



PID Software Status

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PID Overview





Improve the PID performance: $3\sigma \Rightarrow 4\sigma$ at 0.6 < p < 4 GeV.

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Three versions of the standalone TOP software

- Nagoya (T.Mori)
 - ✓ Geant3 based (generation of charged track) + original C++ software (photon propagation).
 - ✓ Effect of hadronic interaction is included.
- Hawaii (K.Nishimura)
 - ✓ Geant4 based.
- Ljubljana (M. Staric)
 - ✓ Analytic method (for reconstruction).

Developed for TOP performance check and design optimization





Recent issuess

- Two configurations
 - ✓2-bar TOP
 - \checkmark 1-bar with expansion



Check performance with actual effects

- ✓MCP-PMT (QE, CE, TTS, dead space), Chromatic dispersion etc.
- $\checkmark T_0$ fluctuation : possible problem for 2-bar option.
- ✓ Incident track fluctuation (angle and position)
- Cross-check / consistency for three simulation programs







Structure /	Need expansion block	Need forward PMT
configuration		Strong bar box (btw 2-bar)
Gap TOP-CDC	Slightly large (~25mm)	Minimum
Acceptance	Large for forward (overlap reg.)	There is a small gap btw 2-bar
Construction	Mirror alignment (probably OK)	2m prototype
Performance	Better for forward part	Better for middle part
Dominant error source	Track extrapolation resolution (<2mrad)	<u>Timing determination (<30ps) for</u> <u>forward (Need precise calib.)</u>







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Conclusion of the TOP configuration:

- 2-bar shows slightly better performance than 1-bar.
- However, 2-bar seems to be affect by 50ps T0 jitter.
 - In present Belle, we have unknown jitter source of ~50ps.
 - We need precise timing calibration.
- 1-bar requires high Q.E. MCP (photodetector), but we expect Hamamatsu will improve Q.E.

Considering the easiness of handling, 1-bar is chosen as a baseline option for the TOP configuration at the special meeting on May 11th.





- Three standalone programs are used for TOP configuration study.
- There are still rooms for optimization (e.g. bar thickness?), and need to check more effects for performance.

- Implementation to basf2
 - ✓ Ljubljana group (Marko Petric) has just started.
 - ✓TOP reconstruction: analytical method.
 - ✓ Geant4 base simulation (approach similar to Hawaii program, but will be prepared from scratch).



Aerogel RICH







Simulation by Ljubljana group (Luca Santelj)

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- The geant4 code has been adapted to roobasf framework.
- Still using rio-0.7 with panther tables.
- We run it on JSI grid, which suffice for our purpose (good training).
- We simulated B \rightarrow Pi⁺ Pi⁻ and B \rightarrow K⁺K⁻ events (~10⁷).
- Everything crucial for study of particle ID efficiency has been included.
- Many inconsistencies in the simulation and reconstruction code were fixed.
- Still some things to do ...



Geometry





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Event Example





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Some Results of PID Eff. Studies



- There is no tracking implemented. For reconstruction we use track position on aerogel from simulation. Eventually this should be changed.
- Pion-Kaon id efficiency:



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Other Studies



[R.Pestotnik @ B2GM]



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Summer Work Plan by Luca san

- Continue efficiency studies.
- I already played a bit with Gearbox.
- I also tried VGM (Virtual Geometry Model), which provides a way for putting Root Tgeo file into Geant4 (so one can test his playings with Gearbox).
- Some detector components, not so relevant for particle ID, still need to be included.
- On the way to start putting aRICH geometry in Gearbox ...
- ... and whole simulation into basf2 and rio-1.0 (changing object persistency and event data model).



Summary



• TOP

✓ three simulation programs for optimization and configuration study.

✓1-bar option is chosen.

✓ Implimentation to basf2 just started.

Aerogel RICH

✓ Standalone version in development. Results look reasonable. More study will be done.

✓ Geometry to Gearbox.

✓Implementation to basf2.





Backup

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Aerogel border - angle 30 deg.



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Granularity matching:



- For higher refractive index combination the ring is matched with the photon detector pitch
- The result is the variation in the number of detected photons of of the order of 50%
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