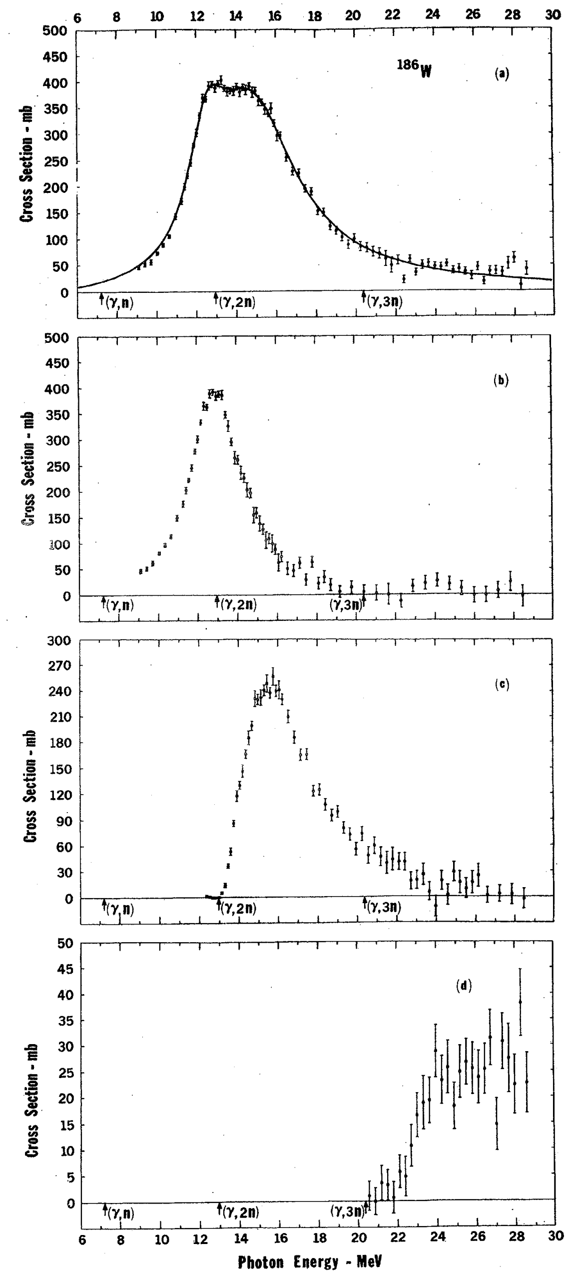
UCN from electron linac ?

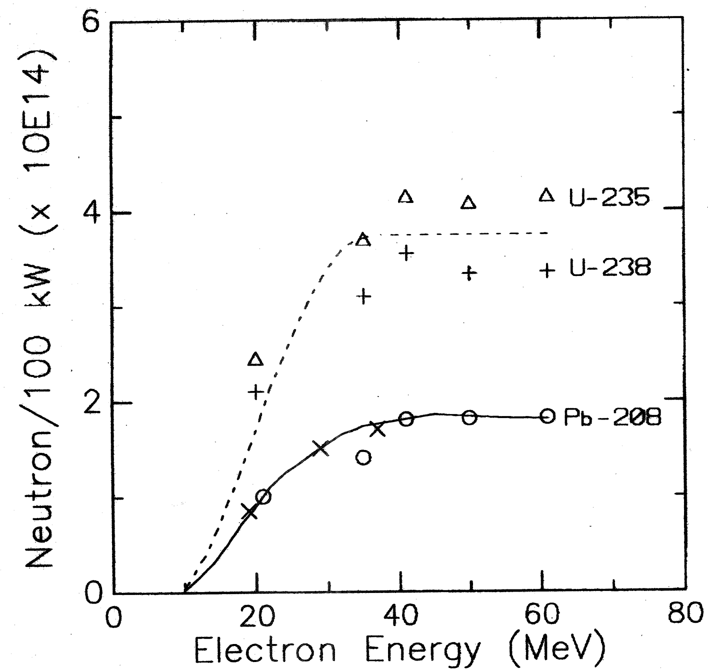
- n flux
- γ-ray heating from beam
- γ-ray heating from residual activity

Photoproduction of n's from (γ,n) is from GDR excitation

$\sigma \propto$ NZ/A $\sim$ Z

For W $\sigma(\gamma, n) \sim (\gamma, 2n) \sim$ 200mB $\sim \sigma(\gamma, \mathrm{f})$ for U
Berman and Fultz RMP 47 (1975) 713





W. Diamond NIM A 432 (1999) 471

- **2x gain from fission**

But fission will make more γ's from activity (see below) and also dissipate extra ~200 MeV from fission fragments
7 n's 500 MeV p; 0.1 n per 50 MeV electron

So 50 μA p's at 500 MeV makes 2x10^{15} n's
equivalent to 14 mA at 50 MeV electrons

Need even more with converter? See Beene talk for practicality

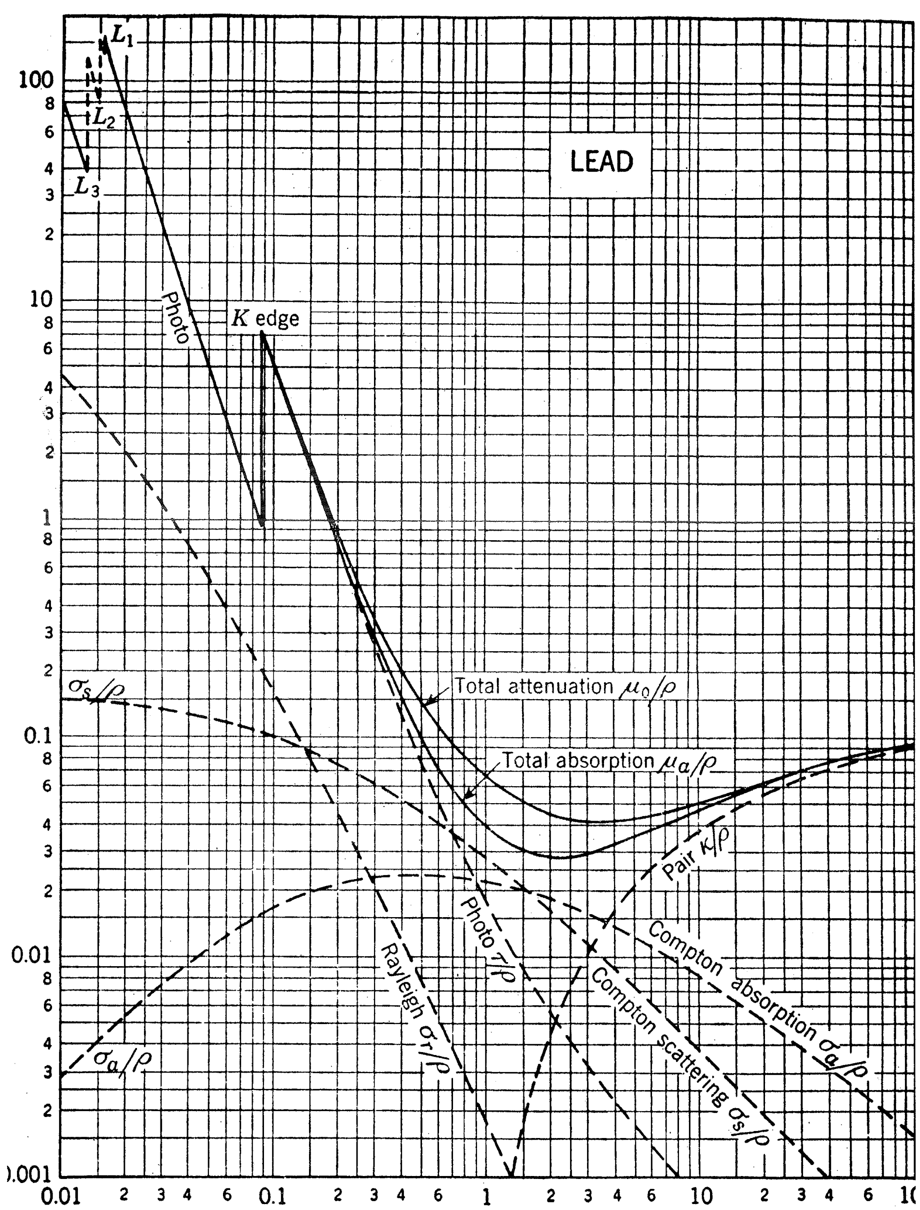
γ-ray heating of aluminum superfluid He vessel

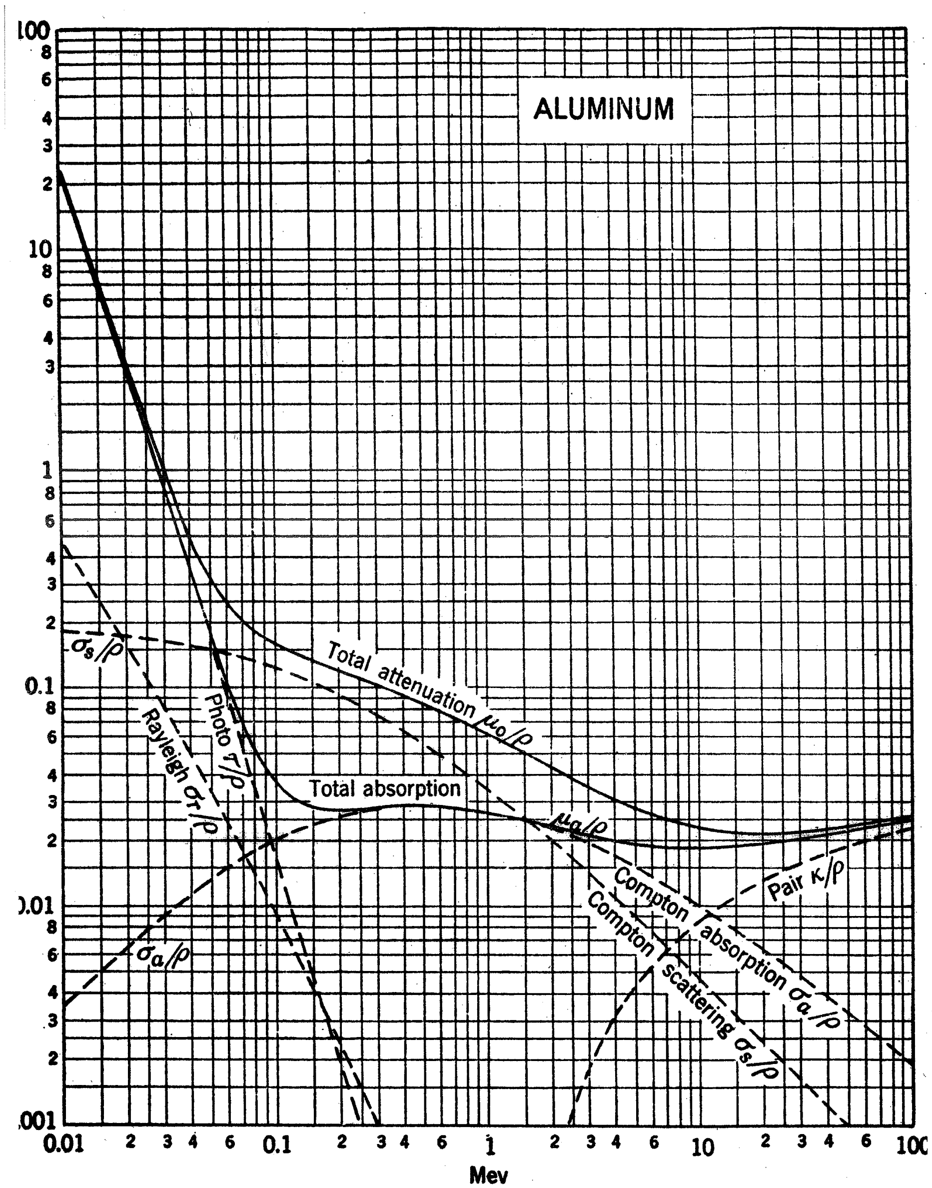
• Masuda PRL 89 (2002) 284801 lists this as main advantage of spallation over reactor

7n's per proton: how many γ's ? I guess 3x more γ's than n's per proton
So maybe the $\sim$ 20 MeV γ-ray beam is actually competitive

• • Residual activity from W(γ,n) makes 100 day $t_{1/2}$ isotopes with $\sim$ 0 γ's produced;
Much better than spallation in residual activity (how important is this?)

Evans *The Atomic Nucleus*





Best transmission through Pb is at $\sim$ 2 MeV

20 MeV $\gamma \rightarrow e^+ \, e^- \rightarrow$ 2 511's and a few more γ's.

- **Needs a real simulation**

Summary: I can't kill this with pencil, paper, Evans, and Leo

	50 μA 500 MeV p	10 mA 50 MeV e^-
n flux/sec	2x10^{15}	1-2x10^{15}
target power	20 kW	500 kW
γ-ray heating from beam	$\sim$ same	$\sim$ same
γ-ray heating from activity	$\sim$ same ?	$\sim$ 0

- Needs a lot of target/converter design

- Needs a real γ-heating simulation for beam, but this might be favorable

Potential advantages and requirements:

- Very little residual activity in W (does this matter?)
- γ-beam heating smaller at 30 MeV than 50 MeV, with little loss of n's (Shane says linac tunable, no problem)
- Macroscopic duty cycle presumably flexible

Discussion: Masuda says that 'γ-ray heating' is primarily from neutron absorption, not from the spallation proton beam. The relevance of the treatment above of other sources of γ-ray heating is therefore unclear.