

Introduction to the Super Belle silicon strip tracker

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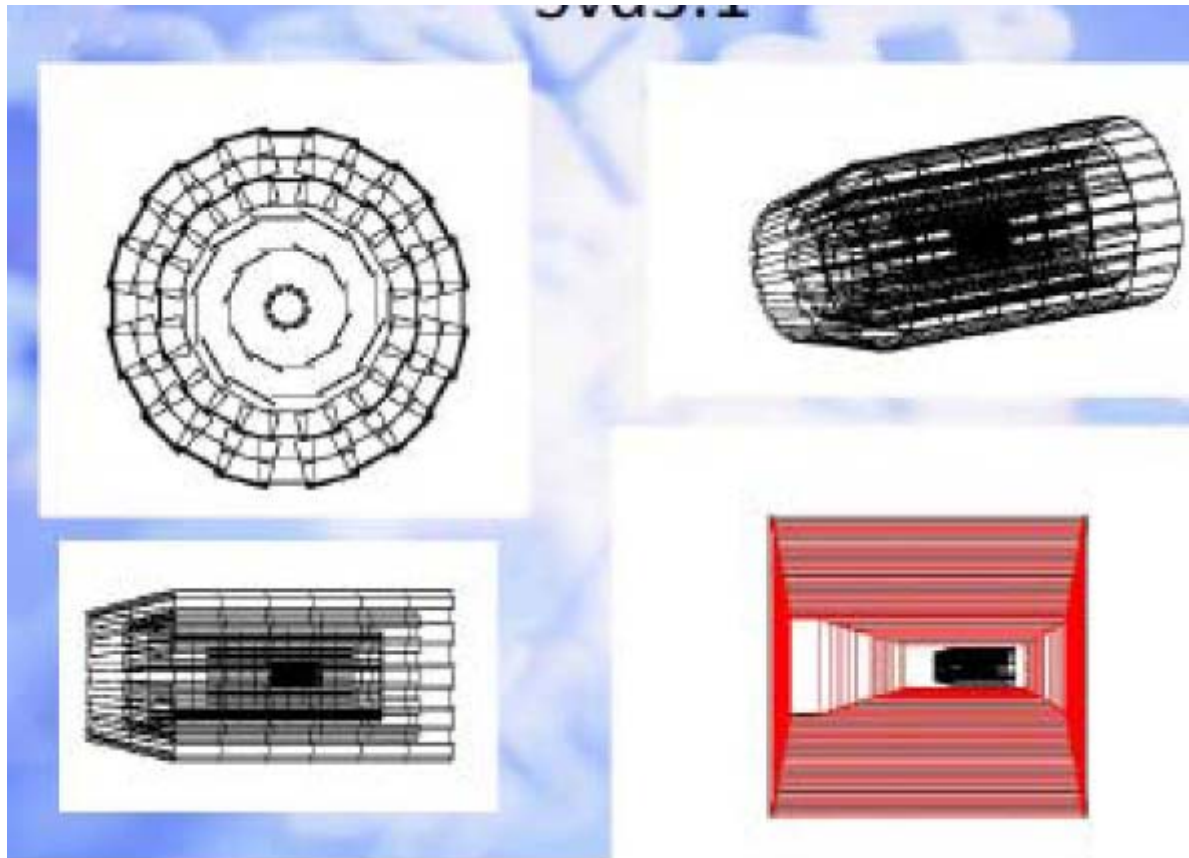
Super KEKB and Belle upgrade

- Purpose
 - Study of CP violation in B meson decay using e+e- collision at Y(4S) CMS energy with $4-8 \times 10^{35}$ /cm²/sec luminosity
- Super KEKB beam structure
 - Bunch crossing: every 2 nsec at the highest luminosity.
 - High occupancy (Beam current : Max: 13.5 A)
- Belle DAQ scheme
 - Trigger rate: 10 kHz (worst average) 30 KHz(worst peak)
 - Trigger latency: 3 usec.
 - (almost) dead-time less readout
- APV25 satisfies the requirements
 - 50 nsec shaping time
 - 192 stage pipe line operated at 40 MHz.
 - Multi-cell readout around the trigger.
 - Further reduction of off-timing background by aveform sampling .

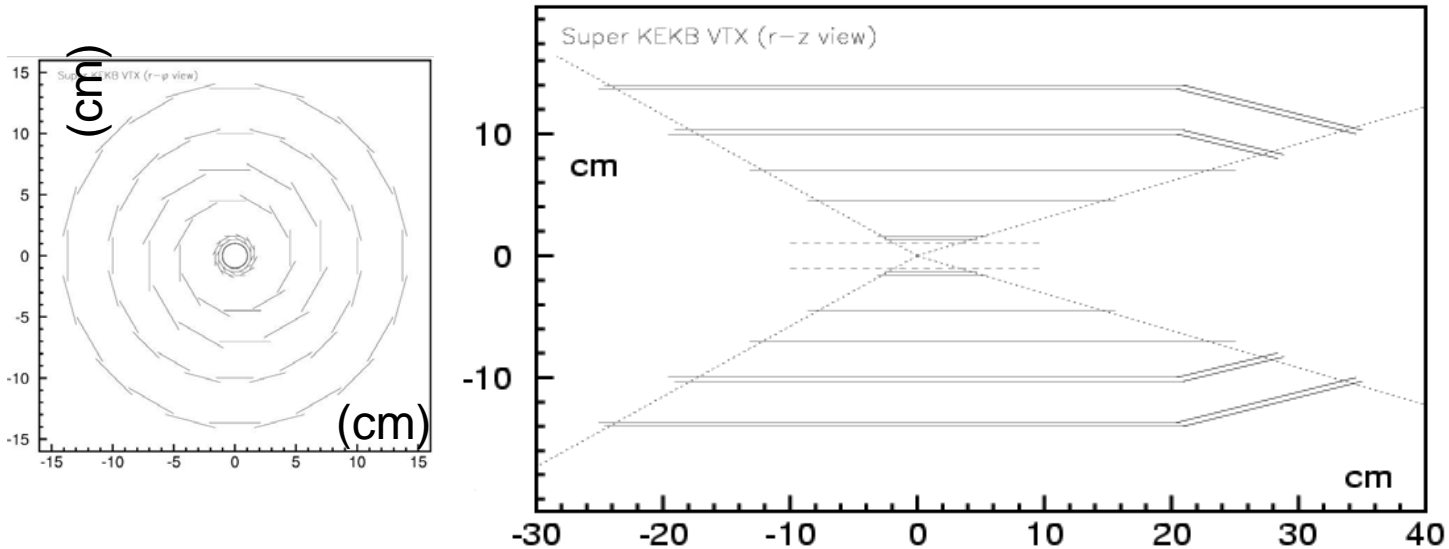
Number of chips

Inner most layer: Pixel

Other layers: DSSD with APV25



Super Belle Vertex Tracker(Lol '04)



- Layer 1 depends on the schedule of KEKB/Belle upgrade.
 - If a pixel detector is ready, Layer 1 DSSD will not be necessary.
- Radius of the beam pipe is under investigation.
- Total DSSD area can be reduced if we introduce more slanted sensors.

Number of chips

Layer	R (cm)	DSSD area (cmxcm)	DSSD sensors per ladder	Number of sensor per layer	Number of ladders per layer	Sensor area per layer(cm ²)	Number of chips per ladder	Number of chips per layer
1	2.5	7.8x2.8	2	12	6	262	32 (L)	192
2	4.5	7.8x2.8	3	36	12	786	32 (L)	384
3	7	7.4x4.0	5	60	12	1776	40 (S)	480
4	10	7.8x2.8	5	120	24	2621	40 (S)	960
4 (slant)	10	Trapezoidal (2.8-2.0) x 7.8	1	24	24	449	8 (S)	192
5	14	7.4x4.0	6	144	24	4262	48 (S)	1152
5 (Slant)	14	Trapezoidal (4.0-2.8) x 14.5 (2 sensors)	1	48	24	1183	16 (S)	384
Total				420	126	11340		3744

(L) --- 32 APV25 chips per ladder

(S) --- 8 APV25 chips per sensor/Origami scheme

Numbers

Item	Summary
Number of Ladders	126 (54 in Belle SVD2)
Number of Sensors	420 (228 in Belle SVD2)
Number of APV25 chip	3744 (864 in Belle SVD2)
Power consumption (0.5W per chip)	1872W (430 W in Belle SVD2)
Cooling Water Flow rate ($\Delta T < 10$ degree)	2.7 liter/min (2.5 liter/min Belle svd2)
Total power supply (PS) current (Vdd=2.5V)	748 A (Naïve estimation)
PS cable cross section for $\Delta V < 1V$ for Vdd and Gnd, 20 m long. $s(\text{copper})=6 \times 10^7 / \Omega \text{m}$	1.3 cm ²
Heat induced in the Vdd and Gnd power cable	361W (20% of total Power)
Repeater cards (REBO, 1 CARD=16 APV25 chip)	234
Mother cards (MAMBO, 6 REBO)	39
Hybrid Cables	444
Cross section of cables (3mmx10mm/Cable)	133 cm ²
Cable thickness for 66 cm ² (RMax=14 cm)	3 cm (with 70% fill factor)

Cable thickness at SVD exit

