

# Ideas for the Mechanical Integration of the Straws

SHiP Collaboration Meeting @ CERN

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The mechanical integration of straw tubes poses different challenges

- Elongation of straws
  - increasing sagging over time
  - need for adjustable tension
- Support frame to hold wire tension
- Frame has to withstand atmospheric pressure if not operated inside vessel

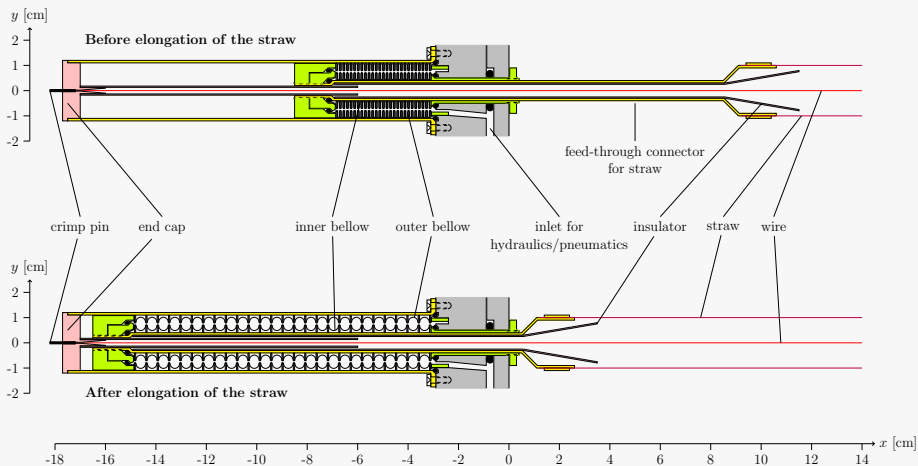
## Properties of straws

- 5 m long with 2 cm diameter
- Needed longitudinal tension (upscaled from NA62): 5 kg
- ▷ Sagging in center: 2 mm
- ▷ Elongation of a few cm

## Deal with elongation of straw over time up to 8 cm

- A first idea: Constant straw tension by hydraulics/pneumatics
- 2 cylindrical bellows, one inside the other, separating
  - drift-gas
  - hydraulic-medium
  - vacuum
- Made of rubber, stabilized by metal disc rings or entirely metal
- Keep wire tension independent of straw tension

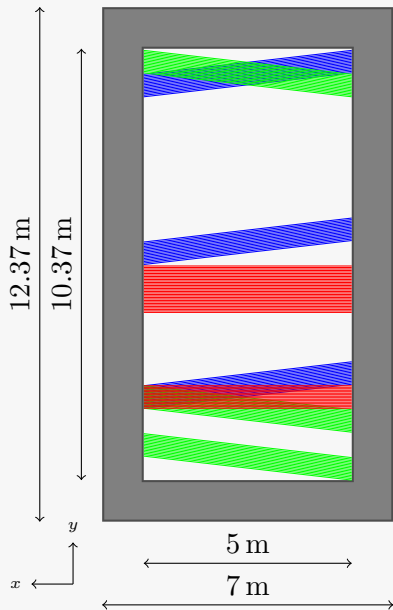
# Before and after elongation of the straw



## Advantages

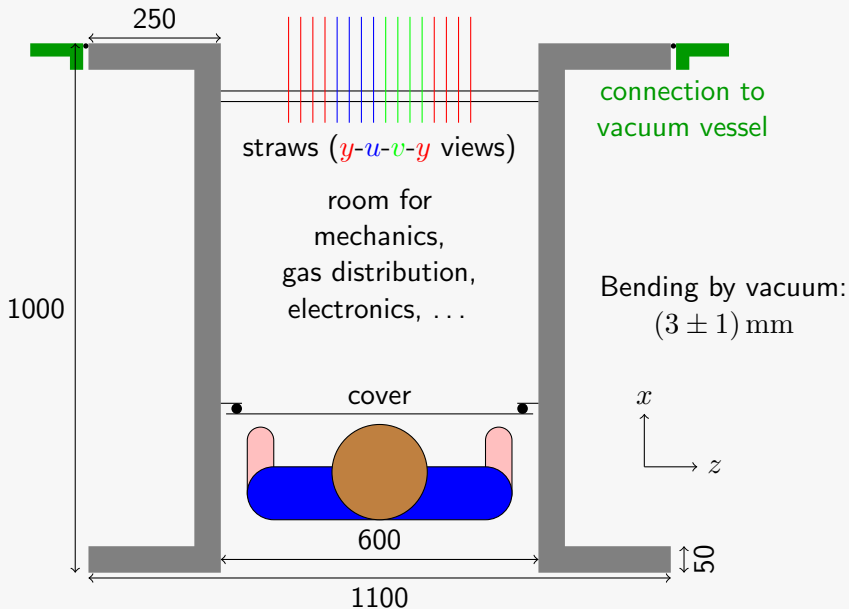
- No glue.
- Only O-ring seals. (proven reliability)
- Use of small, simple, cheap mass-production parts.
- ▷ Proven OPERA technology
  - Easy quality control and repair
  - Bellows: No moving seals, low friction
- Use of bellow-solution only on one side of the straws
- Other side will be fixed
- Read-out etc. on the other side

# Mechanical Structure (view in beam direction)



- 1 station with 4 views has one frame
- straws of stereo views directly inserted at an angle
  - displacement by 16 straws
    - ▷ stereo angle: 115.2 mrad
      - to be checked for performance
    - ▷ 18 groups of 16 straws along  $y$
- ▷ same grouping can be used for common access, electronic modules or gas supply.
- total tension from straws: 22.5 tons
- total weight from atmosphere: 110 tons
- strong stainless steel frame needed
  - ▷ weight: 30 tons

# Frame Cross Section (Top view)



## Decisions to be made

- Is such a huge frame ok for the vacuum vessel?
- Is a *bellow*-solution feasible at reasonable cost

## Next Steps

- Build test-setup
- Get in contact with companies for bellows
- Build prototype for a single tube
- Prototype of array of  $(16 \times 16)$  straws