

High Purity Beam in the TRIUMF M13 CHANNEL

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For the PIENU collaboration

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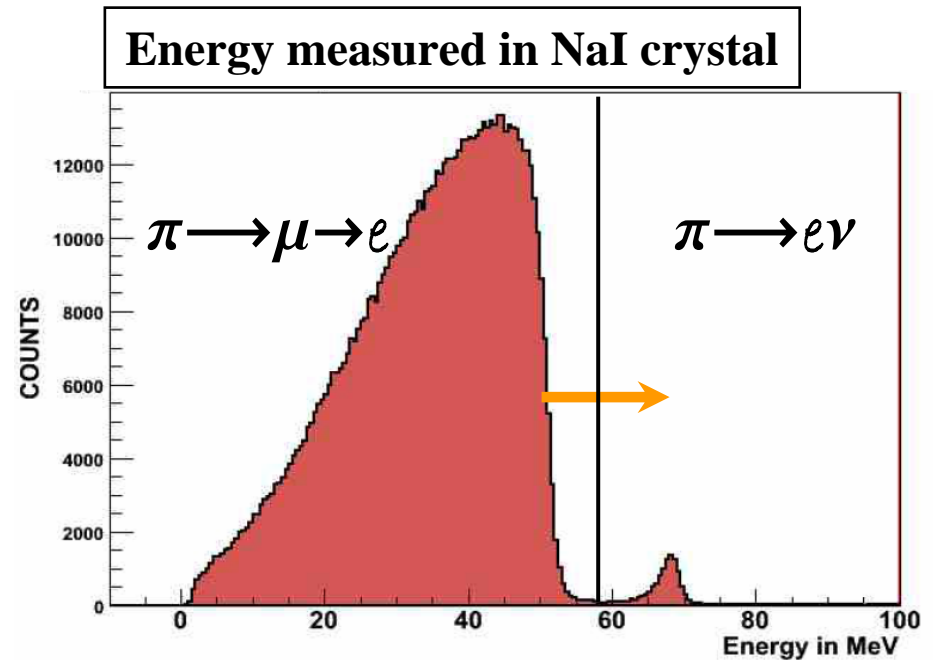
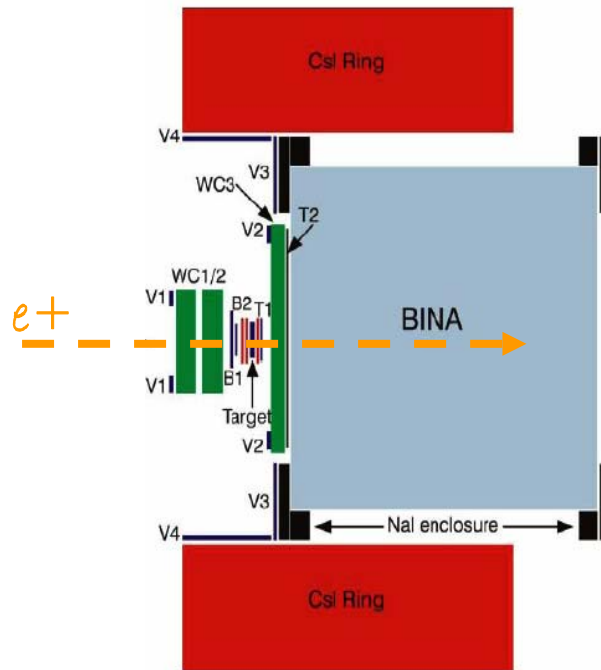
1. Arizona State University, 2. Brookhaven National Laboratory, 3. KEK, 4. Osaka University, 5. TRIUMF, 6. Tsinghua University 7. University of British Columbia, 8. University of Northern British Columbia, 9. Virginia Tech

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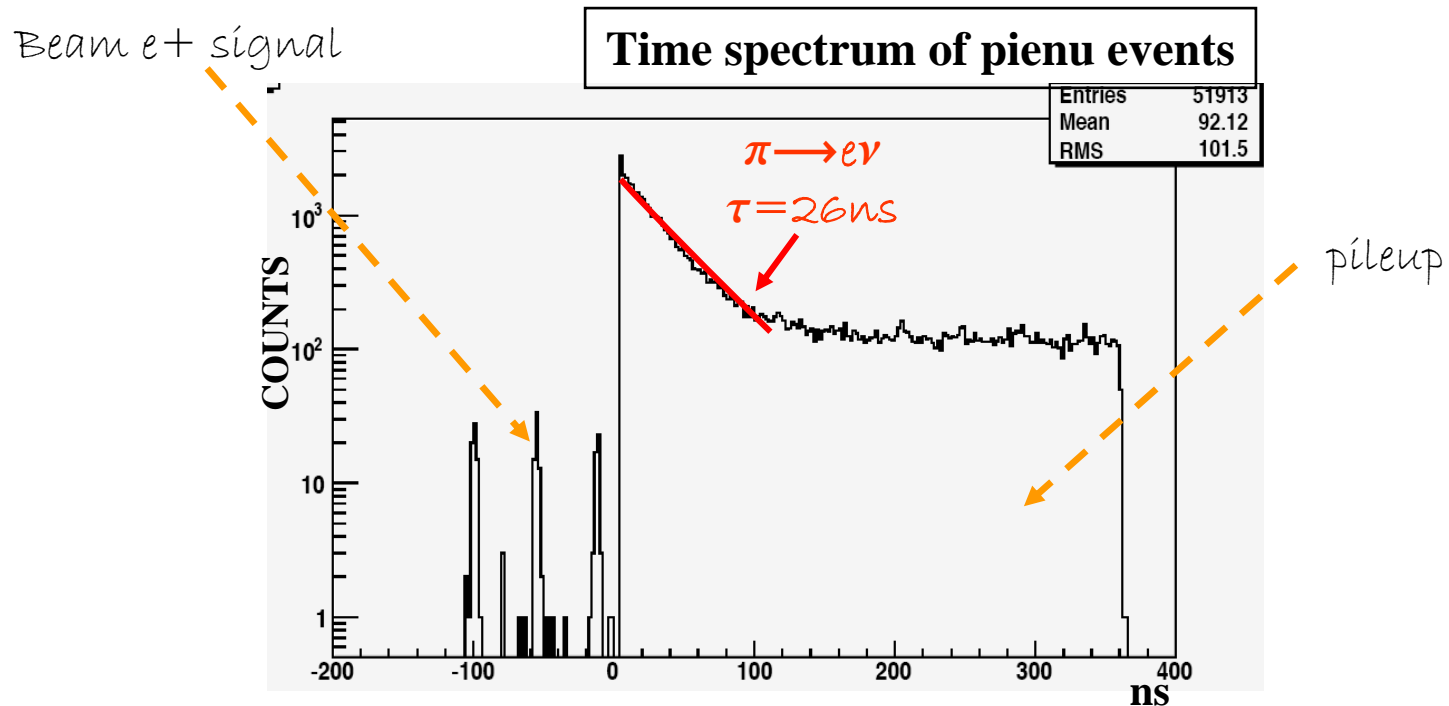
PIENU Experiment

Requirements

- Good beam quality \rightarrow small momentum bite
- Low background
 - Trigger from beam e^+
 - Pileup from beam e^+ hitting beam or detector components



PIENU Experiment (cont'd)



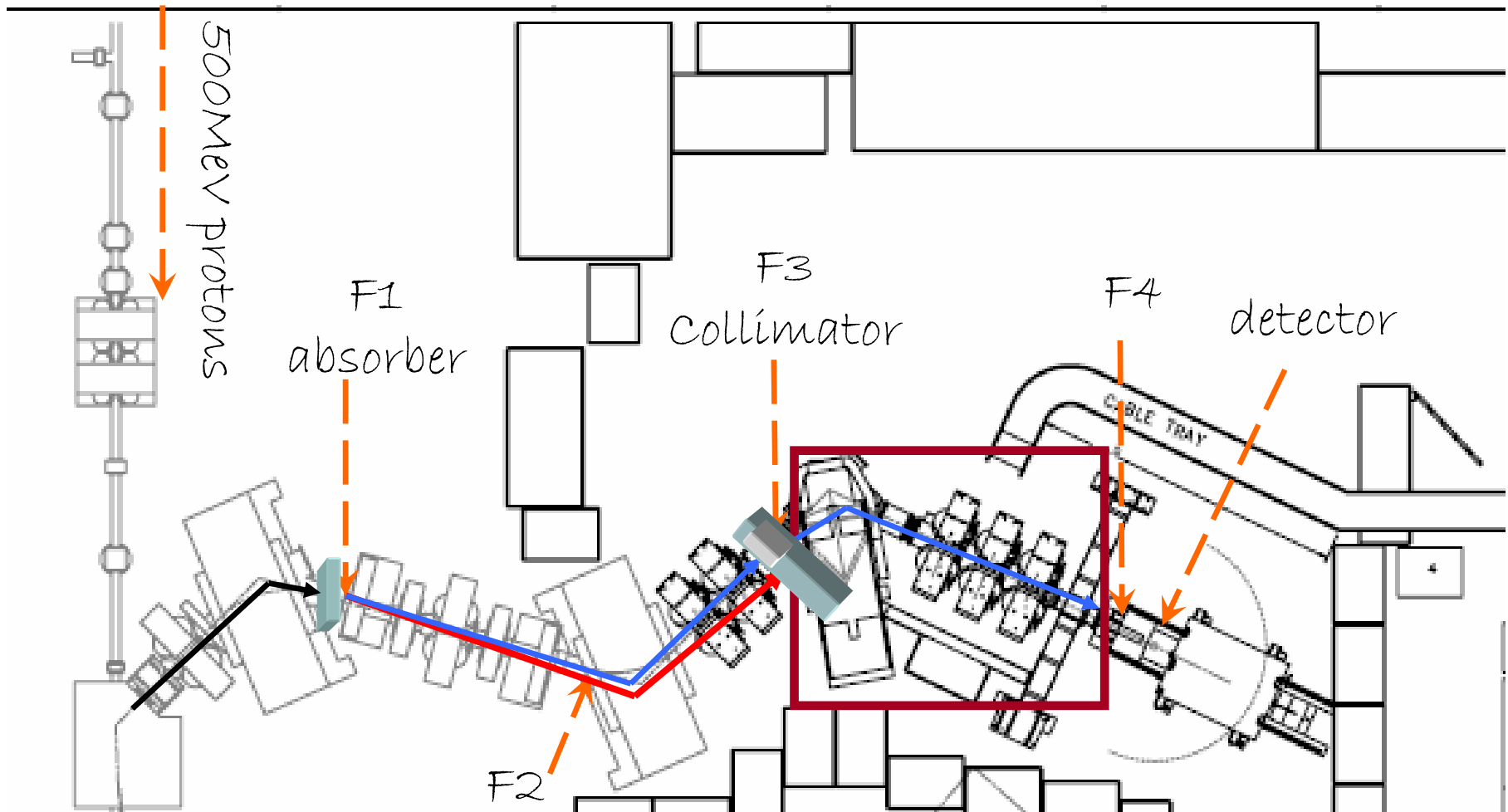
Beam composition before Beamline extension :

$\pi^+ \sim 50\%$

$\mu^+ \sim 20\%$

$e^+ \sim 30\%$

Beamline extension concept



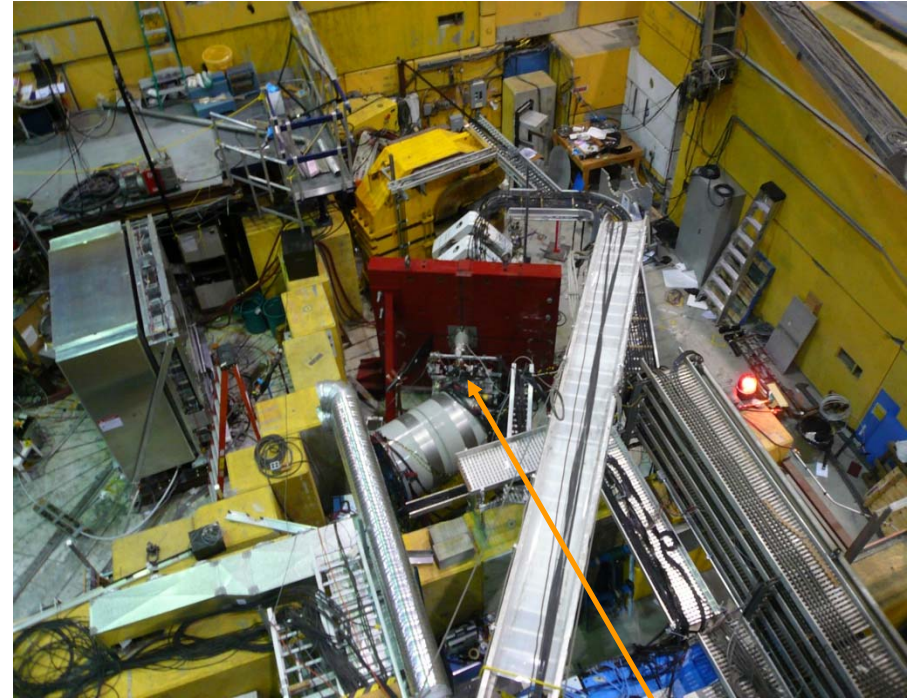
Monte-Carlo

- Beamline extension studies with 2nd order MC beam transport program (REVMOC)
- G4 (G4beamline) simulation of the beamline material's and absorber effects
- Expectations :
 - ~ 4-5 cm e/π separation at F3
 - ~100 e^+ reduction

View of the beamline

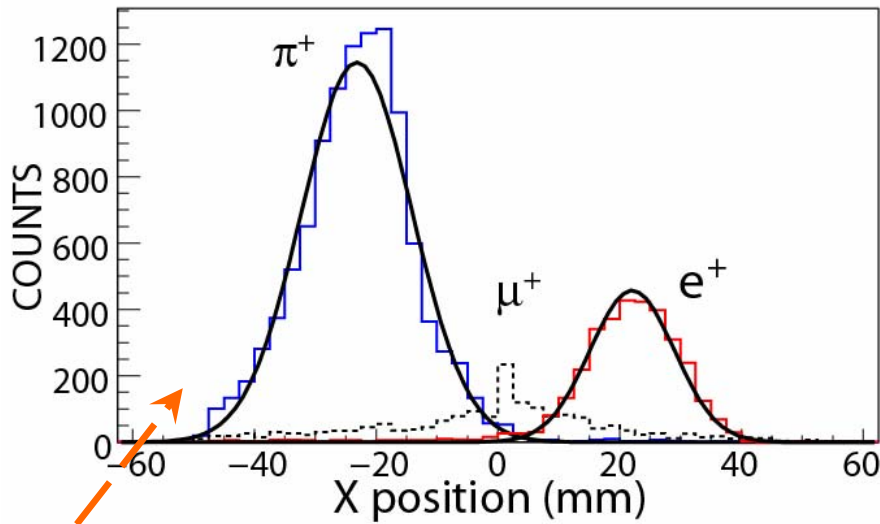


F3
M13 beamline in May 2008

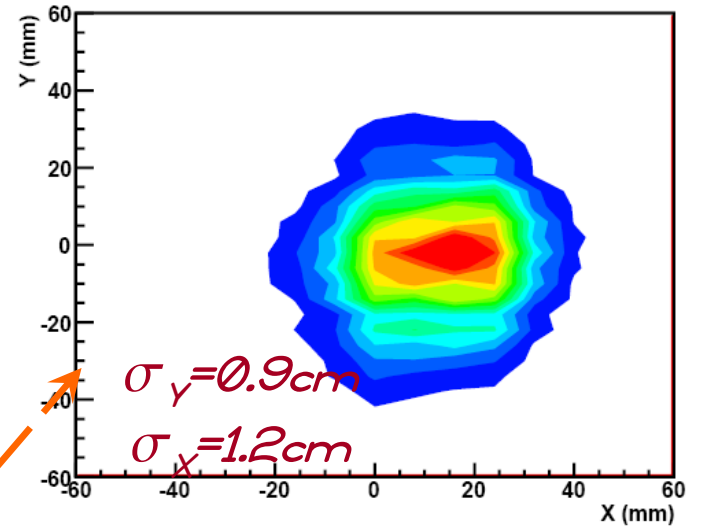


F4
M13 beamline after extension
in May 2009

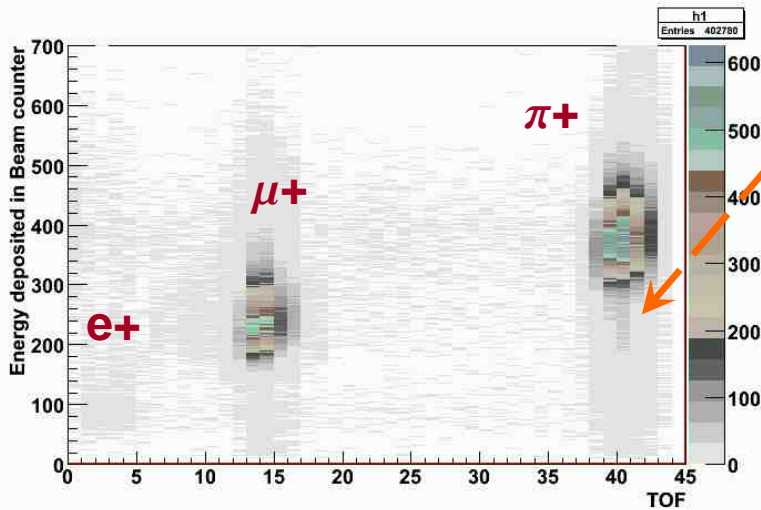
Results



at F3



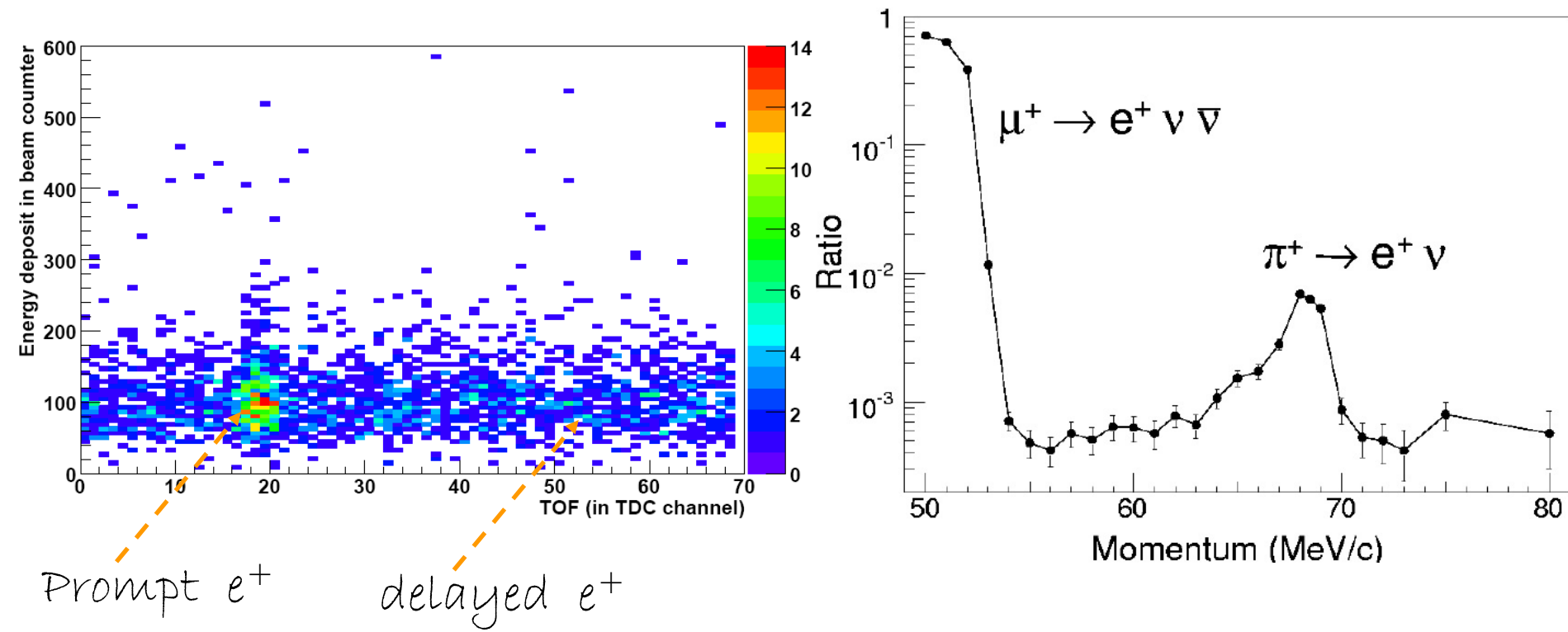
at F4



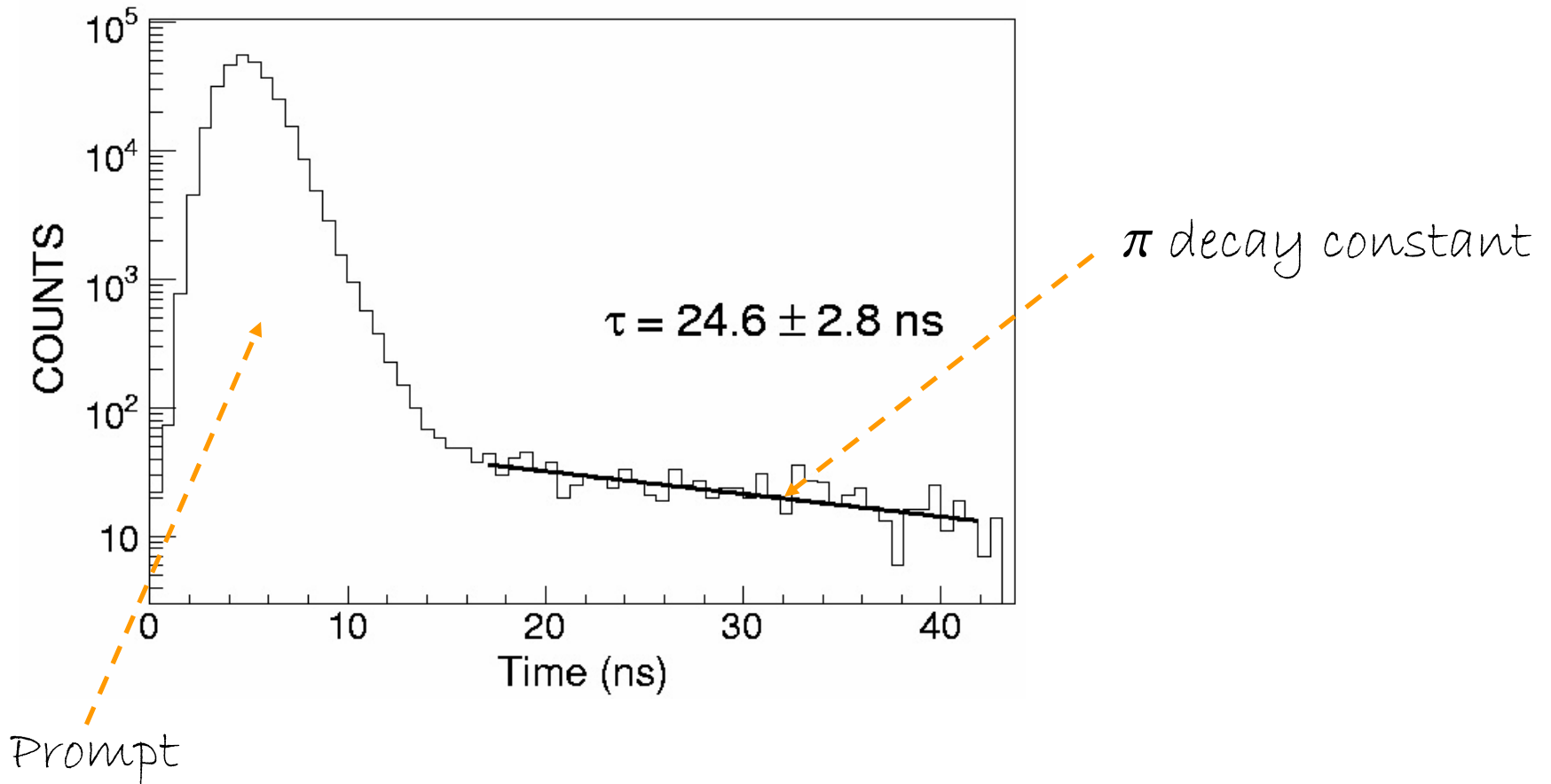
$\pi^+ \sim 82\%$
 $\mu^+ \sim 14\%$
 $e^+ < 2\%$

PIENU decay in production target

- First observation of $\pi \rightarrow e \nu$ from the production target
- Massive ν search



PIENU decay (cont'd)



Target PIENU positrons are 100% polarized

Summary

- The new TRIUMF M13 CHANNEL meets the PIENU experiment's requirements
 - Good beam spot at F4
 - Excellent e^+ suppression (1/60)
- First Observation of pienu decay from the beamline → source of 100% polarized e^+