

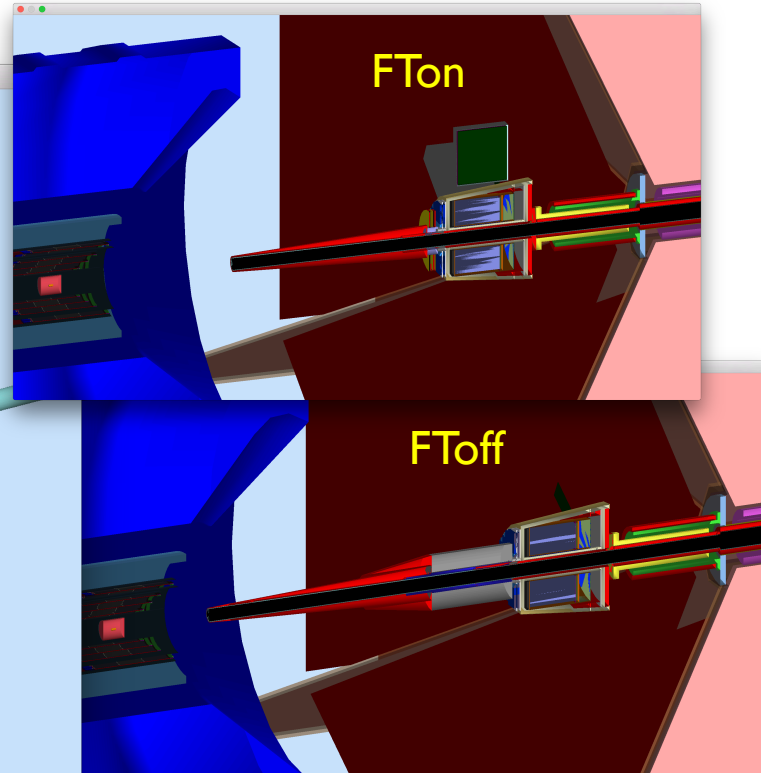
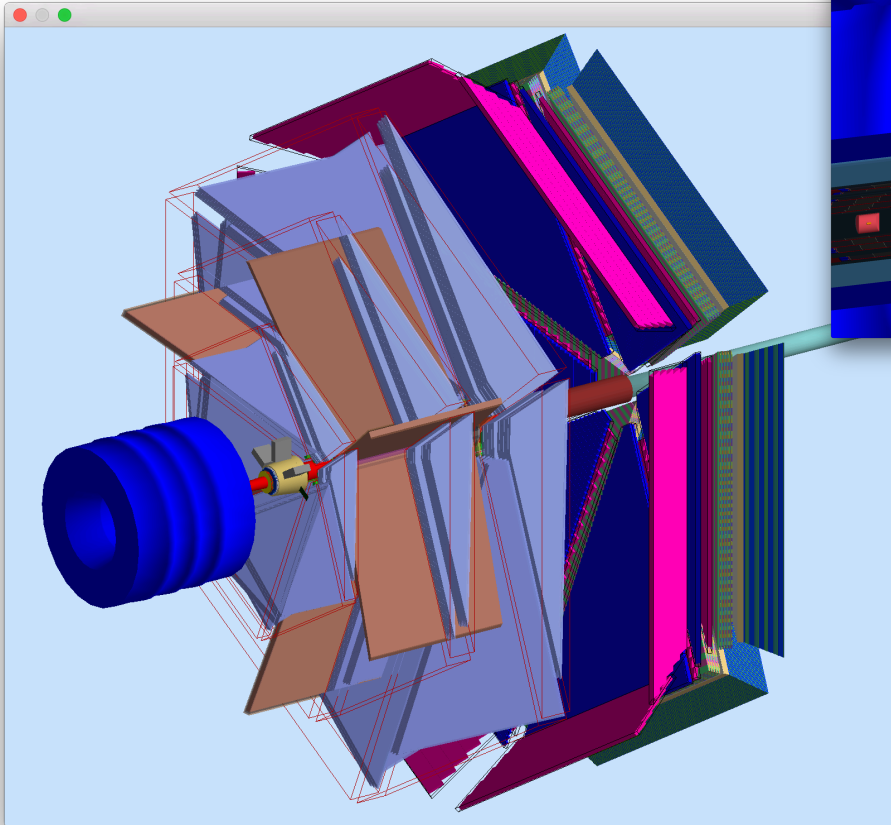
Background rates

R. De Vita

CalCom meeting, 4/29/2016

Detector Configurations

Background arising from beam
interaction in the target



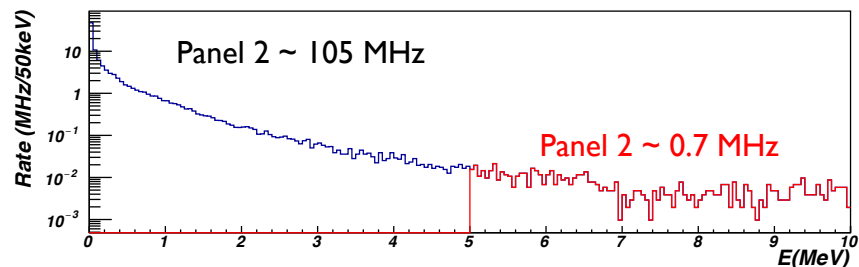
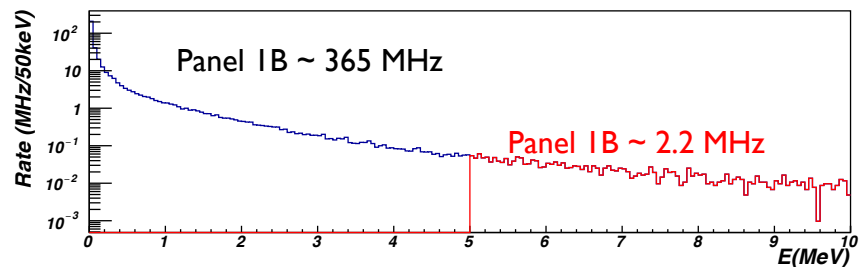
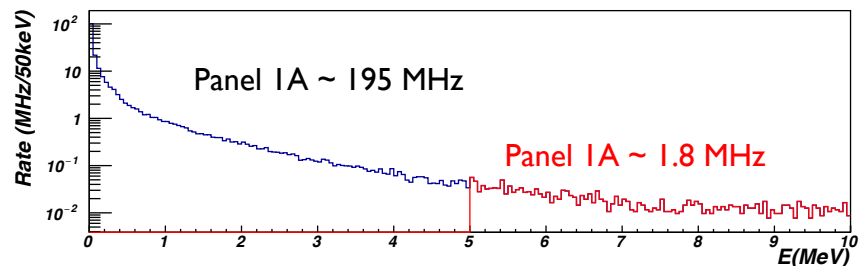
11 GeV @ $10^{35} \text{ cm}^{-2}\text{s}^{-1}$
124000 e- in 250 ns

New simulations with final version of
GEMC 2.3 (i.e. optimized FTOF
digitization)

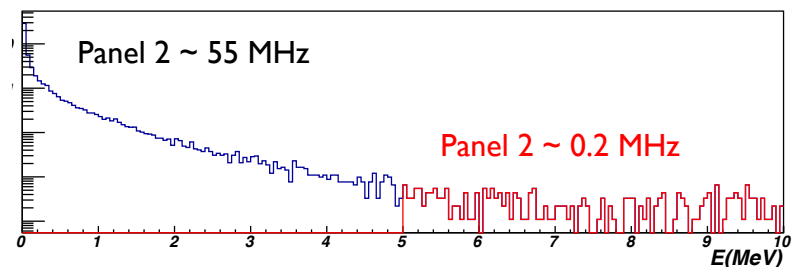
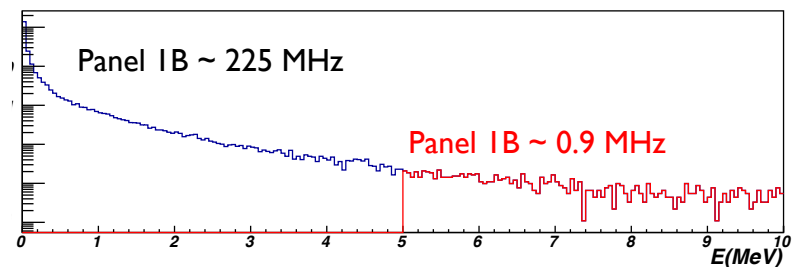
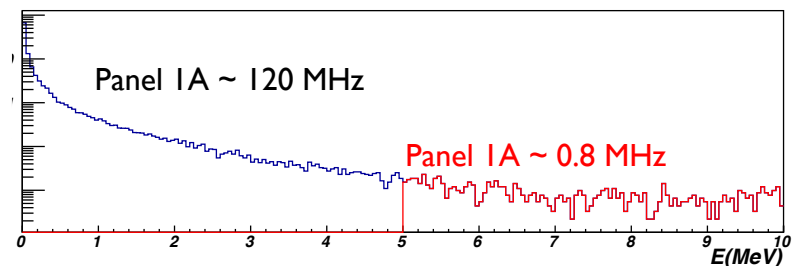
FTOF rates

(sum over all sectors and paddles)

FTon

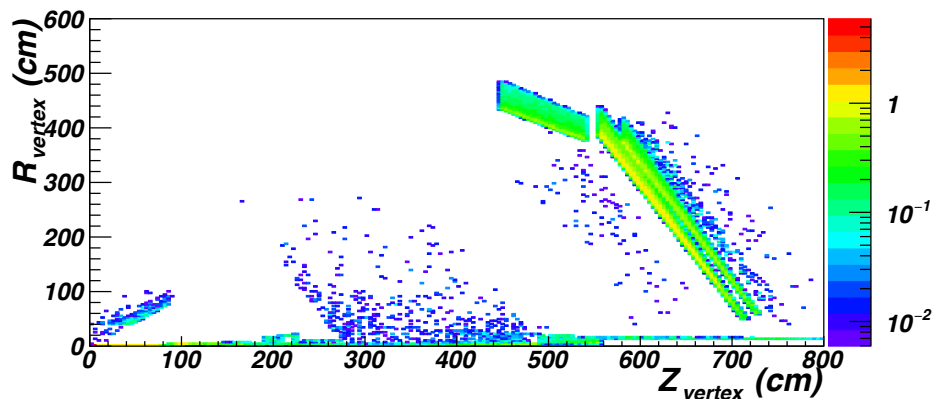


FToff

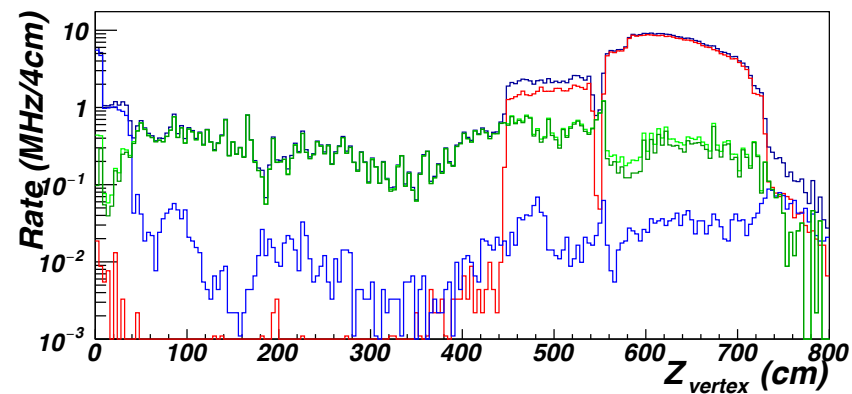
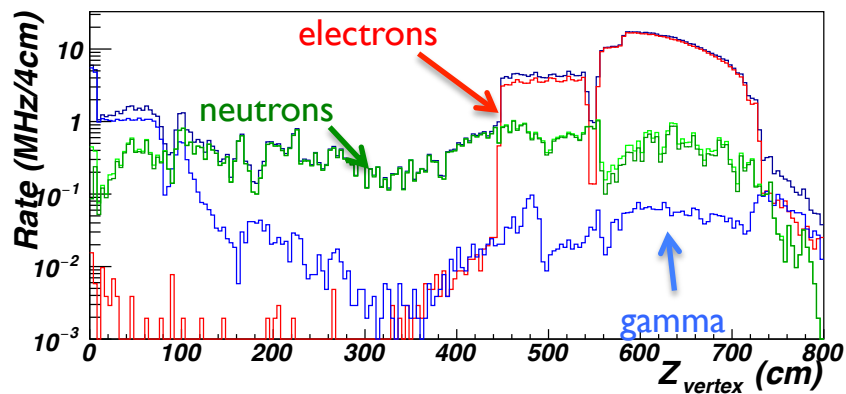
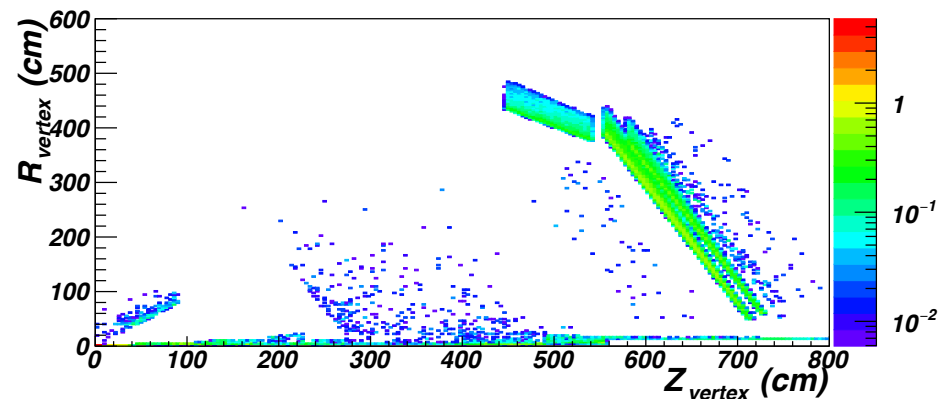


Background origin

FTon



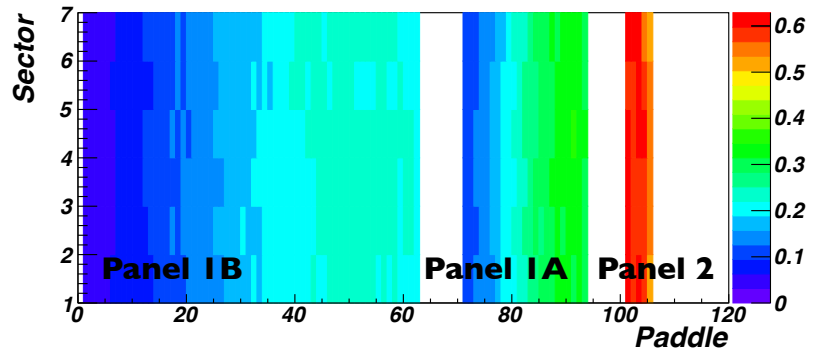
FToff



FTOF counter rates (MHz)

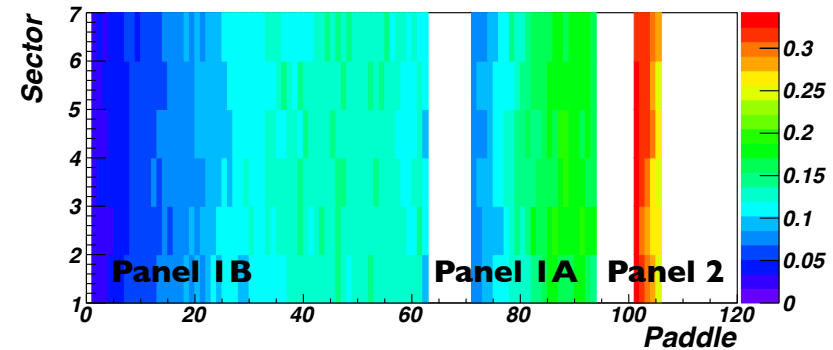
(all energies)

FTon

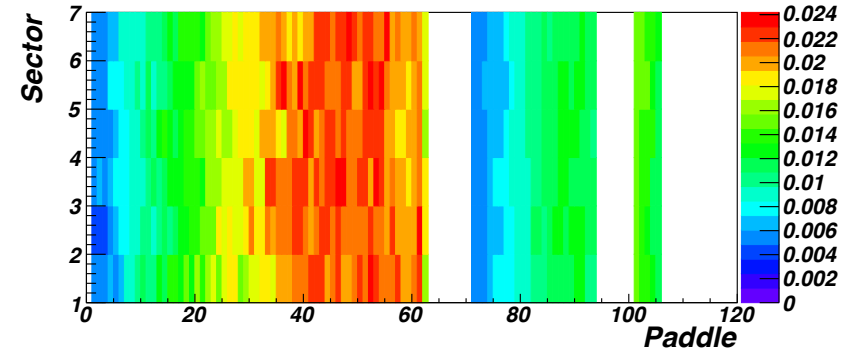
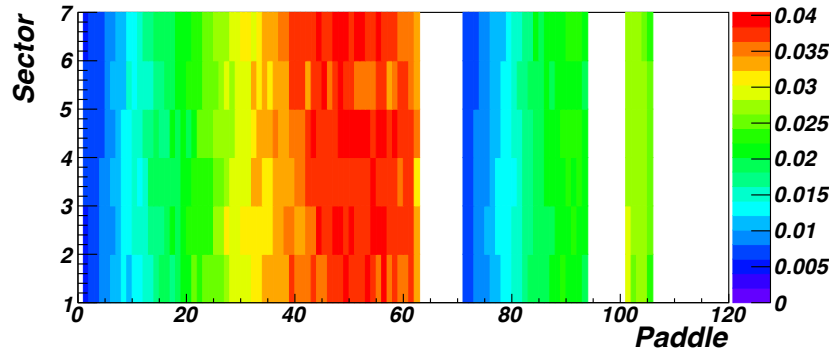


Rate per
Counter

FToff



Rate
normalized
to counter
width



Counter widths:

- Panel 1B: 6 cm
- Panel 1A: 15 cm
- Panel 2: 22 cm

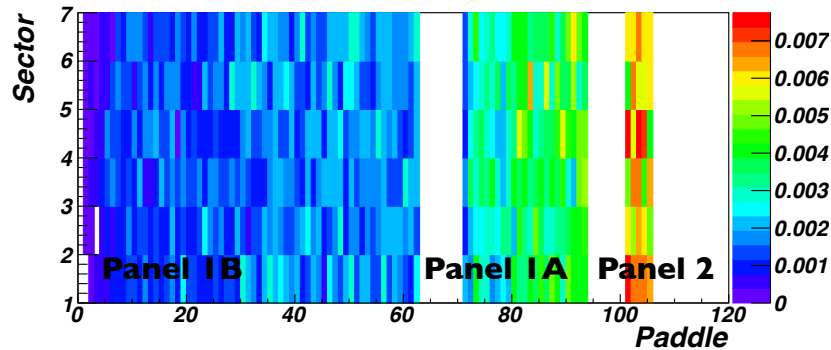
Notes:

- Differences in panel rates are consistent with counter widths
- When normalized to counter widths:
 - max. rates are observed in panel 1B
 - Panel 1A and 2 rates increases smoothly with counter length

FTOF counter rates (MHz)

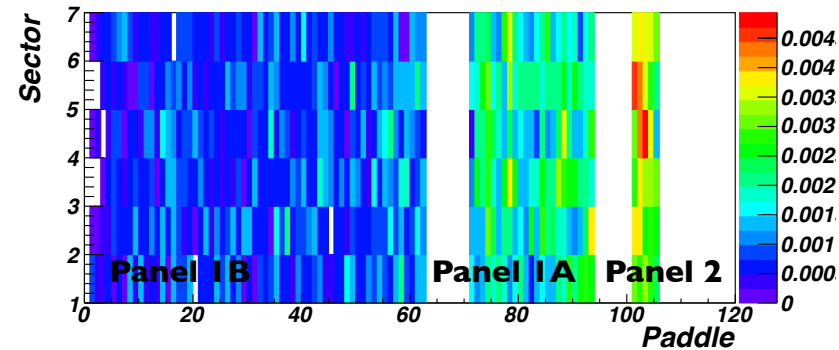
($E_{\text{dep}} > 5 \text{ MeV}$)

FTon

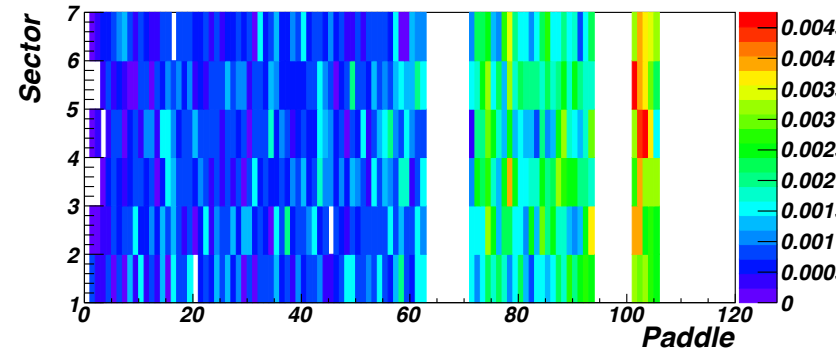
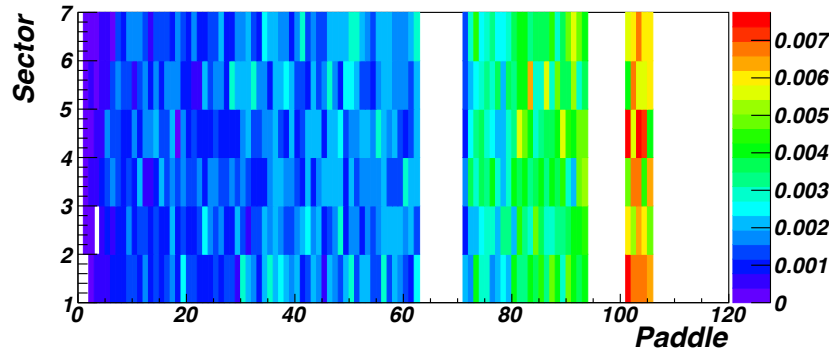


Rate per
Counter

FToff



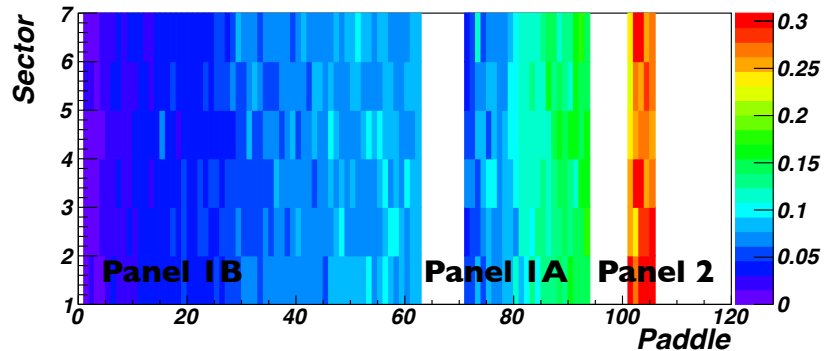
Rate per
counter for
charged
particles*



(*) here charged particles are defined as all particles except neutrals coming from the target; this is motivated by the fact that neutrals coming from regions other than the target are most likely secondaries produced by beam particles

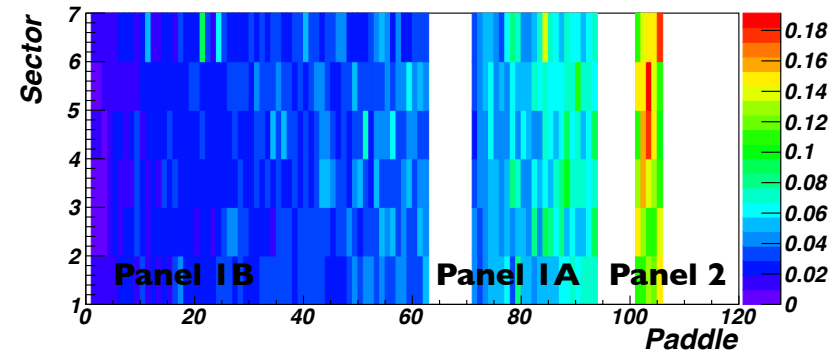
FTOF energy deposition(MeV/us)

FTon

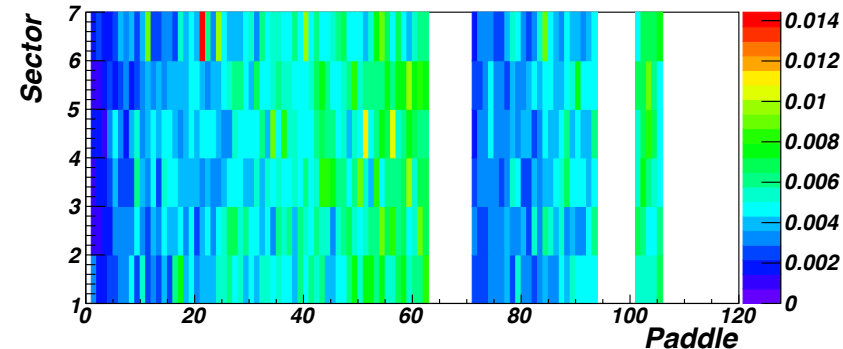
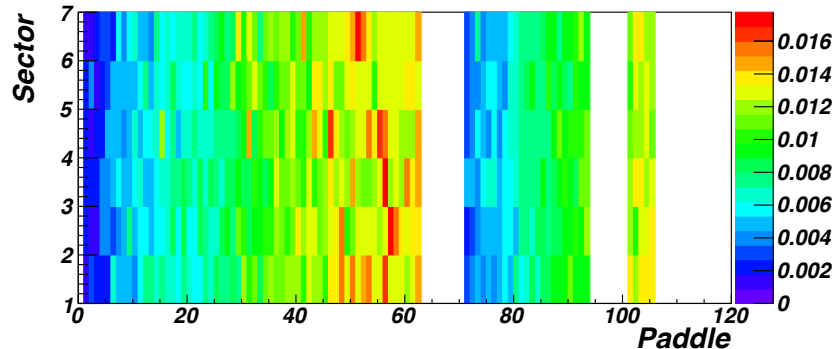


Energy
deposited
per
counter

FToff



Energy
deposition
per
counter
normalized
to counter
width

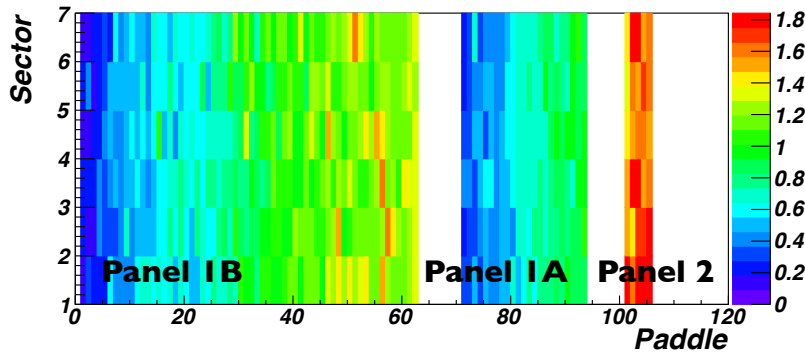


Counter widths:

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- Panel 1A: 15 cm
- Panel 2: 22 cm

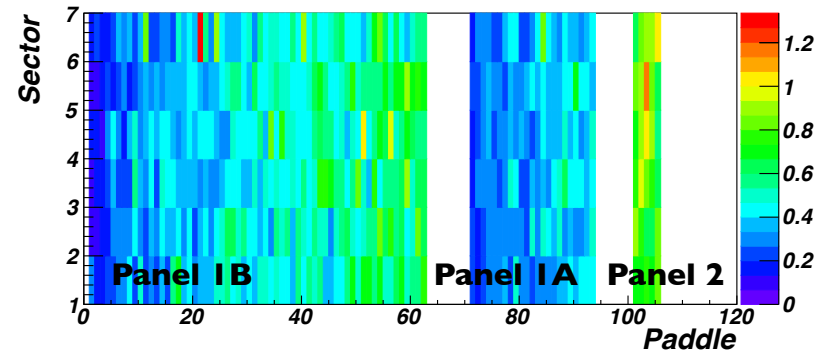
FTOF PMT currents (μA)

FTon

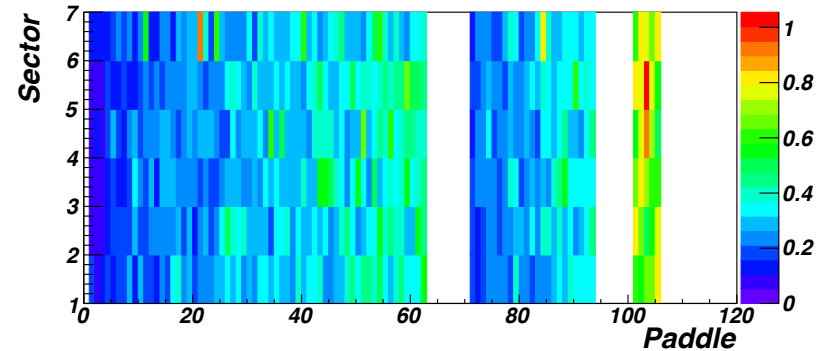
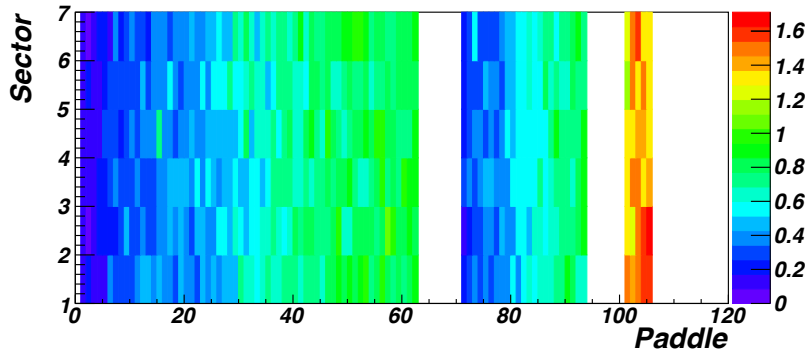


Currents
estimated
from
energy
deposition

FToff



Currents
estimated
from ADCs



See next slide for current estimates

PMT current calculation

PMT current from Edep

- Use average energy deposition per counter from GEMC “true” information
- Use measured FTOF parameters to convert energy to number of photoelectrons

$$\langle i_{PMT} \rangle = \langle N_{phe} \rangle \cdot Q_e \cdot \mathcal{G} \cdot \langle R \rangle$$

$$\langle i_{PMT}^{1a} \rangle = \langle N_{phe}^{1a} \rangle \cdot \left(\frac{\Delta E \text{ (MeV)}}{10 \text{ MeV}} \right) \cdot (1.6 \times 10^{-19} \text{ C/e}) \cdot (1 \times 10^6) \cdot \langle R^{1a} \text{ (Hz)} \rangle$$

$$\bullet \langle N_{phe}^{1a} \rangle = 373$$

$$= 373 \cdot \left(\frac{\Delta E \text{ (MeV)}}{10 \text{ MeV}} \right) \cdot (1.6 \times 10^{-19} \text{ C/e}) \cdot (1 \times 10^6) \cdot \langle R^{1a} \text{ (Hz)} \rangle$$

$$\bullet \langle N_{phe}^{1b} \rangle = 1158$$

- Approximation: “average” number of photoelectrons/MeV

PMT current from ADC

- Use digitized charge ADCL and ADCR (tuned to fADC mode 7 integral – pedestal)
- Convert it to charge

$$Q_{PMT} = \frac{\text{Anode}}{\text{Dynode}} \frac{1}{R_{fADC}} \sum_{\text{samples}} fADC_i \times dT \times C_{fADC}$$

4 ns
1 Volt/2¹² = 0.242 mV

50 ohms

- Approximation: pulse numerical integration