



SILESIAN  
UNIVERSITY  
IN OPAVA

# Interfering reaction channels observed in the ${}^2\text{H}({}^8\text{He}, {}^4\text{He}){}^6\text{H}$ reaction studies

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Silesian University in Opava & FLNR JINR

for ACCULINNA-2 collaboration

I. *Idea*

# Recent results & motivation

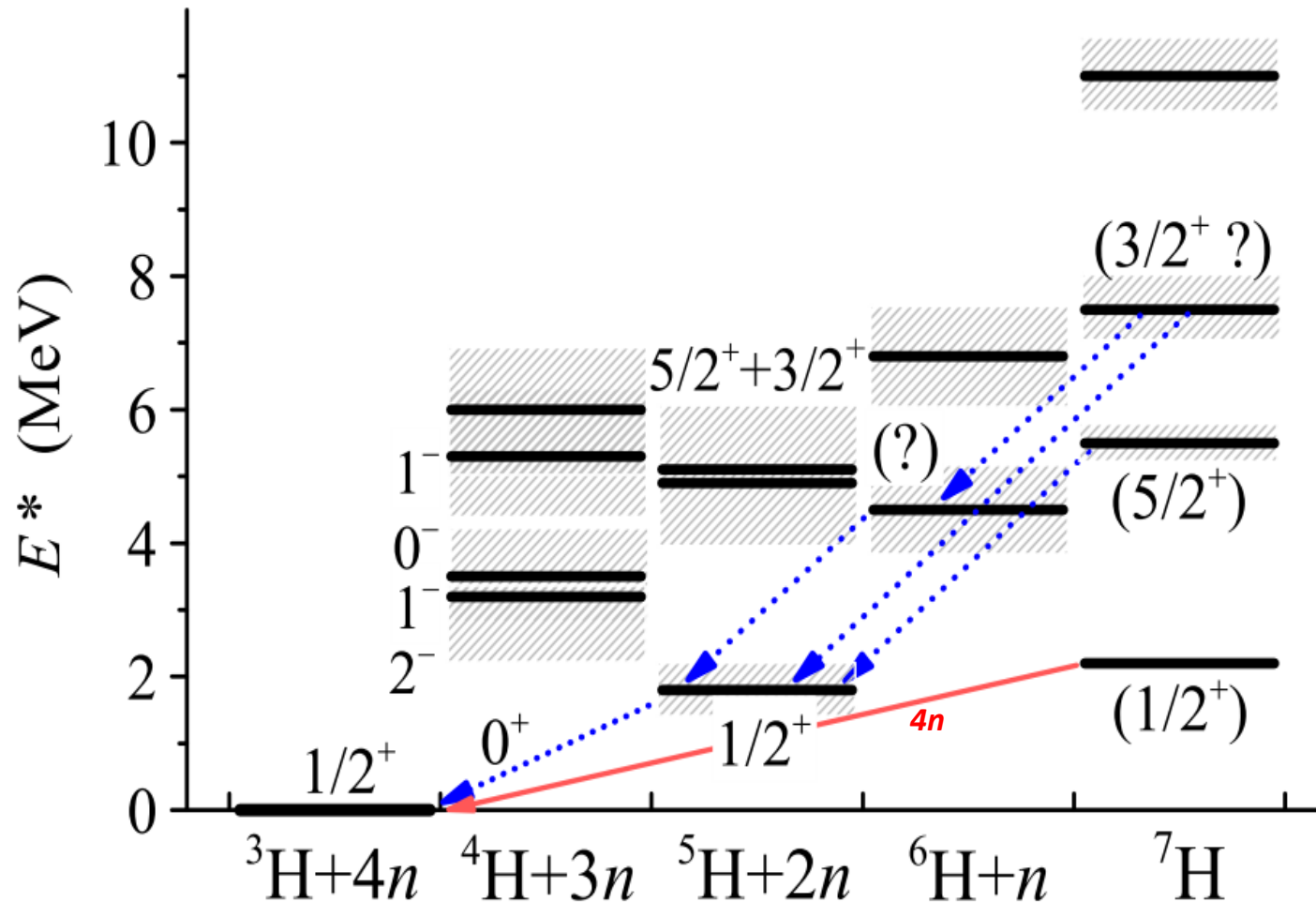
*A.A. Bezbakh, et al., Phys. Rev. Let 124, 022502 (2020)*

*I.A. Muzalevskii, et al., Phys. Rev. C 103, 044313 (2021)*

*E.Yu. Nikolskii, et al., Phys. Rev. C 105, 064605 (2022)*

- **${}^7\text{H}$  states at 2.2 (g.s), 5.5, 7.5, 11 MeV**
- **${}^6\text{H}$  resonance at 4-8 MeV**
  - confirms the  ${}^7\text{H}$  g.s. five-body decay channel

# Recent results & motivation



**${}^6\text{H}$  as the evidence of 5-body decay of  ${}^7\text{H}$**

**Full kinematics for decay investigations is necessary**

# Introduction

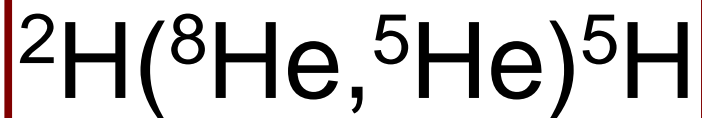
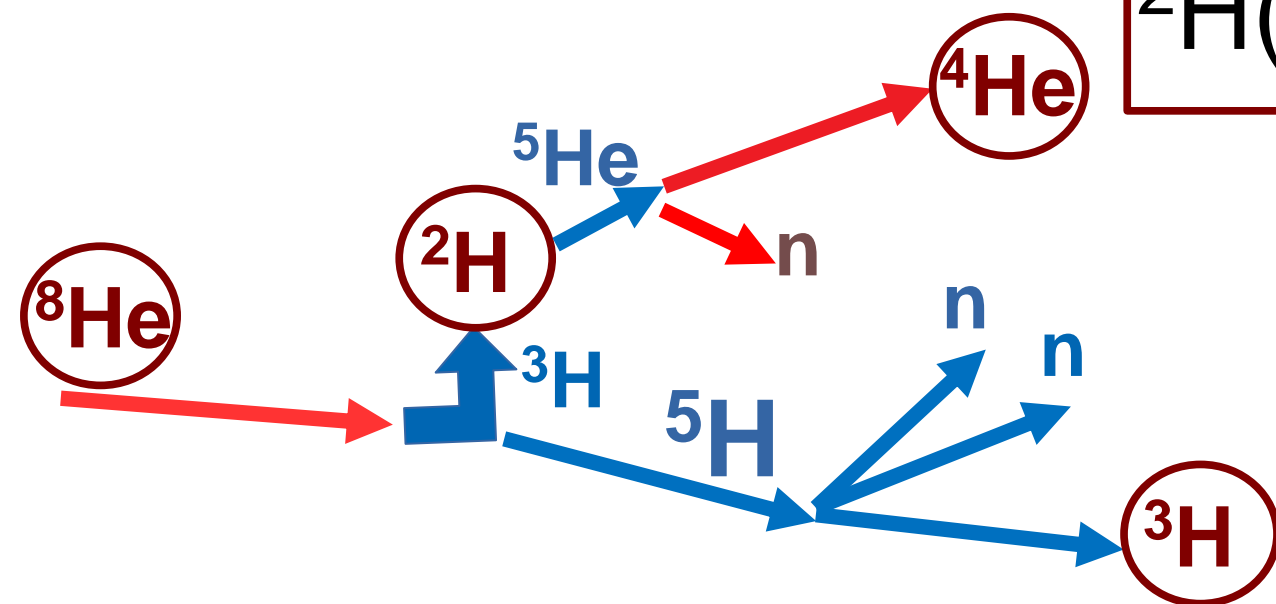
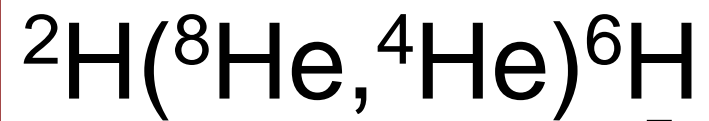
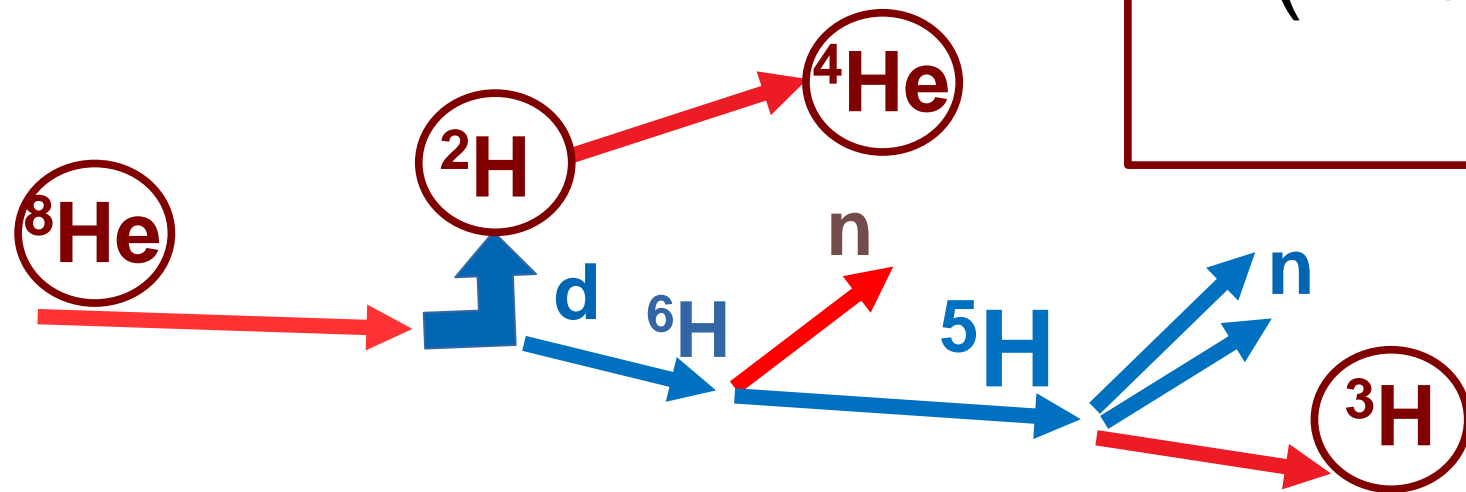
*I.A. Muzalevskii, A.A. Bezbakh, E.Yu. Nikolskii, et al., “Interfering reaction channels observed in the  ${}^2\text{H}({}^8\text{He}, {}^4\text{He}){}^6\text{H}$  reaction studies”, accepted to EPJ Web of Conferences 2023*

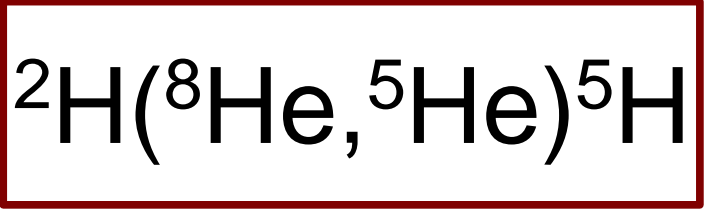
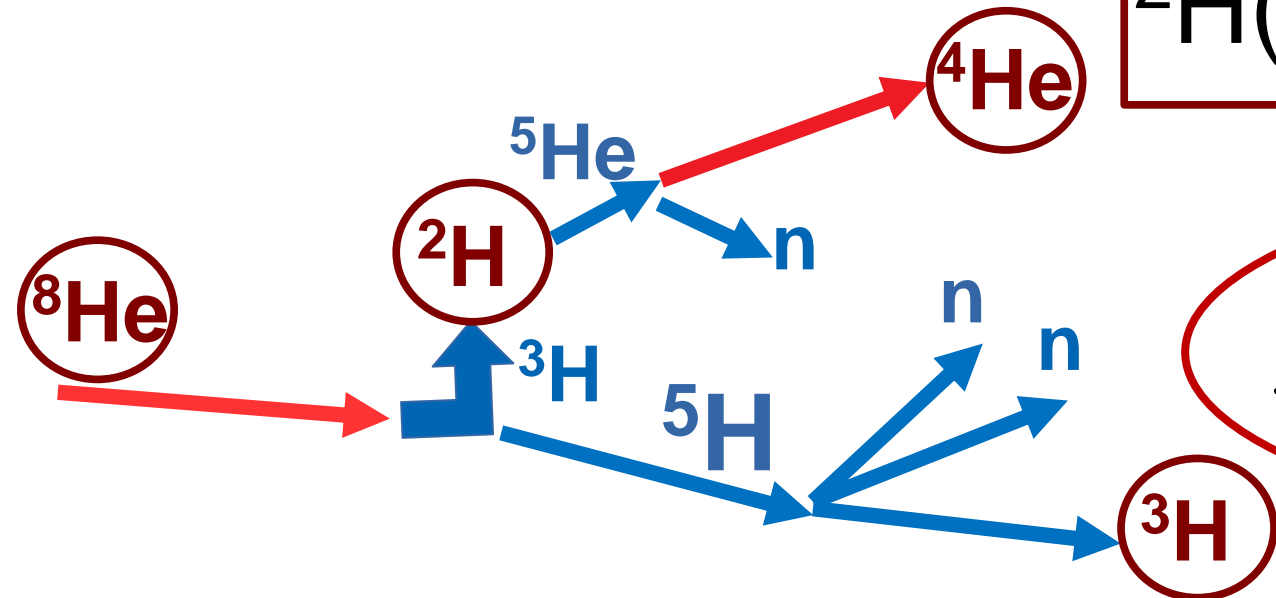
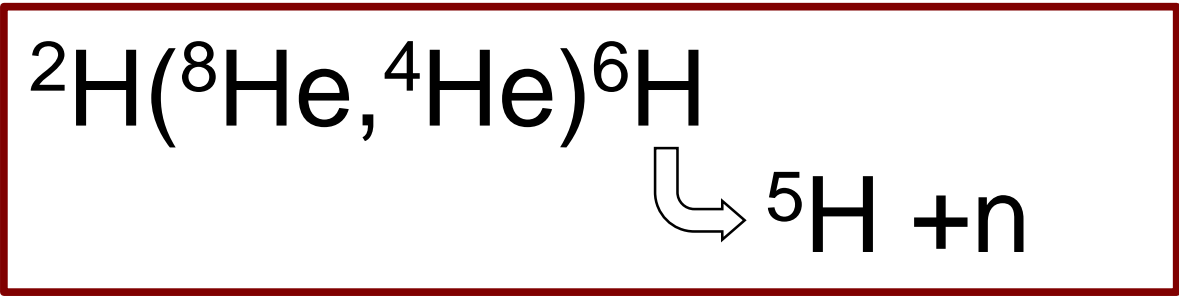
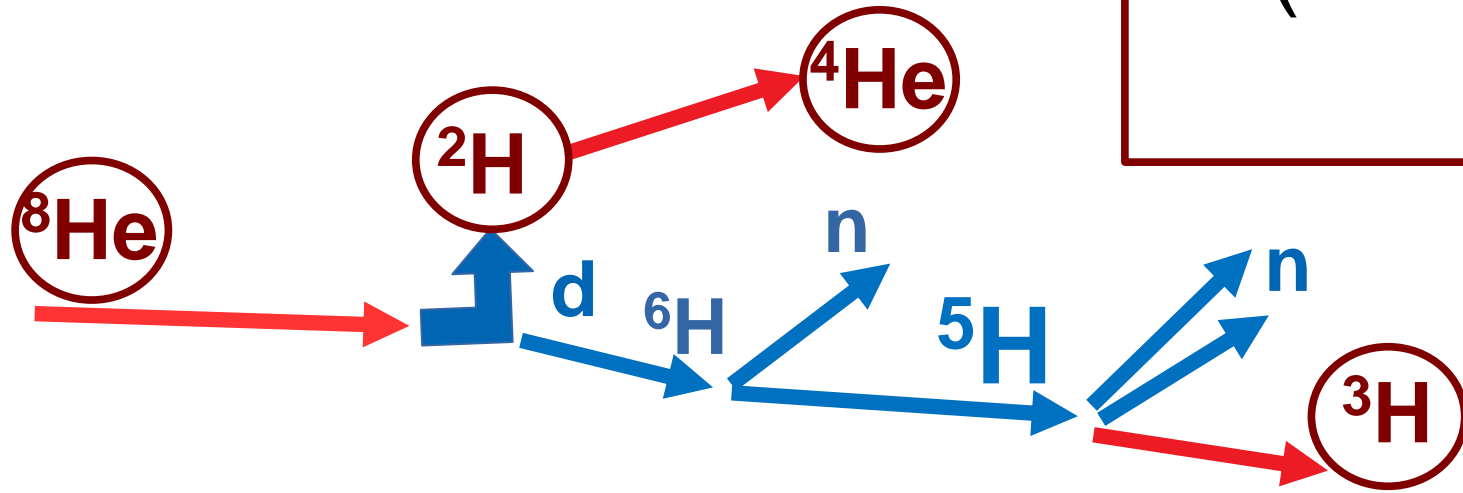
New **experimental** evidence for

- ${}^7\text{H}(\text{g.s}) \rightleftharpoons {}^3\text{H} + 4\text{n}$
- ${}^6\text{H}(\text{g.s}) \rightleftharpoons {}^5\text{H} + \text{n} \rightleftharpoons {}^3\text{H} + 3\text{n}$
- Level scheme reliability

Prospects of new experiments and methodics

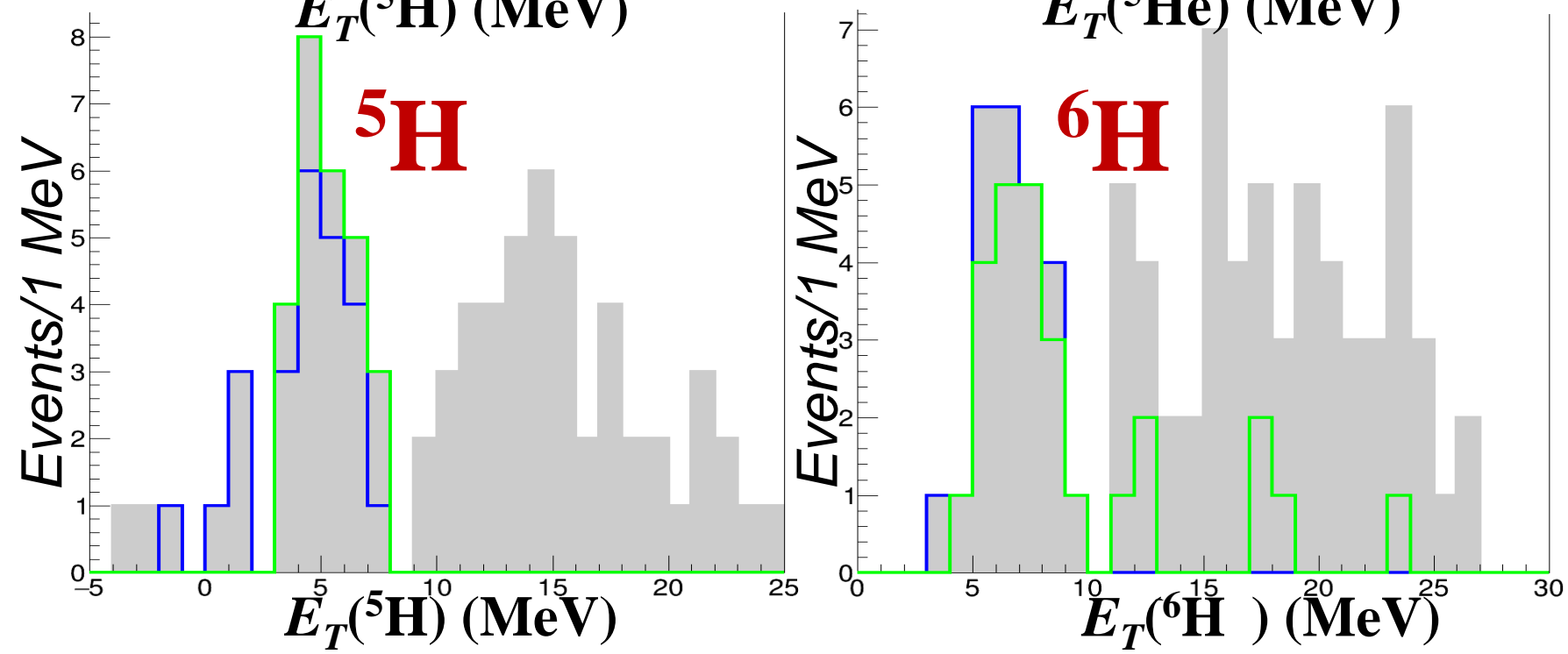
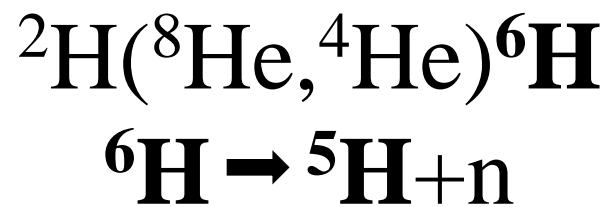
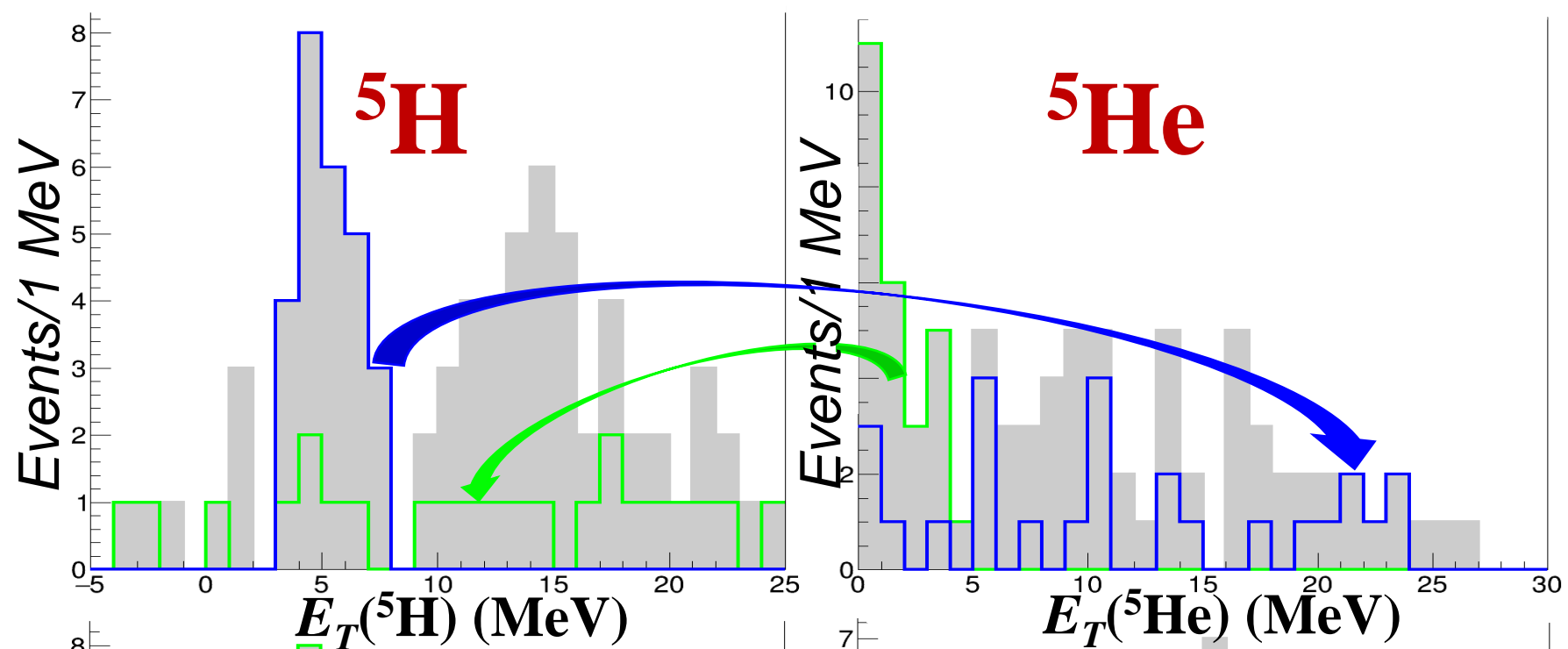
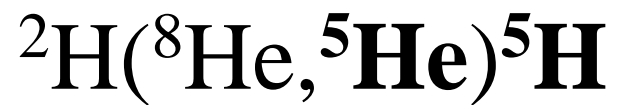
# II. ${}^5\text{H}$ studies in ${}^8\text{He}+{}^2\text{H}$ interaction





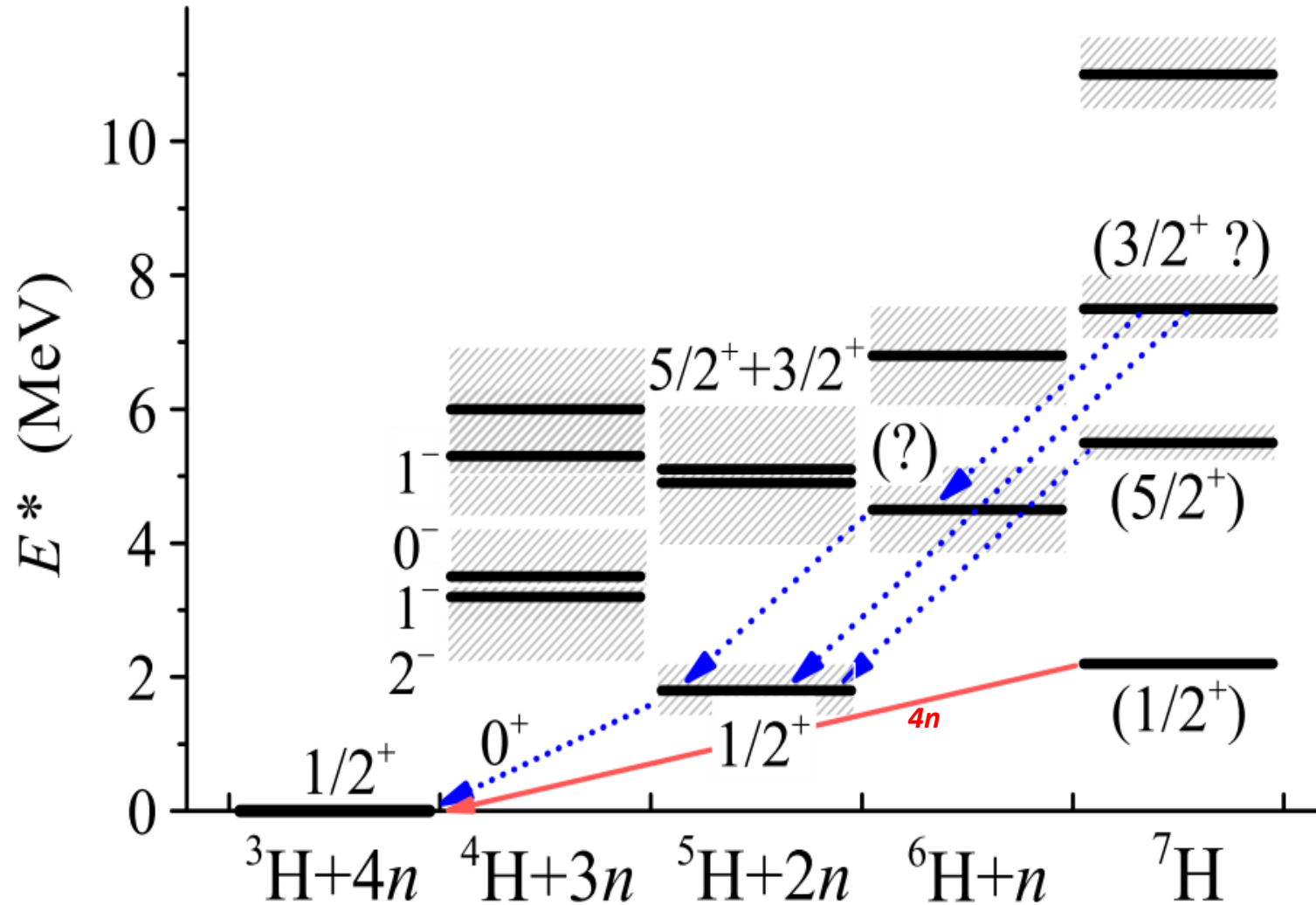
*Missing mass*  
 ${}^5\text{H} = {}^2\text{H} + {}^8\text{He} - {}^4\text{He} - \text{n}$

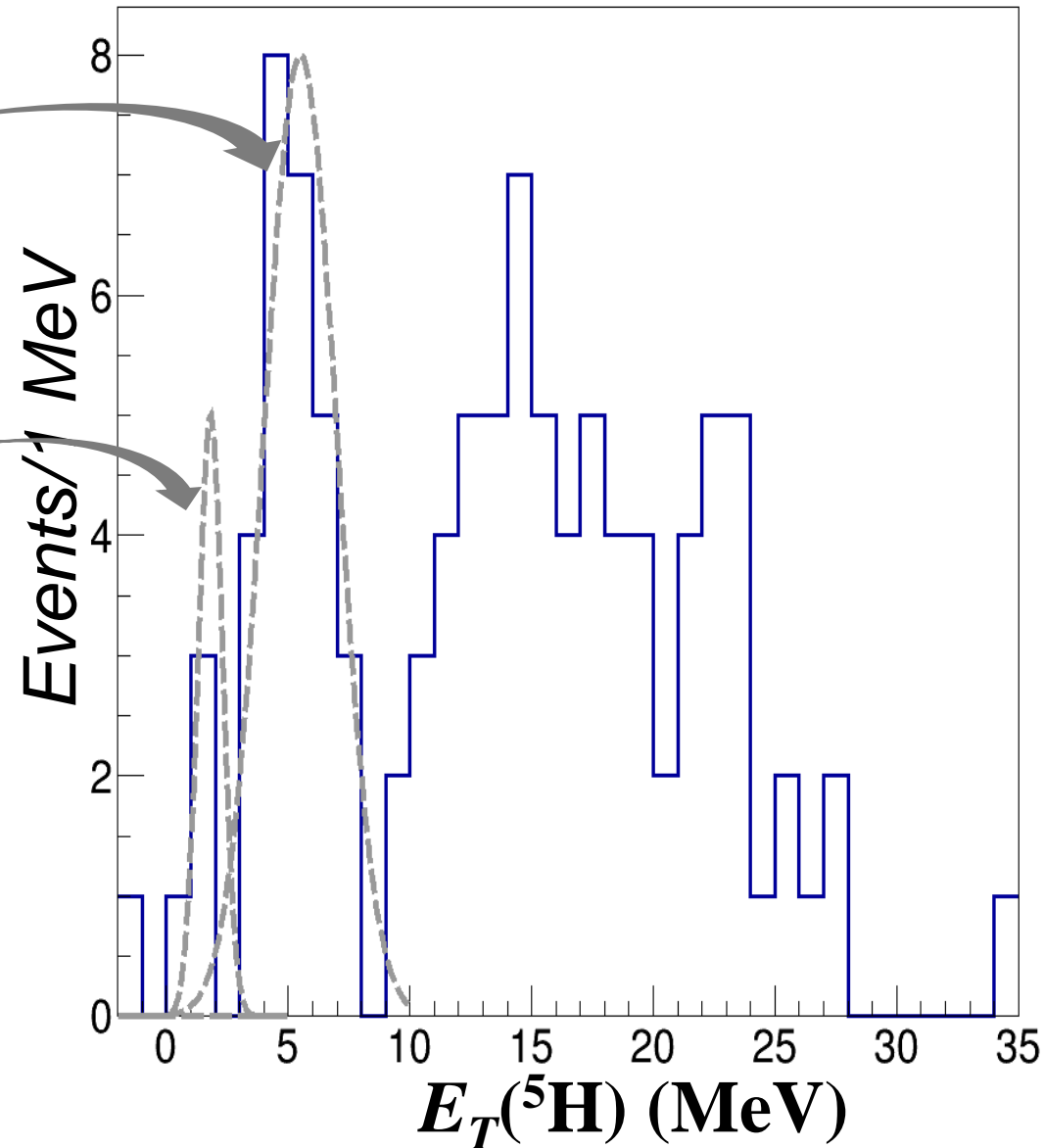
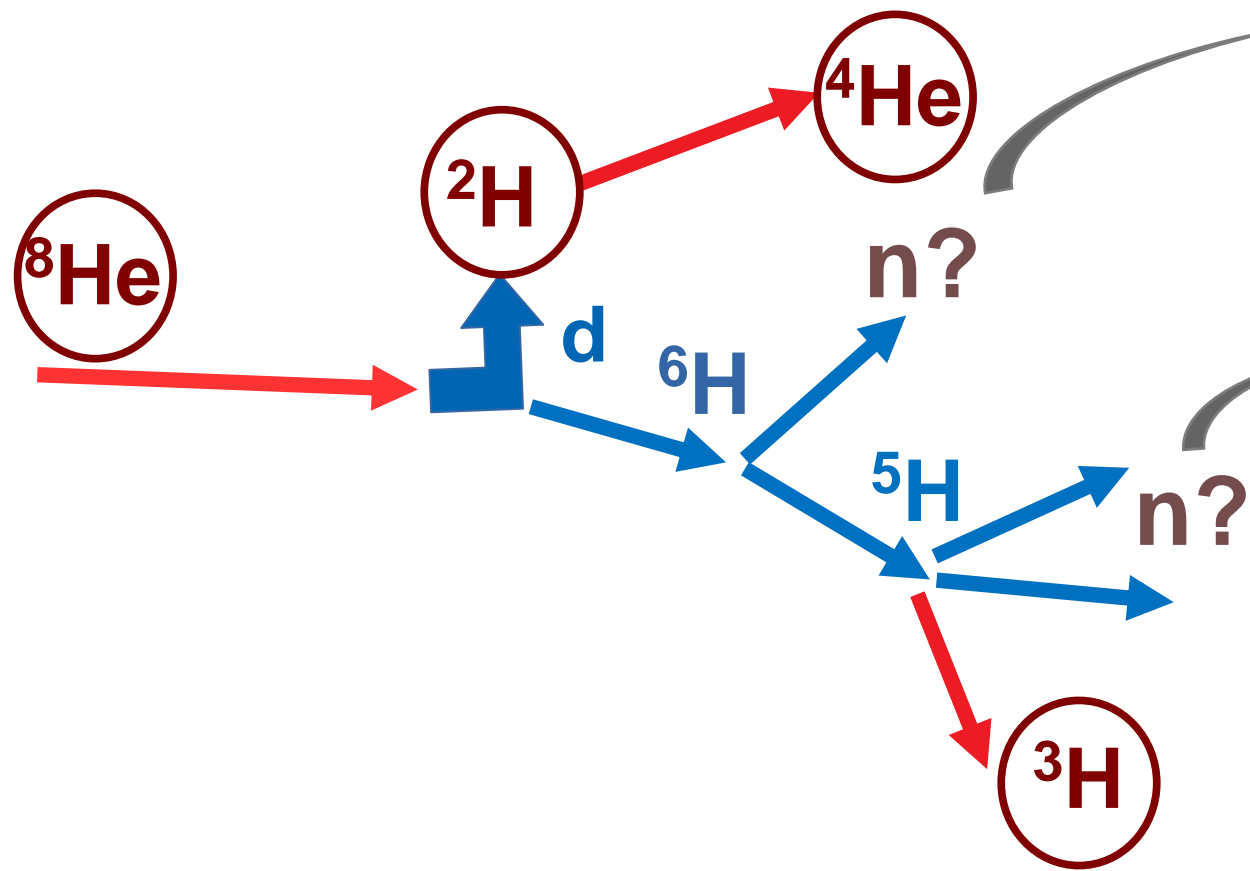




**$^5\text{H}$  MM spectrum is strongly correlated with  $^6\text{H}$**

➤ **Another evidence for  $^6\text{H}$ ,  $^7\text{H}$  decays**

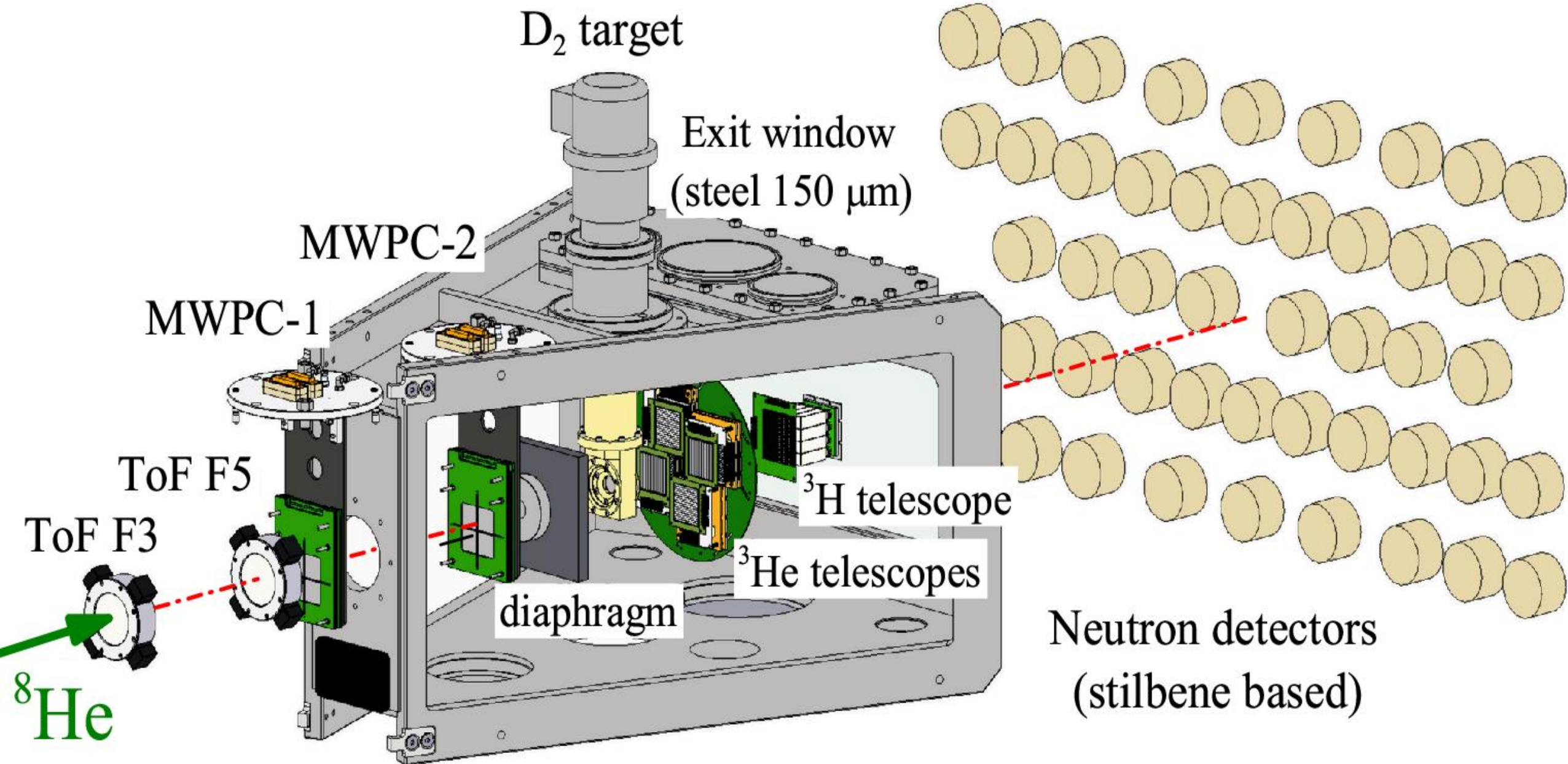




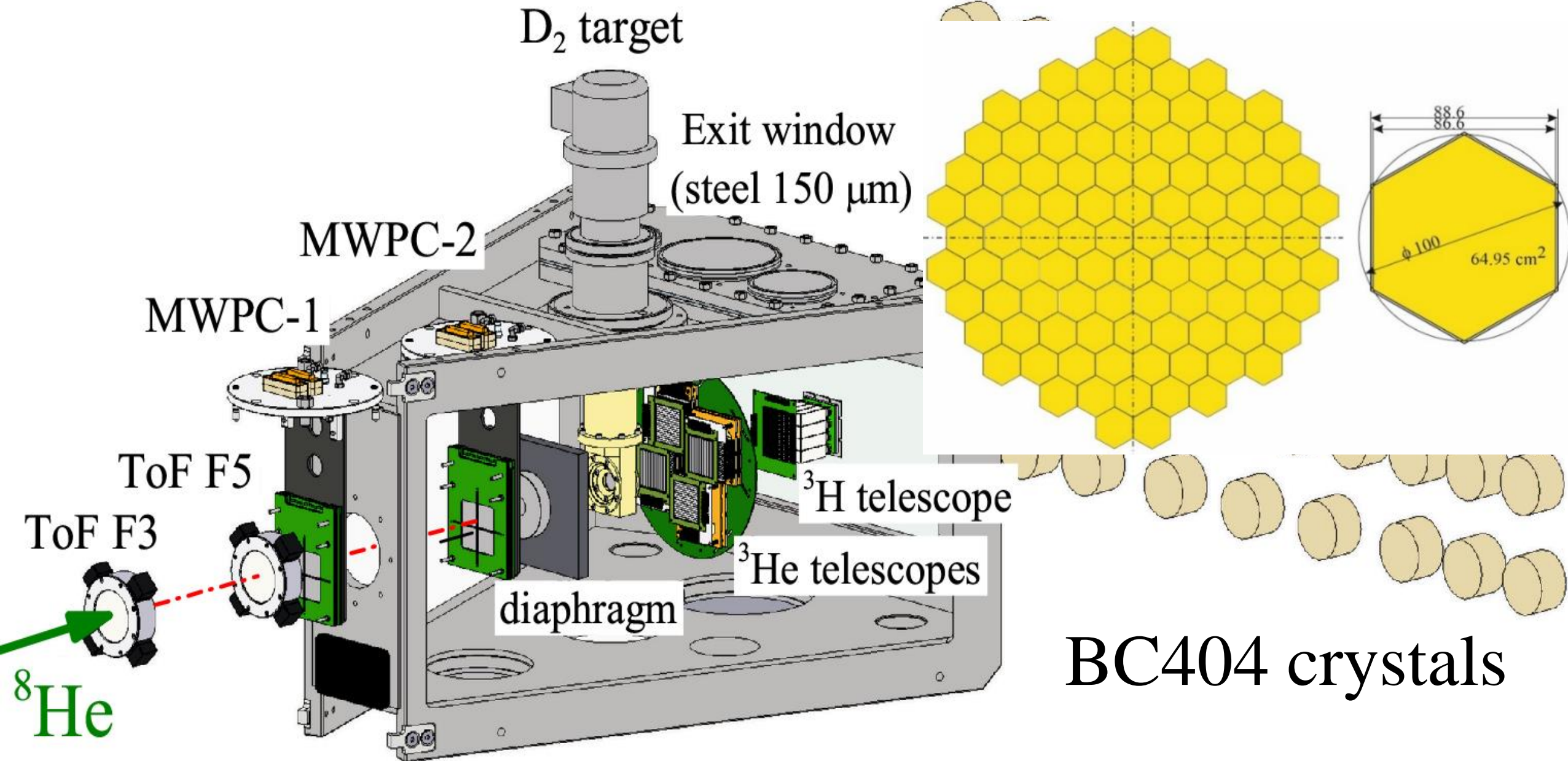
We need: **simulations;**  
**improved neutron detection**

# III. *Prospects*

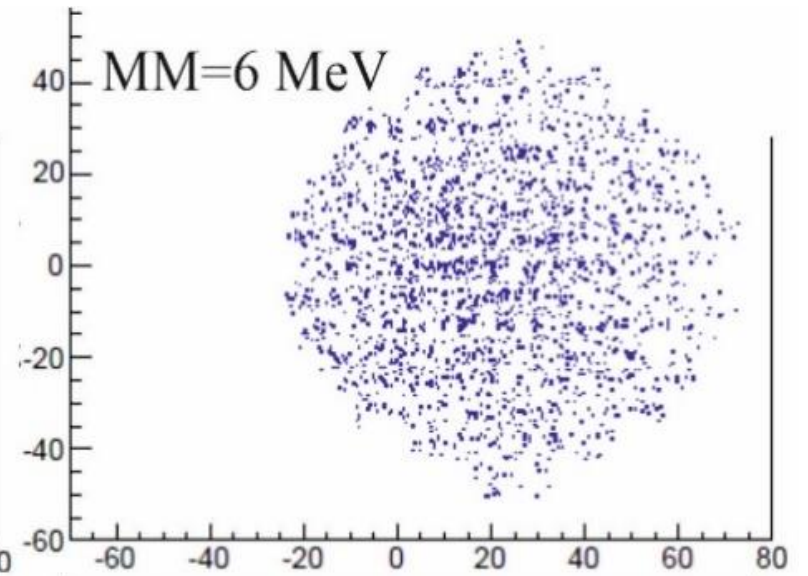
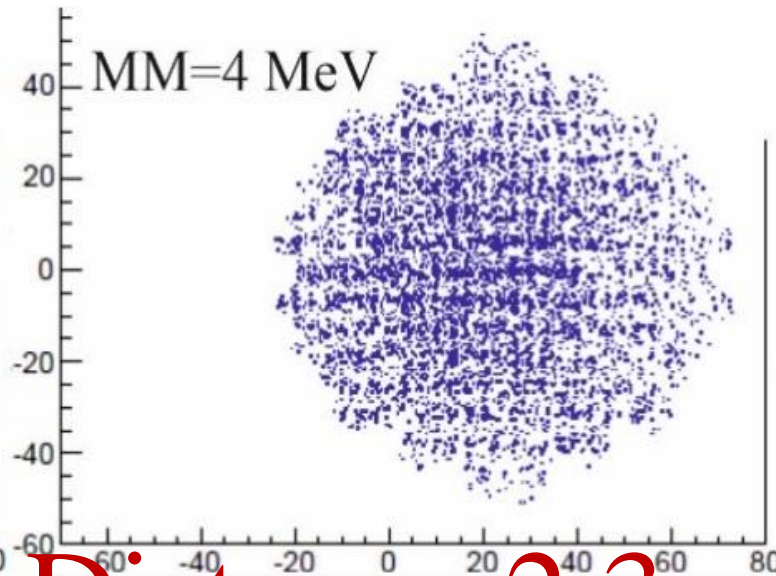
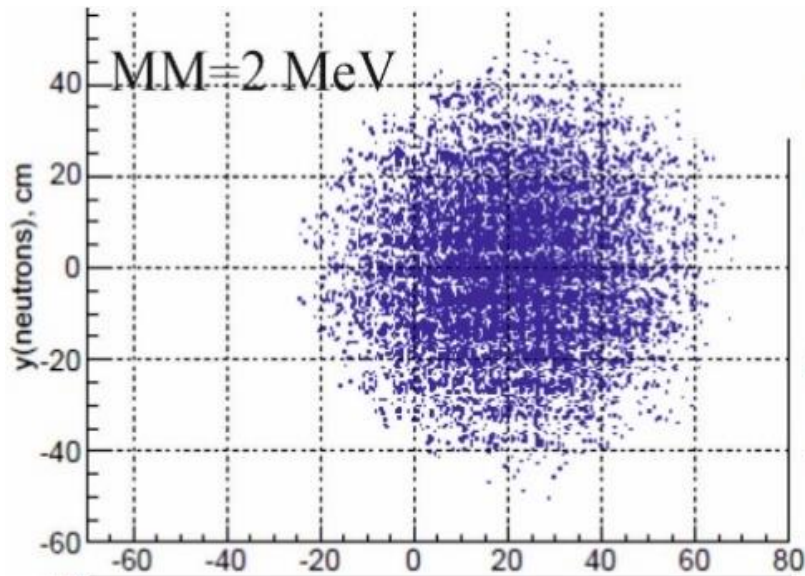
# Old neutron wall: efficiency $\sim 4\%$



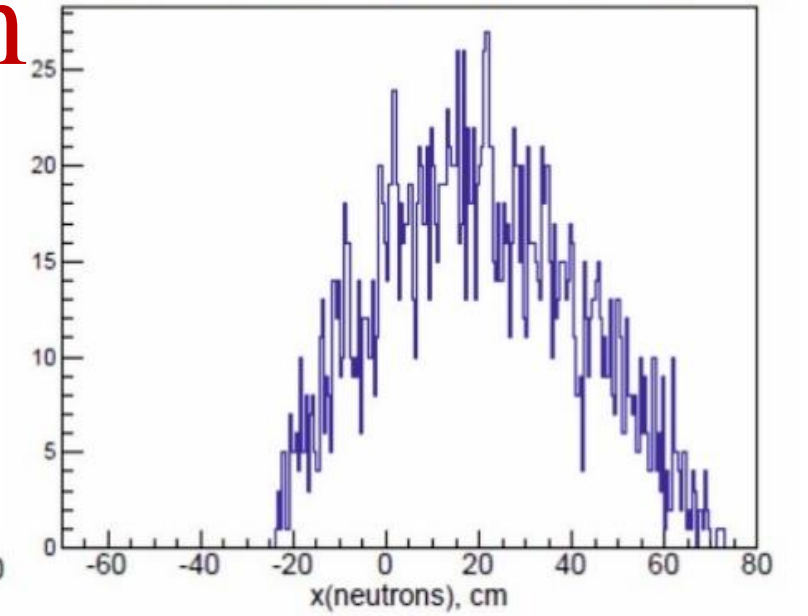
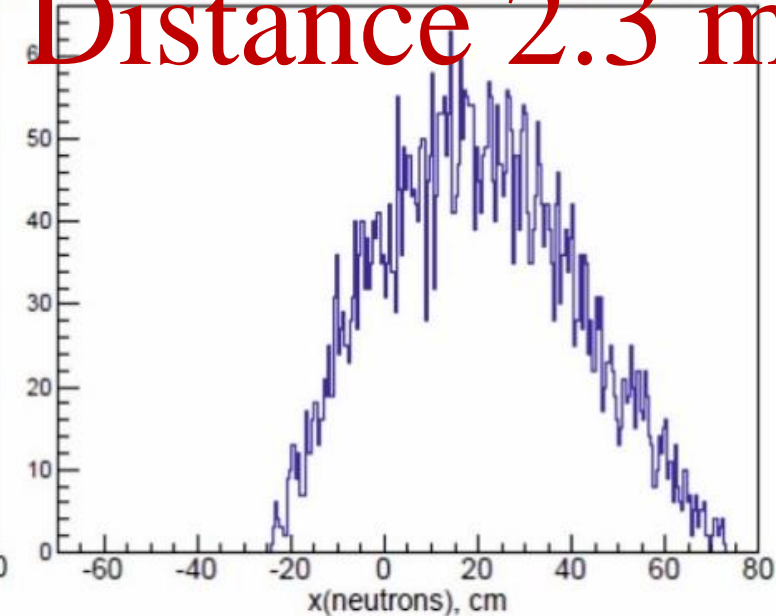
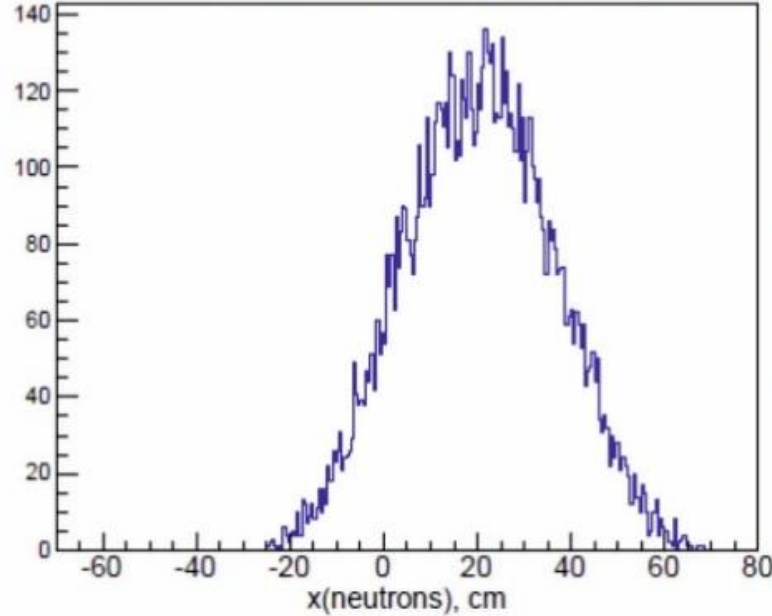
# New neutron wall: efficiency ~40%



# Neutron wall simulations. ${}^2\text{H}({}^8\text{He}, {}^6\text{Li}){}^4\text{n}$



Distance 2.3 m

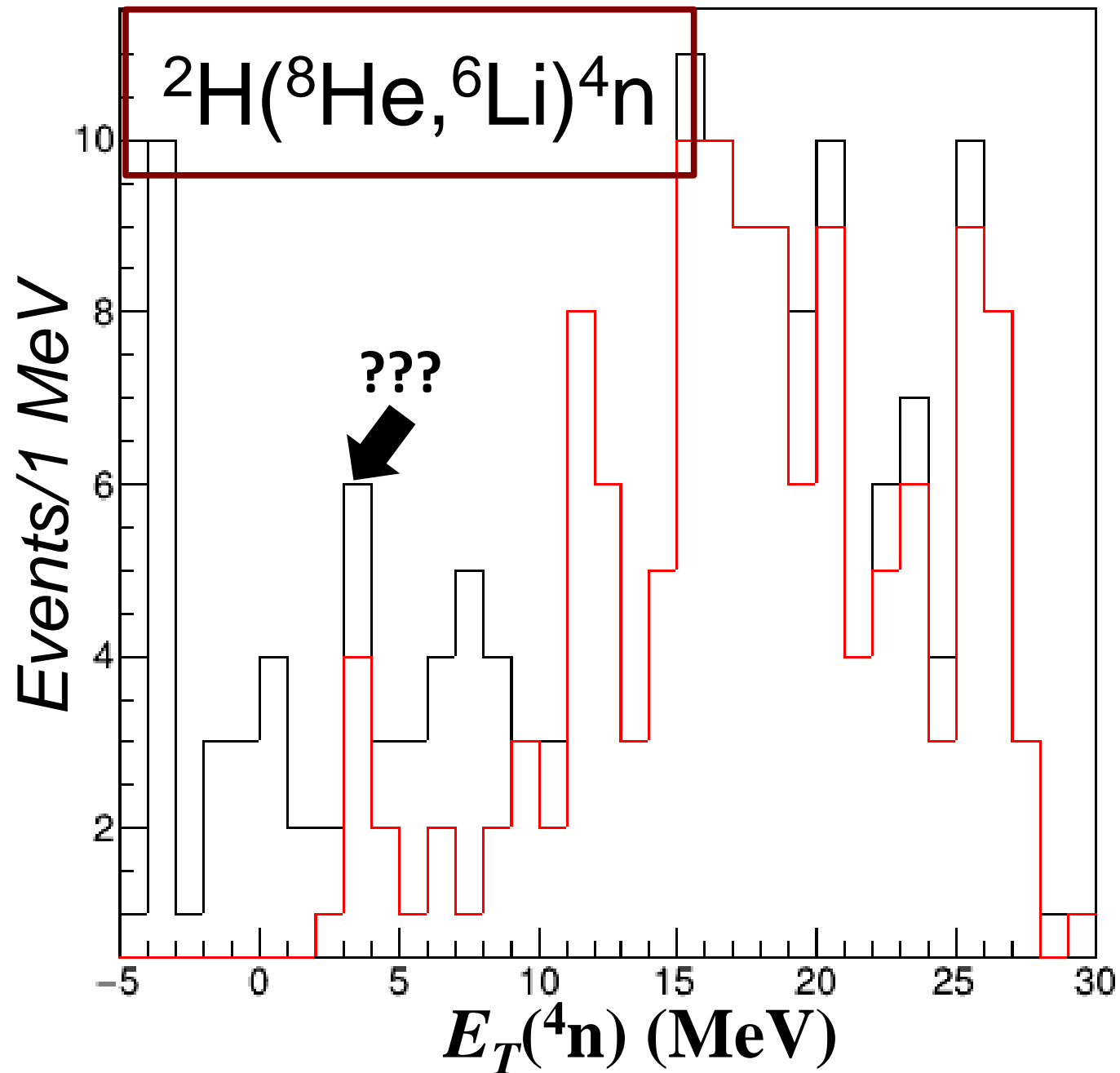


*Grigorenko, L.V., et al., Eur. Phys. J. A 19, 187–201 (2004).*

**$E_T < 4 \text{ MeV}$**

*M. Duer, et al., Nature 678, vol 606, 2022.*

**$E_T \sim 2.37 \text{ MeV}$**





# IV. *Summary*

New **experimental** evidence for

- ${}^7\text{H}(\text{g.s}) \Rightarrow {}^3\text{H} + 4\text{n}$
- ${}^6\text{H}(\text{g.s}) \Rightarrow {}^5\text{H} + \text{n} \Rightarrow {}^3\text{H} + 3\text{n}$
- Level scheme reliability

**New setup allows to study  ${}^7\text{H}$ ,  ${}^6\text{H}$ ,  ${}^4\text{n}$  in full kinematics**

*We need more experimental data  
Simulations will be done in 2023*

*Promising experiment in 2024*

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- Level scheme reliability

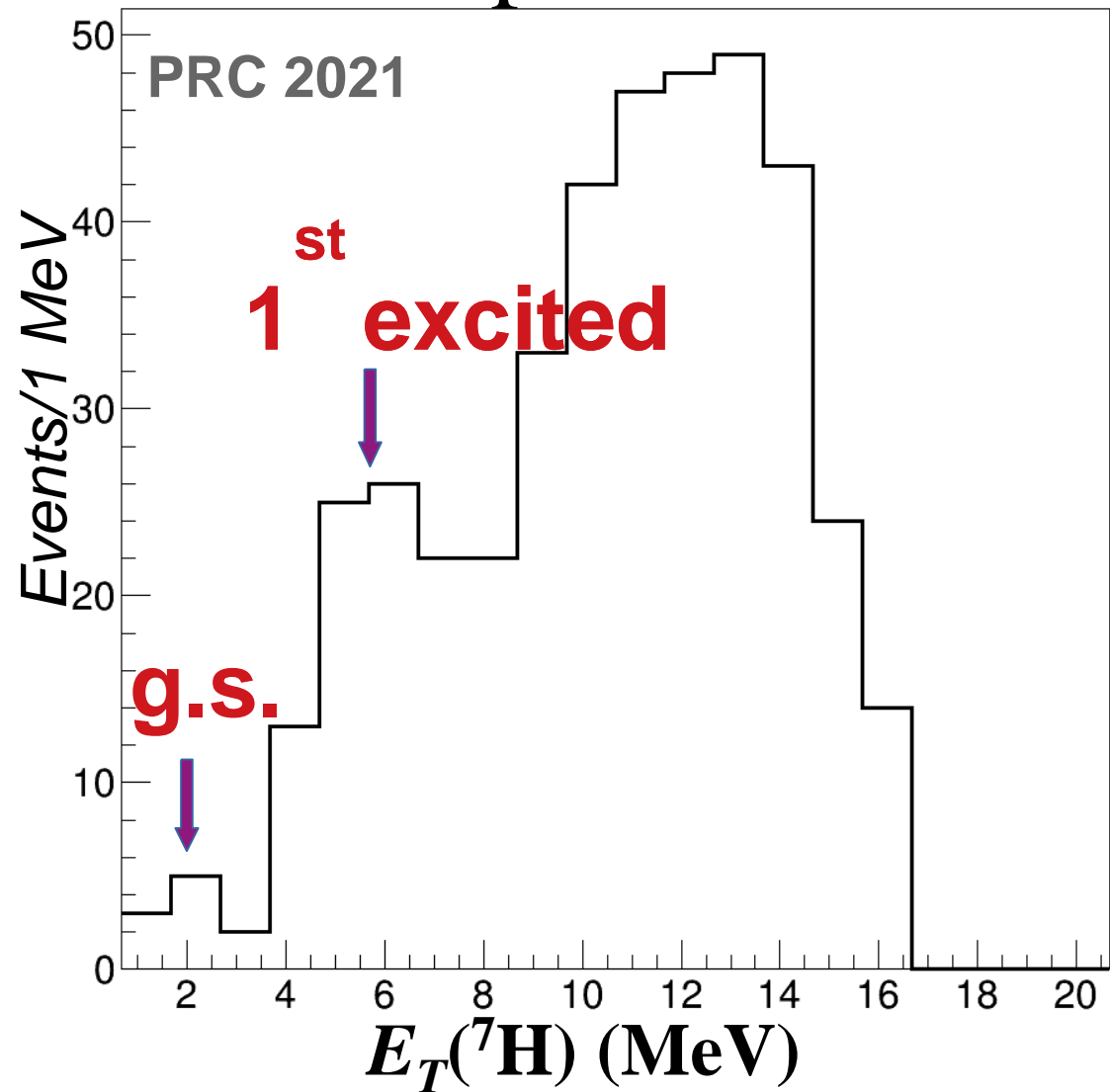
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*Thanks for attention*

# ${}^7\text{H}$ spectrum



# ${}^6\text{H}$ spectrum

