



# Argyle Diamonds

## Installation of the Gekko Modular Diamond Plant



<b>Model:</b>	IPJ1000 – Modular Plant
<b>Purpose:</b>	Bulk sampling of diamond bearing alluvial material
<b>Place:</b>	Argyle Diamond Mine, Western Australia
<b>Senior Project Metallurgist:</b>	Vernon Walz
<b>Date:</b>	2005
<b>Results:</b>	99% recovery of Diamonds

Gekko Systems recently successfully trialed a 20 tonne per hour Modular Diamond Pilot Plant at the Argyle Diamond Mine in Western Australia. The Plant was installed to investigate the possibility of pre-concentrating alluvial and tailings material using an Inline Pressure Jig (IPJ), prior to DMS treatment.

The IPJ is a continuous gravity separation device, capable of producing a low volume, diamond rich concentrate. In several successful diamond applications, the IPJ has been found capable of operating at a cost of US\$0.02 per tonne treated, compared to up to US\$0.25 for DMS treatment. This offers the advantage of incorporating an IPJ into conventional diamond flow sheets as a means of pre-concentrating the feed prior to DMS treatment.

The Argyle Pilot Plant consisted of a Scrubber, Feed Preparation Screen, Single-Stage InLine Pressure Jig (IPJ 1000), and Concentrate and Tails Dewatering Screens. Prior to treatment through the IPJ 1000, approximately 75% of the Plant feed was removed as fine (-2mm) or coarse tailings (+16mm). The IPJ 1000 has a nominal capacity of 15 tonnes per hour. The tests were run at 2.5tph due to feed availability.



**Argyle Diamond Test Plant at Gekko premises prior to delivery**

During the commissioning process, the Pilot Plant was optimized using Gekko Systems Magnetic Polymer Density Tracers. These tracers are cubic in shape, and offer several advantages over conventional non-magnetic tracers, as they are easily recoverable, reusable, and sold at a lower unit cost.

CASE STUDY

For the tracer test work, rare earth magnets were positioned at the discharge ends of the IPJ Concentrate and Tails Screens for easy retrieval of the magnetic tracers. This allowed for a high number of tracers to be added to the IPJ feed, thus improving the statistical validity for each test. In one test, a total of 1380 tracers were utilized. Two of the tracer recovery magnets are illustrated on the left hand side of the picture below.

As part of the optimization process, partition curves using varying tracer sizes were generated to determine the size-by-size separation efficiency of the IPJ 1000. Tracer sizes of 2, 3, 4, 6, and 16 mm were tested, over a density range of 2.7 to 3.5 R.D. Results of these tests showed that 100% recovery of 3.5 s.g. tracers was possible for tracers sized at 4 mm, 6mm, and 16 mm. Recovery of the 2 mm and 3 mm tracers ranged between 95 and 99%. Approximately 20 to 30% of the IPJ feed reported to concentrate for these tests.

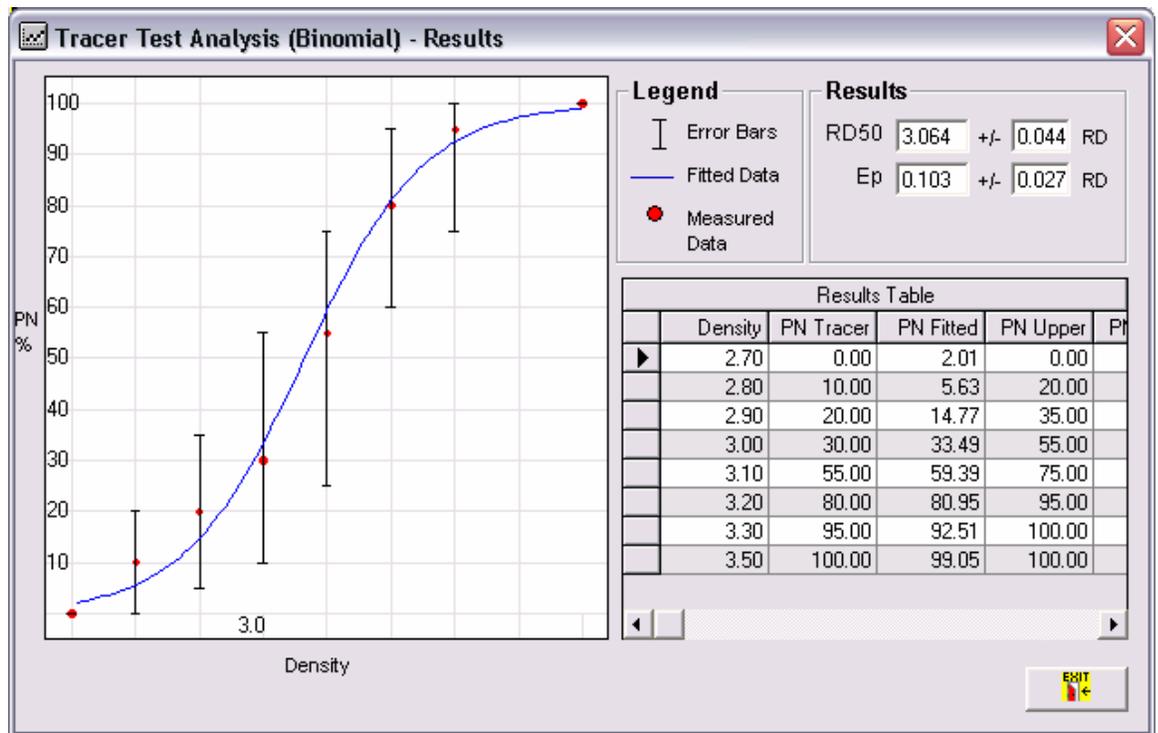


Figure 1. Partition curve for the 2mm tracers

Figure 1 above illustrates a Partition curve generated from 2.0 mm density tracers. The fitted results of this test show a separation density ( $RD_{50}$ ) of 3.064, and probable error ( $Ep$ ) of 0.103.

Separation density ( $RD_{50}$ ) is the density where half the mass of the feed reports to the overflow and half to the underflow. A theoretical perfect separation would pass vertically through the  $RD_{50}$ . The probable error ( $Ep$ ) measures the slope in the middle portion of the Partition curve, which represents the efficiency of separation.

After the completion of the optimization process, a continuous 750 tonne sample of alluvial feed was processed through the Pilot Plant, with 30% of the IPJ feed reporting to the final concentrate.

Concentrate and tails from the IPJ were collected separately, and then treated through the Argyle MkIII DMS and Diamond Recovery Plant for confirmation of diamond recoveries. Results of this work confirmed the original tracer tests, with an overall diamond recovery of 99.9% to the IPJ 1000 concentrate. About 25% of the stones recovered were smaller than 2.5mm in size.

Vernon Walz, Senior Project Metallurgist at Argyle Diamonds was impressed with the overall operation of the plant “The modular plant is well designed and built to a high standard of workmanship, which is important to enable us to meet our high safety standards..... The initial recovery test results were much higher than we expected and exceeded our target level.”

The size/size recovery of diamonds was excellent with some very fine diamonds recovered to concentrate.

Further test work is planned, and will likely focus on optimization of the IPJ grade recovery relationship. It is possible that the volume reporting to the IPJ concentrate can be further reduced below 30%, without having a major impact on diamond recovery.

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