

CANape Quick Start

A Short Introduction To CANape and Its Most Basic Workflows

Agenda

CANape Quick Start

► **What is CANape ?**

How Do I Connect CANape to My ECU ?

How Do I Acquire Data With CANape ?

How Do I Calibrate With CANape ?

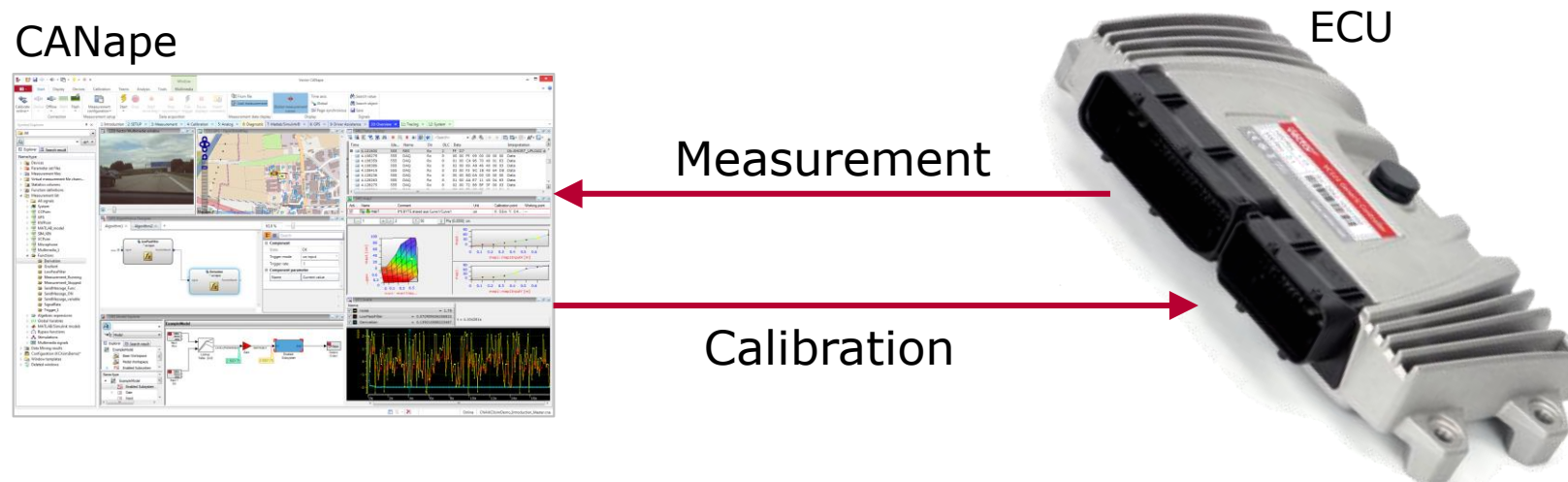
How Do I Log Data With CANape ?

How Do I Analyze Data With CANape ?

Vector Support

What is CANape?

- ▶ CANape = Run-time Measurement and Calibration tool (MC tool)
 - ▶ Run-time = while the ECU is running
 - > No breakpoints allowed!
 - ▶ Measurement = reading data from the ECU memory
 - > Data not already broadcast by the ECU on the CAN bus
 - ▶ Calibration = writing data to the ECU memory
 - > Changing parameter values without having to reflash



- ▶ Many possible applications for development and test

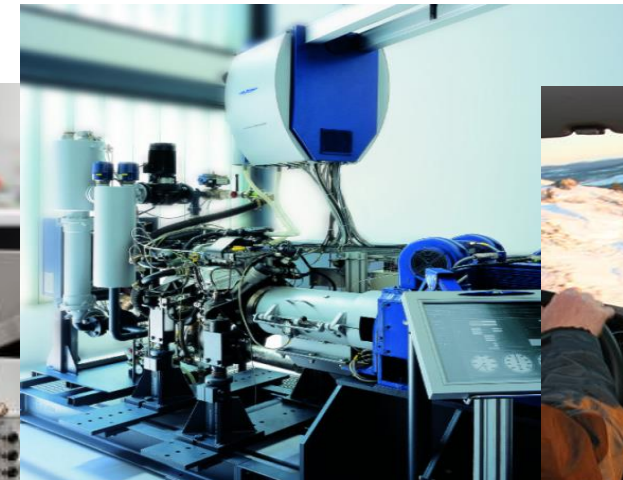
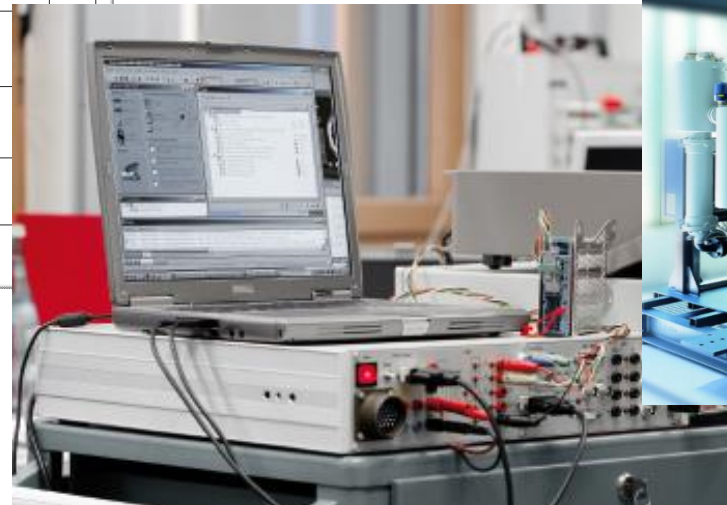
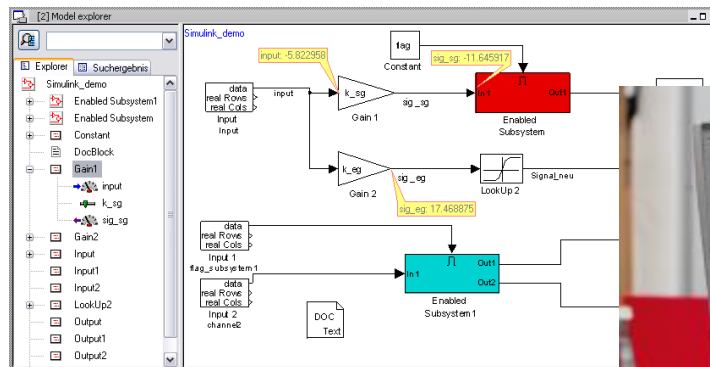
Where is CANape used?

► Development and Test Application Areas

- White-box testing (monitor ECU internal variables)
- Function calibration (on-target or model-based)
- ECU calibration (on-bench or on-vehicle)
- Adding ECU SW access for HIL or test benches
- Dyno/road test data logging

► System Application Areas

- Powertrain – Diesel, gas, hybrid, electric, trans, ...
- Chassis – steering, suspension, brakes, ...
- Safety – passive, active, radar, lidar, ultra sonic, ...
- Body – HVAC, lighting, seats, doors, windows, ...
- Equipment – car, truck, ag, construction, rail, ...



What is CANape ?

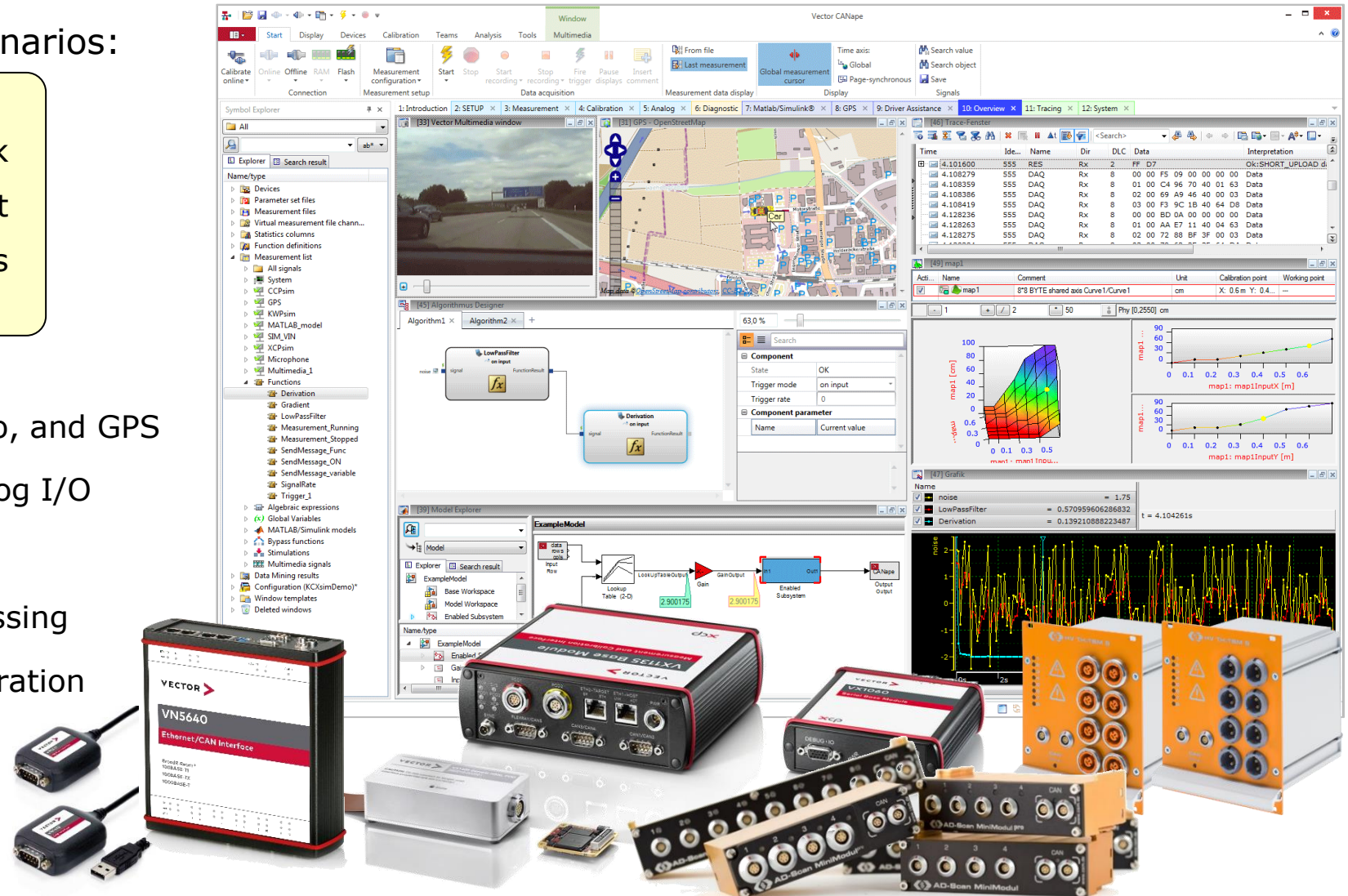


CANape – measurement, calibration, and much more

▶ CANape supports these scenarios:

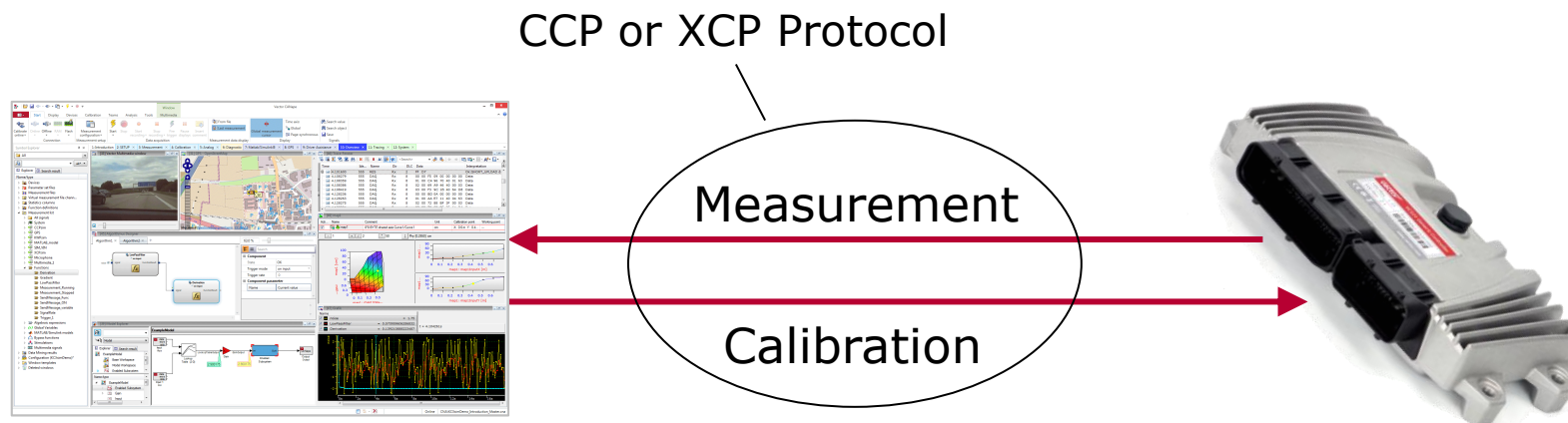
- ▶ ECU Measurement
- ▶ ECU Calibration
- ▶ Data logging
- ▶ Data analysis
- ▶ Vehicle bus monitoring
- ▶ Integration with audio, video, and GPS
- ▶ Integration with digital/analog I/O
- ▶ Model-based development
- ▶ Rapid prototyping and bypassing
- ▶ Automated testing and calibration
- ▶ Data mining
- ▶ Diagnostics
- ▶ Flashing

Quick
Start
Topics



What are CCP and XCP ?

- ▶ CCP / XCP – communication protocols
 - ▶ Open standards from ASAM – www.asam.net
 - ▶ Commands to read data from ECU (measurement)
 - ▶ Commands to write data to ECU (calibration)
 - ▶ Runs on common vehicle networks and instrumentation channels
 - > CCP only runs on CAN (CCP = CAN Calibration Protocol)
 - > XCP can run on many networks – CAN, Ethernet, FlexRay, LIN, ...



What is an A2L file ?

- ▶ A2L – ECU description data file format (ASAP2)
 - ▶ Open standard from ASAM – www.asam.net
 - ▶ Describes all ECU software variables
 - > Source code name and display name
 - > Memory address and data type
 - > Conversion formula and display format
 - ▶ MC tools use A2L data to drive measurement & calibration

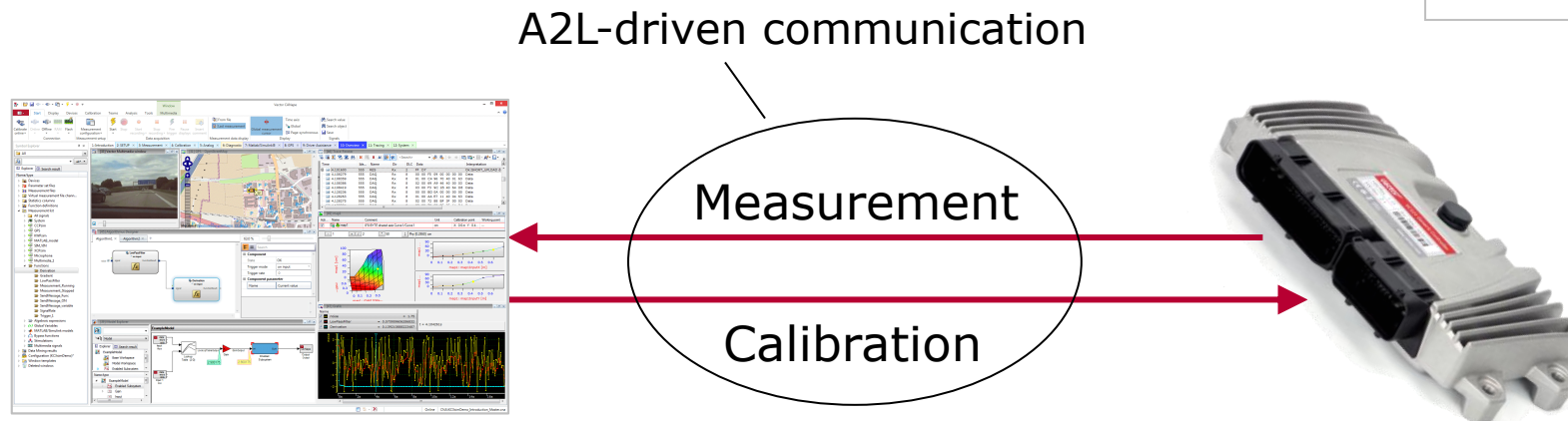
```
/begin MEASUREMENT

    ftefva
    "canister purge rate"
    UBYTE
    fak_ub_b0p5
    1
    100
    0.00
    0.4980

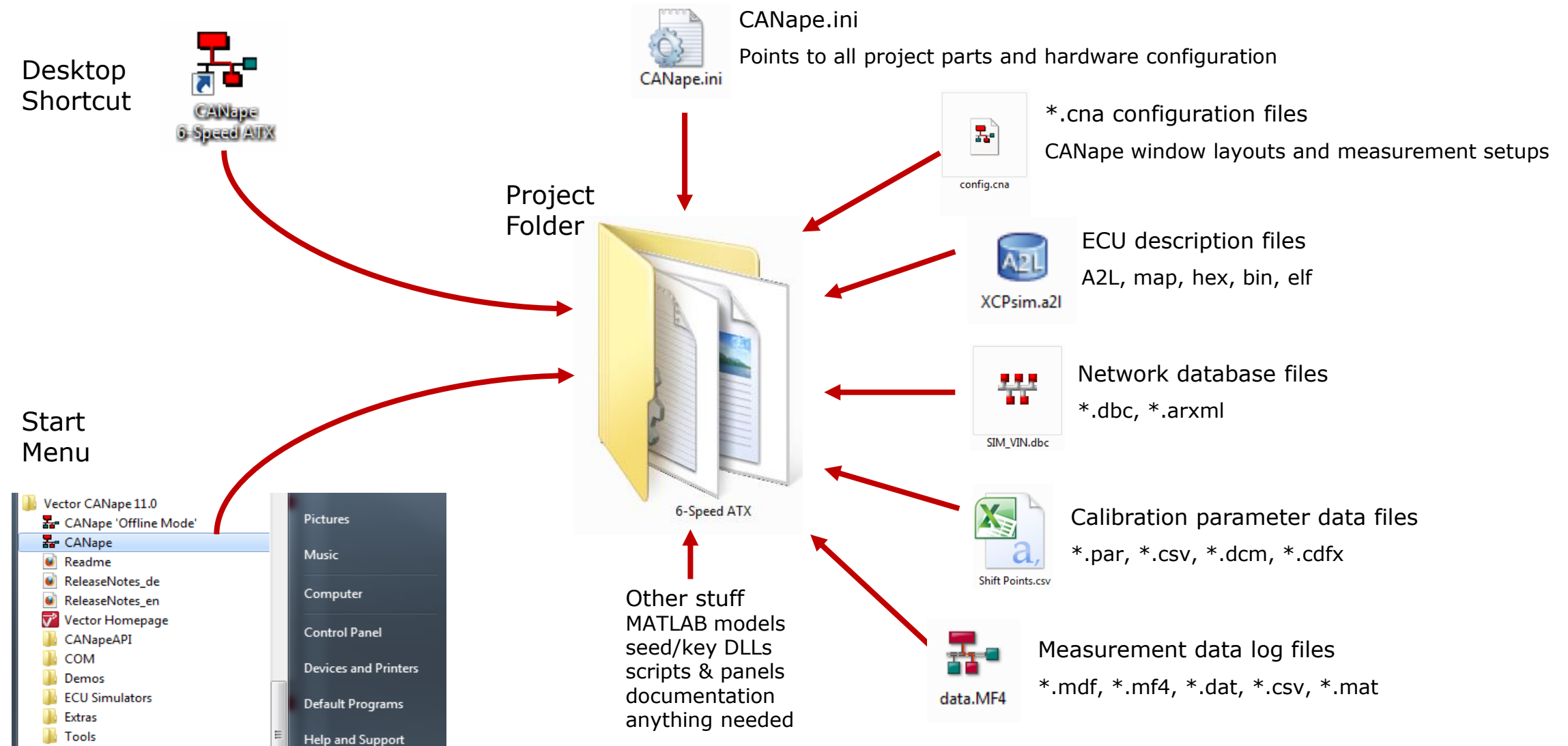
    FORMAT "%6.4"

    ECU_ADDRESS 0x300791

/end MEASUREMENT
```



Projects

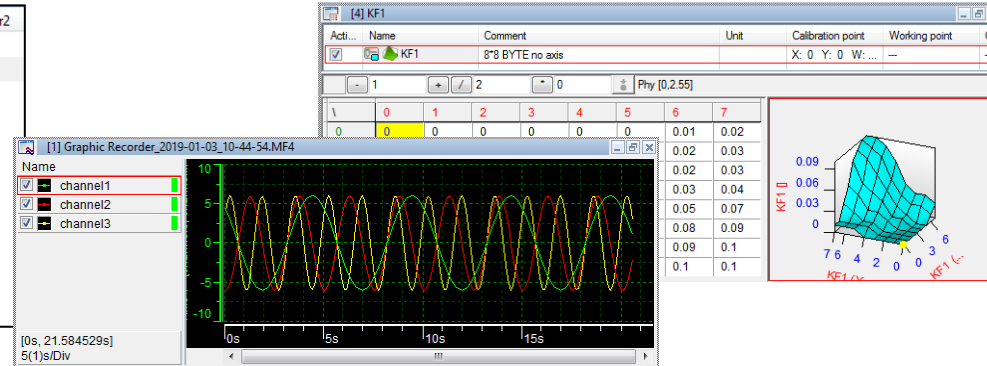


Projects and configurations

Configuration (* .cna)

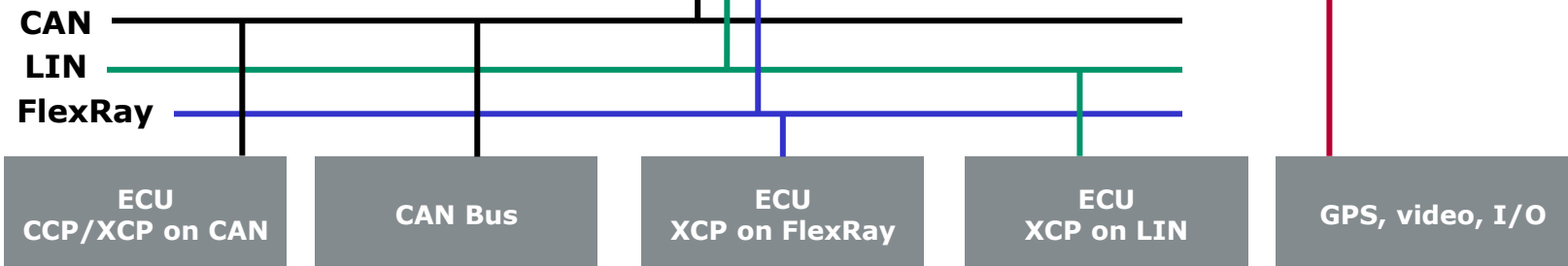
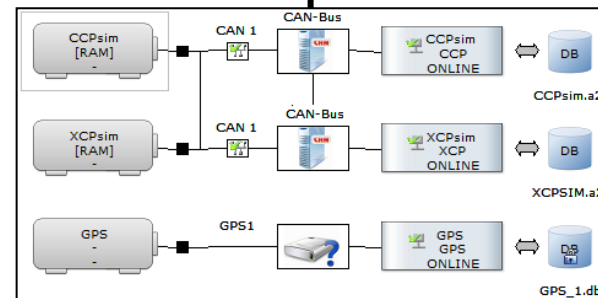
*The data and
tasks CANape is
working on*

Type	Active	Name	Measurement...	Rate	Recorder1	Recorder2
	<input checked="" type="checkbox"/>	channel1	100ms			
	<input checked="" type="checkbox"/>	channel2	cyclic	50		
	<input checked="" type="checkbox"/>	channel2	100ms			
	<input checked="" type="checkbox"/>	Counter_B4	polling	100		
	<input checked="" type="checkbox"/>	GPS_course	polling	100		
	<input checked="" type="checkbox"/>	GPS_speed	polling	100		
	<input checked="" type="checkbox"/>	GPS_x	polling	100		
	<input checked="" type="checkbox"/>	GPS_y	polling	100		
	<input checked="" type="checkbox"/>	GPS_z	polling	100		
	<input checked="" type="checkbox"/>	PWM	10 ms			
	<input checked="" type="checkbox"/>	PWM_Level	10 ms			
	<input checked="" type="checkbox"/>	PWMFiltered	10 ms			



Project (CANape.ini)

*The hardware
CANape is
connected to*



Agenda

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What is CANape ?

► **How Do I Connect CANape to My ECU ?**

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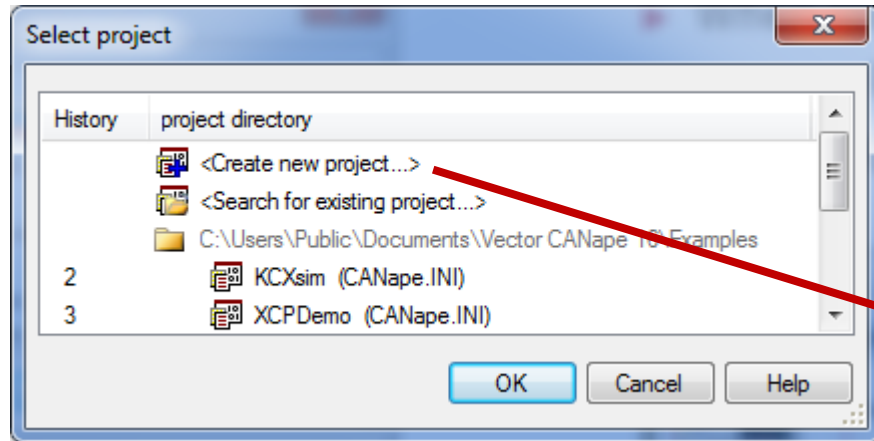
How Do I Calibrate With CANape ?

How Do I Log Data With CANape ?

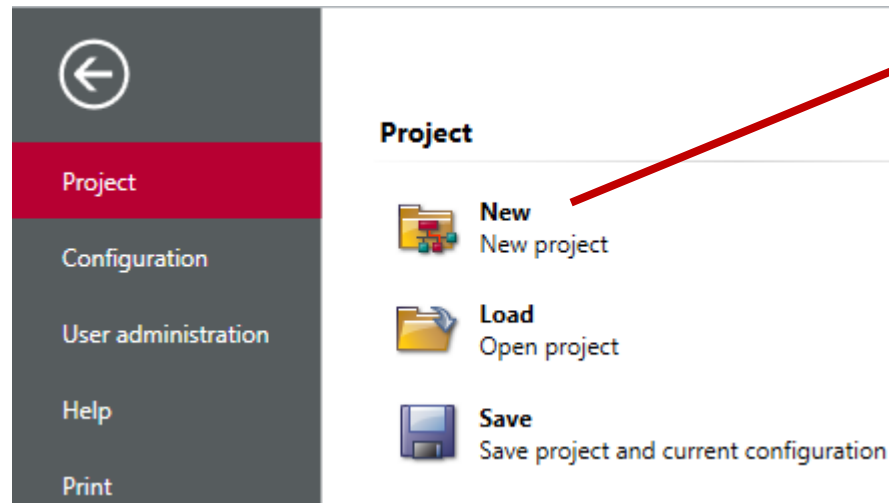
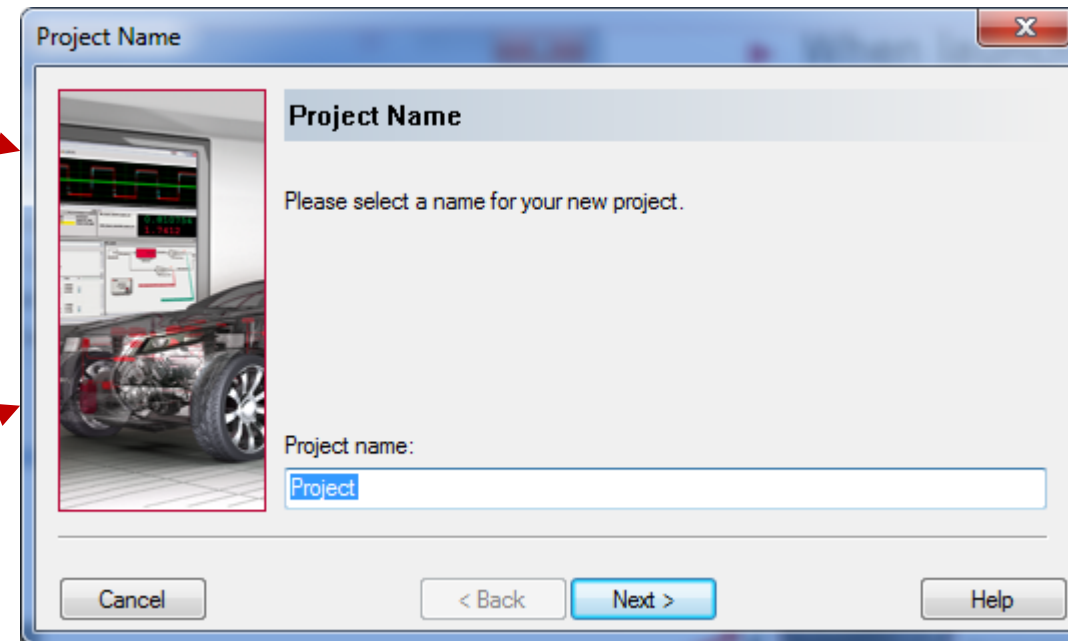
How Do I Analyze Data With CANape ?

Vector Support

Create a project

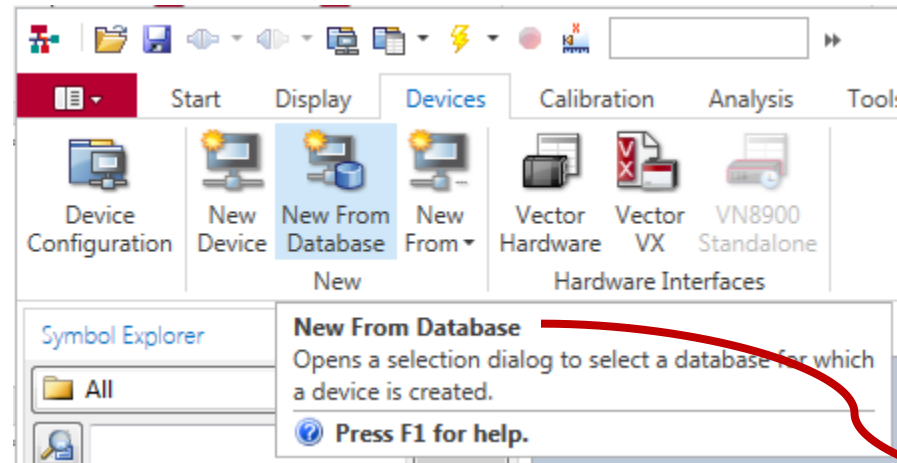


- ▶ When launching CANape
 - OR -
- ▶ New Project... menu command

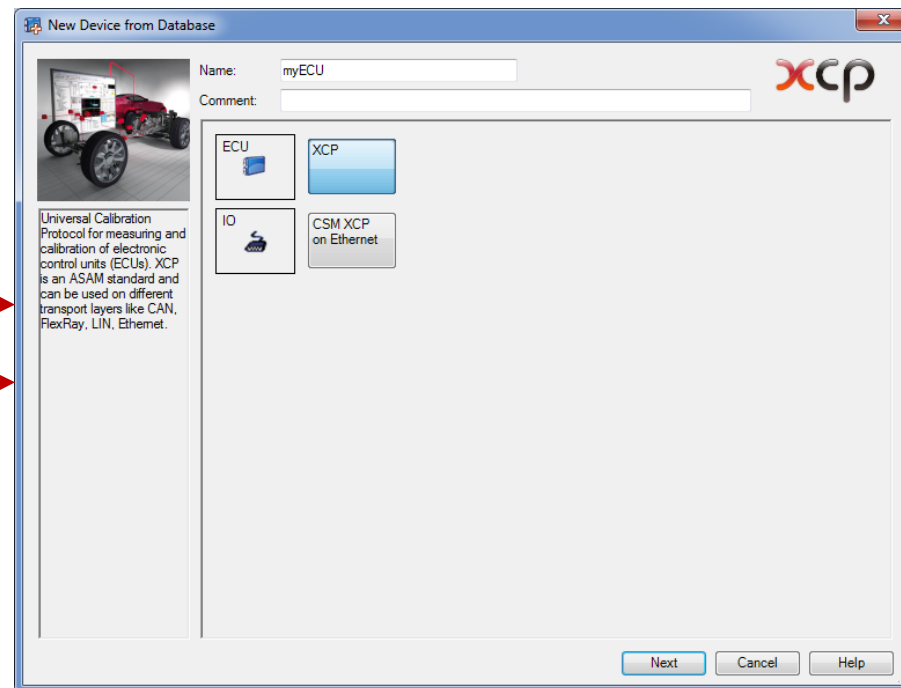


- ▶ Enter project/folder name
- ▶ Set path to the project folder

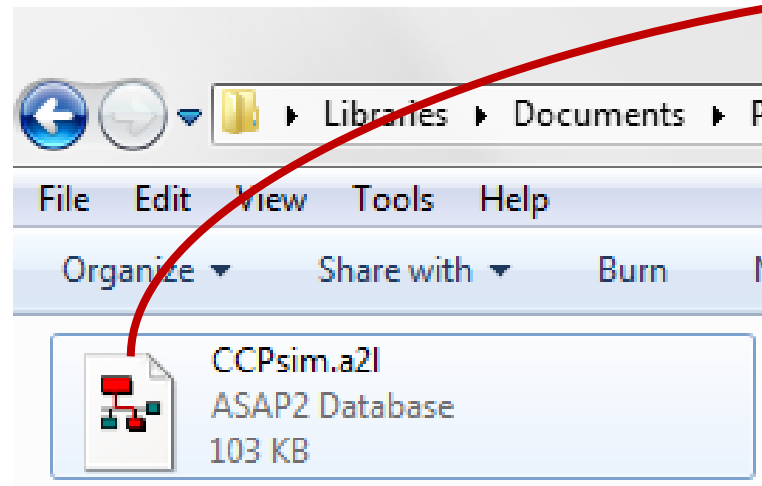
Create a device



- New from Database command in Devices menu



- Drag and drop A2L file into CANape



Connect demo

- ▶ Start ECU simulator
- ▶ Start CANape
 - ▶ Load QuickStart project
 - ▶ Inspect Symbol Explorer – empty device list
- ▶ Create device
 - ▶ Open project directory from lower right corner in CANape
 - ▶ Take note of CANape.ini file
 - ▶ Take note of A2L file
 - ▶ Device > New from database... - call it **MyECU**
 - ▶ Confirm ECU device is now in Symbol Explorer
 - ▶ Confirm ECU device is online and ready to use

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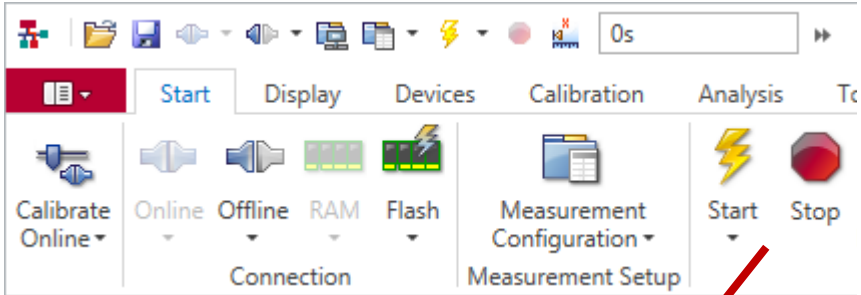
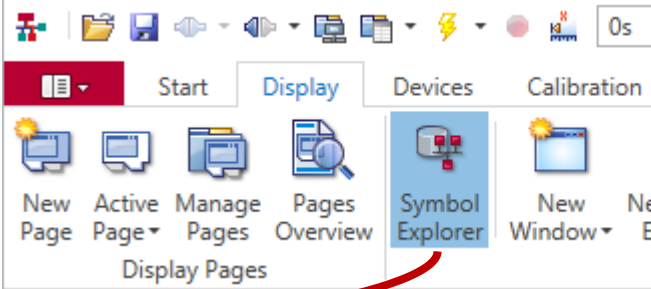
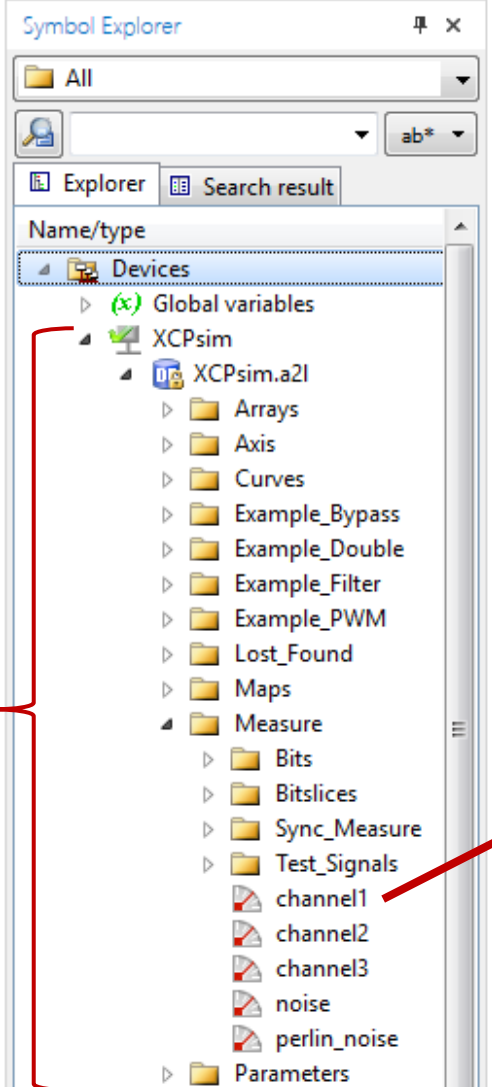
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Vector Support

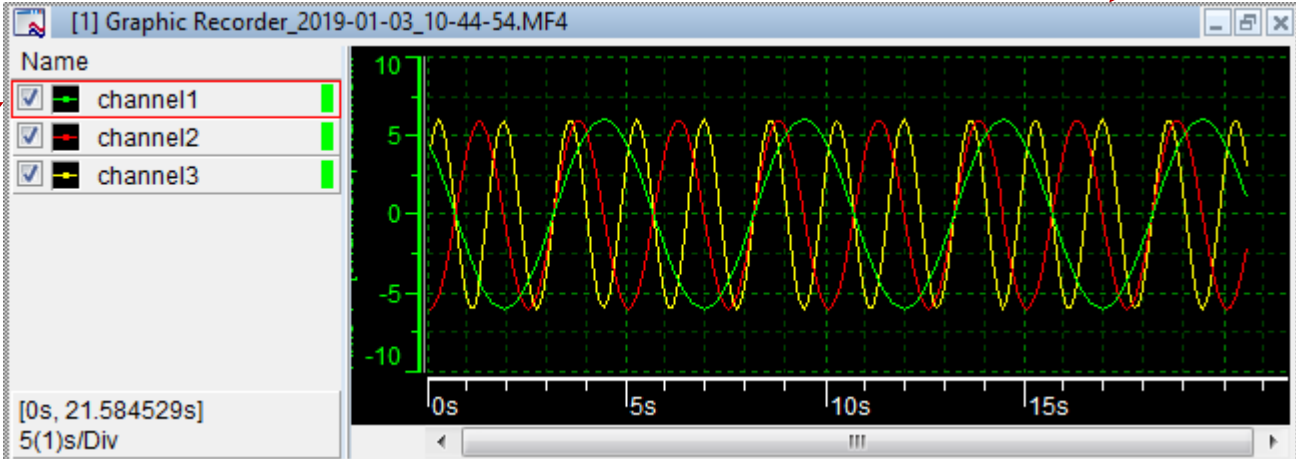
Setting up for measurement

variables from A2L file



starts measurement

stops measurement



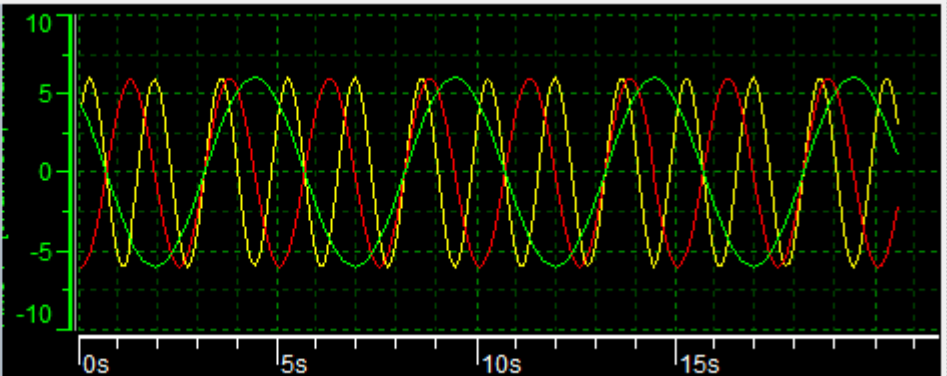
drag & drop

[1] Graphic Recorder_2019-01-03_10-44-54.MF4

Name

- ☒ channel1
- ☒ channel2
- ☒ channel3

[0s, 21.584529s]
5(1)s/Div



Measurement demo

- ▶ Drag-n-drop **channel1** and **channel2** into graphic window
- ▶ Start measurement
- ▶ Wait a few seconds and then Fit signals with "f" key
- ▶ Stop measurement
- ▶ Put same signals in a numeric window and then in a text window
- ▶ Open measurement configuration
 - ▶ Look at pulldown selection list for measurement mode
 - ▶ Set channel2 to polling 500
- ▶ Start measurement
 - ▶ See different sampling rates in graphic and text windows
- ▶ Stop measurement

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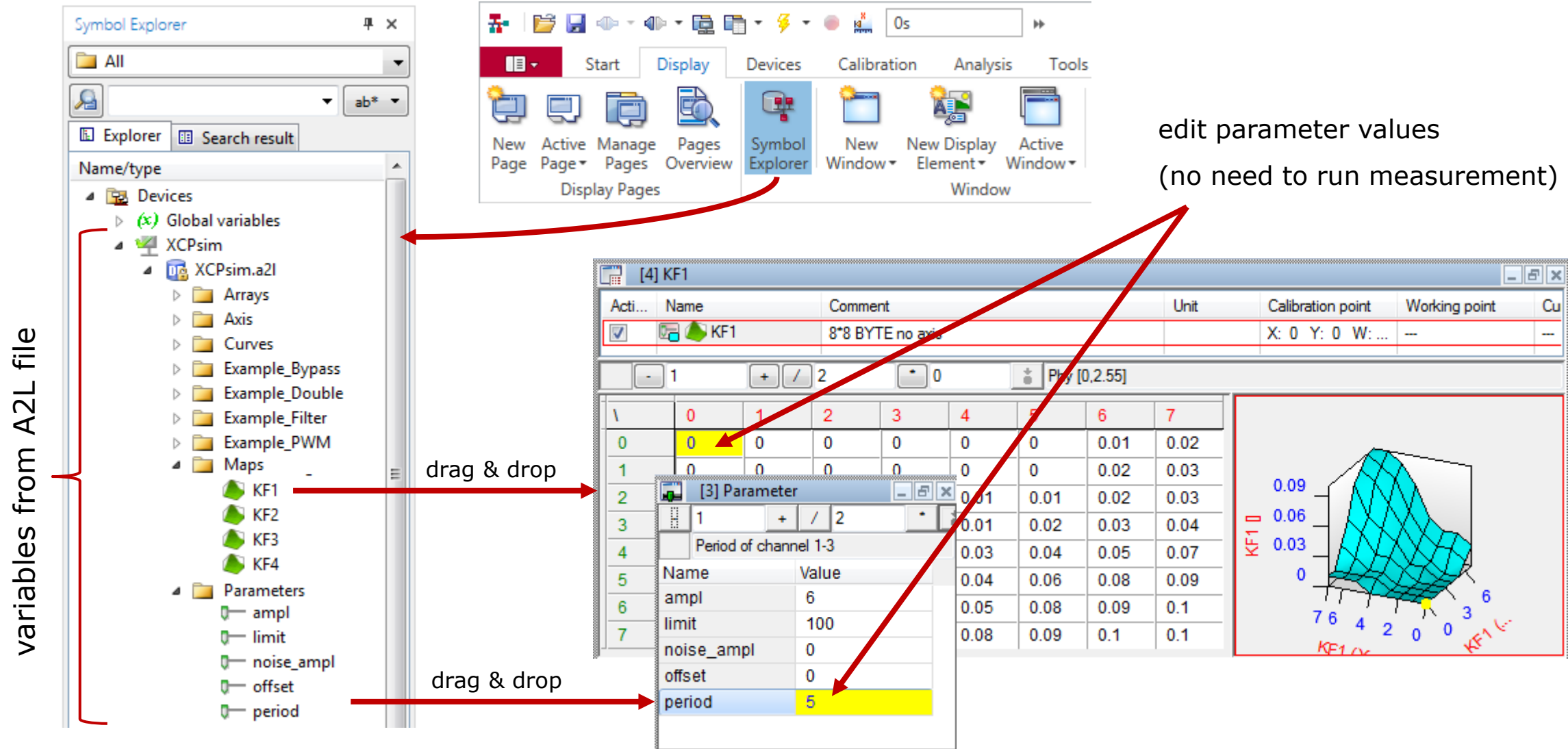
Setting up for calibration

edit parameter values
(no need to run measurement)

variables from A2L file

drag & drop

drag & drop



The screenshot shows the CANape software interface. On the left, the 'Symbol Explorer' window displays a tree structure of variables. A red bracket on the left side of this window is labeled 'variables from A2L file'. The tree includes 'Global variables', 'XCPsim', and 'Parameters'. Under 'Parameters', there are variables like 'ampl', 'limit', 'noise_ampl', 'offset', and 'period'. A red arrow points from the 'period' variable to the 'Parameter' window. The 'Parameter' window shows a table of parameters for 'KF1'. A red arrow points from the 'period' parameter in the table to the 'period' variable in the 'Parameters' list. The 'Parameter' window also shows a 3D surface plot of the 'period' parameter. The 'Calibration' window shows a table of calibration points. A red arrow points from the 'Calibration' window to the 'Parameter' window. The 'Calibration' window also shows a 3D surface plot of the 'period' parameter.

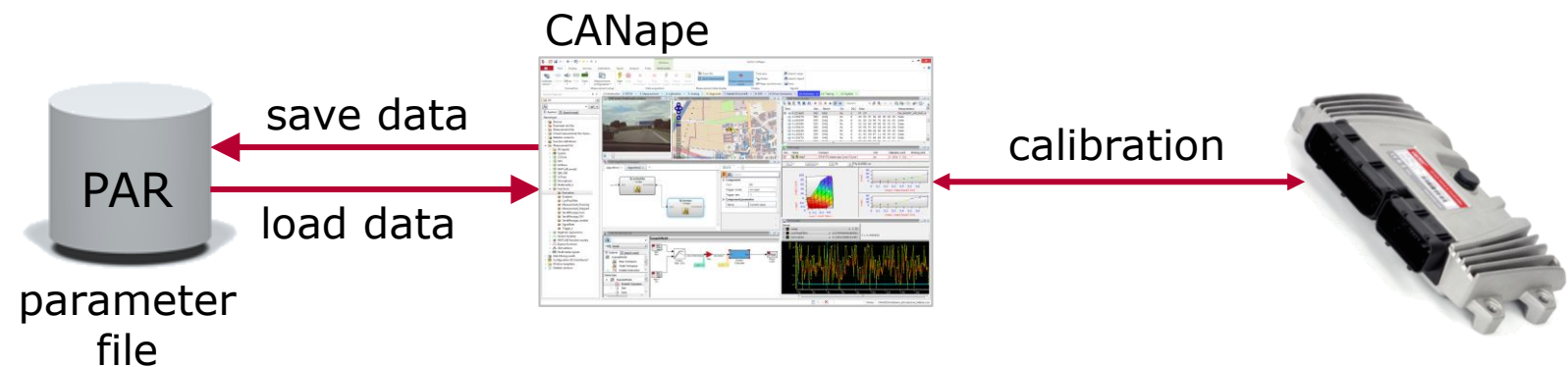
Act...	Name	Comment	Unit	Calibration point	Working point	Cu
<input checked="" type="checkbox"/>	KF1	8*8 BYTE no axis		X: 0 Y: 0 W: ...	--	--

	0	1	2	3	4	5	6	7
0	0	0	0	0	0	0	0.01	0.02
1	0	0	0	0	0	0	0.02	0.03
2	0	0	0	0	0	0	0.01	0.01
3	0	0	0	0	0	0	0.01	0.02
4	0	0	0	0	0	0	0.03	0.04
5	0	0	0	0	0	0	0.04	0.06
6	0	0	0	0	0	0	0.05	0.08
7	0	0	0	0	0	0	0.08	0.09

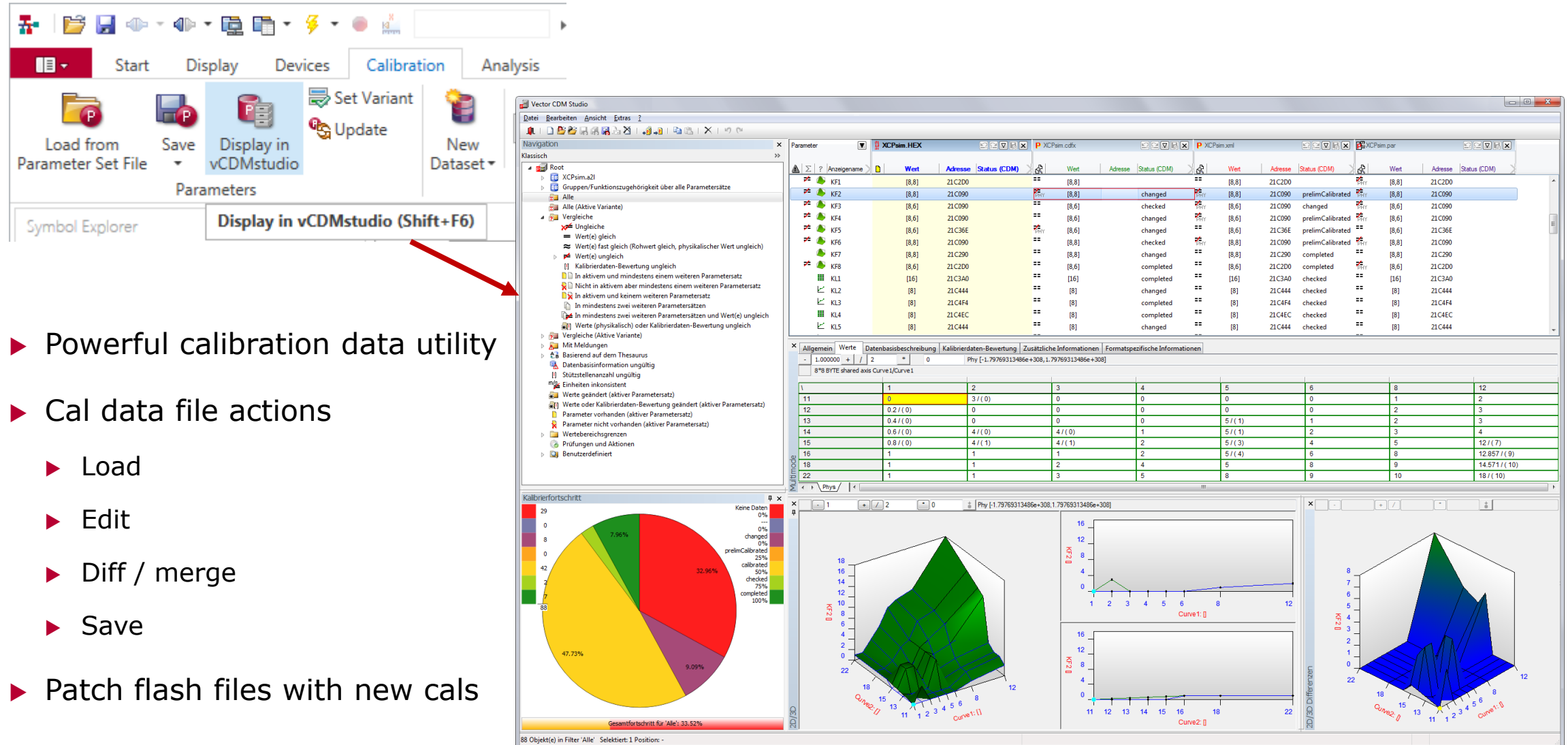
Name	Value
ampl	6
limit	100
noise_ampl	0
offset	0
period	5

Parameter files

- ▶ PAR – calibration PARameter data
 - ▶ Machine readable/writeable file format
 - ▶ Captures calibration data for offline exchange and editing
 - ▶ “PAR” files can mean many different file formats
 - > PAR (Vector)
 - > CSV (Excel)
 - > CVX (ETAS)
 - > CDFX (open standard)
 - > M (MATLAB)



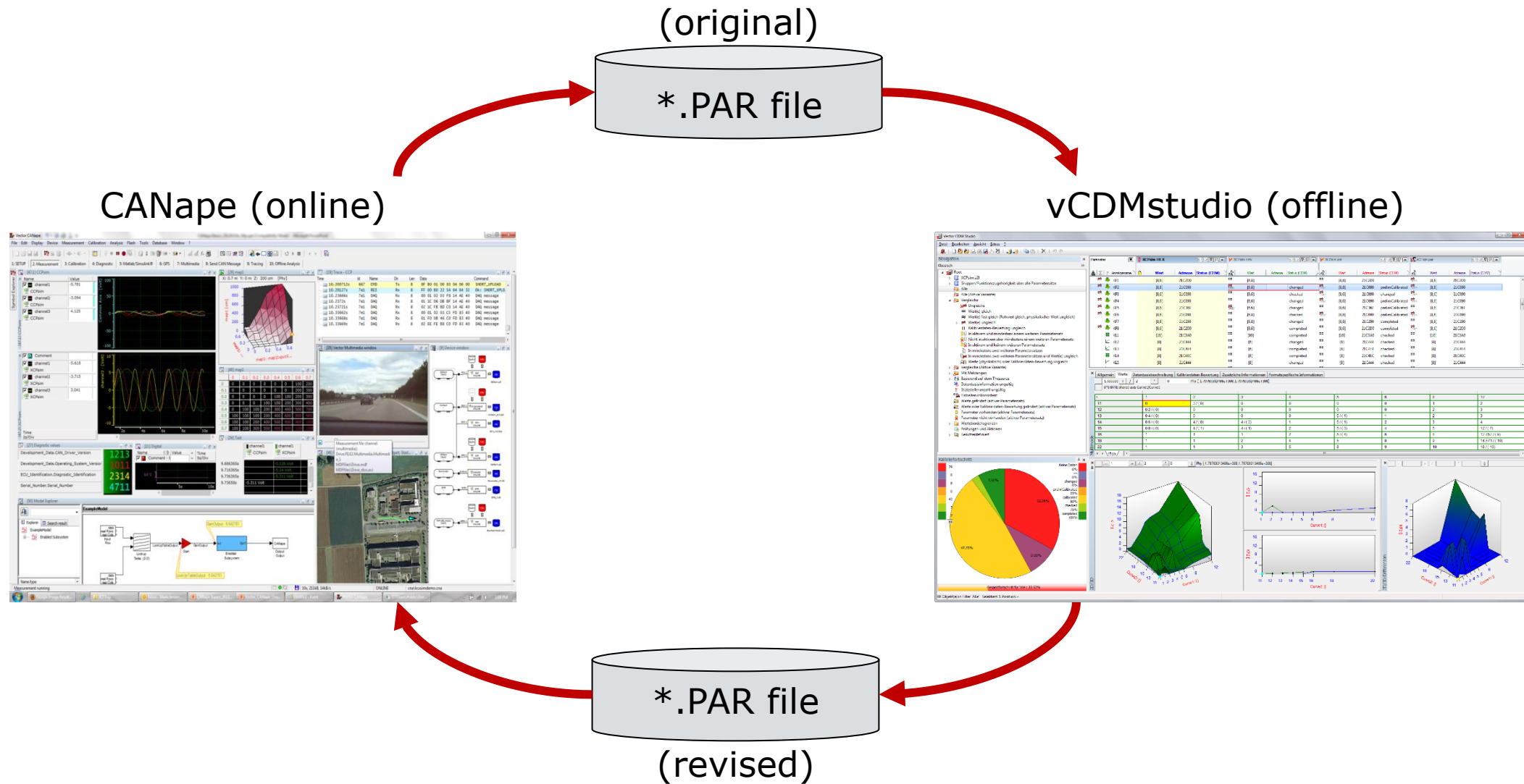
vCDMstudio



The screenshot displays the vCDMstudio software interface, which is used for managing and calibrating CANape data. The interface includes a top menu bar with options like Start, Display, Devices, Calibration, and Analysis. Below the menu is a toolbar with icons for loading, saving, displaying, and updating parameter sets. A central pane shows a tree view of the project structure, including folders for parameters and datasets. A right pane displays a table of calibration data, with columns for parameter name, value, address, and status. A bottom pane shows a 3D surface plot of the calibration data, with axes labeled X, Y, and Z. A legend on the left indicates the status of the data points, ranging from 'Keine Daten' (No Data) to '100%' (Completed).

- ▶ Powerful calibration data utility
- ▶ Cal data file actions
 - ▶ Load
 - ▶ Edit
 - ▶ Diff / merge
 - ▶ Save
- ▶ Patch flash files with new cals

Offline calibration



Calibration demo (part 1)

- ▶ Drag-n-drop **ampl** and **limit** into calibration window
- ▶ Start measurement
 - ▶ Wait a few seconds and then Fit signals with “f” key
 - ▶ Set **ampl** to **10**
 - ▶ Set **limit** to **8**
 - ▶ Observe changes in sine wave output
 - ▶ Stop measurement
- ▶ Work with calibration parameter values
 - ▶ Save cals in **myCals.par**
 - ▶ Change cals
 - ▶ Save cals in **myUpdatedCals.par**
 - ▶ See PAR files in project folder – open them in Notepad

Calibration demo (part 2)

- ▶ Open vCDMstudio
 - ▶ Load current device
 - ▶ Load **myCals.par**
 - ▶ Load **myUpdatedCals.par**
 - ▶ Scroll around to see sparse data
 - ▶ Filter Compare > In the active and 1 more
 - ▶ Filter All
 - ▶ Export top four rows to **myNewCals.par**

Calibration demo (part 3)

- ▶ In cal window, load **myCals.par**
- ▶ Drag-n-drop KF2 to map window
 - ▶ Turn view
 - ▶ Edit point
 - ▶ Zero out lower right corner
 - ▶ Save map as **myKF2Cals.par**
- ▶ Open vCDMstudio
 - ▶ Load **myKF2Cals.par**
 - ▶ Move 3D view to right
 - ▶ Edit a cell in the table
 - ▶ Save **myKF2Cals.par**

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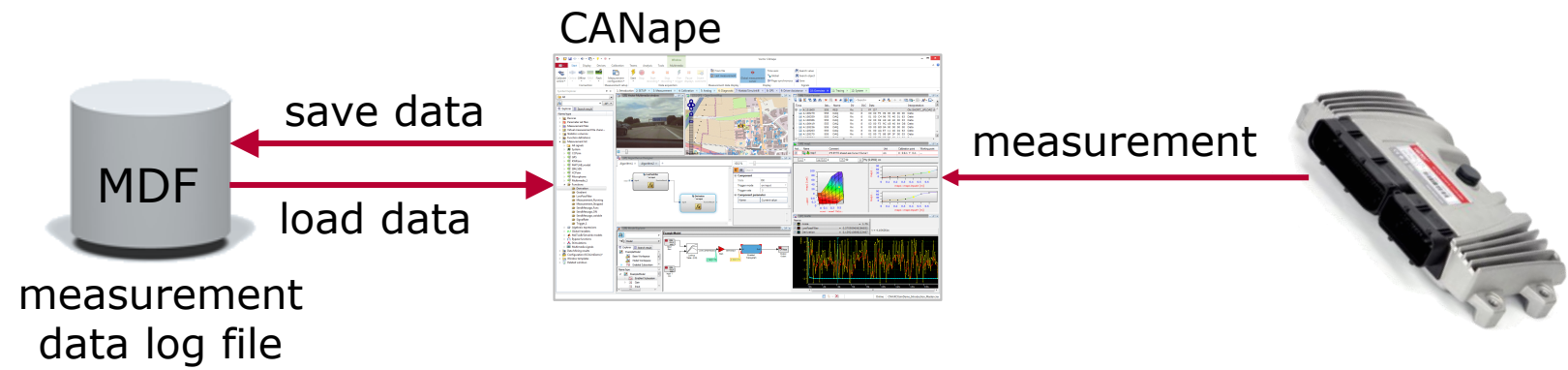
► **How Do I Log Data With CANape ?**

How Do I Analyze Data With CANape ?

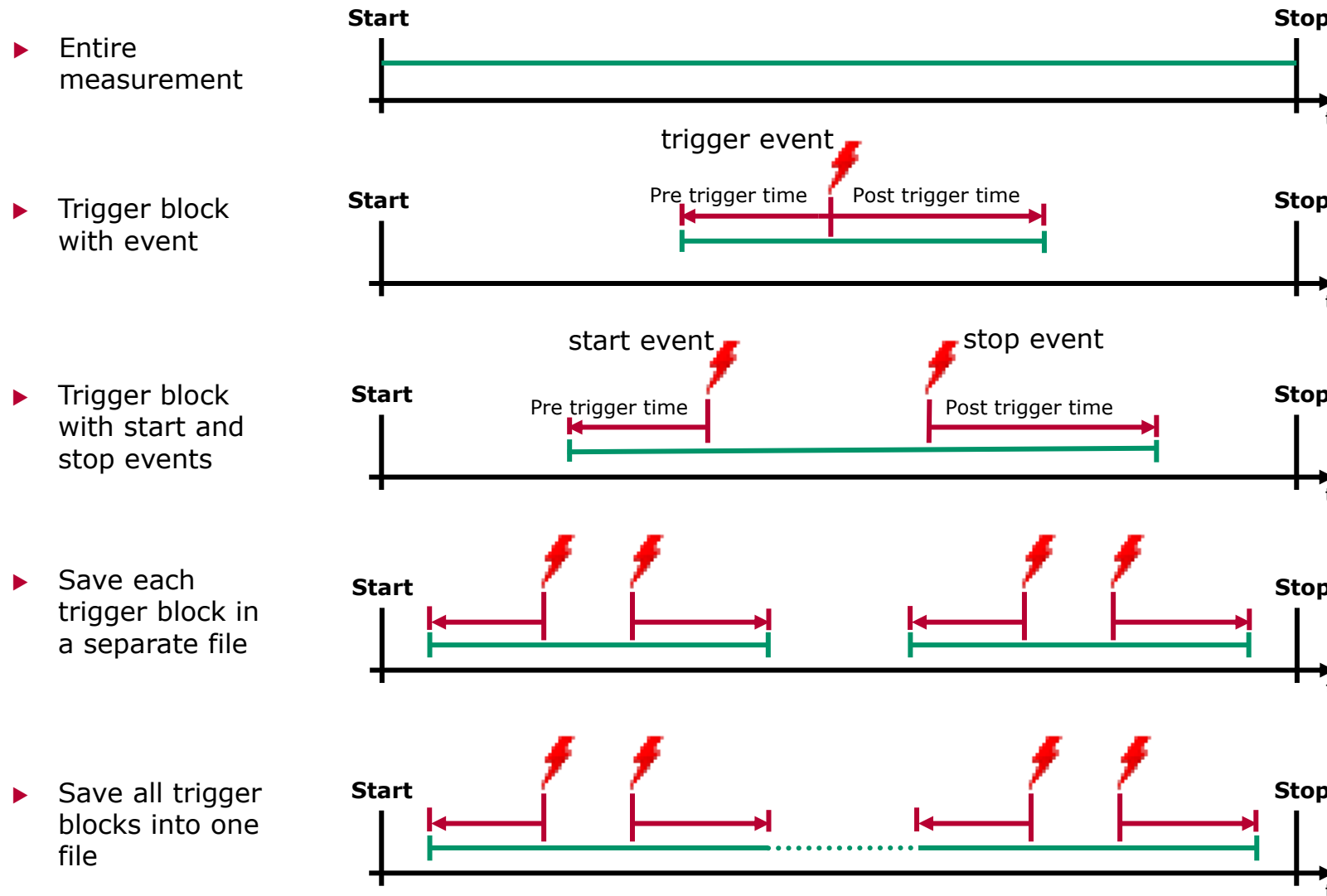
Vector Support

Measurement files

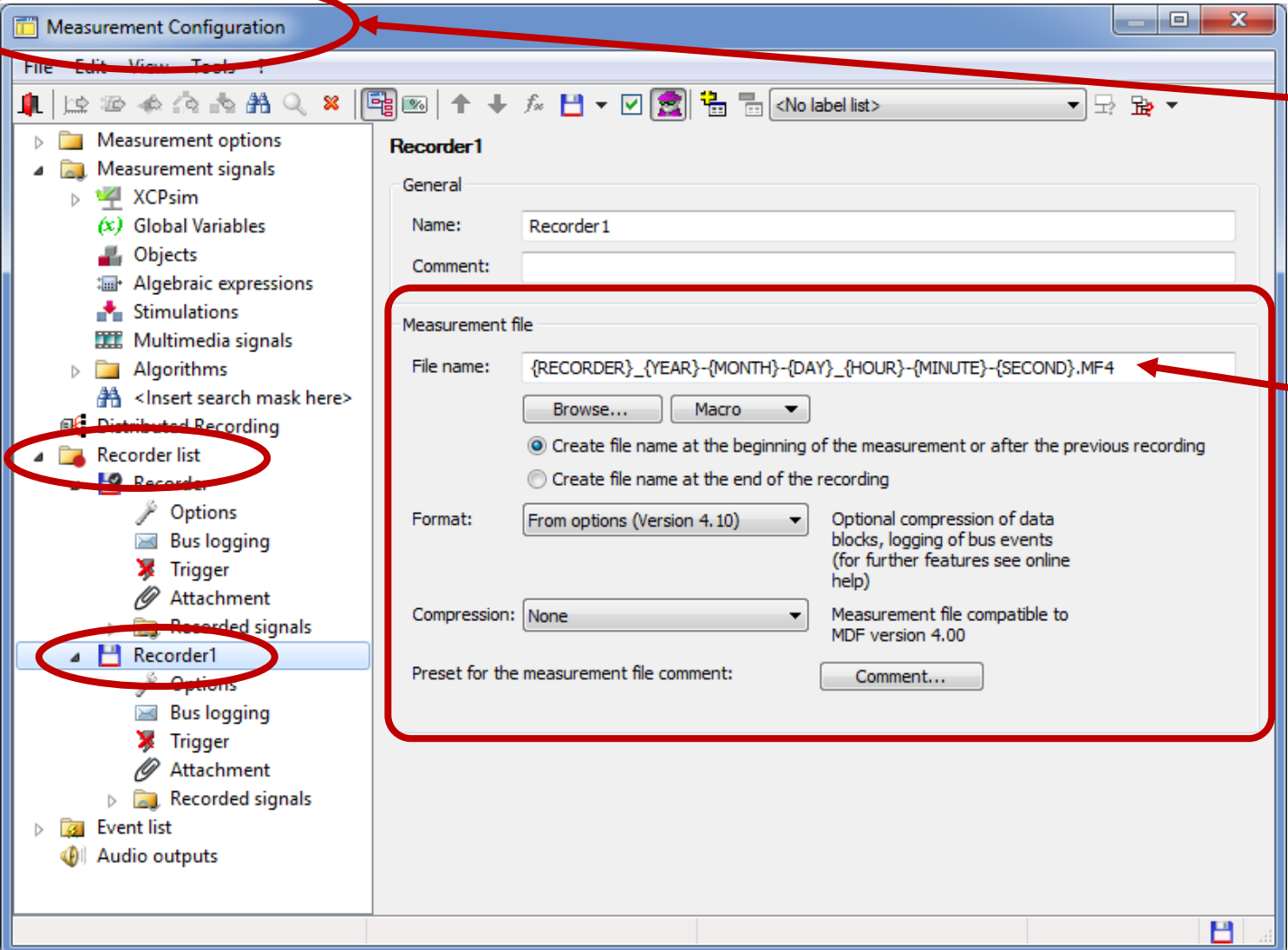
- ▶ MDF – Measurement Data Format
 - ▶ Machine readable/writeable file format
 - ▶ Captures measurement data as log files for offline analysis
 - ▶ Signal data saved in engineering units
 - ▶ Efficient signal-based organization for fast reading
 - ▶ Virtually unlimited file size (new with MDF ver 4)



Recording in CANape



Create a recorder



The screenshot shows the 'Measurement Configuration' window in CANape. The left sidebar contains a tree view with the following structure:

- Measurement options
- Measurement signals
 - XCPsim
 - Global Variables
 - Objects
 - Algebraic expressions
 - Stimulations
 - Multimedia signals
- Algorithms
 - <Insert search mask here>
- Distributed Recording
 - Recorder list (circled in red)
 - Recorder
 - Options
 - Bus logging
 - Trigger
 - Attachment
 - Recorded signals
 - Recorder1 (circled in red)
 - Options
 - Bus logging
 - Trigger
 - Attachment
 - Recorded signals
- Event list
- Audio outputs

The main area displays the configuration for 'Recorder1'.

General

- Name: Recorder1
- Comment:

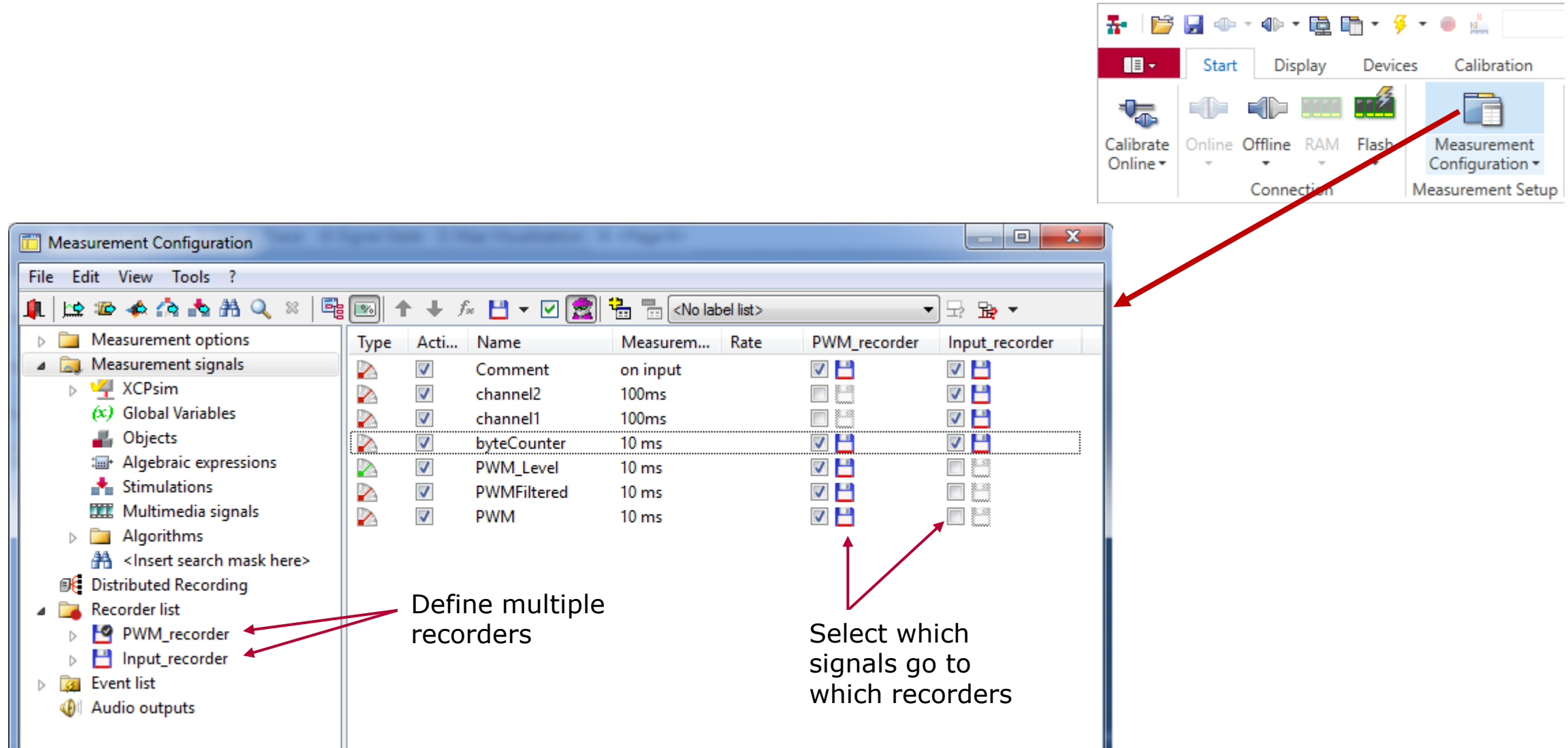
Measurement file

- File name: {RECORDER}_{YEAR}-{MONTH}-{DAY}_{HOUR}-{MINUTE}-{SECOND}.MF4 (circled in red)
- Browse... Macro
- ☒ Create file name at the beginning of the measurement or after the previous recording
- ☐ Create file name at the end of the recording
- Format: From options (Version 4.10)
- Optional compression of data blocks, logging of bus events (for further features see online help)
- Compression: None
- Measurement file compatible to MDF version 4.00
- Preset for the measurement file comment: Comment...

A red arrow points from the 'Measurement Configuration' window title bar to the top toolbar of the main application window, which includes buttons for 'Start', 'Display', 'Devices', 'Calibration', 'Calibrate Online', 'Online', 'Offline', 'RAM', 'Flash', and 'Measurement Configuration'.

Set name and type of log file

Configure Which Signals the Recorder Will Capture



Measurement Configuration

File Edit View Tools ?

Measurement options

Measurement signals

- XCPsim
- Global Variables
- Objects
- Algebraic expressions
- Stimulations
- Multimedia signals
- Algorithms
- <Insert search mask here>
- Distributed Recording
- Recorder list
 - PWM_recorder
 - Input_recorder
- Event list
- Audio outputs

Type	Acti...	Name	Measurem...	Rate	PWM_recorder	Input_recorder
	<input checked="" type="checkbox"/>	Comment	on input		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>	channel2	100ms		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>	channel1	100ms		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>	byteCounter	10 ms		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>	PWM_Level	10 ms		<input checked="" type="checkbox"/>	<input type="checkbox"/>
	<input checked="" type="checkbox"/>	PWMFiltered	10 ms		<input checked="" type="checkbox"/>	<input type="checkbox"/>
	<input checked="" type="checkbox"/>	PWM	10 ms		<input checked="" type="checkbox"/>	<input type="checkbox"/>

Define multiple recorders

Select which signals go to which recorders

Logging Demo

- ▶ Open measurement configuration
 - ▶ Create new recorder "SpikeRecorder"
 - ▶ Activate trigger
 - > Note pre-trigger and post-trigger times
 - > New signal event **channel1** > 12
 - ▶ Go back to measurement signal list
 - > See recorder columns at right
 - > Add **channel1** to SpikeRecorder
- ▶ Start measurement
 - ▶ Wait a few seconds
 - ▶ Set **limit** and **ampl** to 15 to trigger recorder
 - ▶ See recorder start in write window
 - ▶ Stop measurement after logging a few seconds of data
- ▶ Take note of logfile in project directory

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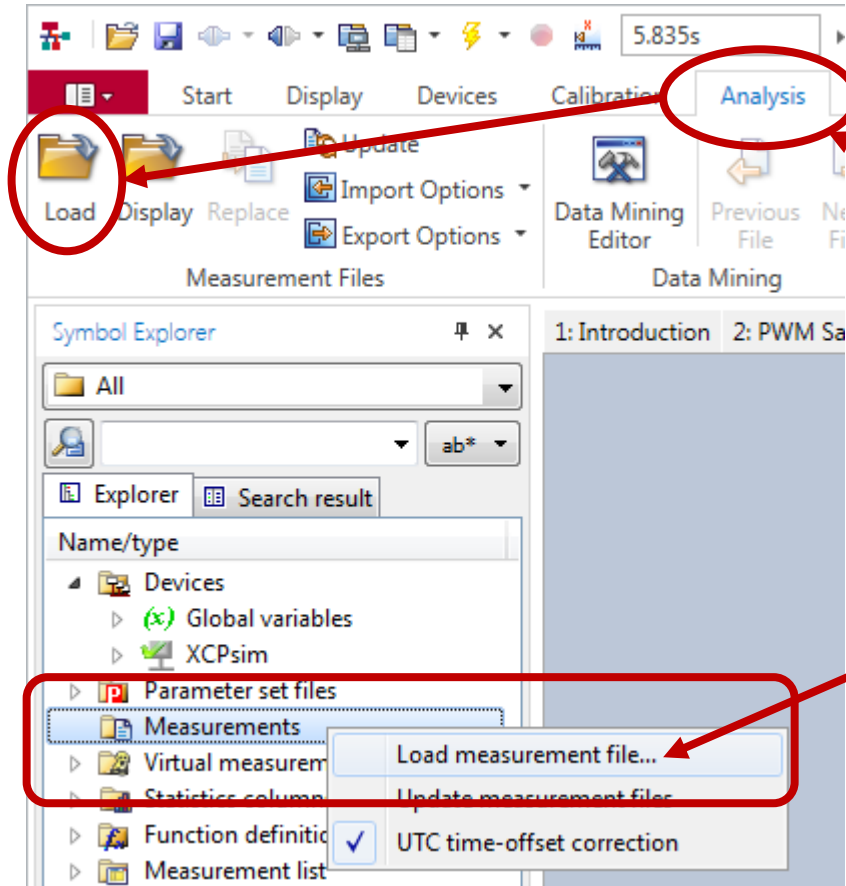
How Do I Calibrate With CANape ?

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► **How Do I Analyze Data With CANape ?**

Vector Support

Open a Log File



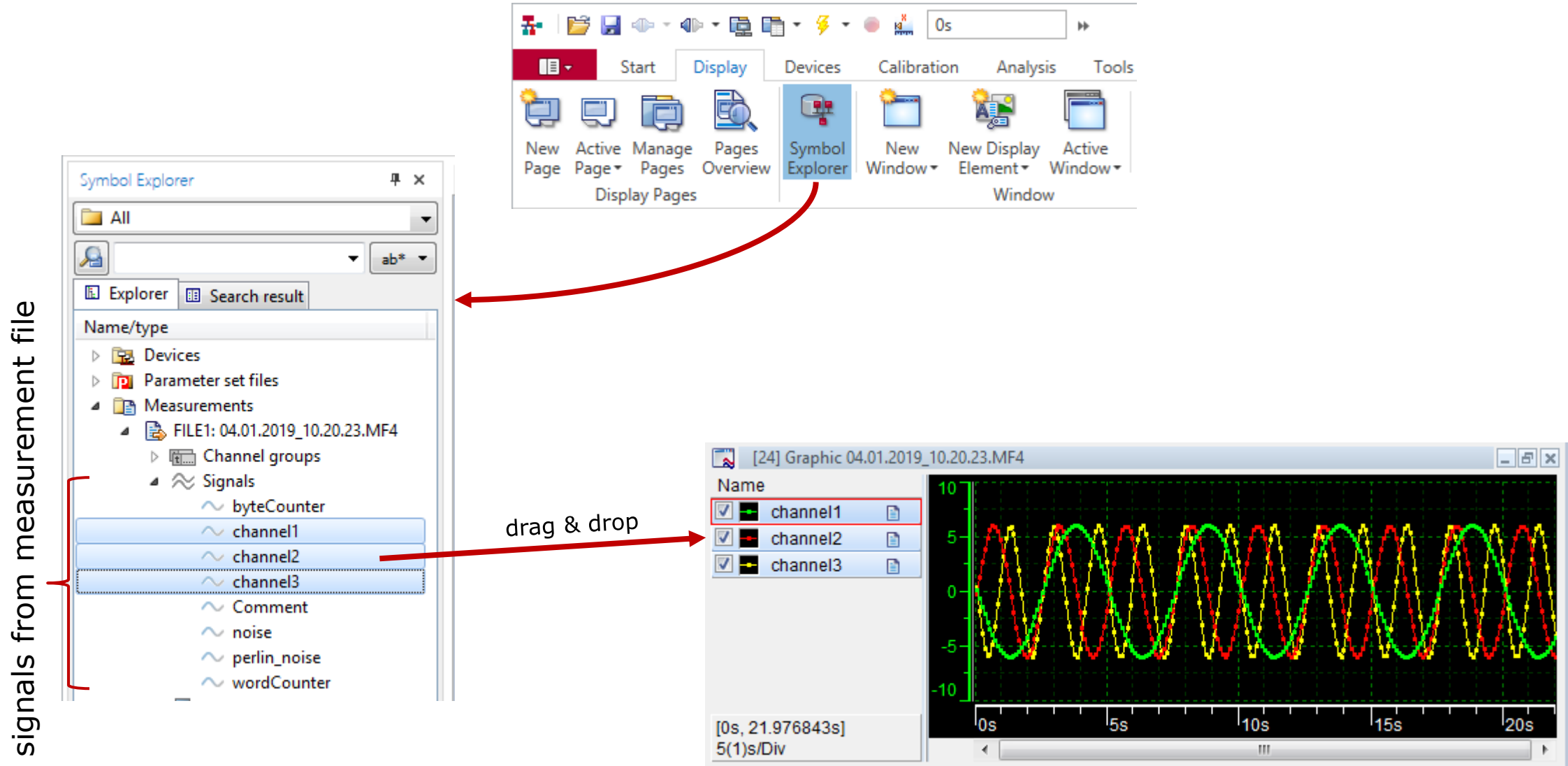
Load files from Analysis menu

– OR –

Load files in Symbol Explorer

Setting up for analysis

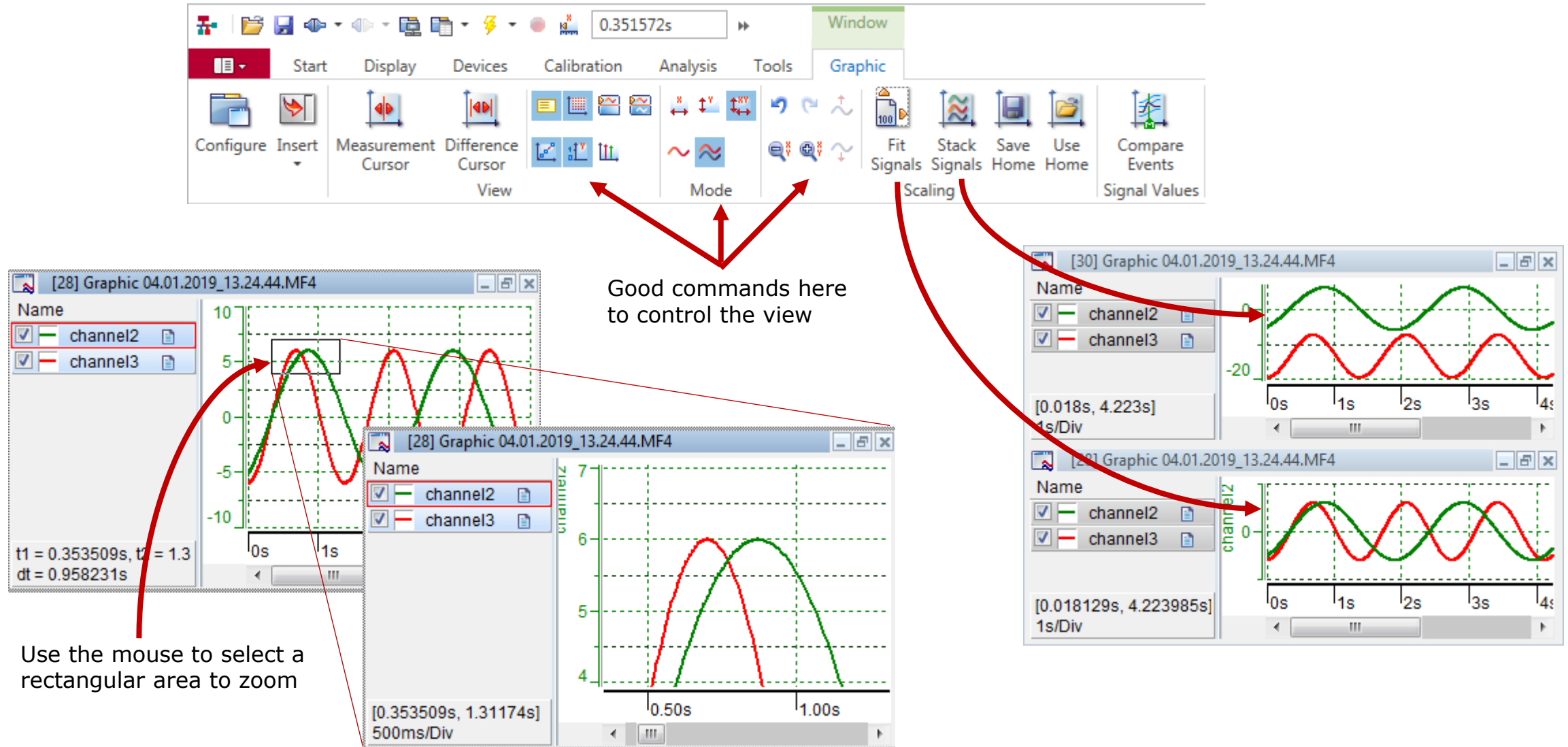
signals from measurement file



The screenshot displays the CANape software interface. On the left, the 'Symbol Explorer' window shows a tree structure under 'Measurements' for 'FILE1: 04.01.2019_10.20.23.MF4'. The 'Signals' folder is expanded, listing 'byteCounter', 'channel1', 'channel2', 'channel3', 'Comment', 'noise', 'perlin_noise', and 'wordCounter'. A red bracket on the left side of the 'Signals' list is labeled 'signals from measurement file'. A red arrow points from the 'channel2' entry in this list to the 'channel2' entry in a table within the '[24] Graphic 04.01.2019_10.20.23.MF4' window. Another red arrow points from the 'Symbol Explorer' window to the 'Symbol Explorer' menu item in the top menu bar. The table in the graphic window lists three channels: 'channel1' (green), 'channel2' (red), and 'channel3' (yellow), all with checkboxes selected. To the right of the table is a waveform plot showing three overlapping sinusoidal signals in green, red, and yellow. The plot has a time axis from 0s to 20s and a vertical axis from -10 to 10. The bottom status bar shows '[0s, 21.976843s]' and '5(1)s/Div'.

drag & drop

Controlling data the data view

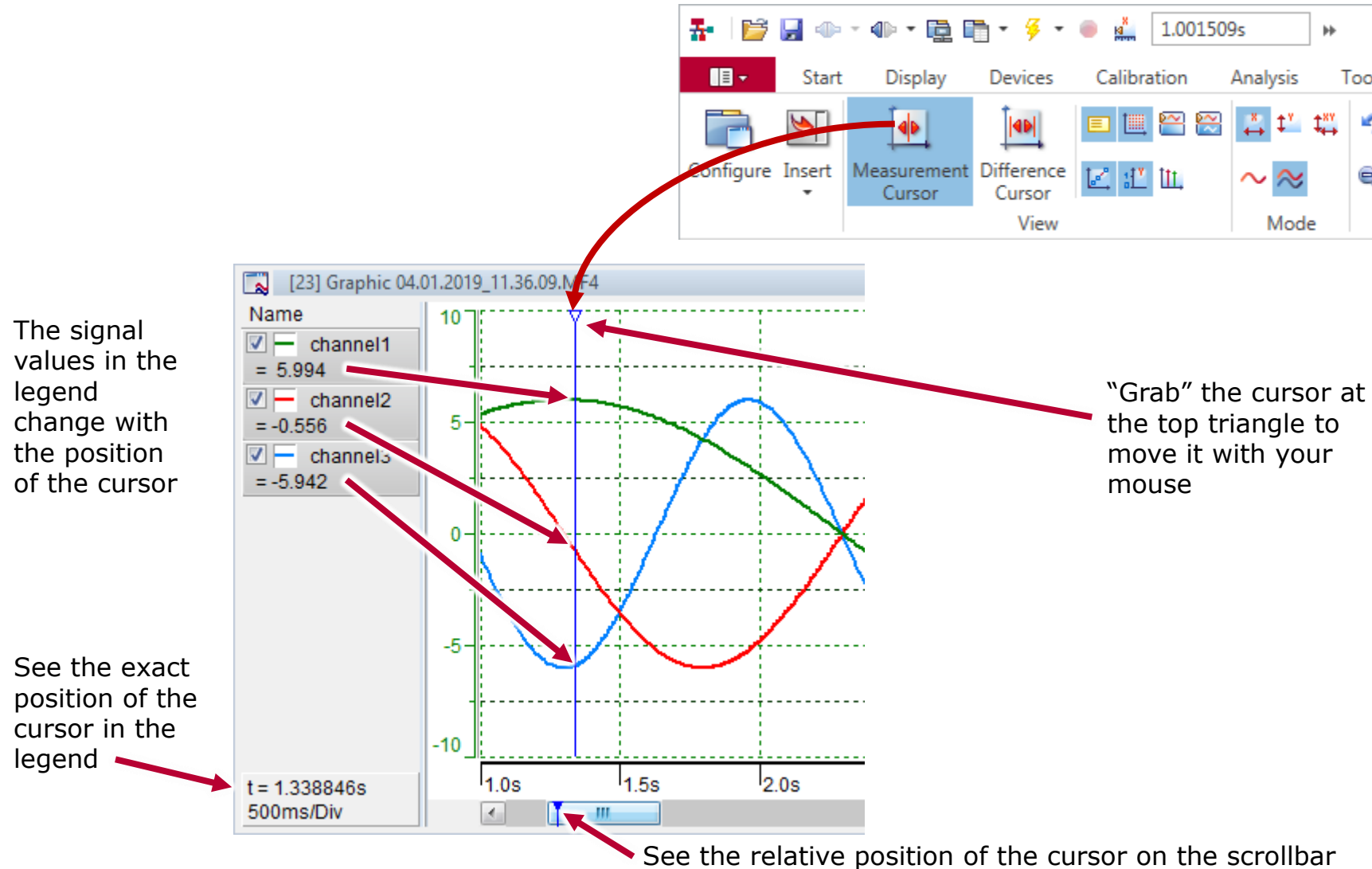


The screenshot displays the CANape software interface. At the top, the 'Graphic' menu is open, showing various options: Configure, Insert, Measurement Cursor, Difference Cursor, View, Mode, Fit Signals, Stack Signals, Save Home, Use Home, and Compare Events. Red arrows point from the 'View' and 'Mode' options in the menu to the zoomed-in waveform windows below. The first window, titled '[28] Graphic 04.01.2019_13.24.44.MF4', shows two waveforms (channel2 in green and channel3 in red) with a time scale of 1s/Div. A red rectangular box is drawn around a portion of the waveforms, with a red arrow pointing to it from the text 'Use the mouse to select a rectangular area to zoom'. The second window, also titled '[28] Graphic 04.01.2019_13.24.44.MF4', shows the same waveforms zoomed in, with a time scale of 500ms/Div. The third window, titled '[30] Graphic 04.01.2019_13.24.44.MF4', shows the waveforms with a time scale of 1s/Div. The text 'Good commands here to control the view' is centered in the middle of the image, with red arrows pointing to the 'View' and 'Mode' options in the 'Graphic' menu.

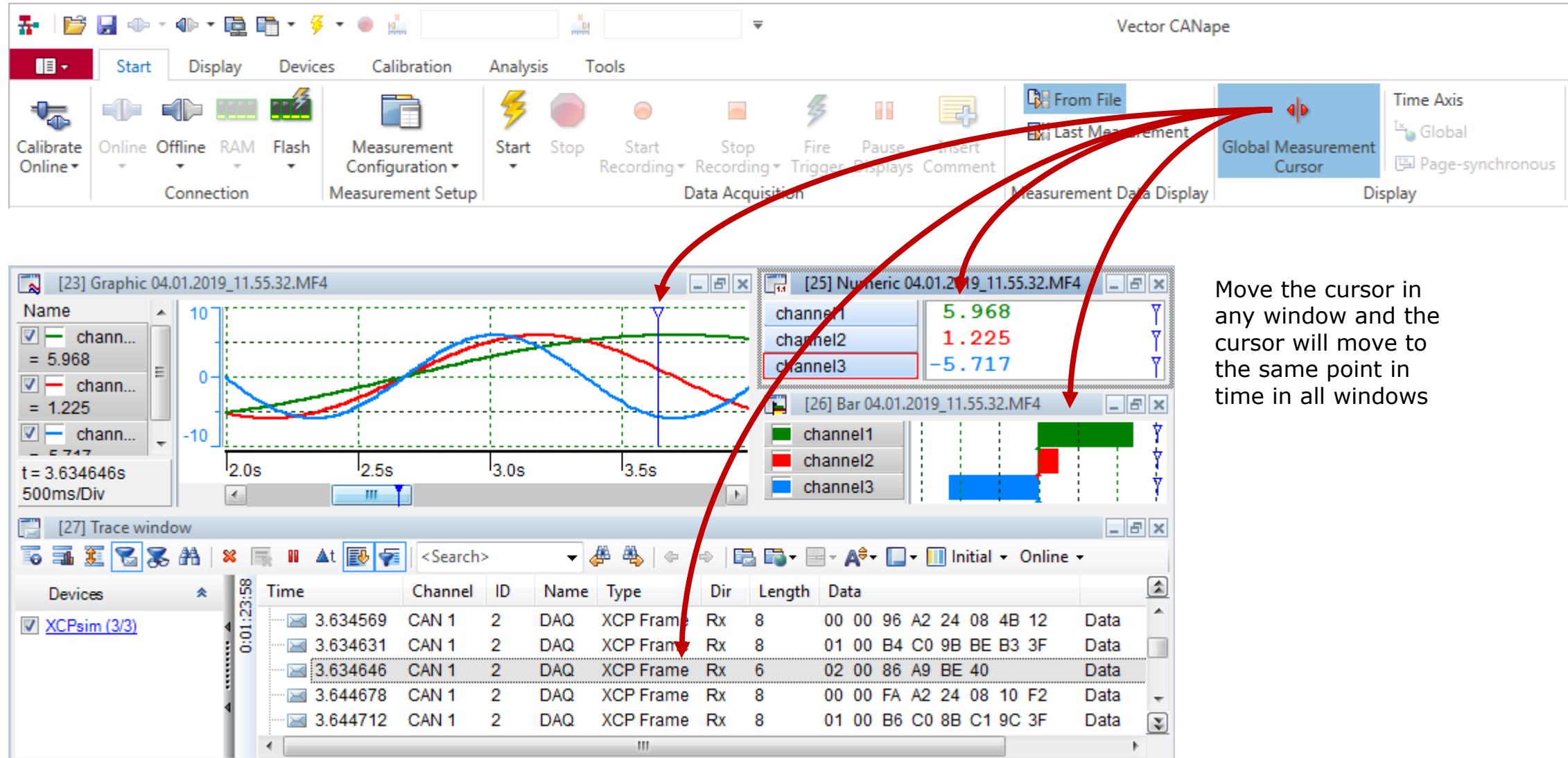
Good commands here to control the view

Use the mouse to select a rectangular area to zoom

Measurement Cursor



Global Measurement Cursor

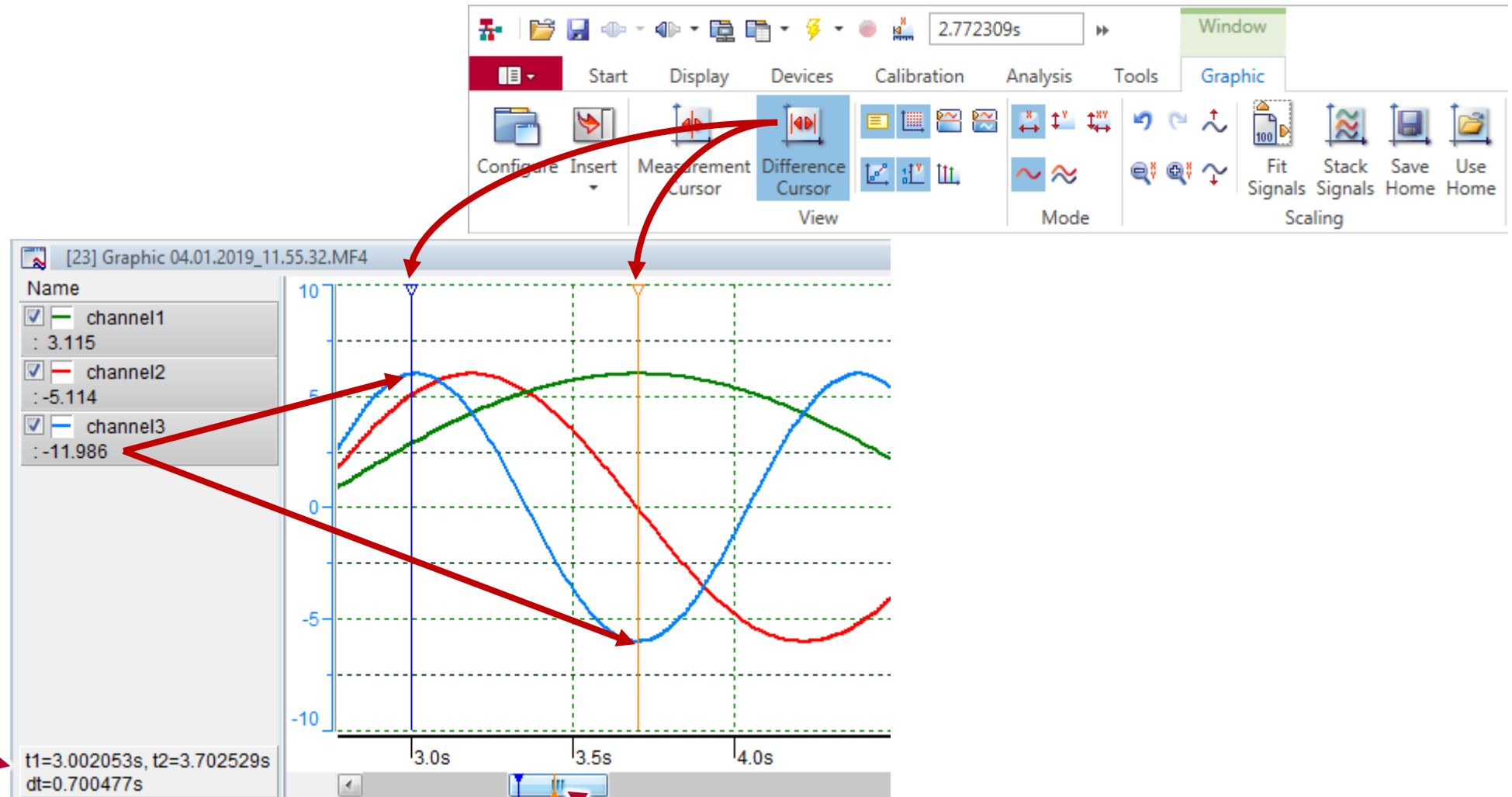


Move the cursor in any window and the cursor will move to the same point in time in all windows

Difference Cursor

The signal values in the legend show the difference in value between the cursor positions

See the exact positions of the cursors in the legend



See the relative positions of the cursors on the scrollbar

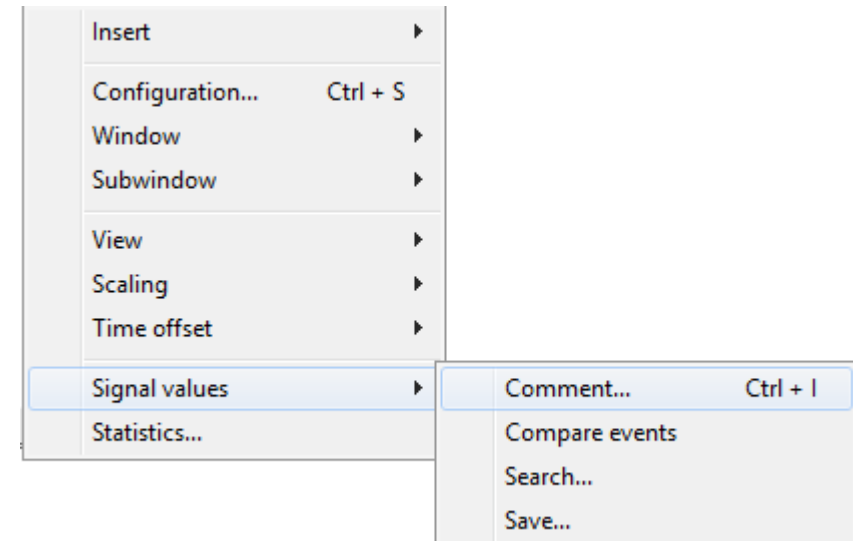
Signal Comments

- Comments can be attached to signal data points to draw attention to points of interest



See the position of all comments on the scrollbar

Right-click on a signal to add a comment



Analysis Demo

- ▶ Find Measurement Files in Symbol Explorer
- ▶ Open log file we just made
- ▶ Drag-n-drop **channel1** to new graphic window
 - ▶ Note trigger markers and pre-trigger data
- ▶ Zoom in – select a rectangle around part of the signal waveform
- ▶ Turn on measurement cursor – move it around
 - ▶ Note value display in legend
- ▶ Turn on difference cursor – move it around
 - ▶ Note value difference display in legend
- ▶ Drag-n-drop absolute value function on signal
 - ▶ Fit signals – well that's no good
 - ▶ Drag one signal onto the other's hot spot – that's better