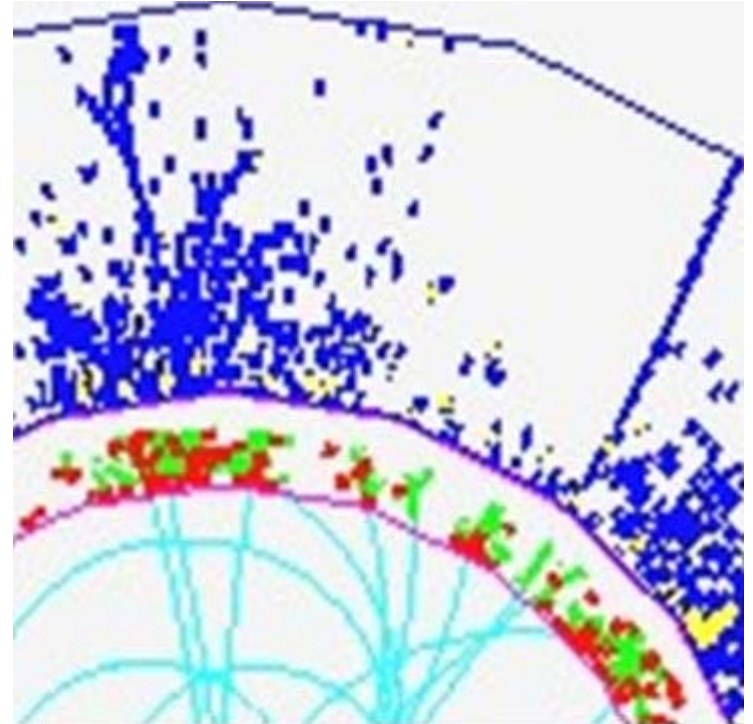


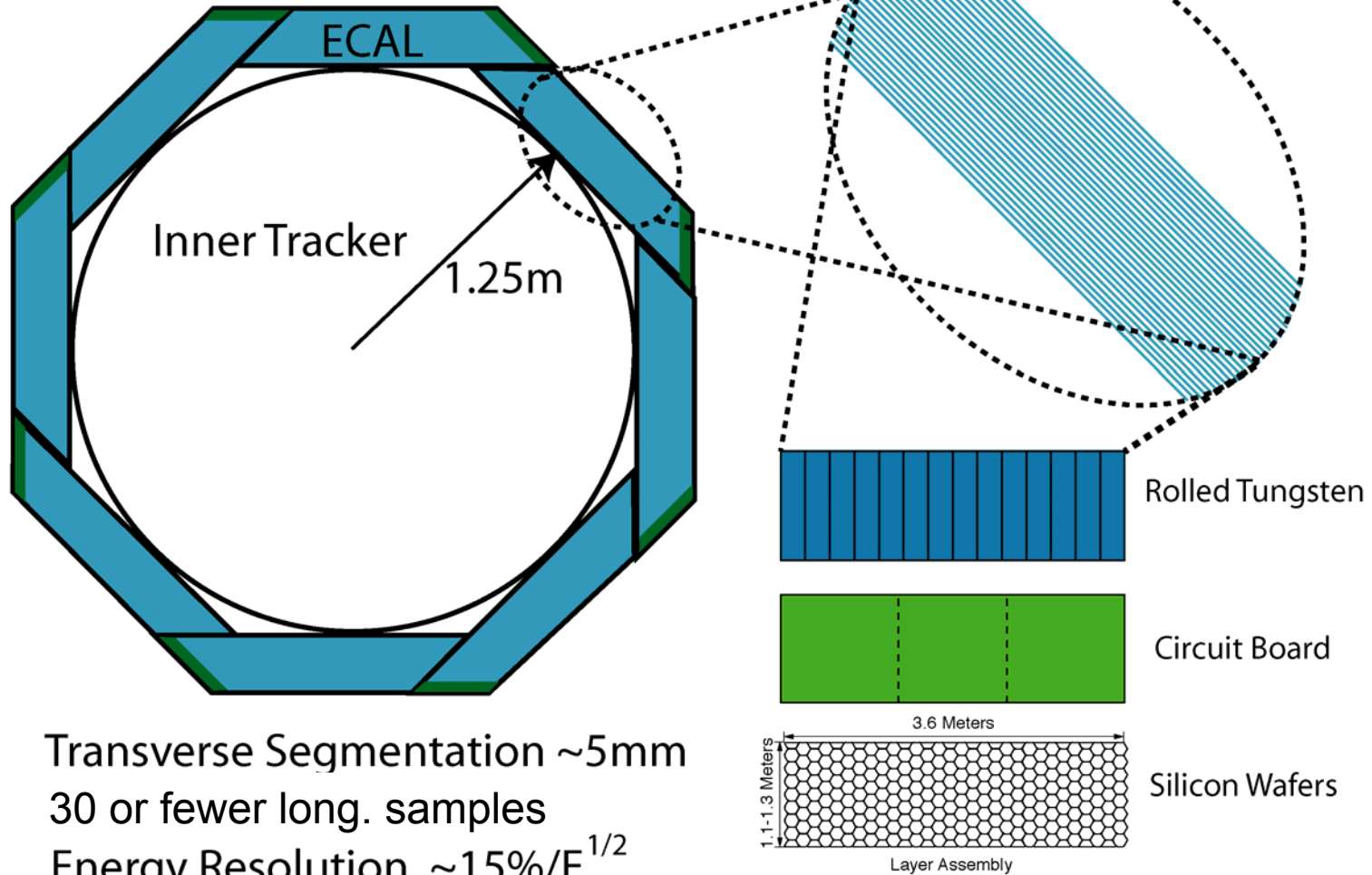
ECal R&D in N. America -- Test Beam Readiness/Plans

- Silicon-tungsten
SLAC, Oregon, Brookhaven (SOB)
- Scintillator tiles – tungsten
U. Colorado, Fermilab
- Hybrid silicon/scintillator – tungsten
U. Kansas



Si-W Concept – SiD version

Si-W Calorimeter Concept

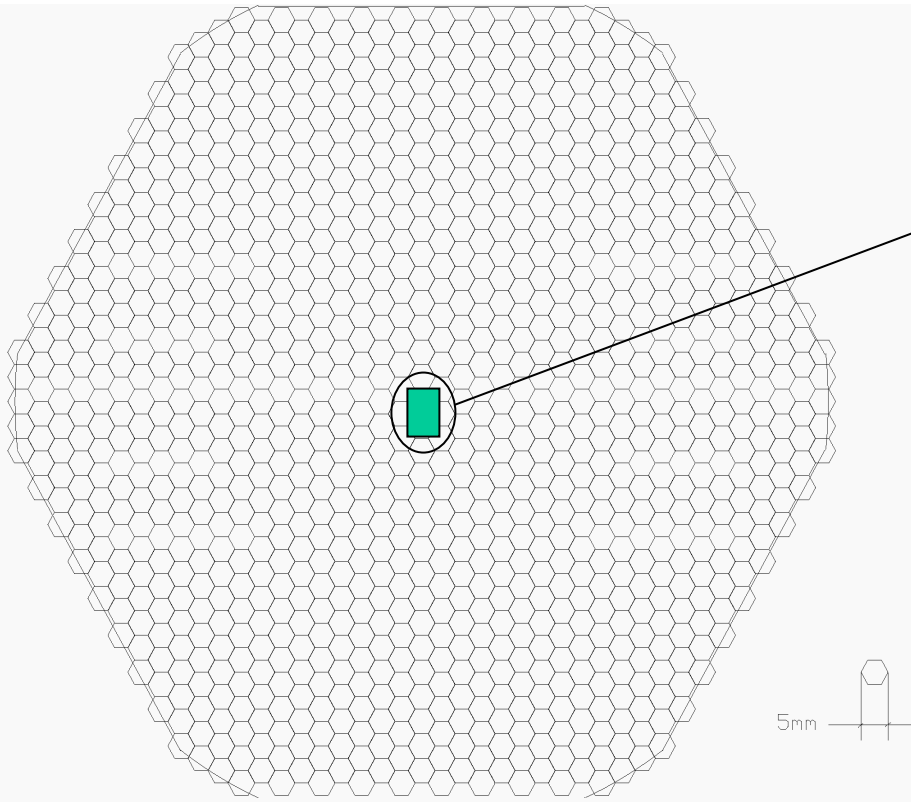
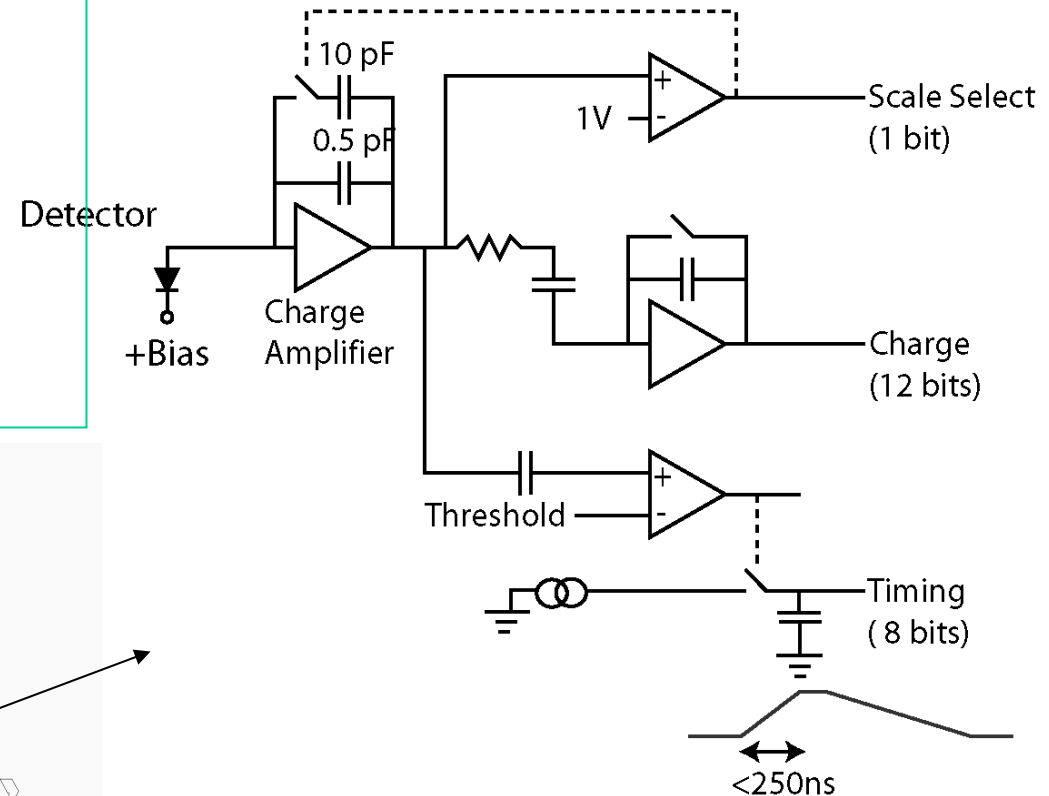


Transverse Segmentation $\sim 5\text{mm}$
30 or fewer long. samples
Energy Resolution $\sim 15\%/E^{1/2}$

Si/W (SOB), contd

Features

- Compact (~1 mm gaps)
- High segmentation with little penalty
- Passive cooling
- Full dynamic range charge and good (few ns) timing measurements



Technologies to be tested

- Dynamically switched C_f
- Bump bonding and on-Silicon metallizations
- System-level readout resolutions

Si/W Test Beam Goals

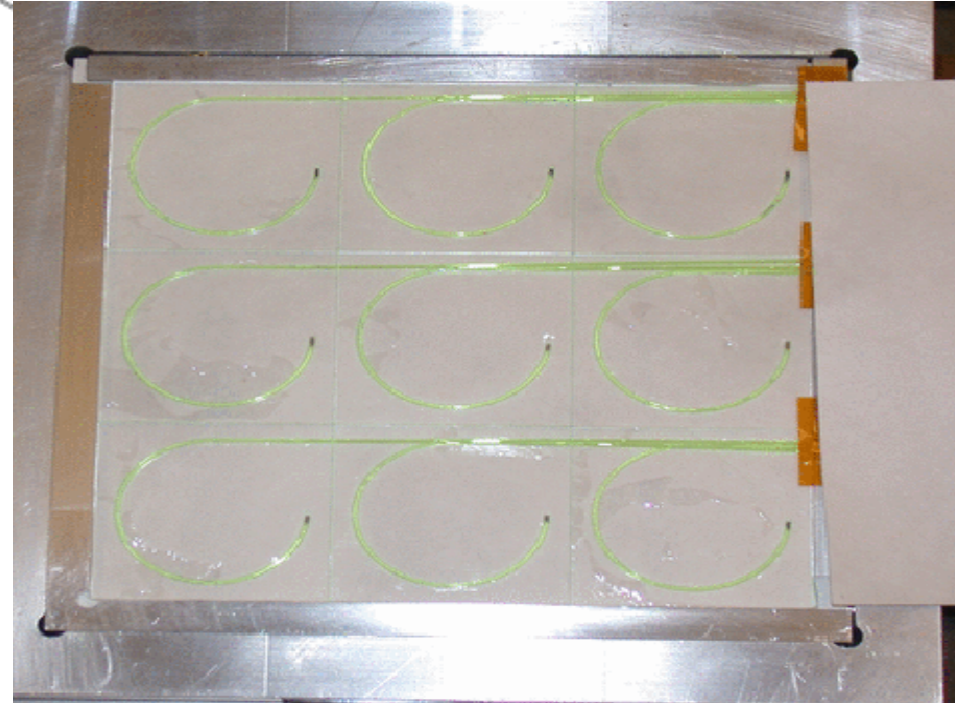
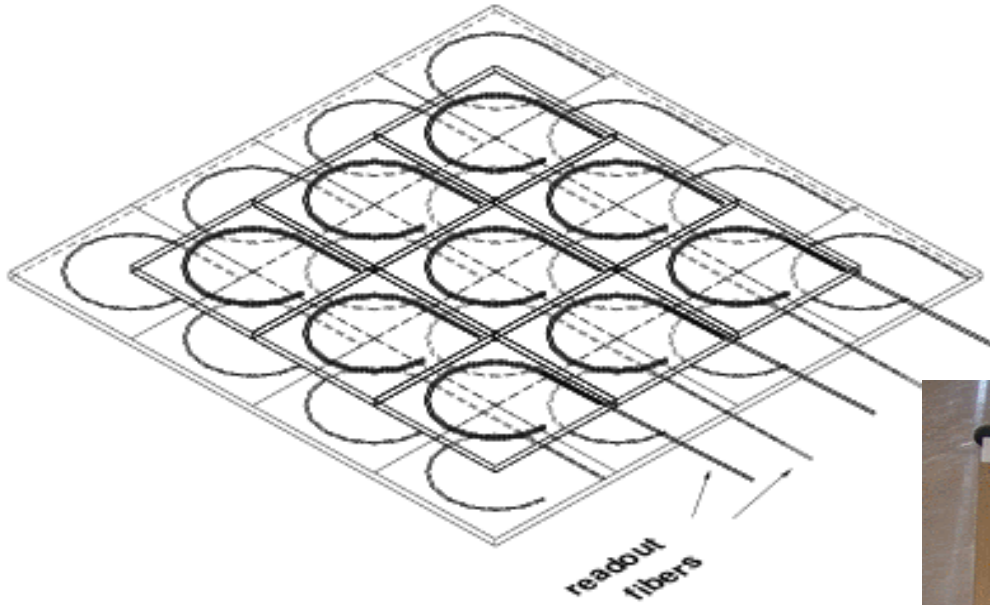
- The ECal test beam priorities are somewhat different from the HCal
 - A full optimization of a HCal design will likely require a hadron shower model which agrees with the test beam data.
 - Much of the ECal design derives from optimization of EM showers in a jet environment.
 - Expect – at least for front half of ECal – to be able to optimize the design independent of test beam.
- First goal for test beam: Test the new technologies.
 - Integrated electronics and bump bonding (heat, noise, etc).
 - This does not require a full-depth module.
 - This does not require a full suite of hadron beams.
- Next goal: A full-depth module. (How wide?)
 - Study full development of hadron showers (global Cal. priority).
 - Optimize back “half” ECal parameters

Si/W Status and Plans

- Note that current design is optimized for warm, but could be optimized for cold
 - Would require digital pipeline → **this is current focus**
 - Would timing still be desirable?
- This year
 - Qualify prototype detectors already in hand
 - Fabricate initial RO chip for technical prototype studies
 - Readout limited fraction of a wafer (\$) (64 of 1024 chns.)
 - Chips probably not in hand before Jan 2005
- 2005
 - Electronics evaluations
 - Bump bonding
 - “Technical” test beam, summer 2005 at earliest
 - A few layers with 1st round detectors and chips
 - Plan for a full ECal module (similar to eventual ECal)
 - Finalize thermal plans, mechanics
 - Provide correct front radiator for hadron shower validation in test beam.
 - Earliest beam test: **Summer 2006**
 - Continue to evaluate configuration options
 - Layering, segmentation

Tile ECal – U. Colorado, FNAL

The Basic Geometrical Structure



Tile ECal (contd.)

(from Uriel Nauenberg)

- Will be ready for test beam in 2006 if funding becomes available in 2005 to build a module.
- The big issue is electronics; we have very little help with that.
- The module will consist of 60 layers or 45 layers
 - For $11\%/ \sqrt{E}$ resolution we need 60 layers of $1/2 X_0$ Tungsten and 2 mm of scintillator, not 45.
 - For $13\%/ \sqrt{E}$ then we can go with 45 layers of $3/4 X_0$ and 3 mm scintillator; (Investigating the spatial resol. deterioration.)

ECAL R&D; Tungsten ECAL with both Si and Scintillator sampling

Graham W. Wilson for Kansas, Kansas State Universities

- **Concept:** physics requires high granularity, reasonable sampling frequency, large BR^2 , compact R_M . \Rightarrow ECAL probably should be W absorber, some Si, some cheaper sampling medium (Scint.).
- All Si is probably best IF it can be cost-effective, IF timing is not important (less so now!), and IF really large R is not dictated by the physics.
- All Scintillator is probably prohibitively expensive due to channel count at sufficient granularity
- **Ongoing R&D:** mostly simulation based on different design possibilities
 - EM energy and angular response studied
 - Photon/hadron separation in progress
 - Critical items
 - Does coarse scintillator granularity work for a hybrid ?
 - Gap size (compactness)
- **Test-beam Wishes & Goals:**
 - could validate the EM response of hybrid ECALs with mixed sampling media
 - Eg. Anti-correlation predicted in Si and Scint. response
 - In **collaboration** with existing groups encourage that data taking opportunities with large volume HCALs and expensive Si-W ECALS can also be used to explore alternative ECAL designs to Si-W
 - Ideally gaps eg. alveoli in the CALICE ECAL could be used to study alternative sampling layers.
 - A hanging-file type approach would facilitate understanding the intrinsic response (but not an engineered hermetic solution ...)
 - Have funds available which can contribute significantly to a prototype ECAL construction and testing on a 2-year time-scale.
 - Envisage wanting electron, pion beams in **summer 2006**
 - Concurrent running with HCAL activities
 - Exactly how to proceed depends on developing collaborations and results of simulation studies (want to use test-beam time and construction funds wisely)