Initial stages of the development of a UK primary standard for positron emitters in gas

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- PET and airborne radioactivity
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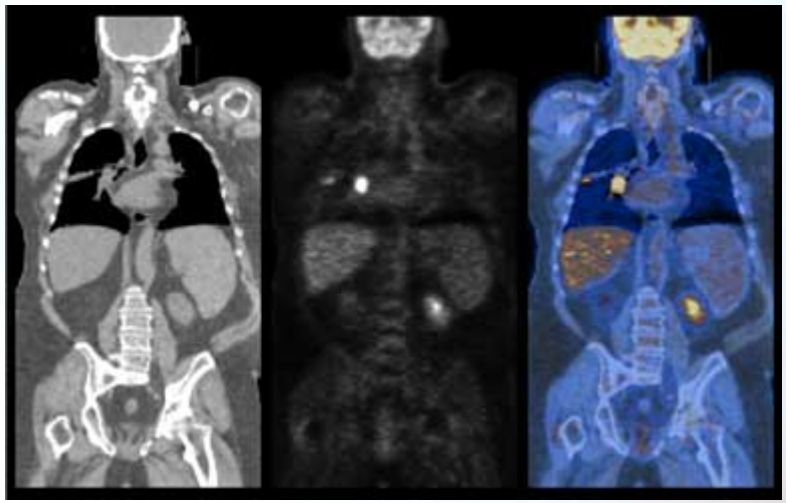
PET and production of positron emitting radionuclides



Description	C-11	N-13	O-15	F-18
Maximum energy of β^+(keV)	960.5	1198.45	1735.0	633.5
Half life (min)	20.37	9.967	2.041	109.728

Airborne Radioactivity

cyclotron

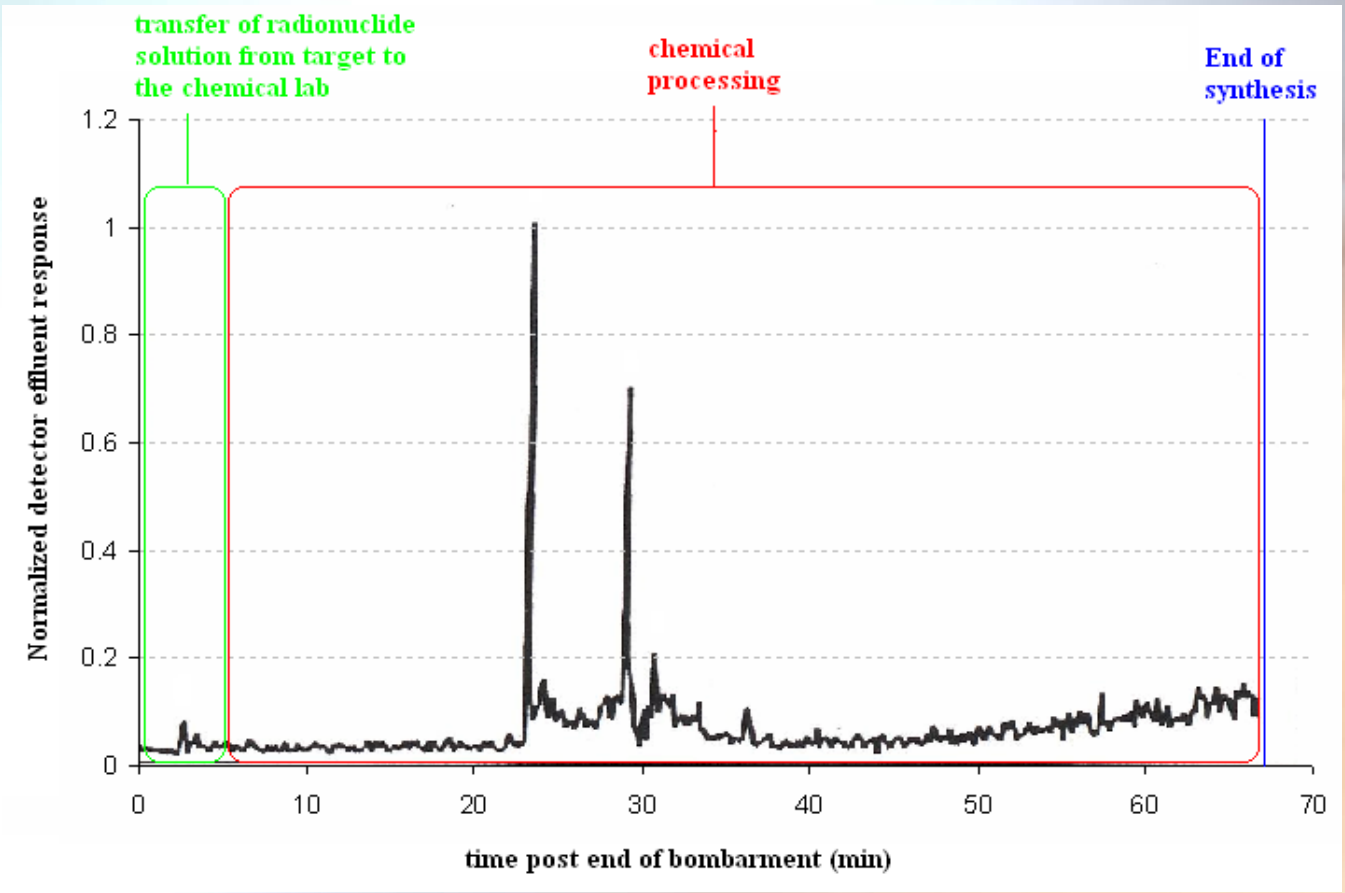
"hot" cells for radiopharmaceutical synthesis

~ 1-100mCi

Environment

Exhaust Duct

Airborne Radioactivity



PET and production of positron emitting radionuclides

UK Department of Health

(Oct.2005)

Framework for the development of PET services in England

15 units → 23 units

A primary standard for positron emitters is essential to ensure the accuracy of the measurements

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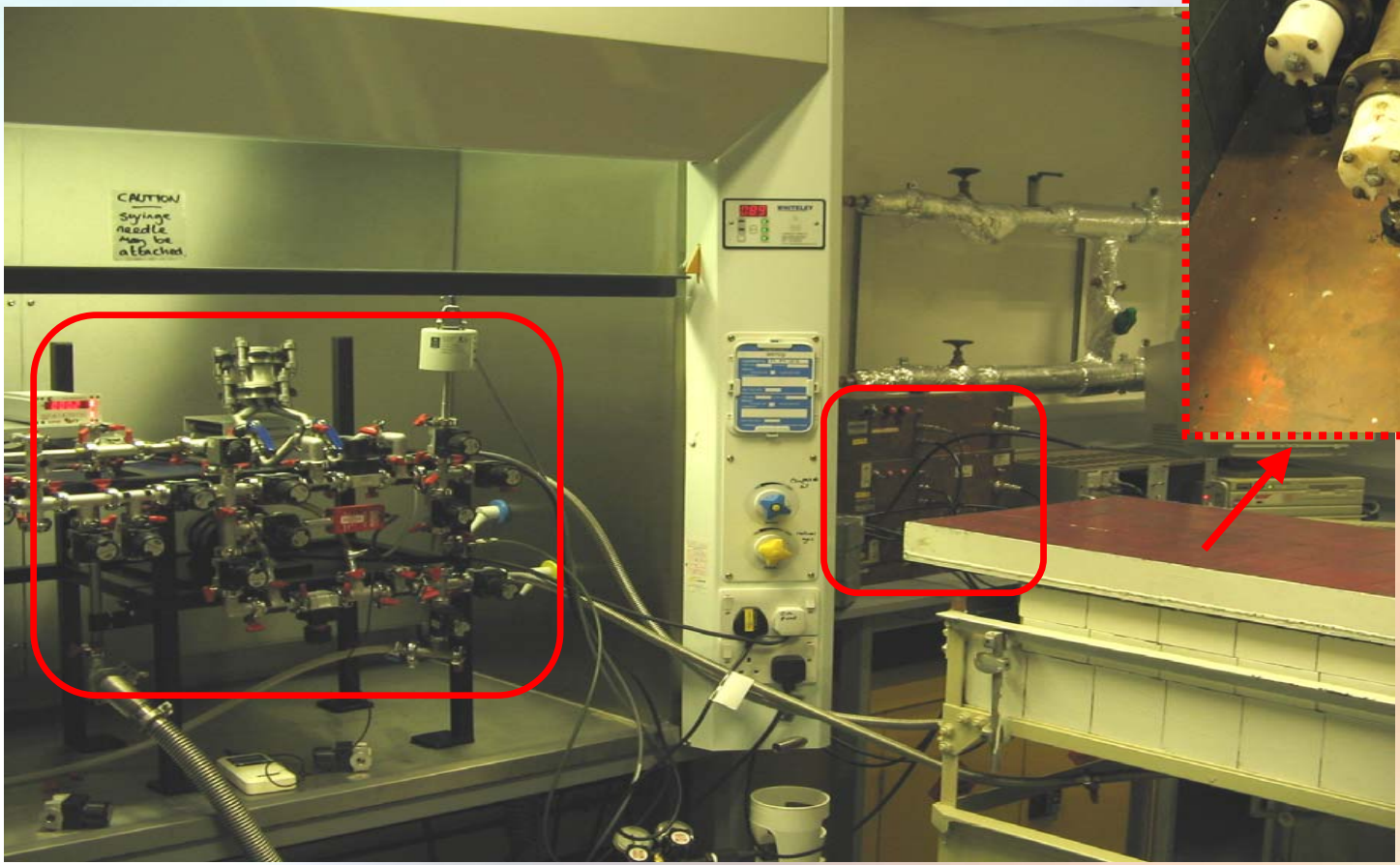
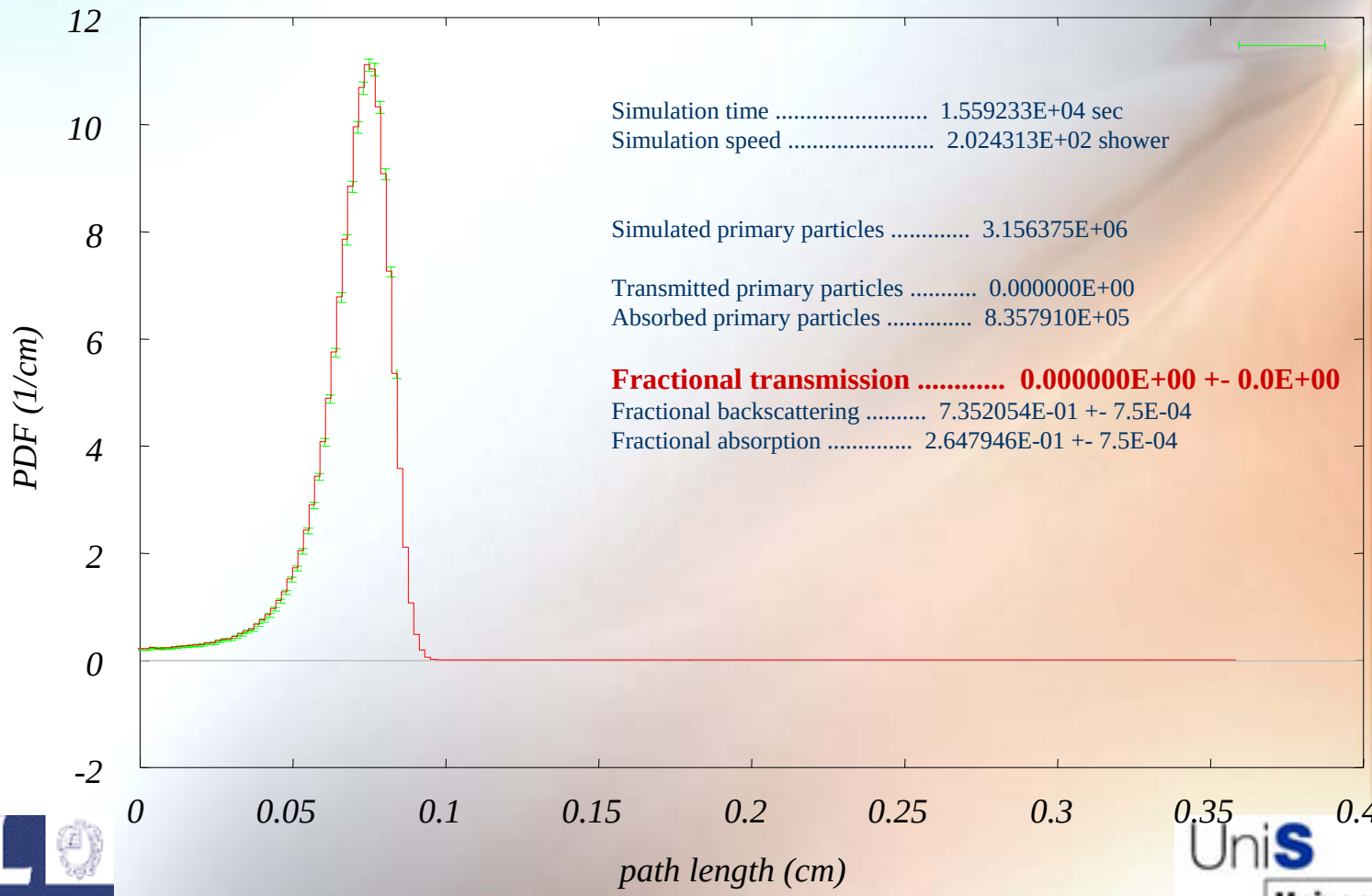
First approach and results (1)



First approach and results(3)

The cross-talk...

Positrons of 960.5 keV in brass



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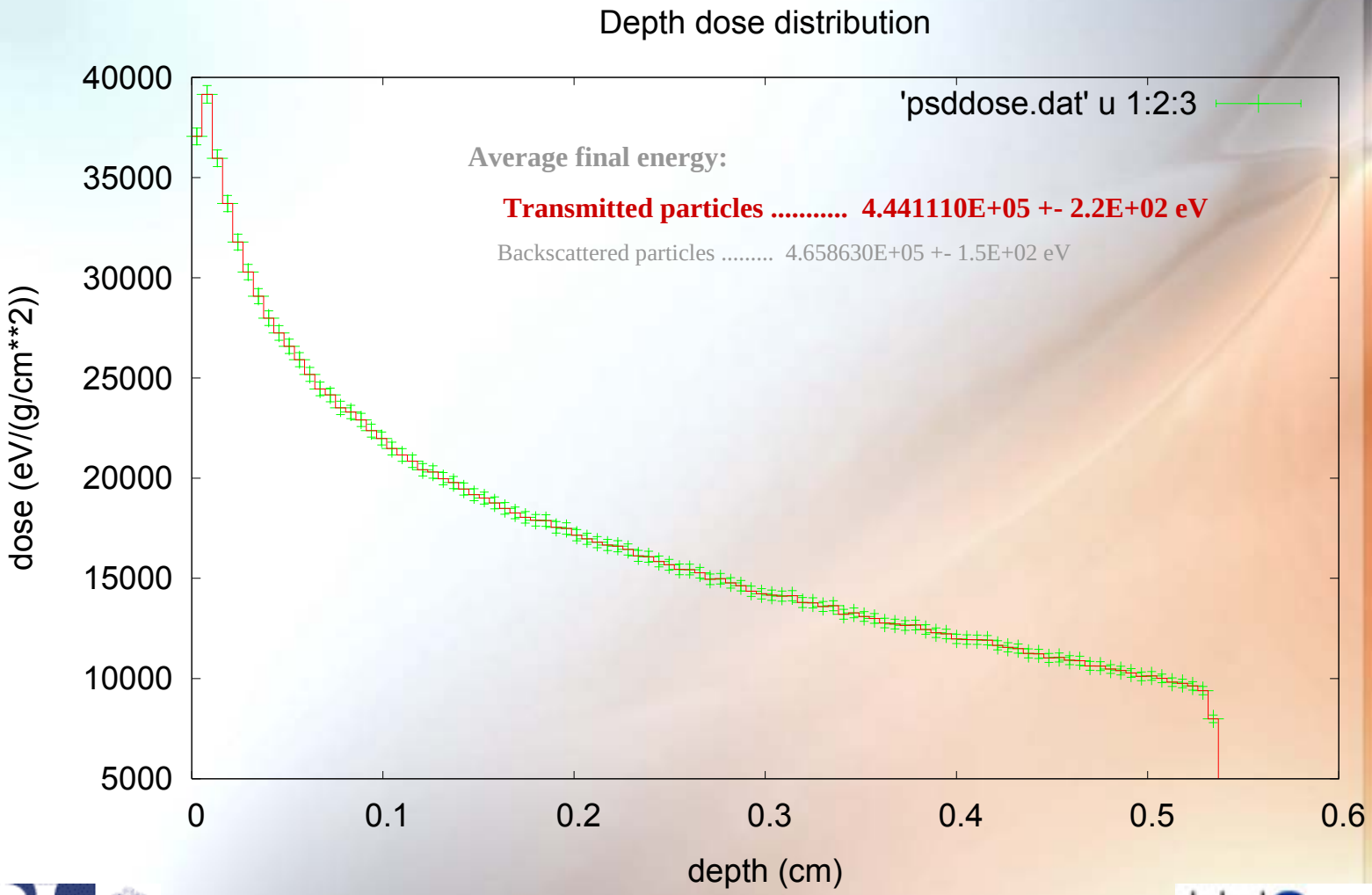
First approach and results(4)

Photons of 511keV in brass



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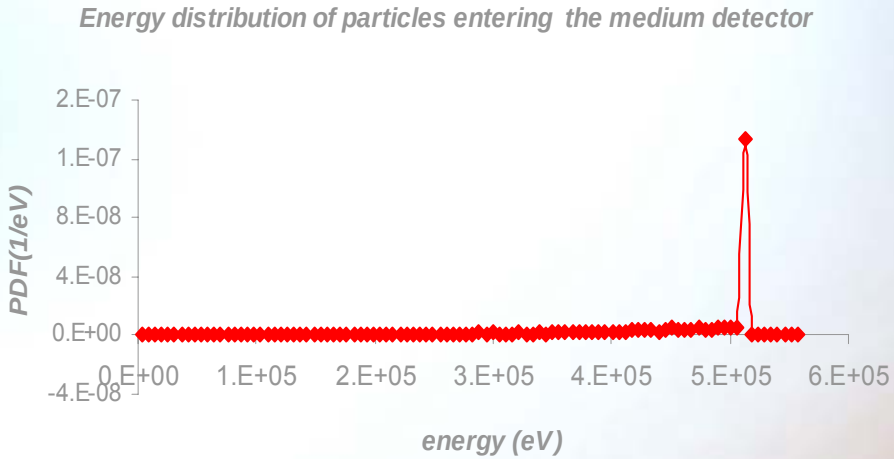
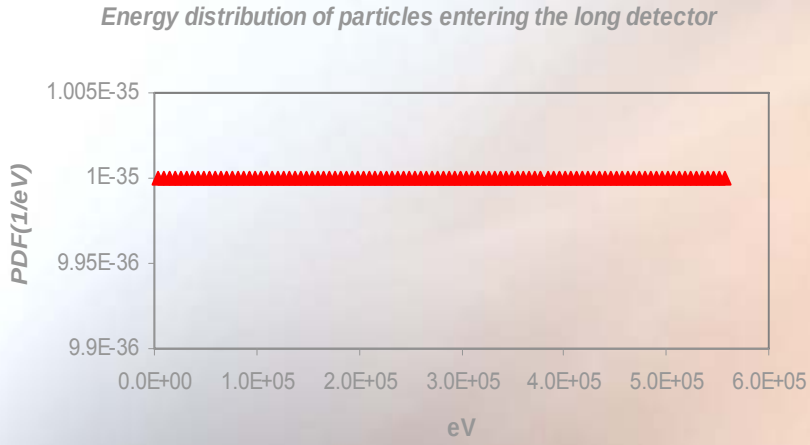
First approach and results(5)

511keV photons

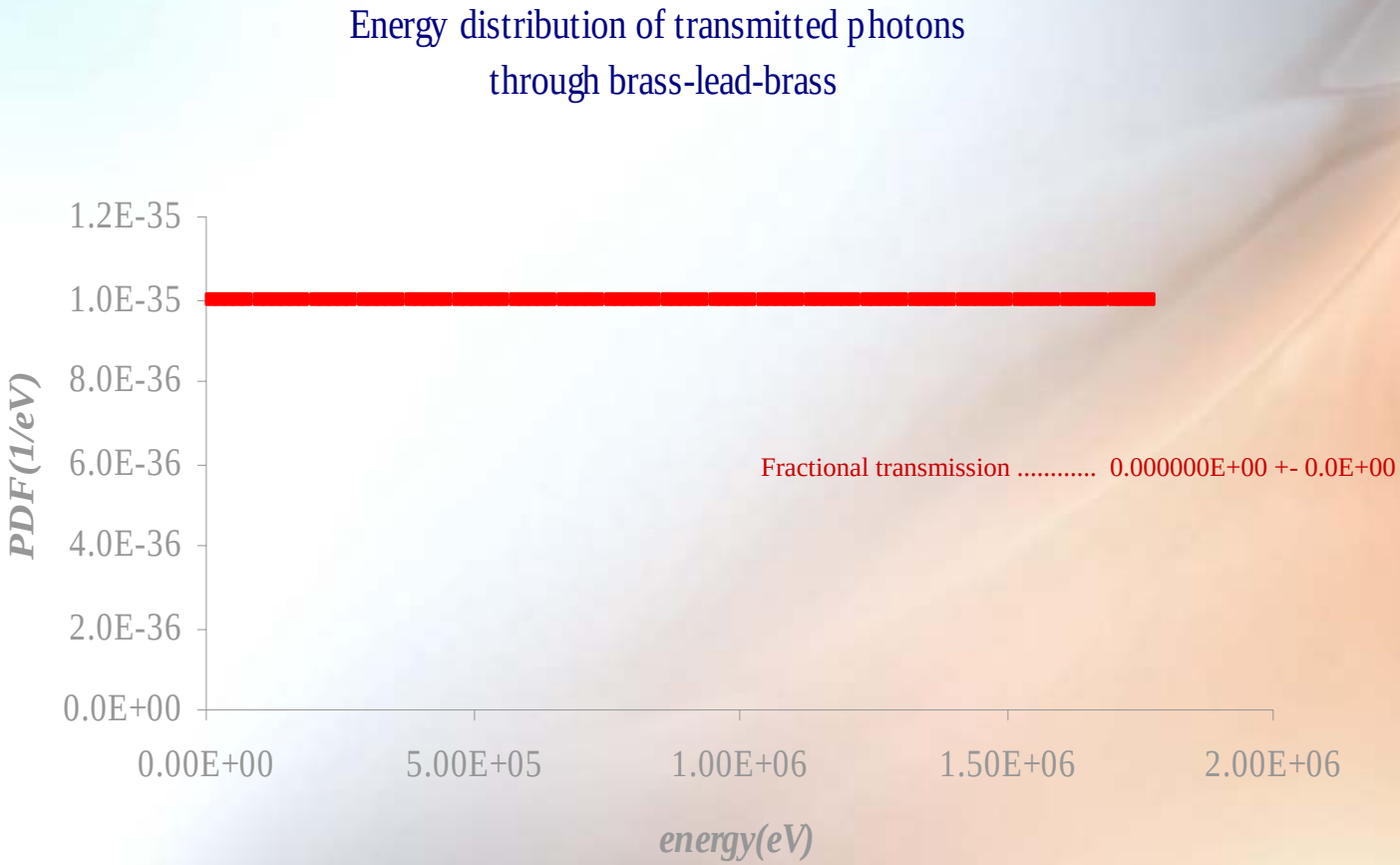


Average incoming energies (impact detectors):
Medium ... 6.675328E+02 +- 3.5E+01 eV
Large ... 0.000000E+00 +- 0.0E+00 eV



First approach and results(6)

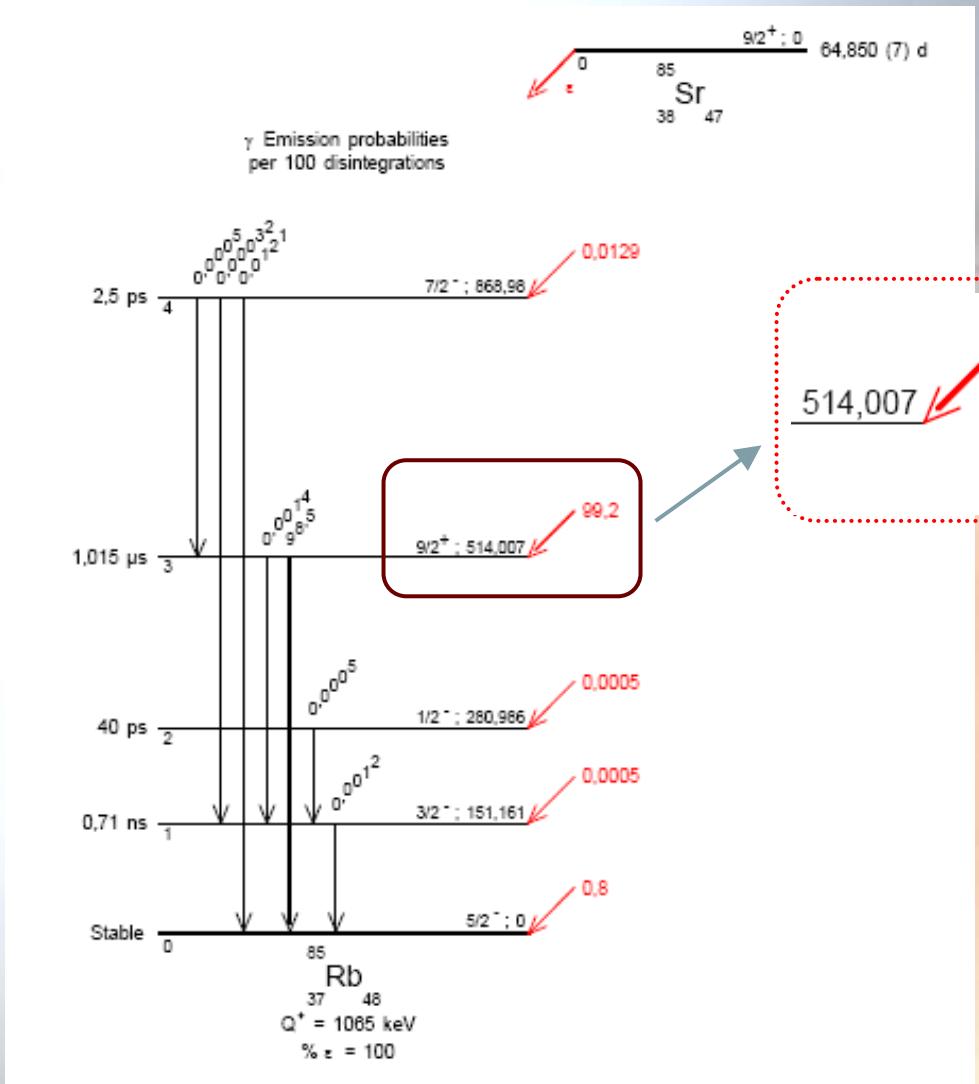
C-11 positrons of 960.3keV in brass-lead(1.8cm)-brass



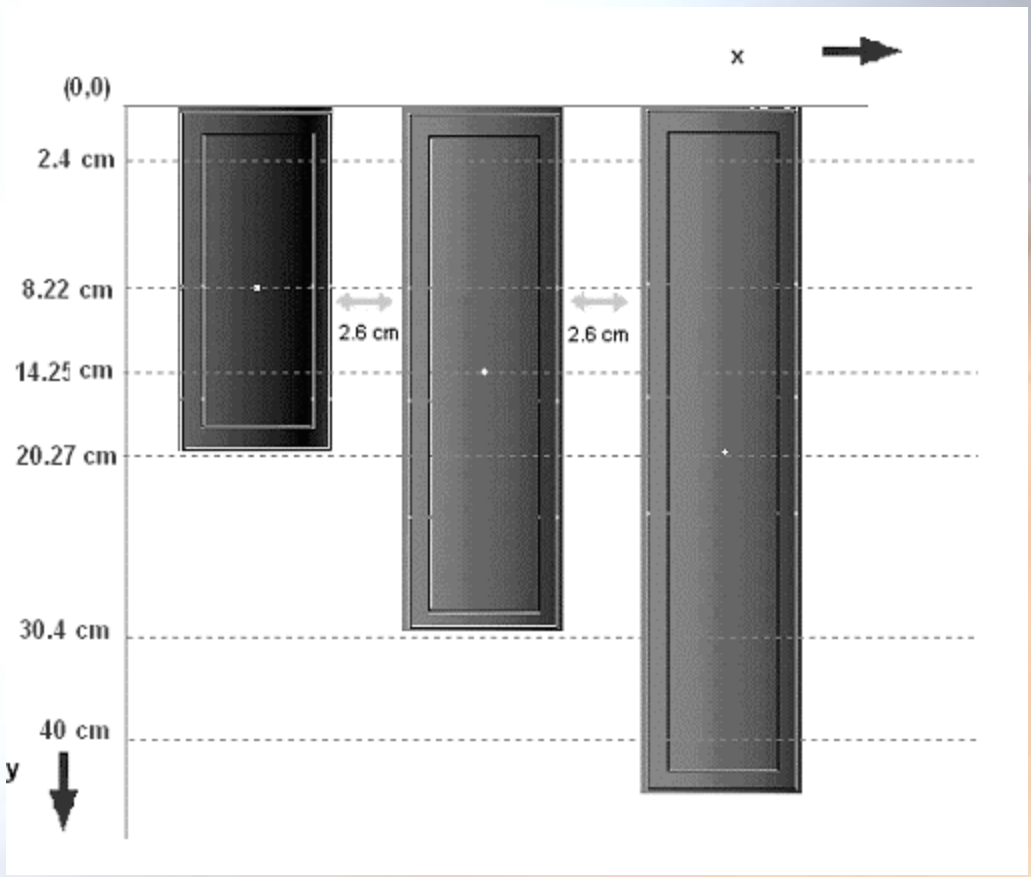
First approach and results(7)

^{85}Sr

($T_{1/2}$= 64.85 d)

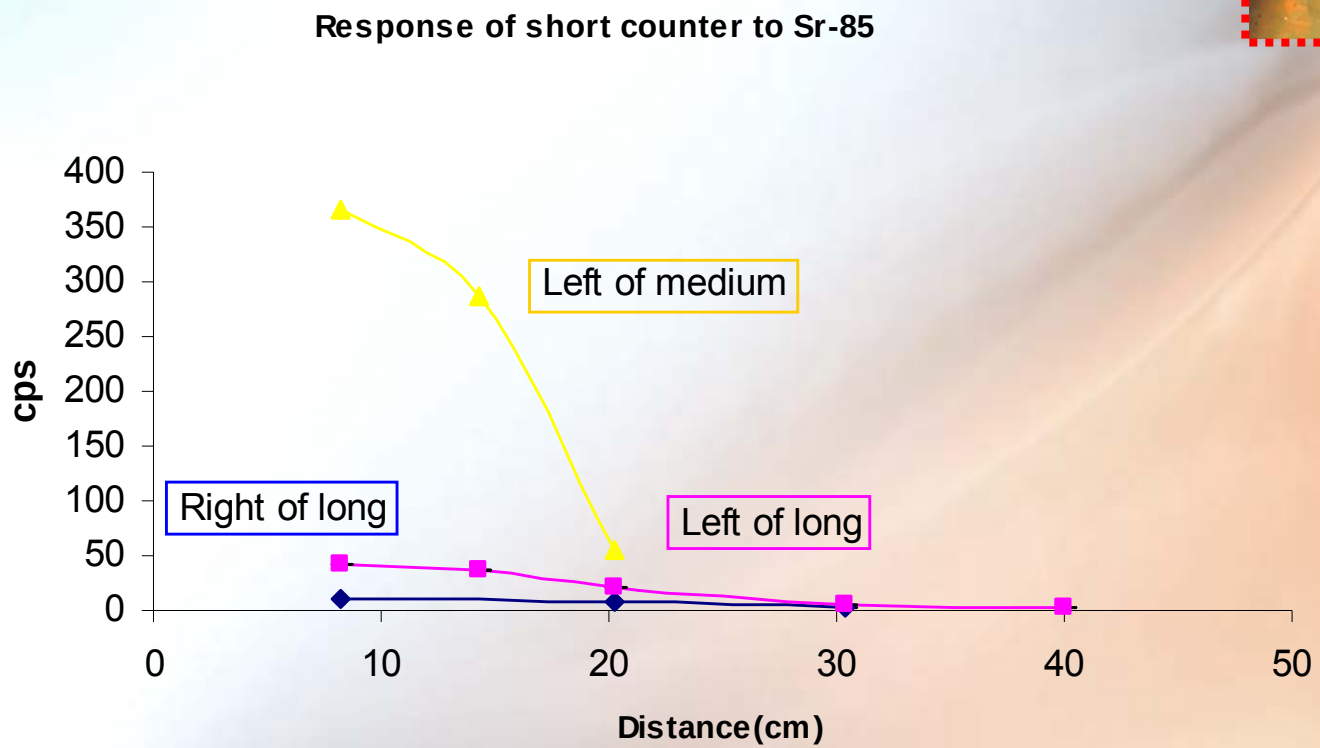


First approach and results(8)



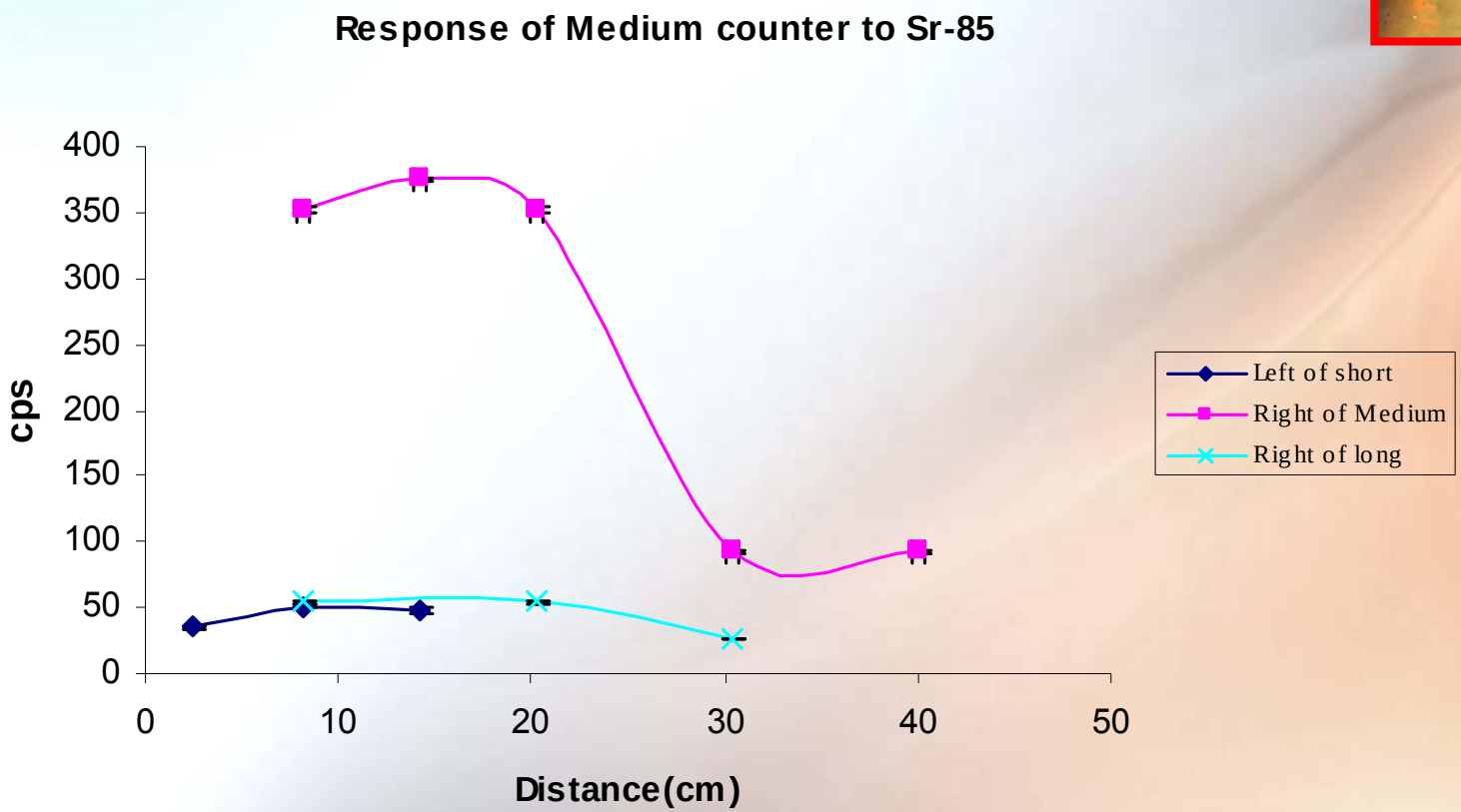
First approach and results(9)

Without lead



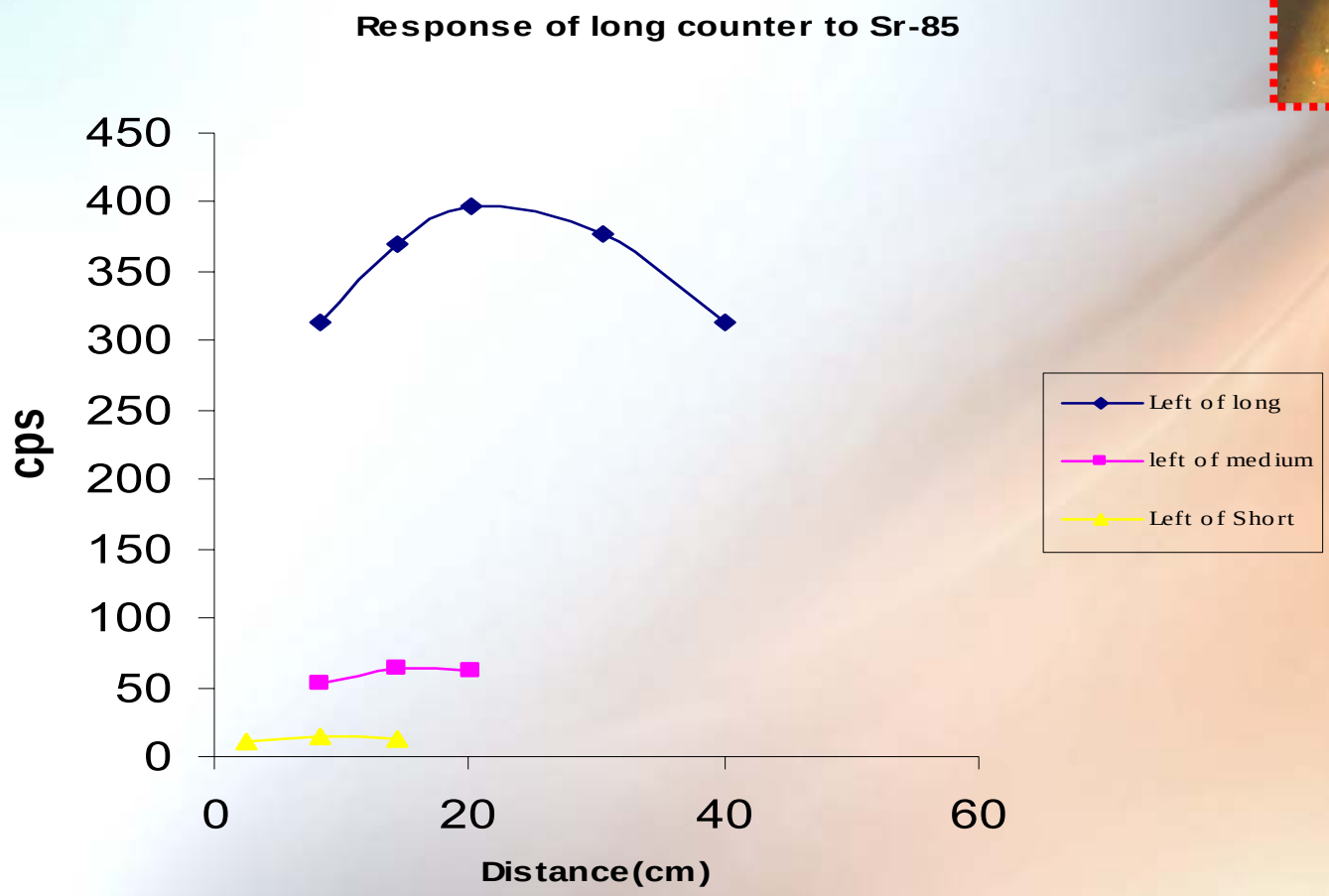
First approach and results(9)

Without lead



First approach and results(9)

Without lead

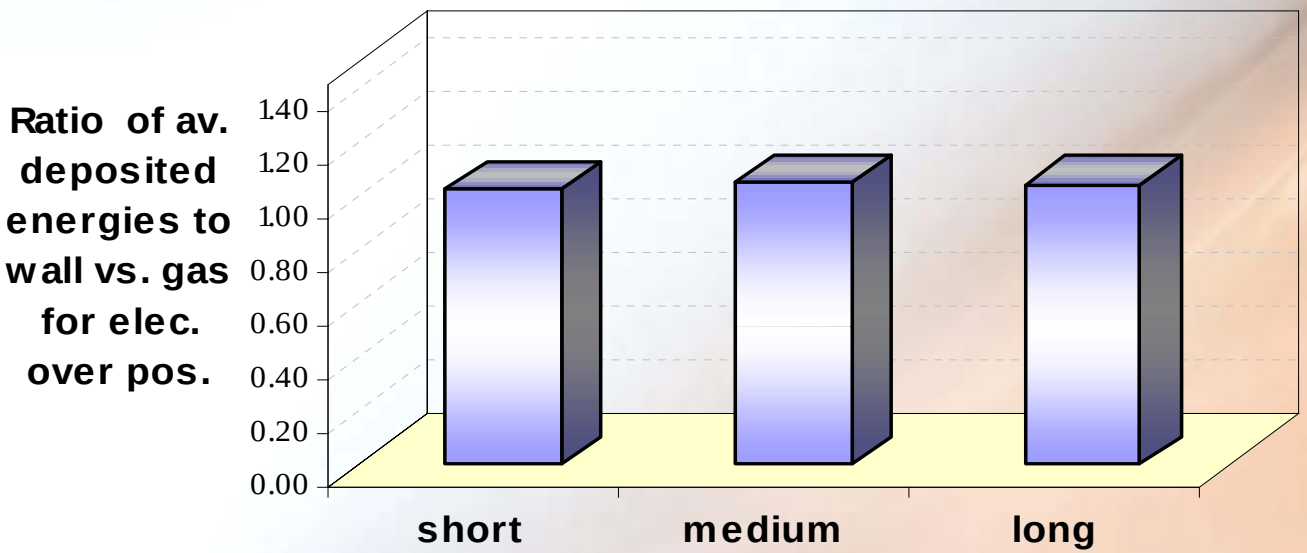


First approach and results(12)

With lead shot → Background

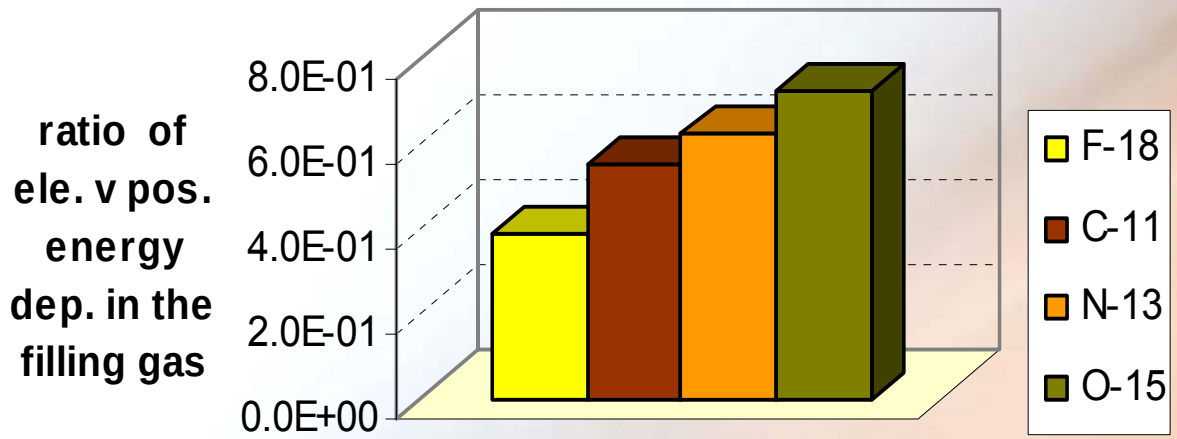
First approach and results(13)

Energy deposition to the walls of the counters in comparison to the gas: El. vs. Pos.



First approach and results(12)

Energy deposition of positron emitting sources in the counters...



First approach and results(13)

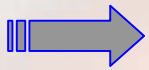
Convert liquid positron emitting source to a gas by acidification of a known mass of $NaHCO_3$ solution.

Next Steps?

First experiment to measure C-11 in a gas form using the proportional counters:

Count a $^{11}CO_2$ sample generated by acidification of a known mass of $NaH^{11}CO_3$ solution

Simultaneously standardise as a liquid by ion-chamber counting



response factor (cps Bq^{-1}) of the brass gas counters to ^{11}C in gaseous form

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Next Steps?

First experiment to measure C-11 in a gas form using the proportional counters:

Develop a transfer instrument calibrated against the primary standard

Next Steps?

Feedback from the user community is necessary

Thank you!