# Report on Database and Header Files for E91011

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The finalized list of which header files and which databases should be used in the analysis of the production data for the N $\rightarrow \Delta$ experiment are found in table 1. These header and databases files can be found in the /work/halla/ndelta-2/headers and /work/halla/ndelta-2/databases directories, respectively.

Each header file contains information pertaining to the particular spectrometer setting such as the magnetic fields of the dipoles, the spectrometer angles, and the spectrometer offsets. The spectrometer angles were determined using formulas (1) and (2),

$$\theta_{spec} = \theta_{fm} - \frac{p_{carbon}}{8458\,\mathrm{mm}}\left(57.296\frac{\mathrm{deg}}{\mathrm{rad}}\right) \quad (1)$$

$$\theta_{fm} = \theta_{LVDT} + \frac{p_{LVDT}}{8458\,\mathrm{mm}}\left(57.296\frac{\mathrm{deg}}{\mathrm{rad}}\right), \quad (2)$$

where $\theta_{spec}$ is the spectrometer angle needed for the header file; $\theta_{fm}$ is the angle between the front jack of the spectrometer and the target; $\theta_{LVDT}$ is the spectrometer angle determined by the LVDT code; $p_{carbon}$ and $p_{LVDT}$ are the carbon and LVDT mis-pointing values found in columns 3 and 6, and columns 4 and 7 of Table 2 in the "mispointing report" on the N $\rightarrow \Delta$ experiment outline webpage, http://www.nscp.umd.edu/~kelly/TJNAF/HALL-A/91-011/AnalysisOutline.htm, respectively; 8458 mm is the distance from the front jack of the spectrometer to the target; and 57.296 $\frac{\mathrm{deg}}{\mathrm{rad}}$ is the degree to radian conversion factor. The electron and hadron spectrometer $x$- and $z$-offsets used in the header files are found in Tables 3 and 4, columns 3 and 6, of the "mispointing report" on the N $\rightarrow \Delta$ experiment outline webpage, respectively. The values used for both the electron and hadron $y$-offsets are those determine by the LVDT code. The header files also contain information specific to the target used, but for all production running this target was liquid $^1$H and thus, this information is the same for all of the header files listed in table 1.

The six finalized databases originated as two databases, db_ndelta_period1 and db_ndelta_period2. The db_ndelta_period1 database was the original database used for the first run periods, May 19 - June 30, 2000 and contained optimized beta, optimized scintillator ADCs, optimized scintillator VDCs, and the correct coefficients for the BPMs as determined by Zhengwei Chai. It also contained the electron $\theta$, $\phi$, $y_{tg}$, y000, t000, and p000 as optimized by Nilanga Liyanage. Nilanga began with the VCD 3.5 GeV database; optimized the t000, y000, and p000 using run number 1760; then optimized the $\theta$ and $\phi$ using $^1$H and sieve slit data using a reduced number of elements in $\theta$; and optimized the y030 element. There are no t000 or y000 terms for electron optics in this database. Nilanga's optimization was then improved upon by Zhengwei. The

| $\theta_{cm}$ | runs | database | header |
|---|---|---|---|
| 0° | 1220-1238 | db_ndelta_1 | hdr_ndelta_thcm0_1 |
| 25° | 1246-1268 | ⋮ | hdr_ndelta_thcm25_1 |
| −25° | 1278-1305 | ⋮ | hdr_ndelta_thcm-25_1 |
| 50° | 1322-1340 | ⋮ | hdr_ndelta_thcm50_1 |
| ⋮ | 1372-1386 | db_ndelta_2 | hdr_ndelta_thcm50_2 |
| −50° | 1400-1418 | ⋮ | hdr_ndelta_thcm-50_1 |
| −90° | 1428-1456 | ⋮ | hdr_ndelta_thcm-90_1 |
| 90° | 1468-1531, 1548 | ⋮ | hdr_ndelta_thcm90_1 |
| 135° | 1568-1654 | db_ndelta_3 | hdr_ndelta_thcm135_1 |
| −135° | 1667-1683 | ⋮ | hdr_ndelta_thcm-135_1 |
| 155° | 1700-1752 | ⋮ | hdr_ndelta_thcm155_1 |
| −155° | 1765-1795, 1802-1805 | ⋮ | hdr_ndelta_thcm-155_1 |
| ⋮ | 1837-2011, 2017-2033 | ⋮ | hdr_ndelta_thcm-155_2 |
| −135° | 2045-2247 | db_ndelta_4 | hdr_ndelta_thcm-135_2 |
| −90° | 2271-2425 | ⋮ | hdr_ndelta_thcm-90_2 |
| −50° | 2437-2492 | ⋮ | hdr_ndelta_thcm-50_2 |
| 0° | 2504-2625 | ⋮ | hdr_ndelta_thcm0_2 |
| 25° | 2632-2675 | ⋮ | hdr_ndelta_thcm25_2 |
| 50° | 2842-3037 | db_ndelta_5 | hdr_ndelta_thcm50_3 |
| 90° | 3050-3306 | ⋮ | hdr_ndelta_thcm90_2 |
| 135° | 3317-3512 | ⋮ | hdr_ndelta_thcm135_2 |
| ⋮ | 3559-3633 | db_ndelta_6 | ⋮ |
| 155° | 3649-3927 | ⋮ | hdr_ndelta_thcm155_2 |
| 180° | 3941-4034 | ⋮ | hdr_ndelta_thcm180_1 |

Table 1: List of database and header files to be used in analysis of production runs.

hadron and electron arm $\delta$s were optimized by Rikki Roché and Emilie Penel, respectively, using the December 1999 $^{12}C$ elastic data. The hadron arm $\theta$ and $\phi$ were optimized by Zhengwei using the December 1999 845 MeV data, while he optimized the hadron arm $y_{tg}$, y000, p000, and t000 using the 700 MeV and 1.0 GeV ndelta pointing data. The differences between db_ndelta_1, db_ndelta_2, db_ndelta_3, and db_ndelta_4 arise in the optimization of the geometric mean (gm). This geometric mean was optimized over four different sets of runs; runs 1220-1340 resulting in db_ndelta_1, runs 1372-1548 resulting in db_ndelta_2, runs 1568-2033 resulting in db_ndelta_3, runs 2045-2675 resulting in db_ndelta_4. Each of these four databases are the same except for this gm optimization. Detailed descriptions of optimization techniques can be found in http://www.jlab.org/~nilanga/physics/optimization.ps.

The db_ndelta_period2 database was the original database to be used for the final run period, July 11 - July 31. The differences between db_ndelta_5 and db_ndelta_6 are limited to optimization of gm and the hadron beta.

The optimizations of the hadron gm, hadron beta, and time offsets were performed by Nilanga and Rikki. The following figures show these optimizations for the first and last production runs using each of the six finalized databases. Figures 1-6 show the hadron arm gm optimization, figures 7-12 show the hadron beta optimization, and figures 13-18 show the electron arm corrected coincidence timing optimization.

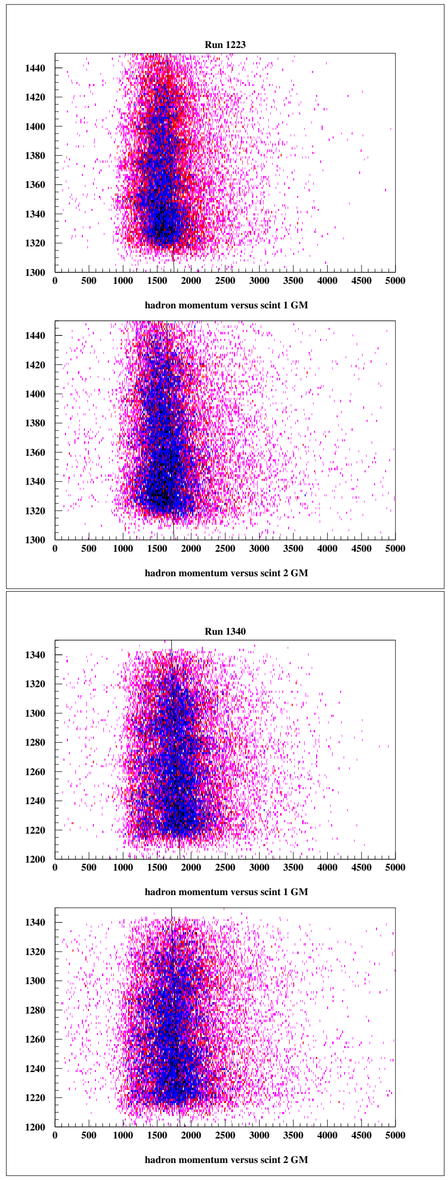



Figure 1: Optimized hadron arm geometric mean versus momentum using db_ndelta_1. ($\theta_{cm} = 0°$ run 1223 and $\theta_{cm} = 50°$ run 1340)

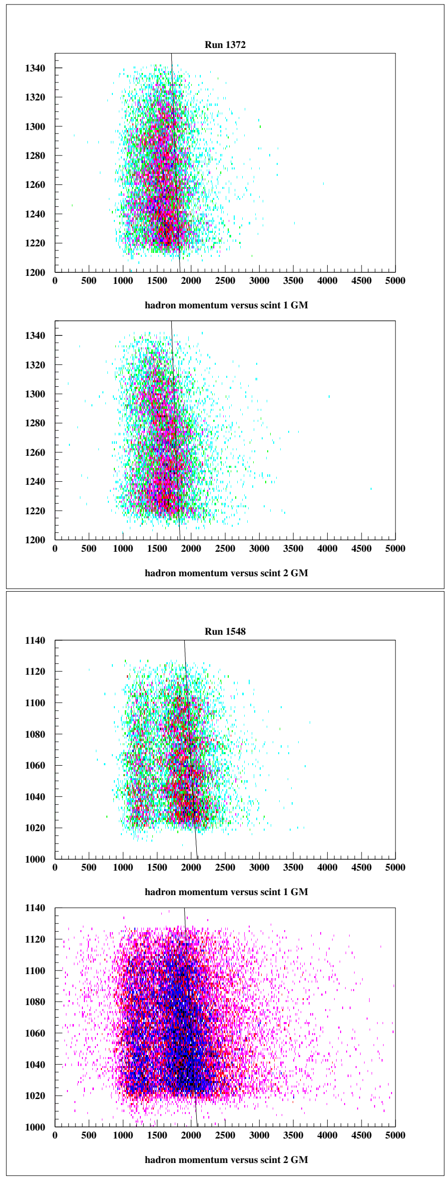



Figure 2: Optimized hadron arm geometric mean versus momentum using db_ndelta_2. ($\theta_{cm} = 50°$ run 1372 and $\theta_{cm} = 90°$ run 1548)

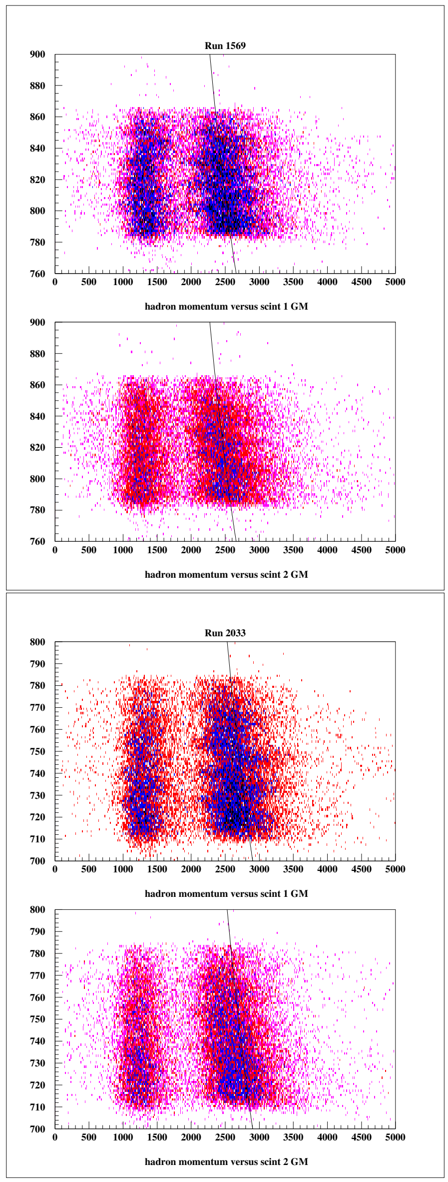



Figure 3: Optimized hadron arm geometric mean versus momentum using db_ndelta_3. ($\theta_{cm} = 135°$ run 1569 and $\theta_{cm} = -155°$ run 2033)

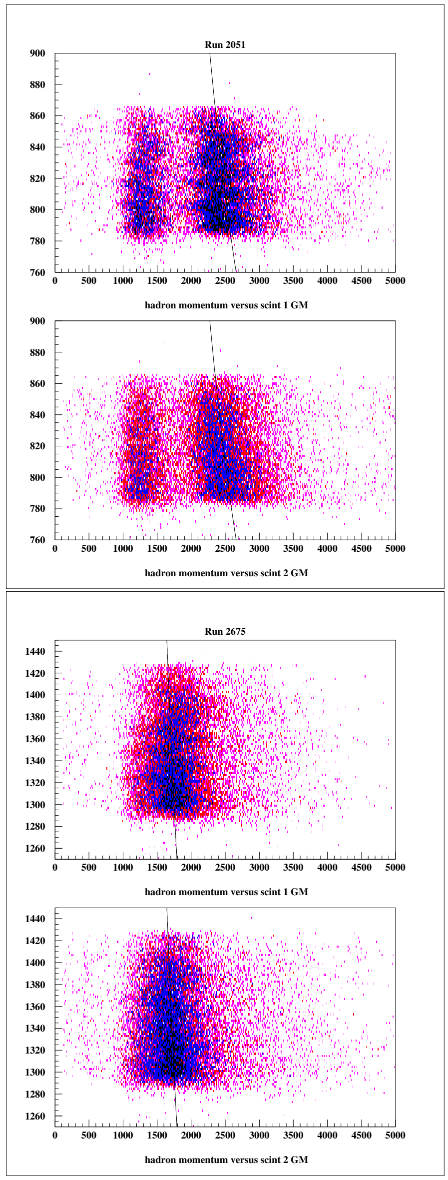



Figure 4: Optimized hadron arm geometric mean versus momentum using db_ndelta_4. ($\theta_{cm} = -135°$ run 2051 and $\theta_{cm} = 25°$ run 2675)

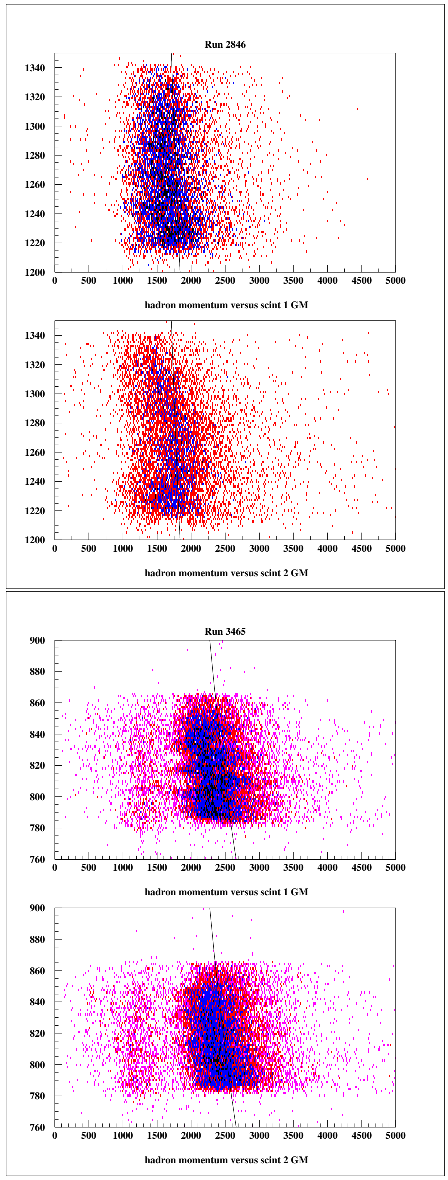



Figure 5: Optimized hadron arm geometric mean versus momentum using db_ndelta_5. ($\theta_{cm} = 50°$ run 2846 and $\theta_{cm} = 135°$ run 3465)

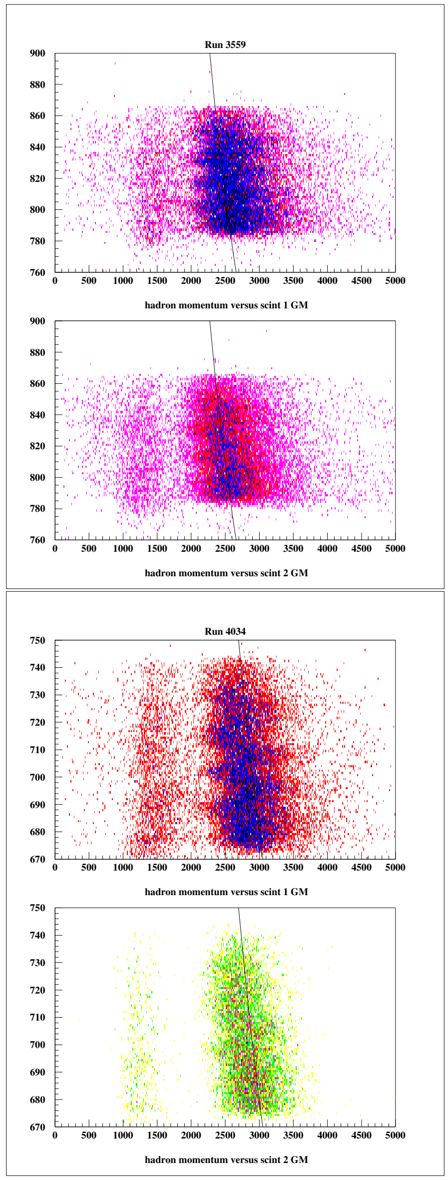



Figure 6: Optimized hadron arm geometric mean versus momentum using db_ndelta_6. ($\theta_{cm} = 135°$ run 3559 and $\theta_{cm} = 180°$ run 4034)

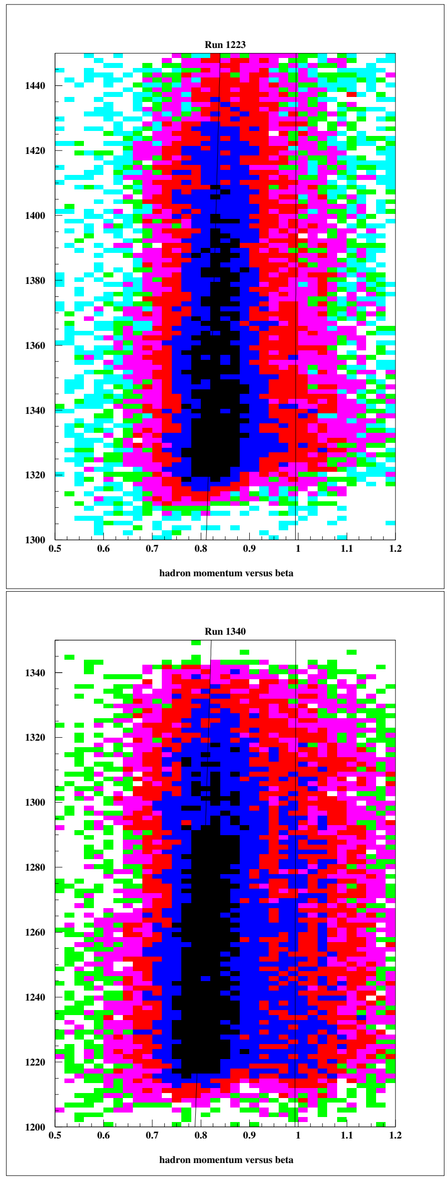
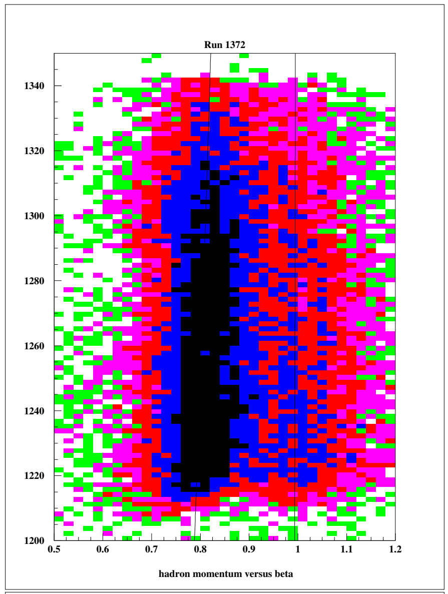



Figure 7: Optimized hadron arm beta versus momentum using db_ndelta_1. ($\theta_{cm} = 0°$ run 1223 and $\theta_{cm} = 50°$ run 1340)



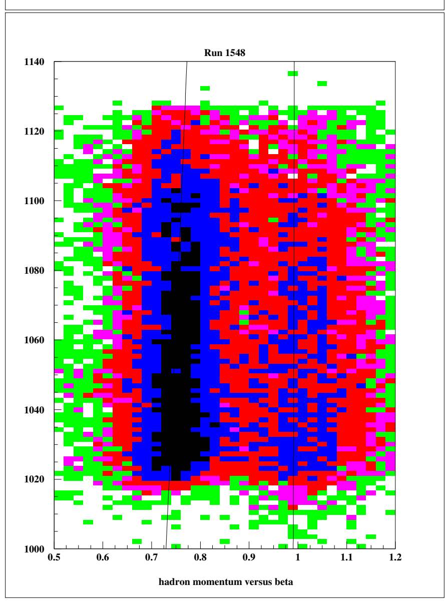




Figure 8: Optimized hadron arm beta versus momentum using db_ndelta_2. ($\theta_{cm} = 50°$ run 1372 and $\theta_{cm} = 90°$ run 1548)

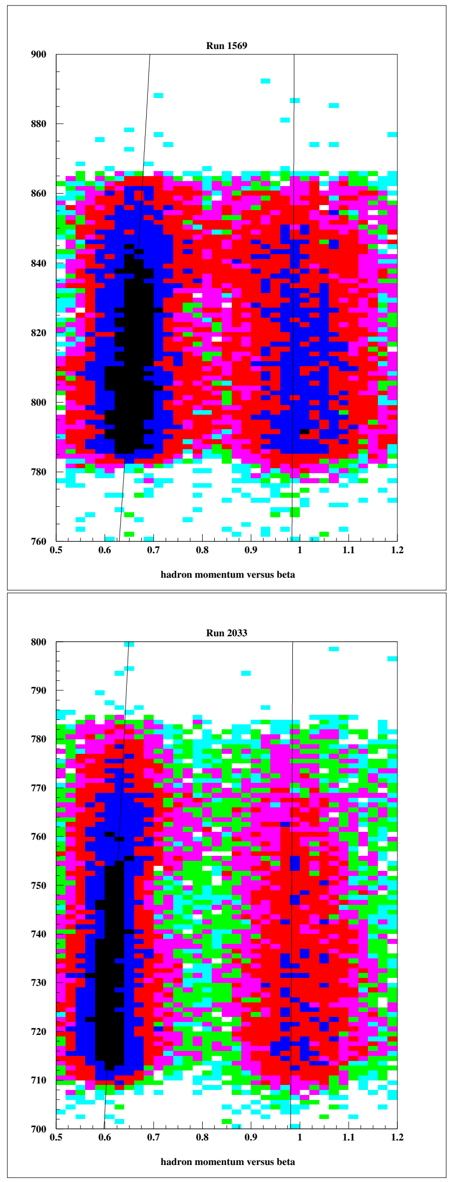



Figure 9: Optimized hadron arm beta versus momentum using db_ndelta_3. ($\theta_{cm} = 135°$ run 1569 and $\theta_{cm} = -155°$ run 2033)

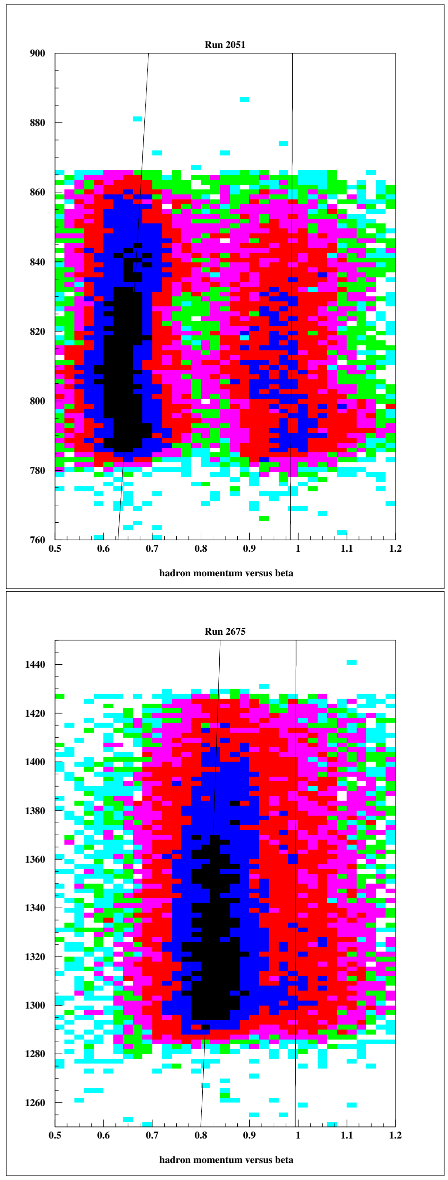
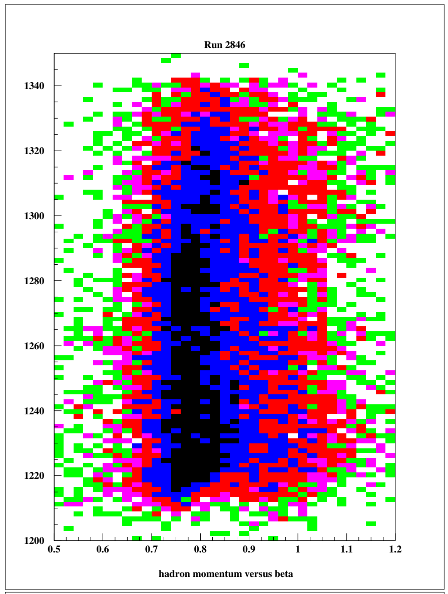



Figure 10: Optimized hadron arm beta versus momentum using db_ndelta_4. ($\theta_{cm} = -135°$ run 2051 and $\theta_{cm} = 25°$ run 2675)



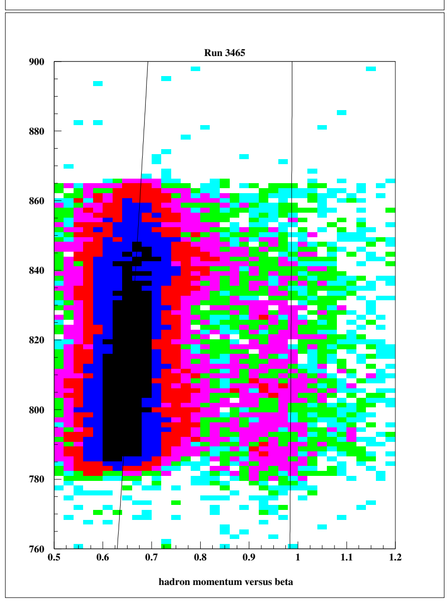




Figure 11: Optimized hadron arm beta versus momentum using db_ndelta_5. ($\theta_{cm} = 50°$ run 2846 and $\theta_{cm} = 135°$ run 3465)

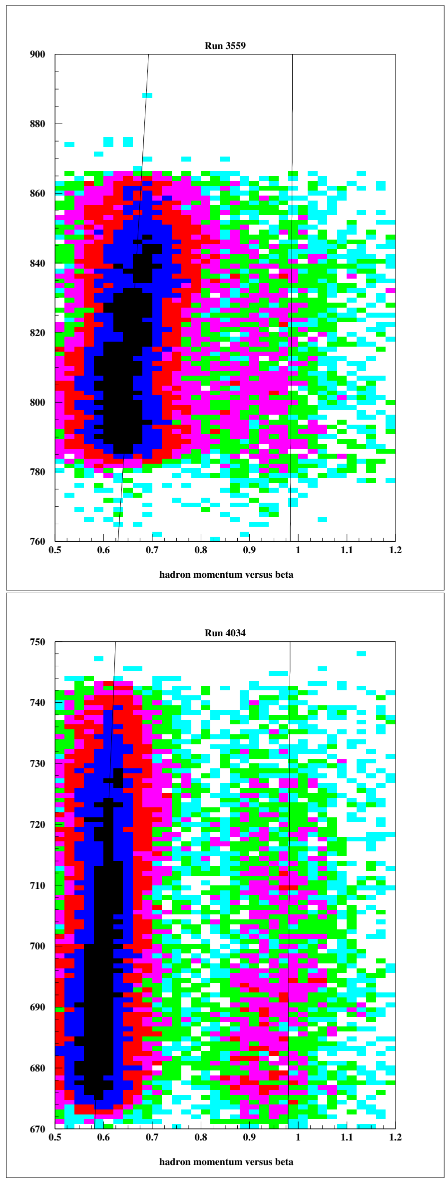



Figure 12: Optimized hadron arm beta versus momentum using db_ndelta_6. ($\theta_{cm} = 135°$ run 3559 and $\theta_{cm} = 180°$ run 4034)

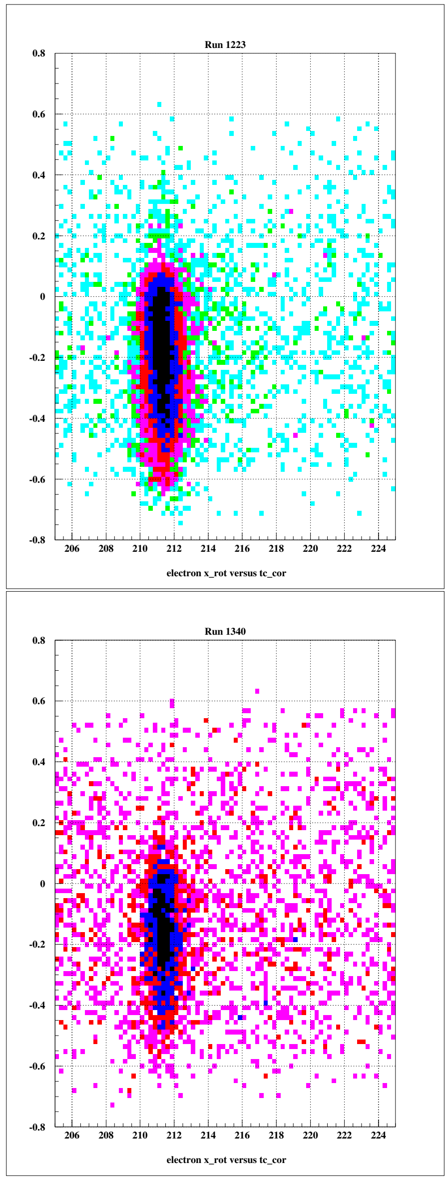



Figure 13: Optimized electron arm tc_cor versus x_rot using db_ndelta_1. ($\theta_{cm} = 0°$ run 1223 and $\theta_{cm} = 50°$ run 1340)

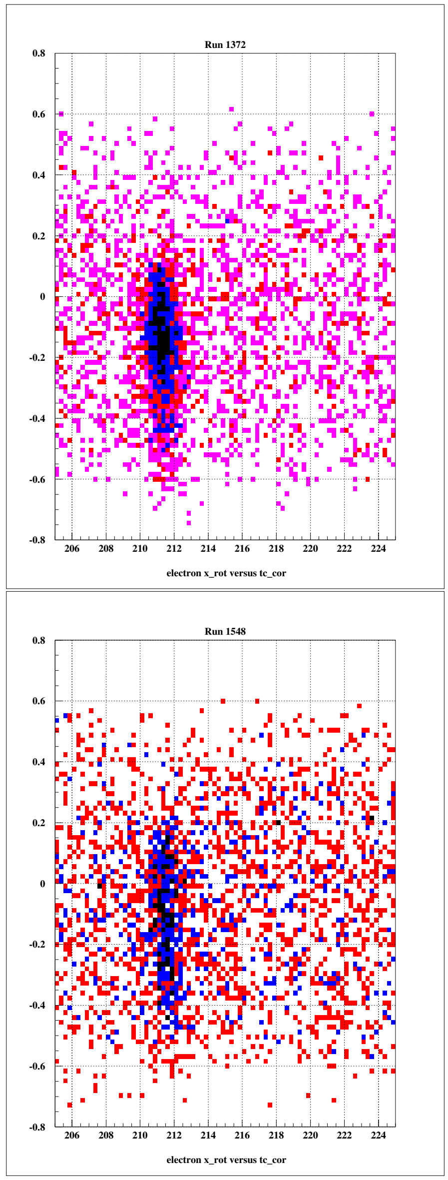



Figure 14: Optimized electron arm tc_cor versus x_rot using db_ndelta_2. ($\theta_{cm} = 50°$ run 1372 and $\theta_{cm} = 90°$ run 1548)

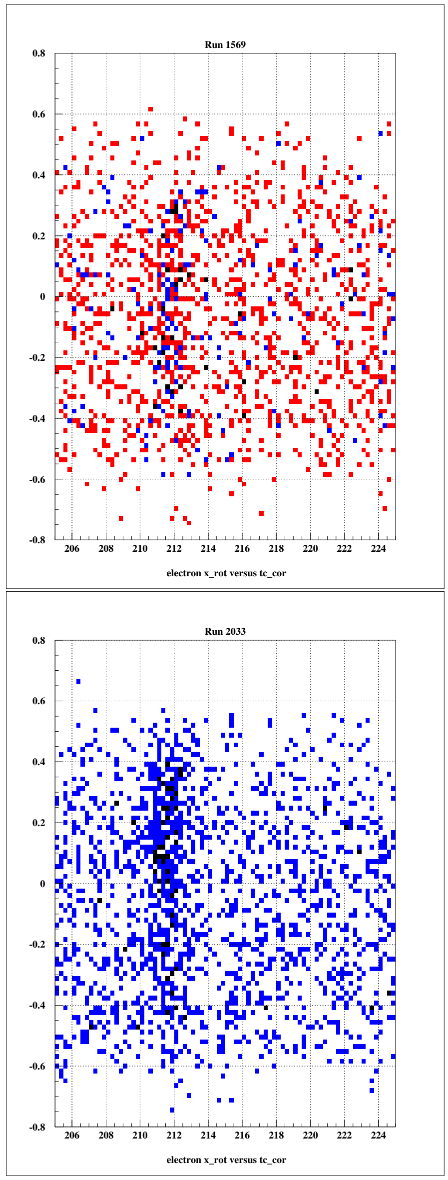
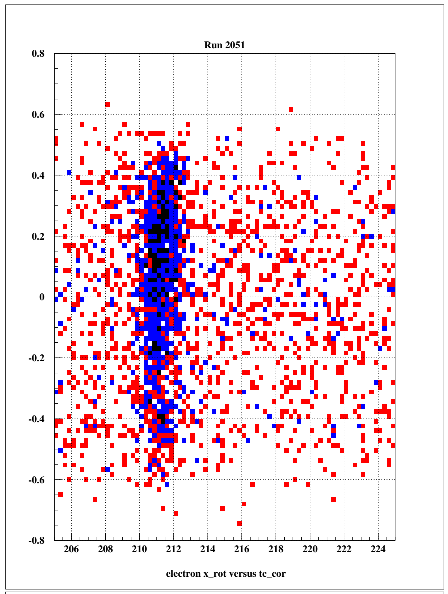



Figure 15: Optimized electron arm tc_cor versus x_rot using db_ndelta_3. ($\theta_{cm} = 135°$ run 1569 and $\theta_{cm} = -155°$ run 2033)



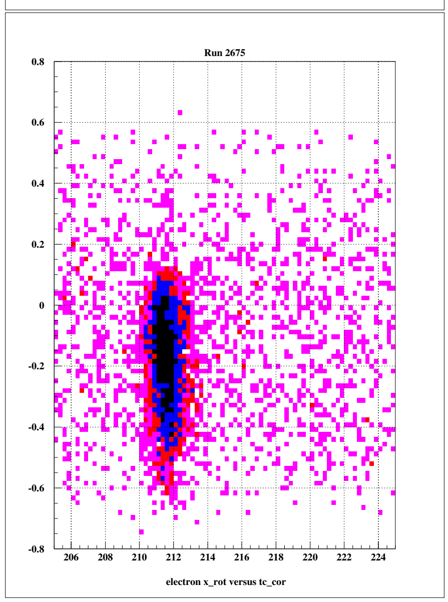




Figure 16: Optimized electron arm tc_cor versus x_rot using db_ndelta_4. ($\theta_{cm} = -135°$ run 2051 and $\theta_{cm} = 25°$ run 2675)

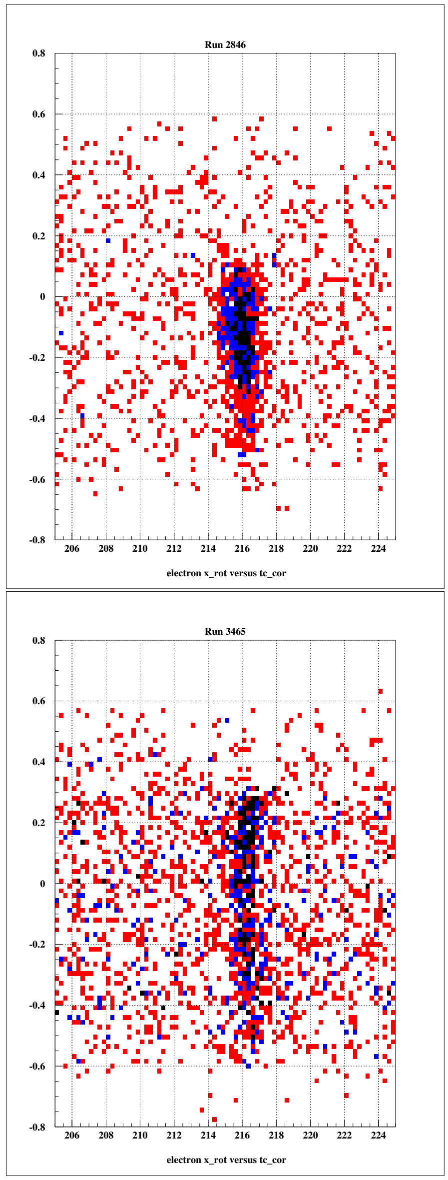
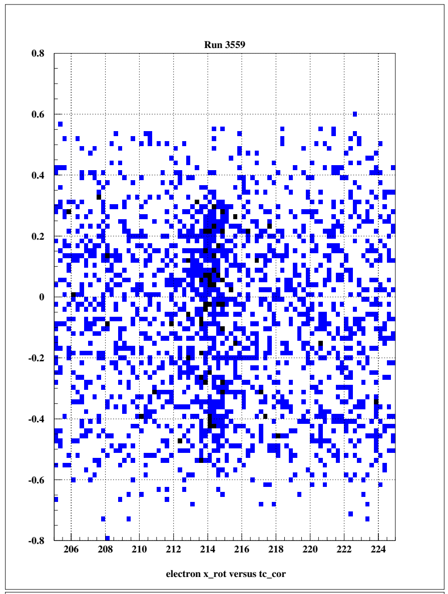



Figure 17: Optimized electron arm tc_cor versus x_rot using db_ndelta_5. ($\theta_{cm} = 50°$ run 2846 and $\theta_{cm} = 135°$ run 3465)



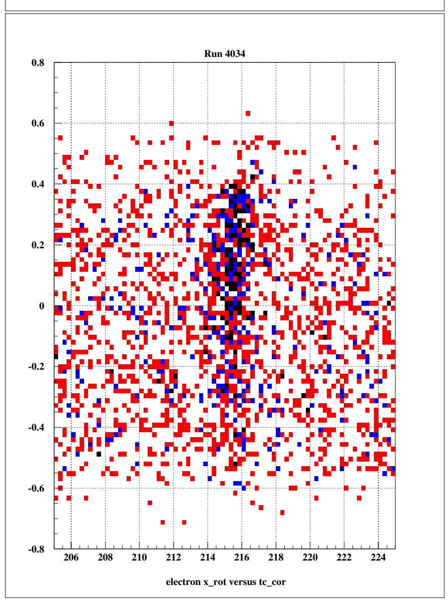




Figure 18: Optimized electron arm tc_cor versus x_rot using db_ndelta_6. ($\theta_{cm} = 135°$ run 3559 and $\theta_{cm} = 180°$ run 4034)