Notes on tests at Saclay April 17, 2015-SNW

We began with some useful tests back in the lab at IRFU before moving to the laser facility at IRAMIS at 11:30. The tests ended at 5 o'clock when it became clear that the chamber performance was significantly degraded. At least one main factor was that Al layer had been eroded away on the backside of the window.

Since chamber lifetime is only incidental to these initial timing studies, we agreed that our plan should be to prepare as soon as possible a replacement window and have spares on hand in case this happens again.

There are some obvious changes that could help ensure stable chamber performance through the tests.
-in order to eliminate gas stability issues it might be good to have double valves.
-since the chamber sparking is likely the main culprit we should limit this as much as possible. One simple thing, short of operating in "trip hold" mode, would be to put an audible alarm whenever there are trips.
-(Thomas found that there were stability issues when the grid was floating and capacitively coupled to the preamp. He fixed this by shunting the input with a 50 ohm terminator. We probably lose half of the signal this way. Better to have a 1 kohm terminator on hand.)
Note: I discussed this last bullet with Erich and he insists that the circuit diagram (Which, unfortunately he won't share with us) would show a low pass filter on the HV line so RF-wise this is an open circuit. Therefore Thomas' use of a 50 ohm terminator is just fine.
Erich also warned that the linear range of the preamp is +/- 1V but it is likely that the departure from linearity is not significant even to a few volts.
-Thomas Gustavsson says the laser spot was 1mm^2. If we could diffuse this by a factor of 5 it would probably lead to longer lifetime of the Al layer for these tests. It would also better simulate a realistic Cerenkov cone.
-There was significant pickup noise from the laser itself, which made it necessary to push the chamber gain. We stored waveforms of this RF noise and should use them to make a strategy to eliminate this issue.
I show some related plots below.
First the MMEGAS signal when operating in the single photon regime and then the same thing on a long(500nsec) time scale.

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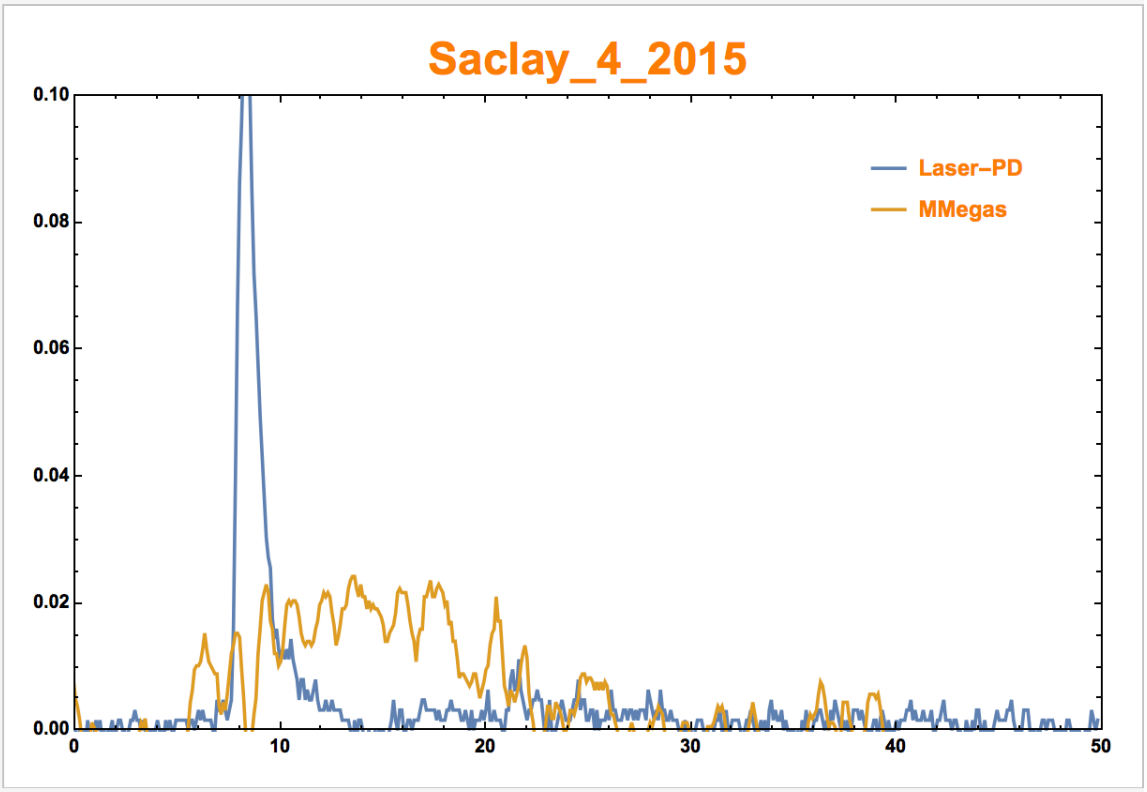
Saclay_4_2015
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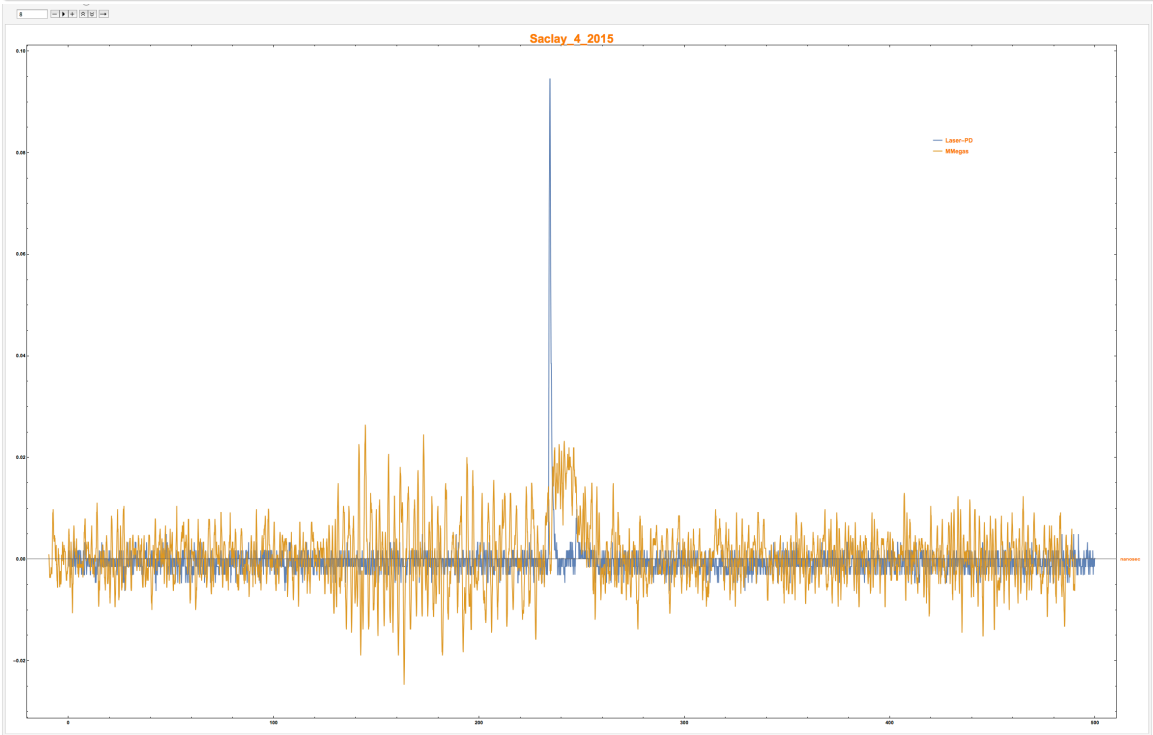
Laser−PD
MMegas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MMegas

Clearly this pickup noise will limit the things we can do. It is not reproducible enough to make a digital subtraction on the waveforms.
The source of the RF pickup is probably the Coherent 9200 Pulse Picker, which applies a fast pulse on a piezoelectric device to postprocess the laser output.

*Model 9200 Pulse Picker Operator's Manual*

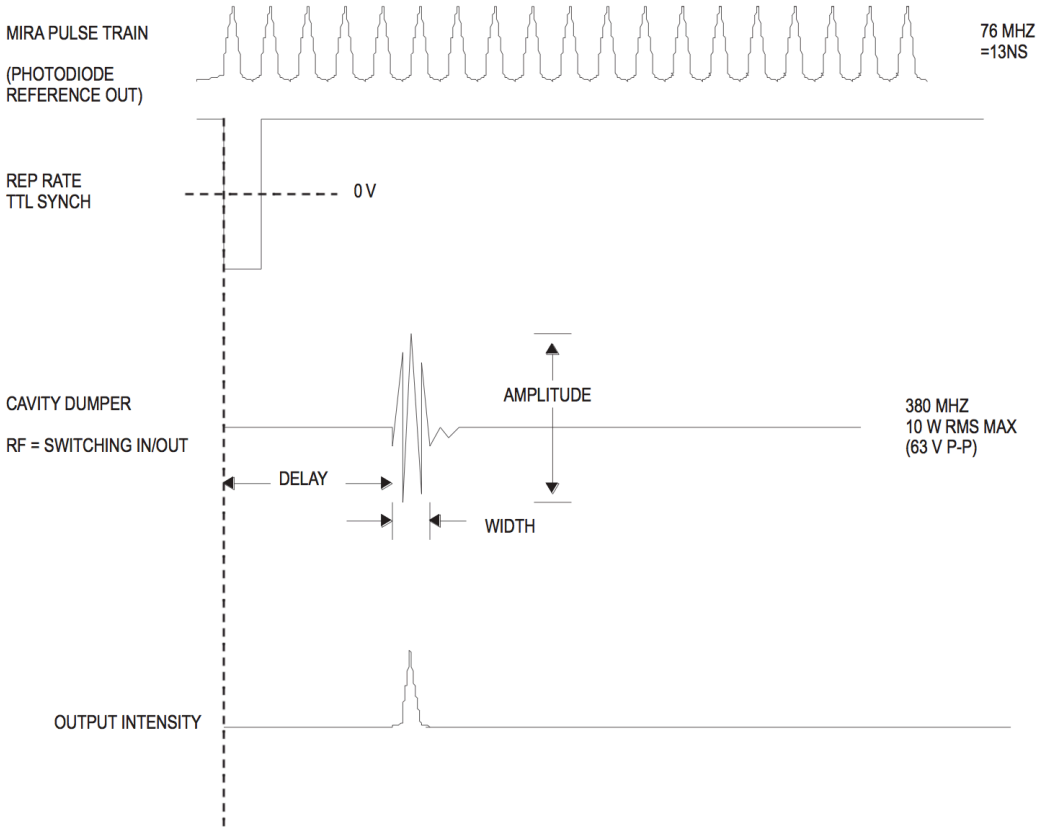


***Figure 3-3. Pulse Picker Timing Diagram***

We had some success reducing the noise by changing the phase of this pulse but we might try more since the pulse picker has both fine and course controls.

Among the things we learned in the morning tests is that a low drift field solution probably won't work. We could only reach much smaller amplitudes. A reduction in extraction efficiency may be partly responsible for this.

We also eliminated the cables/feedthru as a source of the 5nsec risetime although things may have reduced to 4 vs 5 with the new cable I made. But clearly most of the pulse shape has to do with detector physics- including the clear fact that pulses tend to be ~10 nsec wide followed immediately by a 10nsec afterpulse.

But more interesting is the fact that that some aspects of the pulse shape are affected a lot by the field configuration. We found one limit where there appeared to be 2 components to the risetime- starting with a faster one.

We were certainly able to reach single photoelectrons but under conditions that we should try to improve before the next test.

I propose that we do another test as soon as the chamber can be ready. The test would take < ½ day focusing on Ne-Ethane. He-Ethane is also looking like an attractive thing to try in a follow up because of the higher ion drift velocity.

Another lesson learned is that, as much as possible, we should always be recording data while we are doing “initial tests”. I think we agree that, although we did write a lot of data, the morning’s data would have been the most interesting.