AGS Complex Machine Studies (AGS Studies Report No. 301) Total Protons Incident on Booster Dump
Study Period: 2/19/93 - 8/20/93
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Purpose

AGS-OPM 2.5 (1/4/93) specifies that the total number of 1.5 GeV equivalent protons deposited on the Booster dump in 1993 shall not exceed 2.5×10^{19}. This note reports the results of an experiment to measure the number of protons deposited on the dump.

Procedure

Dosimeters were placed at five standard locations near the dump. The five locations were:

1. Downstream end of dump;
2. Upstream end of dump;
3. Upstream end of dump on outer wall of tunnel, 3 feet below the plane of the beam;
4. Five feet upstream of No. 3;
5. Twelve feet upstream of No. 3.

Location No. 1 was normally saturated, so we drop it from further consideration.

Every month the dosimeters were replaced and sent to the Health Physics Group to be read. The results were reported by Roger Thompson in a series of eight memos documented below. On July 22, a special run was carried out wherein we put in a fresh set of dosimeters, ran a known amount of beam into the dump and then removed the dosimeters for reading.

At each location, there were two detectors sensitive to gammas (TLD-700) and two detectors sensitive to gammas and neutrons (TLD-600). They all tracked very well, so in this note for simplicity we report only the TLD-700 results, labeling the two detectors a and b.

Results

Table 1 summarizes the data used in this report. The units are nominally nanoCuries, but we can take them as arbitrary. Figure 1 shows the data as a function of position and Figure 2 shows the data normalized by the calibration run (Run 7). For each run, the ratios should be independent of position and, for our purposes, the lines in Figure 2 are flat enough. For each run we average the ratios over the eight detectors and record the results in Table 2. For the calibration run (Run 7), we put 1.88×10^{15} protons into the dump. Table 2 lists for each run the total protons in the dump, the average protons in the dump per day, and the total protons for 1993. It also gives the OPM limit and a rough estimate of the total number of protons accelerated in the Booster in 1993.

Conclusion

We put the equivalent of 6×10^{17} protons into the Booster dump in 1993, only 2% of our allowed limit of 250×10^{17} and only a small fraction of the protons accelerated in the Booster, which we take to be roughly 250×10^{17}.

TABLE 1

BOOSTER DUMP MONITORING TLD RESULTS

"Net nC" for TLD – 700 units

RUN NUMBER	1	2	3	4	5	6	7	8	9
INSTALLATION DATE	2/19/93	3/16/93	4/5/93	5/6/93	5/18/93	6/16/93	7/22/93	6/23/93	7/22/93
REMOVAL DATE	3/16/93	4/5/93	5/6/93	5/18/93	6/16/93	6/23/93	7/22/93	7/22/93	8/20/93
DAYS of EXPOSURE	25	20	31	12	29	7	1	29	29
DATE of REPORT	MARCH 29	MAY 6	MAY 26	JUNE 9	JULY 16	JULY 16	JULY 30	AUGUST 1	SEPT 1
DETECTOR									
2a	10369	19376	348752	112651	335966	23442	4802.72	479577	96745
2b	5993	18451	313407	120800	407511	32494	4278.2	415876	115190
3a	408	874	11784	4548	9660	1146	160.39	19357	5244
3b	380	887	12546	4443	9704	1259	134.74	19411	5704
4a	200	566	5282	1890	4032	527	79.26	8509	2335
4b	223	507	5238	1979	4058	584	69.83	8019	2322
5a	145	331	2540	1000	2100	350	43.7	3533	1203
5b	132	329	2512	1078	2161	300	40.35	3608	1090

TABLE 2

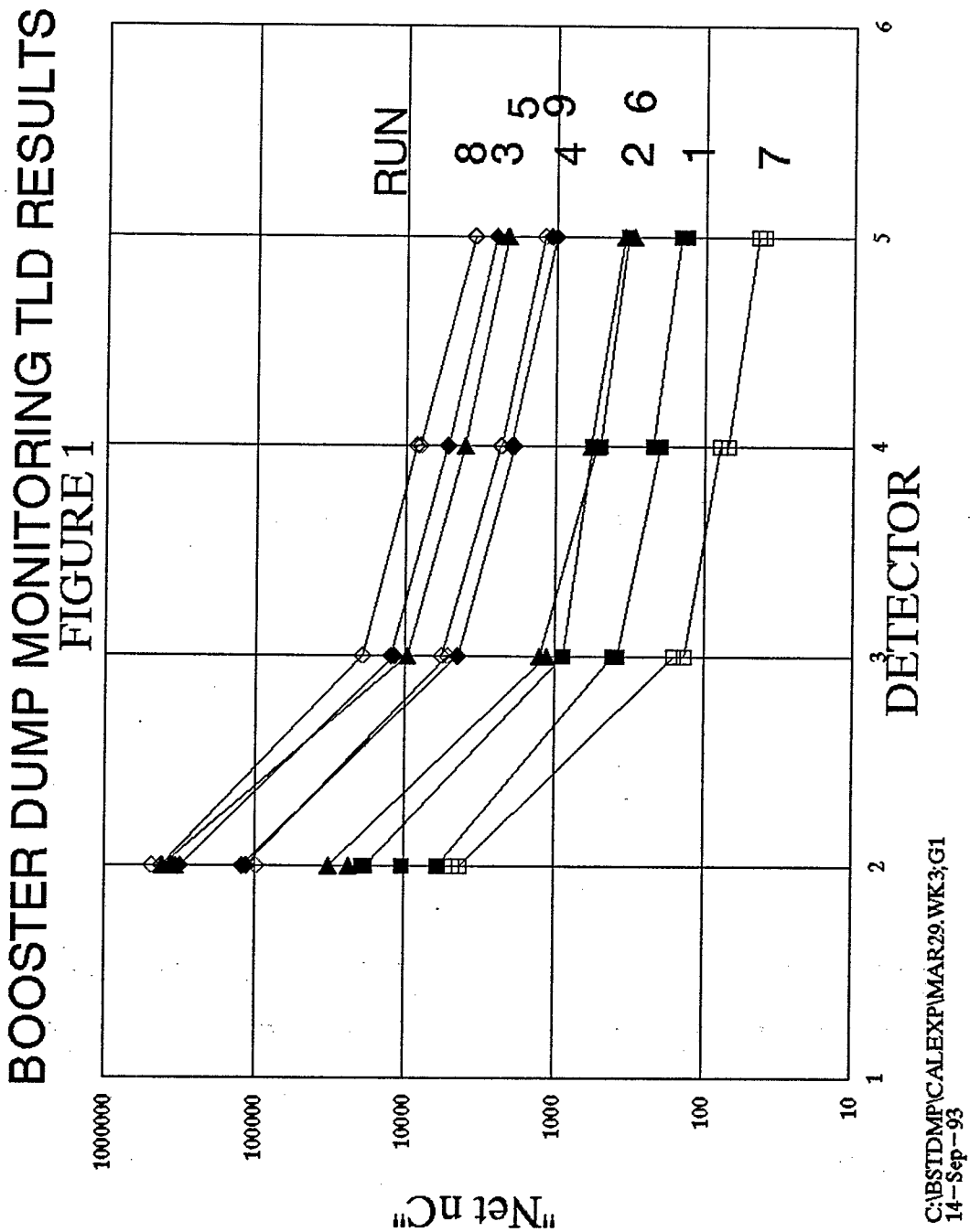
SUMMARY of RESULTS

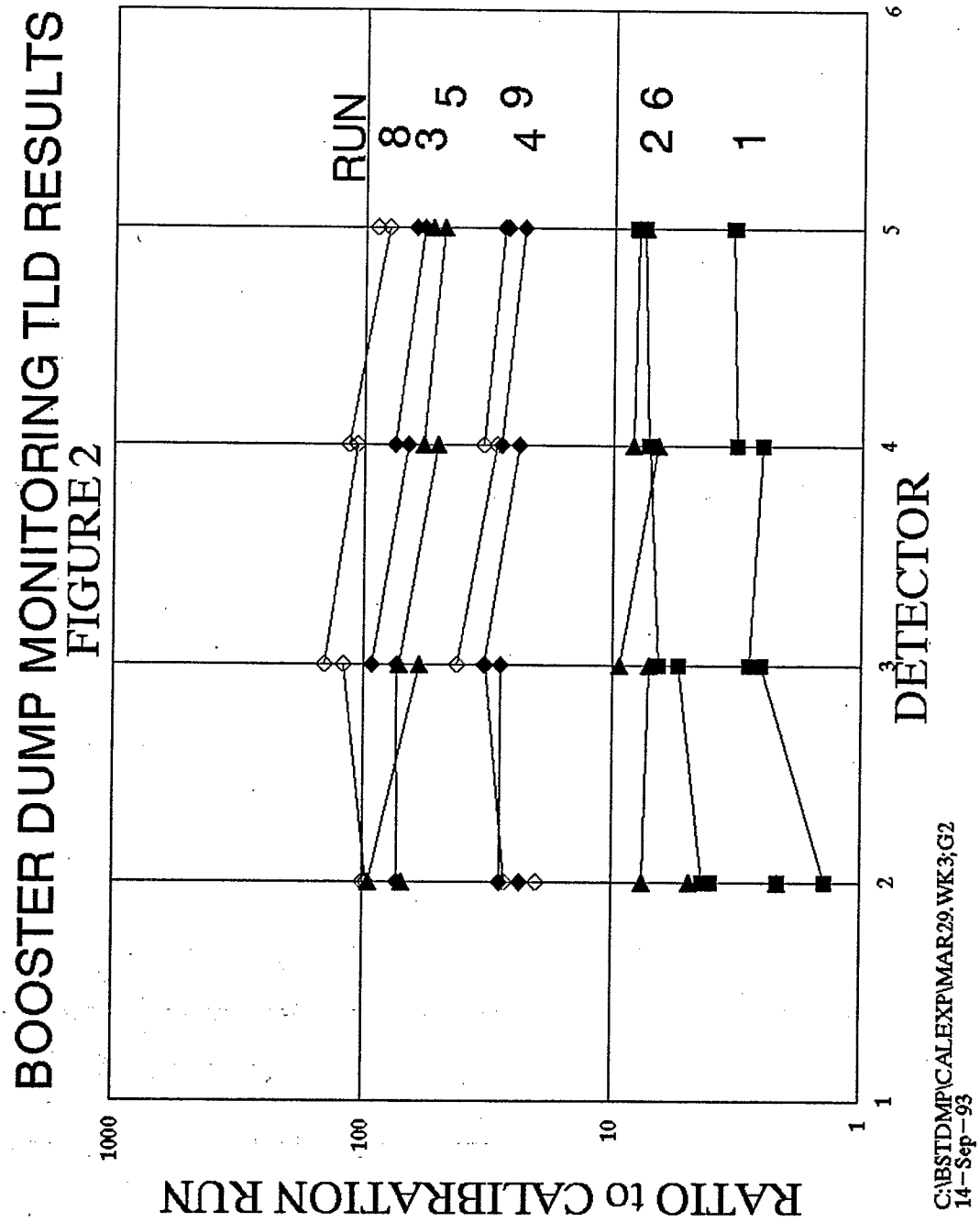
RUN NUMBER	AVERAGE of RATIOS to CALIBRATION RUN	STD	TOTAL PROTONS 10^15	PROTONS per DAY 10^15
7	1		1.88	1.9
1	2.7	0.6	5	0.2
2	6.3	1.4	12	0.6
3	71.8	9.8	135	4.4
4	26.9	3.2	50	4.2
5	63.5	14.4	119	4.1
6	7.4	1.2	14	2.0
8	106.8	18.6	201	6.9
9	29.9	6.0	56	1.9

TOTAL 1.5 GeV EQUIVALENT PROTONS on DUMP	595

OPM LIMIT for DUMP	25000

TOTAL PROTONS ACCELERATED in BOOSTER ~	25000


BOOSTER DUMP MONITORING TLD RESULTS
FIGURE 1
"Net nC"
1000000
100000
10000
1000
100
10
1
2
3
4
5
6
DETECTOR
RUN
8
3
5
9
4
2
6
1
7
C:\BSTDMP\CALEXP\MAR29.WK3;G1
14-Sep-93


BOOSTER DUMP MONITORING TLD RESULTS
FIGURE 2
RUN
8
3
5
4
9
2
6
1
1000
100
10
1
RATIO to CALIBRATION RUN
1
2
3
4
5
6
DETECTOR
C:\BSTDMP\CALEXP\MAR29.WK3;G2
14-Sep-93