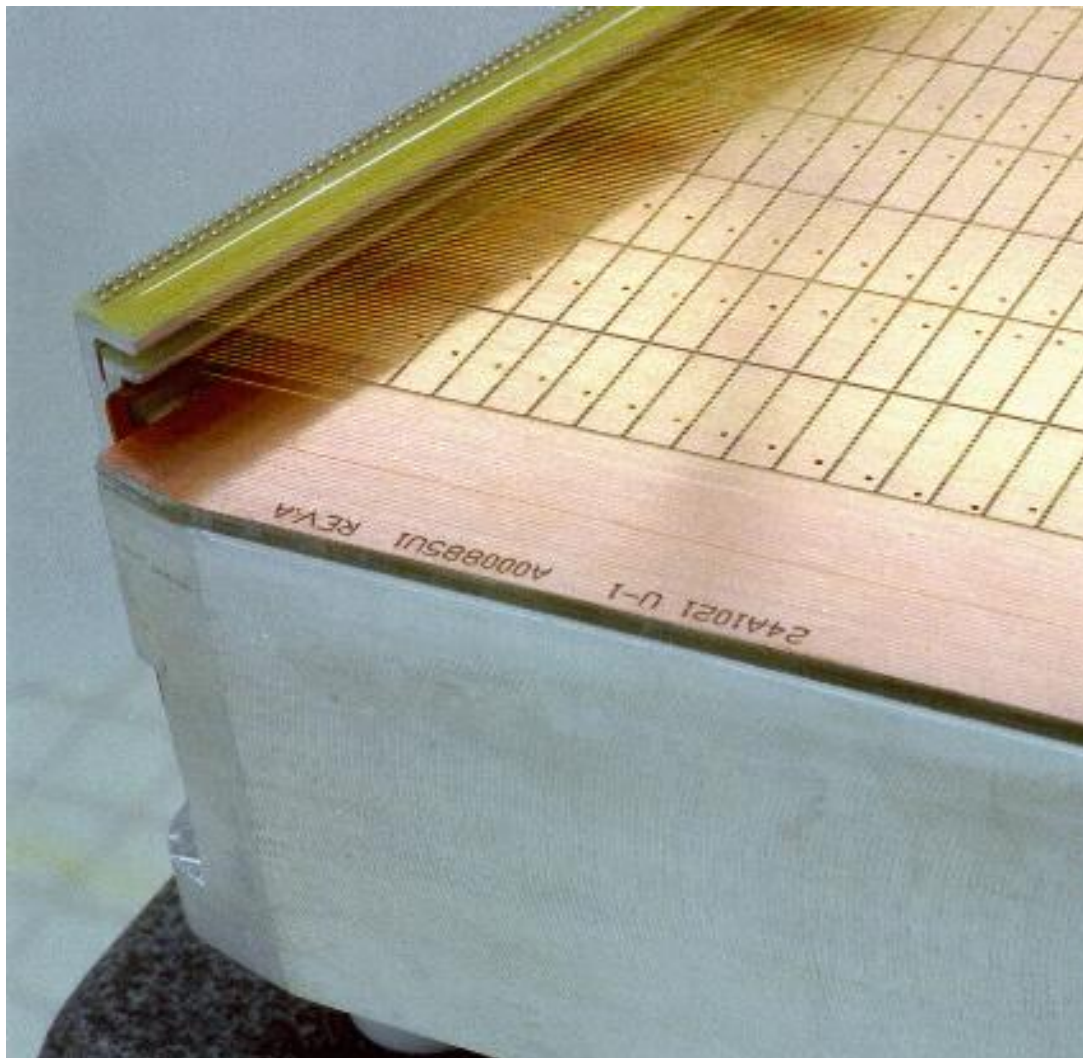


Operation of the STAR TPC at High Luminosity Lessons learned, so far

Jim Thomas

4/06/2009



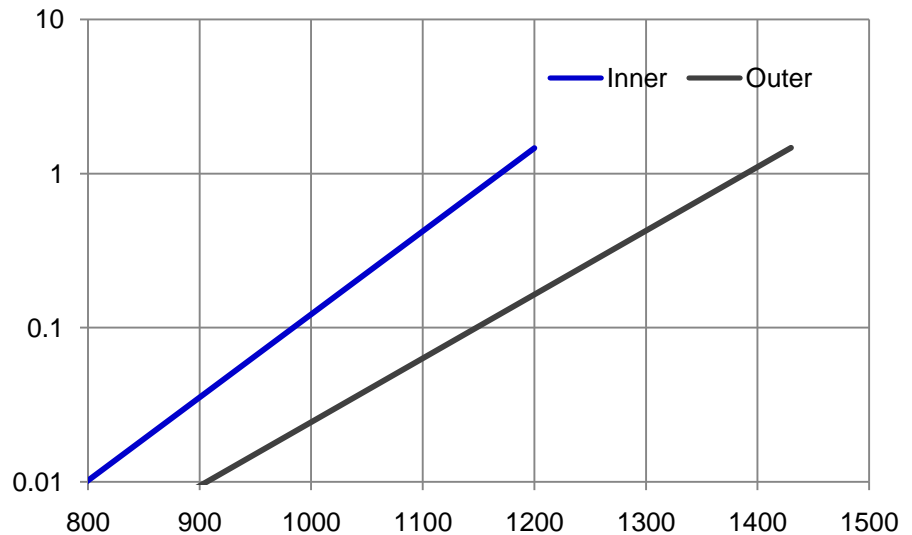
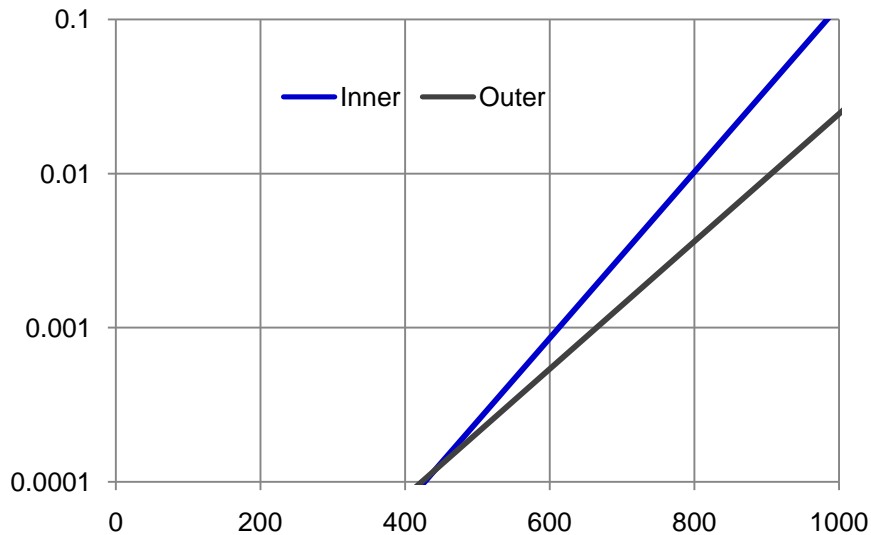
- **Gated Grid**
- **Ground Plane**
- **Anode Wires**
- **Pad Plane**

Sector Operation for 20:1 signal to noise with the original TPC electronics

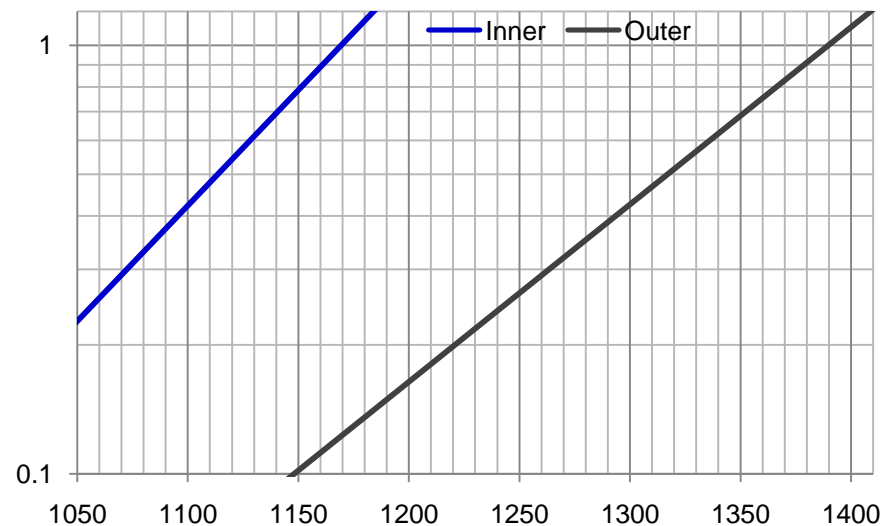
Sector	gas gain	anode voltage
inner	3560	1170
outer	1310	1390

- **The pad response function and cluster finder were designed for 20:1 signal / noise**
- **Present experience is that Anode wires 'trip' at an unacceptable rate at current luminosities in pp500**

Gain on the Anode Wires – an exponential response



- **STAR Inner and Outer sector anode gain .vs. voltage**
 - Measured gain using ^{55}Fe
 - Measured range: 1000 - 1600 V
 - SN263 and W. Betts Thesis
 - And http://www-rnc.lbl.gov/~wieman/gas_gain_check_%20used_Dec_99.htm
- **Relative gain reported vs nominal 1999-2008 settings at 1170 & 1390**



Good news and Bad News



- The bad news is that the TPC inner sectors ‘trip’ too often at current luminosities ... and we really hope to go to $4\times \mathcal{L}_{\text{today}}$
- The good news is that we can lower the voltage on the inner sectors to 1135 volts and the performance of the anodes is stable
- Last year, we installed new electronics (TPX). The S/N ratio for TPX is 30:1 ... the spec for the original STAR TPC was 20:1
 - This suggests that we can lower the gain on both the inner and outer sectors by 1/3 and still achieve baseline performance.
 - The new voltages would be Inner: 1135 V Outer: 1345 V @ 66% gain
- We are proceeding conservatively and are running at 1135 / 1390 V
 - Performance is stable with today’s luminosity and 100 Hz trigger rate
 - We are exploring lower voltage settings to see if further reductions are possible. We will be testing both tracking and dE/dx .

**The STAR TPC can handle today’s pp500 luminosities.
Higher luminosities and trigger rates will require further study.**