Update on VDC studies

Vlassis Petousis ¹ Seamus Riordan ²

¹University of Cyprus

²Stony Brook University

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- Vertical Drift Chambers (VDC's) overview.
- Existing Tracking Algorithm.
- New Reconstruction Algorithm for High Rate Tracking (HRT).
- To Do List...

VDC's overview



Nominal Characteristics

${\sf U}/{\sf V}$ angle	$\pm 45^{0}$	
Sense wires/plane	368	
Wire Spacing	4.24 <i>mm</i>	
Pos. Res	$\sim 100 \mu m$	
Ang. Res	\sim 0.5 <i>mrad</i>	

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- VDC's can **operate** easily at **20kHZ/wire** rate (max Hall A operation till now).
- **Requested** to go in higher rates: 75kHZ/wire ($\sim 5MHz$).
- **Required** hardware and software modification to improve tracking efficiency up to 90%.

APEX High Rate	modifications for performance up to 5 <i>MHz</i>	
HV	-3.5kV (Standard: $-4kV$)	
Disc	JLab Custom, $I_{th} = 1\mu A$ (Standard: $8\mu A$)	
Gas	60-40 Ar/CH_2	
Max Rate	5 <i>MHz</i> (Standard: 500 <i>kHz</i>)	
Gain	25×10^3 (Standard: 20×10^3)	
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VDC's overview

- Tracks enter nominally 45⁰ producing signals in 3 to 7 wires.
- The drift time close to pivot wire and the next to it, varies between 42ns and 76ns respectively. That could be used in advance for a new Tracking Algorithm. [NIM A 474 (2001) 108-131]



Existing Tracking Algorithm (Thanks to Seamus)

- The existing Tracking Algorithm scan's for "V shape" clusters in time.
- Fired wires: $3 \le$ wires in cluster ≤ 7



Existing Tracking Algorithm (Thanks to Seamus)

- Tracking efficiency at Low and High Rate.
- We have efficiency loss in the average wires for High Rates.



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Existing Tracking Algorithm (Thanks to Seamus)

• Efficiency Loss goes up to 40% for highest current.



New Reconstruction Algorithm for HRT

- Tracking in a Narrow Time Window. Less than 200*ns* (5*MHz*)
- Red Circles Even. $30ns \le$ Total Drift Time $\le 100ns$
- Green Circles Odd. 70ns ≤ Total Drift Time ≤ 200ns (Seamus suggestion as an extension to Even case).
- Same Total Drift Time holds for V1,V2 and U1,U2 planes.



New Reconstruction Algorithm for HRT

- Find clusters we could have missed with the previous algorithm.
- 2 or 3 only neighbor fired wires taking in account.
- Narrow tracking time window (≤ 200 ns).
- Within the ± 40 *ns* of the trigger window (Can we do it narrower?).
- The pivot wire is that which gives us the smallest drift time (distance) between the 2 wires in each plane (U, V).
- Information for pivot wire in each U,V plane, helps to avoid "Loss from no clusters".
- Use of an angle cut $(45^0 \pm \delta \theta)$ in support for tracking.
- U and V planes association to prevent ambiguities.
- Hits in correlations between Lower and Upper VDCs.
- Correlations between the VDCs clusters and the S2m.

- Modifications inside the existing tracking algorithm (wires, angle and position requirements cuts).
- Supported information comes from S2m detectors.
- Check for validity using the existing raw data.
- Calculation of final tracking efficiency improvement.

Other suggestions or ideas are more than welcome.

THANK YOU FOR YOUR ATTENTION