# Resistive Plate Chambers as Active Medium in the DHCAL

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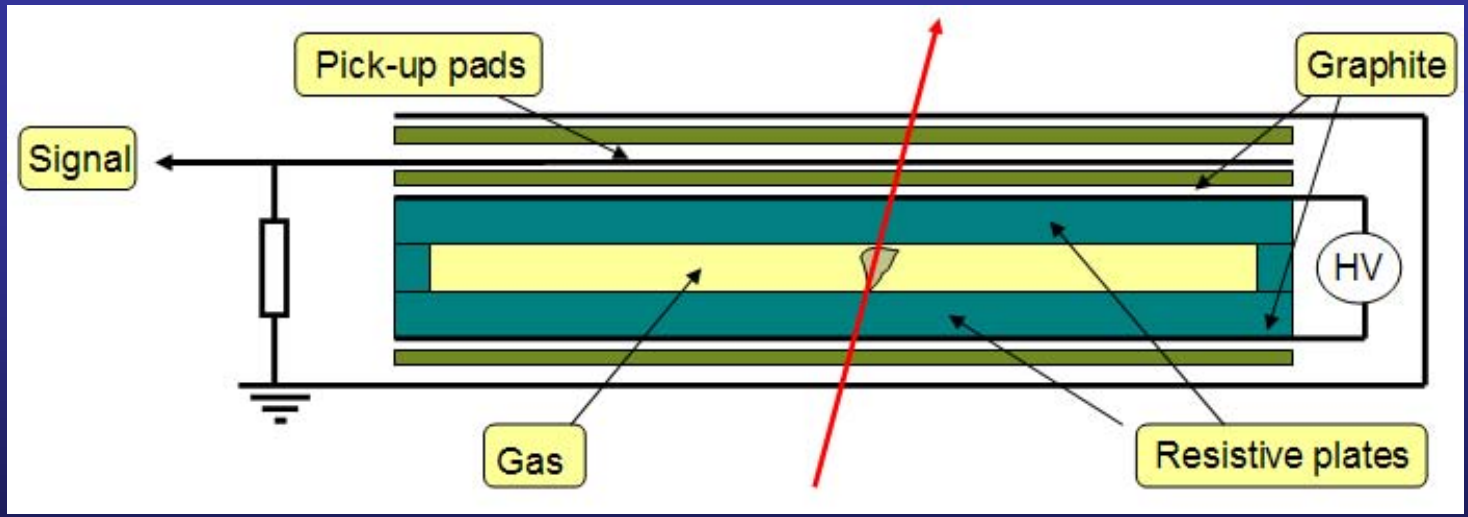


Snowmass Workshop, August 14 – 27, 2005

## Collaborating institutions

Argonne National Laboratory
Boston University
University of Chicago
Fermilab
University of Iowa (Onel et al.)
Protvino (Russia)
Regina (Canada)
(UTA)

# Performance parameters

| | |
|---|---|
| Cell sizes | 1.0 x 1.0 $cm^2$ (for prototype section) |
| MIP detection efficiency | 98% not including borders and electronics (no detailed calorimeter design available) |
| Response to neutrals | ~60%/$\sqrt{E}$ for $K_L^0$, no sensitivity to slow neutrons |
| Intrinsic noise | ~0.1 Hz/$cm^2$ |
| Cross-talk | 1.6 pads/MIP/layer |
| Uniformity over space | Within ± 1% |
| Uniformity over time | No changes observed over months |
| Speed of device | ~20 ms/$cm^2$ recharging time |
| Shower spread | No sensitivity to slow neutrons (maybe can be changed if necessary) |
| Shower containment | Don’t understand question |

# Hardware considerations I

| | |
|---|---|
| Reliability | No problem |
| Provenness | Relatively mature, invented in 1985 |
| Aging | Not observed so far |
| Requirements on T, p, humidity | Robust |
| Effect of magnetic field | None measured |
| HV | Operates with ~ 8 kV |
| Robustness | HV plateau about 100 V |
| Mechanical rigidity | Handle glass with care |

# Hardware considerations II

| | |
|---|---|
| Analog readout | Not useful |
| Rate capability | Recharge time of 20 ms/cm$^2$<br>Sufficient for endcaps<br>Design to cope with higher rates can be devleoped |
| Compatibility with other systems | Yes |

# Hardware considerations III

| | |
|---|---|
| Construction/assembly | Easy |
| Signal collection/routing | Digitization on chamber<br>Challenge of mixing analog & digital signals |
| Electronics | Large number of channels ($50 \cdot 10^6$ channels)<br>Multiplexing is the game… |
| Calibration | Not an issue, due to the high MIP detection $\varepsilon$ |
| Cost (mechanical) | Cheap |
| Cost (readout) | Currently about $1/channnel |
| Cost (operation) | Gas (Freon) no expensive, low flow |

# Time scales

| | | |
|---|---|---|
| **2005** | Russia | Equip 1 $m^2$ with Minsk-based readout (32 x32 channels) |
| | US | Develop and test design of larger chambers |
| | GEMs | Cosmic ray studies with stacks of GEMs |
| | GEMs | Initiate long foil production and testing |
| | US | Prototype ASICs: finalize design |
| | US | Specify remainder of readout system (released soon) |
| | US | Design and prototype all subsystems |
| **2006** | | Produce chambers |
| | | Produce ASICs |
| | | Produce other subsystems |
| **2007** | | Move to test beam |
| | | Take data |
| **2008** | | Take data |
| | | Design LC hadron calorimeter |

**Only possible if funded**

**Tune Hadron Simulation**