NEW-MINE

EU TRAINING NETWORK FOR RESOURCE RECOVERY THROUGH ENHANCED LANDFILL MINING

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Innovative Landfill Exploration and Mechanical Processing

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Renewi Belgium, UGent, RWTH Aachen and Montanuniversität Leoben

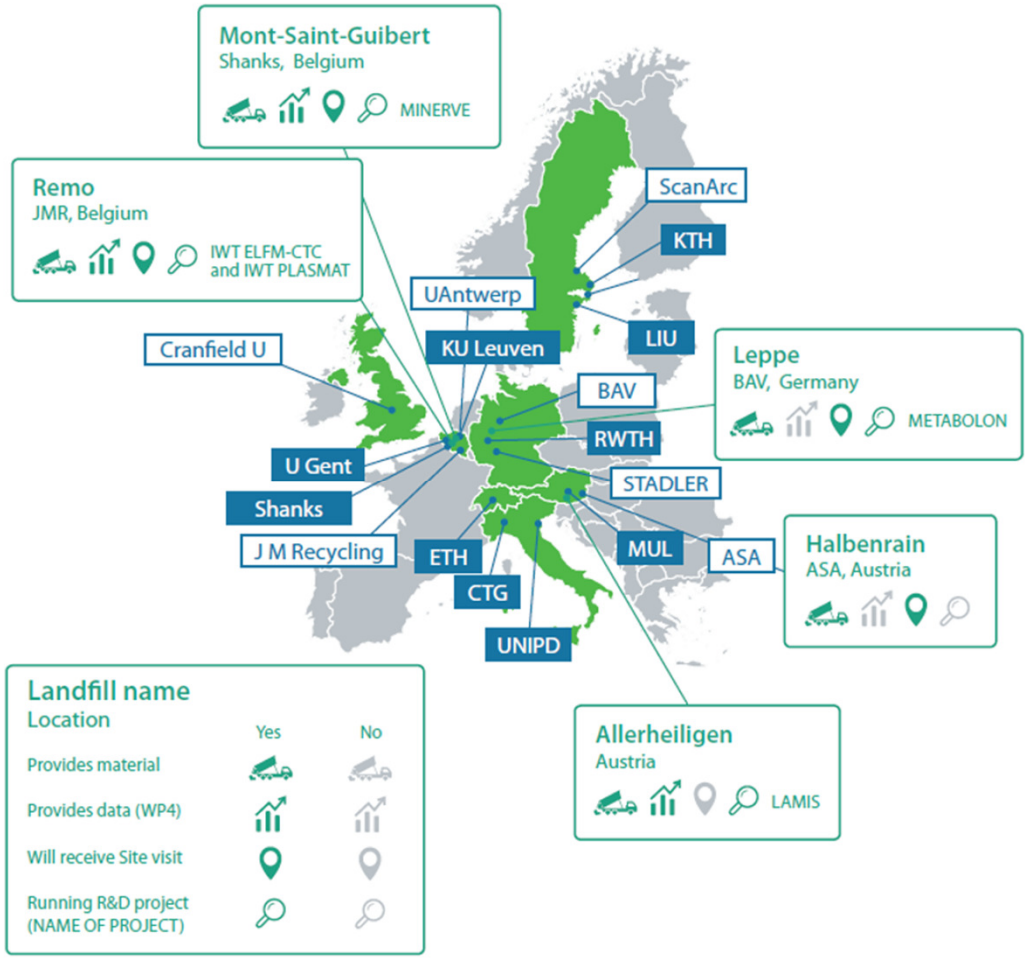
5th International Symposium on Enhanced Landfill Mining Symposium (ELFM V)

February 6th 2020, Leuven - Belgium

Overview

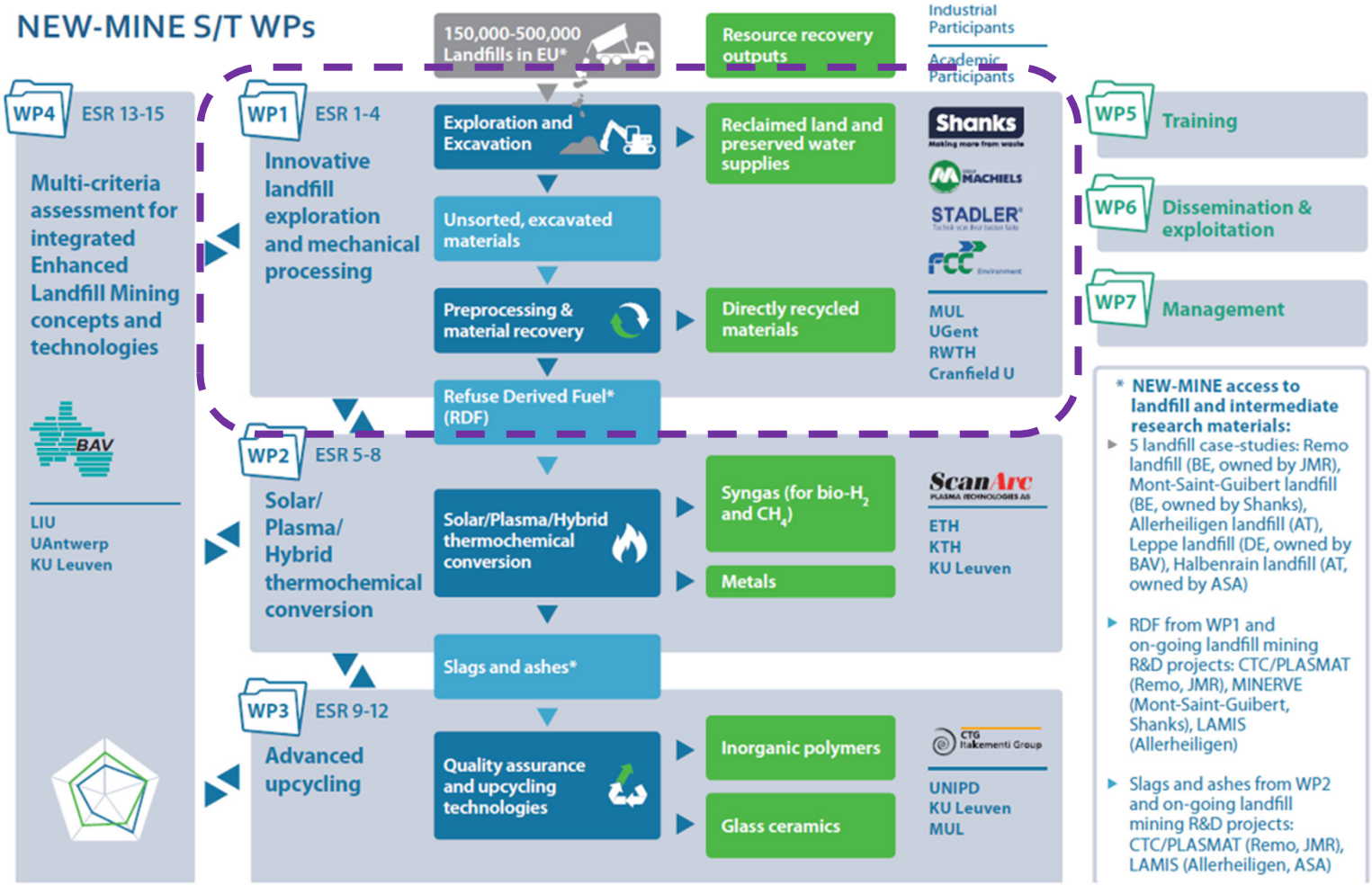
1. Context
2. Geophysical exploration of landfill site
3. Excavation of landfill waste
4. Mech. (pre-)processing of excavated waste
5. Sensor-based sorting
6. Conclusions

Context



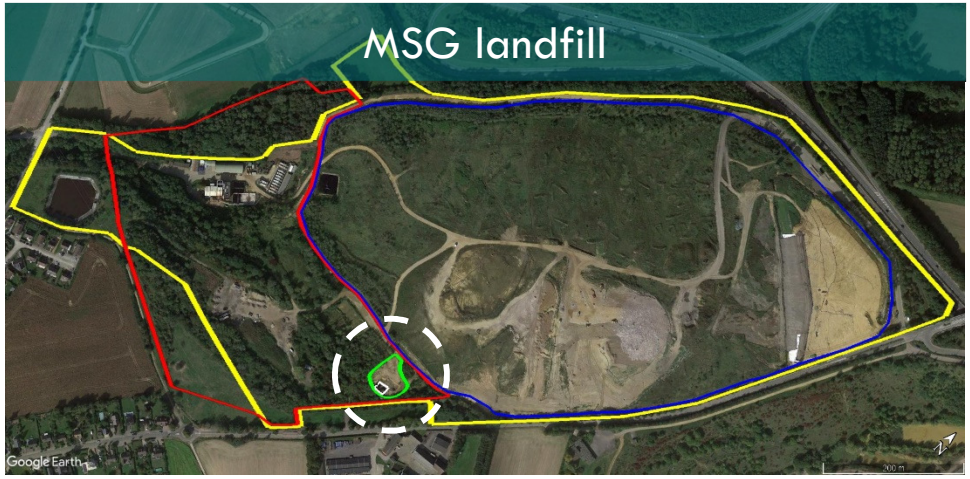
- **EU research program**
- Consortium of **17 partners**
- **Universities, research institutions** and **industry**
- Test and study **implementation** of **ELFM**
  - Legacy landfills & dumpsites
  - Environmental & health impacts
  - Land reclamation
  - Waste-to-material (WtM)
  - Waste-to-energy (WtE)

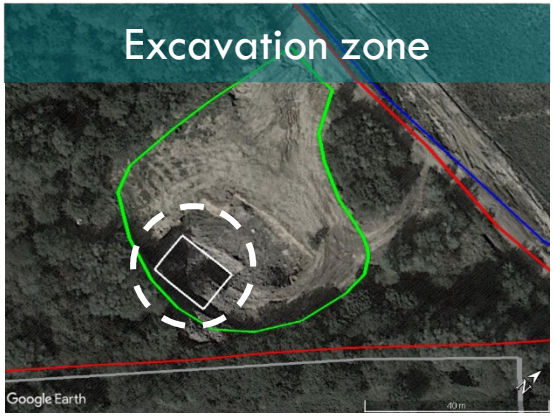
Context


NEW-MINE S/T WPs
150,000-500,000 Landfills in EU*
Resource recovery outputs
Industrial Participants
Academic Participants
WP4 ESR 13-15
Multi-criteria assessment for integrated Enhanced Landfill Mining concepts and technologies
BAV
LIU
UAntwerp
KU Leuven
WP1 ESR 1-4
Innovative landfill exploration and mechanical processing
Exploration and Excavation
Unsorted, excavated materials
Preprocessing & material recovery
Refuse Derived Fuel* (RDF)
Reclaimed land and preserved water supplies
Directly recycled materials
Shanks
MACHIELS
STADLER
FCC Environment
MUL
UGent
RWTH
Cranfield U
WP2 ESR 5-8
Solar/ Plasma/ Hybrid thermochemical conversion
Solar/Plasma/Hybrid thermochemical conversion
Syngas (for bio-H2 and CH4)
Metals
ScanArc
ETH
KTH
KU Leuven
Slags and ashes*
WP3 ESR 9-12
Advanced upcycling
Quality assurance and upcycling technologies
Inorganic polymers
Glass ceramics
CTG Italcementi Group
UNIPD
KU Leuven
MUL
WP5 Training
WP6 Dissemination & exploitation
WP7 Management
* NEW-MINE access to landfill and intermediate research materials:
5 landfill case-studies: Remo landfill (BE, owned by JMR), Mont-Saint-Guibert landfill (BE, owned by Shanks), Allerheiligen landfill (AT), Leppe landfill (DE, owned by BAV), Halbenrain landfill (AT, owned by ASA)
RDF from WP1 and on-going landfill mining R&D projects: CTC/PLASMAT (Remo, JMR), MINERVE (Mont-Saint-Guibert, Shanks), LAMIS (Allerheiligen)
Slags and ashes from WP2 and on-going landfill mining R&D projects: CTC/PLASMAT (Remo, JMR), LAMIS (Allerheiligen, ASA)

Context

- NEW-MINE´s case study on **implementation of ELFM**
- Landfill site in **Mont-Saint-Guibert (MSG)**, Belgium
- **Old part** of landfill
  - **1958 - 2014**
- **MSW**, C&D and non-hazardous IW
- **Geophysical exploration & material excavation** in Jul.-Sep. **2017**



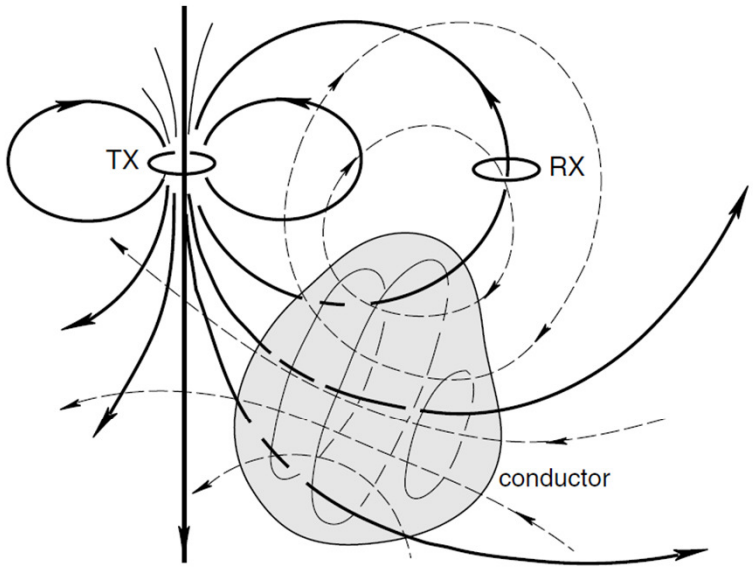


Geophysical exploration

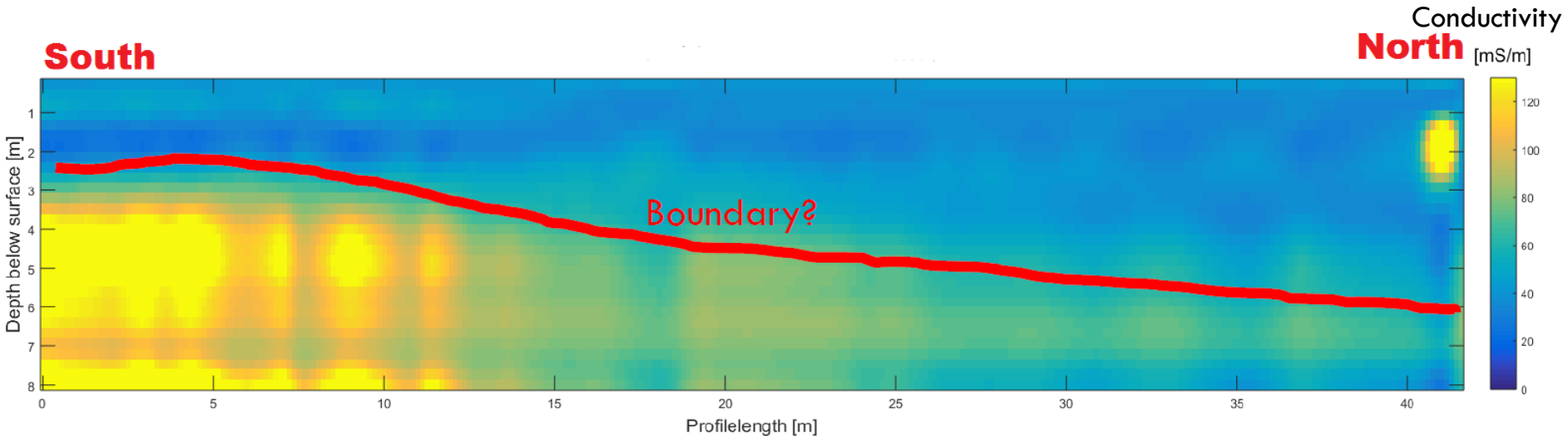
- Exploration of **contrasts in electrical properties of waste material**
- Electrical property = Resistance/Conductance
- **Contrast in conductance = contrast in material?**

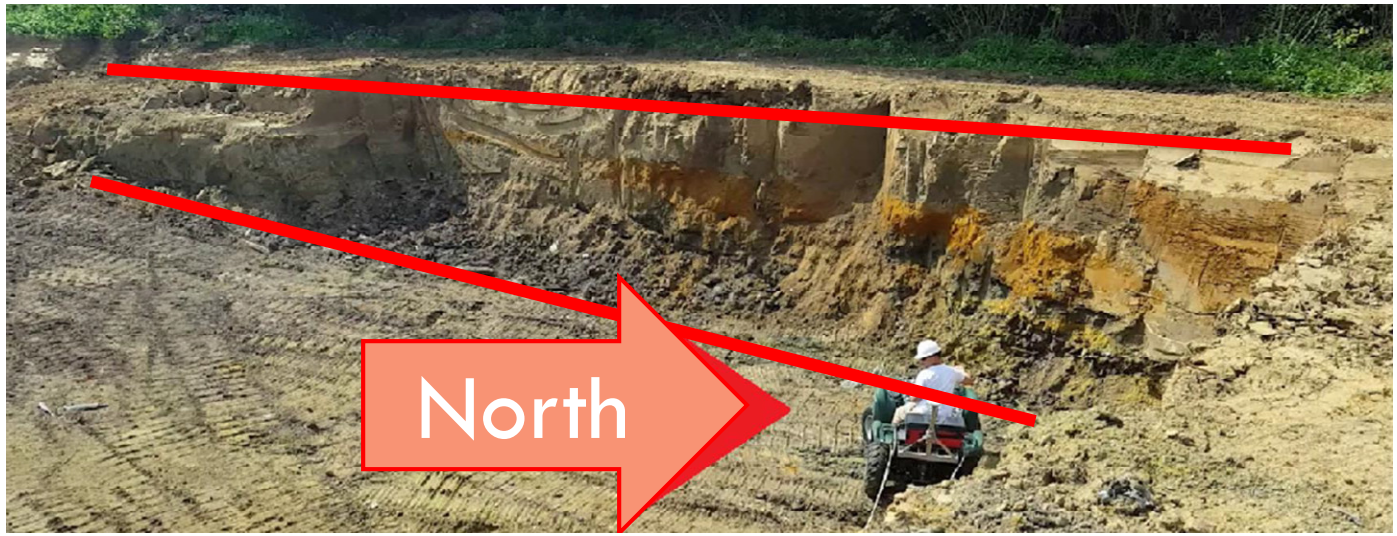
1. Estimation of waste volume: Capping thickness estimation

Induction survey



Results - Induction survey





Second survey – Waste material

2. Exploration of the electrical conductivity of the waste

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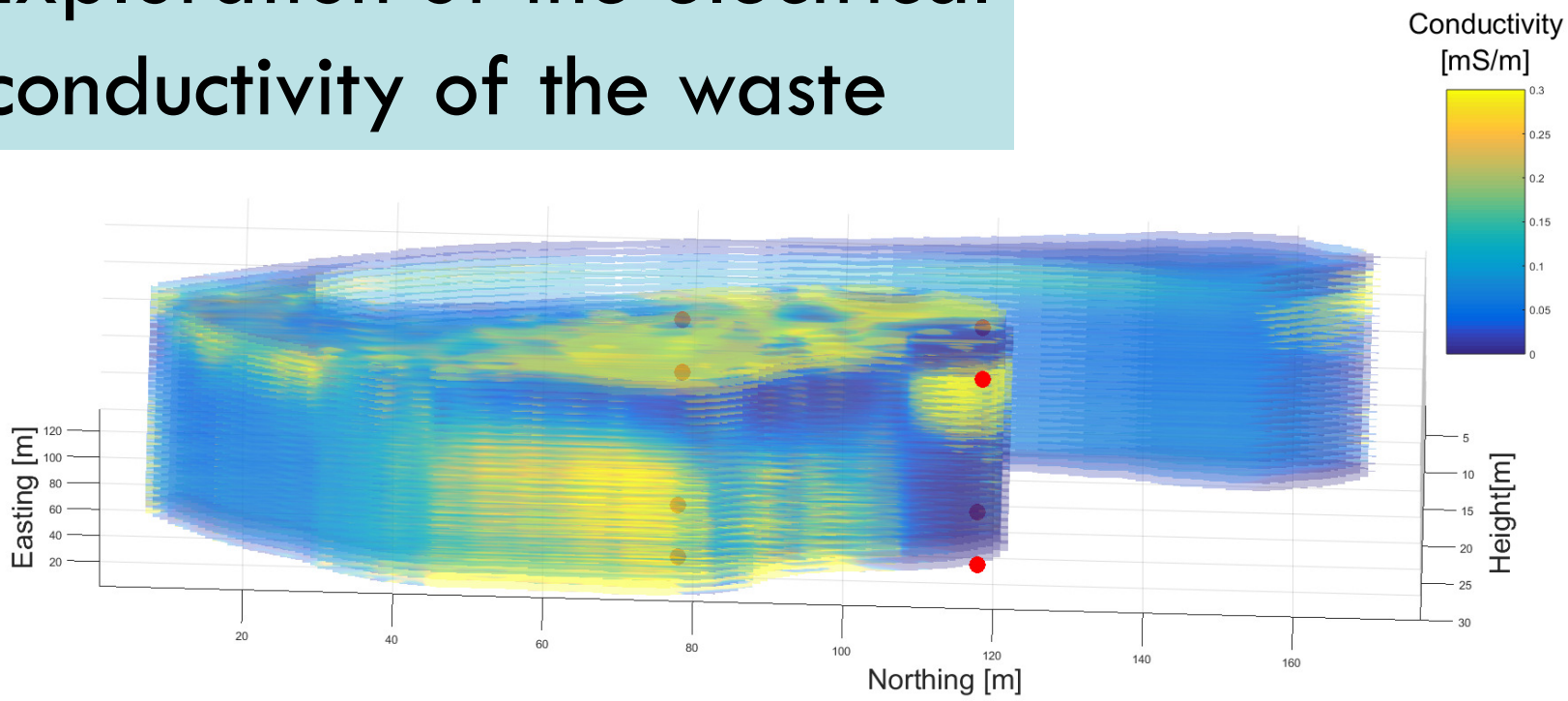
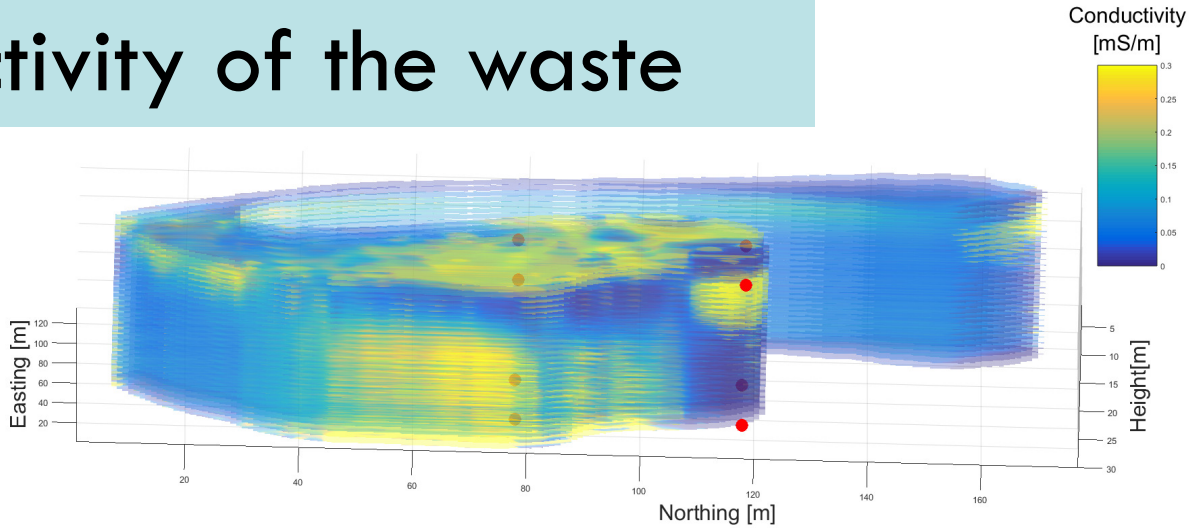


Second survey – Waste material

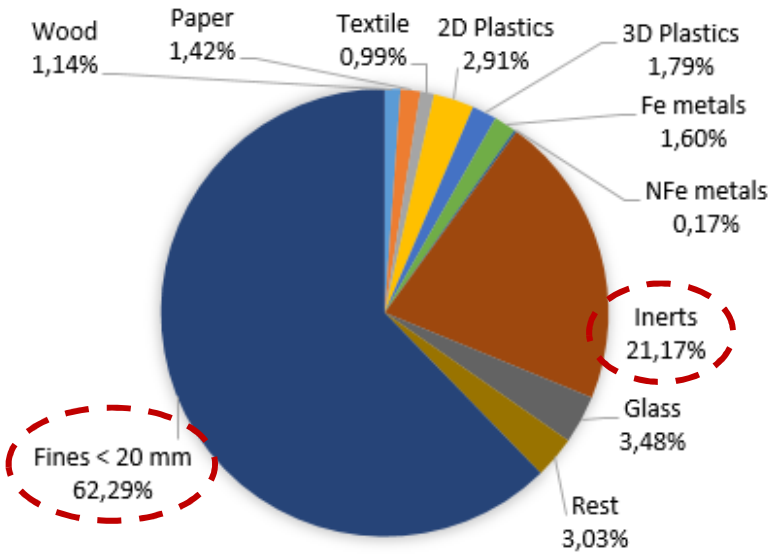
2. Exploration of the electrical conductivity of the waste



→Large variation in electrical conductivity
= large variation in waste material composition?

Excavation of LF waste

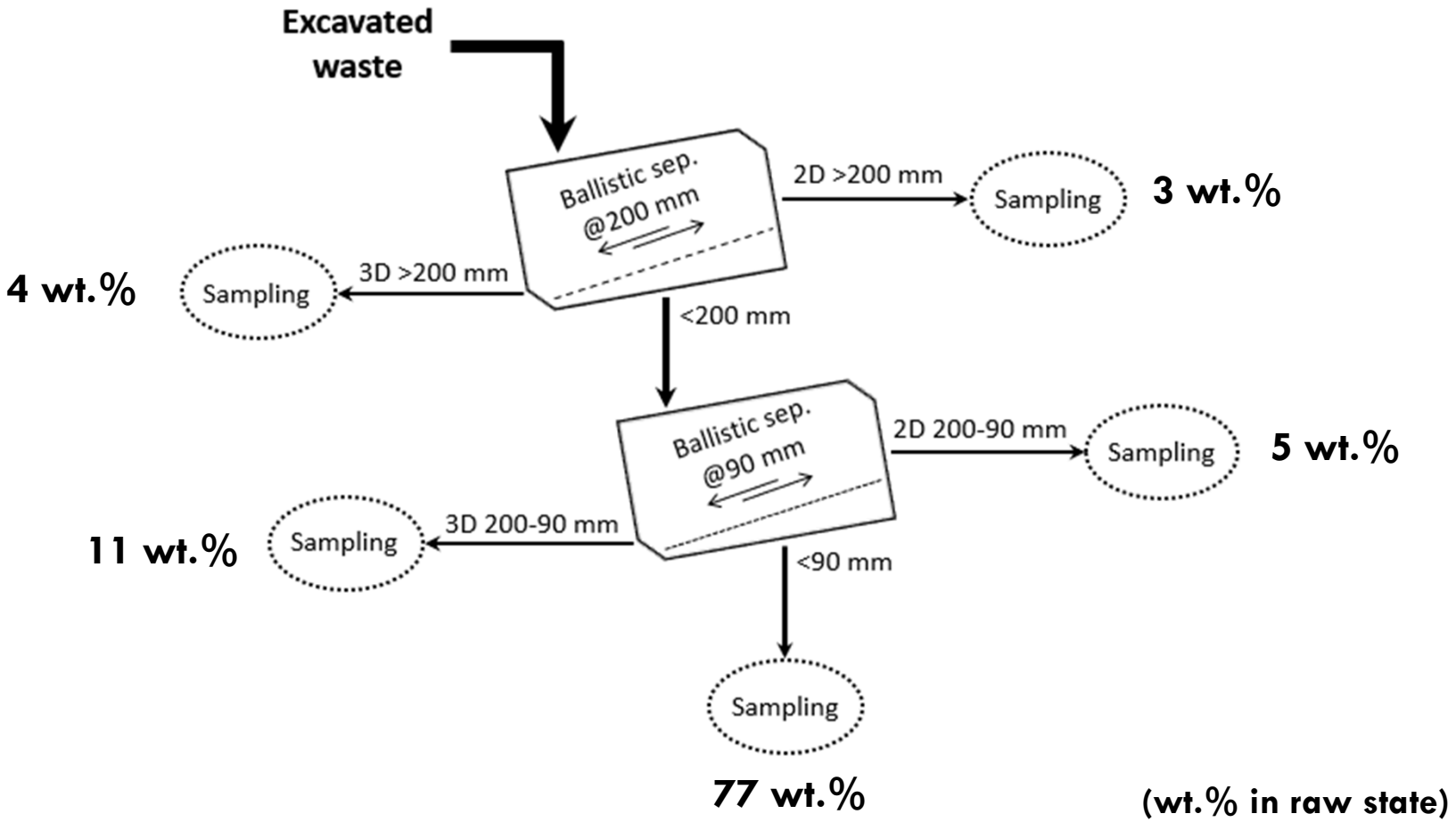
- Total of ~**370 Mg** of waste excavated
- Avg. bulk density of ~**800 kg/m^3**
- Avg. water content of ~**30 wt.%** (raw state)
- Avg. **material composition:**



Mech. pre-processing

- Ballistic separator **Stadler STT 600**
  - 3D fraction
  - 2D fraction
  - Under-screen fraction
- Landfill waste processed **directly** after exc.
- Avg. throughput ~**200 m³/h**

Mech. pre-processing



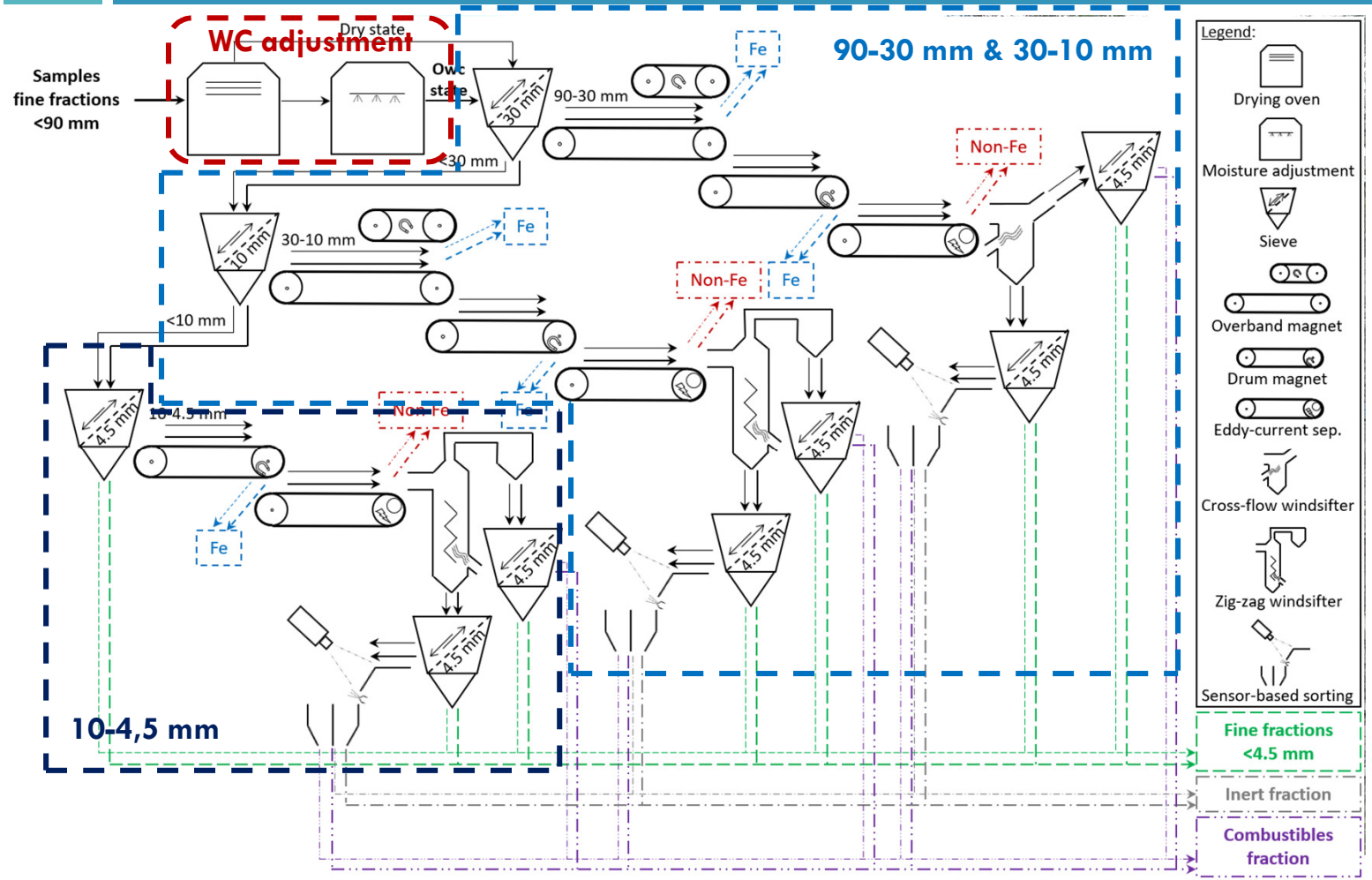
Mech. processing of coarse fractions

	3D Fraction		2D Fraction	
	3D > 200 mm	3D 200-90 mm	2D > 200 mm	2D 200-90 mm
RDF	11,3%	8,7%	56,5%	64,7%
Metals	5,7%	5,6%	1,6%	2,7%
Inert	83,1%	77,5%	7,1%	1,3%
Fines <20 mm	*0,0%	8,2%	34,8%	31,2%

→ WtE

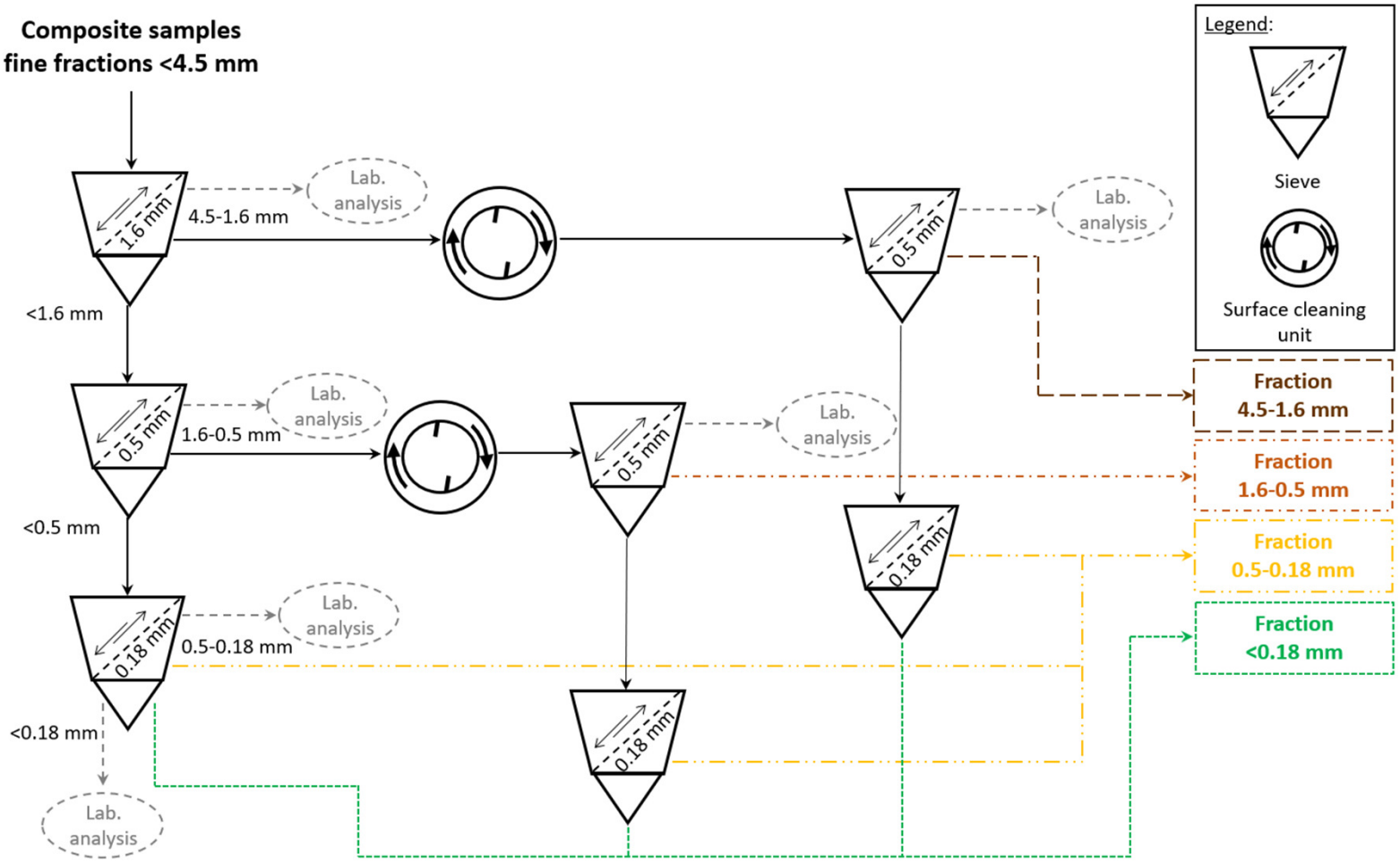
→ WtM

Mech. processing of fine fractions 90-4.5 mm

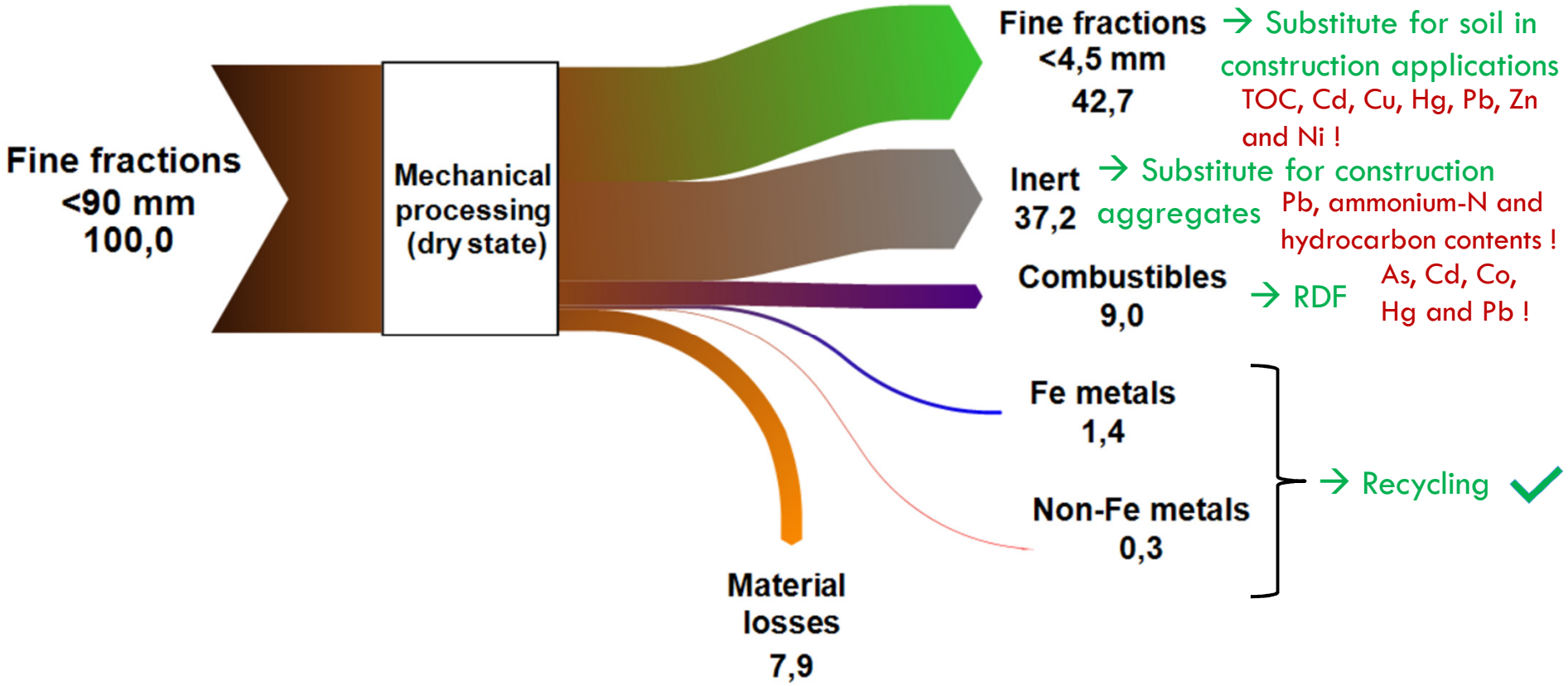


- Fine fractions <4,5 mm
- Inert fraction
- Combustibles fraction
- Fe metals
- Non-Fe metals

Mech. processing of fine fractions <4.5 mm



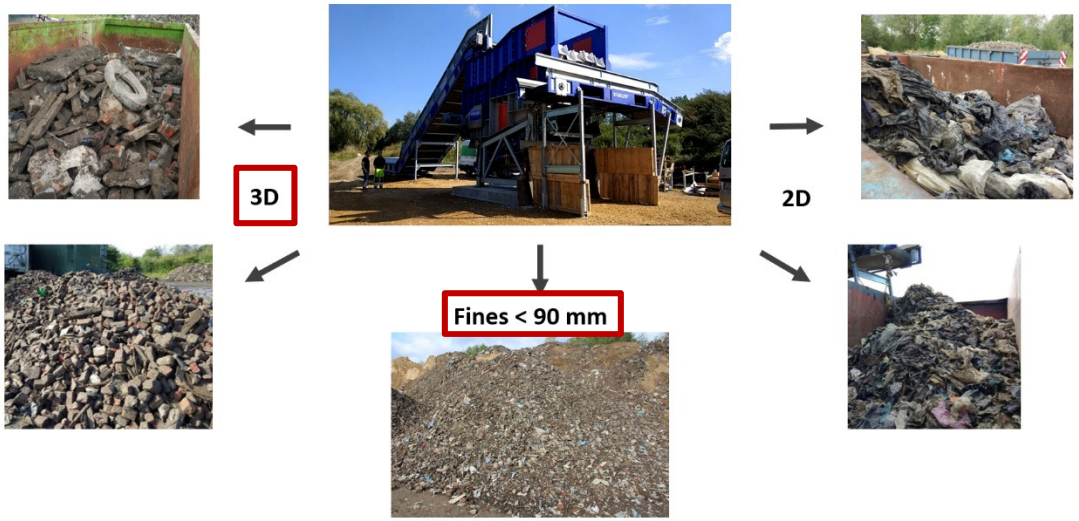
Mass balance of mech. processing of fine fractions



Sensor-based sorting

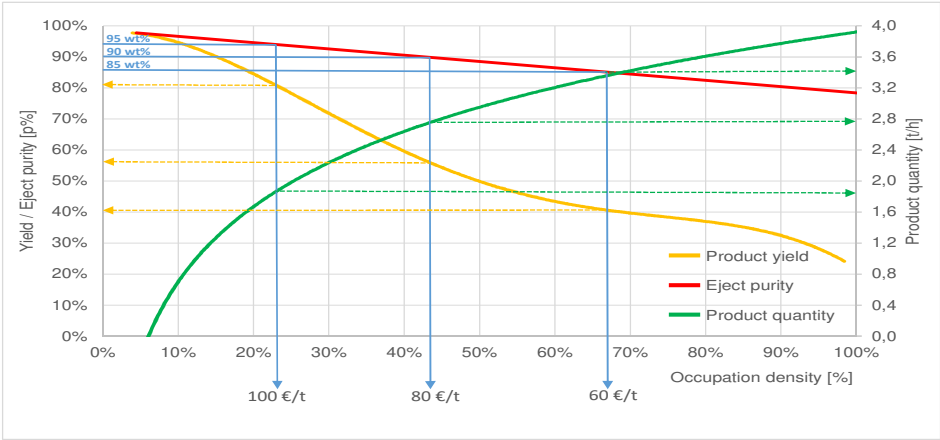
Input to SBS:

- **3D fractions** from ballistic sep.:
  - **200-90 mm**
- **Heavy fractions** from density sep. of **fine fractions:**
  - **90-30 mm**
  - **30-10 mm**
  - **10-4.5 mm**



Influences on ejection:

- Input **composition influences product yield & purity**
- **Throughput rate = Factor for sorting performance**



Influences on NIR-detection:

- **Surface defilements** → Impede detection
- **Humidity alters IR-spectra** → Hinders detection
- **Surface roughness** → Improves identification

Sensor-based sorting

Potential of SBS in ELFM:

- Separation of **plastic types** (>40 mm)
- Sep. of **combustible** and **inert** materials

Refuse plastic chips

Challenges of SBS in ELFM:

- Surface **defilements** in fine fractions
- **Legislation** inhibiting use of recycling products from ELFM
- **Economic feasibility**

Conclusions

- Geophysical methods can **optimize site exploration**
  - **Correlation** between geophysical measurements and waste characteristics **still challenging**
- **Potential** of landfill-mined waste:
  - **Waste-to-Material**
    - Ferrous & non-ferrous metals → **Recycled metals**
    - 3D fractions (≥90 mm) and inert material (<90 mm)

      → **Construction aggregates**
    - Soil-like fractions (<90 mm) → **Soil substitute in construction applications**
  - **Waste-to-Energy**
    - 2D fractions (≥90 mm) and combustible material (<90 mm) → **Alternative fuel (RDF)**

Conclusions

- **Sensor-based sorting** can **enhance** outputs for **WtM** and **WtE** schemes
  - Can significantly **affect economic feasibility**

- In the EU **WtM** and **WtE valorization** schemes strongly **depend on national and local regulations**

- **Greatest challenge in (E)LFM** frequently lays on **economic feasibility** rather than on technical aspects

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THANK YOU FOR YOUR ATTENTION!

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