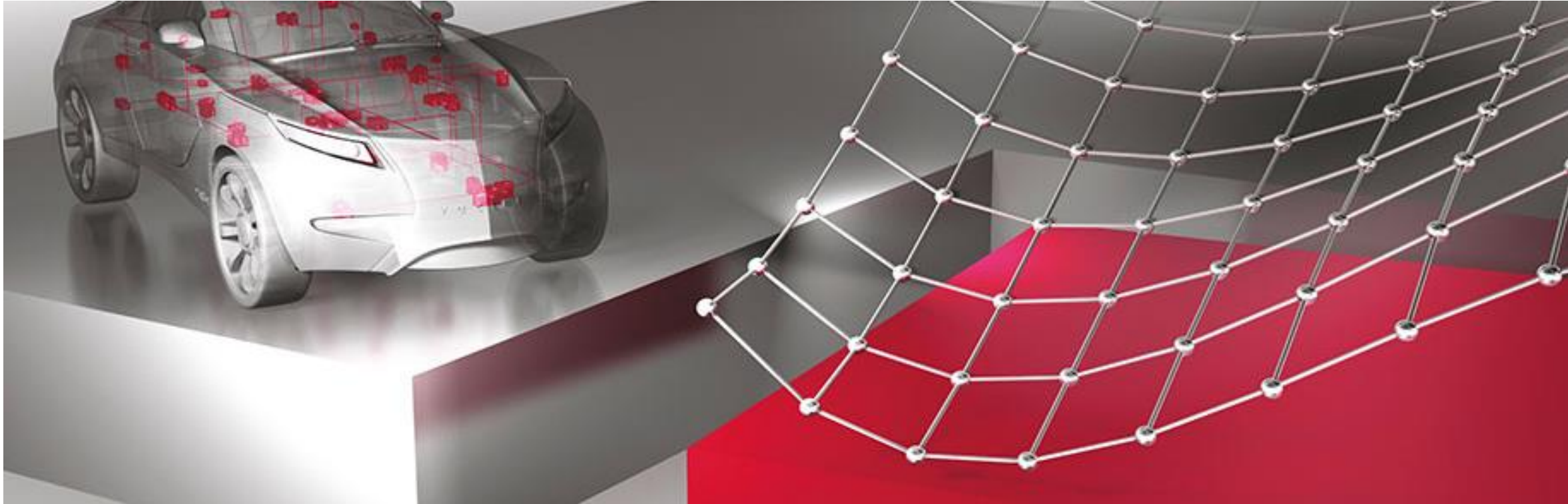




CANape Quick Start

A Short Introduction to CANape and Its Most Basic Workflows

Agenda

► **What is CANape ?**

What is CANape?

What is CANape ?

How Do I Connect CANape to My ECU ?

How Do I Acquire Data With CANape ?

How Do I Calibrate With CANape ?

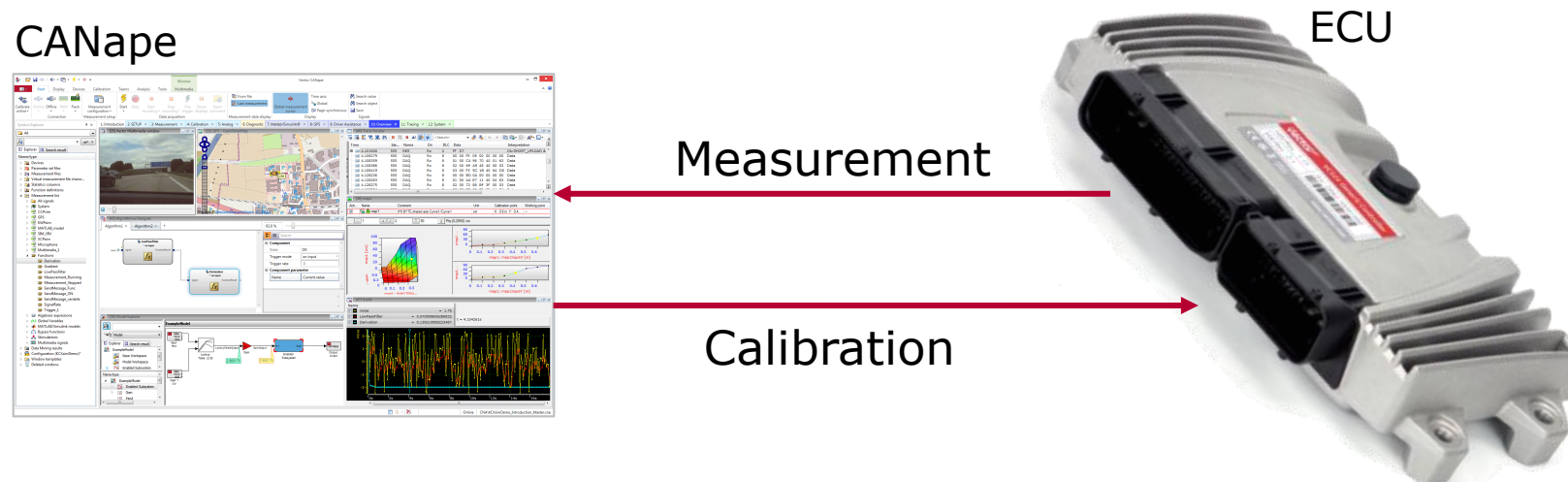
How Do I Log Data With CANape ?

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 to halt the ECU!
 - ▶ **Measurement** = reading data **from** the ECU memory
 - > Including data not already broadcast by the ECU onto the CAN bus
 - ▶ **Calibration** = writing data **to** the ECU memory
 - > Changing "Parameter" values without having to reflash



- ▶ Many possible applications for development and test

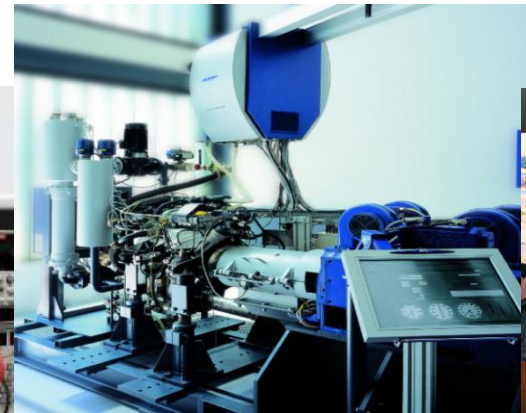
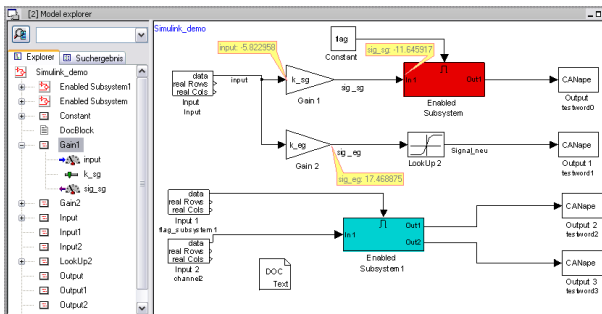
Where is CANape used?

► Development and Test Application Areas

- White-box testing (monitor ECU internal variables)
- Function calibration (on-target or model-based)
- System calibration (on-bench or in-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, construction, agriculture, ...



What is CANape ?

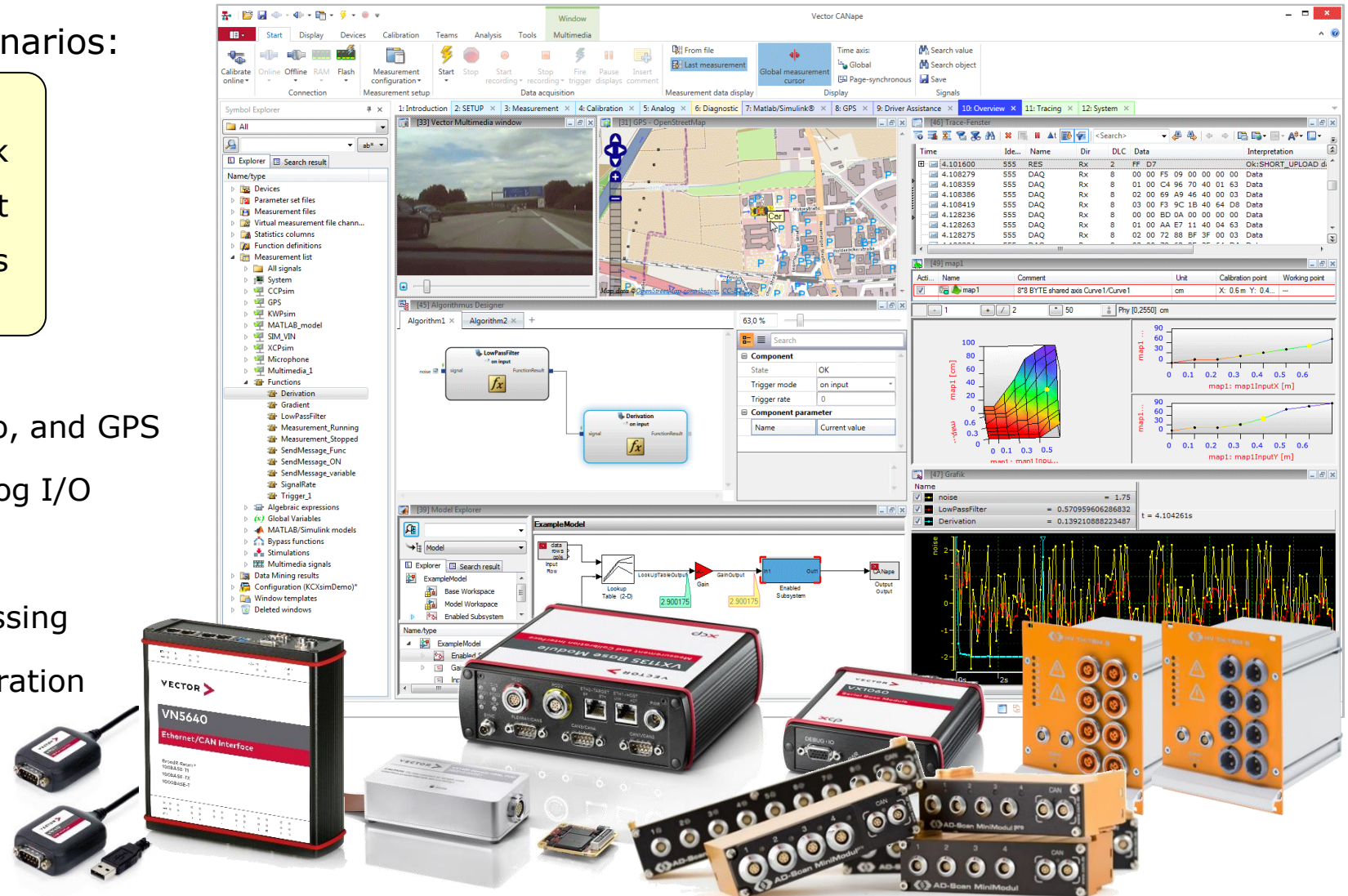


CANape – measurement, calibration, and much more

▶ CANape supports these scenarios:

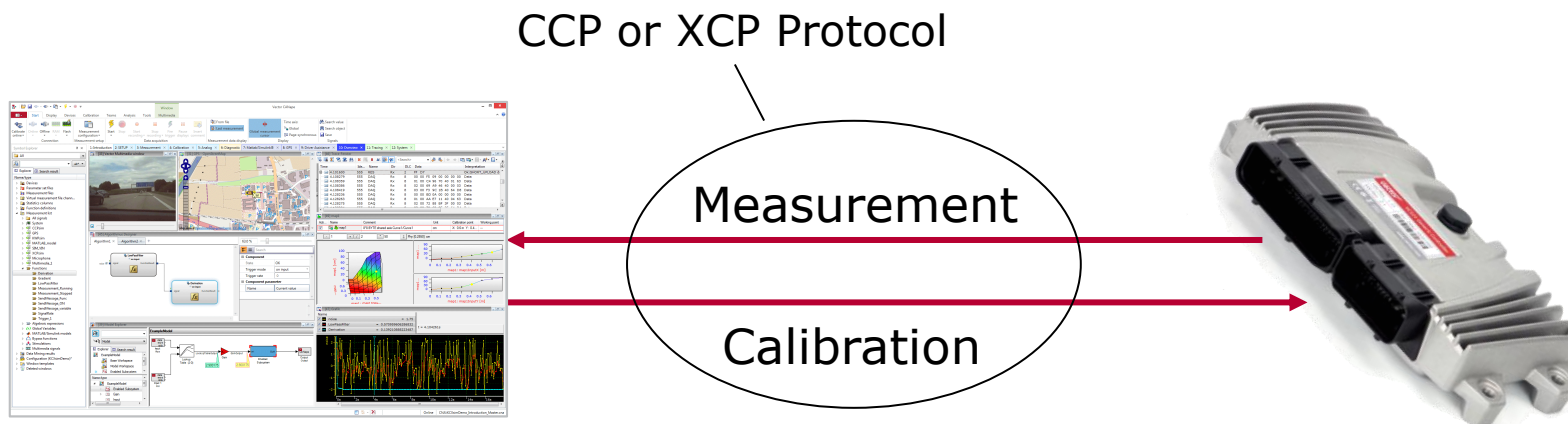
- ▶ ECU Measurement
- ▶ ECU Calibration
- ▶ Data logging
- ▶ Data analysis
- ▶ Vehicle bus monitoring
- ▶ Integration with audio, video, and GPS
- ▶ Integration with digital/analog I/O
- ▶ Model-based development
- ▶ Rapid prototyping and bypassing
- ▶ Automated testing and calibration
- ▶ Data mining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

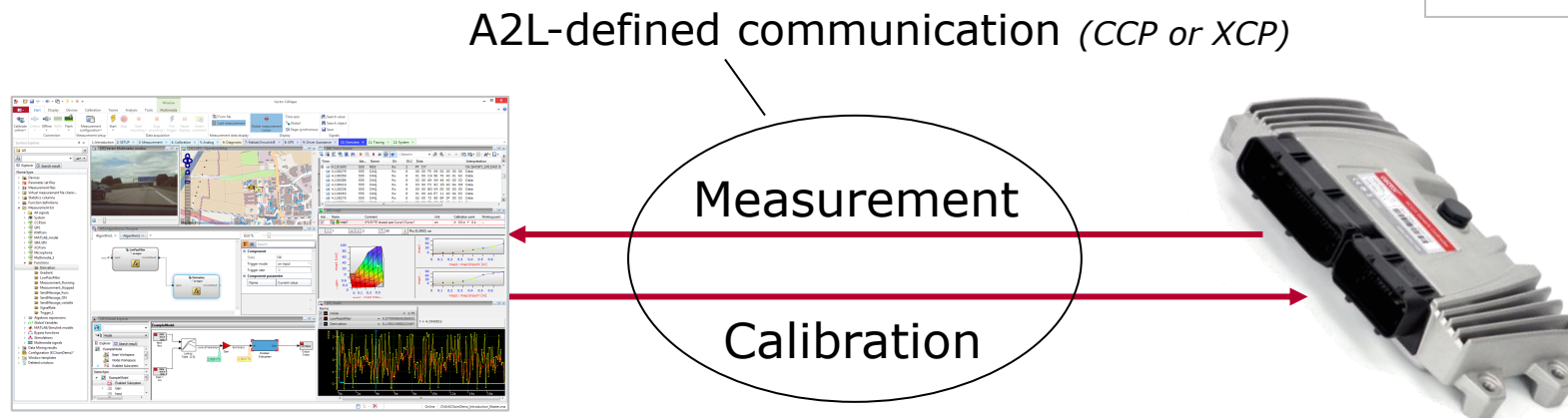
```
/begin MEASUREMENT

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

    FORMAT "%6.4"

    ECU_ADDRESS 0x300791

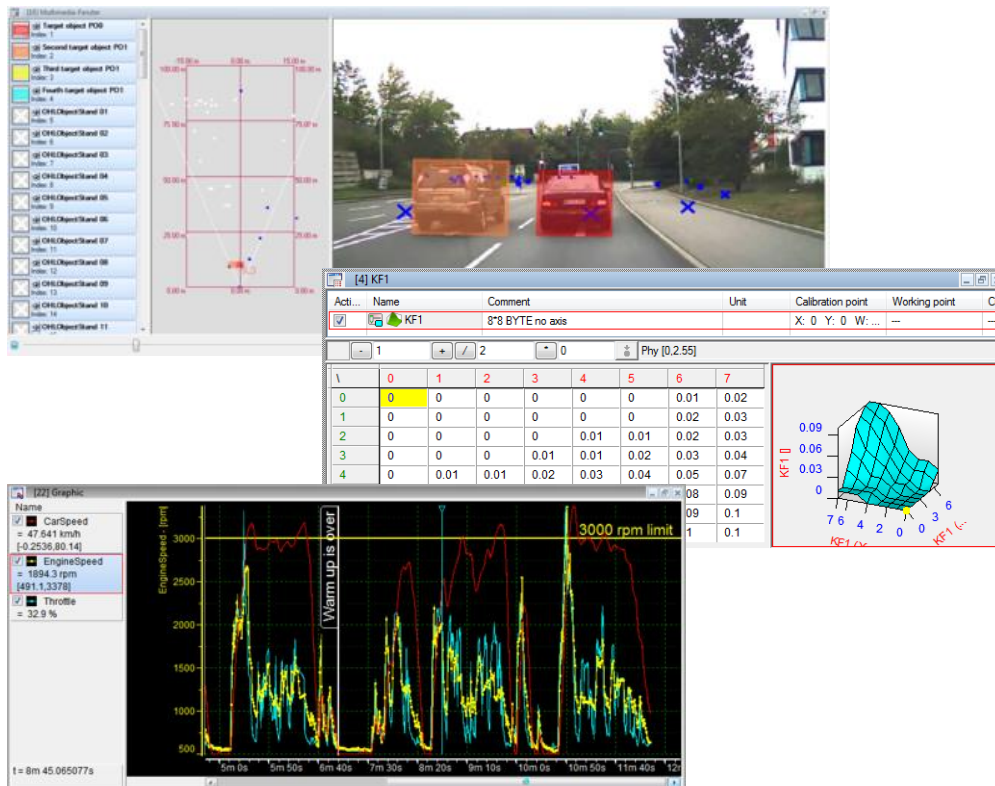
/end MEASUREMENT
```



Projects and configurations

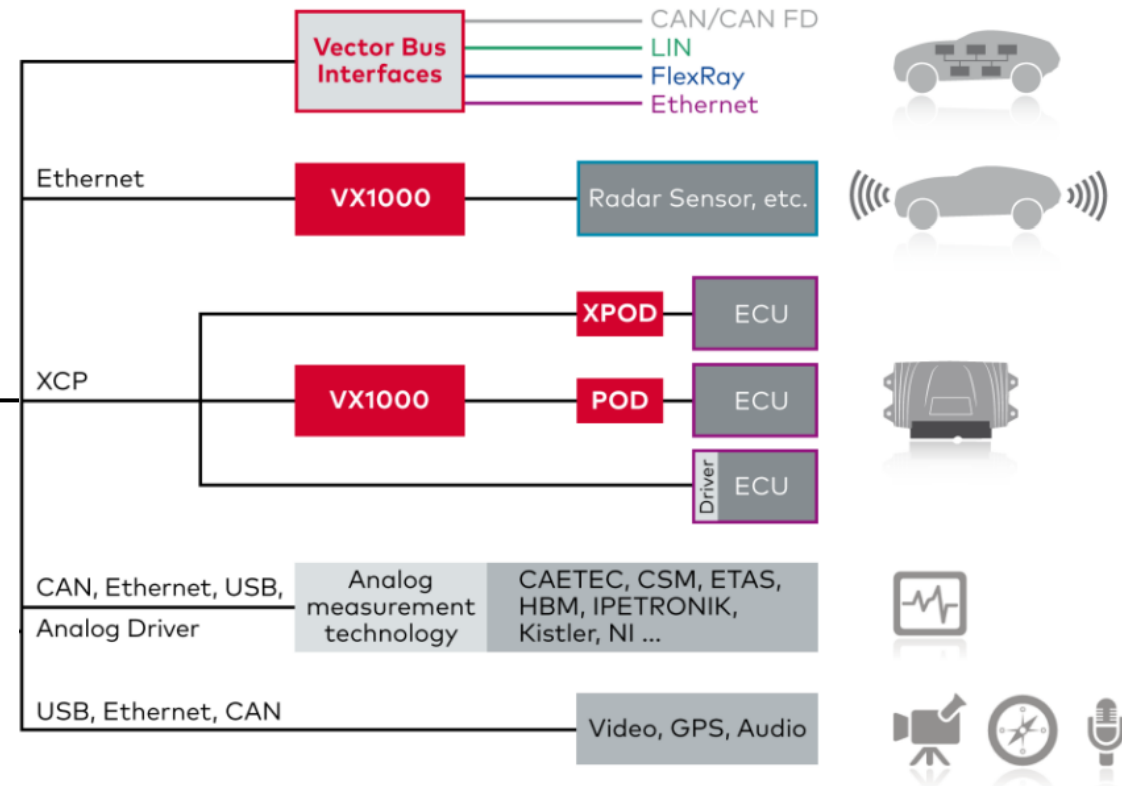
Configuration (* .cna)

*The data, views, and tasks
CANape is working on.*



Project (CANape.ini)

*The equipment that
CANape is working with.*



BusyDriver – ECU/Vehicle Simulator

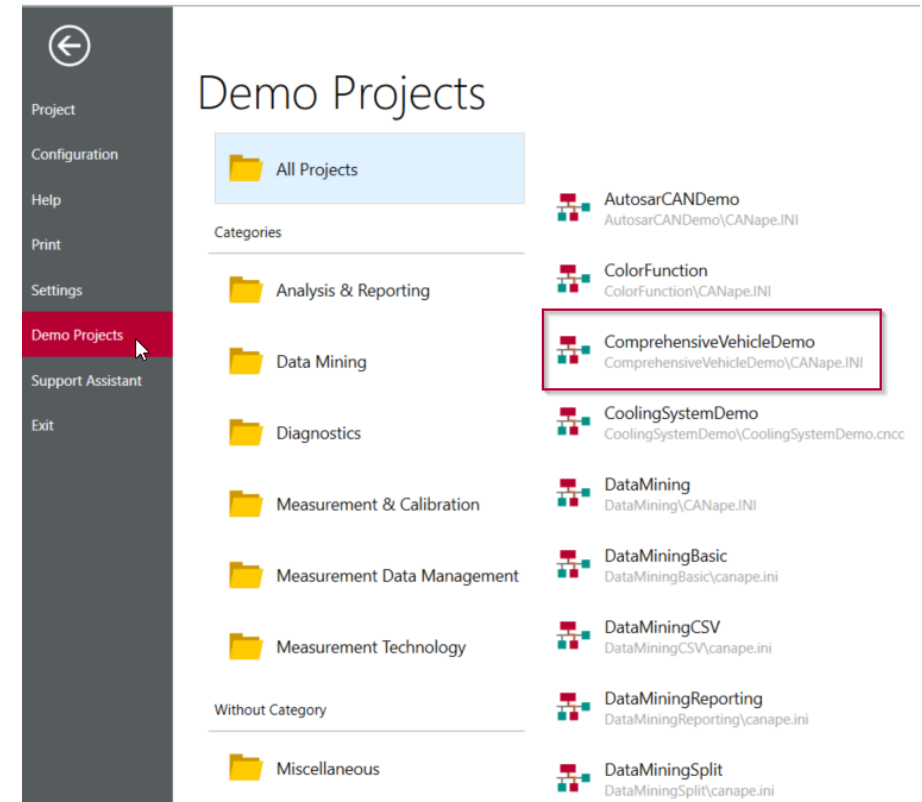
- ▶ Powertrain
 - ▶ Use accelerator & brake to change speed
 - ▶ Automatic transmission changes gears
- ▶ Wipers
 - ▶ Use wiper switch to control wiper mode
 - ▶ Use rain & light sensors to change AUTO speed
- ▶ Signal Generator
 - ▶ Sine wave, sawtooth, and PWM outputs
- ▶ CAN communication
 - ▶ Broadcasts all operational data
 - ▶ Incoming messages control warning lamps
 - ▶ Use switches to control some broadcast data
- ▶ Configuration settings 
- ▶ Help and tool tips 
- ▶ Pin window on top  



Comprehensive Vehicle Demo

- ▶ Run Comprehensive Vehicle Demo
- ▶ Red boxes to guide you
- ▶ Pages for different functions
 - ▶ Transmission
 - ▶ Wipers
 - ▶ Wiper AUTO mode
 - ▶ Wave Generator
 - ▶ Wave map
 - ▶ Lamp Control
 - ▶ CAN
 - ▶ Setup
 - ▶ GPS
 - ▶ Model View

You can find all the CANape demos in the backstage menu



Agenda

What is CANape ?

What is CANape?

What is CANape ?

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

How Do I Acquire Data With CANape ?

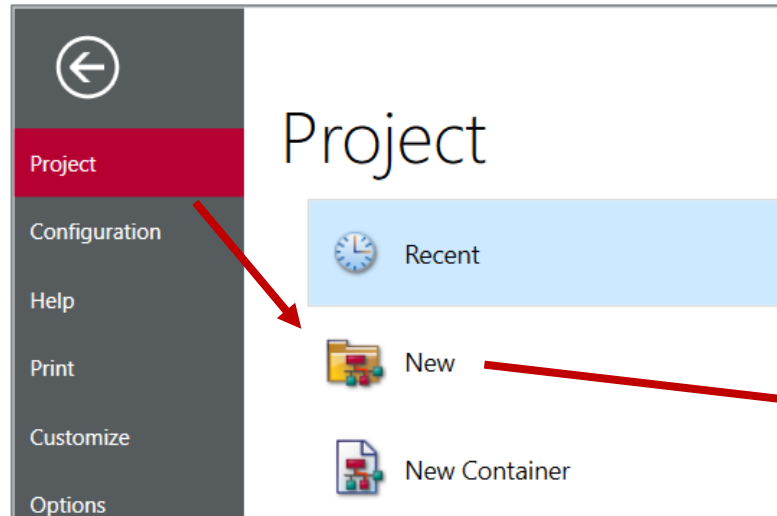
How Do I Calibrate With CANape ?

How Do I Log Data With CANape ?

How Do I Analyze Data With CANape ?

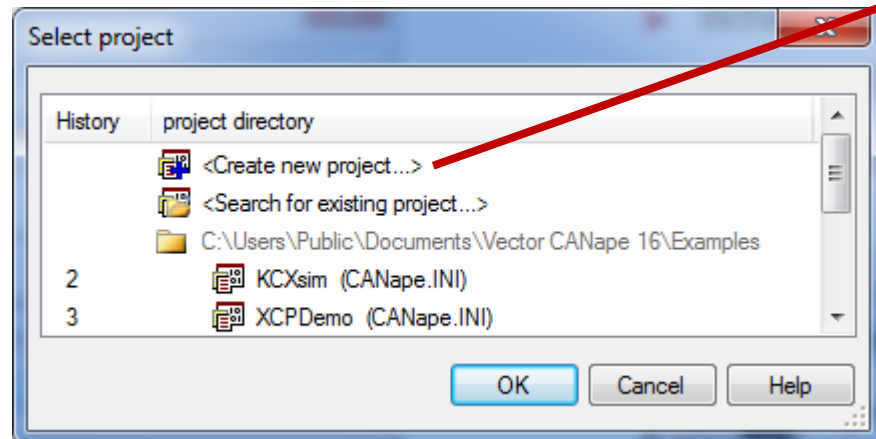
Vector Support

Create a project

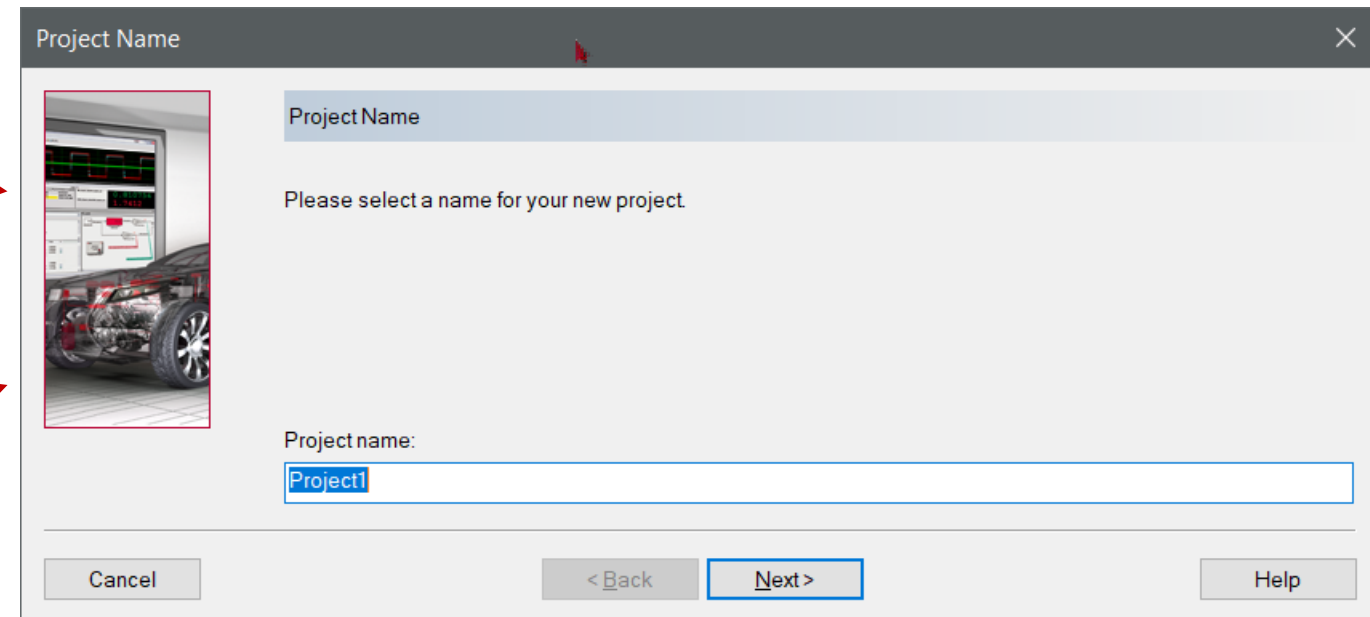


(↑ recent CANape versions, or...)

(↓ older CANape versions)

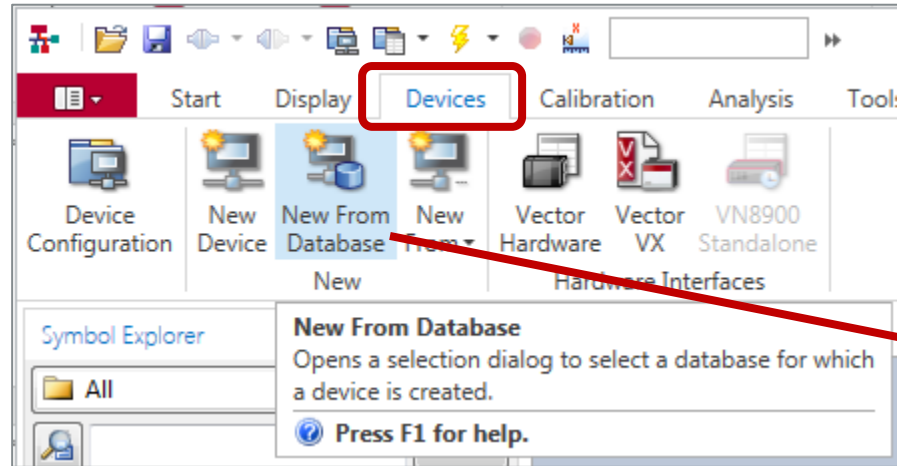


- ▶ "New Project..." backstage-menu command,
- OR -
- ▶ ...when launching CANape:

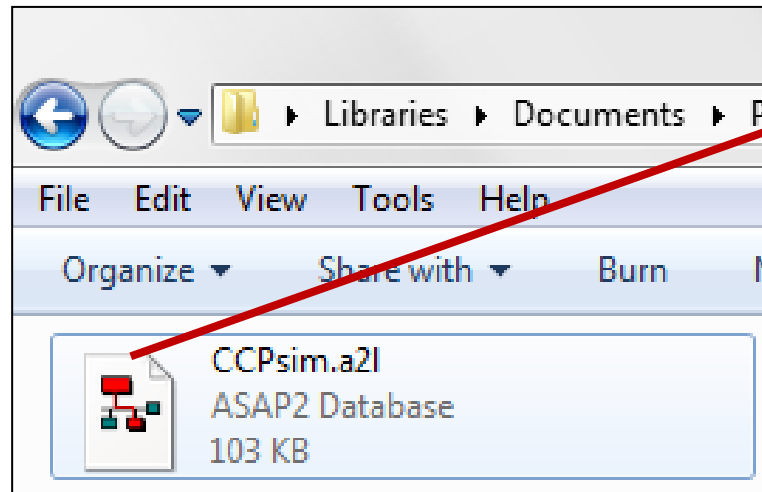


- ▶ Enter project/folder name
- ▶ Set path to the project folder

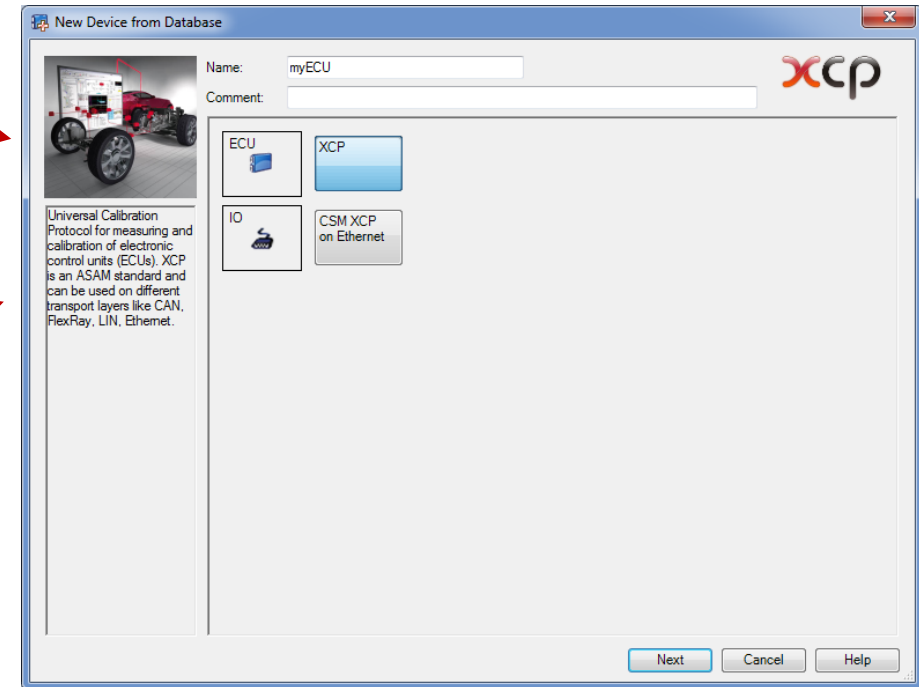
Create a device



Use menu, or...



drag and drop
A2L file



Connect demo

- ▶ Start ECU simulator
- ▶ Start CANape
 - ▶ Create a XCP device and a CAN monitor
 - ▶ Drag and drop the .dbc file
 - ▶ Drag and drop the .a2l file
- ▶ Make sure you have communication
 - ▶ Confirm ECU device is now in Symbol Explorer
 - ▶ Confirm ECU device is online and ready to use

Agenda

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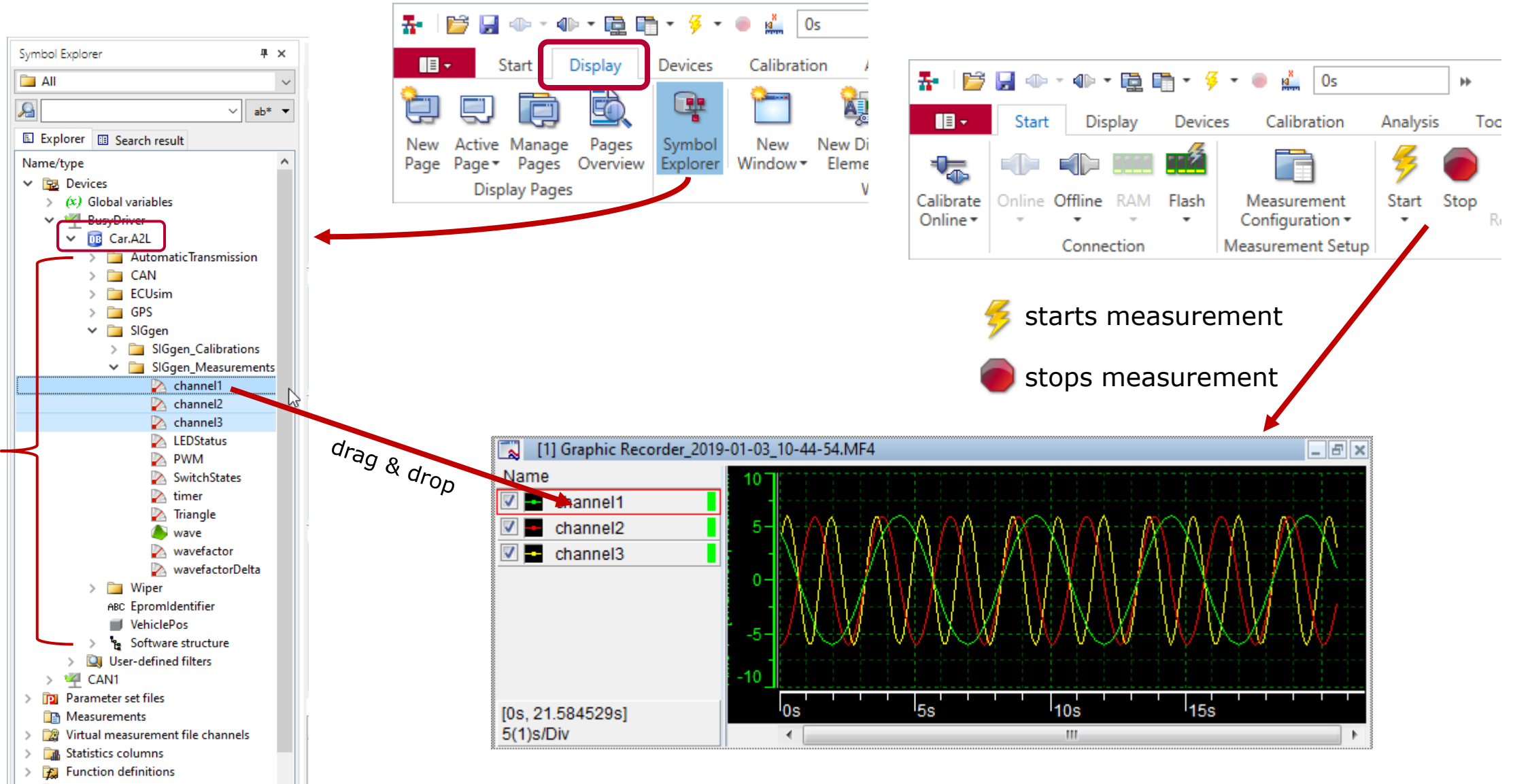
How Do I Log Data With CANape ?

How Do I Analyze Data With CANape ?

Vector Support

Setting up for measurement

variables from A2L file



The image shows the CANape software interface with several key components highlighted:

- Symbol Explorer:** A tree view on the left showing the project structure. Under the 'Car.A2L' folder, a list of variables is shown. A red bracket groups these variables, with a label 'variables from A2L file'. A red arrow points from this group to the 'Display' button in the main toolbar.
- Main Toolbar:** The top of the interface contains a toolbar with buttons for 'Start', 'Display', 'Devices', 'Calibration', 'Analysis', and 'Toc'. The 'Display' button is highlighted with a red box. Below it are buttons for 'New Page', 'Active Page', 'Manage Pages', 'Pages Overview', 'Symbol Explorer', 'New Window', and 'New Element'. Further down are buttons for 'Calibrate Online', 'Online', 'Offline', 'RAM', 'Flash', 'Measurement Configuration', 'Start', and 'Stop'.
- Graphic Recorder:** A window titled '[1] Graphic Recorder_2019-01-03_10-44-54.MF4' is shown at the bottom right. It displays a list of channels (channel1, channel2, channel3) with checkboxes and a 'Name' column. A red arrow points from the 'channel1' variable in the Symbol Explorer to the 'channel1' checkbox in the Graphic Recorder. The main area of the window shows a waveform plot with three channels (red, green, and yellow) over a time range from 0s to 15s. The y-axis ranges from -10 to 10. The x-axis is labeled with time values (0s, 5s, 10s, 15s). The plot shows three overlapping sine waves.

Annotations and actions:

- A red arrow points from the 'Display' button in the main toolbar to the 'Symbol Explorer' window.
- A red arrow points from the 'Start' button in the main toolbar to the 'Start' button in the Graphic Recorder window.
- A red arrow points from the 'Stop' button in the main toolbar to the 'Stop' button in the Graphic Recorder window.
- A red arrow points from the 'channel1' variable in the Symbol Explorer to the 'channel1' checkbox in the Graphic Recorder window, with the label 'drag & drop'.

Measurement demo

- ▶ Drag-&-drop **2 signals** into graphic window
- ▶ Start measurement
- ▶ Wait a few seconds and then in graphic window, press "f" key to Fit signals
- ▶ Stop measurement
- ▶ Put same signals in a numeric window and then in a text window
- ▶ Open "Measurement Configuration" (F4)
 - ▶ Look at pulldown selection list for measurement mode
 - ▶ Poling vs DAQ
- ▶ Start measurement
 - ▶ See different sampling rates in graphic and text windows
- ▶ Stop measurement

Agenda

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How Do I Analyze Data With CANape ?

Vector Support

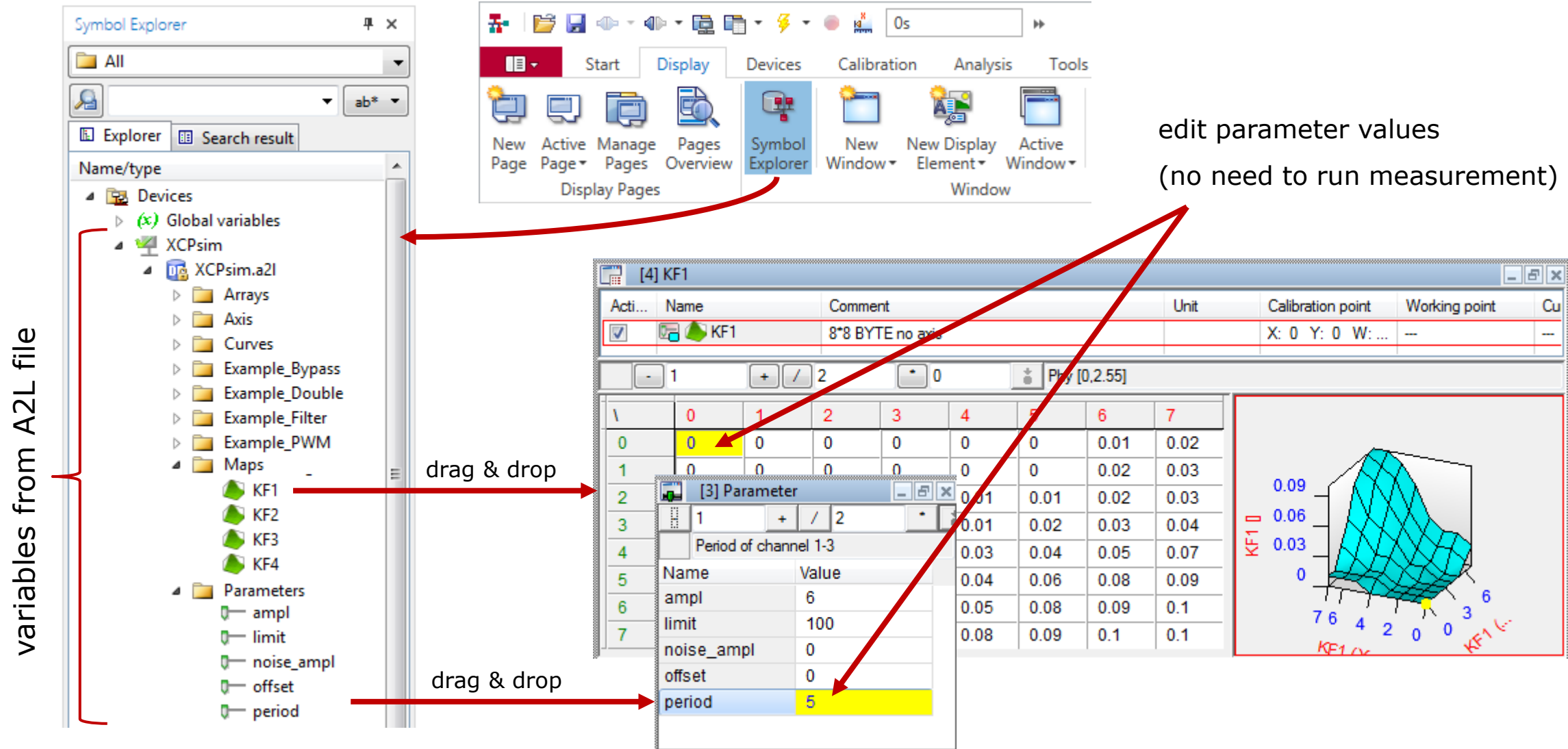
Setting up for calibration

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.

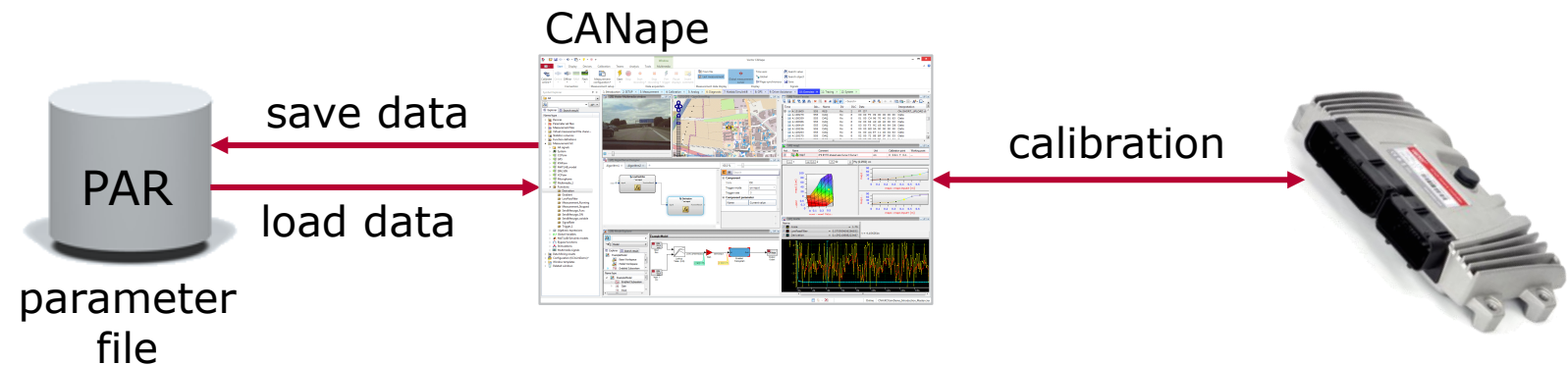
Act...	Name	Comment	Unit	Calibration point	Working point	Cu
☒	KF1	8*8 BYTE no axis		X: 0 Y: 0 W: ...	--	--

	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

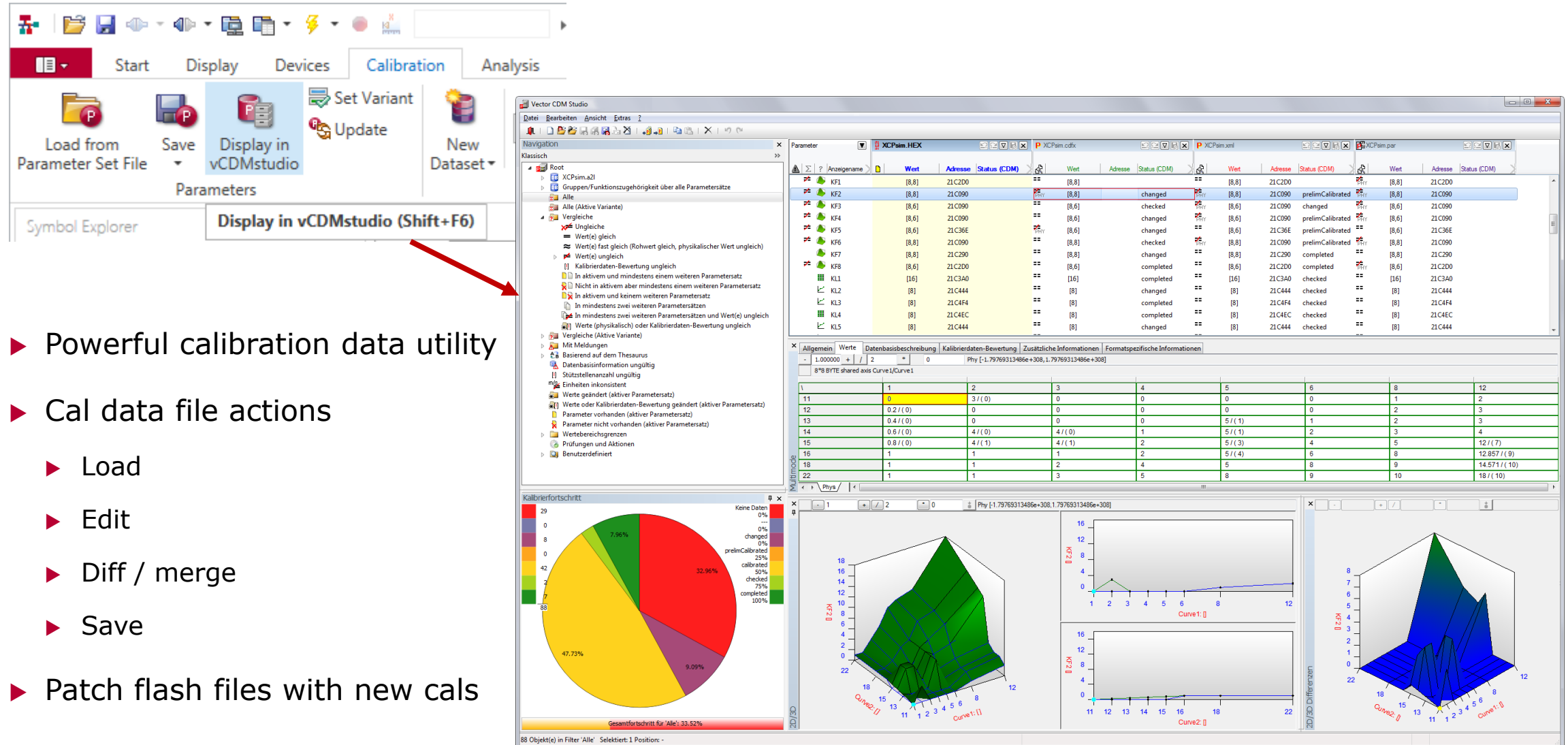
Name	Value
ampl	6
limit	100
noise_ampl	0
offset	0
period	5

Calibration "Parameter files"

- ▶ Captures calibration data for offline exchange and editing
- ▶ Machine readable & writeable file formats, including:
 - > CDFX (open standard)
 - > PAR (Vector)
 - > CSV (Excel)
 - > CVX (ETAS)
 - > DCM (Bosch)
 - > HEX (HEX- or S-record)
 - > M (MATLAB)



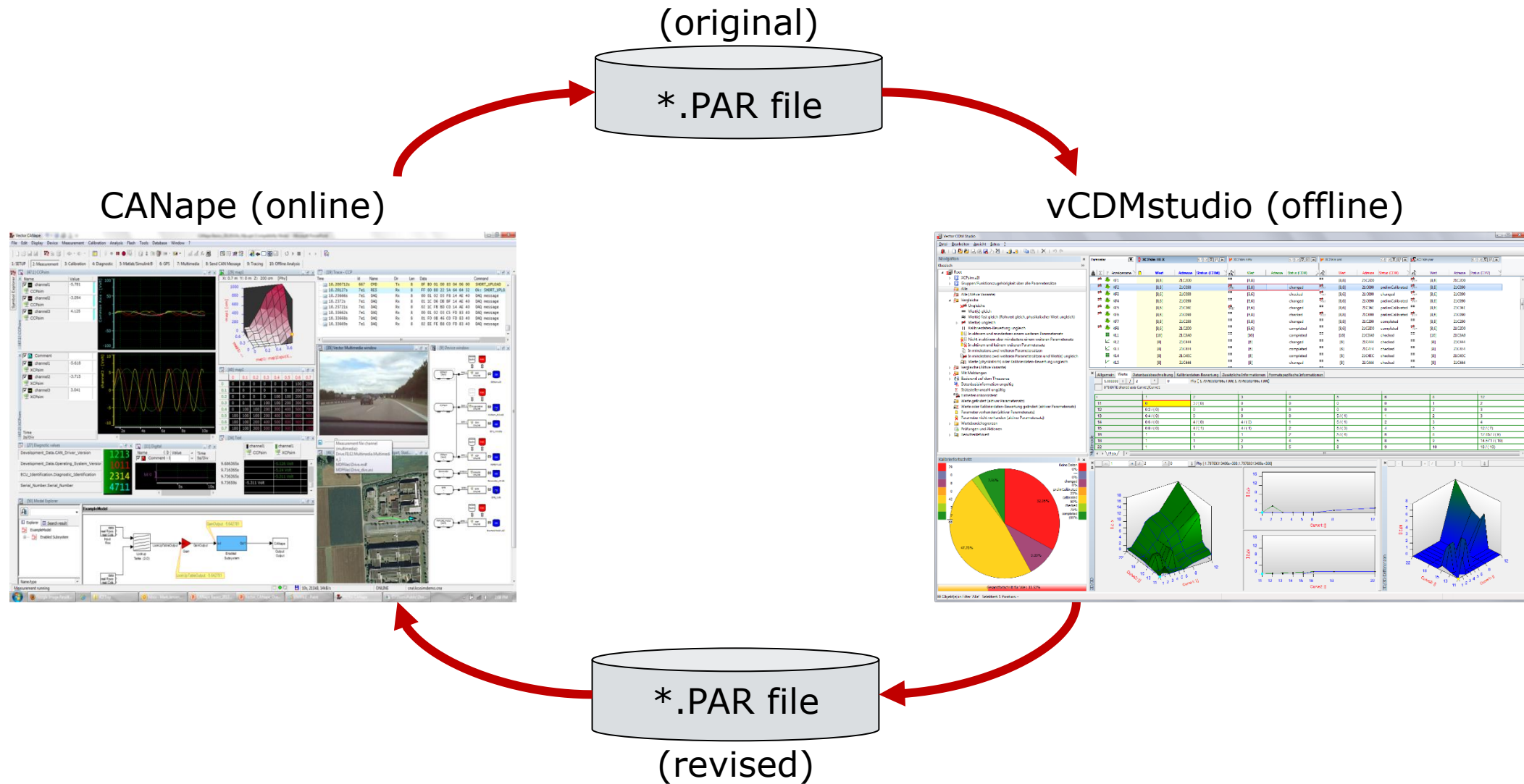
vCDMstudio



The screenshot displays the vCDMstudio software interface, which is used for managing and calibrating CANape data files. The interface includes a top menu bar with options like Start, Display, Devices, Calibration, and Analysis. Below the menu bar, there are several toolbars and panels. A red arrow points to the 'Display in vCDMstudio (Shift+F6)' button in the Parameters section. The main window shows a list of parameters (KF1, KF2, KF3, KF4, KF5, KF6, KF7, KF8, KL1, KL2, KL3, KL4, KL5) with their values, addresses, and status (CDM). Below this, there are tabs for 'Allgemein', 'Werte', 'Datenbasisbeschreibung', 'Kalibrierdaten-Bewertung', 'Zusätzliche Informationen', and 'Format-spezifische Informationen'. The 'Kalibrierdaten-Bewertung' tab is active, showing a table of calibration data. At the bottom left, there is a pie chart showing the distribution of calibration status: 32.96% (red), 47.73% (yellow), 9.09% (purple), and 7.96% (green). The bottom right shows 3D surface plots for parameters KF2 and KL2.

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

Offline calibration



- ▶ Wiper_Measurements into a Graphic Window
- ▶ Wiper_Calibrations into a general Calibration Window
- ▶ Start measurement
 - ▶ Wait a few seconds and then Fit signals with "f" key
 - ▶ Turn on wipers
 - ▶ Change a calibration
 - ▶ Stop measurement
- ▶ Work with calibration parameter values
 - ▶ Save cals in **myCals.par**
 - ▶ Change cals
 - ▶ Save cals in **myUpdatedCals.par**
 - ▶ Observe those PAR-files in project folder – open them in Notepad

Name	Value
AutomaticDuty	55 %
HiDuty	80 %
IntervalCycle	5 s
IntervalDuty	55 %
IntervalInnerCycle	2 s
LoDuty	55 %



vCDM Studio

Vector vCDMstudio

Window

Start Parameter Filter Advanced Copy Check View Main

Copy Paste Paste Quality Data Paste Original Value Undo Redo Copy Selected Copy Filtered Copy All Copy Selected From... Copy All From...

Edit Active Parameter Set Navigation

Navigation

Classic

- Root
 - Car.A2L
 - Groups/Function assignment for all par...
 - All
 - All (active variant)
 - Compare
 - Not equal
 - Value(s) equal
 - Value(s) almost equal (raw value) **Value(s) almost equal (raw value) equal**
 - Value(s) unequal
 - Dimension(s) not equal
 - Parameter type not equal
 - Unit(s) unequal
 - Calibration data quality unequal
 - In the active and at least one more p...
 - Not in the active and at least one mc...
 - In the active and no other parameter
 - In at least two further parameter sets
 - In at least two further parameter sets
 - In all parameter sets
 - Complex comparisons
 - Values (phys) or calibration data qua...
 - Compare (active variant)
 - With messages
 - Hidden parameters
 - Based on the thesaurus
 - Invalid database information
 - Database information is missing (active p...
 - Invalid number of axis points

Parameter

Display name	Value	Value	Value	Value
AutomaticDuty	55 %	55 %	55 %	90 %
HiDuty	90 %	60 %	80 %	90 %
IntervalCycle	5 s	4 s	5 s	2 s
IntervalDuty	55 %		55 %	2 %
LoDuty	20 %	20 %	55 %	20 %

Numeric

1.000000 + / 2 * 55 Phy [0,100] %

Wiper duty cycle during active period of automatic mode

55

Phys Dec Hex(Basis) Bin ASCII

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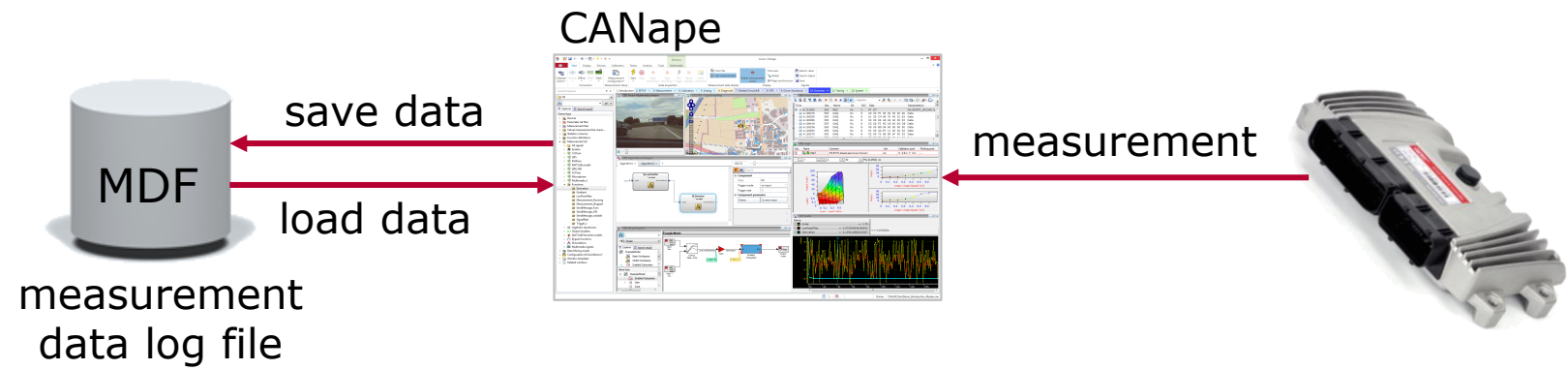
► **How Do I Log Data With CANape ?**

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)

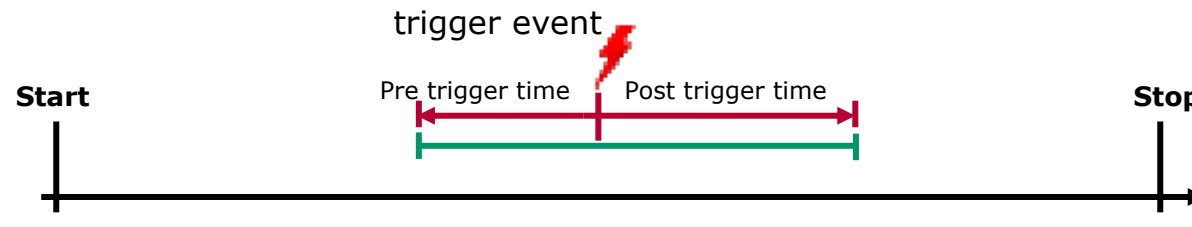


Recording in CANape

- ▶ Entire measurement



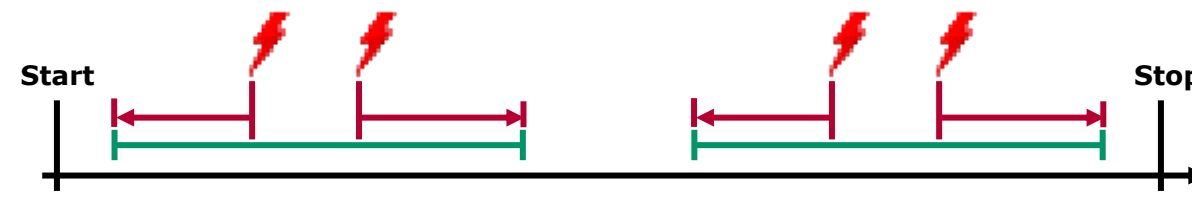
- ▶ Trigger block with event



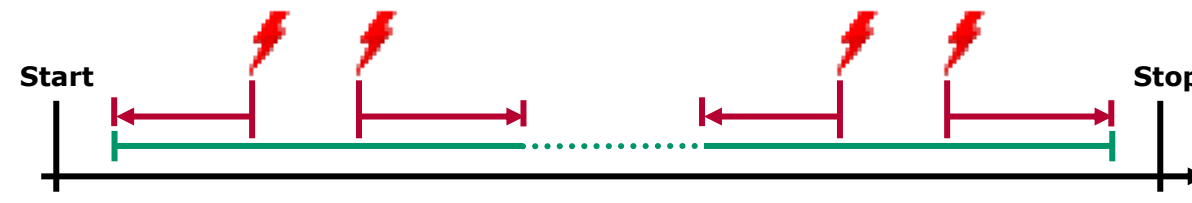
- ▶ Trigger block with start and stop events



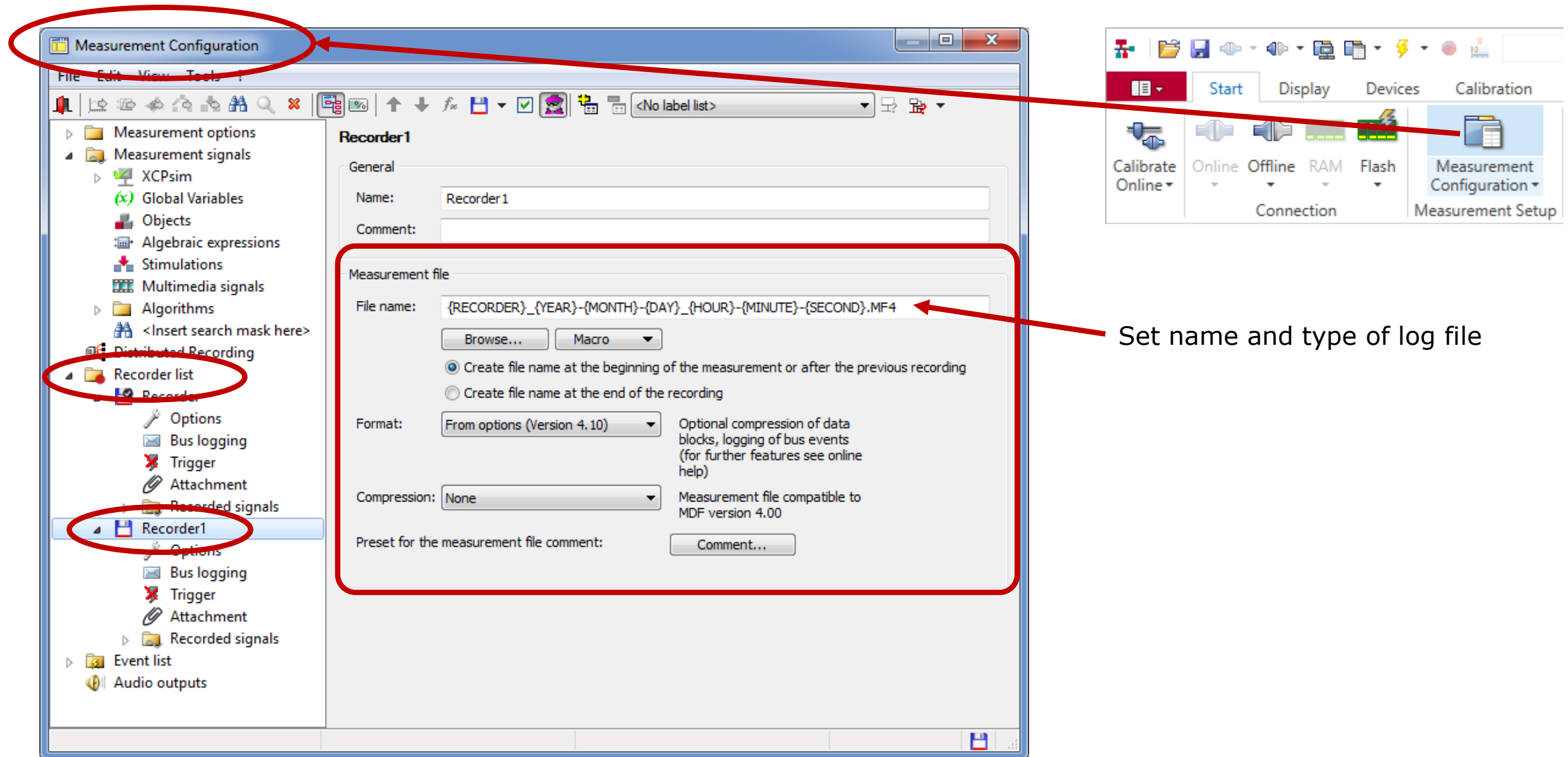
- ▶ Save each trigger block in a separate file



- ▶ Save all trigger blocks into one file



Create a recorder



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

Recorder

Options

Bus logging

Trigger

Attachment

Recorded signals

Recorder1

Options

Bus logging

Trigger

Attachment

Recorded signals

Event list

Audio outputs

Recorder1

General

Name: Recorder1

Comment:

Measurement file

File name: {RECORDER}_{YEAR}-{MONTH}-{DAY}_{HOUR}-{MINUTE}-{SECOND}.MF4

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...

Start Display Devices Calibration

Calibrate Online

Online Offline RAM Flash

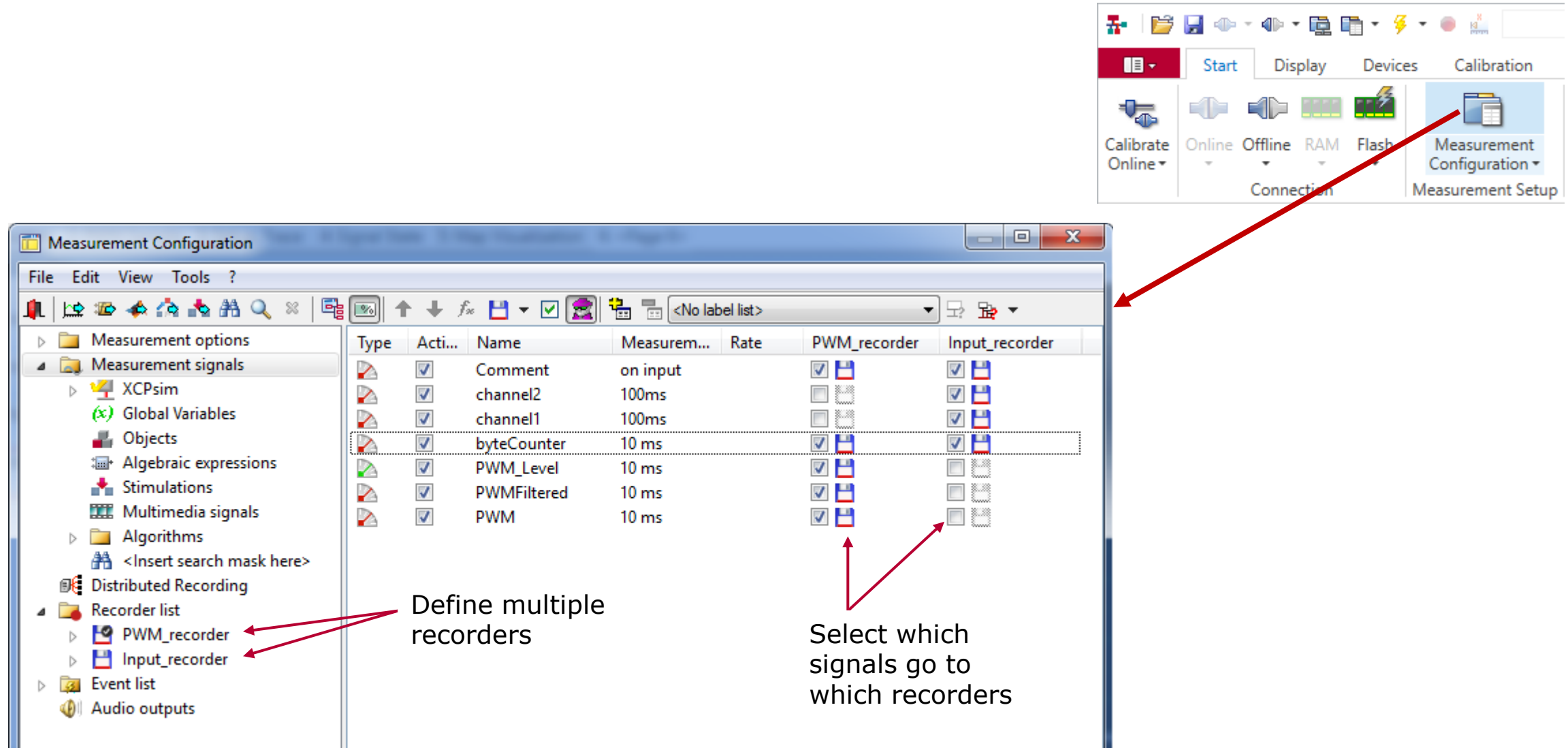
Connection

Measurement Configuration

Measurement Setup

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

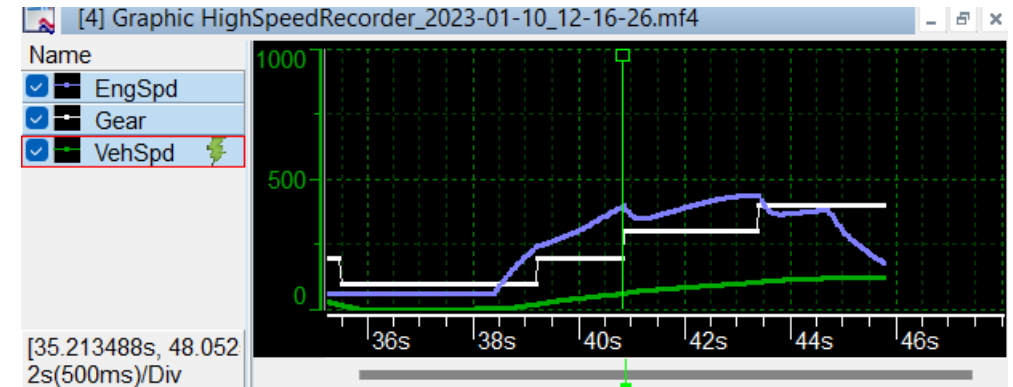
Type	Acti...	Name	Measurem...	Rate	PWM_recorder	Input_recorder
	☒	Comment	on input		☒	☒
	☒	channel2	100ms		☐	☒
	☒	channel1	100ms		☐	☒
	☒	byteCounter	10 ms		☒	☒
	☒	PWM_Level	10 ms		☒	☐
	☒	PWMFiltered	10 ms		☒	☐
	☒	PWM	10 ms		☒	☐

Define multiple recorders

Select which signals go to which recorders

Logging Demo

- ▶ Open measurement configuration
 - ▶ Create new recorder "HighSpeedRecorder"
 - ▶ Activate trigger
 - > Note pre-trigger and post-trigger times
 - > New signal event **VehSpd** > 60
 - ▶ Go back to measurement signal list
 - > See recorder columns at right
 - > Add **VehSpd**, **EngSpd** and **Gear** to HighSpeedRecorder
- ▶ Start measurement
 - ▶ Floor it!
 - ▶ See recorder start in write window when vehicle goes over 60 kph
 - ▶ Stop measurement after logging a few seconds of data
 - ▶ Trigger it a few times
- ▶ Take note of logfile in project directory



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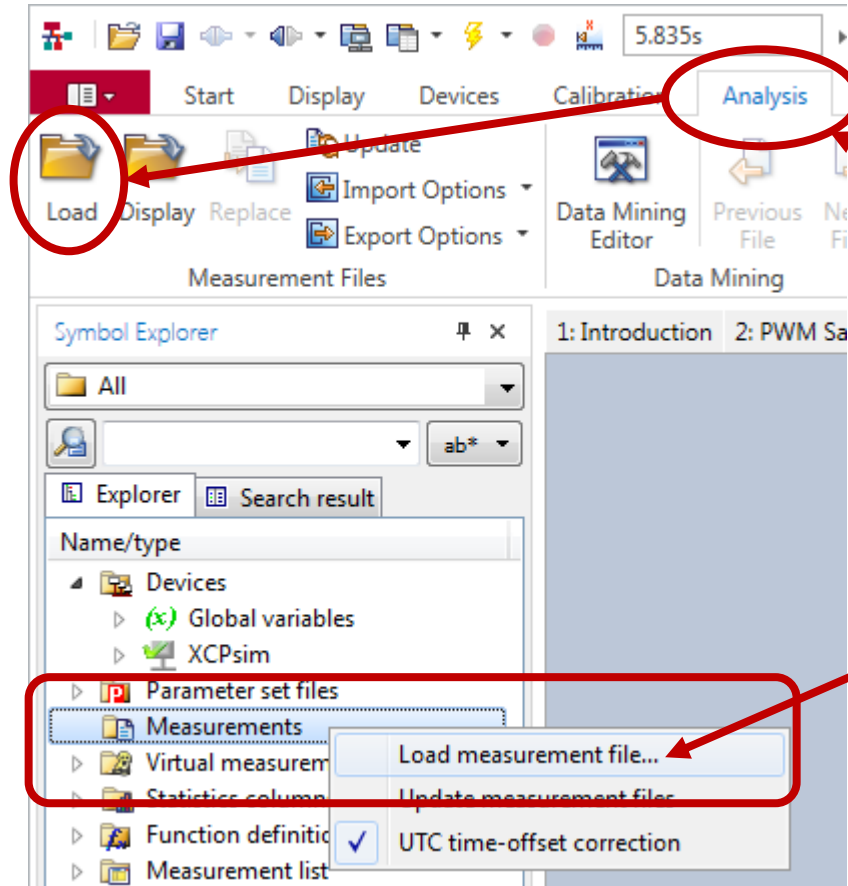
How Do I Calibrate With CANape ?

How Do I Log Data With CANape ?

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

Vector Support

Open a Log File



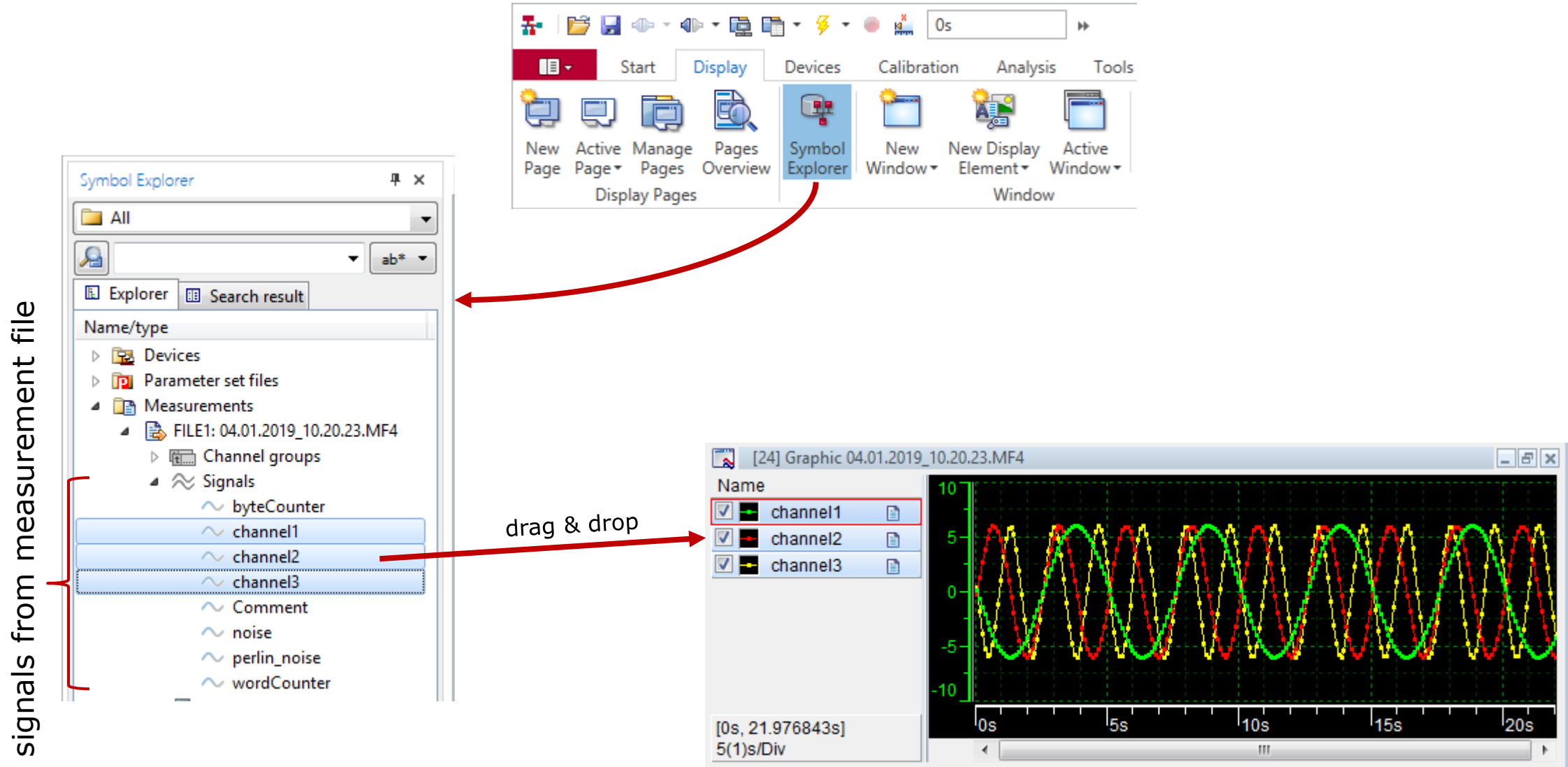
Load files from Analysis menu

– OR –

Load files in Symbol Explorer

Setting up for analysis

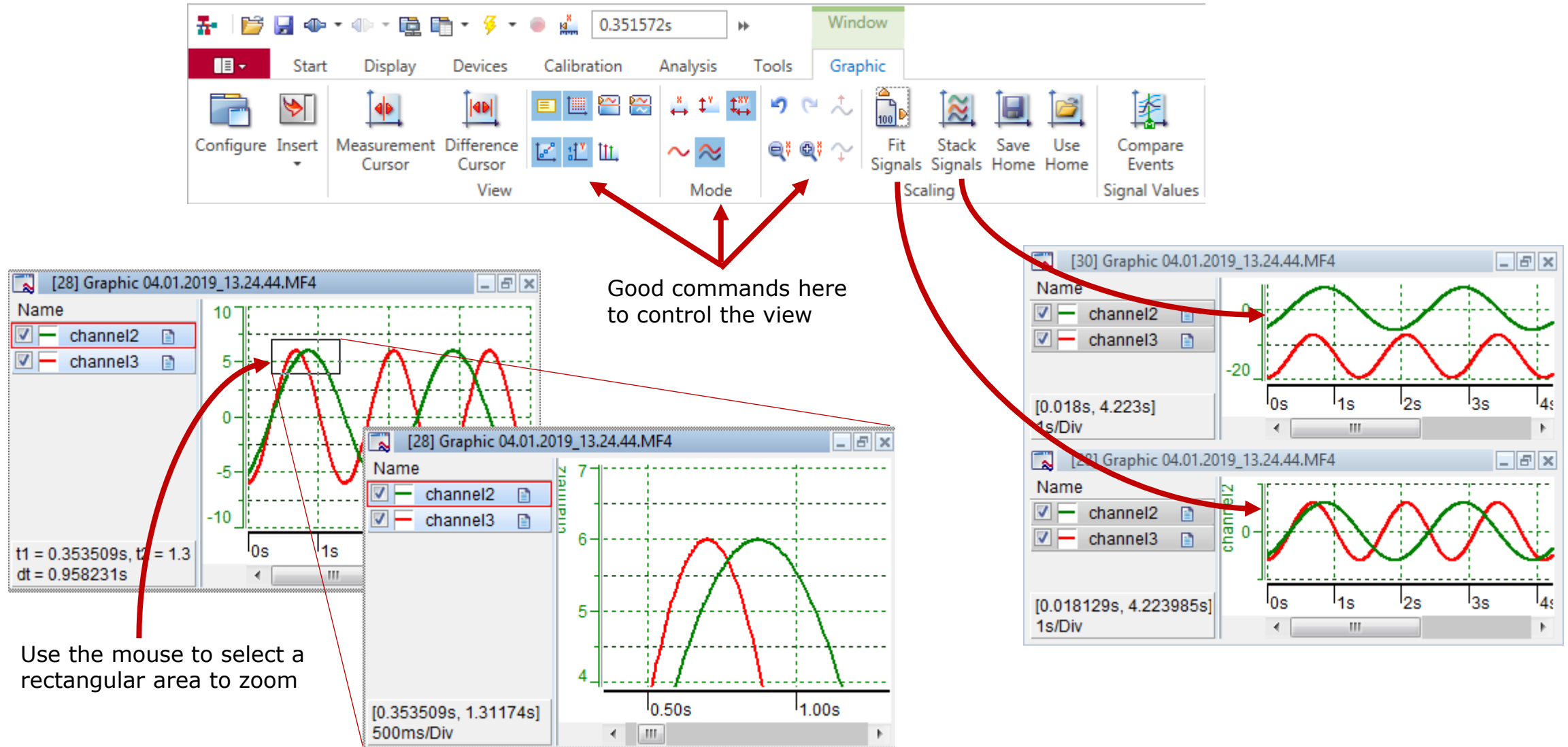
signals from measurement file



The screenshot shows the CANape software interface. On the left, the 'Symbol Explorer' window displays a tree structure under 'Measurements' for 'FILE1: 04.01.2019_10.20.23.MF4'. The 'Signals' folder is expanded, showing a list of signals: 'byteCounter', 'channel1', 'channel2', 'channel3', 'Comment', 'noise', 'perlin_noise', and 'wordCounter'. A red bracket on the left side of the list is labeled 'signals from measurement file'. A red arrow points from the 'channel2' signal to the 'Symbol Explorer' icon in the 'Display' menu. Another red arrow points from the 'channel2' signal to the 'channel2' entry in the 'Name' list of the '[24] Graphic 04.01.2019_10.20.23.MF4' window. The 'Name' list also includes 'channel1' and 'channel3'. The waveform window shows three overlapping sinusoidal signals: a solid green line for 'channel1', a dashed red line for 'channel2', and a dashed yellow line for 'channel3'. The x-axis represents time from 0s to 20s, and the y-axis represents amplitude from -10 to 10. The status bar at the bottom indicates '[0s, 21.976843s]' and '5(1)s/Div'.

drag & drop

Controlling data the data view



Good commands here to control the view

Use the mouse to select a rectangular area to zoom

channel2
channel3

t1 = 0.353509s, t2 = 1.3
dt = 0.958231s

0s 1s

channel2
channel3

[0.353509s, 1.31174s]
500ms/Div

0.50s 1.00s

channel2
channel3

[0.018s, 4.223s]
1s/Div

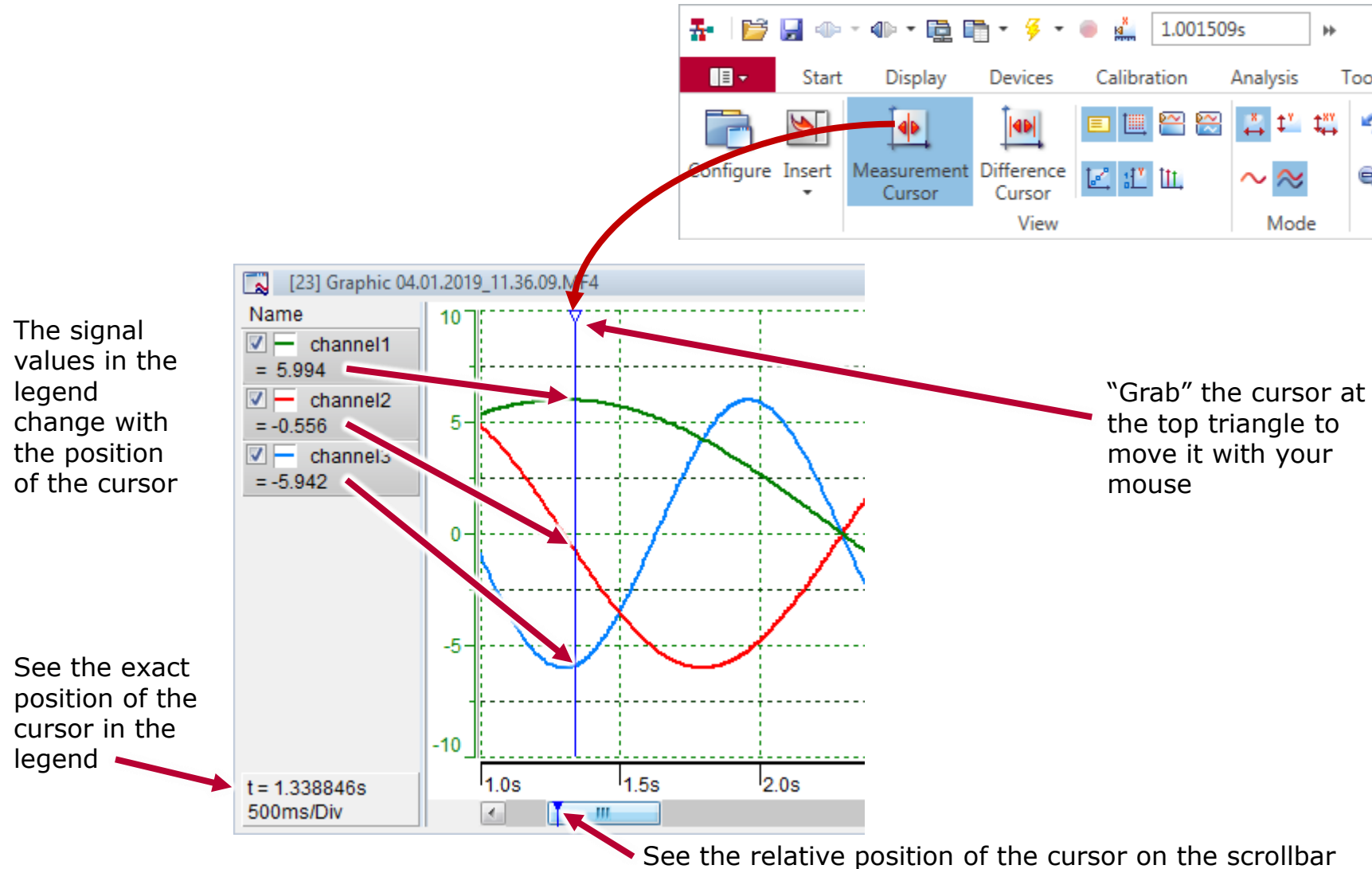
0s 1s 2s 3s 4s

channel2
channel3

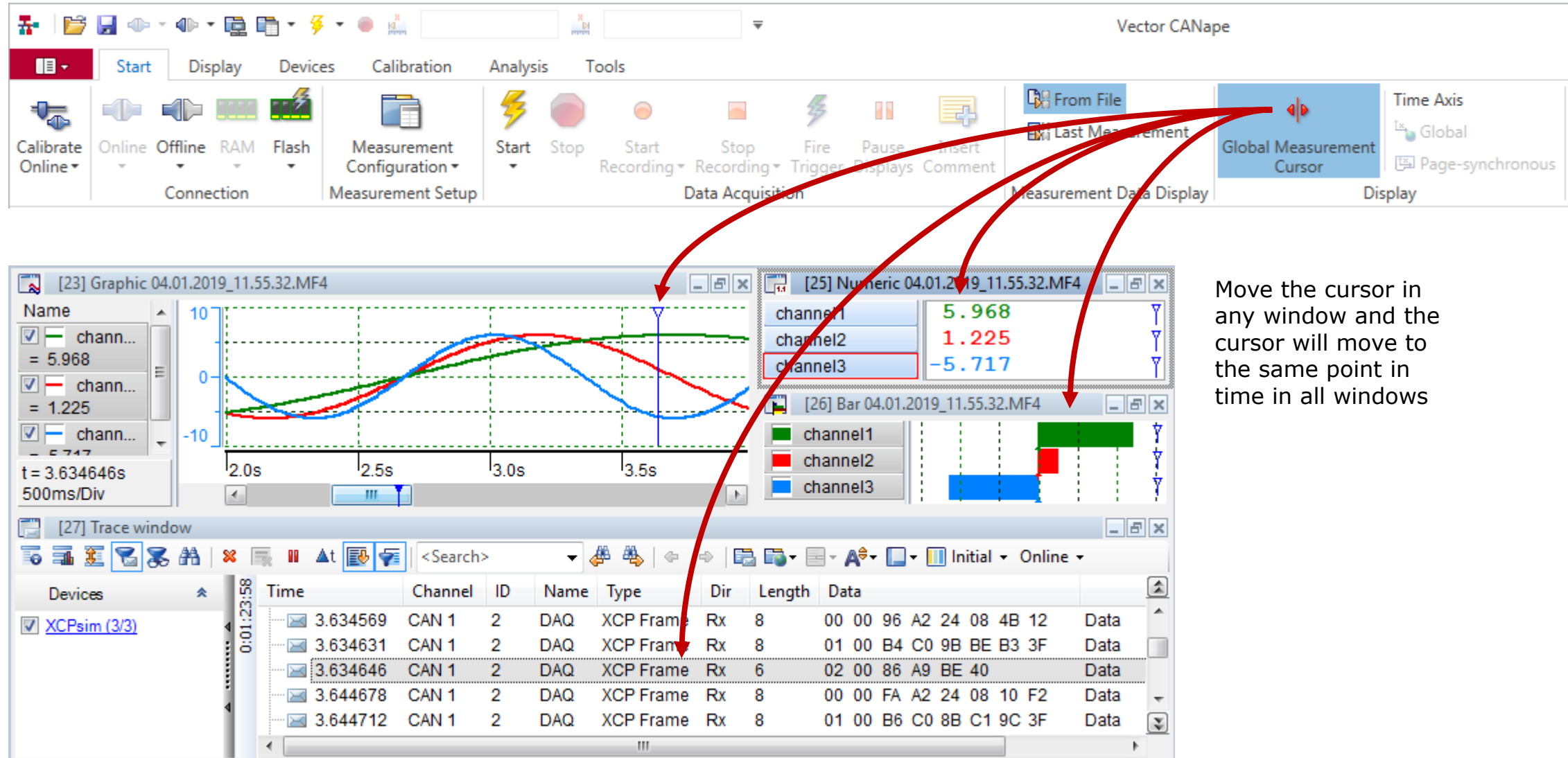
[0.018129s, 4.223985s]
1s/Div

0s 1s 2s 3s 4s

Measurement Cursor



Global Measurement Cursor

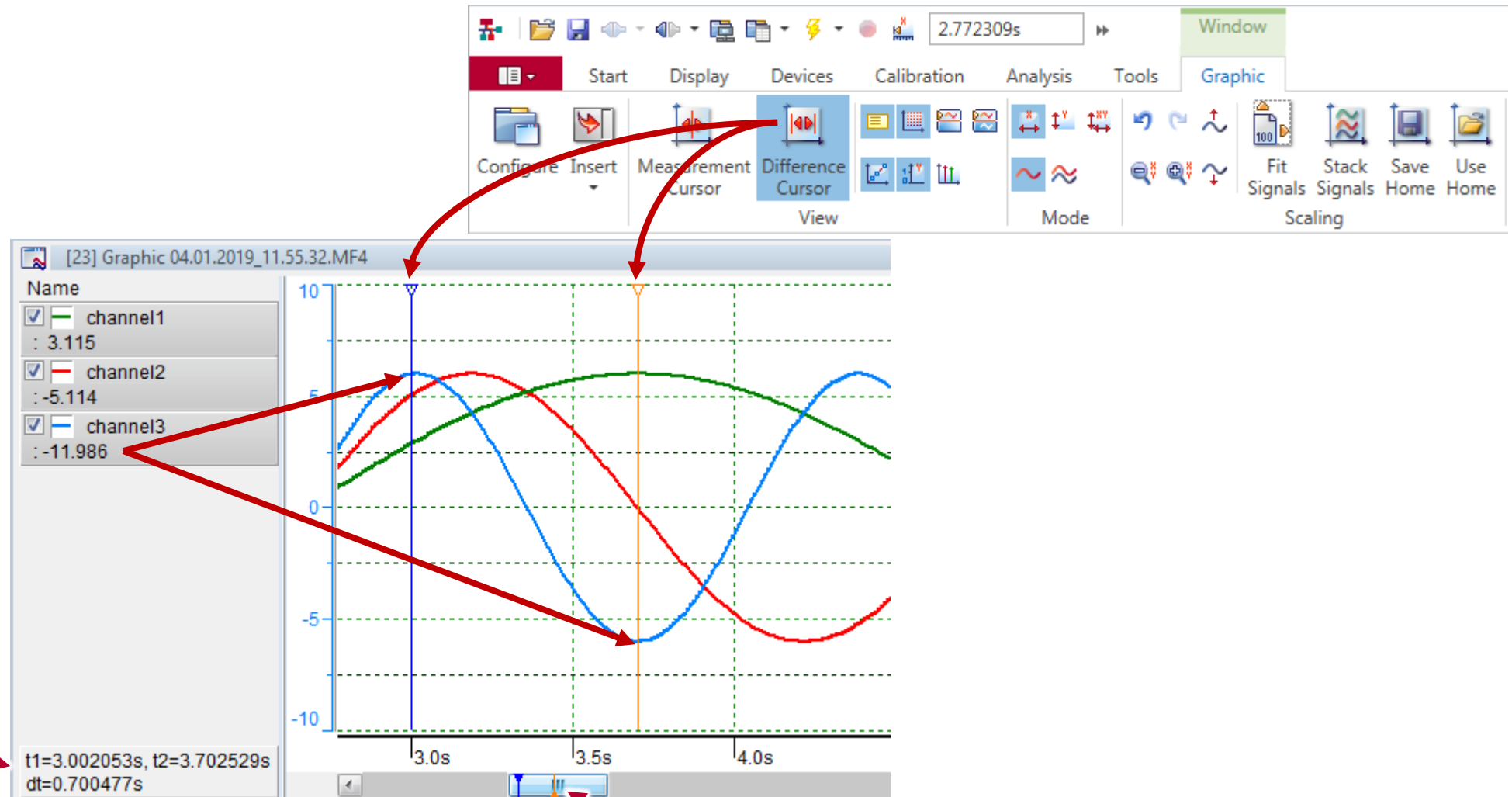


Move the cursor in any window and the cursor will move to the same point in time in all windows

Difference Cursor

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

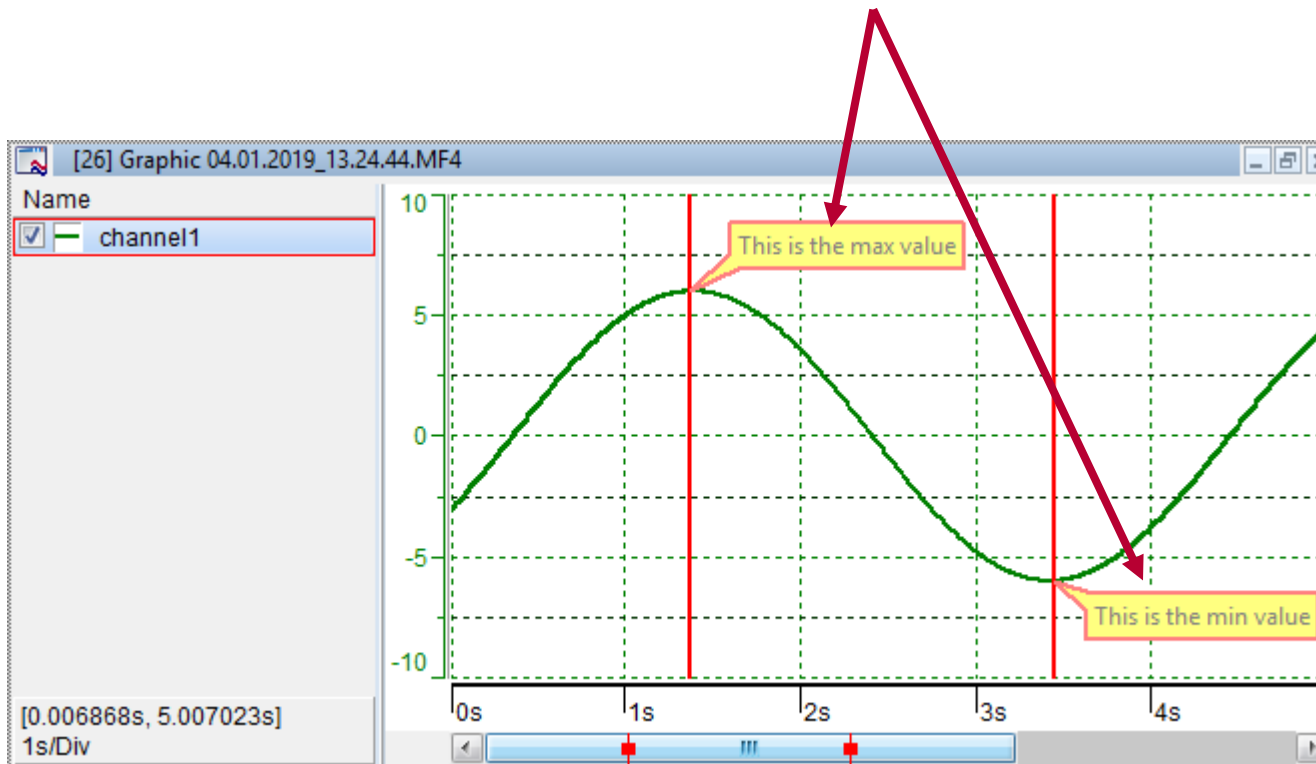
See the exact positions of the cursors in the legend



See the relative positions of the cursors on the scrollbar

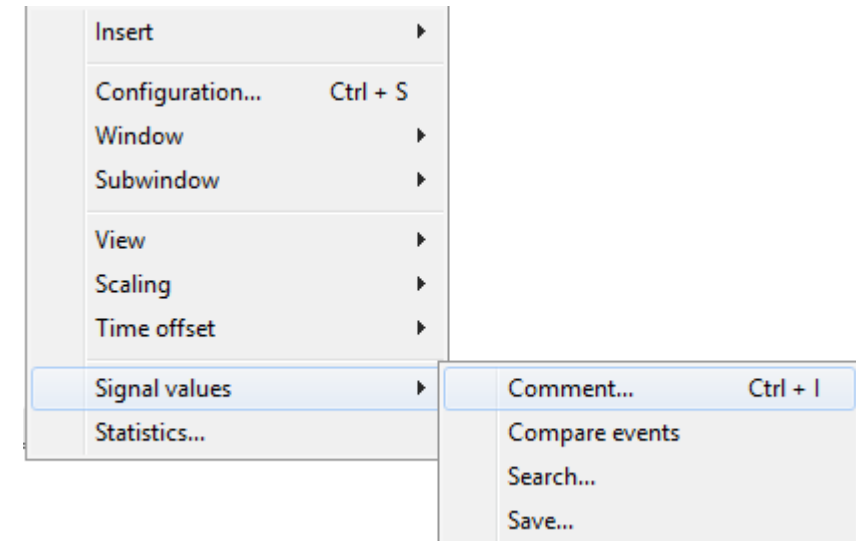
Signal Comments

- 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

- ▶ Drag-n-drop **channel1** to new graphic window
- ▶ Create a log file
- ▶ Find Measurement Files in Symbol Explorer
- ▶ Open log file we just made
- ▶ 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

Agenda

What is CANape ?

What is CANape?

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**

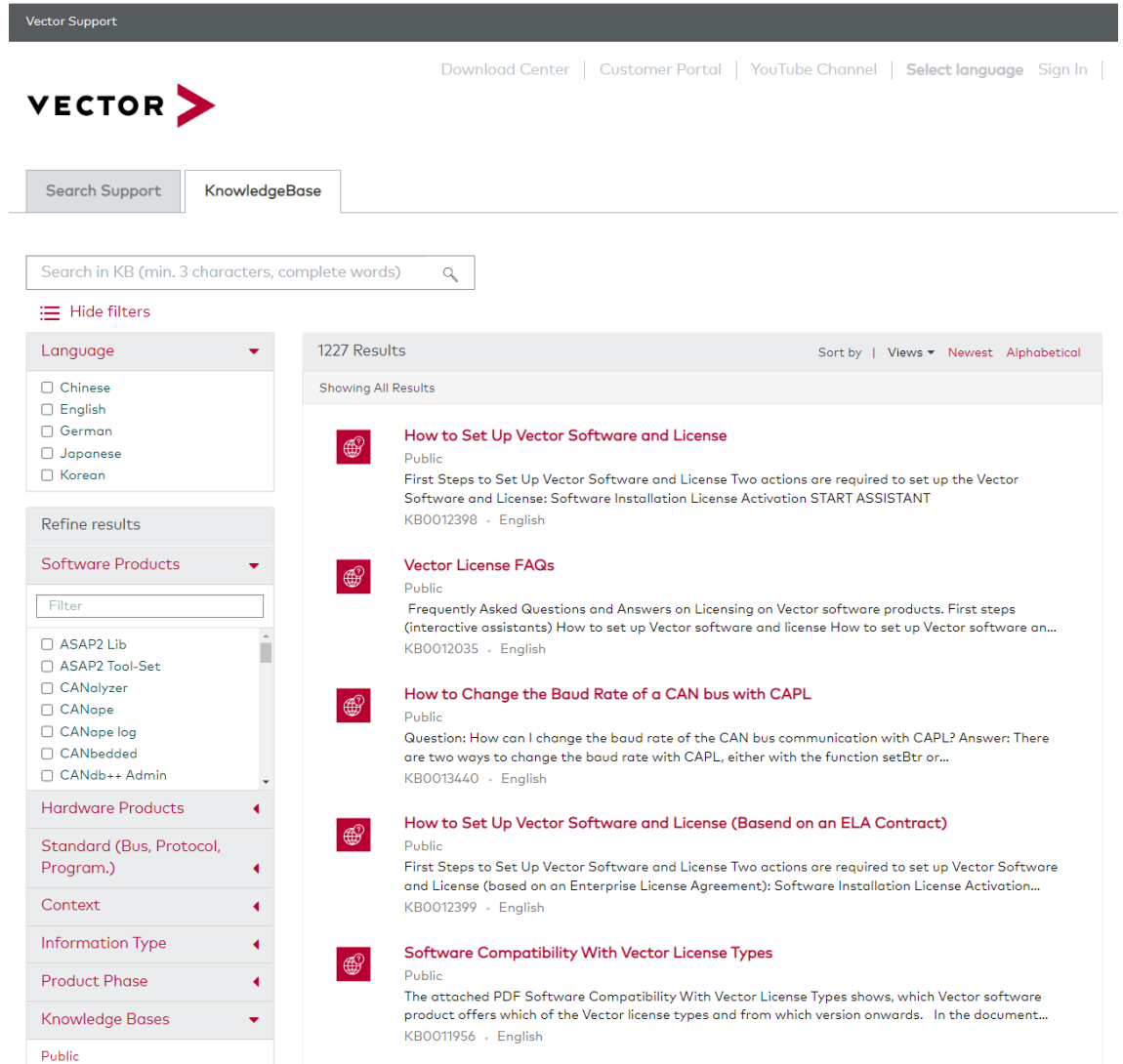
Vector Technical Support

Find...

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support.vector.com

...trainings under
academy.vector.com

...product info under
www.vector.com



The screenshot displays the Vector Support KnowledgeBase interface. At the top, a dark header bar contains the 'Vector Support' text and navigation links: 'Download Center', 'Customer Portal', 'YouTube Channel', 'Select language', and 'Sign In'. Below this, the Vector logo is prominently displayed. A search bar is located under the 'KnowledgeBase' tab, with the placeholder text 'Search in KB (min. 3 characters, complete words)'. To the left of the search results, there are two filter sections. The first, titled 'Language', shows a dropdown menu with options for Chinese, English, German, Japanese, and Korean. The second, titled 'Refine results', includes a 'Software Products' section with a search filter and a list of products: ASAP2 Lib, ASAP2 Tool-Set, CANalyzer, CANape, CANape log, CANbedded, and CANdb++ Admin. Below this is a 'Hardware Products' section with a list of categories: Standard (Bus, Protocol, Program.), Context, Information Type, Product Phase, Knowledge Bases, and Public. The main content area on the right shows '1227 Results' and a 'Showing All Results' message. It lists several articles, each with a red globe icon, a title, a 'Public' status, a brief description, and a KB number. The articles include: 'How to Set Up Vector Software and License' (KB0012398), 'Vector License FAQs' (KB0012035), 'How to Change the Baud Rate of a CAN bus with CAPL' (KB0013440), 'How to Set Up Vector Software and License (Basend on an ELA Contract)' (KB0012399), and 'Software Compatibility With Vector License Types' (KB0011956).