Search for a 4th Neutrino with CeSOX

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Short Baseline Neutrino Anomalies

144Ce-144Pr

- 144Ce, detected via νe + p → e− + n (Q=1.8 MeV)
- High cross-section → read >1 PBq
- (p,ν) detected in coincidence → low background
- 144Ce-144Pr antineutrino generator
- Abundant fission product (5%)
- 144Ce: long-lived (t1/2=411 d)
- 144Pr: short-lived & Qν=1.8 MeV

144Ce Production

- Production at PA Mayak (Russia, Rosatom)
- Activity: >3.7 PBq
  - 10 kg of CeO2 (5 g/cm³)
  - 1.8 t in a double stainless steel cylinders (SFRM)
- Cylindrical W-alloy shield (16.5 g/cm³)
- Dose rate: <90 µSv/h at contact of the shield

144Pr ν-spectrum

- Measurement of f-spectrum (100 kBq 144Ce sample)
- Conversion to ν-spectrum
- Precision on interaction rate: 1%

144Pr ν-signal

νF + p → νe + n: 10000 interactions / 1.5 y / 3.7 PBq

144Ce Activity

- W-Shield in air at LNGS
  - 1000 Watt / 4.7 PBq
  - CeO2, Tmax = 450°C
  - Capsule: Tmax = 380°C
  - Shield surface: Tmax = 95°C
- Dedicated calibrator
  - H2O/CO2 = m CO2 / Tg / Tl / Tmax
  - Heat loss: Tamb = 1 Watt
  - Measure (<1% error)
    - Water T° inlet
    - Water mass flow

Logistic

- AREVA TN-TMR cask
  - Type BU(U) certified by IAEA
  - Extension of licensing for 144Ce + W-shield ongoing
  - Cask booked for 11/2015
- Route (AREVA TNI)
  - Train to Saint Petersburg
  - Boat to Le Havre
  - Truck to LNGS

Sensitivity

- 144Pr: 8 allowed or 1st forbidden transitions
- Measurement of f-spectrum (100 kBq 144Ce sample)
- Precision on interaction rate: 1%

CeSOX clean room for 144Ce production and activity measurement