Background of the KATRIN Experiment

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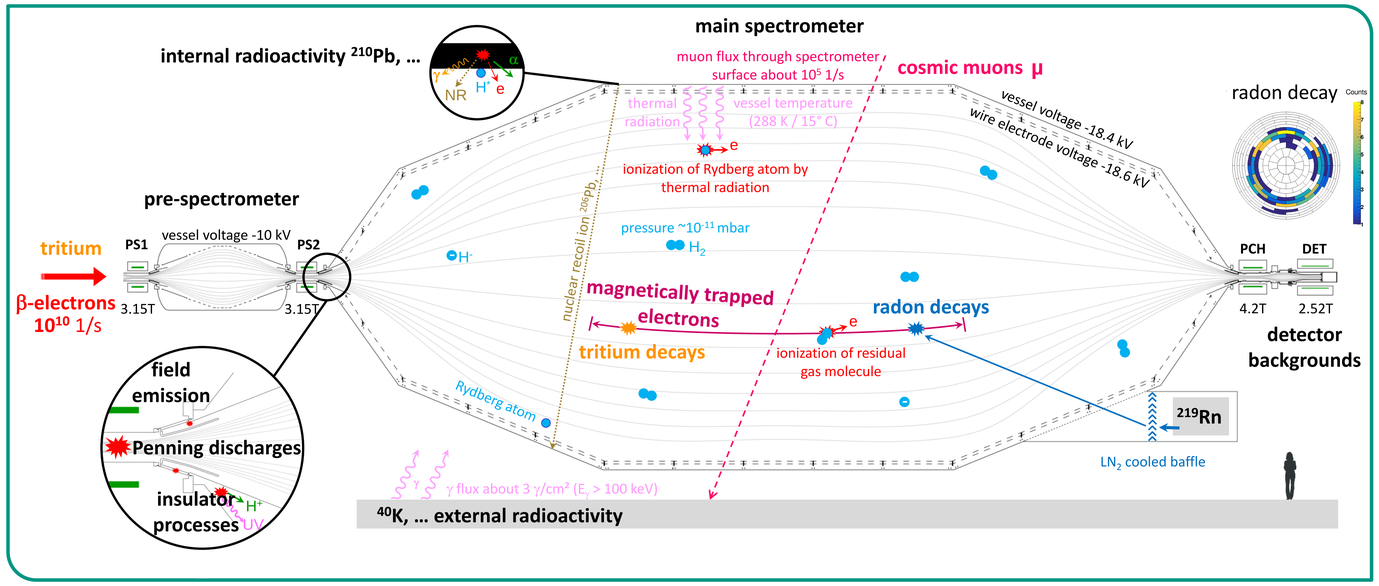
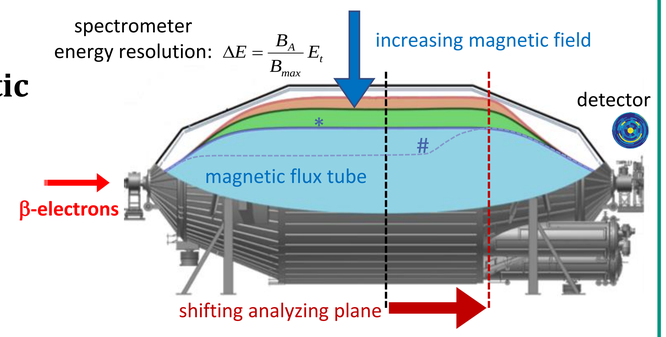
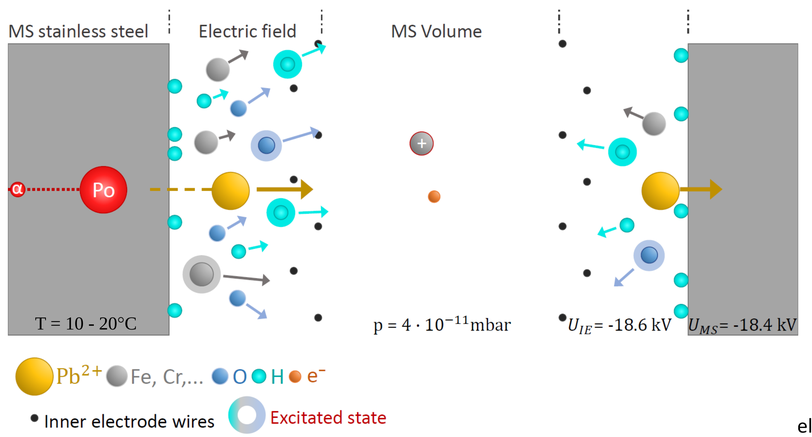


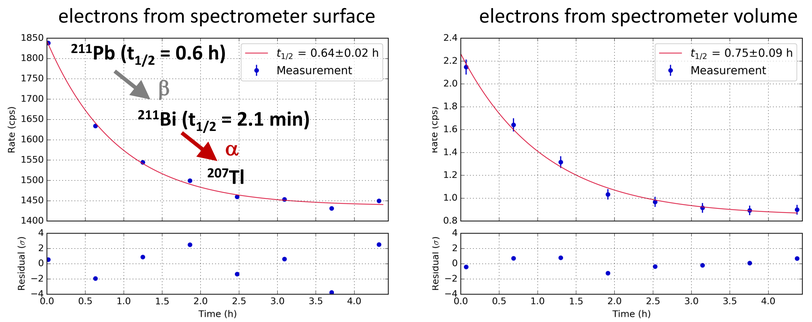
- **Background reduction via electric and magnetic field optimization**
- The Rydberg induced background depends on the flux tube volume observed at the detector

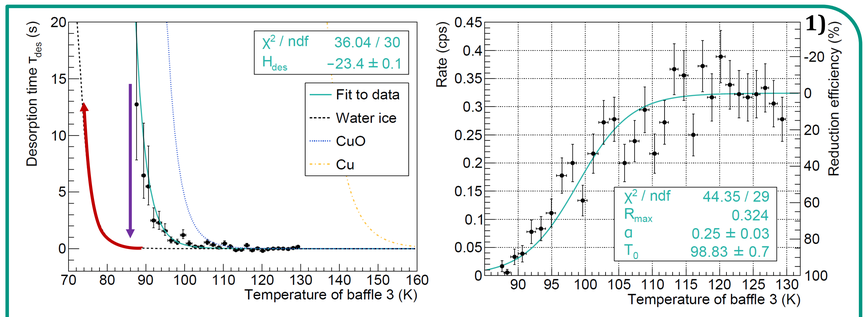


- Increasing the magnetic field reduces the background at the cost of energy resolution *
- Shifting the analysis plane downstream reduces the background at the cost of retarding potential and magnetic field homogeneity #



- **Test: artificial contamination of the MS**
- Investigate decay of activity
- strong correlation of surface and volume background electrons
- Background arises from surface process





- **Rydberg-induced background**
- α-decay of long-living ^{222}Rn progenies
- Recoil ion sputters atoms from surface, some of which in excited states
- Neutral atoms overcome electric field
- Ionization via black-body-radiation
- Magnetic guidance of electrons to detector

- **Radon retention system**: LN_2 cooled baffles capture ^{219}Rn from NEG pumps
- Strong dependence on baffle temperature
- Adsorbed water-ice on its surface decreases efficiency (purple arrow)
- Recent upgrade: pre-cooling compressor
  - Achieved stable temperature of 76K
  - Desorption time significantly increases despite water-ice

1) J. Wolf and F. Harms, AIP Conference Proceedings 1921, 060001 (2018), doi:10.1063/1.5018997

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