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**Datasheet for the decision  
of 11 February 2019**

**Case Number:** T 1347/13 - 3.4.01

**Application Number:** 07859376.1

**Publication Number:** 2095147

**IPC:** G01R33/567, G01R33/565

**Language of the proceedings:** EN

**Title of invention:**

MOTION CORRECTION IN A PET/MRI HYBRID IMAGING SYSTEM

**Applicant:**

Koninklijke Philips N.V.

**Headword:**

PET/MRI motion correction/PHILIPS

**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

Inventive step - (no)



**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 1347/13 - 3.4.01

**D E C I S I O N**  
**of Technical Board of Appeal 3.4.01**  
**of 11 February 2019**

**Appellant:** Koninklijke Philips N.V.  
(Applicant) High Tech Campus 5  
5656 AE Eindhoven (NL)

**Representative:** de Haan, Poul Erik  
Philips International B.V.  
Philips Intellectual Property & Standards  
High Tech Campus 5  
5656 AE Eindhoven (NL)

**Decision under appeal:** **Decision of the Examining Division of the  
European Patent Office posted on 19 March 2013  
refusing European patent application No.  
07859376.1 pursuant to Article 97(2) EPC.**

**Composition of the Board:**

**Chairman** P. Scriven  
**Members:** B. Noll  
R. Winkelhofer

## Summary of Facts and Submissions

- I. This appeal is against the decision of the Examining Division refusing European patent application 07859376.1
- II. The application was refused by reference to the Examining Division's communication dated 9 January 2013 as regards the grounds for refusal.
- III. With the statement setting out the grounds of appeal the appellant filed claims for a main and two auxiliary requests.
- IV. In a communication accompanying a summons to oral proceedings, the Board gave its preliminary opinion on inventive step, having regard to the following documents:  
  
D1: M. Schwaiger et al: "MR-PET: Combining Function, Anatomy, and More", Medical Solutions Special Edition, September 2005.  
  
D6: J. Pipe: "Motion Correction With PROPELLER MRI: Application to Head Motion and Free-Breathing Cardiac Imaging", Magnetic Resonance in Medicine 42, 1999, 963-969.
- V. At the oral proceedings, the appellant formulated its final requests as that the decision under appeal be set aside and a patent be granted on the basis of a main request or two auxiliary requests as filed with the statement of grounds.

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

*A diagnostic imaging arrangement comprising*

- a magnetic resonance examination (1) system operable to acquire magnetic resonance signals;*
- an emission tomography system (2) operable to acquire nuclear decay signals;*
- an analysis module(4) operable to derive motion correction(s) from the magnetic resonance signals; and*
- a reconstruction module (5) operable to reconstruct a motion corrected emission tomographic image from the nuclear decay signals on the basis of motion correction(s),*

*characterised in that*

- the magnetic resonance examination system (1) is configured for repeatedly sampling a centre region of k-space and*
- the analysis module is arranged to derive the motion corrections from variations among the repeatedly sampled centre region of k-space.*

VII. Claim 1 of the first auxiliary request differs from claim 1 of the main request in that the first three paragraphs read:

*A diagnostic imaging arrangement comprising*

- a magnetic resonance examination (1) system operable to acquire magnetic resonance signals, wherein the magnetic resonance signals are acquired using any one of the following: a propeller acquisition*

*sequence, a 3D-TRICKS acquisition sequence,  
and a 4D-TRACKS acquisition sequence;  
- an emission tomography system (2) operable  
to acquire nuclear decay signals, wherein  
the diagnostic imaging arrangement is  
operable to acquire the nuclear decay  
signals and the magnetic resonance signals  
from a volume of interest;  
...*

VIII. Claim 1 of the second auxiliary request adds the further feature

*...  
- the reconstruction module is further  
operable to reconstruct a motion corrected  
magnetic resonance image from the magnetic  
resonance signals on the basis of the motion  
corrections.*

## **Reasons for the Decision**

### *Background*

1. The invention concerns the acquisition of image data in a PET (positron emission tomography) imaging system.
2. PET image data of a part of a human body are captured for diagnostic purpose. However, this acquisition is time-consuming due to the low rate of detectable emissions. A long image acquisition time increases the

risk of image artefacts when the patient to be imaged cannot remain immobile. This is similar to the well-known problem of blurred images when a person moves during exposure in conventional photography.

3. The application suggests an arrangement which can capture PET images even if the patient moves, for example, when the patient changes position during the image capturing time.

*Claim 1 of the main request - inventive step*

4. D1 discloses an arrangement for diagnostic imaging configured simultaneously to capture PET image signals and magnetic resonance (MR) image signals (see Figs 1(A) and (B)). The MR image signals provide navigation or position information). This can "measure navigator signals very quickly", and that position information of the intestine "can be detected in real-time with MRI" and "can be used in MRI to adjust an excited slice position in order to follow the moving anatomy" (see the paragraph bridging the columns on page 26. The skilled reader infers that the MRI system in D1 implicitly comprises an analysis module operable to derive motion correction from the MRI signals.
5. In the same paragraph, D1 further discloses that "[f]or the PET data, this information can be used retrospectively to rebin detected events accordingly". The skilled reader understands this as meaning that, on the basis of the position information obtained from the MRI system, the association of a positron emission with a particular detecting element is changed to another detecting element. The other element is the one that would have detected the event, but for the motion. This

step, therefore, implies that the MRI system in D1 includes, in the words of claim 1, *a reconstruction module ... operable to reconstruct a motion corrected emission tomographic image from the nuclear decay signals on the basis of motion correction(s)*.

6. The appellant argued that the navigator signal in D1 would have been understood by the skilled reader as concerning a one-dimensional "pencil" navigator, which indicated a position only along a single direction. D1 did not address motion compensation but only "motion elimination". Motion elimination meant that the part of the body instantaneously imaged would follow a position of the excited slice. MRI information was only captured at instants in time at which the imaged part of the body did not move and this was, furthermore, the position at which the MR slice was excited. The step of re-binning data in D1 would have been understood by the skilled reader as meaning that captured positron emissions would only be binned to one of two bins corresponding to the reversal positions at which the direction of motion of the body reversed. Thus, captured positron emissions were not intended to be re-binned for a large portion of the imaging time. This limitation would inherently result in a reduction of the detected signal and therefore either prolong the time of capturing an image or reduce the image quality. With the invention, however, the motion compensation permitted the utilisation of all positron detection events. It was, therefore, questionable whether D1 was an appropriate starting point for the assessment of inventive step.
7. The Board is not persuaded by these arguments. The appellant's reading of D1, that the part of the body to be imaged follows the excited slice, is contrary to the

wording, which indicates rather that the position of the excited slice follows the motion of anatomy. Further, D1 is not restricted to the use of any particular navigator signal, such as a navigator signal obtained from a one-dimensional "pencil" navigator element. The system disclosed in D1 is, furthermore, not restricted to only two bins. For this reason, the D1 system does not inherently suffer from a loss of PET signals for which the appellant argued. The skilled person has therefore no reason for interpreting D1 in just the sense for which the appellant argues. Therefore, the Board does not agree that there is a difference between the process of re-binning data as described in D1 and "motion compensation" as in the application. Both expressions imply the same purpose of removing from PET images, on the basis of motion information obtained from MR imaging, artefacts caused by motion of the patient.

8. Accordingly, the claimed arrangement differs from that disclosed in D1 by the characterising features of claim 1: the magnetic resonance examination system is configured for redundantly scanning the centre region of k-space and the analysis module is arranged to derive the motion correction from variations among successive sampling of the centre region of k-space.
9. These features define a particular way of obtaining a signal for motion compensation from the MRI information. The technical problem can be formulated as how to obtain, in a simple and practical manner, a signal suitable for motion compensation.
10. The skilled person, seeking a solution to this problem, would consider D6, which is about reducing motion artefacts in MR imaging. The skilled person is taught,



by D6, that motion artefacts may be reduced by systematically oversampling the central region of k-space and that navigation information can be obtained by collecting MRI data according to a "PROPELLER MRI" acquisition sequence (D6, page 963, the paragraph bridging the columns). This navigation information is used for correcting motion-induced artefacts in the captured image (D6, Fig. 5). The skilled person, starting from D1 and further considering D6, would thus obtain an arrangement which redundantly scans a centre region of k-space and which derives the motion correction from variations between successive samplings of the centre region, and would therefore obtain the arrangement of claim 1.

11. The arrangement of claim 1, therefore, does not involve an inventive step. (Article 56 EPC).

*The auxiliary requests*

12. The same applies to claim 1 of both the first and the second auxiliary requests, since no further distinction is induced by the additional features of these claims. In particular:

*The first auxiliary request*

The additional feature that the diagnostic imaging arrangement is operable to acquire the nuclear decay signals and the magnetic resonance signal from a volume of interest has only explanatory character and does not limit the claimed arrangement vis-à-vis that of D1. Further, using a propeller acquisition sequence for obtaining MR signals for motion correction is explicitly mentioned in D6, see e.g. the abstract.

*The second auxiliary request*

Reconstructing a motion compensated MR resonance image from MR signals on the basis of the motion correction defines only the purpose, which is the same as addressed in D6.

13. The appellant did not submit separate arguments as regards the auxiliary requests.

*Conclusion*

14. Since none of the requests complies with Article 56 EPC, the appeal must be dismissed.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:



R. Schumacher

P. Scriven

Decision electronically authenticated