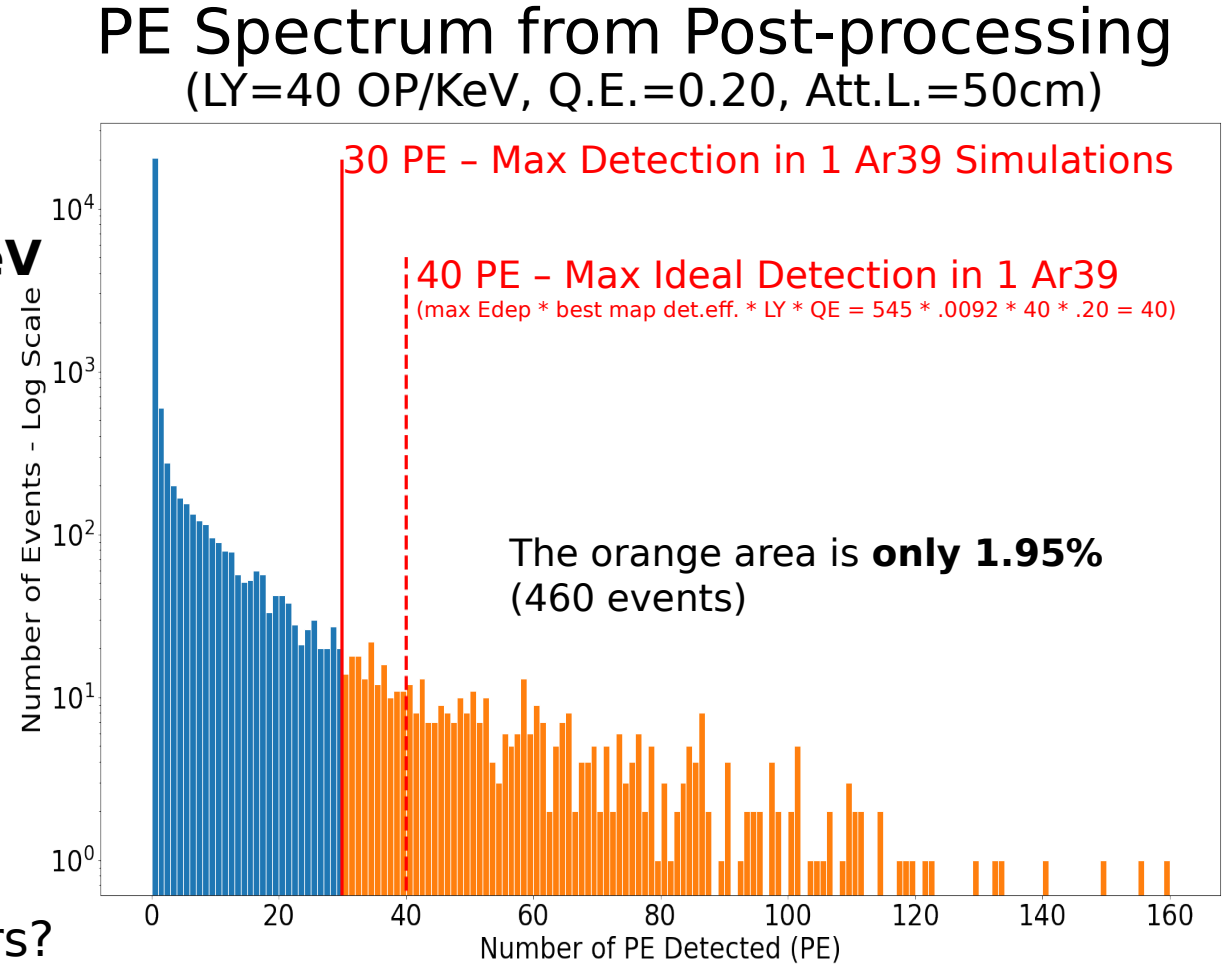
ML4NP: Meeting 12.05.2020

Summary of the slides

- Topic: Post-processing of Ar41 events from Neutron Simulation
- Updates:
  - Comparison PE Spectrum: Ar41 events vs Single Ar39 background.
  - New run of Neutrons wt restricted sampling volume (no whole LAr, only ROI)
- Questions: how to further increase Ar41 production?

Neutron Simulation

- First Run of Neutrons:
  - Number of events: **2M**
  - Neutron Position Sampling: cylinder h=**4m**, r=**2m**
  - Neutron Energy Sampling: spectrum **0-7 MeV**
  - Sensitive Volumes: **LAr**, **FiberCore**
- Result:
  - Output file size: **34 GB**
  - Number of events wt Ar41: **23 554**
- Problem:
  - Number of PE detected is rather low (max=160 PE)
  - A lot of events wt **0 PE** => **20 346** (**86 %**)
  - **Why?** Ar41 production point is far from fibers?

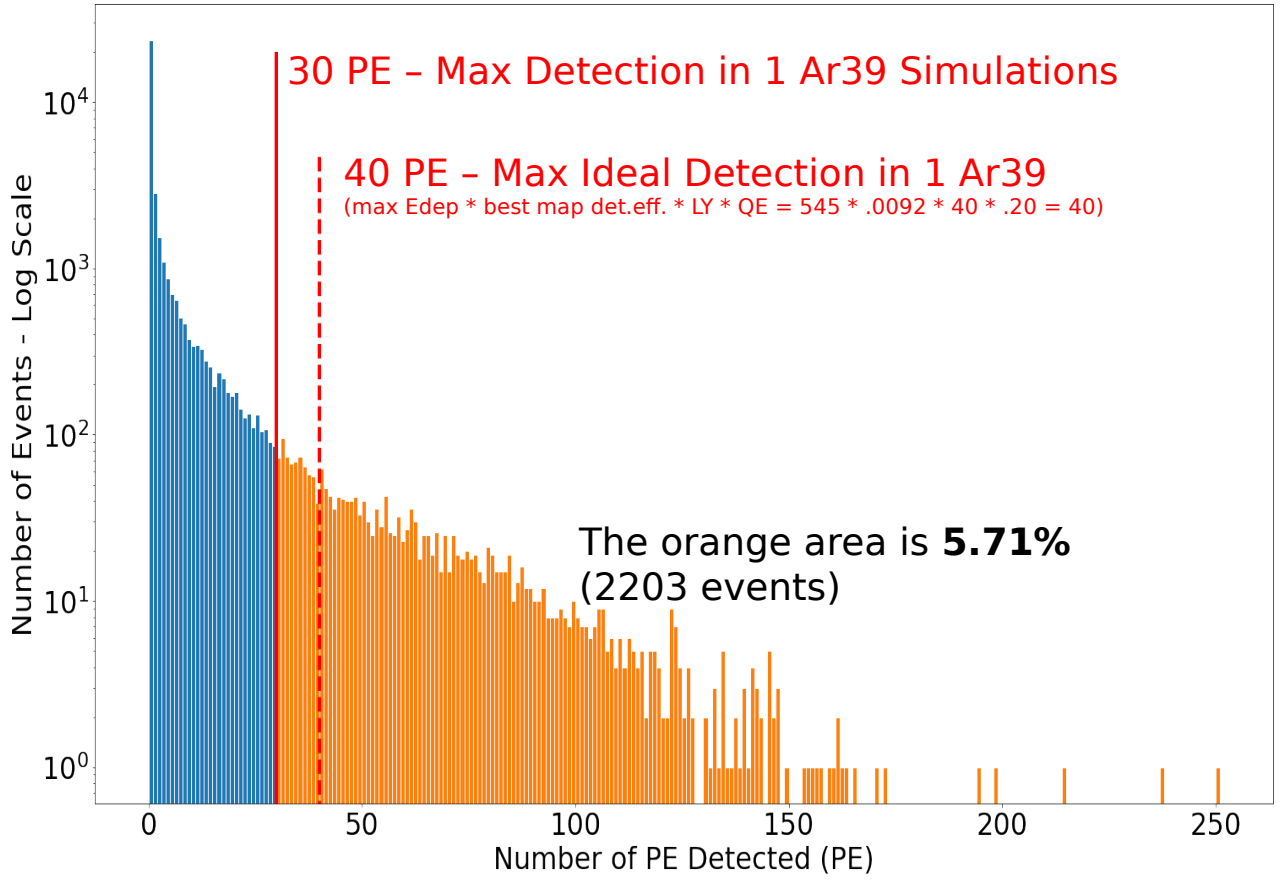


Neutron Simulation

- **Idea**: Sampling in a restricted area to increase the number of Ar41 production close to the fibers
- New Run of Neutrons:
  - Number of events: 2M
  - Neutron Position Sampling: cylinder h=1.69m, r=0.7m (ROI)
  - Neutron Energy Sampling: spectrum 0-20 MeV
  - Sensitive Volumes: Only LAr
- Result:
  - Output file size: **11 GB**
  - Number of events wt Ar41: **38 549**
  - PE Spectrum ranges in [0, **251**] PE
  - Undetected events: 23441 (**61%**)
- Questions and my answers (?):
  - Why higher Ar41 production? *Maybe because we have less neutrons that go outside the LAr volume.*
  - Why higher detections? *Ar41 produced closer to the fibers.*

PE Spectrum from Post-processing

(LY=40 OP/KeV, Q.E.=0.20, Att.L.=50cm)



My questions

1. Can we classify Ar41 de-excitation vs 1 Ar39 decay?
   Probably not, because both of them should be extremely localized.
   Check the **spread** of **Ar41** and compare it wt 1-2 Ar39s.

2. If 1. is true, we obtain only 2K Ar41 events wt >30 PE (even less >40). How can we produce more data?
   1. Restrincting the neutron energy spectrum?
      Lower starting energy → faster neutron capture → more Ar41?
   2. Other ideas?