



The NELAC Institute

Manual Integration

Assessment Forum

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City of Phoenix



Discussion Topics



What Is It



Why Do We Need It with Examples



Areas of Concern



Requirements

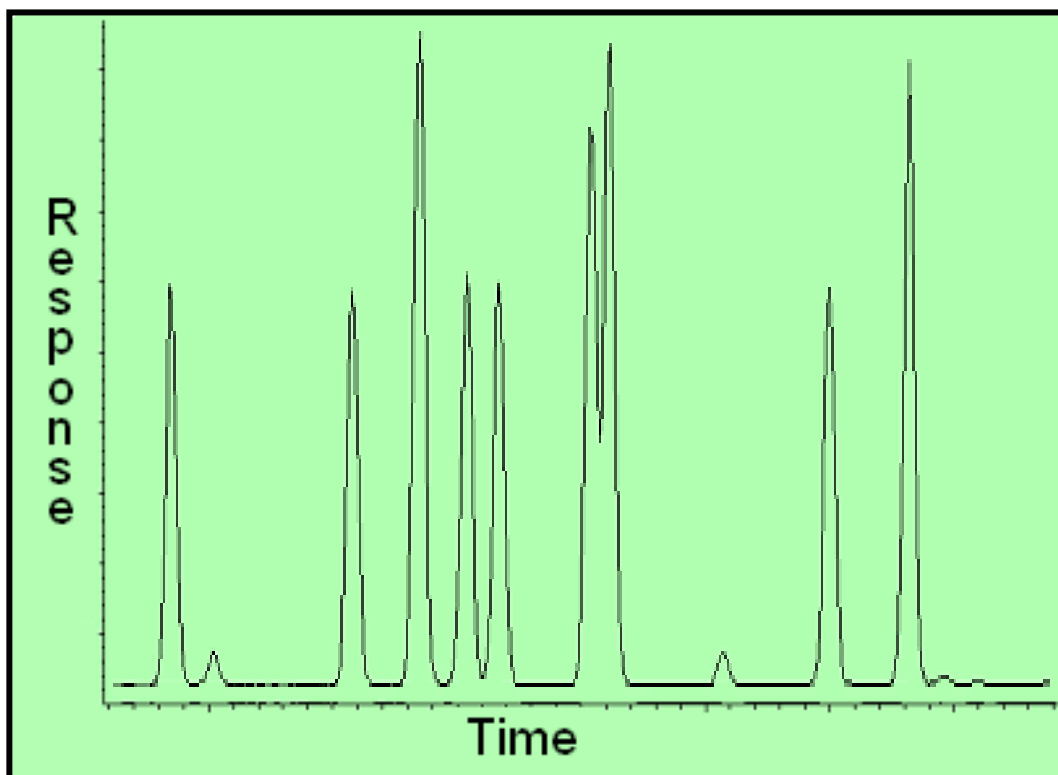


Documentation



What is Manual Integration?

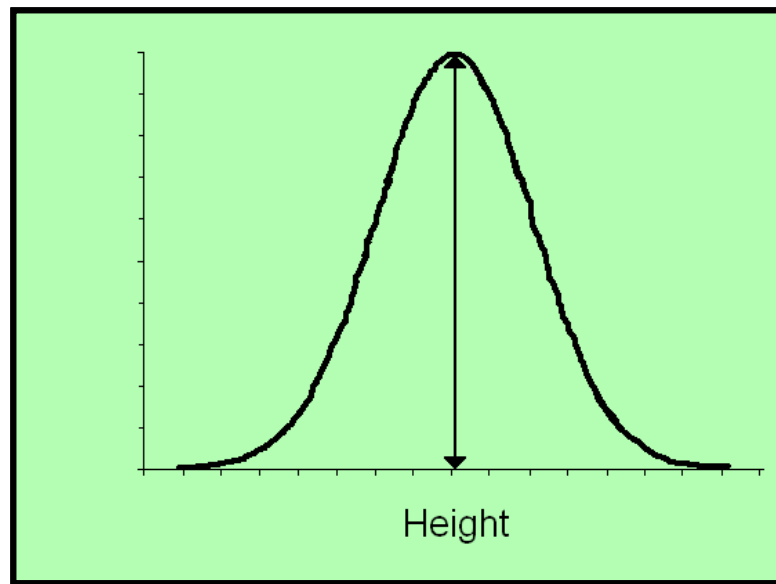
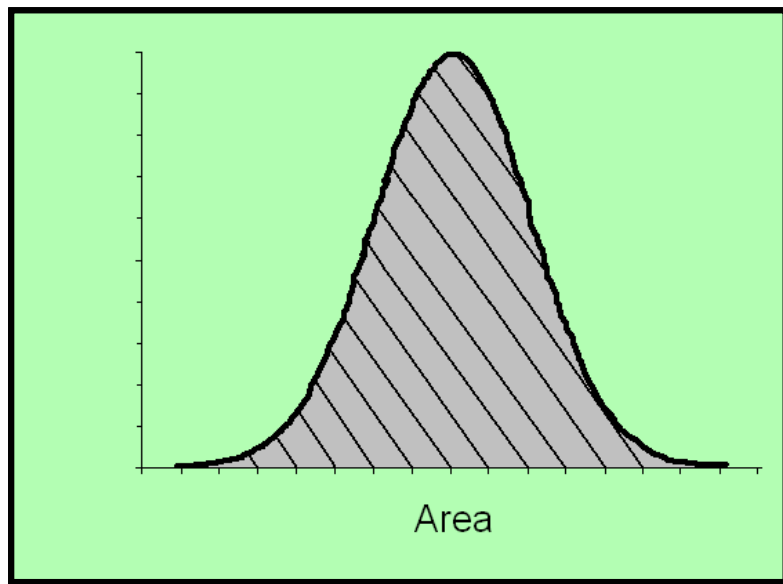
Peak integration is the process used by chromatographic software to determine peak area or height used for quantitation.





What is Manual Integration?

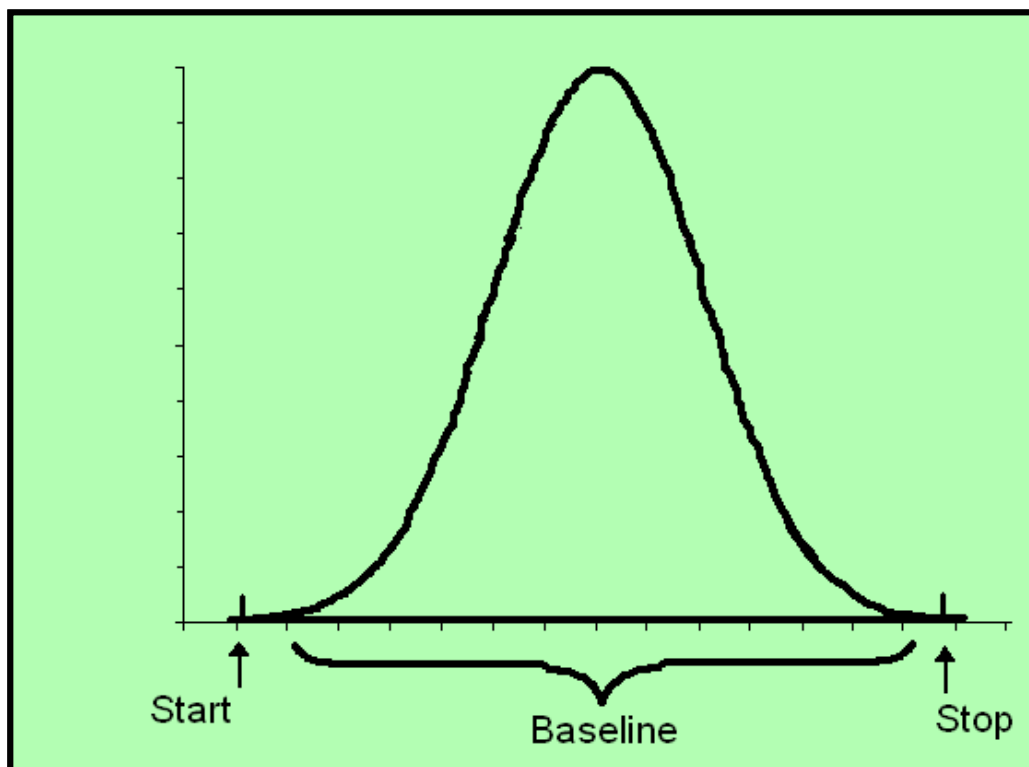
The software may be configured to perform “Automatic Integration” through defined integration parameters.





What is Manual Integration?

“Manual Integration” is the process employed by the data user to integrate peak height or area by manually setting the baseline using chromatographic software.





Why Do We Need To Do It?

Manual integration is performed by the data user when the automatic integration performed by the data system is in error:

- ✓ Software integration limitations;
- ✓ Complicated chromatography due to sample matrix interferences; or
- ✓ Poor resolution or response.

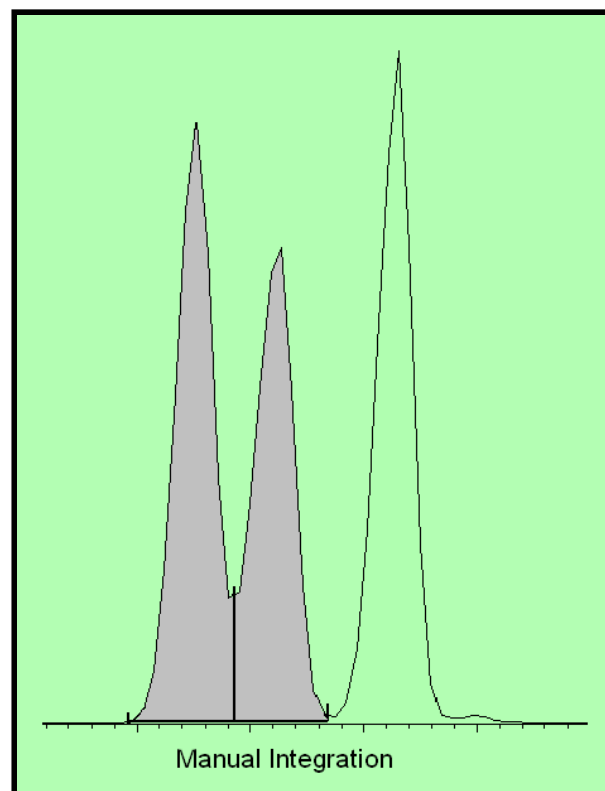
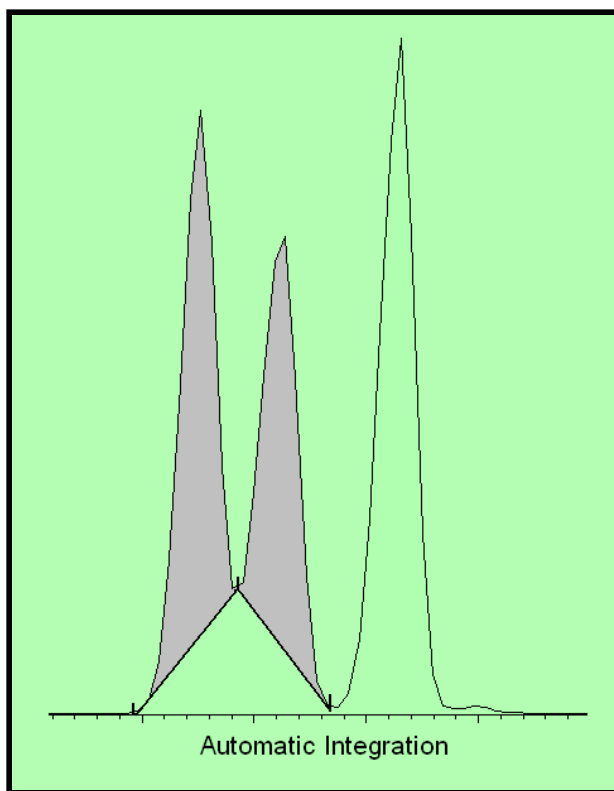


Why Do We Need To Do It?

Software Error: Peak is Not Integrated

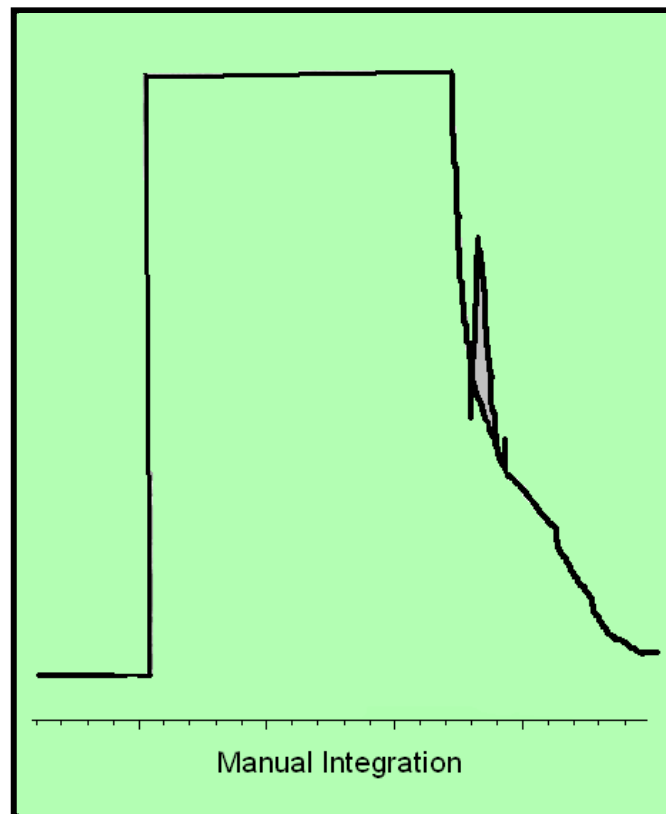
Software Error: Wrong Peak Identified

Why Do We Need To Do It?



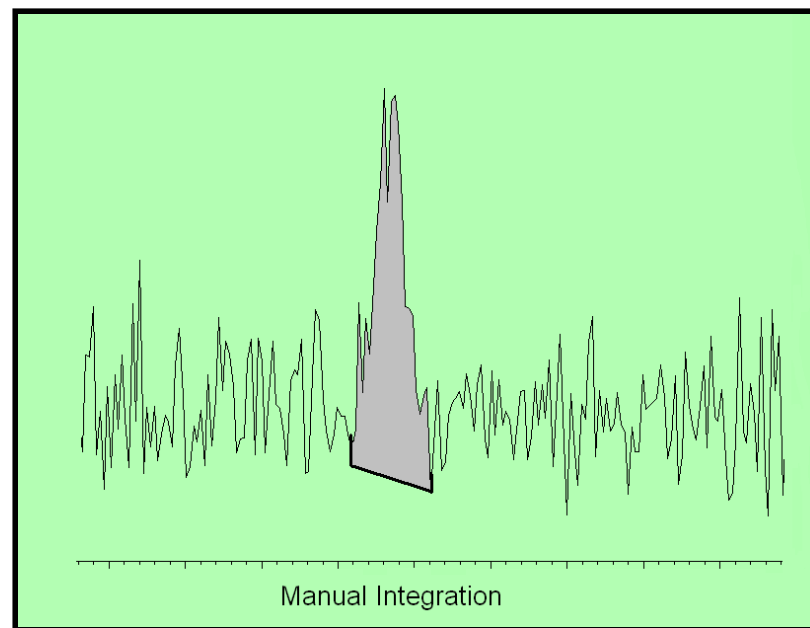
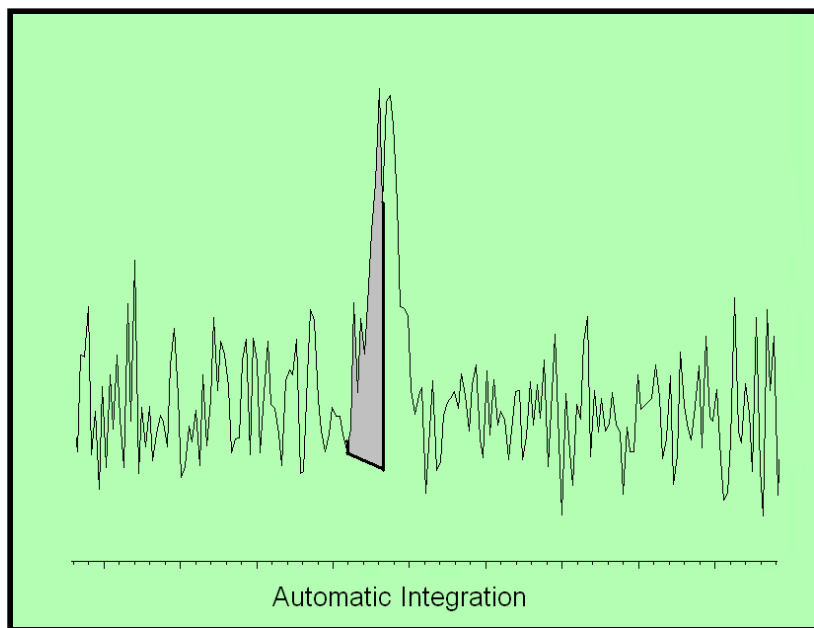
Chromatography Problem 1: Split Peaks

Why Do We Need To Do It?



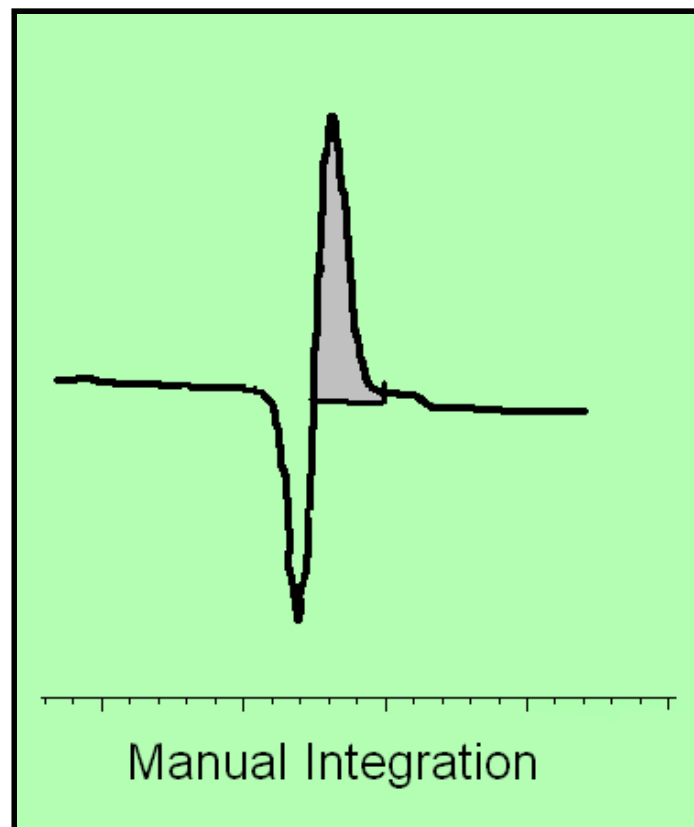
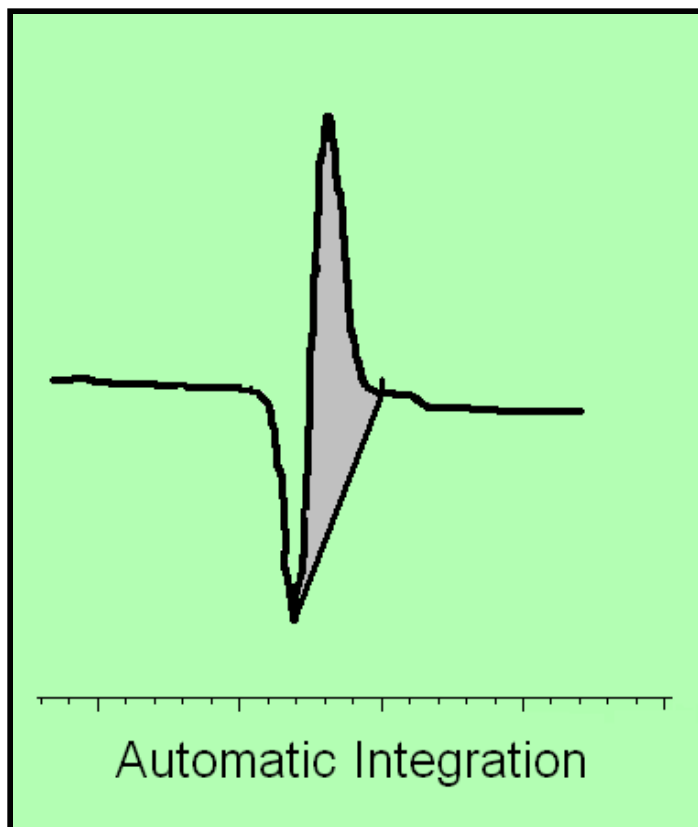
Chromatography Problem 2:
Coelution of Target Compounds/Shoulders

Why Do We Need To Do It?



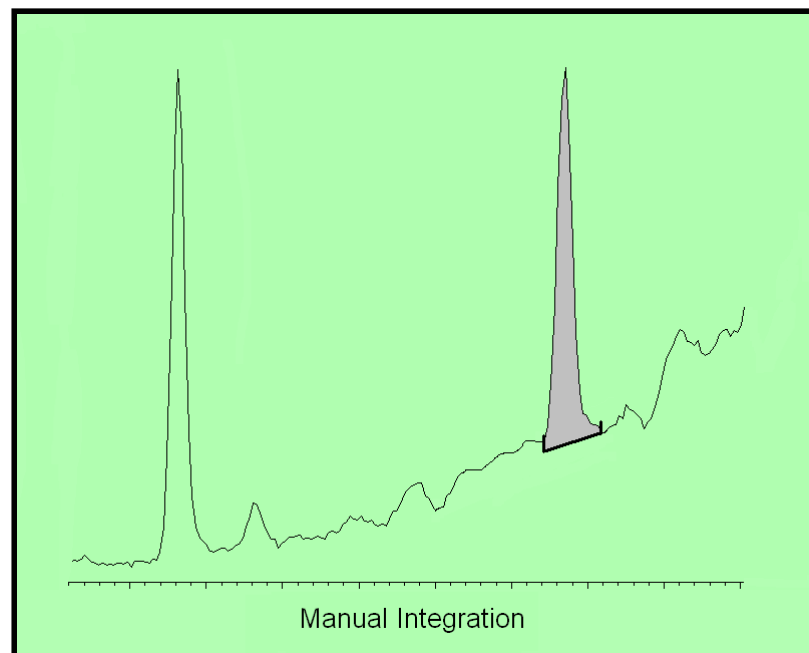
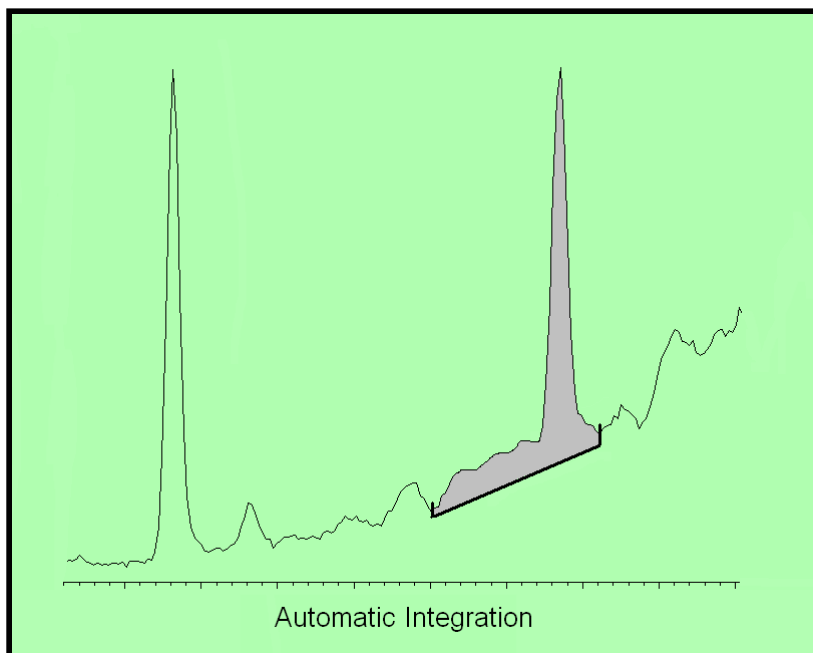
Chromatography Problem 3: Baseline Noise

Why Do We Need To Do It?



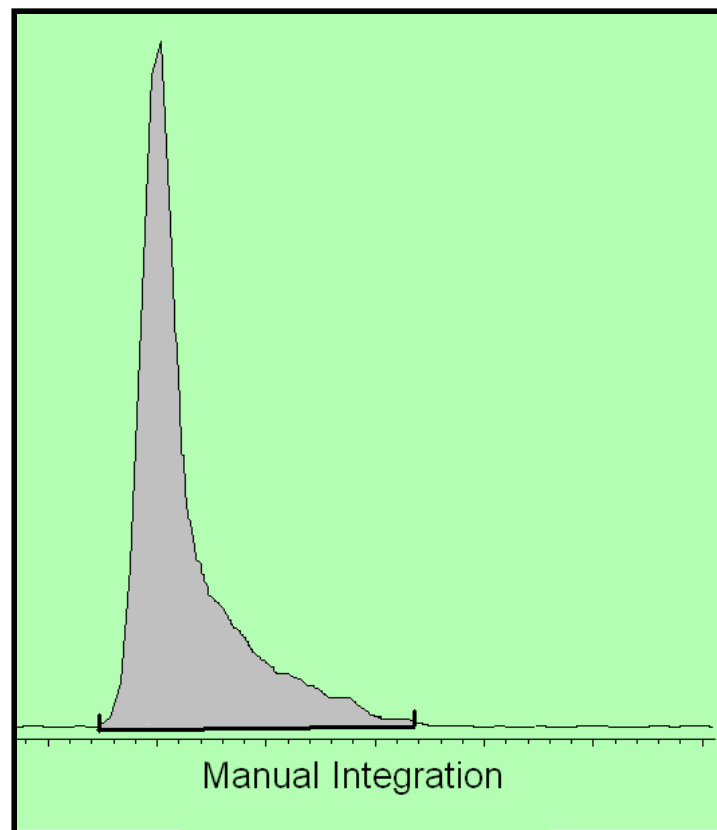
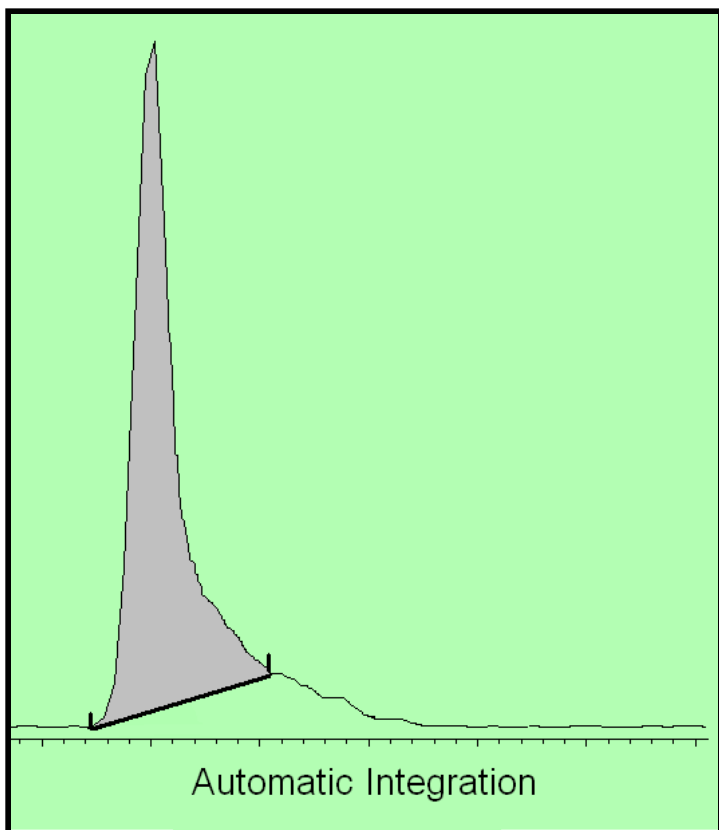
Chromatography Problem 4:
Negative Peaks

Why Do We Need To Do It?



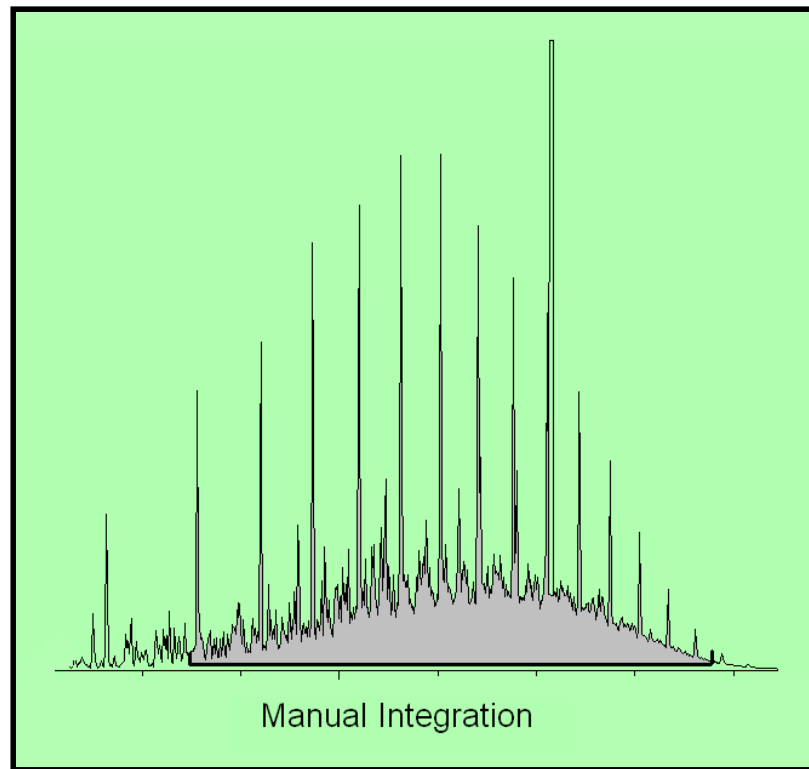
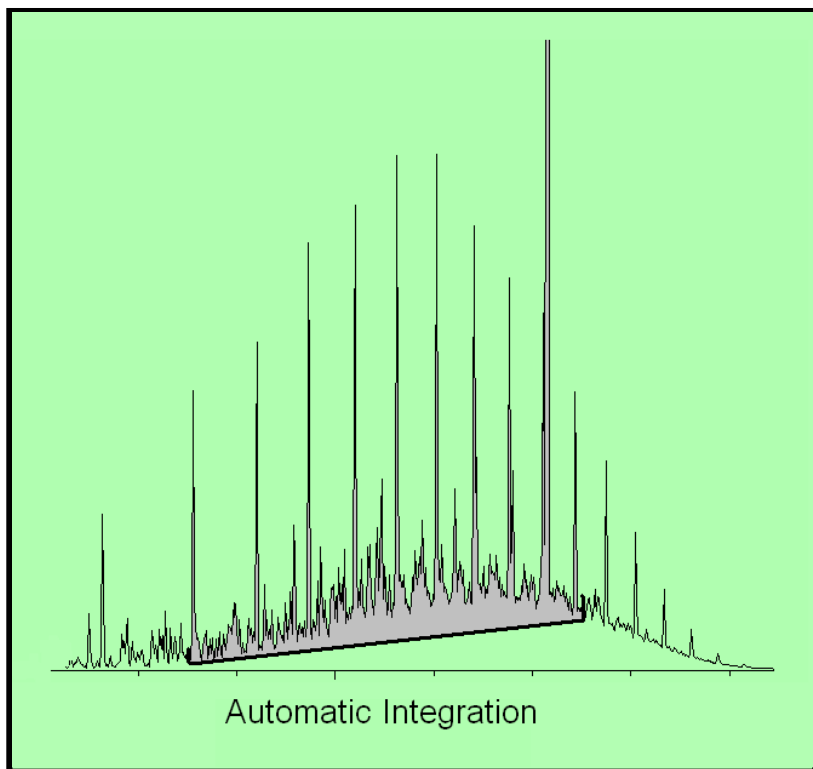
**Chromatography Problem 5:
Rising or Falling Baselines**

Why Do We Need To Do It?



Chromatography Problem 6:
Excessive Peak Tailing

Why Do We Need To Do It?



Chromatography Problem 7:
Integration of Hydrocarbons



Areas of Concern

Manual integration is a perfectly acceptable, and expected procedure to be performed on chromatographic data that has not been integrated appropriately using the software's automatic integration procedures.



Areas of Concern

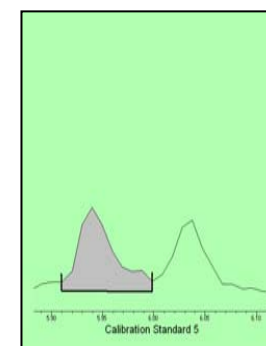
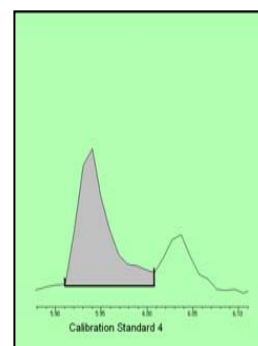
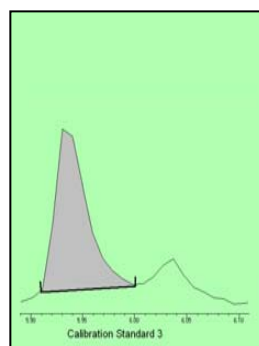
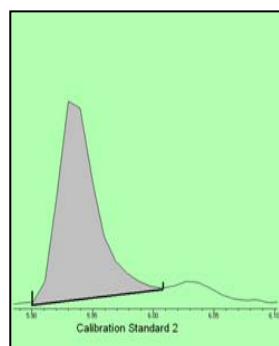
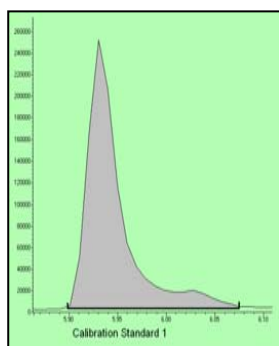
A “No Manual Integration” Policy is a problem...

Computers aren't always right!



Areas of Concern

Consistent and appropriate integrations are scientifically defensible...inconsistent or inappropriate integrations are difficult to defend.

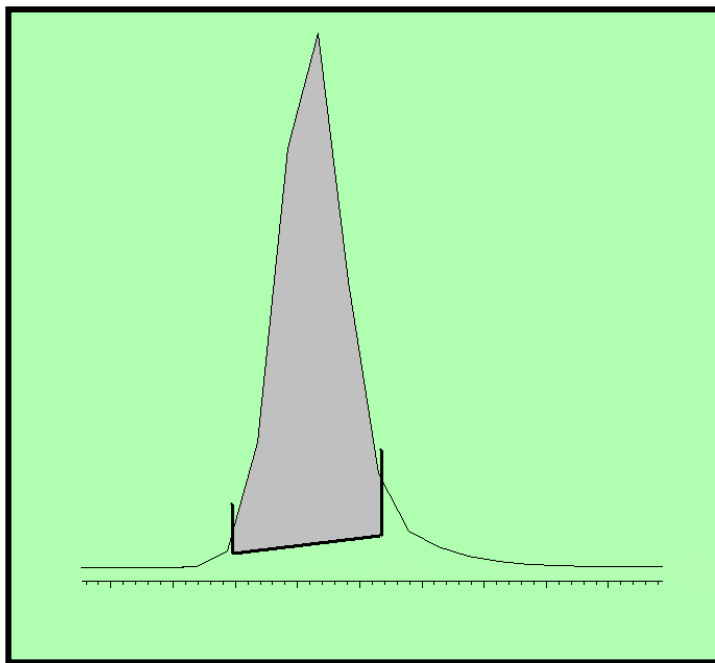


All standards, samples and QC samples must be integrated in the same manner.



Areas of Concern

Manual integrations should NEVER be performed in an attempt to make the data meet method acceptance criteria:

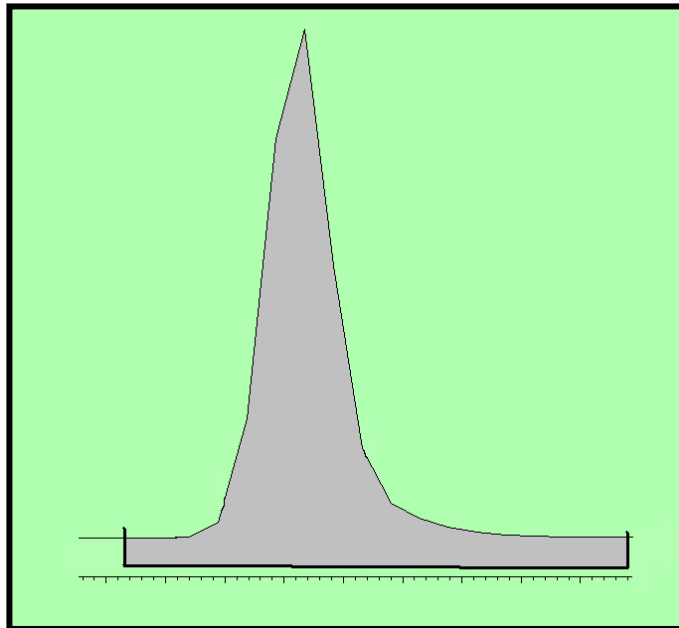


Removing Area from the Peak a.k.a. “Peak Shaving”



Areas of Concern

Manual integrations should NEVER be performed in an attempt to make the data meet method acceptance criteria:

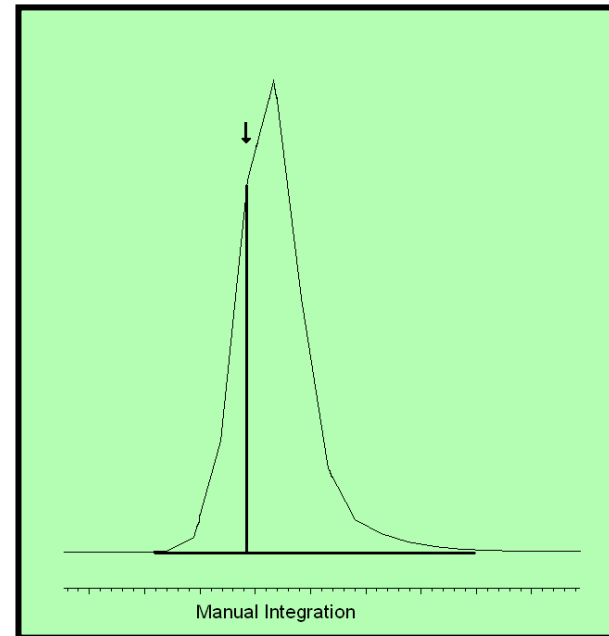
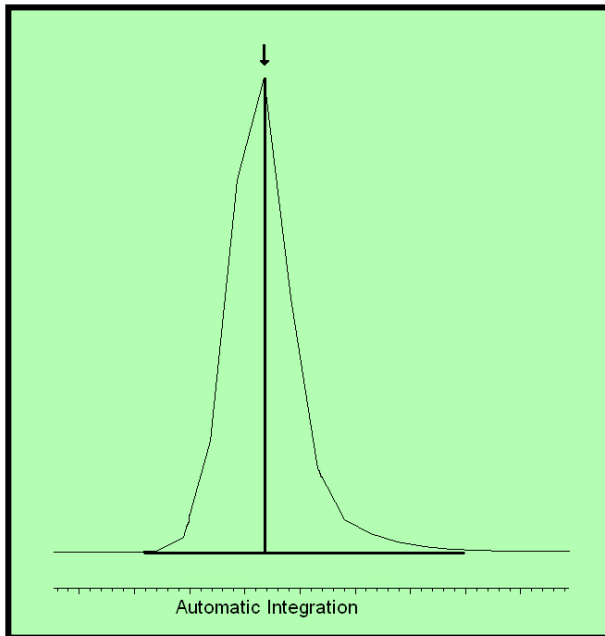


Adding Area to the Peak a.k.a. “Peak Enhancing”



Areas of Concern

Manual integrations should NEVER be performed in an attempt to make the data meet method acceptance criteria:



Changing Peak Height



Areas of Concern

Corrective or Preventative Actions, not manual integration, should be performed when poor resolution or response is the problem.

Enlarged chromatograms must be used to discern the baseline noise.

Always review hard copy data against electronic data.



NELAC 2003 Requirements



On-Site Assessment

Chapter 3, Appendix C, Section C.4.1.7.8

Procedures for allowing manual correction of raw data (e.g. manual integration) and for overriding instrument qualitative results.



Quality Systems

Chapter 5, Control of Records

Section 5.4.12.1.5

The laboratory shall establish a record keeping system that allows the history of the sample and associated data to be readily understood through the documentation. This system shall produce unequivocal, accurate records that document all laboratory activities....



Quality Systems

Chapter 5, Analytical Records

Section 5.4.12.2.2

Observations, data and calculations shall be recorded at the time they are made and shall be identifiable to the specific task.



Quality Systems

Chapter 5, Analytical Records

Section 5.4.12.2.5.3 e)

The essential information to be associated with the analysis..... shall be included

all manual calculations, e.g., manual integrations; and ,



Quality Systems

Chapter 5, Data Integrity Training

Section 5.5.2.7

Specific examples of breaches of ethical behavior should be discussed including improper data manipulations.....



Quality Systems

Chapter 5, Control of Data

Section 5.5.4.7

Calculations and data transfers shall be subject to appropriate checks in a systematic manner.



Quality Systems

Chapter 5, Control of Data

Section 5.5.4.7.1 c)

The laboratory shall establish SOPs addressing manual calculations including manual integrations.



Quality Systems

Chapter 5, Control of Data

Section 5.5.4.7.2.b)

procedures are established and implemented for protecting the data; such procedures shall include, but not be limited to, integrity and confidentiality of data entry or collection, data storage, data transmission and data processing;



TNI Volume 1, Module 2



General Requirements

Volume 1, Module 2

Control of Records (4.13.2.2)

Observations, data and calculations shall be recorded at the time they are made and shall be identifiable to the specific task.



General Requirements

Volume 1, Module 2

Control of Records (4.13.3 a)

The laboratory shall establish a record keeping system that allows the history of the sample and associated data to be readily understood through the documentation. This system shall produce unequivocal, accurate records that document all laboratory activities....



General Requirements

Volume 1, Module 2

Control of Records (4.13.3 f)

All information necessary for the historical reconstruction of data must be maintained by the laboratory.

vii. all manual calculations;



General Requirements

Volume 1, Module 2

Data Integrity Training (5.2.7 e)

Specific examples of breaches of ethical behavior such as improper data manipulations.....



General Requirements

Volume 1, Module 2

Control of Data (5.4.7.1)

Calculations and data transfers shall be subject to appropriate checks in a systematic manner.



General Requirements

Volume 1, Module 2

Control of Data (5.4.7.2 b)

procedures are established and implemented for protecting the data; such procedures shall include, but not be limited to, integrity and confidentiality of data entry or collection, data storage, data transmission and data processing;



Documentation

- ✓ Procedures for All Manual Calculations
(Manual Integrations)

- ✓ Training
(Manual Calculations, Peer Review, and Data Integrity)

- ✓ Analytical Records – All Manual Calculations
(Manual Integrations)



Manual Integration Documentation

✓ Include both the original and manually integrated chromatograms

(NELAC 2003 Analytical Records - historical reconstruction)

✓ Analyst's Initials and Date and Reason

(NELAC 2003 Analytical Records – all lab activities)

✓ Reviewer's Initials and Date

(NELAC 2003 Control of Data – appropriate checks / systematic manner)

✓ Review electronic data against hard copy

(NELAC 2003 Control of Data – protecting the data)



FINALLY...

Manual Integrations are necessary for the generation of data of known and documented quality.

Just because a manual integration has been documented does not mean it's acceptable and/or appropriate.



References

- ✓EPA Region 9 SOP #835, “Chromatographic Integration Procedures”
- ✓Florida Department of Health SOP CM-018-1.5, “Laboratory Policy Regarding Manual Chromatographic Peak Integration”
- ✓EPA OIG Report No. 2006-P-00036, “Promising Techniques Identified to Improve Drinking Water Laboratory Integrity and Reduce Public Health Risks”
- ✓“Chromatographic Integration Methods”, Second Edition, Norman Dyson, 1996



Thank You

Questions?