# Computing Resources

. Current Resources
. Required Resources
. Cost saving efforts
. Headaches
. Reminder of Schedule

## Resource in Belle

#### Present Belle

. CPU : 115.2k SI2k  $\rightarrow$  "2CPUs w/ quad-core"/server (intel Xeon X5460), 4GB memory, 480 servers . Disk : 1.5 PB . Tape : 3.5 PB  $50 = 50 \text{ ab by } 2020 \text{ Bx1}}$  50 = 10 Solution 50 = 10 Solution50



# Our Baseline Design

- . based on the increase of the luminosity provided by KEKB
- . cross section for physics events + empirical BG level

Cross sections	[nb]
BBbar	1
udsc	3
tau (& 2 photon)	4
Sum (physics)	8
Background	16
Sum (all)	24

- . event size (rawdata, DST, mDST, MC) (100kB), (140kB), (30kB), (30kB)
- . MC = 3 x data (minimum requirement)
- . DST/MC production should be done in three months
- . KEK will keep all rawdata, DST, mDST, MC files
- . KEK will process all rawdata

	Belle[2009/05/22]	end of 2015 fy.	end of 2019 fy.
Int. Lum.[1/ab]	0.9	x5 14	50
CPU [kSI2k]	115	550	1180
Disk [PB]	1.5	8 <sub>×</sub>	10 36
Tape [PB]	3.5	38	180

### Electricity cost saving

#### . CPU

Memory ↑

Roadmap AMD (June 30) : 12 (or 16) core @ 2011

: power consumption is almost same

Intel (July 6)

: 8 core @ 2011 w/ hyperthreading

: power consumption is almost same (?)



~4 x current CPU will be achievable w/ almost same power consumption by 2011 (fy. for bidding)

For 2020, further tech?  $32nm \rightarrow 15nm$  process

# Electricity cost saving

#### . Cooling + Infrastructure



IBM (June 22)

- : optimization of air-flow
- : Virtualization

not so sure, but ~5-10% electricity cost might be saved ???

: rack-cooling solution?

Hitachi (July 13)

## Electricity cost

by expecting

. 4-time higher performance CPU w/ same power consumption

. more effective and sophisticated cooling system

We might satisfy the request for CPU power aiming for 2015 ... (I did not take "rental cost" into account)

For the final goal,

can we expect more technological development?



. Tape library (capacity ~ 25,000 tapes : assuming 2TB/tape) ~110  $\mathrm{m^2}$ 

. Disk system unit (1000 disks for 4PB: assuming 4TB/unit)  $\sim 150 \text{ m}^2$  ( $\sim 375 \text{ m}^2$  for 10PB)

. CPU (x10 CPU = ~40,000 cores : assuming 8 core processor) ~220 m<sup>2</sup>  $\rightarrow$  can be reduced (a half ?)

#### Headache

- . cost for Network access
- . cost for cloud computing
- . cost for batch job system (now "LSF")

~ 1-2M\$/year ? for 40,000 cores other batch job system, e.g. NQS (free version?)

. data transfer from current system to Belle-II comp. system we can not keep both old(=Belle)+new(=Belle-II) comp. systems

### Schedule

In order to make the system ready in Mar 2012, we have to submit a budget application in the early next fiscal year



It is important to stick on our schedule to prepare the application (e.g. TDR on this autumn)