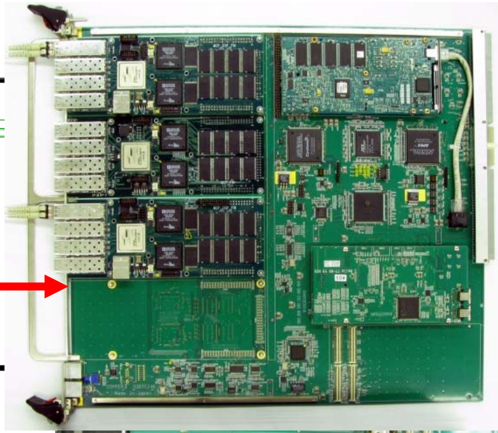
→Advanced Detector Research award

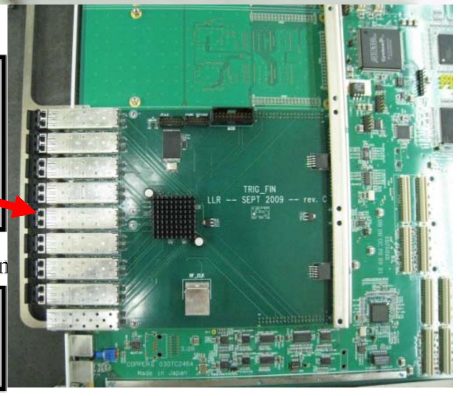
Building toward 1/16 system beam test

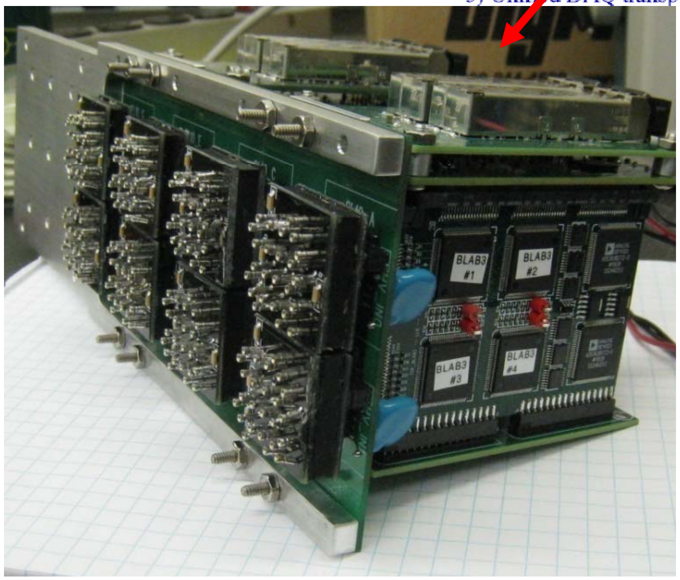


Third generation waveform sampling ASIC









Clock jitter cleaners