Noise Pattern Generator

Getting Started Guide
v1.1

The Noise Pattern Generator allows you to create noise patterns that can be loaded into your Paragon-X or Paragon-neo and used to test your DUT.

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Contents

1 Introduction 3

1.1 System Requirements 3

1.2 Installation 3

1.3 Note on Paragon-neo Pattern Replay 3

2 Using the Noise Pattern Generator 4

2.1 Global Settings 4

2.2 Standard Patterns Overview 4

2.2.1 Pattern: Sine, Square, Triangle, Sawtooth 5

2.2.2 Pattern: MTIE Sine 6

2.2.3 Pattern: Pulse 6

2.2.4 Pattern: Constant 6

2.2.5 Pattern: Gamma 7

2.2.6 Pattern: Gaussian 7

2.3 Creating a Custom Pattern 8

2.4 Pattern Preview 8

2.5 Save / Load 9

2.6 Generating your Pattern File 9

2.7 Applying patterns on Paragon-neo and Paragon-X 9

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1 Introduction

The Calnex Noise Pattern Generator allows you to create noise patterns that can be used by Paragon-X and Paragon-neo to apply noise (delay variation) to packets being sent to your DUT.

A number of basic patterns (such as sine and square) are provided as well as gamma and gaussian distributions. These can be combined into a sequence to create complex patterns.

It is also possible to generate a custom delay pattern by creating a csv file and using the Noise Pattern Generator to convert this into a file that can be used by Paragon-X or Paragon-neo.

1.1 System Requirements

The Noise Pattern Generator is a Windows application. It has been tested on Windows 10 Home and Windows 10 Professional although it is expected to work on other version of Windows.

The application is compatible with Paragon-X software version X.10.41.xx or later and Paragon-neo version 06.00.xx or later.

1.2 Installation

The Noise Pattern Generator is delivered using a Windows installer. The application will be installed in **C:\Program Files (x86)\Calnex**.

1.3 Note on Paragon-neo Pattern Replay

When replaying a pattern on Paragon-neo, if the pattern is shorter than the duration of the replay, then the pattern will repeat (i.e. loop back to the beginning and start again).

However, Paragon-neo can apply noise patterns independently in the forward and reverse directions. In this case, the repeat period is determined by the longer pattern - any difference in the forward and reverse pattern durations will result in no impairment being applied from the shorter pattern until the longer pattern has completed.

This should be considered when generating patterns, especially for example for constant delays where there may be an expectation that a short pattern can be repeated while a longer variable pattern is applied in the other direction.

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2 Using the Noise Pattern Generator

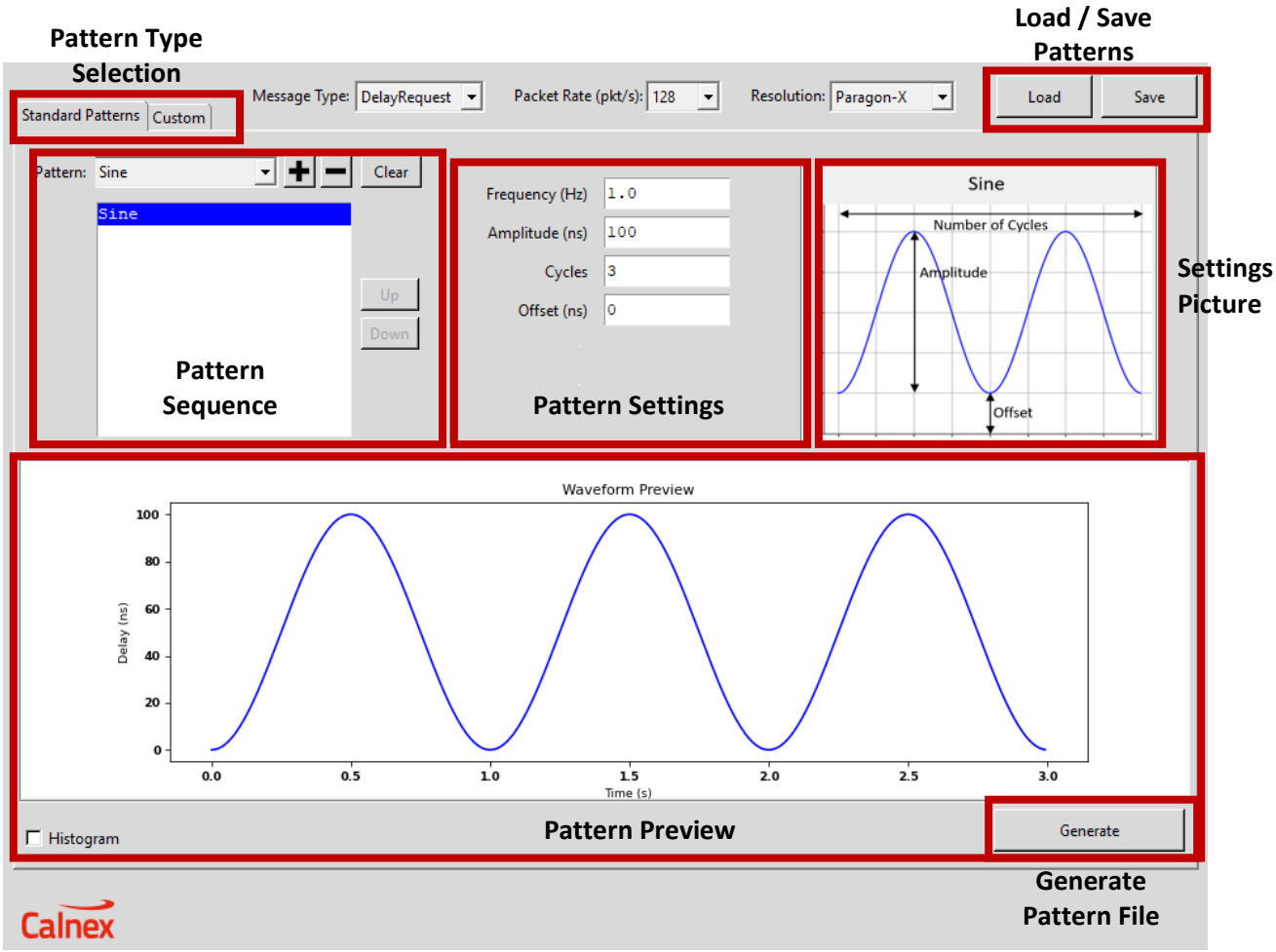
2.1 Global Settings

There are three global settings:

- **Message Type**: Can be *Sync*, *DelayRequest* or *Either*. If the pattern is generated with *Either*, then the pattern can be applied by Paragon-neo in the forward (Sync) or reverse (Delay_Request) directions. Otherwise, the pattern can only be applied to the specified message type – Sync or Delay_Request. This setting is not relevant for Paragon-X.
- **Packet Rate (pkt/s)**: The packet rate at which this pattern is intended to be applied. If the pattern should be able to be applied using multiple packet rates, then separate files must be created for each rate.
- **Resolution**: Paragon-X supports a resolution of 5ns; Paragon-neo supports a resolution of 250ps. Note: When Paragon-X is selected, delays will be rounded to 5ns.

Note that distributions (e.g. *gamma* and *gaussian* patterns) are not affected by the **Packet Rate** setting.

2.2 Standard Patterns Overview



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In the **Standard Patterns** tab, any number of individual patterns can be combined to generate a more complex pattern. The individual patterns currently supported are:

- *Sine*
- *Square*
- *Triangle*
- *Sawtooth*
- *Pulse*
- *Constant*

In addition, *MTIE Sine*, *Gamma* and *Gaussian* patterns can be added.

These patterns are described in detail below.

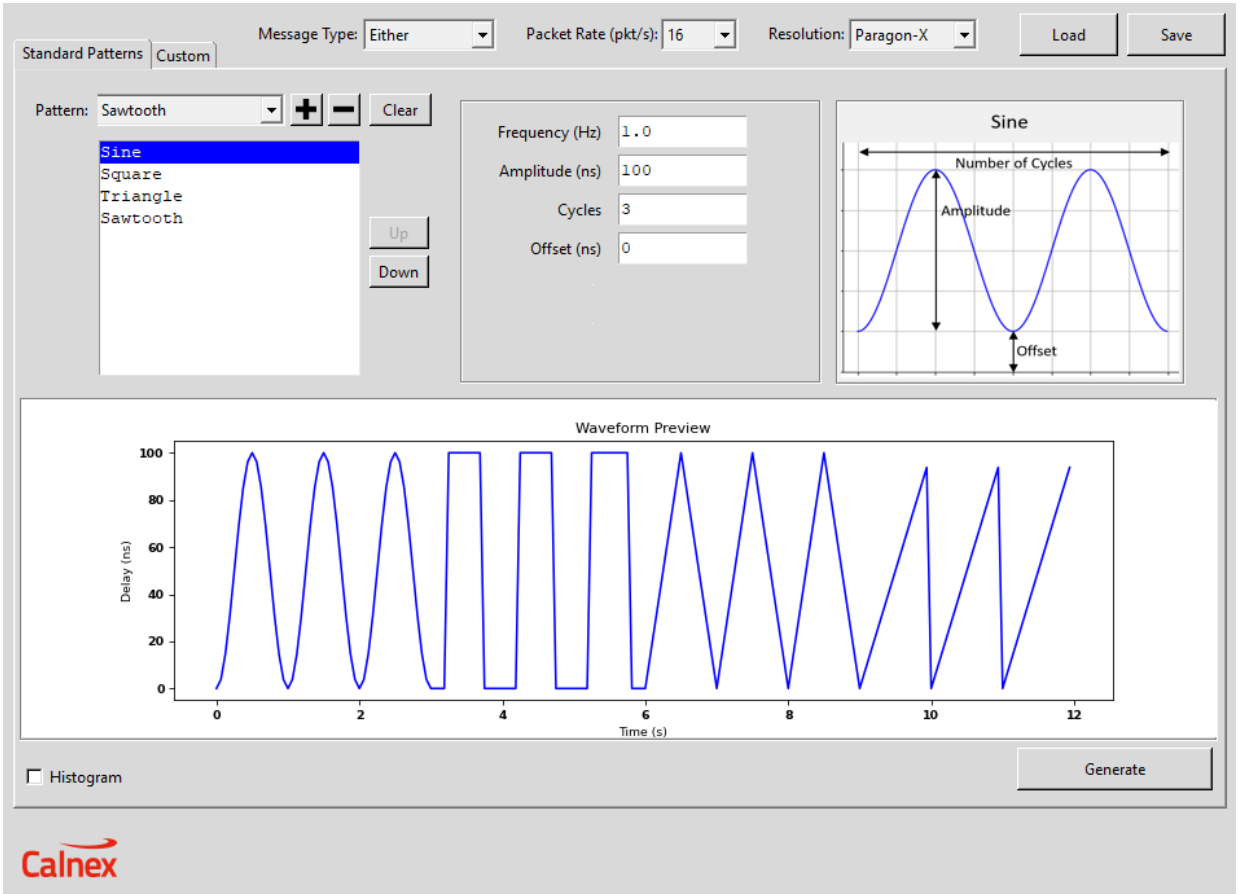
To add a pattern, select it in the drop-down control and then click the **+** button; this will append the pattern into the pattern sequence box. The settings for the selected pattern are shown in the settings area. This is where the settings for each pattern can be configured. The settings picture provides a visual indication of the meaning of each of the parameters.

The pattern preview area shows a preview of the pattern that will be generated and is updated as individual patterns are added / removed or settings are changed.

Individual patterns can be removed from the sequence by clicking on the unwanted item in the pattern sequence box then clicking the **−** sign. The order of patterns can also be modified using the **Up** and **Down** buttons.

2.2.1 Pattern: Sine, Square, Triangle, Sawtooth

Periodic delay patterns defined by **Frequency (Hz)**, **Amplitude (ns)**, **Cycles** (duration) and **Offset (ns)**.



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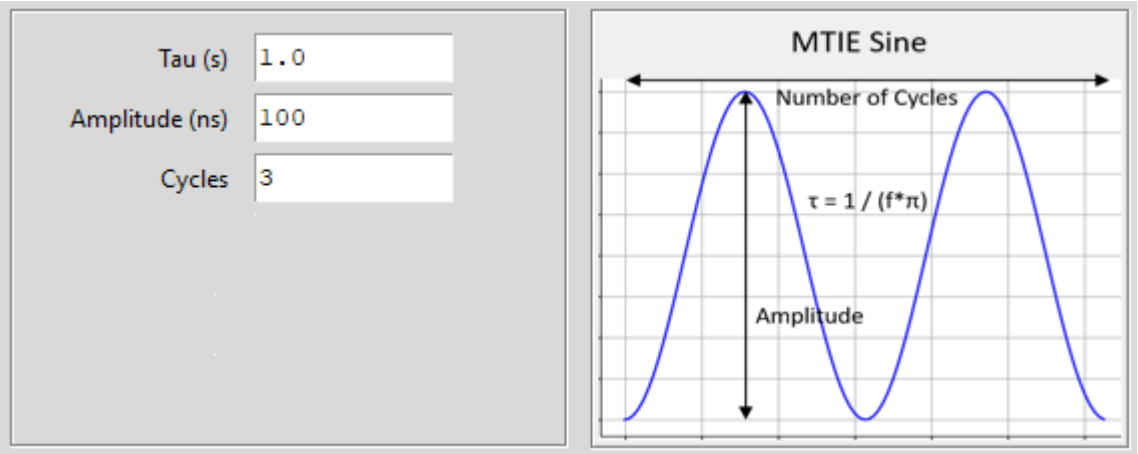
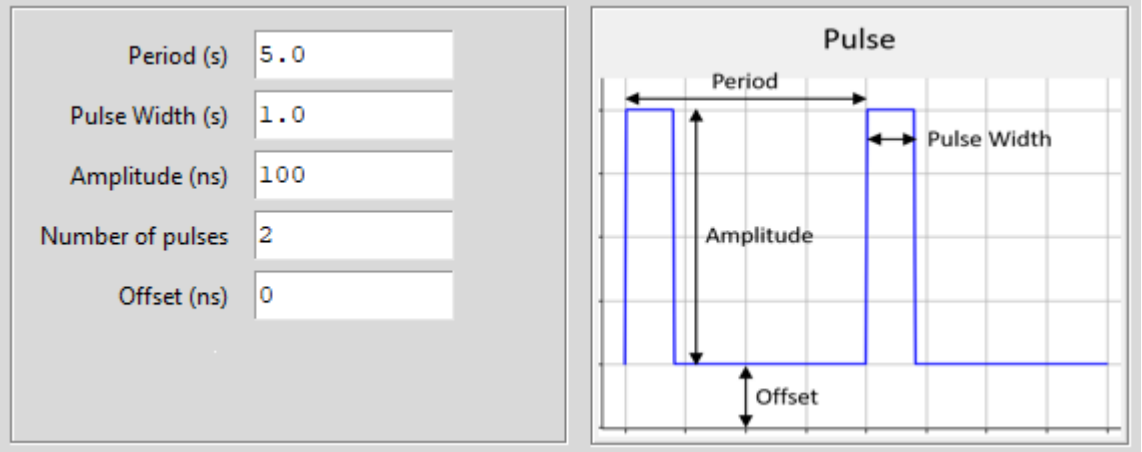
2.2.2 Pattern: MTIE Sine

This pattern is defined by **Tau (s)**, **Amplitude (ns)** and **Cycles** (duration). Configuring multiple instances of this pattern in a sequence allows the creation of a pattern to fit a particular MTIE mask.



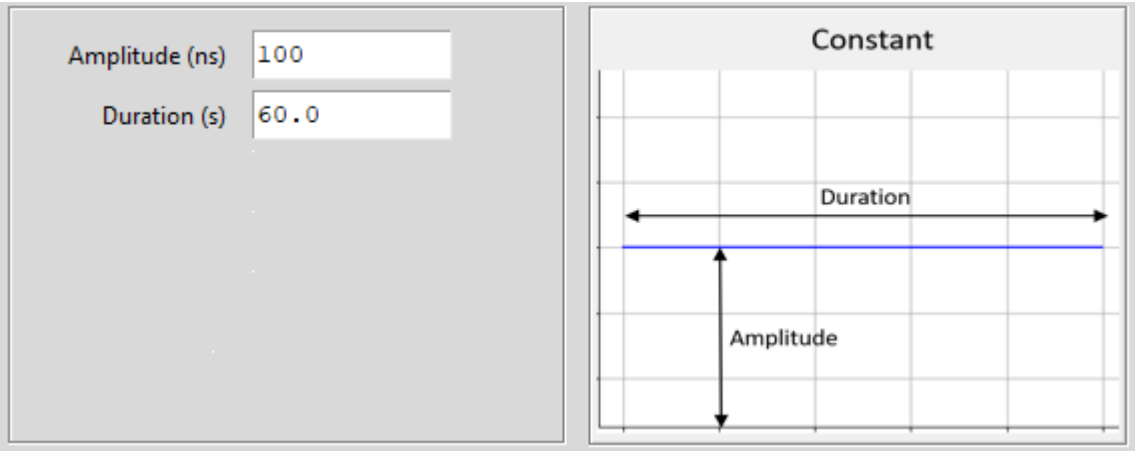
2.2.3 Pattern: Pulse

A periodic pulse pattern defined by **Period (s)**, **Pulse Width (s)**, **Amplitude (ns)**, **Number of pulses** and **Offset (ns)**.



2.2.4 Pattern: Constant

A constant delay defined by **Amplitude (ns)** and **Duration (s)**.



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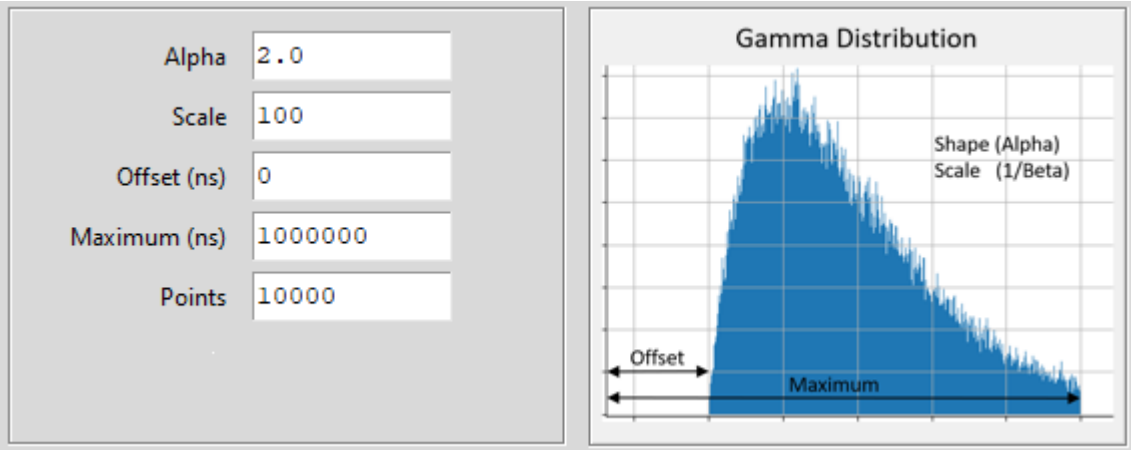
2.2.5 Pattern: Gamma

A gamma distribution defined by **Alpha**, **Scale**, **Offset (ns)**, **Maximum (ns)** and **Points**.



Alpha controls the shape of the distribution while **Scale** controls the magnitude. As a rough rule of thumb, the maximum delay will be of the order of **Scale** * 20 nanoseconds. For example, using a **Scale** value of 100 will produce a distribution where the probability of a delay greater than 2000ns is 0.0005.

This algorithm will produce a distribution that is the same as that produced using the webpage at: https://homepage.divms.uiowa.edu/~mbognar/applets/gamma.html but the **Scale** parameter must be doubled.

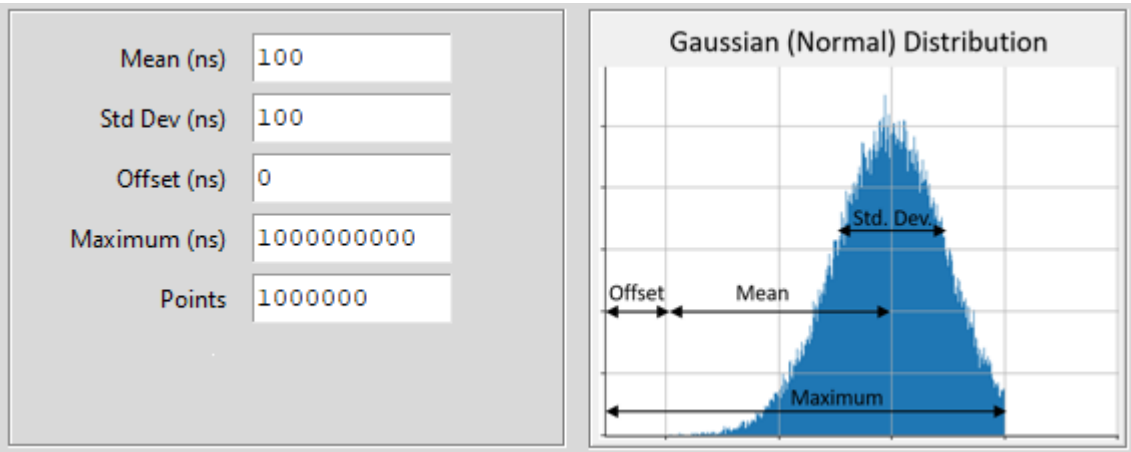
The **Offset** parameter specifies the minimum delay that will be generated. This essentially takes the initial distribution and adds the offset to it.

The **Maximum** parameter is used to truncate the generated distribution. Since a gamma distribution is essentially a probability-based pattern, it is possible that the maximum generated delay may be very large. The **Maximum** parameter specifies that the distribution should be truncated at the specified value.

The **Points** parameter specifies the number of delay points to be generated. Since each point will be applied to a given PTP message, the **Points** parameter and the message rate will determine how long it will take the pattern to be replayed.

2.2.6 Pattern: Gaussian

A gaussian distribution defined by **Mean (ns)**, **Std Dev (ns)**, **Offset (ns)**, **Maximum (ns)** and **Points**.



The **Mean** and **Std Dev** parameters specify the centre and width of the distribution respectively.

Offset is used to shift the distribution to the right and essentially adds a fixed value onto the initial distribution. This means that if **Mean** is set to 100ns and **Offset** is set to 50ns, it is guaranteed that there will

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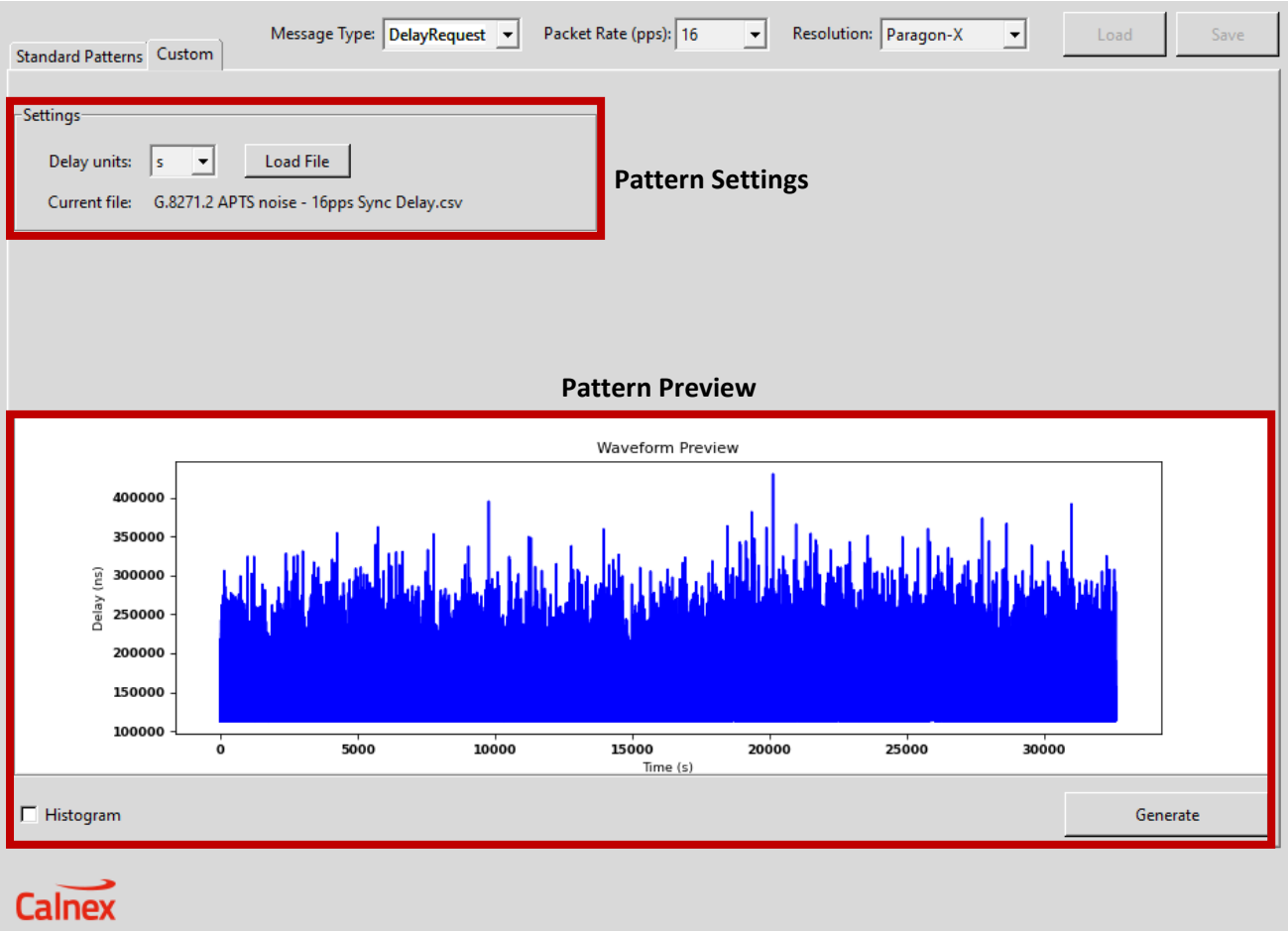
be no delay less than 50ns but the mean will be shifted to 150ns. This allows the shape of the distribution to be maintained while ensuring that there are no delays less than a specified minimum.

The **Maximum** parameter is used to truncate the generated distribution. Since a gaussian distribution is essentially a probability-based pattern, it is possible that the maximum generated delay may be very large. The **Maximum** parameter specifies that the distribution should be truncated at the specified value.

The **Points** parameter specifies the number of delay points to be generated. Since each point will be applied to a given PTP message, the **Points** parameter and the message rate will determine how long it will take the pattern to be replayed.

2.3 Creating a Custom Pattern



In the **Custom** tab, you can load a csv file containing a single column of delay values. This will then be converted into a *cpd* file that can be loaded into a Paragon-X or Paragon-neo.

This facility allows you to import a custom pattern which can then be replayed to test your device or network.

The **Delay units** parameter specifies whether the delay file contains delays in nanoseconds or seconds.

2.4 Pattern Preview

The pattern preview defaults to Delay versus Time. The **Histogram** checkbox allows you to view the generated pattern as a histogram – this is useful for examining the distribution of your pattern. For the custom pattern above:

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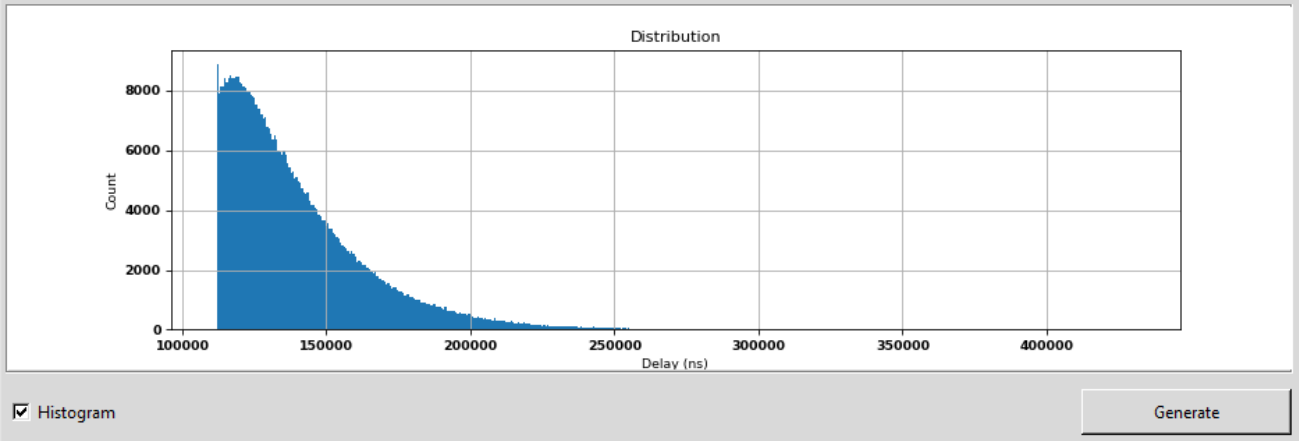

2.5 Save / Load

Once you have created your pattern, you can save the design in an *npg* file which can then be reloaded into the application. This allows you to create a basic pattern and later make modifications to it.

The default folder for *npg* files is **Documents\Calnex\Noise Packet Generator**.

2.6 Generating your Pattern File

Once you have defined you pattern, click **Generate**. You can then save your pattern as a *cpd* file or as a *csv* file. By default, patterns will be saved in **Documents\Calnex\Noise Pattern Generator**.

cpd files can be loaded into Paragon-X or Paragon-neo; *csv* files can only be used with Paragon-X.

2.7 Applying patterns on Paragon-neo and Paragon-X

Please consult the documentation installed on your instrument for instructions on how to load and run a noise pattern.

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