Report on Spectrometer Surveys
(updated 8/11/00)

During long maintanence periods surveys of the spectrometers were done. For each spectrometer an LVDT measures the vertical and horizontal offset of the spectrometer. Four surveys were done for the electron arm and five were done for the hadron arm. Combining all the surveys, the LVDT were calibrated to match the survey results. In Table 1 and Table 2, the survey results are listed and compared to the uncalibrated LVDT result for each arm. The average difference between the survey and LVDT was determined. In general the difference between survey and LVDT was consistent. One exception is the vertical position for the electron arm on July 5th where there is a large deviation between survey and LVDT. In calculating the average difference for the vertical electron position the July 6th comparison was ignored. New calibrated LVDT positions are determined from the differences. The comparsions between survey and calibrated LVDT are shown in Table 3 and Table 4.

Target survey on May 16th. Took average of four positions markers for each set of targets. The positive direction of z is downstream. Before pump and cool down solid target at z-position of +1.57mm and the dummy target are at +1.04mm. After pump and cooldown the z-position shifts by -0.26mm. So solid targets at z-position of +1.31mm and the dummy targets are at +0.78mm.

Target survey on May 26th. Took average of four positions markers for each set of targets. The positive direction of z is downstream. Before pump and cool down solid target at z-position of +1.14mm and the dummy target are at +0.59mm. After pump and cooldown the z-position shifts by -0.68mm. So solid targets at z-position of +0.46mm and the dummy targets are at -0.09mm.

During the June 30th warm up the target ladder shift by +0.68mm. For the cool down on July 7th there was no movement of the target ladder. So solid targets at z-position of +1.14mm and the dummy targets are at +0.59mm.

Date	HRSE pointing (mm)			HRSE vertical offset (mm)		
	Survey	LVDT	Diff	Survey	LVDT	Diff
May 15th	2.44	8.52	-6.08	0.23	0.75	-0.52
June 6th	1.19	7.32	-6.13	-0.20	0.61	-0.81
July 6th	1.91	8.32	-6.41	0.06	2.52	-2.46
Aug 1st	0.87	7.12	-6.25	-0.28	0.62	-0.90
Average			-6.21			-0.74

Table 1: Comparison of electron arm surveys and raw LVDT readings of the spectrometer. Units are mm. For the average difference in vertical offset the value on July 6th was not used.

Date	HRSH pointing (mm)			HRSH vertical offset (mm)		
	Survey	LVDT	Diff	Survey	LVDT	Diff
May 17th	1.09	4.66	-3.57	0.69	-0.46	1.15
June 5th	0.82	4.34	-3.52	0.82	-0.67	1.49
July 5th	0.34	3.89	-3.55	0.34	-0.81	1.23
July 5th*	-1.15	2.12	-3.27	-0.29	-1.30	1.01
Aug 2nd	0.90	4.06	-3.16	1.20	-0.75	1.95
Average			-3.41			1.37

Table 2: Comparison of hadron arm surveys and raw LVDT readings of the spectrometer. Units are mm. On July 5th two surveys were done for different spectrometer angles.

Date	HRSE angle (deg)		HRSE pointing (mm)		HRSE vertical offset (mm)	
	Survey	LVDT	Survey	LVDT	Survey	LVDT
May 15th	18.083	18.082	2.44	2.31	0.23	0.01
June 6th	14.100	14.096	1.19	1.11	-0.20	-0.13
July 6th	18.085	18.087	1.91	2.02	0.06	1.78
Aug 1st	14.102	14.094	0.87	0.91	-0.28	-0.12

Table 3: Comparison of electron arm surveys and LVDT readings of the spectrometer. Units are mm.

Date	HRSH angle (deg)		HRSH pointing (mm)		HRSH vertical offset (mm)	
	Survey	LVDT	Survey	LVDT	Survey	LVDT
May 17th	47.100	47.091	1.09	1.25	0.69	0.91
June 5th	49.725	49.724	0.82	0.93	0.58	0.70
July 5th	47.101	47.096	0.34	0.48	0.58	0.56
July 5th	16.010	16.010	-1.15	-1.29	-0.29	0.07
Aug 2nd	54.202	54.204	0.90	0.65	1.20	0.62

Table 4: Comparison of hadron arm surveys and calibrated LVDT readings of the spectrometer. Units are mm.

Notes on getting EPICS LVDT data in datastream
(updated 8/9/00)

```
Notes on LVDT code
-----------------
1. Luminita Todor wrote a code to get the angle of the
    spectrometer, the horizontal pointing, and the vertical
    offset from the LVDT EPICS data in the CODA file.
    The code is located in /work/halla/ndelta-2/pointing/lvdt
    There are four parts tn.c,princ.c,ali_4.c and mag2.f

2. The code was modified so that the offset used to
```

```
    convert the LVDT pointing and vertical offset
    to the final value uses the average difference with surveys
    during e91011. The lines in ali_4.c  (written by Javier Gomez)
    were modified.
   float HPMoff[2] = {  -3.41, -6.21};/*  calibration h,e offset mkj 8/9/00 */
   float VPMoff[2] = {  1.37, -0.74};/* vert h,e offset mkj 8/9/00 */


3. To compile a Sun version of the code type: survey_sun.com
    The executable is survey_sun

4. To compile a Linux version of the code type: survey_linux.com
    The executable is survey_linux

5. To get the pointing, verting offset and angle for hadron
   and electron.
   type: survey_sun -h -e
   You will be ask:
 What file name ?
 (Please write the complete path.)
/cache/halla/ndelta/raw/ndelta_1831.dat.0

   Then the progem goes the the data file extracting the epics data.
   You will be ask for angle floor mark and vernier:

Angle mark(deg):49.5
Angle vernier(mm):5.7

  Then the program calculates the average values of the
  EPICS quantities needed to calculate the results.
  Then it outputs the following:

========================== ALIGN4 ==============================
Notation:
  +ROLL: spectrometer side downstream HIGHER than upstream
 +PITCH: spectrometer back HIGHER than nose
    HPM: Horizontal Pointing Measurement (vector in polar coord)
```

```
         HPM-ANGL is measured CCW with respect to exit beam pipe.
         HPM-MAG > 0 ==> disp. along HPM-ANGL unit vector
    VPM: Vertical Pointing Measurement.
         VPM > 0 ==> spect. pointing above target.
=================================================================
ROLL  (mrad): -0.25
PITCH (mrad): -0.10
 HPM-ANGL (deg): 220.3
   HPM-MAG (mm): 0.77
SPECT-ANGL(deg): 49.725
       VPM (mm): 0.48
       VPM (mm): 0.48
       x offset(mm):  -0.498
       y offset(mm):   0.477
       z offset(mm):  -0.588

   Then you will be ask for electron arm floor mark and vernier
 e=  1
 Average ex  -0.186380
 Average ey    7.67243E-03
 Average eTemp    27.1449
 Average e_hor_lvdt   -6763.57
 Average e_ver_lvdt    1526.86
Electron arm
Angle mark(deg):14
Angle vernier(mm):49
============================ ALIGN4 ==============================
Notation:
  +ROLL: spectrometer side downstream HIGHER than upstream
 +PITCH: spectrometer back HIGHER than nose
    HPM: Horizontal Pointing Measurement (vector in polar coord)
         HPM-ANGL is measured CCW with respect to exit beam pipe.
         HPM-MAG > 0 ==> disp. along HPM-ANGL unit vector
    VPM: Vertical Pointing Measurement.
         VPM > 0 ==> spect. pointing above target.
=================================================================
ROLL  (mrad): 0.35
```

```
PITCH (mrad): -0.10
 HPM-ANGL (deg): 104.1
   HPM-MAG (mm): 1.24
SPECT-ANGL(deg): 14.095
       VPM (mm): 0.09
       VPM (mm): 0.09
       x offset(mm):   1.207
       y offset(mm):   0.093
       z offset(mm):  -0.303
```

6. The spect-angle and x,y,z offsets can be used in the header file.
   Remember for espace the hadron angle must be negative.
   The offsets have to be in units of meters for the header file.
   If there is a survey comparison can be made to HPM-MAG (mm)
   for horizontal pointing, VPM (mm) for vertical offset
   and SPECT-ANGL(deg) for the angle.