



# **Main Linac EDR Planning: Cavity Fabrication Discussion**

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# Outline

- **Outstanding technical questions**
  - Gradient
  - Cell Shape
  - Materials
  - Processes
- **R&D Priorities**



# Outstanding Technical Issues - 1

- **Gradient**

- Must regard 35 MV/m in vertical test as fixed for EDR
- Remaining issues must be dealt with to maximize probability of achieving acceptable yield at 35 MV/m

- **My recommendation:**

**take this issue off the table – now**

- **Our primary focus must be to reduce technical risk of achieving 35 MV/m – make changes to increase yield, not gradient**
- **Clearly, increased yield now, can support increased gradient later – first thing first**



# Outstanding Technical Issues - 2

- **Cell Shape**

- **Select to provide additional assurance of achieving 35 MV/m goal!**
- 'TESLA' shape only one to have yielded limiting gradient (~42 MV/m) in 9-cell cavity, but provides only modest margin over target
- 'Low-Loss' shapes → cleaning issues, but raise limiting gradient by >10% (increase in margin over target >60%), if field emission eliminated
- 're-entrant' shapes → very serious processing and cleaning issues; limiting gradient increases of >40% (increase in margin over target >100%) but require substantial process R&D.
- Limited time & resources mean we must choose among our options and argue strongly for TESLA shape, but resulting project technical risk is high.

- **My recommendation: LOW LOSS**

**This decision should be official by October 1, 2007**

**Decision on which low loss shape by January 1, 2008**



# Outstanding Technical Issues - 3

- **Materials**

- Standard polycrystalline: supplied material variability still not under control; performance variability, even w/o FE, very poorly understood
- Large grain: qualitative improvement in material uniformity; significant difficulties in fabrication
- Single crystal: ideal, but needs manufacturing development to become available with required dimensions

- **My recommendation:**

## **Large grain material**

- **Advantages:** Uniformity, Lower  $R_{res}$ , Phonon peak
- **Disadvantage:** Poor behavior during deep drawing
- **This decision should be taken now, to influence next year's R&D funding plans**



# Outstanding Technical Issues - 4

- **Processes**

- Welding: chamber pressure determines RRR degradation (Singer: SRF Materials Workshop, FNAL, May 2007). Project should determine allowable degradation and let industry select single- or multi-chamber welders based on economics.
  - **Resolve by Jan 1, 2008**
- Forming: deep drawing – traditional, works well with polycrystalline and single crystal, but not with large-grain material; hydroforming offers better reproducibility and may be more favorable for large-grain
  - **R&D for coming years should be restricted to these two**
- Eddy-Current Scanning: slow, insensitive, needs to be combined with micro-analysis, but best QA tool we have.
  - **Might benefit from R&D, can we push this off on Nb vendors?**