Status of the primary target for the hypernuclear experiment

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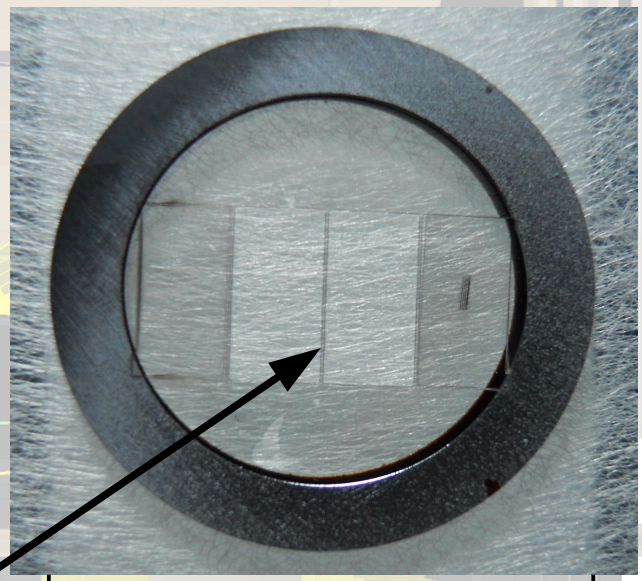
Filament target

Task of the primary target:
production of slow $\bar{\Xi}^{+}$

Requirements:

- **minimal hadronic background in backward direction**
- **constant luminosity of $\bar{p}$-beam**
  ⇒ beam losses, mainly due to coulomb scattering, must be kept low

⇒ ^{12}C micro-wire target with thickness 3 µm, width 100 µm



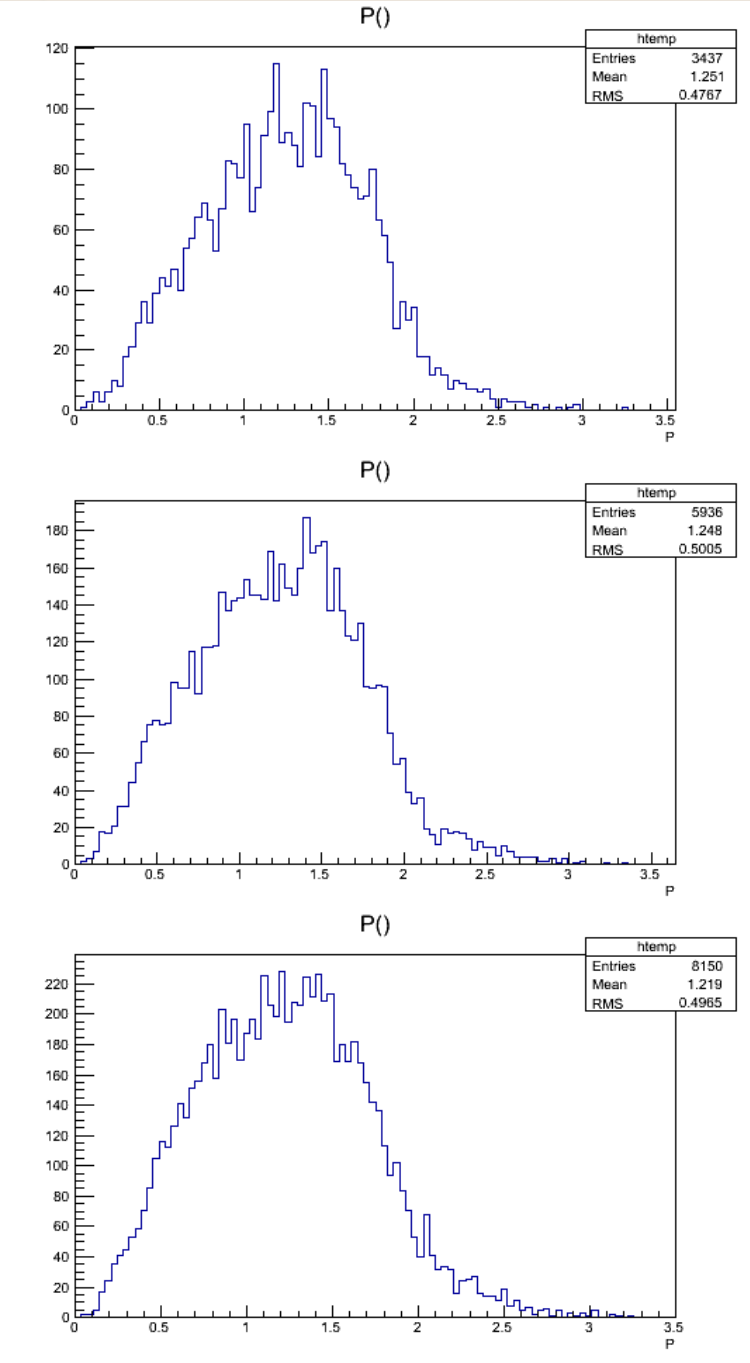
But also other reactions simulated in GiBUU calculations:

- **$\bar{p}$ + ^{28}Si**
- **$\bar{p}$ + ^{48}Ti**
- **$\bar{p}$ + ^{59}Ni**
- **$\bar{p}$ + ^{64}Cu**
- **$\bar{p}$ + ^{184}W**

GiBUU simulations

15.84 million reactions

- $\bar{p}$ + ^{12}C (3437 Ξ^-)
- $\bar{p}$ + ^{28}Si (5936 Ξ^-)
- $\bar{p}$ + ^{48}Ti (8150 Ξ^-)



Increasing number of Ξ^- for higher Z

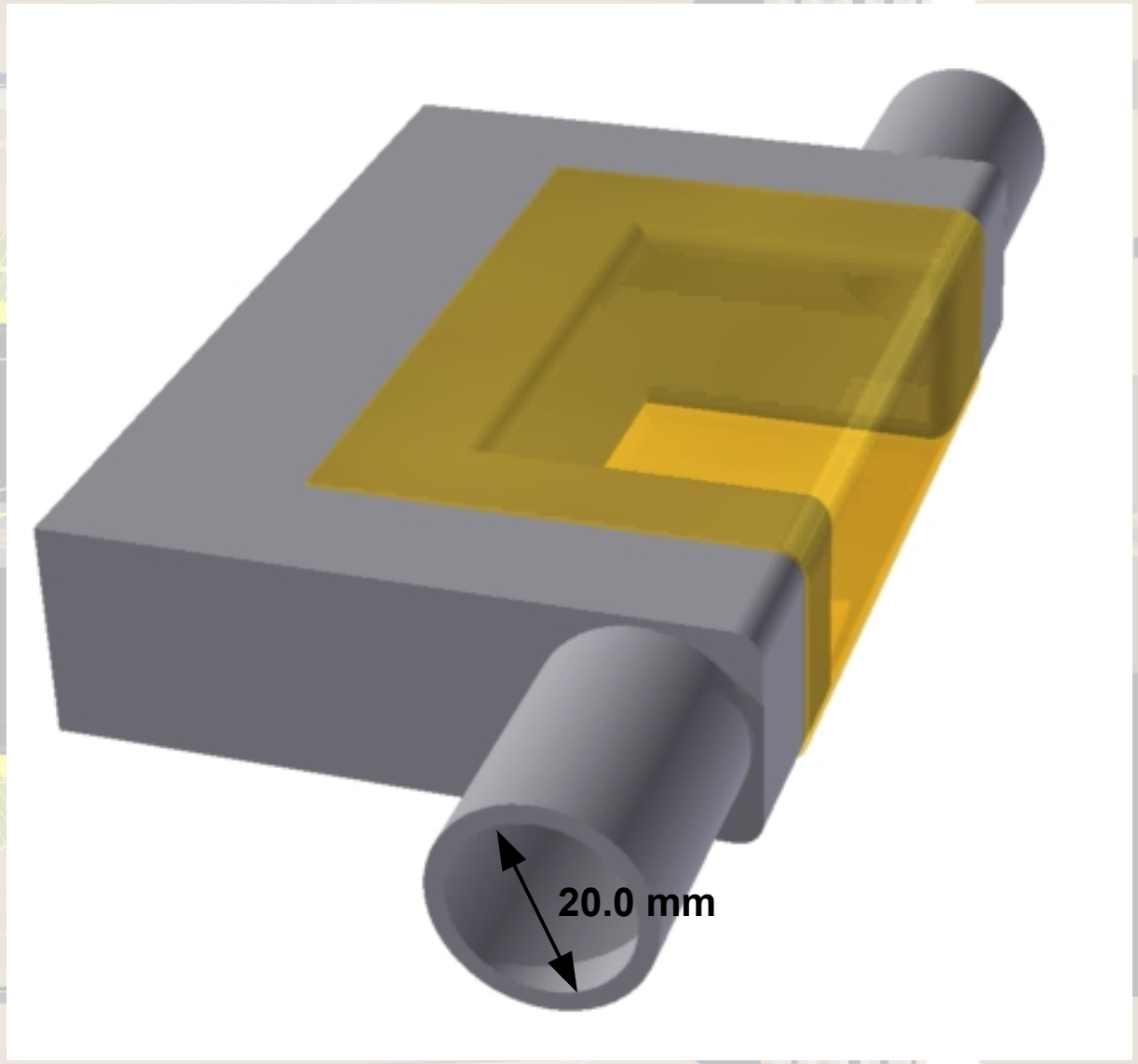
but background (n, π) and beam losses have to be considered

Target chamber

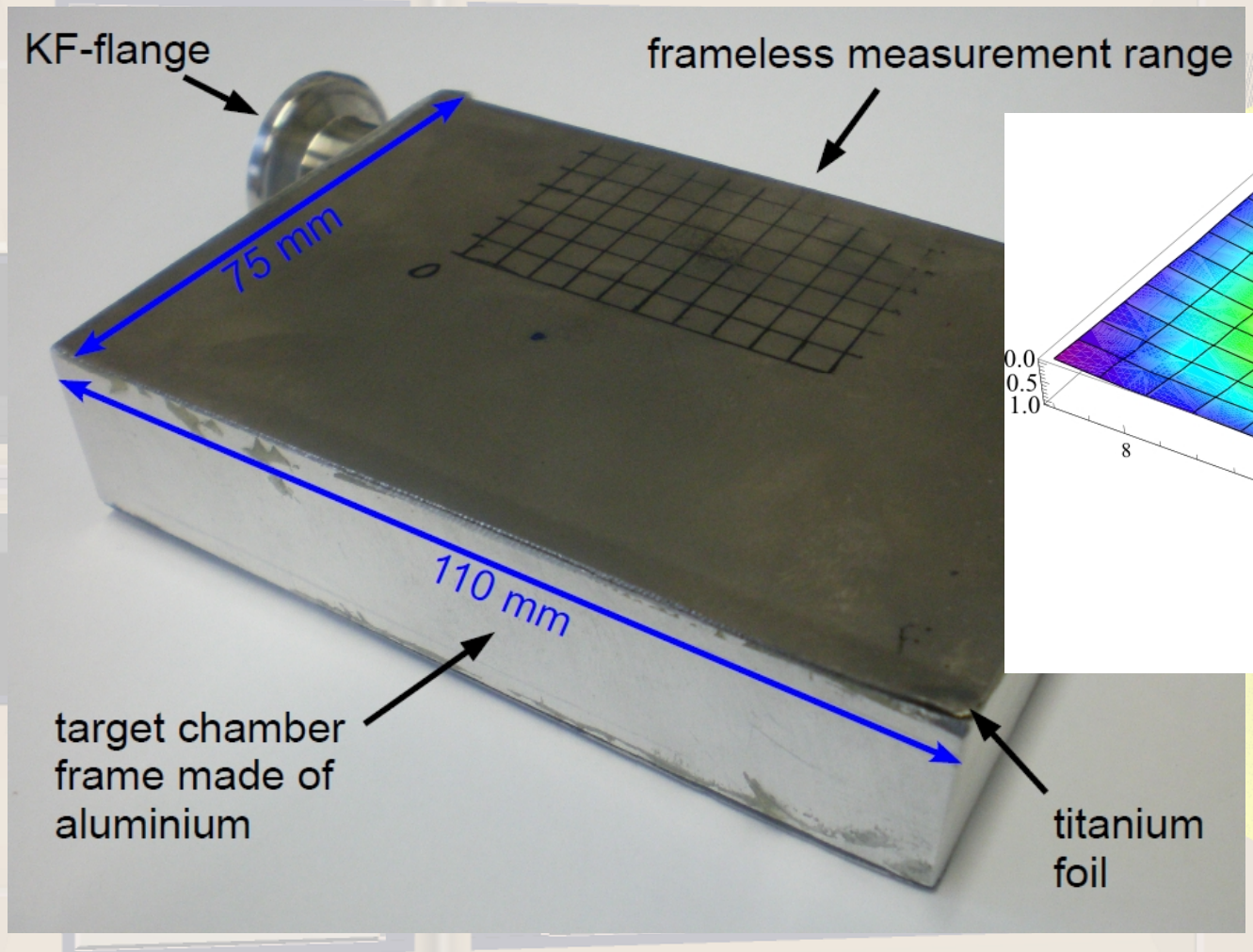
Target chamber with beampipe

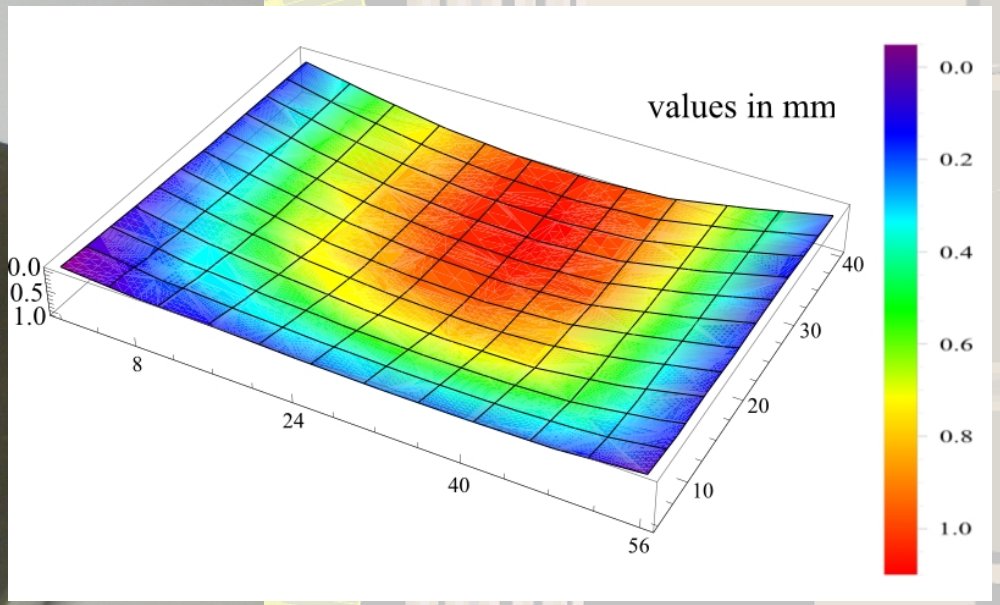
- **former simulations: layers of secondary target as close to vertex as possible**
- **minimal free area for beam steering with 20 mm diameter**

⇒ fixed dimension: 20 mm inner height of target chamber and inner diameter of beampipe

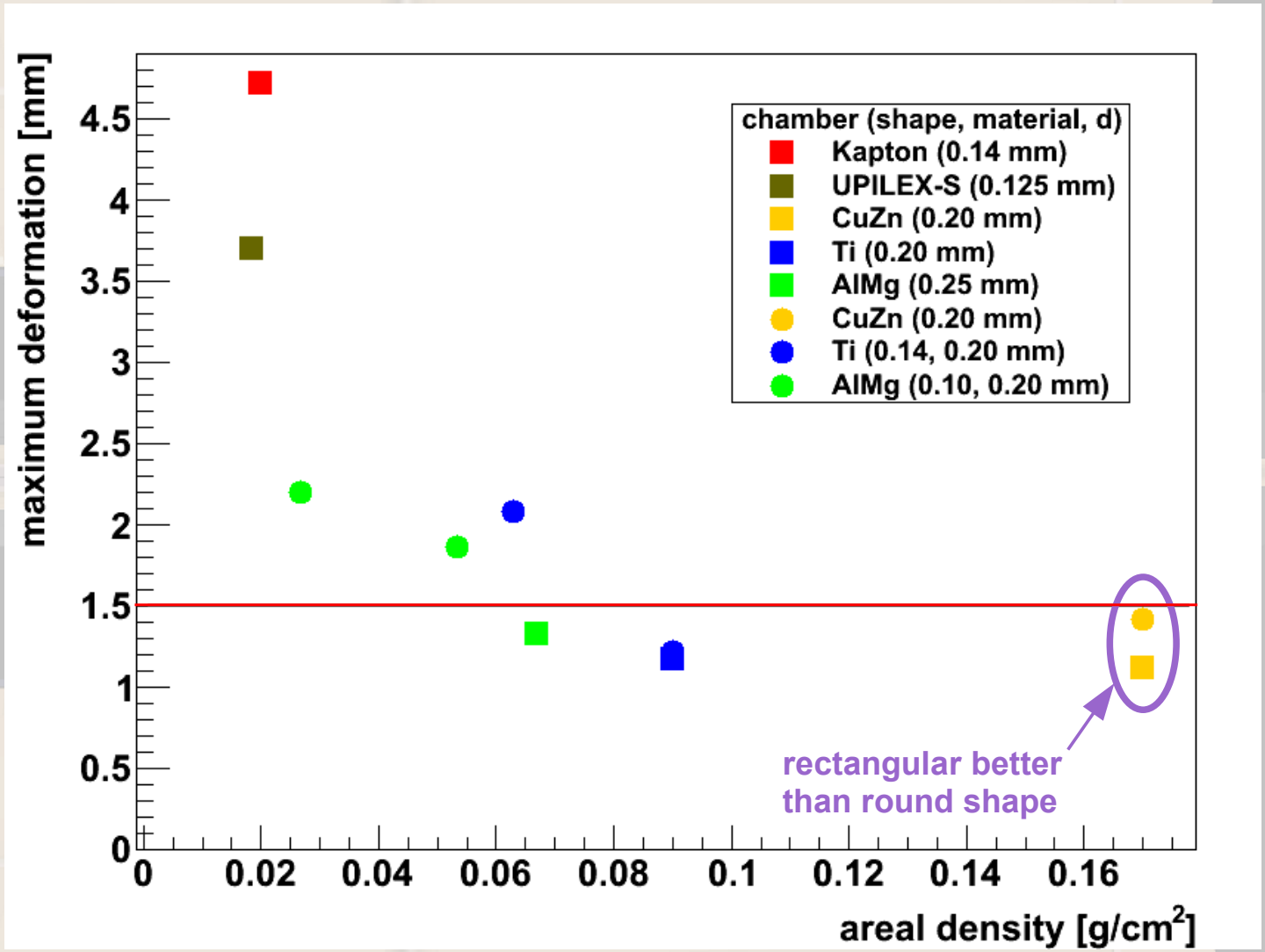


Bending measurements





Bending measurements



Conclusion:

possible materials:

- **titanium 200 µm**
- **AlMg 250 µm**

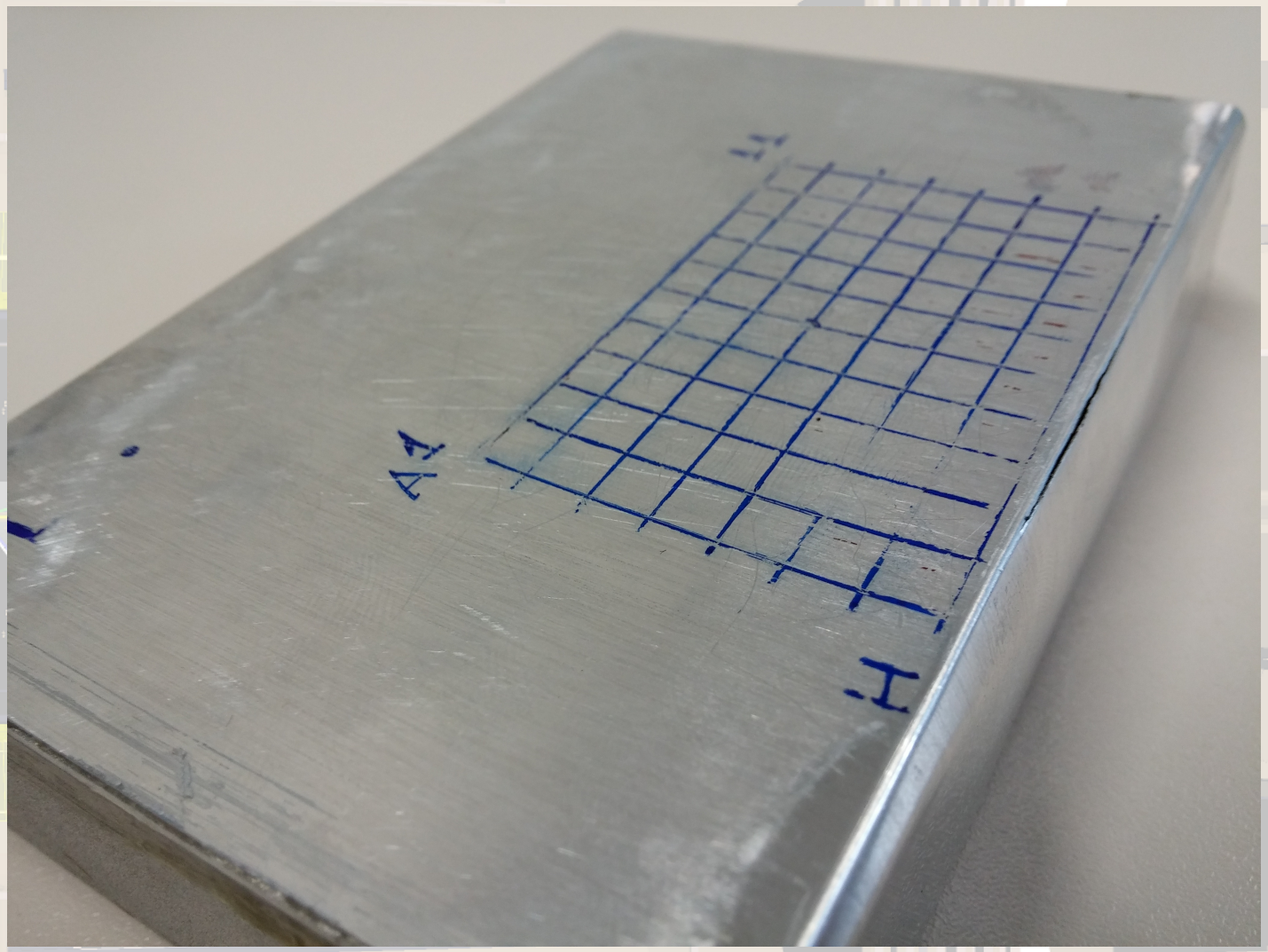
shape:

lower deformation with rectangular frame

but AlMg teared at one edge after 1600 cycles

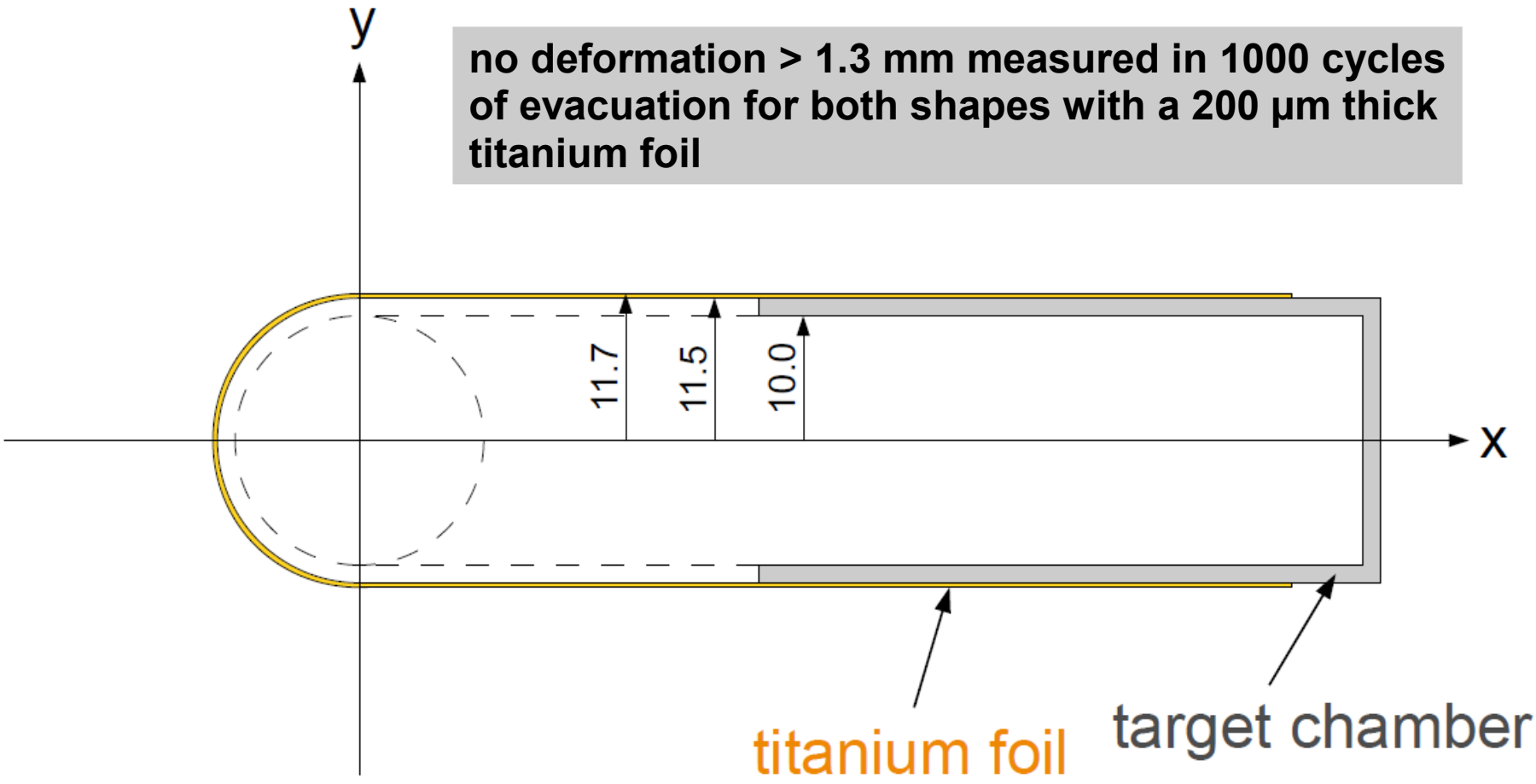
Bending measurements

Crack in 250 µm thick AlMg3 foil along the edge



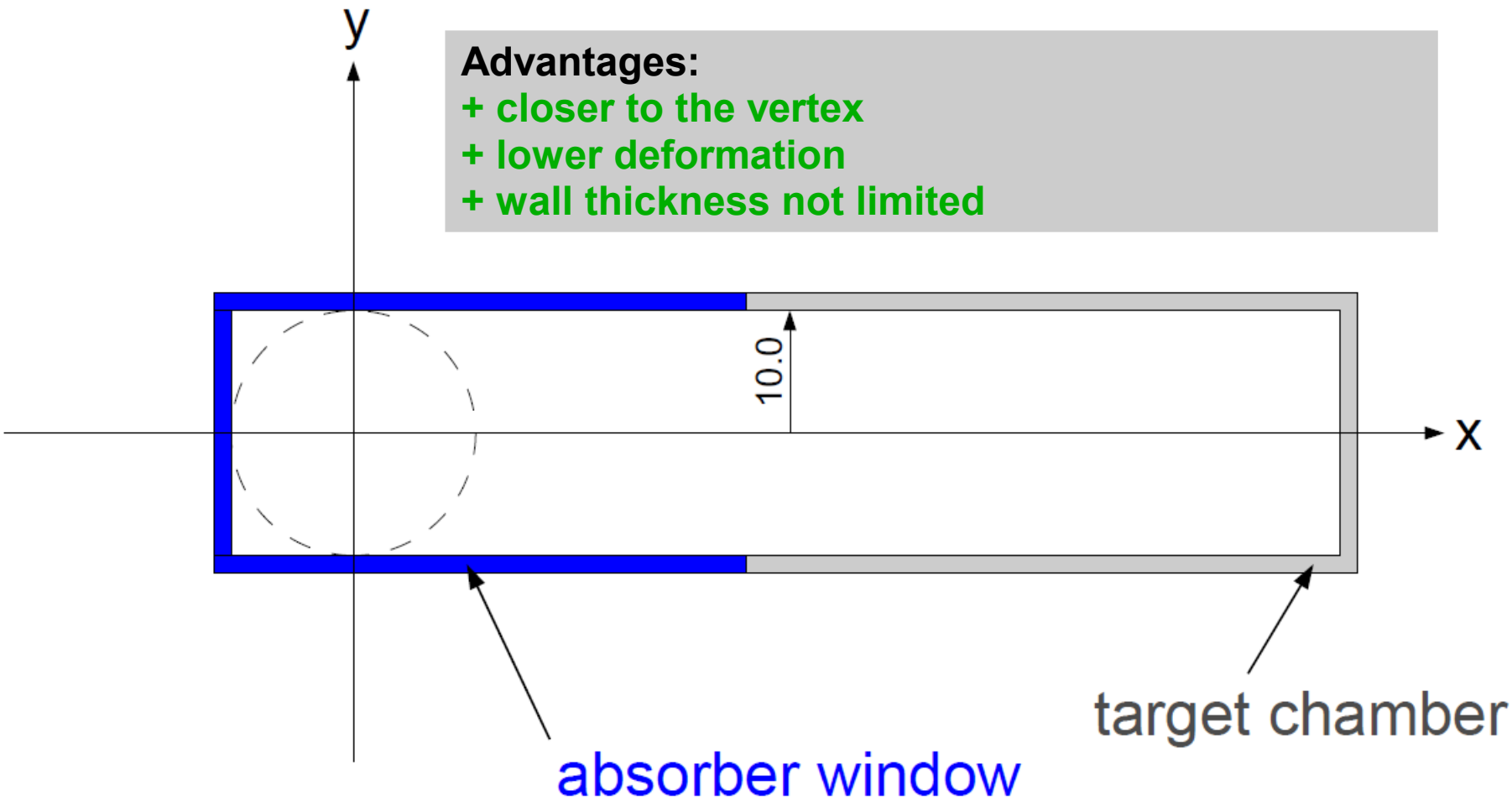
Target chamber dimensions

no deformation > 1.3 mm measured in 1000 cycles of evacuation for both shapes with a 200 µm thick titanium foil



Alternative design

Advantages:
+ closer to the vertex
+ lower deformation
+ wall thickness not limited



Absorber window

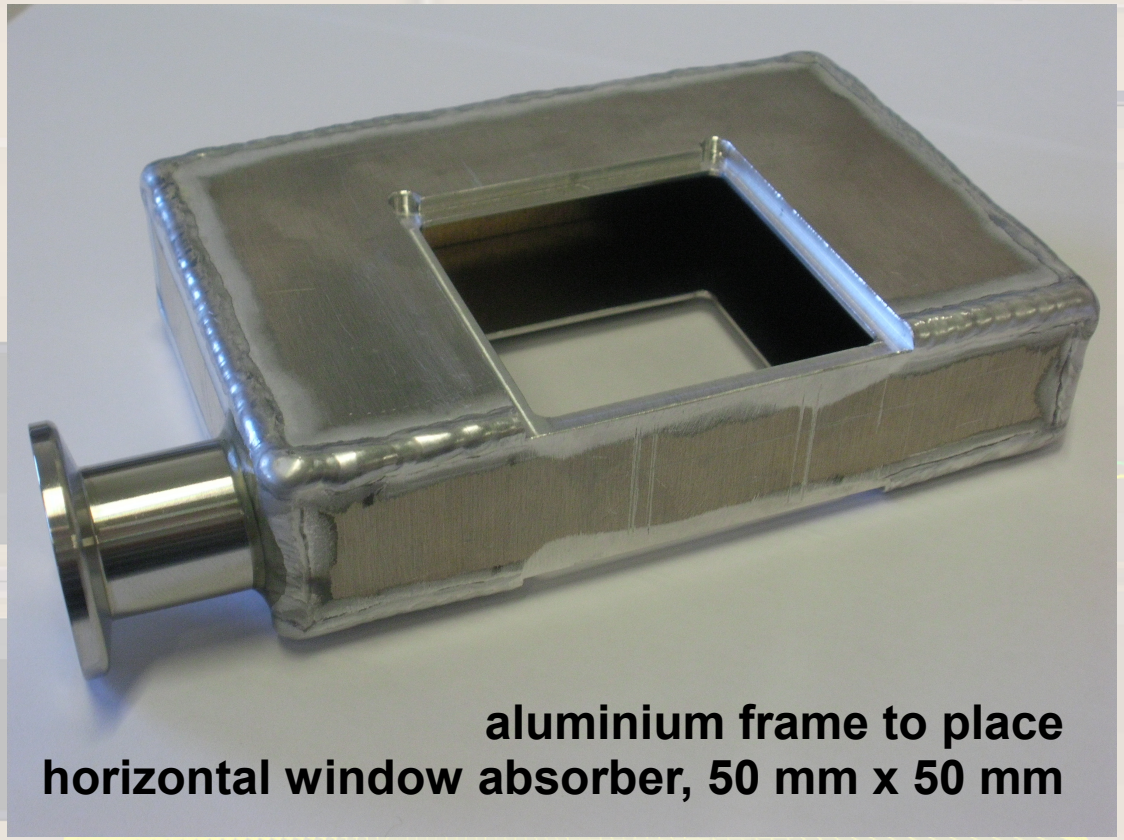
Material requirements:

- **light absorbers planned for secondary target: Be, B, C**
- **mechanical stability**
- **ideally vacuum capable**

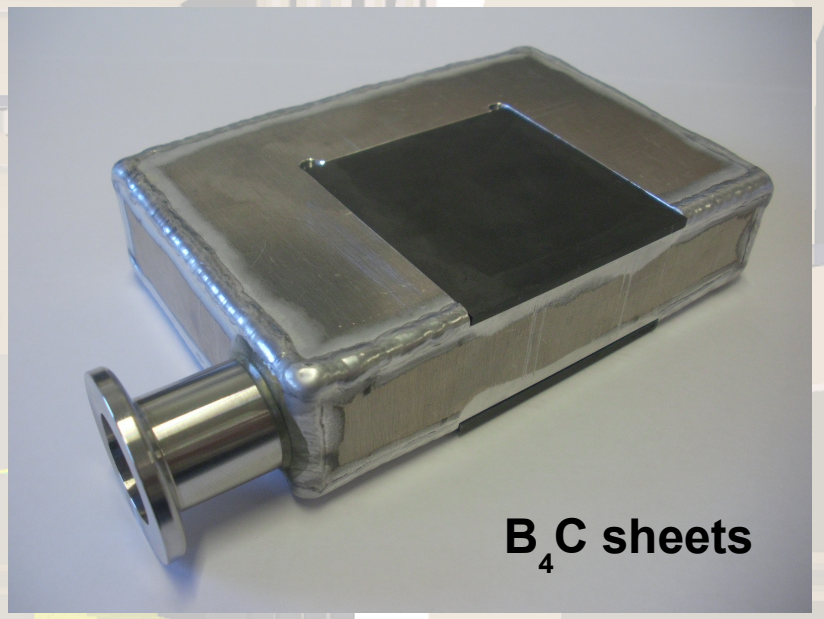
Possibilities:

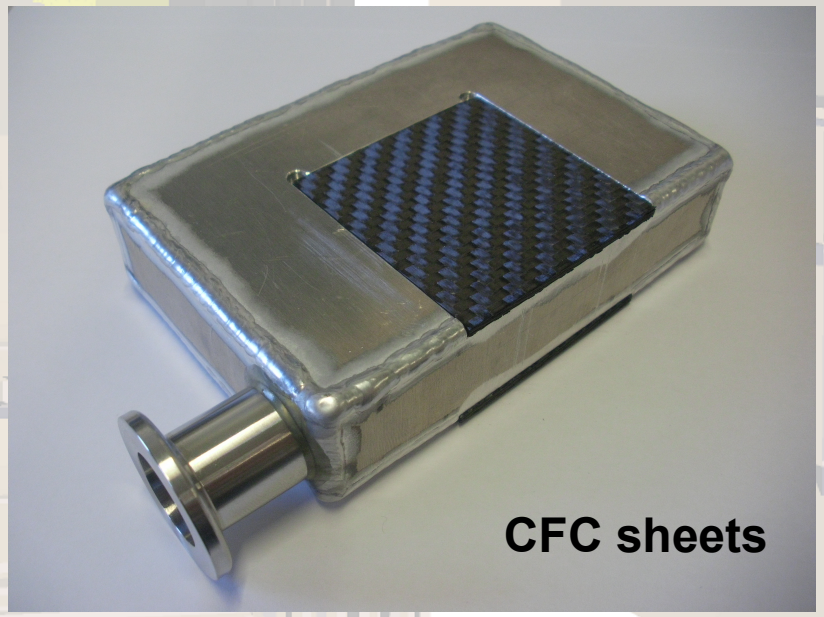
- **Be (- very toxic, not useful for first tests)**
- **C → CVD diamond (- very expensive)**
- **C → CFC (- not vacuum capable)**
- **B (- only few distributors, little diversity in size)**
- **B_4C (very hard material, - nearly not machinable ⇒ little diversity in size)**

Absorber window tests



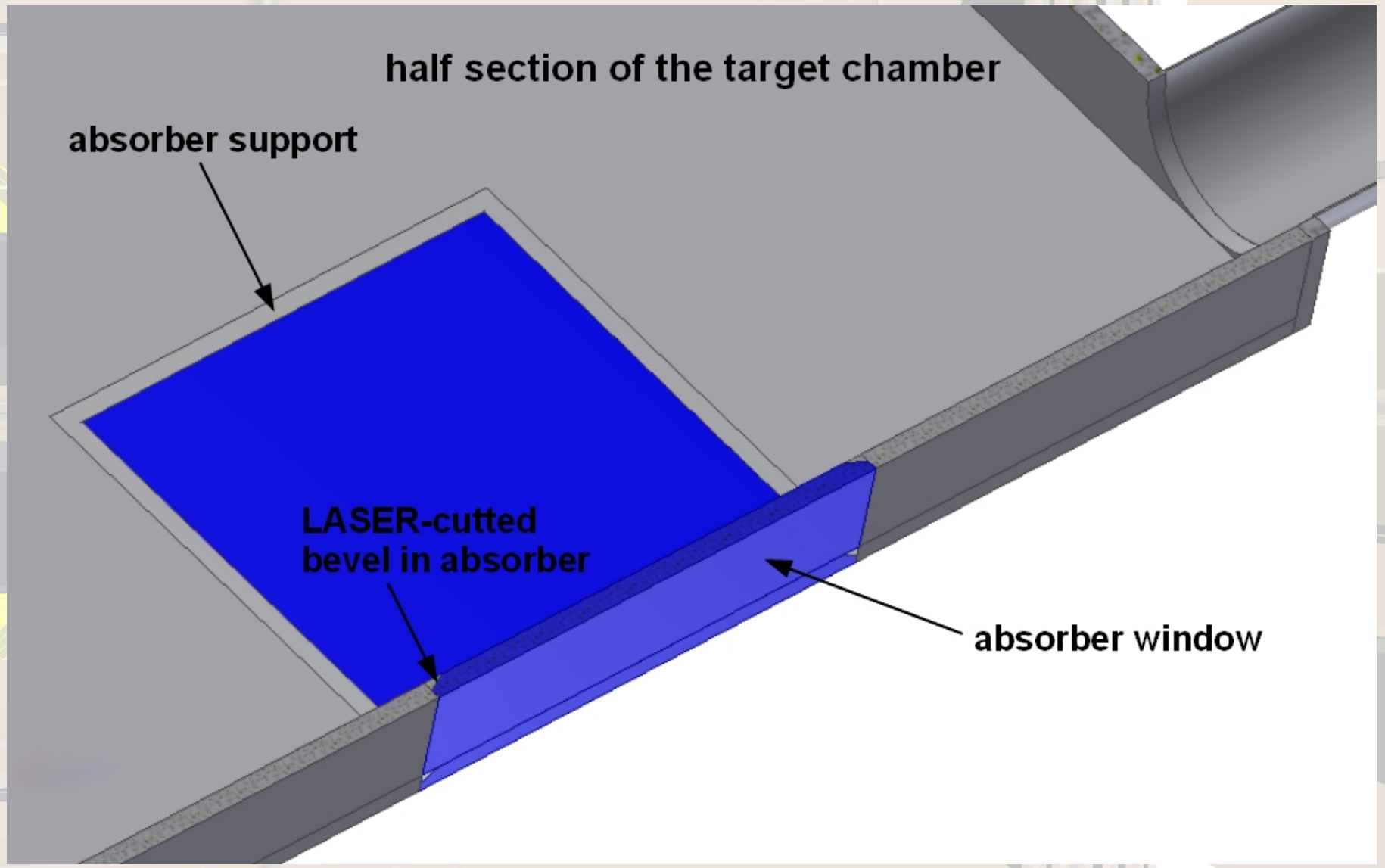
aluminium frame to place
horizontal window absorber, 50 mm x 50 mm



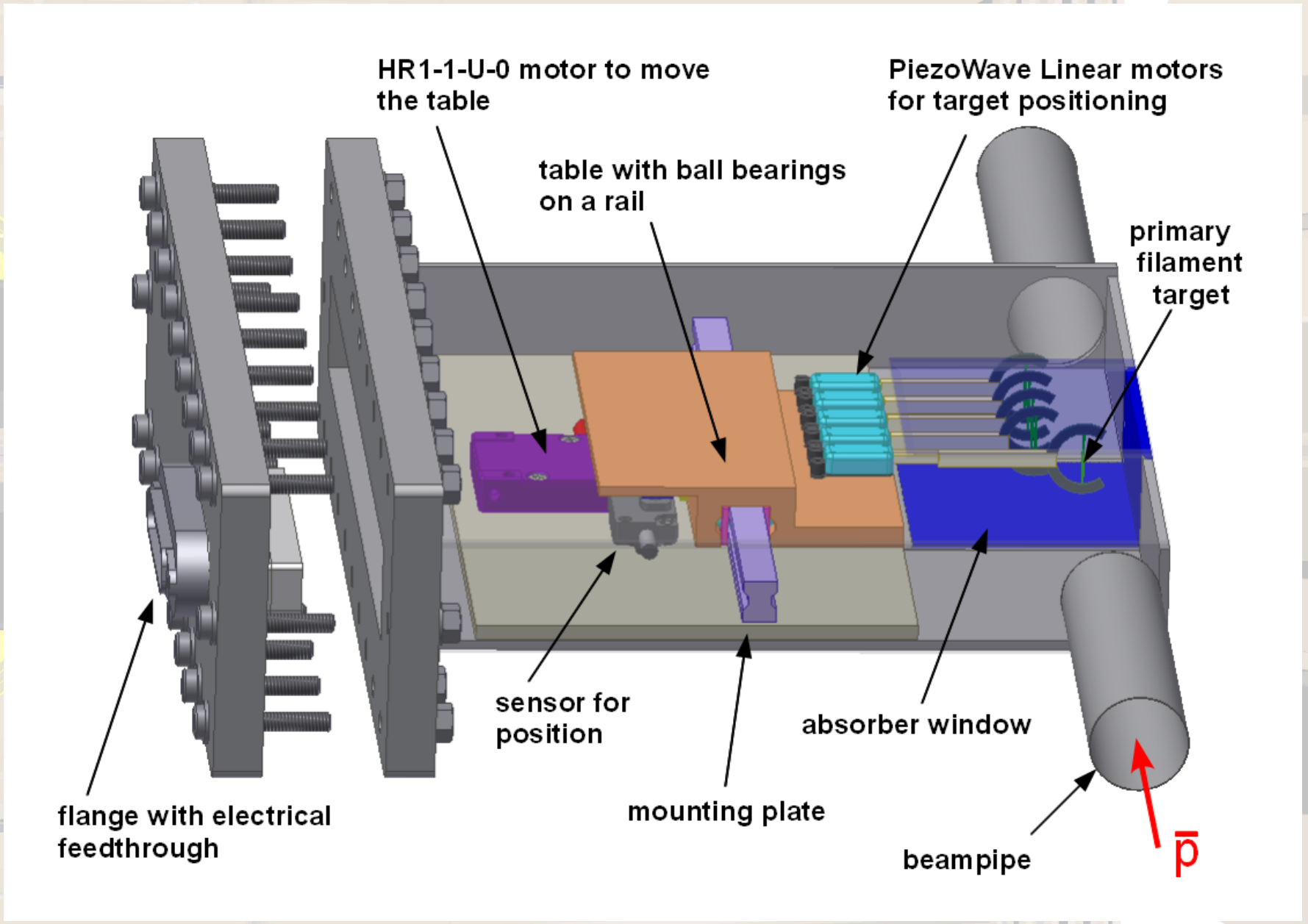


- B_4C and CFC stable at first evacuation
- B_4C chamber tight, CFC chamber is not tight
- Next tests: boron sheets
  gluing of materials
  construct u-profiles
  remove base and fix u-profiles

Improved absorber insertion



Mechanical setup



Outlook

- ongoing GiBUU simulations with different target nuclei, calculation of background and beam losses
- finish the first design of the positioning stage, construction and mounting
- material and gluing tests for an absorber window
- vacuum tests with target chambers based on absorber windows