# Measurement of the neutron flux of the CSNS Back-n beam line

**CHEN Yonghao(陈永浩)**[1, 2], BAO Jie(鲍杰)[3], LUAN Guangyuan(栾广源) [3]
and
the CSNS Back-n collaboration

[1]Institute of High Energy Physics(IHEP), Chinese Academy of Science(CAS), China
[2]Dongguan Neutron Science Center, China
[3]China Institute of Atomic Energy(CIAE), China

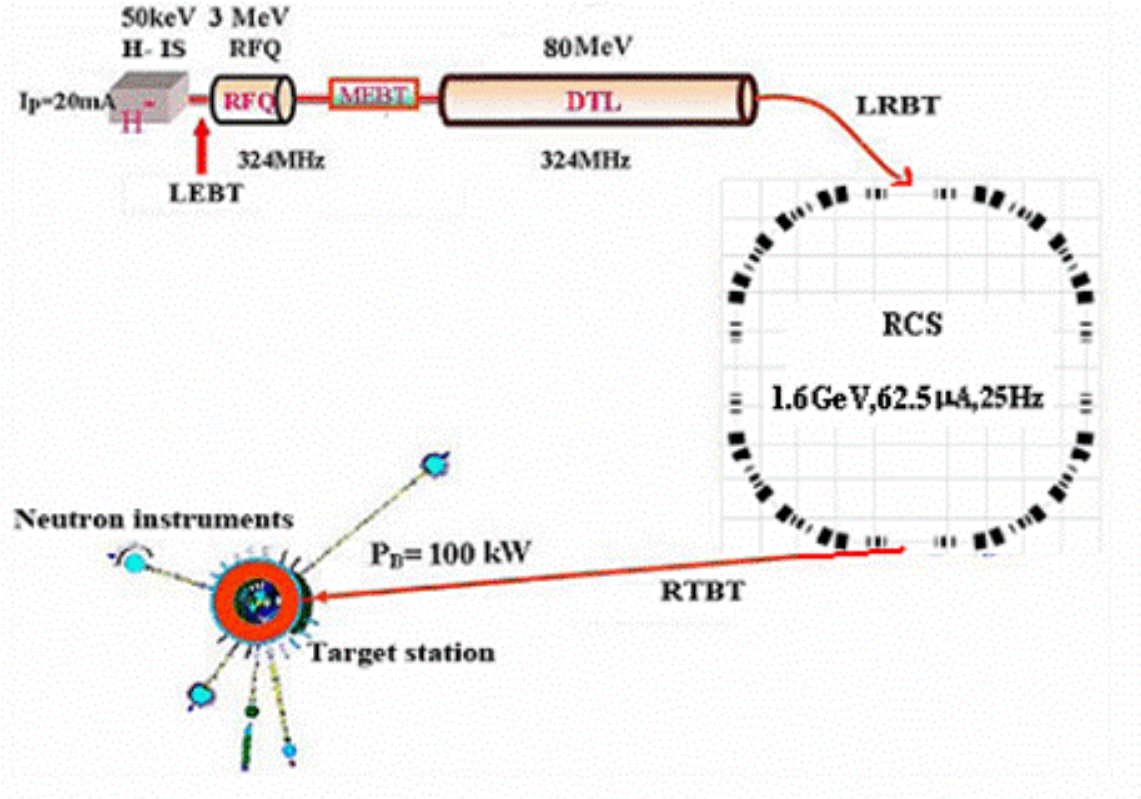
*26th International Seminar on Interactions of Neutrons with Nuclei*
May 28th – June 1st, 2018. Xi'an, China

CSNS CHINESE ACADEMY OF SCIENCES

# Outline

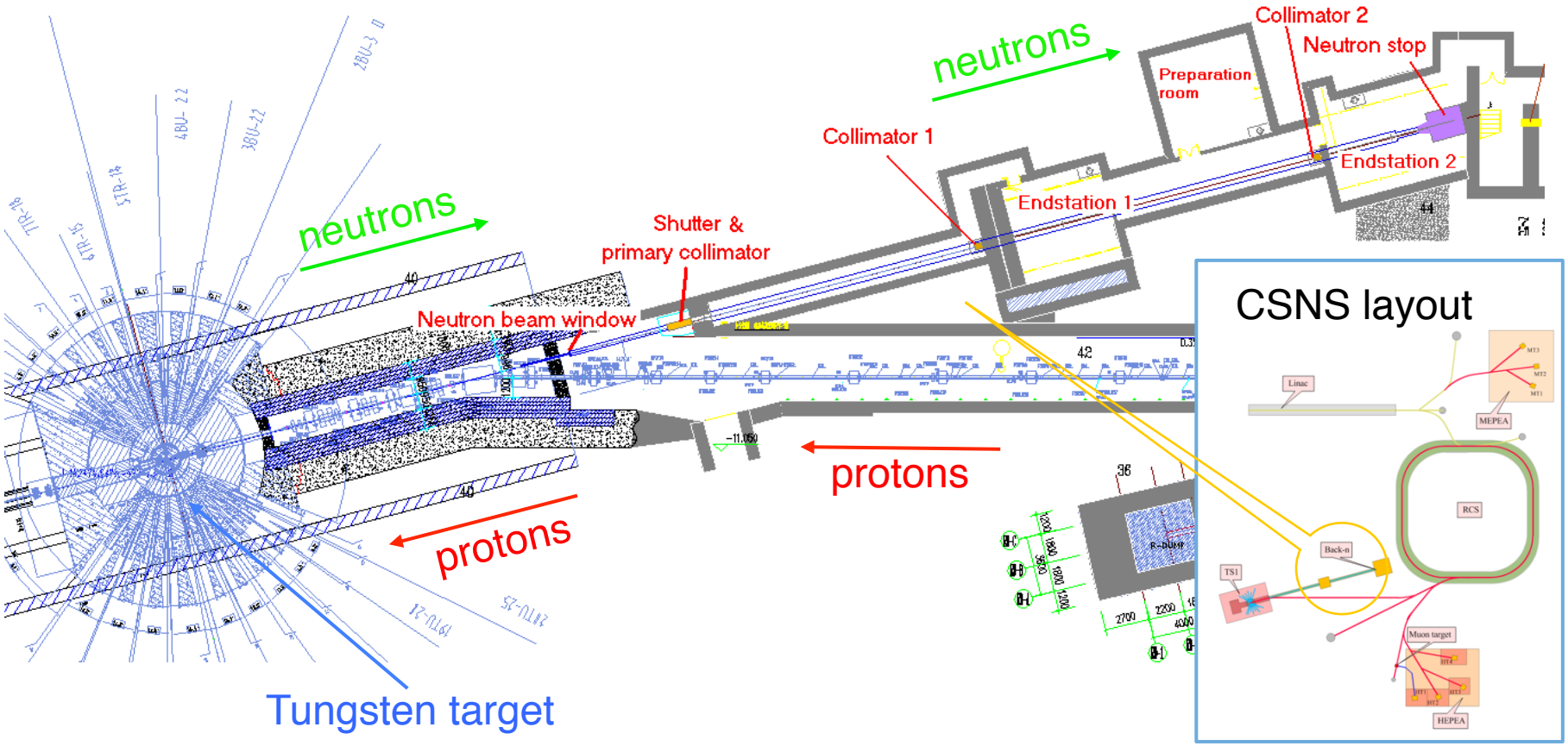
1. Back-n facility at CSNS
2. Detector setup at Back-n
3. Analysis and preliminary results
4. Conclusion and outlooks

# China Spallation Neutron Source (CSNS) accelerating system



# Layout of the Back-n WNS beam line

- Started commissioning since the beginning of 2018
- Beam characterization and several measurements have been carried out

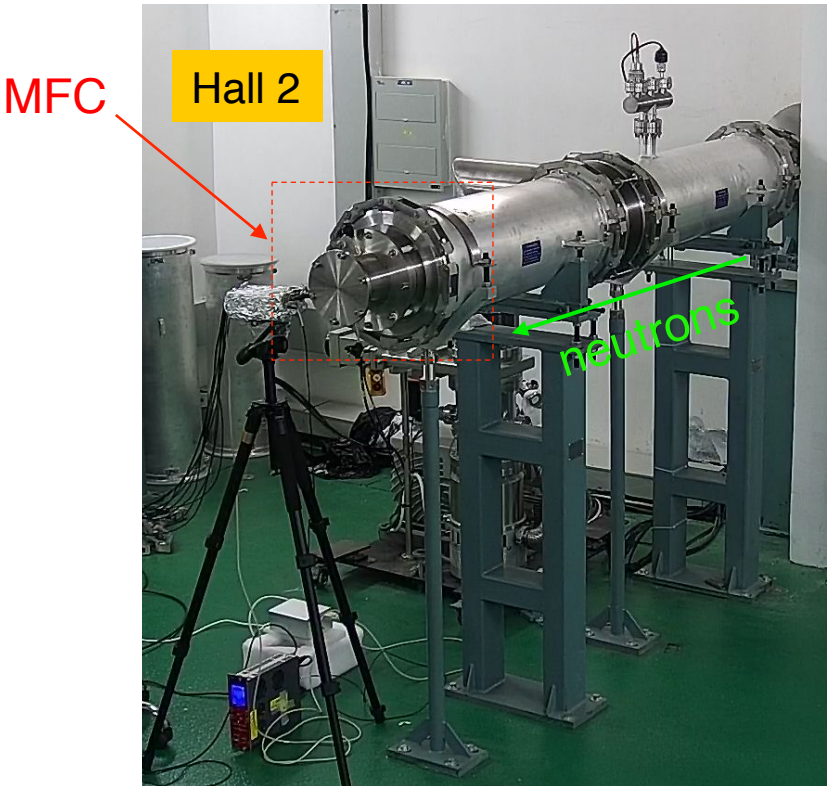


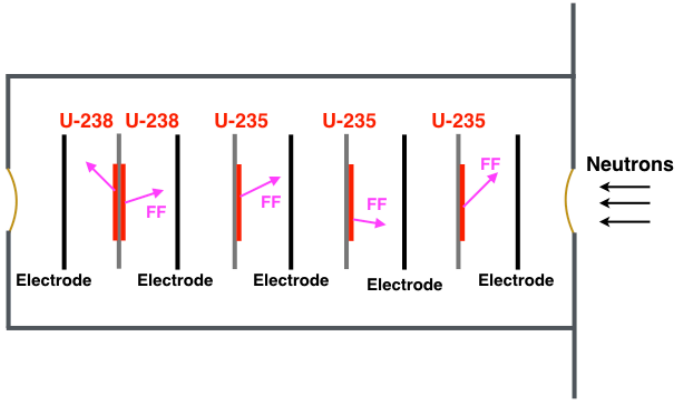
# Outline

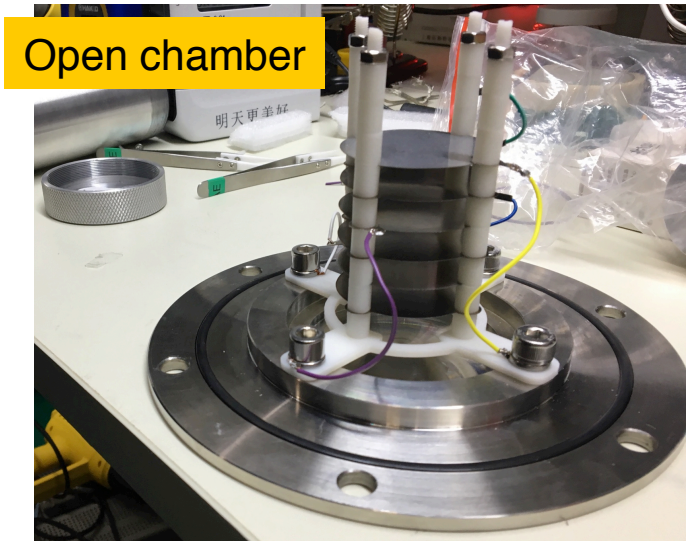
1. Back-n facility at CSNS
2. Detector setup at Back-n
3. Analysis and preliminary results
4. Conclusion and outlooks

Multi-layer Fission Chamber (MFC) developed at CIAE

- 3 U-235 targets
- 2 U-238 targets



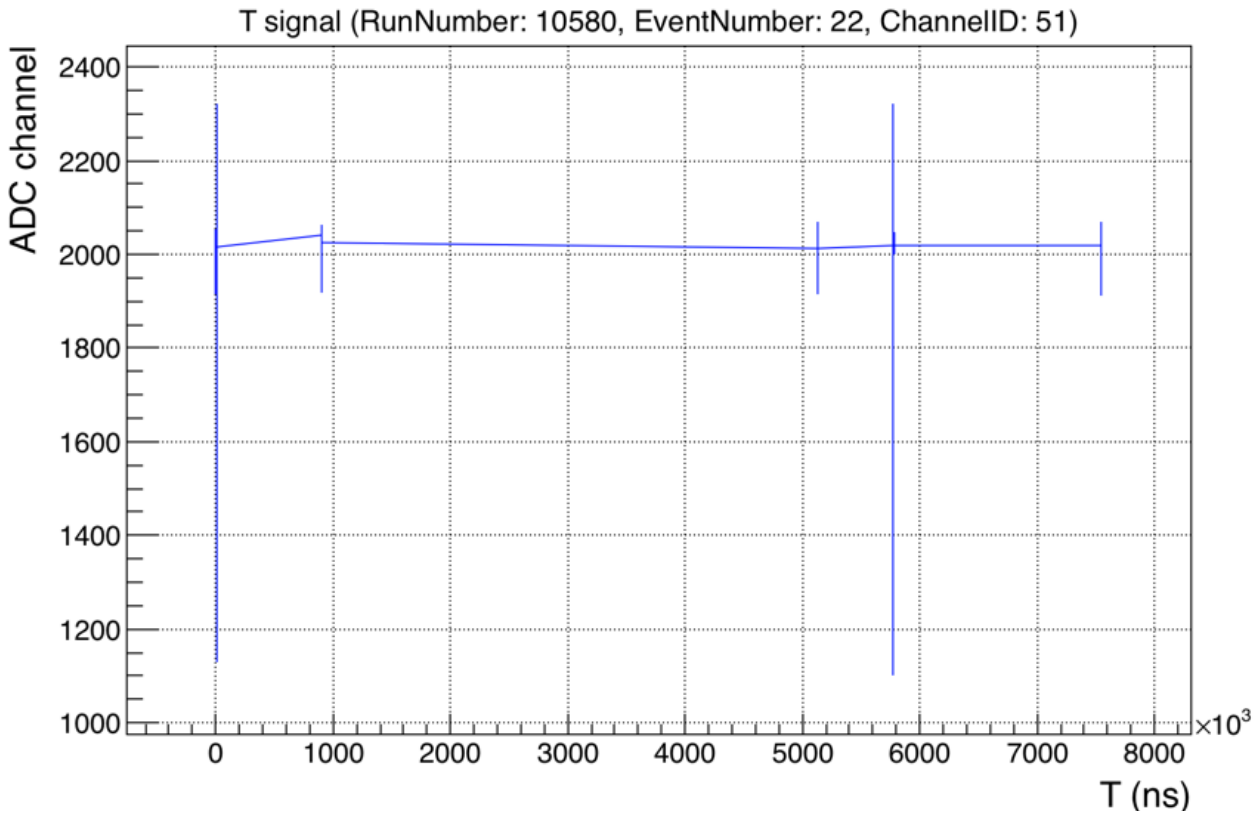



# Outline

1. Back-n facility at CSNS
2. Detector setup at Back-n
3. Analysis and preliminary results
   - -3.1 Raw data treatment
   - -3.2 Time-of-Flight method
   - -3.3 Flux calculation
4. Conclusion and outlooks

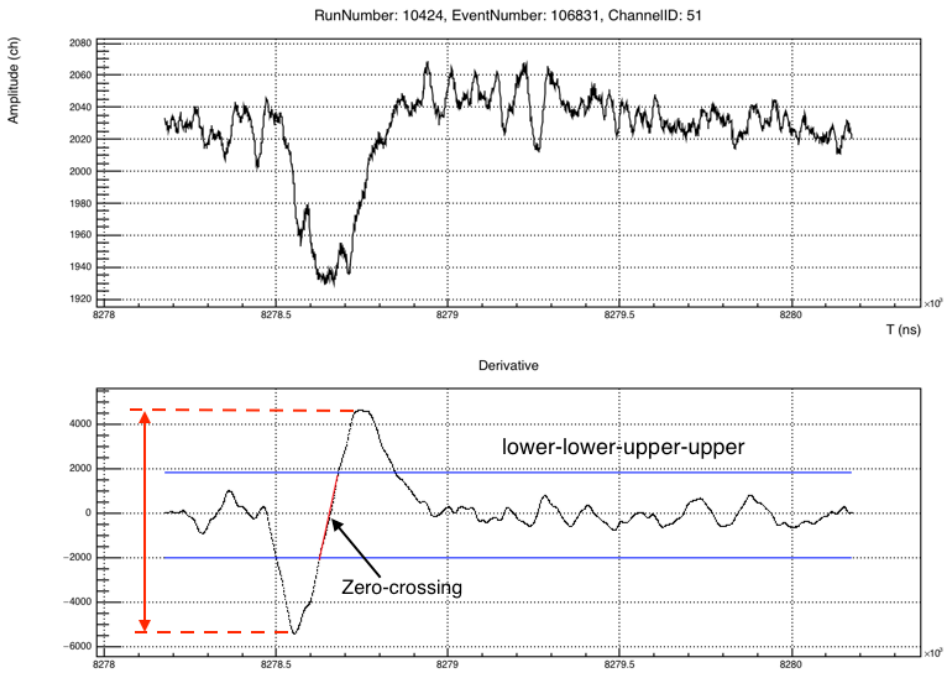
## 3.1 Raw data treatment

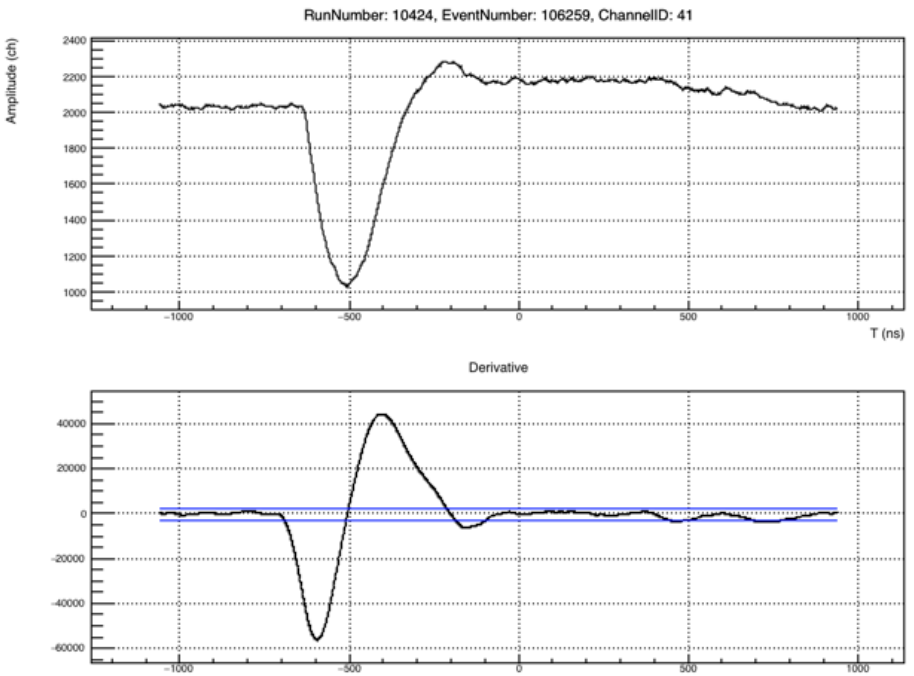
- Digitize all the signal waves in a given time window



# 3.1 Raw data treatment

- Offline pulse shape analysis: extract the signal timing, amplitude…



## 3.2 Time-of-flight method

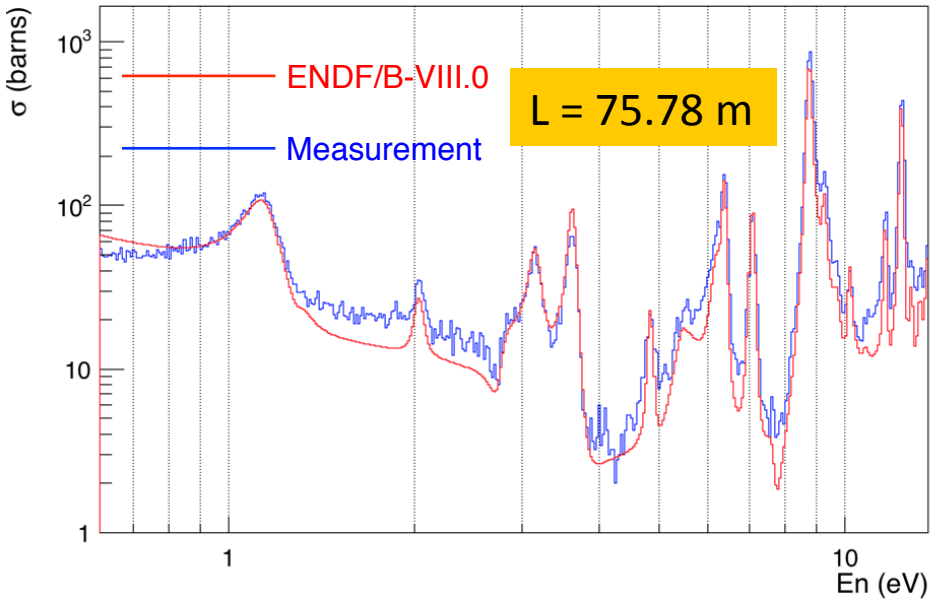
Determine neutron energy $E_n$ by time-of-flight method: $v = \frac{L}{TOF} = \frac{L}{T - T_0}$

*L*—flight path (to be determined)

$T_0$—starting flight time (to be determined)

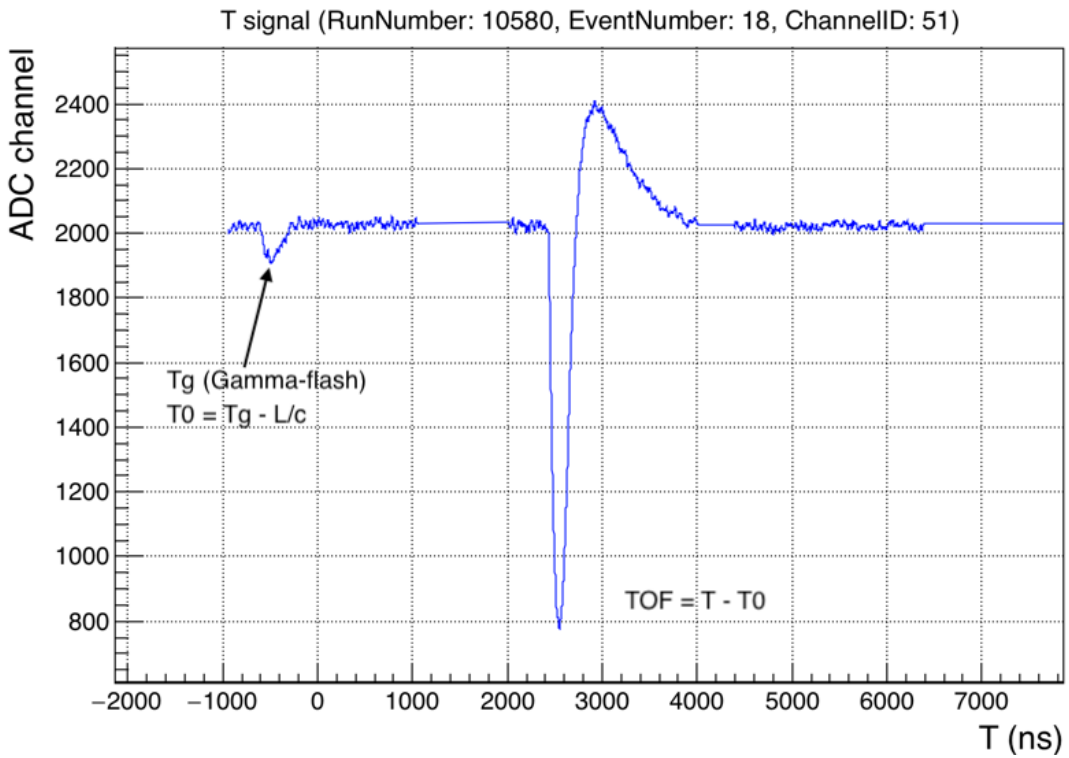
*T*—time given by detector

- *L* is determined by the resonance peaks

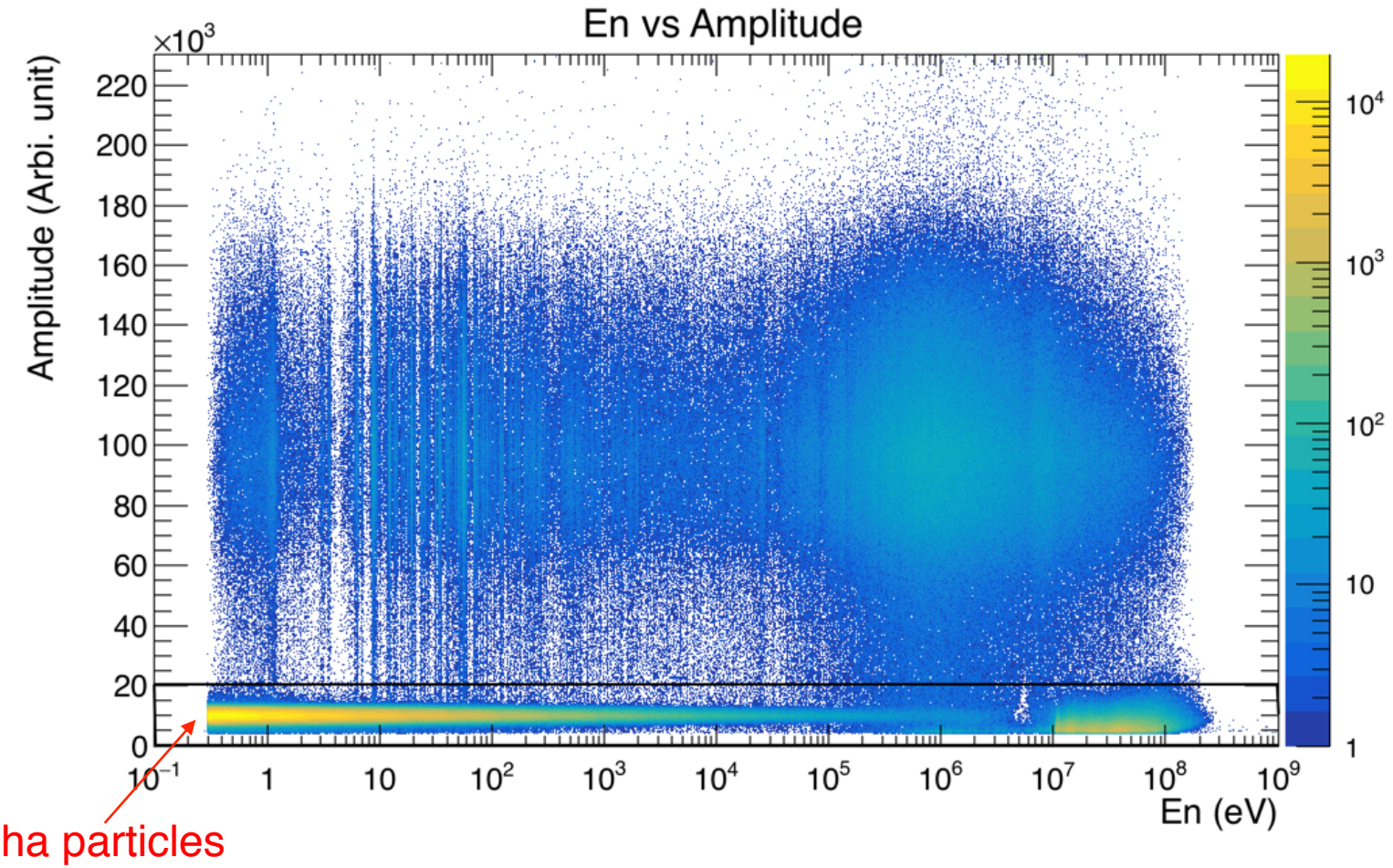


# 3.2 Time-of-flight method

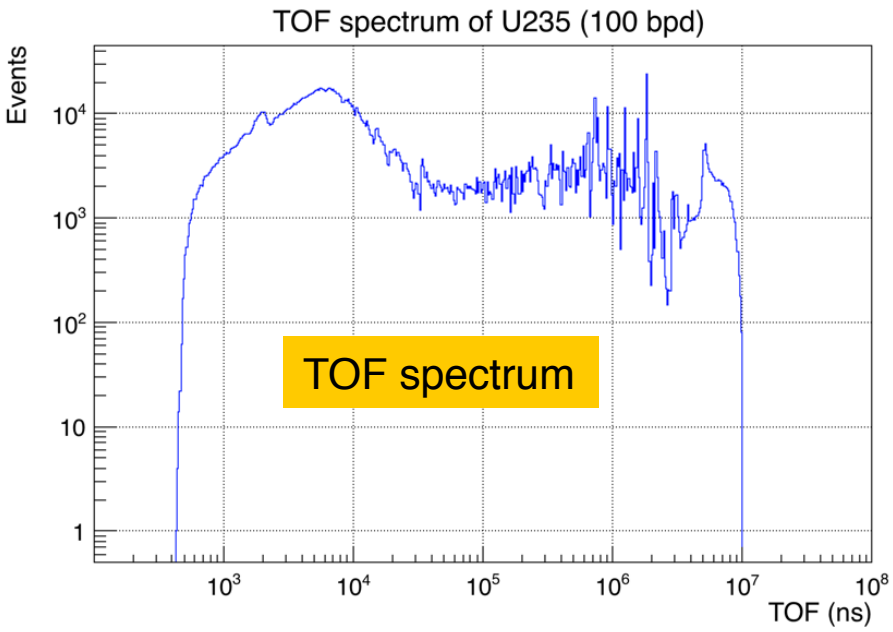
- $T_0$ is determined by the gamma-flash signal

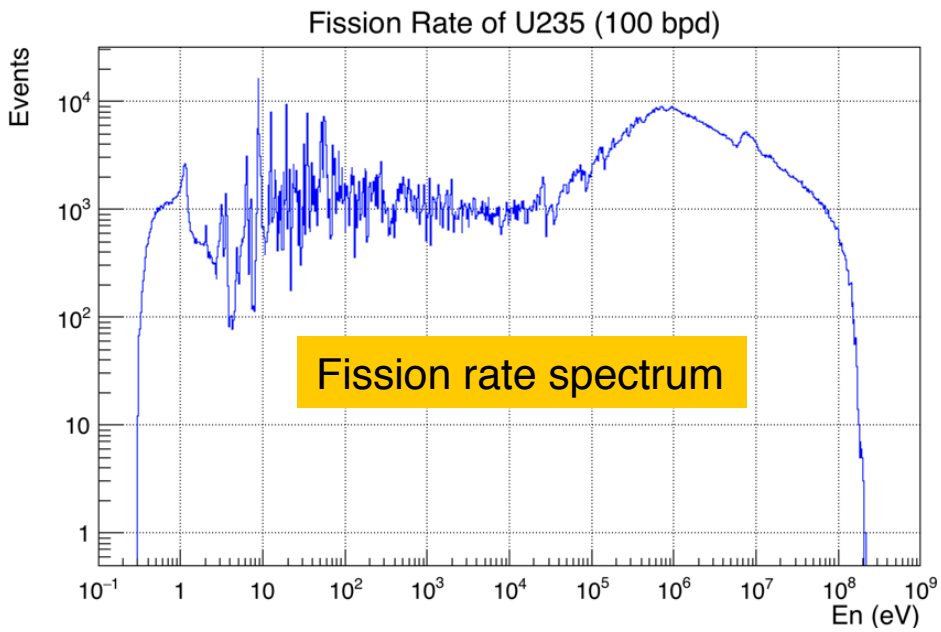


## 3.2 Time-of-flight method



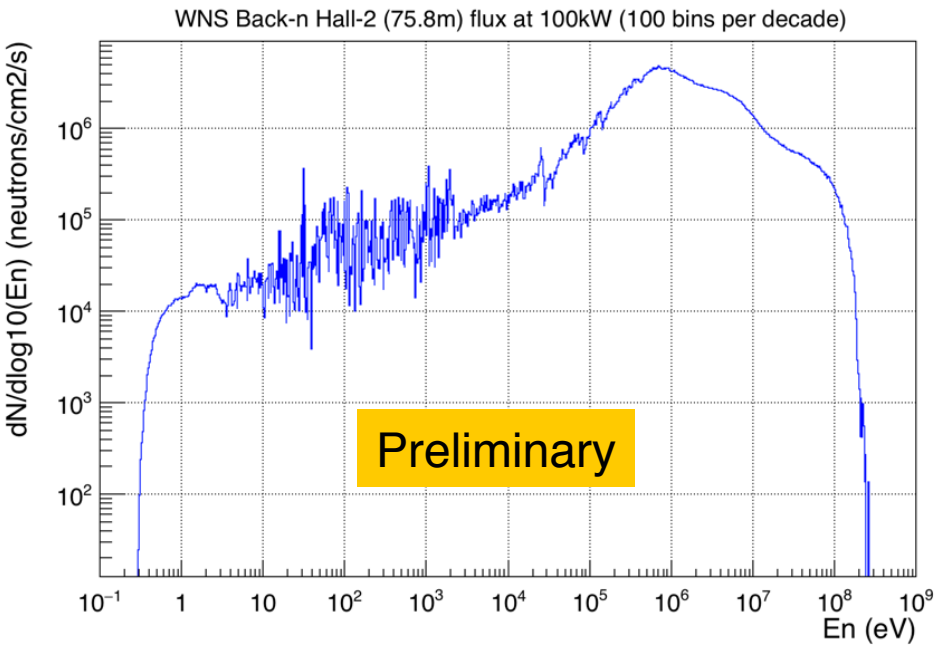
# 3.2 Time-of-flight method

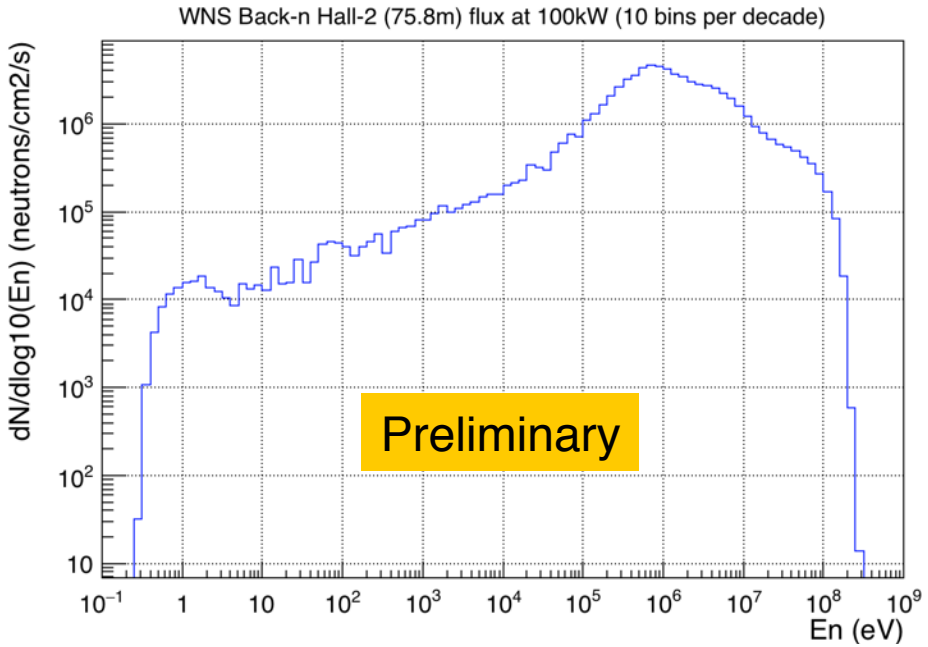


## 3.3 Flux calculation

$$\Phi(E) = \frac{N(E)}{\sigma(E)\varepsilon N_V}$$



# Outline

1. Back-n facility at CSNS
2. Detector setup at Back-n
3. Analysis and preliminary results
4. Conclusion and outlooks

## Conclusion:

First preliminary neutron flux of Back-n WNS beam line from ~1eV to tens of MeV is obtained.

## Outlooks:

1. The detection efficiency of MFC need to be quantitatively determined by Monte Carlo simulation.

2. The flux from ~eV to ~keV will be determined by $^{6}Li(n, \alpha)T$ reaction instead of $^{235}U(n, f)$ reaction

…Thank you for your attention…