ArgonCube 2x2 Physics Study
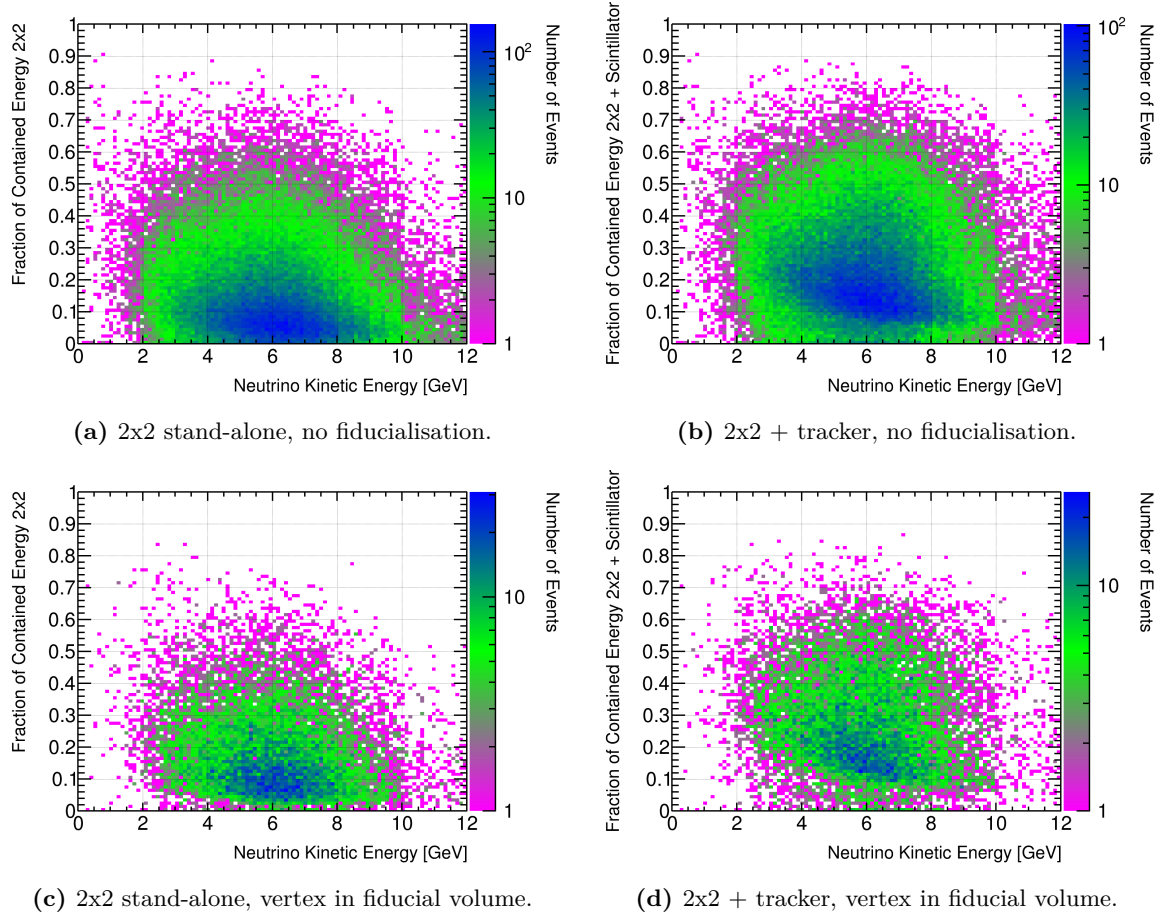
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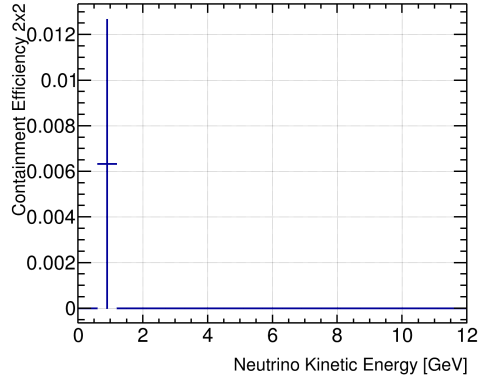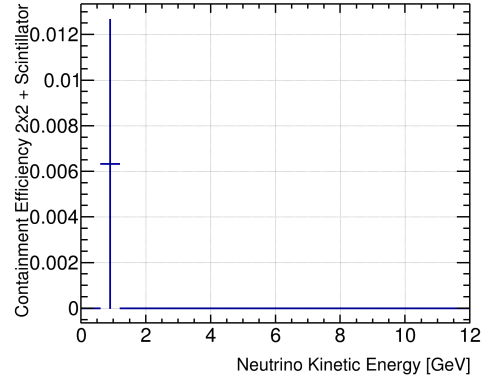
May 7, 2019

1 Neutrino-event

1.1 Full event

(a) 2x2 stand-alone, no fiducialisation.

(b) 2x2 + tracker, no fiducialisation.

(c) 2x2 stand-alone, vertex in fiducial volume.

(d) 2x2 + tracker, vertex in fiducial volume.

Figure 1: Fraction of the parent neutrino kenetic energy deposited within the active detector volume.

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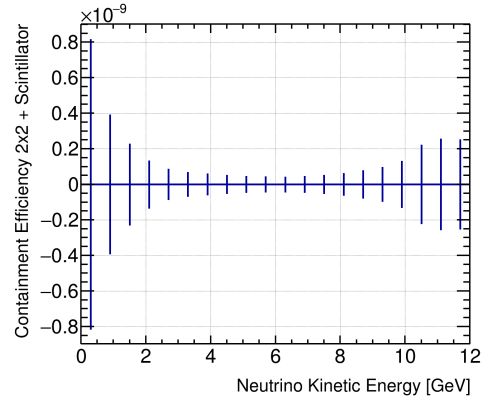
(a) 2x2 stand-alone, no fiducialisation.

(b) 2x2 + tracker, no fiducialisation.
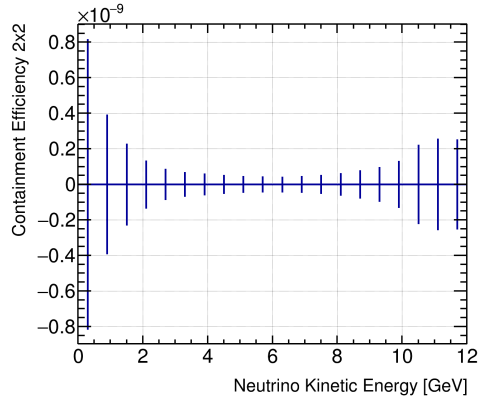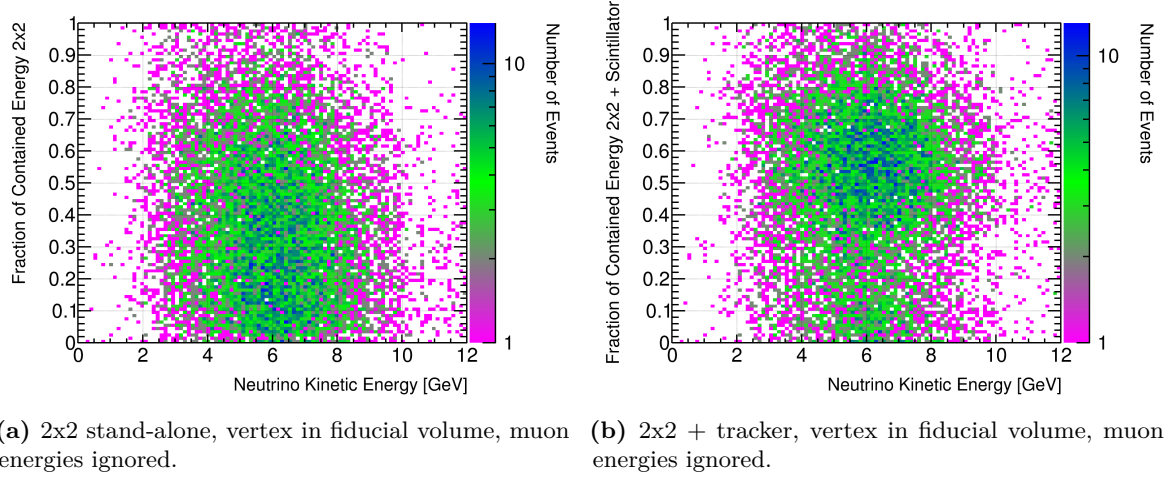

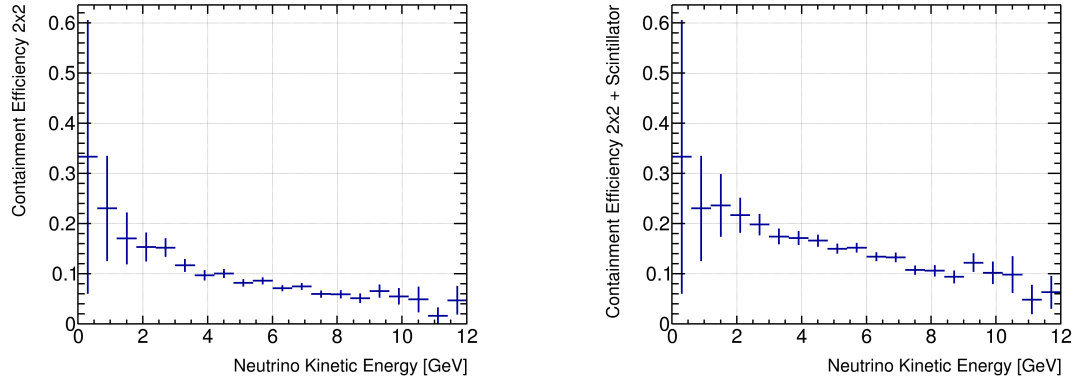**(c)** 2x2 stand-alone, vertex in fiducial volume.

(d) 2x2 + tracker, vertex in fiducial volume.

Figure 2: Event-containment efficiency. An event is classed as contained if at least 90% of the parent neutrino kinetic energy is deposited within the active detector volume.

1.2 Muon energies ignored

(a) 2x2 stand-alone, vertex in fiducial volume, muon energies ignored.

(b) 2x2 + tracker, vertex in fiducial volume, muon energies ignored.

Figure 3: Fraction of the parent neutrino kenetic energy deposited within the active detector volume.

(a) 2x2 stand-alone, vertex in fiducial volume, muon energies ignored.

(b) 2x2 + tracker, vertex in fiducial volume, muon energies ignored.

Figure 4: Event-containment efficiency. An event is classed as contained if at least 90% of the parent neutrino kinetic energy is deposited within the active detector volume.

1.3 Primary muon energy ignored

(a) 2x2 stand-alone, vertex in fiducial volume, primary muon energy ignored.

(b) 2x2 + tracker, vertex in fiducial volume, primary muon energy ignored.

Figure 5: Fraction of the parent neutrino kenetic energy deposited within the active detector volume.

(a) 2x2 stand-alone, vertex in fiducial volume, primary muon energy ignored.

(b) 2x2 + tracker, vertex in fiducial volume, primary muon energy ignored.

Figure 6: Event-containment efficiency. An event is classed as contained if at least 90% of the parent neutrino kinetic energy is deposited within the active detector volume.

2 EM Showers

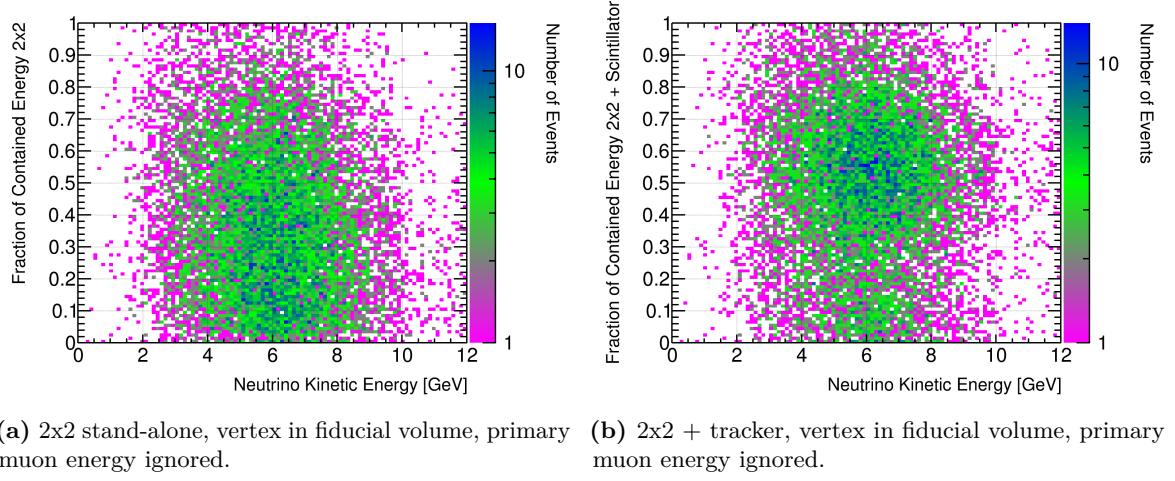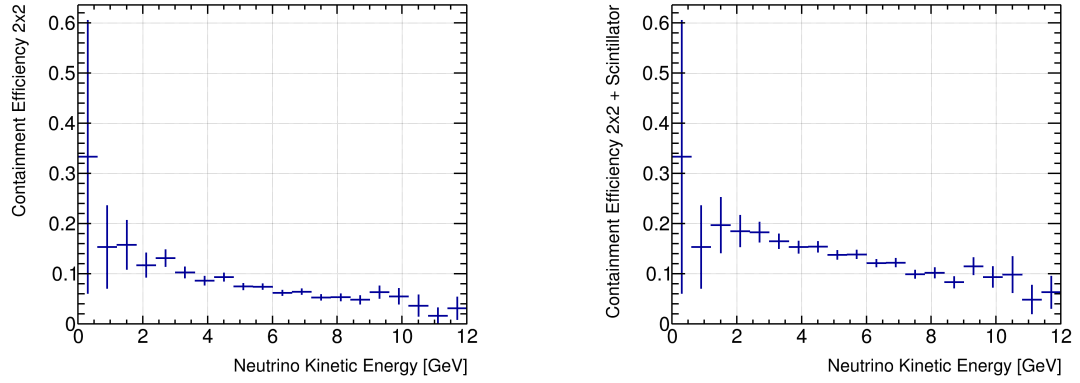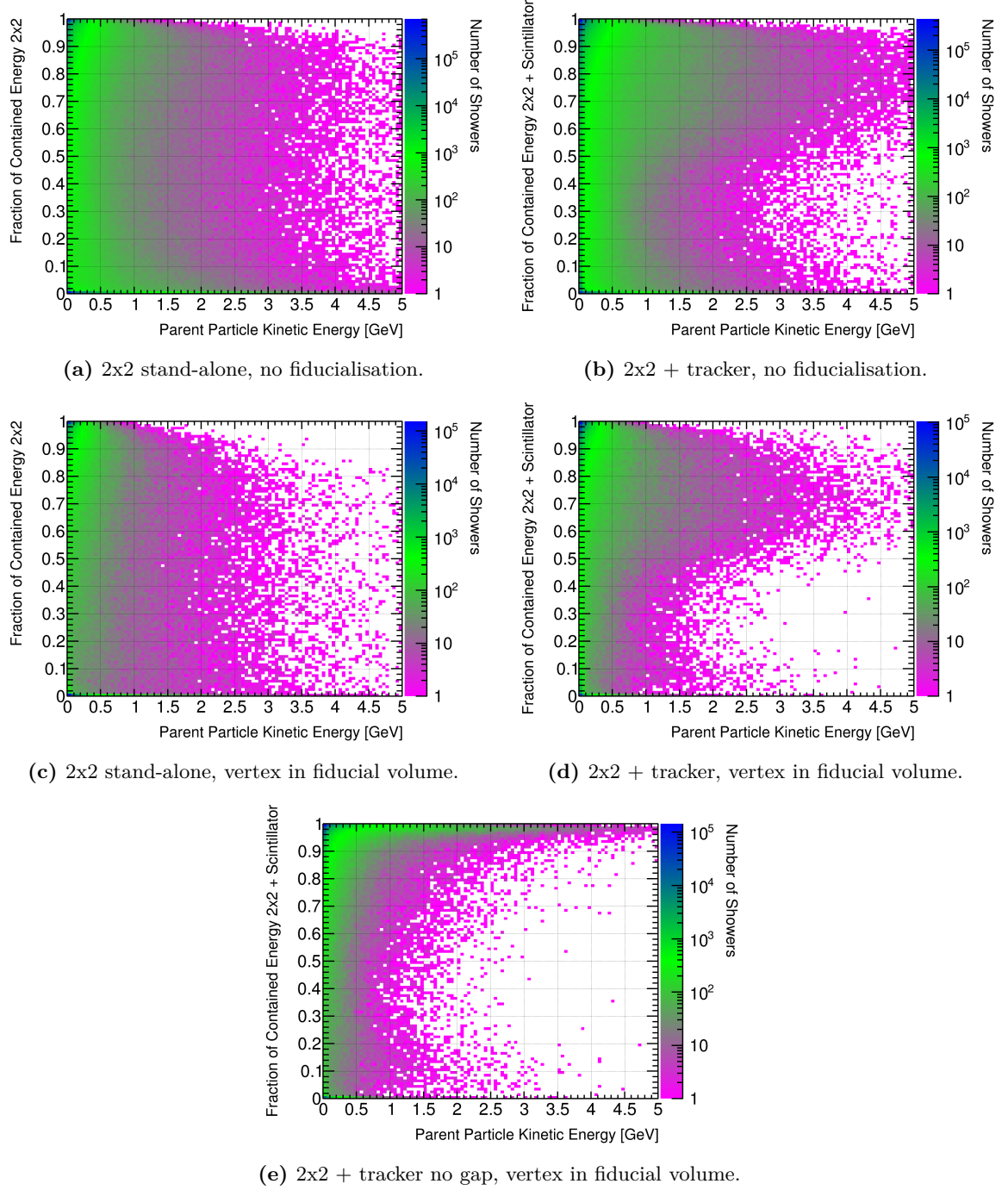## 2.1 Fractional Containment of EM Showers

(a) 2x2 stand-alone, no fiducialisation.

(b) 2x2 + tracker, no fiducialisation.

(c) 2x2 stand-alone, vertex in fiducial volume.

(d) 2x2 + tracker, vertex in fiducial volume.

(e) 2x2 + tracker no gap, vertex in fiducial volume.

Figure 7: Fraction of kinetic shower energy ($e^{\pm}$ mass ignored) deposited within the active detector volume.

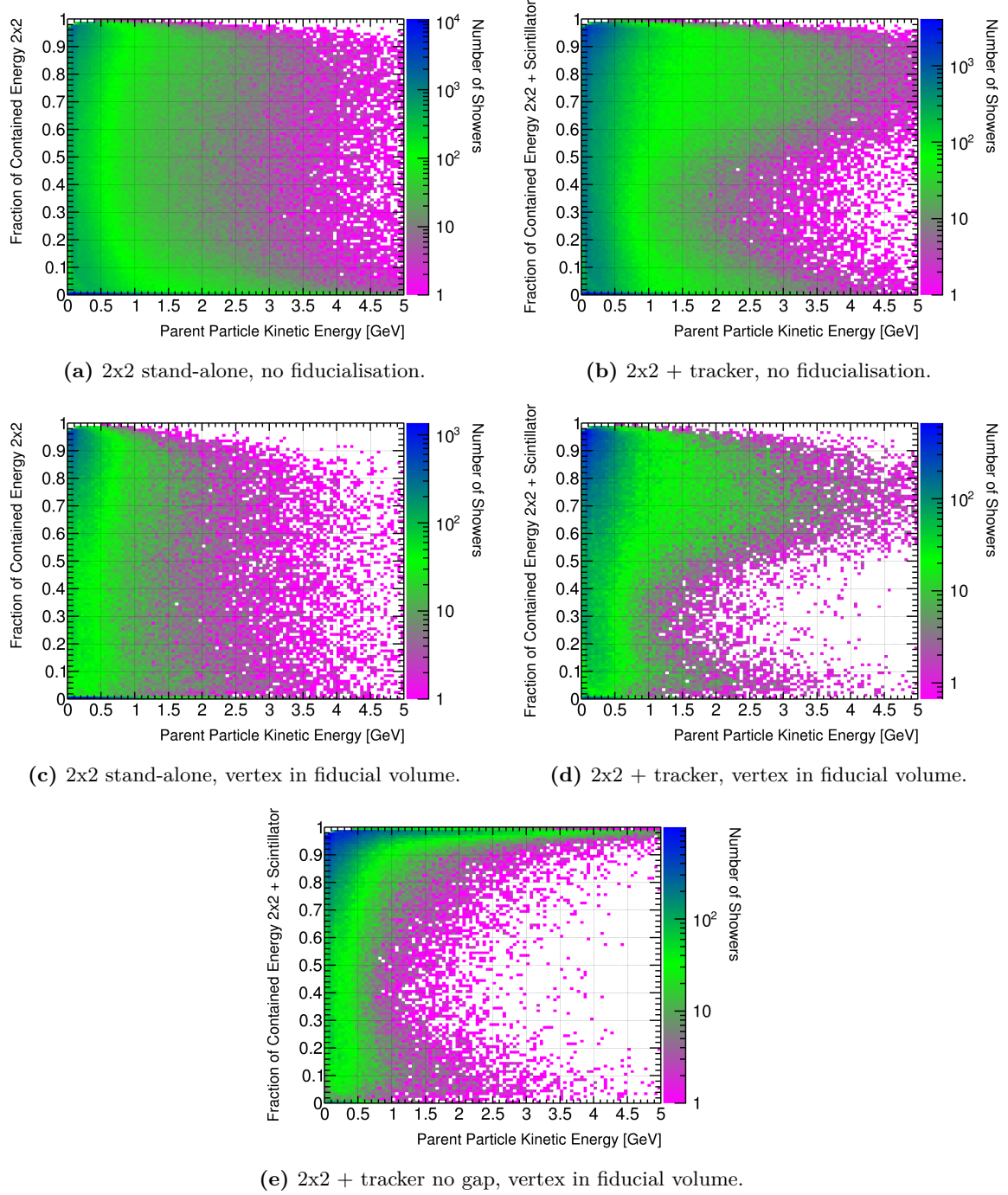## 2.2 Containment Efficiency of EM Showers

(a) 2x2 stand-alone, no fiducialisation.

(b) 2x2 + tracker, no fiducialisation.

(c) 2x2 stand-alone, vertex in fiducial volume.

(d) 2x2 + tracker, vertex in fiducial volume.

(e) 2x2 + tracker no gap, vertex in fiducial volume.
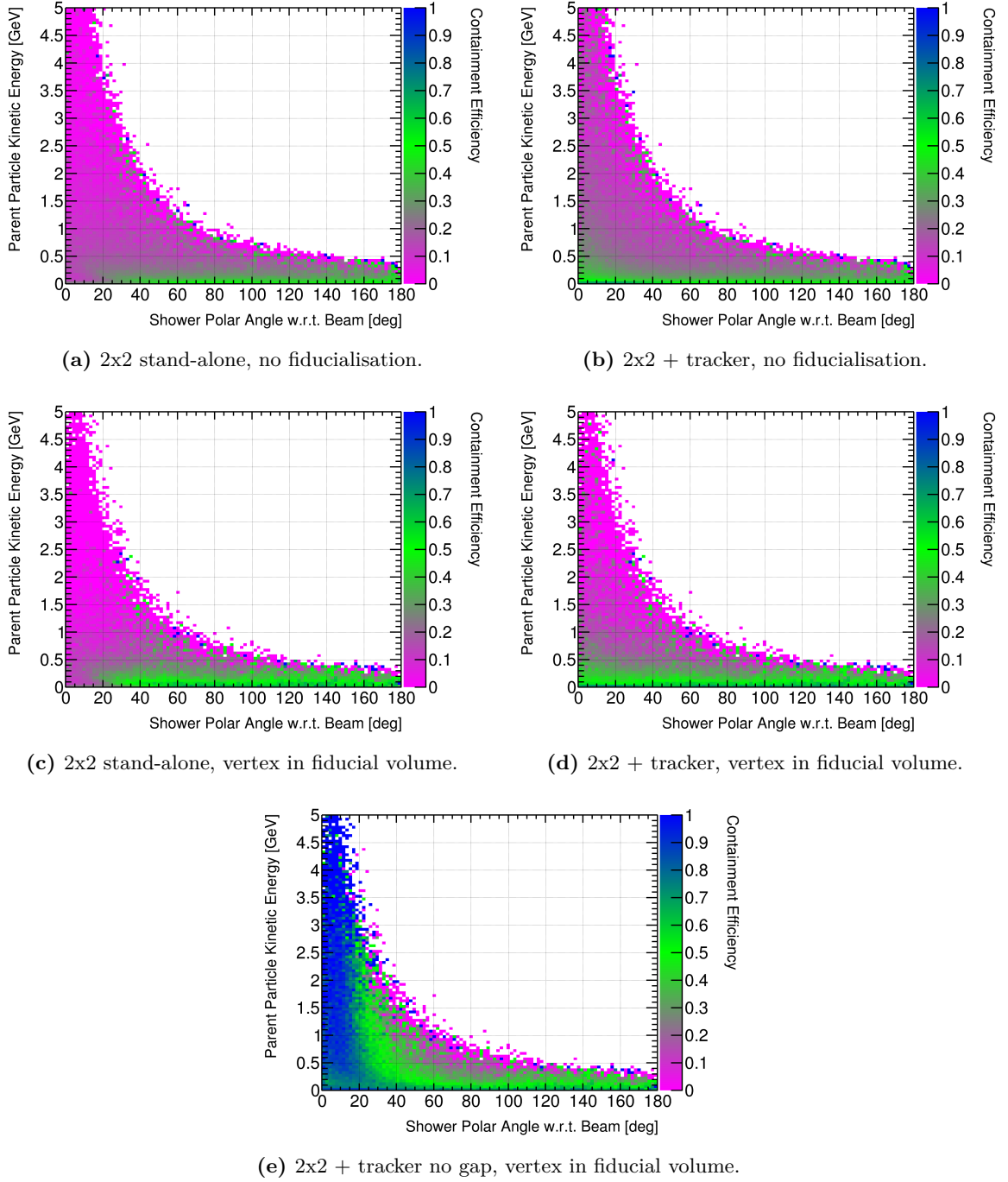
Figure 8: Shower-containment efficiency. A shower is classed as contained if at least 90% of the kinetic shower energy ($e^{\pm}$ mass ignored) is deposited within the active detector volume.
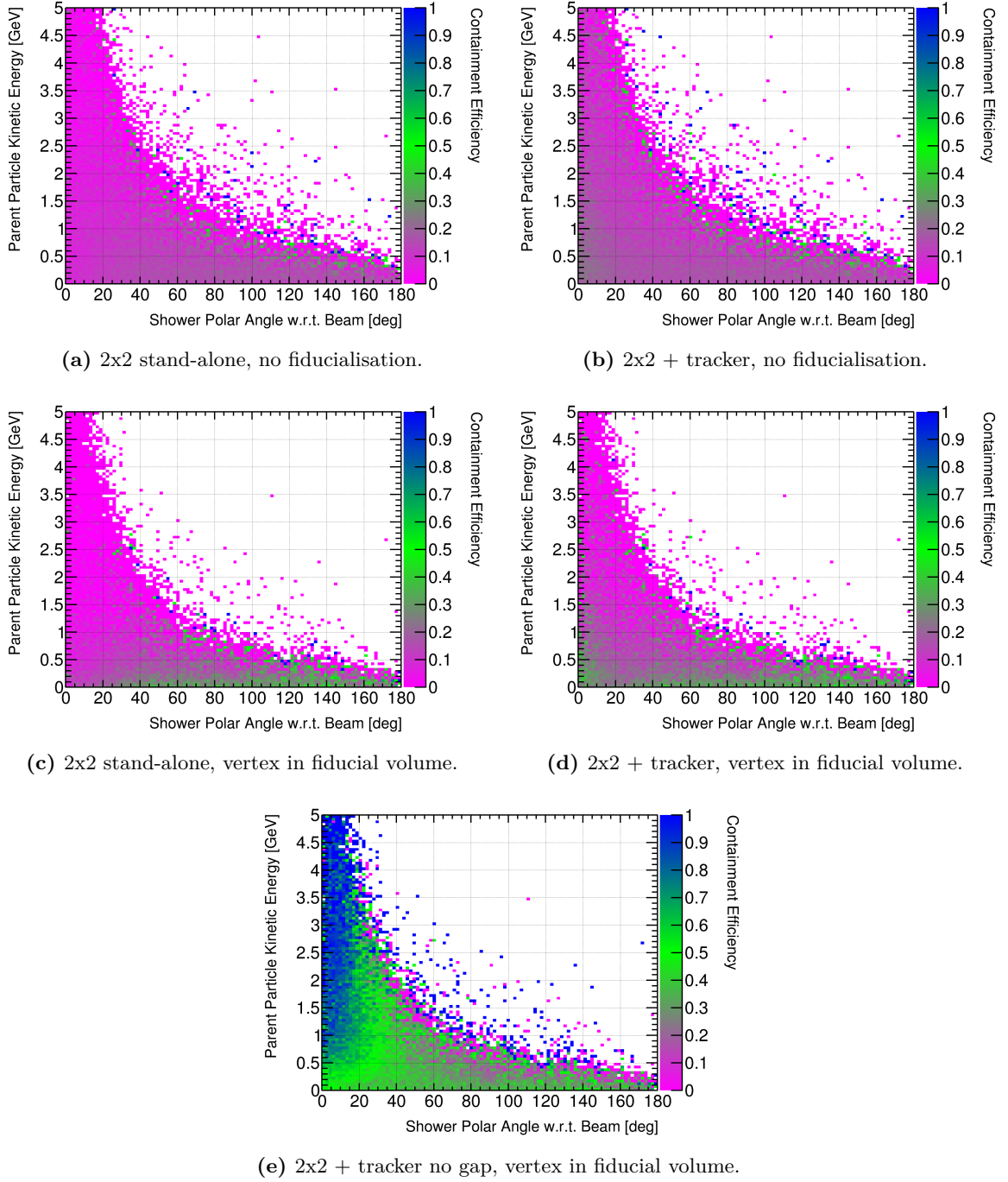
3 π^0 Showers

3.1 Fractional Containment of π^0 Showers

(a) 2x2 stand-alone, no fiducialisation.

(b) 2x2 + tracker, no fiducialisation.

(c) 2x2 stand-alone, vertex in fiducial volume.

(d) 2x2 + tracker, vertex in fiducial volume.

(e) 2x2 + tracker no gap, vertex in fiducial volume.

Figure 9: Fraction of total shower energy (including the π^0 mass) deposited within the active detector volume.

3.2   Containment Efficiency of π^0 Showers

(a) 2x2 stand-alone, no fiducialisation.

(b) 2x2 + tracker, no fiducialisation.

(c) 2x2 stand-alone, vertex in fiducial volume.

(d) 2x2 + tracker, vertex in fiducial volume.

**(e)** 2x2 + tracker no gap, vertex in fiducial volume.

Figure 10: Shower-containment efficiency. A shower is classed as contained if at least 90% of the total shower energy (including the π^0 mass) is deposited within the active detector volume.

4 Proton Induced Showers

4.1 Fractional Containment of Proton Induced Showers

(a) 2x2 stand-alone, no fiducialisation.

(b) 2x2 + tracker, no fiducialisation.
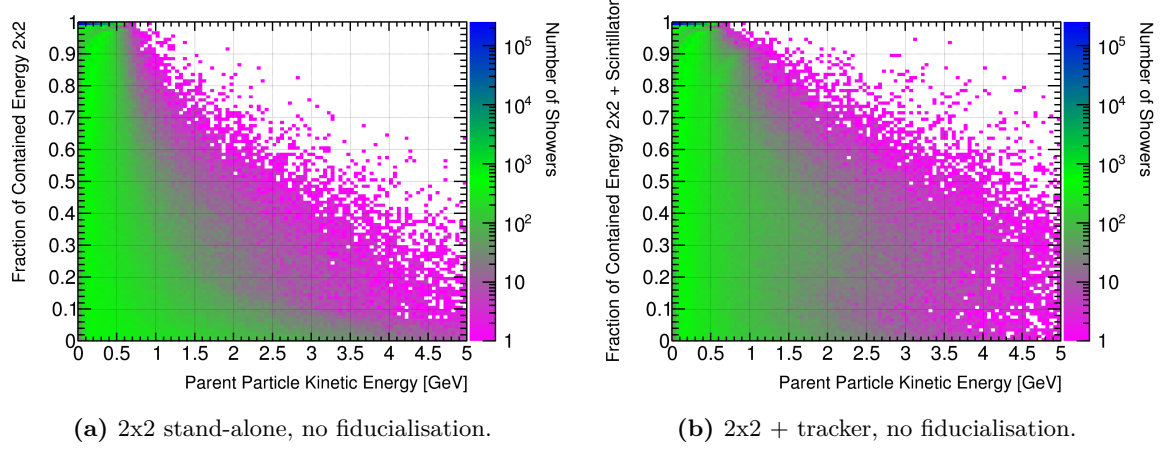
Figure 11: Fraction of initial proton kinetic energy deposited within the active detector volume.

4.2 Containment Efficiency of Proton Induced Showers

(a) 2x2 stand-alone, no fiducialisation.

(b) 2x2 + tracker, no fiducialisation.
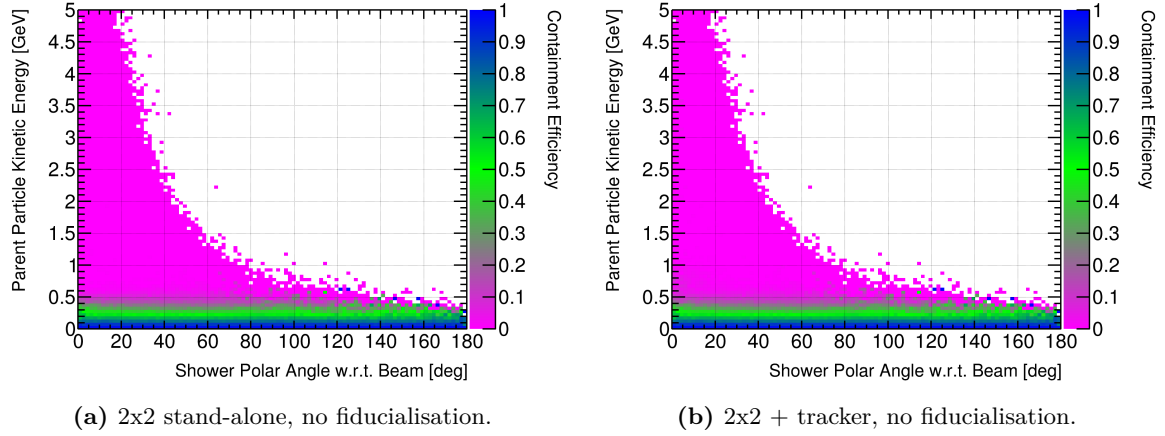
Figure 12: Shower-containment efficiency. A shower is classed as contained if at least 90% of the initial proton kinetic energy is deposited within the active detector volume.