

# **Summary of the Detector Working Group Sessions**

# Detector Summary

## ◆ Critical Issues

- Boost
- Beampipe radius & cooling
- Beam Background environment

## ◆ Physics Opportunities

- Tau-Charm operation
- $B_s$  Production
- Polarization

## ◆ Design Issues

- Forward PID
- Backward EMC & PID
- Reuse of BABAR or BELLE

## ◆ Detector R&D

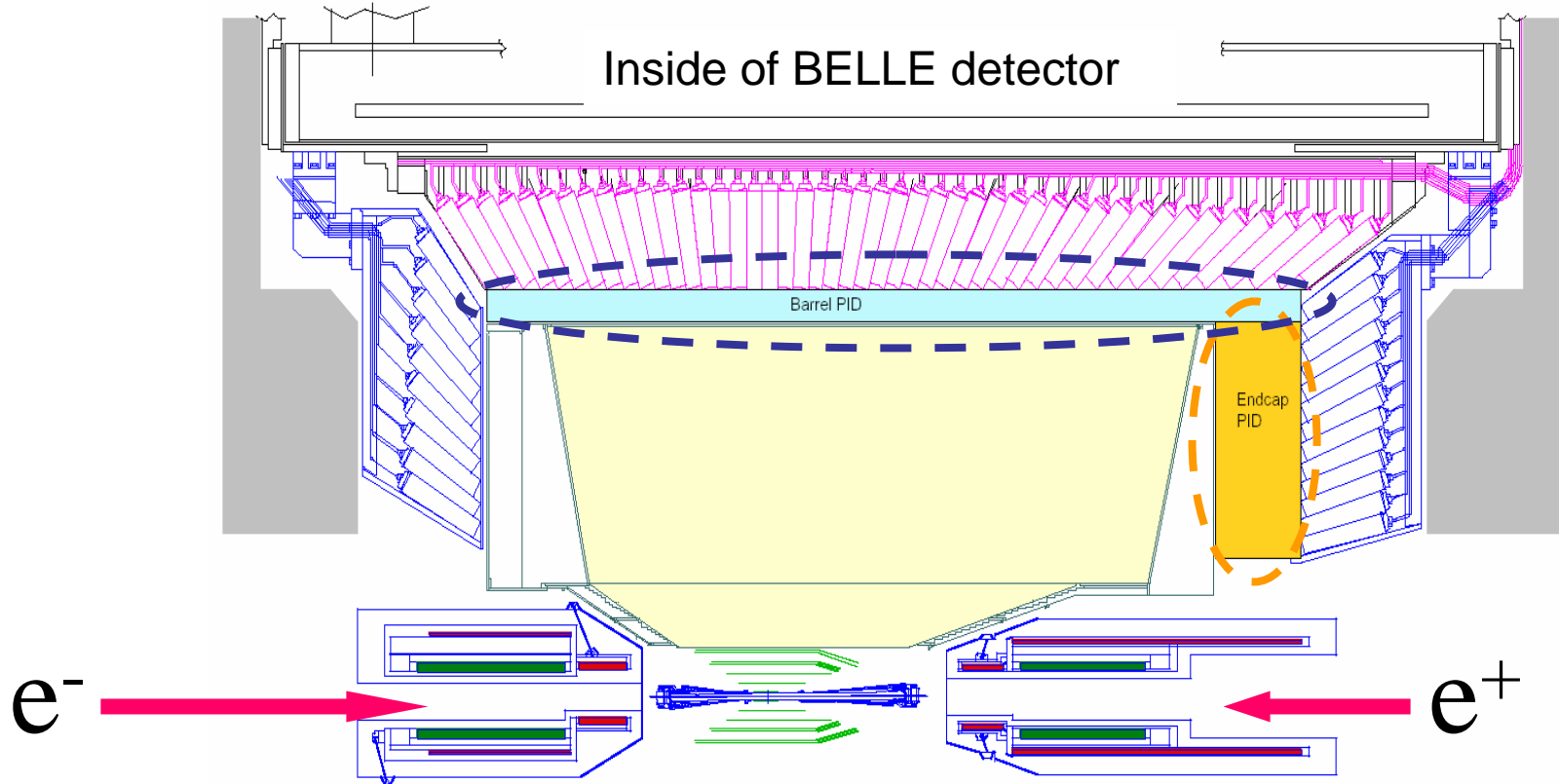
# What we heard at this meeting

- PID
  - Mazuka and Va'vra
- Vertex Detector
  - Neri (simulations)
  - Forti (MAPS)
- Backgrounds
  - Weaver, Paolini and Calderini
- Tracking Chamber
  - Boyarski
- Physics Issues

# PID

# Upgrading BELLE Detector

## Two new particle ID devices, both RICHes



Endcap: **Proximity Focusing Aerogel RICH(A-RICH)**

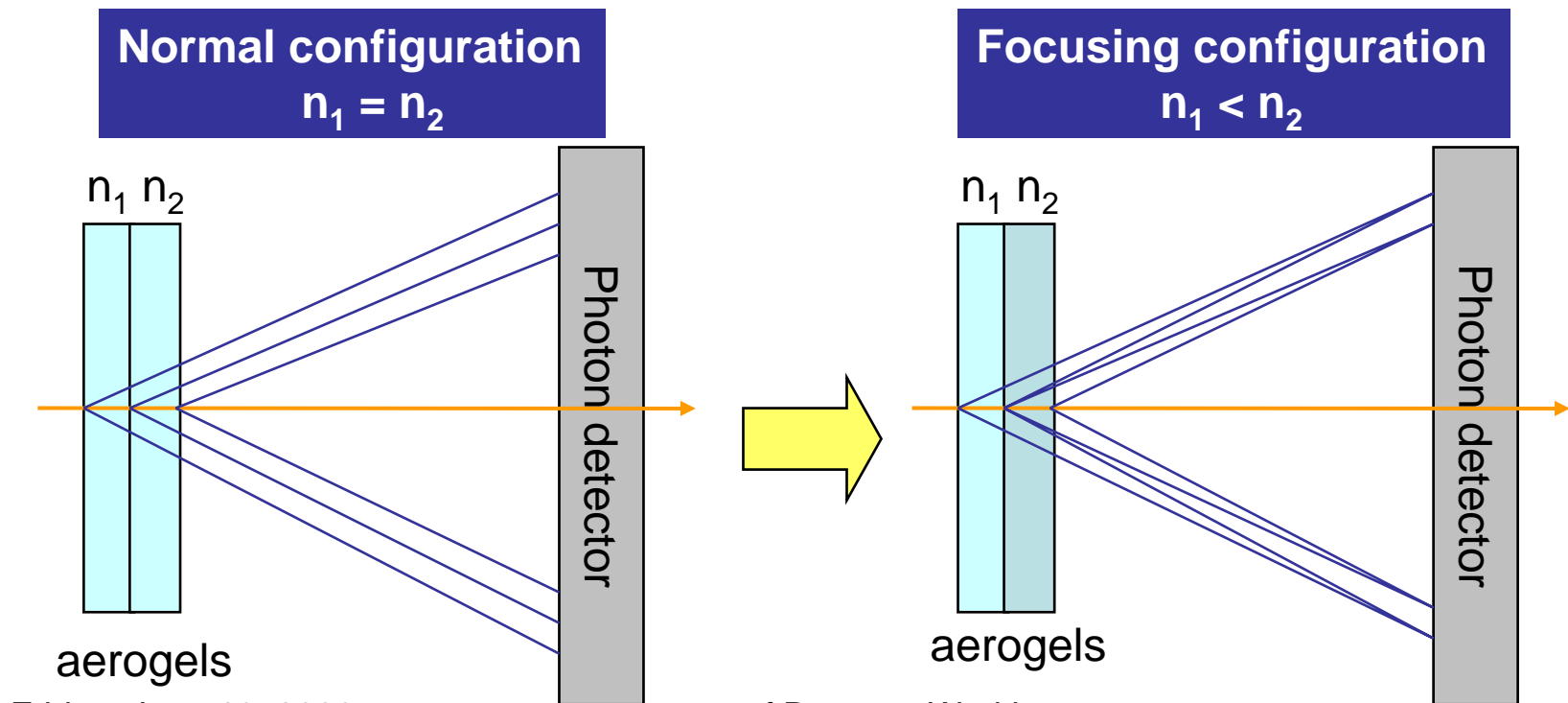
Barrel: **Time of Propagation Counter(TOP)**

# Focusing configuration

A-RICH

How to increase the number of photons without degrading the resolution?

Use radiator with gradually increasing refractive index in down stream direction

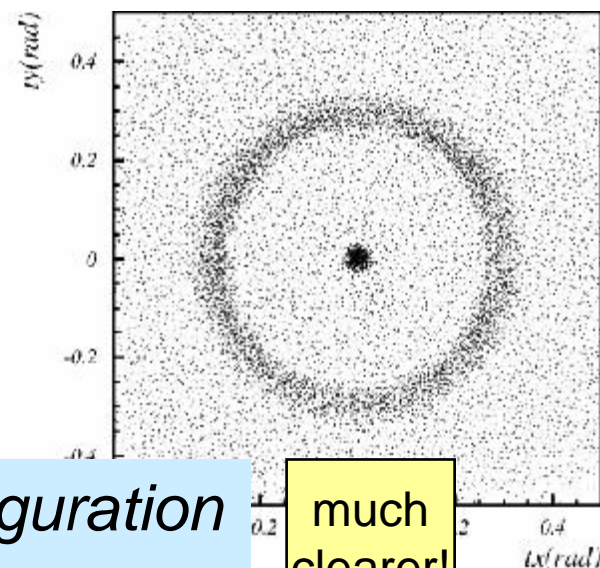
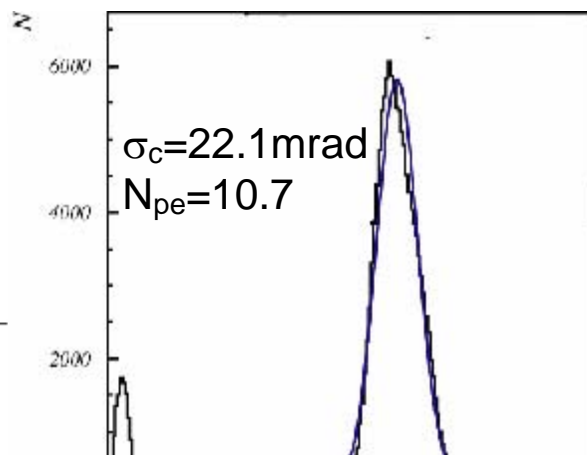
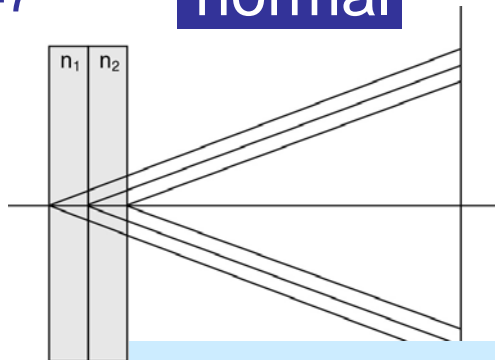


# Results of focusing configuration

A-RICH

4cm thick aerogel  
 $n=1.047$

normal



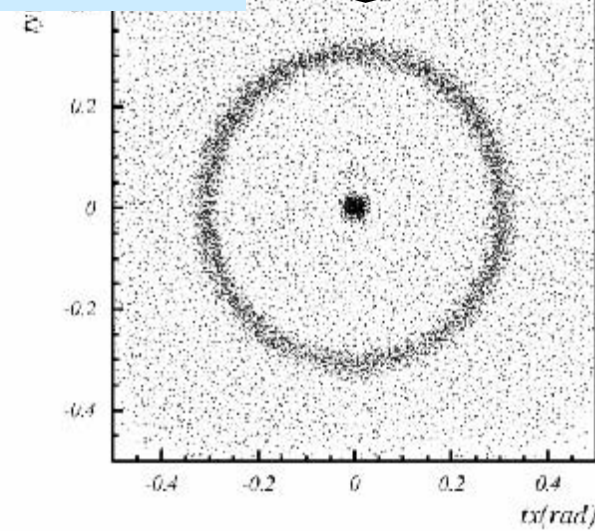
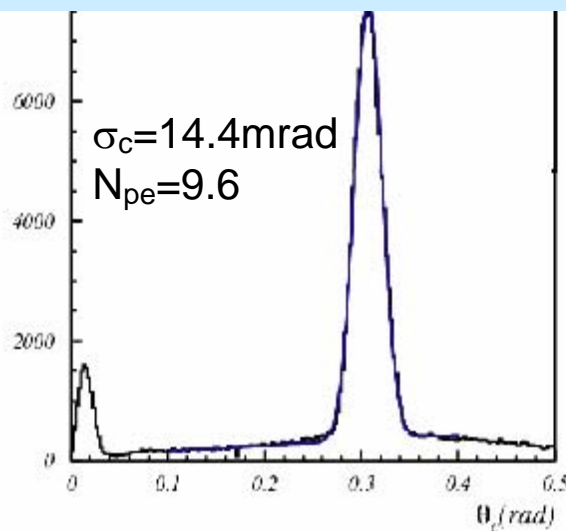
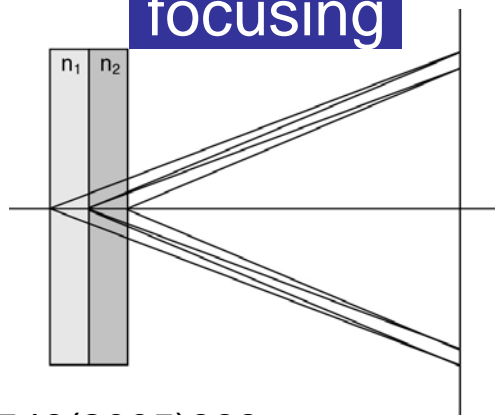
$\pi/K$  separation with focusing configuration

$\sim 4.8\sigma$  @ 4 GeV/c

much clearer!

2 layers of 20  
 $n_1=1.047, n_2=1.057$

focusing



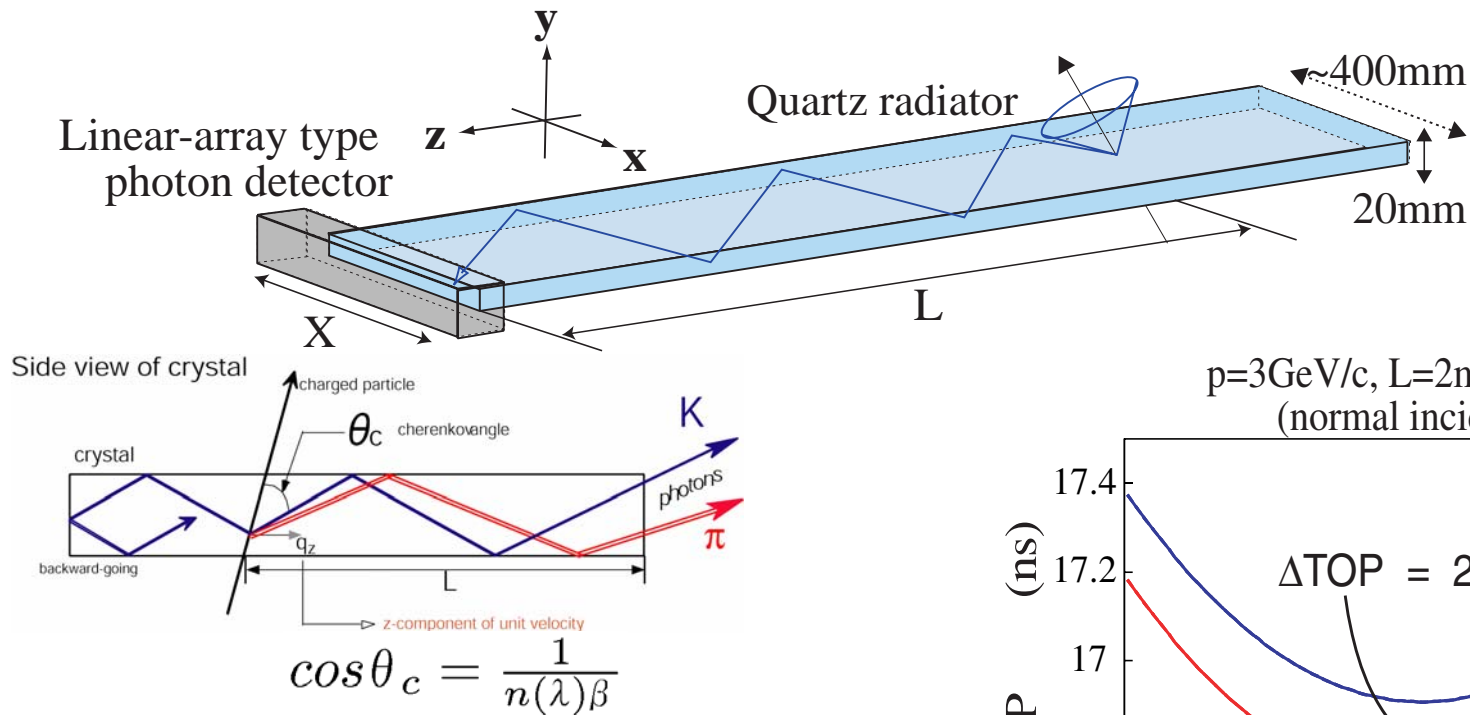
NIM A548(2005)383

Summary of Detector Working  
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# Barrel: TOP counter

TOP

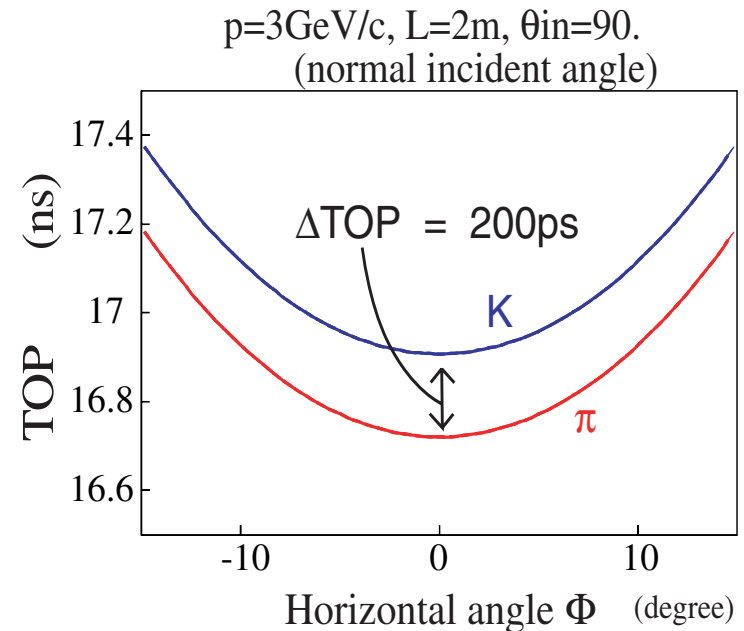
Cherenkov ring imaging is used as timing information



Difference of path length

→ Difference of time of propagation (TOP)  
(+ TOF from IP)

With precise time resolution ( $\sigma \sim 40\text{ps}$ )

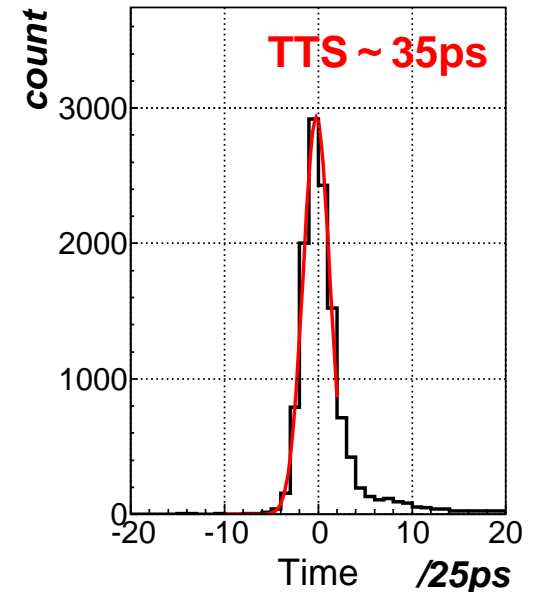
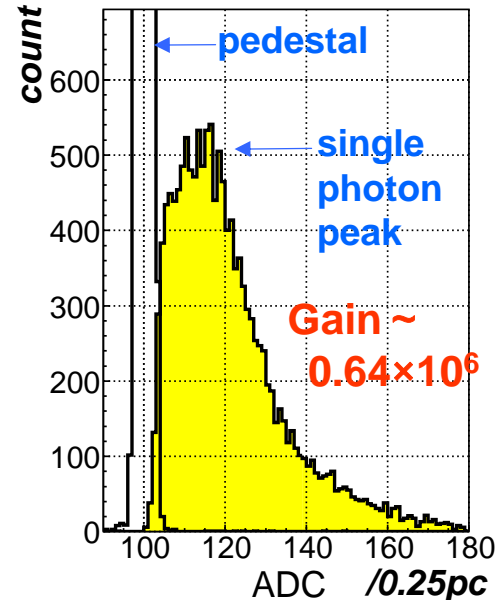
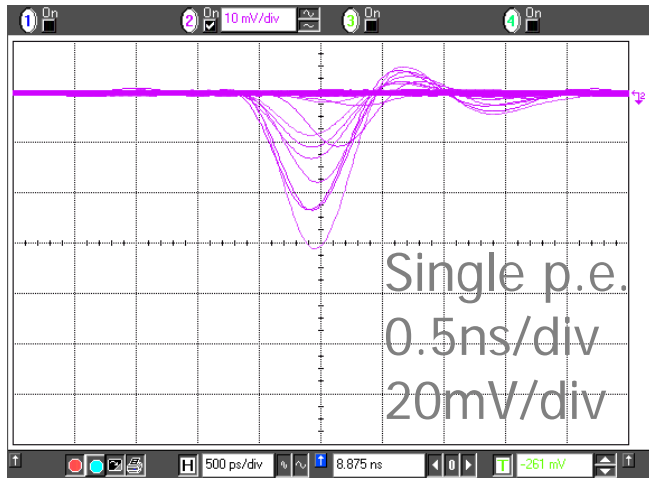




# GaAsP MCP-PMT performance

TOP

## ■ Wave form, ADC and TDC distributions



- Enough gain( $\sim 10^6$ ) to detect single p.e.
- Good time resolution (TTS $\sim 35$ ps) for single p.e.
- Next
  - Check the performance in detail
  - Life time of GaAsP photo-cathode tube

# Summary

We are studying new types of RICH for super KEKB

## Aerogel RICH counter for endcap

- Test the focusing configurations
  - We studied about optimal parameters
- More studies: RICH with TOF (using MCP-PMT)
  - Extend PID ability into low momentum region

## TOP counter for barrel

- M Both RICHes(A-RICH, TOP) look very promising (ps)
- A  $\pi/K$  separation can be over  $4\sigma$  @4GeV/c
- M But there is still a lot of work to be done!
  - It will reduce the effect of chromatic dispersion

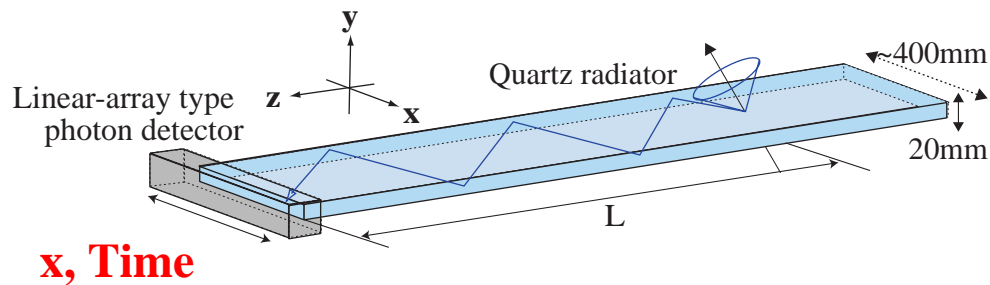
# Improvements compared to BaBar

## DIRC

- Timing resolution improved from  $\sigma \sim 1.7\text{ns}$   $\rightarrow$   $\sigma \leq 150\text{ps}$
- Time resolution at this level can help the Cherenkov angle determination for photon path lengths  $L_{\text{path}} \geq 2\text{-}3\text{m}$
- Time can be used to correct the chromatic broadening
- Better timing improves the background rejection
- Smaller pixel sizes allow smaller detector design, which also reduces sensitivity to the background
- Mirror eliminates effect of the bar thickness

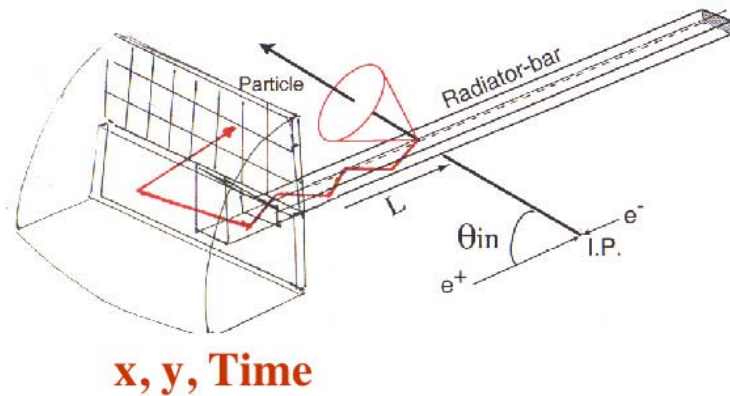
# Examples of two “DIRC-like” detectors

## TOP counter (Nagoya):



- 2D imaging:
  - a) x-coordinate
  - b) TOP ( $\sigma \leq 70\text{ps}$ ).

## Focusing DIRC prototype (SLAC):



- 3D imaging:
  - a) x-coordinate
  - b) y-coordinate
  - c) TOP ( $\sigma \leq 150\text{ps}$ ).

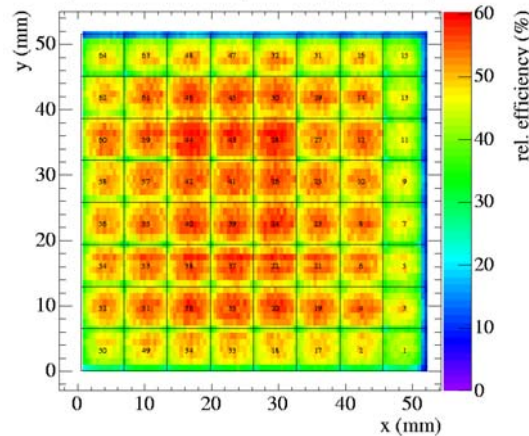
# Photon detectors in the prototype ( $\sigma \sim 70$ - 150ps)

Burle MCP PMT (64 pixels):

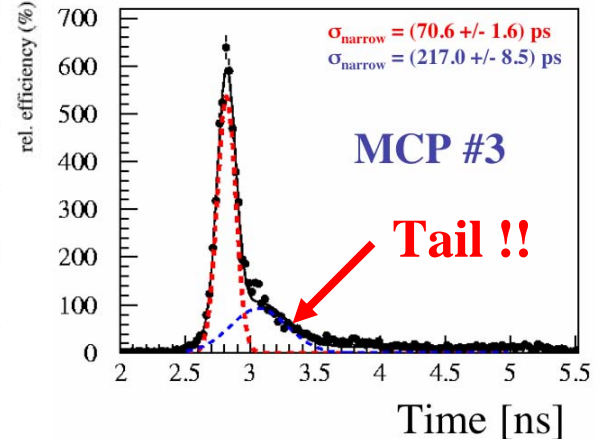
PiLas single pe calibration:



Efficiency w.r.t. Photonis PMT, MCP #15, blue, 2.4kV, 20040607



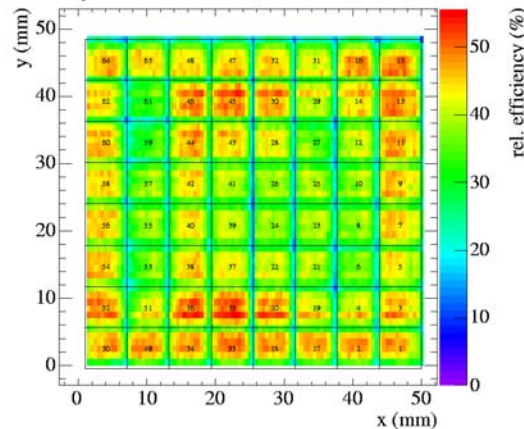
Burle 85011-501 MCP-PMT:



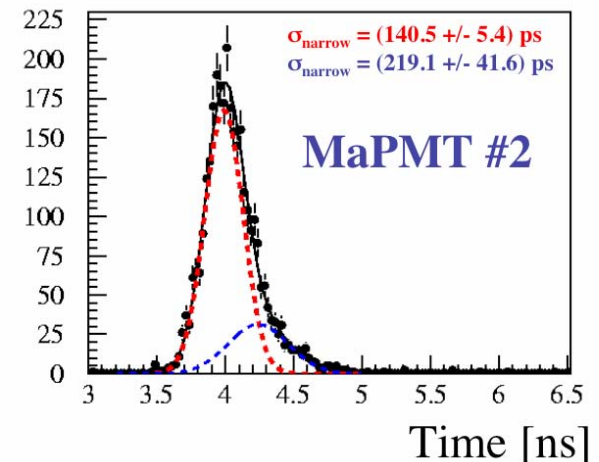
Hamamatsu MaPMT (64 pixels):



Efficiency w.r.t. Photonis PMT, FP #2, blue, 0.9kV, 20040708

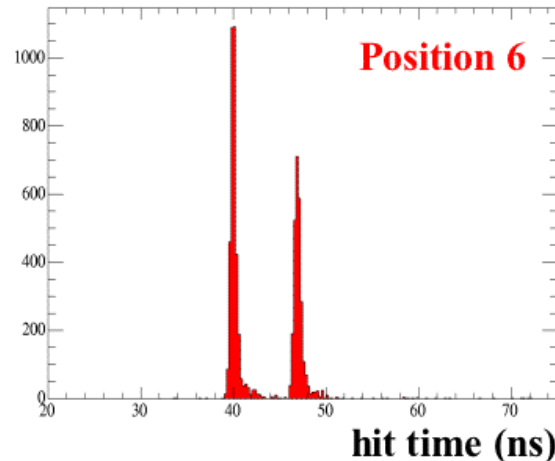
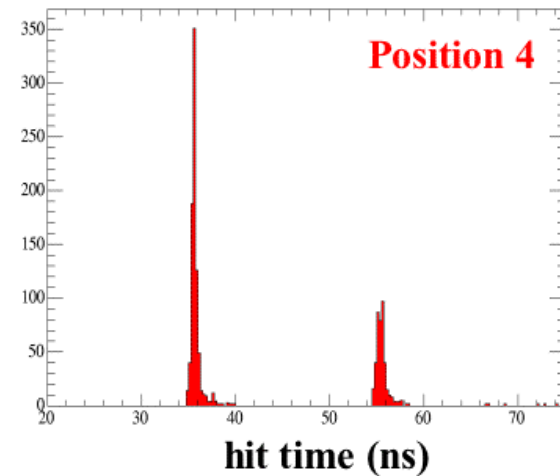
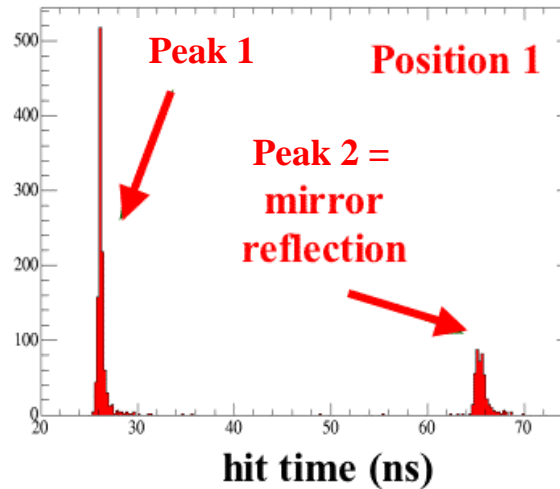
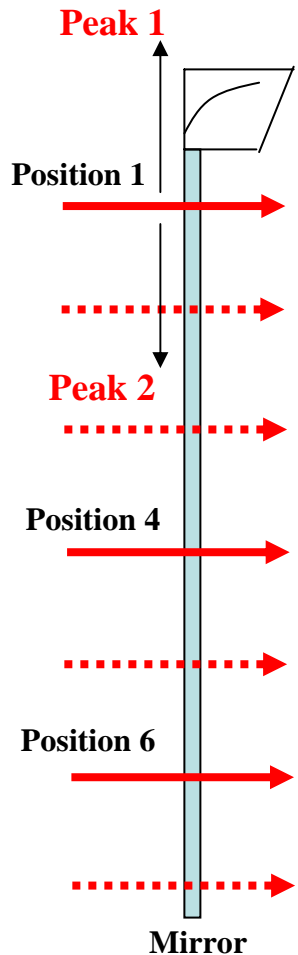


Hamamatsu Flat Panel H8500 PMT:



# Cherenkov ring in the **time domain**

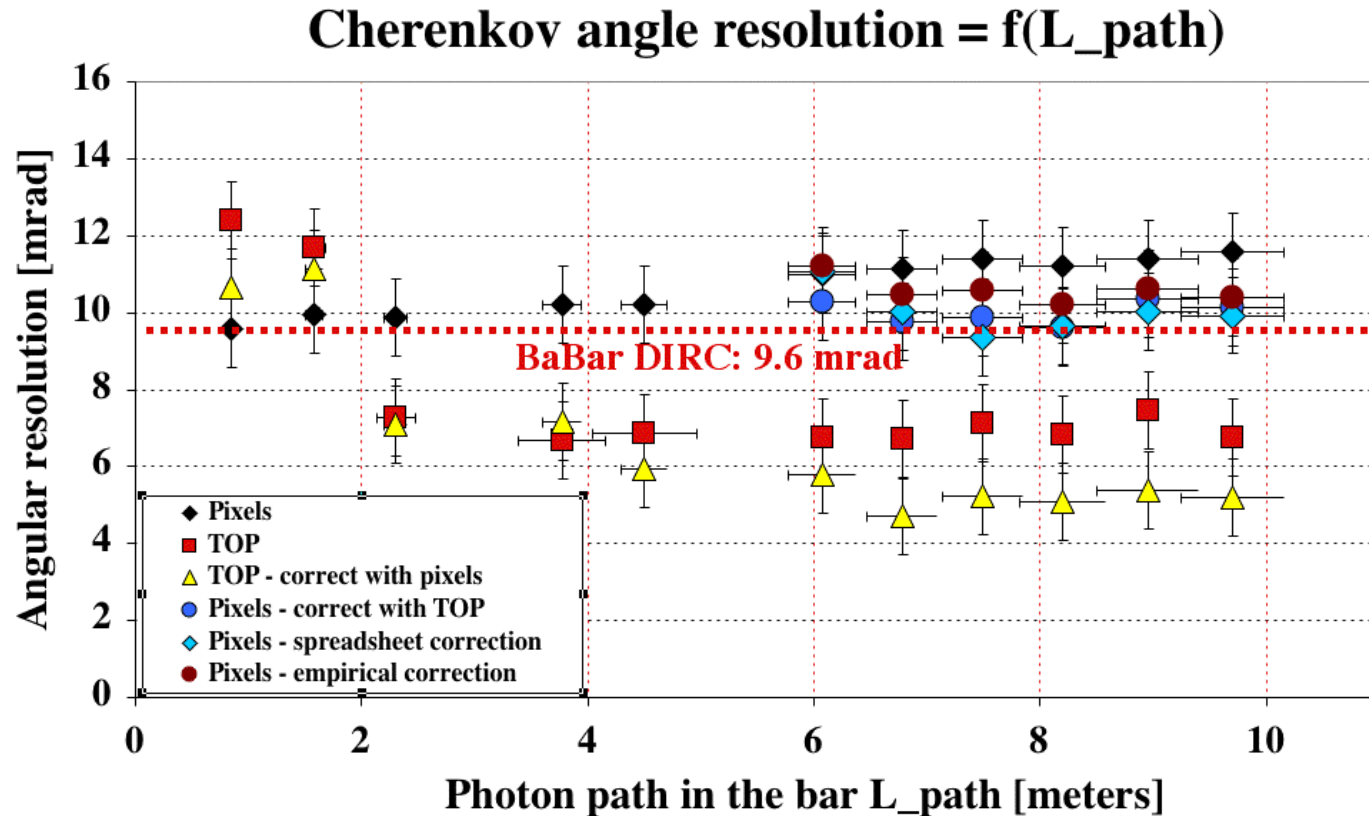
**Pixel #25, Slot #4**



- Two peaks correspond to forward and backward part of the Cherenkov ring.

# Status of chromatic corrections - preliminary

J.V., 5.15.2006

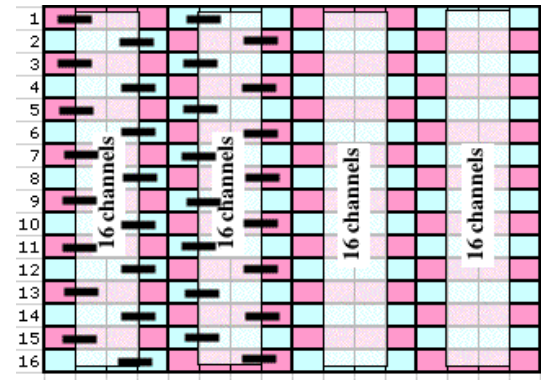
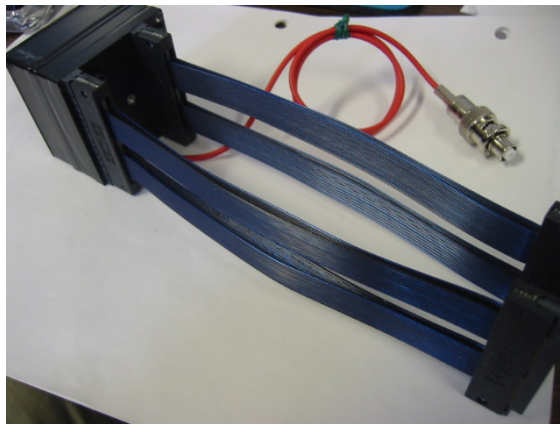
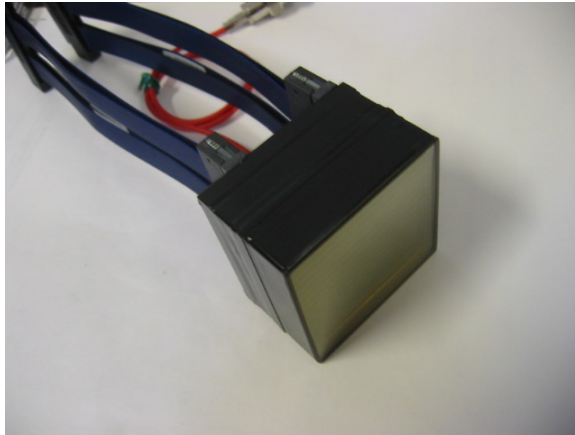


- A slight improvement of ~1-2 mrad for long Lpath.
- Apply the chromatic correction to longer photon paths only

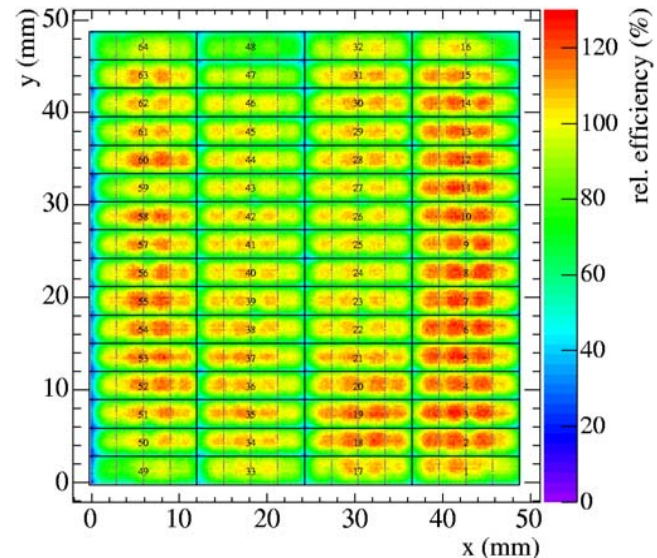


# New 256-pixel Hamamatsu MaPMT H-9500

We made a small adaptor board to connect pads in the following way:



2D scan:



- 256 pixels (16 x 16 pattern).
- Pixel size: 2.8 mmx2.8 mm; pitch 3.04 mm
- 12 stage MaPMT, gain  $\sim 10^6$ , bialkali QE.
- Typical timing resolution  $\sigma \sim 220$  ps.
- Charge sharing important

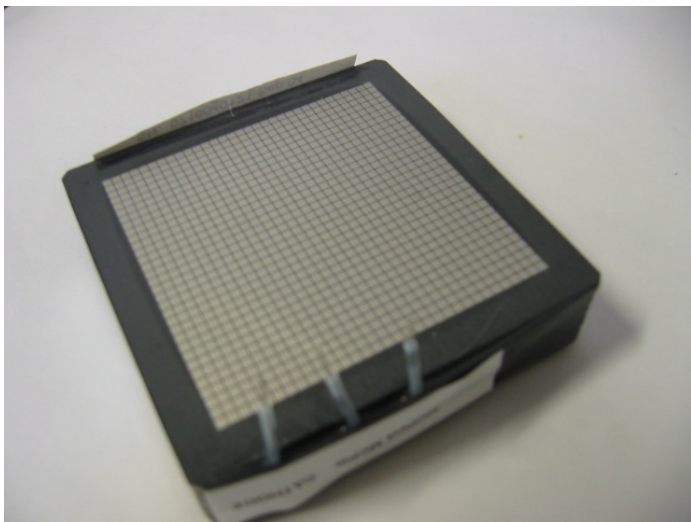
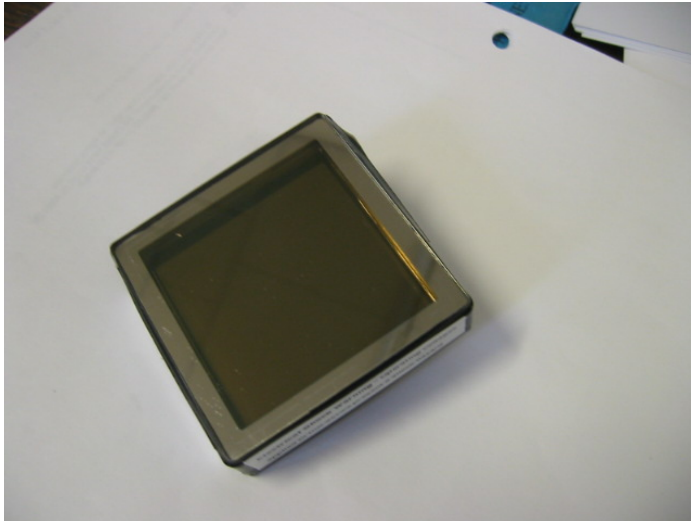
- Large rectangular pad: 1x4 little ones
- This tube was now installed to slot 3

Friday, June 16, 2006

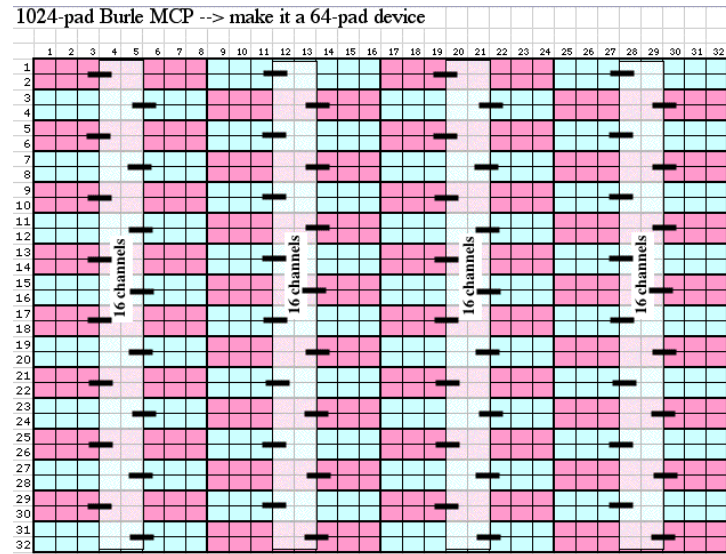
Summary of Detector Working Group Sessions



# “Open area” 1024-pixel Burle MCP 85021-600



**Burle will connect pads as follows:**



- **Large rectangular pad: 2x8 little ones**
- **Small margin around boundary**
- **Nominally 1024 pixels (32 x 32 pattern)**
- **Pixel size: ~1.4mm x 1.4mm**
- **Pitch: 1.6 mm**
- **This tube will be in slot 4 in next run**

# VERTEX DETECTOR WORK

Nicola Neri's simulation of vertexing,

and

Francesco Forti's MAPS report.

For comparison:

BaBar:

R= 27.9 mm  
(32mm Layer1)

SuperB

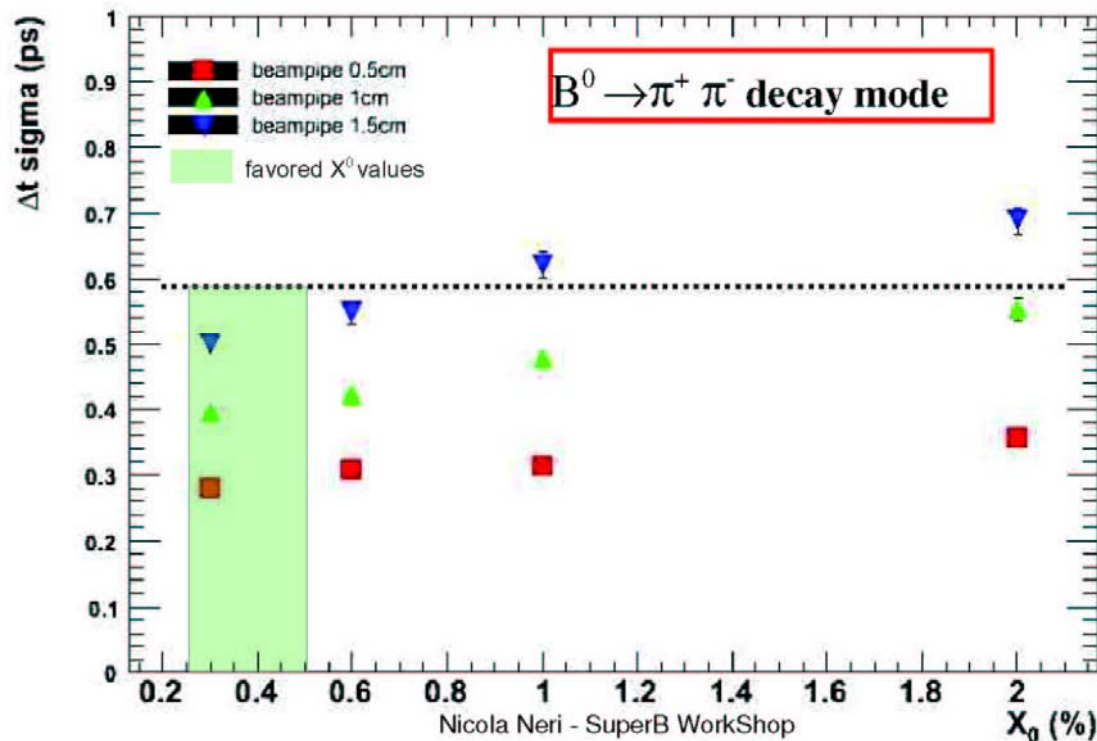
R=10 mm

Total material

1.1% X0

0.48% X0

with a boost of  $\beta\gamma$  0.28

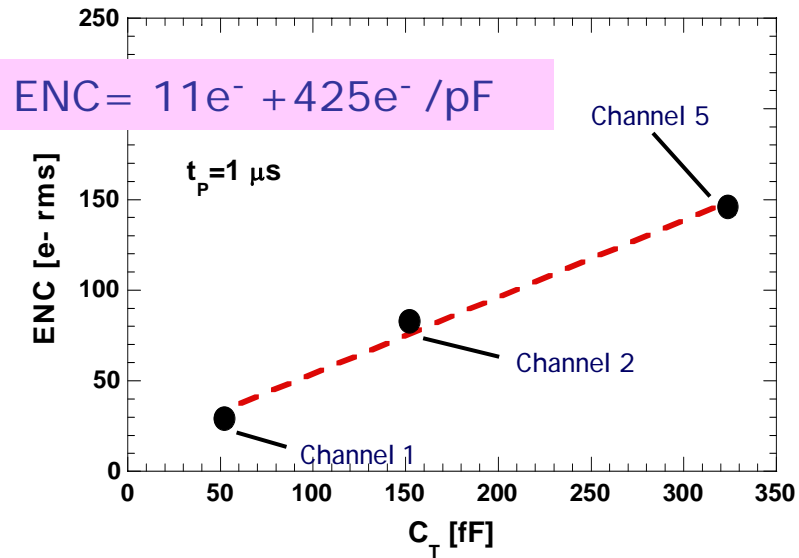
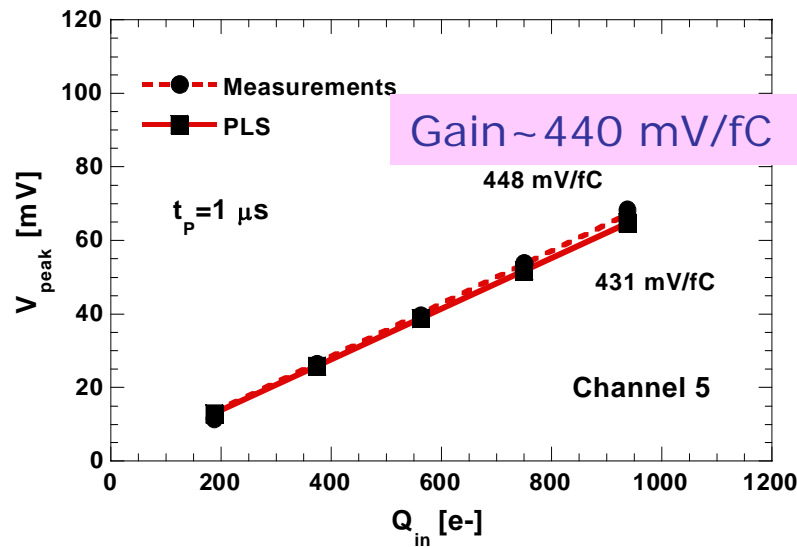


# Outline

- Introduction: standard MAPS for vertex detectors in HEP
- The new features of our MAPS:
  - deep n-well collecting electrode
  - signal processing at pixel level
- The characterization of the 1<sup>st</sup> prototype “Apsel0”:
  - Front-End Electronics
  - Sensor response to:
    - soft X-rays from  $^{55}\text{Fe}$
    - $\beta$ -rays from  $^{90}\text{Sr}/^{90}\text{Y}$
- 2<sup>nd</sup> prototype “Apsel1”:
  - FEE improvements
  - Single channel response to ionizing radiation
  - Test on the matrix
- Next submission: “Apsel2”
- Conclusions

# Gain & Noise Measurements

- Charge sensitivity and Equivalent Noise Charge measured in the three channels with integrated injection capacitance  $C_{inj}$
- Good agreement (~10%) with the post layout simulation results (PLS)



- Equivalent Noise Charge is linear with  $C_{Tot}$

$$C_{Tot} = C_D + C_F + C_{inj} + C_{in}$$

$C_D$  = detector capacitance (~270fF ch.5,  $C_D^{MIM}$ =100fF)

$C_F$  = preamplifier feedback capacitance (8 fF)

$C_{inj}$  = test inj. Capacitance (30 fF)

$C_{in}$  = preamplifier input capacitance (14 fF)

$$ENC = C_T \sqrt{S_W \frac{A_1}{t_p} + A_2 A_f}$$

$S_W$  = series white noise spectral density  
 $A_f = 1/f$  noise power coeff.,  $A_1$ ,  $A_2$  = shaping coeff.

dominant contribution

- Sensor capacitance higher than initially expected: noise performance greatly affected. Room for improvement in next chip submission

# Conclusions (I)

- A novel kind of CMOS MAPS (deep N-well MAPS) has been designed and fabricated in a 130 nm CMOS technology:
  - A deep n-well used as the sensitive electrode
  - The standard readout channel for capacitive detectors used to amplify the charge signal and extract digital information
- The first prototype, **apsel0**, was tested and demonstrated that the sensor has the capability of detecting ionizing radiation.
- In the new chip, **apsel1**, noise and gain issues (present in aysel0) have been correctly addressed.
- Single pixel measurements confirm the observation of soft X and  $\beta$  rays
- The 8x8 (simple) matrix has been successfully readout

# Conclusions (II)

- Still ongoing analysis of the response to radioactive sources from the pixel matrix
- Next submission (Aug. 06) focused on:
  - Cure the threshold dispersion
  - More diagnostic features on pixel matrix
  - Test digital blocks toward data sparsification
- Our final goal: to develop a matrix with sparsified readout suitable to be used in a trigger (L1) system based on associative memories.

# The SLIM5 collaboration (Silicon with Low Interaction with Material – CSN5 INFN)

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<sup>9</sup>INFN Torino and Università degli Studi di Torino

<sup>10</sup>Università degli Studi di Trento and INFN Summer of Detector Working

<sup>11</sup>Università degli Studi di Modena e Reggio Emilia and INFN Padova

## 4 Workpackages:

**.1 MAPS and Front End Electronics**

**.2 Detectors on high-resistivity Silicon**

**.3 Trigger / DAQ**

**.4 Mechanics/Integration/Test-Beam**

Friday, June 16, 2006

Summary of Detector Working

Group Sessions



# Beam Pipe and Backgrounds

A design of a new beam pipe from Pisa  
and  
several reports on background studies.

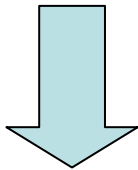
# A possible design

## “Uniform” Water Jacket (8 flat channels)

Single channel area =  $2.35 \text{ mm}^2$

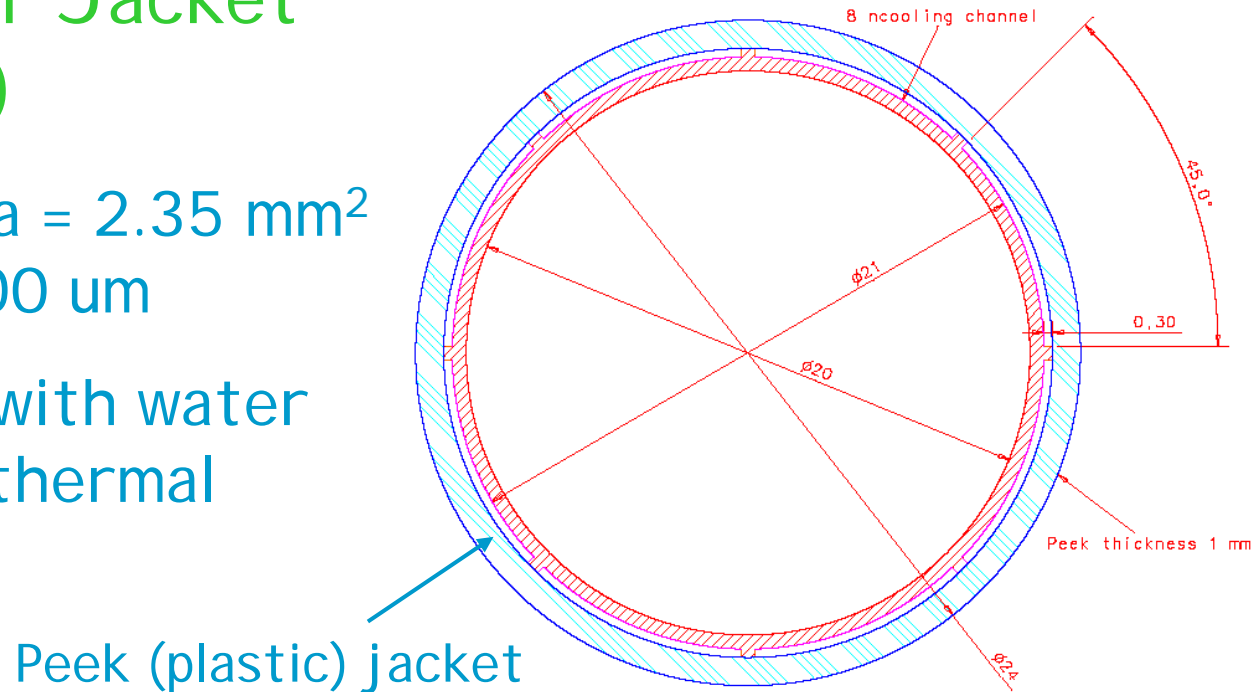
Channel width =  $300 \text{ }\mu\text{m}$

To dissipate 1KW with water  
specific heat and thermal  
conductivity



Flow:  $4.2 \text{ m/s}$  (OK)

Pipe Inner Radius 1 cm



Requires channel 1-side coating  
to prevent erosion  
(7um Ni and/or BerylCoatD)

# Conclusions

- New beam-pipe design has a cooling system. Radial material has been kept to minimum but not a critical parameter.
- Time dependent measurements will take advantage of smaller beam-pipe radius and thinner radial material, allowing lower boost parameters.
- $K_S$ +Neutrals decay modes need a deeper study since could dominate the  $\Delta t$  resolution once optimal tagging performances will be achieved.
- Preliminary results on B-D vertex separation look promising with possible major impact on analysis techniques.

# Backgrounds

- In general, we believe that the backgrounds at Super B are likely to be not much worse than we live with today.
- But with a x100 increase in luminosity we need to work hard on evaluating this, and be wary of new sources.
- Mike Sullivan, with his old tried-and-true tools, and Evgeni Paoloni and Giovanni Calderini, with interesting new tools, are making good progress.

Need to coordinate their work, and bring it to closure.

- We had a nice report in the parallel session from Weaver on detailed measurement of PEP II beam properties, and quantitative attempts to measure beam correlations. Could be helpful in helping a quantitative description of beam-beam effects and understanding backgrounds.

# Tracking Chambers

- There is a lot of work going on by Belle at KEK

Adam Boyarski presented a thorough study of aging in the BaBarChamber, with quantitative modeling

Boyarski's experience :-

1. A water additive can keep a drift chamber alive at very high rates, but water does not prevent film growth.
2. Oxygen can clean cathodes and anodes.
3. The breakdown mechanism in chambers with no additives is due to high E-fields from charge accumulation in thin films on cathodes and Fowler-Nordheim field emission.
4. Cathode aging can be modeled.

# Physics

There has been broad, and rather universal, agreement on the powerful physics reach of a  $10^{36} \text{ cm}^{-2} \text{ sec}^{-1}$  luminosity B Factory.

We heard many new talks at this meeting, making essentially the same story. This is **NOT** our problem.

# Charm/Tau Task Force

David Hitlin is leading a small group looking at physics at lower energy running – charm and tau physics at around 4 GeV.

Their report is due out in a few weeks, and will probably recognize the potential importance of incorporating polarisation rotators for study of polarised tau decays.

# What is needed for the Fall INFN Report

- Energy Asymmetry
- Beam pipe radius
- Beam pipe design
- Backgrounds
- Trigger and DAQ
- PID
- Calorimeter
- R&D
- Polarized Beam



# Re-use of Detectors

When we talk about trying to reuse either of the two B Factory detectors, as we consider getting ready to do SuperB physics, I suggest that we might not confine our eager, lustful eyes only to these two devices – by the time we are ready for that decision, there will be other detectors (paid for by federal funds) that may offer some attractive advantages – like CLEO, DO or CDF.

# SuperB R&D

- We need to consider when is the right time to set up a formal structure to guide the R&D activities. This probably needs to wait until there is a real project, being discussed by world agencies – and it should probably be arranged to have ‘local agencies’ fund ‘local activities’.

# Next Meeting

We still have a lot of work to do.

We will meet again in the fall –  
let's try to work towards some  
closure on the issues that need  
answers before we can write the  
report that INFN needs.













# Summary from Oide's talk at 2005 2<sup>nd</sup> Hawaii SuperBF Workshop

- Present design of SuperKEKB hits fundamental limits in the beam-beam effect and the bunch length (HOM & CSR).
- Higher current is the only way to increase the luminosity.
- Many technical and cost issues are expected with a new RF system.

**HIGH CURRENT and HIGH BACKGROUND IS A  
BIG ISSUE FOR :**

**DETECTOR DESIGN**

**WALL POWER NEEDED**

**•We need a completely different collider scheme.....**

# Solution

**Synergy with ILC + CRAB WAIST**

(3 Km/ 6Km)

ILC ring with ILC FF  
Uncompressed bunches  
Colliding every turn  
crossing angle=2\*25mrad

7+4GeV

BKGD  
expected  
lower than in  
BaBar at  
PEPII.

1.0 cm Beam  
pipe possible  
inside SVT

FF IP FF

# Detector comments

Background should be lower than in Babar. Occupancy would be OK in Vertex Detector even with a smaller radius beam pipe. (from 3cm of Babar down to 1.cm). Simulations are currently run for interaction region and Bgkd.

Apparatus would be more hermetic than Babar and Belle (7+4 GeV).

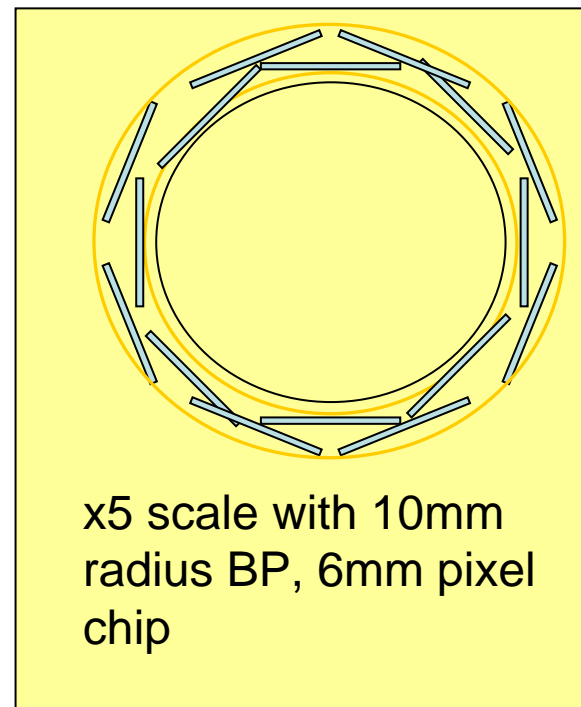
Detectors don't require a major R&D

PID would be needed also in forward/backward direction.

By reducing Lorentz boost higher resolution vertex is needed (MAPS?)

R&D on EMC (Babar Caltech..)

R&D on PID (Babar: Slac) (Belle :KeK ,Lubijana



R&D on Maps within Belle (Hawaii group) and Babar (Pisa+Slac)

Two monolithic active pixel layers glued on beam pipe

Since active region is only  $\sim 10\mu\text{m}$ , silicon can be thinned down to  $\sim 50\mu\text{m}$ . Good resolution  $O(5\mu\text{m})$ .

Improves pattern recognition robustness and safety against background

# Goals

Preliminary evaluation of need for special runs on tau and charm Evaluation of needs for special runs symmetric, at c.m. energies even lower than 10 GeV.

Evaluation of benefits with one polarized beam

Better definition of a single machine design

fix one minimum circumference of the machine

Study of the interaction region and Background

Beam pipe preliminary design

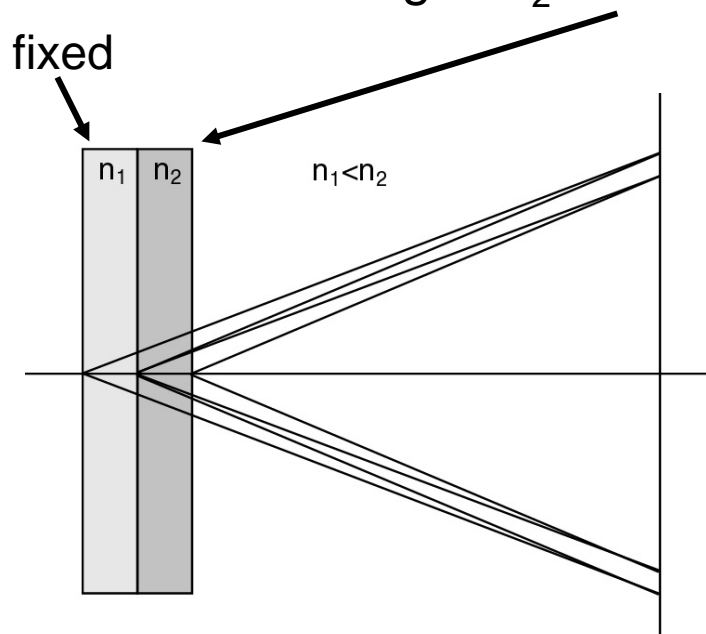
(to move on to a realistic design of vertex-tracker with an adequate R&D)

# Optimization of dual radiator indices

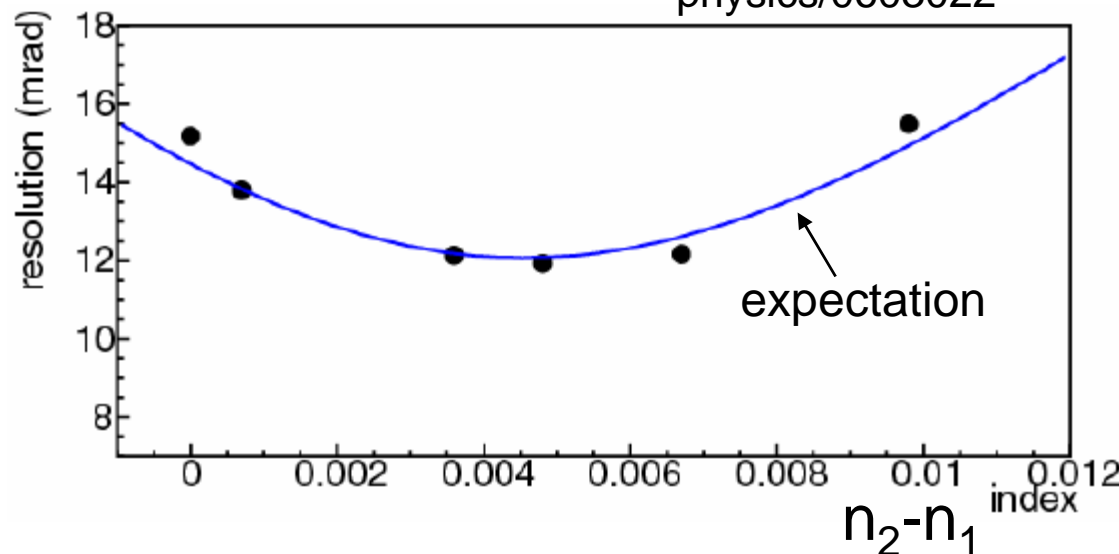
A-RICH

Upstream aerogel:  $n_1=1.045$

Downstream aerogel:  $n_2$  is changed



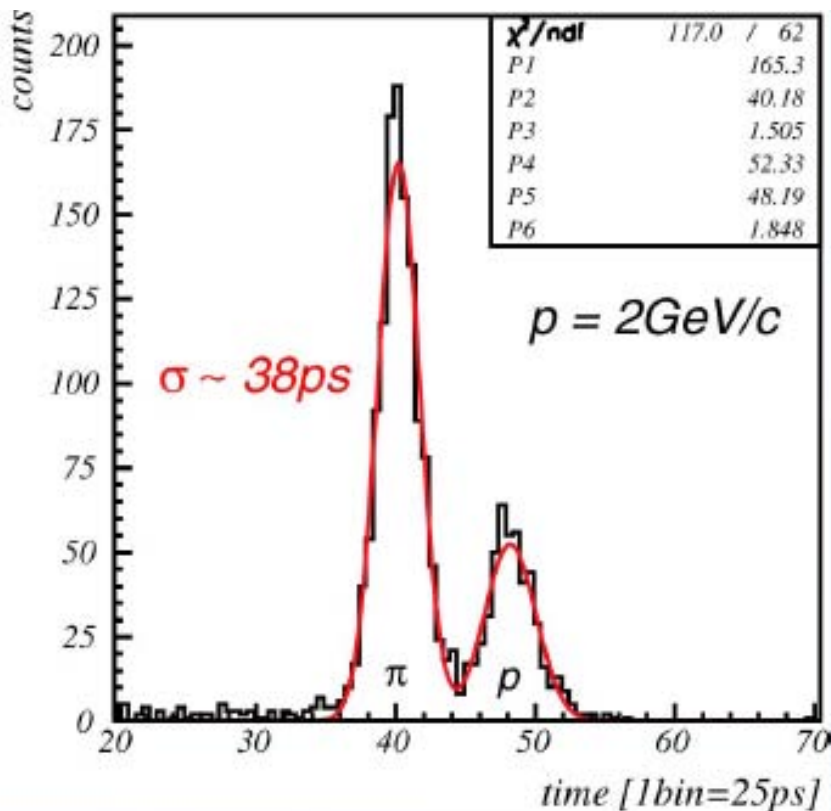
Data points: Dec. 2005 beam test  
physics/0603022



- Measured resolution is in good agreement with expectation
- Wide minimum region allows some tolerances ( $\sim 0.003$ ) in aerogel production

# A-RICH with TOF PID at low momentum

A-RICH



TOF test with pions and protons  
at  $2\text{ GeV}/c$

Photons from PMT window

$\pi/p$  are well separated

Even in distance between start  
counter and MCP-PMT is 65cm,  
instead of 2.0m in Belle

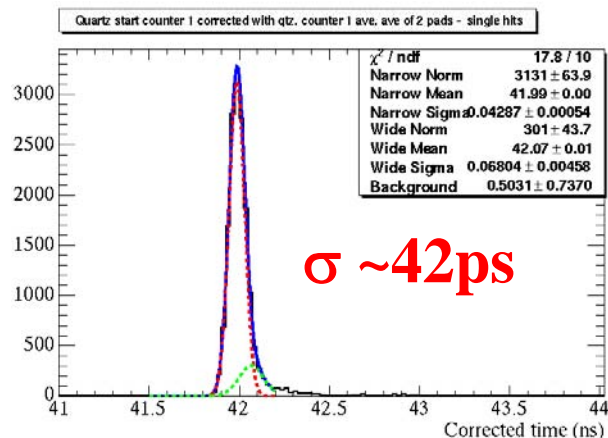
At this test,  $\pi/p$  separation with MCP-PMT

$S_{\text{TOF}} \sim 4.8\sigma$  @  $2\text{ GeV}/c$

A-RICH with TOF  
using MCP-PMT  
looks very promising

# 1. Start counter 1 - Double-quartz counter

Average of 2 pads:



4-pad Burle MCP-PMT:

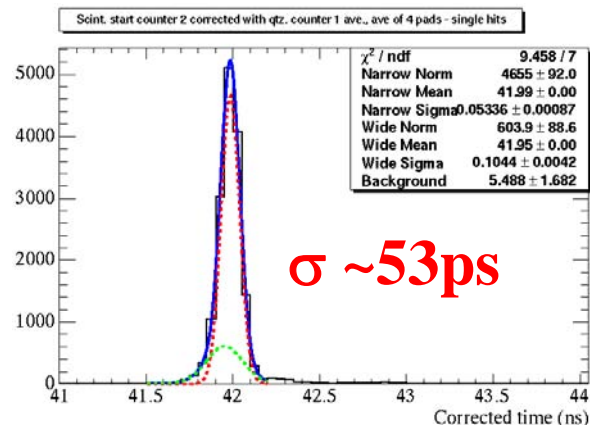


**Local START  
Counters:**

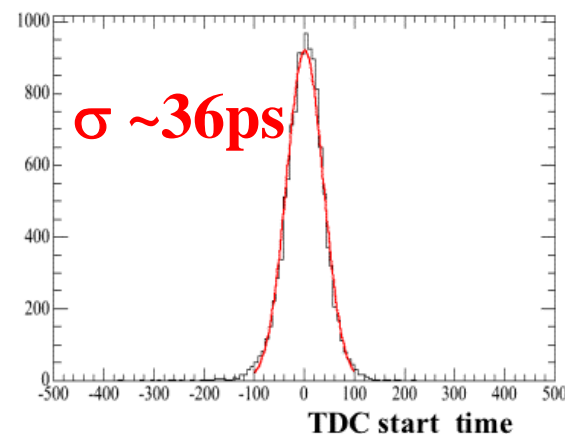
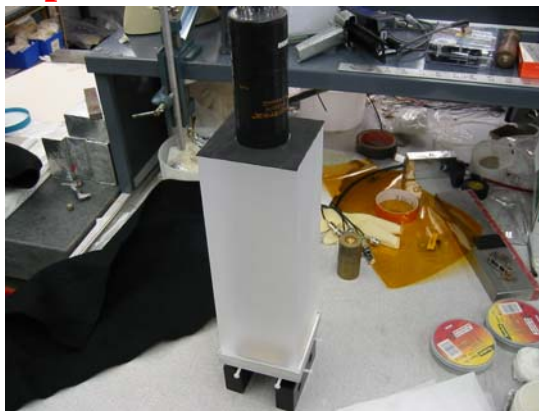
3. Overall average  
of Start 1, Start 2  
and Quantacon  
counters:

# 2. Start counter 2 - Scintillator counter

Average of 4 pads:

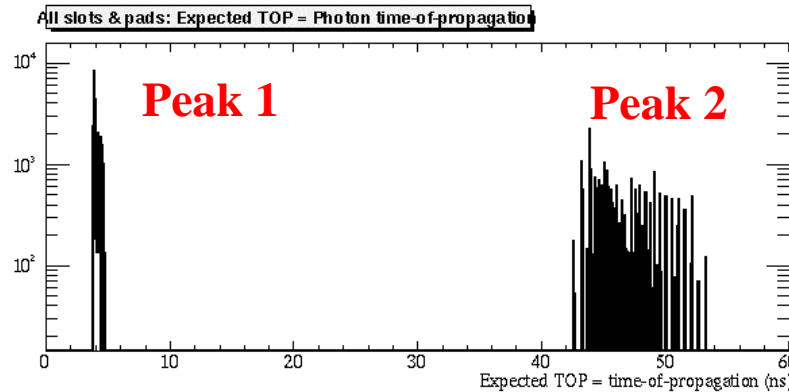
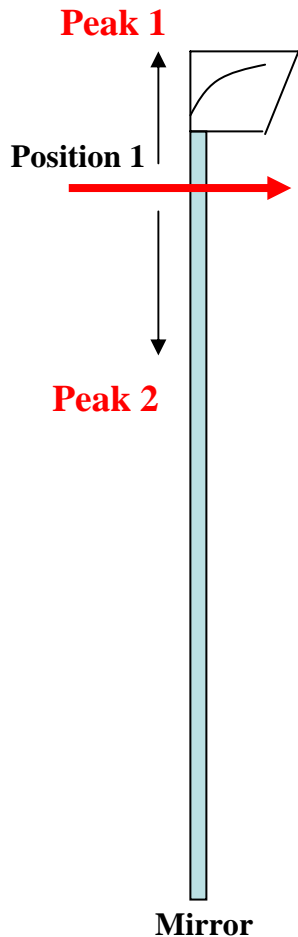


4-pad Burle MCP-PMT :

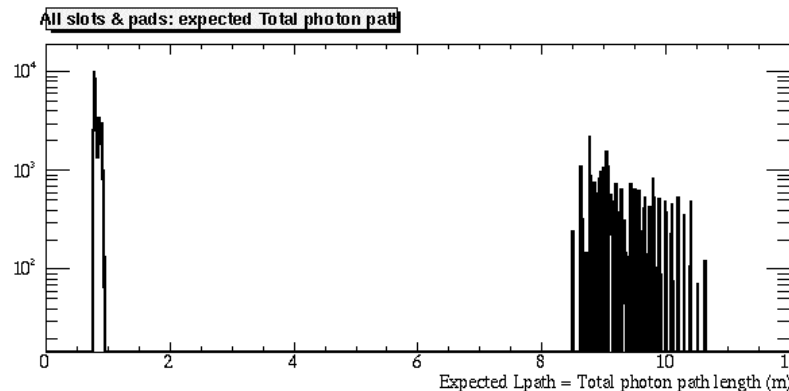


- **Corrections: ADC, hodoscope position and timing drifts.**

# Typical distribution of TOP and Lpath



TOP [ns]



Lpath [m]

- Measured TOP and calculated photon path length Lpath
- Integrate over all slots & pixels

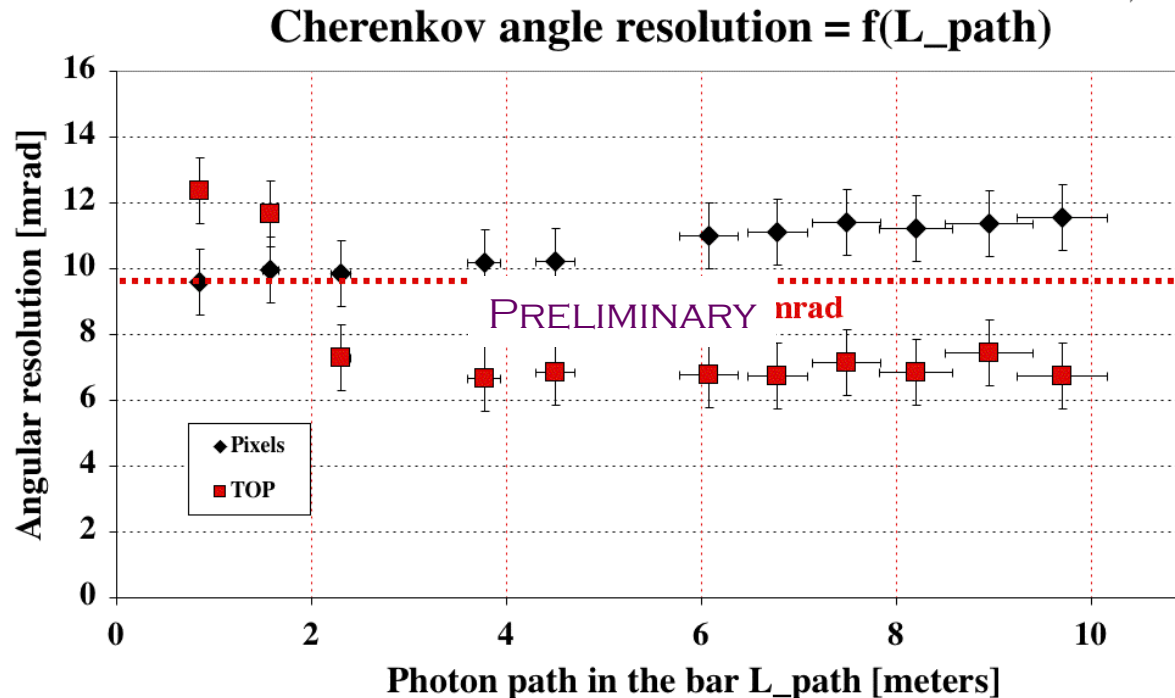


# Summary of preliminary results:

$\Theta_c$  resolution from pixels is 10-12 mrad.

$\Theta_c$  resolution from time of propagation (TOP) improves rapidly with path length, reaches plateau at ~7mrad after 3-4 meters photon path in bar.

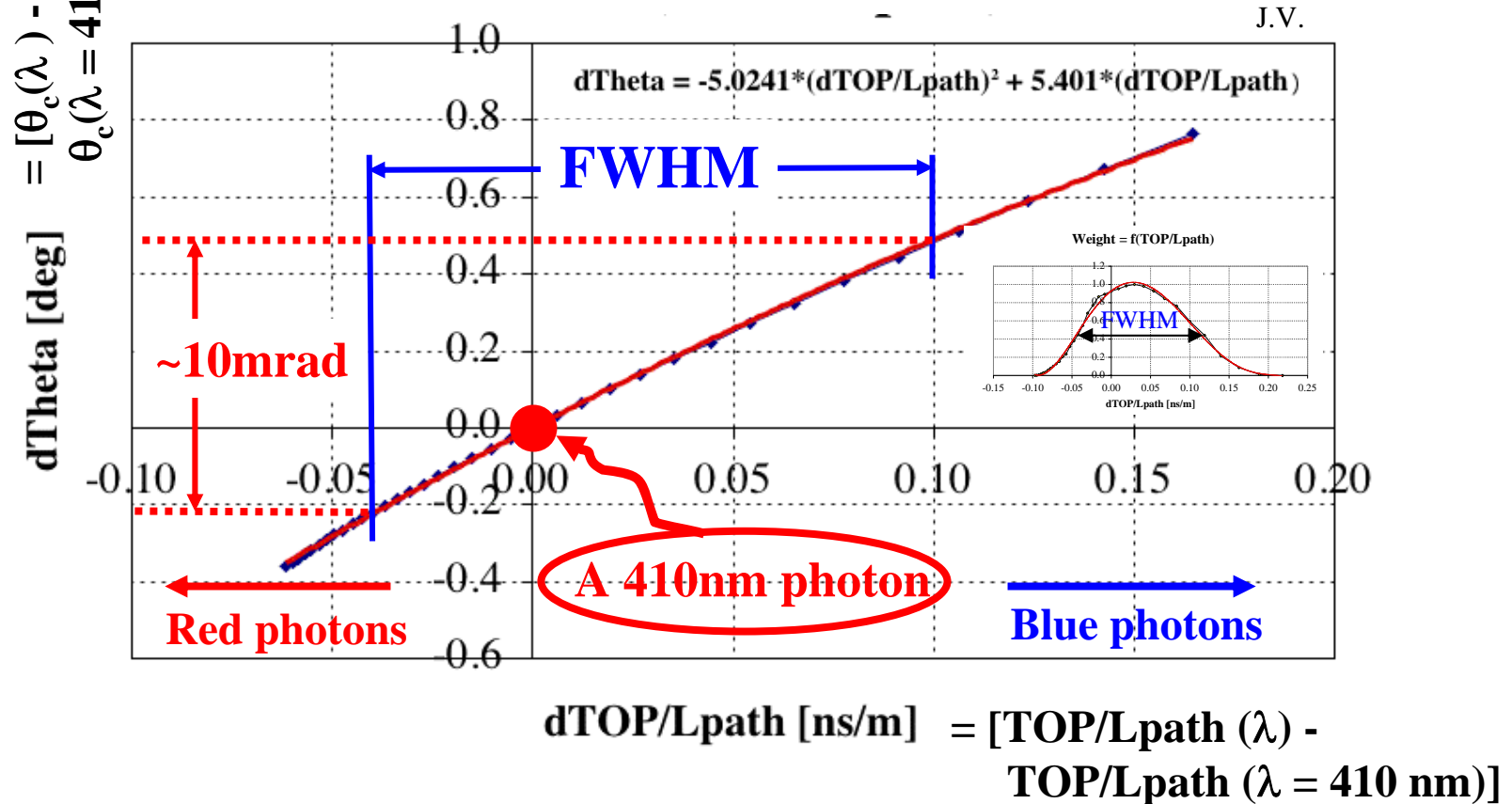
J.V., 5.12.2006



Comments: a) The present TOP-based analysis assumes  $\beta = 1$ ,

b) In the final analysis we will combine pixels & time into a maximum likelihood analysis.

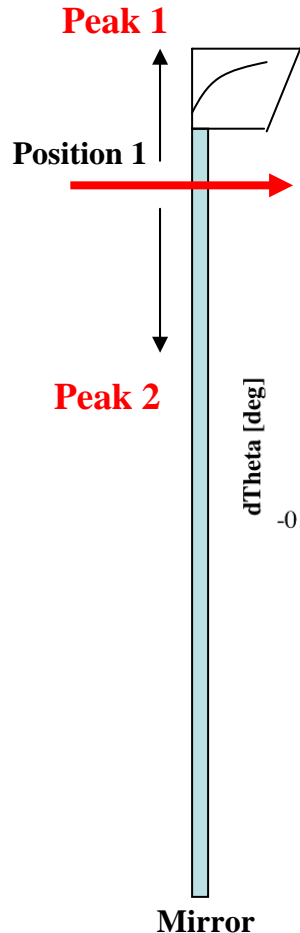
# The chromatic correction (spreadsheet)



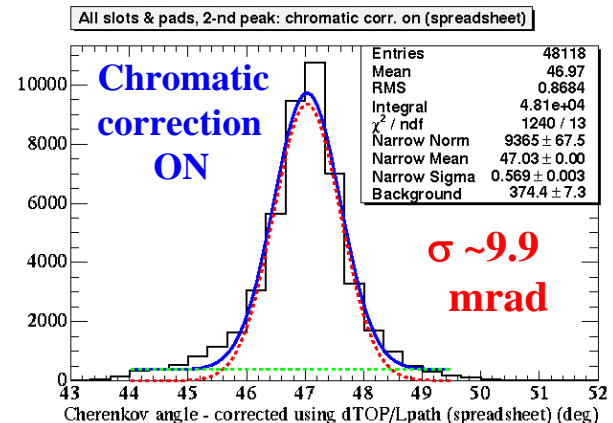
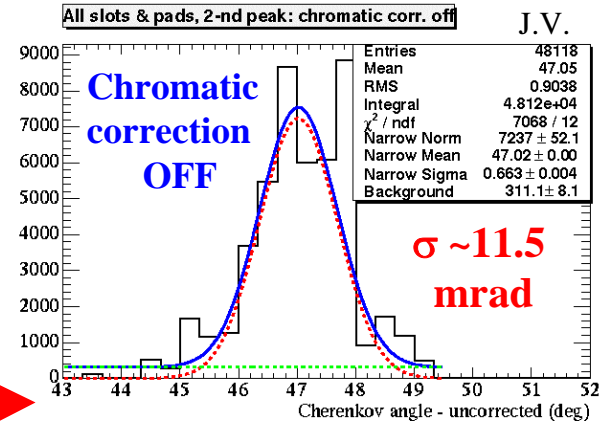
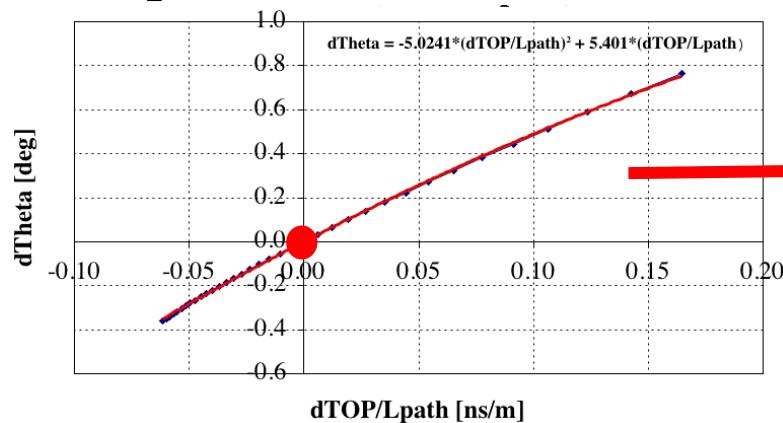
- An average photon with a color of  $\lambda \sim 410 \text{ nm}$  arrives at “0 ns offset” in dTOP/Lpath space. **A photon of different color, arrives either early or late.**
- The overall expected effect is small, only FWHM  $\sim 10 \text{ mrad}$ , or  $\sigma \sim 4 \text{ mrad}$ .

# Method #1: Spreadsheet calculation of $d\theta_c$ vs $d(TOP/Lpath)$ .

All slots, all pads, position 1, Peak 2 only:



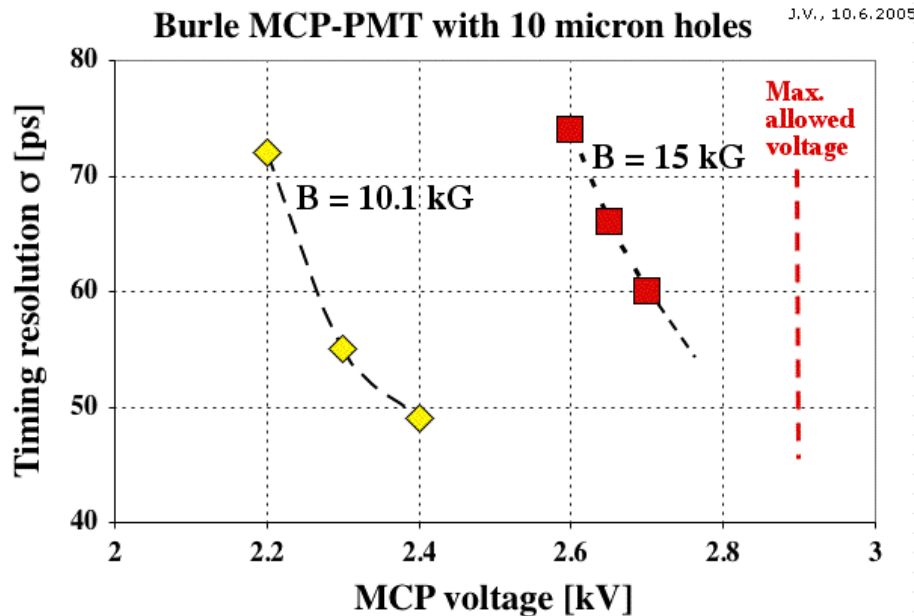
Spreadsheet:



Cher. Angle (pixel) [deg]

- An improvement of  $\sim 1.5$  mrad.

## Timing results at B = 15 kG

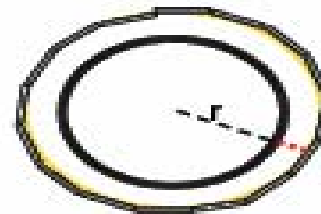


- **Single photoelectrons**
- **10 $\mu$ m hole 4-pad MCP-PMT**
- **Ortec VT-120A amp**
- **It is possible to reach a resolution of  $\sigma$  ~50ps at 15kG.**

# Beam-pipe scenarios

- **conservative scenario:**

- beam pipe radius 1.5cm
- hit resolution  $z, \phi$  side =  $10 \mu\text{m}$
- Radial material =  $0.50\% X_0$



$r=1.5\text{cm}$

- Be beam-pipe
- Kapton foil
- $50 \mu\text{m}$  Silicon pixel

- **most likely scenario:**

- beam pipe radius 1.0cm
- hit resolution  $z, \phi$  side =  $10 \mu\text{m}$
- Radial material =  $0.39\% X_0$



$r=1\text{cm}$

- **aggressive scenario:**

- beam pipe radius 0.5cm
- hit resolution  $z, \phi$  side =  $5 \mu\text{m}$
- Radial material =  $0.24\% X_0$



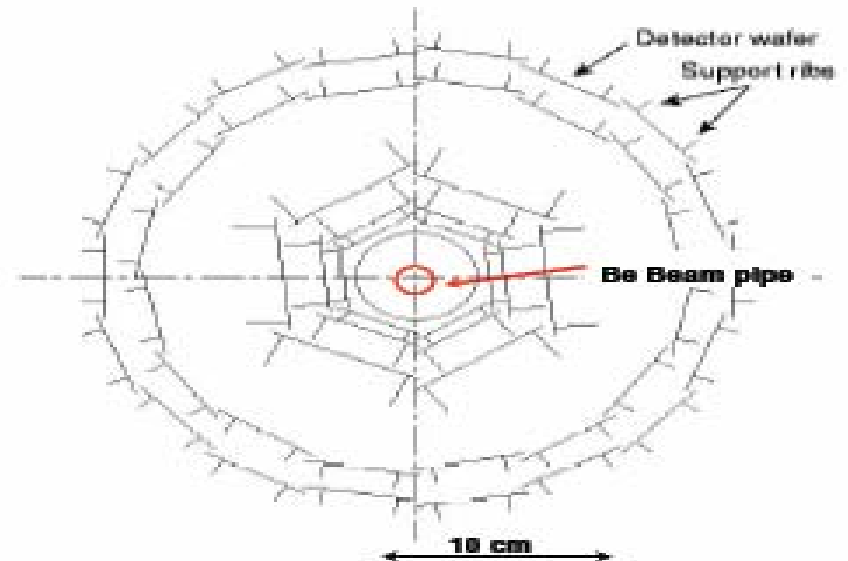
$r=0.5\text{cm}$

# SuperB SVT Geometry

ADDED

| Layer | Radius          |
|-------|-----------------|
| 0     | 1.05 cm         |
| 1     | 3.3 cm          |
| 2     | 4.0 cm          |
| 3     | 5.9 cm          |
| 4     | 9.1 to 12.7 cm  |
| 5     | 11.4 to 14.6 cm |

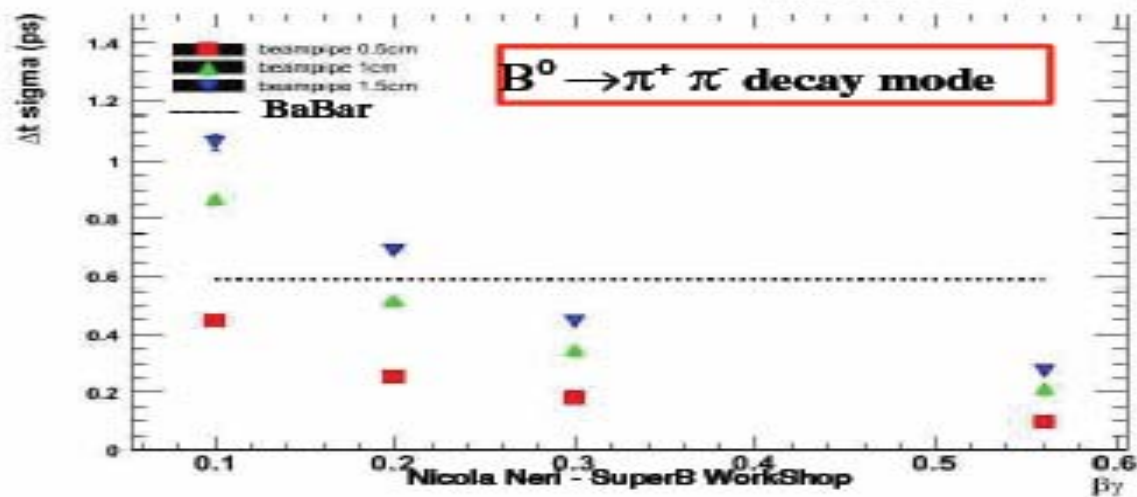
- Added layer0
- Reduced beam-pipe radius 2.5→1cm
- Reduce Be thickness 1.3→0.6mm
- 4  $\mu\text{m}$  Au foil before layer0



(Arched wedge wafers not shown)

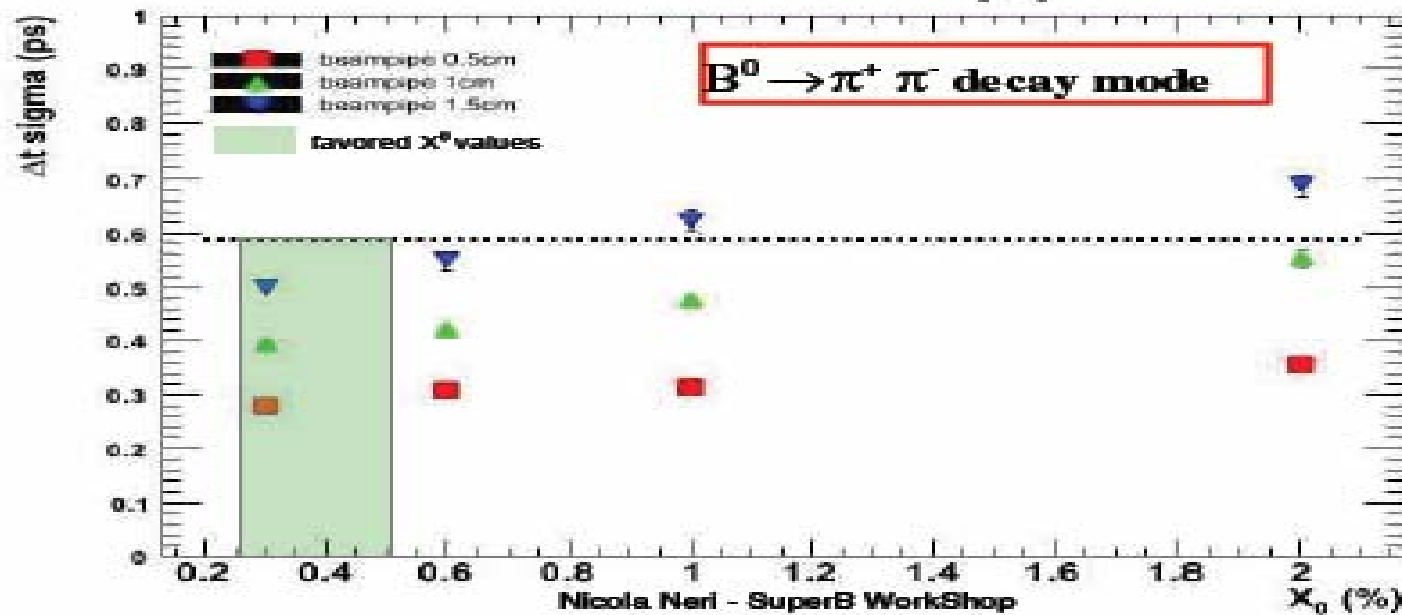
## $\Delta t$ resolution in B decays: exact method

$$\Delta z = \beta_z \gamma \gamma_{CP}^{cms} c \Delta t + \gamma \gamma_{CP}^{cms} p_{z,CP}^{cms} \left[ \frac{|L_z^{CP}|}{|p_{z,CP}|} + \frac{|L_z^{TAG}|}{|p_{z,TAG}|} \right]$$



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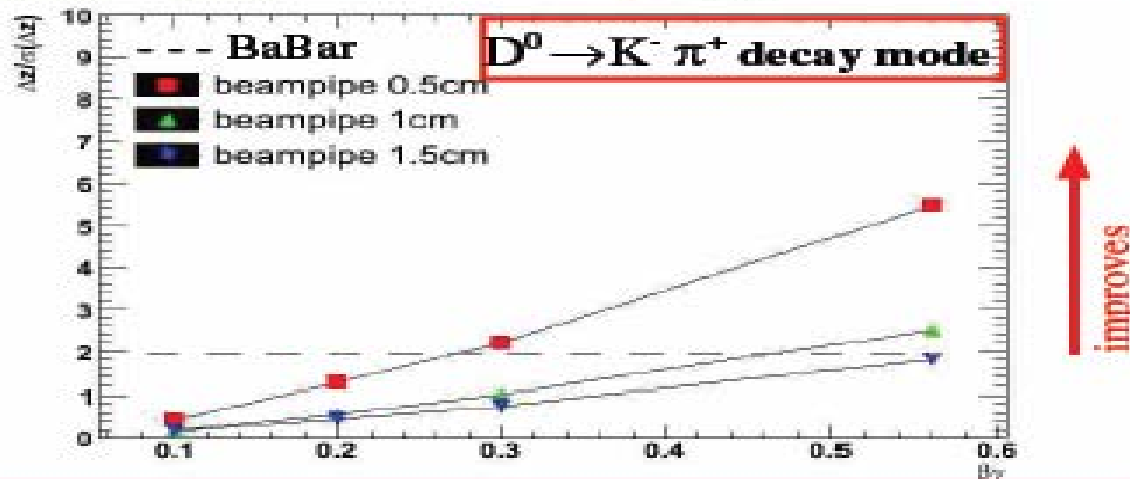
# $\Delta t$ resolution in B decays vs $X_0$ (%) with a boost of $\beta\gamma$ 0.28





# $\Delta z$ resolution in D decays at $\Psi_{3770}$

Assume  $\sigma(\text{Tag})=\sigma(\text{Vtx})$ : low track multiplicity, no charm bias in Tag vtx

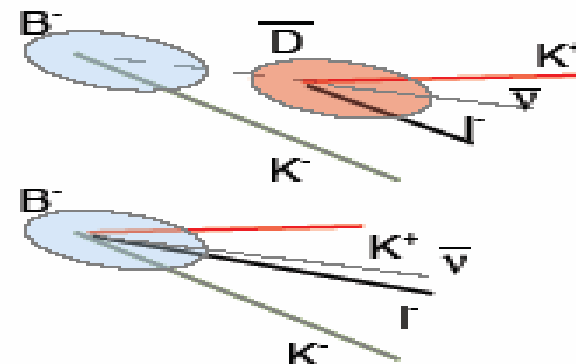


D lifetime 0.4 ps, for B it is 1.5 ps  $\Rightarrow$  Smaller  $\Delta z$  significance.  
Layer0 at 0.5cm and reduction of the radial material is important.

# B-D vertex separation: analysis implications

- Continuum bkg rejection:
  - use  $L/\Delta L$  as Fisher discriminant variable
- Tagging Topological algorithm
  - define a dipole= $L \cdot D$  charge and exploit D sign-B flavor correlation

Rare and/or bkg dominated decay modes

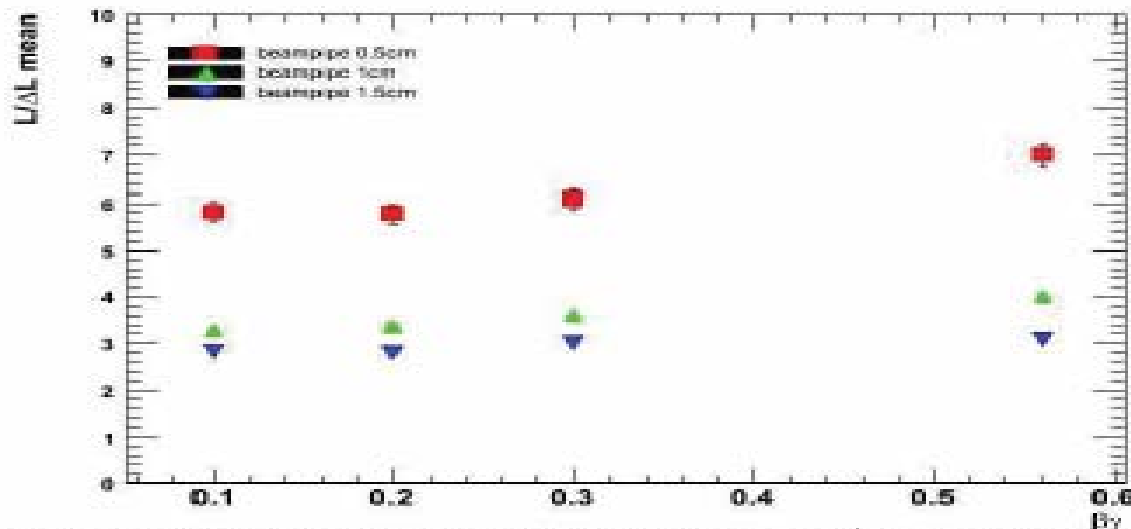


Allow to measure  $rb$  parameter relevant for the  $\gamma$  measurement

Nicola Neri - SuperB WorkShop

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## $L/\Delta L$ : small dependence on boost



The significance of L for  $B \rightarrow DX$  signal events becomes linear with the boost of CM when the  $\beta\gamma$  of the CM dominates wrt to the  $\beta\gamma$  from the B decay.

A common sentiment:

The Standard Model works **unreasonably** well!

Over past 20 years, (almost) all pieces verified:

- LEP checked weak gauge sector at 1–2 loops
- Tevatron has completed fermion spectrum
- Tevatron + HERA + LEP + ... have verified strong interactions/QCD
- B-factories have verified CKM picture of flavor-mixing and CP violation
- Neutrino masses found -- AS EXPECTED
- **Only EW symmetry breaking mechanism remains undiscovered.**

So arguments for SuperB factories based on

- Deciphering the 3 generation riddle
- Determining dynamics leading to CKM structure
- Discovering ultimate source of CPV

will go unheeded by many physicists.

Theorists' view: We are used to "decoupling" flavor physics from new physics that solves hierarchy problem. We generally don't expect non-trivial flavor dynamics anywhere near weak scale.

Flavor measurements are useful constraints on new physics, but are unlikely to teach us much about new physics once it is found. (E.g. LHC Theory Initiative)

Most models of Beyond-the-SM physics have a  
**"FLAVOR PROBLEM"**

In the Standard Model, large FCNCs are prevented by combo of CKM unitarity and small mixings between heavy and light quarks.

In most BTSM proposals, CKM mechanism fails by one loop. It fails because:

- Difficult to maintain CKM as only source of FCNCs if more states carry flavor (e.g. SUSY)
- If 3<sup>rd</sup> generation is "special", it feeds back into all FCNCs (e.g. topcolor)
- If new gauge interactions differentiate flavors, then they directly mediate FCNCs.

But there's more: A SuperB factory is really a Super-Flavor factory. Will produce around  $10^{10}$   $\tau$ -pairs!

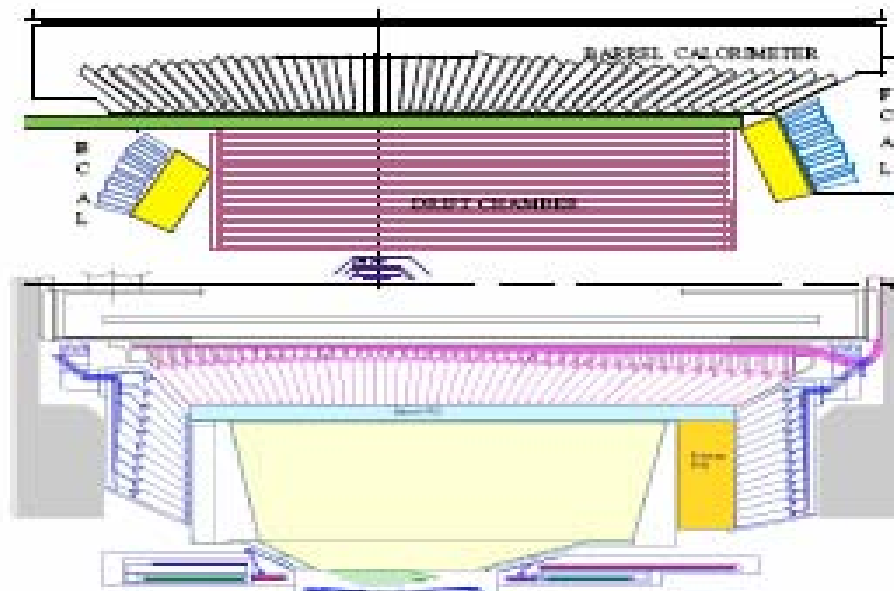
Lots of interesting New Physics in  $\tau$ -sector, thanks to neutrino mixing results.

Reminder:

- In neutrino sector, large mixings occur between  $\nu_\mu$  and  $\nu_\tau$ , and between  $\nu_\mu$  and  $\nu_e$ .
- This vLFV translates into cLFV in SM, but with amplitudes  $\propto (m_\nu/m_W)^2$ . Will never be seen!
- New Physics model often have more direct ways to turn vLFV into cLFV.

## Design Issues

Either BABAR or BELLE could be the basis of a SuperB detector



**BELLE** causes  
problem for **DIRC**

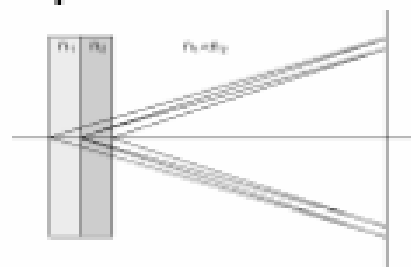
lower boost means backwards detectors more important



## Detector R&D

Silicon R&D - MAPS pixels - Rizzo

forward PID



proximity focussing  
Aerogel - Krizan

Focussing DIRC & new readout - Ratcliff

EMC Endcap occupancy - LYSO or LSO Hitlin

Trigger/DAQ - collision frequency

deadtimeless operation  
Dubois-Felsmann



## Conclusions:

- The success of the Standard Model CKM scenario under severe tests by BaBar/Belle and CDF/D0 means that there is no one golden mode around which to sell a Super-B factory.
- But we KNOW the SM is incomplete from astrophysical data and theoretical consistency. New physics is expected at TeV scale.
- A SuperB factory is needed to constrain and test the kinds of new physics seen at LHC, particularly SUSY. Is nature minimally flavor violating or not?
- A SuperB factory is needed because our arguments might simply be wrong, and we'll never know if we don't check.

# Outline of Summary Detector Working Group Sessions

*David WGS Leith,  
Professor and  
Emeritus Director of Research  
Steering Committee Meeting  
Friday, June 16, 2006*

Friday, June 16, 2006

Summary of Detector Working  
Group Sessions

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# Summary

1. A water additive can keep a drift chamber alive at very high rates, but water does not prevent film growth.
2. Oxygen can clean cathodes and anodes.
3. The breakdown mechanism in chambers with no additives is due to high E-fields from charge accumulation in thin films on cathodes and Fowler-Nordheim field emission.
4. Cathode aging can be modeled.

Adam presented a thorough study of aging in the BaBar Chamber, and quantitative modeling.