

Hvad er de for nogen?

- Symbol: μ^- (eller μ^+)
- Ladning: $-1 e$
- Masse: $0.113 u / 106 \text{ MeV}$
- 2. generations lepton
- Opdaget i 1936

mass →	$\approx 2.3 \text{ MeV}/c^2$	$\approx 1.275 \text{ GeV}/c^2$	$\approx 173.07 \text{ GeV}/c^2$	0	$\approx 126 \text{ GeV}/c^2$
charge →	2/3	2/3	2/3	0	0
spin →	1/2	1/2	1/2	1	0
	u up	c charm	t top	g gluon	H Higgs boson
	$\approx 4.8 \text{ MeV}/c^2$	$\approx 95 \text{ MeV}/c^2$	$\approx 4.18 \text{ GeV}/c^2$	0	
	-1/3	-1/3	-1/3	0	
	1/2	1/2	1/2	1	
QUARKS	d down	s strange	b bottom	γ photon	
	$0.511 \text{ MeV}/c^2$	$105.7 \text{ MeV}/c^2$	$1.777 \text{ GeV}/c^2$	$91.2 \text{ GeV}/c^2$	
	-1	-1	-1	0	
	1/2	1/2	1	1	
	e electron	μ muon	τ tau	Z Z boson	
	$< 2.2 \text{ eV}/c^2$	$< 0.17 \text{ MeV}/c^2$	$< 15.5 \text{ MeV}/c^2$	$80.4 \text{ GeV}/c^2$	
	0	0	0	± 1	
	1/2	1/2	1/2	1	
LEPTONS	ν_e electron neutrino	ν_μ muon neutrino	ν_τ tau neutrino	W W boson	
					GAUGE BOSONS

Hvorfor kan man måle dem?

Beregning af gammafaktoren:

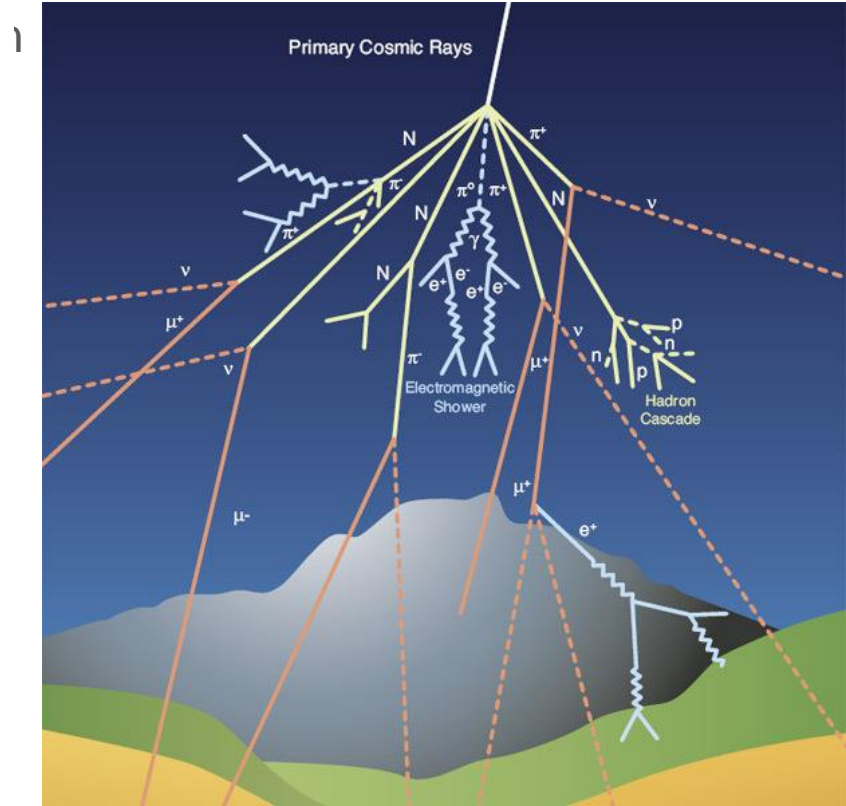
$$\lambda = \frac{1}{\sqrt{1 - \frac{(0,997832 \cdot c)^2}{c^2}}} = 15,1947$$

Beregning af myonens levetid set fra Jorden:

$$t = \lambda \cdot 2,2 \mu\text{s} = 3,3 \cdot 10^{-5} \text{s}$$

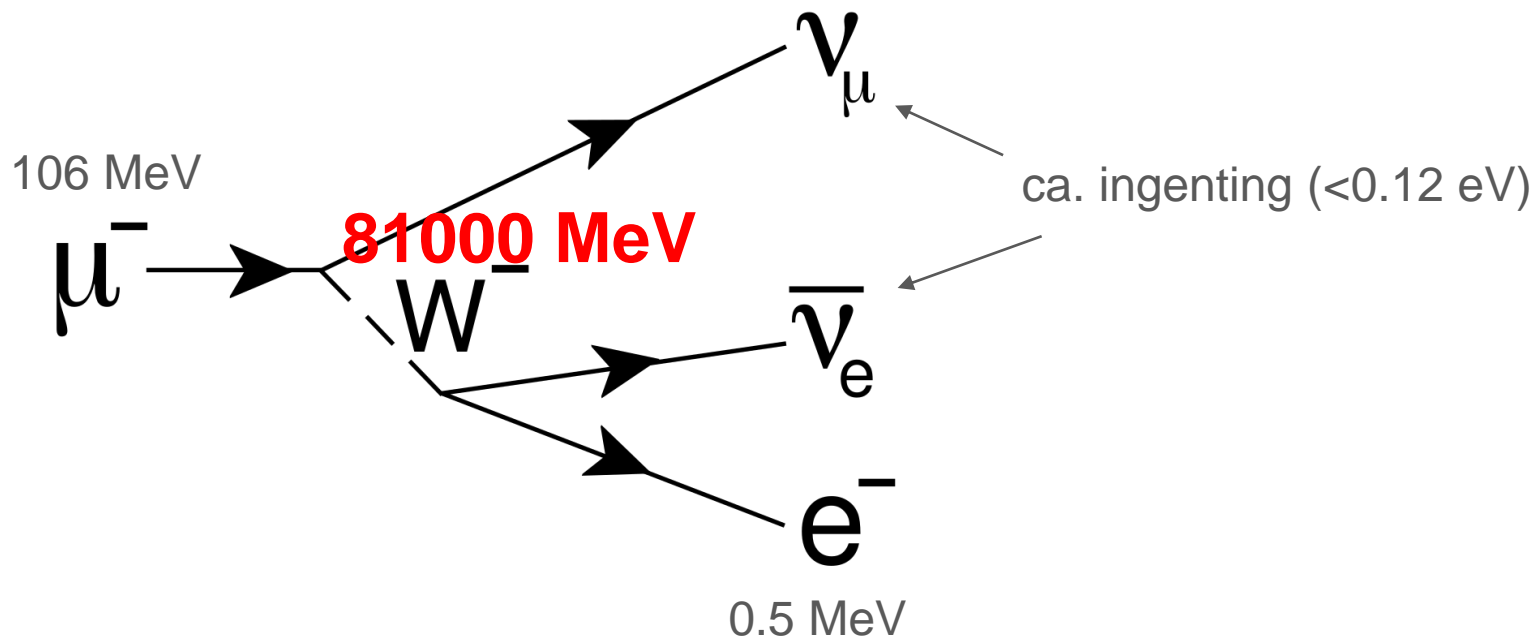
Beregning af den strækning, den når:

$$s = t \cdot 0,997832 \cdot c^2 = 9999,81 \text{ m}$$

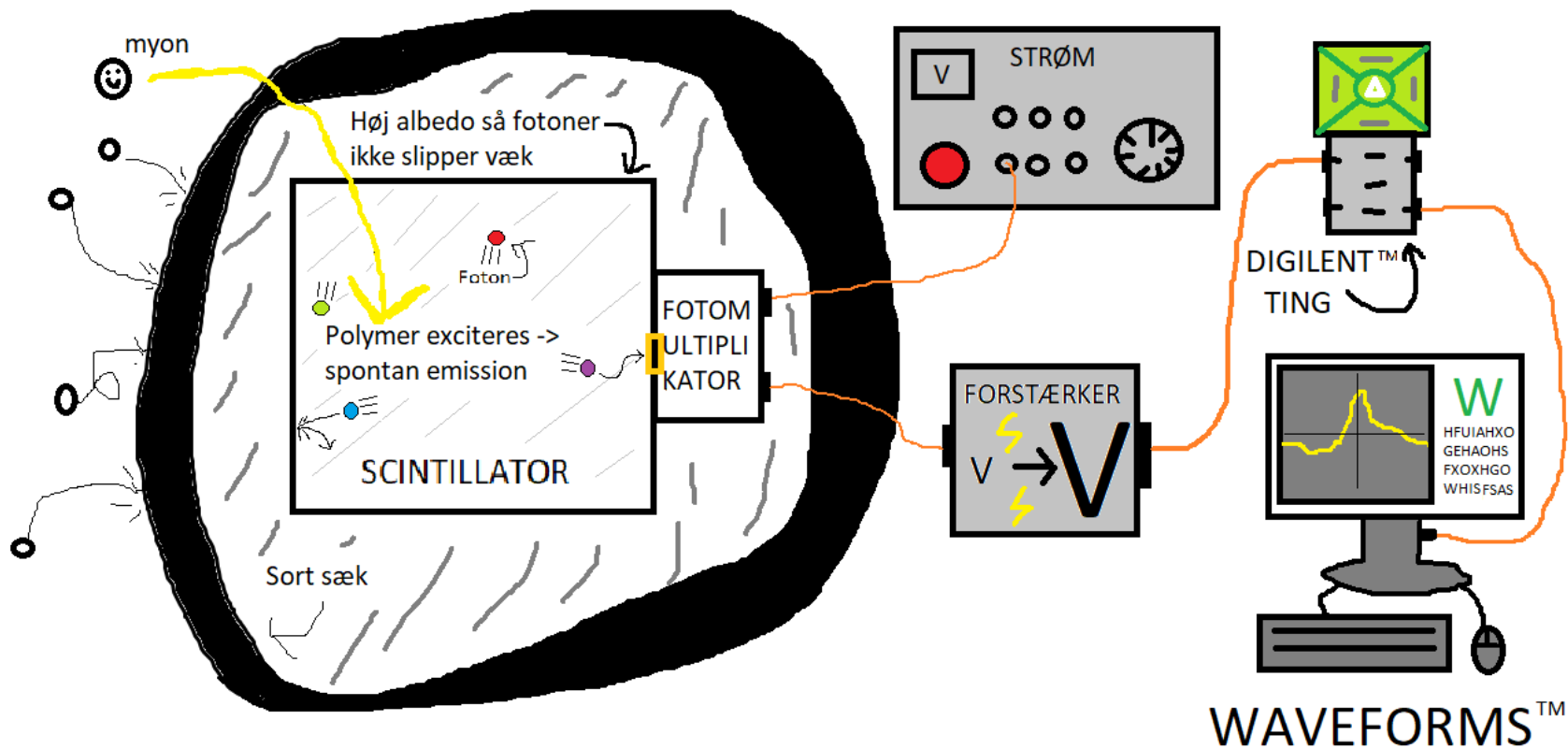


Hvad henfalder myoner til?

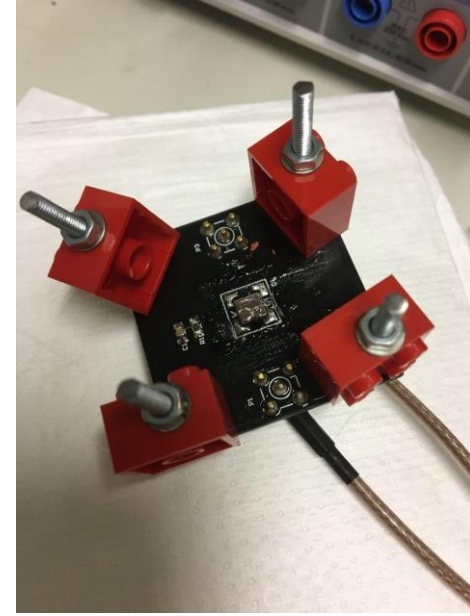
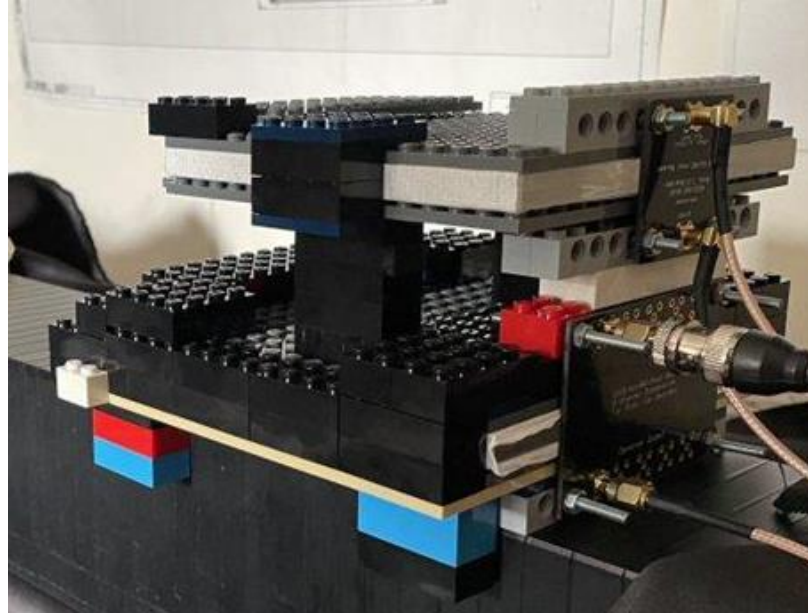
$$\Delta\chi\Delta\rho \geq \frac{\hbar}{2}$$



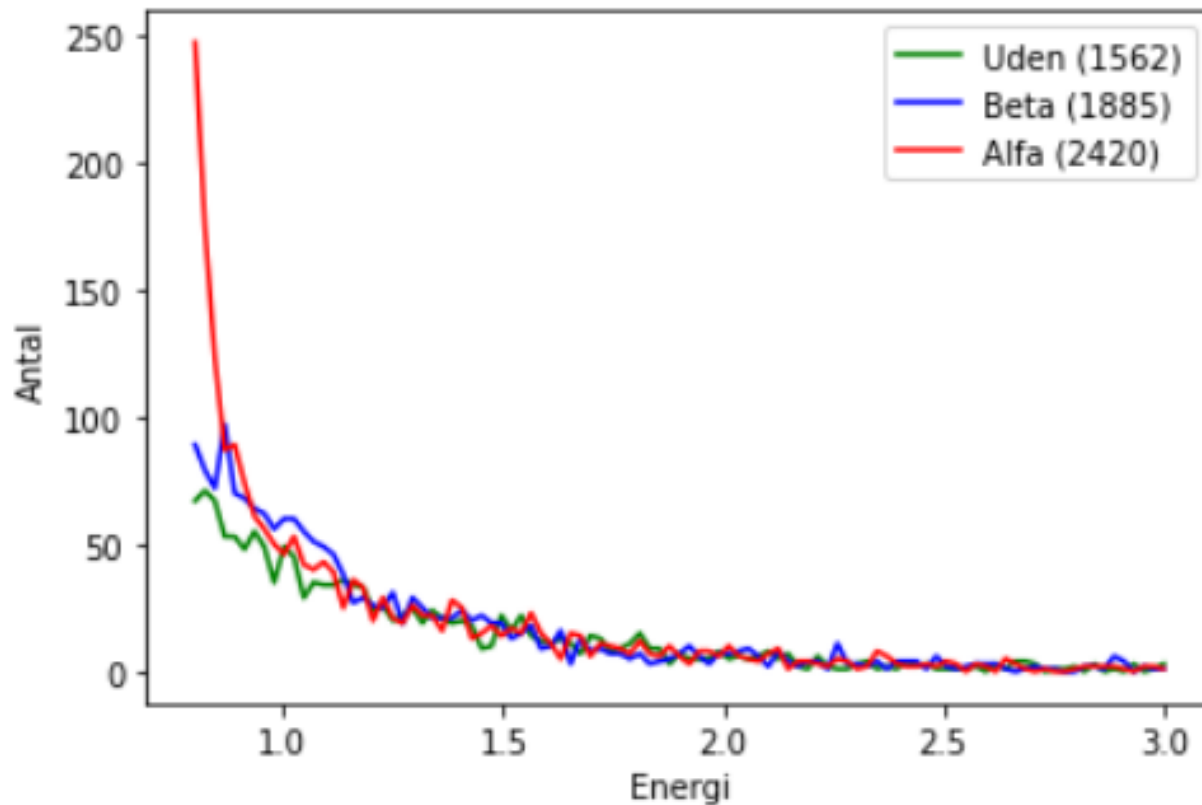
Detektoren



Detektoren

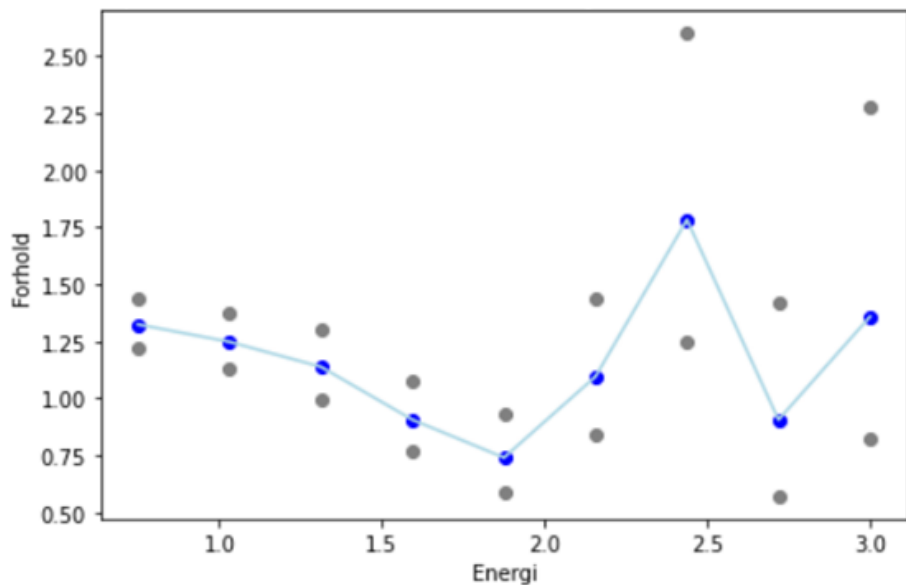


Første detektor med strålingskilder under det sorte stof (10 min)

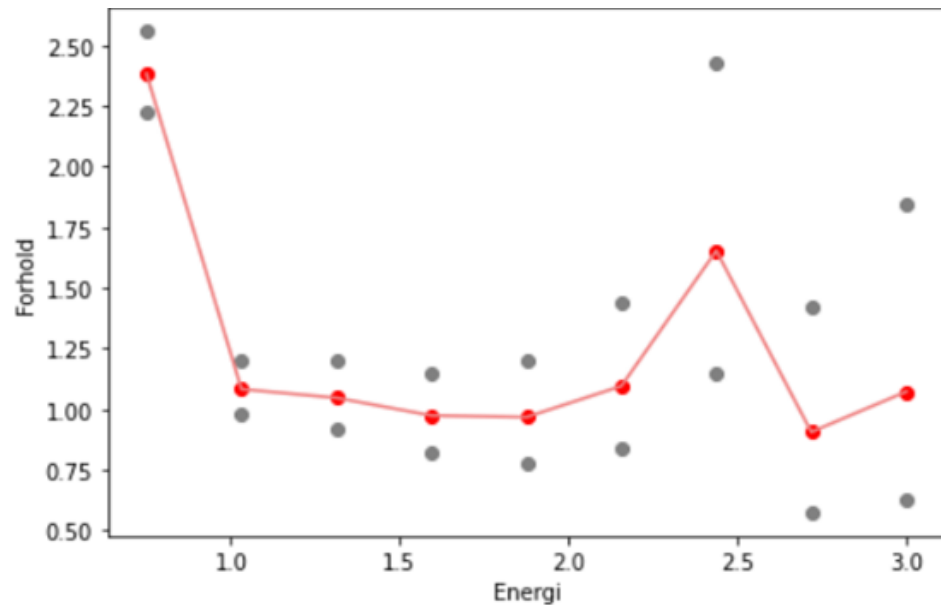


Første detektor med strålingskilder under det sorte stof (10 min)

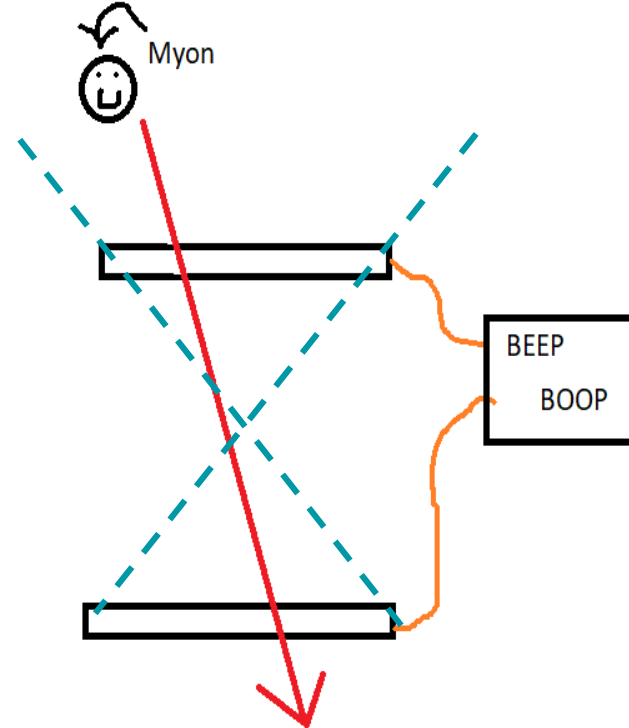
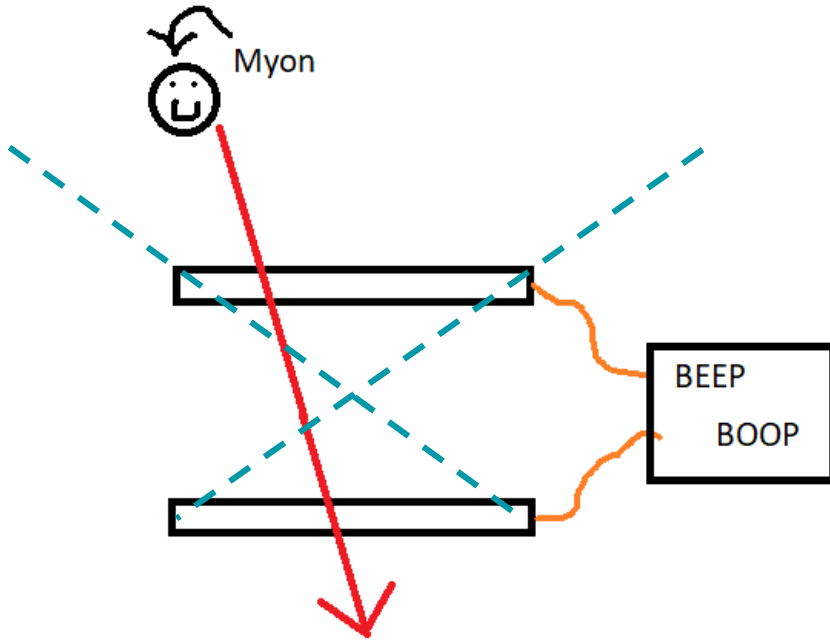
Beta



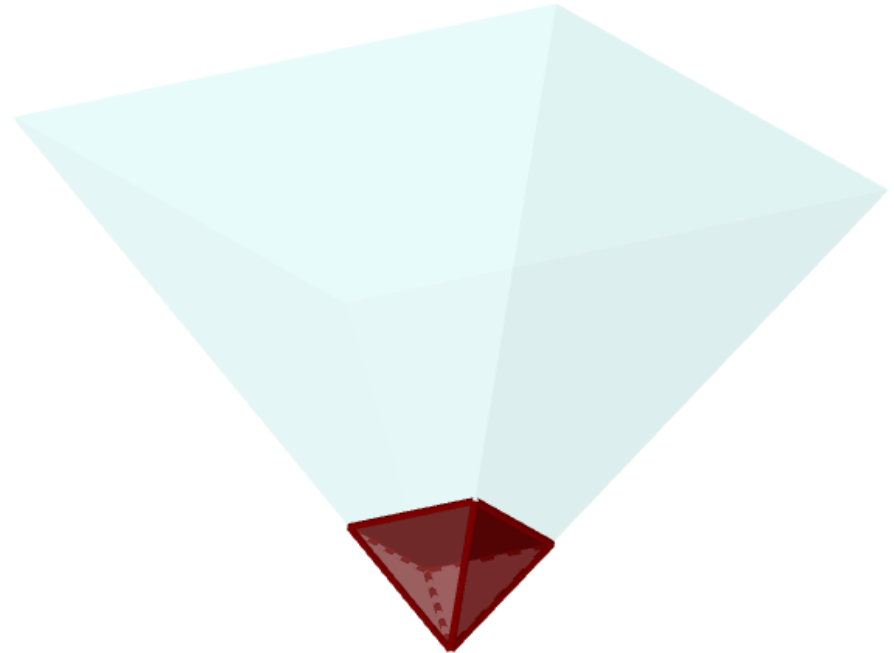
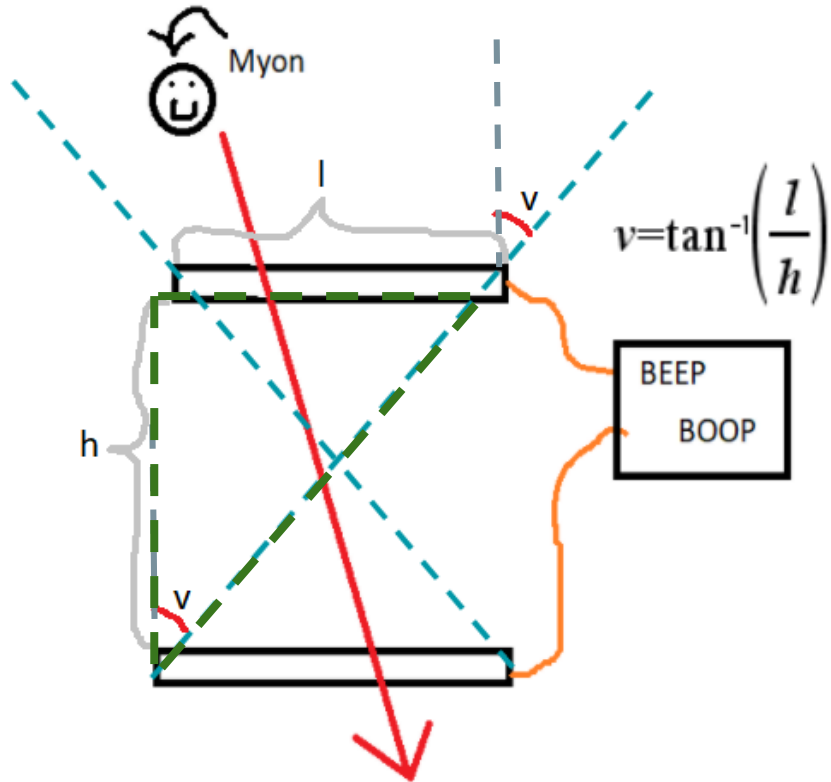
Alfa



Støjreduktion og præcision - 2 detektorer!



Støjreduktion - 2 detektorer!



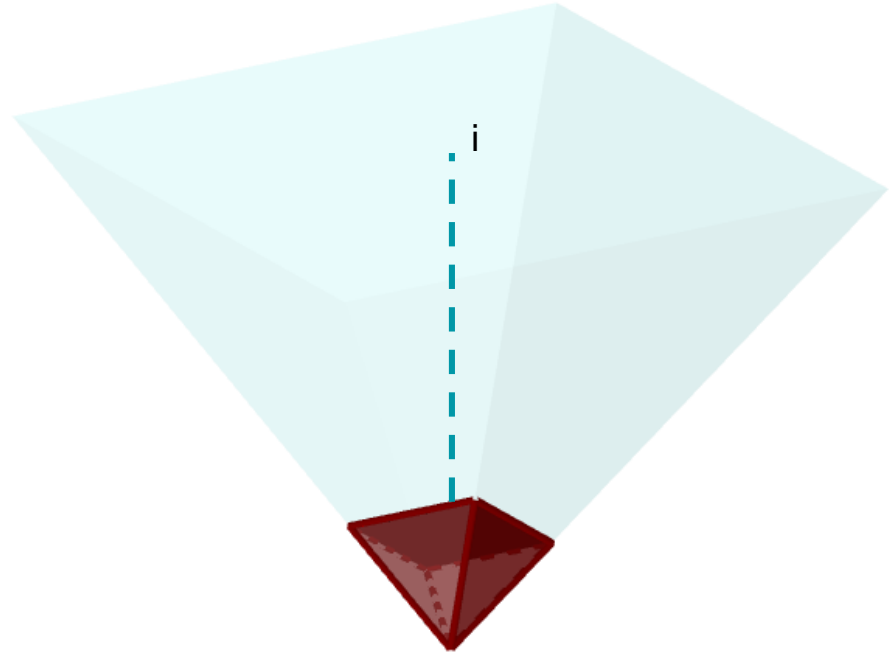
Støjreduktion - 2 detektorer!

$$V = \frac{\left(2 \cdot \tan\left(\tan^{-1}\left(\frac{l}{h}\right)\right) \cdot i + l\right)^2 \cdot \left(i + \frac{h}{2}\right)}{3} - \frac{l^2 \cdot h}{3 \cdot 2}$$

Store pyramide

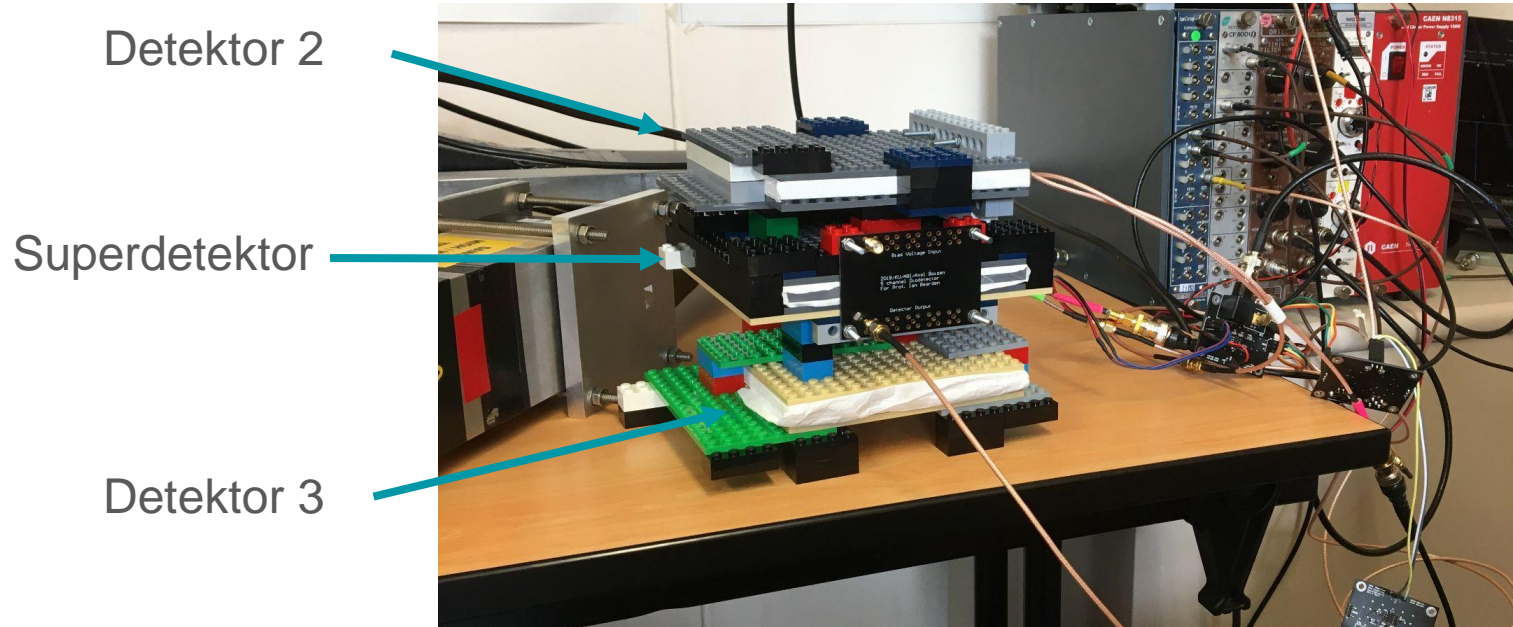
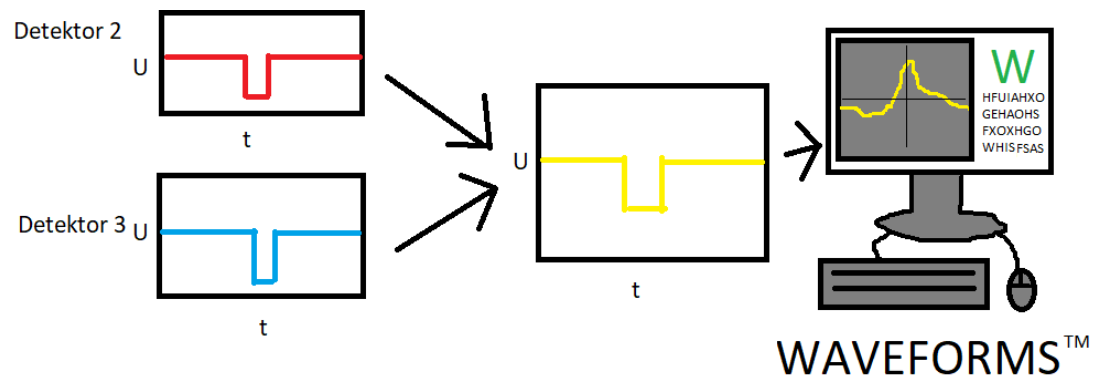
Lille pyramide

$$\frac{(3 \cdot h^2 + 6 \cdot h \cdot i + 4 \cdot i^2) \cdot i \cdot l^2}{3 \cdot h^2}$$



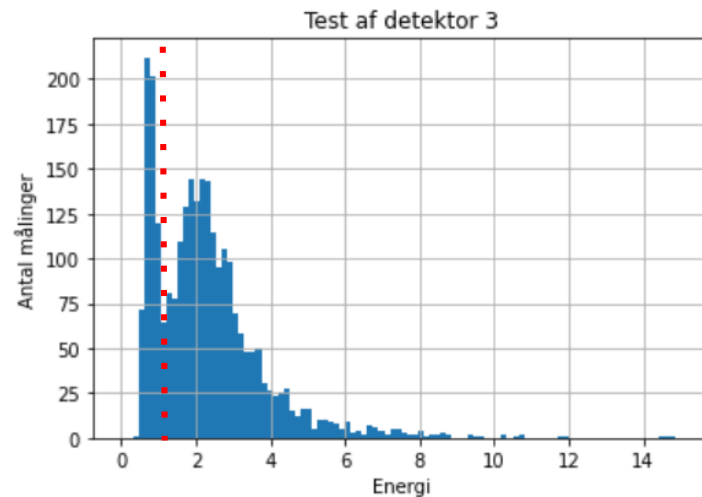
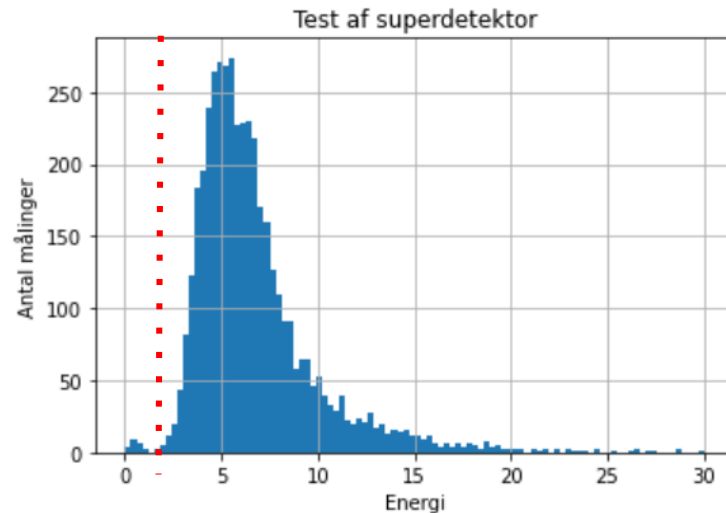
Test af effektivitet

- 3. detektor?!?
- Logic signaler



Resultater

- Superdetektor:
 - 4413 signaler ud af 4435
 - Effektivitet: 99,50%
- Detektor 3:
 - 1942 signaler ud af 2636
 - Effektivitet: 73,67%
- Samlet effektivitet:
 - $73,67\% * 99,50\% = \mathbf{73,30\%}$



ja tak for i dag og smut så hjem

>:(

Flere undersøgelser

- Højdeforskel
 - CERN: 430 m over havets overflade
 - Bjerg:
- Antal myoner i forhold til vinkel:
 - Hvis vinklen er 90 grader = tyndere atmosfære
 - Tykkere atmosfære skulle gerne give færre myoner
 - Bjergene kommer i vejen?

Waveforms