VC - CAB

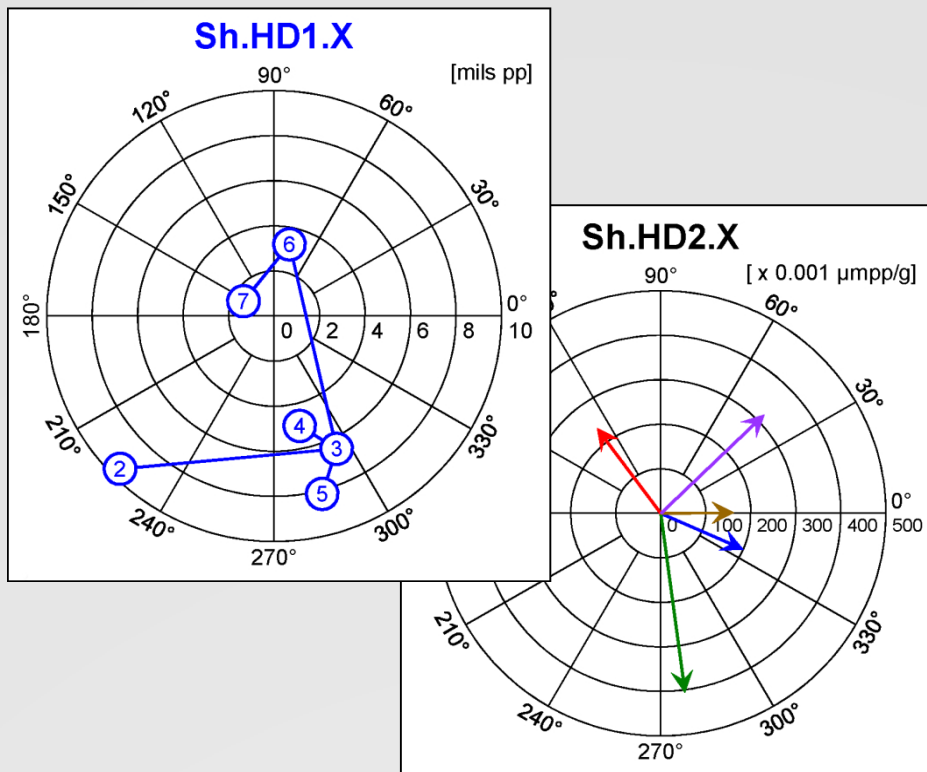## Computer aided balancing program for on-site balancing of rotors

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Multi-Plane-Balancing on Site

Modern methods in design, calculation, fabrication and simulation are state of the art for the manufacture of rotating engines. Despite the high accuracy of these methods, balancing of rotors is often necessary on site.

Balancing reduces the vibrations and therefore the mechanical stress in the engine. As a consequence it increases lifetime of the engine and reduces:

- the risk of damages to bearing, pedestal, casing, foundation, piping etc.
- the distortion of the shaft due to loss of clearances to stationary parts (labyrinths, sealings,...)
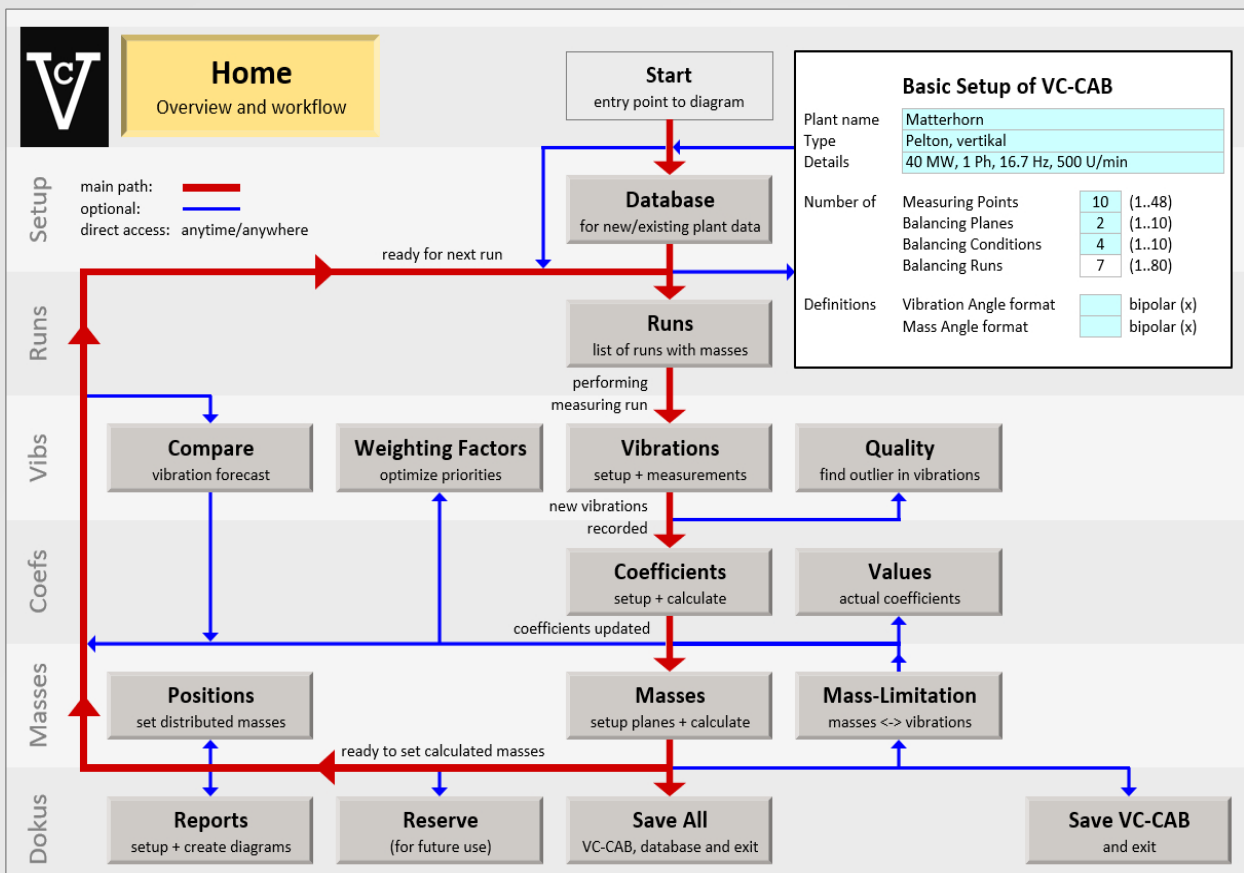- the wear or even destruction of shafts, bearings, support structure, etc.

VC - CAB is a balancing program to balance all types of rotors from simple fans (one sensor, one plane), to hydro and gas turbines and up to the worlds largest steam turbine sets (with 48 sensors, 10 planes, flexible shafts, several critical speeds and for multiple conditions).

VC - CAB It supports the engineer during the complete balancing process. The goal is to achieve a optimal running condition with a minimum of balancing runs. Furthermore, engine-specific information can be stored and serves as an advanced entry-point for future balancing.

VC - CAB is primarily designed for on-site balancing. The basic calculation algorithms were established in 1976. Since then it was succesfully used in power plants and industrial sites to balance all sizes and sorts of engines. Over the years it was continoulsy developed further and new features have been implemented. The latest major release is version 3, operational since 2020.

Menu "Home"

The starting point in VC-CAB is Home with direct access to essential and optional submenus.

Handling and Evaluation of Balancing Data

VC - CAB uses vibration measurements and positions of balancing masses as the main input. Vibration measurements of a run can be taken at a single or at several defined operation modes (so called "balancing conditions") of the engine, such as idle, full load, etc.

Before **VC - CAB** calculates new masses, the user can give to each measuring point and to each balancing condition an individual weight as additional input to the calculation. The algorithm solves the equation system to determine the influence factors and subsequently the main output, the optimal masses for all selected planes.

VC - CAB calculates masses with or without run-out compensation.

Different methods are avaliable to reduce masses or the number of planes, but always with known reduction of balancing quality (simulation in advance).

The table "Best mass-sets" is a tool for efficient use of planes: This example shows that using plane "Ge-DE" only is almost as good as using all 3 planes:

- Sum represents the sum of all weighted vibrations
- Peak [%] represents the highest of all weighted vibrations

Best mass-sets to balance. One for each combination of selected planes:

| Line | Planes in use | Weighted Vibration Indices (run-out compensated) | | Best Mass-Sets | | | | | |
| | | Sum [%] | Peak [%] | LP | | Gen-DE | | Gen-NDE | |
				kg	deg	kg	deg	kg	deg
1	3	**54**	**74**	0.620	108	1.641	210	0.483	102
2	2	**55**	**72**			2.231	234	0.175	71
3	2	55	73	0.175	159	2.335	229		
4	2	57	76	1.315	67			0.955	73
5	1	**56**	**73**			2.327	235		
6	1	68	81	1.398	71				
7	1	88	88					1.168	60
8	0	**100**	**100**						

Submenu "Compare"

"Compare" is one of the optional menus.
It allows comparison of expected vibrations prior to run the engine.

Reading examples:

Selection: Expected vibrations for Balancing run with run-out as measured

Balancing will reduce overall vibrations from 100% to 54%...

... with idle/3000 rpm responsible for 14%

PED.1.VE will read **8.9** mm/s when passing the 1st critical speed at 1050 rpm.
This is the worst weighted measurement at 1050 rpm and therefore **bold**.

Additional features of VC-CAB

- If more runs are performed then necessary, then the equation system is overdetermined. The additionals information is - unless discarded by engineer - used to improve results, using the "least square method". Furthermore it allows detection of faulty and substitution of missing vibration measurements. This allows also balancing based on a run with incomplete measurements.

- All measured and calculated balancing data represent the behavior of the engine and form an engine-specific data set. Such data sets can be stored and reloaded, whenever necessary (menu Database).

- Graphical output visualizes and documents the balancing process and the behavior (influence coefficients) of the engine. See on page 1:
    left: Runs 2 to 7 for balancing on 3 planes, including determination of coefficients
    right: Influence of unity-masses on 5 different planes (set at 0 deg), for 1 measuring point

- A tool for splitting-up of a calculated mass into several masses using avaliable positions and given weights. This may also include removal of existing weights.

- More comprehensive information is found in the **VC - CAB** - documentation.

Technical Information

VC - CAB can handle up to:

- 10   balancing planes
- 48   vibration measuring points (no restriction concerning mounting position or sensor type)
- 10   balancing conditions for each run (different speeds, loads, thermal conditions, etc.)
- 80   runs (including run-out measurements, original- and calibration run)

System requirements

- Excel 2010 (or newer)
- Windows XP, 7, 10 (32 and 64 bit systems) or newer
- PC with USB-port

Scope of supply

- **VC - CAB** is sold under licence. A licence consists of the main program, installation instructions, operating manual, database-files with examples and a dongle (USB-stick for copyright-protection, for local use only). The files can be copied for backup-purposes.
- Optional: Vibro-Consults offers courses for individual and class room training.

Contact

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