Rationale for Quadrupole Range Requirements for 12 GeV CEBAF

Overview

This is a compilation of the underlying rationale leading to the definition of all quadrupole range requirements for the CEBAF 12 GeV Upgrade. The work was started in October 2004 and has undergone numerous revisions until June 2005, during which period the formula was also extended from the 5.5 pass recirculator to transport lines and the straight-ahead injection line. The sections below each summarizes the study of quad range requirements for a specific section as follows:

- Extrapolation of 6 GeV 5 pass quad settings, including Halls A, B & C to 12 GeV, using algorithm of "shortest focal length per group".
- Extrapolation of 6 GeV quad settings for Transport Recombiners at all representative extraction passes (1 through 5) and all hall destinations.
- North & South Linacs and East Spreader/West Recombiners
- Revised quad requirements for straight-ahead 123 MeV Injector.
- Projected Arc 10 quad requirements.

Extrapolation of 6 GeV 5 pass quad settings to 12 GeV (Oct. 2004)

This gives justification on how I arrived at the numbers listed in the Spread sheet for 12 GeV quads on 12 GeV quad strength extrapolation..

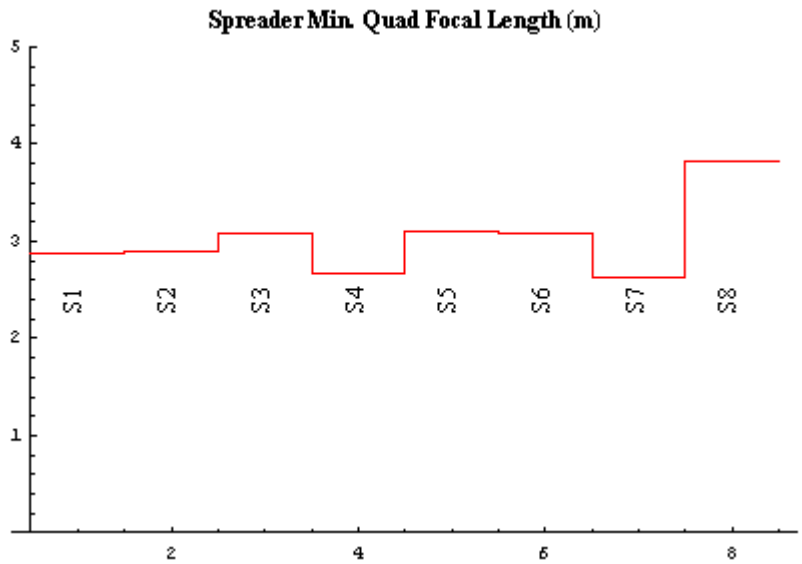
- The starting point is a snapshot on 10/03 of the 5.75 GeV machine with 5 pass delivery[1] to all 3 halls after recent optical fix by Mike Tiefenback.
- First column (A): Quad names excluding Injector and Linac quads (inc. NL00/01) as these are either at the same energy for 12 GeV or will come from new schemes such as different momentum profile in NL & SL.
- Second column (B): Corresponding quad BDL as set on 10/03.
- Third column (C): Quad BDL after incorporating Mike's most recent estimate on field map offsets of QA & QU (This is reflected in the Model Server now with –350 G for QA & -250 G for QU. There was an earlier result with offsets varying by arc, which is now superceded as of 10/18).
- Fourth to ninth (D-I) column: Allowance for tuning. The rationale is as follows:

There are 4 basic groups of tuning quads:

- Spreader matching (plus AT): There are 7 quads in each of Spreaders 1-8, and 5 in Spreader 9. The current scheme of "allowed" matching quads based on design optics is untenable, partly due to deviation of the real optics from design and partly due to observation that using quads other than "allowed" often leads to much better match. Thus all quads originally designated as matching quads are treated as such here. Furthermore an estimate on tuning range based on percentage of current settings may not be correctly assessing the problem, as usually a matching solution will change all quads by similar magnitude, not percentage, as is reasonable. A matching solution can easily change one quad by 20% and the next by 200% if the latter is much weaker to start with. Therefore here the range is defined through a momentum-normalized approach as follows:

[1] This precluded accurate information on the 2-8T line quads on this day. It can be added to this analysis by looking into other saved files at different passes, but I have not collected all of them. It may be useful to compare these with the counterpart Recombiner quads to see if the conclusion made here on the latter is applicable to the transport recombiners.

I looked at all the Spreader matching quad BDL's divided by momentum, basically giving me the inverse focal length, and found that the minimum of such numbers in each Spreader is of roughly the same magnitude for the first 8 Spreaders as shown below.



I will use a nominal value of **3.0385 m** for Spreaders 1-8 derived from their RMS. Spreader 9 matching quads are considerably weaker with minimum focal length of about 7 m. This is treated separately in the following.

I then adopted the rationale assuming if the Spreaders are to be actively used for tuning (mainly betatron matching), all matching quads can be changed by up to ±30% of this focal length, regardless of their momentum, starting values, or whether they are "allowed" quads. The latter 2 points are derived pretty confidently from experience of using these quads, but the 30% number is less firm. I am making a separate column in the spreadsheet for modification to the BDL due to this consideration so it can be scaled to reflect a different view on the 30%.

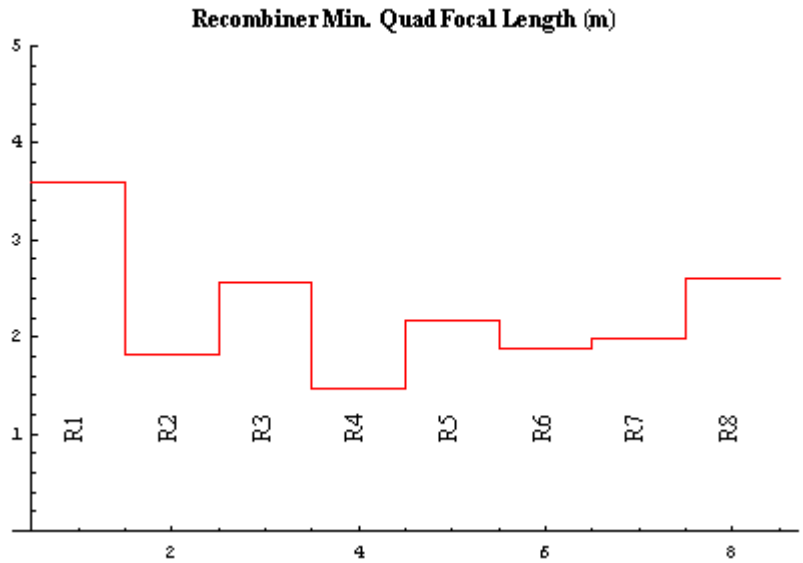
One extra group, the AT line matching quads, is included in the same spirit, although with minimum focal length 10.5 m observed and used.

- Recombiner matching: All the above arguments apply to the Recombiner, with the following distinctions:

The minimum focal lengths of the recombiner matching quads are again similar in magnitude from 1R to 8R, but are stronger as shown below. Minor differences are ignored, such as a weaker 1R strength that will slightly overestimate the changes calculated below in this section, to obtain a RMS nominal focal length of **2.3414 m**. One can also discern the tendency of stronger even Recombiner quads due to North Linac. This small variation is also ignored. Again 9R quads have very different minimum focal length of 4.4 m and will be treated separately.

Another difference in the Recombiner is that I assumed that the current setting already reflected the efforts of betatron matching and covered part of the required tuning range[2]. I put this number at 10%, possibly conservative, and required that an additional variation of 20% in the focal length is needed. This again is debatable and will be made into a separate column in the spreadsheet for manipulation.

[2] In the current ORFP doctrine we only use Recombiner matching quads, which I believe came from the historical accident that we didn't have Linac 30 hz BPM's until much after ORFP was finalized. There is no reason why we can't use them now, but no one does. Not including Spreader matching quads in betatron matching, I believe, is a major reason why we see long-range fighting matching quads (e.g., between 2R & 3R due to mismatch at 3S), reflected in long range Courant Snyder "bumps". Machine sensitivity can result from this. Local blowup in the Spreaders has also misled us into chasing spurious coupling sources. Some matching efforts in the Spreader outside ORFP have been tried with positive effects on overall transport.



- Dispersion: Dispersion quads in Spreaders and Recombiners are quite symmetric, and all followed a very uniform trend in the minimum momentum scaled focal length up to 8S/R, not very surprisingly. The RMS focal lengths used to estimate tuning range for 1S/R to 8S/R are **2.5355 m** and **2.5365 m** respectively. For 9S/R the minimum focal lengths are 7.7294 m and 7.7278 m respectively.

  As for the percentage change to be imposed on this baseline BDL, since the dispersion quads are not expected to change significantly, I used 15%. This may still be somewhat conservative. However I asked Jay to survey the cmpq files for a feel of deviation from design. The answer is they are mostly within 10% of design, but there are a few outliers at 25%. I got the same impression looking at a later cmpq file he sent out to optics oncall people.
- Hall line matching: The first 5 quads in each Hall were used to get the magnitude of momentum-normalized focal length. It turned out that they are all in the range of 2.5-8 m except one weak quad, with an RMS of 5.30 m excluding the weak one. I used the strongest quad at **2.6192 m** as basis for tuning range, and adopted the same rationale for fractional variation as the Recombiner matching quads, namely 20%, since some tuning is already contained in these numbers.
- Injector matching: The 5 quads (0L06-0L10) are used frequently for matching the beam into the North Linac. The minimum focal length is not too short at **5.1771 m**. These quads however have seen significant changes through Injector matching. I used a 60% fraction of the momentum-normalized focal length as tuning allowance, which I believe reflects what is normally seen.
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- 10th column (J): The outcome of adding all the above tuning allowances, moderated by respective fractions, to the current quad BDL's (with the field map offset taken into account) in column C. As stated, the tuning allowances described above without the fractions (100%) are entered in columns 4-9. The fractions assigned to each tuning allowance are entered in N2-N7. With my ignorance of Excel I could only hardcode these numbers in this column (J) to get the total effect. A more skilled user could certainly use the numbers in N2-N7 as variables in this column and play with different scenarios. As can be seen the formula for column J is

```
J<N>=C<N>+D<N>*O2+E<N>*O3+F<N>*O4+G<N>*O5+H<N>*O6+I<N>*O7
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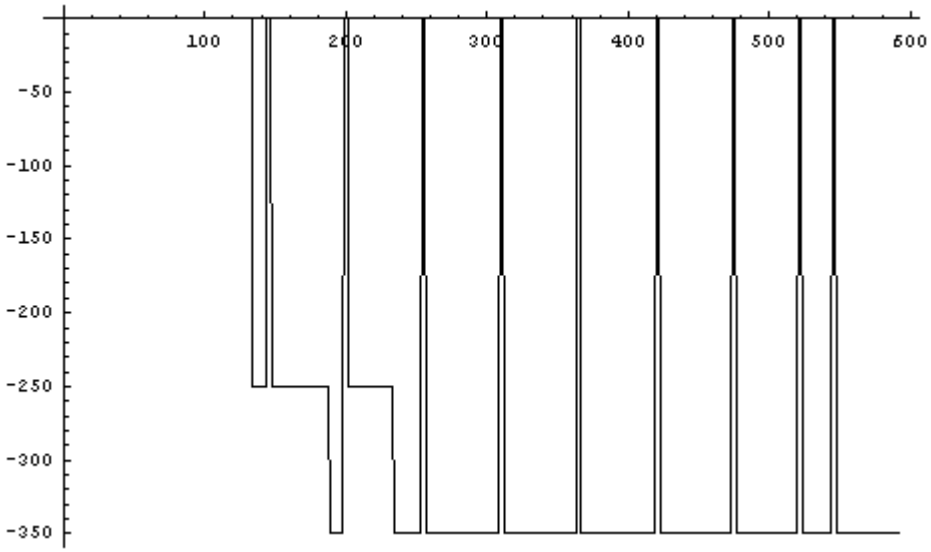
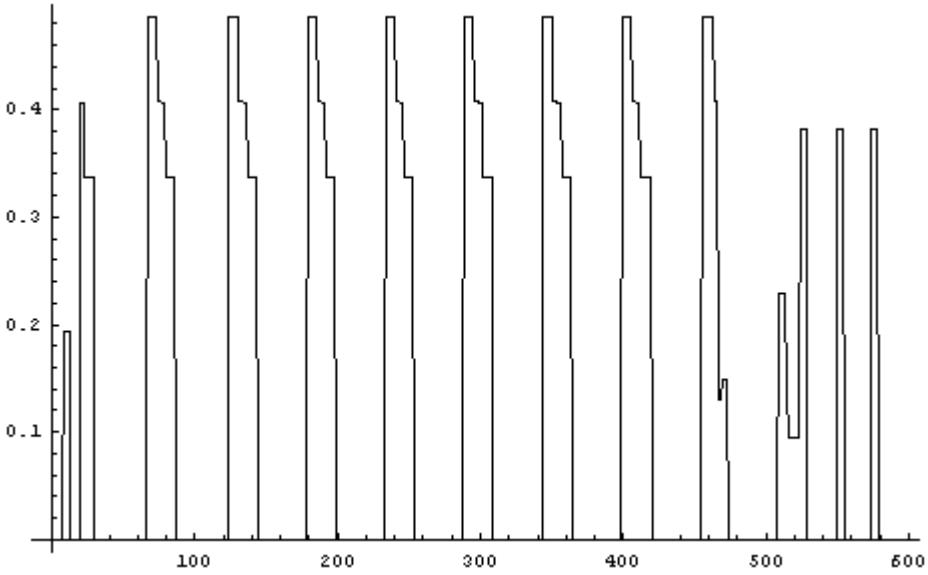
where <*N*> is the row index.

- 11th column (K): Corresponding momentum at each quad.
- 12th column (L): Entries in column J scaled to 12 GeV by multiplying **1.91722** (in N4)

Below are twos more plots. The first one shows the field map offsets added to the quads vs the row index in the spreadsheet, basically column C minus column B.



The next is the net inverse focal length change (1/m) in absolute values allocated for all tuning estimates (column J minus column C). This will change if one changes the assignment of reduction percentage for the various groups of quads of course.



Extrapolation of 6 GeV quad settings for Transport Recombiners (Feb. 2005)

This continues on a previous one in arriving at estimates for required quad strengths at 12 GeV based on existing experience. The current note addresses the requirements in the Transport Recombiners (**TR**). The table below summarizes the AllSave files and their corresponding run configurations used to obtain the final conclusions[3].

AllSave #	Hall	Pass #	P/Linac
3761	A	1	544
3197	B	1	495
3438	C	1	544
4406	A	2	373
3303	B	2	495
4531	C	2	495
4636	A	3	495
3710	B	3	519
4193	C	3	495
3779	A	4	544
4589	B	4	495
4604	C	4	495

The final conclusions are contained in the 2 spreadsheets, **12GeV_TRec_Match.xls** for TR matching quads, and **12GeV_TRec_Disp.xls** for TR dispersion quads.

Te format for both files are the same:
Columns B-D: The BDL value of each quad in Gauss for Hall A, B and C delivery respectively
Columns E-G: The momentum at each quad in MeV/C for Hall A, B and C delivery respectively
Column H: Largest momentum normalized BDL of each quad among Hall A, B and C delivery configurations[4]
Column I: The BDL at each quad corresponding to the above largest momentum normalized BDL, with momentum set at 600 MeV/C/Linac.
Column J: The maximum momentum normalized BDL of all quads corresponding to a particular pass number. In the spirit of previous analysis for the rest of the machine, these will be used as the basis for estimating tuning range for all matching or dispersion quads.
Column K: The above maximum momentum normalized BDL scaled to momentum of 600 MeV/C/Linac and the proper pass number.
Column L: Combination of Column I, the baseline quad strength, and 30% of Column K in the case of matching quads, or 15% of Column K in the case of dispersion quads[5]. These are the estimates of tuning range for each quad scaled to 600 MeV/C/Linac.
Column M: Column L scaled to 1090 MeV/C/Linac, namely estimates on required quad BDL at 12 GeV with tuning range included.
In the note, in contrast to the previous analysis, we did not extract a universal typical focal length for all 9 passes, which was then applied to all passes with proper scaling to represent the tuning range. The main reason is that with a small sample of 4 extraction passes it is more difficult to discern a universal trend and more dangerous to use this trend universally. Thus as indicated in the table, the focal length (or momentum normalized BDL) for each pass is used individually to arrive at the tuning range. The two plots below show the minimum focal lengths of matching and dispersion quads for all extraction passes (accounting for all 3 halls).

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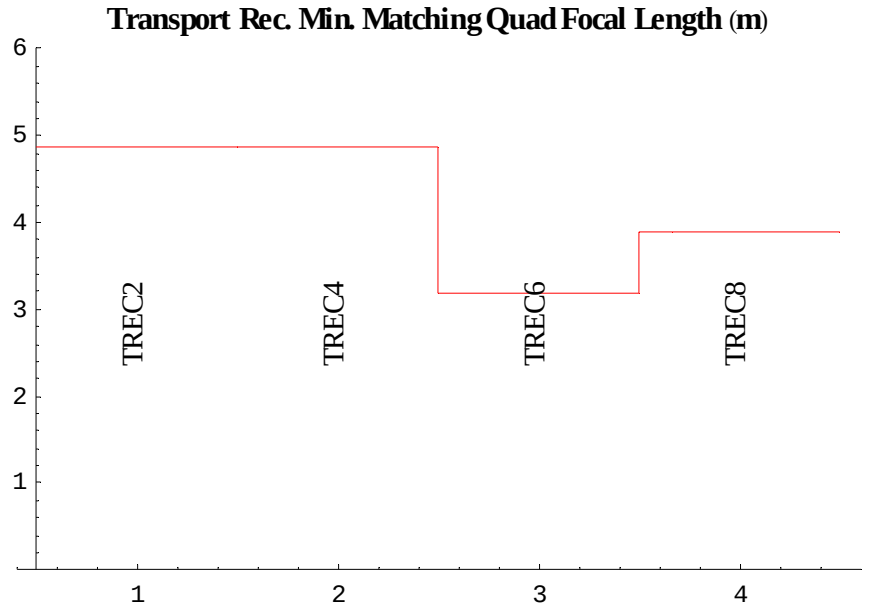
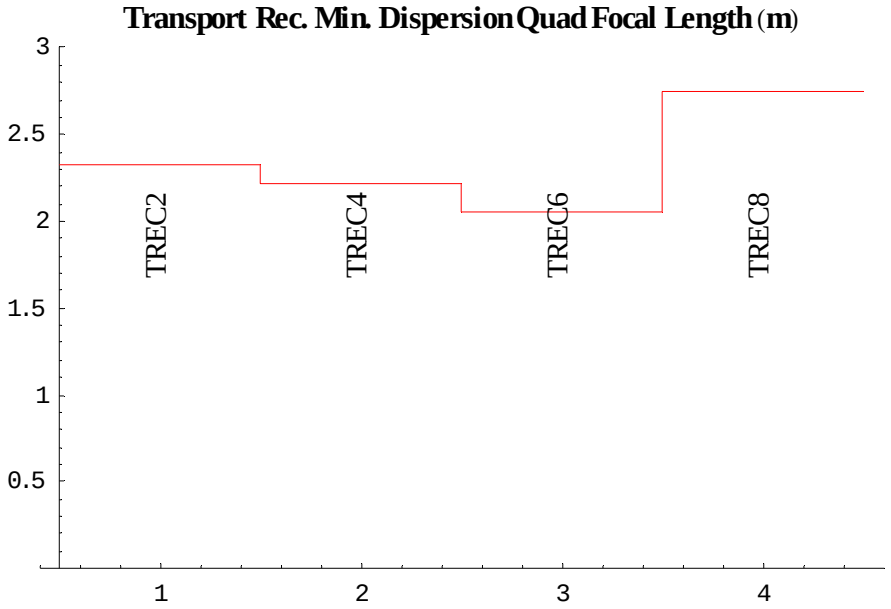
[3] Scott Myers assisted in locating these files. Brian Bevins created program to extract the information from BURT into ASCII files.
[4] MQU quads appeared in some 2nd pass Hall B delivery files. In obtaining largest momentum normalized BDL's the distinction between MQA's and MQU's, which showed very small, if any, differences in momentum normalized BDL, is ignored after the empirical offsets in QA & QU field maps (a la Tiefenback) were included.
[5] This is consistent with treatment of these quads in the previous analysis of the main accelerator.





It's worth noting that the estimated dispersion quad strengths are similar for the transport recombiners and their counterpart recombiners in the main accelerator, most likely because they are dominantly defined by the beam line geometry rather than by incoming beam profile, as is the case with matching quads. For the latter the TR strengths are mostly weaker than their recombiner counterparts. This is likely due to both the need to match into North Linac with stronger quads, and the fact that TR matching is not routinely performed during setup. Because of the above reason the fractional tuning assigned to regular recombiner matching quads was reduced to 20% in the previous analysis, whereas it is kept at 30% in the current result.

North & South Linacs and East Spreader/West Recombiners (March 2005)

The spread sheet for North end summarizes estimates on the North and South Linac quads, including tuning allowances, under the assumption that all 100 MV cryo-modules will be placed at the 5 empty slots at the end. Since such a choice of linac momentum profile has non-trivial implication on the West Recombiners and East Spreaders, the optimal quad solutions for these sections worked out in a previous study under this momentum profile are also included, with best guess at tuning allowances. These should be contrasted with the empirically derived WR/ES quads extrapolated to 12 GeV in a previous note, especially since the momentum ratios between passes are now different between the 6 GeV and the 12 GeV cases.

Explanation of tuning allowances:

North Linac:

The 2 quad BDLs for 1L00 and 1L01 correspond to the optimized solution mentioned above. Considerable tuning range is assigned here (50%) as they play a critical role in balancing optical matching among the 6 passes in the North Linac, and are expected to be heavily relied on for such purposes.

More freedom is also given to quad 1L02 in increasing further the latitude that may be necessary in balancing all 6 passes. It is not as much a part of the 1st pass FODO lattice as the other linac quads, and thus can enjoy more tuning range.

The quad 1L28.has been seen to have a significant impact on the 6-pass envelope control, and thus is also assigned a large tuning allowance (60%). Like 1L02, it is not a rigid part of the linac FODO lattice.

All the other quads are given an allowance of 5% upwards in absolute value only as a safety margin, as deviation from nominal momentum profile can only go in the direction of less momentum, barring extraordinary cases. If this is not the case, the upper bound may need to be increased.

South Linac:

The 2 quad BDLs for 2L01 and 2L27 are assigned a large tuning range (50%) for the same reason as mentioned above. All others are again given a 5% safety margin.

West Recombiner & East Spreader Dispersion Quads:

These BDL's are extracted from the recent optimization study under this North Linac momentum profile. Being dispersion quads, they are given a 15% tuning range in keeping with rationale applied to the rest of the machine on dispersion quads so far.

The only exception happens with 9S02 and 9S03, where the optimized design has 0 G for both quads. In the spreadsheet the empirical values scaled up from 6 GeV operation in a previous note are used instead.

West Recombiner & East Spreader Matching Quads:

These BDL's are extracted from the recent optimization study under this North Linac momentum profile. Being matching quads, they are given a 30% tuning range in keeping with rationale applied to the rest of the machine on matching quads so far. Unlike the practice adopted for empirical WR matching quads, this range is not discounted to 20% to account for existing tuning history, since here the numbers are based on design BDL's.

Quad requirements for straight-ahead 123 MeV Injector (May 2005)

These were derived following the decision to configure the 123 MeV Injector as a one-pass line without recirculation. Justification is given below on how I arrived at these numbers in the spread sheet for Injector

- Examined two offline designs for Injection Chicane: Isochronous and Bunch-compressed, representing two extremes of the quad strengths at different locations.
- For the straight section (123 MeV) before the Chicane (0L06-0L10), used also offline-matched values. The maximum of these (~700 G) is close to that needed in recent Injector re-matching tests.
- Maximum of these 2 configurations at each quad is used as the baseline, on top of which a tuning range of 60% is added to matching quads (0L06-0L10), 30% to dispersion quads (0L02, 04, 06), and 10% to other Chicane quads. These are shown in column **I**.
- In column **J** the maximum of the matching quads (0L06-0L10) is used as the nominal range for all matching quads, as by recent Injector matching experience, any of these quads can take on strength as large as 700 G at 60 MeV in the solution[6].
- The maximum for this group of quads is set by 0R02/06 at 2622.599 G.
- Finally the last row gives the projected MQJ0L05 range, assuming a 40 MeV CM followed by an 80 MeV CM in the Injector. A 60% tuning range is also applied (column **E**). The initial value (275 G) is again taken from the maximum of recent Injector re-matching studies.

[6] As a result the strengths for these quads are about 50% larger than estimated in a previous note based on current running BDL's in the Injector. This reflects a discrepancy also seen in the estimate of West Recombiner quads, as current running configuration does not reflect the desired setup. The 50% difference here is a direct consequence of the fact that the current Injector is not well-matched, and study indicates that some quads need to be 50% stronger to improve the matching.

Projected Arc 10 quad requirements (June 2005)

Taking baseline design for Arc 10 and applying a 2% tutning range for M56 quads & 5% for H-dispersion quads, with quadratic sum amounting to 6% total, one arrives at the spread sheet for Arc 10 quads.

All spread sheets with links provided above are reproduced in the appendices in reduced form.

Appendix A. 5 Pass Quad Tuning Range, Including Halls A, B & C At 12 GeV

Name	BDL_6GeV	Q_Offset	SPr_Match	Rec_Match	Spr_Disp	Rec_Disp	Hall_Match	Inj_Match	sub-total	HM56	TuneRange	BDL12GeV
MQJ0L01	56.9	56.9	0	0	0	0	0	0	56.9	1	56.9	109.0899
MQJ0L02	-125.8	-125.8	0	0	0	0	0	0	-125.8	1	-125.8	-241.186
MQJ0L02A	114.2	114.2	0	0	0	0	0	0	114.2	1	114.2	218.9466
MQJ0L03A	22.5	22.5	0	0	0	0	0	0	22.5	1	22.5	43.13748
MQJ0L03	-41.5	-41.5	0	0	0	0	0	0	-41.5	1	-41.5	-79.5647
MQJ0L04	25.4	25.4	0	0	0	0	0	0	25.4	1	25.4	48.69742
MQJ0L05	-277.806	-277.806	0	0	0	0	0	0	-277.806	1	-277.806	-532.615
MQD0L06	399.028	399.028	0	0	0	0	0	413.176	646.9336	1	646.9336	1240.315
MQD0L07	-413.176	-413.176	0	0	0	0	0	-413.176	-661.082	1	-661.082	-1267.44
MQD0L08	363.714	363.714	0	0	0	0	0	413.176	611.6196	1	611.6196	1172.61
MQD0L09	-223.918	-223.918	0	0	0	0	0	-413.176	-471.824	1	-471.824	-904.59
MQD0L10	322.727	322.727	0	0	0	0	0	413.176	570.6326	1	570.6326	1094.029
MQD0R01	-254.387	-254.387	0	0	0	0	0	0	-254.387	1	-254.387	-487.716
MQD0R02	-0.00012	-0.00012	0	0	0	0	0	0	-0.00012	1	-0.00012	-0.00023
MQD0R03	-127.194	-127.194	0	0	0	0	0	0	-127.194	1	-127.194	-243.859
MQD0R04	279.397	279.397	0	0	0	0	0	0	279.397	1	279.397	535.6658
MQD0R05	-127.035	-127.035	0	0	0	0	0	0	-127.035	1	-127.035	-243.554
MQD0R06	-0.00012	-0.00012	0	0	0	0	0	0	-0.00012	1	-0.00012	-0.00023
MQD0R07	-254.387	-254.387	0	0	0	0	0	0	-254.387	1	-254.387	-487.716
MQB1S01	-4233.3	-4233.3	0	0	-8595.42	0	0	0	-5522.61	1	-5522.61	-10588.1
MQB1S02	6245.54	6245.54	0	0	8595.421	0	0	0	7534.853	1	7534.853	14445.98
MQB1S03	-8299.73	-8299.73	0	0	-8595.42	0	0	0	-9589.04	1	-9589.04	-18384.3
MQB1S04	-7295.43	-7295.43	-7121.42	0	0	0	0	0	-9431.86	1	-9431.86	-18083
MQB1S05	7336.9	7336.9	7121.417	0	0	0	0	0	9473.325	1	9473.325	18162.46
MQB1S06	236.257	236.257	7121.417	0	0	0	0	0	2372.682	1	2372.682	4548.956
MQB1S07	-5939.03	-5939.03	-7121.42	0	0	0	0	0	-8075.45	1	-8075.45	-15482.4
MQB1S08	4812.92	4812.92	7121.417	0	0	0	0	0	6949.345	1	6949.345	13323.43
MQB1S09	-4777.13	-4777.13	-7121.42	0	0	0	0	0	-6913.55	1	-6913.55	-13254.8
MQB1S10	2345.06	2345.06	7121.417	0	0	0	0	0	4481.485	1	4481.485	8591.998
MQB1E01	-1180.95	-1180.95	0	0	0	0	0	0	-1180.95	1	-1180.95	-2264.14
MQB1E02	1761	1761	0	0	0	0	0	0	1761	1	1761	3376.226
MQB1E03	-1940	-1940	0	0	0	0	0	0	-1940	1	-1940	-3719.41
MQB1A01	3517.6	3517.6	0	0	0	0	0	0	3517.6	1	3517.6	6744.017
MQB1A02	-1236.48	-1236.48	0	0	0	0	0	0	-1236.48	1	-1236.48	-2370.61
MQB1A03	-3550.81	-3550.81	0	0	0	0	0	0	-3550.81	1	-3550.81	-6807.69
MQB1A04	6699.35	6699.35	0	0	0	0	0	0	6699.35	1	6699.35	12844.14
MQB1A05	-2675.38	-2675.38	0	0	0	0	0	0	-2675.38	1	-2675.38	-5129.29

MQB1A06	2635.02	2635.02	0	0	0	0	0	0	2635.02	1	2635.02	5051.916
MQB1A07	-2687.37	-2687.37	0	0	0	0	0	0	-2687.37	1	-2687.37	-5152.28
MQB1A08	4934.09	4934.09	0	0	0	0	0	0	4934.09	1	4934.09	9459.741
MQB1A09	-2396.55	-2396.55	0	0	0	0	0	0	-2396.55	1	-2396.55	-4594.72
MQB1A11	3812.67	3812.67	0	0	0	0	0	0	3812.67	1.06	4041.43	7748.315
MQB1A13	-2839.41	-2839.41	0	0	0	0	0	0	-2839.41	1	-2839.41	-5443.78
MQB1A14	4416.18	4416.18	0	0	0	0	0	0	4416.18	1	4416.18	8466.794
MQB1A15	-2702.97	-2702.97	0	0	0	0	0	0	-2702.97	1	-2702.97	-5182.19
MQB1A16	1805.97	1805.97	0	0	0	0	0	0	1805.97	1	1805.97	3462.444
MQB1A17	-3183.94	-3183.94	0	0	0	0	0	0	-3183.94	1	-3183.94	-6104.32
MQB1A18	4242.5	4242.5	0	0	0	0	0	0	4242.5	1	4242.5	8133.811
MQB1A19	-1867.06	-1867.06	0	0	0	0	0	0	-1867.06	1	-1867.06	-3579.57
MQB1A21	2423.11	2423.11	0	0	0	0	0	0	2423.11	1.05	2544.266	4877.92
MQB1A23	-1867.07	-1867.07	0	0	0	0	0	0	-1867.07	1	-1867.07	-3579.59
MQB1A24	4242.49	4242.49	0	0	0	0	0	0	4242.49	1	4242.49	8133.792
MQB1A25	-3183.94	-3183.94	0	0	0	0	0	0	-3183.94	1	-3183.94	-6104.32
MQB1A26	1805.97	1805.97	0	0	0	0	0	0	1805.97	1	1805.97	3462.444
MQB1A27	-2702.96	-2702.96	0	0	0	0	0	0	-2702.96	1	-2702.96	-5182.17
MQB1A28	4416.18	4416.18	0	0	0	0	0	0	4416.18	1	4416.18	8466.794
MQB1A29	-2839.41	-2839.41	0	0	0	0	0	0	-2839.41	1	-2839.41	-5443.78
MQB1A31	3824.16	3824.16	0	0	0	0	0	0	3824.16	1.02	3900.643	7478.395
MQB1A33	-2396.57	-2396.57	0	0	0	0	0	0	-2396.57	1	-2396.57	-4594.75
MQB1A34	4934.06	4934.06	0	0	0	0	0	0	4934.06	1	4934.06	9459.684
MQB1A35	-2687.37	-2687.37	0	0	0	0	0	0	-2687.37	1	-2687.37	-5152.28
MQB1A36	2635.05	2635.05	0	0	0	0	0	0	2635.05	1	2635.05	5051.974
MQB1A37	-2675.38	-2675.38	0	0	0	0	0	0	-2675.38	1	-2675.38	-5129.29
MQB1A38	6699.36	6699.36	0	0	0	0	0	0	6699.36	1	6699.36	12844.15
MQB1A39	-3550.81	-3550.81	0	0	0	0	0	0	-3550.81	1	-3550.81	-6807.69
MQB1A40	881.189	881.189	0	0	0	0	0	0	881.189	1	881.189	1689.434
MQB1R01	3261.7	3261.7	0	10255.54	0	0	0	0	5312.807	1	5312.807	10185.83
MQB1R02	-5882.24	-5882.24	0	-10255.5	0	0	0	0	-7933.35	1	-7933.35	-15210
MQB1R03	3583.38	3583.38	0	10255.54	0	0	0	0	5634.487	1	5634.487	10802.56
MQB1R04	-5816.03	-5816.03	0	-10255.5	0	0	0	0	-7867.14	1	-7867.14	-15083
MQB1R05	5147.88	5147.88	0	10255.54	0	0	0	0	7198.987	1	7198.987	13802.05
MQB1R06	-4171.73	-4171.73	0	-10255.5	0	0	0	0	-6222.84	1	-6222.84	-11930.6
MQB1R07	841.241	841.241	0	10255.54	0	0	0	0	2892.348	1	2892.348	5545.271
MQB1R08	-8070.92	-8070.92	0	0	0	-8596.2	0	0	-9360.35	1	-9360.35	-17945.9
MQB1R09	5668.8	5668.8	0	0	0	8596.204	0	0	6958.23	1	6958.23	13340.47
MQB1R10	-3987.53	-3987.53	0	0	0	-8596.2	0	0	-5276.96	1	-5276.96	-10117.1
MQB2S01	-8163.87	-8163.87	0	0	-16315.4	0	0	0	-10611.2	1	-10611.2	-20344
MQC2S02	14787.4	14787.4	0	0	16315.41	0	0	0	17234.71	1	17234.71	33042.75

MQC2S03	-17392.7	-17392.7	0	0	-16315.4	0	0	0	-19840	1	-19840	-38037.7
MQC2S04	-13857.8	-13857.8	-13517.5	0	0	0	0	0	-17913.1	1	-17913.1	-34343.3
MQC2S05	10003.2	10003.2	13517.53	0	0	0	0	0	14058.46	1	14058.46	26953.17
MQC2S06	2.94E-05	2.94E-05	13517.53	0	0	0	0	0	4055.258	1	4055.258	7774.826
MQC2S07	2.94E-05	2.94E-05	13517.53	0	0	0	0	0	4055.258	1	4055.258	7774.826
MQC2S08	-3734.91	-3734.91	-13517.5	0	0	0	0	0	-7790.17	1	-7790.17	-14935.5
MQC2S09	2.94E-05	2.94E-05	13517.53	0	0	0	0	0	4055.258	1	4055.258	7774.826
MQC2S10	3725.14	3725.14	13517.53	0	0	0	0	0	7780.398	1	7780.398	14916.74
MQB2E01	-3175.17	-3175.17	0	0	0	0	0	0	-3175.17	1	-3175.17	-6087.5
MQB2E02	3410.98	3410.98	0	0	0	0	0	0	3410.98	1	3410.98	6539.602
MQB2E03	-4030.44	-4030.44	0	0	0	0	0	0	-4030.44	1	-4030.44	-7727.24
MQC2A01	4766.3	4766.3	0	0	0	0	0	0	4766.3	1	4766.3	9138.051
MQC2A02	596.926	596.926	0	0	0	0	0	0	596.926	1	596.926	1144.439
MQC2A03	-7444.3	-7444.3	0	0	0	0	0	0	-7444.3	1	-7444.3	-14272.4
MQC2A04	14629.7	14629.7	0	0	0	0	0	0	14629.7	1	14629.7	28048.37
MQC2A05	-6030.52	-6030.52	0	0	0	0	0	0	-6030.52	1	-6030.52	-11561.8
MQC2A06	6418.74	6418.74	0	0	0	0	0	0	6418.74	1	6418.74	12306.14
MQC2A07	-6131.1	-6131.1	0	0	0	0	0	0	-6131.1	1	-6131.1	-11754.7
MQC2A08	12934.4	12934.4	0	0	0	0	0	0	12934.4	1.06	13710.46	26285.99
MQC2A09	-5319.71	-5319.71	0	0	0	0	0	0	-5319.71	1	-5319.71	-10199.1
MQC2A11	6149.44	6149.44	0	0	0	0	0	0	6149.44	1	6149.44	11789.84
MQC2A13	-6863.2	-6863.2	0	0	0	0	0	0	-6863.2	1	-6863.2	-13158.3
MQC2A14	12982.8	12982.8	0	0	0	0	0	0	12982.8	1	12982.8	24890.9
MQC2A15	-4693.78	-4693.78	0	0	0	0	0	0	-4693.78	1	-4693.78	-8999.01
MQC2A16	4625.26	4625.26	0	0	0	0	0	0	4625.26	1	4625.26	8867.646
MQC2A17	-5304.65	-5304.65	0	0	0	0	0	0	-5304.65	1	-5304.65	-10170.2
MQC2A18	6626.91	6626.91	0	0	0	0	0	0	6626.91	1	6626.91	12705.25
MQC2A19	-3328.37	-3328.37	0	0	0	0	0	0	-3328.37	1	-3328.37	-6381.22
MQC2A21	3383.66	3383.66	0	0	0	0	0	0	3383.66	1.05	3552.843	6811.585
MQC2A23	-3328.37	-3328.37	0	0	0	0	0	0	-3328.37	1	-3328.37	-6381.22
MQC2A24	6626.91	6626.91	0	0	0	0	0	0	6626.91	1	6626.91	12705.25
MQC2A25	-5304.65	-5304.65	0	0	0	0	0	0	-5304.65	1	-5304.65	-10170.2
MQC2A26	4625.26	4625.26	0	0	0	0	0	0	4625.26	1	4625.26	8867.646
MQC2A27	-4693.78	-4693.78	0	0	0	0	0	0	-4693.78	1	-4693.78	-8999.01
MQC2A28	12982.8	12982.8	0	0	0	0	0	0	12982.8	1	12982.8	24890.9
MQC2A29	-6863.2	-6863.2	0	0	0	0	0	0	-6863.2	1	-6863.2	-13158.3
MQC2A31	6149.44	6149.44	0	0	0	0	0	0	6149.44	1	6149.44	11789.84
MQC2A33	-5319.71	-5319.71	0	0	0	0	0	0	-5319.71	1	-5319.71	-10199.1
MQC2A34	12940.2	12940.2	0	0	0	0	0	0	12940.2	1.02	13199	25305.41
MQC2A35	-6131.1	-6131.1	0	0	0	0	0	0	-6131.1	1	-6131.1	-11754.7
MQC2A36	6418.74	6418.74	0	0	0	0	0	0	6418.74	1	6418.74	12306.14

MQC2A37	-6030.52	-6030.52	0	0	0	0	0	0	-6030.52	1	-6030.52	-11561.8
MQC2A38	14629.7	14629.7	0	0	0	0	0	0	14629.7	1	14629.7	28048.37
MQC2A39	-7444.3	-7444.3	0	0	0	0	0	0	-7444.3	1	-7444.3	-14272.4
MQC2A40	1703.34	1703.34	0	0	0	0	0	0	1703.34	1	1703.34	3265.679
MQC2R01	12830.5	12830.5	0	19466.56	0	0	0	0	16723.81	1	16723.81	32063.24
MQC2R02	-18327	-18327	0	-19466.6	0	0	0	0	-22220.3	1	-22220.3	-42601.3
MQC2R03	22022.77	22022.77	0	19466.56	0	0	0	0	25916.08	1	25916.08	49686.86
MQC2R04	-15180	-15180	0	-19466.6	0	0	0	0	-19073.3	1	-19073.3	-36567.8
MQC2R05	11024	11024	0	19466.56	0	0	0	0	14917.31	1	14917.31	28599.78
MQC2R06	-1167.05	-1167.05	0	-19466.6	0	0	0	0	-5060.36	1	-5060.36	-9701.83
MQC2R07	-8435.36	-8435.36	0	-19466.6	0	0	0	0	-12328.7	1	-12328.7	-23636.8
MQC2R08	-17273.6	-17273.6	0	0	0	-16316.9	0	0	-19721.1	1	-19721.1	-37809.8
MQC2R09	16624.8	16624.8	0	0	0	16316.89	0	0	19072.33	1	19072.33	36565.88
MQB2R10	-8218.86	-8218.86	0	0	0	-16316.9	0	0	-10666.4	1	-10666.4	-20449.8
MQU3S01	-14119.9	-14369.9	0	0	-24035.4	0	0	0	-17975.2	1	-17975.2	-34462.4
MQU3S02	17619.4	17369.4	0	0	24035.4	0	0	0	20974.71	1	20974.71	40213.16
MQU3S03	-20335	-20585	0	0	-24035.4	0	0	0	-24190.3	1	-24190.3	-46378.2
MQU3S04	-12396.1	-12646.1	-19913.6	0	0	0	0	0	-18620.2	1	-18620.2	-35699
MQU3S05	19143.4	18893.4	19913.63	0	0	0	0	0	24867.49	1	24867.49	47676.48
MQU3S06	550.0002	300.0002	19913.63	0	0	0	0	0	6274.09	1	6274.09	12028.82
MQU3S07	-9563.6	-9813.6	-19913.6	0	0	0	0	0	-15787.7	1	-15787.7	-30268.5
MQU3S08	13623.1	13373.1	19913.63	0	0	0	0	0	19347.19	1	19347.19	37092.84
MQU3S09	-11610.1	-11860.1	-19913.6	0	0	0	0	0	-17834.2	1	-17834.2	-34192.1
MQU3S10	13218.7	12968.7	19913.63	0	0	0	0	0	18942.79	1	18942.79	36317.52
MQB3E01	-6471.16	-6471.16	0	0	0	0	0	0	-6471.16	1	-6471.16	-12406.6
MQB3E02	5933.59	5933.59	0	0	0	0	0	0	5933.59	1	5933.59	11376
MQB3E03	-5999.71	-5999.71	0	0	0	0	0	0	-5999.71	1	-5999.71	-11502.8
MQU3A01	8416.12	8166.12	0	0	0	0	0	0	8166.12	1	8166.12	15656.26
MQU3A02	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6
MQU3A03	18548.2	18298.2	0	0	0	0	0	0	18298.2	1.06	19396.09	37186.6
MQU3A04	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6
MQU3A05	8400.83	8150.83	0	0	0	0	0	0	8150.83	1	8150.83	15626.94
MQU3A06	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6
MQU3A07	18548.2	18298.2	0	0	0	0	0	0	18298.2	1.06	19396.09	37186.6
MQU3A08	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6
MQU3A09	11169.2	10919.2	0	0	0	0	0	0	10919.2	1	10919.2	20934.52
MQU3A10	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6
MQU3A11	18548.2	18298.2	0	0	0	0	0	0	18298.2	1.06	19396.09	37186.6
MQU3A12	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6
MQU3A13	8400.83	8150.83	0	0	0	0	0	0	8150.83	1	8150.83	15626.94
MQU3A14	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6

MQU3A15	18548.2	18298.2	0	0	0	0	0	0	18298.2	1.06	19396.09	37186.6
MQU3A16	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6
MQU3A17	11169.2	10919.2	0	0	0	0	0	0	10919.2	1	10919.2	20934.52
MQU3A18	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6
MQU3A19	18548.2	18298.2	0	0	0	0	0	0	18298.2	1.06	19396.09	37186.6
MQU3A20	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6
MQU3A21	8400.83	8150.83	0	0	0	0	0	0	8150.83	1	8150.83	15626.94
MQU3A22	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6
MQU3A23	18548.2	18298.2	0	0	0	0	0	0	18298.2	1.06	19396.09	37186.6
MQU3A24	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6
MQU3A25	11169.2	10919.2	0	0	0	0	0	0	10919.2	1	10919.2	20934.52
MQU3A26	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6
MQU3A27	18548.2	18298.2	0	0	0	0	0	0	18298.2	1.06	19396.09	37186.6
MQU3A28	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6
MQU3A29	8400.83	8150.83	0	0	0	0	0	0	8150.83	1	8150.83	15626.94
MQU3A30	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6
MQU3A31	18548.2	18298.2	0	0	0	0	0	0	18298.2	1.06	19396.09	37186.6
MQU3A32	-9730.4	-9980.4	0	0	0	0	0	0	-9980.4	1	-9980.4	-19134.6
MQU3R01	18018.3	17768.3	0	28677.58	0	0	0	0	23503.82	1	23503.82	45062.01
MQU3R02	-22535.4	-22785.4	0	-28677.6	0	0	0	0	-28520.9	1	-28520.9	-54680.9
MQU3R03	22087.3	21837.3	0	28677.58	0	0	0	0	27572.82	1	27572.82	52863.19
MQU3R04	-12357.6	-12607.6	0	-28677.6	0	0	0	0	-18343.1	1	-18343.1	-35167.8
MQU3R05	-9207.22	-9457.22	0	-28677.6	0	0	0	0	-15192.7	1	-15192.7	-29127.8
MQU3R06	23119.7	22869.7	0	28677.58	0	0	0	0	28605.21	1	28605.21	54842.52
MQU3R07	-11927.5	-12177.5	0	-28677.6	0	0	0	0	-17913	1	-17913	-34343.2
MQU3R08	-19921.7	-20171.7	0	0	0	-24037.6	0	0	-23777.3	1	-23777.3	-45586.4
MQU3R09	16340.2	16090.2	0	0	0	24037.58	0	0	19695.84	1	19695.84	37761.27
MQU3R10	-14460.5	-14710.5	0	0	0	-24037.6	0	0	-18316.1	1	-18316.1	-35116.1
MQA4S01	-17812	-18162	0	0	-31755.4	0	0	0	-22925.3	1	-22925.3	-43952.9
MQA4S02	28275.9	27925.9	0	0	31755.38	0	0	0	32689.21	1	32689.21	62672.44
MQA4S03	-35019.7	-35369.7	0	0	-31755.4	0	0	0	-40133	1	-40133	-76943.8
MQA4S04	-16777.6	-17127.6	-26309.7	0	0	0	0	0	-25020.5	1	-25020.5	-47969.9
MQA4S05	29311.9	28961.9	26309.74	0	0	0	0	0	36854.82	1	36854.82	70658.85
MQA4S06	-14922.9	-15272.9	-26309.7	0	0	0	0	0	-23165.8	1	-23165.8	-44414
MQA4S07	-0.00026	-350	-26309.7	0	0	0	0	0	-8242.92	1	-8242.92	-15803.5
MQA4S08	-4074.48	-4424.48	-26309.7	0	0	0	0	0	-12317.4	1	-12317.4	-23615.2
MQA4S09	-0.00026	-350	-26309.7	0	0	0	0	0	-8242.92	1	-8242.92	-15803.5
MQA4S10	6895.86	6545.86	26309.74	0	0	0	0	0	14438.78	1	14438.78	27682.34
MQB4E01	-5391.32	-5391.32	0	0	0	0	0	0	-5391.32	1	-5391.32	-10336.4
MQB4E02	6896.04	6896.04	0	0	0	0	0	0	6896.04	1	6896.04	13221.23
MQB4E03	-7771.45	-7771.45	0	0	0	0	0	0	-7771.45	1	-7771.45	-14899.6

MQU4A01	10813.8	10563.8	0	0	0	0	0	0	10563.8	1	10563.8	20253.14
MQU4A02	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQU4A03	23197.3	22947.3	0	0	0	0	0	0	22947.3	1.06	24324.14	46634.75
MQU4A04	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQU4A05	11277.7	11027.7	0	0	0	0	0	0	11027.7	1	11027.7	21142.54
MQU4A06	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQU4A07	23197.3	22947.3	0	0	0	0	0	0	22947.3	1.06	24324.14	46634.75
MQU4A08	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQU4A09	14669.6	14419.6	0	0	0	0	0	0	14419.6	1	14419.6	27645.56
MQU4A10	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQU4A11	23197.3	22947.3	0	0	0	0	0	0	22947.3	1.06	24324.14	46634.75
MQU4A12	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQU4A13	11277.7	11027.7	0	0	0	0	0	0	11027.7	1	11027.7	21142.54
MQU4A14	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQU4A15	23197.3	22947.3	0	0	0	0	0	0	22947.3	1.06	24324.14	46634.75
MQU4A16	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQU4A17	14669.6	14419.6	0	0	0	0	0	0	14419.6	1	14419.6	27645.56
MQU4A18	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQU4A19	23197.3	22947.3	0	0	0	0	0	0	22947.3	1.06	24324.14	46634.75
MQU4A20	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQU4A21	11277.7	11027.7	0	0	0	0	0	0	11027.7	1	11027.7	21142.54
MQU4A22	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQU4A23	23305.3	23055.3	0	0	0	0	0	0	23055.3	1.06	24438.62	46854.24
MQU4A24	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQU4A25	14669.6	14419.6	0	0	0	0	0	0	14419.6	1	14419.6	27645.56
MQU4A26	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQU4A27	23209.5	22959.5	0	0	0	0	0	0	22959.5	1.06	24337.07	46659.54
MQU4A28	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQU4A29	11277.7	11027.7	0	0	0	0	0	0	11027.7	1	11027.7	21142.54
MQU4A30	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQU4A31	23197.1	22947.1	0	0	0	0	0	0	22947.1	1.06	24323.93	46634.34
MQU4A32	-13051.1	-13301.1	0	0	0	0	0	0	-13301.1	1	-13301.1	-25501.1
MQA4R01	28717.1	28367.1	0	37888.6	0	0	0	0	35944.82	1	35944.82	68914.17
MQA4R02	-39347.3	-39697.3	0	-37888.6	0	0	0	0	-47275	1	-47275	-90636.7
MQA4R03	51167.4	50817.4	0	37888.6	0	0	0	0	58395.12	1	58395.12	111956.4
MQA4R04	-52920	-53270	0	-37888.6	0	0	0	0	-60847.7	1	-60847.7	-116659
MQA4R05	21.30075	-328.699	0	-37888.6	0	0	0	0	-7906.42	1	-7906.42	-15158.4
MQA4R06	36486.9	36136.9	0	37888.6	0	0	0	0	43714.62	1	43714.62	83810.59
MQA4R07	-36024.7	-36374.7	0	-37888.6	0	0	0	0	-43952.4	1	-43952.4	-84266.5
MQA4R08	-34944.1	-35294.1	0	0	0	-31758.3	0	0	-40057.8	1	-40057.8	-76799.7
MQA4R09	25241.7	24891.7	0	0	0	31758.27	0	0	29655.44	1	29655.44	56856.04

MQA4R10	-17203.8	-17553.8	0	0	0	-31758.3	0	0	-22317.5	1	-22317.5	-42787.7
MQA5S01	-16479.2	-16829.2	0	0	-39475.4	0	0	0	-22750.5	1	-22750.5	-43617.7
MQA5S02	29410.1	29060.1	0	0	39475.37	0	0	0	34981.4	1	34981.4	67067.09
MQA5S03	-39319.8	-39669.8	0	0	-39475.4	0	0	0	-45591.1	1	-45591.1	-87408.2
MQA5S04	-21038	-21388	-32705.8	0	0	0	0	0	-31199.8	1	-31199.8	-59816.8
MQA5S05	31189.9	30839.9	32705.85	0	0	0	0	0	40651.66	1	40651.66	77938.21
MQA5S06	-10446.2	-10796.2	-32705.8	0	0	0	0	0	-20608	1	-20608	-39510
MQA5S07	-7779.28	-8129.28	-32705.8	0	0	0	0	0	-17941	1	-17941	-34396.9
MQA5S08	5949.4	5599.4	32705.85	0	0	0	0	0	15411.15	1	15411.15	29546.59
MQA5S09	-20253	-20603	-32705.8	0	0	0	0	0	-30414.8	1	-30414.8	-58311.8
MQA5S10	19545.1	19195.1	32705.85	0	0	0	0	0	29006.85	1	29006.85	55612.55
MQB5E01	-9662.92	-9662.92	0	0	0	0	0	0	-9662.92	1	-9662.92	-18526
MQB5E02	10281.5	10281.5	0	0	0	0	0	0	10281.5	1	10281.5	19711.91
MQB5E03	-9482.07	-9482.07	0	0	0	0	0	0	-9482.07	1	-9482.07	-18179.2
MQA5A01	14127.3	13777.3	0	0	0	0	0	0	13777.3	1	13777.3	26414.13
MQA5A02	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5A03	30932.4	30582.4	0	0	0	0	0	0	30582.4	1.06	32417.34	62151.22
MQA5A04	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5A05	13834.4	13484.4	0	0	0	0	0	0	13484.4	1	13484.4	25852.58
MQA5A06	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5A07	30932.4	30582.4	0	0	0	0	0	0	30582.4	1.06	32417.34	62151.22
MQA5A08	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5A09	17571.2	17221.2	0	0	0	0	0	0	17221.2	1	17221.2	33016.85
MQA5A10	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5A11	30932.4	30582.4	0	0	0	0	0	0	30582.4	1.06	32417.34	62151.22
MQA5A12	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5A13	13834.4	13484.4	0	0	0	0	0	0	13484.4	1	13484.4	25852.58
MQA5A14	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5A15	30932.4	30582.4	0	0	0	0	0	0	30582.4	1.06	32417.34	62151.22
MQA5A16	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5A17	17571.2	17221.2	0	0	0	0	0	0	17221.2	1	17221.2	33016.85
MQA5A18	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5A19	30932.4	30582.4	0	0	0	0	0	0	30582.4	1.06	32417.34	62151.22
MQA5A20	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5A21	13834.4	13484.4	0	0	0	0	0	0	13484.4	1	13484.4	25852.58
MQA5A22	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5A23	31245.8	30895.8	0	0	0	0	0	0	30895.8	1.06	32749.55	62788.13
MQA5A24	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5A25	17571.2	17221.2	0	0	0	0	0	0	17221.2	1	17221.2	33016.85
MQA5A26	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5A27	30692.9	30342.9	0	0	0	0	0	0	30342.9	1.06	32163.47	61664.49

MQA5A28	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5A29	13834.5	13484.5	0	0	0	0	0	0	13484.5	1	13484.5	25852.77
MQA5A30	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5A31	30702.9	30352.9	0	0	0	0	0	0	30352.9	1.06	32174.08	61684.82
MQA5A32	-16740.9	-17090.9	0	0	0	0	0	0	-17090.9	1	-17090.9	-32767
MQA5R01	19724.9	19374.9	0	47099.62	0	0	0	0	28794.82	1	28794.82	55206.04
MQA5R02	-44584.4	-44934.4	0	-47099.6	0	0	0	0	-54354.3	1	-54354.3	-104209
MQA5R03	34378.8	34028.8	0	47099.62	0	0	0	0	43448.72	1	43448.72	83300.81
MQA5R04	-36071.2	-36421.2	0	-47099.6	0	0	0	0	-45841.1	1	-45841.1	-87887.6
MQA5R05	38544.4	38194.4	0	47099.62	0	0	0	0	47614.32	1	47614.32	91287.18
MQA5R06	22568.6	22218.6	0	47099.62	0	0	0	0	31638.52	1	31638.52	60658.04
MQA5R07	-25071.5	-25421.5	0	-47099.6	0	0	0	0	-34841.4	1	-34841.4	-66798.7
MQA5R08	-41354	-41704	0	0	0	-39479	0	0	-47625.8	1	-47625.8	-91309.3
MQA5R09	30174.6	29824.6	0	0	0	39478.96	0	0	35746.45	1	35746.45	68533.84
MQA5R10	-16167.8	-16517.8	0	0	0	-39479	0	0	-22439.6	1	-22439.6	-43021.8
MQA6S01	-23491.7	-23841.7	0	0	-47195.4	0	0	0	-30921	1	-30921	-59282.4
MQA6S02	40595.1	40245.1	0	0	47195.36	0	0	0	47324.4	1	47324.4	90731.35
MQA6S03	-57181.4	-57531.4	0	0	-47195.4	0	0	0	-64610.7	1	-64610.7	-123873
MQA6S04	-25830.1	-26180.1	-39102	0	0	0	0	0	-37910.7	1	-37910.7	-72683.2
MQA6S05	37715.6	37365.6	39101.96	0	0	0	0	0	49096.19	1	49096.19	94128.25
MQA6S06	-17880.9	-18230.9	-39102	0	0	0	0	0	-29961.5	1	-29961.5	-57442.8
MQA6S07	-0.00026	-350	-39102	0	0	0	0	0	-12080.6	1	-12080.6	-23161.2
MQA6S08	-9065.14	-9415.14	-39102	0	0	0	0	0	-21145.7	1	-21145.7	-40541
MQA6S09	-0.00026	-350	-39102	0	0	0	0	0	-12080.6	1	-12080.6	-23161.2
MQA6S10	11777.3	11427.3	39101.96	0	0	0	0	0	23157.89	1	23157.89	44398.79
MQC6E01	-10062.7	-10062.7	0	0	0	0	0	0	-10062.7	1	-10062.7	-19292.4
MQC6E02	11052.4	11052.4	0	0	0	0	0	0	11052.4	1	11052.4	21189.9
MQC6E03	-11457.5	-11457.5	0	0	0	0	0	0	-11457.5	1	-11457.5	-21966.6
MQA6A01	16635.1	16285.1	0	0	0	0	0	0	16285.1	1	16285.1	31222.14
MQA6A02	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6A03	35370.8	35020.8	0	0	0	0	0	0	35020.8	1.06	37122.05	71171.18
MQA6A04	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6A05	16605.5	16255.5	0	0	0	0	0	0	16255.5	1	16255.5	31165.39
MQA6A06	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6A07	35370.8	35020.8	0	0	0	0	0	0	35020.8	1.06	37122.05	71171.18
MQA6A08	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6A09	20958.1	20608.1	0	0	0	0	0	0	20608.1	1	20608.1	39510.28
MQA6A10	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6A11	35370.8	35020.8	0	0	0	0	0	0	35020.8	1.06	37122.05	71171.18
MQA6A12	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6A13	16605.5	16255.5	0	0	0	0	0	0	16255.5	1	16255.5	31165.39

MQA6A14	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6A15	35370.8	35020.8	0	0	0	0	0	0	35020.8	1.06	37122.05	71171.18
MQA6A16	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6A17	20958.1	20608.1	0	0	0	0	0	0	20608.1	1	20608.1	39510.28
MQA6A18	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6A19	35370.8	35020.8	0	0	0	0	0	0	35020.8	1.06	37122.05	71171.18
MQA6A20	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6A21	16605.5	16255.5	0	0	0	0	0	0	16255.5	1	16255.5	31165.39
MQA6A22	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6A23	35370.9	35020.9	0	0	0	0	0	0	35020.9	1.06	37122.15	71171.37
MQA6A24	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6A25	20958.1	20608.1	0	0	0	0	0	0	20608.1	1	20608.1	39510.28
MQA6A26	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6A27	35371.1	35021.1	0	0	0	0	0	0	35021.1	1.06	37122.37	71171.79
MQA6A28	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6A29	16605.5	16255.5	0	0	0	0	0	0	16255.5	1	16255.5	31165.39
MQA6A30	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6A31	35370.9	35020.9	0	0	0	0	0	0	35020.9	1.06	37122.15	71171.37
MQA6A32	-19636.8	-19986.8	0	0	0	0	0	0	-19986.8	1	-19986.8	-38319.1
MQA6R01	30275.5	29925.5	0	56310.64	0	0	0	0	41187.63	1	41187.63	78965.79
MQA6R02	-41027.7	-41377.7	0	-56310.6	0	0	0	0	-52639.8	1	-52639.8	-100922
MQA6R03	40132.2	39782.2	0	56310.64	0	0	0	0	51044.33	1	51044.33	97863.26
MQA6R04	-61484.6	-61834.6	0	-56310.6	0	0	0	0	-73096.7	1	-73096.7	-140143
MQA6R05	59909.8	59559.8	0	56310.64	0	0	0	0	70821.93	1	70821.93	135781.3
MQA6R06	-2713.44	-3063.44	0	-56310.6	0	0	0	0	-14325.6	1	-14325.6	-27465.3
MQA6R07	-37844.4	-38194.4	0	-56310.6	0	0	0	0	-49456.5	1	-49456.5	-94819.1
MQA6R08	-56802.3	-57152.3	0	0	0	-47199.7	0	0	-64232.2	1	-64232.2	-123147
MQA6R09	43169.3	42819.3	0	0	0	47199.65	0	0	49899.25	1	49899.25	95667.89
MQA6R10	-24080.1	-24430.1	0	0	0	-47199.7	0	0	-31510	1	-31510	-60411.7
MQA7S01	-28903.7	-29253.7	0	0	-54915.3	0	0	0	-37491	1	-37491	-71878.5
MQA7S02	40946.3	40596.3	0	0	54915.34	0	0	0	48833.6	1	48833.6	93624.81
MQA7S03	-44289.6	-44639.6	0	0	-54915.3	0	0	0	-52876.9	1	-52876.9	-101377
MQA7S04	-20954.6	-21304.6	-45498.1	0	0	0	0	0	-34954	1	-34954	-67014.6
MQA7S05	51528.8	51178.8	45498.07	0	0	0	0	0	64828.22	1	64828.22	124290
MQA7S06	-19327.5	-19677.5	-45498.1	0	0	0	0	0	-33326.9	1	-33326.9	-63895.1
MQA7S07	199.9998	-150	-45498.1	0	0	0	0	0	-13799.4	1	-13799.4	-26456.5
MQA7S08	199.9998	-150	-45498.1	0	0	0	0	0	-13799.4	1	-13799.4	-26456.5
MQA7S09	-19385.3	-19735.3	-45498.1	0	0	0	0	0	-33384.7	1	-33384.7	-64005.9
MQA7S10	24028.4	23678.4	45498.07	0	0	0	0	0	37327.82	1	37327.82	71565.68
MQC7E01	-14041	-14041	0	0	0	0	0	0	-14041	1	-14041	-26919.7
MQC7E02	12512.3	12512.3	0	0	0	0	0	0	12512.3	1	12512.3	23988.85

MQC7E03	-13599.5	-13599.5	0	0	0	0	0	0	-13599.5	1	-13599.5	-26073.2
MQA7A01	16408.3	16058.3	0	0	0	0	0	0	16058.3	1	16058.3	30787.31
MQA7A02	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7A03	44077.8	43727.8	0	0	0	0	0	0	43727.8	1.06	46351.46	88866.01
MQA7A04	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7A05	18713.6	18363.6	0	0	0	0	0	0	18363.6	1	18363.6	35207.08
MQA7A06	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7A07	44077.8	43727.8	0	0	0	0	0	0	43727.8	1.06	46351.46	88866.01
MQA7A08	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7A09	23337.6	22987.6	0	0	0	0	0	0	22987.6	1	22987.6	44072.32
MQA7A10	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7A11	44077.8	43727.8	0	0	0	0	0	0	43727.8	1.06	46351.46	88866.01
MQA7A12	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7A13	18713.6	18363.6	0	0	0	0	0	0	18363.6	1	18363.6	35207.08
MQA7A14	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7A15	44077.8	43727.8	0	0	0	0	0	0	43727.8	1.06	46351.46	88866.01
MQA7A16	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7A17	23337.6	22987.6	0	0	0	0	0	0	22987.6	1	22987.6	44072.32
MQA7A18	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7A19	44077.8	43727.8	0	0	0	0	0	0	43727.8	1.06	46351.46	88866.01
MQA7A20	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7A21	18713.6	18363.6	0	0	0	0	0	0	18363.6	1	18363.6	35207.08
MQA7A22	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7A23	45077.8	44727.8	0	0	0	0	0	0	44727.8	1.06	47411.47	90898.27
MQA7A24	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7A25	23337.6	22987.6	0	0	0	0	0	0	22987.6	1	22987.6	44072.31
MQA7A26	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7A27	44077.8	43727.8	0	0	0	0	0	0	43727.8	1.06	46351.46	88866.01
MQA7A28	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7A29	18713.6	18363.6	0	0	0	0	0	0	18363.6	1	18363.6	35207.08
MQA7A30	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7A31	44577.8	44227.8	0	0	0	0	0	0	44227.8	1.06	46881.47	89882.14
MQA7A32	-23884	-24234	0	0	0	0	0	0	-24234	1	-24234	-46461.9
MQA7R01	40699.8	40349.8	0	65521.66	0	0	0	0	53454.13	1	53454.13	102483.4
MQA7R02	-43970.3	-44320.3	0	-65521.7	0	0	0	0	-57424.6	1	-57424.6	-110096
MQA7R03	67852.7	67502.7	0	65521.66	0	0	0	0	80607.03	1	80607.03	154541.5
MQA7R04	-61803.5	-62153.5	0	-65521.7	0	0	0	0	-75257.8	1	-75257.8	-144286
MQA7R05	50447.39	50097.39	0	65521.66	0	0	0	0	63201.72	1	63201.72	121171.7
MQA7R06	199.999	-150.001	0	-65521.7	0	0	0	0	-13254.3	1	-13254.3	-25411.5
MQA7R07	-36283.8	-36633.8	0	-65521.7	0	0	0	0	-49738.1	1	-49738.1	-95359
MQA7R08	-45011.4	-45361.4	0	0	0	-54920.3	0	0	-53599.4	1	-53599.4	-102762

MQA7R09	41395.2	41045.2	0	0	0	54920.34	0	0	49283.25	1	49283.25	94486.89
MQA7R10	-29028.8	-29378.8	0	0	0	-54920.3	0	0	-37616.9	1	-37616.9	-72119.8
MQA8S01	-38715.2	-39065.2	0	0	-62635.3	0	0	0	-48460.5	1	-48460.5	-92909.5
MQA8S02	53910.4	53560.4	0	0	62635.33	0	0	0	62955.7	1	62955.7	120700
MQA8S03	-59047.4	-59397.4	0	0	-62635.3	0	0	0	-68792.7	1	-68792.7	-131891
MQA8S04	-33060.3	-33410.3	-51894.2	0	0	0	0	0	-48978.6	1	-48978.6	-93902.7
MQA8S05A	40188.7	39838.7	51894.17	0	0	0	0	0	55406.95	1	55406.95	106227.4
MQA8S05B	40188.7	39838.7	51894.17	0	0	0	0	0	55406.95	1	55406.95	106227.4
MQA8S06	-34116.7	-34466.7	-51894.2	0	0	0	0	0	-50035	1	-50035	-95928.1
MQA8S07	-0.00026	-350	-51894.2	0	0	0	0	0	-15918.3	1	-15918.3	-30518.8
MQA8S08	-0.00026	-350	-51894.2	0	0	0	0	0	-15918.3	1	-15918.3	-30518.8
MQA8S09	-24500.8	-24850.8	-51894.2	0	0	0	0	0	-40419.1	1	-40419.1	-77492.3
MQA8S10	30521.5	30171.5	51894.17	0	0	0	0	0	45739.75	1	45739.75	87693.22
MQC8E01	-17145.6	-17145.6	0	0	0	0	0	0	-17145.6	1	-17145.6	-32871.9
MQC8E02	16210.5	16210.5	0	0	0	0	0	0	16210.5	1	16210.5	31079.11
MQC8E03	-15357.6	-15357.6	0	0	0	0	0	0	-15357.6	1	-15357.6	-29443.9
MQA8A01	21933	21583	0	0	0	0	0	0	21583	1	21583	41379.38
MQA8A02	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8A03	47114.8	46764.8	0	0	0	0	0	0	46764.8	1.06	49570.69	95037.97
MQA8A04	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8A05	21402.7	21052.7	0	0	0	0	0	0	21052.7	1	21052.7	40362.68
MQA8A06	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8A07	47114.7	46764.7	0	0	0	0	0	0	46764.7	1.06	49570.58	95037.76
MQA8A08	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8A09	27280.3	26930.3	0	0	0	0	0	0	26930.3	1	26930.3	51631.34
MQA8A10	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8A11	47114.7	46764.7	0	0	0	0	0	0	46764.7	1.06	49570.58	95037.76
MQA8A12	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8A13	21402.7	21052.7	0	0	0	0	0	0	21052.7	1	21052.7	40362.68
MQA8A14	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8A15	47114.7	46764.7	0	0	0	0	0	0	46764.7	1.06	49570.58	95037.76
MQA8A16	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8A17	27280.3	26930.3	0	0	0	0	0	0	26930.3	1	26930.3	51631.34
MQA8A18	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8A19	47114.7	46764.7	0	0	0	0	0	0	46764.7	1.06	49570.58	95037.76
MQA8A20	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8A21	21402.7	21052.7	0	0	0	0	0	0	21052.7	1	21052.7	40362.68
MQA8A22	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8A23	47038.3	46688.3	0	0	0	0	0	0	46688.3	1.06	49489.59	94882.5
MQA8A24	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8A25	27280.3	26930.3	0	0	0	0	0	0	26930.3	1	26930.3	51631.34

MQA8A26	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8A27	47114.7	46764.7	0	0	0	0	0	0	46764.7	1.06	49570.58	95037.76
MQA8A28	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8A29	21402.7	21052.7	0	0	0	0	0	0	21052.7	1	21052.7	40362.68
MQA8A30	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8A31	47114.8	46764.8	0	0	0	0	0	0	46764.8	1.06	49570.69	95037.97
MQA8A32	-26601.8	-26951.8	0	0	0	0	0	0	-26951.8	1	-26951.8	-51672.6
MQA8R01	39641.6	39291.6	0	74732.68	0	0	0	0	54238.14	1	54238.14	103986.5
MQA8R02	-59302.3	-59652.3	0	-74732.7	0	0	0	0	-74598.8	1	-74598.8	-143022
MQA8R03	45102.1	44752.1	0	74732.68	0	0	0	0	59698.64	1	59698.64	114455.5
MQA8R04A	-49646.8	-49996.8	0	-74732.7	0	0	0	0	-64943.3	1	-64943.3	-124511
MQA8R04B	-51151.8	-51501.8	0	-74732.7	0	0	0	0	-66448.3	1	-66448.3	-127396
MQA8R05A	37143.8	36793.8	0	74732.68	0	0	0	0	51740.34	1	51740.34	99197.66
MQA8R05B	37373.5	37023.5	0	74732.68	0	0	0	0	51970.04	1	51970.04	99638.05
MQA8R06	7083.25	6733.25	0	74732.68	0	0	0	0	21679.79	1	21679.79	41564.94
MQA8R07	-44638.9	-44988.9	0	-74732.7	0	0	0	0	-59935.4	1	-59935.4	-114909
MQA8R08	-58862	-59212	0	0	0	-62641	0	0	-68608.2	1	-68608.2	-131537
MQA8R09	53224.2	52874.2	0	0	0	62641.03	0	0	62270.35	1	62270.35	119386
MQA8R10	-40511.8	-40861.8	0	0	0	-62641	0	0	-50258	1	-50258	-96355.6
MQA9S02	-13585.5	-13935.5	0	0	-22358.5	0	0	0	-17289.3	1	-17289.3	-33147.4
MQA9S03	22358.5	22008.5	0	0	22358.5	0	0	0	25362.28	1	25362.28	48625.09
MQA9S04	-0.00026	-350	-25642.3	0	0	0	0	0	-8042.69	1	-8042.69	-15419.6
MQA9S05	-15035.3	-15385.3	-25642.3	0	0	0	0	0	-23078	1	-23078	-44245.6
MQA9S06	21318.8	20968.8	25642.3	0	0	0	0	0	28661.49	1	28661.49	54950.42
MQA9S07	-21318.8	-21668.8	-25642.3	0	0	0	0	0	-29361.5	1	-29361.5	-56292.5
MQA9S08	25642.3	25292.3	25642.3	0	0	0	0	0	32984.99	1	32984.99	63239.53
MQC9E01	-18693.3	-18693.3	0	0	0	0	0	0	-18693.3	1	-18693.3	-35839.2
MQC9E02	18693.3	18693.3	0	0	0	0	0	0	18693.3	1	18693.3	35839.19
MQC9E03	-17414.3	-17414.3	0	0	0	0	0	0	-17414.3	1	-17414.3	-33387.1
MQA9A01	24613.4	24263.4	0	0	0	0	0	0	24263.4	1	24263.4	46518.3
MQA9A02	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8
MQA9A03	56199.1	55849.1	0	0	0	0	0	0	55849.1	1.06	59200.05	113499.6
MQA9A04	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8
MQA9A05	24370.1	24020.1	0	0	0	0	0	0	24020.1	1	24020.1	46051.84
MQA9A06	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8
MQA9A07	56199.1	55849.1	0	0	0	0	0	0	55849.1	1.06	59200.05	113499.6
MQA9A08	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8
MQA9A09	30214.4	29864.4	0	0	0	0	0	0	29864.4	1	29864.4	57256.66
MQA9A10	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8
MQA9A11	56199.1	55849.1	0	0	0	0	0	0	55849.1	1.06	59200.05	113499.6
MQA9A12	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8

MQA9A13	24370.1	24020.1	0	0	0	0	0	0	24020.1	1	24020.1	46051.84
MQA9A14	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8
MQA9A15	56199.3	55849.3	0	0	0	0	0	0	55849.3	1.06	59200.26	113500
MQA9A16	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8
MQA9A17	30214.4	29864.4	0	0	0	0	0	0	29864.4	1	29864.4	57256.66
MQA9A18	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8
MQA9A19	56199.1	55849.1	0	0	0	0	0	0	55849.1	1.06	59200.05	113499.6
MQA9A20	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8
MQA9A21	24370.1	24020.1	0	0	0	0	0	0	24020.1	1	24020.1	46051.84
MQA9A22	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8
MQA9A23	56299.2	55949.2	0	0	0	0	0	0	55949.2	1.06	59306.15	113703
MQA9A24	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8
MQA9A25	30214.4	29864.4	0	0	0	0	0	0	29864.4	1	29864.4	57256.66
MQA9A26	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8
MQA9A27	56199.3	55849.3	0	0	0	0	0	0	55849.3	1.06	59200.26	113500
MQA9A28	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8
MQA9A29	24370.1	24020.1	0	0	0	0	0	0	24020.1	1	24020.1	46051.84
MQA9A30	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8
MQA9A31	56949.3	56599.3	0	0	0	0	0	0	56599.3	1.06	59995.26	115024.2
MQA9A32	-30481.5	-30831.5	0	0	0	0	0	0	-30831.5	1	-30831.5	-59110.8
MQA9R01	36139.5	35789.5	0	39647	0	0	0	0	43718.9	1	43718.9	83818.8
MQA9R02	-39647	-39997	0	-39647	0	0	0	0	-47926.4	1	-47926.4	-91885.5
MQA9R03	7781.88	7431.88	0	39647	0	0	0	0	15361.28	1	15361.28	29450.97
MQA9R04	-7421.13	-7771.13	0	-39647	0	0	0	0	-15700.5	1	-15700.5	-30101.4
MQA9R05	749.3271	399.3271	0	39647	0	0	0	0	8328.727	1	8328.727	15968.01
MQA9R06	23844.2	23494.2	0	0	0	23844.2	0	0	27070.83	1	27070.83	51900.77
MQA9R07	-21479.8	-21829.8	0	0	0	-23844.2	0	0	-25406.4	1	-25406.4	-48709.7
MQAAT01	-9220.46	-9570.46	-18352	0	0	0	0	0	-15076.1	1	-15076.1	-28904.1
MQAAT02	6062.64	5712.64	18352	0	0	0	0	0	11218.24	1	11218.24	21507.85
MQAAT03	-2927.01	-3277.01	-18352	0	0	0	0	0	-8782.61	1	-8782.61	-16838.2
MQAAT04	7961.78	7611.78	18352	0	0	0	0	0	13117.38	1	13117.38	25148.92
MQAAT05	-8100.76	-8450.76	-18352	0	0	0	0	0	-13956.4	1	-13956.4	-26757.4
MQCAT06	7811.83	7811.83	18352	0	0	0	0	0	13317.43	1	13317.43	25532.46
MQCAT07	-18352	-18352	-18352	0	0	0	0	0	-23857.6	1	-23857.6	-45740.3
MQCAT08	16839.9	16839.9	18352	0	0	0	0	0	22345.5	1	22345.5	42841.27
MQA1C01	37890.43	37540.43	0	0	0	0	73220.4	0	52184.51	1	52184.51	100049.3
MQA1C02	-61755.4	-62105.4	0	0	0	0	-73220.4	0	-76749.5	1	-76749.5	-147146
MQA1C03	38740.82	38390.82	0	0	0	0	73220.4	0	53034.9	1	53034.9	101679.6
MQA1C04	46367.13	46017.13	0	0	0	0	73220.4	0	60661.21	1	60661.21	116301
MQA1C05	-26192.8	-26542.8	0	0	0	0	-73220.4	0	-41186.9	1	-41186.9	-78964.3
MQA1C06	3141.169	2791.169	0	0	0	0	0	0	2791.169	1	2791.169	5351.288

MQA1C07	-17542.8	-17892.8	0	0	0	0	0	0	-17892.8	1	-17892.8	-34304.5
MQA1C08	26302.76	25952.76	0	0	0	0	0	0	25952.76	1	25952.76	49757.18
MQA1C09	-0.00026	-350	0	0	0	0	0	0	-350	1	-350	-671.028
MQA1C10	-0.00026	-350	0	0	0	0	0	0	-350	1	-350	-671.028
MQA1C11	-23451.8	-23801.8	0	0	0	0	0	0	-23801.8	1	-23801.8	-45633.3
MQA1C12	47034.83	46684.83	0	0	0	0	0	0	46684.83	1	46684.83	89505.15
MQA1C13	-20510.4	-20860.4	0	0	0	0	0	0	-20860.4	1	-20860.4	-39994
MQA1C14	-0.00026	-350	0	0	0	0	0	0	-350	1	-350	-671.028
MQA1C15	-0.00026	-350	0	0	0	0	0	0	-350	1	-350	-671.028
MQA1C16	25762.75	25412.75	0	0	0	0	0	0	25412.75	1	25412.75	48721.87
MQA1C17	-15871.1	-16221.1	0	0	0	0	0	0	-16221.1	1	-16221.1	-31099.5
MQA1C18	16063.87	15713.87	0	0	0	0	0	0	15713.87	1	15713.87	30126.96
MQA1C19	-58063.7	-58413.7	0	0	0	0	0	0	-58413.7	1	-58413.7	-111992
MQA1C20	31088.94	30738.94	0	0	0	0	0	0	30738.94	1	30738.94	58933.35
MQA1H01	0	-350	0	0	0	0	0	0	-350	1	-350	-671.027
MQM1H02	33922.39	33922.39	0	0	0	0	0	0	33922.39	1	33922.39	65036.73
MQO1H03	0	0	0	0	0	0	0	0	0	1	0	0
MQO1H03A	-34091.5	-34091.5	0	0	0	0	0	0	-34091.5	1	-34091.5	-65361
MQA1H04	3787.3	3437.3	0	0	0	0	0	0	3437.3	1	3437.3	6590.064
MQA1H04A	-0.00026	-350	0	0	0	0	0	0	-350	1	-350	-671.028
MQA2C01	-10582.4	-10932.4	0	0	0	0	-73220.4	0	-25576.5	1	-25576.5	-49035.8
MQA2C02	23127.14	22777.14	0	0	0	0	73220.4	0	37421.22	1	37421.22	71744.76
MQA2C03	-40266	-40616	0	0	0	0	-73220.4	0	-55260.1	1	-55260.1	-105946
MQA2C04	28470.09	28120.09	0	0	0	0	73220.4	0	42764.17	1	42764.17	81988.38
MQA2C05	-73220.4	-73570.4	0	0	0	0	-73220.4	0	-88214.5	1	-88214.5	-169127
MQA2C06	80159.7	79809.7	0	0	0	0	0	0	79809.7	1	79809.7	153012.8
MQA2C07	-78745.8	-79095.8	0	0	0	0	0	0	-79095.8	1	-79095.8	-151644
MQA2C08	80159.7	79809.7	0	0	0	0	0	0	79809.7	1	79809.7	153012.8
MQA2C09	-78745.8	-79095.8	0	0	0	0	0	0	-79095.8	1	-79095.8	-151644
MQA2C10	80159.7	79809.7	0	0	0	0	0	0	79809.7	1	79809.7	153012.8
MQA2C11	-78745.8	-79095.8	0	0	0	0	0	0	-79095.8	1	-79095.8	-151644
MQA2C12	80159.7	79809.7	0	0	0	0	0	0	79809.7	1	79809.7	153012.8
MQA2C13	-78745.8	-79095.8	0	0	0	0	0	0	-79095.8	1	-79095.8	-151644
MQA2C14	80159.7	79809.7	0	0	0	0	0	0	79809.7	1	79809.7	153012.8
MQA2C15	-78745.8	-79095.8	0	0	0	0	0	0	-79095.8	1	-79095.8	-151644
MQA2C16	80159.7	79809.7	0	0	0	0	0	0	79809.7	1	79809.7	153012.8
MQA2C17	-78745.8	-79095.8	0	0	0	0	0	0	-79095.8	1	-79095.8	-151644
MQA2C18	80159.7	79809.7	0	0	0	0	0	0	79809.7	1	79809.7	153012.8
MQA2C19	-78745.8	-79095.8	0	0	0	0	0	0	-79095.8	1	-79095.8	-151644
MQA2C20	70048.59	69698.59	0	0	0	0	0	0	69698.59	1	69698.59	133627.6
MQA2C21	-26170.7	-26520.7	0	0	0	0	0	0	-26520.7	1	-26520.7	-50846.1

MQA2C22	-47720	-48070	0	0	0	0	0	0	-48070	1	-48070	-92160.7
MQA2C23	81963.78	81613.78	0	0	0	0	0	0	81613.78	1	81613.78	156471.7
MQA2C24	-39125.8	-39475.8	0	0	0	0	0	0	-39475.8	1	-39475.8	-75683.9
MQA3C01	37656.5	37306.5	0	0	0	0	73220.4	0	51950.58	1	51950.58	99600.76
MQA3C02	-59325.6	-59675.6	0	0	0	0	-73220.4	0	-74319.6	1	-74319.6	-142487
MQA3C03	37656.5	37306.5	0	0	0	0	73220.4	0	51950.58	1	51950.58	99600.76
MQA3C04	45408.94	45058.94	0	0	0	0	73220.4	0	59703.02	1	59703.02	114463.9
MQA3C05	-30954.8	-31304.8	0	0	0	0	-73220.4	0	-45948.9	1	-45948.9	-88094.2
MQA3C06	7546.837	7196.837	0	0	0	0	0	0	7196.837	1	7196.837	13797.93
MQA3C07	-16694.8	-17044.8	0	0	0	0	0	0	-17044.8	1	-17044.8	-32678.7
MQA3C08	38469.05	38119.05	0	0	0	0	0	0	38119.05	1	38119.05	73082.65
MQA3C09	-0.00026	-350	0	0	0	0	0	0	-350	1	-350	-671.028
MQA3C10	-0.00026	-350	0	0	0	0	0	0	-350	1	-350	-671.028
MQA3C11	-23207.6	-23557.6	0	0	0	0	0	0	-23557.6	1	-23557.6	-45165.1
MQA3C12	46950.07	46600.07	0	0	0	0	0	0	46600.07	1	46600.07	89342.64
MQA3C13	-20310.4	-20660.4	0	0	0	0	0	0	-20660.4	1	-20660.4	-39610.5
MQA3C14	-0.00026	-350	0	0	0	0	0	0	-350	1	-350	-671.028
MQA3C16	22469.96	22119.96	0	0	0	0	0	0	22119.96	1	22119.96	42408.86
MQA3C17	-12791.3	-13141.3	0	0	0	0	0	0	-13141.3	1	-13141.3	-25194.7
MQA3C18	-21617.2	-21967.2	0	0	0	0	0	0	-21967.2	1	-21967.2	-42116
MQA3C19	40691.9	40341.9	0	0	0	0	0	0	40341.9	1	40341.9	77344.34
MQA3C20A	-21745.1	-22095.1	0	0	0	0	0	0	-22095.1	1	-22095.1	-42361.2

Appendix B. Transport Recombiners Quad Tuning Range At All Extraction Passes And Hall Destinations.

Matching Quads

	A BDL (G)	B BDL (G)	C BDL (G)	A Mom (MeV)	B Mom (MeV)	C Mom (MeV)	Max. BDL/Mom.	600 MeV/Linac Equivalent	Max. Mom. Normalized BDL	Full Tuning Increment	BDL Range	12 GeV equivalent
MQB2T01	7030.31	6402.96	7030.32	1149.2	1045.688	1149.2	6.123206	7761.164	6.837549	8666.594	10361.14	18822.74097
MQB2T02	-7850.53	-7149.94	-7850.49	1149.2	1045.688	1149.2	-6.83755	-8666.59	6.837549	-8666.59	-11266.6	-20467.606
MQB2T03	-0.00015	0.112671	0.123604	1149.2	1045.688	1149.2	0.000108	0.136571	6.837549	8666.594	2600.115	4723.541801
MQB2T04	0.000431	0	0.000431	1149.2	1045.688	1149.2	0	0	6.837549	8666.594	2599.978	4723.293697
MQB2T05	-4203.7	-3828.59	-4203.72	1149.2	1045.688	1149.2	-3.66131	-4640.72	6.837549	-8666.59	-7240.69	-13153.9262
MQB2T06	4221.16	3844.49	4221.17	1149.2	1045.688	1149.2	3.676519	4659.988	6.837549	8666.594	7259.966	13188.93834
MQA4T01	9352.7	12411.8	12412.5	1533.963	2035.688	2035.688	5.974296	14741.58	6.842149	16883	19806.48	35981.76575
MQA4T02	-10145.6	-13464	-13464.8	1533.963	2035.688	2035.688	-6.84215	-16883	6.842149	-16883	-21947.9	-39872.0247
MQA4T03	-0.00026	0	-0.00026	1533.963	2035.688	2035.688	-0.22817	-563.003	6.842149	-16883	-5627.9	-10224.0254
MQA4T04	-0.00026	0	-0.00026	1533.963	2035.688	2035.688	-0.22817	-563.003	6.842149	-16883	-5627.9	-10224.0254
MQA4T05	-7038.75	-9340.92	-9341.56	1533.963	2035.688	2035.688	-4.81677	-11885.4	6.842149	-16883	-16950.3	-30793.026
MQA4T06	7092.42	9412.3	9412.78	1533.963	2035.688	2035.688	4.500838	11105.82	6.842149	16883	16170.72	29376.80616
MQA6T01	21228.5	21208	20227.2	3025.688	3172.388	3025.688	6.900415	25307.27	10.47329	38410.79	36830.51	66908.75818
MQA6T02	-18881.7	-19796.2	-18880.6	3025.688	3172.388	3025.688	-6.35614	-23311.2	10.47329	-38410.8	-34834.4	-63282.4713
MQA6T03	-0.00026	-0.00026	-0.00026	3025.688	3172.388	3025.688	-0.11568	-424.243	10.47329	-38410.8	-11947.5	-21704.587
MQA6T04	-0.00026	-0.00026	0.000956	3025.688	3172.388	3025.688	-0.11568	-424.243	10.47329	-38410.8	-11947.5	-21704.587
MQA6T05	-23816.1	-24969	-23814.6	3025.688	3172.388	3025.688	-7.98698	-29292.2	10.47329	-38410.8	-40815.5	-74148.1198
MQA6T06	31740.9	31592.5	32038.9	3025.688	3172.388	3025.688	10.47329	38410.79	10.47329	38410.79	49934.02	90713.47738
MQA8T01	37813.6	30741.2	30741.2	4413.2	4015.688	4015.688	8.488988	41320.15	8.565145	41690.85	53827.4	97786.44467
MQA8T02	-37449.7	-32645.4	-32645.4	4413.2	4015.688	4015.688	-8.56515	-41690.8	8.565145	-41690.8	-54198.1	-98459.8803
MQA8T03	-0.00026	-0.00026	-0.00026	4413.2	4015.688	4015.688	-0.08716	-424.243	8.565145	-41690.8	-12931.5	-23492.2185
MQA8T04	-0.00026	-0.00026	-0.00026	4413.2	4015.688	4015.688	-0.08716	-424.243	8.565145	-41690.8	-12931.5	-23492.2185
MQA8T05	-15925.1	-14504.9	-14504.9	4413.2	4015.688	4015.688	-3.69922	-18005.9	8.565145	-41690.8	-30513.2	-55432.3007
MQA8T06	32905.1	29970.7	29970.7	4413.2	4015.688	4015.688	7.376756	35906.36	8.565145	41690.85	48413.61	87951.39871

Dispersion Quads

	A BDL (G)	B BDL (G)	C BDL (G)	A Mom (MeV)	B Mom (MeV)	C Mom (MeV)	Max. BDL/Mom.	600 MeV/Linac Equivalent	Max. Mom. Normalized BDL	Full Tuning Increment	BDL Range	12 GeV equivalent
MQC2T07	-16478.1	-15007.7	-16478.2	1149.2	1045.688	1149.2	-14.352	-18191.2	14.35199	-18191.2	-20919.8	-38004.34737
MQC2T08	11227.5	10225.6	11227.5	1149.2	1045.688	1149.2	9.77883	12394.67	14.35199	18191.15	15123.34	27474.06657
MQC2T09	-7652.07	-6969.23	-7652.08	1149.2	1045.688	1149.2	-6.66473	-8447.55	14.35199	-18191.2	-11176.2	-20303.47404
MQA4T07	-21961.3	-30280	-29146.2	1533.963	2035.688	2035.688	-14.9974	-37006.1	14.99739	-37006.1	-42557	-77311.82828
MQA4T08	17288.8	22943.9	22945.1	1533.963	2035.688	2035.688	11.14803	27507.76	14.99739	37006.06	33058.67	60056.57778
MQA4T09	-10910.6	-14479.2	-14480.2	1533.963	2035.688	2035.688	-7.34086	-18113.6	14.99739	-37006.1	-23664.5	-42990.46251
MQA6T07	-48717.9	-51076.7	-48714.8	3025.688	3172.388	3025.688	-16.2171	-59476.2	16.21711	-59476.2	-68397.7	-124255.7831
MQA6T08	40855	42833.3	40852.5	3025.688	3172.388	3025.688	13.39159	49113.64	16.21711	59476.24	58035.08	105430.3917
MQA6T09	-18614.8	-19515.8	-18613.6	3025.688	3172.388	3025.688	-6.26793	-22987.6	16.21711	-59476.2	-31909.1	-57968.14879
MQA8T07	-53203.6	-40159.8	-40159.8	4413.2	4015.688	4015.688	-12.1349	-59066.5	12.13487	-59066.5	-67926.4	-123399.7015
MQA8T08	47230	43018.1	43018.1	4413.2	4015.688	4015.688	10.62535	51718.91	12.13487	59066.47	60578.88	110051.6314
MQA8T09	-35066.4	-17538.6	-17538.6	4413.2	4015.688	4015.688	-8.02511	-39062.2	12.13487	-59066.5	-47922.2	-87058.62059

Appendix C. North & South Linacs And East Spreader/West Recombiners Quad Tuning Range

	BDL	Multiplicative Factor	Tuning Range
MQB1L00	24616.8	1.5	36925.2
MQB1L01	-19693.5	1.5	-29540.3
MQB1L02	647.546	1.5	971.319
MQB1L03	-922.594	1.05	-968.724
MQB1L04	1101.066	1.05	1156.119
MQB1L05	-1279.536	1.05	-1343.51
MQB1L06	1458.008	1.05	1530.908
MQB1L07	-1636.485	1.05	-1718.31
MQB1L08	1814.955	1.05	1905.703
MQB1L09	-1993.425	1.05	-2093.1
MQB1L10	2171.895	1.05	2280.49
MQB1L11	-2350.365	1.05	-2467.88
MQB1L12	2528.835	1.05	2655.277
MQB1L13	-2707.305	1.05	-2842.67
MQB1L14	2885.775	1.05	3030.064
MQB1L15	-3064.245	1.05	-3217.46
MQB1L16	3242.715	1.05	3404.851
MQB1L17	-3421.185	1.05	-3592.24
MQB1L18	3599.655	1.05	3779.638
MQB1L19	-3778.125	1.05	-3967.03
MQB1L20	3956.595	1.05	4154.425
MQB1L21	-4135.065	1.05	-4341.82
MQB1L22	4313.535	1.05	4529.212
MQB1L23	-4918.515	1.05	-5164.44
MQB1L24	5523.495	1.05	5799.67
MQB1L25	-6128.475	1.05	-6434.9
MQB1L26	6733.47	1.05	7070.144
MQB1L27	-7338.45	1.05	-7705.37
MQB1L28	7338.45	1.6	11741.52
			0
			0
			0
MQB2L01	7338.45	1.5	11007.68
MQB2L02	-7338.45	1.05	-7705.37
MQB2L03	7516.92	1.05	7892.766
MQB2L04	-7695.39	1.05	-8080.16
MQB2L05	7873.86	1.05	8267.553
MQB2L06	-8052.33	1.05	-8454.95
MQB2L07	8230.8	1.05	8642.34
MQB2L08	-8409.27	1.05	-8829.73
MQB2L09	8587.74	1.05	9017.127
MQB2L10	-8766.21	1.05	-9204.52
MQB2L11	8944.68	1.05	9391.914
MQB2L12	-9123.15	1.05	-9579.31
MQB2L13	9301.62	1.05	9766.701
MQB2L14	-9480.09	1.05	-9954.09
MQB2L15	9658.56	1.05	10141.49

MQB2L16	-9837.03	1.05	-10328.9
MQB2L17	10015.5	1.05	10516.28
MQB2L18	-10194	1.05	-10703.7
MQB2L19	10372.4	1.05	10891.02
MQB2L20	-10550.9	1.05	-11078.4
MQB2L21	10729.4	1.05	11265.87
MQB2L22	-10907.9	1.05	-11453.3
MQB2L23	11512.8	1.05	12088.44
MQB2L24	-12117.8	1.05	-12723.7
MQB2L25	12722.8	1.05	13358.94
MQB2L26	-13327.8	1.05	-13994.2
MQB2L27	14242	1.5	21363
			0
			0
			0
MQC2R08	-33123.87	1.15	-38092.5
MQC2R09	31008.51	1.15	35659.79
MQB2R10	-15391.935	1.15	-17700.7
MQA3S01	-24271.938	1.15	-27912.7
MQA3S02	34268.97	1.15	39409.32
MQA3S03	-42734.76	1.15	-49145
MQA4R08	-67005.21	1.15	-77056
MQA4R09	49872.21	1.15	57353.04
MQA4R10	-32108.88	1.15	-36925.2
MQA5S01	-29851.416	1.15	-34329.1
MQA5S02	60874.41	1.15	70005.57
MQA5S03	-94365.15	1.15	-108520
MQA6R08	-108427.59	1.15	-124692
MQA6R09	81083.97	1.15	93246.57
MQA6R10	-44303.04	1.15	-50948.5
MQA7S01	-80085.36	1.15	-92098.2
MQR7S02	130778.644	1.15	150395.4
MQX7S03	-207855.78	1.15	-239034
MQA8R08	-112404.57	1.15	-129265
MQA8R09	99019.29	1.15	113872.2
MQA8R10	-76192.74	1.15	-87621.7
MQA9S02	-33147	1	-33147
MQA9S03	48625	1	48625
			0
			0
			0
MQC2A40	216.748	1.3	281.7724
MQC2R01	25716.585	1.3	33431.56
MQC2R02	-38345.31	1.3	-49848.9
MQC2R03	45773.82	1.3	59505.97
MQC2R04	-46420.41	1.3	-60346.5
MQC2R05	42495.18	1.3	55243.73
MQC2R06	-60541.23	1.3	-78703.6
MQC2R07	24041.367	1.3	31253.78
MQA3S04	-43907.25	1.3	-57079.4
MQA3S05	41365.35	1.3	53774.96
MQA3S06	15616.359	1.3	20301.27
MQA3S07	-56205.72	1.3	-73067.4
MQA3S08	56816.07	1.3	73860.89

MQA3S09	-42013.95	1.3	-54618.1
MQA3S10	35847.45	1.3	46601.69
MQA4R01	52039.74	1.3	67651.66
MQA4R02	-70027.08	1.3	-91035.2
MQA4R03	136730.28	1.3	177749.4
MQA4R04	-79639.41	1.3	-103531
MQA4R05	-16626.816	1.3	-21614.9
MQA4R06	81809.7	1.3	106352.6
MQA4R07	-66884.22	1.3	-86949.5
MQA5S04	-99832.14	1.3	-129782
MQA5S05	103589.64	1.3	134666.5
MQA5S06	-58273.65	1.3	-75755.7
MQA5S07	-74991.93	1.3	-97489.5
MQA5S08	83115.93	1.3	108050.7
MQA5S09	-70991.49	1.3	-92288.9
MQA5S10	49164.99	1.3	63914.49
MQA6R01	65688.03	1.3	85394.44
MQA6R02	-75096.96	1.3	-97626
MQA6R03	87498.3	1.3	113747.8
MQA6R04	-128214.24	1.3	-166679
MQA6R05	100721.82	1.3	130938.4
MQA6R06	3292.125	1.3	4279.763
MQA6R07	-74696.73	1.3	-97105.7
MQA7S04	-37530.36	1.3	-48789.5
MQA7S05	104835.09	1.3	136285.6
MQA7S06	-83203.83	1.3	-108165
MQA7S07	11503.293	1.3	14954.28
MQA7S08	132061.53	1.3	171680
MQA7S09	-86674.08	1.3	-112676
MQA7S10	67091.94	1.3	87219.52
MQA8R01	106577.52	1.3	138550.8
MQA8R02	-92575.8	1.3	-120349
MQA8R03	158206.98	1.3	205669.1
MQA8R04A	-87905.52	1.3	-114277
MQA8R04B	-87905.52	1.3	-114277
MQA8R05A	37463.49	1.3	48702.54
MQA8R05B	37463.49	1.3	48702.54
MQA8R06	22554.561	1.3	29320.93
MQA8R07	-84685.8	1.3	-110092
MQA9S04	-33243.24	1.3	-43216.2
MQA9S05	54484.11	1.3	70829.34
MQA9S06	-29540.856	1.3	-38403.1
MQA9S07	-79.387	1.3	-103.203
MQA9S08	56695.11	1.3	73703.64
MQAAR01	58248.24	1.3	75722.71
MQAAR02	-120526.29	1.3	-156684
MQAAR03	56677.47	1.3	73680.71
MQAAR04	137698.2	1.3	179007.7
MQAAR05	-102645.21	1.3	-133439
MQAAR06	114911.07	1.3	149384.4
MQAAR07	-46506.57	1.3	-60458.5

Appendix D. Revised Quad Tuning Range for Straight-Ahead 123 MeV Injector

MQD0L06	431.529	819.2653	414.03	796.4294	819.2653	1310.824	2161.43
MQD0L07	-394.076	-748.16	-480.68	-924.638	924.6376	1479.42	2161.43
MQD0L08	584.462	1109.611	363.71	699.6337	1109.611	1775.378	2161.43
MQD0L09	-454.469	-862.817	-223.92	-430.733	862.8173	1380.508	2161.43
MQD0L10	711.552	1350.894	322.73	620.8045	1350.894	**2161.43**	2161.43
MQD0R01	-752.853	-1429.3	-255.13	-490.769	1429.304	1572.235	1572.235
MQD0R02	1062.61	2017.383	0	0	2017.383	2622.599	**2622.599**
MQD0R03	-405.282	-769.435	-127.565	-245.384	769.4349	846.3784	846.3784
MQD0R04	740.495	1405.843	280.213	539.0186	1405.843	1827.595	1827.595
MQD0R05	-405.282	-769.435	-127.406	-245.079	769.4349	846.3784	846.3784
MQD0R06	1062.61	2017.383	0	0	2017.383	2622.599	**2622.599**
MQD0R07	-752.853	-1429.3	-255.13	-490.769	1429.304	1572.235	1572.235
	Isochronous Chicane	Scaled to 123 MeV	Compression Chicance	Scaled to 123 MeV	Max of both	Tuning range	Use Max for 0L06-10

MQJ0L05	275	328.4611	525.5376808
	Current Max. at 37 MeV	Scaled to 45 MeV	Tuning Range

Appendix E. Projected Arc 10 Quad Tuning Range

	BDL	Multiplicative Factor	Tuning Range
MQAAS02	-32871.78	1.3	-42733.314
MQAAS03	58995.66	1.3	76694.358
MQAAS04	1061.001	1.3	1379.3013
MQAAS05	-39710.04	1.3	-51623.052
MQAAS06	37413.42	1.3	48637.446
MQAAS07	-42636.96	1.3	-55428.048
MQAAS08	54256.62	1.3	70533.606
MQCAE01	-39776.13	1	-39776.13
MQCAE02	39776.13	1	39776.13
MQCAE03	-37054.41	1	-37054.41
MQAAA01	58055.76	1	58055.76
MQAAA02	-65120.49	1	-65120.49
MQAAA03	119629.65	1.06	126807.429
MQAAA04	-65120.49	1	-65120.49
MQAAA05	51810.48	1	51810.48
MQAAA06	-65120.49	1	-65120.49
MQAAA07	119629.65	1.06	126807.429
MQAAA08	-65120.49	1	-65120.49
MQAAA09	64290.03	1	64290.03
MQAAA10	-65120.49	1	-65120.49
MQAAA11	119629.65	1.06	126807.429
MQAAA12	-65120.49	1	-65120.49
MQAAA13	51810.48	1	51810.48
MQAAA14	-65120.49	1	-65120.49
MQAAA15	119629.65	1.06	126807.429
MQAAA16	-65120.49	1	-65120.49
MQAAA17	64290.03	1	64290.03
MQAAA18	-65120.49	1	-65120.49
MQAAA19	119629.65	1.06	126807.429
MQAAA20	-65120.49	1	-65120.49
MQAAA21	51810.48	1	51810.48
MQAAA22	-65120.49	1	-65120.49
MQAAA23	119629.65	1.06	126807.429
MQAAA24	-65120.49	1	-65120.49
MQAAA25	64290.03	1	64290.03
MQAAA26	-65120.49	1	-65120.49
MQAAA27	119629.65	1.06	126807.429
MQAAA28	-65120.49	1	-65120.49
MQAAA29	51810.48	1	51810.48
MQAAA30	-65120.49	1	-65120.49
MQAAA31	119629.65	1.06	126807.429
MQAAA32	-65120.49	1	-65120.49
MQAAR01	122697.48	1.3	159506.724
MQAAR02	-108596.55	1.3	-141175.515
MQAAR03	35379.45	1.3	45993.285
MQAAR04	6520.944	1.3	8477.2272
MQAAR05	7098.819	1.3	9228.4647
MQAAR06	31596.93	1.3	41076.009
MQAAR07	-41495.85	1.3	-53944.605

MQBBL00	15842.175	1	15842.175
MQBBL01	-11521.582	1	-11521.582