The Future of Deep Submicron IC Design for HEP
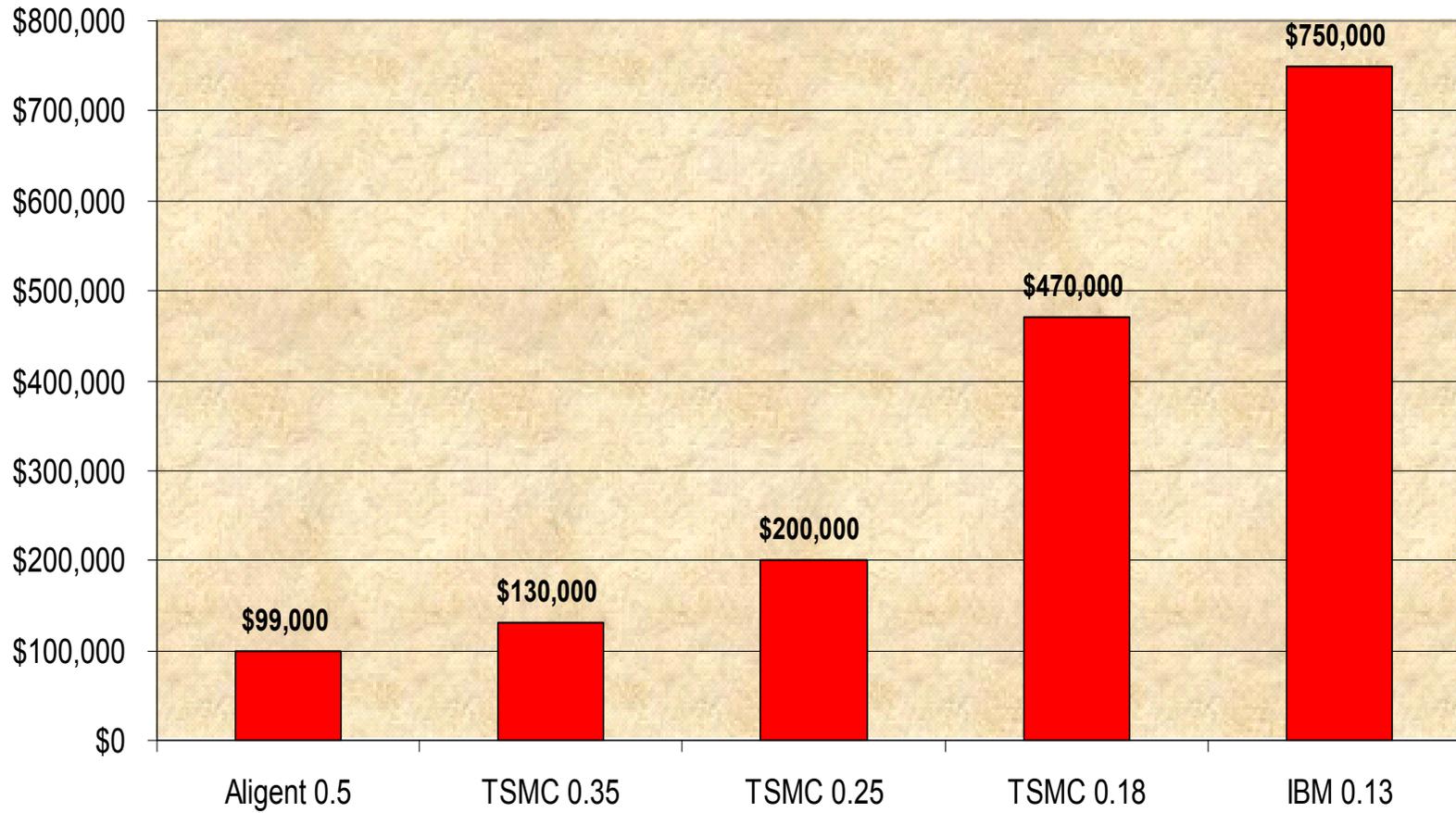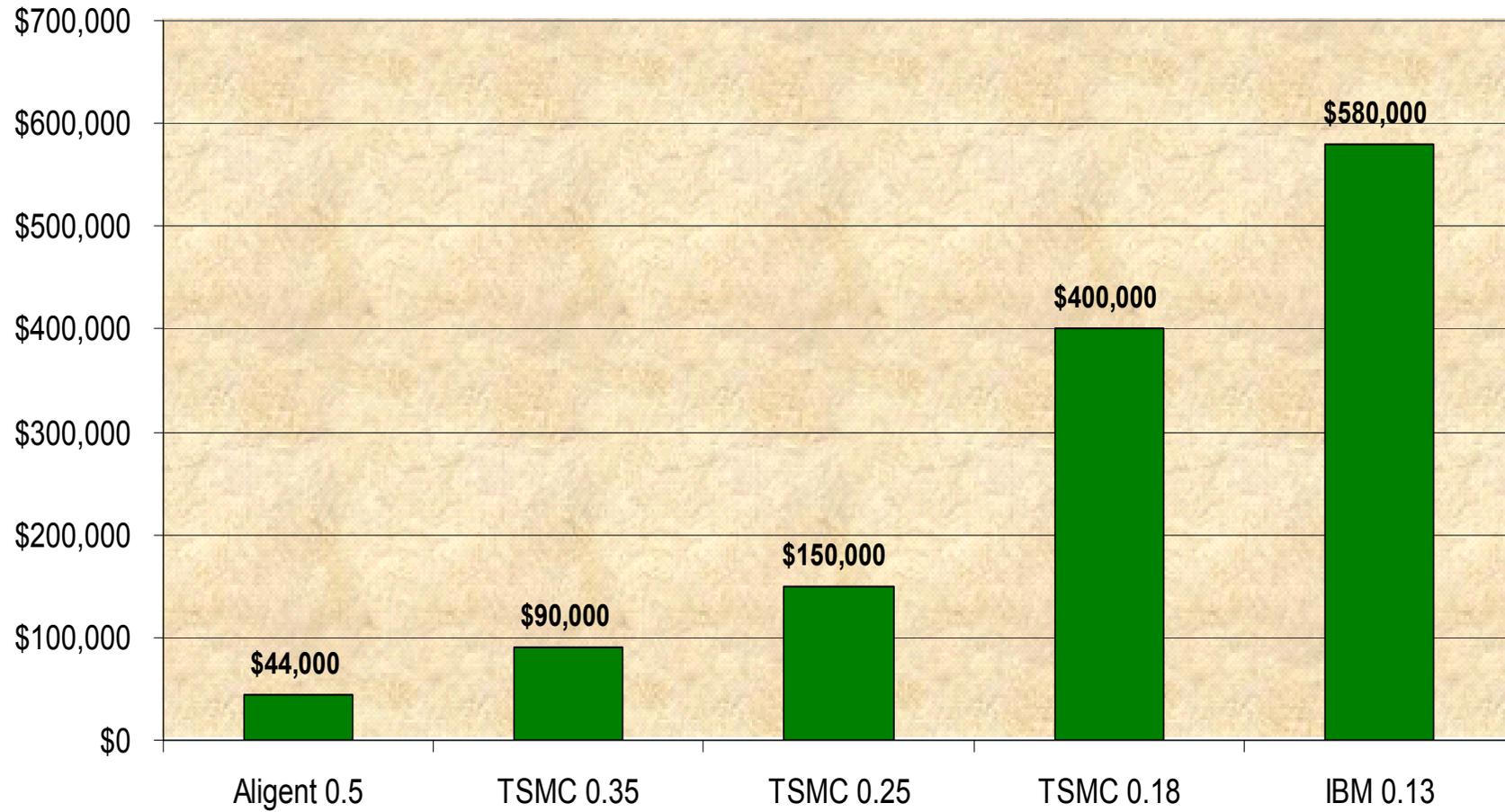
Ray Yarema

Fermilab

Future DSM costs

- Compare fabrication costs from one source (MOSIS)
  - Engineering runs
  - Masks
  - Silicon area
- Fabrication cost could be lower (30%??) if special arrangements are made.
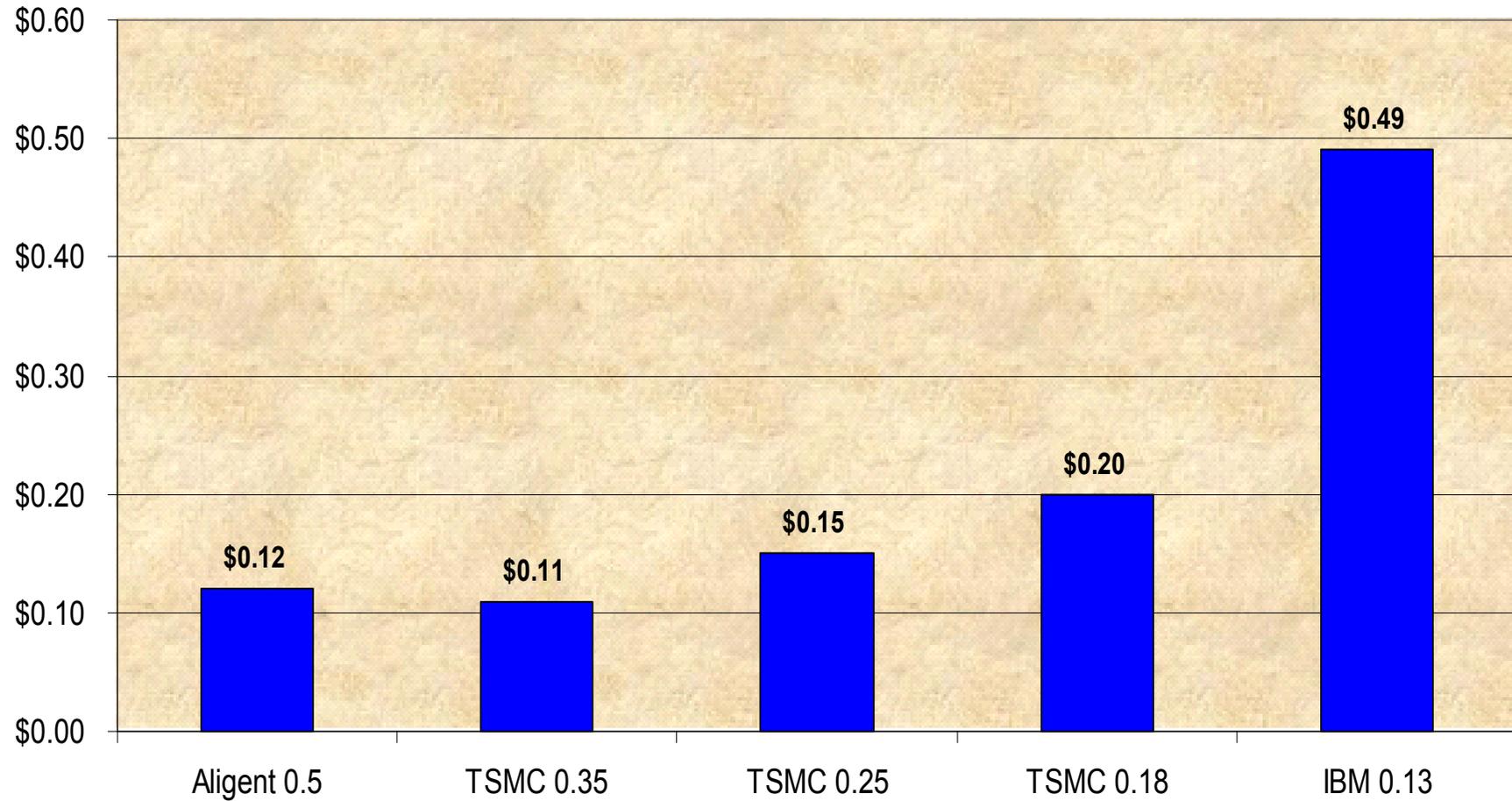- Other engineering costs may still be dominant factor

MOSIS Engineering Run Cost

Mask Costs for Engineering Runs at MOSIS

Engineering Run Wafer Cost/mm2

Future Projects

- Future projects will not be on a scale as large as LHC
  - Next Linear Collider
  - LHC upgrades
  - Astrophysics projects
  - Phenix, BTEV, Off-axis neutrinos, etc.
- Makes private MPW runs more difficult for cost and schedule purposes

Must make some hard decisions

- May be difficult to find frequent, low cost prototyping option. Look at a new way of doing business.

- More than ever

  – it is important to share design information.

  – to save money

Foundry Direct

- **Advantages**
  - **Direct access to foundry personnel**
  - **Perhaps lower cost??**
- **Disadvantages**
  - **Foundry may be less interested than before due to low volume and extended schedule**
  - **Less frequent MPW runs**
  - **Potentially higher cost due to fewer customers if more more frequent runs are desired**
  - **Must negotiate involved contracts for export etc.**
  - **Must use in house personnel to frame projects**
  - **Must do all acceptance characterization in house.**

Commercial Broker

- Advantage
  - Frequent runs
  - Sets up export agreements
  - Characterizes wafers

- Disadvantages
  - Possible higher cost?
  - Direct access to foundry personnel may be less likely?

Compromise Proposal

- Use Regular commercial broker for MPW runs– show MOSIS schedule
- Combine small projects to save on minimum chip area requirement
  - 10 mm2 can accommodate several test circuits – 4 x density of 0.25 and if transistor are not enclosed even more
  - Cost sharing example
  - Receive 40 chips
- Combine projects requiring larger quantities onto common engineering runs to save on large cost driver – the mask cost.

Choice of Process

- Adopt one process to be used in HEP
- Choose one commerical broker– e.g. MOSIS used
- Share design information to reduce engineering effort and time
  - Share libraries,
  - SEU tolerant cells
  - Share radiation testing results
- Need to adopt some standards for common runs
  - Use 6 or 8 levels of metal

Proposal

- Choose MOSIS as the broker
- Choose IBM as the foundry

Summary

- Use commercial broker for MPW runs
- Share 10 mm2 minimum space to save money on small projects
- Plan engineering runs to share mask costs for larger quantities of parts.
- Standardize on 6 or 8 levels of metal
- Standardize on foundry (IBM?)