Application Note

IRS20060406:

Using IRS to make your defect data work for you

FEATURES

IRS OLAP (Online Analytical Processing)

IRS Pivot Chart

IRS Charting

IRS Reporting

Si laz

INTRODUCTION

A typical deployment of SiGlaz Intelligent Defect Analysis software will result in multiple AWB recipes running simultaneously to monitor various manufacturing processes in the fab. Thousands of KLARF files may be analyzed in a single day. These recipes may identify hundreds of spatial signatures per week and create a folder full of KLARF files. All members of the Defect Team, from engineers to managers, will have questions about these signatures; for example, how often do the signatures occur and how many dies are affected?

Figure 1 below shows two examples of circular signatures that are typically observed in production. Figure 2 illustrates an example recipe that generates a KLARF file when a signature is recognized.

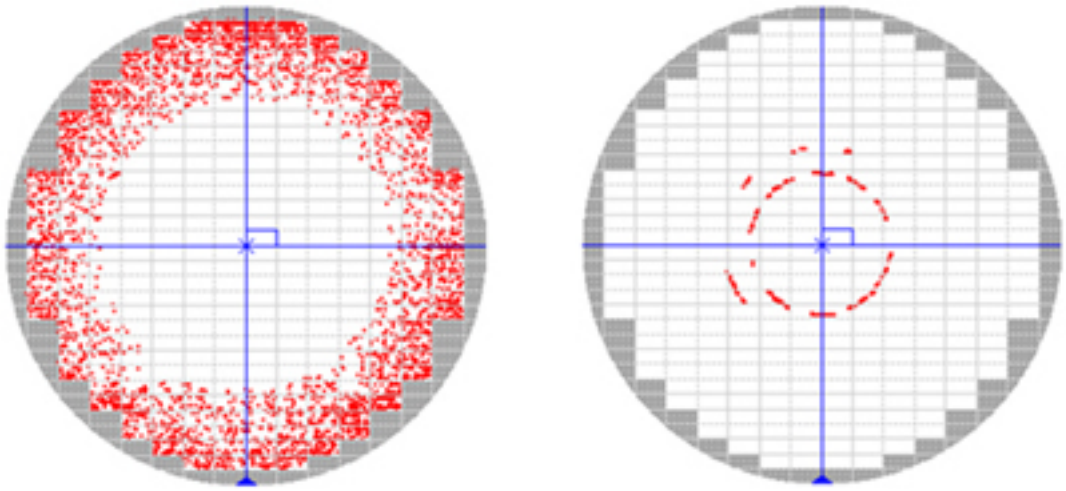

Figure 1: Examples of spatial signatures: Circle: shading (left) and Circle: inner (right)

Online Analytical Processing (OLAP) provided by SiGlaz Intelligent Reporting System (IRS) allows the user to make comparisons, reveal patterns and relationships, and analyze trends. This application note will provide examples how to use OLAP to compare, reveal and analyze, by displaying different views of data, turning data into the knowledge that will help to increase yield and productivity.

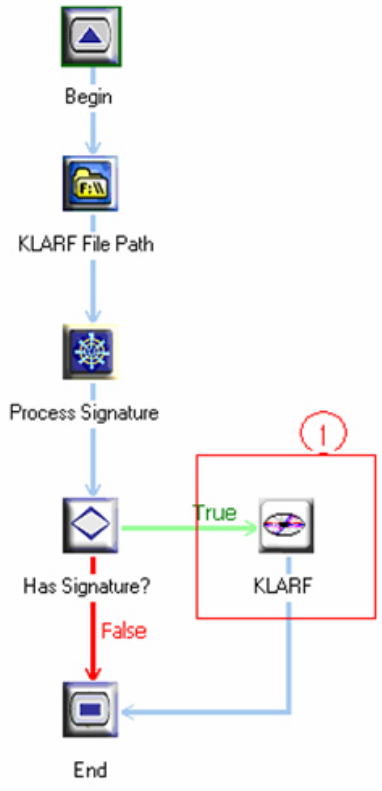

Figure 2: Automated inline process monitoring recipe >>>

ASK THE IMPORTANT QUESTIONS

Most reporting systems provide a limited number of views of the manufacturing data. These views may not answer the full range of questions that are being asked about the data. IRS OLAP allows the user to sort and display signature and classification data to address these key questions and to provide the flexibility to tailor the visualization of the signature data to understand the root-cause of manufacturing process excursions.

To begin the analysis of a set of KLARF files, the user must first decide how best to sort the KLARF data: by lot, by wafer, by step, by slot, by time, by date, by week, by month, or by quarter. IRS then makes it easy to isolate signatures and to understand how and when they occur. The IRS “wizard” guides the user in a step-by-step process to organize the KLARF data. The user then drags and drops the data types from defect classification data into the desired OLAP view.

PIVOT TABLE

The pivot table is one of the techniques used in OLAP to display the KLARF data. Creating a Pivot Table report is about moving information around to see how they all fit together to reveal any trends. You can use the entire dimension provided by IRS to move data around again and again, to drill down to the information that you are seeking for.

WIZARD STEPS

Figure 3 below shows the steps that are used to create a pivot table: 1) Ask questions; 2) Use the IRS wizard; 3) Create the chart to display the data; 4) Repeat #1.

Figure 3: Steps to create pivot tables to analyze KLARF data

1. Ask questions

Formulate the question regarding when a particular signature occurs and what is its impact. For example: During the months of August and September 2005, what lots contained a “Circle” spatial signature. What is the total number of dies affected by this signature?

2. Use IRS Wizard to create the Pivot Table

• Choose ***Defect Classification*** in IRS Report Gallery; See Figure 4 below

Figure 4 IRS Report Gallery >>>

• Follow the wizard steps to create a Pivot Table Chart.

• Browse the ***Output KLARF file path*** defined in the recipe in Figure 2 above, as ***Source Path*** in Figure 5.

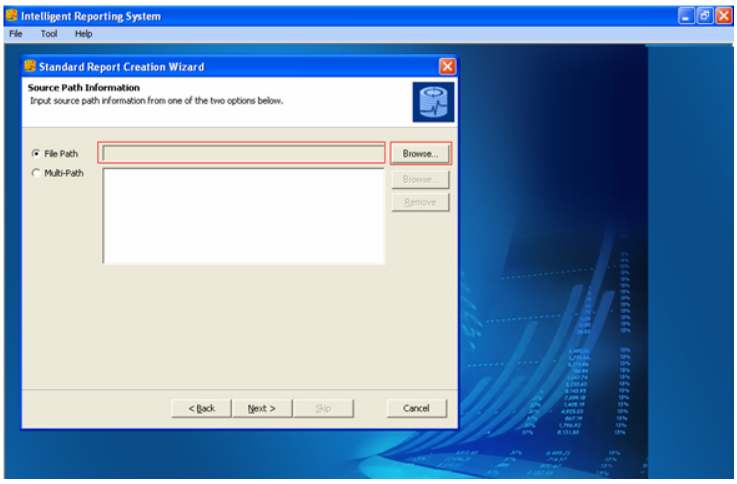

Figure 5: Source Path Information >>>

• Skip **Record Selection Criteria.**

• Skip **Filter Defects by Criteria.**

• Select **Chart** in **Report View Type;** see Figure 6.

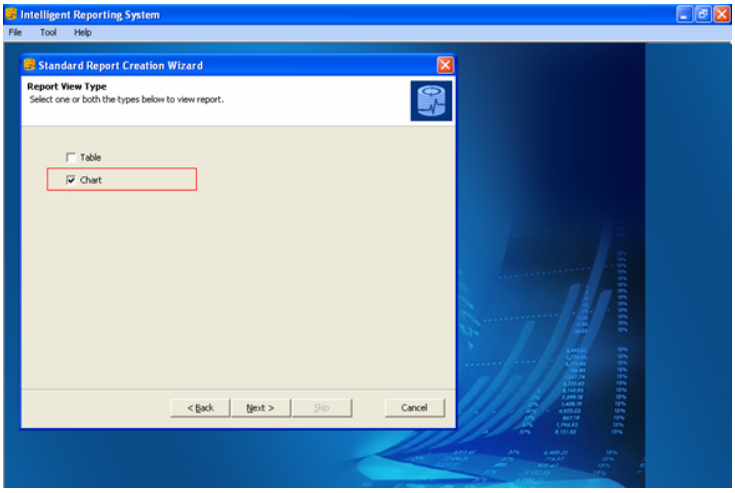

Figure 6 Report View Type >>>

- Click **Next** to skip Chart Layout.
- Choose **Chart Type Bar**.
- Click **Run Report**.
- The IRS OLAP ***data cube*** is now ready for pivoting; see Figure 7.

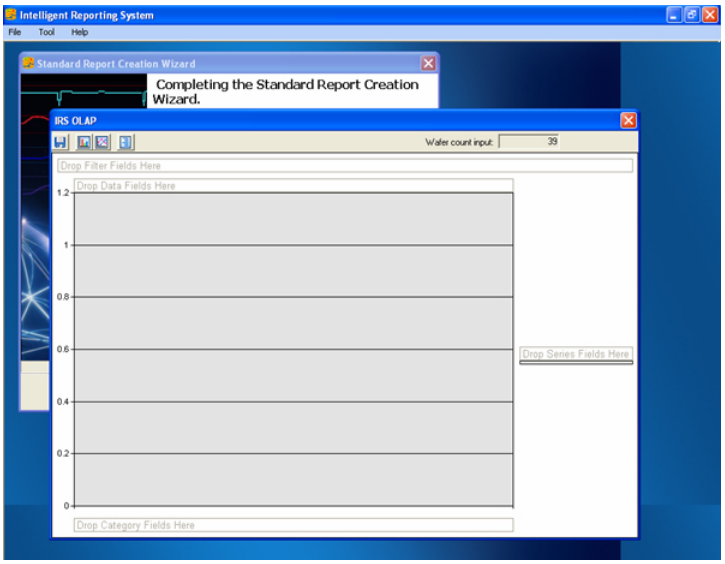

Figure 7: IRS OLAP data cube >>>

3. Create Chart

The IRS wizard has already prepared everything required to create the Pivot Chart view of the KLARF data.

- Click **Chart Field List**. In the **Chart Field List** are the names of the columns from the **source data** (classified defects): 1. Dimensions - Step, Lot, Wafer, Inspection Date, and Classification Number; 2. Measures – Number of defects, Number of defect dies, and Defect die percentage.

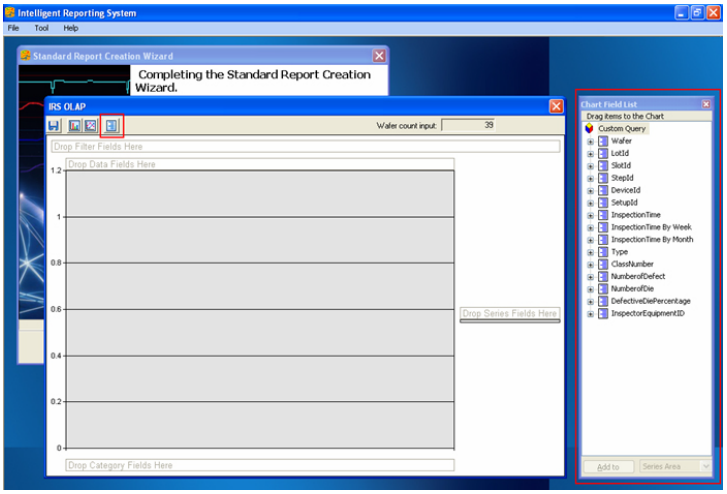

Figure 8: Chart Field List >>>

- Ask a question “How many lots are affected by the spatial signature called **circle:inner**?” (see Figure 1)
- Assume **circle:inner** signature has been previously classified by AWB using CLASSNUM=16.
- Drag **ClassNumber** from **Chart Field List** and drop into the **IRS OLAP** work area, **Drop Filter Fields Here** as shown in Figure 9 below.

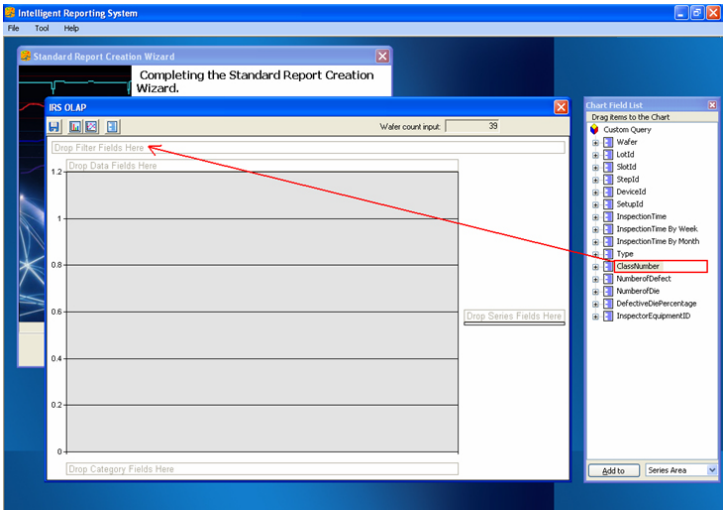

Figure 9: Drag and drop ClassNum into “Drop filter Fields Here” >>>

• Select only **CLASSNUM=16**, **circle:inner** signature, for analysis.

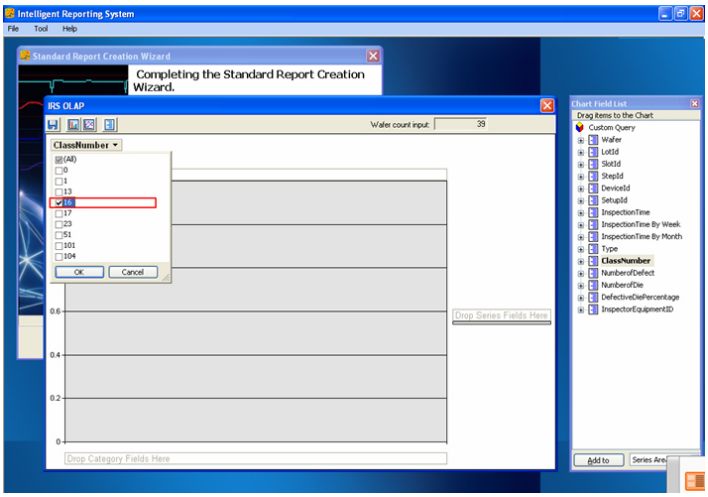

Figure 10: Select CLASSNUM=16 >>>

• Drag the measure field, **NumberOfDie** (Number of defect dies), into **Drop Data Fields Here** in **IRS OLAP** window.

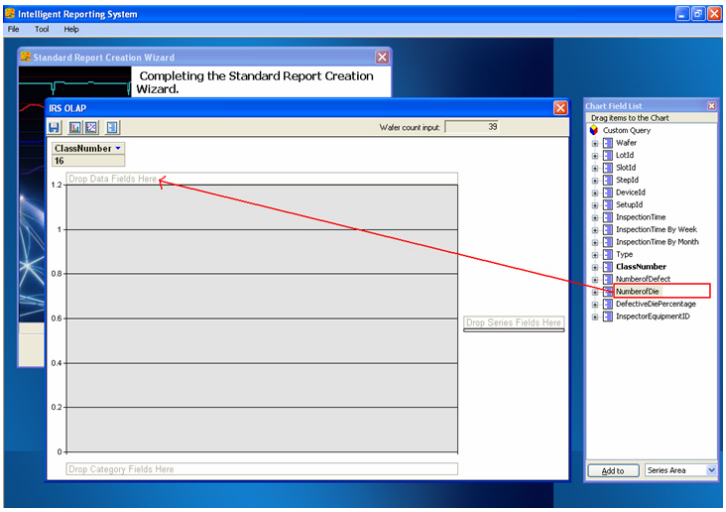

Figure 11: Drop measure field into IRS OLAP >>>

• Figure 12 shows the result. The chart shows that of the 39 wafers in the analysis 264 defect dies are affected by the spatial signature **circle:inner** or CLASSNUM=16.

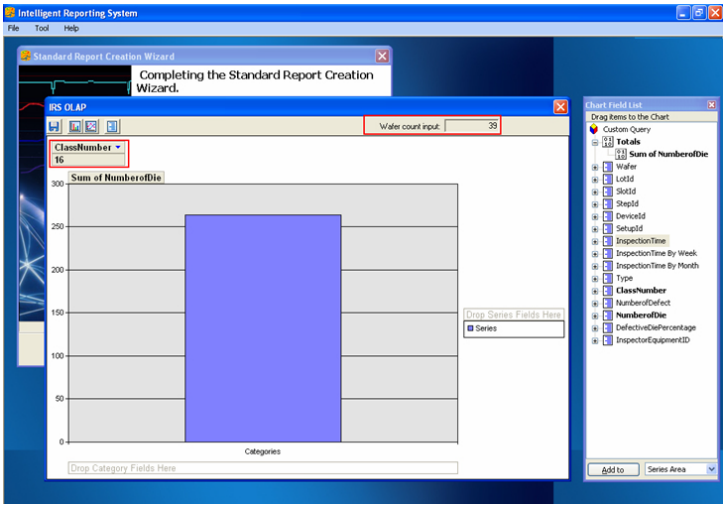

Figure 12: Number of dies are affected by the signature? >>>

• To answer the question “when does the defect signature happen?” Drag Inspection **Time** to the **Drop Category Fields Here**.

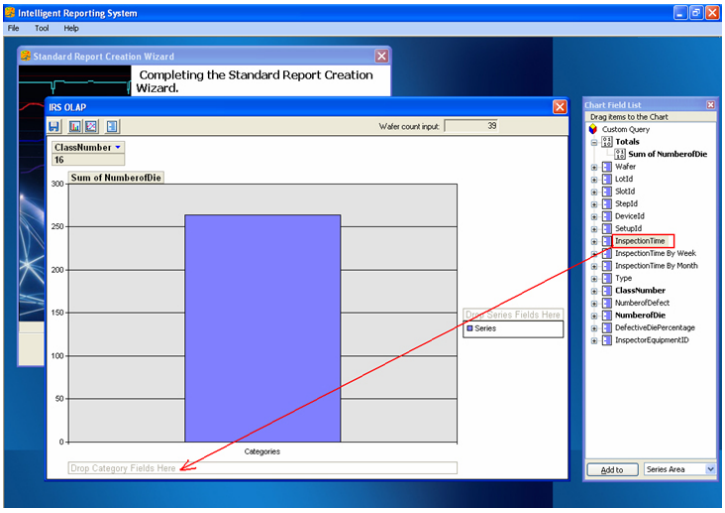

Figure 13: Drag the time dimension into IRS OLAP >>>

• Figure 14 shows the result with time dimension.

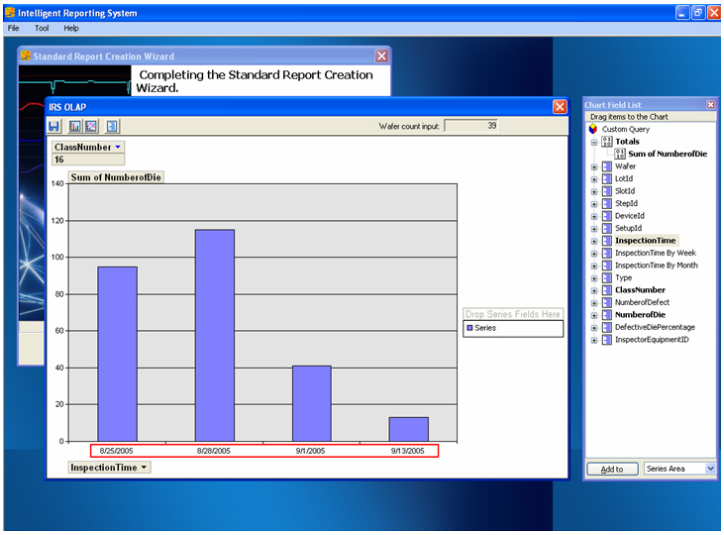

Figure 14: Result with time dimension >>>

• To answer the question, “What Lots are affected?” Drag **LotId** into the **Drop Series Fields Here** in IRS OLAP.
See Figure 14 below.

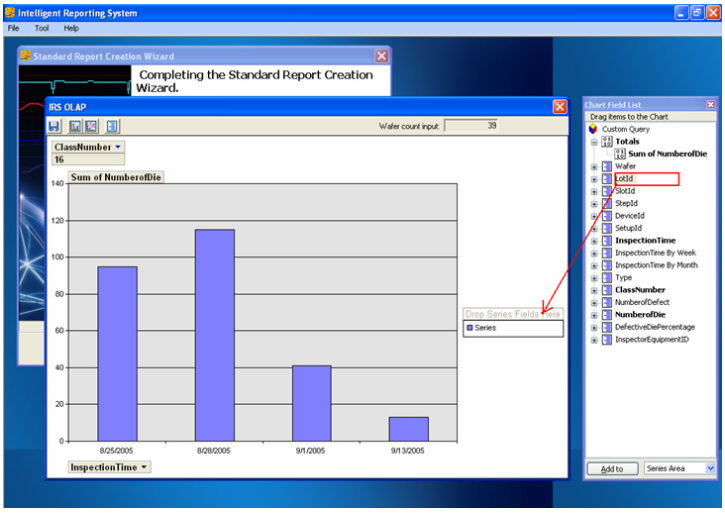

Figure 15: Add Lot ID as another dimension >>>

• Figure 16 shows the result with Lot ID dimension. On 8/28/2005, Lot 2240746_01 has 115 defective dies, the highest of the series.

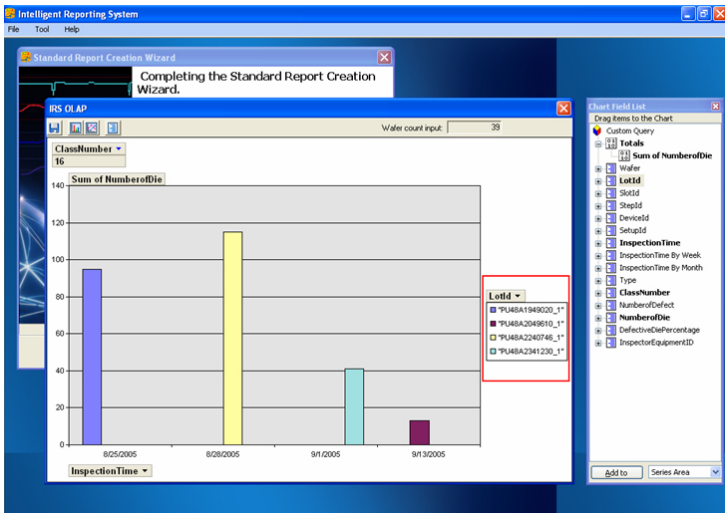

Figure 16: Result with Lot ID dimension added >>>

4. Ask additional questions

Based on the results of the initial analysis, the user may have a follow up question; for example, which wafers have the most defective dies with the signature of interest?

• Drag LotId back into Chart Field List; see Figure 17.

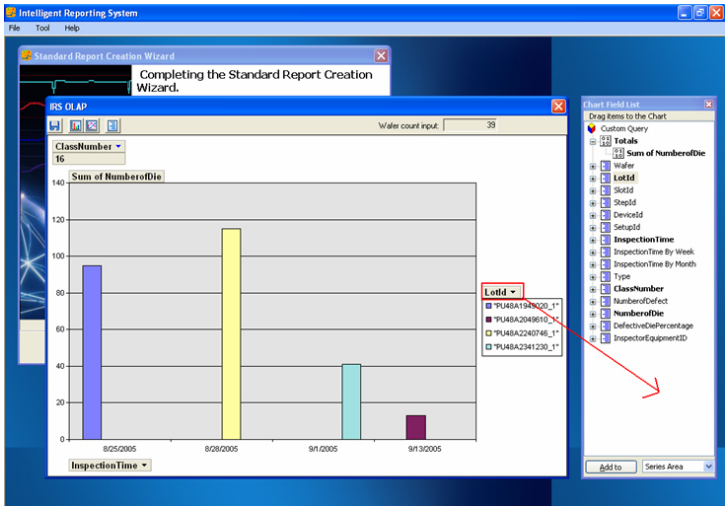

Figure 17 Drag LotId out >>>

• Result without LotId dimension; see Figure 18.

• Drag Wafer into IRS OLAP; see Figure 19.

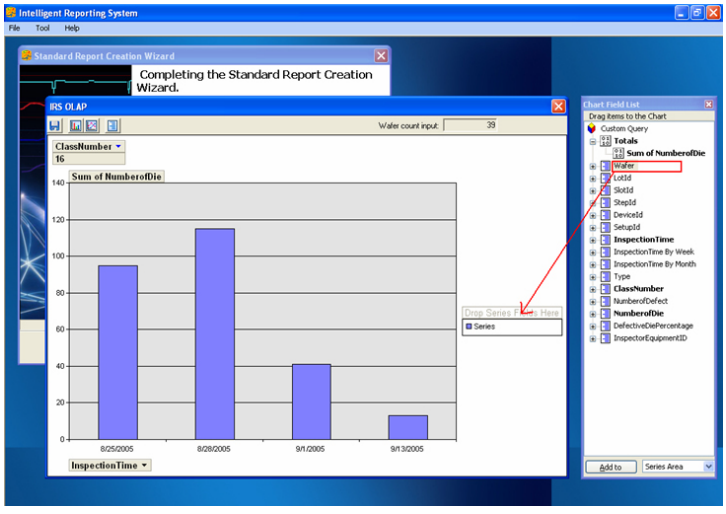

Figure 18 Drag another dimension in, Wafer. >>>

• Figure 19 shows at a glance that Wafer=10 has the highest number of defective dies with the signature of interest.

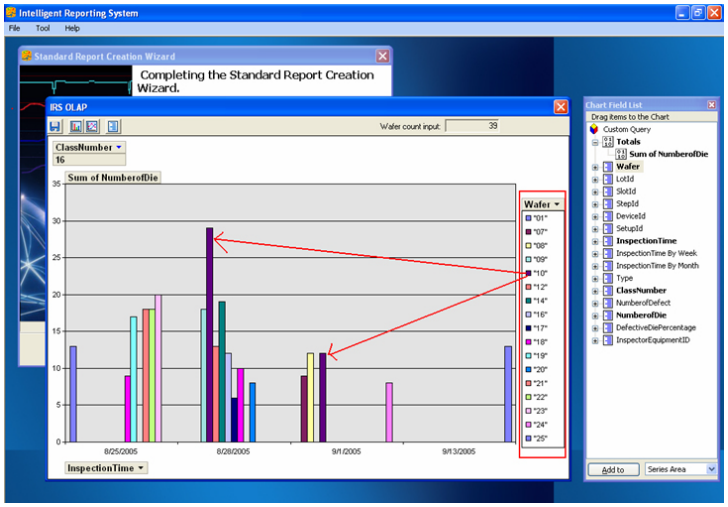

Figure 19 Result with Wafer dimension. >>>

• Ask a further question: "Does wafer 10 that have the highest number of defective dies?" It could help explain further systematic manufacturing problems.

• Drag the time dimension out as in Figure 20.

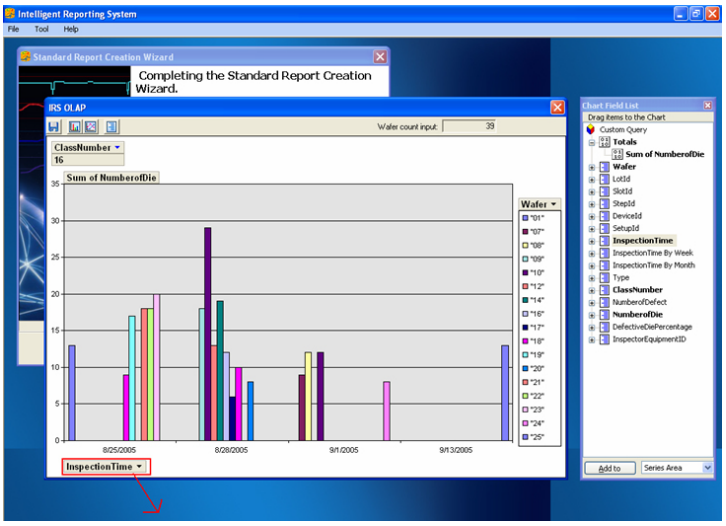

Figure 20: Drag the time dimension out of IRS OLAP >>>

• The results do confirm that Wafer=10 has the highest defect dies; see Figure 21.

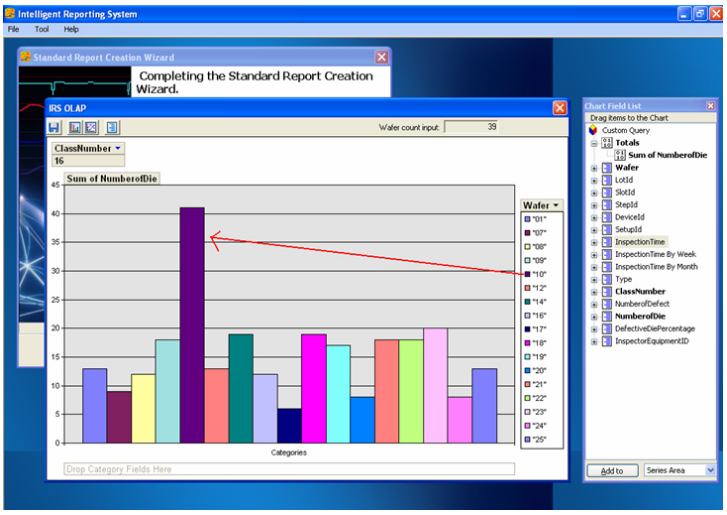

Figure 21 Result with wafer slot in series dimension; time has been removed from series. >>>

• Or you can pivot the Wafer dimension by dragging it to the **Drop Category Fields Here.**

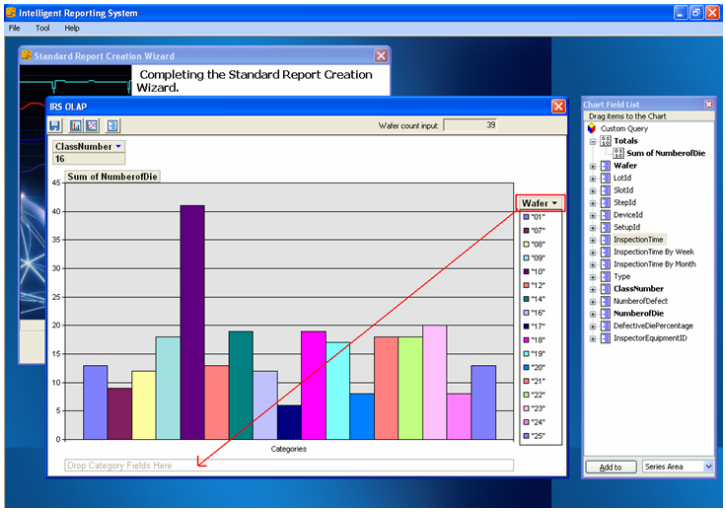

Figure 22: Pivot the dimension. >>>

• Figure 23 shows the same result as above, after pivoting the Wafer dimension.

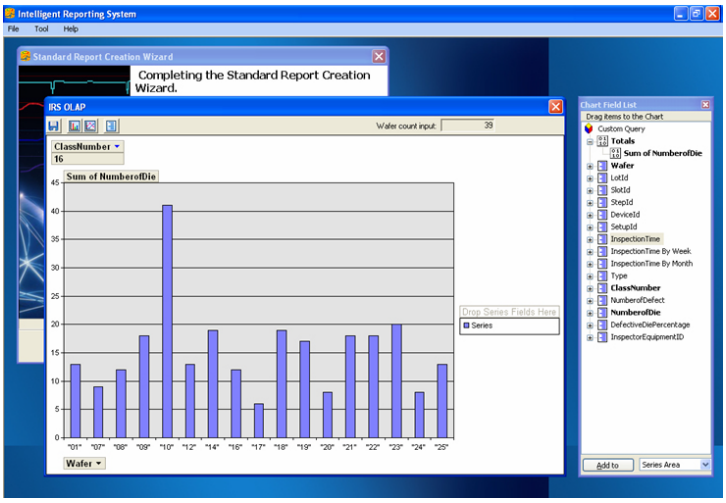

Figure 23: Result after pivoting the Wafer dimension >>>