



# VISIQ

Coherent Signal Analysis  
Software

QUICK START GUIDE

VISIQ version 1.0.6

# 1 VISIQ overview

Quantifi Photonics' coherent signal analysis software VISIQ is designed to make the complex process of coherent signal measurement and DSP optimization as simple as possible. The software performs three main functions: Control of the OMA hardware, digital signal processing and the presentation of the signal properties.

VISIQ works with all popular models of high-performance real-time oscilloscopes and allows an easy configuration of hardware calibration parameters to ensure your hardware impairments are compensated for.

The intuitive and easy-to-use DSP pipeline uses reconfigurable functional nodes that you can drag-and-drop in the graphical sequencer. This innovative approach enables you to try different DSP configurations with immediate feedback, so you can quickly learn how to optimize your coherent DSP. Coherent receiver auto calibration, auto Baud rate detection, adaptive equalizer and nonlinear correction algorithms are available in VISIQ to significantly reduce the set-up time.

For repetitive testing, test automation is available using SCPI and gRPC.

You will require access to the following hardware:

## **Required hardware components:**

- Compatible real-time oscilloscope(s) with four input channels
- Coherent optical receiver
- Coherent modulation signal source
- Computer that will run VISIQ

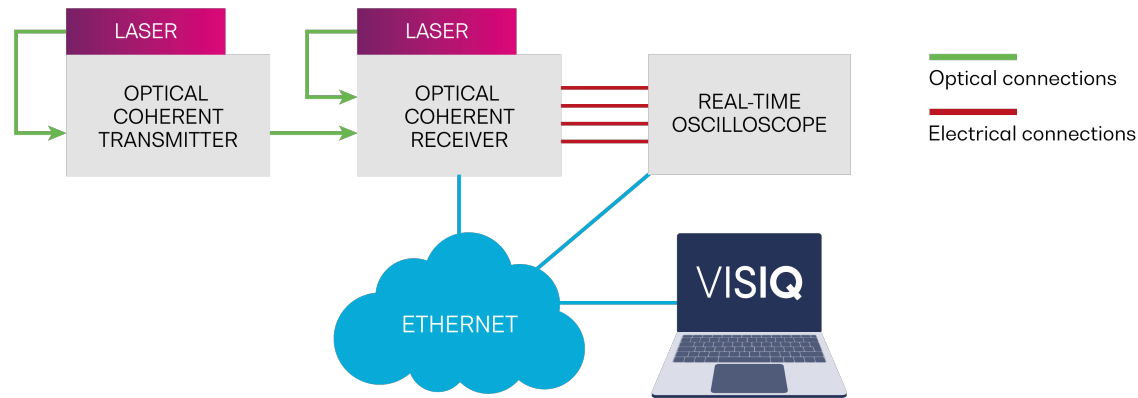
## **Compatible oscilloscopes include:**

- Tektronix SX series real-time oscilloscopes
- Tektronix DX series real-time oscilloscopes
- TeledyneLeCroy LabMaster 10Zi real-time oscilloscopes
- TeledyneLeCroy LabMaster 9Zi real-time oscilloscopes
- Keysight Infiniium UXR-Series real-time oscilloscopes
- Keysight Infiniium V-Series real-time oscilloscopes

## **Computer running VISIQ - minimum requirements:**

- Operating system: Microsoft Windows® 10 (64-bit)
- Processor: Intel® Core™ i5 or faster CPU
- Memory: 8 GB or greater

## 2 Set up hardware



### ► Set up hardware:

#### 1. Connect the coherent optical receiver to the oscilloscope.

Use a set of four phase-matched, high-bandwidth RF cables. Phase matching of  $<1\text{ps}$  is strongly recommended.

#### 2. Connect the oscilloscope to the computer running VISIQ.

Use an Ethernet connection. If the Ethernet environment does not support DHCP automatic IP assignment, set up static IP addresses on the oscilloscope and the computer to ensure that they can ping each other.

#### 3. Coherent optical receiver: If using Quantifi Photonics' IQRX, connect it to the computer running VISIQ.

Use either an Ethernet or USB connection.

If using USB, install Cohesion Operator on the computer first, as it will install the USB driver for IQRX. For details, refer to the IQRX user manual.

#### 4. Connect the optical signal from the coherent optical transmitter to the coherent optical receiver signal input.

### ⚠ WARNING

Practice safe optical handling to protect yourself from harm caused by optical radiation:

- Turn the laser power OFF when making optical connections.
- Clean the optical end-face each time before making connections.
- Once connected, turn the TX laser/signal back on.

► Configure the hardware setup:

1. **Oscilloscope:** Perform channel deskew. Oscilloscopes typically offer a routine for self-deskew.
2. **IQ transmitter hardware: Set it up to generate a reference signal.**  
A 32GBaud 16QAM signal is recommended as a starting point.  
An optical signal power of -3dBm to 0 dBm is recommended.
3. **Local Oscillator (receiver laser): Set the frequency/wavelength to match that of the signal transmitter and turn it on.**  
It is recommended that the LO power be set to the maximum value, not exceeding the input power rating of the coherent receiver.
4. **Oscilloscope:** Check and enable four input channels on the oscilloscope and run oscilloscope acquisitions to check that an appropriate level of signal amplitude is seen. If using Quantifi Photonics' IQRX, a signal amplitude level of 100mVpp or higher is normal and recommended.



#### **WARNING**

It is important that you do NOT exceed the maximum voltage rating of the oscilloscope input. The maximum input voltage is related to the vertical scale setting. Ensure that the oscilloscope is set to a large vertical scale setting such as 100mV/Div, before connecting the coherent receiver or turning on the optical signal input to the receiver. Exceeding the full scale voltage can damage the oscilloscope.

### 3 Install the VISIQ software package

Your Quantifi Photonics sales manager will provide a link and password to access the downloadable software package.

► Install the software package on the computer that will run VISIQ:

1. Download the VISIQ software package and save it on the computer.
2. Run **VISIQ\_<version>.exe** and follow the on-screen installation prompts.

The installation wizard will install required drivers, applications, and desktop icons on the computer.

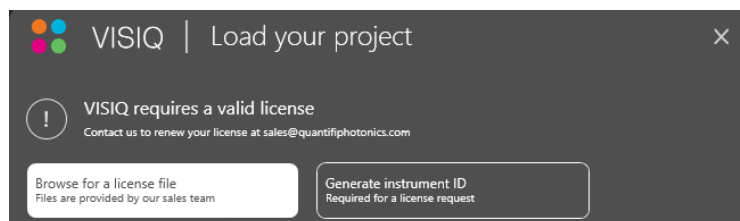
► Activate VISIQ:

1. Open the VISIQ application. In the startup screen, VISIQ will ask for a valid license.
2. To request a license, click **Generate instrument ID**.
3. VISIQ will generate a **hardwareid.hid** file; please email the file to your Quantifi Photonics sales manager.

Note: The license is not transferable. It is only valid for the computer that you have used to generate the instrument ID and cannot be used on (or transferred to) another computer.

4. We will email your license to you; please save it anywhere on the computer.
5. In the startup screen, browse for the license and select it.

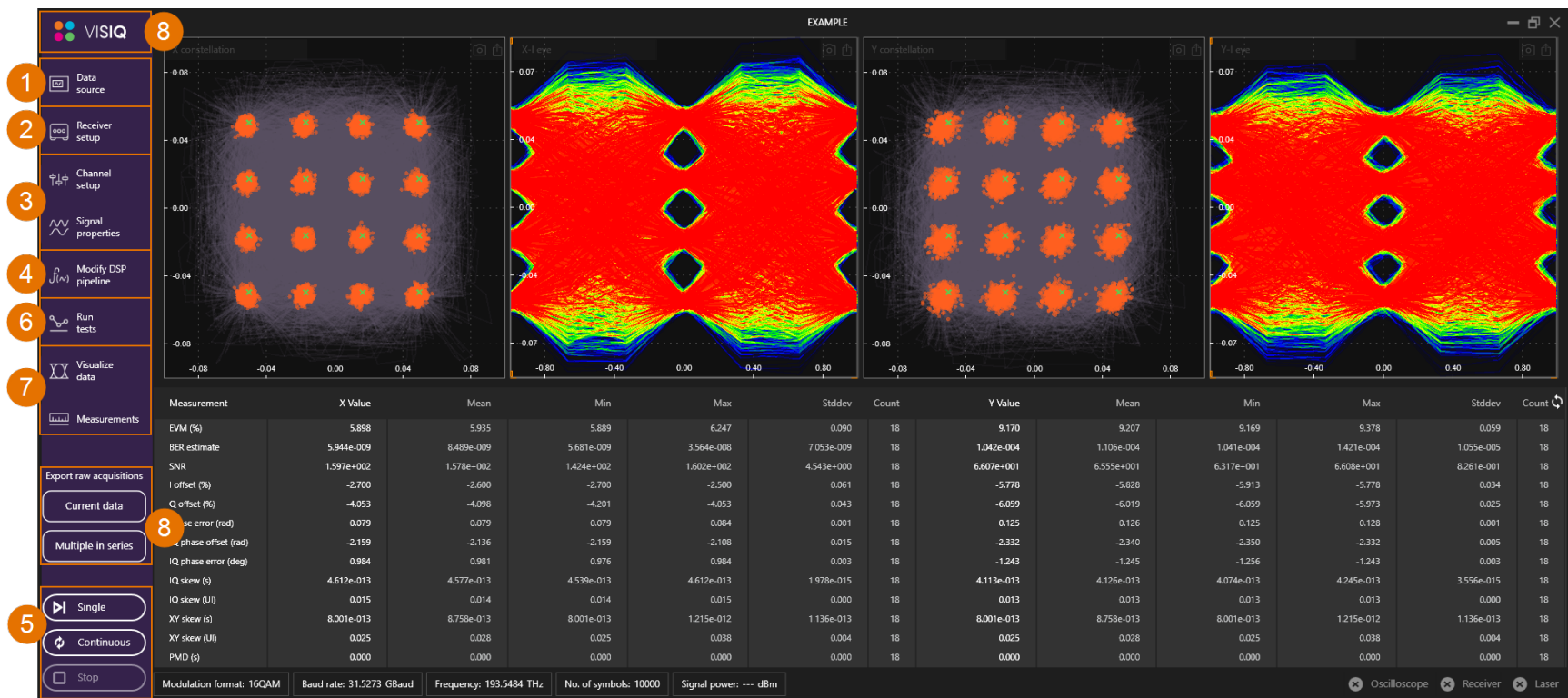
Once the license is verified, VISIQ will be ready for use. Should you encounter any difficulties or have any questions about the license activation process, please contact your Quantifi Photonics sales manager.



## 4 Work with VISIQ

VISIQ enables you to analyze and visualize your signal:

1. Select the **data source**: Connect VISIQ with oscilloscope(s) of your test setup, or select a previously acquired waveform file.
2. Set up the **coherent receiver**.
3. Set **channels** and configure **signal properties**.
4. Configure the **DSP pipeline**.
5. **Run the analysis**.
6. Run error detection tests.
7. Select plots and measurements to display.
8. Load/Save data for further analysis at a later stage, and access system menu functions.

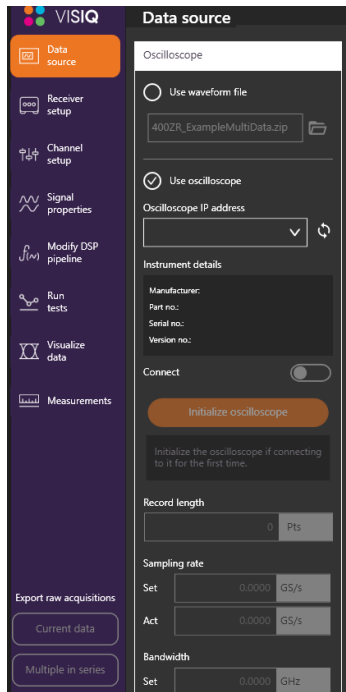


## 4.1 Select the data source

### ► In **Data source**:

1. To acquire live data, connect VISIQ with an **oscilloscope**. If you are using another OMA software product with the oscilloscope, please close it down first.
2. If connecting with the oscilloscope for the first time or after a reboot of the oscilloscope, click **Initialize oscilloscope** to configure it to a state compatible with VISIQ.
3. Alternatively, select a **previously acquired waveform file** as the data source.  
You can find example files in ...\\Quantifi Photonics\\VisIQ\\Examples.

- A waveform file contains raw signal data only.
- A project file can contain raw signal data and includes the settings that were selected when saving the file.

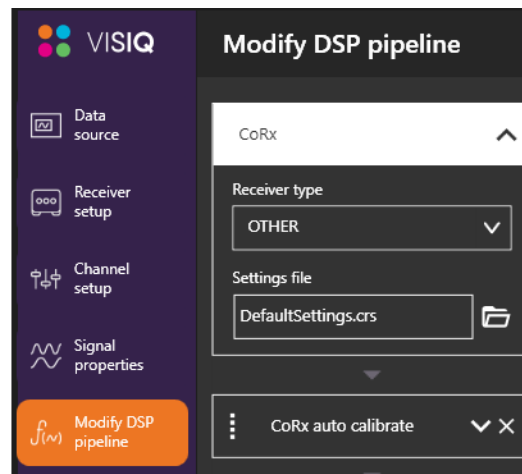
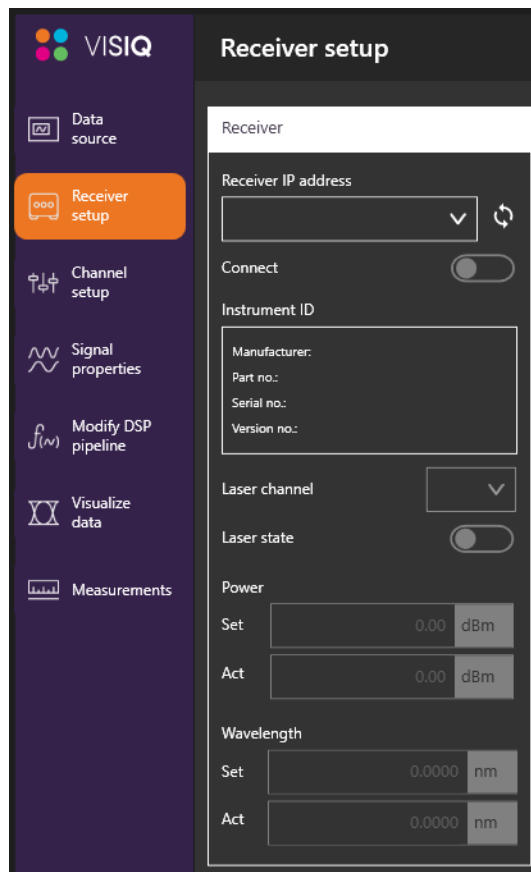


## 4.2 Configure the coherent receiver

This is required if you have selected an oscilloscope as your data source to acquire live data.

► Connect VISIQ with the coherent receiver:

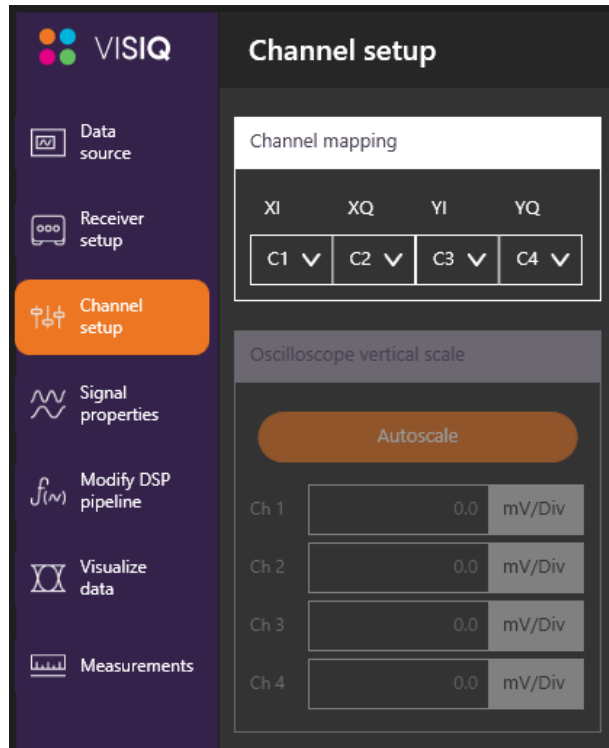
1. **Quantifi Photonics IQRX:** Select or enter the IQRX in **Receiver setup**.
2. **Non-Quantifi Photonics coherent receiver:** Select the receiver type and settings file in **Modify DSP pipeline > CoRx** instead.
3. If required, create a settings file by editing a copy of the example file DefaultSettings.crs. Please leave the original file unchanged.  
You can find the file in ...\\Quantifi Photonics\\VisIQ\\Examples\\Configurations.



## 4.3 Set channel mapping

► In **Channel setup**:

1. Set channel mapping.
2. Set oscilloscope vertical scale.



## 4.4 Configure signal properties

► In **Signal properties**:

1. Define the properties of the received signal.
2. Set the total number of symbols to capture during data acquisition.



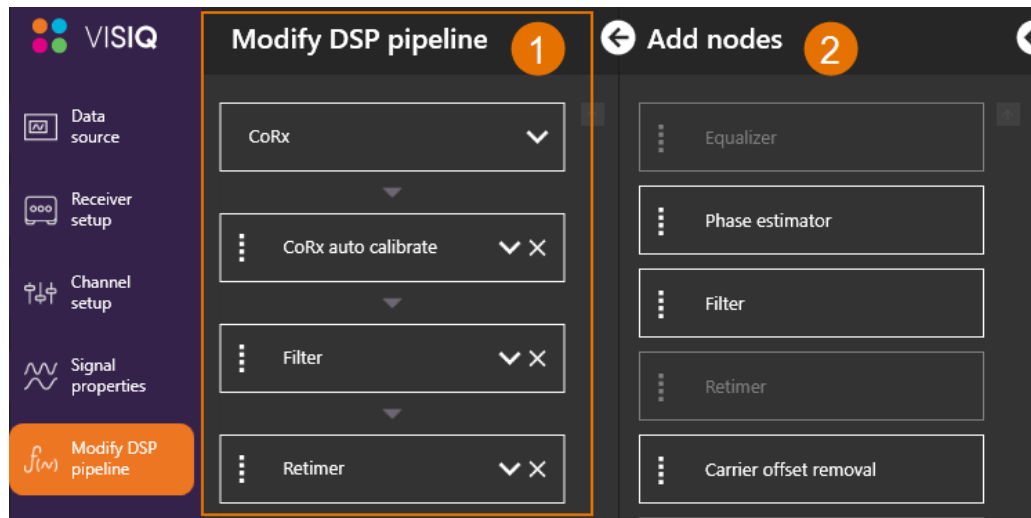
## 4.5 Configure the DSP pipeline

The digital signal processing (DSP) pipeline displays the sequence of functional DSP nodes that will be applied to your signal.

► In **Modify DSP pipeline**:

1. This is your pipeline.
2. Add nodes to the pipeline by dragging & dropping nodes as required.  
At a minimum, the pipeline needs to include the following nodes:

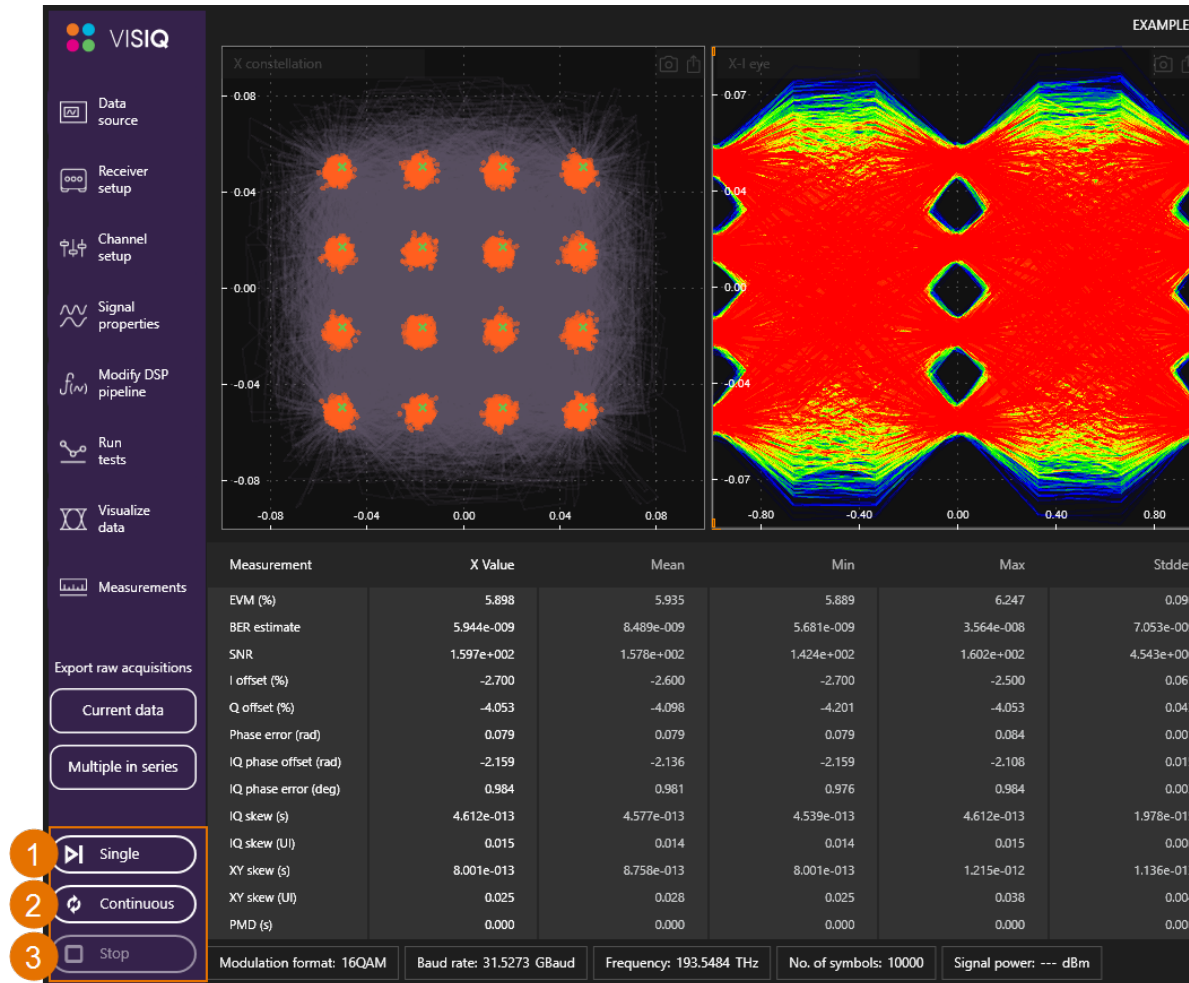
- CoRx
- CoRx auto calibrate
- Retimer
- PolDeMux
- Carrier offset removal
- Phase estimator



## 4.6 Run the analysis

► Acquire data:

1. Click **Single** to capture a single acquisition and capture the number of symbols as selected. Plots and table values will reflect captured data; the counter in the measurement table will go up by one.
2. Click **Continuous** to repeatedly catch a single acquisition. The plots and table values will update as data is captured; the counter in the table will go up by one with each acquisition.
3. Click **Stop** to stop continuous data acquisition.



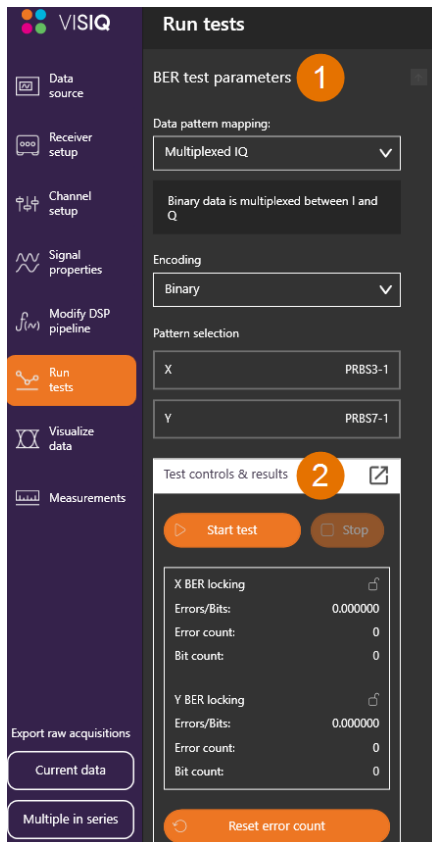
## 4.7 Run tests

The Bit Error Rate measurement in **Run tests** compares the received data pattern to the pre-defined reference pattern configured by the user to make an accumulative error count. VISIQ's BER test supports various multiplexing and encoding options and common PRBS patterns ranging from PRBS3 to PRBS31 are available from the selection menu.

The pattern and encoding you set up in **Run tests** will be copied over to **Signal properties** and vice versa.

► In **Run tests**:

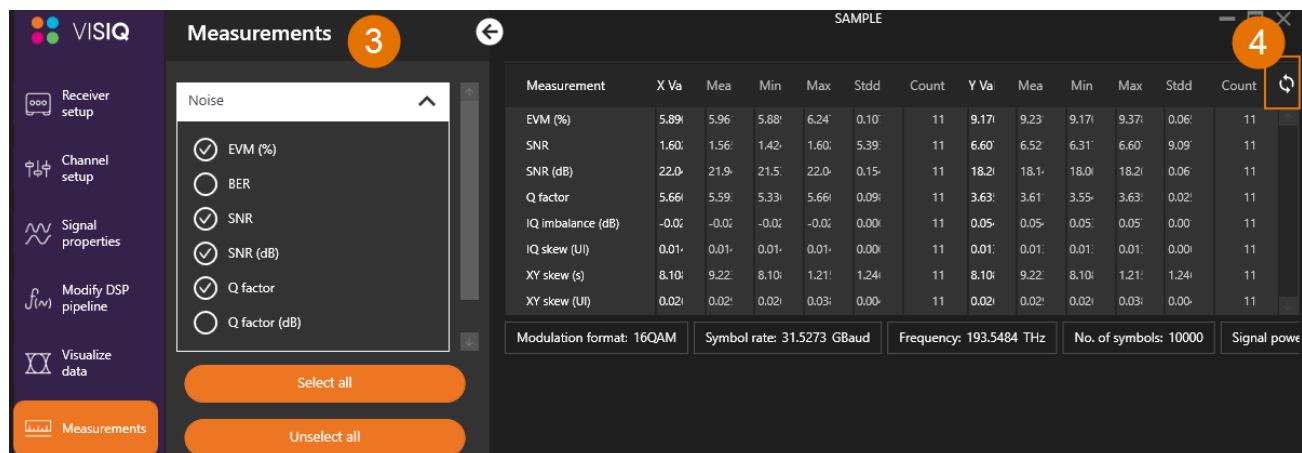
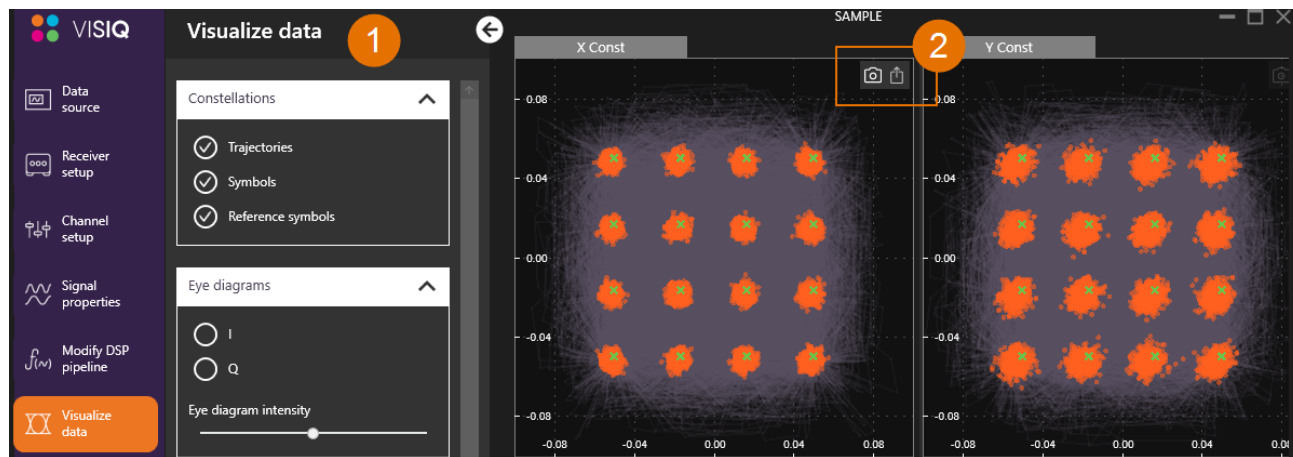
1. Select test parameters.
2. Run the tests.



## 4.8 Manage plots and measurements

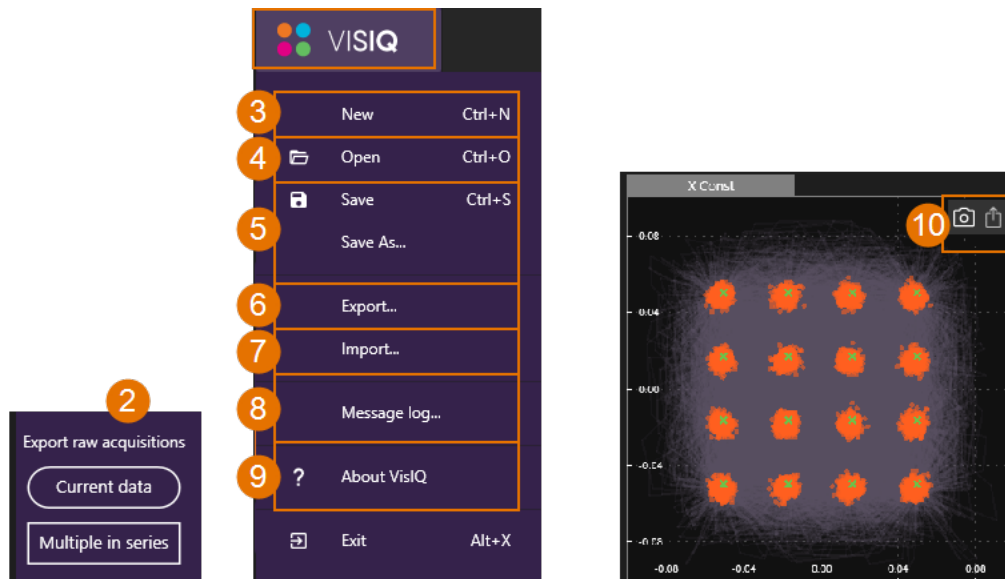
► In **Visualize data** and **Measurements**, select and adjust plots and measurements:

1. Select the plots to display.
2. Process the plots: Save as an image or data file.
3. Select the measurements to list in the table. The table values will update with each data acquisition.
4. Reset the table.



## 4.9 Load/Save data and system menu functions

- ▶ Load previously saved data:
  1. Load a project file in the startup screen, or a waveform file in **Data source**.
- ▶ Export raw acquisitions:
  2. **Current data** or **Multiple in series**.
- ▶ For further options, click the **VISIQ logo**:
  3. Create a new project file.
  4. Load a project file or configuration file.
  5. Save a project file or configuration file.
  6. Save a pipeline file.
  7. Load a pipeline file.
  8. Open the message log.
  9. View details about your VISIQ version, license expiry date and other relevant information.
- 10. Save a plot as an image or data file.



## 5 DSP nodes

You can select from the following DSP nodes when configuring the pipeline:

|                               |                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CoRx</b>                   | <input checked="" type="checkbox"/> always the first node in the pipeline<br><input checked="" type="checkbox"/> cannot be removed         | <p>This node compensates coherent receiver imperfections such as skew, frequency response, and IQ phase error.</p> <p>Relevant receiver settings are stored in a settings file (.crs format). Example settings files are included in the VISIQ software package, locate them in ...\\QuantifiPhotonics\\VisIQ\\Examples\\Configurations.</p> |
| <b>Carrier offset removal</b> |                                                                                                                                            | <p>This node estimates and compensates the residual frequency offset between the carrier and the local oscillator that may be present in your signal. The residual carrier must be <math>&lt;\pm 10\%</math> of the Baud rate to work effectively.</p>                                                                                       |
| <b>Chromatic dispersion</b>   |                                                                                                                                            | <p>This node compensates for chromatic dispersion due to fiber propagation.</p>                                                                                                                                                                                                                                                              |
| <b>CoRx auto calibrate</b>    |                                                                                                                                            | <p>This node manages automatic calibration of the coherent receiver. It calculates and compensates for the DC offsets and the gain for the XI/XQ pair and the YI/YQ pair. It also calculates residual skew between the XI/XQ pair and the YI/YQ pair in the system.</p>                                                                      |
| <b>Equalizer</b>              |                                                                                                                                            | <p>This node calculates the complex (real and imaginary) Finite Impulse Response (FIR) taps. It attempts to correct the frequency response of the signal by training over a defined number over symbols. The training goal is to match the ideal reference symbols.</p>                                                                      |
| <b>Filter</b>                 |                                                                                                                                            | <p>This node works as a digital filter that modifies the frequency components present in the signal.</p>                                                                                                                                                                                                                                     |
| <b>Find Baud rate</b>         | <input checked="" type="checkbox"/> only 1 per pipeline<br><input checked="" type="checkbox"/> insert before <b>Retimer</b> node (if used) | <p>This node detects the Baud rate of the signal and replaces the Baud rate setting in the Stream properties with the discovered Baud rate.</p>                                                                                                                                                                                              |
| <b>IQ offset removal</b>      |                                                                                                                                            | <p>This node corrects IQ offsets that may be present on the signal.</p>                                                                                                                                                                                                                                                                      |

|                             |                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>MATLAB</b>               |                                                                                                                                                                                                                                                                         | <p>This node enables you to add a MATLAB script to the pipeline.</p> <p>The node is <b>only</b> enabled if you have a MATLAB license and an installed MATLAB version 2014a or newer. In the MATLAB node, define the location of the MATLAB file. Example scripts are included in the VISIQ software package, locate them in ...\\Quantifi Photonics\\VisIQ\\Examples\\Scripts.</p> |
| <b>Nonlinear correction</b> |                                                                                                                                                                                                                                                                         | <p>This node can correct gain imbalances, IQ offsets as well as non-linear distortion that may present on the signal.</p>                                                                                                                                                                                                                                                          |
| <b>Phase estimator</b>      |                                                                                                                                                                                                                                                                         | <p>This node calculates and removes the phase errors over time that may be present in the signal. The phase error occurs as a result of the phase noise difference between the carrier and the local oscillator laser.</p>                                                                                                                                                         |
| <b>PolDeMux</b>             |                                                                                                                                                                                                                                                                         | <p>This node demultiplexes the two polarizations of the carrier.</p>                                                                                                                                                                                                                                                                                                               |
| <b>Retimer</b>              | <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> only 1 per pipeline</li> <li><input checked="" type="checkbox"/> insert after <b>Find Baud rate</b> node (if used)</li> <li><input checked="" type="checkbox"/> cannot be removed</li> </ul> | <p>This node retimes the input to a particular sample per Baud.</p> <p>Interpolation is used to create traces of samples per Baud higher than the input. The algorithm also calculates the skew between x pol and y pol that may be present.</p>                                                                                                                                   |

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