

# *Plans for optimal goniometer*

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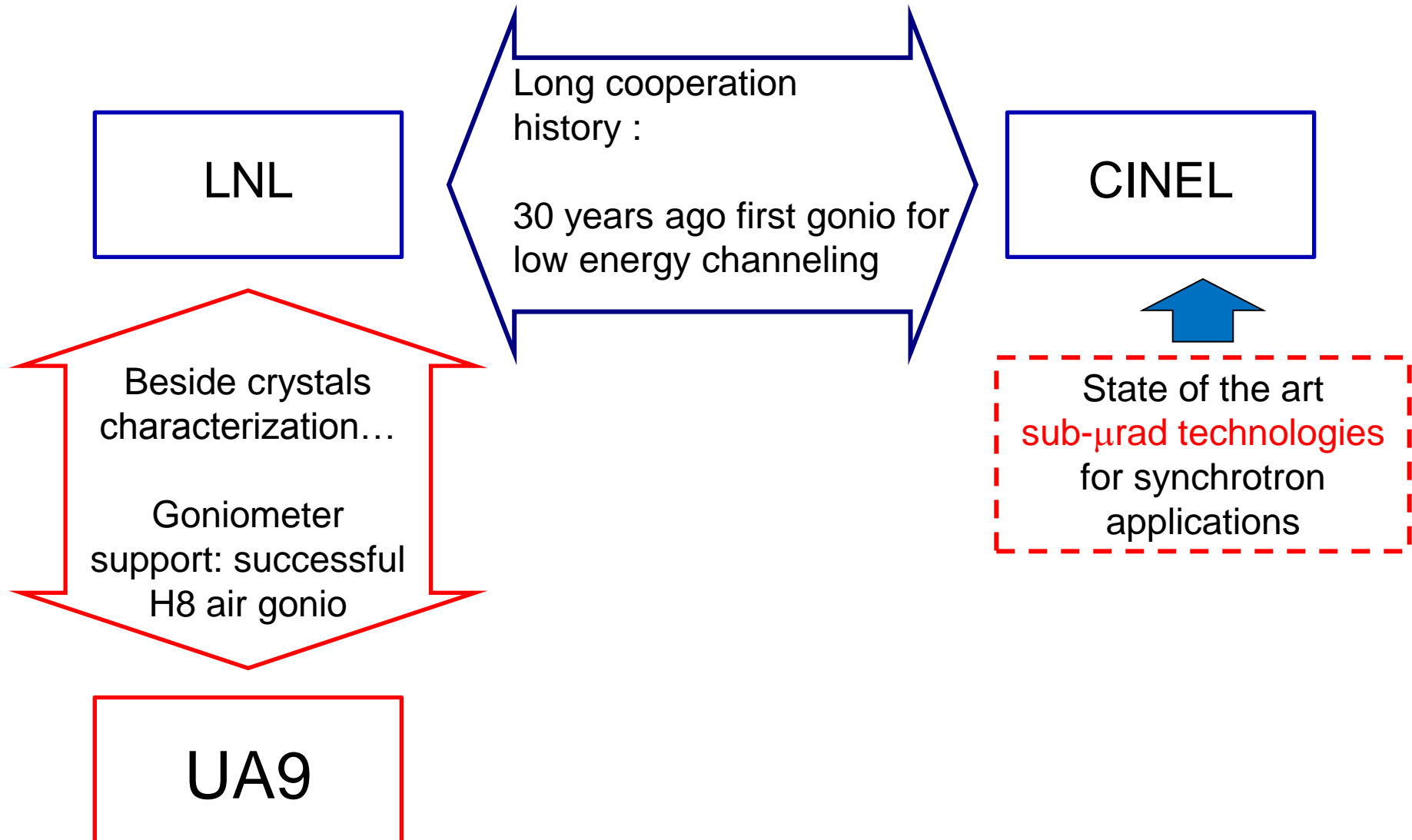
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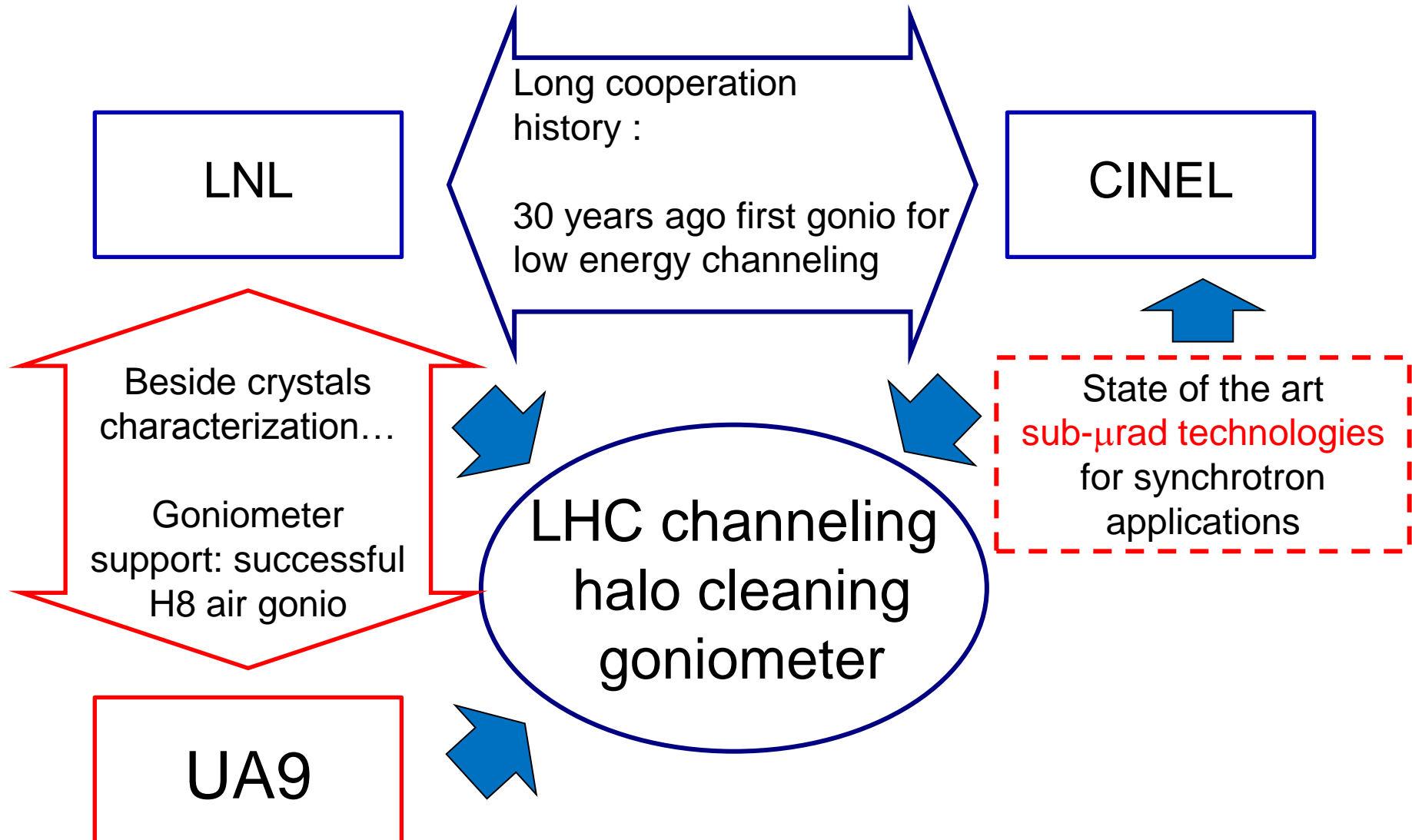
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# *Introduction*



# Introduction



# *LHC is not a synchrotron:*

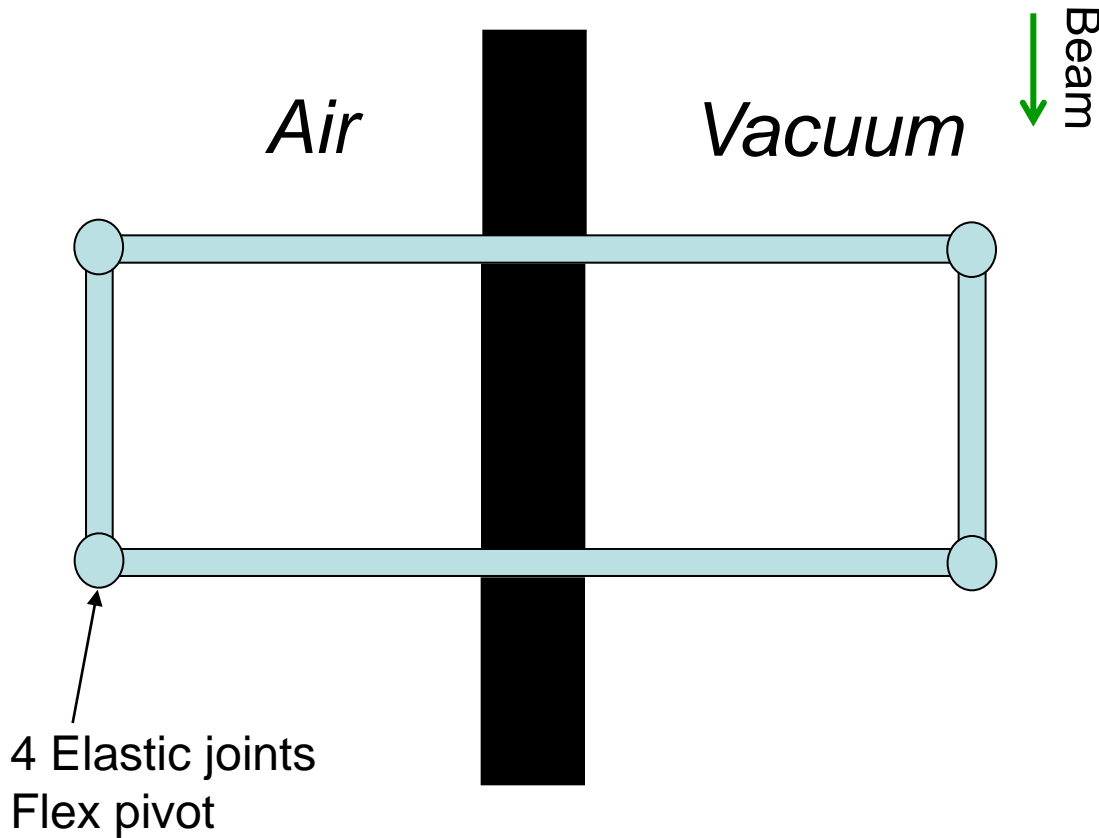
- Different application and geometry
- Different environment (radiation problems, relatively small spaces)

## *First step:*

Realizing a first prototype performing **fraction of  $\mu\text{rad}$**  resolution in a channelling application geometry.

...of course with the mind still tuned to miniaturization and rad-hard...

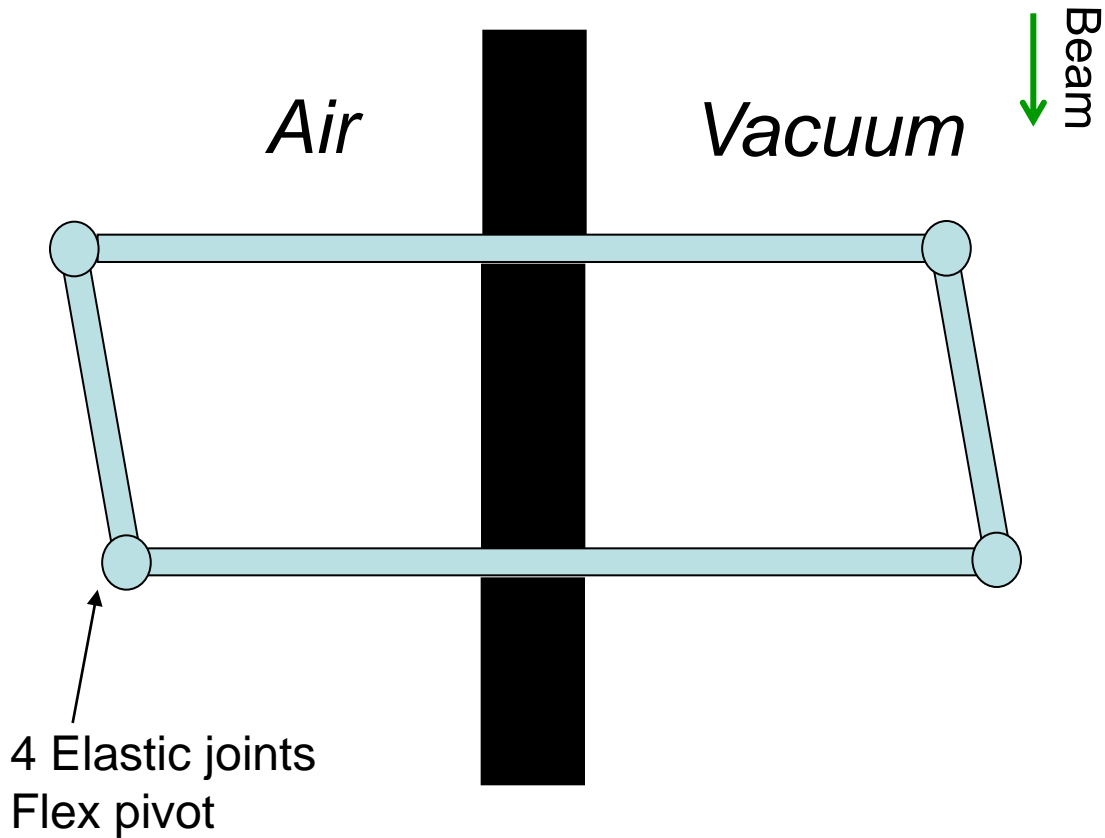
# *First prototype – the concept*



Replica of the movements through an elastic parallelogram



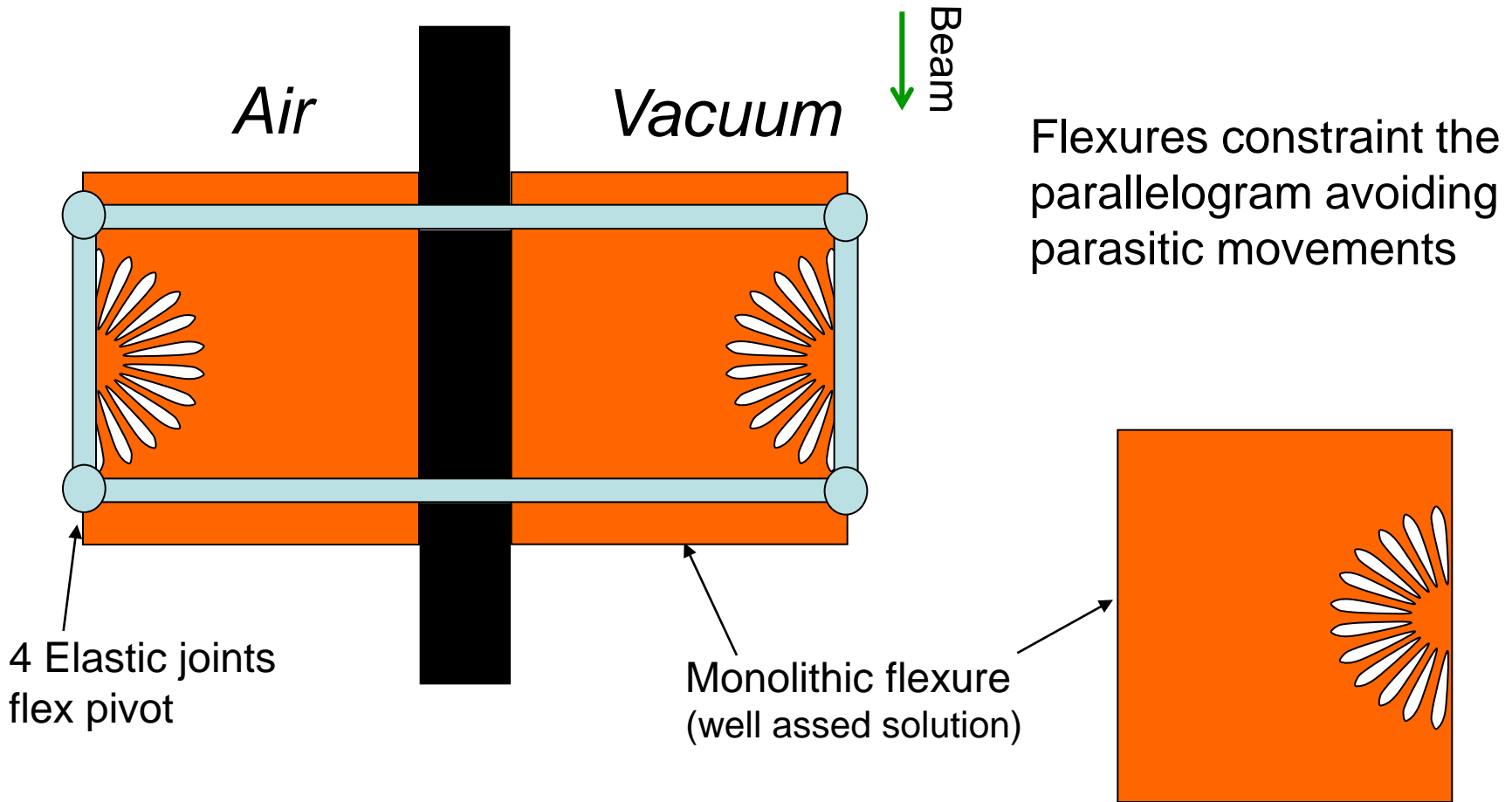
# *First prototype – the concept*



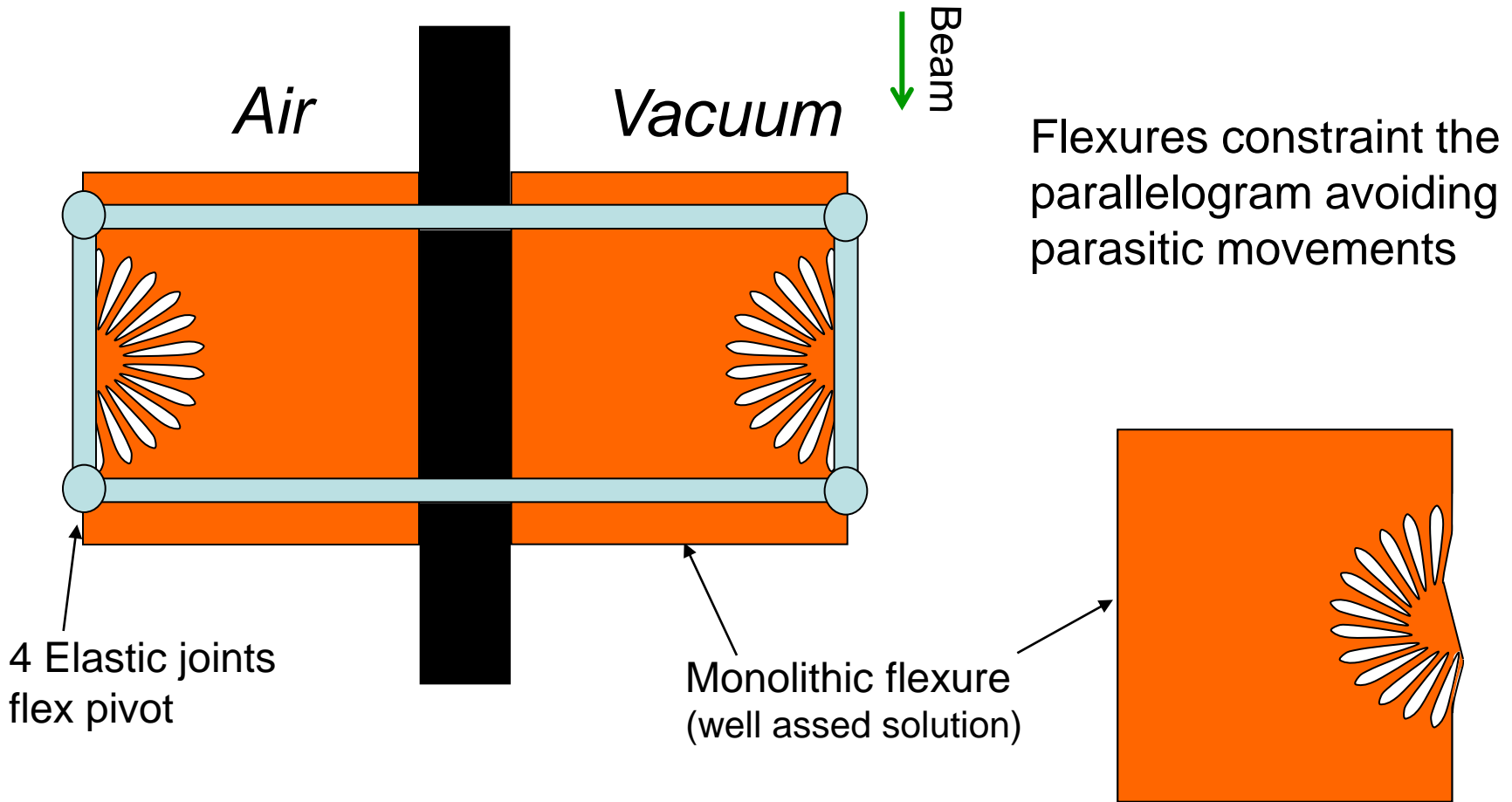
Replica of the movements through an elastic parallelogram



# Rotation concept

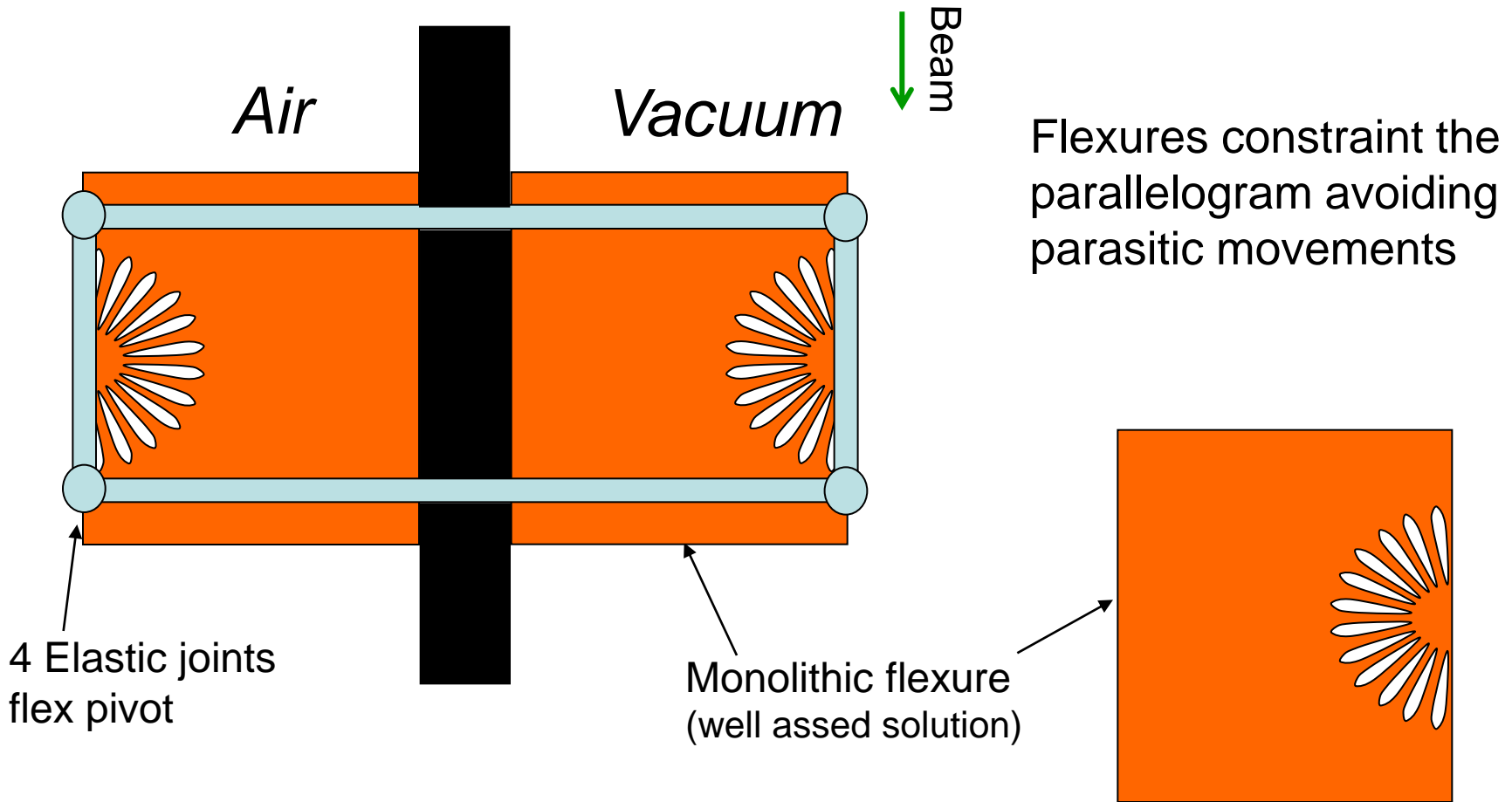


# Rotation concept

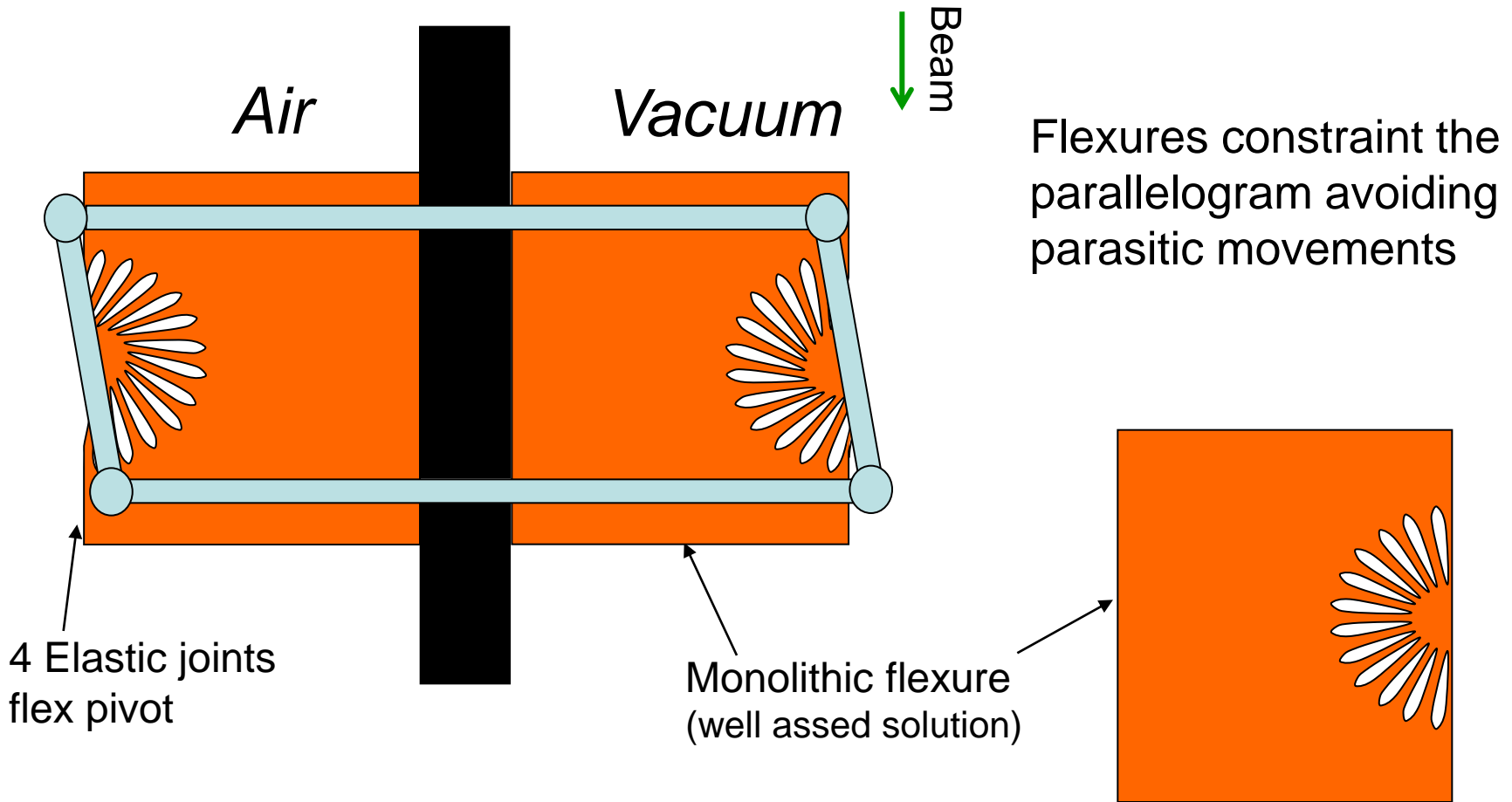




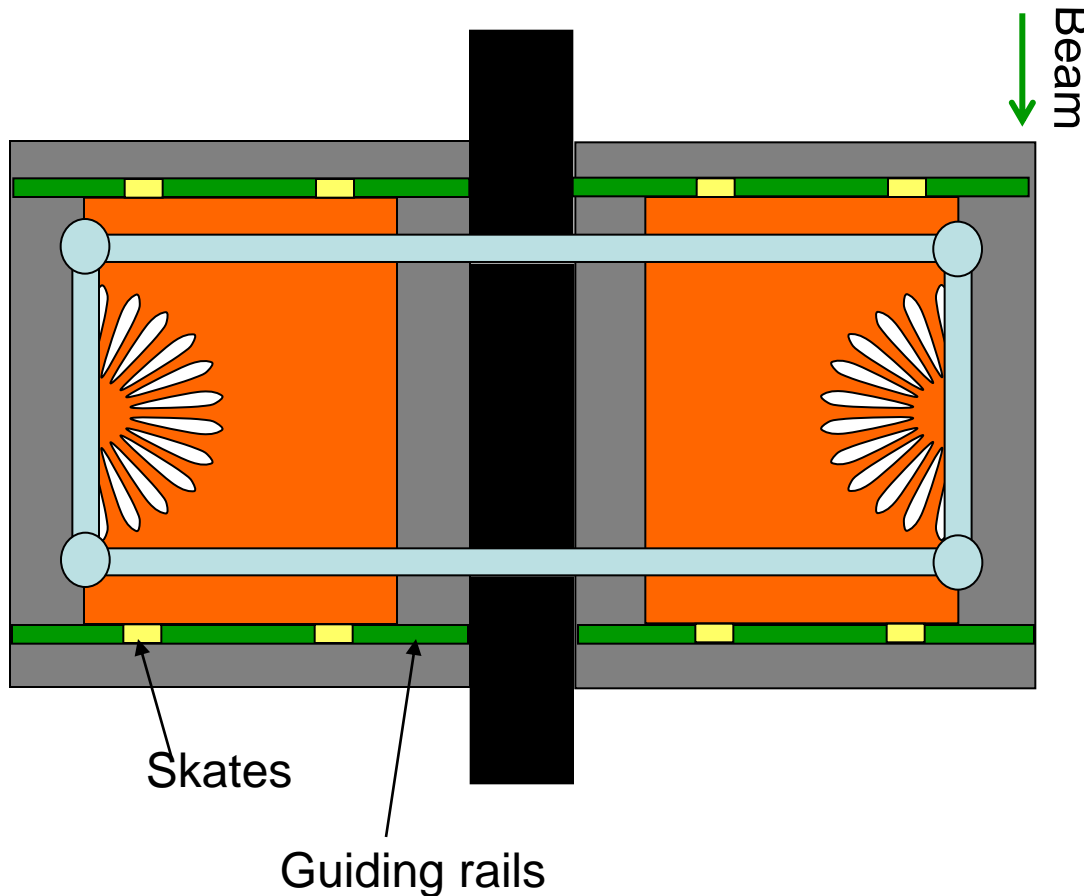
# Rotation concept



# Rotation concept



# *Translation concept*

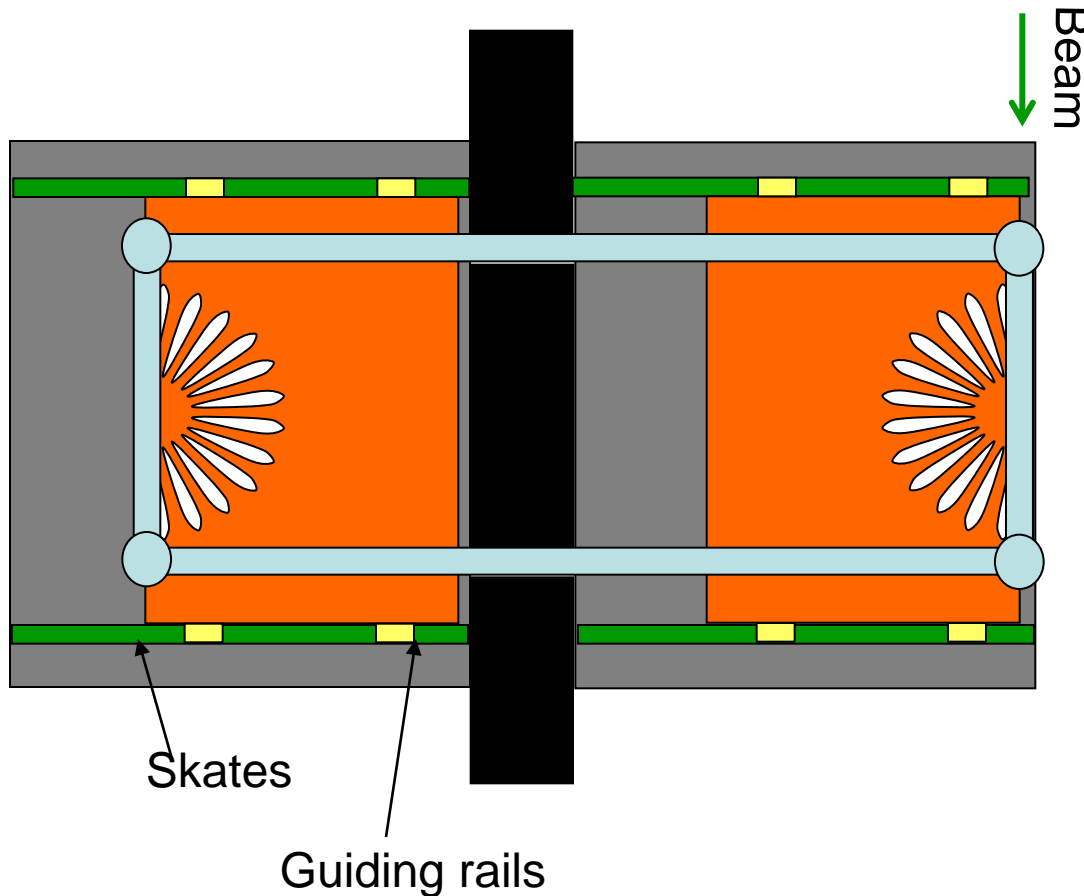


Flexures are mounted on a sliding system.

Angular and translation movements can be transmitted from air to vacuum with reduced parasitic movement.

Elastic system eliminates backlashes.

# *Translation concept*

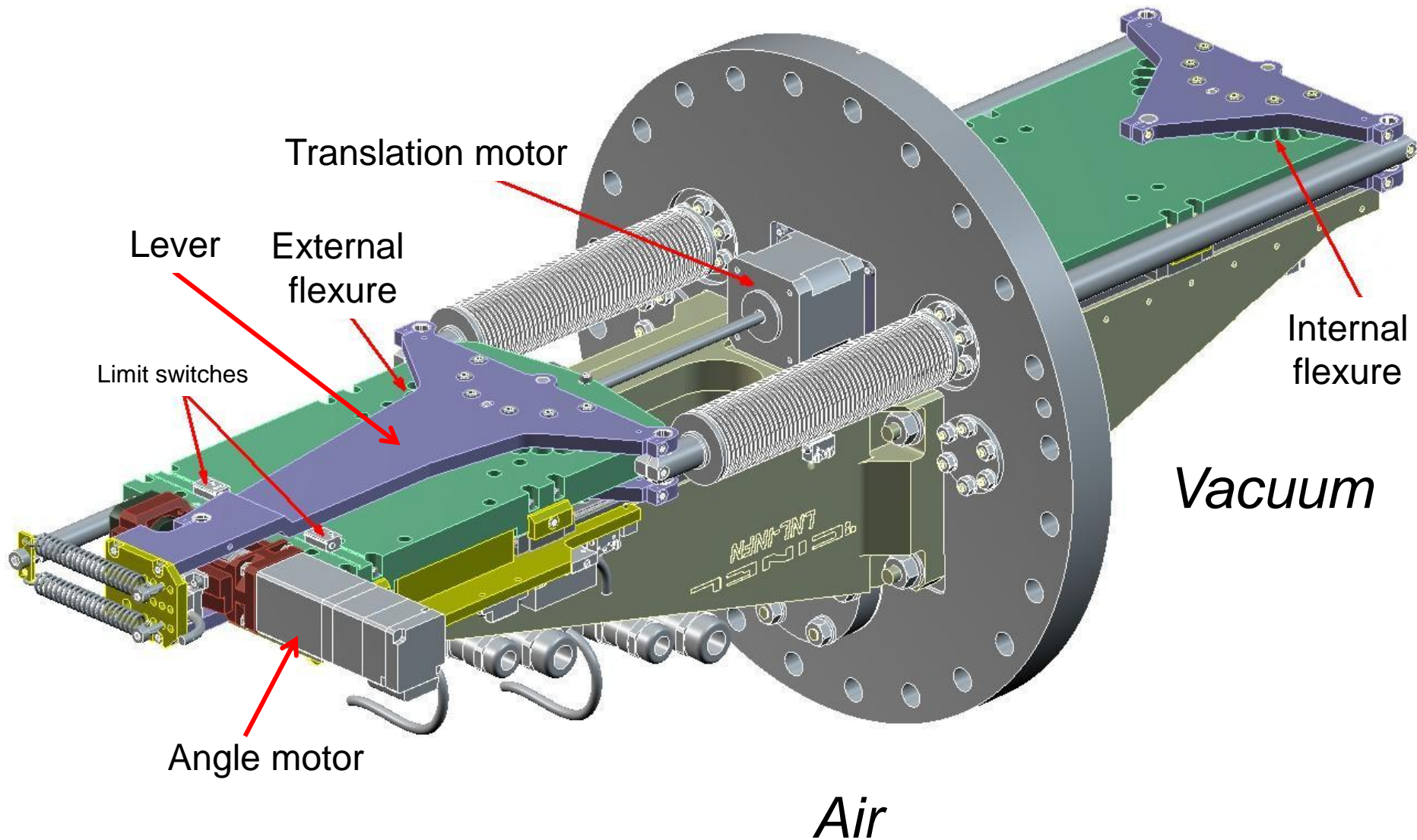


Flexures are mounted on a sliding system.

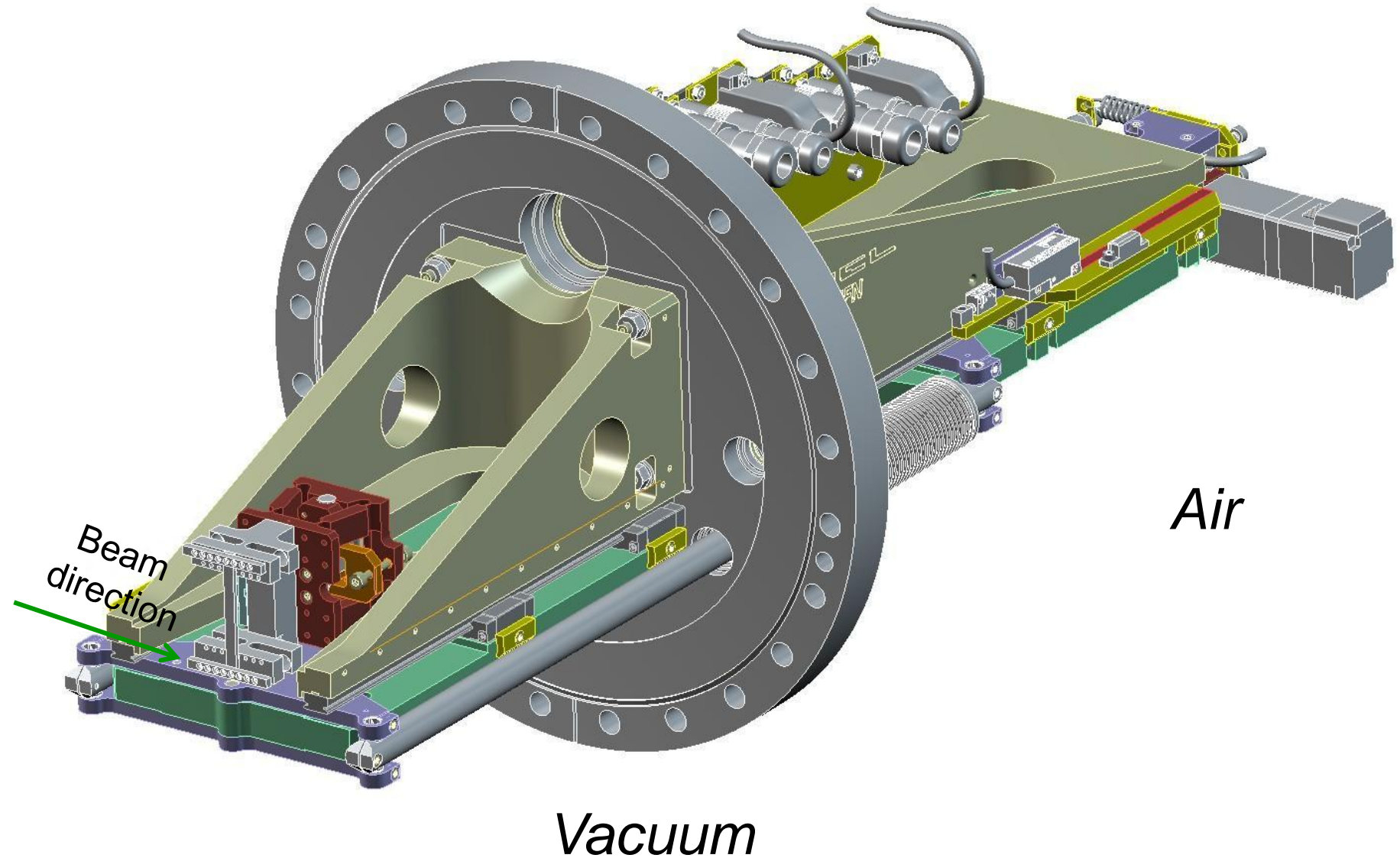
Angular and translation movements can be transmitted from air to vacuum with reduced parasitic movement.

Elastic system eliminates backlashes.

# *The project*



# *The project*



# *Main characteristics*

Size: 750 mm length,  
200 mm flange fitting on.

Translation: 100 mm range  
5  $\mu\text{m}$  resolution

Rotation: 26 mrad range  
0.1  $\mu\text{rad}$  resolution

Rotation expected repeatability (after translation): very few  $\mu\text{rad}$ .... to be tested

# *Rotation resolution*

$$\frac{1}{\text{motor step}} \frac{\text{screw pitch}}{\text{lever length}} =$$



# Rotation resolution

$$\frac{1}{\text{motor step}} \frac{\text{screw pitch}}{\text{lever length}} =$$
$$= \frac{1}{200} \frac{0.5 \text{ mm}}{200 \text{ mm}} = 12.5 \mu\text{rad}$$

# Rotation resolution

$$\frac{1}{\text{motor step}} \frac{\text{screw pitch}}{\text{lever length}} =$$

$$= \frac{1}{200} \frac{0.5 \text{ mm}}{200 \text{ mm}} = 12.5 \mu\text{rad}$$

**BUT**

Harmonic reducer gear gives  
a further **100** reduction

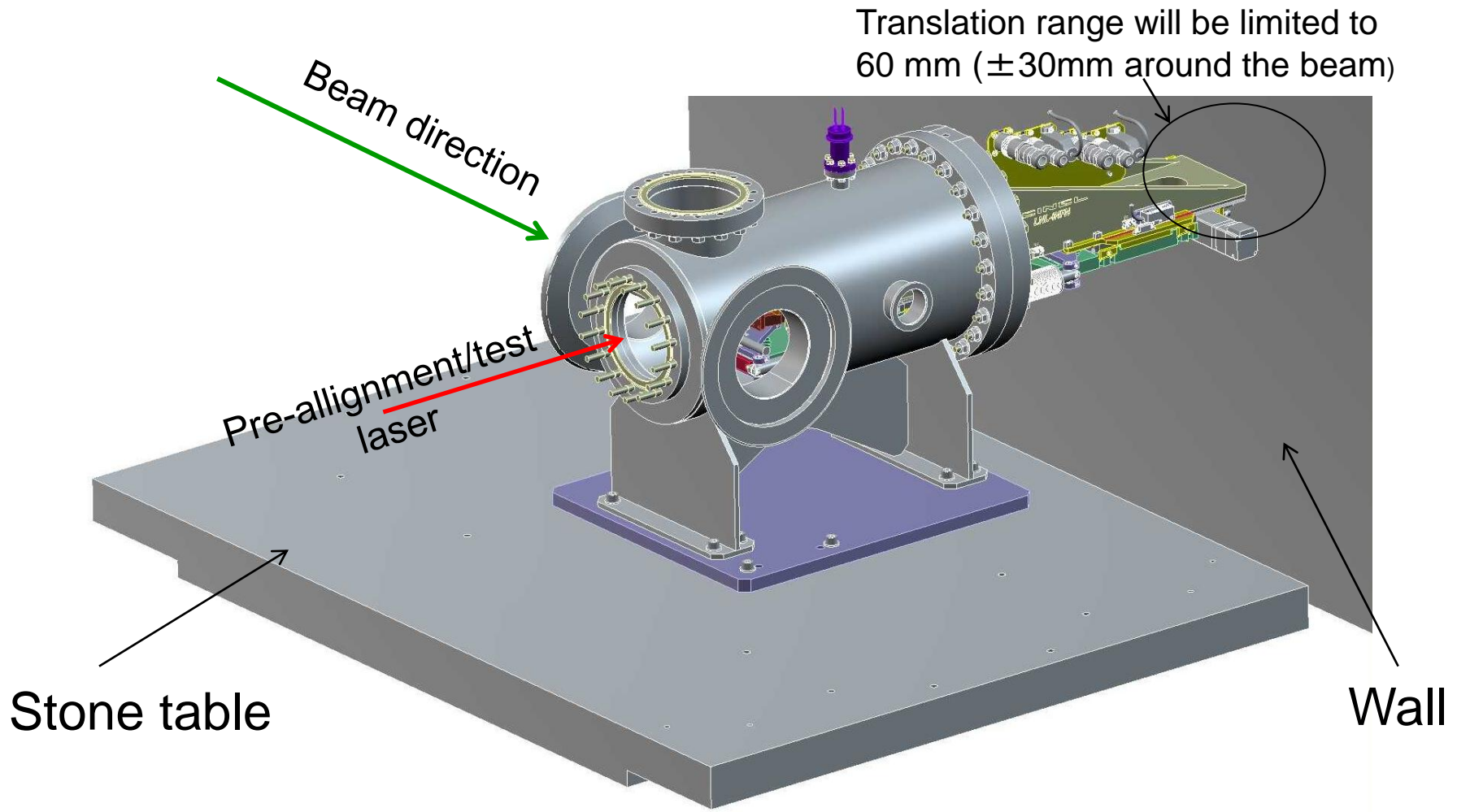


Elastic system  
again no backlash

# *Scheduling*

- The goniometer will be realized within March.
- First week of April: in-house interferometry tests (with fraction of  $\mu\text{rad}$  resolution)
- Just after:
  - ✓ autocollimator test can be performed by UA9.
  - ✓ ready to start with 2<sup>nd</sup> prototype project for LHC.
- Demonstrating channeling feasibility with 1<sup>st</sup> prototype to be decided

# *H8 installation – tank project*



# *Toward LHC*

- Rad Hard:

- ✓ Mechanical parts are OK
- ✓ Motors: not actually, but rad-hard solutions exist
- ✓ Optical encoders: NO, but, after testing the mechanics, we could avoid them in the next gonio
- ✓ Resolver for motor steps control: OK

10 nm resolution encoders with close loop is the CINEL standard choice

- Miniaturization

- ✓ Dimensions can be reduced in case of a lower translation range, geometry should be modified
- ✓ Tests for using a compact flex pivot instead of the flexure are planned

The test will be performed with a minor modification of the actual gonio