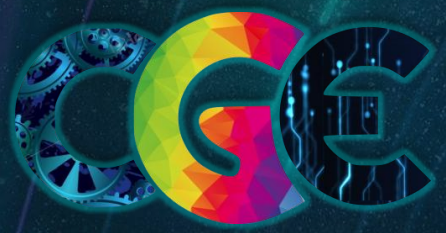
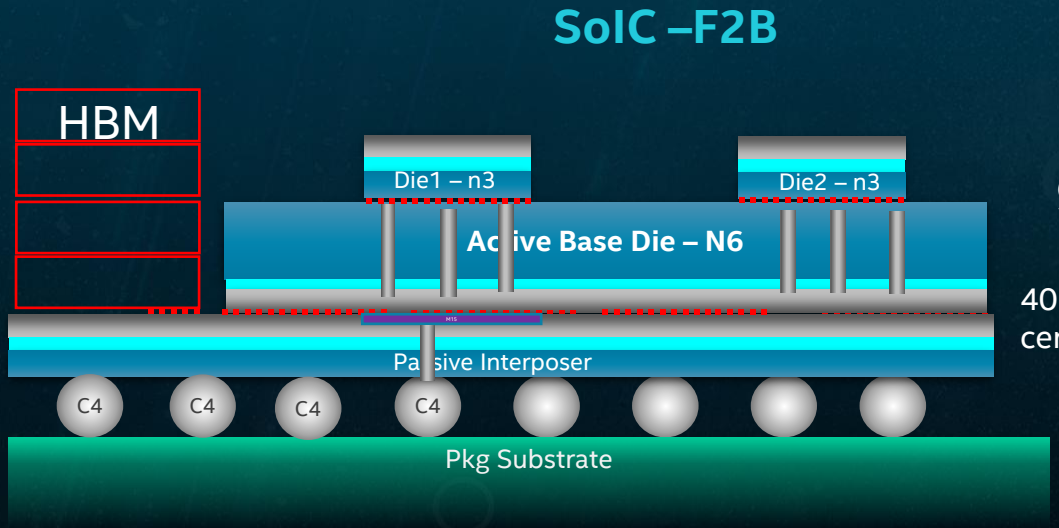


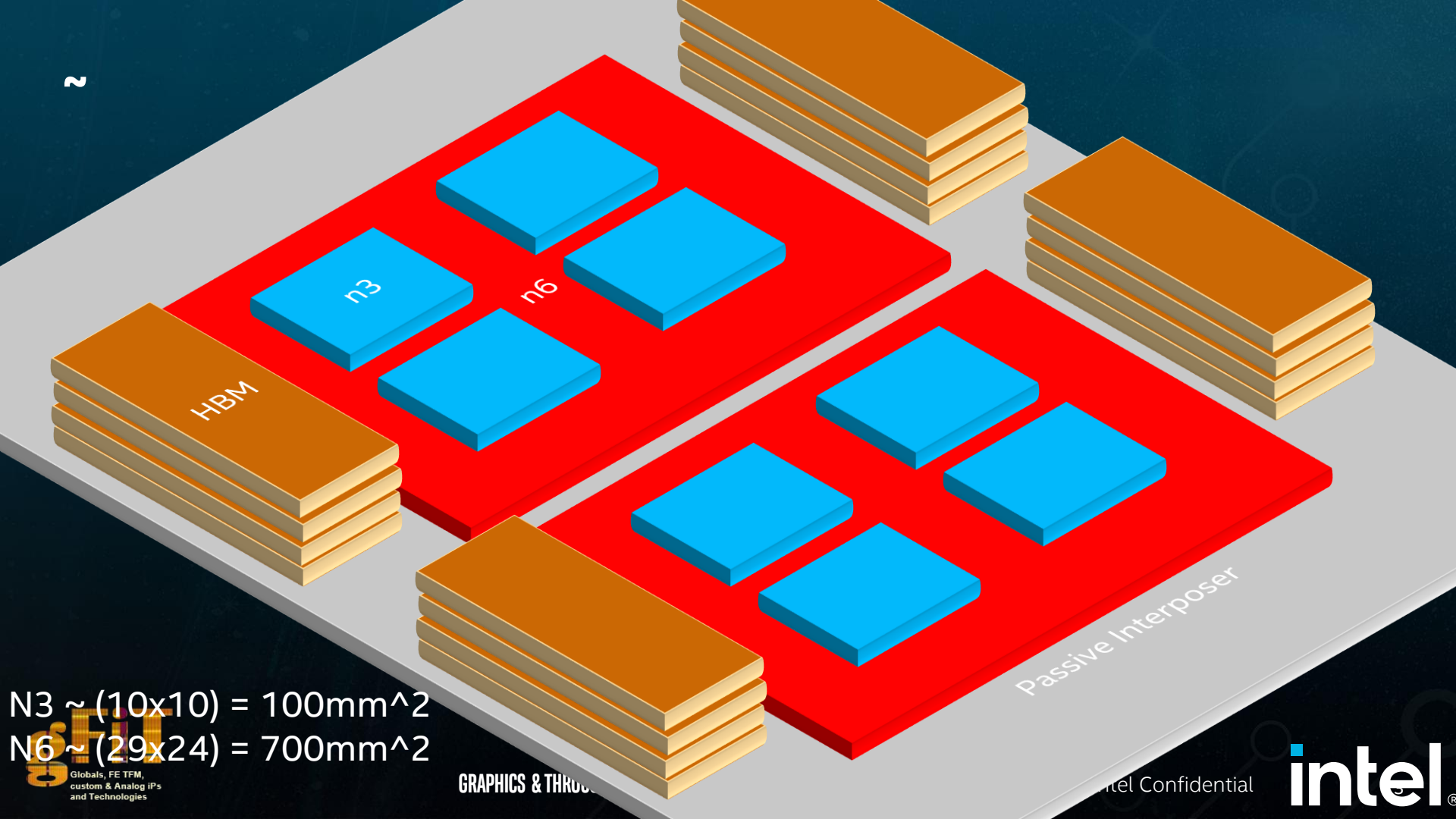
CLIENT GRAPHICS ENGINEERING

TSMC/INTEL SOIC BRAINSTORM

Satish D., Scott S

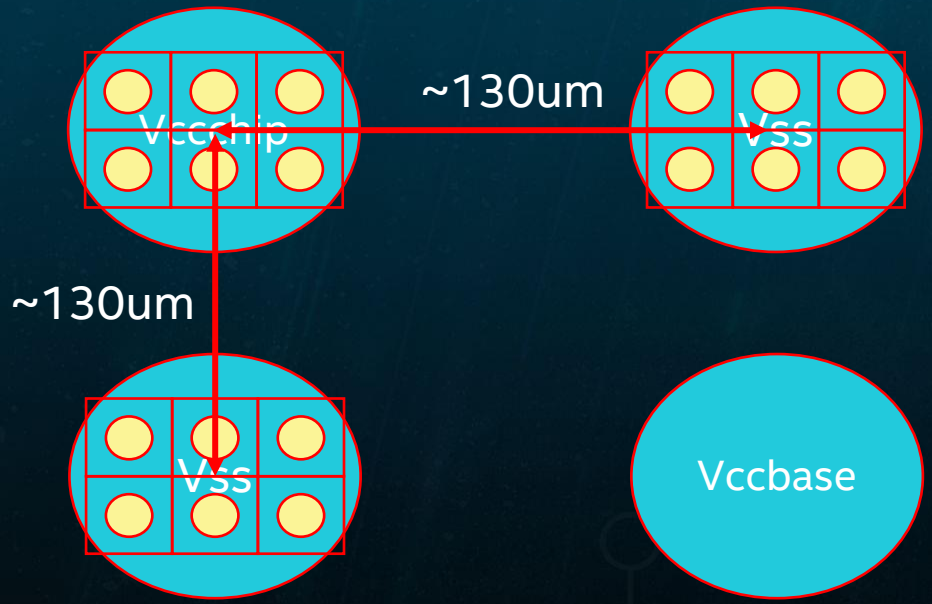
PROPOSAL CARTOON





N3 ~ (10x10) = 100mm^2
N6 ~ (29x24) = 700mm^2

POTENTIAL POWER CONNECTION USING F2B

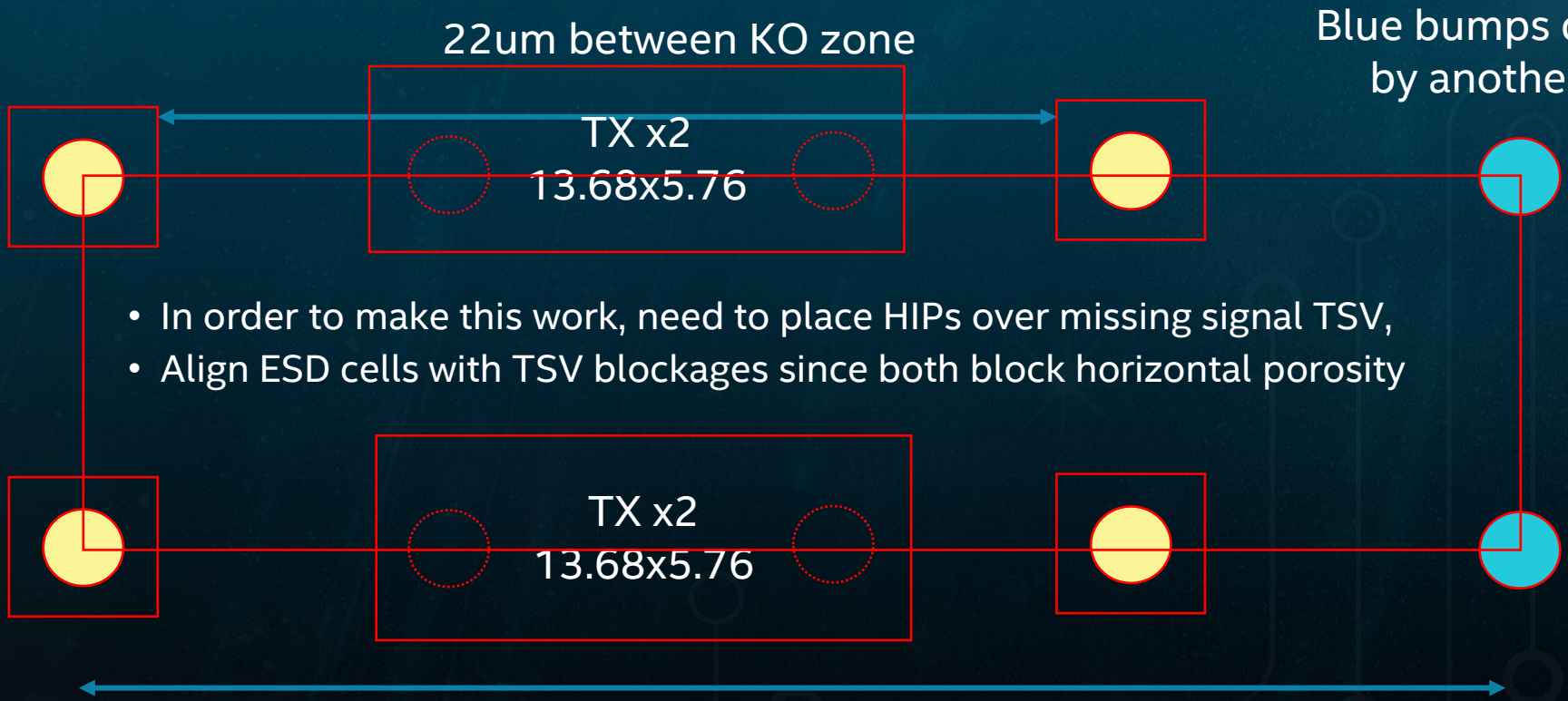


- Put power TSV farm over C4 bump @ 130x130um pitches. No TSVs needed over Vccbase C4s

MEETING THE DENSITY METRIC

- Proposed power TSV – Align a group to the C4 bump to punch through to the top die.
  - Propose a 3x2 array of TSV over top die power C4 bump plus miscellaneous power going to the top die.
  - For a 100mm die(10x10) with 130um pitch C4, 77x77 C4 bump grid
    - 5929 C4's
      - 3000 VSS
      - 750 base Vcc(no TSVs required), 2250 Top die Vcc+misc powers
      - 5250 TSV groups * 6 TSV/C4 = 31,500 TSVs
      - 215k signal TSVs
      - ~2*4=46.5k * 4um^2/TSV = 986k um^2 or 0.986mm^2
      - Estimate about 1% total TSV density across the die for PDN only.
      - Allows up to 1% additional opportunistic TSV placement for improved PDN in areas with no signal, and 1% additional for signal in area of signal.

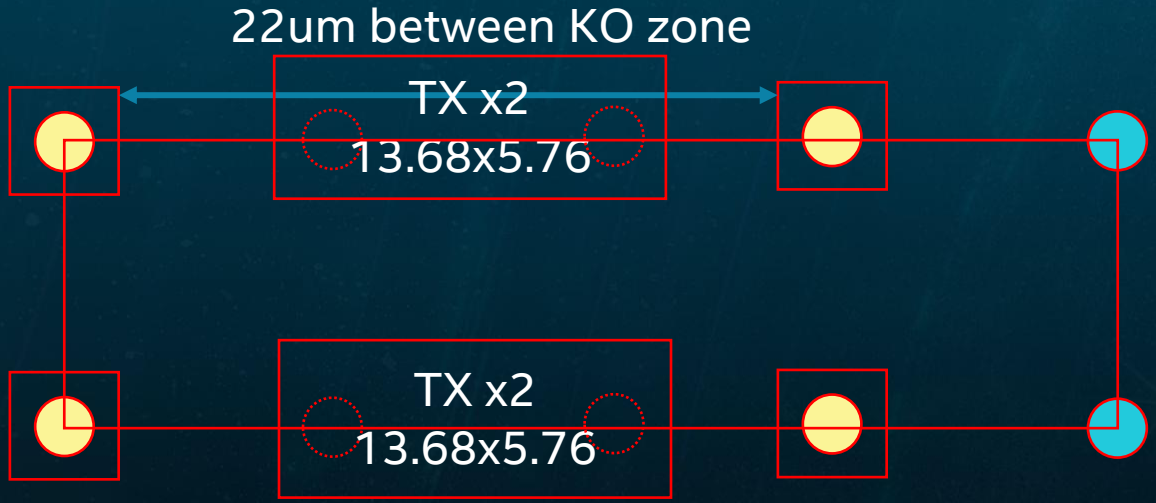
POTENTIAL HIP CONNECTION USING F2B



- In order to make this work, need to place HIPs over missing signal TSV,
- Align ESD cells with TSV blockages since both block horizontal porosity

36um between Hybrid Bond buffers (50% depopulation in X, none in Y)

POTENTIAL HIP CONNECTION USING F2B



- 36um * 9um section. == 324 um^2. 2 full TSV's * 3.14um^2 = 6.28um^2
- 6.28/324 = ~1.94% - Just under max density of 2% -
  - And we had ~1% for power – TSV density looks to limit area for Hybrid Bond pads
  - 45um = 1.55%
  - Let's discuss this (window size=112/112 – need to plan with power TSV's as well to get combined picture)

IMAX CALCULATION

- 50mA/TSV ~T=105C
- 50mA * 2250 C4 for Vcctop * 6 tsvs/C4 = 675A Imax.
- No issue with Imax ☺

OTHER TOPICS

- Thermal Coefficients to do thermal analysis.

- How many die can we stack in this way?
  - If base die contained memory, can we stack multiple base dies with a signal top die to increase memory capacity.

SUMMARY

- Power delivery –TSV density well within the bounds for density and easily meets Imax limits
  - But 112um by 112um window may mean some windows have no TSV's (foils mention no minimum so assume this is OK)
- Signal density seems to be an issue
  - At current n5 sizes for the HIP, TSV density will limit how tightly we can pack Hybrid Bond buffers
  - We exceeded 2% with signals only
  - How much of the 1% power overhead needs to be factored into the signal limit – requires further study of a full D2D Hybrid Bond pad plan including power Hybrid Bond pads.

BACKUP

PROPOSAL CARTOON

F2B – Base die – which implementation?