# ECAL LEAD GLASS STUDY

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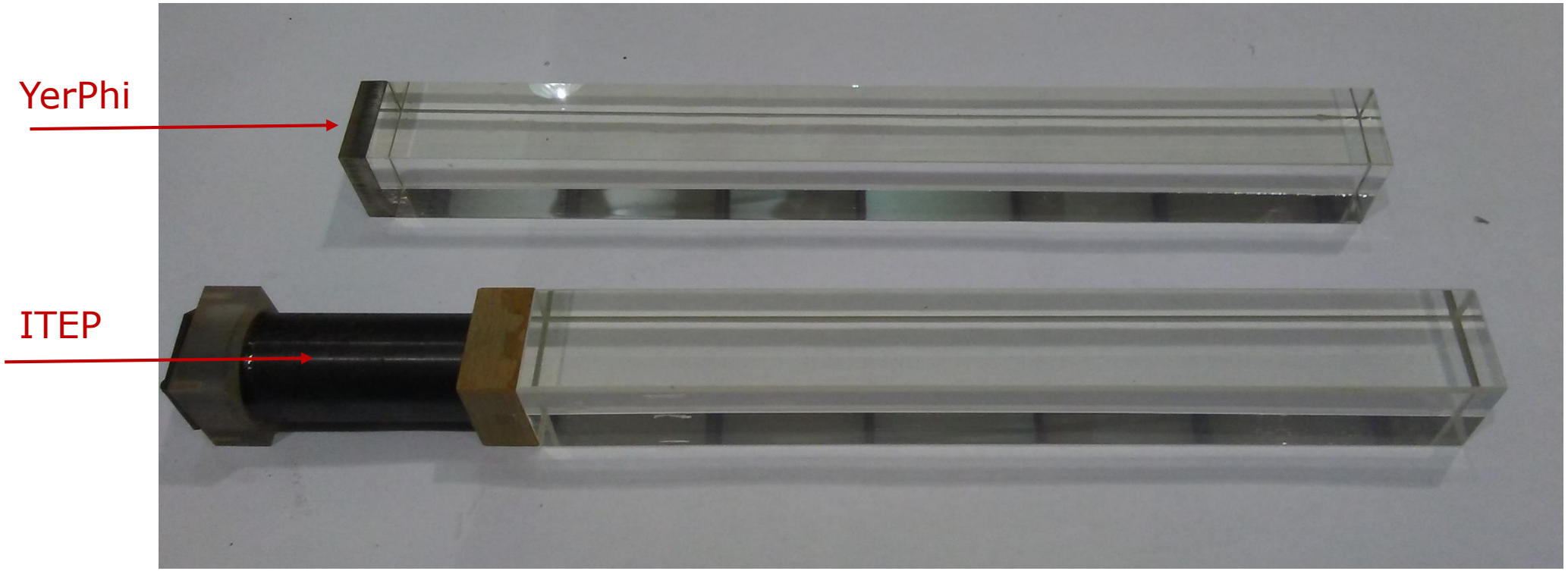
UVa

# LEAD GLASS for ECAL

ECal needs 1600 LG blocks

We have:
~700 LG blocks from YerPhi, Yerevan
>1000 LG blocks from ITEP, Moscow



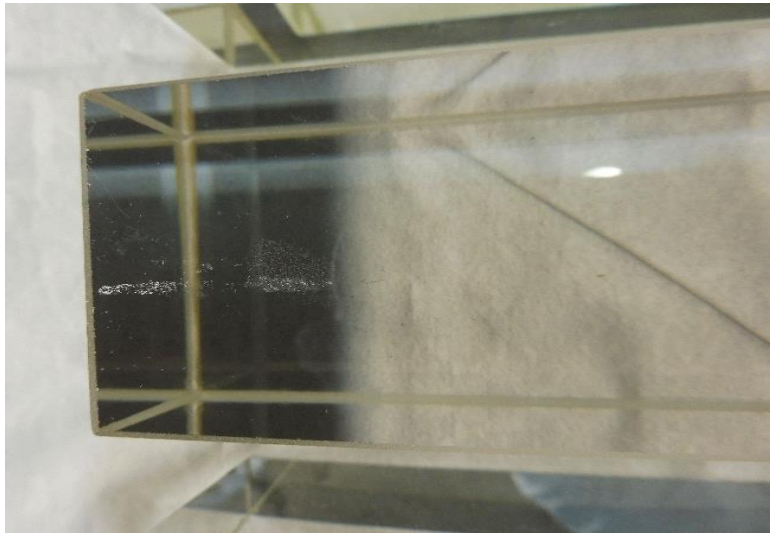
# LEAD GLASS PREPARATION

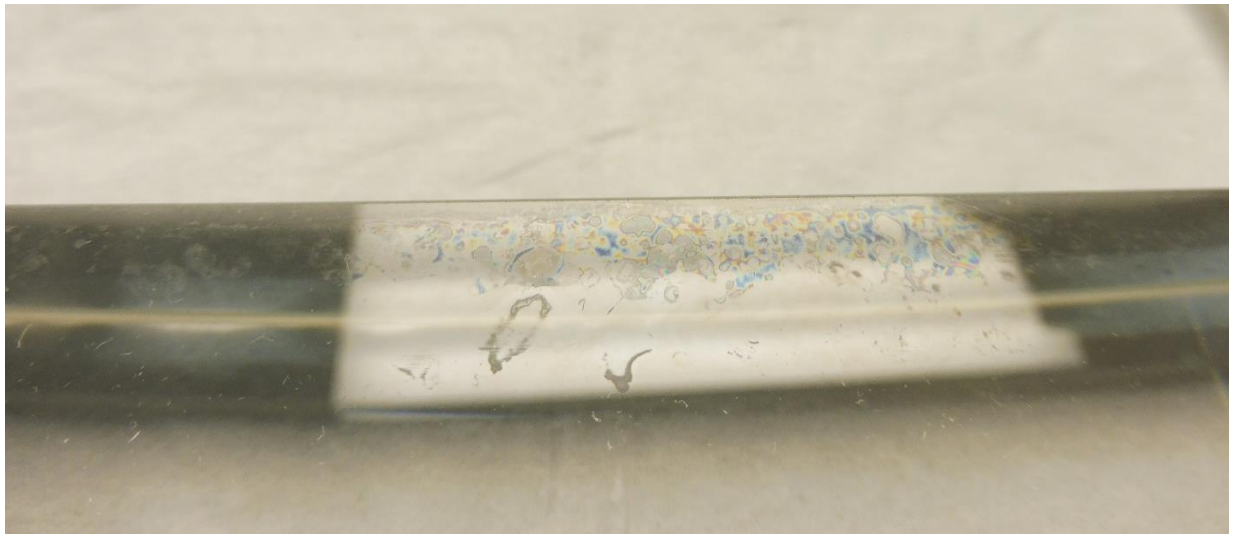
Before gluing LG with light guide:

- YerPhi blocks:
Bake in oven 8 hours at 340°C to separate Ti flange
- Moscow blocks:
Separate PMT with assembly.

- Clean-up face of LG block of epoxy/glue

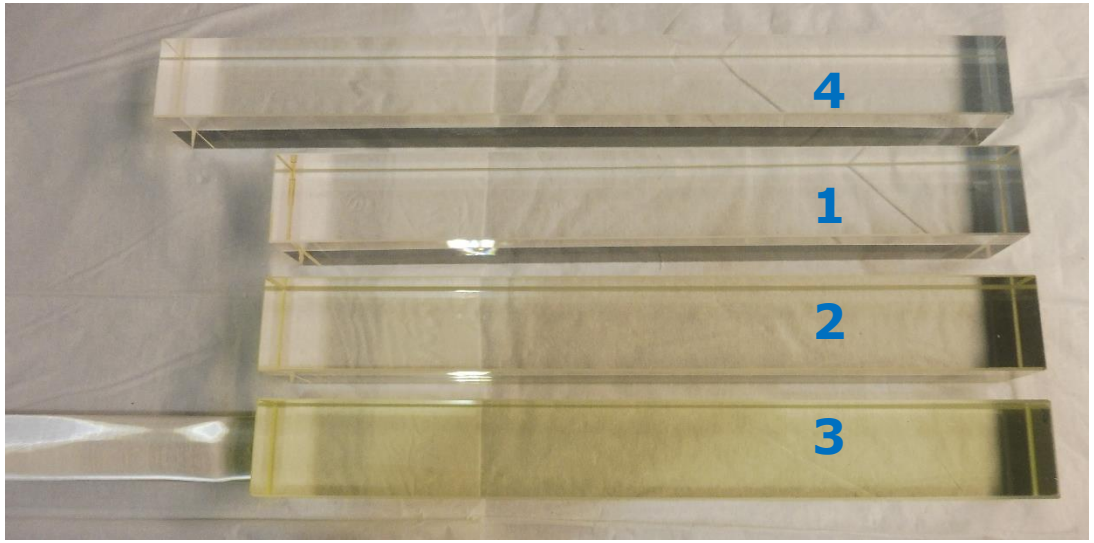
- Clean-up whole surface of LG block

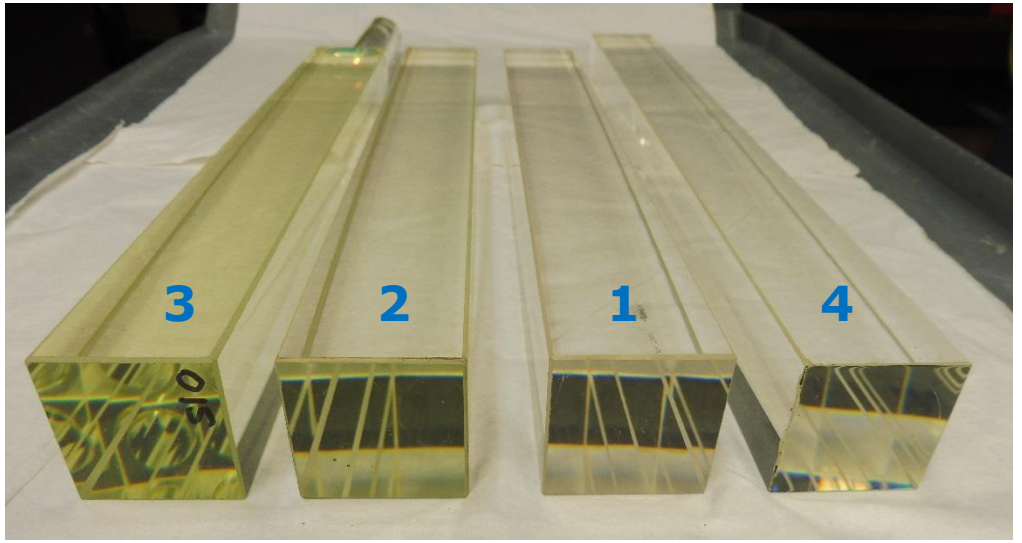




# TYPES of LEAD GLASS BLOCKS

| # | Vendor | Size, cm | Volume, cm3 | Weight, g | Density, g/cm3 | Colour |
|---|---|---|---|---|---|---|
| 1 | ITEP, Moscow | *4.25*4.25*34* | *615* | *2,345* | 3.8 | Clear |
| 2 | ITEP, Moscow | *4.25*4.25*34* | *615* | 2,370 | 3.86 | Light yellow |
| 3 | ITEP, Moscow | *4.25*4.25*34* | *615* | 2,820 | 4.58 | Deep yellow |
| 4 | YERPHI, Yerevan | *4.02*4.02*40* | *646* | 2,490 | 3.85 | Clear |

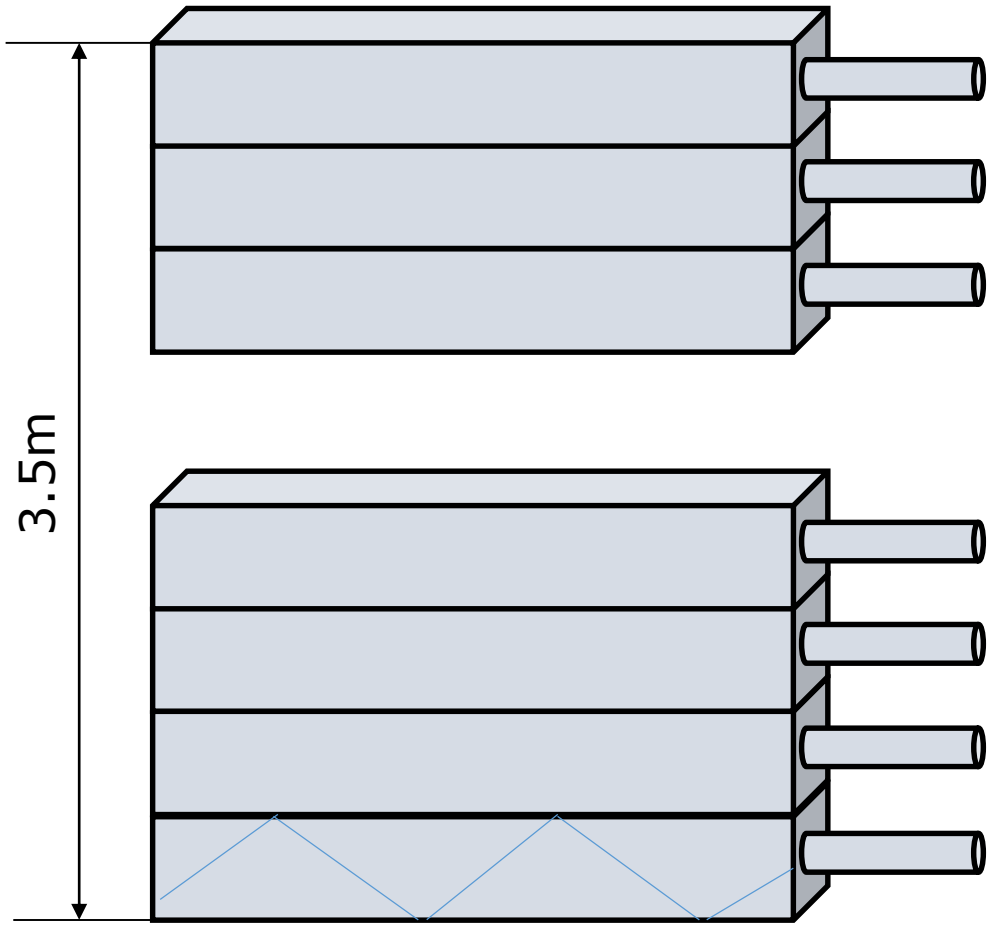


# *TESTS with LG BLOCKS*

ECal assembly:
- LG blocks
- Wrapped with Al foil
- Assembled to detector tower
- Heated up to 220°C
- 3-6 months

***Goals of the study:***
***- Possible damage of LG blocks in the bottom of ECal;***
***- Reducing of light losses due to possible Al foil diffusion/adhesion to LG.***



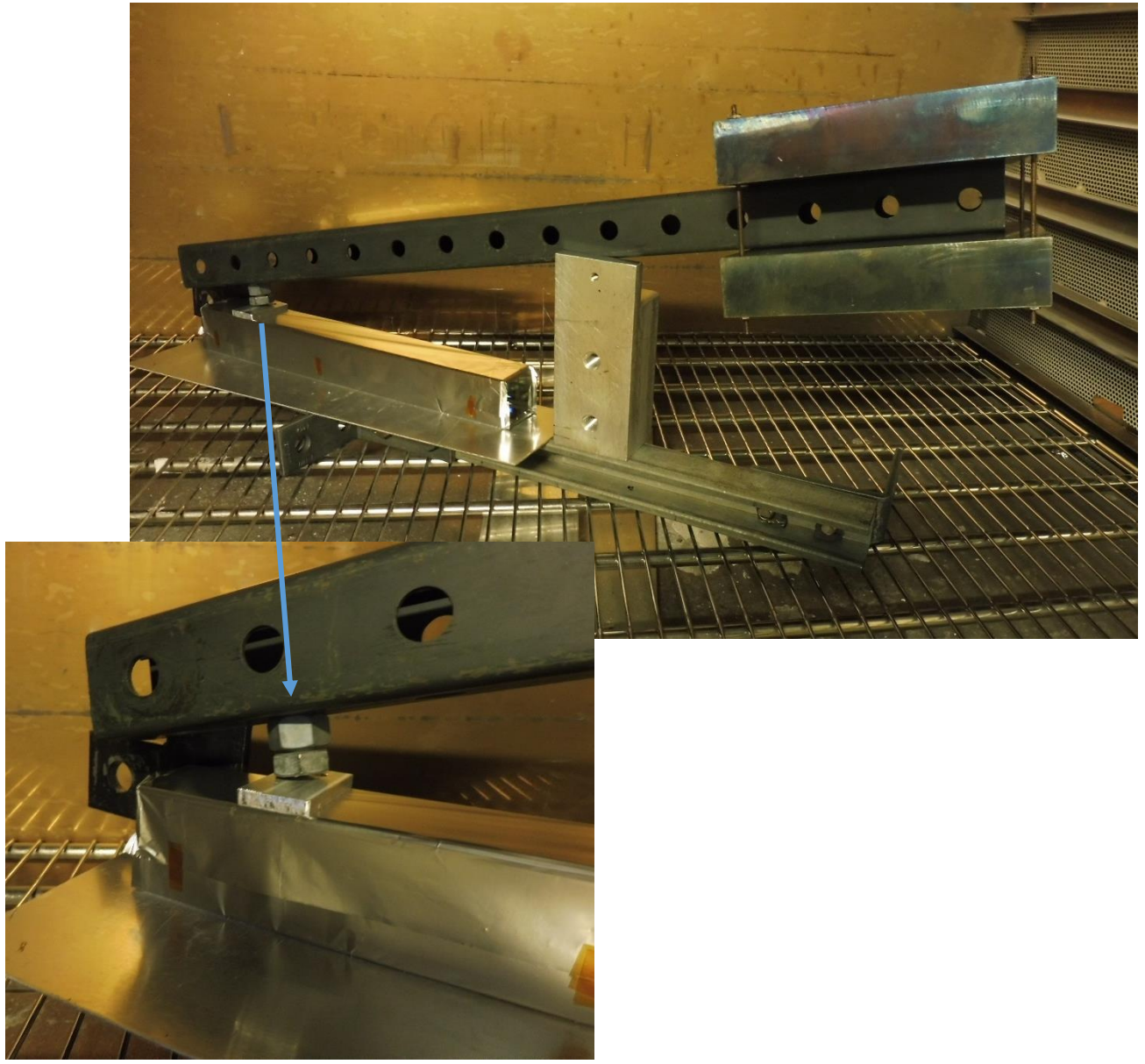
# STAND

Max. height of ECal: 350cm
Max. ECal pressure on a bottom block:
350cm*3.8g/cm3=1.33kg/cm2
LG block S=4.25*34=145cm2
Max. pressure on a LG block:
1.33kg/cm2*143cm2=190kg/block

Type 1 block was used
Block was cleaned with alcohol
Not polished
Heavy duty Al foil (25microns) was used

Oven heating regime:
2 hours ramp up to 240°C (vs. 220°C in ECal)
40 hours at 240°C
2 hours ramp down to 30°C

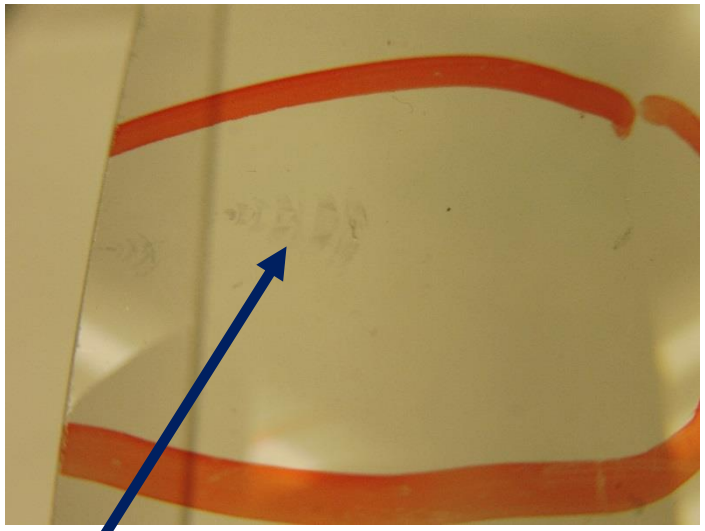
Weight of a stainless steel plate=10(20)kg
Lever ratio =12/1
Effective weight=120(240)kg



# TEST 1 & 2

**Test 1:**
Weight of a stainless steel plate=10kg
Lever ratio =1/12
Effective weight=120kg
Al spacer: 4cm*4cm=16cm2
Pressure on Al spacer 16cm2:
120kg/16cm2=7.5kg/cm2

**Test 2:**
Weight=10kg
Al Spacer 2*4=8cm2
Pressure: 10kg*12/8cm2= 15kg/cm2

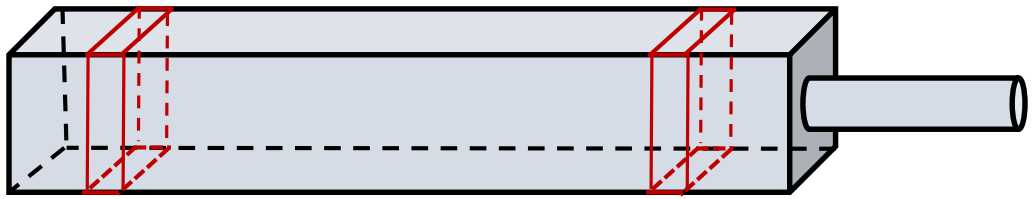


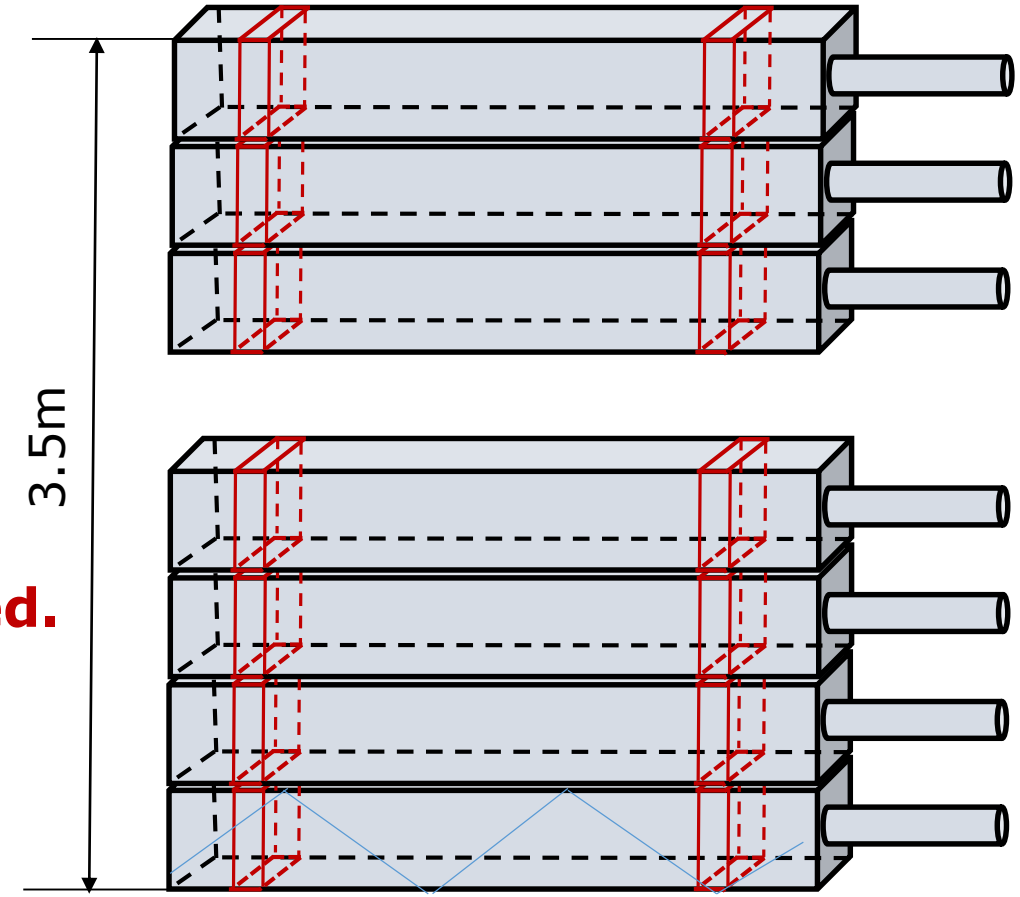
***Dirty blocks must be cleaned/polished carefully before wrapping !***

# PROPOSED DESIGN

Proposed design:
2 Al stripes 2cm with as spacers
Max. pressure on spacer:
190kg/16cm2= 12kg/cm2
LG block S=4.25*34=145cm2
4 sides: 145cm2*4=580cm2
Whole weight of the LG column will be applied to two Al stripes 4*(2cm*4cm)=32cm2.

**In case of Al stripe adhesion/diffusion to LG, only 32/580~5% of LG surface will be affected.**



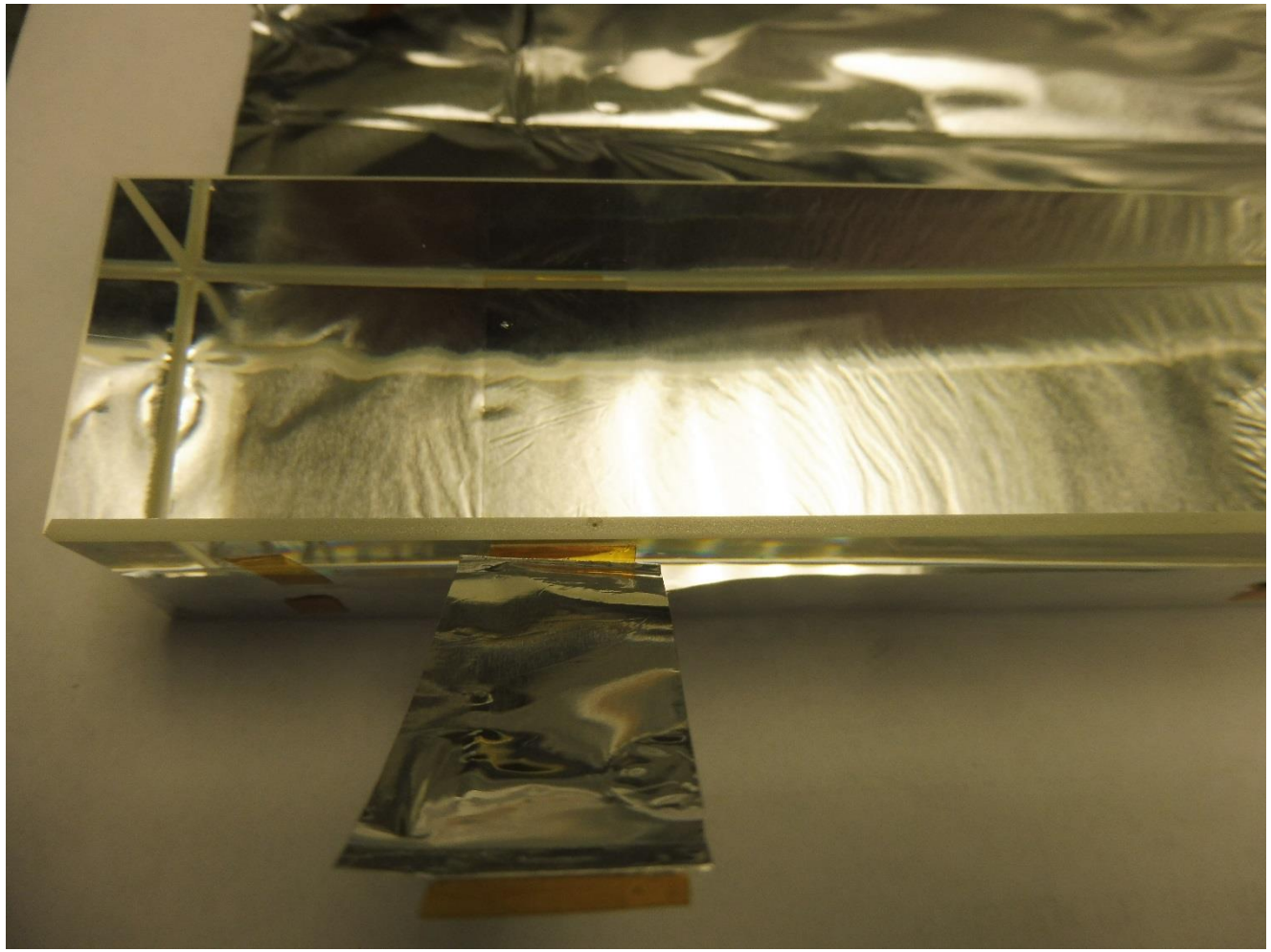


# TEST 3

**Test 3:**
Weight=20kg
Al stripe 2*4=8cm2
Pressure: 20kg*12/8cm2=
30kg/cm2 vs. 12kg/cm2 max. in ECal

***No LG block damages was found***

***No Al adhesion or diffusion to LG was found***



# SUMMARY

***Complex LG blocks preparation procedure is required before gluing LG block and light guide.***

***Surface of dirty LG blocks must be cleaned/polished carefully to prevent Al adhesion/diffusion to LG surface.***

***Result of the test with LG block (30kg/cm2 and 240°C vs. 12kg/cm2 and 220°C as maximum in ECal):***

***- No LG block damages was found;***

***- No Al adhesion or diffusion to LG was found.***

***Propose to use Al stripes as spacers between LG blocks to reduce possible LG block surface with Al adhesion/diffusion.***

***In case of Al stripe adhesion/diffusion to LG, only ~5% of LG surface will be affected.***