

CONFIDENTIAL

GASERA ONE GHG analyzer for CH₄ and N₂O

White Paper

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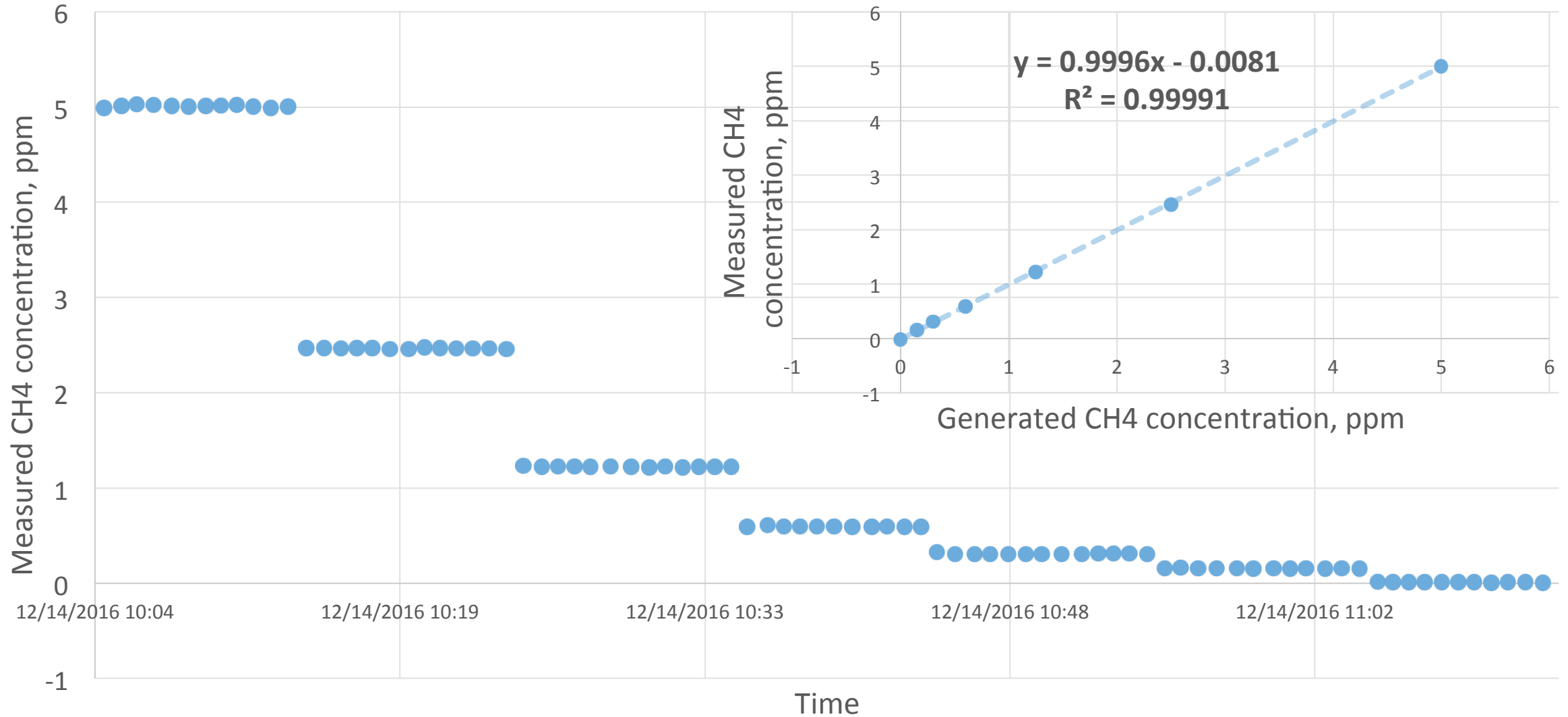
Methane (CH₄) and nitrous oxide (N₂O)

- Methane and nitrous oxide are both naturally occurring (~330 ppb N₂O & ~2 ppm CH₄) inert gases with relatively simple molecular structure.
- They are both also significant greenhouse gases (GHGs) with global warming potential of about 30 (CH₄) and about 300 (N₂O) times higher than carbon dioxide (CO₂).
- Both gases are emitted from industrial and agricultural activities and from soil.

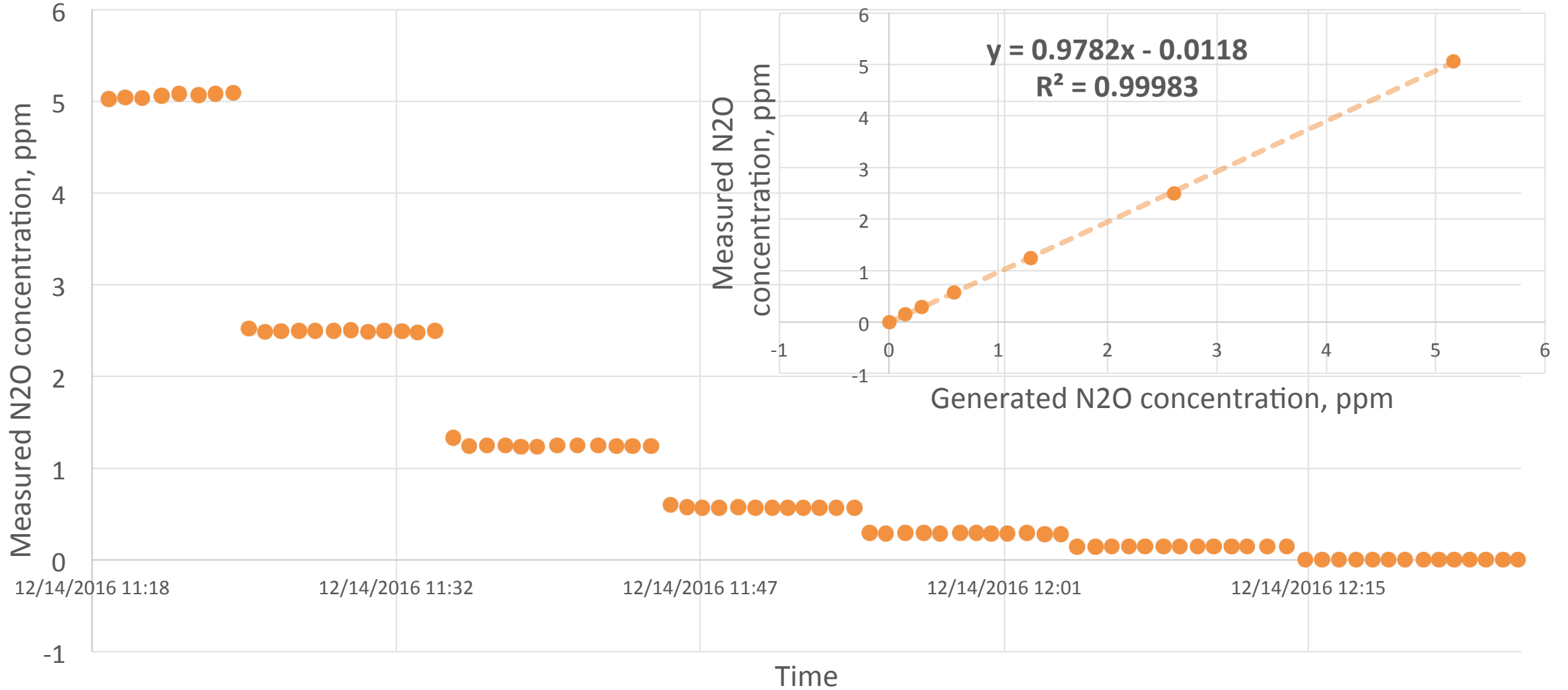
GASERA ONE GHG analyzer – preliminary prototype

- A continuous measurement system with a response time of less than one minute (user selectable).
- Detection limits (2σ) are **1 ppb** for N₂O and **6 ppb** for CH₄, respectively, with an averaging time of 60 sec. The results are achieved using a 50 mW QCL light source (same light source simultaneously measuring both components).
- The response is very linear and gas exchange efficiency is extremely good for both gases.

Linearity (CH4)



Linearity (N2O)

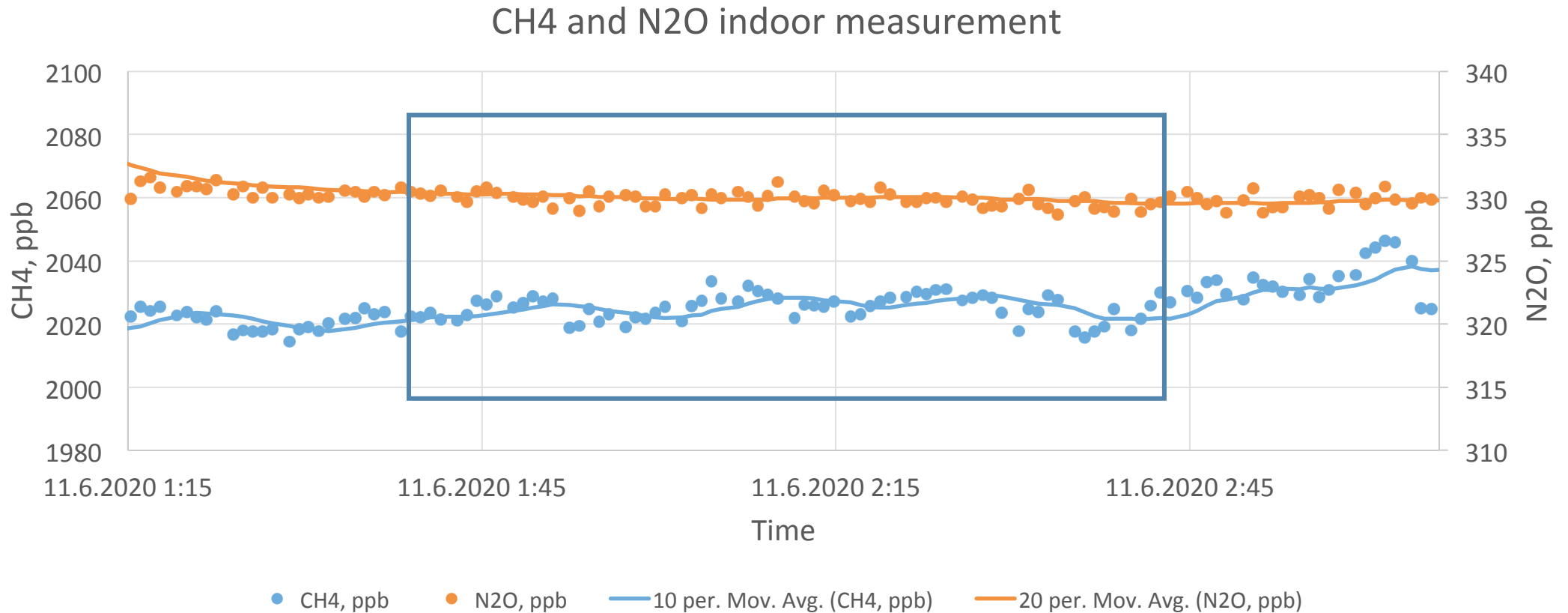


Linearity & Response Time

- An average of the last eight data points at each were used in linearity calculations.
- The response is highly linear over a wide dynamic range. Linearity was tested up to a concentration of 5 ppm for CH₄ and 5.16 ppm for N₂O, respectively. Single point calibration is estimated to give linear response up to 90 ppm (CH₄) and 50 ppm (N₂O) concentrations.
- All the raw data points are shown in the figure where one can see that the response is practically instantaneous for both gases.

Noise

- Noise can be determined from a long measurement performed with laboratory air in a typical office/laboratory space with air conditioning.



Sensitivity (LoD)

- Nitrous oxide level is very stable over the time period and the detection limit determined as two times (**2σ**) the standard deviation of the boxed area dataset is **1 ppb** using **60 sec** averaging time.
- The methane data inside the boxed area results in a detection limit of **6 ppb (2σ)** using the same **60 sec** averaging time.
- With a more powerful light source, the detection limit can be improved by a factor of 2 without adding complexity.

Conclusions

- GASERA ONE GHG unit was characterized in laboratory.
- The analyzer is sensitive, linear and it has fast response time to both CH₄ and N₂O gases.
- Measurements carried out in office shows stable N₂O level and varying CH₄ level, which is expected because e.g. due to human activity.