Wire Procurement and Quality Control for the BABAR Drift Chamber

K.T. McDonald

Princeton U.

June 24, 1996

Wire Types

The drift chamber is 2.76 m = 9.2 ft long.

Order twice nominal length to allow for loss during stringing.

1. 7104 sense wires, 20-μm gold-plated tungsten; as stiff as possible for ease of insertion into crimp pins.
   Order 150,000 ft.
   Vendor: Thermionic Products.

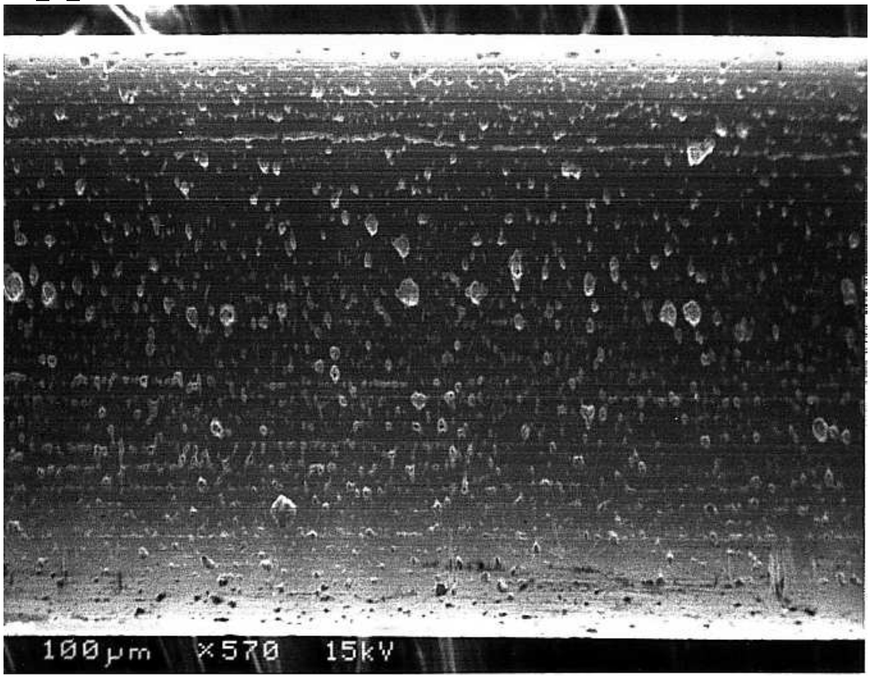
2. 14,208 field wires, 120-μm gold-plated aluminum.
   Order 300,000 ft (change diamond dies every 10,000 ft).
   Vendor: California Fine Wire.

3. 7,456 clearing wires, 80-μm gold-plated aluminum.
   Order 150,000 ft.
   Vendor: California Fine Wire.

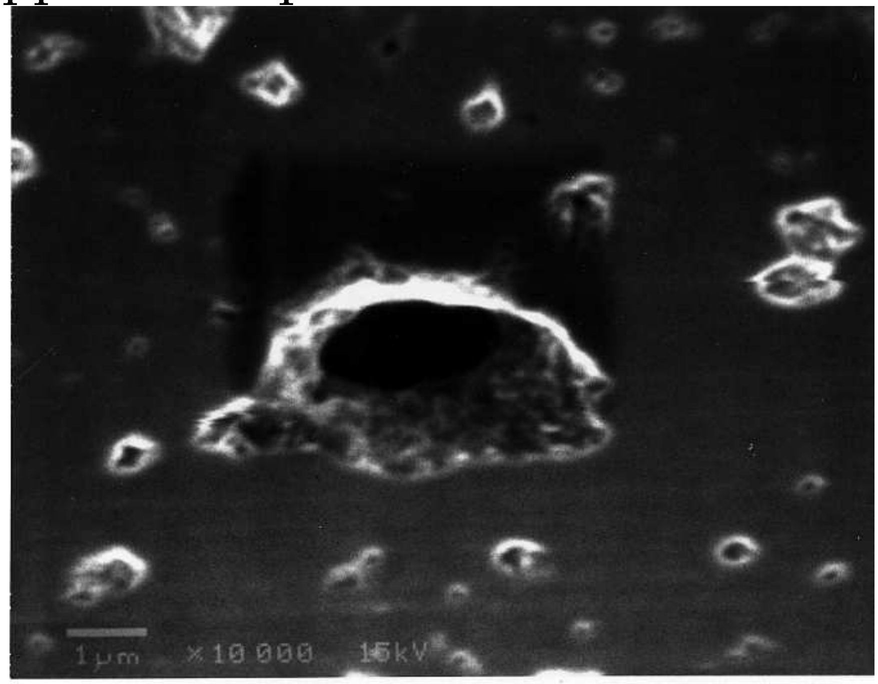
Quality of Aluminum Plating

The gold-plated aluminum wire is pitted.

CLEO wire appears the same.

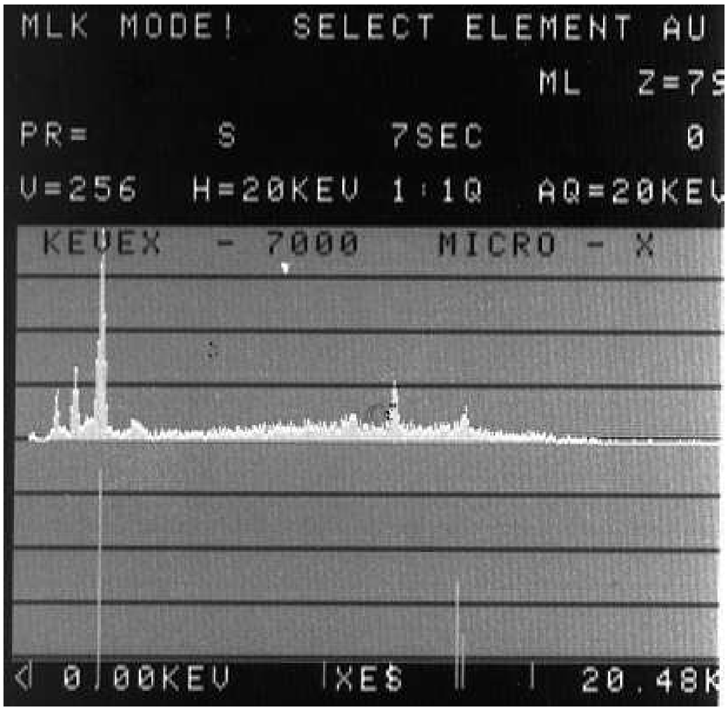


Some pits appear to expose bare aluminum.

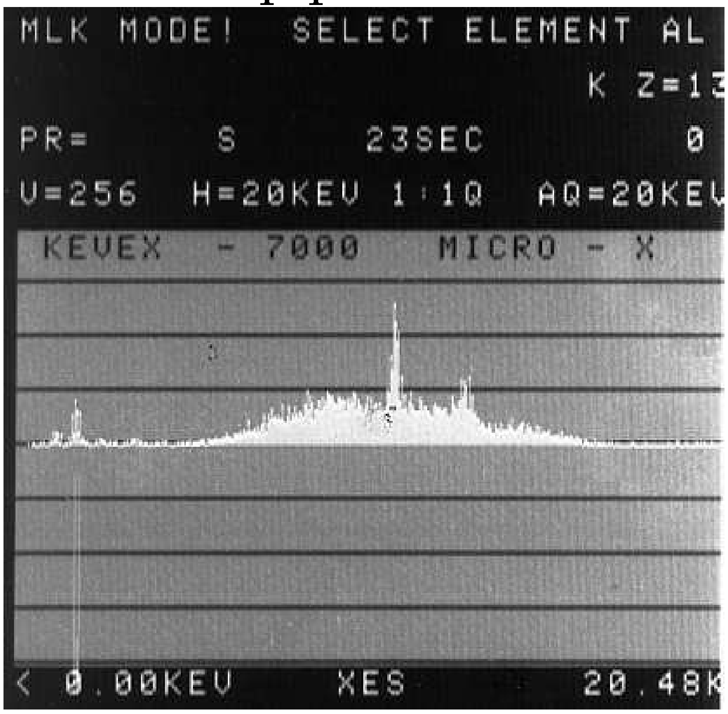


X-Ray Analysis

Both gold and aluminum detected in smooth regions.

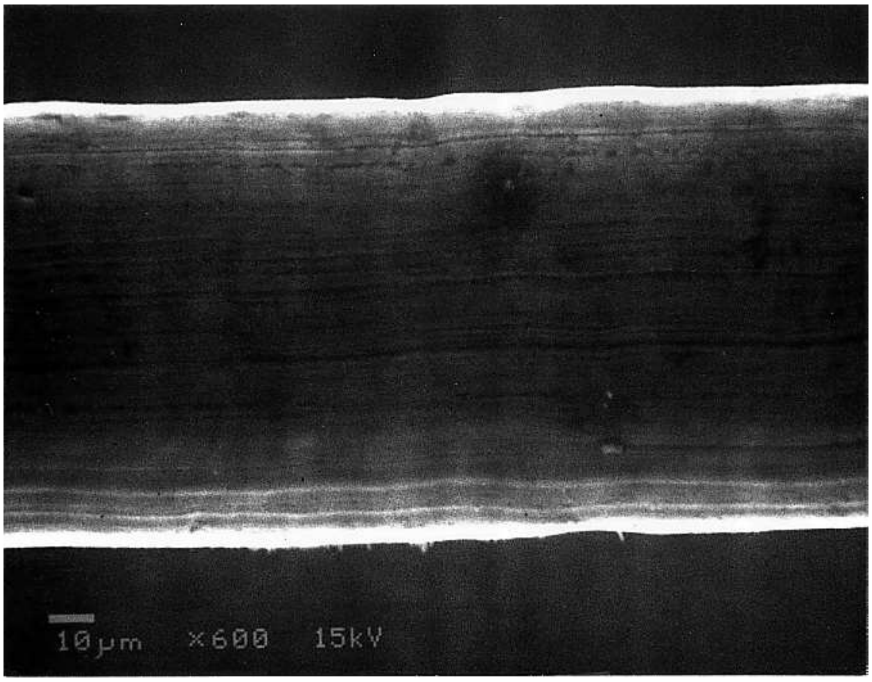


No gold detected in a deep pit.

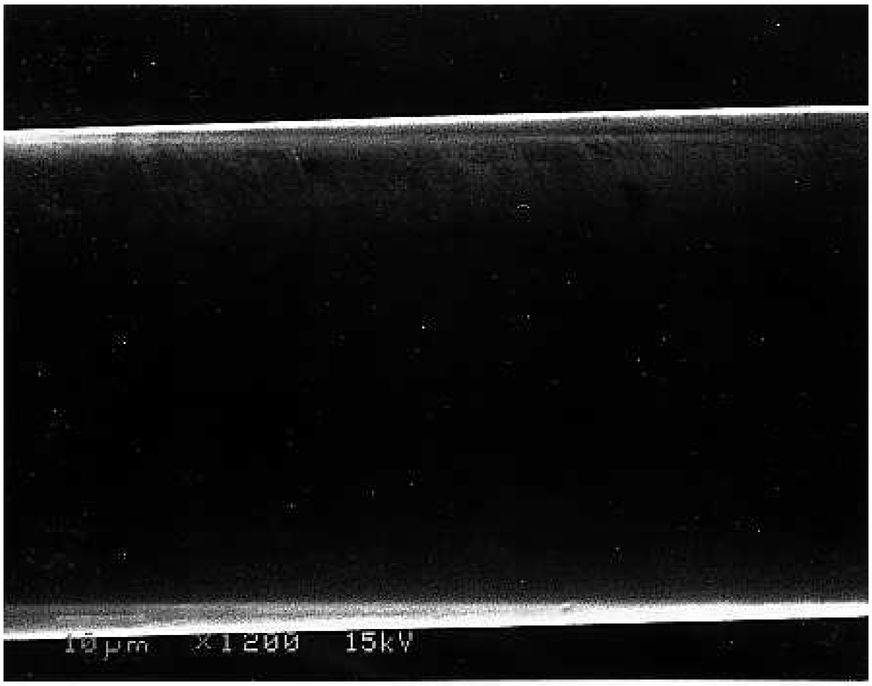


Other Samples from California Fine Wire

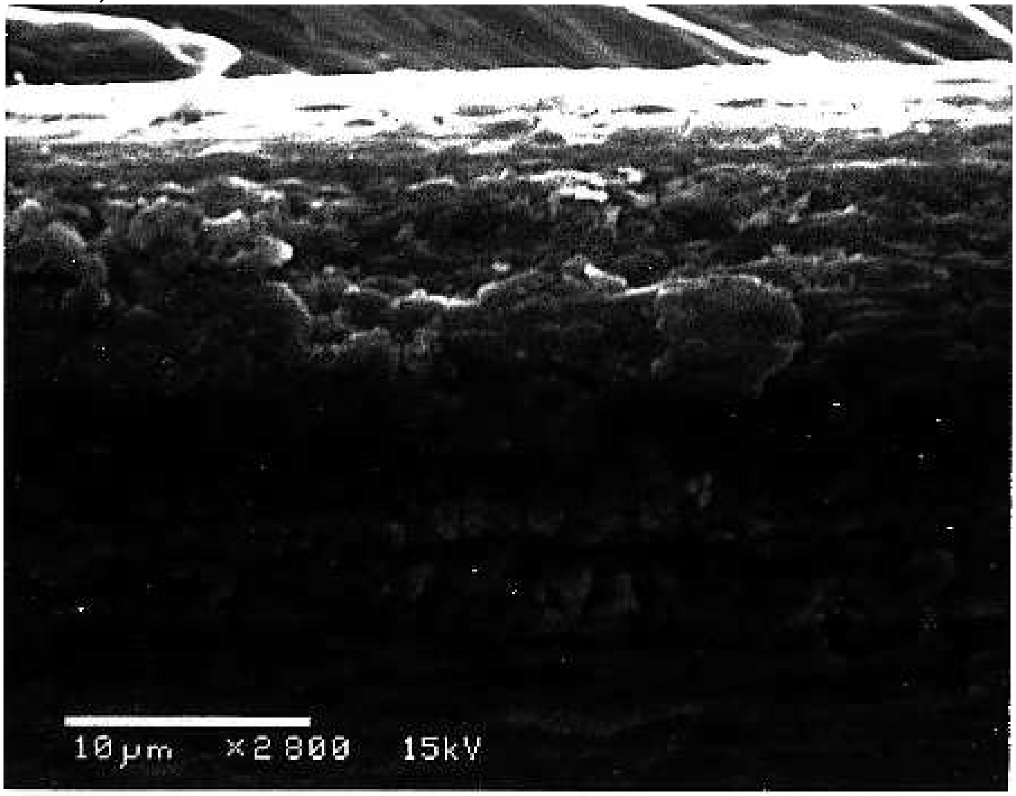
Bare wire, manufactured in 1990.



Silver-plated Al wire manufactured for KLOE in 1994.



Bare Al wire, with 'Alodine' chromate surface treatment.



Is the Gold Plating OK?

Plating on Al cathode wires is to avoid high surface resisitivity, which might lead to positive-charge buildup and eventual breakdown with emission of electrons and/or photons (Malter effect).

The pitting in the surface of the California Fine Wire is a minor effect.

CLEO is currently building drift chamber DR3 with the same wire, with no sign of trouble in tests.

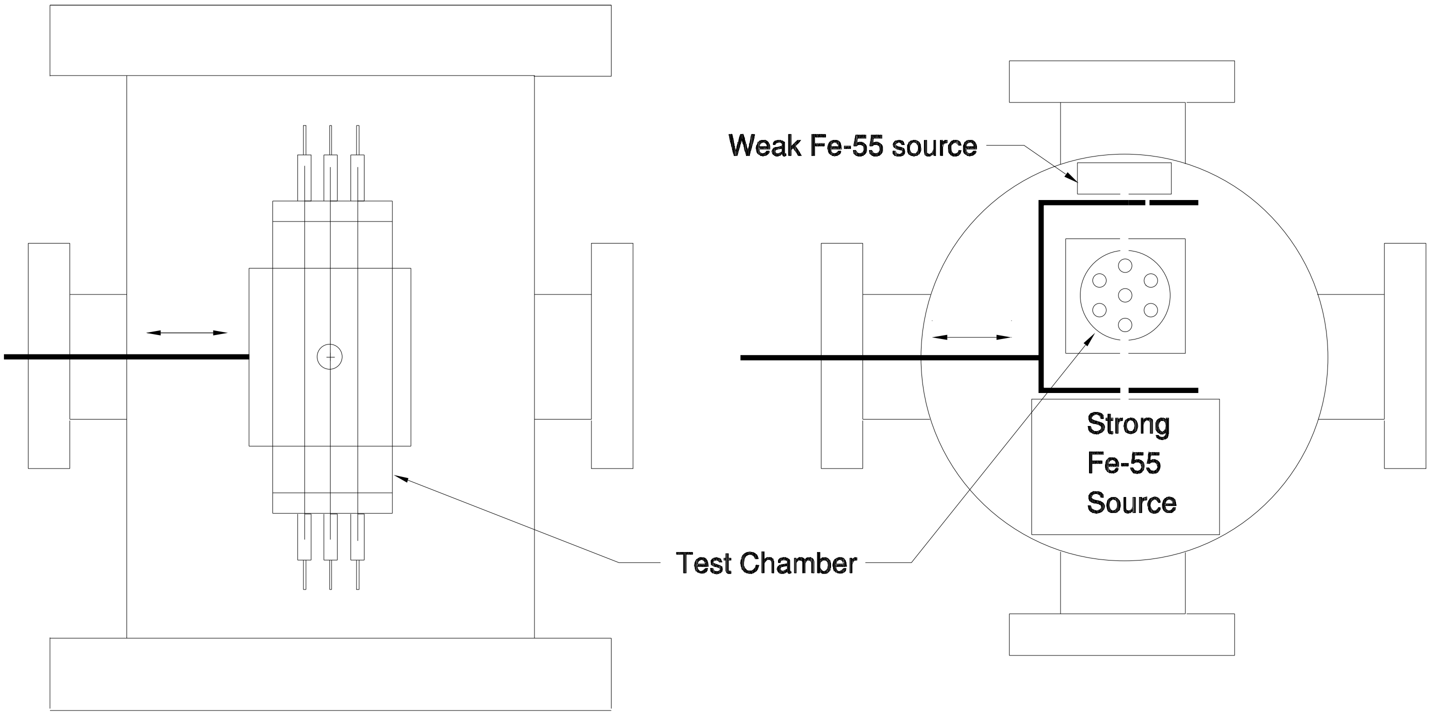
$\Rightarrow$ Reasonably safe to proceed with gold-plated wire from California Fine Wire.

Delivery time $\approx$ 10 weeks, so there is time for R&D.

Change baseline only in event of very striking results.

R&D on Aluminum Wire

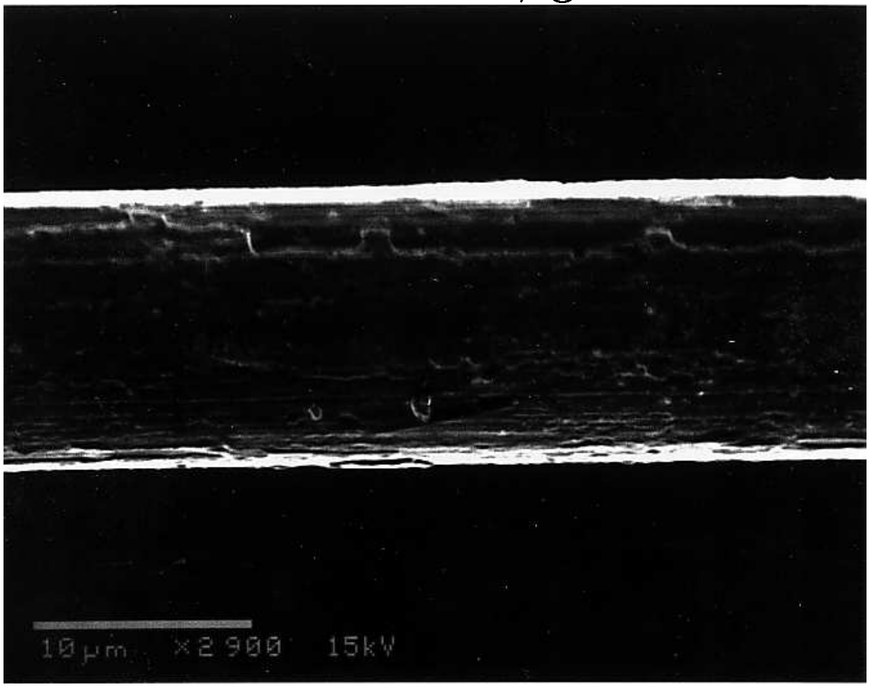
1. The Prototype II drift chamber at SLAC will test performance of baseline wire types.
2. Aging studies in a small chamber are underway at C.S.U.
3. Aging studies in small test chamber with both gold- and silver-plated Al wire from California Fine Wire:



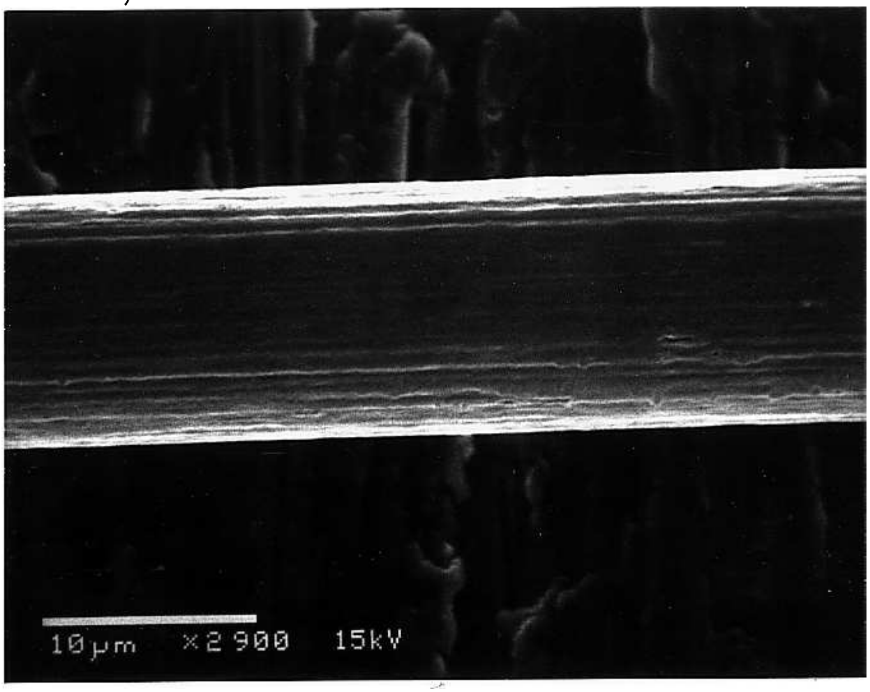
4. Investigate option to have gold plating of bare Al wire from California Fine Wire done in Switzerland by Fluhmann-Galvanoltinech (recemmoned by P. Taras).

Gold-Plated Tungsten Wire

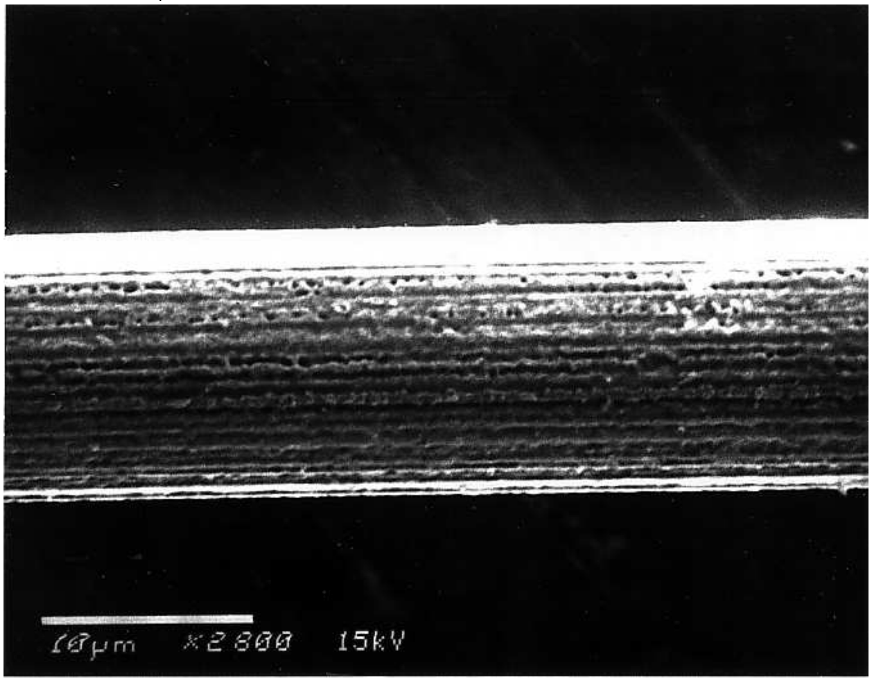
Wire from Thermionics Products; good stiffness.



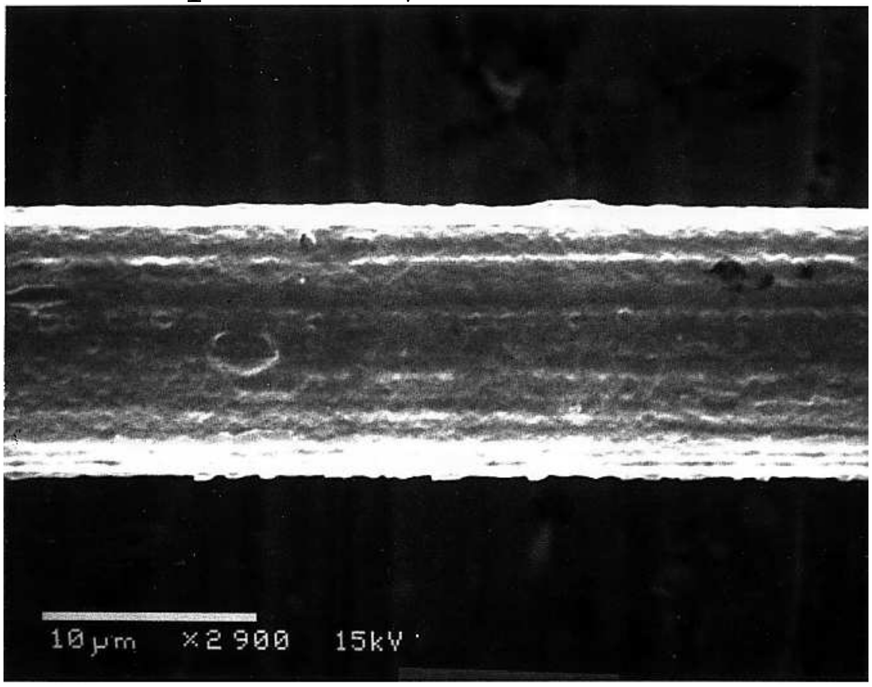
Wire from Luma; better surface but less stiff.



Old wire from GE; considered bad.



Old wire from Philips Elmet; considered bad.



Proposed Quality Control

At least one sample from every spool will be tested as follows:

1. Wire diameter: weigh a 1-m length on a Mettler AT1005 Mass Comparator (accuracy: 0.02 mg); determine ρr^2 to 1%.
2. Spring constanst and breaking force: measure elongation *vs.* force with a Mitutoyo micrometer and a Denver Instruments balance interfaced to a PC.
3. Surface appearance: use an Amray 1200B scanning electron microscope; option to perform x-ray analysis.
4. High-voltage behavior: test a sample as an anode wire in a short chamber using a CAEN N470 programmable power supply interfaced to a PC.

Use BaBar crimp pins in tests 2 and 4.

Not well characterized: thickness of plating.