Measurements of σ_I for Sr and Ni isotopes

12.02.'03 @GSI FRS Meeting

Plan of talk

i Previous experiments

ii Experimental purpose

iii Experimental setup

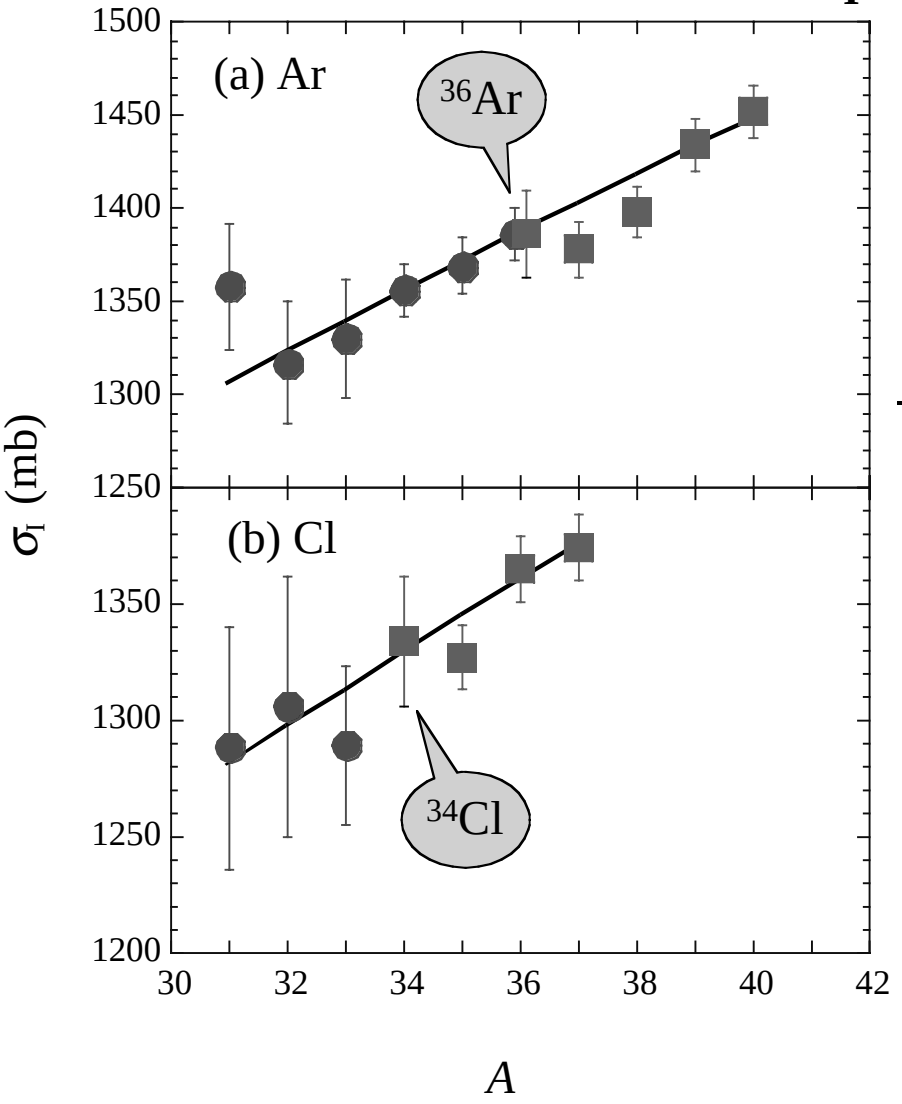
iv Run condition

Participants

A. Ozawa, T. Suda, I. Tanihata, T. Yamaguchi (RIKEN)
T. Suzuki, T. Ohtsubo, S. Watanabe (Uni. Niigata) ;
M. Fukuda (Uni. Osaka) ;
;H. Geissel, M. Hellström, G. Münzenberg, K. Sümmerer (GSI);
L. Chulkov, M. Golovkov (Kurchatov Inst.);
M. Ivanov, R. Janik, B. Sitár, P. Stremeñ (Comenius Univ.)

Previous works

σ_I measurements



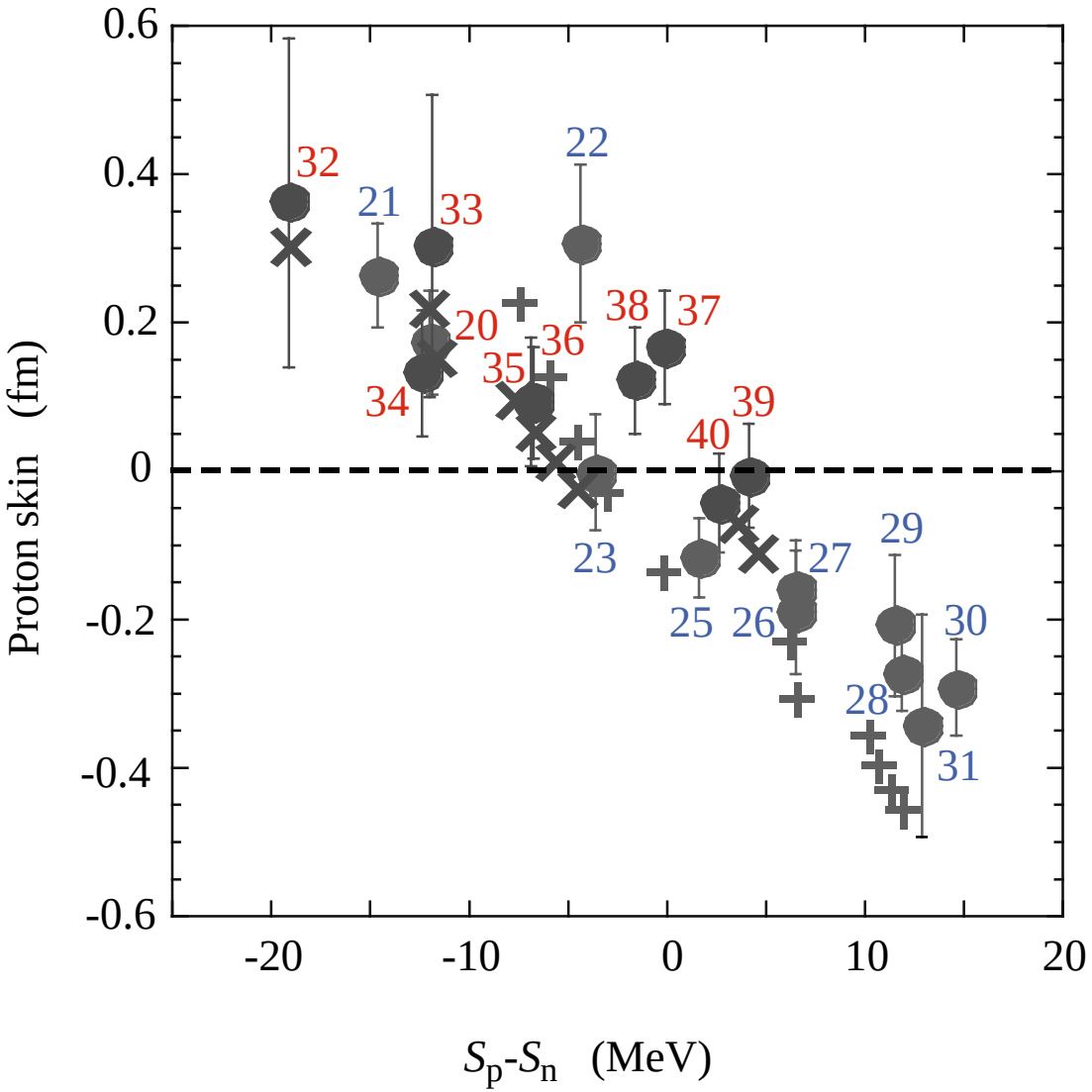
Using ^{40}Ar beam

Using ^{36}Ar beam

$\sigma_I = \pi\,[R_I(^{12}C) + r_0\,A^{1/3}\,]^2$

Results are published in *NPA709(2002)60*.

Correlation between skin and (S_p-S_n)



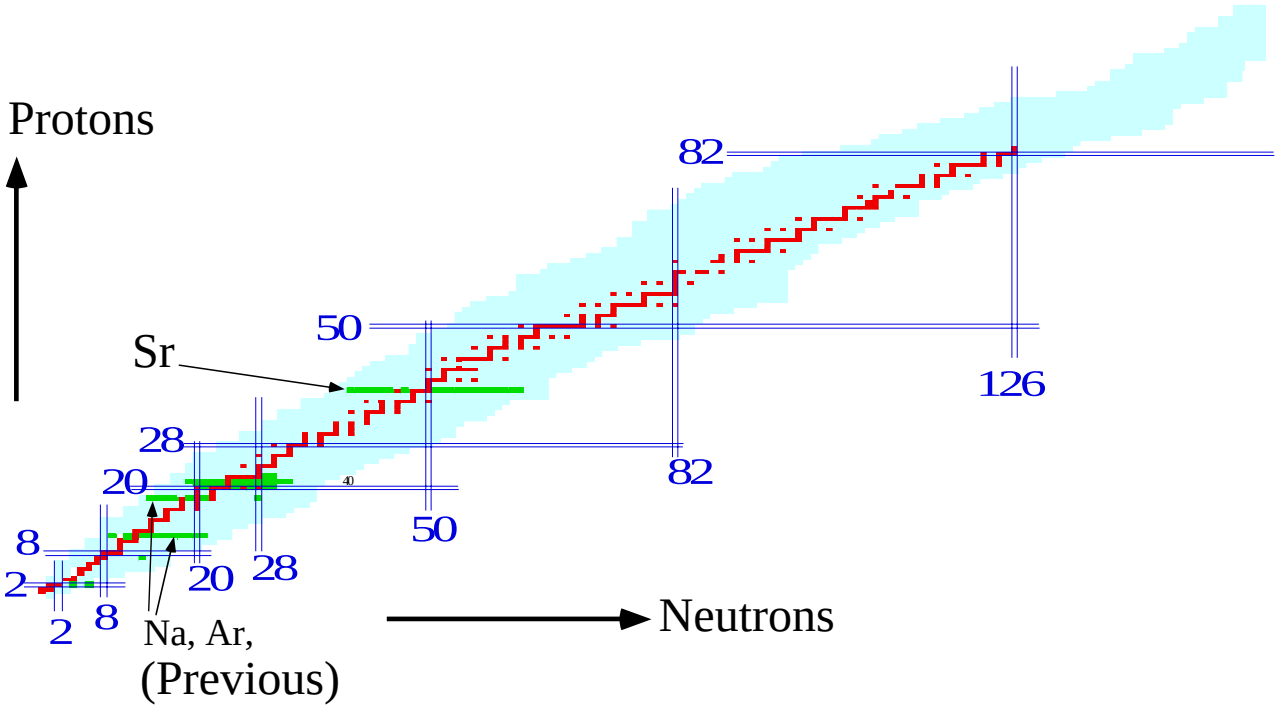
Ar-isotopes

Na-isotopes

RMF(NL3) (**Ar**)

RMF(NL3) (**Na**)

New Proposal (why Sr ?)



Another example of n-skin in *medium-mass* region

A: $<r_c^2>^{1/2}$ are known over a wide range of *N*
Na,Ar, Kr,Sr, Rb, Cd, In (oddZ), Xe,Cs,...,Pt, Pb
B: Single count rate@F2 < 20 kHz (for particle ID)
Lighter Element
C: No isomer state with $T_{1/2}$ > 25 ns (~1/6 *(F0~F2) flight path)

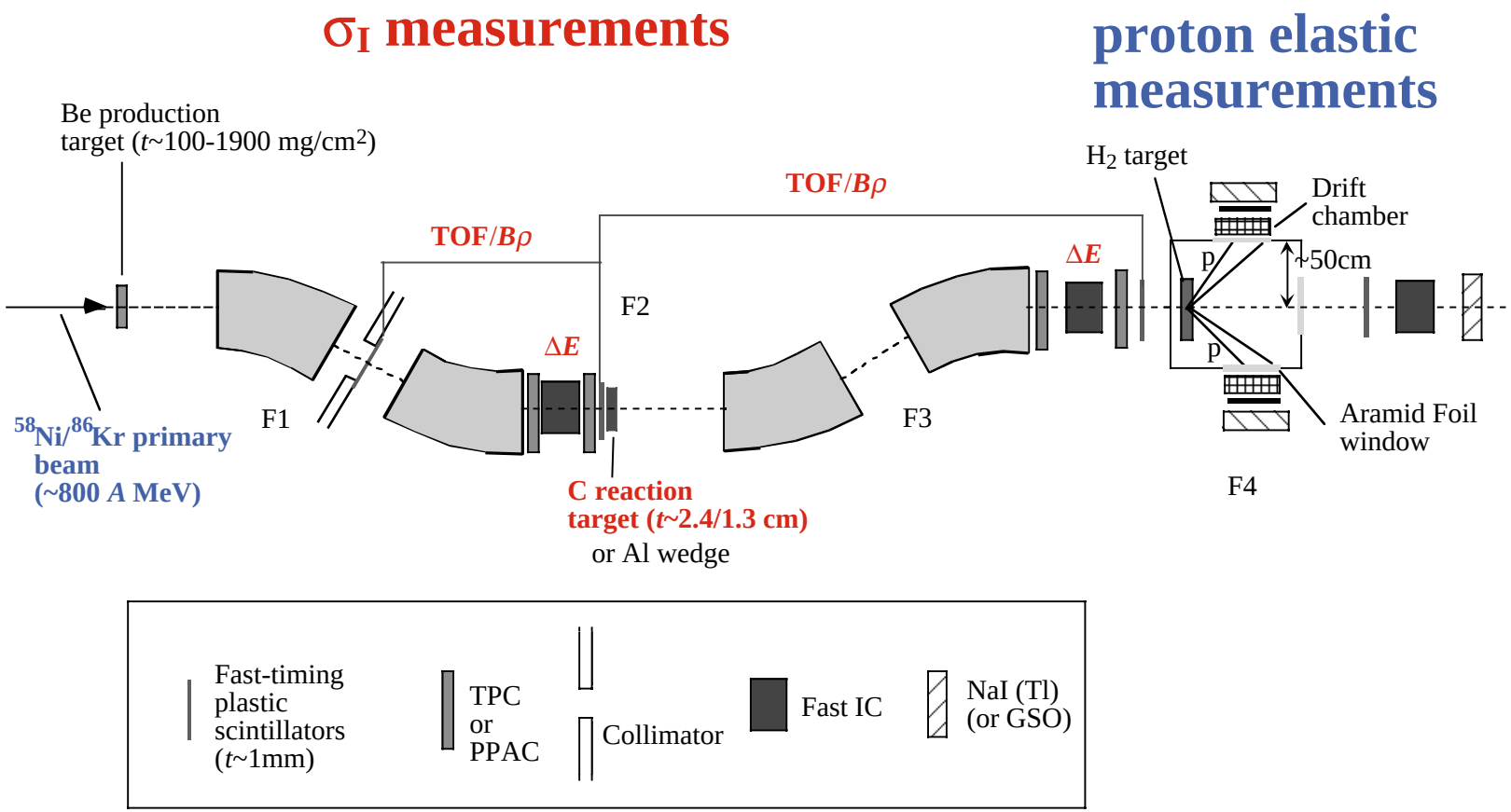
→ 78-100 Sr :$<r_c^2>^{1/2}$
P. Lievens et al., Eur. Phys. Lett. 33, 11 (96).

odd-even straggling???

→ even-mass Sr

Experimental setup

FRS in GSI



Experiment

Isotopes		^{80}Sr	^{88}Sr	^{96}Sr
Primary beam		^{98}Mo		^{124}Sn SIS cooler
target thickness	Be @F0	0.5 g/cm^2	1.0	
	C @F2	1.0	2.7	
Beam intensity		5.1x10^6	2.0x10^6	1.6x10^8
$\sigma_{prod.}$ (mb)		6.2	1.9	7x10^{-4}
rate /spill	^{A}Sr@F2	370	80	4.3
	total@F2	20k for IC	11k	20k for IC
	^{A}Sr@F4			4.2
	total@F4	9 k	10k for IC	530
cut efficiency		0.16	0.37	0.25
rate/spill incl. e		48	38	2
hour (empty & C)		20	20	30
		$\Delta\sigma$~1%		$\Delta\sigma$~2%

FRS tuning 20 *2 =40
RUN 70
Circuits;calibration 10

120 h = 15 shifts

Experiment (readiness)

F2 area

F1& F2 TOF detector	RIKEN/ Niigata
TPCs	Bratislava
High-rate MUSIC	TU-Muenchen / Klaus
Reaction Target	Target-Lab.
Optics	suzuki/ozawa

F4 area

standard detecors

- TPC /MW
- MUSIC
- Scintillator

DAQ (VME)

M. Hellstroem

Summer '03 ~ Winter '04

Recent theoretical works show that matter radii depend strongly on *L*.

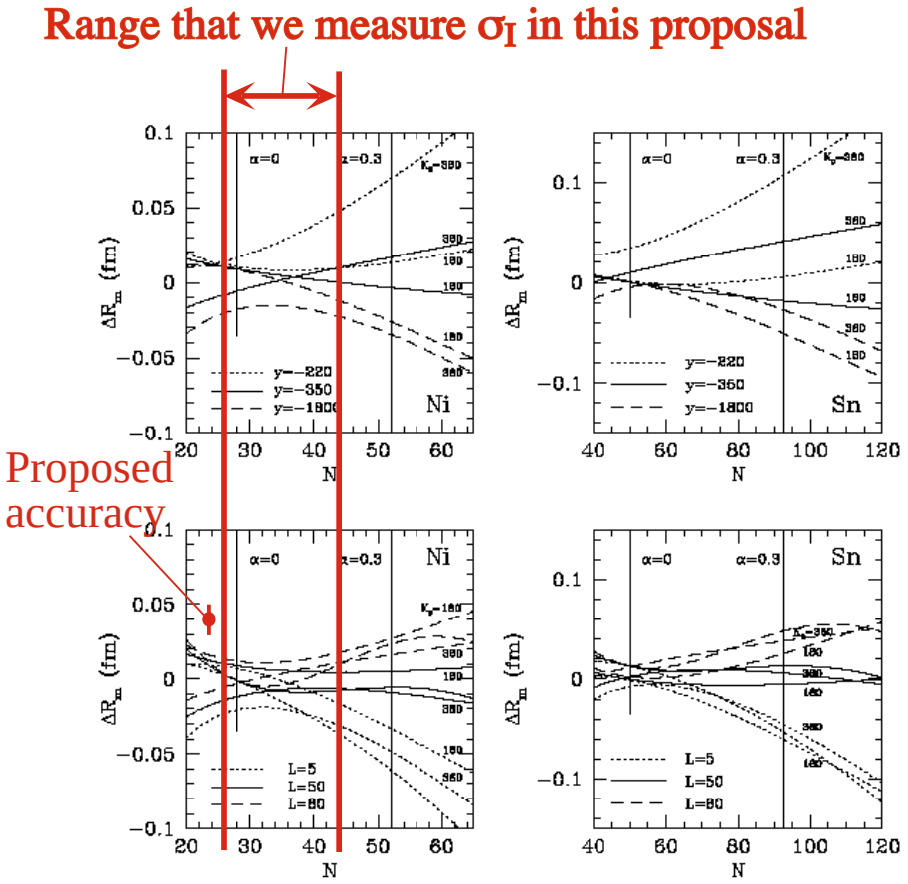


Fig. 5. Differences of the root-mean-square matter radii of Ni and Sn isotopes, ΔR_m, from those calculated for $y = -350$ MeV fm^3 and $K_0 = 230$ MeV (upper panels) and for $L = 50$ MeV and $K_0 = 230$ MeV (lower panels). The thin curves in the lower panels are from formulas (26) and (27).

Summary

- We will measure σ_I for ^{78,88,96}Sr and $^{54\text{-}72}$Ni at ~750*A* MeV at FRS.
- Our main purpose is to deduce n-skin for Sr isotopes.
- Our main purpose is to give constraints on the EOS; the symmetry energy density-derivative coefficient (*L*). (Ni isotopes)
- We require ^{98}Mo/^{124}Sn beams for Sr isotopes.
- All detectors will be ready until 2003 summer.