# BigCal for GEp5
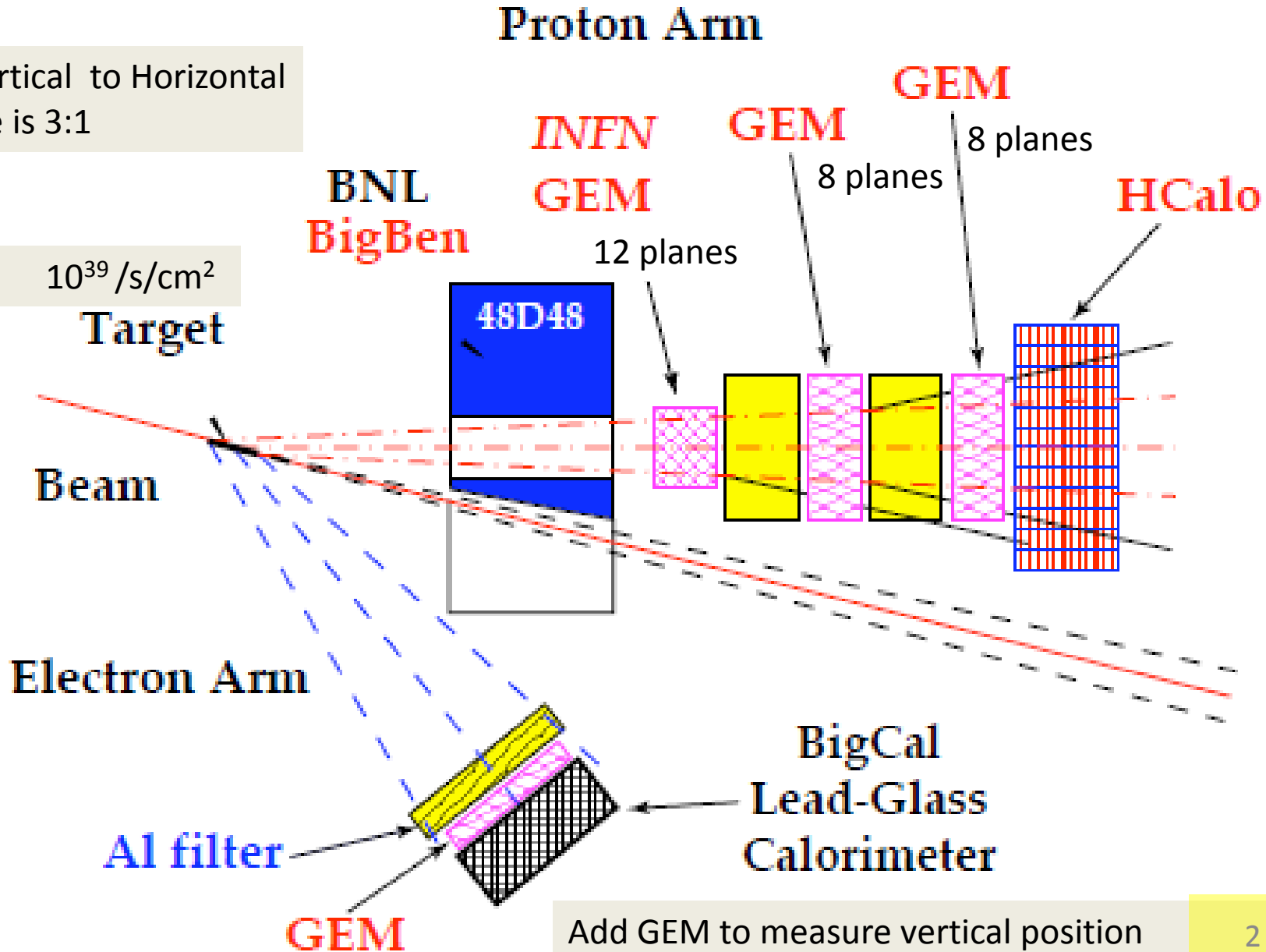
Mark Jones

for the GEp5 Collaboration

# Experiment Setup

Ratio of Vertical to Horizontal acceptance is 3:1

40cm LH2    $10^{39}$ /s/cm$^2$

**Proton Arm**

GEM

GEM

INFN GEM

8 planes

8 planes

BNL BigBen

12 planes

HCalo

Target

48D48

Beam

Electron Arm

Al filter

GEM

BigCal Lead-Glass Calorimeter

Add GEM to measure vertical position
Improve track matching

# Kinematics

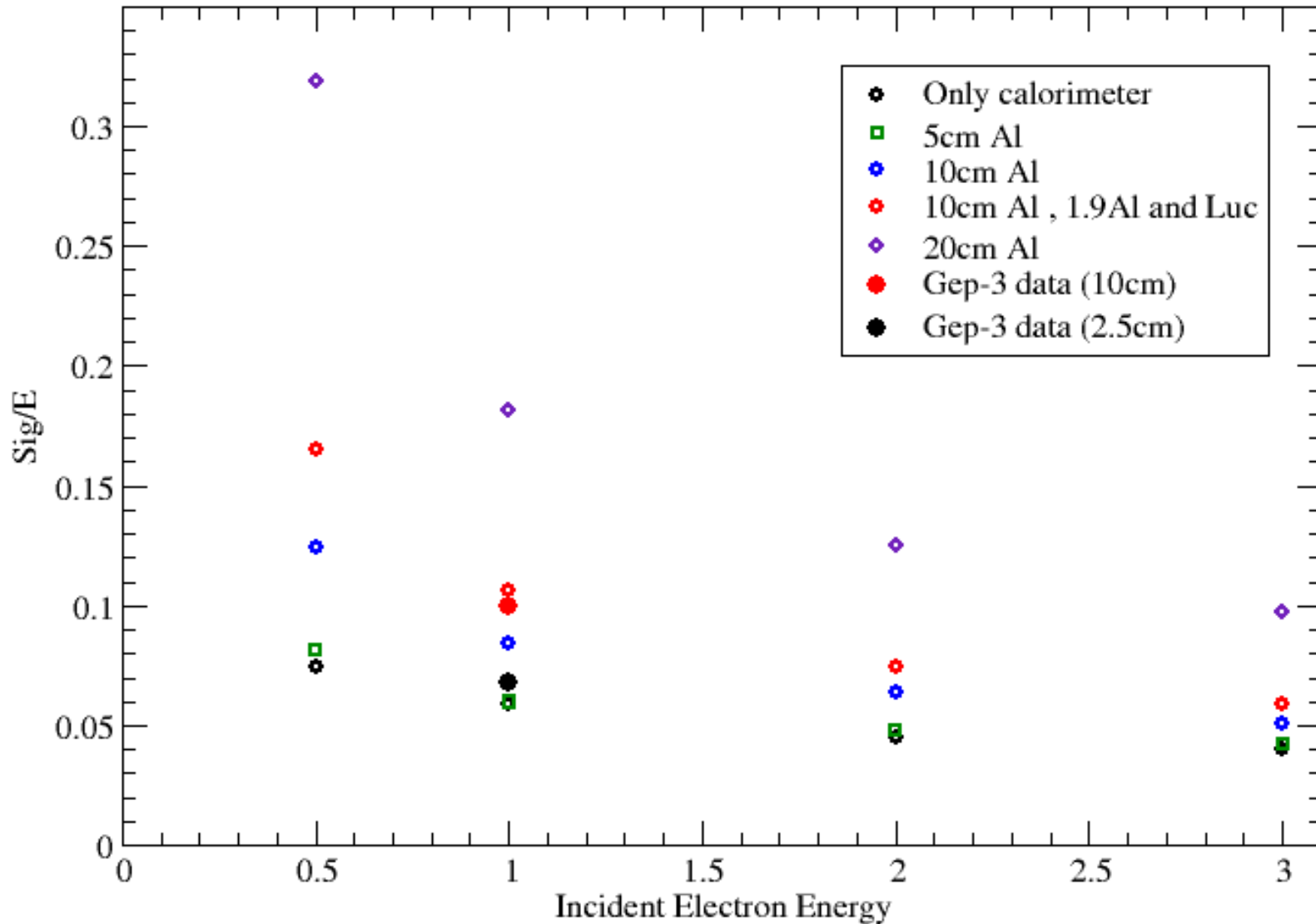| $Q^2$ | $\theta_E$ (deg) | $P_e$ (GeV) | $\Theta_p$ (deg) | $P_p$ (GeV) |
|---|---|---|---|---|
| 14.5 | 39 | 3.27 | 12.0 | 8.61 |
| 12.0 | 29 | 4.60 | 17.4 | 7.27 |
| 10.0 | 35 | 3.5 | 16.7 | 6.3 |
| 5 | 26 | 3.3 | 28 | 3.5 |

# Technical Review on GEp5

**Recommendations**

Provide calculations of the energy and spatial resolution with the 20 cm Al absorber taking into account the average radiation damage. Evaluate the impact of the resolutions on the general performance including tracking and trigger rate. Clarify the impact of the expected energy resolution not meeting the requirement on page 107. Provide evidence or arguments that a 5 fold increase in the UV light intensity will increase the rate of curing by a factor of about 5.
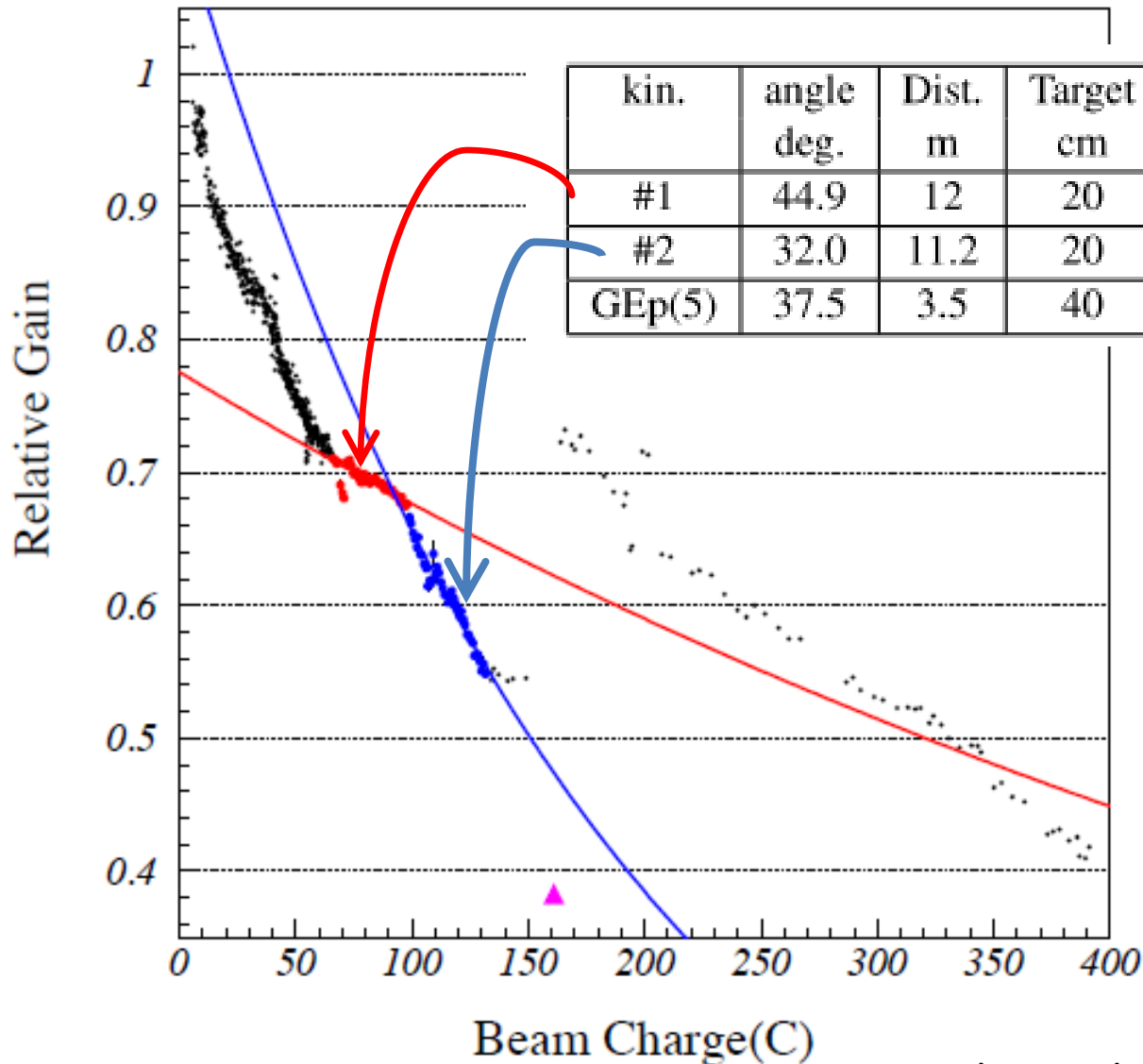
Response:
- Studying energy and position resolution with GEANT. CDR states that 10%/sqrt(E) energy resolution and 1cm position resolution are needed.

- Can we monitor gain stability?

- Plan to do tests of UV curing. Frank Wesselmann is working on setting up test in EEL.
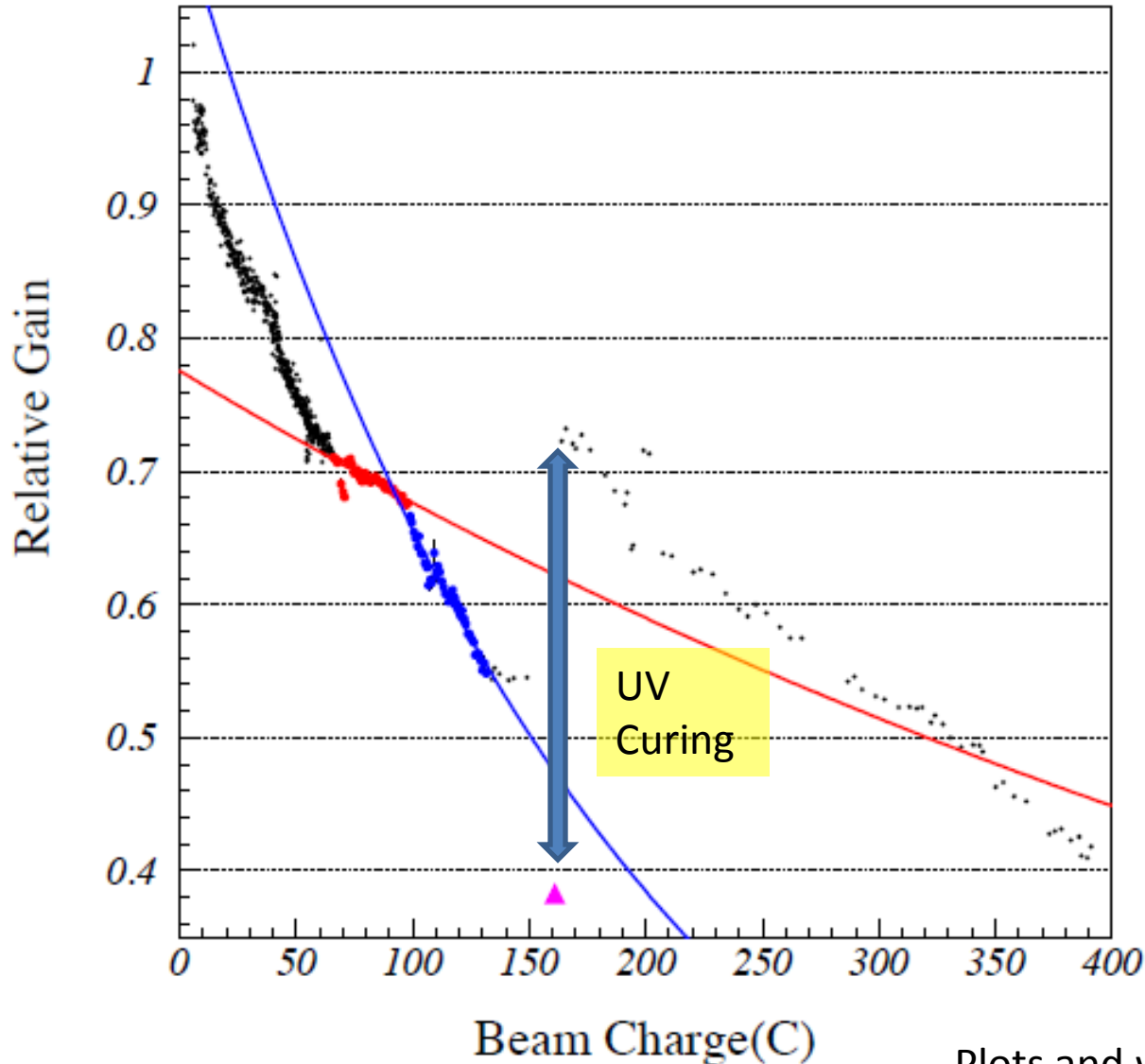
# Energy Resolution

# Gain loss during Gep-3



| kin. | angle deg. | Dist. m | Target cm | E GeV | Gain loss rate $b$ | soft photon flux J/cm$^2$/C |
|------|------------|---------|-----------|-------|--------------------|-----------------------------|
| #1 | 44.9 | 12 | 20 | 2.839 | 0.14%/C | 0.0039 |
| #2 | 32.0 | 11.2 | 20 | 3.539 | 0.53%/C | 0.013 |
| GEp(5) | 37.5 | 3.5 | 40 | 3.539 | $\sim$ 6.7%/C | 0.17 |

- Expect 10x increase in rate of gain loss for Gep5
- For 50uA beam , 1.45 C/8hr

## 10% gain loss in 8hr

Plots and work by Wei Luo

# UV curing during Gep-3



- UV cured the BigCal for 3 days on each ¼ of the detector.

- Improved the gain from 39% to 74%

- Rate of improvement is 1.24%/hr

- For Gep5 expect gain loss of 1.25% /hr

- UV cure for 1hr after 7 hours of running. ( Need to have HV off)

- Need to increase UV intensity by factor of 5.

Plots and work by Wei Luo

# Energy Resolution during Gep-3
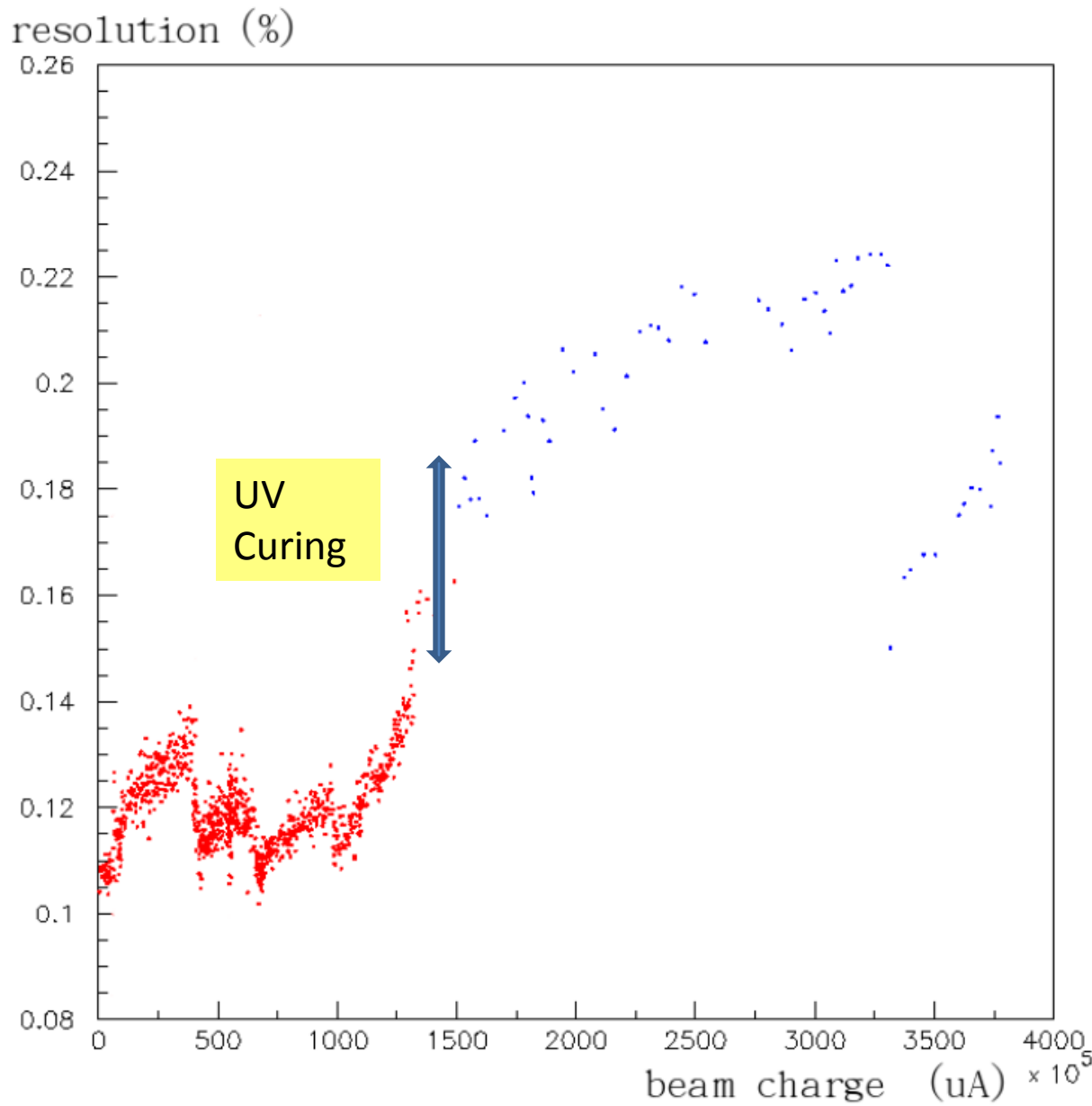
resolution (%)



- Without UV curing expect resolution to change by factor of sqrt(3.6/1.0)=1.9

- But with curing only changed by 1.3

- Resolution changing by 0.06%/C in time just before curing.

- Gep5 expect about 0.6%/C or about 1% change in resolution for 8hr of beam.

UV Curing

beam charge (uA) $\times 10^5$

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# Conclusions

- Started GEANT studies of energy and position resolutions.
- Need to revisit what resolutions are needed.
- Plan to do studies of UV curing and determine the best method.
- Much work needed preparing BigCal and planning on the infrastructure.