Offline Data Processing

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Abstract

Data taken in 99' Spring run have been processed successfully, the procedure of offline data processing is outlined, some future work are discussed.

1 Computing Environment

1.1 3 HP Workstations for Data Production and Calibration

Host	Type	CPU (SPECint95)	RAM (MB)	HD (GB)
HPWS0/1	HP735/125	2×4	2×144	$2 \times (4 + 9)$
HPWS8	HP9000/J2240	34	1024	4×18

- 3 hosts connected by DECHub 900 Concentrator,communication speed 100 Mbps
- CPU power and disk space: much more improved with the addition of HPWS8 (2 Processors)

1.2 2 Local Disks (2×18 GB) on HPTC3/4 Reserved for Storage of DST Files

1.3 5 Tape Drives (Eliant 820) Installed on Each of Above 5 Machines

Tape I/O Speed: ~ 4 Mbps

2 Data Processing Scheme

2.1 Data Production from Online Tape

- The offline data processing begins immediately once an online tape is unloaded
- Three kinds of data are produced for each run according to record type:

- RAW (physical events) runxxxxx.raw
- LUM (luminosity ADC and Scalar) runxxxxx.lum
- ODB (online database, BEPC parameters, online calib., ...) runxxxxx.odb

2.2 Event 'Filtering'

- Every event in RAW data is identified by an event type such as Bhabha, Di-muon or hadron etc. through a simple FILTER program, a filter record is attached to RAW data. The FLT data created, runxxxxx.flt
- No Event was Really Filtered in This Process

2.3 Bhabha and Di-muon Events Selected for Offline Calibration

- Events identified as Bhabha or Di-muon in FLT data are output as BB or MU files for offline calibration. runxxxxx.bb, runxxxxx.mu

2.4 RAW Data Check

- Histograms made using BB events serves as a monitor of detector performance
- The plots similar to online's are sent to BES Counting Room everyday

2.5 Fast Reconstruction (for R scan data)

- A fast reconstruction (using previous runs' calibration constants) carried out at each energy point helps determine the number of hadronic events and data-taking time at that point

2.6 Data Reconstruction

- When calibration constants are OK, all events are fully reconstructed. REC data are produced. runxxxxx.rec

2.7 DST Production

- Data Summary Files compressed from REC data are produced for physics analysis. runxxxxx.dst

3 Data Processed

3.1 Data Taken in the Spring Run

- Run11971 – 12123 J/Ψ data for calibration and trigger study

- Run12124 – 13475 R scan data (85 points, colliding or separated)
- Total online tape number: 184
- Total run number: ~ 1500
- RAW, LUM, ODB, FLT, BB, and MU were produced for each run
- Some run numbers are missing due to online problems (VME crash, wrong operation)

3.2 Data Reconstruction

- Three rounds of reconstruction with V101
  - 1st round (April 2 – April 20), V101, ~ 200 runs, bugs found in MDC and TOF reconstruction, a patch created
  - 2nd round (April 29 – May 22), V101+Patch, ~ 850 runs, DE/DX calibration problem found
  - 3rd round (June 1 – now), V101+Patch+DE/DX re-calibrated, ~ 500 runs, still going on. A problem found in ESC
  - V102 release for next round of reconstruction?
- Reconstruction under V100
  - ~ 100 runs of J/Ψ data for calibration
  - To compare results between V100 and V101, and to test the hardware and software performance, ~ 200 runs of R scan data were also reconstructed under V100
  - CPU time cost for a typical run (30K events): ~ 40 minutes on HPWS8

3.3 DST Files

- New DST format rewritten to incorporate VC subtypes (similar to old format) REC data compressed by a factor of 10. DST files made from 2nd and 3rd round of REC data

4 Data Storage

4.1 Data Sizes (for a typical run)

- RAW ~ 50 MB
- FLT ~ 51 MB (FLT records added)
- REC ~ 150 MB (RAW data included)
- DST ~ 15 MB (new DST format)

Sizes depend slightly on E_{cm}.

4.2 All DST Files Kept on Disks for Physics Analysis

- /data1/offline/dst/runxxxxx.ndst (on HPTC4)
- /data2/offline/dst/runxxxxx.ndst (on HPTC3)

Temporal location of REC data

- /data/d51-4/offline/rec/runxxxxx.rec (on HPWS8)

Temporal location of FLT data

- /data/d30/offline/flt/runxxxxx.flt (on HPWS1)
- /data/d32/offline/flt/runxxxxx.flt (on HPWS0)

4.3 All Kinds of Data (RAW, FLT, REC, BB, ...) Saved in 8mm Tapes

Number of copied 8mm tapes (~ 4.3 GB/Tape):

- RAW $\sim 2 \times 20$
- FLT $\sim 1 \times 20$
- DST $\sim 2 \times 50$
- ...

4.4 All BES-I REC Data Transferred form 6250 Big Tapes to 8mm Cartridge Tapes

5 Future Work

5.1 Auto Data Processing System

- With the rapid increase of data quantity and CPU power, it becomes urgent to speed up this work

5.2 Tape Library Robot

- Worked well on VAX/VMS, should be moved to HP/UX

5.3 Commercial Database

- Useful for many reasons. A symbol of international HEP collaboration.

6 Summary

6.1 Data taken in the Spring run have been processed almost simultaneously with online data-taking

6.2 CPU capability and disk quota enlarged, a fast data processing guaranteed

6.3 To make data procesing more efficient and reduce manpower, ADPS and Tape Robot should be working in the future