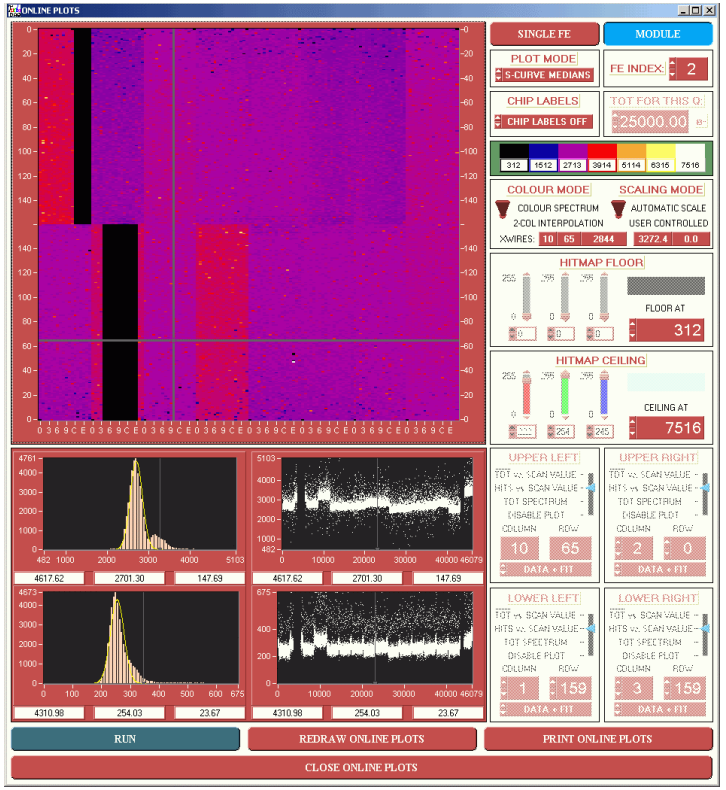
WBS 1.1.1.5
(& W.B.S. 1.1.1.6.2 & Services)
Pixel Module Assembly & Test

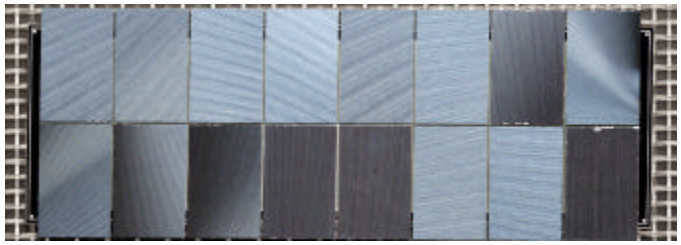
1. **Technical Status**
2. **Goals for 2003**
3. **2004 update**
4. **Service Panels**

Technical Status

- Rad Hard Modules
  - **They work!**
  - **A major milestone**
- Bare Module
- Module Assembly
- Pigtails
- Flex to Module Glue
- Module to Local Support Glue
- HV isolation



Technical Status: Bare Module

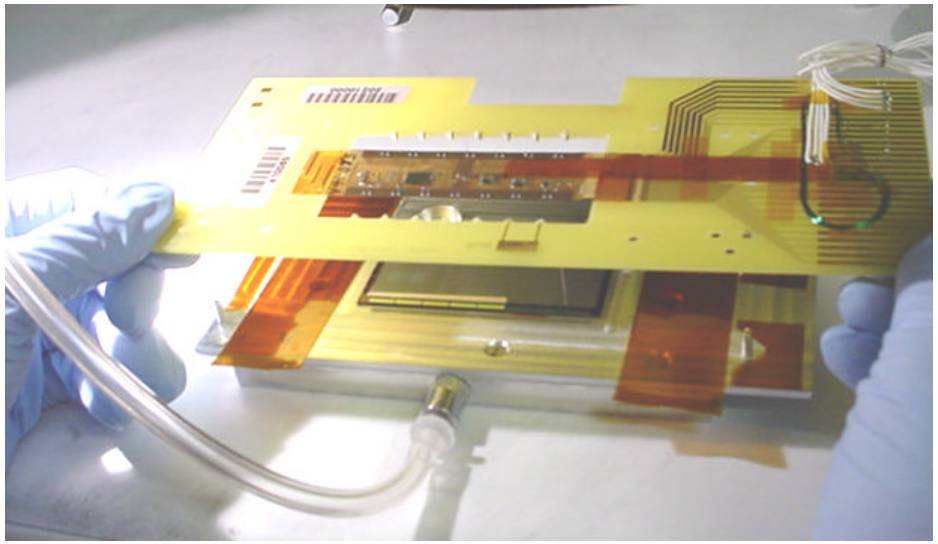


US Responsible for Thinning, dicing & die-probing all AMS bumped wafers

- Bare Module PRR now in December to have significant sample of prototype modules with FE-I.
- IZM bumped dummy wafers successfully thinned. Some recent problems with AMS bumped wafers.
- Need to solve and then thin first AMS hot wafers
- Single die probing under development
- Dummy modules also being produced for PRR- don't expect to need more dummies after that.

Technical Status: Module Assembly

- **Assembly details using PCB frame holder becoming clear**
- **Disk and barrel module procedures procedures differ**
  => Disk modules in US and Barrel modules in Europe is the most efficient path.



Technical Status: Pigtail

- **Barrel pigtail has connector for Type 0 cable**
- **Disk pigtail is integrated to type 0 cable**
- **Microwelding of pure aluminum wire to flex pigtail has proven not reliable enough for production**
- **Will use copper clad aluminum wires soldered to pigtail.**
- **Pigtail + Type 0 cable assembly will be done at LBNL/local vendor**
- **Pigtail to flex attach fixture to be developed at LBNL and exported to Oklahoma**
- **Disk pigtails+type 0 cable assemblies attached to flex at Oklahoma**

Technical Status: Glue

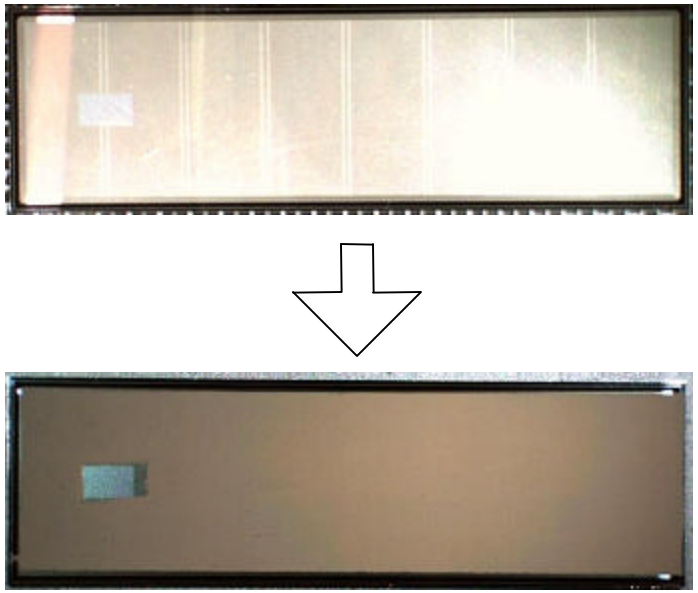
- Flex Hybrid To module Attach
  - **"Bonn" glue pattern has been working well at LBNL. Chosen for production**
  - **Different glue pattern may still be used at Genova- no impact on US effort.**
- Soon-to-be New Baseline for Module to Local Support Glue
  - **Original baseline (still) is CGL**
  - **SE-4445 Silicone to become new baseline**
  - **Few issues left to demonstrate**

Technical Status: HV Isolation

- **Can not test unirradiated module at full voltage**
- **HV tests of flex on frame**
  - Number of flexes that fail HV test is significant
  - Surface current paths are important (alignment holes cause problems)
- **No matter how careful we can not guarantee that flex cover layer will not be damaged between testing & module assembly**
- **Don't know if there are surface current paths in module. Dependence on flex glue pattern?**
- **Expect to learn much about HV isolation of irradiated modules in coming year, now that we have rad hard modules.**
- **Developing sensor back side passivation to head off potential problems**

Technical Status: HV Isolation (cont.)

- Using commercial wafer passivation made of filled polyimide
- Designed for silicon- matched CTE.
- Easy application- screen printed.
- In progress radiation tests and passivation of a full sensor wafer to be used to build IZM modules.



- Passivation being done at LBNL, sensor characterization at New Mexico
- If successful and adopted by collaboration, in house application process would have to be developed (by New Mexico?) and exported to other testing sites.

Goals For 2003

- Develop disk Type 0 cable assembly & test process- fabricate for 70 modules
- Demonstrate volume rad-hard module assembly (of order 70 modules assembled in US).
- Demonstrate back-side sensor passivation
- System test
- Module Burn-in System

2003 Goals: Type 0 Cable

- **Fabricate 2nd round of pigtails ($3.5K – 1.1.1.4.3.2)**
- **Copper clad wire purchase ($3.6K)**
- **PCB for PP0 connector end of cable ($1.7K)**
- **Vendor Assembly of Cables ($1.8K)**
- **Assembly fixtures (40 hrs shop)**
- **Test setup (40 hrs electrical tech.)**
- **In house assembly test (40 hrs mechanical tech.)**
- **Total:**
  - **$8.2K**
  - **120 hours labor ($8K)**

2003 Goals: Wafer Thinnig, Dicing, Die-probing

- **25x Bumped FE-I wafer thinning ($3K)**
- **Cleaning & re-coating in Microlab (50hrs student)**
- **Inspection (25hrs student)**
- **Dicing ($5K)**
- **Cleaning resist in Microlab (25hrs student)**
- **Single Die Probing (780hrs student)**
- **Supplies (gel packs, etc) ($3K)**
- **Totals:**
  - **$11K** **ETC02**
  - **880 hours student ($13.2K)** **16K+11K**

2003 Goals: **Module Assembly**

- Shipping Covers & supplies **($3K)**
- Equipment maintenance **($3K)**
- Technician Assembly Labor **(325hrs)**
- Technician tests (bond pulls, etc.) **(80hrs)**
- Totals
  - **$6K** **ETC02**
  - **440 hours technician ($17.6K)** **14K+13K**

2003 Goals: System Test

- **3 sector system test in 2003**
- **Includes PP0 and service panel, ROD, copper replacement of opto board.**
- **Wires, PC boards, supplies: 10K**
- **Labor 9 different people (spreadsheet), total 1300 hrs**
  - **$10K**
  - **$65K Labor**
  - **This goes on WBS 1.1.1.6.2**

ETC02

27K + 27K

2003 Goals: Burn-in System

- **This would be ideal job for a postdoc we don't have + tech. Support.**
- **Assume Tech. & Engineer labor instead**
- **Develop module electrical burn-in system in FY03**
- **Sector burn-in system left for FY04**
- **System capacity 8 modules at a time, based on x4 PCC**
  - **440 hours experienced technician ($26.4K)**
  - **110 hours engineer ($8.5K)**
  - **40 hours shop ($3.2K)**
  - **$8K board fabrications and purchases**
  - **Total: $46K**

No indep. WBS in ETC02

2003 Module Goals Total

- 1.1.1.5 projsect cost $152K (+46k)
  - $34K purchases **ETC02**
  - $77K Labor **224 + 504**
  - $38K Tooling, X-Ray, PDB, etc.
- 1.1.1.6.2 project cost $ 75K
  - $10K purchases
  - $65K labor
- 1.1.1.4.3.2 $3.5K

Revised Production Assembly
2 Hit System, All in FY04

- **Actual Assembly modules & Type 0 cables, Replaces 1.1.1.5.3.4.2, 1.1.1.5.3.4.3, 1.1.1.5.3.7**
  - **Purchases $34K + Labor $40K = $74K** (was 135+57)
- **Wafer Thinning & Dicing, 1.1.1.5.3.1 & 1.1.1.5.3.2**
  - **Purchases $53K + $7K Labor = $60K** (was 40+17)
- **Single Die Probing, 1.1.1.5.3.3**
  - **Purchases $10K + $7K Labor = $17K** (was 0)
- **Tooling, Equipment, Supplies, 1.1.1.5.3.4.1**
  - **Purchases $10K + $4K Labor = $14K** (was 8+0)
- Note, pigtail fab. Goes in W.B.S. 1.1.1.4
  - Disk Production Pigtails: $18K (was 23)

Other FY04 Costs

- Should include money for next level of system test, to be defined. Assume same cost as FY03: $75K (was 0)
- Should include development of sector burn-in system. This has more sophisticated mechanical components to operate sector at temperature. Assume same cost as FY03 module burn-in system: $46K **(ETC02 has 46K for sector electrical testing)**

Service Panel Production (2004) For 3-Hit System

- 57Kg Cu-Clad Al Wire (+overage) $81K
- Flex fabs, connectors, vendor assy. $66K
- LBNL Tech. Labor 3648Hrs

- Total for Electrical component of Service panel production: $293K
- (2 hit total is $226K)