Compilation of information about BSO option

Kenkichi Miyabayashi

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Characteristics of BSO scintillator

- Heavier; more compact shower.
  - ρ=6.8g/cm^3, X_0=1.15cm, R_M=2.4(?)cm
  - Ref., CsI, ρ=4.5g/cm^3, X_0=1.85cm, R_M=3.5cm

- Wavelength(λ~480nm) match well all the photocathode and solid-state sensors.
  - PureCsI, λ~330nm.

BSO crystal production technology

- Crystal mass production technology basically established by FutekFurnace co.(FFK).
- Oxide co., getting technology transfer from FFK, already has VB furnaces corresponding to 1/8 ~ 1/4 of mass production (by ordering needed pots).
- Target price is ~ 0.35 Myen/piece
- ~3000 or 4000 pieces result in similar (or x1.3 at most) total price of pure CsI.

Oxide co.'s facility

- On April 28th, I visited Oxide company in Yamanashi prefecture.

(http://www.opt-oxide.com/)

- They already have 9 VB furnaces capable to produce 65mmϕ BSO ingot.

2X2X20cm^3 sample crystals

- Supplemental budget allocated for 4 pieces, 3M yen.
- Oxide co. started test production.
- Delivery; mid. Oct.,
  - Preliminary tests to be reported at Nov. Belle-II meeting.

- One borrowed 2.2X2.2X18cm^3 reference crystal (from Prof. H.Shimizu, Tohoku) is now in Nara, to be tested in detail soon.

BSO:Pro and needed checks

- Smaller moriele radius;
  - Better recon. for high momentum π^0
  - Need check with (even simple) GEANT simulation.
- Similar L.O. to pure CsI, λ~480nm
  - Looks to hold by Tomoko's study with PMT.
  - Test with APD planned next month.

Further comments

- Radiation hardness.
- Impact to mechanical support structure;
  - shorter crystal length(more space behind crystals)
  - stress concentration because of higher density?
- Crystal geometry for final cutting and polishing.
  - Being different from PureCsI with CZ furnace, ingot can be cut and polished afterward.
- Smaller cross section(~4x4cm^2) compensate a little longer decay time(~100ns) in terms of pile up suppression.

Cost estimation

Item	Cost/unit	number	OkuYen
Crystal	0.35MYen	~3500	*12
APD	56kYen	~3500	*2
Preamp	~10kYen	~3500	*0.35
Elec.			**1.35
Mech. Str.			**0.5
Test bench			**0.1
Assemble			**0.3
Total			16.6

* depends on crystal final geometry, ** taken or scaled from Alex estimation for PureCsI+PP option.