HPS Note: Golden Run Selection in 2016 Data

Sebouh Paul

1 Abstract

Here, I present a list of all of the "golden runs" to be used in analyses on the HPS 2016 dataset. For most of these runs, the entire run can be included when analyzing data. However, there are a few runs on this list in which there were unusual conditions during part of the run which either make it difficult to get an accurate measurement of the luminosity, or in which the data was taken with unacceptable conditions for analysis. In those cases, I indicate which range of files should be excluded, while the remainder of the run is included in the golden list.

2 Preliminaries

The first step I took towards determining the golden runs was to look through the run spreadsheet to find a list of all of the production runs with version 7 or 8 trigger, either 150 or 200 nA, and the 4 mm tungsten target in place. I excluded the runs that the shift takers labeled as "junk" in the spreadsheet (except for run # 7807, where it appeared that the shift-taker meant to apply the word "junk" to the previous run but clicked on the wrong cell.).

3 Runs and Parts of Runs Excluded

There were a few runs in which the SVT was not at the 0.5 mm position for part of the run. This generally occurred when we started up the beam for the first time each weekend, and we first checked to see if the beam was stable before moving the SVT to its nominal position. Among the runs where this happened, only run 7779 had a large enough amount of data at 0.5 mm that I decided to keep the part of this run with the SVT at 0.5 mm.

There were also a few runs in which MYA recorded unusual values for the DAQ livetime (such as -999). This may be a symptom of a worse problem in the DAQ for these runs, so therefore these are excluded in the golden list. In runs 7961 and 8038, the mya values are nonsensical for all or a large portion of the run. Runs 7962 and 8039 also have this problem, but only for the first few minutes, so I included these runs, but removed with the

portions where the livetime from MYA was unacceptable. Run 8043 had this problem for the first 2/3 of the run, but since the remaining third of the run had acceptable livetime, I decided to keep that part of the run.

The beam blocker just upstream of the Faraday cup was removed during 2 minutes of run 7795. This made the measurement of the beam charge during that run to be much higher than it actually was (the attenuation factor of the beam blocker is ≈ 50). It is unlikely that this would have any effect on the data taken during that time. However, I decided to remove that range of files without the beam blocker, to make the normalization easier.

Run 7989 had no hits in the layer 3 top axial part of the SVT, according to the DQM. In the recon, there are virtually no tracks found in the top half of the SVT. The cause of this is unknown, but this may have been caused by a DAQ problem.

Run 7973 has only one file and the bias was off for most of the run, therefore I excluded it.

There were a few runs (7796, 7801, 7803, 7805, 7807) taken on March 6-7 in which a small number of files were missing. I don't know if the reason for this is DAQ-related, or if there was a problem with copying them to tape. I did not exclude these runs, since I did not find any other problems with them. However, I do make note of the number of files missing in Table 2 and account for the missing luminosity in Table 1.

4 Normalization

All of the luminosities are calculated using good gated beam charge with SVT bias. For most of the runs, I simply used the beam charge from the run-summary sheet. For the runs in which a few files were missing or in which I chose to exclude a range of files, I use the sum of the beam charges from the file-summary sheet of all of the files that I have included.

The luminosity is given by $\ell = Q\left[\frac{\sigma N_A}{q_e A(10^{24}\ \mathrm{b/cm^2})}\right]$, where Q is the beam charge; A is the atomic mass number (183.84 for tungsten); N_A is Avagadro's number, 6.022×10^{23} mol^2; σ is the target's areal density, 0.0078125 g/cm^2; and q_e is the electron charge, $1.60217662 \times 10^{-19}$ C. The quantity in brackets is thus 1.597e-4 nb^{-1}/nC.

5 List of Golden Runs

Table 1 lists the runs that I have selected. Run numbers with asterisks next to them indicate that a certain range of the run is excluded from the golden run list and does not contribute to the luminosity or total events in the table. These ranges of missing or excluded files is given in Table 2

Table 1: List of "golden" runs from the 2016 HPS physics run used in this analysis, corrected for livetime and SVT burst mode efficiency, excluding files with DAQ errors, and periods where the SVT bias was off and other unusual run conditions. An asterisk next to a run number indicates that some of the files in the run are excluded from the list. In this case, the numbers of events and luminosity listed are of the remaining files in the run.

Run Number	Total Events	Luminosity (nb^{-1})
7629	48,445,040	56.47
7630	60,975,330	70.29
7636	148,219,610	168.67
7637	12,100,110	14.30
7644	150,288,740	184.30
7653	25,128,650	29.30
7779*	131,186,351	126.32
7780	121,447,750	104.23
7781	151,580,510	138.14
7782	19,410,430	16.76
7783	3,677,110	4.34
7786	4,746,870	3.94
7795*	116,023,039	37.38
7796	150,763,230	129.49
7798	167,693,140	171.32
7799*	149,954,553	160.63
7800	159,933,840	162.39
7801*	140,431,569	115.89
7803*	145,443,839	139.15
7804	150,163,340	146.10
7805*	130,983,413	129.61
7807*	110,738,242	111.03
7947	100,003,560	161.36
7948	112,391,630	182.72
7949	105,624,080	176.19
7953	25,034,370	32.30
7962*	23,011,403	37.21
7963	100,690,930	165.05
7964	100,426,760	156.40
7965	47,883,630	77.28

Table 1: List of "golden" runs from the 2016 HPS physics run. (continued)

Run Number	Total Events	Luminosity (nb^{-1})
7966	102,294,530	156.65
7968	100,021,800	146.16
7969	9,593,000	15.06
7970	100,430,650	141.43
7972	72,335,630	124.09
7976	25,210,890	43.13
7982	16,805,500	29.89
7983	100,237,730	175.35
7984	105,389,430	186.27
7985	103,263,260	183.61
7986	102,740,620	182.61
7987	104,291,800	186.08
7988	100,041,960	174.62
8025	100,257,350	171.80
8026	100,229,880	173.34
8027	103,477,890	175.63
8028	119,665,800	200.79
8029	100,850,170	169.53
8030	68,263,790	114.83
8031	58,215,590	97.86
8039*	94,955,778	164.65
8040	100,283,730	173.74
8041	29,615,580	51.17
8043*	28,089,049	49.35
8044	100,089,230	174.74
8045	101,535,140	158.97
8046	101,280,500	152.38
8047	100,918,360	166.05
8048	100,013,000	172.99
8049	22,101,030	37.81
8051	29,492,890	49.83
8055	54,455,460	100.94
8057	100,049,810	183.98
8058	100,069,290	176.57
8059	110,092,750	194.64
8072	108,117,590	202.07
8073	103,940,210	167.06

Table 1: List of "golden" runs from the 2016 HPS physics run. (continued)

Run Number	Total Events	Luminosity (nb^{-1})
8074	88,071,400	157.69
8075	34,367,160	64.42
8077	57,189,610	106.63
8085	59,817,680	123.96
8086	97,369,240	191.09
8087	109,983,980	184.81
8088	27,287,810	54.80
8090	31,698,590	60.13
8092	99,450,940	184.97
8094	100,575,040	189.27
8095	105,290,240	162.69
8096	100,177,890	163.48
8097	99,131,050	172.20
8098	101,838,720	193.62
8099	128,774,050	241.24
Total	7,234,141,136	10685.27

Table 2: List of ranges of files excluded from golden runs. Reasons for excluding regions are explained in more detail in Section 3. An asterisk indicates that files are missing from tape and are not part of a contiguous range.

Run Number #	Excluded Range	Reason for Exclusion
7779	0 - 58	SVT position not at 0.5 mm
7795	135 - 150	beam blocker not in place
7799	*	3 files missing
7801	*	16 files missing
7803	*	14 files missing
7805	*	25 files missing
7807	*	12 files missing
7962	0-4	livetime from mya
8039	0-11	livetime from mya
8043	0-165	livetime from mya

6 Conclusions

This list contains 82 runs, with a total of 7,292,550,593 events and 10634.68 nb^{-1} of luminosity. This is equivalent to 3.85 days of runtime with 200 nA with no beam trips and 100% livetime. The beam charges that were used to calculate these numbers can be found in the 2016 run spreadsheet, in the golden runs sheet.