

S I G N E T

# **Things That are No Longer Disliked**

**May 15, 2002**

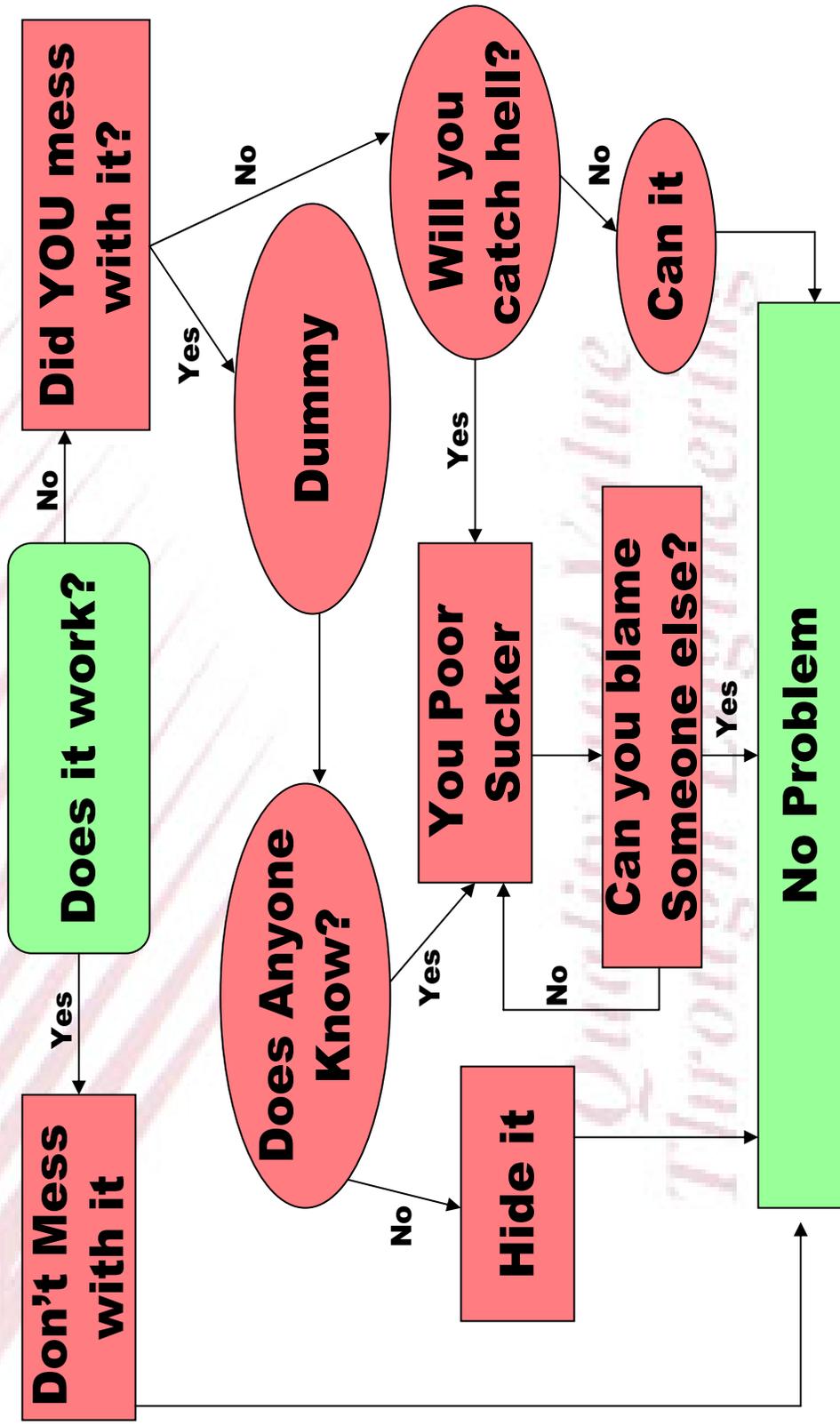
**Mike Gunneen**

*Quality and Value  
Through Engineering*

# Issues and Solutions

- **OEM's cannot produce a tool that is all things to all customers**
- **The need exists to Modify, Enhance and Improve upon OEM components to suit individual manufacturing requirements**
- **Equipment Engineers need to step back and ask the question "What can be done to better tailor my planter to my applications"?**
- **The following Problem Solving Flow Chart may be of use.**

# Problem Solving Flow Chart



## A2F - 350D Issues

- **Arc Chamber**
- **Extraction Assembly**
- **Filament Clamp**
- **Gas Feed Tube**
- **Freeman Filament life**

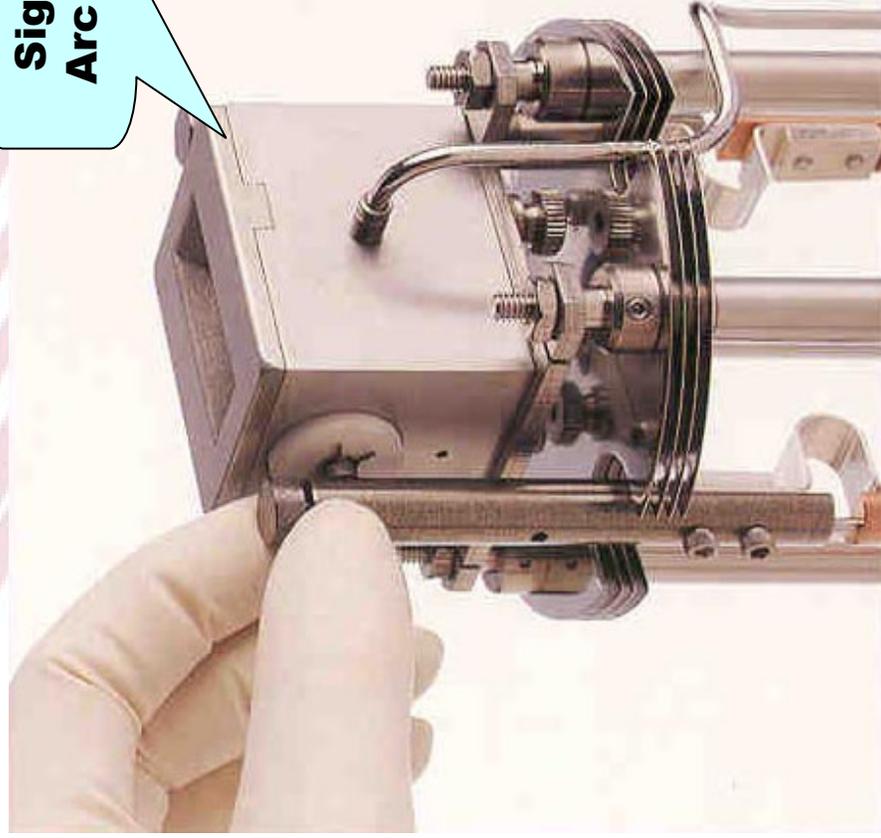
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# **A2F - 350D Solutions**

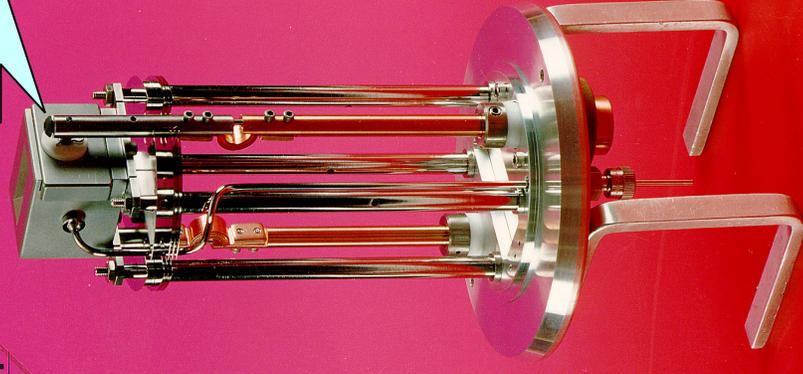
- **30-5000 Arc Chamber**
- **32-5393 Improved Filament Clamp**
- **31-8494 Enhanced Gas Feed Tube**
- **30-5395-7 Extraction Assembly**
- **Freeman to Bernas upgrade**

# A2F - 350D Solutions

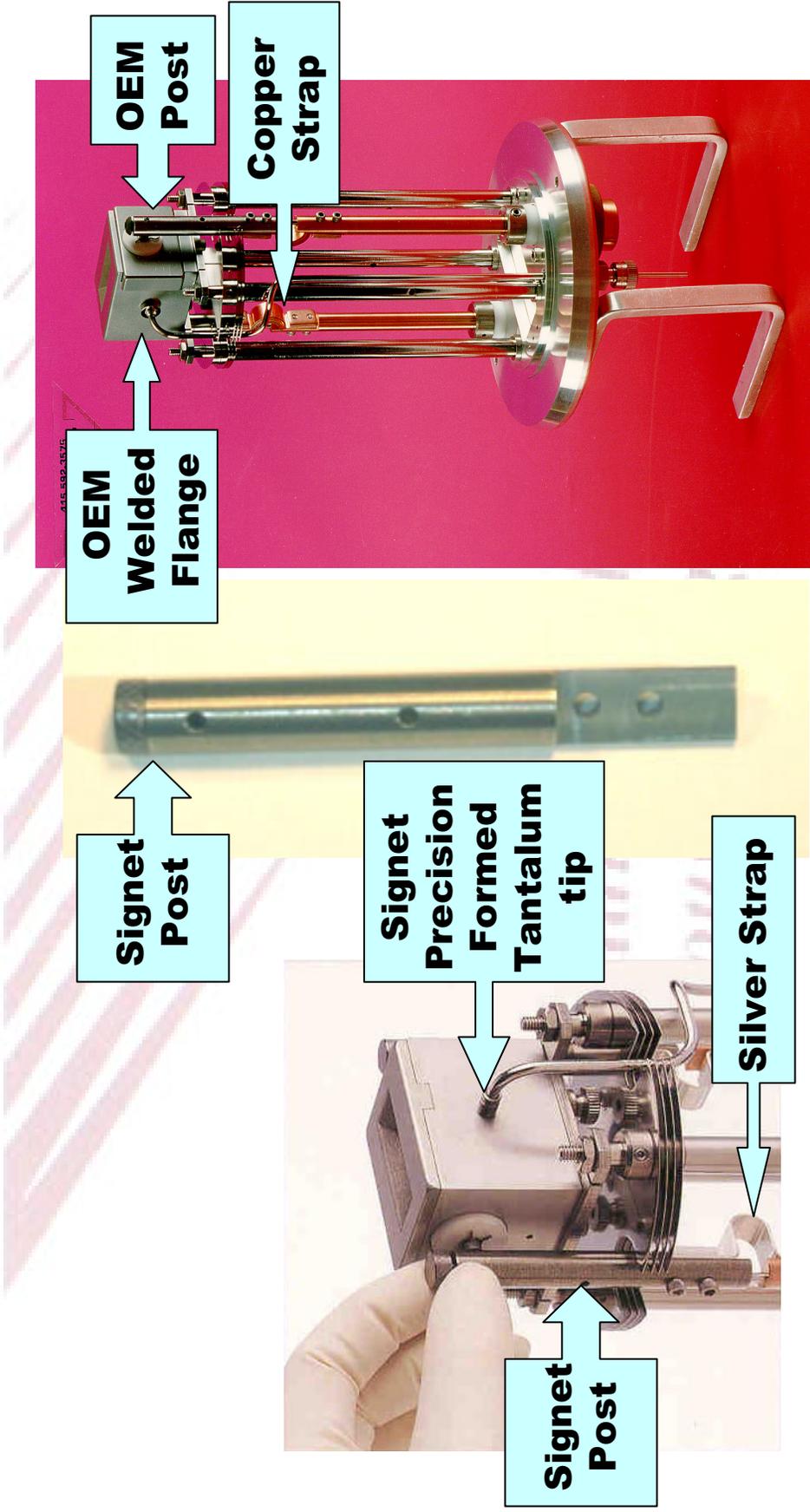
**Signet 5000  
Arc Chamber**



**OEM  
Arc Chamber**



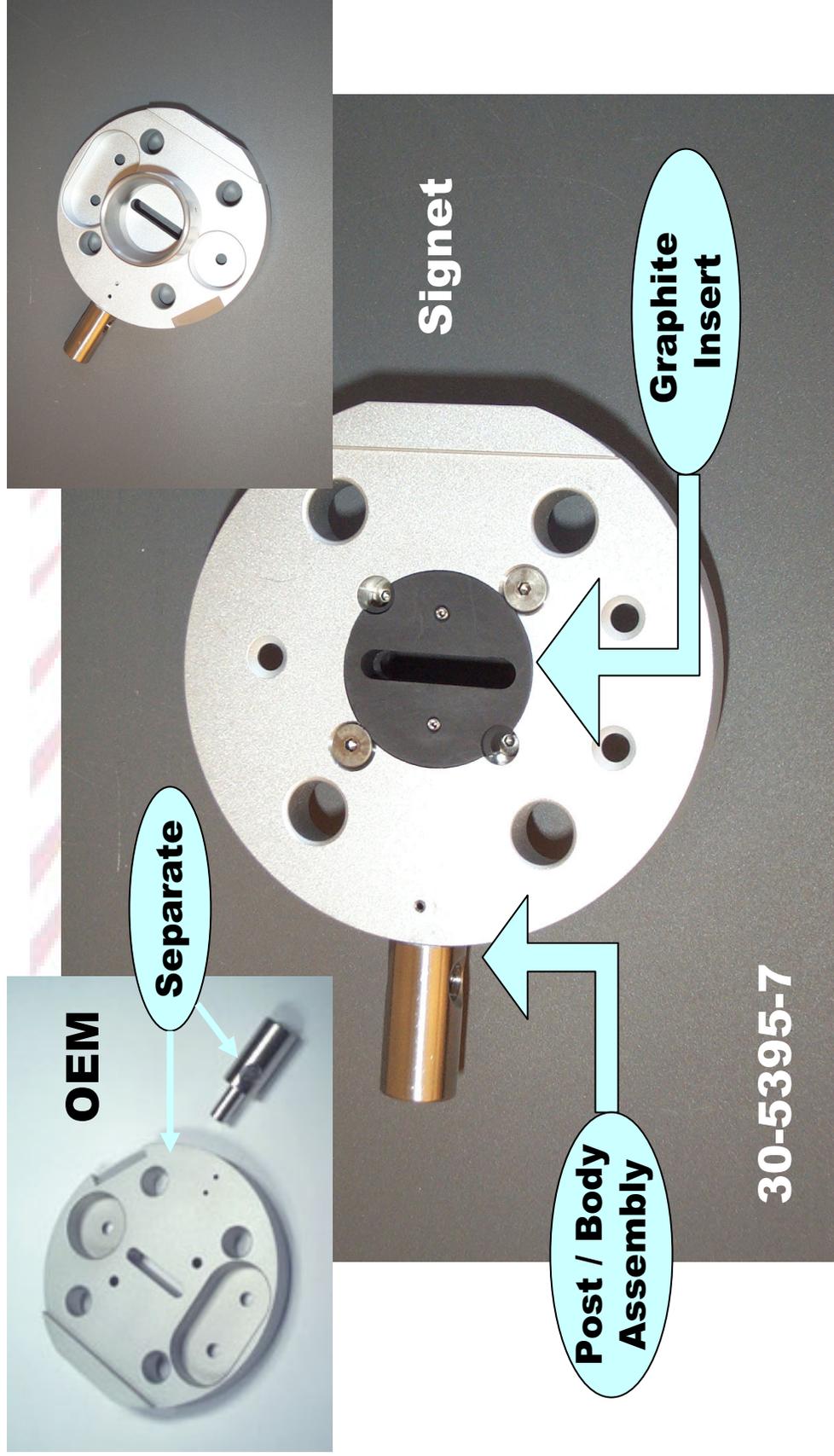
# A2F - 350D Solutions



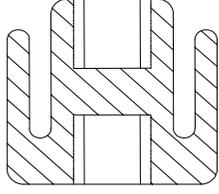
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# A2F - 350D Solutions



# SIGNET Extraction Solutions

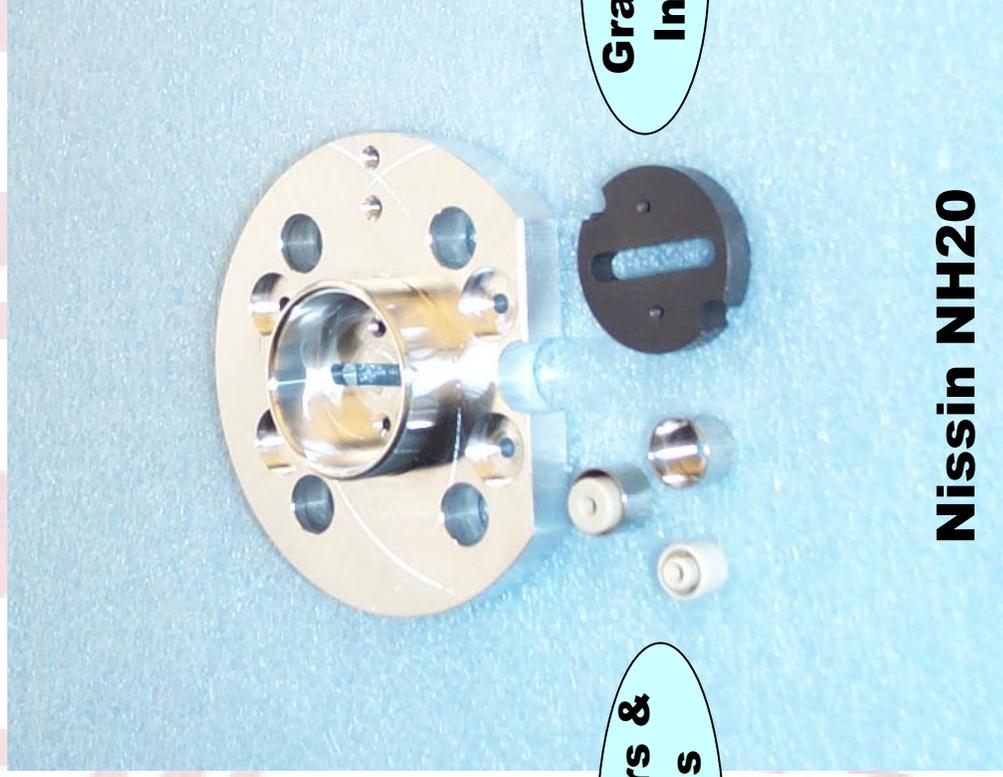


Cross-section view of 30-6042 shows the internal shielding.

## SIGNET IMPROVED STANDOFF

First sold March 7, 1989

# Extraction Solutions



# 6200 Issues

- **A major complaint about the 6200 implanter is the short Filament life**
- **Previous attempts to convert to a Bernas source to extend the filament life required a complete new ion source that cost more than most FAB's could afford to spend**

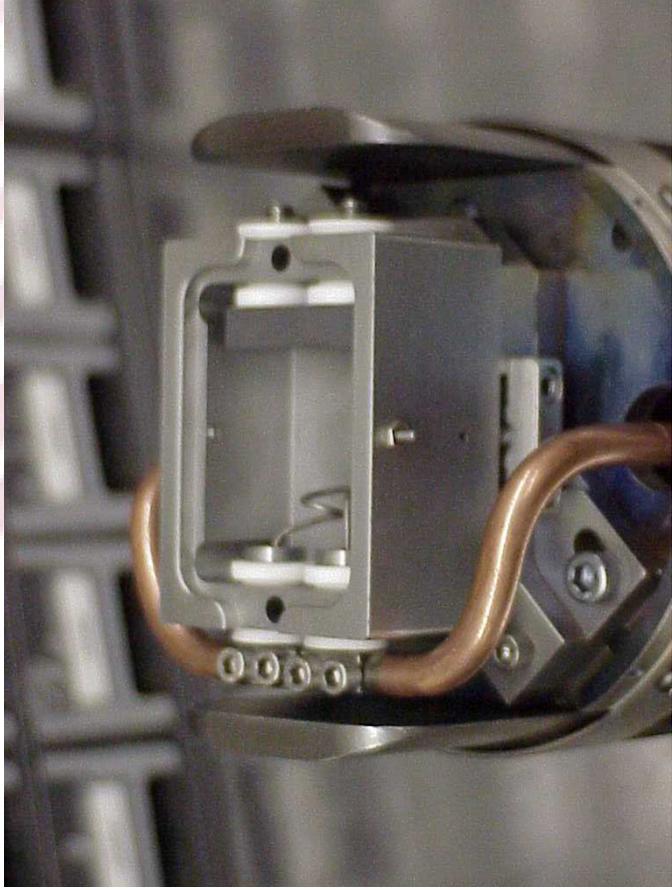
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## 6200 Solutions

- **Signet developed a source conversion at an affordable price using an existing Freeman ion source.**

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# Signet 6200 Bernas



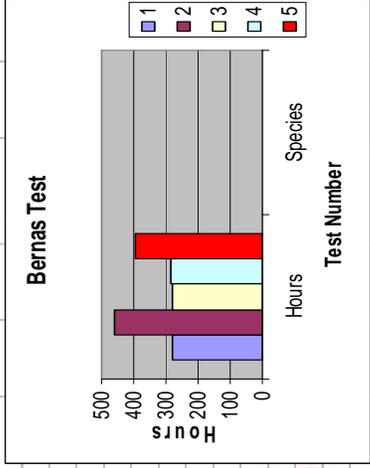
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# Signet 6200 Bernas

Bernas tests				
Unit : Eaton 6200				
Species = AsH4, BF3 and PHOS				
Beam Current: 240uA - 430uA				
A HT Source was fitted with the Bernas components				
Freeman HT normal life time = 96 hours = +/- 20 hours				
Hours = time to filament failure				
Test number	Hours	Species	Ave. Beam Current	
1	280	AsH4	400uA	
2	462	AsH4	240- 430uA	
3	280	AsH4 + BF3	240 uA	
4	286	AsH4 + BF3 + PHOS	240 uA	
5	396	AsH4 + BF3 + PHOS	240 uA	



# SGMFT

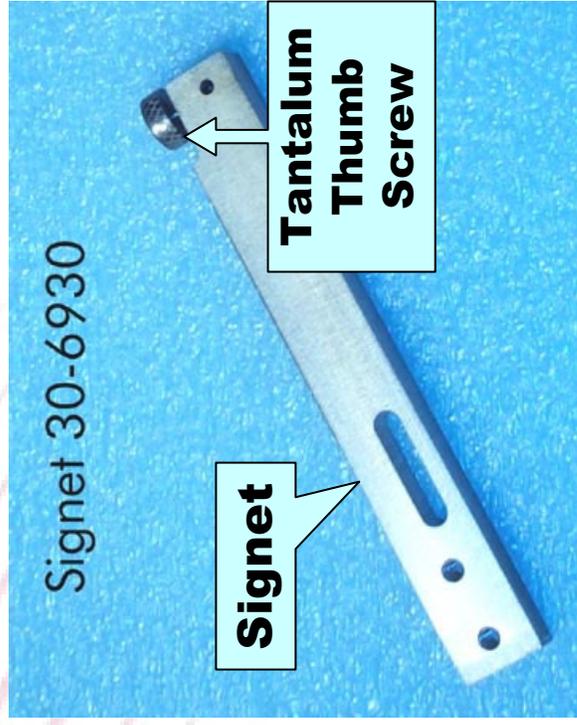
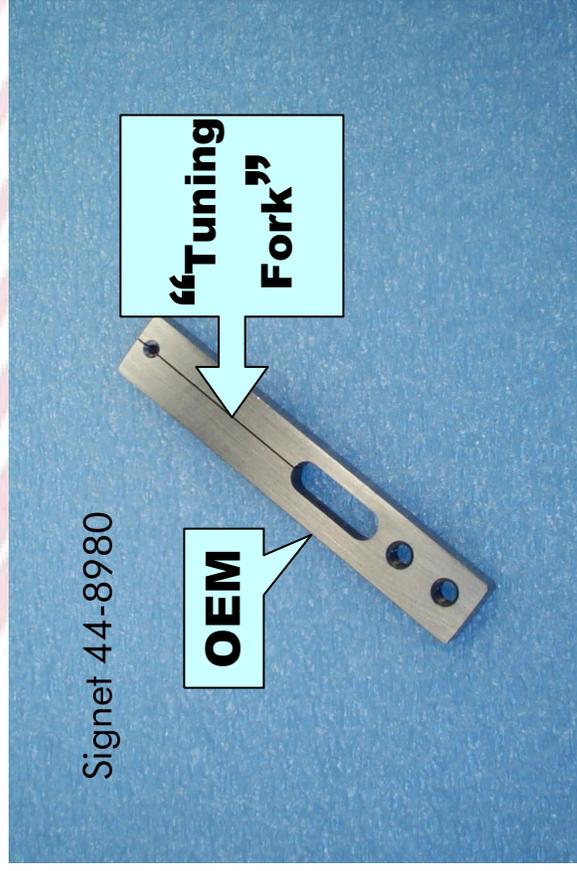
## E220 / E500 Issues

- **Filament Clamps**
- **Costly Boron Nitride Insulators**
- **Six piece Arc Chamber**
- **Life of Arc Chamber**
- **Freeman performance**

# **E220 / E500 Solutions**

- **Improved Filament Clamps**
- **Offer Alumina as an alternative to costly Boron Nitride**
- **Replaced six piece Arc Chamber with monolithic Signet 7000 series Arc Chamber**
- **Replaceable Aperture and Long “U” Liner**
- **Upgraded Freeman E220 to Bernas source**

# SIGMET E220 / E500 Solutions



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# SIGMET E220 / E500 Solutions



# SIGMET

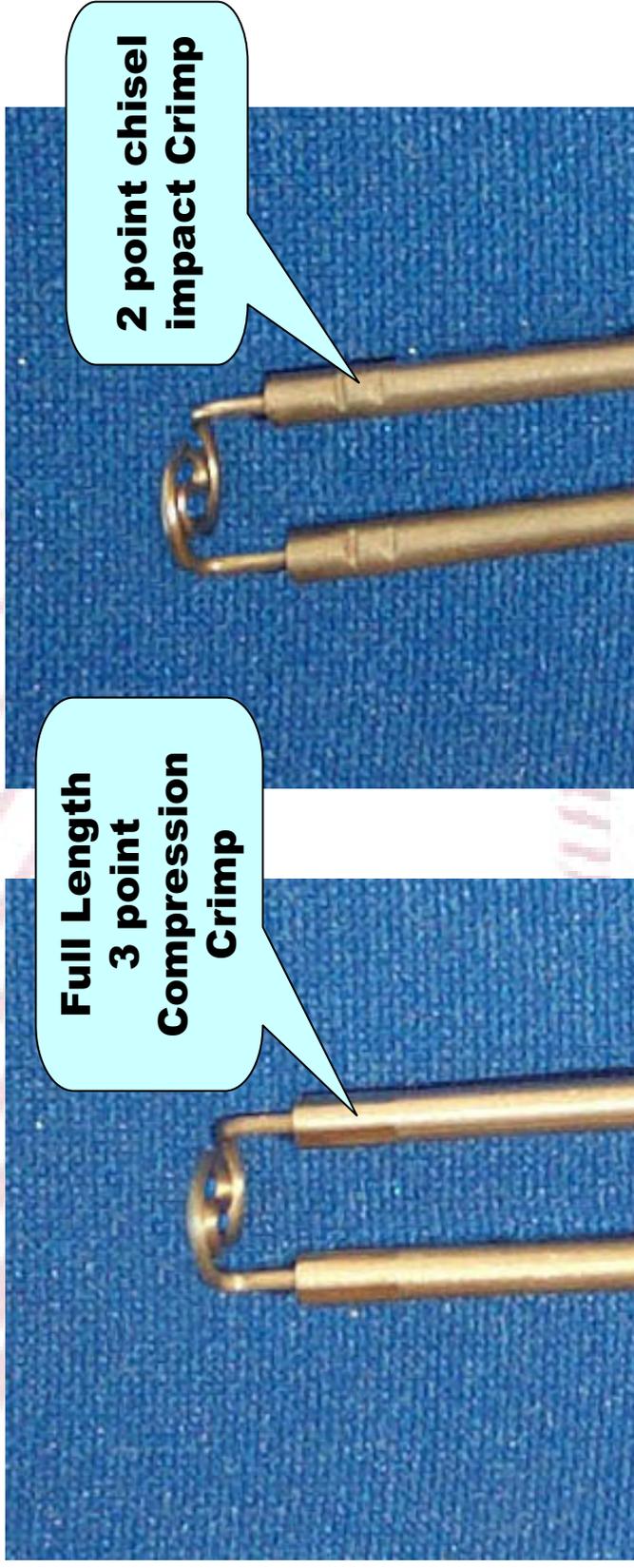
## GSD Series

- **Customers were not happy with:**
  - ▶ **ELS Filament had alignment problems causing assembly problems and premature filament failure**
  - ▶ **Filament Clamp - Design issues**
  - ▶ **Arc Chambers are large and costly to replace at EOL**
  - ▶ **Cathode wire shorted easily**

# Filament Design Issues

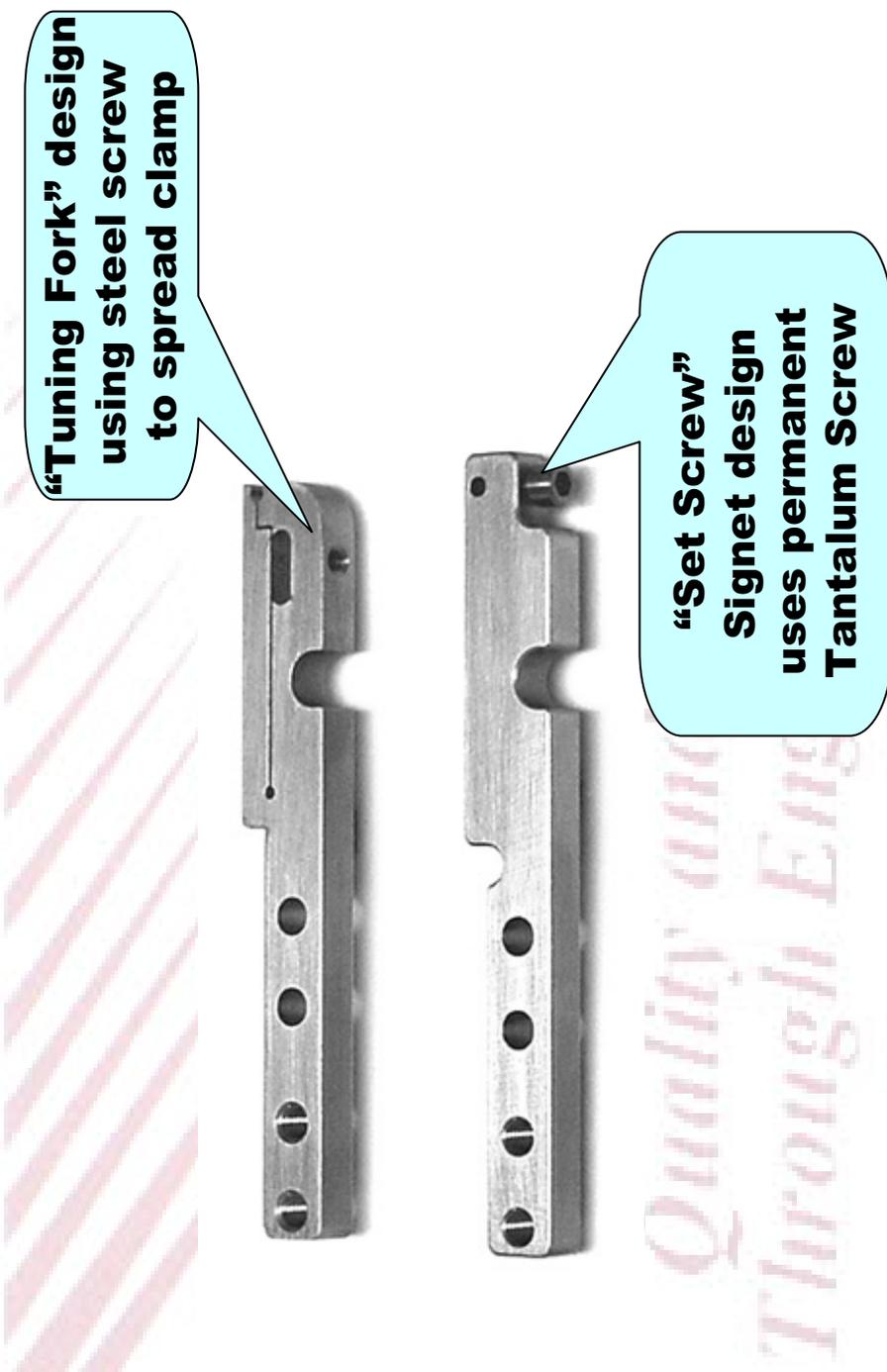
- **The ELS filament is a Tungsten filament mounted using Tantalum legs bend at 90° where the clamp is connected**
- **Cleaning of the mounting hole in the Tantalum legs has always been a problem.**
- **Crimping of the Tantalum to the Tungsten often damages the Tungsten and is inconsistent**
- **Signet improved on the cleaning to enhance electrical conductivity and reduce outgassing**
- **Signet improved on the crimping to reduce the incidence of cracking the tungsten and improve on electrical conductivity**

# Filament Design Issues



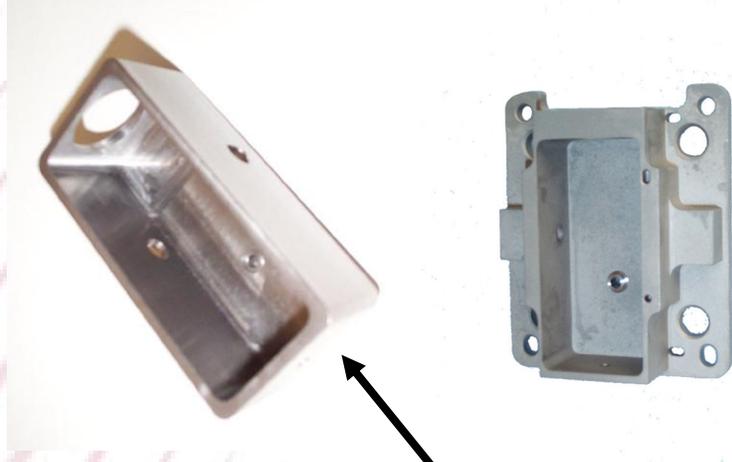
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# Filament Clamp Design Issues



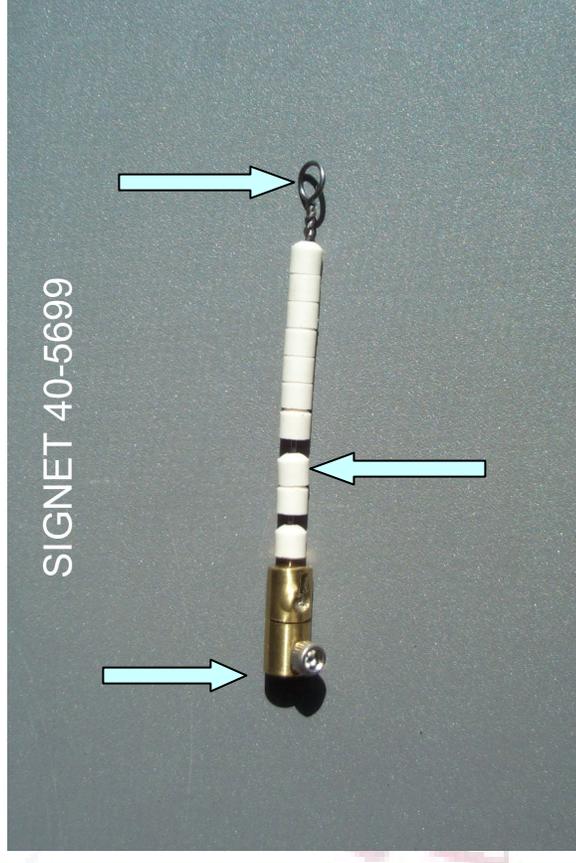
# Costly Arc Chambers

- The GSD uses a massive Arc Chamber that is costly in Moly and very costly in Tungsten.
- Signet developed manufacturing techniques that allowed us to produce a Tungsten Arc Chamber at an affordable price
- Signet designed a **heavy duty liner** that protects the Arc Chamber, extending its life significantly.



# Cathode Wire Assy.

- **The OEM cathode wire can easily short out**
- **Signet addressed this problem and solved it by insulating the wire**
- **Signet one piece design is easier to replace**



# **VISION Issues**

- **High Cost of Tungsten Parts**
- **Expensive, Fragile, Cumbersome Gas Feed**
- **Filament Clamp Design**
- **Costly Ceramics**
- **Base Plate Design and Cost**
- **Repeller Design**

# **SVISION Solutions**

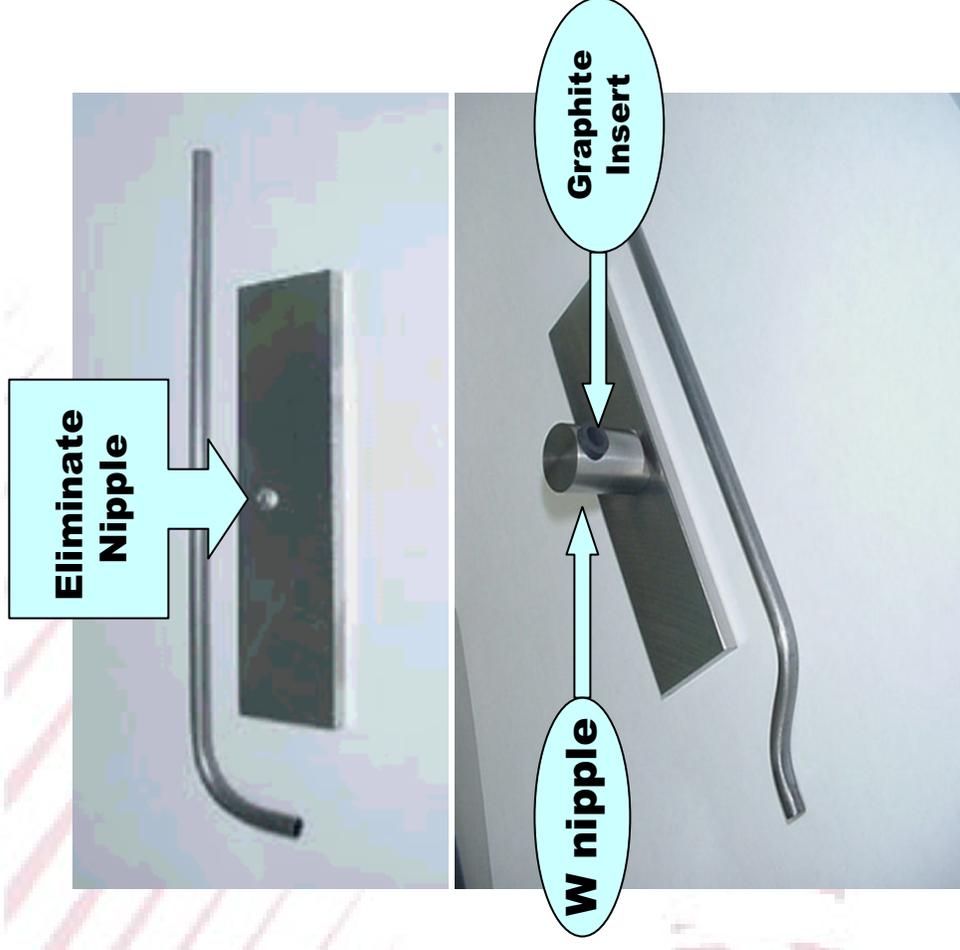
- **Offer Moly / TZM Alternative**
- **Improved Gas Feed**
- **Improved Filament Clamp**
- **Reduced Number of Ceramics**
- **Improved / Lower Cost Base Plate**
- **Improved Repeller**

# **Moly / TZM**

- **OEM standard is Tungsten**
- **Cost of Tungsten is ~3X Moly**
- **Tungsten is only needed for BF<sub>2</sub>**
- **Analyzer Magnets do not distinguish Mo<sup>++</sup> from B<sup>+</sup> ions**
- **When not running Boron Tungsten is an unnecessary expense**

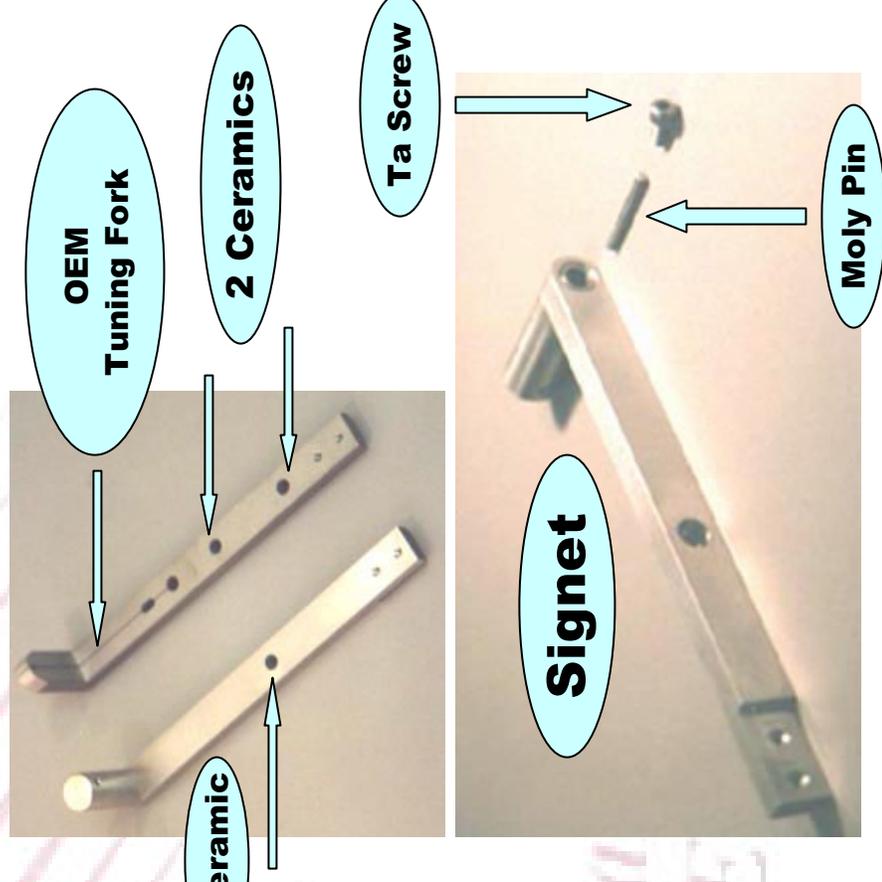
# Improved Gas Feed

- **OEM uses Expensive, Fragile Tungsten Nipple with Graphite insert.**
- **Signet eliminates the Nipple and Graphite insert and channels the gas directly into the Arc Chamber.**
- **Signet parts costs significantly less and is easier to install and harder to damage during service.**



# Filament Clamp

- **OEM uses “Tuning Fork” design which is prone to splitting and deforming causing poor electrical connection.**
- **Signet uses proven set screw clamping incorporating materials that actually tighten up as the parts heat up.**
- **The only consumable parts are an inexpensive screw and Moly Pin.**
- **Signet eliminates one ceramic saving money and making alignment easier**



# Improved Base Plate

- **Original OEM design used 3/8" thick Tungsten Base plate that was extensively machined leaving four fragile lips to locate the side and end plates.**
- **These were prone to breaking in use, during maintenance and handling**
- **This is an expensive and cumbersome design**
- **Signet uses a simpler and stronger design that minimizes the amount of machining and material loss while providing a stronger and more positive locating method for holding the side and end plates in place.**
- **This reduces the cost of the part, makes cleaning easier, makes assembly easier and faster.**

# Original Base Plate

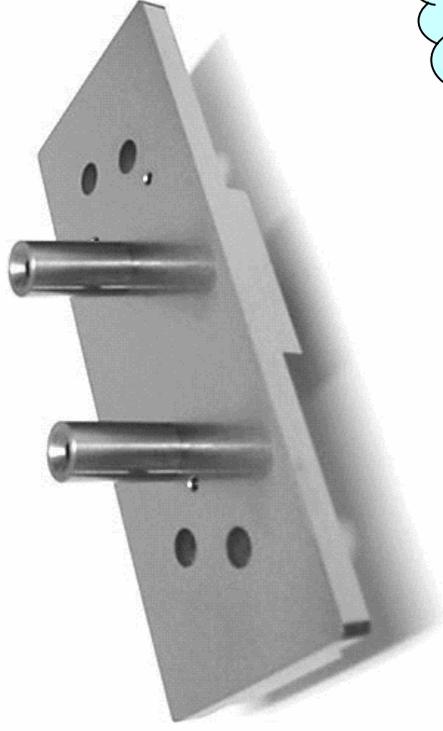
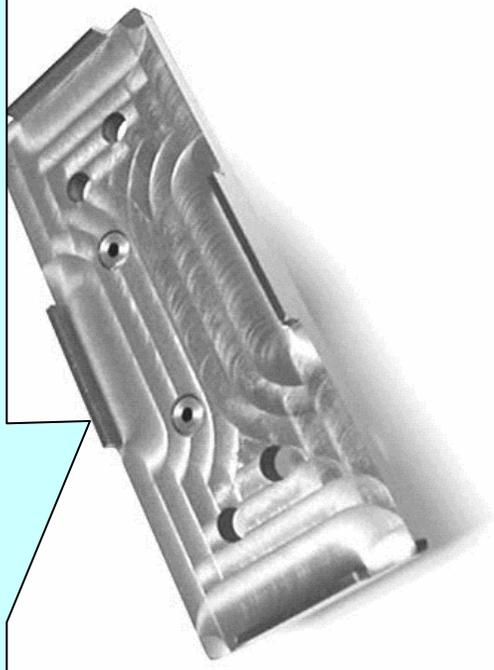


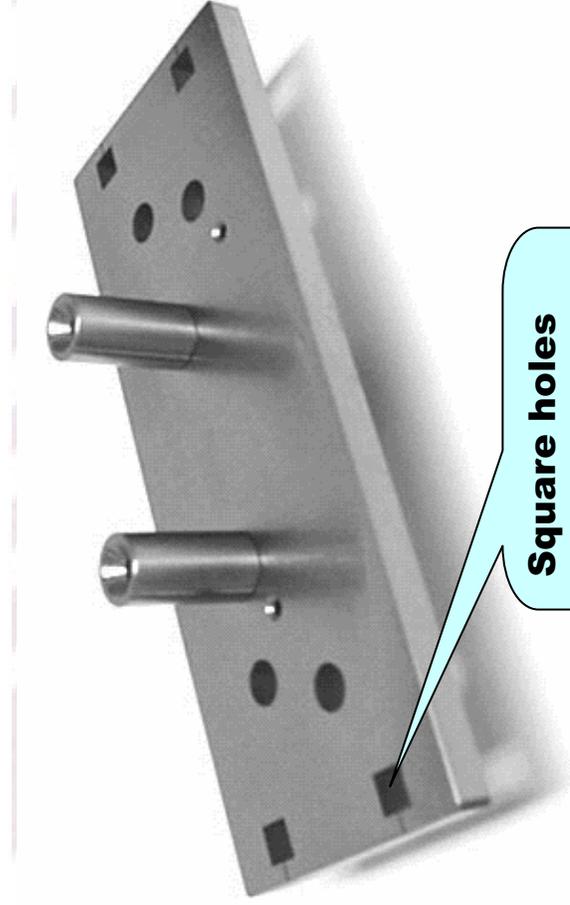
Plate is machined leaving only these brittle lips to locate the side and end plates. Machining is very costly and a third of the Tungsten is machined away



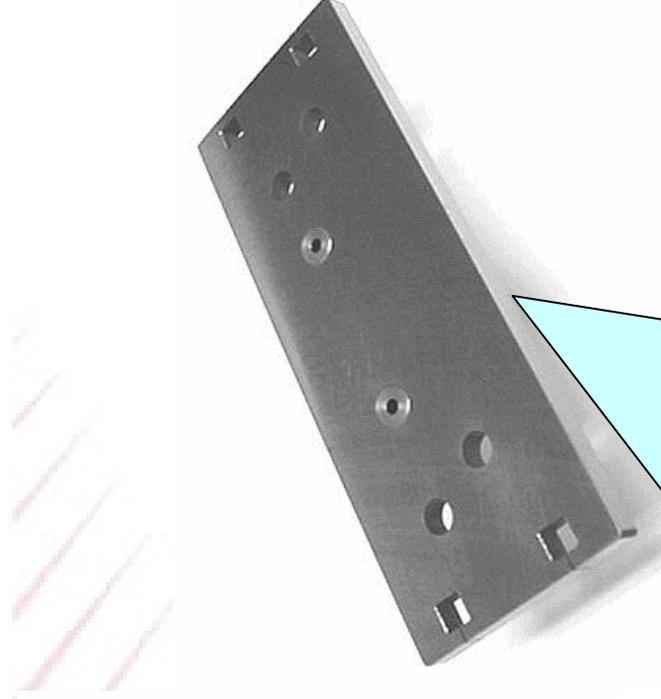
Ouch!



# Improved Base Plate



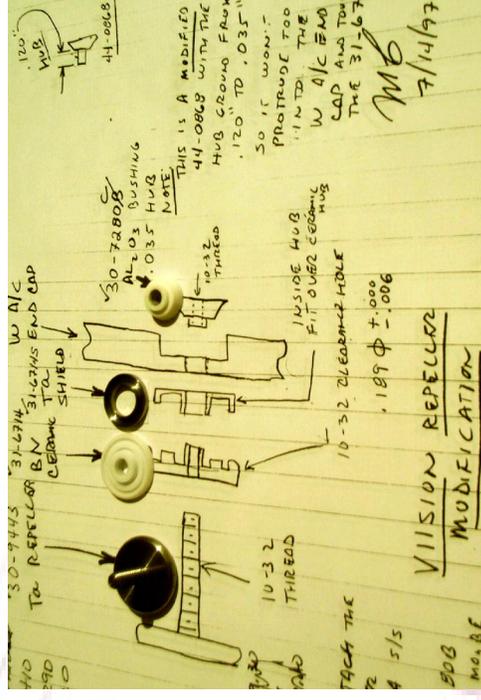
**Square holes allow End Plate to positively lock in place**



**Eliminate machining of "lips" Thinner plate is used and machining costs are greatly reduced**

# Improved Repeller Assy.

**Signet recognized a design weakness with the original OEM repeller assembly and developed an improved assembly. Subsequently the OEM revised their design.**



## **AMAT Issues & Solutions**

- **Delivery of consumable parts can result in down time**
  - **Local stock offered for same day shipping**
  - **Dozens of graphite parts have been added to improve customers up time**
- **Graphite contamination from source and beam line components**
  - **Offer refractory metal alternatives for graphite**

# Conclusion

- **There is always room for improvement**
- **Reaction to unique requirements can adapt or improve an implanters performance**
- **Having the parts you need when you need them saves time & \$\$.... Kitting**
- **Providing support for older tools that the OEM's no longer support**

# Conclusion

- **Often individual customers have needs that are too specific for the OEM to make global changes to accommodate**
- **Ask the question: “what can be done to better tailor my implant to my applications”**

**Things That are No Longer Disliked**

**Thank you**

**Mike Cunneen**

