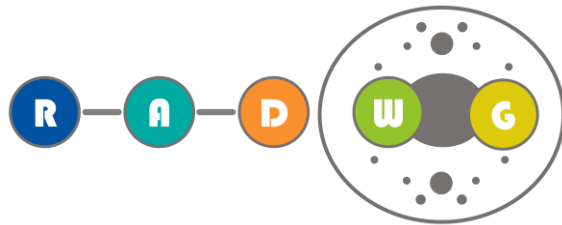


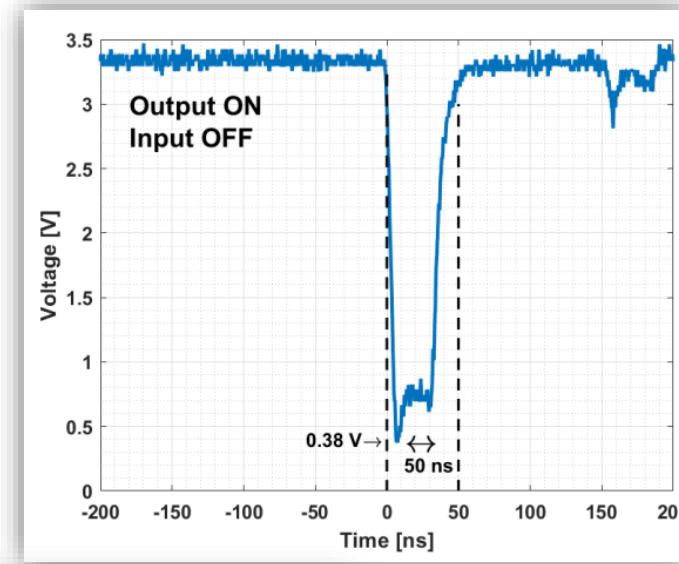
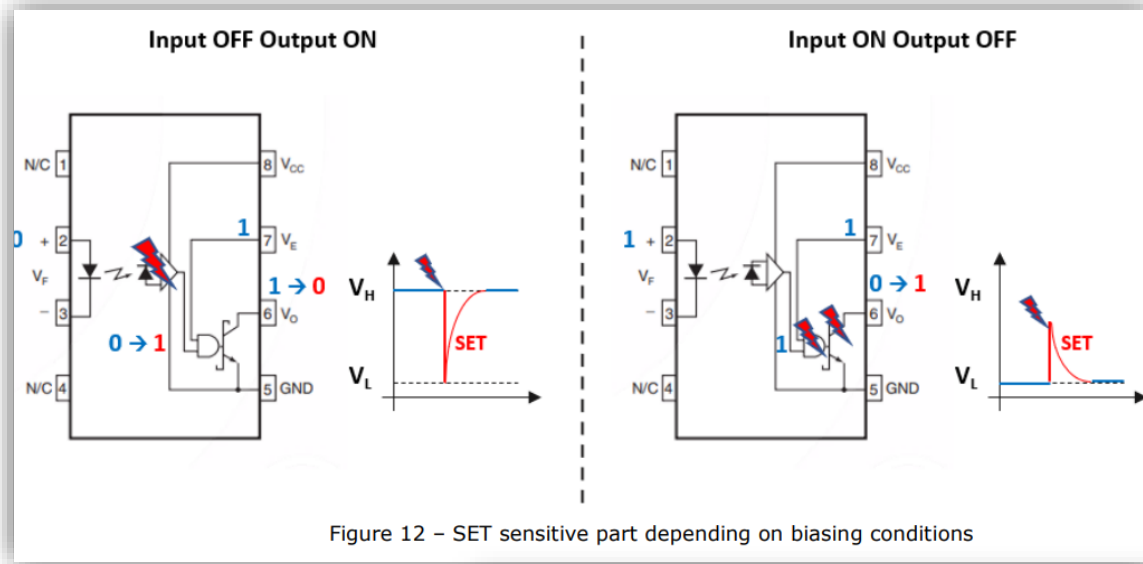
# CIBU Optocoupler response at IRRAD

Rudy Ferraro & Bruno Glecer



# Select Optocoupler

## ➤ HCPL-060L-500: Digital 3.3V output optocoupler



Very low variation of SET Time observed

Reference	Cross-section [cm <sup>2</sup> /device]	
	Input OFF Output ON	Input ON Output OFF
FOD060RL	$3.94 \cdot 10^{-8}$	$6.43 \cdot 10^{-10}$
HCPL-060L-500E	$3.67 \cdot 10^{-8}$	$3.31 \cdot 10^{-11}$

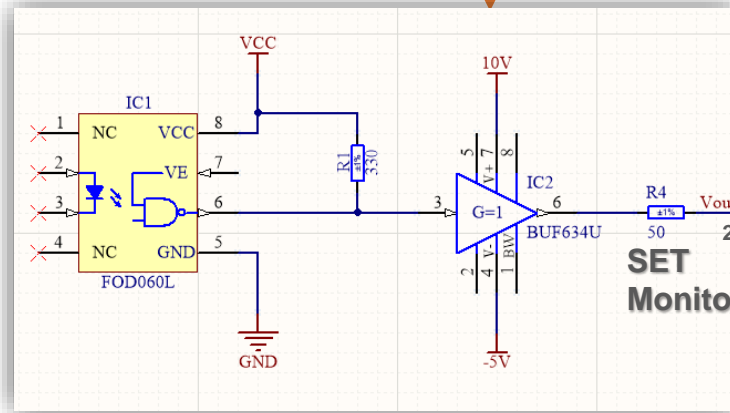
Table 15 – Devices total SET cross-sections in both biasing conditions

# Test Setup

Irradiation Room

IRRAD Control Room

DUT Board



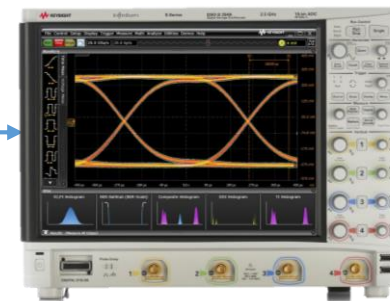
Power Supply



Powering

3\*20 m coaxial cables

Scope (DSOS254A)

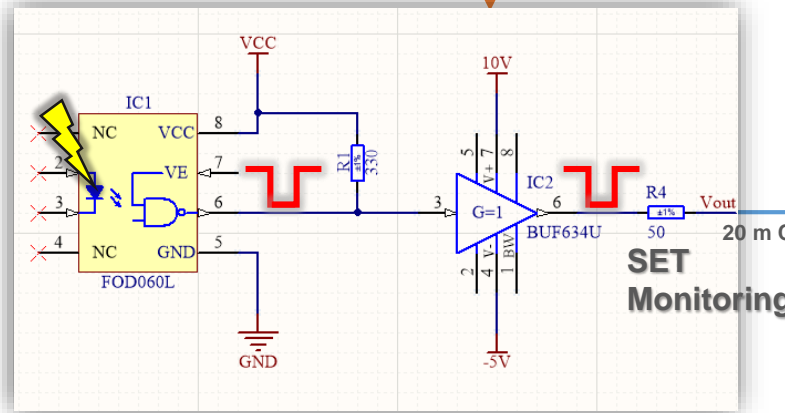


# Test Setup

Irradiation Room

IRRAD/CHARM Control Room

DUT Board



Powering



3\*20 m coaxial cables

Scope (DSOS254A)



Not so far from beam, but its SET cross-section is several order of magnitude lower than the optocoupler one

# IRRAD Facility

IRRAD Installation:

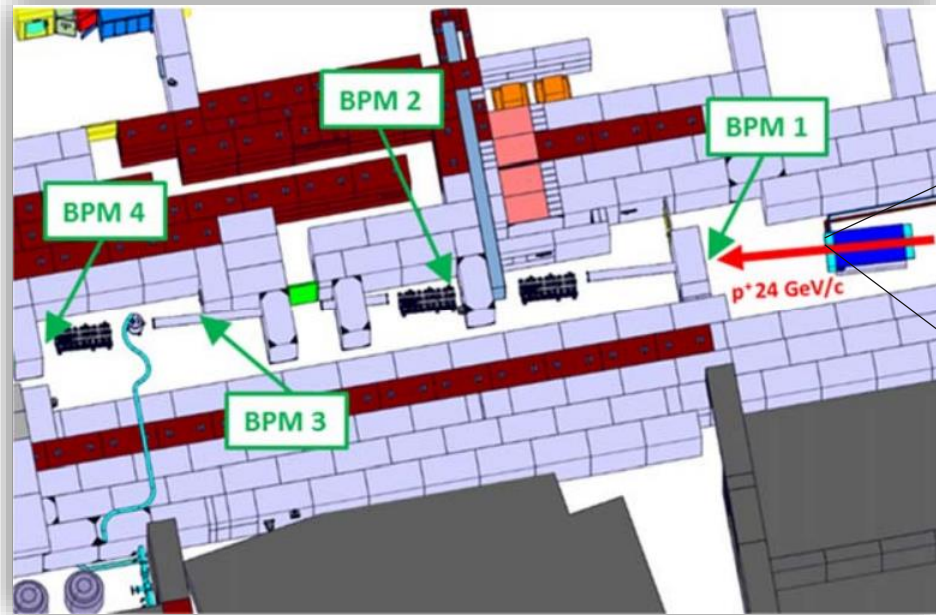
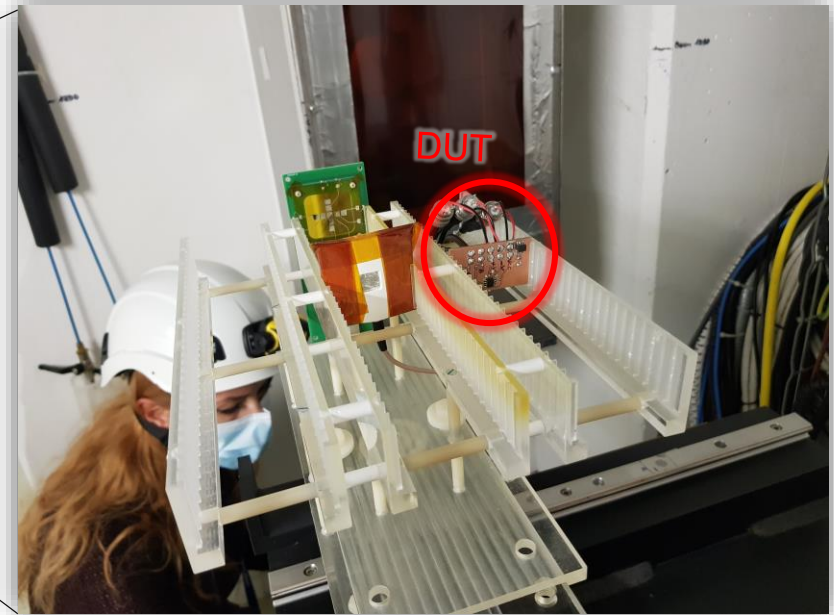
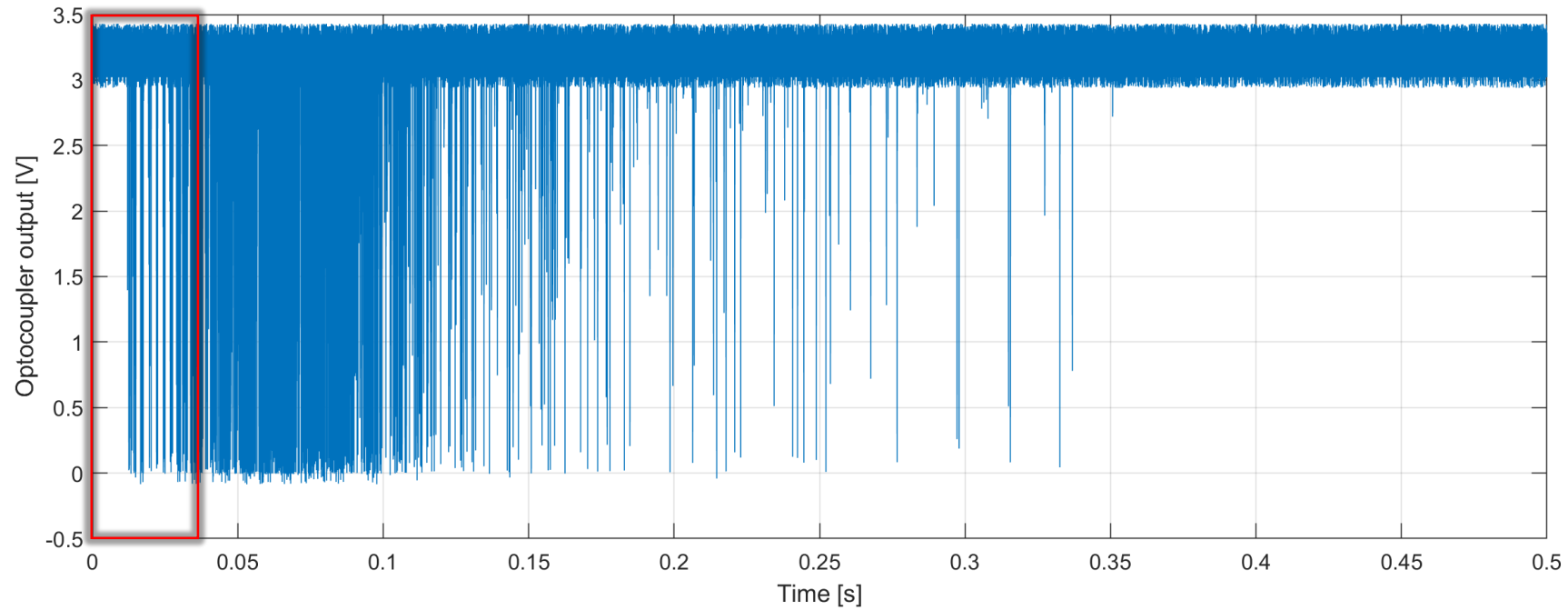


Table 1

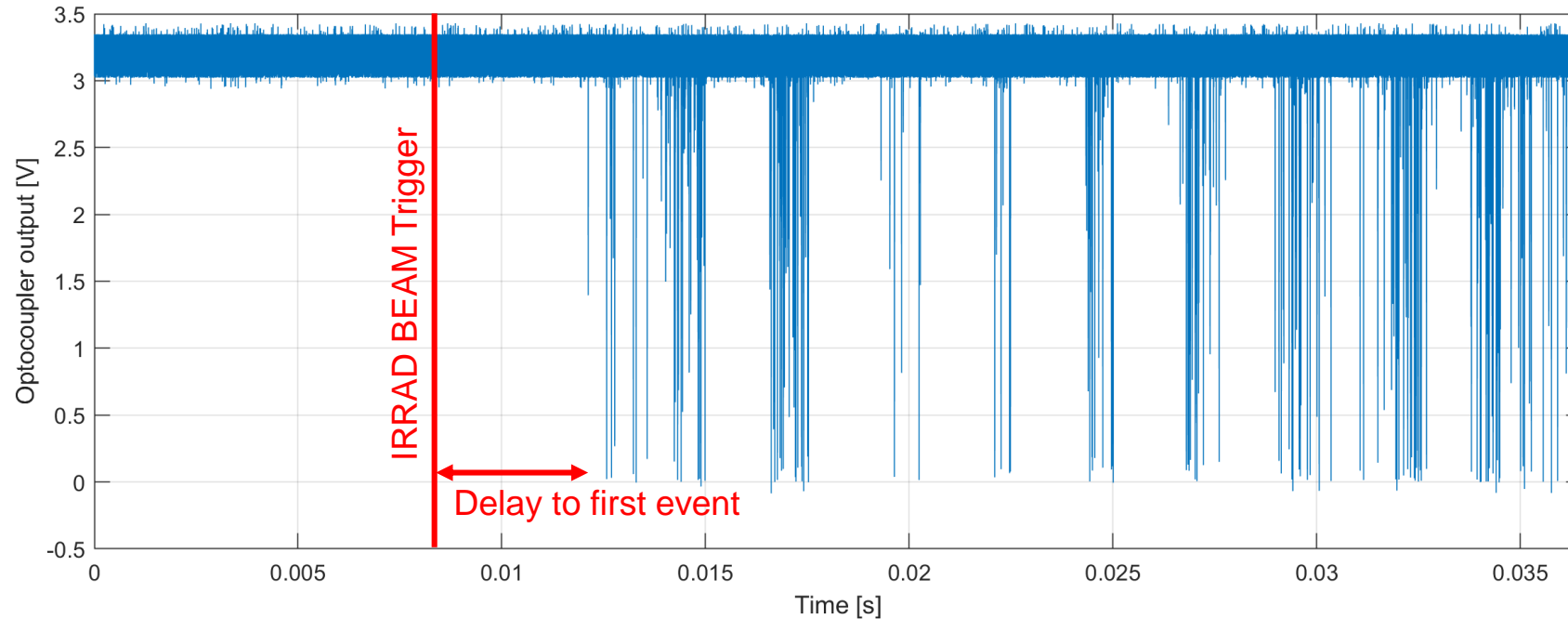


# Example of acquired spill





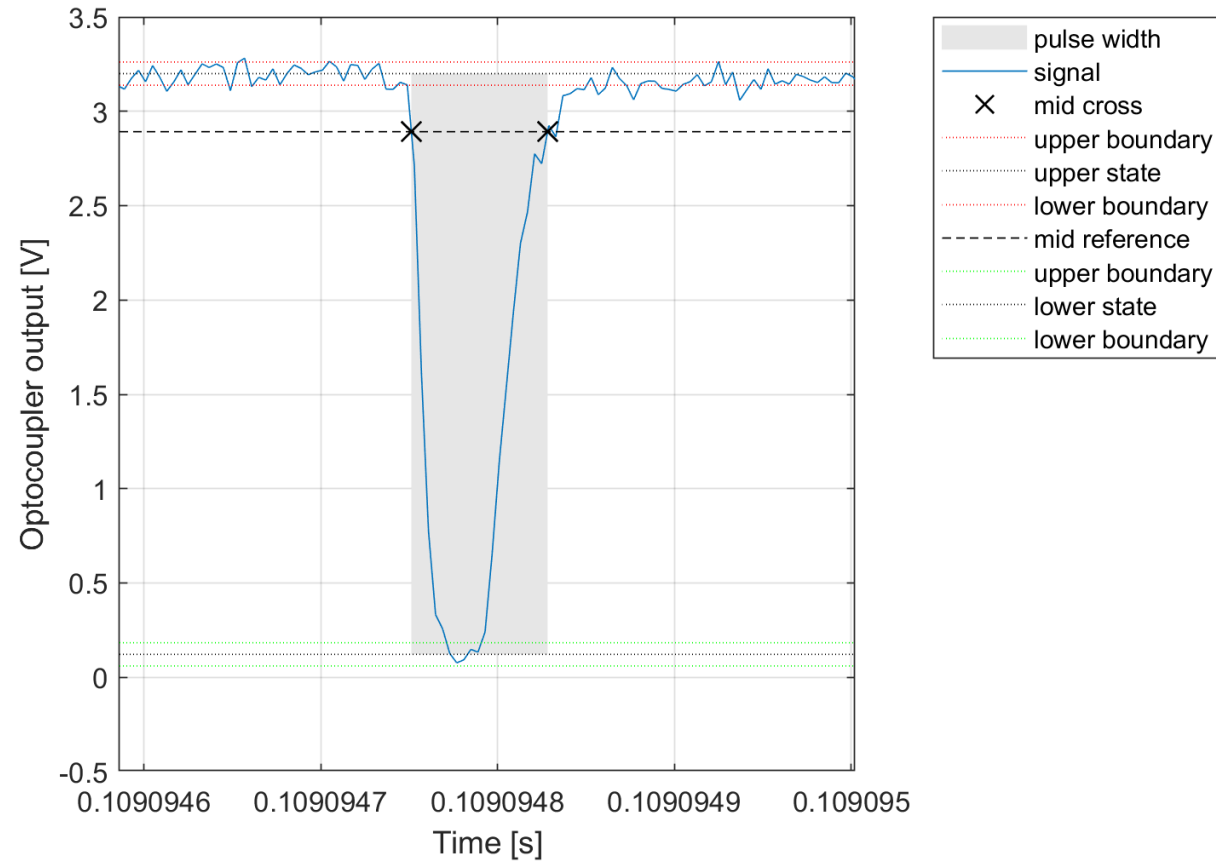
# Spill Trigger issue



- The used trigger is supposed to indicate the “Start” of the spill
- Systematic delay between beam trigger and first event measured (~3.75 ms)
- Same delay to first event visible on Ruben’s setup

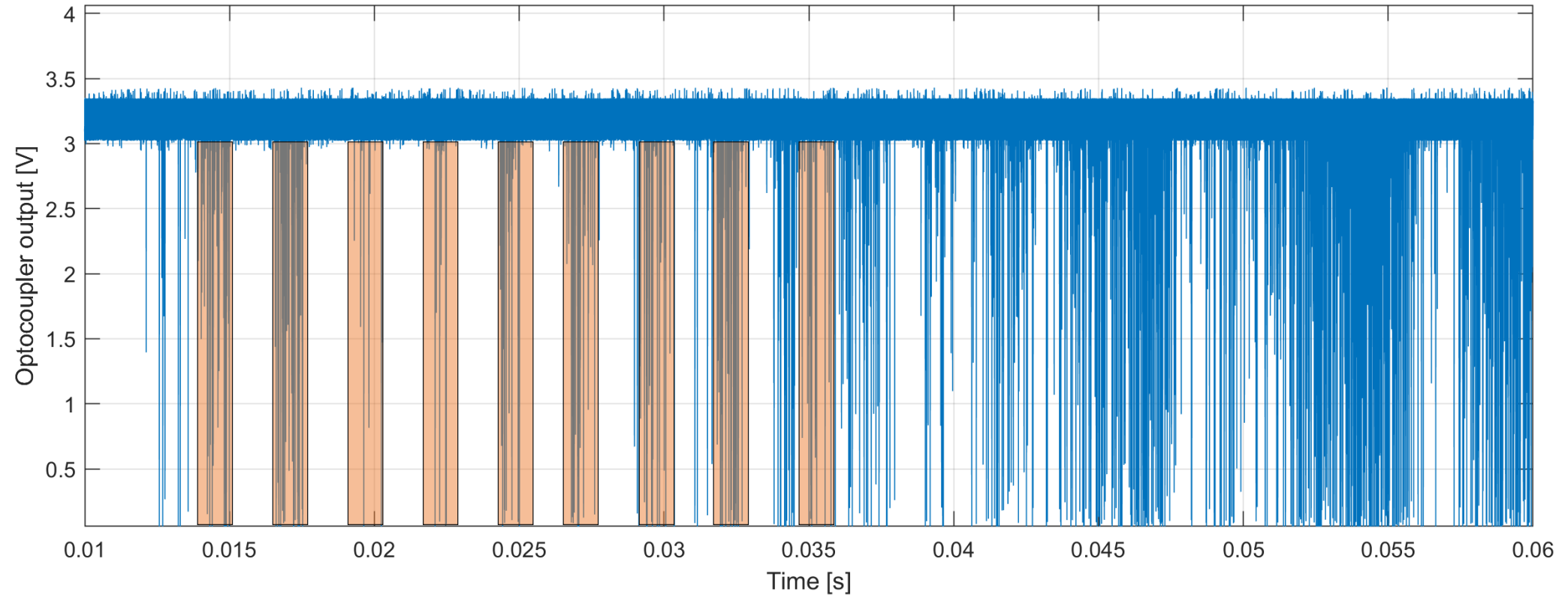
# SET Detection and measurement

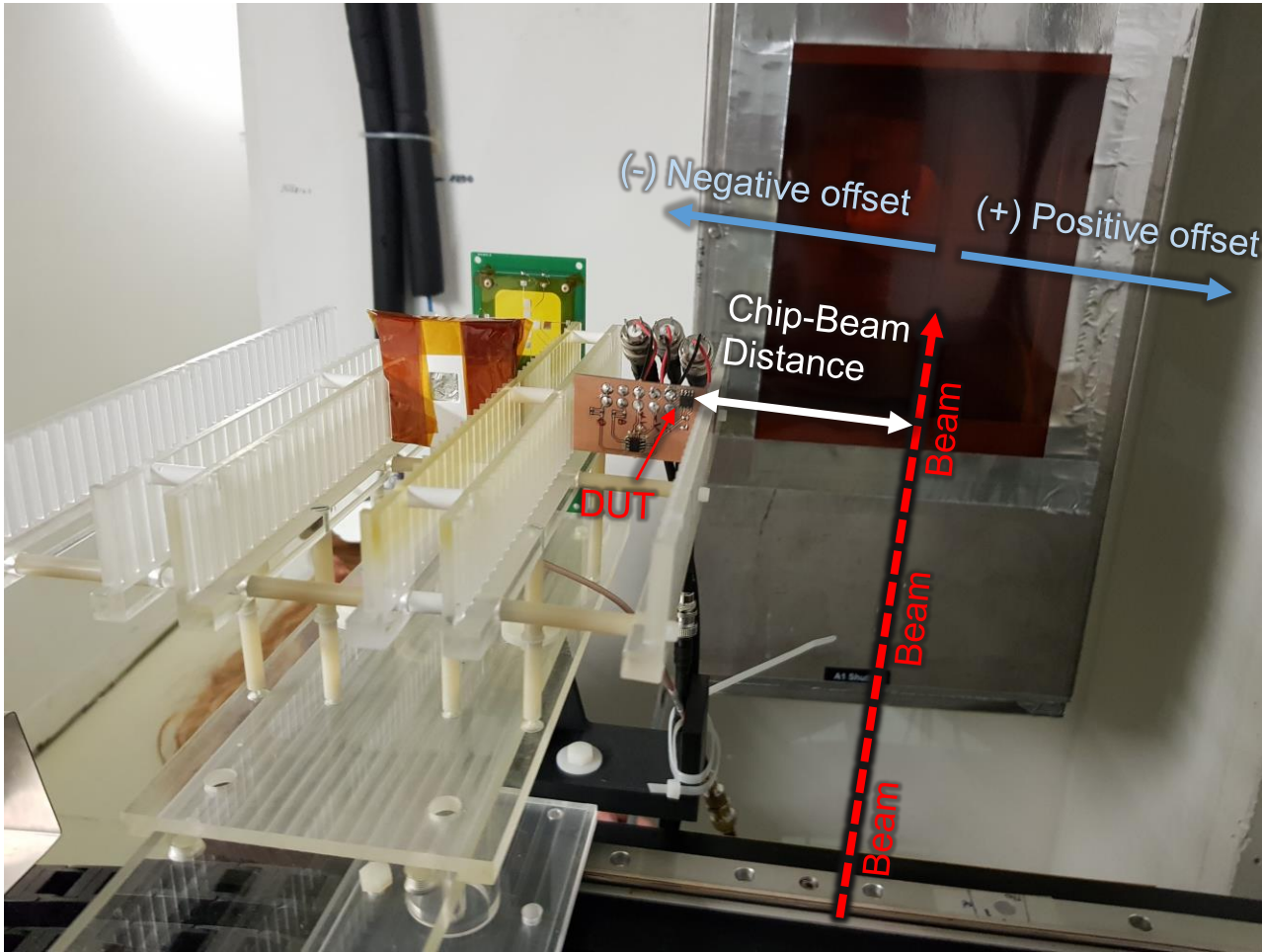
Example of SET:



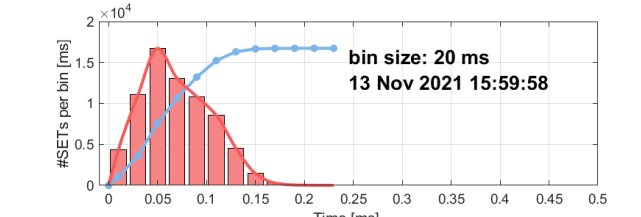
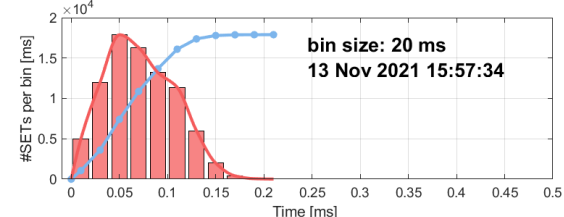
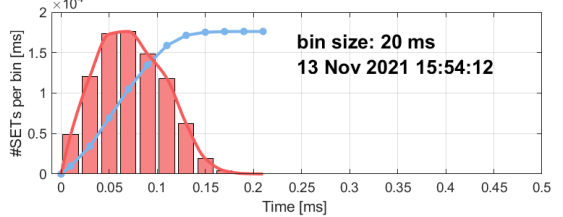
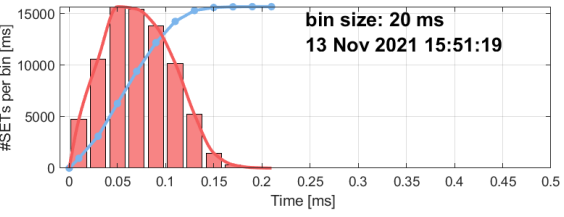
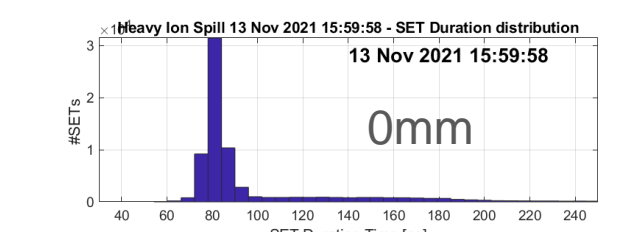
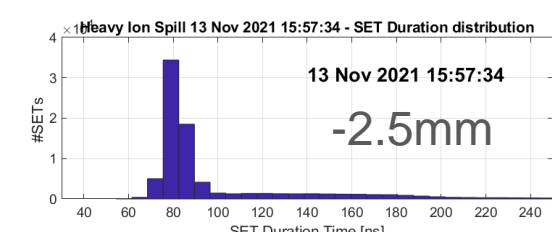
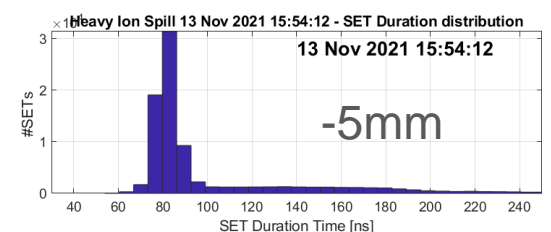
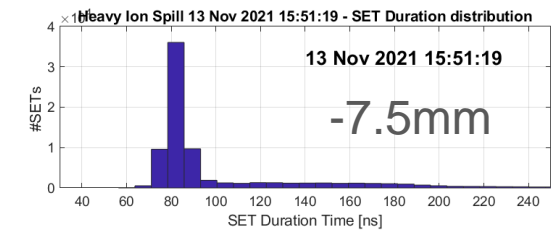
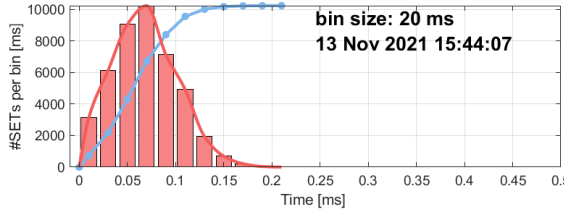
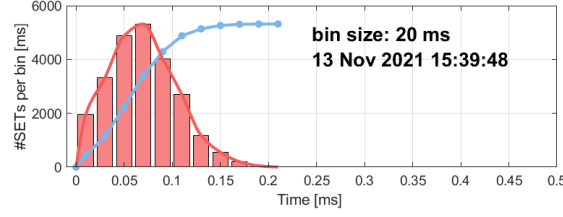
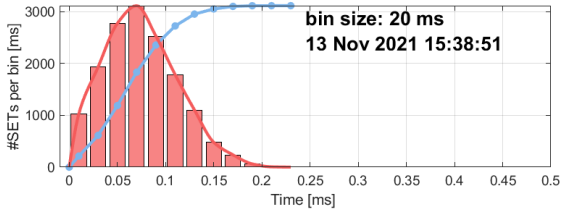
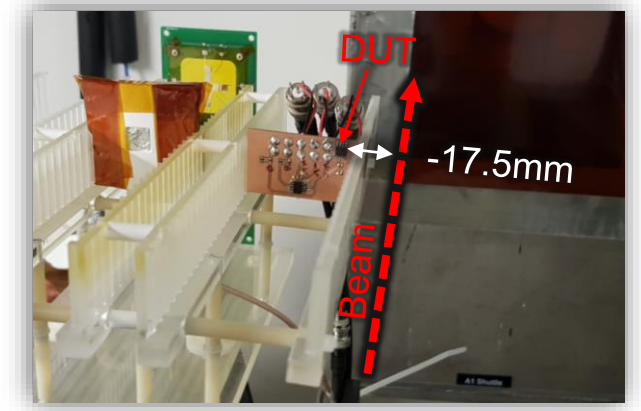
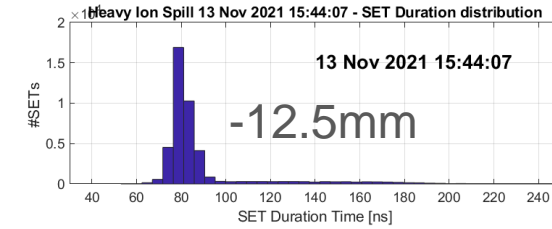
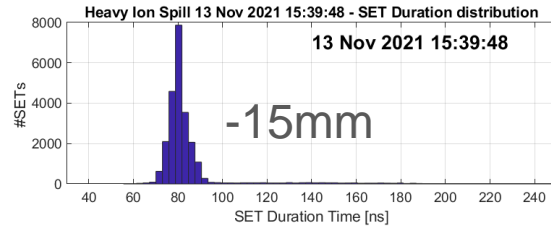
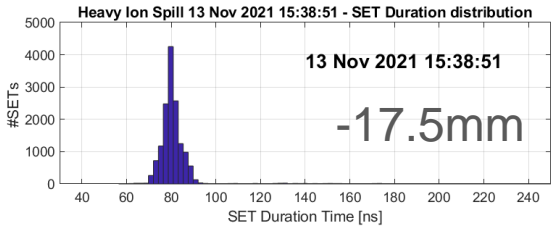


# Beam injection pattern

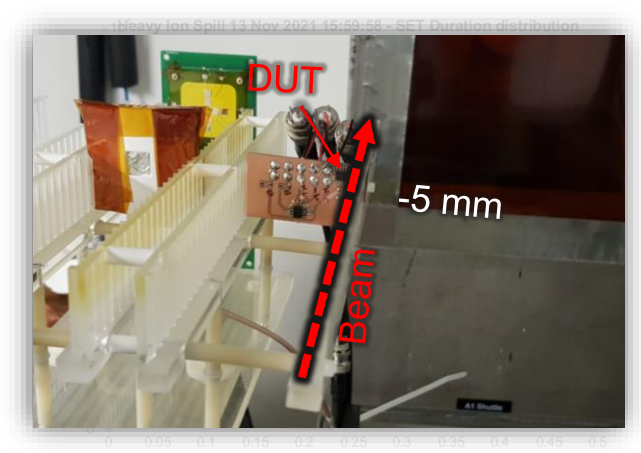
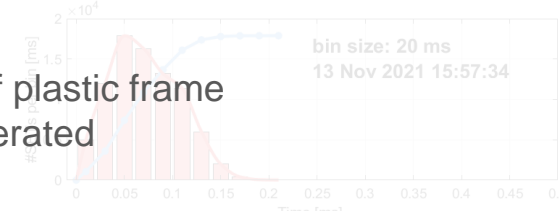
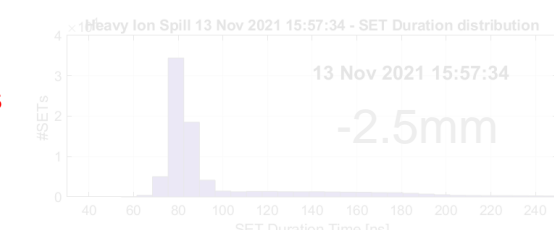
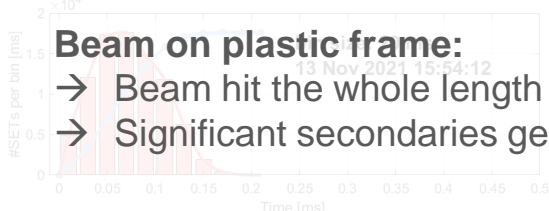
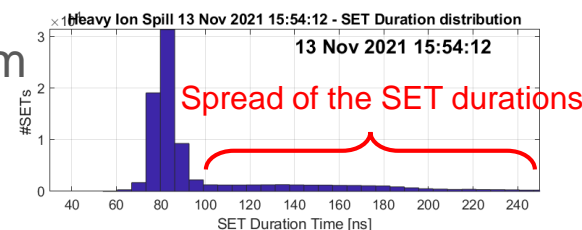
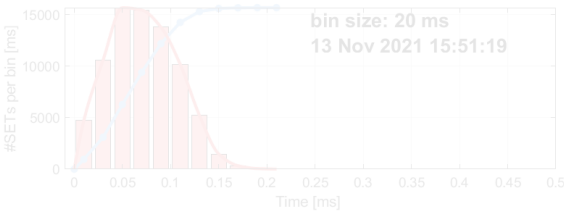
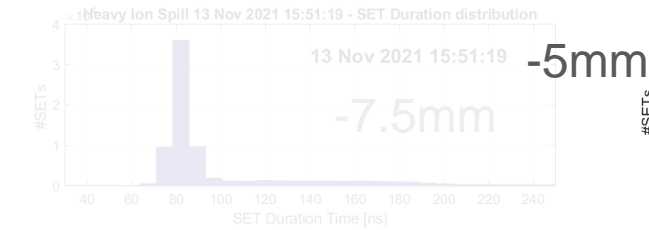
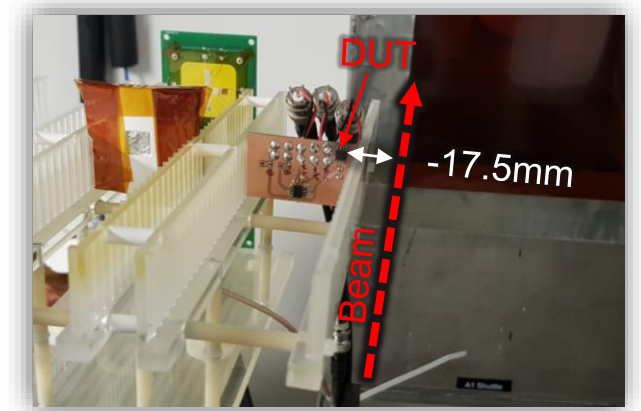
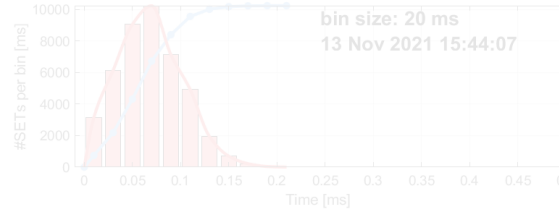
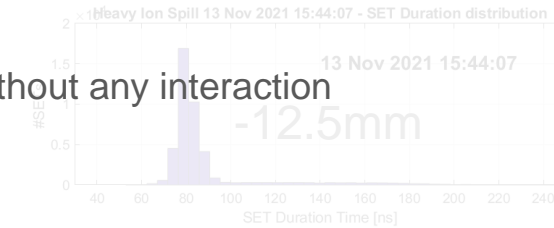
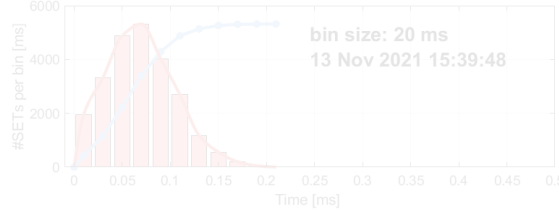
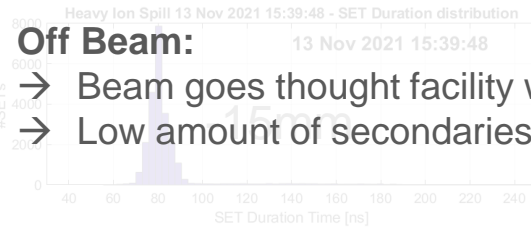
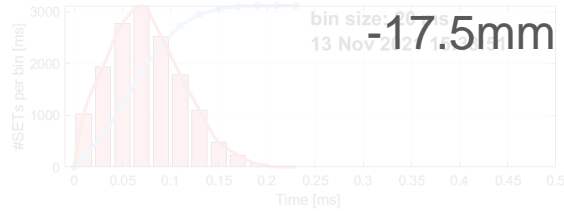
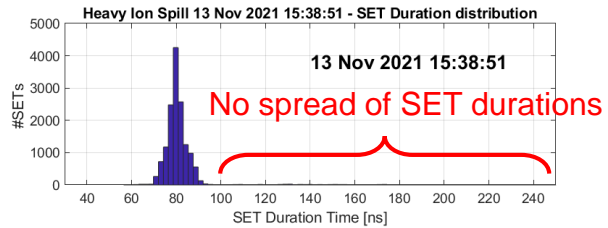




# Heavy Ion: Position shift left

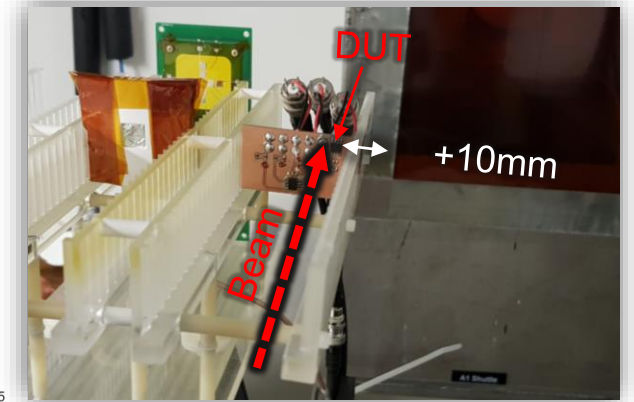
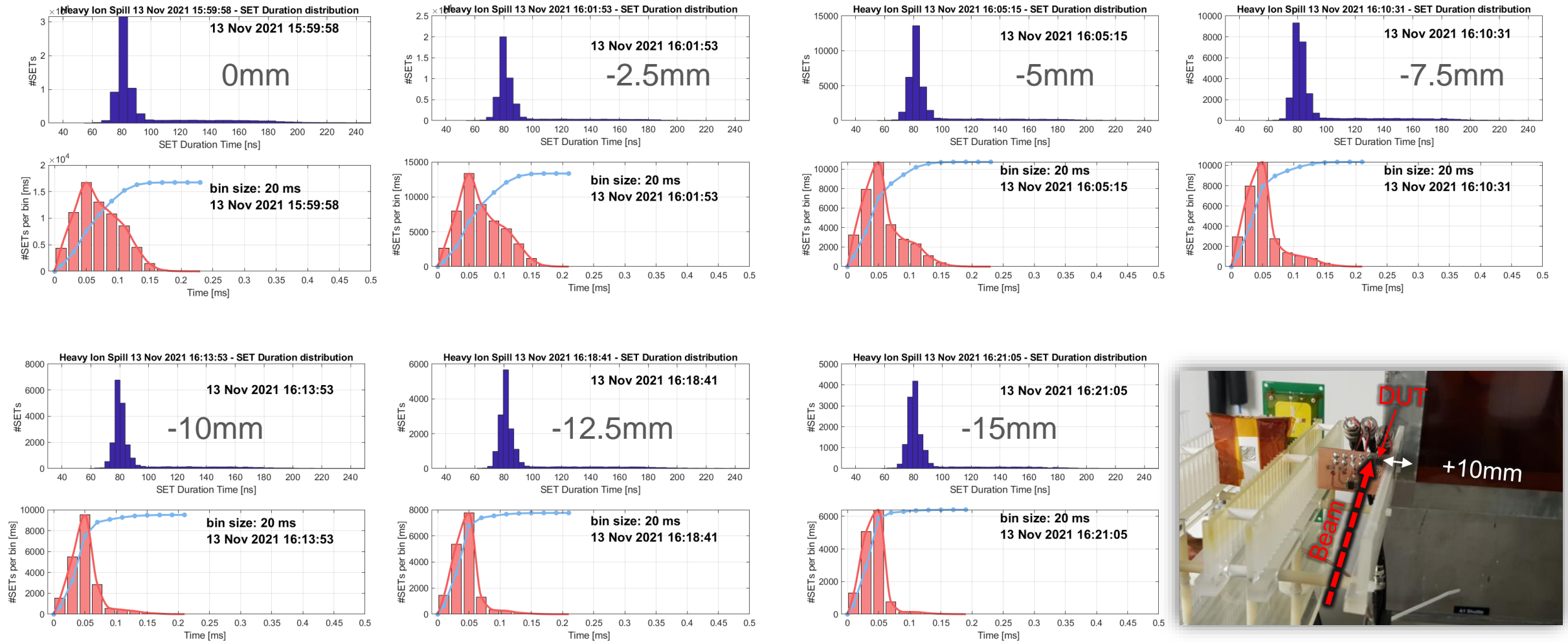


# Heavy Ion: Position shift left



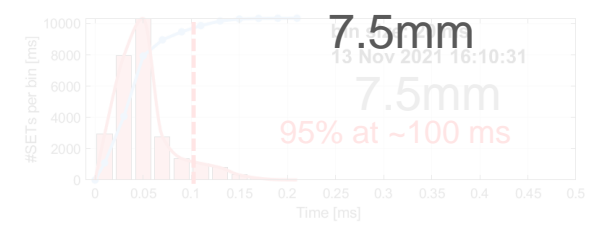
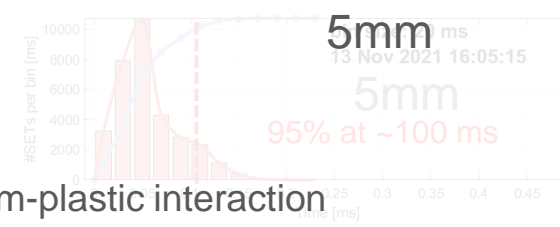
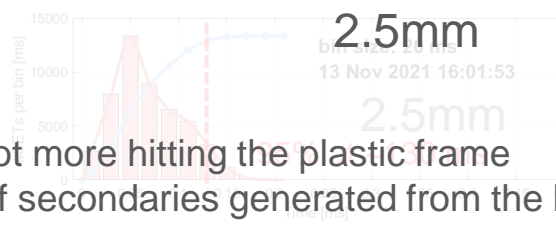
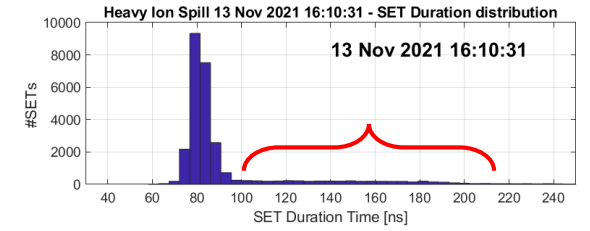
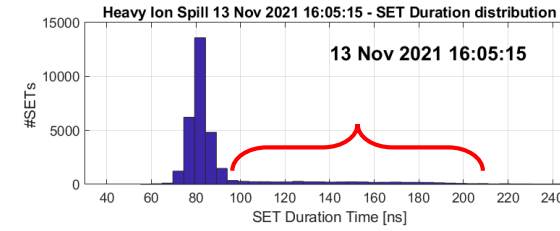
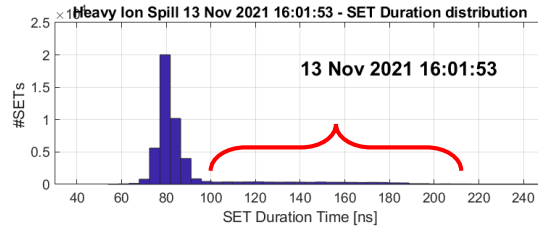
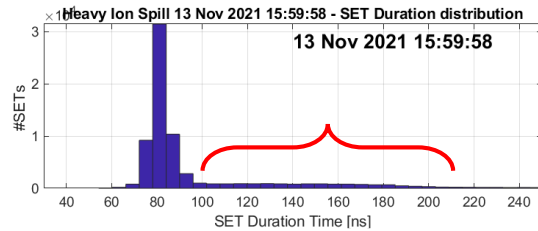
**Beam on plastic frame:**  
→ Beam hit the whole length of plastic frame  
→ Significant secondaries generated

# Heavy Ion: Position shift right

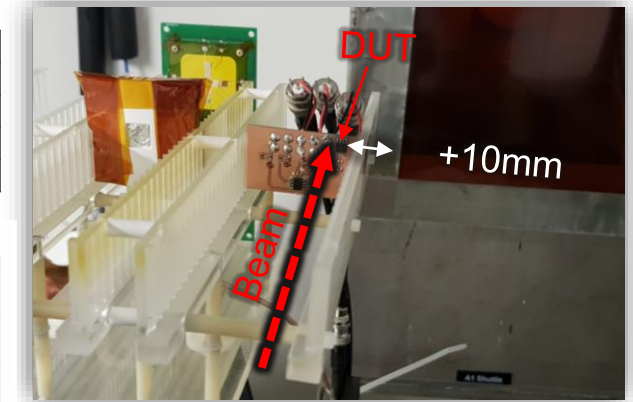
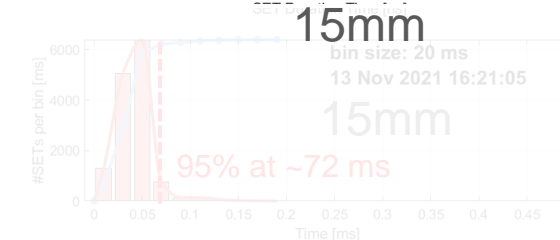
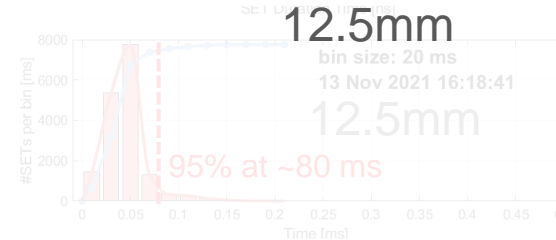
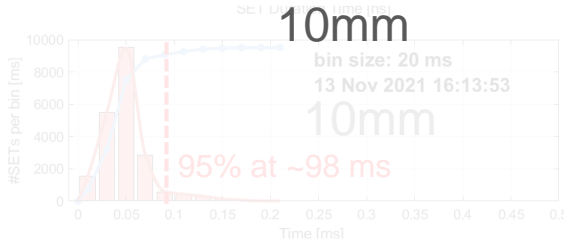
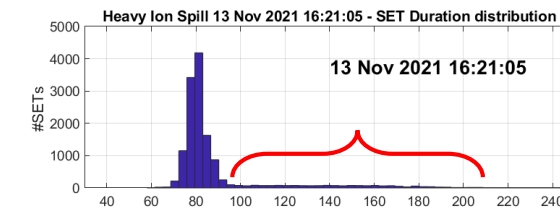
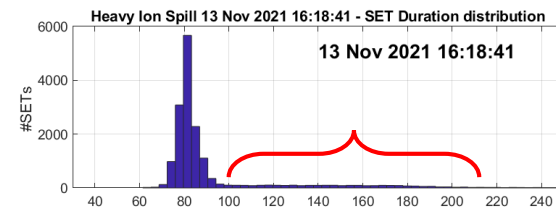
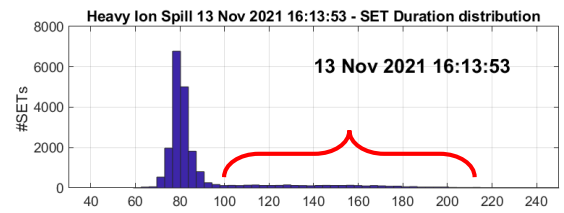




# Heavy Ion: Position shift right

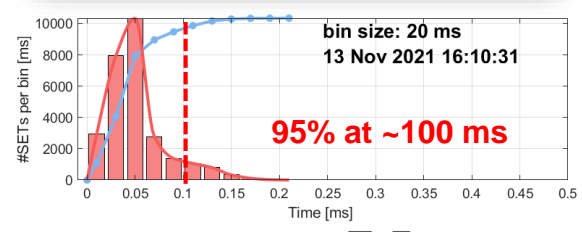
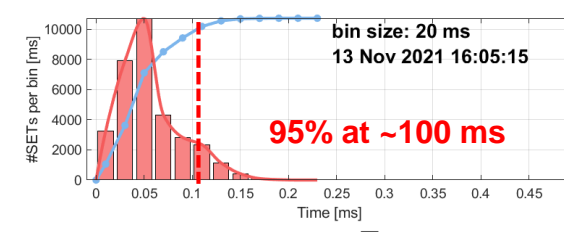
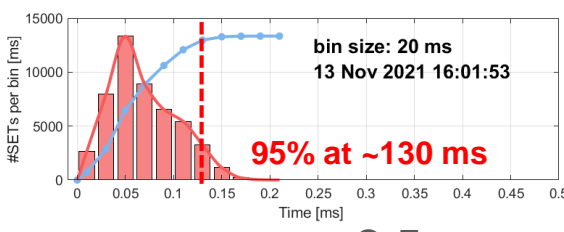
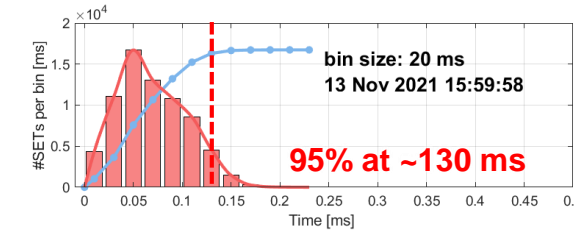
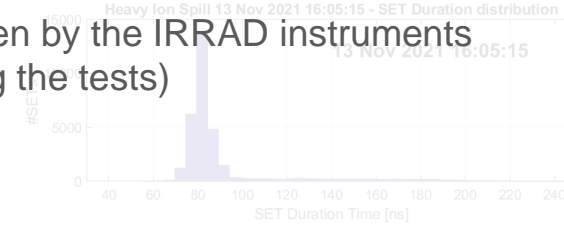
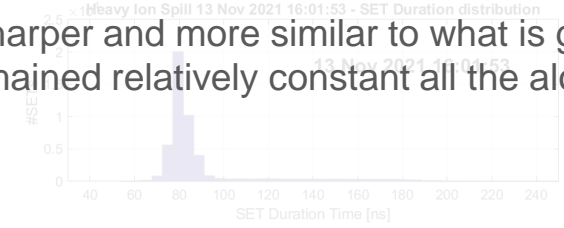
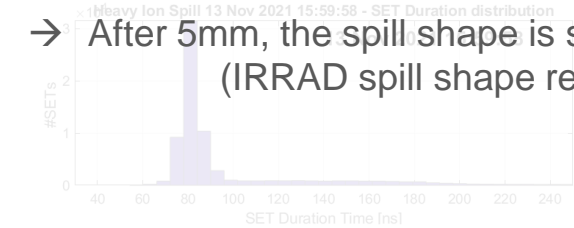
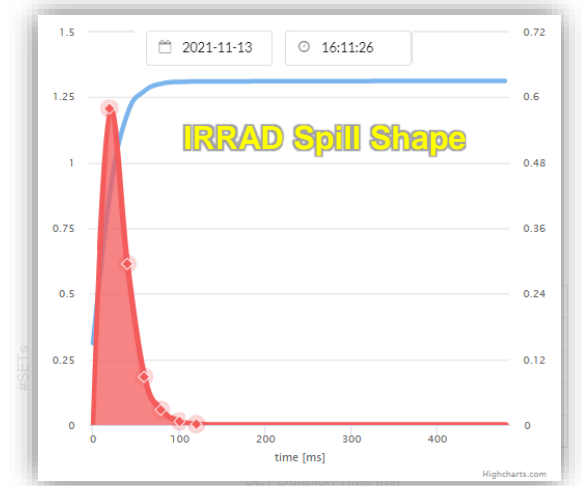


- After 10mm, the beam is not more hitting the plastic frame
- This reduces the number of secondaries generated from the beam-plastic interaction
- However, secondaries can be generated from beam-pcb / BNC connectors



# Heavy Ion: Position shift right

→ After 5mm, the spill shape is sharper and more similar to what is given by the IRRAD instruments (IRRAD spill shape remained relatively constant all the along the tests)

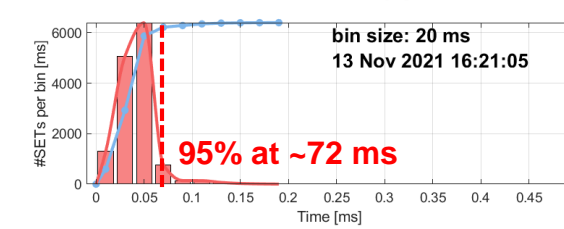
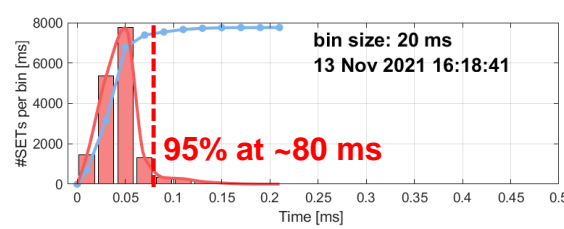
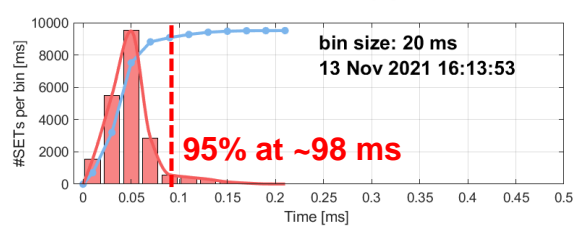
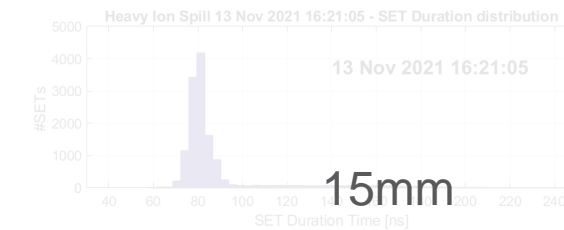
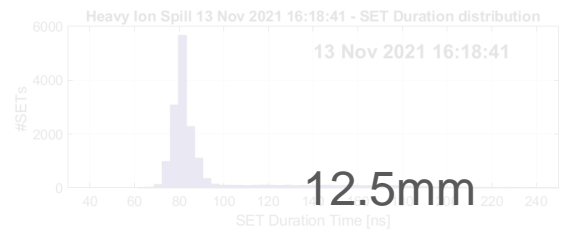
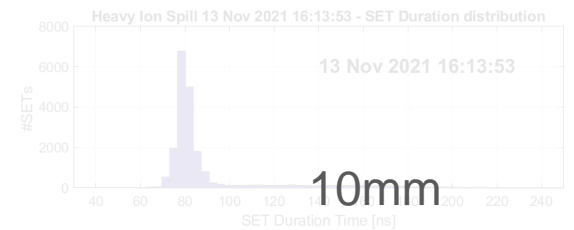


0mm

2.5mm

5mm

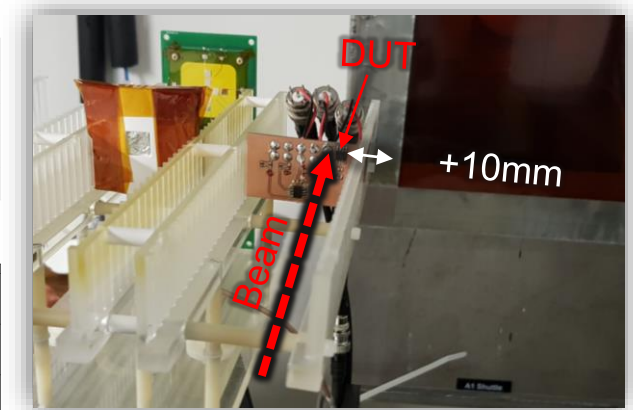
7.5mm



10mm

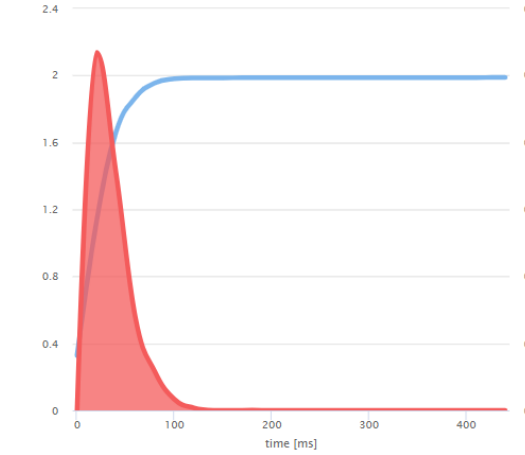
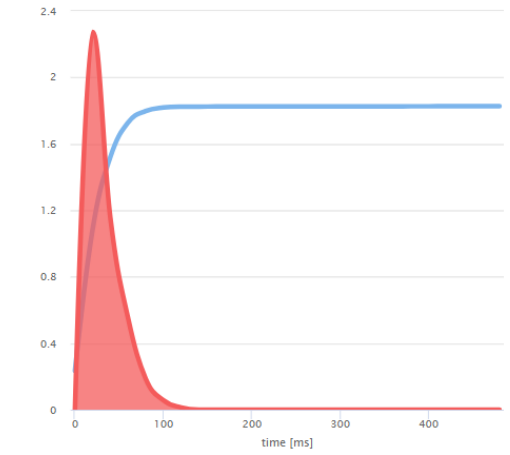
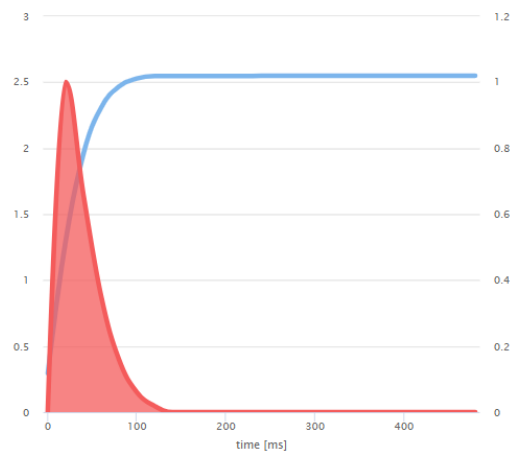
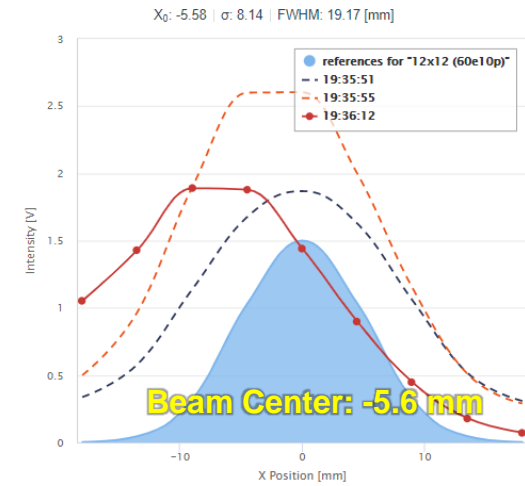
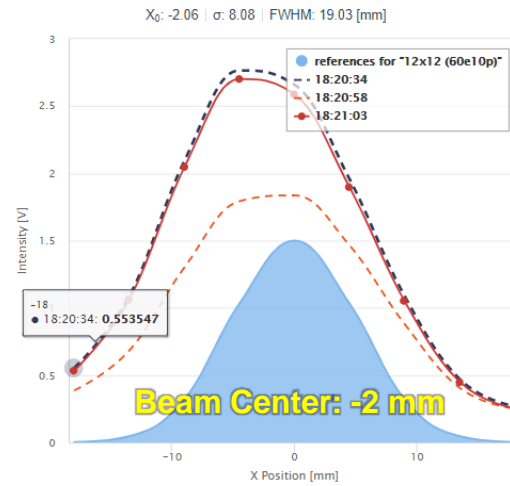
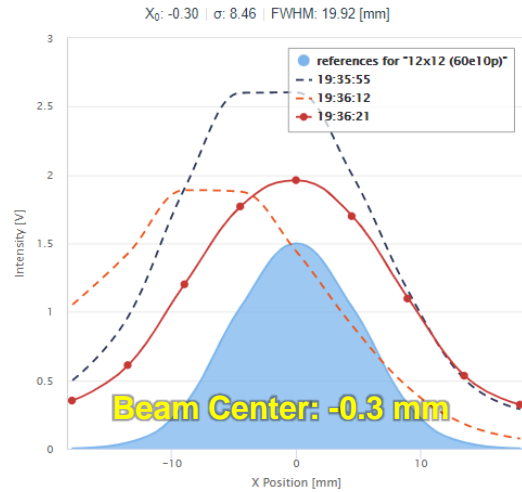
12.5mm

15mm

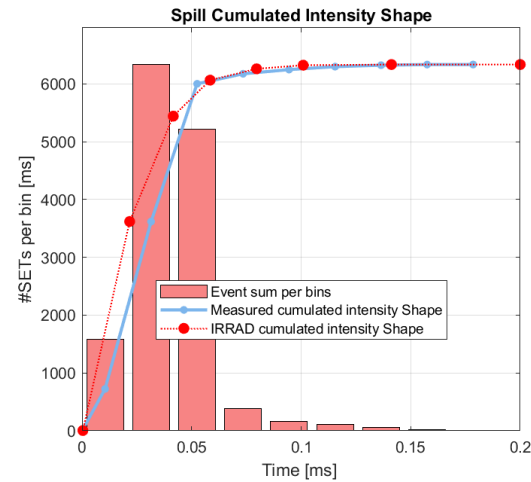
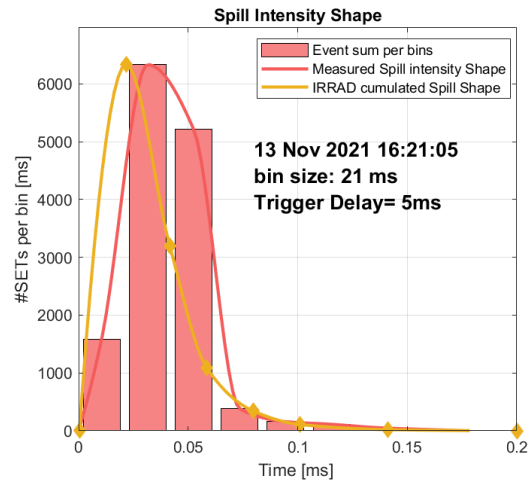
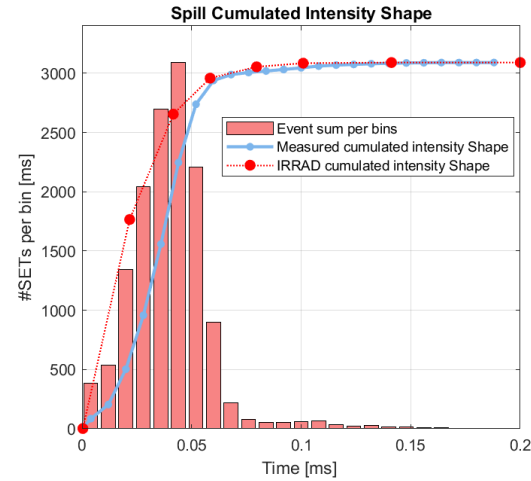
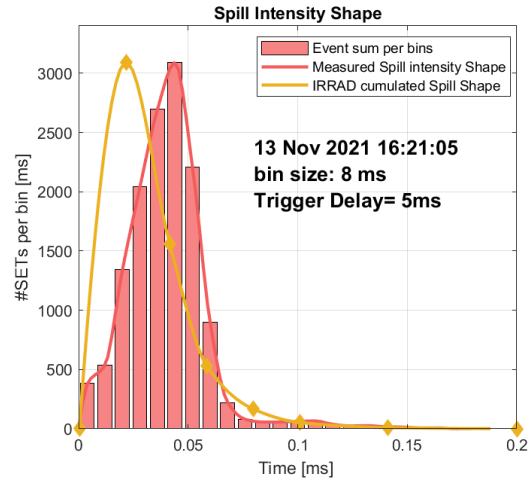




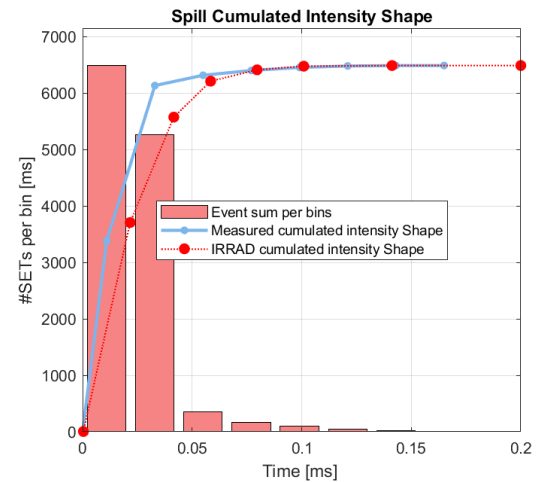
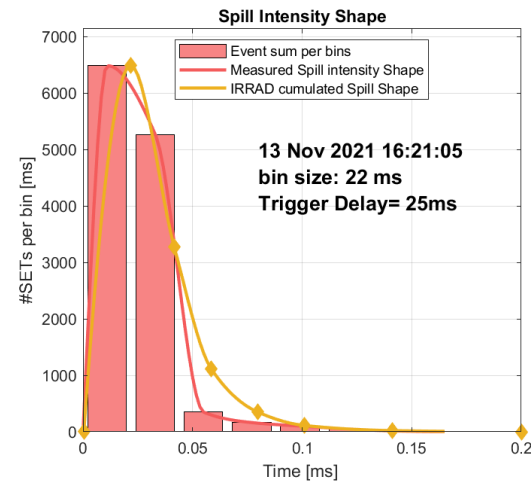
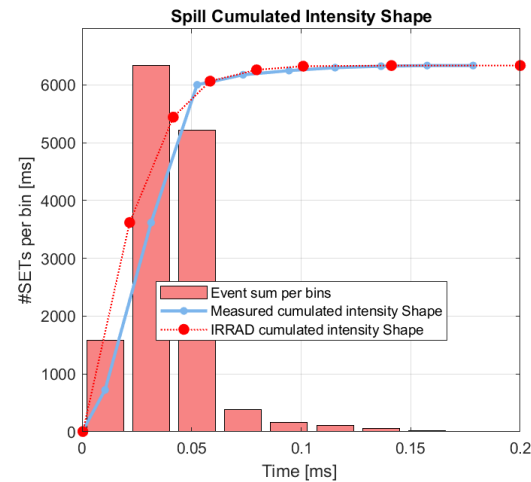
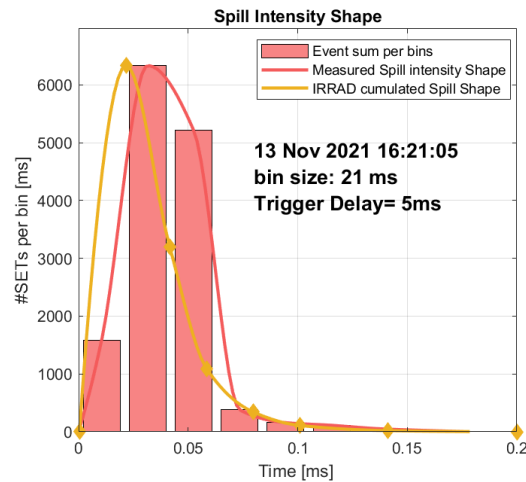
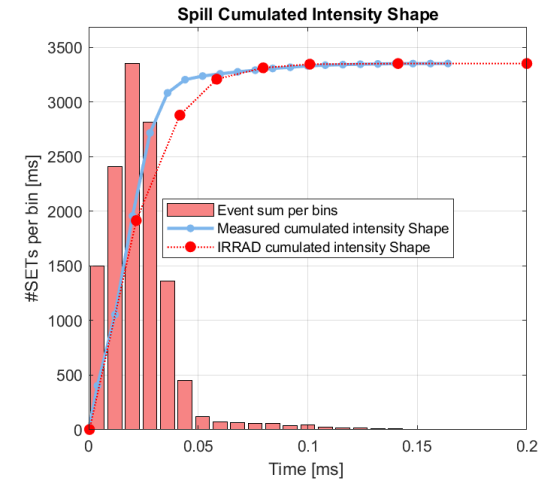
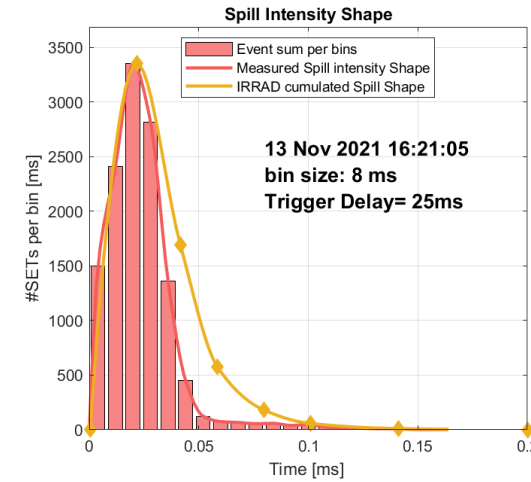
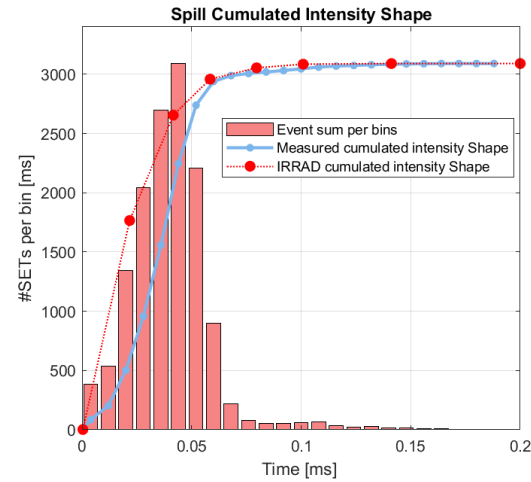
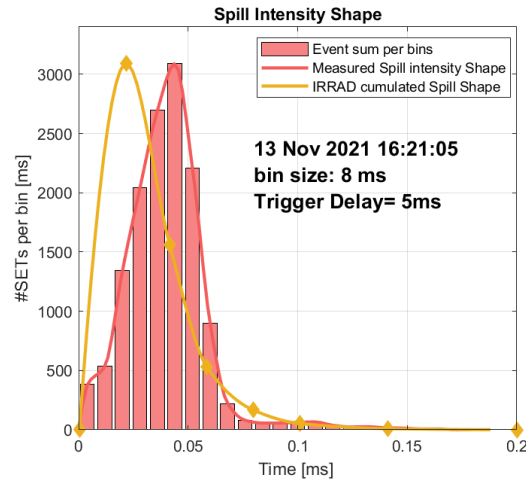
# IRRAD spill shape vs beam center offset



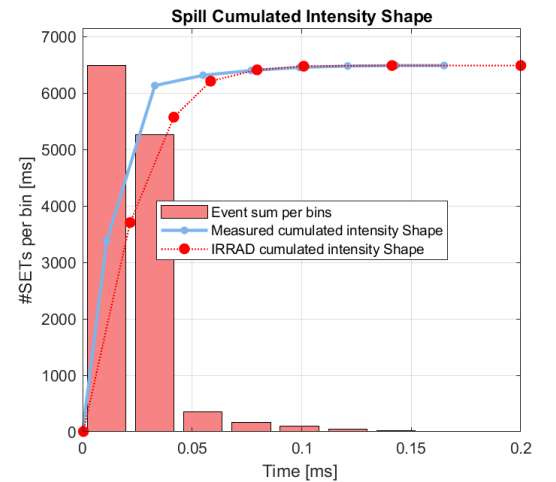
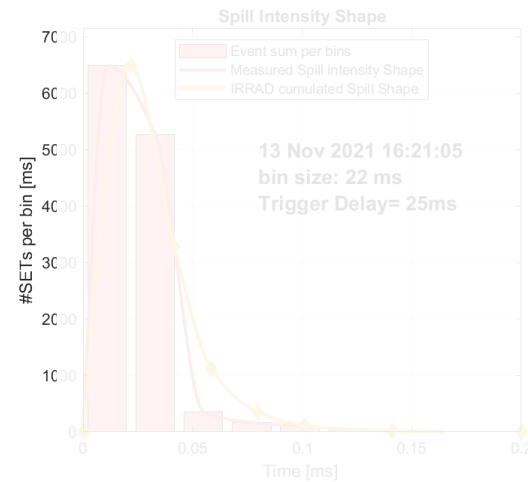
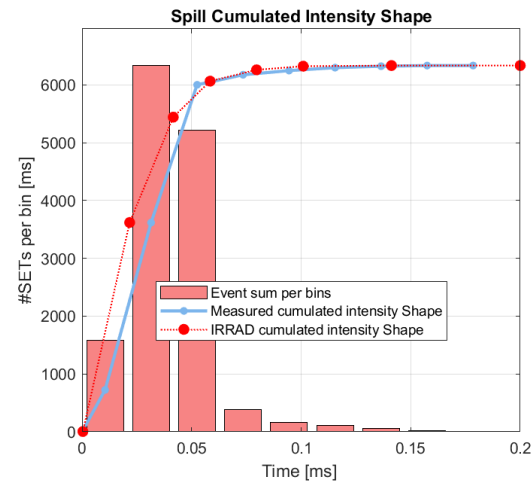
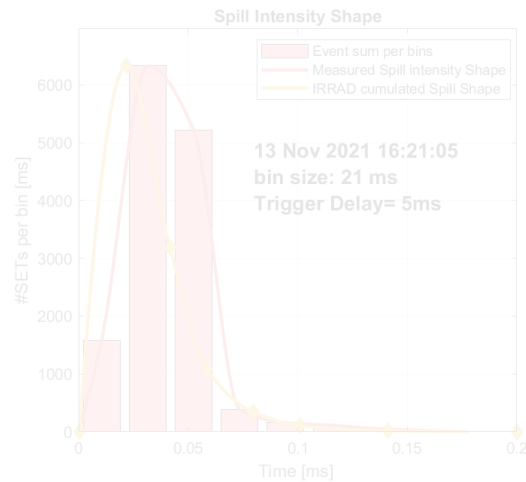
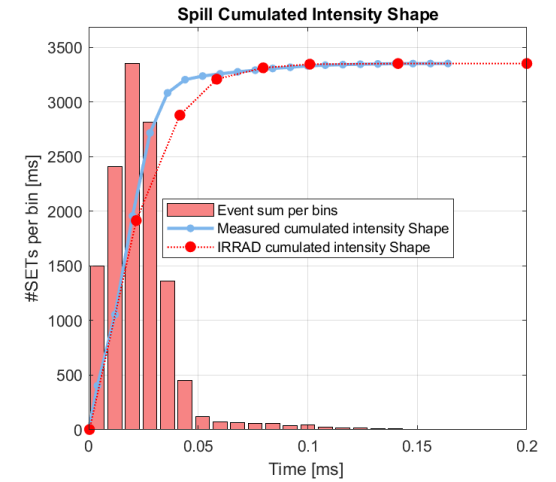
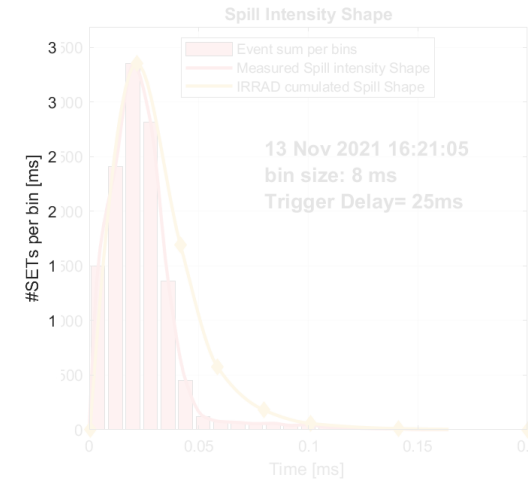
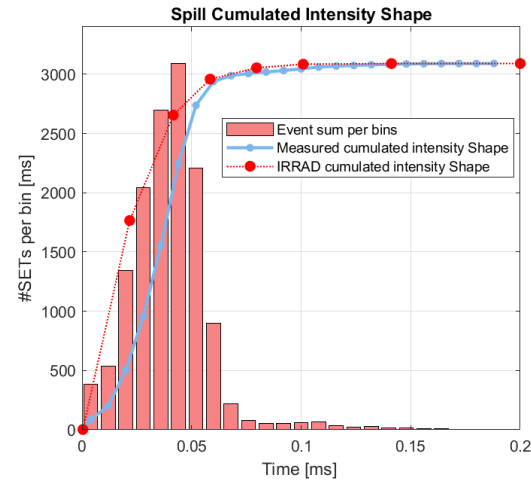
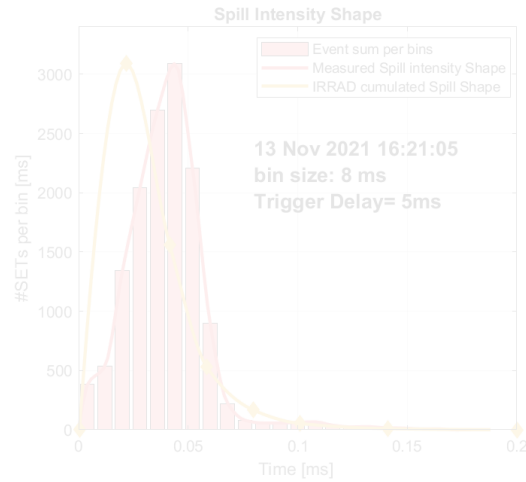
# Heavy Ion: spill shape comparison



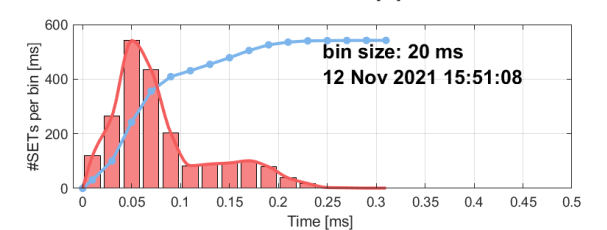
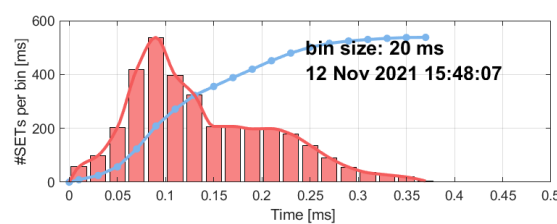
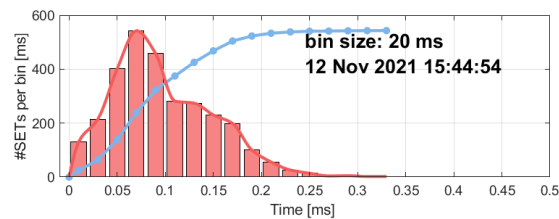
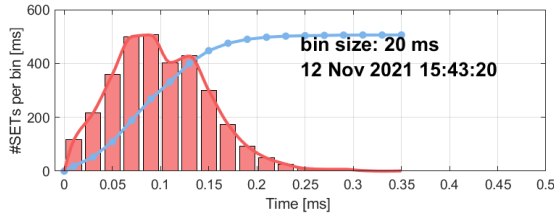
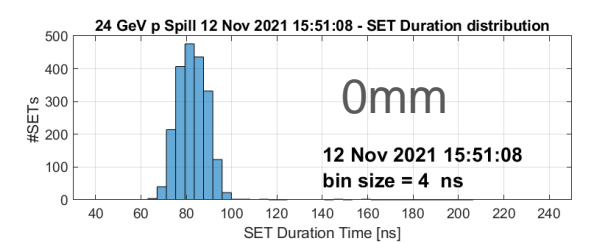
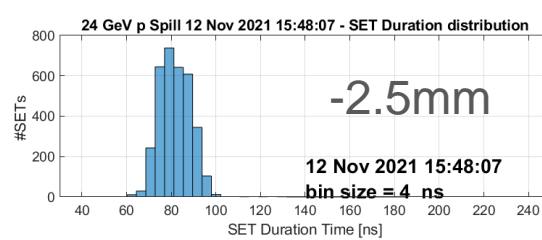
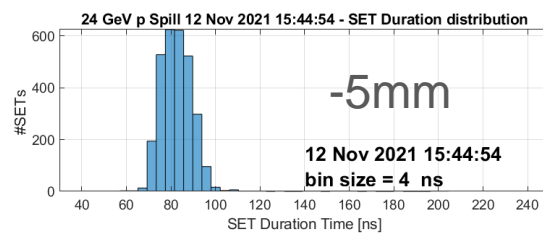
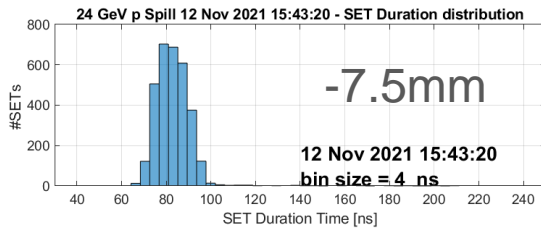
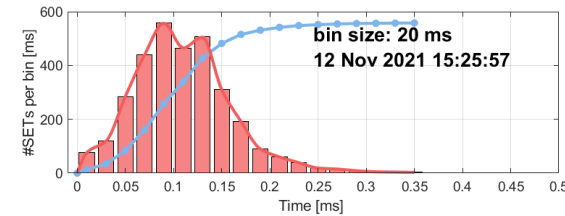
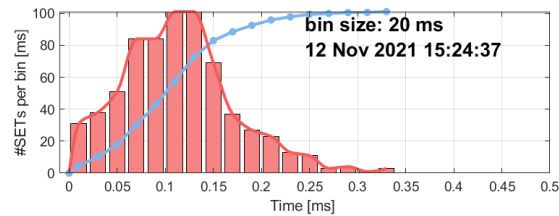
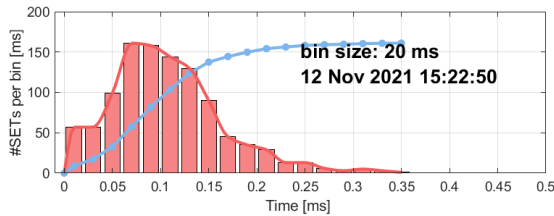
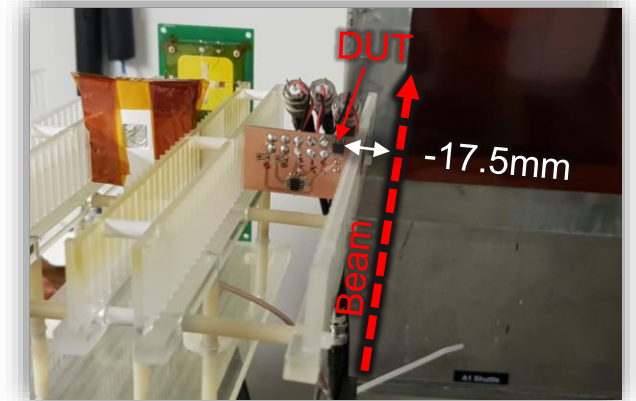
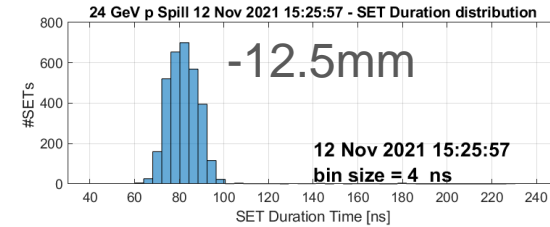
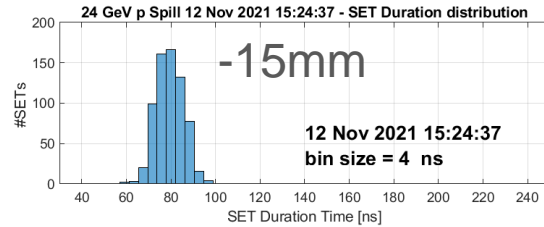
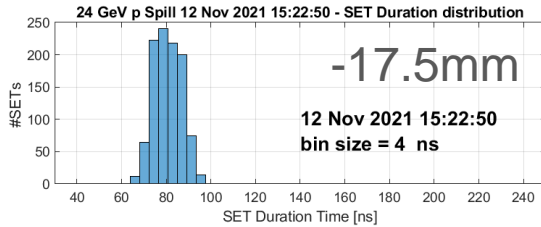
# Heavy Ion: spill shape comparison



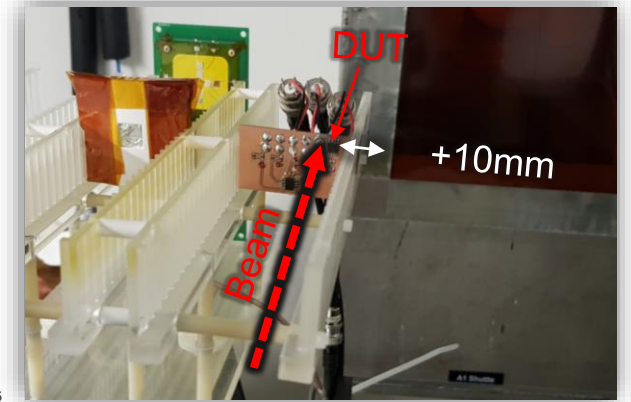
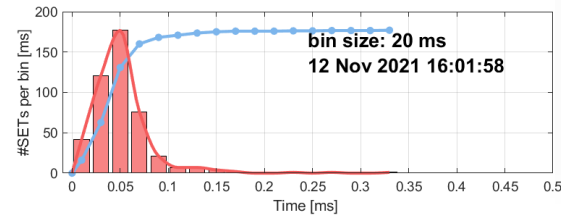
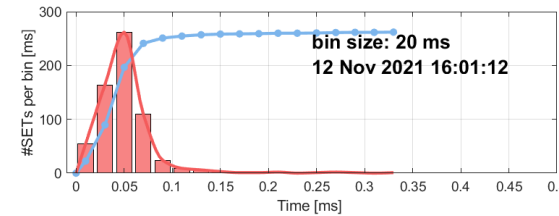
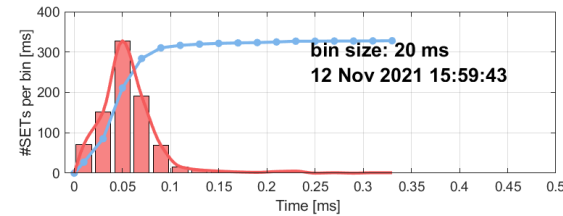
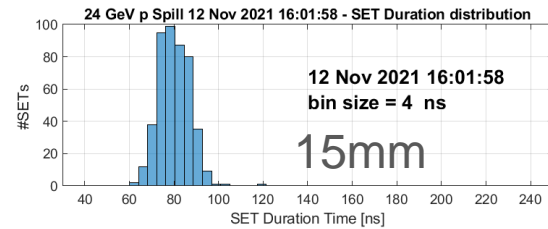
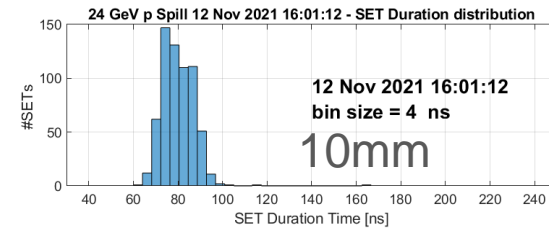
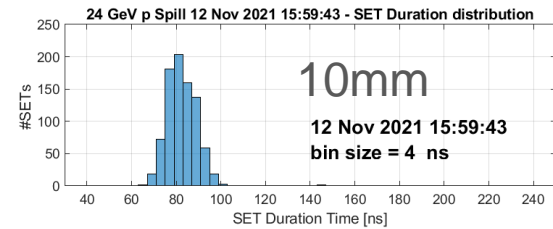
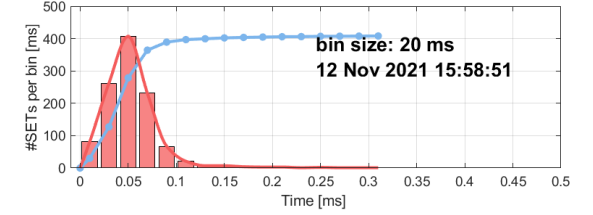
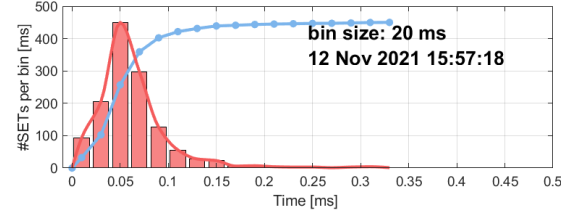
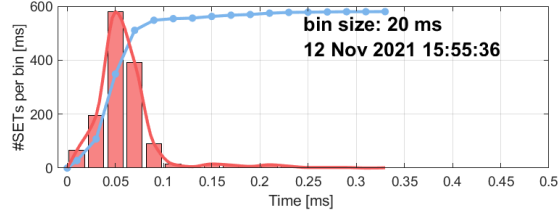
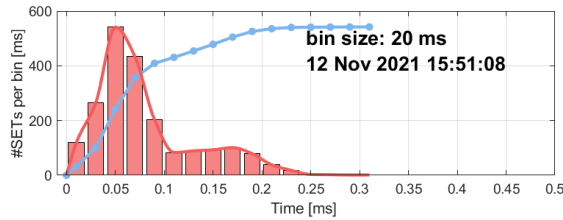
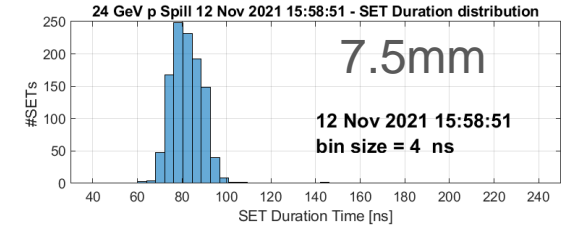
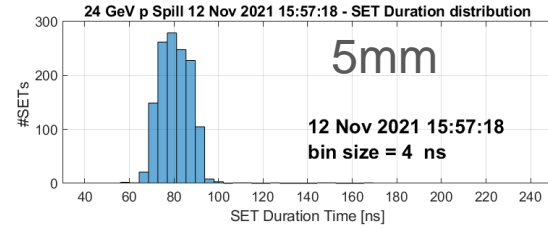
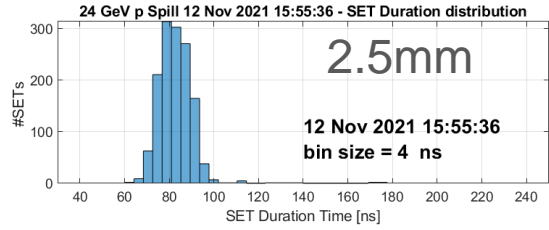
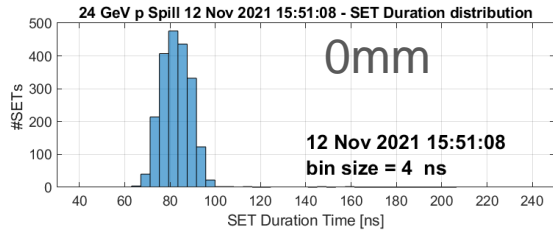
# Heavy Ion: spill shape comparison



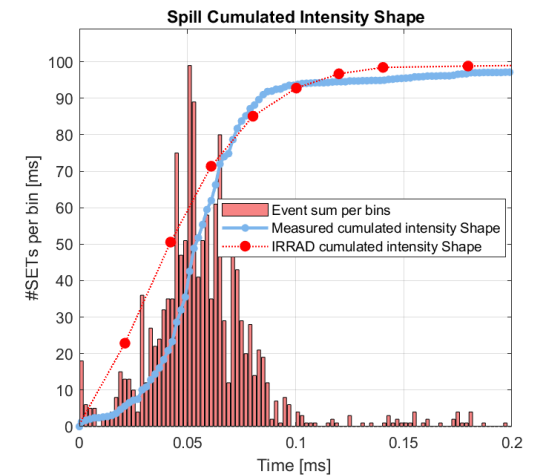
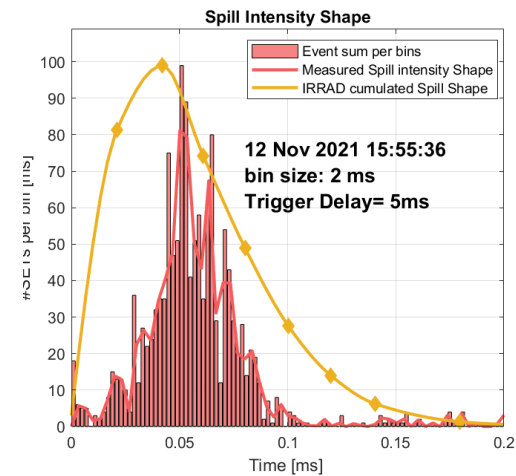
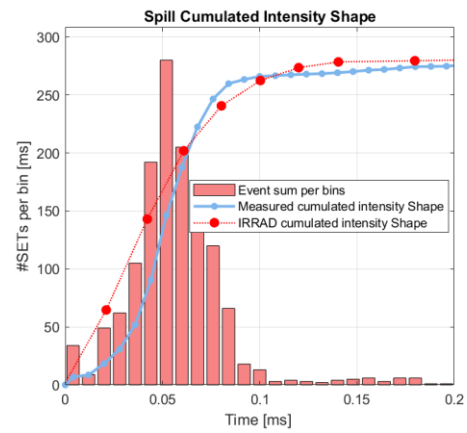
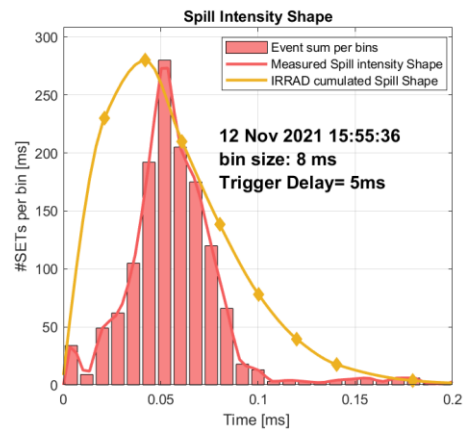
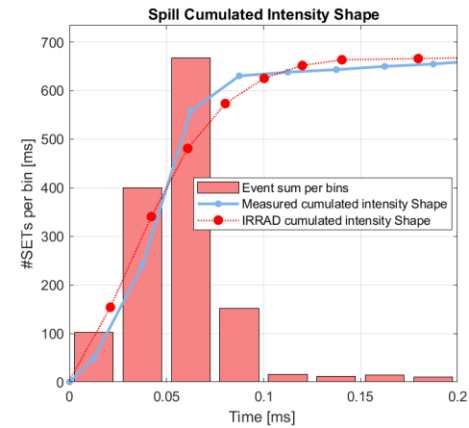
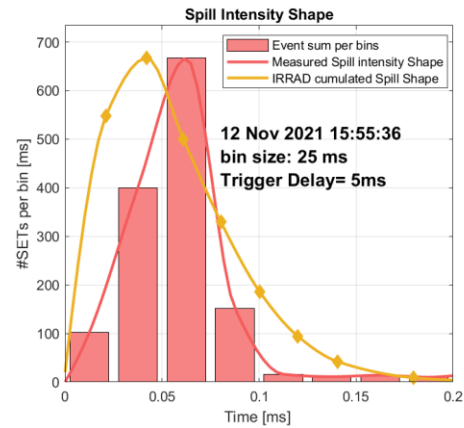
# 24 GeV Proton: Position shift left



# 24 GeV Proton: Position shift right



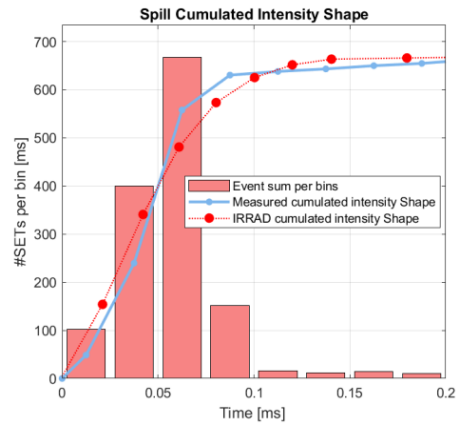
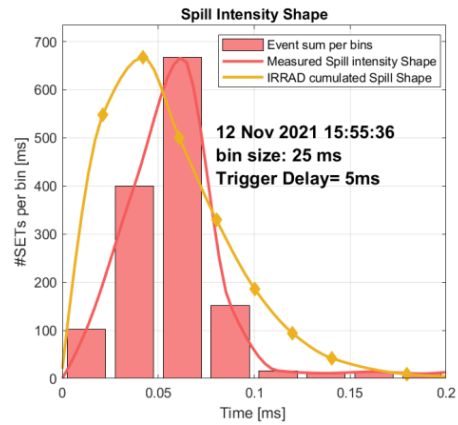
# 24 GeV proton: spill shape comparison



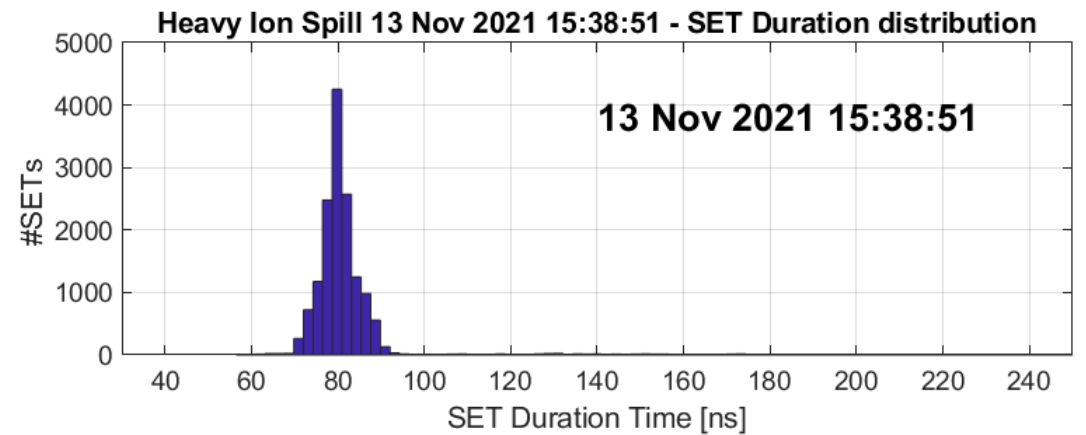
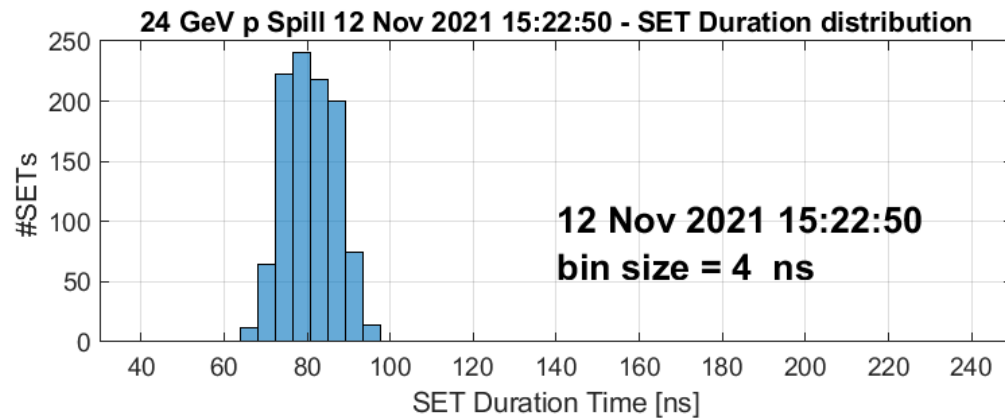
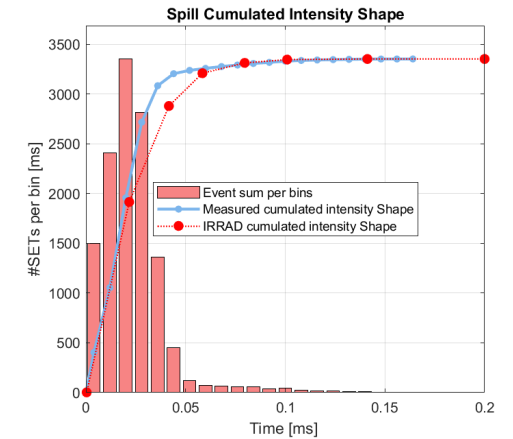
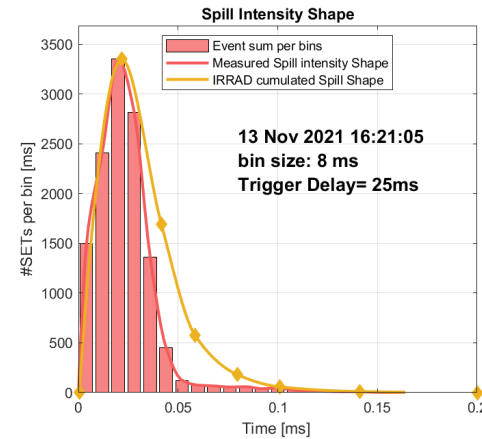


# IRRAD Final Results

## → Proton Results



## → Heavy Ion Results



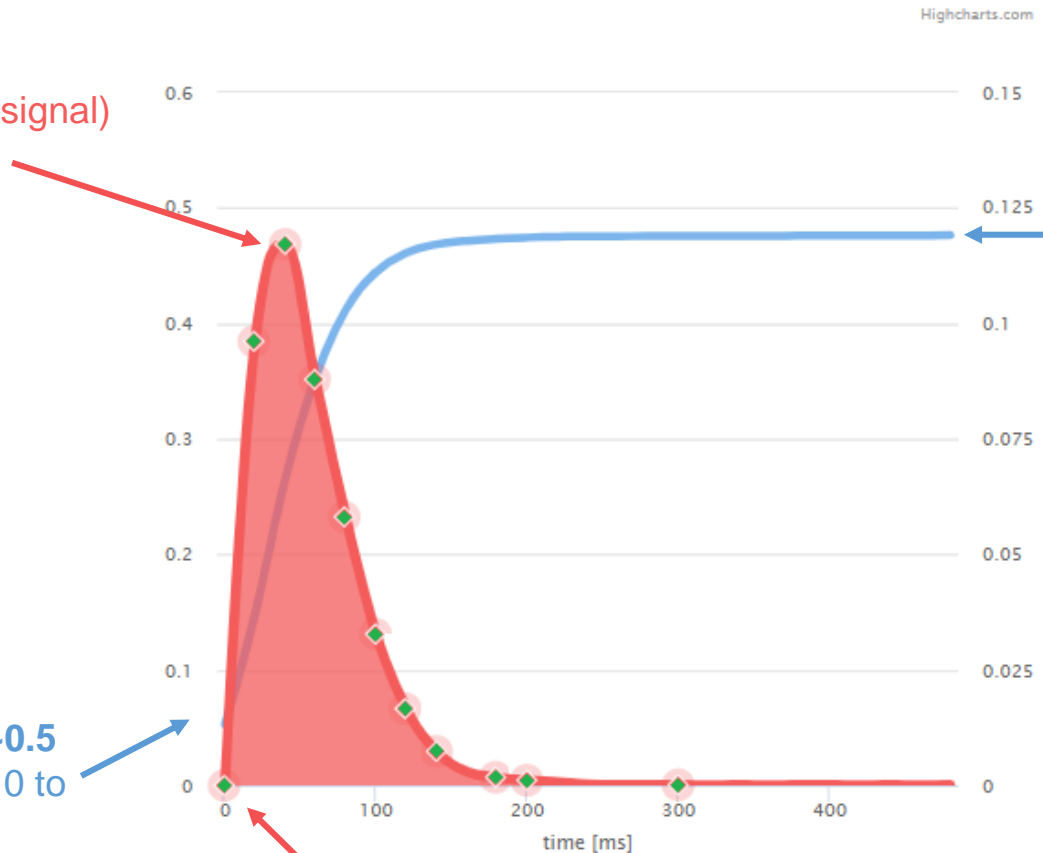


01/12/2021



# IRRAD Spill shape reconstruction

This is what they calculate  
(derivative of the integrated signal)



This is what they measure  
(integrated intensity)

First integrated point is at ~0.5  
→ So, this is integration from 0 to 20 ms after the trigger?

= 0, so the performed derivative is a “right derivative” → induce a shift of 1 sample to the right: 20 ms