Pure CsI+PP option. A.Kuzmin, Belle-II Jul. 7, 2009

- Advantages/Disadvantages
- Question to answer before starting
- Cost estimation
- Plans

Barrel Keep crystals and PA Change electronics shaping time $\tau = 0.5\mu s + WFA$ Endcap Pure CsI +PP +new PA Change electronics shaping time $\tau = 30ns + WFA$



Advantages

- Counters shows good performance:
 - Electronics noise < 200 keV
 - Pileup noise < 600 keV
 - Good time and energy resolution
- The technology of pure CsI production is developed
- Pure CsI can be produced by several companies Kharkov, SainGoban, Shanghai(?), Bejin(?)
- The technology of CsI crystals wrapping and providing nonuniformity was developed.
- The technology of case fixing at the CsI crystal exists
- PP gain factor about 150-250 not very high
- Change PP gain factor in magnetic fields about 3 times(not very big)
- PP gain factor approximately linear depends on HV (not very strong)
- PP can be produced within 2 years

Disadvantages

- Height of PP 50mm → longer counters → modification of mechanical construction
- Gain factor of PP depends on magnatic field
- Long term stability of gain factor for vacuum devices is worse than for semiconductor
- One PP per crystal \rightarrow less reliability

Tests to be done

• Longterm stability of PP

Two counters was assebled two years ago and are stable within 3%.

The degradation can be induced by time, cathode accumulated charge, anode accumulated charge. It can be different in magnetic field (because change of mean path lenght)

Assuming 20 000 e/MeV anode signal(without magnatic field) and 7 000 e/MeV in magnetic field dose = 1 krad/year It gives: 40(13) nA average current for PP; We need to operate for 10 years;

- Long term stability without magnatic field 2400 nA \times 2 month = 40 nA \times 10 years.(DC mode) Jeri, Ming-Chuan+, V.Shebalin (KEK)(Test pulse mode)
- Long term stability in magnetic field 800 nA \times 2 month = 13 nA \times 10 years.(DC mode + pulse hight), (A.Garmash, BINP)

End of September we'll got answer.

• Radiation hardness of the crystals from different purchaser

The Kharkov crystals rad hardness were tested: up to 15 krad

Shanghai and Saint Goban are under testing

• Mechanical design of endcap:

Start to communicate with mechanical workshop at KEK

Barrel electronics

	new system	price okuyen
Number of VME crates	36 + 2	0.3
Number of VME shapers	432 + 28	1.6
Number of VME collectors	36 + 4	0.2
Number of FAM	36 + 4	0.1
Number of crates in E.Hut	1	0.1
Number of digitizing boards	9	0.1
Total		2.4

General statistics

options	Price for unit	Full
Number of crystals		2112
Number geom.types		69
Weight of CsI, 10^3 kg		10.5
Price, okuyen	3/cm ³ +10%	8
Number of PP		2 112
Price, okuyen	70 kyen	1.5
Preamplifier+box		2 112
Price	10 kyen	0.22
Number of VME shaper boards		144 + 10
Number of VME collector boards		16 + 2
Number of HV		32
Price, okuyen		0.9
Mechanical		
modification		
Price, okuyen		0.5
Test benchs		0.1
Assembling		0.3
Total price, okuen		11.5

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Preliminary Time table

		20	09	2010		2011			2012				2013				
		III	IV	Ι	II	III	IV	Ι	II	III	IV	Ι	II	III	IV	Ι	II
Crystal	preperation	x	x	x	x												
	production					x	x	x	x	x	x	x	x				
PP	preperation	x	x	x	x	x											
	production					x	x	x		x	x	x					
	test						x	x	x	x	x	x	x				
PA	design	x	x	x	x												
	$\operatorname{production}$					x	x										
Counter box	design	x	x	x	x												
	production					x	x										
Counter	production							x	x	x	x	x	x	x			
	test							x	x	x	x	x	x	x	x		
Mechanical	design				x	x											
structure	$\operatorname{production}$						x	\mathbf{x}									
Assembling	mechanical															x	
	test															x	x
installation	into Belle																x
VME shaper-	production				x				x				x				
digitizer(slow)	test					x	x			x	x			x	x		
VME shaper-	design	x	x	x	x	x	x										
digitizer(fast)	$\operatorname{production}$						x				x				x		ĺ
test							x	x			x	x			x	x	
System test																x	x