

# ***TOF local shielding and commissioning***

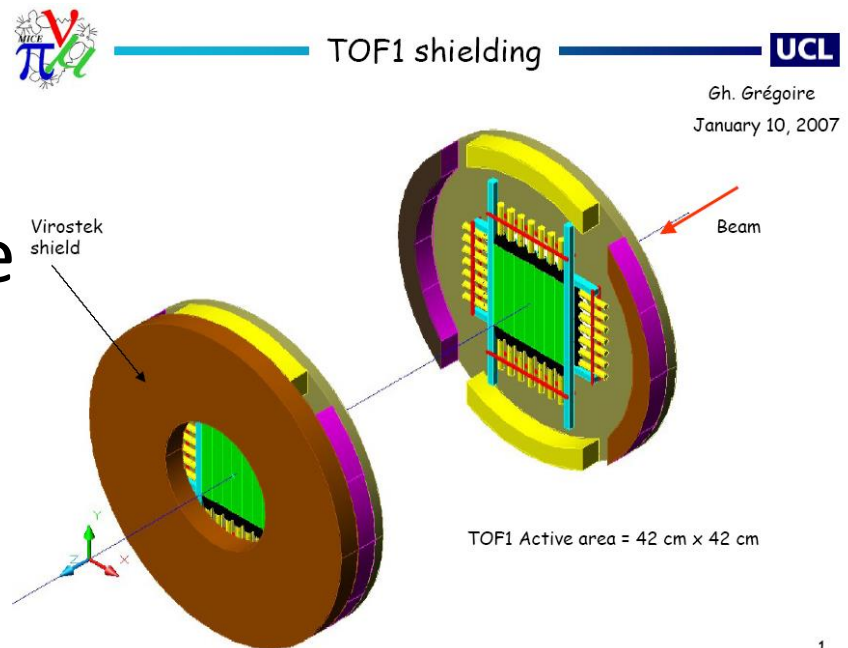
**M. Bonesini**  
**Sezione INFN Milano Bicocca**

# Outline

1. TOF1 local shielding
2. Readiness of TOF system for STEPIV
3. Conclusions

# 1. TOF1 Local shielding

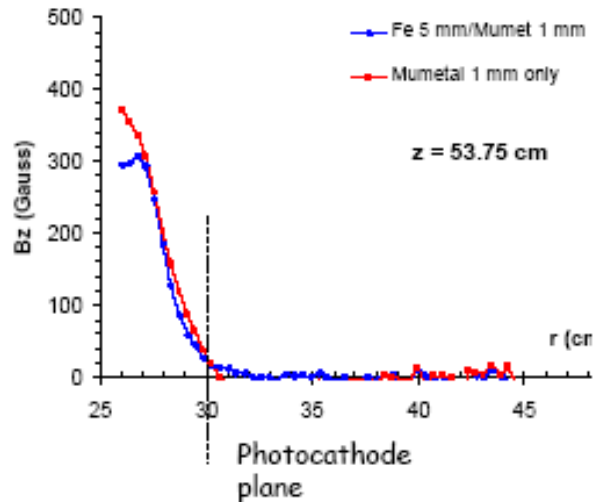
- Magnetic shielding of TOF1 was with an external cage
- But with PRY it seemed not effective
- What to do ?



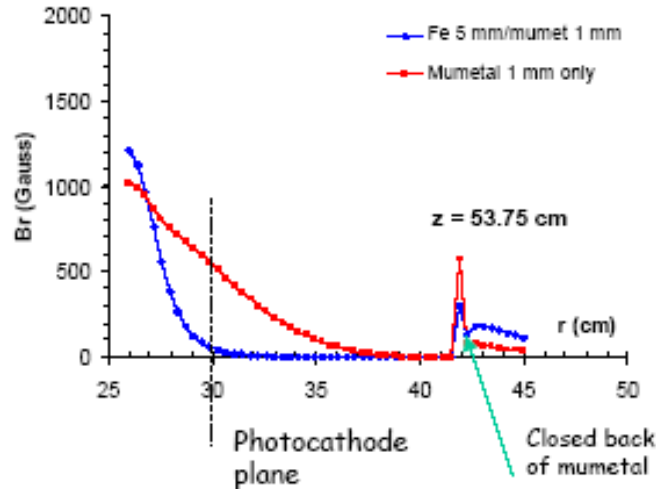
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# Field components along PMT axis



Radial component for middle PMT



Longitudinal component for middle PM

It is seen that:

- The **radial** component remains very weak since the cage structure did already the whole job

Central hole diameter = 600 mm

1-mm mumetal only

- The **mumetal alone** is clearly not sufficient to get an acceptable **longitudinal** component.

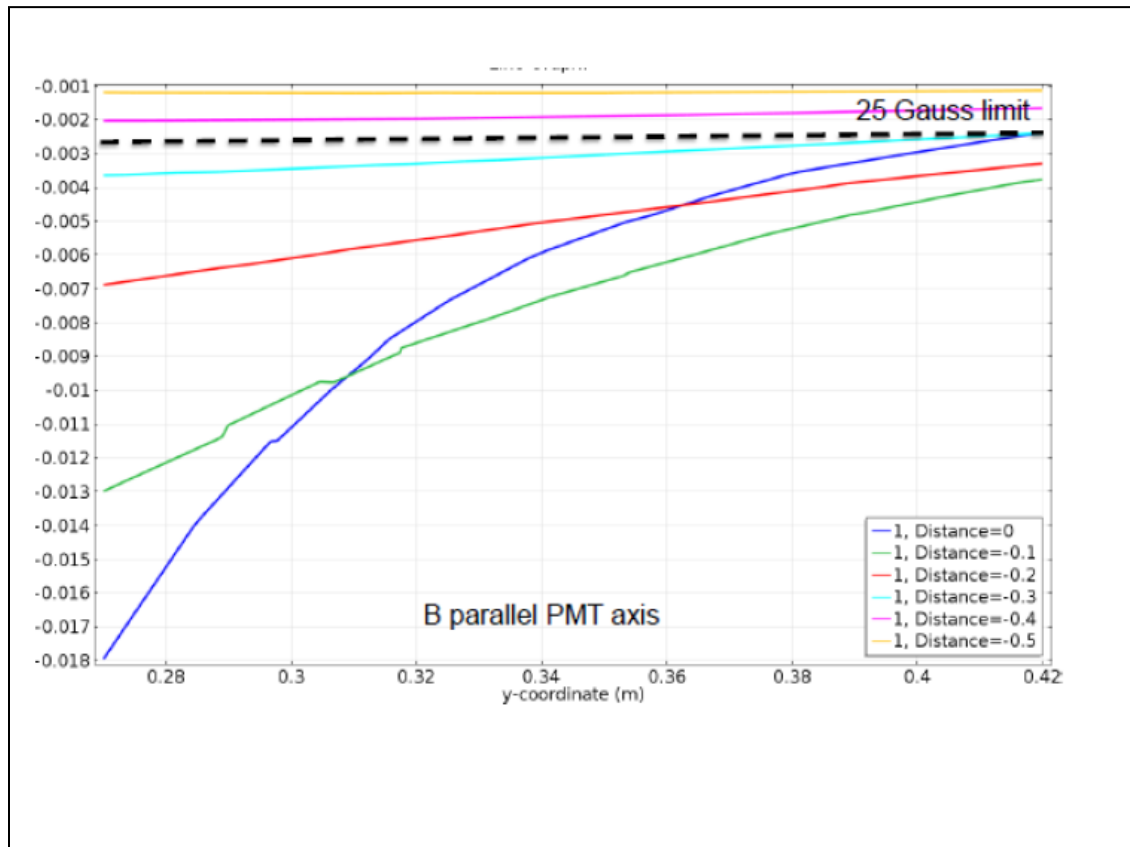
At the end we were forced to have a cage for TOF1 ... [we, as TOF group, were NOT in favour of it ]: it added complications to HW



## The cage phantom hinged around

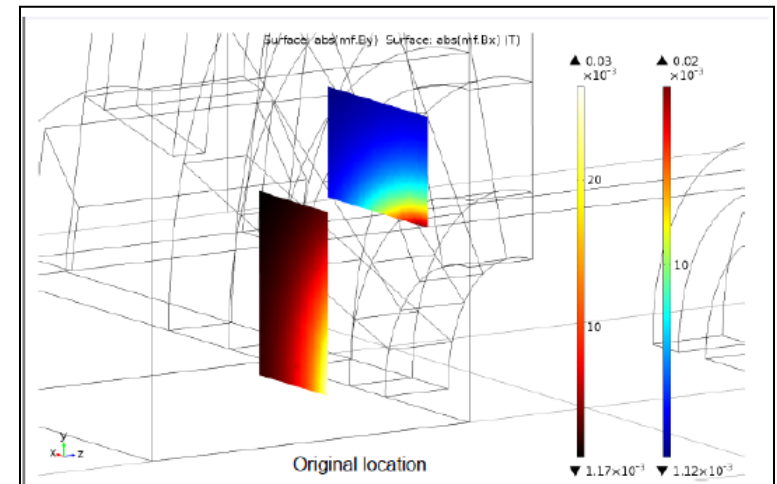
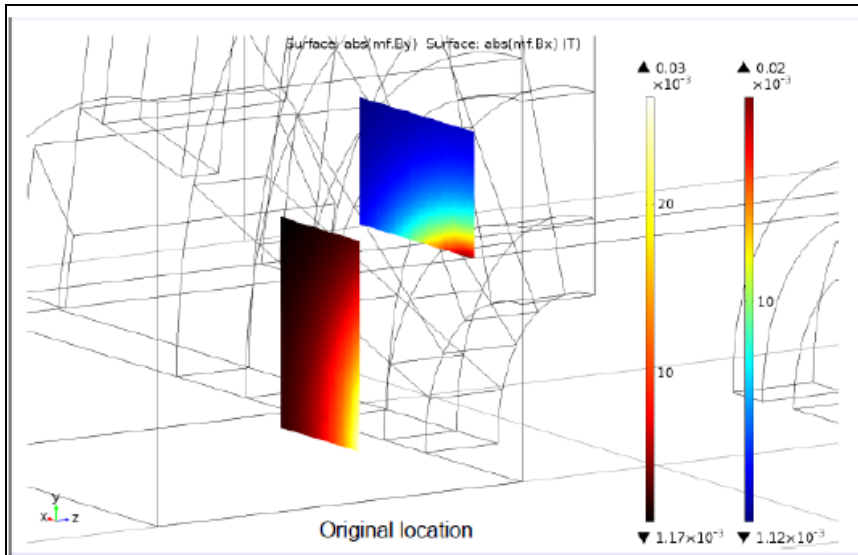


# Simulations from H. Witte (I)



Moving away TOF1 of  $\sim 40$  cm reduces the field to a manageable level ( $< 25$  G) [see next slides]

# Simulations from H. Witte (II)





# Behaviour in B field of R4998 PMTs

R. Bertoni et al / Nuclear Instruments and Methods in Physics Research A 615 (2010) 14–26

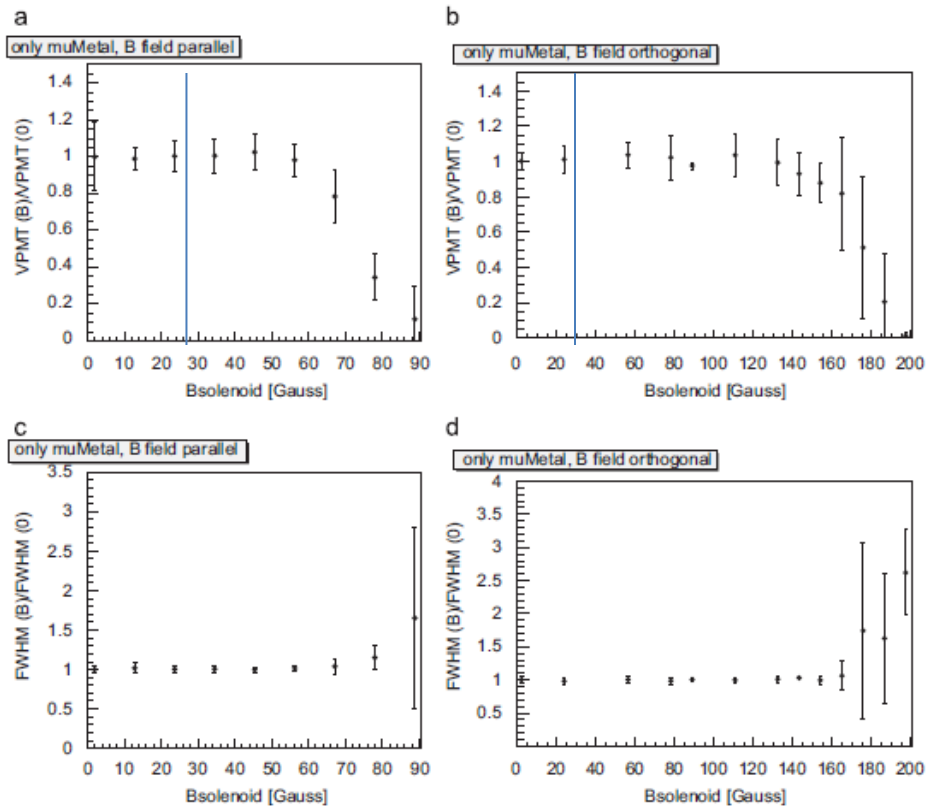


Fig. 7. Signal ratio at field  $B$  and  $B = 0\text{ G}$  and FWHM ratio at field  $B$  and  $B = 0\text{ G}$  for the timing difference, measured as  $\Delta t = t_{\text{START}} - t_{\text{STOP}}$  with only the mu-metal shielding of 1 mm for the PMTs. Left panel: longitudinal field, right panel: orthogonal field. The plots show the average and rms for a sample of 10 R4998 PMTs.

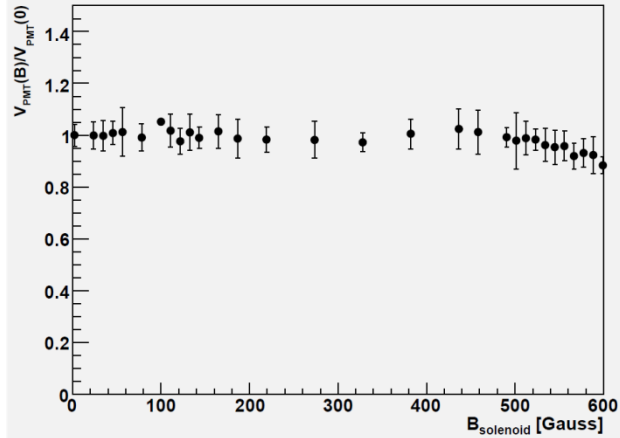
If fringe field is  $< 25\text{ G}$   
we are OK



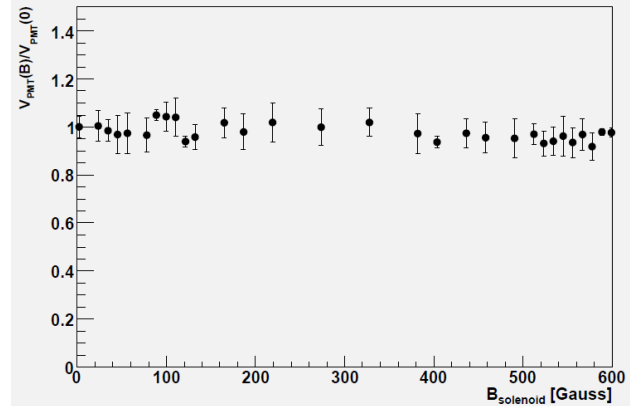


# Box shielding with ARMCO

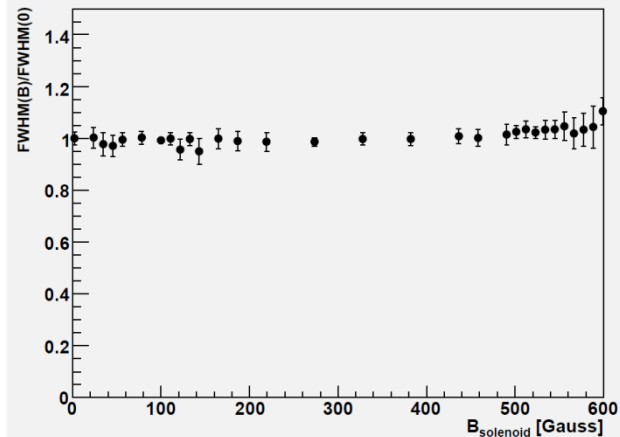
feARMCO, 5x5 no extension



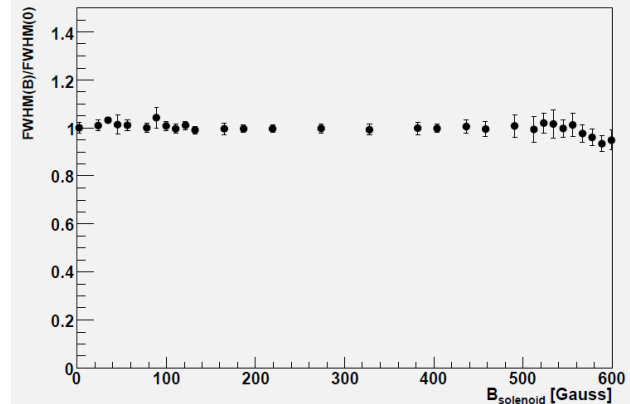
feARMCO, 6x6 no extension



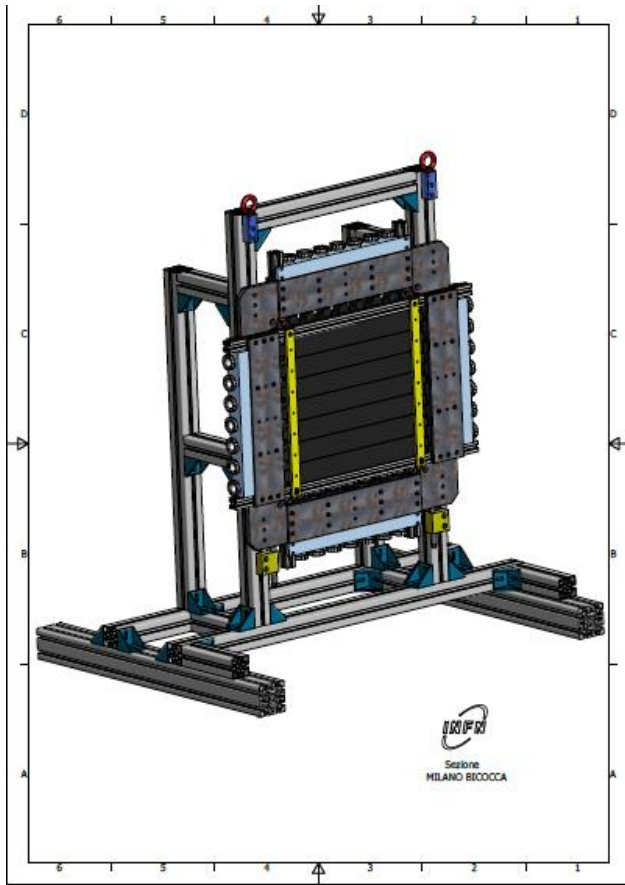
feARMCO, 5x5 no extension



feARMCO, 6x6 no extension



# Some details on TOF1 local shielding

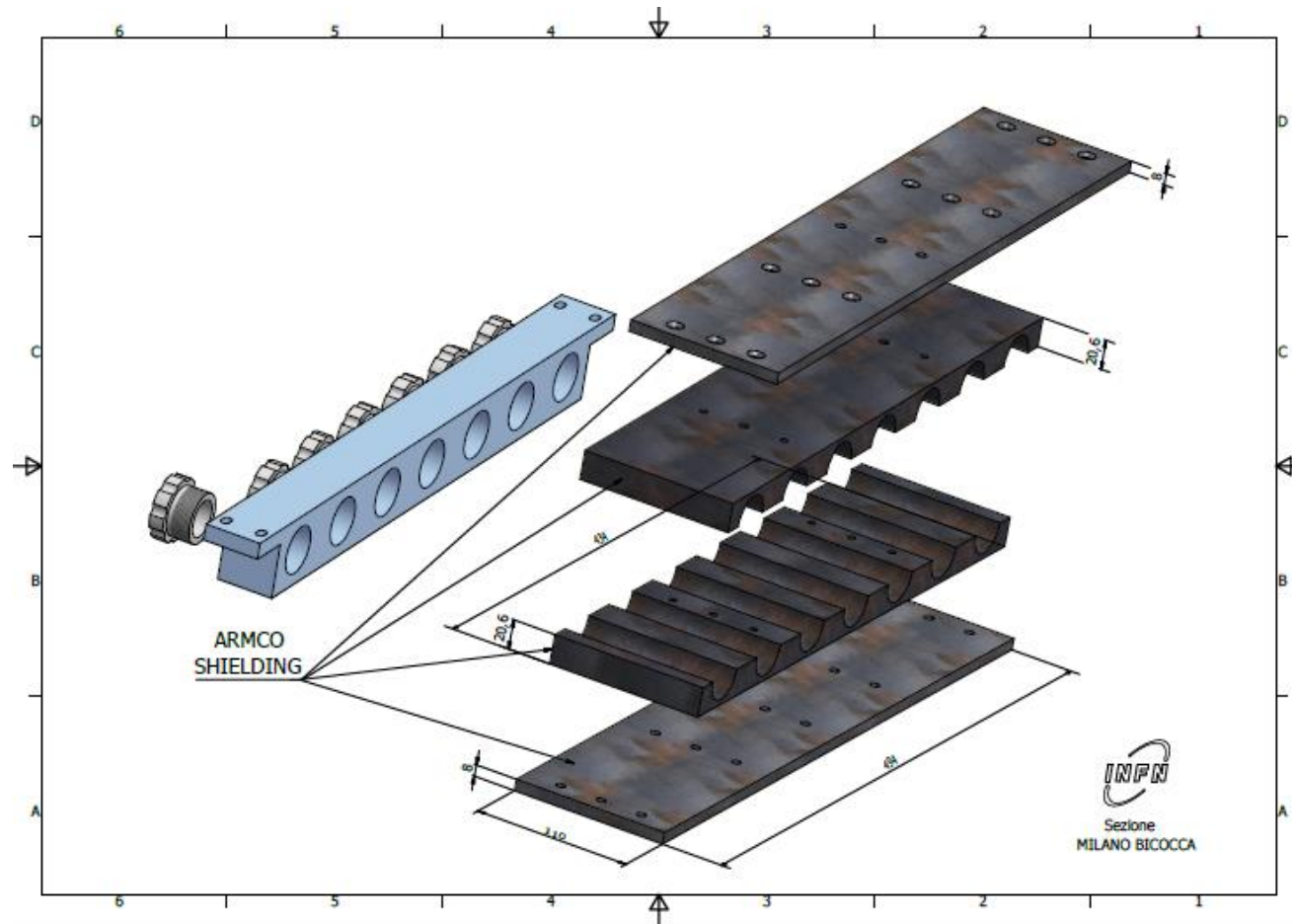


- Keep present mechanics structure for TOF1
- Adds only ARMCO plates for shielding
- to a reinforced structure
- Avoiding to move TOF1 detector from MICE Hall

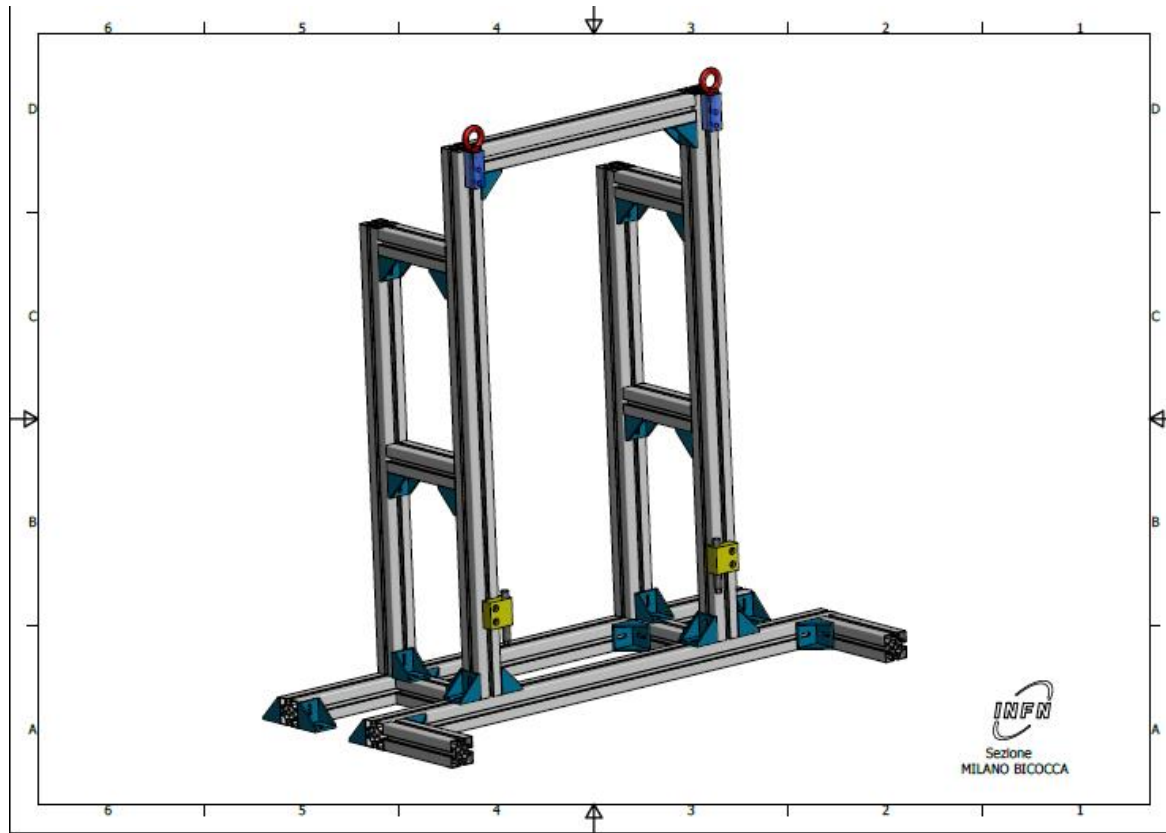
## OPERATIONS:

- Survey of existing TOF1
- Costruction at INFN MIB of local shielding pieces and new support
- Installation at RAL

# Mechanical pieces



# New TOF1 support structure



# Some images of the operations





# In its final place ...

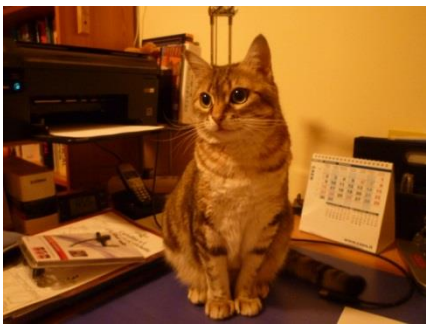


# Readiness of TOF system for STEP IV

- The TOF system (TOF0,TOF1,TOF2) is working smoothly since 2009 and we do not foresee problems for STEP IV operations
- The only difference is the presence of fringe fields from solenoids (but shielding must work is simulations were correct)
- After shielding operations on TOF1 only 1 PMT was found broken and replaced
- We will need some days of data taking for calibrations + a survey







# Conclusions

- Local shielding of TOF1 implemented to reduce operation risks
- TOF system is ready to take STEP IV data. The only problem we fear is that PMTs are now ~ 6 years old and we have not many spares
- documentation is updated