Fast, Rad-Hard Gas Cerenkov Luminosity Monitor: Update since Cornell

John Hauptman, Iowa State University

SLAC ALCPG, 7-10 June 2004

Gas Cerenkov Luminosity Monitor

- Virgil Barnes (Purdue) has joined us and bought back the stainless steel tube solution. This is still the best for geometry and flexibility.
- New method to obtain very smooth and highly polished metallic surfaces (Sandia, IBEST).
- Calculations show good energy and angular resolutions. This is G3; G4 still has bugs reflecting Cerenkov light from repeated elements.
- NESTOR/LBNL 2 GHz waveform digitizer made-to-order for us.
- Better means to produce 1.4 ns bursts of blue light for testing PMTs, digitization and readout.

Synopsis of technique: Cerenkov light in a gas

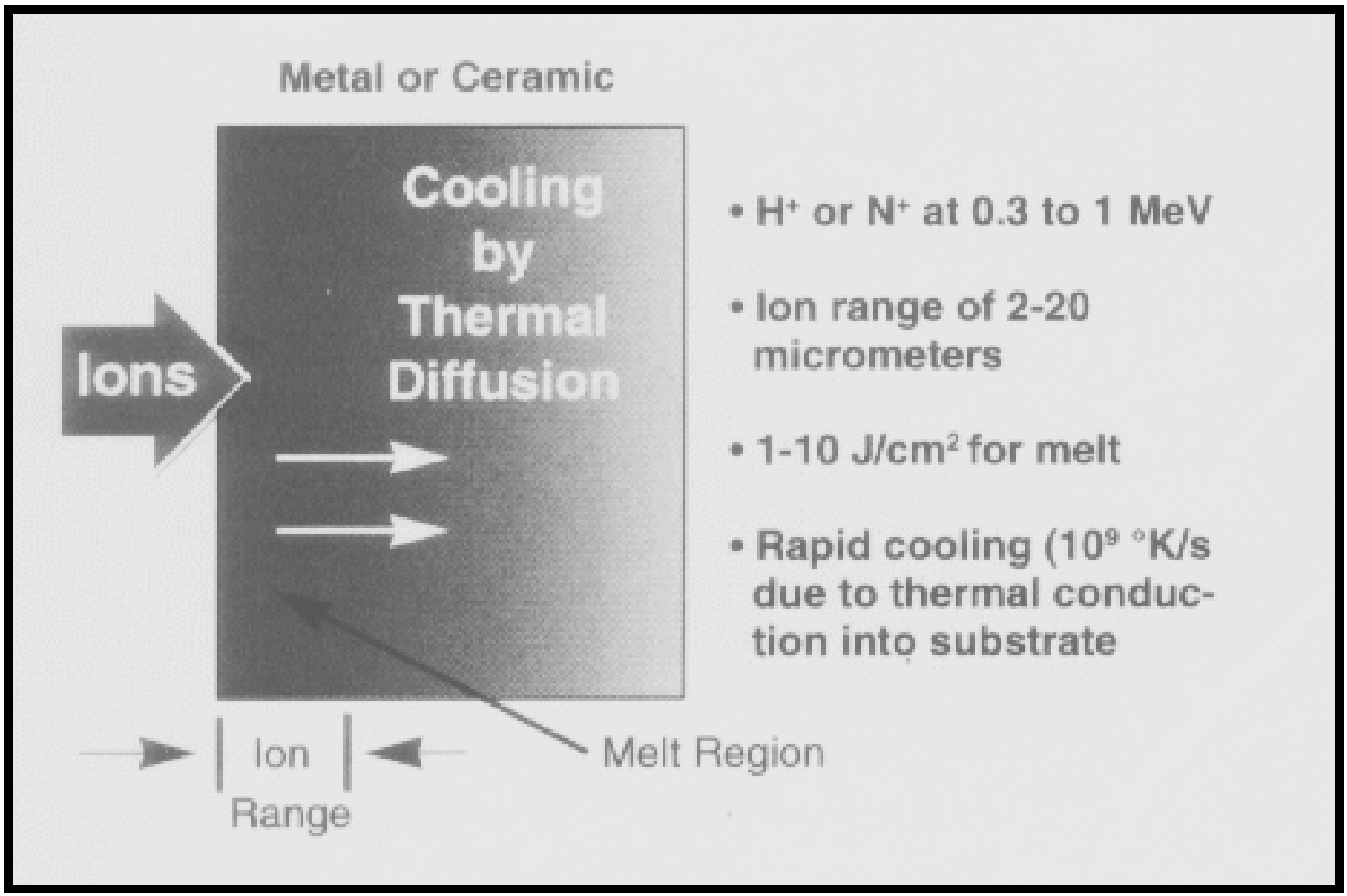
"Good"

- Threshold > 10 MeV
  (blind to low energy e/gamma in IR and beta-decays from radioactivation)
- Energy & spatial information carried by photons (fast, flushed within 1.4 ns bunch)
- Metal+Gas extremely radiation hard (probably "indestructible")
- **12** ps light pulse

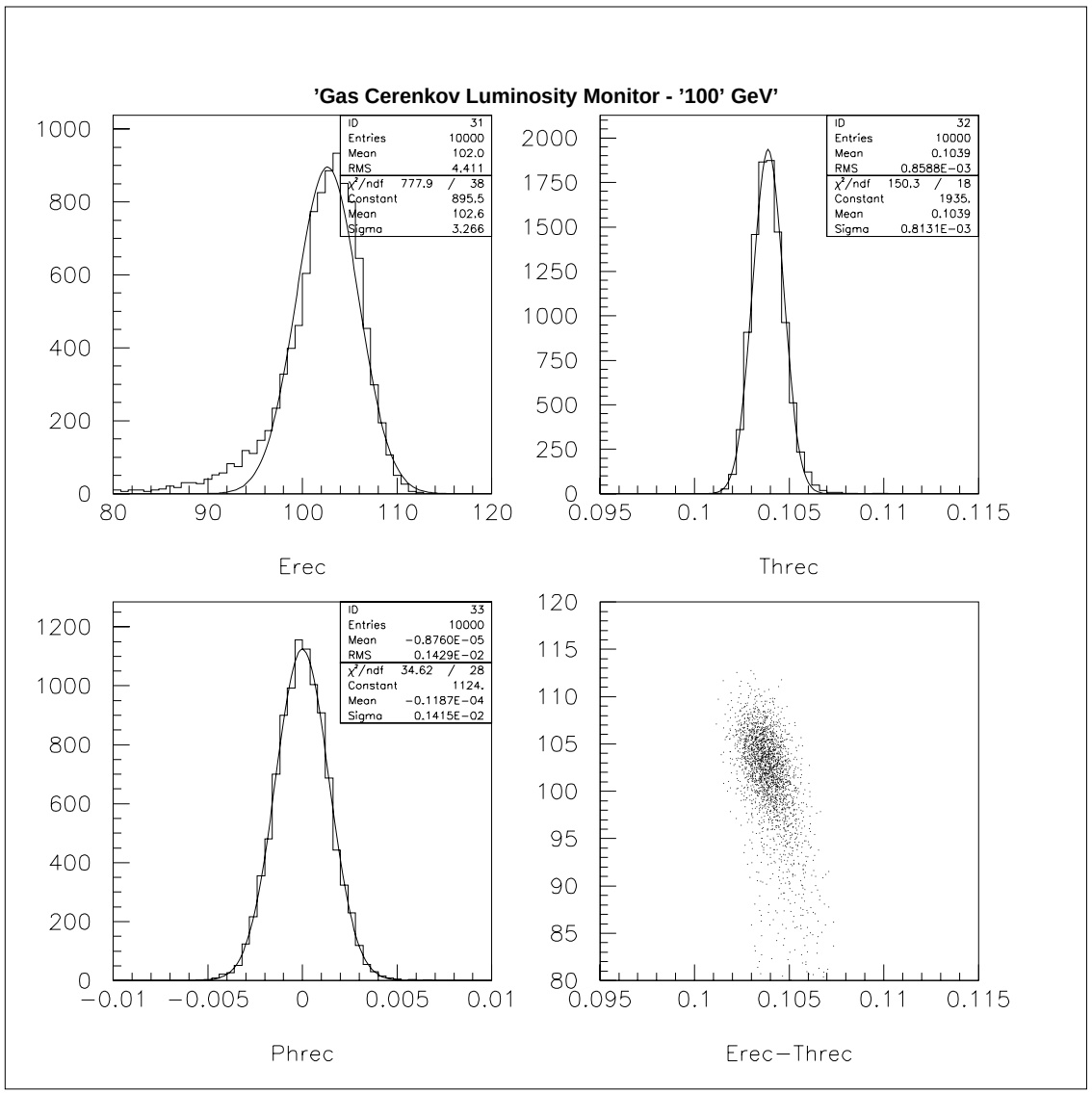
"Not so good"

- Requires grazing angle reflectivity near 1.0
  (metallic smoothness)
- Small correlation between shower angle and energy (correctible)
- Too many possible, and clever, geometries!

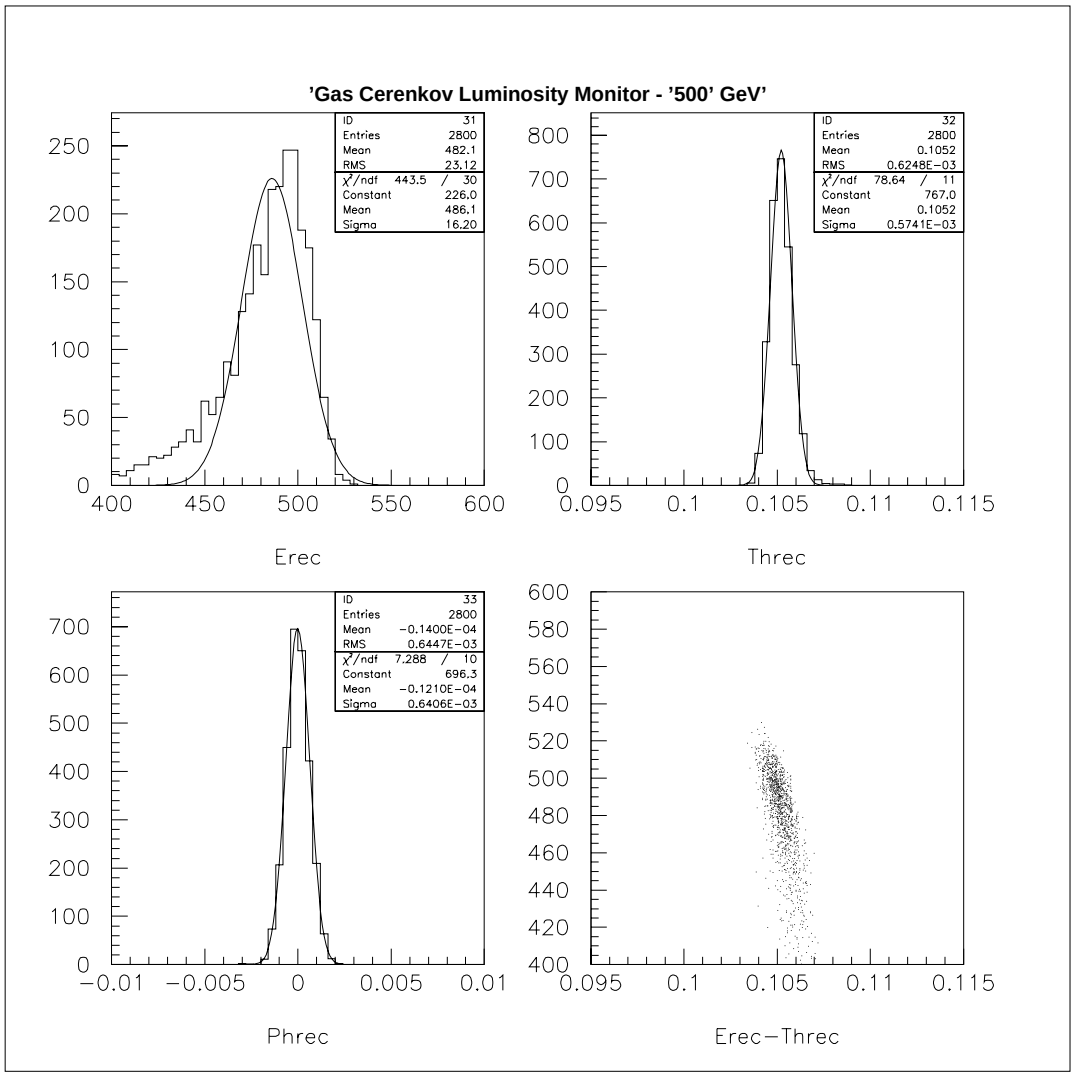
Sandia Ion Beam



100 GeV e-


'Gas Cerenkov Luminosity Monitor - '100' GeV'
ID 31
Entries 10000
Mean 102.0
RMS 4.411
χ²/ndf 777.9 / 38
Constant 895.5
Mean 102.6
Sigma 3.266
Erec
ID 32
Entries 10000
Mean 0.1039
RMS 0.8588E−03
χ²/ndf 150.3 / 18
Constant 1935.
Mean 0.1039
Sigma 0.8131E−03
Threc
ID 33
Entries 10000
Mean −0.8760E−05
RMS 0.1429E−02
χ²/ndf 34.62 / 28
Constant 1124.
Mean −0.1187E−04
Sigma 0.1415E−02
Phrec
Erec−Threc

500 GeV e-


'Gas Cerenkov Luminosity Monitor - '500' GeV'
ID 31
Entries 2800
Mean 482.1
RMS 23.12
χ²/ndf 443.5 / 30
Constant 226.0
Mean 486.1
Sigma 16.20
Erec
ID 32
Entries 2800
Mean 0.1052
RMS 0.6248E-03
χ²/ndf 78.64 / 11
Constant 767.0
Mean 0.1052
Sigma 0.5741E-03
Threc
ID 33
Entries 2800
Mean -0.1400E-04
RMS 0.6447E-03
χ²/ndf 7.288 / 10
Constant 696.3
Mean -0.1210E-04
Sigma 0.6406E-03
Phrec
Erec-Threc