

GENERAL SPECIFICATION

Geoinformation

GS EP GIN 007

Loading geophysical data into a geoscience study

00	10/2017	First version
Rev.:	Date	Purpose of the revision

Owning entity: EXPLO/GTS	Managing entity: EXPLO/GTS/IGR
Other Approving entity(ies):	

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1. Scope

This document defines the requirements and procedures for loading and quality controlling geophysical data in geoscience studies.

Its purpose is to ensure that all the geophysical data is loaded and controlled in a standardized manner.

This document applies to all geoscience studies using geophysical data in projects operated by an Exploration & Production entity.

It does not concern well seismic data, which is covered elsewhere.

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

Reference	Title
ISO 3166-1	Country codes (https://www.iso.org/obp/ui/fr/#search)
OGP	Formats for the exchange of positioning data (http://www.iogp.org/bookstore/product/ogp-p211-positioning-data-exchange-format/)

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published.

Reference	Title
GS EP GIN 122	Deliverables and Delivery Procedure for Surface Seismic Acquisition and Processing Data
GS EP GIN 304	Geosciences GIS Data Standard Requirement for GIS studies
GS EP GIN 307	Unique identifier and seismic data indexing

3. Definitions

The following definitions apply exclusively for this document.

AICP: abbreviation for Availability-Integrity-Confidentiality-Proof & Control.

AVA: Amplitude Variation with Angle.

AVO: Amplitude Variation with Offset.

CA: Confidentiality Agreement.

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Capitalization: indexing in the reference database to ensure the information valorization, sustainability and availability.

Clipping: the operation of eliminating extreme amplitudes from the seismic data.

Confidentiality: characterizes information which must not be disclosed to unauthorized persons or entities. It is one of the four classification criteria required by the Group Security policy (A, I, C, P).

Confidentiality level: a confidentiality level (C) is attached to each piece of geoscience information. There are four confidentiality levels, associated with four different distribution perimeters: internal (C1), restricted (C2), confidential (C3) and secret (C4).

CDP: Common Depth Point.

CRS (Coordinate Reference System): geodesy and coordinate reference system used.

Dataset: name given to the result of a given geophysical processing, carried out on a 2D line or a 3D seismic or non-seismic cube (velocities, resistivity, etc.).

Datum Plane: reference horizontal plane (MSL – Mean Sea Level – for marine seismic acquisitions and SRD - Seismic Reference Datum – for land acquisitions).

Dropsite: intranet website used to transfer data to the Datagate entity. It is used to monitor the different steps of loading and validate loading in the study.

DMS: Data Master Seismic.

Geoscience information: applies to information, documents or raw, processed or interpreted data, whatever its type, source and media.

Geoscience study:

The term "geoscience study" combines in a single category the following tasks:

- Data research, detection and collection.
- Data analysis, interpretation, modeling and reporting by geoscience teams using one or more software applications installed on their dedicated workstations.
- Administration of study data and products (results, files, models, reports, etc.).

They are conducted mainly by actors in the Geology, Geophysics, Reservoir Engineering and Geoinformation disciplines, under the responsibility of the Study Manager (sometimes called the Project Manager).

Geophysical interpretation data: any data originating from an interpretation carried out on a geophysical section or volume. These results can be horizons, polygons or fault planes, grids, etc.

GIS: Geographic Information System.

Header: header of a digital file containing information on the data to be found in that file.

In-line direction: direction parallel to the receiver lines in a 3D survey.

Metadata: data that describes or defines information about the seismic data. The format of a data file, its size and its origin are examples of metadata, as are the date at which it was entered in a database, or its qualification rating.

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Navigation control utility: software used to check the geometry of 2D seismic lines. The CDP, X, Y values and geodesy are entered into the system to check their consistency with the positioning.

Non-seismic geophysical data: geophysical data, excluding raw and processed seismic data, originating from on-site acquisition operations performed by the Company or from a third-party operator or commercial exchanges.

Reference databases: databases that store reference data, i.e. data to be preserved because it serves or has served at one point as reference in a geoscience study. Chronologically, the first reference data is the raw data as provided by the measurement operator. Several versions of the reference data can be preserved after that.

Seismic data: raw and processed seismic data originating from on-site acquisition operations performed by the Company or a third-party operator, under the responsibility of the Seismic Acquisition entity.

Static corrections: all the corrections applied to seismic data to compensate for the different effects of topography and of the weathered layer characterized by constant time shifts.

Seismic envelope: geographical scope of a 3D seismic survey.

SEG-Y: digital format in which seismic acquisitions and processing are saved.

SLA: Supplement License Agreement.

SP: Shot Point.

SRD: "Seismic Reference Datum" is a fictitious reference plane from which all the shot point and trace data is measured, such that the velocity under this reference plane is constant.

Time Shift: the "Time Shift" may be a *delay recording time*, the shift to refer recording times to another seismic datum plane or a regional match (depending on the different processing/acquisition results, etc.).

Trace: recorded data obtained by a sensor.

Tracking system: software used by the Datagate team to follow up requests, i.e. monitor data and/or documents in digital format, at each stage of their processing.

X-line direction: direction orthogonal to the receiver lines and parallel to the source lines in a 3D survey.

4. Roles and responsibilities

4.1 Data Owner

The Data Owner may be an internal or external entity of the Company.

He/she is responsible for:

- Defining the rules for values applicable to data, and validity rules (e.g. information expiration date).
- Providing the description, confidentiality level and service life of the information.

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- Estimating the volume of data that will be produced to anticipate the means to be implemented.

4.2 Data Provider

The Data Provider, either internal or external to the Company, produces the information and transmits it to the Data Managers. It may be an entity receiving the data from external entities.

He/she is responsible for:

- Checking that the Data Owner has applied the rules and procedures applicable to the information transferred.
- Defining the means to be implemented to comply with the contractual and legal rules and requirements imposed by the Data Owner and the Company.
- Ensuring that data information is sent in accordance with Group security rules.
- Guaranteeing the complete transfer of the information produced.

Within the Geoinformation entity at headquarters, the Data Provider function is carried out by the geographical coordinations.

4.3 Reference and Master Data Manager

The Reference and Master Data Manager (RMDM) function is defined in the DAMA-DMBOK.

The RMDM is a member of the Geoinformation discipline who serves as interface between the geoscience Study Manager (sometimes called Project Manager) and the Staging Data Manager (SDM). The RMDM function is carried out by the geographical coordinations.

Responsibilities of the RMDM:

- Ensuring that the data associated with his/her geographical zone is completely transferred by the Data Provider(s).
- Coordinating access rights to data within his/her zone.
- Knowing all the data available or currently being acquired/produced for his/her zone.
- Ensuring that the study environment is created and organized.
- Ensuring that the study data is organized, and that requests and modifications are tracked within the scope of his/her activity.
- Sending requests for the execution and follow-up of the latter to the Staging Data Manager.

4.4 Staging Data Manager

The Staging Data Manager (SDM) is responsible for reception and control of the data to be loaded in the studies. The SDM function is carried out at headquarters by the seismic representatives of the Datagate & Geodesy entity, called Datagate throughout this document.

The SDM is responsible for:

- Checking the compliance of received data, using the tracking system.

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- Ensuring the quality of received data to be loaded in the studies and/or reference databases.
- Ensuring the good quality of uploading in the studies and/or reference databases.
- Checking the positioning of the seismic data before and after loading.
- Ensuring that the loading complies with the Company quality requirements.

4.5 Corporate Data Manager

The Corporate Data Manager is in charge of input into and maintenance of the corporate databases.

He/she is responsible for:

- Applying the rules defined by the Data Owner and the Company as regards data management and preservation.
- Completing or correcting the metadata to ensure the appropriate data preservation, identification and usage.

4.6 Data Operations Manager

The Data Operations Manager (DOM) ensures that the seismic and geophysical data is loaded in compliance with the information provided by the SDM.

The DOM is responsible for:

- Loading the seismic data into the studies.
- Checking the positioning of the seismic data before and after loading.
- Georeferencing the positioning data.
- Ensuring that the loading complies with the Company quality requirements.

4.7 Interpreter

The interpreter is the user of the data loaded or needed for the study, and is under the responsibility of the Study Manager. The Interpreter checks that seismic data loaded in the study is valid.

5. General process for reception and analysis of the geophysical data by the Datagate

This document describes the steps in the overall geophysical data quality control and uploading process, from reception to loading into the studies and finally capitalization in the reference database (see figure 1).

{Rule 1:

All loading of geophysical data in a geoscience study shall be carried out by the Datagate entity.}

The Datagate entity is then responsible for sending the data to the reference database to ensure its sustainability.

The process is initiated by a loading request issued by the Data Owner sent to the Data Provider.

The Data Provider then examines the request by making an inventory and qualifying the data before sending it to the Datagate entity through the tracking system interface (see **Appendix 3**).

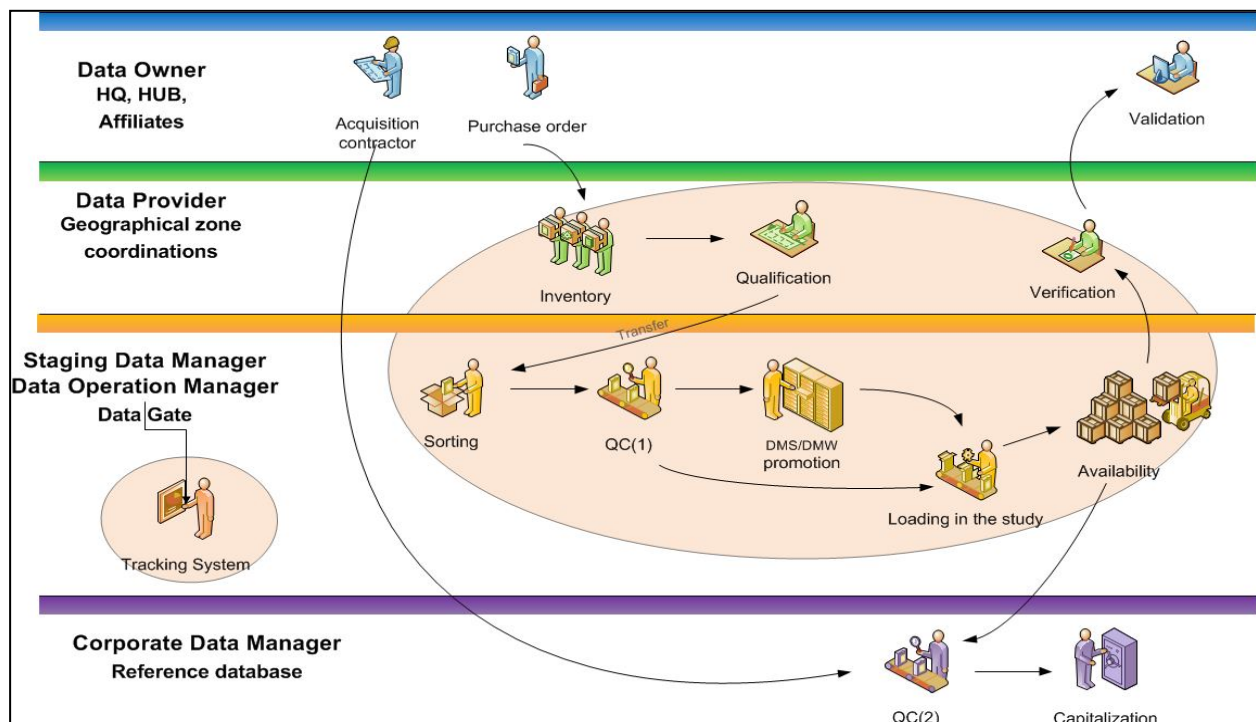


Figure 1: diagram of the general process

{Rule 2:

After the geophysical data reception, the Datagate entity shall control their quality before loading them into the study or into the reference database.}

5.1 Geophysical data concerned

This applies to a certain category of geophysical data, i.e.:

- Data from seismic acquisitions and associated documents (navigation data, operator reports, etc.).
- 2D or 3D seismic processing or re-processing data (amplitudes, velocities, anisotropy, impedance inversions, AVO, etc.).
- Microseismic data (passive seismic acquisition).
- Seismic data from site surveys (2DHR), sub-bottom profiler, etc.

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- Data from interpretations (horizons, grids, faults, polygons).
- Cultural data (country, permit or block limits, etc.).
- Positioning data (navigation data, GIS, position map, etc.).
- Gravi-Mag data.

This does not concern the packages of well data nor the document packages. However, packages of seismic data may contain seismic processing and/or acquisition reports. These reports are used.

The paragraphs below only concern seismic acquisition and processing data (including their positioning) for which the quality control (QC) and loading workflow have been defined.

Non-seismic, microseismic or well seismic geophysical data are accepted by the Datagate, but their QC workflow first goes through the specialty entities.

5.2 Geophysical data acceptance

For logistics reasons, the contractor seismic data arrives directly to the seismic data department in Pau.

The Data Owner and/or Data Provider send(s) the initial request for loading and archiving geophysical data to the Datagate.

They upload the data packages directly to the Datagate Dropsite. This exchange interface has a tracking system.

Each time a data package is added, a unique package identification number is automatically generated and assigned to it by the tracking system. All the actions carried out on that data package in the studies or in the reference database can be tracked using that number.

The package number combines the following elements:

- **PP** = Country code (ISO 3166-1 alpha-2).
- **ZZZ_XXX** = owner entity of the data (a list of values in AGIL format is available for the data owner entities).
- **SSSS** = chronological number.

Example: PG_APC_PNG_3856

Some of the information in the tracking system is mandatory, such as the data origin, the data confidentiality level, the CRS and the cost allocation number (RFS no.) to be used.

To ensure that no data is lost, it is essential that the Data Owner and/or Data Provider specify whether or not the seismic data is to be capitalized in the reference database.

{Rule 3:

All geophysical data shall:

- Be given a confidentiality level.
- Have a specified origin.
- Have a CRS defined and validated by the Company (see **GS EP GIN 304**).

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In the tracking system, the Data Provider, or Data Owner, enters the date on which the data is expected to be made available in the study, specifies the study name and any other comment.

When transferring the data, it is important to provide all the available documents relating to the data positioning or processing (e.g. processing/acquisition report, shape files, UKOOA reports, etc.).

For documents with a contractually imposed preservation date, the SDM is required to check that the CA number for dataroom data and/or the SLA number for purchased data (e.g. speculative data) are specified. If not, he/she has to contact the owner entity to obtain them.

5.3 Geophysical data analysis

The analysis mostly focuses on the data content and format. As soon as the data packages are accepted by the Datagate, the SDM analyzes the data received and checks the integrity of the files and the content of information in the mandatory metadata.

The analysis more particularly consists in:

- Checking the compliance of data received with the information on the delivery slip and in the tracking system.
- Checking the compliance of deliverables with the contracts (see [GS EP GIN 122](#)).
- Checking that the confidentiality level is attached to the data.
- Checking that the origin of the documents is specified (dataroom, affiliate, partner, etc.).
- Depending on the data origin, checking that the CA and/or SLA numbers are indicated.
- Checking that the data CRS is specified.
- Checking the content of mandatory metadata.

{Rule 4:

The SDM shall ask the Data Provider to resend the data if the format or media received is non-compliant or illegible.}

6. Seismic data quality control and loading process

The process begins with a quality control of the data received followed by loading in the study and finally making it available in the reference database for capitalization.

{Rule 5:

The DOM shall analyze and quality control the data to be loaded.}

The DOM more particularly analyzes the quality of seismic data positioning (see section 7), the loading formats and parameters (see section 8.1). He/she applies the rules specific to seismic data (see section 8.2 to 8.5) and follows data naming instructions (see section 8.6).

7. Step A: analysis of seismic data positioning and quality rating

The DOM begins the control phase by analyzing the EBCDIC headers, the navigation files and all the documents relating to the data positioning in order to check that the positioning is correct.

7.1 Analysis of 2D seismic data positioning

To quality control the 2D post-stack seismic navigation data, the DOM extracts the navigation data in ASCII format from the SEG-Y files (tools for extracting navigation data from SEG-Y files are available at headquarters).

The ASCII file contains, as a minimum, the geodesy of the lines, the name of the lines, the SP numbers and XY values associated with each CDP.

The DOM uses the navigation control utility to detect any positioning anomaly in the data received.

The error messages detected during navigation QC are listed below:

- Duplicate points

The "duplicate points" error message is generated when CDPs overlap. This happens when two different CDP numbers have the same coordinates.

- Angular anomaly

This error message appears when the seismic lines change direction. It often happens when line segments are merged.

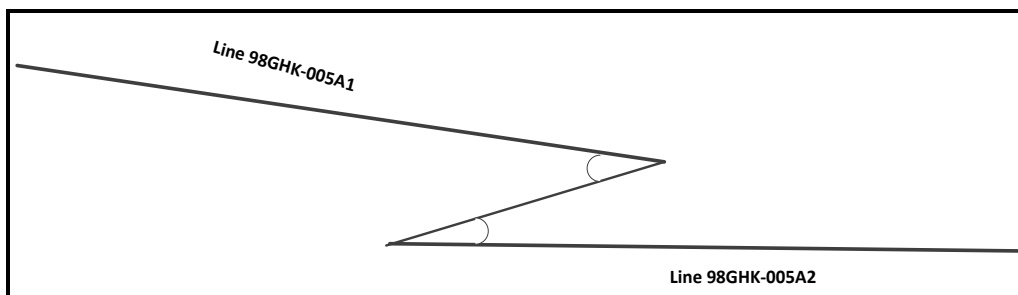


Figure 2: example of a change of direction

The default threshold value of the angle formed by these lines is 80 degrees. This threshold can be modified depending on the case.

- Loop found

This error message appears when a loop forms when coordinates go backwards between two different SPs, as illustrated in the figure below.

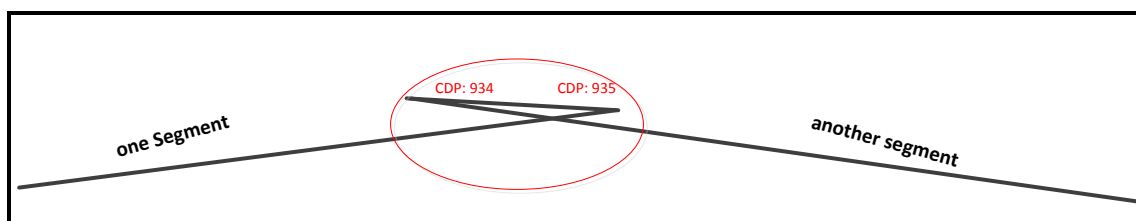


Figure 3: example of a loop

- Coordinate gap factor

The software calculates the average distance between two consecutive CDPs and automatically detects illogical distances. The threshold can be modified depending on the data received.

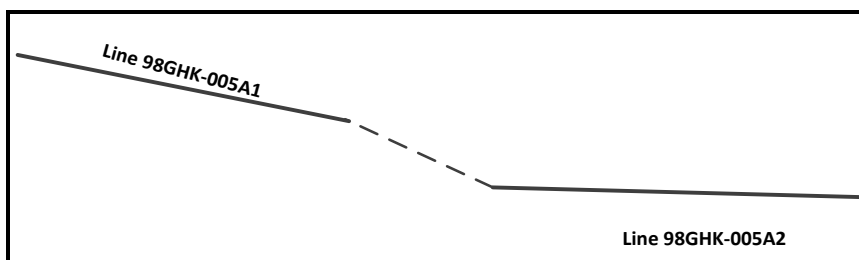


Figure 4: example of a coordinate gap

7.2 Analysis of 3D seismic data positioning

When creating a 3D survey, the following information needs to be entered in the seismic interpretation software:

- Geodesy.
- Survey name.
- Point of origin.
- Inline and Xline orientation.
- Inline and Xline spacing.
- Number of Inlines and Xlines.
- Inline and Xline increment.

Information regarding the 3D survey positioning can be found directly in the EBCDIC header when all of its fields have been properly filled in (see figure 5).

```
C30
C31 TOTAL COORDINATE SYS CODE: REGN19GREDGML, NAME: REGVEN UTM ZONE 19N 69deg W,
C32 EPSG COORDINATE SYS CODE : 2202, NAME: REGVEN / UTM ZONE 19N
C33 BIN GRID XOR=787380.69, YOR=1085304.2, BIN SIZE 12.5X12.5M,
C34 AZX =5.47170574, AZY=3.90090941 rad, ORIGIN(0,0 BIN CENTRE)
C35 INL402 XL400 X:787178.00,Y:1078218.42 INL402 XL1400 X:795783.33,Y:1069152.09
C36 IL2512 XL1400 X:776653.37,Y1050994.85 IL2512 XL400 X:768048.04,Y:1060061.18
C37 CONTENTS/BYTE:BIN_X:181-184, BIN_Y:185-188, INLINE:189-192, XLINE:193-196
C38 BIN_Z: 203-206 (DEPTH COUNTED FROM DPA DOWNWARDS); CDP_NB: 21-24
C39 REGIONAL STATIC: 235-236; UNITS IN HEADERS: CM; POLARITY=NORMAL SEG
C40 END EBCDIC
```

Figure 5: example of a fully completed EBCDIC header

The DOM nevertheless carries out an in-depth analysis to make sure this positioning is correct. He/she starts the analysis by comparing the survey parameters specified in the header with those provided in the processing/acquisition reports in order to check the consistency of this information.

The DOM compares the 3D survey parameters calculated using the information provided in the SEG-Y seismic traces (X, Y, IL, XL) with those found in the processing report or in the header. Utility programs developed in-house can be used to calculate these parameters.

Note: In Sismage, the X and Y azimuths are defined as follows:

AZX is the angle between the positive X axe and the first Xline:

$$AZX = 90 - \text{Sismage XlineAngle}$$

AZY is the angle between the positive X axe and the first Inline:

$$AZY = 90 - \text{Sismage ILineAngle}$$

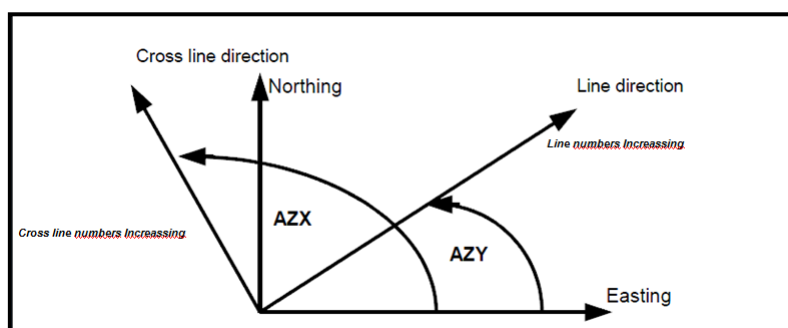


Figure 6: orientation of the grid

7.3 Quality rating of 2D/3D seismic data positioning

The positioning quality rating is used to qualify the positioning of seismic data. This information makes it easier to QC data already loaded and serves as a criterion for comparing seismic surveys.

{Rule 6:

A positioning quality rating shall be specified for all seismic data loaded in a study}

Positioning quality can be rated as follows:

A: very good; **B**: good, or **C**: weak.

The qualification of data positioning concerns the navigation data of 2D seismic lines and the parameters selected when creating 3D seismic surveys.

7.3.1 A-rated positioning

- 2D seismic data

A 2D seismic line positioning is considered very good and given an **A** rating when the data is received with:

- The corresponding acquisition and/or processing report.
- The corresponding seismic navigation files in the formats defined by the **OGP** (formerly UKOOA).

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It is important to check that the coordinates from SEG-Y are consistent with the UKOOA coordinates and that the QC performed by the navigation control utility has not detected any errors (except when justified).

- 3D seismic data

For the positioning of a 3D survey to be certified and **A**-rated, it is imperative to be in possession of all the following documents:

- The corresponding acquisition and/or processing report.
- A fully completed EBCDIC header.
- A Bin Center file, in the format defined by the [OGP](#).

In order to check the quality of navigation data provided in SEG-Y, the DOM checks that the coordinates extracted from SEG-Y (X, Y, Inlines, Xlines) correspond to those of the Bin Center. The DOM then compares the parameters of the 3D grid specified in the reports with those of the 3200 header. If all the information is consistent, the DOM can start to create the 3D survey and give its positioning an **A** rating.

Note: if the Bin Center positions are not provided with the data, an **A** rating can exceptionally be assigned if all the other QC results are positive.

7.3.2 B-rated positioning

This concerns data received without the navigation files in the formats defined by the [OGP](#) and without a report.

- 2D seismic data

The positioning of seismic lines is **B**-rated when:

- The header of the SEG-Y files received is fully completed.
- The information in the header is consistent with the information extracted from SEG-Y (SP/DCP numbers, X, Y values).
- The report issued by the navigation control utility is empty (except when an error is justified).

- 3D seismic data

This concerns seismic cubes received with only one EBCDIC header fully completed.

The consistency of the information in the EBCDIC header needs to be checked by comparing the value of the parameters calculated using the X, Y values extracted from SEG-Y. If all this information is consistent, the 3D survey can be created and its positioning can be given a **B** rating.