

CHARGE -PICKUP IN 1 A GeV Pb COLLISIONS WITH DIFFERENT TARGETS

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RELATIVISTIC ENERGIES

∞ TWO MECHANISMS:

- Quasi-elastic (direct) reaction.
- Δ -resonance formation (example: $n \rightarrow \Delta^0 \rightarrow p + \pi^-$).

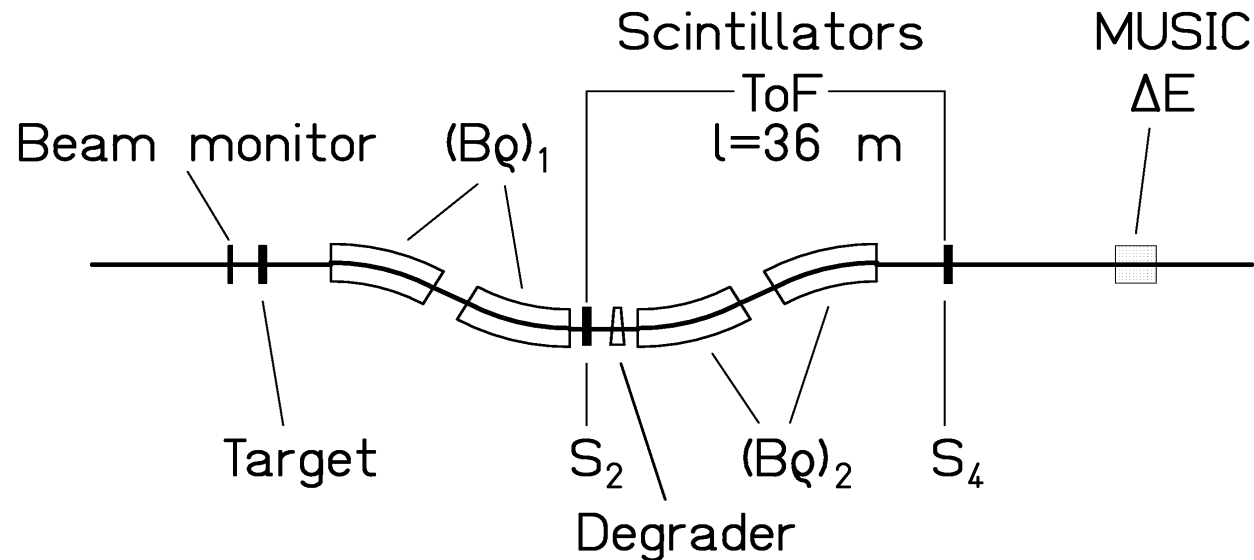
∞ WHY?

- Important test for any microscopic model on nucleon-nucleon interactions.
- These data: **Po** production in Pb-Bi spallation target for ADS.

∞ BUT:

- Few data, mostly restricted to total charge-pickup cross sections.

EXPERIMENT



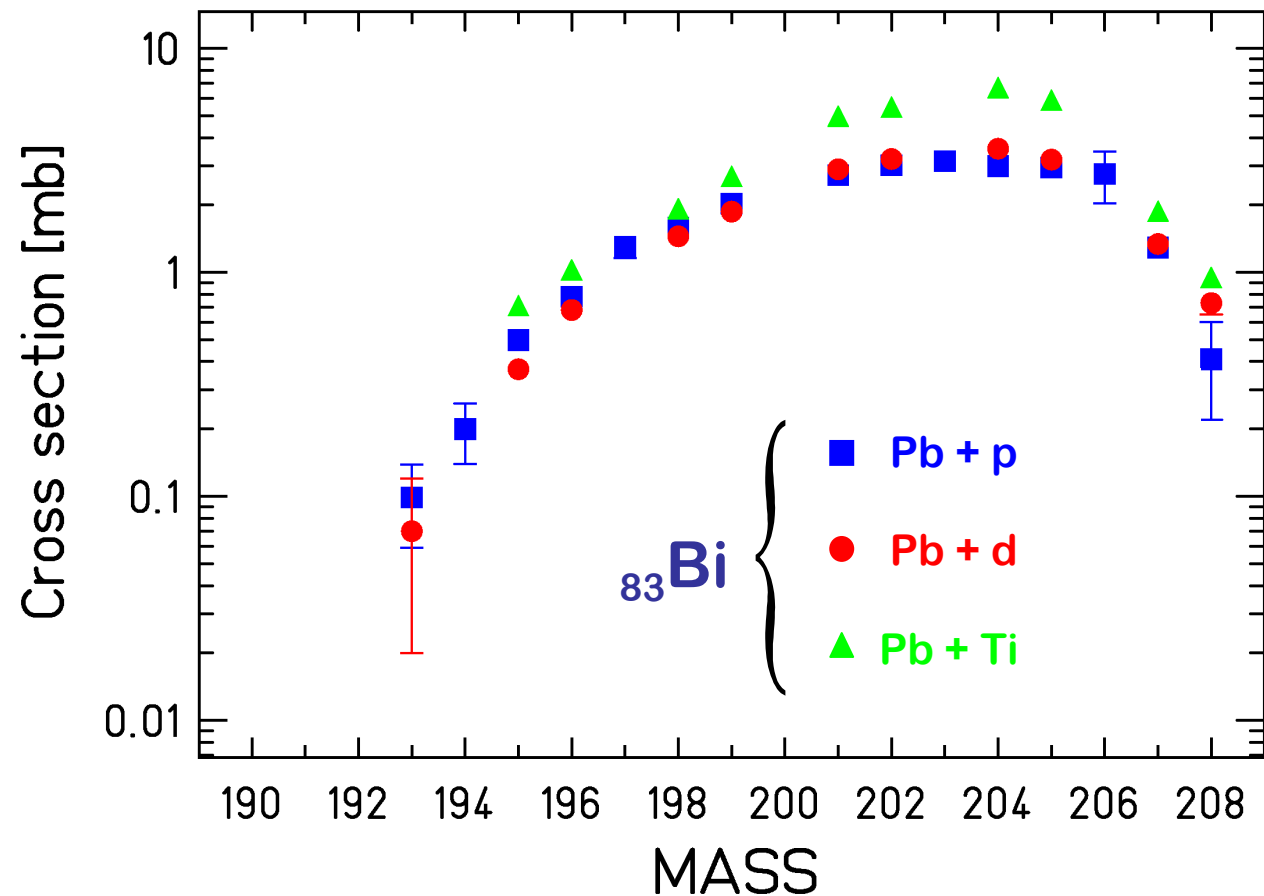
⌘ TARGETS:

- $(87.3 \pm 2.2) \text{ mg/cm}^2$ liquid **hydrogen**.
- $(206 \pm 6) \text{ mg/cm}^2$ liquid **deuteron**.
- '**Titanium**' $\Leftrightarrow$ empty target container.

T. Enqvist et al., NPA 686 (2001) 481.

RESULTS: TOTAL AND PARTIAL CHARGE-PICKUP CROSS SECTIONS

σ_{tot} [mb]		
$^{208}\text{Pb}+p$	$^{208}\text{Pb}+d$	$^{208}\text{Pb}+\text{Ti}$
28 ± 6	30 ± 7	50 ± 9



COMPARISON WITH MODEL CALCULATIONS

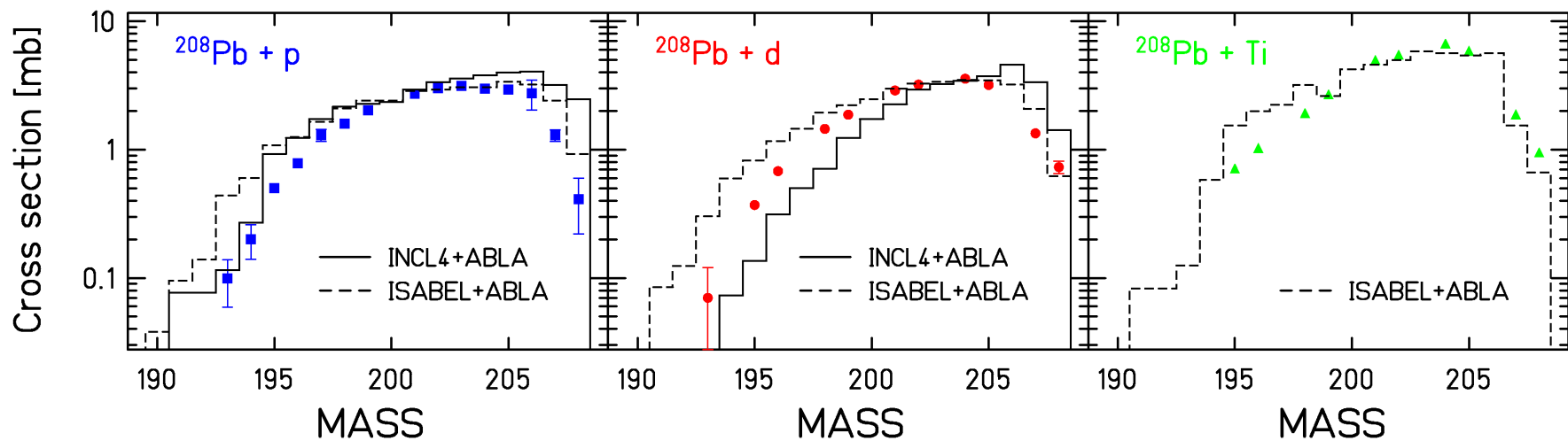
∞ TWO STAGE PROCESS:

1. INTRA-NUCLEAR CASCADE $\Rightarrow$
2. EVAPORATION / FISSION $\Rightarrow$ ABLA

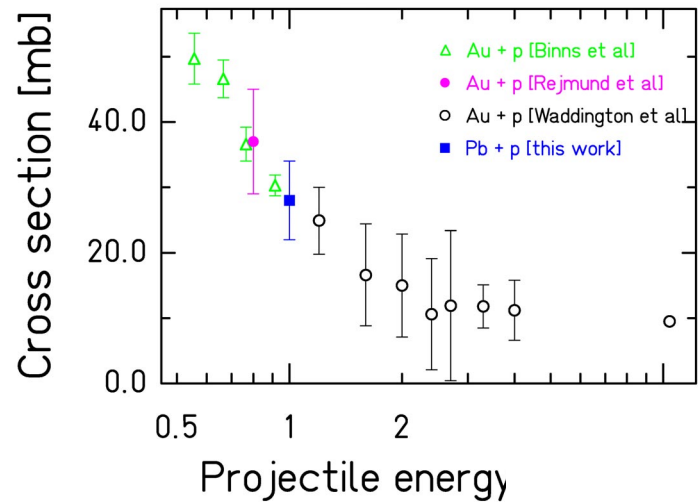
INCL4
ISABEL

^{83}Bi partial cross sections:

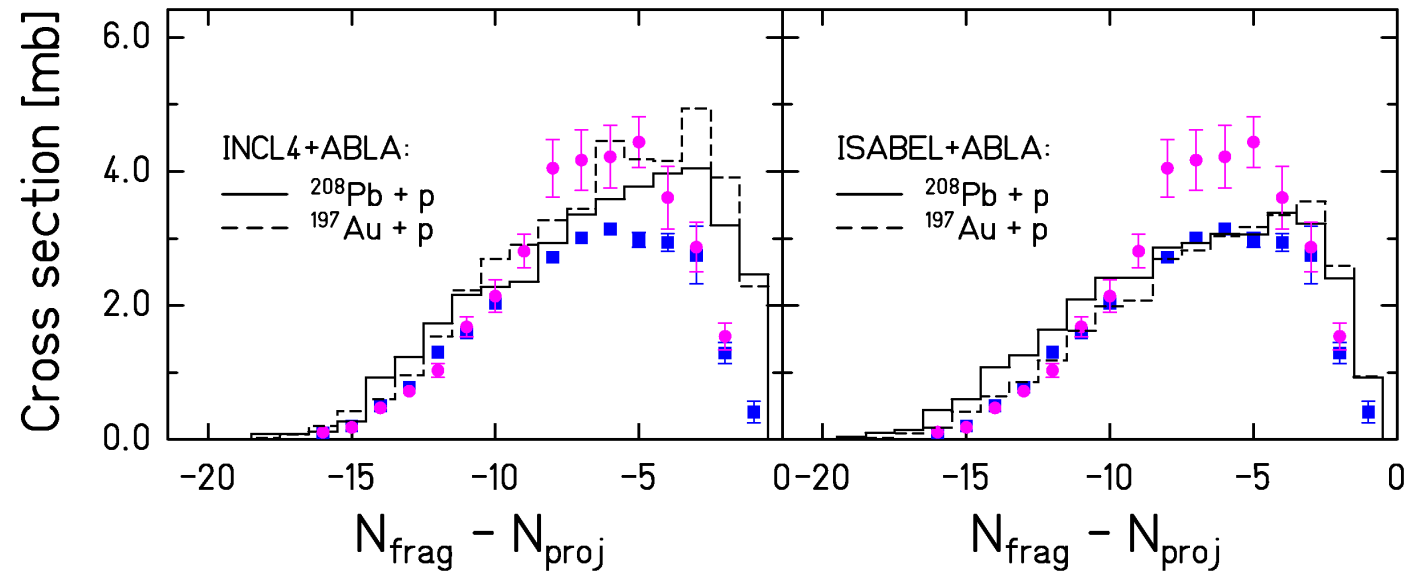
σ_{tot} [mb]		
$^{208}\text{Pb}+p$	$^{208}\text{Pb}+d$	$^{208}\text{Pb}+\text{Ti}$
28 ± 6	30 ± 7	50 ± 9
39	30	-
34	33	51



INFLUENCE OF PROJECTILE ENERGY



$\bullet$ ^{197}Au (0.8 A GeV) + p $\rightarrow$ $_{80}\text{Hg}$,
F. Rejmund et al., NPA 683 (2001) 540.
 $\blacksquare$ ^{208}Pb (1 A GeV) + p $\rightarrow$ $_{83}\text{Bi}$



POLONIUM PRODUCTION IN Pb-Bi TARGET FOR ADS



⌘ No data in the energy range of interest !

⌘ Calculations → differences between 35 % and 70 %.

⌘ Estimation → from measured production cross sections for ^{207}Bi and ^{208}Bi
in $^{208}\text{Pb} + p$ at 1 A GeV.

	σ_{ISABEL} [mb]	σ_{INCL4} [mb]	σ_{estim} [mb]
^{208}Po	2.70	3.64	< 1.29
^{209}Po	0.97	3.53	< 0.41

SUMMARY AND OUTLOOK

- ✂ Isotopically resolved charge-pickup cross sections of relativistic ^{208}Pb projectiles in the interactions with different targets give new insight in the physics involved.
- ✂ Problems with describing experimental results in the case of proton and deuteron induced charge-pickup reactions.
- ✂ Consequence on the target-activity calculations for accelerator driven systems.
- ✂ Need for model improvement and more data.