# Neutron background measurement and simulation

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# Motivation

Measurement of beta-delayed neutron emission probability ($P_n$) at RIBF

1.Is RIKEN suitable for neutron experiment?
Neutron background measurement at F11

2.What is optimum configuration of detector array?
Simulation for future experiment

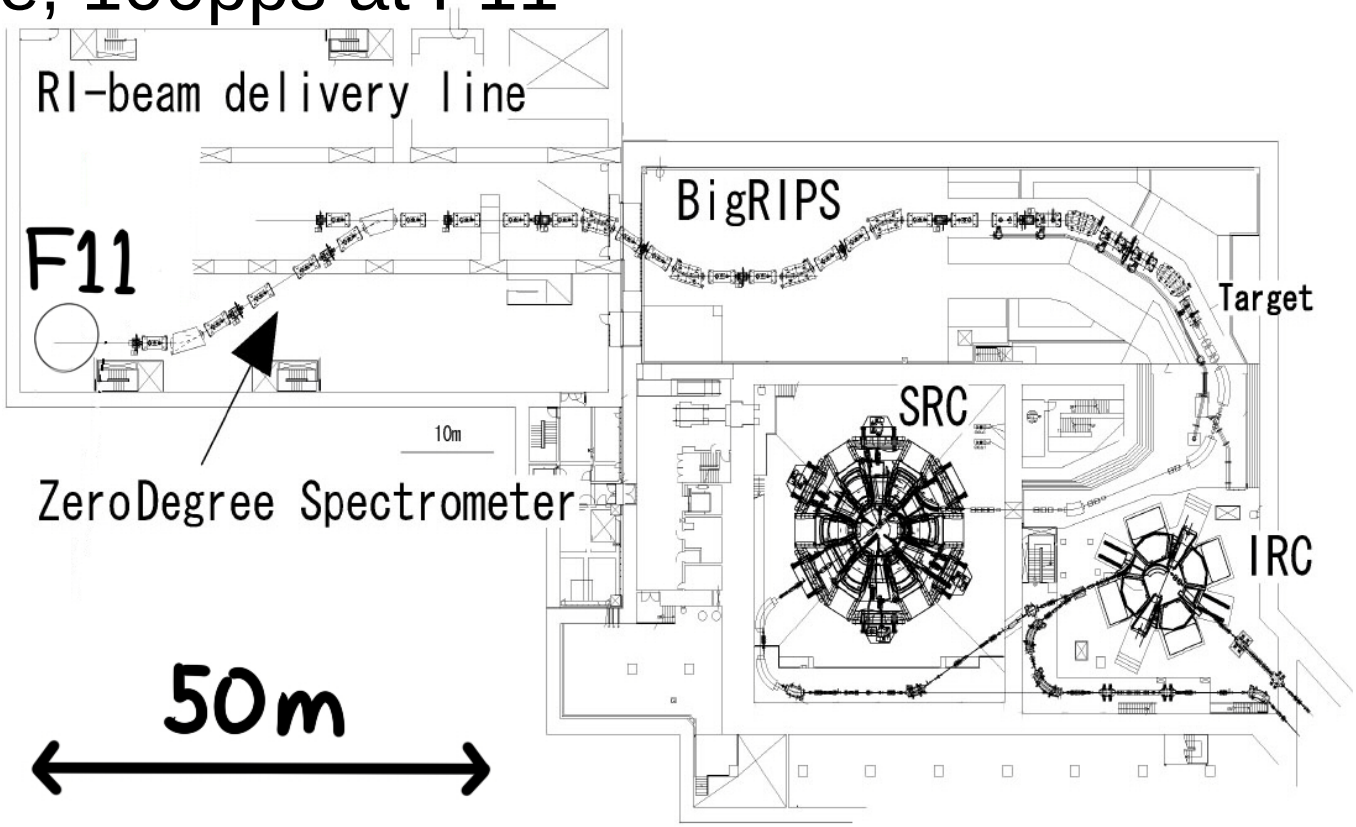
# 1.Neutron Background Measurement at F11

# Neutron background measurement during EURICA campaign

May, 2013

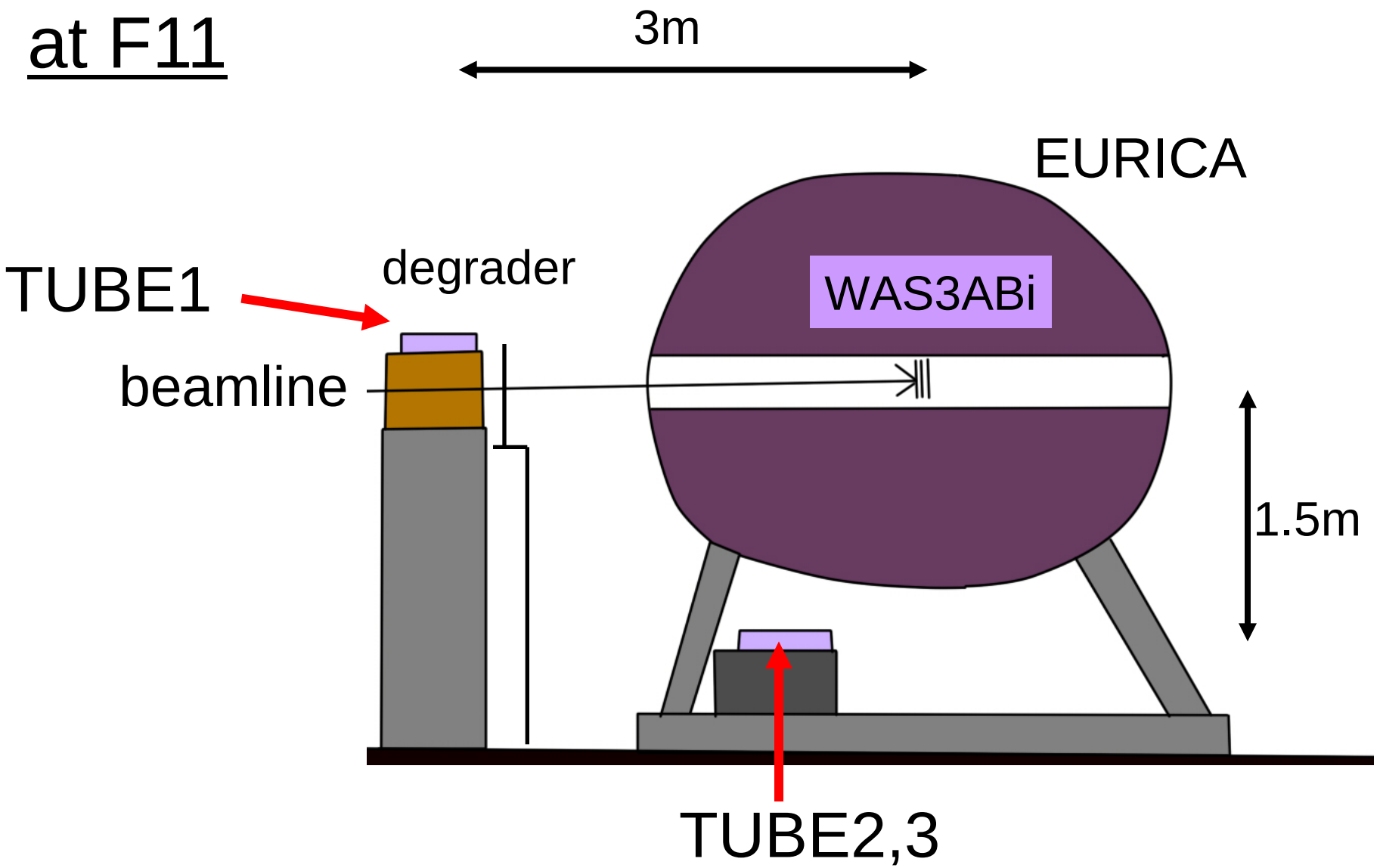
RIBF87 experiment (A.Odahara, et, al)

$^{142}$Te, 100pps at F11

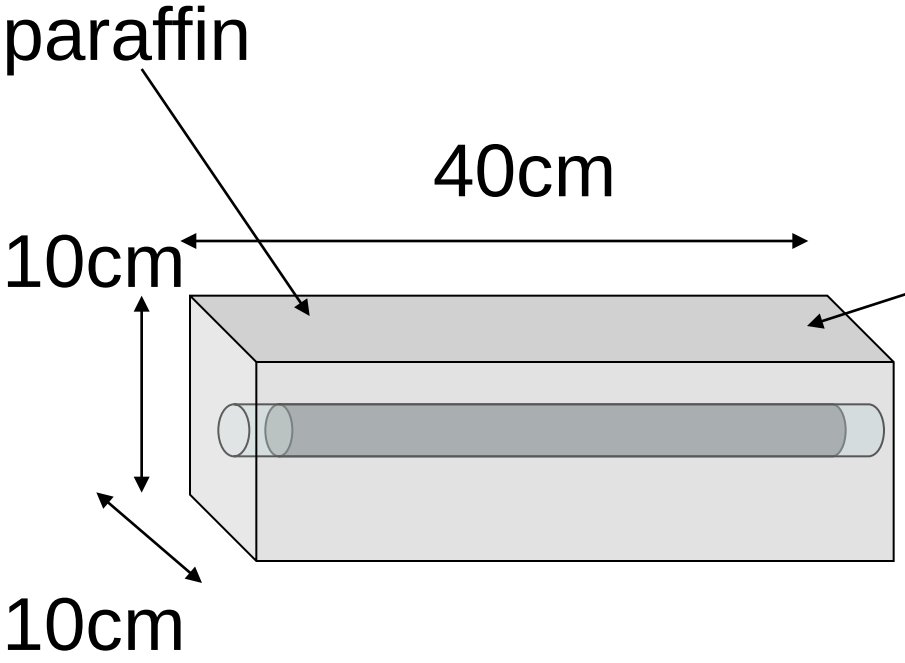


# Experimental set up

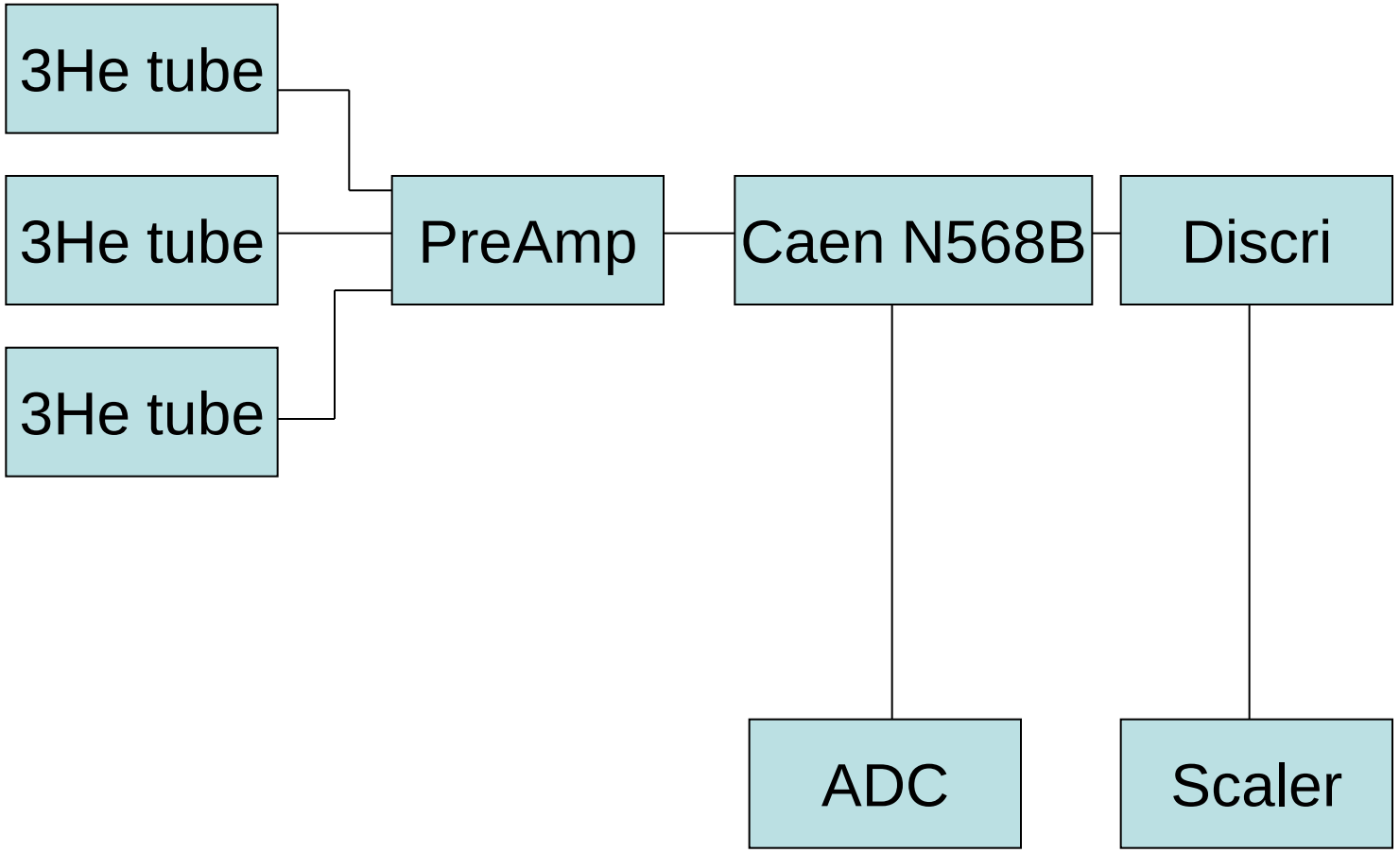
at F11



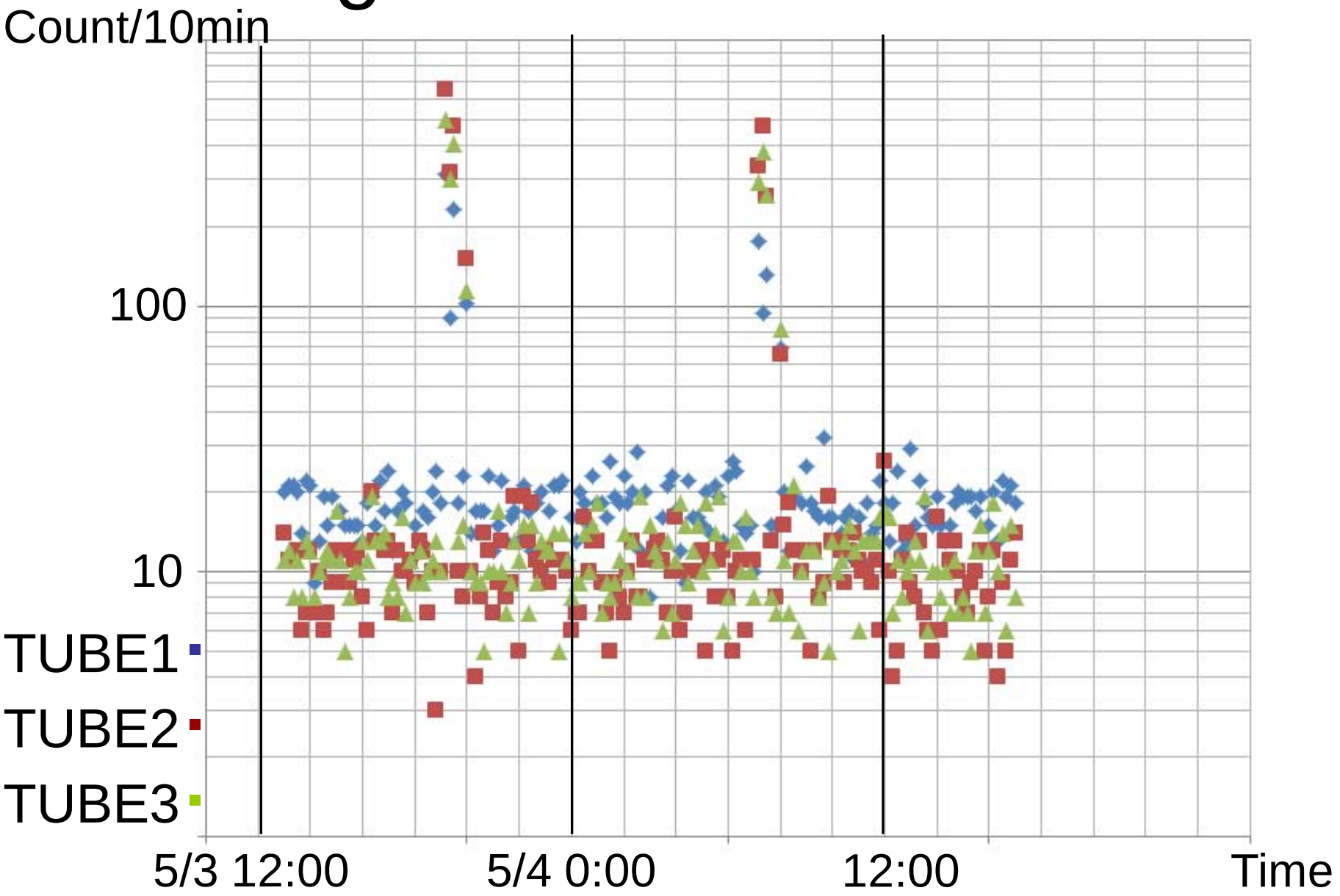
# Tube 1



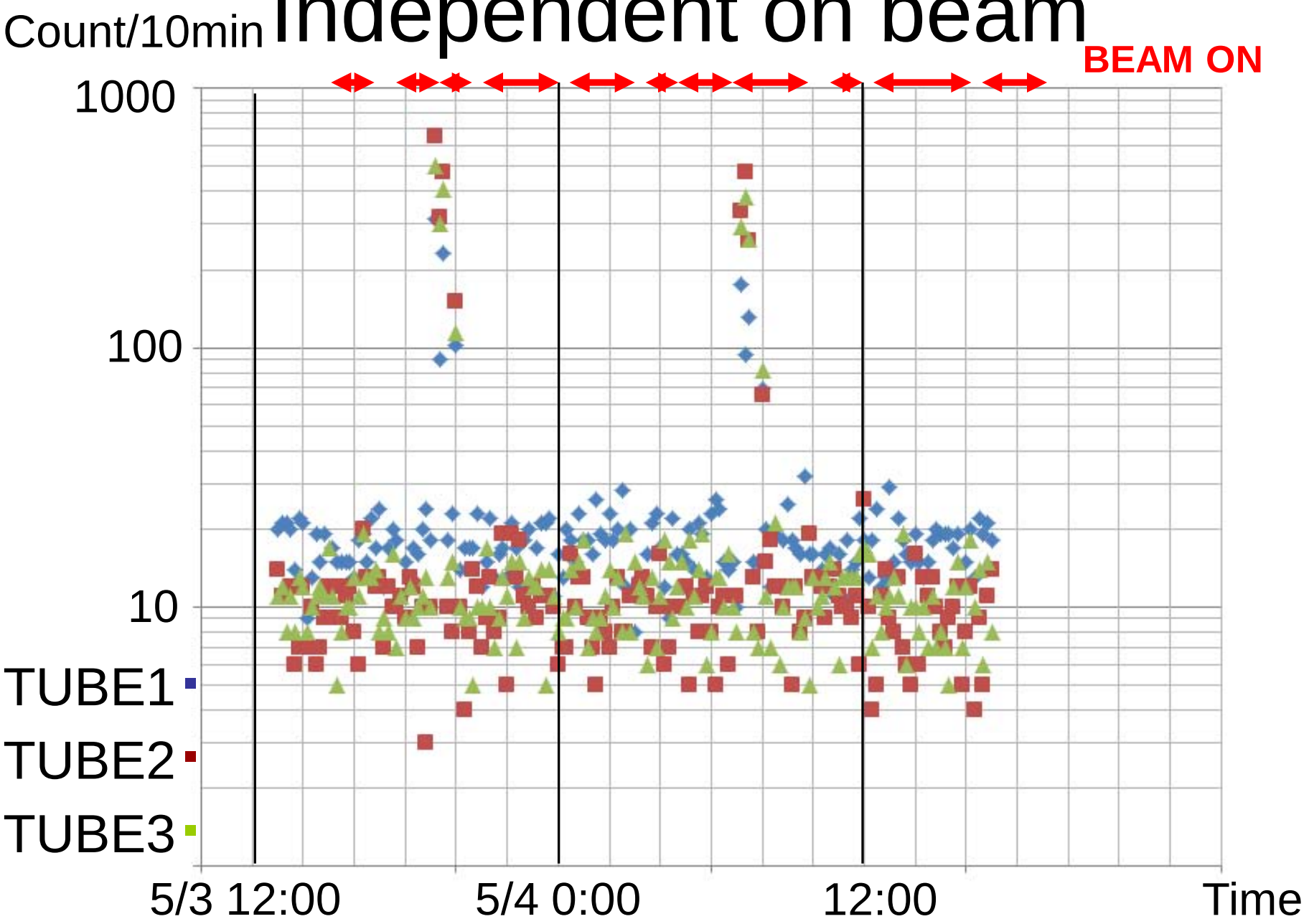

# Circuit


3He tube
3He tube
3He tube
PreAmp
Caen N568B
Discri
ADC
Scaler

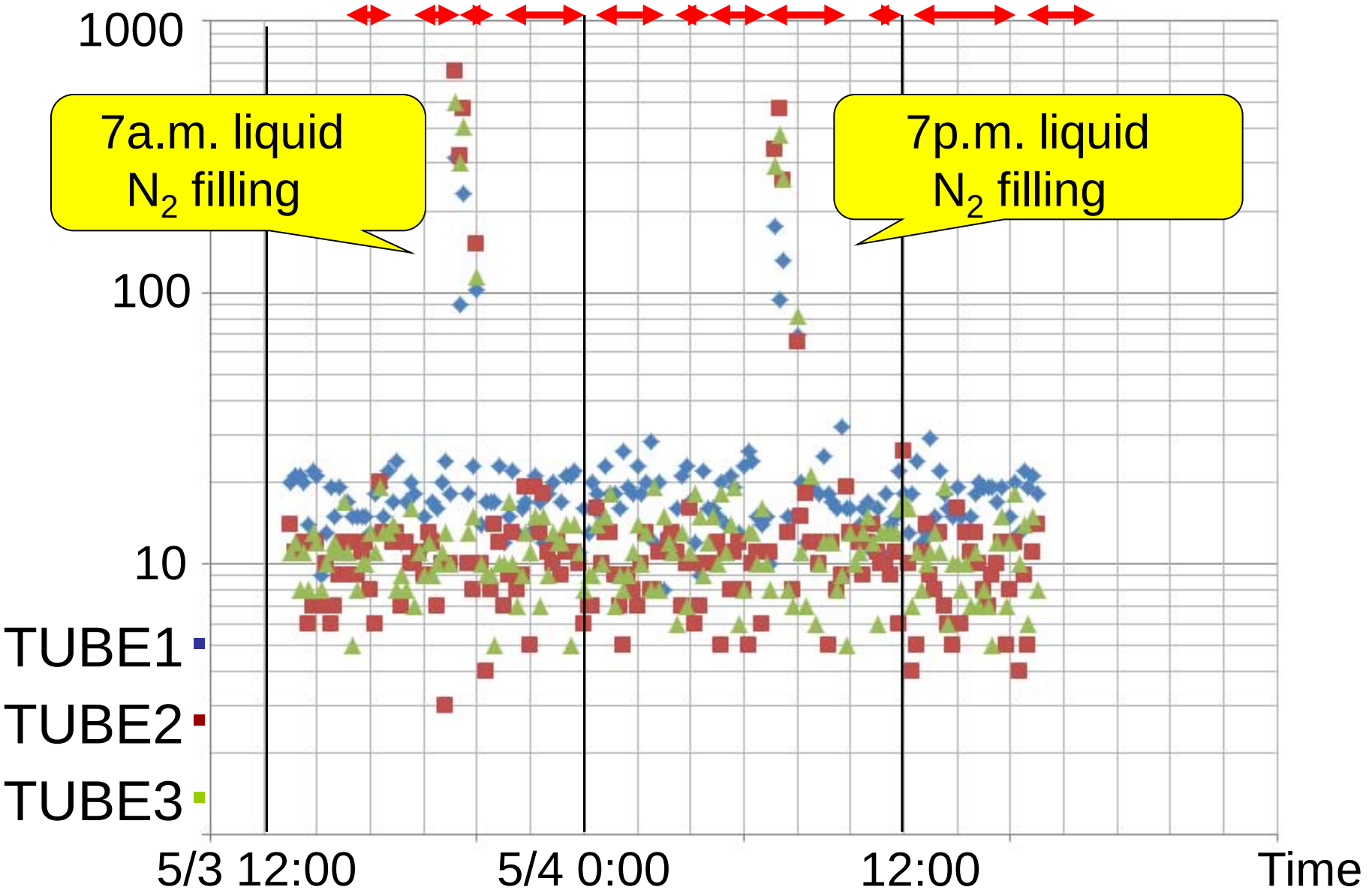
# Background count rate is low



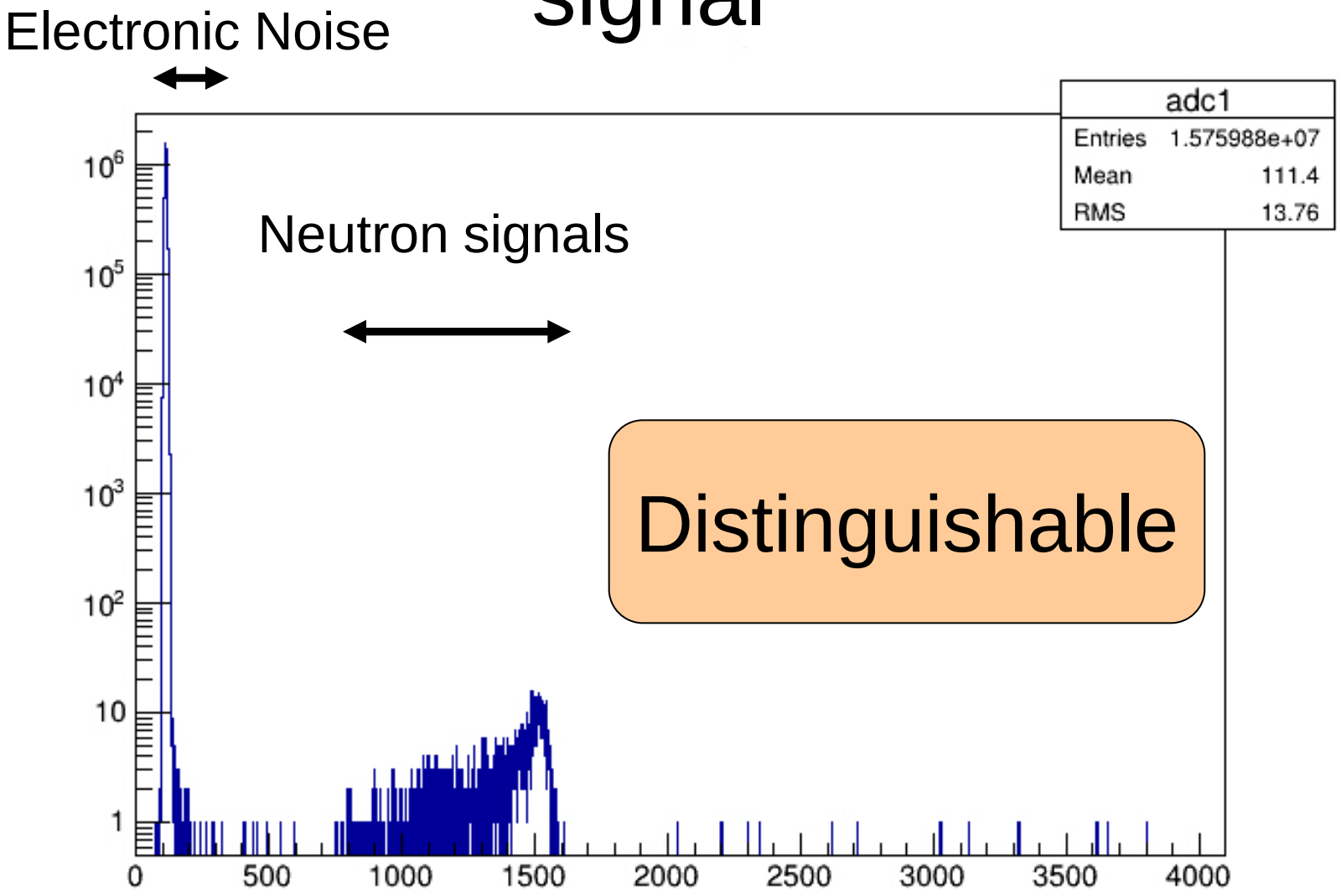
# Independent on beam



# Electronic noise from liquid $N_2$



# Distinguishable between noise and signal



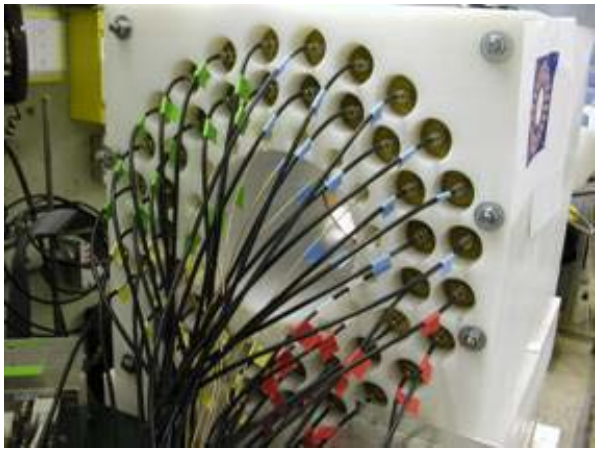
# 2.Simulation for future experiment

# Design of neutron detector array

- GOALS

-- High efficiency

-- Flat energy dependence

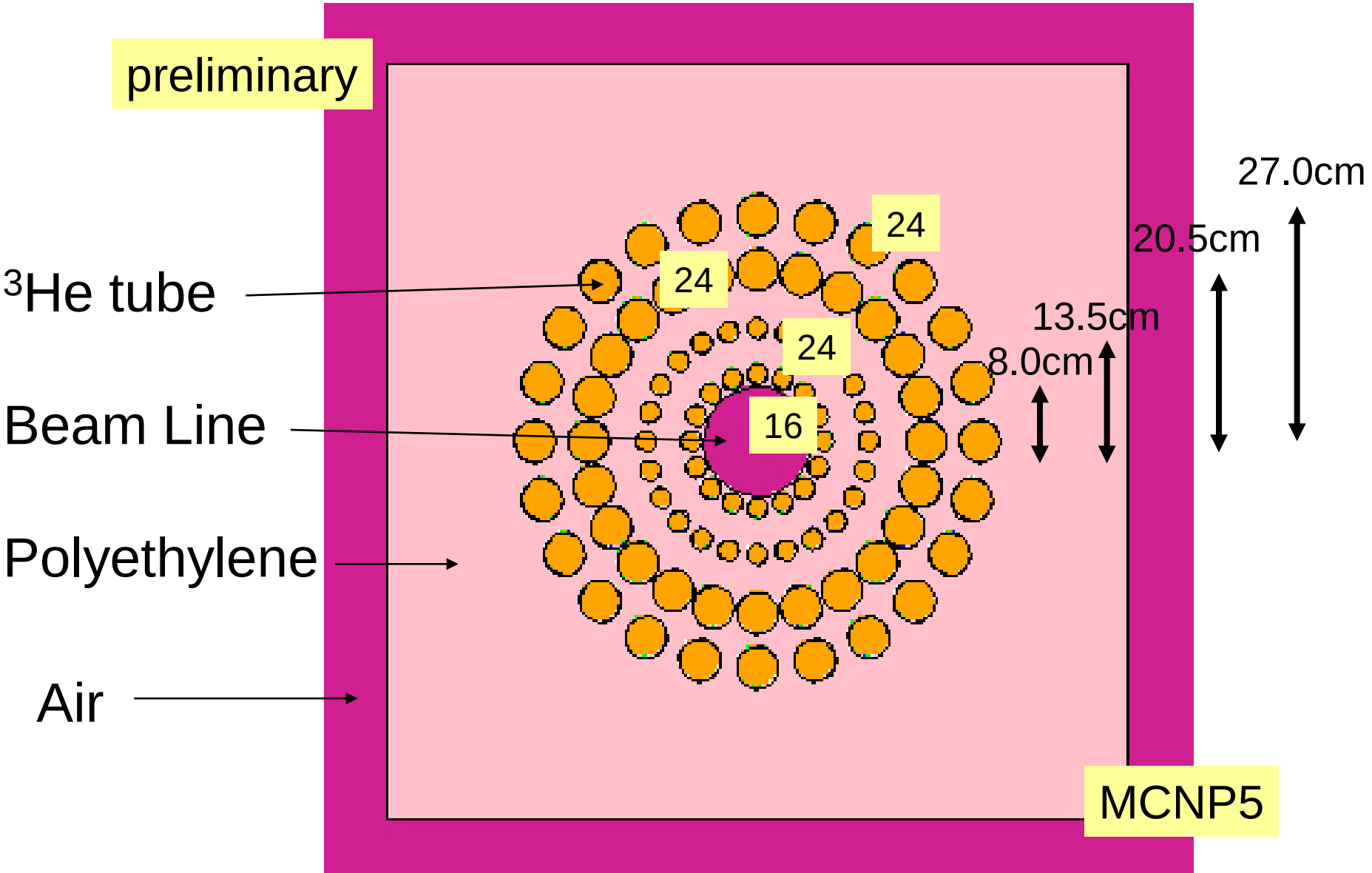


→ Discussion about optimum configuration with simulator(MCNP5)

# Available $^3$He tubes

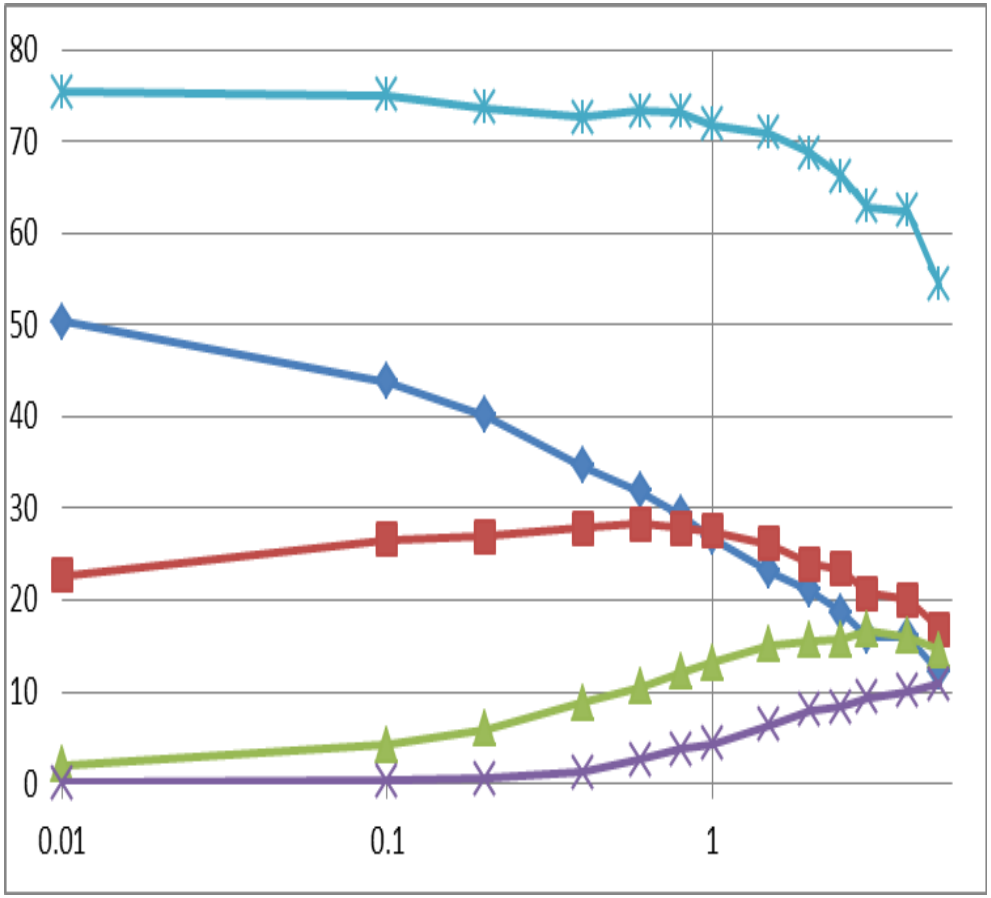
| | |
|---|---|
| RIKEN(JPN) | 27x(5atm, φ2.54cm, 30cm) |
| UPC(ESP) | 42x(8atm, φ2.54cm, 30cm) |
| GSI(DEU) | 10x(10atm, φ2.54cm, 60cm) |
| JINR(RUS) | 20x(4atm, φ3.00cm, 50cm) |
| ORNL(USA) | 58x(10atm, φ5.08cm, 60.96cm)<br>16x(10atm, φ2.54cm, 60.96cm) |

# Arrangement of $^{3}$He array at RIBF



# Total efficiency

Detection Efficiency (%)



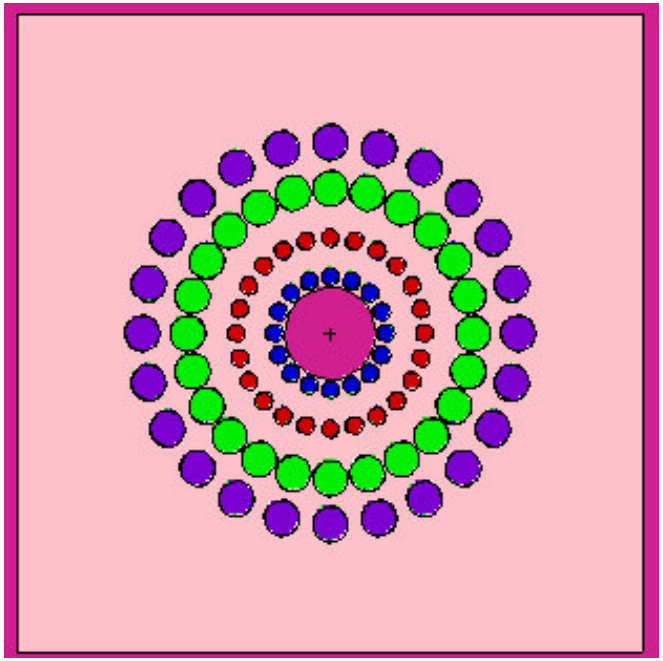

total

1st ring

2nd ring

3rd ring

4th ring



Neutron Energy [MeV]

# Summary

- Neutron background count rate is very LOW
- RIKEN is appropriate for neutron experiment
- Detection efficiency can be over 70% according to simulation (<1.5MeV)
- Higher efficiency(~80%) and flatter energy dependence will be achieved with more optimized simulation

Thank you!