

Automatic Characterisation and Sorting of Large Quantities of Soil and Rubble

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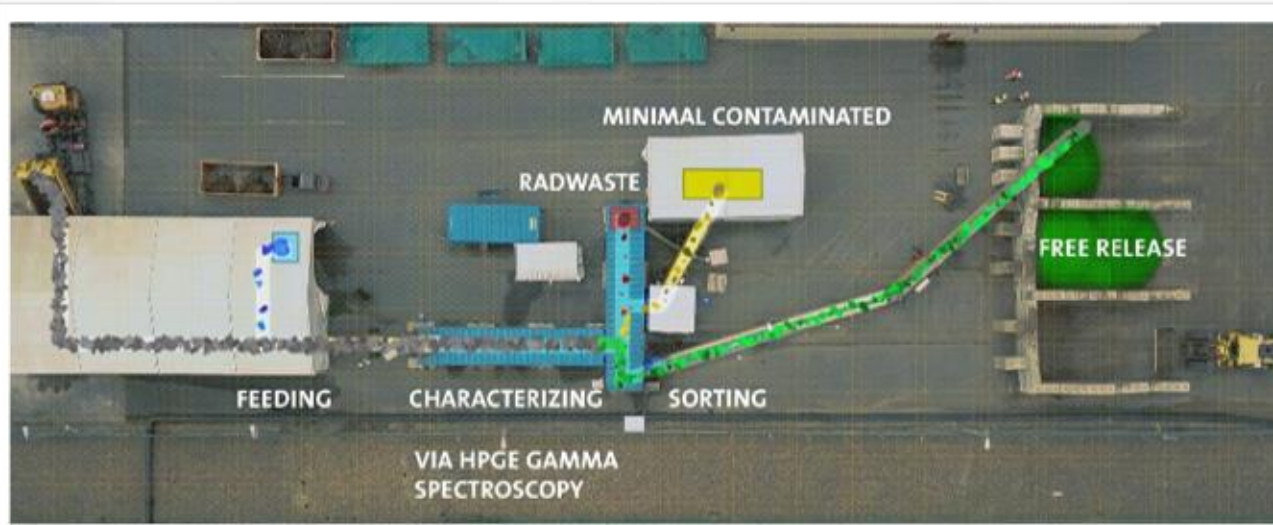
Outline

1. **FREMES – Solution for large soil amounts**
2. **Two projects successfully finished**
3. **Challenges and success factors**
4. **Conclusions**



Photos in this presentation:
with courtesy of FBFC International and
Angarsk Electrochemical Combine

FREMES – Solution for large soil amounts



- **Radiological characterization** of large amounts of potentially contaminated bulk materials (soil, building rubble, etc.)
- Material fed and processed in a continuous stream
- Automated U-235 measurement
- Sorting into 3 defined waste categories
- Main components:
 - 2x HPGe gamma spectrometers
 - Scale and material sensors
 - Automated belts
 - Measurement computer

FREMES – Solution for large soil amounts

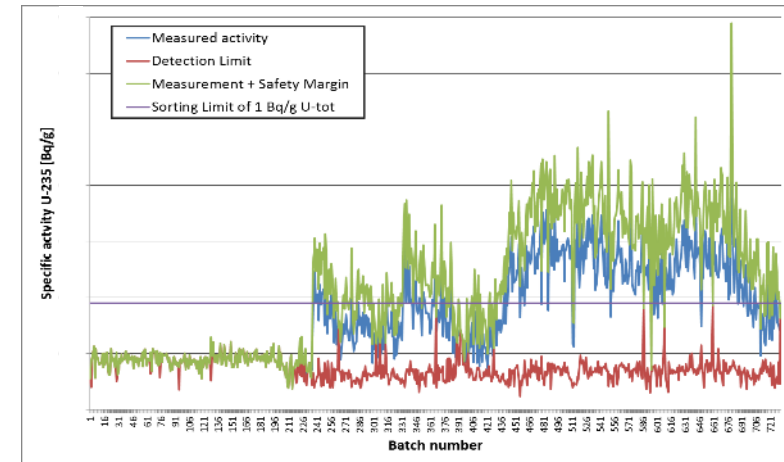
New design of proven concept:
NUKEM site remediation in Hanau

- 100 tons / hour
- 33 500 tons in 15 months (2001 – 2003)



Overall challenges:

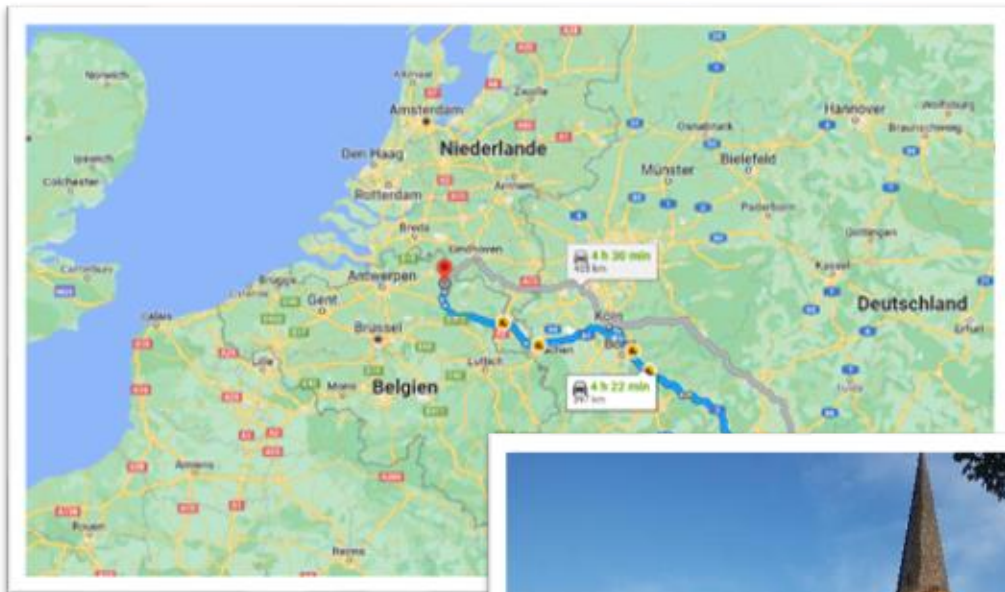
- Automation for large material amount
(~ 5000 spectra per day)



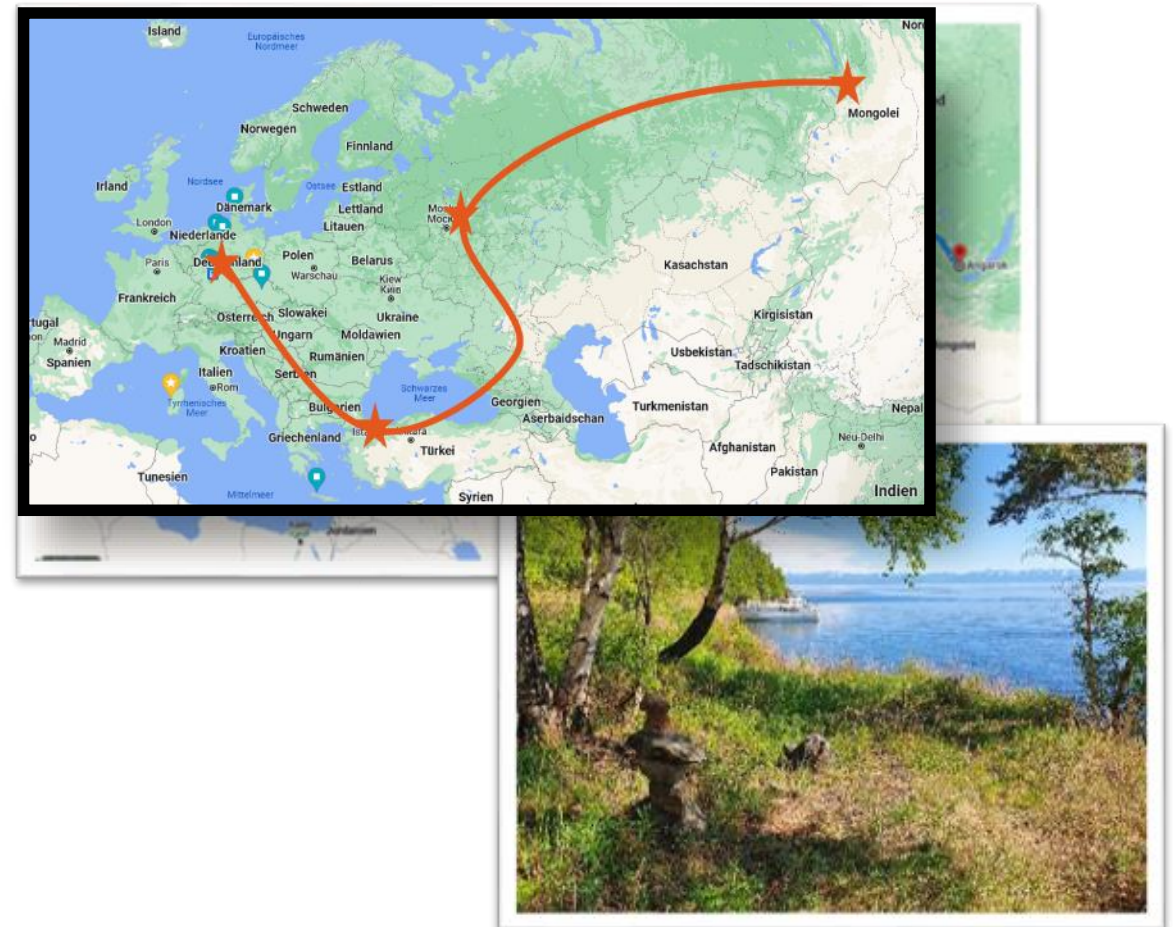
- Reliable process against inner and outer influences
- Easily operable by normal site personnel
- All within quality/authority, time and budget

Two projects successfully finished

FBFC International, Dessel, Belgium



Angarsk Electrochemical Combinate (AECC), Angarsk, (Irkutsk/Siberia), Russia



Project 1: FREMES Dessel



Task:

- Remediation of fuel fabrication plant in narrow time constraint
- Planned 4 000 tons soil measured and sorted
- Facility and operation service rented

Status:

- Over 45 000 tons material processed
- Extended to building materials

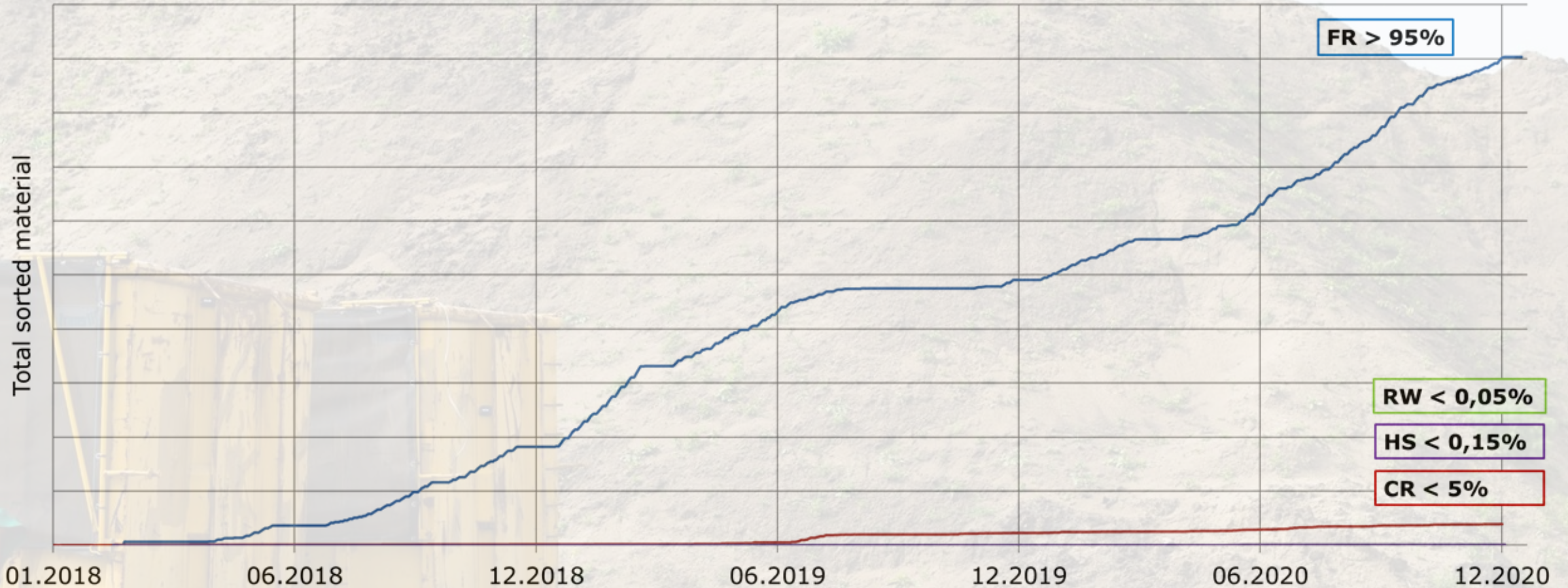
Duration:

- Commissioning: 6 months
- Operation: 3 years (2018 – 2021)



Project 1: FREMES Dessel

FREMES FBFC Dessel - 45.150 tons total sorted material



Project 1: FREMES Dessel

- Task successfully finished within quality, time and budget
- Site cleaned and released from nuclear supervision by royal decree in 2022
- Amount of potential radioactive waste reduced drastically



BELGISCH STAATSBLADE — 02.05.2022 — MONITEUR BELGE

40271

ANDERE BESLUITEN — AUTRES ARRETES

FEDERALE OVERHEIDSDIENST KANSELARIJ VAN DE EERSTE MINISTER

[C — 2022/31576]

Personnel. — Benoeming

Bij koninklijk besluit van 24 maart 2022, wordt de heer Grégoire LAMBIN benoemd tot rijksambtenaar in de klasse A2 bij de Federale Interneauditedienst in een betrekking van het Franse taalkader, met ingang van 1 februari 2022.

Overeenkomstig de gecoördineerde wetten op de Raad van State kan beroep worden ingediend binnen de zestig dagen na deze bekendmaking. Het verzoekschrift hiertoe dient bij ter post aangetekende brief aan de Raad van State, Wetenschapsstraat 33, te 1040 BRUSSEL te worden toegezonden.

SERVICE PUBLIC FEDERAL CHANCELLERIE DU PREMIER MINISTRE

[C — 2022/31576]

Personnel. — Nomination

Par arrêté royal du 24 mars 2022, Monsieur Grégoire LAMBIN est nommé agent de l'Etat dans la classe A2 au Service Fédéral d'Audit Interne dans un emploi du cadre linguistique français, à partir du 1^{er} février 2022.

Conformément aux lois coordonnées sur le Conseil d'Etat, un recours peut être introduit endéans les soixante jours après cette publication. La requête doit être envoyée sous pli recommandé à la poste, au Conseil d'Etat, rue de la Science 33, à 1040 BRUXELLES.

FEDERALE OVERHEIDSDIENST BINNENLANDSE ZAKEN

[C — 2022/40779]

Federaal Agentschap voor Nucleaire Controle. — Kennisgeving. — Koninklijk besluit waarbij het koninklijk besluit van 18 oktober 2013 houdende de ontmantelingsvergunning betreffende de installaties van de naamloze vennootschap FBFC International te Dessel wordt opgeheven, en de naamloze vennootschap FBFC International de lijst der installaties classées de classe 1

SERVICE PUBLIC FEDERAL INTERIEUR

[C — 2022/40779]

Agence fédérale de Contrôle nucléaire. — Notification. — Arrêté royal abrogeant l'arrêté royal du 18 octobre 2013 portant l'autorisation de démantèlement des installations de la société anonyme FBFC International à Dessel, et supprimant la société anonyme FBFC International de la liste des établissements classés de classe 1

Project 2: FREMES Angarsk



Task:

- Remediation of old enrichment plant on site
- Operation only summer (Siberia)
- Strong time constraint for commissioning
- Facility delivered, operated by customer

Status:

- Delivered and commissioned on time
- Support during warranty period

Duration:

- Commissioning: 1 month (2022-05)
- Operation: ongoing from 2022-06



Project 2: FREMES Angarsk

АТОМНАЯ 2.0 ЭНЕРГИЯ

Главная Публикации Библиотека Партнеры Научный портал Поиск

Новости 9 июня 2022 80

На АЭХК введена в эксплуатацию установка по радиационной сортировке грунтов FREMES немецкой компании NUKEM Technologies



На площадке Ангарского электролизного химического комбината (АО «АЭХК», входит в Топливную компанию Росатома «ТВЭЛ») в рамках проекта по выводу из эксплуатации ранее остановленных объектов заработала

Тематики
Вывод из эксплуатации (2466)

- Facility delivered and commissioned on time and to customer's satisfaction
- Personnel trained and ready for use
- Overcome the obstacles distance, political situation, etc.

Challenges and success factors

Task simple, facility design clear ...

... but many influence factors, that can make it complicated.

FREMES Dessel - Challenges

Technical Challenges:

- Original concept proven, but new design
 - technology completely new to implement
 - no more personnel of old project
 - operation parameters not yet optimized
- “Childhood diseases” of software during commissioning (relatively long startup phase)
- Operators have monotoneous job and lack physical insight

Unanticipated effects in practice;

- Soil lighter and sandier compared to pre-study
- Mechanical and electrical weak points
- Defects of motors, sensors, and transport equipment

Organisational challenges:

- Time constraints / payed per ton (“Time is money”)
- Outer influences
 - Weather conditions
 - Logistics problems on customer’s side
 - Corona pandemics
- Frequent optimization queries from customer

FREMES Dessel – Success factors

Challenges summary:

- New design
- Reliable automation
- Software and parameter optimization
- Mechanical and electrical problems
- Operation on site
- Defects and outer influences
- Queries from customer

Success factors:

- Careful commissioning, calibration and testing
- Continuous remote support during operation
 - Specialists reachable at all time
 - Data regularly checked by an expert
 - Spare parts already on site
- Continuous optimization during whole project
 - Parallel to operation
 - Optimization of user interaction (Murphy's law)
- Personnel motivated and well-trained
- No-blame culture, Lessons learned
- Direct and trustful communication channel with customer and authorities, efficient approval

FREMES Angarsk – Challenges

| Field of challenge | Dessel | Angarsk |
|------------------------------------|--|---|
| Operation concept | <ul style="list-style-type: none"> • Service sold per material • Own supervision | <ul style="list-style-type: none"> • Facility sold, customer operates • Warranty service |
| Distance to site | <ul style="list-style-type: none"> • 400 km / 4 driving hours | <ul style="list-style-type: none"> • 7,500 km / >30 travel hours • 6 time zones |
| Traveling | <ul style="list-style-type: none"> • No problem | <ul style="list-style-type: none"> • No direct flights • No payment methods and other |
| Export / Regulations | <ul style="list-style-type: none"> • Inside EU • Nearly no problems | <ul style="list-style-type: none"> • Outside EU • Sanctions and strong custom control in whole delivery chain |
| Culture / Language | <ul style="list-style-type: none"> • Close / English available | <ul style="list-style-type: none"> • Notable cultural differences • English restricted / Translator |
| Remote support | <ul style="list-style-type: none"> • Easy, good internet | <ul style="list-style-type: none"> • Difficult, slow internet |
| Access to site | <ul style="list-style-type: none"> • Standard security measures and working possibility | <ul style="list-style-type: none"> • Strong formalities for access • Limited working time |
| Preparation of surroundings | <ul style="list-style-type: none"> • Good communication and regular visits • Clear preparation | <ul style="list-style-type: none"> • Regular communication important for clarification • Still much different on site than expected |
| Technical | <ul style="list-style-type: none"> • [Discussed before] | <ul style="list-style-type: none"> • Problems with fitting of equipment • Damages from transport |

FREMES Angarsk – Success factors

| Field of challenge | Opposing success factor |
|------------------------------------|---|
| Distance/Travel | <ul style="list-style-type: none">• Motivated team• Support from customer |
| Export / Regulations | <ul style="list-style-type: none">• Motivated team (much effort was given)• Effective export control process inside NUKEM |
| Culture / Language | <ul style="list-style-type: none">• Site manager / translator employed• Cultural awareness |
| Access to site | <ul style="list-style-type: none">• Good planning and efficient use of time• Motivated team |
| Preparation of surroundings | <ul style="list-style-type: none">• Constant communication with customer• Goal-oriented and pragmatic solutions |
| Technical | <ul style="list-style-type: none">• Careful planning, calibration and testing• Optimization during first project (Dessel) payed off here |

Challenges and Success factors

Conclusions

FREMES Dessel:

- Challenges mainly technical and from unexpected events

FREMES Angarsk:

- Challenges mainly organizational and from outer circumstances

| Key challenges | Key success factors |
|--|---|
| <ul style="list-style-type: none">• New design• Reliable automation | <ul style="list-style-type: none">• Thorough test• Continuous optimization |
| <ul style="list-style-type: none">• Unexpected effects on site | <ul style="list-style-type: none">• Expect the unexpected<ul style="list-style-type: none">• Plan reserve• Communicate with customer |
| <ul style="list-style-type: none">• Outer influences, surprises | <ul style="list-style-type: none">• Motivated team• Willingness of all parties to succeed |

Most important success factors:



Motivated team

Careful preparation

„Das Geheimnis des Könnens liegt im Wollen“

**Alle gut verfolgten
Dinge hatten bisher
Erfolg.**

F. Nietzsche

F. Nietzsche



We are looking forward to a road with many more successful applications !



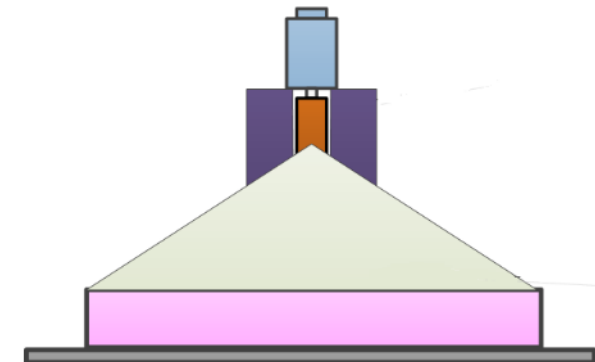
**Thanks for your
attention**

End of Presentation

Backup Slides

Function and optimization of radiological sorting

- Material buffered and lead to a continuous stream
- Defined geometry suitable for gamma spectrometry measurement
- Automated evaluation
 - using pre-calculated efficiency by Monte Carlo simulation
 - supported by verification measurements
- Dessel: ca. 2 million single spectra evaluated over 3 years
- Design throughput: 10 tons / hour



Function and optimization of radiological sorting

- Initial design was conservative and allowed for increase of typical detection limit
- Increase of filling height possible with only minor radiological impact
- Throughput could be increased by roughly 25 % by simple setup- and calibration optimization
- Throughputs up to 15 tons/h achieved at final stage (also depending on material)

