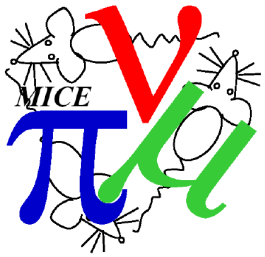

Science & Technology Facilities Council
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Spill Structure (in time delay runs 2888-2895)

Stefania Ricciardi, STFC RAL

MICE 30th Collaboration Meeting

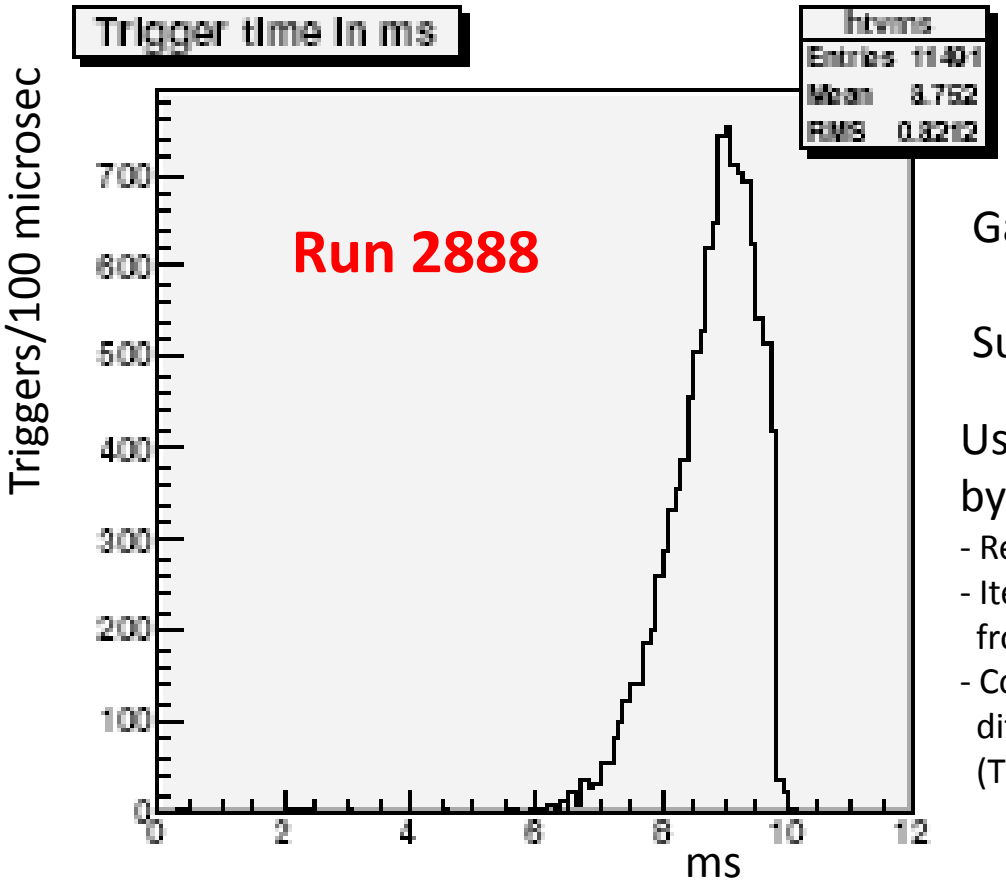
Oxford, 7/7/2011

Motivation

• Validate the assumption that we can have most of the trigger rate in a spill that is about 1ms long.

In MICE, the Spill length is constrained by three systems:
The RF, the target and the DAQ.
The RF has a duty factor of 1/1000 which means that if we want the spill to repeat at 1Hz, the spill length can only be 1ms. This is because normal copper cavities tend to heat up when used at high gradient. If we go for longer spills, the time between spill should be increased.
If we go for too long spills we might exceed the size of the event buffers in the readout electronics we use for the DAQ.
On the other hand, shorter spill repeating more frequently is not allowed by the target system (limited acceleration and coil heating).
1 ms has been chosen as a good trade off. (JSG)

Instantaneous trigger rate



Gate = 10ms [12500 TDC units]

Sum of ~200 spills

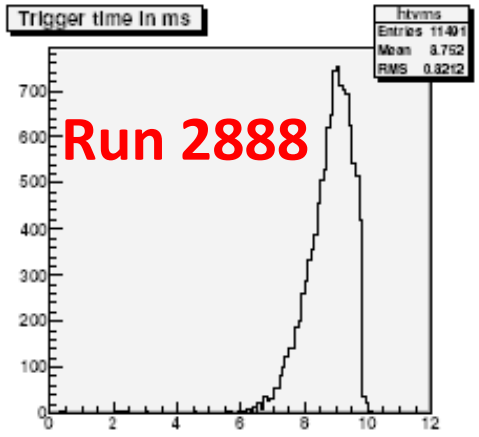
Using a G4Mice application developed by Jean-Sebastien, Adam Dobbs et al.:

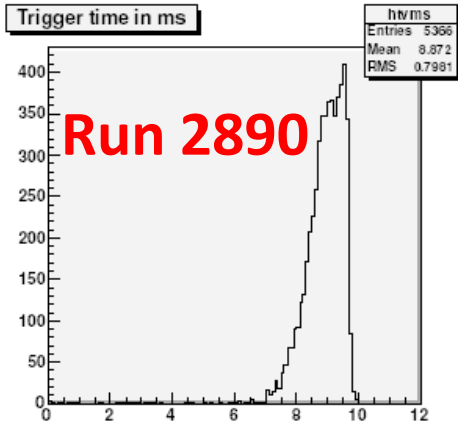
- Read trigger time from TDC (26 bits word, LSB =800ns)
- Iteratively find time end-of-burst from hit pattern, knowing ISIS period (20ms)
- Compute time from start of spill: difference between the two above (TDC overflow dealt with)

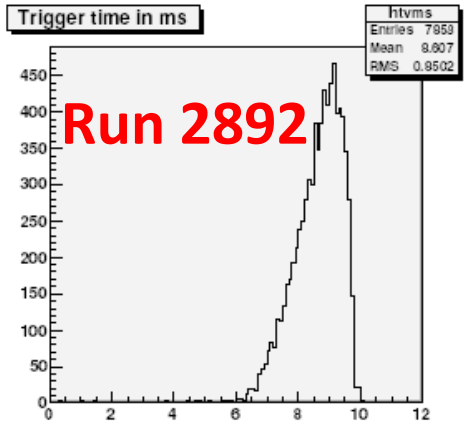
Run Conditions Summary

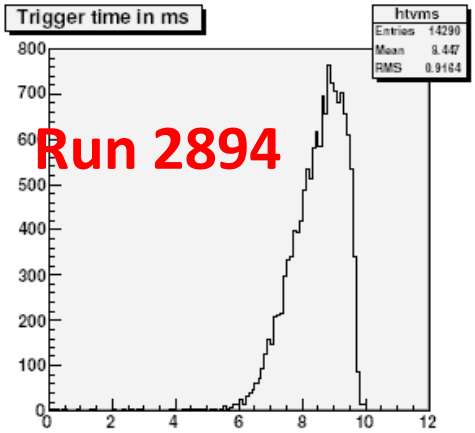
	Target delay	Nominal Beam loss (mV)	Triggers/Spill	Number of pulses
2888	0010000111	1400	66	201
2889	0010001011	850	45	200
2890	0010001111	600	30	200
2891	0010001001	800	42	200
2892	0001111111	1700	81	118
2893	0001111111	1500	72	200
	0001110111	3600		28
2894	0001111011	1500	68	200
2895	0001111001	1700	76	200

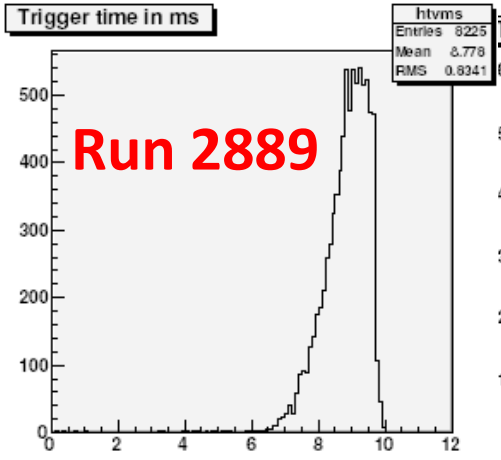
Instantaneous trigger rate (run 2888-2895)

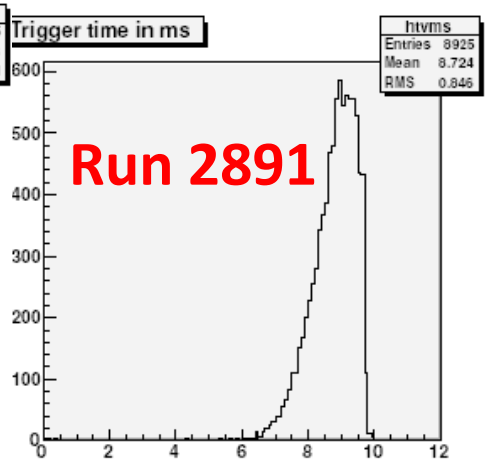


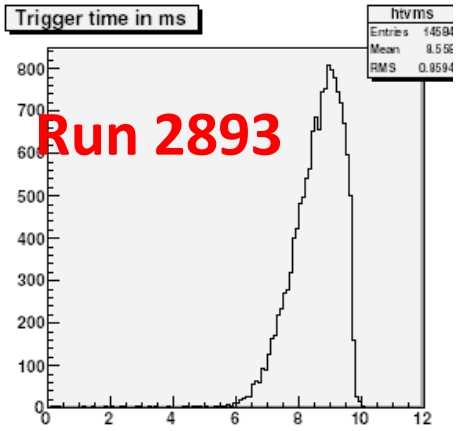


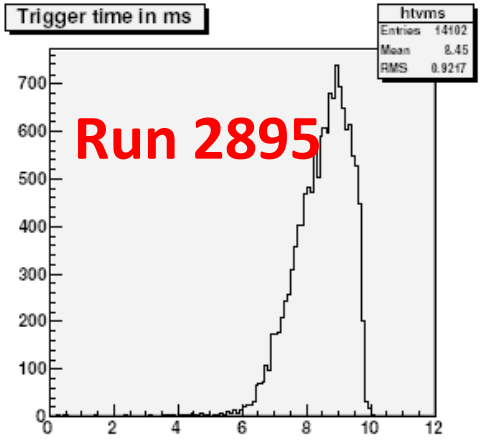








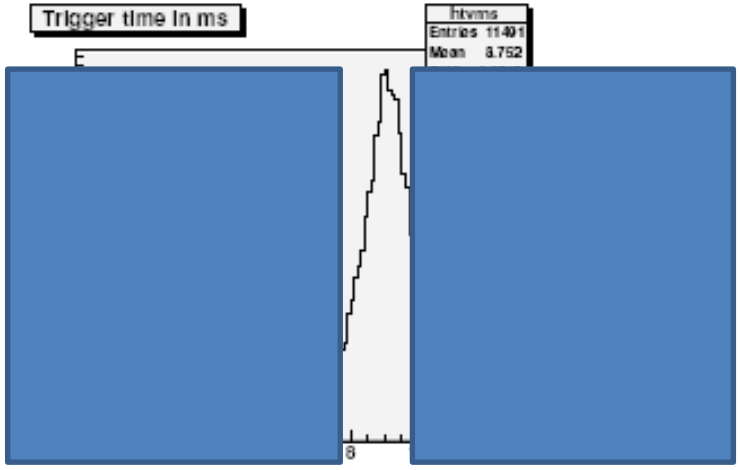




So, what can we learn?

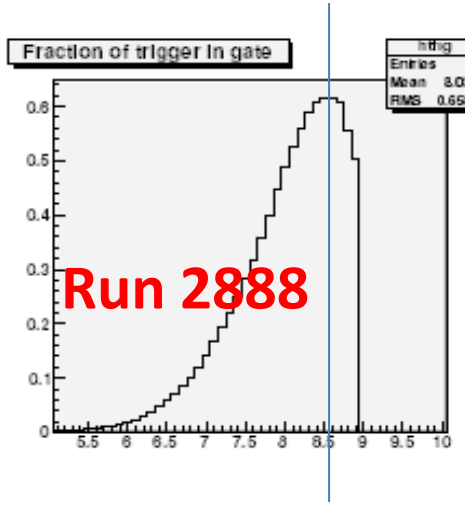
The quality factor is the ratio of the number of triggers in a 1 ms spill to the total number of trigger.

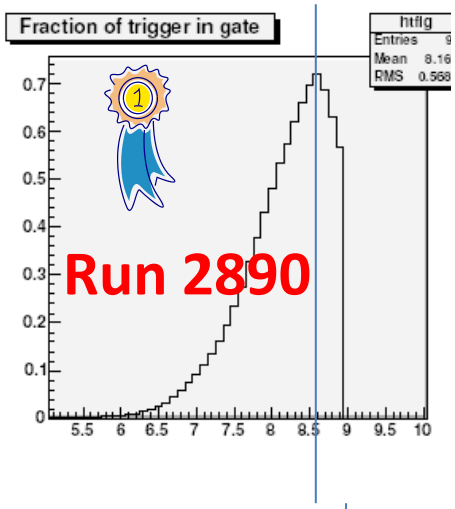
*Up to know, we have been trying to optimize the number of triggers per spill for a given beam loss. Your results allow an additional degree of freedom since we can slide the final ~1ms spill gate to where the muon yield is the best. (*J_S Graulich *)*

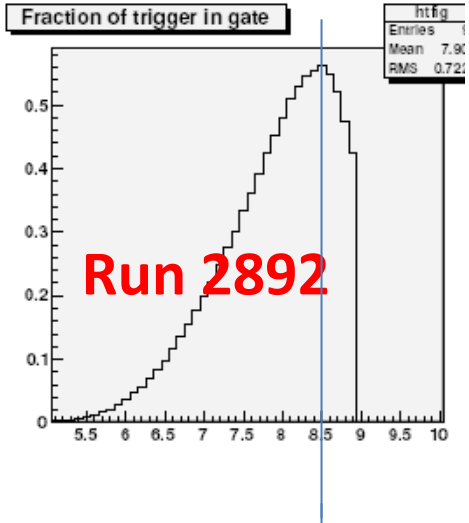


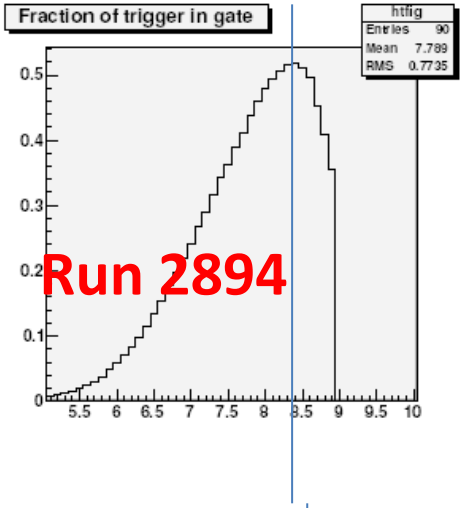
Fraction of triggers in 1ms gate vs time gate is opened

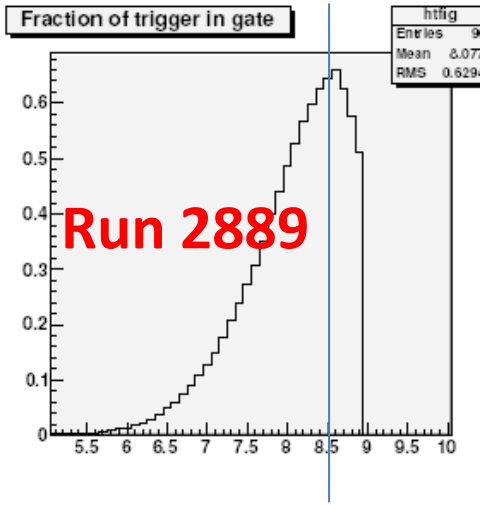
Peak jitter ~0.2 ms

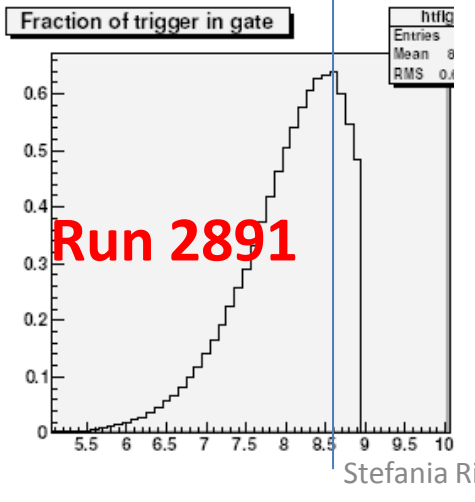


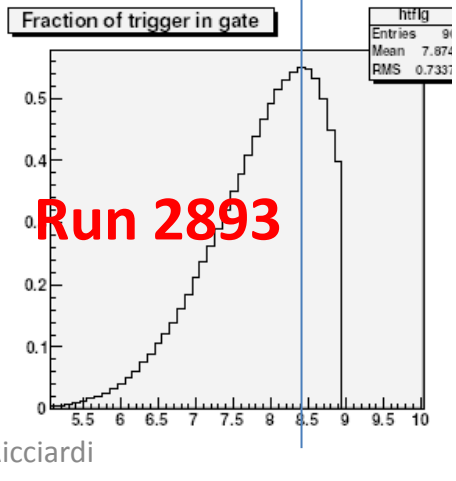


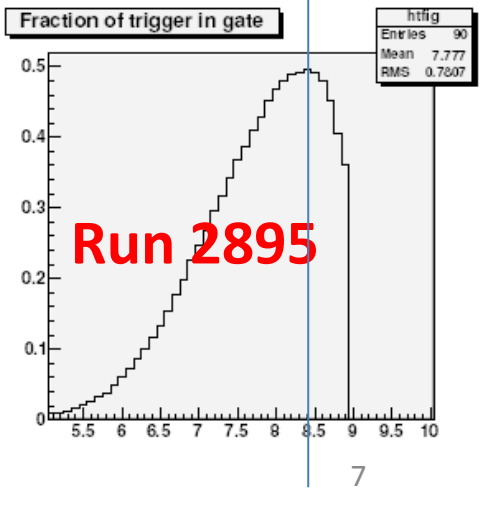




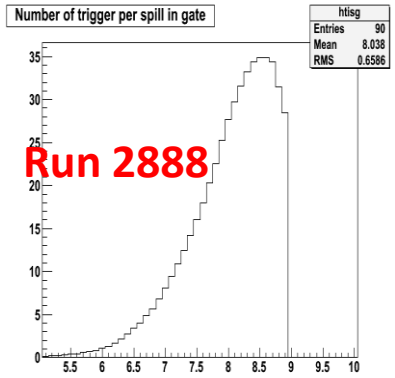


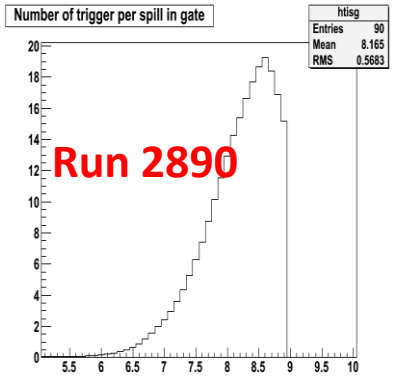


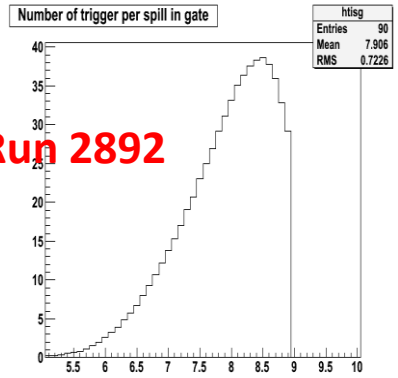


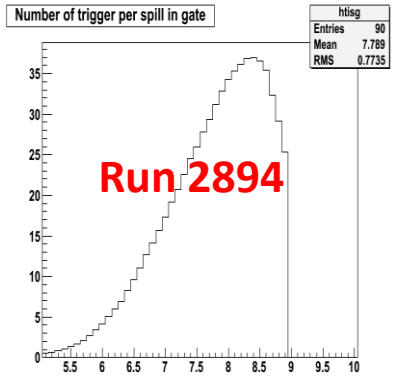


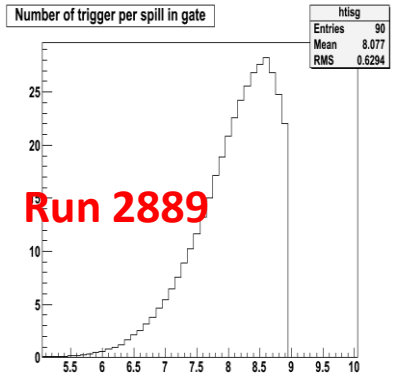
Number of triggers/spill in 1ms gate vs time gate is opened

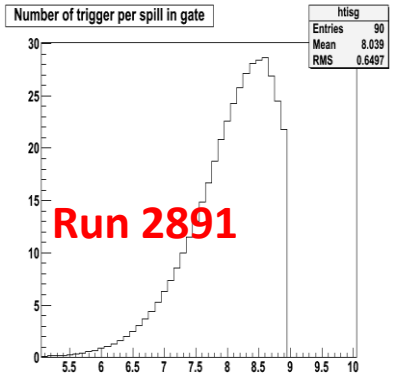


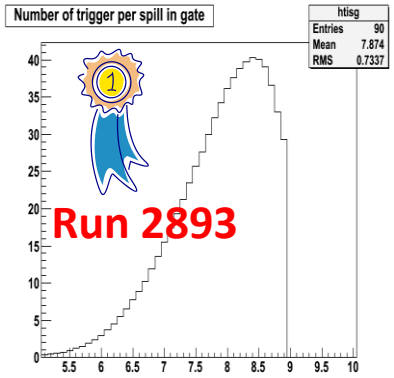


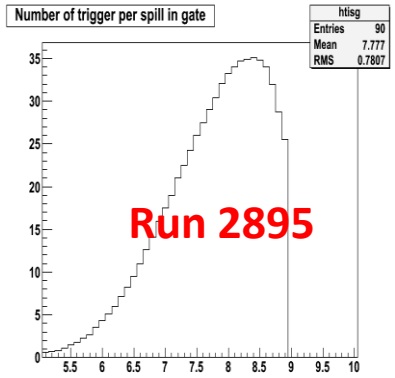












Summary

• The fraction of triggers in 1ms can reach between 50-70% of the total, depending on the delay, for the optimal gate
•The start of the optimal 1ms gate is rather independent of the target delay
•number of trigger/spill varies by a factor 2 for the tested delays
(max intensity corresponds to ~50% trigger fraction in 1 ms)

Acknowledgements

Many thanks to all the people who have helped me with this exercise:
Adam Dobbs, J-S Graulich, Henri Nebrenski, Chris Rogers, Chris Tunnell

Additional material

Number of triggers in 1ms gate vs time gate is opened