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CEMIS-OULU  
UNIT OF MEASUREMENT TECHNOLOGY

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## CEMIS in brief



Vipuvoimaa  
EU:lta  
2007–2013



Euroopan unioni  
Euroopan aluekehitysrahasto



Euroopan unioni  
Euroopan sosiaalirahasto

CEMIS is a contract based joint centre of University of Oulu, University of Jyväskylä, Technology Research Centre VTT, Centre for Metrology and Accreditation MIKES and Kajaani University of Applied Sciences. CEMIS is founded Kajaani in 2010 and employs around 110 professionals. CEMIS specialises in research and higher education in the field of measurement and information systems.



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# CEMIS-OULU: HISTORY

- One unit of Kajaani University Consortium
- Founded in 2011 by merging former laboratory of biotechnology, measurement and sensor laboratory, research actions of CWC in Kainuu and research actions of TOL in Kainuu.
- One director, three research groups
- Research groups:
  - Analytical and bioanalytical chemistry (Sotkamo)
  - Optical spectroscopy (Kajaani)
  - Image based measurements (Kajaani)



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# UNIVERSITY OF OULU, UNIT OF MEASUREMENT TECHNOLOGY, CEMIS-OULU

- Organisation of about 50 specialists located in **Kajaani** and **Sotkamo**
- Unit is performing internationally high level applied research in optical spectroscopy, image based measurements and in analytical chemistry and bioanalytics.
- **Main application areas** are measurements and measurement technology in connection to mining, environment , well being (sports and health), renewable forest industry and bioenergy.
- Budget in 2013 is about 4,5 M€, out of which over 90% is external funding.



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# Real-time monitoring of industrial minerals quality - RAIKU

New solution for on-line quality control in industrial mineral production

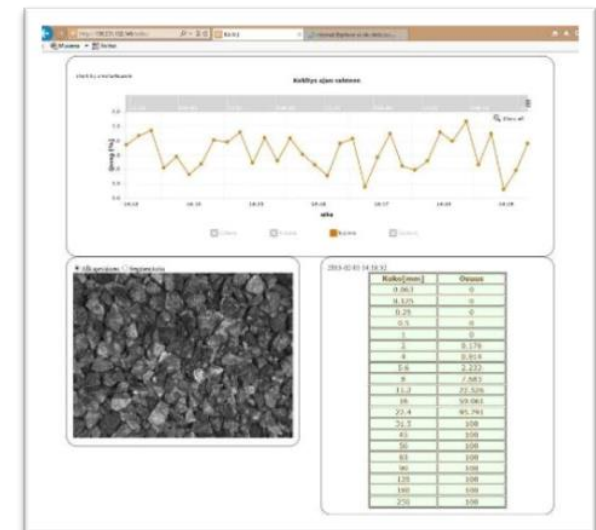
Based on imaging measurements by smart cameras, novel image processing algorithms and wireless, internet based data management system

Enables better control of crushing process

Aims to develop new concept to manage quality of industrial minerals through whole processing chain starting a quarry up to an end-user

Field tests made with industrial mineral producers

Funding: Tekes





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## Automated online trace metal analyzer - MEAN

Develop fast and reliable on-line measurement system for determination of trace metal content.

Field tests to evaluate the compatibility of the technique in harsh conditions.

Enables better control of crushing process

Recognize market potential and study new business opportunities for on-line metal measurements.

Field tests made with industrial mineral producers

Funding: Tekes - Finnish Funding Agency for Innovation



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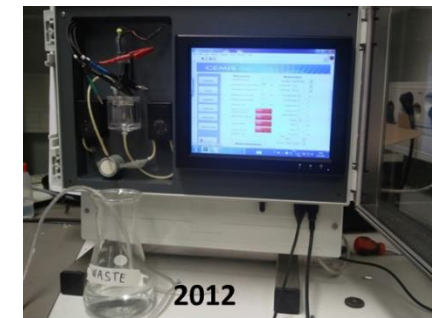
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## MEAN device: Technical details

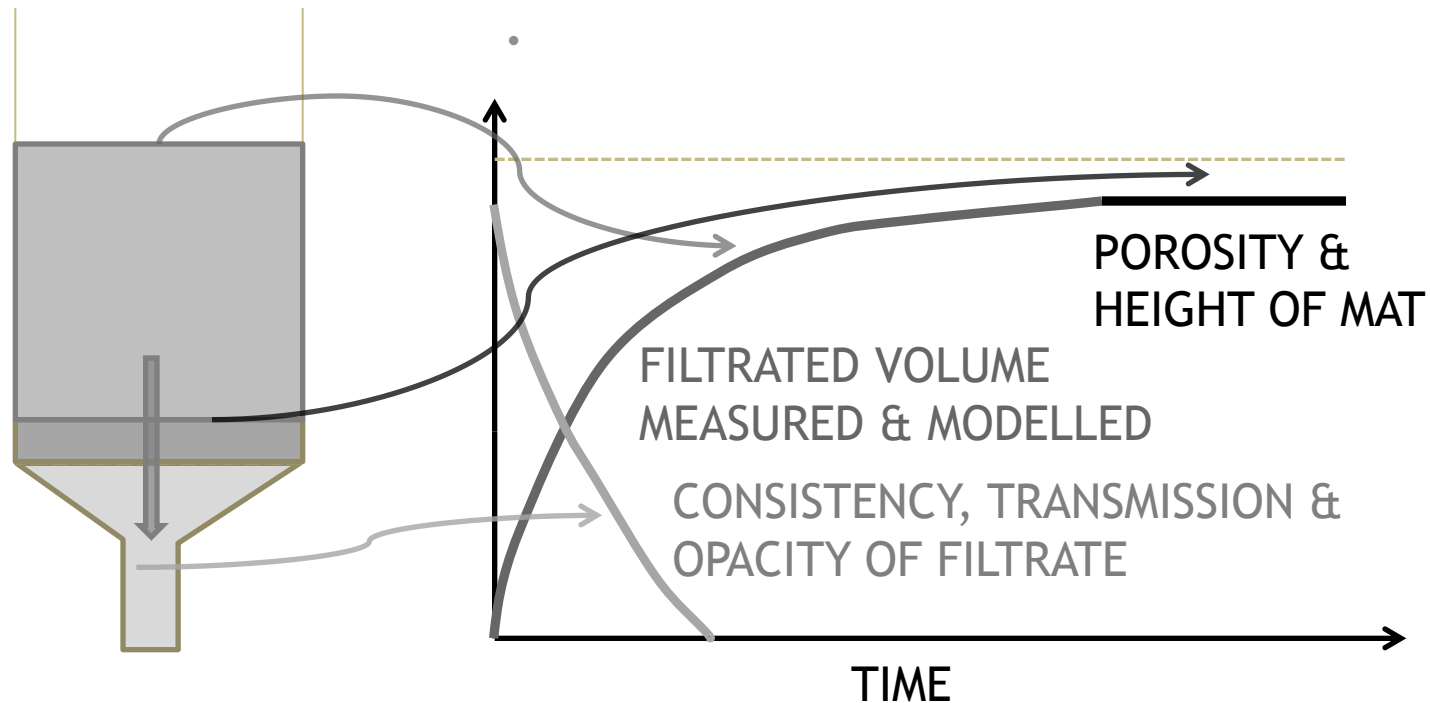
Analysis is based on electrochemical technique (square wave voltammetry), in which electrochemically active metal ions present in water sample are determined by their specific reduction potentials

### Key features:

- ✓ Several metal analytes (e.g. Cu, Pb, Zn...)
- ✓ Low detection limit <  $\mu\text{g/L}$  (sub-ppb)
- ✓ Fast analysis < 5 minutes
- ✓ No toxic reagents used, Mercury-free operation
- ✓ Automated sampling
- ✓ Integrated sample pre-treatment by UV-digestion
- ✓ Low maintenance and running costs
- ✓ Wireless data transfer + remote control via cloud service
- ✓ Battery-operated
- ✓ Robust design, suitable for field use



# MEASURING SYSTEM FOR FILTRATION OF MINERAL SLURRIES

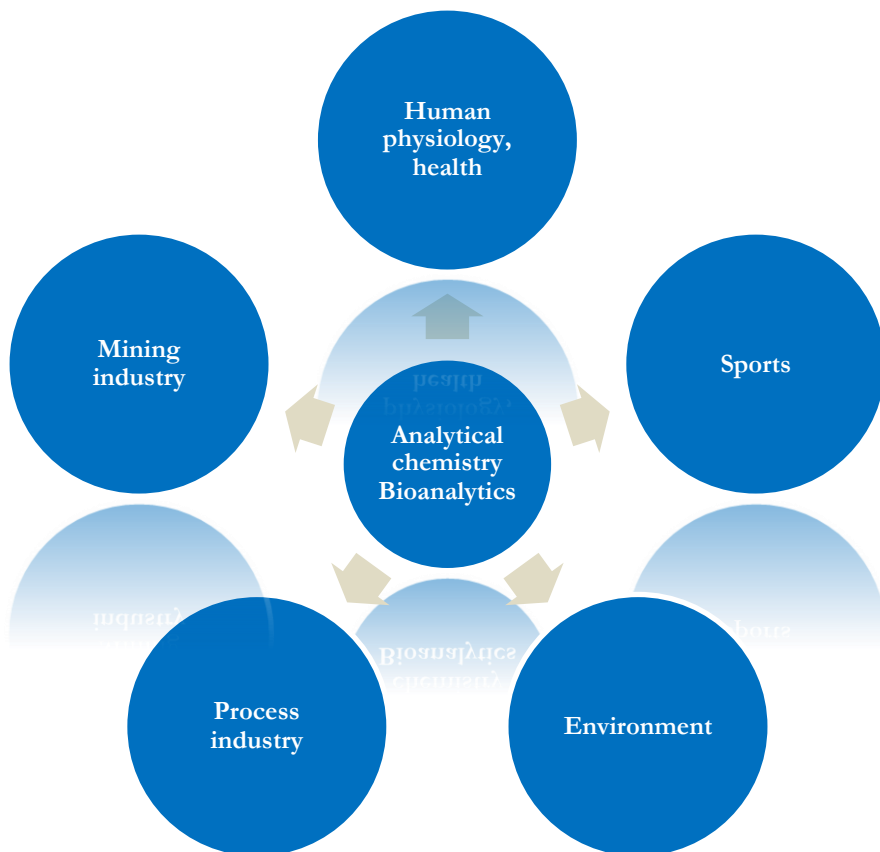




# Analytical chemistry and bioanalytics

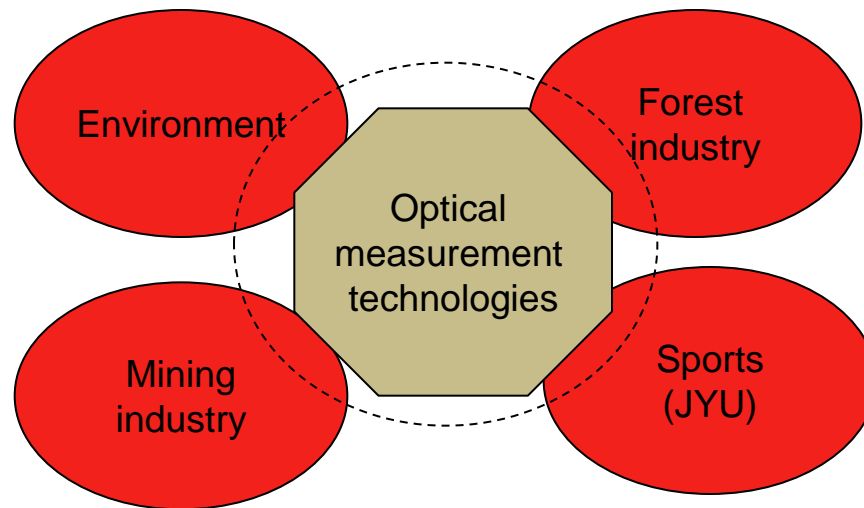
Competence focuses:

- To develop biosensors and analytical methods to specifically define the desired bio-molecules, metals and environmental compounds
- Research towards developing novel bioanalytical methods for process measurements (on-line)
- Research and analytical services



# Optical spectroscopy group - operation idea

- group generates knowledge to the optical measurement technology.
- know-how is increased by scientific work, which utilized methods and devices of optics and optical spectroscopy.
- developed measurement technology is tested and exploited with natural waters, industrial suspensions and wood material.





# Image Based Measurements - IBM Group.

- Assignment:
  - To develop 3D imaging methods for on-line inspection of industrial materials .
  
- Policy:
  - Adapting latest biomedical 3D imaging modalities for industrial applications.
  
- Current work:
  - Probing the microstructure of materials by analysing the scattered light field.
  - Developing in-line holographic microscopy and electric tweezers for particle imaging.
  
- Expected work:
  - Tomographic 3D imaging of turbid / translucent materials.

