# Consistency check of Pulse Shape Discrimination for BEGe Detectors

**Outline:**

- **Motivation**
- **Data Analysis**
- **Outlook & Summary**


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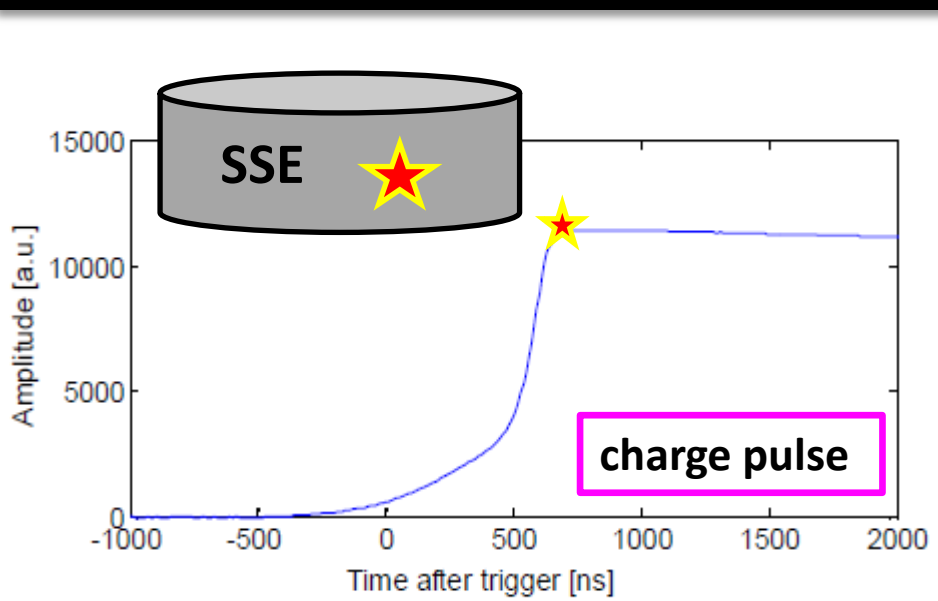
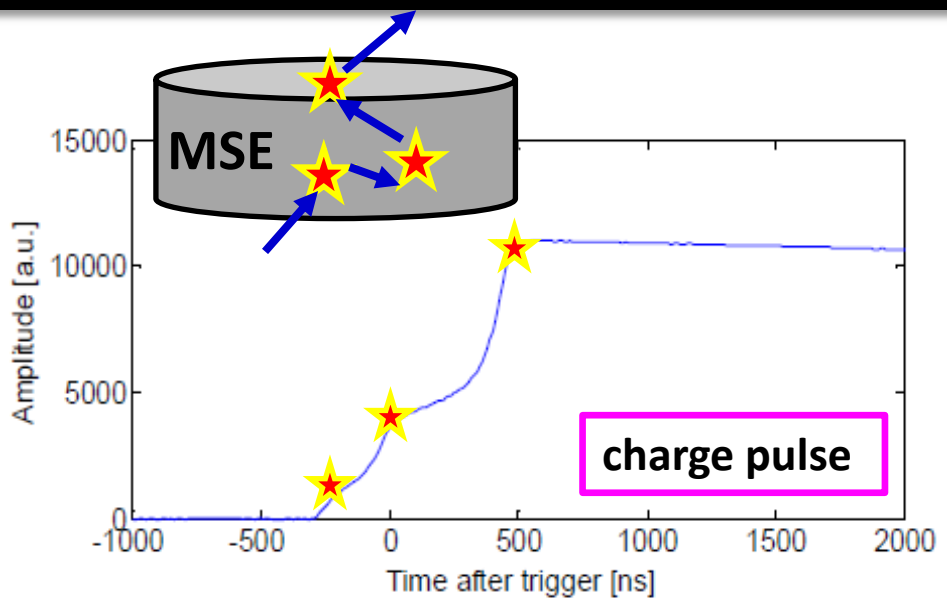
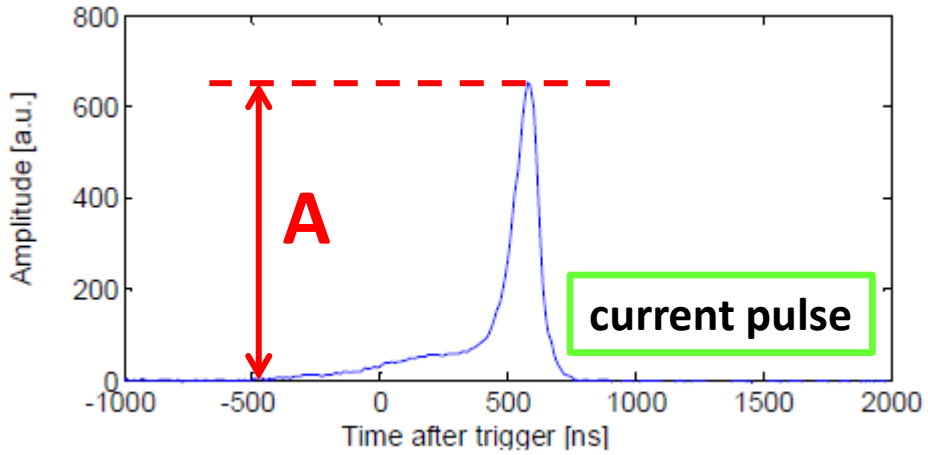
# Motivation

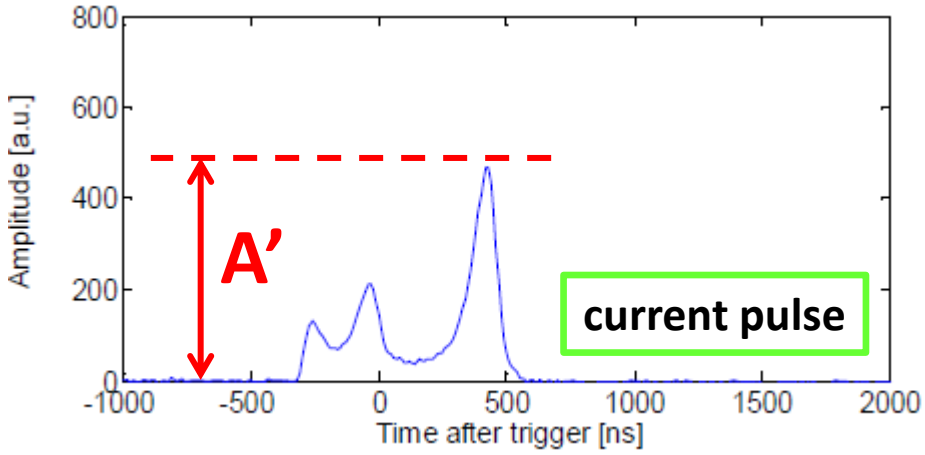
- GERDA: Searching for 0νββ decay
- Background recognition utilizing PSD method
- Define PSD parameters for SSE/MSE discrimination using calibration data
- Event topology & event location distribution :
  - 0νββ ≅ 2νββ except E dependence
  - Calibration ?= 0νββ
- Investigate systematic uncertainty due to event topology & event location on PSD
- The method:
  Comparison of PSD for 2νββ/calibration data

# A/E : Pulse Shape Discrimination Method



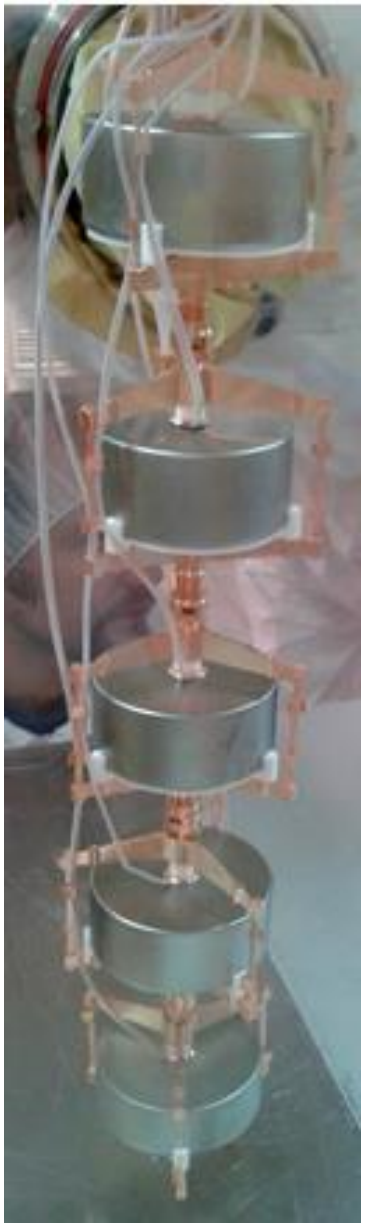




Dušan Budjaš et al, JINST 4 P10007, 2009

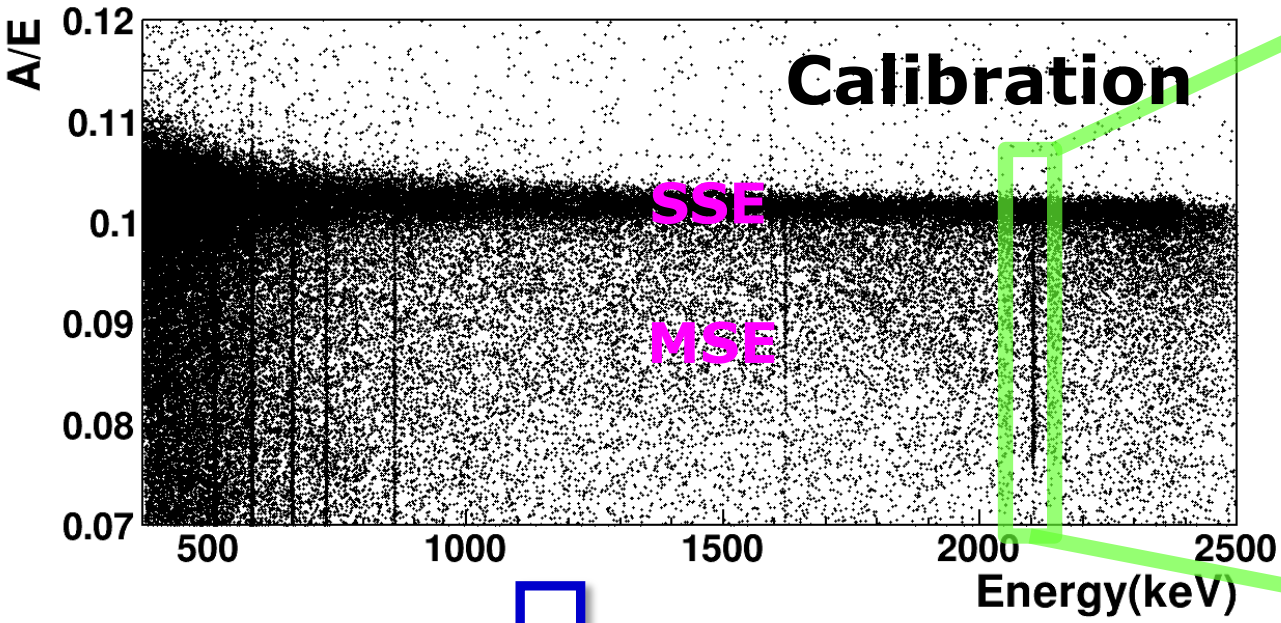
- **A/E PSD method:**
  **Use "Ratio of Maximum Amplitude to Energy"**
  **for discriminating SSE/MSE**

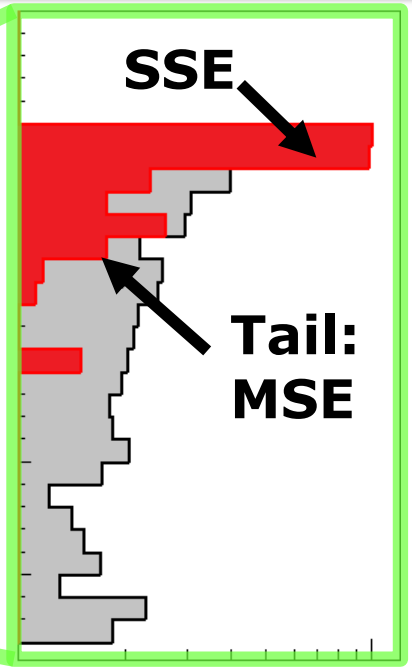
# Pre-test mode for GERDA Phase-II

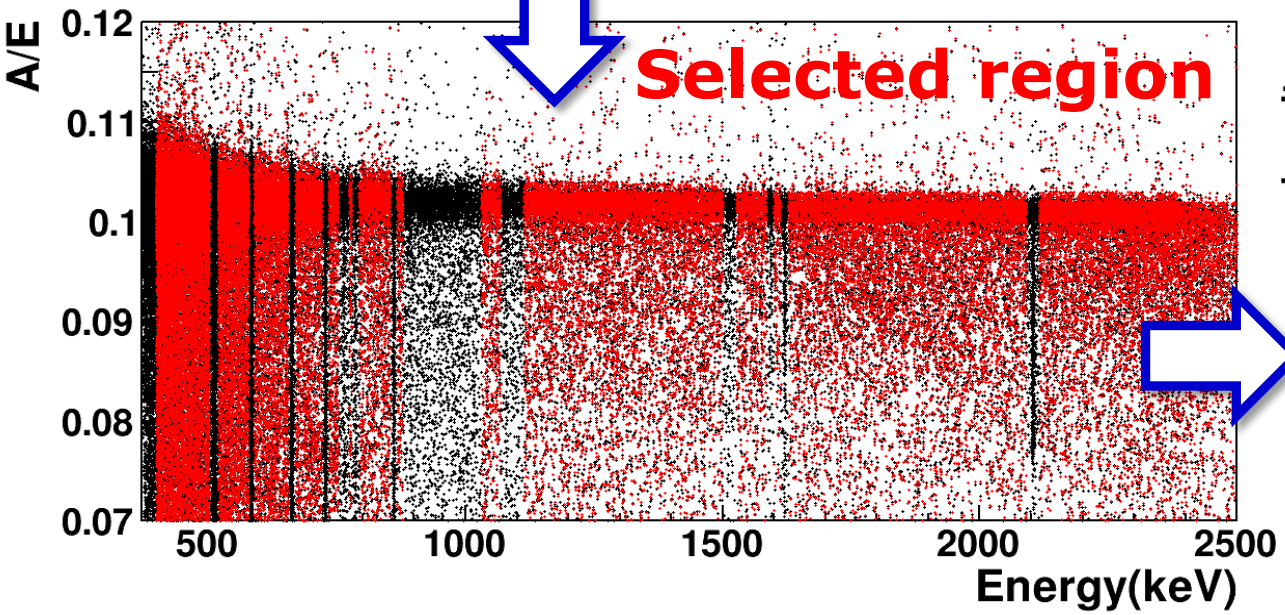


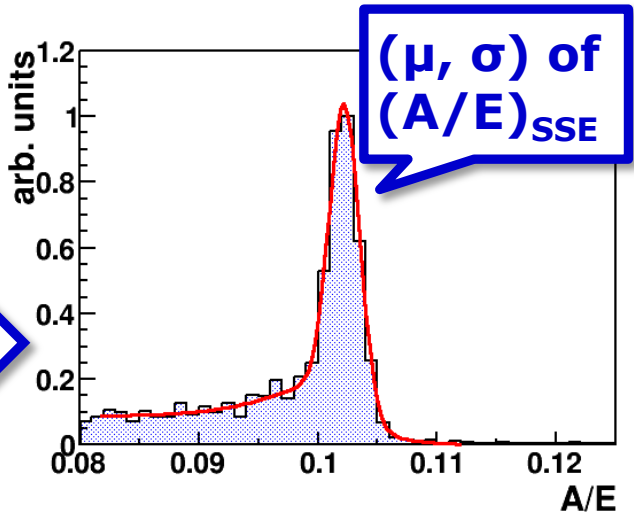
- GERDA Phase-I using 6 coaxial $^{enr}$Ge detectors
- Pre-test mode for Phase-II: Additional 5 $^{enr}$BEGe detectors
- Advantages of BEGe detectors:
  - ΔE < 3.0keV @ 2.6 MeV
  - Powerful PSD: A/E parameter
- Total mass of $^{enr}$BEGe detectors:
  - 3.6 kg
- Data taking: Since July, 2012
- Exposure:
  - 2νββ: 1.51 kg·yr
  - Calibration: 88.04 kg·hr

# SSE for calibration data

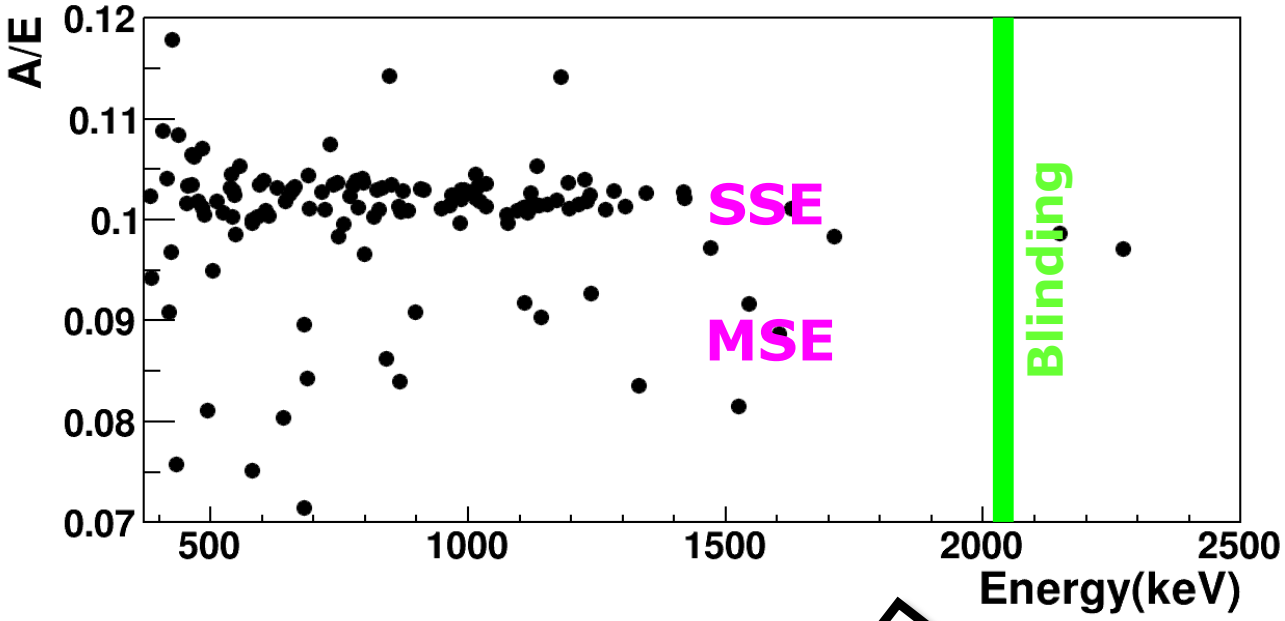


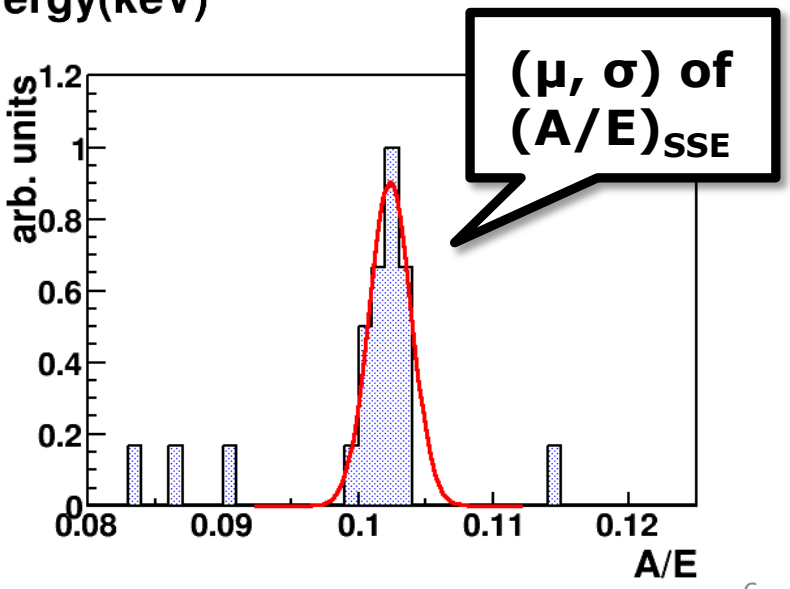



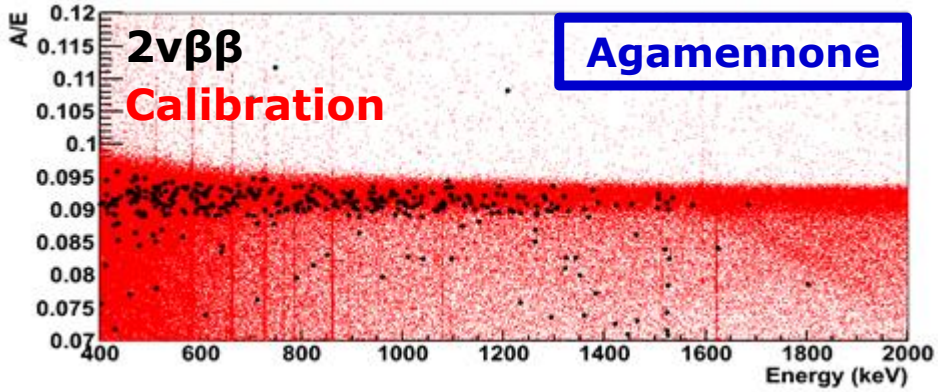
# SSE for 2νββ data

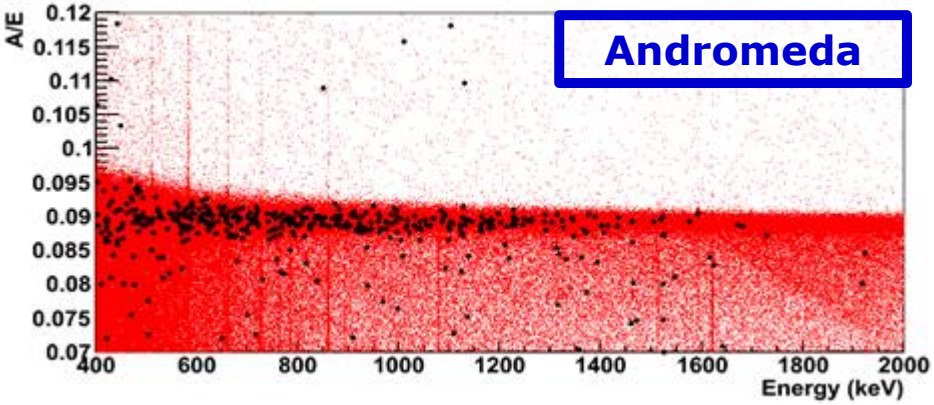


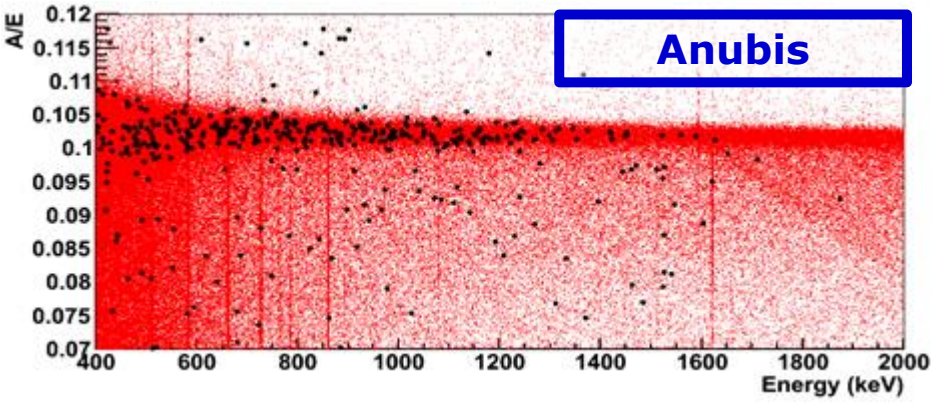



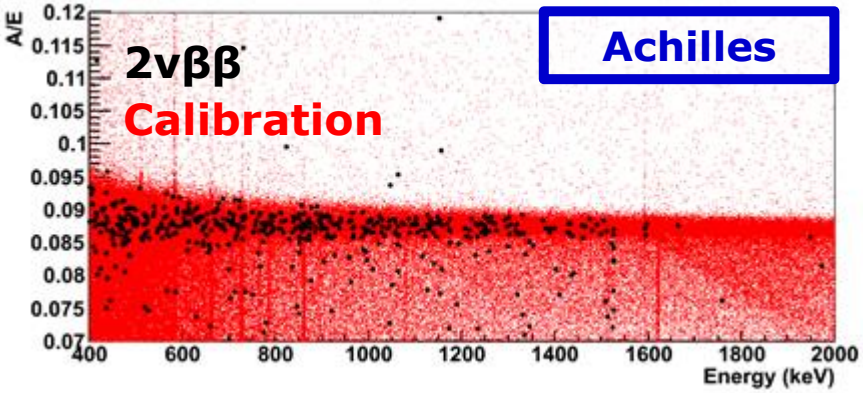

- **Energy region for consistency check : 600 keV - 1.2 MeV, ΔE = 200 keV**

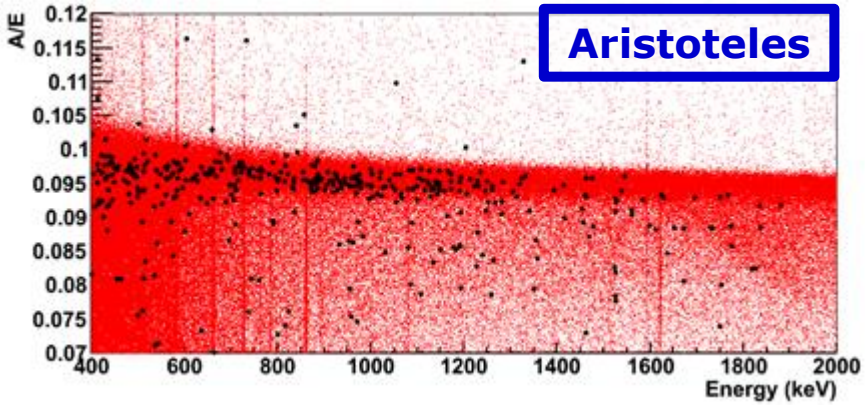
# A/E-versus-E for 2νββ/calibration data



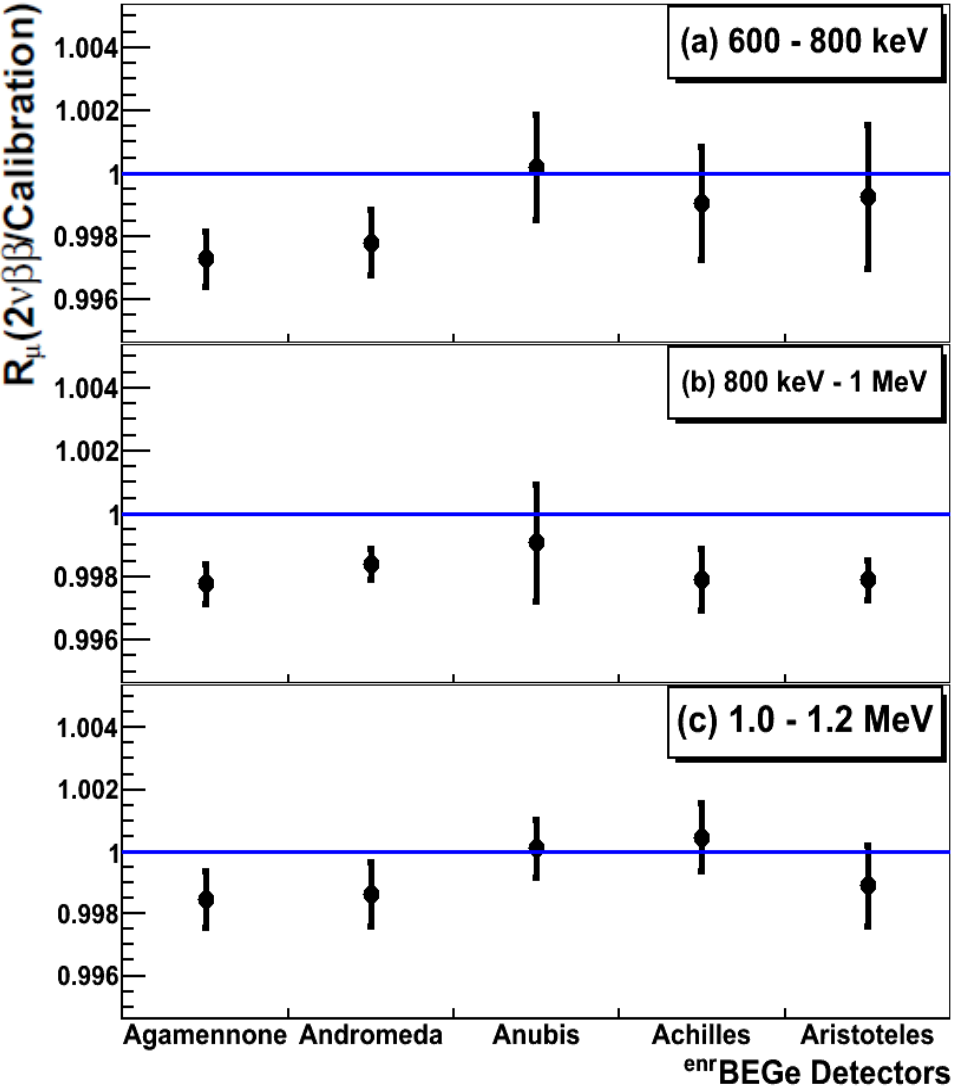



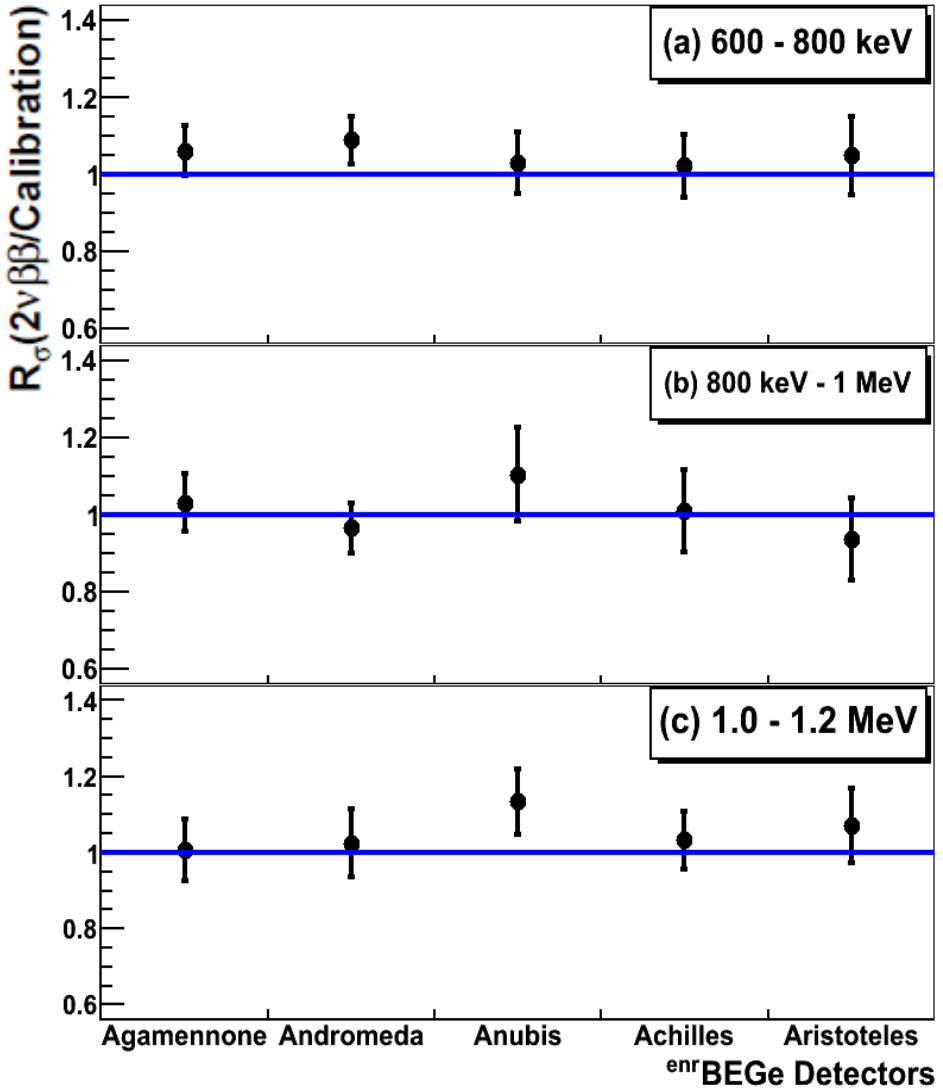



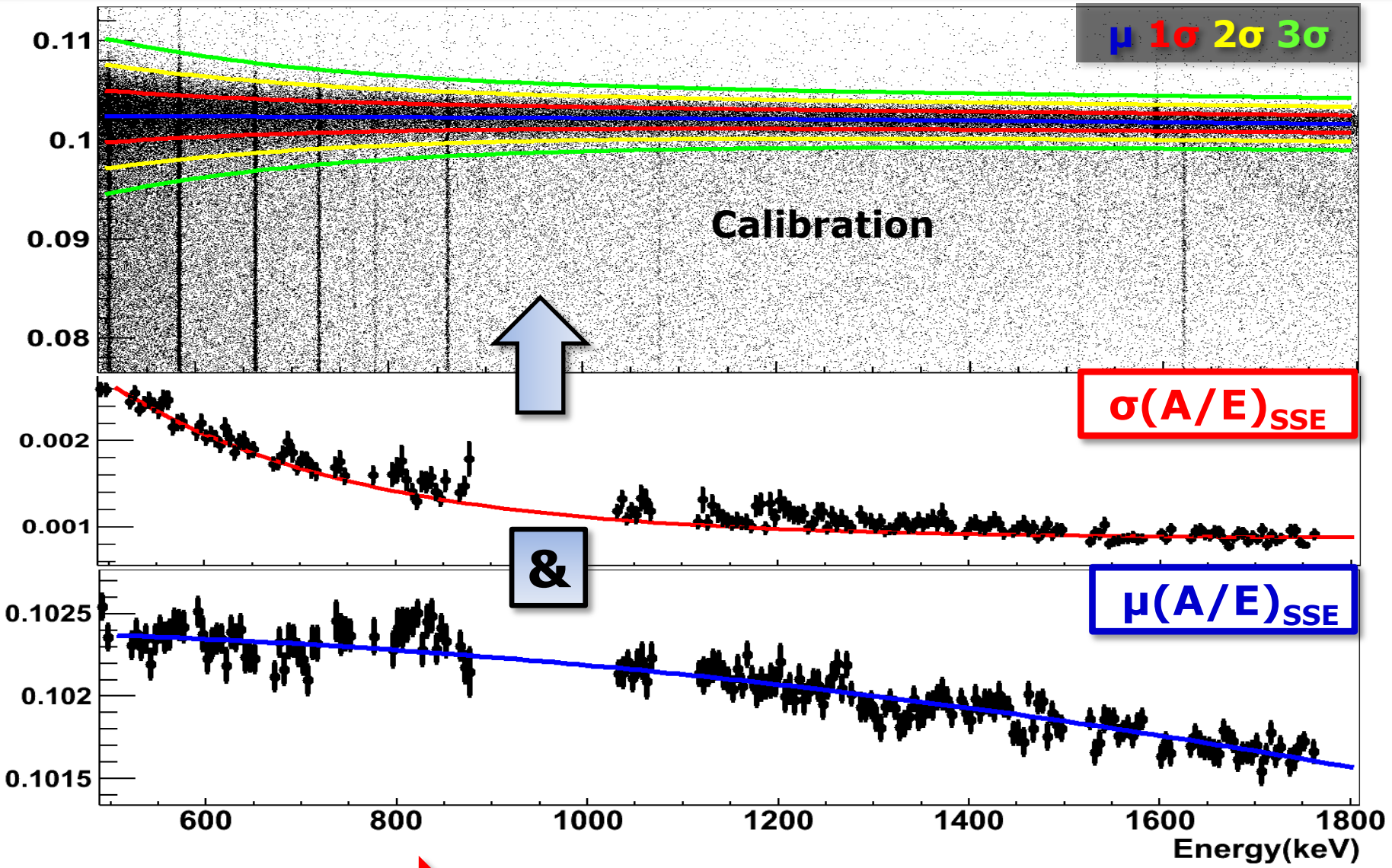
# Consistency check for two methods




➢ **No systematic uncertainty of A/E was found!**

# A/E Resolution as function of Energy




➢ A/E (E) ➡ Improvement in recognition efficiency of SSE/MSE

# Outlook & Summary

- **PSD can improve sensitivity for 0νββ experiments**
- **A/E for BEGe provides powerful SSE/MSE pulse shape recognition efficiency**
- **Topological & event location difference between 2νββ/calibration data**
- **Deviations between methods dominated by statistical uncertainties**
- **Possible improvement in recognition eff. of SSE/MSE by A/E(E)**