Implementation of AOI in a High-Volume Manufacturing Environment

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Overview

- Previous process at this Fab

- What was implemented

- Improvements in process resulting from NSX implementation

- Tremendous benefits resulting from NSX implementation

- Payback $$$

- The improvements possible in your Fab

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Customer Fab

- 100mm Fab shipping sawn wafers offshore for assembly

- Utilized manual inspection with paper trails for T&A inspection and tracking of defects

- Wafer maps were not used in the process
  - *prober map did not go to assembly, etc…*

- Defect categories,location and die count data recorded on paper by operator
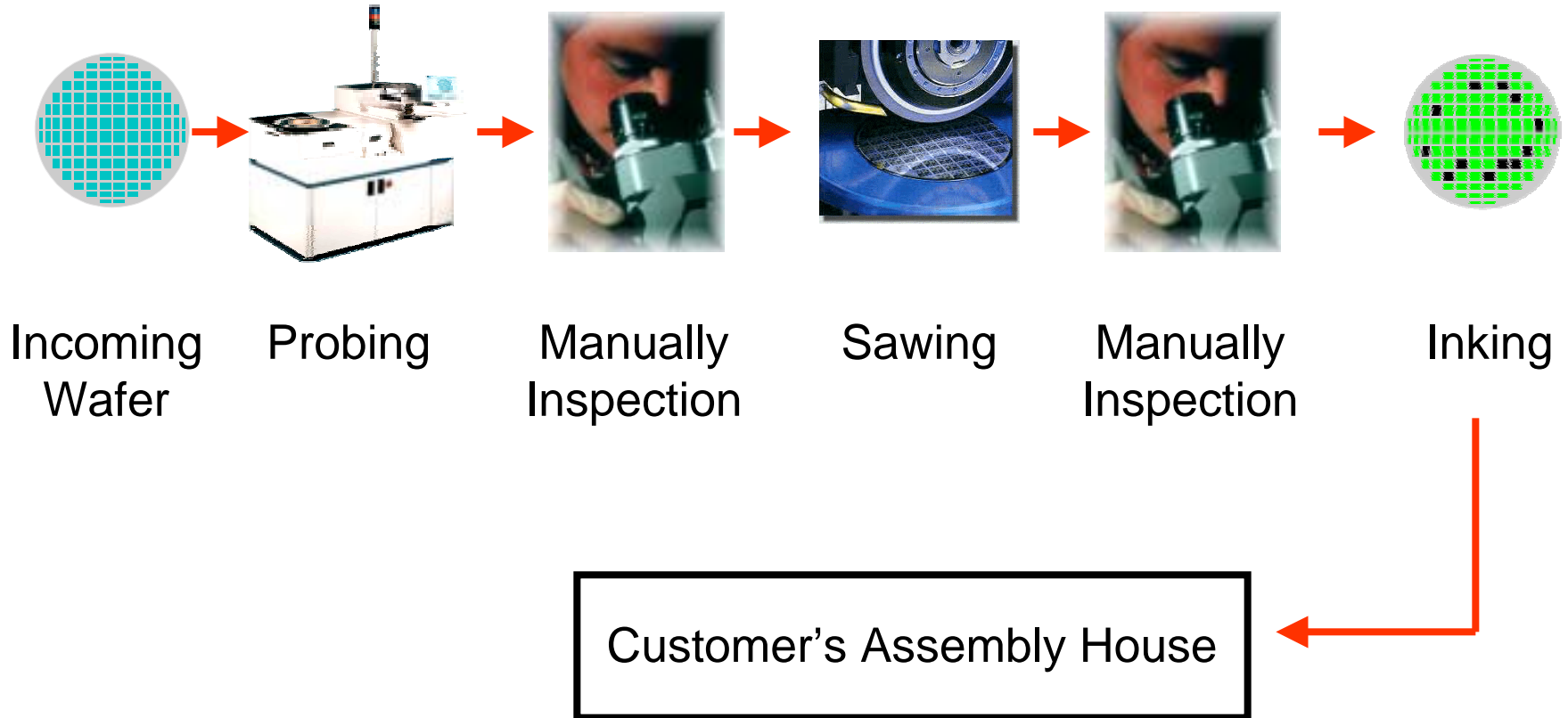
- Inking wafers for pick and place

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What was wrong?

- Defects not being found during inspection

- Die count variances between customer and foundry assembly site

- Inaccurate recording of defect location and type
  – *only as accurate as the operator made it*

- No quick feedback to engineering

- Inking

- Major production ramp
  – *could not train or hire enough operators to meet ramp*

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Customer's Previous Process

Incoming Wafer → Probing → Manually Inspection → Sawing → Manually Inspection → Inking

Customer's Assembly House

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Solving the problems

- NSX-90 automatic visual inspection

- Electronic wafer maps

- Wafer map server (*provided by customer)*

- Offline review

- Automatic defect classification

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NSX-90 Capabilities Implemented

- Automated Optical Inspection
- Wafer Map Import/Update and Export
- Auto Retrain- *automatically modifies inspection recipe as your process changes*
- Defect Classification Coding (*currently manual)*
- Film Frame Handling
- Automated Defect Classification
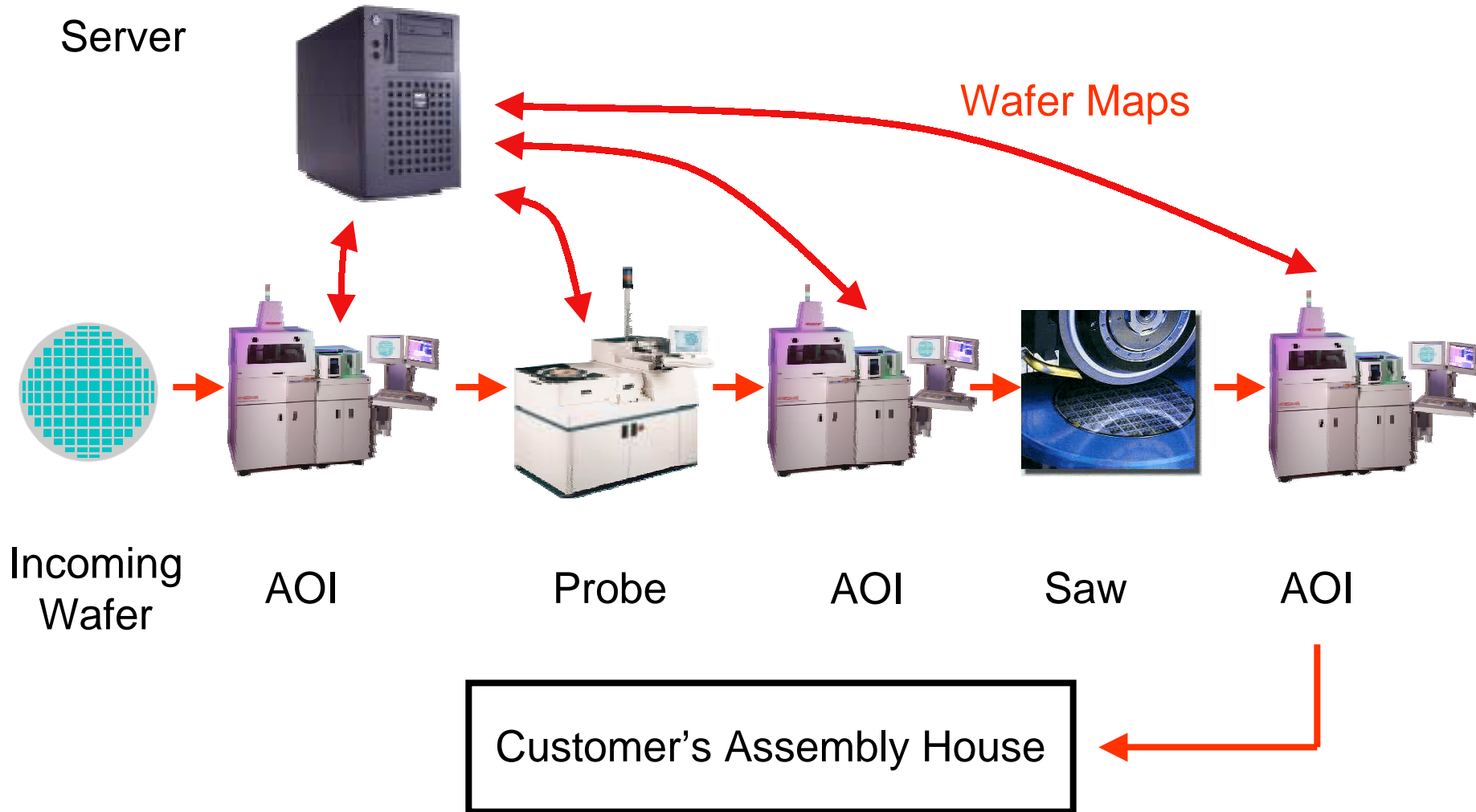 - *Currently being phased in over next quarter*

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NSX-90 Specifications

- Defect Sensitivity down to 0.5 microns
    - *Typically 10 micron in this application*
- Repeatability greater than 95%
- Uptime greater than 97%

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Enhanced Process

Server

Wafer Maps

Incoming Wafer   AOI   Probe   AOI   Saw   AOI

Customer's Assembly House

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Results

- Elimination of inking
  - *Wafers sent to offshore assembly house with electronic wafer maps*

- Accurate recording of defects
  - *Location*
  - *Classification*

- Wafer maps implemented

- Elimination of manual inspection

- "Real time" review of defects

"Tangible" Benefits

- Inking process step removed
  - *Saved time, resources and floor space*
  - *Eliminated chance of inking wrong die*

- Pick and place defects eliminated
  - *Locating ink dots not required*
  - Wafer maps sent to "end customer"

- Count variance issues eliminated
  - *Customer count discrepancies due to operator miscount "We shipped 10k and they received 9.5k?"*

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Throughput Improvement

*"The NSX-90 alone cut inspection cycle time
by a factor of 4 when compared to manual inspection"*

**Throughput by Tool
Including Defect Classification**

*Estimate

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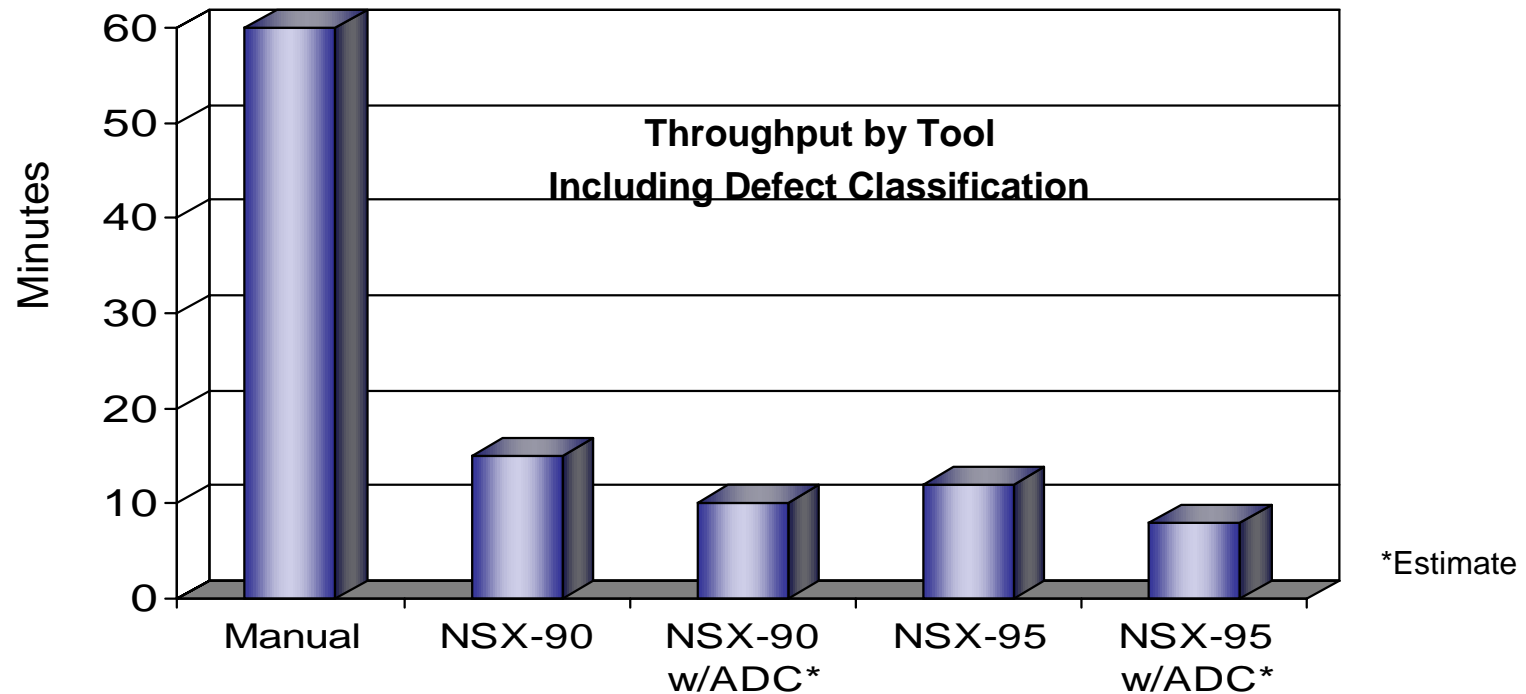
Yield Improvement

Added 1.5% to yield numbers

=

60,000 additional good die per week
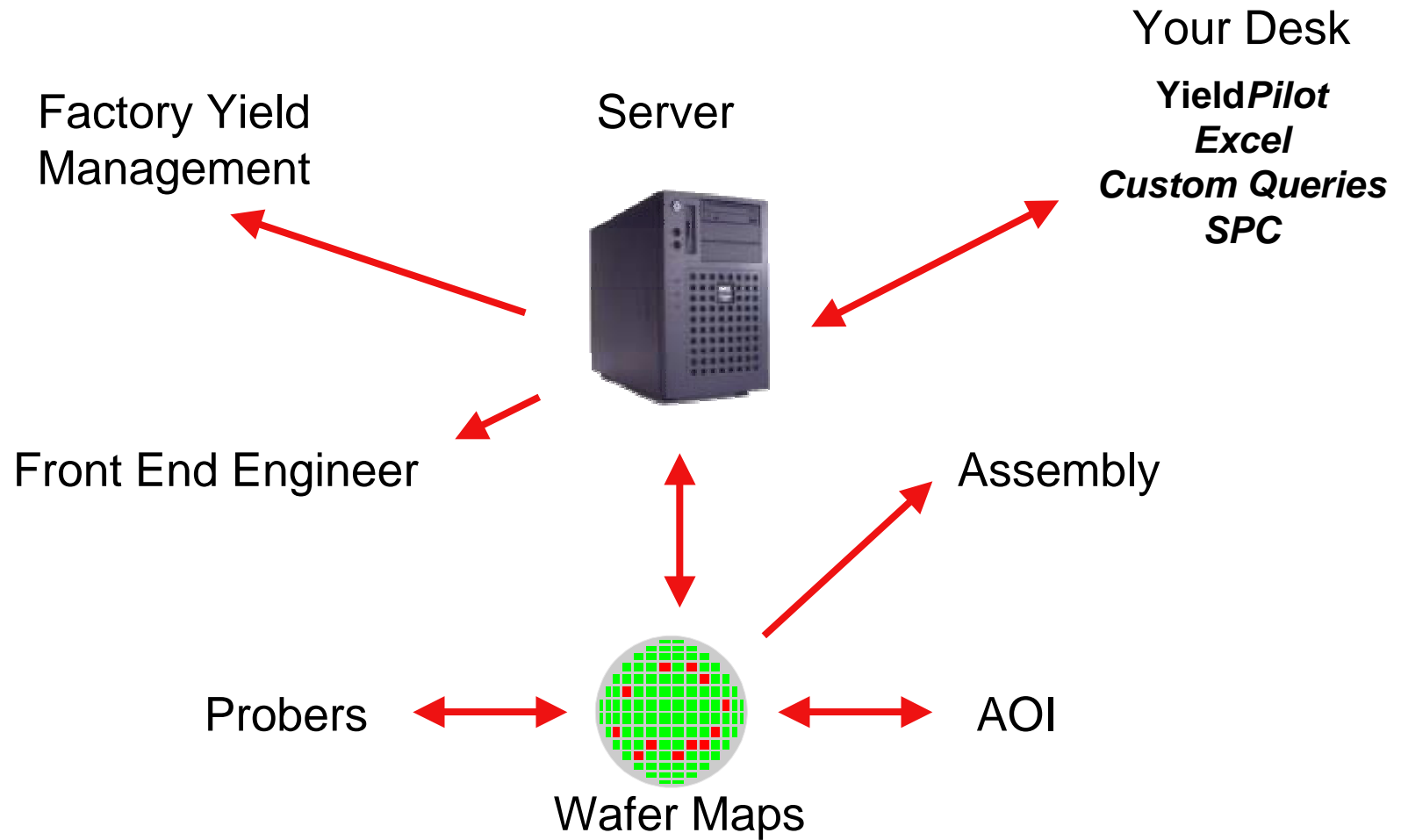
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Payback in 8 weeks

Intangible Benefits

- Higher end-customer satisfaction due to higher quality of incoming products - *making their job easier!*

- Reduced human fatigue as operators are not looking through microscopes 8 hours a day

- Ergonomic improvements

- Operators utilized for other tasks- speeds ramp up

- Confidence in inspection –
  "*The NSX does not miss defects - operators do*"

  Quote from manager at customer site

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Ultimate Data Distribution - *Where*

Your Desk

Factory Yield
Management

Server

Yield*Pilot*
Excel
Custom Queries
SPC

Front End Engineer

Assembly

Probers

AOI

Wafer Maps

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What Data Can We Provide?

- Bump inspection
  - Diameter, height, area, presence, shape, coplanarity,…

- Probe mark
  - Presence, area, boundary intrusion

  and/or

  - Location on pad (4 dims), area, number of marks

- Active Area
  - Chips, cracks, particles, FM, …
  - Saw damage

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How Much Data Can You Get?

Tons of Data from Probe or Bump Metrology

2400 die, 8 pads, 100% Inspection, 1000 wafer/day

Wafer	230,400	12.8 Mb
Lot	5,760,000	320 Mb
Day	230,400,000	12 Gb

Thinking 300mm?

Count on approximately 41 Mb of data

per wafer for full metrology!!!

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Implementation of the NSX

- **Increased Fab productivity and profits**
  - Improvements in your process through use of accurate and complete data
  - Elimination of process steps that are dirty or prone to create defects - i.e.- *Inking*
  - Yield improvements- *quality of work as well as process improvements*
  - Throughput, throughput, throughput

- **Quality of work improvements**
  - Higher quality inspection and accurate data
  - Improved job satisfaction - *Operators do not sit in front of a microscope for 8 hours = less turnover*

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August Technology

- Founded 1993

- Bloomington, MN

- Cassette and FOUP inspection

- Automated visual inspection

- Bump, probe and sawn wafer inspection

- Over 85 NSX systems installed worldwide

- Wafer, film frame & Auer boat handling

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August Technology's Post-Fab

- Whole wafers
  - Active die area, bond pads, bump

- Sawn wafers
  - Chips, FM, cracks, scratches…

- Die in waffle pack or Gel-pak

- Yield*Pilot^{TM}* – defect data and process analysis
  - Data server
  - Browser integration

- **300mm inspection ready today!**

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