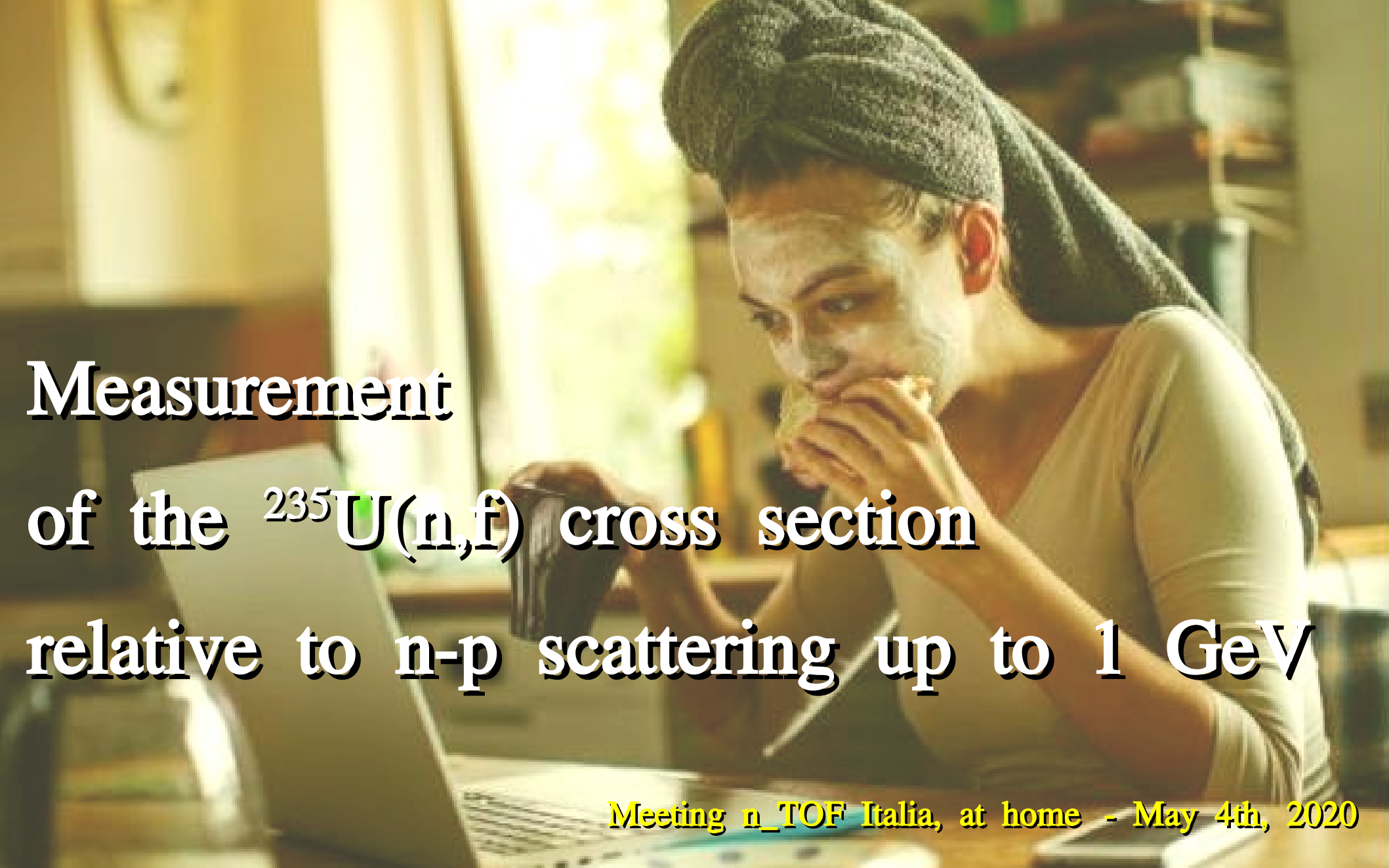
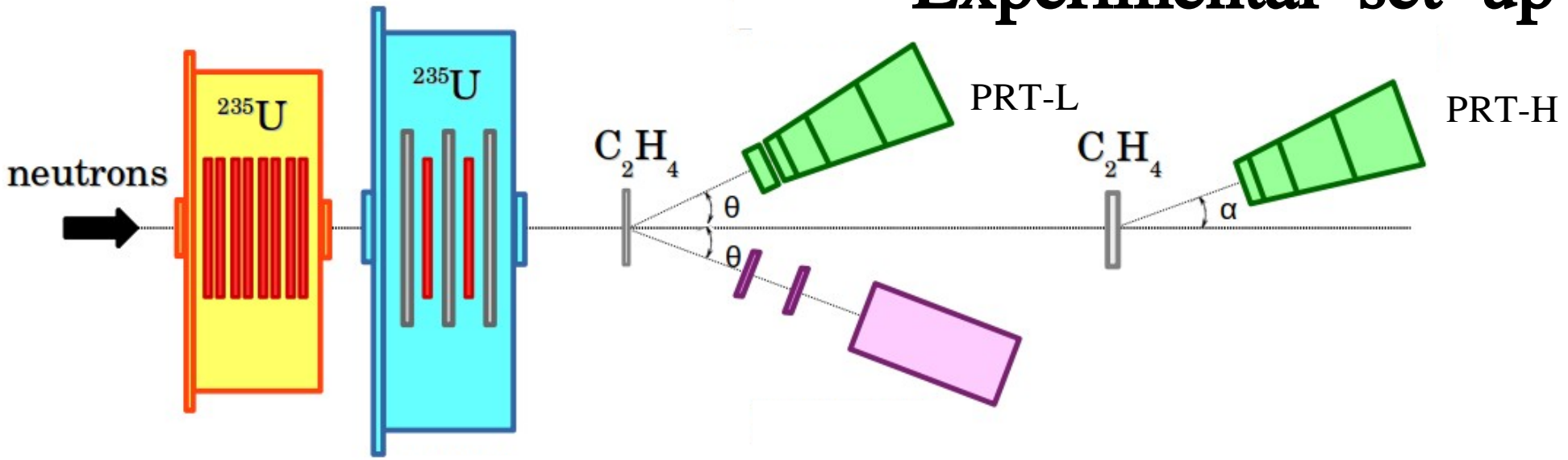


Measurement of the ^{235}U(n,f) cross section relative to n-p scattering up to 1 GeV

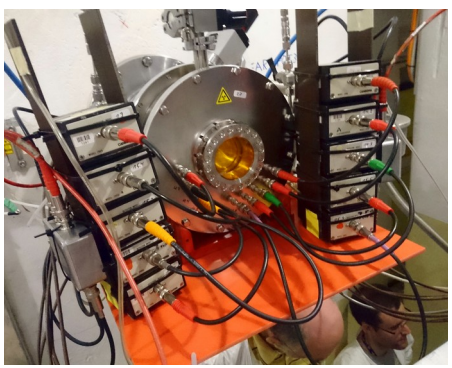
Meeting n_TOF Italia, at home - May 4th, 2020

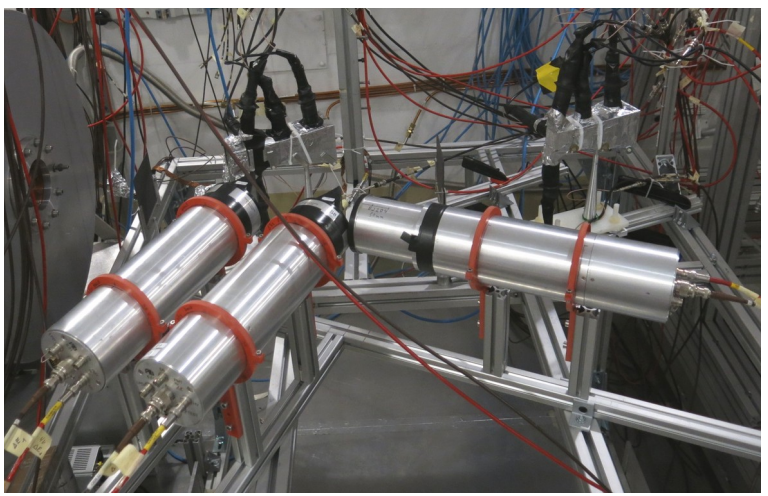
Experimental set up



^{235}U fission reaction

Neutron flux





1. Neutron flux

Monte Carlo simulations: GEANT & MCNP

PRT – L: 2 Silicon Detectors & 4 plastic Scintillators

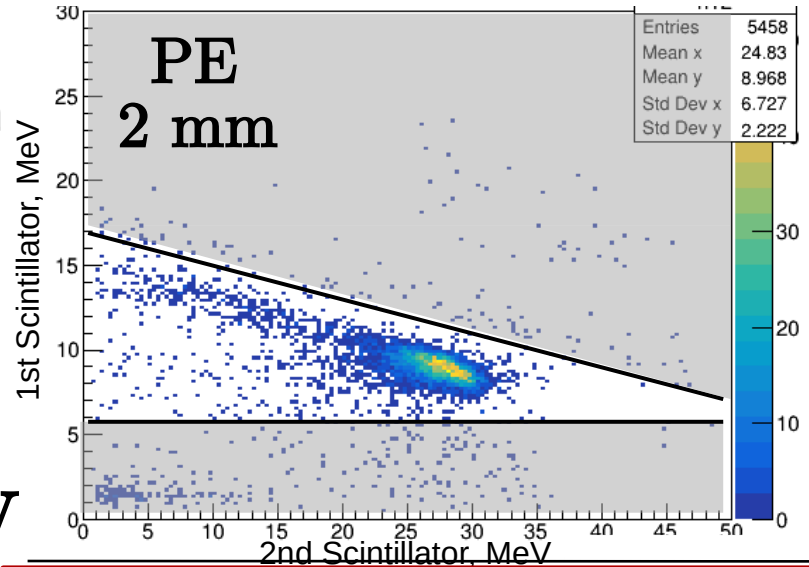
2. PPACs

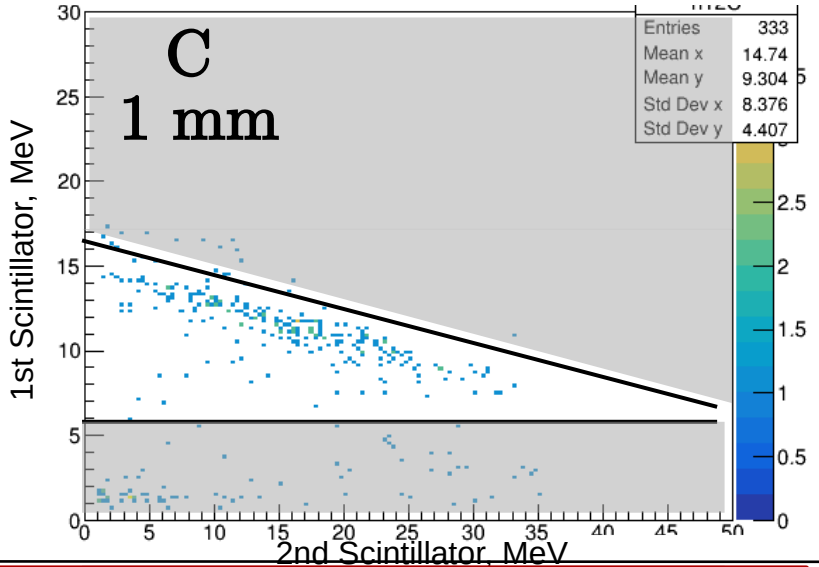
3. First comparison with PTB

Flux extraction

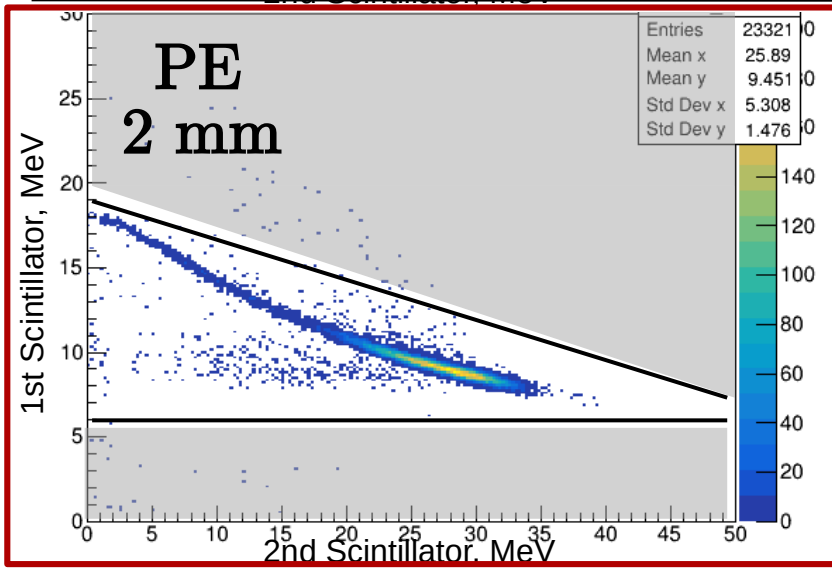
Data

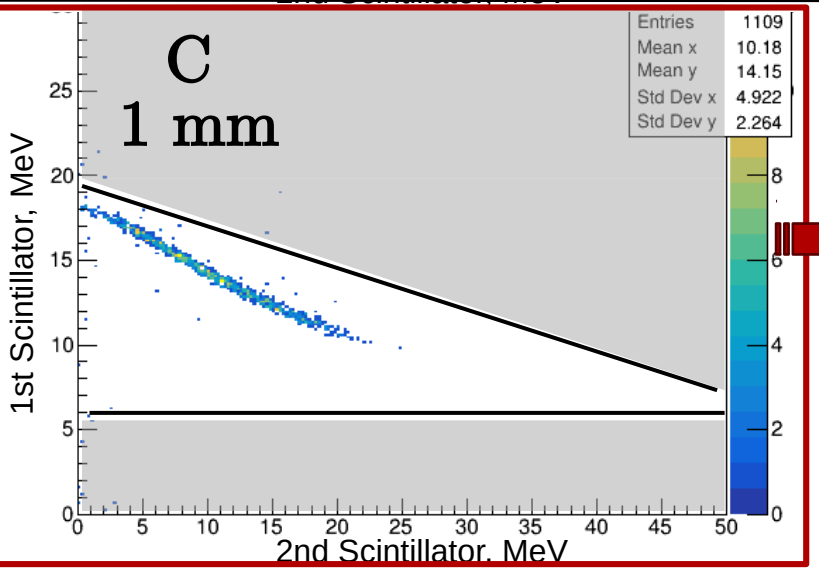
50 MeV





MC



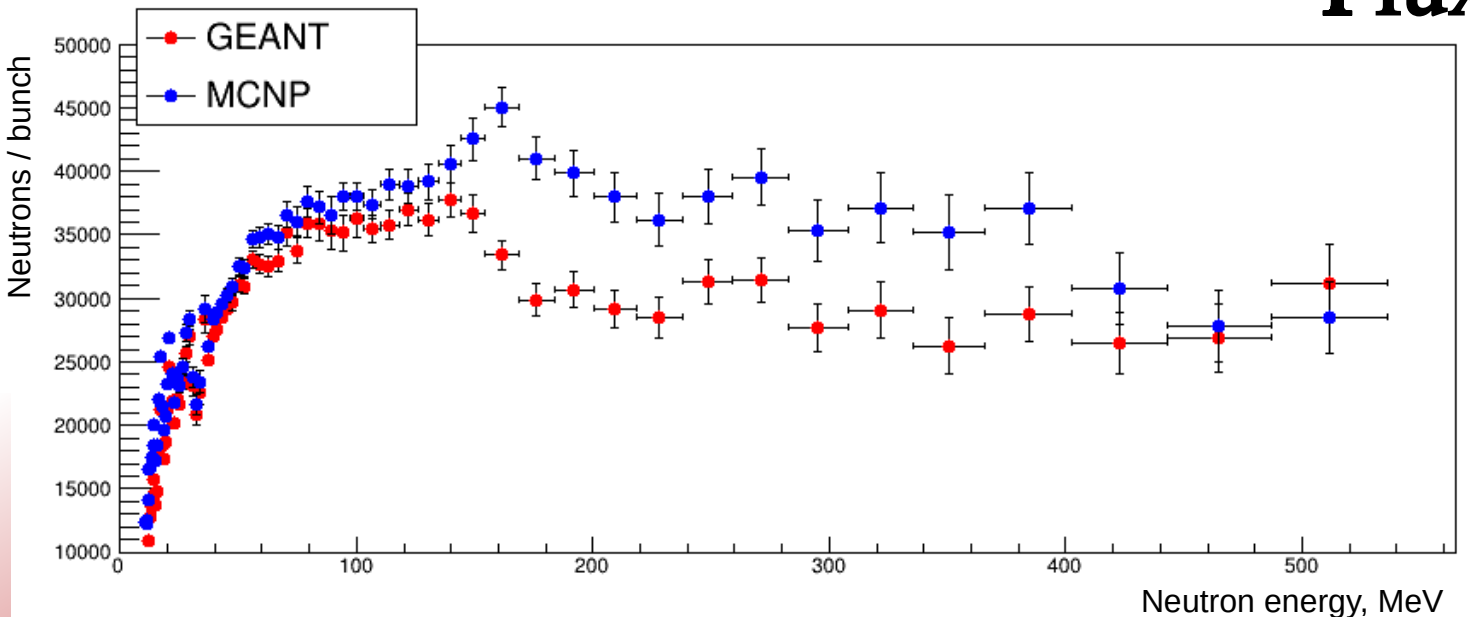


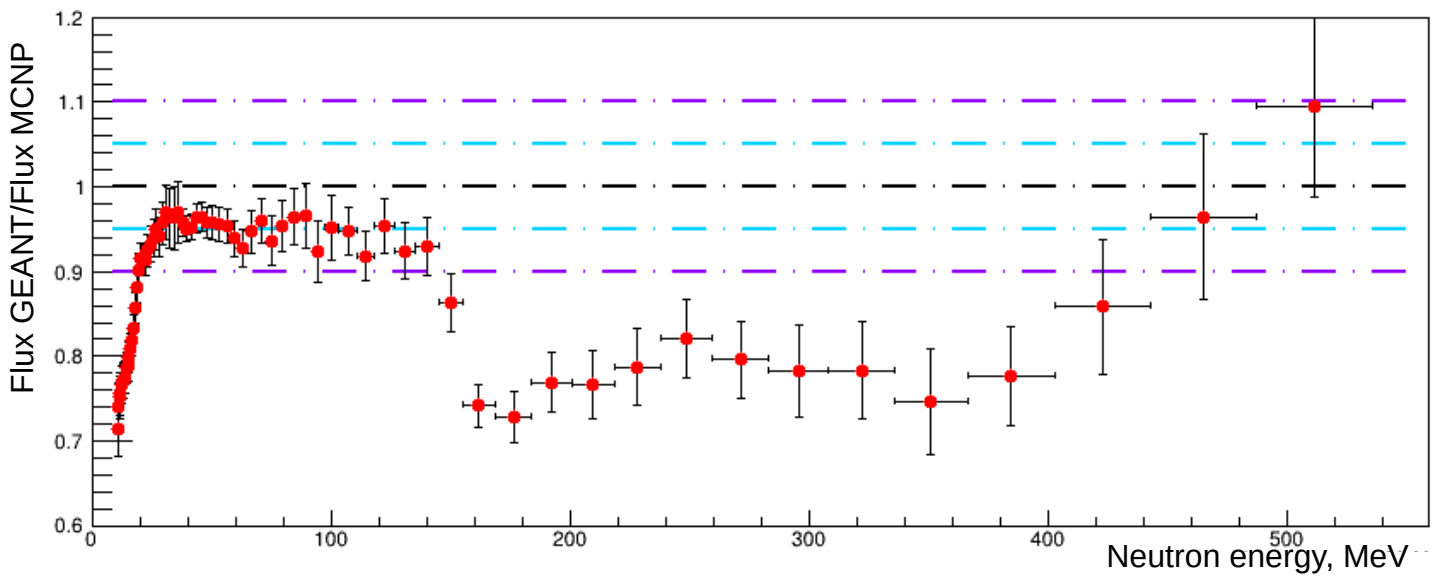
n_H

ε

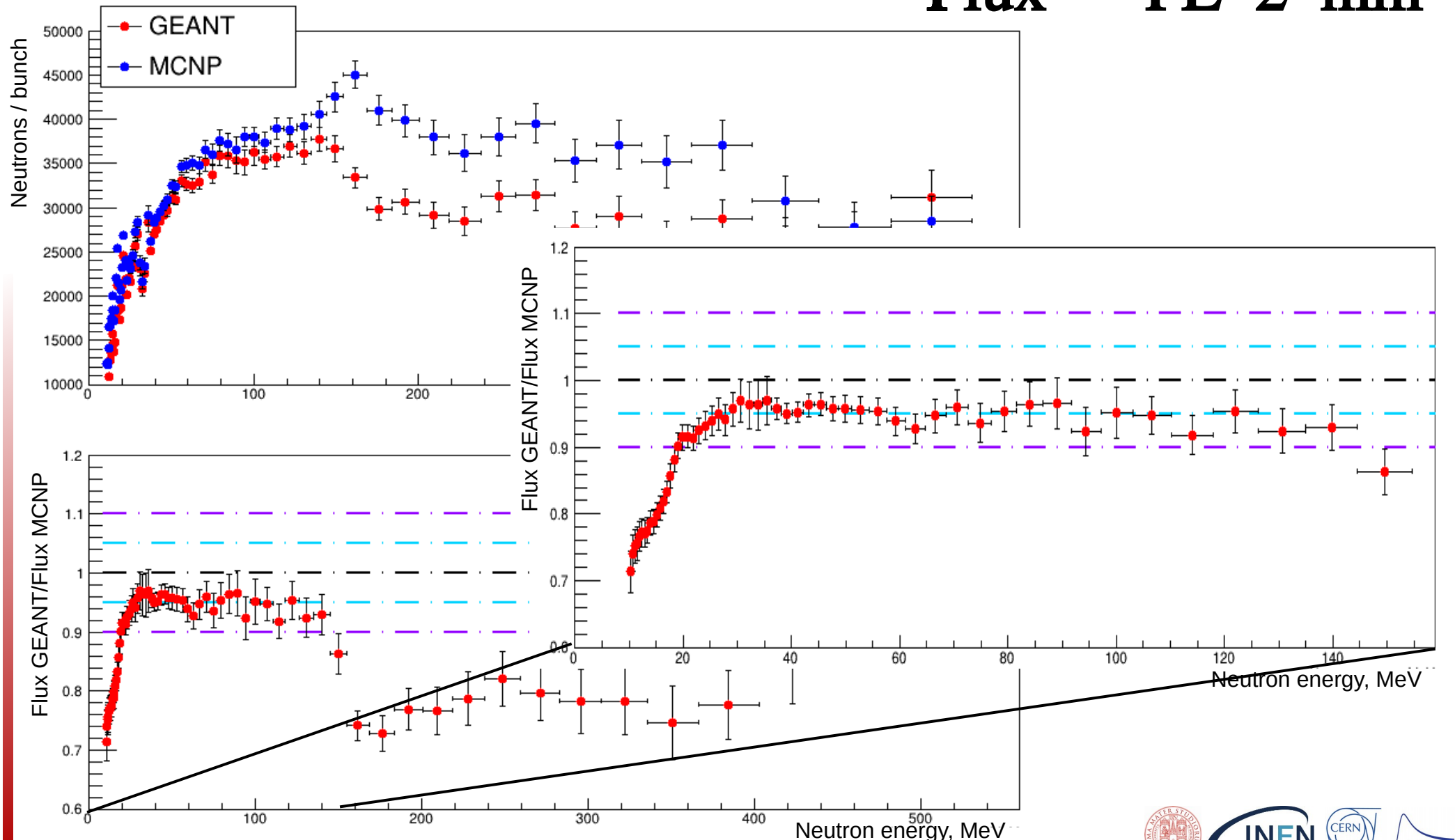
$d\sigma/d\Omega$

Flux – PE 2 mm

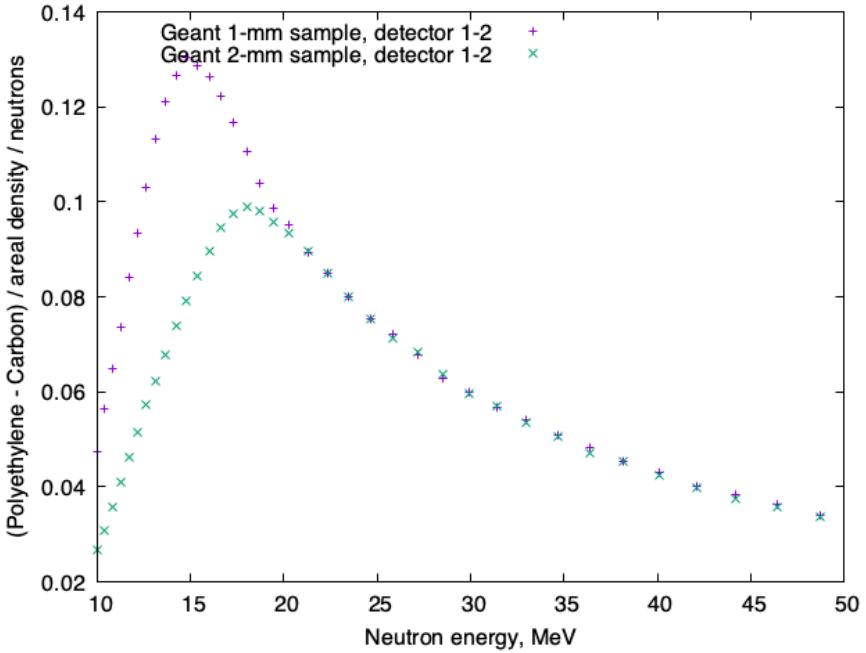

GEANT
MCNP
Neutrons / bunch
Neutron energy, MeV

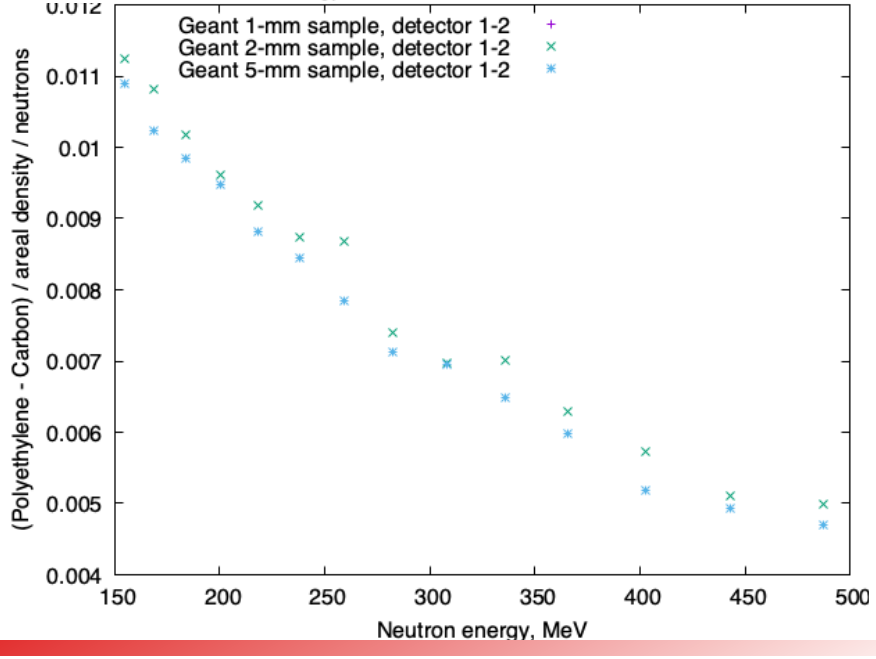

Flux GEANT/Flux MCNP
Neutron energy, MeV

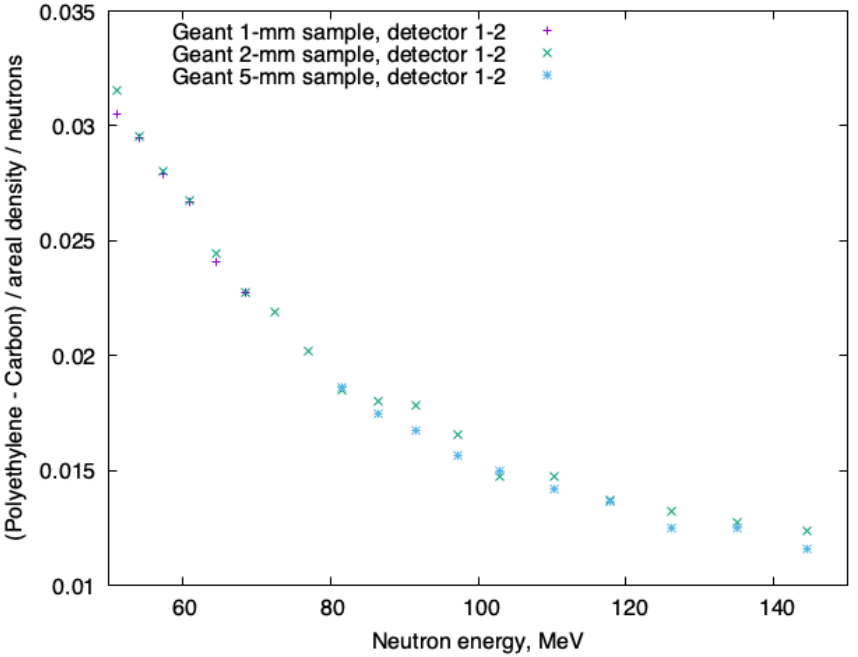
Flux – PE 2 mm


GEANT
MCNP
Neutrons / bunch
Flux GEANT/Flux MCNP
Neutron energy, MeV
Flux GEANT/Flux MCNP
Neutron energy, MeV

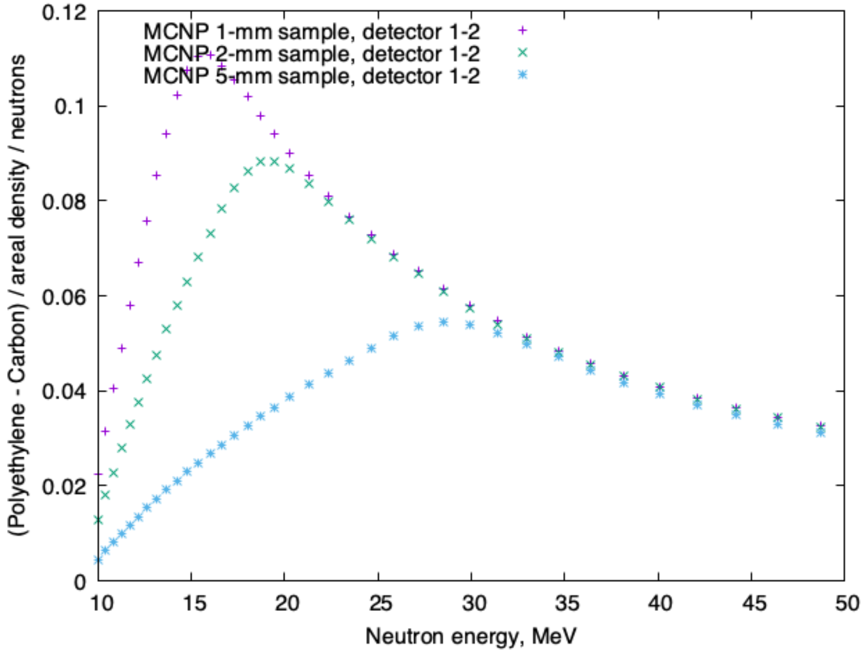
Simulations - GEANT

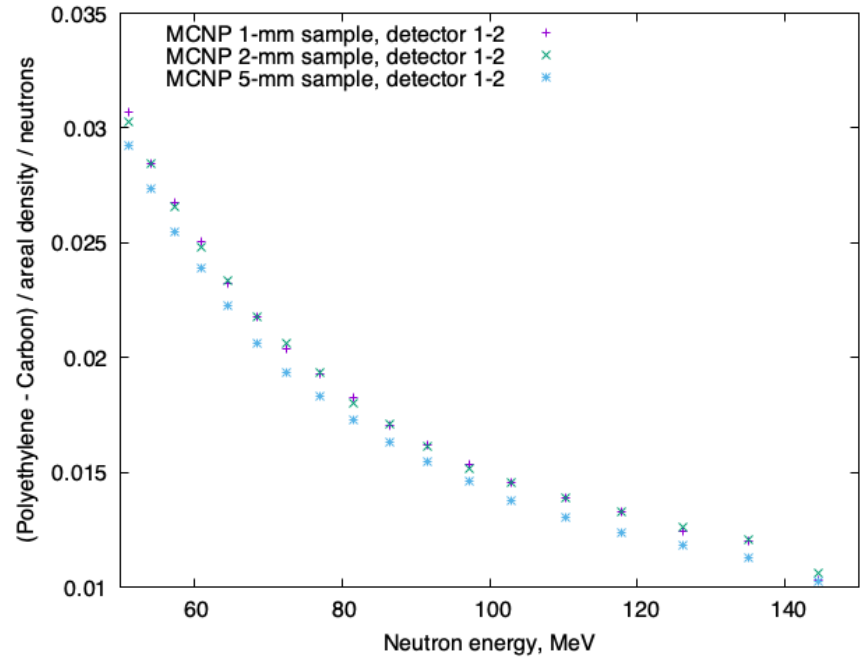


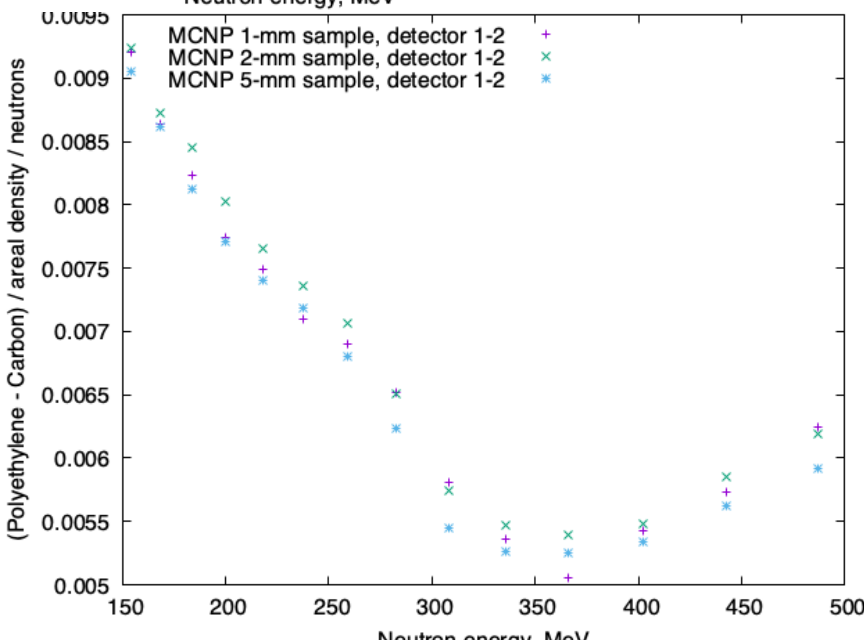




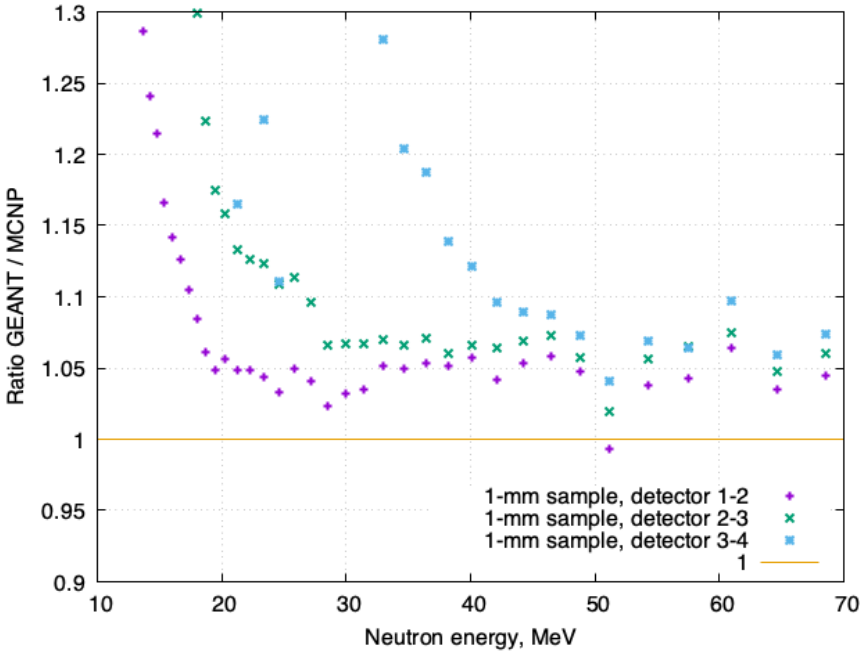
Simulations - MCNP

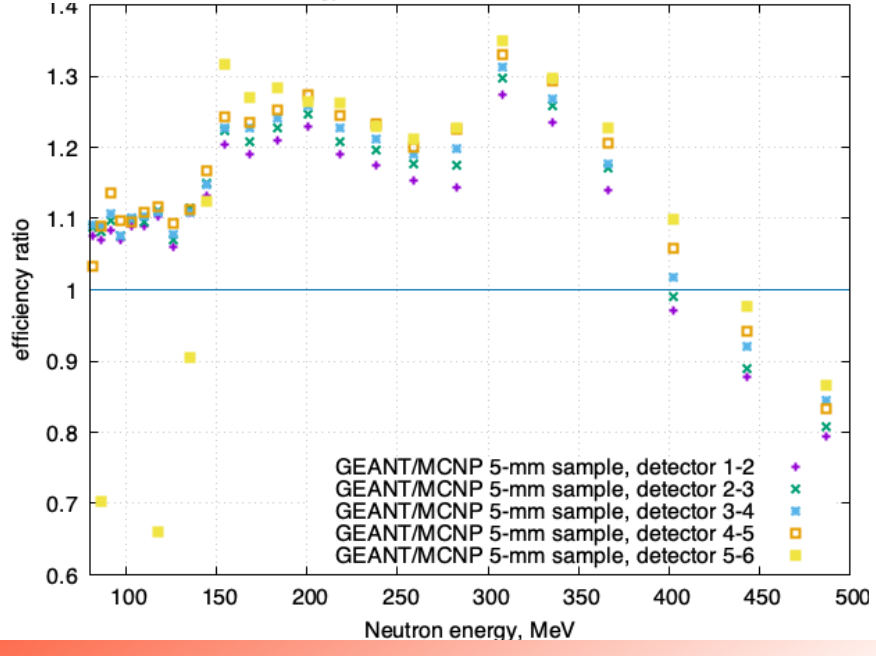


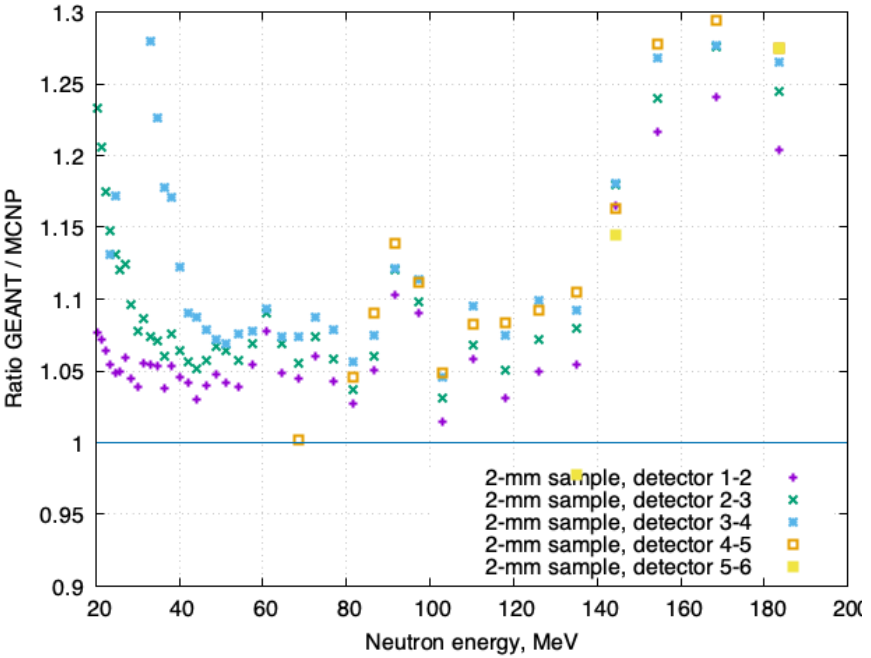




Simulations - GEANT/MCNP







1. Neutron flux

Monte Carlo Simulations: GEANT & MCNP

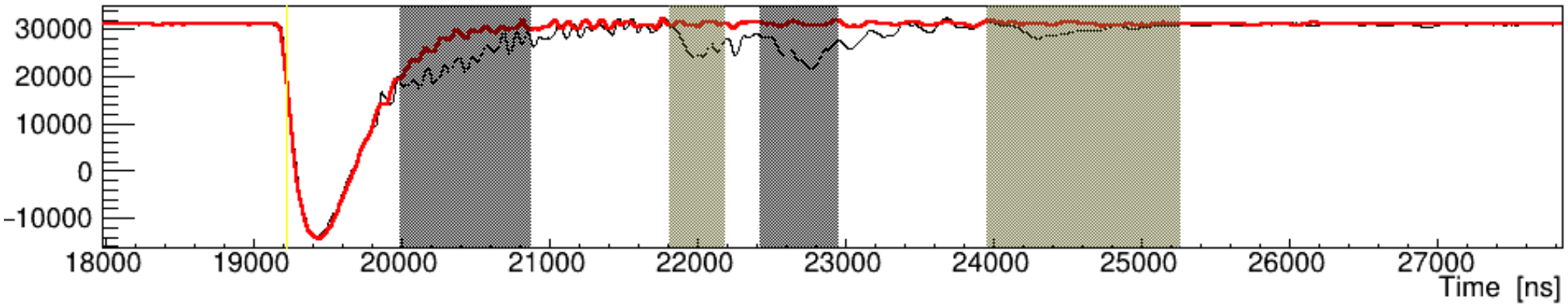
PRT – L: 2 Silicon Detectors & 4 plastic Scintillators

2. PPACs

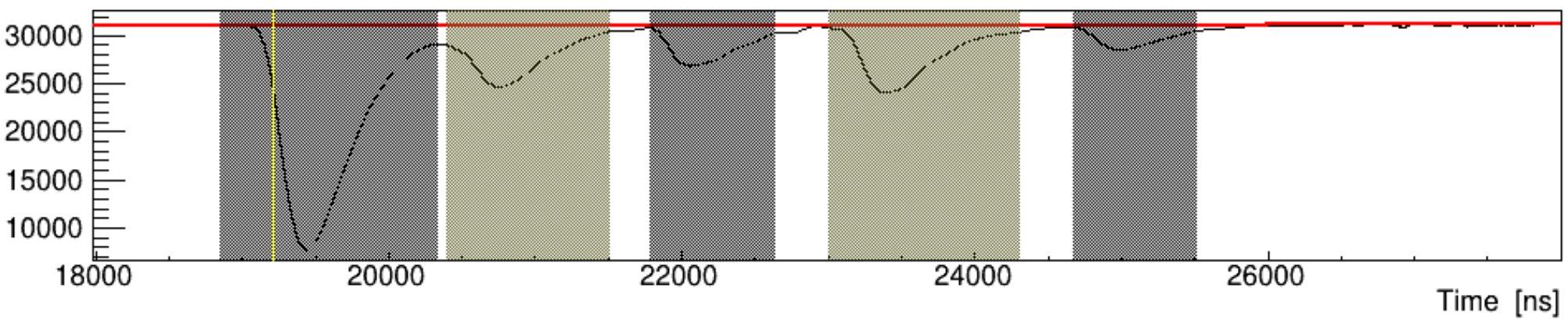
3. First comparison with PTB

Silicon detector – Signal reconstruction

Baseline

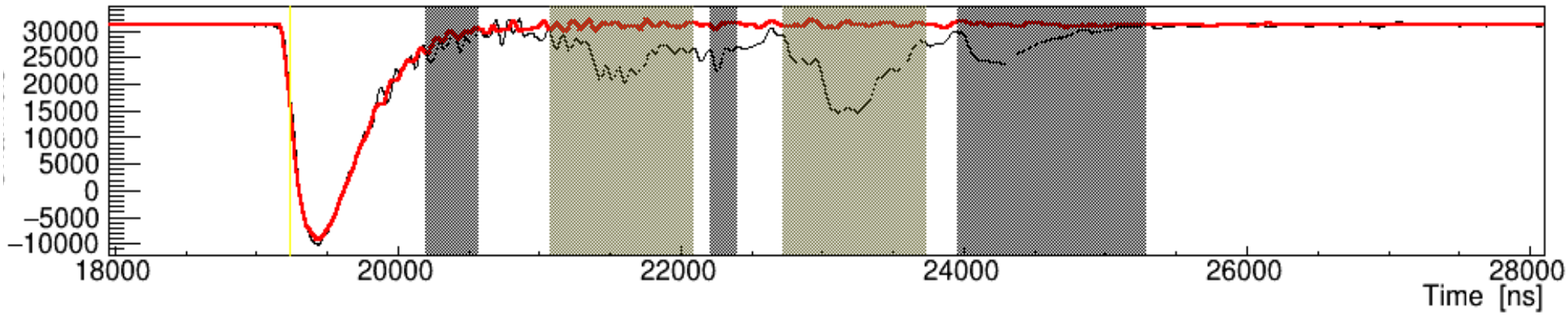


Fourier transform

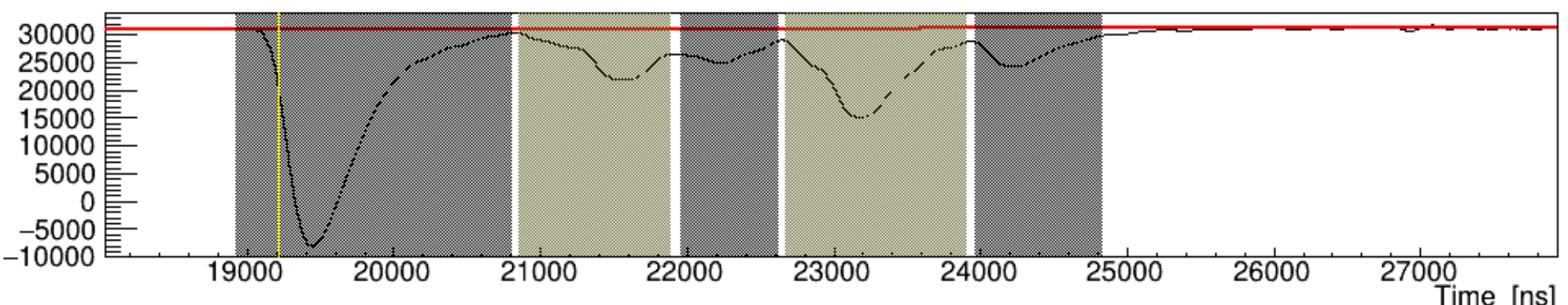


Silicon detector – Signal reconstruction

Baseline

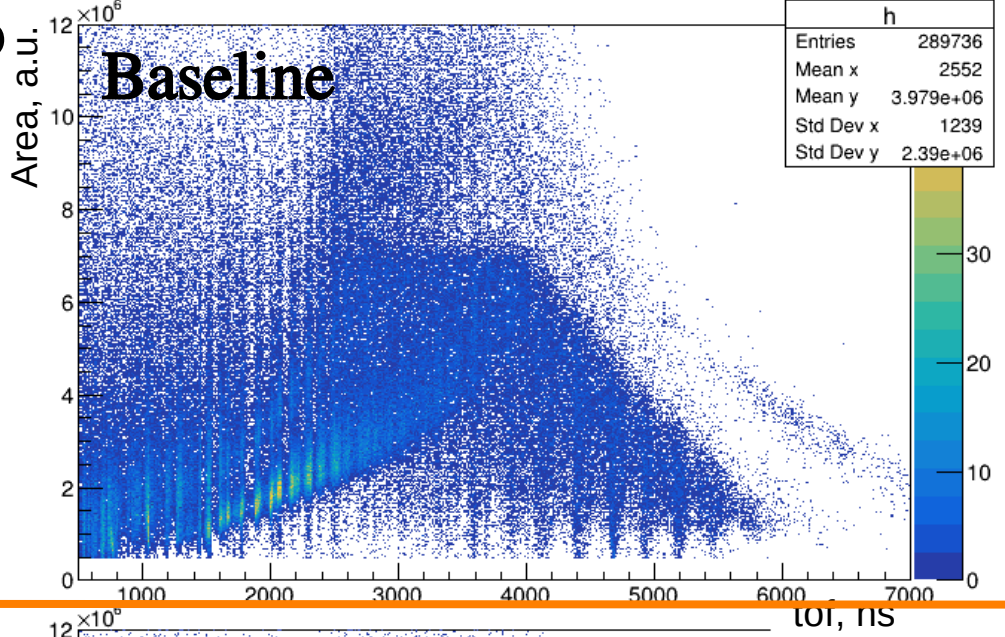


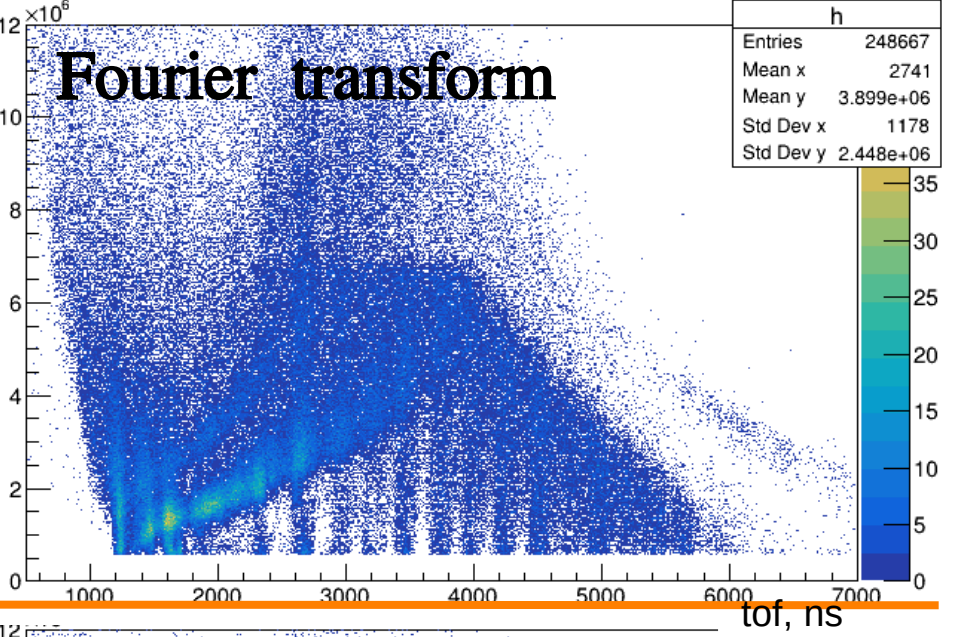
Fourier transform

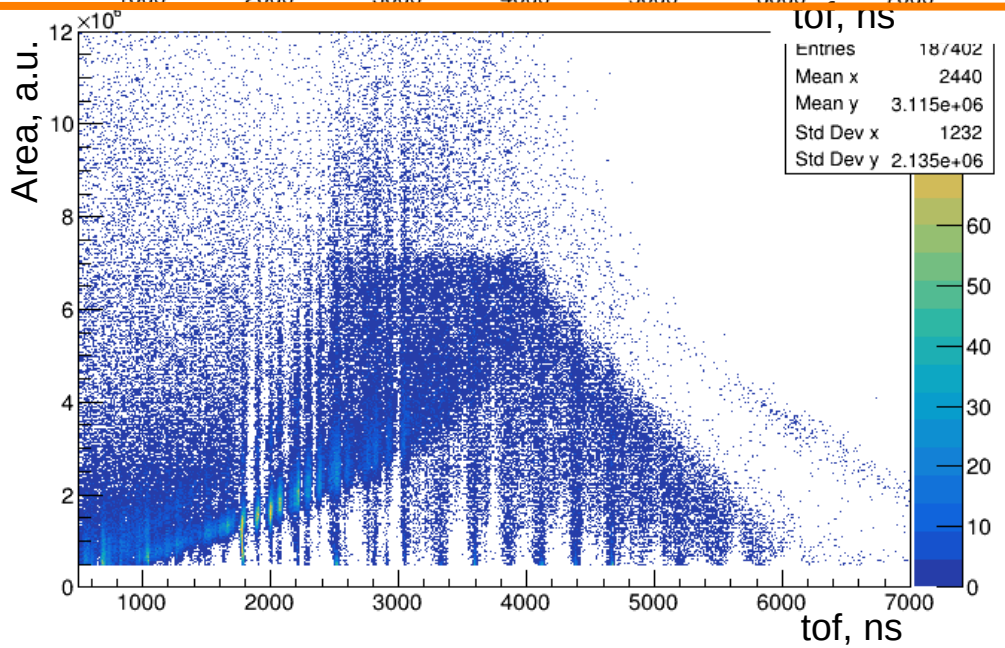


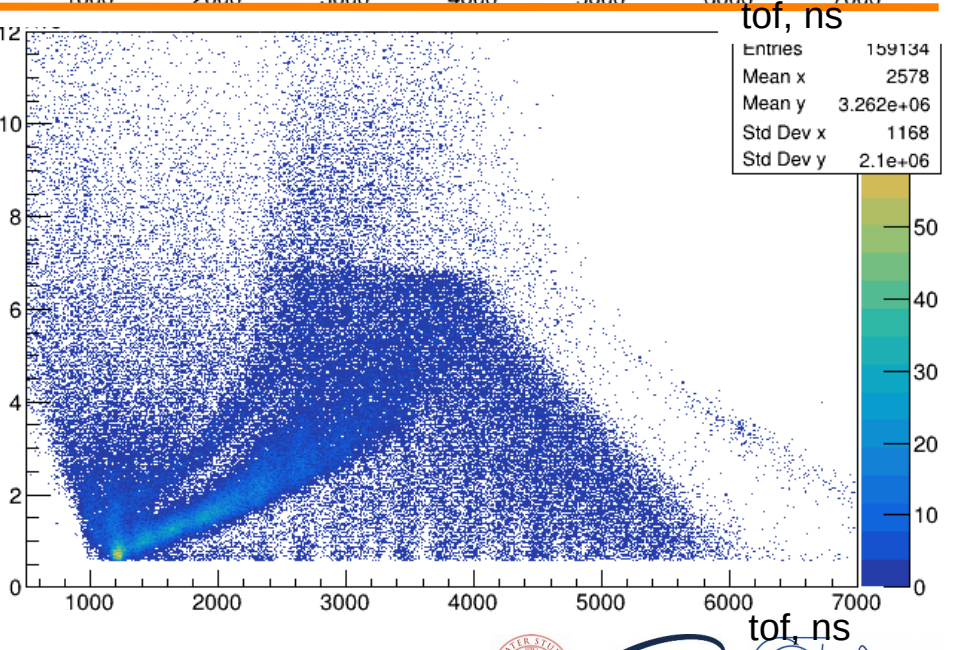
Dedicated

Parasitic



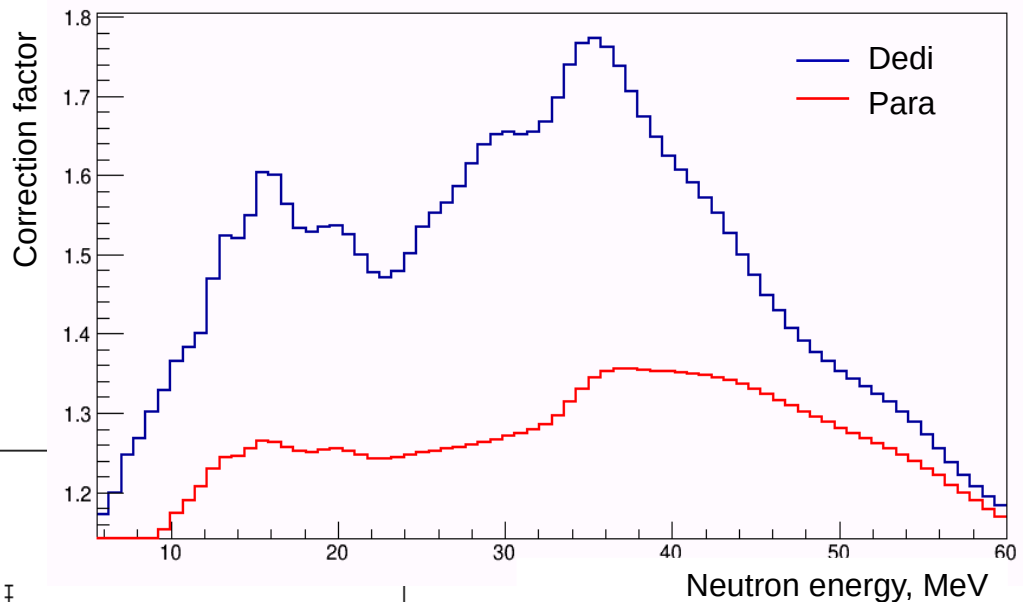


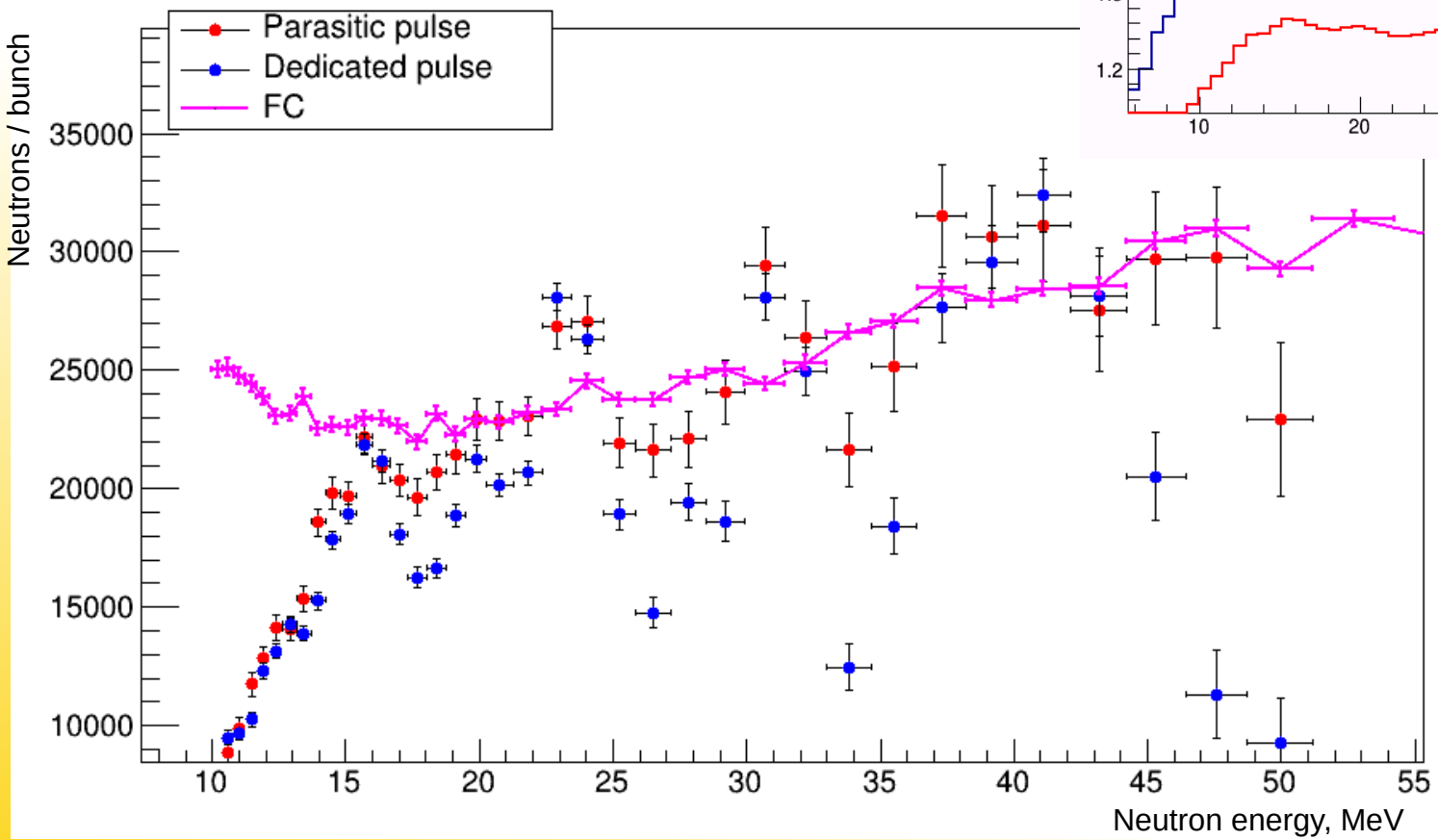




Extracted flux

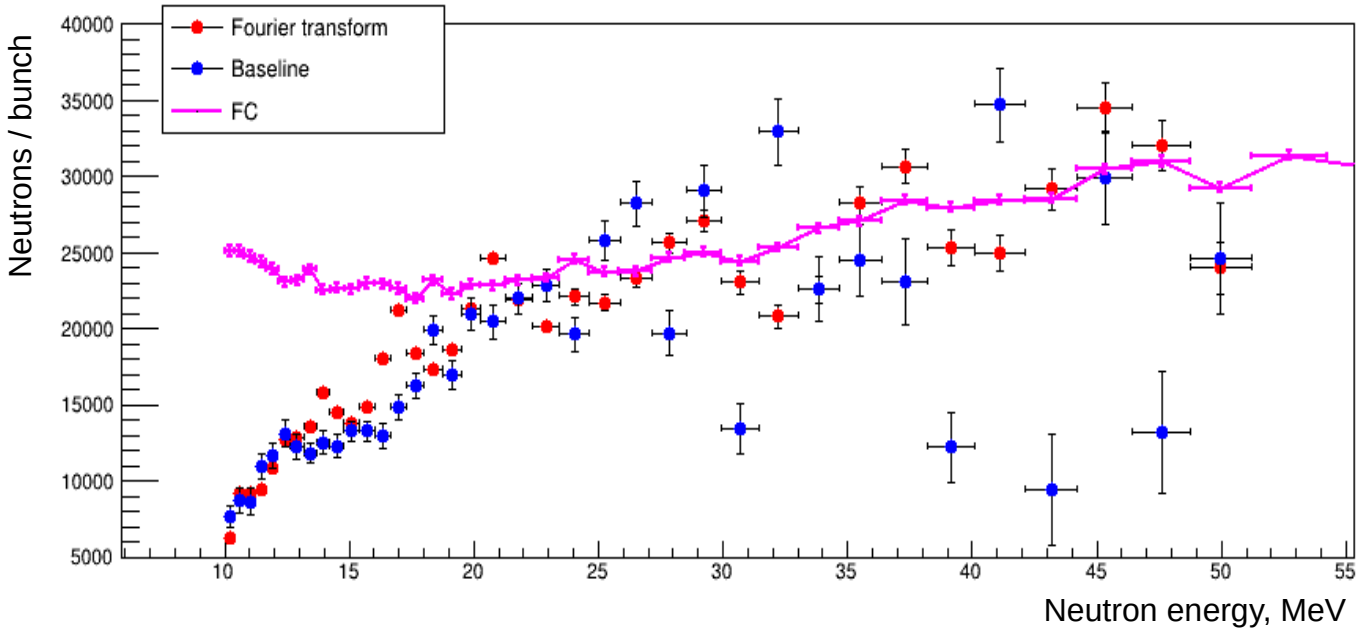
1. Comparison between dedicated and parasitic pulses





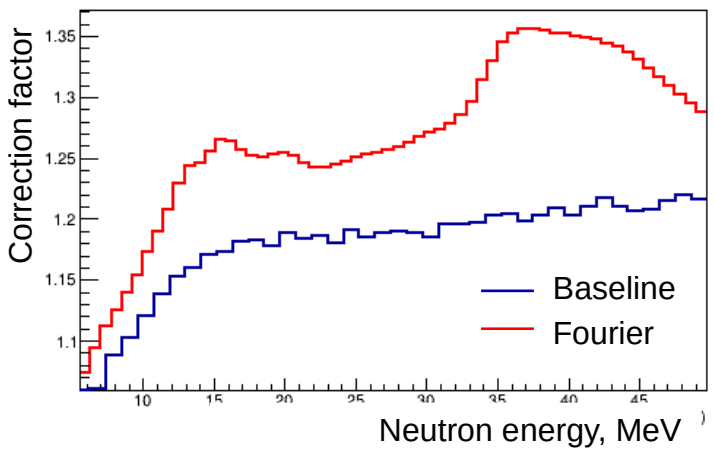
PE 2 mm

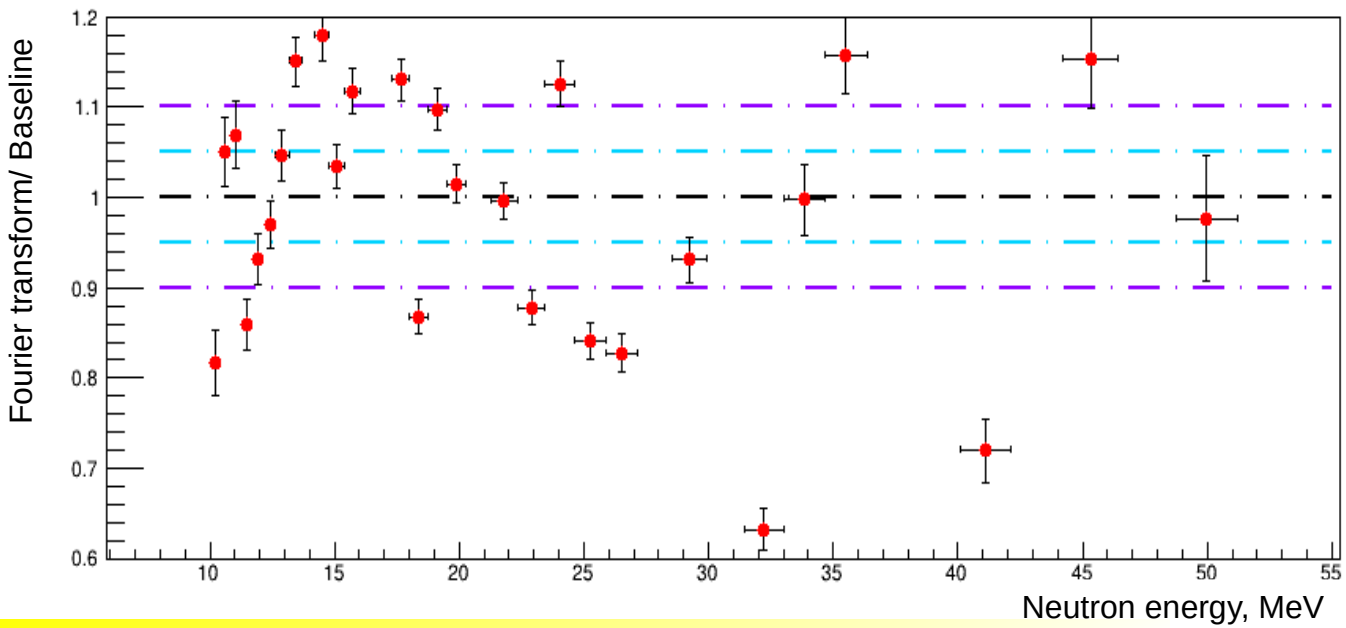
Extracted flux



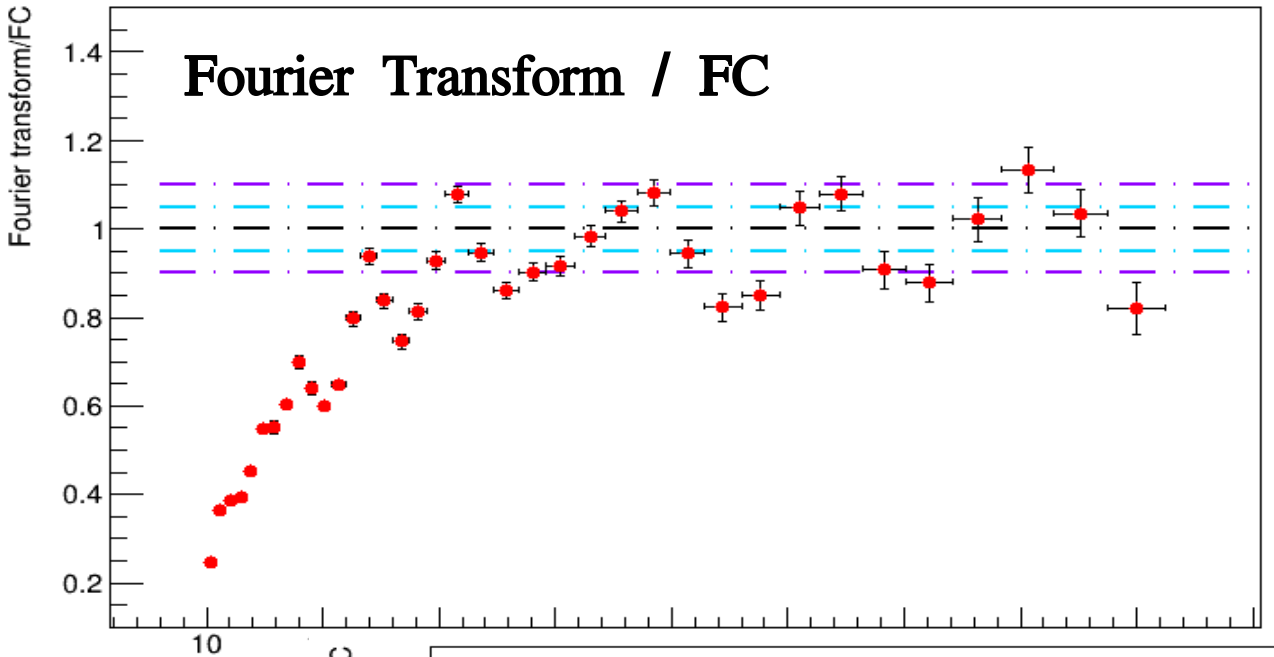
2. Comparison between fourier transform and baseline subtraction

PE 2 mm

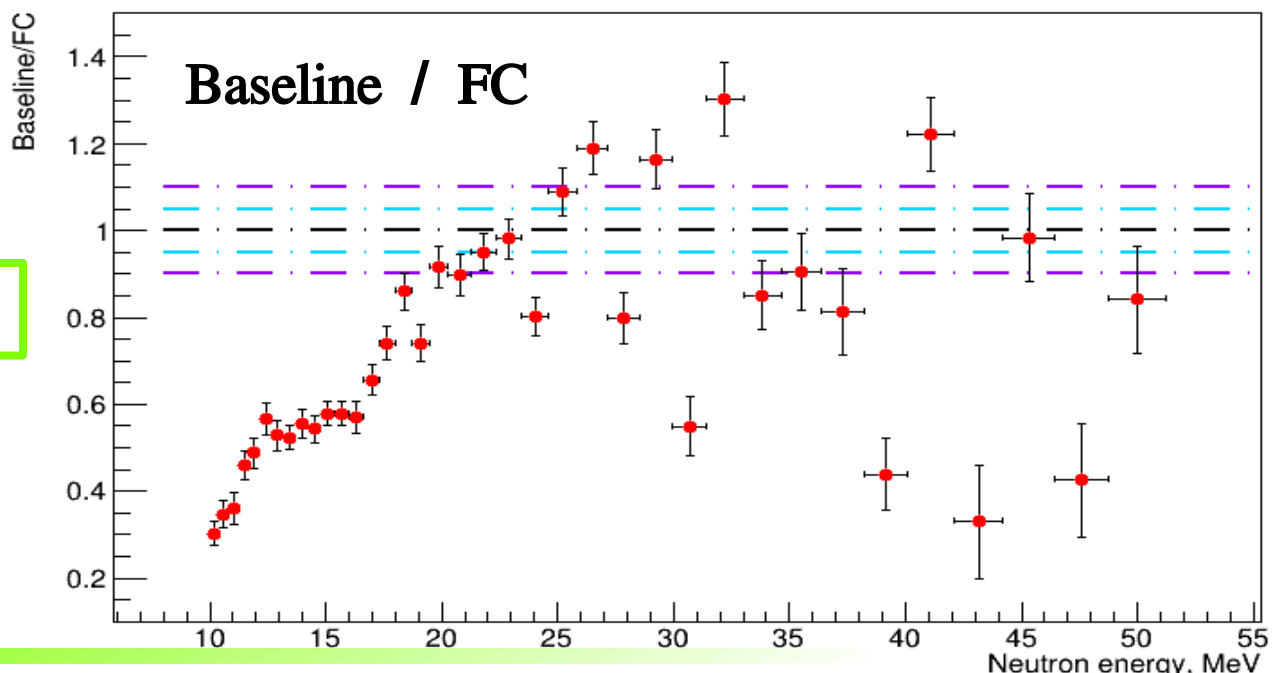




Extracted flux

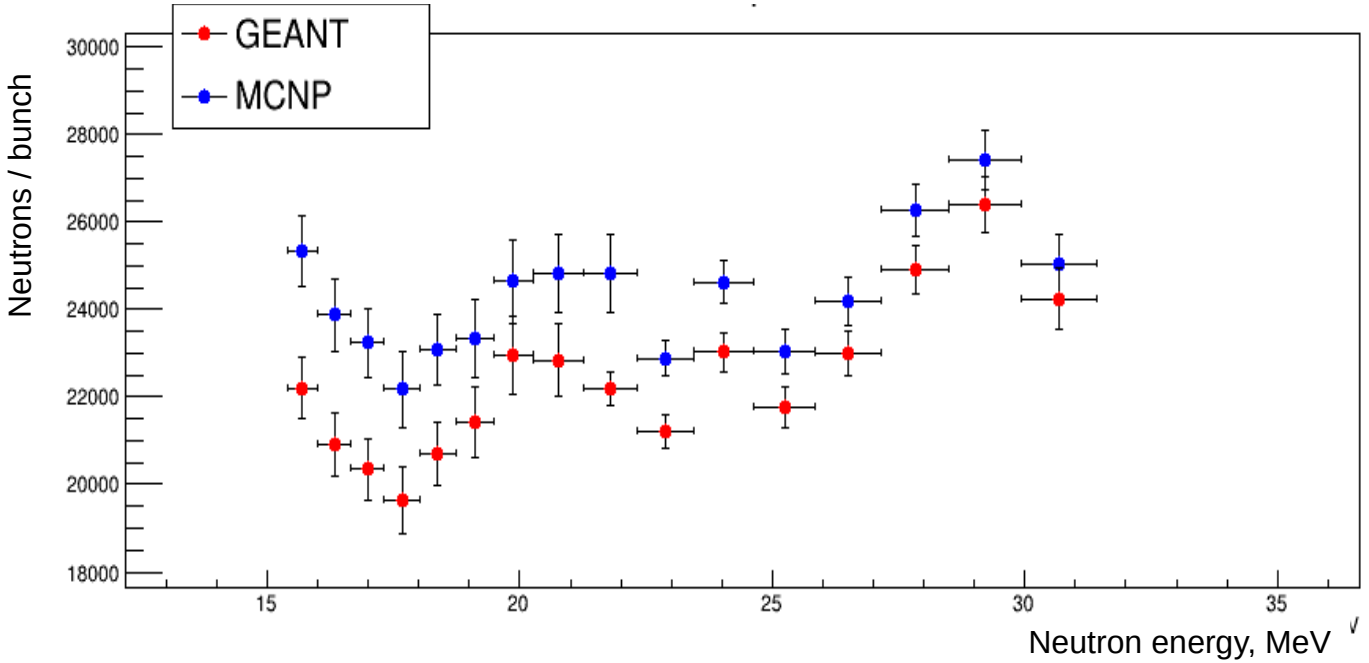


2. Comparison between fourier transform and baseline subtraction



PE 2 mm

Extracted flux

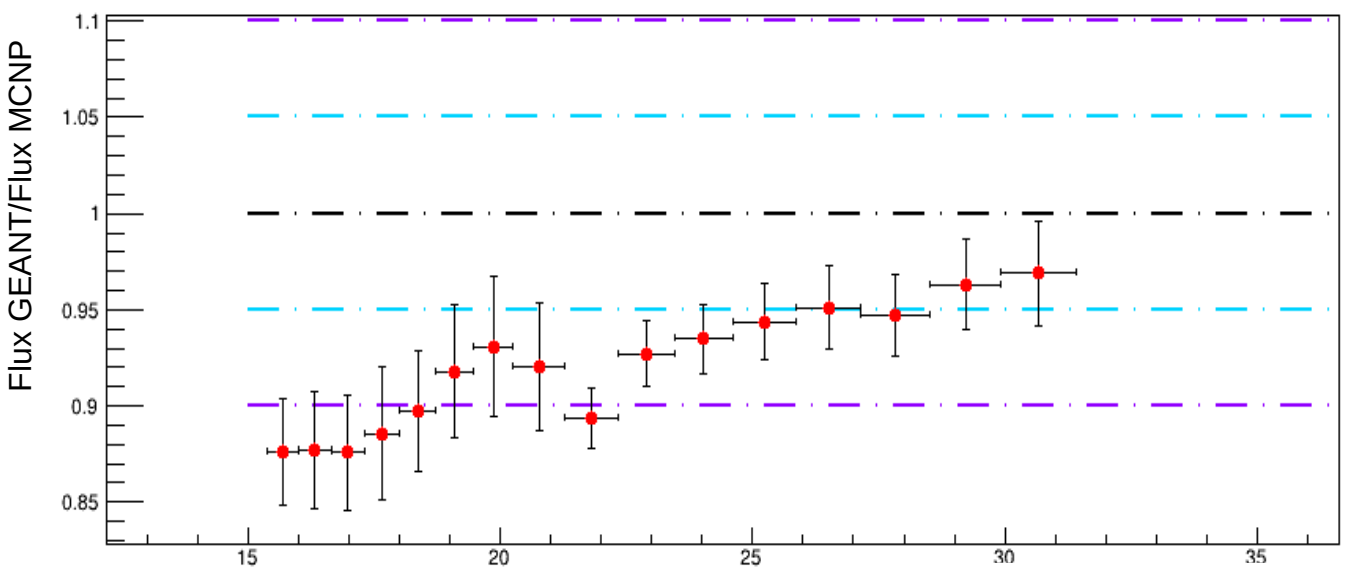


Fourier Transform

PE 1 mm

+

PE 2mm



1. Neutron flux

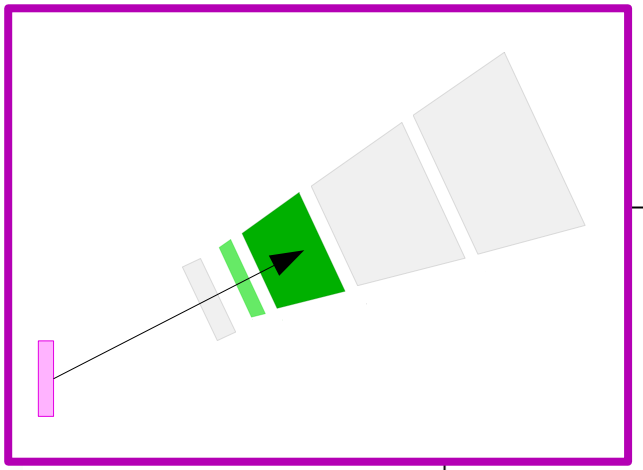
Monte Carlo Simulations: GEANT & MCNP

PRT – L: 2 Silicon Detectors & 4 plastic Scintillators

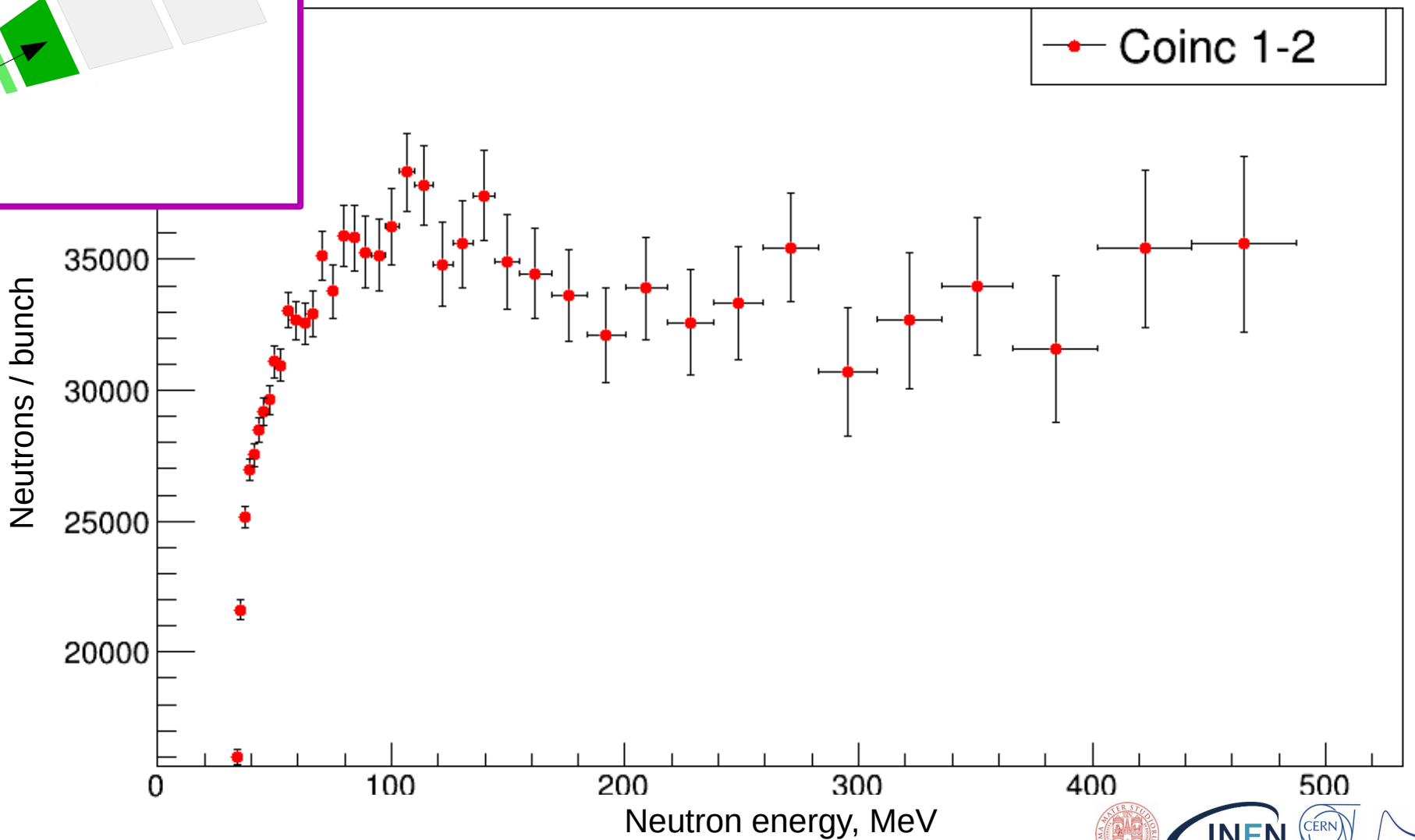
2. PPACs

3. First comparison with PTB

Neutron flux extraction

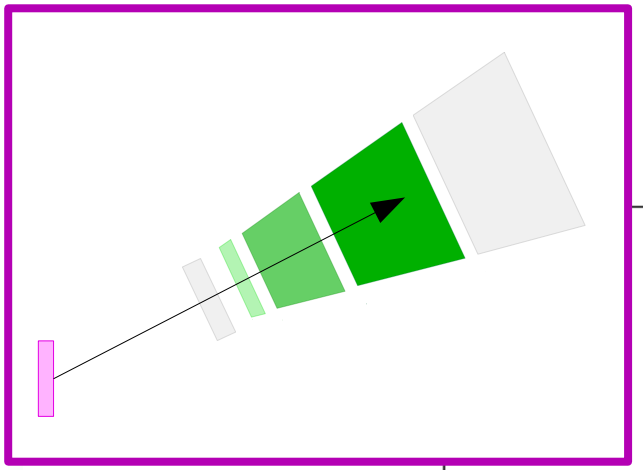


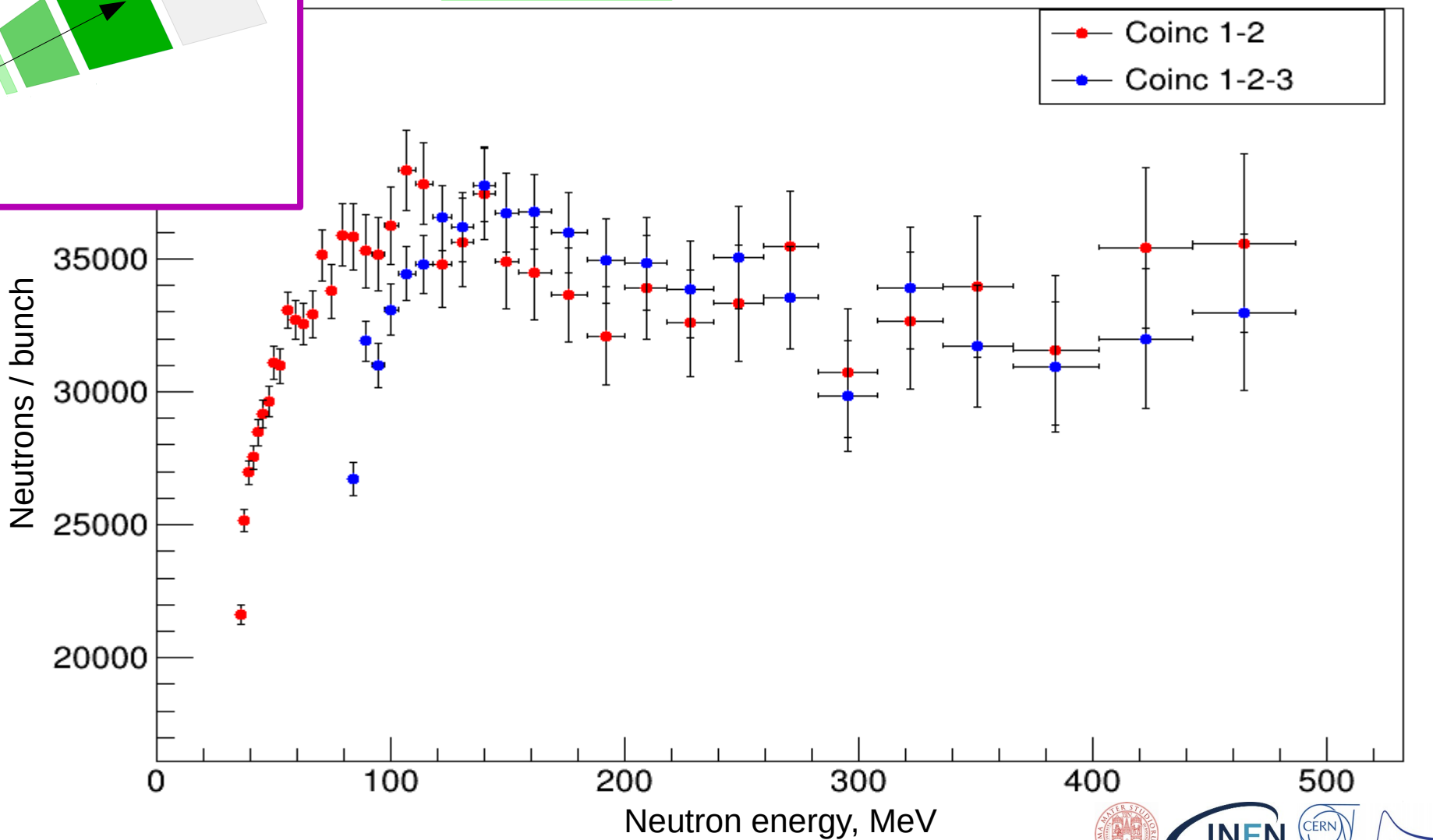
PE 2 mm



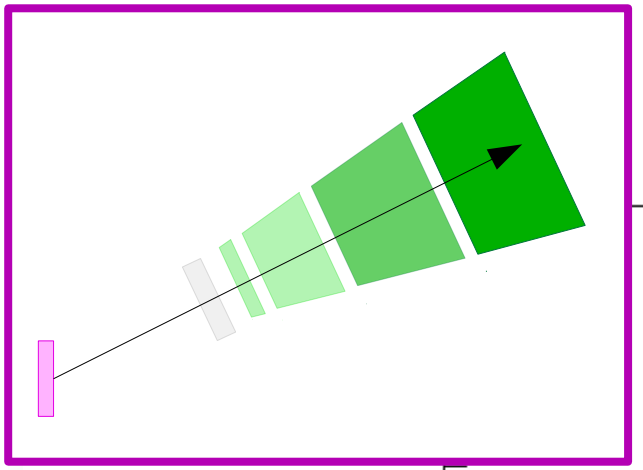
Neutron flux extraction

PE 2 mm

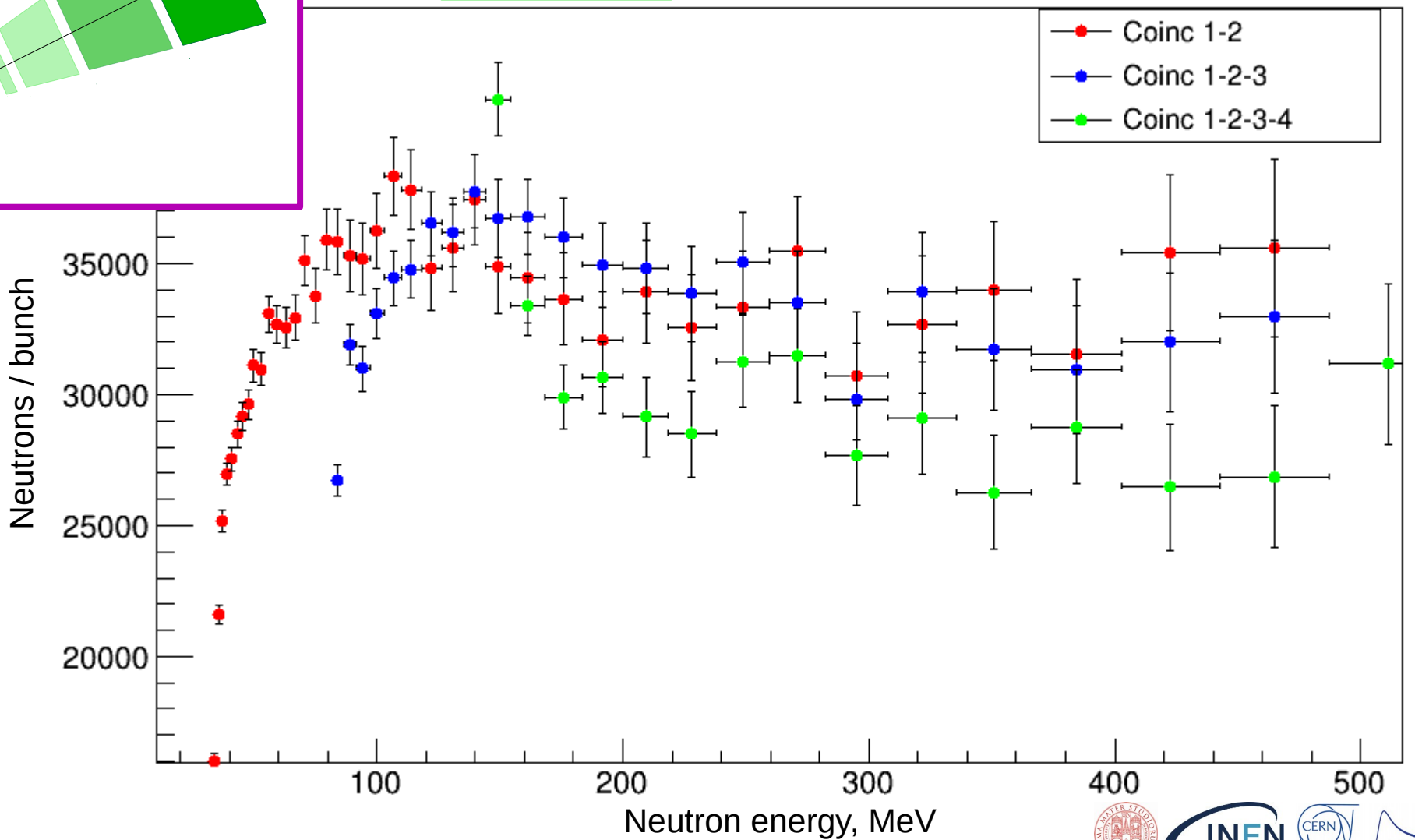




Neutron flux extraction

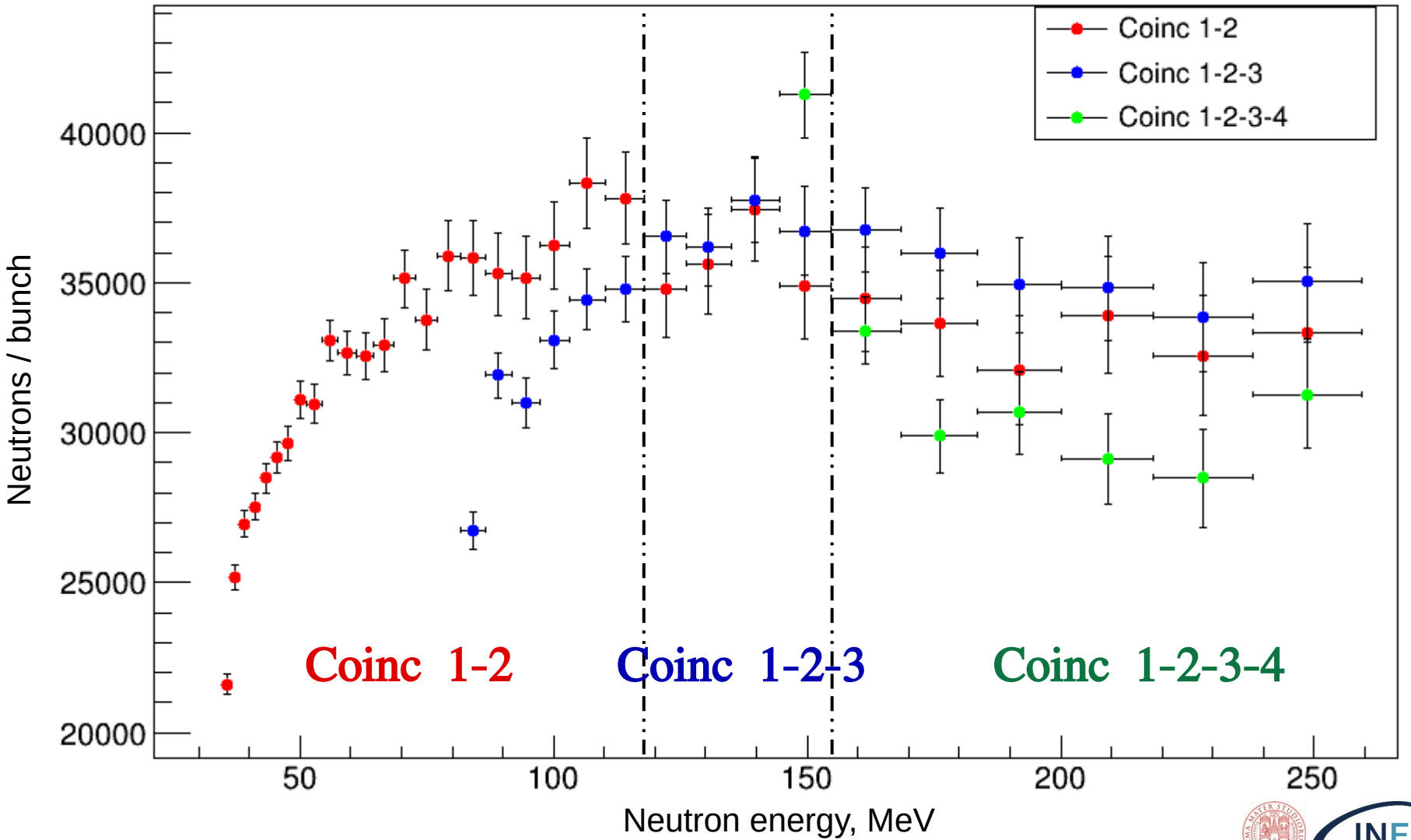


PE 2 mm

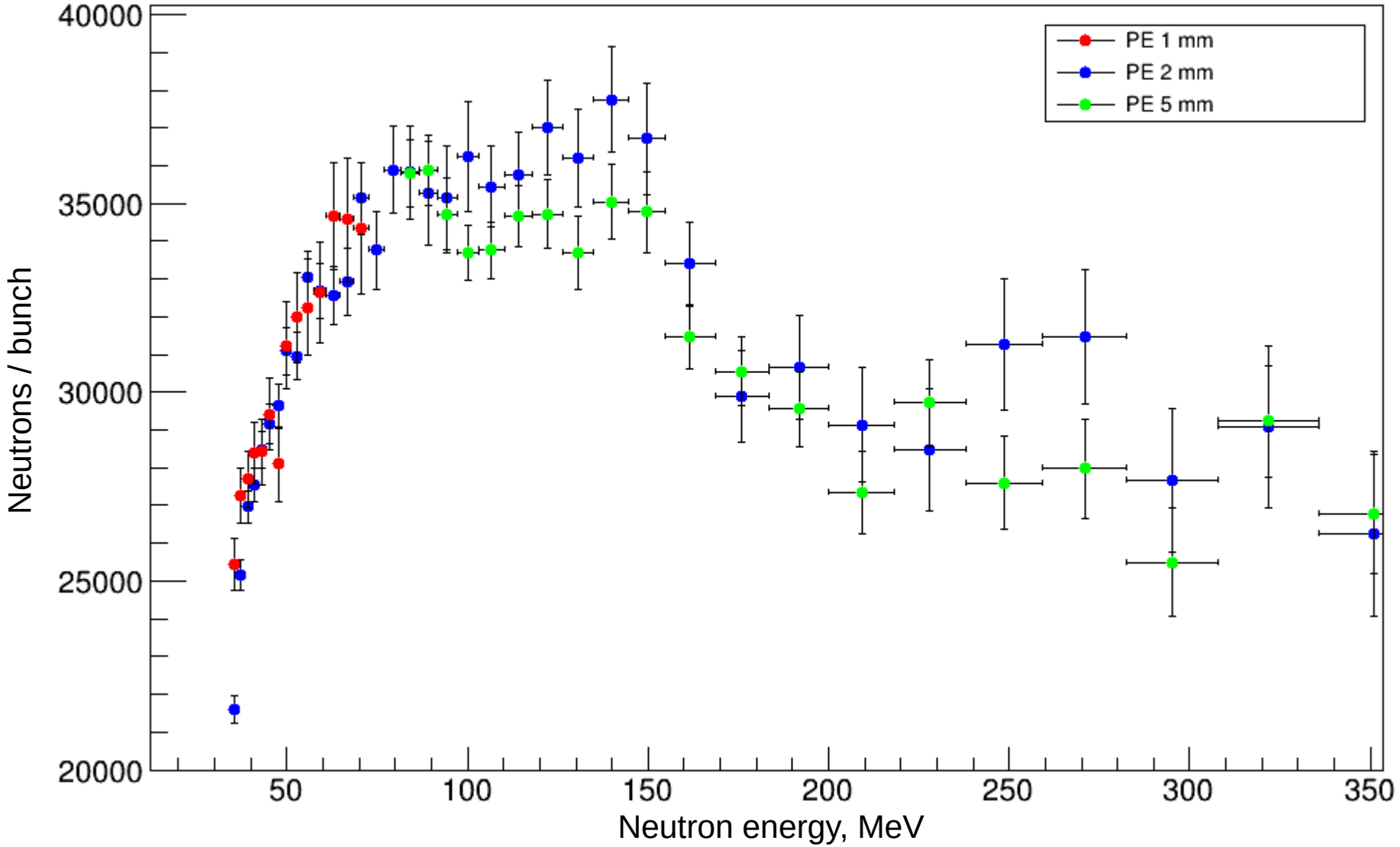


Neutron flux extraction

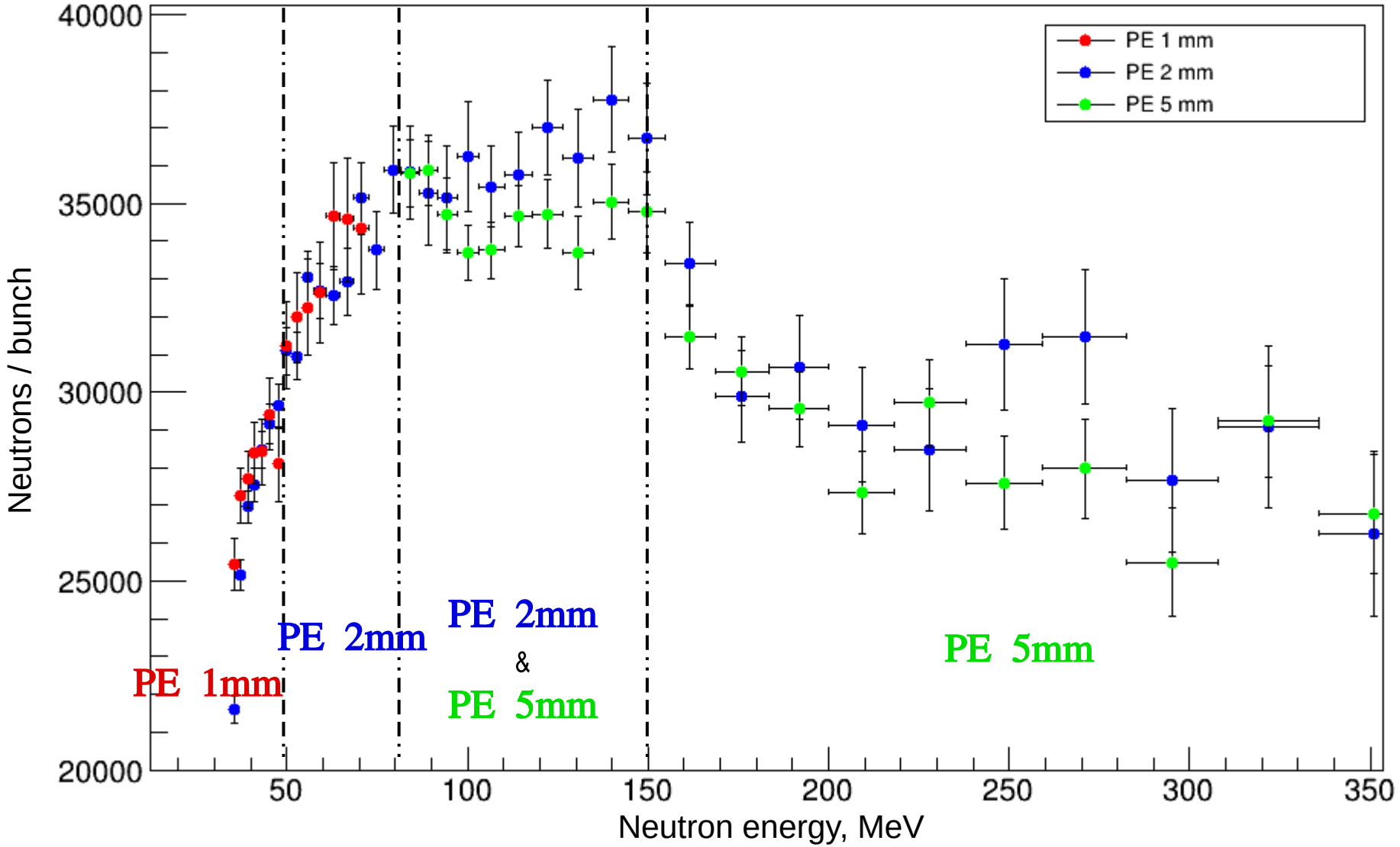
PE 2 mm



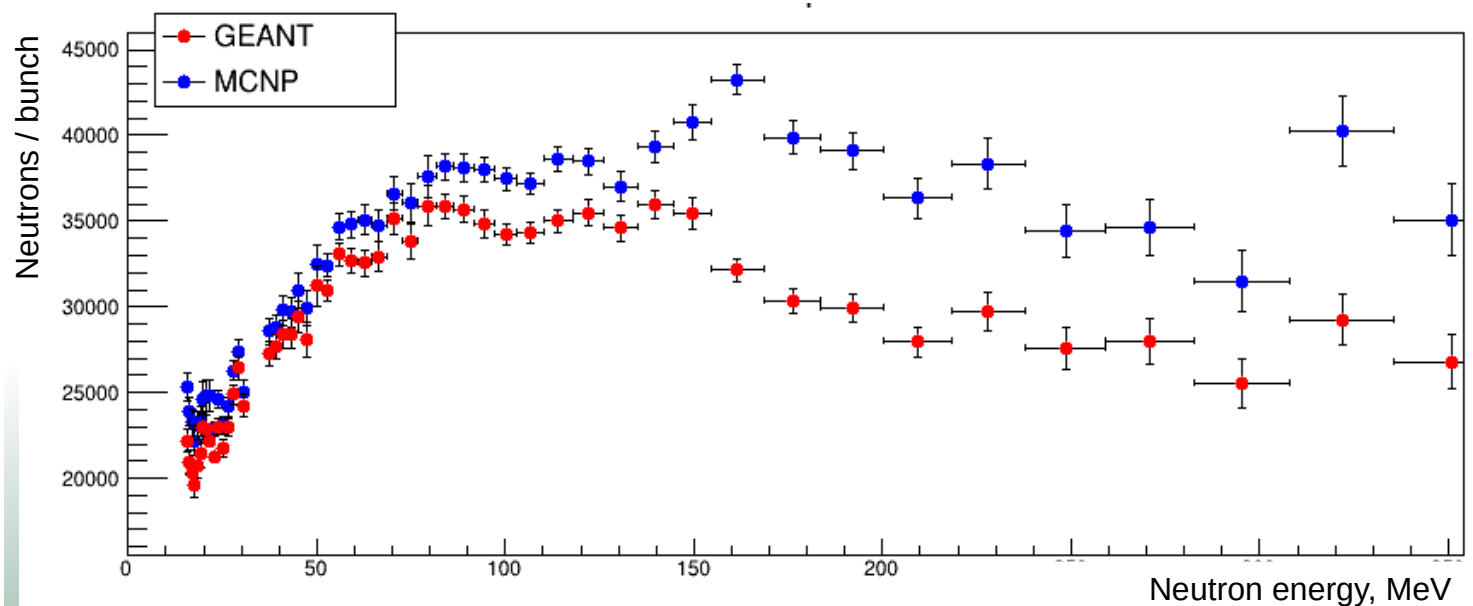
Neutron flux extraction

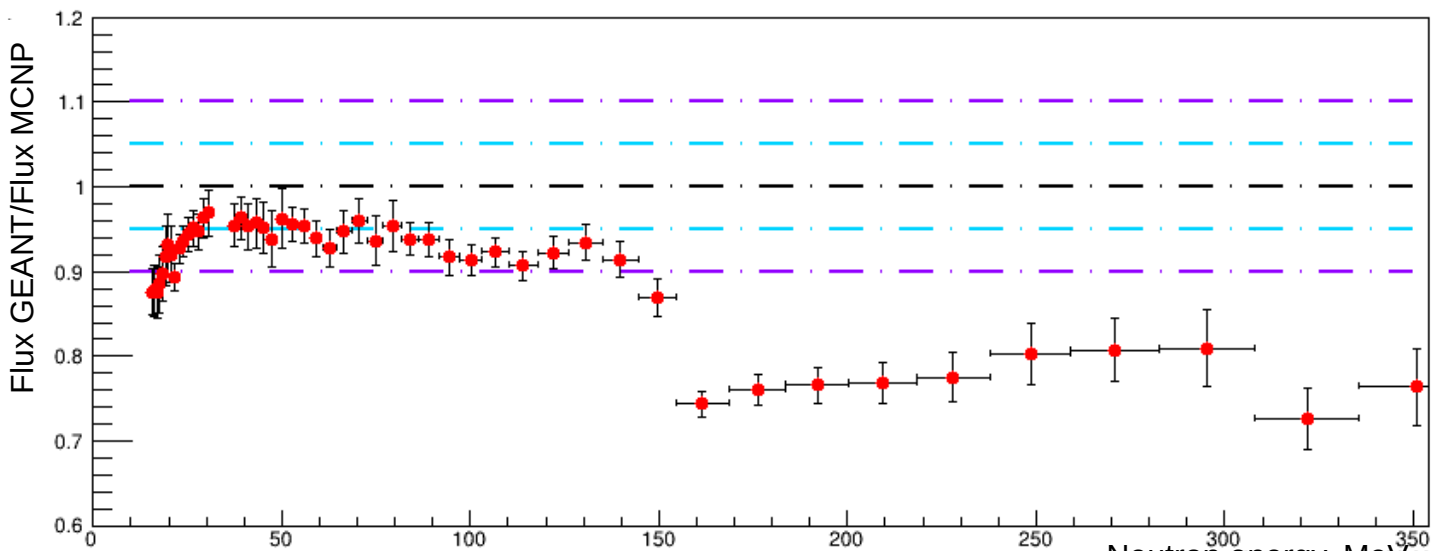


Neutron flux extraction

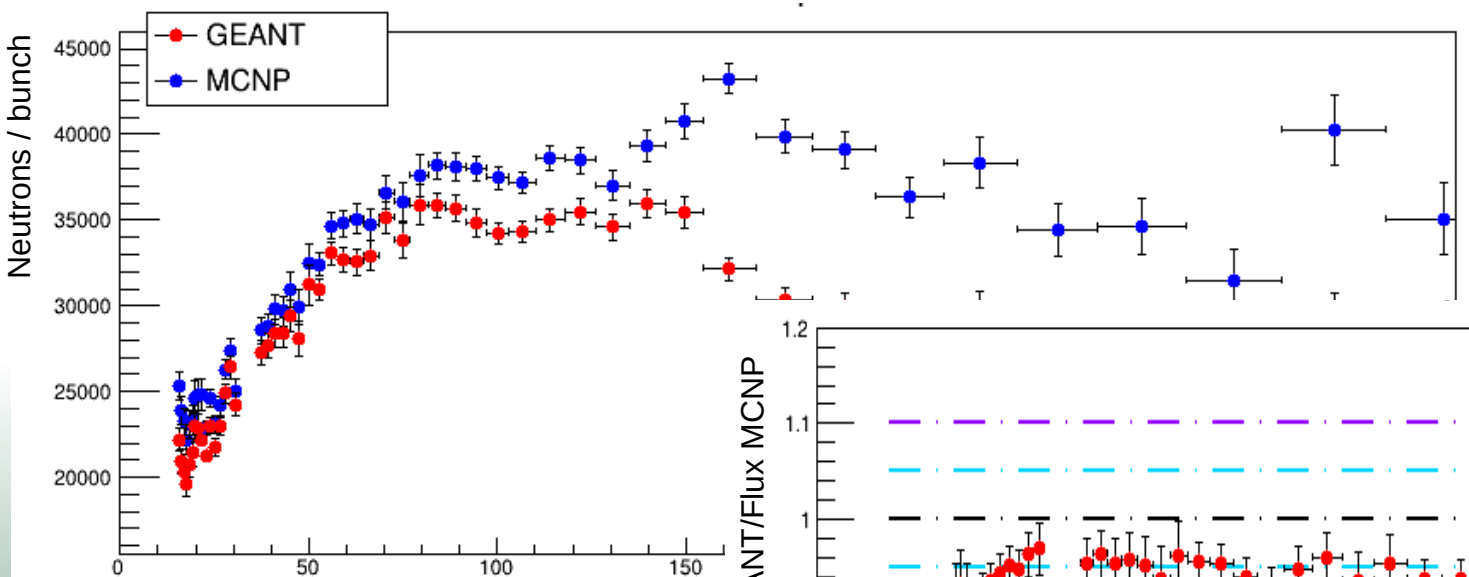


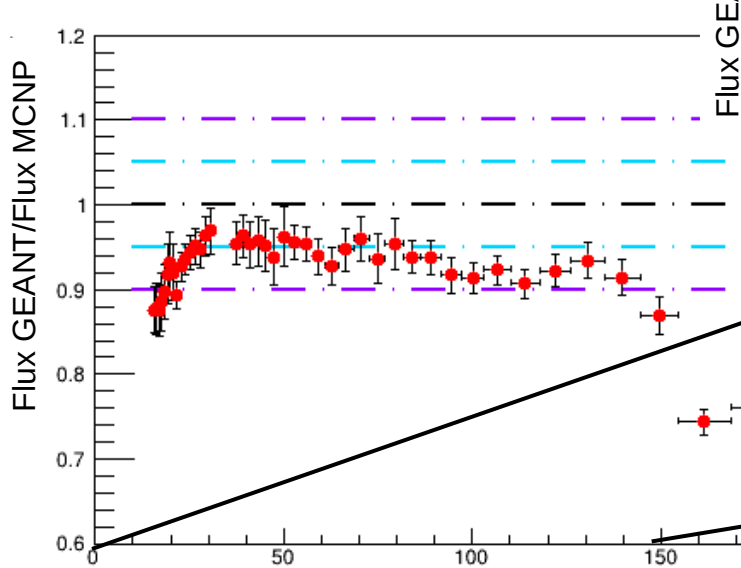
Flux Si&Sci – PE 1 mm + 2 mm + 5 mm

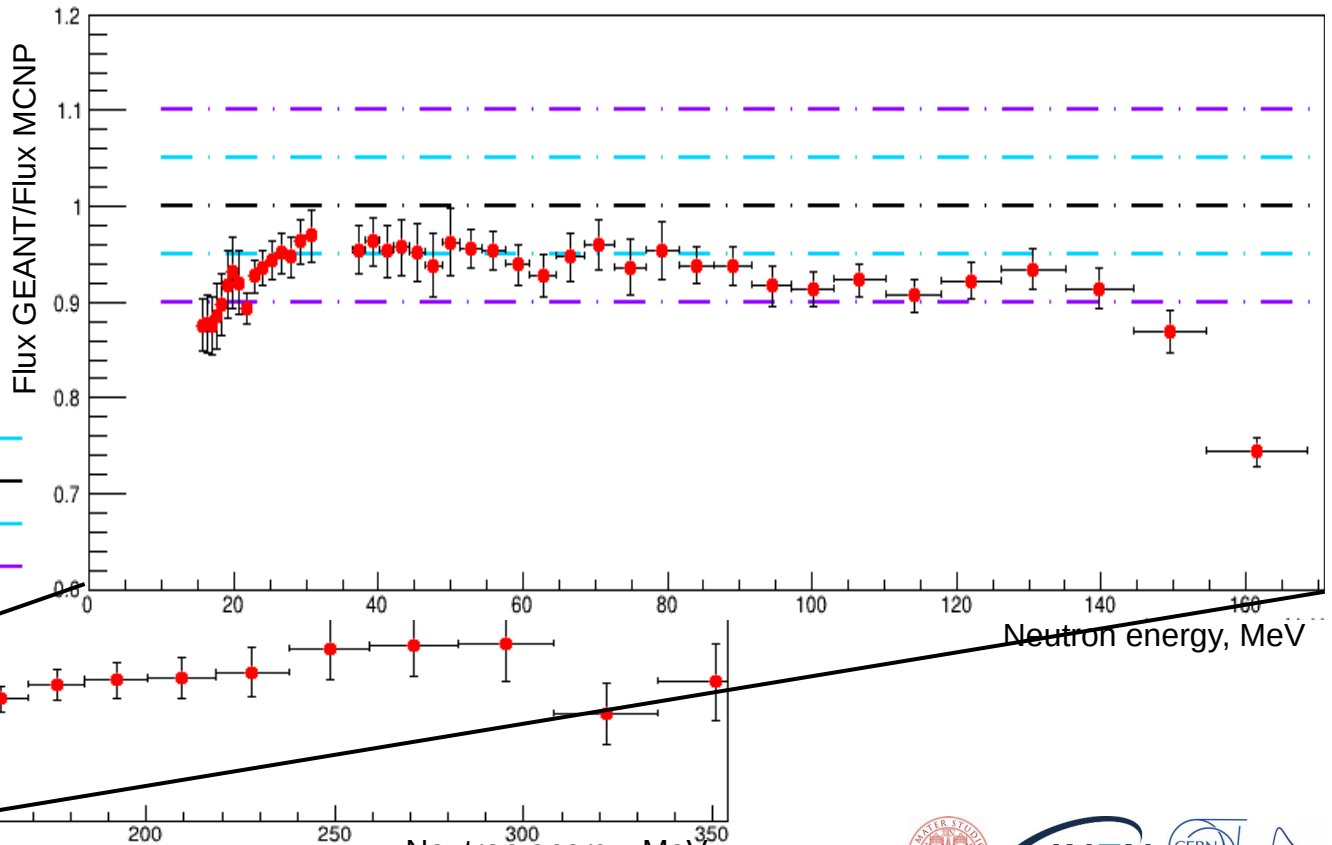




Flux Si&Sci – PE 1 mm + 2 mm + 5 mm







Neutron energy, MeV

1. Neutron flux

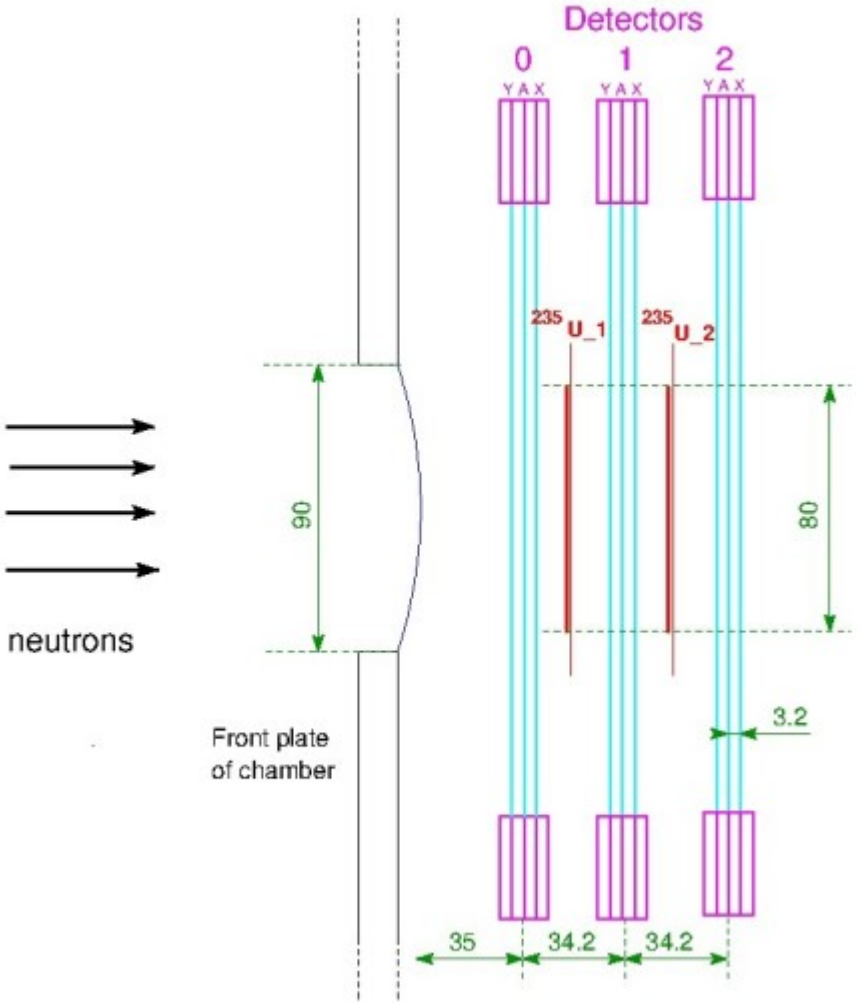
Monte Carlo Simulations: GEANT & MCNP

PRT – L: 2 Silicon Detectors & 4 plastic Scintillators

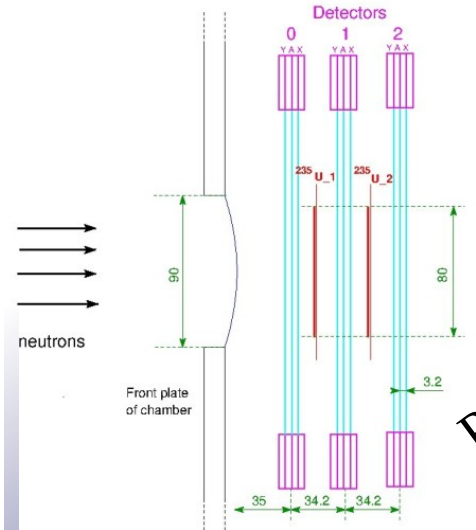
2. PPACs

3. First comparison with PTB

PPACs


Detectors
0
1
2
Y A X
Y A X
Y A X
235 U_1
235 U_2
neutrons
90
80
3.2
Front plate
of chamber
35
34.2
34.2

PPACs



PPAC 1

PPAC 2

Target

Fission product 1

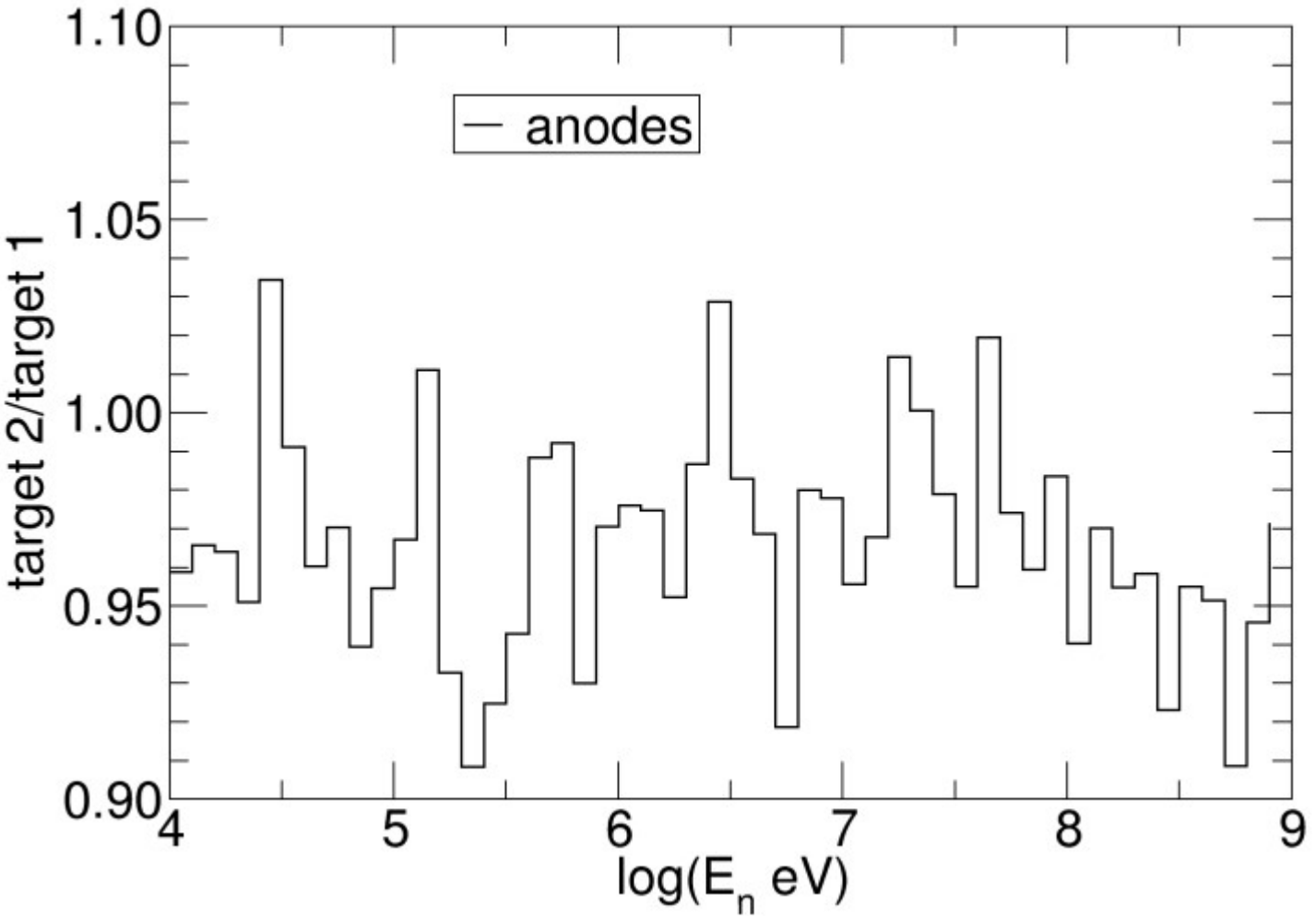
Fission product 2

Neutrons

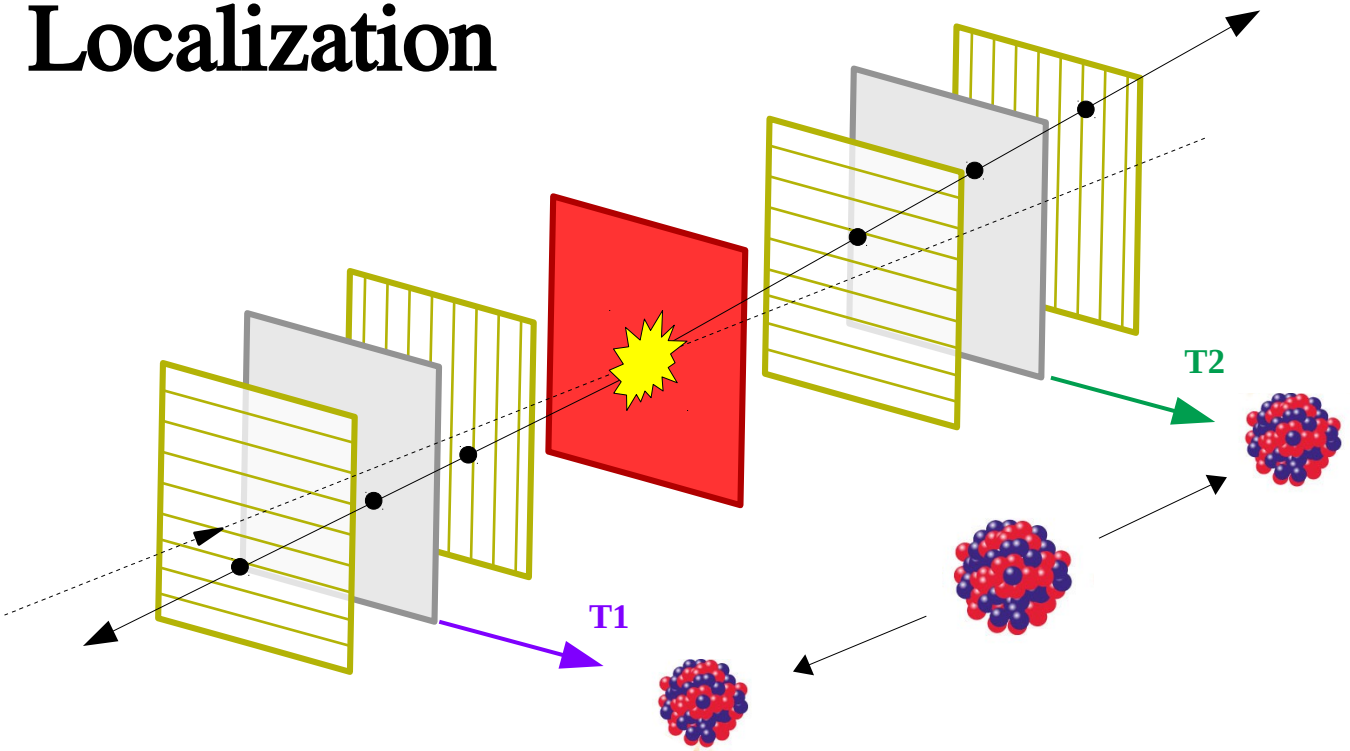
T1

T2

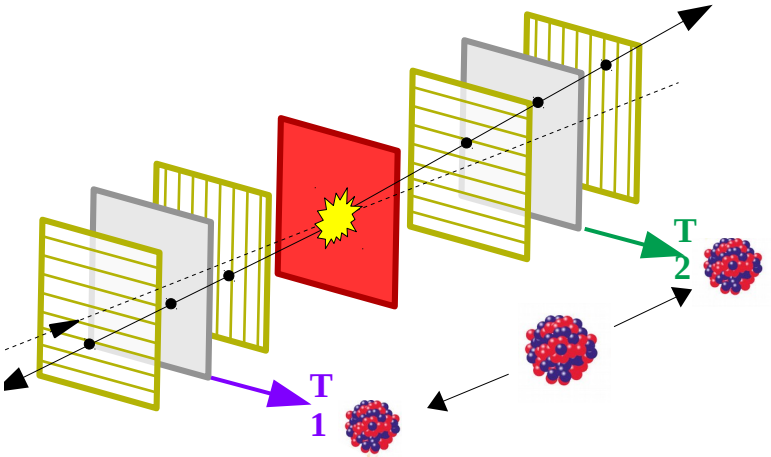
Coincidences between anodes

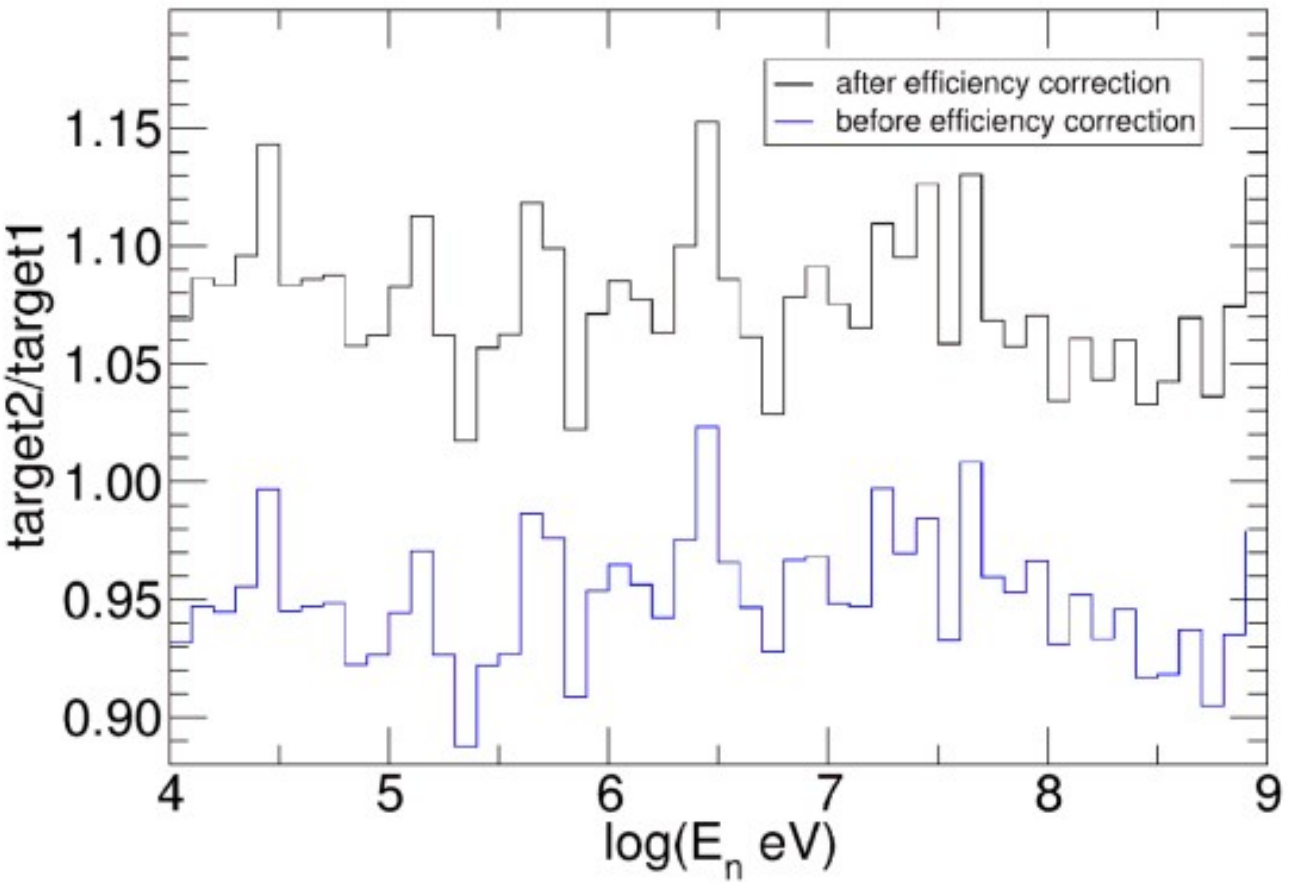


Coincidences & Localization

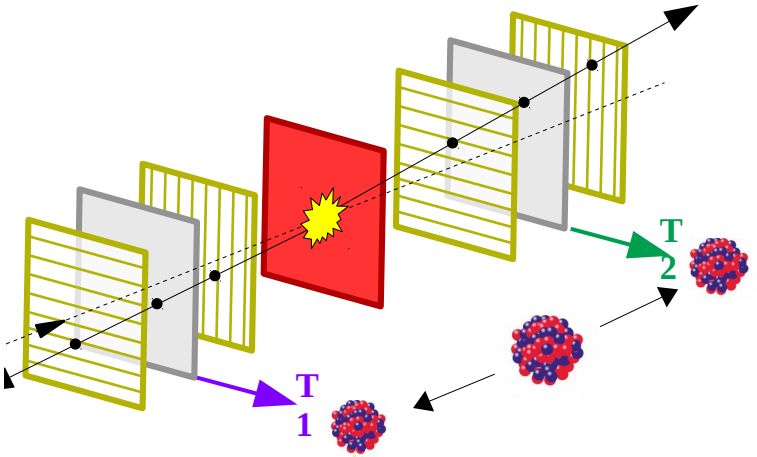


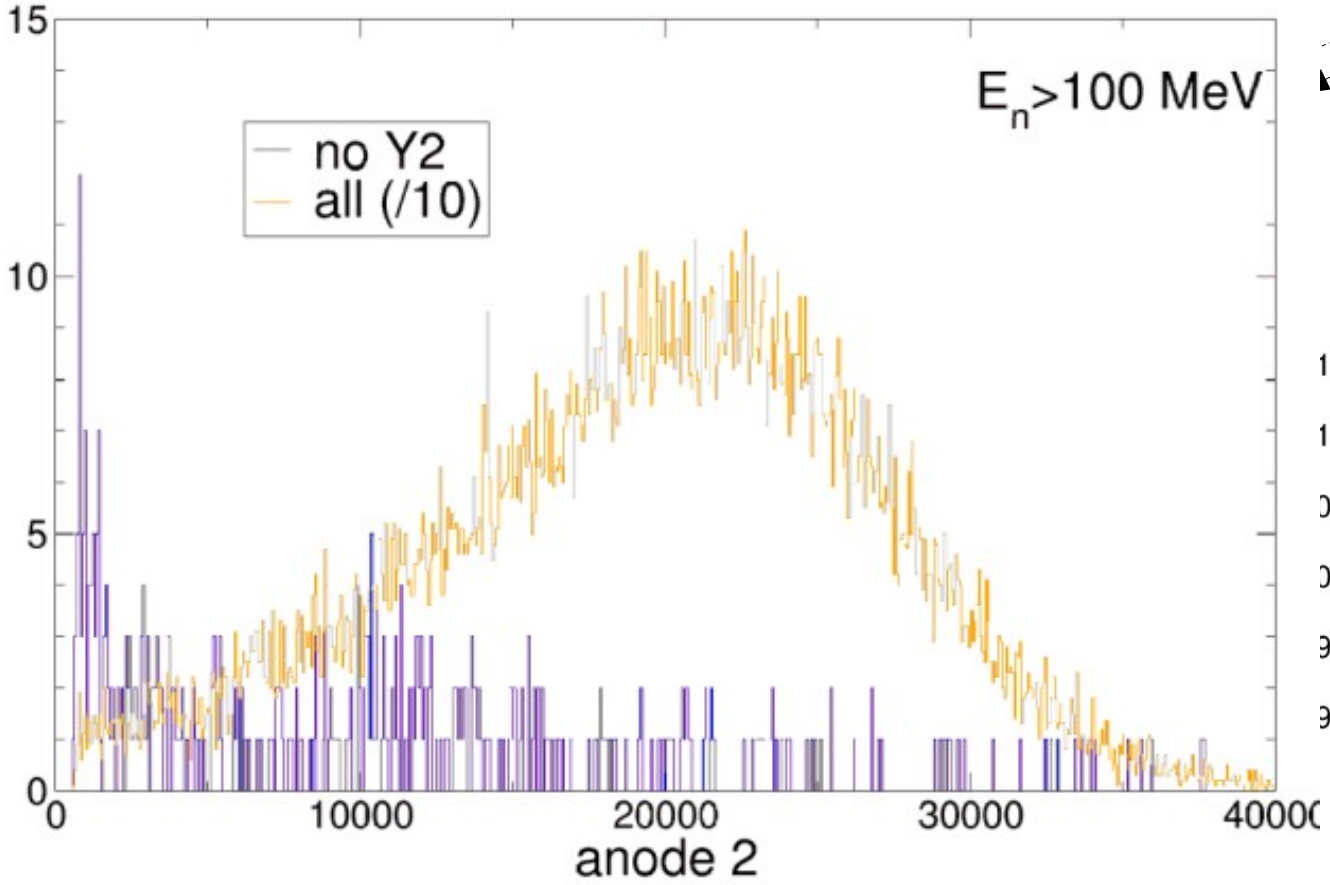
Coincidences & Localization

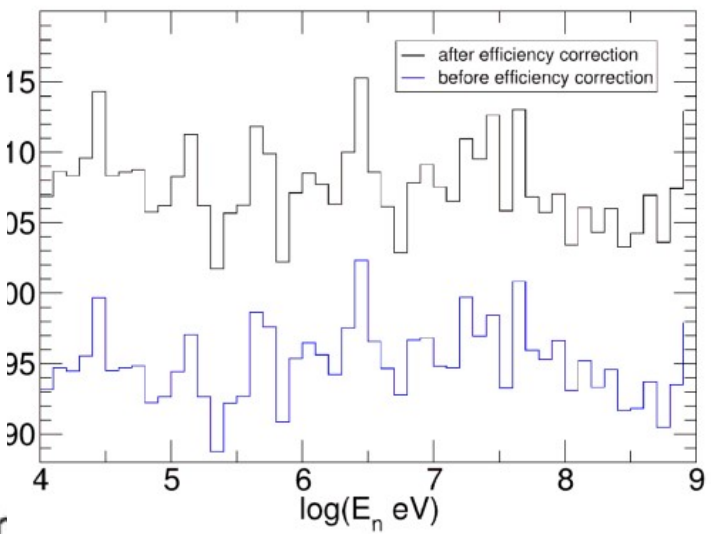




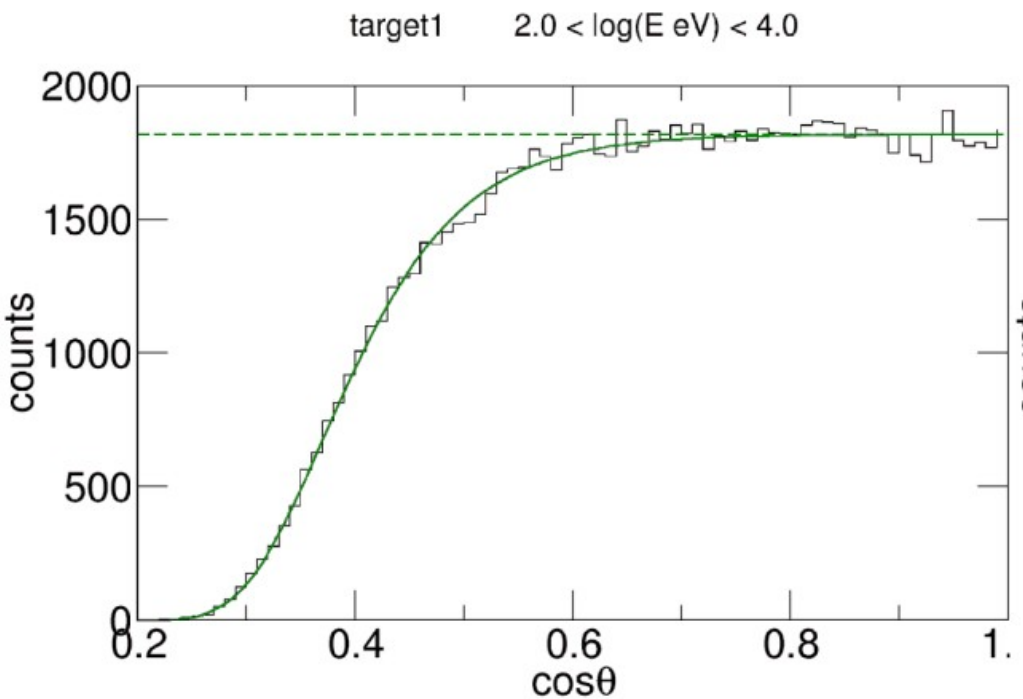
Coincidences & Localization



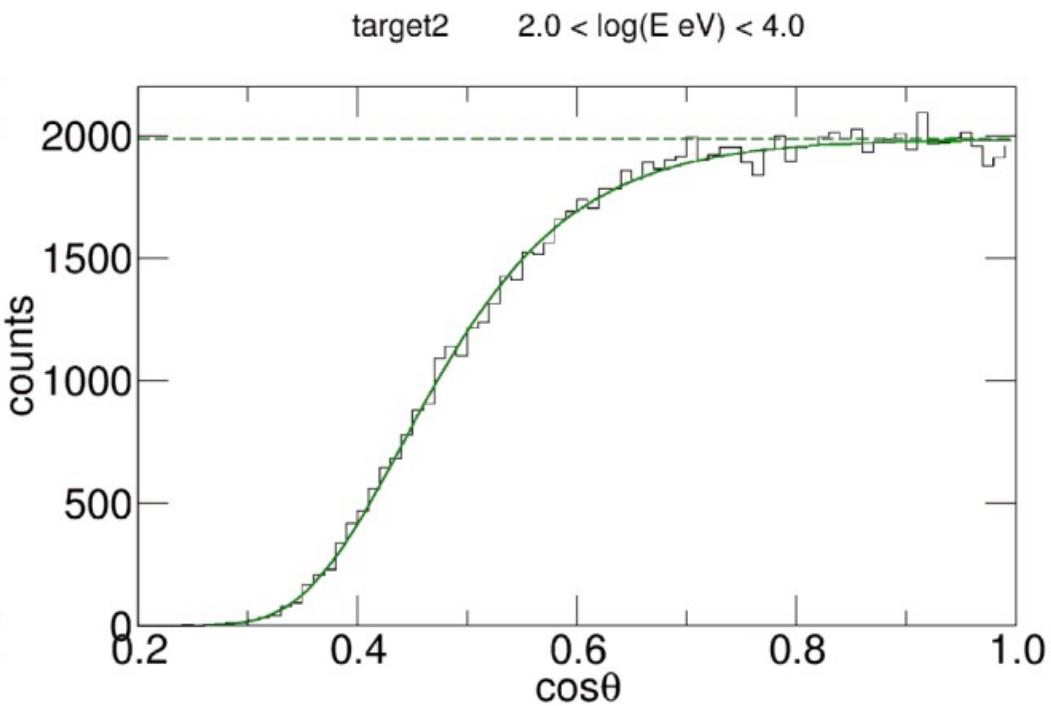




Absolute efficiency

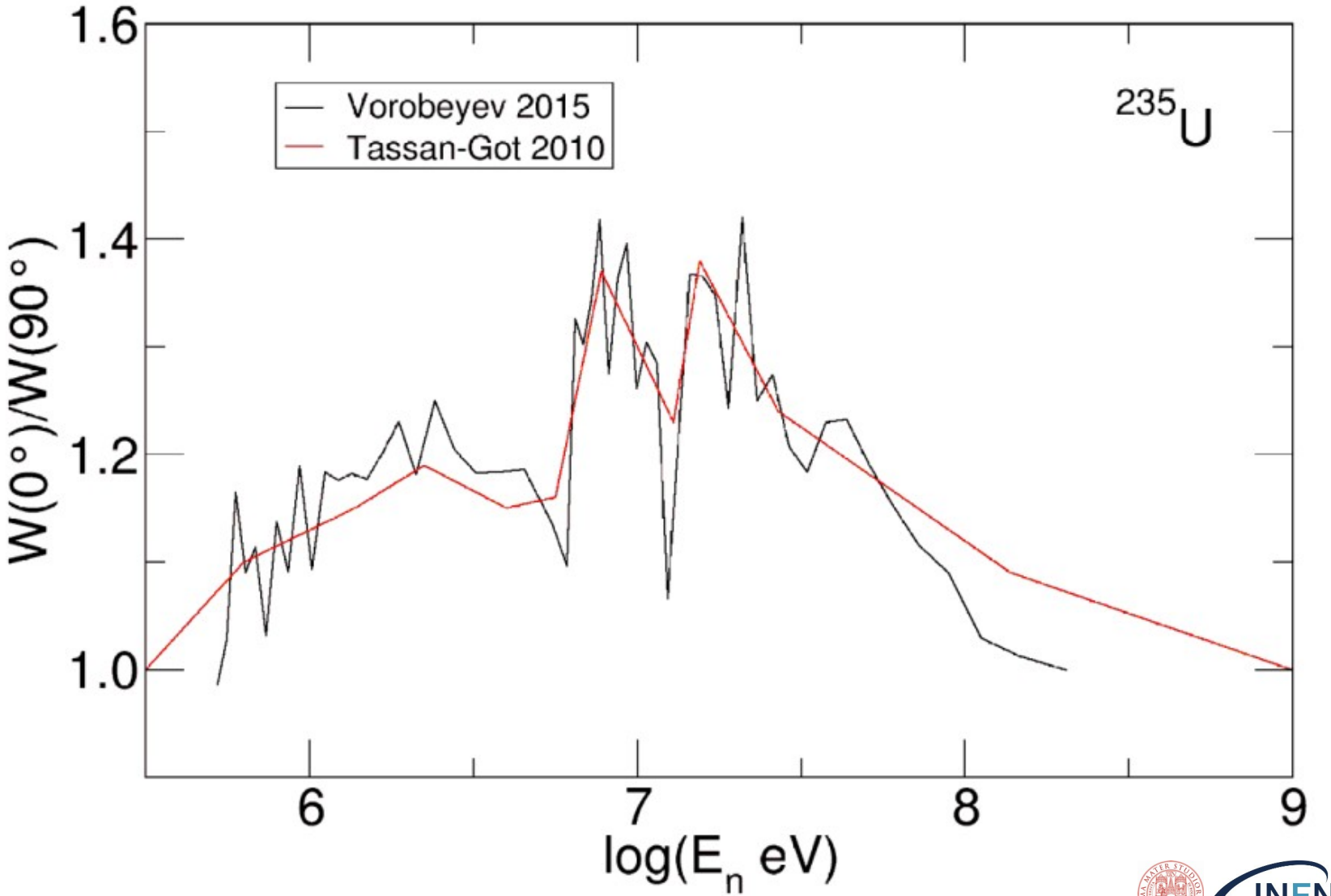


ε = 0.589

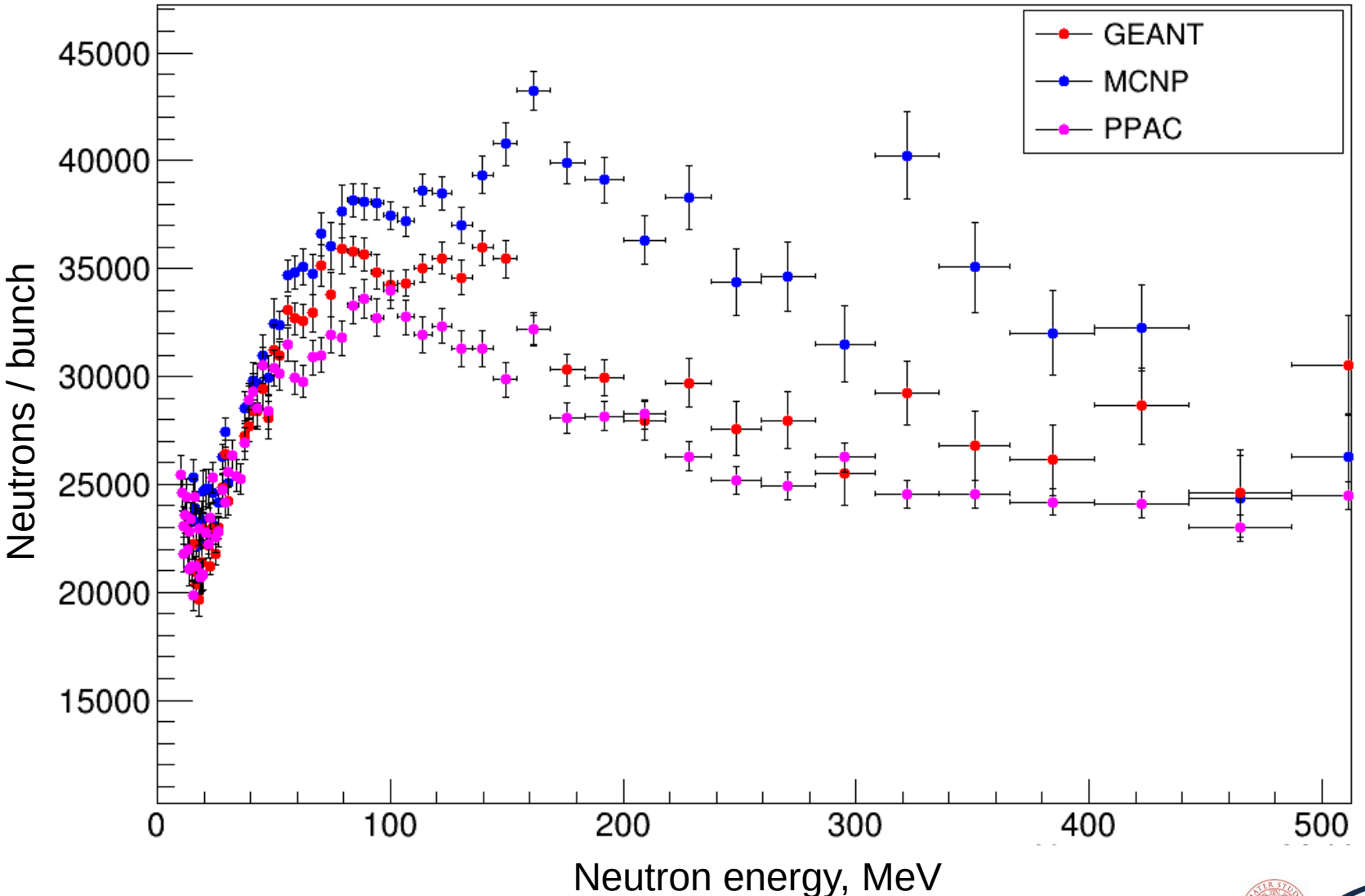


ε = 0.510

Anisotropy

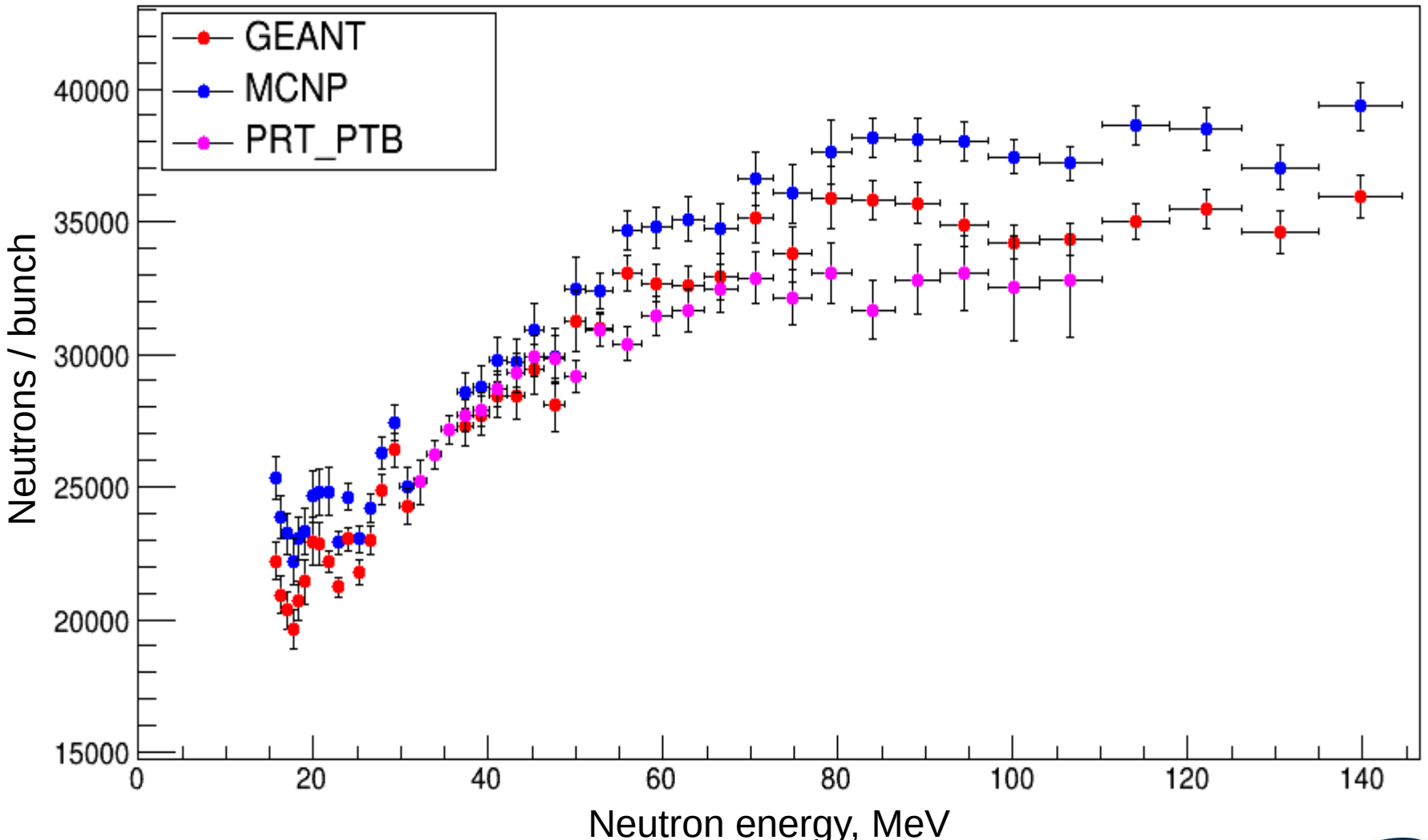

Vorobeyev 2015
Tassan-Got 2010
^{235}U
W(0°)/W(90°)
1.6
1.4
1.2
1.0
6
7
8
9
log(E$_n$ eV)

Neutron Flux

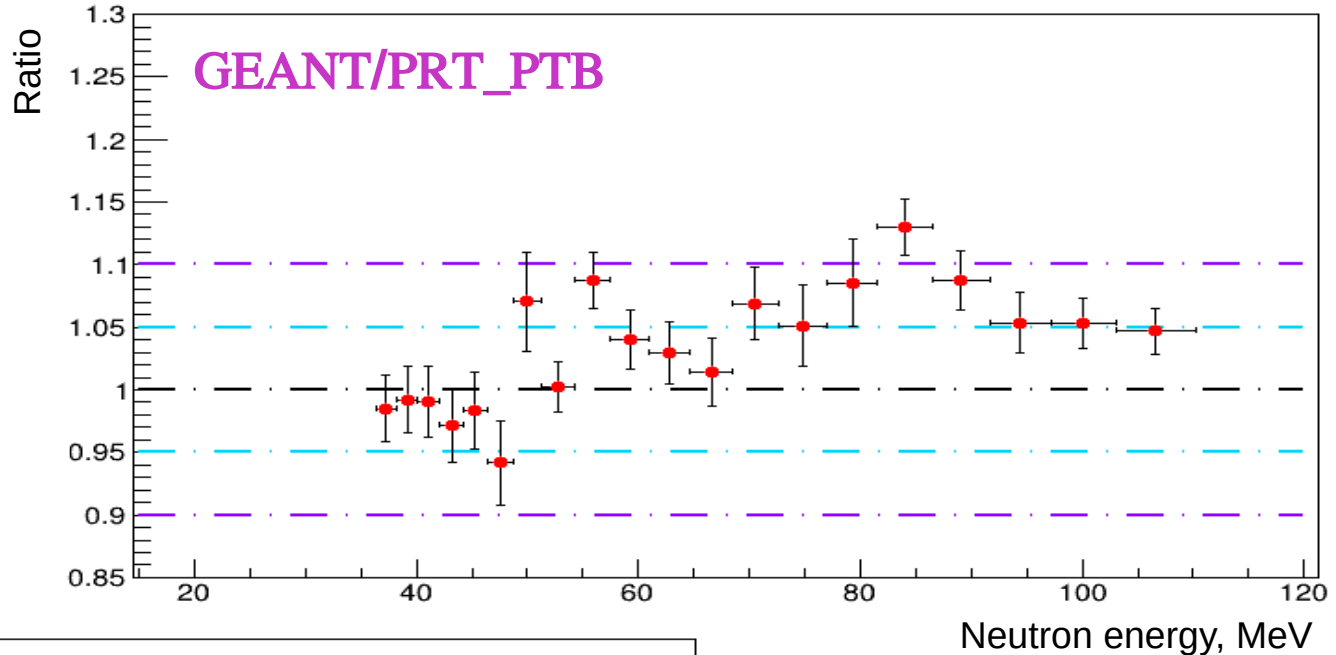


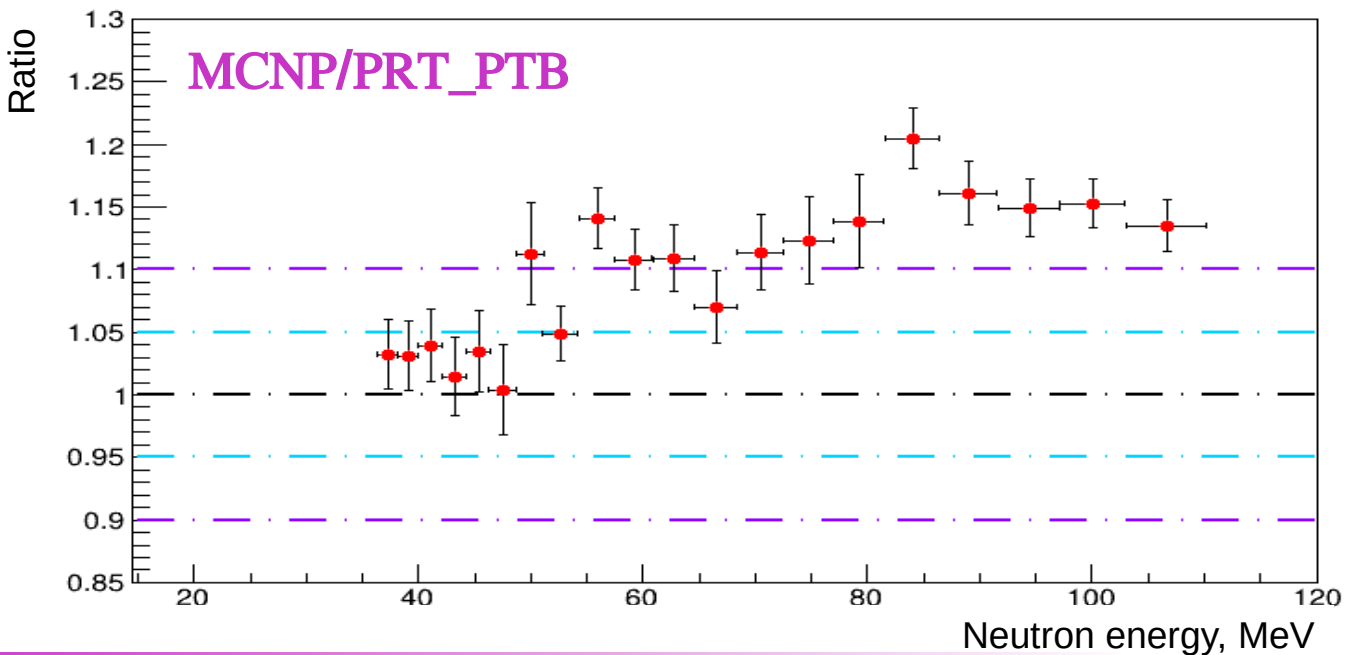

1. Neutron flux
Monte Carlo Simulations: GEANT & MCNP
PRT – L: 2 Silicon Detectors & 4 plastic Scintillators
2. PPACs
3. First comparison with PTB

Neutron Flux

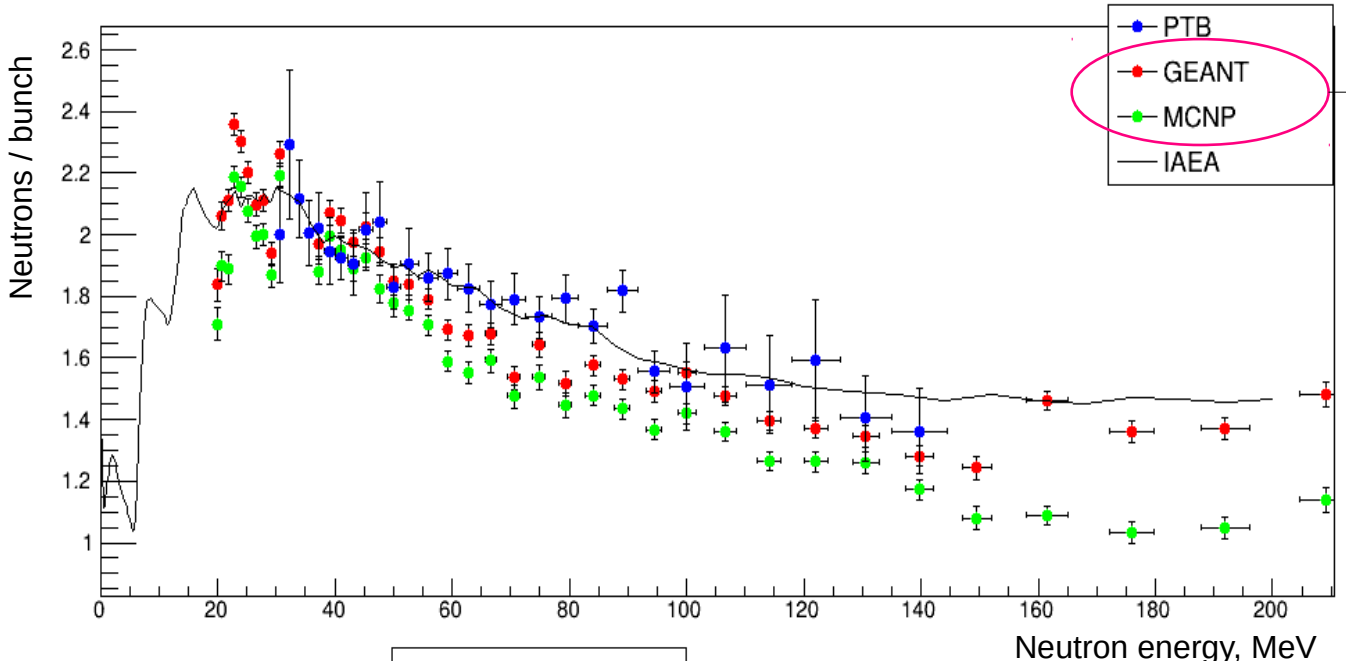


Neutron Flux

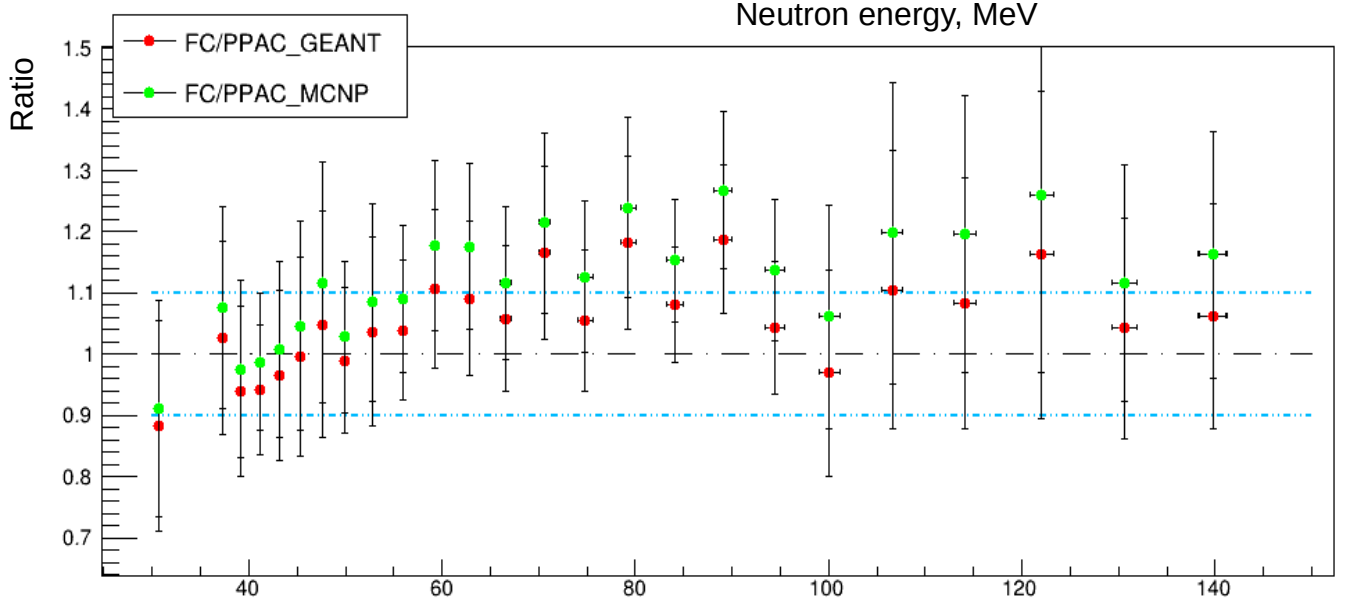




Fission cross section



PPACs



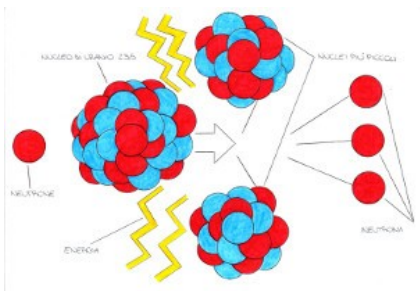
Backup

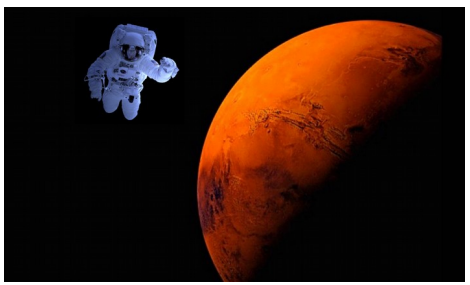

SOLO DUE ANNI DICEVANO
LO METTI SUL CV
CHE VUOI CHE SUCCEDA DICEVANO
LA PANDEMIA MORTACCI LORO !!!
DA CENT'ANNI NON SUCCEDEVA DA CENT'ANNI
il Vetero

INDC International Nuclear Data Commitee

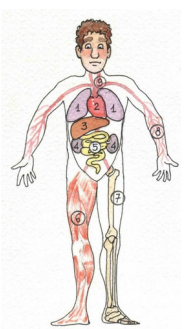
*"...Our analysis indicates that the <u>new absolute measurements of the neutron induced fission cross section</u> (e.g. **<u>relative to n-p scattering</u>**) on **<u>Uranium</u>**, Bismuth, Lead and Plutonium have the highest priority in establishing neutron induced fission reaction standard **<u>above 200 MeV</u>**..."*

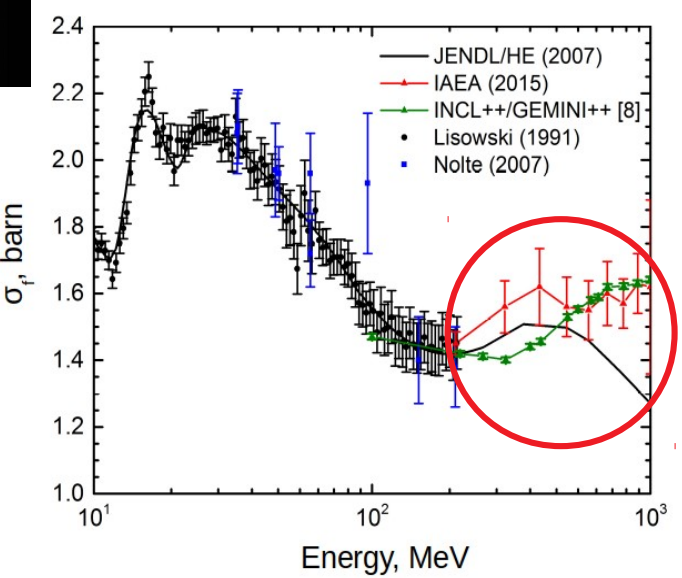
(INDC(NDS)-0681 Distr. ST/J/G/NM, IAEA 2015)

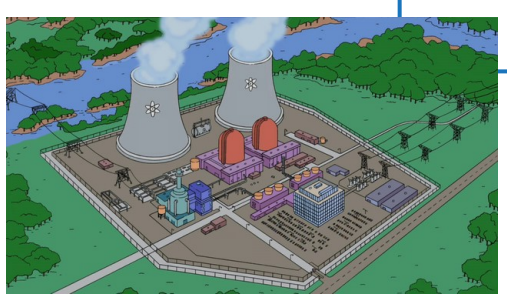


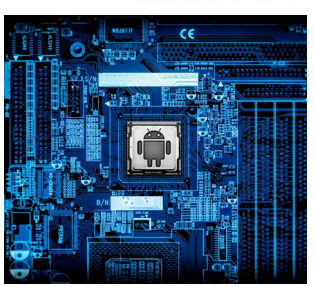


^{235}U(n,f) is one of the most significant cross-section standards at 0.025 eV and [0.15-200] MeV **<u>BUT</u>** there are **<u>no experimental data above 200 MeV</u>**

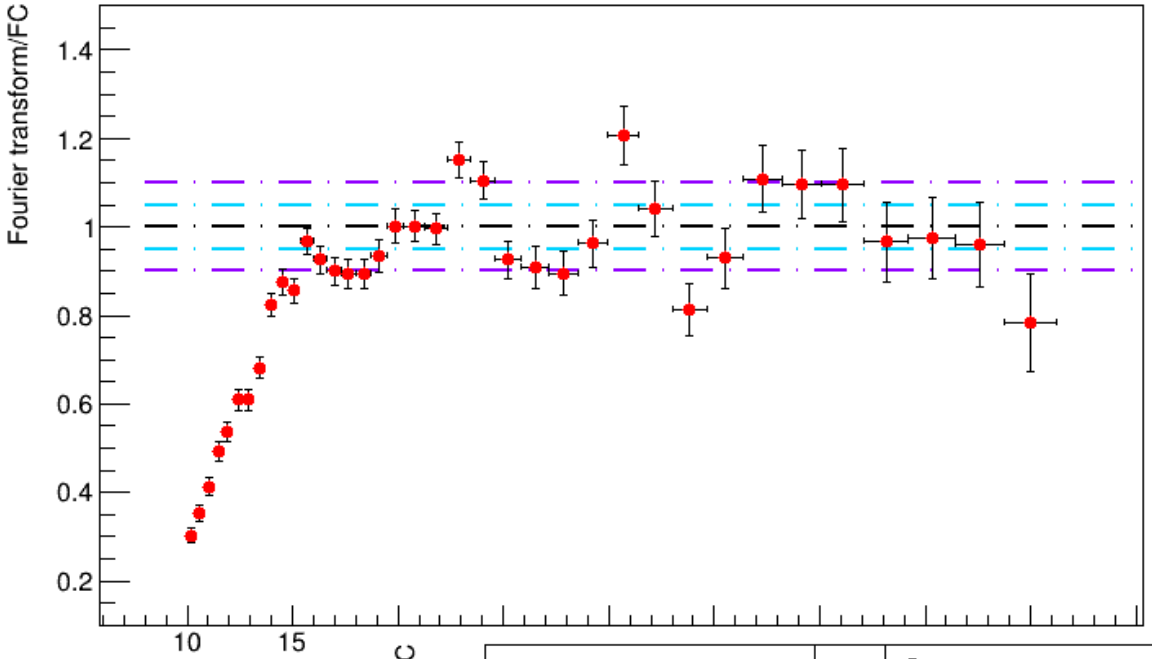


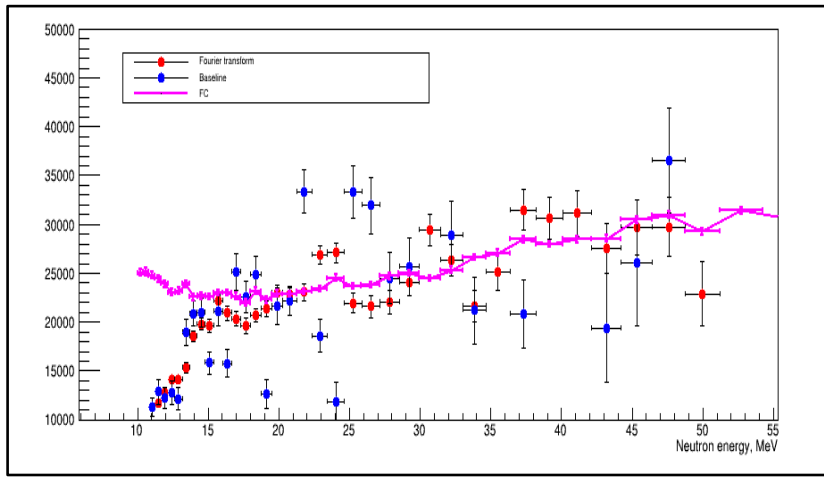


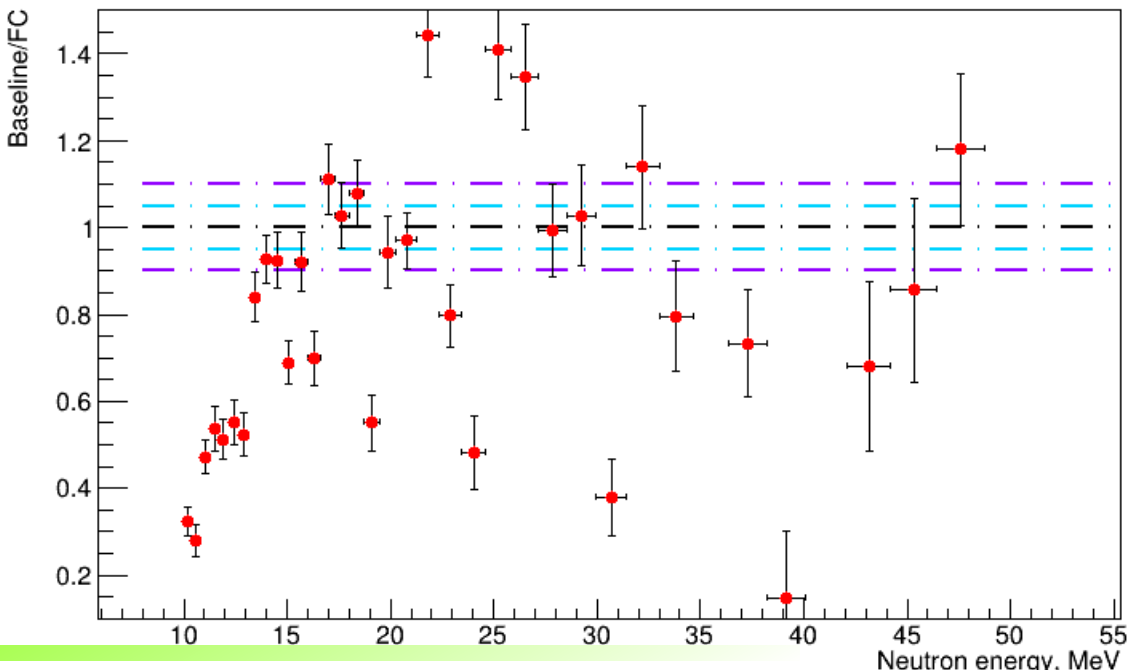




Extracted flux



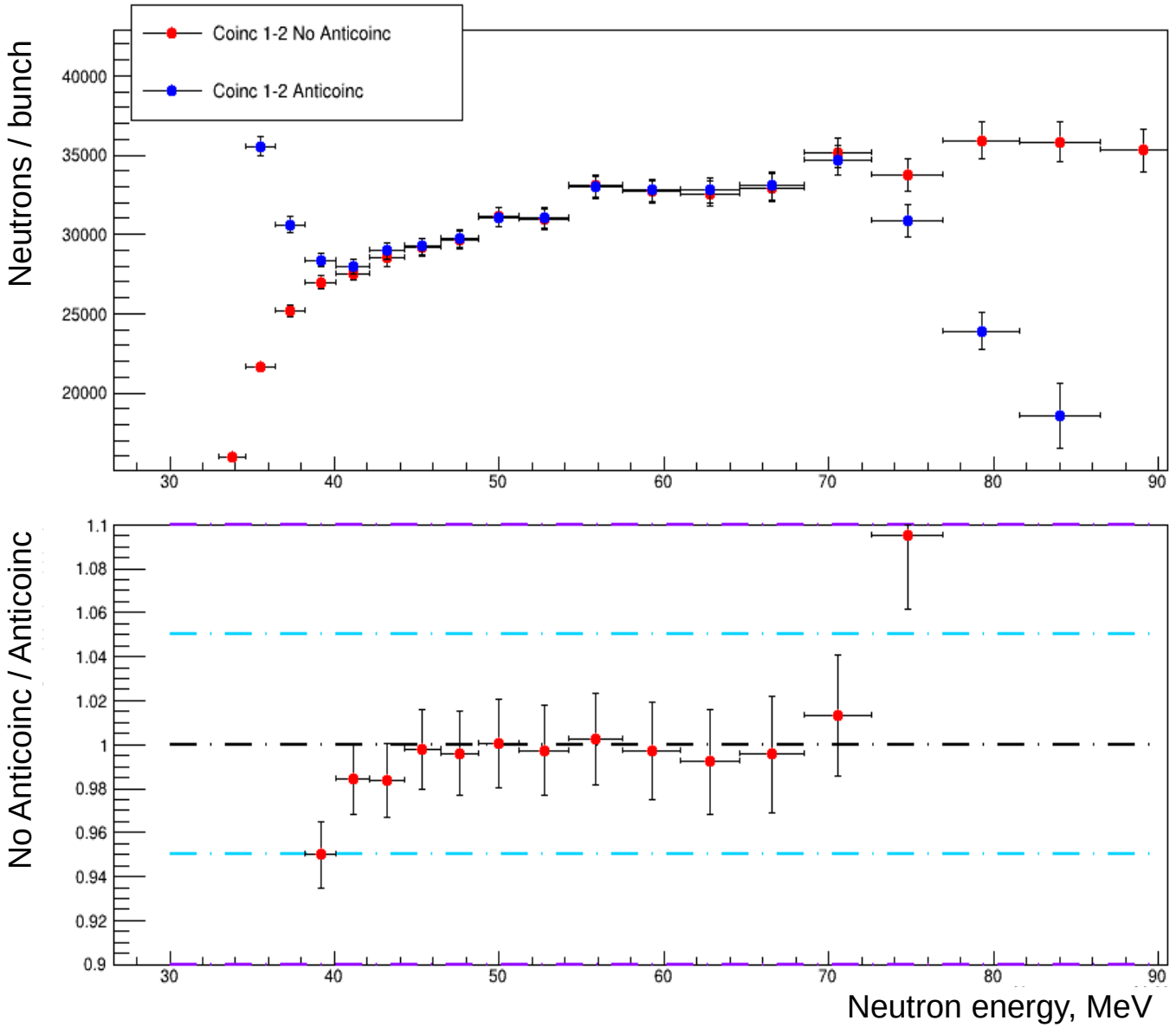




PE 1 mm

2. Comparison between fourier transform and baseline subtraction

Neutron flux extraction



PE 2 mm

Neutron flux extraction

PE 2 mm