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Published:

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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

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(54) Title: MULTI-DIMENSIONAL SURVEY SCANS FOR IMPROVED DATA DEPENDENT ACQUISITIONS

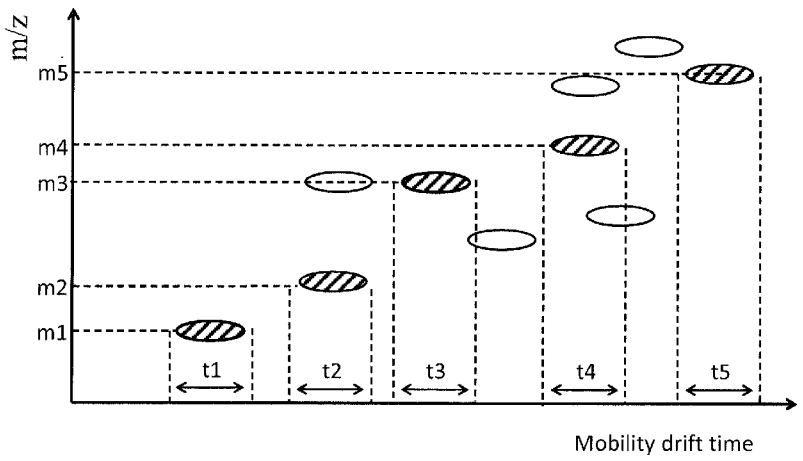

Figure 4

(57) Abstract: A method of analysing ions is disclosed comprising performing an initial multi- dimensional survey scan comprising separating parent ions according to a first physico- chemical property (e.g. ion mobility) and then separating the parent ions accord - ing to a second physico-chemical property (e.g. mass to charge ratio). A plurality of parent ions of interest are then determined from the initial multi-dimensional survey scan. Once parent ions of interest have been determined, the plurality of parent ions of interest are sequentially selected based upon the first and second physico-chemical properties during a single cycle of separation. The parent ions of interest may then be fragmented and corresponding fragment ions may then be mass analysed.

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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2013/050595

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01J49/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01J G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CHEROKEE S. HOAGLUND-HYZER ET AL: "Ion Trap/Ion Mobility/Quadrupole/Time-of-Flight Mass Spectrometry for Peptide Mixture Analysis", ANALYTICAL CHEMISTRY, vol. 73, no. 2, 1 January 2001 (2001-01-01), pages 177-184, XP055093020, ISSN: 0003-2700, DOI: 10.1021/ac0007783	1-24, 29-42
Y	abstract page 177, right-hand column page 179, left-hand column page 181, left-hand column page 182, paragraph Nested (Drift) Flight Time Distributions for ... figures 1-3,5	25-28
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 February 2014	27/02/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Cornelussen, Ronald

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2013/050595

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-24, 29-42

Methods of data dependent acquisition. Performing a survey scan in which ions are separated according to one or two physico-chemical properties. Based on the results of this survey scan several ions of interest are selected for further processing. In a subsequent experiment run these ions are subsequently selected and further analysed, e.g. by fragmenting them.

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2. claims: 25-28

Method of data dependent acquisition. The selection of ions of interest is similar to invention 1. Invention 2 differs from invention 1 in that several steps of fragmentation are performed during the analysis process.

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/023633 A1 (WANG YONGDONG [US] ET AL) 1 February 2007 (2007-02-01) paragraph [0027]	1,5-10, 13-18, 20-24, 29-31, 33,37,39
Y	US 2010/078551 A1 (LOBODA ALEXANDRE [CA]) 1 April 2010 (2010-04-01) paragraph [0038] - paragraph [0049] figure 2	25-28
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A	ERIN SHAMMEL BAKER ET AL: "An LC-IMS-MS Platform Providing Increased Dynamic Range for High-Throughput Proteomic Studies", JOURNAL OF PROTEOME RESEARCH, vol. 9, no. 2, 5 February 2010 (2010-02-05), pages 997-1006, XP055093300, ISSN: 1535-3893, DOI: 10.1021/pr900888b the whole document	34-36, 40-42
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A	HOAGLUND-HYZER C S ET AL: "Mobility Labeling for Parallel CID of Ion Mixtures", ANALYTICAL CHEMISTRY, AMERICAN CHEMICAL SOCIETY, US, vol. 72, no. 13, 1 July 2000 (2000-07-01), pages 2737-2740, XP002314242, ISSN: 0003-2700, DOI: 10.1021/AC0000170 the whole document	1-24, 29-42

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3

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	HOAGLUND-HYZER C S ET AL: "Coupling Ion Mobility Separations, Collisional Activation Techniques, and Multiple Stages of MS for Analysis of Complex Peptide Mixtures", ANALYTICAL CHEMISTRY, AMERICAN CHEMICAL SOCIETY, US, vol. 74, no. 5, 2 February 2002 (2002-02-02), pages 992-1006, XP002371949, ISSN: 0003-2700, DOI: 10.1021/AC010837S the whole document	1-24, 29-42
A	STEPHEN J. VALENTINE ET AL: "Toward Plasma Proteome Profiling with Ion Mobility-Mass Spectrometry", JOURNAL OF PROTEOME RESEARCH, vol. 5, no. 11, 1 November 2006 (2006-11-01), pages 2977-2984, XP055007695, ISSN: 1535-3893, DOI: 10.1021/pr060232i the whole document	1-24, 29-42
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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