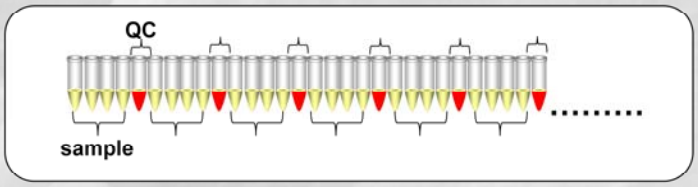
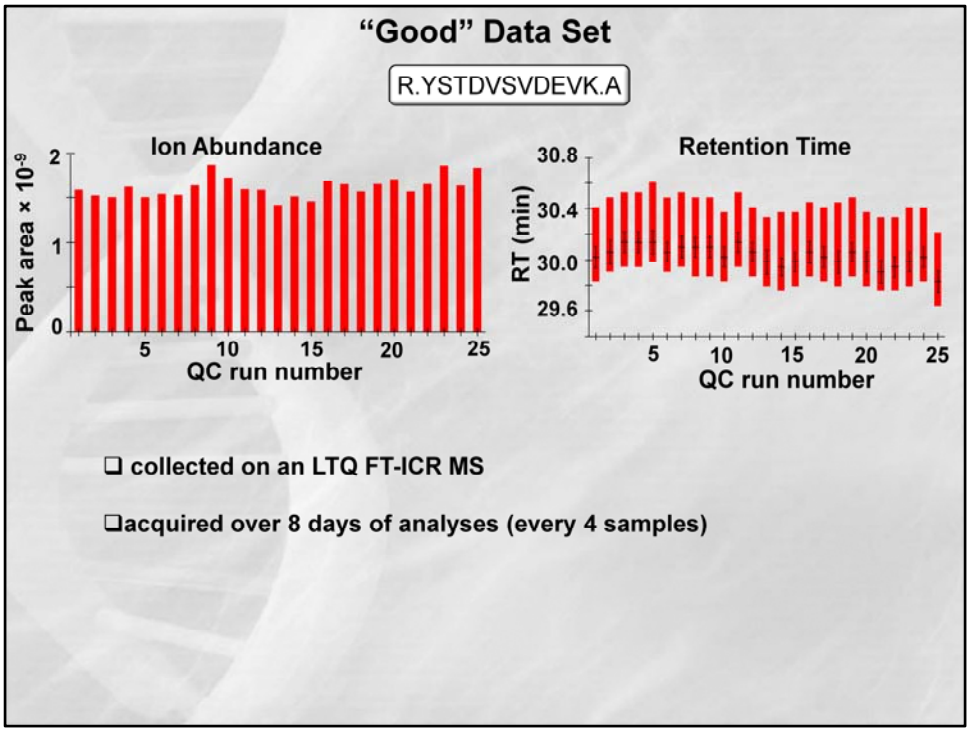
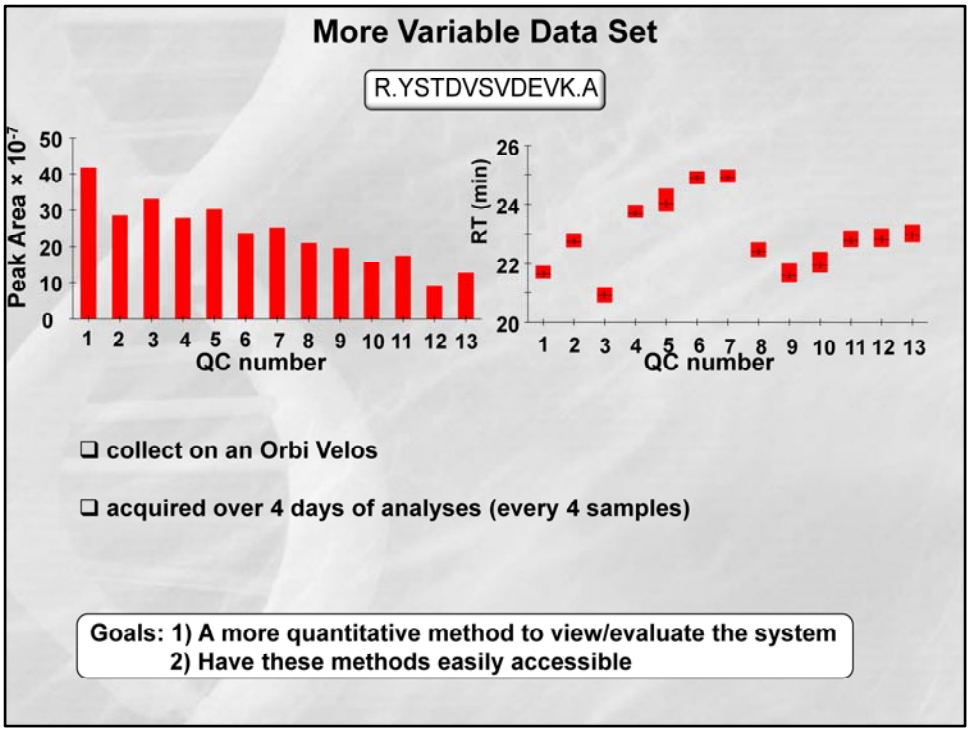
Systems Suitability – Large Sample Sets

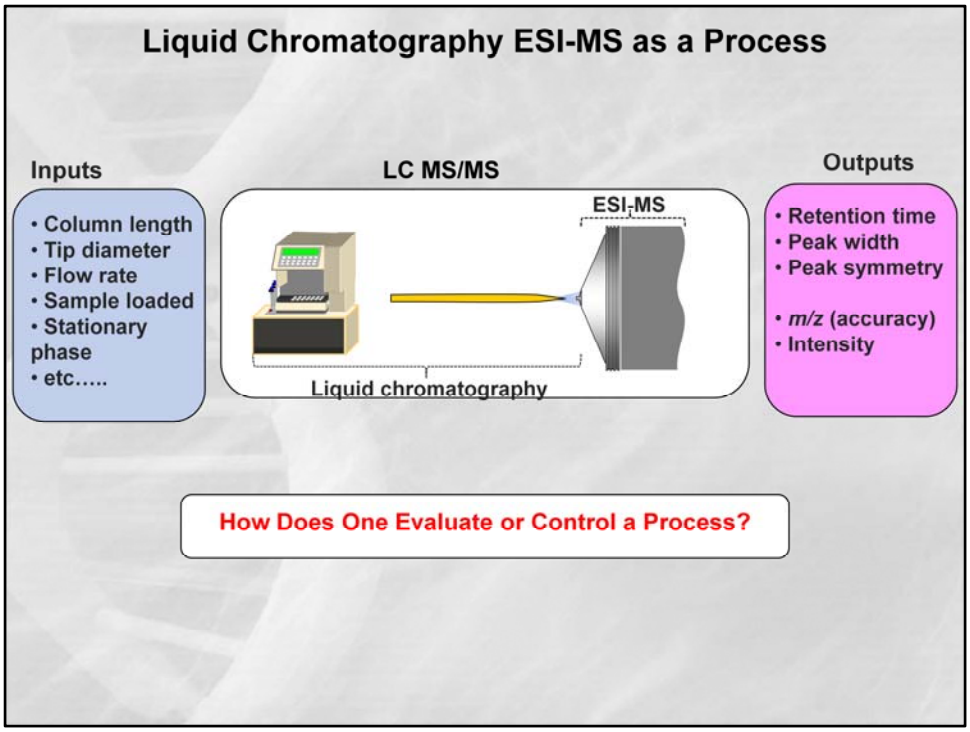


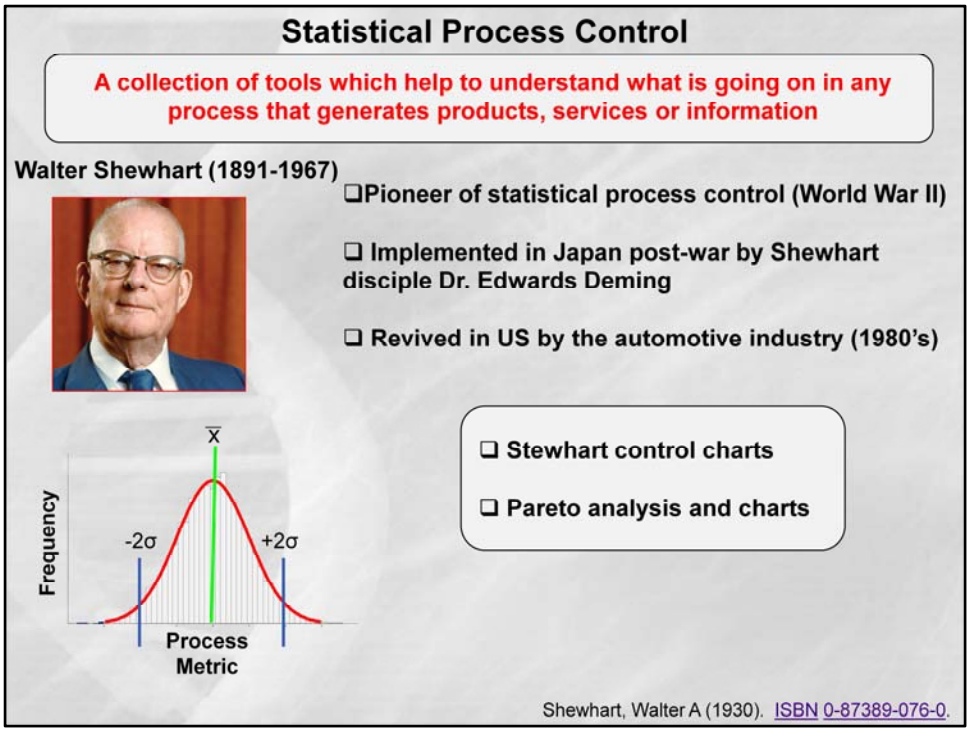
- ❑ QC (standard bovine digest) ran every 4-5 samples
- ❑ Full scan MS1 and Target 6-10 stable peptides (varying retention times)
- ❑ Monitor peak area (abundance) and retention time in Skyline


"Good" Data Set
R.YSTDVSVDEVK.A
Ion Abundance
Peak area × 10^-9
2
1
0
5
10
15
20
25
QC run number
Retention Time
RT (min)
30.8
30.4
30.0
29.6
5
10
15
20
25
QC run number
❑ collected on an LTQ FT-ICR MS
❑acquired over 8 days of analyses (every 4 samples)



This variability is very important – not only is this hurting our sensitivity its increasing our variance which limits our power to identify true differences


Liquid Chromatography ESI-MS as a Process
Inputs
• Column length
• Tip diameter
• Flow rate
• Sample loaded
• Stationary phase
• etc…..
LC MS/MS
ESI-MS
Liquid chromatography
Outputs
• Retention time
• Peak width
• Peak symmetry
• m/z (accuracy)
• Intensity
How Does One Evaluate or Control a Process?

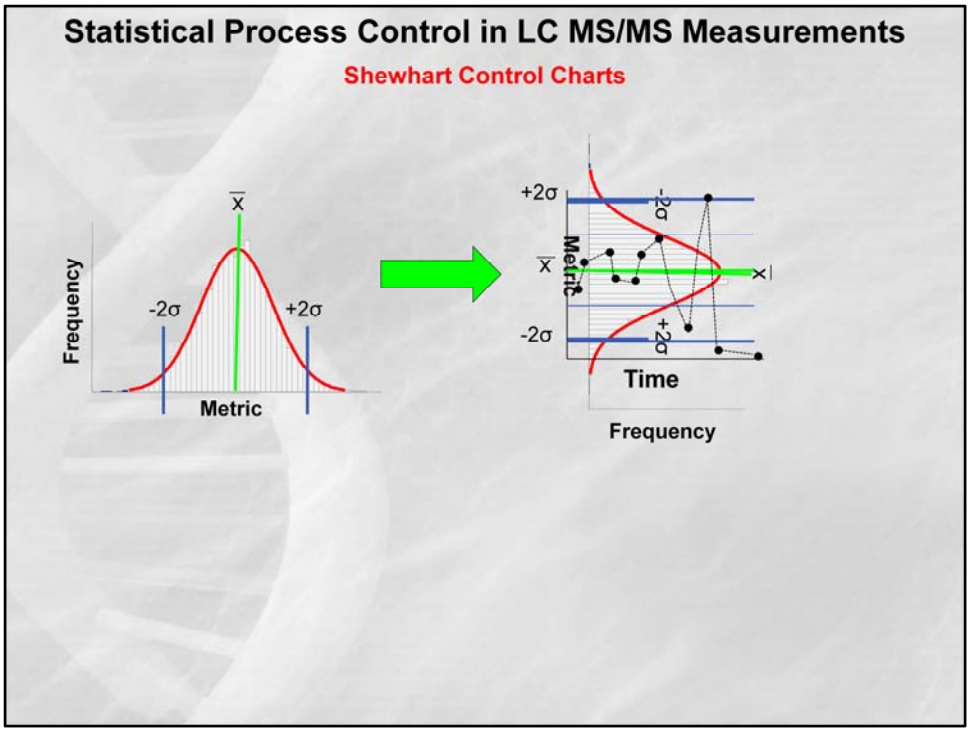


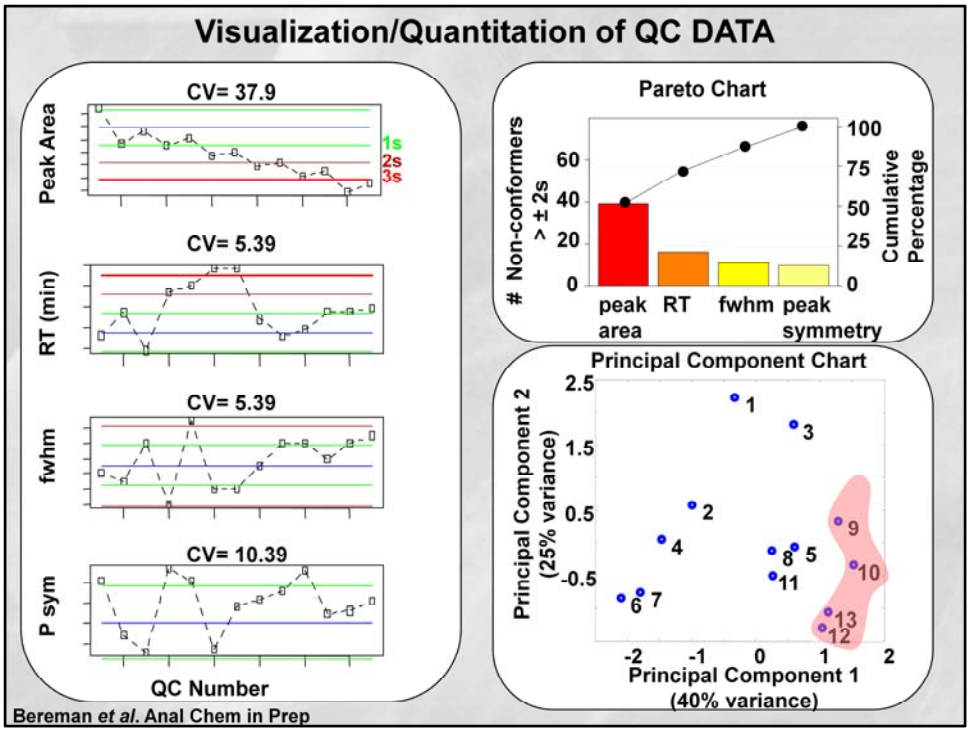
The birth of Modern Quality Control is often associate with a man named Walter Shewhart He was a physicist working at Bell Laboratories and got involved in industrial Production problems. And developed very usefl statistical techniques for analyzing and controlling processes in industry and were applied most extensively and sucessfully in war production during World War II. Then post war production these theories were laregly ignored. Dr. Demming a Disciple of Shewart actually taught the japanese post war about quality management techniques and the principles of SPC he had learned from Shehwart. Japanese actually applied these techniques (after their industries had been destroyed by war). The turn around of japanese industry and the pre war notion of the country producing poor quality products

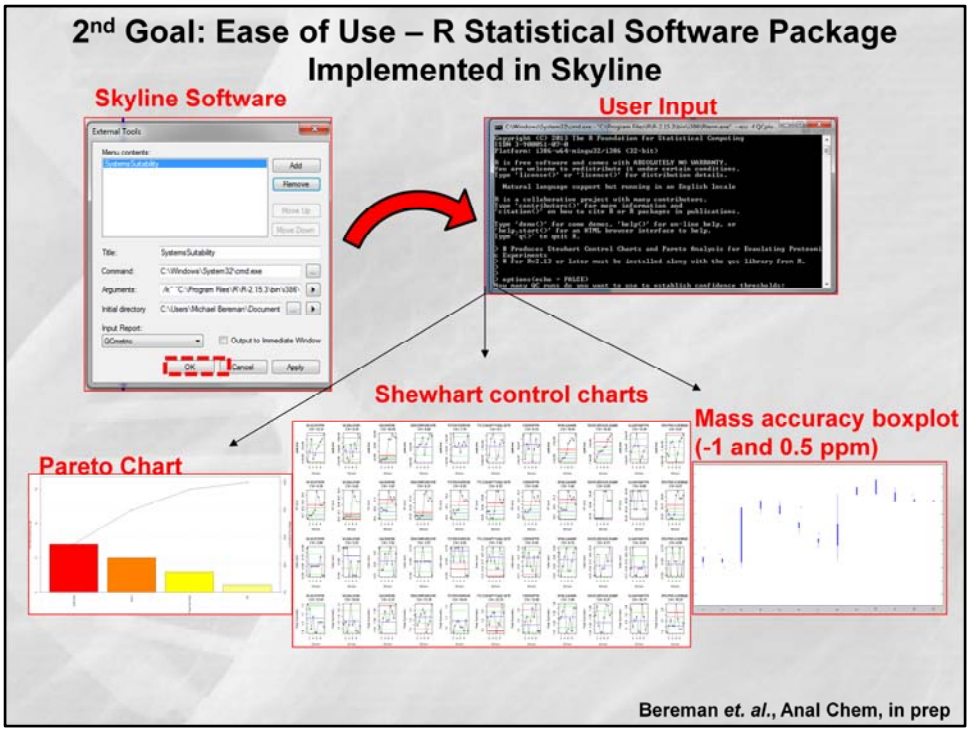
In the united states credit for a Major revival of SPC goes to the automatoic companies chiefly Ford Motor company – which began an aggressive compain for SPC - 20% SpC US companies had adopted. Intial efforts focused on detection of bad products… Demming was the first to say why are we interested in detection how about Prevention of bad products

The implementation of SPC by is accredited as the main driving force in the japanse industrial revolution and their often times superior product.

Dr. Shewhart identified two sources of process variation: **Chance** variation that is inherent in process, and stable over time, and **Assignable**, or**Uncontrolled** variation, which is unstable over time - the result of specific events outside the system. Dr. Deming relabeled chance variation as**Common Cause** variation, and assignable variation as **Special Cause** variation.


Statistical Process Control in LC MS/MS Measurements
Shewhart Control Charts
Frequency
-2σ
+2σ
Metric
+2σ
-2σ
Metric
Time
Frequency


Visualization/Quantitation of QC DATA
CV= 37.9
Peak Area
1s
2s
3s
CV= 5.39
RT (min)
CV= 5.39
fwhm
CV= 10.39
P sym
QC Number
Pareto Chart
Non-conformers > ± 2s
Cumulative Percentage
peak area
RT
fwhm
peak symmetry
Principal Component Chart
Principal Component 2 (25% variance)
Principal Component 1 (40% variance)
Bereman et al. Anal Chem in Prep



Peak areas electrospray are very important Whats nice is we can can get this information in near real time. No exporting of data just readily implemented by click a button. Also since Skyline works across all major vendors this also works is vendor neutral.

Resources

- http://www.asms.org/member-center/interest-groups/lcms-and-related-topics (where these slides and list will be posted)

- http://www.lcresources.com/resources/TSWiz/TroubleShootingWiz.htm
- http://www.chromacademy.com/hplc-training.html
- http://www.chromacademy.com/mass-spec-training.html
- http://www.newobjective.com/electrospray/index.shtml
- http://www.abrf.org/index.cfm/list.index
- http://peptide.nist.gov/software/nist_msqc_pipeline/NIST_MSQC_Pipeline.html