Trigger efficiency evaluation in the xenon run of the BM@N experiment with a beam kinetic energy of 3.8 AGeV

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Outline



- 1. Trigger system
- 2. BD efficiency
- 3. FD efficiency
- 4. Pile up suppression using BC2
- 5. Dependence of trigger system parameters on run id
- 6. Efficiency of BD and FD and its systematics
- 7. Interface for getting trigger efficiency in BmnRoot
- 8. Conclusion

Trigger system







BD efficiency



Base procedure

- Denominator: events with MBT flag (after reduction) && FD signals in TW
- Numerator: as denominator &&
 BD signals in TW (NBD≥4)
 ε_{BD}: numerator divided by

denominator



FD parameters Trigger window

Signal amplitude



BD efficiency



70



- Runs with **Mixed Trigger** Correction for events with NBD<4
- 1 Xe ion by **BC1** in 3 µs



FD efficiency



Base procedure

- Denominator: events with CCT1 flag (after reduction) && BD signals in TW
- Numerator: as denominator &&
 FD signals in TW
 (Amp_{FD}<4250)
- ϵ_{FD} : numerator divided by denominator



✓ Runs with Mixed Trigger
 ✓ 1 Xe ion by BC1 in 3 µs
 (suppresses the number of events by ~4 times)

Pile up suppression using BC2





- Long and deep negative tail after the signal in BC2
 - Only positive amplitudes are included in the integral
 - The integral is calculated in a window of ±150 ns relative to the middle of trigger window (TW)
 The peak with 1 Xe ion is clearly distinguished by the integral

Pile up suppression using BC2





- ✓ Different BC2 trigger windows
 ✓ Part of events after nBC2Xe==1 cut
 ✓ Total FD efficiency
 ✓ The window TML 40 perior shown as entimeday.
- The window TW±40 ns is chosen as optimal

8

Dependence of trigger system parameters on run id







10⁵

10⁴

 10^{3}



BC2 time by TQDC
 BC2 time is stable during Xe run
 BC2 integral changed

BD and FD efficiency by runs





BD efficiency is quite stable during Xe run
 FD efficiency varies significantly

BD and FD efficiency systematics

✓ The statistical uncertainty in each NTrPV bin does not exceed 5%
 ✓ 4 run ranges for systematics of **BD**, 5 run ranges – for **FD** ✓ When calculating the ε_{BD}, the BC2 cat rejects 0.5% of events, for ε_{FD} – 8%

Combined efficiency of BD and FD

- Efficiency reaches a plateau (90-95%) above 15 NTrPV and below
 9 fm according to b
- Peripheral events are recorded with less efficiency (down to 20%)

Interface for getting trigger efficiency

git.jinr.ru/nica/bmnroot/-/tree/dev/physics/run8?ref_type=heads Update ~ \rightarrow C Explore Sign in Register Q Search or go to ... NICA / - BmnRoot M Project 2 dev ~ bmnroot / physics / run8 Find file Code v Man BmnRoot clang-format fix 2 88 Manage ß cebd6b83 History Vasily Plotnikov authored 4 weeks ago 🔁 Plan <>> Code 5 Name Last commit Last update Deploy > ... -11 Monitor 5 C++ BmnTriggerEfficiencyRun8.cxx clang-format fix 2 4 weeks ago Analvze h BmnTriggerEfficiencyRun8.h Add fNBd field 1 month ago

- ✓ Added BmnTriggerEfficiencyRun8 class to BmnRoot
- ✓ Allows to obtain the ϵ_{Tr} , its statistical and systematic uncertainties by the run id and the NTrPV
- \checkmark Allows to select events for analysis
- Example of use in a macro CheckTriggerEfficiencyInterfaceRun8.C

- 1. The methodology for assessing the trigger efficiency has been developed
- 2. The efficient way to filter pile up events using BC2 beam counter has been found
- 3. The analysis of the stability of the key trigger detectors during the Xe run was carried out
- 4. Added interface to BmnRoot to get trigger efficiency
- 5. The correctness of the estimate of ε_{Tr} was verified by calculating the cross section of inelastic interactions Xe + CsI based on the BM@N data
- 6. Planned for publication in **PEPAN Lett**, reviewer needed

Thank you for attention!

Pile up suppression using BC1

NBD<4 correction procedure

Base procedure

- Denominator (h1): events with MBT flag (AR) && FD signals in TW
- Numerator (h2): as denominator&& BD signals in TW
- Numerator divided by denominator

Correction for h2

- h3: events with CCT2 flag
 (AR) && NBD<4 (signals in TW)
 - h4: events with MBT flag (AR) && (NBD==4 || NBD==5)
- ✓ h5: events with CCT2 flag (AR) && (NBD==4 || NBD==5)
- ✓ h3 → Scale(NEvents(h4)/ NEvents(h5))
- ✓ $h2 \rightarrow Add(h3)$

BD efficiency and systematics

The central value is explored in more detail (in 13 run ranges)

✓ The statistical uncertainty in each NTrPV bin does not exceed 5%

FD efficiency and systematics

✓ The central value is explored in more detail (in 62 run ranges)

✓ The statistical uncertainty in each NTrPV bin does not exceed 5%