GEM TN-93-340

Iarocci Tube Radiography

Richard Sawicki
Lawrence Livermore National Laboratory

September 1, 1992

Abstract:

Presented are the results of radiographs of a small Iarroci tube-strip board assembly. The reason for this study was to determine if it was possible to accurately measure the location of the sensing wires contained within the assembly.

Superconducting Super Collider Laboratory
2550 Beckleymeade Avenue, Mail Stop 2005
Dallas TX 75237-3946
(214) 708-6325
Fax: (214) 708-6088

Memorandum

To: G. Mitselmahker
From: R. Sawicki RWS
Subject: Iarocci tube radiography
Date: September 1, 1992

Per your request, radiographs of a small Iarroci tube-strip board assembly have been taken. The reason for this was to determine if it were possible to accurately measure the location of the sensing wires contained within that assembly. The key issue that this effort addressed was being able to discriminate the wires in an assembly that contained other components and structure (support frame, cathodes ...). It was argued that if this could be performed on this test vehicle then full scale PDT's or LSDT's would also be feasible. Results are favorable; resolution of the placement of all wires in the assemblies is about 12 microns.

The assembly that was sent to LLNL for examination is described in the attached memorandum from Yuri Bonushkin. Twenty four, 50 micron diameter, gold plated tungsten wires were mounted in a 6 x 4 rectangular array. This array was exposed to 200 kev x-rays at an incident angle of about 3 degrees. Because of the incidence angle of the x-rays the wires appear in groups of four, each group corresponding to wires located in the same horizontal position. Figure 1 shows radiographs for four of the groupings. Wires are clearly distinguishable. The radiographs were submitted to a precision microdensitometer that read and recorded the positions of the wire. Output of these scans are also shown on Figure 1 and show that the wires are easily resolved. Figure 2 is an expanded presentation of the microdensitometer scan showing a single wire. Pixel size is 12 microns and wire center location can be resolved to at least that precision. Figures 3 - 6 show scans along each end of the wire array along with the corresponding wire center locations as determined by the microdensitometer processing routines. Results are in pixels and can be transformed to microns by multiplying by 12.

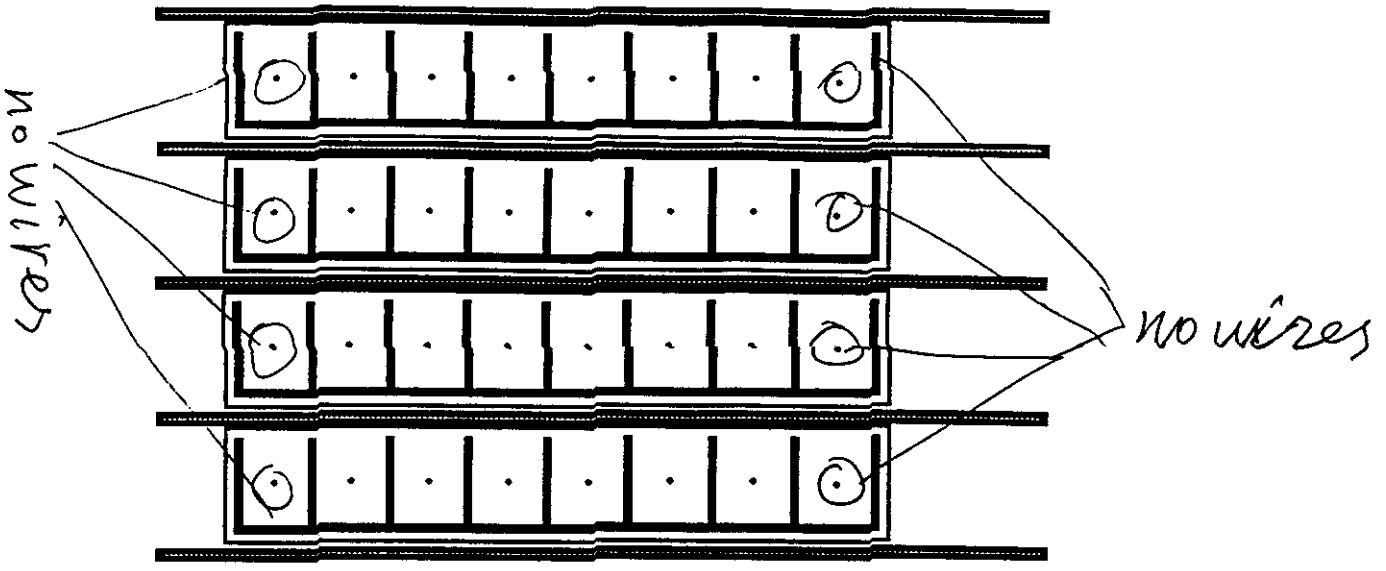
The results of this exercise indicate that accurately verifying the relative position of the wires in a drift chamber using radiographing is feasible. The technique can be adapted to chambers which are 3 m wide by taking multiple exposures and using fiducials to link film segments together. You have asked about the possibility of building an x-ray scanner that could more quickly scan across the wire plan and record real-time the wire locations with an electronic x-ray sensor. This too is conceivable but would require development time and money. In the mean time, the radiography technique has been demonstrated to work and can be used to verify in the near term wire placement of chamber prototypes that are being delivered to the Texas Test Rig. In order to do this at LLNL some support fixturing would have to designed and fabricated to hold the chambers during test. Development of a rapid scanner would require authorization from SSCL prior to commencement.

cc: M. Harris
M. Marx
F. Nimblett
G. Sanders

F. Taylor
C. Van Bibber
[redacted]

Dear Rick,

The assembly you are recieving is a small Iarocci tube-strip boards assembly. The cathode is aluminum with wall thickness equal to 1mm, cell size is 10x10 mm. The wires are 50 micron gold plated tungsten and there're no wires in the two side cells of each tube.



The wire are supposed to be soldered with rather pour precision, say, 500 microns. You can tilt the chamber a bit to see them one by one. It's also interesting to know the strip boards positioning accuracy, it's supposed to be well below 100 microns.

For any questions mail me at SSCVX1::BONUSHKIN, as Gena wanted me to take care of this. It was our group at Dubna, who tried to play with X-rays for wire position determination inside a chamber. I can also get you in touch with a person who was originally enthusiast of this idea.

Best regards, Yuri Bonushkin.

BONUSHKIN MEMORANDUM

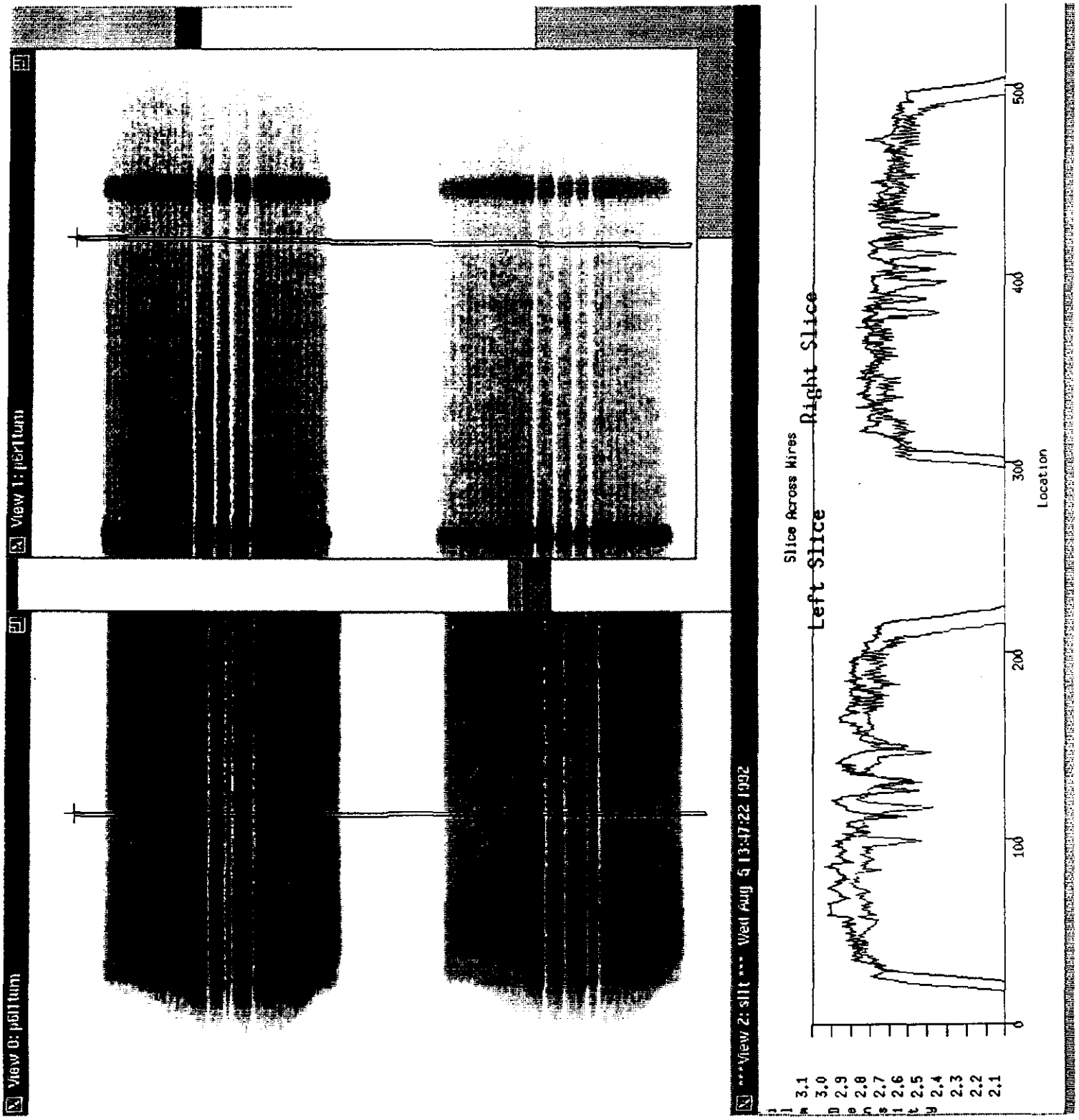


FIGURE 1. RADIOGRAPHS + MICRODENSITOMETER SCANS

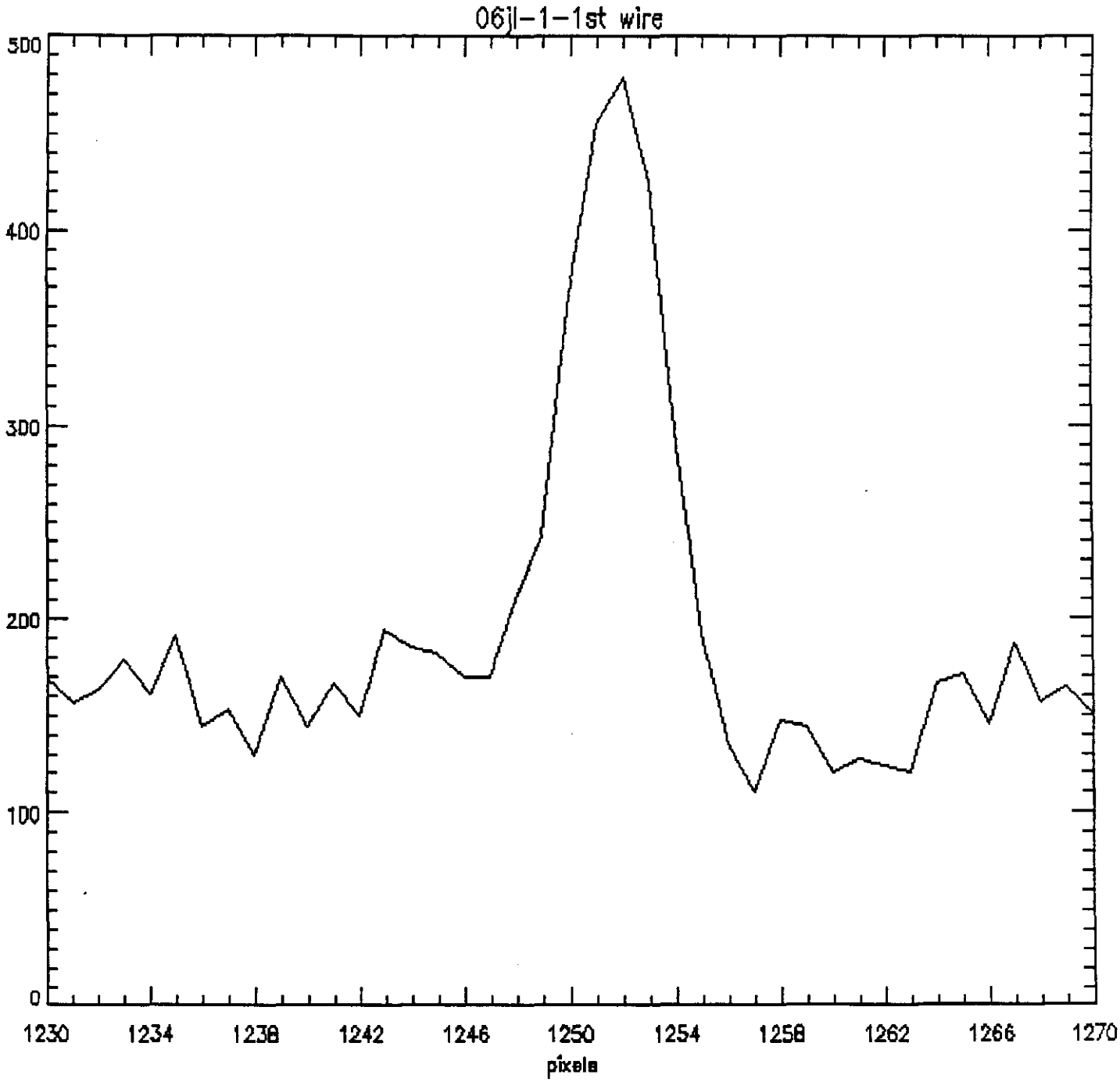


FIGURE 2. SINGLE WIRE RESOLUTION

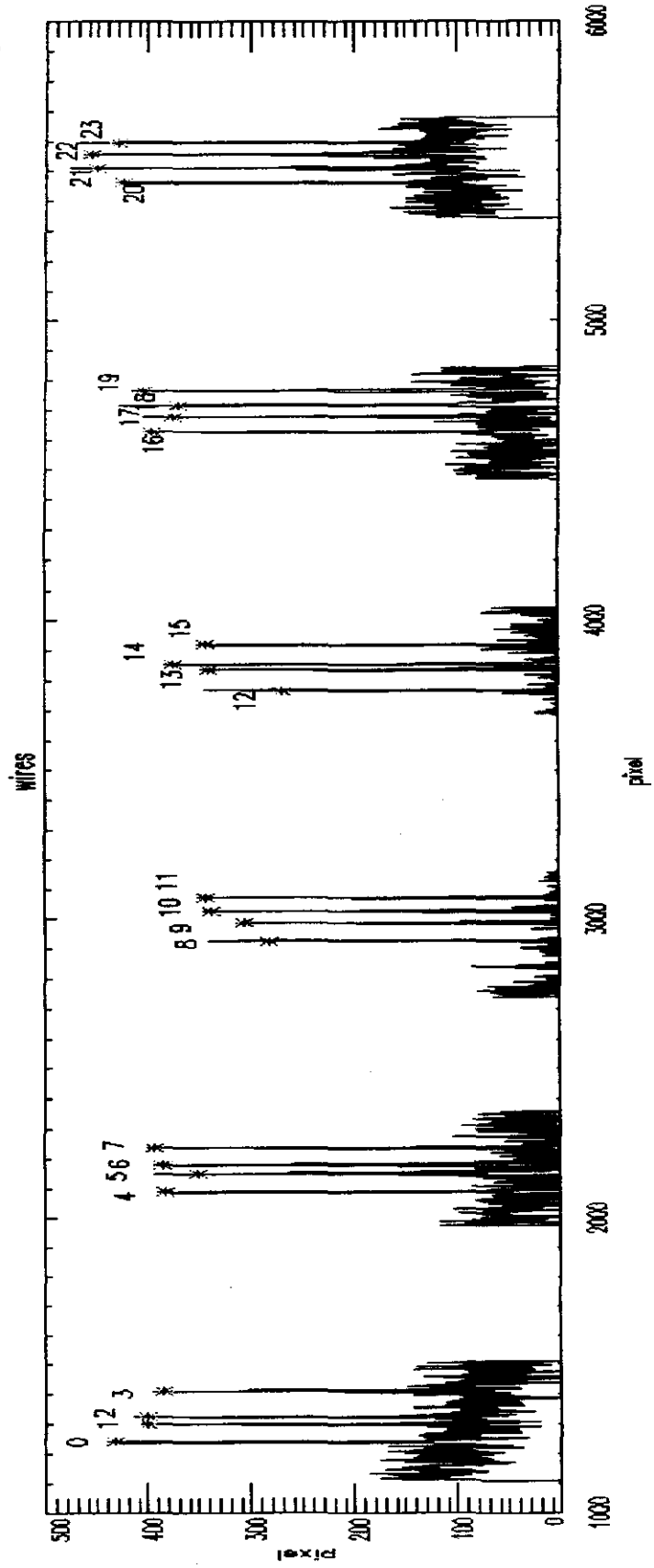


FIGURE 3. MICRODENSITOMETER SCAN - END A

Locations of wires
14-Aug-1992... J. Ticehurst

Peak 0	at	1239.50
Peak 1	at	1300.50
Peak 2	at	1324.50
Peak 3	at	1409.50
Peak 4	at	2088.50
Peak 5	at	2149.50
Peak 6	at	2179.00
Peak 7	at	2237.00
Peak 8	at	2927.50
Peak 9	at	2989.50
Peak 10	at	3028.00
Peak 11	at	3073.00
Peak 12	at	3768.50
Peak 13	at	3838.00
Peak 14	at	3855.00
Peak 15	at	3920.50
Peak 16	at	4627.50
Peak 17	at	4678.50
Peak 18	at	4717.50
Peak 19	at	4766.50
Peak 20	at	5462.50
Peak 21	at	5510.50
Peak 22	at	5556.50
Peak 23	at	5595.50

FIGURURE 4. PIXEL COUNTS - END A

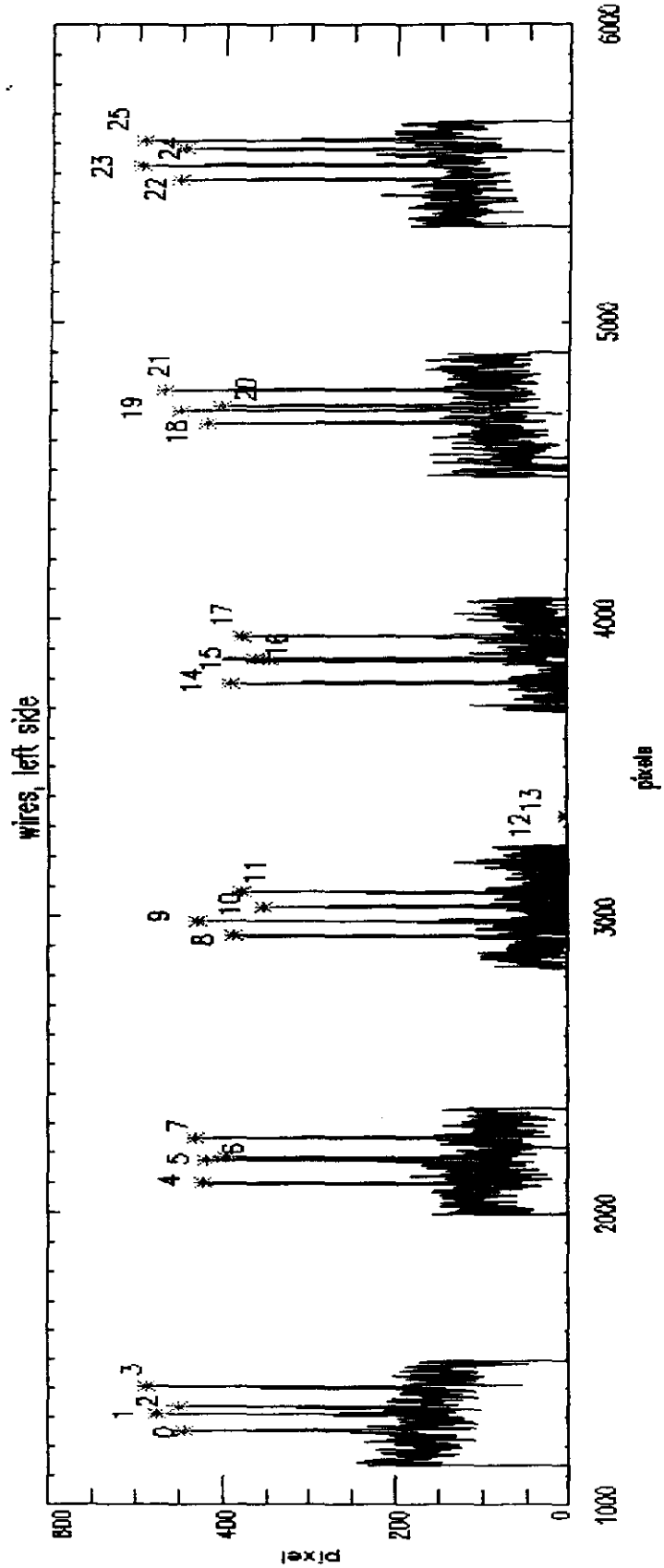


FIGURE 5. MICRODENSITOMETER SCAN - END B

Peak locations: left side
14-Aug-1992... Judy Ticehurst

Peak	0	at	1251.50
Peak	1	at	1308.50
Peak	2	at	1335.00
Peak	3	at	1403.00
Peak	4	at	2100.00
Peak	5	at	2176.00
Peak	6	at	2184.50
Peak	7	at	2251.00
Peak	8	at	2935.00
Peak	9	at	2985.00
Peak	10	at	3033.00
Peak	11	at	3084.50
Peak	12	at	3332.50
Peak	13	at	3336.50
Peak	14	at	3784.00
Peak	15	at	3859.50
Peak	16	at	3866.00
Peak	17	at	3941.00
Peak	18	at	4661.50
Peak	19	at	4703.00
Peak	20	at	4719.00
Peak	21	at	4772.50
Peak	22	at	5481.00
Peak	23	at	5528.00
Peak	24	at	5584.00
Peak	25	at	5612.00

FIGURE 6. PIXEL COUNT - END B