Properties of Neon, Magnesium, and Silicon Primary Cosmic Rays Results from the Alpha Magnetic Spectrometer - SUPPLEMENTAL MATERIAL -

(AMS Collaboration)

For references see the main text.

Detector.— The tracker has nine layers, the first $L1$ at the top of the detector, the second $L2$ above the magnet, six $L3$ to $L8$ within the bore of the magnet, and the last $L9$ above the ECAL. $L2$ to $L8$ constitute the inner tracker. Each layer of the tracker provides an independent measurement of the charge Z with a resolution of $\Delta Z/Z = 3\%$ for Z=10, 12, and 14 nuclei. Overall, the inner tracker has a resolution of $\Delta Z/Z$ =1.3% for these nuclei. The spatial resolution in each tracker layer is 6.7 μm for Z=10 nuclei, 7.1 μm for Z=12 and 7.4 μm for Z=14. Together, the tracker and the magnet measure the rigidity R of charged cosmic rays, with a maximum detectable rigidity MDR of 3.2 TV for Z=10, 3.1 TV for Z=12 and 3.0 TV for Z=14 over the 3 m lever arm from $L1$ to $L9$.

Two of the TOF planes are located above the magnet (upper TOF) and two planes are below the magnet (lower TOF). The overall velocity ($\beta = v/c$) resolution has been measured to be $\Delta(1/\beta) = 0.01$ for Z=10, 12, and 14 nuclei. This discriminates between upward- and downward-going particles. The pulse heights of the two upper planes are combined to provide an independent measurement of the charge with an accuracy $\Delta Z/Z = 2\%$. The pulse heights from the two lower planes are combined to provide another independent charge measurement with the same accuracy.

Results.— Fitting the He, C and O fluxes over the rigidity range 60 GV to 3 TV with Eq. (5) simultaneously with common parameters s, γ, R_0, $\Delta\gamma$ yields $C_{\mathrm{He}} = (950 \pm 10) \times 10^{-4}$ m^{-2}sr^{-1}s^{-1}GV^{-1}, $C_{\mathrm{C}} = (31 \pm 1) \times 10^{-4}$ m^{-2}sr^{-1}s^{-1}GV^{-1}, $C_{\mathrm{O}} = (33 \pm 1) \times 10^{-4}$ m^{-2}sr^{-1}s^{-1}GV^{-1}, $\gamma_{\mathrm{HeCO}} = -2.756 \pm 0.002$, $\Delta\gamma = 0.170 \pm 0.015$, $s = 0.05 \pm 0.015$, and $R_0 = 340^{+40}_{-30}$ GV.

The fit of the normalization parameters C_{Ne}, C_{Mg}, and C_{Si} was performed on the Ne, Mg, and Si fluxes together with Eq. (5) above 86.5 GV fixing the γ_{NeMgSi}, $\Delta\gamma$, s, and R_0 parameters. We used the $\Delta\gamma$, s, and R_0 values obtained from the simultaneous fit to the He, C, and O fluxes and $\gamma_{\mathrm{NeMgSi}} = \gamma_{\mathrm{HeCO}} + \langle\delta\rangle$, where $\langle\delta\rangle = -0.045$ is the average spectral index of Ne/O, Mg/O and Si/O flux ratios above 86.5 GV, see Eq. (4). The fit yields $C_{\mathrm{Ne}} = (5.6 \pm 0.2) \times 10^{-4}$, $C_{\mathrm{Mg}} = (6.7 \pm 0.3) \times 10^{-4}$, and $C_{\mathrm{Si}} = (6.0 \pm 0.3) \times 10^{-4}$ in units of m^{-2}sr^{-1}s^{-1}GV^{-1}.

TABLE SI: The Ne flux Φ as a function of rigidity at the top of AMS in units of $[\mathrm{m}^2 \cdot \mathrm{sr} \cdot \mathrm{s} \cdot \mathrm{GV}]^{-1}$ including errors due to statistics (stat.); contributions to the systematic error from the trigger and acceptance (acc.); the rigidity resolution function and unfolding (unf.); the absolute rigidity scale (scale); and the total systematic error (syst.). The contribution of individual sources to the systematic error are added in quadrature to arrive at the total systematic error.

Rigidity [GV]	Φ	$\sigma_{\text{stat.}}$	$\sigma_{\text{acc.}}$	$\sigma_{\text{unf.}}$	σ_{scale}	$\sigma_{\text{syst.}}$	
2.15 – 2.40	(2.371	0.013	0.094	0.052	0.012	0.108)	$\times 10^{-1}$
2.40 – 2.67	(2.200	0.011	0.084	0.029	0.007	0.089)	$\times 10^{-1}$
2.67 – 2.97	(1.995	0.009	0.074	0.019	0.003	0.076)	$\times 10^{-1}$
2.97 – 3.29	(1.800	0.008	0.065	0.015	0.001	0.067)	$\times 10^{-1}$
3.29 – 3.64	(1.609	0.007	0.057	0.012	0.000	0.059)	$\times 10^{-1}$
3.64 – 4.02	(1.405	0.006	0.050	0.009	0.001	0.050)	$\times 10^{-1}$
4.02 – 4.43	(1.210	0.005	0.042	0.007	0.001	0.043)	$\times 10^{-1}$
4.43 – 4.88	(1.047	0.004	0.036	0.005	0.001	0.037)	$\times 10^{-1}$
4.88 – 5.37	(8.875	0.032	0.307	0.041	0.014	0.310)	$\times 10^{-2}$
5.37 – 5.90	(7.490	0.027	0.258	0.031	0.014	0.260)	$\times 10^{-2}$
5.90 – 6.47	(6.329	0.023	0.217	0.024	0.013	0.219)	$\times 10^{-2}$
6.47 – 7.09	(5.279	0.019	0.181	0.018	0.012	0.182)	$\times 10^{-2}$
7.09 – 7.76	(4.341	0.015	0.149	0.013	0.010	0.150)	$\times 10^{-2}$
7.76 – 8.48	(3.622	0.013	0.124	0.010	0.009	0.125)	$\times 10^{-2}$
8.48 – 9.26	(3.017	0.011	0.103	0.008	0.008	0.104)	$\times 10^{-2}$
9.26 – 10.1	(2.449	0.009	0.084	0.006	0.007	0.084)	$\times 10^{-2}$
10.1 – 11.0	(2.013	0.008	0.069	0.005	0.006	0.069)	$\times 10^{-2}$
11.0 – 12.0	(1.653	0.007	0.057	0.004	0.005	0.057)	$\times 10^{-2}$
12.0 – 13.0	(1.339	0.006	0.046	0.003	0.004	0.046)	$\times 10^{-2}$
13.0 – 14.1	(1.108	0.005	0.038	0.002	0.004	0.038)	$\times 10^{-2}$
14.1 – 15.3	(9.052	0.042	0.310	0.020	0.030	0.312)	$\times 10^{-3}$
15.3 – 16.6	(7.356	0.036	0.252	0.016	0.025	0.254)	$\times 10^{-3}$
16.6 – 18.0	(6.074	0.031	0.208	0.014	0.021	0.210)	$\times 10^{-3}$
18.0 – 19.5	(4.997	0.026	0.171	0.012	0.017	0.172)	$\times 10^{-3}$
19.5 – 21.1	(4.047	0.022	0.139	0.010	0.014	0.140)	$\times 10^{-3}$
21.1 – 22.8	(3.341	0.018	0.115	0.009	0.012	0.116)	$\times 10^{-3}$
22.8 – 24.7	(2.760	0.015	0.095	0.008	0.010	0.095)	$\times 10^{-3}$
24.7 – 26.7	(2.237	0.013	0.077	0.007	0.008	0.077)	$\times 10^{-3}$
26.7 – 28.8	(1.845	0.011	0.063	0.006	0.007	0.064)	$\times 10^{-3}$
28.8 – 31.1	(1.486	0.009	0.051	0.005	0.006	0.052)	$\times 10^{-3}$
31.1 – 33.5	(1.226	0.008	0.042	0.004	0.005	0.043)	$\times 10^{-3}$
33.5 – 36.1	(1.019	0.007	0.035	0.004	0.004	0.035)	$\times 10^{-3}$
36.1 – 38.9	(8.259	0.060	0.284	0.033	0.033	0.288)	$\times 10^{-4}$
38.9 – 41.9	(6.901	0.053	0.237	0.028	0.028	0.241)	$\times 10^{-4}$
41.9 – 45.1	(5.668	0.046	0.195	0.024	0.023	0.198)	$\times 10^{-4}$
45.1 – 48.5	(4.627	0.040	0.159	0.021	0.019	0.162)	$\times 10^{-4}$
48.5 – 52.2	(3.830	0.035	0.132	0.018	0.016	0.134)	$\times 10^{-4}$
52.2 – 56.1	(3.163	0.031	0.109	0.015	0.014	0.111)	$\times 10^{-4}$

Table continued

TABLE SI – *(Continued).*

Rigidity [GV]	Φ	$\sigma_{\text{stat.}}$	$\sigma_{\text{acc.}}$	$\sigma_{\text{unf.}}$	σ_{scale}	$\sigma_{\text{syst.}}$	
56.1 – 60.3	(2.582	0.027	0.089	0.013	0.011	0.091)	$\times 10^{-4}$
60.3 – 64.8	(2.104	0.024	0.073	0.011	0.010	0.074)	$\times 10^{-4}$
64.8 – 69.7	(1.746	0.021	0.060	0.009	0.008	0.062)	$\times 10^{-4}$
69.7 – 74.9	(1.429	0.018	0.049	0.008	0.007	0.050)	$\times 10^{-4}$
74.9 – 80.5	(1.185	0.016	0.041	0.007	0.006	0.042)	$\times 10^{-4}$
80.5 – 86.5	(9.599	0.138	0.332	0.054	0.048	0.340)	$\times 10^{-5}$
86.5 – 93.0	(7.880	0.120	0.273	0.045	0.041	0.280)	$\times 10^{-5}$
93.0 – 100	(6.402	0.104	0.222	0.037	0.034	0.228)	$\times 10^{-5}$
100 – 108	(5.217	0.088	0.181	0.031	0.029	0.186)	$\times 10^{-5}$
108 – 116	(4.183	0.079	0.145	0.025	0.024	0.149)	$\times 10^{-5}$
116 – 125	(3.520	0.068	0.122	0.021	0.021	0.126)	$\times 10^{-5}$
125 – 135	(2.825	0.058	0.098	0.017	0.017	0.101)	$\times 10^{-5}$
135 – 147	(2.327	0.048	0.081	0.014	0.015	0.083)	$\times 10^{-5}$
147 – 160	(1.749	0.040	0.061	0.010	0.012	0.063)	$\times 10^{-5}$
160 – 175	(1.354	0.033	0.047	0.008	0.009	0.049)	$\times 10^{-5}$
175 – 192	(1.069	0.027	0.037	0.006	0.008	0.039)	$\times 10^{-5}$
192 – 211	(8.396	0.228	0.293	0.051	0.066	0.305)	$\times 10^{-6}$
211 – 233	(6.460	0.186	0.226	0.041	0.054	0.236)	$\times 10^{-6}$
233 – 259	(5.000	0.150	0.175	0.033	0.045	0.184)	$\times 10^{-6}$
259 – 291	(3.527	0.114	0.124	0.025	0.035	0.131)	$\times 10^{-6}$
291 – 330	(2.643	0.089	0.093	0.020	0.029	0.099)	$\times 10^{-6}$
330 – 379	(1.885	0.067	0.067	0.016	0.023	0.072)	$\times 10^{-6}$
379 – 441	(1.248	0.049	0.044	0.012	0.017	0.049)	$\times 10^{-6}$
441 – 525	(8.288	0.341	0.296	0.099	0.133	0.339)	$\times 10^{-7}$
525 – 660	(4.684	0.202	0.169	0.070	0.093	0.205)	$\times 10^{-7}$
660 – 860	(2.419	0.120	0.089	0.047	0.063	0.119)	$\times 10^{-7}$
860 – 1200	(1.187	0.065	0.045	0.032	0.044	0.070)	$\times 10^{-7}$
1200 – 3000	(2.791	0.338	0.131	0.048	0.137	0.196)	$\times 10^{-8}$

TABLE SII: The Mg flux Φ as a function of rigidity at the top of AMS in units of $[\mathrm{m}^2 \cdot \mathrm{sr} \cdot \mathrm{s} \cdot \mathrm{GV}]^{-1}$ including errors due to statistics (stat.); contributions to the systematic error from the trigger, acceptance, and background (acc.); the rigidity resolution function and unfolding (unf.); the absolute rigidity scale (scale); and the total systematic error (syst.). The contribution of individual sources to the systematic error are added in quadrature to arrive at the total systematic error.

Rigidity [GV]	Φ	$\sigma_{\text{stat.}}$	$\sigma_{\text{acc.}}$	$\sigma_{\text{unf.}}$	σ_{scale}	$\sigma_{\text{syst.}}$	
2.15 – 2.40	(3.081	0.015	0.126	0.039	0.015	0.132)	$\times10^{-1}$
2.40 – 2.67	(2.808	0.012	0.110	0.033	0.009	0.115)	$\times10^{-1}$
2.67 – 2.97	(2.492	0.010	0.095	0.026	0.004	0.099)	$\times10^{-1}$
2.97 – 3.29	(2.193	0.009	0.082	0.020	0.002	0.084)	$\times10^{-1}$
3.29 – 3.64	(1.951	0.007	0.072	0.016	0.000	0.073)	$\times10^{-1}$
3.64 – 4.02	(1.692	0.006	0.061	0.012	0.001	0.063)	$\times10^{-1}$
4.02 – 4.43	(1.462	0.005	0.053	0.010	0.001	0.053)	$\times10^{-1}$
4.43 – 4.88	(1.251	0.004	0.045	0.007	0.002	0.045)	$\times10^{-1}$
4.88 – 5.37	(1.070	0.003	0.038	0.006	0.002	0.038)	$\times10^{-1}$
5.37 – 5.90	(9.028	0.029	0.320	0.042	0.017	0.323)	$\times10^{-2}$
5.90 – 6.47	(7.503	0.024	0.265	0.032	0.016	0.268)	$\times10^{-2}$
6.47 – 7.09	(6.266	0.020	0.221	0.024	0.014	0.223)	$\times10^{-2}$
7.09 – 7.76	(5.204	0.016	0.184	0.018	0.013	0.185)	$\times10^{-2}$
7.76 – 8.48	(4.307	0.014	0.152	0.014	0.011	0.153)	$\times10^{-2}$
8.48 – 9.26	(3.546	0.011	0.125	0.011	0.010	0.126)	$\times10^{-2}$
9.26 – 10.1	(2.914	0.010	0.103	0.009	0.008	0.103)	$\times10^{-2}$
10.1 – 11.0	(2.402	0.008	0.085	0.007	0.007	0.085)	$\times10^{-2}$
11.0 – 12.0	(1.953	0.007	0.069	0.005	0.006	0.069)	$\times10^{-2}$
12.0 – 13.0	(1.602	0.006	0.056	0.004	0.005	0.057)	$\times10^{-2}$
13.0 – 14.1	(1.320	0.005	0.046	0.004	0.004	0.047)	$\times10^{-2}$
14.1 – 15.3	(1.091	0.005	0.038	0.003	0.004	0.039)	$\times10^{-2}$
15.3 – 16.6	(8.924	0.039	0.314	0.025	0.030	0.317)	$\times10^{-3}$
16.6 – 18.0	(7.279	0.033	0.256	0.020	0.025	0.258)	$\times10^{-3}$
18.0 – 19.5	(5.992	0.028	0.211	0.017	0.021	0.213)	$\times10^{-3}$
19.5 – 21.1	(4.872	0.024	0.172	0.015	0.017	0.173)	$\times10^{-3}$
21.1 – 22.8	(3.984	0.020	0.140	0.012	0.014	0.142)	$\times10^{-3}$
22.8 – 24.7	(3.259	0.016	0.115	0.011	0.012	0.116)	$\times10^{-3}$
24.7 – 26.7	(2.665	0.014	0.094	0.009	0.010	0.095)	$\times10^{-3}$
26.7 – 28.8	(2.189	0.012	0.077	0.008	0.008	0.078)	$\times10^{-3}$
28.8 – 31.1	(1.809	0.010	0.064	0.007	0.007	0.065)	$\times10^{-3}$
31.1 – 33.5	(1.488	0.009	0.053	0.006	0.006	0.053)	$\times10^{-3}$
33.5 – 36.1	(1.225	0.007	0.043	0.005	0.005	0.044)	$\times10^{-3}$
36.1 – 38.9	(1.004	0.006	0.036	0.004	0.004	0.036)	$\times10^{-3}$
38.9 – 41.9	(8.113	0.056	0.287	0.035	0.033	0.291)	$\times10^{-4}$
41.9 – 45.1	(6.826	0.050	0.242	0.030	0.028	0.246)	$\times10^{-4}$
45.1 – 48.5	(5.534	0.043	0.197	0.025	0.023	0.199)	$\times10^{-4}$
48.5 – 52.2	(4.567	0.038	0.162	0.021	0.019	0.165)	$\times10^{-4}$
52.2 – 56.1	(3.752	0.033	0.134	0.018	0.016	0.136)	$\times10^{-4}$

Table continued

TABLE SII – *(Continued)*.

Rigidity [GV]	Φ	$\sigma_{\text{stat.}}$	$\sigma_{\text{acc.}}$	$\sigma_{\text{unf.}}$	σ_{scale}	$\sigma_{\text{syst.}}$	
56.1 – 60.3	(3.096	0.029	0.110	0.015	0.014	0.112)	$\times10^{-4}$
60.3 – 64.8	(2.532	0.026	0.090	0.013	0.011	0.092)	$\times10^{-4}$
64.8 – 69.7	(2.076	0.022	0.074	0.011	0.010	0.076)	$\times10^{-4}$
69.7 – 74.9	(1.714	0.019	0.061	0.009	0.008	0.063)	$\times10^{-4}$
74.9 – 80.5	(1.369	0.017	0.049	0.007	0.007	0.050)	$\times10^{-4}$
80.5 – 86.5	(1.157	0.015	0.042	0.006	0.006	0.042)	$\times10^{-4}$
86.5 – 93.0	(9.427	0.129	0.339	0.050	0.049	0.346)	$\times10^{-5}$
93.0 – 100	(7.783	0.113	0.280	0.042	0.041	0.286)	$\times10^{-5}$
100 – 108	(6.223	0.095	0.224	0.033	0.034	0.229)	$\times10^{-5}$
108 – 116	(5.199	0.086	0.187	0.028	0.029	0.192)	$\times10^{-5}$
116 – 125	(4.263	0.074	0.154	0.022	0.025	0.157)	$\times10^{-5}$
125 – 135	(3.465	0.063	0.125	0.018	0.021	0.128)	$\times10^{-5}$
135 – 147	(2.736	0.051	0.099	0.014	0.017	0.101)	$\times10^{-5}$
147 – 160	(2.154	0.044	0.078	0.011	0.014	0.080)	$\times10^{-5}$
160 – 175	(1.673	0.036	0.061	0.009	0.012	0.062)	$\times10^{-5}$
175 – 192	(1.295	0.030	0.047	0.007	0.009	0.048)	$\times10^{-5}$
192 – 211	(1.025	0.025	0.037	0.006	0.008	0.039)	$\times10^{-5}$
211 – 233	(7.857	0.203	0.286	0.044	0.065	0.297)	$\times10^{-6}$
233 – 259	(5.952	0.162	0.217	0.036	0.054	0.227)	$\times10^{-6}$
259 – 291	(4.305	0.125	0.158	0.028	0.043	0.166)	$\times10^{-6}$
291 – 330	(3.247	0.098	0.119	0.024	0.036	0.127)	$\times10^{-6}$
330 – 379	(2.179	0.072	0.080	0.019	0.027	0.087)	$\times10^{-6}$
379 – 441	(1.416	0.051	0.053	0.015	0.020	0.058)	$\times10^{-6}$
441 – 525	(9.378	0.360	0.350	0.120	0.159	0.403)	$\times10^{-7}$
525 – 660	(6.083	0.229	0.230	0.100	0.129	0.282)	$\times10^{-7}$
660 – 860	(2.841	0.129	0.109	0.063	0.080	0.149)	$\times10^{-7}$
860 – 1200	(1.385	0.069	0.055	0.043	0.055	0.089)	$\times10^{-7}$
1200 – 3000	(2.529	0.320	0.120	0.049	0.151	0.199)	$\times10^{-8}$

TABLE SIII: The Si flux Φ as a function of rigidity at the top of AMS in units of $[\mathrm{m}^2 \cdot \mathrm{sr} \cdot \mathrm{s} \cdot \mathrm{GV}]^{-1}$ including errors due to statistics (stat.); contributions to the systematic error from the trigger, acceptance, and background (acc.); the rigidity resolution function and unfolding (unf.); the absolute rigidity scale (scale); and the total systematic error (syst.). The contribution of individual sources to the systematic error are added in quadrature to arrive at the total systematic error.

Rigidity [GV]	Φ	$\sigma_{\text{stat.}}$	$\sigma_{\text{acc.}}$	$\sigma_{\text{unf.}}$	σ_{scale}	$\sigma_{\text{syst.}}$	
2.15 – 2.40	(2.172	0.013	0.093	0.102	0.011	0.138)	$\times10^{-1}$
2.40 – 2.67	(2.012	0.011	0.083	0.046	0.006	0.095)	$\times10^{-1}$
2.67 – 2.97	(1.826	0.009	0.073	0.023	0.003	0.076)	$\times10^{-1}$
2.97 – 3.29	(1.635	0.008	0.064	0.018	0.001	0.066)	$\times10^{-1}$
3.29 – 3.64	(1.454	0.006	0.056	0.014	0.000	0.057)	$\times10^{-1}$
3.64 – 4.02	(1.263	0.005	0.048	0.010	0.001	0.049)	$\times10^{-1}$
4.02 – 4.43	(1.085	0.004	0.041	0.008	0.001	0.041)	$\times10^{-1}$
4.43 – 4.88	(9.373	0.037	0.349	0.060	0.012	0.355)	$\times10^{-2}$
4.88 – 5.37	(7.906	0.030	0.293	0.046	0.013	0.297)	$\times10^{-2}$
5.37 – 5.90	(6.637	0.025	0.246	0.035	0.012	0.248)	$\times10^{-2}$
5.90 – 6.47	(5.656	0.021	0.209	0.027	0.012	0.211)	$\times10^{-2}$
6.47 – 7.09	(4.721	0.017	0.174	0.021	0.011	0.176)	$\times10^{-2}$
7.09 – 7.76	(3.977	0.014	0.147	0.016	0.010	0.148)	$\times10^{-2}$
7.76 – 8.48	(3.251	0.012	0.120	0.013	0.008	0.121)	$\times10^{-2}$
8.48 – 9.26	(2.717	0.010	0.100	0.010	0.007	0.101)	$\times10^{-2}$
9.26 – 10.1	(2.247	0.009	0.083	0.008	0.006	0.083)	$\times10^{-2}$
10.1 – 11.0	(1.859	0.007	0.069	0.006	0.005	0.069)	$\times10^{-2}$
11.0 – 12.0	(1.523	0.006	0.056	0.005	0.005	0.057)	$\times10^{-2}$
12.0 – 13.0	(1.260	0.006	0.046	0.004	0.004	0.047)	$\times10^{-2}$
13.0 – 14.1	(1.046	0.005	0.039	0.003	0.003	0.039)	$\times10^{-2}$
14.1 – 15.3	(8.551	0.041	0.315	0.027	0.028	0.318)	$\times10^{-3}$
15.3 – 16.6	(7.036	0.035	0.260	0.022	0.024	0.262)	$\times10^{-3}$
16.6 – 18.0	(5.759	0.030	0.213	0.018	0.020	0.214)	$\times10^{-3}$
18.0 – 19.5	(4.735	0.025	0.175	0.015	0.017	0.176)	$\times10^{-3}$
19.5 – 21.1	(3.916	0.021	0.145	0.012	0.014	0.146)	$\times10^{-3}$
21.1 – 22.8	(3.200	0.018	0.118	0.010	0.012	0.119)	$\times10^{-3}$
22.8 – 24.7	(2.623	0.015	0.097	0.008	0.010	0.098)	$\times10^{-3}$
24.7 – 26.7	(2.171	0.013	0.080	0.007	0.008	0.081)	$\times10^{-3}$
26.7 – 28.8	(1.799	0.011	0.067	0.006	0.007	0.067)	$\times10^{-3}$
28.8 – 31.1	(1.487	0.009	0.055	0.005	0.006	0.056)	$\times10^{-3}$
31.1 – 33.5	(1.231	0.008	0.046	0.004	0.005	0.046)	$\times10^{-3}$
33.5 – 36.1	(1.012	0.007	0.038	0.003	0.004	0.038)	$\times10^{-3}$
36.1 – 38.9	(8.446	0.060	0.313	0.029	0.034	0.317)	$\times10^{-4}$
38.9 – 41.9	(6.887	0.053	0.256	0.024	0.028	0.258)	$\times10^{-4}$
41.9 – 45.1	(5.681	0.046	0.211	0.020	0.023	0.214)	$\times10^{-4}$
45.1 – 48.5	(4.776	0.041	0.178	0.017	0.020	0.180)	$\times10^{-4}$
48.5 – 52.2	(3.951	0.036	0.147	0.015	0.017	0.149)	$\times10^{-4}$
52.2 – 56.1	(3.245	0.032	0.121	0.012	0.014	0.123)	$\times10^{-4}$

Table continued

TABLE SIII – *(Continued)*.

Rigidity [GV]	Φ	$\sigma_{\text{stat.}}$	$\sigma_{\text{acc.}}$	$\sigma_{\text{unf.}}$	σ_{scale}	$\sigma_{\text{syst.}}$	
56.1 – 60.3	(2.603	0.027	0.097	0.010	0.011	0.099)	$\times10^{-4}$
60.3 – 64.8	(2.225	0.025	0.083	0.009	0.010	0.084)	$\times10^{-4}$
64.8 – 69.7	(1.813	0.021	0.068	0.007	0.008	0.069)	$\times10^{-4}$
69.7 – 74.9	(1.493	0.019	0.056	0.006	0.007	0.057)	$\times10^{-4}$
74.9 – 80.5	(1.232	0.016	0.046	0.005	0.006	0.047)	$\times10^{-4}$
80.5 – 86.5	(1.025	0.014	0.039	0.004	0.005	0.039)	$\times10^{-4}$
86.5 – 93.0	(8.458	0.126	0.319	0.037	0.043	0.324)	$\times10^{-5}$
93.0 – 100	(6.665	0.107	0.252	0.029	0.035	0.256)	$\times10^{-5}$
100 – 108	(5.725	0.093	0.217	0.026	0.031	0.220)	$\times10^{-5}$
108 – 116	(4.469	0.082	0.169	0.020	0.025	0.172)	$\times10^{-5}$
116 – 125	(3.820	0.072	0.145	0.018	0.022	0.148)	$\times10^{-5}$
125 – 135	(3.059	0.061	0.116	0.014	0.018	0.118)	$\times10^{-5}$
135 – 147	(2.348	0.049	0.089	0.011	0.014	0.091)	$\times10^{-5}$
147 – 160	(1.934	0.042	0.074	0.010	0.012	0.075)	$\times10^{-5}$
160 – 175	(1.566	0.035	0.060	0.008	0.011	0.061)	$\times10^{-5}$
175 – 192	(1.199	0.029	0.046	0.006	0.009	0.047)	$\times10^{-5}$
192 – 211	(9.191	0.241	0.353	0.052	0.071	0.363)	$\times10^{-6}$
211 – 233	(6.880	0.194	0.265	0.042	0.057	0.274)	$\times10^{-6}$
233 – 259	(5.595	0.161	0.216	0.037	0.050	0.225)	$\times10^{-6}$
259 – 291	(3.907	0.121	0.151	0.028	0.038	0.159)	$\times10^{-6}$
291 – 330	(2.757	0.092	0.107	0.022	0.030	0.114)	$\times10^{-6}$
330 – 379	(1.960	0.070	0.077	0.018	0.024	0.082)	$\times10^{-6}$
379 – 441	(1.387	0.052	0.055	0.015	0.020	0.060)	$\times10^{-6}$
441 – 525	(8.397	0.348	0.333	0.110	0.143	0.379)	$\times10^{-7}$
525 – 660	(5.295	0.219	0.213	0.089	0.112	0.256)	$\times10^{-7}$
660 – 860	(2.732	0.129	0.112	0.061	0.077	0.149)	$\times10^{-7}$
860 – 1200	(1.146	0.064	0.048	0.036	0.046	0.076)	$\times10^{-7}$
1200 – 3000	(1.999	0.293	0.105	0.036	0.115	0.160)	$\times10^{-8}$

TABLE SIV: The neon to magnesium flux ratio Ne/Mg as a function of rigidity including errors due to statistics (stat.); contributions to the systematic error from the trigger, acceptance, and background (acc.); the rigidity resolution function and unfolding (unf.); the absolute rigidity scale (scale); and the total systematic error (syst.). The statistical errors are the sum in quadrature of the ratios of neon and magnesium flux statistical errors to the corresponding flux values, multiplied by the Ne/Mg flux ratio. The systematic errors from the background subtraction, the trigger, and the event reconstruction and selection are likewise added in quadrature. The correlations in the systematic errors from the uncertainty in nuclear interaction cross sections, the unfolding and the absolute rigidity scale between the neon and magnesium fluxes have been taken into account in calculating the corresponding systematic errors of the Ne/Mg flux ratio. The contribution of individual sources to the systematic error are added in quadrature to arrive at the total systematic uncertainty.

Rigidity [GV]	Ne/Mg	$\sigma_{\text{stat.}}$	$\sigma_{\text{acc.}}$	$\sigma_{\text{unf.}}$	σ_{scale}	$\sigma_{\text{syst.}}$
2.15 – 2.40	0.7697	0.0056	0.0236	0.0148	0.0000	0.0279
2.40 – 2.67	0.7834	0.0052	0.0238	0.0097	0.0000	0.0257
2.67 – 2.97	0.8006	0.0049	0.0241	0.0079	0.0000	0.0254
2.97 – 3.29	0.8209	0.0048	0.0246	0.0072	0.0000	0.0256
3.29 – 3.64	0.8249	0.0046	0.0246	0.0064	0.0000	0.0255
3.64 – 4.02	0.8303	0.0045	0.0247	0.0058	0.0000	0.0254
4.02 – 4.43	0.8276	0.0044	0.0246	0.0051	0.0000	0.0251
4.43 – 4.88	0.8372	0.0042	0.0249	0.0046	0.0000	0.0253
4.88 – 5.37	0.8292	0.0040	0.0246	0.0041	0.0000	0.0250
5.37 – 5.90	0.8297	0.0040	0.0247	0.0037	0.0000	0.0249
5.90 – 6.47	0.8436	0.0040	0.0251	0.0034	0.0000	0.0253
6.47 – 7.09	0.8426	0.0040	0.0251	0.0030	0.0000	0.0252
7.09 – 7.76	0.8342	0.0039	0.0248	0.0028	0.0000	0.0250
7.76 – 8.48	0.8408	0.0040	0.0250	0.0026	0.0000	0.0252
8.48 – 9.26	0.8509	0.0041	0.0253	0.0024	0.0000	0.0255
9.26 – 10.1	0.8405	0.0042	0.0250	0.0023	0.0000	0.0251
10.1 – 11.0	0.8381	0.0043	0.0250	0.0022	0.0000	0.0251
11.0 – 12.0	0.8465	0.0045	0.0252	0.0021	0.0000	0.0253
12.0 – 13.0	0.8357	0.0049	0.0249	0.0021	0.0000	0.0250
13.0 – 14.1	0.8391	0.0051	0.0250	0.0021	0.0000	0.0251
14.1 – 15.3	0.8301	0.0052	0.0248	0.0021	0.0000	0.0249
15.3 – 16.6	0.8243	0.0054	0.0246	0.0021	0.0000	0.0247
16.6 – 18.0	0.8345	0.0057	0.0249	0.0022	0.0000	0.0250
18.0 – 19.5	0.8341	0.0059	0.0249	0.0022	0.0000	0.0250
19.5 – 21.1	0.8306	0.0060	0.0249	0.0023	0.0000	0.0250
21.1 – 22.8	0.8387	0.0062	0.0251	0.0024	0.0000	0.0252
22.8 – 24.7	0.8468	0.0063	0.0254	0.0026	0.0000	0.0255
24.7 – 26.7	0.8396	0.0065	0.0252	0.0027	0.0000	0.0253
26.7 – 28.8	0.8426	0.0067	0.0253	0.0028	0.0000	0.0255
28.8 – 31.1	0.8216	0.0068	0.0247	0.0029	0.0000	0.0249
31.1 – 33.5	0.8238	0.0072	0.0248	0.0030	0.0000	0.0250

Table continued

TABLE SIV – *(Continued)*.

Rigidity [GV]	Ne/Mg	$\sigma_{\text{stat.}}$	$\sigma_{\text{acc.}}$	$\sigma_{\text{unf.}}$	σ_{scale}	$\sigma_{\text{syst.}}$
33.5 – 36.1	0.8323	0.0076	0.0251	0.0032	0.0000	0.0253
36.1 – 38.9	0.8225	0.0080	0.0249	0.0033	0.0000	0.0251
38.9 – 41.9	0.8506	0.0088	0.0258	0.0036	0.0000	0.0260
41.9 – 45.1	0.8303	0.0091	0.0252	0.0036	0.0000	0.0255
45.1 – 48.5	0.8362	0.0098	0.0254	0.0038	0.0000	0.0257
48.5 – 52.2	0.8386	0.0104	0.0256	0.0039	0.0000	0.0259
52.2 – 56.1	0.8431	0.0112	0.0258	0.0041	0.0000	0.0261
56.1 – 60.3	0.8341	0.0118	0.0255	0.0041	0.0000	0.0259
60.3 – 64.8	0.8310	0.0125	0.0255	0.0042	0.0000	0.0259
64.8 – 69.7	0.8413	0.0134	0.0259	0.0044	0.0000	0.0263
69.7 – 74.9	0.8340	0.0142	0.0257	0.0044	0.0000	0.0261
74.9 – 80.5	0.8653	0.0157	0.0267	0.0047	0.0000	0.0272
80.5 – 86.5	0.8296	0.0160	0.0257	0.0046	0.0000	0.0261
86.5 – 93.0	0.8359	0.0171	0.0259	0.0046	0.0001	0.0264
93.0 – 100	0.8227	0.0179	0.0256	0.0046	0.0001	0.0260
100 – 108	0.8383	0.0190	0.0261	0.0047	0.0001	0.0265
108 – 116	0.8046	0.0202	0.0251	0.0045	0.0001	0.0255
116 – 125	0.8256	0.0214	0.0258	0.0046	0.0001	0.0262
125 – 135	0.8154	0.0223	0.0255	0.0046	0.0001	0.0259
135 – 147	0.8506	0.0236	0.0267	0.0047	0.0001	0.0271
147 – 160	0.8118	0.0247	0.0255	0.0045	0.0001	0.0259
160 – 175	0.8093	0.0261	0.0255	0.0045	0.0001	0.0259
175 – 192	0.8249	0.0282	0.0261	0.0047	0.0001	0.0265
192 – 211	0.8190	0.0298	0.0260	0.0047	0.0001	0.0264
211 – 233	0.8223	0.0317	0.0262	0.0049	0.0001	0.0266
233 – 259	0.8400	0.0341	0.0268	0.0053	0.0000	0.0273
259 – 291	0.8193	0.0355	0.0263	0.0056	0.0001	0.0269
291 – 330	0.8139	0.0368	0.0262	0.0062	0.0002	0.0269
330 – 379	0.8651	0.0420	0.0280	0.0075	0.0004	0.0290
379 – 441	0.8813	0.0469	0.0287	0.0090	0.0006	0.0301
441 – 525	0.8838	0.0497	0.0290	0.0109	0.0009	0.0310
525 – 660	0.7701	0.0441	0.0255	0.0121	0.0011	0.0283
660 – 860	0.8517	0.0572	0.0285	0.0179	0.0018	0.0337
860 – 1200	0.8573	0.0634	0.0292	0.0250	0.0022	0.0385
1200 – 3000	1.1038	0.1932	0.0512	0.0202	0.0118	0.0563

TABLE SV: The silicon to magnesium flux ratio Si/Mg as a function of rigidity including errors due to statistics (stat.); contributions to the systematic error from the trigger, acceptance, and background (acc.); the rigidity resolution function and unfolding (unf.); the absolute rigidity scale (scale); and the total systematic error (syst.). The statistical errors are the sum in quadrature of the ratios of silicon and magnesium flux statistical errors to the corresponding flux values, multiplied by the Si/Mg flux ratio. The systematic errors from the background subtraction, the trigger, and the event reconstruction and selection are likewise added in quadrature. The correlations in the systematic errors from the uncertainty in nuclear interaction cross sections, the unfolding and the absolute rigidity scale between the silicon and magnesium fluxes have been taken into account in calculating the corresponding systematic errors of the Si/Mg flux ratio. The contribution of individual sources to the systematic error are added in quadrature to arrive at the total systematic uncertainty.

Rigidity [GV]	Si/Mg	$\sigma_{\text{stat.}}$	$\sigma_{\text{acc.}}$	$\sigma_{\text{unf.}}$	σ_{scale}	$\sigma_{\text{syst.}}$
2.15 – 2.40	0.7052	0.0053	0.0226	0.0298	0.0001	0.0374
2.40 – 2.67	0.7166	0.0049	0.0226	0.0141	0.0001	0.0267
2.67 – 2.97	0.7325	0.0046	0.0229	0.0087	0.0000	0.0245
2.97 – 3.29	0.7455	0.0045	0.0231	0.0075	0.0000	0.0243
3.29 – 3.64	0.7455	0.0042	0.0230	0.0066	0.0000	0.0240
3.64 – 4.02	0.7462	0.0041	0.0230	0.0058	0.0000	0.0237
4.02 – 4.43	0.7418	0.0040	0.0228	0.0051	0.0000	0.0234
4.43 – 4.88	0.7494	0.0038	0.0230	0.0046	0.0000	0.0235
4.88 – 5.37	0.7387	0.0036	0.0227	0.0041	0.0000	0.0231
5.37 – 5.90	0.7352	0.0036	0.0226	0.0036	0.0000	0.0229
5.90 – 6.47	0.7539	0.0037	0.0232	0.0034	0.0000	0.0235
6.47 – 7.09	0.7534	0.0036	0.0232	0.0031	0.0000	0.0234
7.09 – 7.76	0.7643	0.0037	0.0236	0.0029	0.0000	0.0238
7.76 – 8.48	0.7548	0.0036	0.0233	0.0027	0.0000	0.0235
8.48 – 9.26	0.7662	0.0037	0.0237	0.0026	0.0000	0.0239
9.26 – 10.1	0.7711	0.0039	0.0239	0.0025	0.0000	0.0240
10.1 – 11.0	0.7739	0.0041	0.0240	0.0025	0.0000	0.0241
11.0 – 12.0	0.7797	0.0042	0.0242	0.0024	0.0000	0.0243
12.0 – 13.0	0.7867	0.0046	0.0244	0.0024	0.0000	0.0245
13.0 – 14.1	0.7928	0.0048	0.0246	0.0024	0.0000	0.0247
14.1 – 15.3	0.7841	0.0050	0.0244	0.0023	0.0000	0.0245
15.3 – 16.6	0.7884	0.0052	0.0245	0.0023	0.0000	0.0246
16.6 – 18.0	0.7912	0.0054	0.0246	0.0024	0.0000	0.0247
18.0 – 19.5	0.7903	0.0056	0.0246	0.0024	0.0000	0.0247
19.5 – 21.1	0.8038	0.0059	0.0250	0.0025	0.0000	0.0251
21.1 – 22.8	0.8032	0.0060	0.0250	0.0025	0.0000	0.0251
22.8 – 24.7	0.8047	0.0060	0.0251	0.0026	0.0001	0.0252
24.7 – 26.7	0.8148	0.0063	0.0254	0.0027	0.0001	0.0256
26.7 – 28.8	0.8217	0.0066	0.0257	0.0028	0.0001	0.0258
28.8 – 31.1	0.8219	0.0067	0.0257	0.0029	0.0001	0.0259
31.1 – 33.5	0.8268	0.0072	0.0259	0.0030	0.0001	0.0261

Table continued

TABLE SV – *(Continued)*.

Rigidity [GV]	Si/Mg	$\sigma_{\text{stat.}}$	$\sigma_{\text{acc.}}$	$\sigma_{\text{unf.}}$	σ_{scale}	$\sigma_{\text{syst.}}$
33.5 – 36.1	0.8267	0.0075	0.0260	0.0031	0.0001	0.0262
36.1 – 38.9	0.8411	0.0081	0.0265	0.0032	0.0001	0.0267
38.9 – 41.9	0.8488	0.0088	0.0268	0.0033	0.0001	0.0270
41.9 – 45.1	0.8323	0.0091	0.0264	0.0034	0.0001	0.0266
45.1 – 48.5	0.8630	0.0101	0.0274	0.0036	0.0001	0.0277
48.5 – 52.2	0.8652	0.0107	0.0276	0.0037	0.0001	0.0278
52.2 – 56.1	0.8648	0.0114	0.0277	0.0038	0.0001	0.0279
56.1 – 60.3	0.8408	0.0119	0.0270	0.0038	0.0001	0.0273
60.3 – 64.8	0.8786	0.0131	0.0283	0.0040	0.0002	0.0286
64.8 – 69.7	0.8735	0.0138	0.0283	0.0041	0.0002	0.0285
69.7 – 74.9	0.8709	0.0147	0.0283	0.0041	0.0002	0.0286
74.9 – 80.5	0.8997	0.0162	0.0293	0.0043	0.0002	0.0296
80.5 – 86.5	0.8861	0.0169	0.0289	0.0043	0.0002	0.0293
86.5 – 93.0	0.8972	0.0181	0.0294	0.0044	0.0002	0.0297
93.0 – 100	0.8564	0.0186	0.0281	0.0042	0.0002	0.0284
100 – 108	0.9199	0.0205	0.0303	0.0046	0.0002	0.0306
108 – 116	0.8597	0.0213	0.0284	0.0043	0.0002	0.0287
116 – 125	0.8960	0.0229	0.0296	0.0045	0.0001	0.0300
125 – 135	0.8829	0.0238	0.0293	0.0044	0.0001	0.0296
135 – 147	0.8583	0.0239	0.0286	0.0043	0.0001	0.0289
147 – 160	0.8980	0.0268	0.0300	0.0045	0.0001	0.0303
160 – 175	0.9362	0.0292	0.0314	0.0048	0.0001	0.0318
175 – 192	0.9258	0.0309	0.0312	0.0049	0.0001	0.0316
192 – 211	0.8966	0.0321	0.0303	0.0050	0.0001	0.0307
211 – 233	0.8756	0.0335	0.0298	0.0051	0.0001	0.0302
233 – 259	0.9401	0.0373	0.0321	0.0059	0.0001	0.0327
259 – 291	0.9076	0.0385	0.0312	0.0063	0.0001	0.0318
291 – 330	0.8492	0.0383	0.0294	0.0066	0.0001	0.0301
330 – 379	0.8994	0.0435	0.0313	0.0081	0.0000	0.0324
379 – 441	0.9798	0.0512	0.0344	0.0104	0.0000	0.0360
441 – 525	0.8954	0.0506	0.0318	0.0116	0.0000	0.0338
525 – 660	0.8705	0.0486	0.0313	0.0145	0.0001	0.0345
660 – 860	0.9618	0.0631	0.0351	0.0214	0.0001	0.0411
860 – 1200	0.8279	0.0624	0.0308	0.0258	0.0002	0.0402
1200 – 3000	0.7906	0.1531	0.0398	0.0149	0.0020	0.0426

TABLE SVI: The neon to oxygen flux ratio Ne/O as a function of rigidity including errors due to statistics (stat.); contributions to the systematic error from the trigger, acceptance, and background (acc.); the rigidity resolution function and unfolding (unf.); the absolute rigidity scale (scale); and the total systematic error (syst.). The statistical errors are the sum in quadrature of the ratios of neon and oxygen flux statistical errors to the corresponding flux values, multiplied by the Ne/O flux ratio. The systematic errors from the background subtraction, the trigger, and the event reconstruction and selection are likewise added in quadrature. The correlations in the systematic errors from the uncertainty in nuclear interaction cross sections, the unfolding and the absolute rigidity scale between the neon and oxygen fluxes have been taken into account in calculating the corresponding systematic errors of the Ne/O flux ratio. The contribution of individual sources to the systematic error are added in quadrature to arrive at the total systematic uncertainty.

Rigidity [GV]	Ne/O	$\sigma_{\text{stat.}}$	$\sigma_{\text{acc.}}$	$\sigma_{\text{unf.}}$	σ_{scale}	$\sigma_{\text{syst.}}$
2.15 – 2.40	0.1535	0.0009	0.0046	0.0029	0.0000	0.0055
2.40 – 2.67	0.1544	0.0008	0.0045	0.0018	0.0000	0.0048
2.67 – 2.97	0.1543	0.0008	0.0043	0.0014	0.0000	0.0046
2.97 – 3.29	0.1569	0.0007	0.0043	0.0012	0.0000	0.0045
3.29 – 3.64	0.1603	0.0007	0.0044	0.0011	0.0000	0.0045
3.64 – 4.02	0.1615	0.0007	0.0044	0.0010	0.0000	0.0045
4.02 – 4.43	0.1626	0.0007	0.0044	0.0009	0.0000	0.0044
4.43 – 4.88	0.1658	0.0007	0.0044	0.0008	0.0000	0.0045
4.88 – 5.37	0.1665	0.0006	0.0044	0.0007	0.0000	0.0045
5.37 – 5.90	0.1678	0.0006	0.0045	0.0006	0.0000	0.0045
5.90 – 6.47	0.1700	0.0006	0.0045	0.0006	0.0000	0.0045
6.47 – 7.09	0.1708	0.0006	0.0045	0.0005	0.0000	0.0046
7.09 – 7.76	0.1704	0.0006	0.0045	0.0005	0.0000	0.0046
7.76 – 8.48	0.1723	0.0006	0.0046	0.0004	0.0000	0.0046
8.48 – 9.26	0.1746	0.0007	0.0047	0.0004	0.0000	0.0047
9.26 – 10.1	0.1727	0.0007	0.0046	0.0004	0.0000	0.0046
10.1 – 11.0	0.1738	0.0007	0.0046	0.0004	0.0000	0.0047
11.0 – 12.0	0.1738	0.0007	0.0046	0.0004	0.0000	0.0047
12.0 – 13.0	0.1712	0.0008	0.0046	0.0003	0.0000	0.0046
13.0 – 14.1	0.1723	0.0008	0.0046	0.0004	0.0000	0.0046
14.1 – 15.3	0.1722	0.0009	0.0046	0.0004	0.0000	0.0046
15.3 – 16.6	0.1700	0.0009	0.0046	0.0004	0.0000	0.0046
16.6 – 18.0	0.1716	0.0009	0.0046	0.0004	0.0000	0.0046
18.0 – 19.5	0.1716	0.0010	0.0046	0.0004	0.0000	0.0046
19.5 – 21.1	0.1694	0.0010	0.0046	0.0004	0.0000	0.0046
21.1 – 22.8	0.1702	0.0010	0.0046	0.0004	0.0000	0.0046
22.8 – 24.7	0.1720	0.0010	0.0047	0.0005	0.0000	0.0047
24.7 – 26.7	0.1707	0.0010	0.0046	0.0005	0.0000	0.0047
26.7 – 28.8	0.1716	0.0011	0.0047	0.0005	0.0000	0.0047
28.8 – 31.1	0.1673	0.0011	0.0046	0.0005	0.0000	0.0046
31.1 – 33.5	0.1676	0.0012	0.0046	0.0006	0.0000	0.0046
33.5 – 36.1	0.1697	0.0012	0.0047	0.0006	0.0000	0.0047

Table continued

TABLE SVI – *(Continued)*.

Rigidity [GV]	Ne/O	$\sigma_{\text{stat.}}$	$\sigma_{\text{acc.}}$	$\sigma_{\text{unf.}}$	σ_{scale}	$\sigma_{\text{syst.}}$
36.1 – 38.9	0.1663	0.0013	0.0046	0.0006	0.0000	0.0046
38.9 – 41.9	0.1703	0.0014	0.0047	0.0007	0.0000	0.0048
41.9 – 45.1	0.1690	0.0015	0.0047	0.0007	0.0000	0.0048
45.1 – 48.5	0.1668	0.0016	0.0047	0.0007	0.0000	0.0047
48.5 – 52.2	0.1672	0.0016	0.0047	0.0007	0.0000	0.0048
52.2 – 56.1	0.1677	0.0018	0.0047	0.0008	0.0000	0.0048
56.1 – 60.3	0.1671	0.0019	0.0047	0.0008	0.0000	0.0048
60.3 – 64.8	0.1643	0.0020	0.0047	0.0008	0.0000	0.0047
64.8 – 69.7	0.1660	0.0021	0.0048	0.0008	0.0000	0.0048
69.7 – 74.9	0.1663	0.0023	0.0048	0.0009	0.0000	0.0049
74.9 – 80.5	0.1666	0.0024	0.0048	0.0009	0.0000	0.0049
80.5 – 86.5	0.1635	0.0025	0.0048	0.0009	0.0000	0.0048
86.5 – 93.0	0.1637	0.0027	0.0048	0.0009	0.0000	0.0049
93.0 – 100	0.1627	0.0028	0.0048	0.0009	0.0001	0.0049
100 – 108	0.1614	0.0029	0.0048	0.0009	0.0001	0.0049
108 – 116	0.1575	0.0032	0.0047	0.0009	0.0001	0.0048
116 – 125	0.1613	0.0033	0.0049	0.0009	0.0001	0.0049
125 – 135	0.1598	0.0035	0.0048	0.0009	0.0001	0.0049
135 – 147	0.1641	0.0036	0.0050	0.0010	0.0001	0.0051
147 – 160	0.1571	0.0038	0.0048	0.0009	0.0001	0.0049
160 – 175	0.1532	0.0039	0.0048	0.0009	0.0001	0.0049
175 – 192	0.1537	0.0042	0.0048	0.0010	0.0001	0.0049
192 – 211	0.1542	0.0045	0.0049	0.0010	0.0001	0.0050
211 – 233	0.1552	0.0047	0.0050	0.0011	0.0000	0.0051
233 – 259	0.1588	0.0051	0.0052	0.0012	0.0000	0.0053
259 – 291	0.1485	0.0051	0.0049	0.0012	0.0000	0.0050
291 – 330	0.1548	0.0056	0.0052	0.0014	0.0000	0.0053
330 – 379	0.1564	0.0059	0.0053	0.0016	0.0001	0.0055
379 – 441	0.1534	0.0064	0.0053	0.0018	0.0002	0.0056
441 – 525	0.1604	0.0070	0.0057	0.0023	0.0003	0.0061
525 – 660	0.1529	0.0070	0.0055	0.0028	0.0005	0.0062
660 – 860	0.1476	0.0078	0.0055	0.0036	0.0006	0.0066
860 – 1200	0.1542	0.0089	0.0060	0.0053	0.0007	0.0080
1200 – 3000	0.1798	0.0232	0.0093	0.0054	0.0003	0.0107

TABLE SVII: The magnesium to oxygen flux ratio Mg/O as a function of rigidity including errors due to statistics (stat.); contributions to the systematic error from the trigger, acceptance, and background (acc.); the rigidity resolution function and unfolding (unf.); the absolute rigidity scale (scale); and the total systematic error (syst.). The statistical errors are the sum in quadrature of the ratios of magnesium and oxygen flux statistical errors to the corresponding flux values, multiplied by the Mg/O flux ratio. The systematic errors from the background subtraction, the trigger, and the event reconstruction and selection are likewise added in quadrature. The correlations in the systematic errors from the uncertainty in nuclear interaction cross sections, the unfolding and the absolute rigidity scale between the magnesium and oxygen fluxes have been taken into account in calculating the corresponding systematic errors of the Mg/O flux ratio. The contribution of individual sources to the systematic error are added in quadrature to arrive at the total systematic uncertainty.

Rigidity [GV]	Mg/O	$\sigma_{\text{stat.}}$	$\sigma_{\text{acc.}}$	$\sigma_{\text{unf.}}$	σ_{scale}	$\sigma_{\text{syst.}}$
2.15 – 2.40	0.1994	0.0010	0.0061	0.0025	0.0000	0.0066
2.40 – 2.67	0.1971	0.0009	0.0058	0.0022	0.0000	0.0062
2.67 – 2.97	0.1928	0.0008	0.0055	0.0019	0.0000	0.0058
2.97 – 3.29	0.1912	0.0008	0.0054	0.0016	0.0000	0.0056
3.29 – 3.64	0.1943	0.0008	0.0054	0.0014	0.0000	0.0056
3.64 – 4.02	0.1945	0.0008	0.0053	0.0013	0.0000	0.0055
4.02 – 4.43	0.1965	0.0008	0.0053	0.0011	0.0000	0.0055
4.43 – 4.88	0.1981	0.0007	0.0054	0.0010	0.0000	0.0055
4.88 – 5.37	0.2008	0.0007	0.0054	0.0009	0.0000	0.0055
5.37 – 5.90	0.2023	0.0007	0.0055	0.0008	0.0000	0.0055
5.90 – 6.47	0.2015	0.0007	0.0054	0.0007	0.0000	0.0055
6.47 – 7.09	0.2027	0.0007	0.0055	0.0007	0.0000	0.0055
7.09 – 7.76	0.2043	0.0007	0.0055	0.0006	0.0000	0.0056
7.76 – 8.48	0.2049	0.0007	0.0055	0.0006	0.0000	0.0056
8.48 – 9.26	0.2052	0.0007	0.0056	0.0006	0.0000	0.0056
9.26 – 10.1	0.2054	0.0007	0.0056	0.0005	0.0000	0.0056
10.1 – 11.0	0.2073	0.0008	0.0056	0.0005	0.0000	0.0057
11.0 – 12.0	0.2054	0.0008	0.0056	0.0005	0.0000	0.0056
12.0 – 13.0	0.2049	0.0009	0.0056	0.0005	0.0000	0.0056
13.0 – 14.1	0.2054	0.0009	0.0056	0.0005	0.0000	0.0056
14.1 – 15.3	0.2075	0.0009	0.0057	0.0005	0.0000	0.0057
15.3 – 16.6	0.2062	0.0010	0.0056	0.0005	0.0000	0.0057
16.6 – 18.0	0.2056	0.0010	0.0056	0.0005	0.0000	0.0056
18.0 – 19.5	0.2057	0.0011	0.0056	0.0005	0.0000	0.0057
19.5 – 21.1	0.2039	0.0011	0.0056	0.0006	0.0000	0.0056
21.1 – 22.8	0.2030	0.0011	0.0056	0.0006	0.0000	0.0056
22.8 – 24.7	0.2031	0.0011	0.0056	0.0006	0.0000	0.0056
24.7 – 26.7	0.2033	0.0011	0.0056	0.0006	0.0000	0.0056
26.7 – 28.8	0.2037	0.0012	0.0056	0.0007	0.0000	0.0057
28.8 – 31.1	0.2036	0.0012	0.0057	0.0007	0.0000	0.0057
31.1 – 33.5	0.2034	0.0013	0.0057	0.0007	0.0000	0.0057

Table continued

TABLE SVII – *(Continued)*.

Rigidity [GV]	Mg/O	$\sigma_{\mathrm{stat.}}$	$\sigma_{\mathrm{acc.}}$	$\sigma_{\mathrm{unf.}}$	σ_{scale}	$\sigma_{\mathrm{syst.}}$
33.5 – 36.1	0.2038	0.0013	0.0057	0.0008	0.0000	0.0058
36.1 – 38.9	0.2022	0.0014	0.0057	0.0008	0.0000	0.0057
38.9 – 41.9	0.2002	0.0015	0.0056	0.0008	0.0000	0.0057
41.9 – 45.1	0.2036	0.0016	0.0058	0.0008	0.0000	0.0058
45.1 – 48.5	0.1995	0.0017	0.0057	0.0009	0.0000	0.0057
48.5 – 52.2	0.1994	0.0018	0.0057	0.0009	0.0000	0.0058
52.2 – 56.1	0.1989	0.0019	0.0057	0.0009	0.0000	0.0058
56.1 – 60.3	0.2003	0.0021	0.0058	0.0009	0.0000	0.0059
60.3 – 64.8	0.1976	0.0022	0.0058	0.0010	0.0000	0.0058
64.8 – 69.7	0.1974	0.0023	0.0058	0.0010	0.0000	0.0059
69.7 – 74.9	0.1994	0.0025	0.0059	0.0010	0.0000	0.0060
74.9 – 80.5	0.1926	0.0026	0.0057	0.0010	0.0000	0.0058
80.5 – 86.5	0.1971	0.0028	0.0059	0.0010	0.0000	0.0060
86.5 – 93.0	0.1959	0.0029	0.0059	0.0010	0.0000	0.0060
93.0 – 100	0.1978	0.0031	0.0060	0.0011	0.0000	0.0061
100 – 108	0.1925	0.0032	0.0059	0.0010	0.0001	0.0060
108 – 116	0.1958	0.0035	0.0060	0.0011	0.0001	0.0061
116 – 125	0.1953	0.0037	0.0060	0.0011	0.0001	0.0061
125 – 135	0.1959	0.0039	0.0061	0.0011	0.0001	0.0062
135 – 147	0.1929	0.0039	0.0061	0.0011	0.0001	0.0061
147 – 160	0.1935	0.0042	0.0061	0.0011	0.0001	0.0062
160 – 175	0.1894	0.0044	0.0061	0.0011	0.0001	0.0062
175 – 192	0.1863	0.0046	0.0060	0.0011	0.0001	0.0061
192 – 211	0.1883	0.0049	0.0061	0.0012	0.0001	0.0063
211 – 233	0.1887	0.0053	0.0062	0.0012	0.0000	0.0064
233 – 259	0.1891	0.0056	0.0063	0.0013	0.0000	0.0065
259 – 291	0.1813	0.0056	0.0061	0.0014	0.0000	0.0063
291 – 330	0.1902	0.0062	0.0065	0.0017	0.0000	0.0067
330 – 379	0.1808	0.0064	0.0063	0.0018	0.0000	0.0066
379 – 441	0.1740	0.0068	0.0062	0.0021	0.0001	0.0065
441 – 525	0.1815	0.0075	0.0066	0.0027	0.0002	0.0071
525 – 660	0.1985	0.0081	0.0074	0.0037	0.0003	0.0083
660 – 860	0.1732	0.0084	0.0067	0.0044	0.0003	0.0080
860 – 1200	0.1799	0.0097	0.0072	0.0063	0.0004	0.0096
1200 – 3000	0.1629	0.0218	0.0084	0.0049	0.0015	0.0098

TABLE SVIII: The silicon to oxygen flux ratio Si/O as a function of rigidity including errors due to statistics (stat.); contributions to the systematic error from the trigger, acceptance, and background (acc.); the rigidity resolution function and unfolding (unf.); the absolute rigidity scale (scale); and the total systematic error (syst.). The statistical errors are the sum in quadrature of the ratios of silicon and oxygen flux statistical errors to the corresponding flux values, multiplied by the Si/O flux ratio. The systematic errors from the background subtraction, the trigger, and the event reconstruction and selection are likewise added in quadrature. The correlations in the systematic errors from the uncertainty in nuclear interaction cross sections, the unfolding and the absolute rigidity scale between the silicon and oxygen fluxes have been taken into account in calculating the corresponding systematic errors of the Si/O flux ratio. The contribution of individual sources to the systematic error are added in quadrature to arrive at the total systematic uncertainty.

Rigidity [GV]	Si/O	$\sigma_{\text{stat.}}$	$\sigma_{\text{acc.}}$	$\sigma_{\text{unf.}}$	σ_{scale}	$\sigma_{\text{syst.}}$
2.15 – 2.40	0.1406	0.0009	0.0045	0.0060	0.0000	0.0075
2.40 – 2.67	0.1413	0.0008	0.0043	0.0028	0.0000	0.0052
2.67 – 2.97	0.1412	0.0007	0.0042	0.0016	0.0000	0.0045
2.97 – 3.29	0.1425	0.0007	0.0041	0.0014	0.0000	0.0044
3.29 – 3.64	0.1449	0.0007	0.0041	0.0012	0.0000	0.0043
3.64 – 4.02	0.1452	0.0007	0.0041	0.0011	0.0000	0.0042
4.02 – 4.43	0.1457	0.0006	0.0041	0.0009	0.0000	0.0042
4.43 – 4.88	0.1484	0.0006	0.0041	0.0008	0.0000	0.0042
4.88 – 5.37	0.1484	0.0006	0.0041	0.0007	0.0000	0.0042
5.37 – 5.90	0.1487	0.0006	0.0041	0.0007	0.0000	0.0042
5.90 – 6.47	0.1519	0.0006	0.0042	0.0006	0.0000	0.0043
6.47 – 7.09	0.1527	0.0006	0.0042	0.0006	0.0000	0.0043
7.09 – 7.76	0.1562	0.0006	0.0044	0.0006	0.0000	0.0044
7.76 – 8.48	0.1547	0.0006	0.0043	0.0005	0.0000	0.0043
8.48 – 9.26	0.1572	0.0006	0.0044	0.0005	0.0000	0.0044
9.26 – 10.1	0.1584	0.0006	0.0044	0.0005	0.0000	0.0045
10.1 – 11.0	0.1605	0.0007	0.0045	0.0005	0.0000	0.0045
11.0 – 12.0	0.1601	0.0007	0.0045	0.0005	0.0000	0.0045
12.0 – 13.0	0.1612	0.0008	0.0045	0.0005	0.0000	0.0046
13.0 – 14.1	0.1628	0.0008	0.0046	0.0005	0.0000	0.0046
14.1 – 15.3	0.1627	0.0008	0.0046	0.0005	0.0000	0.0046
15.3 – 16.6	0.1626	0.0009	0.0046	0.0005	0.0000	0.0046
16.6 – 18.0	0.1627	0.0009	0.0046	0.0005	0.0000	0.0046
18.0 – 19.5	0.1626	0.0009	0.0046	0.0005	0.0000	0.0046
19.5 – 21.1	0.1639	0.0010	0.0046	0.0005	0.0000	0.0047
21.1 – 22.8	0.1630	0.0010	0.0046	0.0005	0.0000	0.0047
22.8 – 24.7	0.1635	0.0010	0.0047	0.0005	0.0000	0.0047
24.7 – 26.7	0.1656	0.0010	0.0047	0.0005	0.0000	0.0048
26.7 – 28.8	0.1674	0.0011	0.0048	0.0005	0.0000	0.0048
28.8 – 31.1	0.1674	0.0011	0.0048	0.0005	0.0000	0.0048
31.1 – 33.5	0.1682	0.0012	0.0048	0.0006	0.0000	0.0049
33.5 – 36.1	0.1685	0.0012	0.0049	0.0006	0.0000	0.0049

Table continued

TABLE SVIII – *(Continued).*

Rigidity [GV]	Si/O	$\sigma_{\text{stat.}}$	$\sigma_{\text{acc.}}$	$\sigma_{\text{unf.}}$	σ_{scale}	$\sigma_{\text{syst.}}$
36.1 – 38.9	0.1701	0.0013	0.0049	0.0006	0.0000	0.0050
38.9 – 41.9	0.1700	0.0014	0.0050	0.0006	0.0000	0.0050
41.9 – 45.1	0.1694	0.0015	0.0050	0.0006	0.0000	0.0050
45.1 – 48.5	0.1721	0.0016	0.0051	0.0007	0.0000	0.0051
48.5 – 52.2	0.1725	0.0017	0.0051	0.0007	0.0000	0.0052
52.2 – 56.1	0.1720	0.0018	0.0051	0.0007	0.0000	0.0052
56.1 – 60.3	0.1684	0.0019	0.0050	0.0007	0.0000	0.0051
60.3 – 64.8	0.1737	0.0020	0.0052	0.0008	0.0000	0.0053
64.8 – 69.7	0.1724	0.0022	0.0052	0.0008	0.0000	0.0053
69.7 – 74.9	0.1737	0.0023	0.0053	0.0008	0.0000	0.0054
74.9 – 80.5	0.1733	0.0025	0.0053	0.0008	0.0000	0.0054
80.5 – 86.5	0.1747	0.0026	0.0054	0.0008	0.0000	0.0055
86.5 – 93.0	0.1757	0.0028	0.0055	0.0009	0.0000	0.0055
93.0 – 100	0.1694	0.0029	0.0053	0.0008	0.0000	0.0054
100 – 108	0.1771	0.0031	0.0056	0.0009	0.0000	0.0057
108 – 116	0.1683	0.0033	0.0053	0.0009	0.0000	0.0054
116 – 125	0.1750	0.0035	0.0056	0.0009	0.0000	0.0057
125 – 135	0.1730	0.0037	0.0056	0.0009	0.0000	0.0057
135 – 147	0.1655	0.0037	0.0054	0.0009	0.0000	0.0055
147 – 160	0.1737	0.0041	0.0057	0.0010	0.0000	0.0058
160 – 175	0.1773	0.0043	0.0059	0.0010	0.0000	0.0060
175 – 192	0.1725	0.0045	0.0058	0.0010	0.0000	0.0059
192 – 211	0.1688	0.0047	0.0057	0.0011	0.0000	0.0058
211 – 233	0.1652	0.0050	0.0057	0.0011	0.0000	0.0058
233 – 259	0.1777	0.0055	0.0062	0.0013	0.0000	0.0063
259 – 291	0.1645	0.0055	0.0058	0.0013	0.0000	0.0059
291 – 330	0.1615	0.0058	0.0058	0.0015	0.0000	0.0059
330 – 379	0.1626	0.0061	0.0059	0.0017	0.0000	0.0061
379 – 441	0.1705	0.0068	0.0063	0.0021	0.0001	0.0066
441 – 525	0.1625	0.0072	0.0061	0.0024	0.0001	0.0066
525 – 660	0.1728	0.0076	0.0067	0.0033	0.0003	0.0075
660 – 860	0.1666	0.0084	0.0067	0.0042	0.0003	0.0079
860 – 1200	0.1489	0.0089	0.0062	0.0053	0.0003	0.0082
1200 – 3000	0.1288	0.0197	0.0072	0.0038	0.0008	0.0082

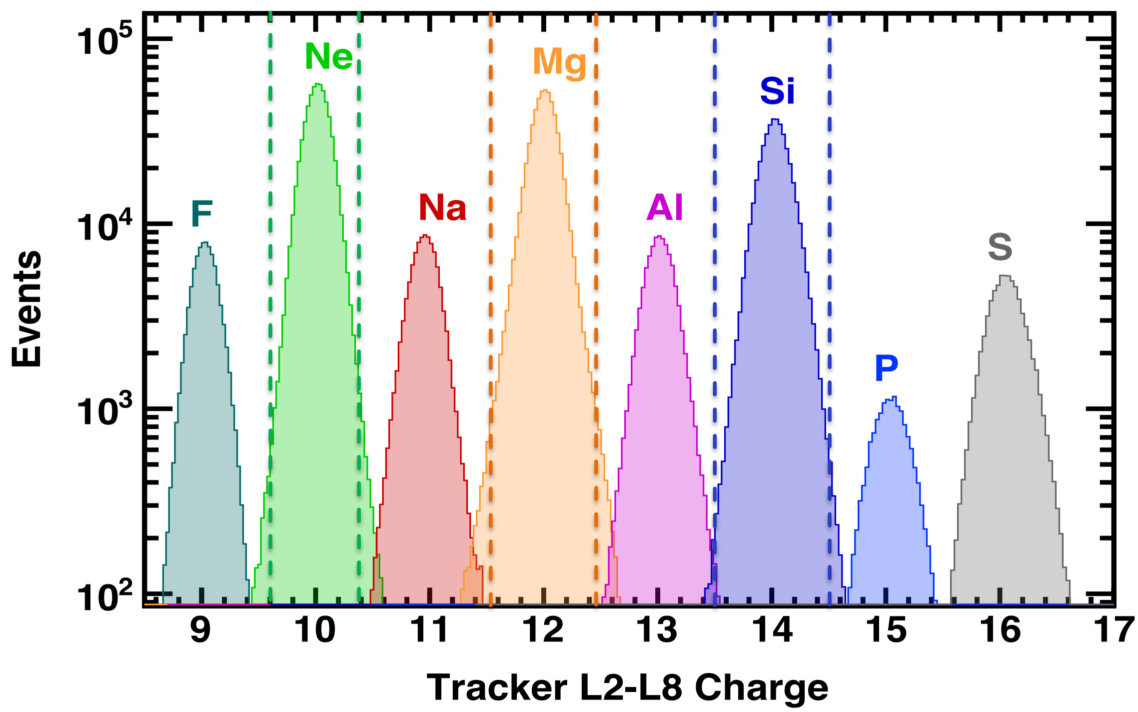

FIG. S1. Distribution of the charge measured with the inner tracker $L2$-$L8$ for samples from $Z = 9$ to $Z = 16$ selected by the combined charge measured with $L1$, the upper TOF, and the lower TOF over the rigidities above 4 GV. The colored vertical lines correspond to the charge selection in the inner tracker for neon (green), magnesium (orange) and silicon (blue).

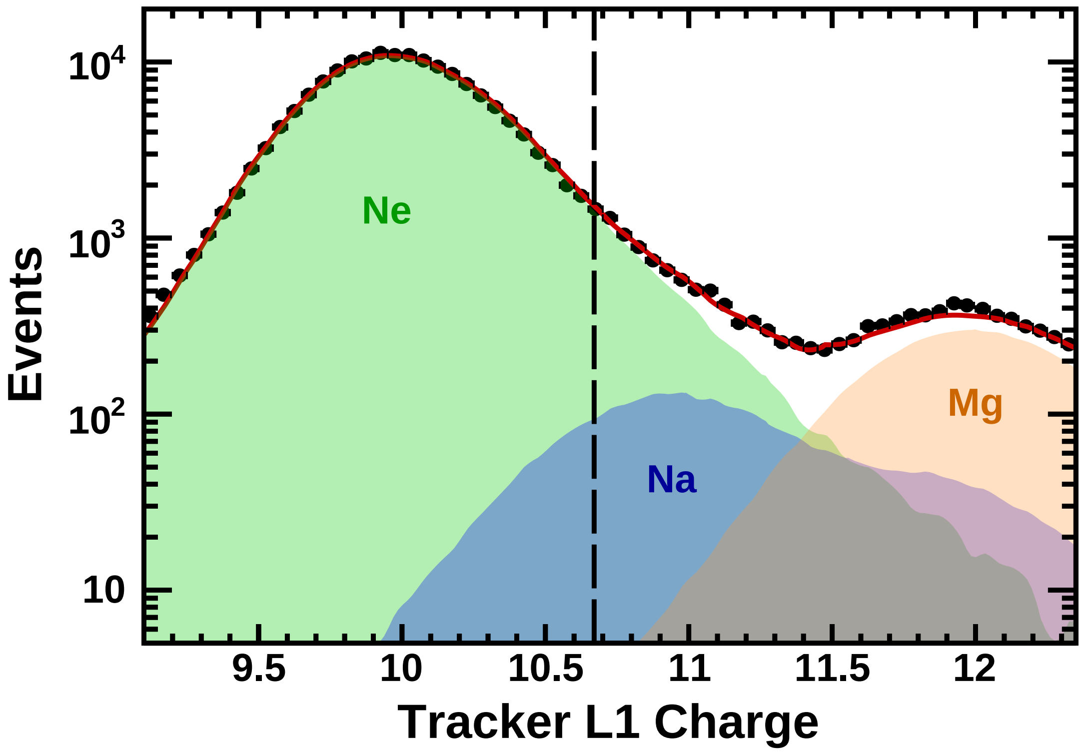

FIG. S2. Charge distributions measured by tracker $L1$ for neon events selected by the inner tracker in the rigidity range between 9 and 11 GV (black dots). The solid red curve shows the fit to the data of the Ne, Na and Mg charge distribution templates. The templates are obtained from non-interacting samples at $L2$ by the use of the charge measurement with $L1$, upper TOF, and $L3$-$L8$. The charge selection applied on tracker $L1$ is shown as vertical dashed line. After selection, the residual Na background is found to be $<0.3\%$.

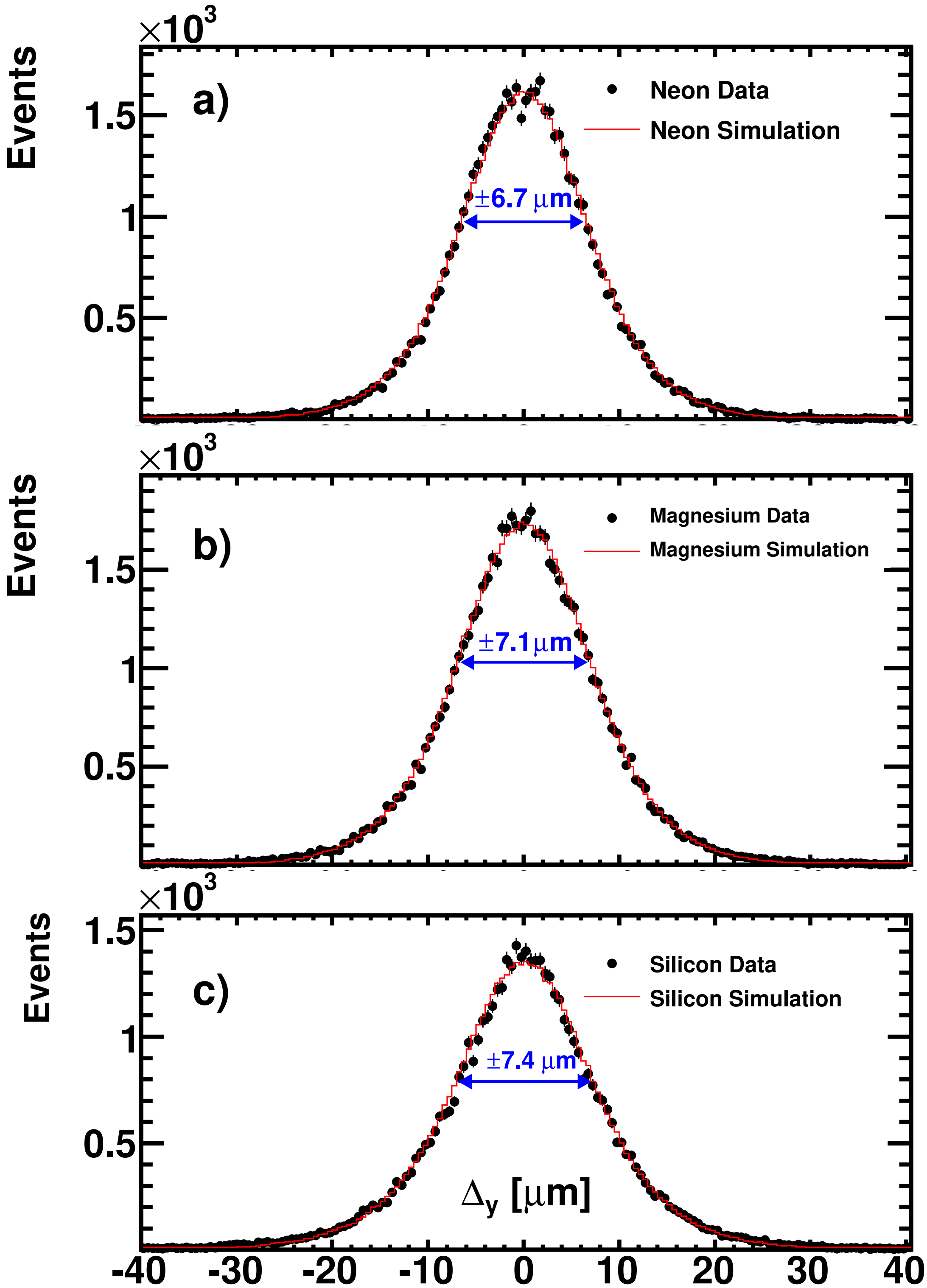

FIG. S3. Comparison of the differences of the coordinates measured in $L3$ or $L5$ to those obtained from the track fit using the measurements from $L1$, $L2$, $L4$, $L6$, $L7$, and $L8$ between data and simulation in the rigidity range $R > 50$ GV for (a) neon, (b) magnesium, and (c) silicon nuclei. The observed bending coordinate accuracy is 6.7 μm for neon, 7.1 μm for magnesium and 7.4 μm for silicon.

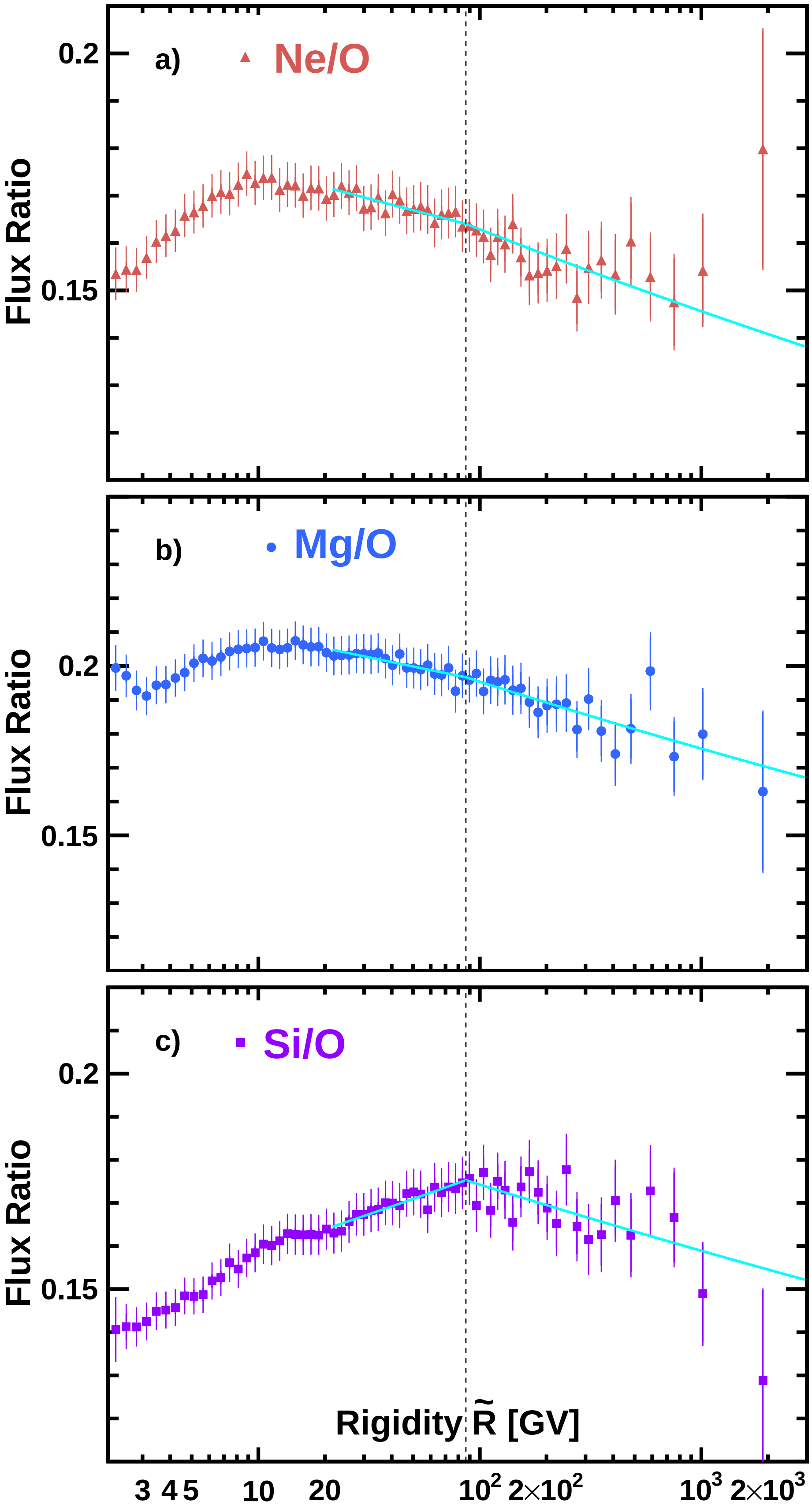

FIG. S4. The AMS a) Ne/O, b) Mg/O, and c) Si/O ratios as functions of rigidity. The solid lines indicate the fits of Eq. (4) for rigidities above 20 GV with χ^2/d.o.f. = 16/38, 19/38 and 27/38 for Ne/O, Mg/O, and Si/O, respectively. The vertical dashed lines are placed at 86.5 GV which separates two fit interval of Eq. (4).