SHMS Heavy Gas Čerenkov

Garth Huber

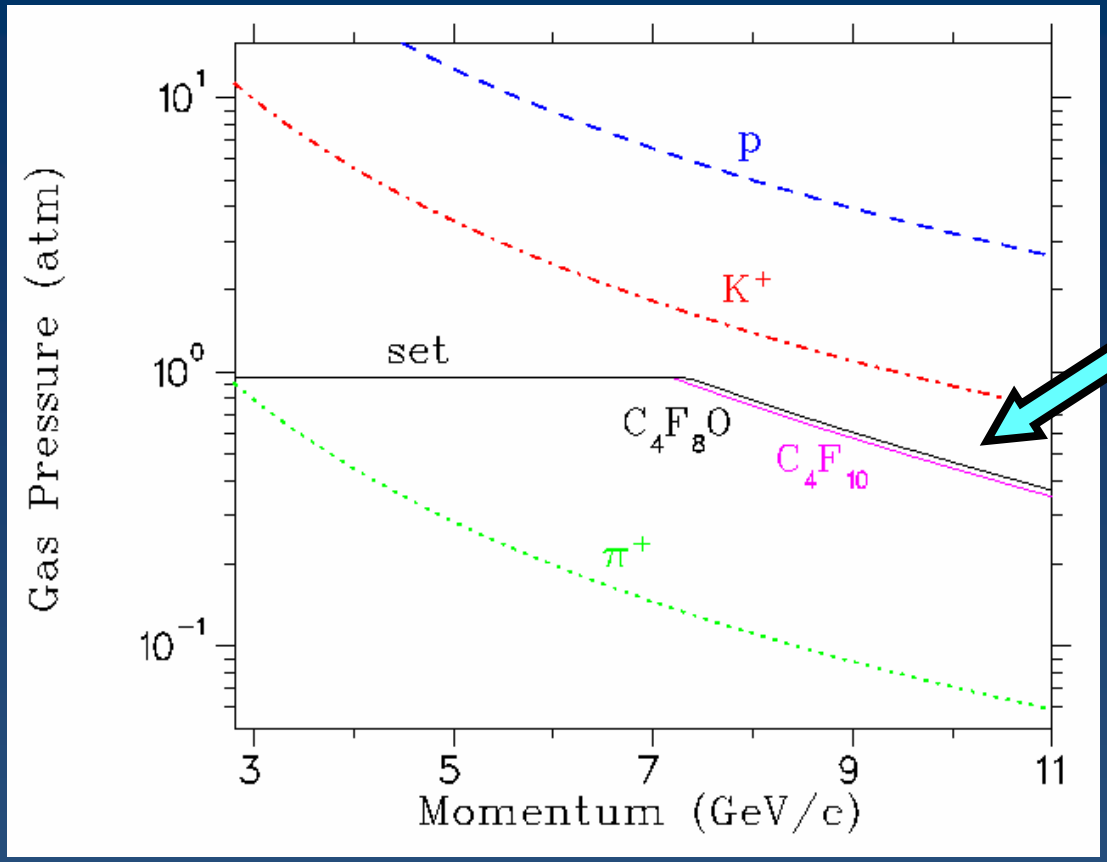
UNIVERSITY OF REGINA

Hall C User's Summer Workshop, August 5, 2008.

Introduction

- At higher momenta, hadron species cannot be reliably distinguished by time of flight over the 2.2 m SHMS detector stack baseline.
- Good PID can be obtained with a series of Čerenkov detectors:
  - e^-/π^- $\Rightarrow$ Noble Gas Čerenkov ($n-1 < 10^{-4}$)
  - $\pi^+/K^+ \Rightarrow$ Heavy Gas Čerenkov ($n-1 \leq 10^{-3}$)
  - $K^+/p \Rightarrow$ Aerogel Čerenkov ($n-1 \leq 0.03$)
- Heavy Gas Čerenkov will be the primary means for π^+/K^+ separation above 3.4 GeV/c.
  - 1 m long cylinder with 1.6 m diameter, to be operated at sub-atmospheric pressure.

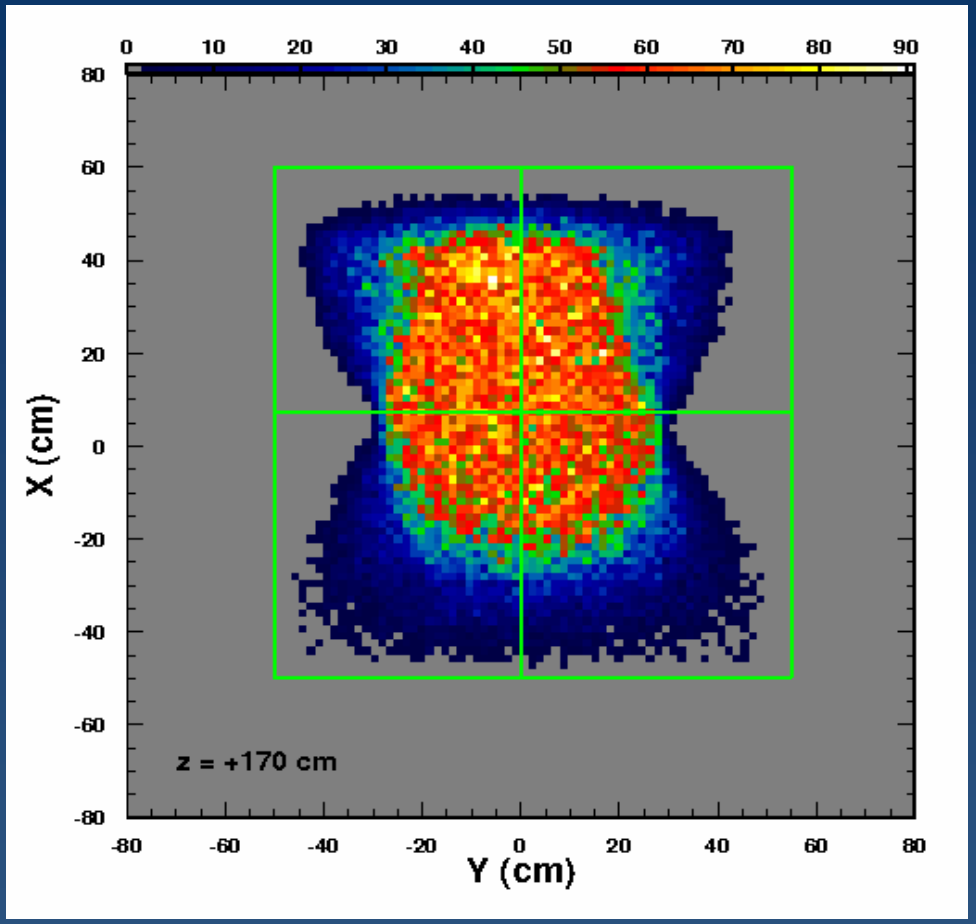
Dr. Garth Huber, Dept. of Physics, Univ. of Regina, Regina, SK S4S0A2, Canada.

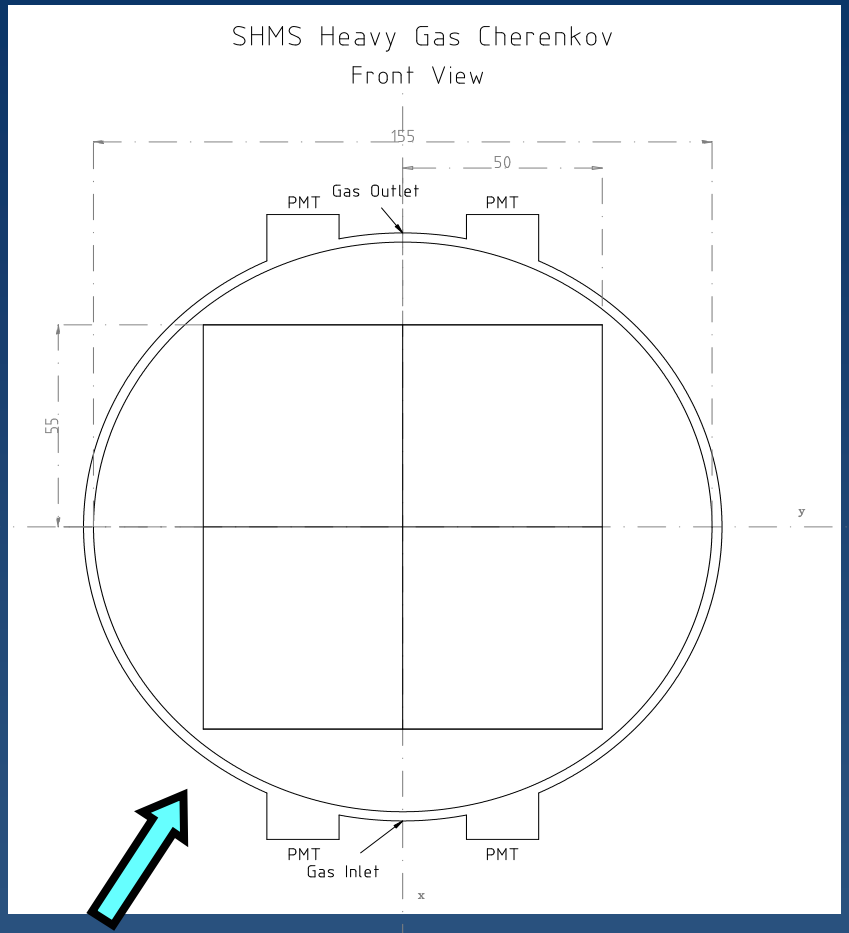


Gap between the `**set**' and `**K**' curves takes into account the SHMS momentum bite and a possible 0.1 atm error in the setting of the gas pressure regulator.

- Gas recirculation and purification system needed since gas pressure will be changed at higher SHMS momenta.
  - Maintain sub-atmosphere (0.95 atm) pressure below 7.3 GeV/c.
  - Above 7.3 GeV/c, reduce gas pressure to maintain good π/K separation.

Focal Plane Coverage

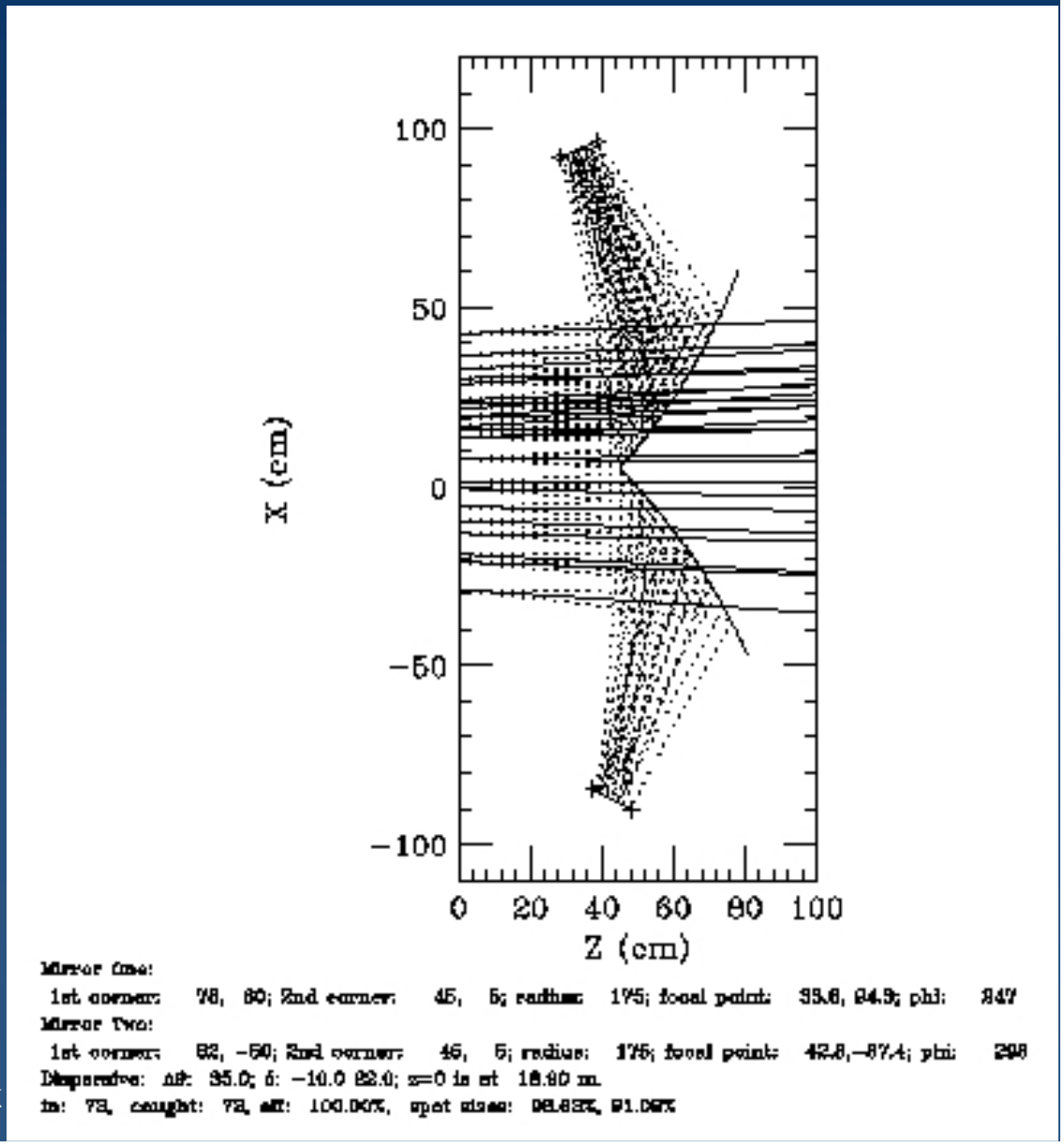




- Non-magnetic stainless steel pressure vessel.
  - 1.6m diameter cylinder.
- Titanium entrance and exit windows.

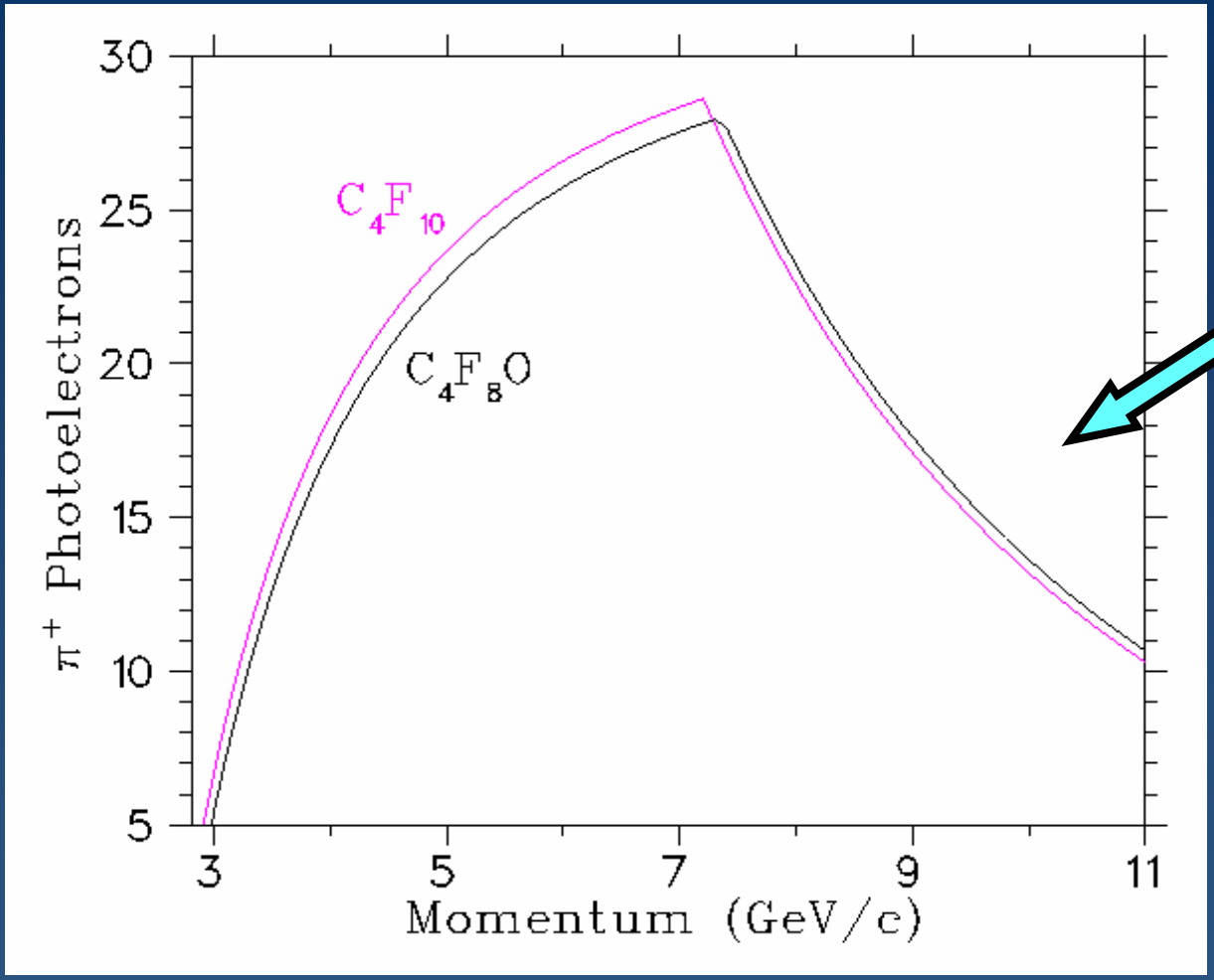
Optical Ray Tracing Studies

- Co-ordinating design with Donal Day.
- Four thin glass spherical mirrors (50cmx55cm, radius=175cm) each viewed by a 5” PMT.
- Asymmetric SHMS envelope dictates different mirror and PMT placements for ±δ.



Dr. Garth Huber, Dept. of Physics, Univ. of Regina, Regina, SK

Projected Performance



Projected #p.e. assuming 0.6m effective radiator path length and possible optical misalignment.

Useful (7 p.e.) lower momentum limit estimated to be 3.4 GeV/c.

Dr. Garth Huber, Dept. of Physics, Univ. of Regina, Regina, SK S4S0A2, Canada.

Updated Timeline

- Design: 2008-2010.
  - GuideIt studies (CERN optics package).
  - Mechanical design.
- NSERC grant application: Fall 2009.
  - New date dictated by DOE timeline and recent comments by NSERC re. possible GlueX BCAL support.
- Construction: 2011-2012.
- Delivery to JLab: Winter, 2013.
- Installation in Hall C: Summer, 2013.
- Detector checkout (no beam): Winter, 2014.