Dear Lukas,
This note is to provide context for how we could use the coming 2 weeks in H4 for further testing of HFS (HyperFastSilicon) as well as some practical info.

The past weeks have been pretty successful and we've taken data from 3 different detectors (differing in their packaging and interconnects but mostly with variants of the Transimpedance amplifier designed at U. Penn- hence their names Penn0,Penn1,Penn2,Penn3).
Penn0 was tested in 2016 and differs from Penn1&2, tested just now in that the latter have the intended integration of mesh readout detector and amp. As you'll see below this made a big improvement.

What we could get from the coming period:

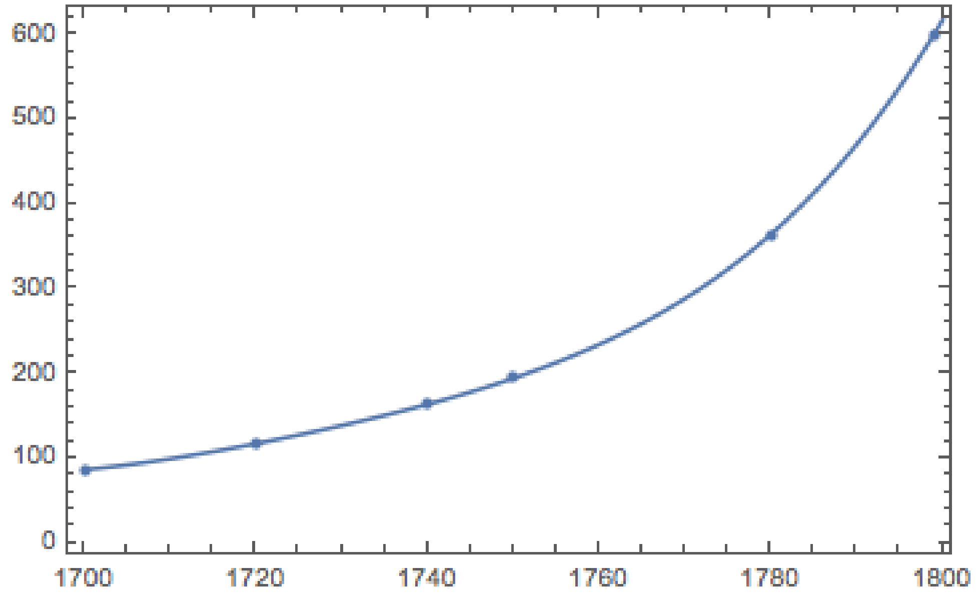
1) Penn1&2 (and Penn0) now have data collected with a variety of triggers (large and small area) with tracking and MCP start time. There have been scans of detector bias from -1700V through -1776V (whereas most of 2016 was at -1800V).
   What would be most valuable is to accumulate further statistics (the detectors are in and ready to take more data) with a large (ie larger than the 9x9mm^2 detector area) to give more detailed performance maps at, say, -1750V.

2) The last weeks have been a long saga with Penn3. After Princeton dropped out of packaging we started from a bare amplifier shipped 2 weeks ago from Penn with the intention of mounting a removable wafer metalized by Matteo at EPFL but this detector was damaged when he removed it from his test board. I then worked with the PC shop to mount a ~2014 era HFS which doesn't easily lend itself to this. We were successful and the detector works fine. However the stray inductance, etc with this jury rig was very different from what Penn designed for and the amplifer is unstable. So we shipped it FEDEX back to Penn/MitchNewcomer to modify and he should get it back to CERN by Monday next.
   This will be a crucial measurement because, by characterizing in a beam this removable detector, we can finally initiate a program of beam testing (for timing) irradiated HFS detectors and have a first result before end 2017, as I have been promising. It will complement the lab characterization that Matteo will report this month at a conference of our detectors (2nd round) irradiated to 10^{15} neq/cm^2.

Significance of first results from 2017

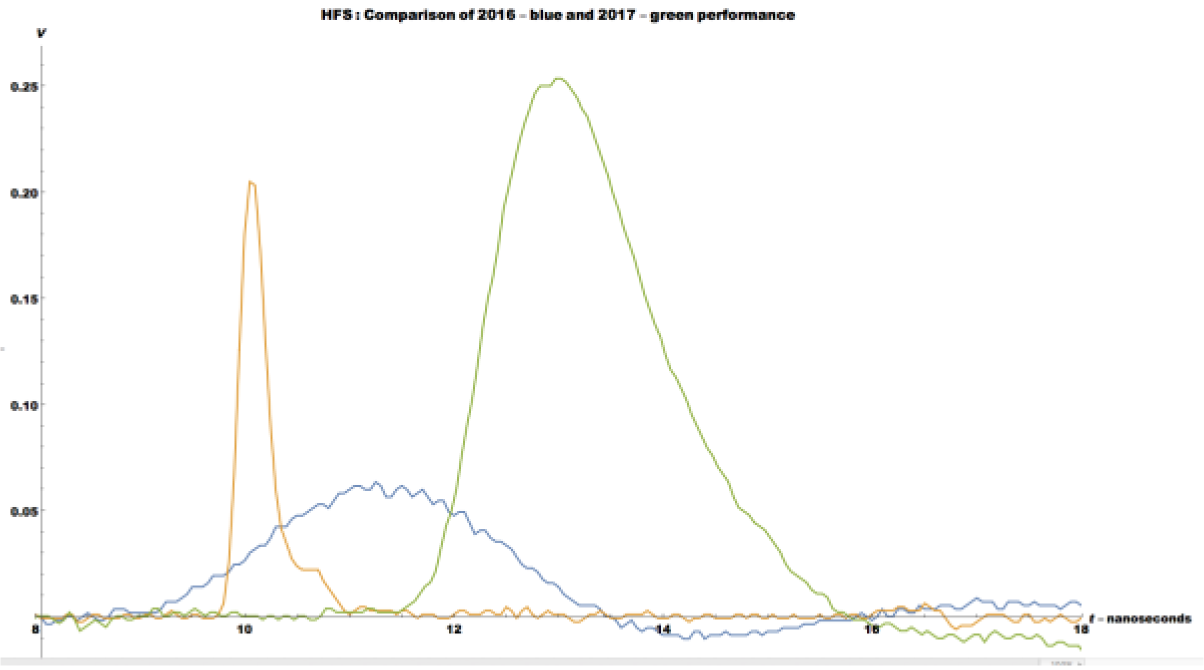
There has been a striking improvement in signal quality that resulted from the effort during the past year to realize the electronics solution to the risetime and signal to noise limitations of HFS. The idea of HFS is to obtain the best timing performance of any MIP detector with a useful pixel size of ~1/2 cm^2. We achieved this goal (except for our MCP +/- 4 picoseconds result which is simply the best detector money can buy). But we were pushing Gain higher than we would like to.

Below I illustrate the improvement with a typical event showing MCP signal, 2016 detector (operated at 1750V=> Gain~200) and the 2017 detector (operated at 1720V=>Gain~115). Below I show the gain curve and the signals. You can see that we are now succeeding in getting away from the steep part of the gain curve- which is a good thing.

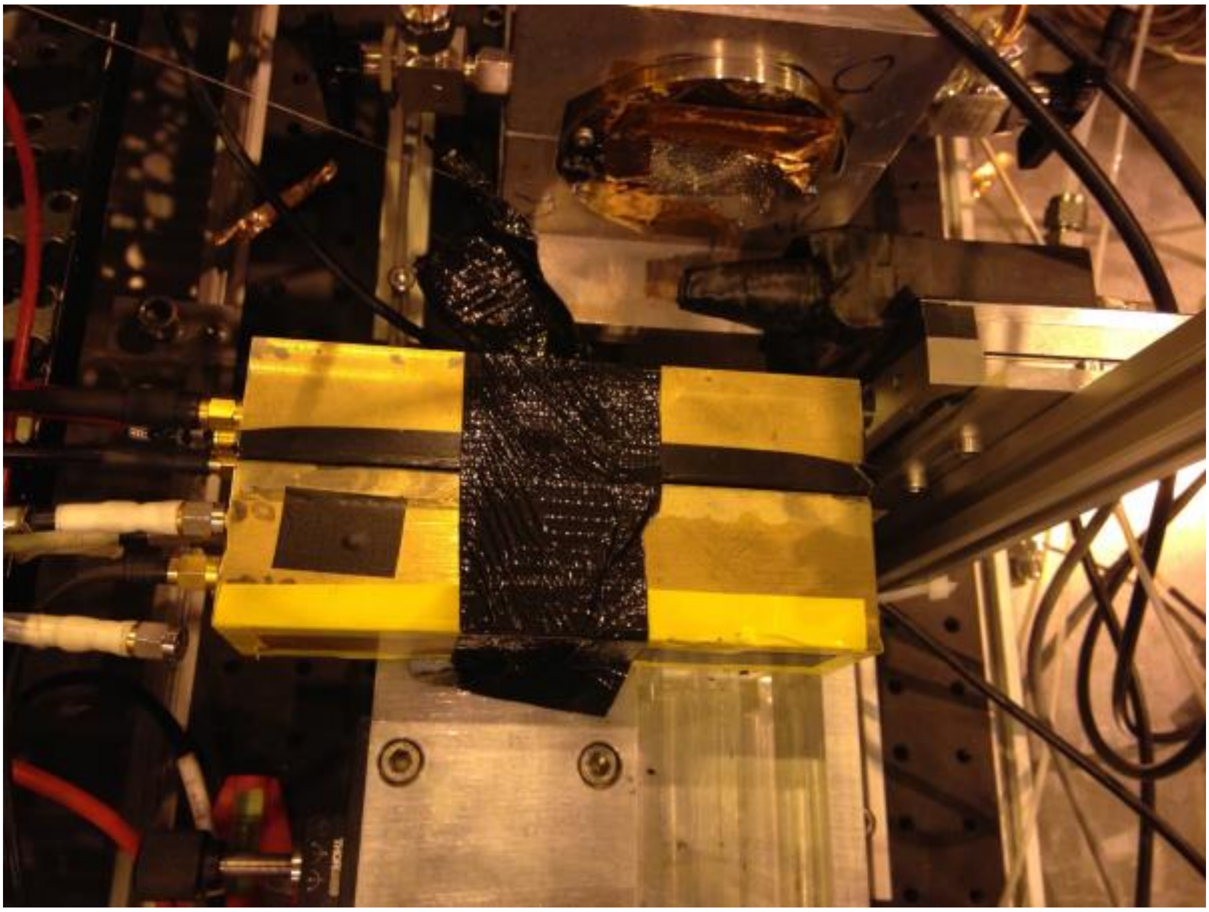


Gain vs. HV (HFS)

Dramatic improvement in Signal Quality



Some Practicalities



The detector housings locate on the jig alignment plate as shown above. To the left you see the relevant connectors (Vcc=3.4V, HV bias, Signal out). The “test pulse” input we don’t use. The output goes to an external 13 dB additional amplifier using 5V power.

The HV cables start from iSeg(CH1&2) go through PPanels (A01&A02) and then short cables (labelled 1 and 3). Always operate the iSeg with “Kill Enable” on. Try to bring up voltages while keeping the current below spikes of ~1-2 microAmp. But the nominal current is ~ 200-400 nAmp.

Cheers,
Sebastian