NDE Open File Format

NDE 3.1.0 File Format: Plate Conventions

Logo

Description automatically generated

Evident

Version 0.9

April 1, 2023

# NDE File Format: Plate Conventions

* By the .nde file format’s convention, surface id:0 is the outer surface (or top for plates) and surface id:1 is the inner surface (or bottom for plates).
* **Units:** Angles are expressed in degrees, while all other units in the dataset are in International System (SI) units, expressed in meters and seconds unless otherwise indicated by a "unit" key. For example, the "Bitfield" and "Percent" units are used for the ascan in the dataset object.

## Axis and Coordinate System Definitions

* U, V, W: Local or surface coordinate system. It is the main coordinate by which everything is related in each file. It describes positions on the specimen surface (u, v) and depth (w).
  + origin: Set on the surface of the specimen and some preferred direction along the surface. For example, U can be set along the center line of a weld.
  + The U axis is defined by the scenario. In a general mapping scenario, it can be described as the "active" axis, which often corresponds to the Scan axis and is the one on which probes are usually swept in one-line scan acquisition. For a weld scenario, U is defined along the weld.
  + The Vaxis is perpendicular to U. In most cases, it corresponds to the Index axis in raster acquisition.
  + The W axis is normal to the surface and points inside the material. W is particularly useful in total focusing method (TFM) acquisition to position the data. However, in most cases, an "Ultrasound" axis is used to describe the data instead.
  + The U and V axis properties are given in the dataEncodings object of the domain setup.
* Xw, Yw, Zw: The wedge coordinate system.
  + origin: Located in the middle and at the bottom of its front (blue axis system in the figure)**.**
* Xe, Ye, Ze: The elements coordinate system.
  + origin: Located in the middle of the first element surface (green axis system in the figure).
* X, Y, Z: Global referential axis. It is independent of the acquisition and serves to position the data on the specimen. These are akin to real-world coordinates defined by the user for the specimen.
  + origin: Arbitrary and stays the same across files for a given specimen. It is usually defined by the user on the specimen with some marking or physical reference in the specimen environment.
  + **NOTE**: Currently, with NDE format version 3.1.0, the X, Y, and Z axis are not used nor defined in the NDE file, but to show inspection results in 3D, one would have to translate everything to this coordinate system.
* beams axis: An axis used in the HDF5 dataset rather than a physical one where each element contains one beam's positions and parameters. It is used in PAUT scenarios when the beams do not fit well in a U, V grid. Giving the coordinate by beams simplifies their use in these scenarios.
* Ultrasoundaxis**:** Time-based information sampled by an ultrasonic acquisition system and the specified probe/wedge configuration.

## Wedge:

* The wedge origin is centered at the bottom of its front face (blue axis system in the figure).
* The wedge skew angle is defined by the angle between the wedge and U axis.
* Its starting position is given in relation to the U and V axis with the uCoordinateOffset and vCoordinateOffset located in the domain setup at wedges[0].positioning.
* The width, height and length of the wedge are found at wedges[0].angleBeamWedge.

## Probes:

* Position of the first element is given by; "primaryOffset", "secondaryOffset" and "tertiaryOffset" found in wedges[0].angleBeamWedge.mountingLocations. These three offsets are given in relation to the wedge coordinate system where the primary, secondary, and tertiary offsets are on the Yw, Xw, and Zw axis respectively.
* Reference Position (.Ref): Probes are referenced to other objects (wedge, specimen, etc.) through this point. The reference position is defined from the position of the first element when the probe skew = 0.

Diagram, engineering drawing

Description automatically generated

Figure 1 – Example of a typical plate scenario with a weld and two probes in relation to the **U** and **V** axis.

Chart

Description automatically generated

Figure 2 - Raster example with the **U** and **V** axis.

Chart

Description automatically generated

Figure 3 - Wedge parameters and referential system conventions.

Chart

Description automatically generatedA picture containing text, sky, several

Description automatically generated

Figure 4 – Top views of different skew angles for reference. The skew angle is taken from the **U-axis** to the wedge **Yw-axis**.

Figure 3 - Wedge parameters and referential system conventions.

Diagram, engineering drawing

Description automatically generated

Figure 5 – Isometric views of different skew angles for reference. The skew angle is taken from the **U-axis** to the wedge **Yw-axis**.