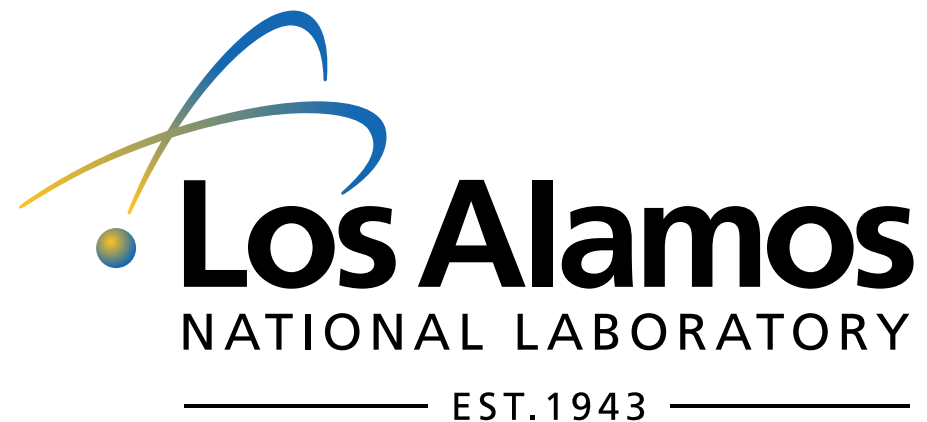# Beam-Gas Background Study
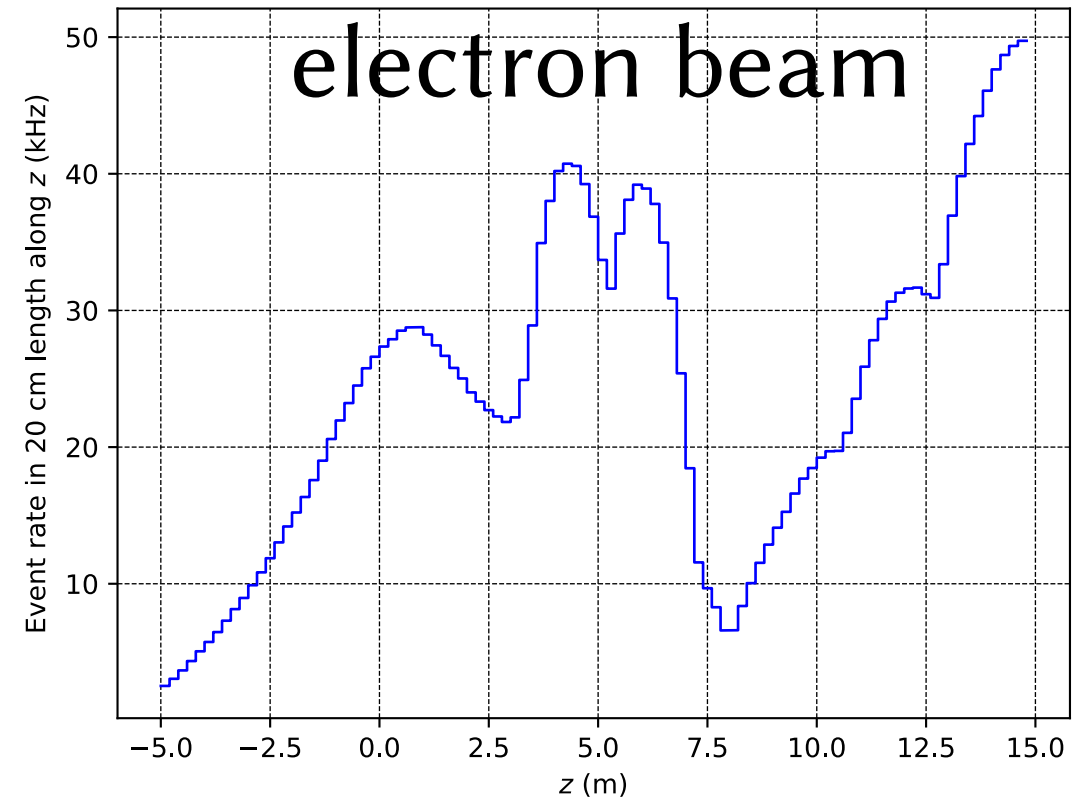
Kei Nagai
June 16th, 2022
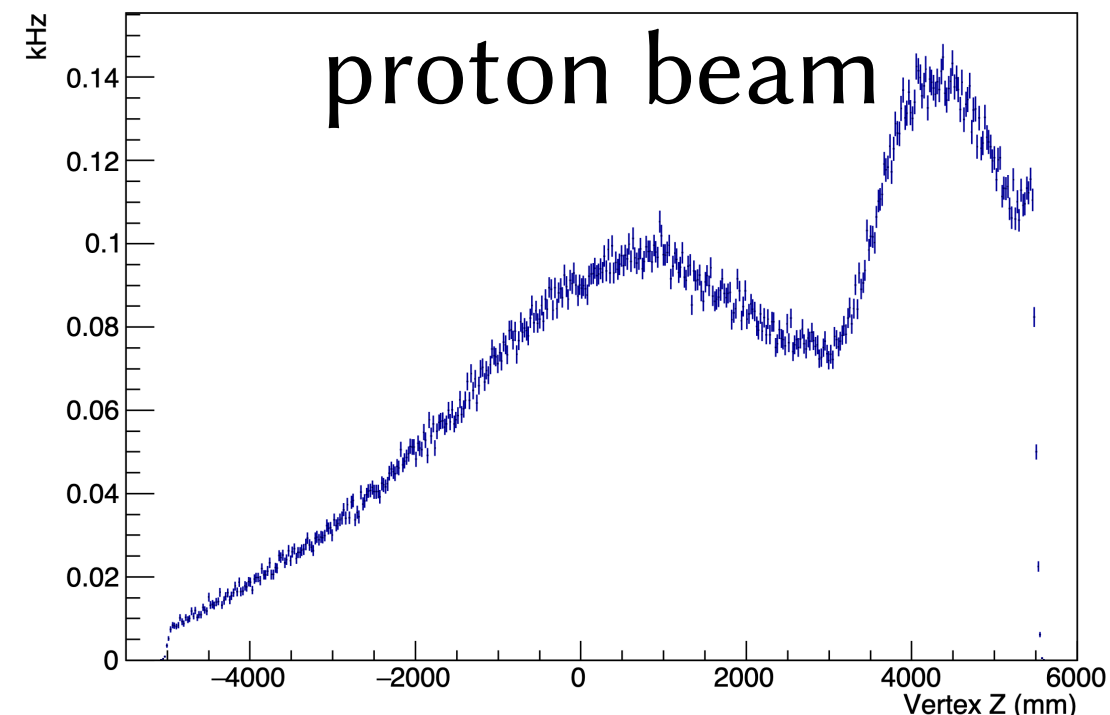
Overview

- See the detector response of the electron/proton beam-gas background
  - ▸ Mix with ep events later to see the effects on track finding

- Input files from Zhengqiao and Jaroslav
  - ▸ Hadron & electron
    - ★ 275 GeV proton beam
    - ★ 10 GeV electron beam
  - ▸ Electron beam-gas background file format is not compatible for fun4all. Thanks to Kolja and Cameron, we were able to use the available files using eicsmear.

- Use Fun4All (ECCE) with some modification
  - ▸ Magnetic field: 1.5 T
  - ▸ Enabled tracking
    - ★ Tracking on the silicon detectors only
  - ▸ Beam-pipe with/without gold coating

Production rate

- <u>https://wiki.bnl.gov/athena/index.php/Beam_backgrounds</u>

- $R = \sigma \times L$

  - ▸ σ: cross section
  - ▸ L : luminosity of background
    - ★ (beam current) x (gas density) x (length)

- Figures: production rate as function of Z

- Total production rate
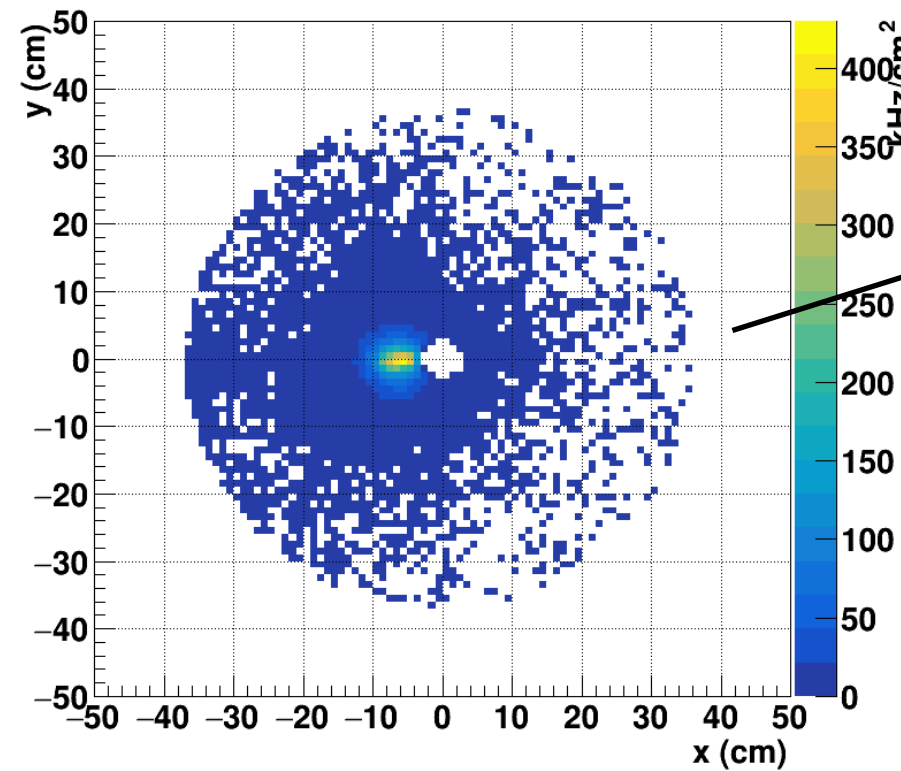 - ▸ Electron beam: 2,463.83 kHz
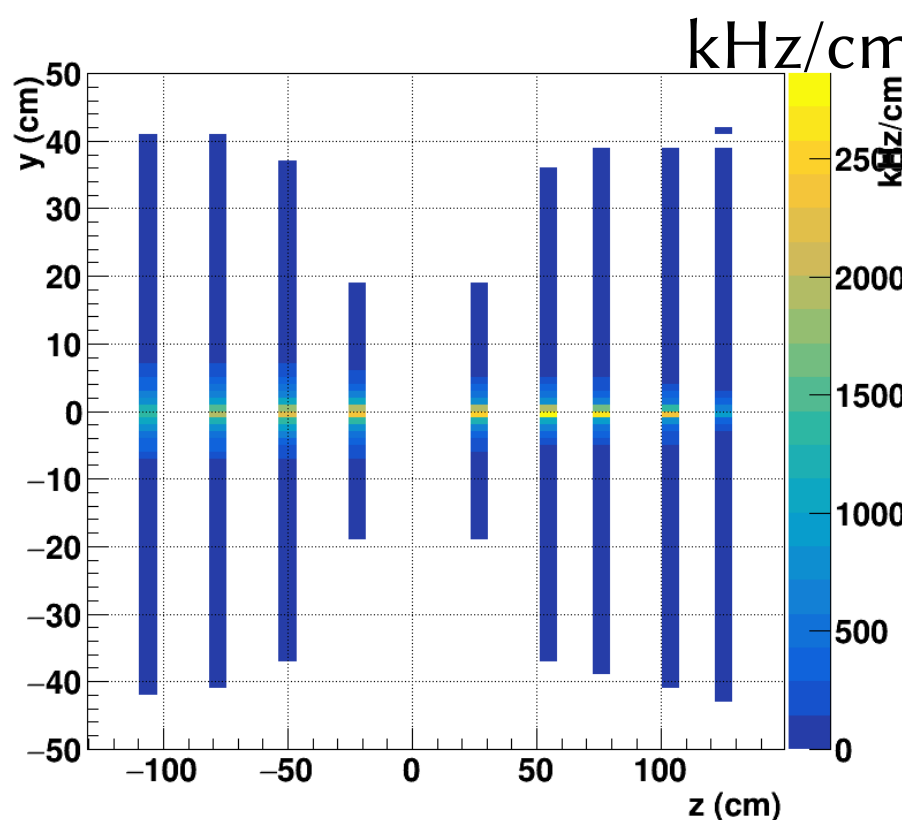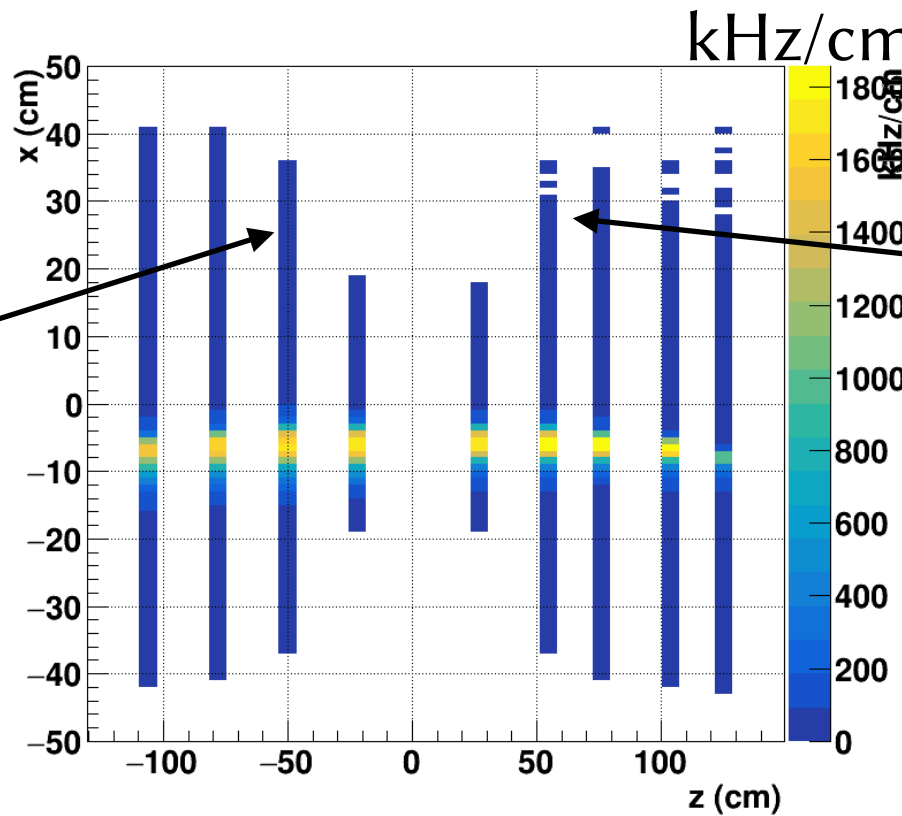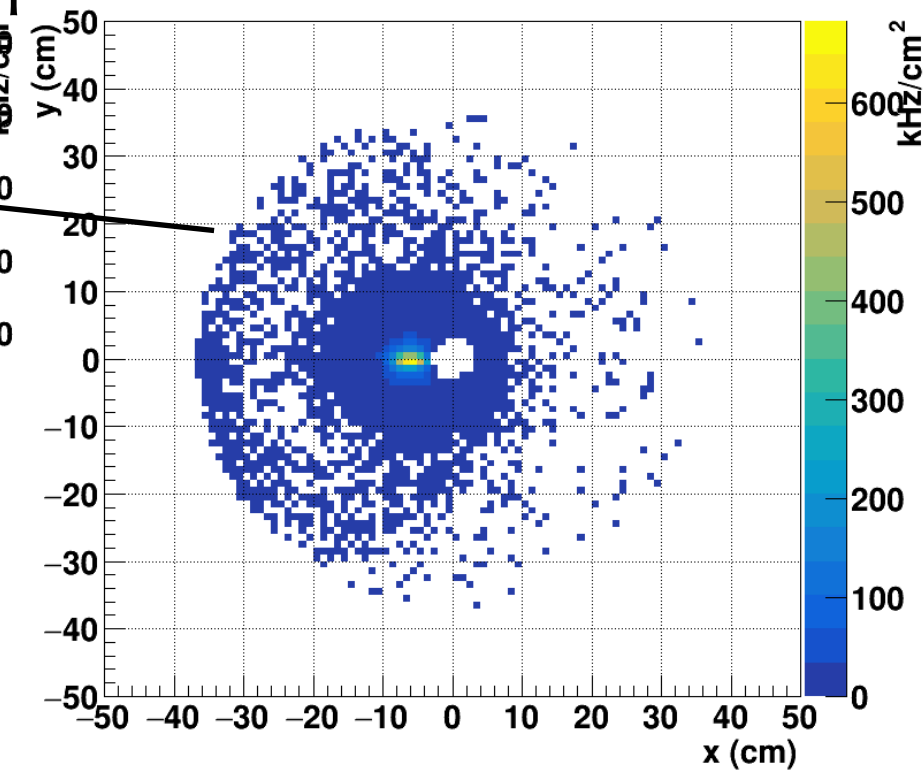 - ▸ Proton   beam: 31.45 kHz

electron beam

Vertex z

proton beam

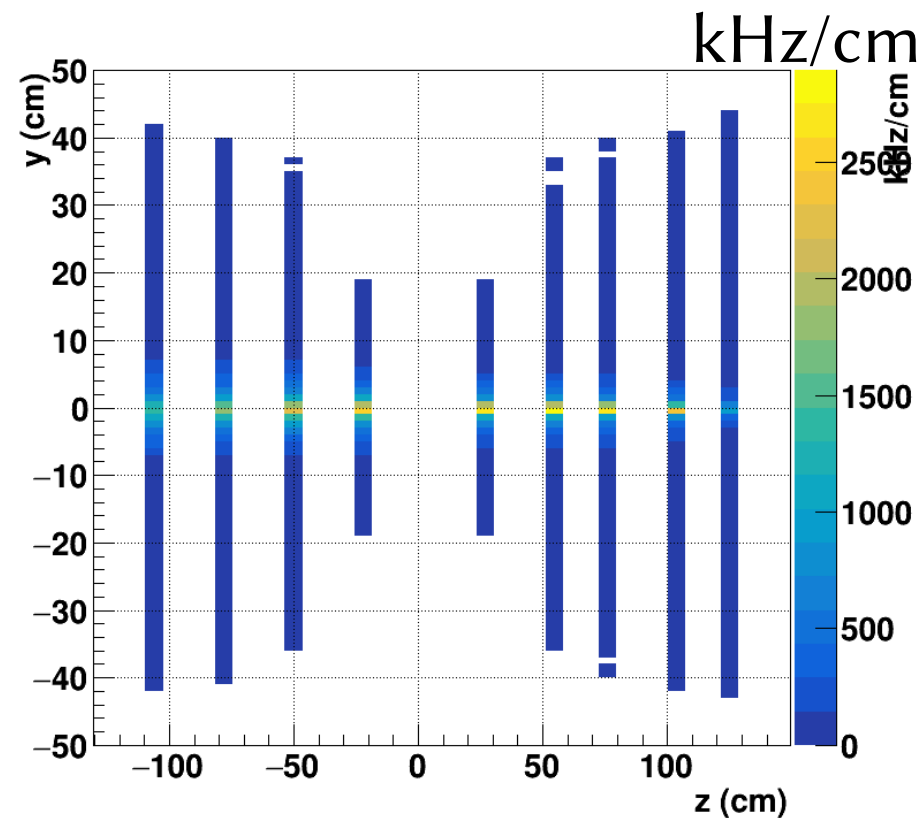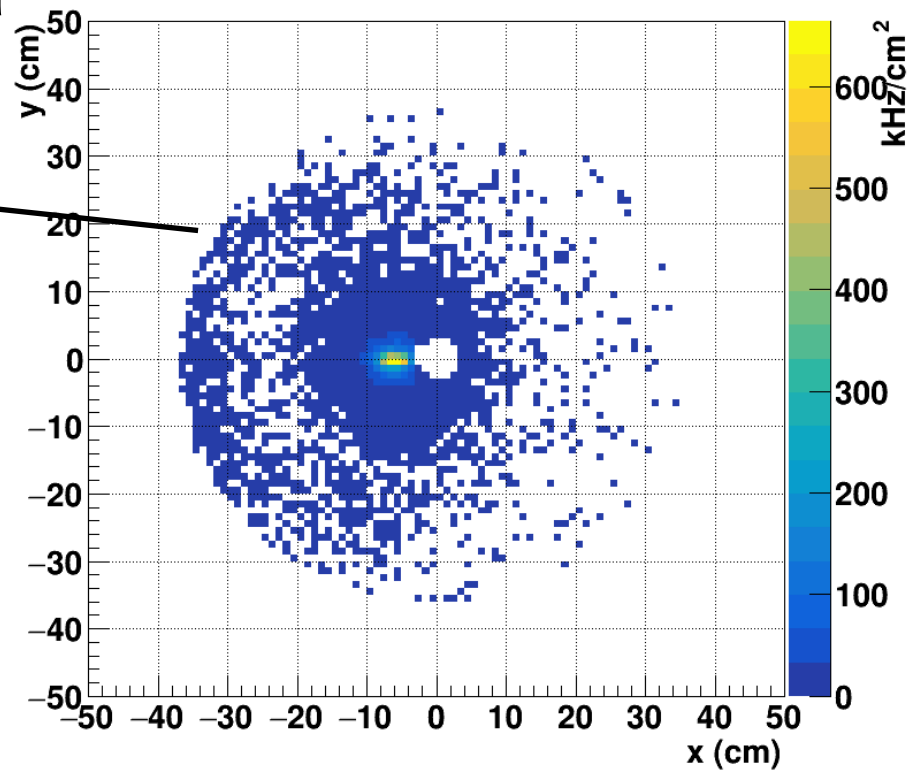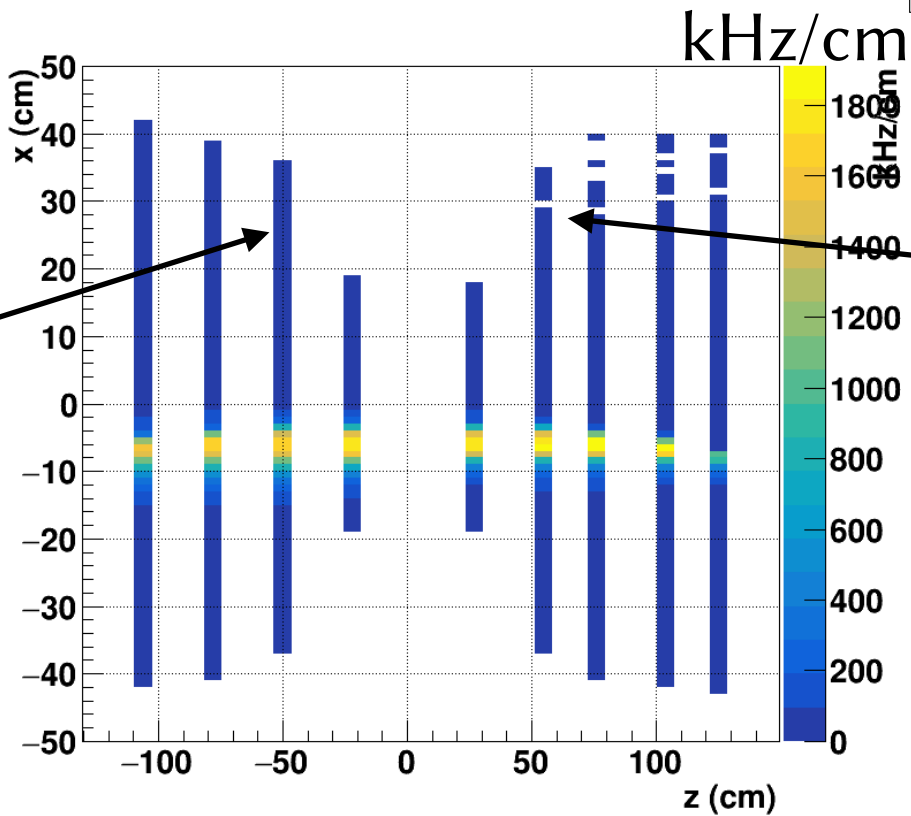# Hits on Silicon disc (FST, EFST)

- Electron beam-gas

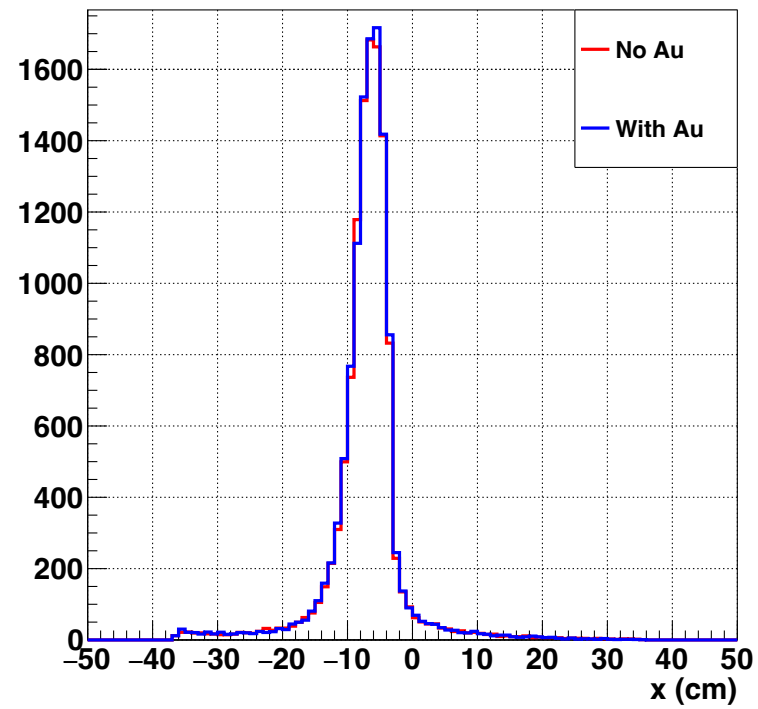- No Au coating

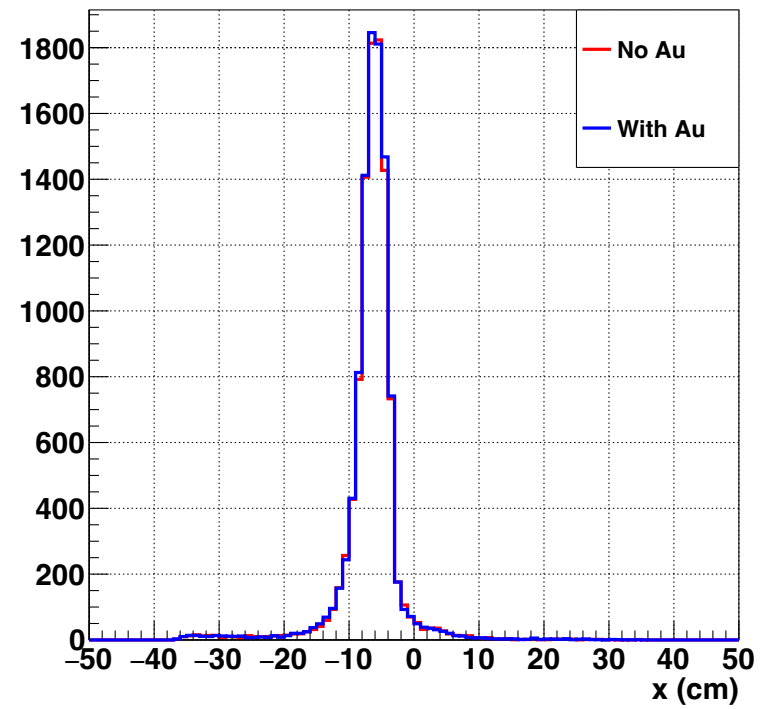# Hits on Silicon disc (FST, EFST)

EFST_1

FST_1

kHz/cm

kHz/cm
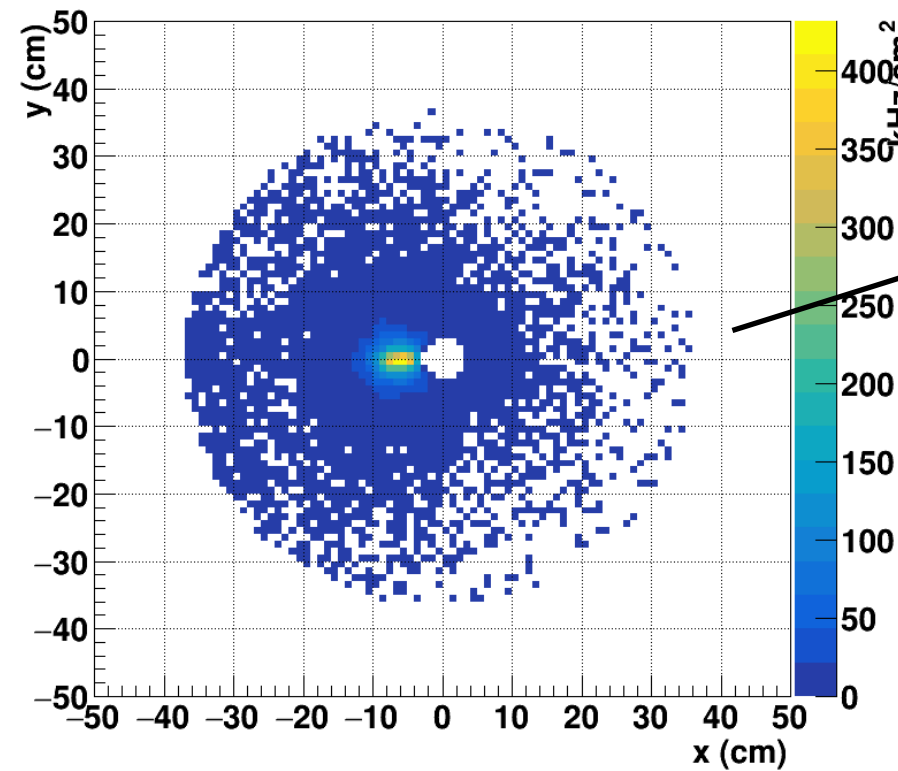
- Electron beam-gas

- With Au coating

kHz/cm

With/Without Au

EFST_1

FST_1

- No impact on electron beam gas interaction

EFST_1 l With Au / Without Au

FST_1 l With Au / Without Au

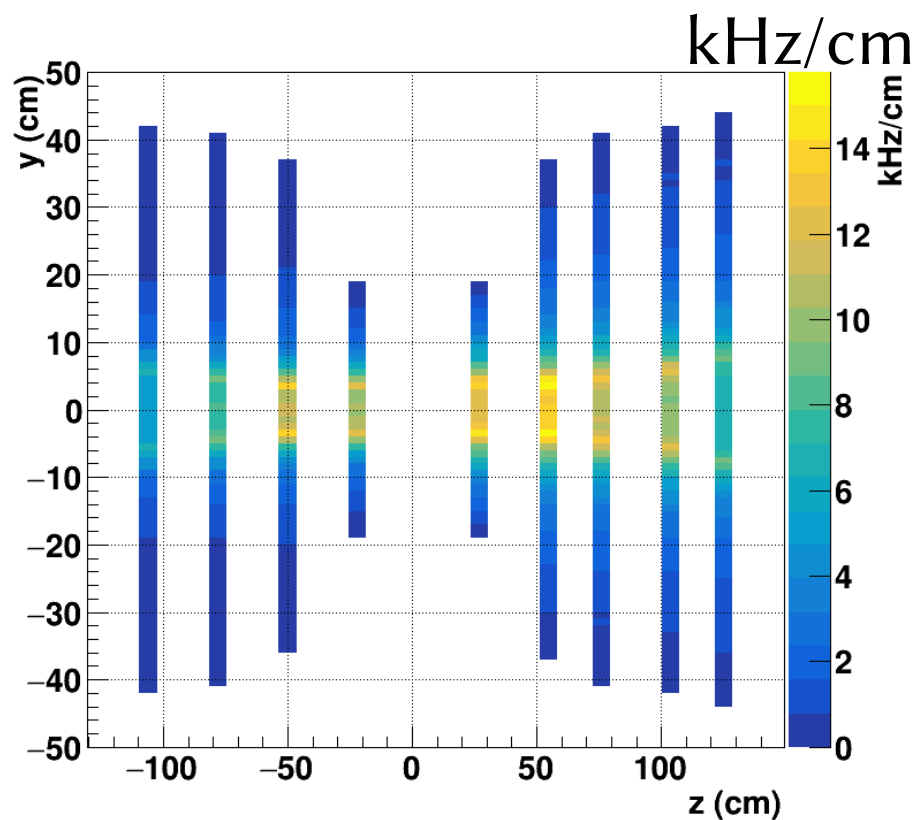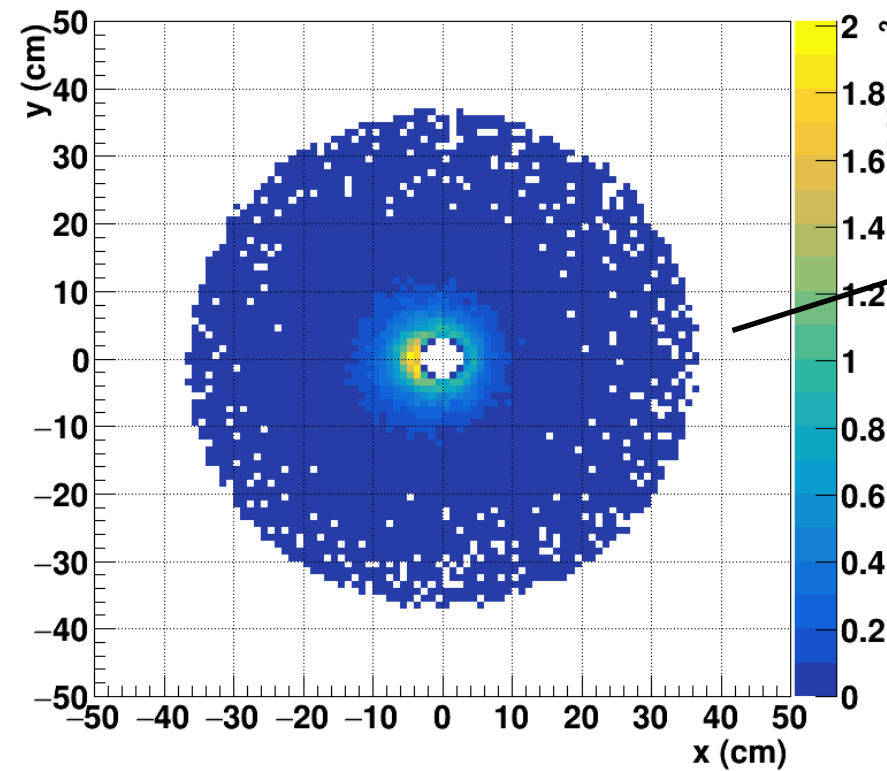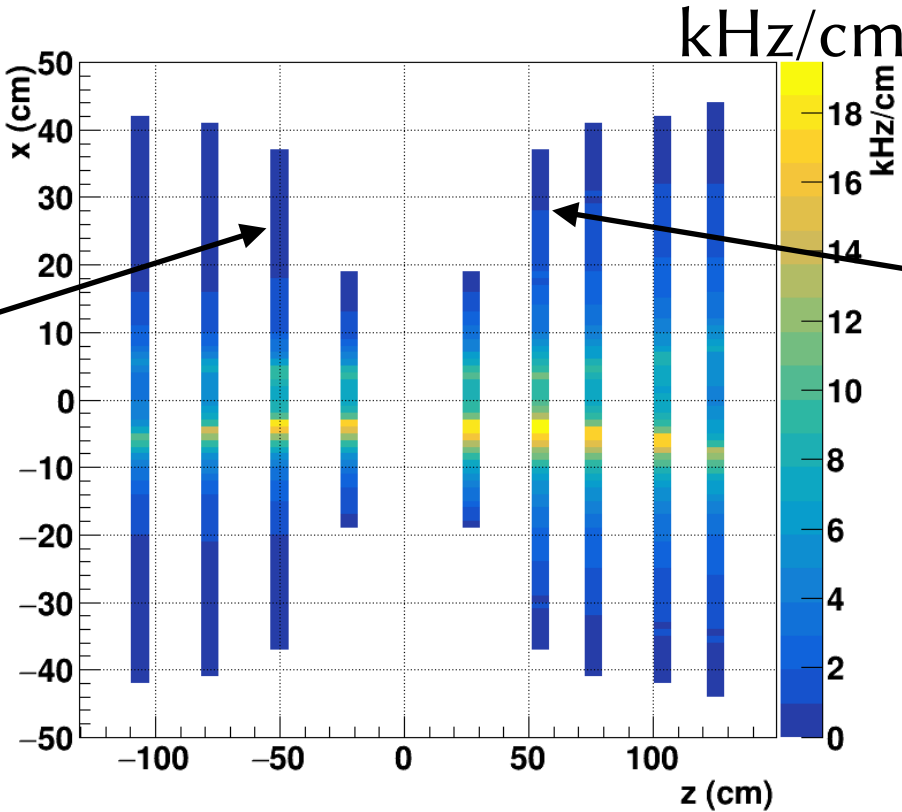# Hits on Silicon disc (FST, EFST)
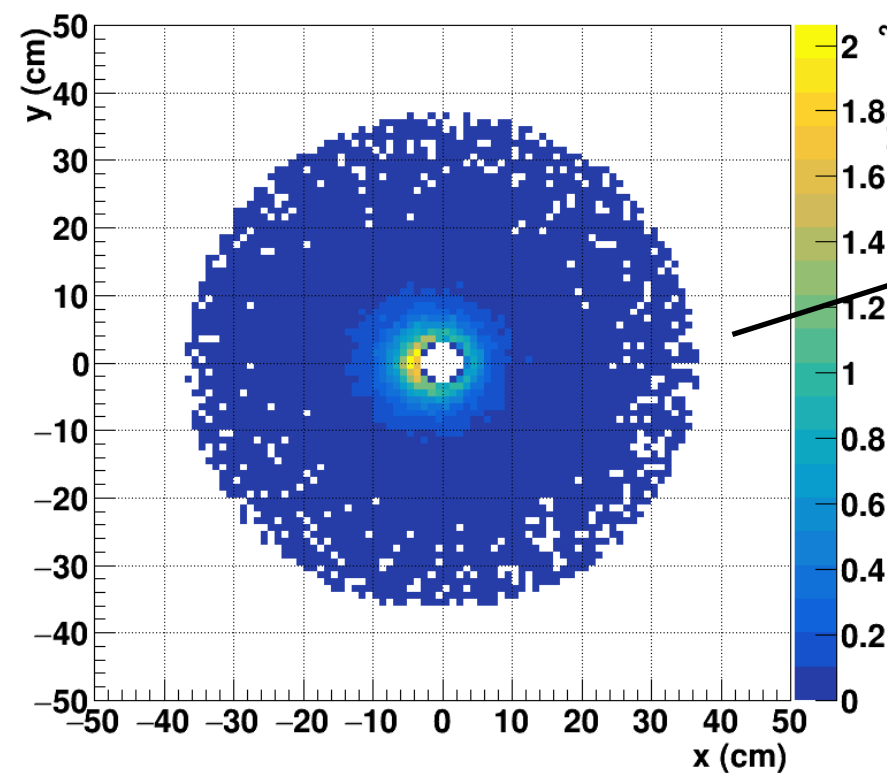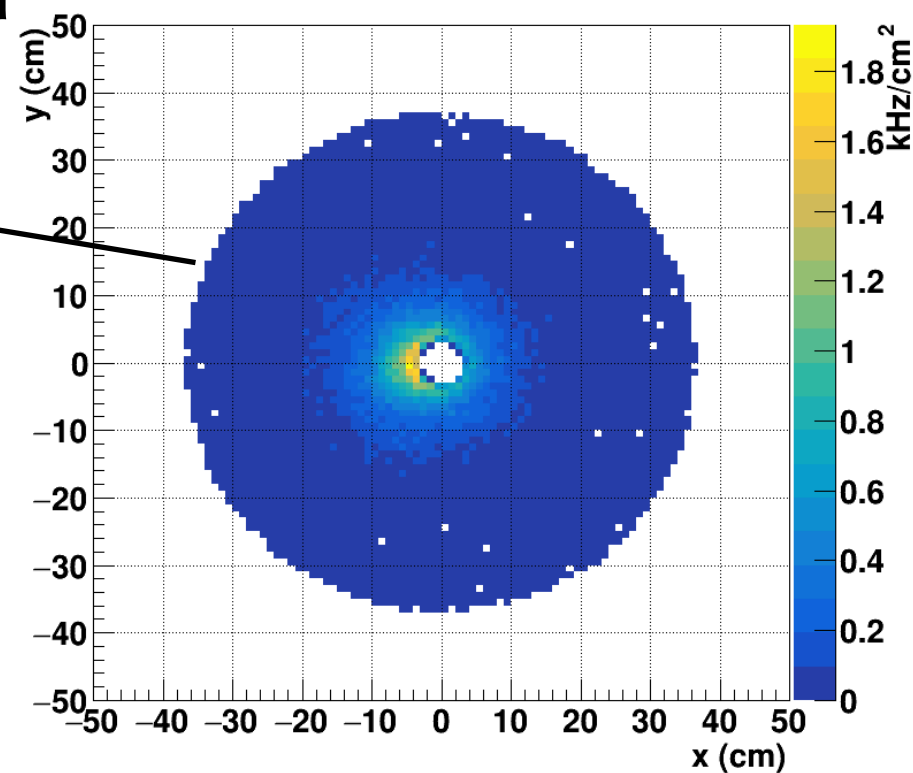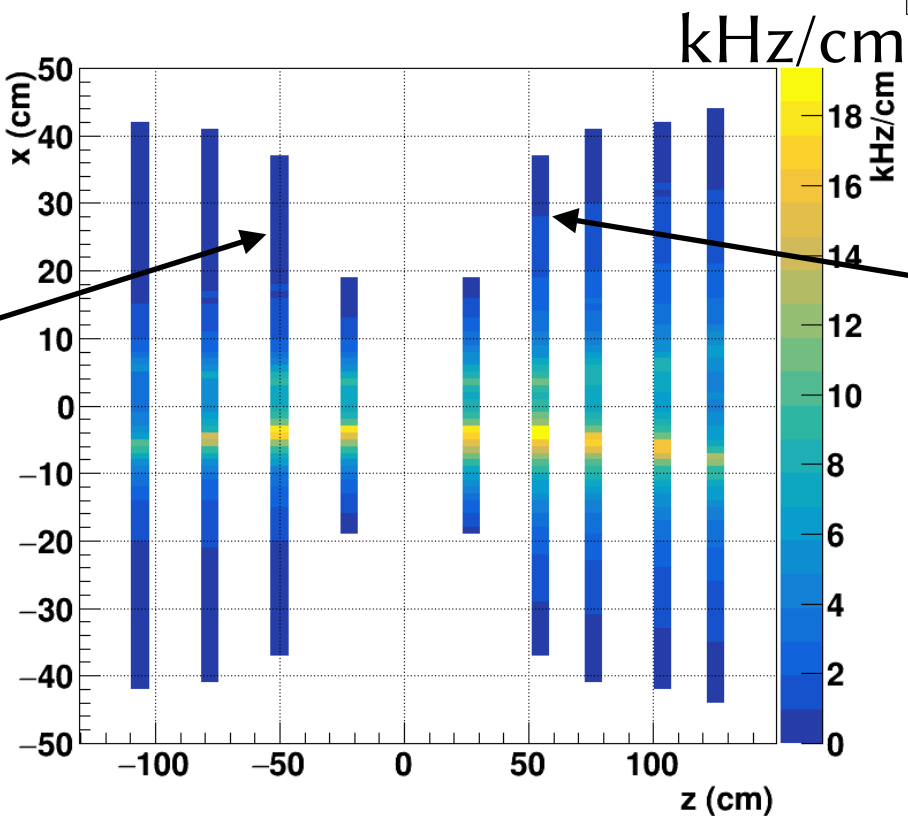
- Hadron beam-gas

- No Au coating
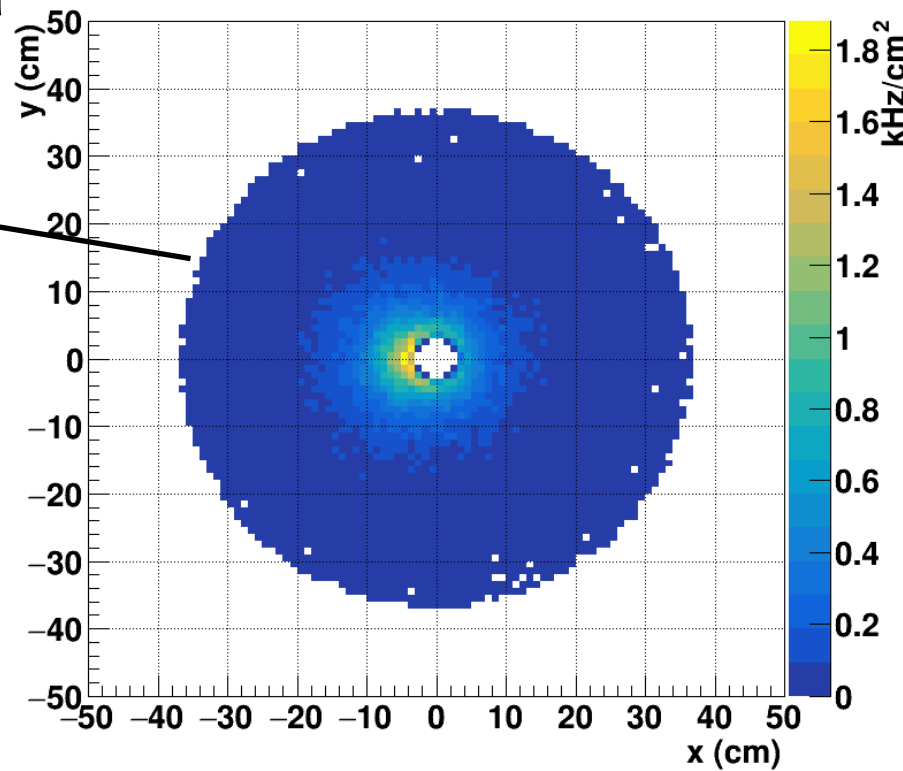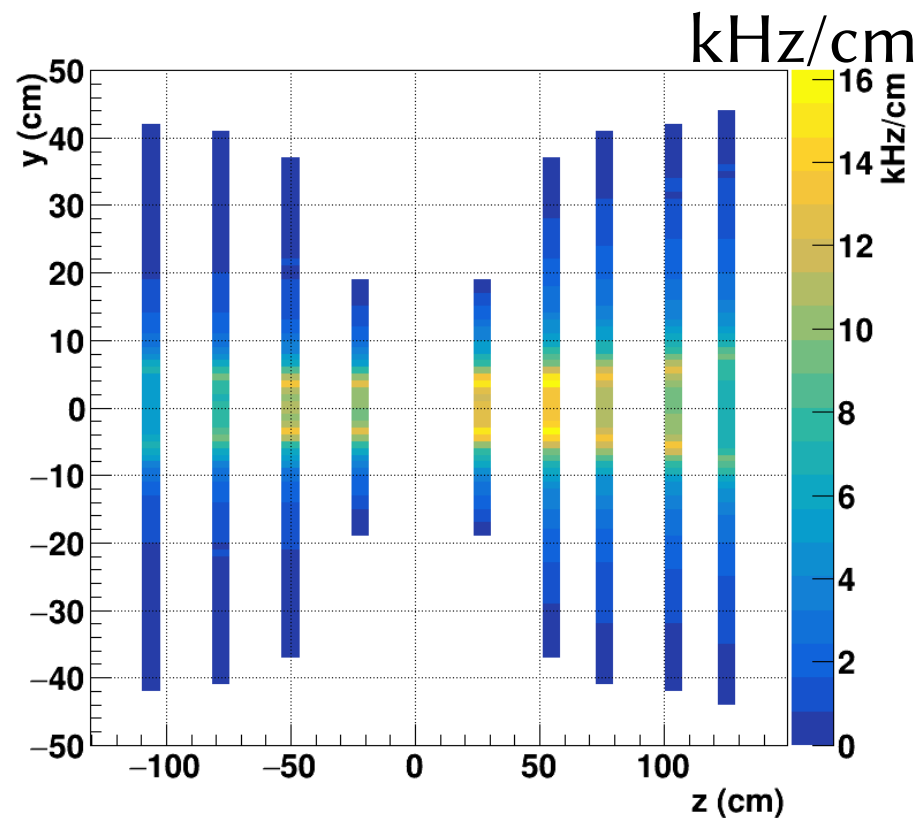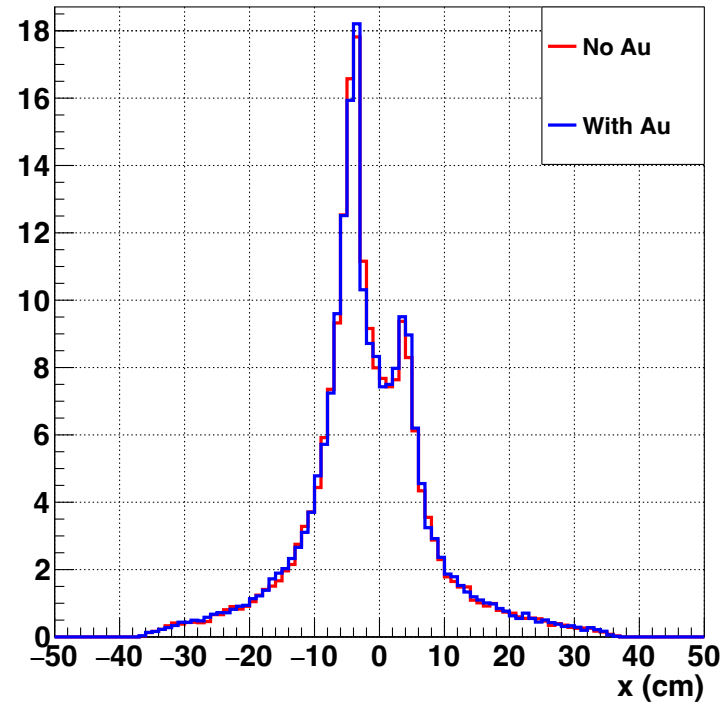
Hits on Silicon disc (FST, EFST)

- Hadron beam-gas

- With Au coating

With/Without Au
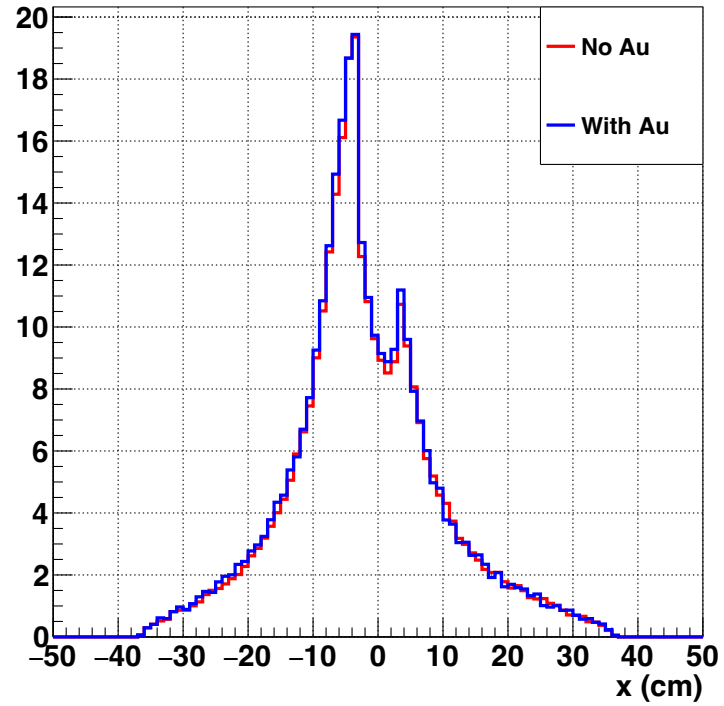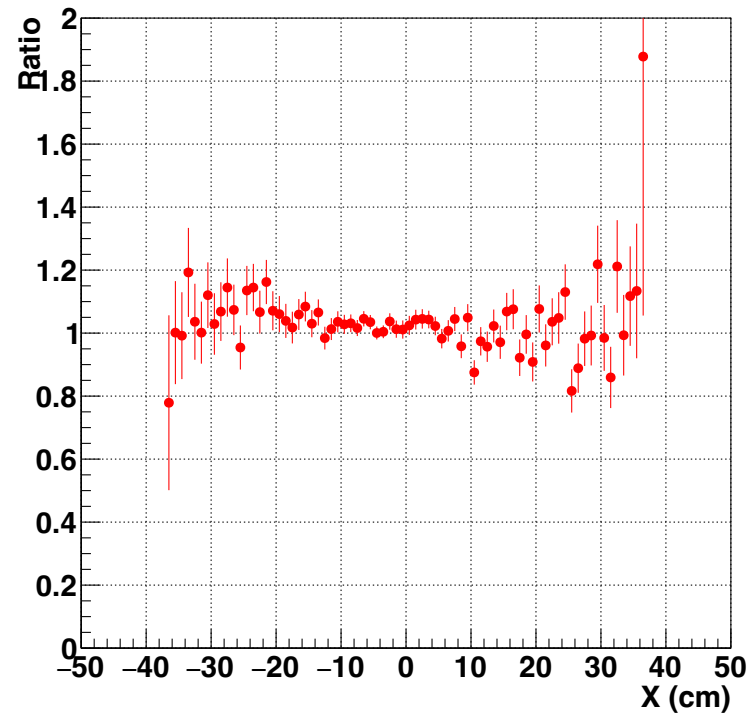
EFST_1

FST_1

- No impact on proton beam gas interaction

EFST_1 | With Au / Without Au

FST_1 | With Au / Without Au

EFST_1 (top left) — Electron beam

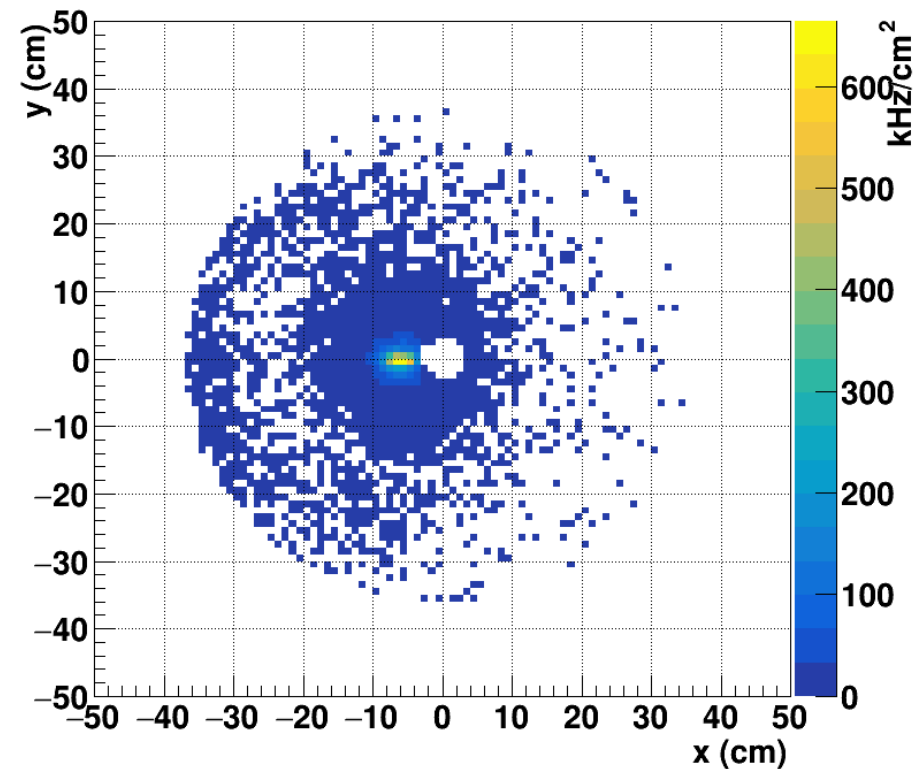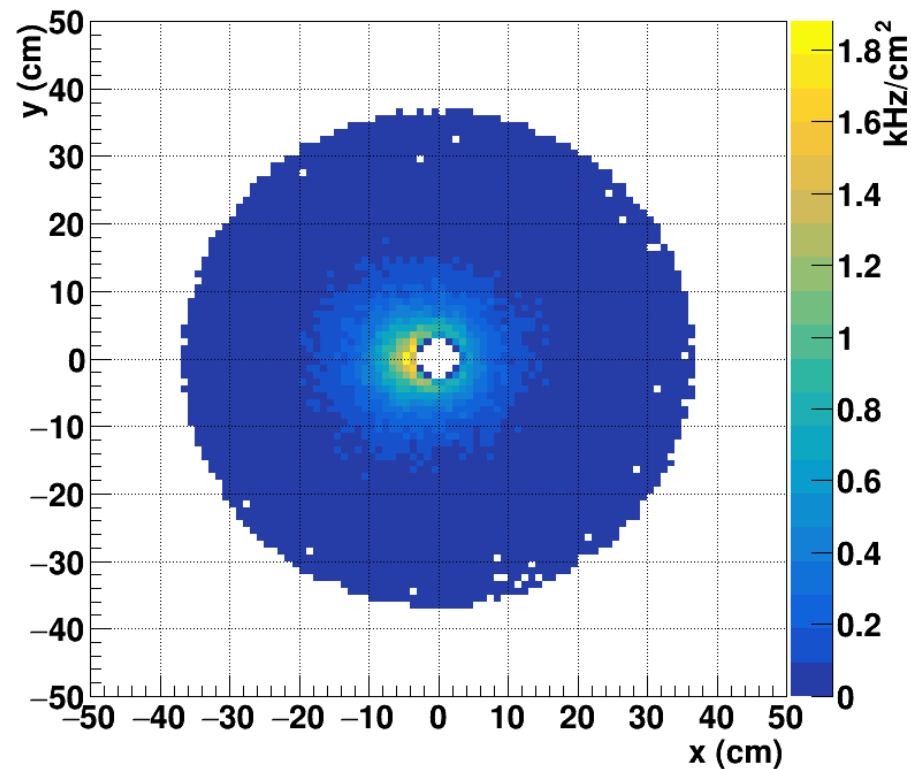EFST_1 (top right) — Proton beam
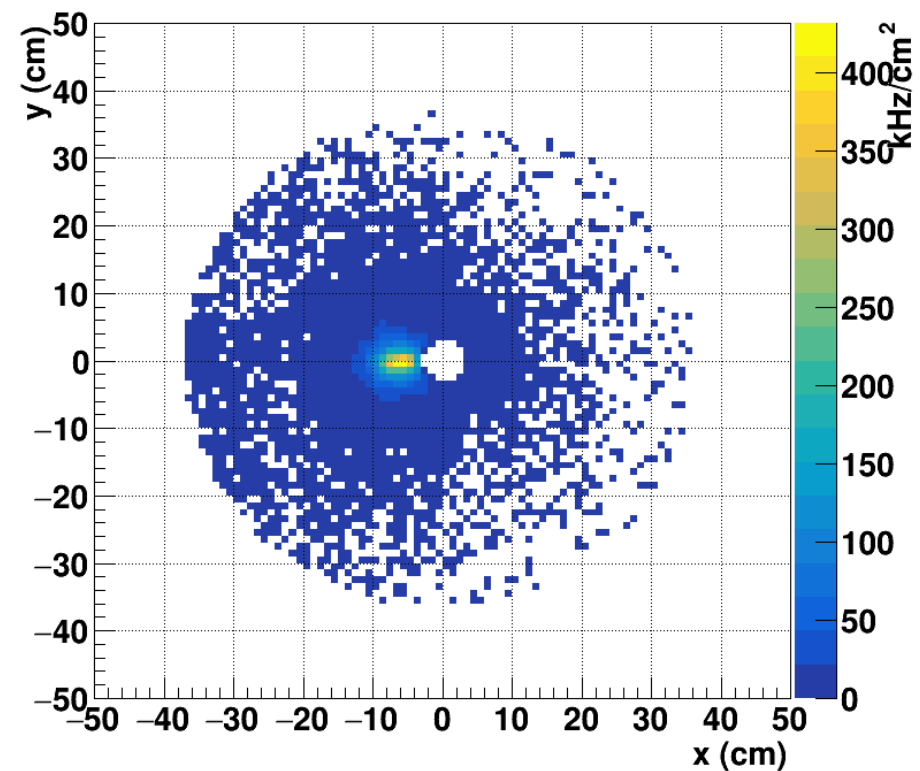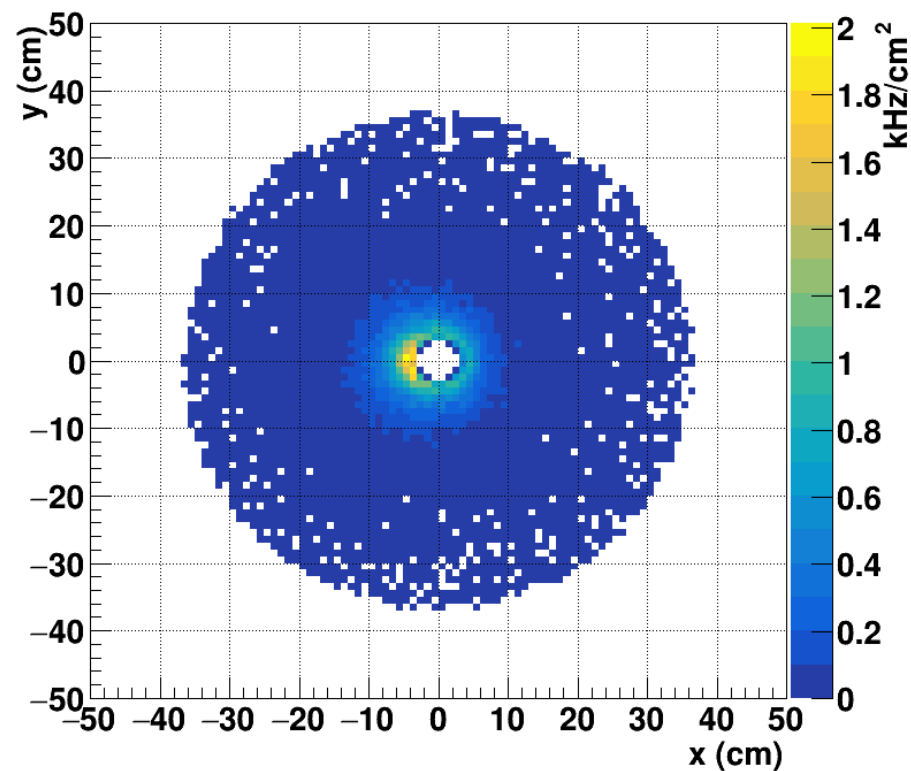
FST_1 Electron beam

FST_1 Proton beam

- Proton beam-gas background distributes broadly but rate itself is much smaller than that of electron beam-gas background

To do

- Mix these background with ep events
  - ‣ Embed?

- Effects on track finding