

# Update on AMS Software Status

- Summary of AMS software developments since AMS User's Meeting

Current Version: V4.3

- Description of Changes in Various Screens
- Description of Future upgrades

# Modifications of Parameter Menu

- AMS Software versions 3.8.3 and up use Parameter Menu Version 3 (225 total parameters). These software versions will automatically convert the Parameter Menu Version 2 to Menu Version 3. **HOWEVER, OLD VERSIONS CANNOT DO THE REVERSE!!!!!!**
- When updating to newer versions of the software always make a backup of the old menu versions- Also, in the logfiles directory, you can find menu.prm files saved according to date.

# Parameter Menu Changes (1)

Save & Quit    Quit w/o Saving

Flow, Size & Mass Calib.    Mass Spectrometer    Multiplier & Chopper    Data Acquisition Boards    Averaging & Saving

Graphs    **Single Particles**    Serial Ports    Analog In and Out Calib.    String Parameters

**AMS TOF SIGNAL:**

**Automatic Single Particle Threshold**

Time (sec. per TOF m/z) w/o Threshold Crossings Before Quitting SP Threshold Mode  Typically ~ 10 sec/mass, can be tuned according to experiment, with longer times for low particle concentrations.

**SP Averaging and Saving**

Points to Save with SP Before Peak (<0)

Points to Save with SP After Peak

Points on Either Side of Peak for SP Average

Save All SP to File (.spd)  
 Yes     No    Otherwise Saves a Limited Number (~ 1,000) to TOF.itx file

**LIGHT SCATTERING SIGNAL:**    These parameters can be used if a Lt Scattering module has been installed in your AMS

Light Scattering Mode  
 ON     OFF

Light Scattering Threshold for single particles (bits)

Light Scattering Sliding Window (Pts)

Distance between Laser beam and Oven [cm]

Save LS Signals to File  
 Yes     No

LS Signal is saved to Files (\*.lsd, \*.toflsd).

Make sure this is set to OFF if not using LS

# Parameter Menu Changes (2)

Save & Quit    Quit w/o Saving

Flow, Size & Mass Calib.    Mass Spectrometer    Multiplier & Chopper    Data Acquisition Boards    Averaging & Saving

Graphs    Single Particles    Serial Ports    **Analog In and Out Calib.**    String Parameters

**Calibration of the Analog Inputs of the Slow Board**

Channel	Parameter	Value	Gain	Range
Channel 0	Ambient Temp (C) =	1000.000	*V0 + 0.000	10
Channel 1	Heater Temp =	130.00	*V1 + 0.00	10
Channel 2	Ambient P =	0.00	*V2 + 0.00	10
Channel 3	Flow Rate (cm3/s) =	1.727	*V3 + -1.570	10
Channel 4	Rel Humidity (%) =	10.00	*V4 + 10.00	10
Channel 5	Channel5	0.00	*V5 + 0.00	10
Channel 6	Channel6	0.00	*V6 + 0.00	10
Channel 7	Channel7	0.00	*V7 + 0.00	10

Pick Desired Voltage Range: (+/- V)

**Analog Input Reading**    Press Button to Read Analog Inputs

Read AI

Calibrate with Gilibrator or Drycal

- Channel 1, 2, and 4 hardwired to new parameters, but channel 5,6,7 variable
- Dropdown boxes require Desired Voltage Range NOT Gain
- Average voltages measured for each channel over save periods saved in info wave of MS.itx and TOF.itx

# Parameter Menu Changes (3)

## Averaging and Saving Tab: Saving of Transient Files

### Saving of TOF and MS Data

Note: Make sure that the different averaging and saving modes are not active simultaneously

Run Number for Last Data Files Saved (0 to 9999)

Format of Saved Data

ITX  HDF  BOTH

Save TOF Size Dist. vs dLog10Da

Yes  No

Efficient Data Saving Mode

Yes  No

NOT IMPLEMENTED YET: Saves repetitive information only on the first file of a series of files saved

Fixed Time for Next Save in min. (e.g. 10 min. for 6:00 PM, 6:10 PM, 6:20 PM...) (<0: OFF)  Needs to be  $\geq 0.1$  min.

### Saving of Log Files

\_MainLog.dat

Save Main Log File

Yes  No

Save TOF Size Dist Log

Yes  No

Save MS Difference Stick Log

Yes  No

AutoSave Interval (s) of Slow Board Inputs (<0 Off)  File 'Slowlog.dat'

\*\*\*\*\* All log files above are saved in C:\AMS\AMSDa\data\AMSLogFiles\*\*\*\*\*

Save Transient Files

Yes  No

Transient File Saving:

Enter Transient Save Directory:

# Parameter Menu Changes (4)

## Mass Spectrometer Tab

### Mass Calibration

amu = Intercept + Slope \* (bits of DA)

Intercept  Slope  Max Mass for 10V Out = 214.1 amu

### Mass Resolution Controls

Note: Actual Resol = Resol. Set \* (1 + amu \* Slope)

Resolution Setting  Slope of Rel. Resol. Function for Balzers

### Ionizer and Quadrupole Controls

See p. 36 of Balzers QMA 430 Manual for Information about these Parameters and their Adjustment

Default Em. (mA)  Filament Used  1  2

Ion Ref. (V)  Extraction (V)  Emission (mA)

Cathode (V)  Deflection Inner (V)  Heater Bias (V)

Focus (V)  Field Axis (V)  Deflection Outer (V)

### Ionizer Tuning Parameters

m/z for Ionizer Tuning

Number of Spectra to Average

Interval (min.) for AutoTune (<0: Off)

Tune All or Only One Parameter

All  Deflection  Heater Bias  Focus  Extraction

Tuning Routine

Slow (MS Display)  Fast

### Parameters Related to Ionization Efficiency

Estimated Ionization & Transmission Efficiency

m/z (amu) for Air Beam in TOF

Reference MS Airbeam (Hz)

### m/z Range in Mass Spectrum

Lowest m/z in Mass Spectrum Scanned  Displayed

Highest m/z in Mass Spectrum

Peak Width to Calculate MS (amu):

Threshold for Aerosol Signal in MS:

### Calculation of Zero Level in Mass Spectrum

The zero level (DC offset) in the Mass Spectrum mode is determined by choosing TWD regions (at low and high amu) where the signal is very low. If the actual scan does not comprise either region, no correction is made. If only one region is scanned, a constant correction is made. If both regions are scanned, a correction is linearly interpolated for all amus. The parameters below allow you to choose those regions

Lower Limit of First Zero Region (amu)

Upper Limit of First Zero Region (amu)

Lower Limit of Second Zero Region (amu)

Upper Limit of Second Zero Region (amu)

Updated each time  
IE is calibrated via  
Shift-M

# Default Menu:

**AMS Default Parameters**

Save Changes and Exit    Exit without Saving

AMS Operating Mode    **Data Acquisition/Saving**    Hardware    Software

**Data Acquisition Boards**    See Nat. Inst. "Measurement and Automation Explorer"

Fast Board (NI PCI-6110E)    Device Number

Slow Board (NI PCI-6024E)    Device Number

Slow Board Installed  
 Yes     No

Board Used to Control Chopper Servo  
 Fast     Slow

Analog Output Board (PCI-6703)    Device Number

A/D Gain for Mass Spec Signal (ch. 0)     ▼

A/D Gain for Chopper Signal (ch. 1)     ▼

**Saving**    Saving can be externally controlled via the digital input lines on the Slow Board. If External Save Control is turned on, AutoSaving will take place on every change of state in chosen input line.

ExternalSaveControl On  
 Yes     No

Digital Input Line For Save Control     ▼

Digital Switch Dead Time(min)        Reaveraging of data after each save will be delayed by dead time

External  
Save  
Control  
through  
Digital Line

# Default Menu:

**AMS Default Parameters**

Save Changes and Exit    Exit without Saving

AMS Operating Mode    Data Acquisition/Saving    **Hardware**    Software

### Mass Spectrometer

Particle Flight Distance (m)

Duty Cycle of Chopper     Chopper Signal Trigger Direction  
 Up     Down

Quadrupole in Use  
 Balzers QMA 430     UTI 100C

High Current Ionizer Installed  
 Yes     No    High Current Ionizer denoted by letters SPEZ at back of Balzers control module.

### Detector

Multiplier High Voltage Control  
 Aerodyne 3kV  
 Aerodyne 4kV  
 Balzers

Resistance of Multiplier (Ohm)   
18 MOhm for Balzers, 200 MOhm for SRS

Gain of External Amplifier

Specify Ionizer



# Menu Error Checking: (Turn OFF by hitting NO. Turn back ON by pressing “c” while in parameter menu).

## Suggestions for better format?

The screenshot shows a control interface for a mass spectrometer. At the top, there are buttons for 'Save & Quit' and 'Quit w/o Saving'. Below these are several menu tabs: 'Graphs', 'Single Particles', 'Serial Ports', 'Analog In and Out Calib.', 'Flow, Size & Mass Calib.', 'Mass Spectrometer', 'Multiplier & Chopper', and 'Data Acquisition Boards'. The 'Mass Spectrometer' tab is active.

**Mass Calibration**  $\text{amu} = \text{Intercept} + \text{Slope} * (\text{bits of DA})$   
Intercept: 54.6854 Slope: 0.004866 Max Mass for 10V Out = 214.1 amu

**Mass Resolution Controls** Note: Actual Resol = Resol. Set \* (1 + amu \* Slope)  
Resolution Setting: 12 Slope of Rel. Resol. Function for Balzers: 0.00363

**Ionizer and Quadrupole Controls** See p. 36 of Balzers QMA 430 Manual for Information about these Parameters and their Adjustment  
Default Em. (mA): 0.25 Filament Used:  1  2  
Ion Ref. (V): 79 Extraction (V):  
Cathode (V): 71.0 Deflection Inner (V):  
Focus (V): 17.25 Field Axis (V):

**Ionizer Tuning Parameters**  
m/z for Ionizer Tuning: 28.0

**m/z Range in Mass Spectrum**  
Lowest m/z in Mass Spectrum: 0  
Highest m/z in Mass Spectrum: 150  
Peak Width to Calculate MS (amu): 0.  
Threshold for Aerosol Signal in MS: 0.

**Calculation of Zero Level in Mass Spectrum**  
The zero level (DC offset) in the Mass Spectrum is calculated by averaging the TW/D regions (at low m/z) and the high m/z regions (at high m/z). If the actual scan is very low, the zero level is set to the low m/z region. If the actual scan is very high, the zero level is set to the high m/z region. If the actual scan is in the middle, the zero level is interpolated for all amu regions. Choose those regions.

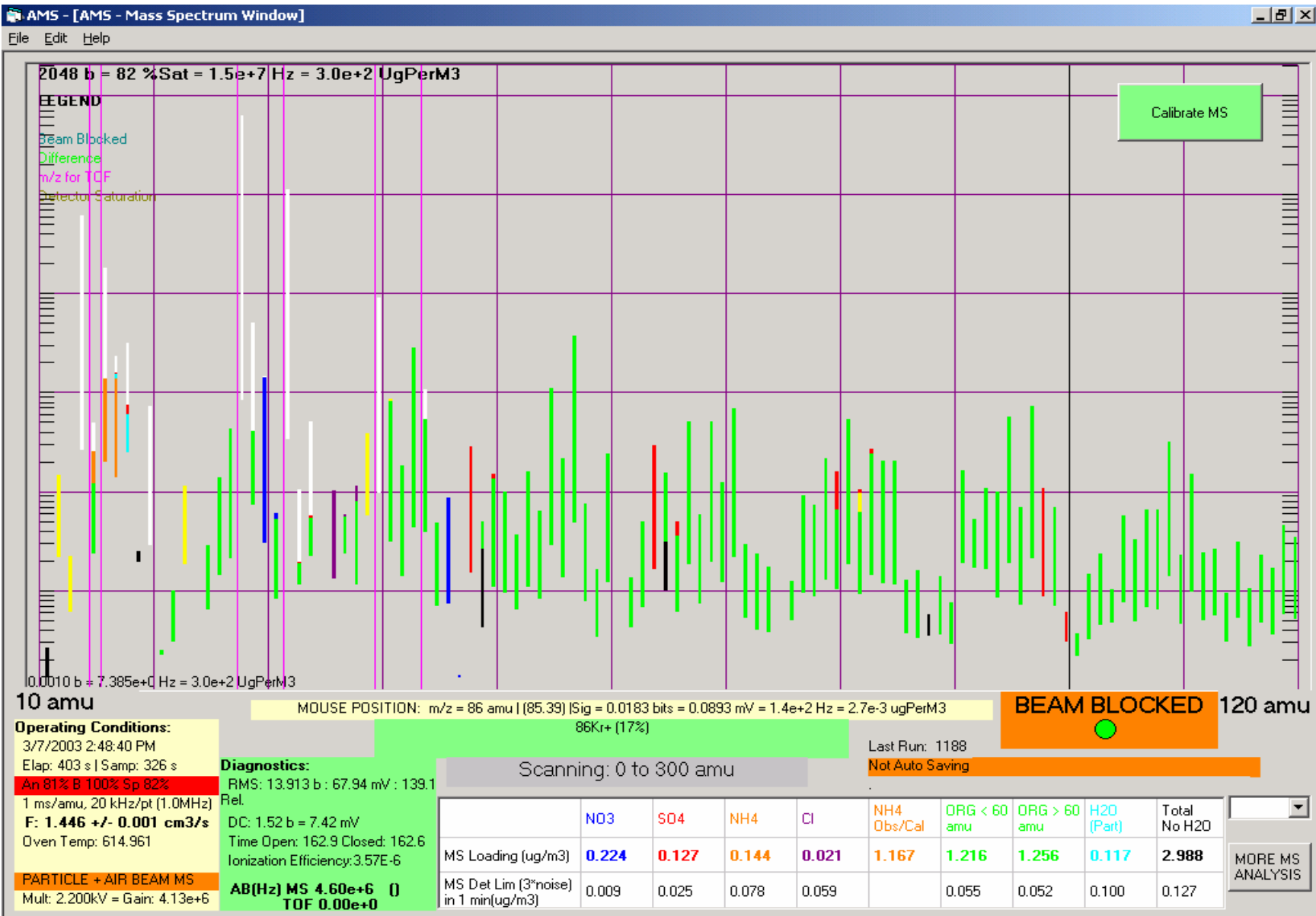
**Menu ERROR Warnings**  
3/7/03 10:44:48 AM , >>>> WARNING: Running w/o Data Acquisition  
3/7/03 10:44:48 AM , >>>> WARNING: Single Point Servo Operation  
3/7/03 10:44:48 AM , >>>> WARNING: Simulating Chopper  
3/7/03 10:44:48 AM , >>>> WARNING: Select appropriate ionizer in Hardware Tab of Default Menu  
Do You Want to See these Menu Warnings Again?  
(NOTE: To Turn Menu Error Checking Back On, Press the c Key while in Parameter Menu)  
Yes No

All  Deflection  Heater Bias  Focus  Extraction

# Mass Spec Window Display

## Goals:

- Provide tools to help interpret the complex mass spectrum in real time.
- Work towards similar if not identical MS displays in both James Allan's analysis program and the AMS Software.
- Coloring of MS peaks according to Species (**Sulfate**, **Nitrate**, **Water**, **Ammonium**, **Organic**)
- Calculation of nitrate equivalent mass loadings of the various species - this still needs to be refined to account for all interferences. *Try to integrate reading of batch files used in James' program into the AMS program.*



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Access with “n” and “f” keystrokes

## 1) Air Fragments (White)

$$\text{AirFrag}(14) = \text{MSStickDiff}\#(14)$$

$$\text{AirFrag}(15) = 0.00368 * \text{AirFrag}(14)$$

$$\text{AirFrag}(16) = \text{m.m16To28Ratio} * \text{MSStickDiff}\#(28)$$

$$\text{AirFrag}(16) = \text{AirFrag}(16) + \text{m.m16To18Ratio} * \text{GPWater18}$$

$$\text{AirFrag}(17) = 0.000381 * \text{AirFrag}(16) + \text{m.m17To18Ratio} * \text{GPWater18}$$

$$\text{AirFrag}(18) = 0.002 * \text{AirFrag}(16) + \text{GPWater18} \text{ (Calc from RH,T,P inputs)}$$

$$\text{AirFrag}(20) = \text{MSStickDiff}\#(20)$$

$$\text{AirFrag}(28) = \text{MSStickDiff}\#(28)$$

$$\text{AirFrag}(29) = 0.00736 * \text{AirFrag}(28)$$

$$\text{AirFrag}(30) = 0.0000136 * \text{AirFrag}(28)$$

$$\text{AirFrag}(44) = (\text{m.AmbCO2ppm}) / 1000000\# * 1.5 * 1.25 * \text{AirFrag}(28)$$

// NOTE HERE THAT the Factor of 1.5 accounts for IE differences between m/z44  
//and m/z 28. The factor of 1.25 accounts for fraction of N2 in air

$$\text{AirFrag}(32) = \text{MSStickDiff}\#(32) - \text{SO4Frag}(32)$$

$$\text{AirFrag}(33) = 0.000762 * \text{MSStickDiff}(32)$$

$$\text{AirFrag}(34) = 0.004 * \text{MSStickDiff}(32)$$

$$\text{AirFrag}(40) = \text{MSStickDiff}\#(40)$$

## 2) NO3 Fragments (Dark Blue)

$$\text{NO3Frag}(30) = \text{MSStickDiff}\#(30) - \text{AirFrag}(30)$$

$$\text{NO3Frag}(31) = 0.00405 * \text{NO3Frag}(30)$$

$$\text{NO3Frag}(32) = 0.002 * \text{NO3Frag}(30)$$

$$\text{NO3Frag}(46) = \text{MSStickDiff}\#(46)$$

$$\text{NO3Frag}(47) = 0.00443 * \text{NO3Frag}(46)$$

$$\text{NO3Frag}(48) = 0.004 * \text{NO3Frag}(46)$$

## 3) SO4 Fragments (Red)

$$\text{SO4Frag}(48) = \text{MSStickDiff}\#(48) - \text{NO3Frag}(48)$$

$$\text{SO4Frag}(50) = 0.044 * \text{SO4Frag}(48)$$

$$\text{SO4Frag}(64) = \text{MSStickDiff}\#(64)$$

$$\text{SO4Frag}(65) = \text{MSStickDiff}(65) - \text{OrganicFrag}(65)$$

$$\text{SO4Frag}(66) = 0.044 * \text{SO4Frag}(64)$$

$$\text{SO4Frag}(18) = \text{m.SO4WaterFactor} * (\text{SO4Frag}(48) + \text{SO4Frag}(64))$$

$$\text{SO4Frag}(17) = \text{m.m17To18Ratio} * \text{SO4Frag}(18)$$

$$\text{SO4Frag}(16) = \text{m.m16To18Ratio} * \text{SO4Frag}(18)$$

$$\text{SO4Frag}(80) = \text{MSStickDiff}(80) - \text{OrganicFrag}(80)$$

$$\text{SO4Frag}(81) = \text{MSStickDiff}(81) - \text{OrganicFrag}(81)$$

$$\text{SO4Frag}(82) = 0.044 * \text{SO4Frag}(80)$$

$$\text{SO4Frag}(83) = 0.044 * \text{SO4Frag}(81)$$

### 3) SO4 Fragments cont....

'\$multiplier is guess from Doug W

$$\text{SO4Frag}(32) = 0.15 * (\text{SO4Frag}(48) + \text{SO4Frag}(64))$$

$$\text{SO4Frag}(33) = 0.0079 * \text{SO4Frag}(32)$$

$$\text{SO4Frag}(34) = 0.044 * \text{SO4Frag}(32)$$

$$\text{SO4Frag}(98) = \text{MSStickDiff}\#(98)$$

$$\text{SO4Frag}(100) = 0.044 * \text{SO4Frag}(98)$$

### 4) H2O Fragments (light Blue)

$$\text{H2OFrag}(18) = \text{MSStickDiff}\#(18) - \text{AirFrag}(18) - \text{SO4Frag}(18)$$

$$\text{H2OFrag}(17) = \text{m.m17To18Ratio} * \text{H2OFrag}(18)$$

$$\text{H2OFrag}(16) = \text{m.m16To18Ratio} * \text{H2OFrag}(18)$$

#### 4) NH4Frag (Orange)

$$\text{NH4Frag}(17) = \text{MSStickDiff}\#(17)$$

$$\text{NH4Frag}(17) = \text{NH4Frag}(17) - \text{H2OFrag}(17) - \text{AirFrag}(17) - \text{SO4Frag}(17)$$

$$\text{NH4Frag}(16) = \text{NH4Frag}(16) - \text{H2OFrag}(16) - \text{AirFrag}(16) - \text{SO4Frag}(16)$$

$$\text{NH4Frag}(15) = 0.1 * \text{NH4Frag}(16)$$

#### 5) “Unknown” Frag

- Cl at m/z 35,36,37,38 (Purple)

-Na,F,K,W,Pthalic Acid (Yellow)

$$\text{UnkFrag}(49) = \text{MSStickDiff}(49) - \text{SO4Frag}(49) - \text{OrganicFrag}(49)$$

$$\text{UnkFrag}(66) = \text{MSStickDiff}(66) - \text{SO4Frag}(66) - \text{OrganicFrag}(66)$$

$$\text{UnkFrag}(82) = \text{MSStickDiff}(82) - \text{SO4Frag}(82) - \text{OrganicFrag}(82)$$

## 6) Organic Frags

$$\text{OrganicFrag}(49) = \text{OrganicFrag}(63)$$

$$\text{OrganicFrag}(65) = (\text{OrganicFrag}(79) + \text{OrganicFrag}(51)) / 2$$

$$\text{OrganicFrag}(66) = (\text{OrganicFrag}(52))$$

$$\text{OrganicFrag}(82) = (\text{OrganicFrag}(96) + \text{OrganicFrag}(68)) / 2$$

$$\text{OrganicFrag}(81) = (\text{OrganicFrag}(95) + \text{OrganicFrag}(67)) / 2$$

$$\text{OrganicFrag}(80) = (\text{OrganicFrag}(94) + \text{OrganicFrag}(66)) / 2$$

$$\text{OrganicFrag}(18) = \text{m.CO2WaterFactor} * \text{OrganicFrag}(44)$$

$$\text{OrganicFrag}(17) = \text{m.m17To18Ratio} * \text{OrganicFrag}(18)$$

$$\text{OrganicFrag}(16) = \text{m.m16To18Ratio} * \text{OrganicFrag}(18)$$

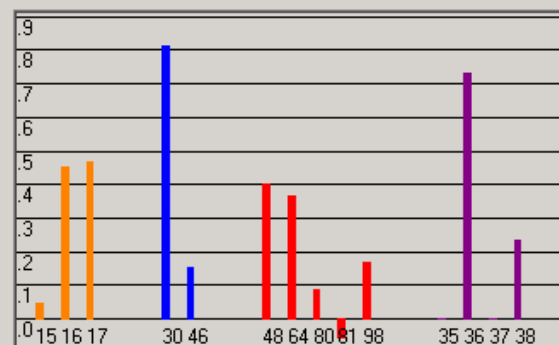
Organic Frags at all other amus calculated as difference between MS Diff signal and the values calculated for the rest of the species at those amus.



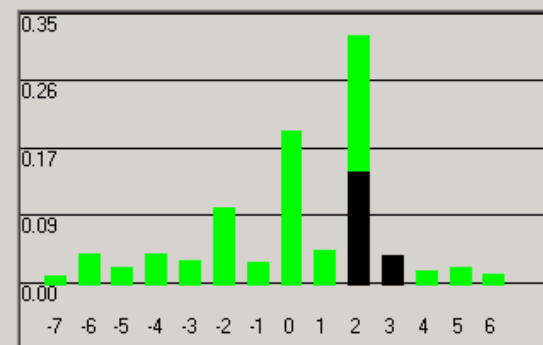
## Operating Conditions

3/7/2003 2:47:05 PM  
 Version 4.3modb (March 5, 2003)  
 Elap: 306 s | Samp: 248 s  
 F: 1.446 +/- 0.001 cm<sup>3</sup>/s  
 Oven Temp: 611.279  
 Mult: 2.200kV = Gain: 4.13e+6

## Fragmentation Ratios for Inorganics



## Delta Pattern for Organics



## INPUTS FOR CALCULATIONS

## Airbeam Calculations:

CO<sub>2</sub> (ppm)       Amb Temp (C)        Use AI 0  
 RH (%)        Use AI 4      Amb Pressure(Torr)        Use AI 2  
 IE (m/z 18)/ IE (m/z 28)   
 (For H<sub>2</sub>O Vapor Calc):

## Electronic Noise:

Electronic Noise in 10 sec (bits)       Scaling Factor for Counting Noise

## Fragmentation Patterns:

16/14 Ratio (O<sup>+</sup>/N<sup>+</sup>)   
 16/18 Ratio (O<sup>+</sup>/H<sub>2</sub>O<sup>+</sup>)   
 17/18 Ratio (OH<sup>+</sup>/H<sub>2</sub>O<sup>+</sup>)   
 H<sub>2</sub>O from SO<sub>3</sub> (H<sub>2</sub>O<sup>+</sup>/48+64)   
 H<sub>2</sub>O from OrgAcids (H<sub>2</sub>O<sup>+</sup>/CO<sub>2</sub><sup>+</sup>)

## Factors For Calculating Mass From Frags:

IE/MW of Species Relative to NO<sub>3</sub> (30+46)

NH<sub>4</sub>   
 SO<sub>4</sub>   
 ORG

	Mass(ug/m <sup>3</sup> )	Frag Ratios
NH <sub>4</sub>	0.147	0.1 : 1.0 : 1.0
NO <sub>3</sub>	0.080	1.0 : 0.2
SO <sub>4</sub>	0.123	1.1 : 1.0 : 0.2 : -0.2 : 0.5
Cl	0.018	Ref m/z 35=0
Org <60	1.185	
Org >60	1.242	

## m/z's with S/N &gt; 3

delta-7: 118, 132, 146,  
 delta-6: 49, 63, 77, 91, 105, 119, 133, 147, 175, 189, 203,  
 delta-5: 50, 78, 92, 106, 120, 134,  
 delta-4: 51, 65, 79, 93, 107, 121, 135, 163, 177, 219,  
 delta-3: 38, 52, 66, 80, 94, 108, 122, 150, 164, 192,  
 delta-2: 25, 53, 67, 81, 95, 109, 123, 137, 151, 165, 193,  
 delta-1: 26, 54, 68, 82, 96, 110, 124, 138, 152, 166,  
 delta 0: 27, 41, 55, 69, 83, 97, 111, 125, 139, 153, 181, 195,  
 delta 1: 42, 56, 70, 84, 112, 126, 140, 154, 168, 196,  
 delta 2: 29, 43, 57, 71, 85, 99, 113, 127, 141, 155, 169,  
 delta 3: 44, 58, 72, 128, 142, 156,  
 delta 4: 31, 45, 59, 73, 87, 115, 129, 143, 157,  
 delta 5: 60, 74, 102, 116, 130,  
 delta 6: 89, 103, 117, 145, 159, 173, 215,

Save  
Changes &  
Exit

Exit w/o  
Save

Change  
TOF  
Masses

## Species Mass Calculations

$$\text{NitrateMass} = \text{NO3Frag}(30) + \text{NO3Frag}(46)$$

$$\text{SulfateMass} = (\text{Sum of non-zero SO4 Frags}) * 1/m.\text{SO4IERelNO3}$$

$$\text{AmmoniumMass} = (\text{NH4Frag}(16) + \text{NH4Frag}(17)) * 1/m.\text{NH4IERelNO3} * 1.05$$

\*\*\*\*NOTE the factor of 1.05 is to account for m/z 15

$$\text{OrganicMass} = (\text{Sum of non-zero OrganicFrag}) * 1/m.\text{OrgIERelNO3}$$

## Factors Not Yet Taken Into Account

- Species dependent Collection Efficiencies
- Change in multiplier gain since last calibration

**SHOULD THESE BE INCLUDED ALSO?**

TOF Mass Step Number	m/z nominal (amu)	Offset (amu)		Sing. Part. Thres. Mult.	# Pts. Sliding Window Avg.	DC Mark (0:Front, 1: Back.	Species	Group Member		m/z set (amu)	m/z set (bits)	Quad. Resol. set (b)				
1	15	-0.60		0.46	4	1	NH4	AC		14.40	1466	3659				
2	16	-0.60		0.69	4	1	NH4	ACF		15.40	1564	3672				
3	28	-0.65		0.69	4	1	AIR	B		27.35	2741	3829				
4	32	-0.60		0.99	4	1				31.40	3139	3882				
5	40	-0.65		0.62	4	2				39.35	3922	3987				
6	44	-0.65		0.90	4	2	ORG	DF		43.35	4316	4040				
7	2	-0.65		2.00	4	2				1.35	181	3487				
8	4	-0.61		0.46	4	1				3.39	382	3514				
9	17	-0.65		0.69	4	1	NH4	AC		16.35	1658	3685				
10	18	-0.60		0.98	4	1	SO4	WFS		17.40	1761	3698				
11	19	-0.70		1.01	4	1				18.30	1850	3710				
12	20	-0.65		0.60	4	1				19.35	1953	3724				
13	26	-0.70		1.07	4	1				25.30	2539	3802				
14	26	-0.50		0.54	4	0				25.50	2559	3805				
15	30	-0.65		3.00	4	2	NO3	NFC		29.35	2937	3855				
16	35	-0.65		0.57	4	2				34.35	3430	3921				
17	36	-0.65		0.58	4	2				35.35	3528	3934				
18	39	-0.70		0.40	4	2				38.30	3818	3973				
19	43	-0.60		0.58	4	2	ORG	DF		42.40	4222	4027				
20	45	-0.65		0.21	4	0				44.35	4414	4053				
21	46	-0.70		0.48	2	2		I		45.30	4508	4065				
22	46	-0.65		0.01	4	2	NO3	NFC		45.35	4512	4066				
23	48	-0.60		0.26	4	2	SO4	SF		47.40	4714	4093				
24	50	-0.70		0.27	4	2		I		49.30	4901	4118				
25	55	-0.60		0.70	4	2	ORG	DF		54.40	5403	4185				
26	57	-0.60		0.86	4	2	ORG	DF		56.40	5600	4211				
27	57	-0.60		0.54	4	2	ORG	DF		56.40	5600	4211				
28	58	-0.65		0.90	4	2				57.35	5694	4224				
29	64	-0.60		0.30	4	2	SO4	SF		63.40	6289	4303				
30	69	-0.60		0.39	4	2				68.40	6781	4369				
31	77	-0.40		0.22	4	2	ORG	DF		76.60	7589	4477				
32	80	-0.70		0.21	4	2	SO4	S		79.30	7854	4512				
33	81	-0.60		0.25	4	2	SO4	S		80.40	7963	4527				
34	83	-0.65		0.14	4	2				82.35	8155	4552				
35	85	-0.60		0.28	4	2				84.40	8356	4579				
36	91	-0.60		0.33	4	2				90.40	8947	4658				
37	98	-0.65		0.21	4	2	SO4	S		97.35	9631	4750				
38	104	-0.60		2.00	4	2	PSL	P		103.40	10227	4829				
39	111	-0.70		0.60	4	2				110.30	10906	4920				
40	202	-0.70		0.60	4	2				201.30	19863	6116				
Keys	+/-									Auto	Auto	Auto				



## CONTROL KEYSTROKES

Shift & +/- for 1 amu, Alt & +/- for 10 amu  
Alt & C: Set Grp/Spec Text to Default

Mass for 10V Out (Max. Output of Board) = 332.4 amu

Group Code Selected:

## DEFAULT GROUP SETTINGS:

B: Airbeam  
I: Single Ion  
A: Ammonium (15,16,17)  
N: Nitrate (30,46)  
S: Sulfate (18,48,64,80,81,98,18)  
W: Water(18)  
C: Calibration (A+N)  
O: Organics (43,44,55,57,77)  
F: Field Masses  
P: PSL

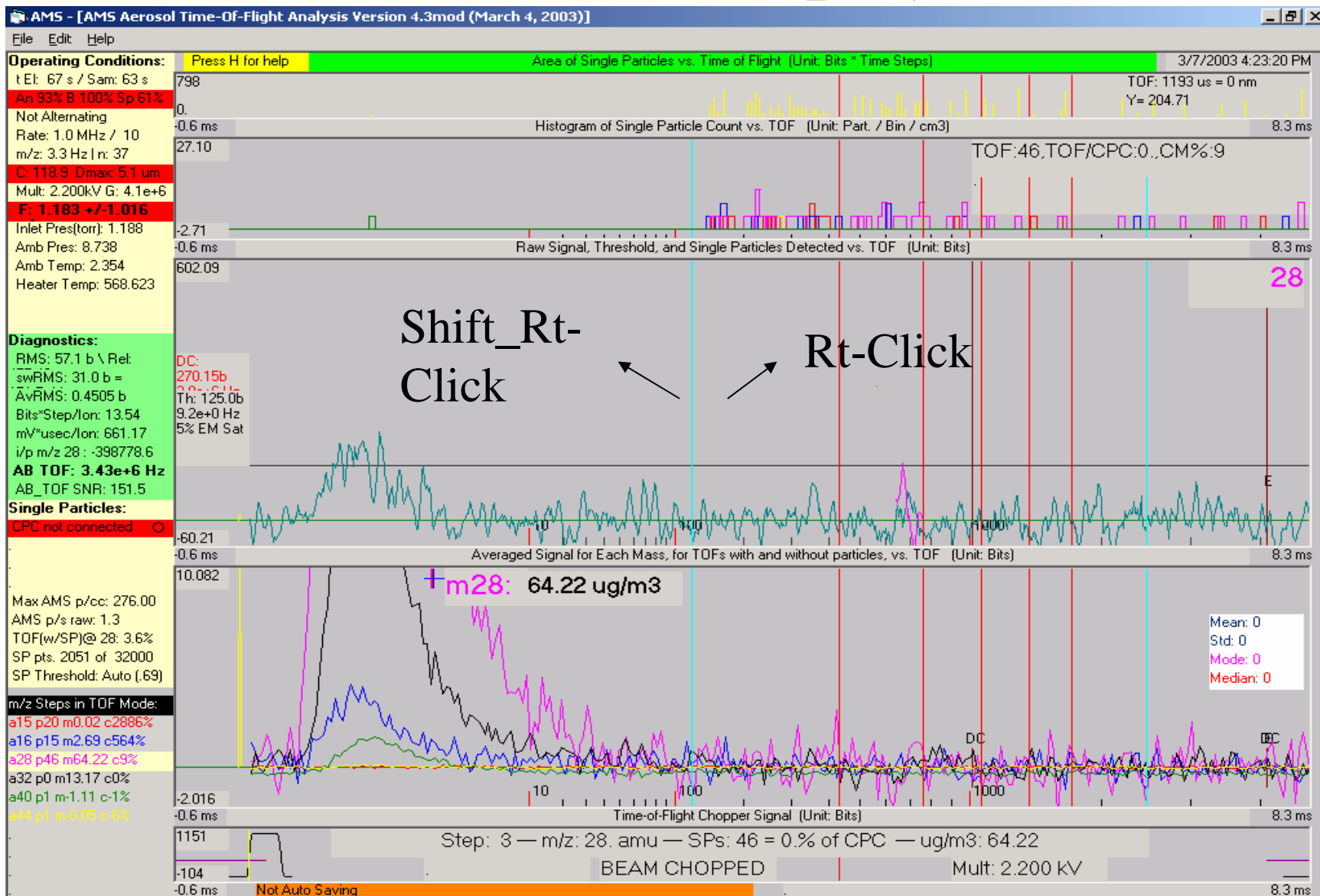
m/z List separated by commas

## GROUP CODE ERROR STATUS:

Single Ion Sliding Window is >2.  
Multiple Masses with Group Code I

Alt-C to clear and set defaults. Note hardwired Group member and Species settings.

# TOF Window Display



# Future Updates

- Continue to try and simplify displays/labels so that user can easily find important information/operating parameters.
- Computer-controlled ramping of Oven temperature
- Jump-MS Mode
- Move to saving files in HDF format
- Setting Menu Parameters via files/ Macro language ?
- Integrated Mode to allow for switching between the various operating methods.