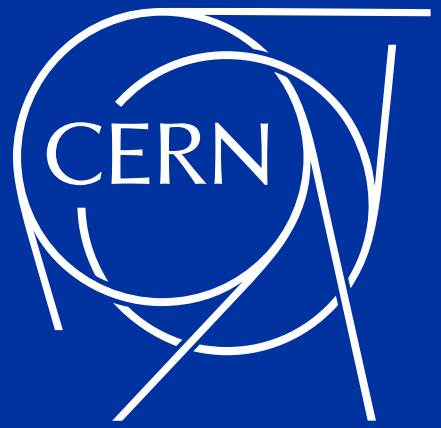

Wire Scanner Mechanics Brainstorming Status

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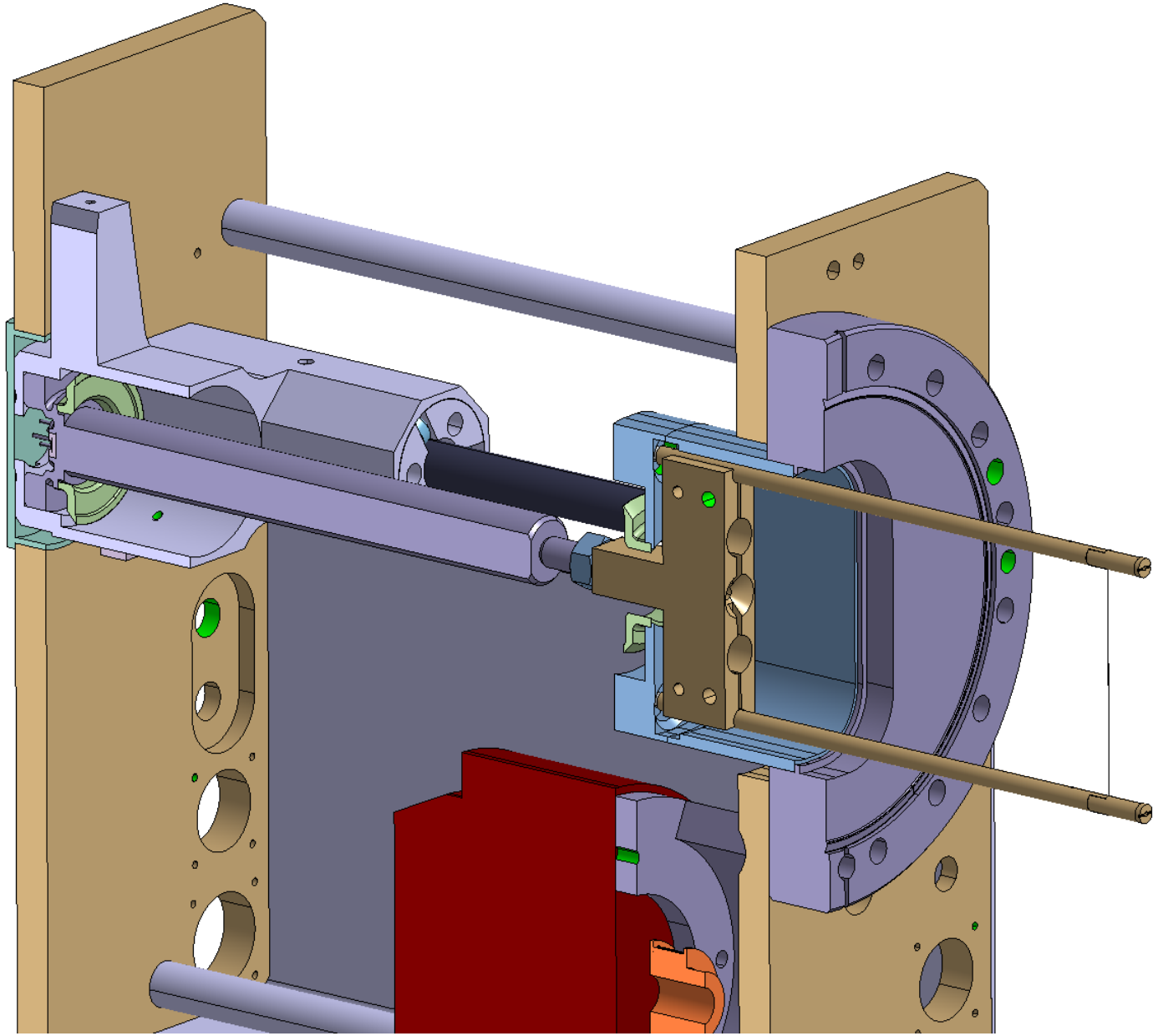
Introduction

- **Brainstorming on mechanical design of consolidated wire scanner held over the last month**
  - Literature search of operational scanners
  - Preliminary review of existing designs and new concepts
  - Preliminary design and analysis for a LHC device (in progress)
  - Principally using availability of short-term personnel in the ML section
- **Focusing on:**
  - A modified version of the existing design [Hybrid+] , resolving the main mechanical issues (Bellows reliability, feedthrough reliability, fork design, wire attachment)
  - One or more [New] designs, using modern concepts and systems with potential reach for
    - Use as a halo monitoring device
    - Installation of ‘nano’ wires to improve scan intensity reach

Hybrid+: Primary objectives

- Reduce vibrations in the system during operation
- Reduce risk of wire breaking
- Improve ease of assembly and maintenance

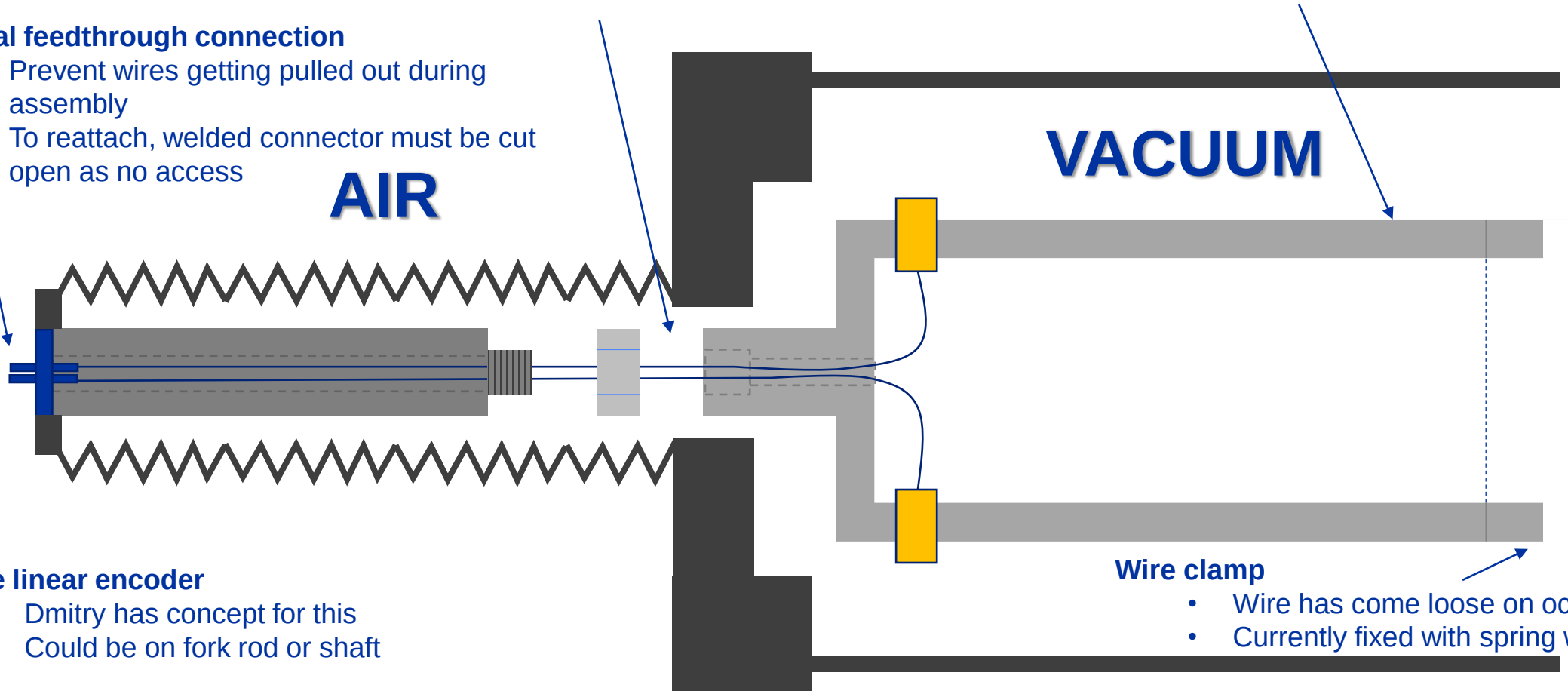


Hybrid+: Areas to improve

Fork – shaft attachment
- Difficult to assemble perfectly square

Fork design
- Reduce vibrations of wire
- Prevent wire breaking easily during assembly

Electrical feedthrough connection
- Prevent wires getting pulled out during assembly
- To reattach, welded connector must be cut open as no access



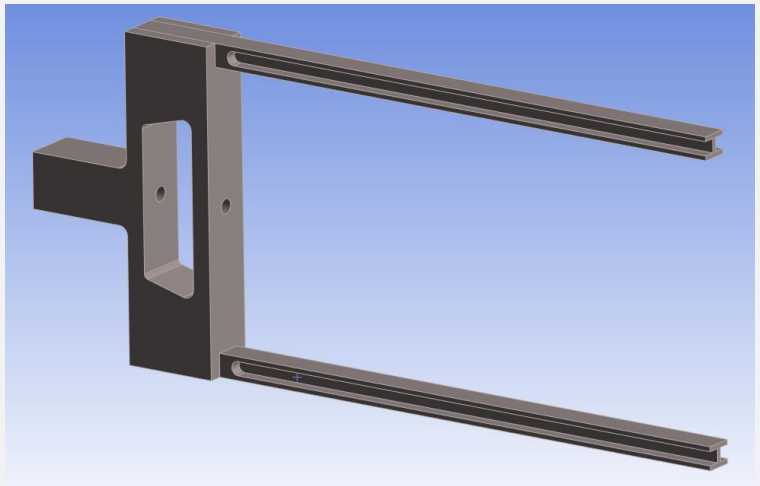
Include linear encoder
- Dmitry has concept for this
- Could be on fork rod or shaft

Wire clamp
- Wire has come loose on occasion
- Currently fixed with spring washers

Hybrid+: Current fork concepts

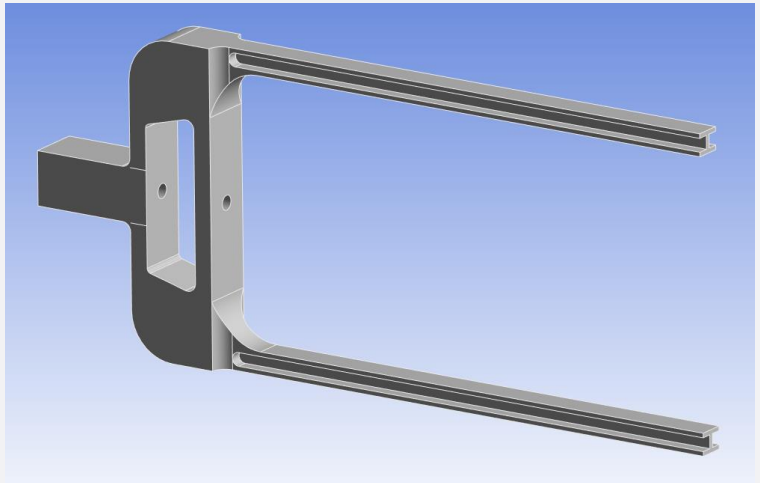
Original design: 4.5N for 0.83 mm deflection
0.089 kg

Machined Titanium (bolted assembly)



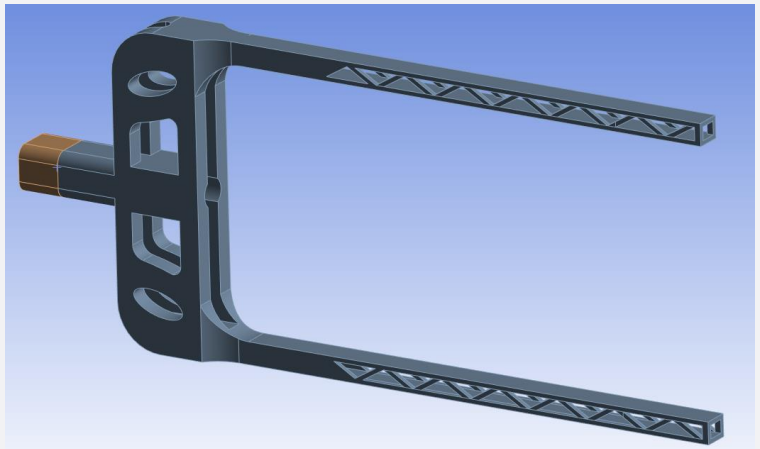
- 7 N (0.83 mm)
- 0.08 kg

Solid ceramic (Alumina)



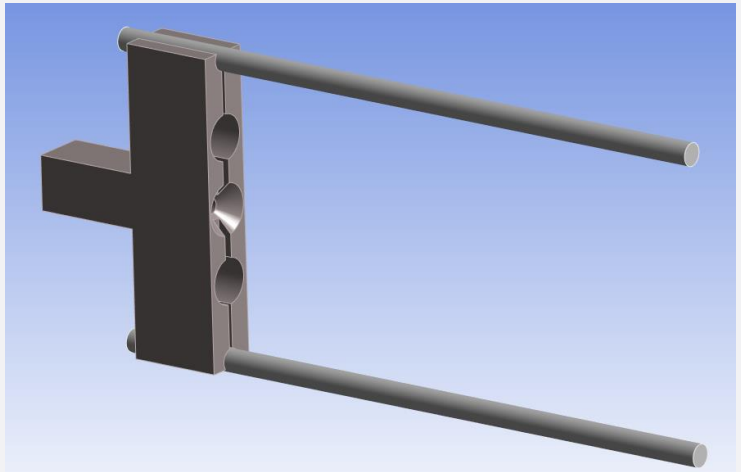
- 17.5N (0.83mm)
- 0.062 kg

3d printed Titanium



- 8.2 N (0.83mm)
- 0.064 kg

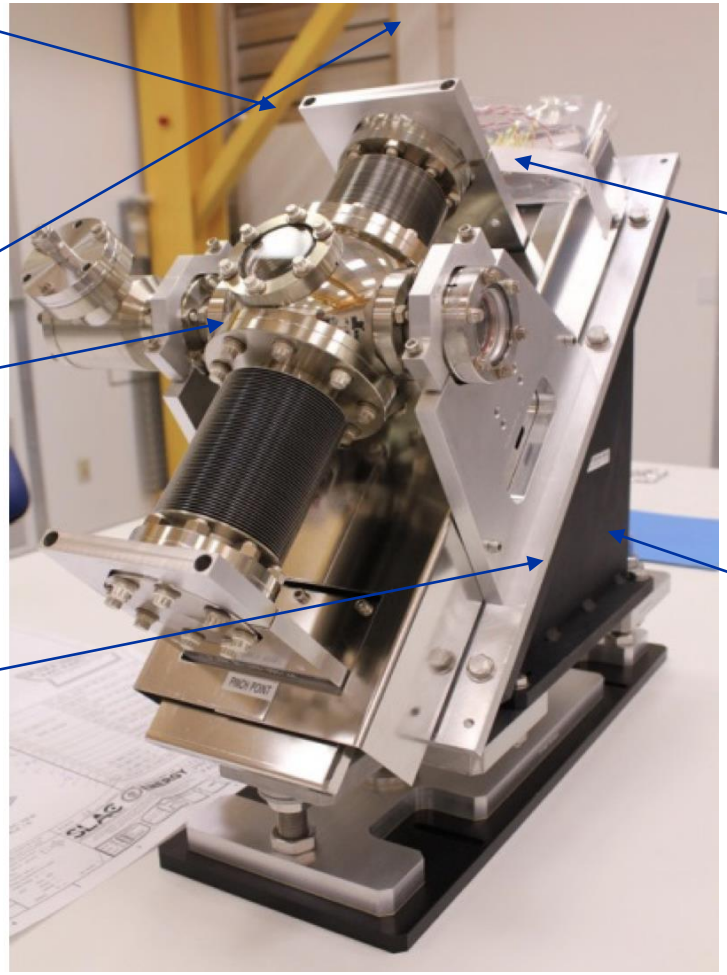
Original design with ceramic arms



- 10 N (0.83mm)
- 0.083kg

Double Bellow System

Description



Double Bellow System

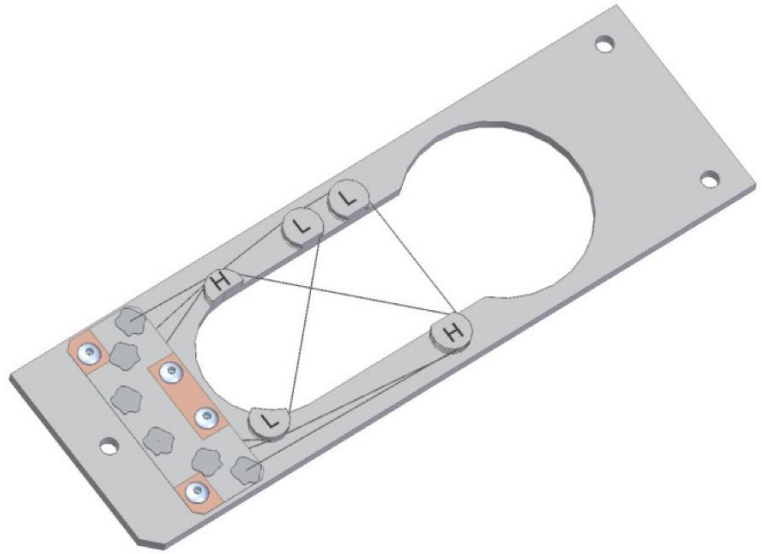
Advantages

- **Proven concept at SLAC → scale to LHC dimension**
- **Less vibration**
- **Multiple-wire scans possible**
- **Bakeable system**
- **Few in-vacuum components**
- **Off-the-shelf components**

Double Bellow System

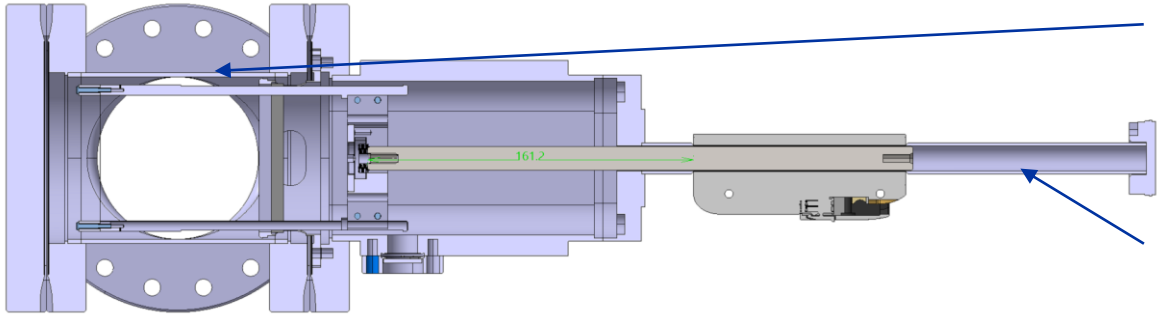
Lessons Learned from SLAC

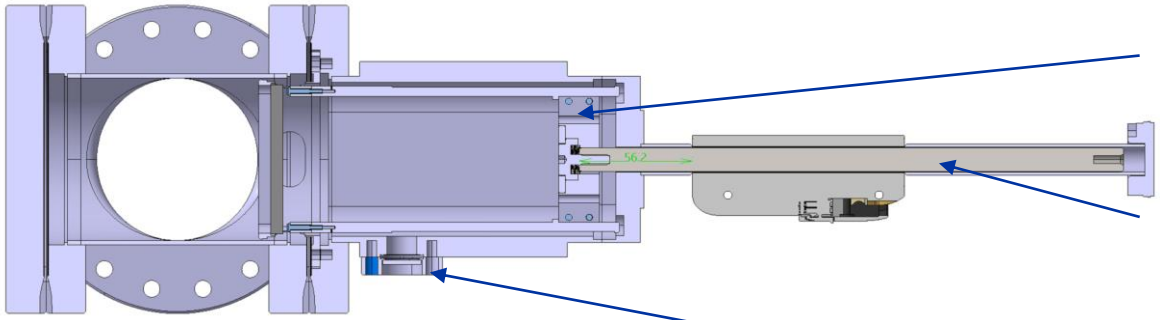
- **Reliable system**
- **No bellow failues**
- **High accuracy measurement ($1\ \mu m$)**
- **Less vibrations than in ball screw system**
- **Best performance with aluminium-silicon alloy wire**



Direct Drive System

Option 1





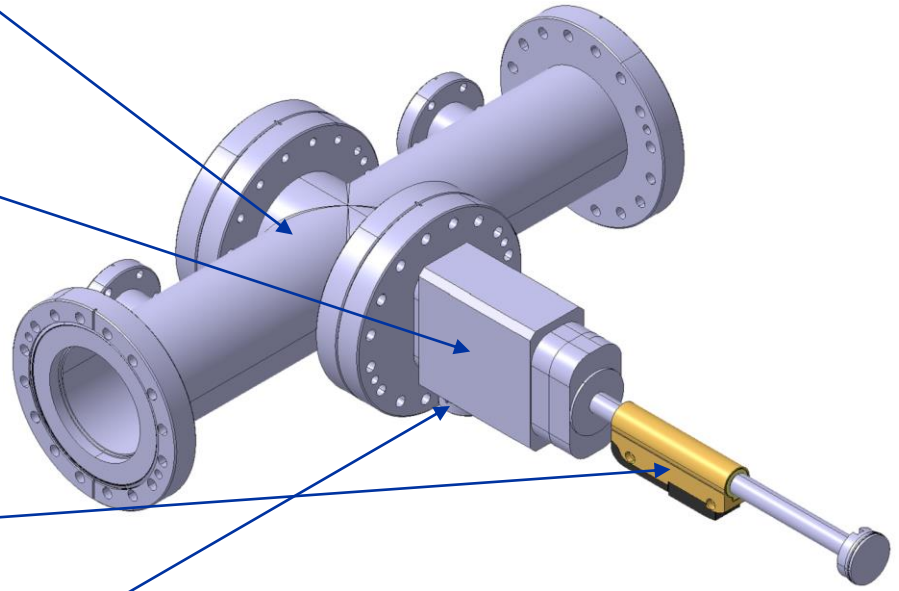
Vacuum Chamber

BWS Chamber

Fork

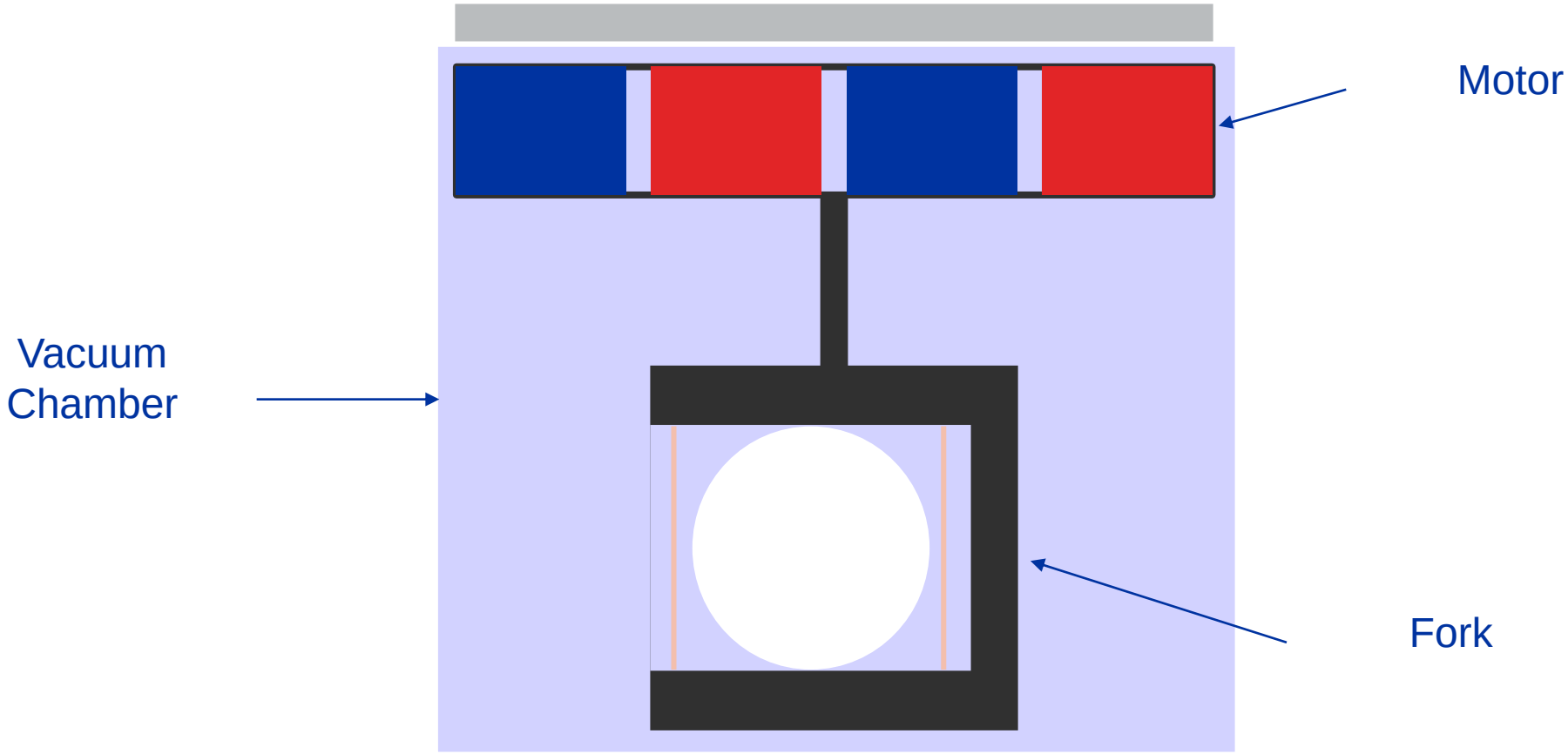
Motor

Position Sensor



Direct Drive System

Option 2



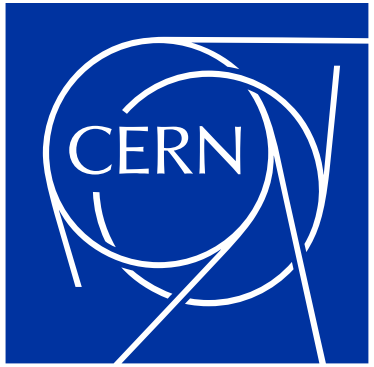
Direct Drive System

Advantages

- No backlash
- No reversal errors
- No mechanical wear
- Less down time for maintenance
- Improved cycle times
- Higher accelerations and velocity
- No lubrication required

Proposed milestones for mechanics development

- **YETS 2023/4**
  - Install a ‘Hybrid+’ design in the LHC
  - Install a prototype ‘new’ design in the SPS (or at least support/tank installation with instrument coming in a TS)
- **Run 3/2024**
  - Test the ‘Hybrid+’ design under operational conditions in the LHC
  - Test the new design in MD mode in the SPS
- **YETS 2024/5**
  - Install a ‘final prototype’ in the LHC



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