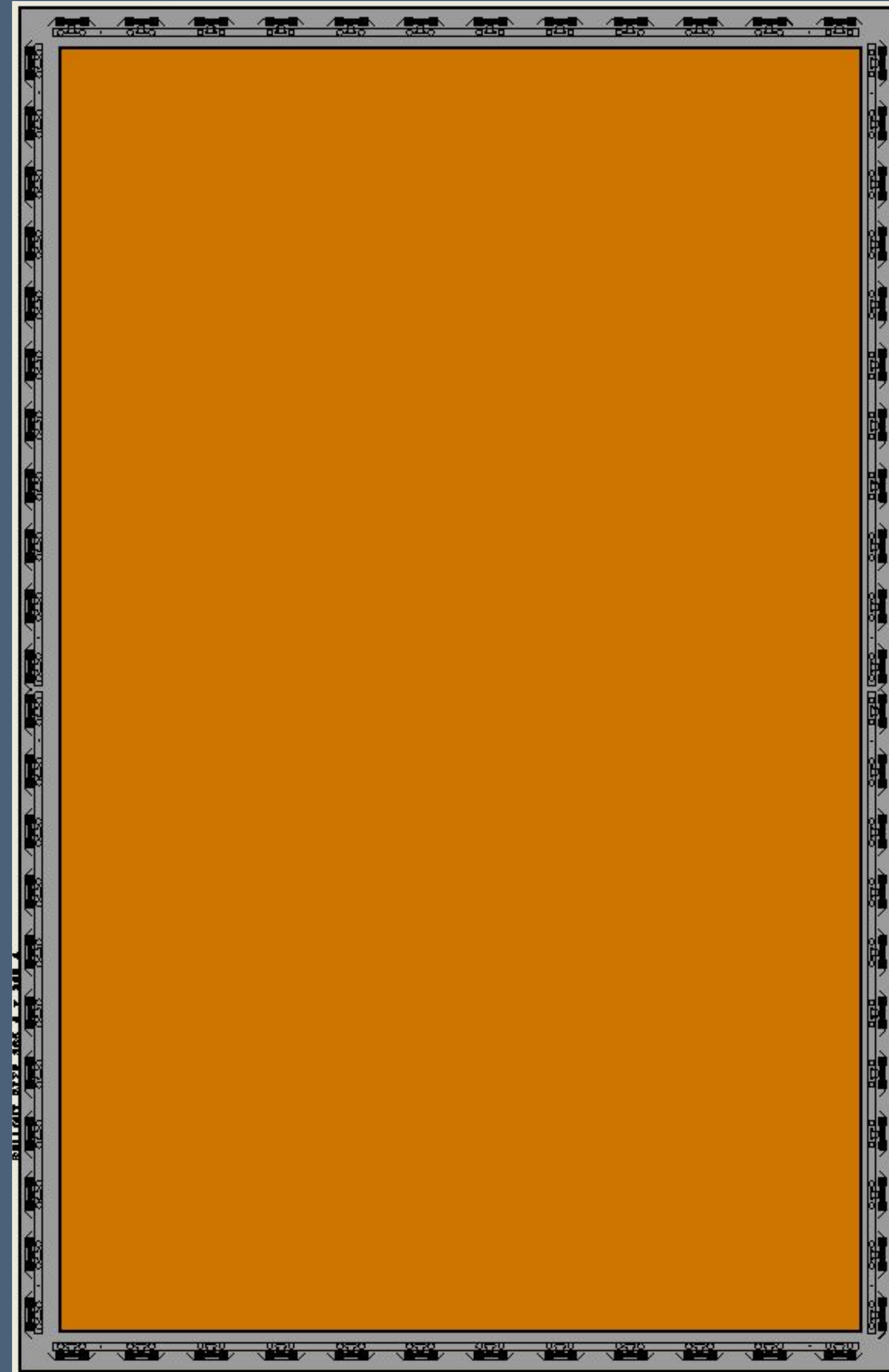


CYGNO-04 GEM detector status

Outlines

- What we have done so far
- Work towards assembly
- Plans



What we have done so far

2 GEM foils have been bought from MPDG lab two years ago.

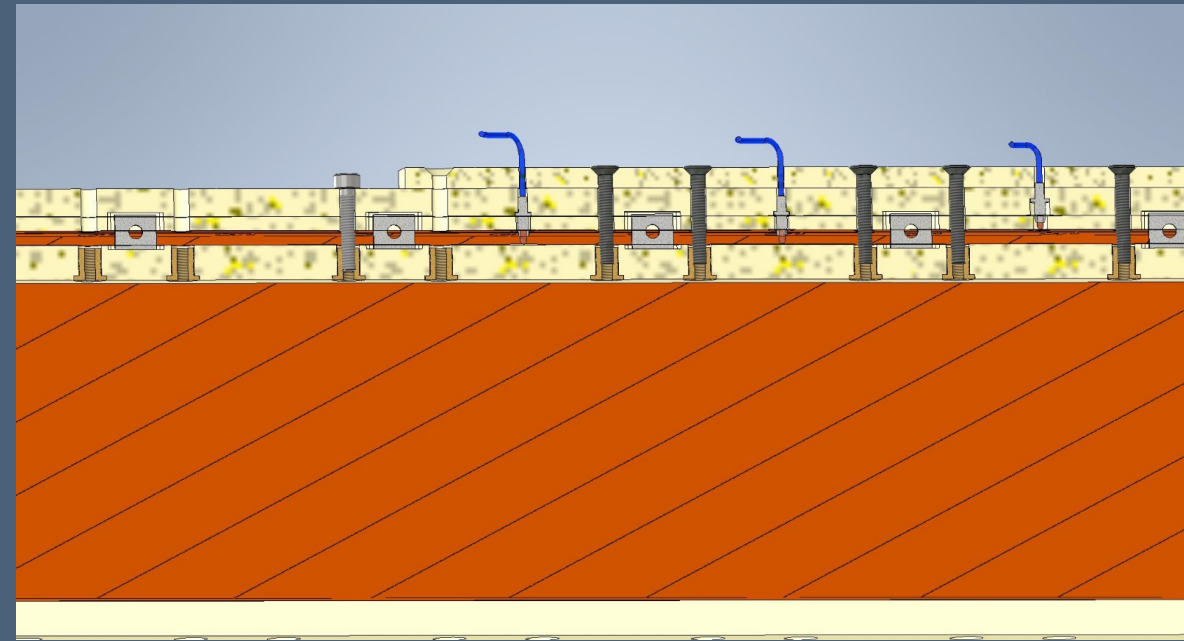
These foils are “low radioactivity” GEM in the sense that have been extra washed with de-ionised high pressure water after chemical etching to better remove the chemical leftover (mostly Potassium)

The foils active area dimensions are 50X80 cm²

The HV sectors separation is the standard one

One extra washed GEM foils will be send to LNGS for radioactivity measurement by the end of the month

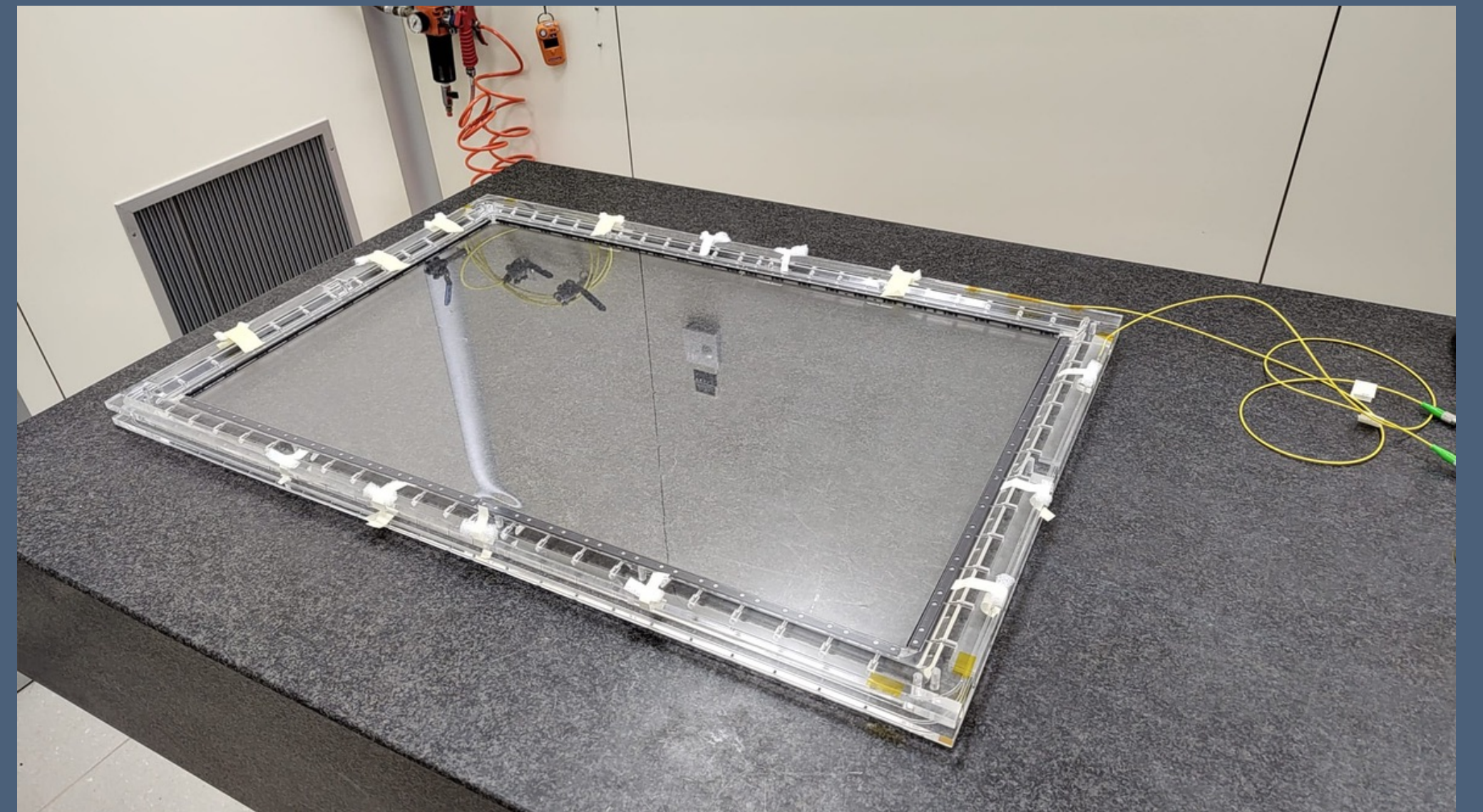
What we have done so far



Complete redesign of internal frames (huge thanks to Daniele) needed from the GEM stack assembly and to apply the mechanical tension to the foils
Internal frames will also provide the HV contacts for the 3 GEM foils

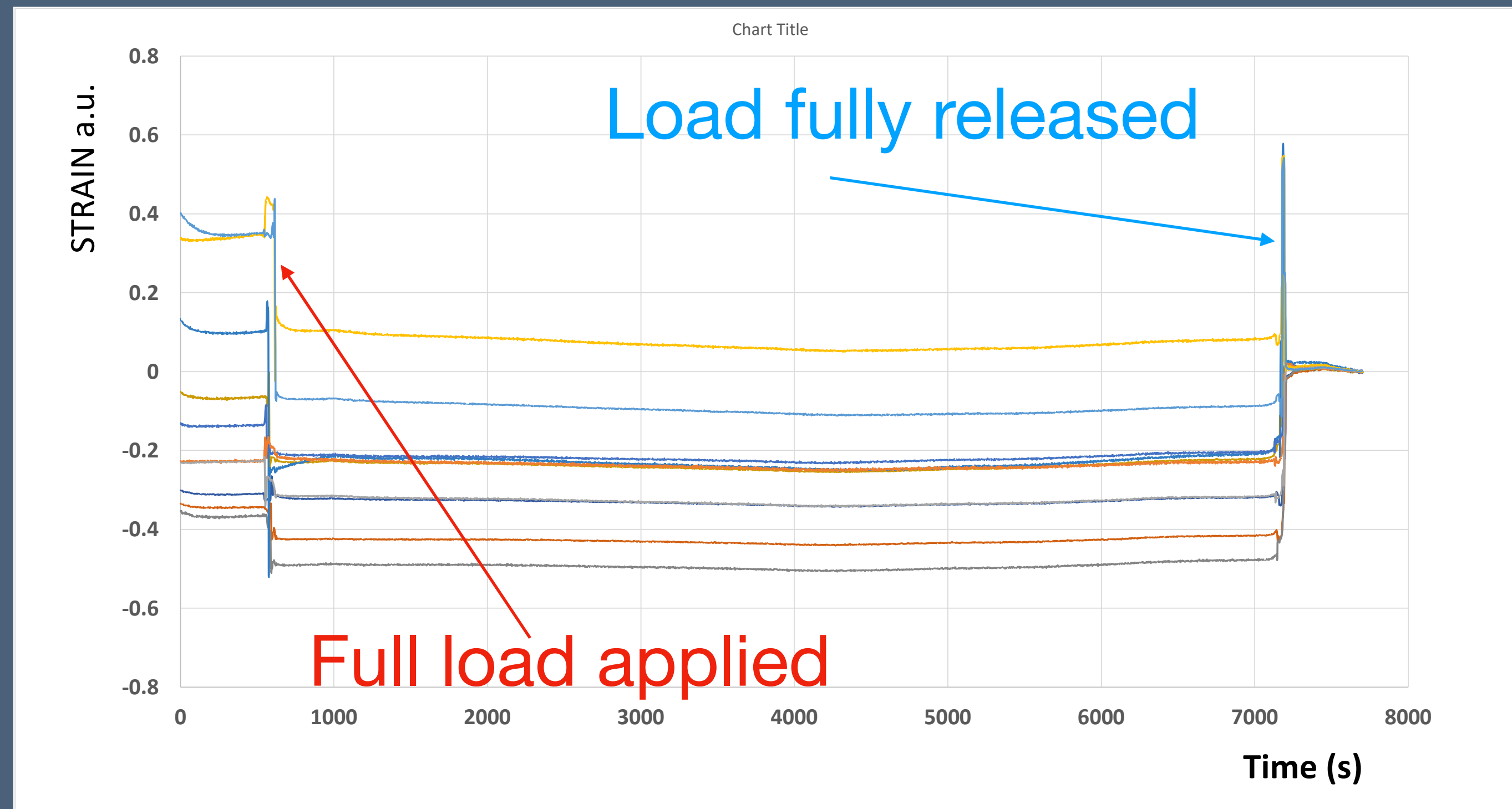
Finalised the external frame (PMMA) that must provide to mechanical tension rigidity. Will be also the mechanical support for the GEM into the CYGNO-04 active area (field cage).

The mechanical rigidity of the PMMA external frame has been tested by means of a "fake" GEM stack (150 μm Mylar foils) stretched and monitored by means of FBG sensors (still on the external frame)



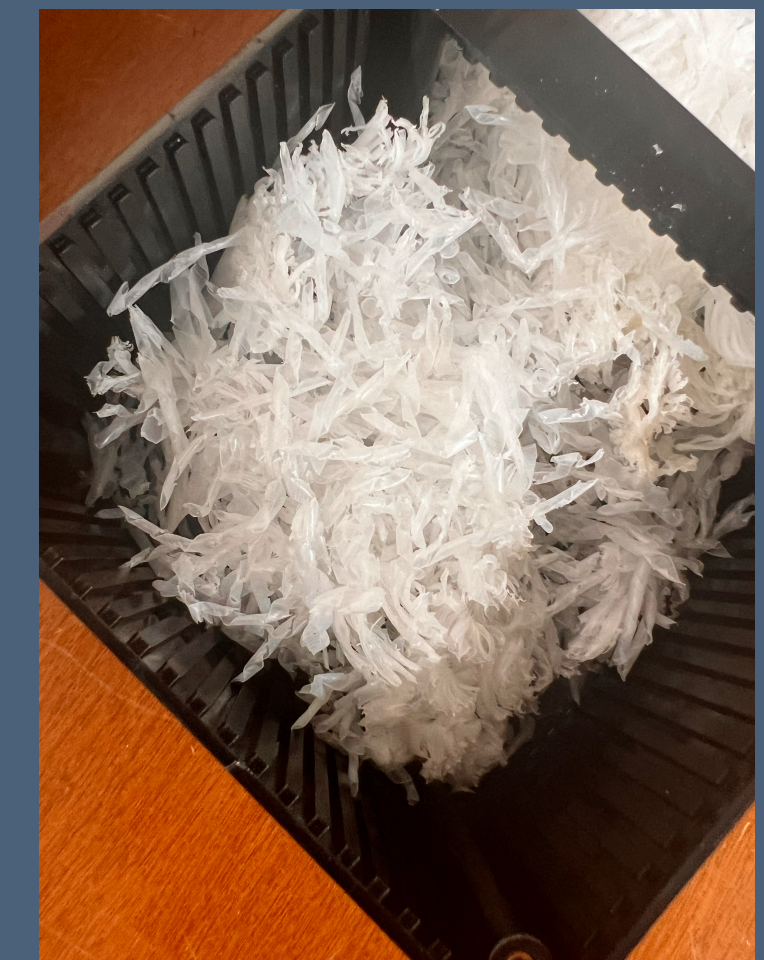
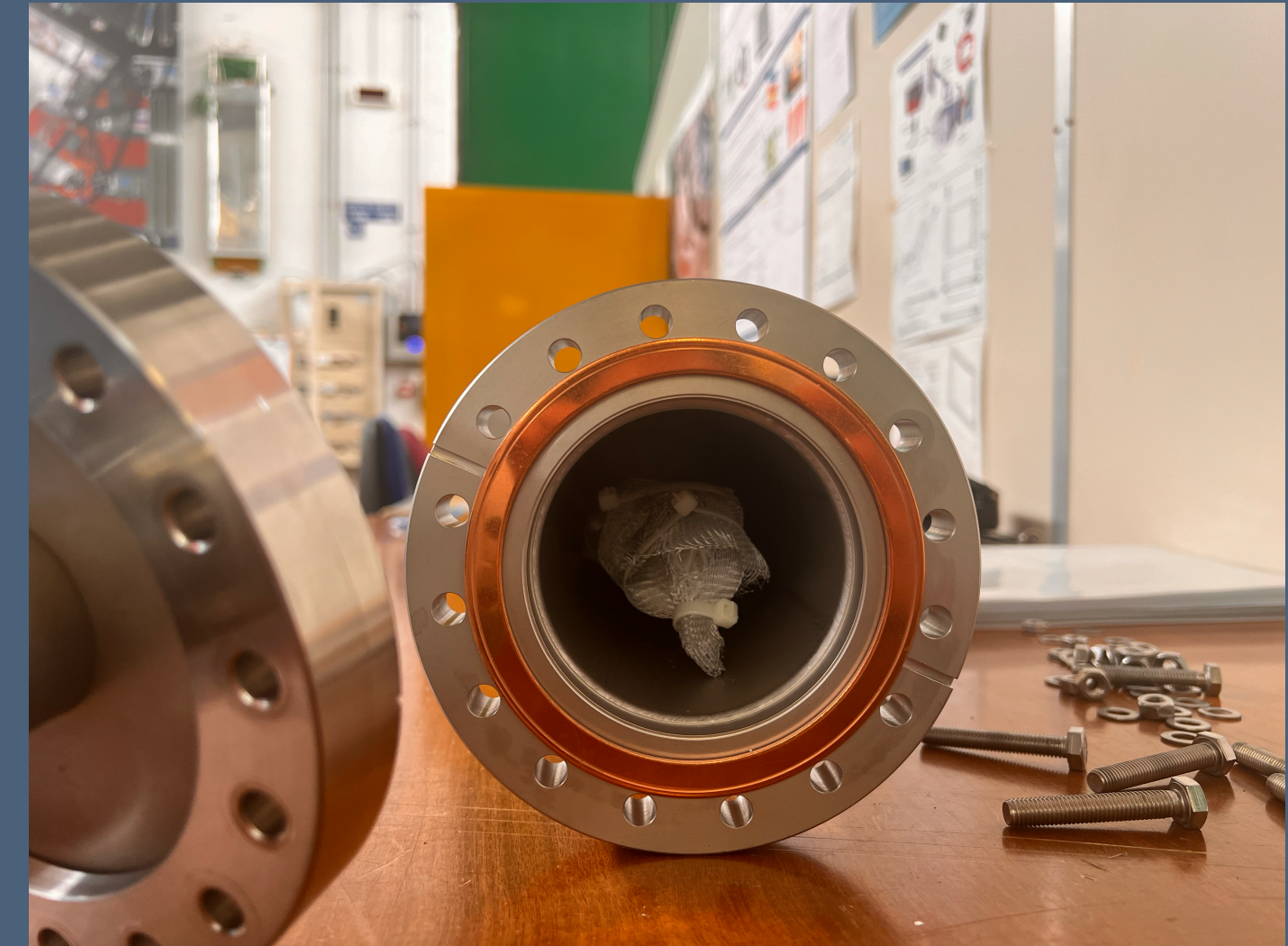
What we have done so far

- The behaviour is very similar to the expected one. Due a mistake the gluing of the FBGs was not done with the foil fully unloaded
- However the main and good result is the stability of the FBGs response in the between of the two regions when the mechanical load has been applied and removed.
- Similar test will be done with real GEM once assembled and stretched in the frame



What we have done so far

- We proposed to use NYLON6 as material for the internal frames since Plexiglass is too fragile and cannot secure the robustness during the GEM pulling
- NYLON6 samples have been sent to LNGS radioactivity measurement facility (see Donatella talk for preliminary results).
- We put NYLON6 samples in a pure CF₄ environment (3 Bar overpressure) for three months, to have a quick indication of possible incompatibility (although in literature was stated there is no).
- No evidence of deterioration of NYLON6 after 3 months of pure CF₄ exposure



Work towards assembly

- **We started to define a kind of cleaning procedure and handling protocol**
 - 1) All operation that involve the touch of materials that could go on contact with assembly materials MUST be done wearing gloves**
 - 2) all screws and metallic parts needed for the GEM stack assembly have been cleaned with**
 - **Isopropilic alcol in ultrasonic bath (USB) for 1 hour (50 degrees)**
 - **washed (USB) with a solution of de-ionized water and citric acid (4 L - 1 Kg) (50 degrees)**
 - **1 hour final washing (USB) with de-ionized water (50 degrees)**
 - **All screws are finally stored in sealed plastic bags.**

All these steps should be validated by radioactivity measurements performed on the same sample after each test. Anyhow we have some hundred of washed screws that can be measured at LNGS

Work towards assembly

- **The NYLOS6 internal frames have been finally manufactured (HUGE WORK! Many many to A. Zossi) following Daniele's drawings**
- **The frames have been cleaned first to remove small debris from the machinery.**
- **washed for two hours (USB) with di-ionized water and citric acid solution (4 L - 1 Kg) 50 degrees**
- **Washed for two hours (USB) with di-ionezed water 50 degrees**

All these steps should be validated by radioactivity measurements performed on the same sample after each test

Anyhow we have some hundred of washed screws that can be measured at LNGS

Work towards assembly

- **Assembly tools...contain critical part..**
- **During assembly foils should be cleaned from dust floating into the air by means of a silicon roll use in clean rooms for chips wafers cleaning. CMS has one but is clearly contaminated being used for CMS GEM (no extra cleaning for chemical etching leftover).**
- **We must buy a new one for CYGNO but it will take one month to be delivered at minumim**
- **We have a backup solution by blowing GEM foils with dry and clean Nitrogen flow.**
- **All screw drives and other metallic tools needed for the assembly will be cleaned with isopropilic alcol and citric acid solution**

Work towards assembly

- **GEM stack storage box**
- **Needed to store the GEM stack after assembly in the external frame**
- **Will be flushed with Ar/CO₂ or dry and clean nitrogen to keep GEM foils clean and safe.**
- **Will allow to power GEM foils separately or all together**
- **Ar/CO₂ could allow us to power the stack and see signals from GEM 3 bottom**



Plans

IF everything will go right...

We should have the GEM stack ready by the end of this week

Stato della validazione materiale

WBS ID	WBS item	min. phys. requiremet	how to (minimal)	staus	phys. target	how to (target)	status
	cathod		Cu, 2mm, 50*80, radiopurezza, ecc	R&D		materiale, spessore, dimesioni, radiopurezza, ecc es Lomba cathode	missing
	cathod - frame		PMMA, ...	validated, design			missing
	cathod - connector			validated, design			missing
	cathod - feed through			R&D			missing
	cathod - cable			validated, design			missing
	cathod - Hv ISEG						missing
	side A/B - field cage			R&D			missing
	side A/B - field cage frame			R&D			missing
	side A/B - field cage resistors			validated, design			missing
	Filed cage BOX	135kg total mass (box+GEM frame)	PMMA				
	side A/B - GEM		Katpon/copper	validated, design			missing
	side A/B - GEM internal frame		Nylon 66	validated, design			missing
	side A/B - GEM Stack instert		Brass	validated, design			missing
	side A/B - GEM stack screws		Stainless steel	validated, design			missing
	side A/B - GEM HV pins		Copper/gold/nickel/stanless steel	ready			missing
	side A/B - GEM resistors		Nickel/ceramic	validated, design			missing
	side A/B - GEM External frame	See Field cage BOX	PMMA	validated, design			missing
	side A/B - GEM Pulling screws		Stainless steel	validated, design			missing
	side A/B - GEM T-nuts		Stainless steel	ready			missing
	side A/B - GEM connectors		???????	missing			missing
	side A/B - GEM feed through signal			R&D			missing
	side A/B - GEM feed through HV			R&D			missing
	side A/B - GAS feed through			validated, design			missing