MEMO 26 August, 2002

To: John D'Auria for the DRAGON Group

From: Joel Rogers

Re: DRAGON "822" Analysis and TUDA

At the last meeting, DAH showed that the data analysis has only a few remaining problems, which I believe can be traced to uncertainties in the beam energy for some of the data runs. In this memo, I show how we can use the measured time-of-flight of the beam to obtain a consistent energy calibration so that we can be confident of our comparisons with TUDA.

Fig. 1 shows the beam energy as measured by elastic-time vs the beam-energy as measured by the Prague magnet. The data fall very accurately on two lines, which indicates that: (1) Prague energy precision is better than 1 keV/u and (2) an energy scale change occurred between the 47XX runs and 48XX runs. The latter conclusion is consistent with a Nov. 8 entry in DRAGON logbook #4 which states that a Prague calibration error had occurred on Nov. 6. The 48XX runs were done on Nov. 9, after the error was discovered and, I assume, corrected.

The relationship between Prague energies and DRAGON MD1 energies is shown in Fig. 2. 45-degree lines, drawn through the 47XX and later 62XX runs, show that the MD1 values scale with Prague values, but MD1 has more scatter than Prague. I believe this scatter in the MD1 values is the source of the bad chi-squared which has resulted when all the "822" data were fit using MD1. Elastic-time can be used to realign some of the energy scales measured by Prague onto a single scale. Unfortunately, no elastic time was acquired for the 62XX runs. I have tried to correct the scattered MD1 values onto a single Prague scale, even without the elastic time. After much work and much guess-work, chi-squared did not improve much.

If we forget about the 62XX data for now, we can use elastic-time as the primary measure of energy. In Fig. 1 I slid the measured 47XX Prague values horizontally to lie on the 48XX line. The new Prague values were read from the positions of the hash marks on the 48XX line and entered into Table I as the column "Ein". Also in Table I are "Elastic" and "Capture" yields, computed from coincidence-spectra counts divided by ("Live time fraction" x "Beam" x pressure) values.

Fig. 3a shows the "Elastic" data from Table I plotted as a function of Prague energy. The two measurements at Ein=865 keV/u agree within errors, showing that the combined energy scale is internally consistent. The width of the "CAPTURE" curve in Fig. 3b is about 18 keV/u, which should give a proton width in rough agreement with TUDA. Subtracting 6 keV/u from the position of the resonance in Fig. 3a gives a resonance energy of 861 keV/u, in good agreement with TUDA's 863+-10 keV/u.

I have asked Lothar to fit the data of Fig. 3 and compare the DRAGON resonant parameters to TUDA's.

Joel

TABLE I

^{21}Na + p "822" RESONANCE ENERGY SCAN DATA

Run#	E_{in} (keV/u)	Elastic[4] yield (10^{-10}/T)	Capture[4] yield (10^{-12}/T)[3]	Elastic-r.f. TOF (0.5 ns)	Livetime fraction	Beam particles (10^{12})
4834	850	5.08[1]	$3.8 \pm 0.9^{4.7}_{2.9}$	283	.98	1.03
4835	855	4.84[1]	$5.9 \pm 1.0^{6.9}_{4.9}$	292	.79	1.54
4788	859.5	4.29[1]	$5.7 \pm 0.7^{6.4}_{5.0}$	302	.98	2.66
4791	865	5.40[1]	$9.4 \pm 1.3^{10.7}_{8.1}$	313.4	.80	1.44
4829	865	5.49[1]	$11.0 \pm 1.0^{12}_{10}$	314	.95	2.27
4795	870.5	7.13[1]	$8.0 \pm 0.9^{8.9}_{7.1}$	324.5	.90	2.60
4797	875.5	7.66[1]	$4.6 \pm 0.7^{5.3}_{3.9}$	336	.92	2.31
4799	881	8.54[2]	—	345±1	1.0	0.124

NOTES:

1) Elastic yield systematic error estimated at ±5%.
2) #4799 has additional statistical error of 4.5%.
3) Capture yield errors are statistical only.
4) Pressure in the denominator of Elastic and Capture yields = 4.7 Torr for all these runs.

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FIGURE 1

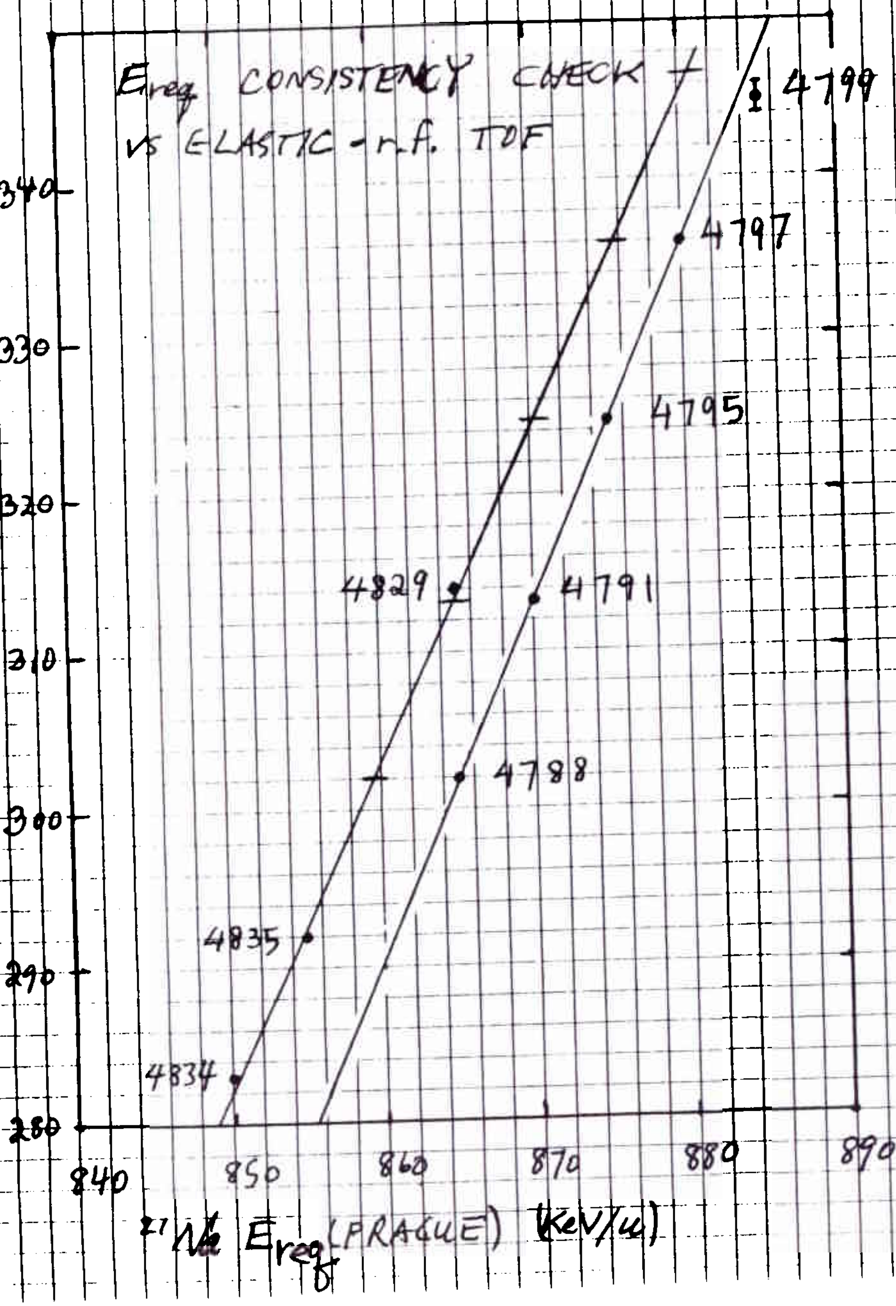
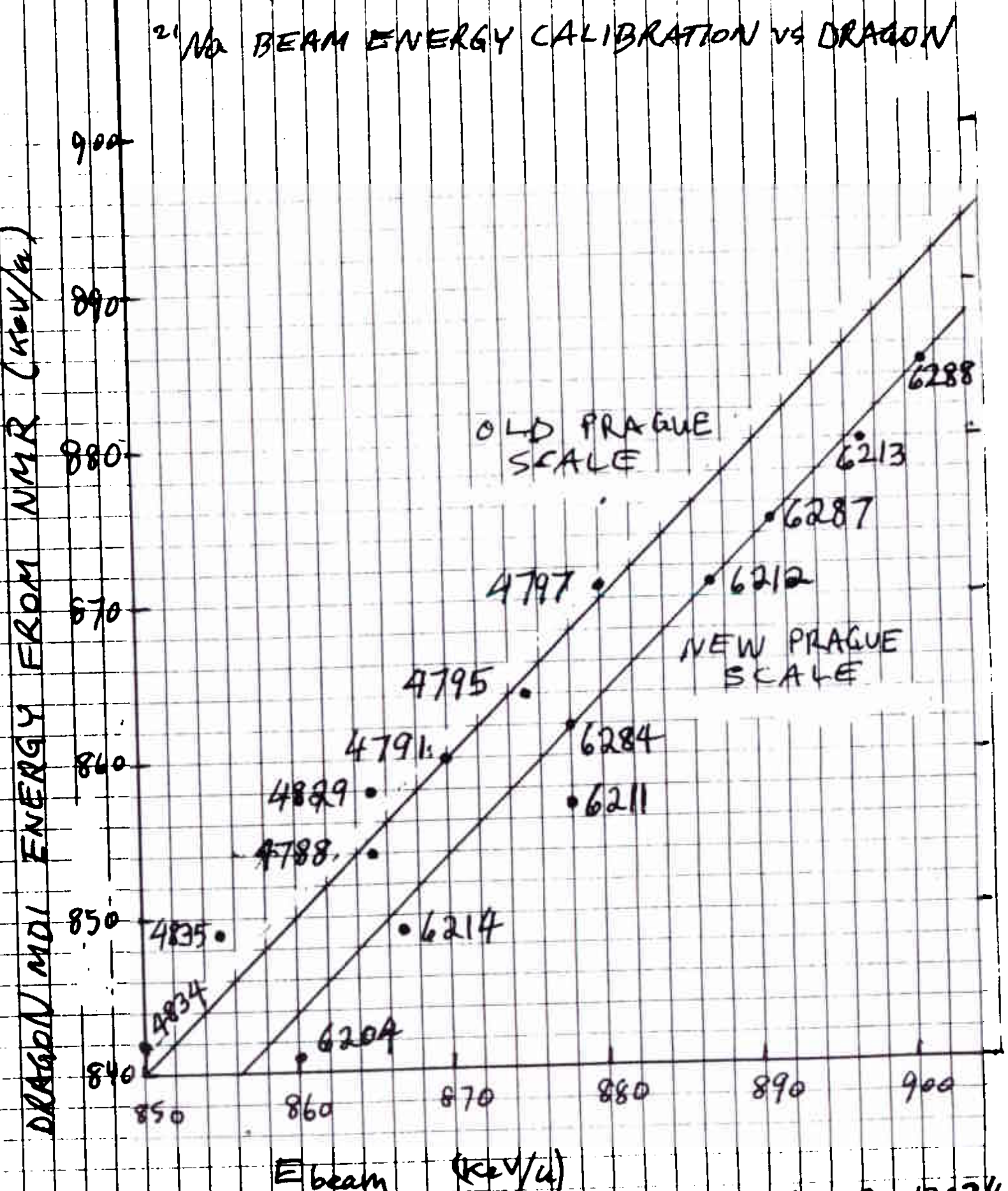


FIGURE 2



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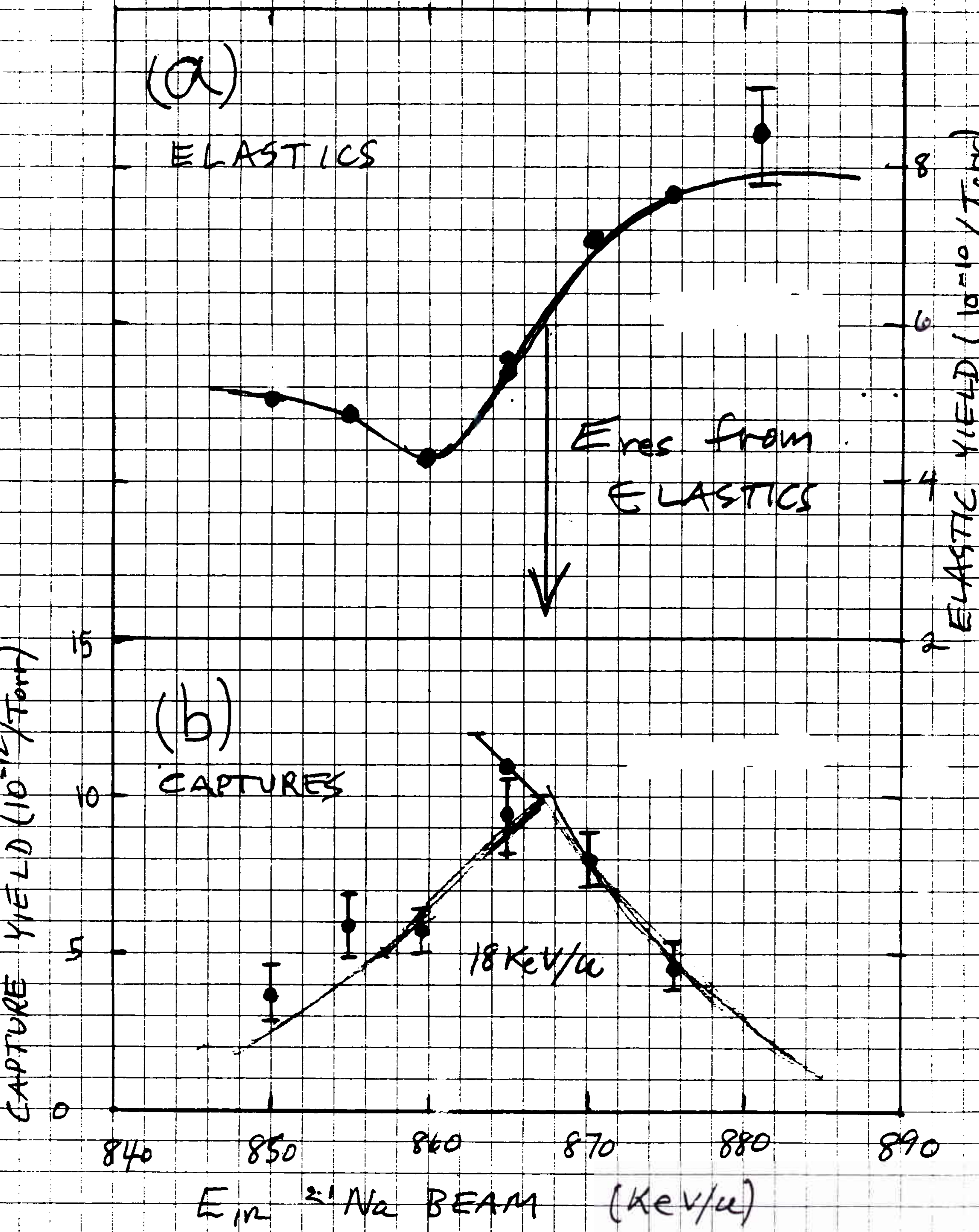
^{21}Na+p "822" RESONANCE SCAN FIGURE 3



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