CONFIDENTIAL

GASERA ONE HF (Hydrogen fluoride) White paper

TH

18.11.2016

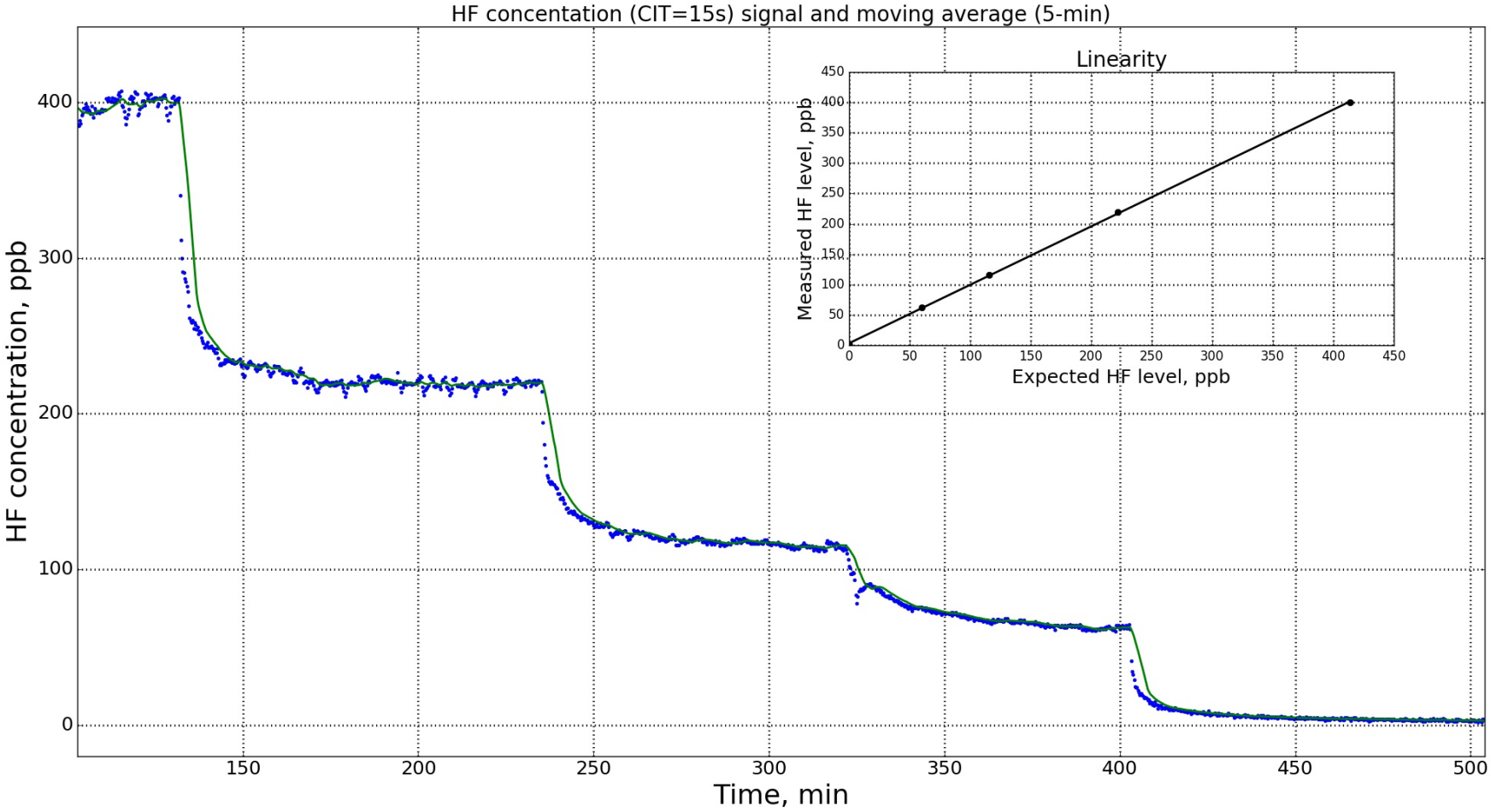
HF

- Hydrogen fluoride is a highly dangerous gas which forms corrosive and toxic hydrofluoric acid upon contact with moisture
- Widely used chemical in pharmaceutical, petrochemical, polymer and microfabrication industries
- A well-know “sticky” molecule that must be sampled correctly
  - A very small gold coated cell in GASERA ONE is ideal for HF sensing

GASERA ONE HF analyzer – preliminary prototype

- A continuous measurement system with a response time of 15-minutes
- Detection limit (2σ) is **0.5 ppb** for 1-minute sample time, and achieved with a standard laser. Optional version has a detection limit of **0.2 ppb** with a more powerful laser.
- GASERA ONE unit also measures water, which is primarily used for laser frequency calibration

Linearity (standard laser)



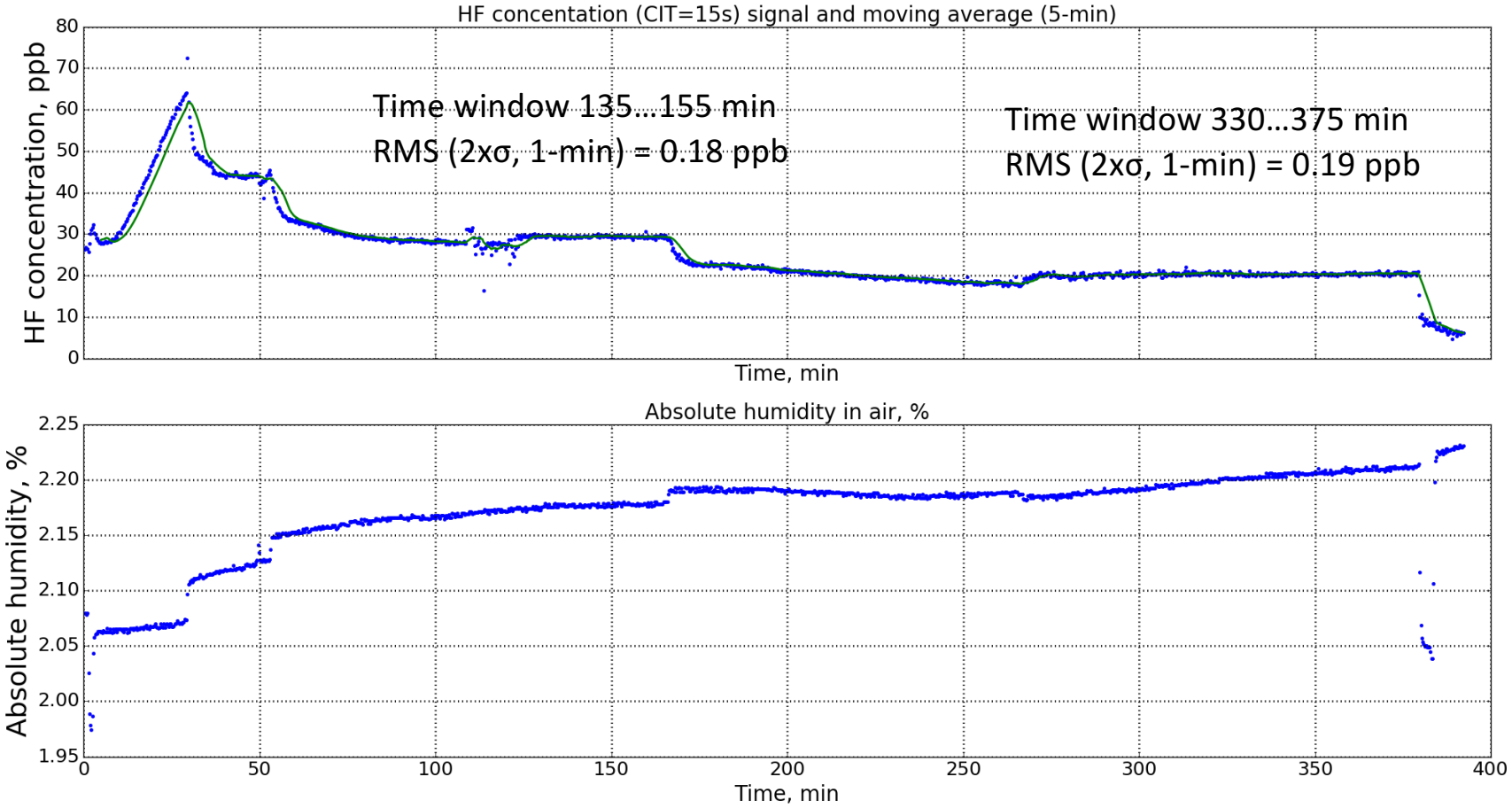
Linearity & response time

- The response is very linear over a wide dynamic range. Linearity was tested up to a concentration of 400 ppb.

- All the data points are shown in the figure where one can see that the response time is in the order of 10 minutes and 20 minutes for 80% and 90% response, respectively.

- As HF is very “sticky”, one must keep in mind that part of the delay/response time is due to the HF generation system (mixing HF from cylinder with humidified lab air) itself

Detection (optional laser)



Detection limit

- Stable levels that can be used to determine detection limits are challenging to produce with current gas mixing system.

- The inherent stability of the Gasera ONE HF is very good enabling < 0.1 ppb detection limits with modest averaging of less than 10 minutes.

- The Sensitivity can be improved by a factor 2 by changing the optical configuration based on customer needs.

Conclusions

- GASERA ONE HF was characterized in laboratory with HF cylinder from Linde.
- The analyzer is sensitive, linear and it has good response to a very sticky gas.
- GASERA ONE HF analyzer was also tested successfully in a clean room (confidential data).
- Demonstrated LOD of **0.2 ppb** (2xσ, 1-min) can be further improved by increasing integration time or by changing the optical configuration based on customer needs.