

LABORATÓRIO DE INSTRUMENTAÇÃO
E FÍSICA EXPERIMENTAL DE PARTÍCULAS
partículas e tecnologia

TOPAS Automator

Supervisors:

Carolina Felgueiras
Daniel Galaviz

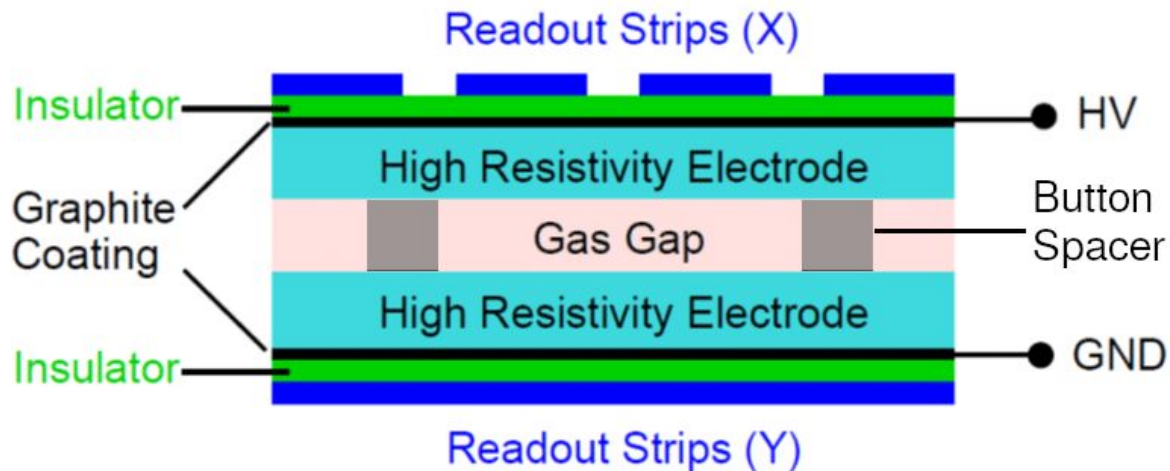
Tomás Campante Tavares
(FCUL)

1.

Everything you need to know

Let's get started

RPCs



RPCs detect
charged particles

Figure 1: Resistive plate chamber (RPC).

Retrieved from: <https://haftatech.wordpress.com/2018/10/02/my-report-on-resistive-plate-chambers-at-cern/>

Resistive Plate Chambers for neutrons

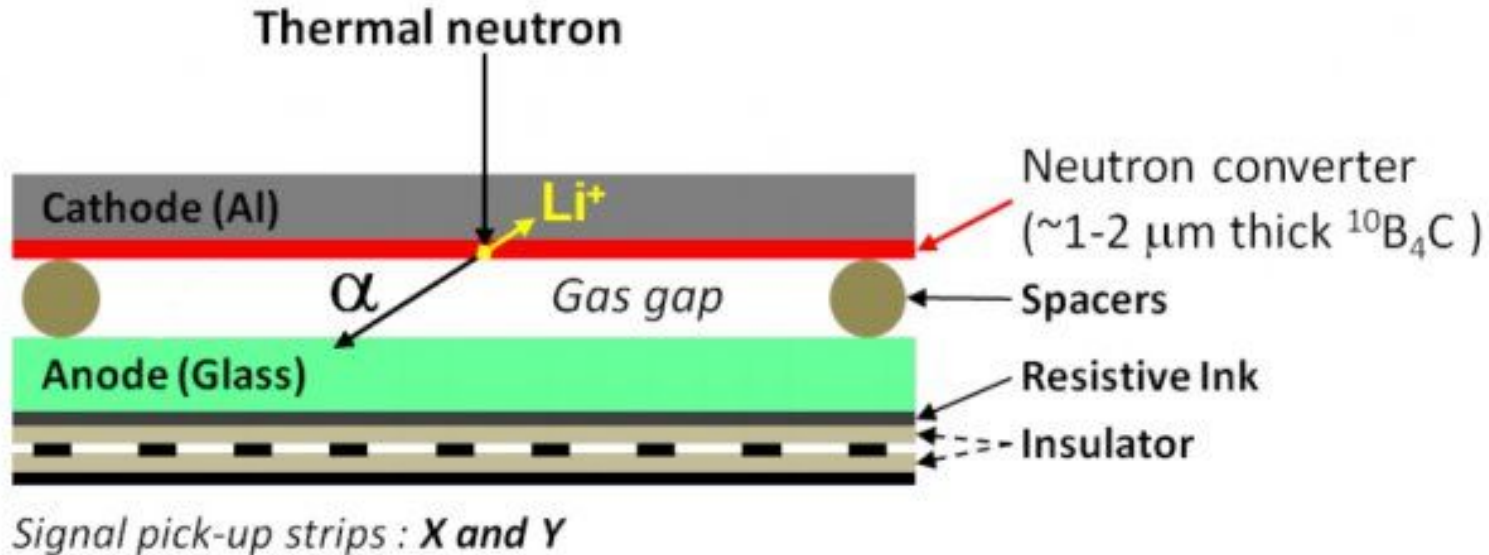
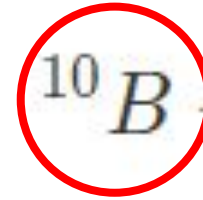
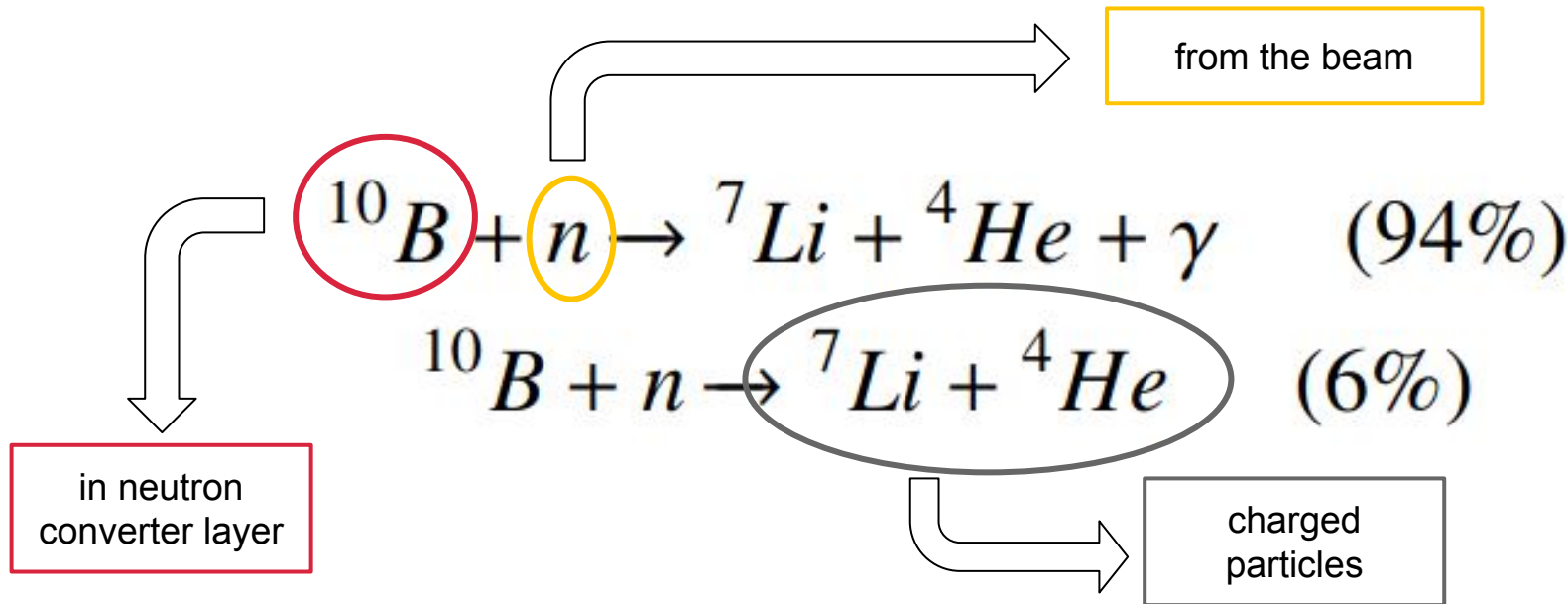


Figure 2: Neutron resistive plate chamber (nRPC).

Retrieved from: <https://sine2020.eu/about/the-road-to-the-ess/rpcs-how-they-work.html>

Nuclear reactions in neutron converter layer



Retrieved from: L.M.S. Margato and A. Morozov. *Boron-10 lined RPCs for sub-millimeter resolution thermal neutron detectors: conceptual design and performance considerations*. 2018.

2.

About TOPAS

Where we will do our simulations



TOPAS' input example

```
1nrpc
Ficheiro  Editar  Ver

# Simplest TOPAS example.
# A box in a beam with EM physics.

d:Ge/RPC/HalfSide = 5. cm

### World ###
s:Ge/World/Type      = "IsBox"
s:Ge/World/Material   = "Vacuum"
d:Ge/World/HLX        = 5. cm
d:Ge/World/HLY        = 5. cm
d:Ge/World/HLZ        = 5. cm
d:Ge/World/TransX     = 0. cm
d:Ge/World/TransY     = 0. cm
d:Ge/World/TransZ     = 0. cm
d:Ge/World/RotX       = 0. deg
d:Ge/World/RotY       = 0. deg
d:Ge/World/RotZ       = 0. deg

sv:Ph/Default/Modules = 1 "g4h-phy_QGSP_BIC_HP"

#sv:Ph/Default/Modules = 5 "g4h-elastic_HP", "g4h-phy_FTFP_BERT_HP", "g4h-
phy_QGSP_BIC_HP", "g4h-phy_QGSP_BERT_HP", "g4h-phy_QGSP_BIC_AllHP"

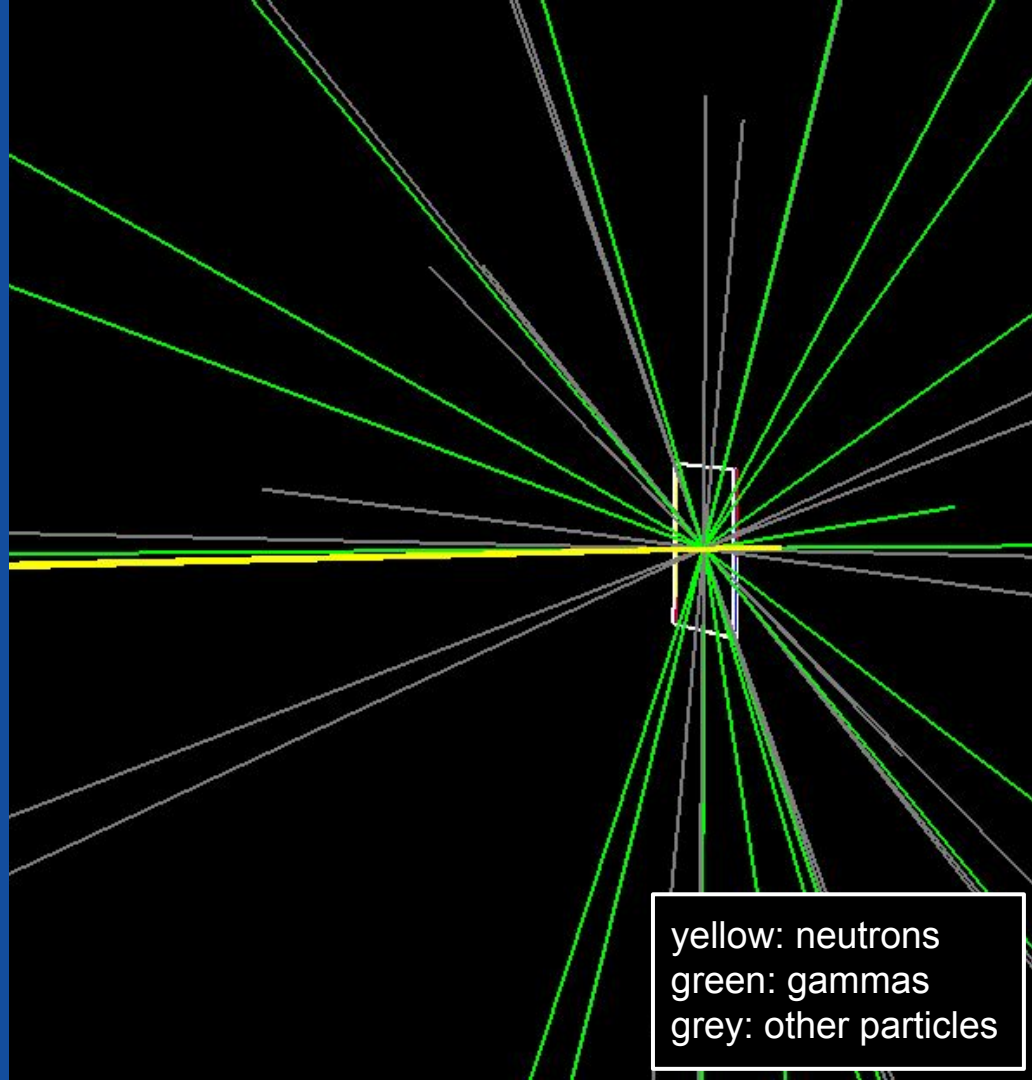
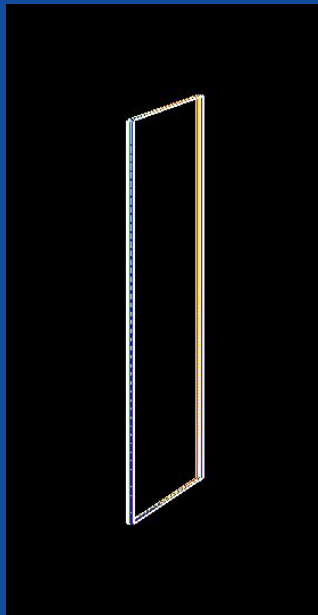
s:Gr/ViewA/Type      = "OpenGL"
i:Gr/ViewA/WindowSizeX = 1024
i:Gr/ViewA/WindowSizeY = 768
b:Gr/ViewA/IncludeAxes = "False"
d:Gr/ViewA/Theta      = 55 deg
d:Gr/ViewA/Phi        = 20 deg
s:Gr/ViewA/Projection = "Perspective"
d:Gr/ViewA/PerspectiveAngle = 30 deg
u:Gr/ViewA/Zoom        = 2.
d:Gr/ViewA/AxesSize    = 1. # size of axes
```

Ln 1, Col 26 100% Windows (CRLF) UTF-8

TOPAS' output example - simulation

Simulation:

**Beam of
neutrons**
passing
through a
nRPC.





AUTOMATION

noun [U]

UK /ˌɔː.təˈmeɪ.ʃən/ US /ˌɑː.təˈmeɪ.ʃən/

the use of machines and computers that can operate without needing human control

3.

Overview

A sneak peek into the program



Created interface

TOPAS Automator
Home About Help

☐ Do you want to see the axes in the simulation?

Number of nRPCs: 1

Distance between the first nRPC and the beam (in cm): 5

☒ Include paraffin moderators?

☒ Include side paraffin moderators?

Thickness of the moderators (in cm): 2

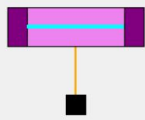
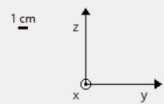

Beam's energy (from 2.5e-6 to 6 MeV): 5 MeV

Amount of neutrons in beam: 100

Filename: rpc-1_moderators-True_sidemoderators-True_2cm_5MeV.txt

[Save file](#) [View content](#) [Open with TOPAS](#)

SETUP'S PREVIEW
(top view)



- Blue lines: nRPCs
- Orange line: neutron beam
- Violet and purple boxes: paraffin moderators

Automation just
for n-RPCs

☐ Do you want to see the axes in the simulation?

Number of nRPCs: 1

Distance between the first nRPC and the beam (in cm): 5

☒ Include paraffin moderators?

☒ Include side paraffin moderators?

Thickness of the moderators (in cm): 2

Beam's energy (from 2.5e-6 to 6 MeV): 5 MeV

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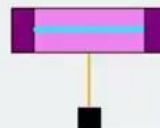
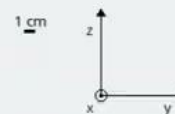
View content

Open with TOPAS



SETUP'S PREVIEW

(top view)



● Blue lines: nRPCs
● Orange line: neutron beam
● Violet and purple boxes: paraffin moderators

TOPAS Automator User Guide

Download & Installation

Click [here](#) to access TOPAS Automator Download page.

Before running the `topasautomator.py` file with `python3`, make sure you have the Tkinter and Pillow modules from Python in your machine.

To do so, if you are on Windows or Linux, open your terminal and type in (one line at a time).

```
python get-pip.py

pip install Pillow
pip install tk
```

TOPAS Automator GitHub

TomasCampante / TopasAutomator Public

Notifications

Fork 1

Star 2

<> Code Issues Pull requests 2 Actions Projects Security Insights

main 1 branch 0 tags

Go to file Code

TomasCampante minor bugs corrected and new userguide 7058153 4 days ago 17 commits

DoNotDelete	minor bugs corrected and new userguide	4 days ago
README.md	minor bugs corrected and new userguide	4 days ago
auxiliaryFunctions.py	minor bugs corrected and new userguide	4 days ago
topasautomator.py	minor bugs corrected and new userguide	4 days ago

README.md

Topas Automator

This is a program to automate the usage of nRPC in TOPAS.

To know more go to our User Guide: <https://nuc-ria.notion.site/TOPAS-Automator-User-Guide-4d8877b8c534433aa655322c855499a0>

Last modification: august the 31th 11:00 AM
Version 4.2.2

About

STILL IN DEVELOPMENT

Readme

Activity

2 stars

1 watching

1 fork

Report repository

Releases

No releases published

Packages

No packages published

Languages

Python 100.0%

<https://github.com/TomasCampante/TopasAutomator>

4.

The next steps

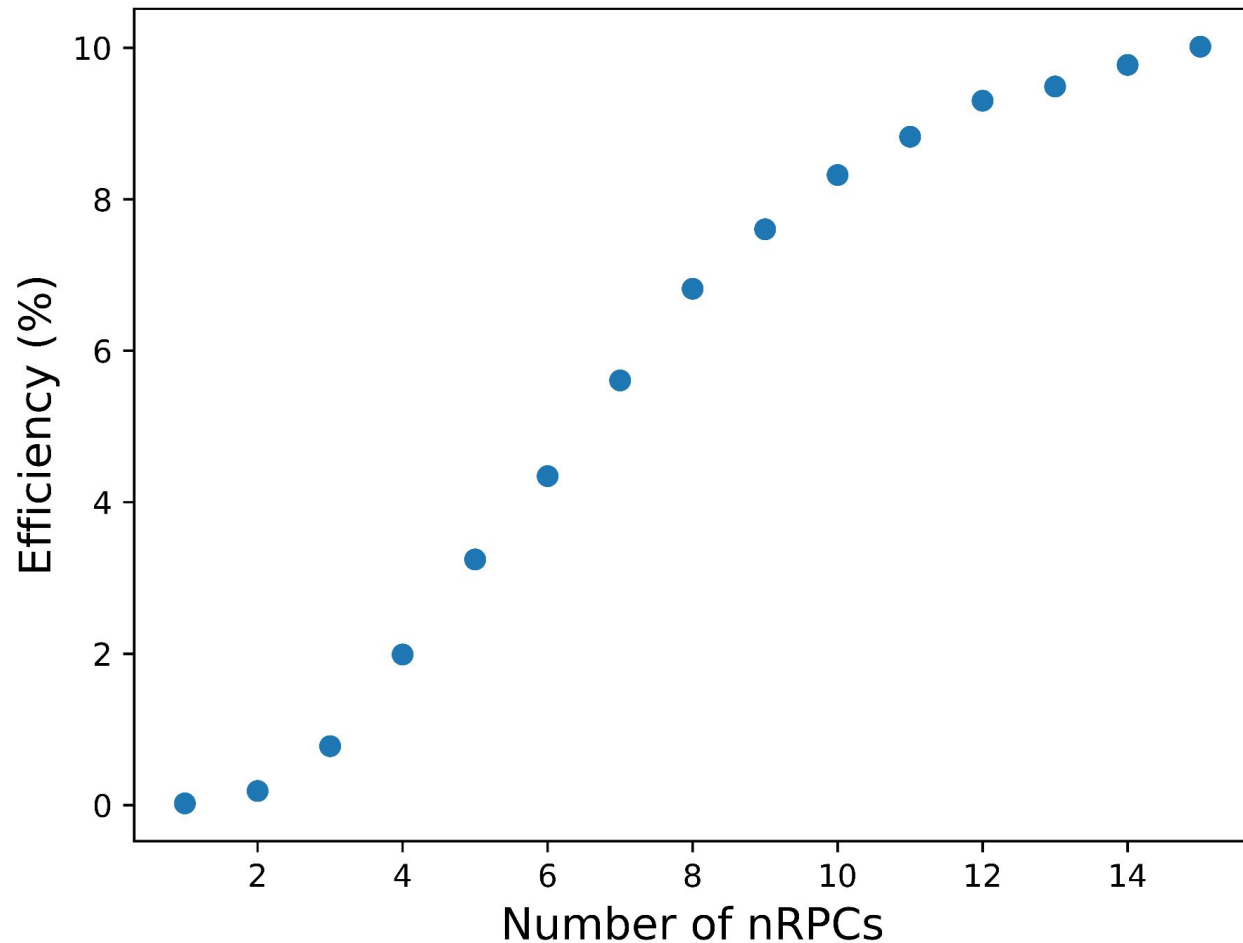
Simulations

Efficiency and #nRPCs

- 5,23 MeV

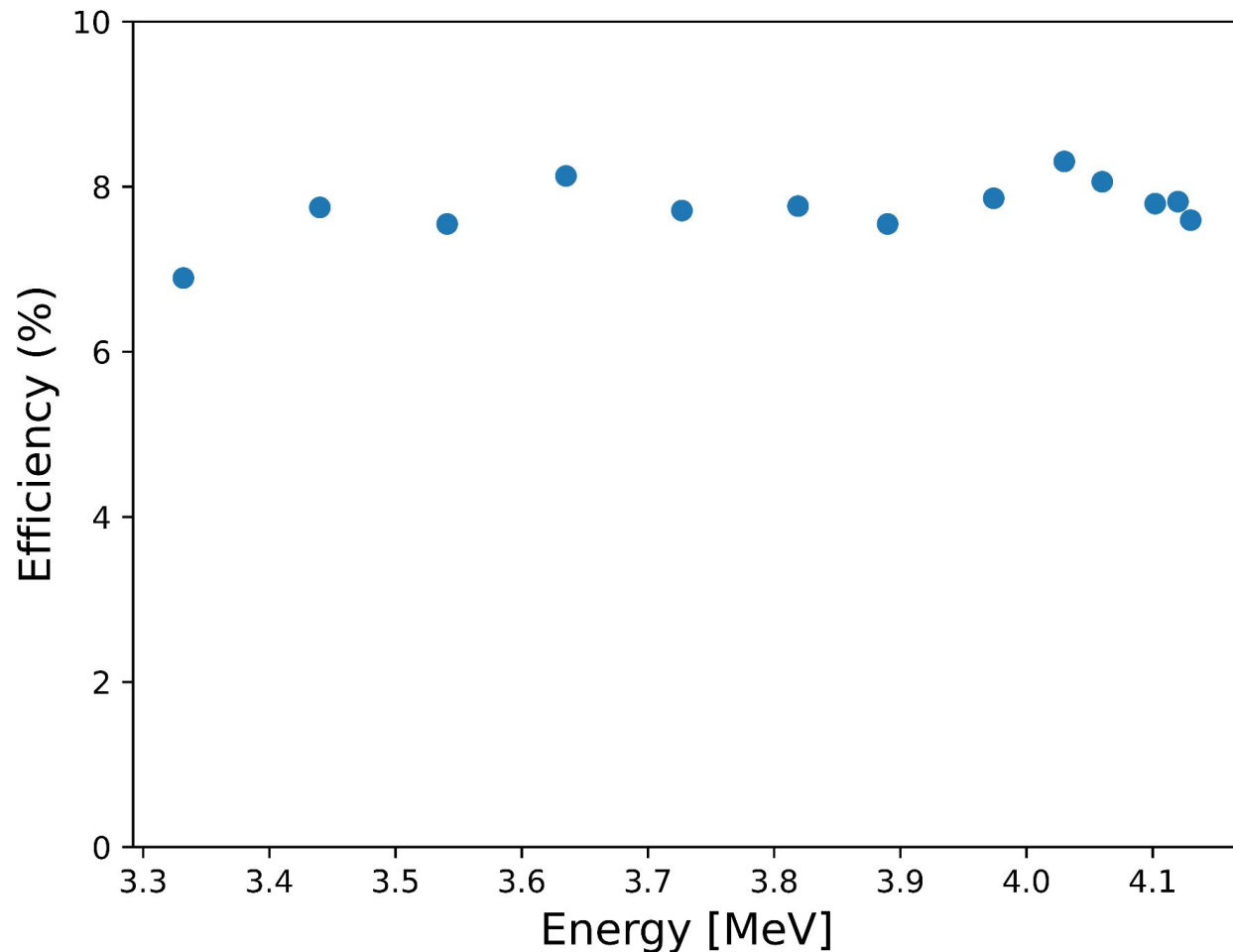
- 1 cm of moderators

- 20000 neutrons



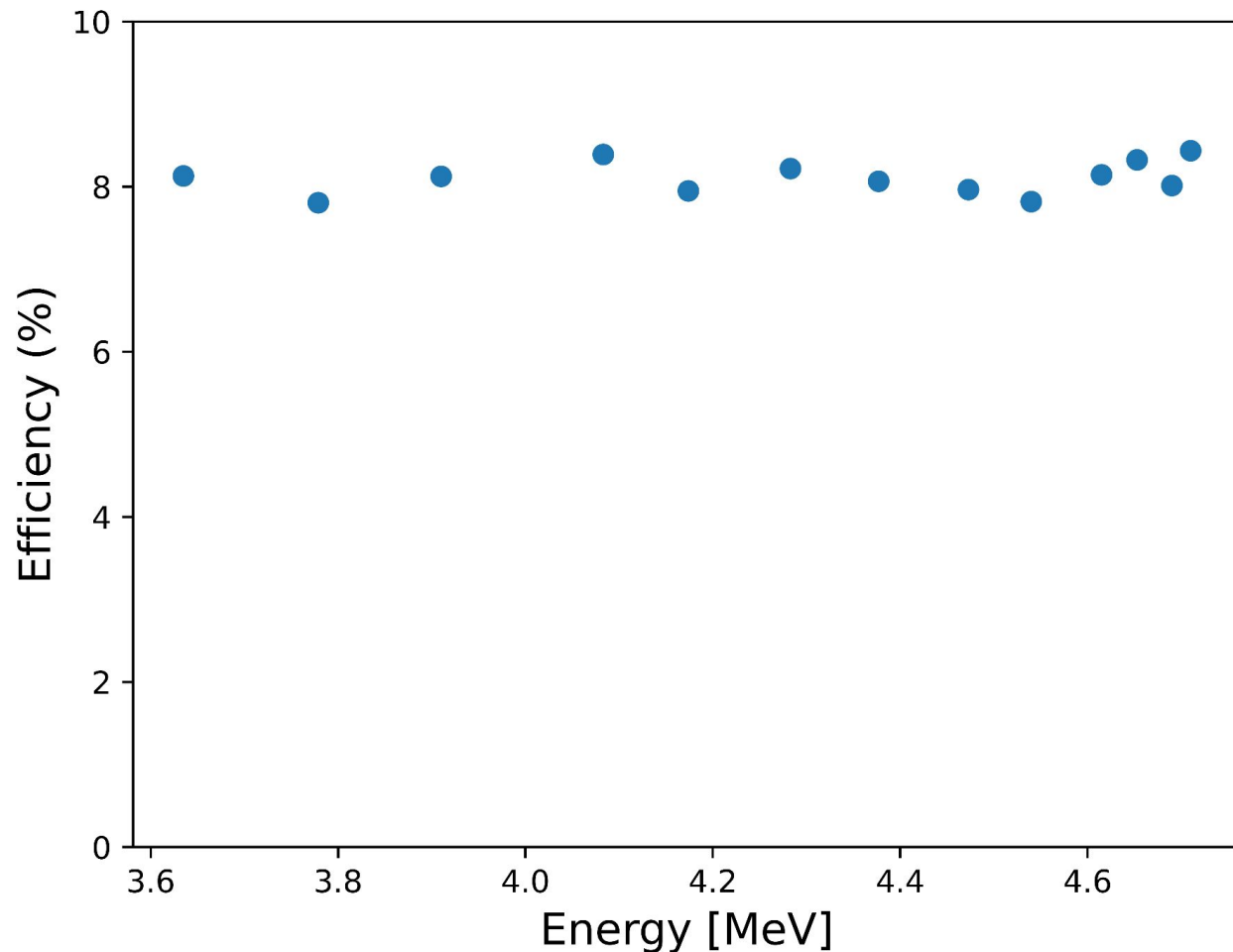
Efficiency and energy

- 10 nRPCs
- 1 cm of moderators
- 20000 neutrons



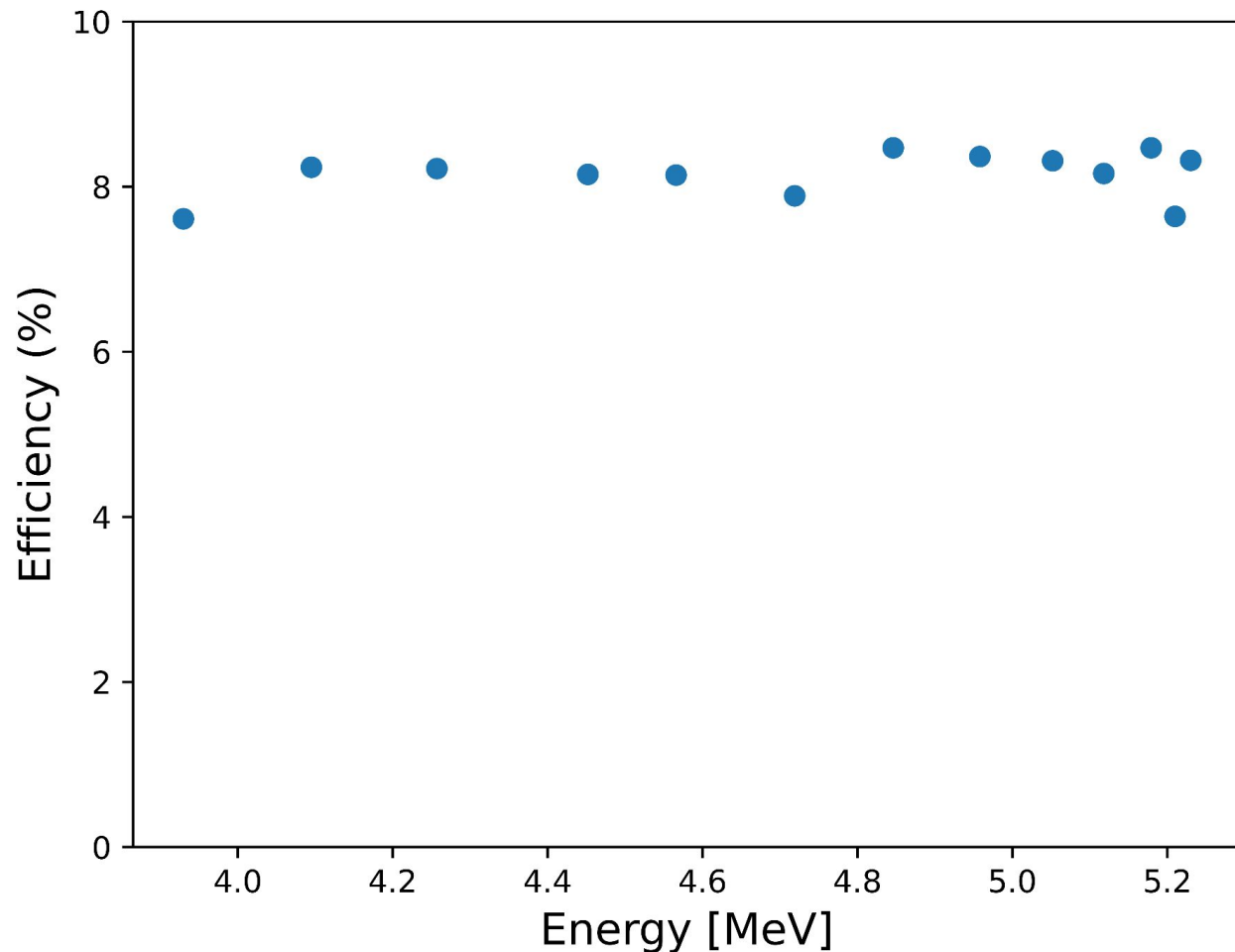
Efficiency and energy

- 10 nRPCs
- 1 cm of moderators
- 20000 neutrons



Efficiency and energy

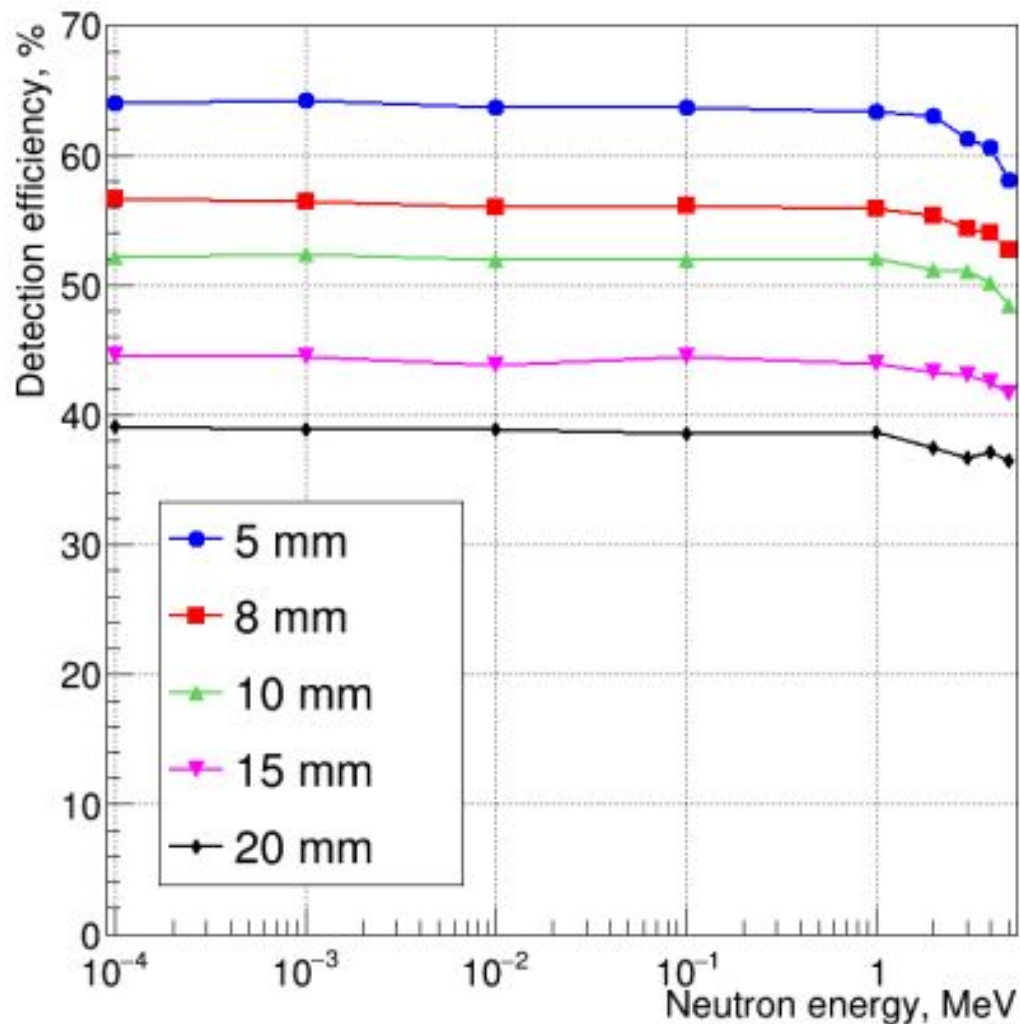
- 10 nRPCs
- 1 cm of moderators
- 20000 neutrons



Efficiency and energy

Figure 4: Cubic moderator with regular 10B-RPC spacing for different moderator thicknesses.

Retrieved from: A. Morozov et al 2022 JINST 17 P02016



Questions



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TOPAS Automator

B10 (n, α) or Li7 production

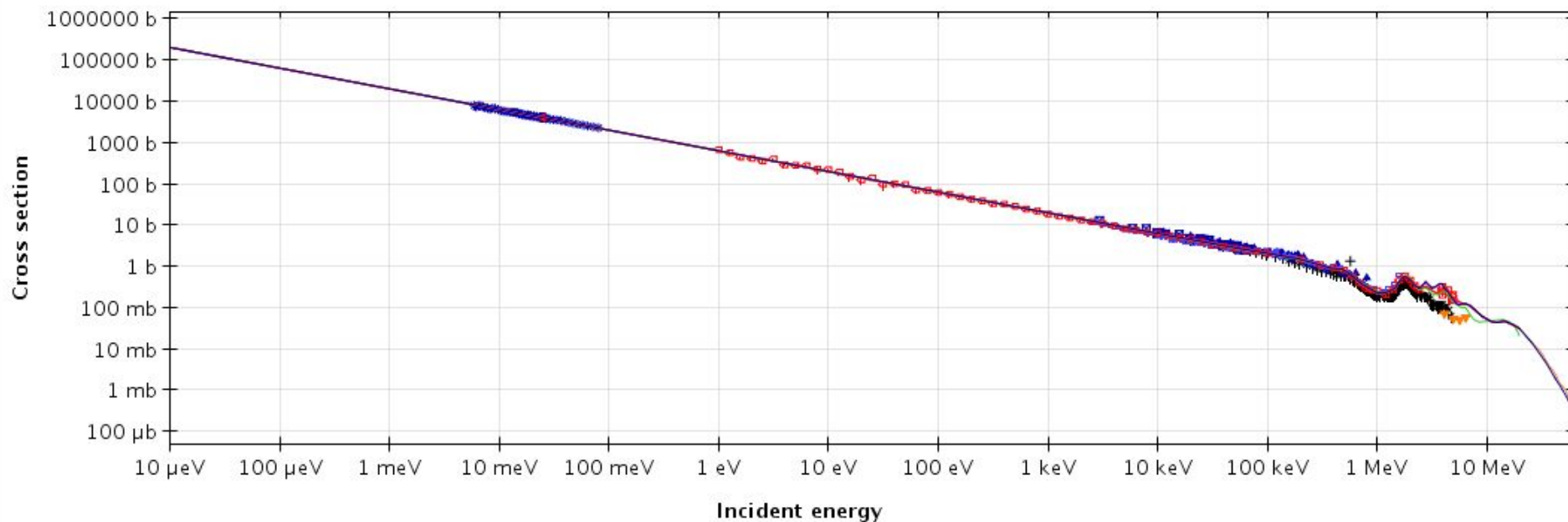


Figure 4: Neutron cross section.

Retrieved from: JanisWeb <https://www.oecd-neo.org/janisweb/book/neutrons/B10/MT107/renderer/1013>



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