VECTOR

vMDM

Product Information

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V1.8 01/2025

Valid for vMDM as of version 4.4

1 Overview

1.1 Introduction

vMDM (Vector Measurement Data Management) is the solution for efficient management and analysis of large data volumes from development, test bench operation and vehicle tests. With vMDM, you can save your measurement data securely, protect it against unauthorized access and simplify the exchange of measurement data between distributed teams. With vMDM, large-scale CPU-intensive analyses, statistical metrics and reports are performed by vMDM without any computational requirements on the engineer's workstation.

1.2 vMDM Software-as-a-Service (SaaS)

Vector supports you in using vMDM with a new "Software-as-a-Service (SaaS)" offering for the Vector Team Services platform. Vector provides the necessary infrastructure (hardware, software & highly scalable storage solution), which can be rented by you fitting to your demand. This eliminates all acquisition and maintenance costs.

All operational services (data backup, application process monitoring and much more) are included in the costs. The annual license costs also include software updates including data migration, so that the latest product features can always be used. Vector Support is available as a contact for professional and technical questions. This enables your department to quickly and easily implement a measurement data management solution at complete cost transparency.

Many security measures (encryption, client separation, ISO 27001) ensure a high level of data security. Selected, globally distributed data centers ensure fast response times.

1.3 vMDM as part of the Vector Logger Cloud solution

The Vector Team Services applications vLoggerCloud and vMDM basic together form the entry-level solution for managing Vector GL Loggers and the measurement data they collect.

If the functionality of the vMDM basic variant is not sufficient, for example because you want to automatically synchronize your data with the own private or hybrid cloud, convert logger raw data to MDF or BLF or analyze your logger data in the cloud, you can upgrade to a full vMDM fun[1] or pro at any time.

[1] fun = fundamental

1.4 vMDM and Vector Logger Suite

The vMDM user interface for data management ("vMDM Explorer") is integrated in the Vector Logger Suite. No additional client license is required to use the vMDM functions such as metadata-based search, conversion or download of the original or converted logger data.

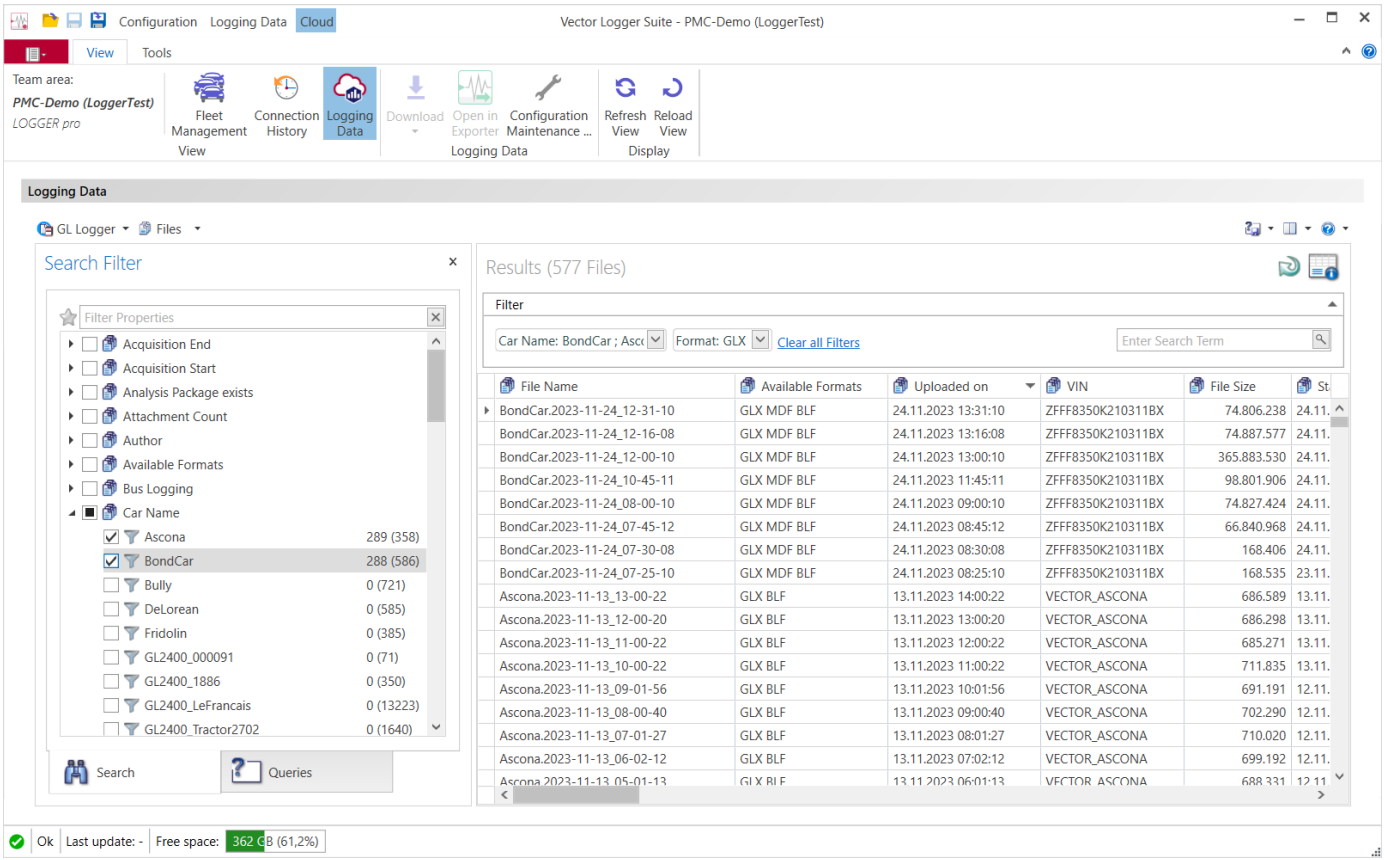

Figure 1: vMDM Explorer in the Vector Logger Suite

1.5 vMDM Integration in CANape and vSignalyzer

For users who work with the Vector tools CANape, vSignalyzer or vMeasure the vMDM Client is offered as an installation option. In addition to the CANape, vSignalyzer or vMeasure license, no additional option license is required for use.

Data can be imported into vMDM either from the Vector Tools or with the Vector Shell Extension, simply via the context menu in Windows Explorer.

CANape and vSignalyzer users also get convenient access to measurement data stored and managed in the vMDM Cloud. Developers of data analysis and visualizations can create and test them in CANape and vSignalyzer and make them available in the vMDM Cloud.

1.6 Overview of Advantages

- Secure storage of measurement data and measurement data attachments from test benches, road testing and endurance testing
- Protection of data through organization of data files in the cloud with user-specific permissions
- Easy searching, filtering, and display of measurement data
- Automatic indexing of measurement data on import
- Flexible data indexing based on metadata containing measurement attributes, calculated metrics, and data provided by other systems
- Conversion of measurement data stored in the Cloud, automatic or on demand

- Automated data analysis and reporting without any computational load on the user's PC
- Project-specific reporting of measurement data and statistical analysis of meta data
- Scalable solution for multi-user environments
- Familiar working environment through seamless integration with the Vector tool landscape. You define scripts, data analytics and data mining functions as usual in vSignalyzer or CANape.
- Minimum IT investment through software-as-a-service architecture

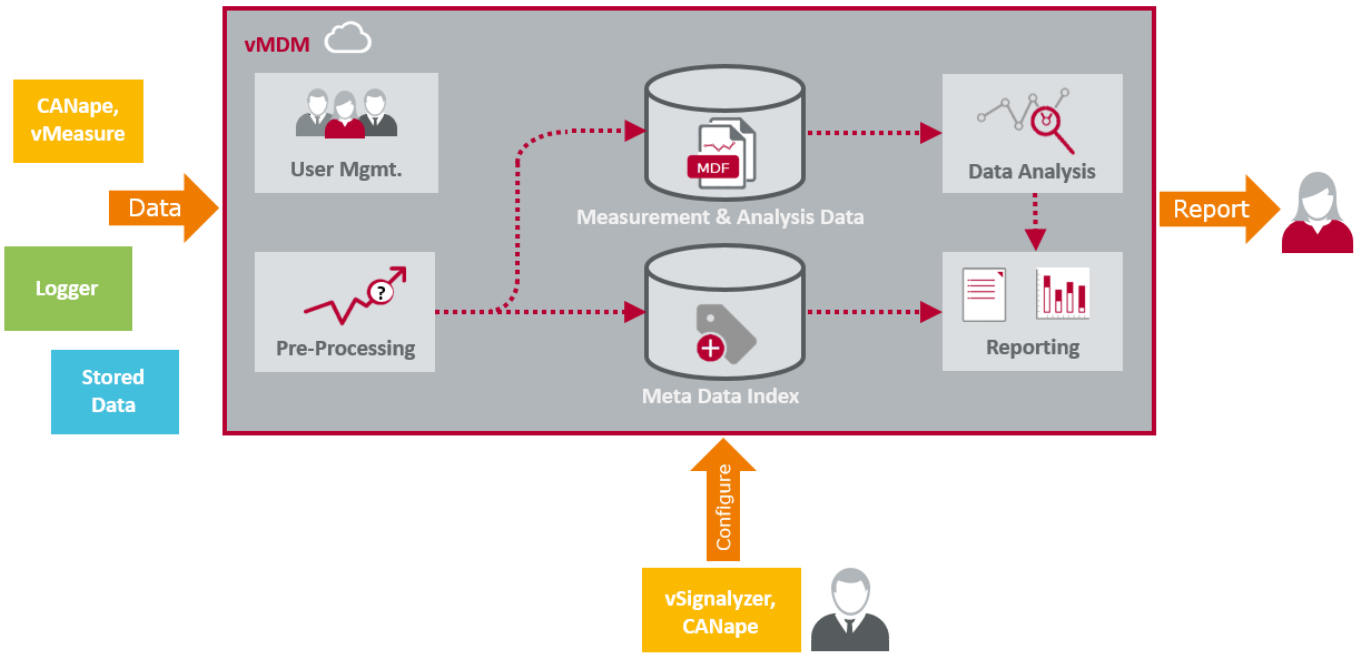

Figure 2: Overview of the most important vMDM components

1.7 System Requirements

1.7.1 vMDM pro SaaS

- Subscription license for vMDM pro or fun SaaS
- Ingest-packages for measurement file upload to the cloud
- Internet access

1.7.2 vMDM pro Enterprise

On request, vMDM pro can be provided as well as an on-premise solution.

Operating System:

- Windows Server 2019 Englisch
- Windows Server 2019 English
- Windows Server 2016 English

Recommended* hardware configuration:

- Windows VM for vMDM processes:
  - 16-core CPU, 32 GB RAM
  - 50 GB free space on system partition, 500 GB on data partition
  - Network share with sufficient free space for measurement data
- Linux VM for database and Elasticsearch:
  - 8-core CPU, 32 GB RAM
  - 10 GB free space on system partition, 50 GB on data partition

* a dual VM configuration is recommended as it simplifies a future capacity and performance extension

Single VM configuration:

- 16-core CPU, 64 GB RAM
- 50 GB free space on system partition, 500 GB on data partition
- Network share with sufficient free space for measurement data

Minimum configuration*:

- 8-core CPU, 16 GB RAM
- 10 GB free space on system partition, 200 GB on data partition
- Network share with sufficient free space for measurement data

* Only for test installations, not recommended for productive use

1.8 Further Information

Various documents are available on the web for vMDM, CANape, vSignalyzer and vMeasure exp. In addition, you will find further valuable expertise in the form of technical articles and application notes. For more information, visit the **Vector Download-Center**.

2 Basic Functions

- Integration of vMDM in CANape, vSignalyzer vMeasure and Vector Logger Suite for navigation, searches, and data transfer
- Automatic upload of measurement data after measurement with CANape and vMeasure
- Interactive and automated analysis of the measurement data stored in the vMDM Cloud with CANape or vSignalyzer
- Simple drag & drop export of measurement files from the vMDM Cloud
- Creation of queries for the storage of dynamic search requests
- Export of query results in CSV or Excel format for creation of statistical analyses
- Setup and management of data catalogs and so-called collections as well as of user permissions
- Automated data analysis and report generation in vMDM with CASL or Python
- Freely configurable pre-processing when loading measurement files
- Cration of statistical reports in vMDM
- Offline edit of measurement properties with the vMDM Property Editor
- Metadata enrichment from external sources (Configuration-management, “digital-twin”, ...)

3 Save Measurement Data in the vMDM Cloud

3.1 Import Measurement Data from Vector GL Loggers

With the vLoggerCloud, Vector offers a powerful and scalable solution for managing your Vector GL Loggers in the Team Services platform. The loggers can upload the recorded data directly to the cloud using an optionally available LTE router, where it is automatically imported into vMDM and indexed. This gives you access to all vMDM functions for data management and further processing such as data conversion, pre-processing and report generation.

3.2 Measurement Data Import with CANape and vMeasure

vMDM offers a variety of possibilities to import your measurement data into the vMDM cloud:

When using the Vector tools CANape and vMeasure exp, you can specify in the recorder configuration whether you want to store the recorded data in a vMDM cloud collection. vMDM then automatically and reliably transfers the data in the background. Short-term or even longer offline states of your measuring computer are accounted for, and interrupted transmissions are automatically resumed as soon as a connection to the cloud is available again.

Raw data from the Vector Logger Cloud in the same Cloud tenant is automatically stored and indexed by vMDM in a collection you specify.

- A manual transfer of MDF measurement data is also possible via the Vector Shell Extension. Selected MDF files can be copied or moved to the desired target collection in the cloud with one click.
- vMDM also provides automation tools, either via corresponding functions in the CANape / vSignalyzer script language CASL or via the vMDM PowerShell SDK and the pyMDM python library if integration into external programs or scripts is required.

3.3 Measurement Data Attachments

The MDF format allows you to supplement your measurement data with important data in the form of attachments. This can be network databases or multimedia data such as audio, image or video files. Attachments can be embedded in the MDF measurement file or referenced as an external file in the MDF file. Both types of attachments are handled by vMDM and are automatically included in import, indexing and download.

3.4 Optimizations

In order to transfer large amounts of data into the cloud securely and with high performance, vMDM makes a number of optimizations:

- MDF files are automatically converted into compressed MDF files without loss before transferring them to vMDM. Reduced file sizes reduce transfer times and storage space requirements.
- In situations where no internet connection with high quality and bandwidth is available (e.g. if working at home or staying at a hotel) you can easily adjust the transfer characteristics in vMDM with the help of a slider between "Performance optimized" and "Secure transfer".
- Measurement files or attachments already stored in the vMDM Cloud are recognized via checksums. This avoids multiple uploads and storage of large, identical files (e.g. attachments with network databases).

4 Synchronize Measurement Data with the own Cloud

vMDM is a powerful solution for permanently storing and analyzing measurement data. Nevertheless, there are often reasons to store all or part of the measurement data in your own IT environment or your own private cloud.

For this case, vMDM in the pro and fun variants provides with the vMDM PowerShell SDK and the pyMDM python library a flexible solution for the script-based download of measurement data that can be easily adapted to the respective requirements.

5 Measurement Data Index for Optimized Search Operations

With the measurement data index, measurement data can be quickly found, queries for specific views defined and analyses limited to specific measurement data. vMDM determines additional index data during the initial analysis of the measurement files as part of pre-processing. This allows comprehensive classifications and evaluation profiles as well as event counts in categorized measurement files with just a few mouse clicks.

You determine the properties to be indexed individually for each collection by using user-defined properties according to your requirements. This provides you with a powerful tool for describing and structuring your measurement results.

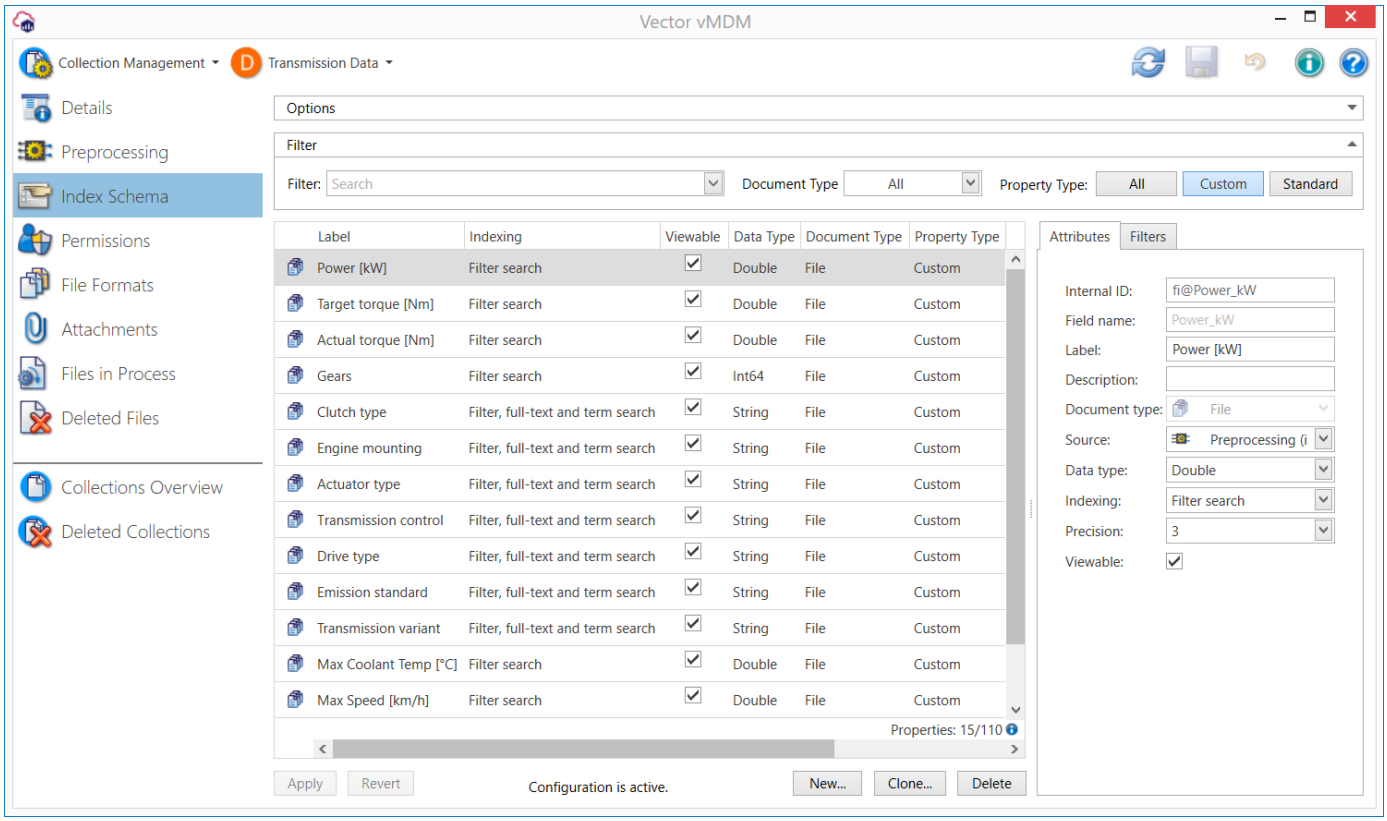

Figure 3: Configuration of the vMDM Index Schema

6 File Formats

6.1 ASAM MDF

vMDM uses the MDF format as its primary data format, as it provides many excellent features for the storage and evaluation of measurement data from the automotive industry:

- Support of user-specific meta data in the file header enables a flexible enrichment of your measurement data with attributes that you can use for searching and filtering in vMDM.
- Storage of measurement data in uniform or individual acquisition grids, data types of fixed or variable size, scalar or complex structured data.
- Support of various data storage strategies, each optimized for different applications such as measurement data acquisition or evaluation. Measurement data can thus be optimized for fast data access in the further tool chain after acquisition without loss of information.
- Lossless compression optimized for measurement data.
- The MDF data format is also constantly being extended and improved by the ASAM standardization committee to meet the evolving requirements of the automotive industry.

6.2 Vector GL Logger Raw Data Format

The Vector loggers of the GL product family record data in a raw data format optimized for logging applications. vMDM supports the storage and indexing of this raw data. For further data analysis, however, the data must be available in MDF format. vMDM therefore enables conversion of the raw data (using a database analysis package) into MDF format. This is done in the vMDM Cloud, depending on the configuration either automatically after import or on demand during export.

6.3 Additional Formats

vMDM supports conversion and export of stored measurement data to MATLAB, Excel or ASCII format. This allows you to use additional tools in your data evaluation tool chain.

7 Display and Manual Evaluation of Measurement Data

With the vMDM Explorer window in CANape and vSignalyzer, you have direct access to all centrally stored and managed measurement data without having to pass through an external database application or the Windows File Manager.

You use features and metadata that you are free to define yourself to filter and sort even very large volumes of measurement data in seconds in order to solve specific problems. With a single mouse click, and using the proven capabilities of your Vector tool, you can display and analyze the retrieved measurement data quickly and conveniently. Data transfer is performed automatically in the background and a data cache permits accelerated access during recurrent operations on the same data.

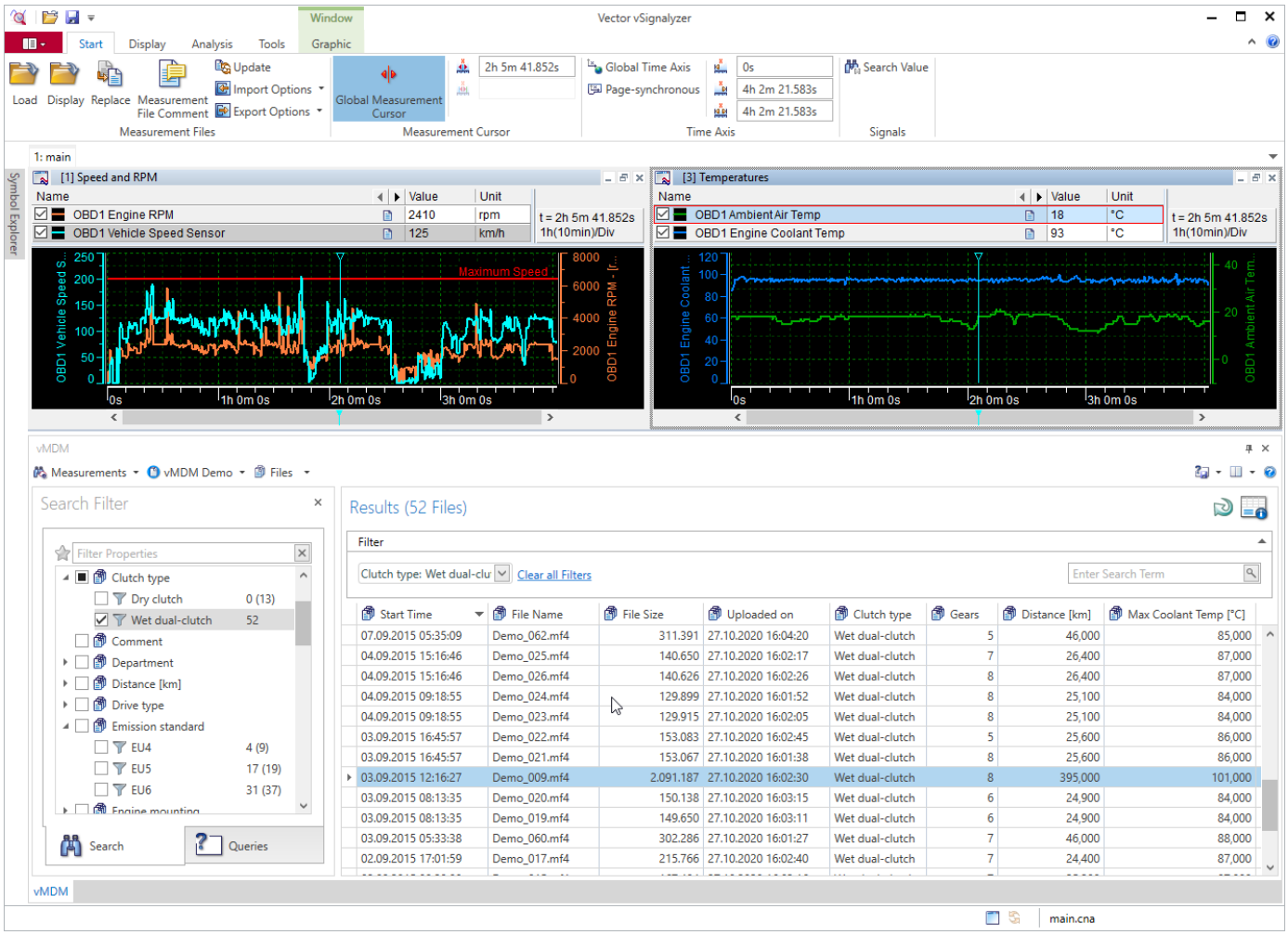

Figure 4: Search filters accelerate the search for measurement data with vMDM Explorer in vSignalyzer

8 Automated Data Preprocessing

For each vMDM collection one or several preprocessing steps can be configured, which allow you to automatically perform a user defined analysis of measurement files directly after upload.

A preprocessing step is developed and tested at the workstation either...

...in the CANape / vSignalyzer Data Mining Editor. All available analysis tools can be used during preprocessing, such as CASL scripts, virtual measurement file channels and global variables. Analysis results are configured in Analysis Profiles and can then be used later during report creation.

...or with the VSCode Vector Cloud Script Extension and the pyMDM Python library

Additional to the creation of analysis data, you can also create or modify meta data of an uploaded measurement file. For example, it is possible to add minimum, maximum or average temperature values from a measurement to the vMDM index or the number of gear shifts performed during a test drive.

Whether using the Data Mining Editor or the VSCode Extension: With one click you upload the preprocessing step to the cloud and activate it for all new measurement files of the selected vMDM collection.

9 Automated Report Generation

The vMDM reporting function enables you to create meaningful reports about your measurement data according to your needs.

The subset of measurement data for which you want to create a report is selected using meta data filters, in the same way as when searching data. This allows you to analyze exactly the data you are interested in, for example a specific time range, one or several variants, test vehicles or test stands, or even specific properties of the unit under test or environment, such as SW version, or maximum ambient temperature during the test drive.

The analysis is based on the analysis results created during preprocessing or the meta data index. This type of data allows an efficient and performant processing compared to the typically large size of measurement files. vMDM reports can be executed in a short time frame, even for large amounts of measurement data.

Report templates created by users can be easily adapted to individual needs, e.g. by modifying the filter criteria or the parameters of the report script. It is also possible to set up a time schedule for repetitive report execution.

Reports are managed in Report Groups, which allow you to manage access to reports independent of the measurement data access rights.

10 Scalable Multi-User Solution

vMDM is scalable as a multi-user system depending on the expected data volume and the required server performance. The measurement data is organized into customer- or project-specific data catalogs known as collections and is securely protected against unauthorized access by means of user-specific roles and permissions.

11 Data Security

The data in vMDM is protected against unauthorized access. vMDM user authorizations, specific read/write permissions and protection against accidental deletion all make secure data management possible.

The operation of vMDM in the cloud provides a high level of data security with a number of different measures (encrypted data transfer, client separation, ISO 27001).

12 Engineering Services

To allow you to concentrate fully on your ECU development activities, Vector supports you both with its expertise and with its tailor-made, fully-fledged solutions for your particular tasks. The range of services extends from consulting, for example for the development of customer-specific analysis scripts, through support during integration and on to site visits by a field application engineer.

13 Training

We offer training courses for CANape and vSignalyzer both in our seminar rooms and on-site at the customer's premises.

You will find more information on the training events and dates on the web at: **www.vector-academy.com**.

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