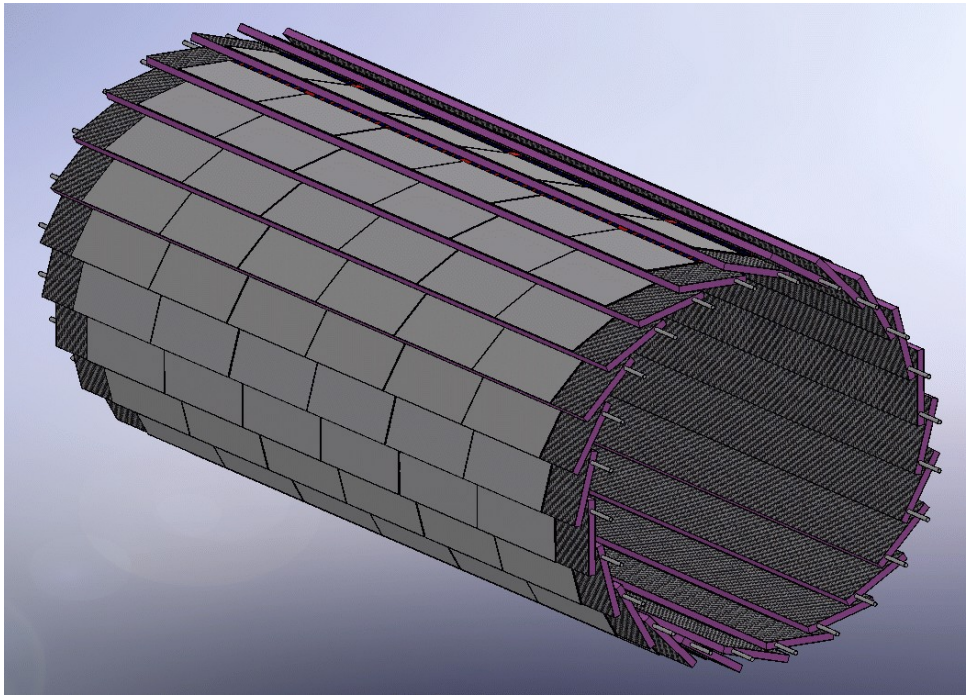
Intermediate Silicon Tracker status

Gerrit van Nieuwenhuizen

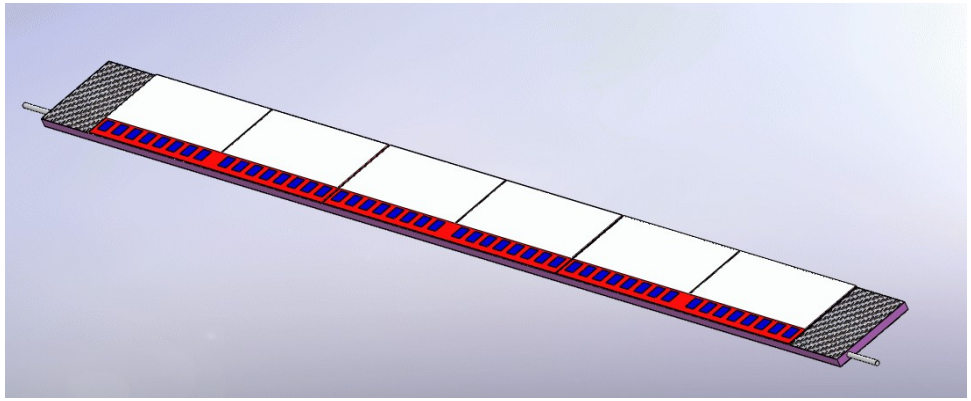
HFT monthly meeting

LBNL, May 14, 2009

IST design (2008)

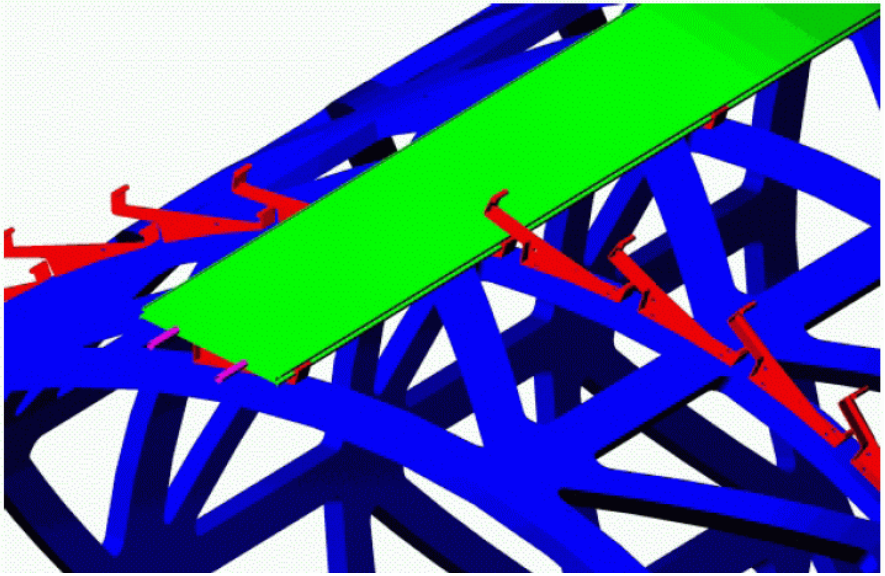


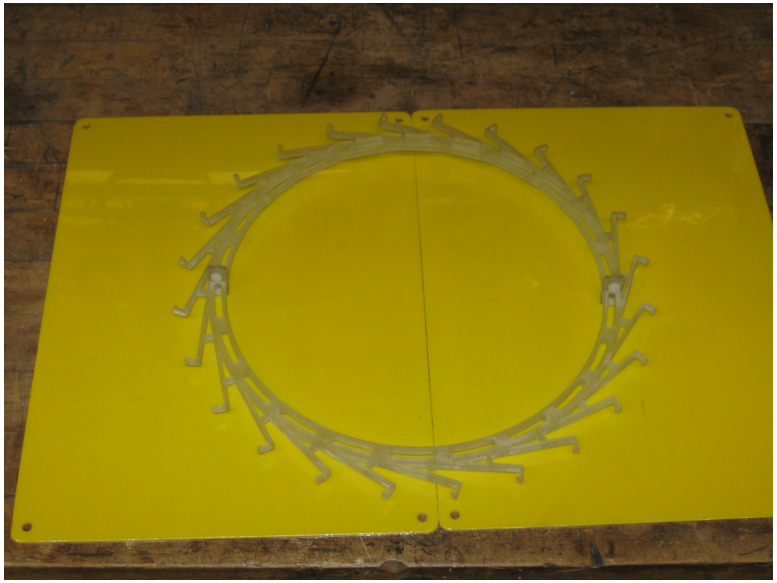
24 tiled ladders at 14cm radius



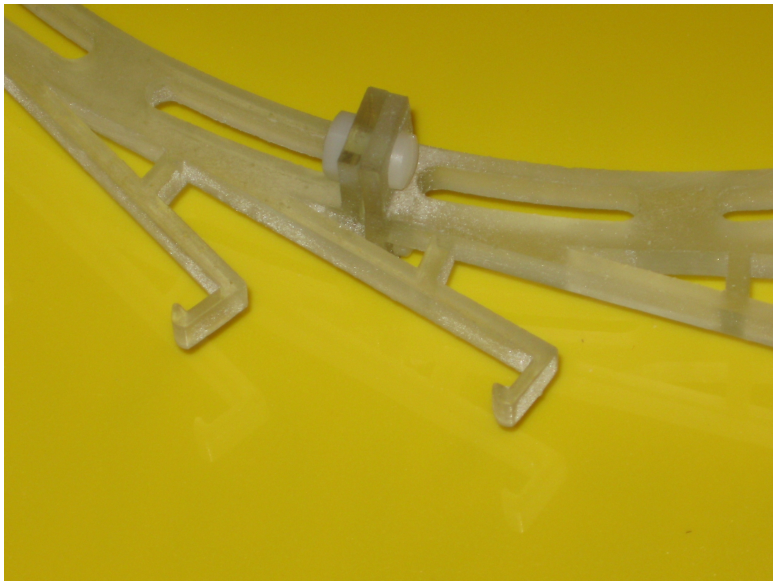
3 modules (= 6 sensors) per ladder

Ladder and support prototyping



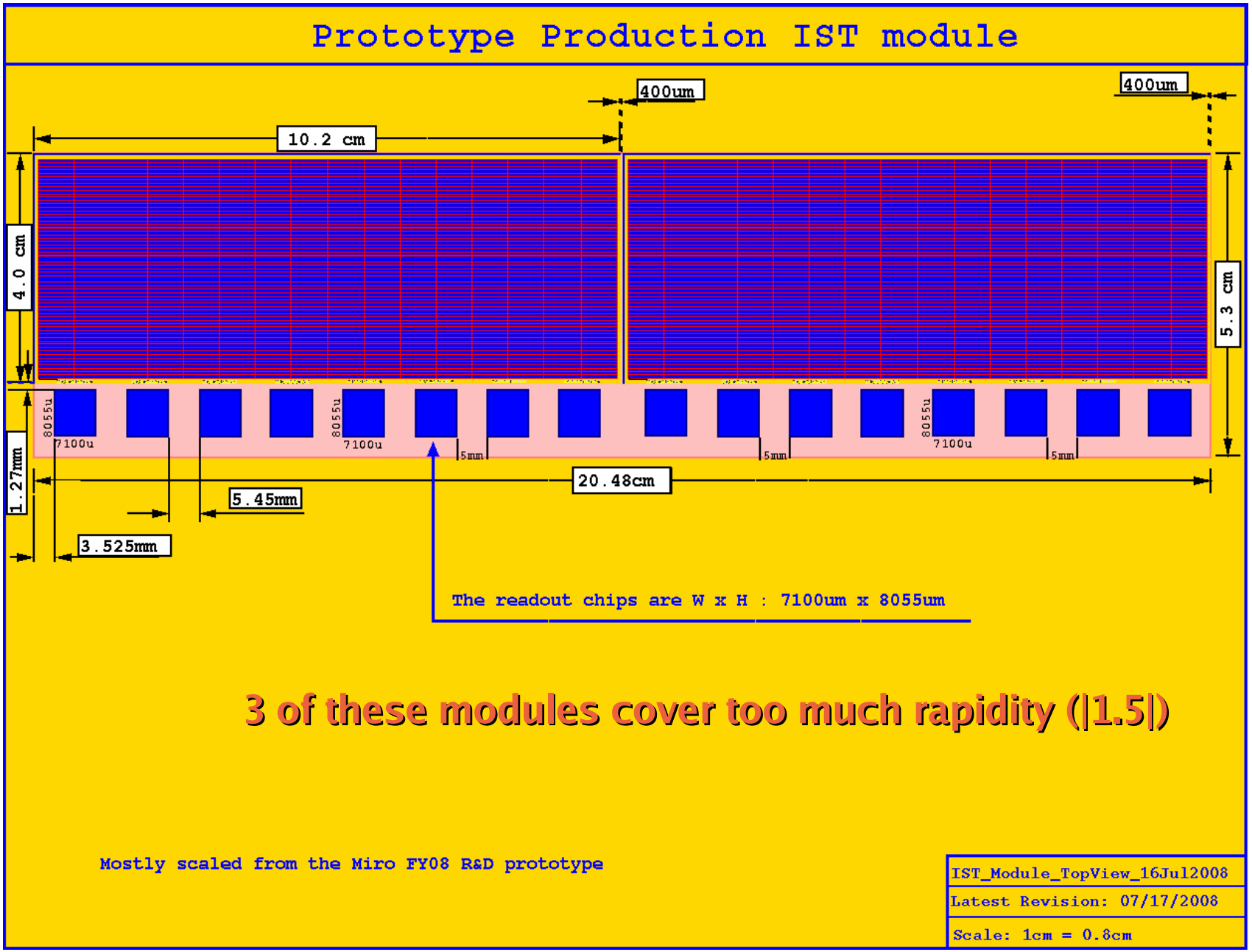


Ladder prototype



Support rapid prototyping

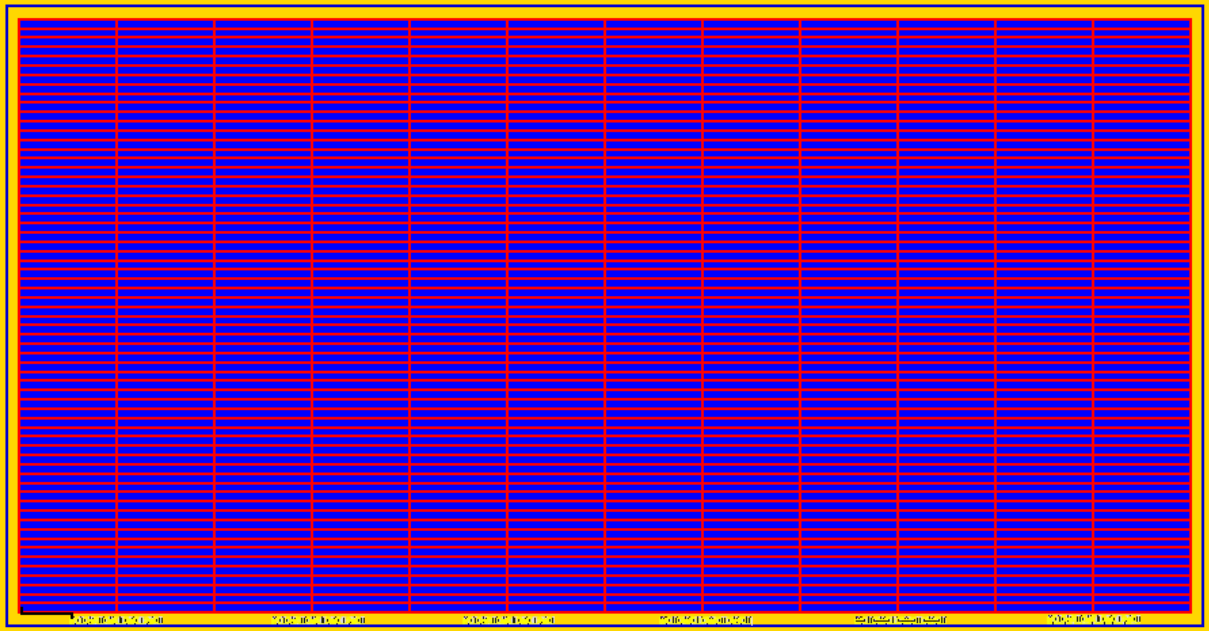
The 2008 module



3 of these modules cover too much rapidity (|1.5|)

A shorter sensor for 2009

IST silicon pad sensor design for Hamamatsu quote

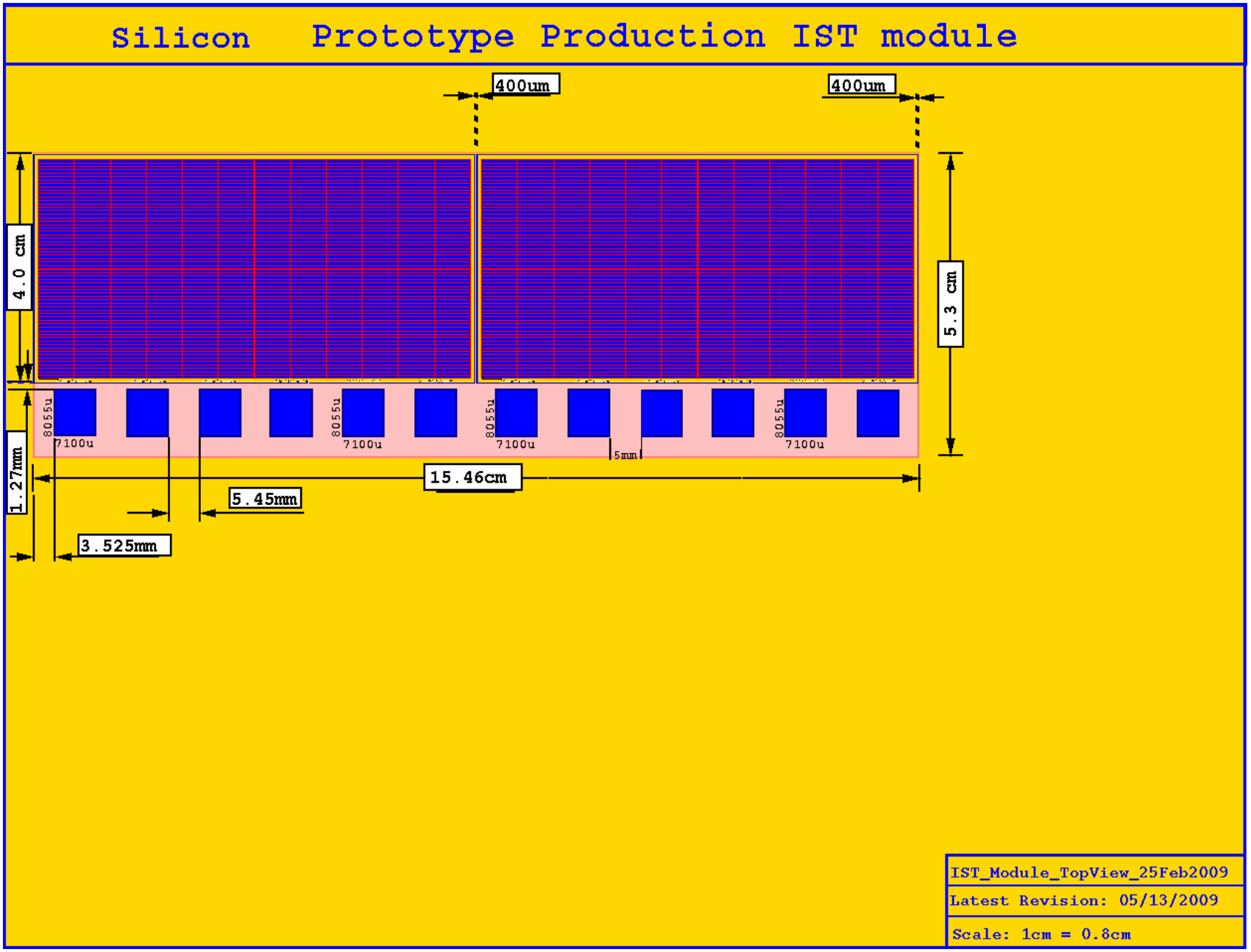


Silicon sensor size: 76.900mm x 40.000mm
Active area pitch: 6275um x 596um
Edge structure left & right: 800um
Top edge structure: 800um
Bottom edge structure: 1056um
12 columns x 64 rows

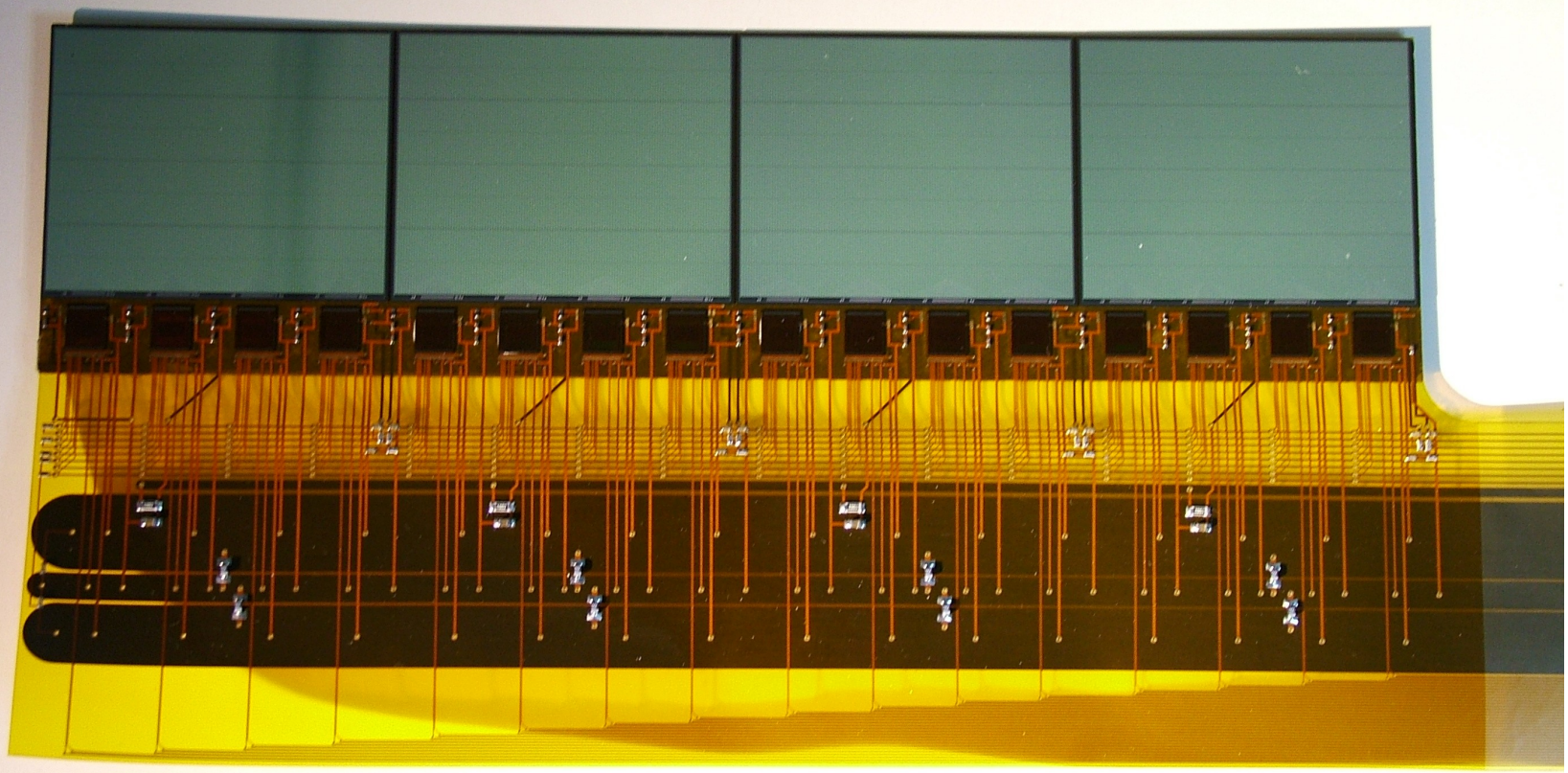
6 Sensors cover a bit over 1.2 in rapidity
400um gaps (max) between sensors means total gap of 2000um between sensors
leading to a spatial efficiency of 97.8%

HamamatsuDesign_25Apr2009
Latest Revision: 05/12/2009
Scale: 1cm = 0.4cm

Makes a shorter module



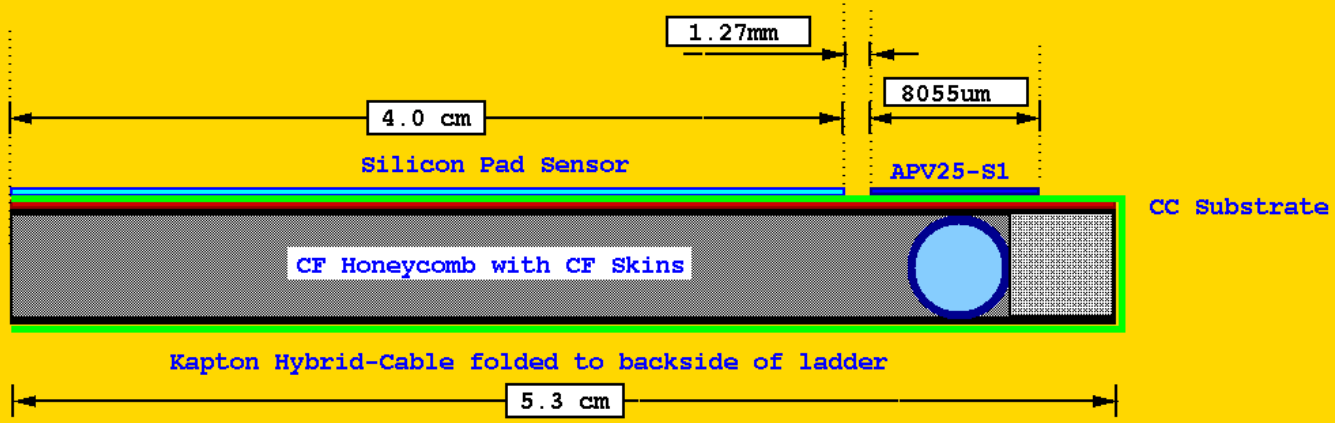
Prototype with 4 sensors



Setting up the wire bonding parameter

Optimizing material budget

Radiation Length estimate for IST module



Silicon Sensor: 300um = 0.32%Xo
APV25-S1: 8055um X 7100um Silicon, 300um = 0.32%Xo
Kapton (polyamide), RadLen=28.6cm, 2 X 250um = 0.17%Xo
  Cu traces, 17um/Cu-layer, 2 layers @ 50% coverage = 0.12%Xo
Carbon-Carbon, RadLen=22.0cm, 0.5mm = 0.23%Xo
Carbon Fiber Skin: 10mil+glue = 300um = 0.11%Xo
Ultracore Honeycomb 0.4953cm = 0.06%Xo
Al Cooling tube OD 4.10mm ID 3.50mm = ...%Xo
   Water, OD 3.50mm = ...%Xo
   (OR Al Cooling tube OD 3.00mm ID 2.60mm = ...%Xo)
      (Fluorinert C5F12, OD 2.60mm = ...%Xo)

Silicon: 2.33gr/cm3, RadLen=9.36cm
Water: 1gr/cm3, RadLen=36.08cm
UltraCore UCF-119-3/16-3.5: 0.056gr/cm3, RadLen=860cm (0.09gr/cm3 E.A.?)
Carbon Fiber: 1.713gr/cm3, RadLen=28cm
Aluminum (Pure): 2.70gr/cm3, RadLen=8.897cm
Copper (Pure): 8.96gr/cm3, RadLen=1.43cm

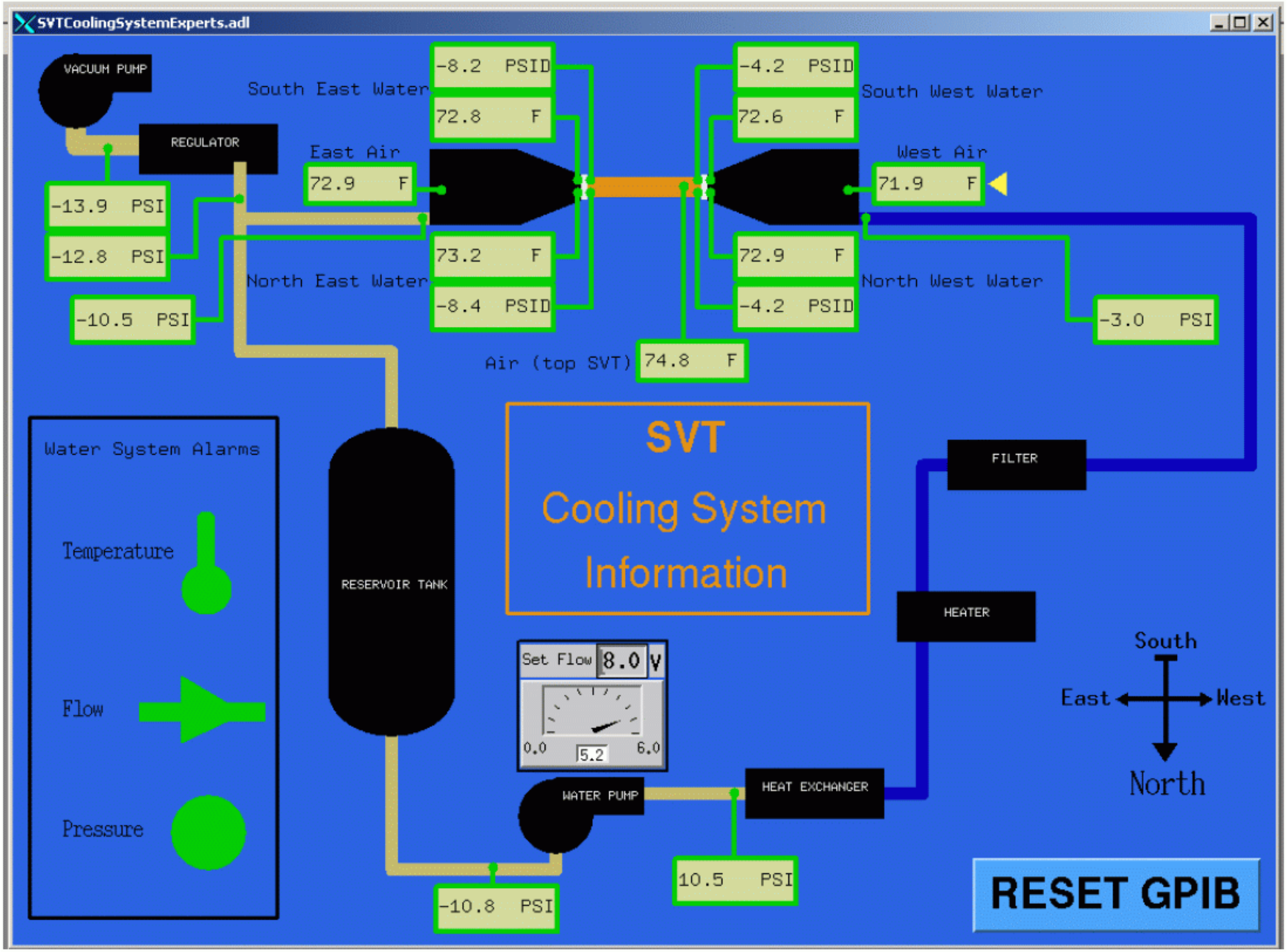
Averaged RadLen over 5.3cm width is about 1.2%Xo

0.049%	Readout Chip
0.060%	CF Honeycomb
0.12%	Cu Traces Hybrid
0.11%	CF Skin + Glue
0.11%	CF Skin + Glue
0.23%	Carbon-Carbon core
0.24%	Silicon Sensor
0.05%	Cooling Water
0.08%	Al Cooling Tube
0.17%	Kapton

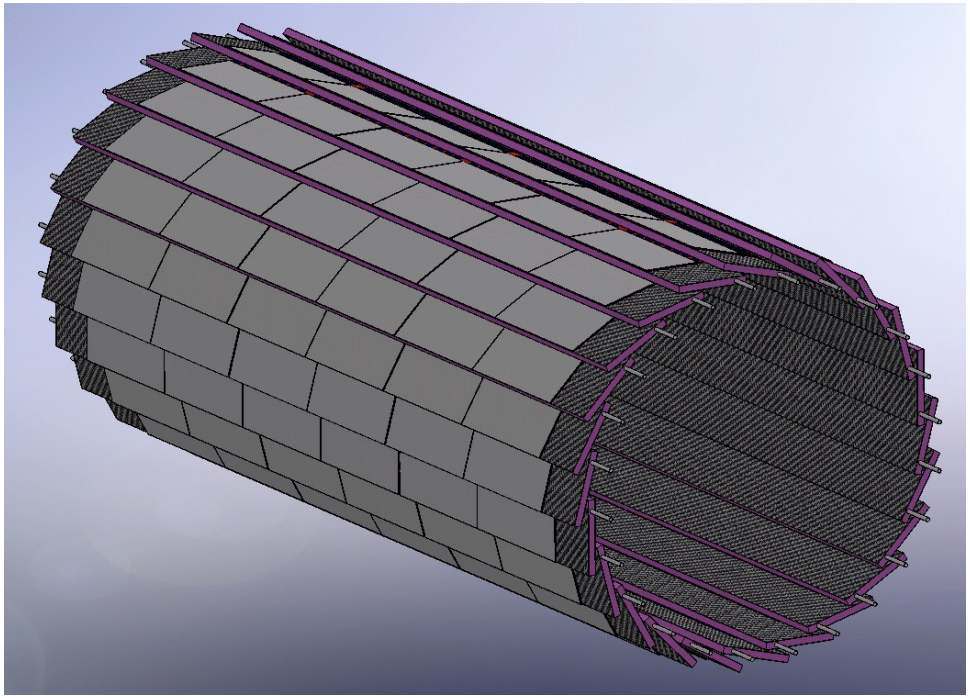
1 cooling tube adds 0.13% Xo

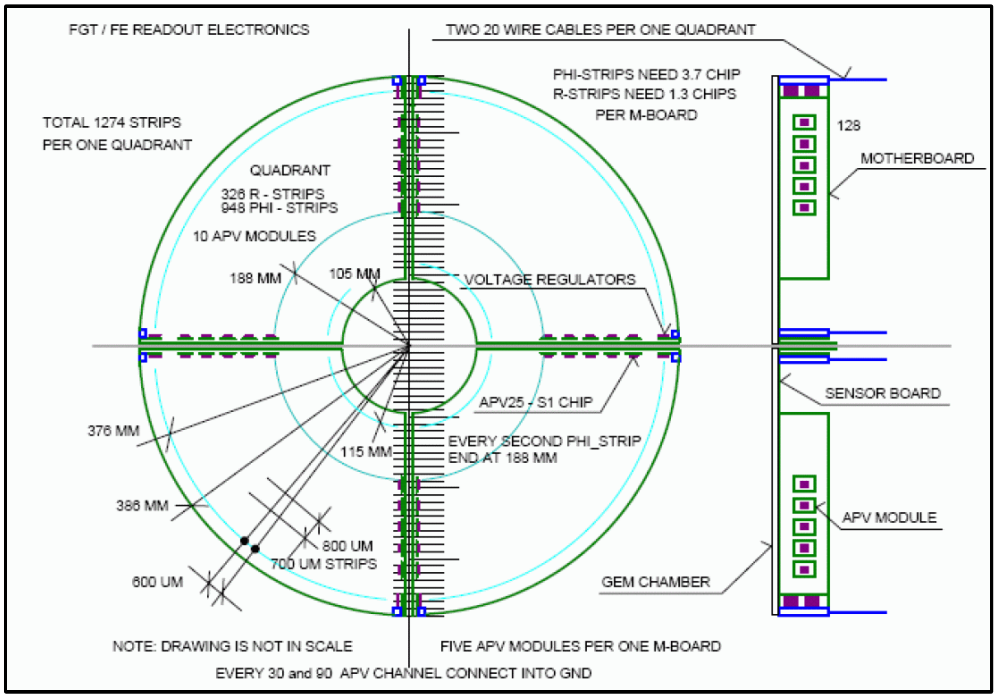
IST_Module_SideView_22Apr2008
Latest Revision: 05/13/2008
Scale: 1cm = 0.3cm

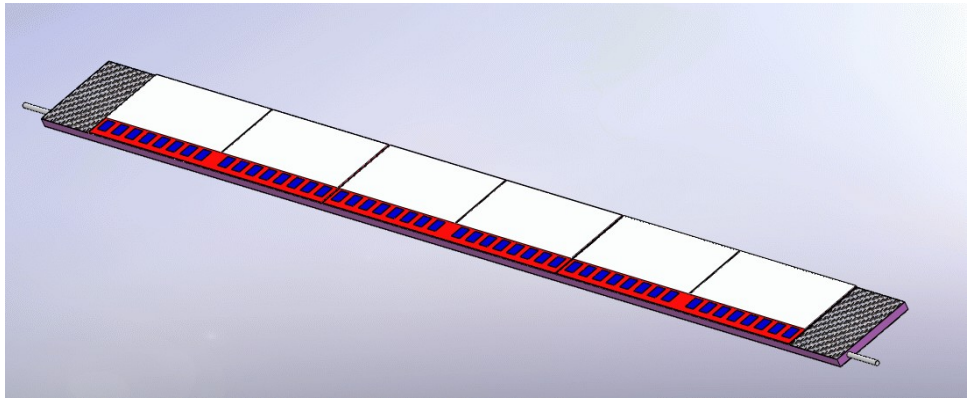
Refurbish SVT cooling system



Number of chips needed





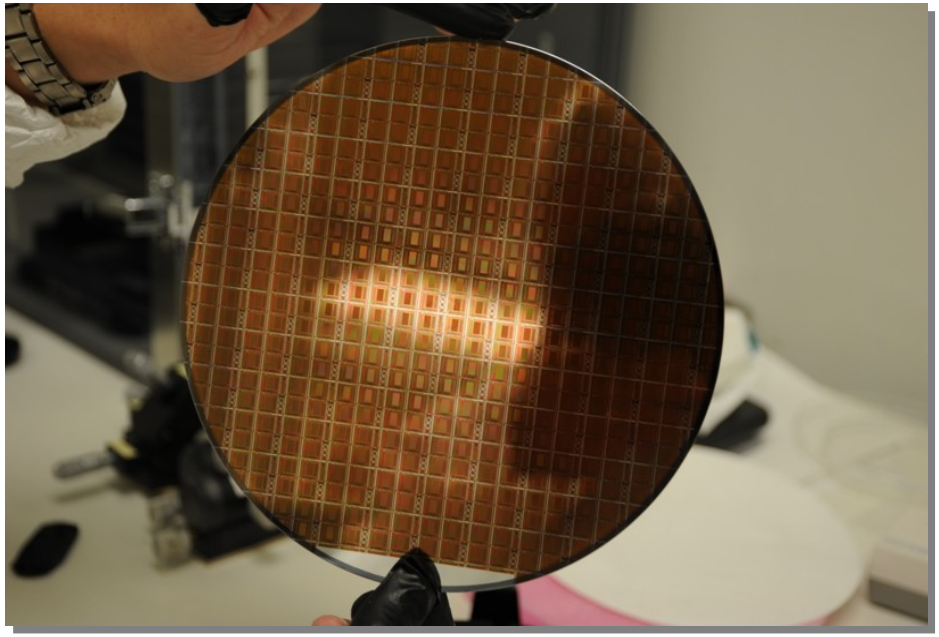


FGT: 600 chips (50% spares, 40% cont.)

IST: 1800 chips (10% spares, 40% cont.)

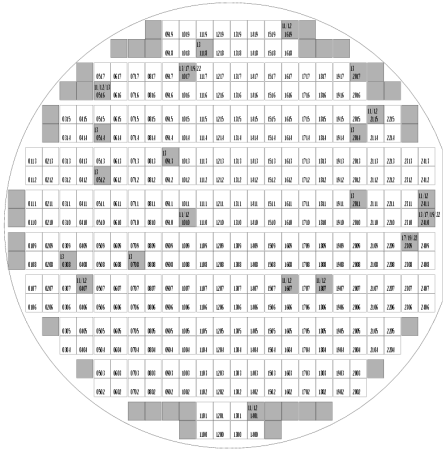
2400 APV25-S1 chips to procure

8 APV Wafers at MIT

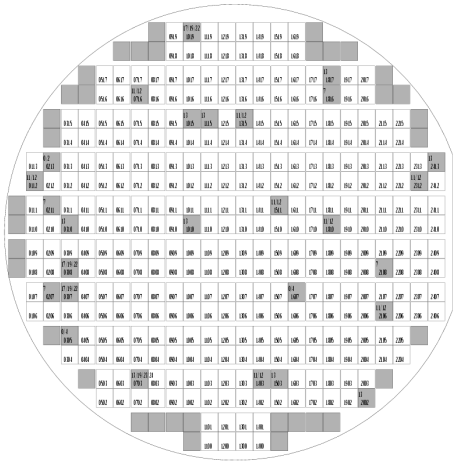


Known Good Die (KGD) maps

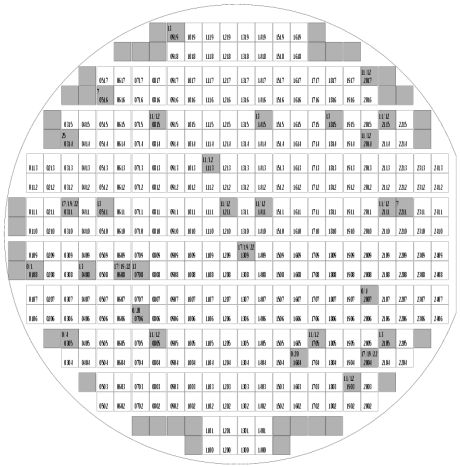
Wafer Map: K8MG5RT



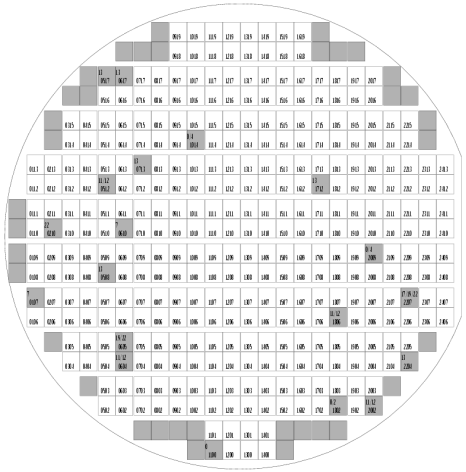
Wafer Map: X04AQYT



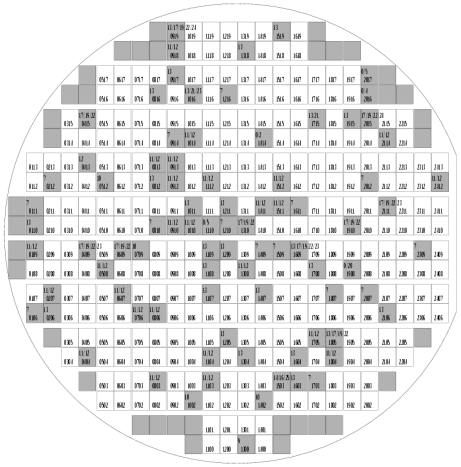
Wafer Map: X04ARFT



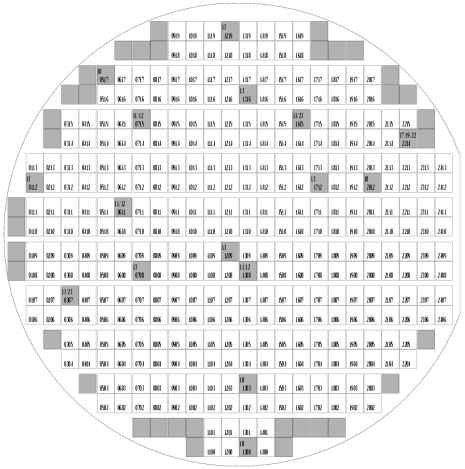
Wafer Map: X04BSWT



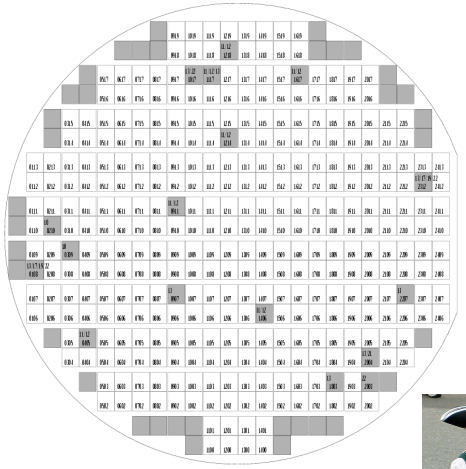
Wafer Map: X14AQXT



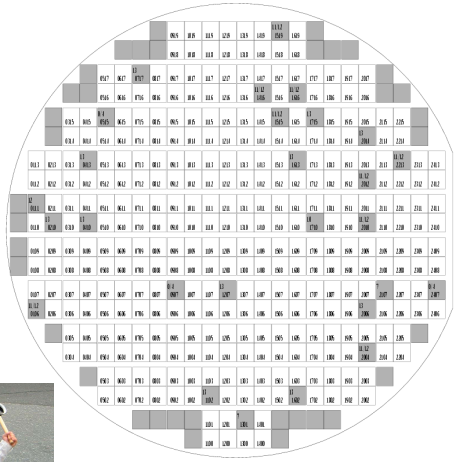
Wafer Map: X14ARET



Wafer Map: X5482PT



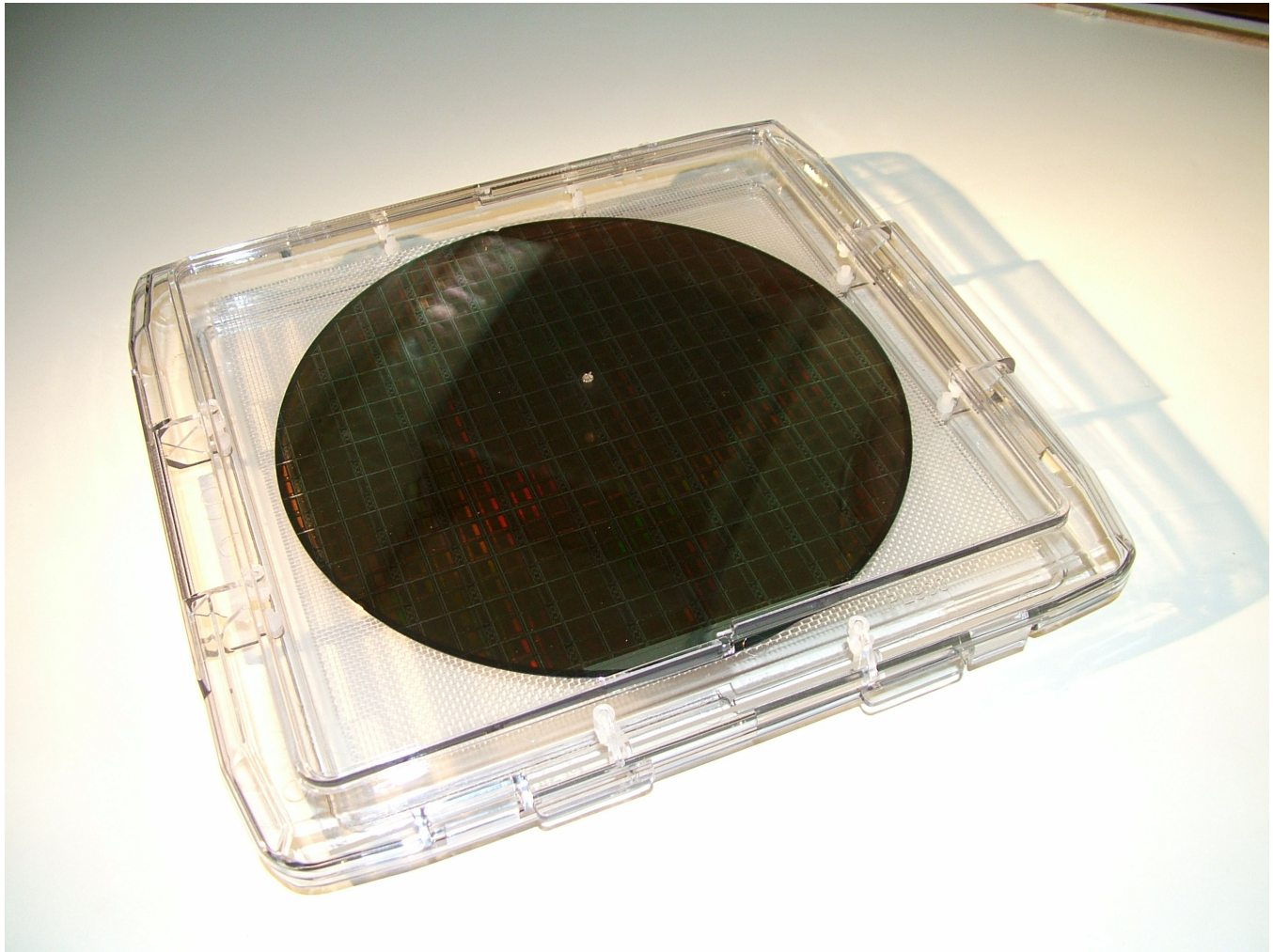
Wafer Map: X6482NT



And the final tally is.....

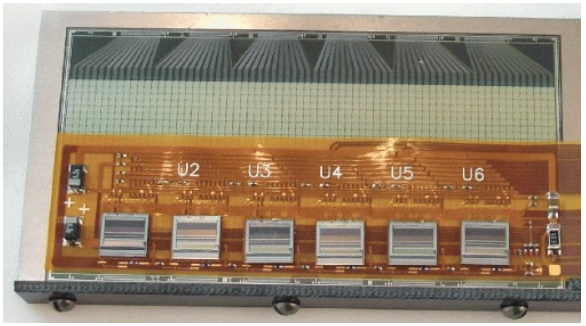
.....2637.....

Dicing first wafer

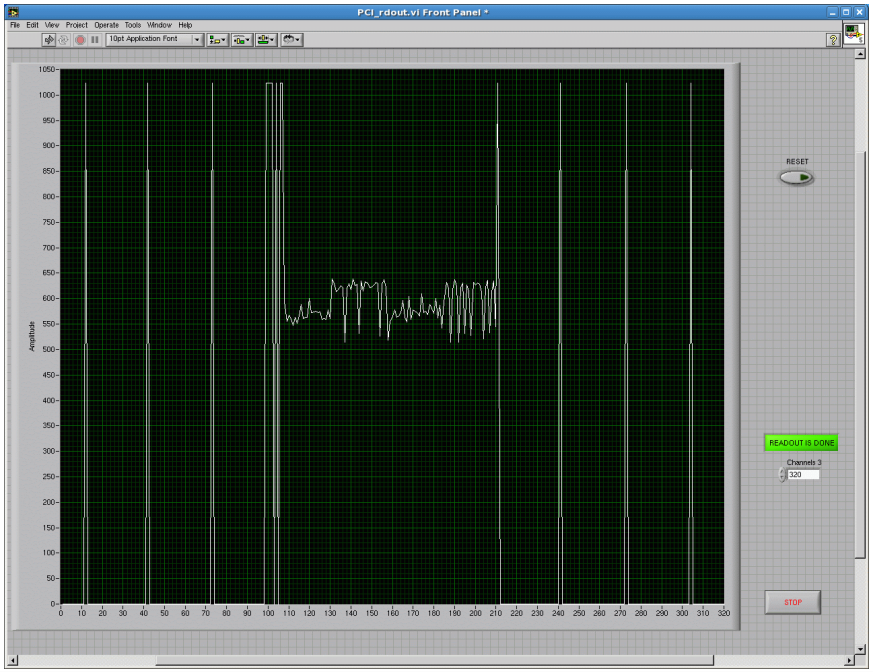


← Diced at APV
Chips stored in Gel-Paks

Test some chips



Test readout system



My glass is half-full, but.....

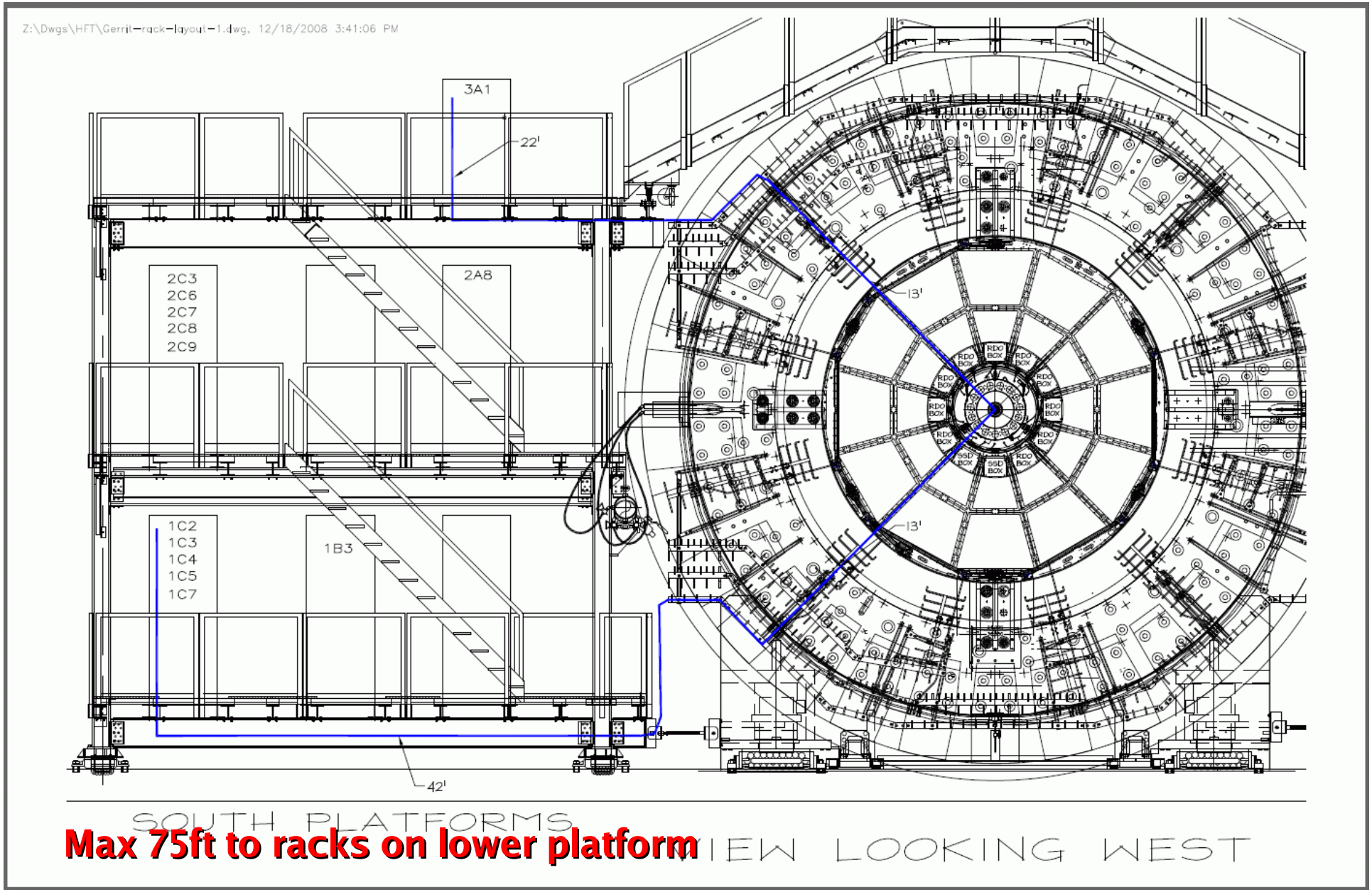
- many, many problems with readout
  - . OS incompatibilities
  - . dying I/O card and computer
  - . LabView incompatibilities
  - . I2C on APV test strip broken

Attempted solutions

- . LabView 8.6 for Linux
- . New computer
- . Use USB instead of PCI I/O card

Just started with new readout.....

Expected cable runs



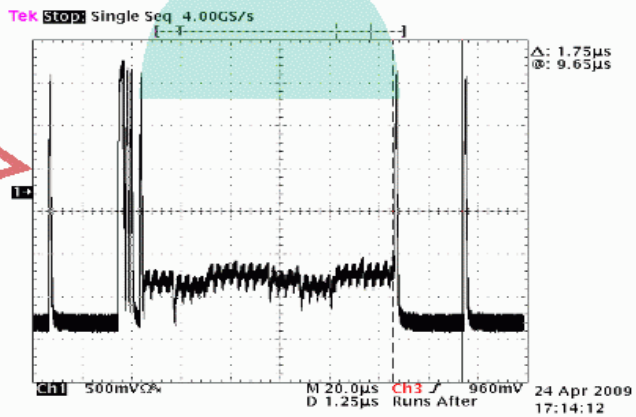
Max 75ft to racks on lower platform

APV long cable driving test

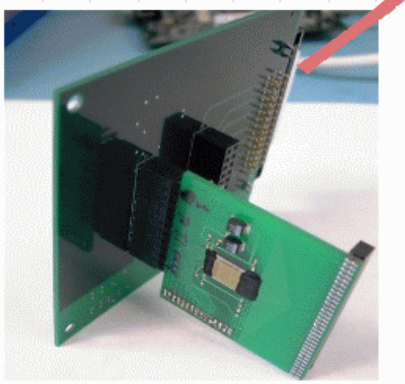
Readout board frontend prototype and long cable test

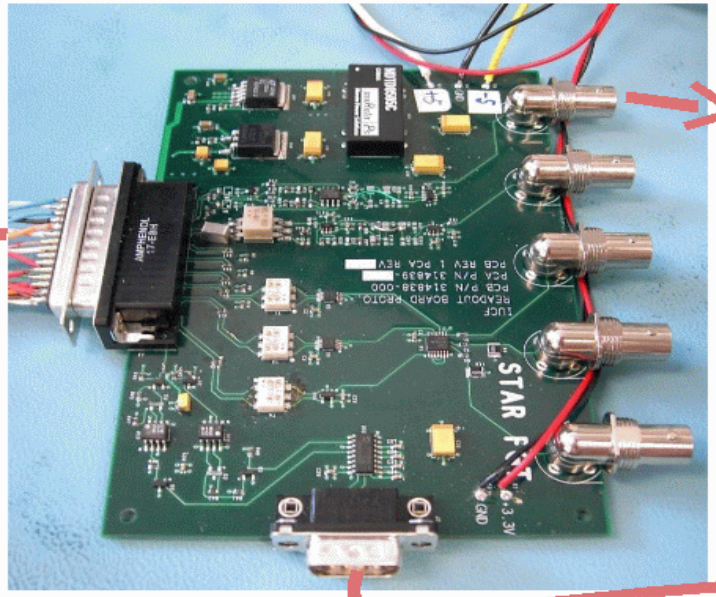
- Demonstrated basic operation of APV
- 170% of planned cable length
- Equalization filter designed and tested
- ADC (anti-alias) filter design in progress
- Tests with Struck ADC module and full FGT APV board within next weeks

A typical APV event, 128 channels' data (here only pedestals)



110 feet Belden #1424A





Slow controls PC

Concluding remarks