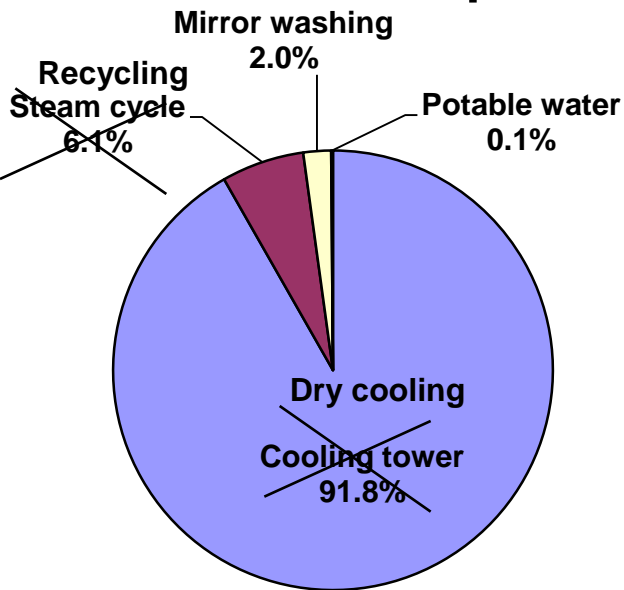


How does CSP react under desert conditions?

Robert Pitz-Paal, DLR; N. Geuder, CSP-Services

Water consumption

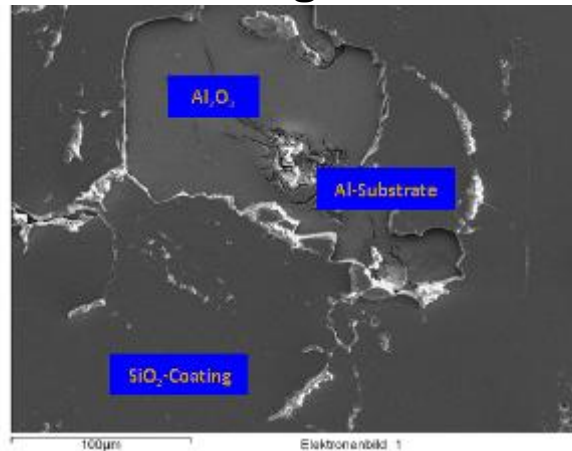


Washing (no recycling yet)

75 l / MWh (low soil.)
30 l / m² year (mirror surface)
0,5 l/m² per washing cycle

Rainfall Cairo = 25 l/m²year

Reflector Degradation?



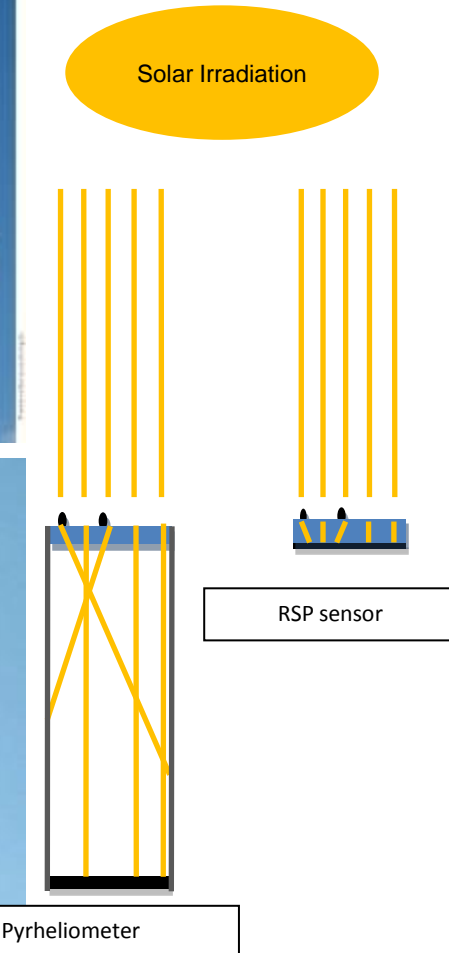
- Glass mirrors have proven high robustness over >25 years in operation
- Front surface mirrors are more sensible
- DLR has established accelerated aging methods for specific reflector types

Reflector Soiling

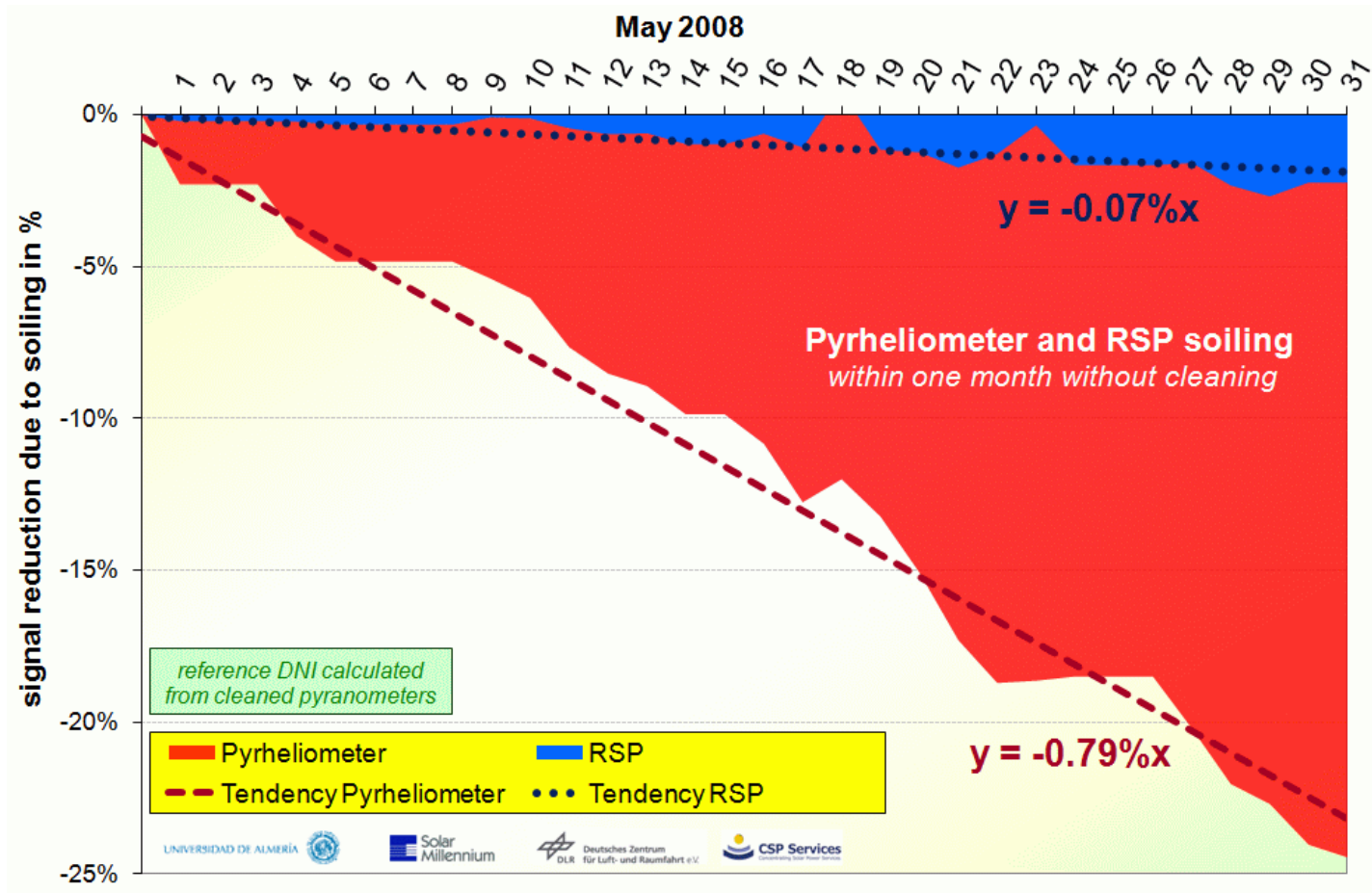


First experience based on soiling of radiation sensors

- Soiling of Pyrheliometers similar to soiling of reflectors
- Soiling of RSP Sensors similar to soiling of PV Modules
- Evaluation of data from different Meteo-Stations lead to first estimates of soiling characteristic

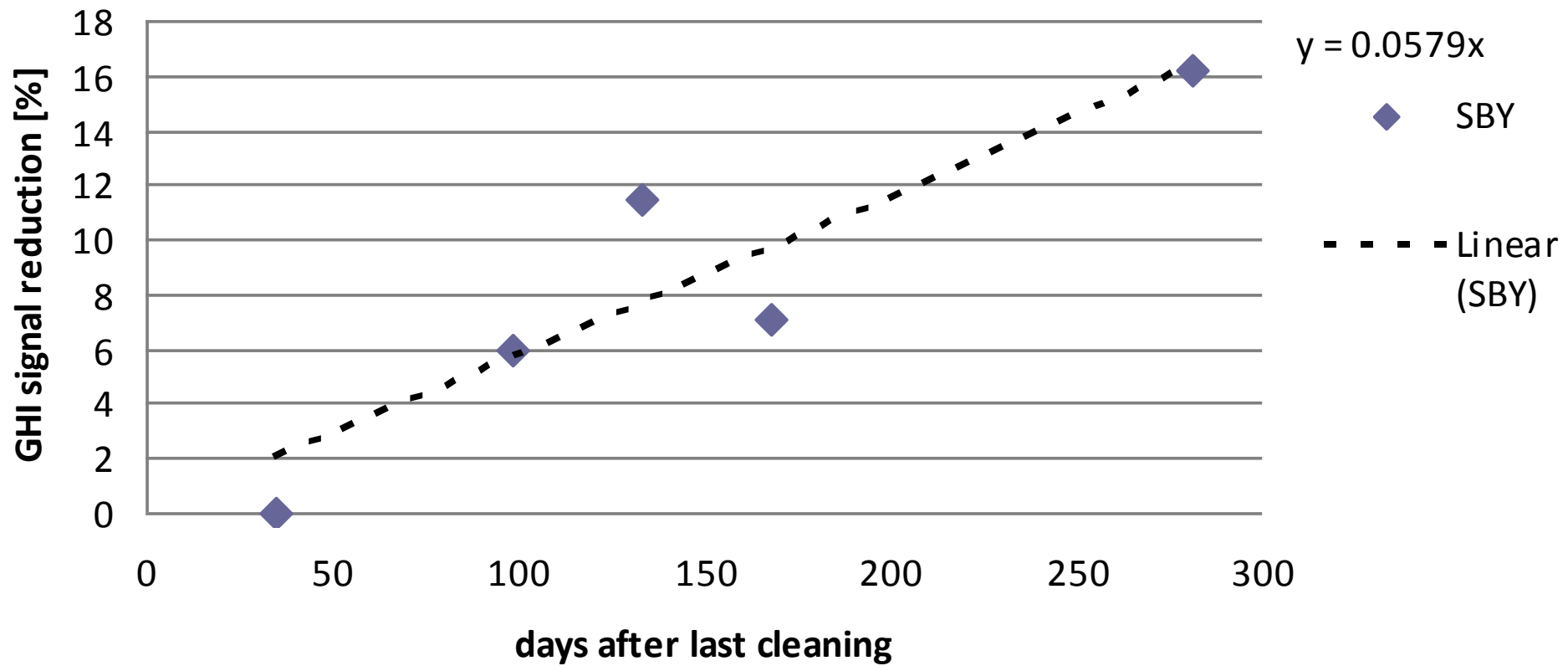


Soiling at University of Almería, Spain

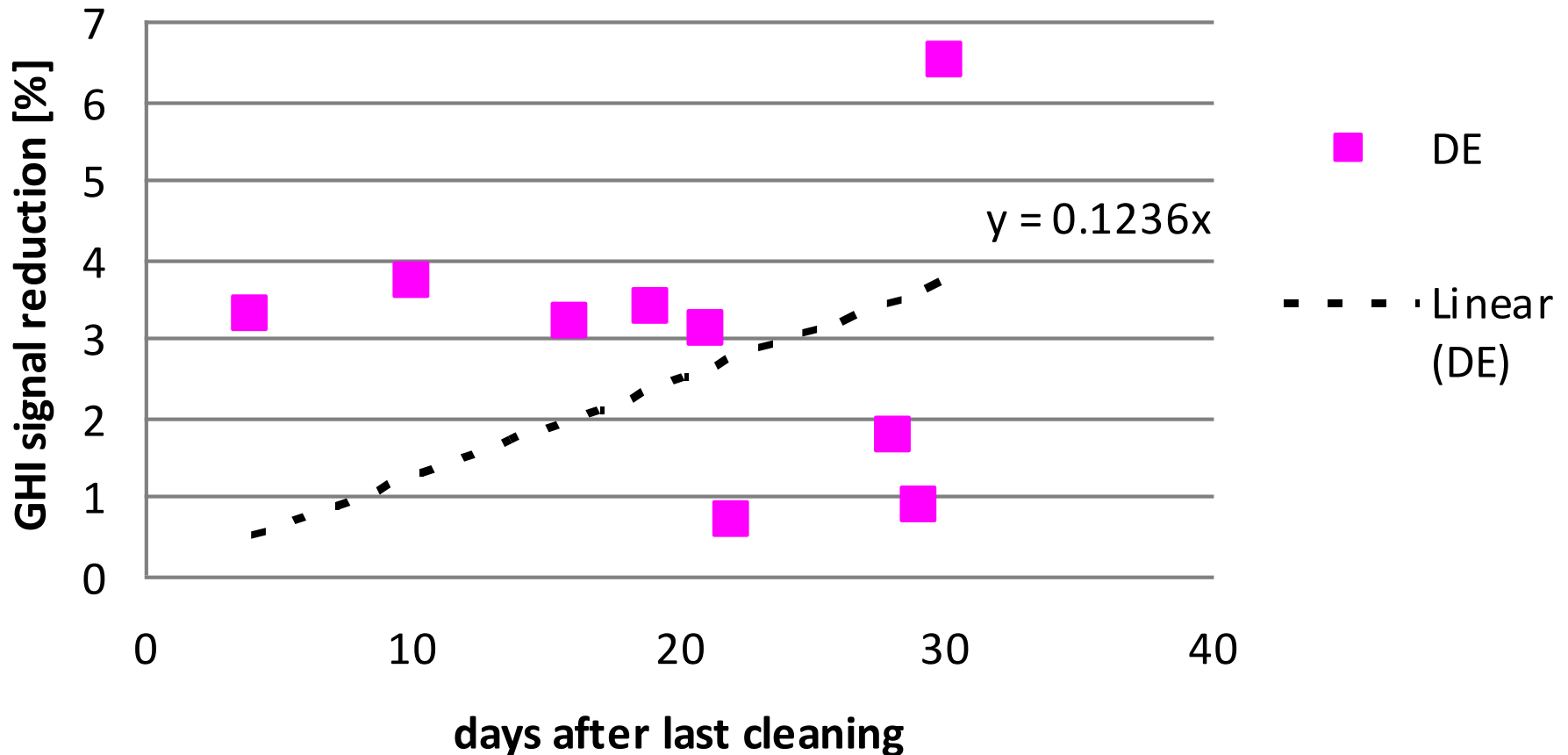


Location: University of Almería

RSI soiling in sand desert close to sea



RSI soiling in dry agricultural environment with grass vegetation



Conclusion

- CSP Systems need regular washing at least on a weekly basis, PV Systems on a monthly basis in desert environment
- Soiling depends strongly on site (and seasonal) conditions. Variations can be in the order of a factor 2-3
- 5% average soiling leads to revenue losses of 3-6 \$/m²year (depending on electricity price)
- Cleaning need 20 – 40 l/m²
- Cleaning methods could be potentially improved with respect to water usage and water recycling