The Summary of the Calibration of the J/ψ Data From Run13500 to 16844

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June 7, 2000

•The Upgrading of BES Software Version From V101 to V102

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•Summary and Conclusion

1 The Upgrading of BES Software From version V101 to V102

The J/ψ data from Run13500 to 16844 is calibrated and reconstructed by BES version v102 which is upgrated from v101. The main differences from V102 to V101 is:

- The Modification of bugs of the codes found in the data analysis of the R-value. Some of the calibration codes have been changed and put into BES library. This job was done by Chen Guangpei, Mao Zepu, Huang Xiuping, Sun Liangfeng and so on.
- The upgrading of the codes, in which found bugs in the analysis for run13500-13700, is: dcunpack, seterg, vcunpk, beshbk, bscrpt, dccons, set_resk, dexcin, dexcon, filsrv, trkevl, dexfit, runchk, ovrcon, calchk, tofrpt, dexfit, escrpt, bceclu, bsccin, chkcst, norbsc, read_bscscan, calc_resk, parcit, tof, tristn. The details of this parts is listed in the file runcal/v102/besopt/v102.opt.
- The add and modification of some new MC codes and some physics analysis codes for BESII, such as the new generator codes and the "Telesis" and so on. This job has done by Chen Jiangchuan, Lu Feng and others.

- The codes in which has some format or some algorithm does not compatible with the linux machine and alpha machine have been changed. This works has done by Derrick Kong, Ye Shuwei, Zhang Dahua, Mao Zepu and others

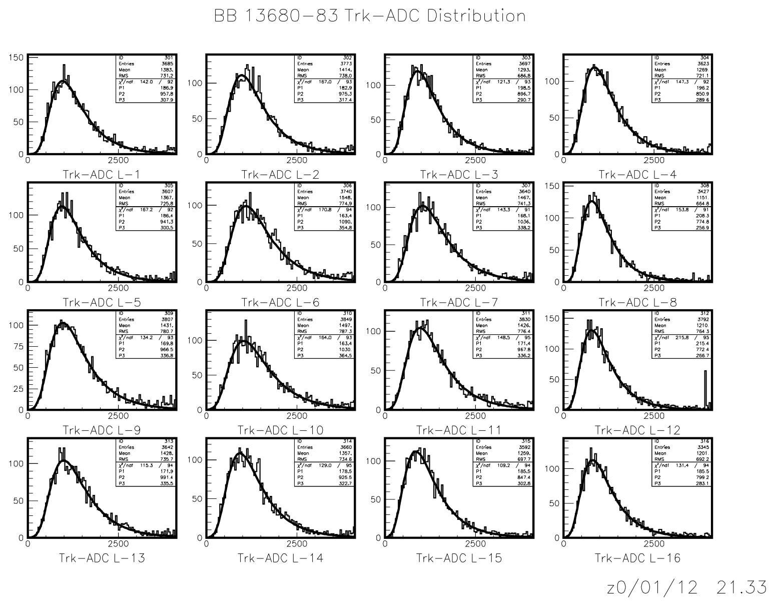
- About 142 source files and 13 common statements have been changed since Feb. 12, 1999(v101 creating time), include some new codes and common statments block.

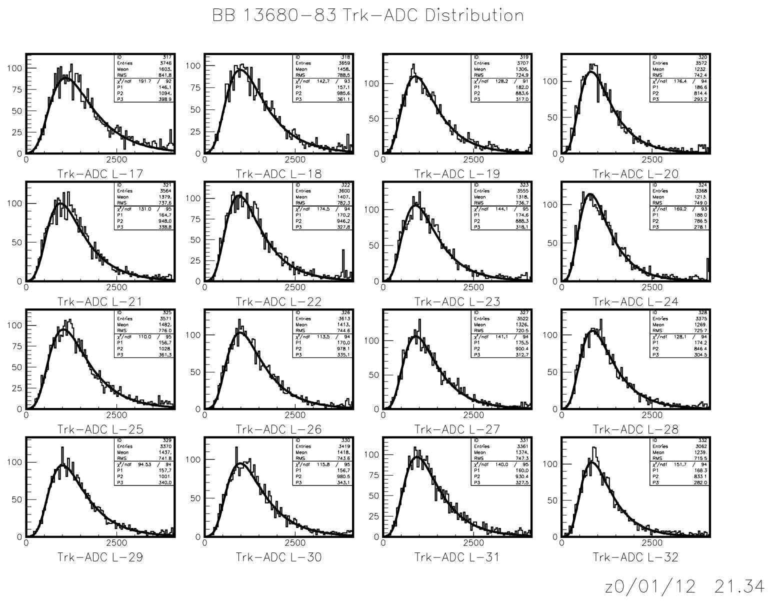
2 The Data Quality and Offline Calibration for run13500-16844

2.1 The Data Quality Study

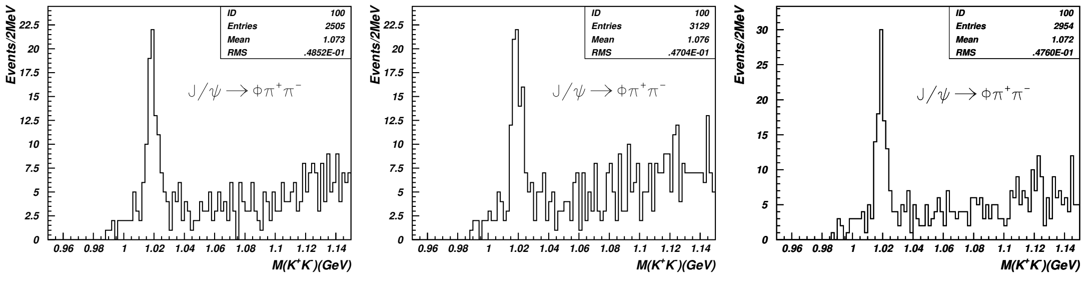
At beginning of the data taken, the data quality checking is very important, it provides the data information for hardware and online data taken system to adjust the BES detector working condition and data taken parameters. It is useful also to prepare the offline data calibration and reconstruction. The main jobs that we did in this period is as following:

- The study of the pulse height(ADC) of MDC: The purpose of this job is to provide the criteria for MDC to increasing the high voltage of the field wire. Because we found the efficiency of the MDC wire is little lower, and there is a little dips in the $\cos(\phi)$ distribution of the hadranic events in last year. changing the high voltage of the field wire and get MDC pulse height and check the $\cos(\phi)$ distribution of the hadranic events. In final, we get MDC ADC distribution of each layers as following figures. The details about this parts can be found in the proceedings of BES month meeting 2000[1].





- The checking of the error matrix of the charged tracks: The $1/\sigma_{xy}^2$ (σ_{xy}: MDC spatial resolution) is considerated as the tracking fit-weight used in the MDC tracking, so σ_{xy} will effect the error matrix of the charged particle tracks. If the track error is not consistents with that of truth, the TELESIS codes will give out the poor fitting. At beginning, we use the spatial resolution got from the calibration of MDC(about 200μm) as fit-weight, it can not satisfy the requirement of the TELESIS. Then about 250μm as fit-weight got by a special way, the results of TELESIS is still not good. Finally a function: $\sigma_{xy} = A + \frac{B}{\sqrt{Q}} + C \times Q$ is used to calculate the σ_{xy} according to the dE/dx value of the particles. By this way to get the fit-weight and do the MDC tracking, then application the TELESIS fitting, the invariant mass plot of J/$\psi \to \phi\pi\pi$ as shown in Fig.1 is comparable with BESI.



But the quality of the real data is changed very complexly around the data taken time, more study and further correction are required. The details about this job described in the proceedings of BES month meeting 2000[2].

- The study of the VC "online calibration". This job is done by Online, DPG and Calibration group, final we found that spatial resolution of VC is not good after this calibration, this testing was give up.

2.2 The Offline Data Calibration

- MDC TS (Time system) calibration: Because of the MDC online_T_0 is not stable as shown Fig.1 during the data taken period, The calibration of the MDC TS was done 5 times according to the variance of the online T_0. Each calibration times, the main works is the correction of the T_0, drift speed, wire-survey, and the QT correction. The details can see the report reported by Quijf in this meeting[3]. The σ_p of the momentum of the Bhabha events before and after calibration is shown in Fig.2. Although the σ_p in Fig.2(b) is much better than that of before calibration, it still not very stable, more correction will be required.

Fig.1 MDC Online T0 VS Run Number(13500−16844)

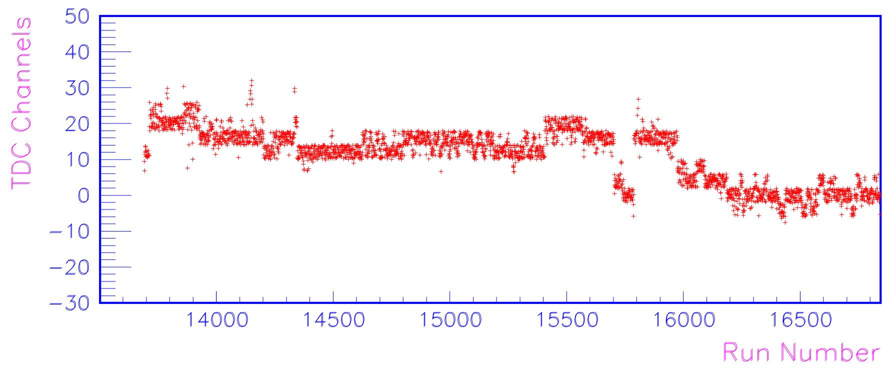
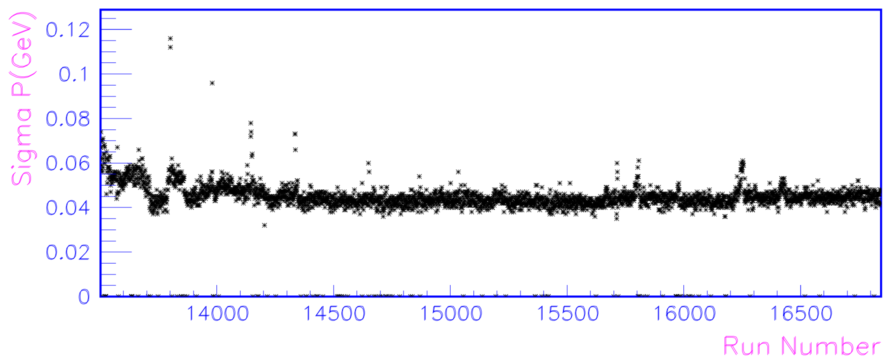


Fig. 2 The Standard Deviation of MDC Momtum VS Run



- The MDC dE/dx system calibration was done two times, The calibration region is run13500-15784 and run15785-16844 respectively. Because the MDC high voltages of the field wire changed in some cells of layer 4 and layes 6, it effects the dE/dx resolution from run15785. The system calibration constants files was put in the runcal/v102/caldex/cal13500_15784/ and runcal/v102/caldex/cal15785_16844/, so the dE/dx run by run calibration was done in those two directory separately. The dE/dx resolution versus the run number before the second system calibration and after the second system calibration for 15785_16844 is shown in Fig.3. It indicates the resolution is better after second system Calibration. The Fig.4 showns the dE/dx resolution around run number. The average dE/dx resolution is about 8.45% in this period.

Fig. 3 MDC dE/dx Reso. Shift in 15784 and 15785

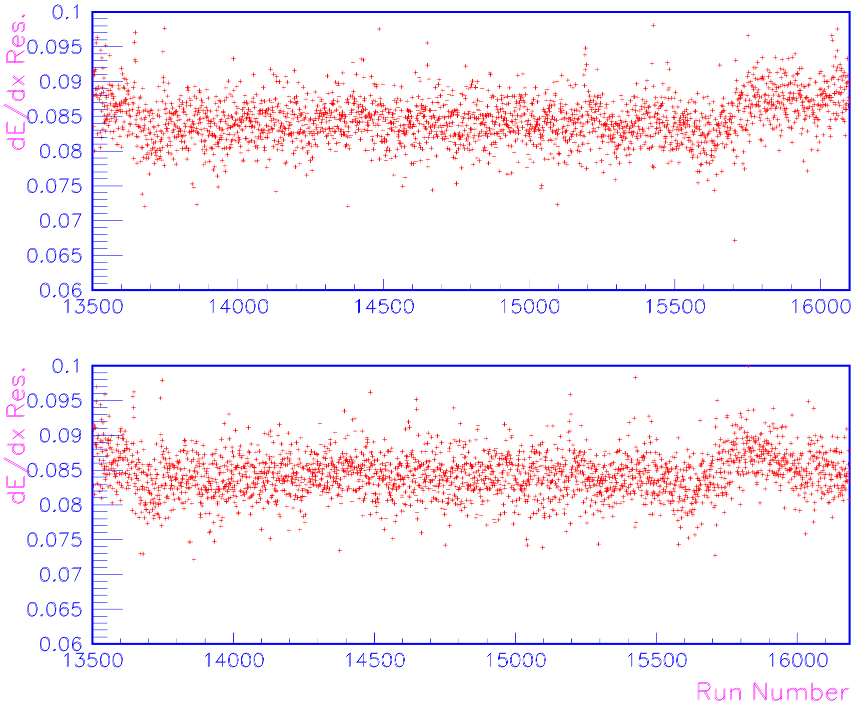
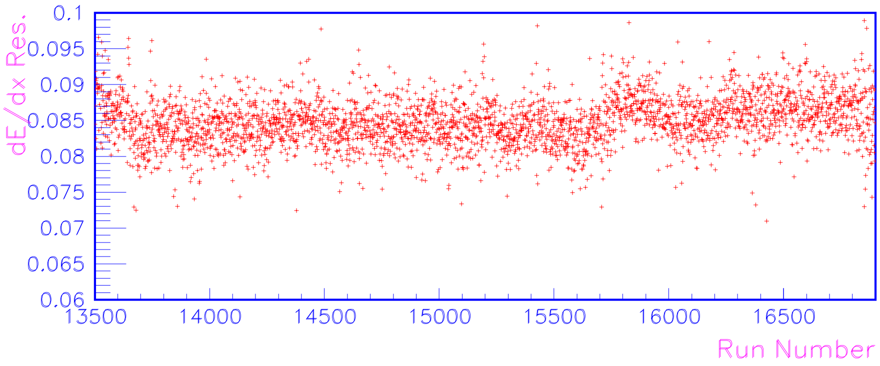


Fig.4 dE/dx Reso. VS Run



- BSC calibration, The BSC Raw ADC is very unstable during this period. The maximum amplitude changed up to 30% as shown in fig.5, This phenomenon strongly effect the average track energy in BSC. To solve this problem, a new calibration method is exploited and very successful to overcome the raw BSC-ADC unstable problem. The Fig.6 shows the mean energy shift of clusters(from BhaBha events) of each run in relative percentage versus the run number comparison with old calibration way, in which the mean energy shift is around 1% by new way and 6% by old way. The details can be seen in the report by Huang Xiuping in this meeting[4]. The mean energy and energy resolution from the BhaBha events around run number is shown Fig.7. It shows that the mean energy is very consistent after taking the new calibration method. Fig. 8

shown the energy resolution of the ESC around the run numbers. There is a jump around run13900 and run14900, it is said that is cased by the electronics system.

Fig.5 Mean Raw ADC of BSC (pur run) from BhaBha Event

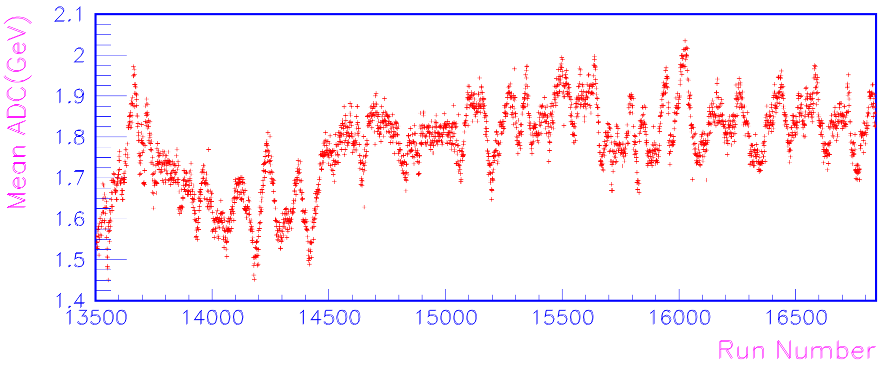


Fig. 6 BSC Mean Energy Relative Variances VS Run(old and new Cal.)

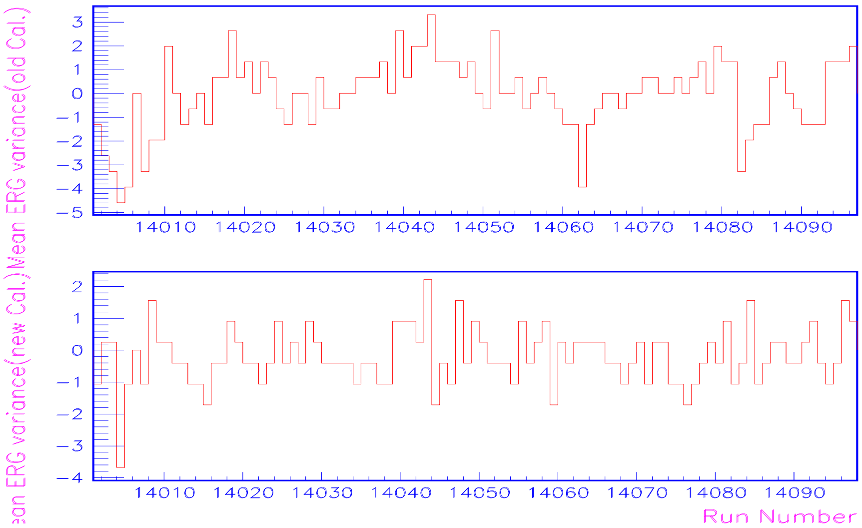


Fig.7 BSC Mean Energy and ERG Res. Of BB VS Run

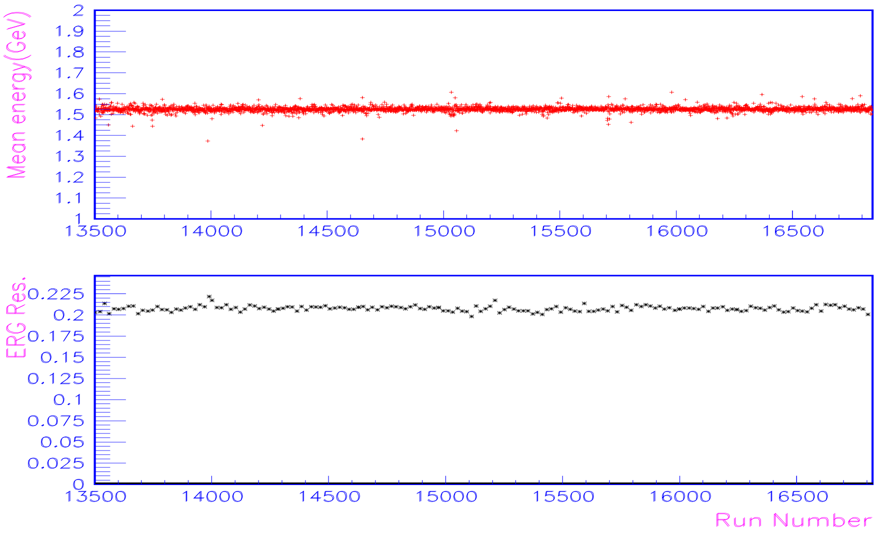
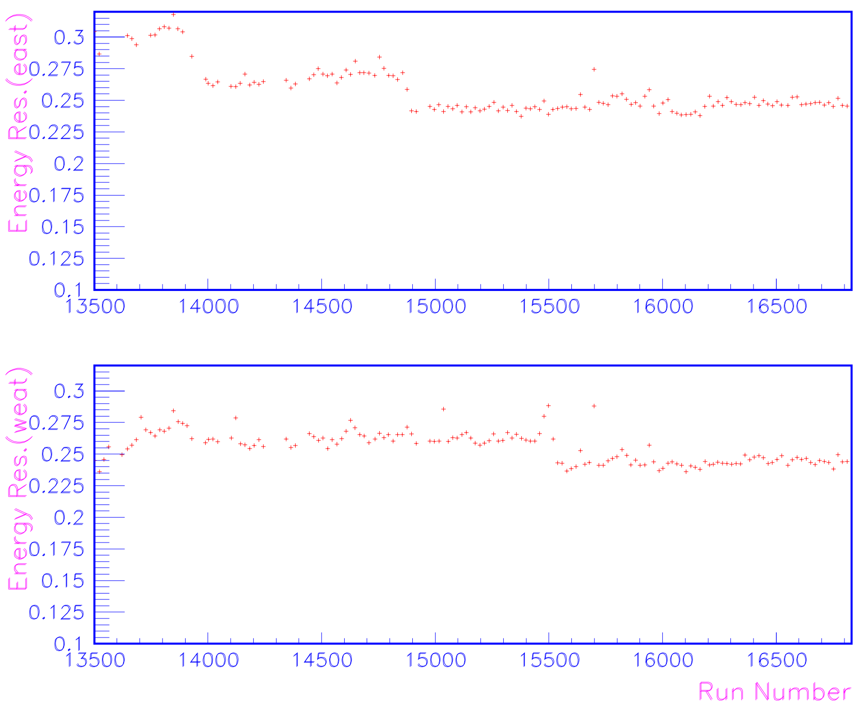
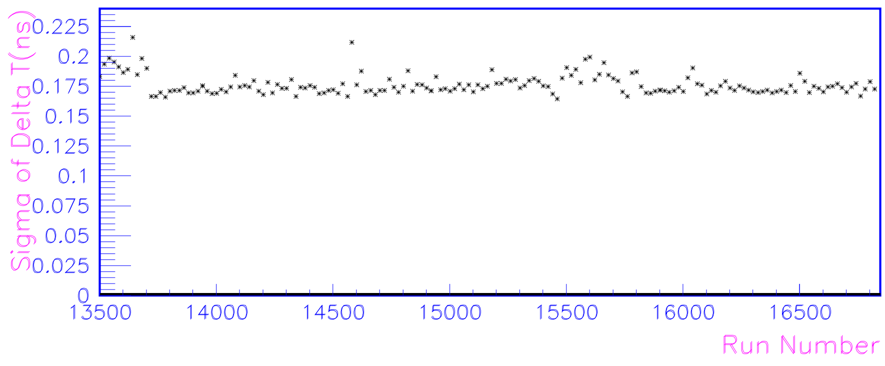


Fig.8 ESC Energy Res. of East and West Side VS Run

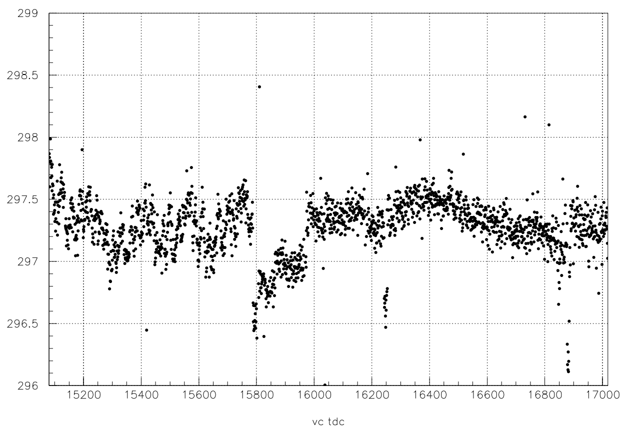


- The calibration of TOF counter is done per twenty run, The Fig.9 shows the time resolution versus run number. The average time resolution is about 174ps. This job is done by Dr. Cheng Baosen, the details can be seen in his web side.

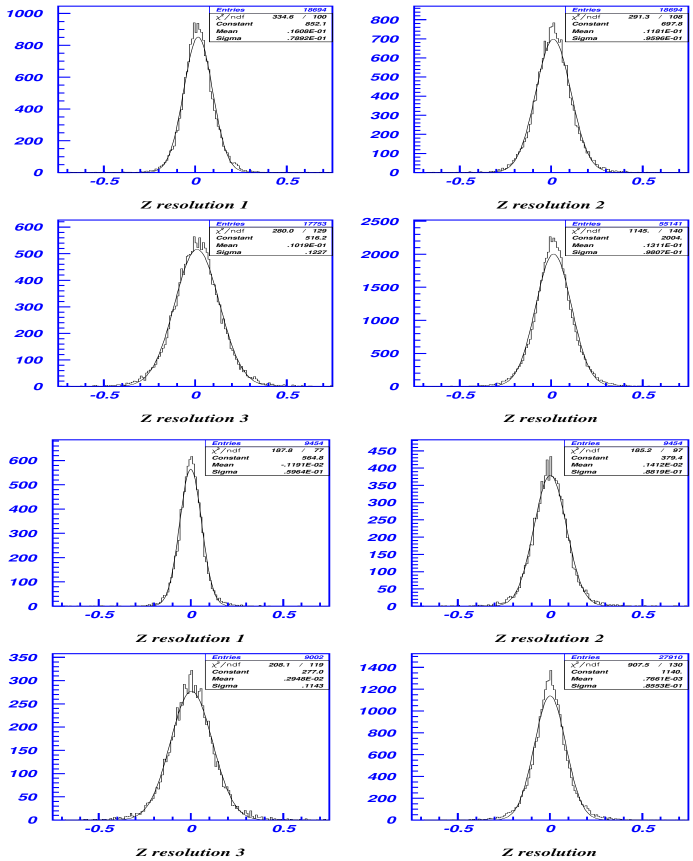
Fig.9 TOF Time Deviation VS Run



- The data quality checking and the calibration of VC TS(Time System) is responsible by Yuang Ye. The online-T_0 of the VC in this period is variant in some time as shown in following figure. Because the one TDC channel responds 2ns, the variance of the T_0 is very sensitive for quality of the VC tracking. The VC TS was calibrated 13 times in total. The spatial resolution of the VC is about 98 μm



- The calibration of muon chamber is separated two kinds in hardware and software. The hardware-calibration was done by electronics people 10 years ago for BESI, the software calibration need to input the hardware-calibration constants. A new method is used for the software-Cal., The system error of the z-position is reduced to 5.7cm from 7.9cm. This job is done by Sun Liangfeng, more details is described in the proceeding of BES month meeting[5].



- Summary of the offline data calibration constants for each subdetectors is listed in table 1.

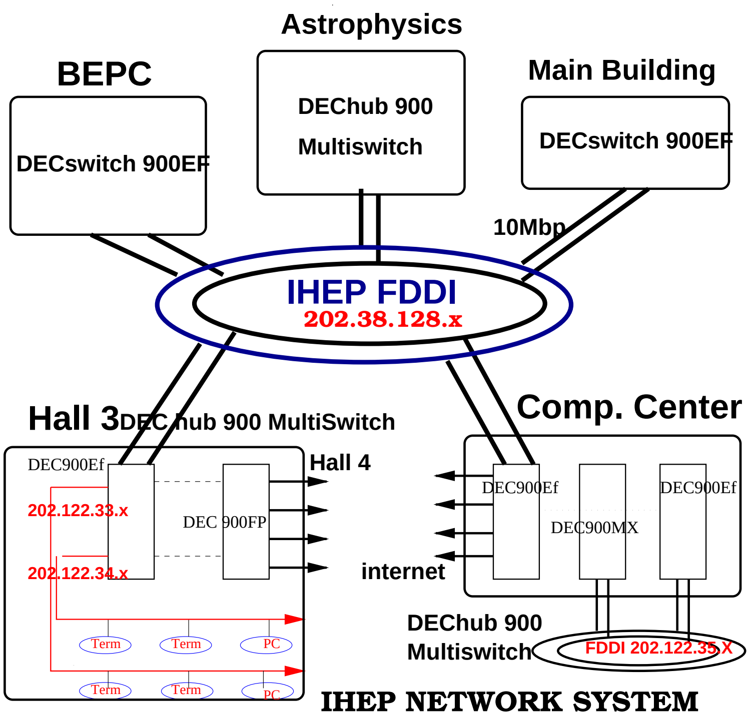
Table 1. The summary of Data Off-line Calibration for Run13500-16844

Name of Det.	Run No.	Cal. status
MDC T_0 MDC-Hot	13500–16844 13500–16844	4 times 32 times
MDC dE/dx Sys. cal.	13500–16844	2 times
MDC dE/dx	13500–16844	run by run
BSC	13500–16844	per 20 run one times
ESC	13500–16844	per 20 run one times
TOFB	13500–16844	per 20 run one times
VC	13500–16844	13 times
μ ID	13500–16844	1 times

3 The Works Concerned With Calibration Group

3.1 The Upgrading of Network System of Hall No.3 and Hall No.4

The network system of BES physics analysis include Computer Center, hall 3 and hall 4 was created about in 1992 and upgraded in 1997 by Hu Xiaoqi and so on. up to 1999, the status is shown as following figure.



IHEP NETWORK SYSTEM

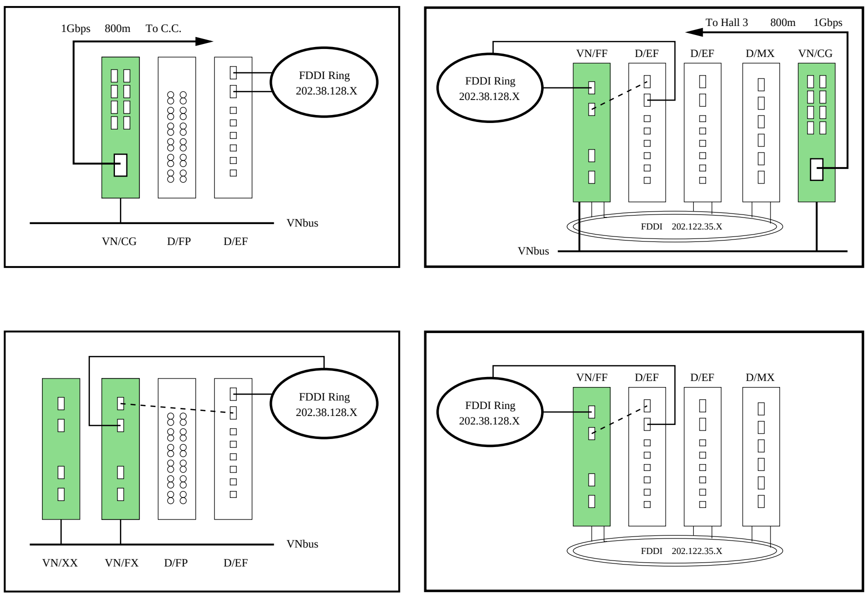
There are main problems as following:

- Two bottle-neck: About 95% users worked in hall 3 and visit Computer Center by the network. There are two 10Mbps bottle-neck in each visit. The first one is from hall 3 to IHEP main ring(FDDI). The second one is from IHEP FDDI to BES computer(HPWS1-7) of Computer Center. This two 10Mbps bottle-neck increasing the collision frequency and decreasing the visiting efficiency

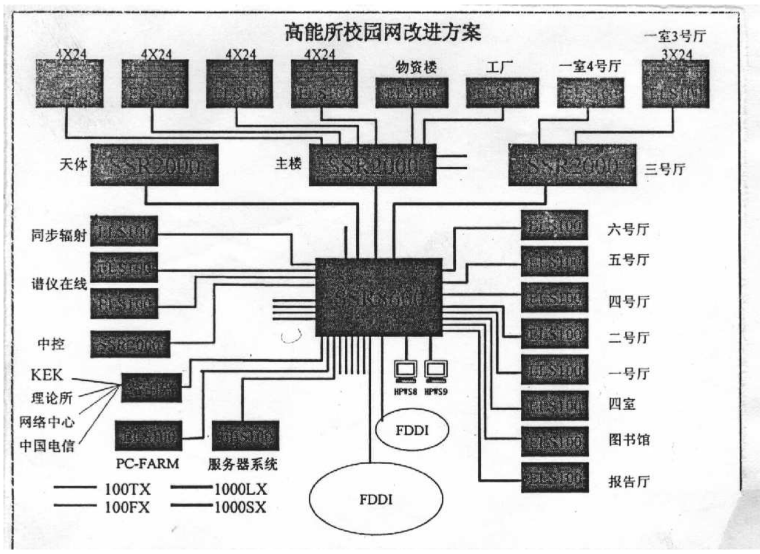
- Crossing two net-segments: It must go through two net-segment to make one visiting for BES physics analysis user in hall 3: beginning from 33 or 34 net-segment by terminal or PC(202.122.34.* or 202.122.33.*) in hall 3 connects up to the 128 net-segment of FDDI main ring by DEChub 900multiswitch(202.38.128), and from 128 net-segment down to 35 net-segment of BES computer of Computer Center(202.122.35.*). This will reduce the visiting speed.

- Poor cabling system: There are about 60 web site in the net-segment 202.122.33 and share single cable with 10Mbps net speed, and more 30 web site in net-segment 202.122.34. This cabling structure is very poor for visiting efficiency. The repairing also is very difficult if network system meet some problem.

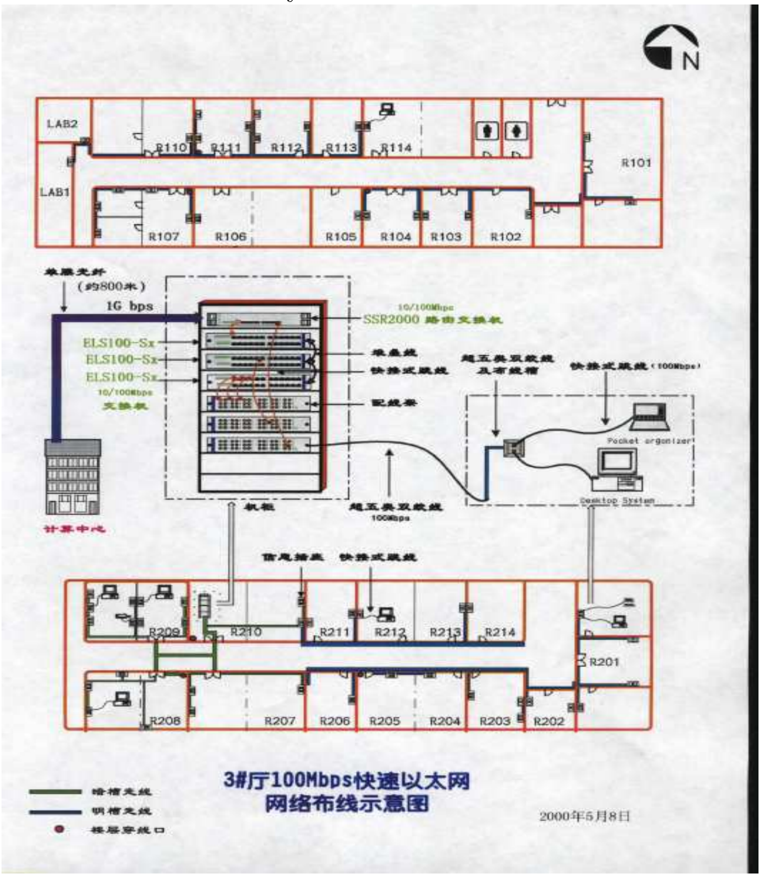
In this case, we submitted a propose to upgrade the BES network system in the July 21 1999[6]. The main principle is shown in following figure. In Figure(a,b), add one VN900CG model for hall 3 and VN900CG and VN900FF for Computer Center, hall 3 and Computer Center is connected by optical fiber with 1Gbps, then users in hall 3 can visit Computer Center and each other by 100Mbps. In figure(c,d), use the IHEP FDDI main ring and add the VN900FF, VN900FX for hall 3 and VN900FF for Computer Conter, then the results almost is same as figure(a,b).



After discussed more details, a new IHEP network system has been created and it is responsible by Computer Division as shown following figure(this plan will be finished in this year):

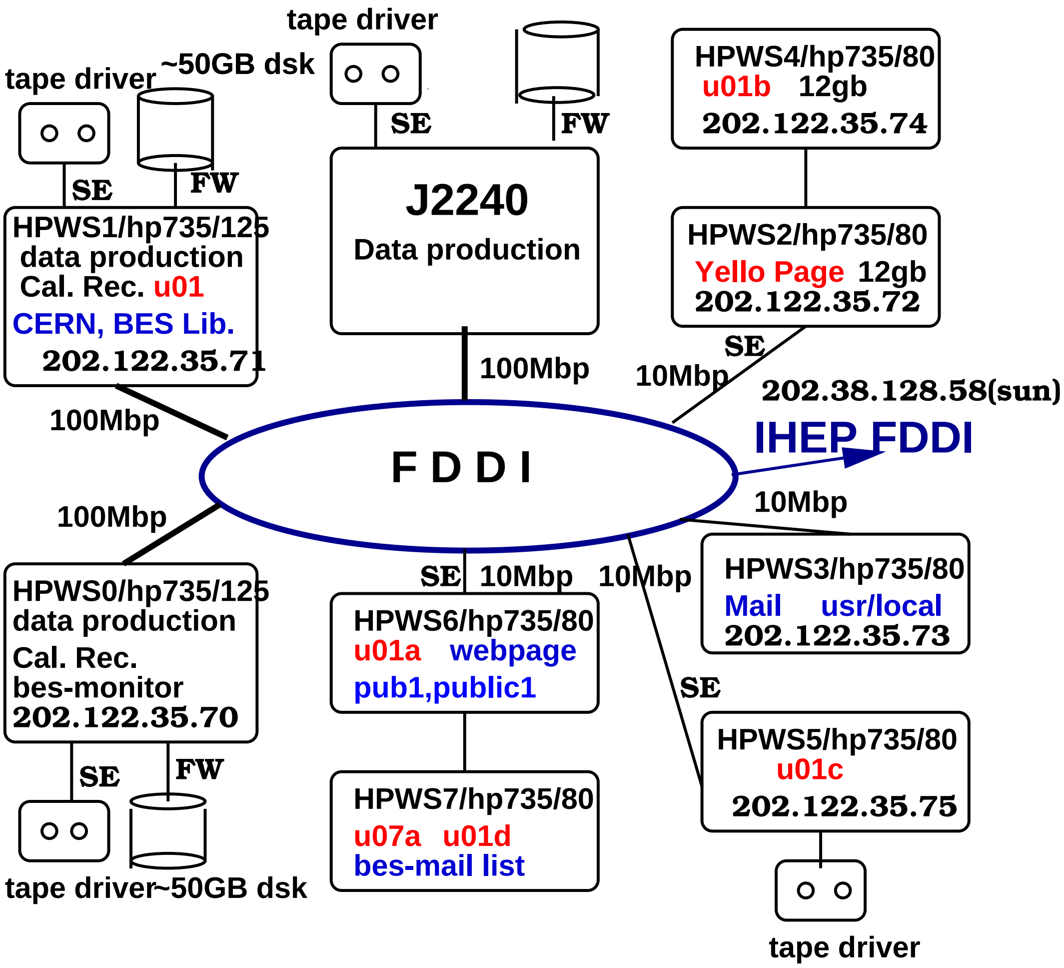


In order to suit the new IHEP 1GMbps network system, the cabling system for hall 3 and hall 4 must be upgraded. this job has finished according to the Standard of SCS(Structured Cabling System) and EIA(CommerciaBuilding Telecommunication Cabling Standard) in beginning of this year as shown in following figure. There are about 97 nodes in hall 3 and 31 nodes in hall 4. The users in hall 3 and 4 can visit each other with 100Mbps by the switcher ELS100 after the IHEP new network system finished. Now it is still 10Mbps Ethernet.



3.2 The Creating of the Physics Analysis Linux-Platform in Hall 3

Because we will take 50×10^6 j/ψ data within recent two years, The total CPU power is about 70 SPECINT95($6\times$ 4+$2\times$ 4.4 +$2\times$ 17) as shown in following figure. It is not enough to treat so many J/ψ data.

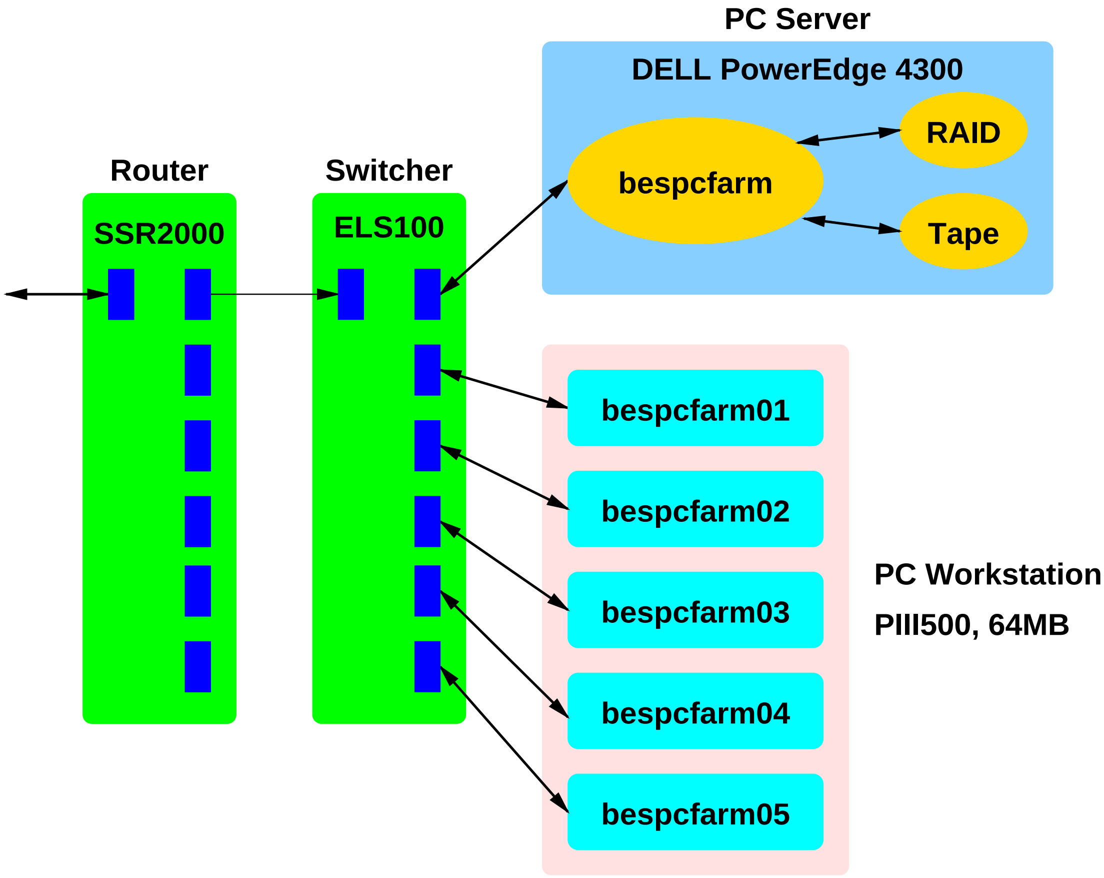


BES Offline Computer System(computer center)

After the discussion with the computer experts and physicists, we determine increasing one HP workstation for the data reconstruction, and create the physics analysis platform in hall 3.[7]. Now the physics analysis platform BESPCFARM has been set up, The construction and the performance is shown in the following figure and listed in the table. this system now is available for physics analysis. The data reconstruction codes will be improved in near future. the equivalent CPU power is 255 SPECINT95, about $7\times$J2240(hpws8). The details can be seen in the report of this meeting[8].

Bespcfarm Architecture

Bespcfarm Architecture



PC Server:	DELL PowerEdge 4300 PIII500 CPU$\times$2, 256MB SDRAM, 17GB SCSI HD
RAID:	36GB$\times$6, RAID Mode 5
PC Workstation:	PIII500 CPU, 64MB SDRAM, 13GB IDE HD
Switcher:	Cabletron SmartStack ELS100-S24TX2M
Tape Drive	EXABYTE EXB-8505ST
Equivalent CPU (SPECINT95)	51$\times$5 (HPWS8=34)

3.3 The MC realization of real data from run13500-16844

The MC realization for the run13500 to 16844 is done in three region 13500-15797, 15798-16242 and 16243-17018. The constant files of realization of the dead wirs of the MDC and BSC are dcl_021.sobcons, dcl_022.sobcons and dcl_023.sobcons respectively. The constant files for the wire efficiency, the start position and the spatial resolution of the tracks of MDC; for the wire efficiency, the amplitude and the correction factors of the BSC ADC; for the time standard deviation of TOF, are brl_021.sobcons, brl_022.sobcons and brl_023.sobcons respectively. Dr. Bian Jianguo is responsible this job. The details is described in his report of this meeting[9].

4 The Summary and Conclusion

- After the offfline data correction and calibration, the data quality and data stability of the MDC, BSC, TOF and VC in this region looks good.

- The total data number is largest since BESI, some subdetectors on the calibration and reconstruction is very fast and roughly, further correction will be need to improve the data quality precision.

- The Summary of the Detector Performance is listed in table 2.

Table 2. The Preliminary Detector Performance for Run13500-16844

Parameters	Performance
MDC-Time:	
W-EFF	$\simeq$ **96.60** %.
W-σ_{xy}	$\simeq$ **190-200** μ**m**
Mom-Reso.	$\delta p/p \simeq 1.55\%\sqrt{(1+p^2)}$
MDC dE/dx:	
σ_{tru} **BB-event**	$\simeq$ **8.48** %.
BTOF:	
σ_T **mean**	$\simeq$ **173.90 ps.**
Atten. Leng.	$\simeq$ **3. m**
BSC:	
ERG-Reso.	$\delta E/\sqrt{E} \simeq 20.74\%$.
Err-Z-Posit.	$\simeq$ **2.6 cm**
ESC:	
ERG-Reso.	$\delta E/\sqrt{E} \simeq 25.0\%$.
Vert. Chamber:	
W-σ_{xy}	$\simeq$ **98** μ**m**
W-EFF	$\simeq 93.2 - -94.4\%$

5 REFERENCES

[1] The Status of the Offline Calibration for Run13500-13827, reported in BES month meeting, Z. P. Mao, 2000/3.

[2] The Improvement Of The Calculation Method Of The Error-Matrix In MDC Track Fit, reported in BES month meeting, Z. P. Mao. 2000/4 .

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[5] The calibration of the Mu counter, Sun Liangfeng

[6] A Propose to Upgrade the BES Network System, Liu Ruirong 1999/7/21

[7] A Propose to create the PC-linux physics analysis platform in hall 3, inner report Liu Tiarong 1999

[8] The installation, test and the performance of the BESPCFARM, Liu Tianrong

[9] The data quality and the MC realization for J/psi data run13500-16844, Bian Jianguo