Neutrons in PWO

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Motivation Motivation

- The full energy deposit of an EM-shower reflects the kinetic energy of the initiating particle ($e^{\pm}$, photons),
- The read-out signal for hadrons in scintillators is non-linear and typically smaller than for $e^{\pm}$ or photons with the same particle energy,
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- **What neutrons do in the PWO?**

The Neutron Source The Setup

The Svedberg Laboratory, Uppsala, Sweden

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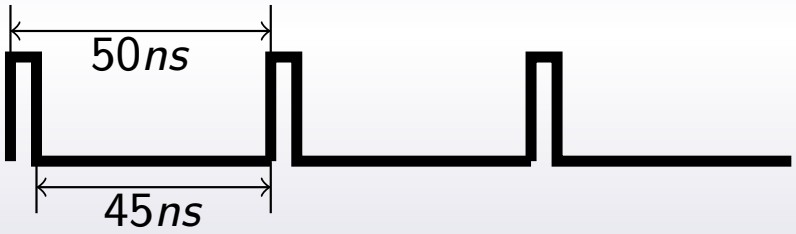

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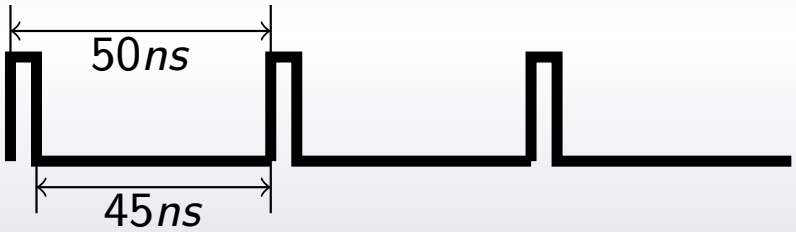

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  - 20mm collimator
  - $\rightarrow$ 55 neutrons/cm^2/s

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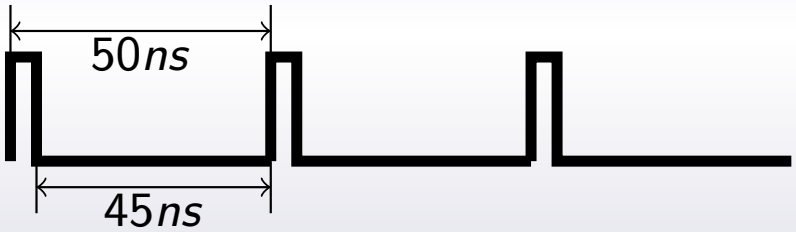

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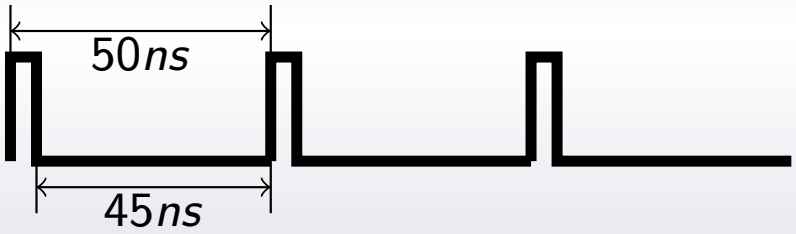
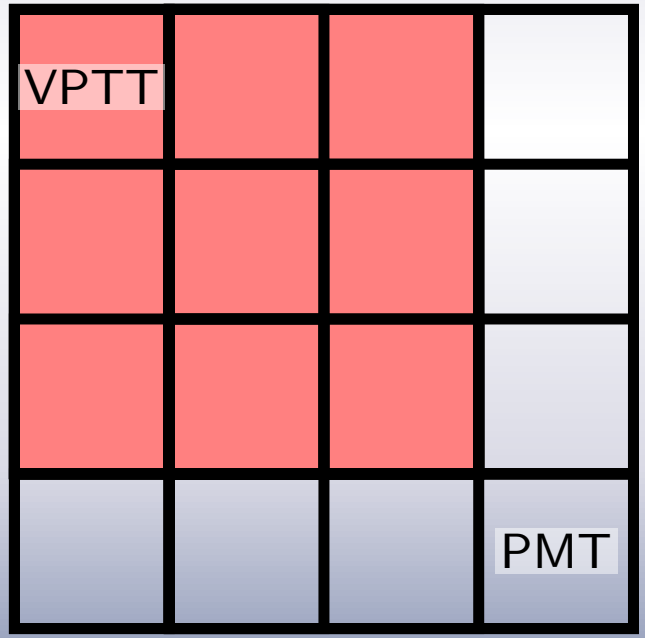


  - 2mm Li-target
  - 20mm collimator
  - $\rightarrow$ 55 neutrons/cm^2/s
  - beam-spot on the scintillators: oval shape 20mm horizontally, 10mm vertically
  - the energy of the neutrons is 175$\pm$0.5MeV
    with equally large continuous bckg between 0 and 175 MeV

The Detector and the Electronics The Setup

- 4x4 forward-endcap-type PWO crystals
- 3x3 crystals equipped with VPTT (Hamamtsu R11375) and 'Basel' preamp (SP883d)
- 7 crystals were equipped with PMTs
- The signals were processed by 'Uppsala' flash-ADCs, and stored on disk
- The ADCs were running on self-triggered mode



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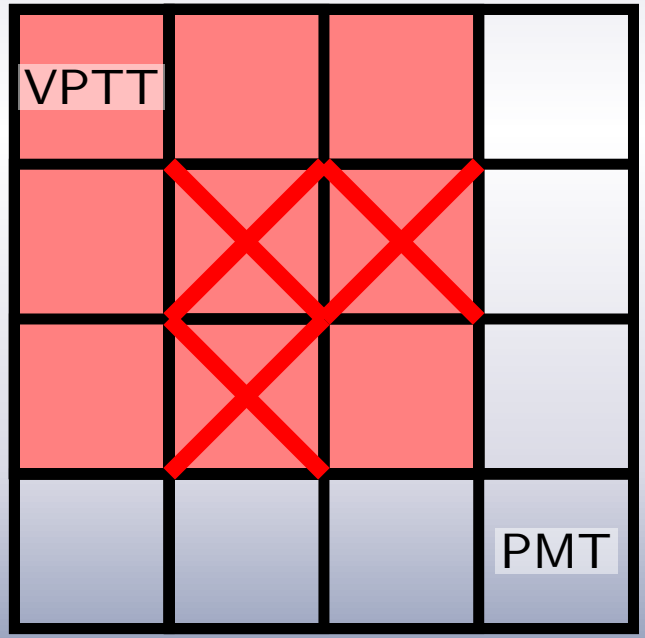

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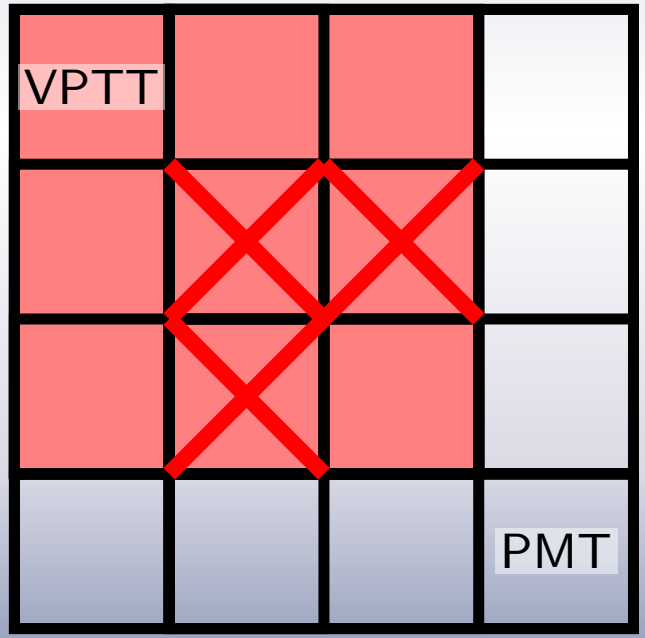
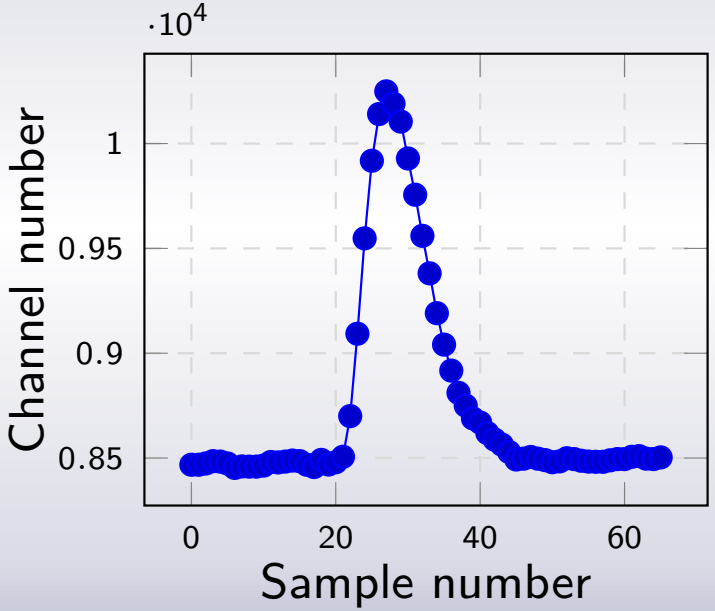
- The beam was aimed to the center 'VPTT-crystal'



Analysis Analysis

- Signal shape



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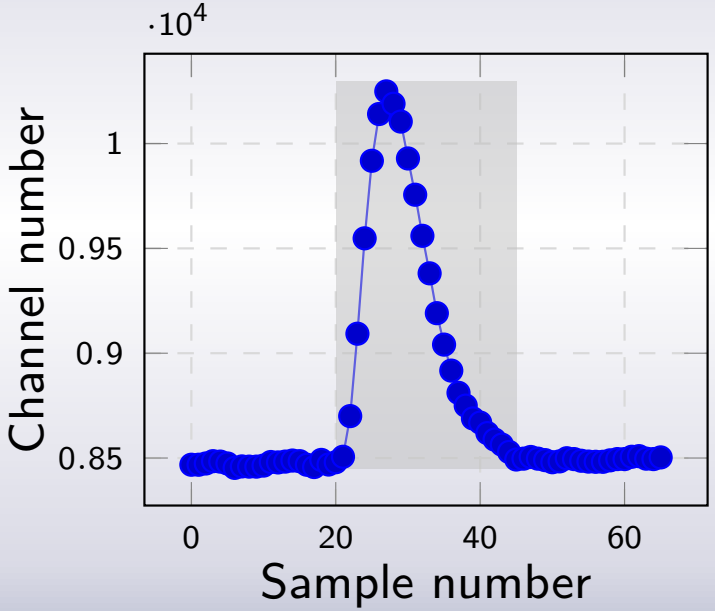

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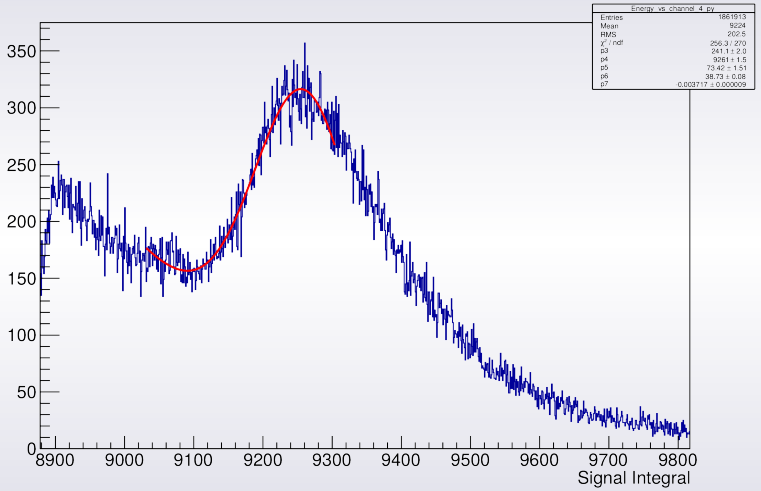

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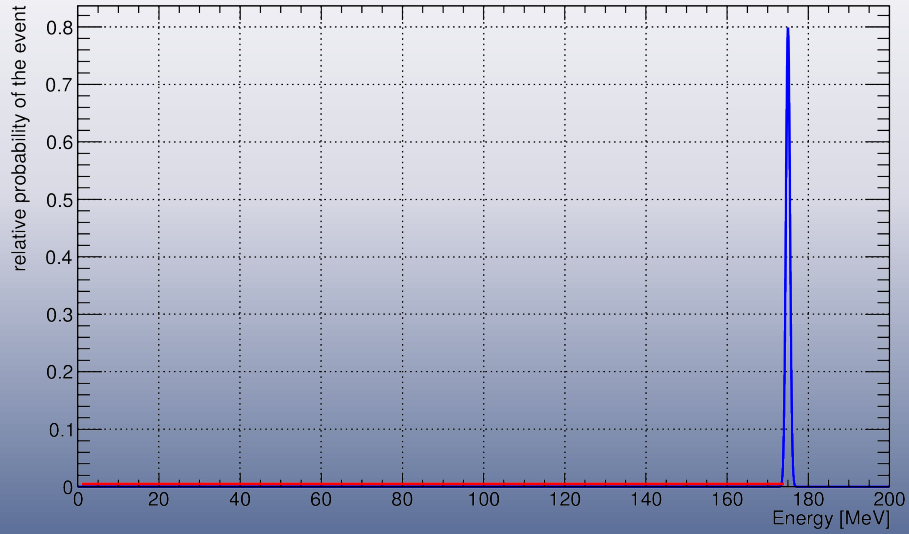
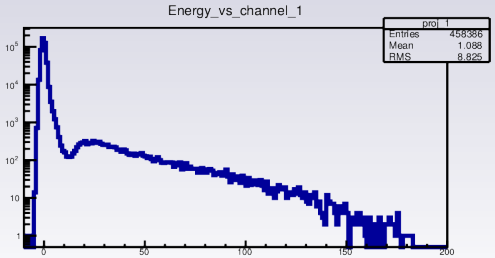
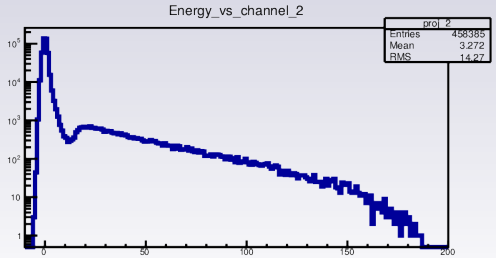
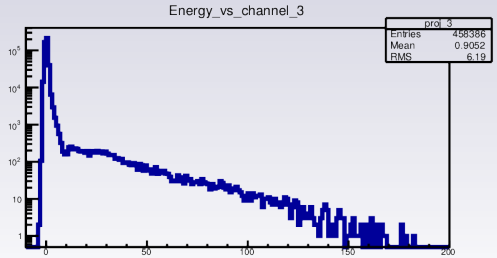
- realistic geometry of the setup (with dead materials)
- realistic geometry of the beam
- the best possible approximation of the physics (QGS_BERT_HP)
- distribution of the energy of the neutron with
  - gaussian energy distribution around the nominal energy with the nominal width
  - continuum spectrum

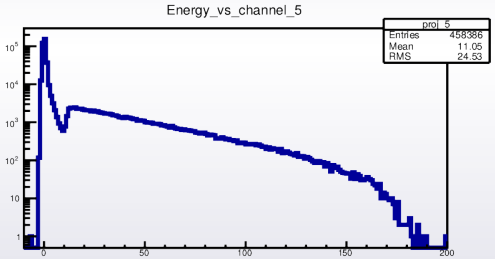


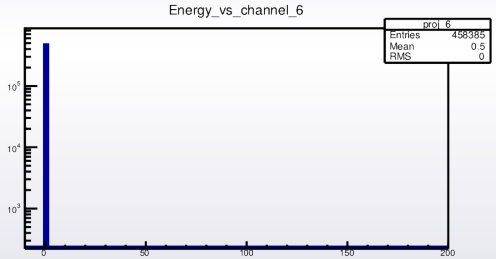
Results Results

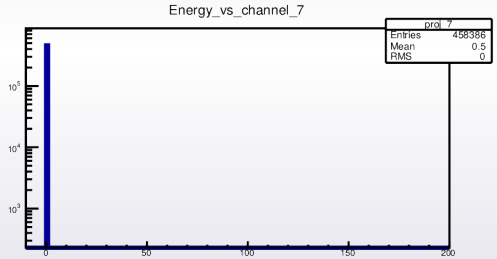


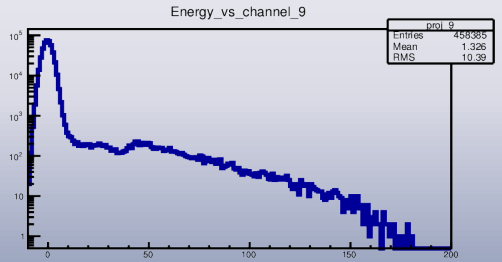


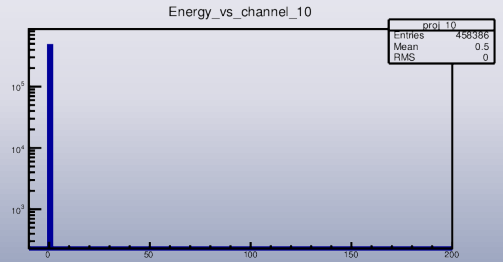


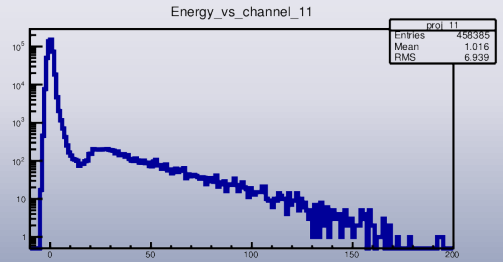












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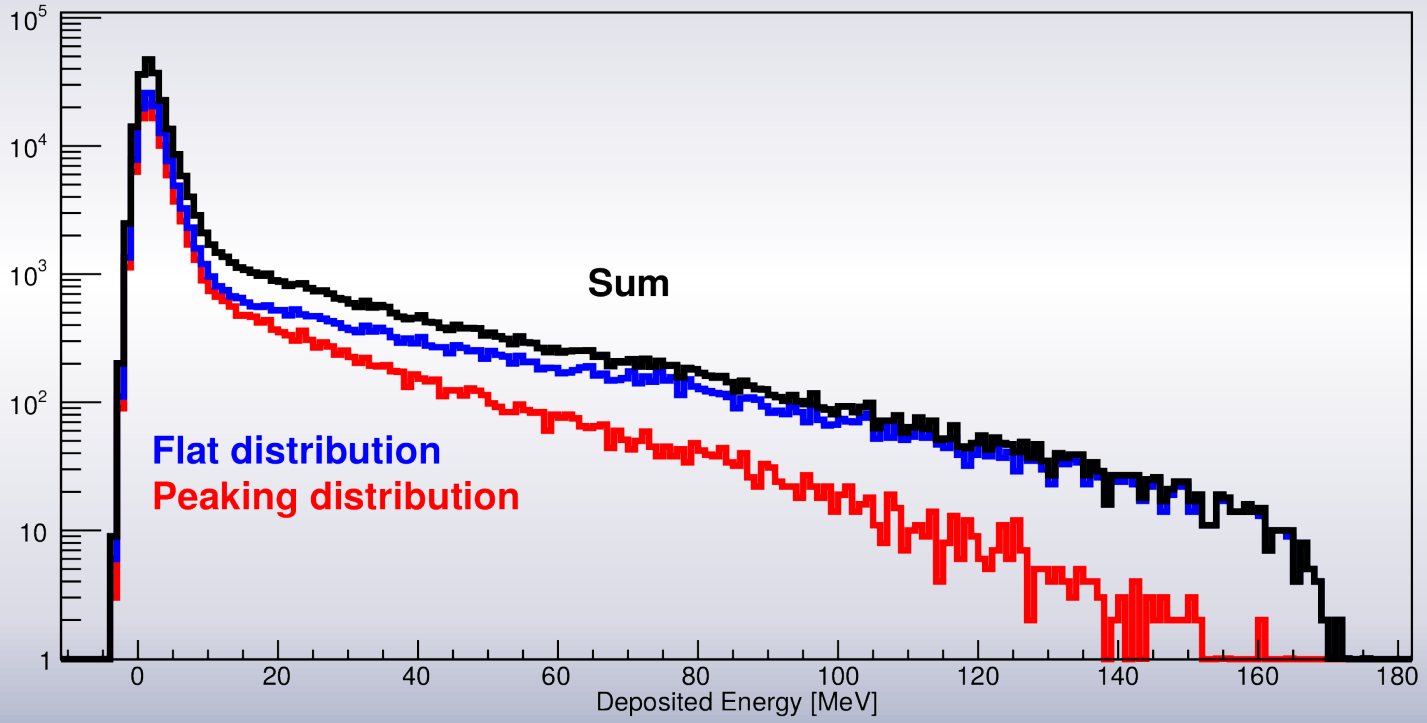

Outlook Outlook

Redo the experiment

- with a more perfect setup
- with lower energy
- using more energy bins