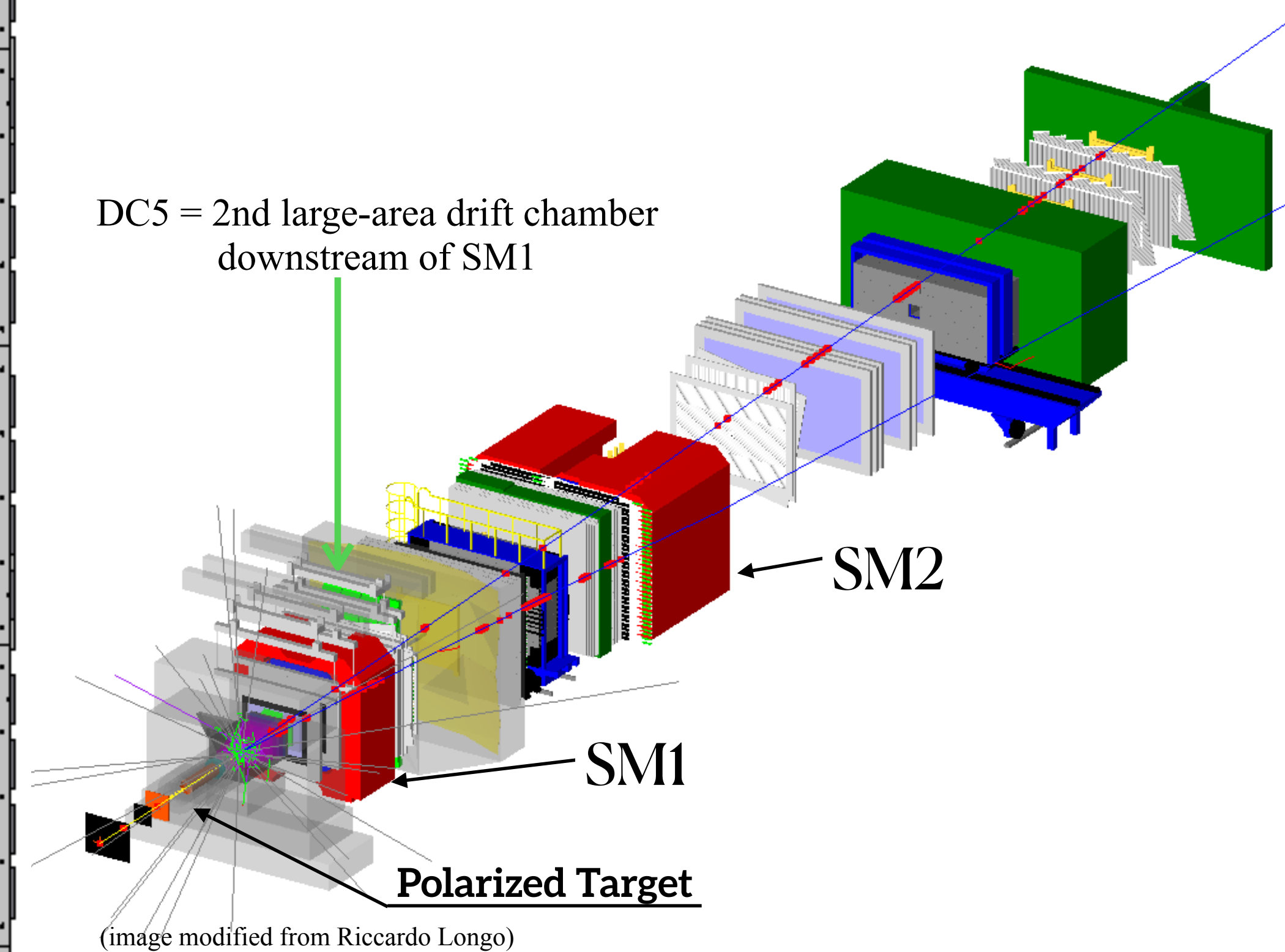


# DC5 repair plans

## COMPASS Technical Board Meeting 2021-11-16

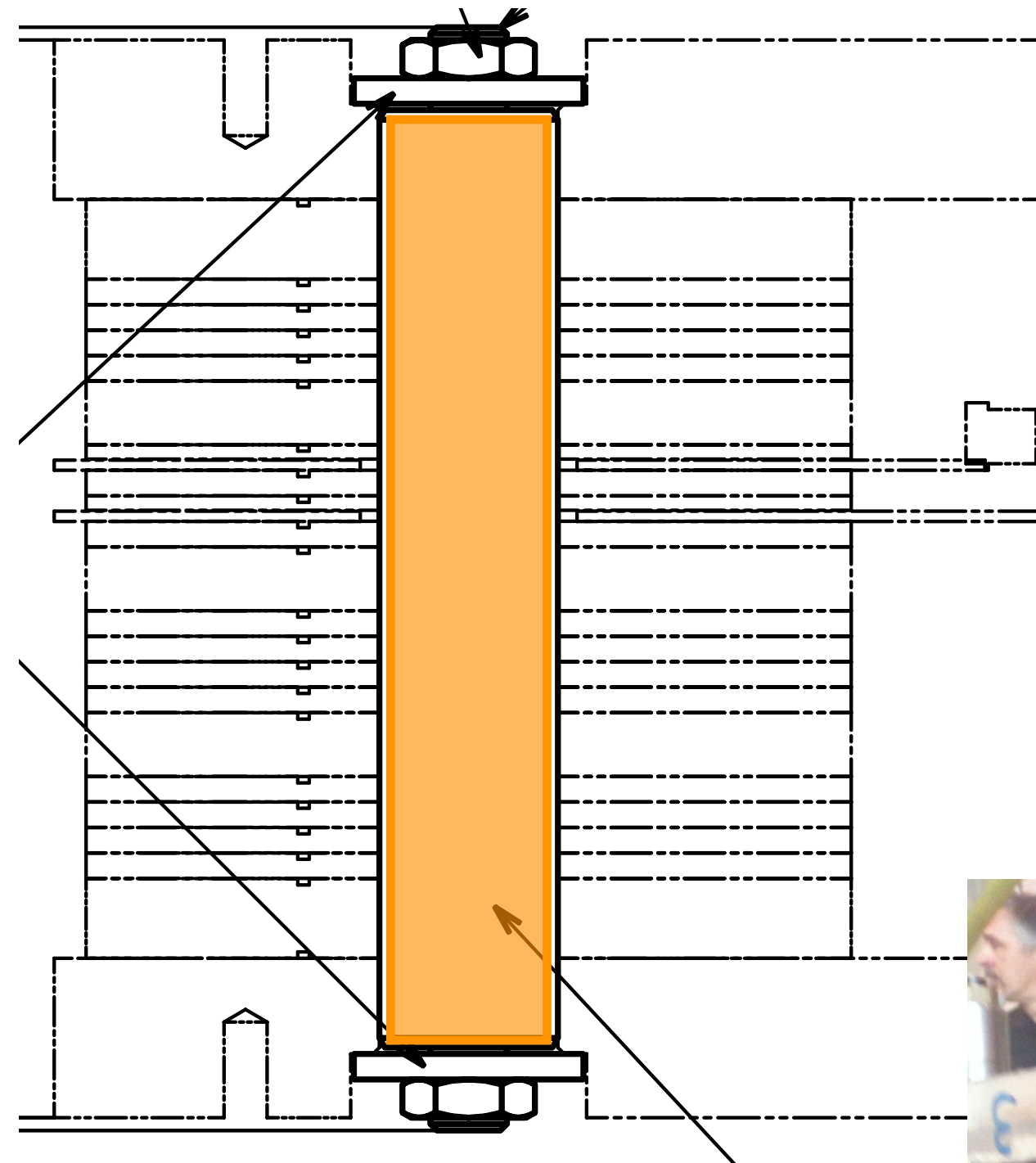


(DC4/5 design drawings Saclay / UIUC D. Durand / J. Blackburn)

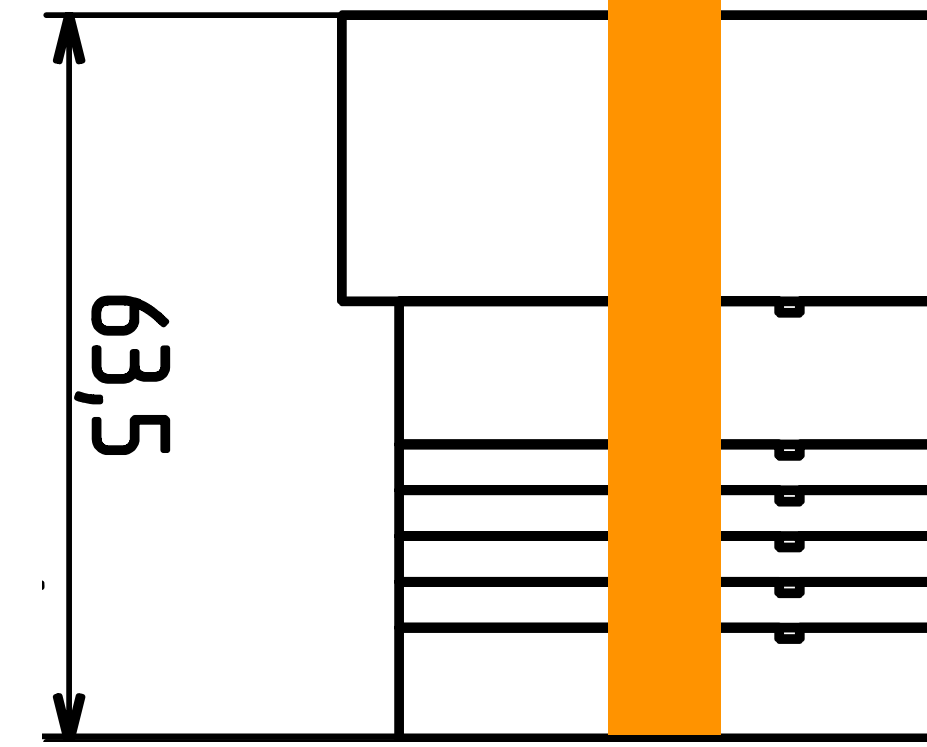
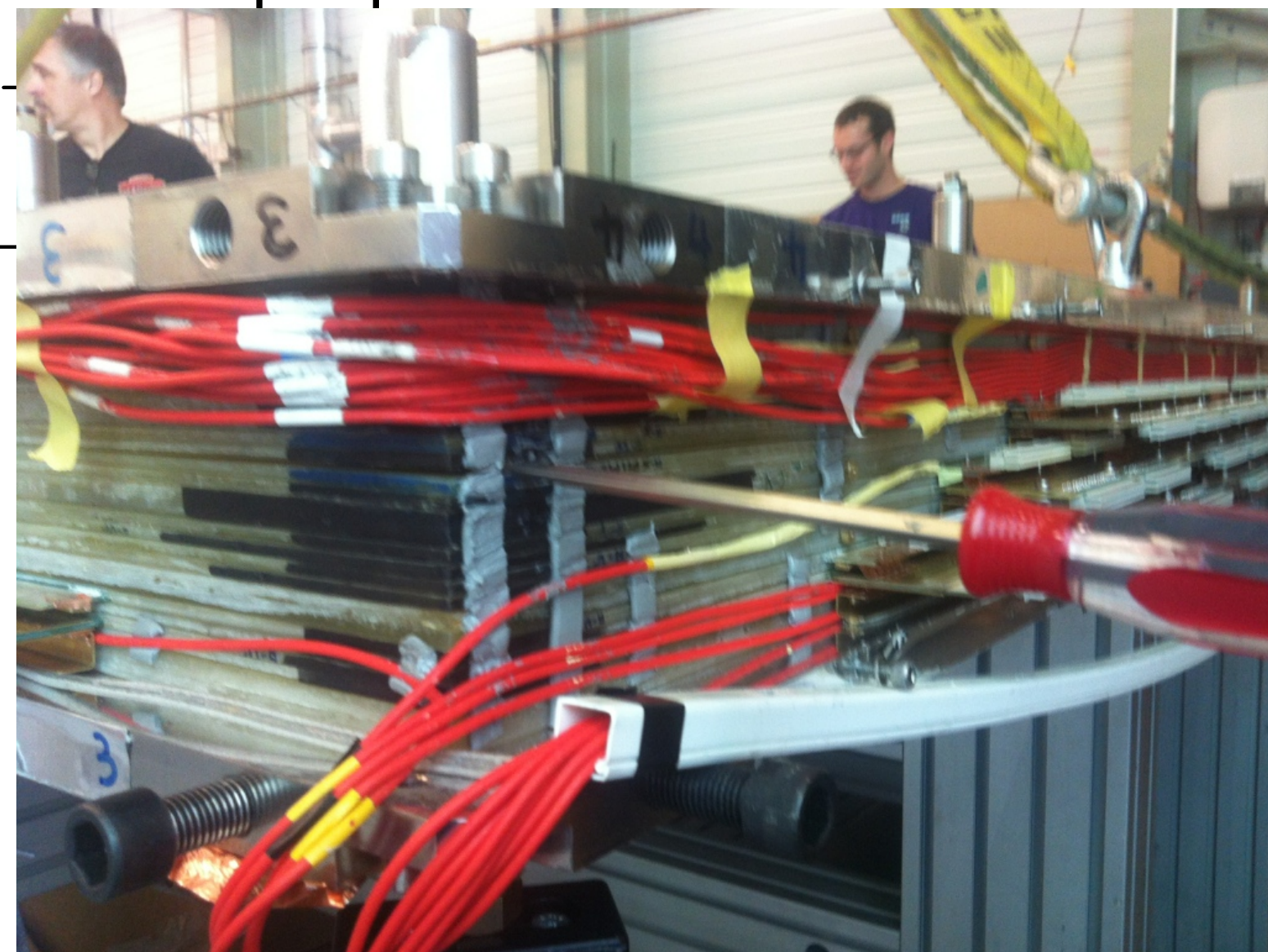
Caroline Riedl (UIUC)



# DC5 stack & opening at specific layer



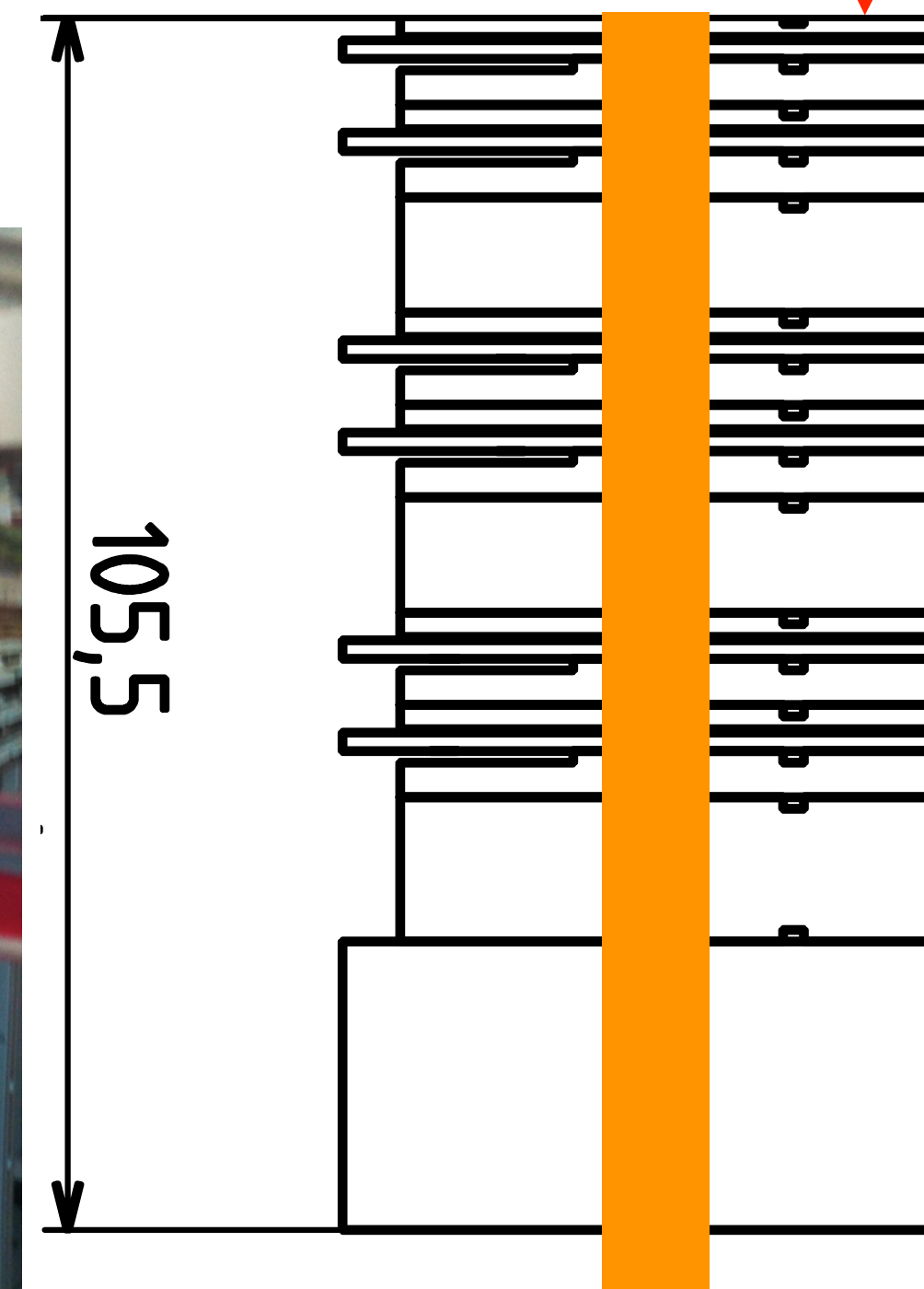
DC5 assembly pin (40x)



20x: every 2nd pin

X-anode is now topmost frame

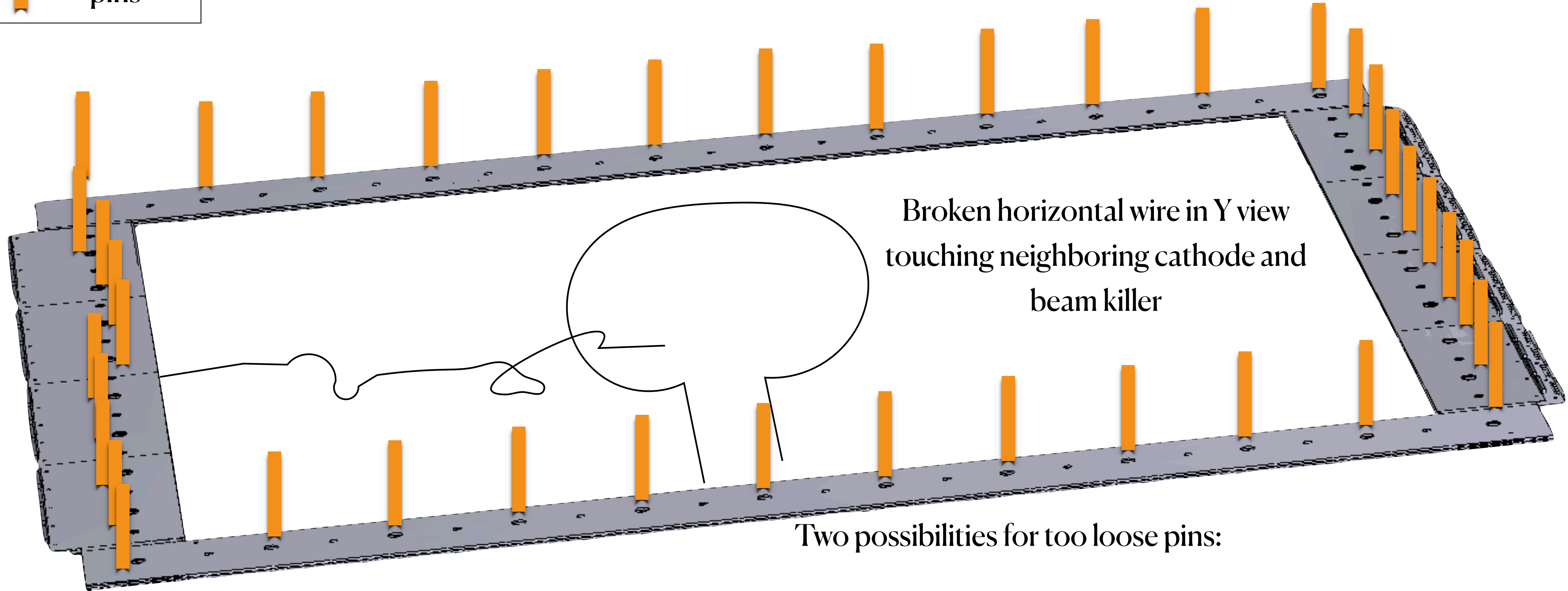
20x: every 2nd pin





# Assumed scenario as of July 2021

40 assembly pins



Broken horizontal wire in Y view touching neighboring cathode and beam killer

Two possibilities for too loose pins:

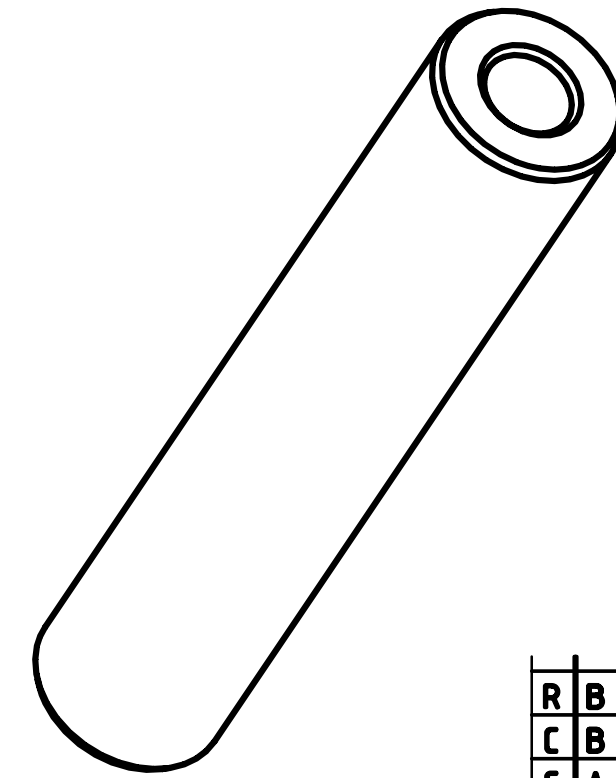
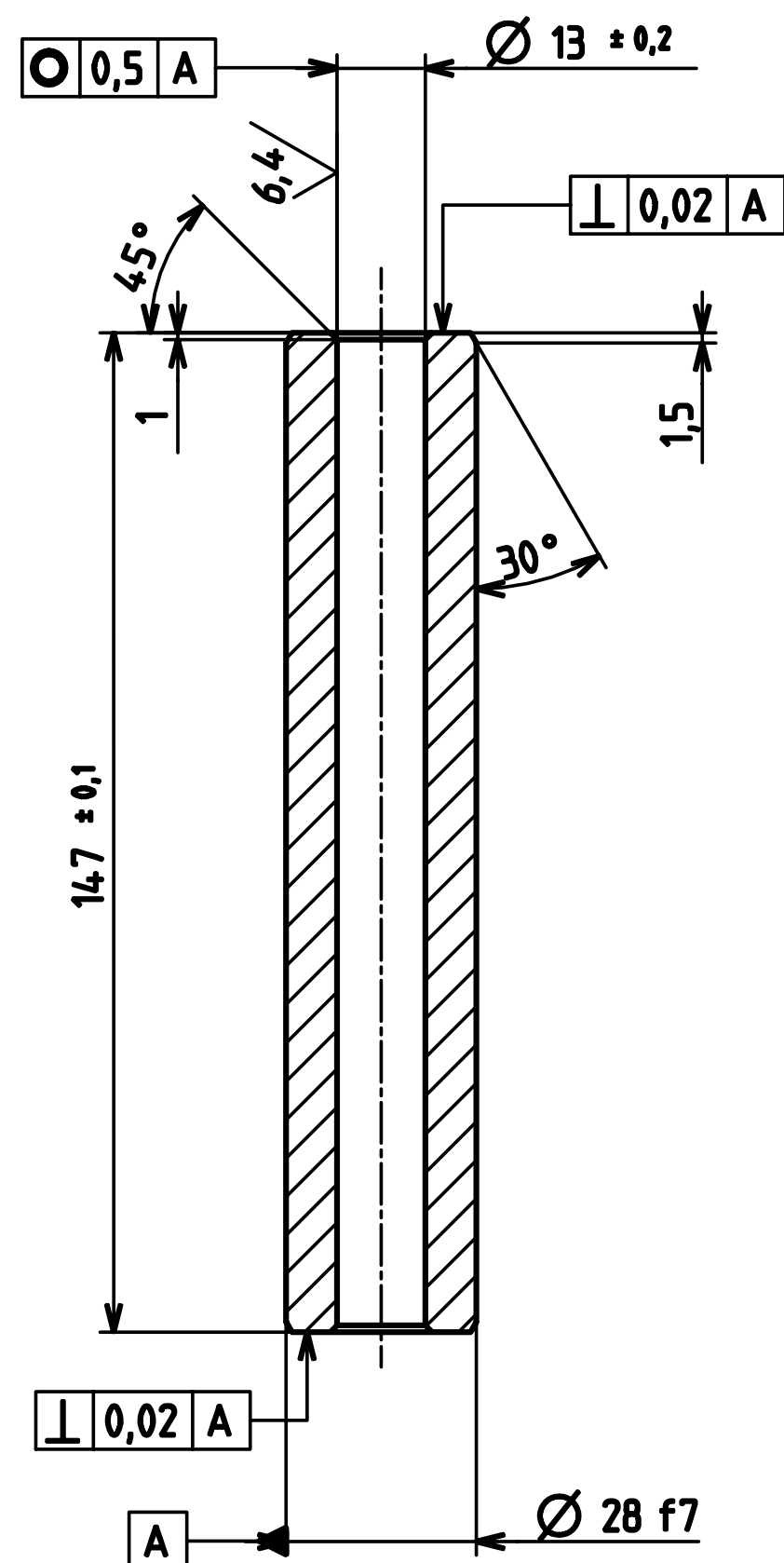
- Corner assembly pins are very tight
- Some (5-6) pins towards the center of G10 strips are very loose (they fall right through)
- G10 frames worn out → insert pins of slightly larger diameter
- Pins worn out → insert new pins of nominal design



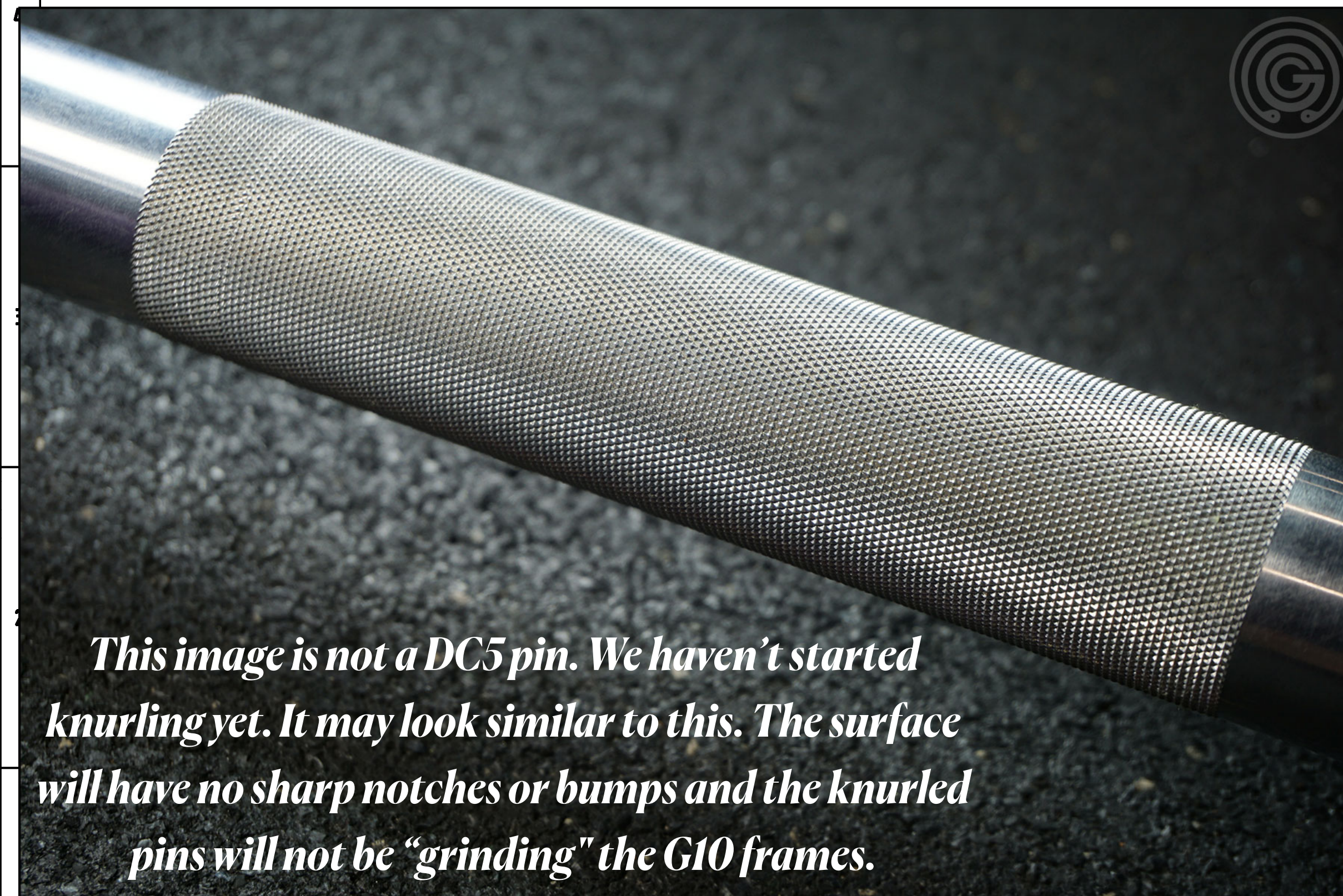
# Replacing some DC5 assembly pins

- 20 new steel pins from Atlas Tool Works, Inc. (Chicago, IL) have arrived at UIUC
- Nominal design (dia 28 mm)
- At UIUC Nuclear Physics Lab: will knurl 10 of them

**Knurling** is a finishing process in metalworking where grooves or patterns are formed on the surface of a finished part. This process displaces the material and *increases the diameter* of the workpiece.



Tolérances Générales	- Casser les angles vifs Break all sharp edges	St. Ind.	Date	Réf. approb. ou modif.	Dess.	Vérif.
	- Tol. ang: Ang. tol	Matière / Material : Z3 CND 17-12-02 - 316L - 1.440				
	I.R.G. 1,6	Trait. th. / Heat treatments :				
	H 1,6	Protection / Shielding : Kolsterising				
h	S-Ens. / Next Assy. : 9B 64.10 DM- 6105 000	Séparateur / Separator				
Js	0,00	S-Traitant / Supplier				
	Quantité / Quantity : 1	Echelle / Scale : 1/1	Masse / Mass : 600g			
	Plan dessiné avec le système C.A.O. EUCLID. Ne peut être modifié que par le même système. C.A.O. drawing. Do not make manual revisions or alterations					
	B.D. COMPASS,610,TLER			Réf. C.A.O. 61051001RB		
	COMPASS LAT - Chambre nue Fourniture fini					
C.E.A. / SACLAY						



*This image is not a DC5 pin. We haven't started knurling yet. It may look similar to this. The surface will have no sharp notches or bumps and the knurled pins will not be "grinding" the G10 frames.*



# Replacing some DC5 assembly pins - procedure

- First repair the broken wire
- Then replace too loose pins...
- One at a time, while nearby pins are fully engaged
  - ... with knurled pins (if holes got wider), or
  - ... with new nominal-design pins (if old pins show wear)
- Decide on case-by-case basis.
  - 5-6 are really bad.
  - Corners are probably fine.
- If needed, knurl more at CERN using knurling tools (?) in COMPASS workshop (French knurl = moleter?)

# UIUC plans for DC5 repair

✓ done

🕒 waiting for

🕒 to do

November 2021	December 2021	January 2021 <span style="float: right;">→ t</span>	
<p>✓ team submits travel petitions</p> <p>🕒 waiting for approval from UIUC to travel internationally</p> <p>✓ steel pins arrive at UIUC</p> <p>🕒 knurl some pins</p> <p>🕒 ship all pins to CERN (Meyrin)</p>	<p>🕒 pins arrive at CERN</p> <p>🕒 transport DC5 to clean area (Dec 15 - Vincent / Stefano)</p> <p>Y on top!</p>	<p style="text-align: center;"><u>Jan 10-16</u></p> <p>Mo, Tu: strip down support frame and brass shielding as much as necessary</p> <p>Wed: open, repair and close chamber</p> <p>Th, Fr: replace loose pins and tighten to nominal tension, HV tests</p> <p>Sa, Su: float</p>	<p style="text-align: center;"><u>Jan 17-21</u></p> <p>Mo, Tu: assemble support frame, HV tests FEE tests</p> <p>We, Th: Transport to 888 and installation</p> <p>Fr: float</p>

# Summary: planned UIUC DC5 repair & refurbishing campaign in January 2022

- Final goal: leave DC5 in a state that all four views can be operated under HV
- UIUC team:
  - Technicians: Eric Thorsland, Adam Wehe, Lucas Reeves
  - Physicists: Caroline Riedl, Vincent Andrieux, April Townsend (+ Riccardo Longo part time if needed + possibly Matthias Perdekamp)
- Travel approvals are pending.
- Academia Sinica has been informed; they are expected to not be able to travel to CERN
- It would be good if the surroundings of the heavy-duty table in the clean area could be cleaned up.
- It would be good to know if there are knurling tools at the COMPASS workshop available (French knurl = moleter?)
- It would be good to have the standalone DAQ available in the clean area for FEE tests.





photo by Stefano

November 16, 2021



# Overview: DC5 2018 - 2021

- April 2018: shock incident on DC5 in experimental hall
- June 2018: Y' (Y2) HV disabled, cannot hold nominal HV. Until end of dy18 run.
- June 2019: transport of DC5 from spectrometer to clean area.  
Diagnosis: now not only Y' damaged, but also Y.
- September 2019: opening of DC5 and repair of Y' (nylon wire) and Y (sense wire).  
This was the status during my talk given at the September 2019 CM.  
[http://wwwcompass.cern.ch/compass/collaboration/2019/co\\_1909/pdf/DC5\\_2019\\_CMSept\\_Riedl\\_v2.pdf](http://wwwcompass.cern.ch/compass/collaboration/2019/co_1909/pdf/DC5_2019_CMSept_Riedl_v2.pdf)  
After closing the chamber it was realized that some parts of the detector cannot be supplied with HV. This was the status at the Nov 2019 TB meeting:  
<https://indico.cern.ch/event/772364/contributions/3628640/attachments/1942756/3222164/DC5-repair-TBNov2019.pdf>
- January 2020: open DC5 and fix HV connections - BK-X', BK-Y, BK-V', C-V'.
  - The opening procedure caused a wire to break in V', which was also fixed.
  - Then installed DC5 January 24, 2020.
  - HV could be ramped to nominal for all views.
- February 2020: HV raised last time, all OK. Then: no critical interventions...
- January 21, 2021: HV in Y view cannot be ramped. Diagnosis: broken wire in Y. Very likely in the same region as the Y sense wire that was repaired in Sept. 2019 (see above).



## Why didn't we repair before the 2021 run?

- **COVID situation:** only as of the 2nd week of June, US citizens or permanent residents who are vaccinated can travel without quarantine on both sides. EU citizens without US passport or Green Card cannot come / return to the US unless they have a National Interest Exception from a US consulate in Europe.
- We considered it then a **too big risk** to go into another default repair campaign, at a relative **haste** and without any improvements on the procedure - our experience shows that more wires can break

## What will we do differently next time and why?

- Our suspicion: some holes in the G10 frames are worn out due to the repetitive opening. Opening / closing the chamber is a quite aggressive operation during that the 40 high-precision assembly pins are pushed through the entire thickness of the chamber.
- We are going to replace some of the existing pins - in particular those in the center - with pins of slightly larger diameter