



## Commissioning Lock Issues:

- **Reminder I: Scope and goals**
- **Reminder II: The design**
- **Transforming a virtual world to reality**
- **Reality strikes**
- **How to adopt reality?**
- **Preparations for 3 string cable arm**



# Reminder I: Scope and Goals

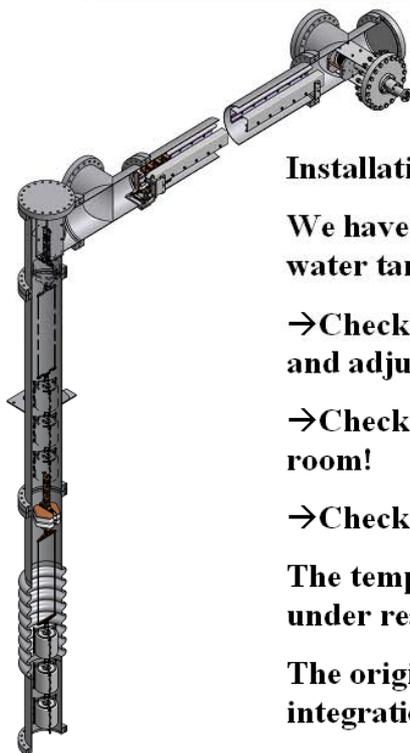
Béla Majorovits



TG5 Clean Room and Lock



## A Temporary Lock System



The temporary lock system:

Installation of the final lock system will not be possible before mid 09

We have the possibility to go for a commissioning phase and fill cryostat and water tank before installing the monster.

→ Check movements of cryostat neck with respect to superstructure beams and adjust lock support structure!

→ Check Background conditions in cryostat while still accessible via clean room!

→ Check Phase I detectors and electronics

The temporary lock is being designed by MPI Munich with help from LNGS under realistic circumstances.

The original linear pulley system is being used. For the lock cylinder and integration only standard materials are used.

→ No considerable time delay due to additional development (<2 months)



Max-Planck-Institut für Physik  
(Werner Heisenberg Institut)

GERDA collaboration meeting, June 9<sup>th</sup>-12<sup>th</sup> 2008, LNGS

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## Reminder I: Scope and Goals

**The commissioning lock was planned as such:**

**Use the time while waiting for the final lock to demonstrate:**

- **Electronics**
- **Cable tree**
- **Background (to some extent)**
- **Structural integrity**

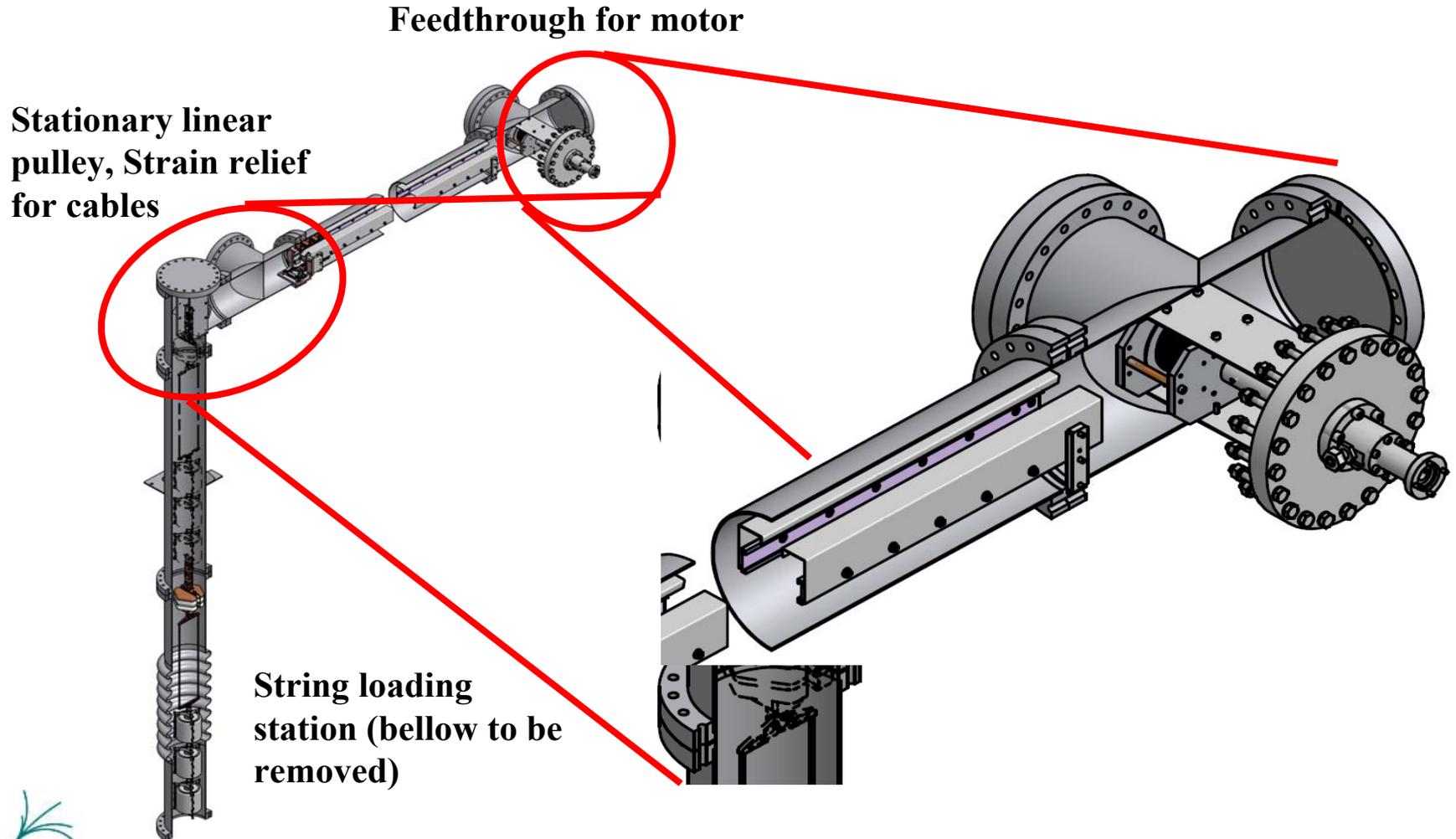
**It was equipped with an additional large 250shutter in order to be able to deploy 3 string with one cable arm.**

**→ Use as many as possible components from the final lock, minimize extra design work.**





# Reminder II: The Design



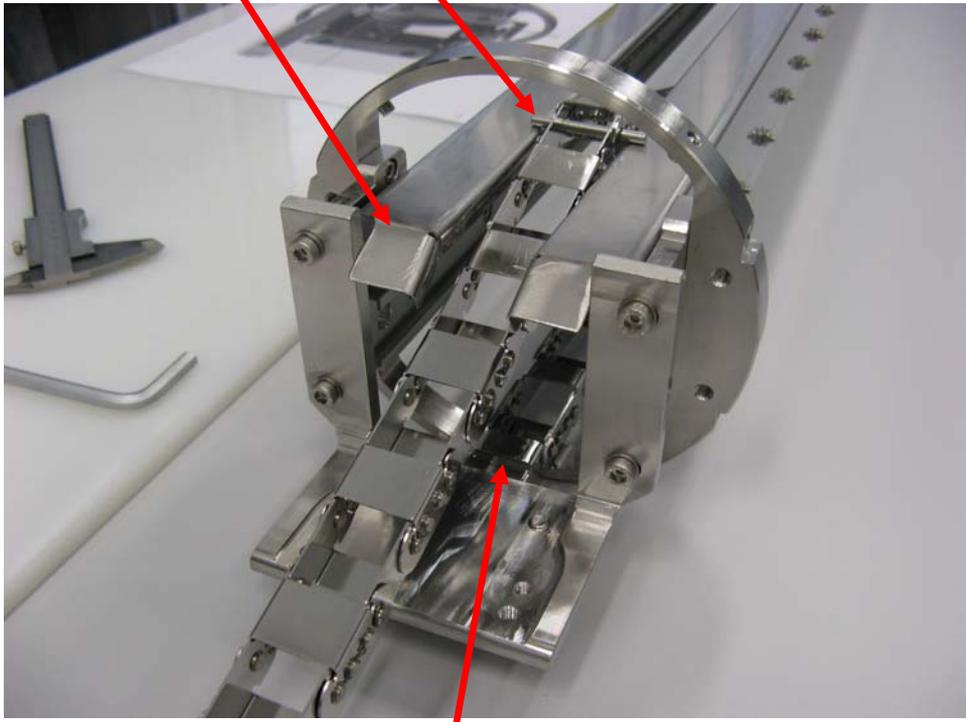


# Transforming a Virtual World to Reality

Guide rail ramp

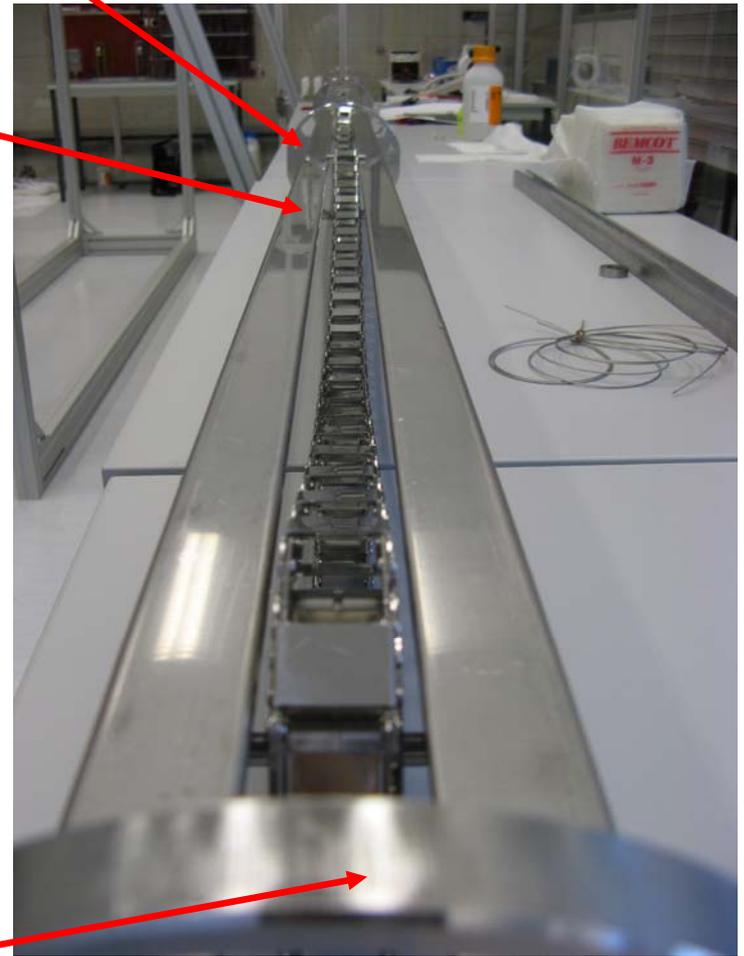
Movable pulley

Bolt against sagging



Strain relief

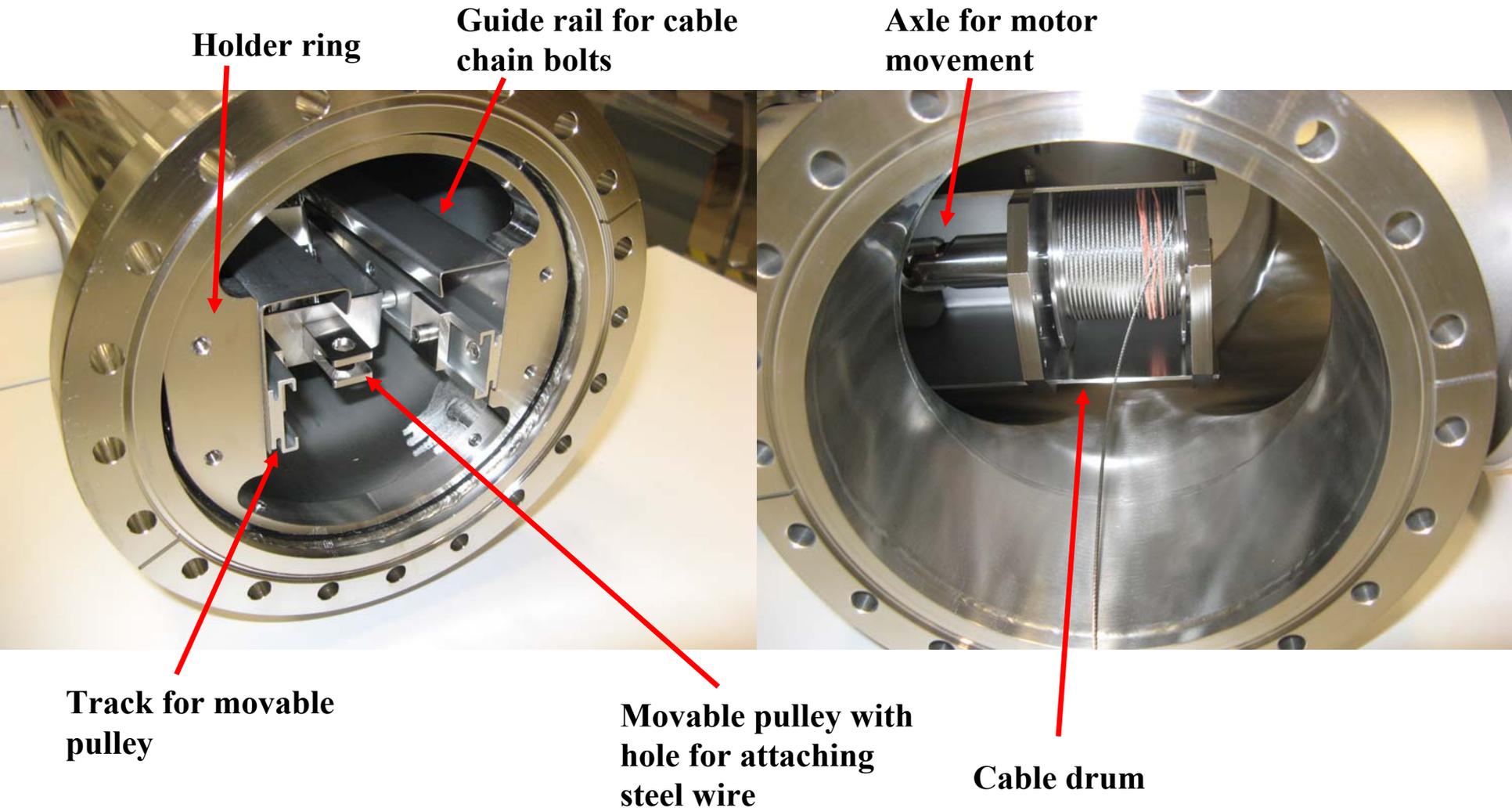
Guide rail



Energy chain

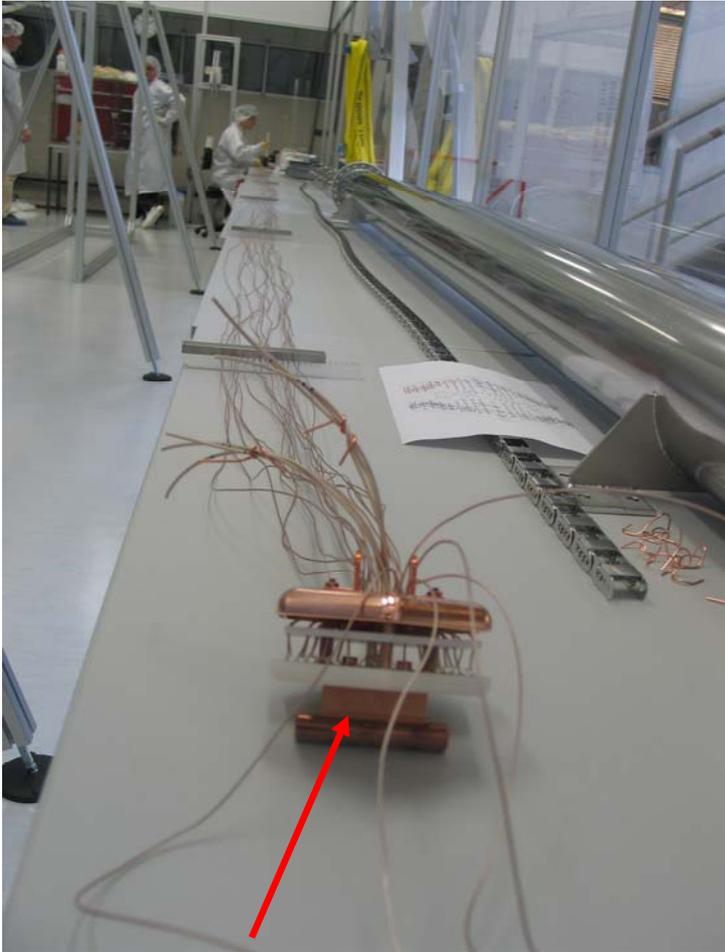


# Transforming a Virtual World to Reality





# Transforming a Virtual World to Reality



**Matrix with signal cables attached**





# Transforming a Virtual World to Reality



**Matrix with signal cables attached. All in cable chain**



# Transforming a Virtual World to Reality

Cable arm in tube on scaffolding.



Dummy weight on matrix.



# Reality Strikes

movie removed



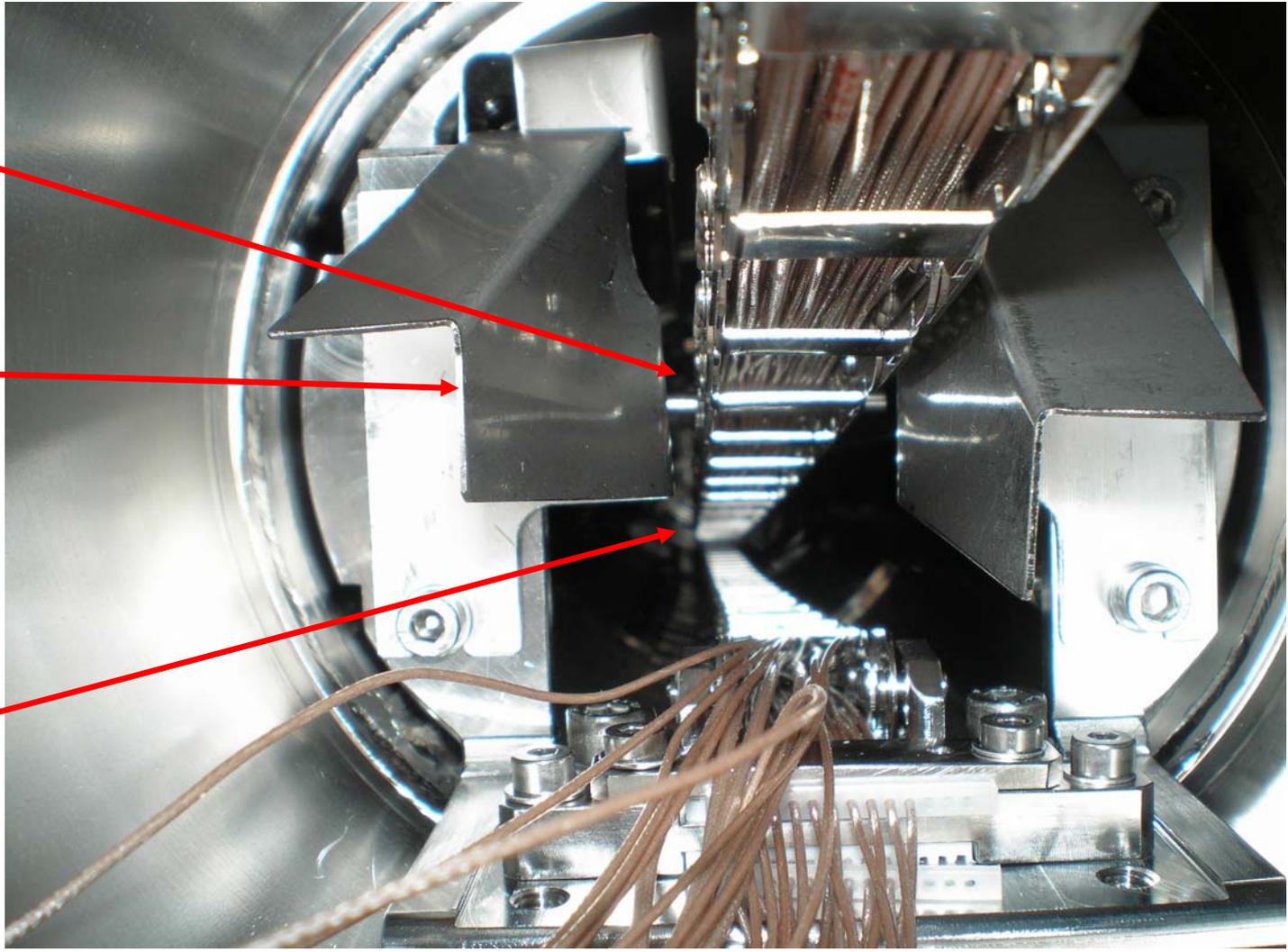


# Reality Strikes

**Guide bolt got underneath ramp due to missing weight**

**Guide bolt ramp got damaged by pulling bolts with motors.**

**Sagging of cable chain due to missing weight  
→ Upper chain gets stuck in lower chain elements**



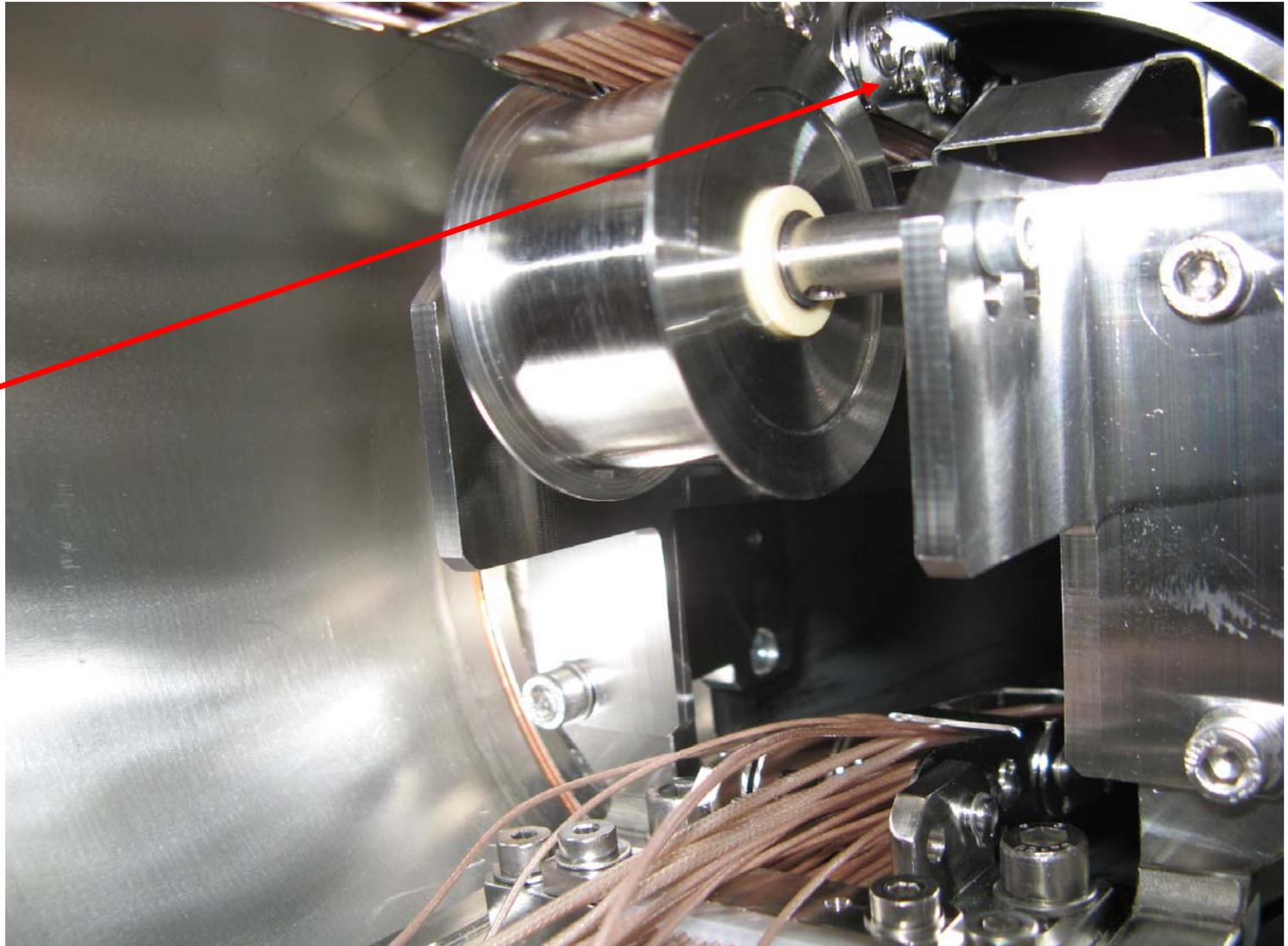


# Reality Strikes





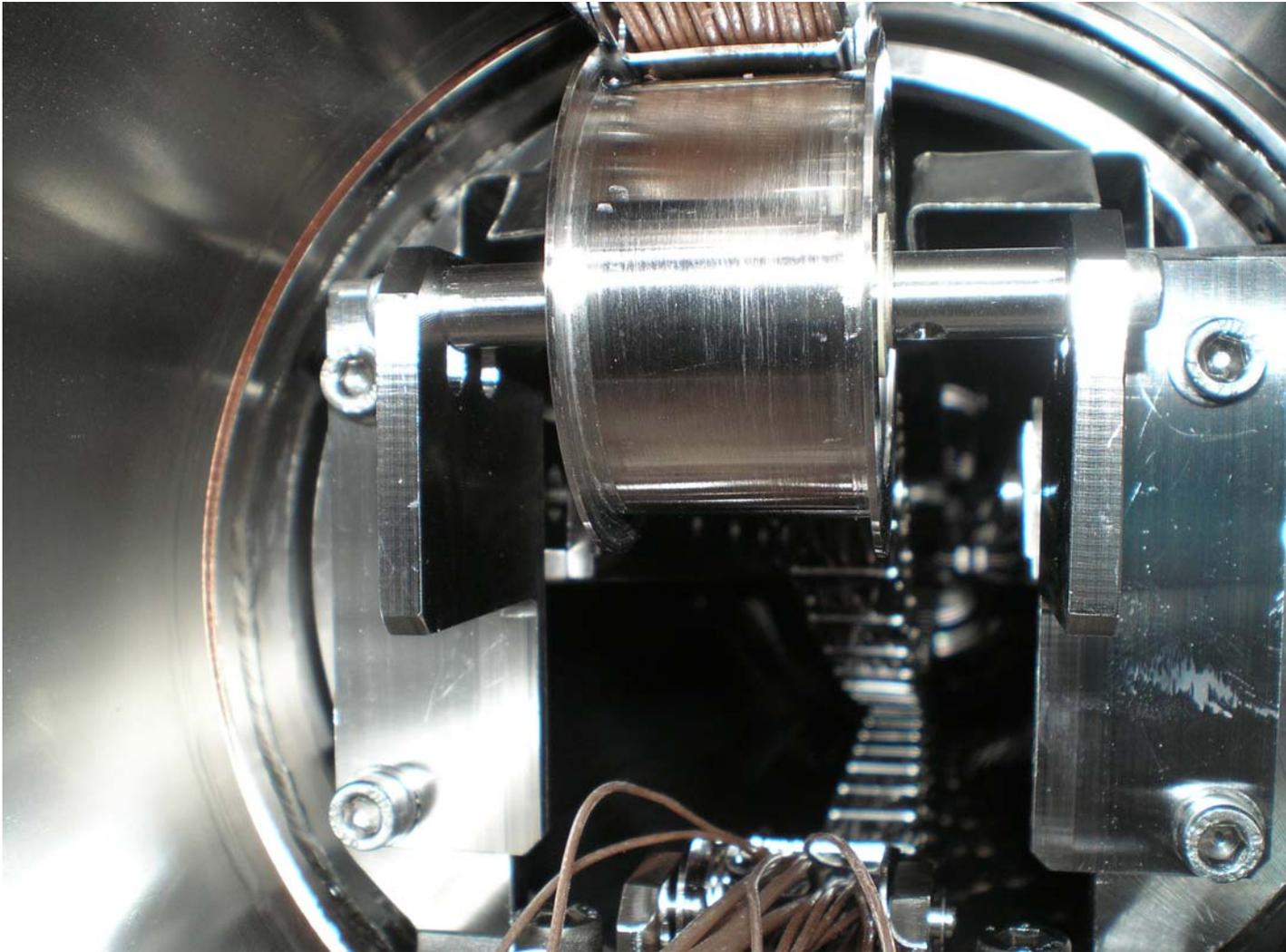
# Reality Strikes



**Ramp has been exchanged by “pulley bridge” → Bolts can not get underneath rail at this position**

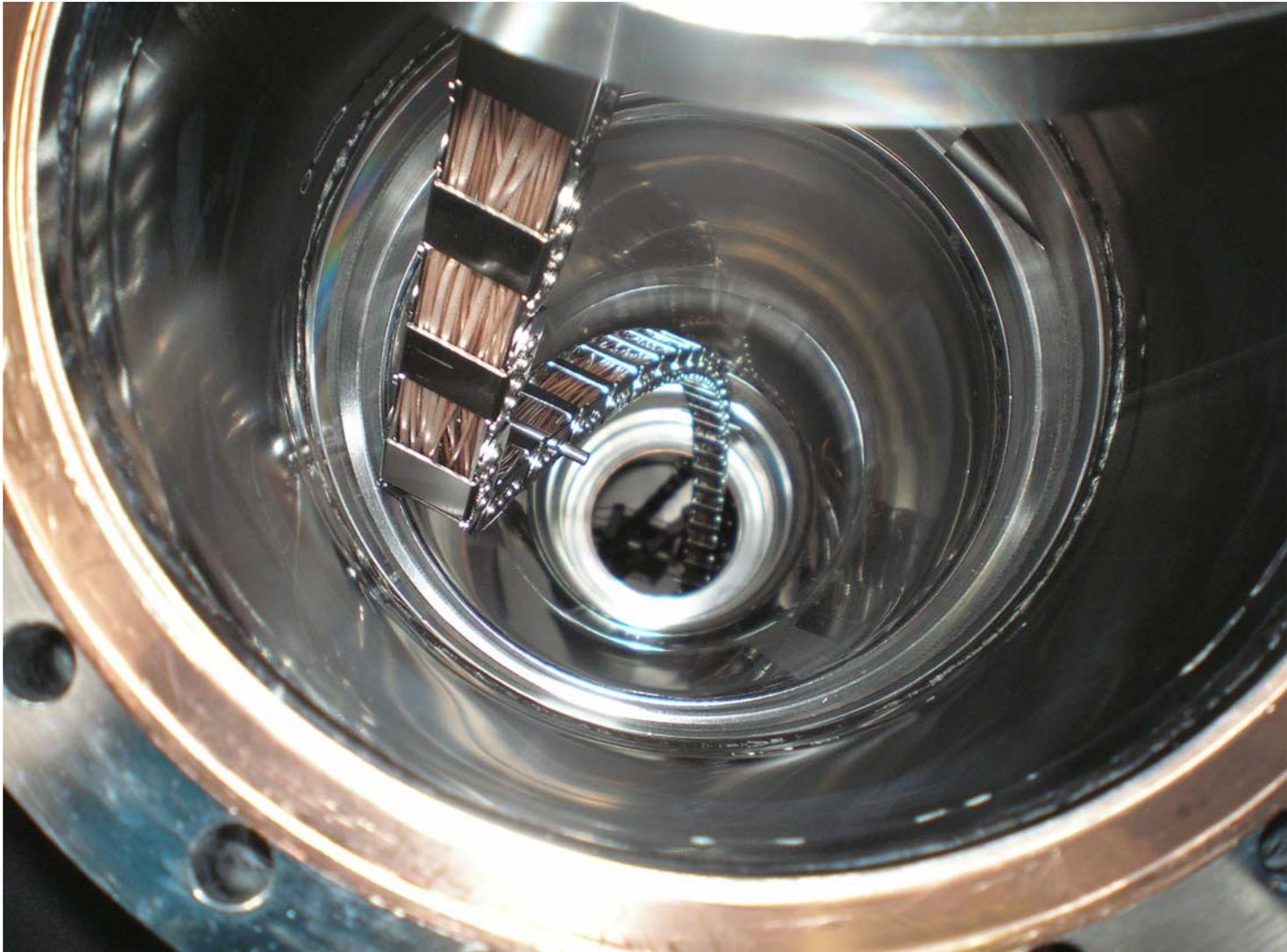


# Reality Strikes



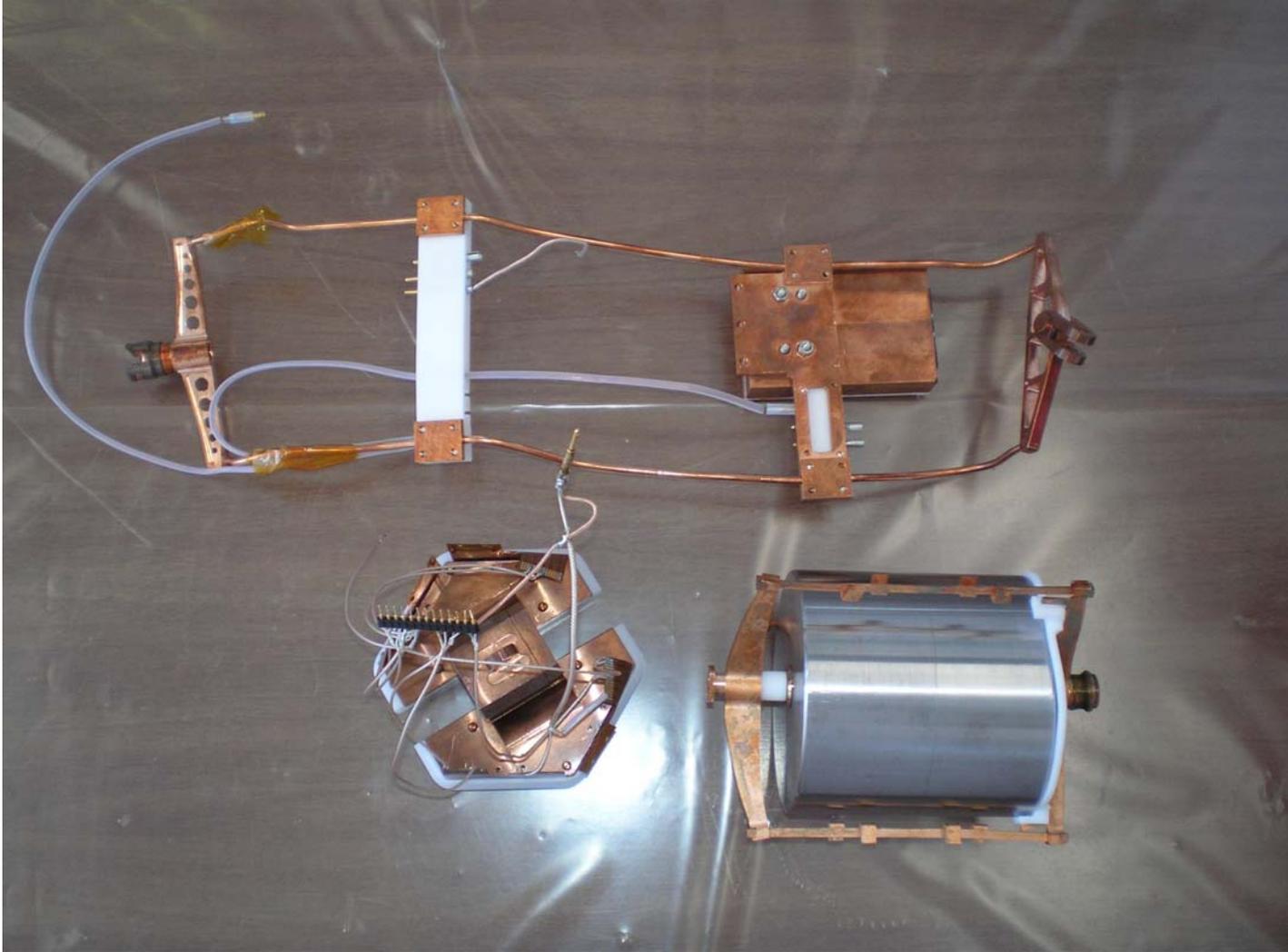


# Reality Strikes





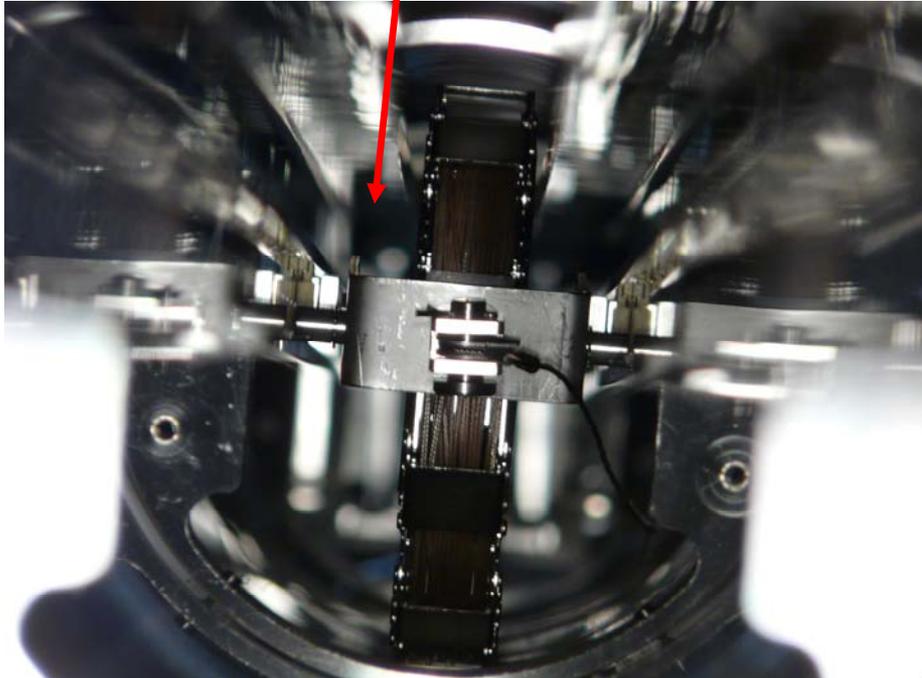
# Reality Strikes



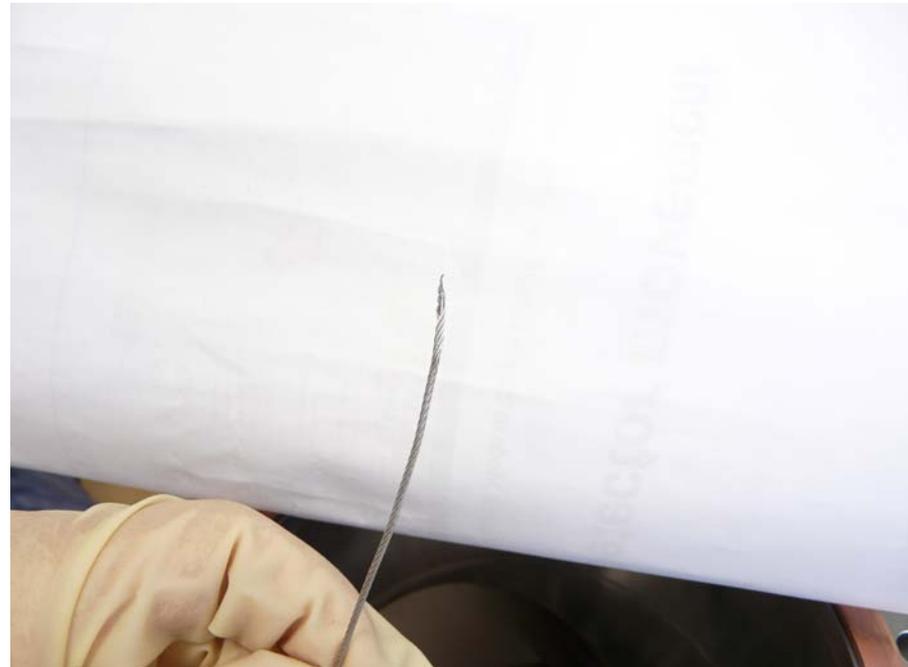


# Reality Strikes

**Linear pulley inside track. Broken steel wire**



**Steel wire underwent rupture test: Ruptured with 138kg of weight**





## Reality Strikes

### Further problems occurred:

- **Leak in tube (one of the CF flanges not tightened) → Condensation on matrix → Pogo pin problems**
- **Pogo pins wrong way around → Scratches in copper matrix**
- **Oscillations of chain have increased after accident → Despite no visible damage, change of bending behaviour**
- **Too fast immersion into LAr → Oscillations → Matrix got stuck in heat exchanger**





# Submerging a String to LAr

movie removed



# DON'T PANIC

*The Hitchhiker's Guide to the Galaxy*





## How to Adopt to Reality

### Safety features to be implemented:

- **Stiffen guide rails, slight redesign of rails**
- **Implement hard wired end switches**
- **Install viewport on top (maybe also to be used for distance measurement?)**
- **Additional possibility to monitor horizontal arm**
- **Get friction clutch to decouple motor from pulley in case of too large force**
- **Minimize oscillations by vertical chain guide**
- **Buy and test spindle system**
- **Formalize procedures**
- **Control of real position of matrix (?)**





# How to Adopt to Reality

## Time plan for implementation of changes\*:

Task	Responsible	KW 38		KW 39		KW 40		KW 41		KW 42		KW 43		KW 44		KW 45		KW 46		KW 47		KW 48		KW 49		KW 50		
		2008/09/14	2008/09/15	2008/09/16	2008/09/17	2008/09/18	2008/09/19	2008/09/20	2008/09/21	2008/09/22	2008/09/23	2008/09/24	2008/09/25	2008/09/26	2008/09/27	2008/09/28	2008/09/29	2008/09/30	2008/10/01	2008/10/02	2008/10/03	2008/10/04	2008/10/05	2008/10/06	2008/10/07	2008/10/08	2008/10/09	2008/10/10
Design of support rings	Mayer	x																										
Redesign of guide rails (decrease of height, round)	Mayer	x	x	x																								
Redesign top flange - viewports, separate pulley	Mayer																											
Design incremental encoder 50 deg pulley	Mayer																											
Get incremental encoder	Mayer																											
Design CF150 flange with 3 CF35 profiles	vogt																											
Design vertical chain guide and hooper for ends	vogt																											
Design deflection pulley hooper support on hubs	vogt																											
Design clutch and axle connection	vogt																											
Choose and get friction clutch	vogt																											
Production of support rings for linear pulley rails	workshop																											
Produce guide rails from one piece ext. compo	external																											
Make sure enough CF150 blind flanges are avail	Leber																											
Machine CF 150 feedthrough with 3 CF35 flanges	workshop																											
Production of vertical chain guide	workshop																											
Modify deflection pulley hooper	workshop																											
Handwiring design of end switch	Biedmeier																											
Install and test system stiffened and chain guide	workshop																											
Leak test of externally produced feedthroughs	Kopmala																											
Machine new feedthroughs (not necessary)	Biedmeier																											
Machine and weld Flanges for viewports on top	workshop																											
Install incremental encoder	workshop																											
Design hard wiring PLC 50 deg pulley	Medelberg																											
New calibration source flanges have to be implem																												
Remount complete system (incl. dist measure)																												
Test of distance measurement - laser system																												
Mechanical test																												
Leak test of system																												

# According to which the first lock could be ready this year for installation in hall A

Disclaimer: the time plane is valid for a perfect world (h=c=π=1). No unexpected or unplanned events are foreseen. Maximum productivity and perfect planning of all involved parties (project managers, directors, engineers, technicians, workshops, external company employees, suppliers of external companies, etc.) is assumed. For a realistic time plan please multiply time spans with (square of) a natural constant of your convenience!



## How to Adopt to Reality

- **Cable arm in Hall di Montaggio will not be used like this!**
- **2<sup>nd</sup> arm at Munich will be upgraded, other cable arm used for phase I**
- **Cable arm in Hall di Montaggio will be upgraded to a three string cable arm**





# Preparations in Clean Room:





# Preparations in Clean Room:





## Preparations in Clean Room:





## Preparations for 3 String Cable Arm





## Preparations for 3 String Cable Arm





## Preparations for 3 String Cable Arm





## Conclusions:

- **Commissioning of lock in Hall di Montaggio is really commissioning**
- **Implementation of redundant safety has started**
- **Some of the required implementations are time consuming and not as straight forward as seems**
- **Second cable arm will be equipped to be installed underground**
- **Shutter on cryostat is mounted**
- **Preparations for (Phase I) 3 string cable arm need more work**

