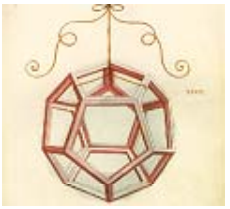
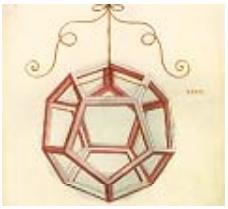


Accelerating structures: goals and requirements

M.Taborelli, TS-MME



What is required for the machine:

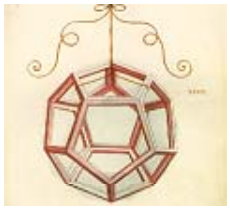
Best efficiency and cost for given luminosity and energy

Constraints:

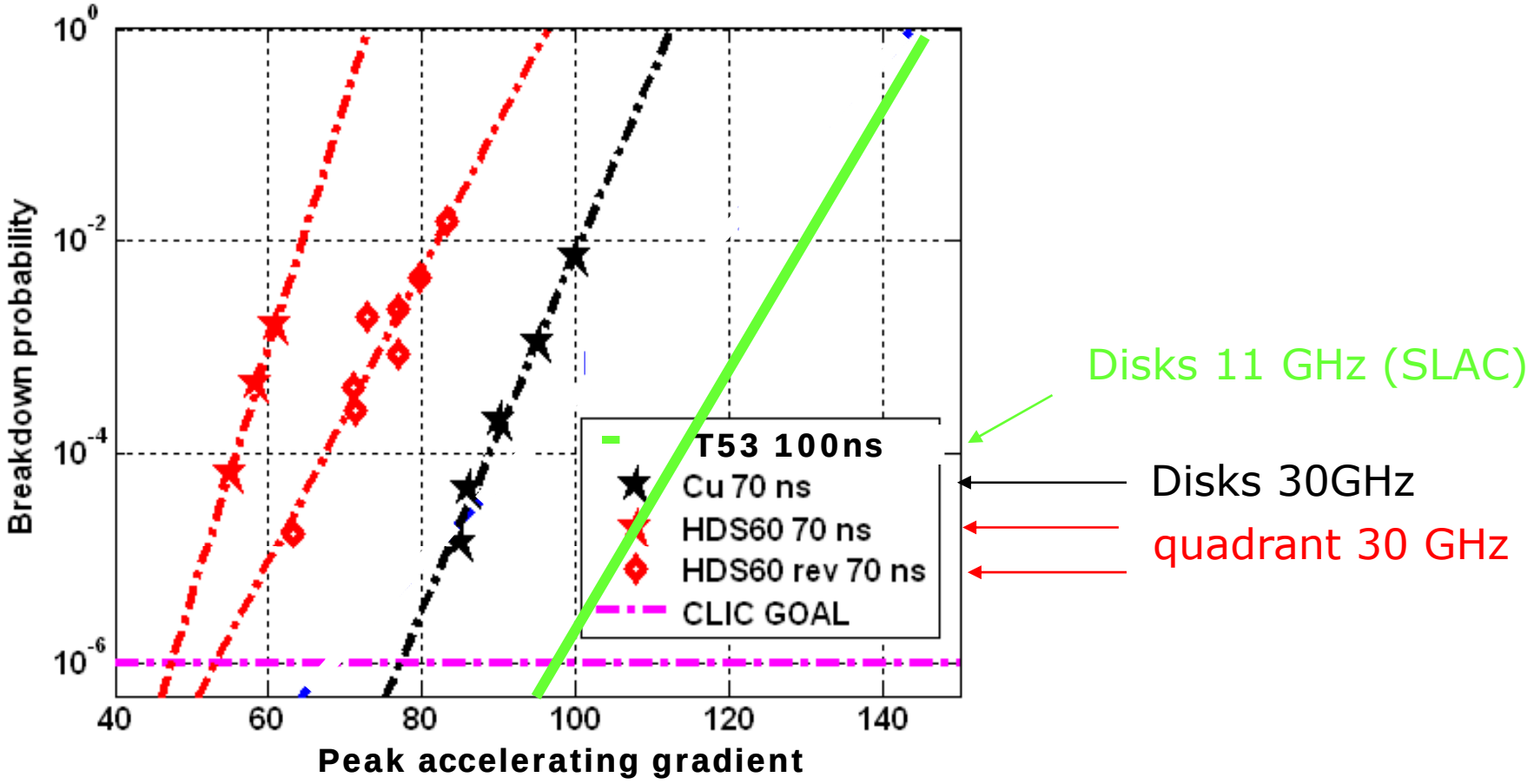
- breakdown rate (BDR), scaling as a function of (P, τ, C): 10^{-6} BDR is a practical BDR (loss of 10% luminosity with 10^5 structures)
- pulsed surface heating: limit ΔTmax (fatigue) to withstand about 10^{11} cycles
- beam dynamics (keep low beam emittance, reduce wake fields…)

Other reasonable conditions:

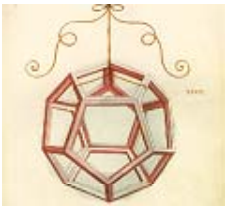
- an achievable gradient close to optimum to be proved by 2010: 100MV/m (for appropriate pulse length)
- achievable accuracy and shape for the structure that must be manufactured



Is 100MV/M, 10^{-6} BDR achievable with OFE-copper? Yes



(Adapted from S.Doebert)



Still something remains to be demonstrated:

Efficient damping of perturbing RF modes should be implemented (the T53 structure does not have)

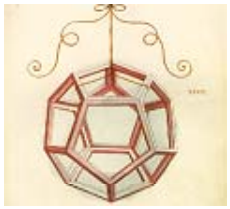
Manufacturing technology

100MV/m : it is likely that conditioning at slightly higher field is needed

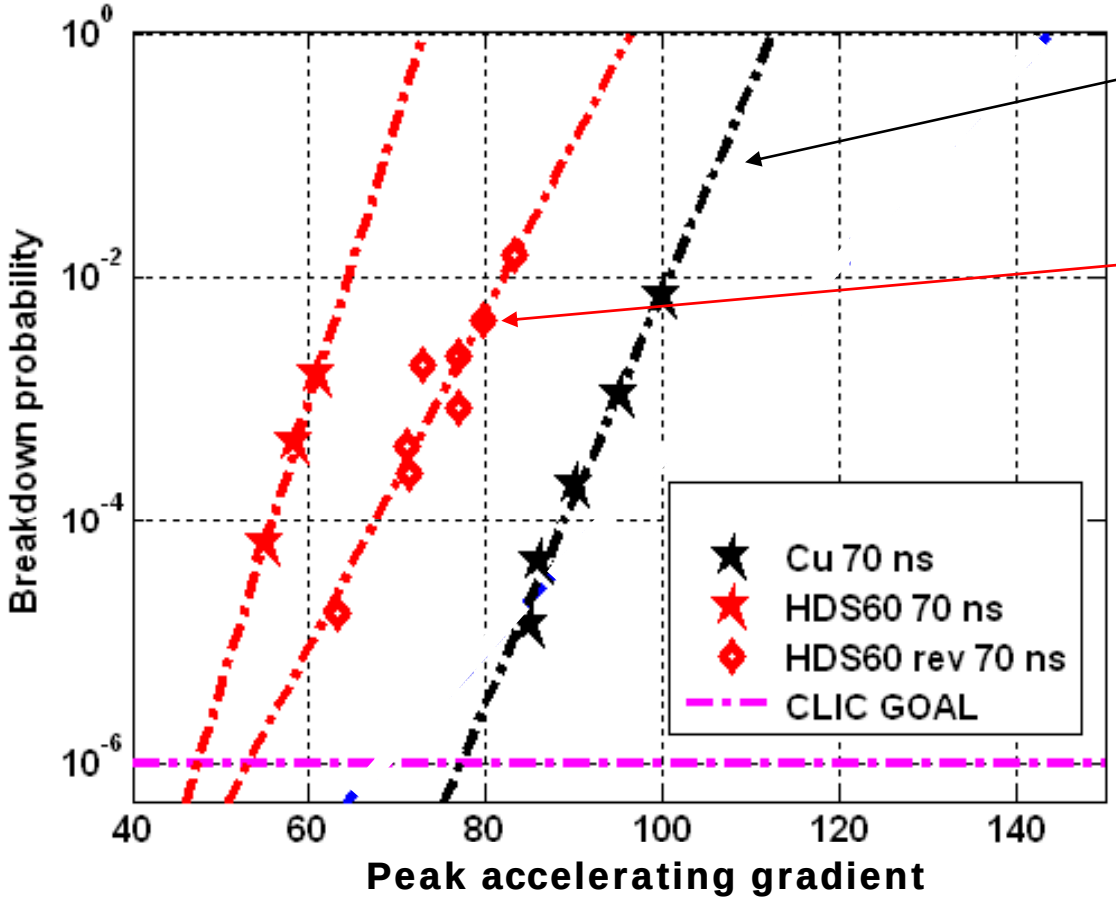
Surface prep., thermal treatment

T53 was annealed OFE-copper: it is not proved that this holds 10^{11} fatigue RF cycles

material



Different technologies of manufacturing and assembly

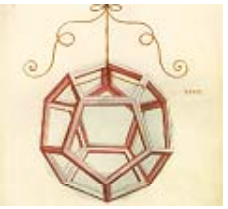


Disks
Diamond turned, brazed

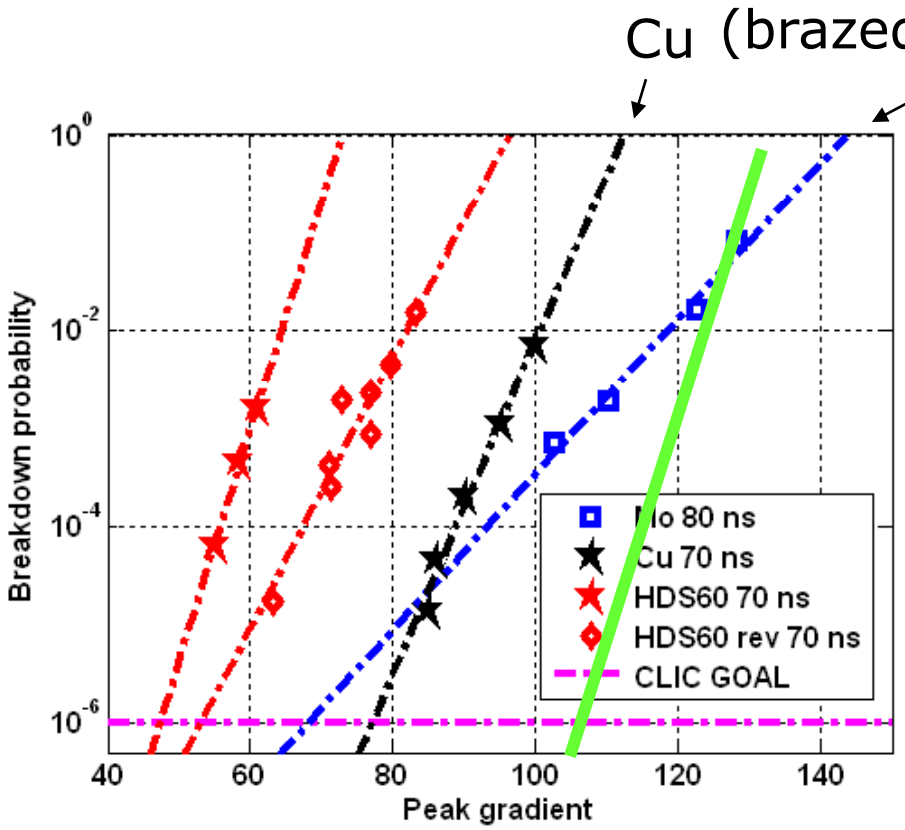
quadrant milled

Different surface finishing
Different assembly
Different thermal treatment

(Adapted from S.Doebert)



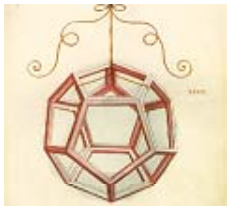
Higher gradient with other materials? Molybdenum



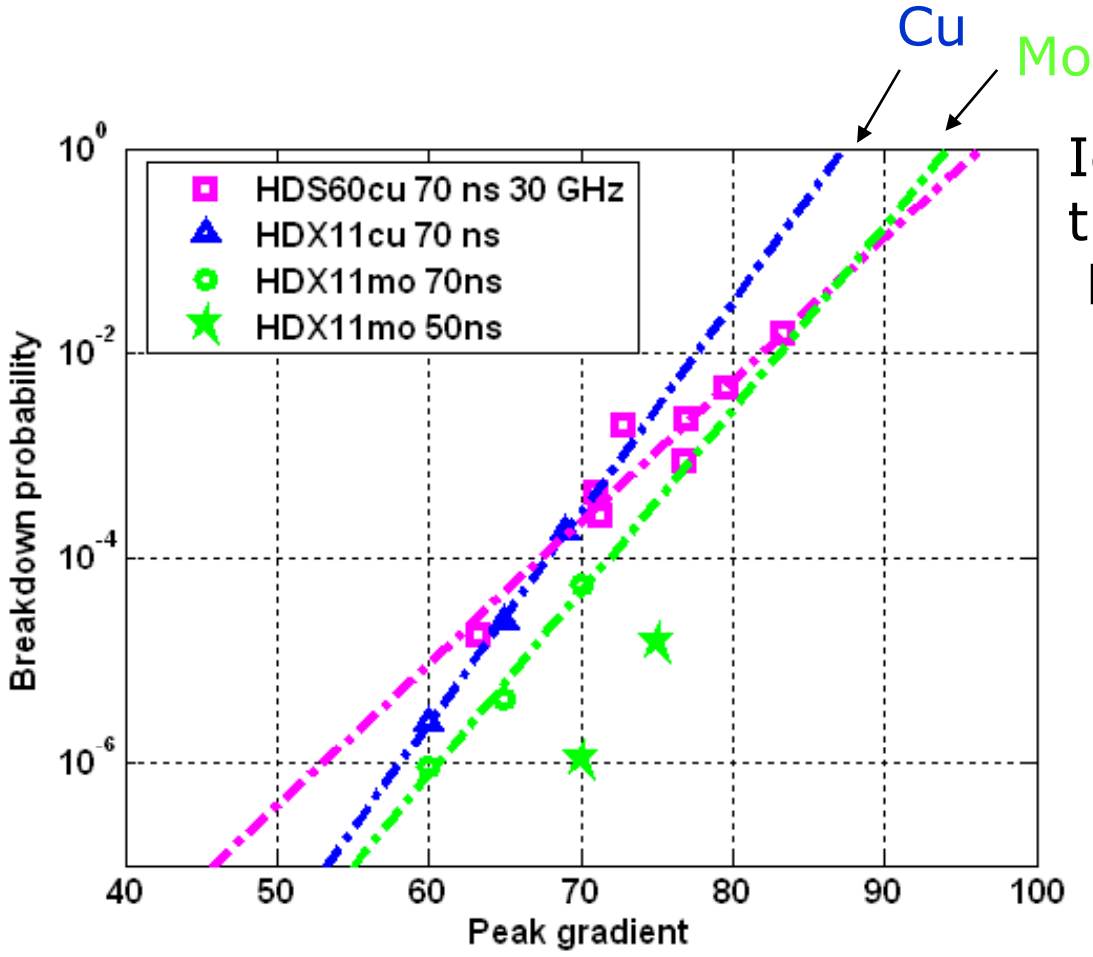
Mo shows better performance at high BDR
...but is worse at low BDR

The slope:
the origin of the slope is not understood yet:
-is it due to clamping vs brazing assembly?
-is it a material property

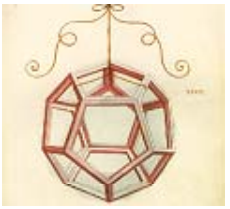
If we understand breakdown can we make Mo like this?



A single slope for Cu and many slopes of Mo….



Identical geometry and treatment: Mo and Cu have the same slope



Conclusions:

Base material for the structures is copper (…alloy)

- introduce damping, understand difference quadrant disk
- control surface finishing from manufacturing (TS)
- optimize surface/thermal treatment, cleaning (TS)
- prove fatigue resistance or find better copper-alloy (TS)
- achieve required shape accuracy (TS)

Parallel development on material R&D for higher gradient:

- DC–spark testing (TS)
- Bi-metal is needed: development of a joining method to join a refractory metal to a copper alloy (TS)
- Machining of refractory metals (TS)