Systematic Effects in the Tritium Source of KATRIN

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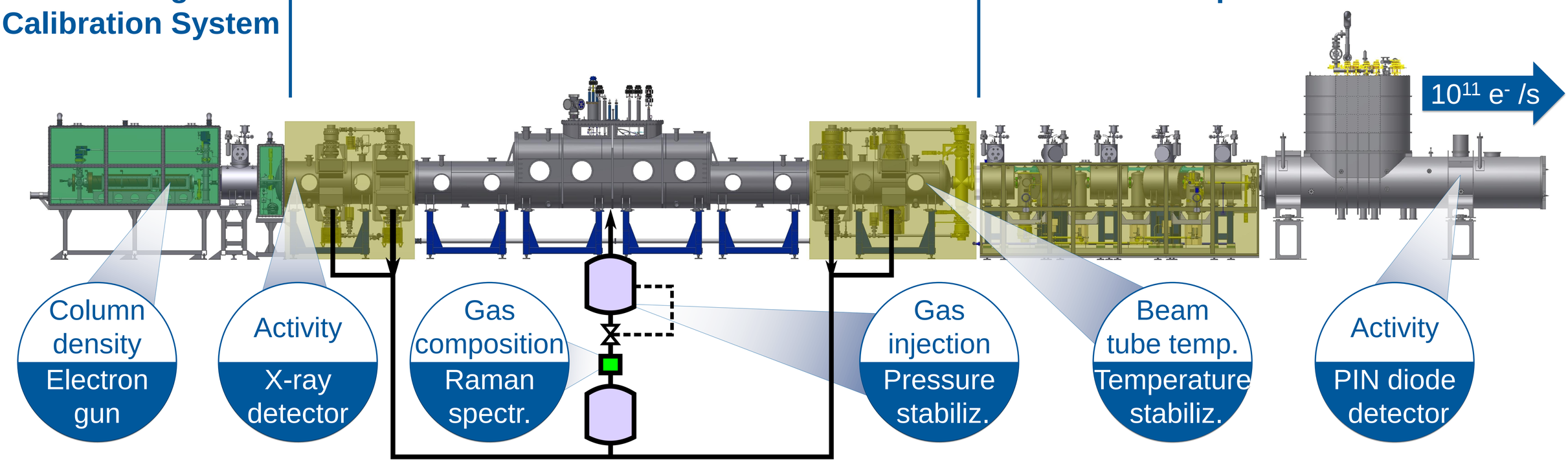
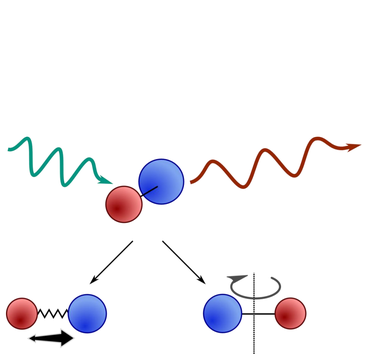
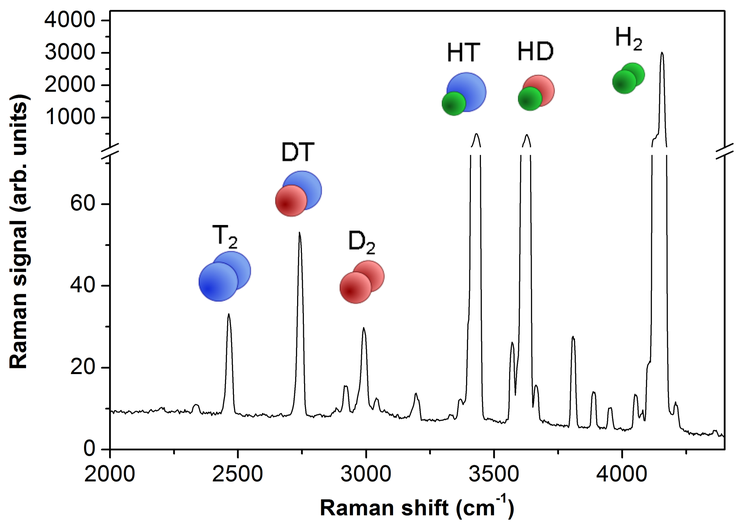
Monitoring of the KATRIN Source and Transport System



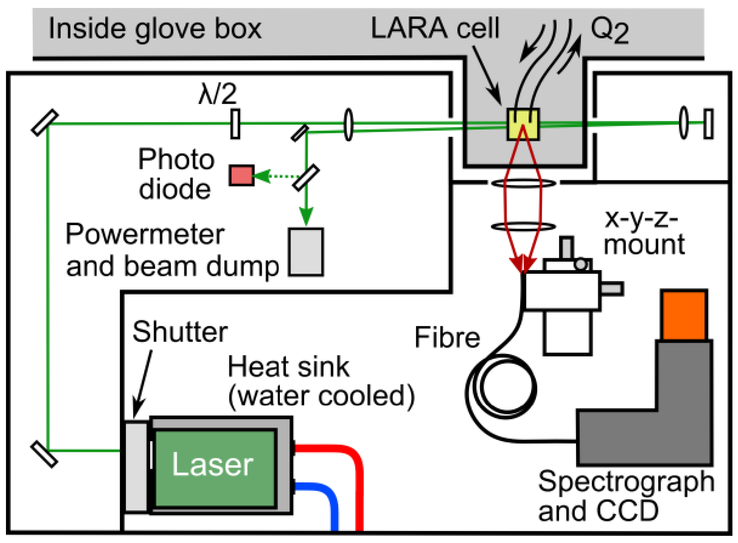
- **Challenge: Improvement of systematics by a factor of 100 compared to previous experiments**
- Closed tritium cycle: 10 kg T_2 / year
- **Monitoring of temperature, activity, gas pressure and composition on 10^{-3} level essential for target sensitivity of KATRIN (m_ν = 200 meV, 90% C.L.)**
- Achieved temperature stability: $5 \cdot 10^{-5}$
- Achieved pressure stability: $2 \cdot 10^{-4}$
- Achieved activity and composition precision : $< 10^{-3}$

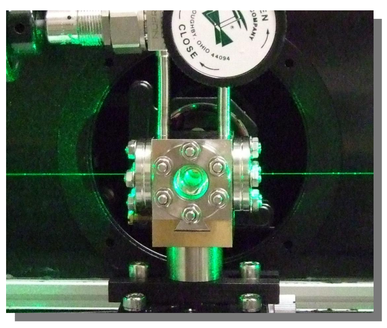
Example: Raman Spectroscopy for Measurement of Tritium Purity





- Composition measurements with 60 s sampling time
- Achieved precision better than 10^{-3}
- Calibration accuracy better than 3 %

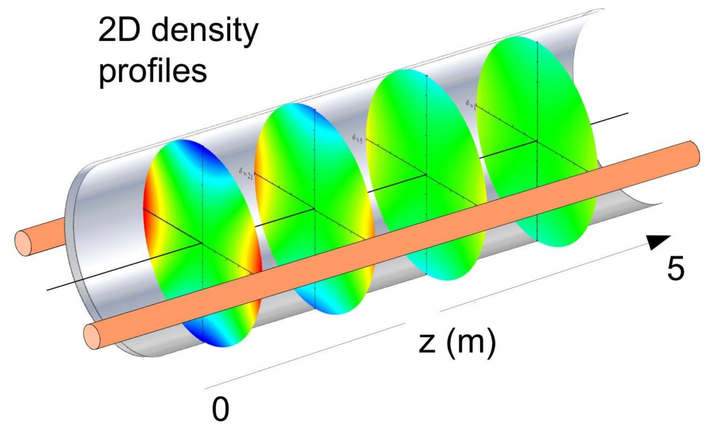




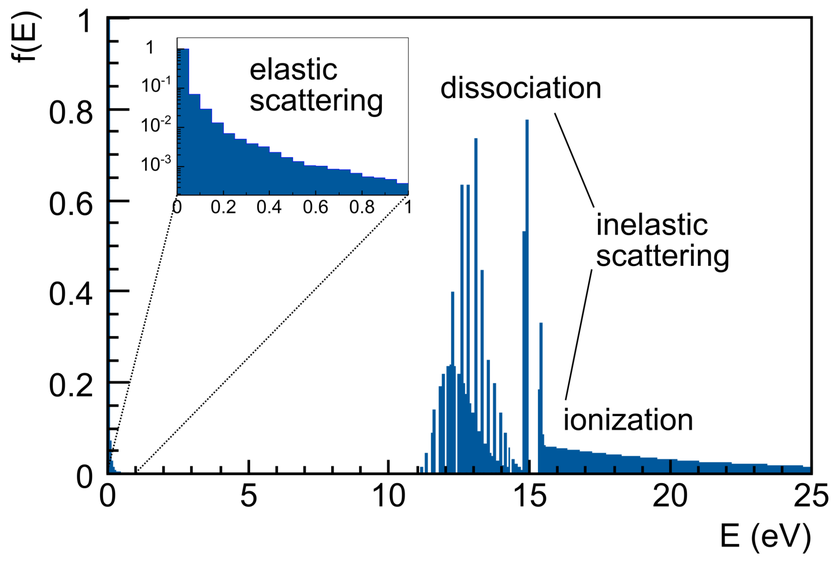
- **Successful development of monitoring system for tritium purity**
- **Important for the source modeling**

Comprehensive Description of β-Spectrum and Energy Losses

- 3D and time-resolved source model



- Energy loss function of β-electrons



- **KATRIN is able to minimize systematic effects in the neutrino mass analysis**
- Prospects of reducing source-related systematics beyond design values

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