$\pi f_{7/2}$ strength distribution in neutron-rich copper: the ^{72}Zn(d,^{3}He)^{71}Cu transfer reaction

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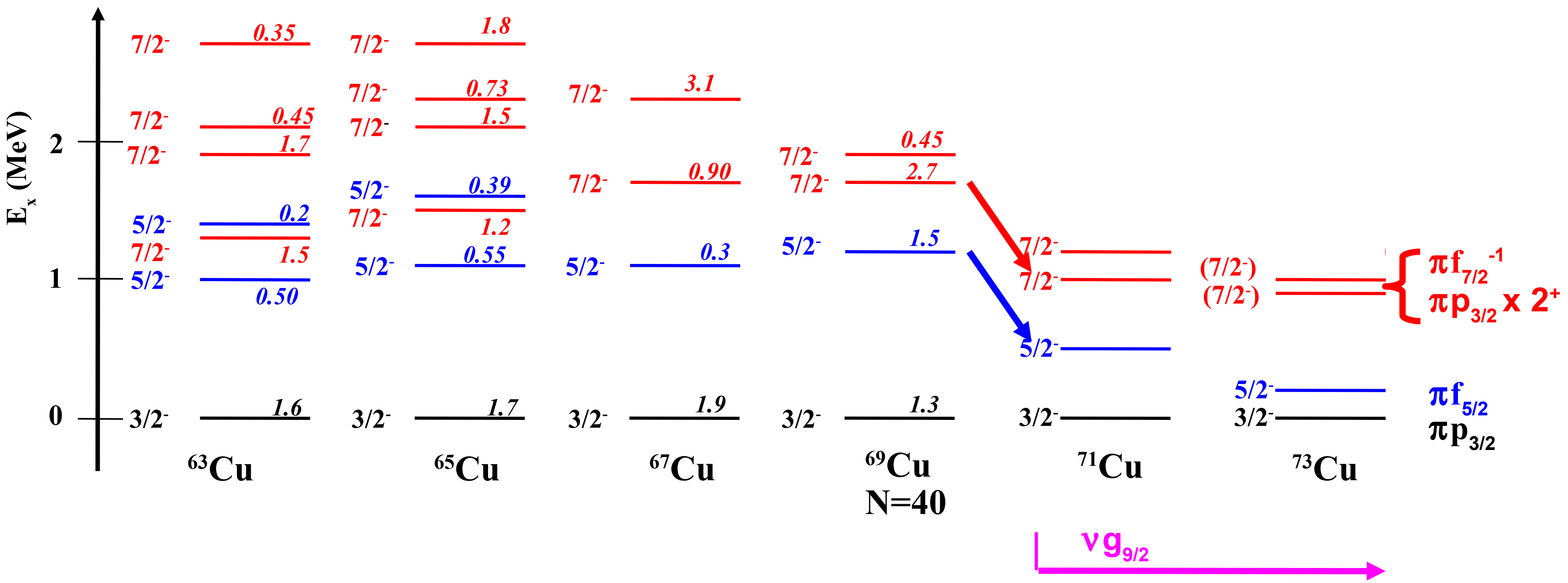
J Elseviers, University of Leuven, Belgium

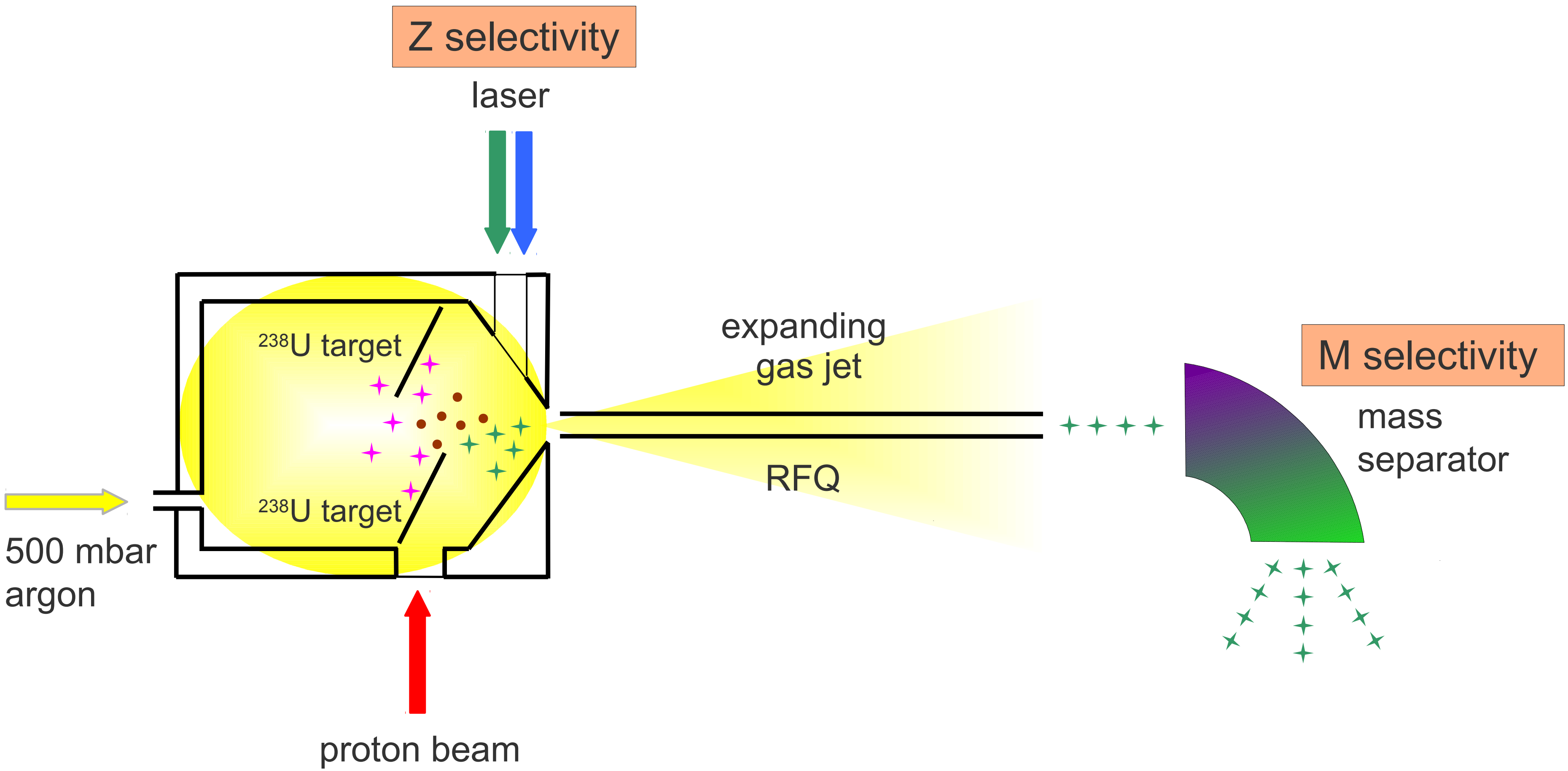
Level structure of neutron-rich copper isotopes

$_{29}Cu = {}_{28}Ni \times \pi$



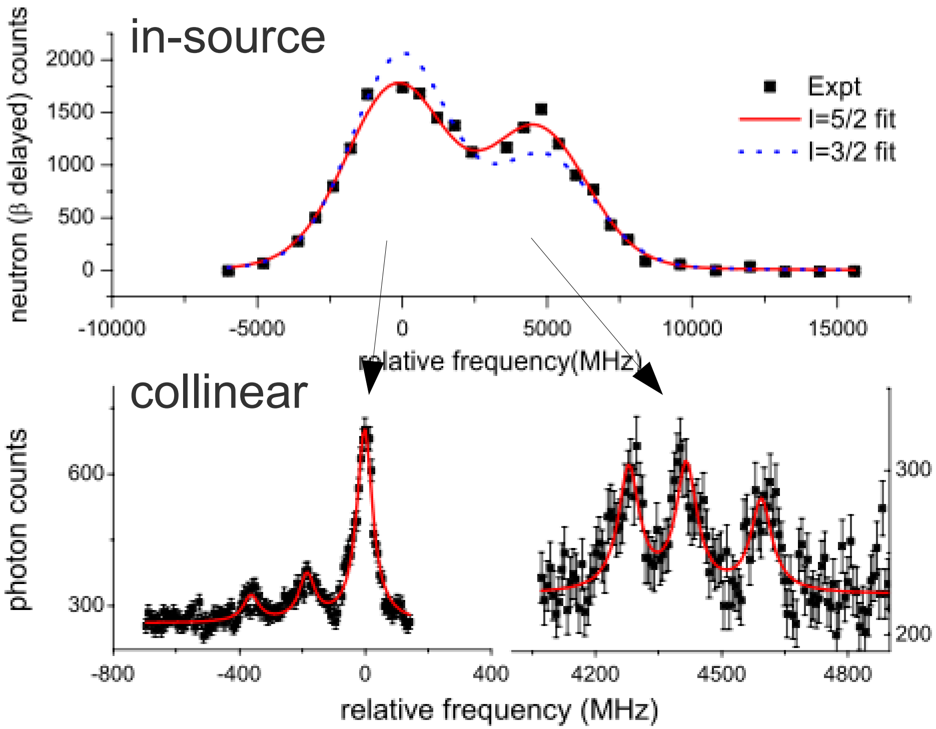
S Franchoo et al, PRL 81 (1998)

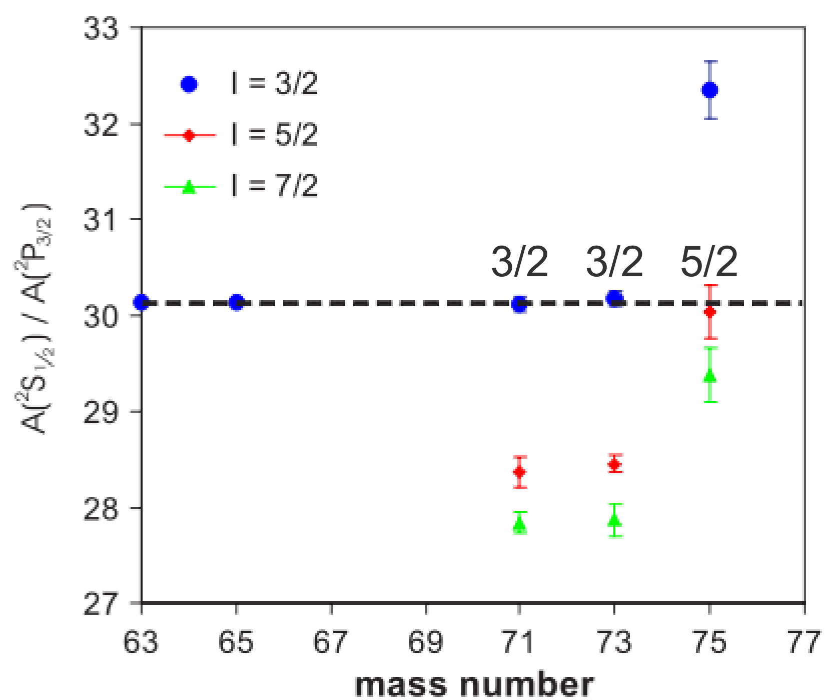
Laser gas cell



Y Kudryavtsev et al, NIM B267 (2009)

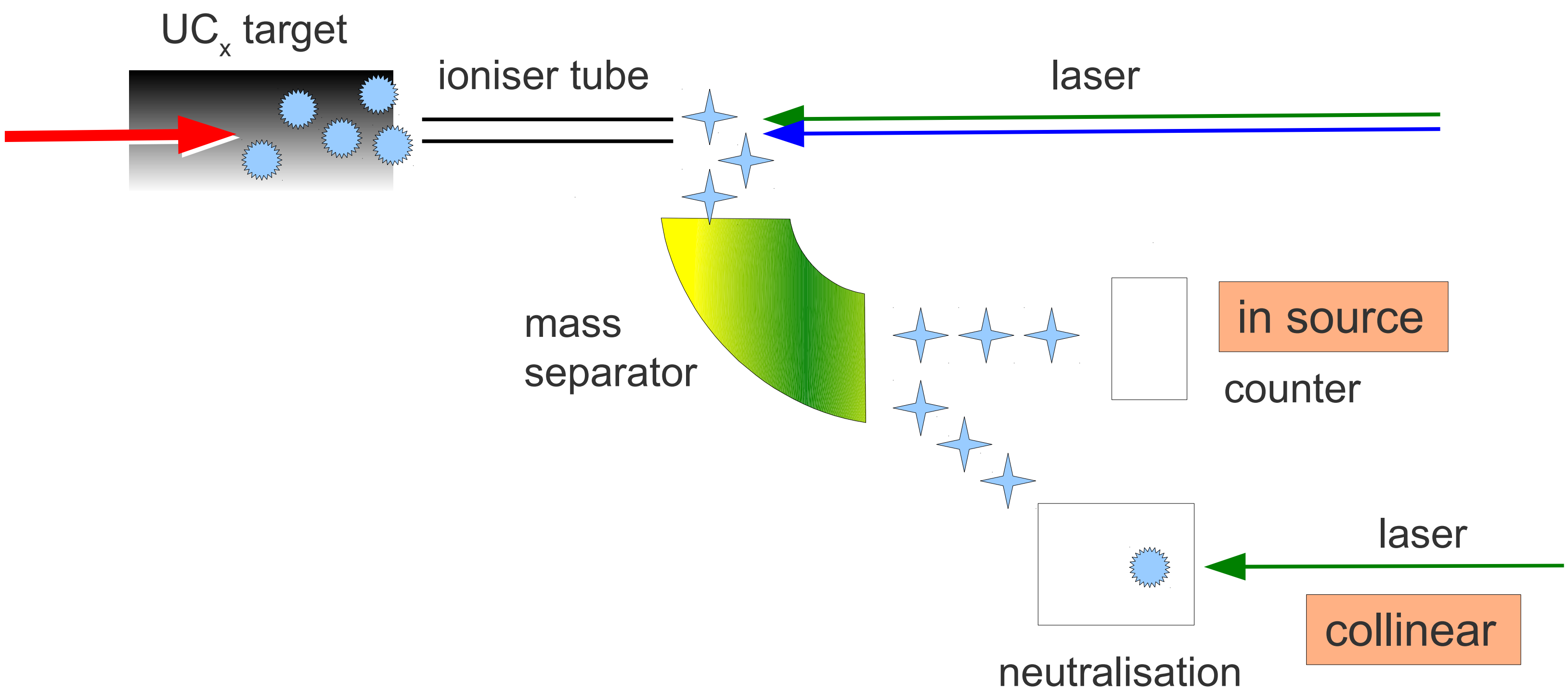
^{75}Cu ground-state spin





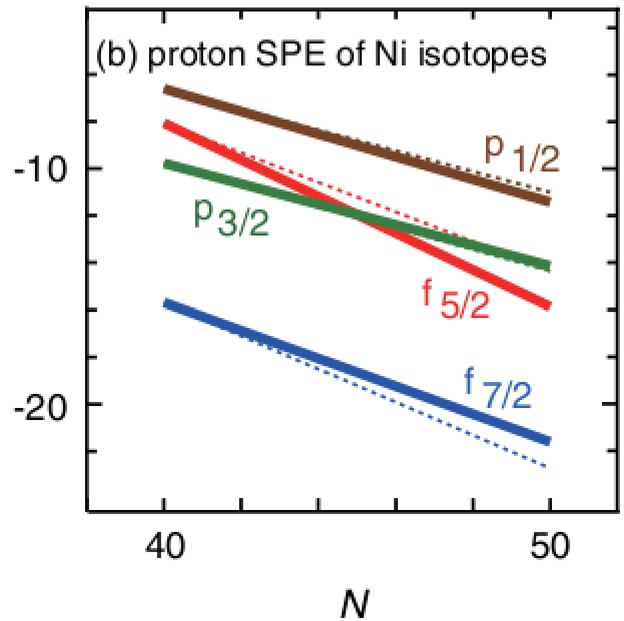
$A = \mu B/IJ$

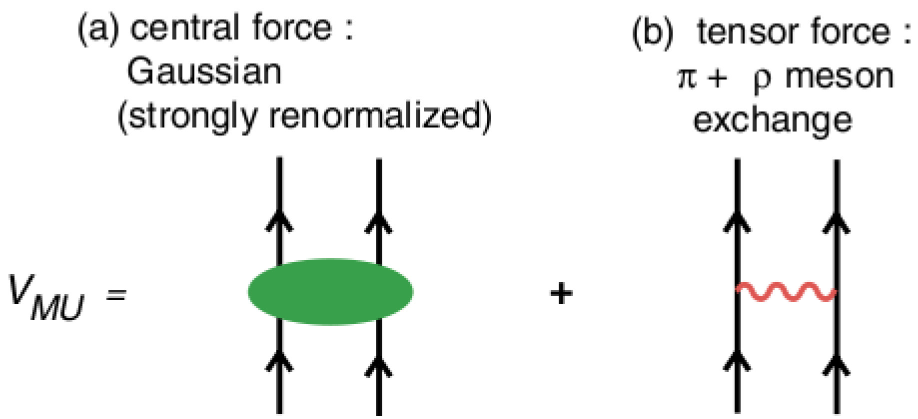
K Flanagan et al, PRL 103 (2009)



	in source	collinear
resolution	>1 GHz	<100 MHz
count rate	10 /s	150 /s

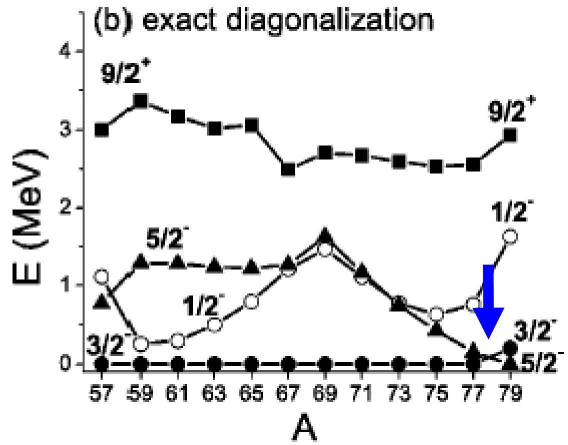
Effect of tensor force on proton SPE in nickel

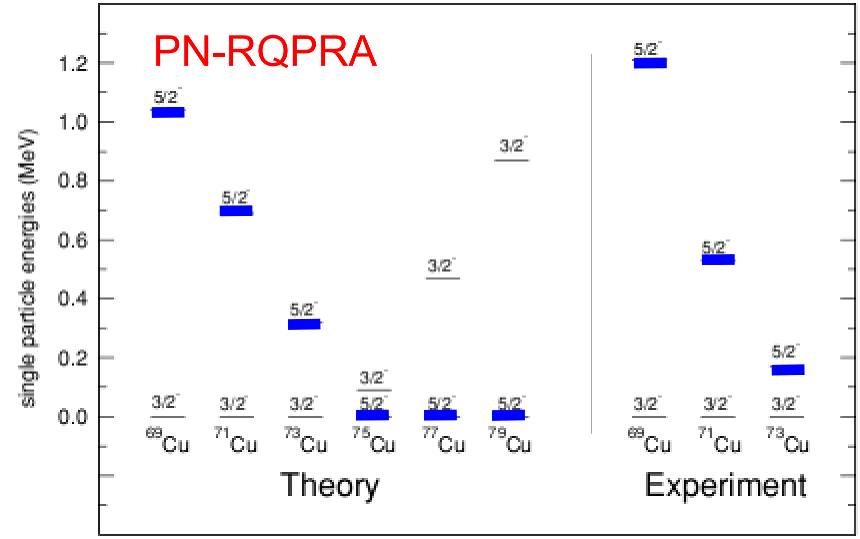




$\pi f_{5/2}$ observed... ⇒ behaviour of $\pi f_{7/2}$?

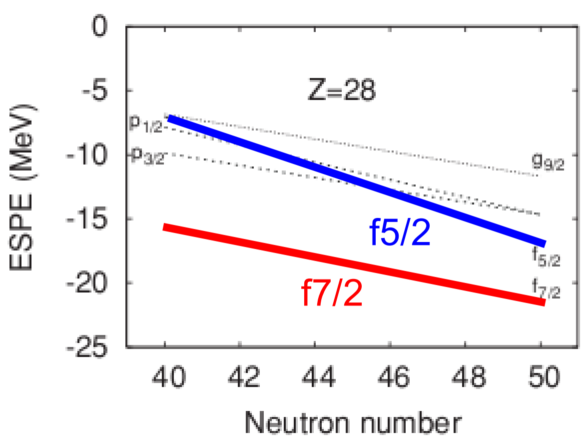
T Otsuka et al, PRL 104 (2010)

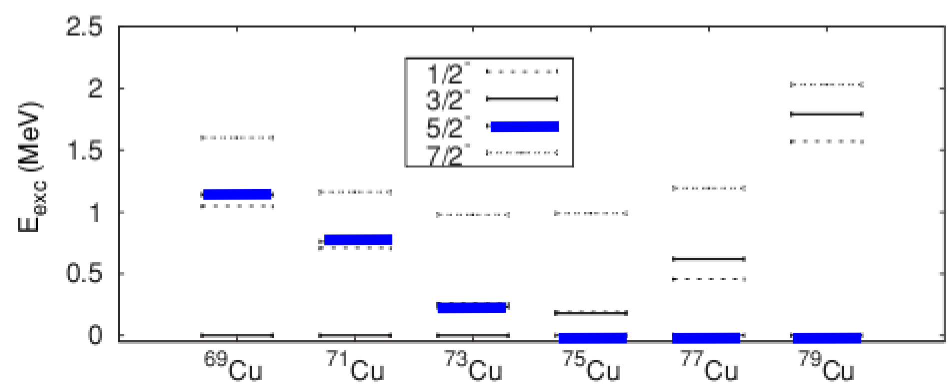




N Smirnova et al, PRC 69 (2004)

T Nikšić et al, PRC 71 (2005)





K Sieja & F Nowacki, PRC 81 (2010)

also: A Lisetskiy et al, PRC 70 (2005), M Honma et al, PRC 80 (2009)...

Well described by theory but needs spectroscopic factors

Measure evolution of $\pi f_{7/2}$ strength in transfer

$^{70}Zn(d,^{3}He)^{69}Cu$ at 12 MeV/u

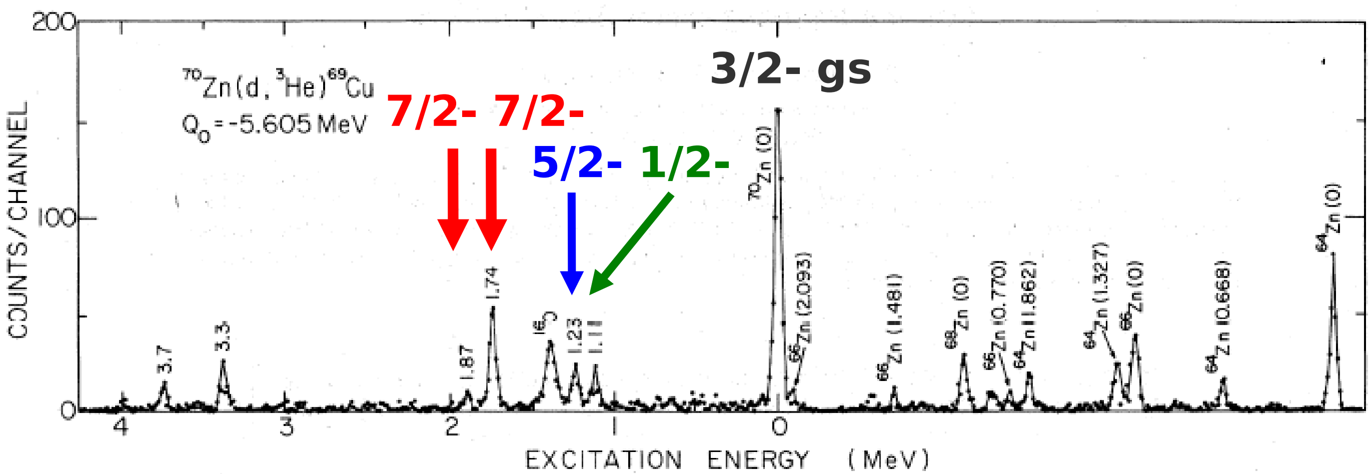
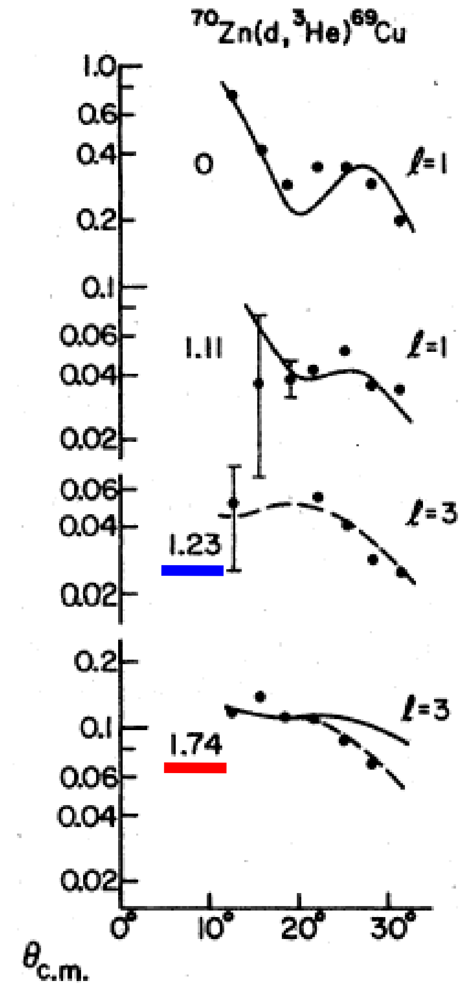


FIG. 2. Spectrum of $^{70}Zn(d,^{3}He)$ at 21° lab. Peaks resulting from other zinc isotopes are indicated.

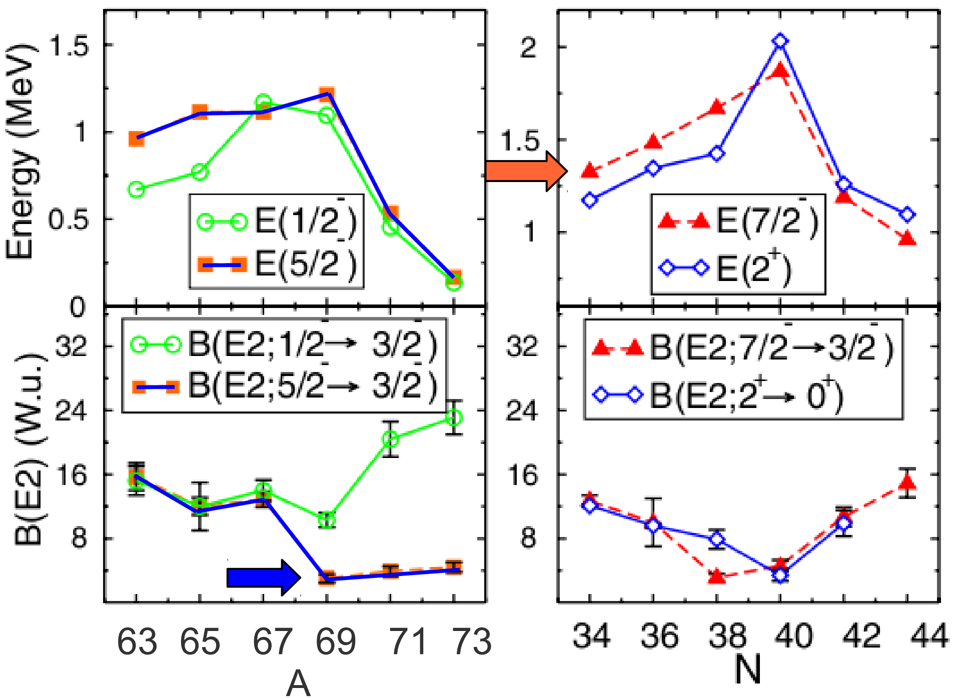


^{69}Cu	0	$\frac{3}{2}^-$	1.3
	1.11	$\frac{1}{2}^-$	0.46
	1.23	$\frac{5}{2}^-$	1.5
	1.74	$\frac{7}{2}^-$	2.7
	1.87	$\frac{7}{2}^-$	0.45

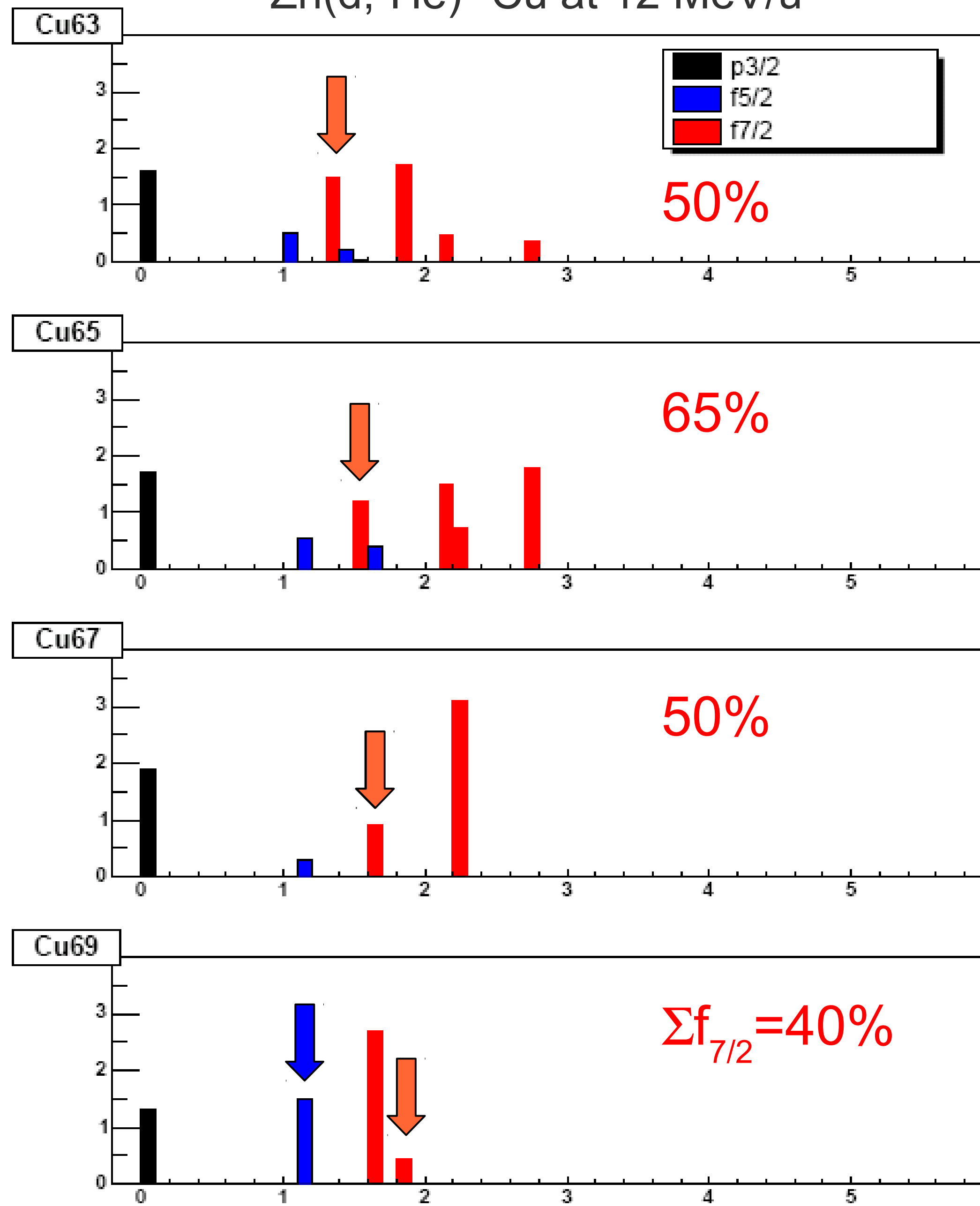
$\{ \pi f_{7/2}^{-1}, \pi p_{3/2} \times 2^+$

Zeidman & Nolen, PRC 18 (1978) 2122

Coulomb excitation at 3 MeV/u



^{70}Zn(d,^{3}He)^{69}Cu at 12 MeV/u

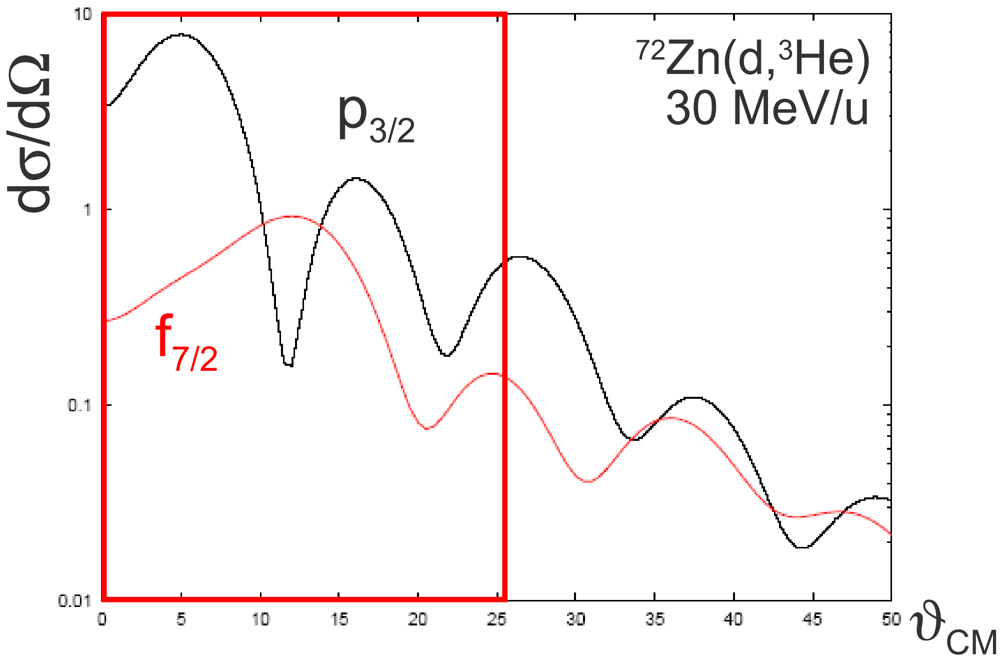


$C^2S\ \{\pi p_{3/2} x 2^+\}_{7/2}$ ↘

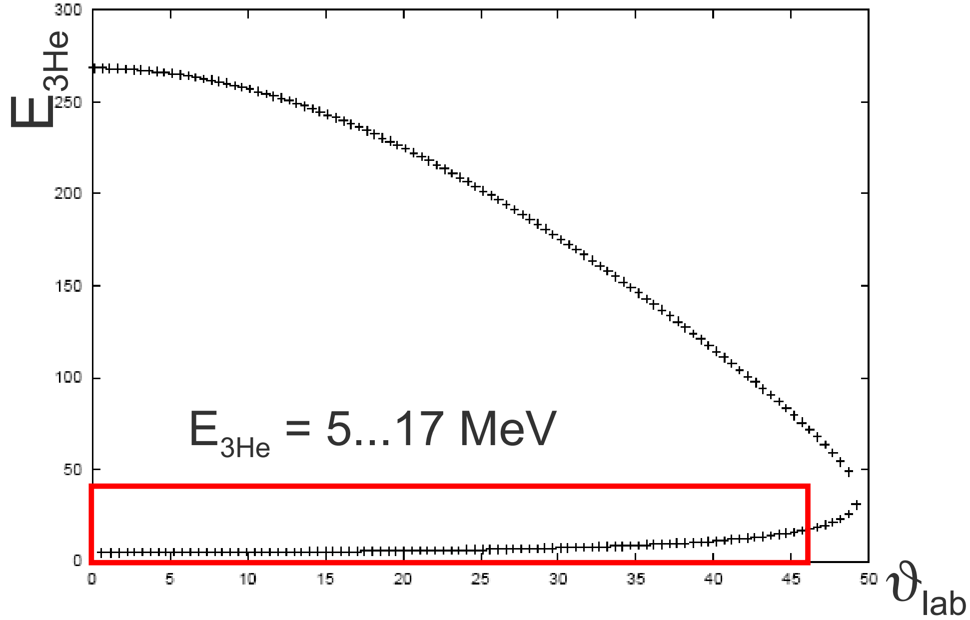
πf strengths concentrating ?

I Stefanescu et al, PRL 100 (2008)

extracted from Zeidman & Nolen, PRC 18 (1978)

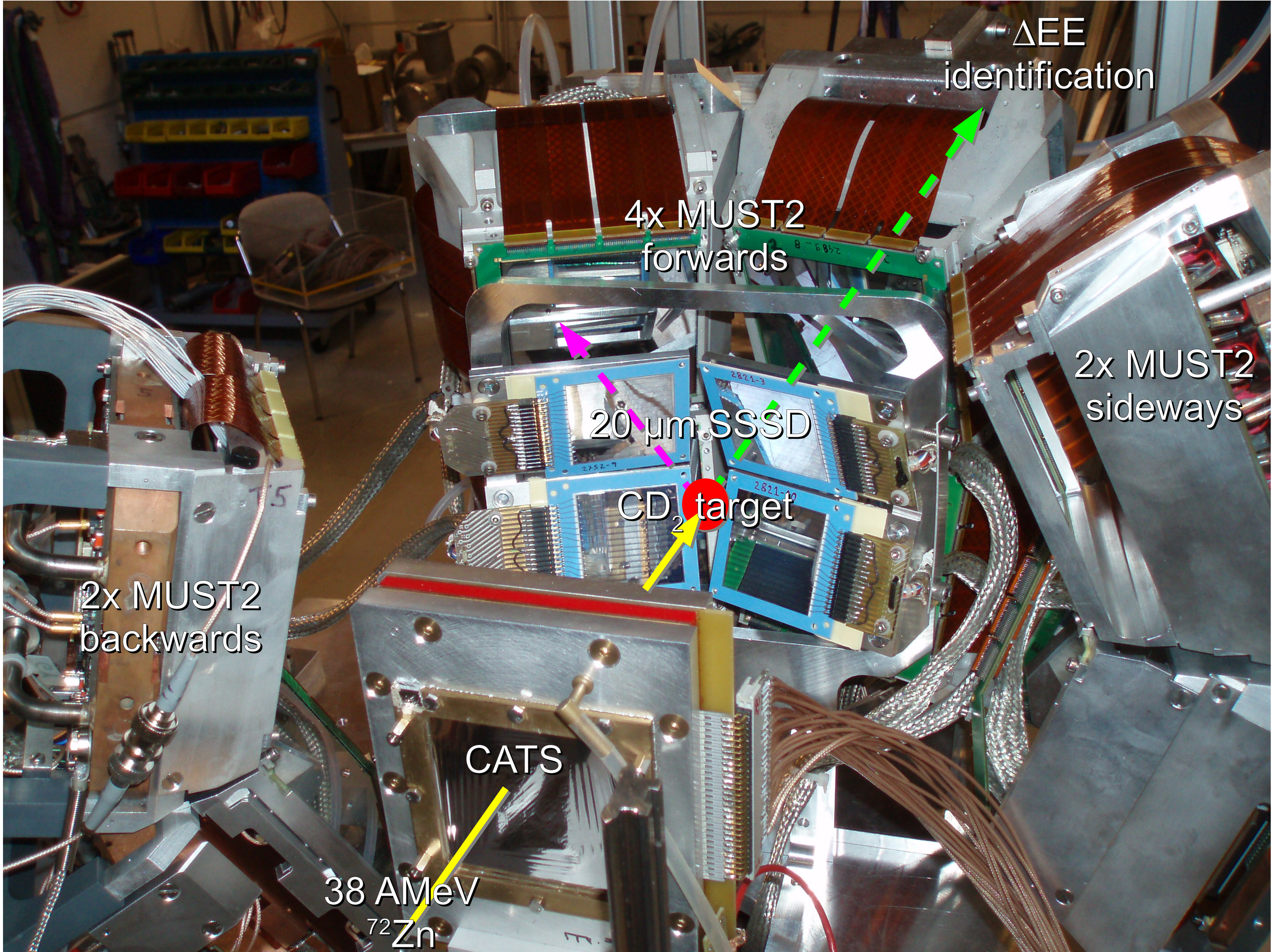


low cross section,
high beam intensity:
sampling ionisation chamber

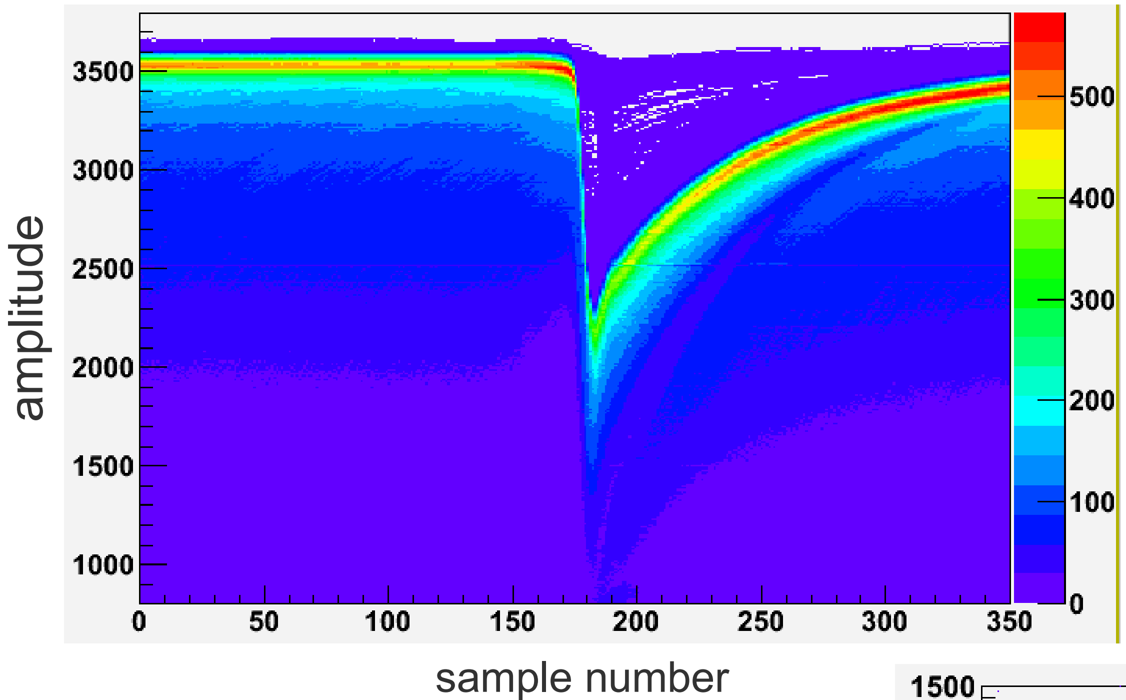


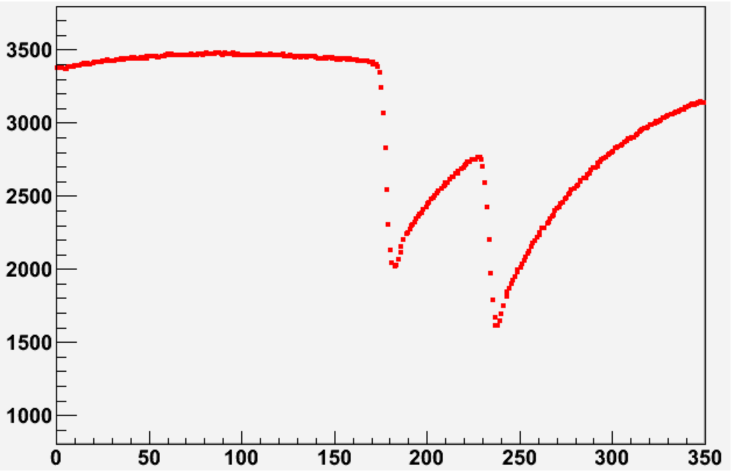
low energy:
thin 20 µm Si for ΔE

<u>setup:</u>
2xCATS: beam tracking
SSSD+MUST2: light ejectile
IC+plastic: heavy ejectile


ΔEE
identification
4x MUST2
forwards
2x MUST2
sideways
20 μm SSSD
CD2 target
2x MUST2
backwards
CATS
38 AMeV
72Zn

Ionisation chamber



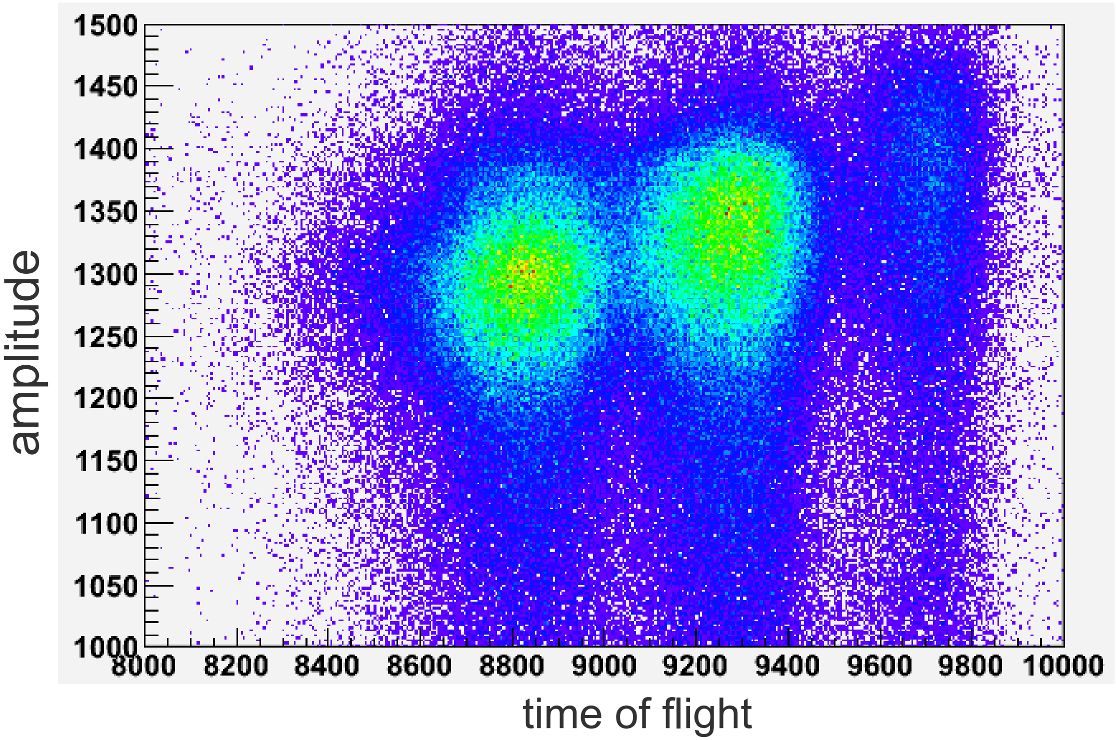


40 MHz sampling rate
(25 ns step, 8.75 μs range)

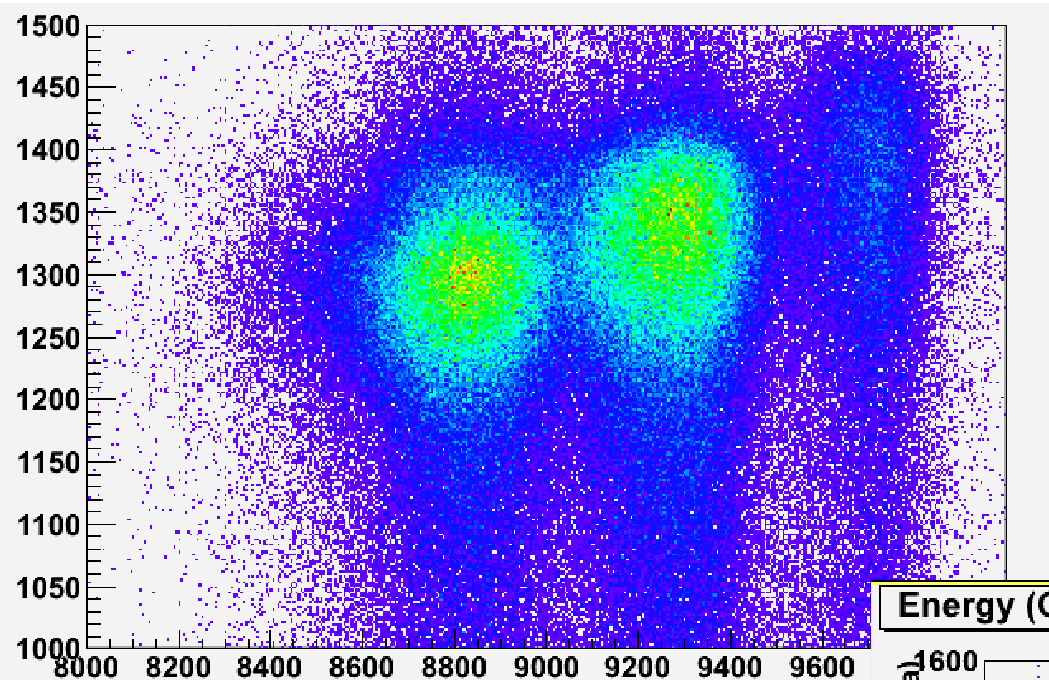
recover pile-up events

fit amplitude relative to shifting base line

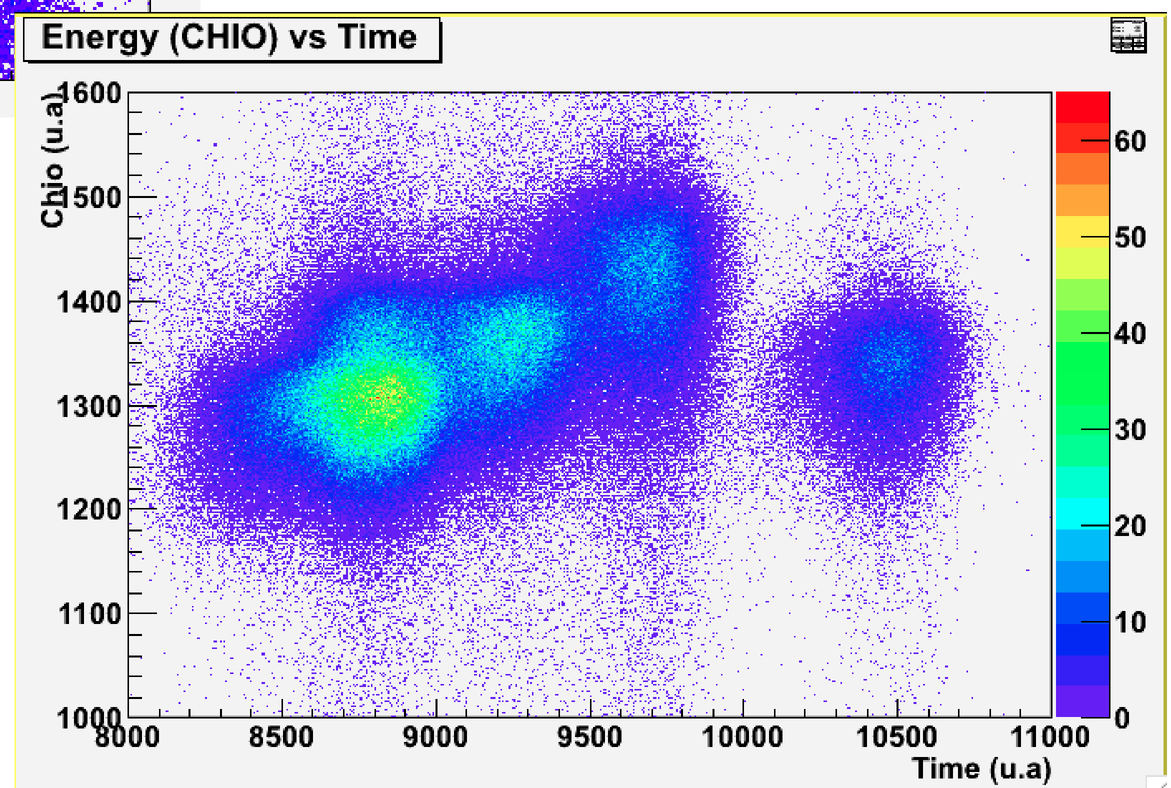
preliminary conclusion: fitting algorithm should be improved



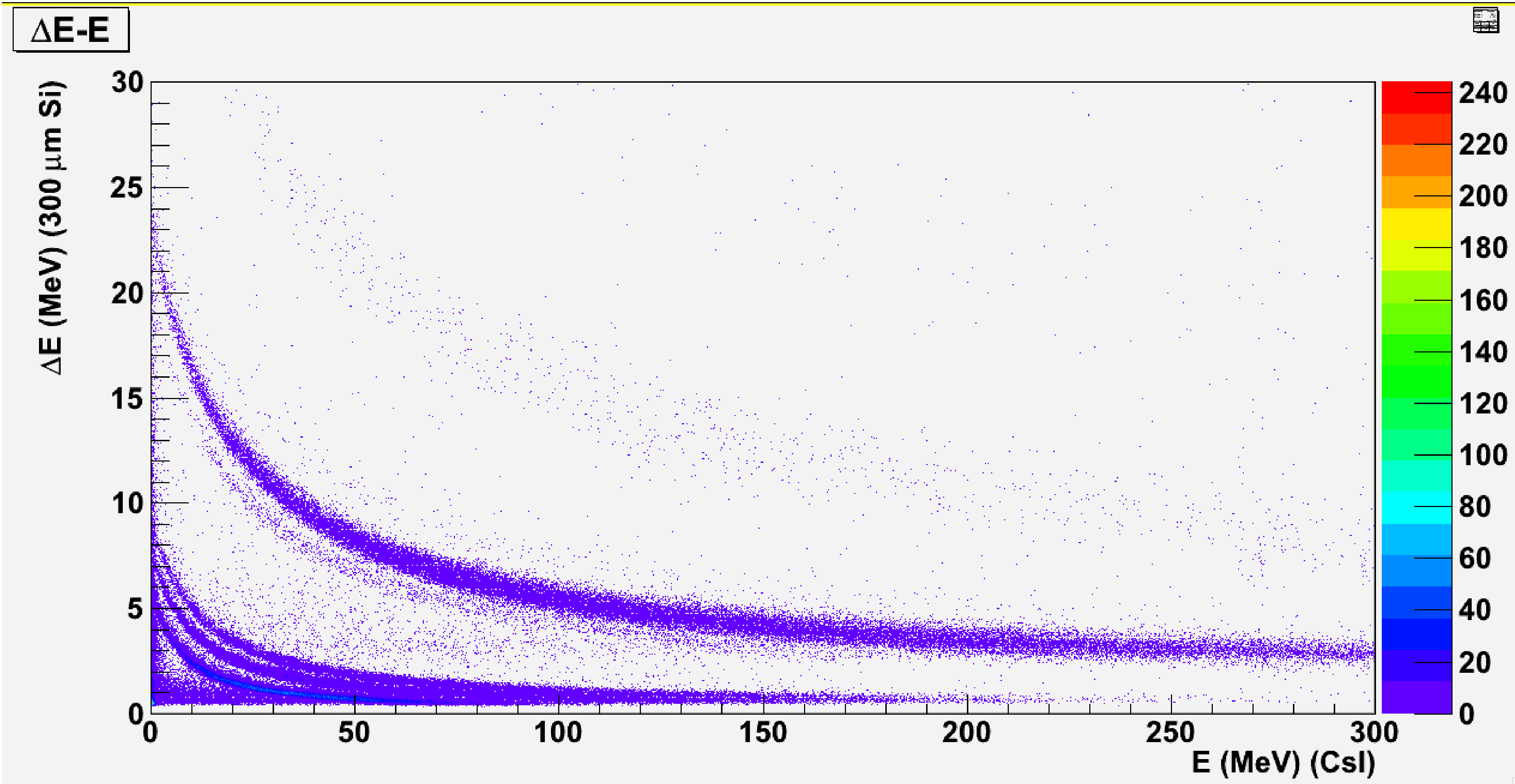
Ionisation chamber



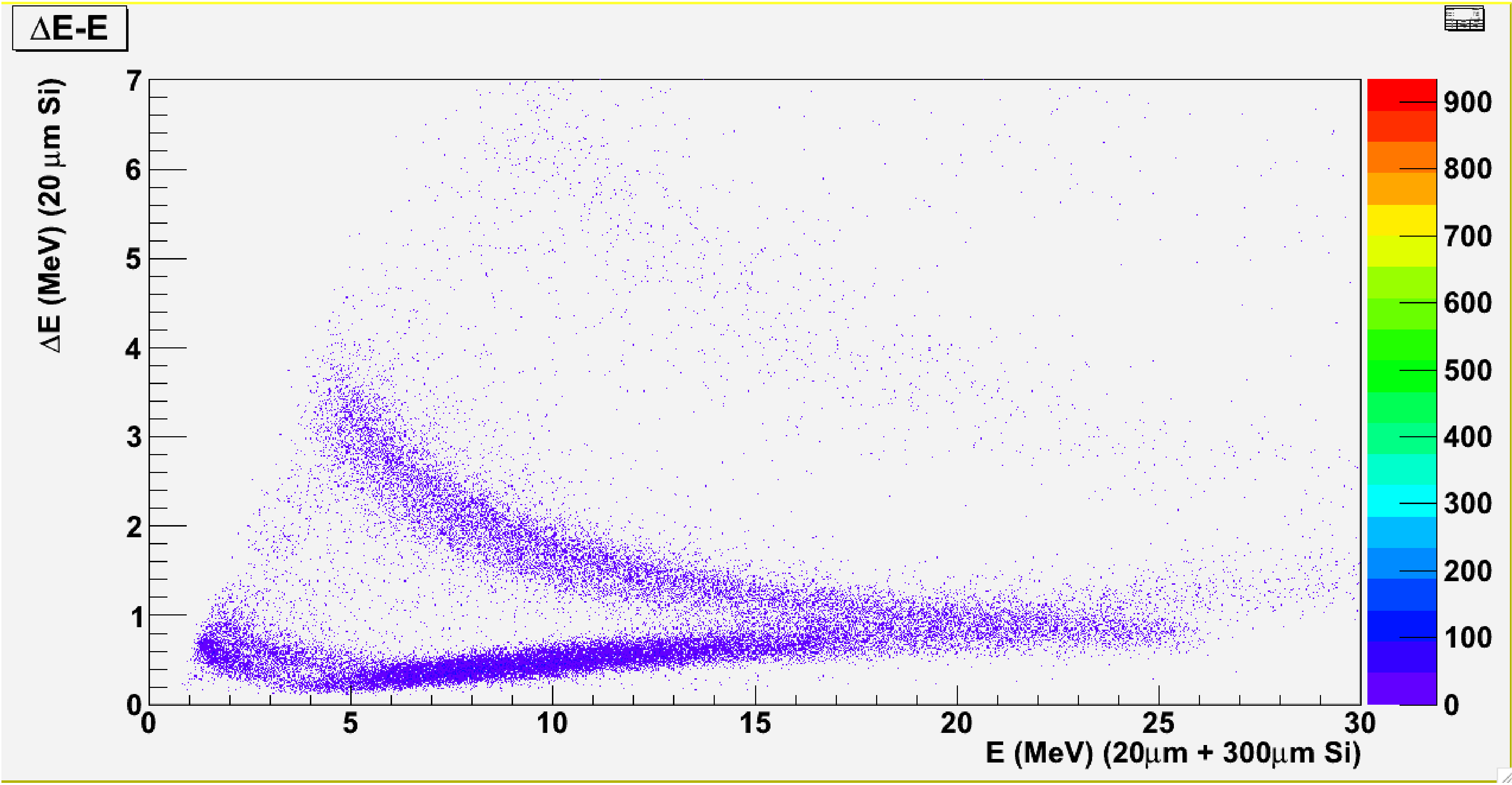
changing beam composition



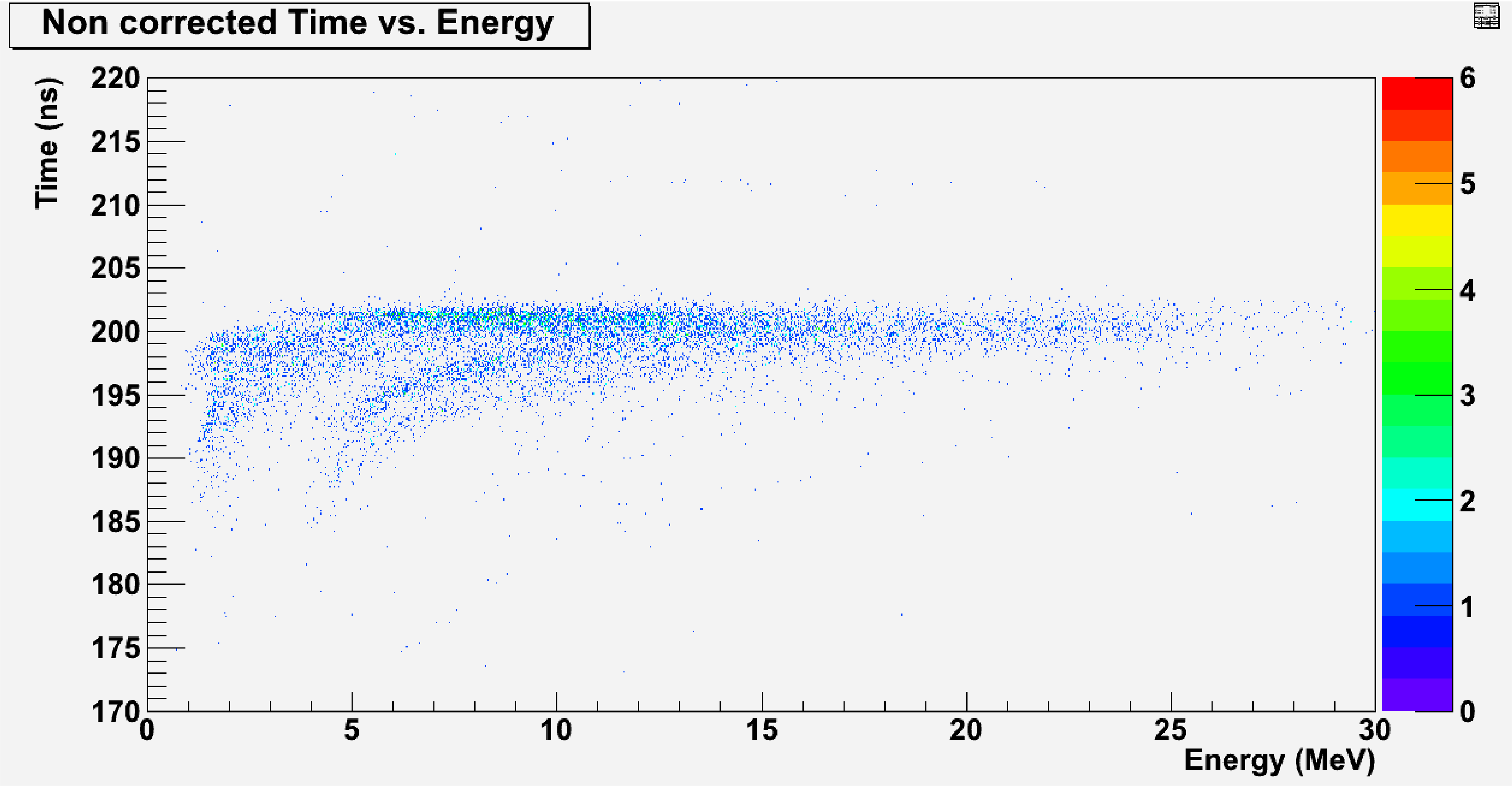
Particle identification



ΔE-E in second and third stage of Must2: 300μ vs CsI (higher energies)

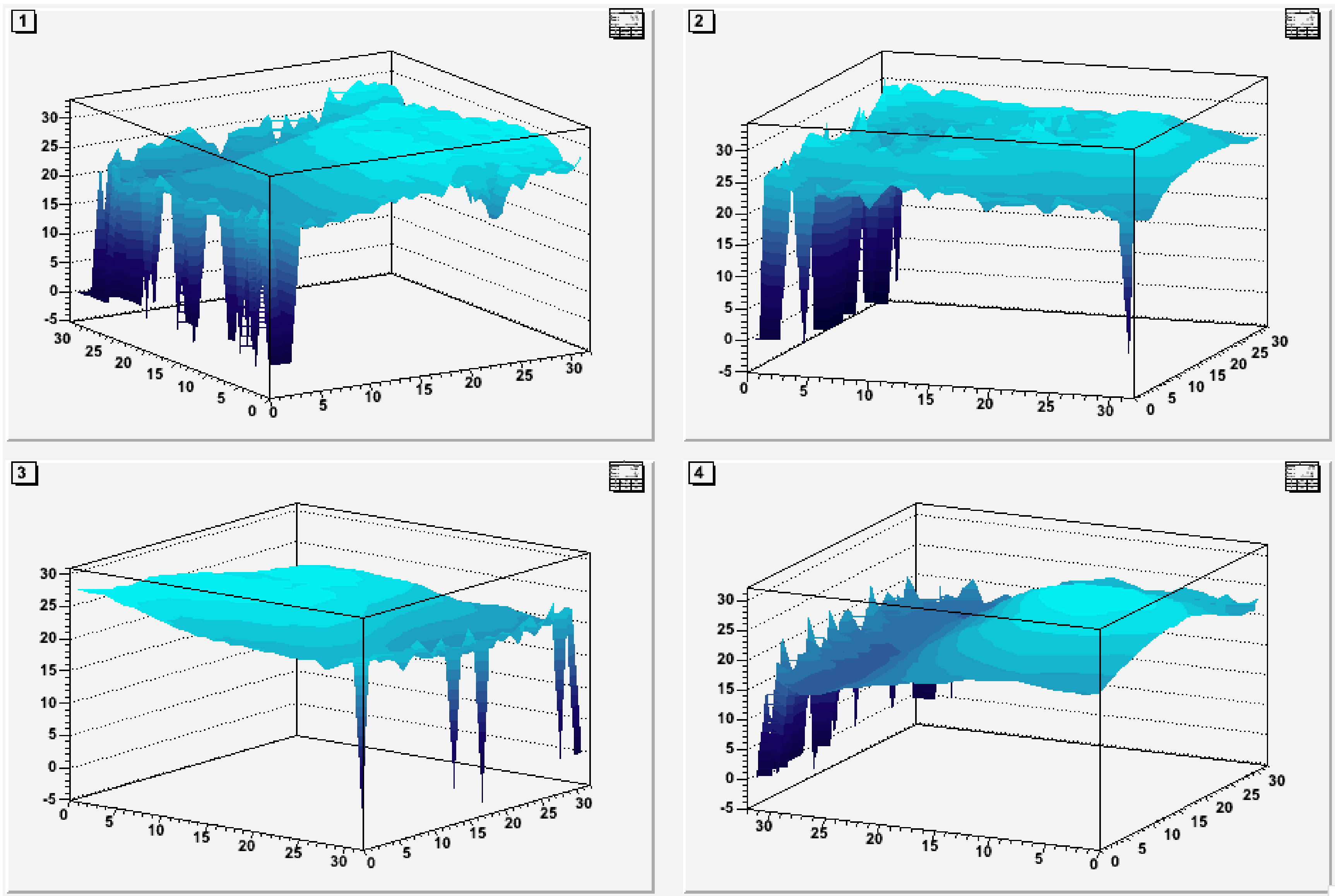


ΔE-E in first and second stage of Must2: 20μ vs 20+300μ (lower energies)

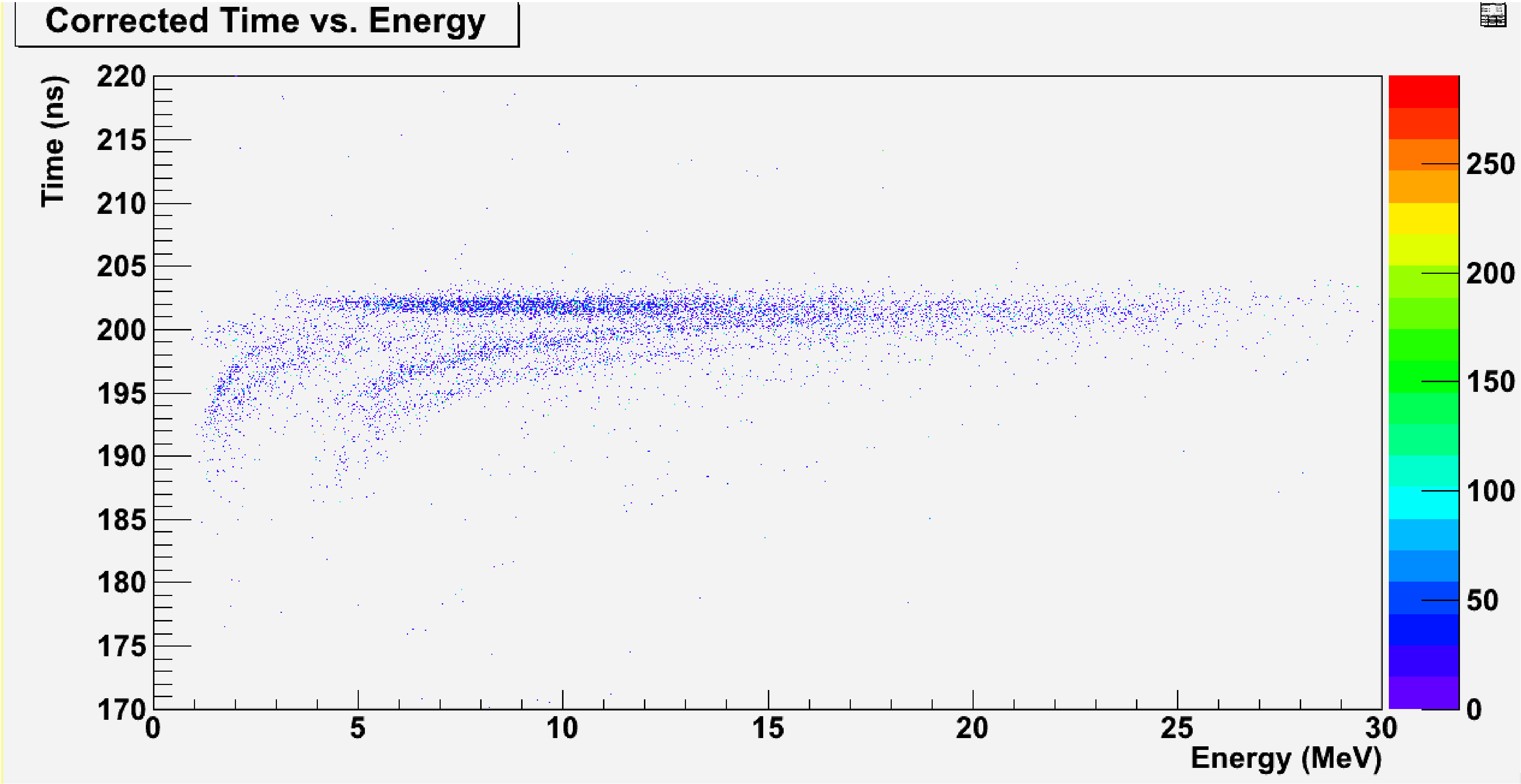


TOF-E without correction

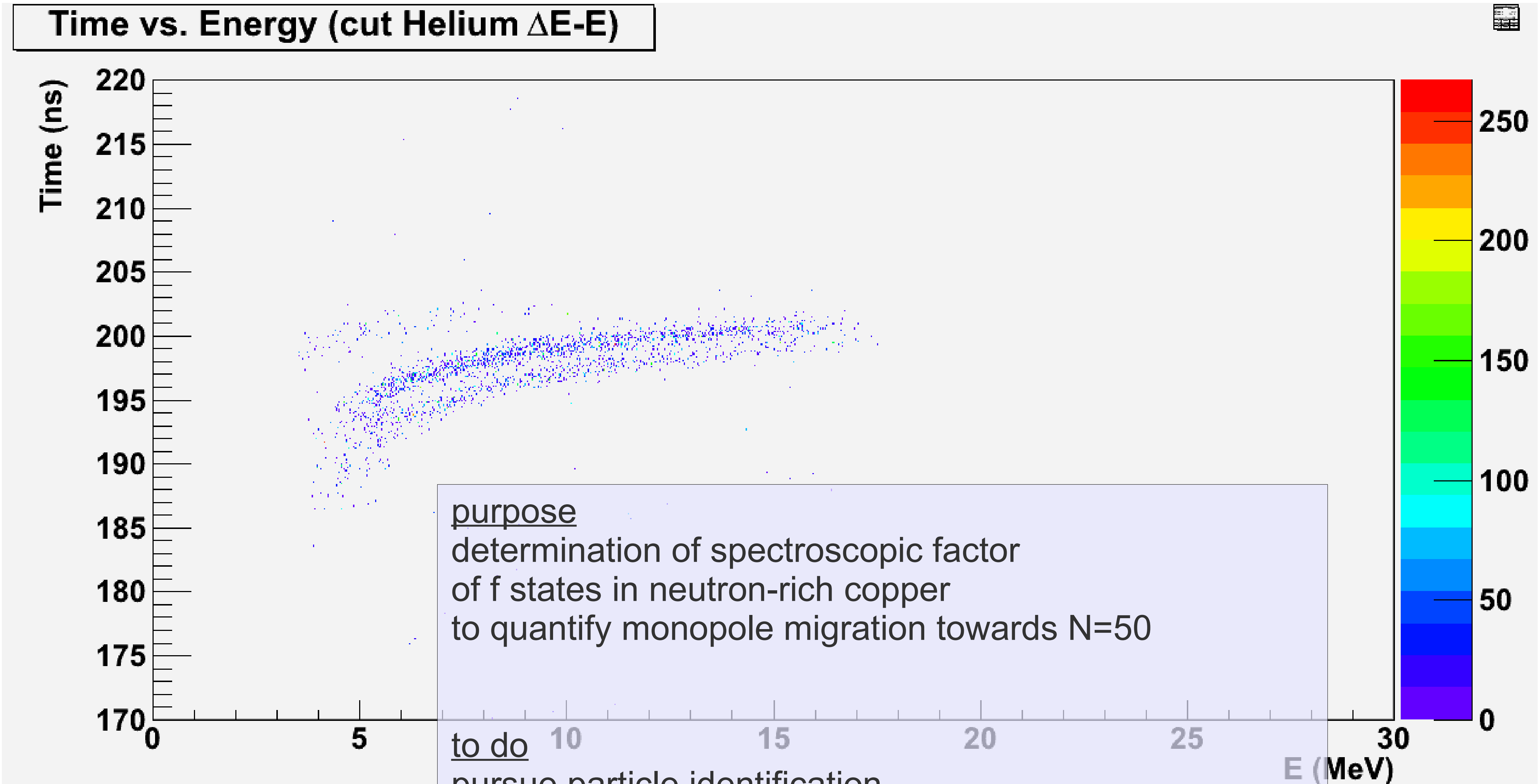
20μ SSSD



thickness defect: local density correction



TOF-E corrected for thickness defect of 20μ SSSD



<u>purpose</u>

determination of spectroscopic factor
of f states in neutron-rich copper
to quantify monopole migration towards N=50

<u>to do</u>

pursue particle identification
improve digitisation algorithm
CATS beam tracking detectors (correct for beam spot)
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