





# Trace MS Plus™

*Manual Alignment Procedure*

*PN 120281*

*Revision A*

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# 1 Introduction

This procedure describes the method for the manual alignment of the RF (dip), mass resolution and initial mass calibration for the Trace MS Plus mass spectrometer running Xcalibur 1.4, except where noted. The RF alignment needs to be done whenever any of the RF components are changed. These parts include the RF Generator (Coil Assembly), rods and pre-filter. Normally an RF alignment does not need to be done when the rods or pre-filter are cleaned. The mass resolution alignment needs to be done when the rods, pre-filter is cleaned or replaced. Resolution also needs to be done when the analog board is replaced.

## 2 Description

There are two current instrument versions, the 800 amu and 1000 amu versions. The C579A analog PCB is used on the 800 amu version while the C772A is used on the 1000 amu version. They both align in the same manner but are not interchangeable. In order to change the mass range for an instrument the proper RF coil and analog PCB needs to be selected. The 800 amu system uses the C579A along with the C004A RF coil and the 1000 amu instrument uses the C772A analog PCB with the C770A RF coil.

The RF alignment is a process that electrically matches the RF generator and coil assembly to the main analytical rods. This needs to be done in order to supply optimum RF power to the rods during an analytical scan to a maximum mass range of 800 or 1020 amu. When properly tuned the rectified RF on the rods will scan from 0 volts to approximately 240 volts. The matching of the system components is accomplished by varying the capacitance of the RF coils using variable capacitors located in the RF generator (coil) box. The variable capacitors have to be adjusted to the same relative positions to ensure balance between the rod pairs. The system is set in a fixed low voltage state by the position of an align switch on the analog PCB to stabilize the RF during alignment and preventing high voltage arcing if the coils become grossly misaligned. The adjustable capacitors are then evenly adjusted for a minimum output level at selected test points. This represents optimum transmission of the RF to the rods.

The manual resolution adjustment is an initial adjustment of the mass scale, offset, slope, and linearity of the RF/DC scan across the entire mass range. This adjustment will get the alignment close enough so that a fine adjustment can be successful during autotune. There are four adjustment potentiometers, low mass resolution (R69), high mass resolution (R70), linearity (R76), and mass scale (R58).

In addition there is a course peak width jumper (J12). All of these adjustments are interact with each other in order to successfully align the instrument for unit resolution across the entire mass range. This alignment is normally only needed after replacement of the analog PCB or analyzer. Normal cleaning should not effect these adjustments.

## 3 System Set-Up

### 3.1 Tools Needed

- 3.1.1 There are a minimum of tools required in order to align the RF generator and the analog PCB's.  
**Caution:** Care must be taken when connecting and disconnecting test leads and making adjustments to prevent damage and shock.
- 3.1.2 The required tools are:
  - 3.5 digit digital multi-meter
  - Voltmeter leads with insulated locking micro-clips
  - Non-conductive potentiometer adjustment tool

### 3.2 Instrument Set-Up

- 3.2.1 Vent and turn off instrument.
- 3.2.2 Lower left side electronics panel.
- 3.2.3 Remove RF d-connector and standoffs from top of analog board.
- 3.2.4 Remove screws holding on metal cover on analog board.
- 3.2.5 Remove source cable and grommet from bottom of metal cover and place cover and screws to one side as not to make contact with electronic parts.

### 3.3 System Initialization

- 3.3.1 Create a engineers super tune icon
- 3.3.2 Right click on Trace MS Plus Tune icon and select 'Create Shortcut'.
- 3.3.3 Right click on new Trace MS Plus Tune icon.
- 3.3.4 Select '**Properties**'
- 3.3.5 Click on end of 'Target' string
- 3.3.6 Type in '<sp>- Engineer<sp>-Super<sp>-ShowTune' leaving a space in front of all three dashes. <sp> denotes a space.
- 3.3.7 Rename new icon 'Trace MS Plus Super Tune'

- 3.3.8** Turn instrument on.
- 3.3.9** Open tune page using super tune icon.
- 3.3.10** Verify tune page is communicating with MS by observing tune icon, musical note, in top right of tune window is rotating.
- 3.3.11** Right click on orb in lower right corner of display, should be red.
- 3.3.12** Select pump.
- 3.3.13** Verify roughing pump engages and system reaches vacuum, flashing amber vacuum on left side electronics panel goes to constant on.
- 3.3.14** Allow Interface and Source temperatures to stabilize at 250<sup>0</sup> and 200<sup>0</sup> C respectively.
- 3.3.15** Set up three full scan segments at mass 69, 264 and 502.
- 3.3.16** Set both segments 4 amu wide at a scan rate of 0.2 AMU/sec.
- 3.3.17** Set parameters as following: (See Figure 1)
  - Ion Energy (V): 1.5
  - Ion Energy Ramp (V): 0.5
  - LM Res: 12.5
  - HM Res: 12.5
  - Lens 1 (V): 8
  - Lens 2 (V): 70
  - Repeller (V): 0.5
  - Emission Energy (V): 70
  - Emission Current (uA): 150
  - Multiplier: 200

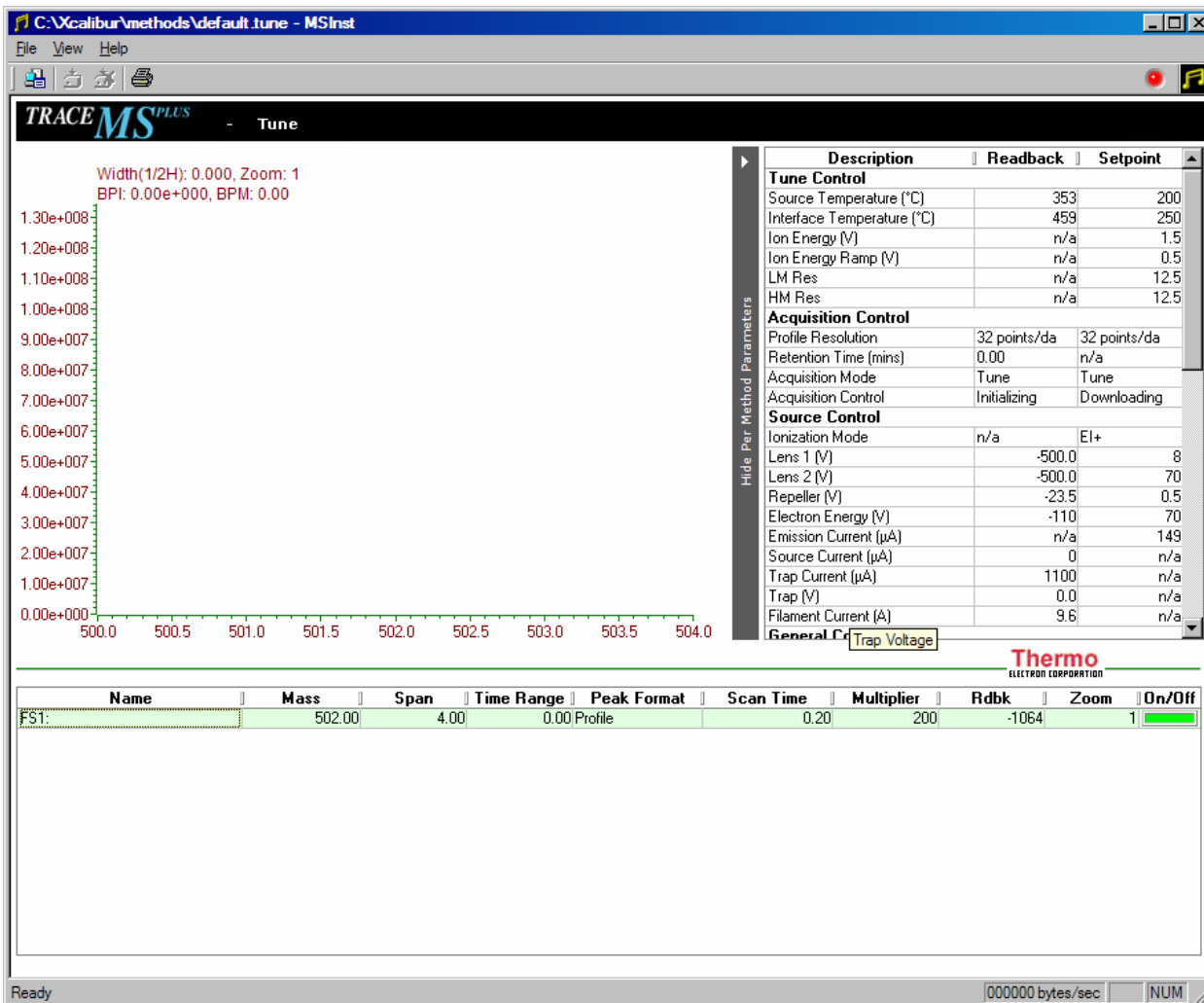


Figure 1 (Initial Tune Parameters)

## 4 RF Alignment

### 4.1 RF Generator Set-Up

- 4.1.1** Using a non-conductive adjustment tool, rotate both RF adjustment capacitors, located through holes in case fully clockwise.  
**NOTE:** gently turn to full clockwise position. Over tightening will **damage** RF capacitors and the RF generator will need replacement.
- 4.1.2** Set RF capacitors to midway, 10 turns from the fully CCW. (Some systems may only have one adjustment).  
**NOTE:** Ensure that both capacitors are equally turned to maintain balance.

## 4.2 RF Test Set-Up

- 4.2.1 Set the align switch to 'Align' (Down position)
- 4.2.2 Set digital multi-meter to VDC auto scale.
- 4.2.3 Verify instrument is in standby, orb on lower right corner of tune page is amber.
- 4.2.4 Verify 'Align' switch is in the align position, downward.
- 4.2.5 Using microprobes connect '+' to TP13 and 'Gnd' to ground TP right of TP 13. (See Figure 3)
- 4.2.6 Select 'Operate' in tune status page.

## 4.3 RF Coil Alignment

- 4.3.1 While monitoring voltmeter adjust RF capacitors equally until a maximum voltage is reached. (See Figure 2) This voltage is normally between 3.5 and 9.5 VDC.
- 4.3.2 De-select 'Operate' in tune status page.
- 4.3.3 Set the align switch to 'Normal'
- 4.3.4 Remove voltmeter probes
- 4.3.5 Install metal cover on analog board

## 4.4 RF Coil Check (1000 amu)

- 4.4.1 Select 'Operate' in tune status page.
- 4.4.2 In full scan mode set mass to 69 amu with a span to 0 amu.
- 4.4.3 Verify DC #1 and DC #2 (Generator) is reading 20 volts +/- 10 volts.
- 4.4.4 In full scan mode set mass to 502 amu with a span to 0 amu.
- 4.4.5 Verify DC #1 and DC #2 (Generator) is reading 124 volts +/- 15 volts.
- 4.4.6 De-select 'Operate' in tune status page.

RF Capacitor Adjustments

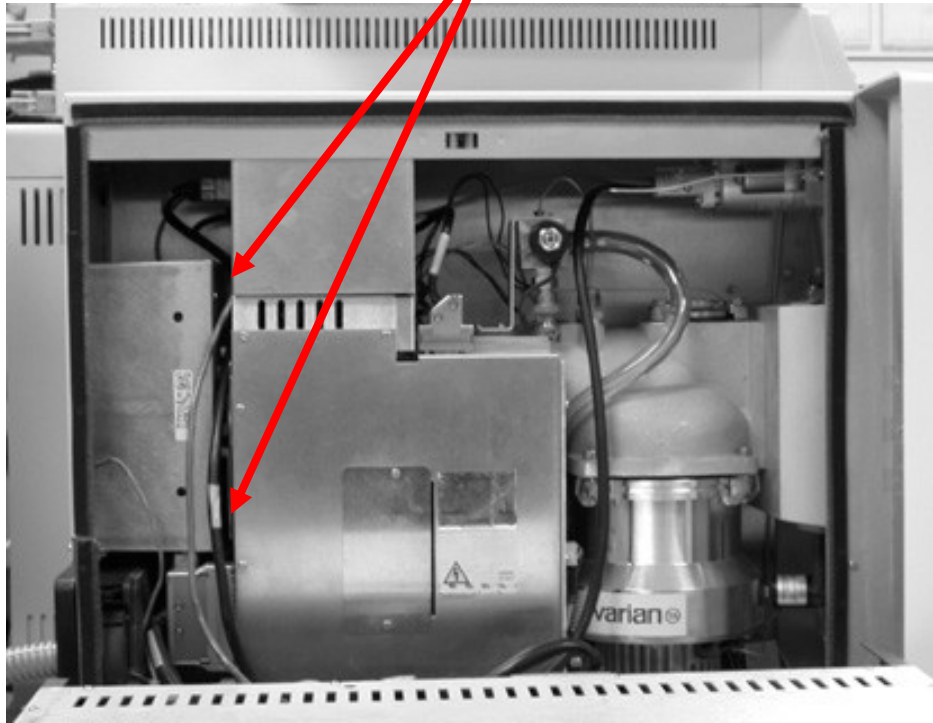


Figure 2 (RF Adjustments)

# 5 Resolution Alignment

## 5.1 Tune Page Set-Up

- 5.1.1 Open Trace MS Plus Super Tune page.
- 5.1.2 In the 'Options' menu select 'Disable Calibration' check box.  
**NOTE:** For TraceMS and Voyager open **vUncalibrated.cal** file as calibration file then re- select tune page by selecting view/tune.

## 5.2 Analog PCB Initial Set-Up

- 5.2.1 Open the access panel on Analog board cover
- 5.2.2 Turn linearity adjustment (R76) fully counter clockwise (CCW).
- 5.2.3 Select 'Operate' in tune status page.
- 5.2.4 Turn Calibration gas 'On' in tune status page.
- 5.2.5 Allow peaks to stabilize.

## 5.3 Analog PCB Adjustment

**NOTE:** The 50% width is displayed in the upper left hand corner of the tune window. TraceMS and Voyagers need to manually interpret width from the profile graph.

- 5.3.1 Turn on full scan segments for masses 69 and 502.
- 5.3.2 Adjust 'Low Mass Resolution' for half height resolution of mass 69 to .625 AMU
- 5.3.3 Adjust 'Hi Mass Resolution' for half height resolution of mass 502 to .625 AMU
- 5.3.4 Repeat steps 3.2 and 3.3 until both masses have a resolution of .625 AMU.
- 5.3.5 Display and adjust 'Mass Scale pot to so that the 264 peak is at center mass.
- 5.3.6 De-select 'Operate' in tune status page.
- 5.3.7 In the 'Options' menu deselect 'Disable Calibration' check box.
- 5.3.8 Replace access cover on analog board cover.
- 5.3.9 Run Autotune.

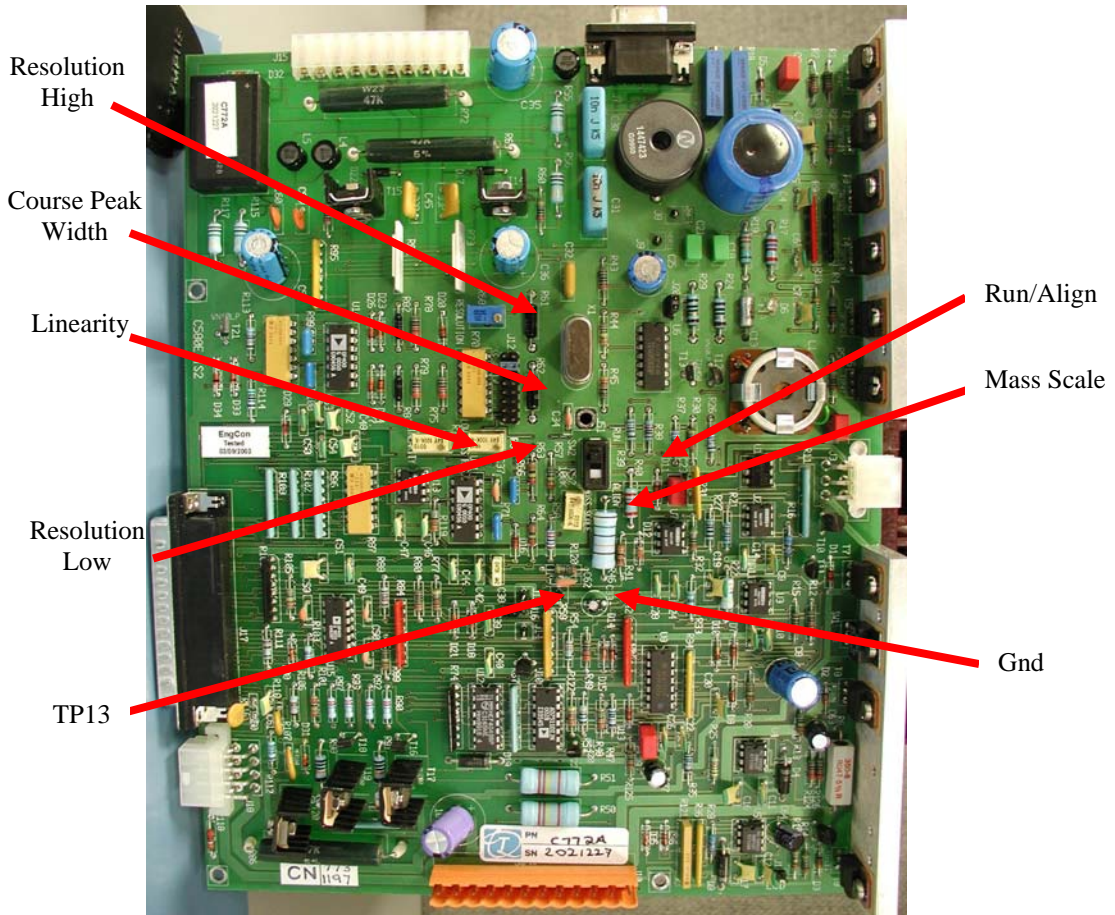


Figure 3 (Analog PCB)