



# LArGe@MPIK:

Latest results of the LAr scintillation investigations

for the LArGe@GS / GERDA purposes

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GERDA meeting, Milano, 13 -15 November 2006

# Contents

## 1. Common Introduction

(for 3 (+1) talks about progress in scintillation detection with LArGe@MPIK)

## 2. Gamma spectrometry with LArGe@MPIK

# Conclusion of the Conclusions

(GERDA meeting, LNGS, 26th-28th June 2006)

- It was shown that the **LAr scintillator** is a powerful tool to be used in GERDA as:
  1. **Gamma spectrometer** with large active volume (for direct measurement of gamma background inside the GERDA facility)
  2. Large volume **Neutron detector** ( spectrometer) (for direct measurement of neutron background and neutron – gamma delayed (anti-) coincidence inside the GERDA facility)
  3. **Radon detector** ( alpha-spectrometer) (for direct monitoring of Radon (Thoron) inside the GERDA facility)

3 + 1  
talks

Introduction

LArGe@MPIK  
as **Gamma spectrometer**  
**/Active shield**

A.Smolnikov

LArGe@MPIK  
as **Neutron detector**  
**/n- flux monitoring**

S.Vasiliev

LArGe@MPIK  
as **Alpha spectrometer**  
**/Radon detector**

Conclusion

P.Pieffer

LArGe@MPIK ⇒ LArGe@GS

⇒ GERDA

Status  
of  
**LArGe at LNGS**  
and plans

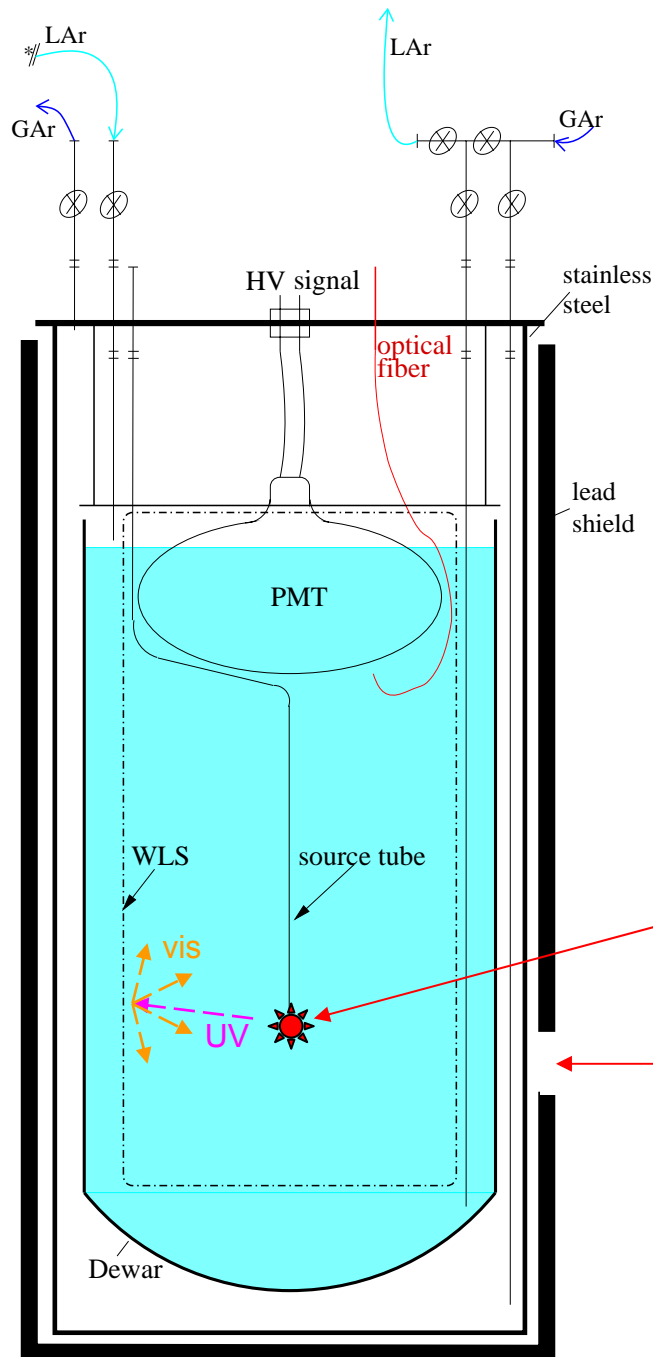
**Main conclusion**

S.Schoenert

# Introduction

# LArGe@MPI-K:

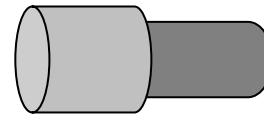
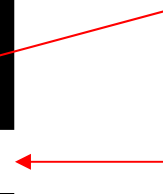
## Schematic system description



- Dewar  $\varnothing$ 29 cm, h=65 cm (43 L – total volume)
- Light detection: WLS (VM2000 + PST/TPB) + PMT(8", ETL 9357-KFLB)
- Active volume  $\varnothing$ 20 cm, h=43 cm  $\approx$  19 kg LAr (13,5 L)
- Shielding: 5 cm lead (+ 10 cm BP for n) +15 mwe underground

Measurements:

Internal source



Nal – detector used for:

- 1) coincidence measurements;
- 2) reference measurements.

External source

# LArGe@MPIK set-up



1. Our goals **for the June – November 2006 period**

2. Where we were **in June'06**

(GERDA meeting, LNGS, 26-28 June 2006)

and where we are **in November'06**

(GERDA meeting, Milano, 13 -15 November 2006 )

3. What has been done **for the June – November 2006 period ?**

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4. Which more important results have been obtained ?

5. Are we ready to go from **LArGe@MPIK** test facility

to:  $\Rightarrow$  **LArGe@GS** pilot set up  $\Rightarrow$  **GERDA** ?



## 4. Which more important results have been obtained ?

1. **Test of long term stability** of the scintillation part of LArGe@MPIK set up for at least ½ year of operation. **-done - Stable for at least ½ year**

2. **Improvement of: -done**

light yield - **↑ at least 3 times**

/ energy resolution - **↓ ~ 2 times**

/ pulse shape - **improved**

/ signal to noise - **improved**

/ energy threshold - **↓ ~ 2 times**

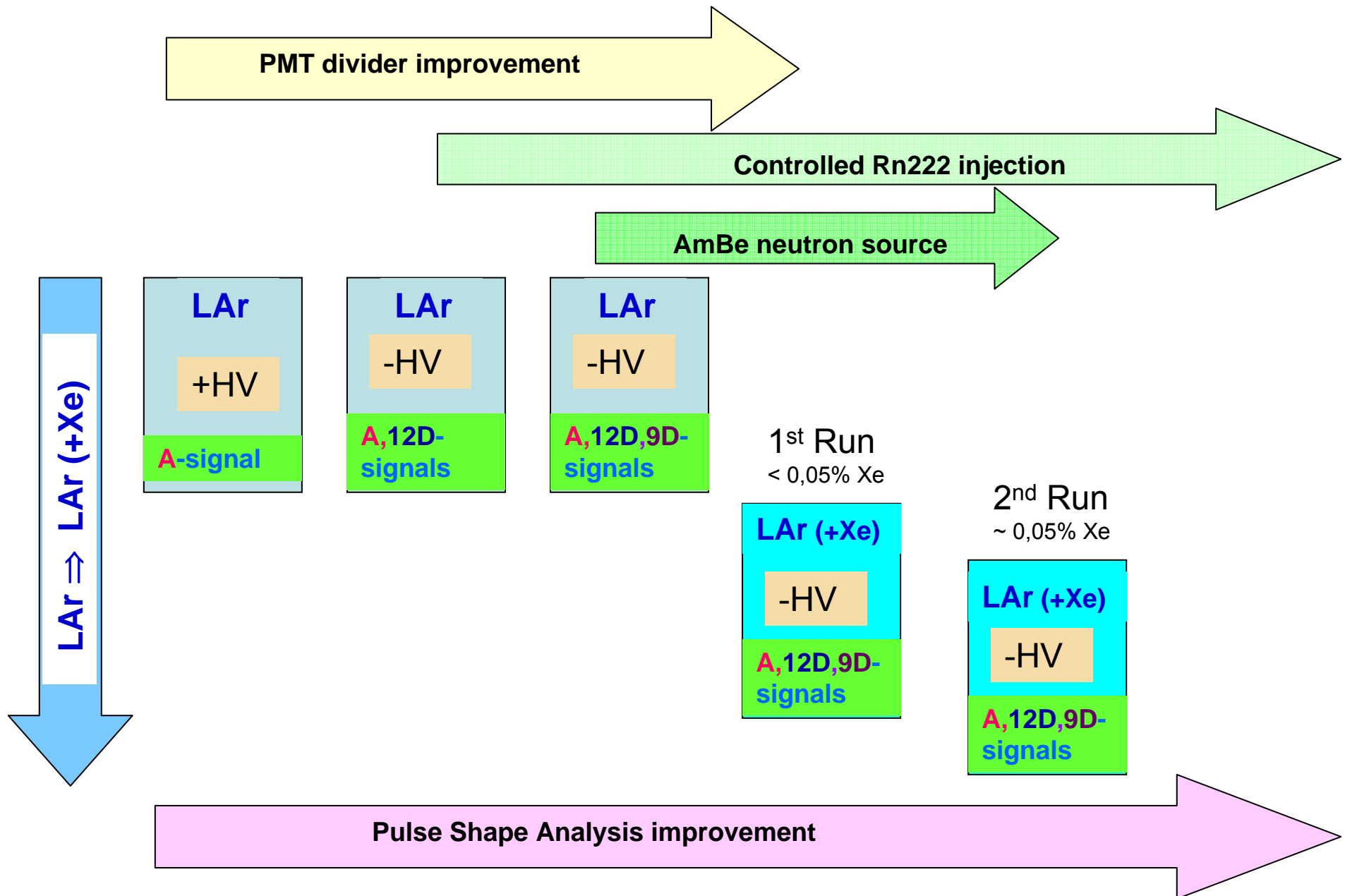
/  $\gamma\beta$  -  $n$  -  $\alpha$  selection - **in progress**

3. **Estimation of Rn222 detection sensitivity - in progress**

5. Are we ready to go from LArGe@MPIK test facility

to:  $\Rightarrow$  **LArGe@GS pilot set up**  $\Rightarrow$  **GERDA ? - Yes**

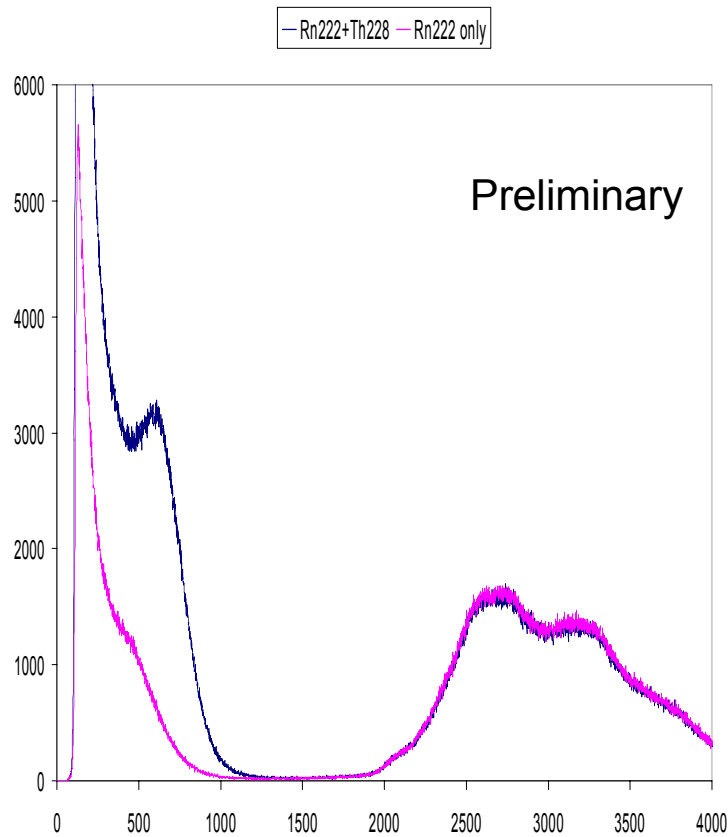
### 3. What has been performed ( June – November 2006)



Where we were in June'06

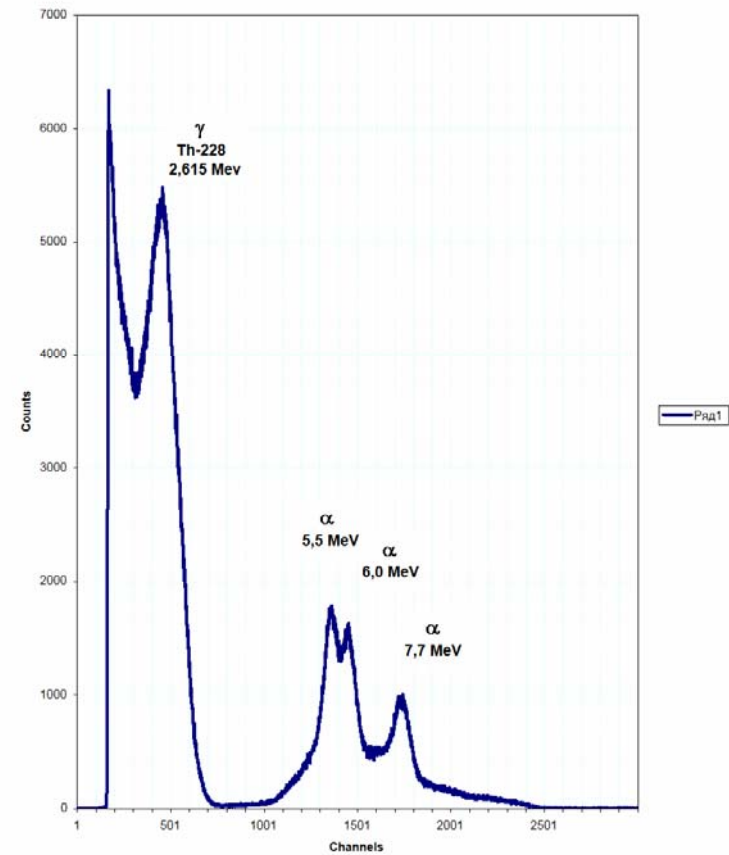
and where we are in November'06

**$^{222}\text{Rn} + ^{228}\text{Th}$  spectrum**  
(GERDA meeting, LNGS, 26th-28th June 2006)



**November'06**

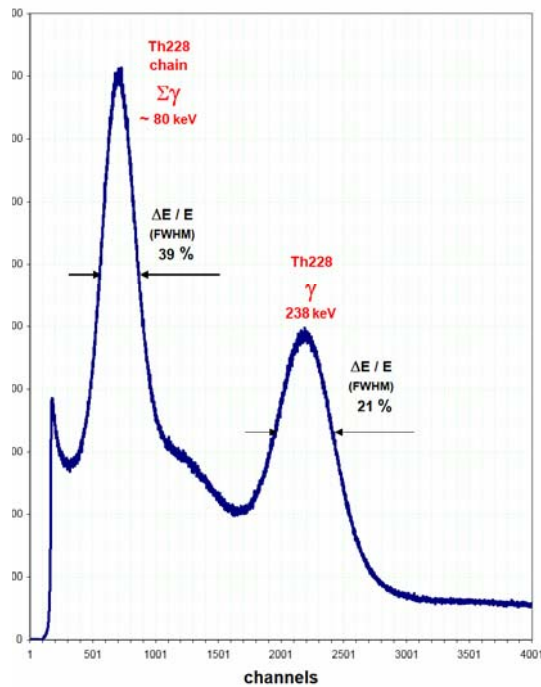
**$\text{Rn}^{222} + \text{Th}^{228}$  (3 kBq inner)**  
**in L-Ar test facility**  
(- 1520 HV, anode output)



# LArGe@MPIK as Gamma-spectrometer

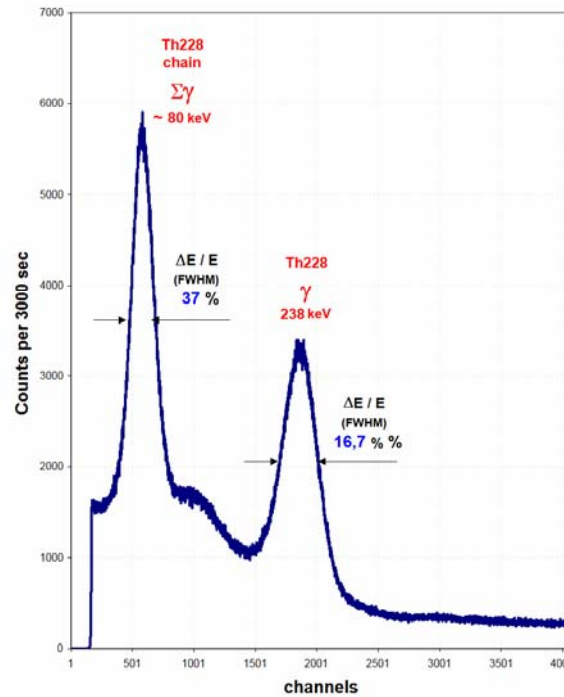
## LAr

Th228 internal source (3 kBq)  
 Amplification = 200 x0,683  
 Spectrum accumulated with MCA



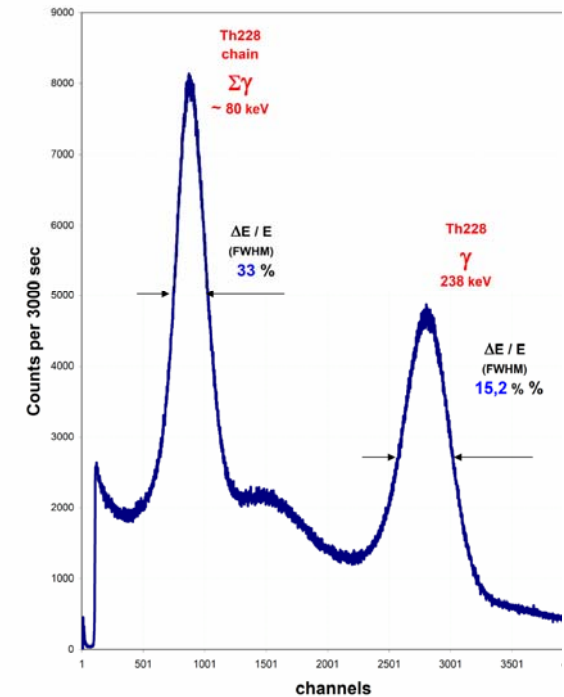
## L(Ar + Xe)

Th228 internal source (3 kBq)  
 Amplification = 100 x0,683  
 Spectrum accumulated with MCA

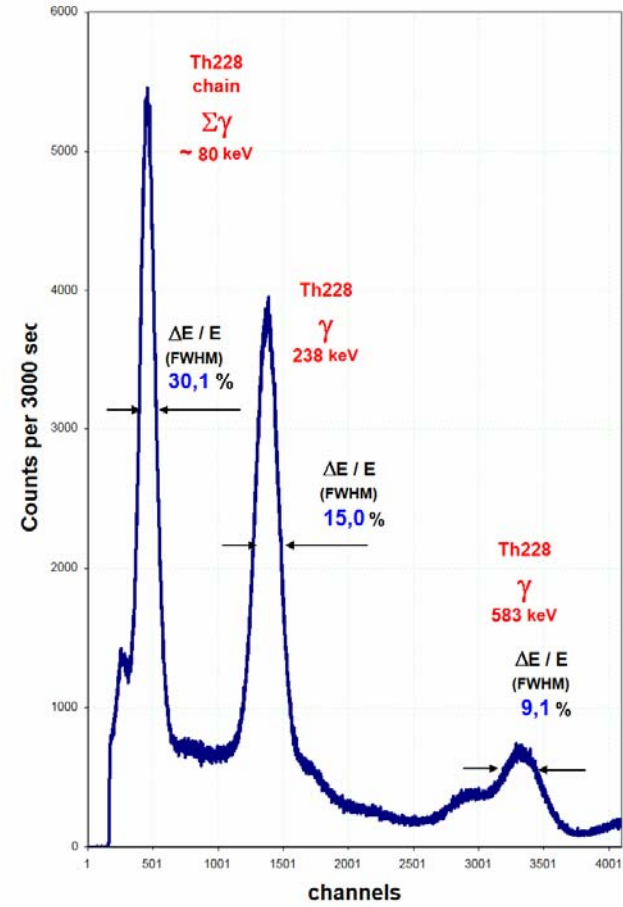
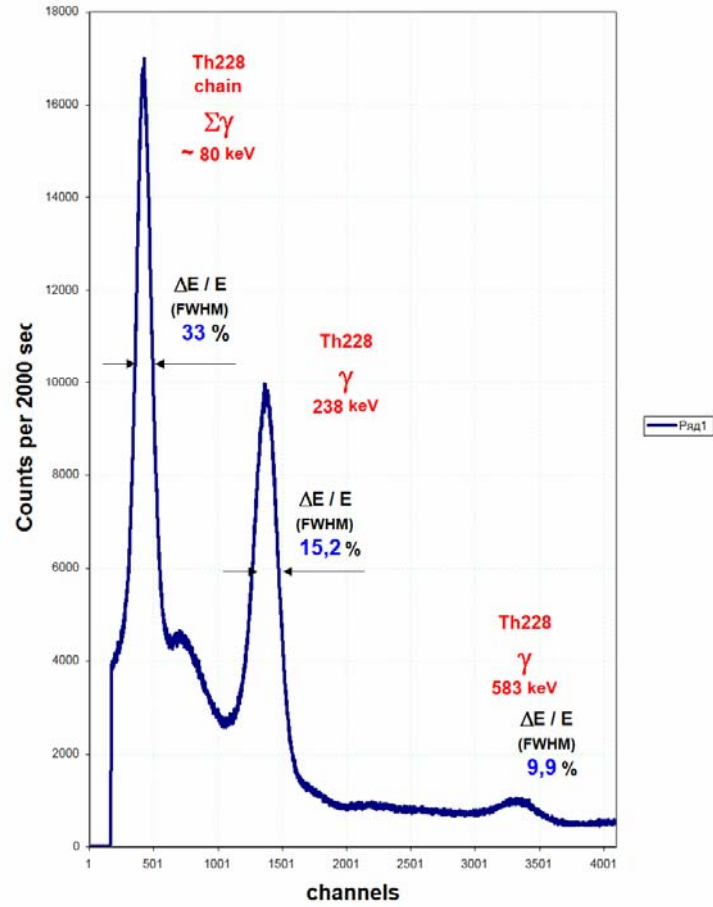


## L(Ar + Xe) - Last Run

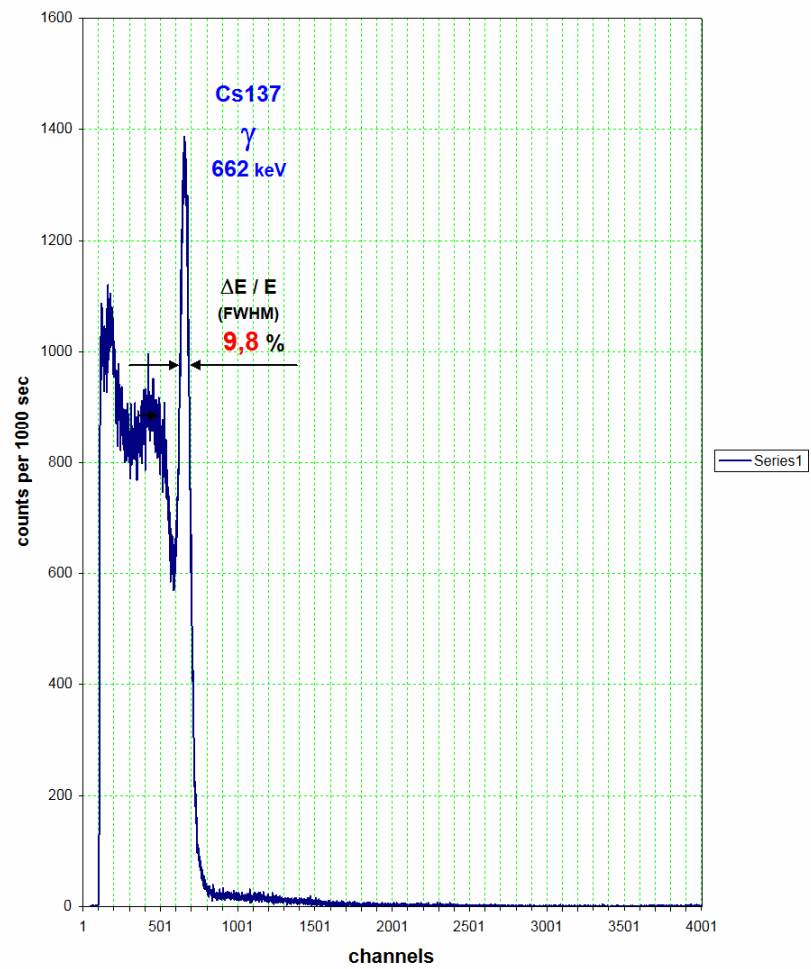
Th228 internal source (3 kBq)  
 Amplification = 100 x0,683  
 Spectrum accumulated with MCA



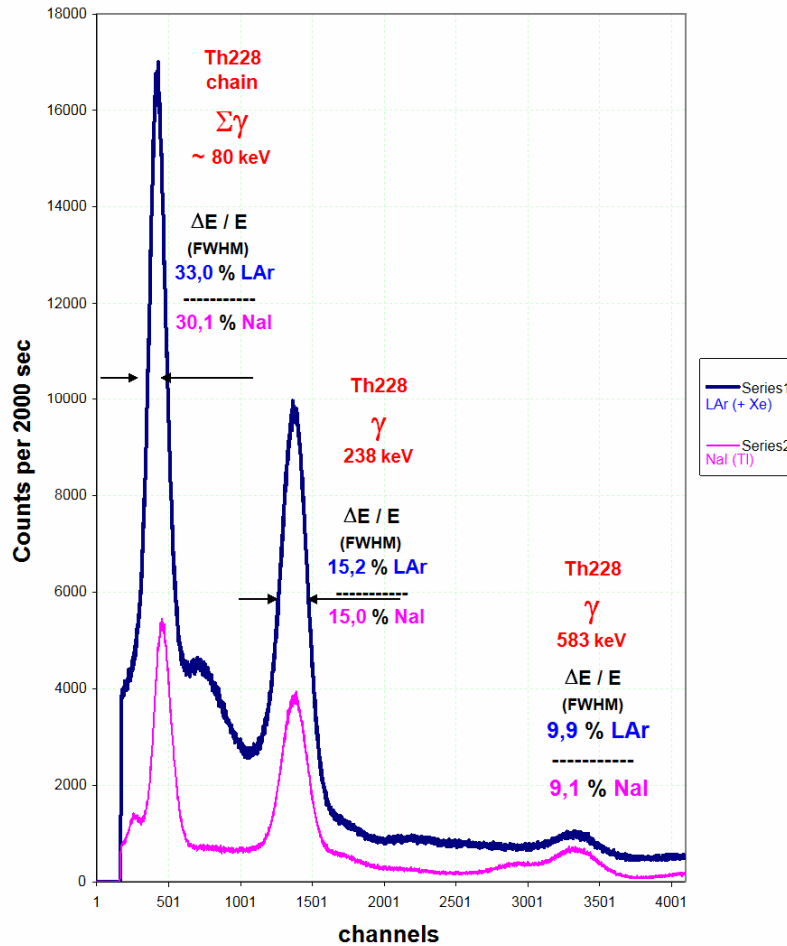
L(Ar + Xe)  
 Th228 internal source (3 kBq)  
 Amplification = 50 x0,683  
 Spectrum accumulated with MCA



LAr(+Xe)  
Cs137 internal source  
Amplification = 10 x0,683  
Spectrum accumulated with MCA



LAr (+ Xe) vs NaI (TI)  
Th228 source (3 kBq)  
Amplification = 50 x0,683  
Spectrum accumulated with MCA



Instead of

Conclusion

for the **Gamma spectrometry part**

For LArGe@MPIK

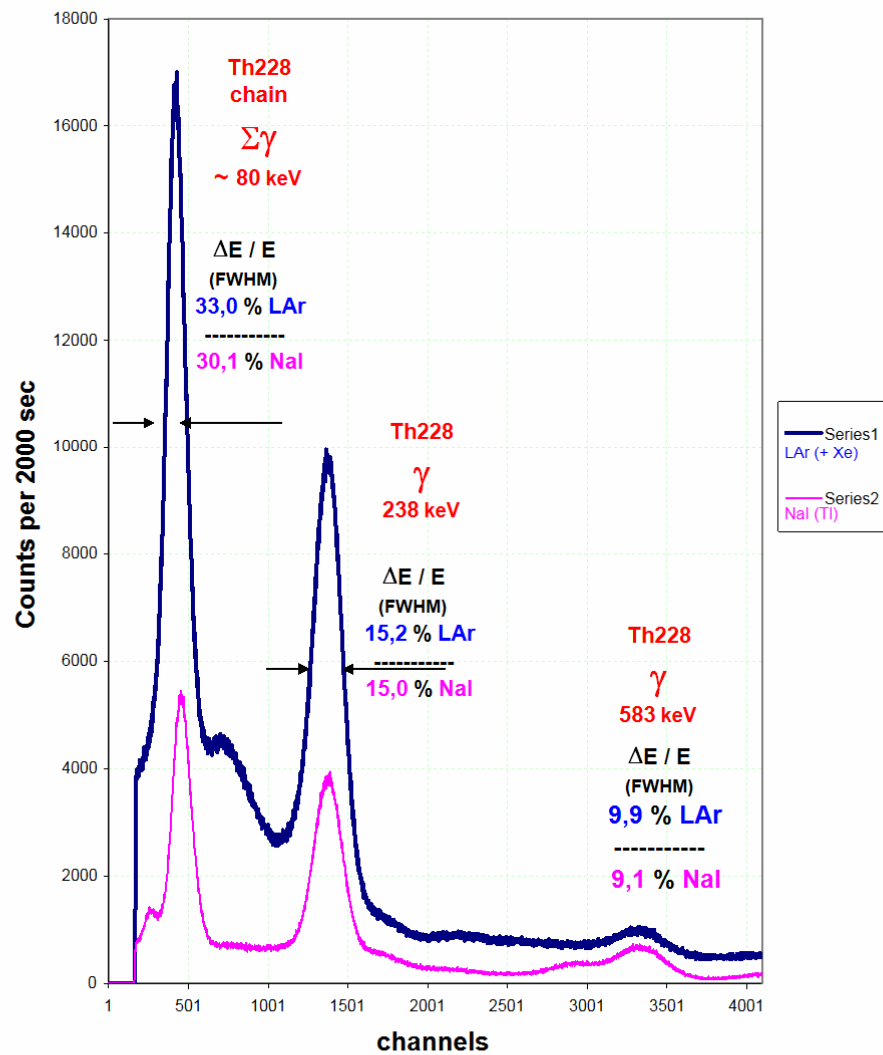
Energy resolution **7,5 % at 1 MeV**

comparable

with NaI detectors

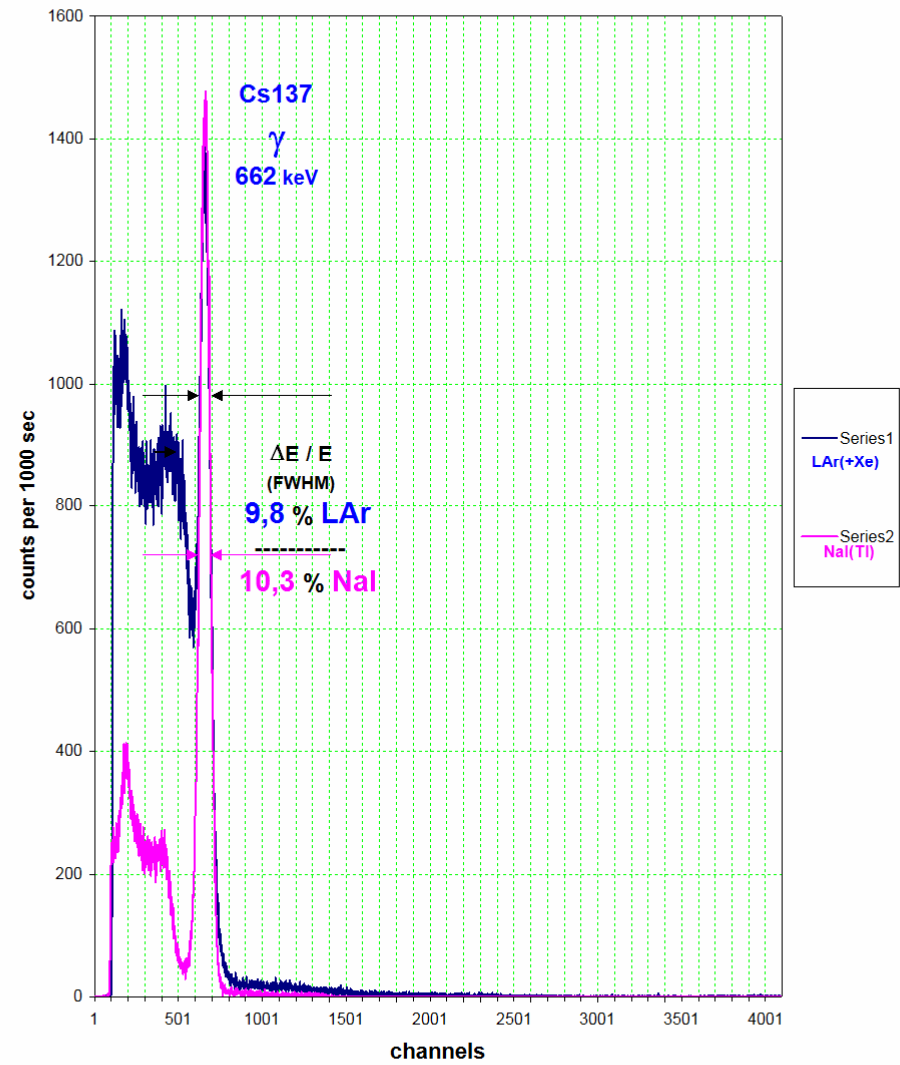
**is achieved !**

LAr (+ Xe) vs NaI (TI)  
Th228 source (3 kBq)  
Amplification = 50 x0,683  
Spectrum accumulated with MCA

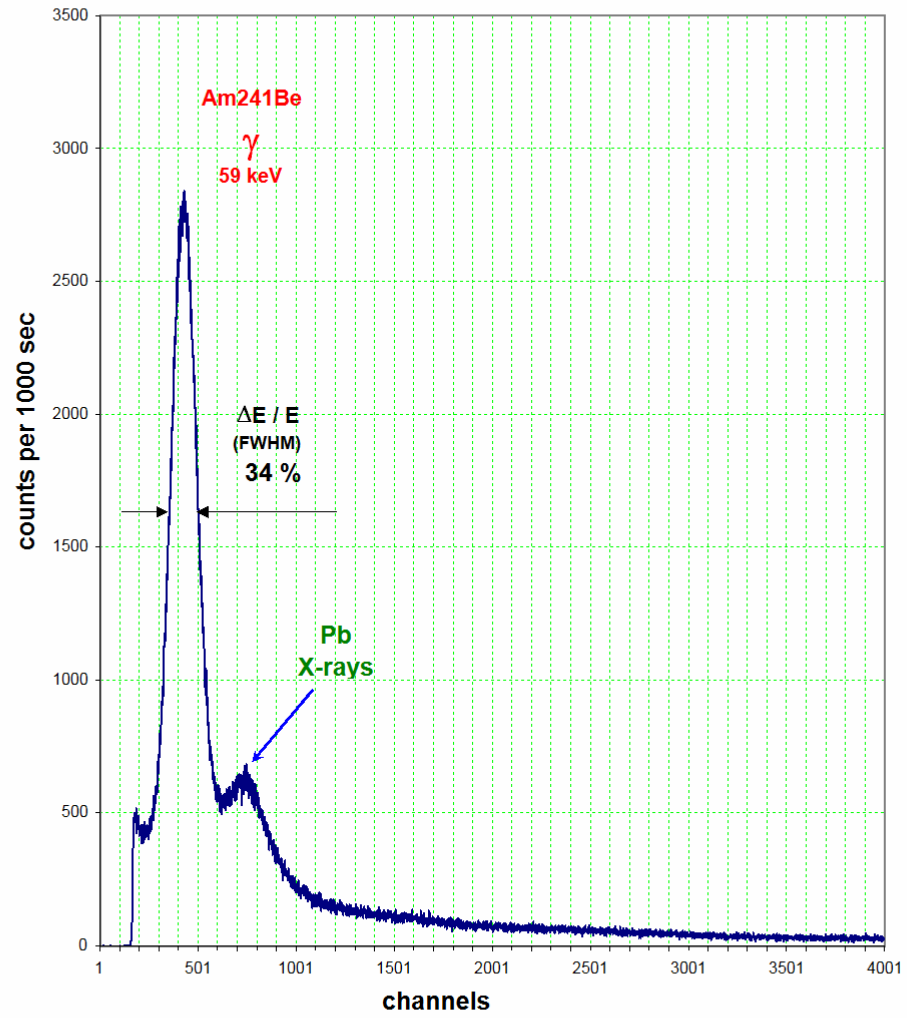




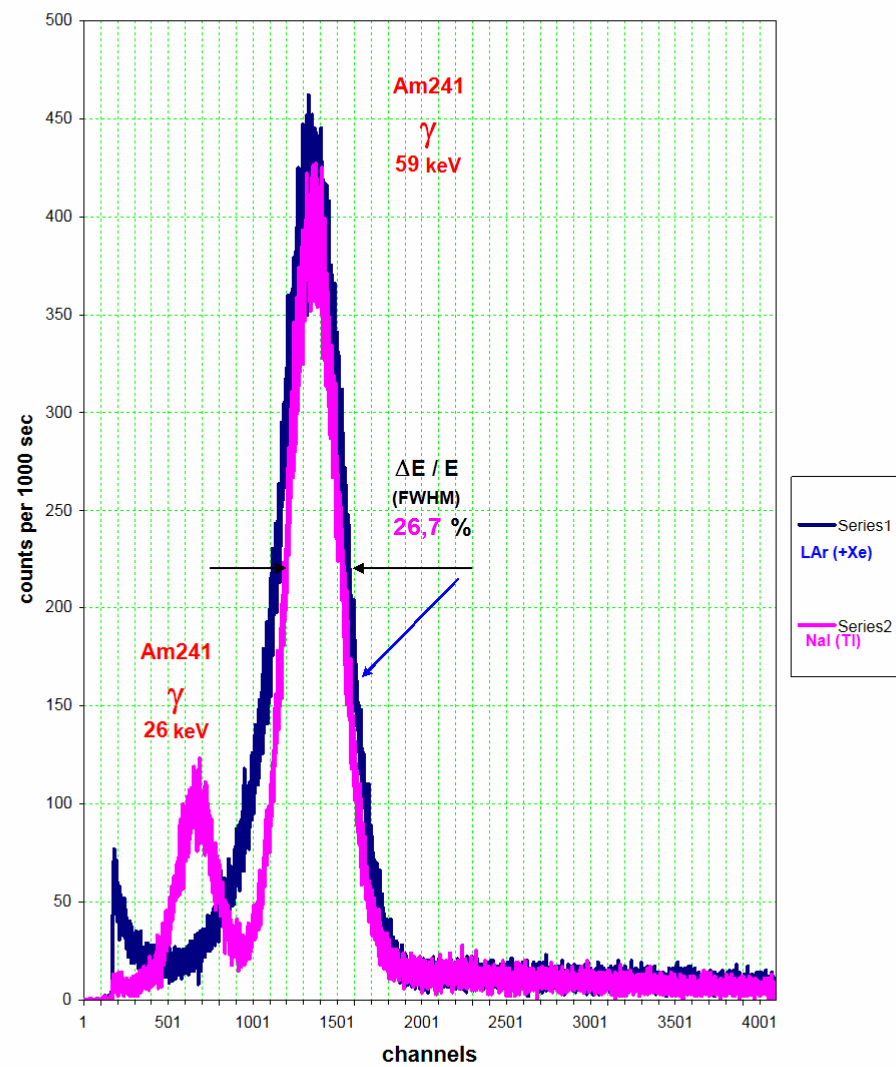
**LAr(+Xe) vs NaI(Tl)**  
Cs137 internal source  
Amplification = 10 x0,683  
Spectrum accumulated with MCA



L(Ar + Xe)  
Am241Be external source (in window)  
Amplification = 100 x0,683  
Spectrum accumulated with MCA



LAr (+Xe) vs NaI (TI)  
Am241 internal source (  
Amplification = 200 x0,683  
Spectrum accumulated with MCA



**LAr (+Xe) vs LAr**  
Am241 internal source (  
Amplification = 200 x0,683  
Spectrum accumulated with MCA

