COMPILATION: Unit 9 - lab practicum using updated momentum paradigm lab setup

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I recently read about the updated momentum paradigm lab on the list serve (Mark Schober). This is the one using mass and velocity (position) ratios.

I tried it this year and it worked great! My slopes for m1/m2 vs v2/v1 were almost exactly one in every class. This was a far cry from previous explosion labs which can be tricky. Anyway, I think my students got a much better handle on the concept than in previous years and it had the bonus of not requiring a lot of electronic gear that sometimes got in the way. Hats off to Mark and his group for this contribution.

I used the same setup to do a lab practicum at the end of the unit. I modified it by placing force sensors at the end stops to provide a sharp spike to check how "simultaneously" the carts got there. Each lab group was given a "mystery item" (stapler, baseball, batteries, etc.) of unknown mass. Students were allowed to mass the carts and the mystery item but were not allowed anything else except pencil and paper. Once they had a prediction for where to place the carts, they set them up and we ran 3 trials to get an average "delta t" , difference in arrival time at the ends of the track. I just used Logger Pro to check the time at the peak of the force spike in the F vs. t graph. I used a grading scale as shown:

5 points	delta t < 0.03s
4	0.03-0.05
3	0.05-0.07
2	0.07-0.09
1	0.09-0.11
0	> 0.11

Out of all of my classes (16 groups or so) I only had 3 groups get less than 5 points. I even had two groups get all 3 trials with a delta t of 0.0s! One thing to note is that I was using a sample rate of 50 per second, so the minimum separation of force spikes was 0.02s. I did not play with the
sample rate to see how that would have affected the results, because it worked well. Obviously, the higher the sample rate, the finer the time resolution, but my students were plenty impressed with themselves in being able to hit such a small delta t target. Also, I did not pay attention to when the leading edge of the force spike occurred. One could argue about the true arrival time and where that is on the force graph, but it's not a critical part of the assessment. Plus, it's easier to find the tip of the spike :)

I used Dual Range Force Sensors with the rubber coated bumpers installed and set on the 10N range. There is no need to calibrate them since you are just interested in the impact spike.

Again, many thanks to Mark, and I hope my extension proves useful to others.