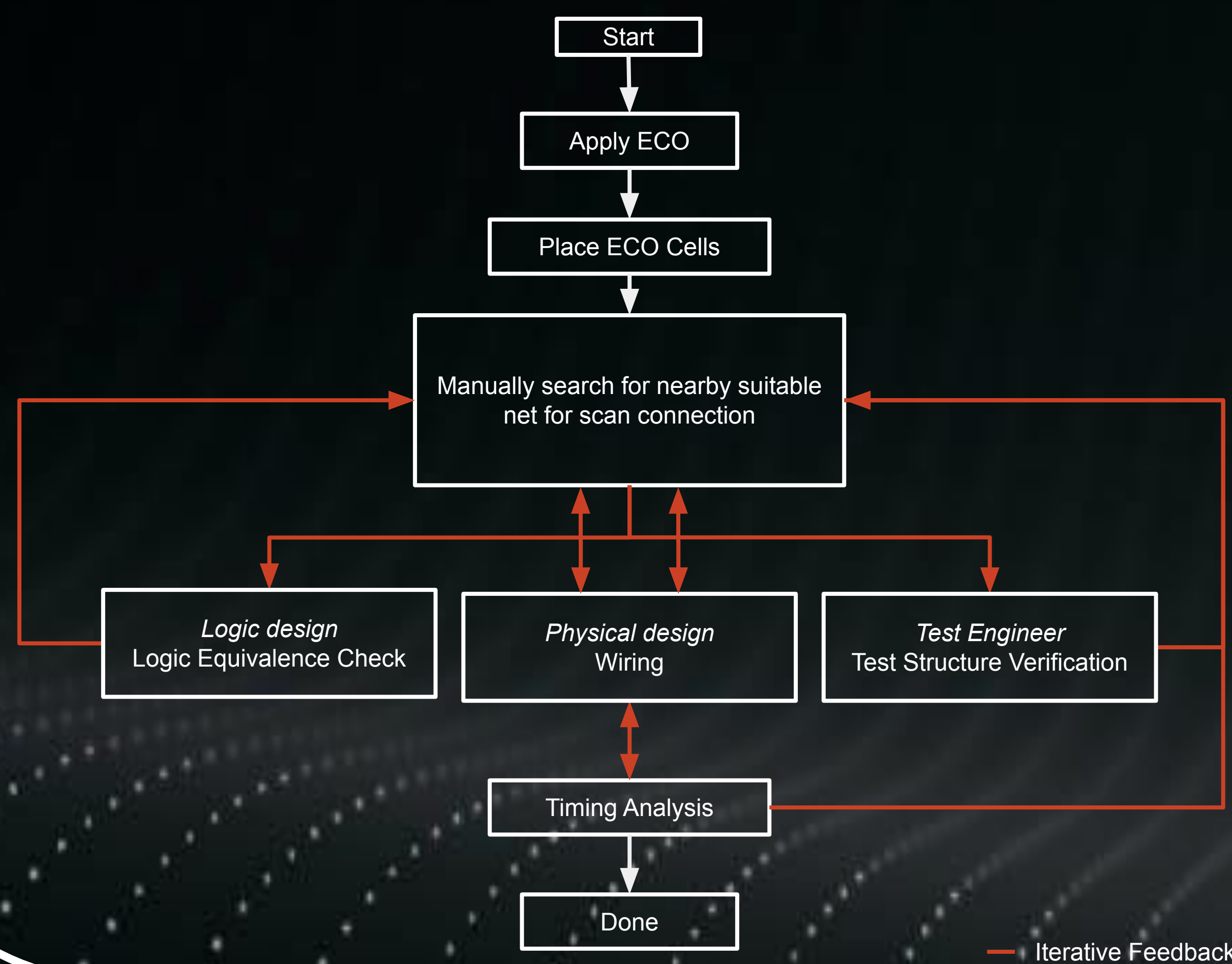


Congestion Aware Incremental Scan Connections for ECO Flip Flops

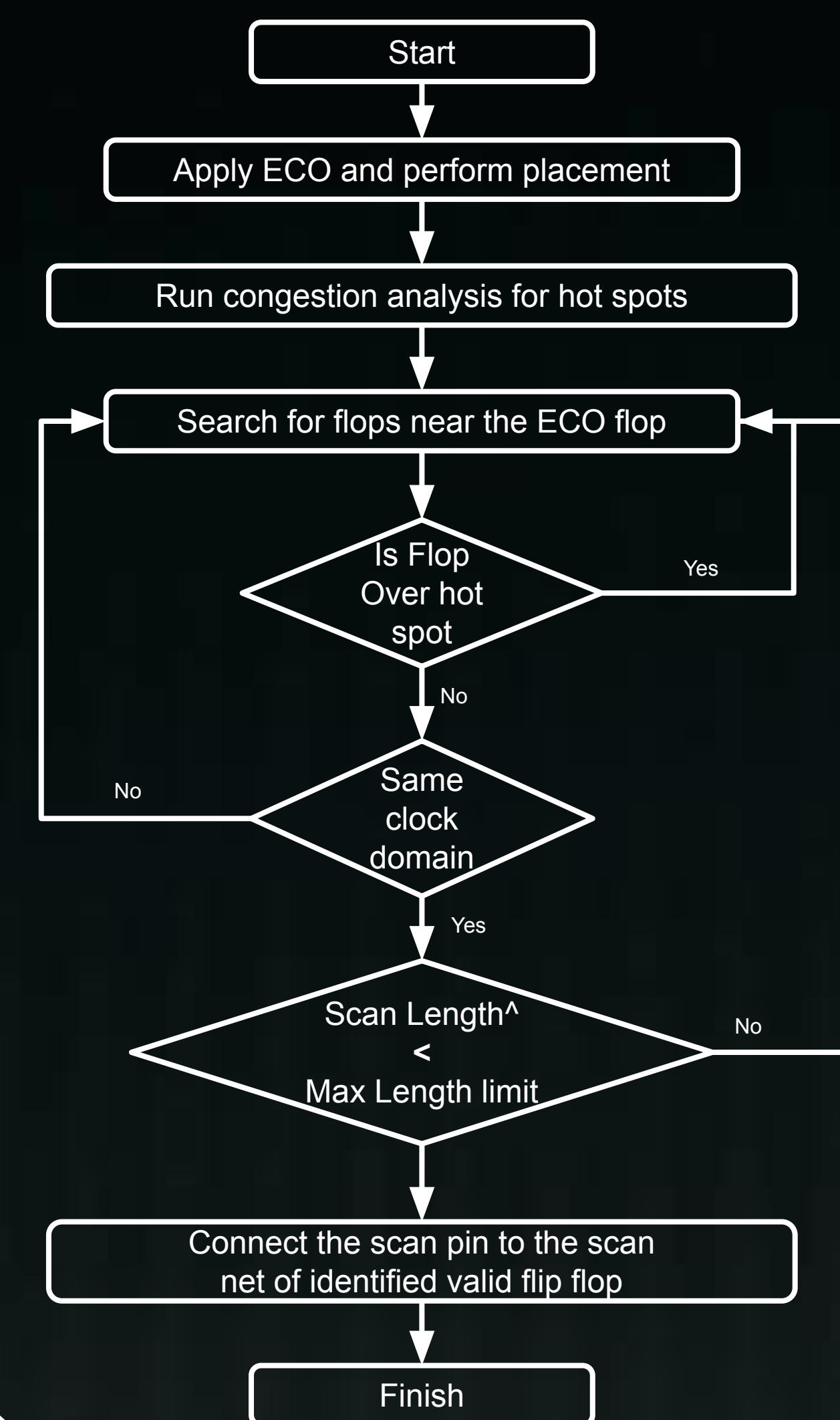
Alok Chandra (Avera Semi) Sandeep Prajapati (Avera Semi) Sai Vijay Ram (Laksh Semiconductors)

Motivation

- Typical method of implementing Engineering Change Orders (ECO's) containing flip-flops in multi-million gate designs
- Very iterative and expensive (in terms of time) in a placed/timing closed design.
- An arbitrary decision concerning scan connection can create issues including DRC errata, timing impacta, TSV fails, wiring congestion, etc.
- Tedious to implement if large numbers of flops get added.

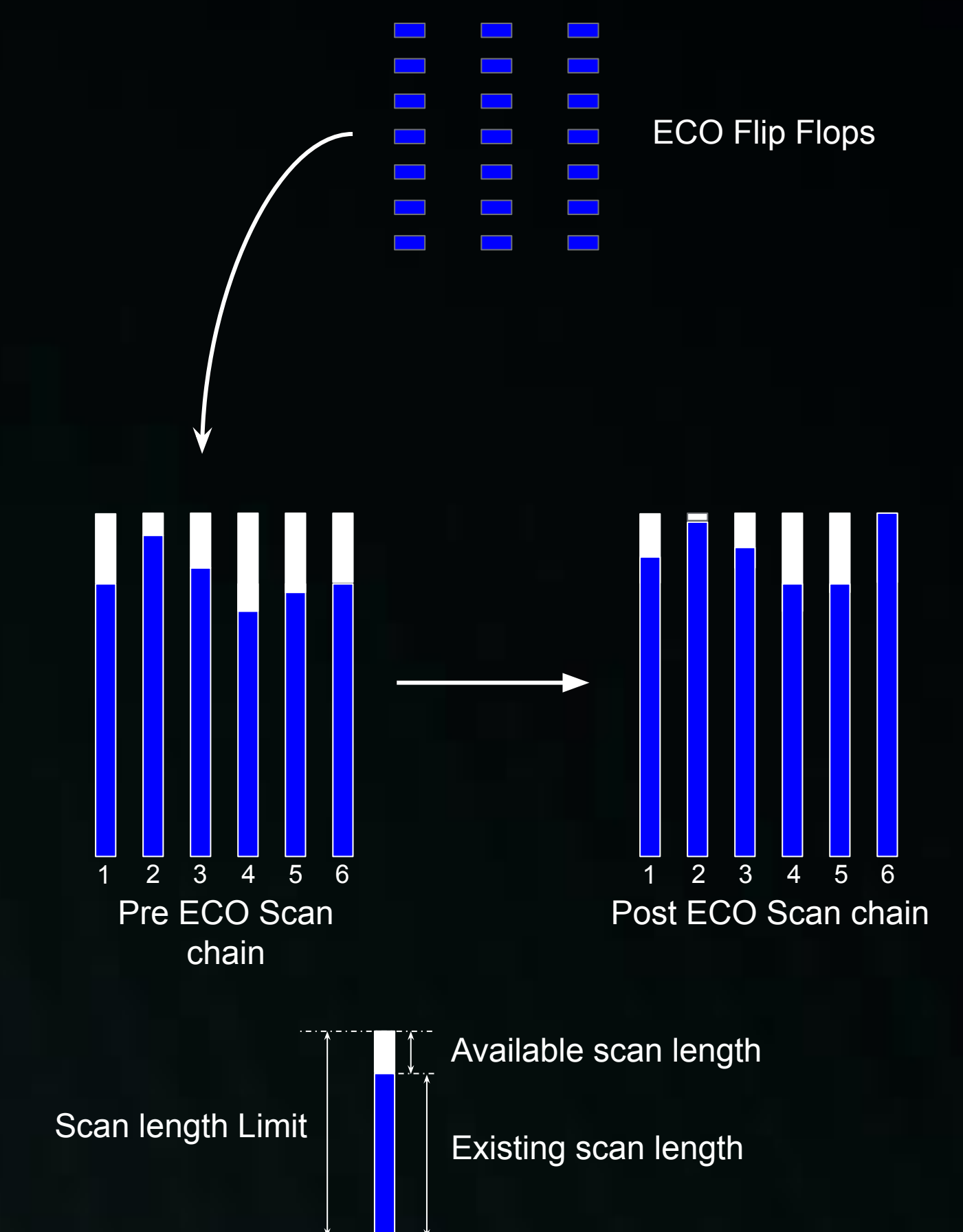


Algorithm

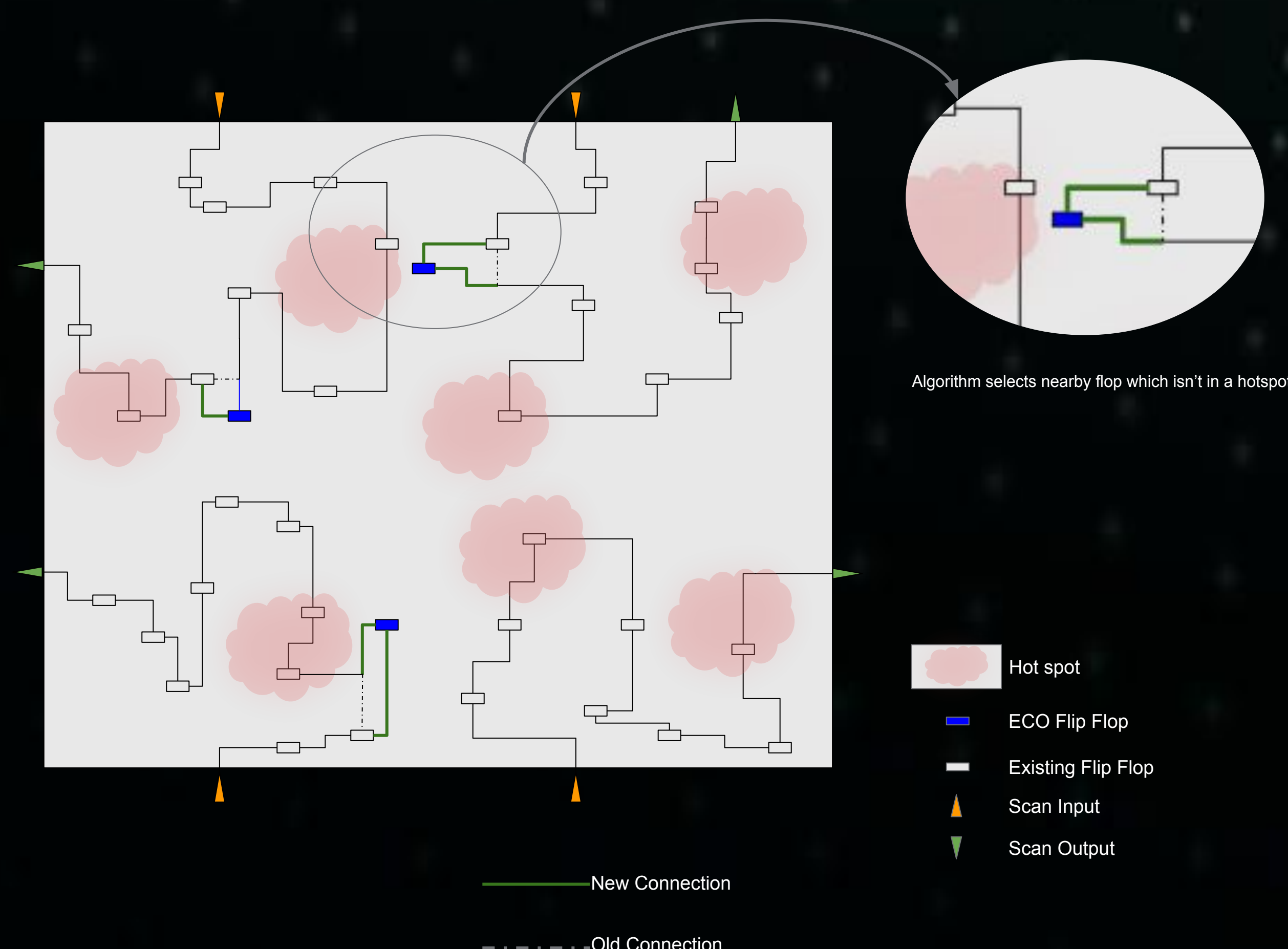


x -- initial search area range
y -- step size for increment
n -- number of loops
■ Newly added Flip Flop

[^]Scan Length here is inferred as the number of scan flops in a particular scan chain and not wire length



Automated scan connections for ECO Flip Flops



Use of area based hotspot to choose nearby valid scan chain

Evidence



Output of the script on command line

```
innovus 43> findSIConnection A_RXIDSER_A_RX_PRBS_CHK_PRBS_Q_REG_2

#### ECO Flop :
A_RXIDSER_A_RX_PRBS_CHK_PRBS_Q_REG_2
At loc == 137.48 76.32 138.208 76.8
Flops in hotspot area :
A_RXIDSER_A_RX_PRBS_CHK_PRBS_Q_REG_5
A_RXIDSER_A_RX_PRBS_CHK_PRBS_Q_REG_6
Flops in another clock domain :
# nearest Same Clock domain Flop : A_RXIDSER_A_RX_PRBS_CHK_PRBS_Q_REG_3
# At offset of : 1.0 and box {137.2 77.28 137.928 77.76}

# Following commands can be used to make the new scan connections
attachterm A_RXIDSER_A_RX_PRBS_CHK_PRBS_Q_REG_4 SI n_17233
attachterm A_RXIDSER_A_RX_PRBS_CHK_PRBS_Q_REG_4 SE PRECTS_FE_OFN4114_n

Took 468 milliseconds to complete
innovus 44>
```

- Provides a fast, efficient and easy method to assign scan connections which are TSV/DRC compliant and Timing/Wiring friendly.

Future expansion/enhancements

- Enhance to support Multi Bit Flip Flops
- Alternative method of performing scan-reordering with hotspot avoidance
- Scan chain balancing at physical design level
- Incremental hot-spot calculation post flop addition

Summary

- The method was tested intensively for development of High Speed SerDes IP/Chip.
- Automated Incremental Scan Chain connections for ECO Flip Flops provides the following benefits
 - Turn Around Time reduced over multi folds.
 - Minimizes handoffs from Test and Logic teams in implementation
 - Hot spot aware
 - Minimizes disturbances in existing design caused by coupling/congestion/DRC etc.
 - TSV compliant for Max Scan Chain Length