



[Tile light yield and uniformity]

Miguel Bernardo, João Gentil, Ricardo Gonalo

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Summary

Our goal is to characterize real-sized plastic tiles as planned for the FCC HCAL

- Measure of the light yield and uniformity
- Use realistic readout:
- Wavelength shifting optical fibre of appropriate length
- Readout by PMT – no SiPM available at the moment

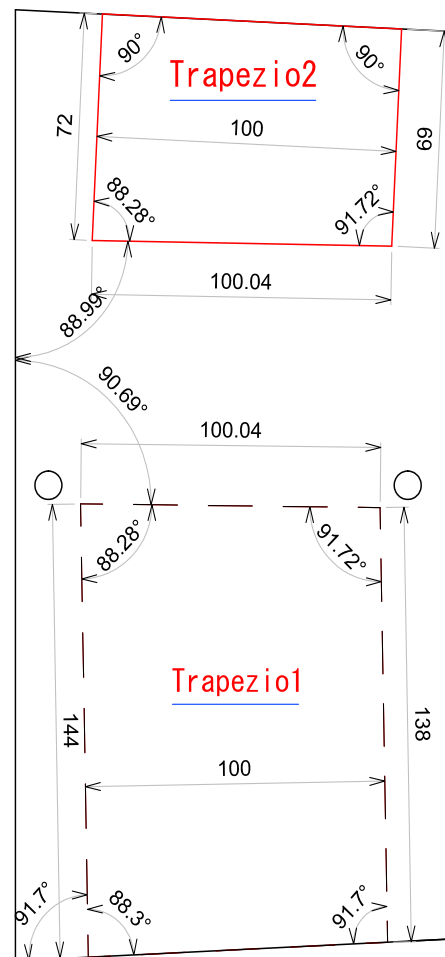
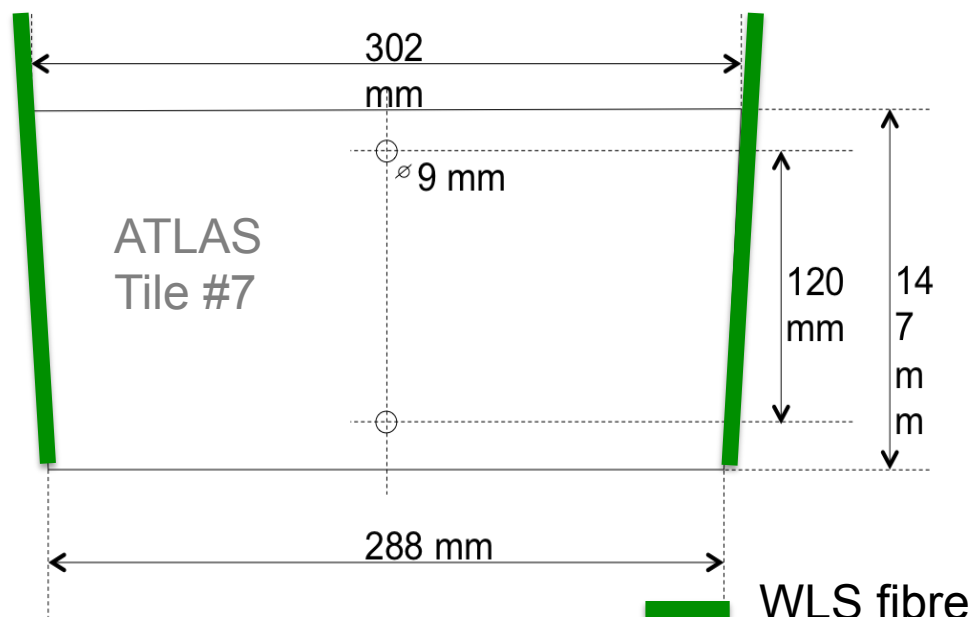
Outline:

- Cutting tiles to realistic sizes
- Experimental setup
- Light yield measurements

Scintillating Tiles

Used one #7 tile from ATLAS TileCal pre-production to obtain:

- One half-tile from layer 1
- One tile from layer 1
- One half-tile from layer 10



Telha7

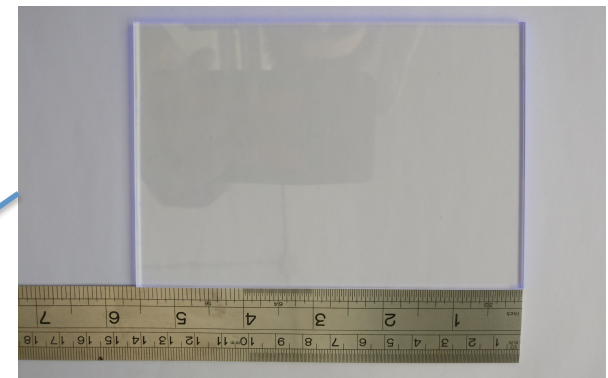
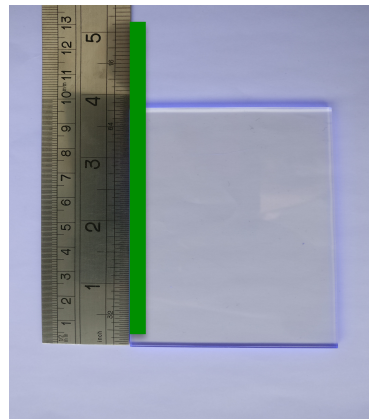
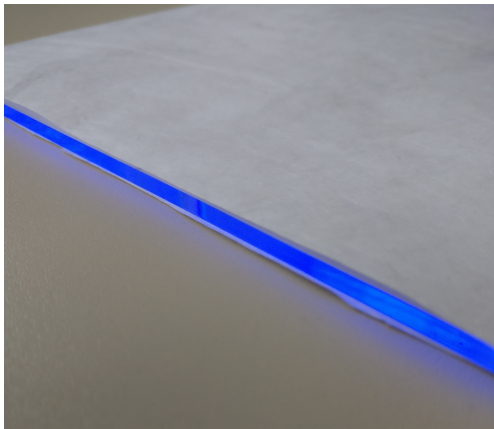
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Scintillating Tiles

Used one #7 tile from ATLAS TileCal pre-production to obtain:

- One half-tile from layer 1
- One tile from layer 1
- One half-tile from layer 10

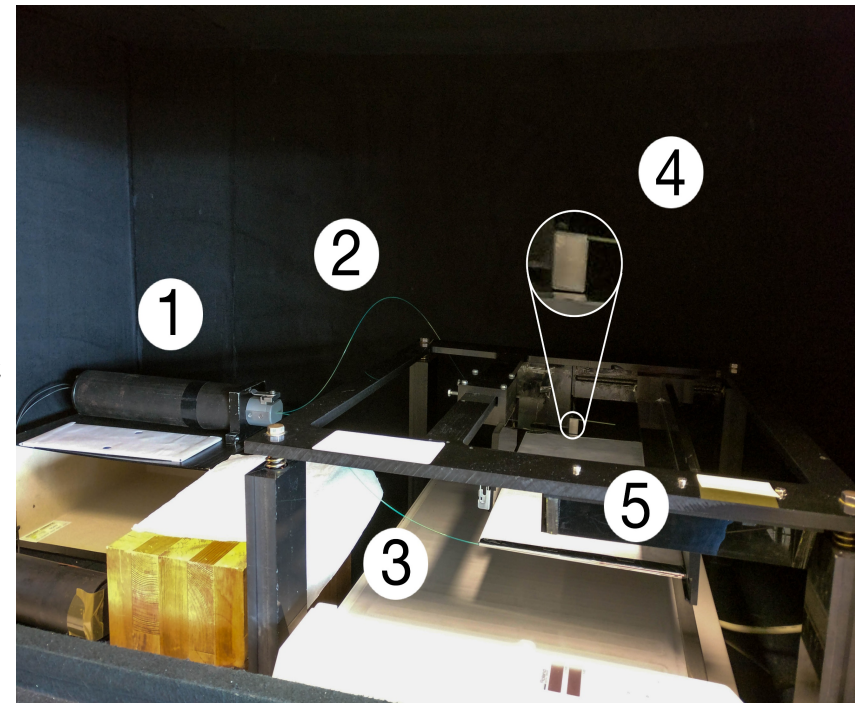
Tiles wrapped in TYVEK to increase uniformity



Experimental Setup

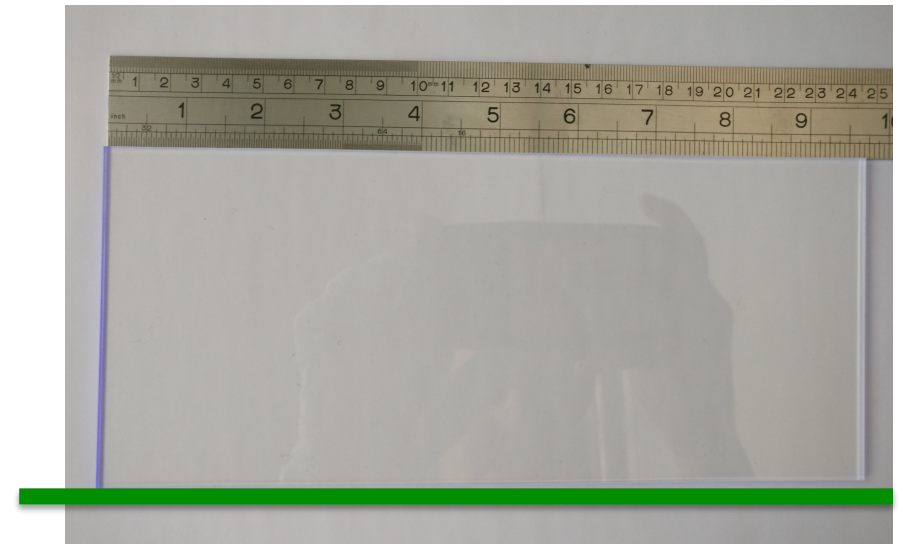
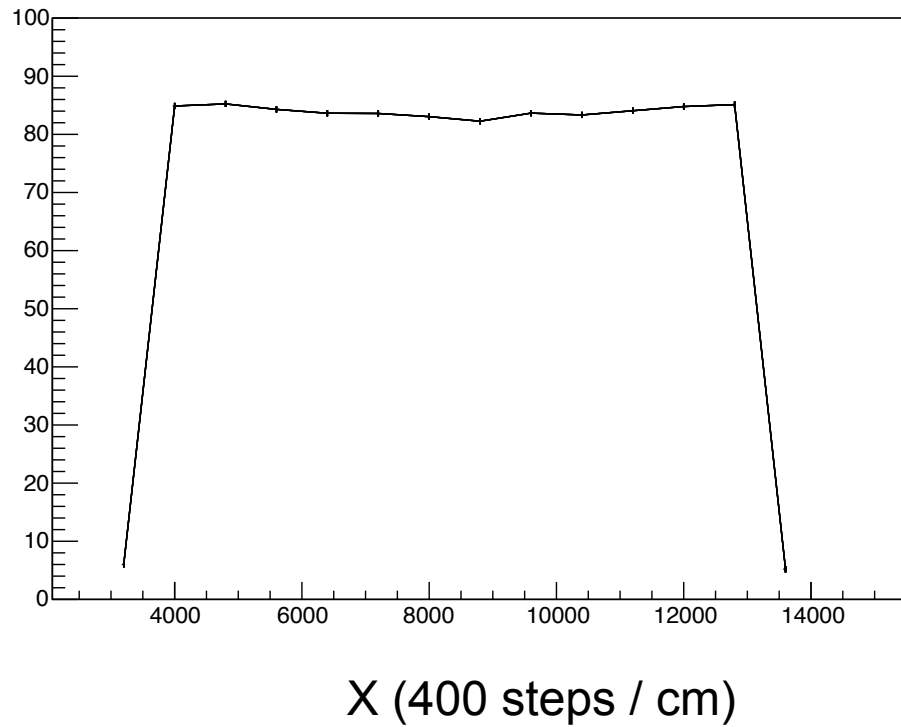
- Source mounted on a X-Y arm
- $^{90}\text{Sr}/^{90}\text{Y}$ β^- source
- $E_{\text{max}} = 546 \text{ keV} / 2.283 \text{ MeV}$, $A \approx 0.5 \text{ mCi}$
- Optical readout: wavelength-shifting fibre
- Readout: photomultiplier in current mode
- Light yield is with respect to reference plastic scintillator tile

1. Photomultiplier tube
2. WLS fibre reading reference tile
3. WLS fibre reading test tile
4. Reference scintillating tile
5. Test scintillating tile



Results so far

Response uniformity of tile #10 (note relative yield)



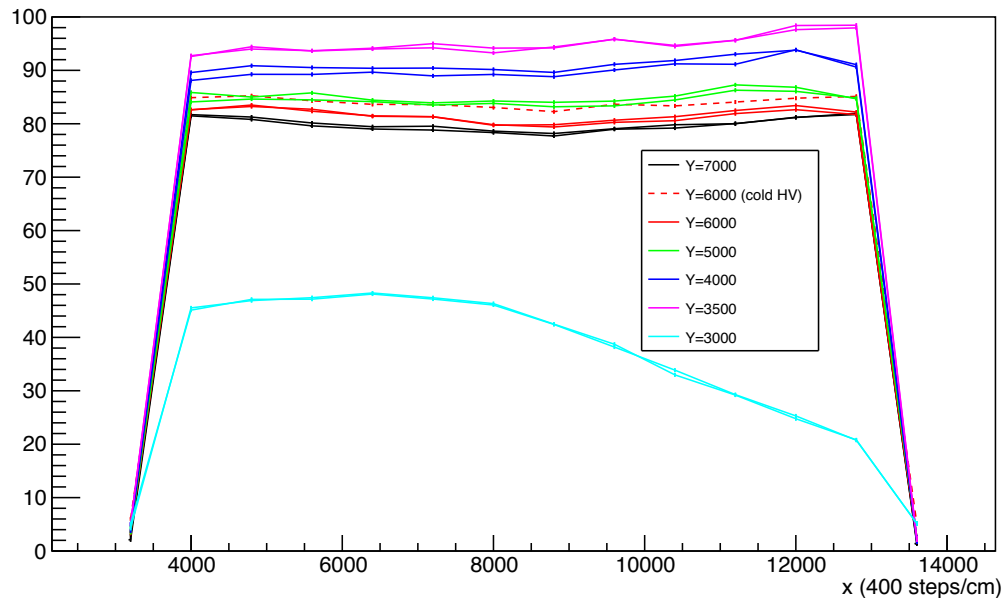
X (400 steps / cm) →

— WLS fibre

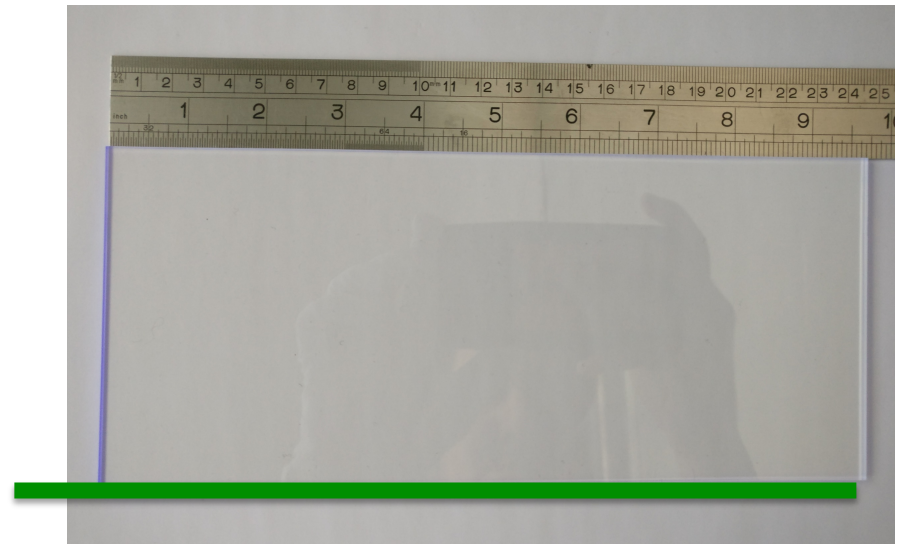
Results so far

Reproducibility of results tested with of tile #10

- Around 2% except for changing/unstable conditions (around 5% for cold HV source)



X (400 steps / cm)

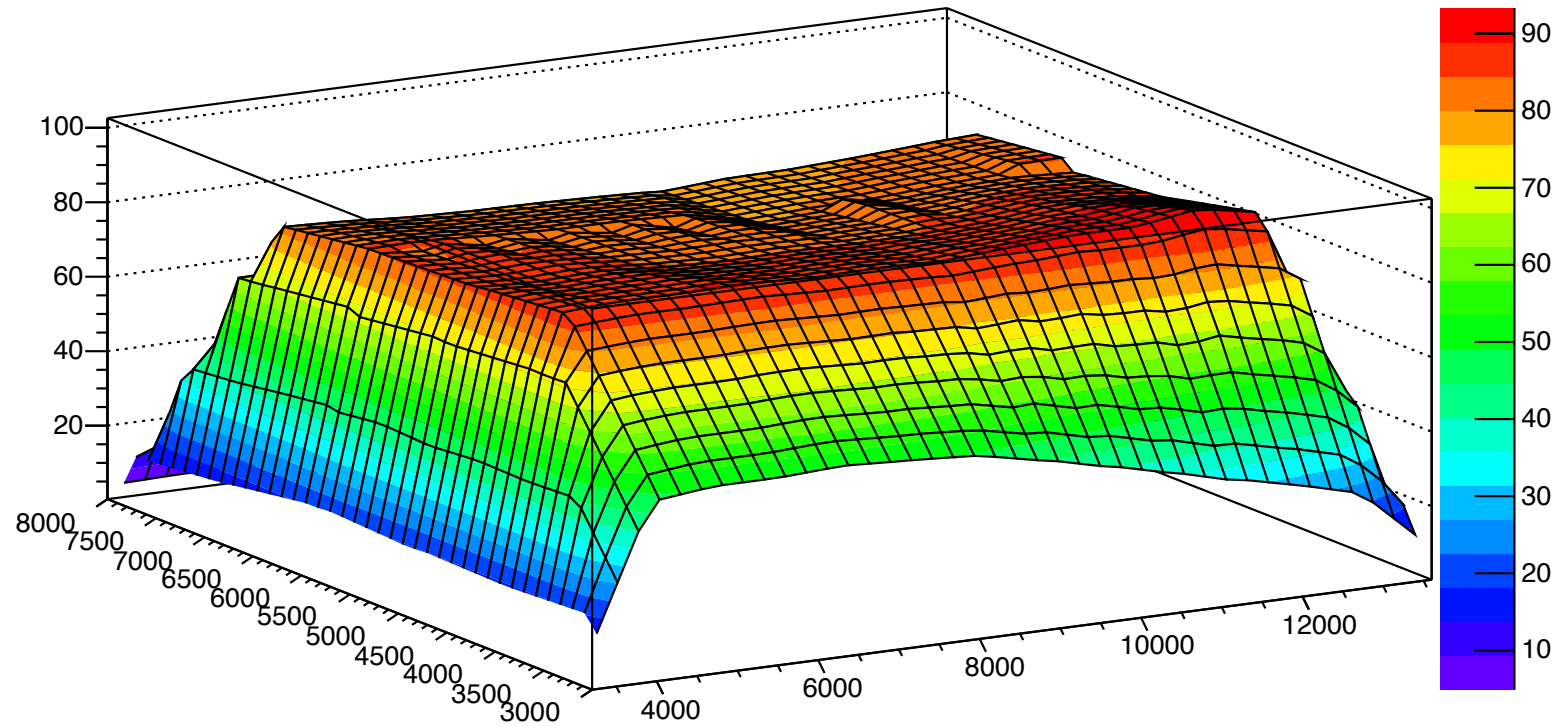


X (400 steps / cm)

WLS fibre

Results so far

Response uniformity of tile #10 (note relative yield)



Results so far

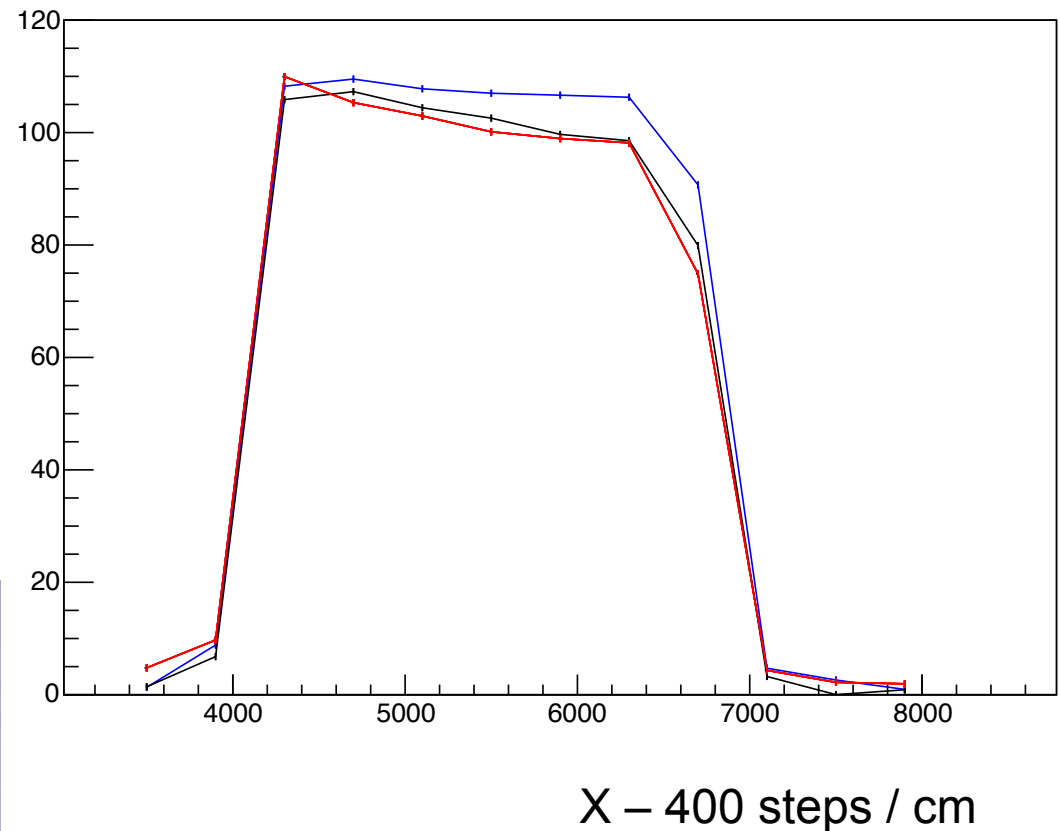
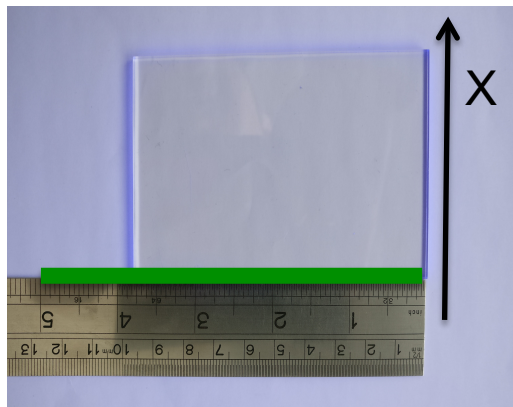
Response uniformity of tile #1 (note relative yield)

$$\text{Response} = 100 \times (\text{Signal} - \text{Noise}) / \text{Reference}$$

Tiles read by 2.3 m WLS fibre
Tiles wrapped in TYVEK
WLS fibre contact-coupled to tile
Held in place by TYVEK envelope
Each point corresponds to 30
current measurements
Error bar is standard deviation

Curves in figure:

1. Nearer to PMT
2. Middle
3. Far end



WLS fibre

Results so far

Response uniformity of tile #10 (note relative yield)

$$\text{Response} = 100 \times (\text{Signal} - \text{Noise}) / \text{Reference}$$

Tiles read by 1 m WLS fibre

Tiles wrapped in TYVEK

WLS fibre contact-coupled to tile

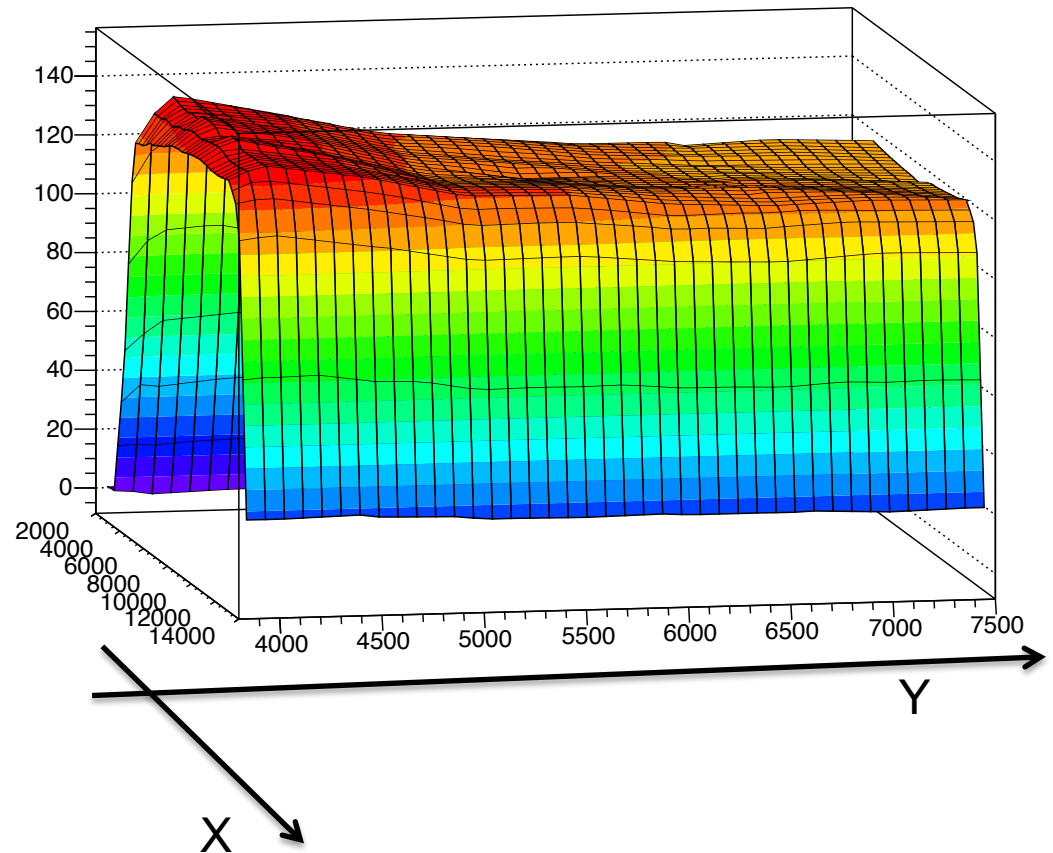
Held in place by TYVEK envelope

Each point corresponds to 30
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— WLS fibre



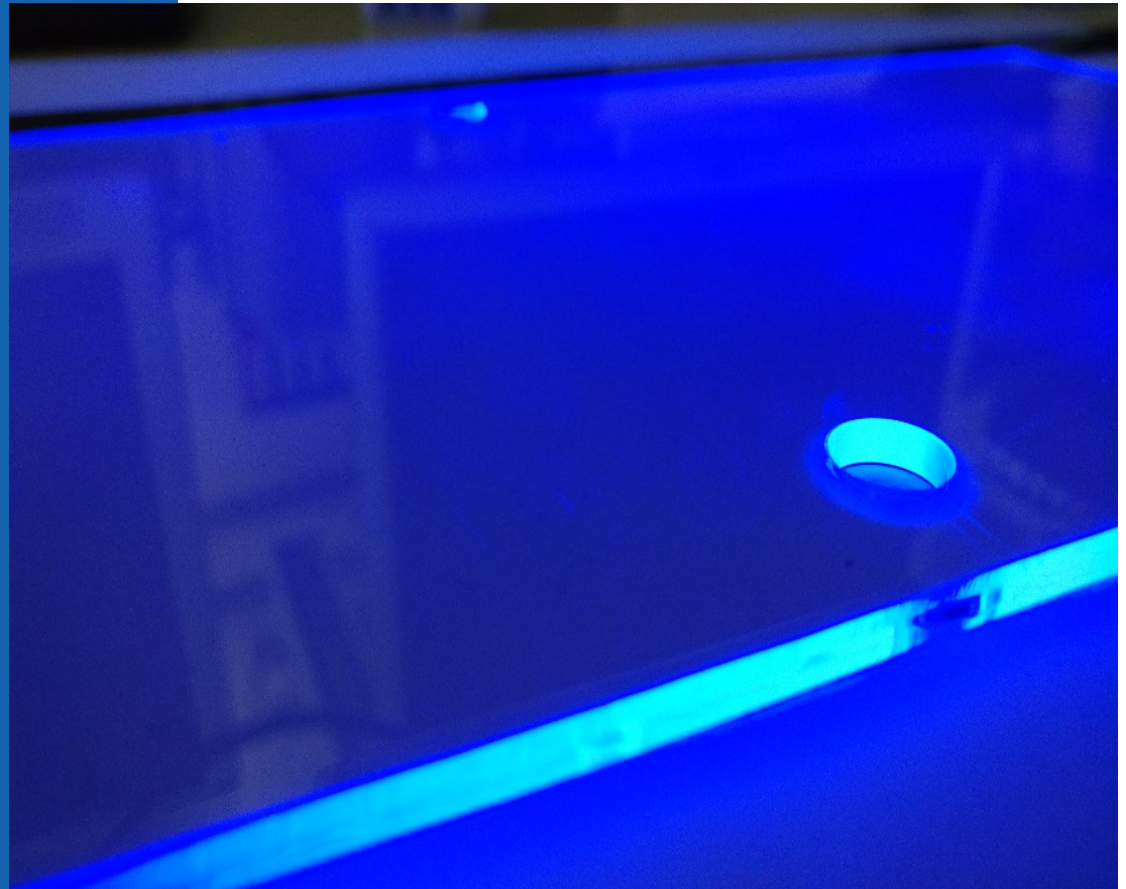
Outlook

First measurements done but many still missing:

- Measure tile #10 with shorter fibre
- Comparing uniformity with/without TYVEK
- Comparing with known TileCal tile – to normalize response
- Ideally get hold of SiPM to repeat measurements

Bonus slides

Comments welcome!



Ciências
ULisboa

FCT



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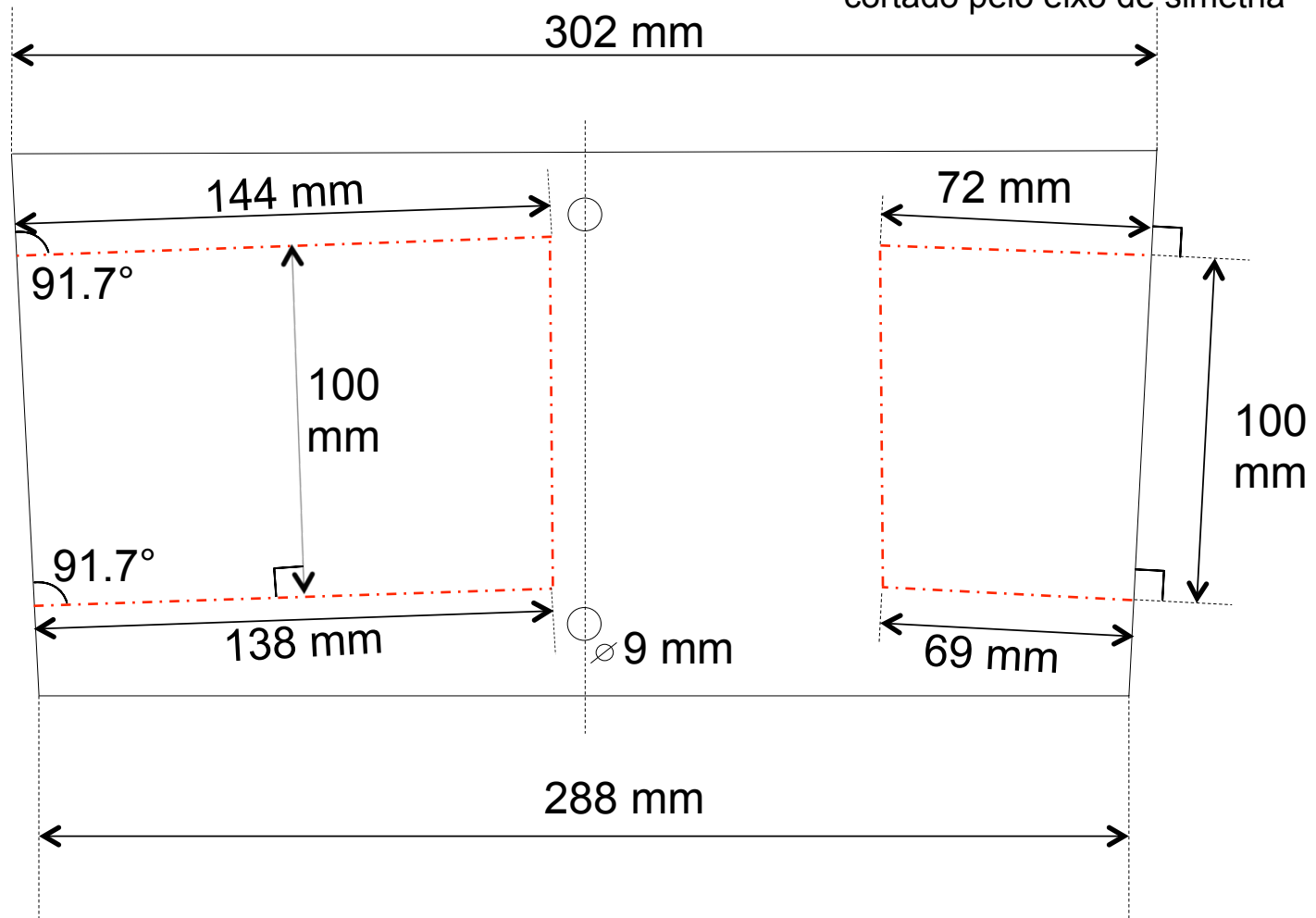
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Estruturais e de Investimento

Corte e polimento

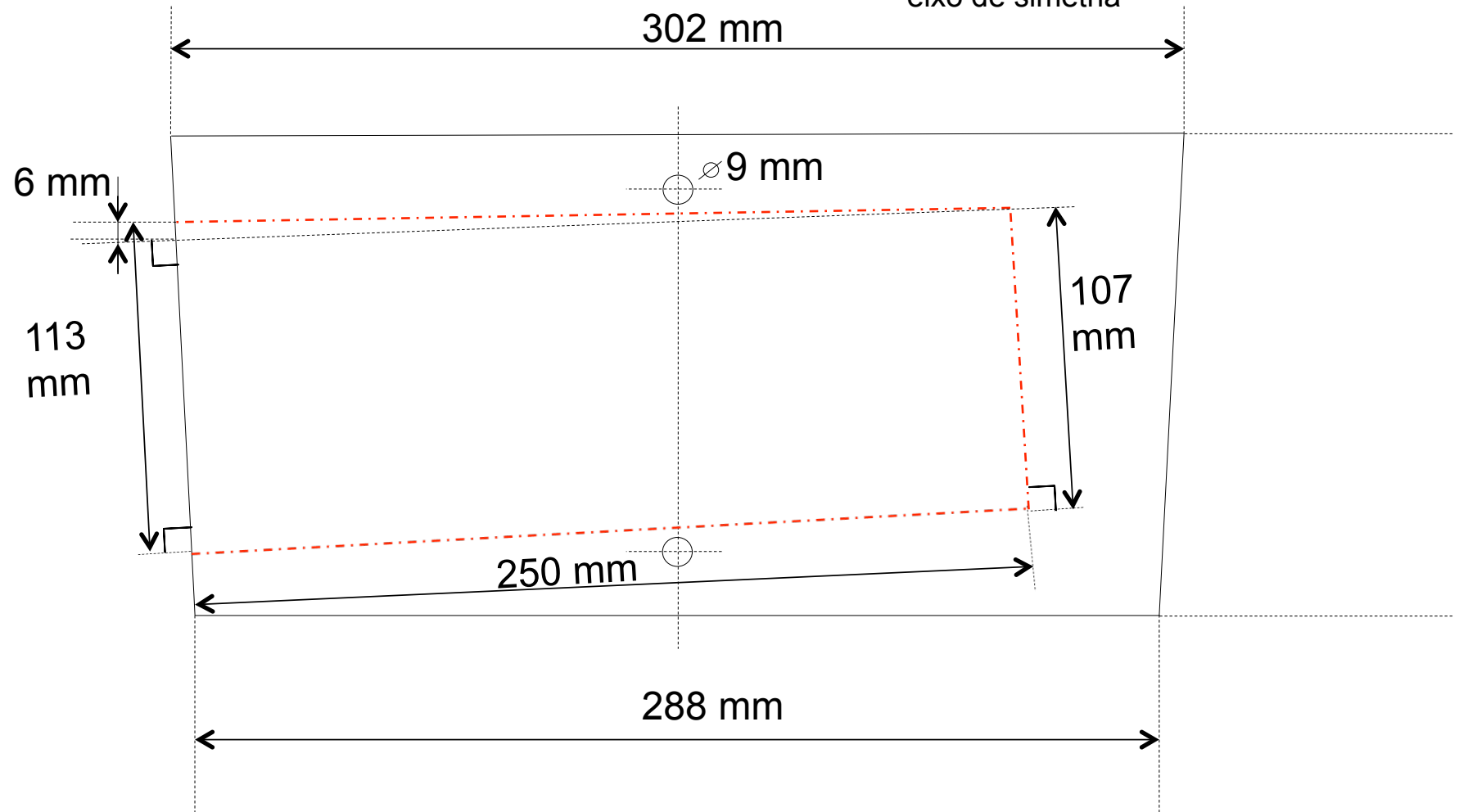
Telha tipo 7 de ATLAS TileCal
Hipótese B (Telha #2): obter um trapézio
com altura de 100 mm de altura e bases
de 144 e 138 mm, mais um meio trapézio
cortado pelo eixo de simetria



----- Corte e polimento

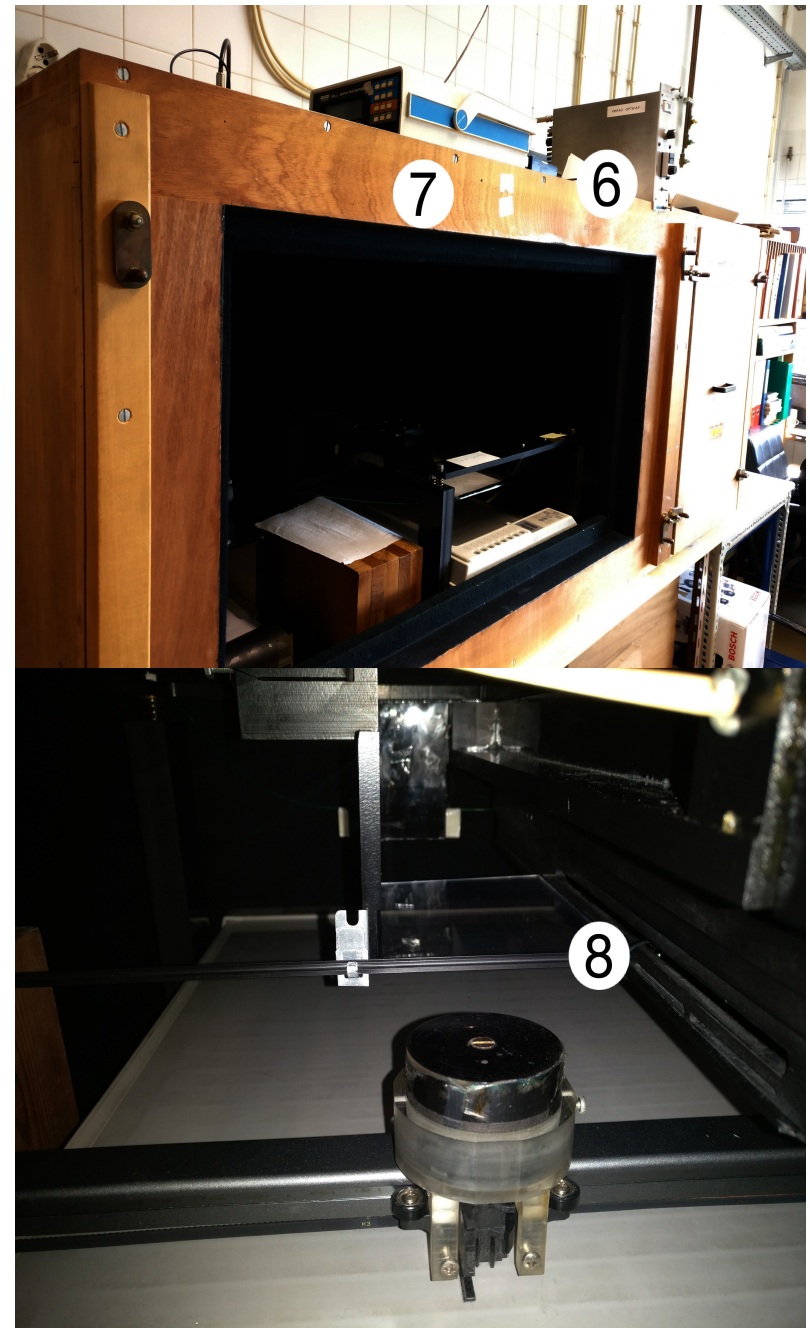
Telha tipo 7 de ATLAS TileCal

Hipótese B (Telha #3): obter meio trapézio com altura de 250 mm e bases de $226/2 = 113$ mm e $214/2 = 107$ mm, cortado pelo eixo de simetria



Experimental setup

- 6 – high-voltage source
- 7 – digital multimeter to read PMT current
- 8 radioactive source on X-Y arm



Test using ATLAS #7 tile

