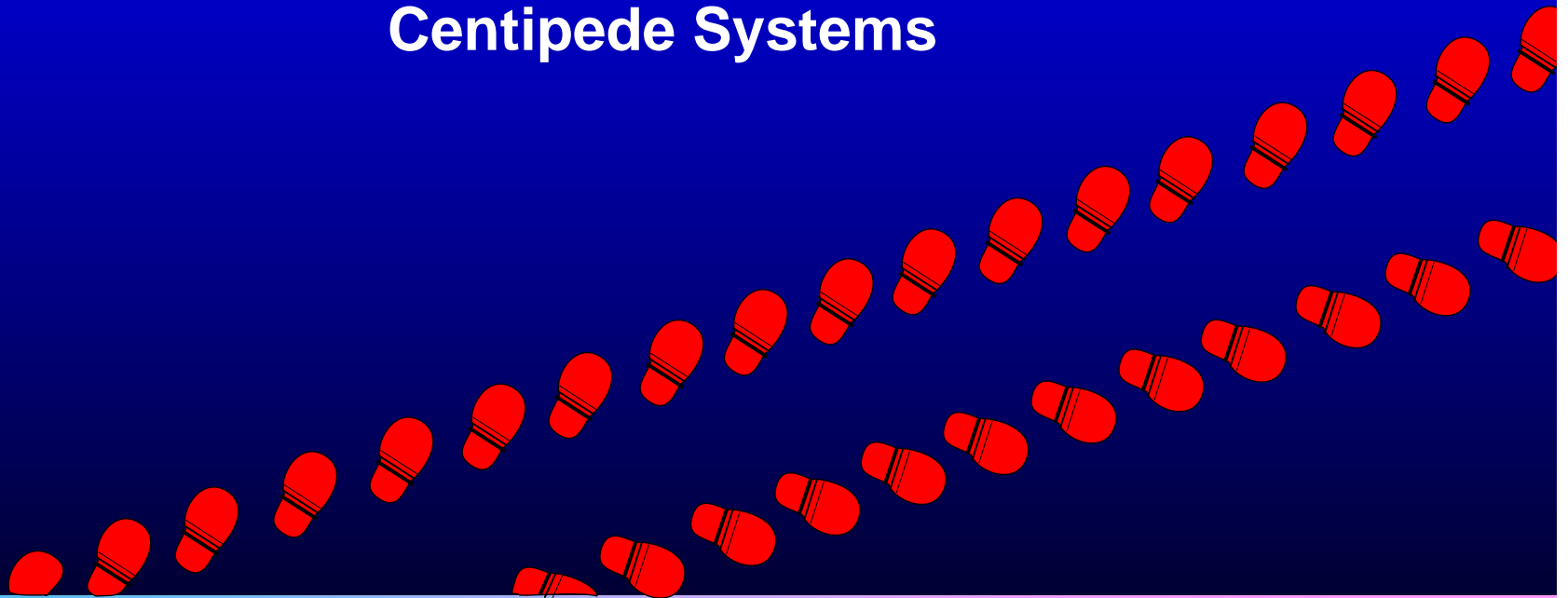


Flexible Carrier Enables Automated Test-in-Tray

**Dr. Tom Di Stefano
Centipede Systems**





Running in Parallel

TnT is limited only by Test Electronics

- Parallel test at fixed DUT positions
- Parallel to 256+ DUTS

Fast TnT Index Times

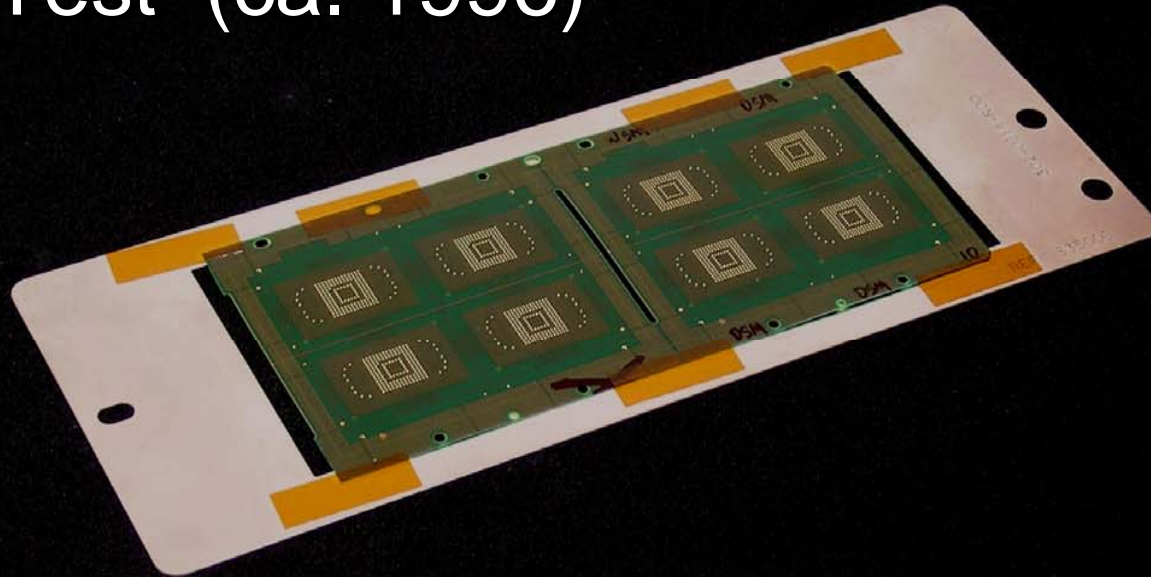
- FlexFrame Carrier allows index time < 500 ms
- Index time includes environmental chamber, thermal



Test in Tray (TNT)

- **Standard Formats**
- **Minimum Custom Fixturing**
- **Fully Automatic Handling**
- **Parts Stay in Tray Throughout**
- **All Device Types (WLP to MEMS)**

Strip Test (ca. 1996)



High Productivity ... but Limited:

- Entangles Packaging & Test Processes
- Dimensional Stability Limits Array Size
- Handling is Complex/Expensive
- Applicable only to Parts Fabricated in Strip

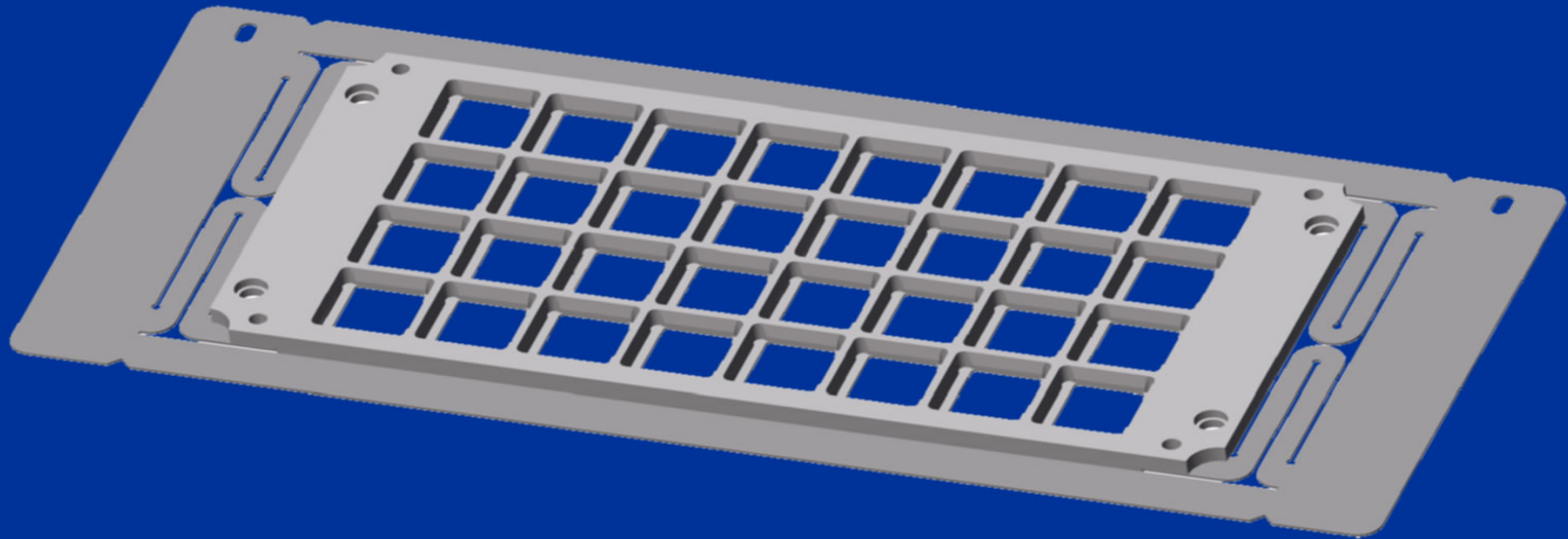
TnT FlexFrame™ Tray



Highest Productivity

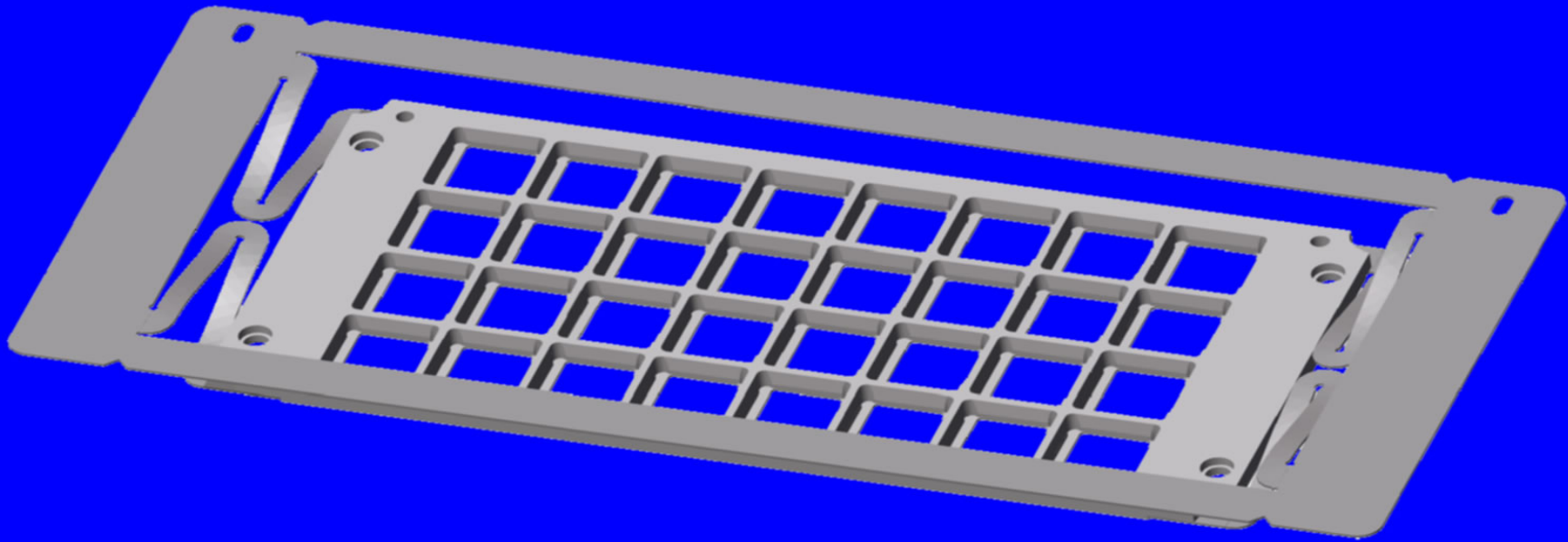
- Automation of all Test Operations
- CTE Matched To Contactor
- Simple (Inexpensive) Handling
- Applicable from WLP to MEMS

FlexFrame Tray (Retracted)



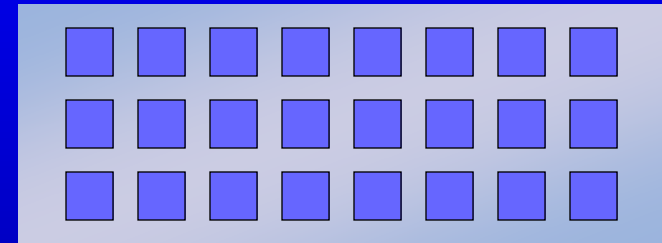
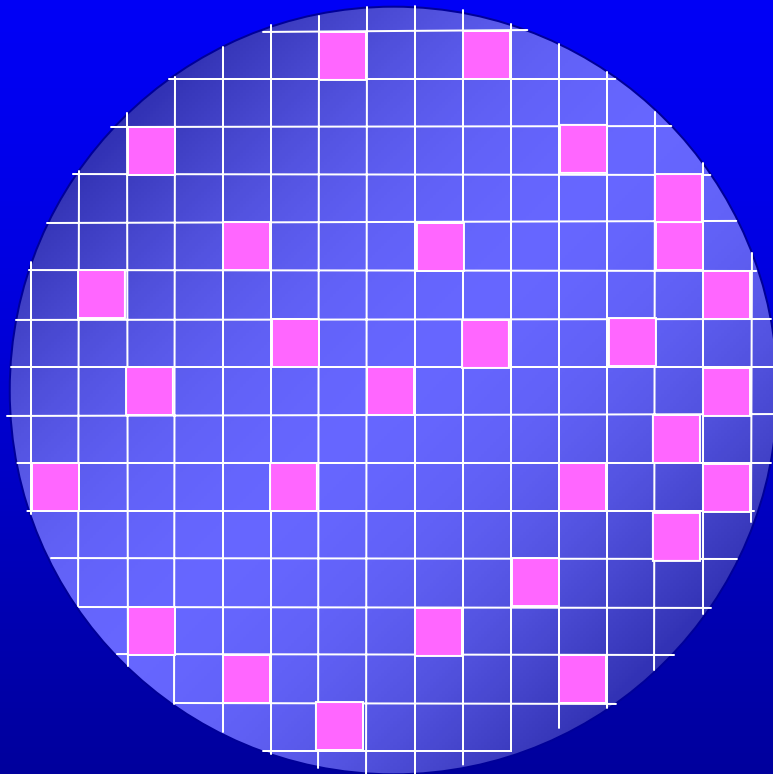
* PATENTS APPLIED FOR

FlexFrame Tray (Extended)



* PATENTS APPLIED FOR

Eliminate “Dead Soldiers” in Testing

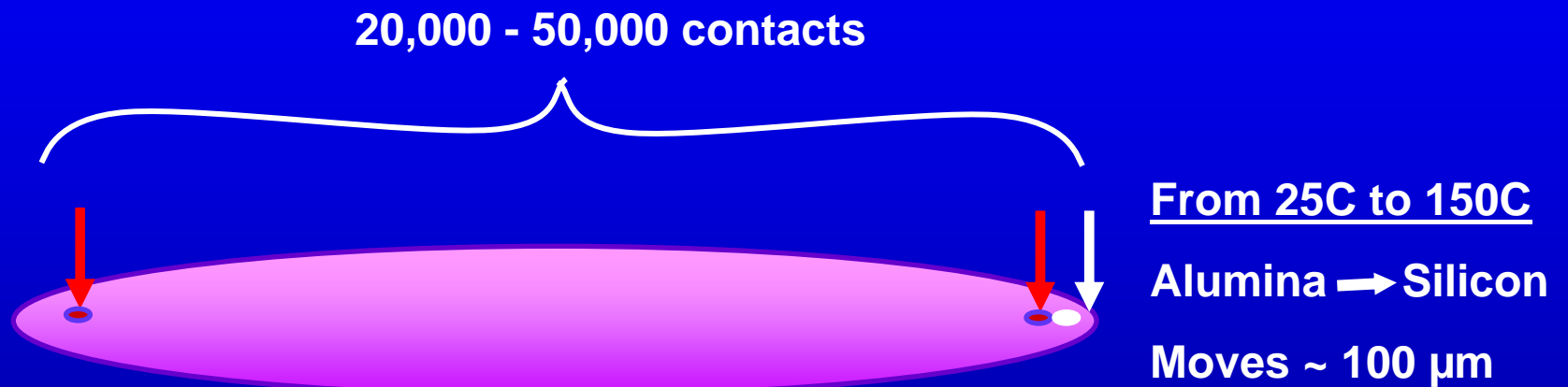


Test-in-Tray

- Test only good die
- Standardized handling
- Test and Burn-in on the same tray
- Cost !

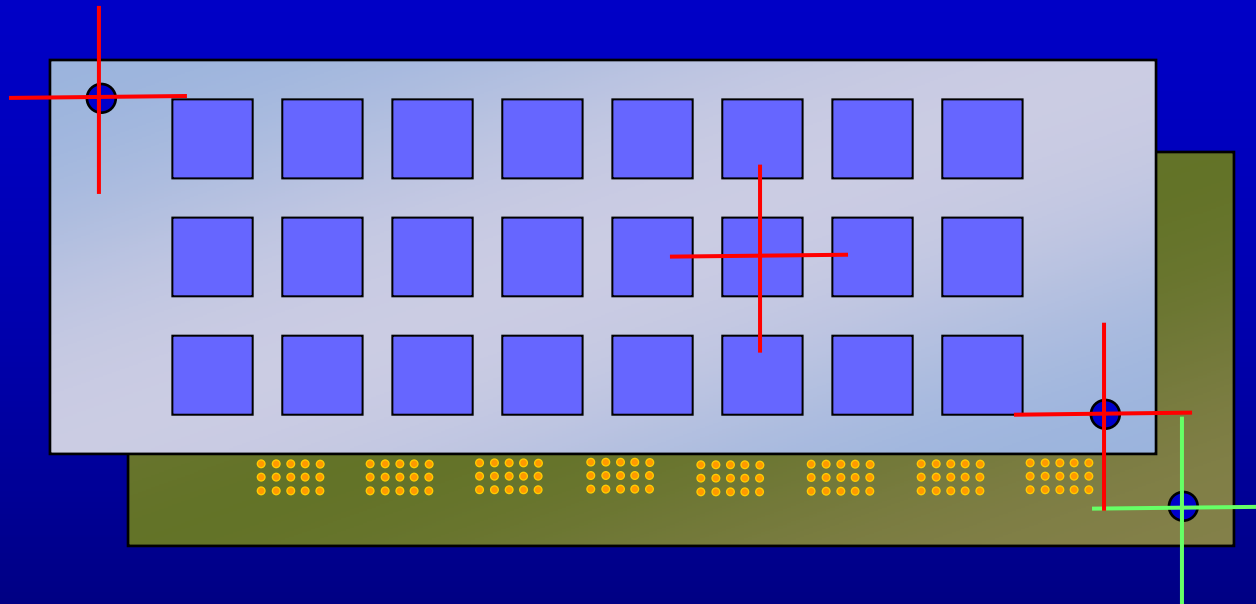
Full Wafer Burn-in ??

Technical Obstacles:



Cost: Must cost \ll \$50,000
Equivalent to burn-in sockets & boards.

TnT Provides Dimensional Integrity



Device Position is Set

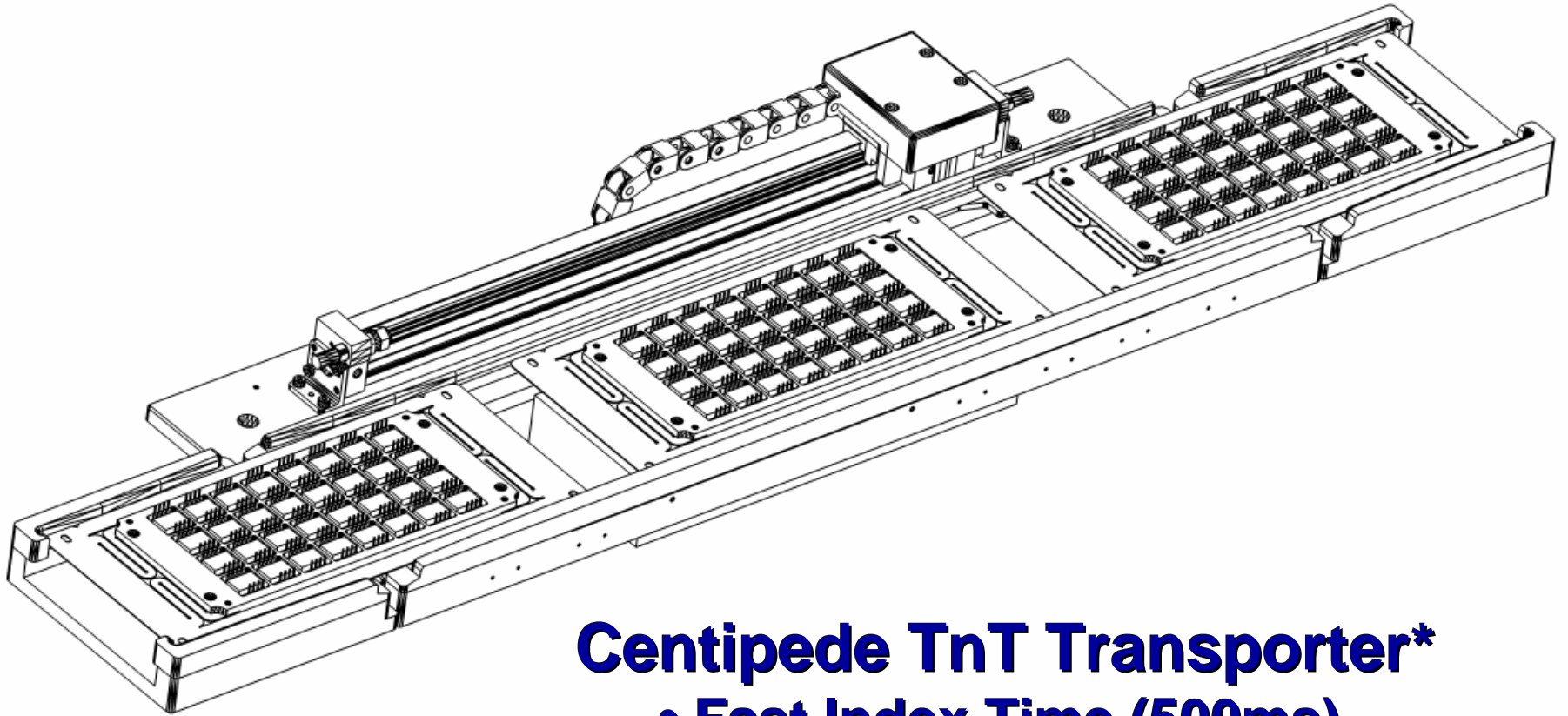
- CTE Matched to Socket
- DUTs On Standard Centers
- Accurate to +/- 5 μm for FlexFrame Carrier

TnT Processes

Automatic Handling Throughout the Back End

- Automated Burn-in, TDBI, Intelligent Stress Test, Run-in, ...
- Stress Test at Temperature
- Laser Trim
- Performance Test and Speed Binning
- Marking
- Post Test Processing
- Pack & Ship

- Potential for Lights Out Manufacturing



Centipede TnT Transporter*

- **Fast Index Time (500ms)**
- **Daisy Chain Capability**

*** PATENTS IN PROCESS**

Open TnT Architecture

Tray Contactors

- Contech Solutions
- RTI, Inc.
- ...

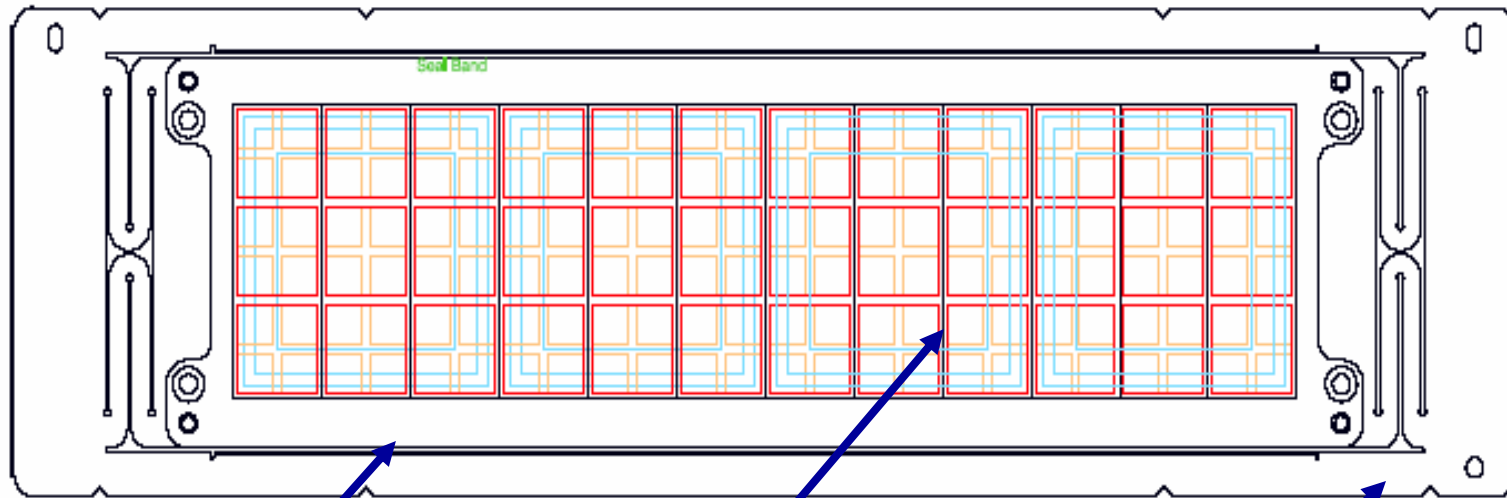
Automation

- SM Associates
- Martek Automation
- ...

This is Only the Beginning ...

FlexFrame Standards

(one of 4+ candidates)



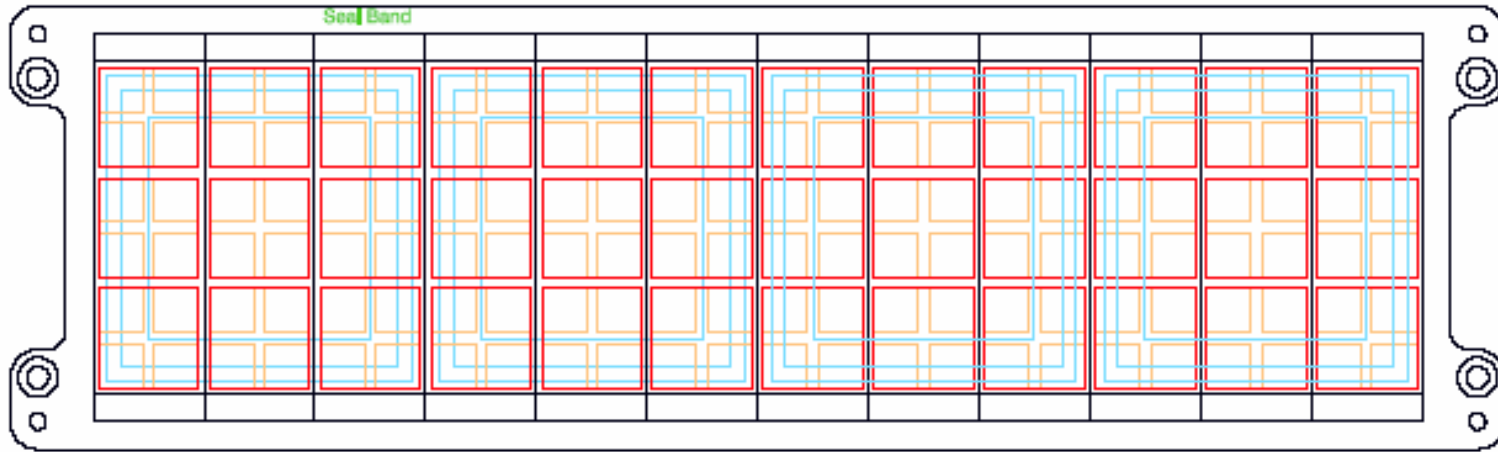
Tray Insert

DUT Arrangements

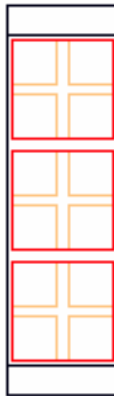
- 45, 50, 55 mm (x4)
- 18 mm (x36)
- 9x18mm (x72)
- 9 mm (x144)

FlexFrame™

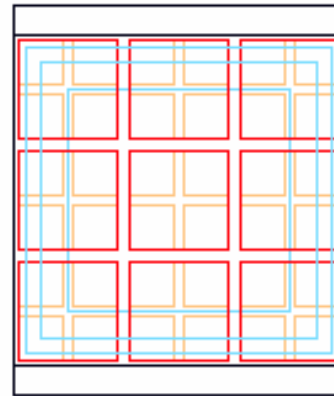
TnT Contactors (example layouts)

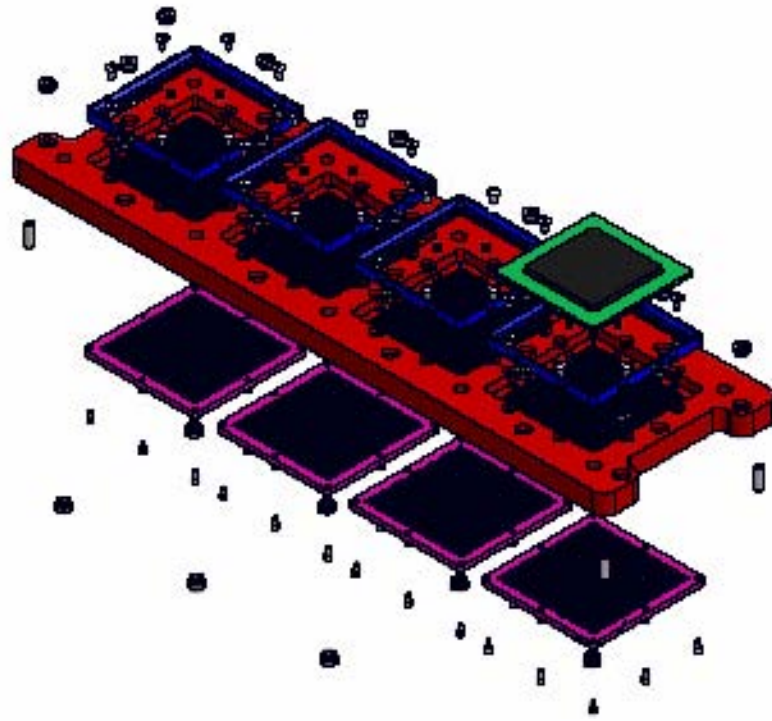


**20x60mm segment
(x12 replaceable segments)**



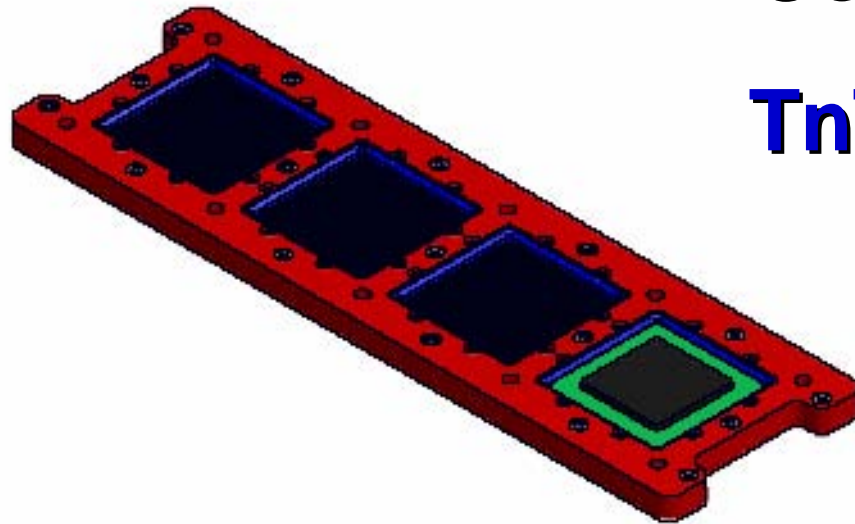
**60x60mm segment
(x4 replaceable segments)**

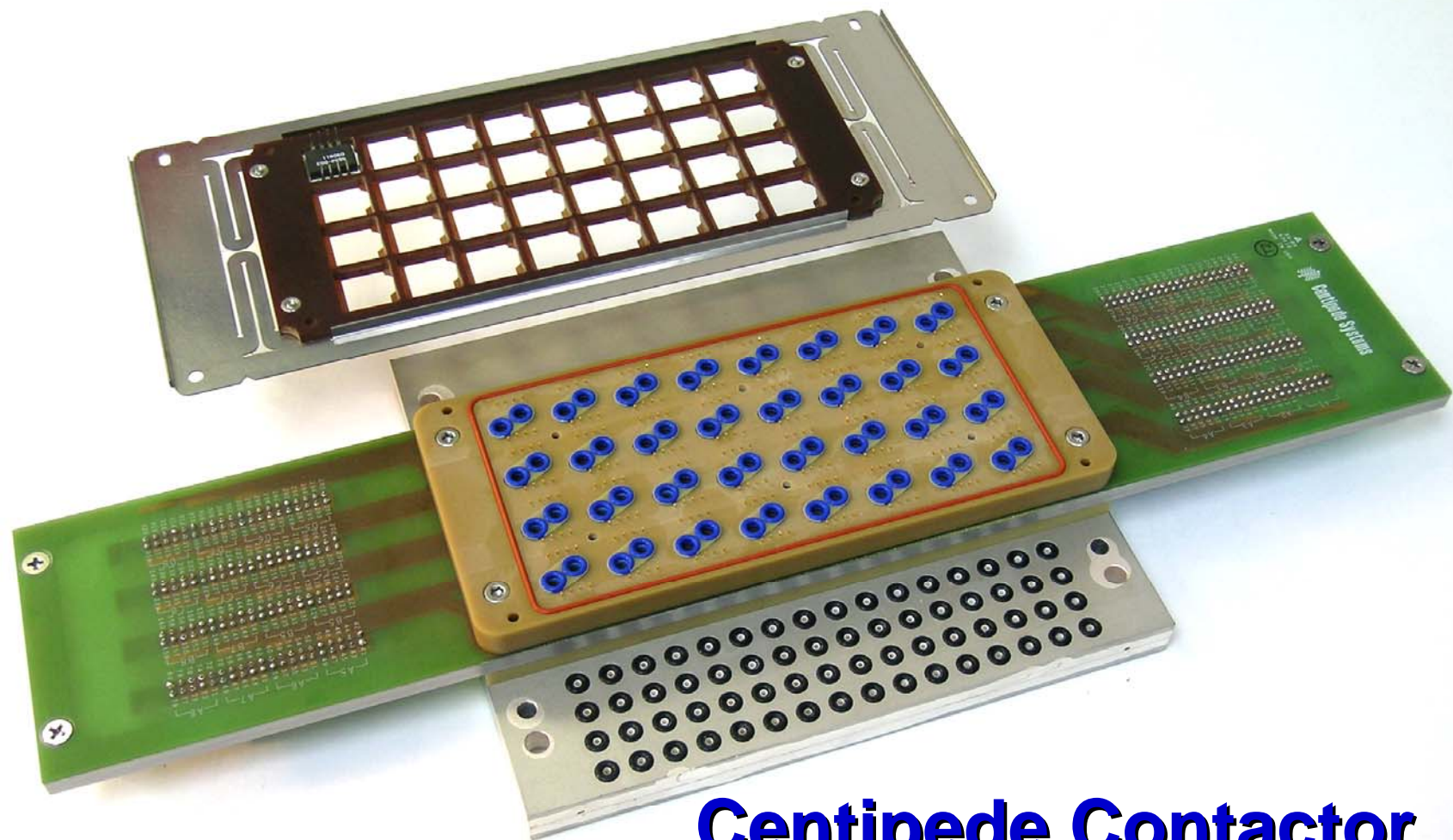




Contech Solutions

TnT Contactor





Centipede Contactor

- Independent Pressure Ports
- Full x32 Tray Contactor

TnT Device Types

FlexFrame Trays:

- BGA to 60mm x 60mm
- CSP, QFN, QFP, TSOP, ...
- MEMS

FlexFrame Carriers (May 2010):

- WLP
- TSV
- Flip-chip
- Stacked dice

FlexFrame Trays

Adaptable to all processes

- to 240°C (for high temp material trays)
- reuseable
- serialized (need standards!)

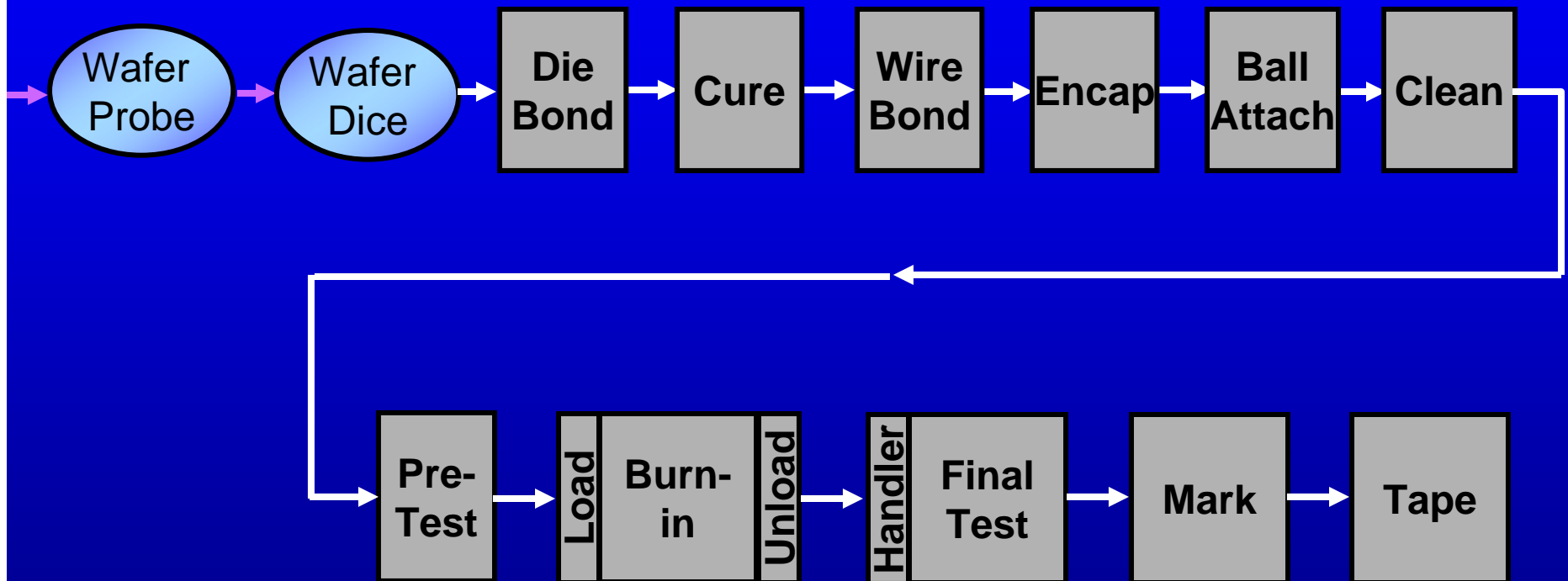
Custom CTE Systems

- 17 ppm/°C
- 10 ppm/°C
- low CTE

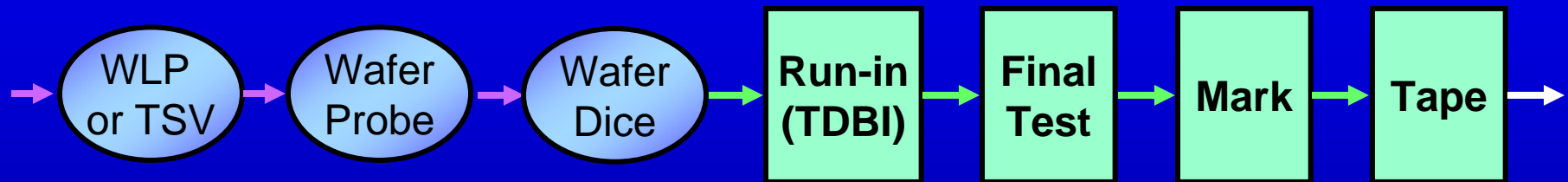
Centipede Offers Broad Availability

Traditional Back End

- Many different fixtures and “standards”
- *Ad Hoc* agglomeration of handling protocols

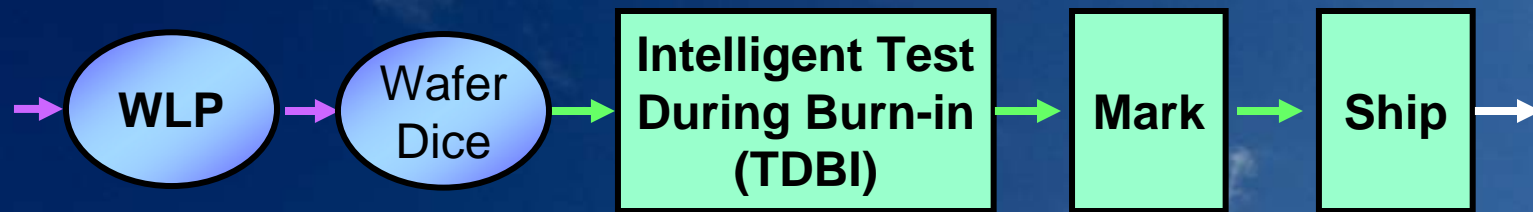


Integrated Back End



Lights Out Automation = FOUP Transport + TNT Transport

A Bit of “Blue Sky”



Centipede Role

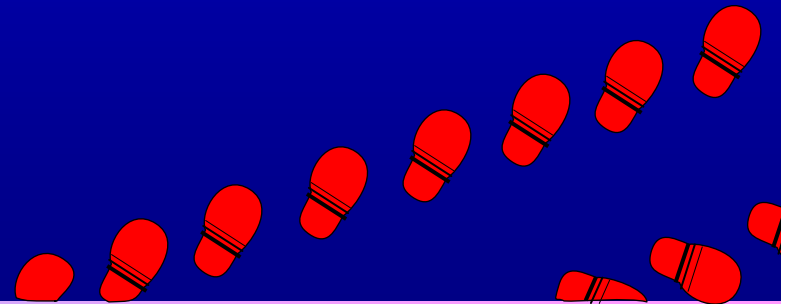
Provide Enabling Elements

- FlexFrames and FlexFrame Carriers
- Transporters
- ...

Facilitate Growth of the Infrastructure

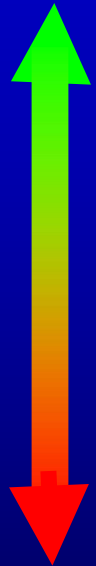
- Contactors
- Trays
- Automation
- Data Handling

Standards !



TnT Potential

TnT will revolutionize semiconductor test !



- Intelligent Manufacturing
- Standardized Automated Transport
- Forward and Backward Data Traceability
- Simplified, Standardized Fixtures
- Full Parallel Test

Or ... ???