HRS Detector Hut

Vacuum exit window:

	Hall A NIM	SIMC
thickness	127 µm	100 µm
radiation length	2.54 cm	3.56 cm (agrees w/ Pdg)
Distance to VDC 1 center	-15 cm	-15.522 cm

Not exactly → The paper seems to assume 45° particle ($\sqrt{2}$)

{but this disagrees w/ tech note it cites} {also, somewhat convenient number... inch to cm ?}

technote: LeRose, JLab-TN-00-001

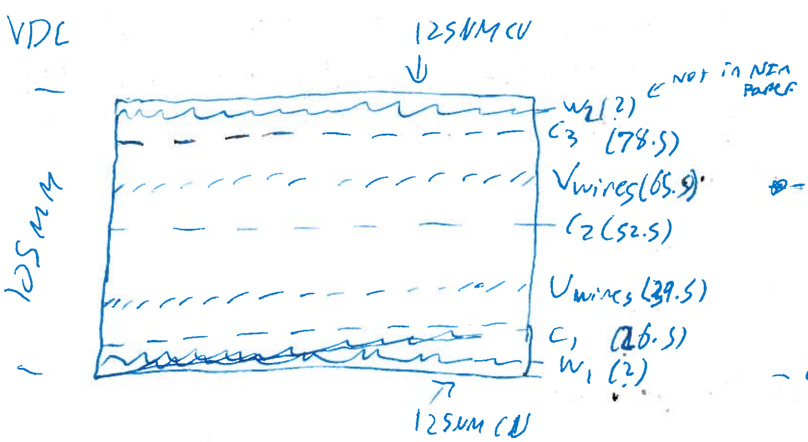
So, keep everything same in SIMC. But might as well assume the particle goes at 45°.

VDC:

What's in SIMC clearly needs to be changed. So, might as well just talk about what's in NIM 474(2001) 108-131.

- 0.335 m between VDC's
- 0.230 m of air between VDCs
- sense region ~~goes from~~ is $(X_{full}, Y_{full}) = (2.118\,m, 0.288\,m)$
- Thickness of VDC is 0.105 m

VDC



- sense wires are basically tungsten with diameter of 20 µm. Since it is unlikely for wire to be hit by passing particle, probably won't use
- W_1, W_2 (gas windows): Thickness of 6 µm mylar. Location (rel):
- C_1, C_2, C_3 (HV windows): Thickness of 6 µm mylar + 850 Å gold plating (double for C2)

- cage has windows of 25 µm Al
- Gas is Argon/Ethane (50%/50% by volume) (62%/38% by weight)

VDC (cont.): In simulation do following:

Assume at Entrance to VDC1:
1) Multiple scatter from Al cage window
2) Multiple scatter from CU window
3) Multiple scatter from Gas window
4) Drift to C_1 (also multiple scatter in gas) [which order?]
5) Multiple scatter in C_1 → 5A) Drift next to U-wire plane and smear with resolution and save value
6) Repeat (4,5) for C_2 → 6A) same as 5A for V plane
7) Repeat (4,5) for C_3
8) Drift to VDC exit (also multiple scatter in gas)
9) Multiple scatter in 2,3 (maybe should include in drift(8))
10) drift/Mult. scat in air between VDCs
11) Repeat (2-9) in VDC2
12) Repeat (1) in VDC2 (maybe include in drift(8))

In MC_hrsR(L).f (SIMC), it says that VDC is offset +4.8 mm...
Is this true?

Radiation Length Information:

Air: 3.039×10^4 cm (PDG)
3.042×10^4 cm (SIMC) (close enough)

CO_2: 1.965×10^4 cm (PDG, 1 atm @ 20°C)
3.0020 cm (SIMC, 0.5 atm. Not sure why they thought their operated at ½ atm... I guess they just copied a bunch of stuff from the HMS...)

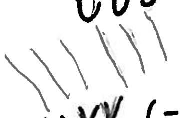
62138 Ar/Ethane: $\frac{1}{X_0} = \frac{0.62}{X_{Ar}} + \frac{0.38}{X_{Eth}}$

$X_{Ar} = 1.176 \times 10^4$ cm, $X_{Eth} = 3.615 \times 10^4$ cm

$X_0 = 1.5815 \times 10^4$ cm (1.67002×10^4 in SIMC)

Straw chamber

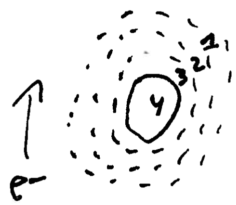
UUU (+45° to dispersive x)



VVV (−45° to dispersive x)

(different orientation for back chambers)

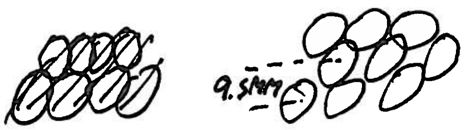
1008 straws
(3102 for back chambers)



1) 50 nm thick mylar
2) 50 nm thick mylar
3) 10 nm thick Al

} Pass through twice

4) 10.44 mm straw (diameter), 62%/38% Argon/ethane by volume



Active areas: ~~66~~ 60 × 209 cm^2 for front chambers (CH1, CH2)
124 × 272 cm^2 (CH3)
142 × 995 cm^2 (CH4)

0.36 m carbon fibre pannels at top and bottom of ~~66~~ CH3, CH4 (does it cover whole thing? Is it still there?)

1.9 cm thick / 31.5 cm wide plastic/Al honeycomb ↳ ~~8~~ checked. only covers electronics

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Cherenkov

- Atmospheric pressure CO_2 used as radiator
- NIM paper says X/Y full size is 250 × 80 cm^2 (~2 m^2). However, says only cover 0.8 m^2 w/ angle divergences of 20°.
- 10 mirrors, 90 cm radius of curve; PMTs at R/2. Rectangular dimensions of 38 × 48 cm^2. Paper says 5.5 × 10^{-3} radiation lengths. ~1 mm thick Plexiglass, 13 mm phenolic honeycomb, 70 nm Al, 30 nm MgF_2
- Old ~~mirrors~~ windows are Tedlar; same back and front; ~~[illegible]~~ 75 µm thick (I think, but 37.5 possible) ~~[illegible]~~. In any case, total window material given to be 25.8 × 10^{-4} χ.

Cherenkov (cont.)

- We measured x/y dimensions at several points.

At Minimum (2.5" from front plane):

244.5 x 60.33 cm^2

Joint after minimum:

260.35 x 76.20 cm^2

At Back (Near Mirrors):

244.5 x 83.19 cm^2

- New windows are 5 Mil (~125 μM) Al. They are used on RHRS (Front/Back) and LHRS (Front). Old window is used on back of LHRS

Hodoscopes (S0, S1, S2M)

- Scintillators come from Eljen (Perhaps EJ-200, 204, 208, or 212), or from Bicron (BC-402, according to Bogdan; but perhaps 404, 406, 408, 412)
- Polymer Base is PolyVinylToluene.

Radiation Length: 42.54 cm (PDG)
42.4 cm (SIMC)

- Sizes (Half X, Half Y, Full Z) (in M):

S0: 0.85 M, 0.125 M, 0.01 M (from Schematic) (Bogdan)

S1: 0.88 M, 0.18 M, 0.005 M (from Hall A database)

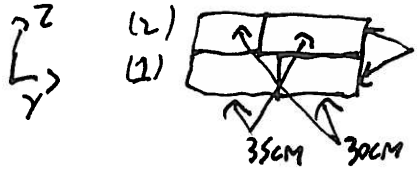
S2M: 1.118 M, 0.216 M, 0.05 M (from Schematic) (Bogdan)

- For the RHRS, we find S0 is offset -4.8 cm in Y w.r.t. the VDC
S2 is offset -16.6 cm in X w.r.t. the VDC

- According to optics database, the VDC on RHRS (LHRS) is offset by +5.16 mm (+8.07 mm)

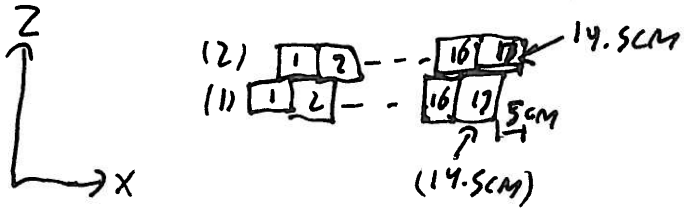
Calorimeter

- On HRS-L, two (Pion rejector layers):



- Material is SF-5 (Lead-glass)

* Radiation length is 2.55 cm (SIMC uses 14.83... for some reason)

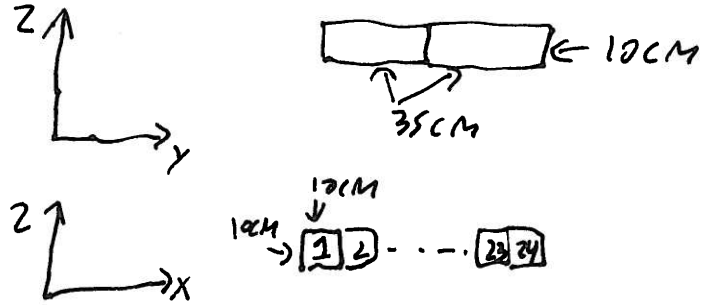


25 MM AL in front of PRL 1

So ~~total~~ total half x, half y = (123.25 cm, 32.5 cm)

- On HRS-R, one Pre-shower, one shower:

Pre-shower:



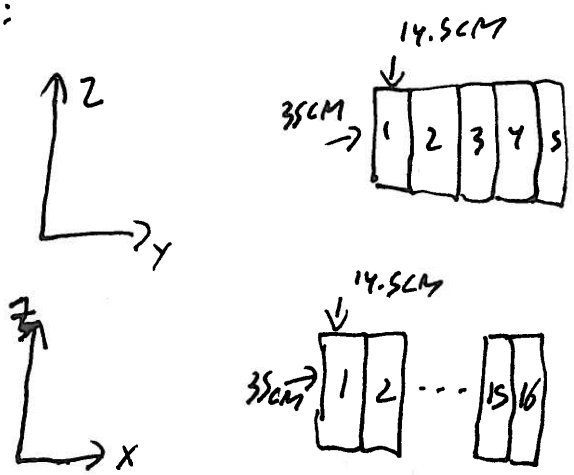
- Material is * TF-1 (Lead-glass)

* ~~Radiation length~~ Radiation length is 2.74 cm (2.5 - 2.8 cm in other sources)

So total half x, half y = (120 cm, 35 cm)

13 MM Al before Pre-shower, 19 MM Al after Preshower

Shower:



Material is SF_5

So total half x, half y = (116 cm, 36.25 cm)

* No offset between centers of shower and preshower in either direction.

Some additional notes from looking at Analyzer database/data:

- for LHRS, smaller block is at -y for Pr1, ~~Sh~~
- Database claims Pr2 is shifted up (to -x) ~~for Pr2~~ on LHRS
- When determining the detector z positions, I allowed the block sizes to vary slightly. So, instead of 14.5 CM, I found the following:

Pr1: 14.75 cm

Pr2: 15 cm

PS: 10.1 cm

Sh: 15.25 cm