

Light Distribution in the E3/E4 Scintillation Counters of the ATLAS Tile Calorimeter

Catherine Hsu (University of the Witwatersrand(SA))

Eirini Vichou (UIUC)

Oleg Solovyanov (Protvino)

Aim

- Measure light collection uniformity and response in the E3 and E4 scintillation counters of the Tile Calorimeter (TileCal) using Sr-90 beta source.

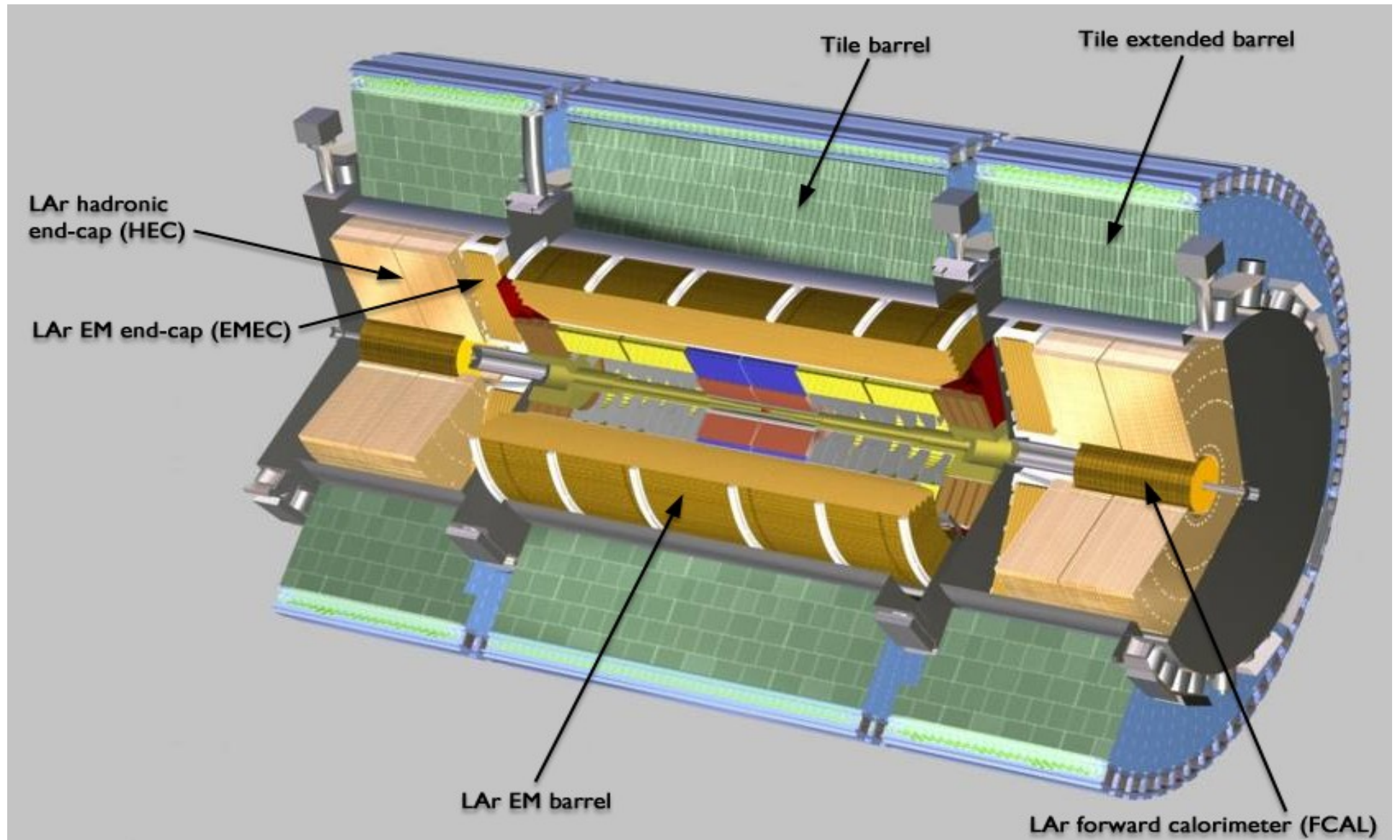
ATLAS Tile Calorimeter

Tile Hadronic Calorimeter (TileCal) measures accurately the energy and position of:

- Electrons
- Photons
- Taus
- Isolated hadrons
- Jets

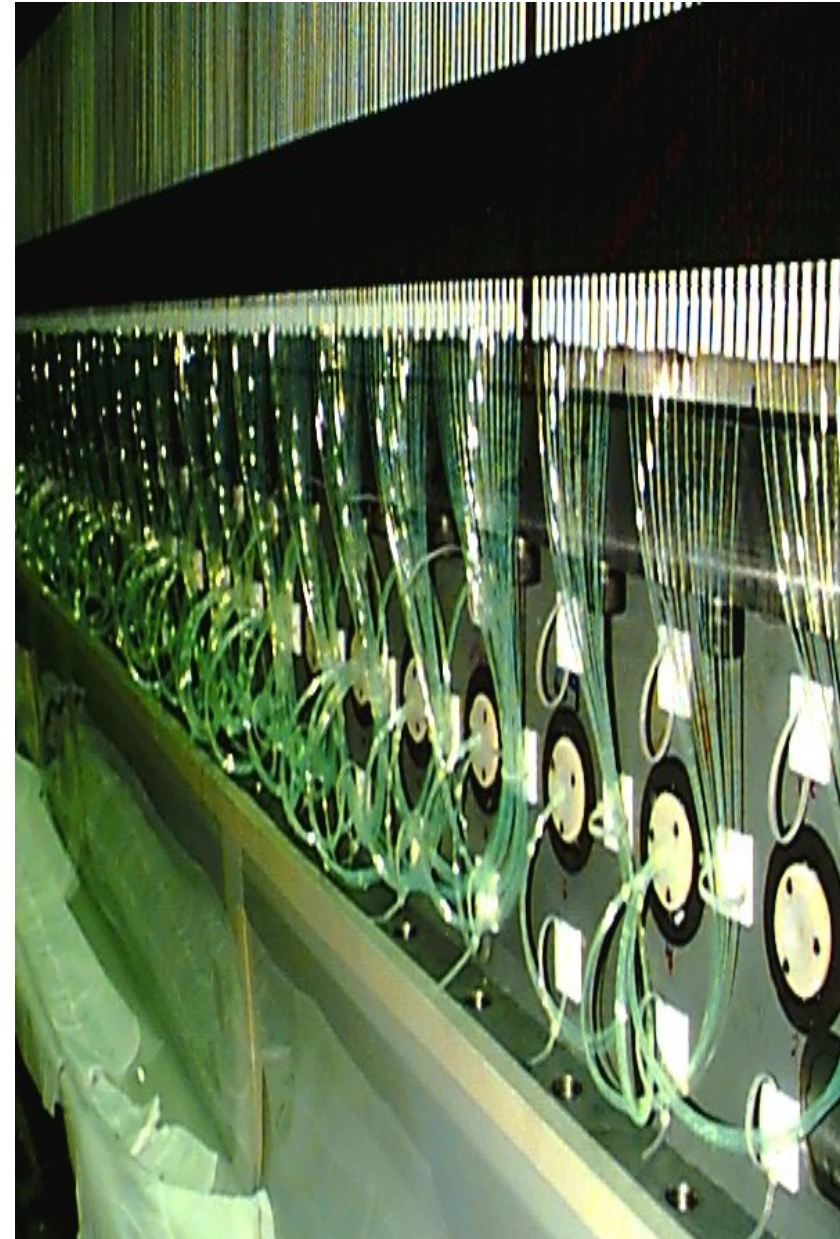
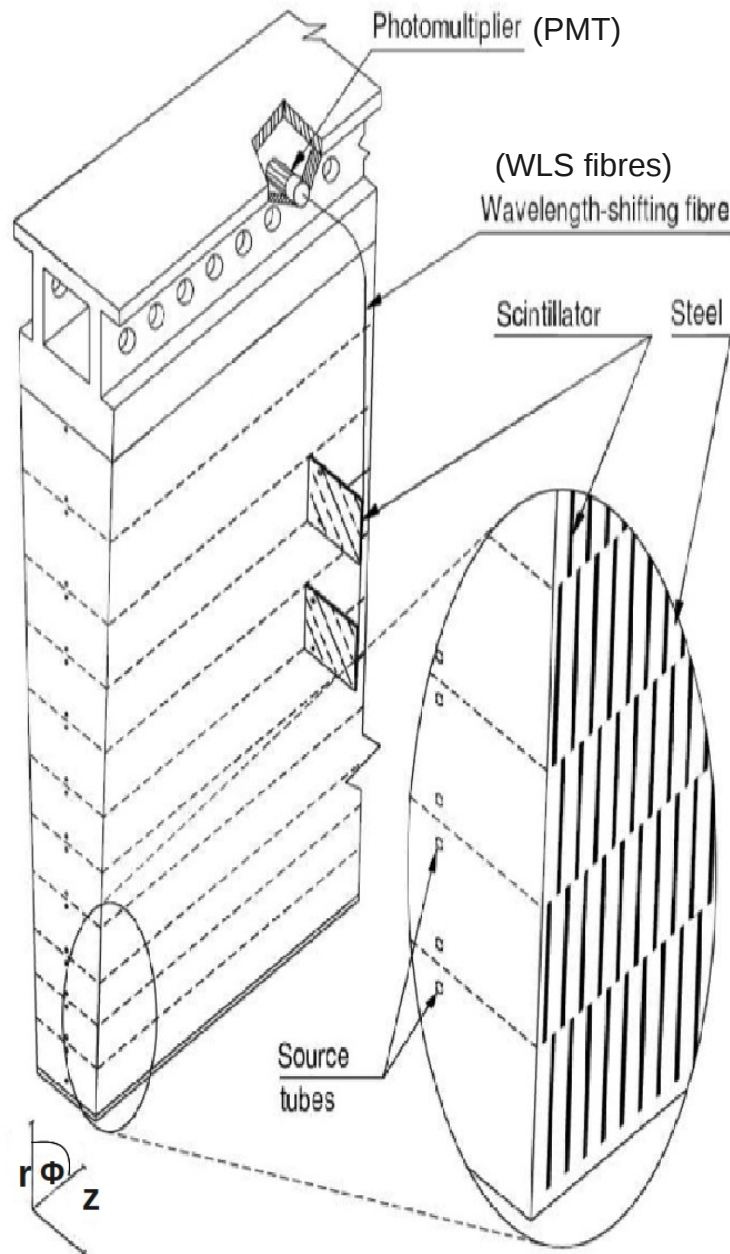
ATLAS Tile Calorimeter

Structure of ATLAS TileCal

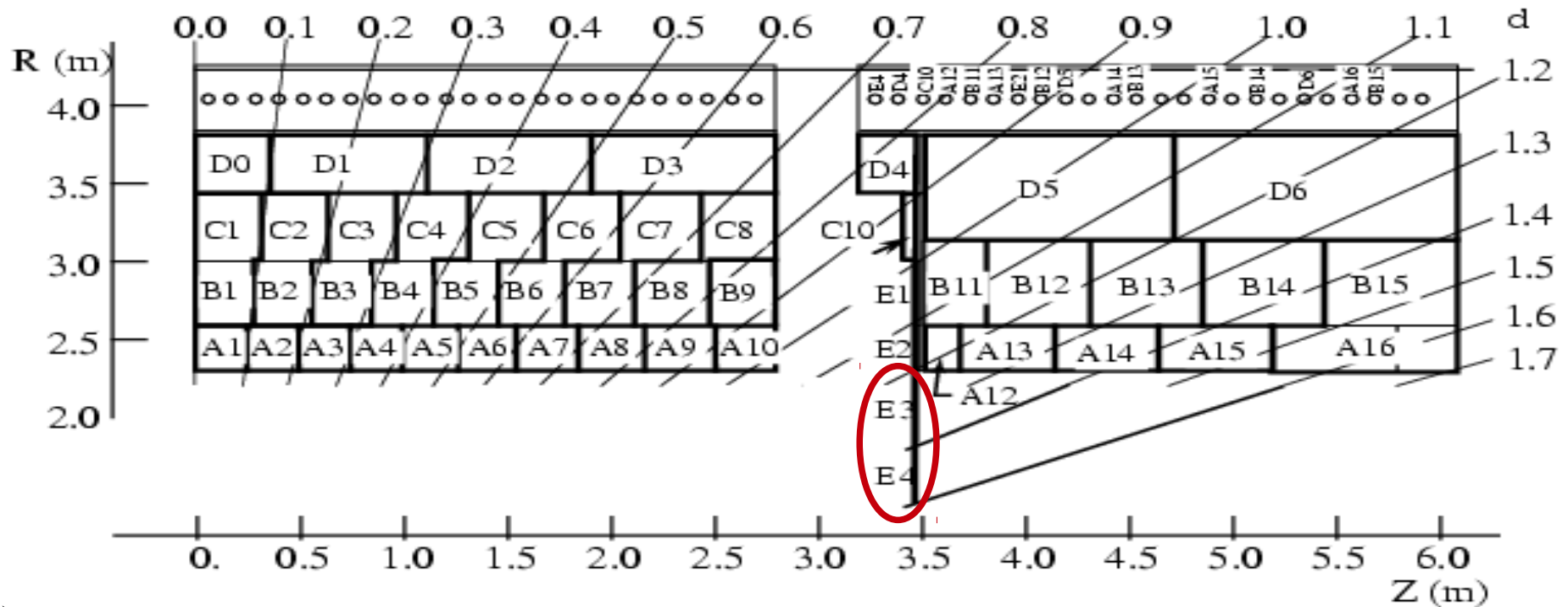


ATLAS Tile Calorimeter

Module

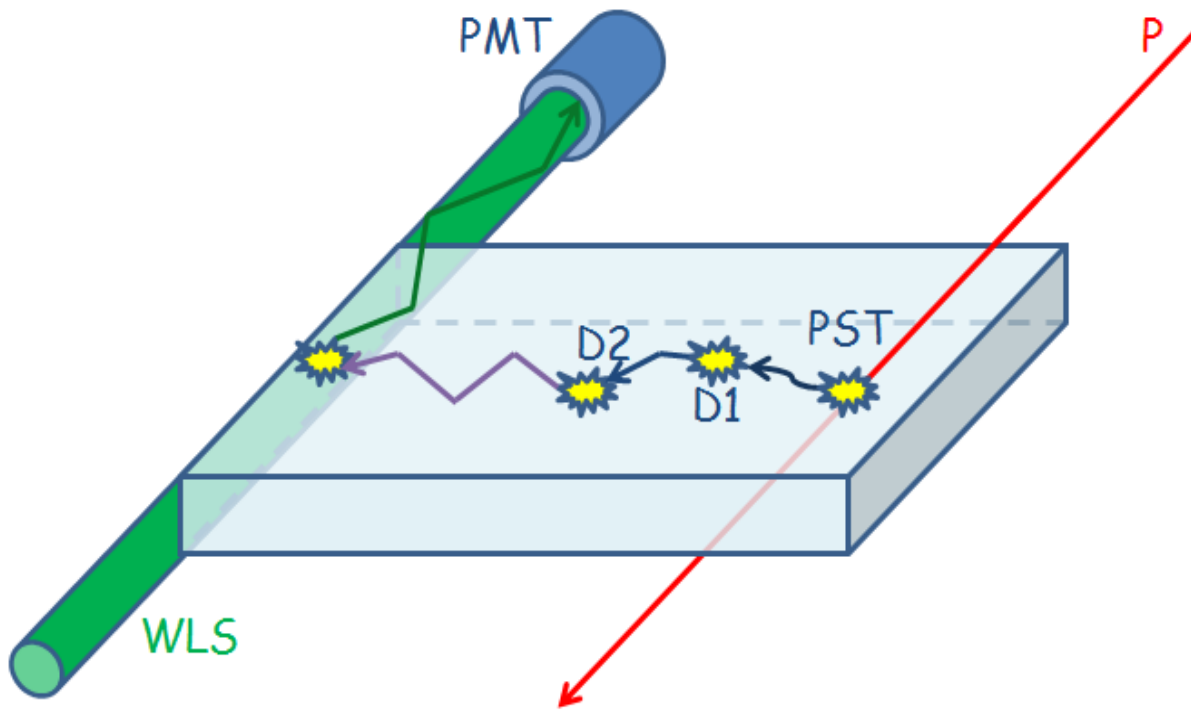


What is E3 and E4 and why study light uniformity in them



- E3/E4 are crack scintillators
- Occur in the gap region between the central barrel and extended barrel
- Extend into the region between the LAr barrel and endcap EM calorimeters
- Measures energy of the shower produced from particles interacting with the dead material of the cryostat walls of EM calorimeters and with the inner detector cables

How the scintillator works



Artist's representation of the workings of the scintillator



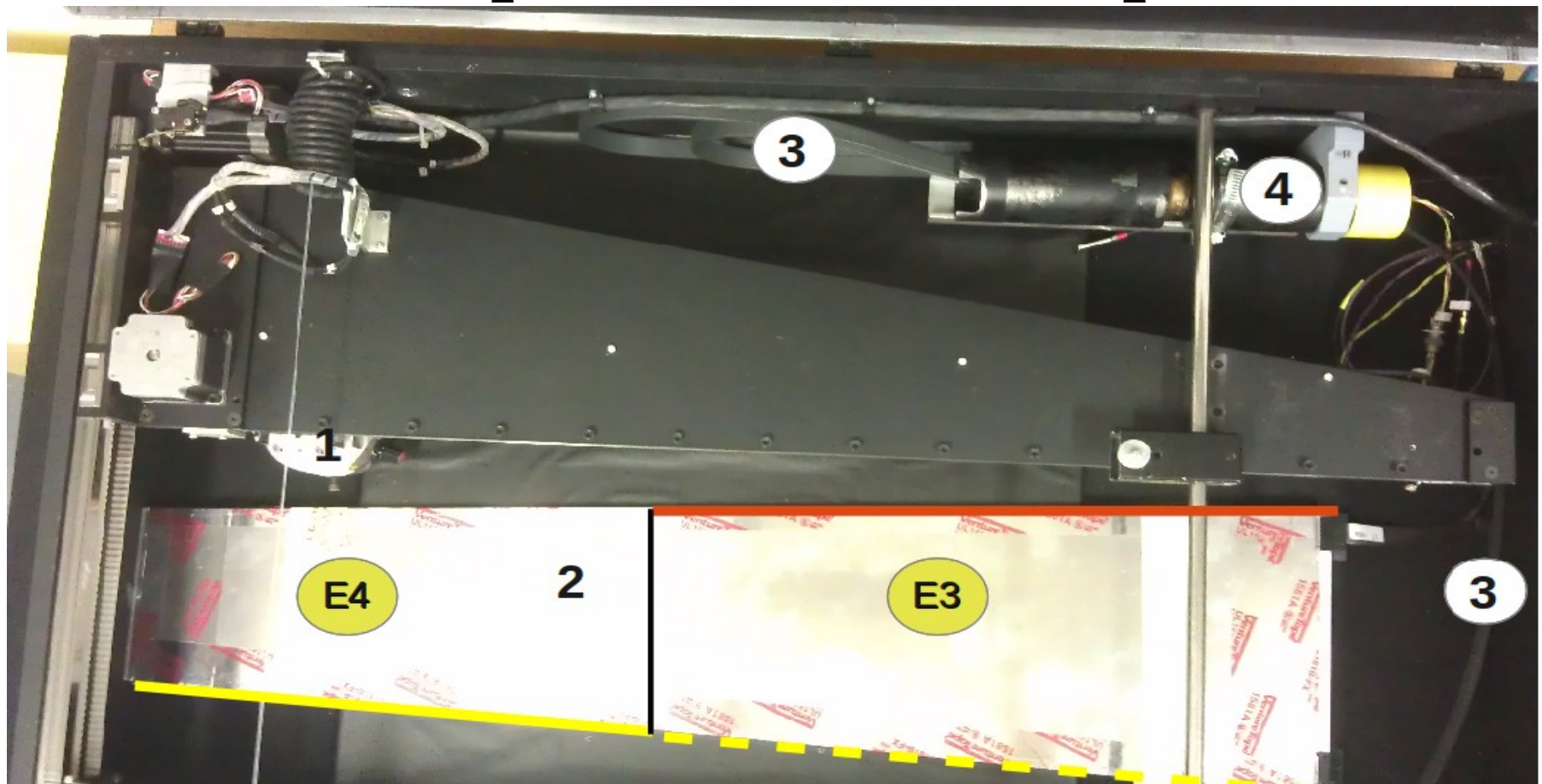
Tyvek paper covering the scintillator tile

Experimental Setup



The Sr90 laboratory consists of the light-tight scanbox, control crate, multimeter and data acquisition PC.

Experimental Setup



1: Sr90 (electron) source

2: Scintillator counter

3: WLS fibres

4: PMT tube



E3 WLS fibres



E4 WLS fibres



Part of fibres outside
tyvek paper

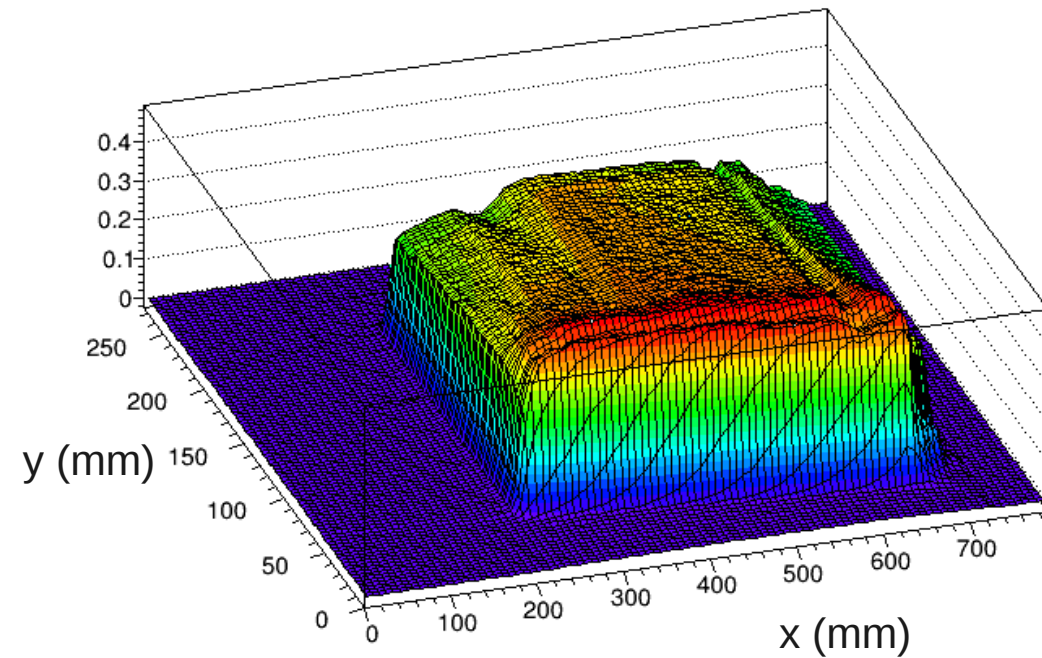


Representing boundary
between E3/E4

2D response map

E3 with Al cover

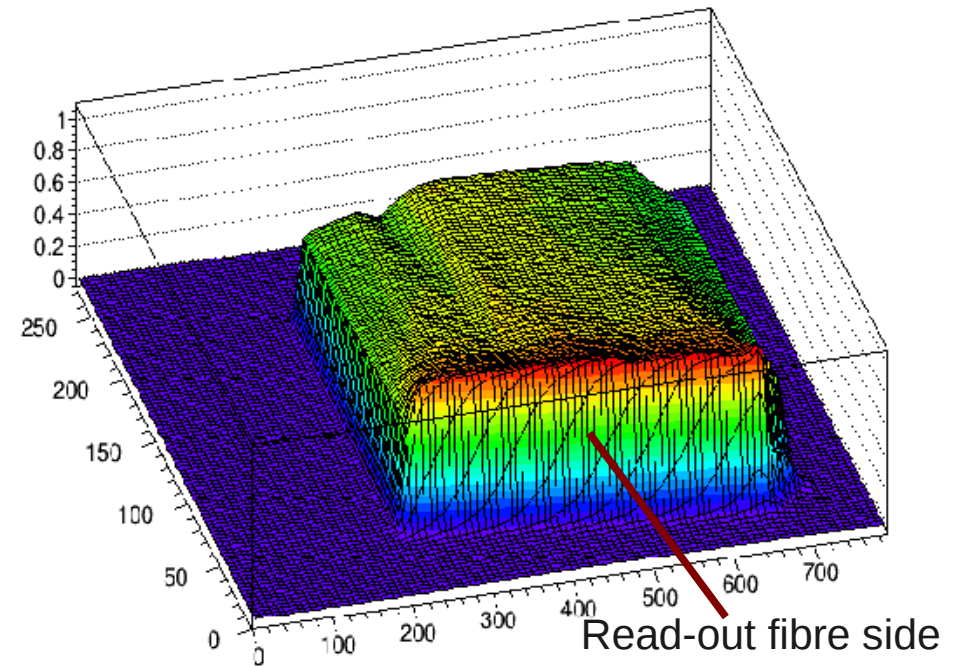
pmt:y:x



Response
non-uniformity: ~16%
RMS

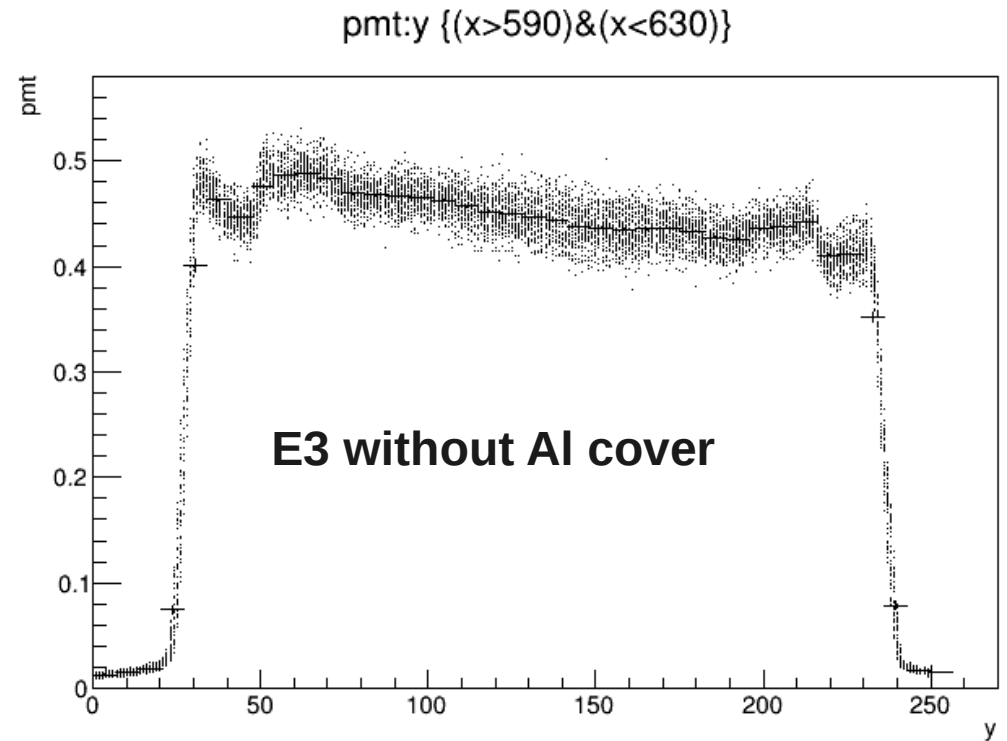
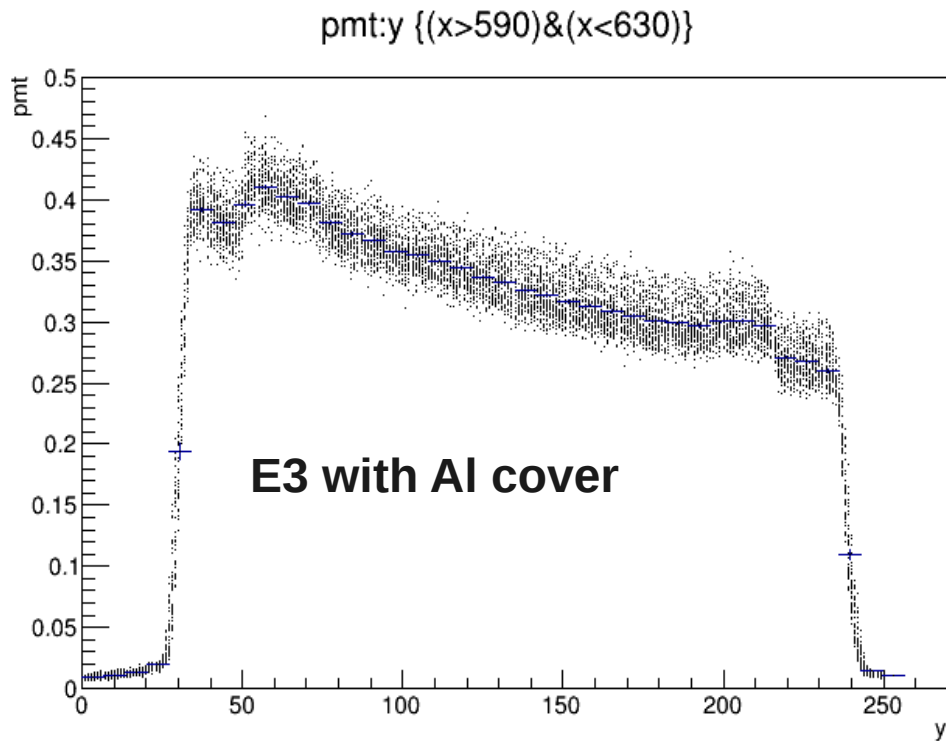
E3 without Al cover

pmt:y:x



Response
non-uniformity: ~15%
RMS

Profile plot



Plots show a typical attenuation pattern along y (mm).

Conclusion and next steps

- The Tile Calorimeter is an important part of ATLAS
- Uniformity of the light response in the E3 and E4 scintillation counters ensures a good energy resolution for dead region
- Many factors affect the light collection uniformity across the scintillation counters
- Compare the irradiated scintillation counters with the unused ones (ones we measured) to determine if the scintillation counters on the ATLAS detector need to be changed
- The old counters are still mounted on the detector, but we will measure them when they are taken out the cavern. 2 counters will be extracted and measured

I would like to thank my supervisors
and the group for all their help and
guidance.

Thank you!