

Finnish In-Kind Projects for FAIR



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UNIVERSITY OF JYVÄSKYLÄ

Outline

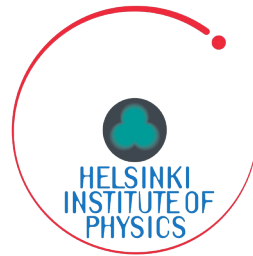
- Finnish contribution to FAIR
- Helsinki Institute of Physics
- Items identified appropriate for Finnish in-kind contribution
- Status of each project
- Summary

Finnish contribution

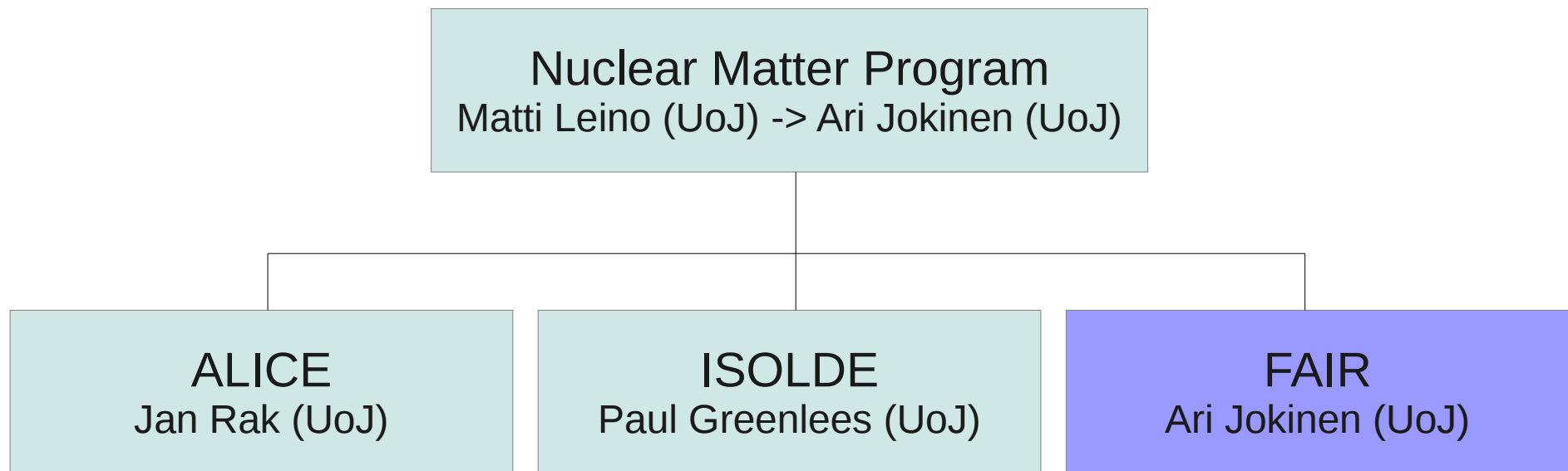
- The Ministry of Education issued 5M€ as Finnish contribution to FAIR (0.5%) back in 200x.
- Finland is a joint shareholder with Sweden
- Cash contribution to FAIR 1.5M€
- The rest is foreseen to be delivered as in-kind contribution
- Finnish scientific participation is in NuSTAR (HISPEC/DESPEC, MATS, LaSpec)
 - in-kind contribution to Super-FRS (cost book items)
- The 1.25M€ originally reserved for the experiments, is now redirected to Super-FRS too

Helsinki Institute of Physics

- Finnish participation in FAIR is managed through HIP
- Jointly run by U of Helsinki, Aalto U, U of Jyväskylä, Tampere U of Tech, Lappeenranta U of Tech
- Director J. Äystö
- Programs: Theory, High energy physics (TOTEM), CMS, Planck, CLOUD, Technology, Nuclear matter
- Detector laboratory (ALICE, CMS, TOTEM, GEM-TPC)

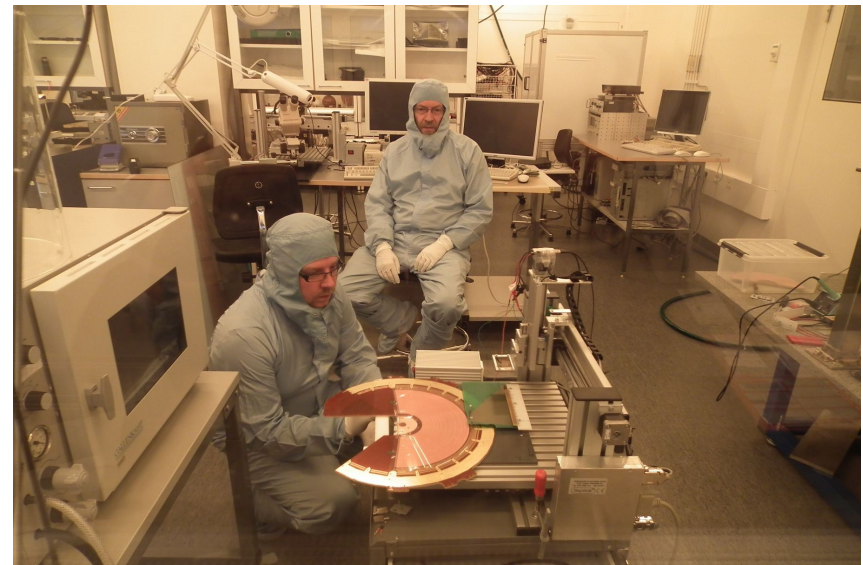
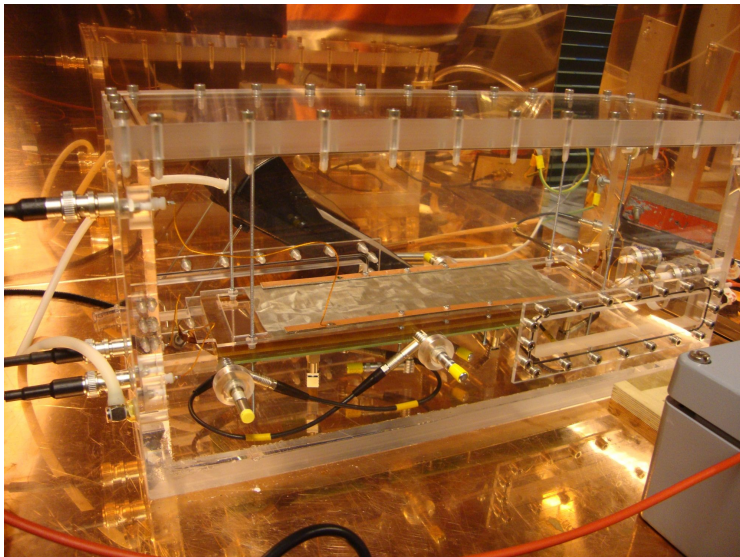


HIP/Nuclear matter program



HIP Detector Laboratory

- GEM expertise, TOTEM T2, ALICE ITS upgrade (100sqm of GEM)
- E. Tuominen, F. García
- Premises: Laboratory, two clean rooms (lab tour)
- Equipment: environmental test chamber, probe station, profilometer, wire bonders, programmable xy-table,...



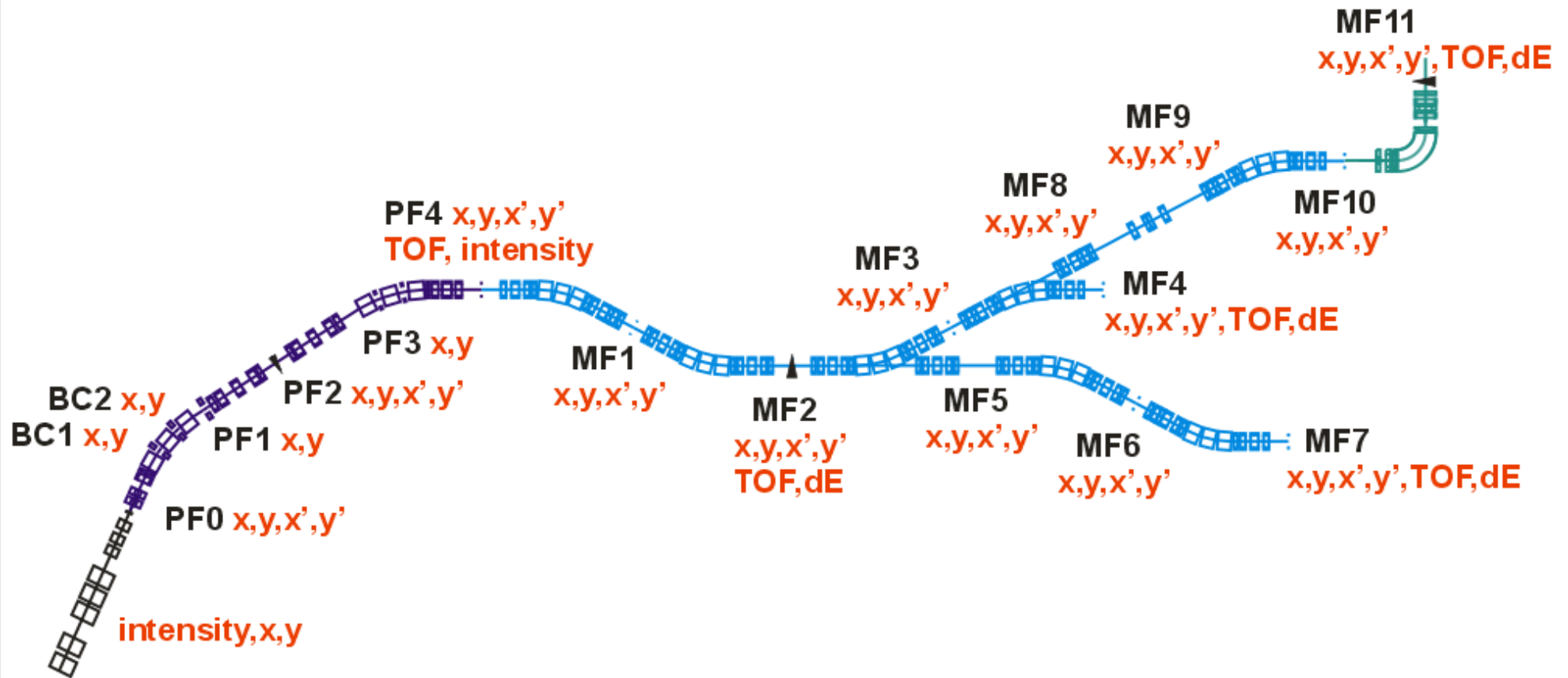
Identified cost book items

- Super-FRS beam diagnostics:
 - GEM-TPC (slow extraction)
 - SEM Grid (fast extraction)
 - Detector ladder (actuator for above devices)
- Super-FRS Power cabinets
- Super-FRS Target flask
- Super-FRS Lifting devices
- Gas cell equipment

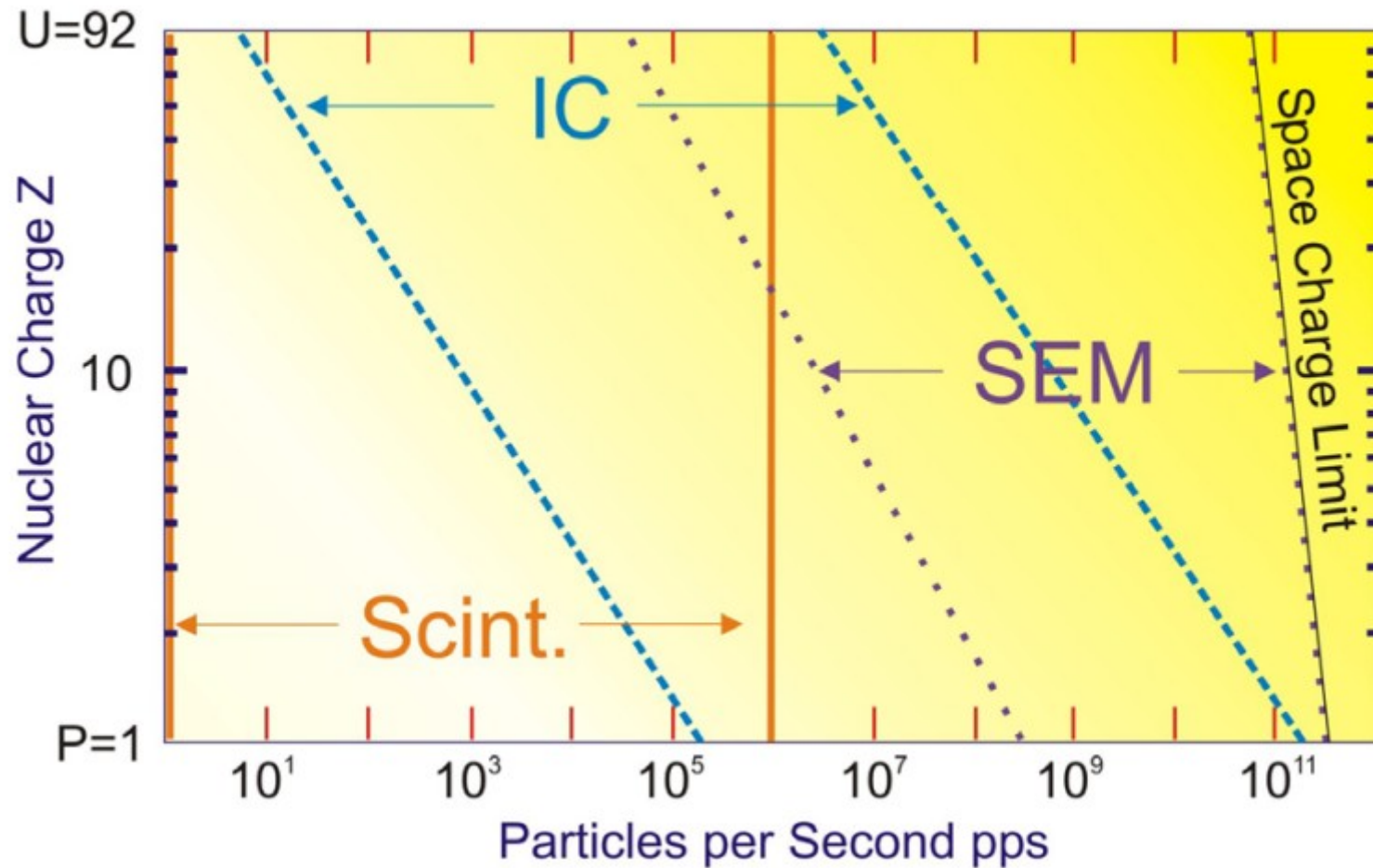
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Super-FRS beam tracking

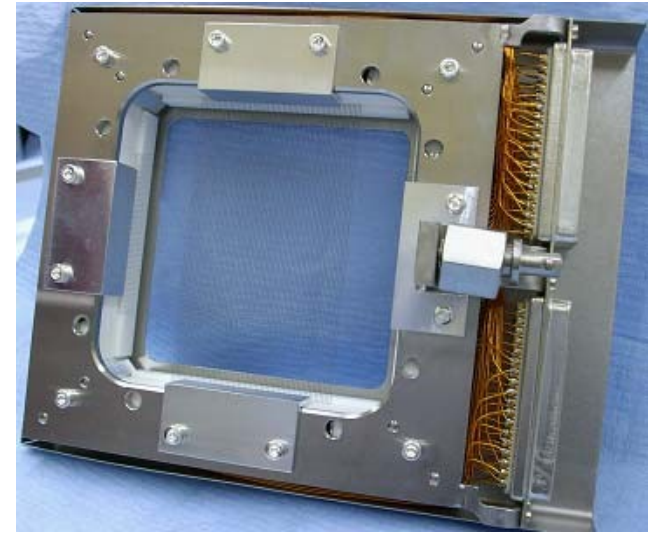


Intensity ranges

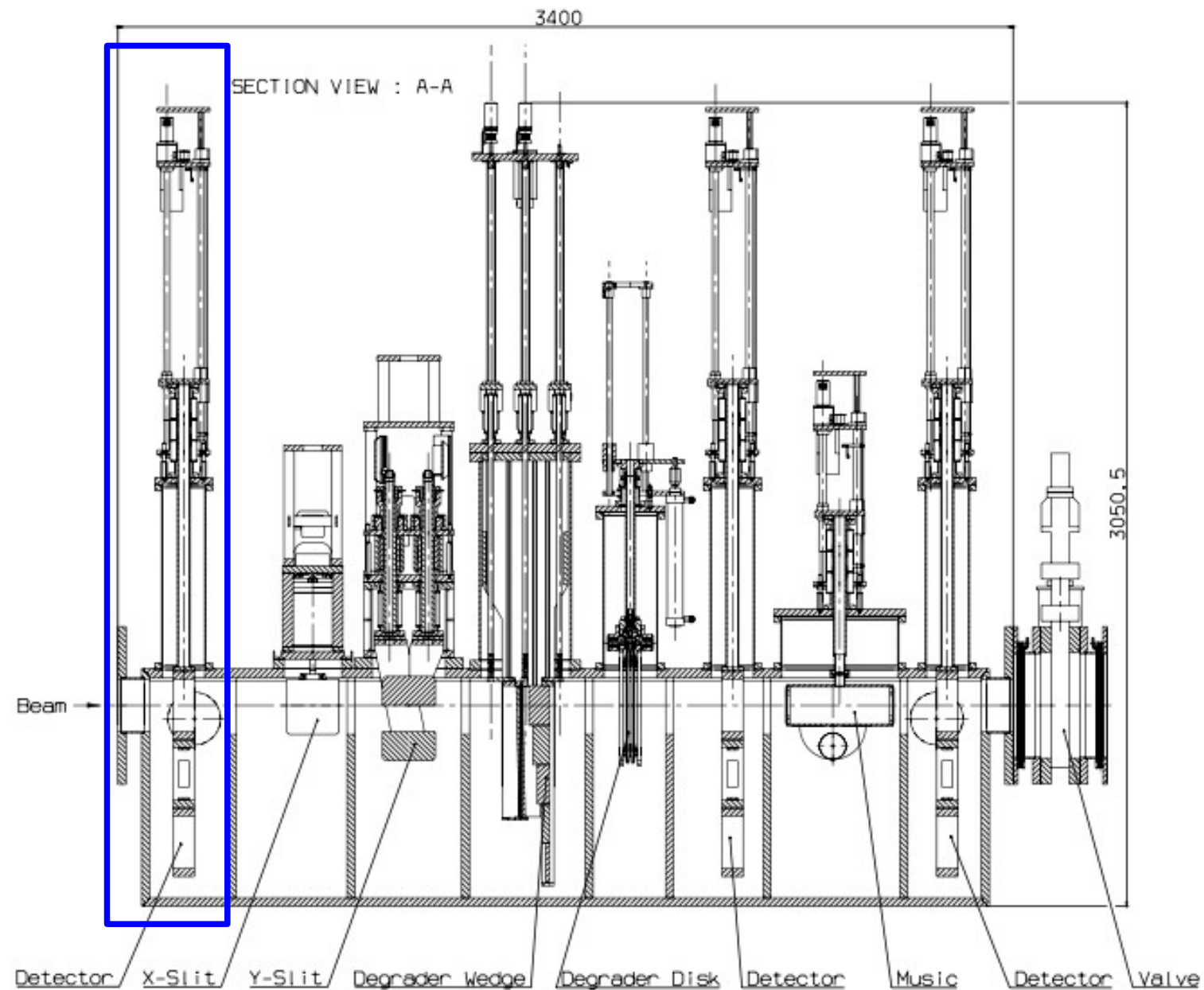


Secondary electron Emission Grid

- Horizontal and vertical wire array
- Current measured from each wire
- Fast extraction $<100\text{ms}$
- Known physical parameters:
 - Quantity needed 32 + spares
 - Overall length: 300 mm
 - Horizontal aperture: 100 mm
 - Vertical aperture: 100 mm
 - Intensity range (energy deposition): $<100\text{ mW/mm}$



Detector Ladder



Super-FRS beam tracking

- GEM-TPC in prototype phase (F. García's talk)
- EoI on SEM Grid and Detector Ladder
- Proposal presented one week ago in IKRB meeting
- The IKRB recommends assignment to the Council

*"The IKRB recommends to the Council to assign the **SEM Grid Detectors and the Drive Ladders** for Super-FRS beam diagnosticsto the **Swedish-Finnish** shareholderwith the **Helsinki Institute of Physics** as Provider."*

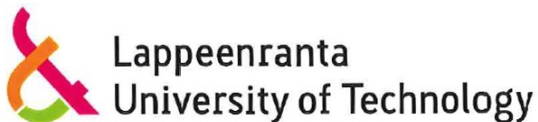
- Engineer hired by HIP (K. Rytönen) to prepare concept design with FAIR/GSI people. UoJ in charge of this project.
- Searching partner companies

Identified cost book items

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- Super-FRS Target flask
- Super-FRS Lifting devices
- Gas cell equipment

Power cabinets for Super-FRS

- EoI presented to IKRB, Proposal accepted IKRB VI 2/2013
- Partners:
 - Initial phase collaboration: Rejlers Ltd.
 - Academic: Lappeenranta Uni. of Tech.
 - Company: PowerNet
- Confidentiality agreement signed, access to design documents
- Control interface provided by GSI/FAIR

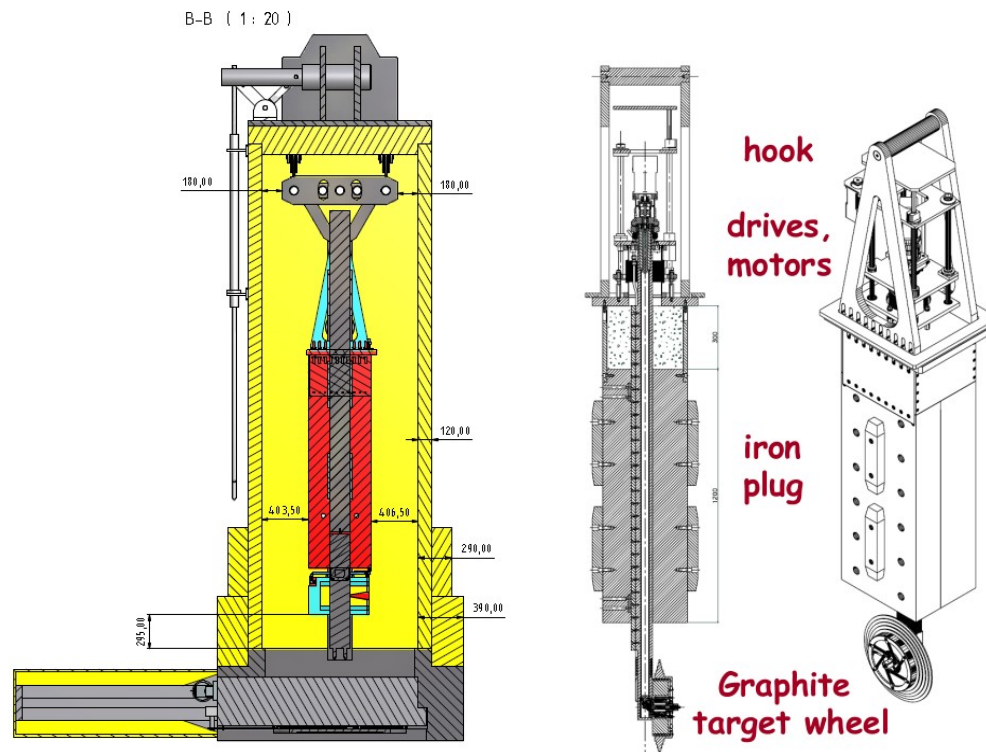


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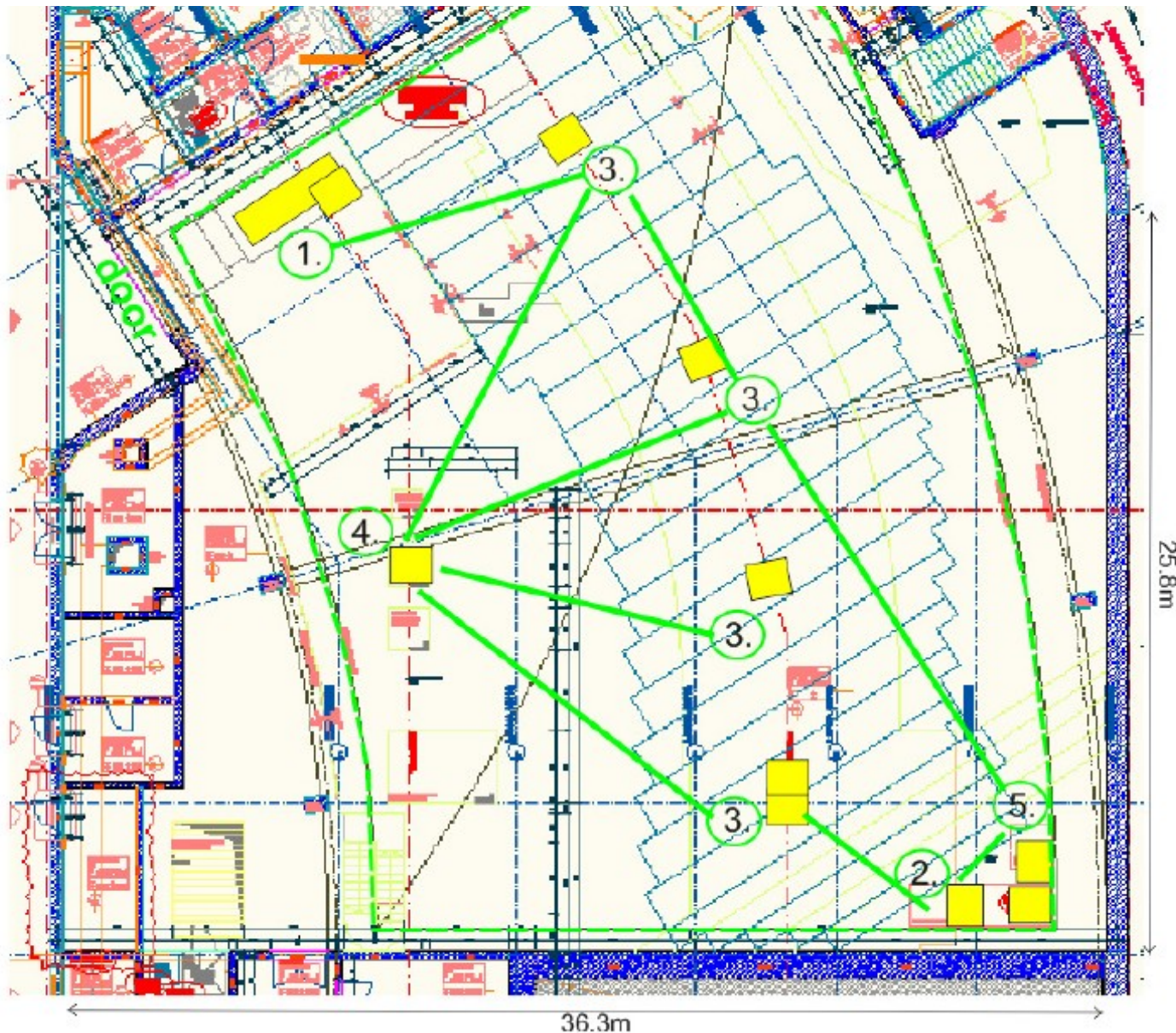
Super-FRS flask

- Movable shielding and lifting system
- Local transportation of beam line inserts, "plugs", that hold targets, collimators etc. to the hot cell for processing and storage



PSI Flask

Super-FRS Flask Positions

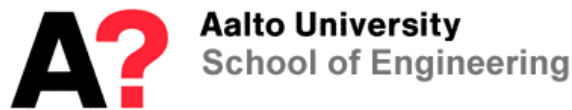


Flask project status

- Eol, Proposal VII IKRB, 01 Oct 2013

*"The IKRB recommends to the Council to assign the **Safety transport container**... ..to the **Swedish-Finnish** shareholder... ..with the **Helsinki Institute of Physics** as Provider."*

- Academic partner: Aalto University
- Discussions with Hollming Works and ENMAC
- Meeting with GSI people this week

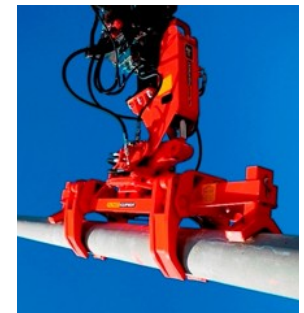


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Super-FRS Lifting devices

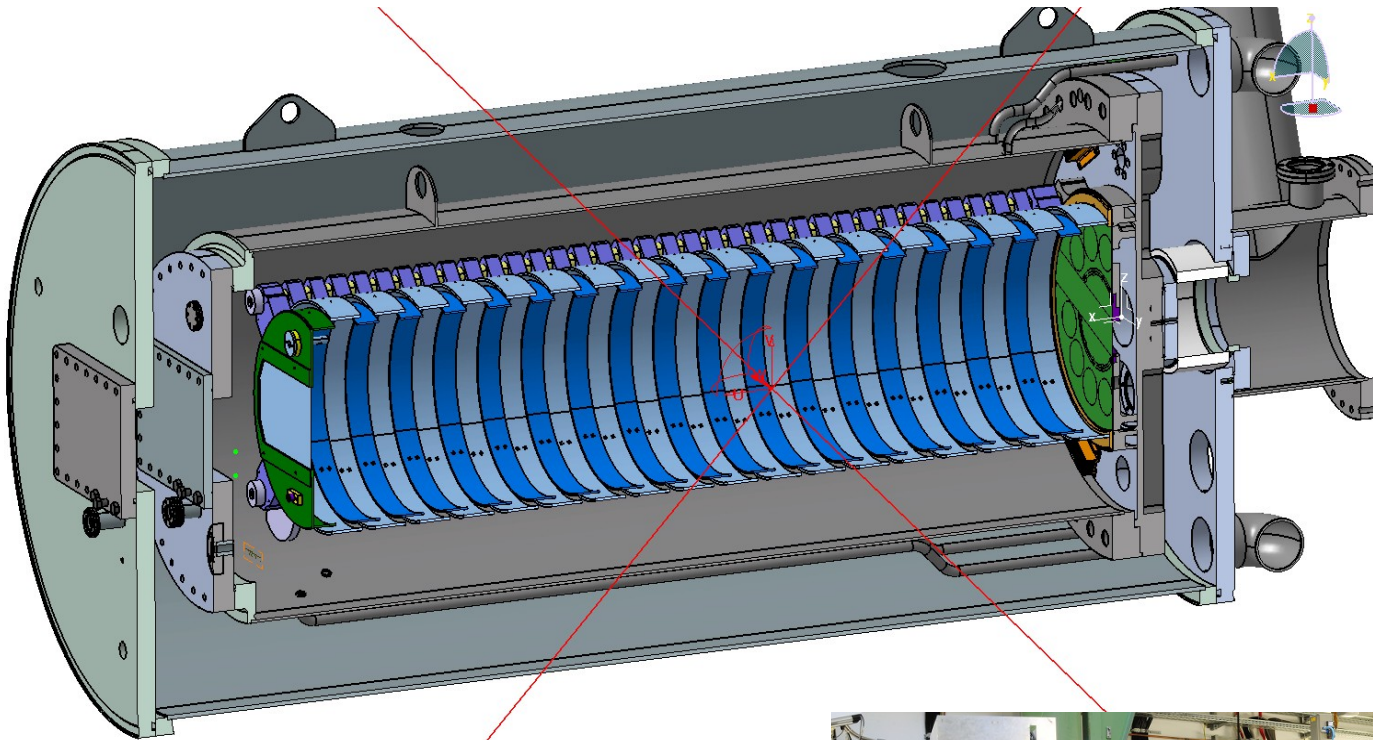
- Multipurpose mobile lifting device (CB code 2.4.7.6.2.1)
 - Extendable 8 m, Slewing 360 deg, Capacity 3 ton?
 - Changeable head:
 - crane
 - platform/basket for personnel (3 pers)
 - fork
 - grabble for concrete blocks
 - pipe handling
- 8 stationary systems (CB code 2.4.7.6.2.2)
- Total cost book value 174k€
- EoI submitted
- Commercial solutions sought



Identified cost book items

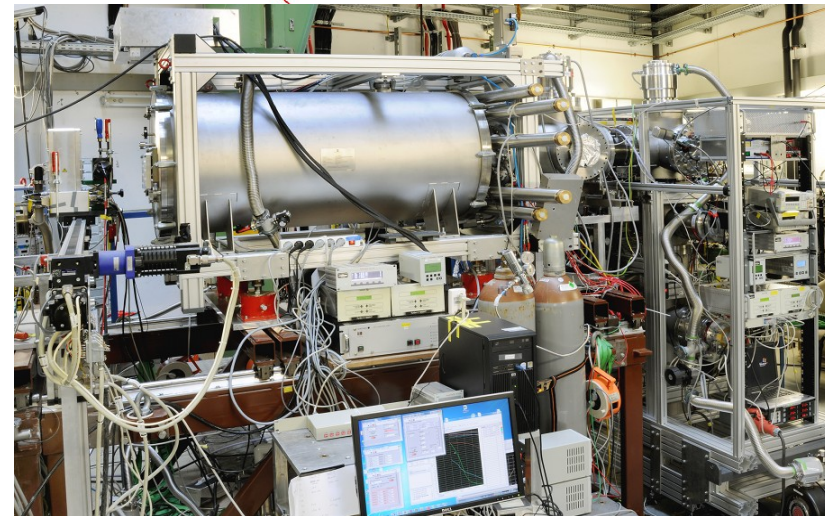
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Super-FRS Gas Cell



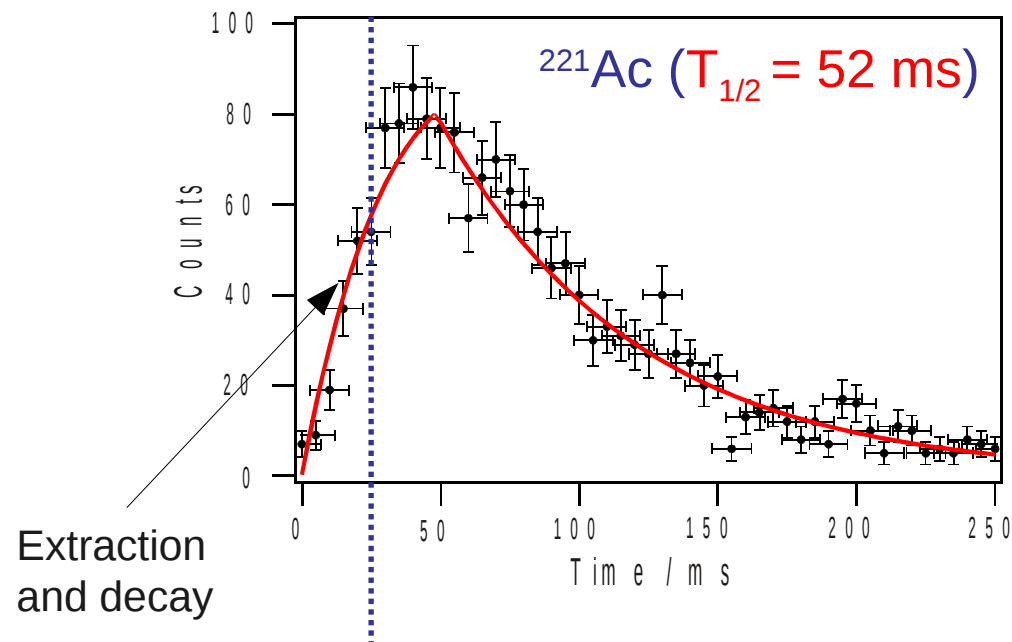
Cryogenic Stopping Cell (prototype)

- Length 1m
- Diameter 25cm
- Gas temperature 60...70K
- Gas pressure 330mbar T_{room} equivalent
(1 atm T_{room} achievable)



Cryo stopping cell test results

- Extraction time 25ms

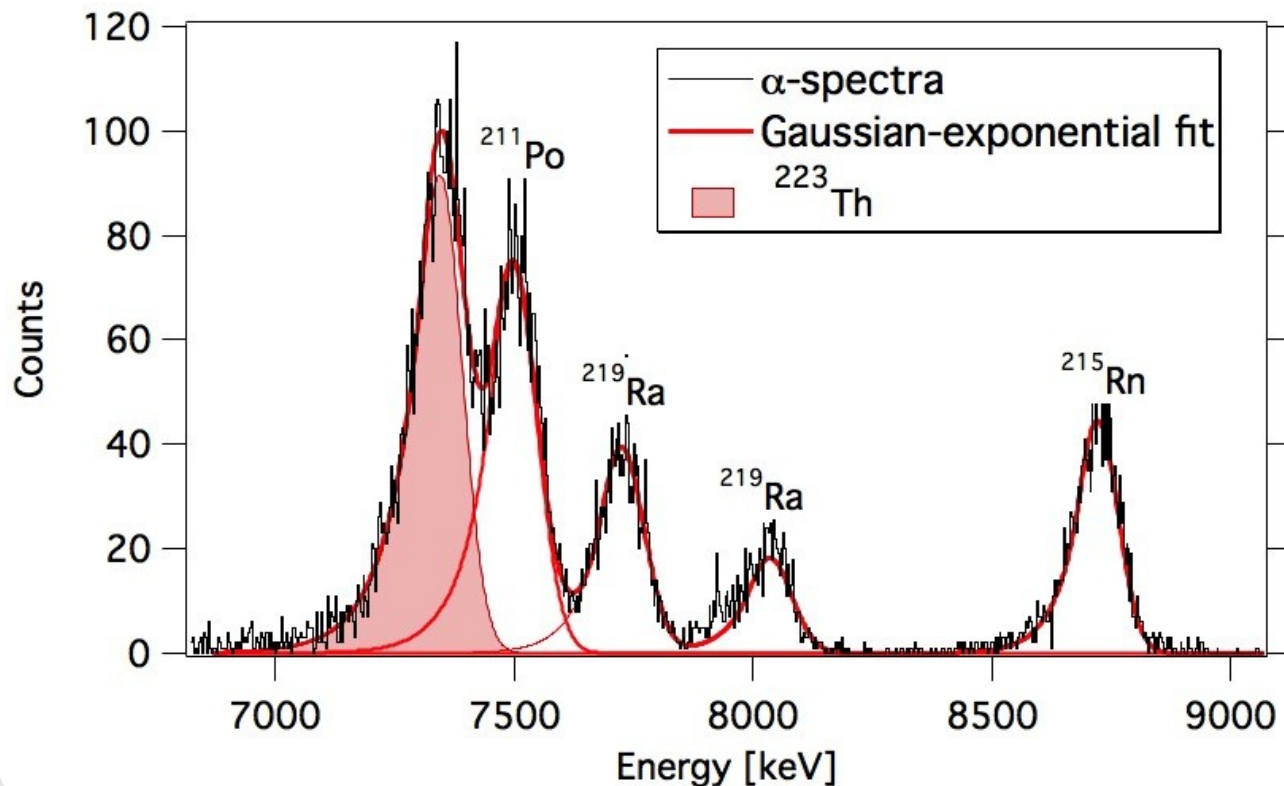


Mean extraction time $T_{\text{extr}} = 23 \text{ ms}$
Theory ($K_0=15 \text{ cm}^2/\text{Vs}$) $T_{\text{extr}} = 27 \text{ ms}$

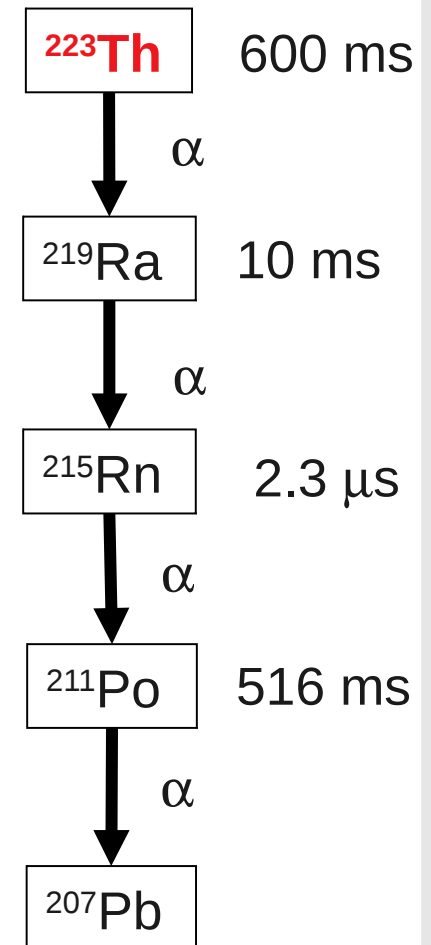
S. Purushothaman et al., epl submitted (2013)

Cryo stopping cell test results

- Extraction time 25ms
- Total efficiency 12% (^{223}Th)
 - 27% stopping
 - 43% survival+extraction

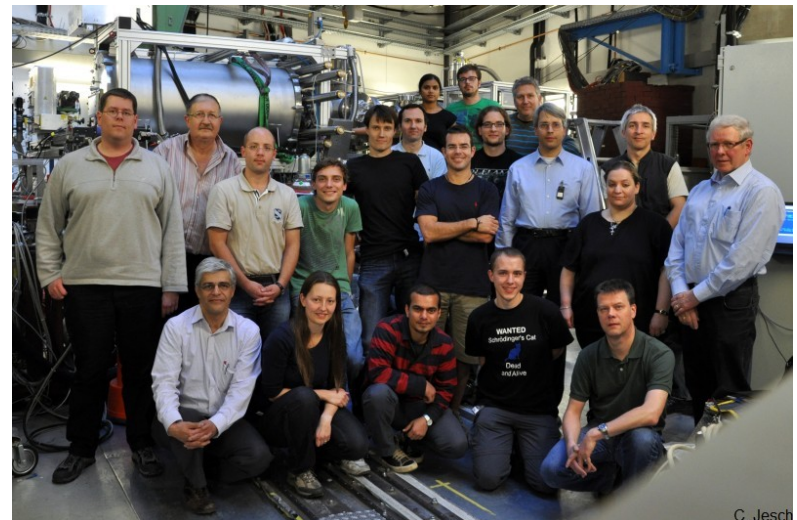
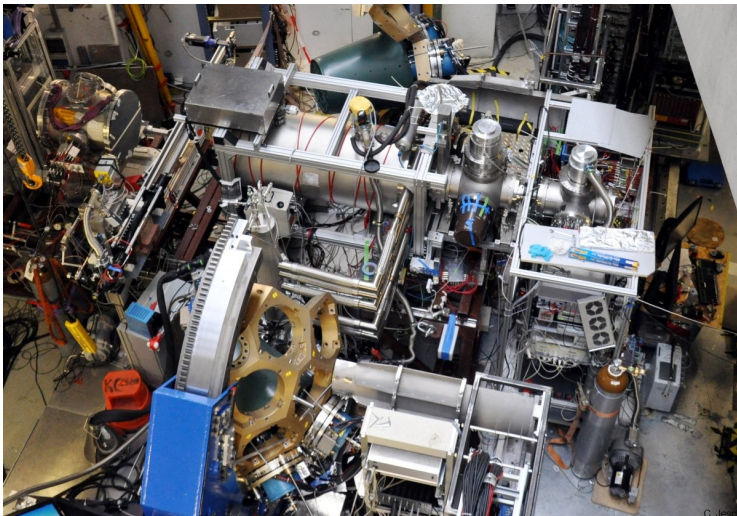


urushothaman et al., epl submitted (2013)



Gas cell equipment

- EoI on two cost book items
 - 2.4.11.2.7 Roots
 - 2.4.11.2.8 vacuum + gas handling
- Concept is still unclear but 210k€ is reserved for the gas cell



Summary of CB items

- Super-FRS beam diagnostics:
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total CB value 3.4237M€

• Cash contribution	1.5M€
Total	~5M€