Understanding the ^{11}Be beta-p decay

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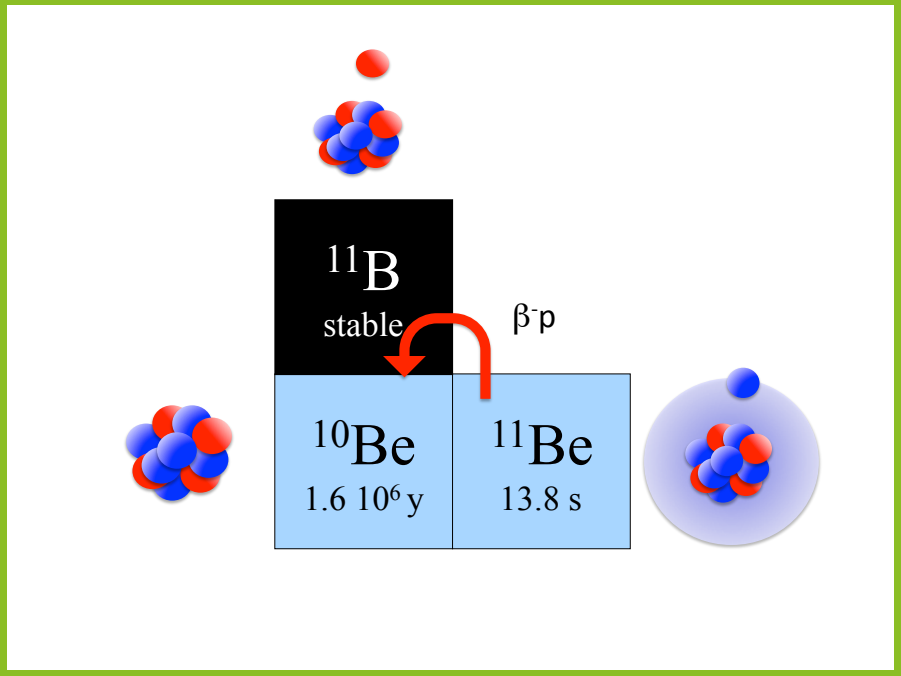


RESULTS OF IS541

› Observed ^{10}Be via AMS in a ^{11}Be sample
› Separation from contaminants: below 10^{-6} level
› Deduced branching ratio (8.3+-0.9) 10^{-6}
› Recently published, Phys.Lett. B732 (2014) 305

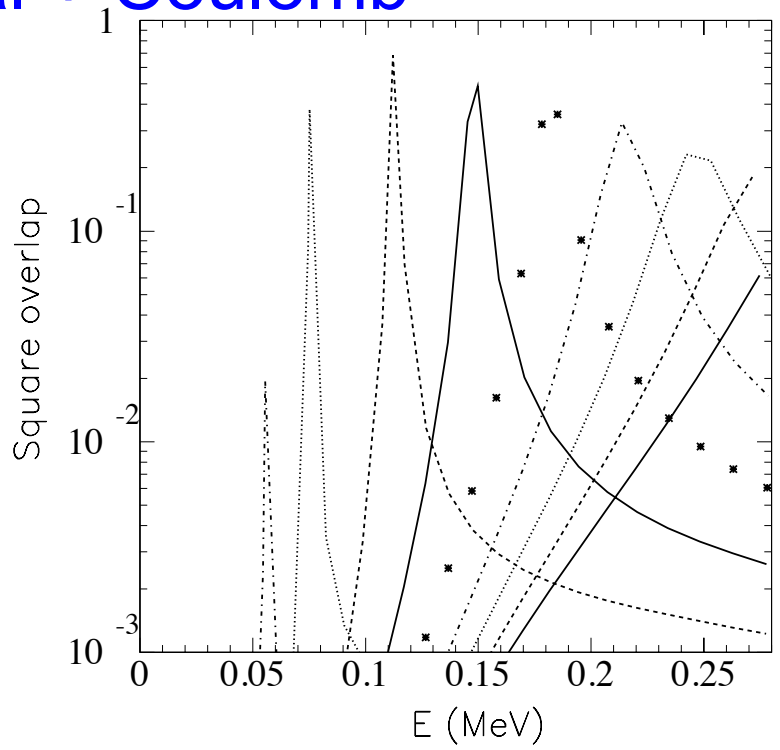
› Result consistent with 2001 measurement
› Branching ratio much higher than predictions

› Calculations – must be tested
› Need to verify the branching ratio

THE SIMPLE MODEL

- ^{11}Be as ^{10}Be+n, simple potential
- ^{10}Be+p with similar potential + Coulomb
- Discretized continuum
- See “resonance”:

- Potential depth unknown
- Can find branching ratio

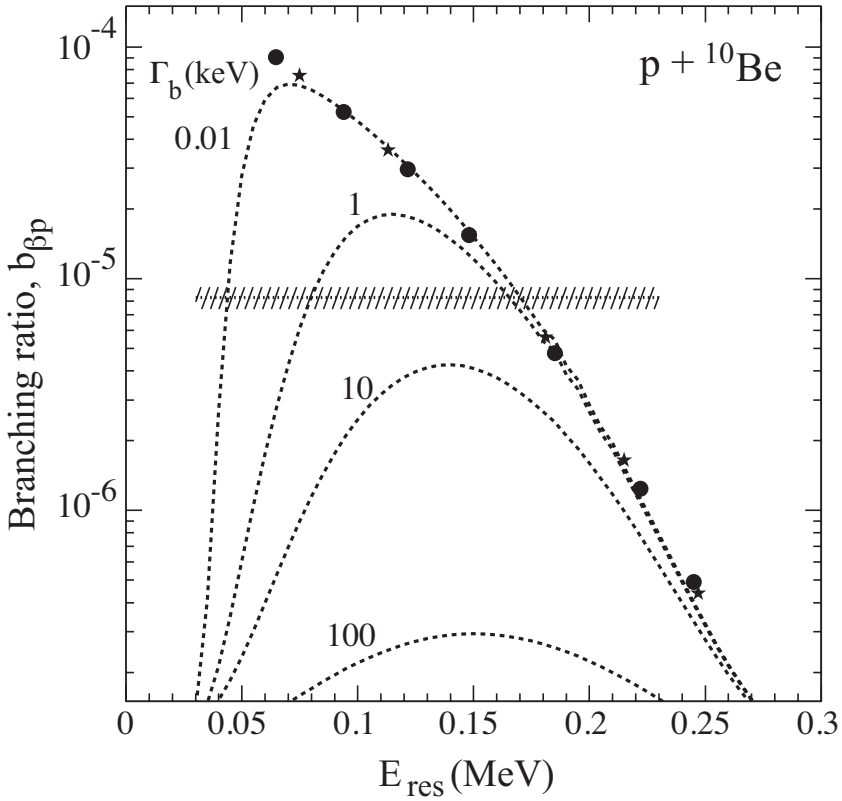


RESULTS OF SIMPLE MODELS

- Branching ratio from continuum model (symbols)
- + from R-matrix (curves)
- Gamma$_b$ = other decays
- Theory assumes B_{GT}=3

- Experiment = band

- New resonance needed
- 50 keV < E_{res} < 200 keV
- Mainly proton decaying



ISOSPIN…

› Use the simple single-particle picture (e.g. Bohr and Mottelson, vol 1, p. 315-6):

› IAS = 1/3 "^{10}Be+p" and 2/3 "^{10}B(T=1)+n"
› Exp: at 12.554(13) MeV, 1.325 MeV above ^{10}Be+p threshold

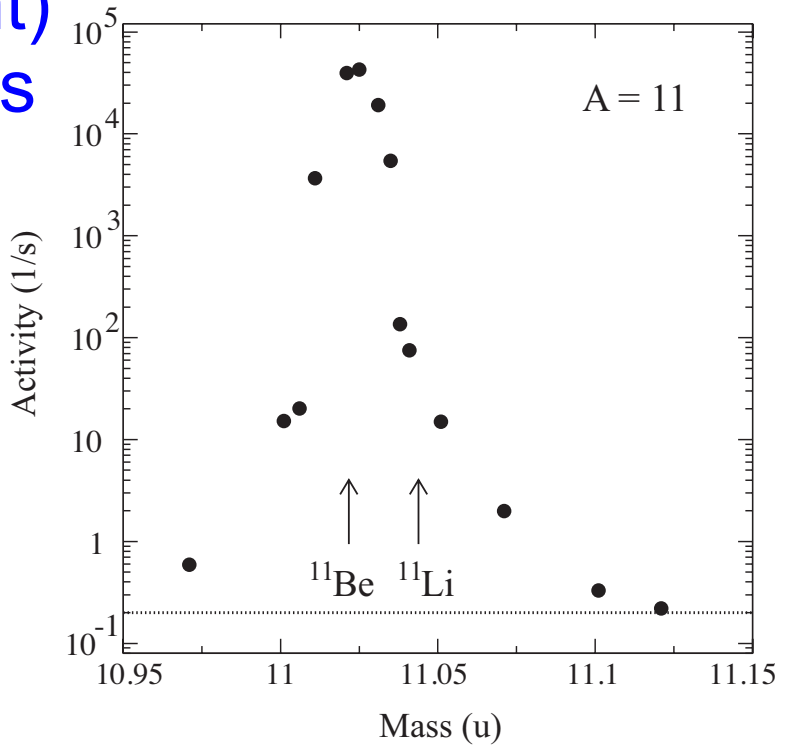
› Anti-analogue = 2/3 "^{10}Be+p" and 1/3 "^{10}B(T=1)+n"
› Theory estimation of position ?
› Would explain (not just parameterize) why the decay is strong

IS541 REMAINING SHIFTS

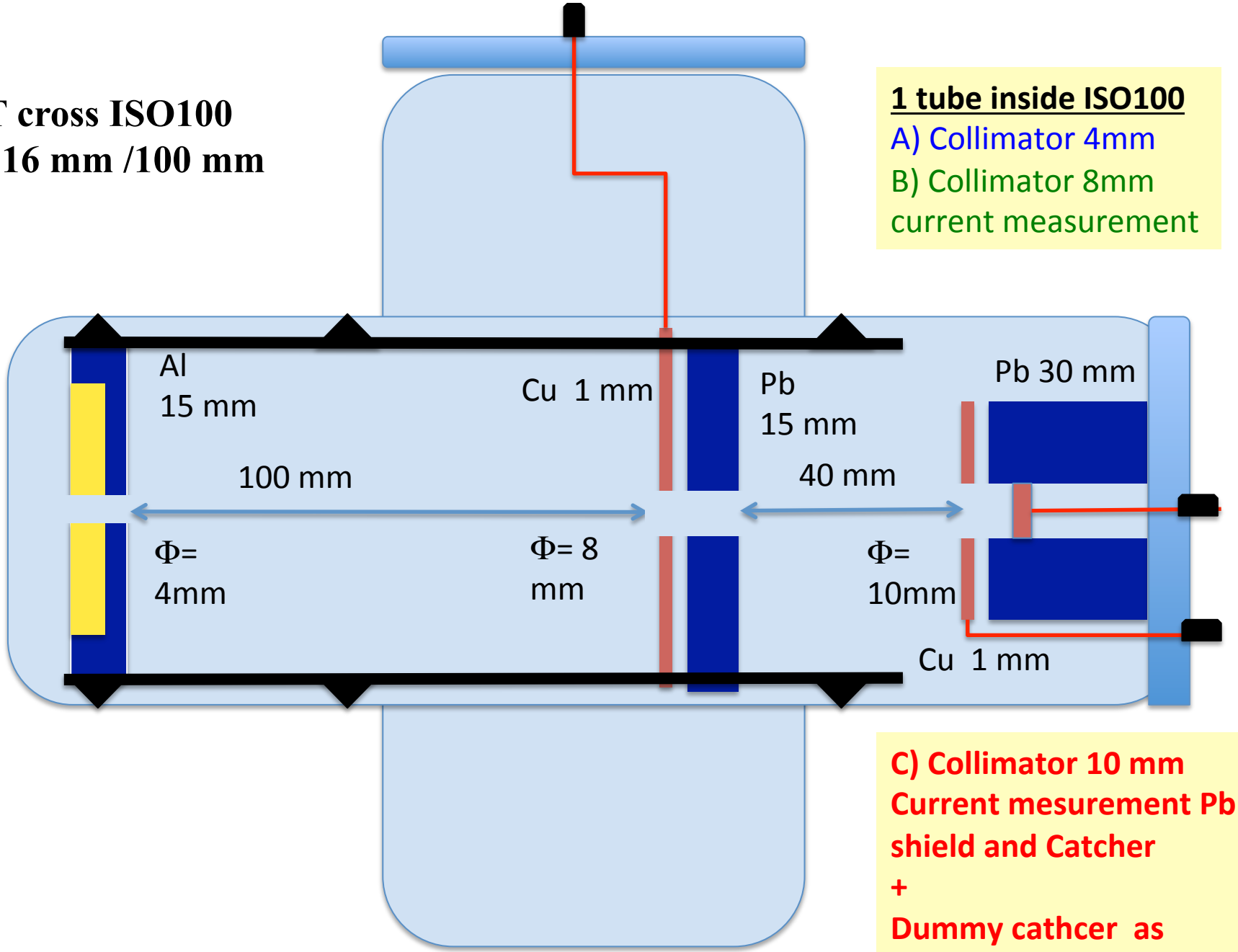
› Use our remaining 5 shifts to redo the exp (need less collection time than first thought)
› Include more systematic checks

› Keep the set-up ?
› Skip current reading ?
› More gamma-ray detectors ?
› Different shielding ?

› Detect protons directly ??

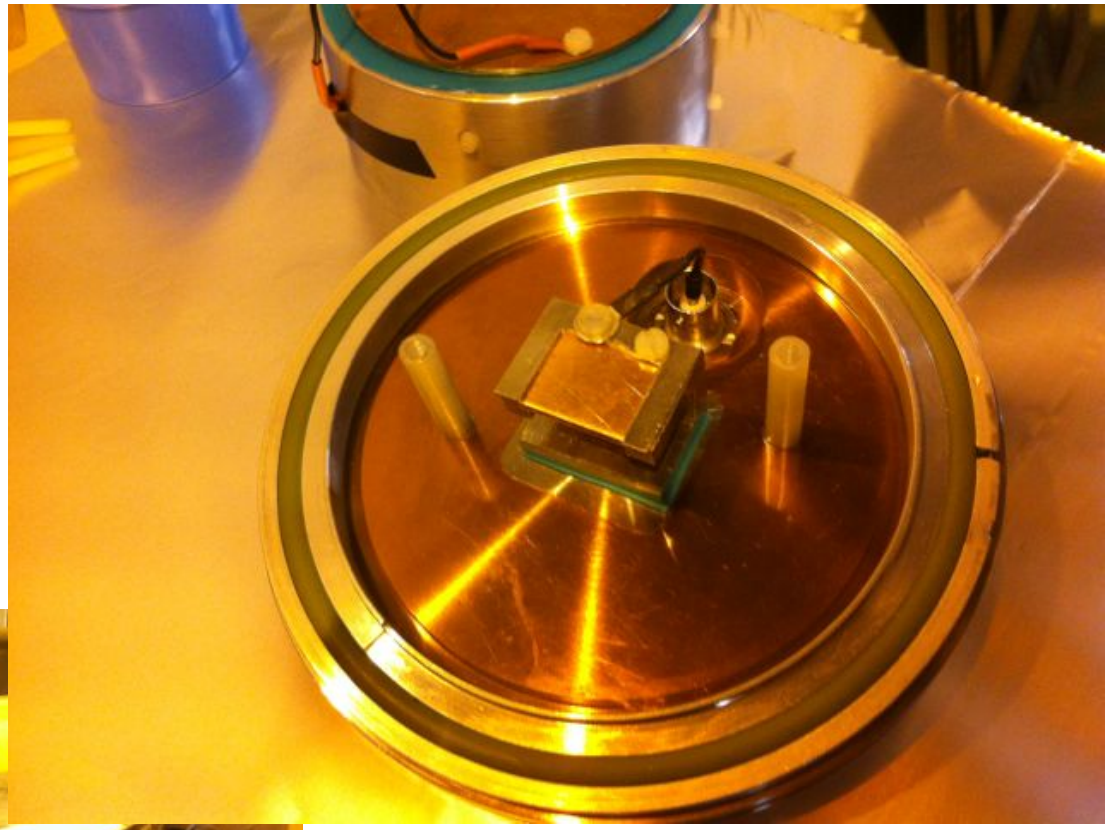


T cross ISO100
216 mm /100 mm



1 tube inside ISO100
A) Collimator 4mm
B) Collimator 8mm
current measurement

C) Collimator 10 mm
Current mesurement Pb shield and Catcher
+
Dummy cathcer as F-cup during setup



SEE THE RESONANCE DIRECTLY?

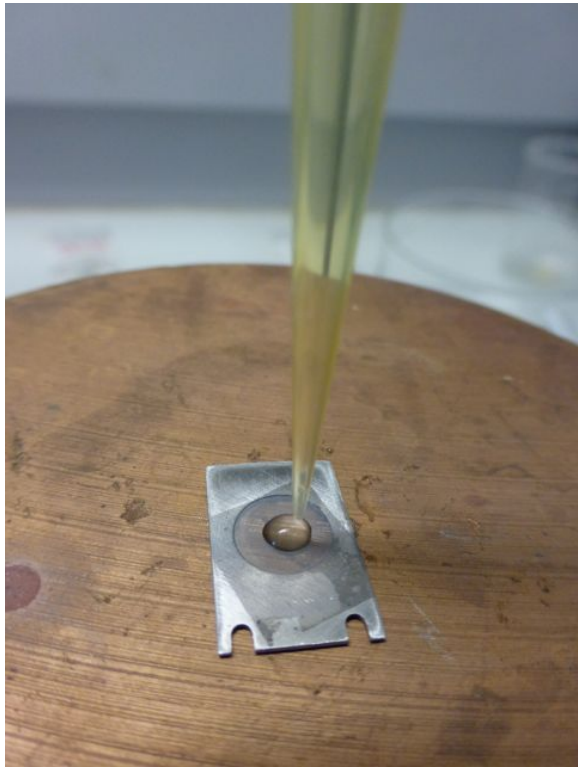
› Expect it to be visible only in p+^{10}Be scattering
› Not seen in any earlier experiment

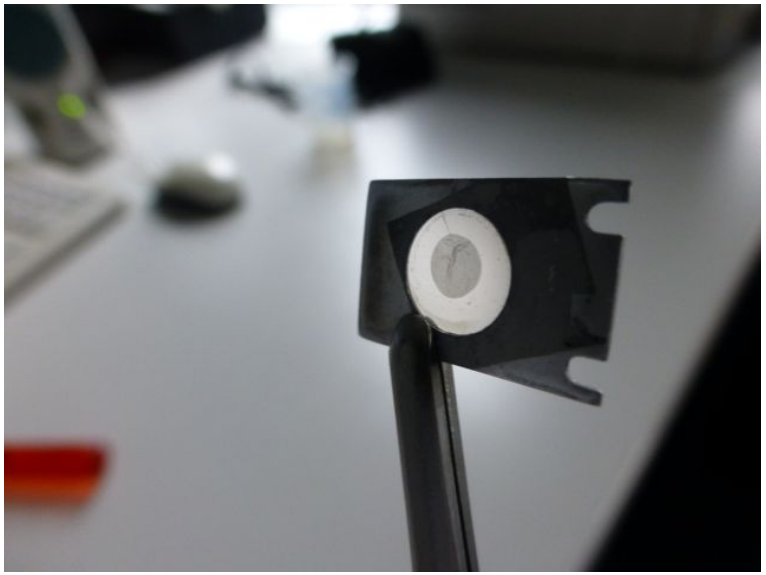
› Aarhus: low-E p-beam on ^{10}Be target
› Targets made at PSI

› Other approach: inverse kinematics !
› At ISOLDE or with off-line source ??

Target preparation at PSI

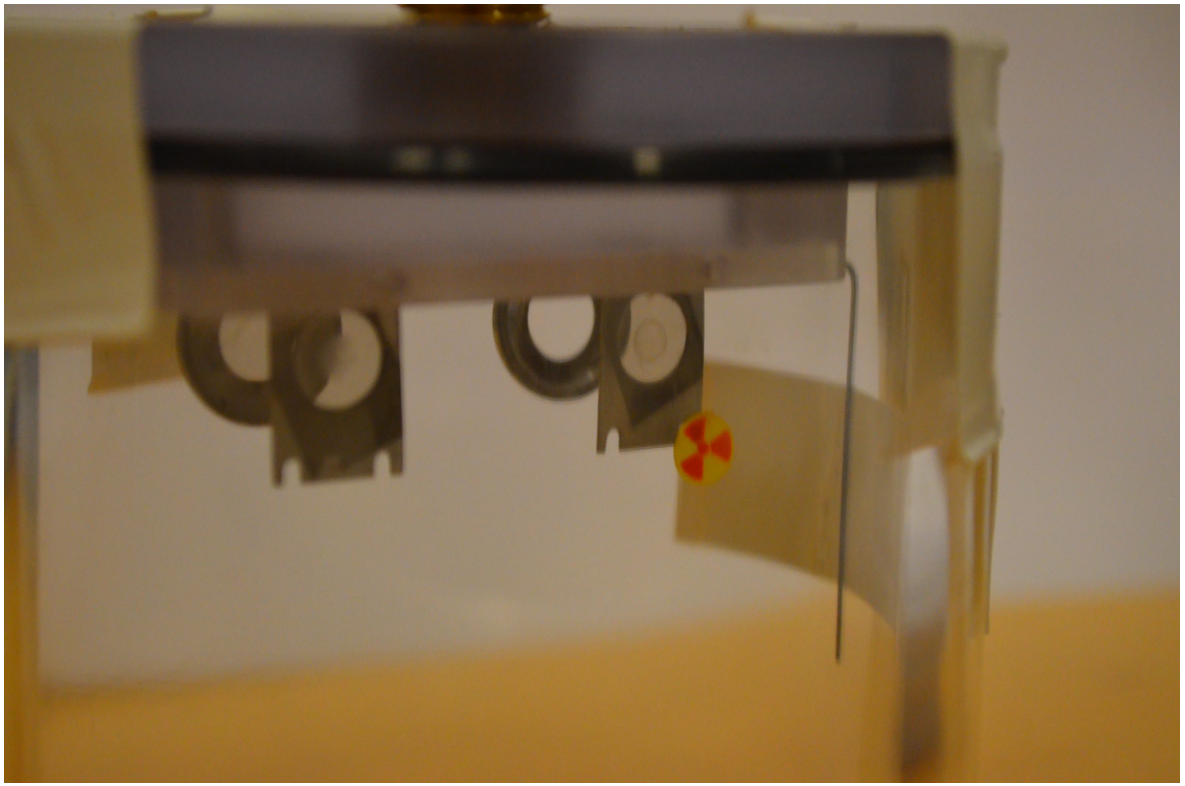
Stephan Heinitz, Dorothea Schumann…





CURRENT TARGET

› 25 microgram/cm^2 $BeCl_2$ on 4 microgram/cm^2 C
› Several other components, including ^{9}Be (2.4:1)
› First test at Aarhus



EXPERIMENT IN AARHUS

- Should use p-beam 100-250 keV
- Look at backward angles (lowest Rutherford cross-section and best separation of protons)

- Less than 10 keV separation of protons from scattering on mass 10 and 12…

- Energy loss in target about 10 keV
- May not get conclusive result !