Summary of μSRBeam Studies at M13

TWIST Collaboration Meeting

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(Talk summary goes here.)

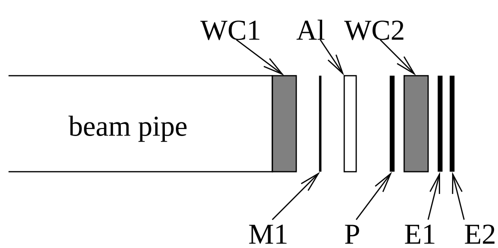
Momentum Scans

Beryllium target	**1st scan**	**2nd scan**
B1 Field at Edge (Gauss)	878.7 ± 0.4	877.8 ± 0.4
Momentum bite	1.6%	1.8%

- Scans with beryllium T1 target took place Nov. 13 and Nov. 20, 2000.
- Scans performed using muon scaler normalized to T1ION scaler (ie. normalized to proton current).
- B1 field measured by NMR probe.
  - Uncertainty represents coarseness of B1 power supply control.
- Momentum bite = width of edge (10%–90% levels).

$$B \propto p \quad \Rightarrow \quad \frac{dB}{B} = \frac{dp}{p}$$

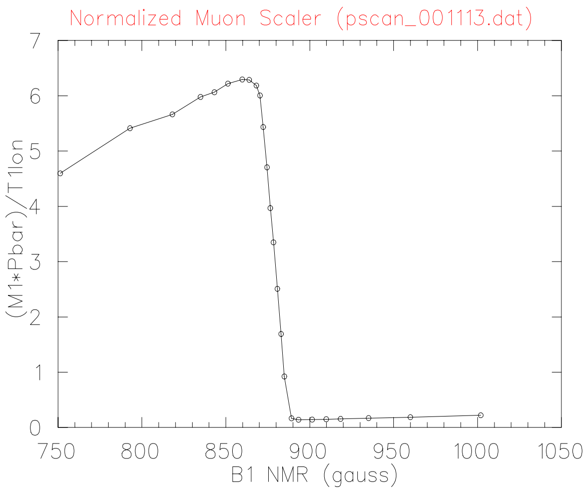
  - Good agreement with Jaap Doornbos's prediction:
    F1 Horizontal Slit @ 2.5 cm $\Rightarrow \frac{dp}{p} = 2\%$.



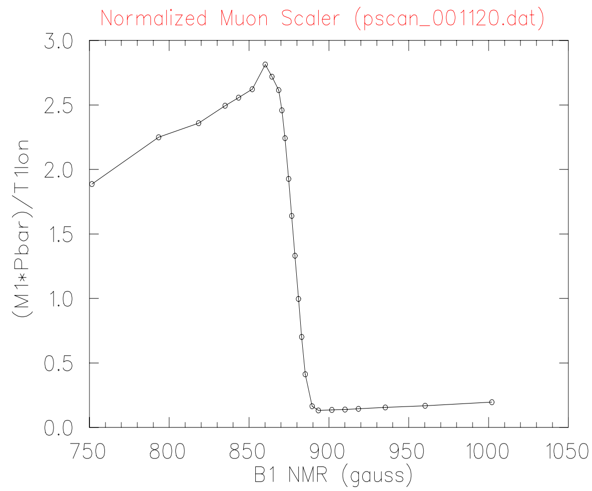
Schematic of apparatus. M1, P, E1, E2 are scintillators. WC1, WC2 are wire chambers. Al is aluminum sheets. (Not to scale.)

Momentum Scans—Beryllium Target

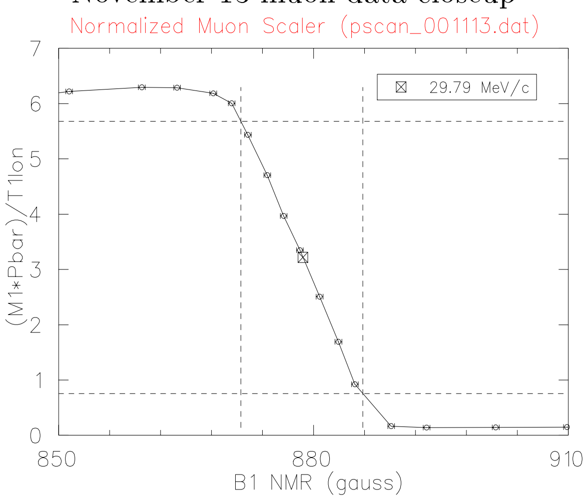
November 13 muon data



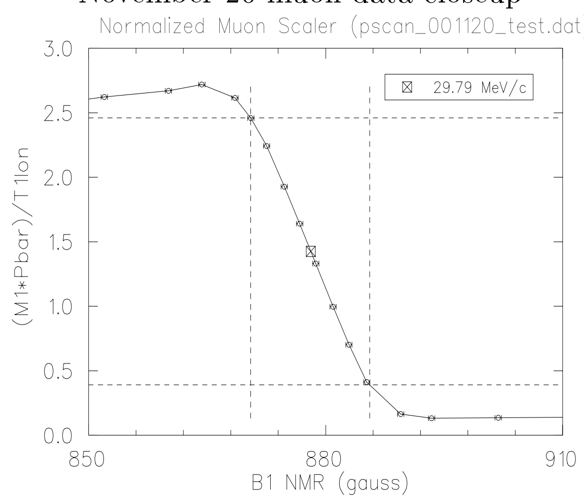
November 20 muon data



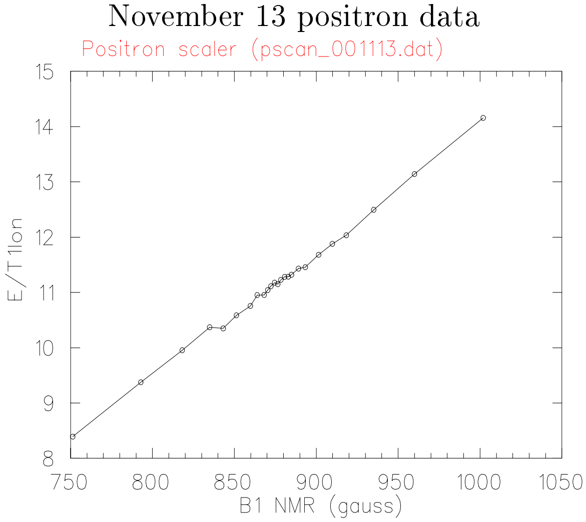
November 13 muon data closeup



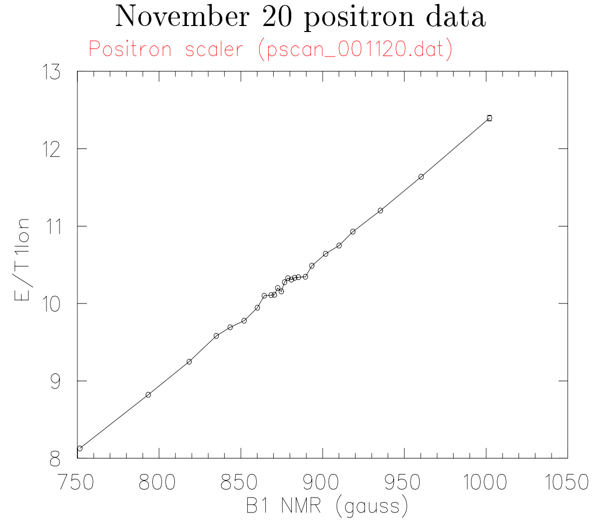
November 20 muon data closeup



November 13 positron data



November 20 positron data



Summary of μSRStudy Results

Particle Type	**Relative Rate**	**Relative Polarization**
Surface muons*	1.00	1.000 ± 0.008
"Mystery" muons**	0.00227	0.9 ± 0.3
Cloud muons	0.089	0.299 ± 0.006
Pions	0.018	
Positrons	5.2	

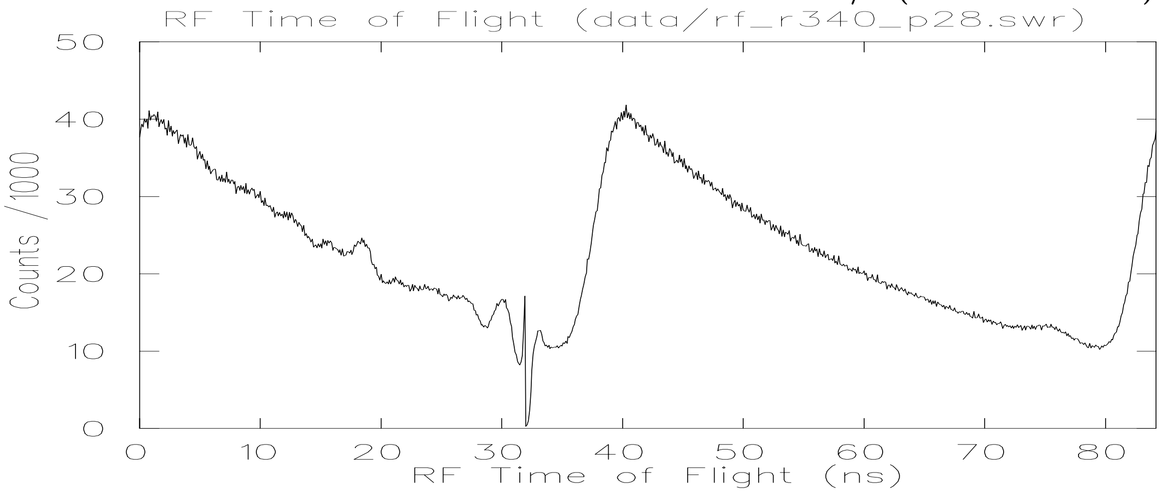
* Rates and Polarizations are relative to surface muon measurements.
** These are believed to be surface muons.

RF Structure of M13 Beam

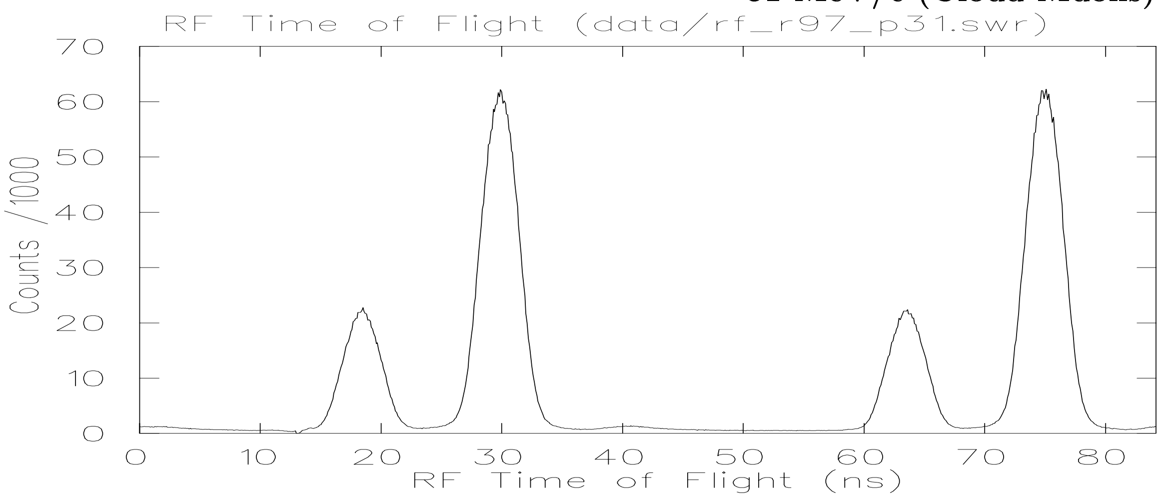
- Proton beam composed of pulses, cyclotron frequency $\approx$ 43 ns.
- M13 beam has structure on the same frequency.
- Particle types:
  - Surface muons
  - Cloud muons
  - Pions
  - Correlated positrons
  - Uncorrelated positrons

RF Time-of-Flight

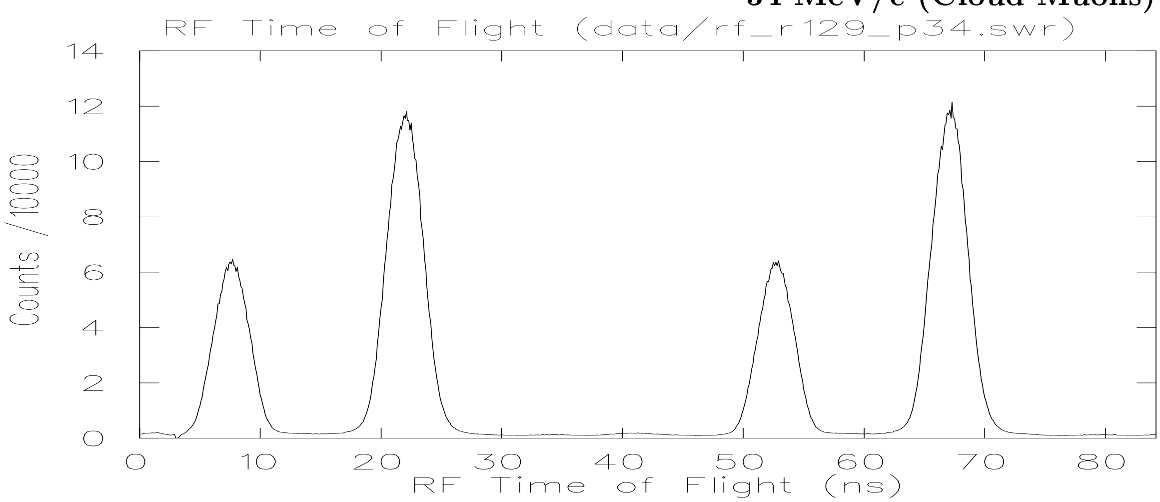
28 MeV/c (Surface Muons)



31 MeV/c (Cloud Muons)

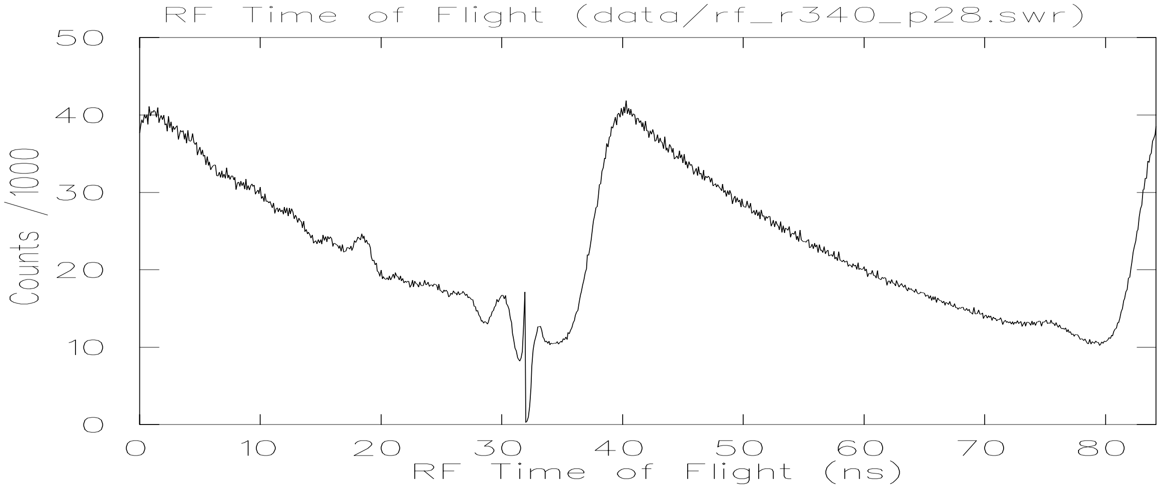


34 MeV/c (Cloud Muons)



Peak Positions at 28 MeV/c

Actual TOF data

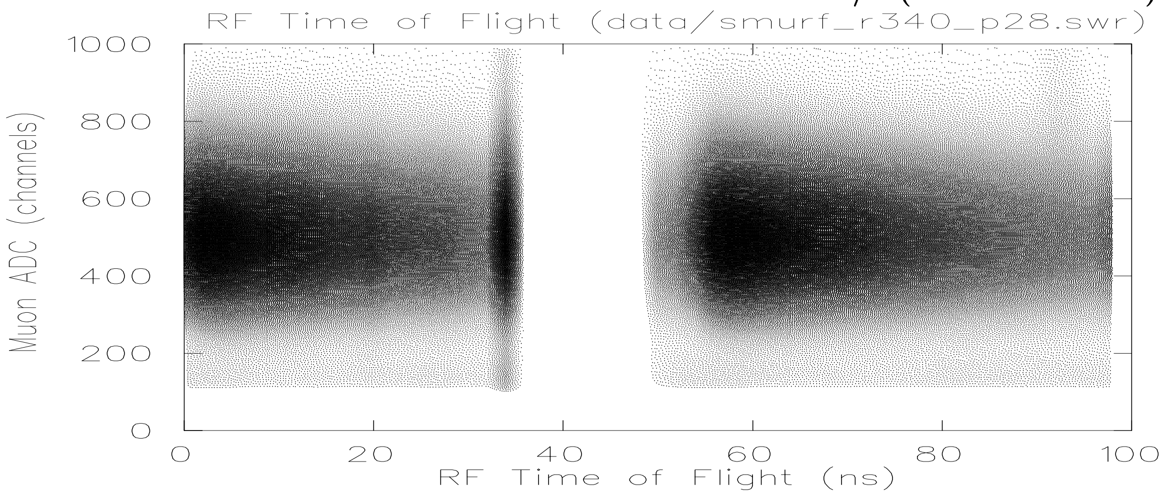


Projected pion and cloud muon peaks

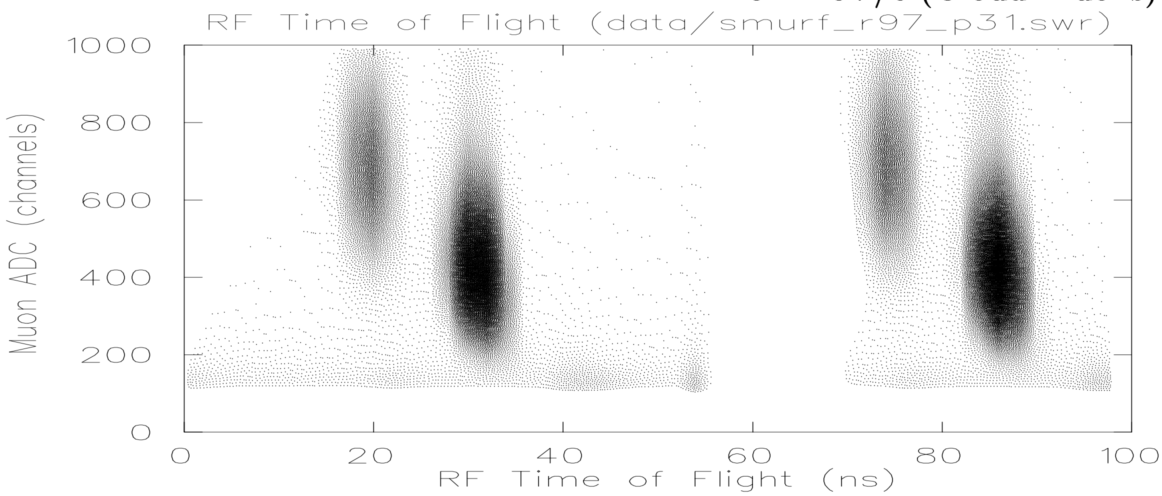
(still to come...)

Muon ADC vs. RF TOF

28 MeV/c (Surface Muons)



31 MeV/c (Cloud Muons)



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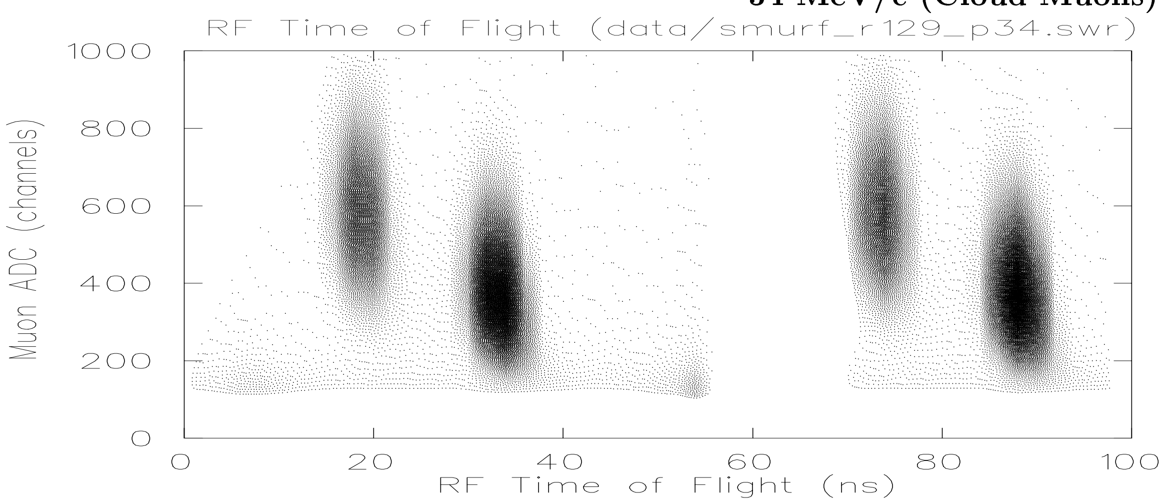


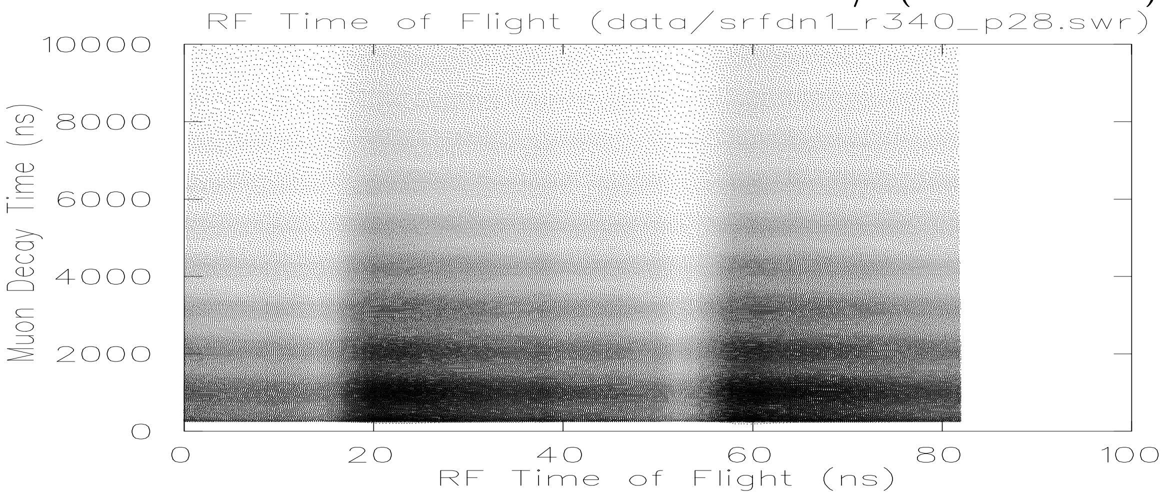
The Calculation of Rates

(Explanation of rate estimation methods goes here. Discusses Muon ADC cut (¿300 Channels), and T1 ION scaler normalization. Also discusses which scalers were used for these measurements (Muon Counter and Positron Counter).)

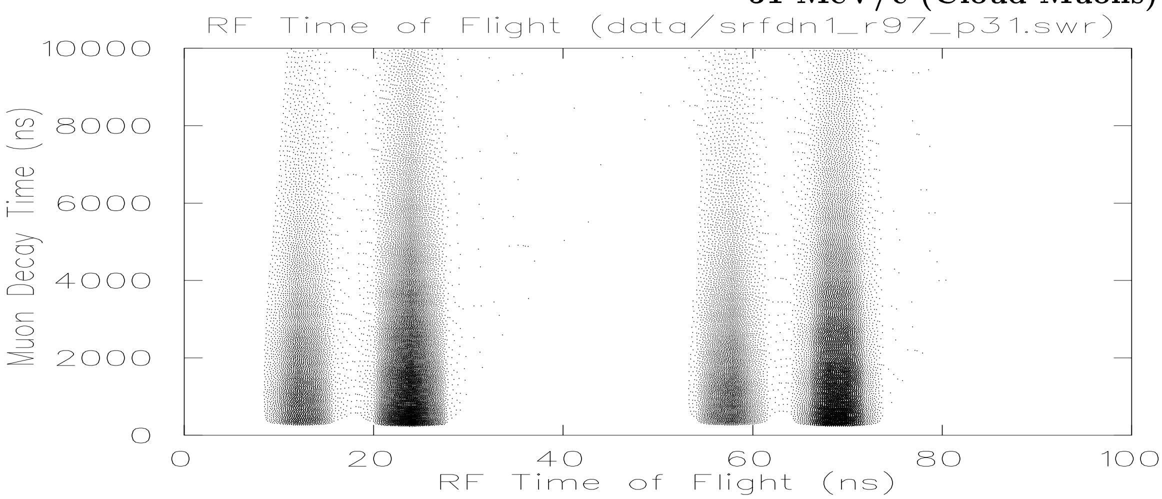
Correlations between Muon Decay Times and RF TOF

(Note: the RF phases are wrong, here. They'll be corrected by the meeting...)

28 MeV/c (Surface Muons)



31 MeV/c (Cloud Muons)



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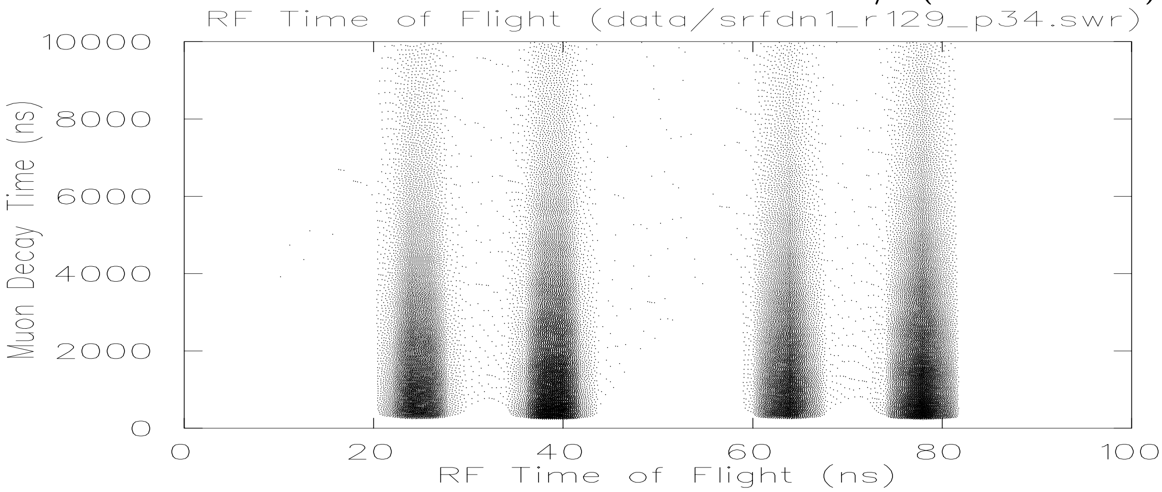

μSRTheory

(This will be a description of what μSRis, as well as the function used to describe it.)

Muon Decay Curves

(Plots showing muon decay data and their best-fit μSRfunctions go here.)

Explanation of “Mystery” Muons

(Discussion of why we think “Mystery” muons are merely more surface muons, including a demonstration that the RF TOF distribution follows a pion decay curve, and reminder that “Mystery” muons have the same polarization as Surface muons.)

Summary and Conclusion