Status of Work at TRIUMF

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SuperB DCH Detector R&D Meeting
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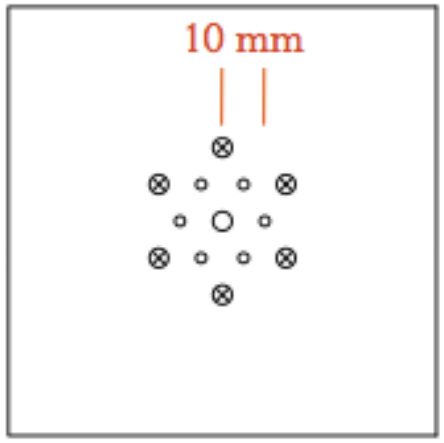
TRIUMF activities

- Ageing chamber
- Gas gain studies
- Cluster counting for PID

Ageing Chamber

- ~170mC/cm
- Monitor ratio of gain between aged chamber and control chamber (sensitive to 1%)
  - No difference so far
- No obvious sign of self sustaining field emission yet



○ Anode Wire 20 μ gold-plated tungsten sense wire

∘ Field Wires, bussed together and grounded
120 μ gold-plated aluminum field wires

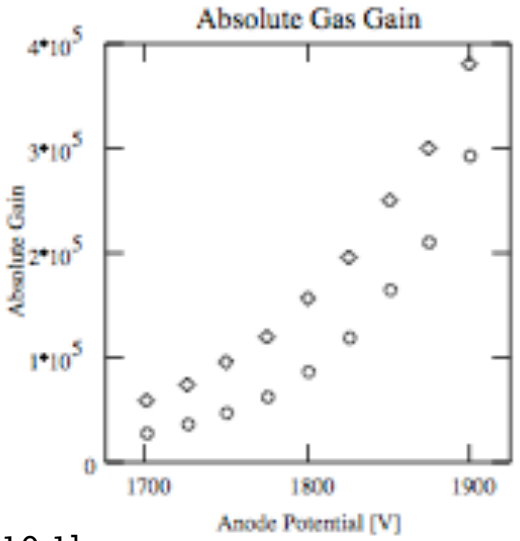
⊗ Bias Wires, bussed together and at 1480V

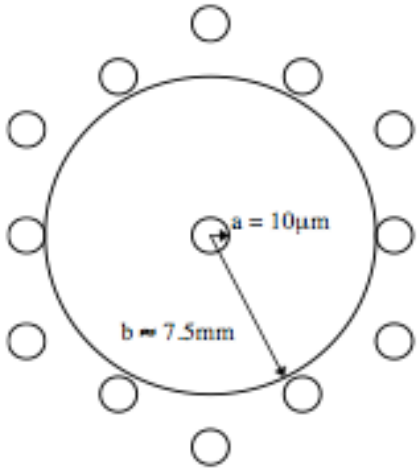
Bias wire 1480V gives same field as an infinite BaBar chamber

Gas Studies

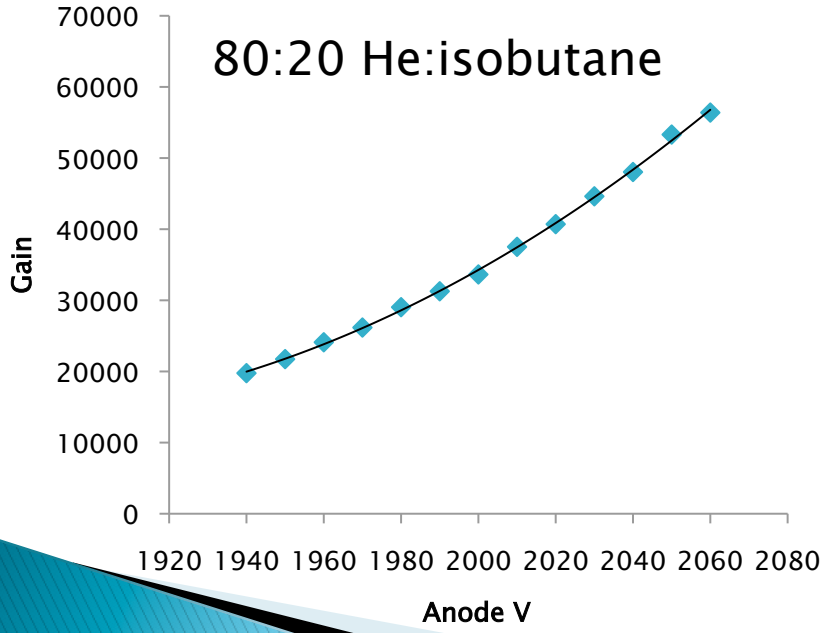
- With test chamber, measure gains for different anode voltages keeping all else constant
- Calculate Diethorn parameters
- Combine results with age of chamber to help determine what gain to operate at

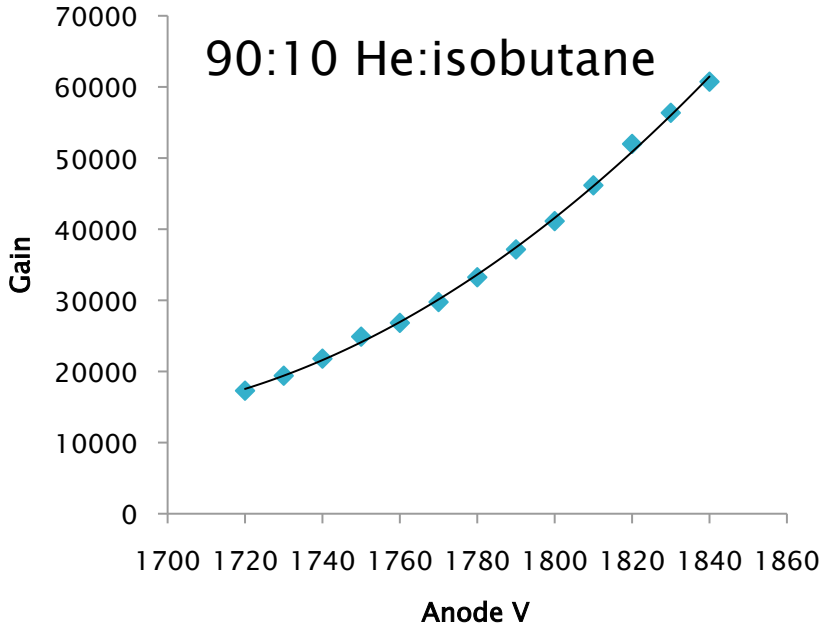
Babar
TNDC-96-51





HRS gas = [Ar:CO2:CH4] [89:10:1]



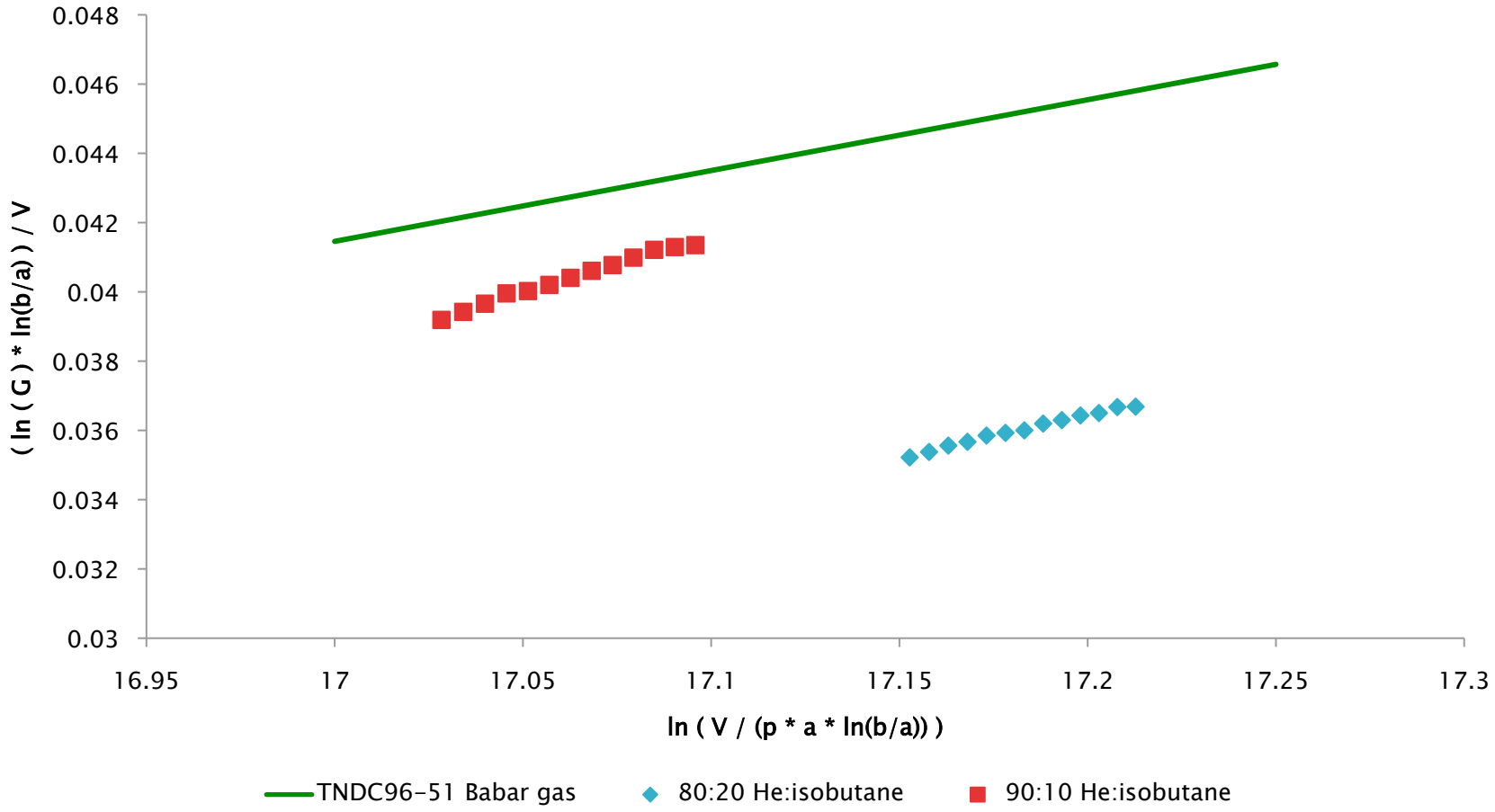


Diethorn Equation

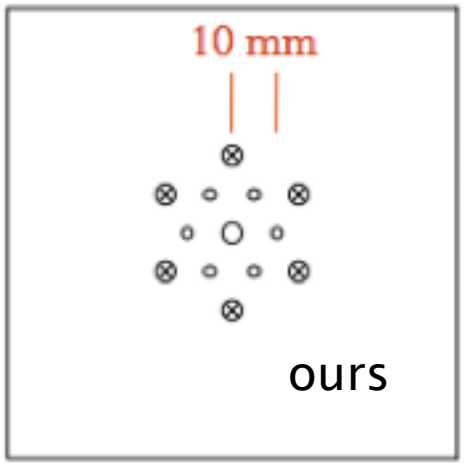
- a = anode wire radius (10μm)
- b = drift tube radius (1.0±0.3cm)
- V = anode voltage (negligible error)
- G = gas gain (~30% calibration error)
- p = density relative to NTP (1.00±0.02)
- ΔV = voltage gain in one MFP
- E_{min} = minimum electric field to start multiplication

$$\frac{\ln(b/a)}{V}\ln G = \frac{\ln 2}{\Delta V}\ln\left(\frac{V}{pa\ln(b/a)}\right) - \frac{\ln 2}{\Delta V}\ln E_{\min}$$

Diethorn Parameters for 80:20 and 90:10 He:isobutane



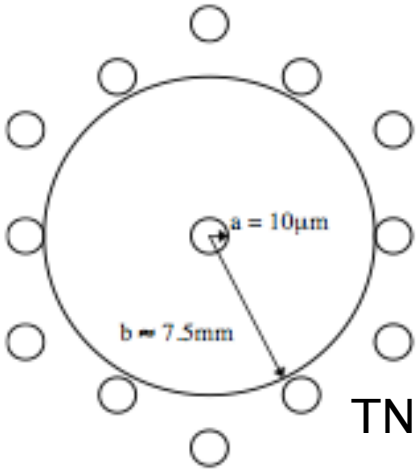
Gas	ΔV (V)	E_{min} (keV/cm)	VΔG/GΔV	ρΔG/GΔρ
80:20 He:isobutane Babar TNDC-96-51	33.9	31.8	17.5	-5.6
80:20 He:isobutane at 2000V	28±2	68±10	17.6±0.2	-7.2±0.5
90:10 He:isobutane at 1800V	21±2	76±10	19.2±0.3	-8.5±0.5



Diethorn parameterization is for cylindrical counter tube

We have bias wires of 1480V

Gas properties should be the same regardless



Babar TNDC-96-51

Relating Ageing and Gas Gain

- Use Dana's results to calculate how much energy gets deposited onto a wire in the entire SuperB lifetime

- For an arbitrary scenario:
  - Luminosity (~70000 fb^{-1})
  - Hits per unit luminosity per cm at the worst part of the wire (~20000/fb^{-1}/cm)
  - Energy deposited per hit (~2000 keV)
  - Electrons liberated per unit energy (~30e^-/keV)
  - Gas gain (~50000 from Babar)
  - Converstion (1.602×10^{-16} mC/e^-)

- Age = ~700mC/cm

- Helps us get an idea of what gain to use

Cluster Counting for PID

- Will use a TRIUMF beam of e, μ, and π to measure dE/dx for PID
- Start in October
- Philip is designing the test chamber
  - one square cell of 2.7m length using 90:10 He:isobutane