

WIKI SOL VEST V. 2014 CERN

# $\beta$ -delayed $\alpha$ -decay of $^{16}\text{N}$

– experiments performed at the AGOR/Tripp-facility

Jonas Refsgaard

April 29th

**MAGISOL meeting 2014, CERN**



AARHUS  
UNIVERSITY

DEPARTMENT OF PHYSICS AND ASTRONOMY

# Physics

- Explain relative abundance of  $^{12}\text{C}$  and  $^{16}\text{O}$ .

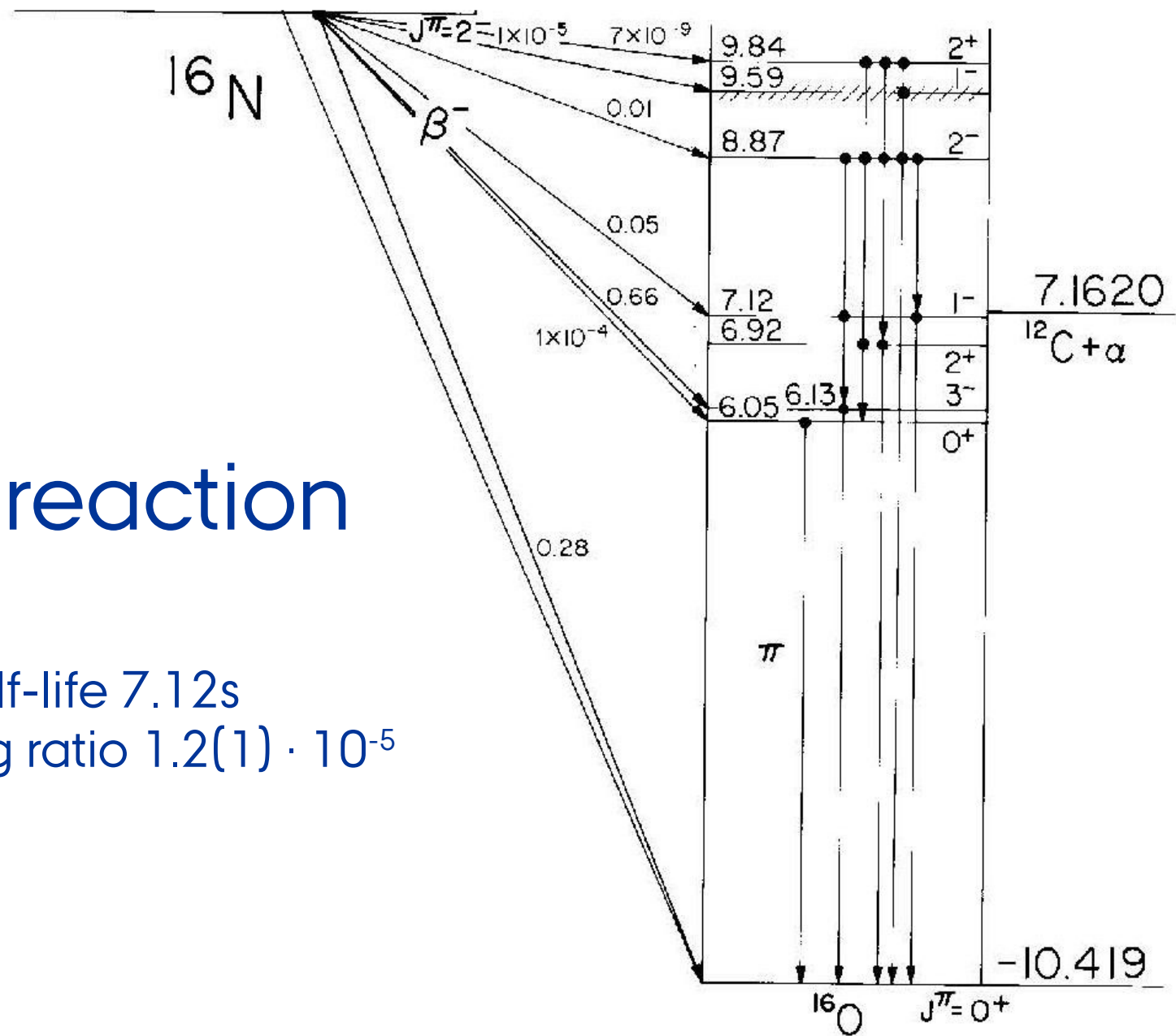


- Direct measurement of reaction at stellar He-burning energies is not feasible.
- E1-contribution to the reaction can be constrained by measuring the inverse process
- Large contribution to uncertainty comes from the branching ratio for  $\alpha$ -decay.

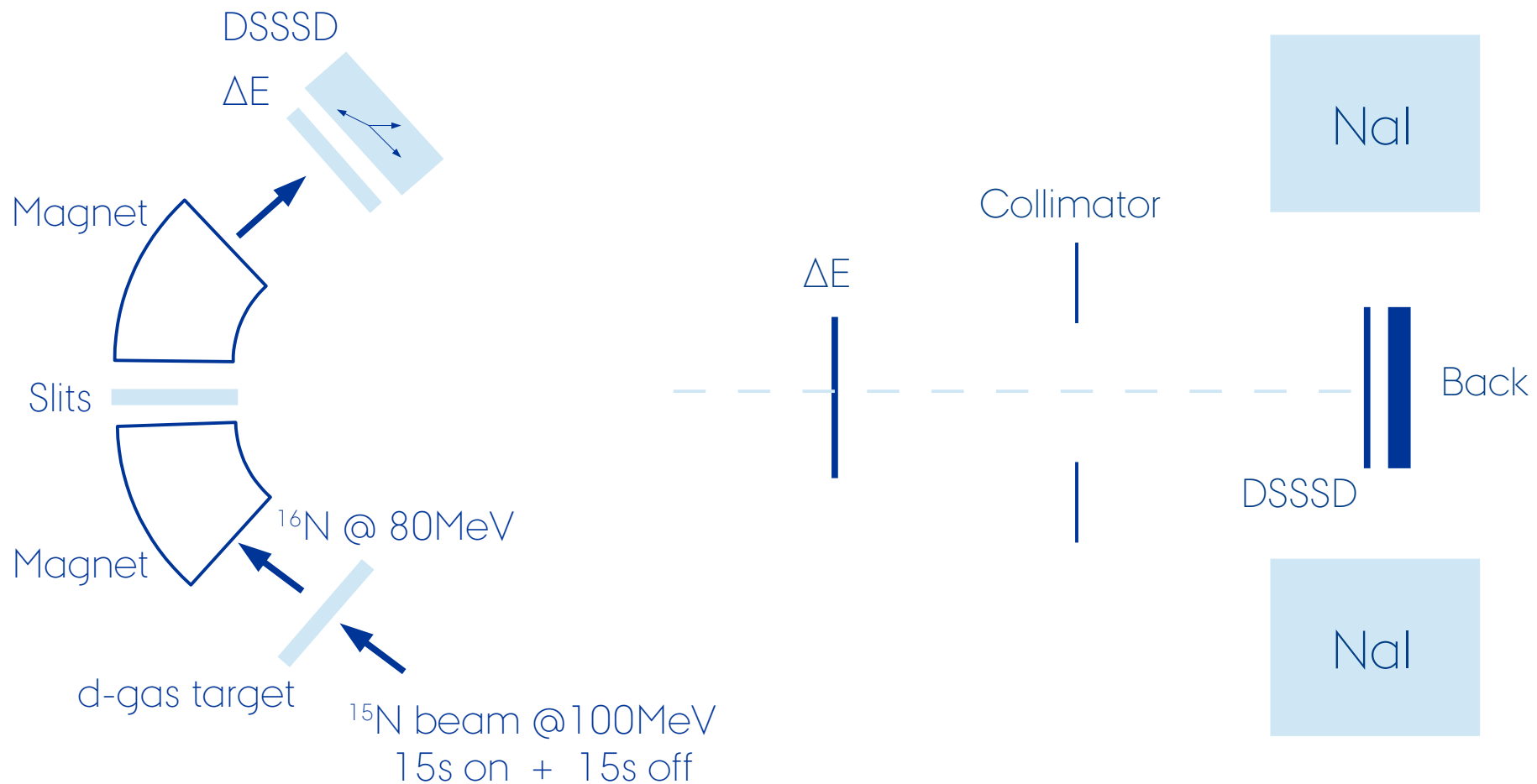


# The reaction

half-life 7.12s  
branching ratio  $1.2(1) \cdot 10^{-5}$

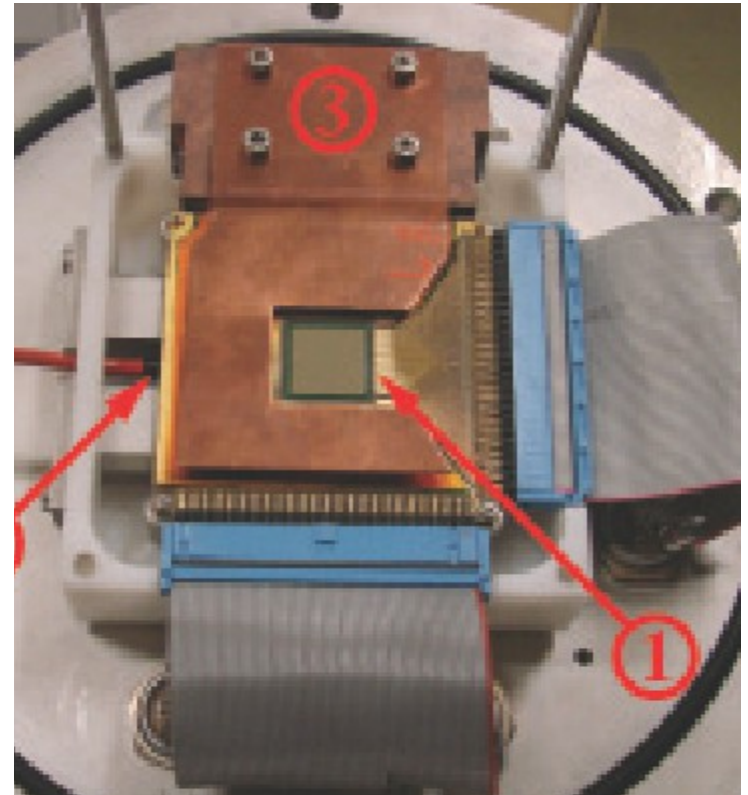
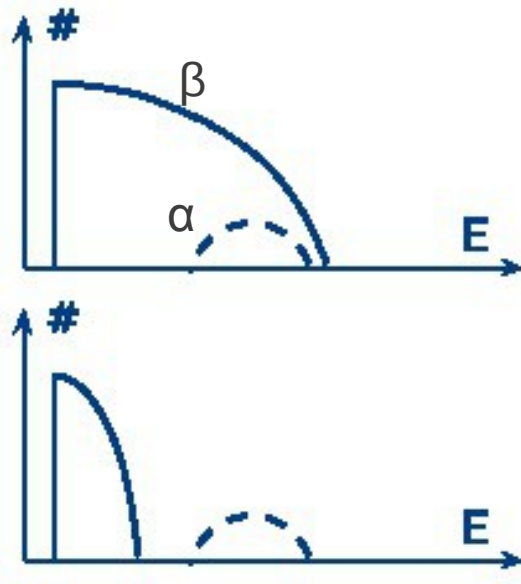


# Experiment



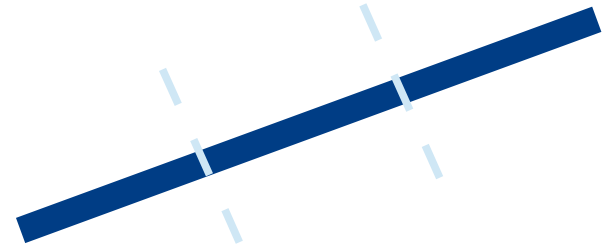
# Detector

- DSSSD, 48 x 48 strips, 2304 pixels.
- Pixels:  $78 \times 300 \times 300 \mu\text{m}^3$ .

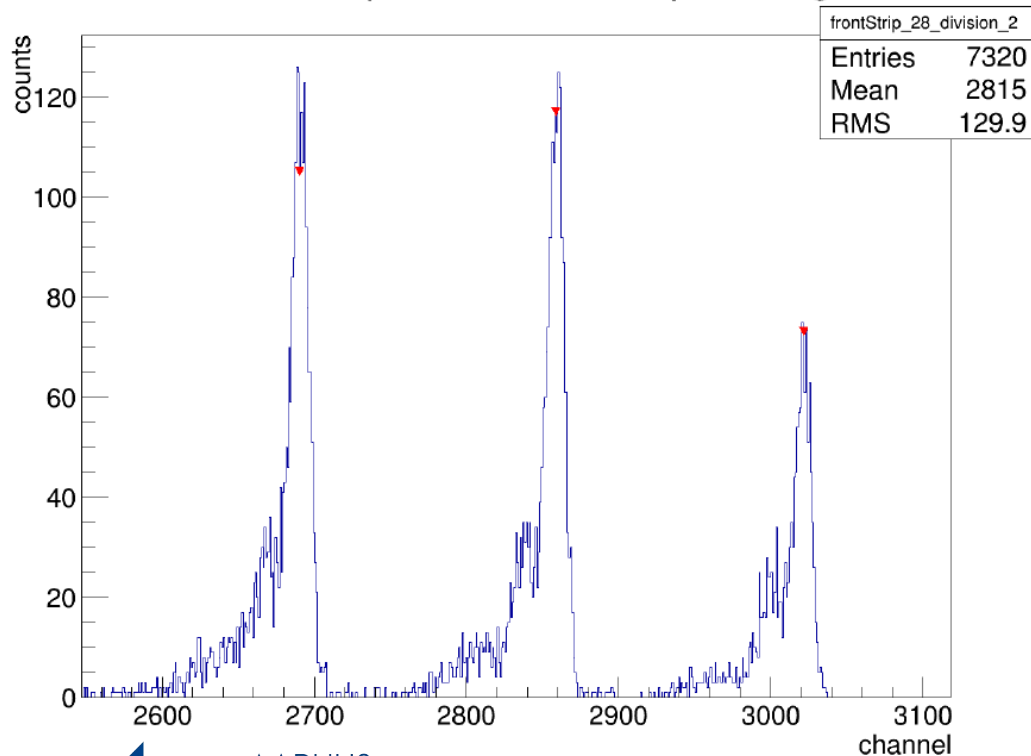


# Energy calibration

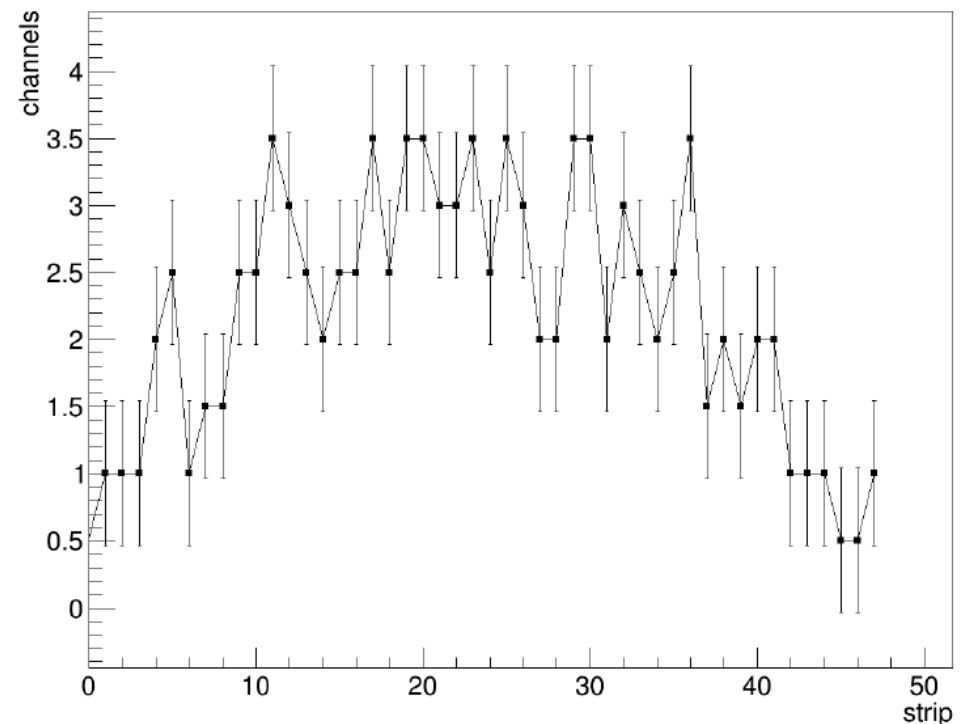
- Source of  $^{239}\text{Np}$ ,  $^{241}\text{Am}$  and  $^{244}\text{Cm}$
- Either dead layer or internal effect.



Front Strip Division, 16 strip binning



Front strip response curvature, Cm-peak

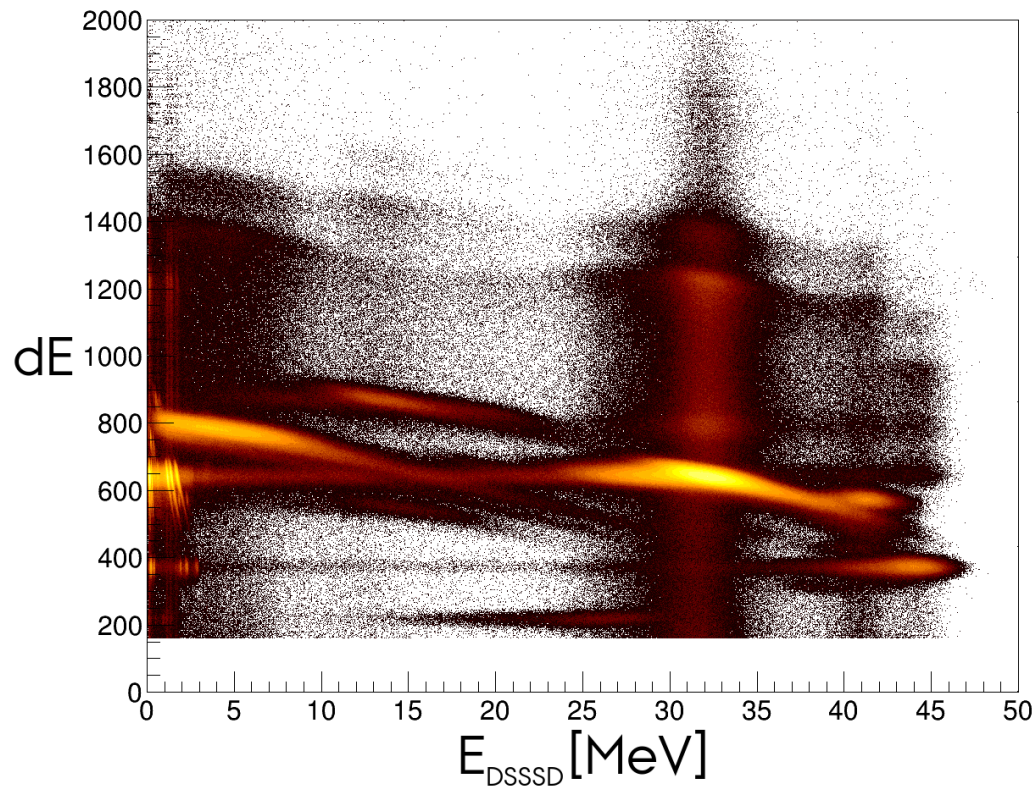


AARHUS  
UNIVERSITY

DEPARTMENT OF PHYSICS AND ASTRONOMY

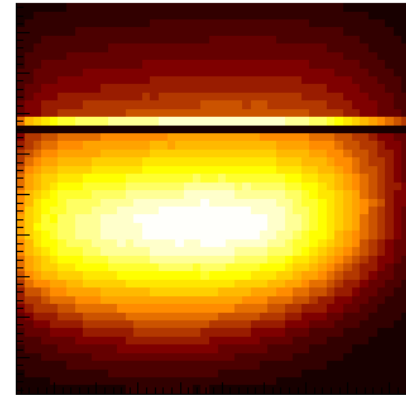
Jonas Refsgaard

# The data

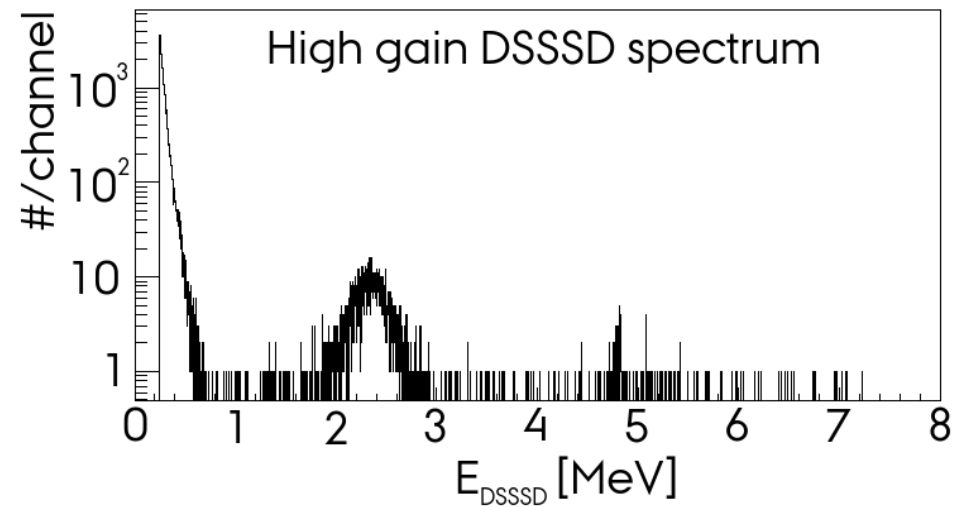
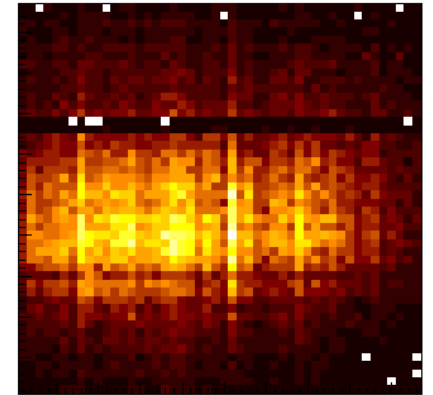


- Two amplification chains.

Implantations



Decays



# Normalisation 1, dead time

- Trigger → scaler.

$$\text{Eff}(\%) = \frac{\text{Accepted triggers}}{\text{Total triggers}}$$

- Cyclotron duty-cycle.





# Normalisation 1, dead time

- Trigger → scaler.

$$\text{Eff}(\%) = \frac{\text{Accepted triggers}}{\text{Total triggers}}$$

- Cyclotron duty-cycle.



# Normalisation 1, dead time

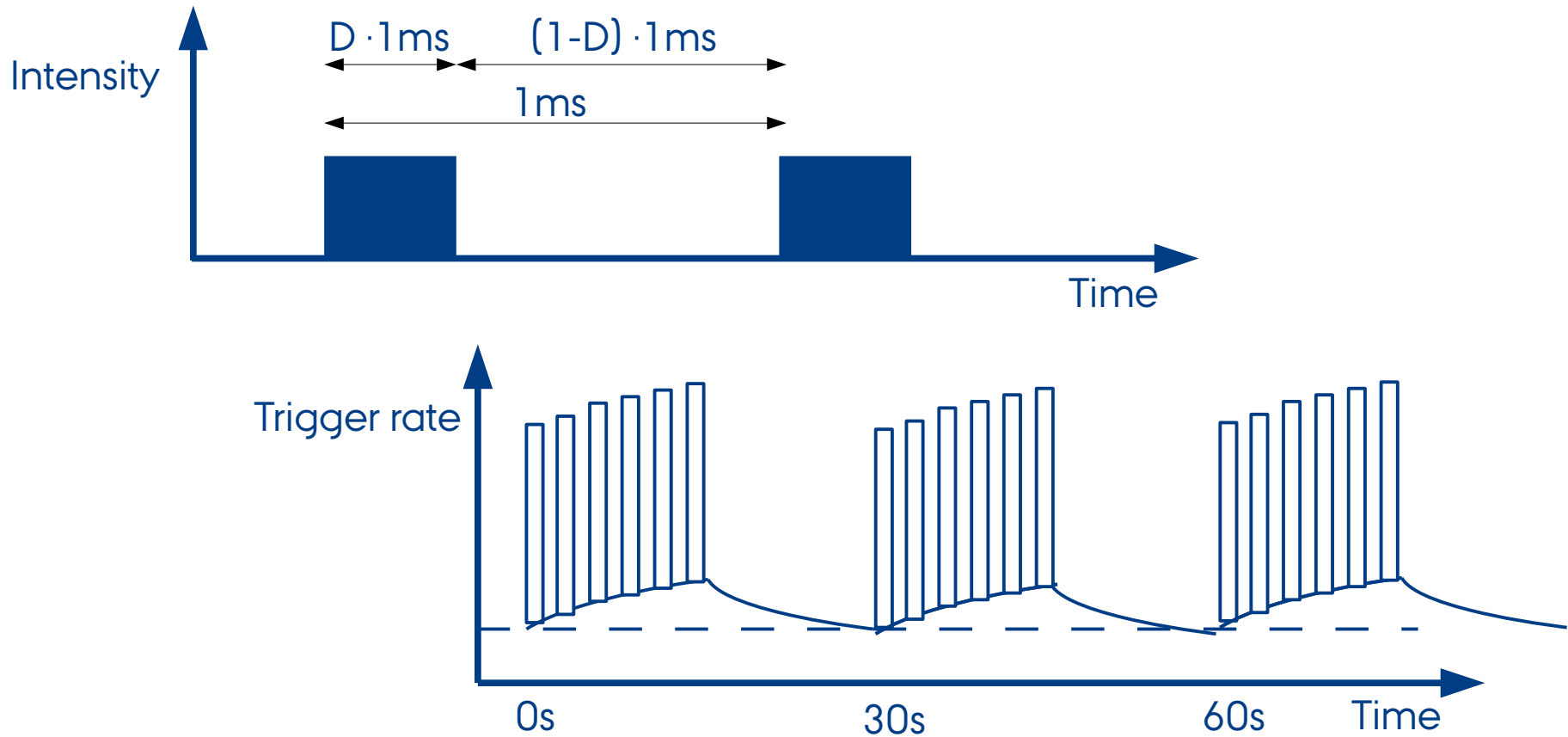
- Trigger → scaler.

$$\text{Eff}(\%) = \frac{\text{Accepted triggers}}{\text{Total triggers}}$$

- Cyclotron duty-cycle.



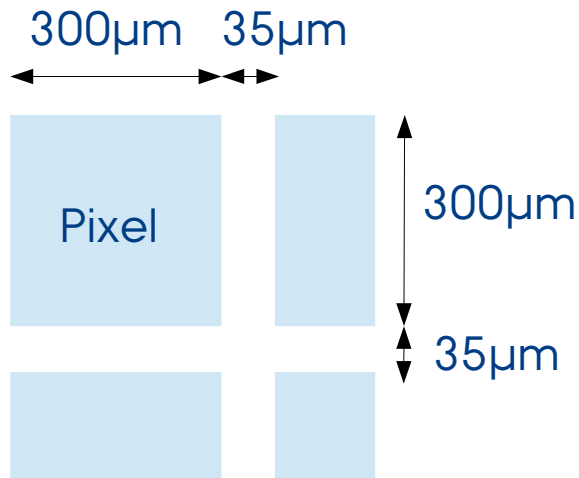
# Normalisation 1, cont.



- Correction now dependent on  $D$  (which changes)



# Normalisation 2, sharing



- ~20% of detector area between strips.
- Implantation vs. decay.
- To be investigated.



# Summary

- Normalisation is the most challenging part of the analysis.
- Lessons to be learned:
  - Cyclotrons are pulsed.
  - Running with excessive dead time can be bad.
  - Check electronics with oscilloscope.
- Spectroscopy is not affected by dead time.

