4.3 SUMMARY

We have identified all sources of the MINOS Beam Data Process (BDP) failure modes with >1% loss in efficiency for the period Feb 1st,2005 - Feb 28, 2006. Almost all the failure modes identified have been addressed and preventative measures implemented. For the period Feb 1st, 2005 - Feb 28, 2006 the ND GPS system recorded 7.79M spills whereas the BDP process logged 7.68M spills. We find the overall BDP spill logging efficiency to be 98.6% when compared to the number of spills recorded by the ND GPS system. The BDP spill logging efficiency has been $> 99.5\%$ for the period Dec, 2005 through Feb, 2006. The fraction of BDP recorded spills where the NuMI toroids failed to readout is negligible; being $\sim 0.1\%$.

We have compared the total number of POT recorded by the BDP to the NuMI dataloggers. We find occasional differences in spill intensity values for TORTGT recorded in the NuMI dataloggers and by the BDP for the same spill. The difference in recorded intensity for the same spill is on the order of the ADC resolution which is 0.03% at 25E12. Overall, we find the Dataloggers record on average 0.03% higher daily POT values as compared to the BDP when both systems are operating normally which is consistent with the differences in individual spill values noted earlier. We consider this source of uncertainty on the torioid POT values to be negligible. We find that the NuMI datalogger recorded a total of 1.415 E20 POT (raw) for the period Feb 1st, 2005 through Feb 25, 2006 and the BDP recorded a total of 1.401E12 (raw) [5]. The difference in the total POT logged by the NuMI dataloggers and the BDP is $\sim 1\%$ and is consistent with the BDP spill logging efficiency of $\sim 98.6\%$.

The timeline breakdown for different beam configurations is discussed in Appendix C. Table 8 summarizes total POT integrated for different beam configurations after correcting for toroid calibrations [6] and including the uncertainties on the toroid readout discussed in Section 3.

Table 8: Integrated POT as recorded by the BDP for different beam running conditions. For data collected from Jan 21, 2005 through Feb 25, 2006.

Target location	Horn current	BDP POT
-250 cm	-200 kA	1.60 ± 0.05E18
-100 cm	-200 kA	1.20 ± 0.04E18
0 cm	-200 kA	0.676 ± 0.023E18
-10cm	0 kA	2.915 ± 0.030E18
-10cm	-170 kA	1.466 ± 0.015E18
-10cm	-200 kA	1.366 ± 0.014E18
-10cm	-185 kA	1.297 ± 0.013 E20
All	All	1.390 ± 0.014 E20

We studied the accuracy of beam data timestamps compared to the ND GPS timing system. We find that the accuracy of matching the beam data timestamps with the ND GPS spill times is better than 100 milliseconds. The efficiency of matching ND snarls with beam data spills is consistent with the BDP livetime.

[5] No toroid calibrations have been applied to these numbers

[6] The calibrations applied are a reduction of 4% on all TORTGT readings recorded prior to the gate change on July 26, 2005

position at the target for quality cuts for this earlier dataset.

Table 13: Summary of data selection efficiencies.

Month	BDP POT	Intensity > 0.5 E12	+Horn current	+Beam on target
March	7.04 E17	99.97	98.97%	72.98 %
May	67.4 E17	99.98 %	99.98 %	99.23 %
June	103.7 E17	99.98%	99.34%	99.27%
July	130.9 E17	99.98%	99.98%	99.69%
August	170.5 E17	99.998%	97.27%	97.25%
Sept	192.1 E17	99.998%	99.85%	99.81%
Oct	101.4 E17	100.00%	99.69%	99.57%
Nov	185.6 E17	100%	99.99%	99.81 %
Dec	147.3 E17	100%	99.64%	99.51 %
Total	1.111 E20			

Several classes exist in the MINOS offline framework which implement a loose set of default beam data quality cuts on a spill-by-spill basis. A detailed description of the default cuts applied in the MINOS offline analysis framework and instructions on how to use the spill quality selection classes is found in reference [10].

C Summary of different NuMI running conditions

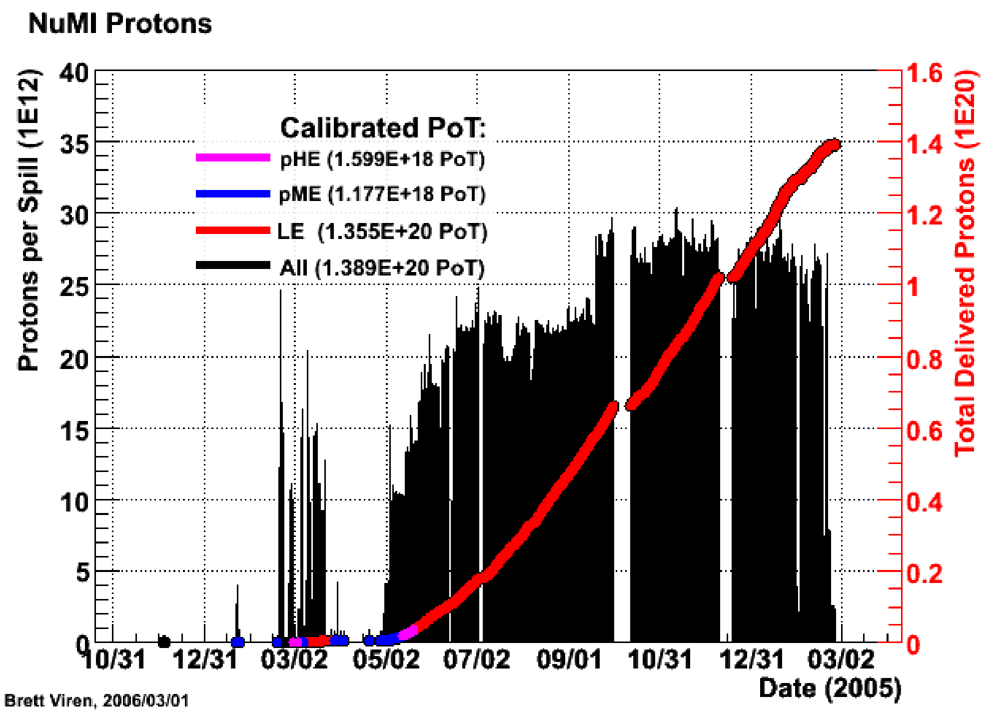

Figure 60: NuMI integrated and instantaneous POT as recorded by the BDP. POT calibration corrections are applied.

Table 15: Summary of different NuMI beam running conditions Feb, 2005 through Feb, 2006. These are for planned changes, unplanned changes in beam conditions such as horn current trips are not indicated in this list. Times are UTC. POT have calibrations applied. *Throw away spills with $< 0.1E12$ to exclude noise/pedestals. **Variation in toroid readouts.

Target location	Horn current	Start time	End time	POT*
-100 cm	-200 kA	2005-02-01	2005-02-27 21:30:50	2.39-3.10 E16 **
-250 cm	-200 kA	2005-02-27 21:43:35	2005-03-04 01:22:05	3.57-3.66 E15 **
-100 cm	-200 kA	2005-03-04 01:32:18	2005-03-07 23:52:44	5.73-5.84 E15 **
0 cm	-200 kA	2005-03-08 23:16:23	2005-03-23	6.68-6.83 E17 **
-100 cm	-200 kA	2005-04-30 20:19:37	2005-05-12 19:53:03	1.168 E18
-250 cm	-200 kA	2005-05-12 22:37:18	2005-05-20 16:00:21	1.596 E18
-10 cm	-185 kA	2005-05-20 19:44:16	2005-07-29 17:54:28	2.519 E19
-10 cm	-170 kA	2005-07-29 17:58:06	2005-08-01 18:58:08	1.466 E18
-10 cm	-200 kA	2005-08-01 19:01:30	2005-08-03 23:44:34	1.366 E18
-10 cm	-185 kA	2005-08-03 23:46:43	2006-02-10 21:03:43	1.016 E20
-10 cm	0 kA	2006-02-10 21:05:43	2006-02-15 13:37:04	2.915 E18
-10 cm	-185 kA	2006-02-15 18:05:02	2006-02-25 23:02:59	2.949 E18
Total		2005-02-01	2006-02-25 23:02:59	1.390 E20