

An aerial photograph of the Swansea University campus in Swansea, Wales, UK. The image shows a large, modern building complex with a prominent curved structure, surrounded by green spaces and trees. In the foreground, a sandy beach and the sea are visible. The text is overlaid in a bright green, italicized font.

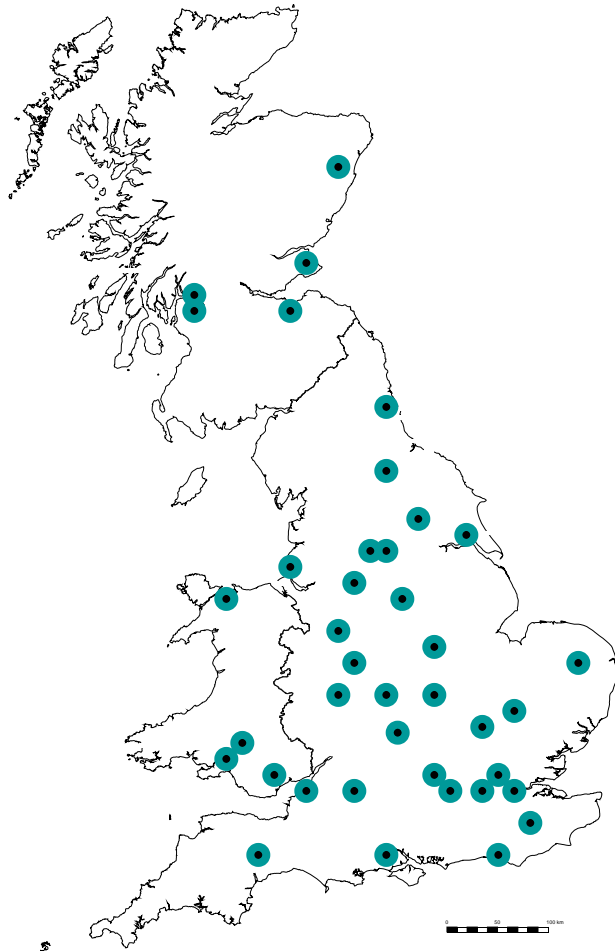
*Use of the Nanomate for reliable
accurate mass measurement in a service
environment*

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NMSSC



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Each year:

- 66 institutions
- 230 research groups
- 16,000 analyses
- <5 days average turnaround

EPSRC NMSSC Services

(Free to the UK academic community)

- Mass spectrometry (MS) analysis
- Supplement to university in-house services
- Problem solving
- Consultation
- Education
- Research and development

A major role of the service is delivery of an accurate mass measurement service, often with full scan spectrum also required:

- *Huge variety of sample types;*
- *Most samples "pure" products (target synthesis).*

History of NMSSC accurate mass methods since 2000

1

FULL SCAN

- (a) EI/CI with robotic probe
- (b) ESI with loop injection.

+

ACCURATE MASS

- Peak match on magnetic sector using (a) ESI (b) EI (c) other mode.

SNAGS

- *2-stage process requiring many staff and many instruments.*
- *EI/CI with robotic probe gave reliable results but required relatively high maintenance and knowledgeable staff.*
- *ESI with loop injection gave huge carry-over problems leading to confusing results and labour intensive solutions: e.g. repeat analyses and multiple blanks.*

History of NMSSC accurate mass methods since 2000

2

FULL SCAN

- (a)ESI with Nanomate
- (b)EI/CI with robotic probe

+

ACCURATE MASS

Peak match on magnetic sector using (a) ESI (b) EI (c) other mode.

IMPROVEMENTS

- ESI carry-over problems solved (so ESI becomes preferred method)*
- Use of different solvents and additives becomes easy and valid comparisons can be made due to lack of carry-over.*

SNAGS

- Process is still 2-stage requiring multiple staff and instruments.*
- Positive and negative analysis now require two analyses (Nanomate limitation).*

History of NMSSC accurate mass methods since 2000

3

FULL SCAN

+

ACCURATE MASS

(a) ESI on Nanomate with Orbitrap gives full-scan acc. mass

(b) Other ionisation modes

(b) Peak match on magnetic sector using other modes.

SNAGS

• Inadequate auto-reporting software makes data processing the new slow step.

IMPROVEMENTS

- 1-stage process with concomitant advantages.*
- Other improvements gained in method 2 are retained.*
- Method suitable for more than 80% of NMSSC accurate mass work.*

High-resolution full-scan accurate mass system in NMSSC:
Advion Nanomate with ThermoFisher LTQ-Orbitrap

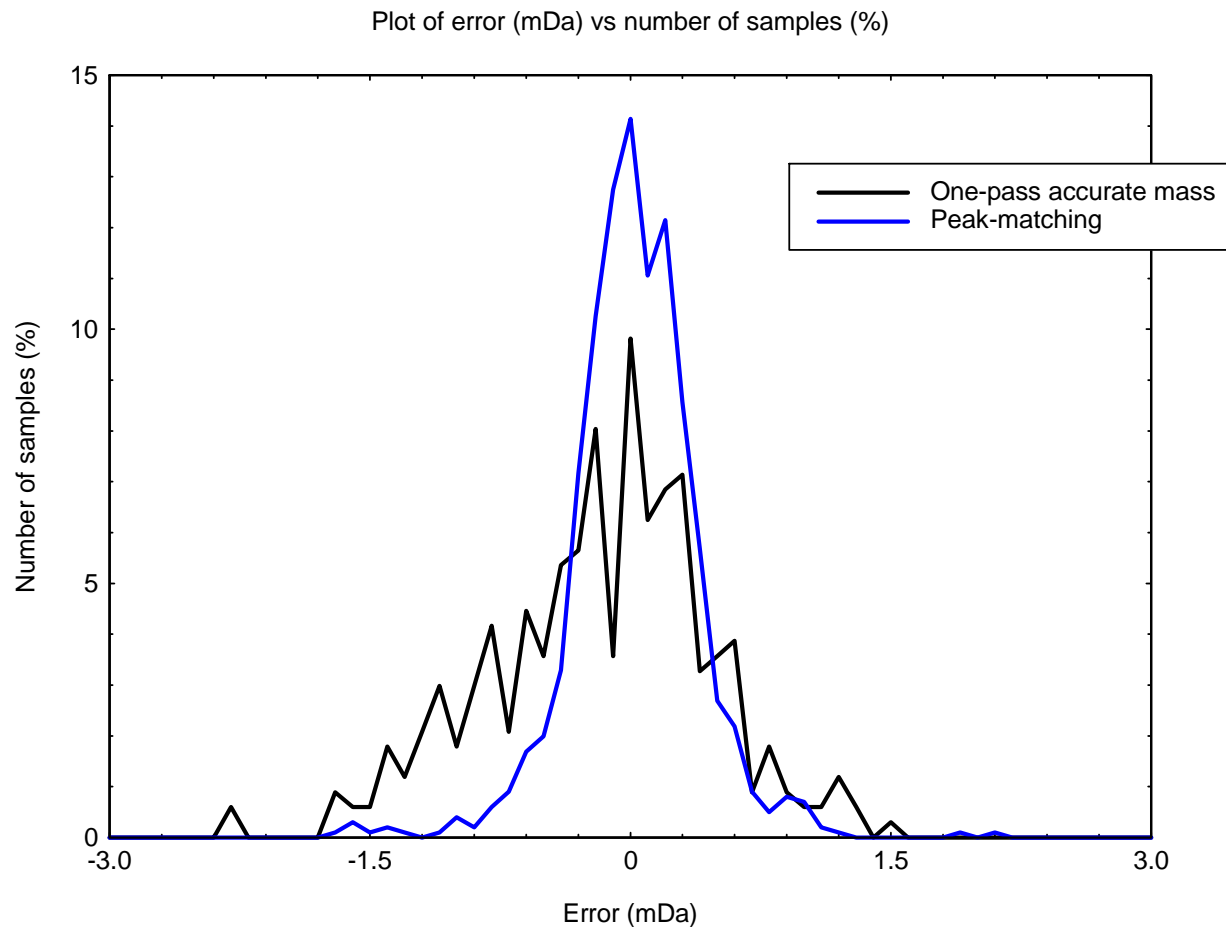


Advantages of new method

- One-stage process so fewer instruments and staff required.
- Faster sample turnaround.
- Improved laboratory efficiency, throughput and cost effectiveness.
- Use of Triversa NanoMate allows high sample throughput, with minimal repeats or carry-over (4 analyses per minute).
- Facility for accurate mass MS/MS and MSⁿ adds value.
- High-resolution with accurate mass over the full-scan mass range gives increased confidence for characterisation due to:
 - Accurate masses of all isotopes
 - Elemental identification (e.g. ³⁴S)
- Improved analytical quality and extended capability.

Accuracy of measurements

RMS mass error is 0.35mDa (peak-matching) and 0.43 mDa (Orbitrap full-scan).



Plot of error (mDa) vs. number of samples (%). Number of samples for peak matching 1004, number of samples for one-pass accurate mass 336 (August 2008).

- **Details of Full-scan Accurate Mass Method**

- Accurate mass measurements are obtained using the ThermoFisher LTQ Orbitrap XL mass spectrometer fitted with an Advion Nanomate Triversa nano-electrospray source.
- Accurate mass and characterisation spectra are obtained simultaneously at a resolution of 10^5 (at m/z 400).
- Typical Source Settings used:
 - Nano-electrospray voltage: 1.4kV;
 - Capillary temp.: 200°C;
- External mass calibration performed each day; Xcalibur v2.0.7 software used to process data.
- With a few exceptions*, samples for positive mode analysis are diluted into 1ml MeOH (10% NH₄OAc) before loading into the NanoMate tray.
- Samples requiring confirmation of anion are analysed by switching polarity on the LTQ – due to the limitation of the NanoMate this requires a second analysis.
- Using the standard electrospray source with loop-injection or LC autosampler, polarity-switching can be performed in one pass.

*Salts, organometallics, water sensitive compounds

Conclusions

- Nanomate (or similar zero-carryover device) is key to reliable ESI compound screening when analyte types are very varied.
- As well as the expected and obvious advantages, the Nanomate brings added value to our service through the total independence of different experiments without requirement for system purging.

Acknowledgements

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References

NMSSC poster: “Accurate Mass Measurement in a Service Environment”, BMSS Annual Conference, York 2008 [see: www.nmssc.ac.uk/publications].