Measuring Hydrogen Fluences in the Genesis Collectors: A Progress Report

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Summary of Last Year's Presentation

- Can get reproducible data if we control instrument conditions and stay ~1.5 mm from the edge of sample or holder mask.
- Can detect extraction-field distortions with E-gun and by comparing H/C with CH/C_2. First-order corrections are possible.
- Reported a beam-current dependence, but this was an artifact of our integration method.
- Standards did not agree with one another.

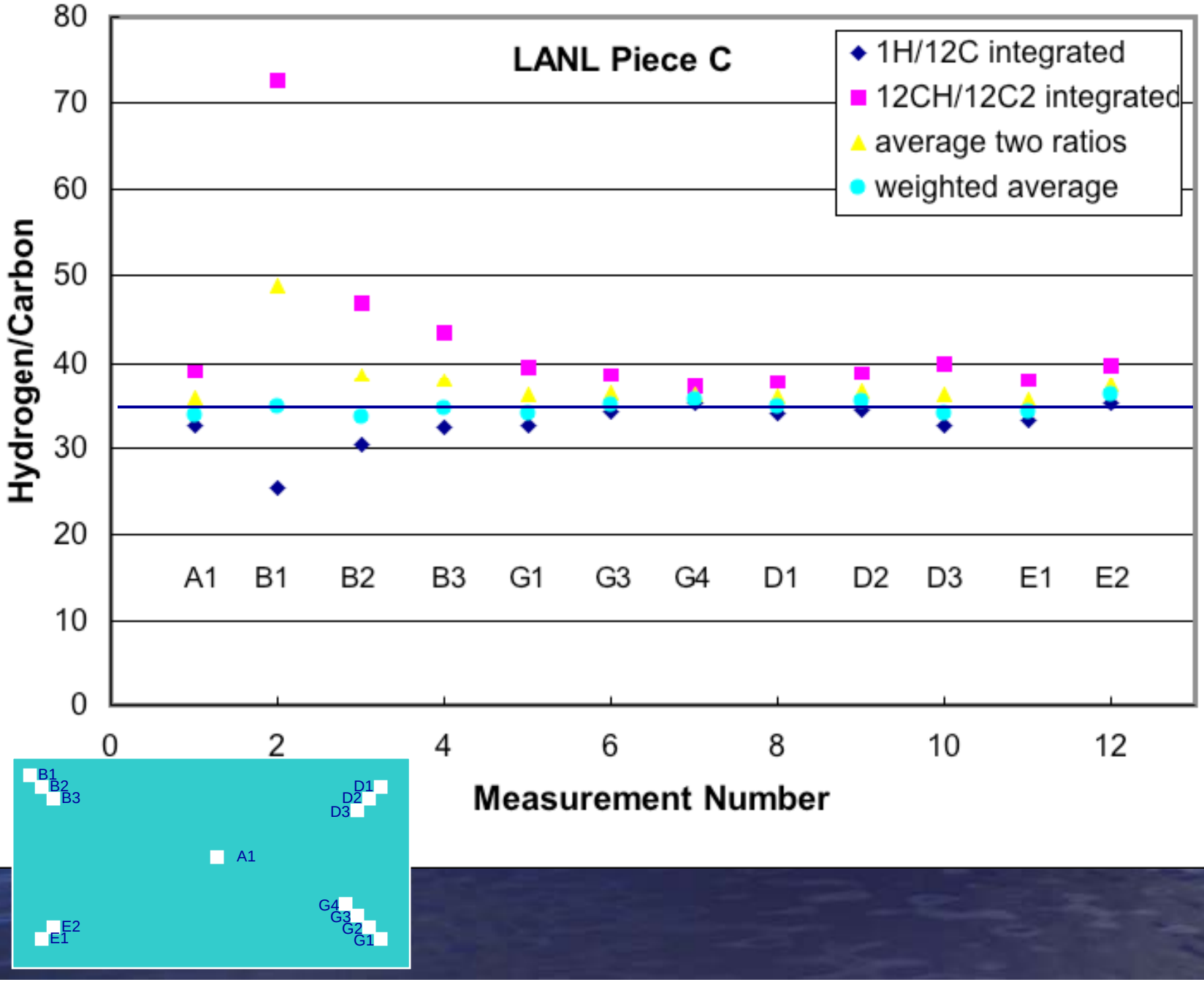
$\Rightarrow$ We estimated that measurements could be made with ~5% precision and accuracy (2 σ).

During the Past 12 Months

- Obtained a new standard from Los Alamos National Lab with a nominal H fluence of $1.8 \times 10^{16}/cm^2$.
- Obtained new sample holders that better match the size of available GENESIS samples.
- Four DOS samples were allocated for measurement:
  - B/C array, E array, H array, L array
- Measured new and old standards to find a set that agree with each other.
- Revised measurement details to improve reproducibility and to better sample the shallow solar wind.

Analytical Conditions

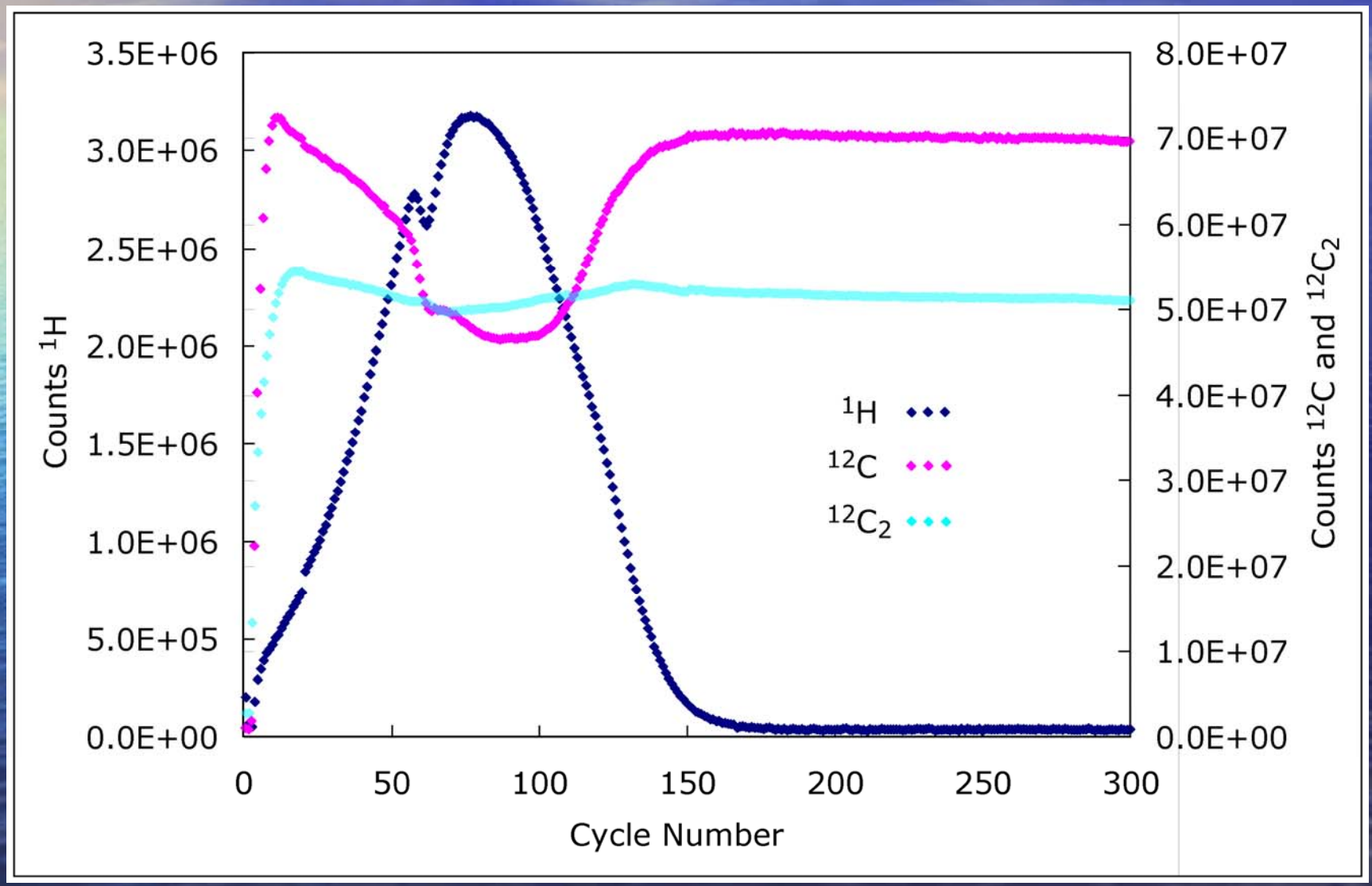
- Sample chamber vacuum <5×10^{-10} torr.
- Contrast aperture 150 μm. Field aperture open.
- 100x100 μm raster, E-gate 40% (central 25x25 μm area).
- Dynamic transfer system on.
- Automatic beam centering in field aperture.
- Mass resolving power ~3000 (M/ΔM).
- Electron gun used to degas the sample surface and to evaluate extraction field. Not used during measurement.
- Primary beam current 1, 2, and 4 nAmps.
- Measured ^{1}H, ^{12}C, $^{12}C^{1}H$, $^{12}C_2$
  - 4 nA beam current: all on FC2 Faraday cup.
  - 1, 2nA beam currents: ^{1}H and ^{12}CH on EM, ^{12}C and $^{12}C_2$ on FC2


LANL Piece C
1H/12C integrated
12CH/12C2 integrated
average two ratios
weighted average
Hydrogen/Carbon
Measurement Number
80
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
A1
B1
B2
B3
G1
G3
G4
D1
D2
D3
E1
E2

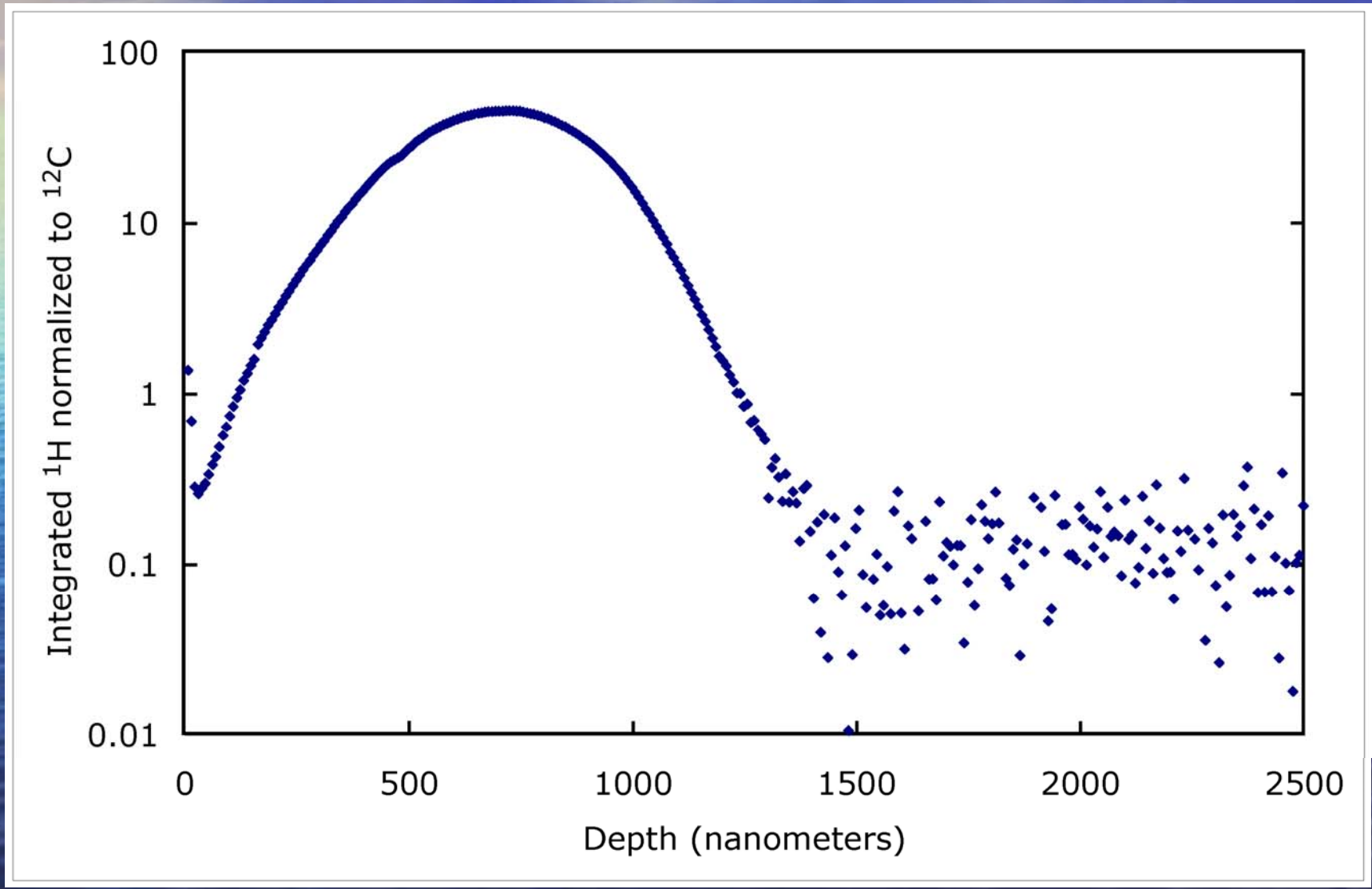
Standards

- New DOS standard from Los Alamos National Lab.
  - nominal H fluence: $1.8 \times 10^{16}/cm^2$, 18 keV.
- Previous standards:
  - Sandia-5, nominal fluence $1.5 \times 10^{17}/cm^2$, 14-20 keV
  - SWRI, nominal fluence $1.8 \times 10^{16}/cm^2$, 7.7 keV

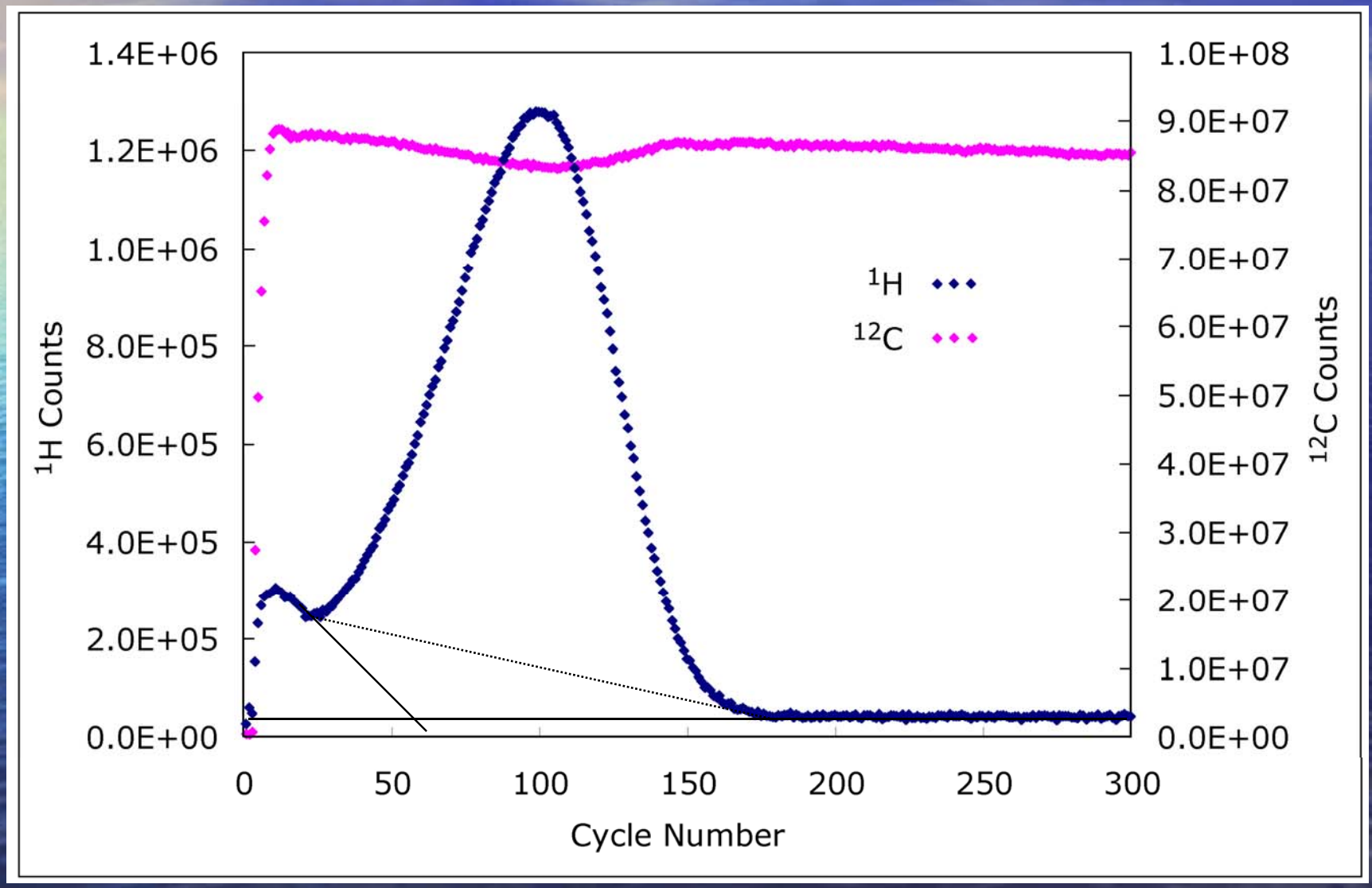
Sandia 5 Count-rate Profiles



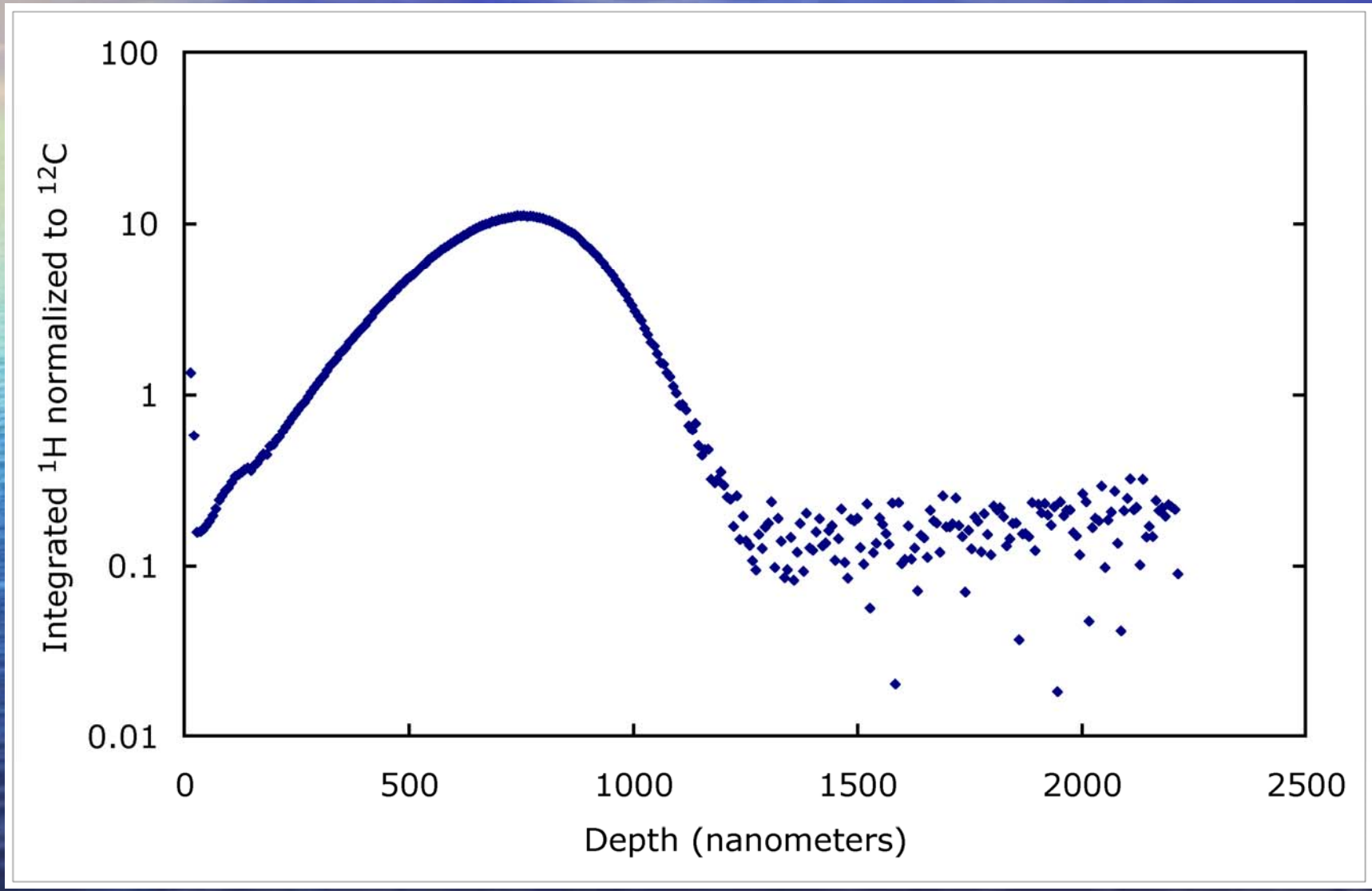
Sandia 5 $^{1}H/^{12}C$ ratio



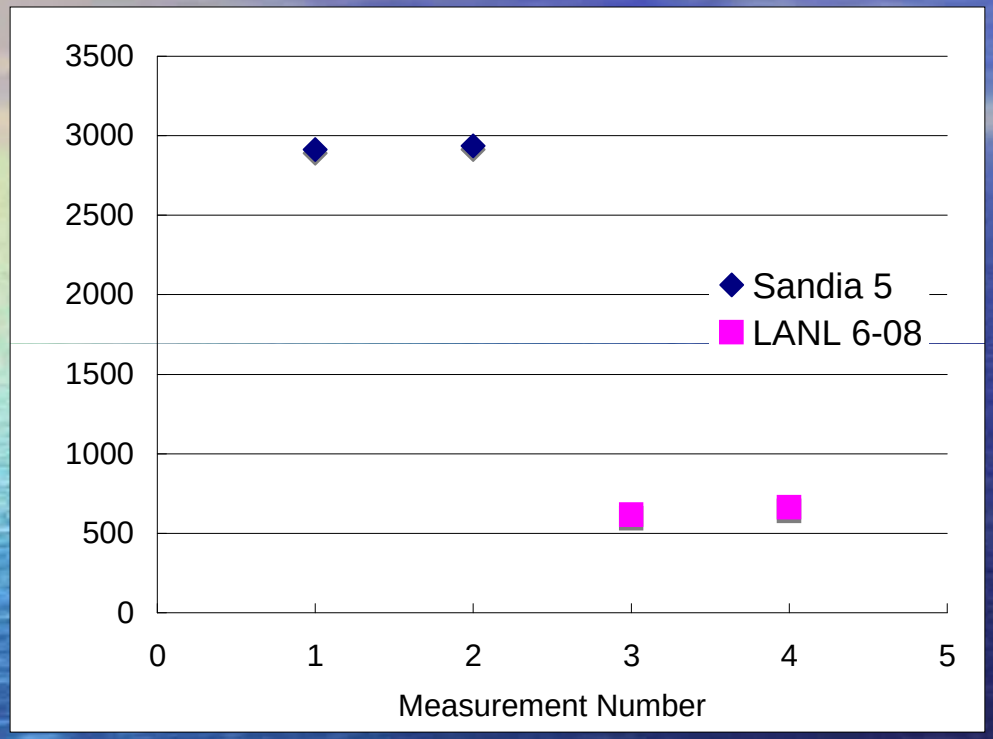
LANL 6-08 Count-rate Profiles



LANL 6-08 $^{1}H/^{12}C$ ratio



Compare Sandia 5 and LANL 6-08



Conditions

- 4 nA primary beam
- 100 mm raster
- Egate 40%
- MRP ~4000
- Detector FC2

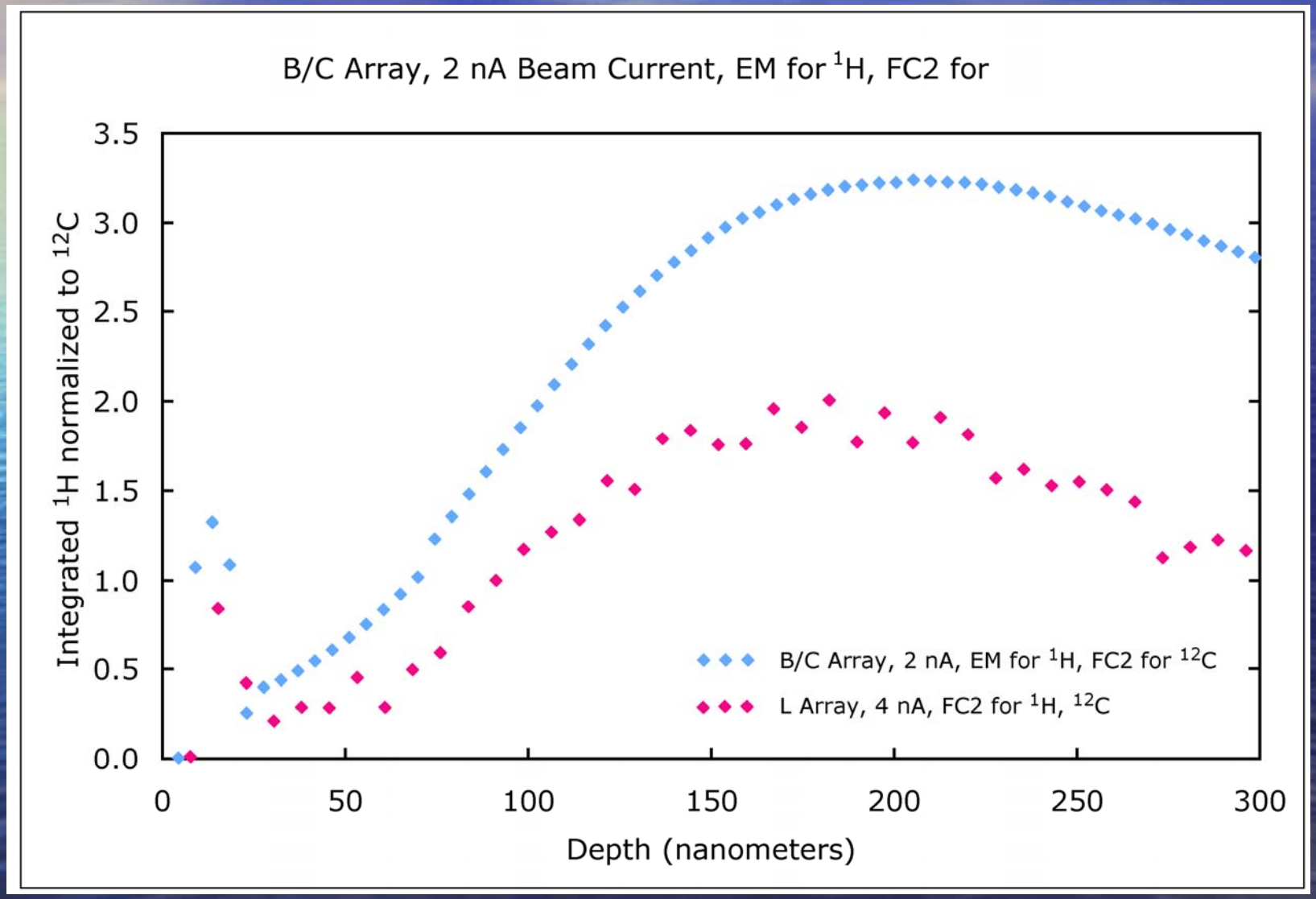
Nominal: LANL 6-08 $1.8 \times 10^{16}/cm^2$

Sandia-5 $1.5 \times 10^{17}/cm^2$ Ratio 0.12

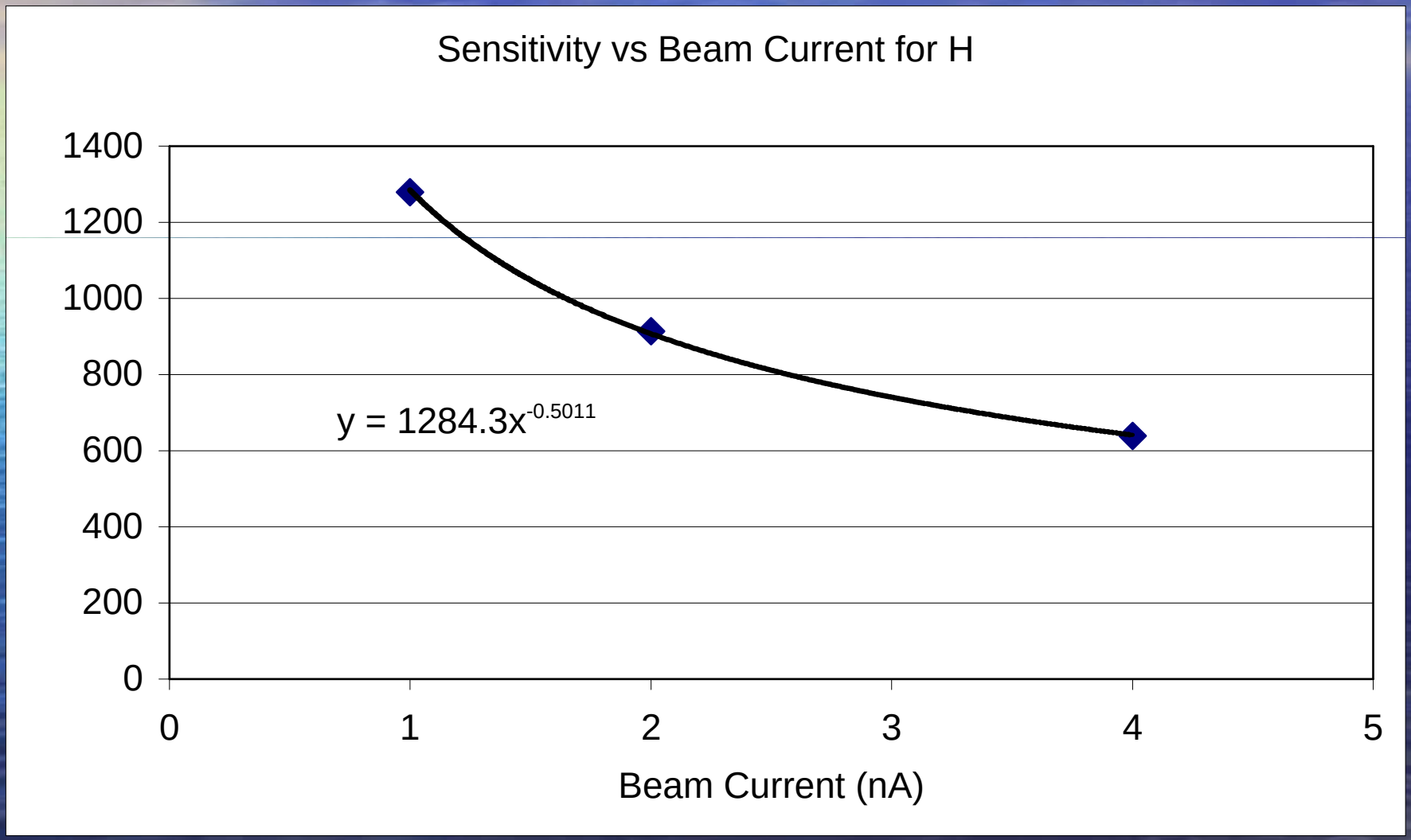
Measured: LANL 6-08 638.8 ± 65.0

Sandia-5 2926.1 ± 33.2 Ratio 0.22

Minimizing Surface Transient Effects



Beam Current Dependence



What’s next?

- Solve the problem with standardization.

Standards

- Previous DOS standards:
  - Sandia-5, nominal fluence $1.5 \times 10^{17}/cm^2$, 14-20 keV
  - SWRI, nominal fluence $1.8 \times 10^{16}/cm^2$, 7.7 keV
  - LANL 6-08, nominal fluence $1.8 \times 10^{16}/cm^2$, 18 keV
- New DOS standards:
  - Kroko, nominal fluence $2 \times 10^{15}/cm^2$, 15 keV
  - Kroko, nominal fluence $6 \times 10^{15}/cm^2$, 15 keV
- New Si standards:
  - SWRI, nominal fluence $1.8 \times 10^{16}/cm^2$, 7.7 keV
  - LANL 6-08, nominal fluence $1.8 \times 10^{16}/cm^2$, 18 keV
  - Kroko, nominal fluence $2 \times 10^{15}/cm^2$, 15 keV
  - Kroko, nominal fluence $6 \times 10^{15}/cm^2$, 15 keV

What’s next?

- Solve the problem with standardization.
- Optimize measurement of the shallow portion of the implants.
- Make the measurements!