Revised Track Fitting for Run_20200316_162107.dat:

This run in the test beam contains 33,647 triggers in 35,847 cycles.

Currently I find (plot c col-3 row5):

| | |
|---|---|
| 4_hit tracks | 450 |
| 5_hit tracks | 3238 |
| 6_hit tracks | 29,166 (87 % of all triggers) |
| All tracks | 32,754 (97 % of all triggers) |

Previously, I had accepted some hits which were separated by a full sensor strip from the fitted track position. Such hits are most likely spurious hits. They occurred predominantly in the three sensors which have only ~97 % efficiency (S0, S2 and S5), much less so in the other three sensors. As a result of this new cut some of the 6-hit tracks (87 % c.f. 91 % before) were downgraded to 5-hit tracks, while the total number of tracks remained approximately the same (97 % c.f. 98 % before).

Residuals in individual sensors:
Residuals in individual sensors after fitting are shown in column-2. The distributions are well fitted with Gaussians and there are no events in under- or overflow. The variances for the residuals range from 6.6 to 7.4 um in four of the sensors, while S2 and S5 have variances of 10 and 13 um, respectively. It is not understood why S2 and S5 have much larger variances than the other four sensors.

The numbers of entries in each histogram yield the individual efficiencies. I find for:
S0 = 97 %
S1 = 99 %
S2 = 97 %
S3 = 99 %
S4 = 100 %
S5 = 96 %
Multiplying out these efficiencies I find an overall efficiency of 88 %, close enough to the 87 % quoted above..

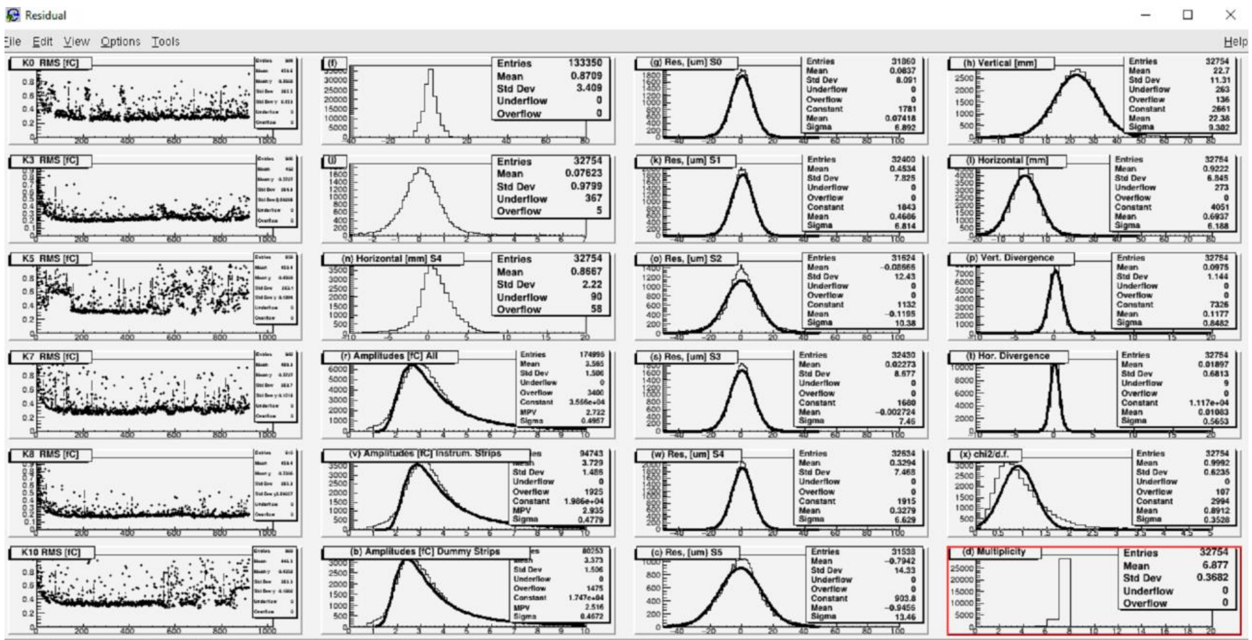
Since the sensors were closely spaced, and since the horizontal resolution due to the shallow stereo angle is ~30 times worse than the vertical resolution, there is not enough information to determine the horizontal angle from the sensors alone. Least-squares fits using three parameters were presented previously (vertical position and angle and horizontal position).

Determining the horizontal angle from the sensor data results in a very wide angular distribution which is not compatible with tracks originating in the upstream bending magnet. Tracks originate from a target ~10 m upstream of Lycoris. To incorporate this information into the fitting, two constraints on the horizontal and vertical positions of the beam at the origin with a sigma of 5 mm were included.

Plot h in column-3 row 0 shows the vertical distribution of the beam at the target, plot l the same for the horizontal, plot p the vertical angular distribution and plot l the same for the horizontal.

The weight for sensor hits was (inverse 7 um-squared) and chi2/d.f. is plotted in x (col-3 row-4). The peak is at 0.7 with a tail out to 3.

Fit errors (from the diagonal elements of the error matrix) were presented earlier and are 6um for the vertical position, 110 um for the horizontal position and of 0.11 [mrad] for the vertical angle.




Amplitude Spectra:
In column-1, plot r are displayed the amplitude spectra for all tracks and all sensor planes, 175,000 entries in total. The Landau fit yields an MPV of 2.8 fC and the mean is 3.6 fC. The expected mean for a 300 um depletion is 4 fC.

In order to separate the amplitude spectra from instrumented and dummy strips I use the information from fitted tracks. The resolution in each sensor is ~6 um while the strip width is 25 um. So the track position should determine quite reliably if the hit was generated in one or the other strip type.

Plot v shows the amplitude spectrum for hits in instrumented strips (as defined above). The MPV is 2.9 fC and the mean 3.7 fC. There are 54 % of the total in that plot, slightly more than the expected ½.

Plot b shows the spectrum for the presumed hits in dummy strips. The MPV is 2.5 fC and the mean 3.4 fC.

Column-0 shows noise as a function of strip address for all six sensors. Sensors S1 and S4 are near perfect with 0.2 fC noise throughout (S/N=18). S0 and S3 are pretty good too and S2 and S5 are the worst, but even for those sensors the noise rarely exceeds 0.8 fC and the performance seems to be good enough for track reconstruction.

The noise increases quite strongly near zero, which is attributed to the sensor frame.