

Toy SCT_Digitisation MC

SCT Digitisation Task Force Meeting

25th May 2010

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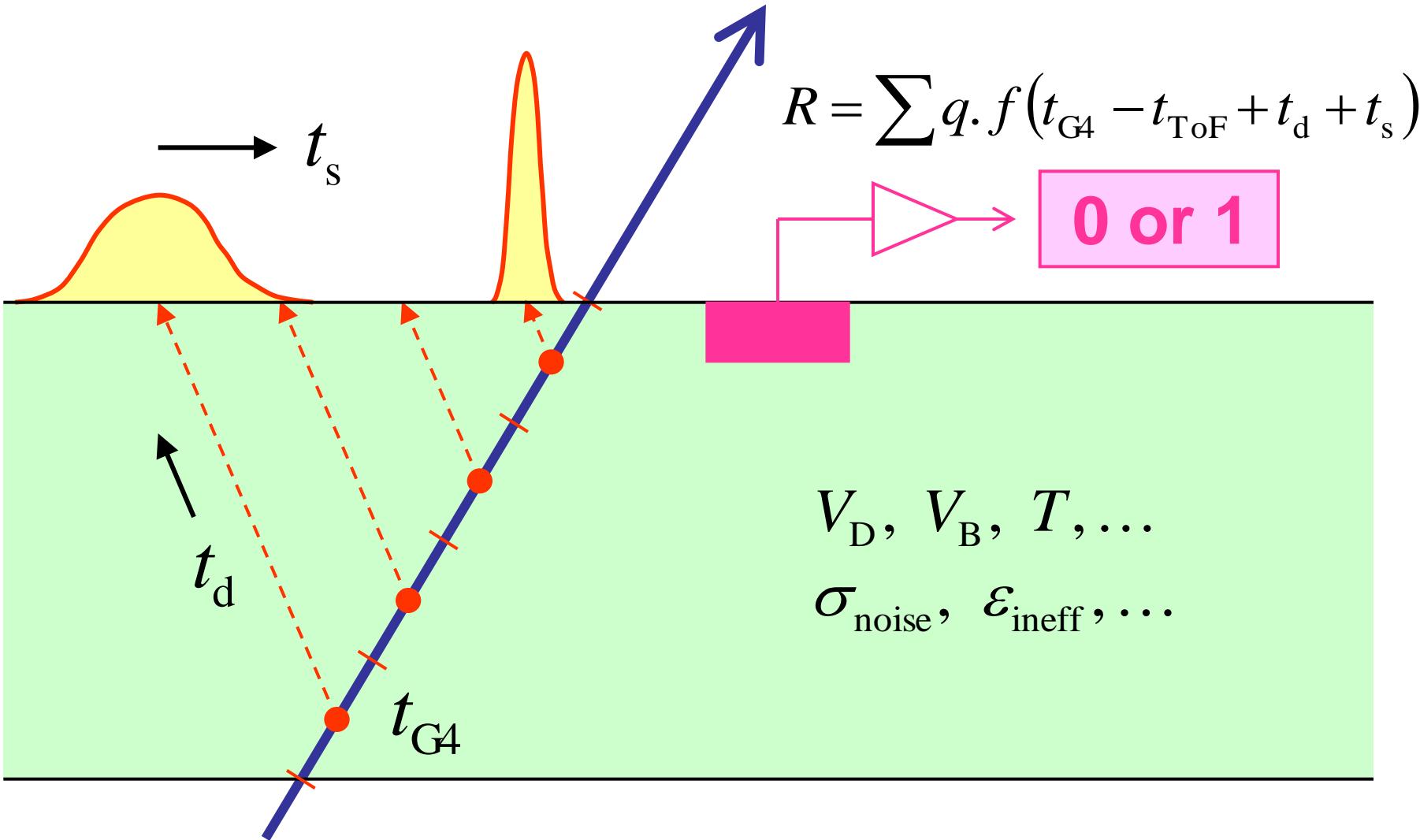
- ◆ Toy MC implementation
 - “stand-alone” but still within Athena
- ◆ Some example output plots



fast check of SCT_Digitisation model response

(analog or digital / toy clusters)

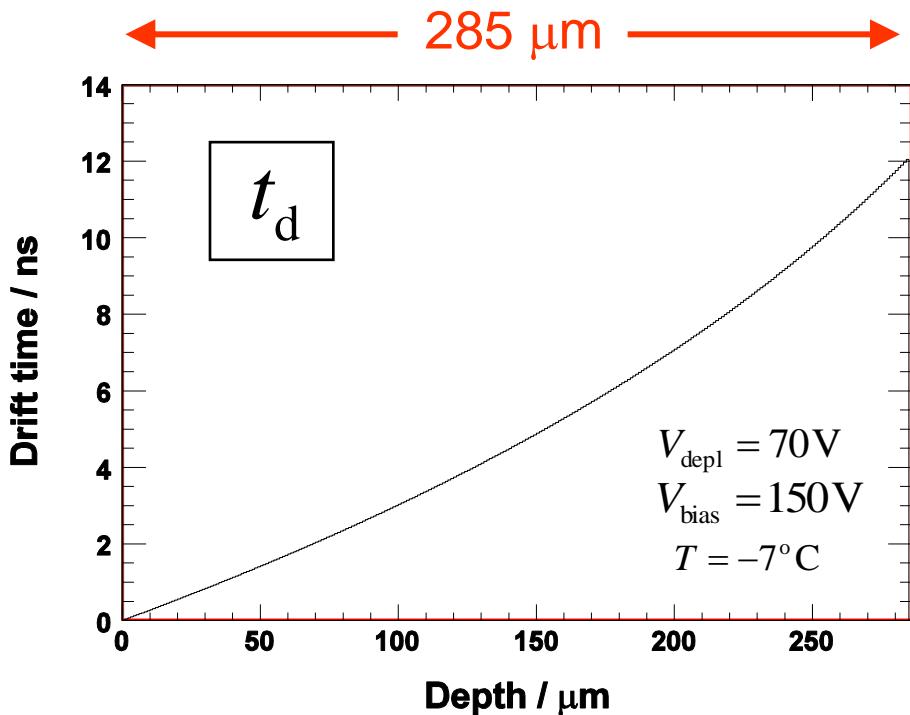
SCT Digitisation Model



Toy MC Implementation

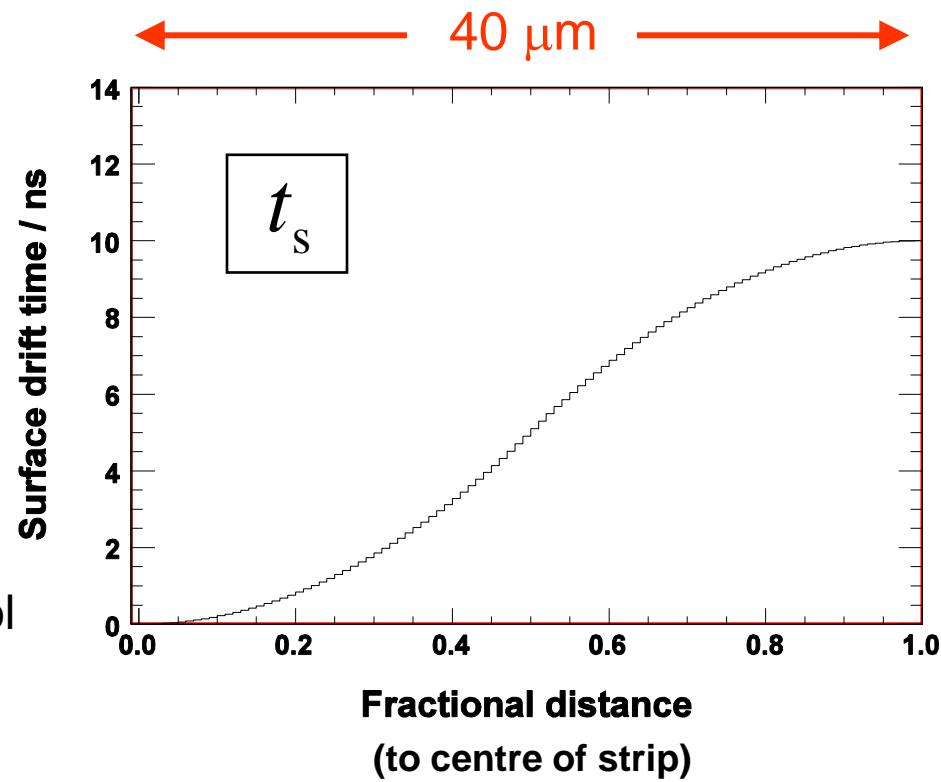
- ◆ Call SCT_Digitisation methods from user code in Athena :
 - SCT_SurfaceChargesGenerator
 - DriftTime(...)
 - SurfaceDriftTime(...)
 - DiffusionSigma(...)
 - response(...)
 - crosstalk(...)
 - SCT_Amp
 - SCT_FrontEnd
 - SCT_StripDiscriminator
 - SCT_TimeWalkGenerator
 - SCT_RandomDisabledCellGenerator
- ◆ Create SiCharge objects with desired charge, time
- ◆ Access to standard geometry and other parameters

Drift time components in SCT Digitisation



SCT_SurfaceChargesGeneratorTool
→DriftTime(depth)

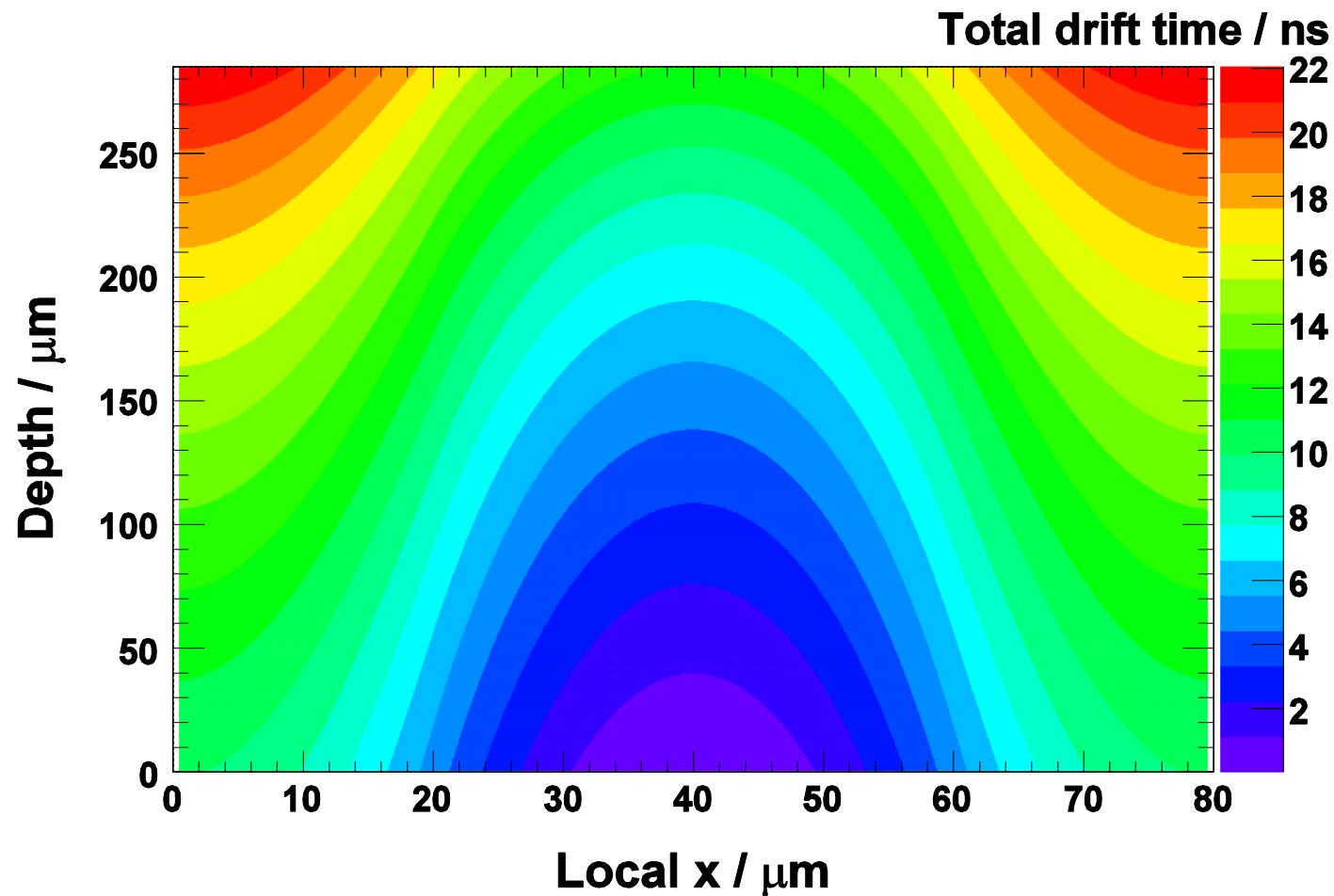
SCT_SurfaceChargesGeneratorTool
→DriftTime(depth)



Fractional distance
(to centre of strip)

Total drift time over one cell

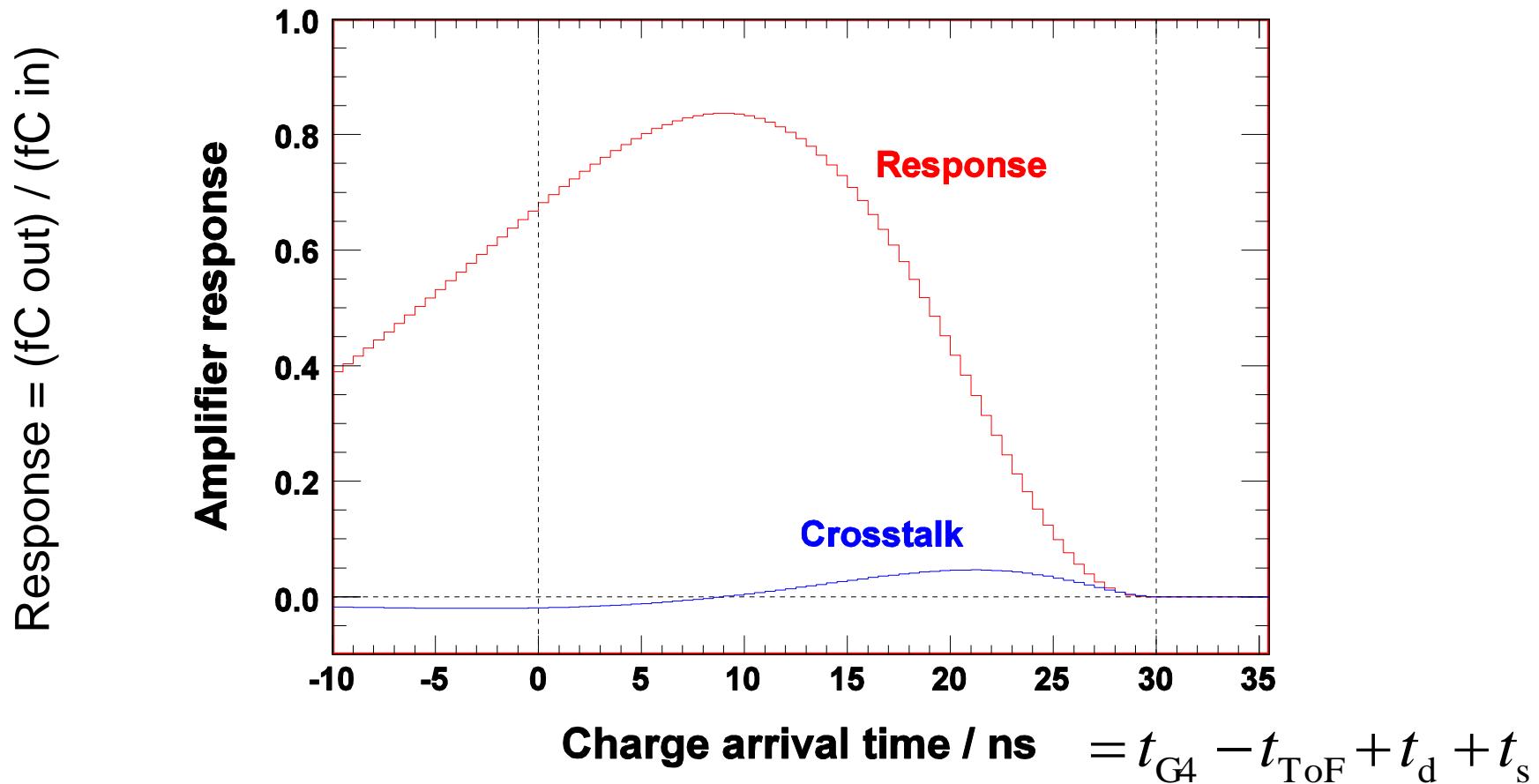
$$t = t_d + t_s$$



Model of amplifier response

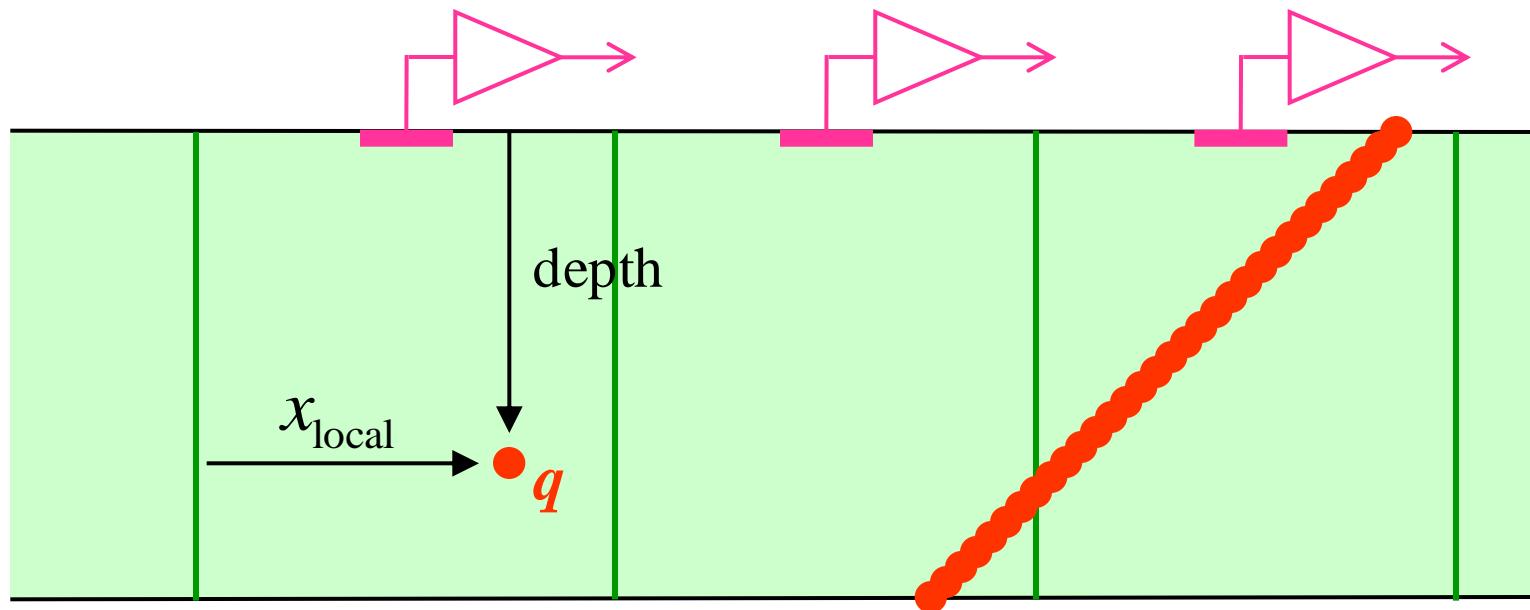
SCT_Amp Tool → response(chargeList,timeOfThreshold)

SCT_Amp Tool → crosstalk(chargeList,timeOfThreshold)



Stand-alone (“toy”) digitisation

- ◆ Map response to charge deposition over one cell :

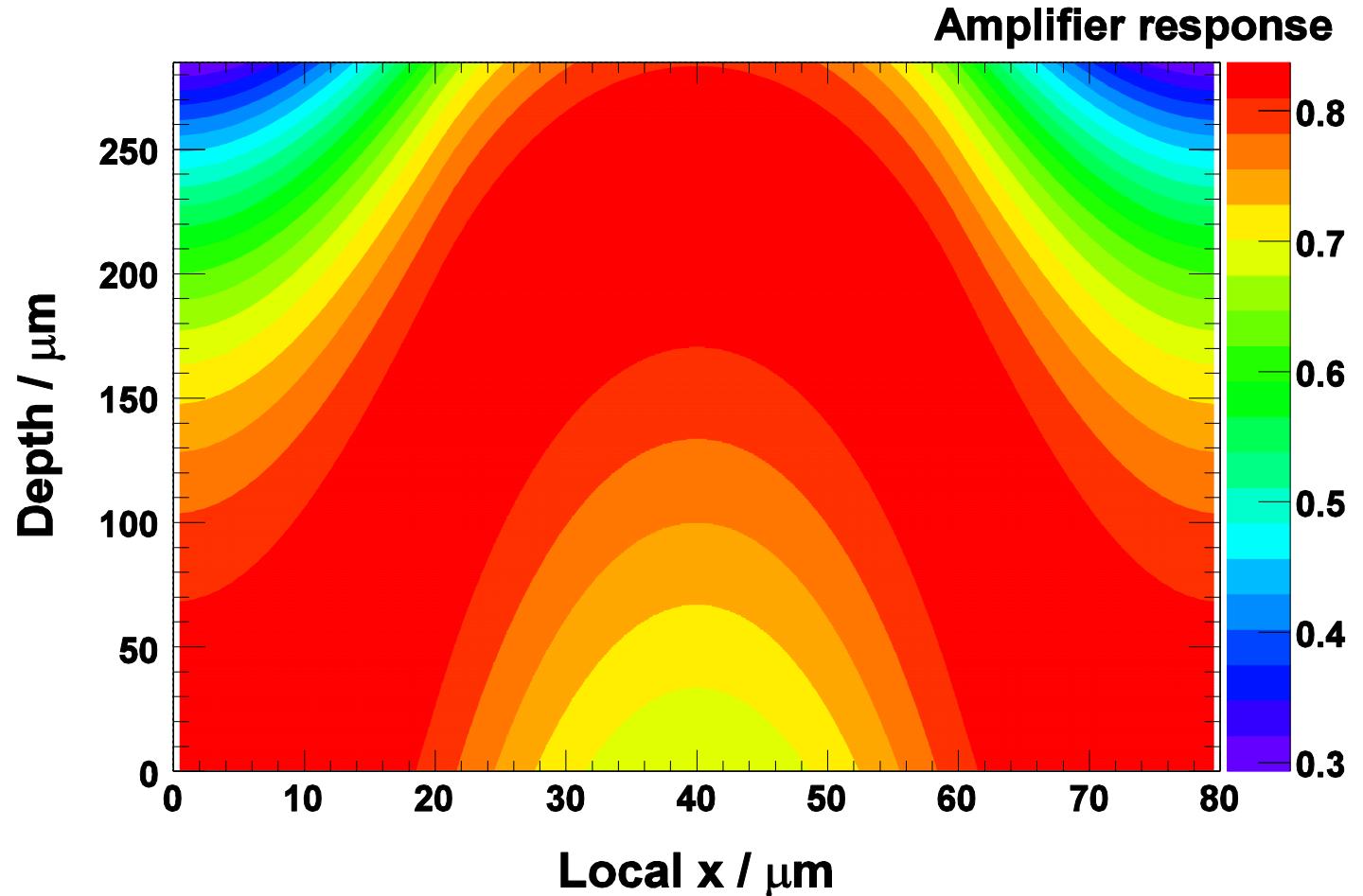


- ◆ Map response to “muons” vs position and angle :
 - integrate response along a “muon” trajectory
 - apply 1fC threshold and study toy clusters

Response vs Position in cell

$$t_{G4} = t_{\text{ToF}}$$

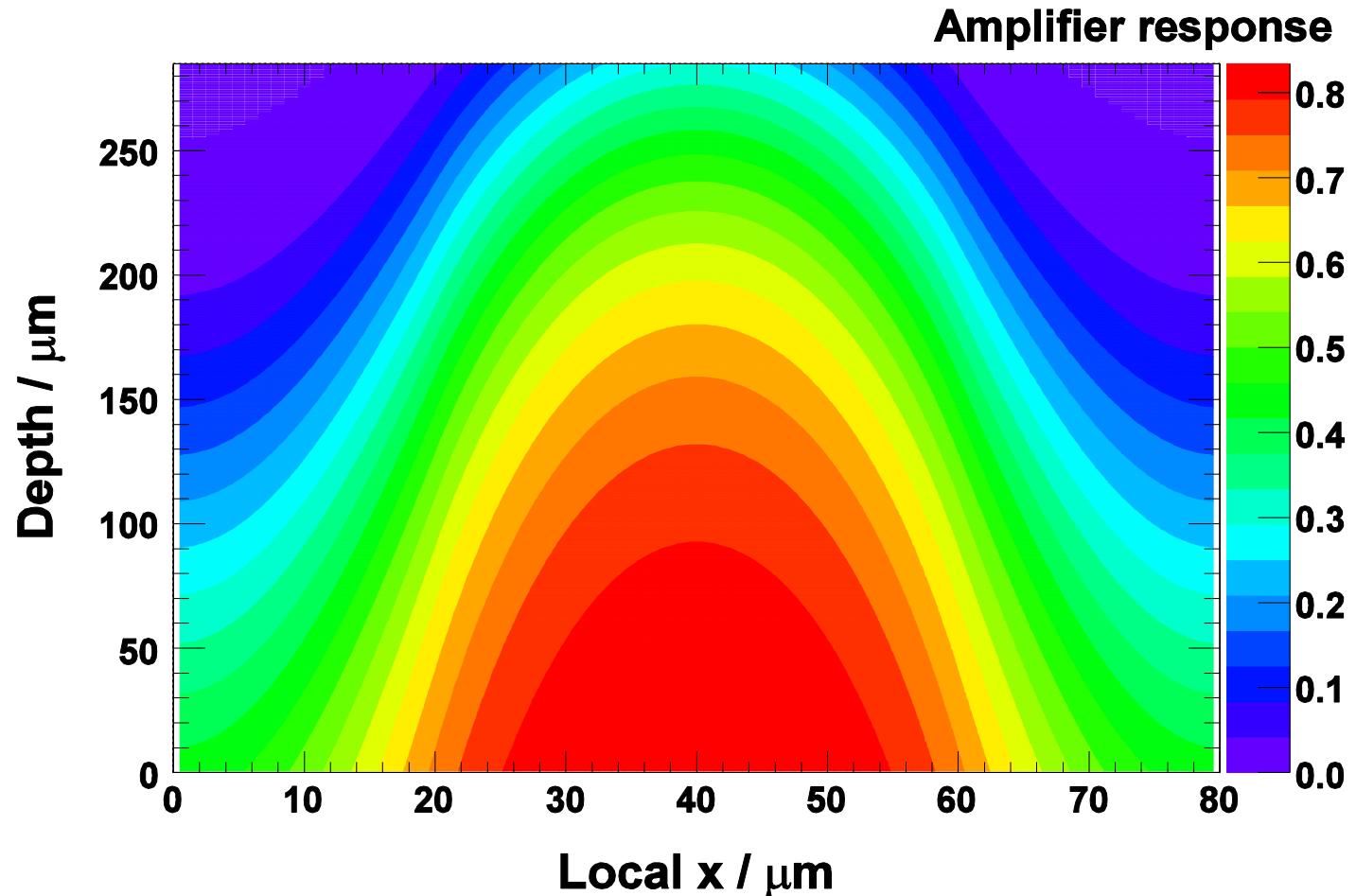
response = (fC out) / (true fC deposited)



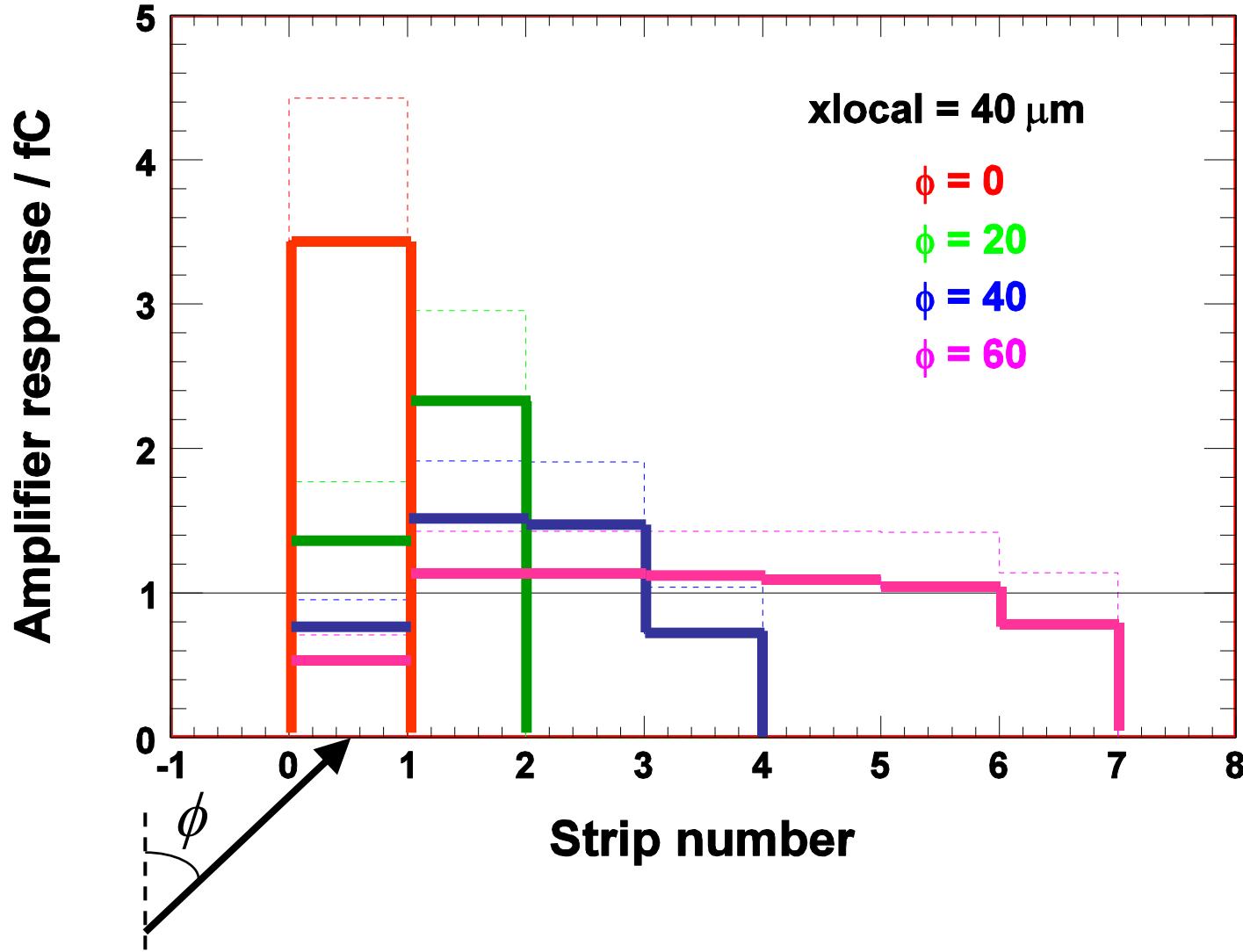
Response vs Position in cell

$$t_{G4} = t_{\text{ToF}} + 10 \text{ ns}$$

response = (fC out) / (true fC deposited)



Toy clusters from toy muons



Summary

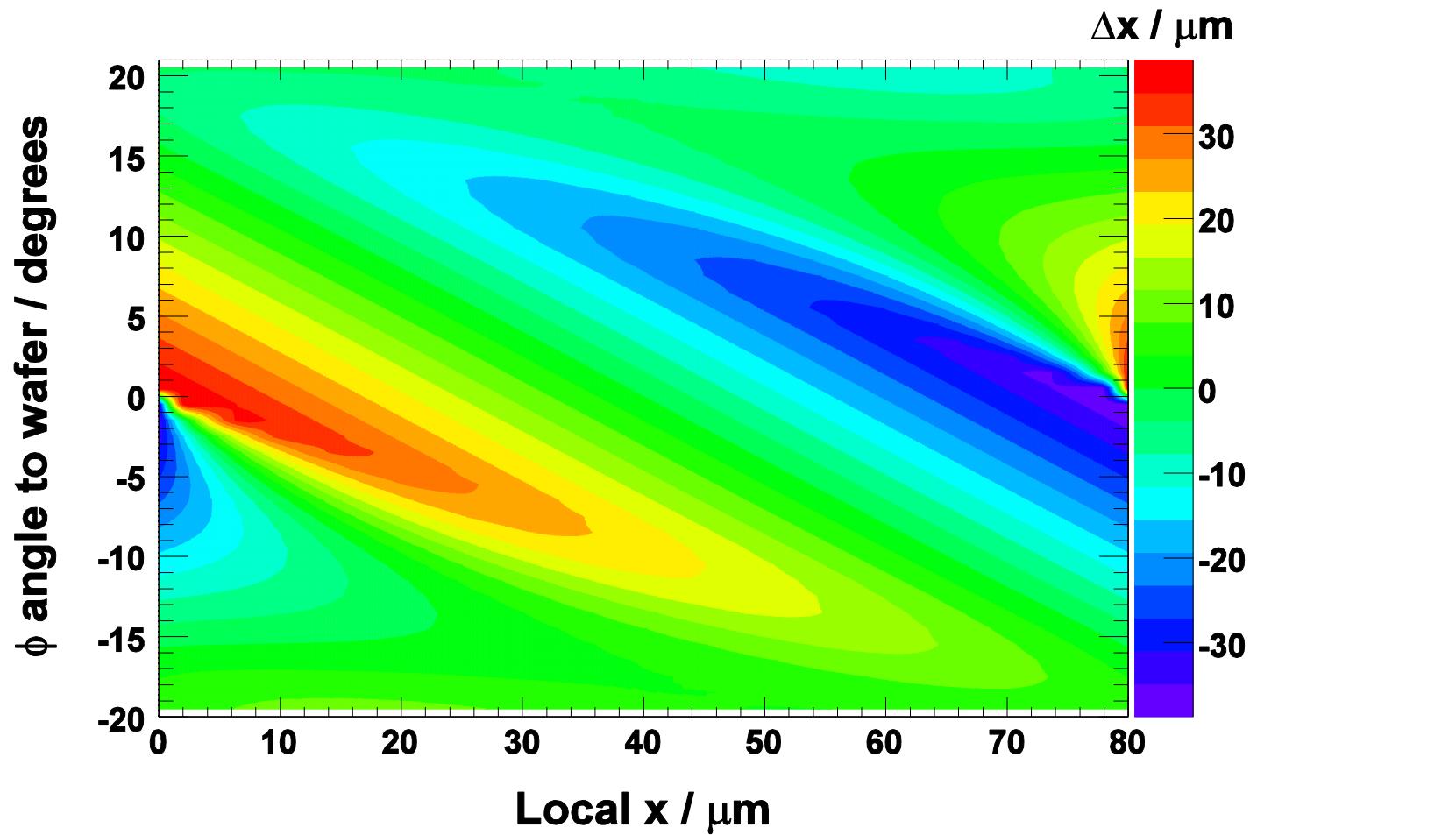
- ◆ Toy SCT_Digitisation MC :
 - calls core methods of SCT_Digitisation package stand-alone, but still within Athena
 - allows fast map of model response to blobs of charge or to line charges
(toy tracks → toy clusters)
- ◆ Last run in anger in 13.0.10 :
 - now resurrecting in 15.6.8 in case useful
(e.g. to incorporate some features of Taka Kondo MC ?)

BACKUP SLIDES

Position bias in toy digitisation

$t_{\text{GEANT}} = 5 \text{ ns}$

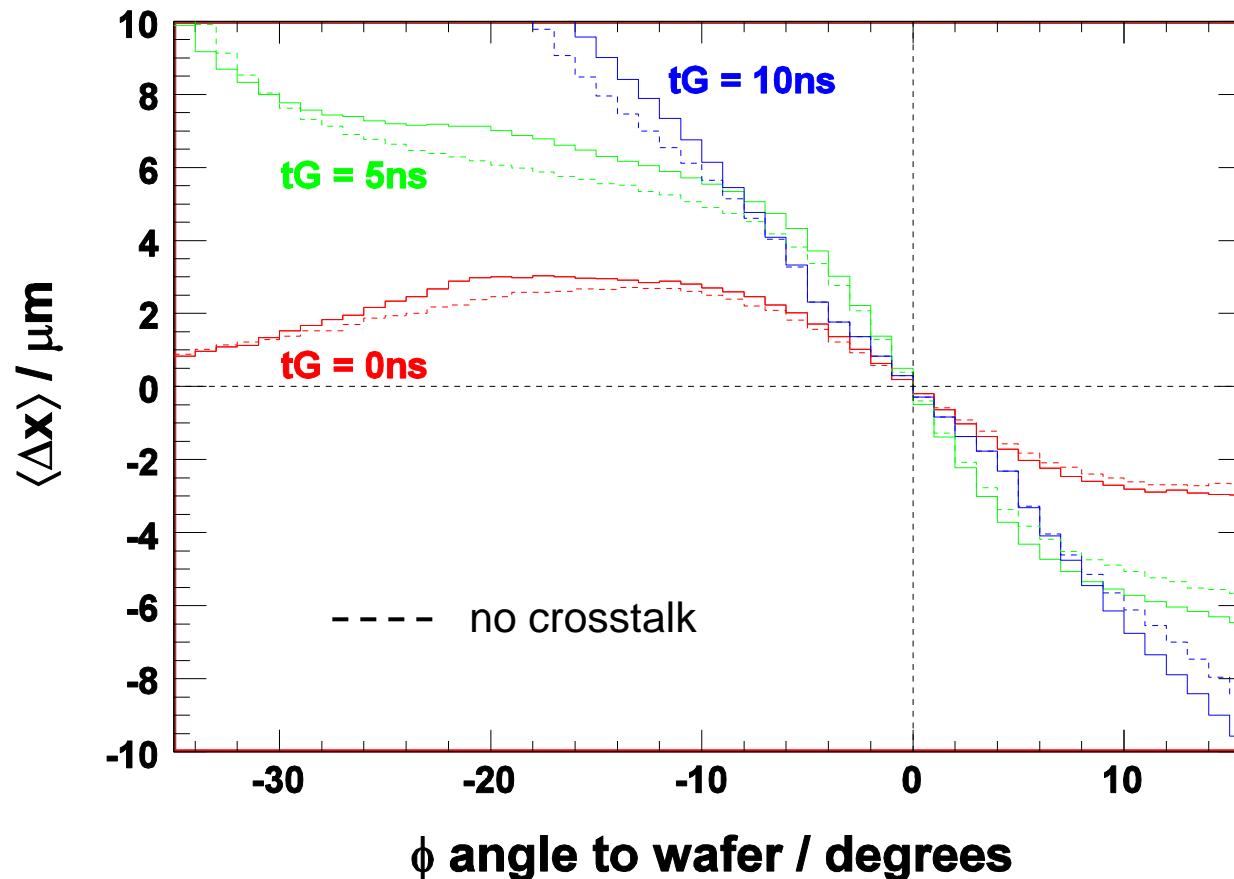
$$\Delta x = x_{\text{local}}^{\text{toy cluster}} - x_{\text{local}}^{\text{toy muon}}$$



Position bias in toy digitisation

$$\Delta x = x_{\text{local}}^{\text{toy cluster}} - x_{\text{local}}^{\text{toy muon}}$$

(for uniform distribution in x_{local})



⇒ position bias reproduced in simplified model

Toy digitisation

- Zero Lorentz angle
- No diffusion
- No noise
- No crosstalk
- Just geometry and dE/dx , plus
 - SCT_SurfaceChargesGenerator (charge drift)
 - SCT_Amp (electronics response)
- Also “truth”: just geometry and dE/dx

Cluster resolution vs Phi: Toy model

