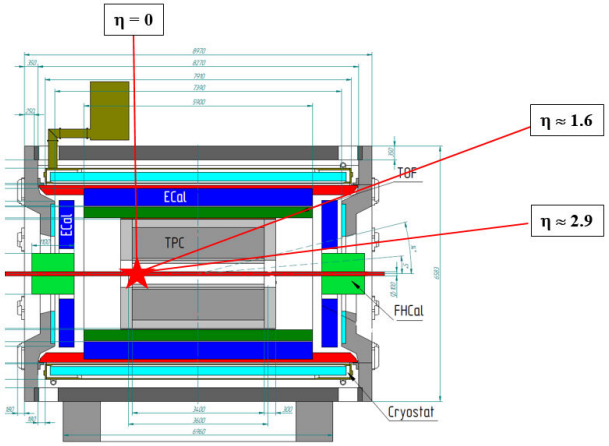
MPD trigger efficiency in the fixed target mode (Cu/Sn-La/W wires at different locations)

V. Riabov

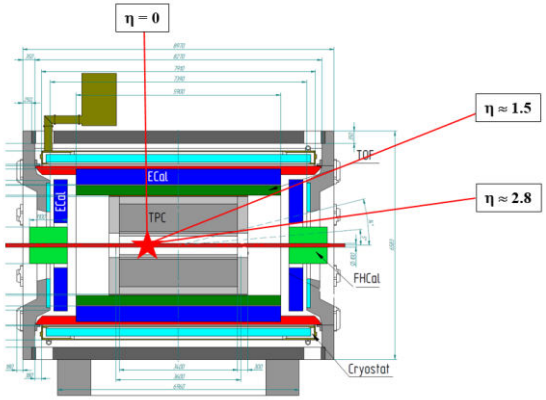
Fixed target configurations

- With a target located at z = -150 cm

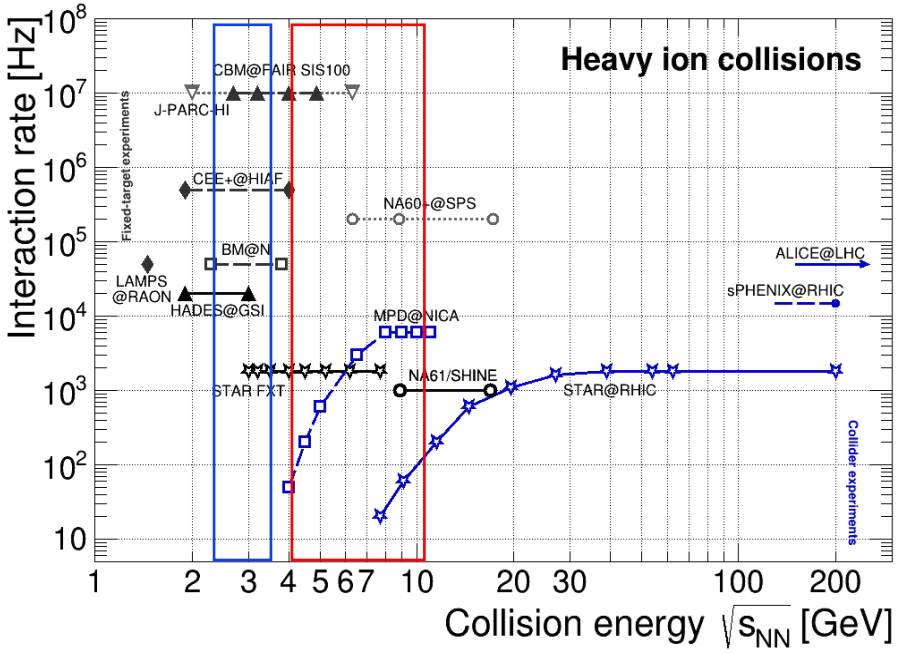


E_{beam}	$\sqrt{s_{NN}}$ collider mode	$\sqrt{s_{NN}}$ FXT mode	η_{CM}	CMS coverage
2.0	4	2.4	0.7	-0.7; 0.9 (2.2)
5.5	11	3.5	1.23	-1.23; 0.37 (1.67)

- With a target located at z = -115 cm



E_{beam}	$\sqrt{s_{NN}}$ collider mode	$\sqrt{s_{NN}}$ FXT mode	η_{CM}	CMS coverage
2.0	4	2.4	0.7	-0.8; 0.8 (2.1)
5.5	11	3.5	1.23	-1.33; 0.27 (1.57)



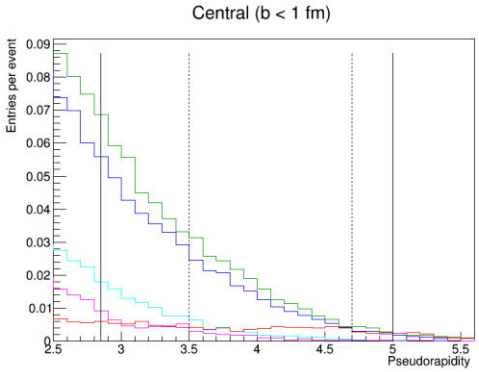
- In heavy-ion collisions:
  - ✓ MPD trigger system based on the FFD, FHCAL and TOF provides high efficiency in the FXT mode
  - ✓ potential problems with online T0 and vertex at lower beam energies
- Potential wire materials: Cu, Sn (La), W
- Potential wire position: 80-115 cm from the MPD center

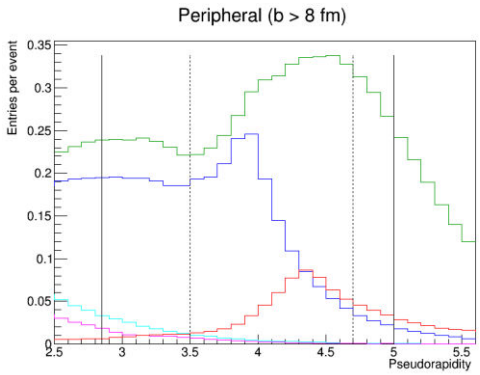
FXT mode, light systems

- DCM-QGSM-SMM is run in FXT mode at E_{kin} = 2.5·A GeV
- Target position was considered:
  - ✓ x = 0, y = 0, z = -115 cm → full detector configuration
  - ✓ x = 0, y = 0, z = -85 cm → full detector configuration
- Xe+Cu (0.5 M events), Xe+Sn (0.5 M events), Xe+W (0.5 M events)
- Three subsystems for trigger formation:
  - ✓ FFD-E (FFD-W ignored)
  - ✓ FHCAL-E (FHCAL-W ignored)
  - ✓ TOF, use fast logical signals from 280 MRPCs (fires if at least one hit detected in the whole MRPC chamber)

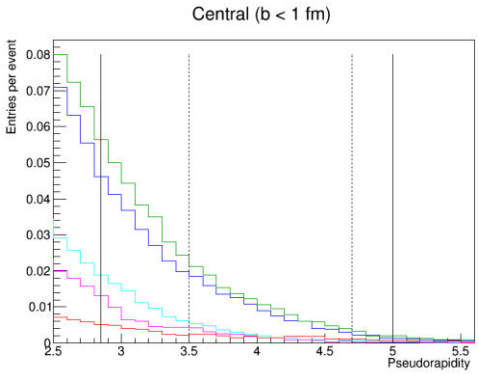
Particle composition, z_{vertex} = -115 cm

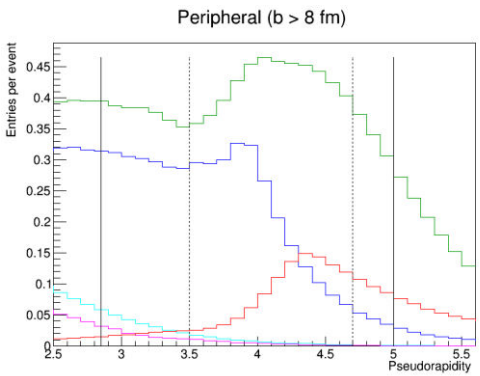
- Xe + Cu



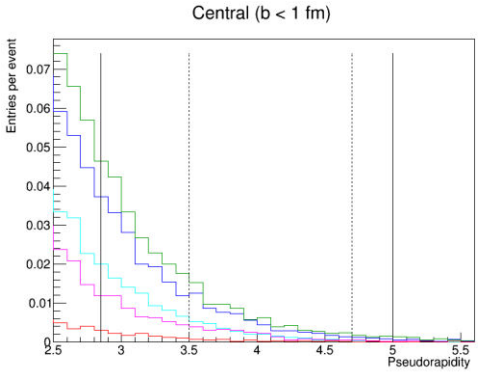


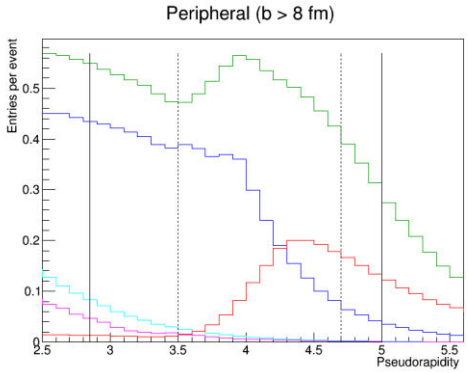
- Xe + Sn





- Xe + W





FFD

FHCAL

Pions

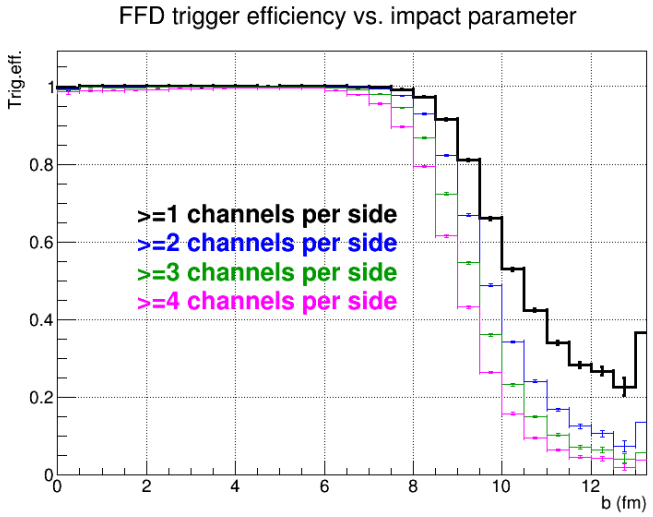
Protons

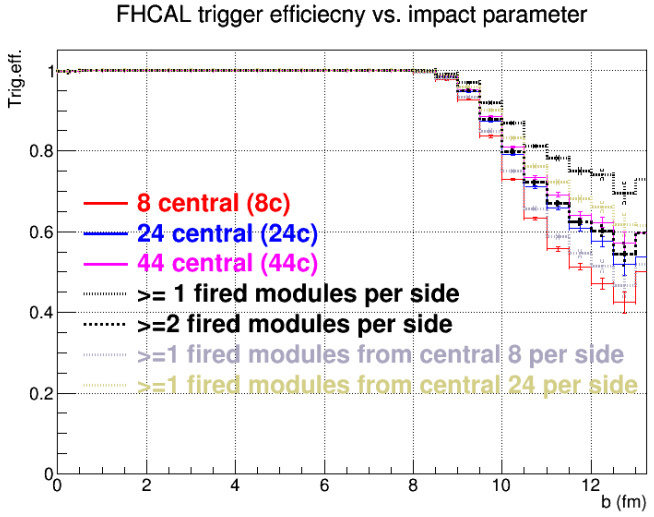
Neutrons

Fragments

Photons

Xe + Cu , z_{vertex} = -115 cm





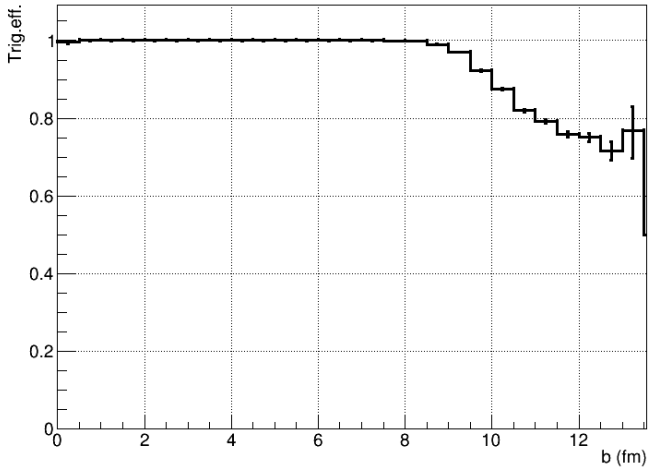
Efficiency:

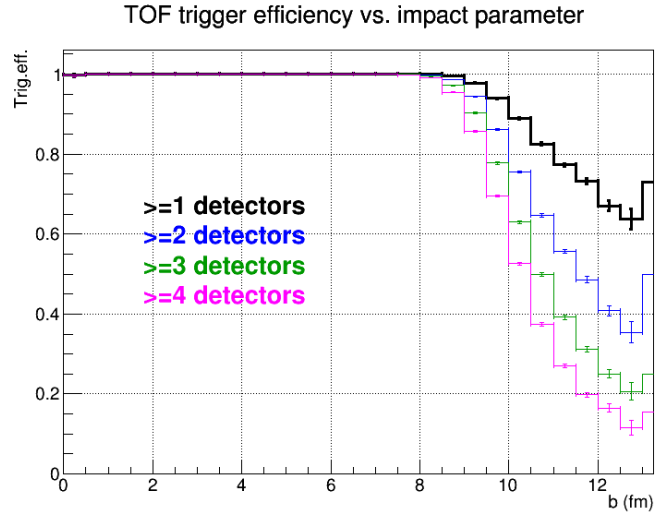
FFD: 86, 80, 74, 70%

FHCAL: 96, 95, 95, 94%

FFD|FHCAL: 96%

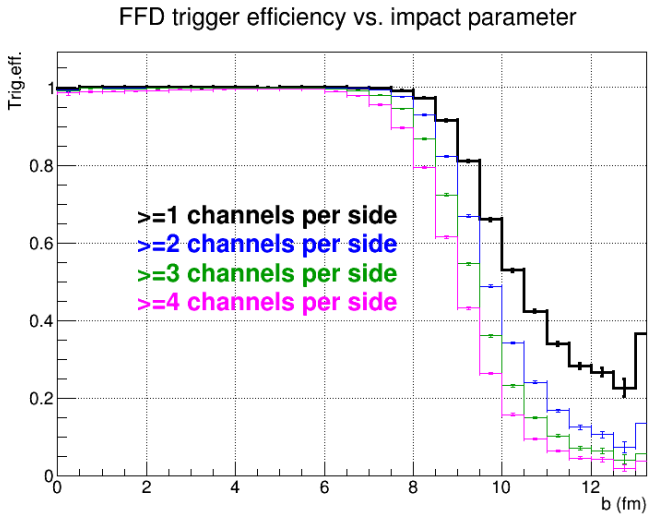
TOF: 97, 92, 90, 86%

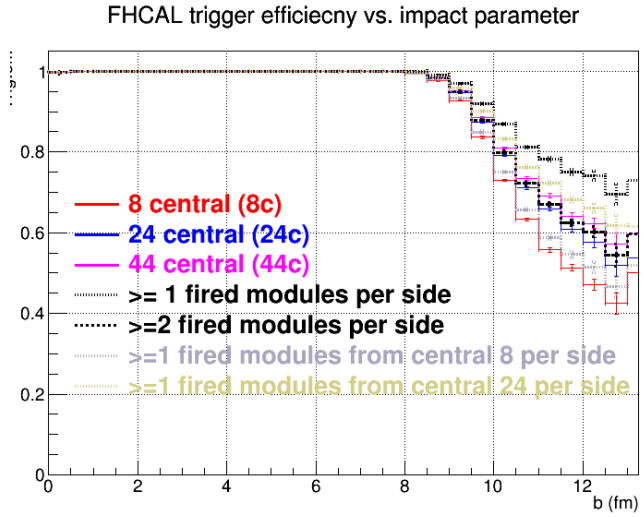


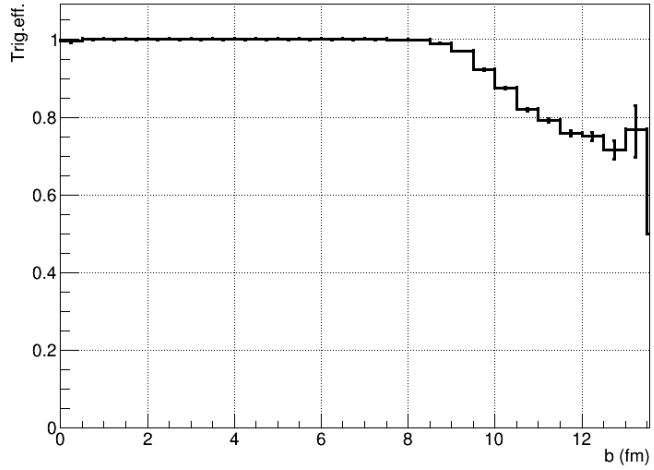


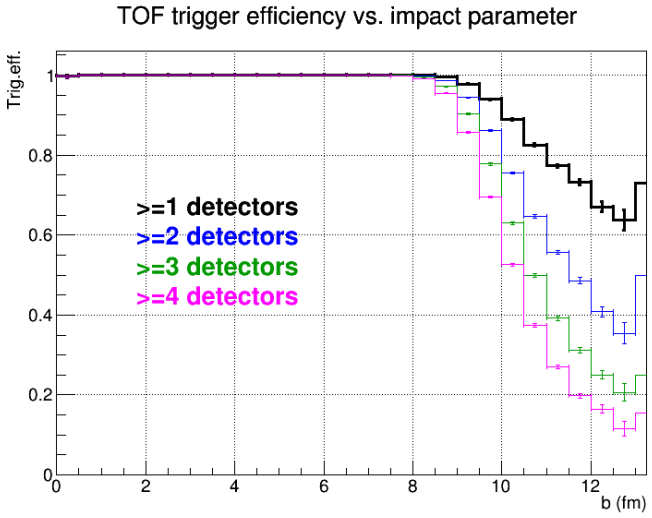
- 100% efficiency for (semi)central collisions

Xe + Cu , z_{vertex} = -85 cm







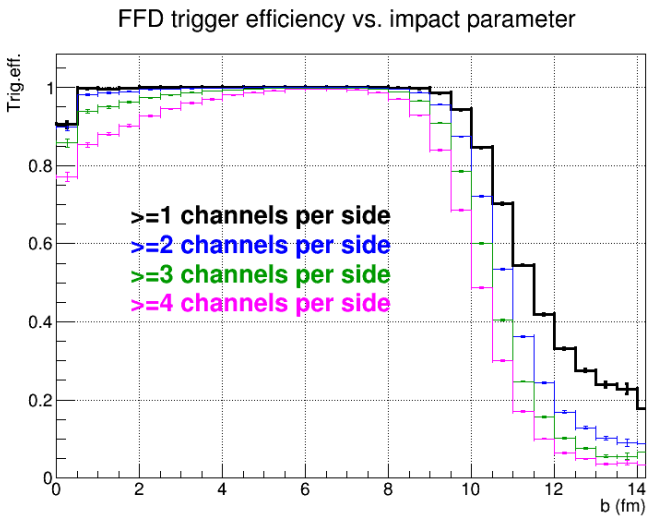


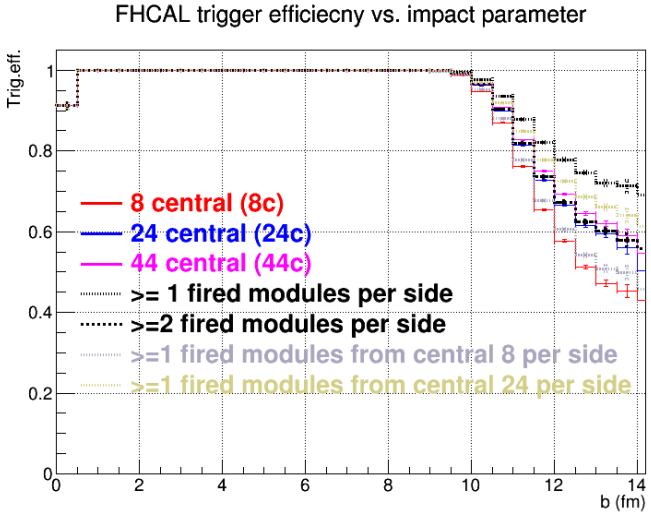
Efficiency:

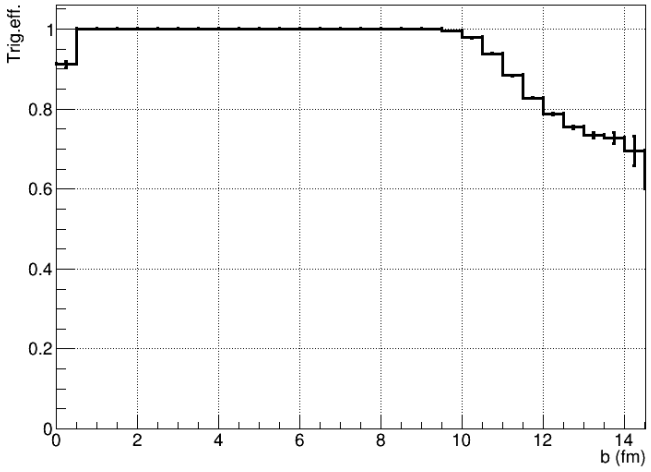
- FFD: 86, 80, 74, 70%
- FHCAL: 96, 95, 95, 94%
- FFD|FHCAL: 96%
- TOF: 96, 93 89, 86%

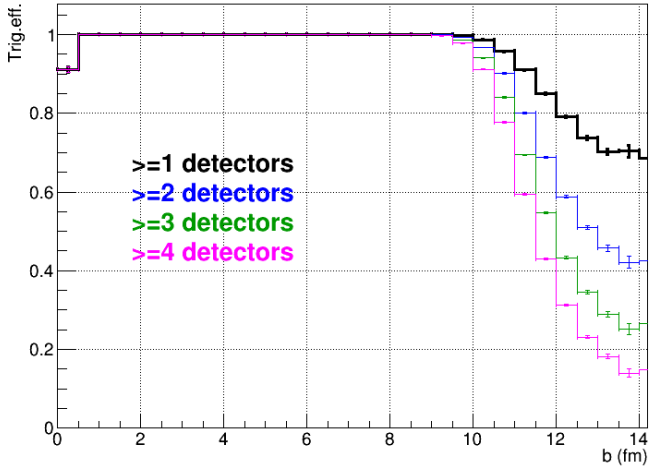
- 100% efficiency for (semi)central collisions

Xe + Sn , z_{vertex} = -115 cm







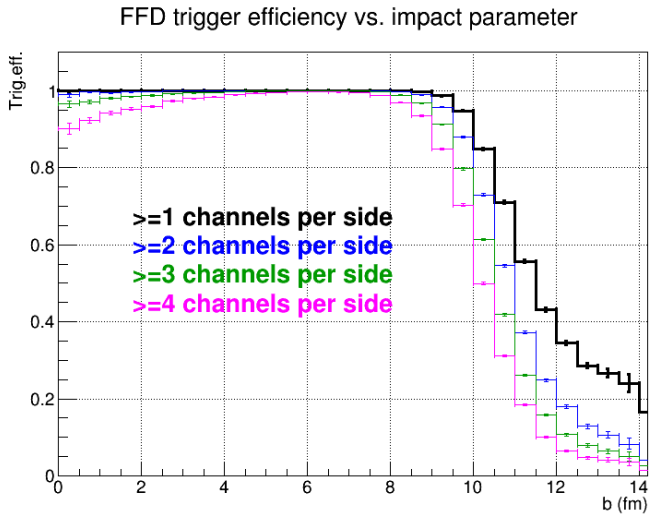


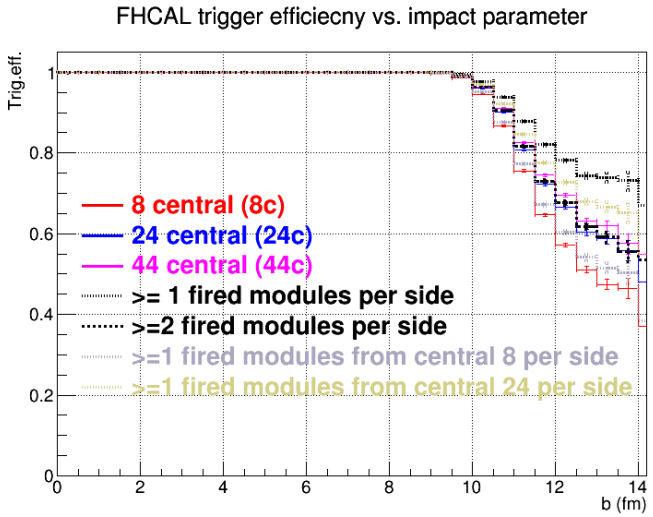
Efficiency:

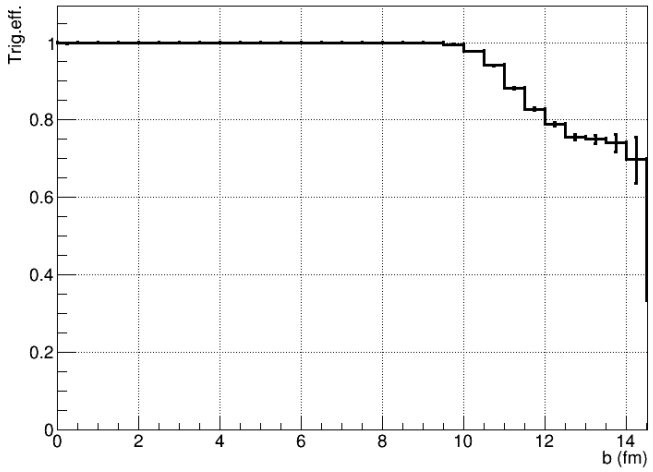
- FFD: 87, 81, 77, 72%
- FHCAL: 97, 96, 95, 95%
- FFD|FHCAL: 97%
- TOF: 97, 94, 91, 89%

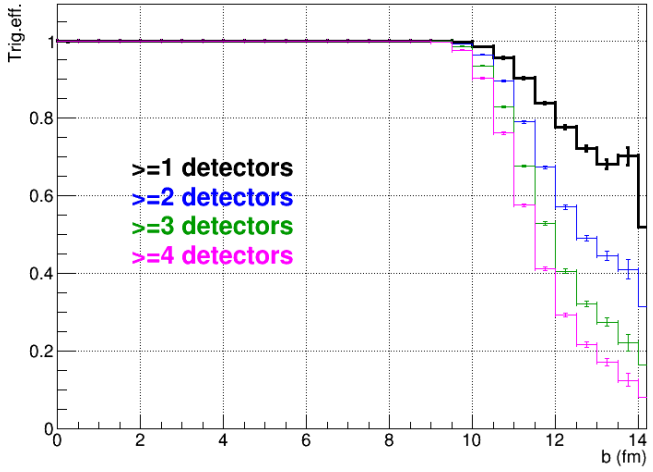
- Observe mild drop of efficiency for most central collisions

Xe + Sn , z_{vertex} = -85 cm





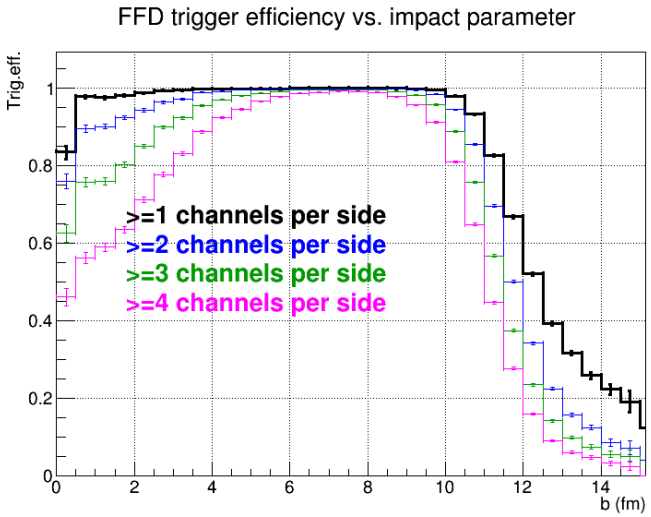


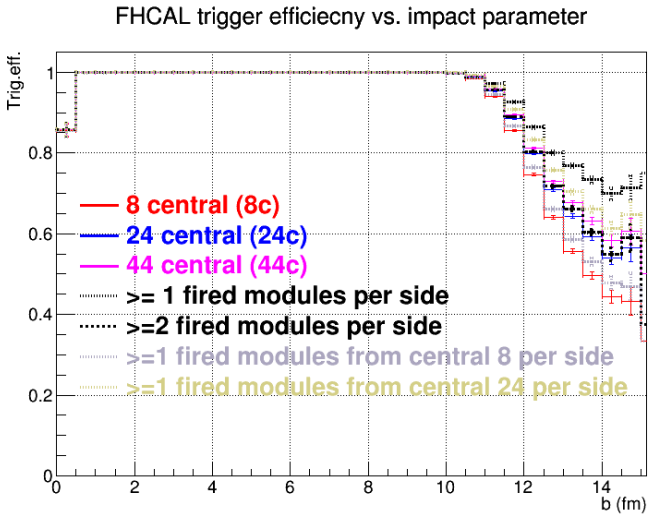


- Efficiency:
  - FFD: 87, 82, 78, 73%
  - FHCAL: 97, 96, 95, 95%
  - FFD|FHCAL: 97%
  - TOF: 97, 94, 91, 88%

- Drop of efficiency for most central collisions became smaller

Xe + W , z_{vertex} = -115 cm





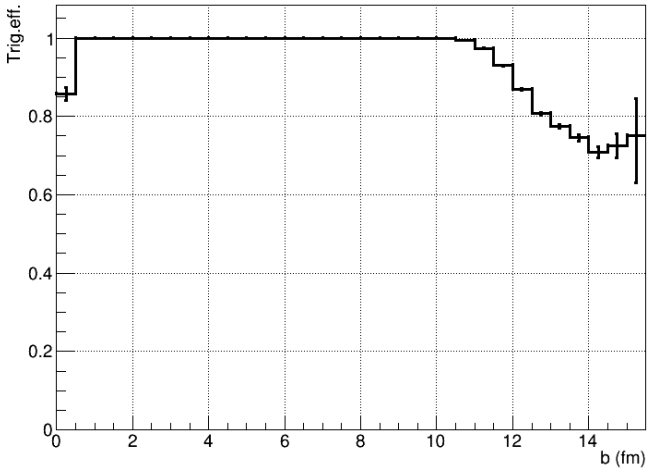
Efficiency:

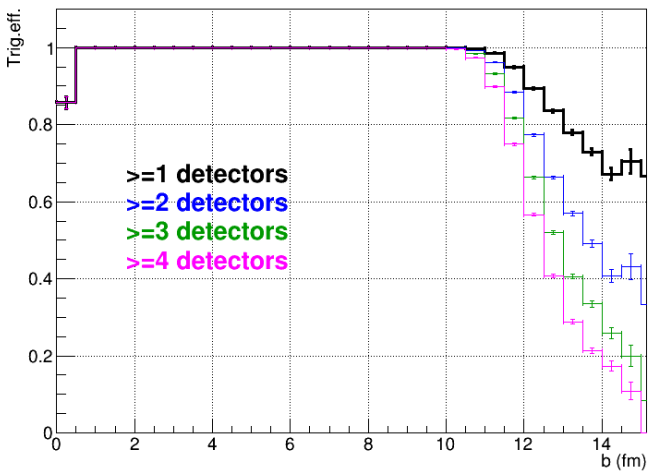
FFD: 88, 82, 78, 72%

FHCAL: 97, 96, 96, 95%

FFD|FHCAL: 97%

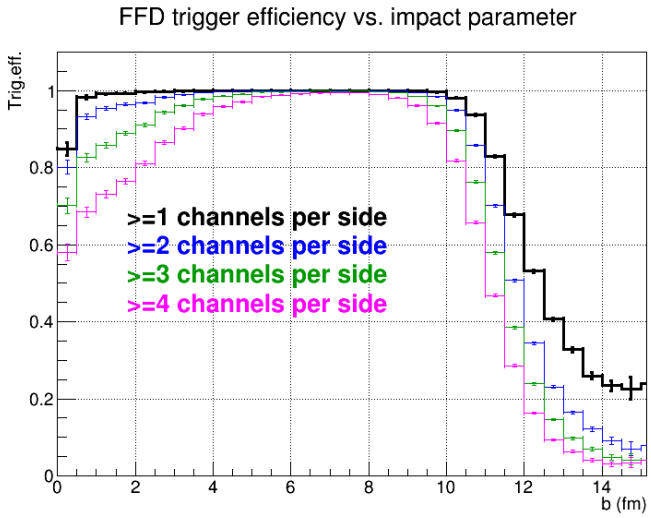
TOF: 97, 94, 92, 90%

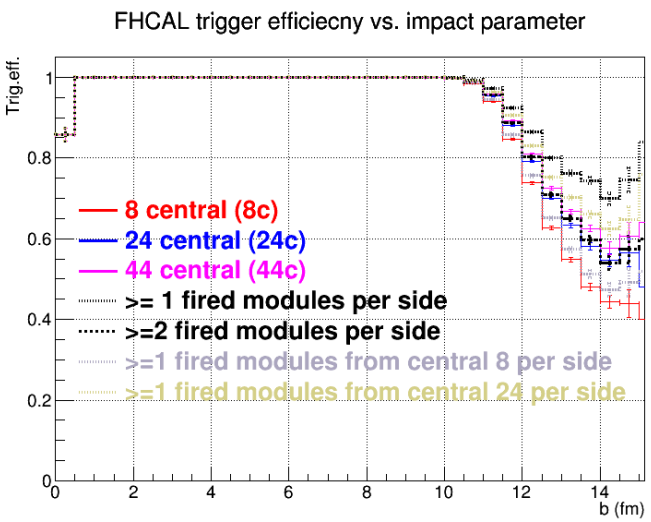


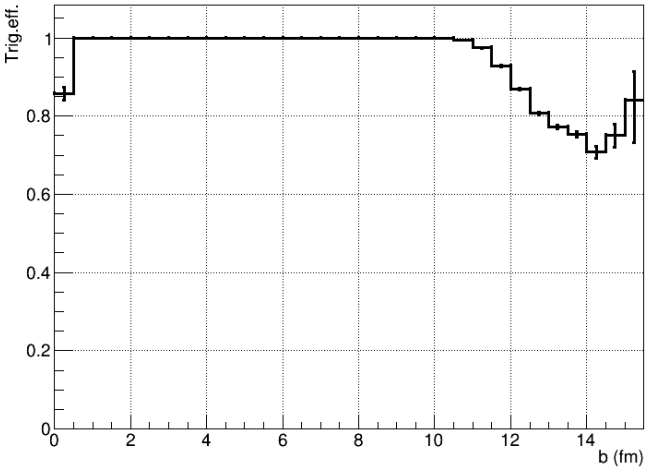


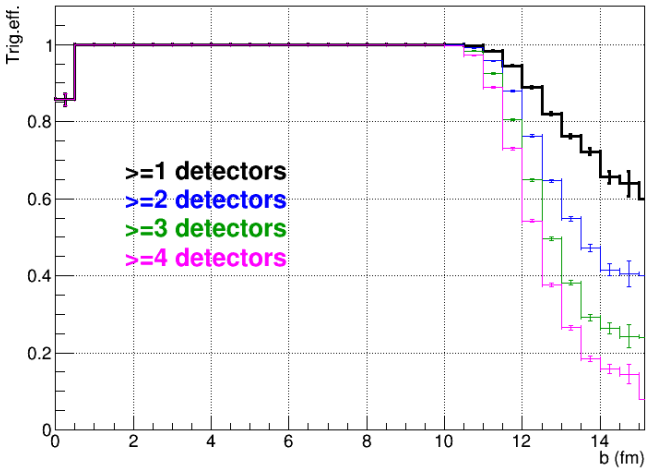
- Observe stronger drop of efficiency for most central collisions and higher efficiency for peripheral collisions for W compared with Sn

Xe + W , z_{vertex} = -85 cm







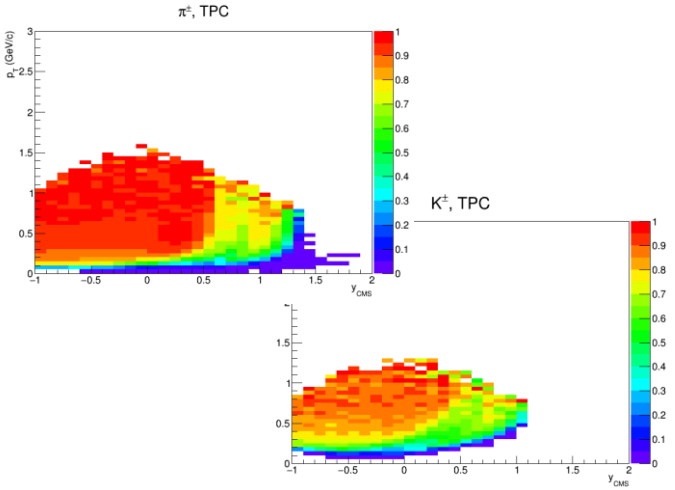


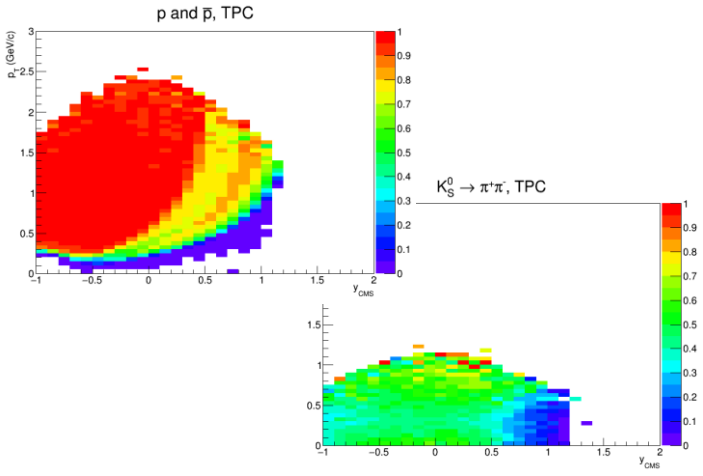
- Efficiency:
  - FFD: 88, 82, 78, 74%
  - FHCAL: 97, 96, 96, 95%
  - FFD|FHCAL: 97%
  - TOF: 97, 94, 91, 89%

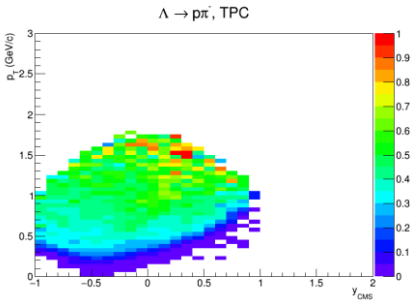
- Drop of efficiency for most central collisions became smaller

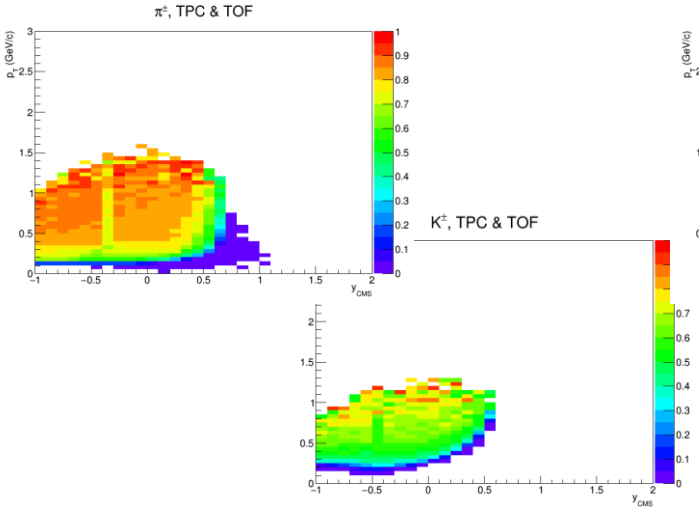
Efficiency for π/K/p/Ks/Λ, z_{vertex} = -115 cm

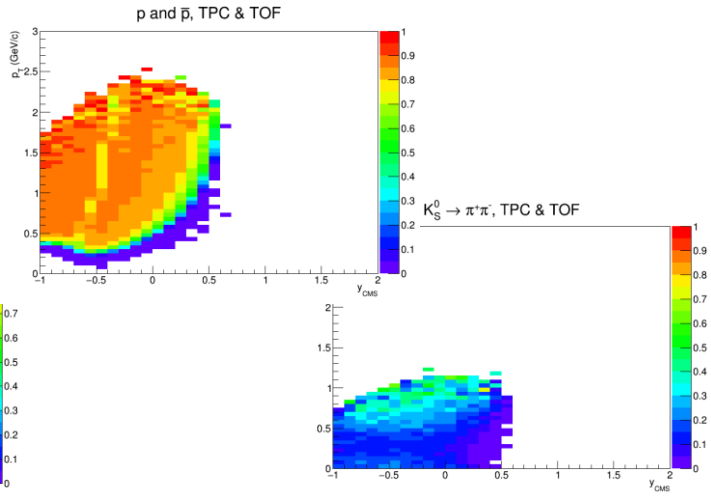
- N_{hits} > 10; DCA < 2 cm; Primary particles ($R_{production}$ < 1 cm)

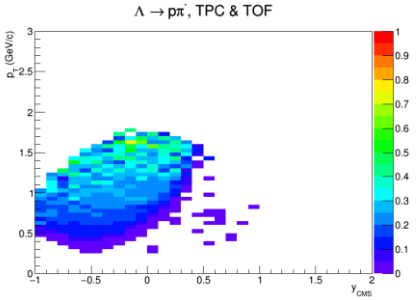






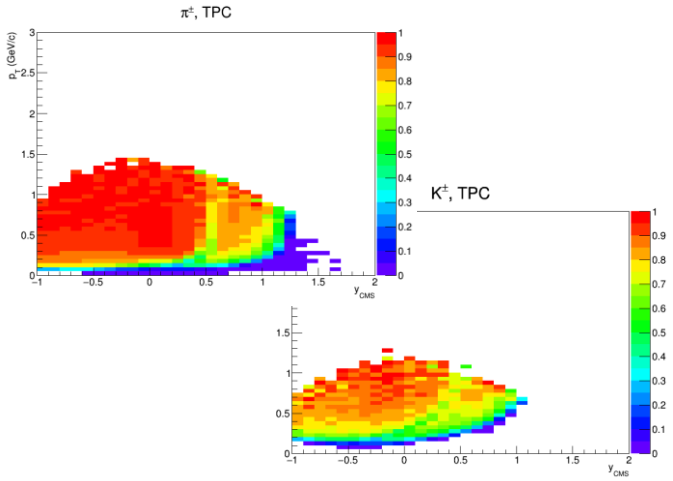


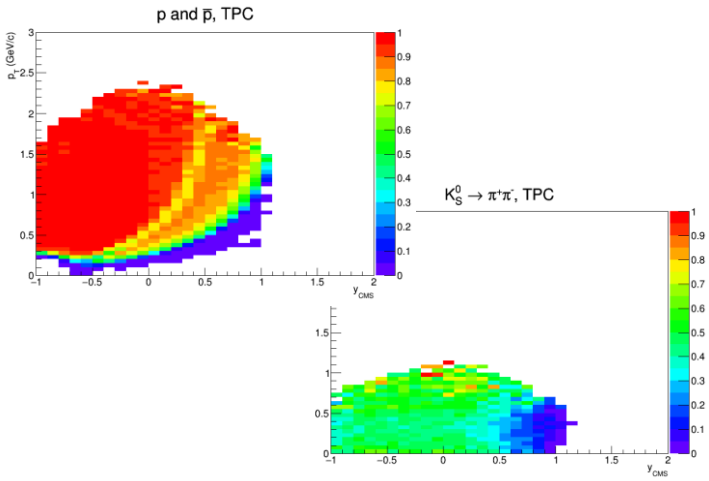


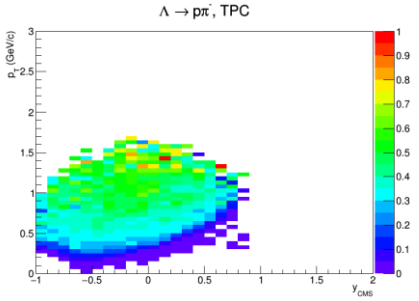


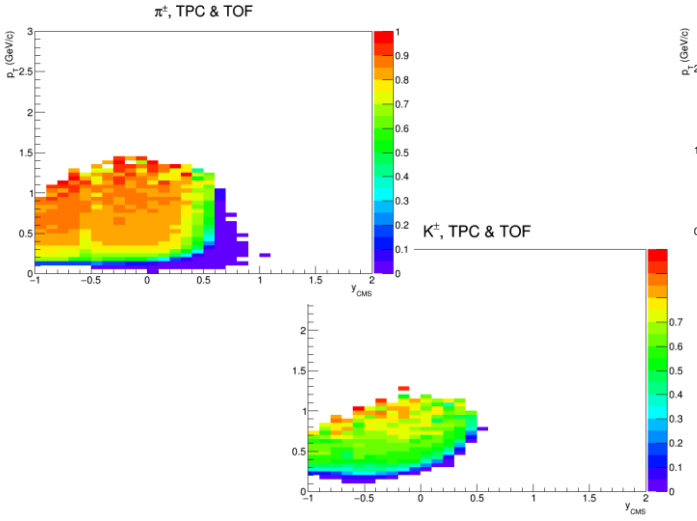
Efficiency for π/K/p/Ks/Λ, z_{vertex} = -85 cm

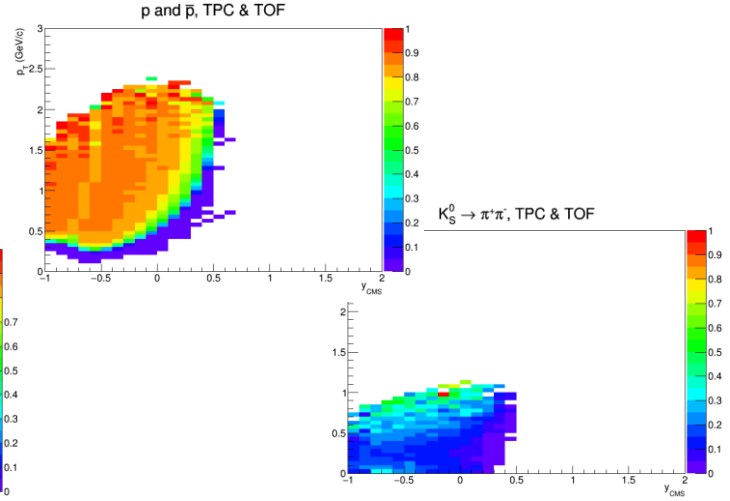
- N_{hits} > 10; DCA < 2 cm; Primary particles ($R_{production}$ < 1 cm)

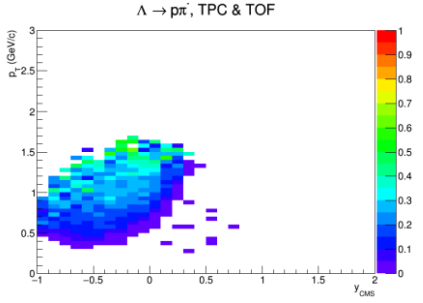












Conclusions

- Trigger efficiency is slightly better if event vertex is closer to the MPD center
- Trigger efficiency drops below 100% in most central collisions for heavier targets, the heavier the target the larger the effect. Qualitatively effect is explained in slide 4, which reports lower occupancy for forward detectors for heavier targets
- Detector acceptance gets worse as the event vertex moves closer to the MPD center
- Event vertex within 80-115 cm still provides reasonable p_T-coverage at $y_{CMS} \sim 0$

BACKUP