Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 16 November 2023

Case Number: T 1106/20 - 3.4.03

Application Number: 14710625.6

Publication Number: 2973643

IPC: H01J49/00, G01N27/62

Language of the proceedings: EN

Title of invention:
A DDA EXPERIMENT WITH REDUCED DATA PROCESSING

Applicant:
Micromass UK Limited

Relevant legal provisions:
RPBA 2020 Art. 13(2)
EPC Art. 56

Keyword:
Amendment after summons - exceptional circumstances (yes) - taken into account (yes)
Inventive step - (no) - obvious alternative

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 1106/20 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 16 November 2023

Appellant: (Applicant)	Micromass UK Limited Stamford Avenue Altrincham Road Wilmslow SK9 4AX (GB)
Representative:	Dehns St. Bride's House 10 Salisbury Square London EC4Y 8JD (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 13 December 2019 refusing European patent application No. 14710625.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	G. Decker
Members:	J. Thomas
	A. Böhm-Pélissier

Summary of Facts and Submissions

I. The appeal is against the decision of the examining division to refuse European patent application No. 14 710 625 on the grounds that the claimed subject-matter did not involve an inventive step within the meaning of Article 56 EPC.

II. At the end of the oral proceedings before the board the appellant requested, as a sole request, that a patent be granted on the basis of the set of claims according to the main request filed with the letter dated 4 July 2023.

III. Reference is made to the following documents:
D1: WO 2008/025014 A2
D2: GB 2 389 704 A
D4: "Ion mobility - mass spectrometry", A. B. Kanu et al., Journal of Mass Spectrometry, 2008, Vol. 43, pages 1 to 22; XP 055006825

IV. Claim 1 of the main request reads as follows:

"*A method of mass spectrometry comprising:*
performing a survey scan of a plurality of different types of parent or precursor ions, wherein said survey scan comprises analysing the ion mobilities of the ions and mass analysing the ions;
determining the charge states of parent or precursor ions analysed in the survey scan based on their determined combinations of ion mobility and mass to charge ratio;

selecting a parent or precursor ion for fragmentation or reaction based on its determined charge state; and

fragmenting or reacting said selected ion, wherein the fragmentation or reaction conditions are selected from a plurality of different fragmentation or reaction conditions based upon the determined charge state of the selected ion."

V. The appellant's arguments, insofar as they are relevant to the present decision, may be summarised as follows:

The appellant considered document D1 to be an appropriate closest prior art. In the appellant's view, the method defined by claim 1 contained two differentiating features when compared to D1. Besides the undisputed differentiating feature identified by the board (i.e. that the survey scan comprises analysing the ion mobilities of the ions in order to determine the charge states of parent or precursor ions on the basis of their determined combinations of ion mobility and mass to charge ratio), the appellant identified a further differentiating feature, namely the method step of "*selecting a parent or precursor ion for fragmentation or reaction based on its determined charge state*". According to the appellant's understanding, the selection of the ion species of interest in document D1 was not based on their charge state, the latter being used merely to select the fragmentation or reaction conditions. Instead, the selection was based on the criteria listed in paragraph [0004] or on standard known parameters. Mass spectrometry provided the intensity peaks, and the selection was based on these peaks. Charge state was not considered in the selection of ions of interest.

The use of an ion mobility analyser in the survey scan was not obvious to the skilled person since there was no hint anywhere of the use of an ion mobility analyser in a survey scan. This set-up had the particular advantage of reducing the dead time due to processing, as mentioned in the description, page 9, lines 22 to 26. This advantage was realised in the refinement of the measuring set-up according to claim 1. Therefore, the subject-matter defined in claim 1 involved an inventive step.

Reasons for the Decision

1. Admission of the main request (Article 13(2) RPBA 2020)

The main request was submitted after notification of a summons to oral proceedings. The admittance of this request is therefore governed by Article 13(2) RPBA 2020.

The amendments to this request were made in response to an objection raised by the board for the first time in its communication under Article 15(1) RPBA 2020. The appellant overcame the board's objection by deleting a dependent claim.

As the appellant could not have responded to this objection earlier and, moreover, the amendment overcame the objection, the board considered the exceptional circumstances - as required by Article 13(2) RPBA 2020 - to be given, and it thus admitted the request into the proceedings.

2. Inventive step

2.1 Closest prior art

2.1.1 Document D1 represents a suitable starting point for discussing inventive step since it relates to a data-directed acquisition method comprising a combined mass spectroscopy in a survey scan and a subsequent fragmentation process.

This is not disputed by the appellant.

2.1.2 Document D1 discloses (the references in brackets are those of document D1; struck-out features are not disclosed in document D1) a method of mass spectrometry (title) comprising:
performing a survey scan (paragraphs [0003] and [0006]) of a plurality of different types of parent or precursor ions (paragraph [0006]), wherein said survey scan comprises ~~analysing the ion mobilities of the ions and~~ mass analysing the ions (paragraph [0006]);
determining the charge states of parent or precursor ions (paragraph [0006]) analysed in the survey scan based on their determined ~~combinations of ion mobility and~~ mass to charge ratio (paragraphs [0006], [0007], [0013]);
selecting a parent or precursor ion for fragmentation or reaction based on its determined charge state (paragraphs [0004], [0017], [0018], [0019] and [0021]);
fragmenting or reacting said selected ion (paragraph [0007]), wherein the fragmentation or reaction conditions are selected from a plurality of different fragmentation or reaction conditions (paragraph [0007]) based upon the determined charge state of the selected ion (paragraphs [0007], [0020] and [0021]).

2.2 Contrary to the appellant's assertion and the examining division's findings, the board is of the opinion that document D1 does indeed disclose the feature "*selecting a parent or precursor ion for fragmentation or reaction based on its determined charge state*".

2.2.1 Document D1, paragraph [0019], discloses that the ion species of interest, i.e. the parent or precursor ion selected for the fragmentation process, is selected or identified by applying specified input criteria. Input criteria are listed in document D1 in paragraph [0004], but that list is not to be considered exhaustive, as is explicitly stated in paragraph [0019] of D1 ("*According to the present example, controller 140 is programmed to select the three ion species yielding the highest intensities in the mass spectrum. Alternative implementations of this method may utilize other input criteria (including but not limited to those listed above) in place of or in combination with the intensity criteria.";* emphasis added by the board). A further input criterion is mentioned in paragraph [0017], fourth sentence, of document D1, namely the charge state ("*The present invention expands the capabilities of data-dependent methodology by including within its scope additional input criteria (e.g., charge state)*"). The board sees no convincing reason why this additional input criterion mentioned in paragraph [0017] should not be considered an alternative or additional input criterion to the criteria mentioned in paragraph [0004] of document D1. The skilled reader would directly and unambiguously understand this additional information in paragraph [0017] of the charge state as a further possible input criterion within the list mentioned in paragraph [0004]. This understanding is further supported by paragraph [0019], which mentions that "*[a]lternative implementations of this method may*

utilize other input criteria (including but not limited to those listed above) in place of or in combination with the intensity criteria".

2.2.2 Therefore, the skilled reader would directly and unambiguously deduce from document D1 that, instead of the intensities used in the "*present example*" discussed in paragraph [0019] of D1, alternative implementations can use other input criteria, charge state being explicitly mentioned in paragraph [0017] of document D1. Document D1 therefore discloses the possibility of selecting the ions on the basis of their charge state.

The board is convinced that the skilled reader would not limit the input criterion of the "*charge state*" solely to the selection of the fragmentation or reaction conditions. Indeed, the skilled reader would understand the "*charge state*" as a possible input criterion beyond those listed in paragraph [0004], meaning that the charge state is used to select the ion species of interest.

2.2.3 This understanding is further confirmed by the fact that, according to paragraph [0021], last sentence, of document D1, the "*charge state determination may be performed as part of the preprocessing operations ..., i.e., prior to ... selection of an ion species of interest*". Therefore, document D1 discloses that the determination of the charge state in one of the disclosed embodiments can be carried out prior to the selection of the ion species of interest, meaning that the charge state is a parameter at hand when the selection of the species for interest is carried out. Since the fragmentation conditions are tailored to the charge state, this parameter can also be used as a selection criterion. This is all the more true since

document D1 discloses in paragraph [0018], referring to a first method step 201, that the "*[p]reprocessing of the mass spectrum may include the execution of algorithms to assign charge states to m/z peaks in the mass spectrum*". The method step 220 is further explained in paragraph [0019], in which it is indicated that the ions of interest are to be identified by applying the input criteria. Therefore, the skilled reader would immediately understand that the "*charge state*" can be an input criterion.

2.2.4 Contrary to the appellant's arguments, the board is of the opinion that the teaching of document D1 is not limited to the selection of the ion species of interest exclusively according to their peak intensities in the mass spectrum or according to conventional measurements as listed in paragraph [0004] of document D1. The selection of the ion species of interest according to their intensities is explicitly mentioned as an "*example*". If intensities constitute only one example of an input criterion, the disclosure must necessarily include other possibilities, which - as explained above - include the charge state.

2.2.5 Furthermore, the formulation of claim 1 according to which the selection of parent or precursor ions for fragmentation or reaction is "*based on the determined charge state*" should not be understood in a limited sense in that the charge state is the only and exclusive parameter relevant for the selection. The wording of claim 1 encompasses the understanding that the "*charge state*" can be considered alongside other input criteria, such as the intensities. Therefore, it may be that the appellant's argument that the selection in document D1 is based on intensities is correct. In this case, however, it may be that this selection is

only the first part of a selection process that further refines the ion species through an additional selection based on charge state.

2.2.6 Finally, even if it is assumed - for the sake of argument - that the selection of ions of interest on the basis of their charge state is not explicitly disclosed in document D1, this selection criterion would at least be regarded as an implicitly included condition. This is due to the wording of claim 1, as detailed in the previous paragraph, and taking into account the fact that the fragmentation and the reaction conditions are adapted to the charge state of the ion species of interest. Therefore, the selection of ions must somehow be based on their charge state, which is therefore an implicit feature. The selected dissociation type only works correctly if the charge state of the selected ion species has been selected accordingly and fits the dissociation type. Therefore, the selection of the ion species must at least implicitly be "*based on its determined charge state*".

2.3 Differentiating feature

Due to the features disclosed in document D1, as explained above in points 2.1 and 2.2, with sub-points, the method defined in claim 1 differs from that known from document D1 only through the following feature:

The "*survey scan comprises analysing the ion mobilities of the ions*".

2.4 Technical problem / technical effect

This differentiating feature solves the objective technical problem of providing an efficient and

improved survey scan that allows a more precise analysis of the ions of interest.

It has the technical effect of facilitating the processing method following the survey scan (prior to the fragmentation process) by determining the charge state of the ions in an efficient manner.

2.5 Obviousness

2.5.1 The skilled person seeking an efficient way to select the ions of interest will know that the combination of a mass spectrometer with an ion mobility analyser provides an accurate resolution of the charge state when analysing ions. This common general knowledge is illustrated in documents D2 (Figures 3 to 6; abstract) or D4 (Figure 3; page 7, right column, last paragraph). The skilled person knows that this common general knowledge applies in the same way to a survey scan and a fragmentation process. The combination of mass spectrometry and ion mobility analysis allows the separation of the precursor or parent ions according to their specific charge state. The determination of the charge state of the precursor or parent ions from the data measured in the survey scan using an ion mobility analyser is therefore obvious to the skilled person. Therefore, the skilled person would replace one of the mass spectrometers used in document D1 by an ion mobility analyser, this arrangement being similar to the measurement set-up used in documents D2 or D4.

2.5.2 Contrary to the appellant's assertion, the board is of the opinion that the skilled person does not need a specific hint for integrating an ion mobility analyser into the survey scan. The reason for this is that the use of a survey scan is already disclosed in document

D1. The skilled person merely realises, when using an ion mobility analyser instead of a second mass spectrometer as used in document D1, that the determination of the charge state of ions can be rendered more efficient. This knowledge is independent from its specific application thereof in either the survey scan or a separation process of the ions. Therefore, it is obvious to the skilled person to replace one of the two mass spectrometers used in document D1 (see abstract and Figure 1) in the survey scan by an ion mobility analyser in order to render the determination of the charge state more efficient.

2.5.3 Finally, the board doubts the correctness of the appellant's argument that the use of an ion mobility analyser would significantly reduce the dead time spent on processing. In both measurement scans, the one used in document D1 and the one used in the set-up according to claim 1, the charge state is derived from measurement data in a processing step. It is not a directly measured value. Therefore, additional processing is required in both arrangements. However, in the patent application at hand it has not been demonstrated that the processing as defined in claim 1 reduces the dead time in a significant manner.

2.5.4 Therefore, the objective technical problem to be solved could even be formulated as providing an alternative measurement set-up for the survey scan compared to the one known from document D1, without taking into account any particular advantage of this change. This would render the replacement of one of the mass spectrometers used in document D1 with an ion mobility spectrometer even more obvious.

2.6 Taking all these considerations into account, the board concludes that the differentiating feature defined in claim 1 is obvious to the skilled person in view of document D1 in combination with their common general knowledge. Therefore, the subject-matter defined in claim 1 of the main request does not involve an inventive step (Articles 52(1) and 56 EPC).

3. Since the main request is the only request on file and it does not fulfil the requirements of Articles 52(1) and 56 EPC, the appeal must fail.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

S. Sánchez Chiquero G. Decker

Decision electronically authenticated