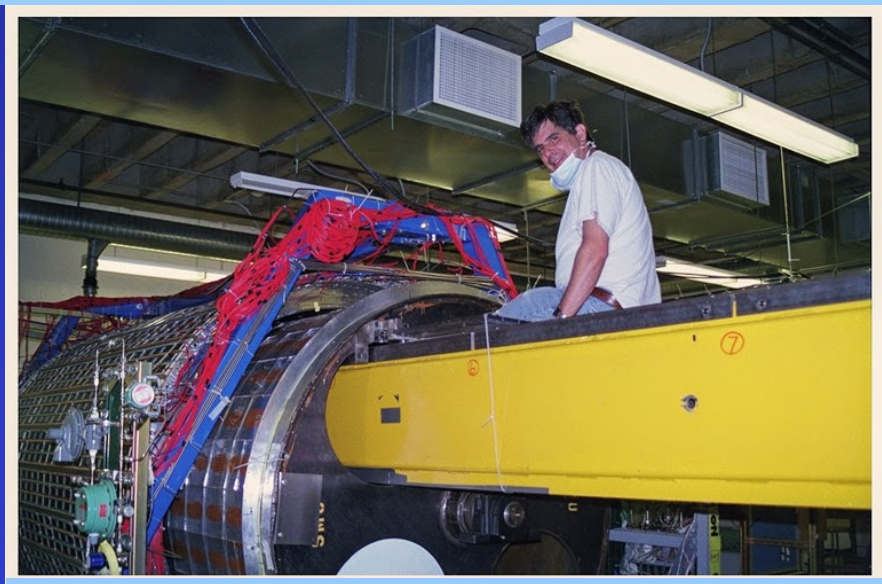
Homage to Sheldon Stone



Franz Muheim
University of Edinburgh

Thanks to Marina Artuso and
Tomasz Skarnicki for pictures

11th International workshop on Ring Imaging Cherenkov Detectors
RICH2022 12 to 16 September 2022 at Edinburgh

Sheldon Stone 1946 - 2021

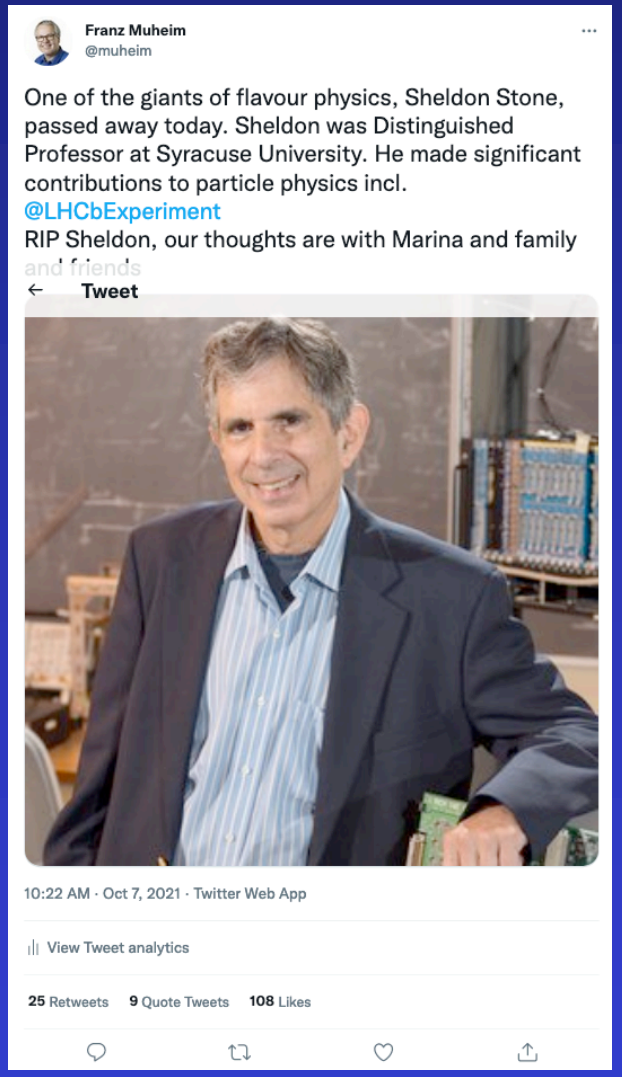
Syracuse University
College of Arts & Sciences

Sheldon Stone

A&S Mourns the Loss of Sheldon Stone, Distinguished Professor of Physics.

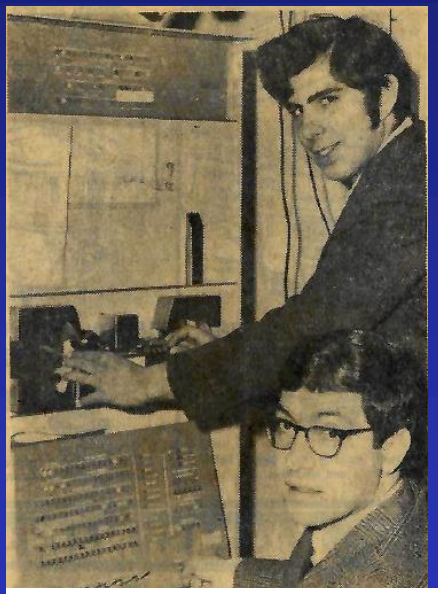
Sheldon Stone, distinguished professor of physics in the College of Arts and Sciences (A&S), passed away on October 6, after battling a chronic illness for many years. He is survived by his wife and close colleague Marina Artuso, also a professor of physics at Syracuse University. (Read the article).

Share your memories.



Sheldon's CV

- **Education**:
  - Brooklyn Technical High School, New York City
  - B.S. Physics, Brooklyn College (1967) Cum Laude
  - Ph.D. Physics, University of Rochester (1972)



Sheldon, and Tom Ferbel

- **Positions**:
  - 1971 - 1973 Research Associate, Vanderbilt University
  - 1973 - 1979 Assistant Professor of Physics, Vanderbilt University (1977-79 on leave at LNS)
  - 1979 - 1991 Senior Research Associate Laboratory of Nuclear Studies, Cornell University
  - 1991-2021 Professor, Syracuse University

Personal Memories

- **I met Sheldon first in the late 1980s**
  - He visited PSI where I was a PhD student.
  - I got hooked on flavour physics by lectures from him and others at a winter school in Zuoz.
  - Since then our paths crossed frequently and he influenced me profoundly.

Sheldon 1986 in Heidelberg

- **In the early 1990s, Sheldon hired me as a postdoc in Syracuse.**
  - Working along him was great, I admired his knowledge of and passion for physics and he had a nose for exciting CLEO analyses.
  - In my last year at Syracuse we designed the CLEO III RICH.
- **Sheldon was a proponent of a B-physics experiment at a hadron collider**
  - In 1996 he became Co-Spokesman of BTeV experiment at Fermilab
  - I started LHCb so for several years we were friendly competitors.
- **Sheldon was good company**
  - I had left CLEO but we regularly met, e.g. at conferences.
  - We enjoyed going for meals and a good bottle of wine.

Sheldon and RICH detectors

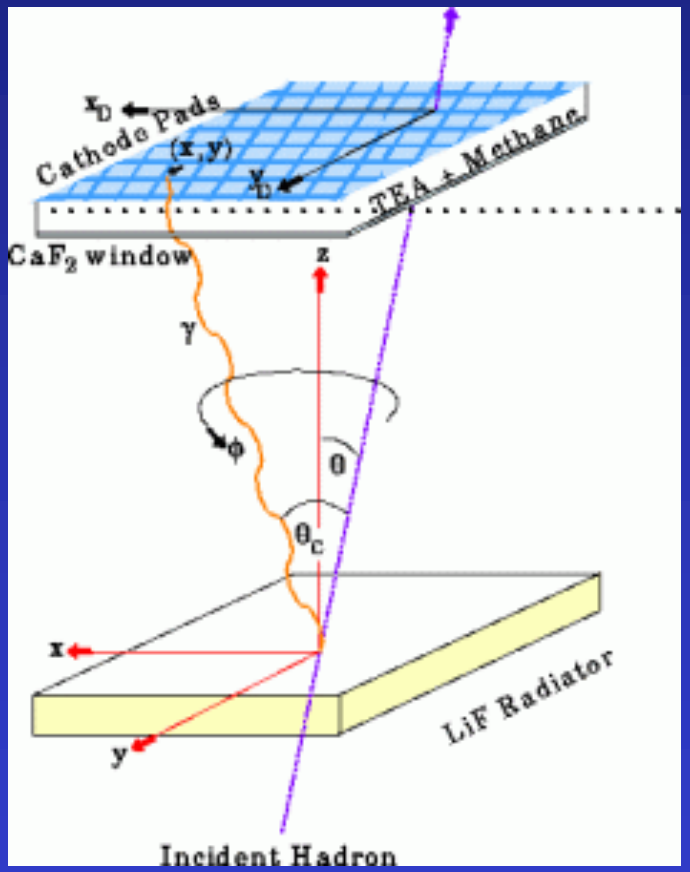
- **RICH Workshop series**
  - Sheldon was a member of International Scientific Advisory Committee from 1995 to 2013
- **1st workshop RICH 1993 - Bari (Italy)**
  - Artuso, M. et al , A fast ring imaging detector for the CLEO upgrade
  - Syracuse proposes a FastRICH for CLEO upgrade
  - Starts collaboration with Ypsilantis, Seguinot, Arnold et al.
- **Backstory**
  - In 1993 Cornell loses bid for asymmetric B-factory to SLAC
  - Cornell obtains funding for for CESR and CLEO-III upgrades

RICH1993 at Bari
Klaus Honscheid, Sheldon, Marina and Ray Mountain

Sheldon proposes CLEO-III RICH

- **CLEO III RICH design and construction**
  - Proposed and led by Syracuse group under Sheldon's leadership

- **Main features of CLEO III RICH**
  - Fast RICH principle
  - LiF radiator and CaF_2 window
  - TEA & Methane photosensor
  - MWPC coupled to cathode pads
- **Challenges**
  - UV based quantum efficiency 135 – 165 nm
  - Photon detectors
  - Mechanical design for radiator and window



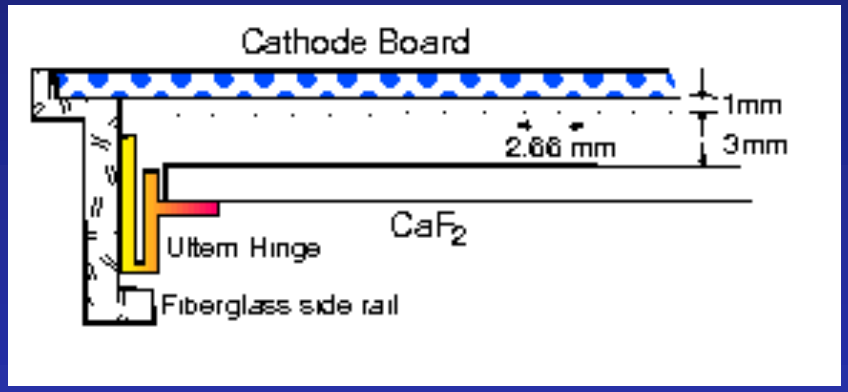
Dinner at Chateau Farges

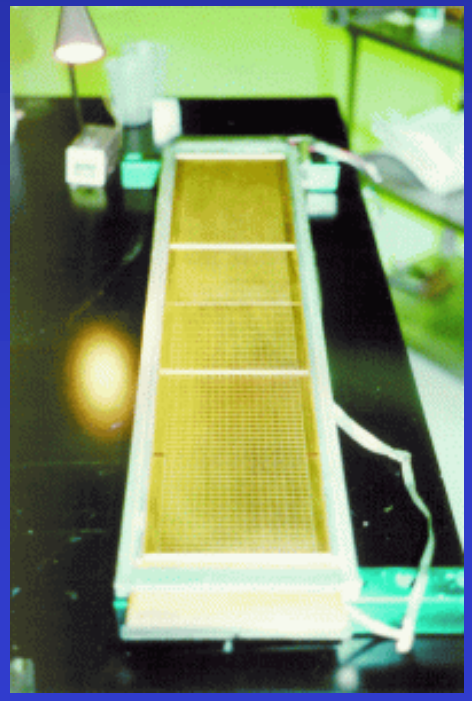
- **In my last year at Syracuse I contributed to the CLEO-III RICH Design**
  - In summer 1994 we went to CERN for a testbeam of a prototype Fast RICH detector with a CsI photocathode, led by Tom Ypsilantis, Jacques Seguinot et al.
  - It quickly became clear that the device did not work as expected.
  - We were quite depressed, also hungry,
    and we went for dinner at Chateau de Farges.
    It was there and then that - over good food and wine –
    Sheldon, Marina and I first discussed
    a CLEO-III RICH design using
    methane gas and triethylamine (TEA)
    as photosensor and a LiF radiator.
    We left in a much better mood.

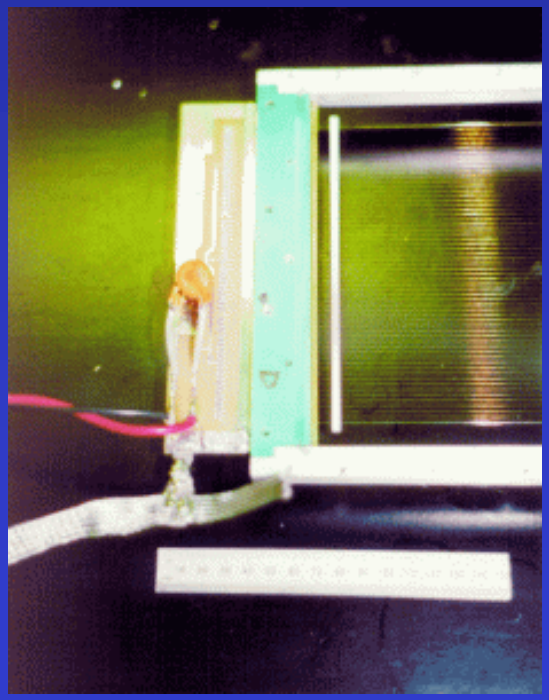
Château de Farges

CLEO III RICH protoype

- **CLEO III RICH prototype**
  - Designed and constructed at Syracuse
  - I had experience with MWPCs and built the wire chamber

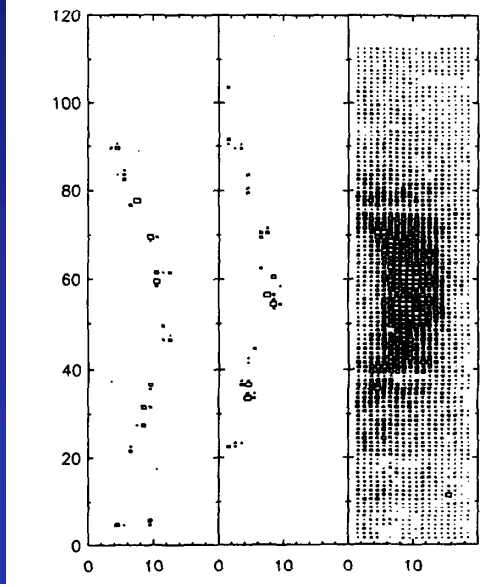






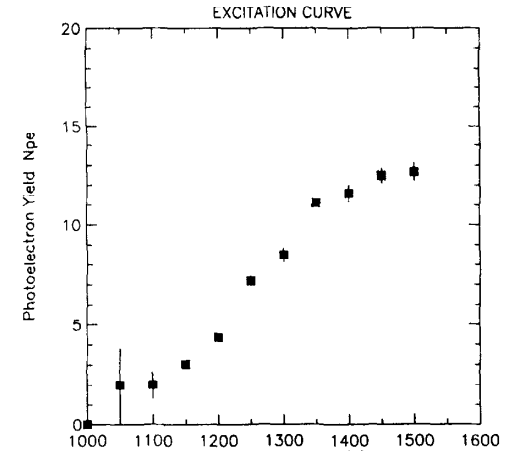
RICH1995 at Uppsala

- **RICH1995 – Uppsala (Sweden)**
  - Syracuse contributions
  - M. Artuso, The ring imaging detector for CLEO-III
  - S. Playfer et al, Prototype studies for the CLEO-III RICH
  - A. Efimov et al, Monte Carlo studies of a novel LiF radiator for RICH detectors



Single rings and distribution

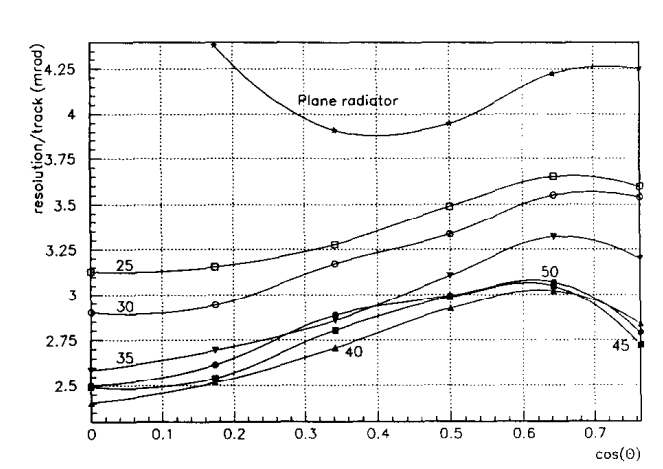
- **Results from CLEO-III RICH prototype**
  - Using cosmic ray test stand
  - Plateau of ~12.5 photo electrons
  - ”These results convince us that a RICH detector can be successfully built for CLEO III. “



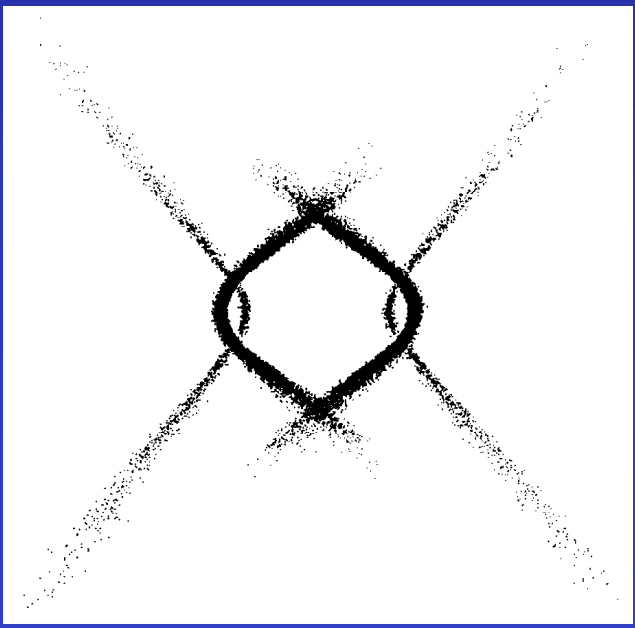
PE yield vs high voltage

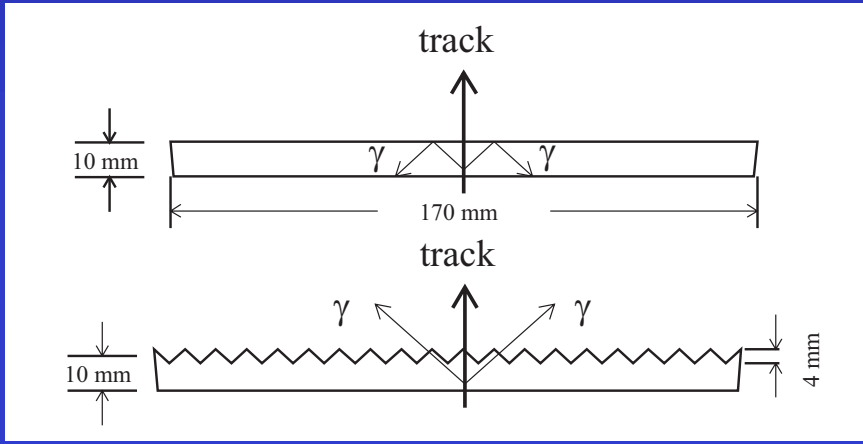
Sawtooth radiator

- **Coffee discussions**
  - π−K separation at p of 2.8 GeV/c is ~3σ
    Can this be increased?
  - At z = 0 photons in LiF will undergo
    total internal reflection, need to tilt mirrors
    This requires space and is difficult



- **Novel radiator concept**
  - Sheldon and Alexander Efimov - Sawtooth radiator
  - Simulations first presented at RICH1995



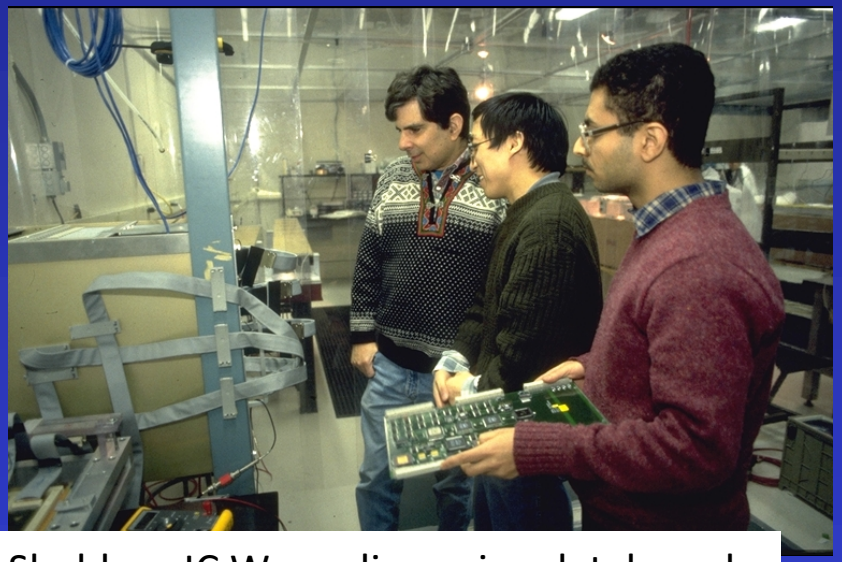


Syracuse RICH talks

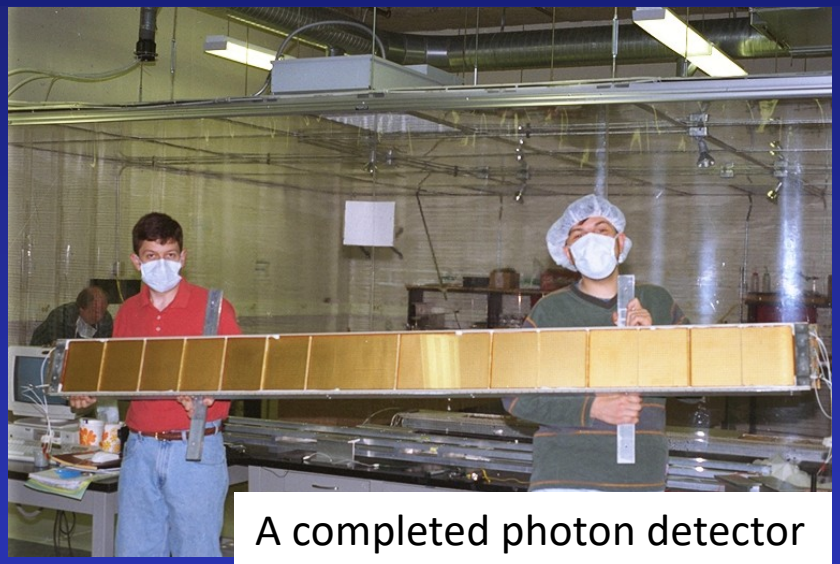
- **RICH 1998 - Ein Gedi (Dead Sea, Israel)**
  - Invited talk - S Stone, Physics results from RICH detectors
  - R. Mountain et al., The CLEO-III ring imaging Cherenkov detector Results from Fermilab test beam
- **RICH 2002 - Pylos (Greece)**
  - S. Blusk, Design and expected performance of the BTeV RICH
  - M. Artuso et al. Construction, pattern recognition and performance of the CLEO-III LiF-TEA RICH detector
  - R. Mountain, Development of a hybrid photodiode and its front end electronics for the BTeV experiment
- **RICH 2004 - Playa de Carmen (Mexico)**
  - R. Sia, Performance of the LiF-TEA Ring Imaging Cerenkov detector at CLEO
  - M. Artuso, The BTeV RICH front end electronics
  - T. Skwarnicki, Beam test of a C_4F_8O MAPMT RICH prototype

CLEO-III RICH construction

- **Photon detectors**
  - Built and assembled at Syracuse
  - Presented at RICH1998 and RICH2002



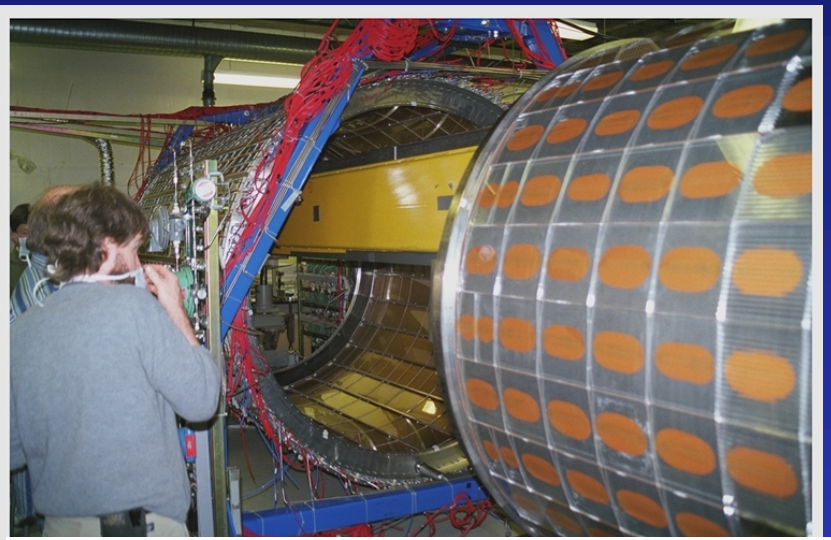
Sheldon, JC Wang discussing databoards



A completed photon detector

Inside 30 photon detectors, Sacha Kopp

CLEO-III RICH installation



Start of mating photon detectors with radiators

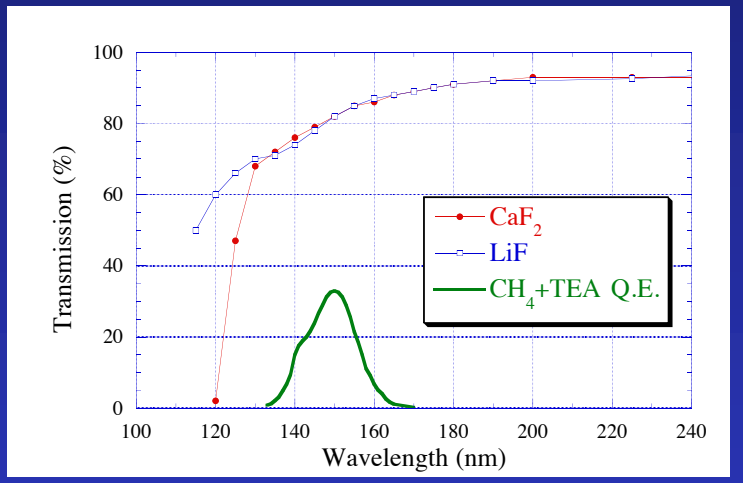
Almost finished

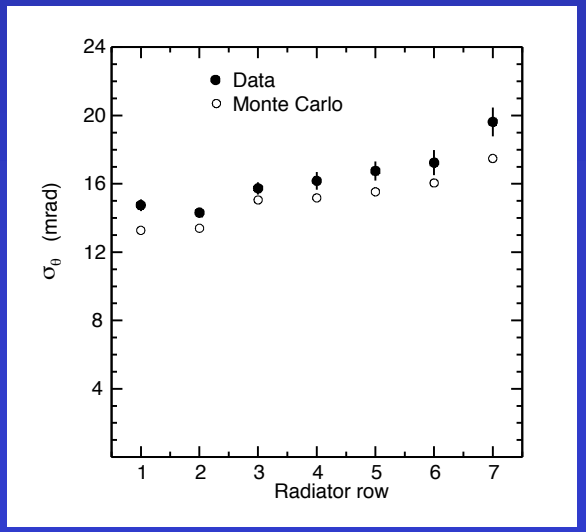
Ray Mountain and Sheldon, Transfer to Cornell/ CLEO

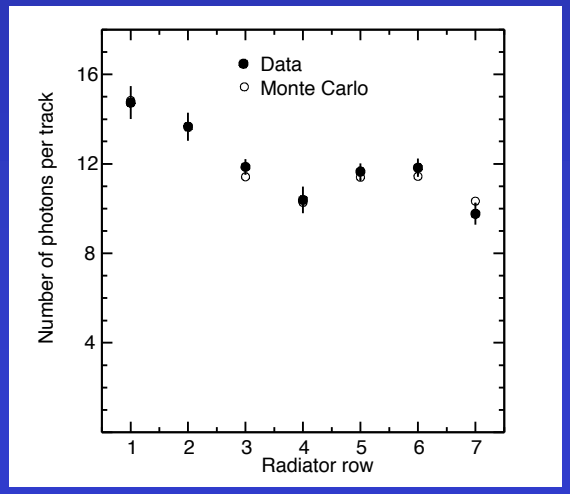
Inserting into CLEO magnet

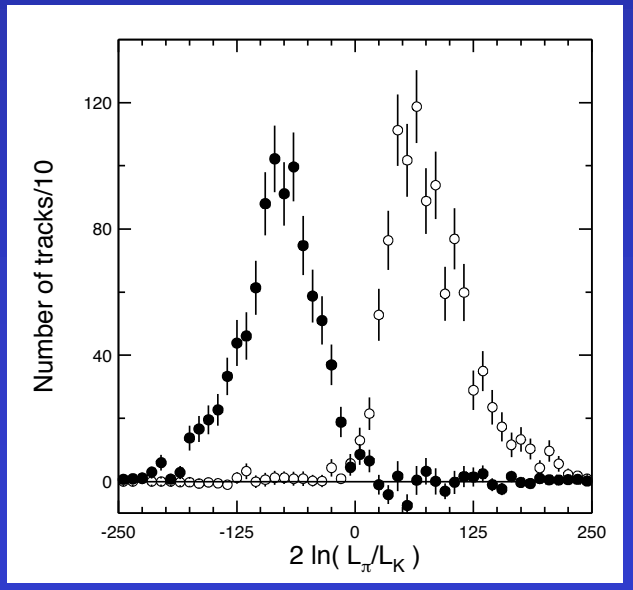
CLEO-III RICH

- **Performance**
  - First CLEO-III then CLEO-c at charm threshold
  - O_2 level kept below a few ppm
  - Photon yield kept constant
  - Excellent π–K separation
  - At p = 1 o 1.5 GeV/c (CLEO-c) fake rates at 1%
  - M. Artuso et al., The CLEO RICH detector



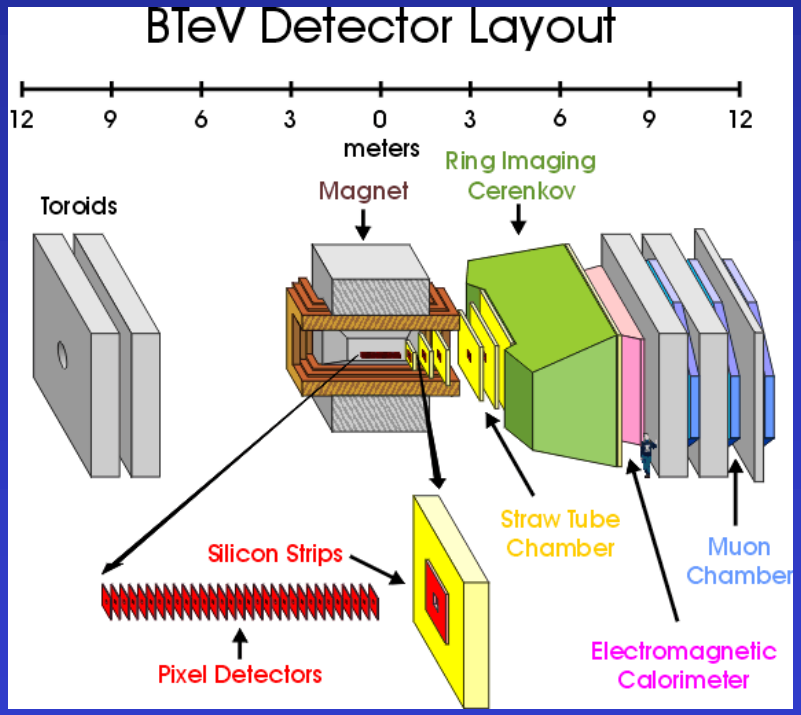






Sheldon in BTeV

- **BTeV**
  - Sheldon was an early proponent of BTeV experiment at Fermilab
  - In 1996 Sheldon became Co-Spokesman of BTeV

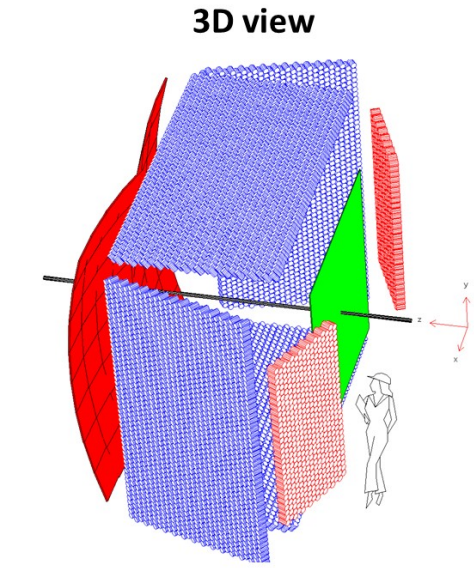


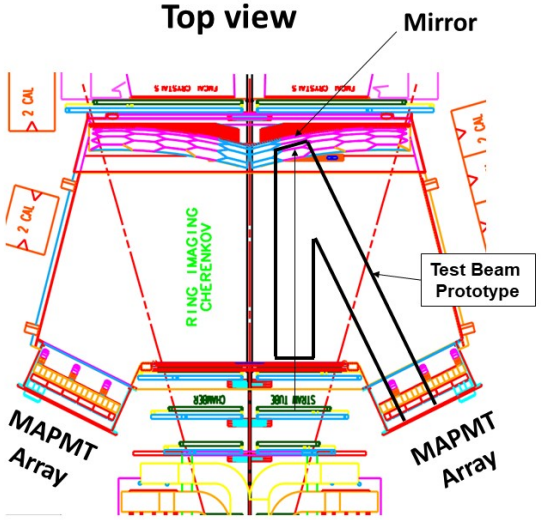
BTeV spokespersons – Sheldon and Joel Butler

BTeV RICH

- **BTeV RICH**
  - Syracuse designed RICH detector
    Sheldon, Marina Artuso, Steve Blusk,
    Ray Mountain, Tomasz Swarnicki, JC Wang
  - Replaced C_4F_{10} with C_4F_8O RICH gas radiator
  - Used MaPMTs as photon detectors
  - Presented at RICH2002 and RICH2004

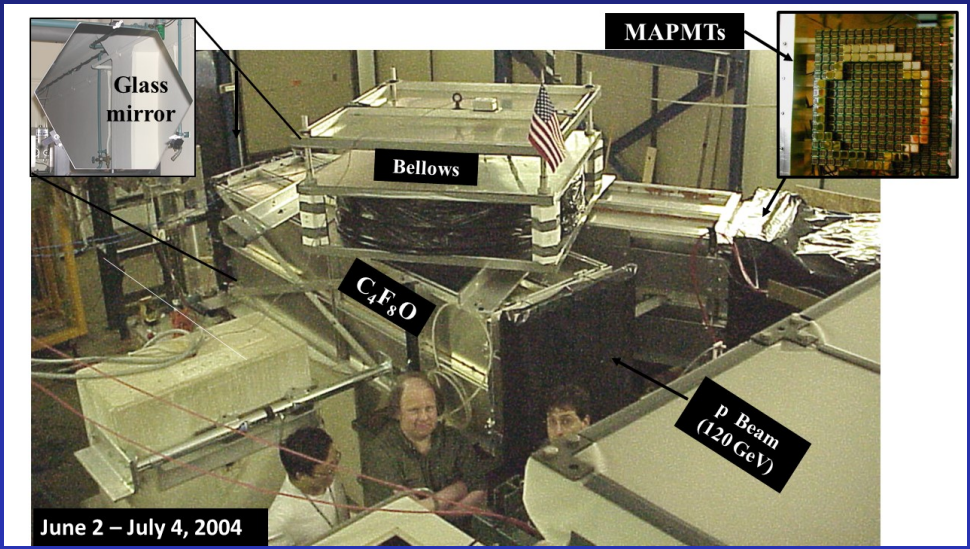
Tomasz Skwarnicki, Sheldon, Marina, Steve Blusk

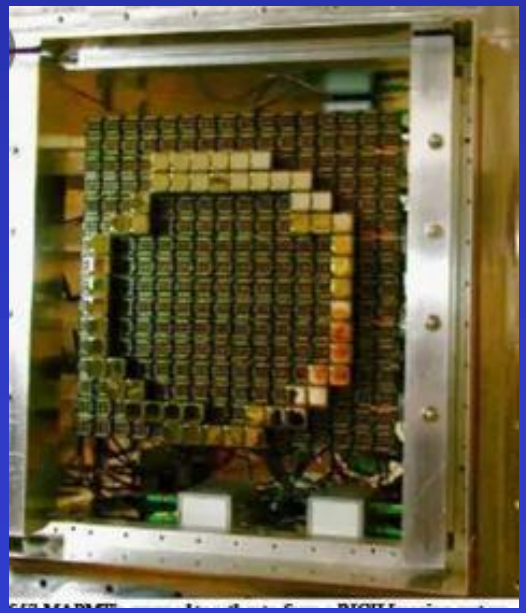


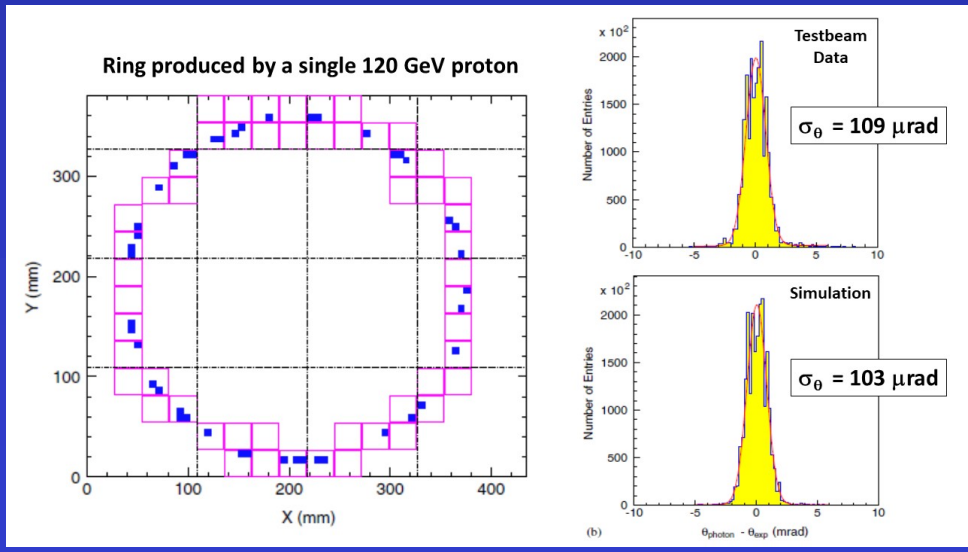


BTeV RICH

- **BTeV RICH prototype**
  - Built at Syracuse and tested with beams at Fermilab
  - Presented at RICH2004







Sheldon in LHCb

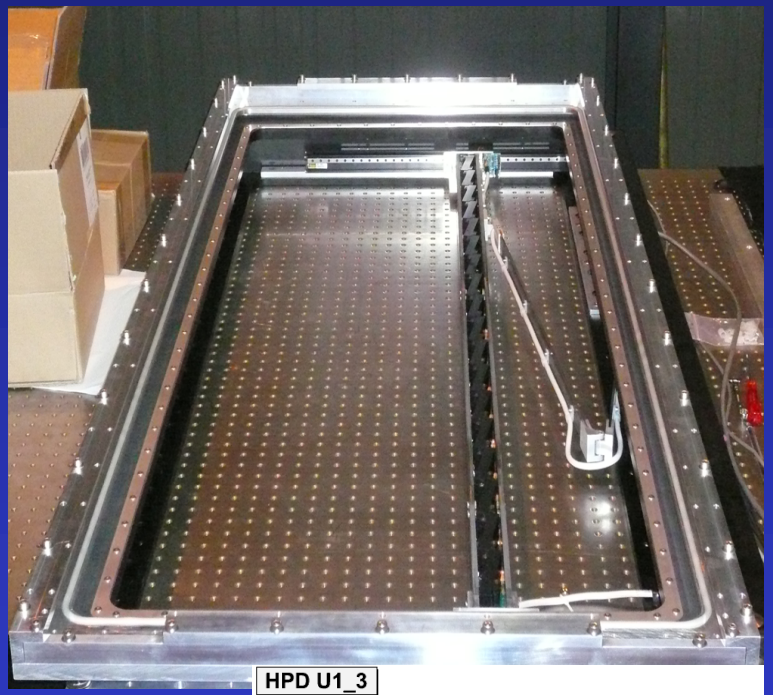
- **Sheldon and Syracuse joined LHCb in 2005**
  - When BTeV was cancelled, I was very happy to help to get his group into LHCb.
  - We resumed working closely together.
  - Sheldon hadn't lost a step.

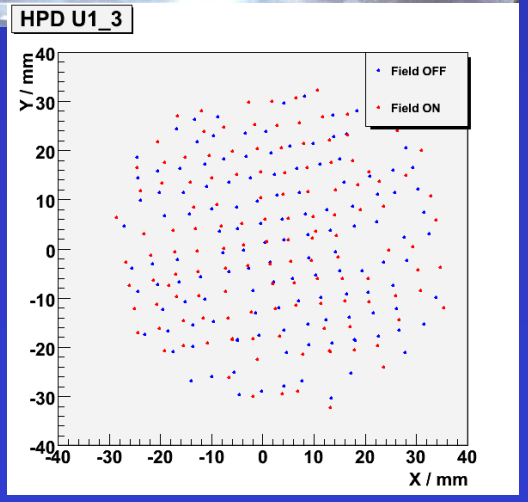
LHCb week Barcelona 2005

- **Sheldon in LHCb**
  - He became one of the most prolific producers of LHCb papers.
  - Making sure that we published early after switching on LHCb and again at the beginning of Run II. His physics knowledge and insight was as always superb.
  - He was on the team that discovered pentaquarks.
  - Sheldon and me were both pushing the LHCb upgrade, he was LHCb upgrade coordinator.
  - He was deputy project leader of the upstream tracker until the end.

LHCb RICH

- **LHCb RICH magnetic distortion calibration system**
  - Syracuse built magnetic distortion calibration system for RICH1
  - Collimated LEDs on moveable bar, retracted during collisions
  - Cherenkov angle resolution per photon improved by a factor of 2



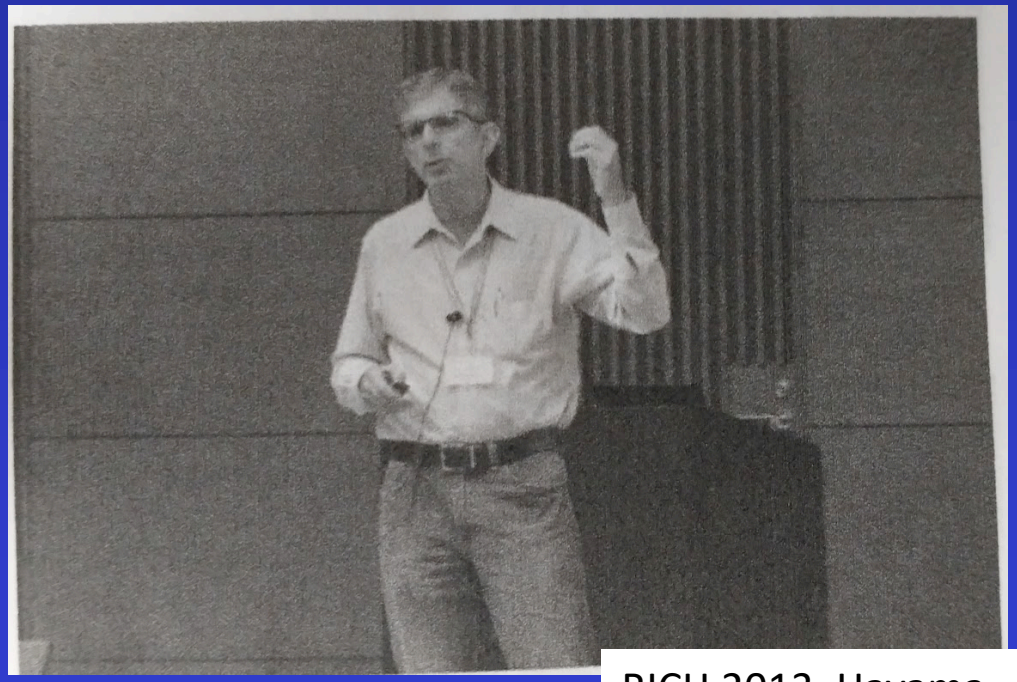


- **RICH 2010, Cassis France**
  - F. Muheim, The ring imaging Cherenkov detectors of the LHCb experiment
- **Paper**
  - A. Borgia et al, The magnetic distortion calibration system of the LHCb RICH1 detector

Sheldon's RICH talks

- **RICH 1998 - Ein Gedi (Dead Sea, Israel)**
  - Invited talk - S Stone, Physics results from RICH detectors
  - "It takes a Village to build a RICH, a village of knowledge cultivated at this conference. There are several different technologies …
    producing great results in neutrino physics, b decays and QCD. "

- **RICH 2013 -**
  Hayama (Kanagama, Japan)
  - Invited talk - S Stone,
    Use of RICH detectors for physics



RICH 2013, Hayama

Panofsky Prize

- **2019 W.K.H. Panofsky Prize in Experimental Particle Physics Recipient**
  - **Sheldon Leslie Stone**
    Syracuse University

- **Citation:**
  - "For transformative contributions to flavor physics and hadron spectroscopy, in particular through intellectual leadership on detector construction and analysis on the CLEO and Large Hadron Collider beauty experiments, and for the long- standing, deeply influential advocacy for flavor physics at hadron colliders."

Sheldon was a polymath

- **Enormous productivity**
  - Huge numbers of papers in CLEO and LHCb , backed up by analysis notes
- **Gifted speaker and great communicator**
  - Gave talks a ~100 conferences and workshops and lectured at ~10 schools
- **Forward looking with superb physics insight**
  - Proposing a new detector at CESR (CLEO II), initiating R&D for CsI(Tl) calorimeter
  - Led the design and construction of CLEO-II calorimeter
  - Pushing for a B-factory, for a B-physics experiment at a hadron collider
  - Proposing RICH detector for CLEO-III
  - Proposing to operate CLEO/CESR at charm threshold
  - Pushing for LHCb upgrade, LHCb upgrade coordinator
- **Passion for physics, talking with**
  - People at all career stages
  - Experimentalists and theorists
  - Detector builders and data analysts

RIP Sheldon

- **Sheldon - we miss you**

Sheldon and Marina at Lake Placid
LHCb week 2017

Backup

The end