ITRS
Round-Robin Testing
of the
*n*PCD

Documenting the Presence
and
Elemental Characterization
of
Nanoparticles in Ultra-Pure Water

Test Parameters

Test Sites: 5 ITRS Semiconductor Manufacturing Sites (specific sites are not identified)

Sample Location: Before and After Final Filtration (Both cartridge and UF systems)

Particle Capture NanoParticle Collection Device (*n*PCD)

- Instrument captures and agglomerates sub-50 nanometer particles
- Capture time ranged from 9 to 24 hours
- Capture volume ranged from 200 to 540 Liters

Particle Collection: 0.1 Micron Gold Coated Membrane Filter

Particle Analysis: SEM/EDS

Data Presentation

Particle Counts	Laser particle counter plots documenting the concentration of particles greater than 50 nanometers released from *n*PCD during the transfer of particles to the 0.1 micron membrane (not available at all sites)
Particle Graphs:	Bar graph documenting percent elemental concentration of particles collected on the SEM membrane before and after final filtration
SEM Micrographs:	SEM pictures of particles

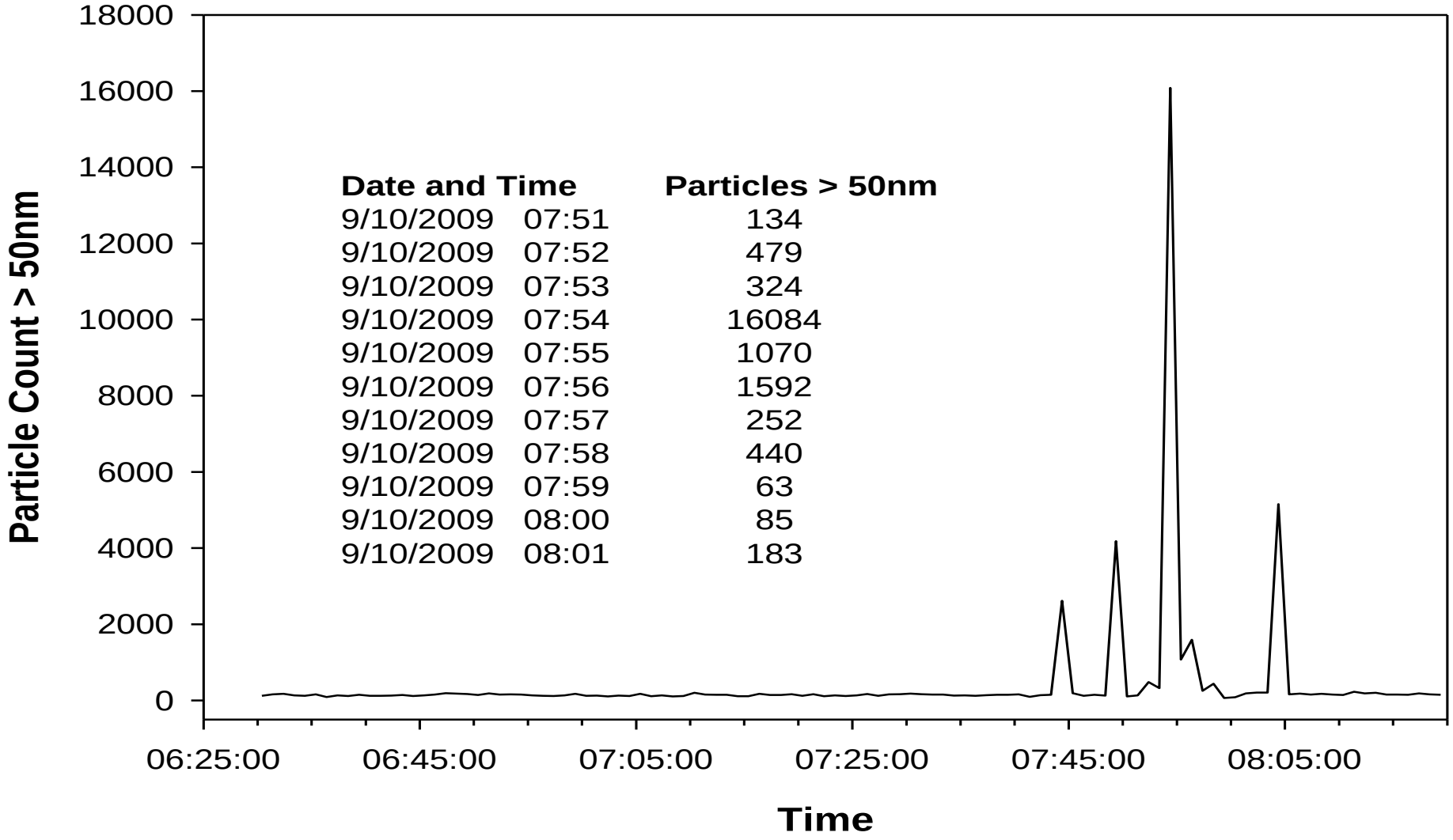
FAB 2
Fab 2 Showed a Typical Collection of Sub-50 Nanometer Particles

Sample One: Supply to Final Filtration

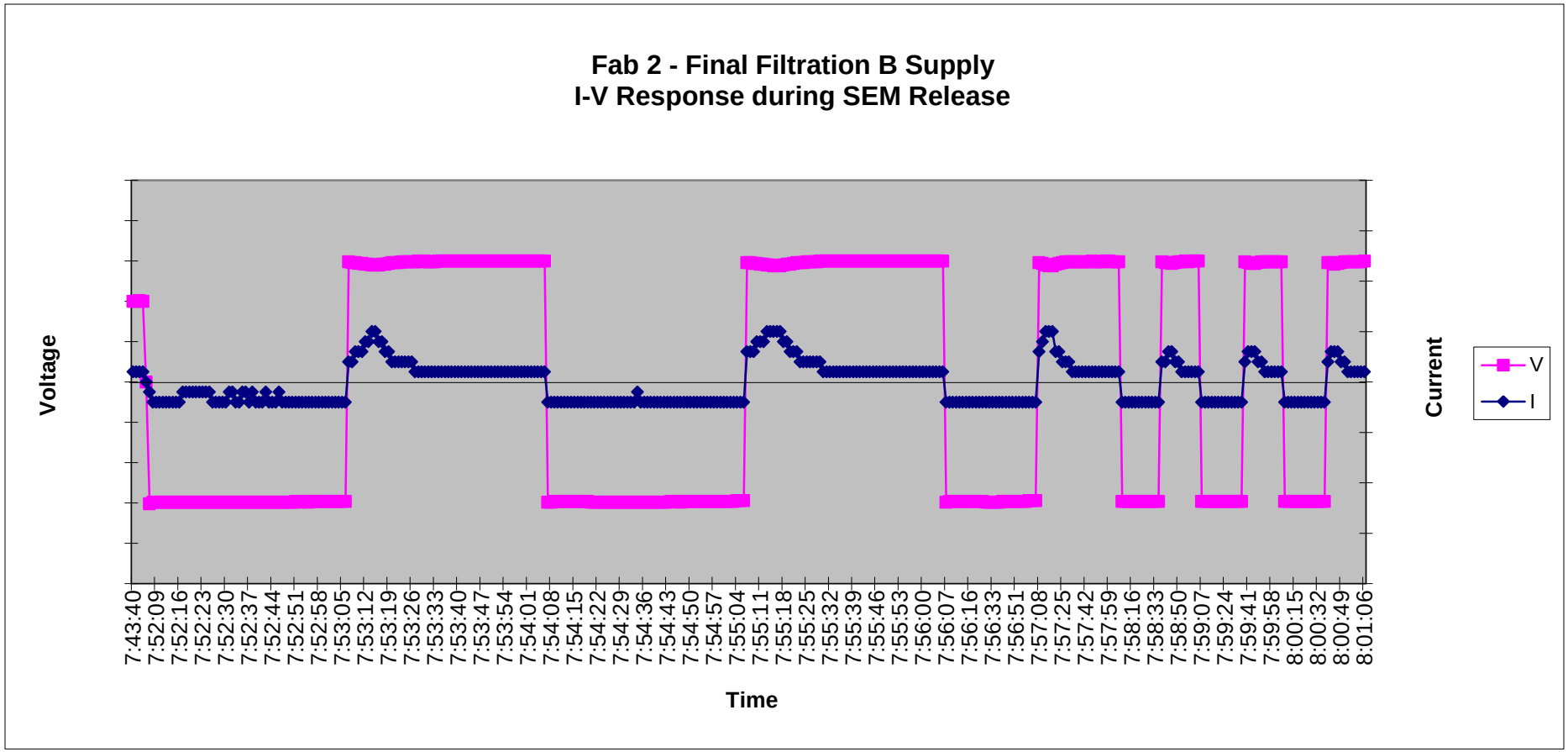
Sample Two Product of Final Filtration
(same system as sample one)

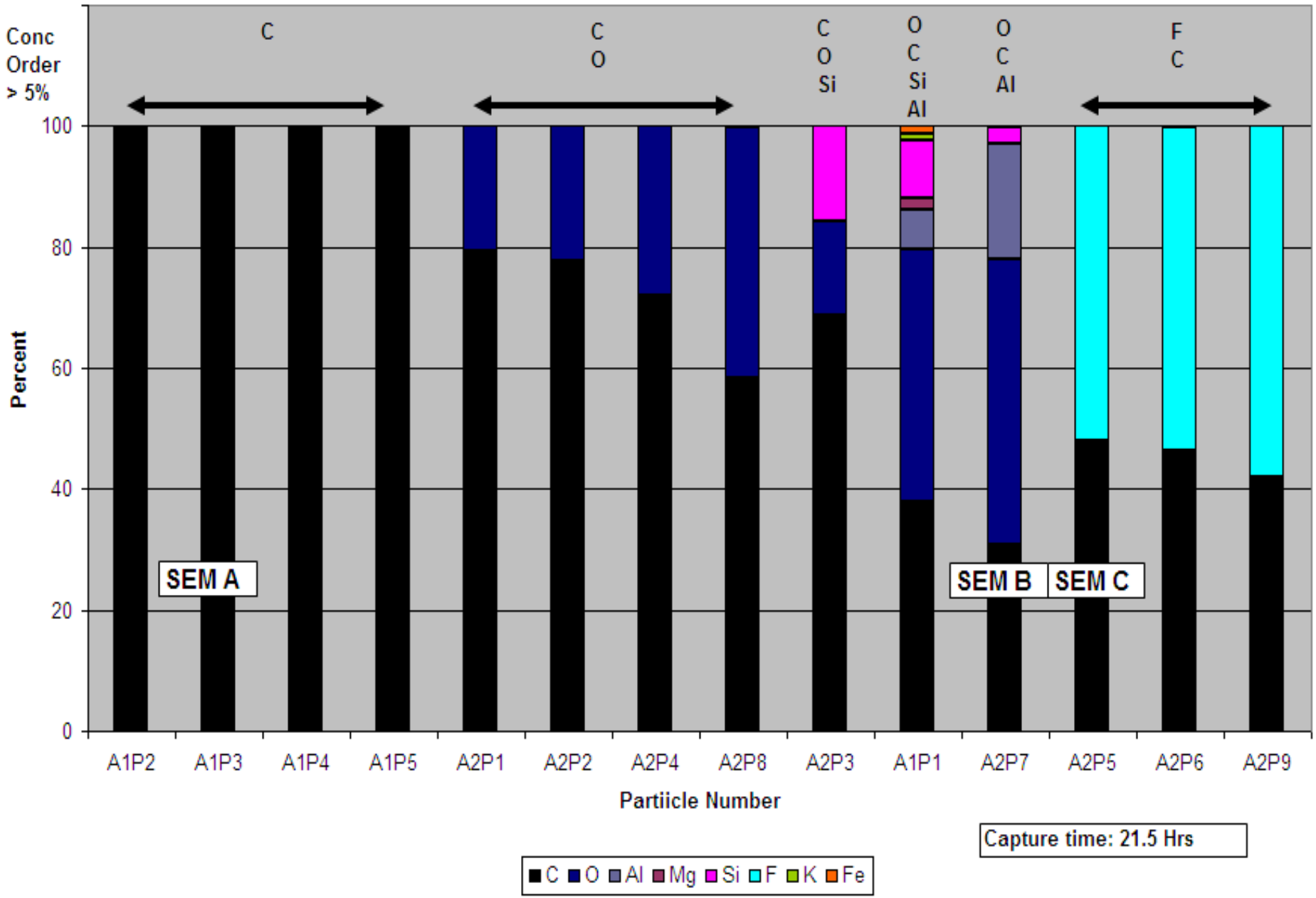
Sample Three Product of Final Filtration
(not associated with Sample one)

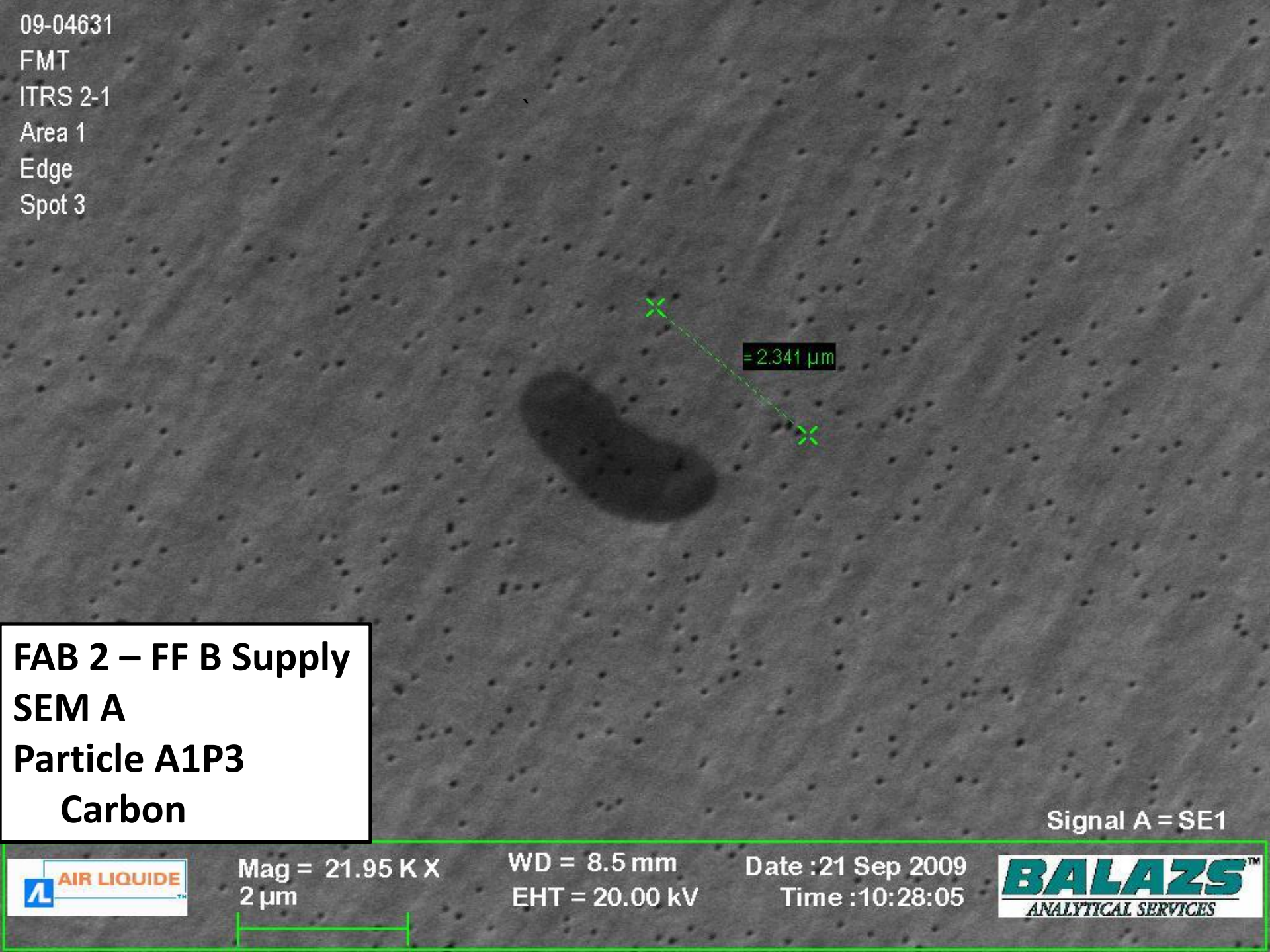
FAB 2 – Final Filter B Supply
Particle Release Documented by Laser Particle Counter
21.5 Hours Capture Time

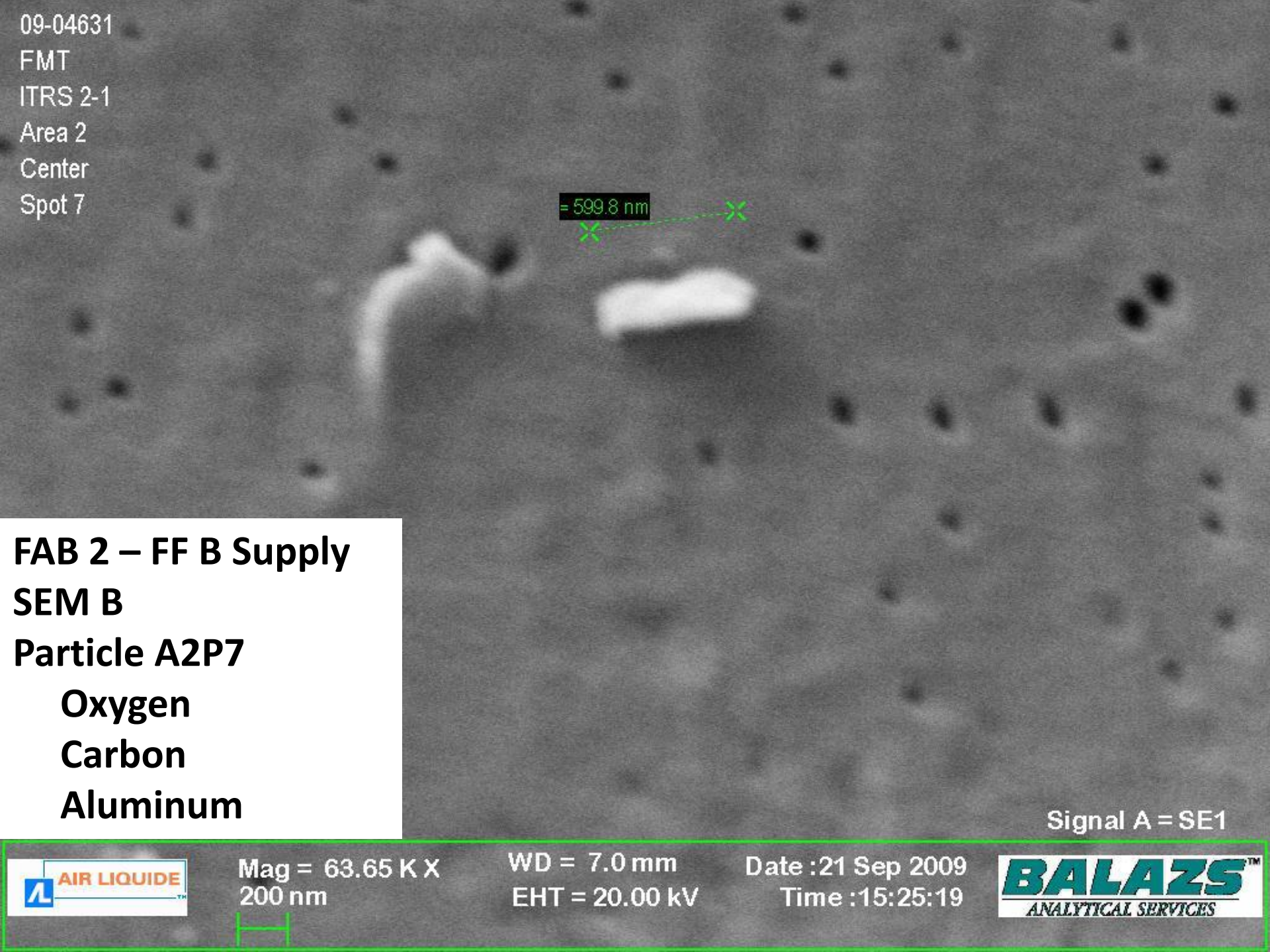


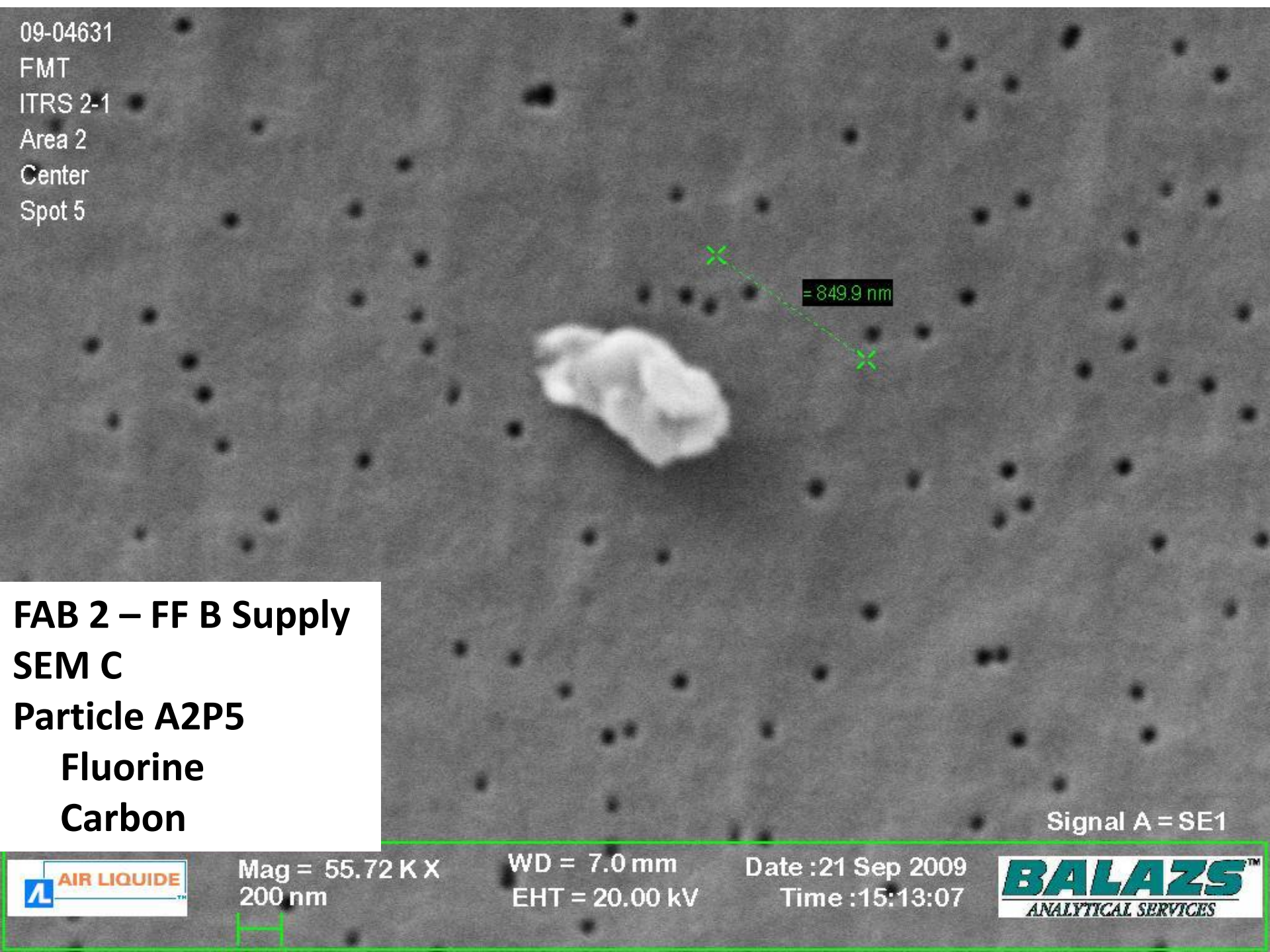
Date and Time		Particles > 50nm
9/10/2009	07:51	134
9/10/2009	07:52	479
9/10/2009	07:53	324
9/10/2009	07:54	16084
9/10/2009	07:55	1070
9/10/2009	07:56	1592
9/10/2009	07:57	252
9/10/2009	07:58	440
9/10/2009	07:59	63
9/10/2009	08:00	85
9/10/2009	08:01	183


Fab 2 - Final Filtration B Supply
I-V Response during SEM Release
Voltage
Current
Time
V
I
7:43:40
7:52:09
7:52:16
7:52:23
7:52:30
7:52:37
7:52:44
7:52:51
7:52:58
7:53:05
7:53:12
7:53:19
7:53:26
7:53:33
7:53:40
7:53:47
7:53:54
7:54:01
7:54:08
7:54:15
7:54:22
7:54:29
7:54:36
7:54:43
7:54:50
7:54:57
7:55:04
7:55:11
7:55:18
7:55:25
7:55:32
7:55:39
7:55:46
7:55:53
7:56:00
7:56:07
7:56:16
7:56:33
7:56:51
7:57:08
7:57:25
7:57:42
7:57:59
7:58:16
7:58:33
7:58:50
7:59:07
7:59:24
7:59:41
7:59:58
8:00:15
8:00:32
8:00:49
8:01:06


FAB 2 - Final Filtration B Supply
Percent Elemental Concentration in Particles
Conc Order > 5%
C
C O
C O Si
O C Si Al
O C Al
F C
Percent
100
80
60
40
20
0
SEM A
SEM B
SEM C
A1P2
A1P3
A1P4
A1P5
A2P1
A2P2
A2P4
A2P8
A2P3
A1P1
A2P7
A2P5
A2P6
A2P9
Partiicle Number
Capture time: 21.5 Hrs
C O Al Mg Si F K Fe

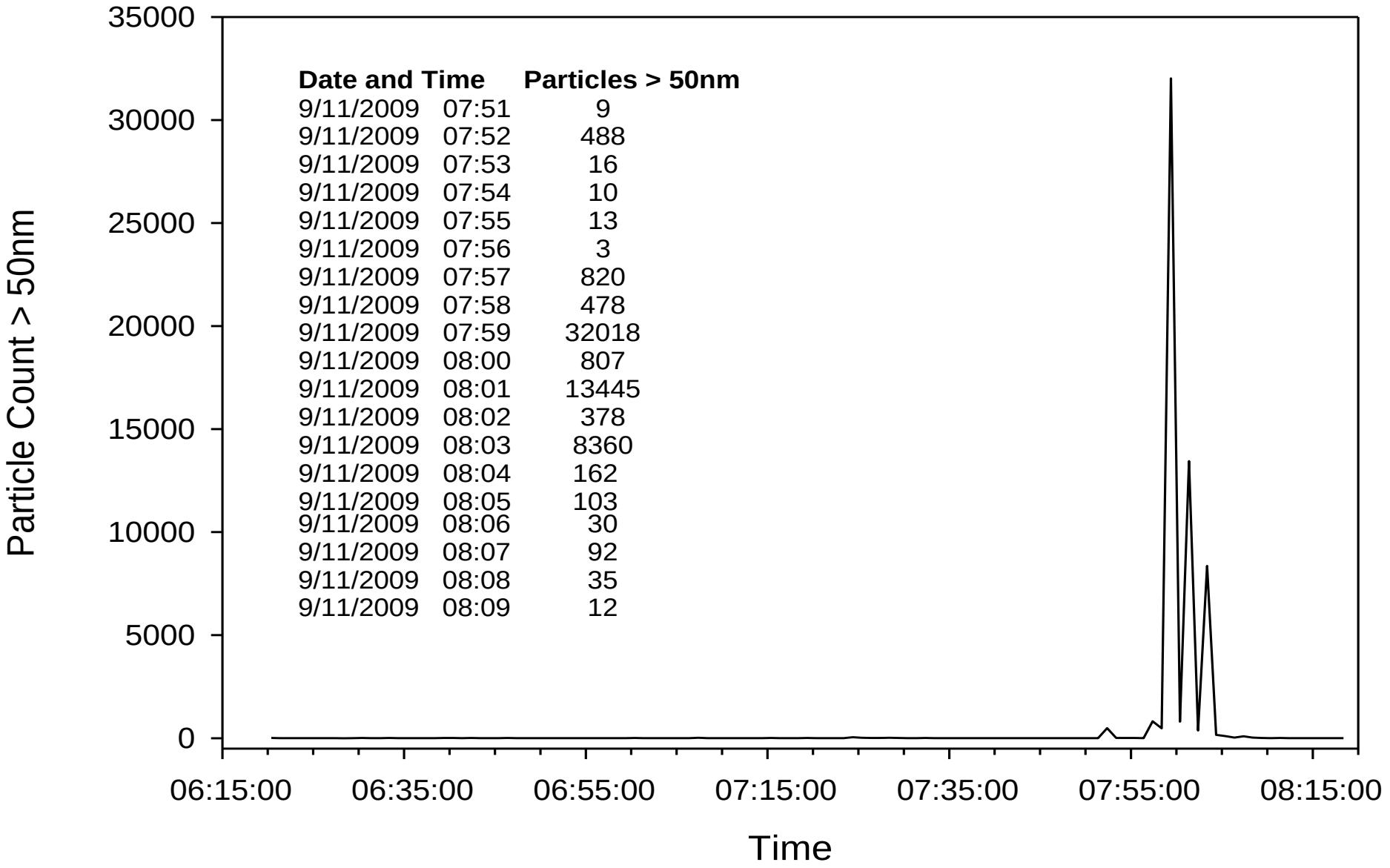

09-04631
FMT
ITRS 2-1
Area 1
Edge
Spot 3
= 2.341 µm
FAB 2 – FF B Supply
SEM A
Particle A1P3
Carbon
Signal A = SE1
AIR LIQUIDE
Mag = 21.95 K X
2 µm
WD = 8.5 mm
EHT = 20.00 kV
Date :21 Sep 2009
Time :10:28:05
BALAZS
ANALYTICAL SERVICES


09-04631
FMT
ITRS 2-1
Area 2
Center
Spot 7
= 599.8 nm
FAB 2 – FF B Supply
SEM B
Particle A2P7
Oxygen
Carbon
Aluminum
Signal A = SE1
AIR LIQUIDE
Mag = 63.65 K X
200 nm
WD = 7.0 mm
EHT = 20.00 kV
Date :21 Sep 2009
Time :15:25:19
BALAZS
ANALYTICAL SERVICES

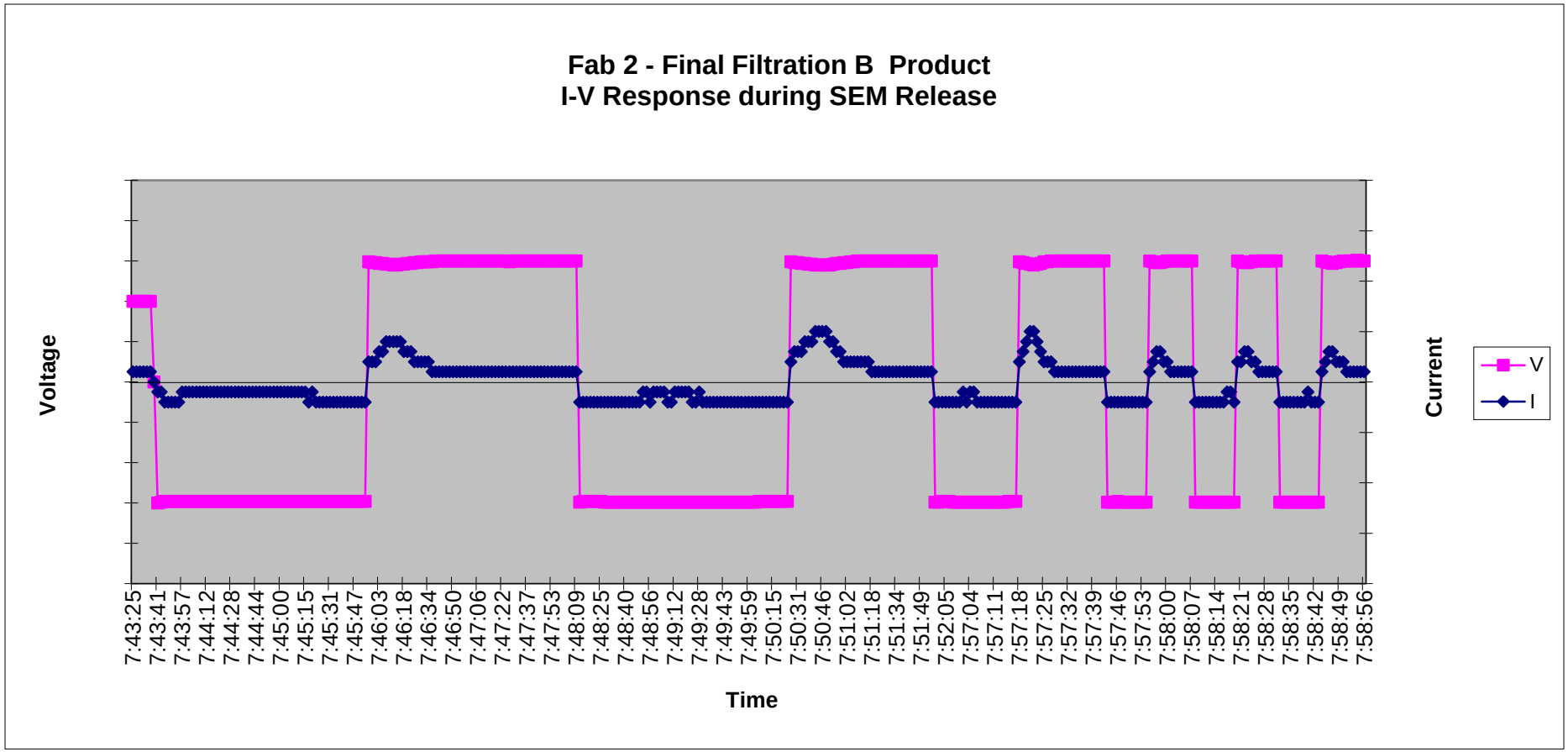


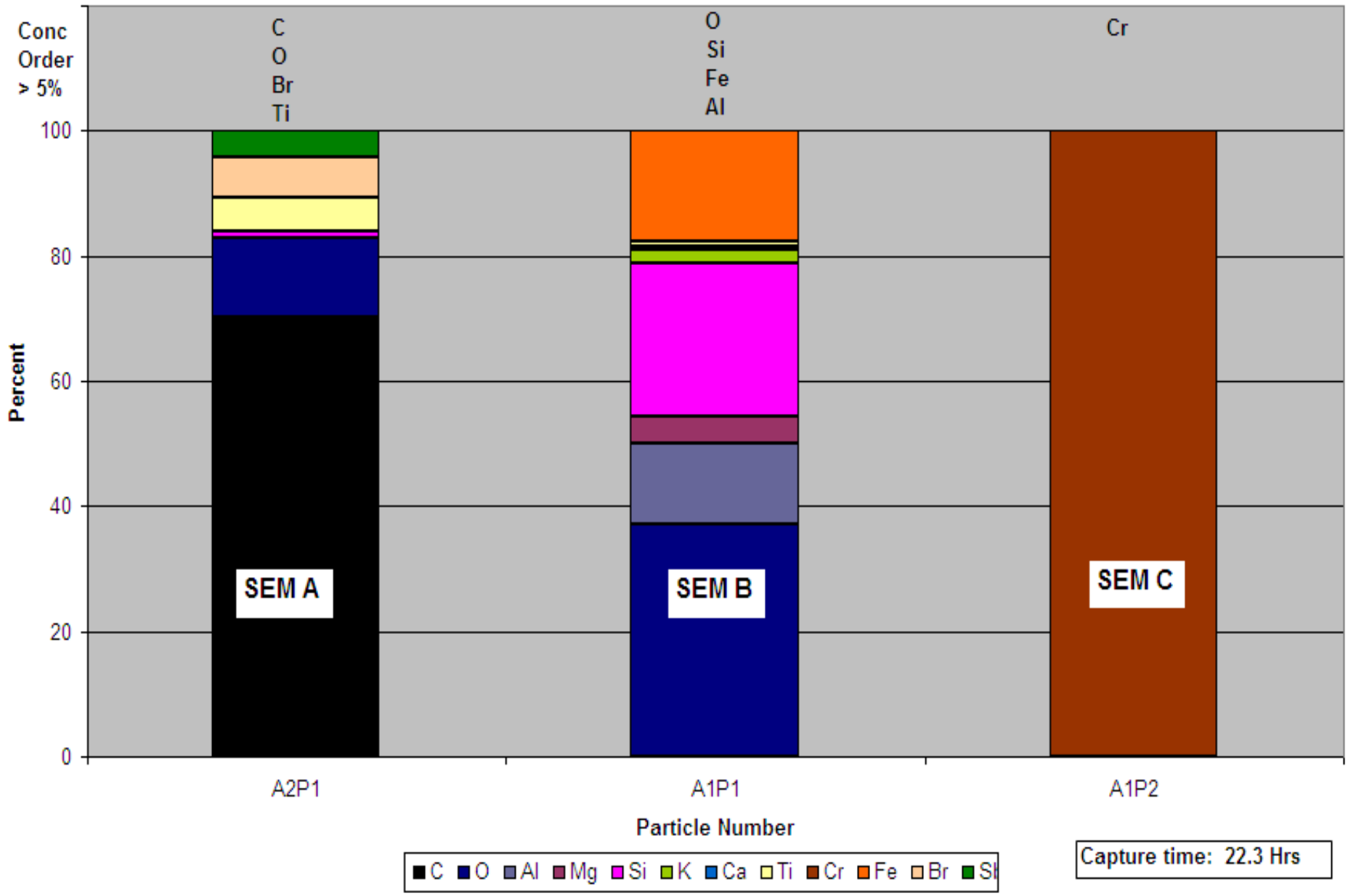
FAB 2 – FF B Supply
SEM C
Particle A2P5
Fluorine
Carbon

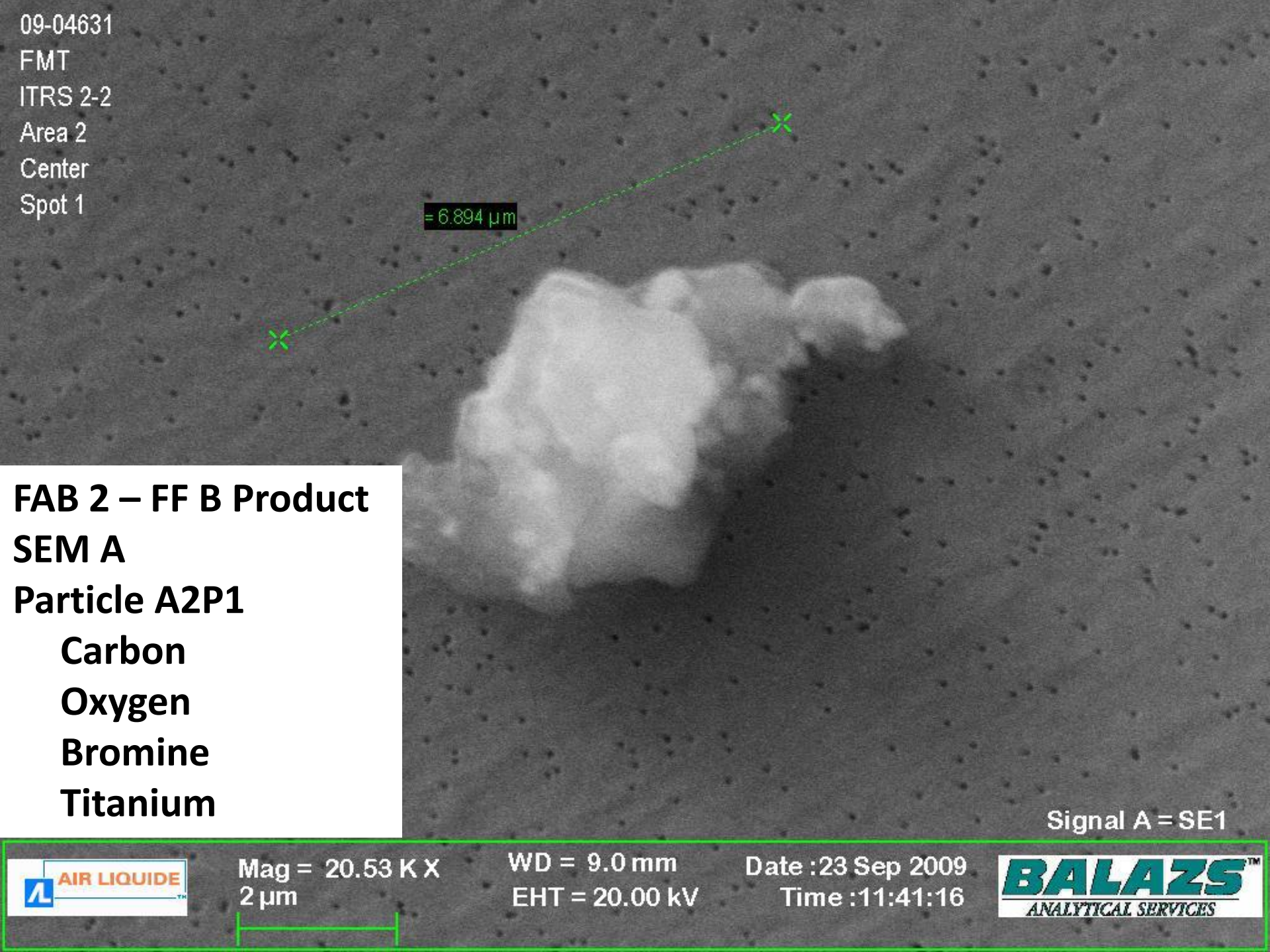
FAB 2 – Final Filter B Product
Particle Release Documented by Laser Particle Counter
22.3 Hours Capture Time

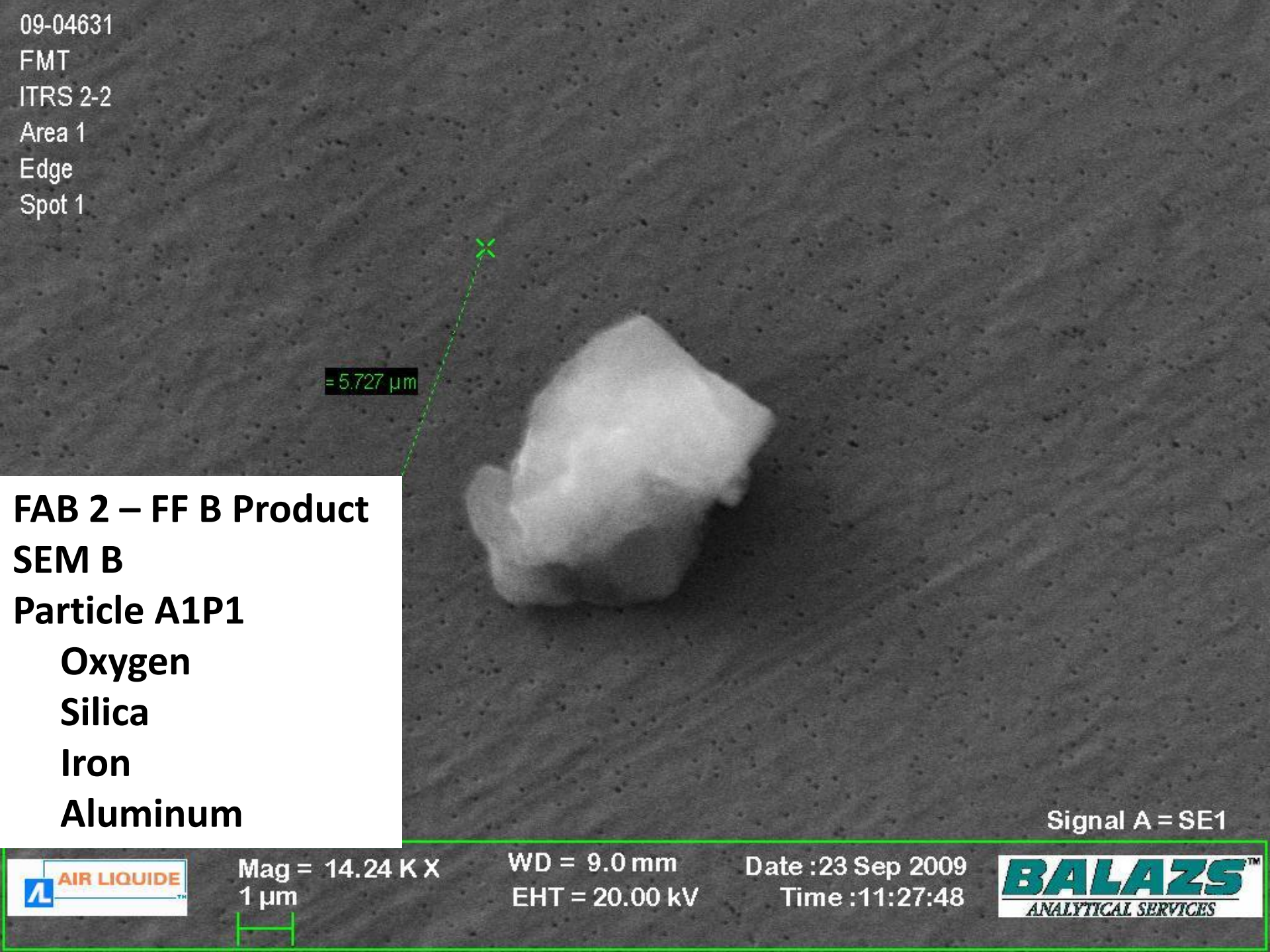


Date and Time		Particles > 50nm
9/11/2009	07:51	9
9/11/2009	07:52	488
9/11/2009	07:53	16
9/11/2009	07:54	10
9/11/2009	07:55	13
9/11/2009	07:56	3
9/11/2009	07:57	820
9/11/2009	07:58	478
9/11/2009	07:59	32018
9/11/2009	08:00	807
9/11/2009	08:01	13445
9/11/2009	08:02	378
9/11/2009	08:03	8360
9/11/2009	08:04	162
9/11/2009	08:05	103
9/11/2009	08:06	30
9/11/2009	08:07	92
9/11/2009	08:08	35
9/11/2009	08:09	12


Fab 2 - Final Filtration B Product
I-V Response during SEM Release
Voltage
Current
Time
V
I
7:43:25
7:43:41
7:43:57
7:44:12
7:44:28
7:44:44
7:45:00
7:45:15
7:45:31
7:45:47
7:46:03
7:46:18
7:46:34
7:46:50
7:47:06
7:47:22
7:47:37
7:47:53
7:48:09
7:48:25
7:48:40
7:48:56
7:49:12
7:49:28
7:49:43
7:49:59
7:50:15
7:50:31
7:50:46
7:51:02
7:51:18
7:51:34
7:51:49
7:52:05
7:57:04
7:57:11
7:57:18
7:57:25
7:57:32
7:57:39
7:57:46
7:57:53
7:58:00
7:58:07
7:58:14
7:58:21
7:58:28
7:58:35
7:58:42
7:58:49
7:58:56

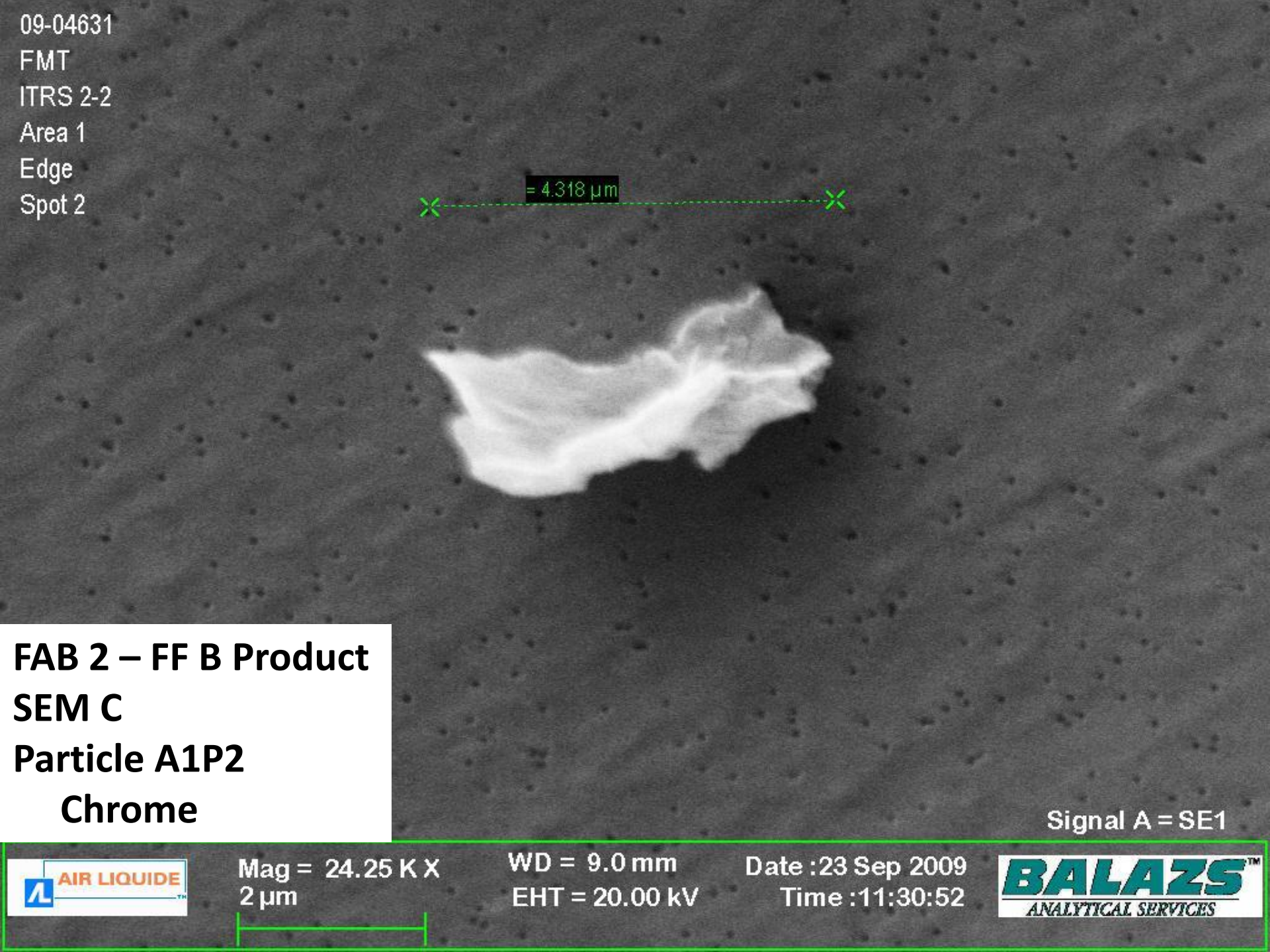

FAB 2 - Final Filtration B Product
Percent Elemental Concentration in Particles
Conc Order > 5%
C O Br Ti
O Si Fe Al
Cr
100
80
60
40
20
0
Percent
SEM A
SEM B
SEM C
A2P1
A1P1
A1P2
Particle Number
C O Al Mg Si K Ca Ti Cr Fe Br Sl
Capture time: 22.3 Hrs


09-04631
FMT
ITRS 2-2
Area 2
Center
Spot 1
= 6.894 µm
FAB 2 – FF B Product
SEM A
Particle A2P1
Carbon
Oxygen
Bromine
Titanium
Signal A = SE1
AIR LIQUIDE
Mag = 20.53 K X
2 µm
WD = 9.0 mm
EHT = 20.00 kV
Date :23 Sep 2009
Time :11:41:16
BALAZS
ANALYTICAL SERVICES



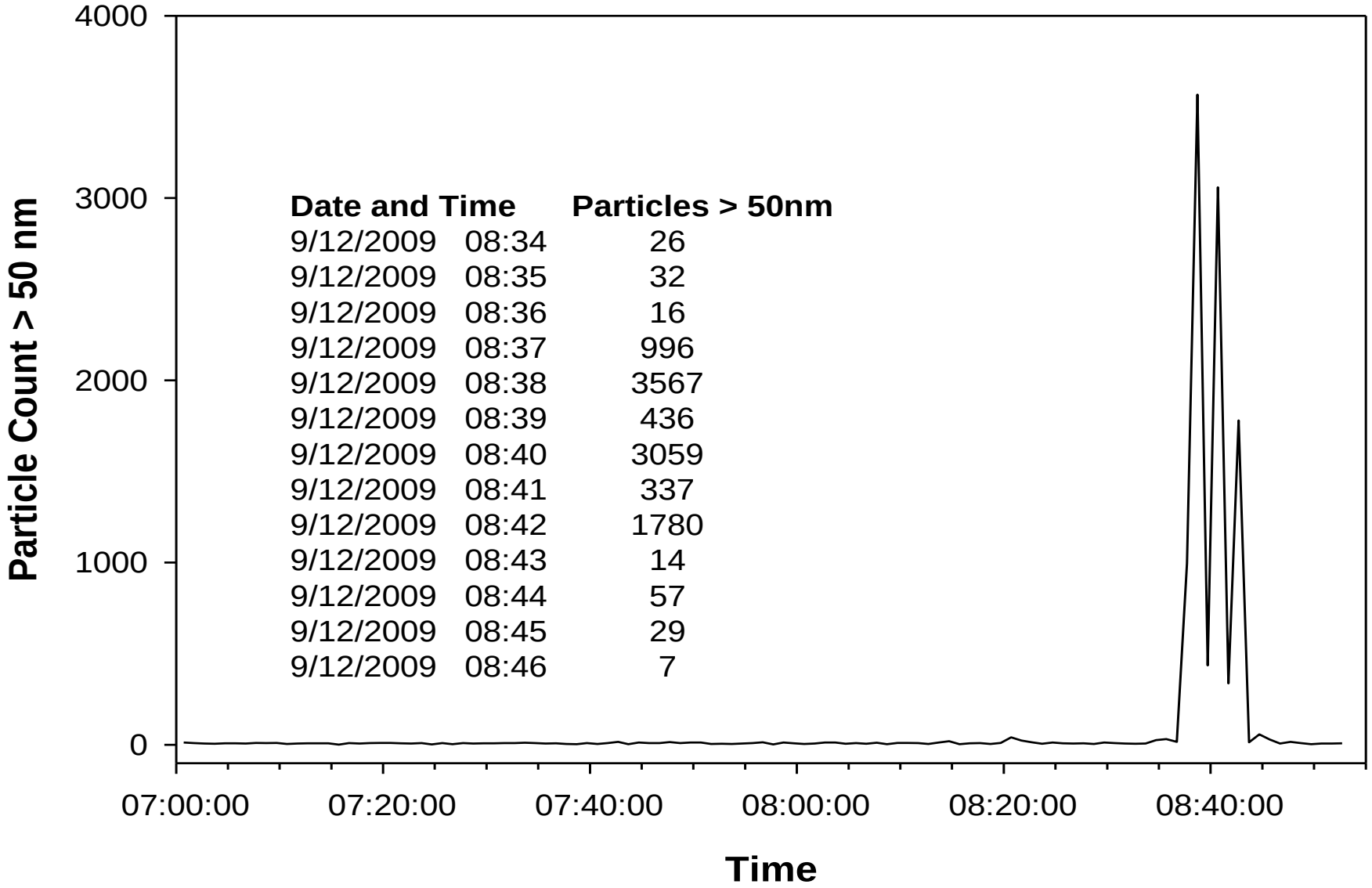
FAB 2 – FF B Product
SEM B
Particle A1P1

- **Oxygen**
- **Silica**
- **Iron**
- **Aluminum**

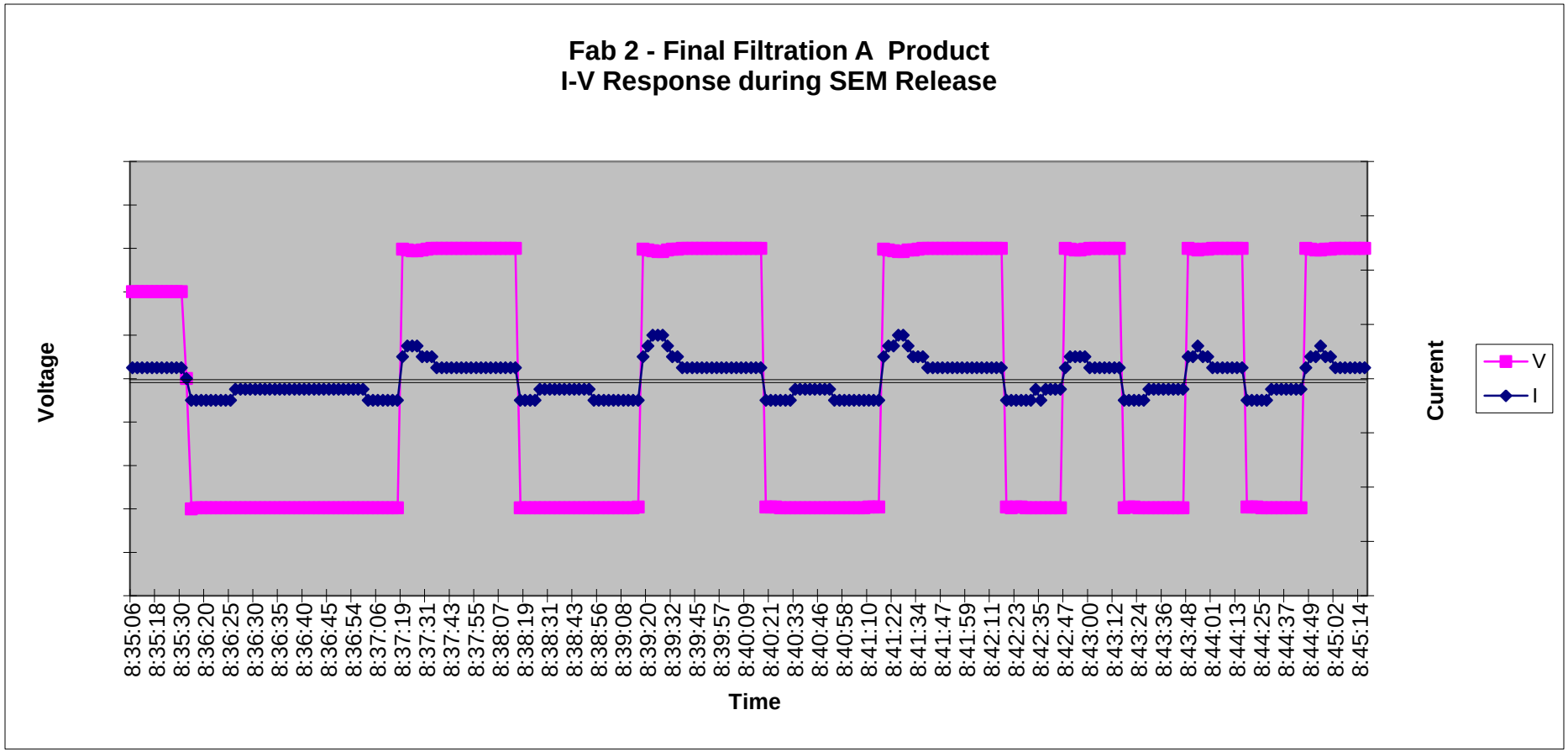


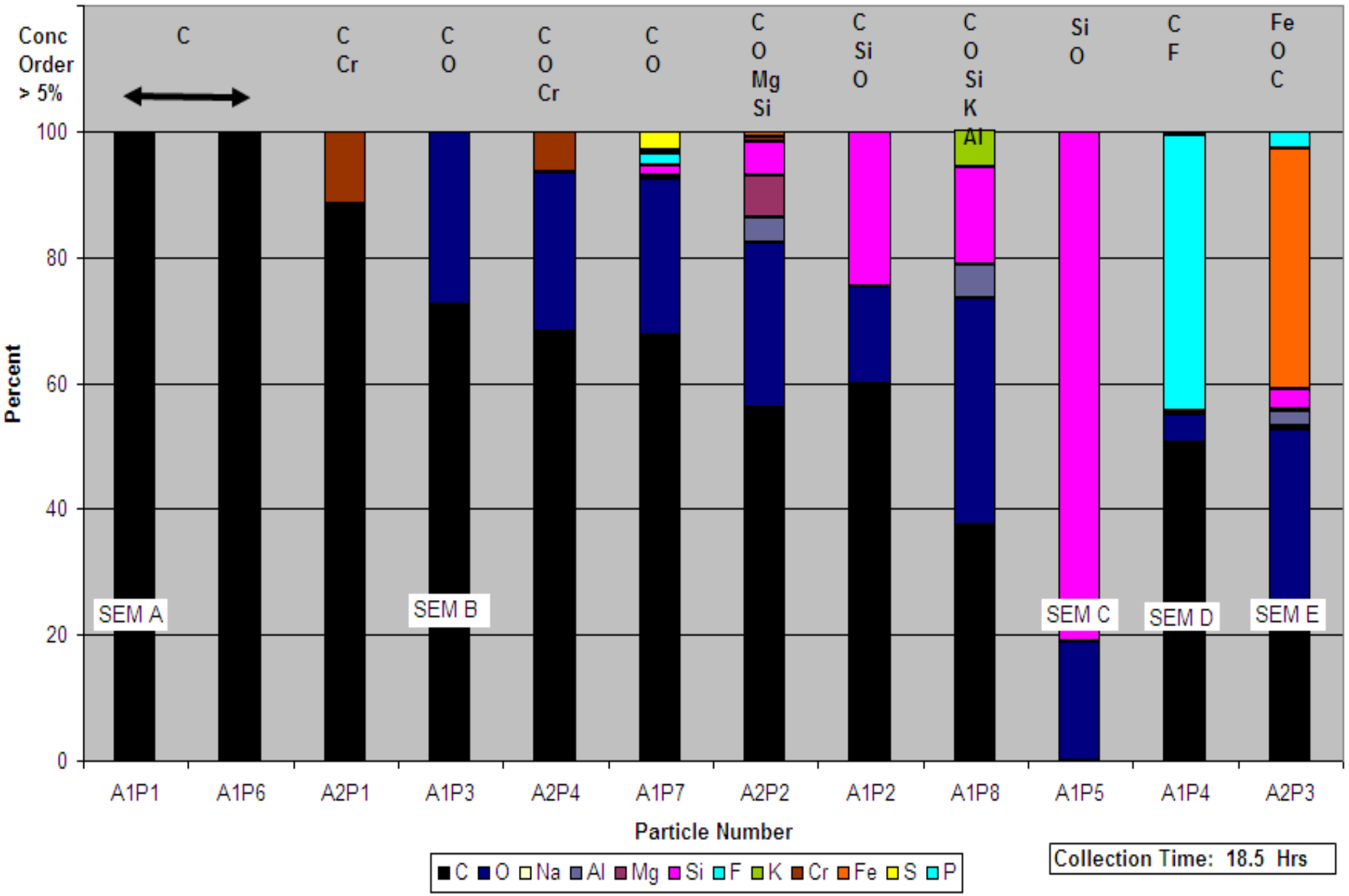
FAB 2 – FF B Product
SEM C
Particle A1P2
Chrome

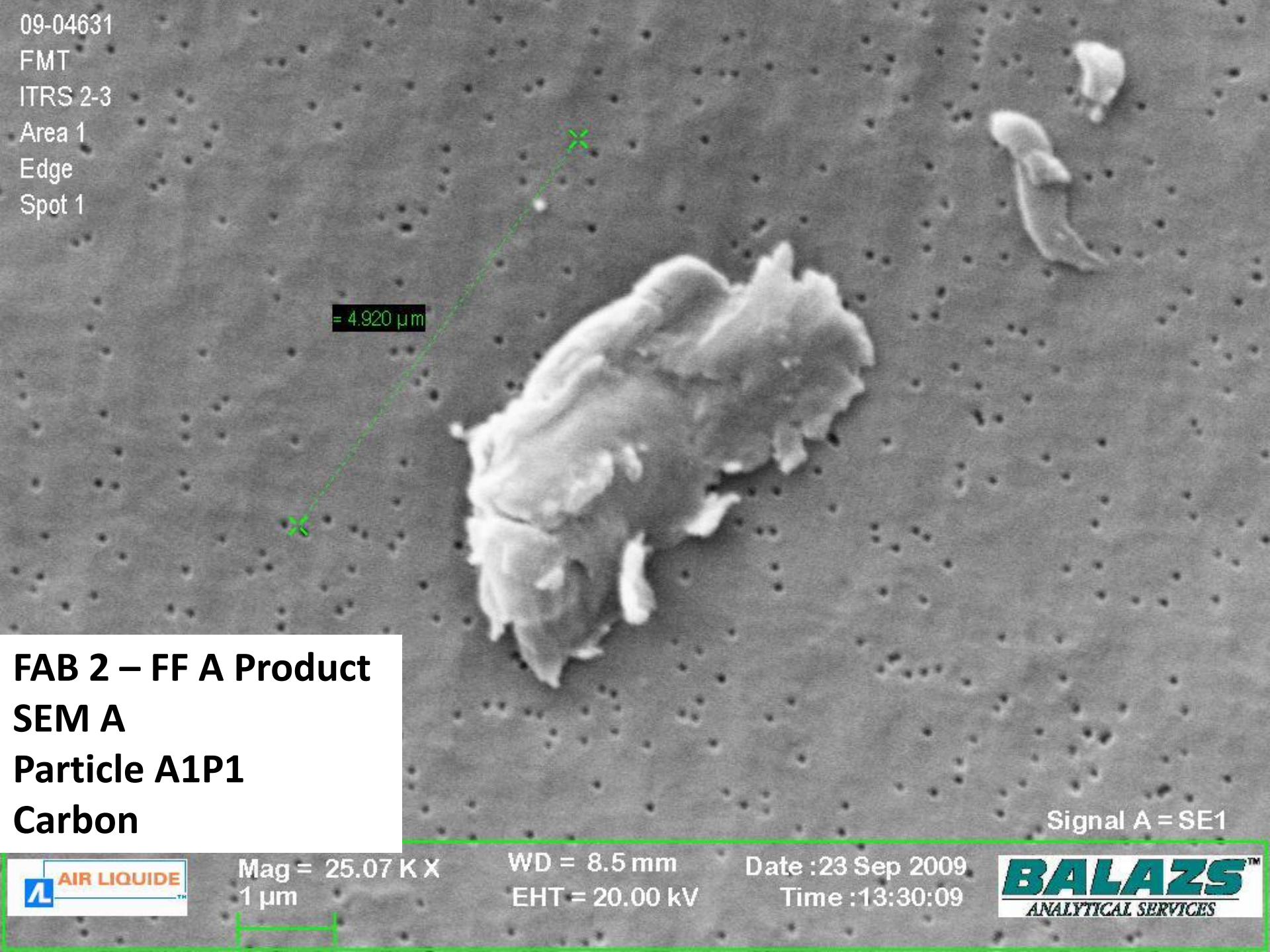
FAB 2 – Final Filter A Product
Particle Release Documented by Laser Particle Counter
18.5 Hours Capture Time



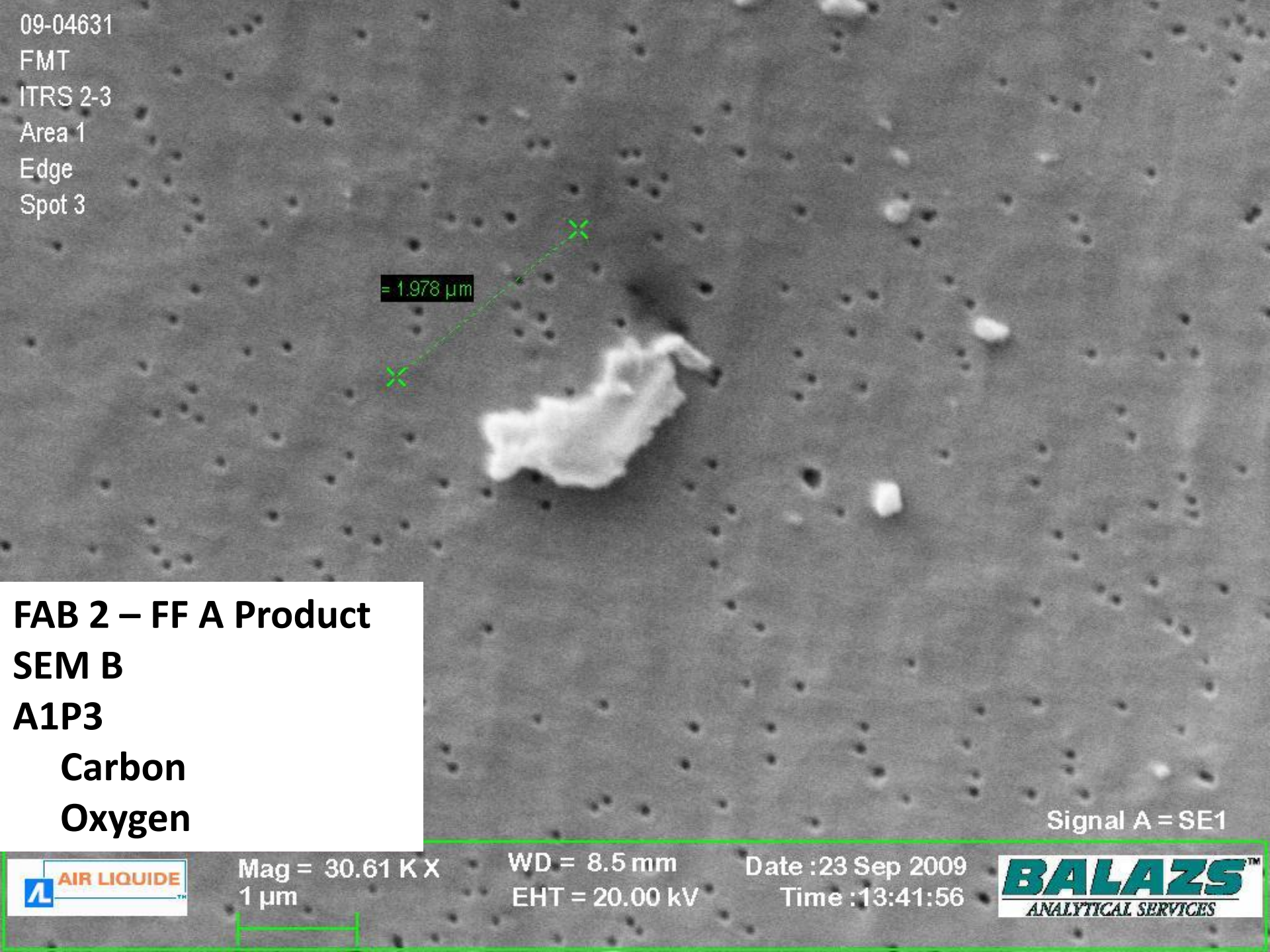
Date and Time		Particles > 50nm
9/12/2009	08:34	26
9/12/2009	08:35	32
9/12/2009	08:36	16
9/12/2009	08:37	996
9/12/2009	08:38	3567
9/12/2009	08:39	436
9/12/2009	08:40	3059
9/12/2009	08:41	337
9/12/2009	08:42	1780
9/12/2009	08:43	14
9/12/2009	08:44	57
9/12/2009	08:45	29
9/12/2009	08:46	7

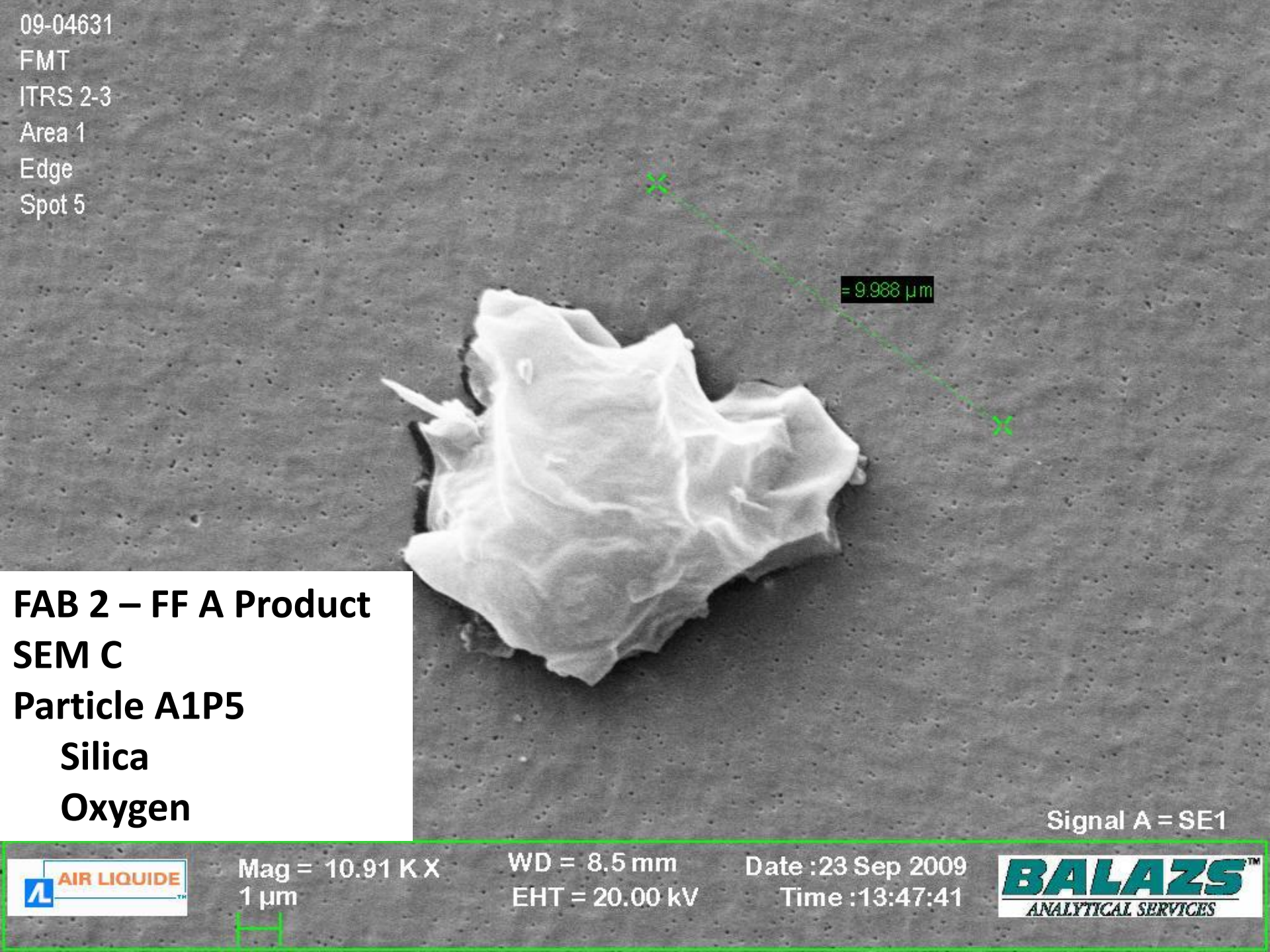

Fab 2 - Final Filtration A Product
I-V Response during SEM Release
Voltage
Current
Time
V
I
8:35:06
8:35:18
8:35:30
8:36:20
8:36:25
8:36:30
8:36:35
8:36:40
8:36:45
8:36:54
8:37:06
8:37:19
8:37:31
8:37:43
8:37:55
8:38:07
8:38:19
8:38:31
8:38:43
8:38:56
8:39:08
8:39:20
8:39:32
8:39:45
8:39:57
8:40:09
8:40:21
8:40:33
8:40:46
8:40:58
8:41:10
8:41:22
8:41:34
8:41:47
8:41:59
8:42:11
8:42:23
8:42:35
8:42:47
8:43:00
8:43:12
8:43:24
8:43:36
8:43:48
8:44:01
8:44:13
8:44:25
8:44:37
8:44:49
8:45:02
8:45:14


FAB2 - Final Filtration A Product
Percent Elemental Concentration in Particles
Conc Order > 5%
C
C Cr
C O
C O Cr
C O
C O Mg Si
C Si O
C O Si K Al
Si O
C F
Fe O C
Percent
100
80
60
40
20
0
SEM A
SEM B
SEM C
SEM D
SEM E
A1P1
A1P6
A2P1
A1P3
A2P4
A1P7
A2P2
A1P2
A1P8
A1P5
A1P4
A2P3
Particle Number
C O Na Al Mg Si F K Cr Fe S P
Collection Time: 18.5 Hrs



FAB 2 – FF A Product
SEM A
Particle A1P1
Carbon


09-04631
FMT
ITRS 2-3
Area 1
Edge
Spot 3
= 1.978 µm
FAB 2 – FF A Product
SEM B
A1P3
Carbon
Oxygen
Signal A = SE1
AIR LIQUIDE
Mag = 30.61 K X
1 µm
WD = 8.5 mm
EHT = 20.00 kV
Date :23 Sep 2009
Time :13:41:56
BALAZS
ANALYTICAL SERVICES

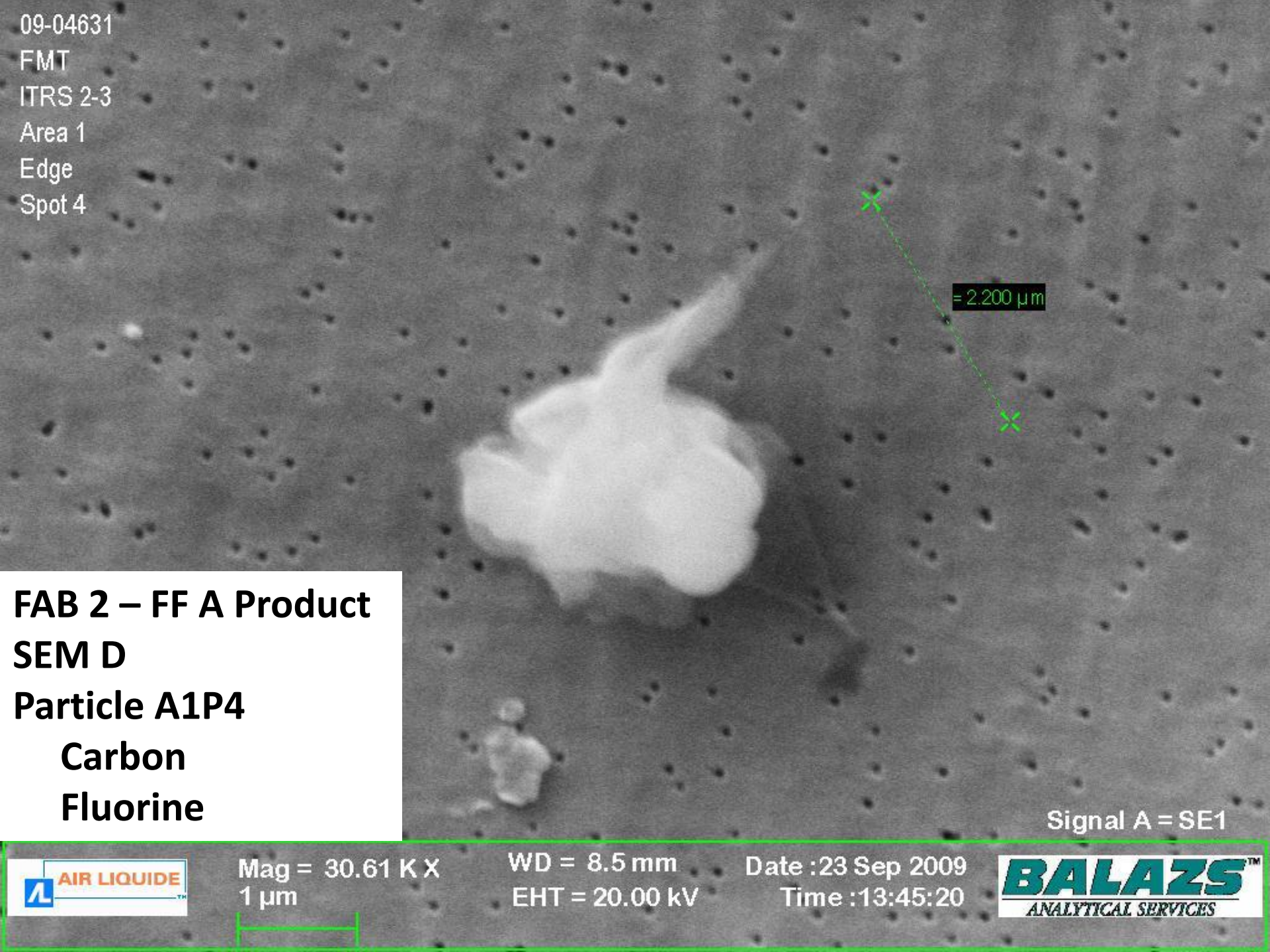


FAB 2 – FF A Product

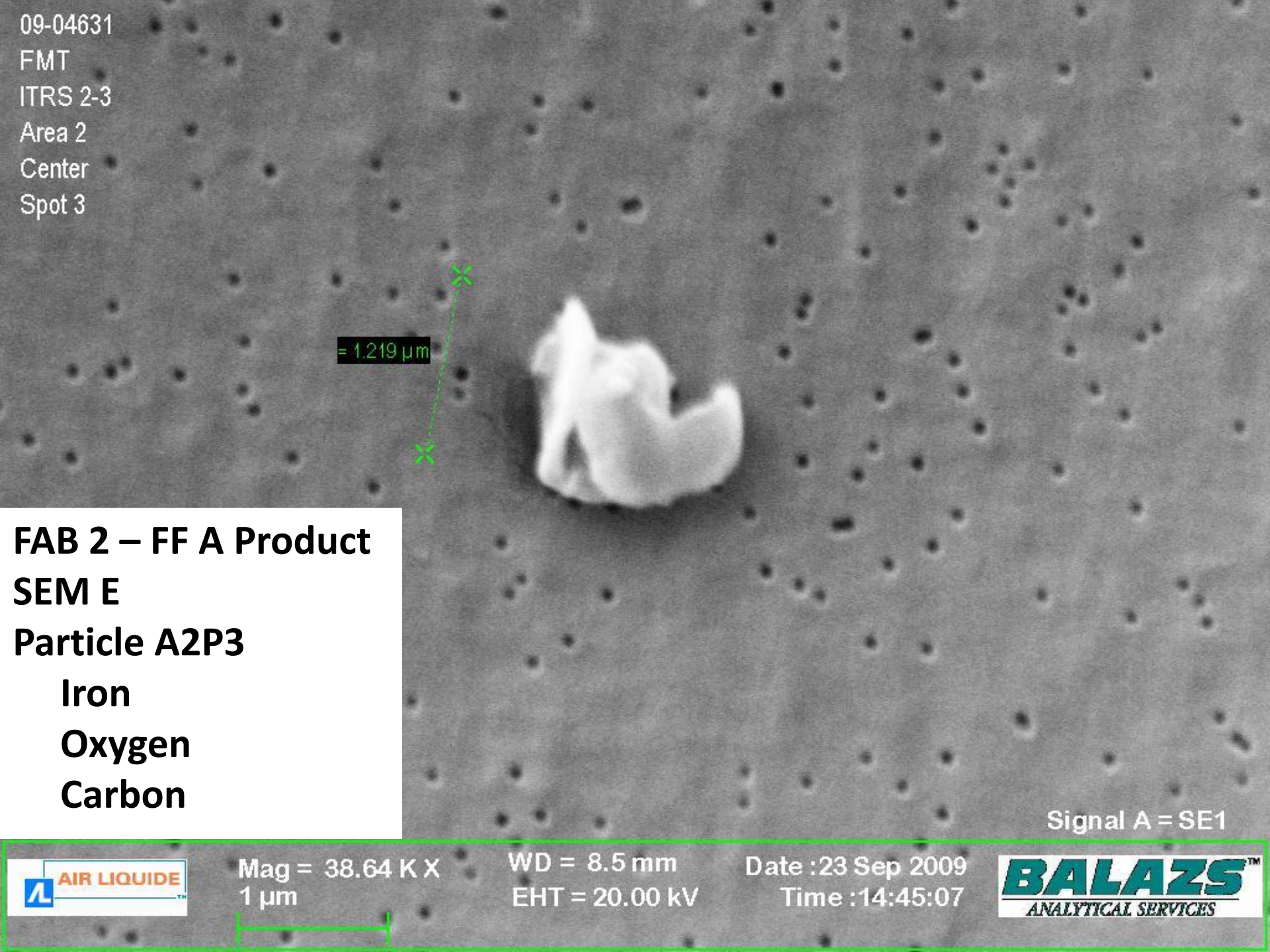
SEM C

Particle A1P5

- **Silica**
- **Oxygen**



FAB 2 – FF A Product
SEM D
Particle A1P4
Carbon
Fluorine



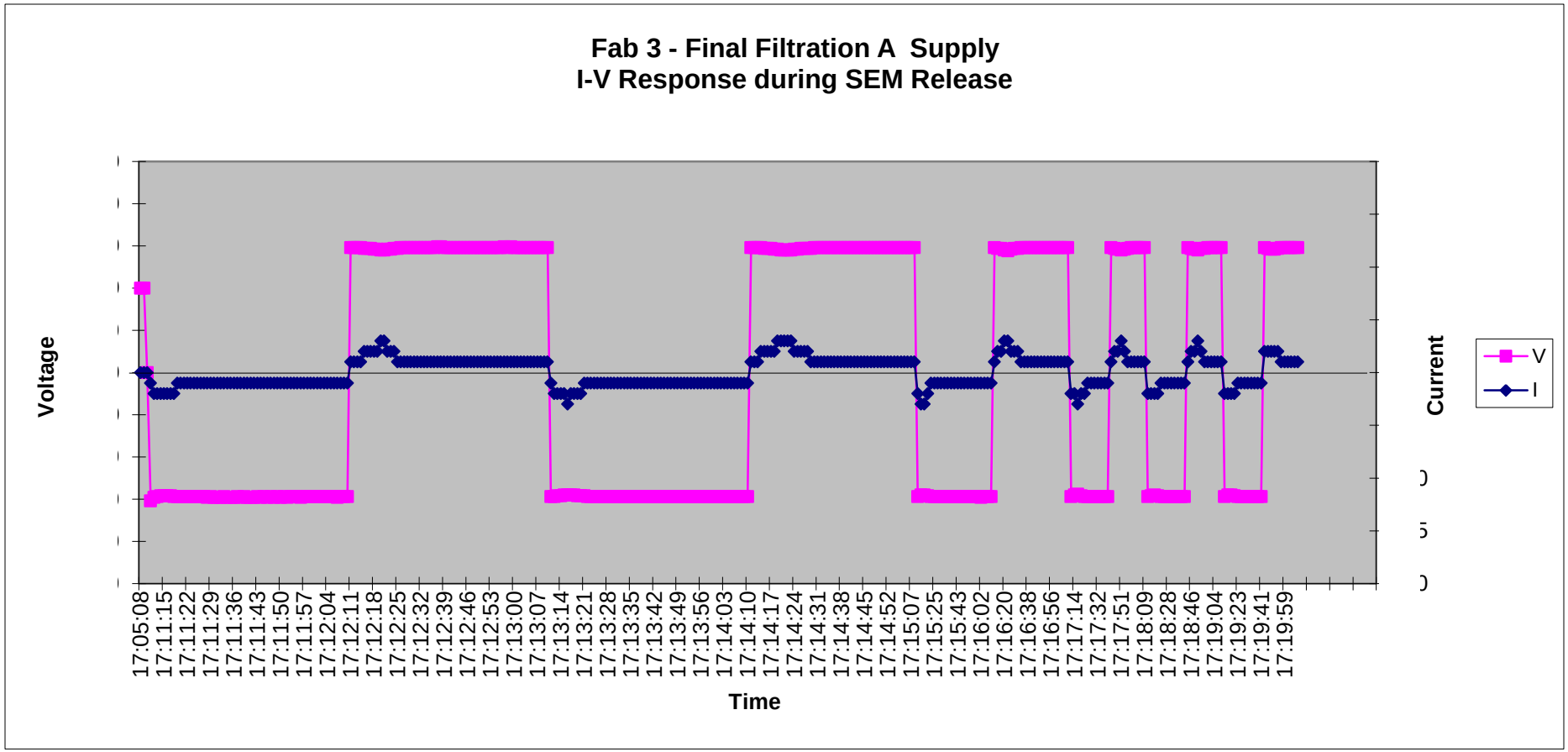
FAB 2 – FF A Product
SEM E
Particle A2P3

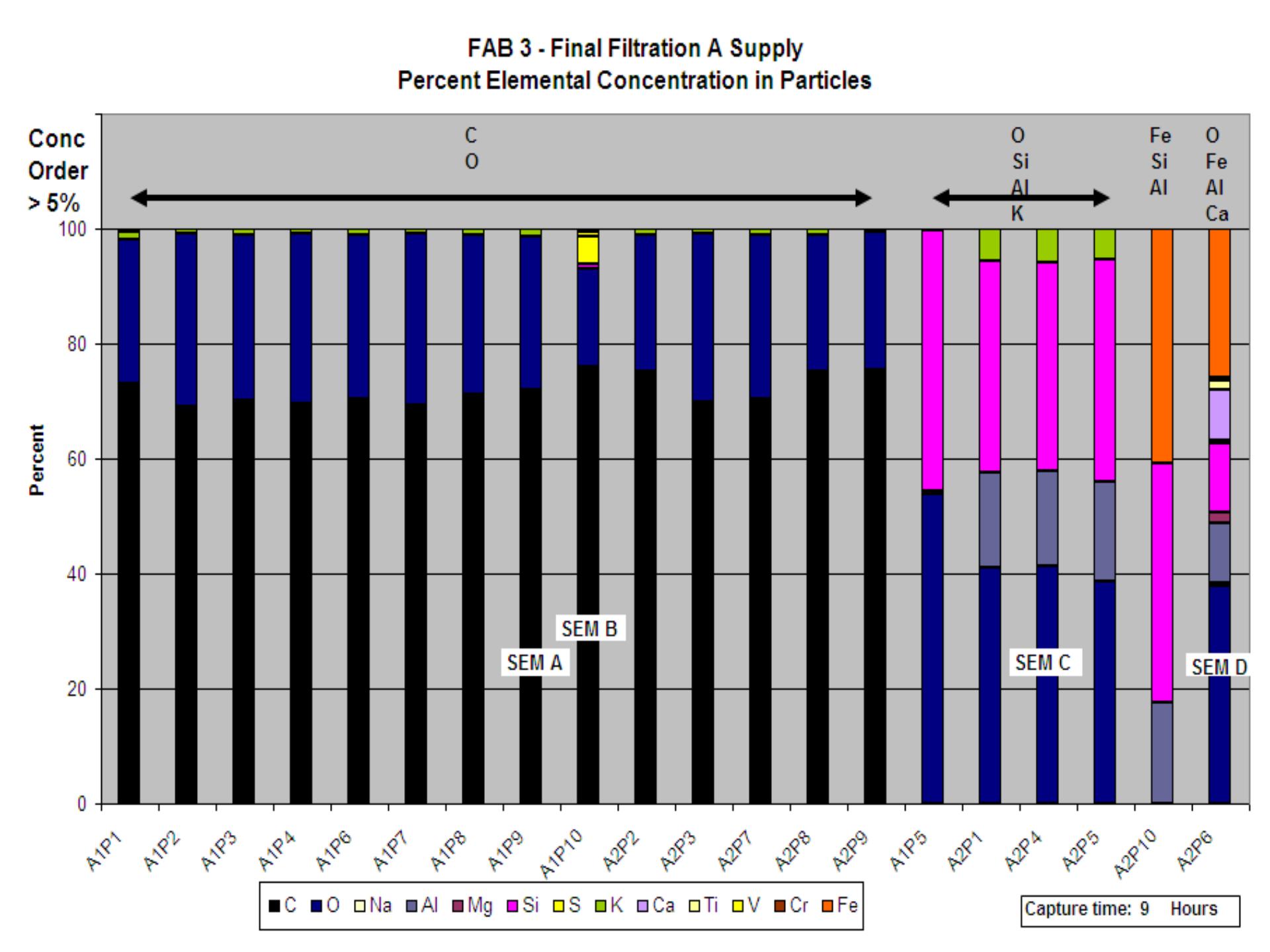
- **Iron**
- **Oxygen**
- **Carbon**

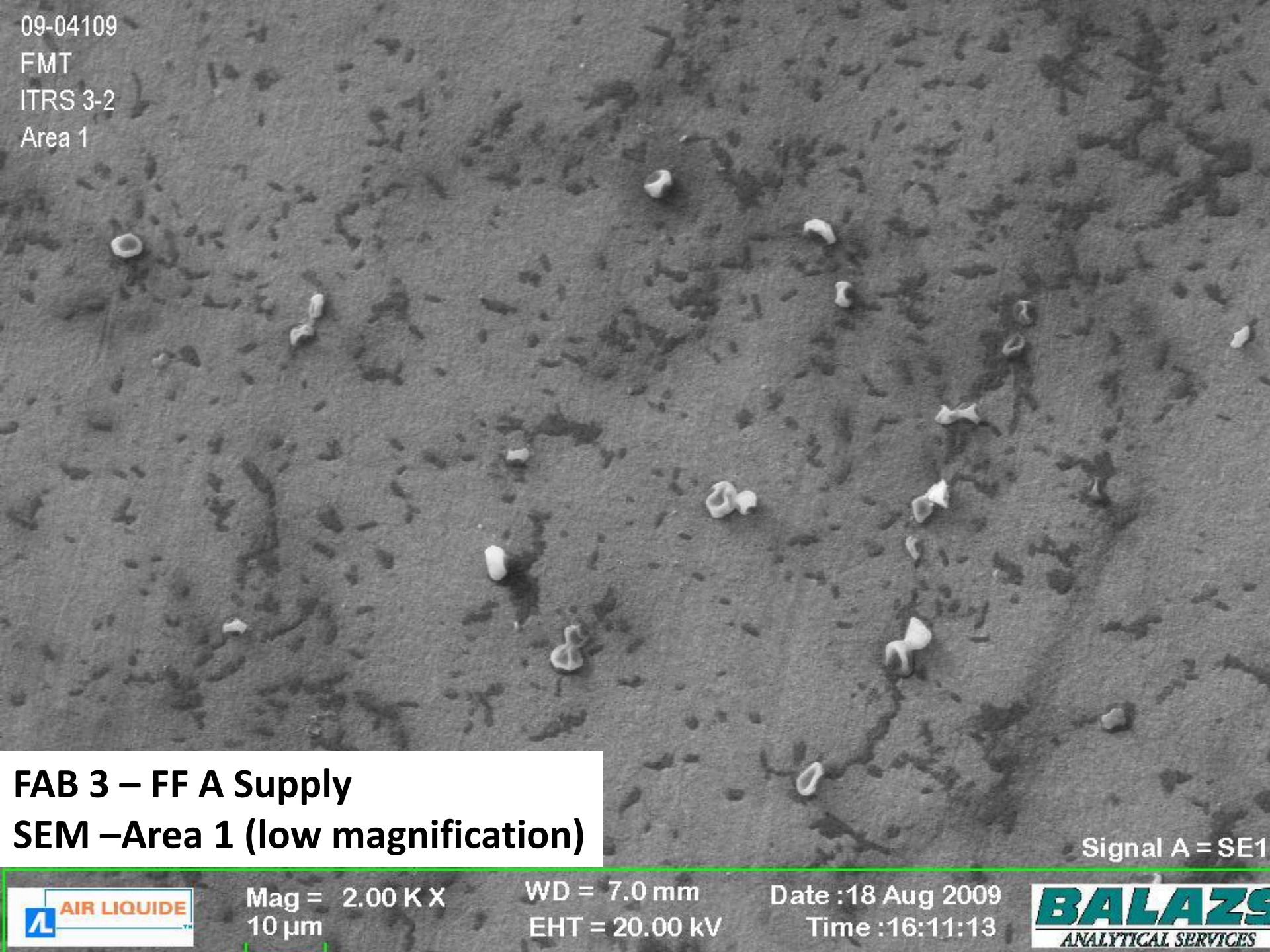
FAB 3
Fab 3 Showed a High Concentration of Organic Contamination

Sample One: Supply to Final Filtration

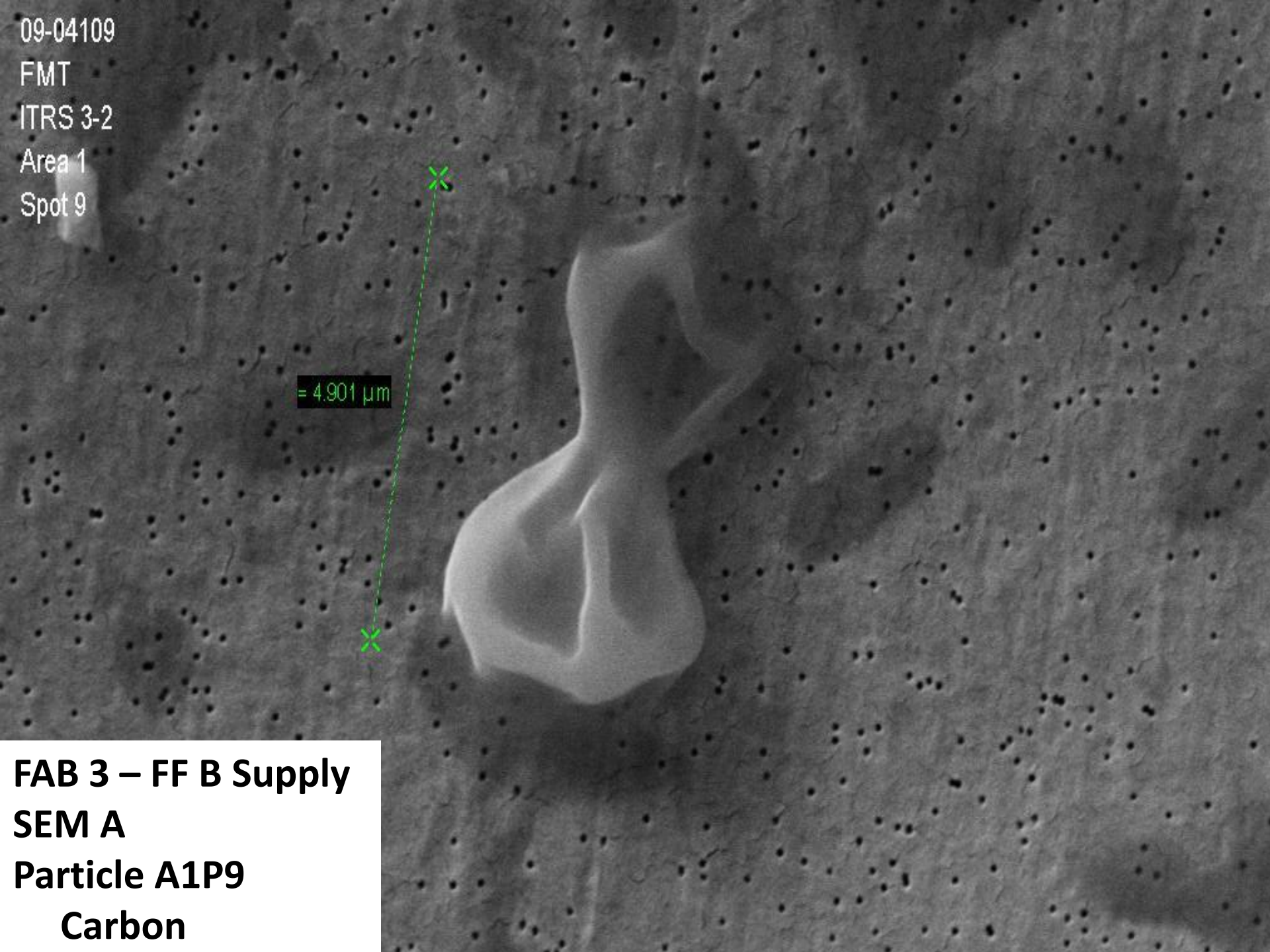
Sample Two Product of Final Filtration (same system as sample one)


Fab 3 - Final Filtration A Supply
I-V Response during SEM Release
Voltage
Current
Time
V
I
17:05:08
17:11:15
17:11:22
17:11:29
17:11:36
17:11:43
17:11:50
17:11:57
17:12:04
17:12:11
17:12:18
17:12:25
17:12:32
17:12:39
17:12:46
17:12:53
17:13:00
17:13:07
17:13:14
17:13:21
17:13:28
17:13:35
17:13:42
17:13:49
17:13:56
17:14:03
17:14:10
17:14:17
17:14:24
17:14:31
17:14:38
17:14:45
17:14:52
17:15:07
17:15:25
17:15:43
17:16:02
17:16:20
17:16:38
17:16:56
17:17:14
17:17:32
17:17:51
17:18:09
17:18:28
17:18:46
17:19:04
17:19:23
17:19:41
17:19:59

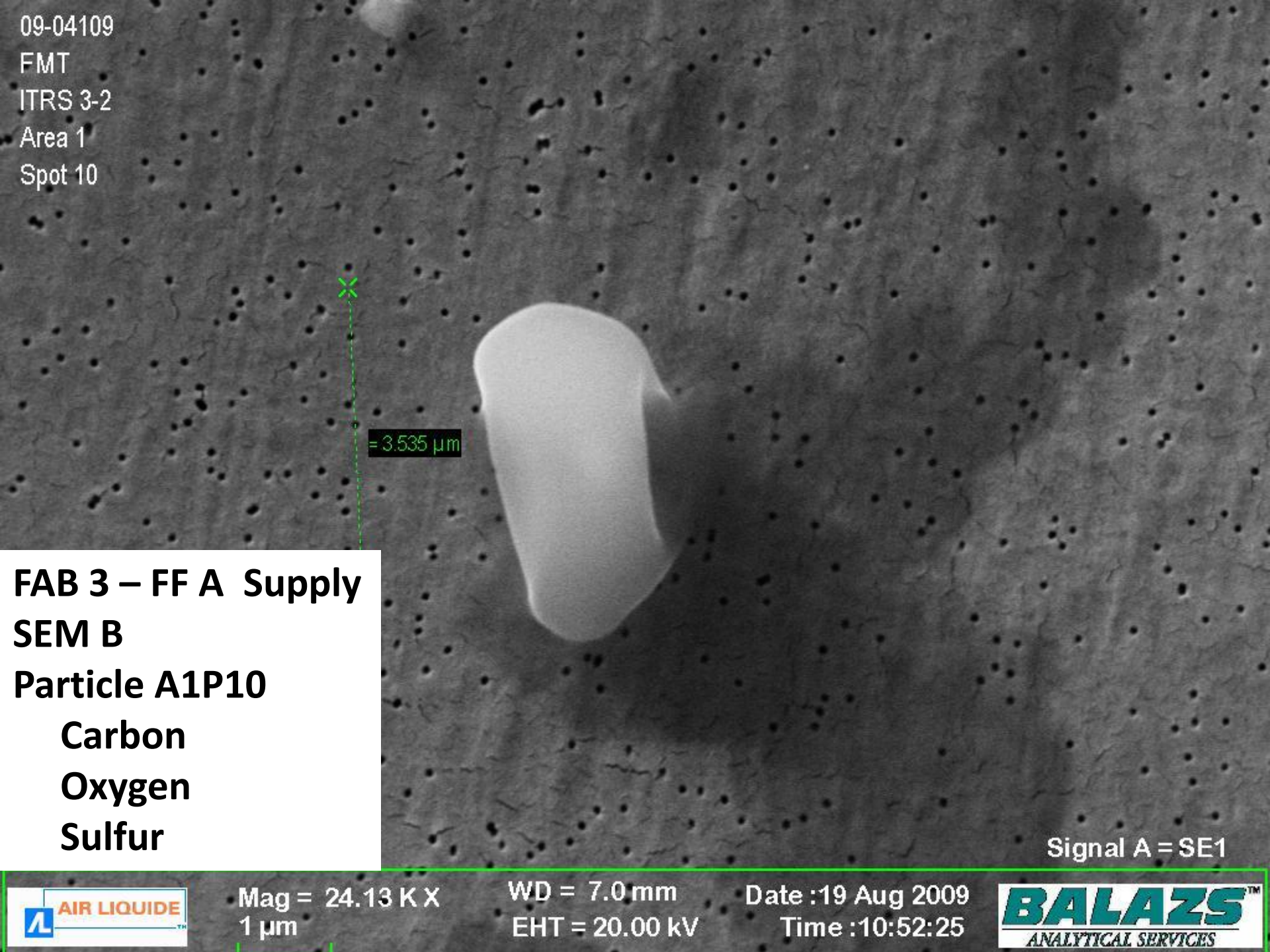

FAB 3 - Final Filtration A Supply
Percent Elemental Concentration in Particles
Conc Order > 5%
C O
O Si Al K
Fe Si Al
O Fe Al Ca
Percent
100
80
60
40
20
0
SEM A
SEM B
SEM C
SEM D
A1P1
A1P2
A1P3
A1P4
A1P6
A1P7
A1P8
A1P9
A1P10
A2P2
A2P3
A2P7
A2P8
A2P9
A1P5
A2P1
A2P4
A2P5
A2P10
A2P6
C O Na Al Mg Si S K Ca Ti V Cr Fe
Capture time: 9 Hours

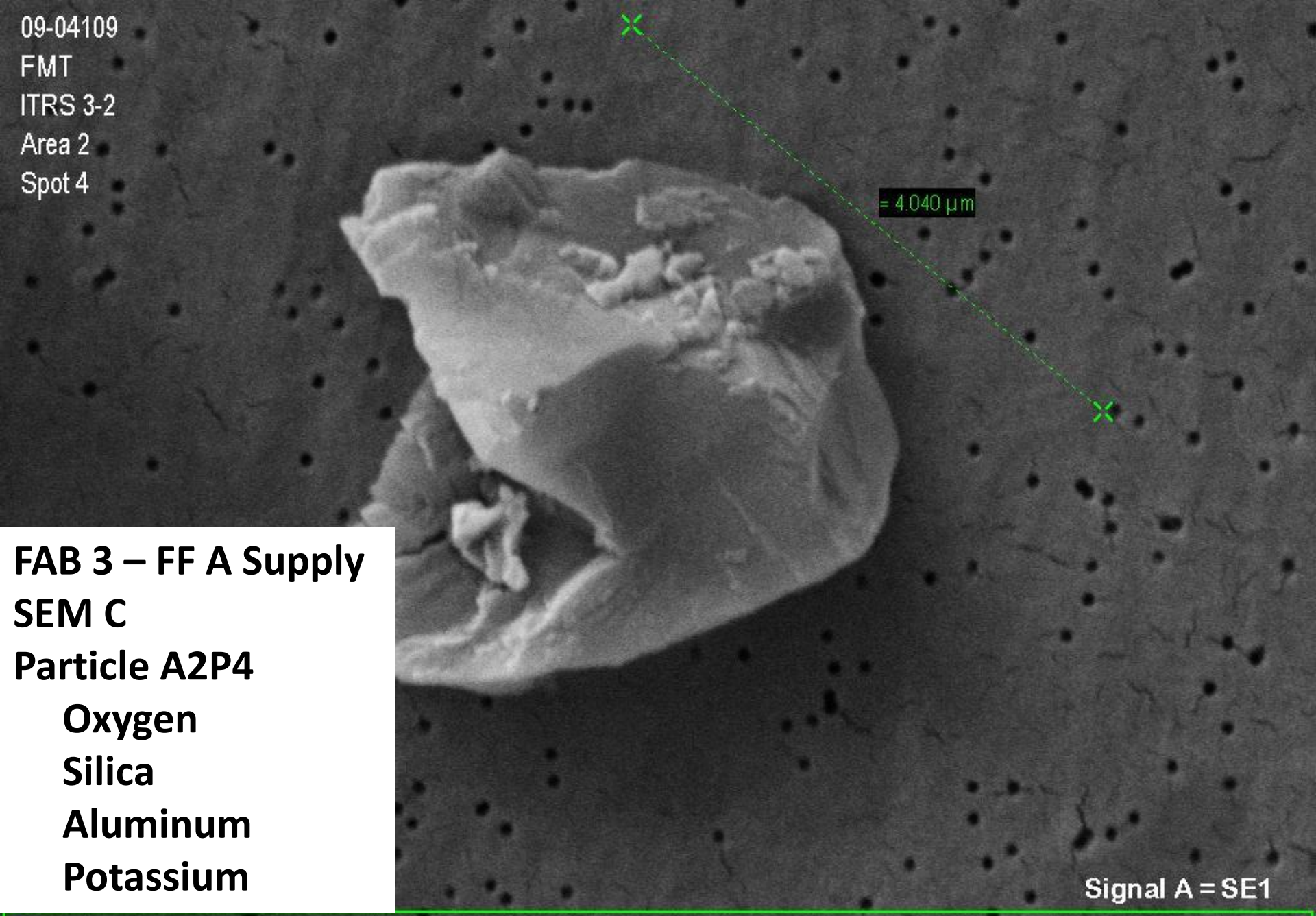


FAB 3 – FF A Supply
SEM –Area 1 (low magnification)



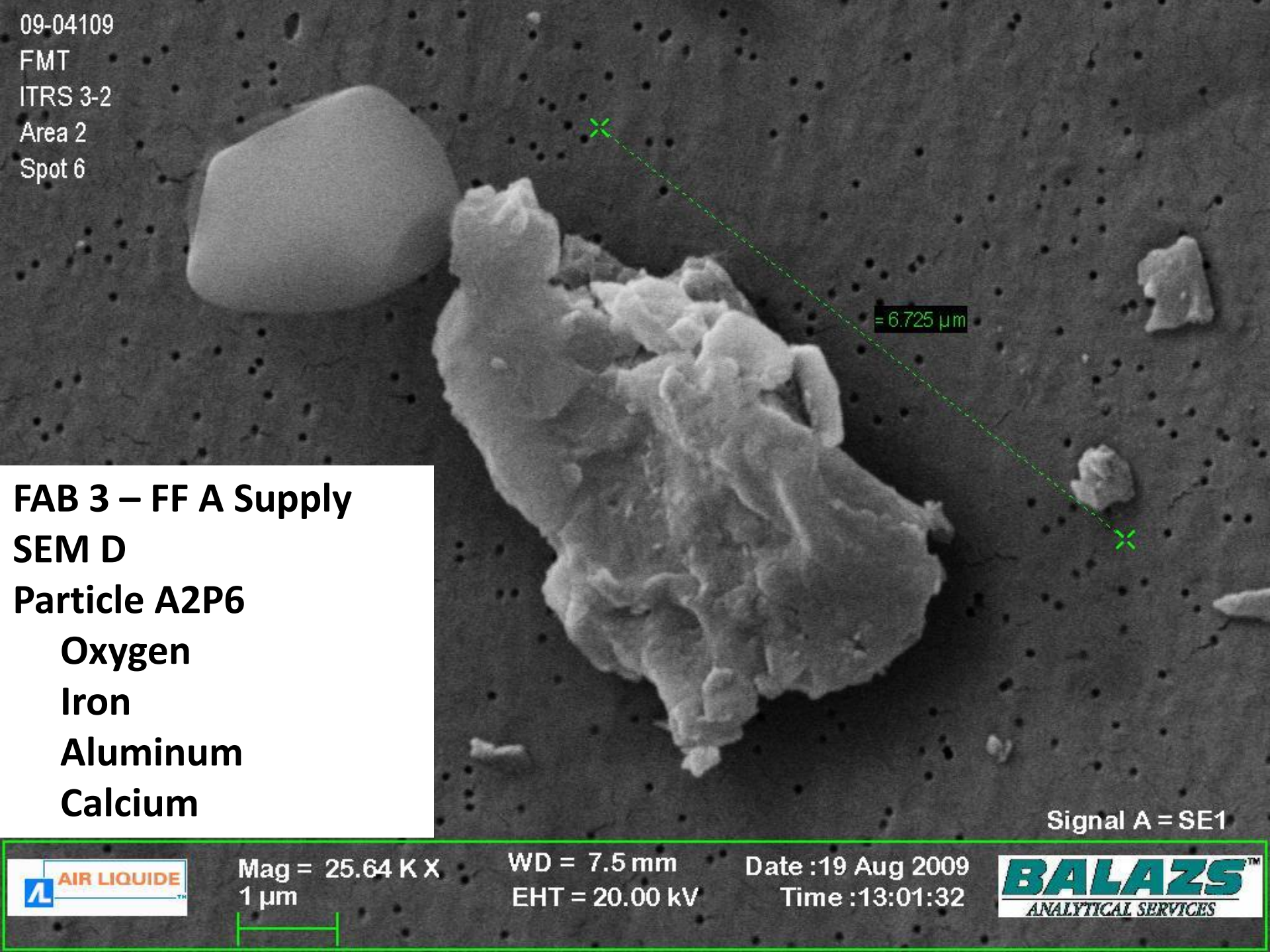
FAB 3 – FF B Supply
SEM A
Particle A1P9
Carbon


09-04109
FMT
ITRS 3-2
Area 1
Spot 10
= 3.535 µm
FAB 3 – FF A Supply
SEM B
Particle A1P10
Carbon
Oxygen
Sulfur
Signal A = SE1
AIR LIQUIDE
Mag = 24.13 K X
1 µm
WD = 7.0 mm
EHT = 20.00 kV
Date :19 Aug 2009
Time :10:52:25
BALAZS
ANALYTICAL SERVICES



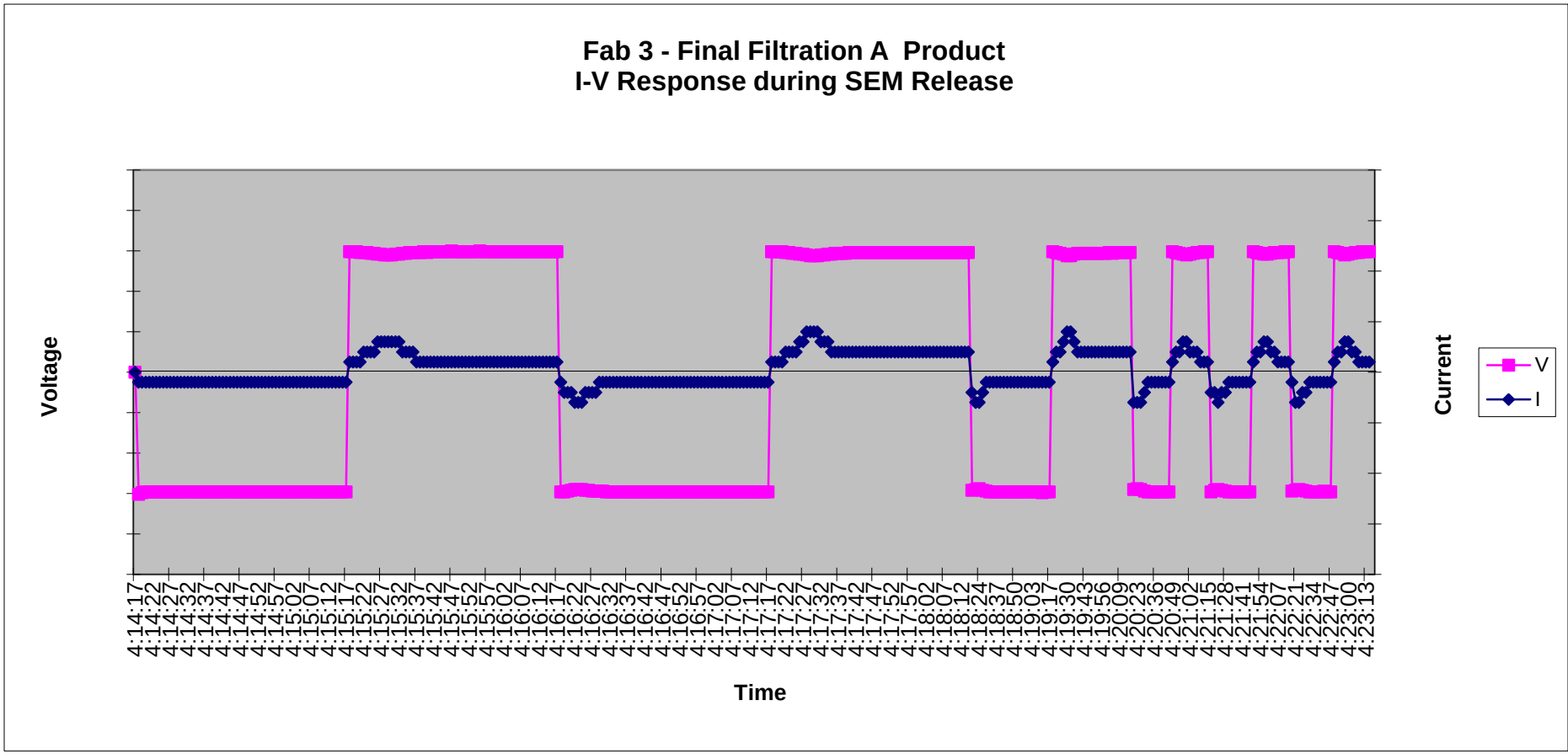
FAB 3 – FF A Supply
SEM C
Particle A2P4

- **Oxygen**
- **Silica**
- **Aluminum**
- **Potassium**

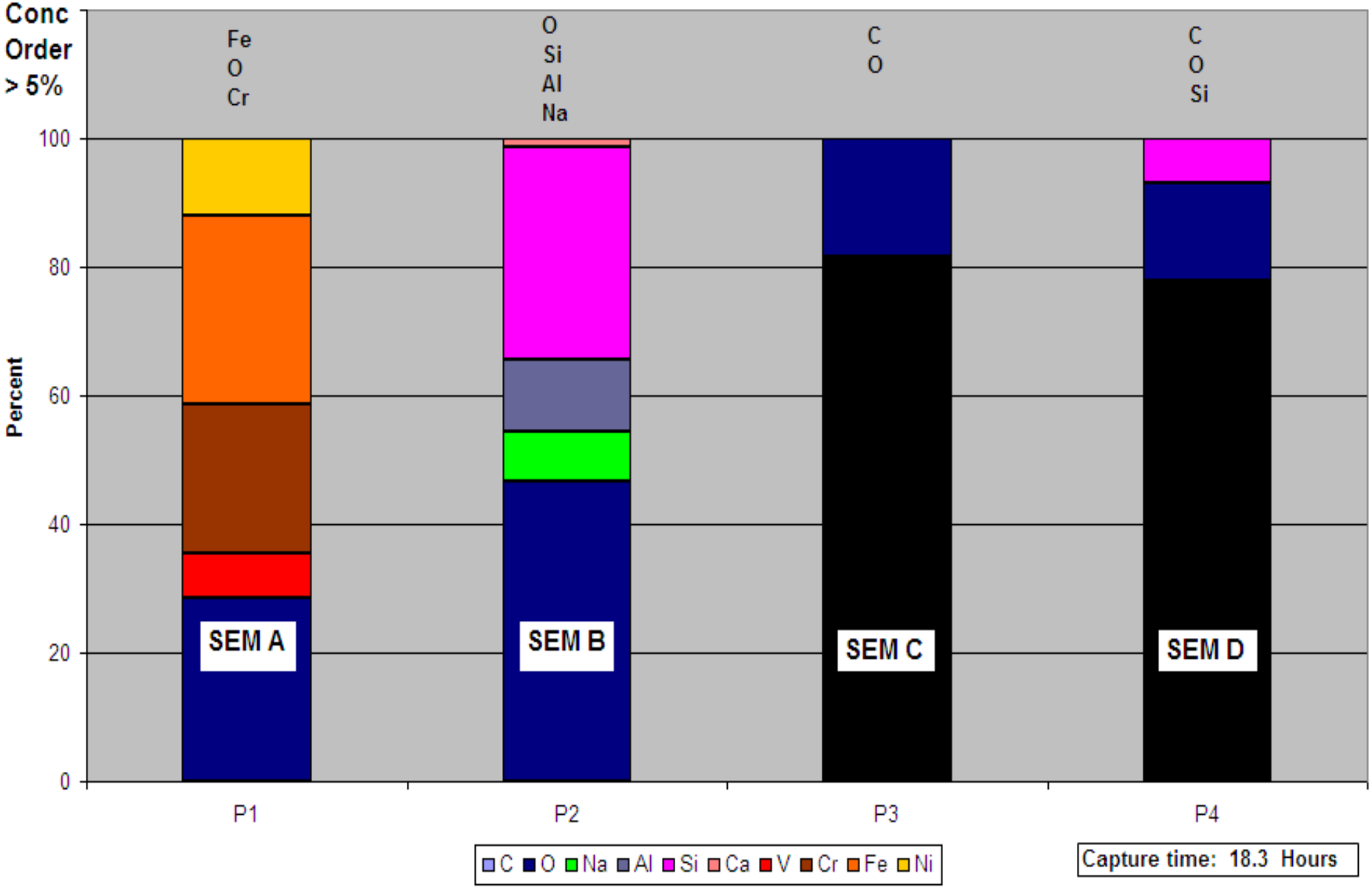


FAB 3 – FF A Supply
SEM D
Particle A2P6

- **Oxygen**
- **Iron**
- **Aluminum**
- **Calcium**


Fab 3 - Final Filtration A Product
I-V Response during SEM Release
Voltage
Current
Time
V
I
4:14:17
4:14:22
4:14:27
4:14:32
4:14:37
4:14:42
4:14:47
4:14:52
4:14:57
4:15:02
4:15:07
4:15:12
4:15:17
4:15:22
4:15:27
4:15:32
4:15:37
4:15:42
4:15:47
4:15:52
4:15:57
4:16:02
4:16:07
4:16:12
4:16:17
4:16:22
4:16:27
4:16:32
4:16:37
4:16:42
4:16:47
4:16:52
4:16:57
4:17:02
4:17:07
4:17:12
4:17:17
4:17:22
4:17:27
4:17:32
4:17:37
4:17:42
4:17:47
4:17:52
4:17:57
4:18:02
4:18:07
4:18:12
4:18:24
4:18:37
4:18:50
4:19:03
4:19:17
4:19:30
4:19:43
4:19:56
4:20:09
4:20:23
4:20:36
4:20:49
4:21:02
4:21:15
4:21:28
4:21:41
4:21:54
4:22:07
4:22:21
4:22:34
4:22:47
4:23:00
4:23:13

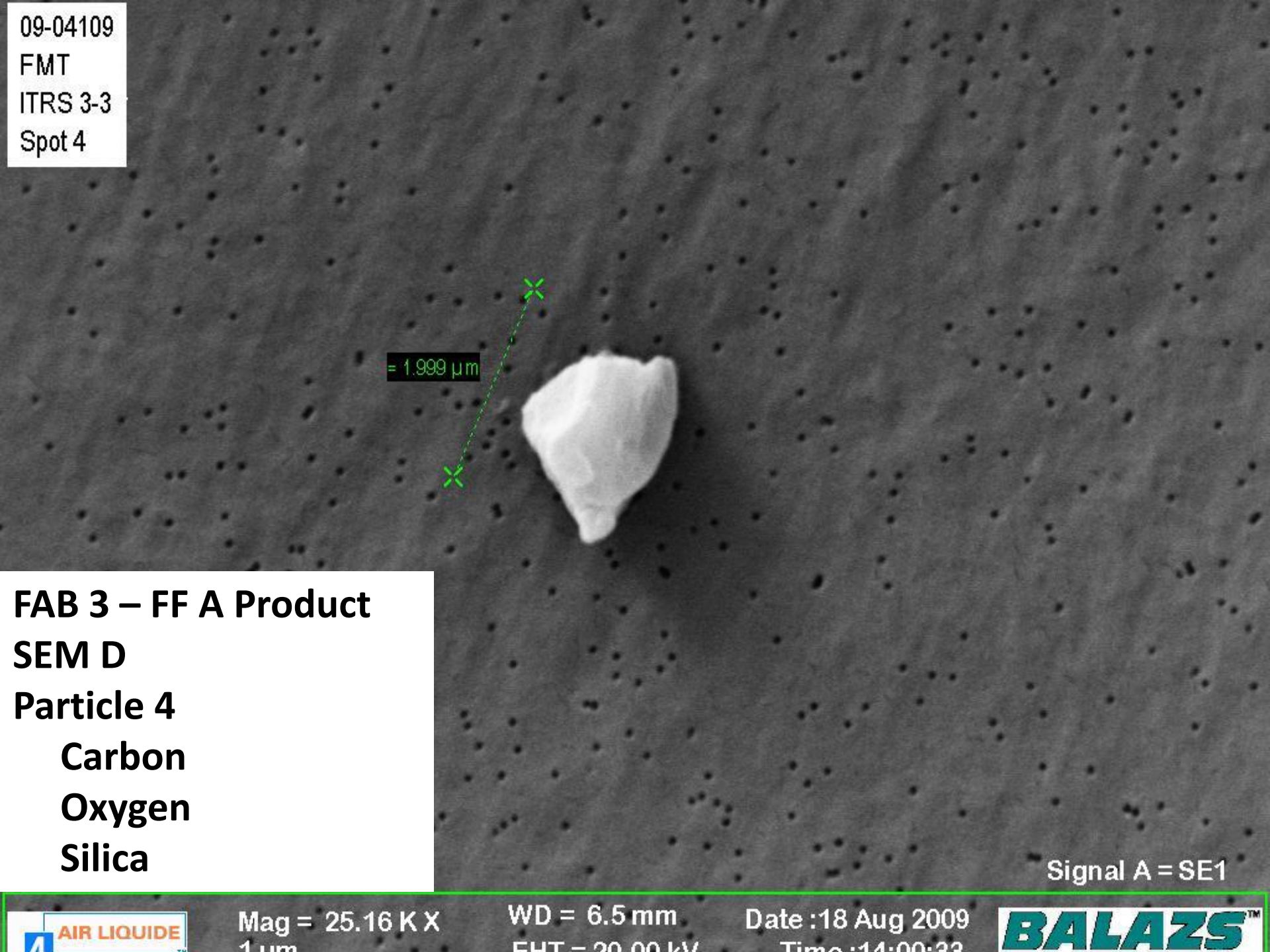
FAB 3 - Final Filtration A Product
Percent Elemental Concentration in Particles




09-04109
FMT
ITRS 3-3
Spot 1
= 526.5 nm
FAB 3 – FF A Supply
SEM A
Particle 1
Iron
Oxygen
Chrome
Signal A = SE1
AIR LIQUIDE
Mag = 52.31 K X
1 µm
WD = 7.0 mm
EHT = 20.00 kV
Date :18 Aug 2009
Time :14:09:26
BALAZS
ANALYTICAL SERVICES


09-04109
FMT
ITRS 3-3
Spot 2
= 1.912 µm
FAB 3 – FF A Product
SEM B
Particle 2
Oxygen
Silica
Aluminum
Sodium
Signal A = SE1
AIR LIQUIDE
Mag = 21.30 K X
2 µm
WD = 7.0 mm
EHT = 20.00 kV
Date :18 Aug 2009
Time :14:06:43
BALAZS
ANALYTICAL SERVICES


09-04109
FMT
ITRS 3-3
Spot 3
= 3.395 µm
FAB 3 – FF A Product
SEM C
Particle 3
Carbon
Oxygen
Signal A = SE1
AIR LIQUIDE
Mag = 16.32 K X
2 µm
WD = 7.0 mm
EHT = 20.00 kV
Date :18 Aug 2009
Time :14:03:58
BALAZS
ANALYTICAL SERVICES



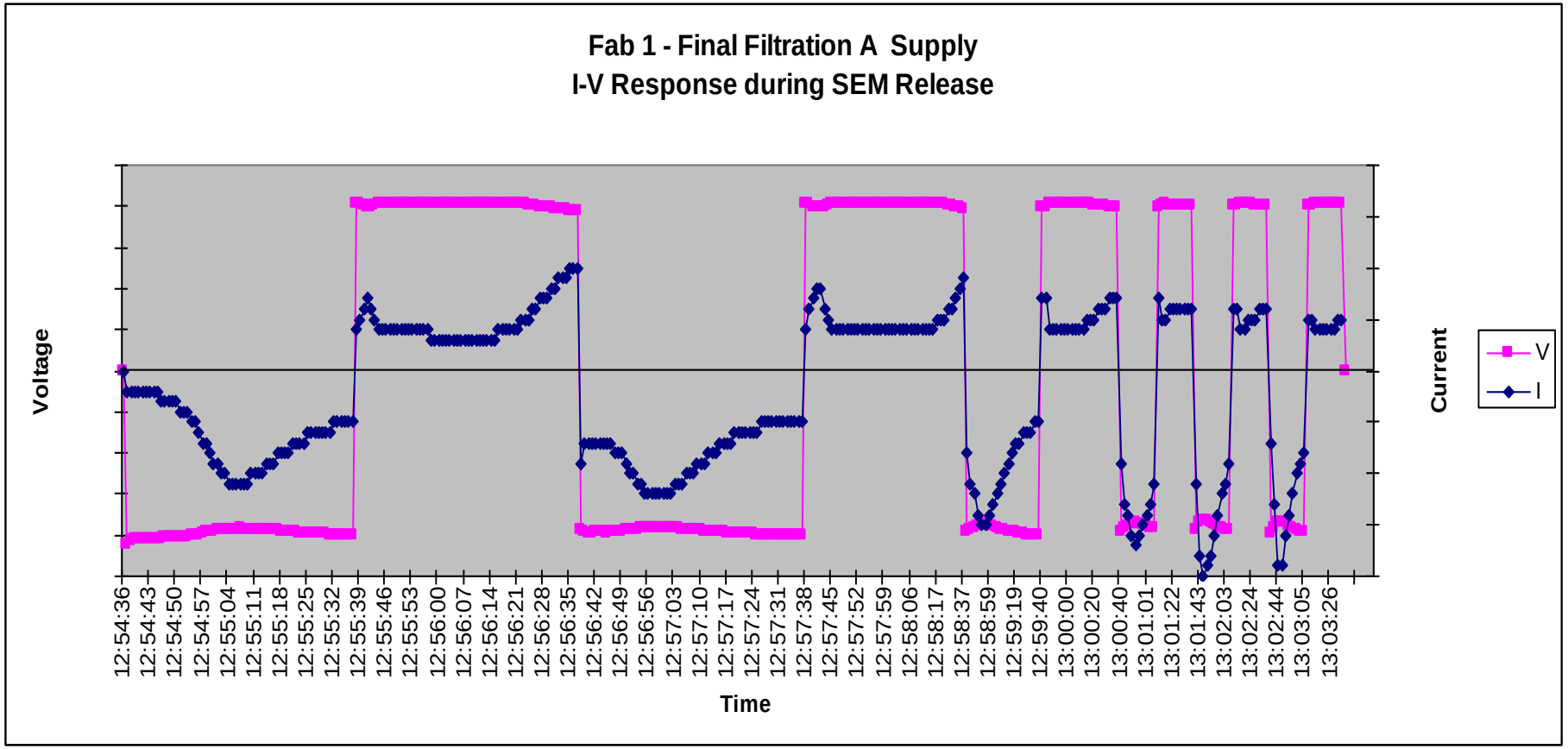
FAB 3 – FF A Product
SEM D
Particle 4

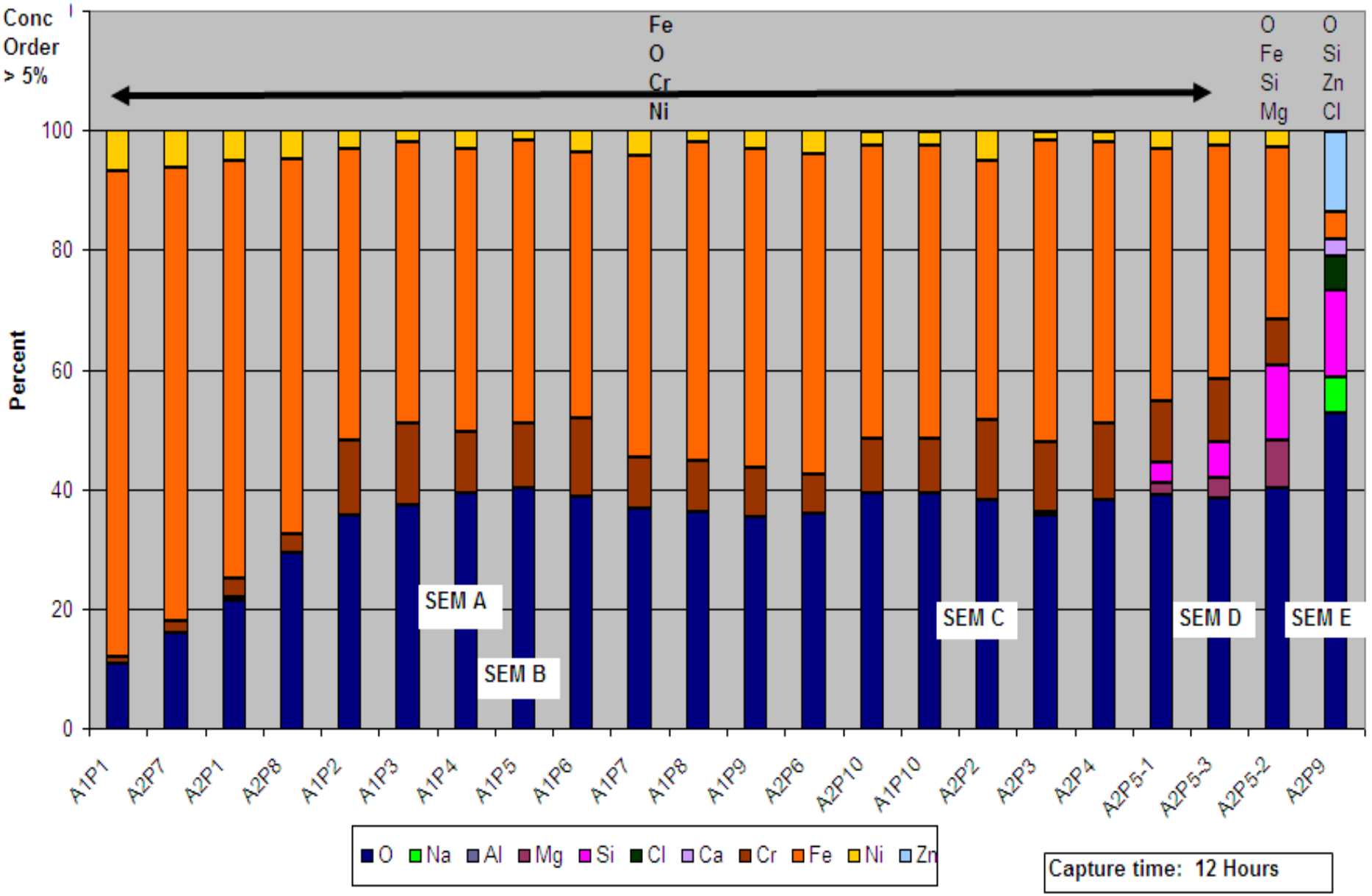
- **Carbon**
- **Oxygen**
- **Silica**

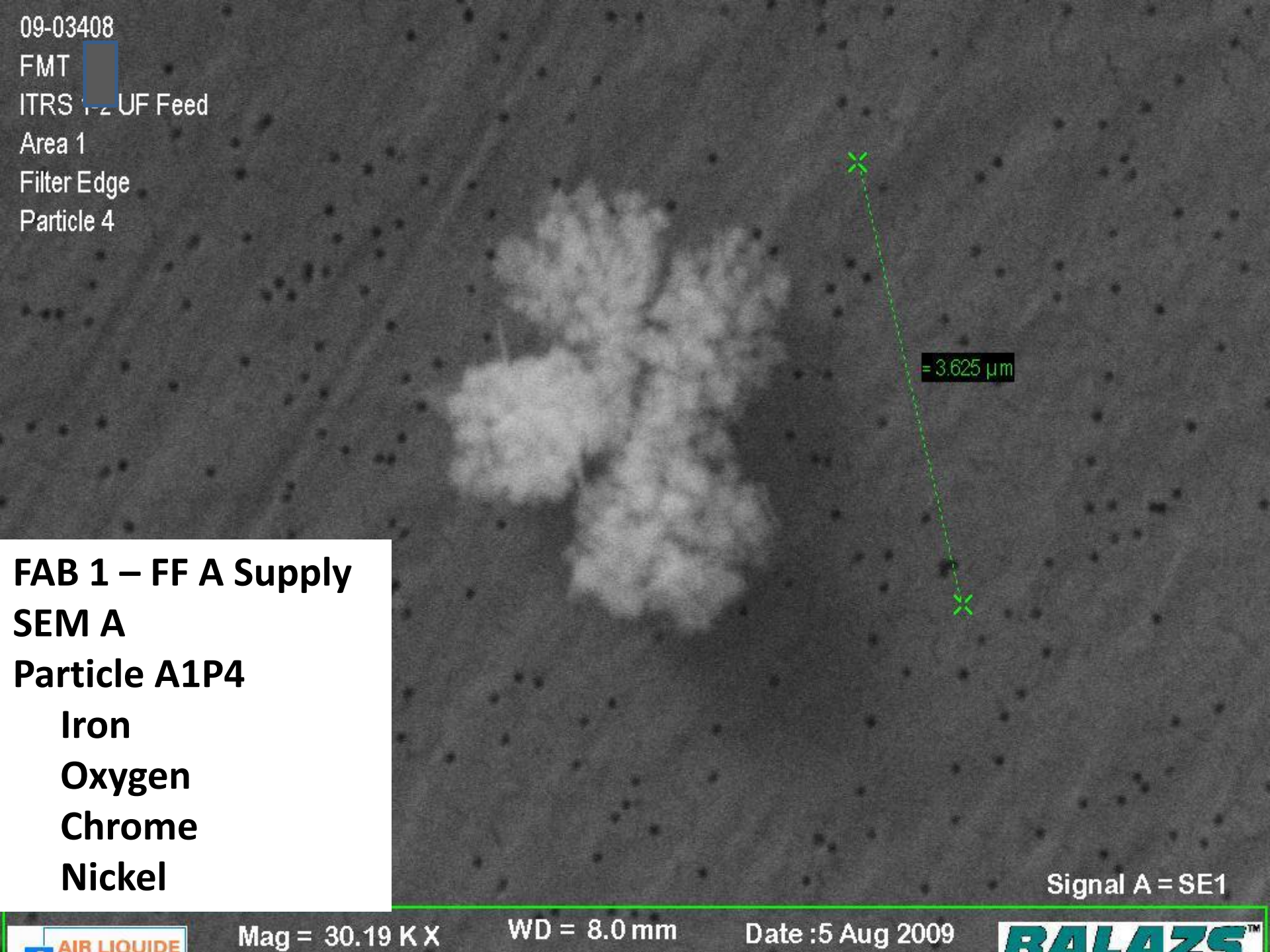
FAB 1
Fab 1 Showed a High Concentration of Stainless Steel Particles

Sample One: Supply to Final Filtration

Sample Two Product of Final Filtration (same system as sample one)

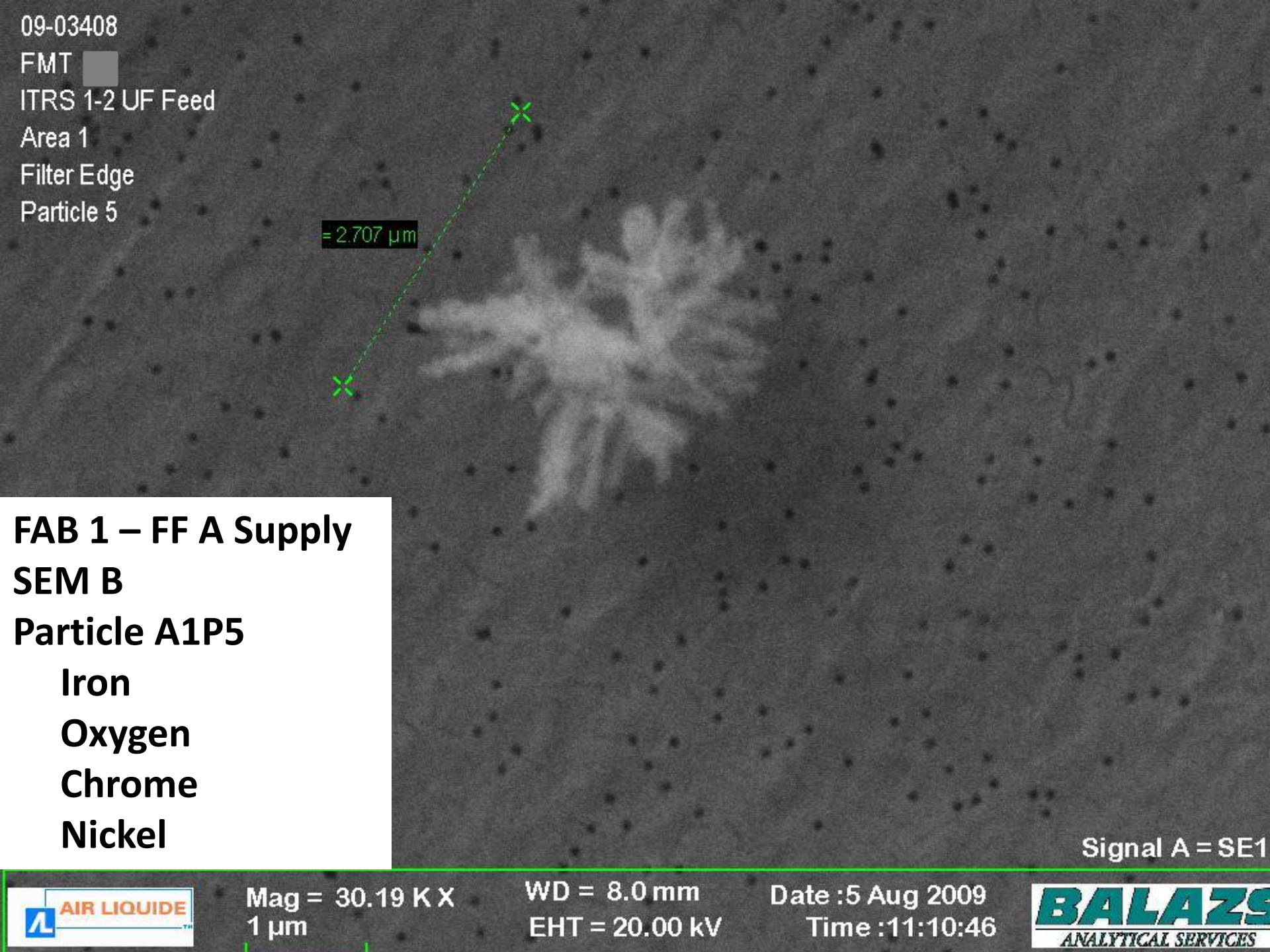

Fab 1 - Final Filtration A Supply
I-V Response during SEM Release
Voltage
Current
Time
V
I
12:54:36
12:54:43
12:54:50
12:54:57
12:55:04
12:55:11
12:55:18
12:55:25
12:55:32
12:55:39
12:55:46
12:55:53
12:56:00
12:56:07
12:56:14
12:56:21
12:56:28
12:56:35
12:56:42
12:56:49
12:56:56
12:57:03
12:57:10
12:57:17
12:57:24
12:57:31
12:57:38
12:57:45
12:57:52
12:57:59
12:58:06
12:58:17
12:58:37
12:58:59
12:59:19
12:59:40
13:00:00
13:00:20
13:00:40
13:01:01
13:01:22
13:01:43
13:02:03
13:02:24
13:02:44
13:03:05
13:03:26


FAB 1 - Final Filtration A Supply
Percent Elemental Concentration in Particles
Conc Order > 5%
Fe
O
Cr
Ni
O
Fe
Si
Mg
O
Si
Zn
Cl
Percent
100
80
60
40
20
0
SEM A
SEM B
SEM C
SEM D
SEM E
A1P1
A2P7
A2P1
A2P8
A1P2
A1P3
A1P4
A1P5
A1P6
A1P7
A1P8
A1P9
A2P6
A2P10
A1P10
A2P2
A2P3
A2P4
A2P5-1
A2P5-3
A2P5-2
A2P9
O
Na
Al
Mg
Si
Cl
Ca
Cr
Fe
Ni
Zn
Capture time: 12 Hours



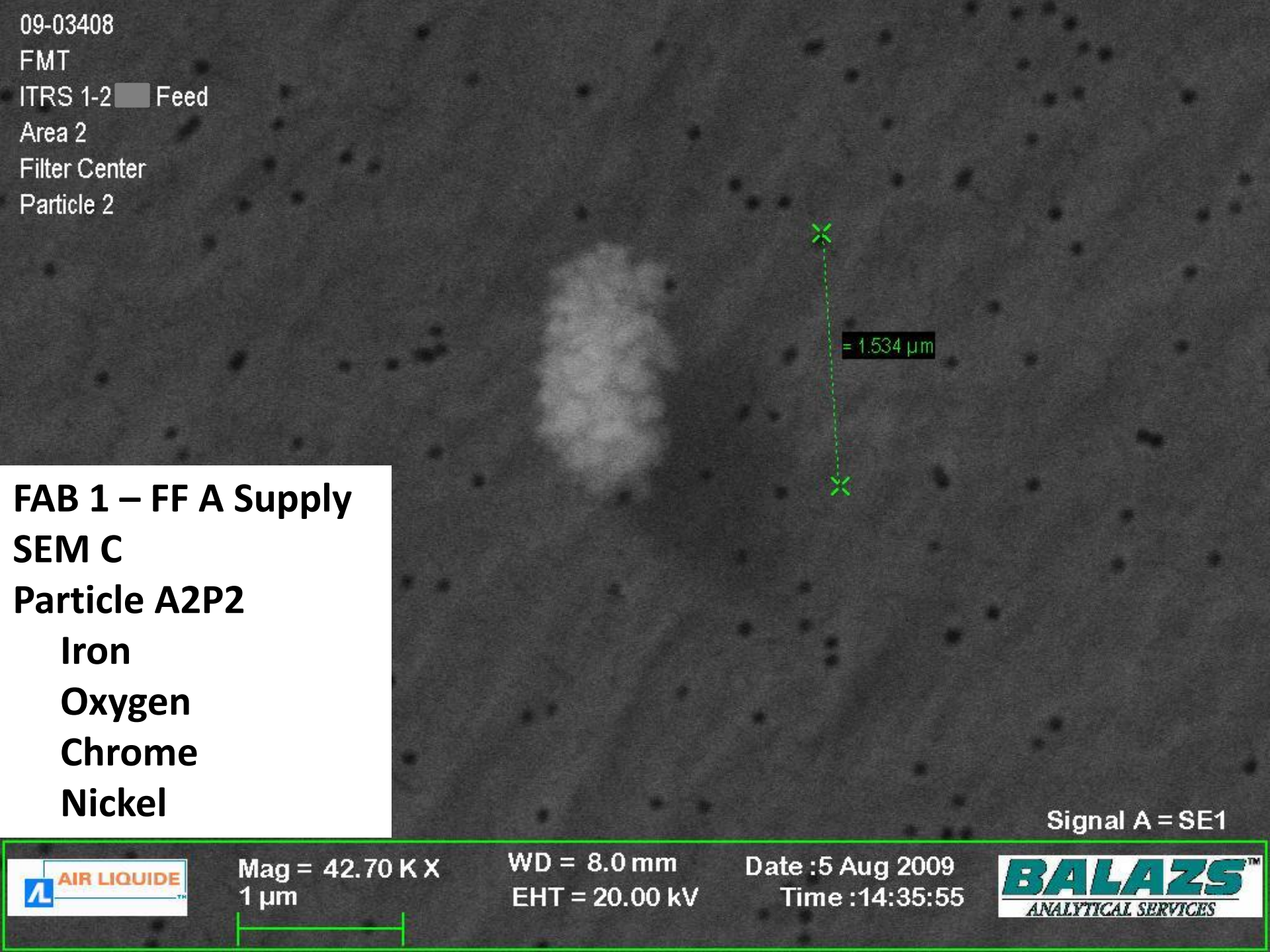
FAB 1 – FF A Supply
SEM A
Particle A1P4

- **Iron**
- **Oxygen**
- **Chrome**
- **Nickel**



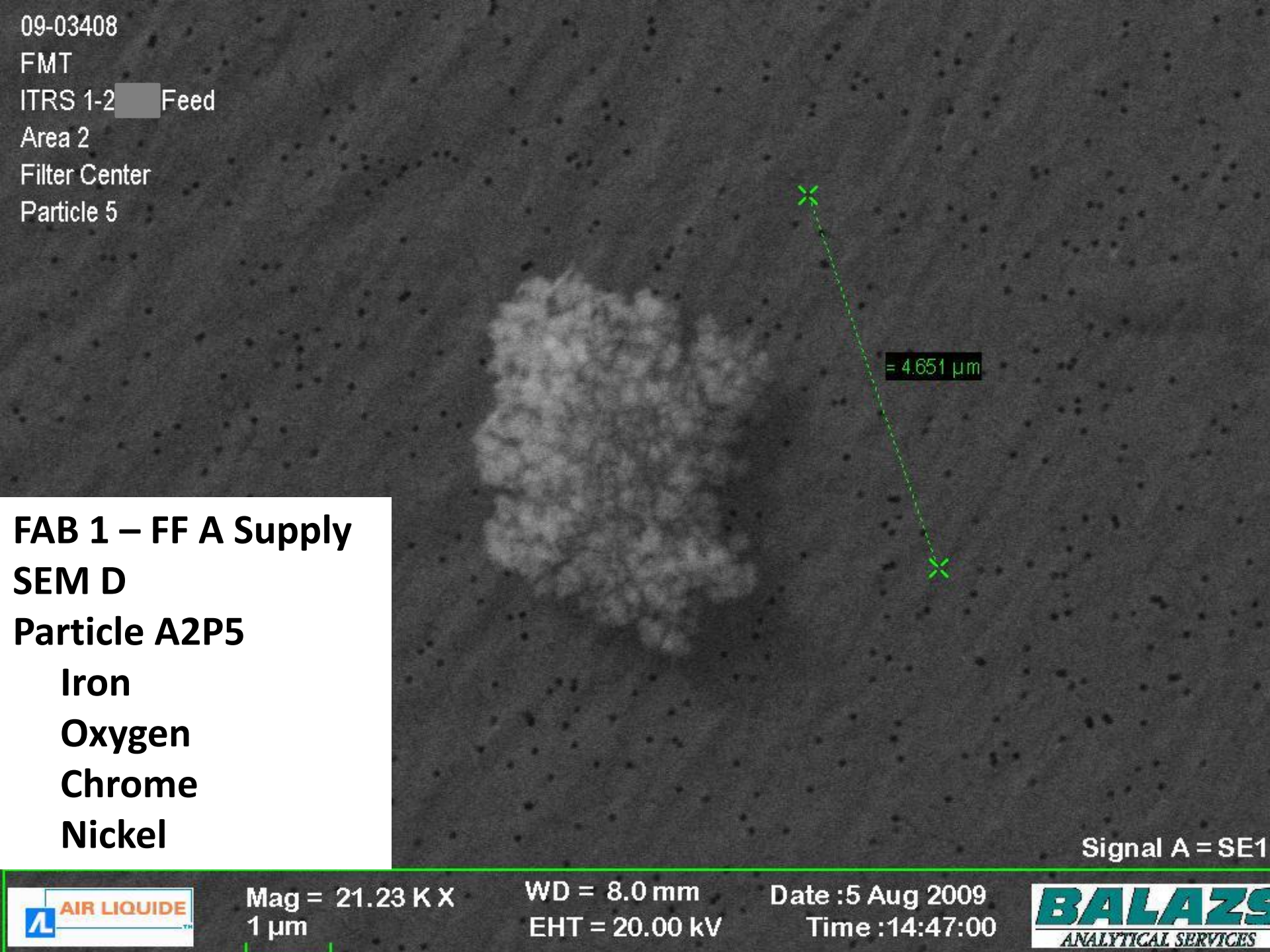
FAB 1 – FF A Supply
SEM B
Particle A1P5

- **Iron**
- **Oxygen**
- **Chrome**
- **Nickel**



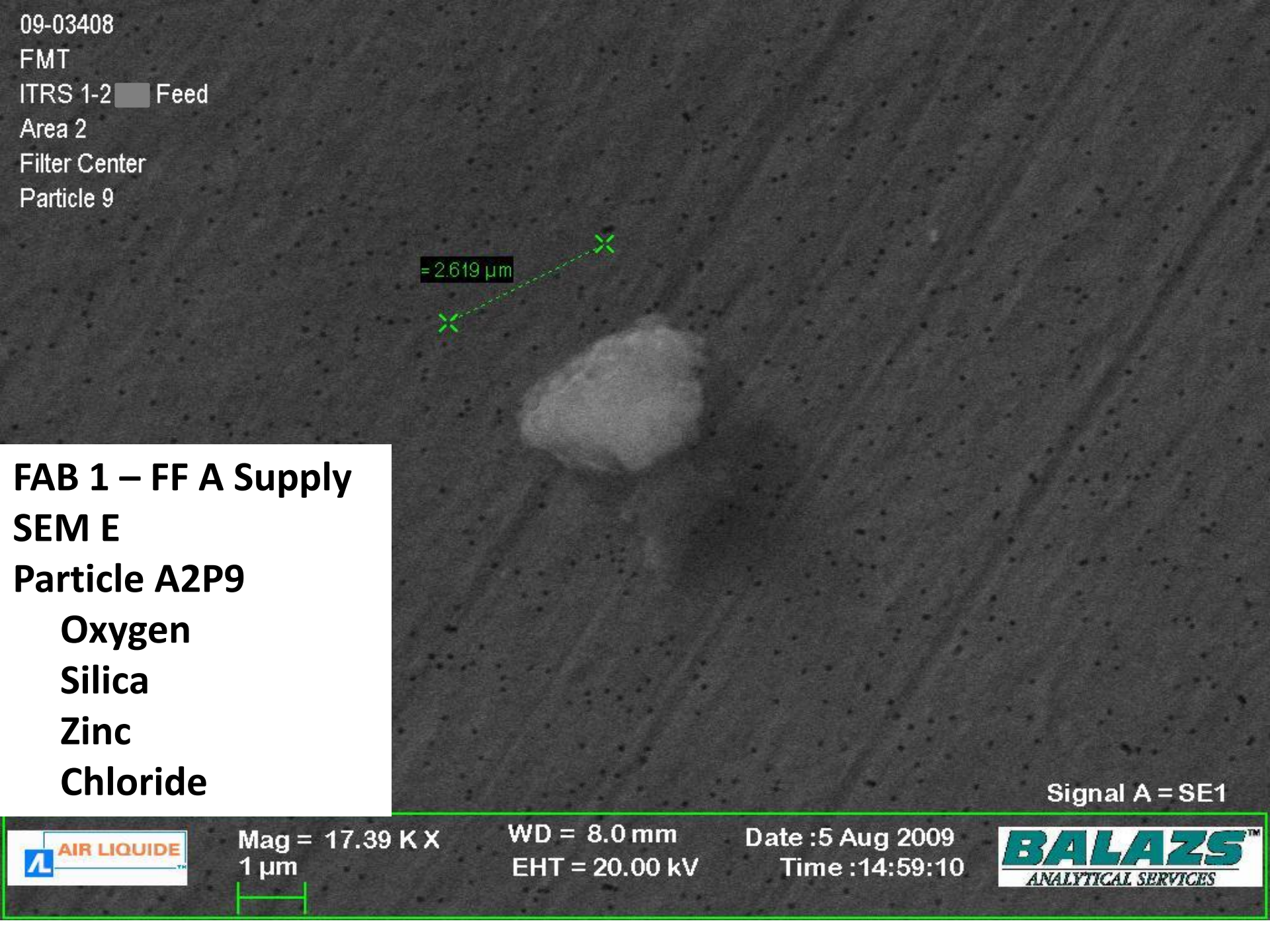
FAB 1 – FF A Supply
SEM C
Particle A2P2

- **Iron**
- **Oxygen**
- **Chrome**
- **Nickel**

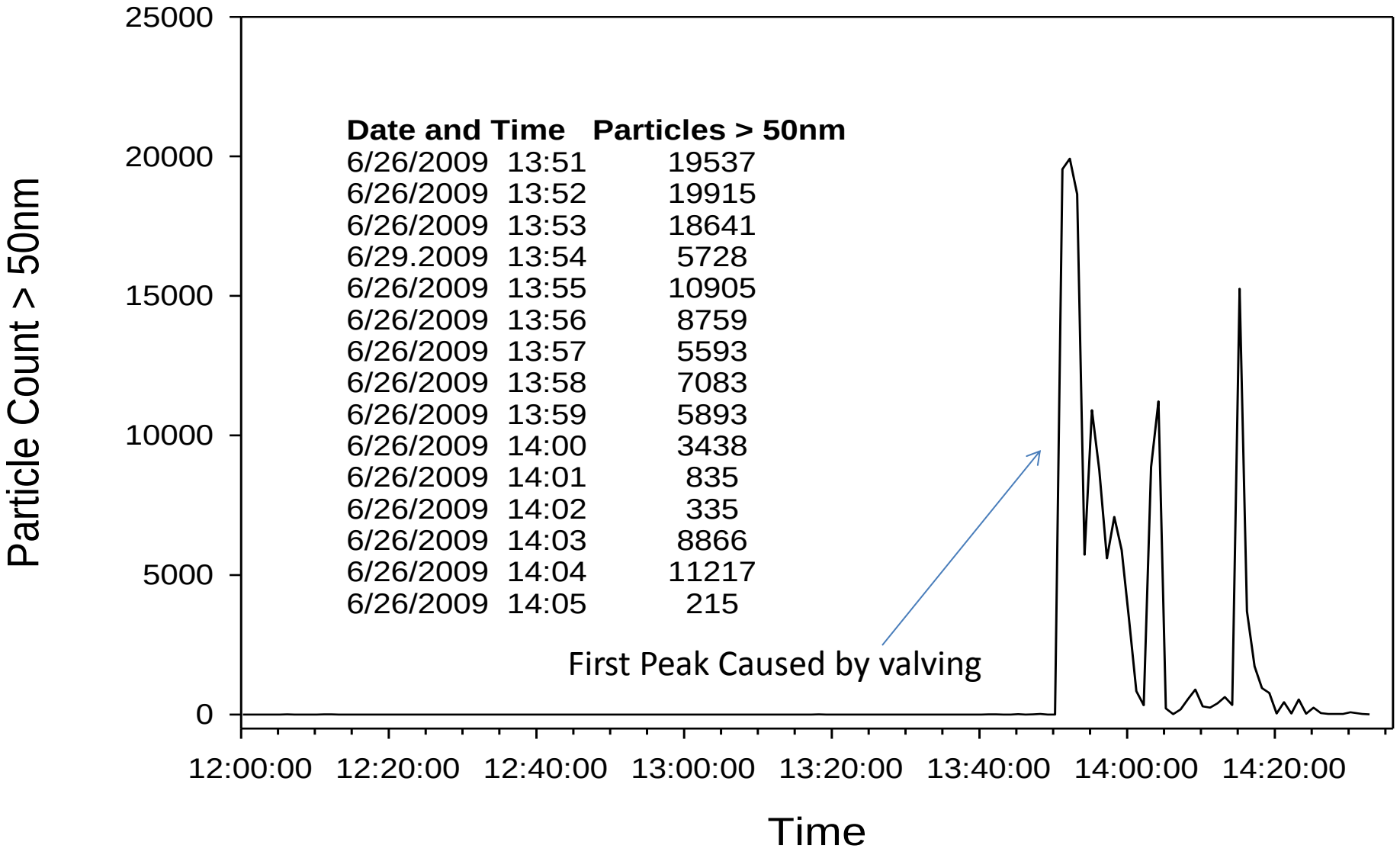


FAB 1 – FF A Supply
SEM D
Particle A2P5

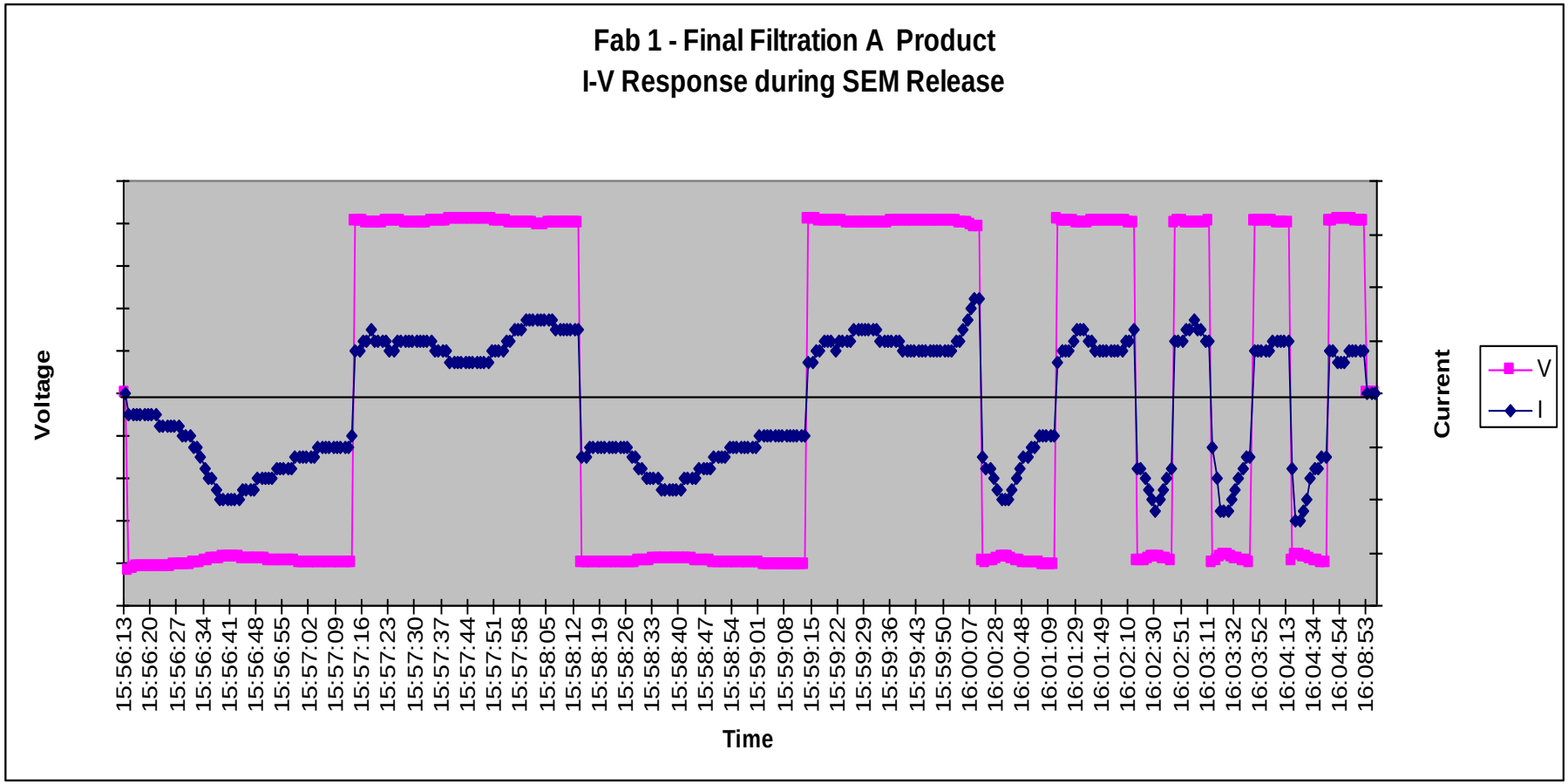
- **Iron**
- **Oxygen**
- **Chrome**
- **Nickel**


09-03408
FMT
ITRS 1-2 Feed
Area 2
Filter Center
Particle 9
= 2.619 µm
FAB 1 – FF A Supply
SEM E
Particle A2P9
Oxygen
Silica
Zinc
Chloride
Signal A = SE1
AIR LIQUIDE
Mag = 17.39 K X
1 µm
WD = 8.0 mm
EHT = 20.00 kV
Date :5 Aug 2009
Time :14:59:10
BALAZS
ANALYTICAL SERVICES

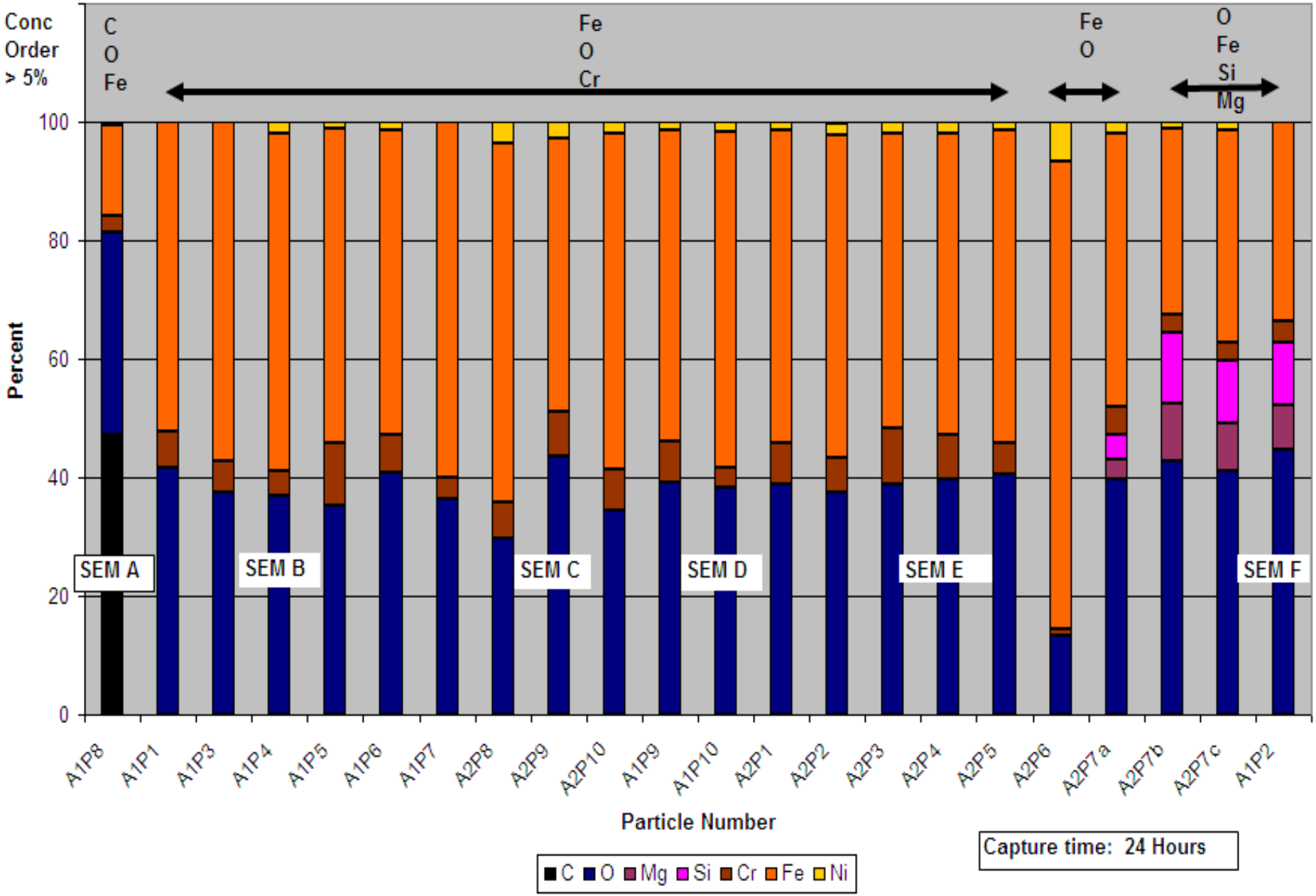
FAB 1 – Final Filter A Product
Particle Release Documented by Laser Particle Counter
24 Hours Capture Time

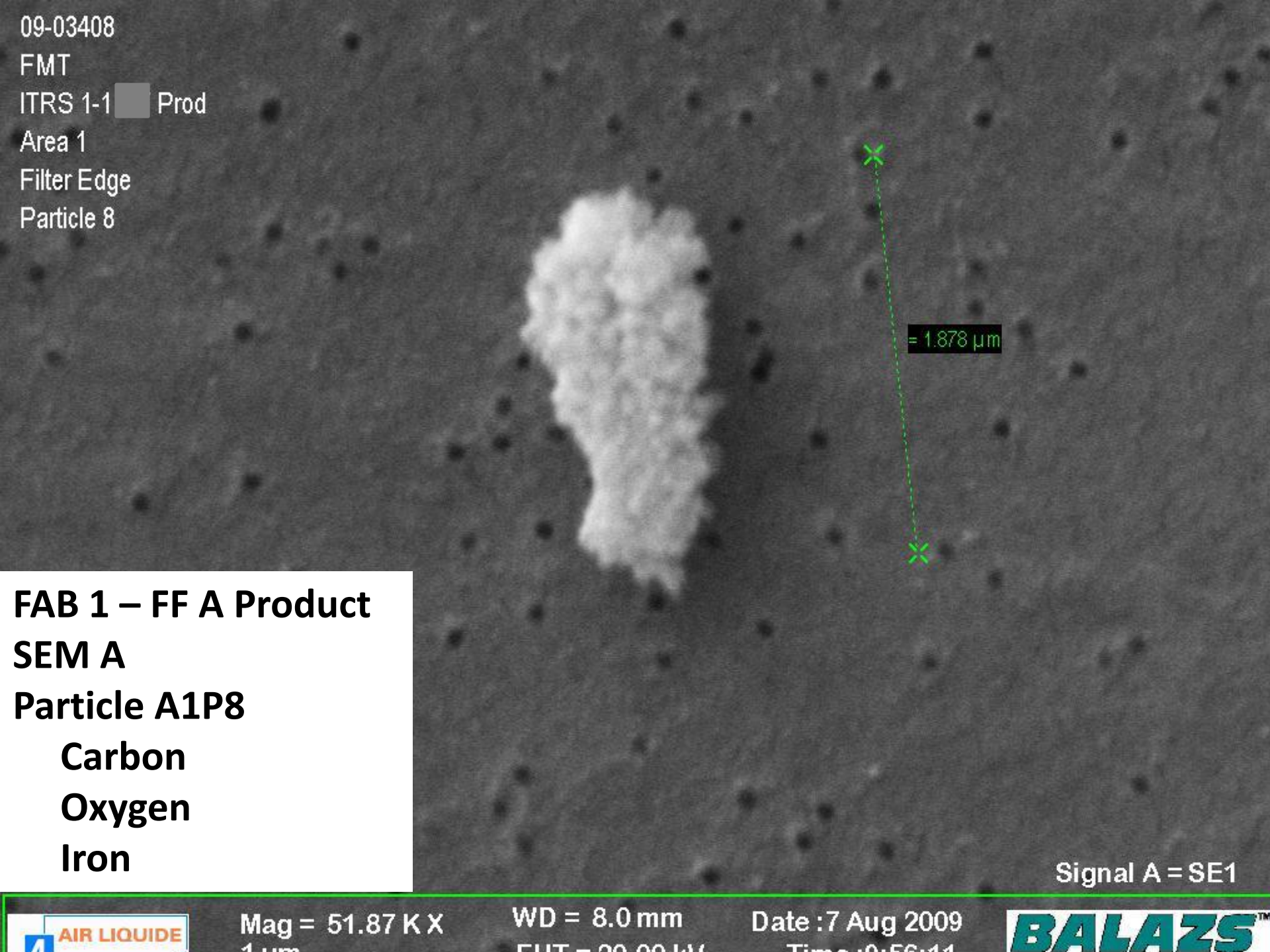


Date and Time	Particles > 50nm
6/26/2009 13:51	19537
6/26/2009 13:52	19915
6/26/2009 13:53	18641
6/29.2009 13:54	5728
6/26/2009 13:55	10905
6/26/2009 13:56	8759
6/26/2009 13:57	5593
6/26/2009 13:58	7083
6/26/2009 13:59	5893
6/26/2009 14:00	3438
6/26/2009 14:01	835
6/26/2009 14:02	335
6/26/2009 14:03	8866
6/26/2009 14:04	11217
6/26/2009 14:05	215


Fab 1 - Final Filtration A Product
I-V Response during SEM Release
Voltage
Current
Time
V
I
15:56:13
15:56:20
15:56:27
15:56:34
15:56:41
15:56:48
15:56:55
15:57:02
15:57:09
15:57:16
15:57:23
15:57:30
15:57:37
15:57:44
15:57:51
15:57:58
15:58:05
15:58:12
15:58:19
15:58:26
15:58:33
15:58:40
15:58:47
15:58:54
15:59:01
15:59:08
15:59:15
15:59:22
15:59:29
15:59:36
15:59:43
15:59:50
16:00:07
16:00:28
16:00:48
16:01:09
16:01:29
16:01:49
16:02:10
16:02:30
16:02:51
16:03:11
16:03:32
16:03:52
16:04:13
16:04:34
16:04:54
16:08:53

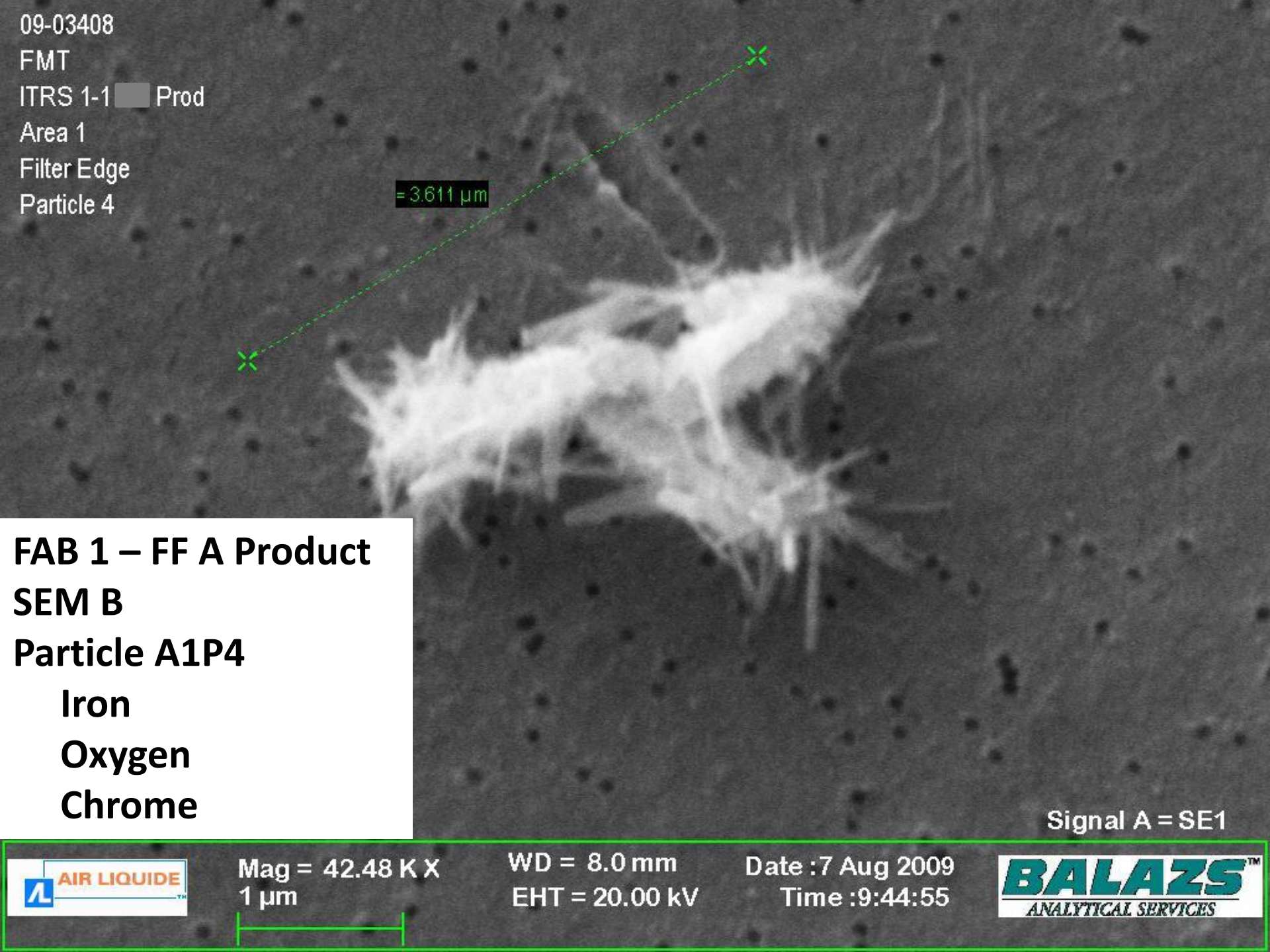
FAB 1 - Final Filtration A Product
Percent Elemental Concentration in Particles





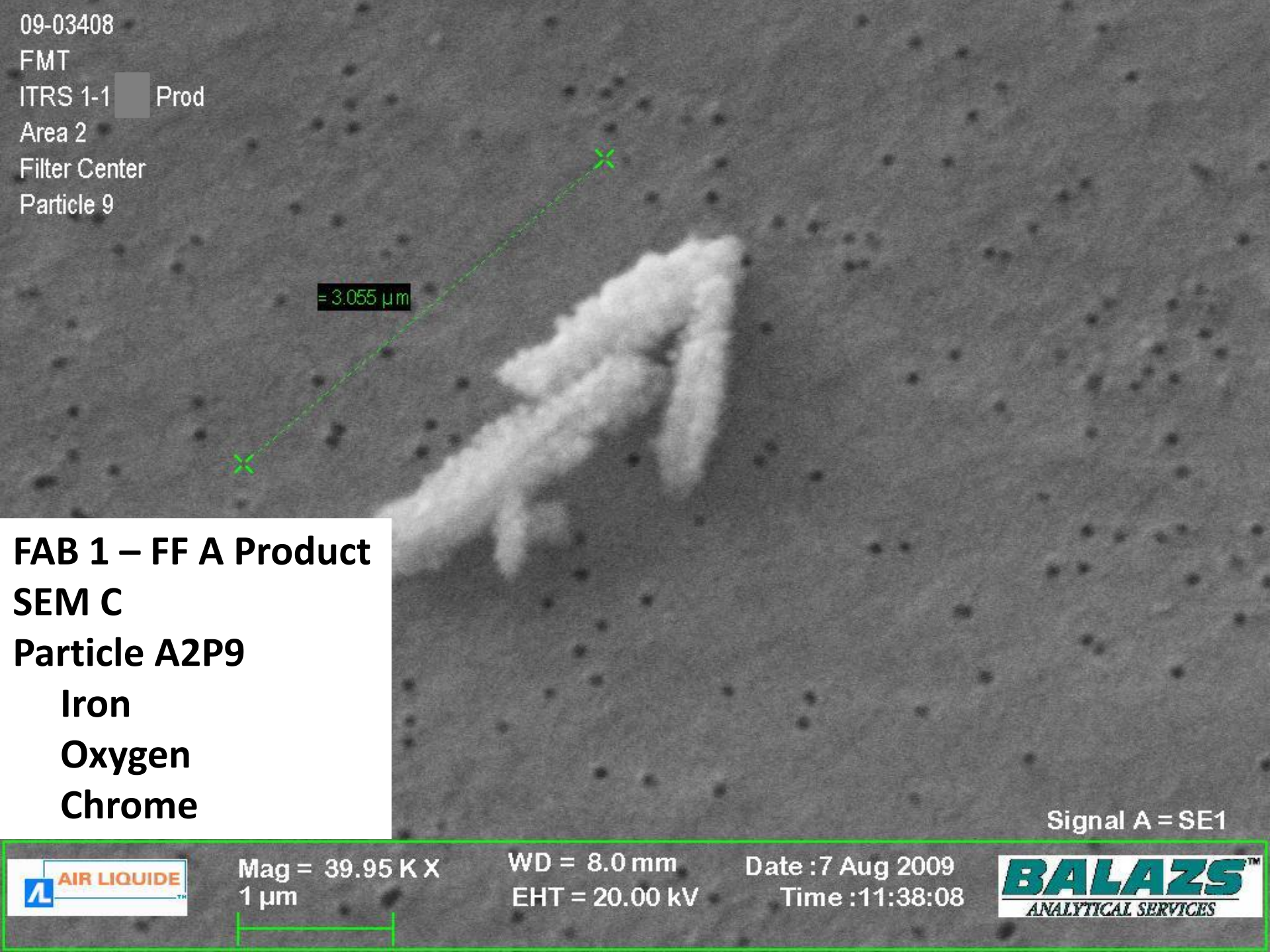
FAB 1 – FF A Product
SEM A
Particle A1P8

- **Carbon**
- **Oxygen**
- **Iron**



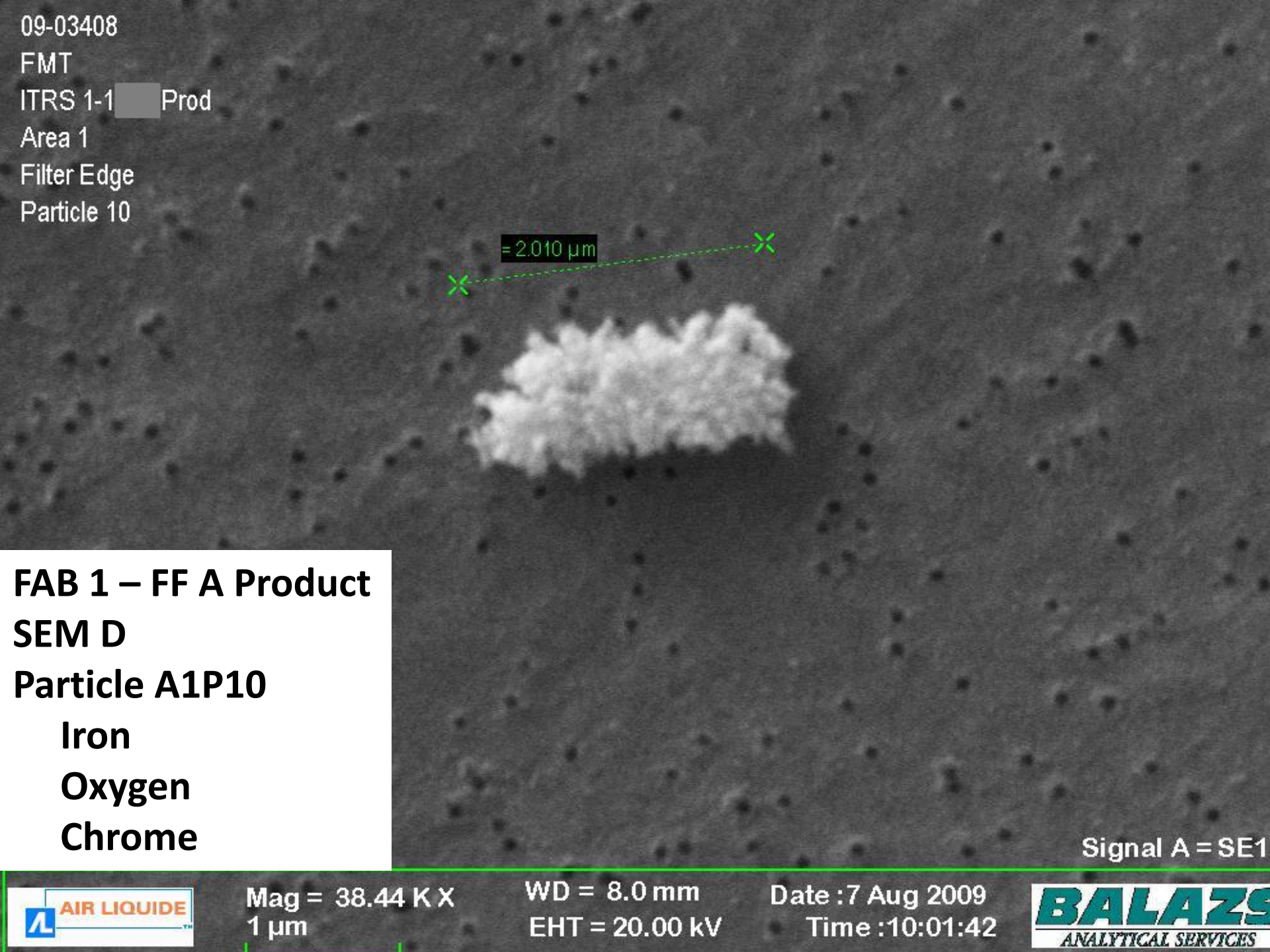
FAB 1 – FF A Product
SEM B
Particle A1P4

- **Iron**
- **Oxygen**
- **Chrome**



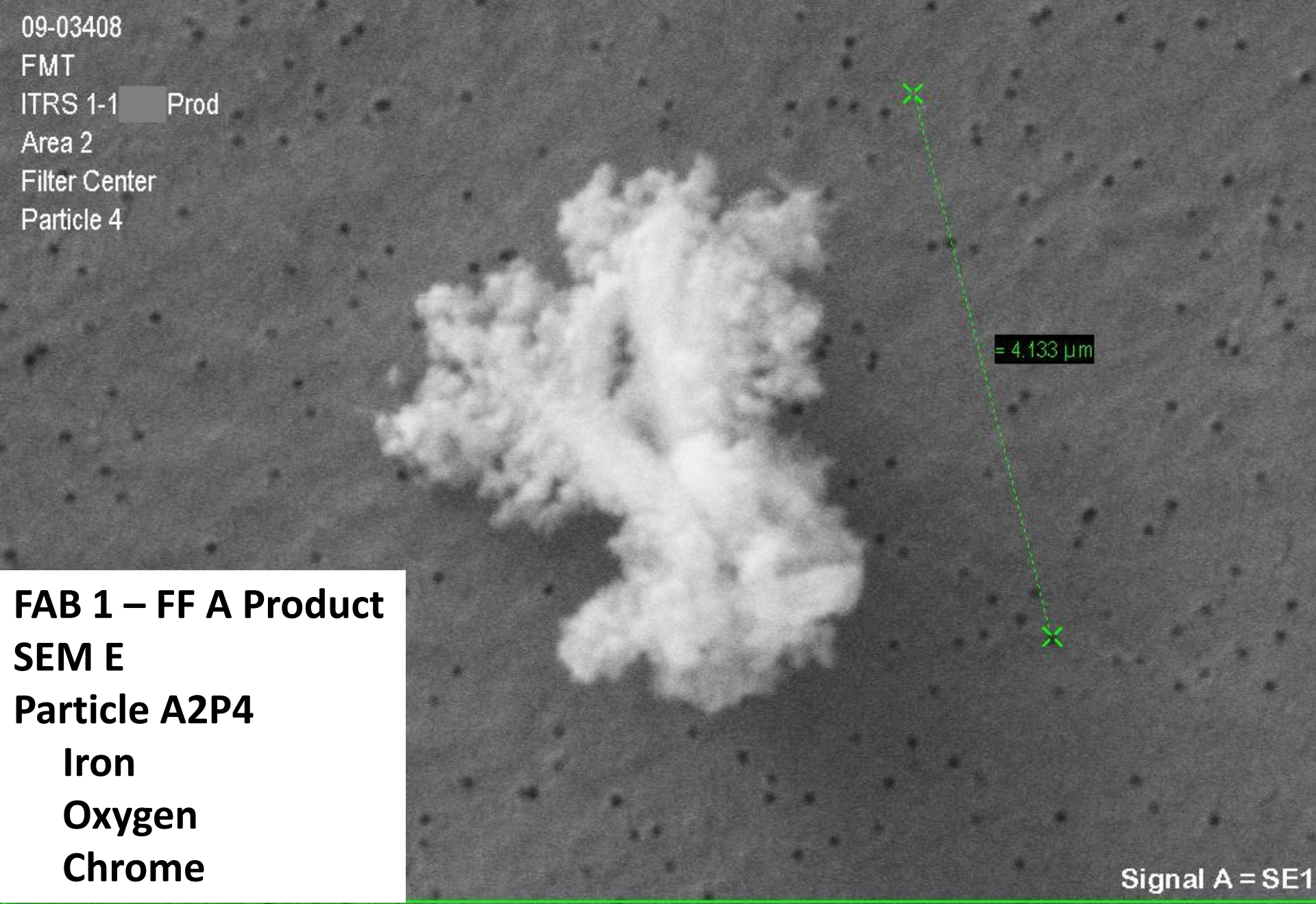
FAB 1 – FF A Product
SEM C
Particle A2P9

- **Iron**
- **Oxygen**
- **Chrome**



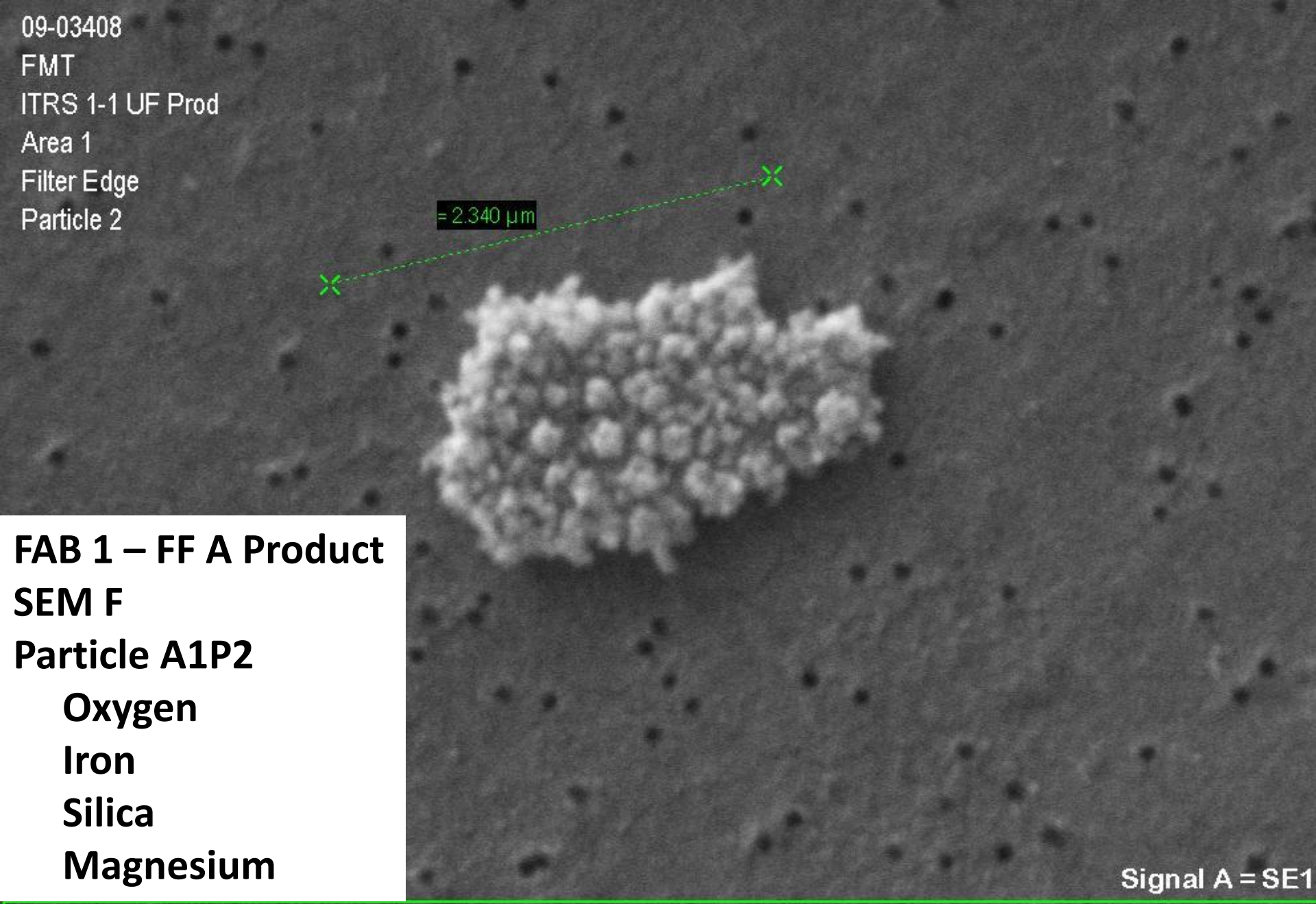
FAB 1 – FF A Product
SEM D
Particle A1P10

- **Iron**
- **Oxygen**
- **Chrome**



FAB 1 – FF A Product
SEM E
Particle A2P4

- **Iron**
- **Oxygen**
- **Chrome**



FAB 1 – FF A Product
SEM F
Particle A1P2

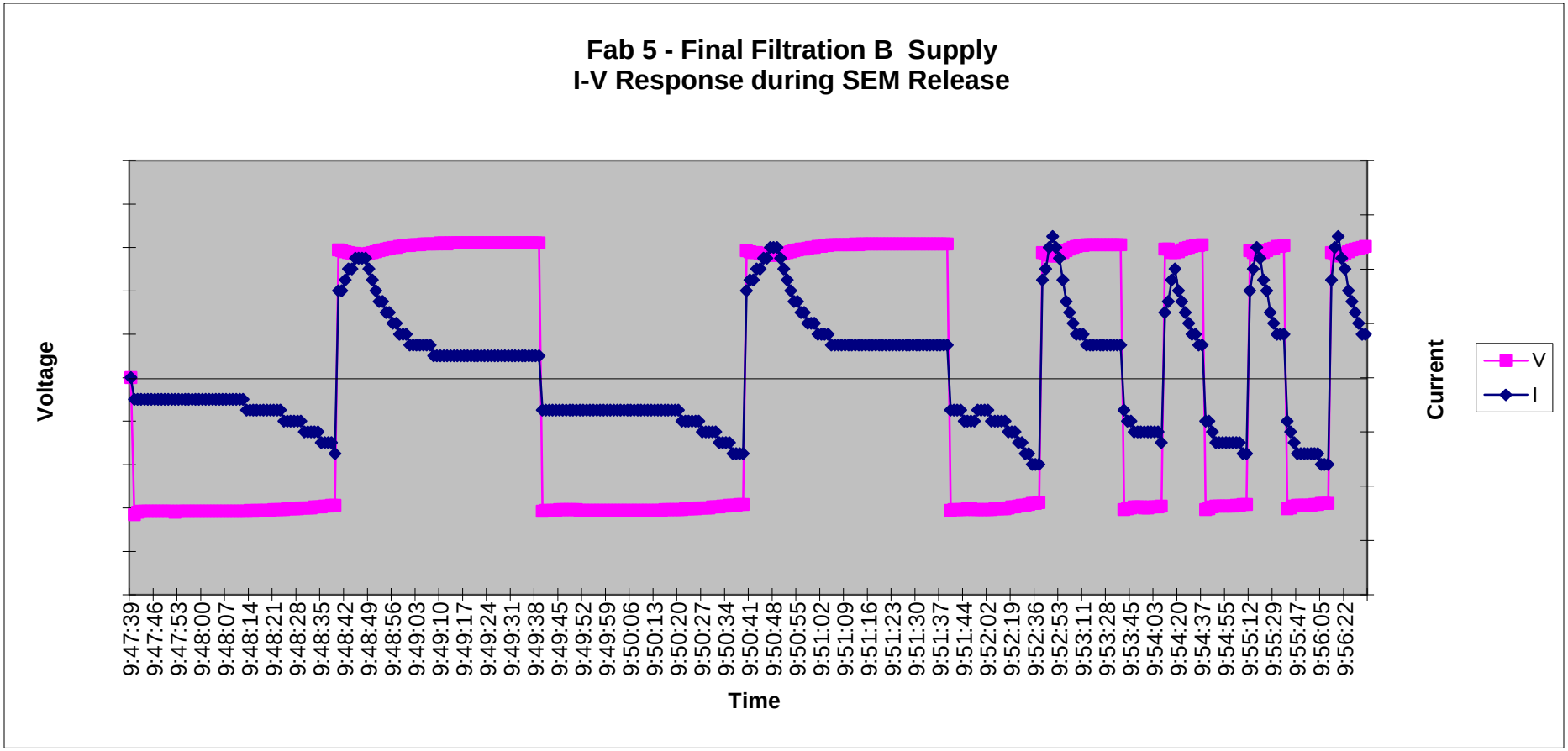
- **Oxygen**
- **Iron**
- **Silica**
- **Magnesium**

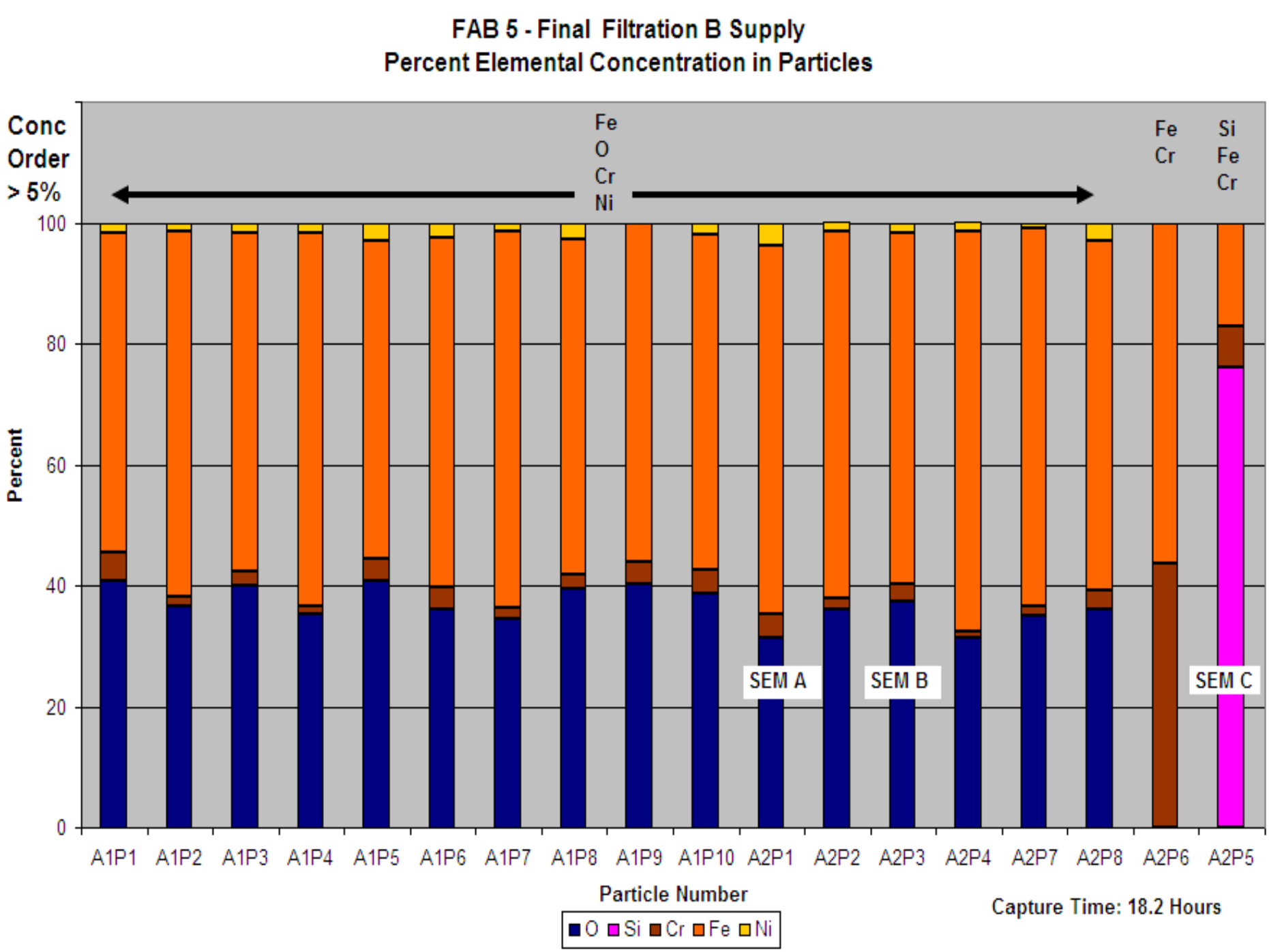
FAB 5

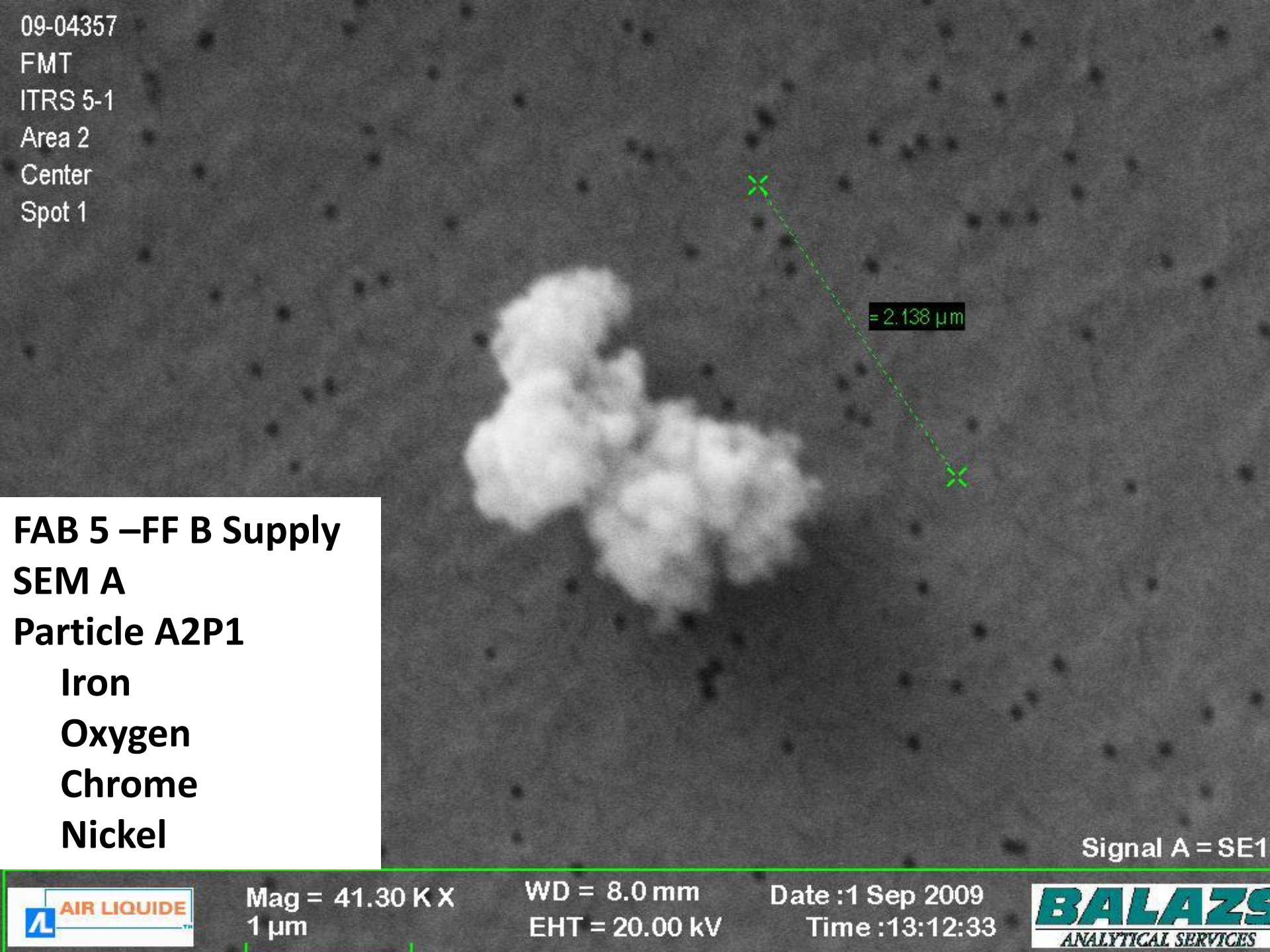
Fab 5 Showed a High Concentration of Stainless Steel Particles on Feed Water and a Significant Amount of Carbon on the Final Filtration Product Water

Sample One: Supply to Final Filtration

Sample Two Product of Final Filtration
(same system as sample one)

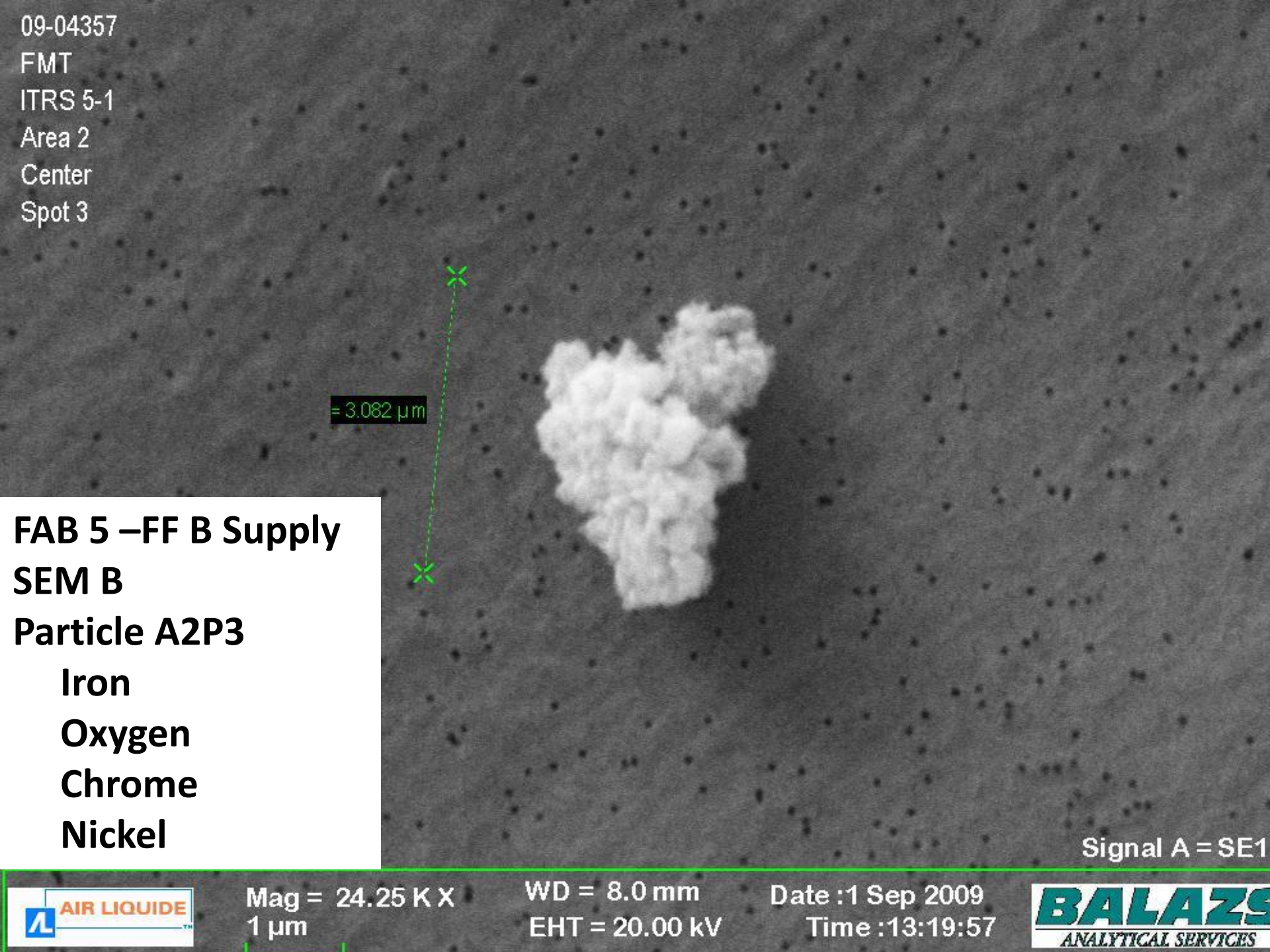

Fab 5 - Final Filtration B Supply
I-V Response during SEM Release
Voltage
Current
Time
V
I
9:47:39
9:47:46
9:47:53
9:48:00
9:48:07
9:48:14
9:48:21
9:48:28
9:48:35
9:48:42
9:48:49
9:48:56
9:49:03
9:49:10
9:49:17
9:49:24
9:49:31
9:49:38
9:49:45
9:49:52
9:49:59
9:50:06
9:50:13
9:50:20
9:50:27
9:50:34
9:50:41
9:50:48
9:50:55
9:51:02
9:51:09
9:51:16
9:51:23
9:51:30
9:51:37
9:51:44
9:52:02
9:52:19
9:52:36
9:52:53
9:53:11
9:53:28
9:53:45
9:54:03
9:54:20
9:54:37
9:54:55
9:55:12
9:55:29
9:55:47
9:56:05
9:56:22

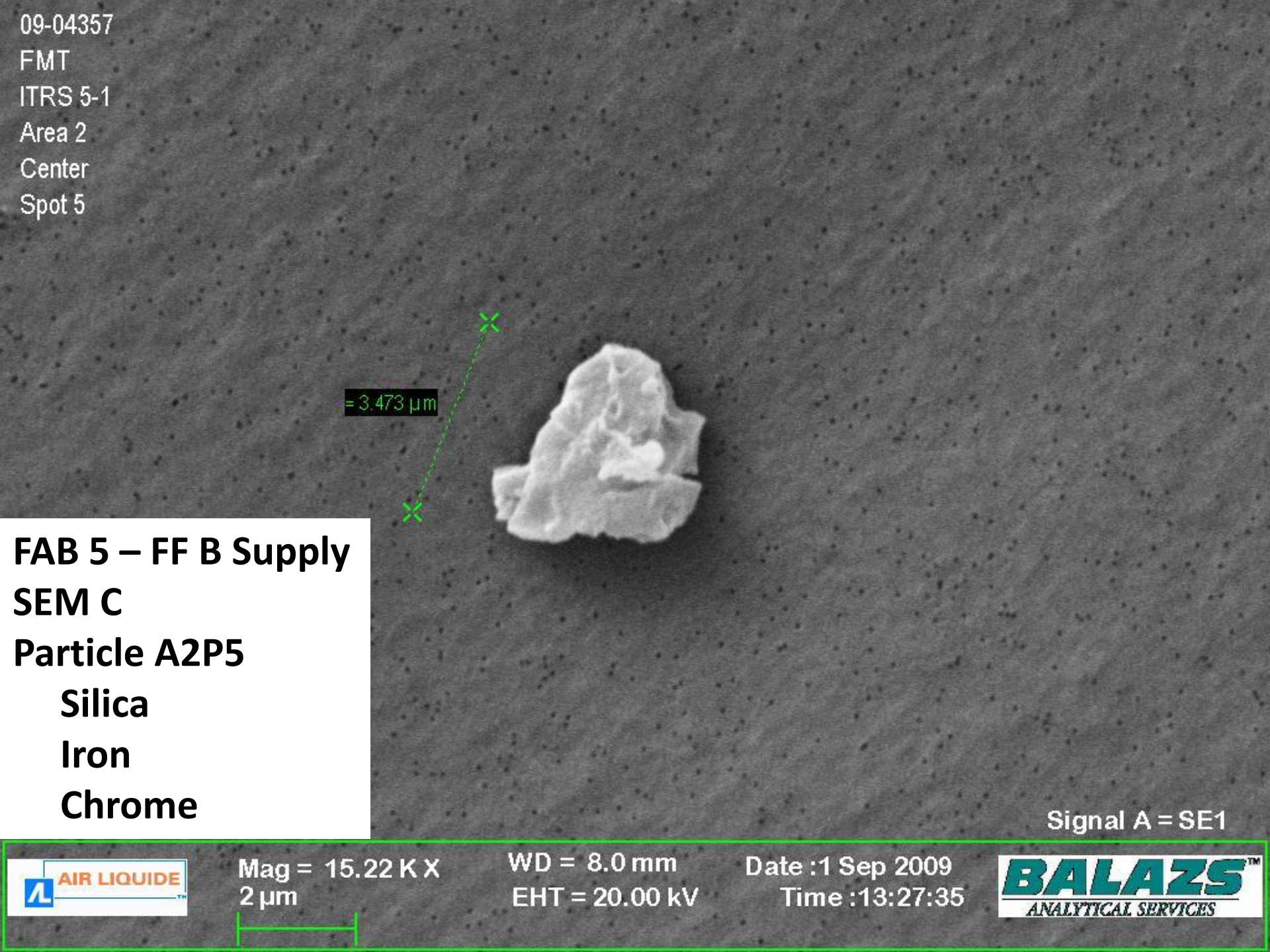

FAB 5 - Final Filtration B Supply
Percent Elemental Concentration in Particles
Conc Order > 5%
Fe O Cr Ni
Fe Cr
Si Fe Cr
Percent
100
80
60
40
20
0
SEM A
SEM B
SEM C
A1P1 A1P2 A1P3 A1P4 A1P5 A1P6 A1P7 A1P8 A1P9 A1P10 A2P1 A2P2 A2P3 A2P4 A2P7 A2P8 A2P6 A2P5
Particle Number
O Si Cr Fe Ni
Capture Time: 18.2 Hours



FAB 5 –FF B Supply
SEM A
Particle A2P1

- **Iron**
- **Oxygen**
- **Chrome**
- **Nickel**

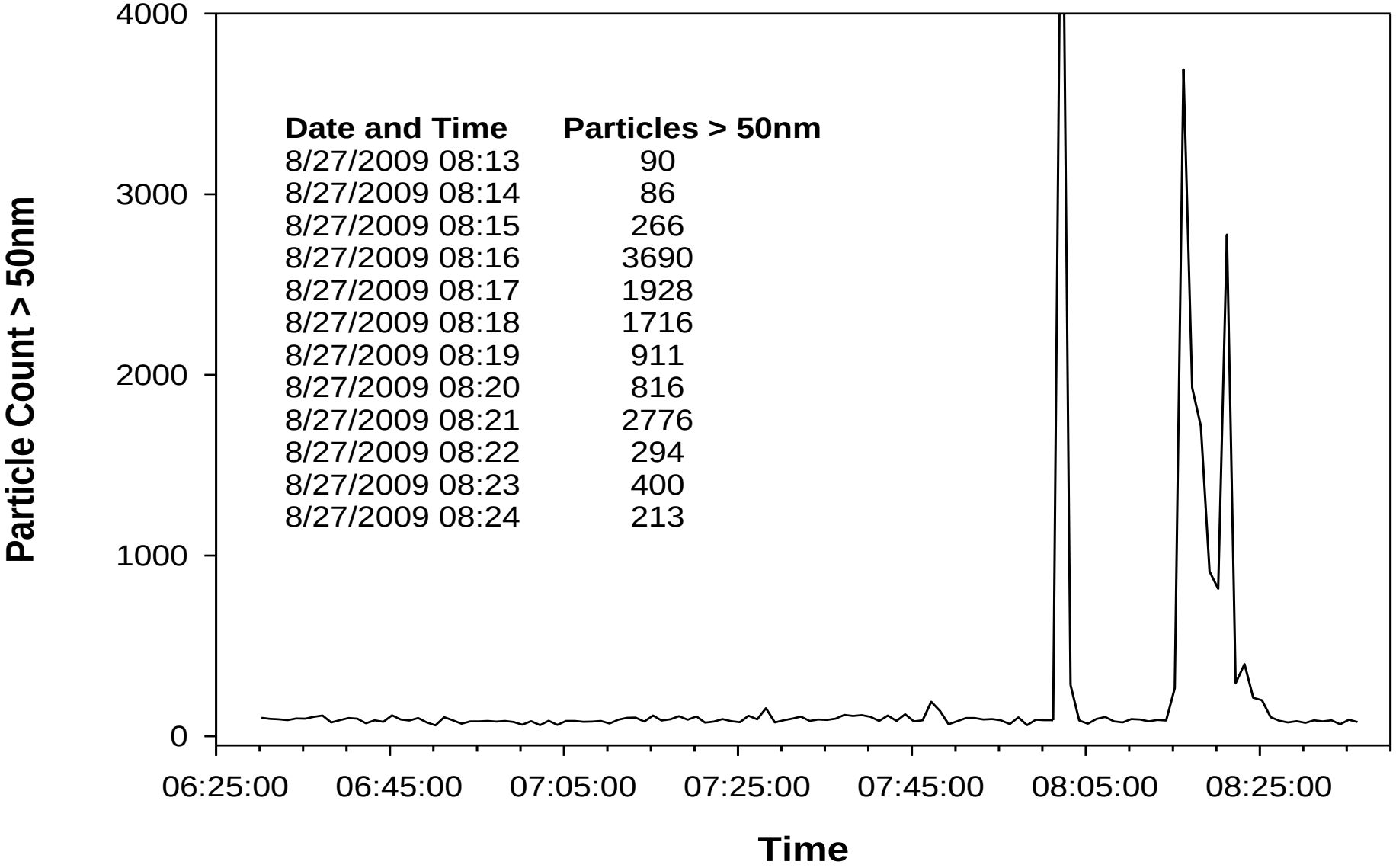

09-04357
FMT
ITRS 5-1
Area 2
Center
Spot 3
= 3.082 µm
FAB 5 –FF B Supply
SEM B
Particle A2P3
Iron
Oxygen
Chrome
Nickel
Signal A = SE1
AIR LIQUIDE
Mag = 24.25 K X
1 µm
WD = 8.0 mm
EHT = 20.00 kV
Date :1 Sep 2009
Time :13:19:57
BALAZS
ANALYTICAL SERVICES



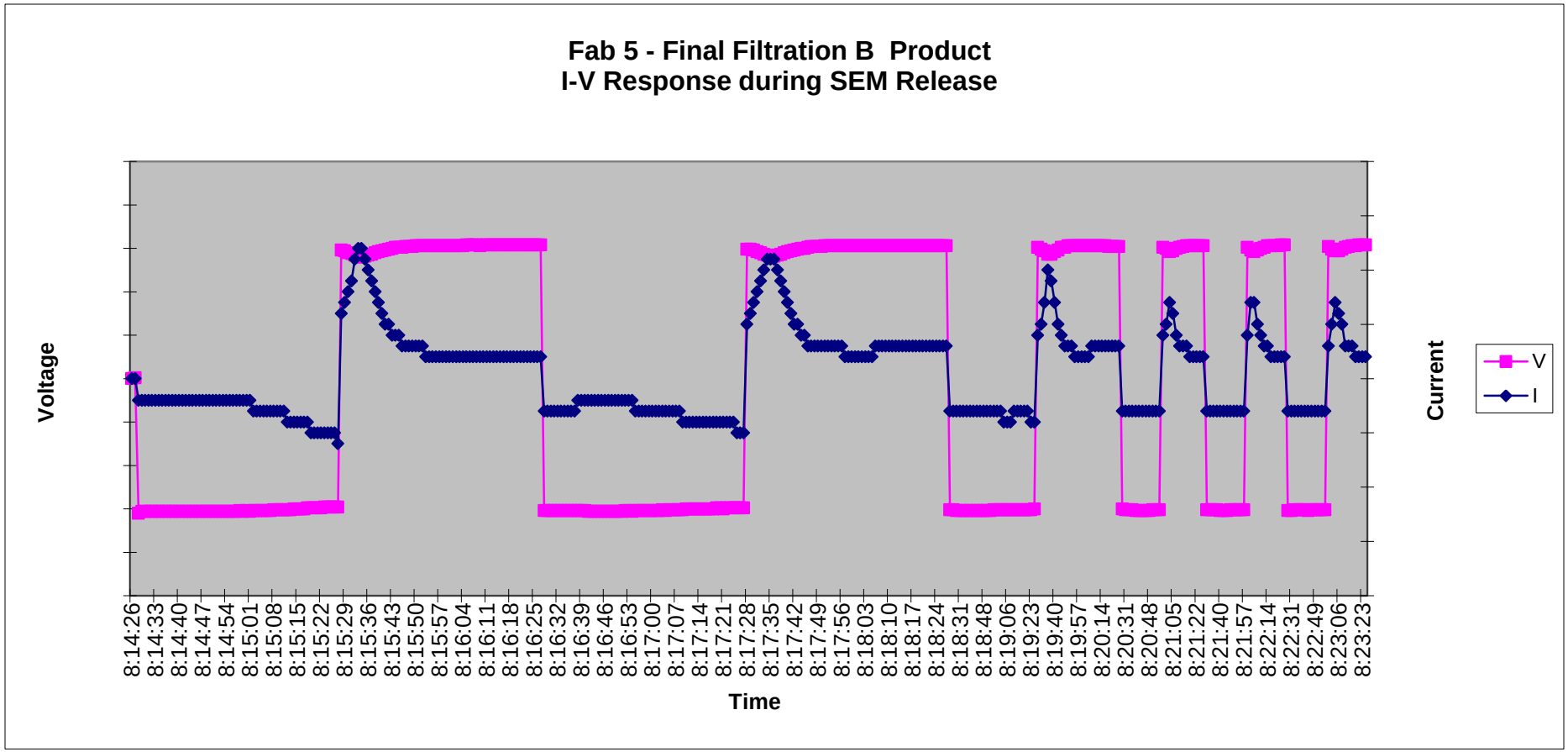
FAB 5 – FF B Supply
SEM C
Particle A2P5

- **Silica**
- **Iron**
- **Chrome**

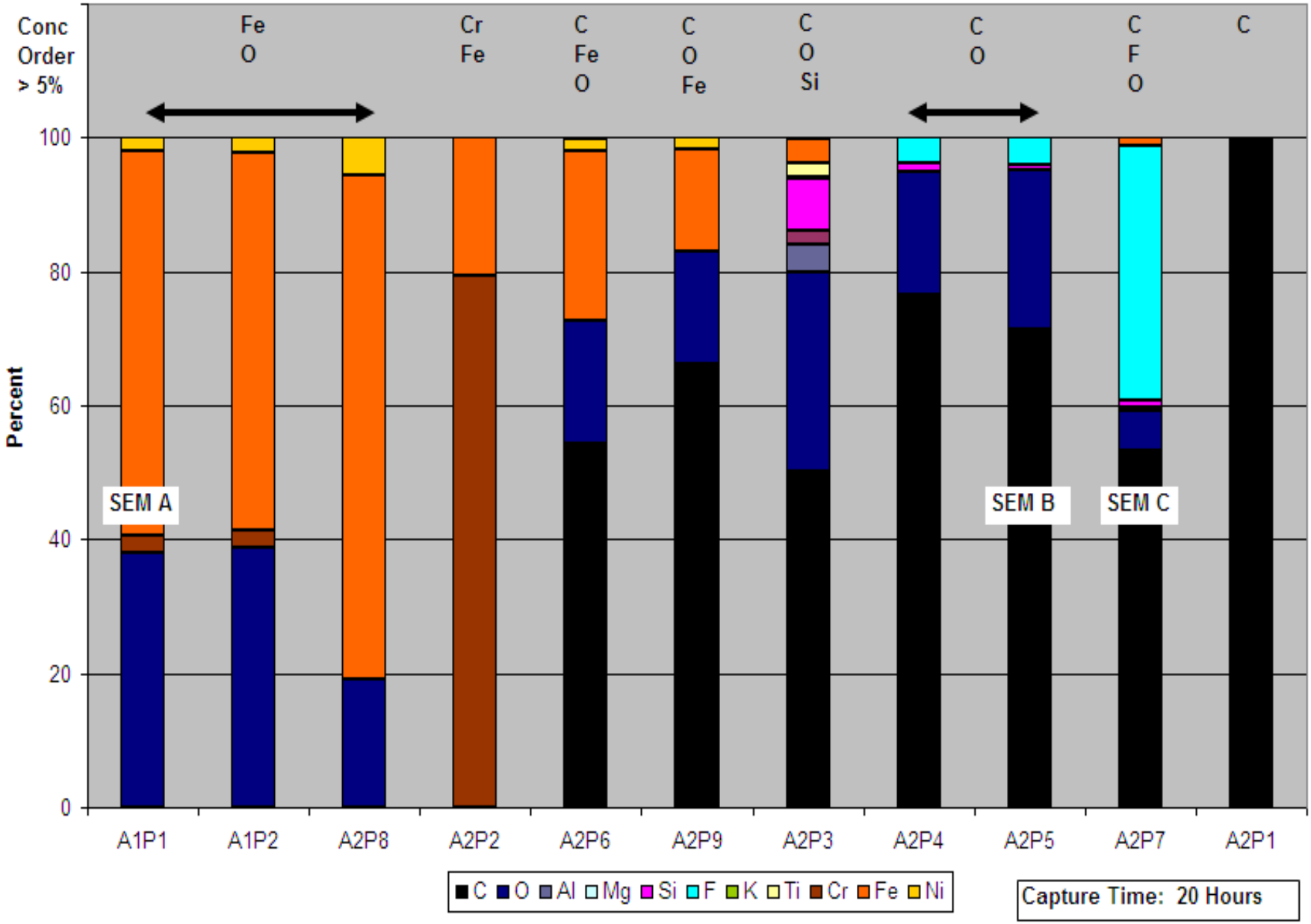
FAB 5 – Final Filter B Product
Particle Release Documented by Laser Particle Counter
20 Hours Capture Time

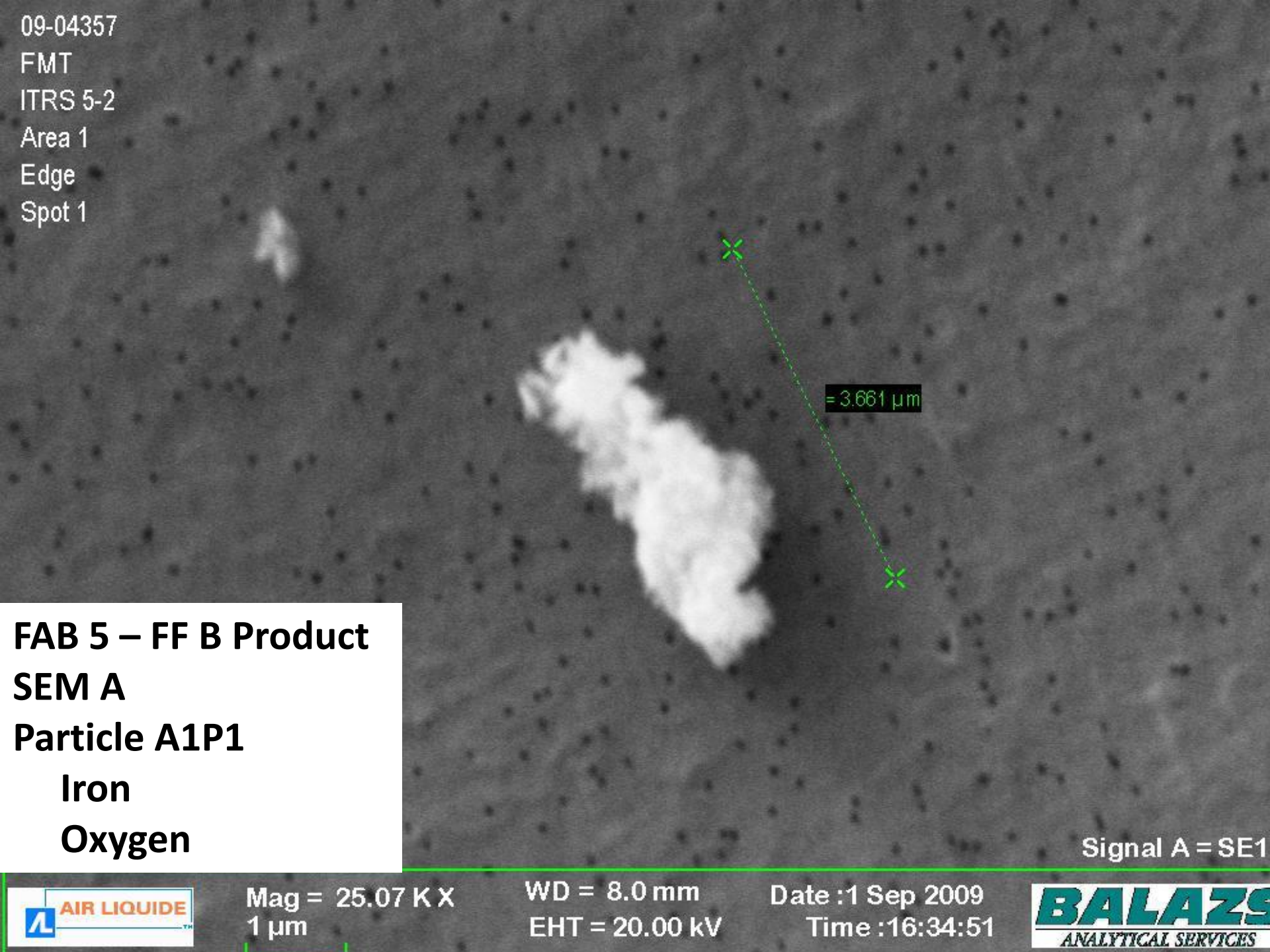


Date and Time	Particles > 50nm
8/27/2009 08:13	90
8/27/2009 08:14	86
8/27/2009 08:15	266
8/27/2009 08:16	3690
8/27/2009 08:17	1928
8/27/2009 08:18	1716
8/27/2009 08:19	911
8/27/2009 08:20	816
8/27/2009 08:21	2776
8/27/2009 08:22	294
8/27/2009 08:23	400
8/27/2009 08:24	213

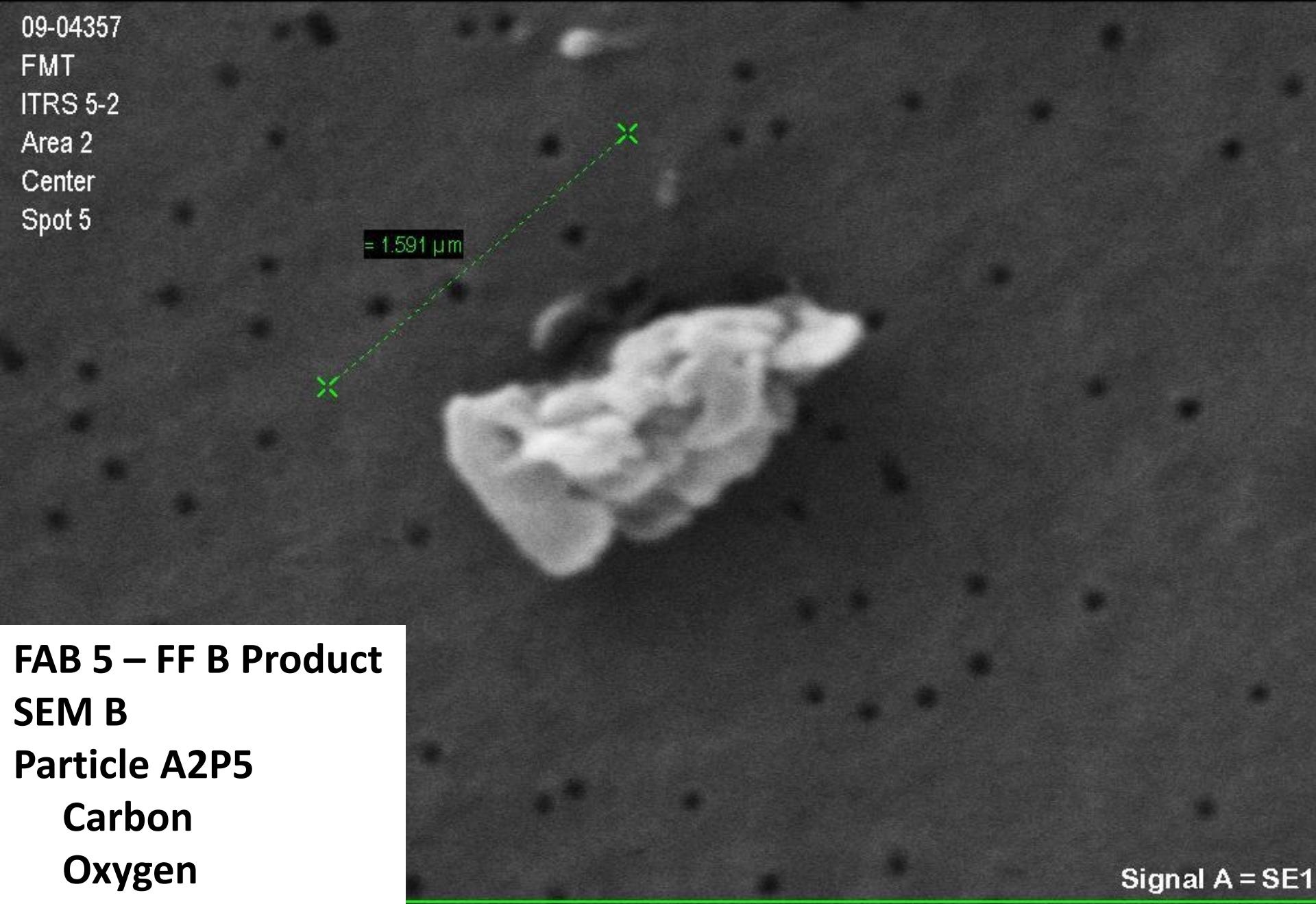

Fab 5 - Final Filtration B Product
I-V Response during SEM Release
Voltage
Current
Time
V
I
8:14:26
8:14:33
8:14:40
8:14:47
8:14:54
8:15:01
8:15:08
8:15:15
8:15:22
8:15:29
8:15:36
8:15:43
8:15:50
8:15:57
8:16:04
8:16:11
8:16:18
8:16:25
8:16:32
8:16:39
8:16:46
8:16:53
8:17:00
8:17:07
8:17:14
8:17:21
8:17:28
8:17:35
8:17:42
8:17:49
8:17:56
8:18:03
8:18:10
8:18:17
8:18:24
8:18:31
8:18:48
8:19:06
8:19:23
8:19:40
8:19:57
8:20:14
8:20:31
8:20:48
8:21:05
8:21:22
8:21:40
8:21:57
8:22:14
8:22:31
8:22:49
8:23:06
8:23:23

Fab 5 - Final Filtration B Product
Percent Elemental Concentration in Particles

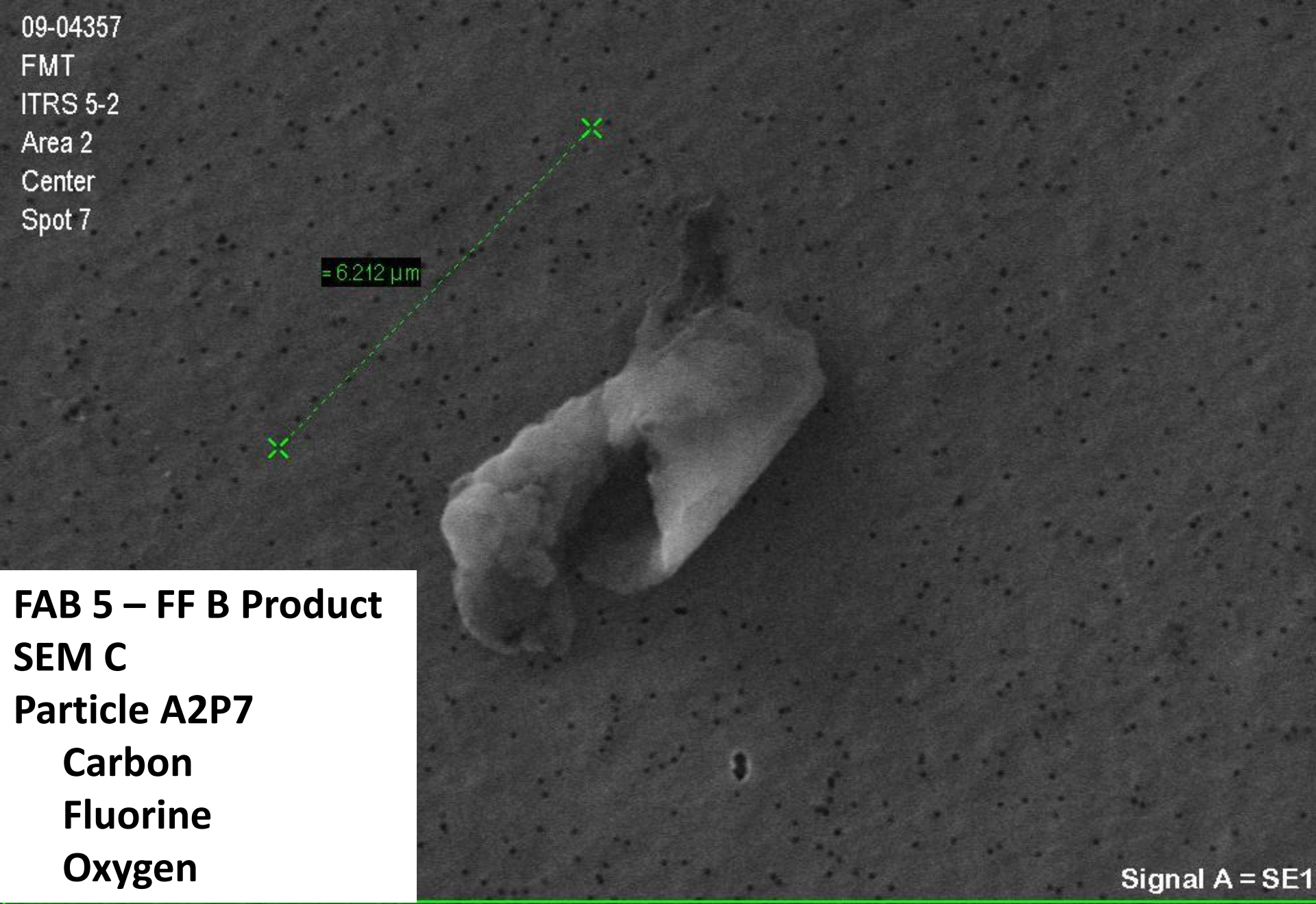




FAB 5 – FF B Product
SEM A
Particle A1P1
Iron
Oxygen



FAB 5 – FF B Product
SEM B
Particle A2P5
Carbon
Oxygen



FAB 5 – FF B Product
SEM C
Particle A2P7

- **Carbon**
- **Fluorine**
- **Oxygen**

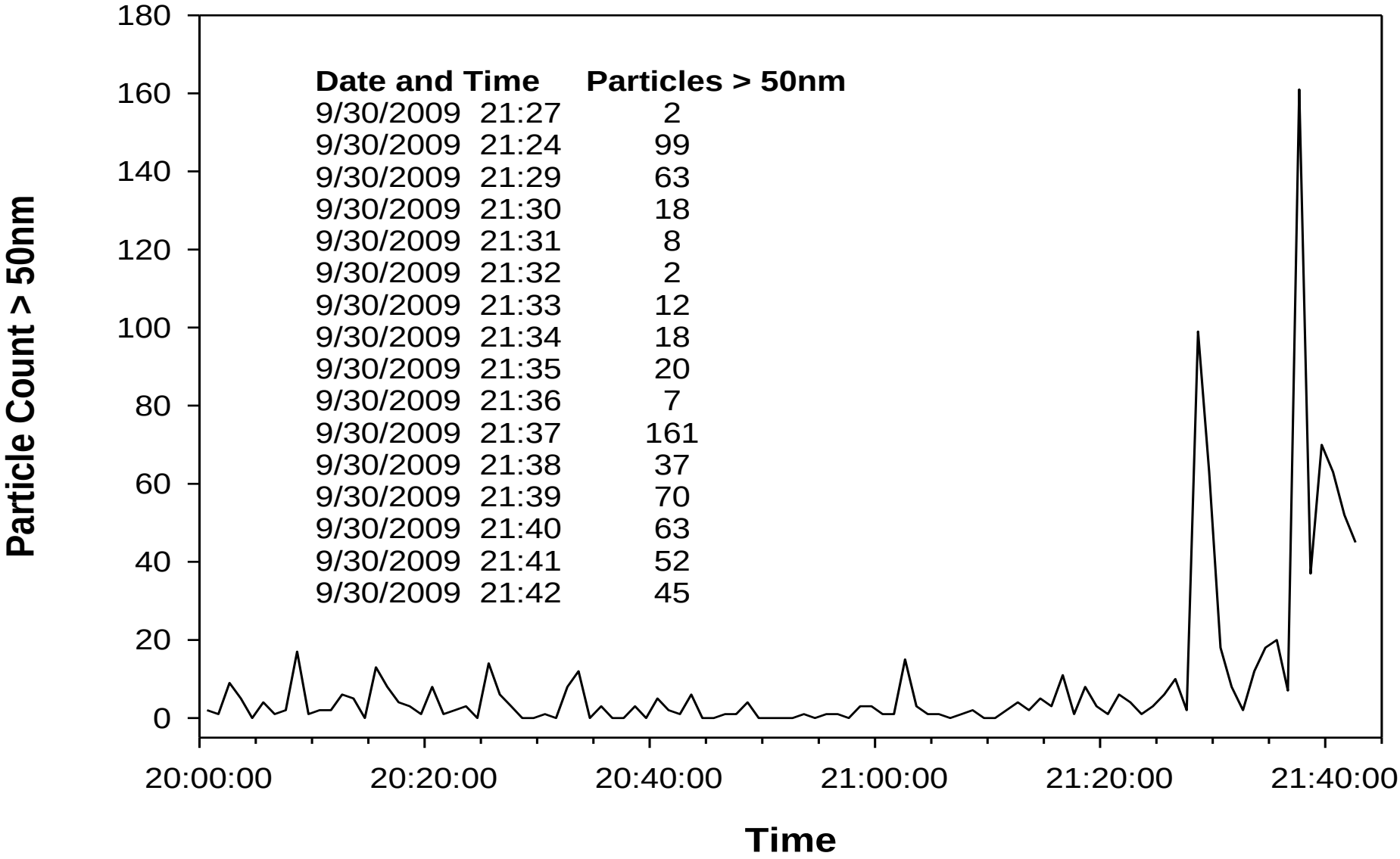
FAB 4
Fab 4 Showed a Variety of Typical Elemental Particles Found in UPW

Sample One: Supply to Final Filtration

Sample Two: Product of Final Filtration (same system as sample one)

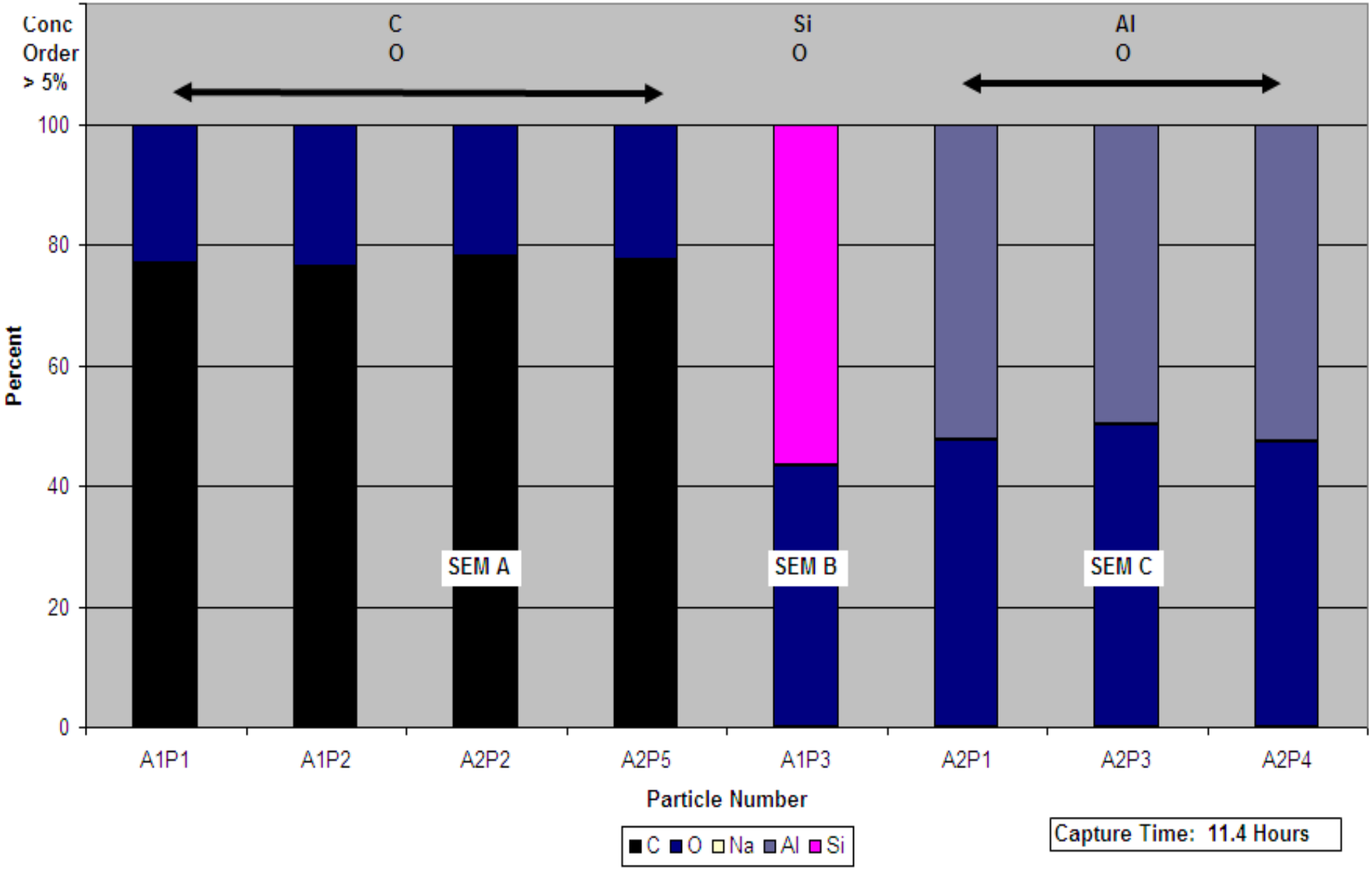
Sample Three: Product of Final Filtration (not associated with Sample one)

FAB 4 – Final Filter A Supply
Particle Release Documented by Laser Particle Counter
11.4 Hours Capture Time

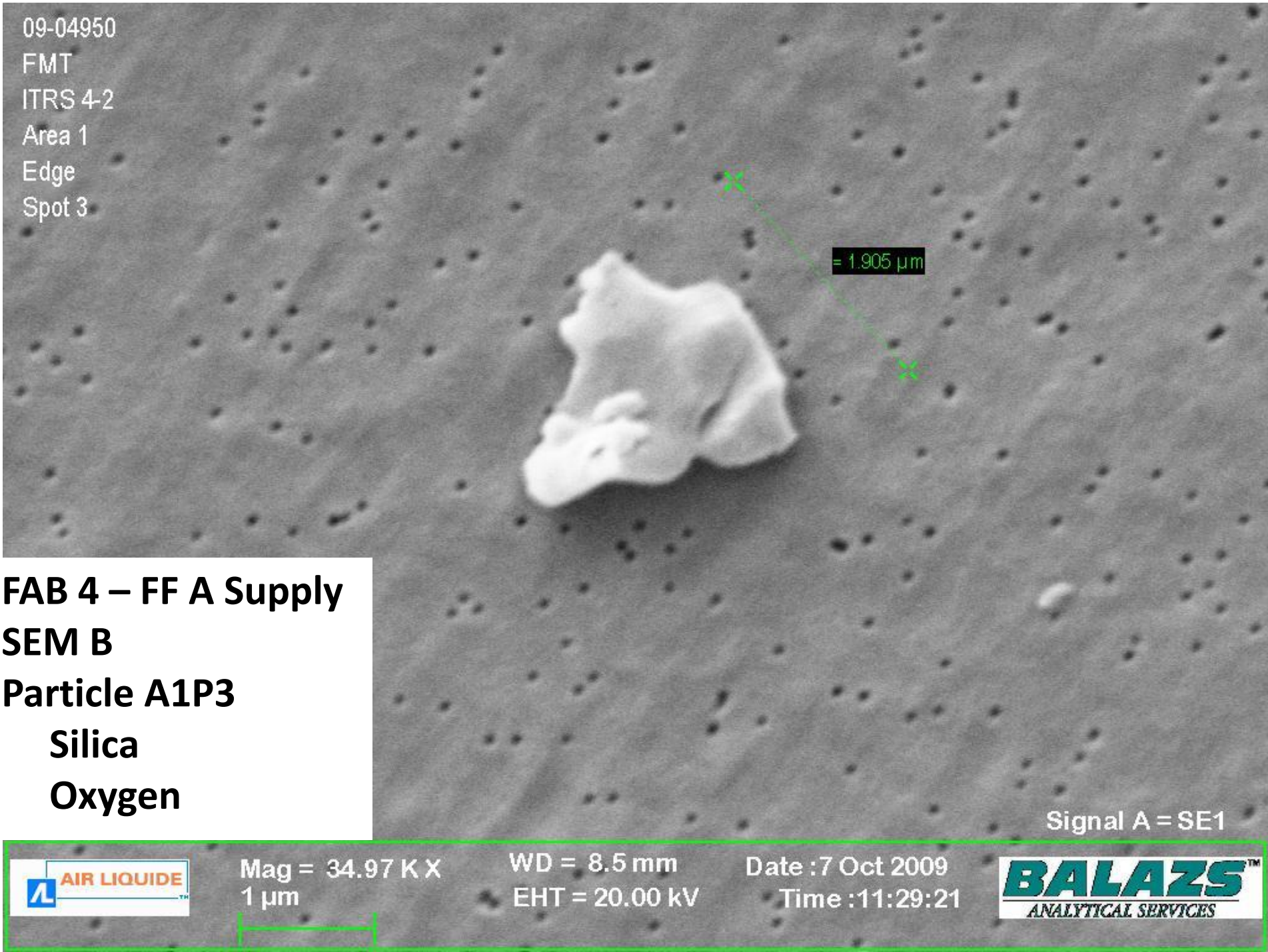


Date and Time	Particles > 50nm
9/30/2009 21:27	2
9/30/2009 21:24	99
9/30/2009 21:29	63
9/30/2009 21:30	18
9/30/2009 21:31	8
9/30/2009 21:32	2
9/30/2009 21:33	12
9/30/2009 21:34	18
9/30/2009 21:35	20
9/30/2009 21:36	7
9/30/2009 21:37	161
9/30/2009 21:38	37
9/30/2009 21:39	70
9/30/2009 21:40	63
9/30/2009 21:41	52
9/30/2009 21:42	45

FAB 4 - Final Filtration A Supply
Percent Elemental Concentration in Particles



FAB 4 – FF A Supply
SEM A
Particle A2P2
Carbon
Oxygen

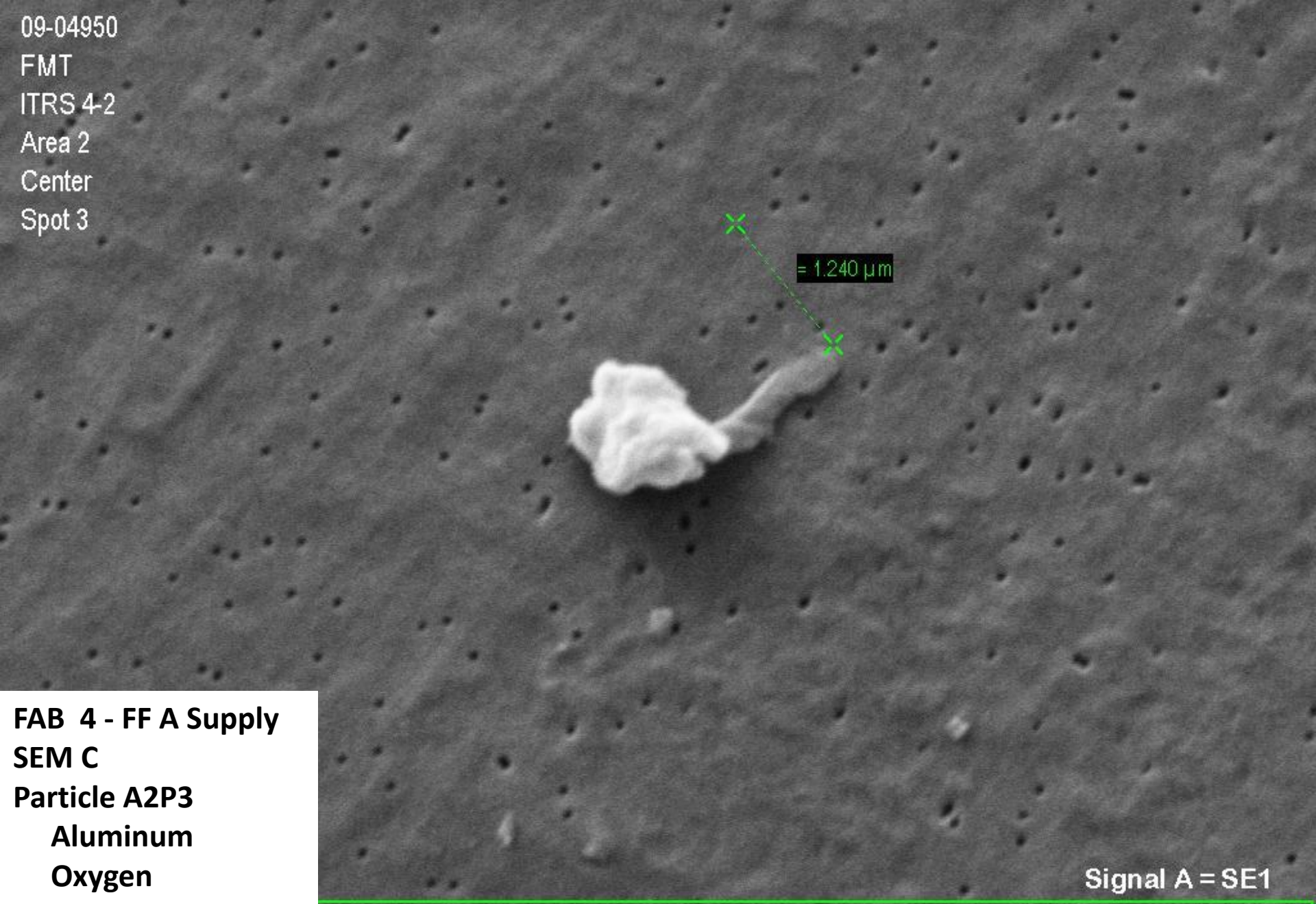


FAB 4 – FF A Supply

SEM B

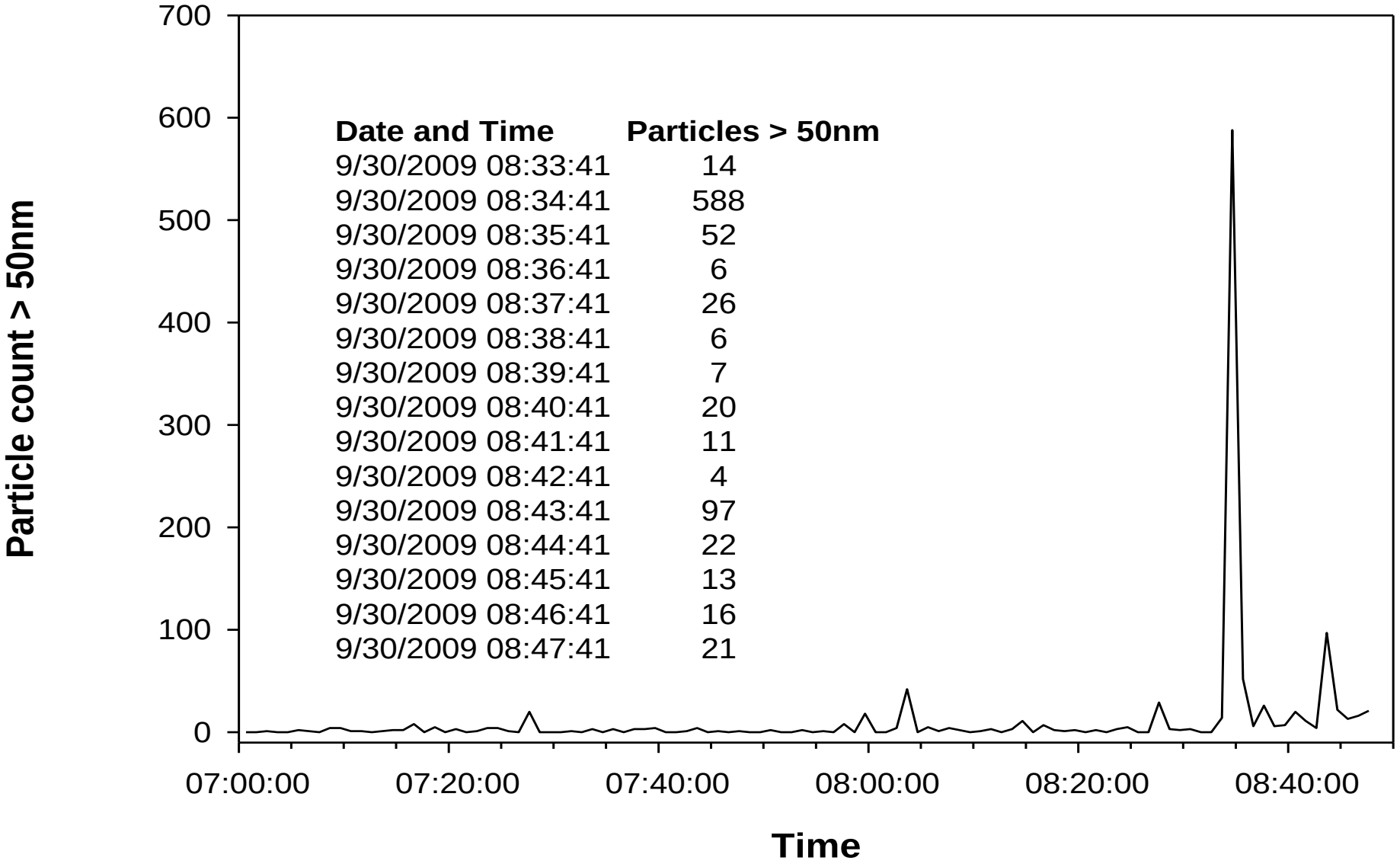
Particle A1P3

- **Silica**
- **Oxygen**

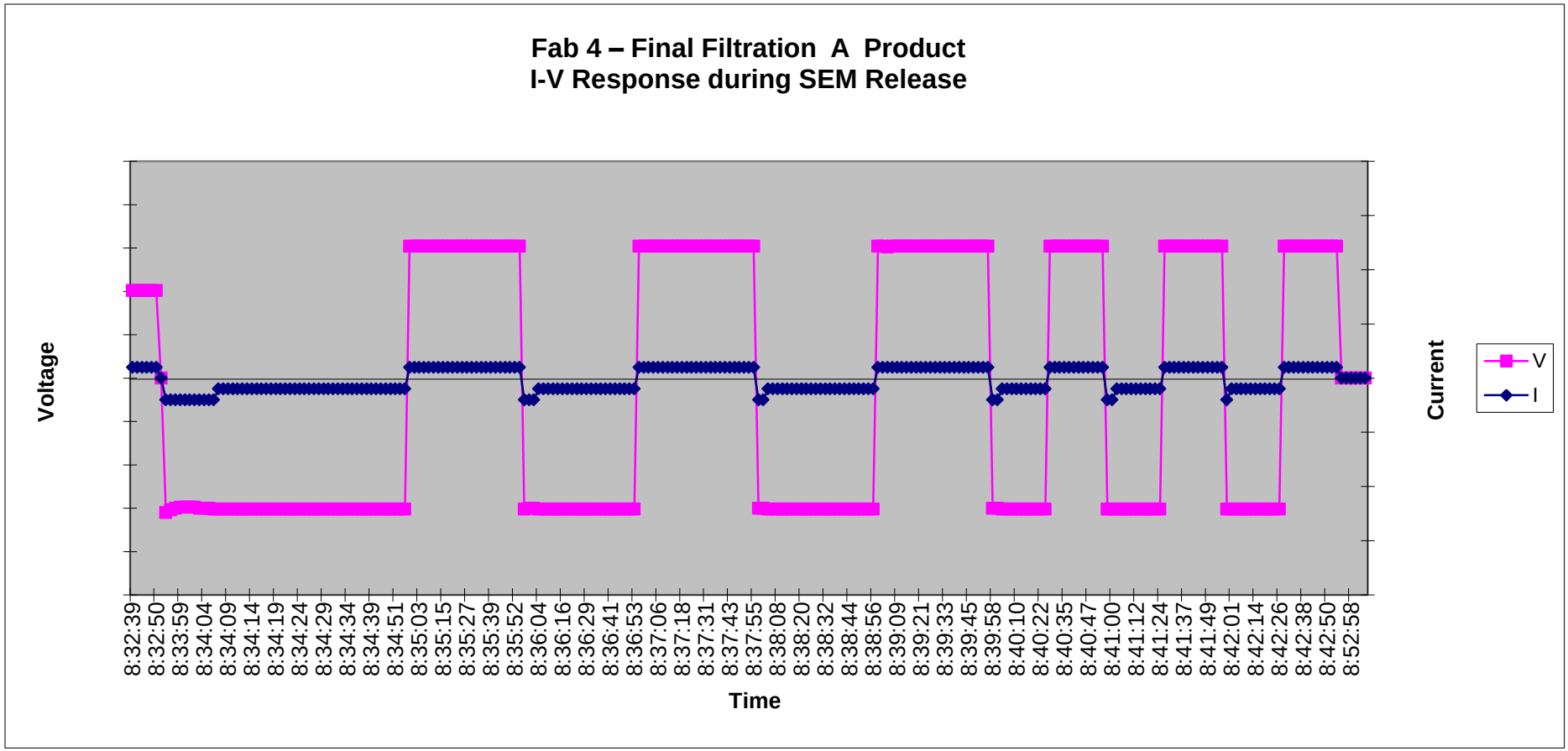


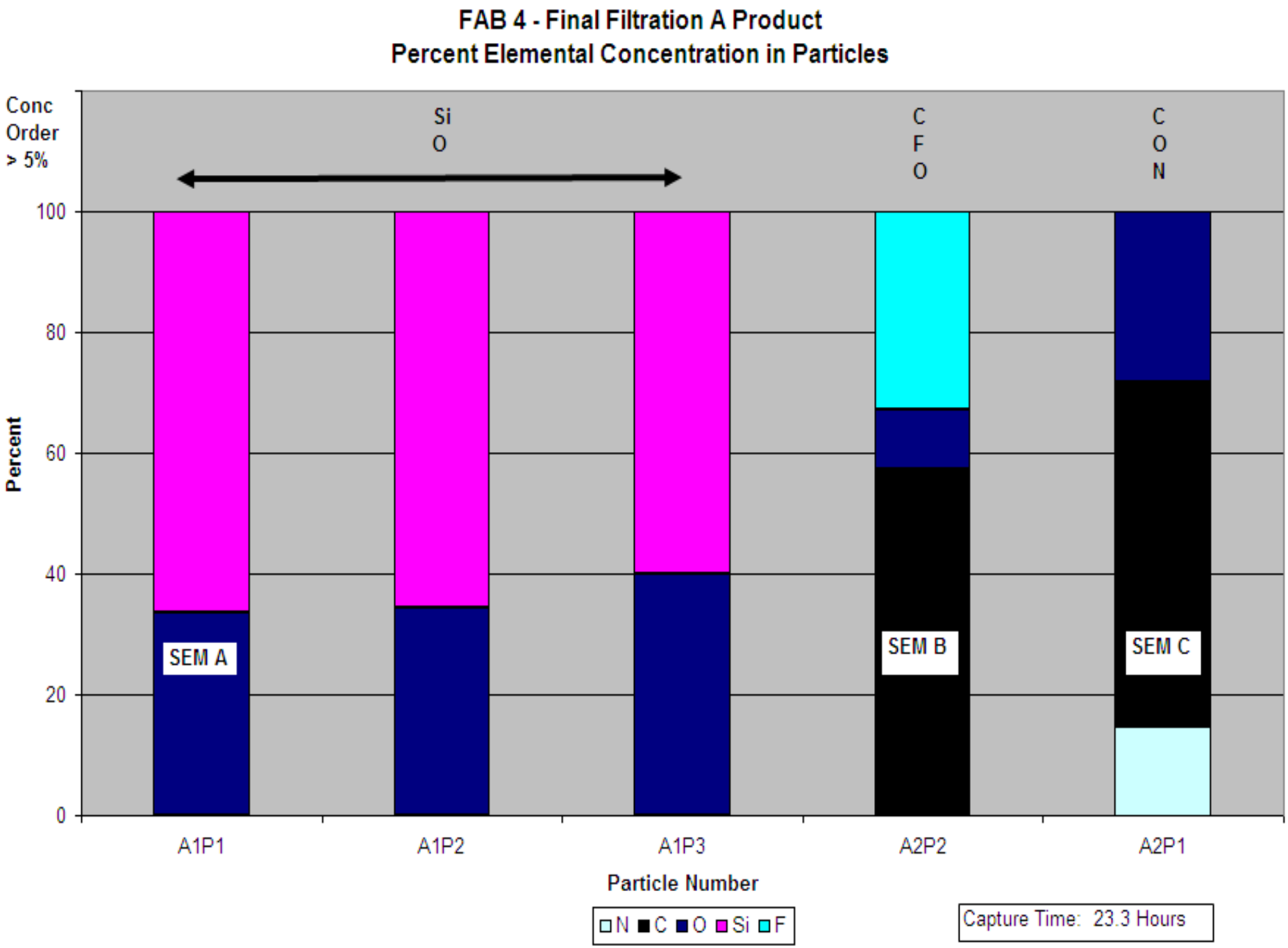
FAB 4 - FF A Supply
SEM C
Particle A2P3
Aluminum
Oxygen

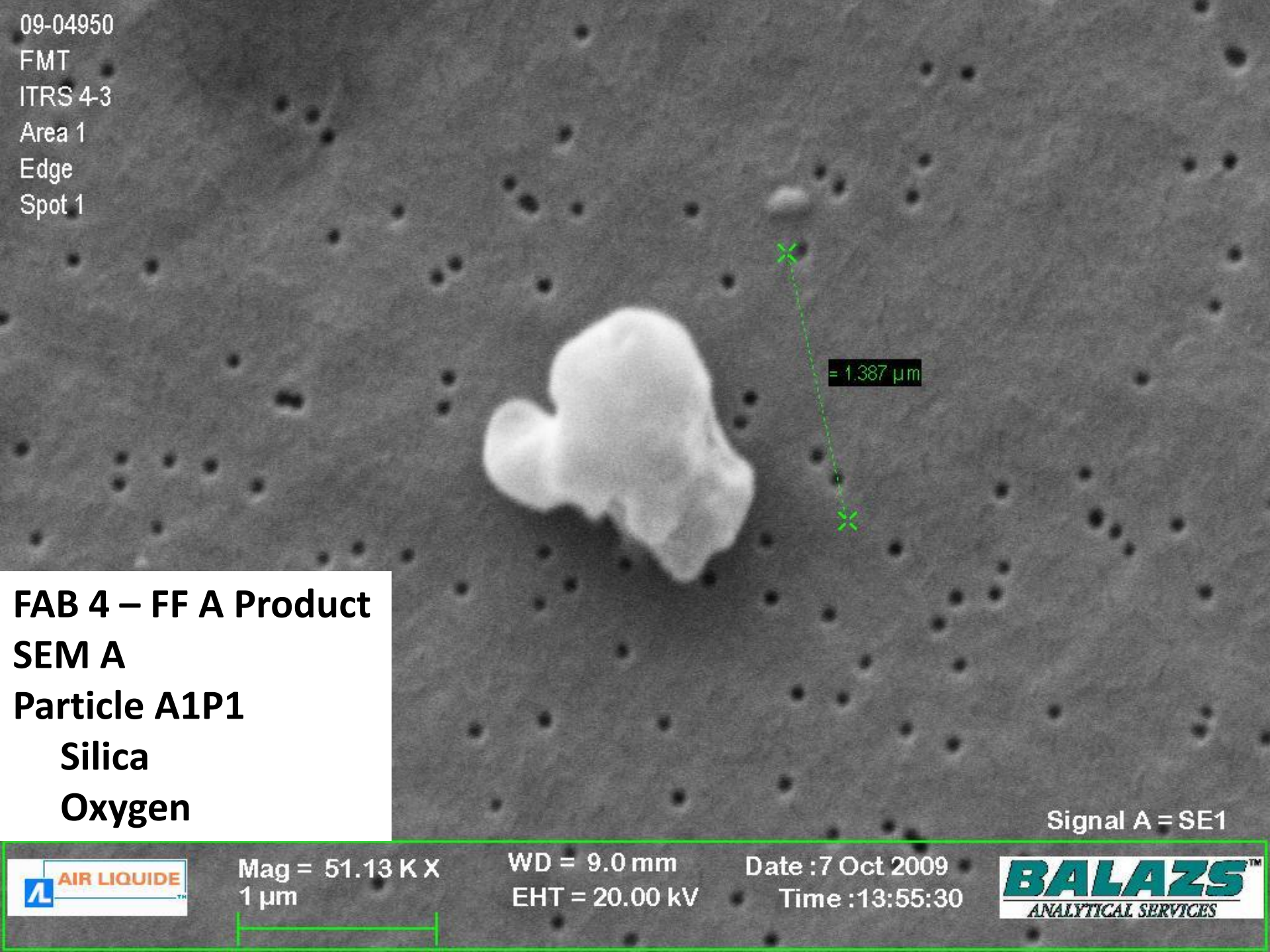
FAB 4 – Final Filter A Product
Particle Release Documented by Laser Particle Counter
23.3 Hours Capture Time



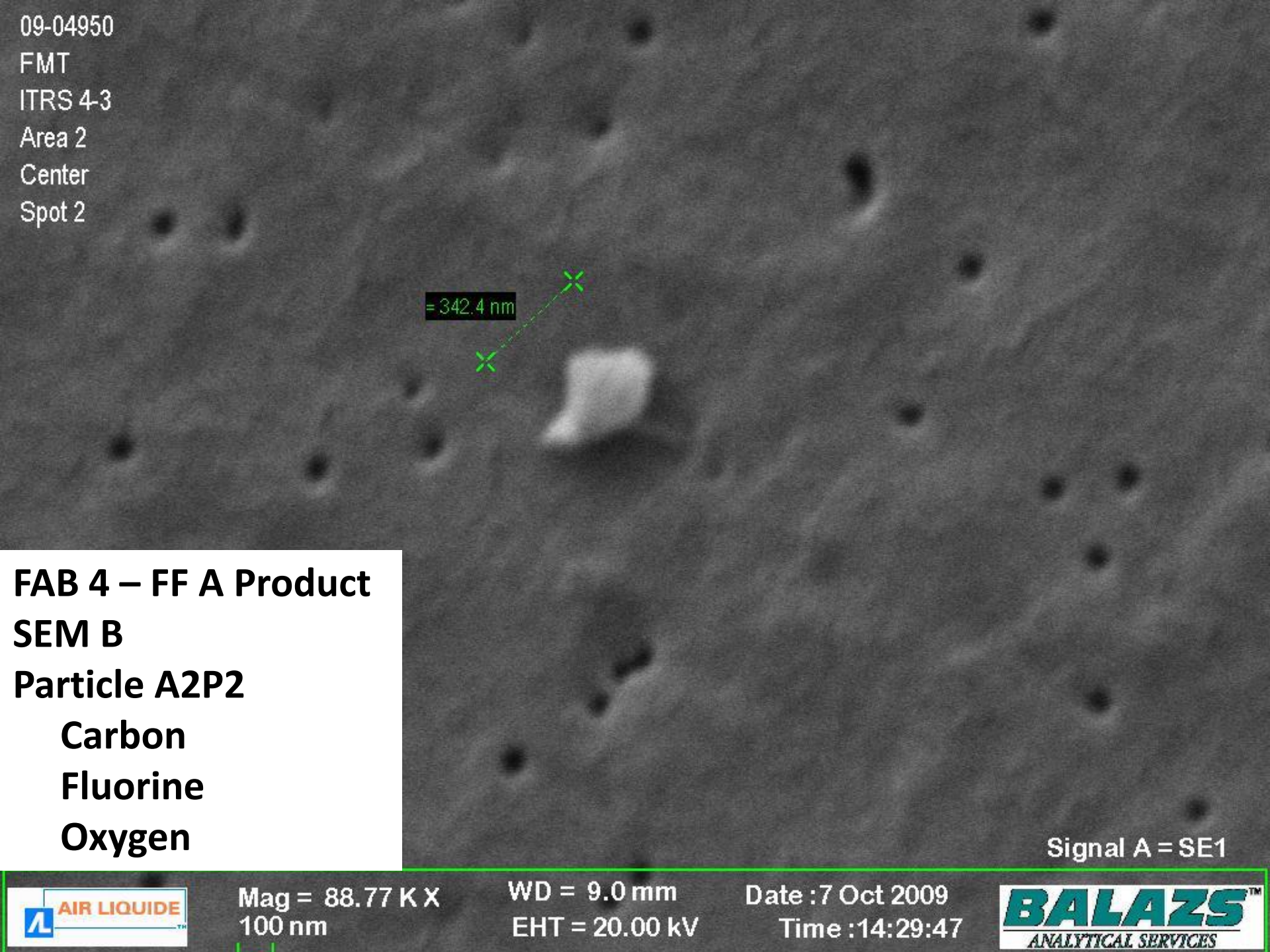
Date and Time	Particles > 50nm
9/30/2009 08:33:41	14
9/30/2009 08:34:41	588
9/30/2009 08:35:41	52
9/30/2009 08:36:41	6
9/30/2009 08:37:41	26
9/30/2009 08:38:41	6
9/30/2009 08:39:41	7
9/30/2009 08:40:41	20
9/30/2009 08:41:41	11
9/30/2009 08:42:41	4
9/30/2009 08:43:41	97
9/30/2009 08:44:41	22
9/30/2009 08:45:41	13
9/30/2009 08:46:41	16
9/30/2009 08:47:41	21


Fab 4 – Final Filtration A Product
I-V Response during SEM Release
Voltage
Current
Time
V
I
8:32:39
8:32:50
8:33:59
8:34:04
8:34:09
8:34:14
8:34:19
8:34:24
8:34:29
8:34:34
8:34:39
8:34:51
8:35:03
8:35:15
8:35:27
8:35:39
8:35:52
8:36:04
8:36:16
8:36:29
8:36:41
8:36:53
8:37:06
8:37:18
8:37:31
8:37:43
8:37:55
8:38:08
8:38:20
8:38:32
8:38:44
8:38:56
8:39:09
8:39:21
8:39:33
8:39:45
8:39:58
8:40:10
8:40:22
8:40:35
8:40:47
8:41:00
8:41:12
8:41:24
8:41:37
8:41:49
8:42:01
8:42:14
8:42:26
8:42:38
8:42:50
8:52:58


FAB 4 - Final Filtration A Product
Percent Elemental Concentration in Particles
Conc Order > 5%
Si O
C F O
C O N
100
80
60
40
20
0
Percent
SEM A
SEM B
SEM C
A1P1
A1P2
A1P3
A2P2
A2P1
Particle Number
N C O Si F
Capture Time: 23.3 Hours

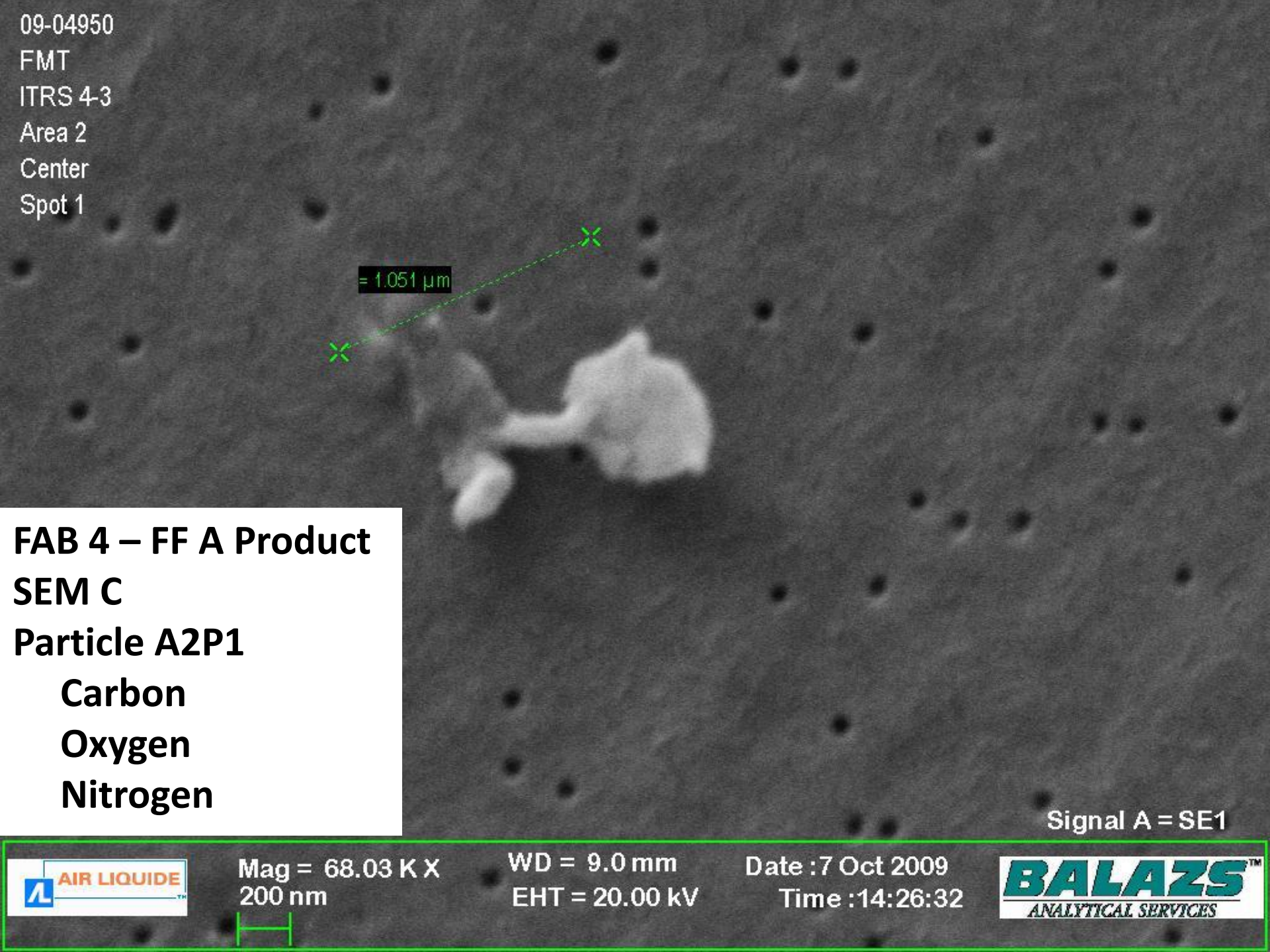


FAB 4 – FF A Product
SEM A
Particle A1P1
Silica
Oxygen



FAB 4 – FF A Product
SEM B
Particle A2P2

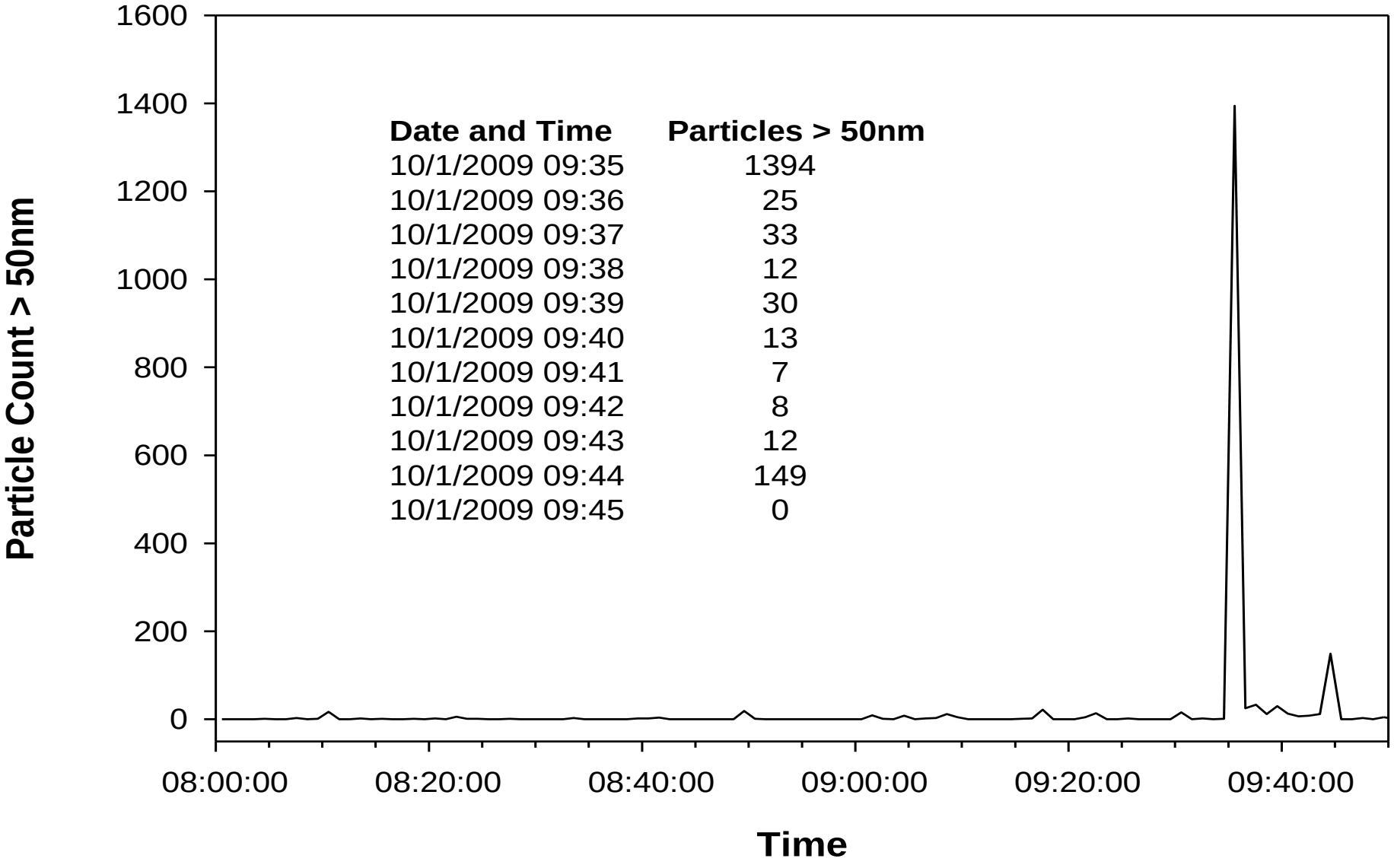
- **Carbon**
- **Fluorine**
- **Oxygen**



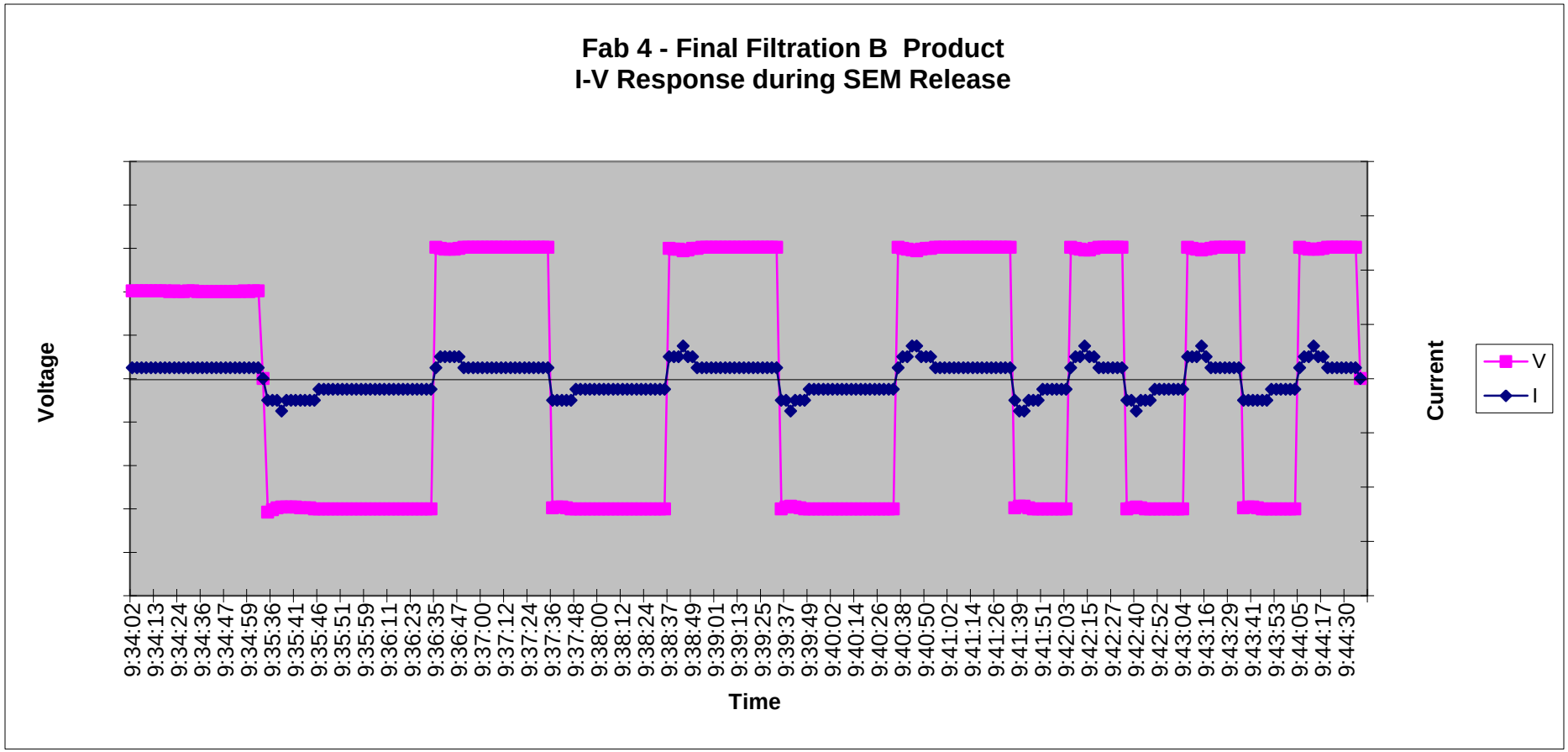
FAB 4 – FF A Product
SEM C
Particle A2P1

- **Carbon**
- **Oxygen**
- **Nitrogen**

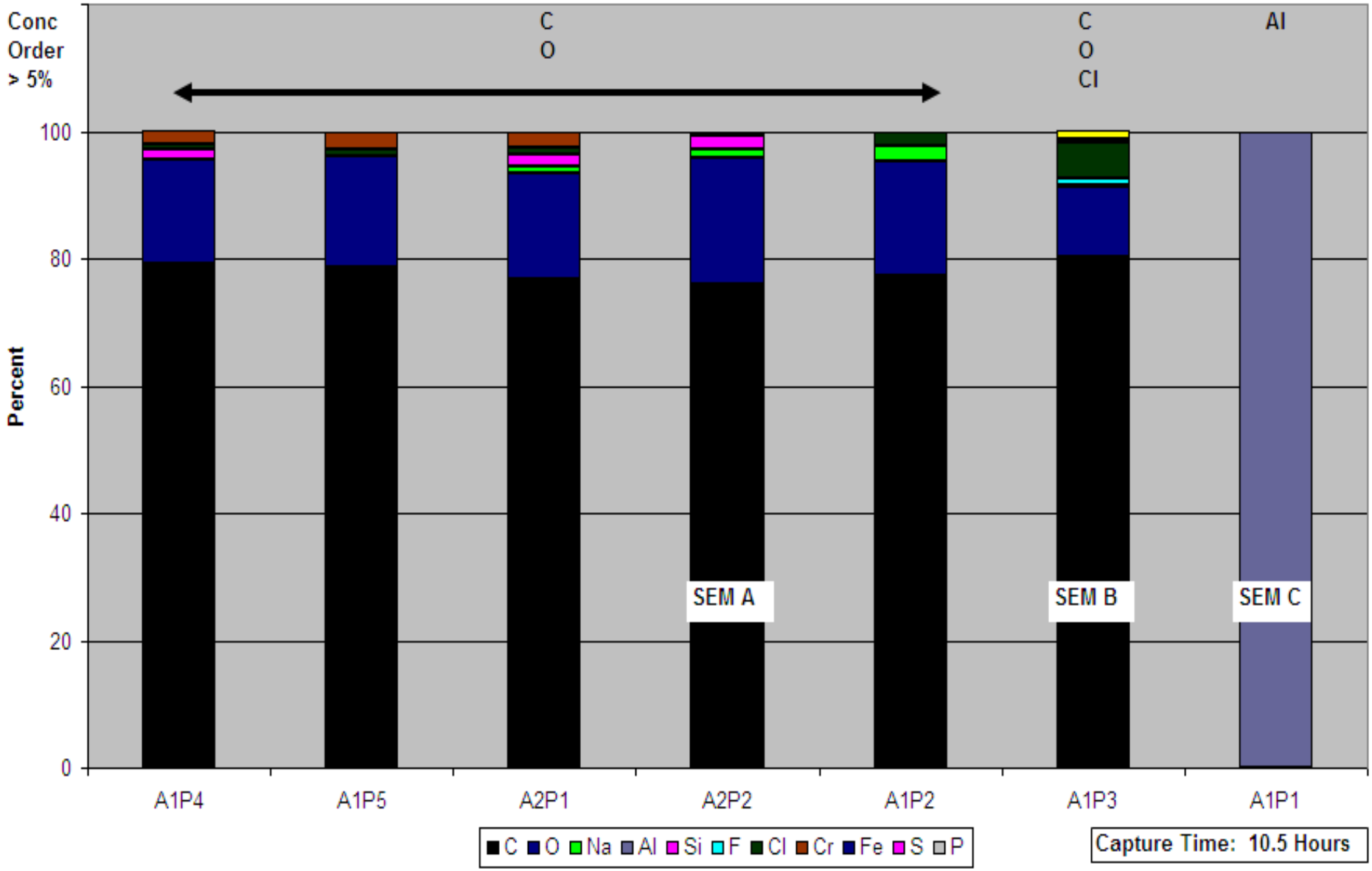
FAB 4 – Final Filter B Product
Particle Release Documented by Laser Particle Counter
10.5 Hours Capture Time

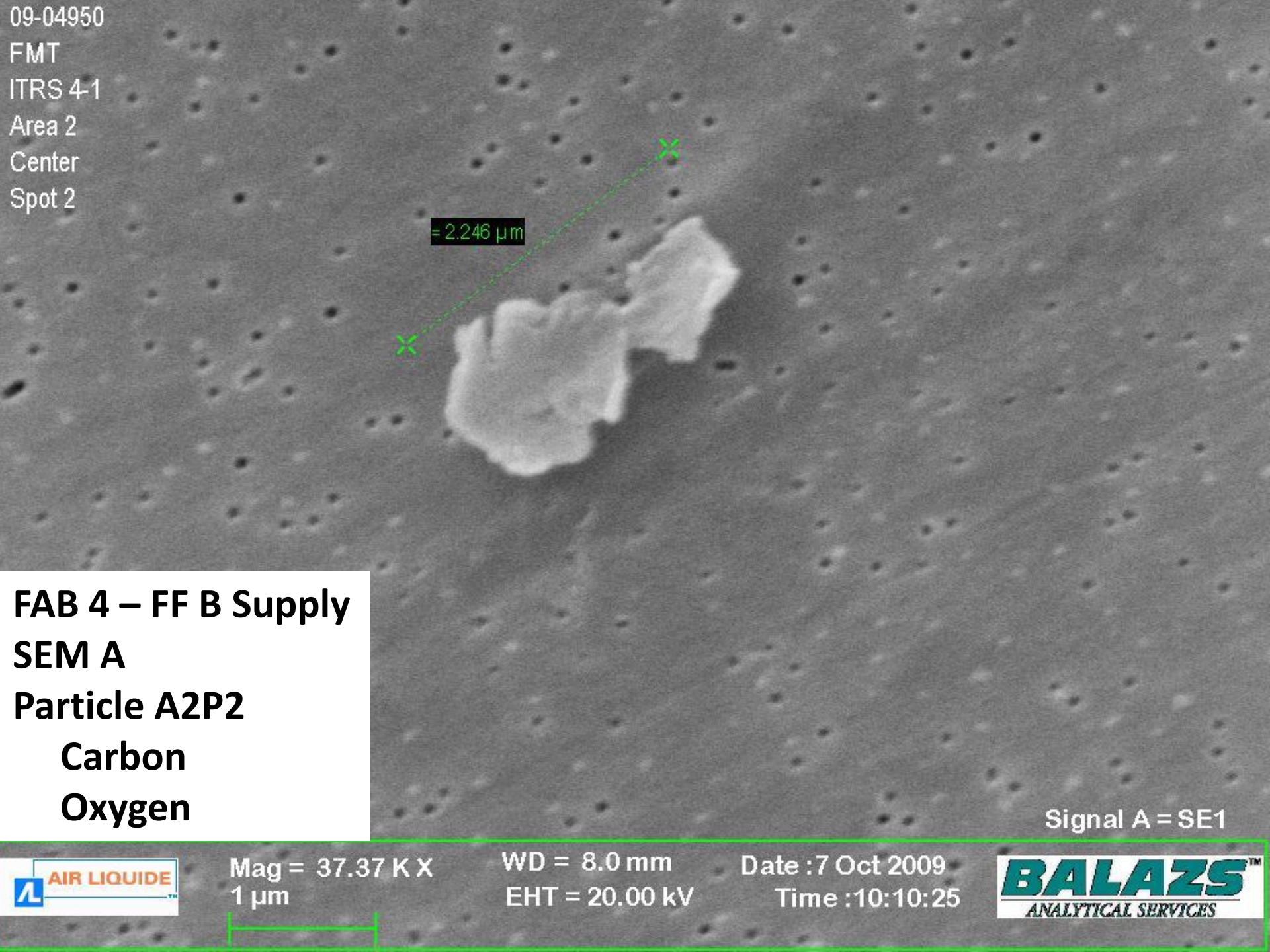


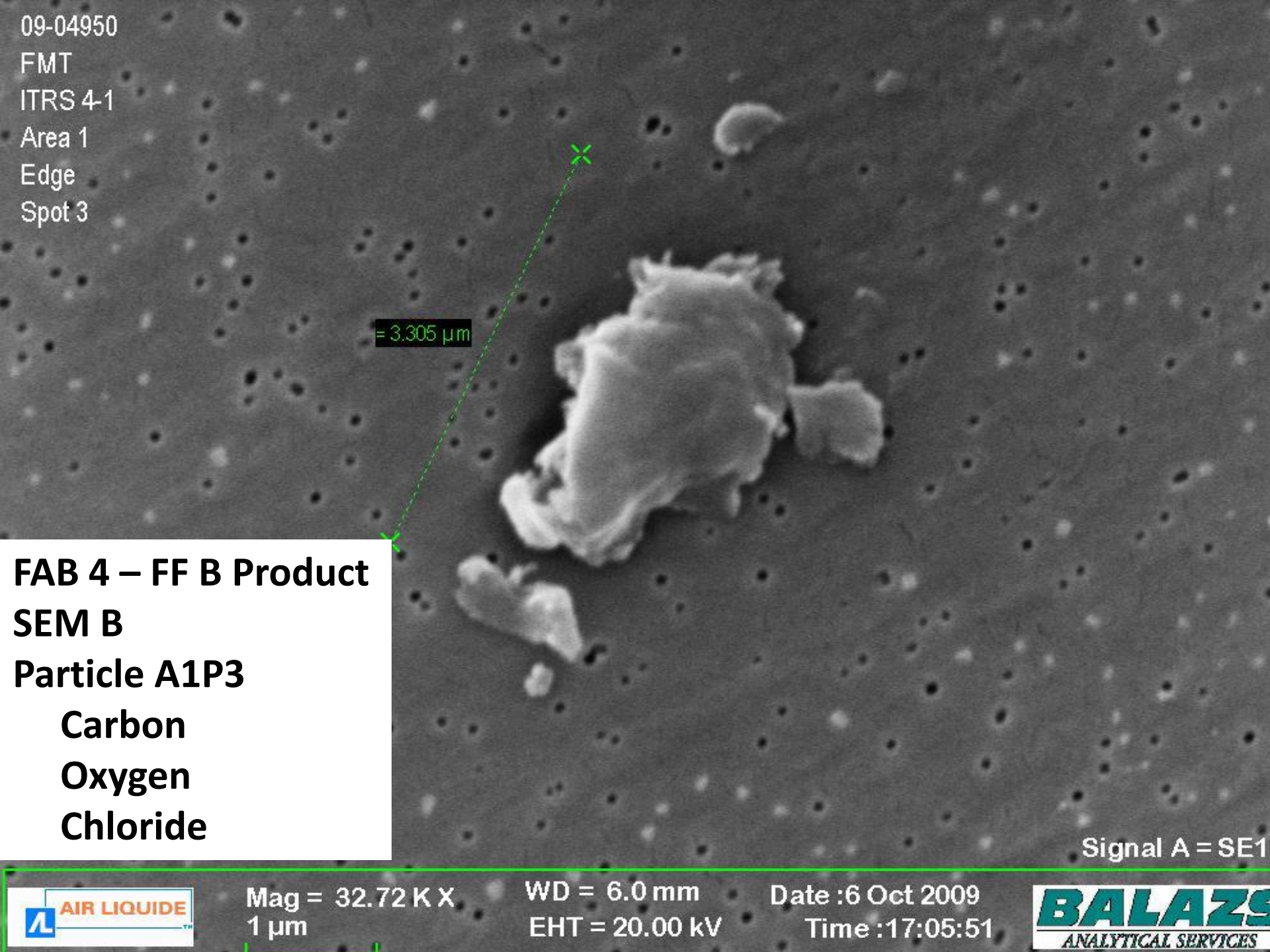
Date and Time	Particles > 50nm
10/1/2009 09:35	1394
10/1/2009 09:36	25
10/1/2009 09:37	33
10/1/2009 09:38	12
10/1/2009 09:39	30
10/1/2009 09:40	13
10/1/2009 09:41	7
10/1/2009 09:42	8
10/1/2009 09:43	12
10/1/2009 09:44	149
10/1/2009 09:45	0


Fab 4 - Final Filtration B Product
I-V Response during SEM Release
Voltage
Current
Time
V
I
9:34:02
9:34:13
9:34:24
9:34:36
9:34:47
9:34:59
9:35:36
9:35:41
9:35:46
9:35:51
9:35:59
9:36:11
9:36:23
9:36:35
9:36:47
9:37:00
9:37:12
9:37:24
9:37:36
9:37:48
9:38:00
9:38:12
9:38:24
9:38:37
9:38:49
9:39:01
9:39:13
9:39:25
9:39:37
9:39:49
9:40:02
9:40:14
9:40:26
9:40:38
9:40:50
9:41:02
9:41:14
9:41:26
9:41:39
9:41:51
9:42:03
9:42:15
9:42:27
9:42:40
9:42:52
9:43:04
9:43:16
9:43:29
9:43:41
9:43:53
9:44:05
9:44:17
9:44:30

FAB 4 - Final Filtration B Product
Percent Elemental Concentration in Particles




09-04950
FMT
ITRS 4-1
Area 2
Center
Spot 2
= 2.246 µm
FAB 4 – FF B Supply
SEM A
Particle A2P2
Carbon
Oxygen
Signal A = SE1
AIR LIQUIDE
Mag = 37.37 K X
1 µm
WD = 8.0 mm
EHT = 20.00 kV
Date :7 Oct 2009
Time :10:10:25
BALAZS
ANALYTICAL SERVICES



FAB 4 – FF B Product
SEM B
Particle A1P3

- **Carbon**
- **Oxygen**
- **Chloride**

FAB 4 – FF B Product
SEM 1
Particle A1P1
Aluminum

New Particle Metrology Supports the 2008 Front End Process Defect Targets.

- Identifies elemental composition
- Operates below 50 nm particle size
- Provides concentration data
- Leverages proven SEM analysis techniques
- Provides fast and actionable data