Comparison of online and offline Luminosity

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Charmonium Meeting 29.3.17

Overview

1. Checks for current Beam Time
2. Comparison to older Data Sets

Checks for current Beam Time

Event Selection

Good Tracks

- Cut on interaction region: $R_{xy} < 1\,\mathrm{cm}$, $R_z < 10\,\mathrm{cm}$.
- Cut on direction: $|\cos\vartheta| < 0.8$.
- For loose electron identification: $E/pc > 0.7$.

Event Topology

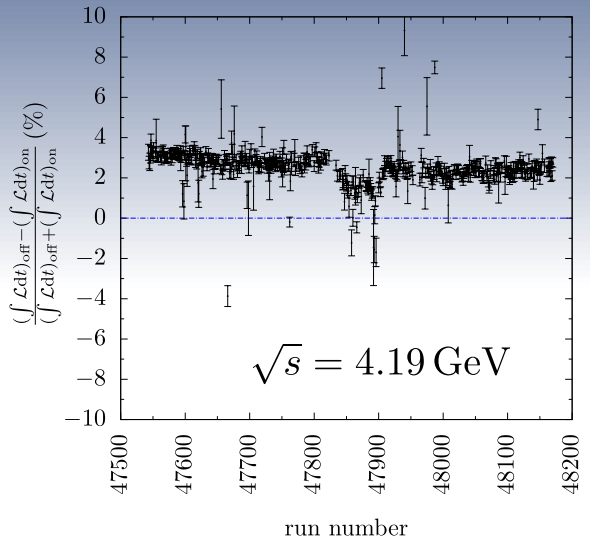
- Number of positively charged particles: $n_+ = 1$.
- Number of positively charged particles: $n_- = 1$.
- No veto on photons.

Cuts similar to old BESII $\int \mathcal{L}\mathrm{d}t$ measurement (arXiv:1503.03408)

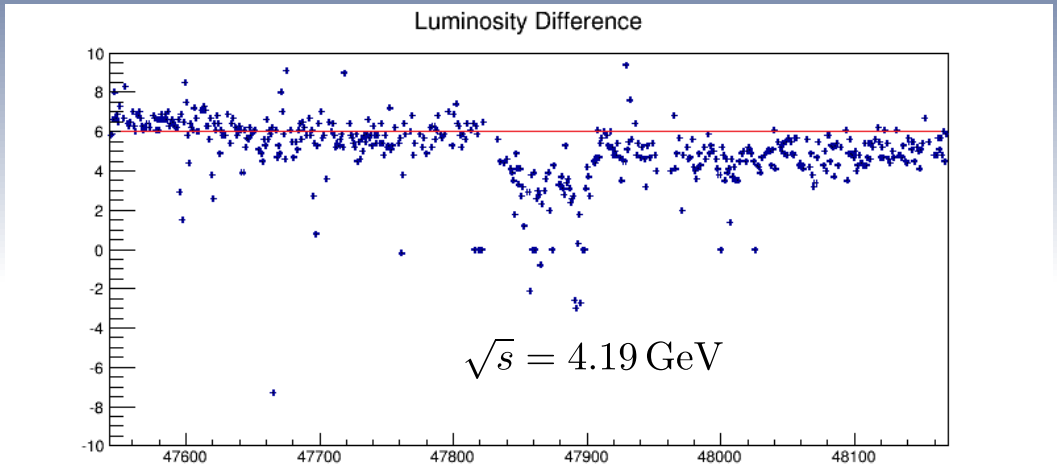
- $\alpha(e^+, e^-) > 175°$.
- $0.47 \cdot \sqrt{s} < pc < 4\,\mathrm{GeV}$.
- $E_{\mathrm{shower}} > 0.36 \cdot \sqrt{s}$.

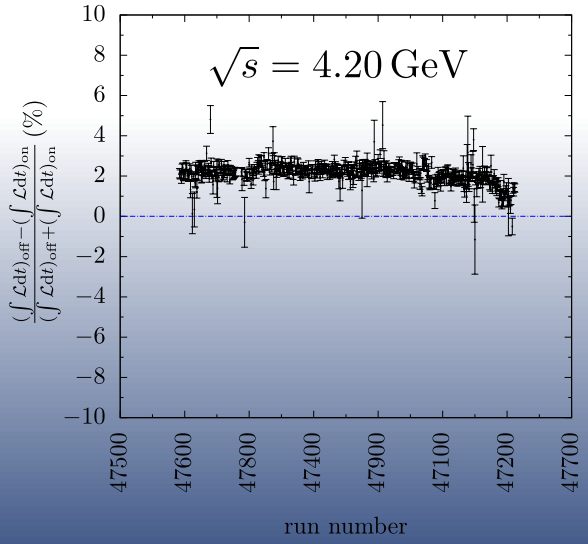
Run-by-Run Comparison: $\sqrt{s} = 4.20,\ 4.21\,\text{GeV}$

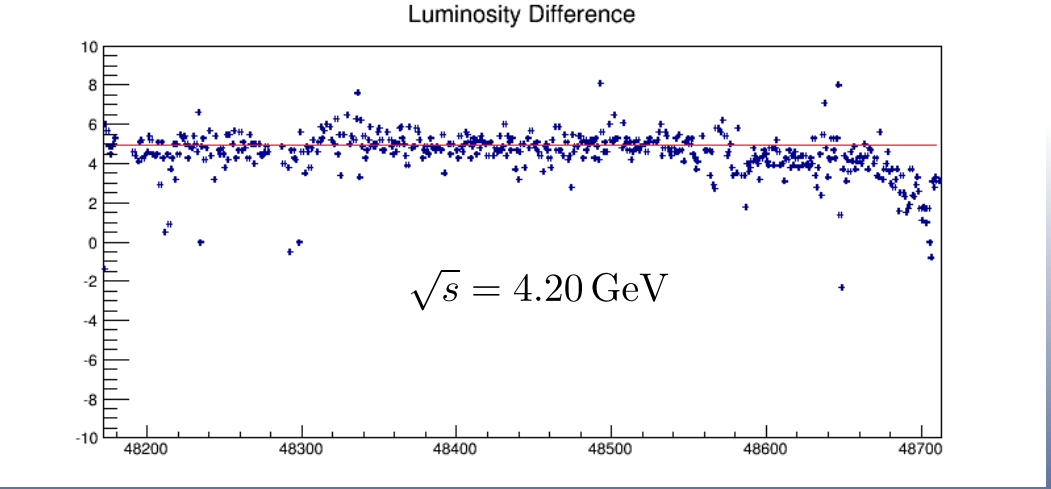
This Analysis



Yifan

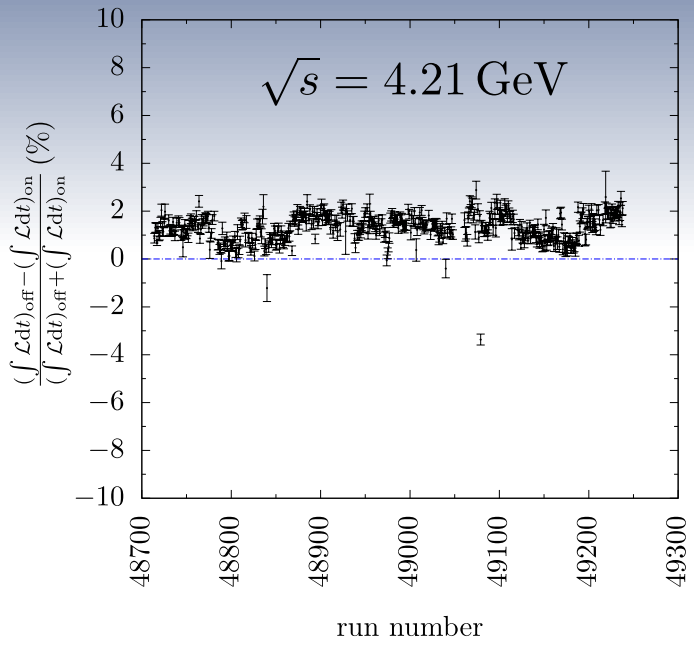




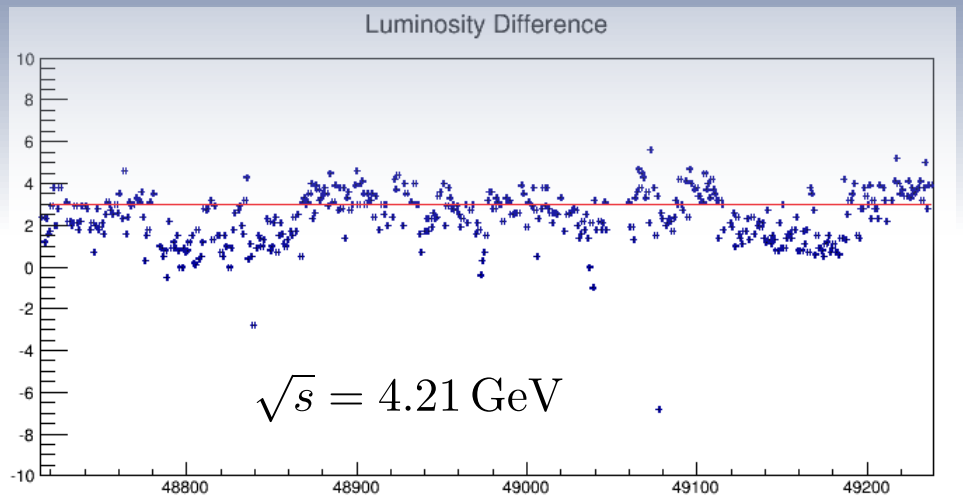


Run-by-Run Comparison: $\sqrt{s} = 4.21\,\mathrm{GeV}$

This Analysis



Yifan



- Scaling is different:
  - Here: $1/(\int \mathcal{L}_{\mathrm{off}}\mathrm{d}t + \int \mathcal{L}_{\mathrm{on}}\mathrm{d}t)$.
  - Yifan: $1/\int \mathcal{L}_{\mathrm{off}}\mathrm{d}t$ or $1/\int \mathcal{L}_{\mathrm{on}}\mathrm{d}t$.
  - Overall Scale is different by a factor of 2.
- Good agreement of the two measurements.

Global Comparison

$\sqrt{s}$ (MeV)	Online	Offline	$\int \mathcal{L}dt\,(\mathrm{pb}^{-1})$ only runs present as dst file and in database
4190	492.59 (490.7)	$517.6 \pm 1.6\,(518.2)$	508.4
4200	487.55 (489.7)	$518.7 \pm 1.3\,(520.1)$	507.3
4210	496.84 (491.0)	$510.2 \pm 1.1\,(509.0)$	509.2

This Analysis(Yifan)

- Offline luminosities are read from SQL database.
- Very good agreement with Yifans result.

Reason for large discrepancy between offline and online values

- Some runs are present as dst file, but missing in the database.
- The online luminosity should be larger (missing runs).

Missing runs:

- $\sqrt{s} = 4190\,\mathrm{MeV}$:
  47817, 47820, 47821, 47822, 47862, 47875, 47898, 47899, 48001, 48027
- $\sqrt{s} = 4200\,\mathrm{MeV}$:
  48189, 48299, 48707

Missing Runs: Easy way to verify

Search dst files with run number

```
# enter data folder for sqrtS = 4.19 GeV
cd /besfs/offline/data/702p01/xyz/4190/dst
# search for run 47817
find -iname *47817*
--> ./161227/run_0047817_All_file009_SFO-1.dst
--> ./161227/run_0047817_All_file005_SFO-1.dst
...
```

Search in SQL database

```
mysql --user=guest --password=guestpass -h bes3db2.ihep.ac.cn
use run;
# search for the run number 47817
select run_number,IntLumEndcapEE
       from OnlineLum where run_number=47817;
-->Empty set (0.00 sec)
```

- Can also be checked via webinterface on `http://bes3db.ihep.ac.cn`.

Comparison to older Data Sets

Remarks

Why perform such a task?

Learn for the current beam time what beahaviour of the relative luminosity difference can be expected.

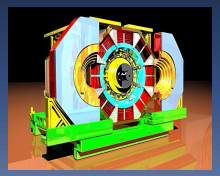
How the plots are created

- Information read from SQL database.
- database: **offlinedb**.
- table: **OfflineLum**.
- offline luminosity (from $\gamma\gamma$): **OfflineTwoGam**.

```
use offlinedb;
select RunNo, IntLumEndcapEE, OfflineTwoGam, OfflineBhabha
       from OfflineLum;
```

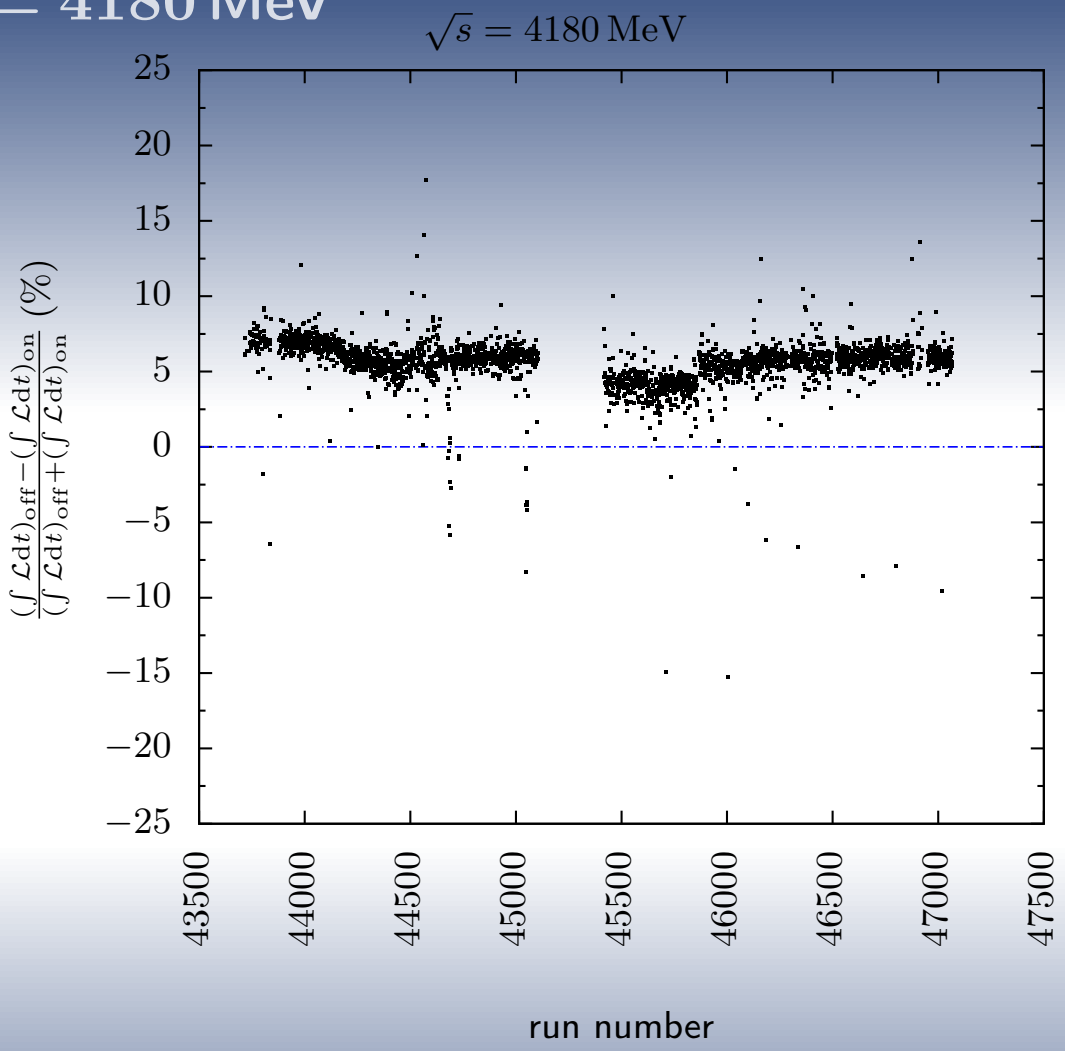
Missing offline luminosity by Bhabha scattering in SQL database

- Offline luminosity by Bhabha is always "NULL" in SQL database.
- Does anybody know why?



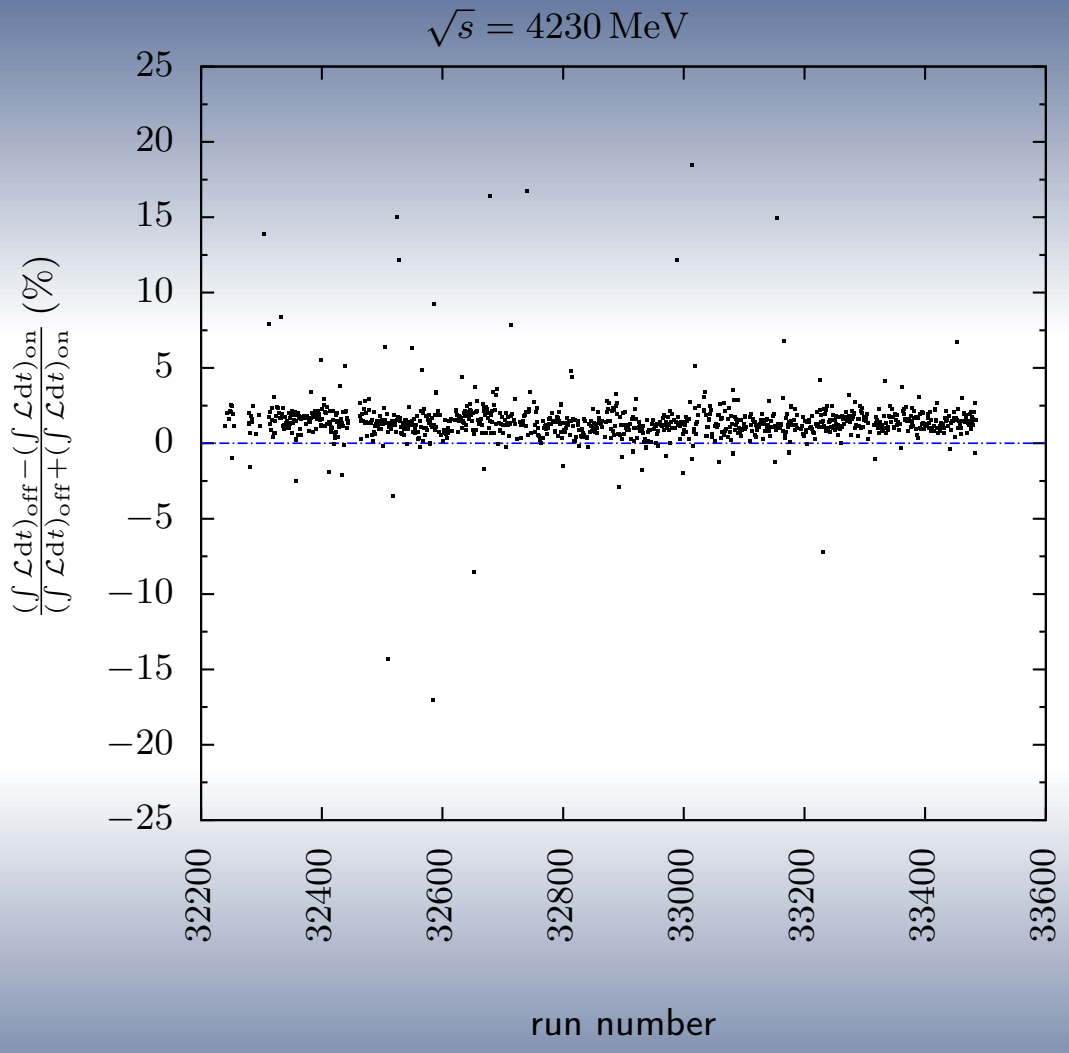
Comparison to older Data Sets

$\sqrt{s} = 4180\,\text{MeV}$



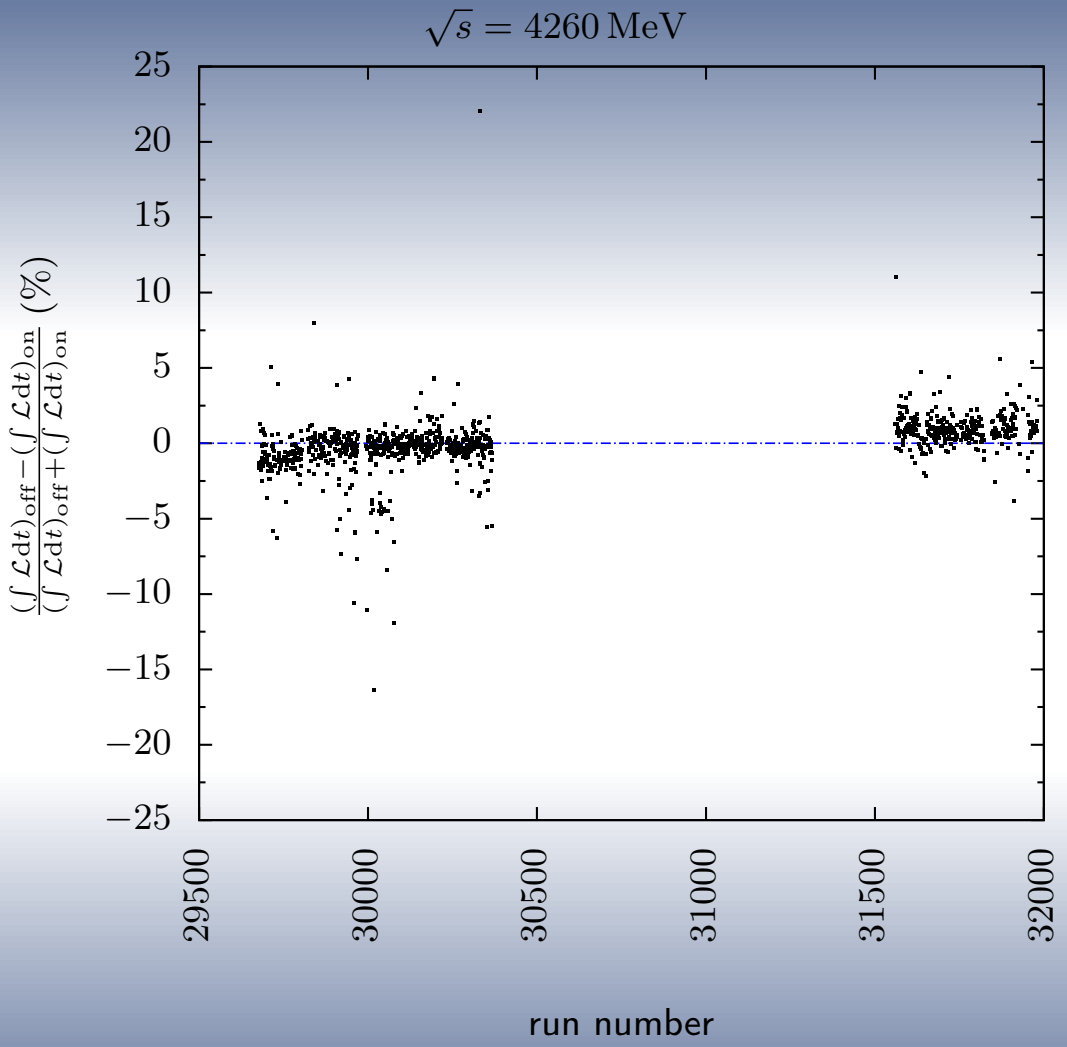
- No point shown if luminosity is not available for online OR offline values.
- No errors are given in the SQL database.

$\sqrt{s} = 4230\,\mathrm{MeV}$



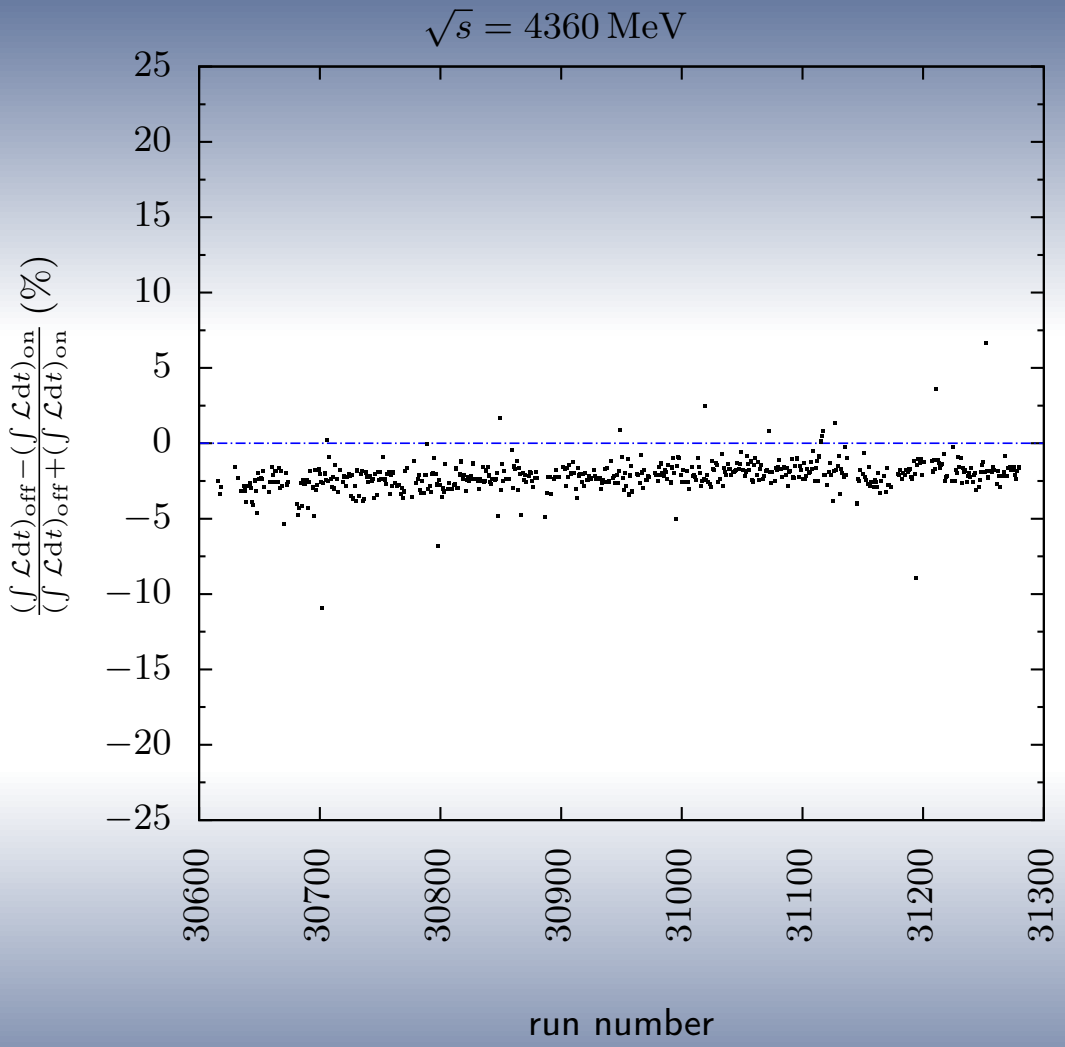
Relative difference constant and close to zero.

$\sqrt{s} = 4260\,\mathrm{MeV}$



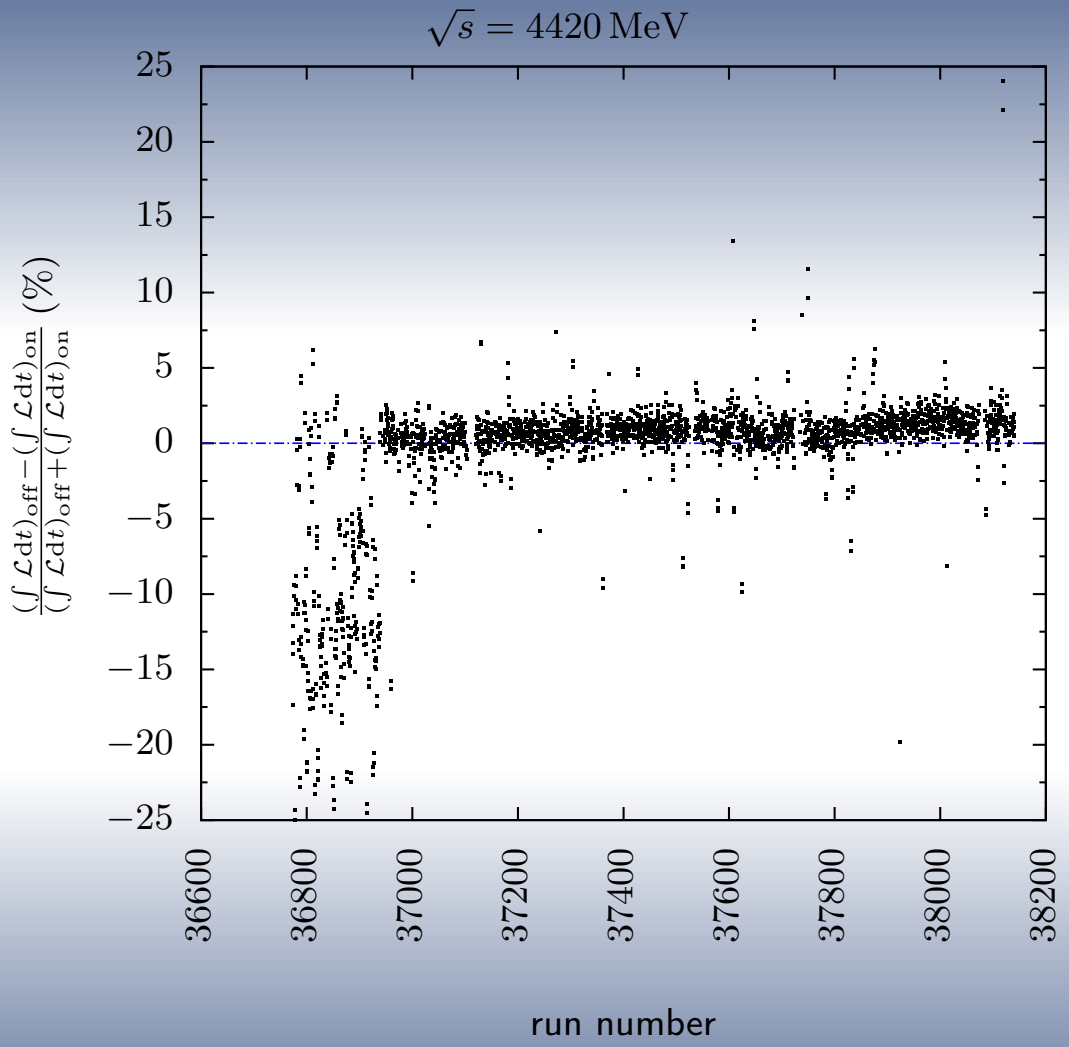
Data taking at $\sqrt{s} = 4.36\,\mathrm{GeV}$ in the "hole".

$\sqrt{s} = 4360\,\mathrm{MeV}$



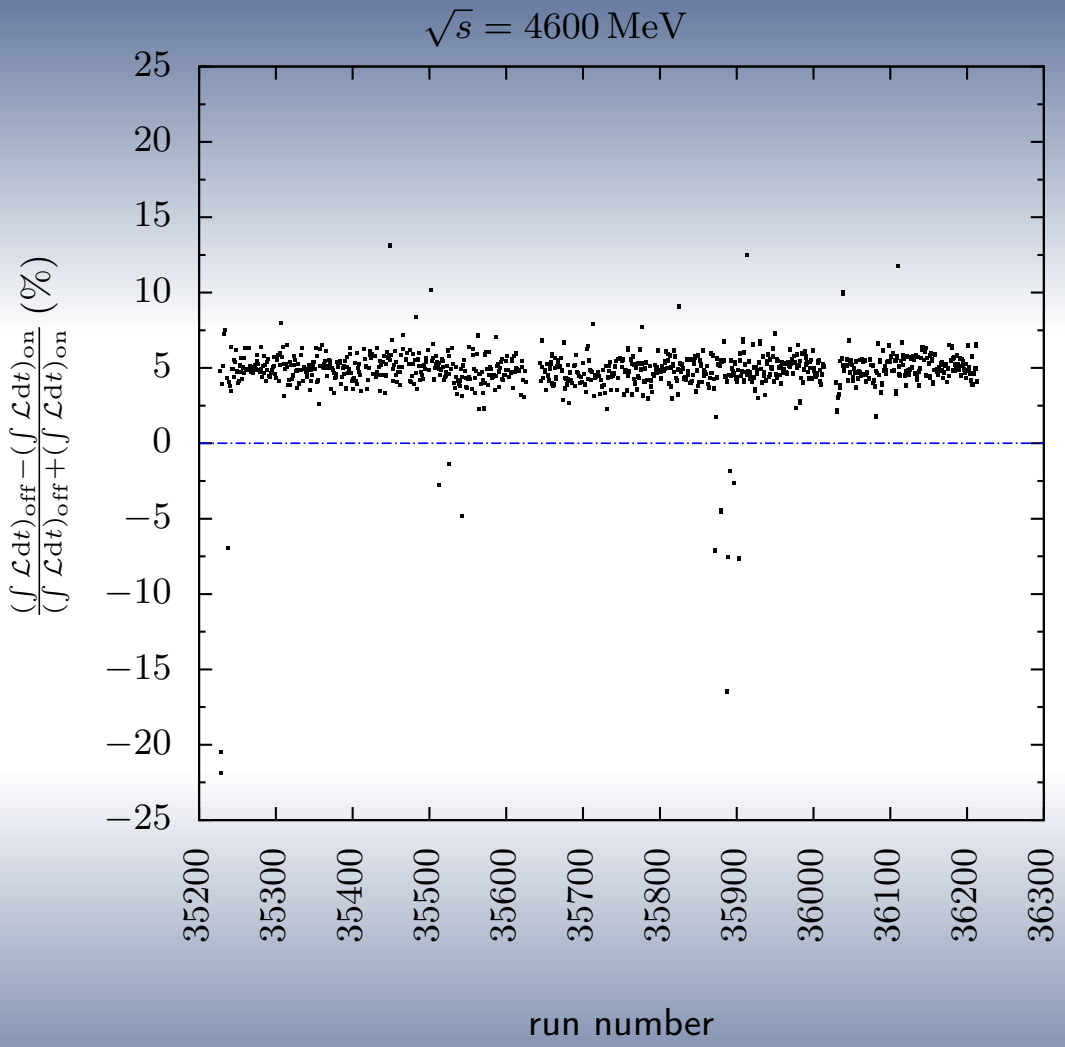
- Offline luminosities are systematically smaller.
- Relative difference lineary rising with run number.

$\sqrt{s} = 4420\,\mathrm{MeV}$



Very large scattering for run runmbers $\lesssim 37000$.

$\sqrt{s} = 4600\,\mathrm{MeV}$



Biggest systematic deviation of all investigated samples.

Summary

Concerning the older samples

- Step function behavior for longer or disconnected runs: $\sqrt{s} = 4180,\ 4260\,\mathrm{MeV}$.
- Systematic shifts of relative luminosity difference:
  - Linear rise for $\sqrt{s} = 4360,\ 4420\,\mathrm{MeV}$.
  - Constant for $\sqrt{s} = 4230,\ 4600\,\mathrm{MeV}$.
- Systematic deviation of relative luminosity difference strongly energy/run period dependant.

Concerning the current beam time

- Very good agreement with Yifans result.
- "Strange effects" (dip in middle of $\sqrt{s} = 4190\,\mathrm{MeV}$, drop at end of $\sqrt{s} = 4200\,\mathrm{MeV}$, step function like behaviour of $\sqrt{s} = 4210\,\mathrm{MeV}$) can be confirmed.
- Systematic deviation of $\Delta\mathcal{L}/\mathcal{L}$ is large for $\sqrt{s} = 4190,\ 4200\,\mathrm{MeV}$.

Problems

- Run infomation is missing for some runs in database!
- No offline luminosity by Bhabha scattering available in SQL database!