Study of BES-II Data Reconstructed on PC/Linux Platform

Can we do BES-II data offline reconstruction on PC/Linux with code Version of 102 for direct J/ψ physics analysis ? [1]

Gang Rong Kanglin He Shaoqiang Zhang

BES Monthly' Meeting, IHEP, Beijing, March 14, 2000

1. **Why Need Data Reconstructed on PC/Linux ?**

2. **BES-II Software of V102 and PCs/Linux Platform**

3. **BES-II Data Reconstruction on PCs/Linux**

4. **Comparision of Physics Analysis with the Data Reconstructed on HP/UX and PC/Linux**

5. **Summary**

[1]The talk is given at BES Monthly' Meeting at IHEP on March 14, 2000. It was based on many useful discussions with Profs. Z.G. Zhao, Y.N. Guo, Y.C. Zhu, N.D. Qin, S.T. Xue, W.G. Li and D.H Zhang.

WHY NEED DATA RECONSTRUCTED ON PC/Linux ?

- PCs/Linux – PC is cheaper and Linux is free software. Easier to get more CPU and Larger Disk.

  BES-II J/ψ physics analysis is planed to perform on PC/Linux platform with data reconstructed on HP/UX. For these reasons, we at least need to generate and reconstruct Monte Carlo data at PC/Linux platform.

- Actually, if we can do BES-II data reconstruction, MC (Monte Carlo) simulation and MC data reconstruction on PC/Linux platform together with physics analysis, we can obtain physics result much faster than that based on the data reconstructed on PH/UX at IHEP.

- At present, there are some opened questions to be answered before the BES-II data reconstructed on the PC/Linux platform can be directly used for physics analysis on PC/Linux platform. One of the questions is whether the reconstructed BES-II data obtained on PC/Linux and HP/UX platforms are comparable.

  Other one is how well the physics results are comparable each other with the data reconstructed on HP/UX and PC/Linux.

- Is it possible to switch data offline reconstruction from HP/UX to PC/Linux ?

  To answer the opened questions, we studied the BES-II data off-line reconstruction on PC/Linux, and made some comparisons of physics analysis based on the data reconstructed on both PC/Linux and HP/UX platforms.

  The comparison results show that the physics analysis results for inclusive and exclusive J/ψ decays are comparable within 1% for total number of events observed from the data reconstructed on HP/UX and PC/Linux platforms.

BES-II SOFTWARE (V102) AND PC/Linux PLATFORM

The feasility study of that whether the BES-II data reconstructed on PC/Linux platform can be directly used in J/ψ physics analysis is performed based on the BES-II software of version 102.

- BES-II Software of Version 102

  The data off-line reconstruction software of version 102 was copied from BES-II software library on HP Workstation to the main PC server – PIII-500 PC of our "Distributed Network Clustering PCs System" (see our another talk presented at the Meeting) of D physics group, where the codes were converted from HP version into Linux version and the BES-II software library was built on 14 March, 2000.

- PC/Linux Platform

  The Red-hat 6.1 Linux was used as operation system for the PCs Cluster.

BES-II J/ψ DATA OFFLINE RECONSTRUCTION ON PC/Linux PLATFORM

- The Data Reconstructed on HP/UX with V102 code

  The data reconstructed on HP/UX were done by Data Production Group.

- The Data Reconstructed on PC/Linux with V102 code

  Using BES-II data off-line calibration constants obtained on HP/UX (copied them from "/bes/bes/share/const2/v102" on HP Workstation), 400 runs data (from run14201 to run14600) are reconstructed on the PC/Linux platform with the PCs System.

COMPARISON OF PHYSICS ANALYSIS WITH THE DATA RECONSTRUCTED ON HP/UX AND PC/Linux

The inclusive and exclusive physics analyses were only based on reconstructed 3-momentum vectors of charged particles and particle Identification information without using Kinematic fitting.

- High Statistic Inclusive Analysis
  - Inclusve $\overline{K^0}$
    See plots ...
  - Inclusve $\overline{K^{0*}}$
    See plots ...
  - Inclusve ϕ
    See plots ...
- High Statistic Exclusive Analysis
  - $J/\psi \to K^+K^-\pi^+\pi^-$
    with $Br(J/\psi \to K^+K^-\pi^+\pi^-) = (7.2 \pm 2.3) \times 10^{-3}$
    See plots ...
  -

Table 1: Summary of the numbers of events observed from the data reconstructed on HP/UX and PC/Linux.

Decay Modes	No. of events observed on HP/UX	No. of events observed on PC/Linux	$\frac{\text{No.(HP)-No.(PC)}}{\text{No.(HP)+No.(PC)}}$
Inclusive $\overline{K^0}$	1171.0 ± 89.1	1178.6 ± 89.3	0.0032
Inclusive $\overline{K^{0*}}$	719.2 ± 61.3	724.3 ± 61.2	0.0035
Inclusive ϕ	188.3 ± 21.2	184.3 ± 23.1	0.0107
$J/\psi \to K^+K^-\pi^+\pi^-$	2934	2945	0.0019
$J/\psi \to \phi\pi^+\pi^-$	237	237	0.000
$J/\psi \to \phi f_0(980)$	57	57	0.000

- Low Statistic Exclusive Analysis
  - $J/\psi \to \phi\pi^+\pi^-$

    with $Br(J/\psi \to \phi\pi^+\pi^-) = (8.0 \pm 1.2) \times 10^{-4}$
    See plots ...

  - $J/\psi \to \phi f_0(980)$

    with $Br(J/\psi \to \phi f_0(980)) = (3.2 \pm 0.9) \times 10^{-4}$
    See plots ...

Table 2: Summary of the masses and standard diveations of the mass distributions observed from the data reconstructed on HP/UX and PC/Linux. The values in () are the standard diveations.

Decay Modes	Mass measured on HP/UX [GeV]	Mass measured on HP/UX [GeV]	$\frac{\text{M(HP)-M(PC)}}{\text{M(HP)+M(PC)}}$
Inclusive $\overline{K^0}$	0.4961 ± 0.0005	0.4961 ± 0.0005	0.0000
	(0.0065 ± 0.0005)	(0.0065 ± 0.0005)	0.0000
Inclusive $\overline{K^{0*}}$	0.8927 ± 0.0022	0.8930 ± 0.0022	0.0002
	()	()	
Inclusive ϕ	1.0158 ± 0.0008	1.0160 ± 0.0009	0.0001
	(0.0073 ± 0.0011)	0.0071 ± 0.0013	0.0138
$J/\psi \to K^+K^-\pi^+\pi^-$	3.0973 ± 0.0009	3.0970 ± 0.0008	0.0000
	(0.0428 ± 0.0008)	(0.0428 ± 0.0008)	0.0000
$J/\psi \to \phi\pi^+\pi^-$	3.0933 ± 0.0030	3.0931 ± 0.003	0.0000
	(0.0427 ± 0.0026)	(0.0420 ± 0.0025)	0.0083
$J/\psi \to \phi f_0(980)$			0.000
	($\pm$)	($\pm$)	0.0000

SUMMARY

Using 400 runs (run14201-14600) BES-II J/ψ data reconstructed on both PC/Linux and HP/UX, we studied the possibility to reconstruct the data on PC/Linux platform for directe use in physics analysis. From the comparison of physics analysis results obtained from the data reconstructed on both PC/Linux and HP/UX, we find that

- the number of events for inclusive $\overline{K^0}$, $\overline{K^{0*}}$, ϕ and for the exclusive $J/\psi \to K^+K^-\pi^+\pi^-, \phi\pi^+\pi^-$ and ϕf_0 are the same within $< 1\%$ from the data reconstructed on the two platforms.
- the masses of the $\overline{K^0}$, $\overline{K^{0*}}$, ϕ and J/ψ measured from the data are the same within 0.8%.

These mean that the physics results based on the data reconstructed on the two platforms are the same within 1% level. So **the data reconstructed on the PC/Linux platform can be directly used in physics analysis.**