

^{35}Ca decay

beta-delayed 1- and 2-proton

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beta delayed proton(s) emission program

^{31}Ar studied at ISOLDE

previous decay studies

Berkeley, J. Aystö et al. (1985)

GANIL, W. Trinder et al. (1999)

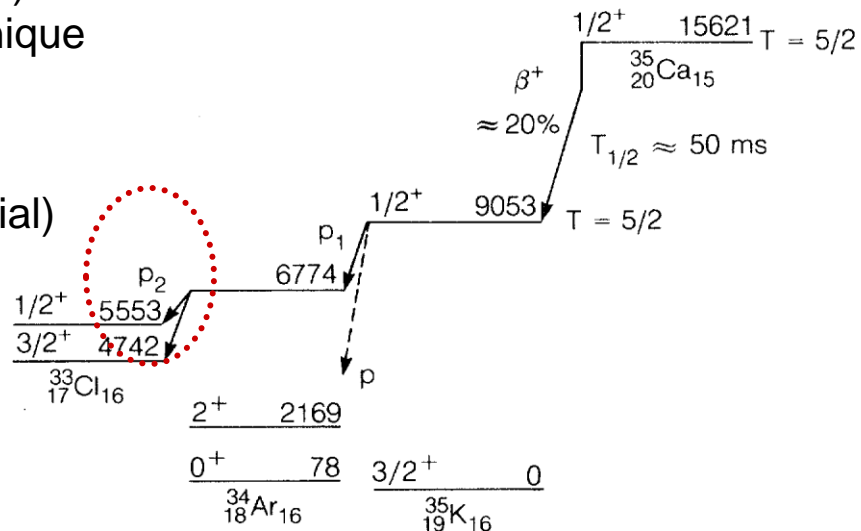
Previous experiments

1985 Berkeley, J. Aystö *et al.*, PRL 55 (1985) 1384

$^{40}\text{Ca}(^3\text{He},\alpha 4n)$ reaction, helium-jet technique
small angle proton-proton coincidences
with ΔE - E silicon telescope

- only β -2p measurement (sequential)
- first decay scheme

$\log ft(\text{IAS}) = 3.09$
 $T_{1/2} = 50 \pm 30 \text{ ms}$
 $\Delta m = 4463 \pm 60 \text{ keV (IMME)}$



1999 GANIL, W. Trinder *et al.*, PLB 459 (1999) 67

^{40}Ca fragmentation, LISE implantation / decay experiment
gamma: 3 Ge (70%) and 2 NaI detectors

- 19 β -p(γ) transitions \rightarrow B(GT) (weaker quenching than **sd** shell)
- no β - γ
- no β -2p to excited state in ^{33}Cl

$\log ft(\text{IAS}) = 4.1$ \leftarrow missed strength ?
 $T_{1/2} = 25.7 \pm 0.2 \text{ ms}$
 $\Delta m = 4530 \pm 66 \text{ keV (IMME)}$

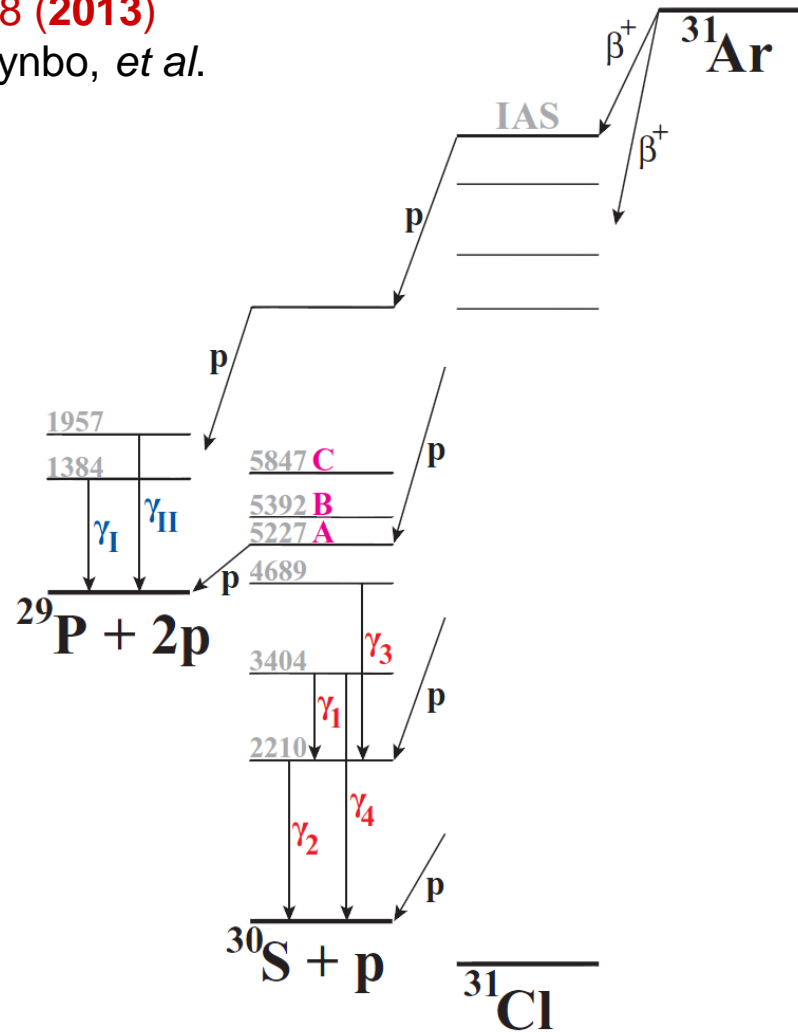
^{31}Ar and ^{35}Ca at ISOLDE

current proposal is continuation of β -p and β -2p decay studies at ISOLDE

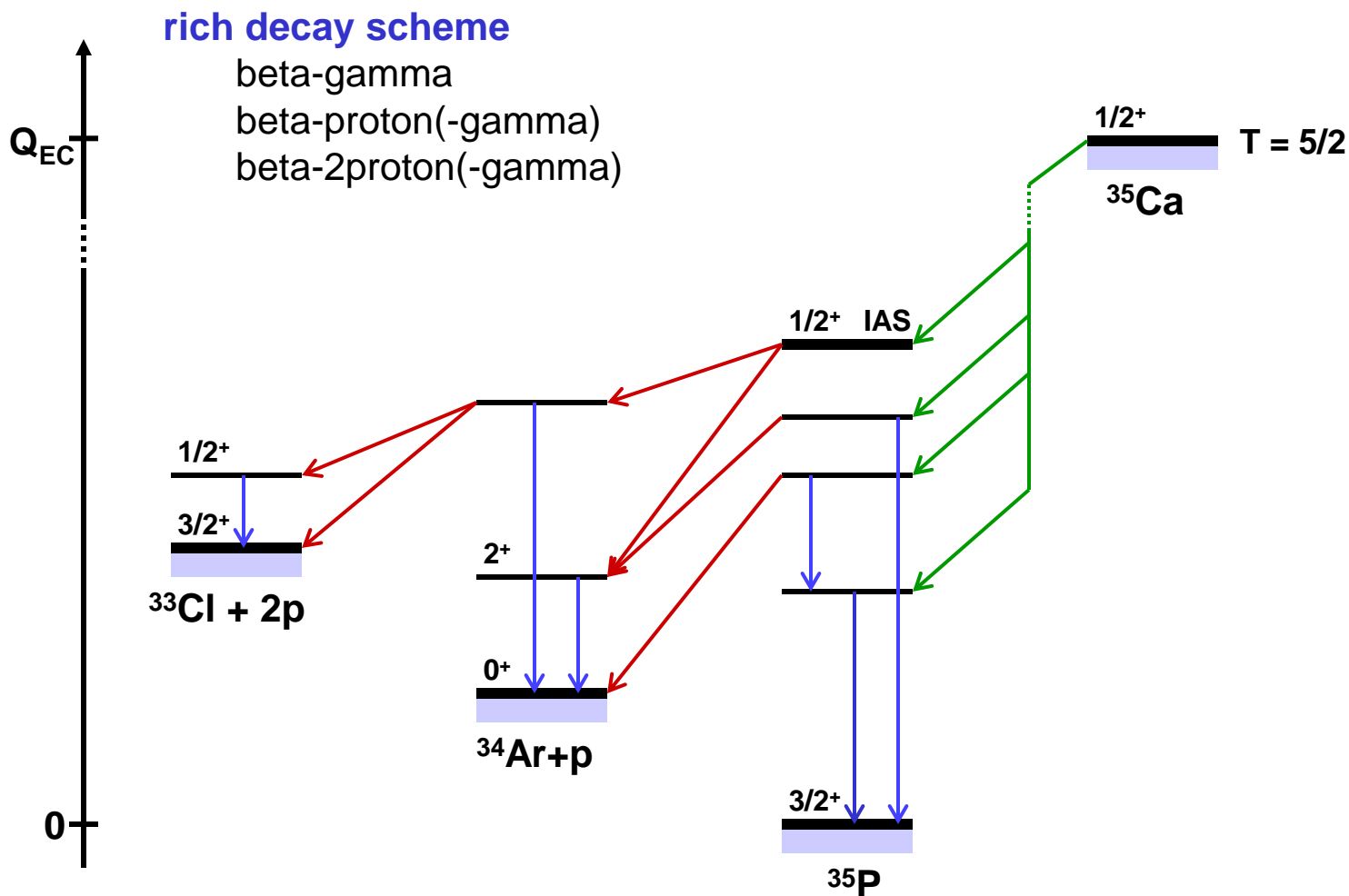
^{31}Ar experiment : **Phys. Rev. C 87, 055808 (2013)**
G. T. Koldste, H.O.U. Fynbo, et al.

mainly study of ^{30}S resonances (β -p)

- nucleosynthesis
- β -p(γ) and β -2p
- new experimental method for Γ_p / Γ_γ estimate



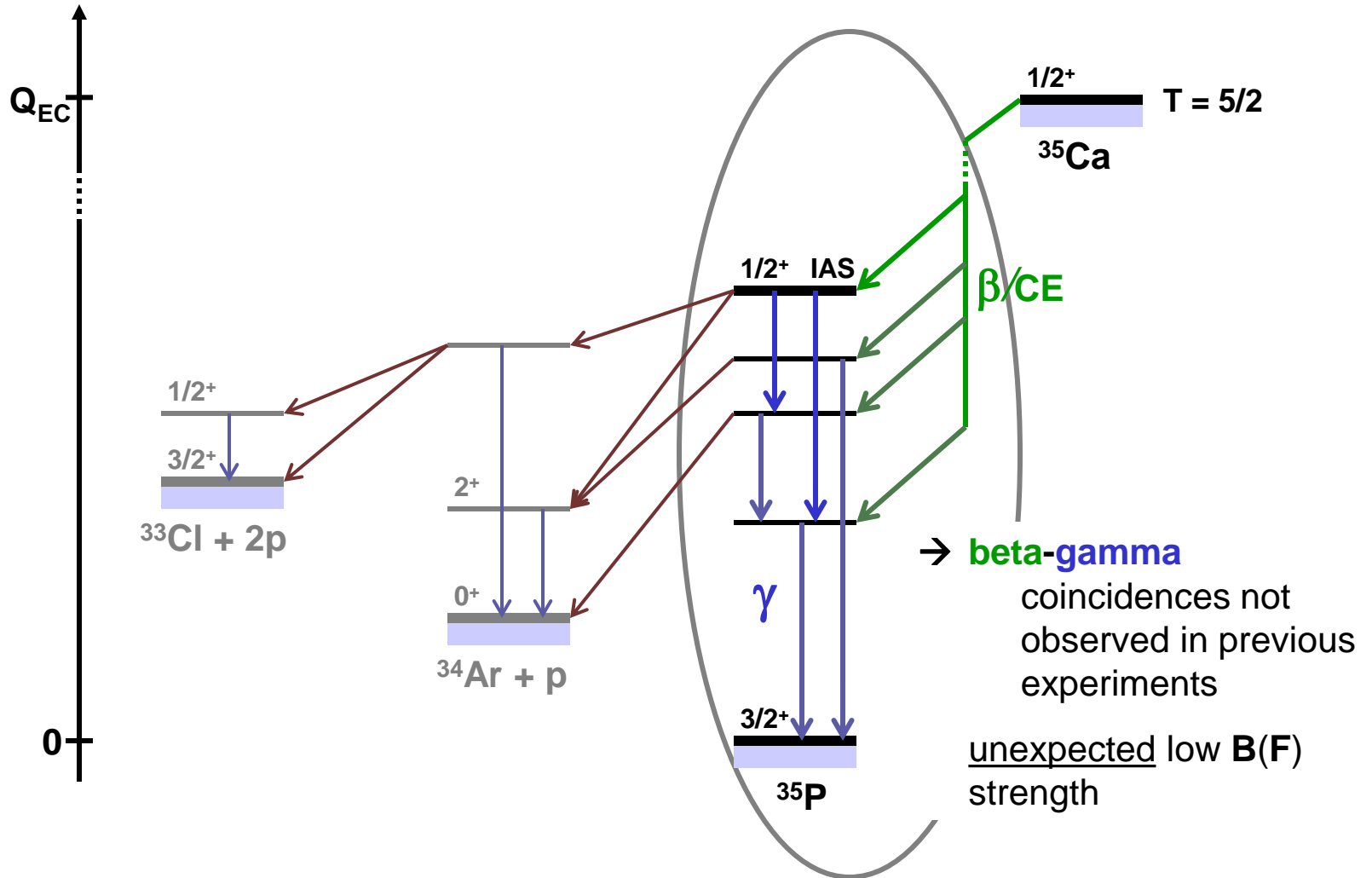
purpose of the experiment (I)



decay spectroscopy

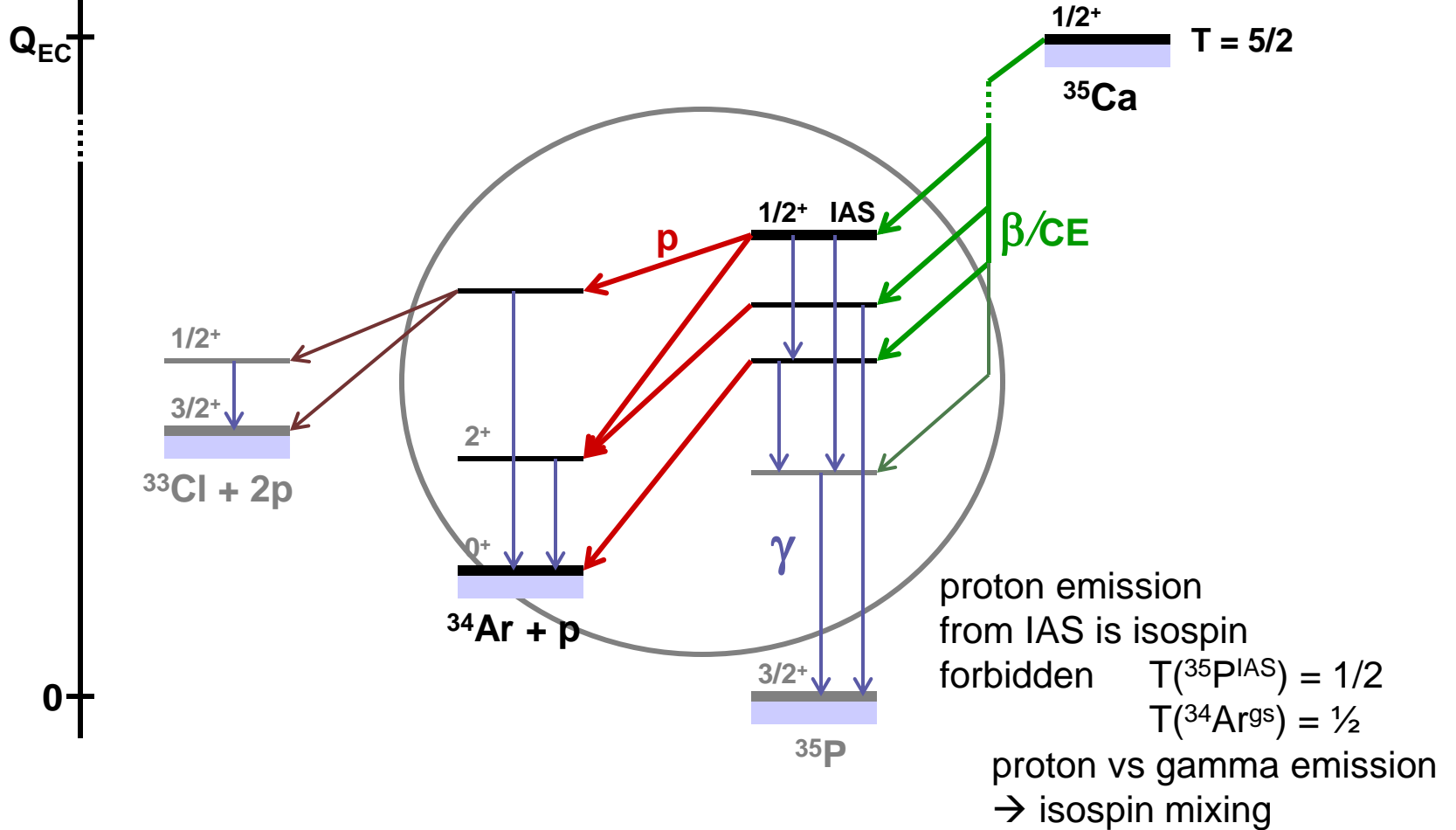
a unique access to drip-line nuclei

purpose of the experiment (II)

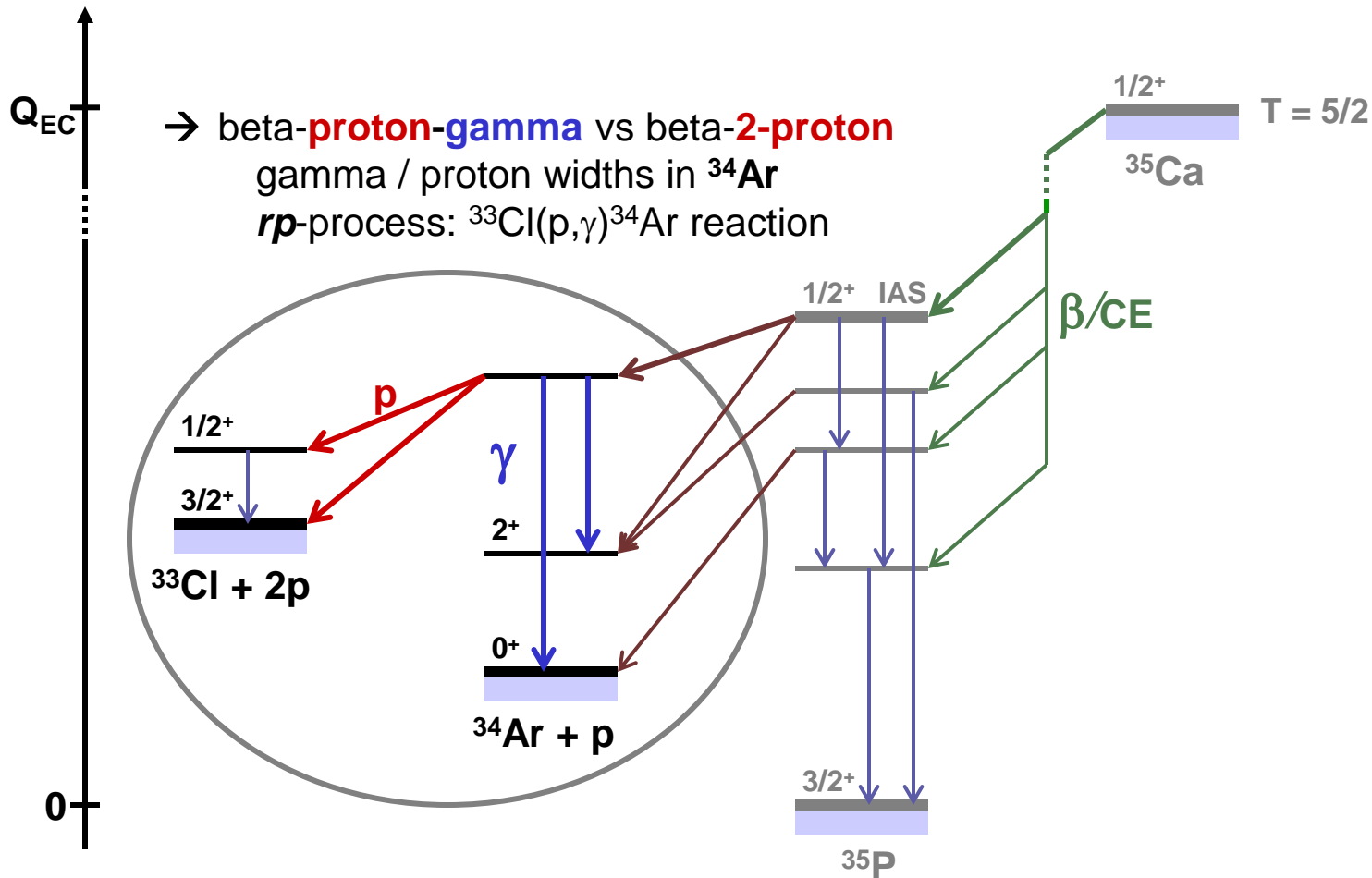


purpose of the experiment (III)

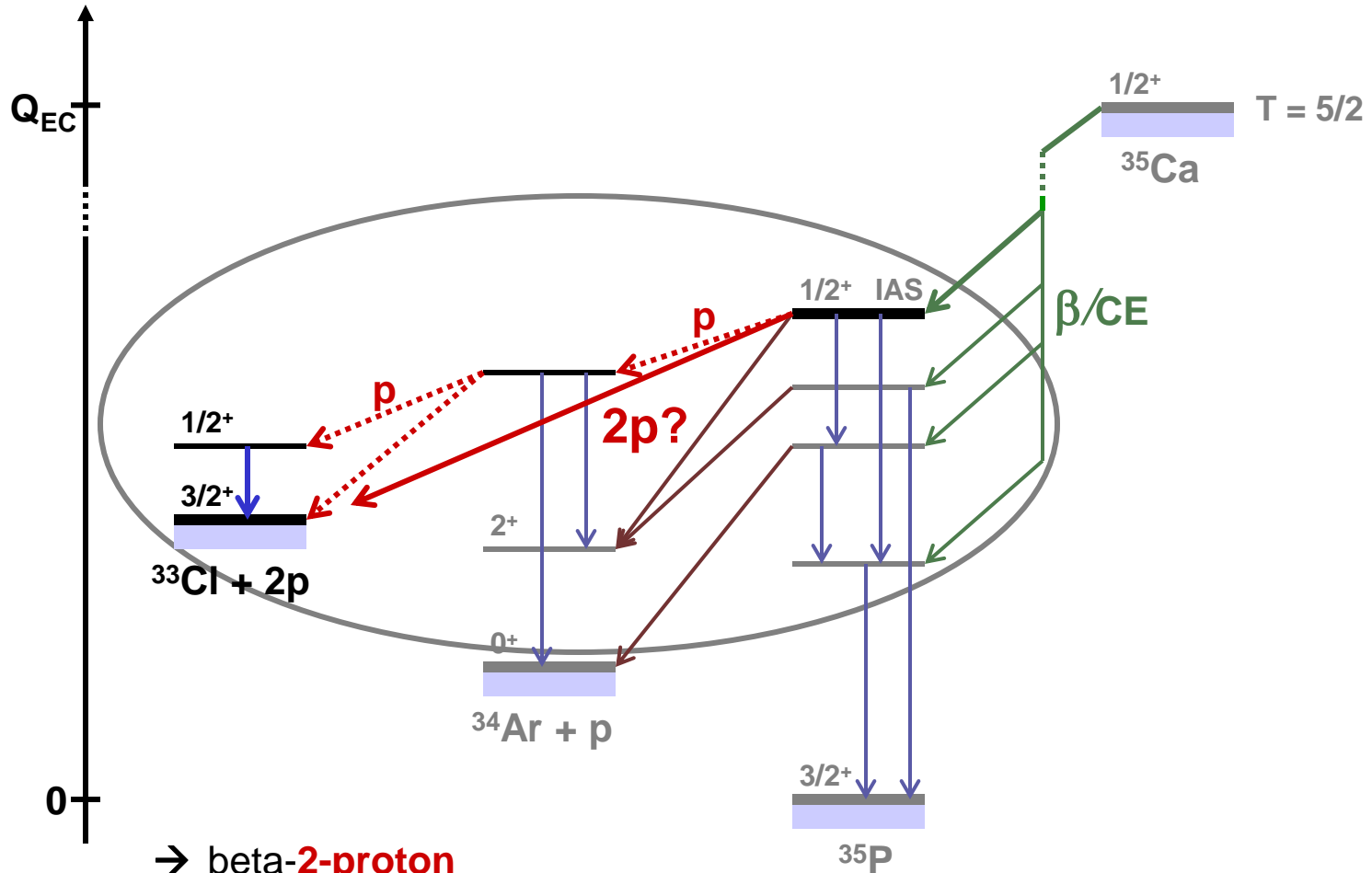
→ **beta-proton** unresolved proton groups (GANIL) → improved resol. **B(GT)** distribution (including β - γ ?)



purpose of the experiment (IV)



purpose of the experiment (V)

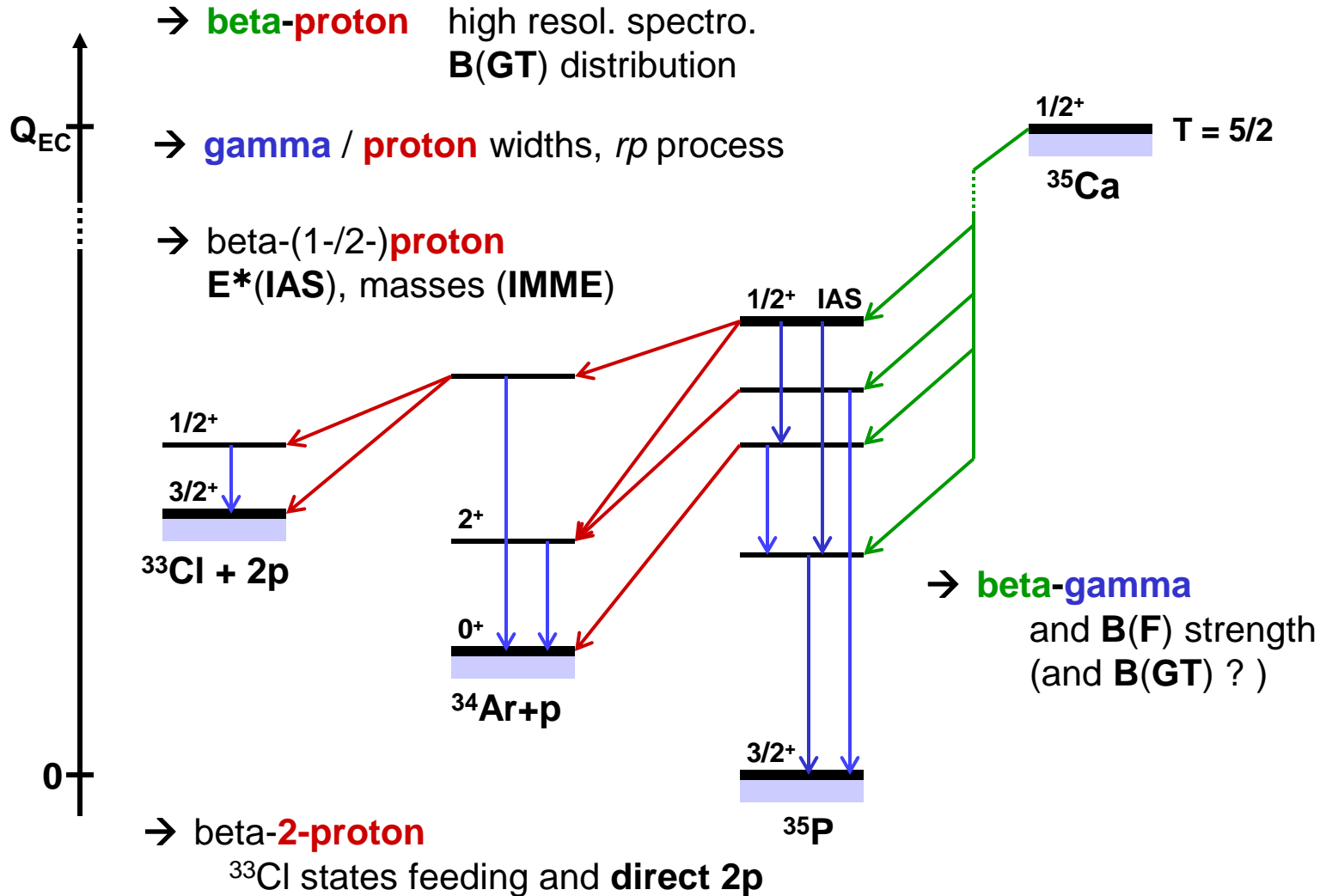


→ beta-**2-proton**

feeding of excited state in ^{33}Cl ? (seen at Berkeley, not at GANIL)

search for a **direct 2-proton** branch (never evidenced in $\beta 2p$)

purpose of the experiment (summary)



detection set-up (I): charged particles

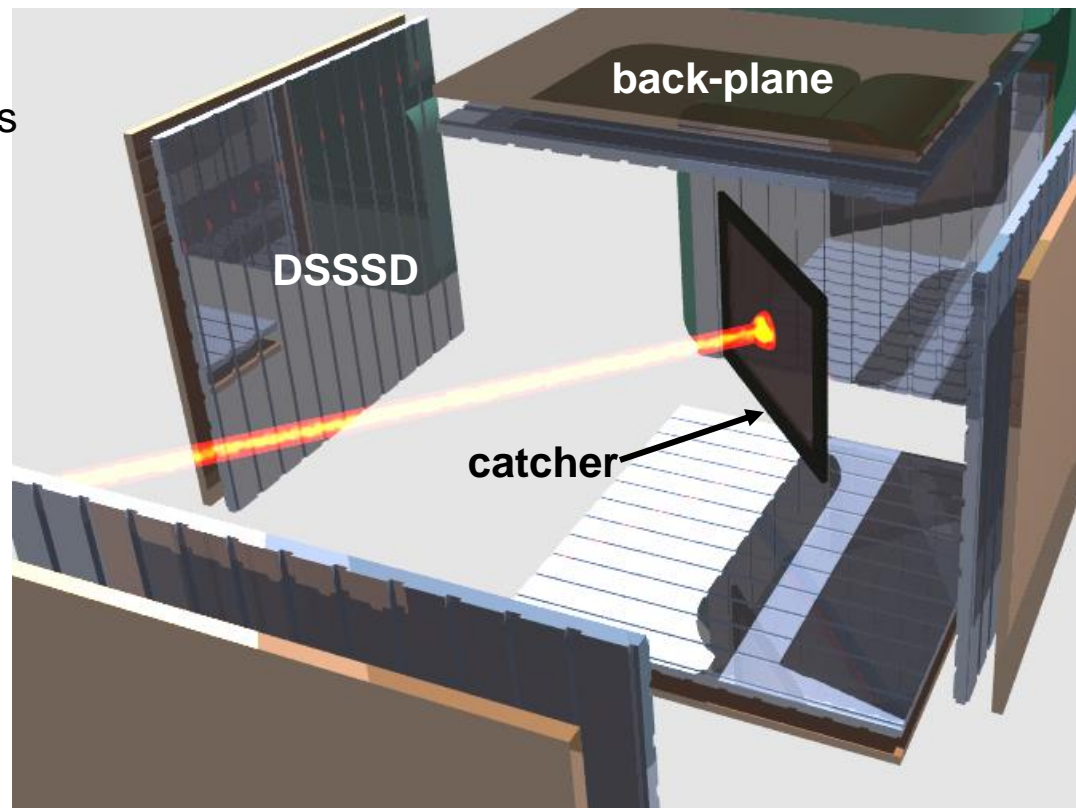
“Silicon-cube” device

- 6 **DSSSD** for protons → high granularity (2p emission angles)
- detection efficiency ~60% for 1 proton
- energy FWHM ~ 25 keV (low noise P.A.)

back-detectors

- beta suppression
- high-energy protons

ions deposited on a thin **mylar catcher**

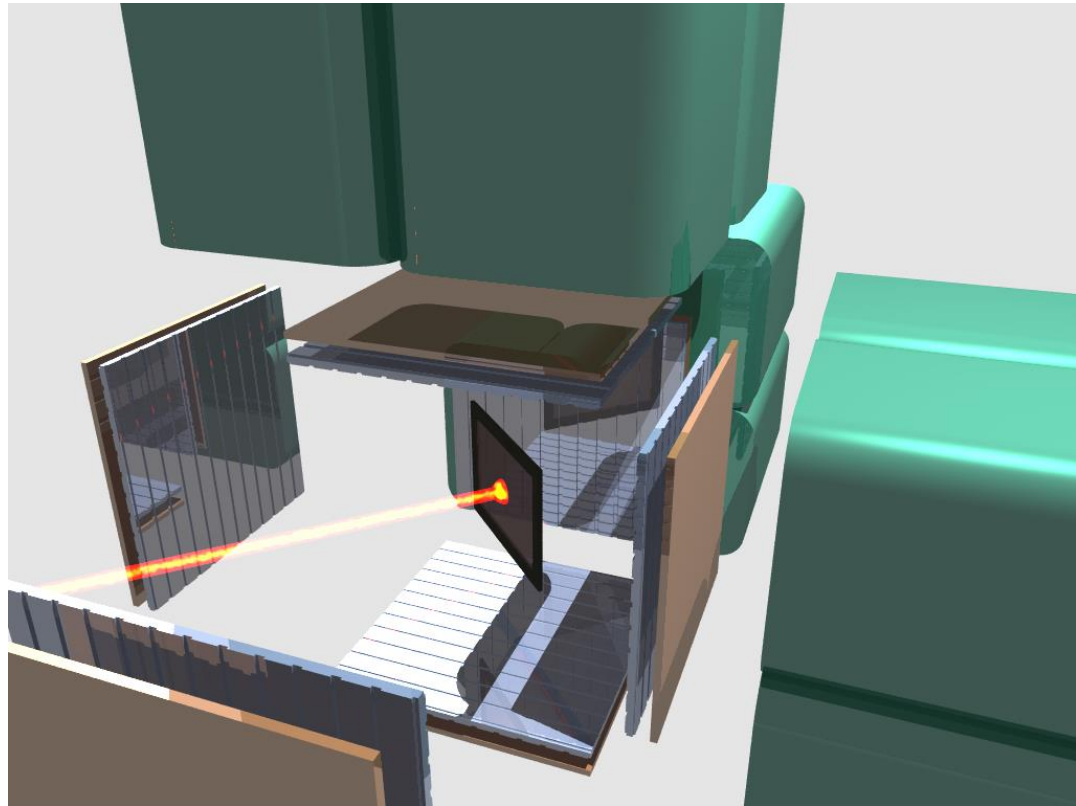


detection set-up (II): gamma-rays

Germanium detectors

2 Ge-clusters (si-cube originally designed for 3 Ge-clovers)
(^{31}Ar experiment with 2 MINIBALL clusters)

- high resolution
- efficiency ~10-15%
(at 1 MeV)
close geometry
(~8 cm)



beam-time request

production with *TiC* targets (under tests, unknown count rates)

measurements: cycles ($T_{1/2}$) ~ 1 shift (~20% “duty cycle”)
continuous production (**100%**)

experiment “duty cycle” **~75 %**

detection efficiency 1 proton **~50 %**
2 protons **~25 %**

daily count rates

	βp	$\beta 2p$ total	$\beta 2p$ direct
with 0.1 ^{35}Ca / s	3000	60	0.6 ?

beam-time request

- Beam and separator tuning **3 shifts**
- Set-up tuning and calibration ($^{37,36}\text{Ca}$...) **3 shifts**
- Experiment (^{35}Ca beam) **24 shifts**
- **Total** **30 shifts**



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thank you for your attention...