

# SGP40 – VOC Index for Experts

Version 1.1  
Stäfa, August 2020



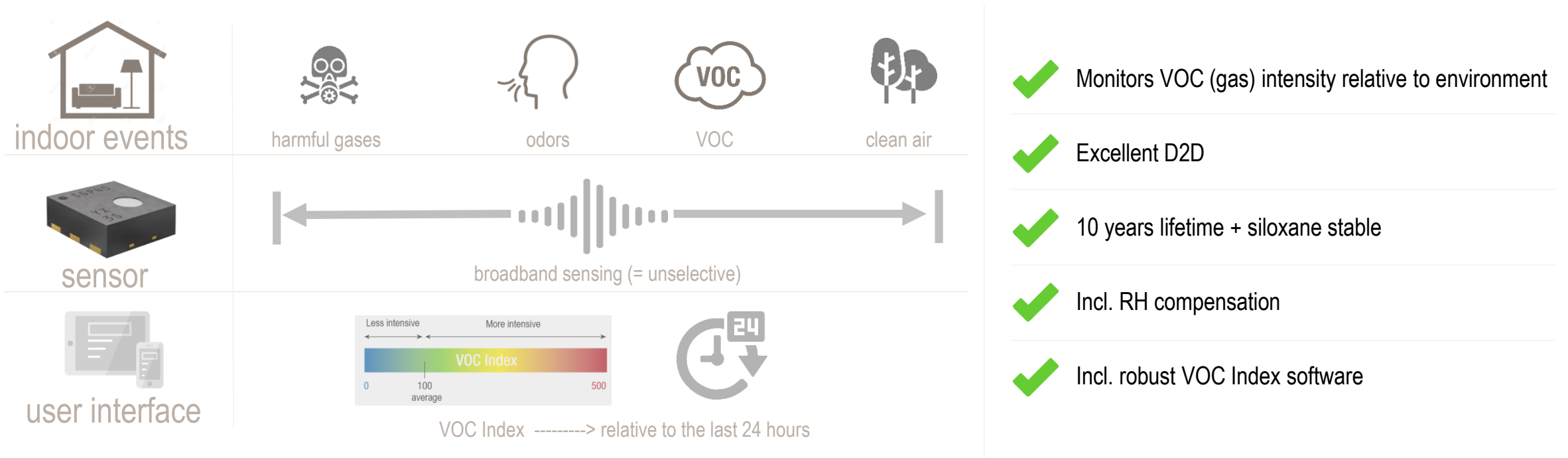
# VOC air pollutants and their sources



## Examples of air pollutants and their source

- |               |   |
|---------------|---|
| Harmful gases | <input type="checkbox"/> Acetone (paints, glues)  |
|               | <input type="checkbox"/> Toluene (furniture, mattresses, building products)                 |
| Other gases   | <input type="checkbox"/> Ethanol (alcohol, cleaner, perfume)                                |
| Odors         | <input type="checkbox"/> Hydrogen sulfide, volatile sulfuric compounds (rotten food, farts) |
|               | <input type="checkbox"/> Ammonia, amines (pet pee)  |
| Smoke         | <input type="checkbox"/> Benzene, nitrosamines (cigarette smoke)                            |

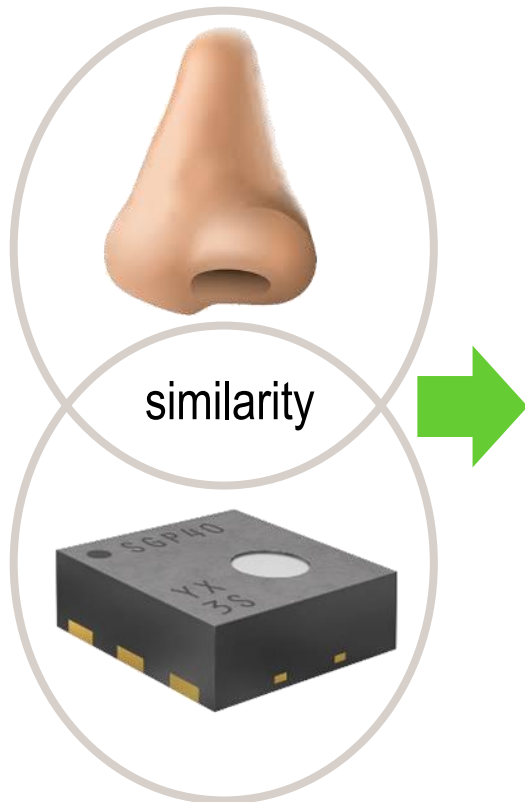
# Monitoring indoor air with the VOC Index



## Customer benefits for air purifiers

- VOC Index behaves similar to human nose
- Extends auto mode to gas events
- Fits well to APs with high VOC CADRs
- Proves that an air device works
- Adapts to filter saturation
- Adapts to room backgrounds

# Three main components of the VOC Index signal



## ☐ **How strong?** Detects **relative intensity** of VOC events

SGP40 detects odorless gases as well, but it cannot discriminate between different VOCs.

## ☐ **How long?** Detects VOC event **duration**

Human nose adapts in a few minutes. SGP40 adapts in a few hours.

## ☐ **How often?** Informs about VOC event **frequency**

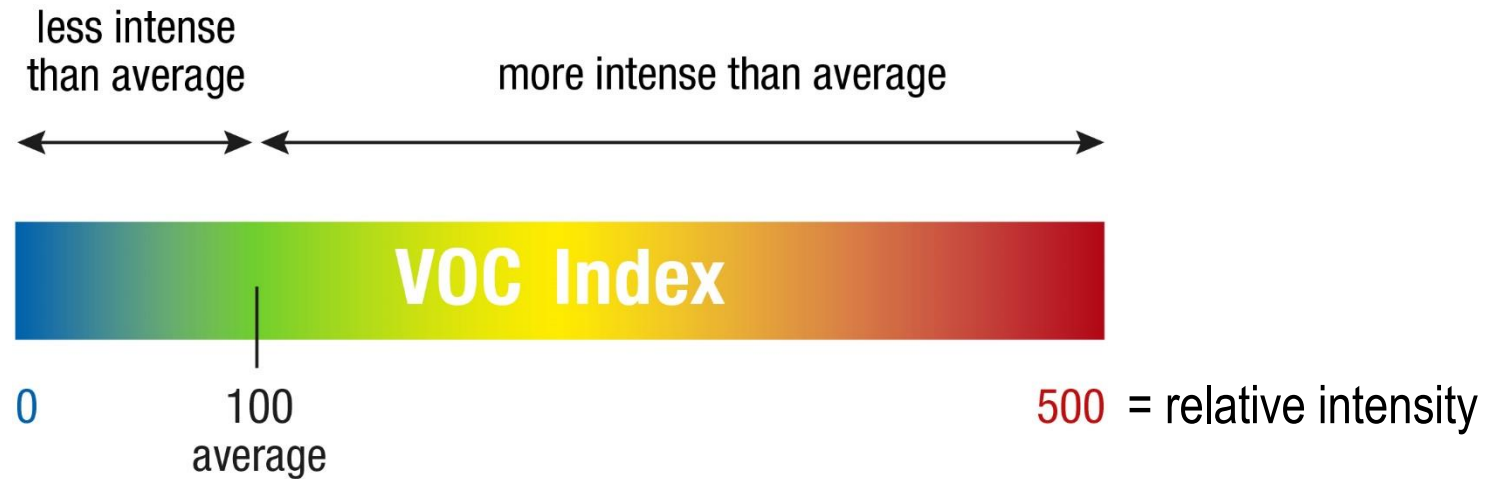


Example: smelling an orange



# The VOC Index covers all information needed

How intense?

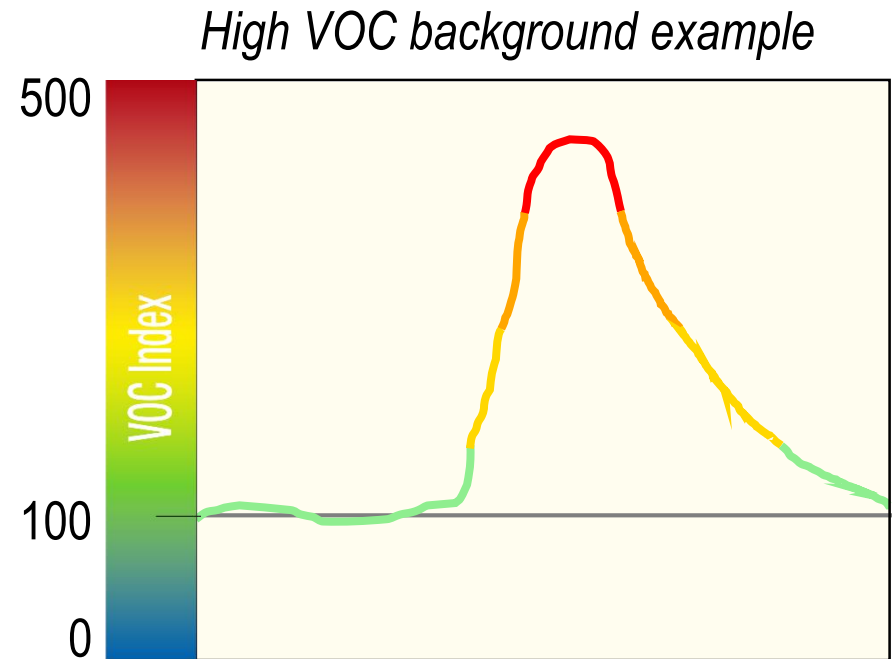
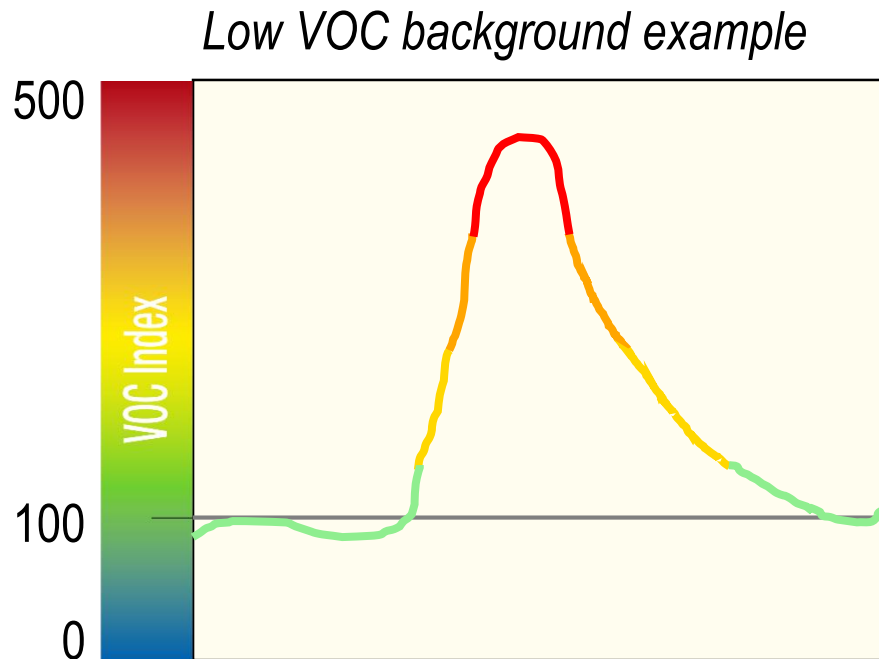


VOC Index...

- ☐ ...shows **changes** of intensity **relative** to the history in the room
- ☐ ...is referenced to the **average of VOCs** present over the last 24 h in the room
- ☐ ...behaves similar to a human nose, a MOX sensor is not able to detect the absolute VOC concentration
- ☐ ...starts going back to average VOC Index **after 3 h** for very long events – adapts to background

# Visualizing VOC events by means of VOC Index

VOC Index visualizes VOC events on a logarithmic scale<sup>1,2</sup> and relative to typical indoor gas composition during the recent 24 h. This means that level “typical” refers to the typical conditions of the environment. The scale does not represent absolute concentrations.



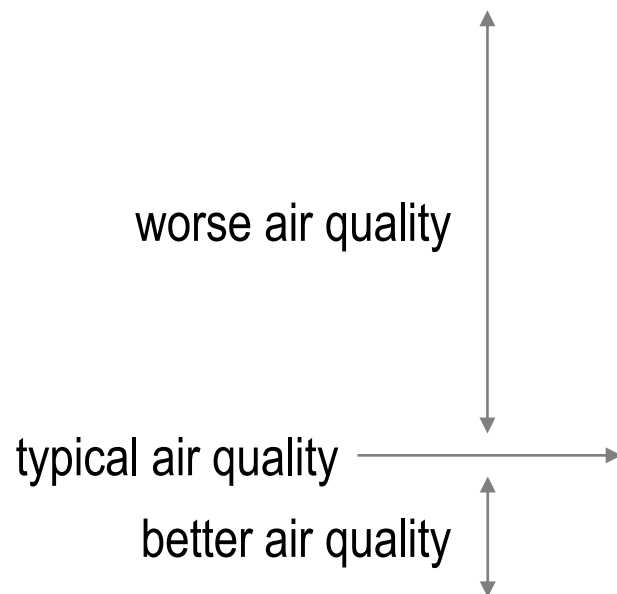
<sup>1</sup> Bundesgesundheitsblatt – Gesundheitsforschung Gesundheitsschutz 2007, 50:990–1005, Springer Medizin Verlag 2007

<sup>2</sup> Air quality guidelines for Europe – 2nd Edition; hg. v. World Health Organization – WHO, Copenhagen (2000)

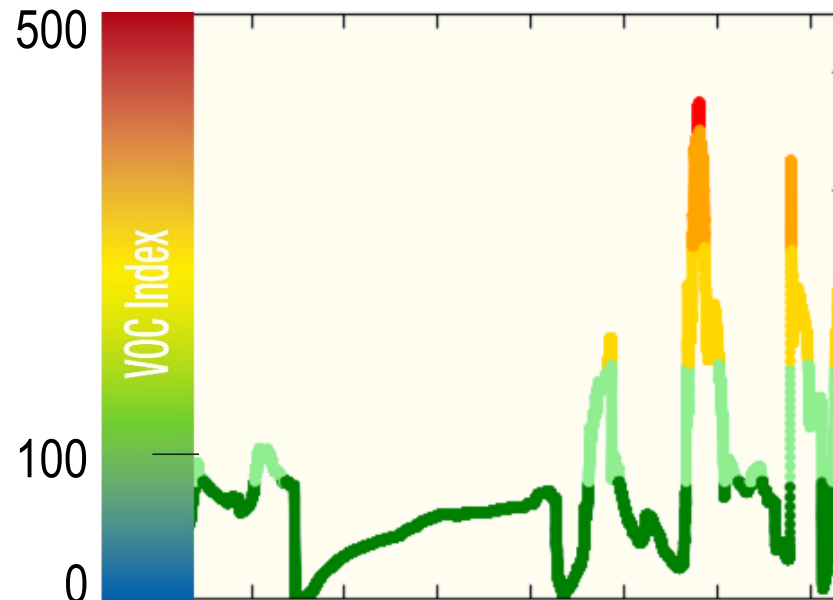
# Next-level air treatment

VOC Index notifies end users or air treatment devices when air pollution changes. Notifications are actionable in environments with low and high VOC backgrounds independent of the absolute VOC concentrations.

## Interpretation



## Example



## Recommendation

Ventilate, purify  
intensely

Ventilate, purify

No need to  
ventilate, purify





## VOC Index accuracy

- Laboratory
- Field



# Proxy gas ethanol

Laboratory tests typically use a proxy gas for real life VOCs. Sensirion recommends ethanol as proxy gas:

- ✓ The SGP40 sensor sensitivity to ethanol is representative of the ISO-standard VOC mix (*n*-octane + *m*-xylene)<sup>1</sup> and other VOCs occurring in everyday life<sup>2</sup>
- ✓ Ethanol is safe and easy to acquire
- ✓ Ethanol enables a simple test setup, only one gas to mix with zero air and humidity

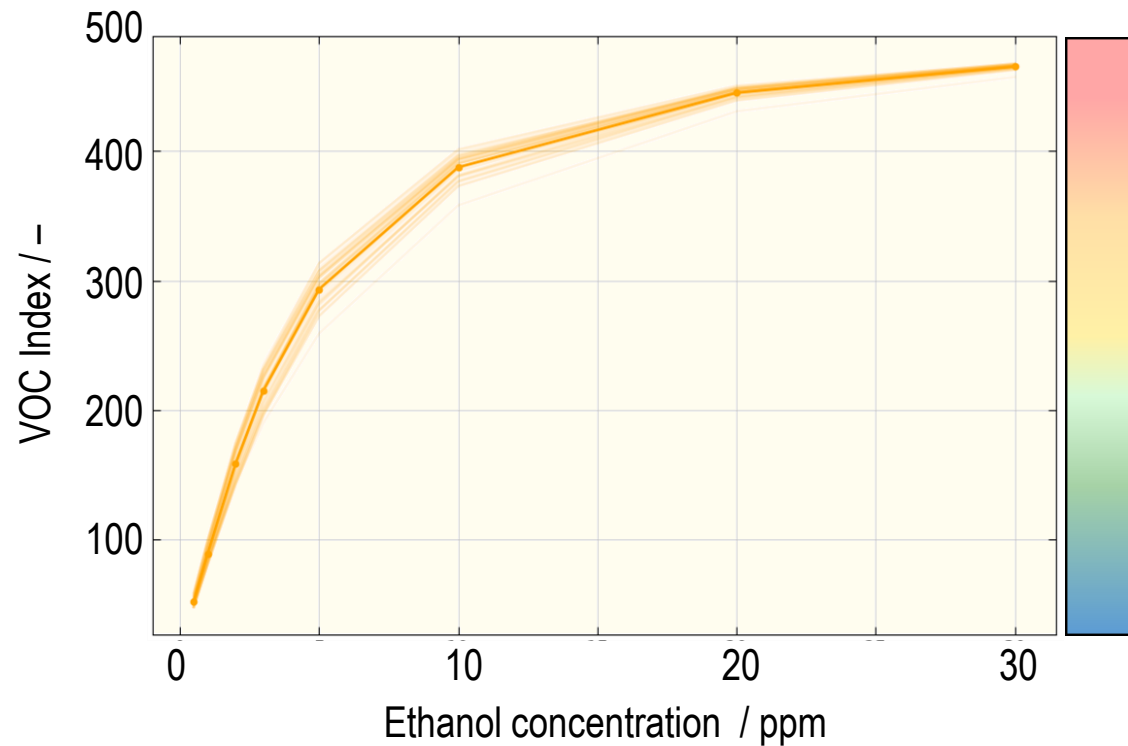


[1] ISO 16000-29 Indoor air – Part 29: Test methods for VOC detectors

[2] For more details, please ask for the “SGP40 Performance Report”

# Laboratory accuracy

After stabilization at 1 ppm of EtOH in a test chamber (equivalent to a small controlled room in a “perfect world”)



*Note: The shown relationship holds only for the standard VOC test sequence<sup>1</sup> as provided by Sensirion.*

<sup>1</sup> For details please refer to Sensirion's application note «SGP40 Testing Guide»

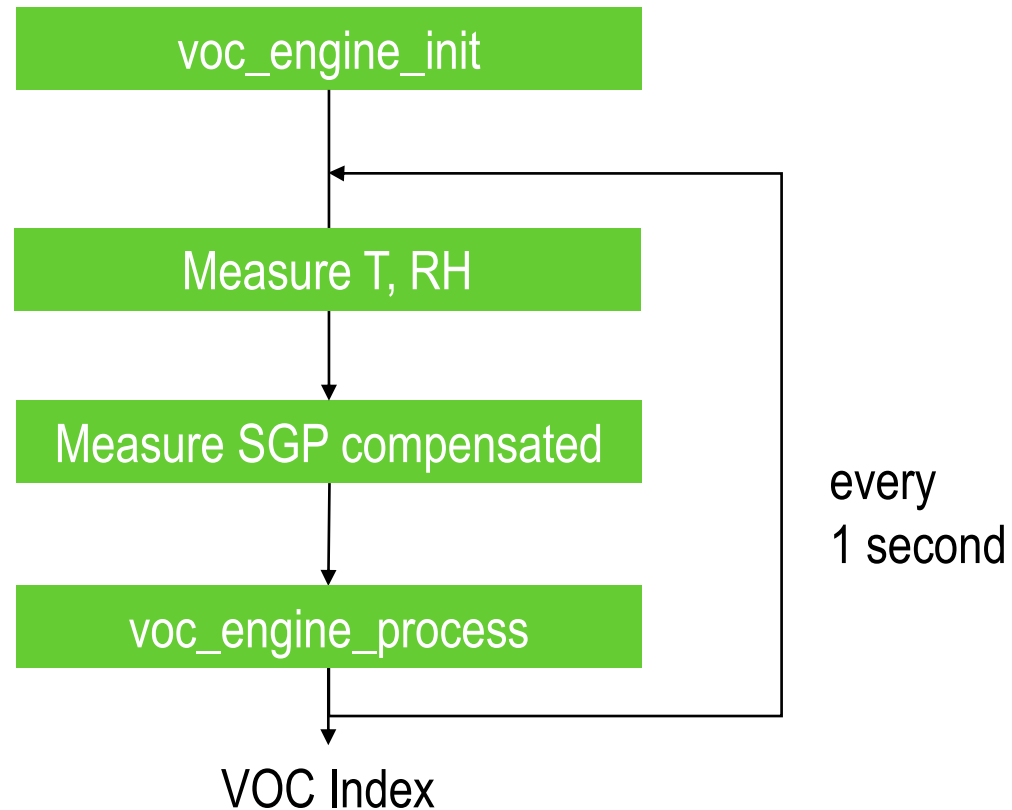
A man with a beard, wearing a blue and white striped shirt, is pointing with a blue pen at a whiteboard. The whiteboard has several yellow and orange sticky notes and handwritten diagrams. In the background, another man is visible, looking at the whiteboard. The scene is set in a modern office environment.

# VOC Algorithm

- Signal flow
- Startup
- Long-term behavior

# Signal flow in the VOC Index driver

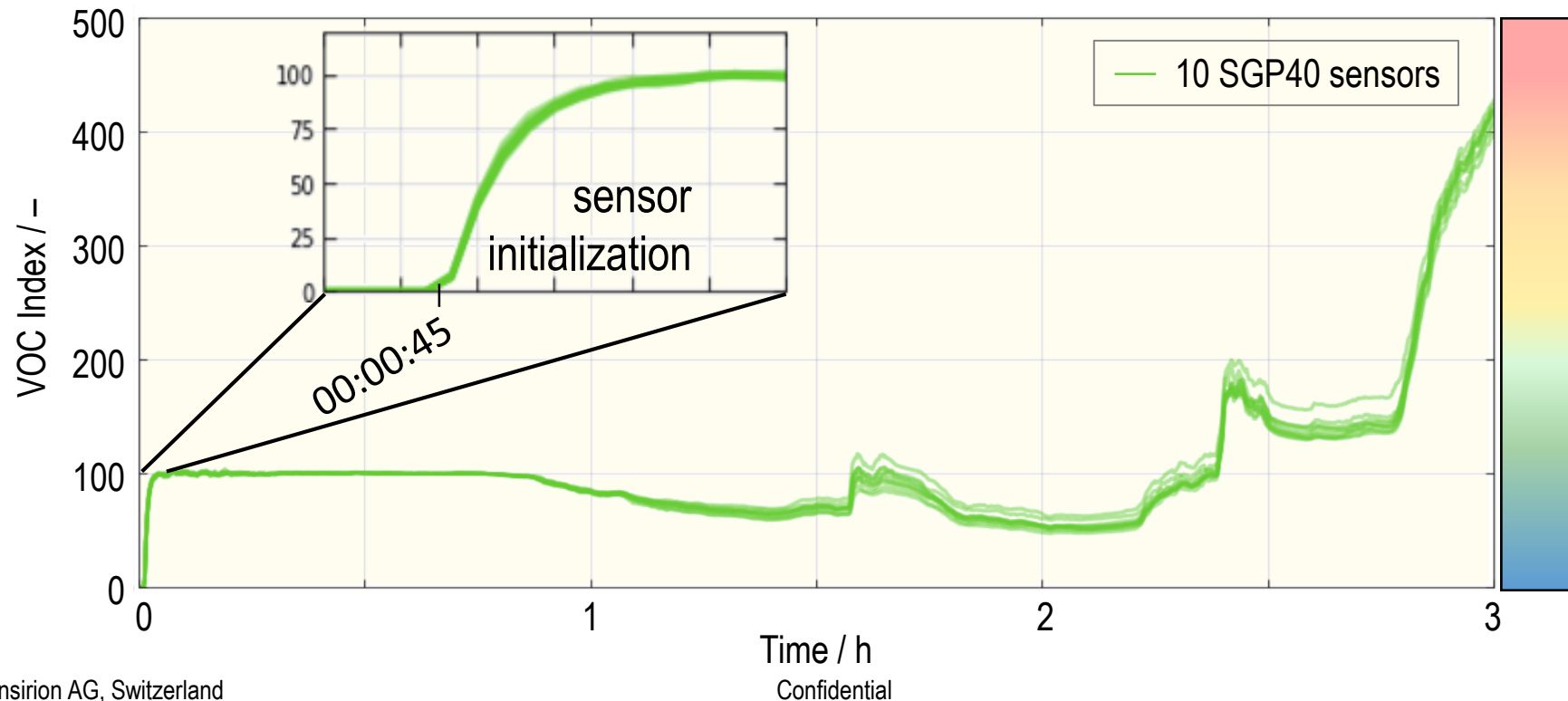
VOC Algorithm calculates VOC Index from measurements with SGP40 and SHT sensors:



# Startup

The VOC Algorithm initializes in two phases:

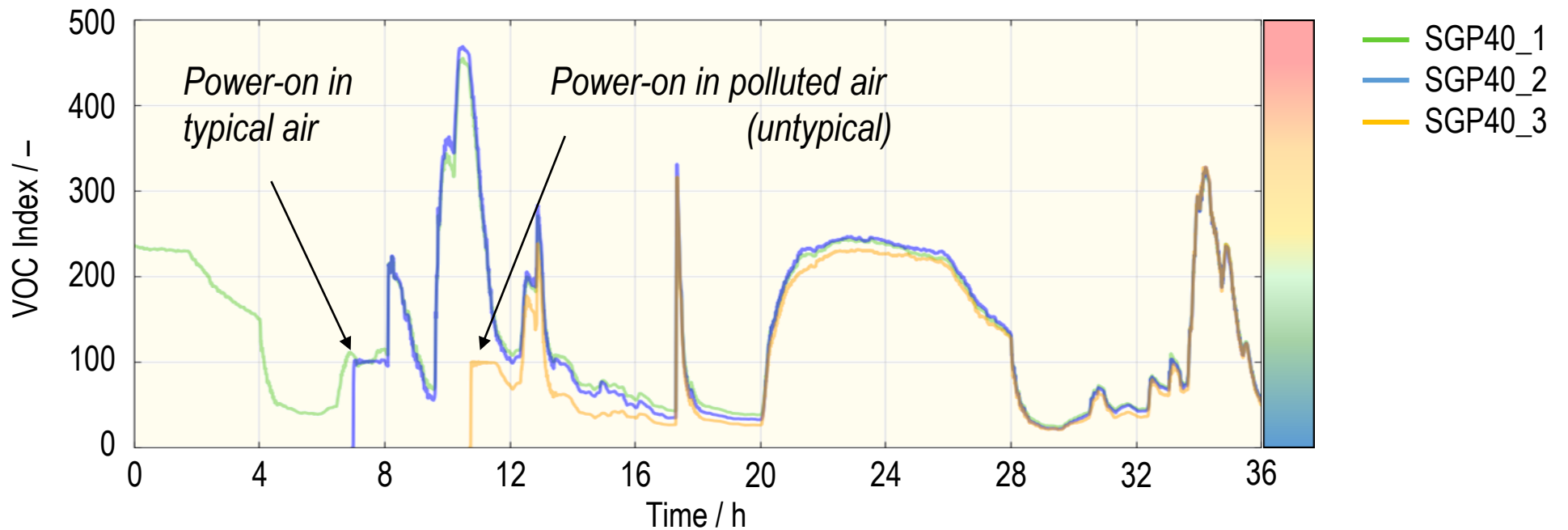
- 0...1.5 h: fast adaptation to the environment. Signal always initializes in level “typical”. From the beginning, sensor-to-sensor-variation is excellent and fast VOC events are shown.
- >1.5 h: final, slow adaptation.  
Even very slow changes in chemical air pollution are now visualized for best user experience.



# Long-term behavior

The VOC Algorithm constantly estimates sensor baseline and sensitivity from statistical data of the past 24 h. For this reason, multiple VOC Index signals are most similar if history is equal since startup. When placed into a common room but with different histories, all VOC Index signals usually converge within 1 to 12 h.

*Figure: Three sensor modules with different histories converge after few hours:*





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