

Conference Report

CHanalysis 2025 – Analytical Science between Chemistry, Physics and Cultural Heritage

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Beatenberg hosted the annual gathering of Switzerland's analytical science community on March 19–20, 2025, under the auspices of the Swiss Chemical Society's Division of Analytical Sciences (DAS). With its sweeping views and quiet surroundings, the venue remains a place where science can speak, unfiltered, across generations and disciplines. The DAS president, Dr. Davide Bleiner, opened the event by welcoming the participants and sponsors and introduced the 2024 DAS highlights. In addition to acknowledging the newest changes in the DAS board, he emphasized the importance of the recent *CHIMIA* special issue 'Analytical Innovators', reflecting the vibrant intellectual ecosystem of analytical sciences in Switzerland. The *CHanalysis* 2025 program was rich and balanced, opening with a keynote by Prof. Dr. **William Tong** Provost of the San Diego State University, and concluding with awards that recognized not only scientific rigor but creativity and societal impact.

William Tong, captured the attention of the audience with a lecture that embodied the transdisciplinary spirit of the conference. Introducing himself with humour, he navigated a complex territory with accessibility, presenting nonlinear and multiphoton laser spectroscopy capable of zeptomole detection. His talk bridged physics and chemistry—from depth profiling of single cells and probing stable isotope ratios, to real-time monitoring of Alzheimer's and cardiac biomarkers. His vision extended to the remote sensing of explosive materials, the analysis of DNA, and even the dating of ancient artifacts—clearly exemplifying how advanced laser spectroscopy can weave between chemistry, physics, and heritage sciences. His closing remarks on global scientific outreach through the ACS Recognition Program reinforced the international and integrative nature of modern analytical work.

The extent of analytical science unfolded further with a rich mix of academic and industrial contributions. Prof. **Cyril Portmann** and Prof. **Fiorella Lucarini** offered a window into the applied research conducted at HEIA-FR, a University of Applied Sciences in western Switzerland. Their work emphasized analytical chemistry's impact in process chemistry and sustainability, from capillary electrophoresis used to ensure drug quality in developing countries, to per- and polyfluoroalkyl substances (PFAS) studies in lake fish and innovative devices to protect against wolf attacks on livestock. The fusion of analytical tools with real-world societal needs was further exemplified in their antimicrobial screening of fungi and extremophiles, a research line at the edge of chemical biology.

The Simon-Widmer Award 2025 was presented to Prof. **Robert E. Gyurcsányi** (Budapest University of Technology), whose spectroscopic work on virus detection through nanopipette technology and unconventional aptamer strategies marked a milestone in merging nanotechnology and biosensing (Fig. 1). By filling the technological gap between nanopores and Coulter counters and introducing innovative silver-coating techniques for virus detection,



Fig. 1. The Simon-Widmer Award 2025 is awarded to Prof. Robert E. Gyurcsányi from Budapest University of Technology by Prof. Eric Bakker and Davide Bleiner (© Eric Bakker).

he showcased how analytical science pushes technical boundaries while addressing urgent biomedical questions.

Industry event partners brought in complementary perspectives. Bruker's presentation of rapid ambient FT-IR and Raman imaging systems demonstrated how analytical hardware can be augmented through quantum cascade laser technology for process control and imaging. Brechbühler's innovative ITEX method for volatile organic compounds detection in water achieved a 93-fold sensitivity improvement, and Metrohm highlighted how shelf-life prediction of edible oils can be refined by combining chemometrics with traditional oxidation methods. These talks illustrated how analytical instrumentation evolves not in isolation, but in feedback with emerging challenges in manufacturing, regulation, and consumer safety.

From the physical sciences, several talks showed how analytical methods unlock structure and process. **Sharath Rameshbabu** introduced composition and structural characterization of thin films to realize the first ever distributed-feedback X-ray laser on a chip. **Ayush Agarwal** (Fig. 2) presented Paul Scherrer Institute's (PSI) method for biogas impurity monitoring, quantifying sulphur and siloxanes using ICP-MS after isopropanol extraction—highlighting how even trace components in energy production have major technological consequences. **Gabriel Junquetti Mattos** offered a fast method for tracking ionic activity *via* fluorescence-coupled electrochemical microscopy, underscoring the dynamic interface between signal processing, light, and electrochemistry. Meanwhile, **Andrea Castellaneta's** design-of-experiment approach to oxysterol separation reflected how data-driven chromatography can resolve complex biochemical pathways.

Steven J. Chow addressed environmental challenges with analytical depth, focusing on PFAS tracking in water, sludge, and biota. His team's analytical protocols push the boundaries of detection, requiring sample enrichment by orders of magnitude and creative approaches to resolve coeluting compounds—essential, given the regulatory threshold of <100 ng/L for some PFAS by 2026 in Switzerland. His talk typified how environmental chem-

istry increasingly relies on analytical innovation for regulatory and ecological stewardship.

The cultural heritage dimension of analytical science found powerful resonance on the second day. Prof. **Markus Strobl** demonstrated how neutron tomography provides unmatched contrast for organic matter, enabling non-destructive analysis of historical artifacts, such as medieval swords. The ability to reconstruct internal microstructures and detect corrosion patterns places analytical science at the heart of artifact preservation. Similarly, **Laura Hendricks** presented a protocol for compound-specific radiocarbon dating of red dyes, reducing the carbon mass needed to analyse historical pigments. By carefully refining chemical extraction and chromatography, her work opens new possibilities for dating artworks too delicate for conventional methods.

In the same spirit, **Giacomo Musile** introduced portable electrophoretic tools for detecting illicit substances like GHB (gamma-hydroxybutyric acid) in biological samples, designed to be compact and forensic-ready. **Katherina Schmidt-Ott** took us into the world of medieval manuscripts, using non-invasive tools—handheld XRF, portable Raman, and microscopy—to trace ink compositions and uncover historical practices in manuscript production and restoration. **Issa Briki** added yet another layer of cross-disciplinary reach, introducing muonic X-ray analysis at PSI for elemental and isotopic profiling, with depth resolution and enough precision to trace the extra-terrestrial origin of archaeological arrowheads—an achievement that resonated beyond the scientific community.

A panel discussion, organised by Jens Jacobsen, on artificial intelligence and big data in analytical workflows rounded off the event. While many participants welcomed the potential of computational tools, a strong consensus emerged around the necessity for rigorous data validation and human centered evaluation—reminding all that while tools may evolve, the foundation of analytical science remains firmly rooted in creativity, reproducibility, and scientific curiosity.

CHanalysis 2025, under the theme of bridging chemistry, physics, and cultural heritage, not only highlighted the technical excellence of Swiss and international researchers but also illustrated how analytical science functions as a connector across disciplines and societal needs. From lasers probing DNA to neutrons scanning ancient swords, the two-day meeting affirmed that innovation in analytical science is most powerful when it transcends boundaries—intellectually, instrumentally, and culturally. The community looks forward to its next edition on March 18-19 2026, returning to the heights of Beatenberg to continue shaping the future of this far-reaching field.



Fig. 2. Ayush Agarwal in lively discussion with cultural heritage expert Prof. Edith Joseph (© Eric Bakker).

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