The 30 GHz accelerating structure testing program

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CTF3 collaboration meeting
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The CLIC design accelerating gradient is 150 MV/m (high!)

At this level of gradient we are constrained by two main physical effects:
rf breakdown and pulsed surface heating.

We are addressing the constraints through two main paths:

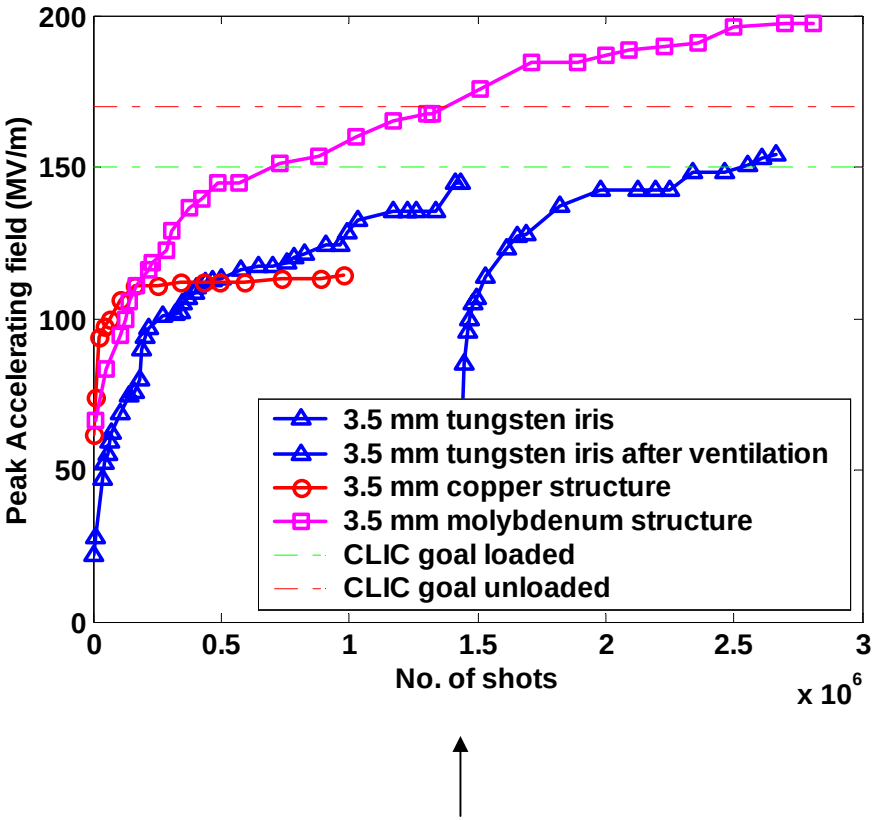
rf and linac design: Full optimization including rf breakdown, pulsed surface heating, short and long range wakefields, rf-to-beam efficiency and luminosity criteria - low surface fields, short pulse lengths.

Materials: refractory metals and copper alloys

This week's accelerating structure parameters:

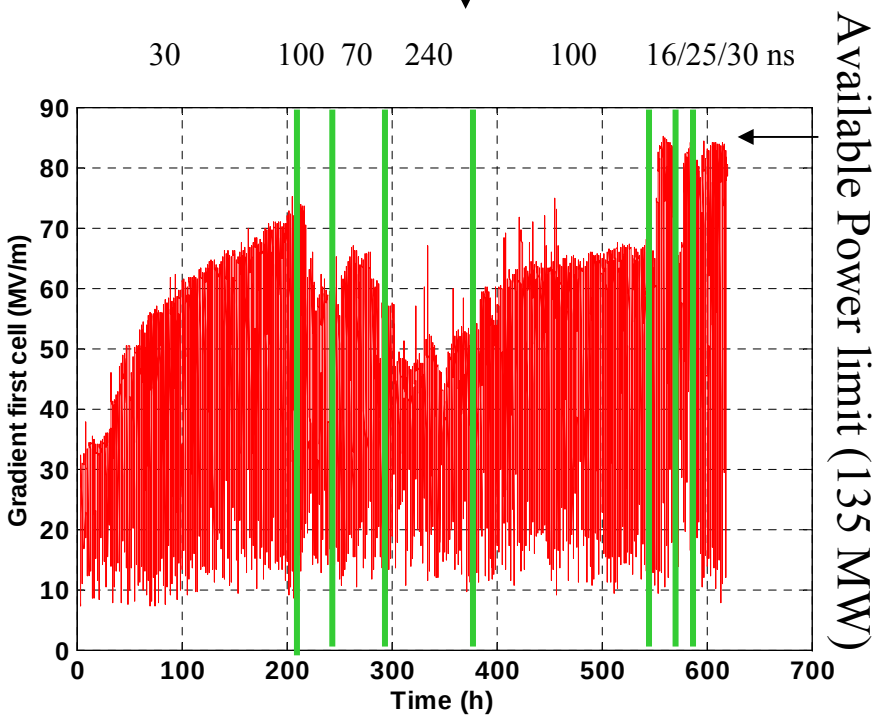
150 MV/m accelerating gradient (fixed)
30 GHz (fixed)
42 ns pulse length
160 MW structure input power
7 J total pulse energy
ΔT of 50ºK

Breakdown results so far



93 MW

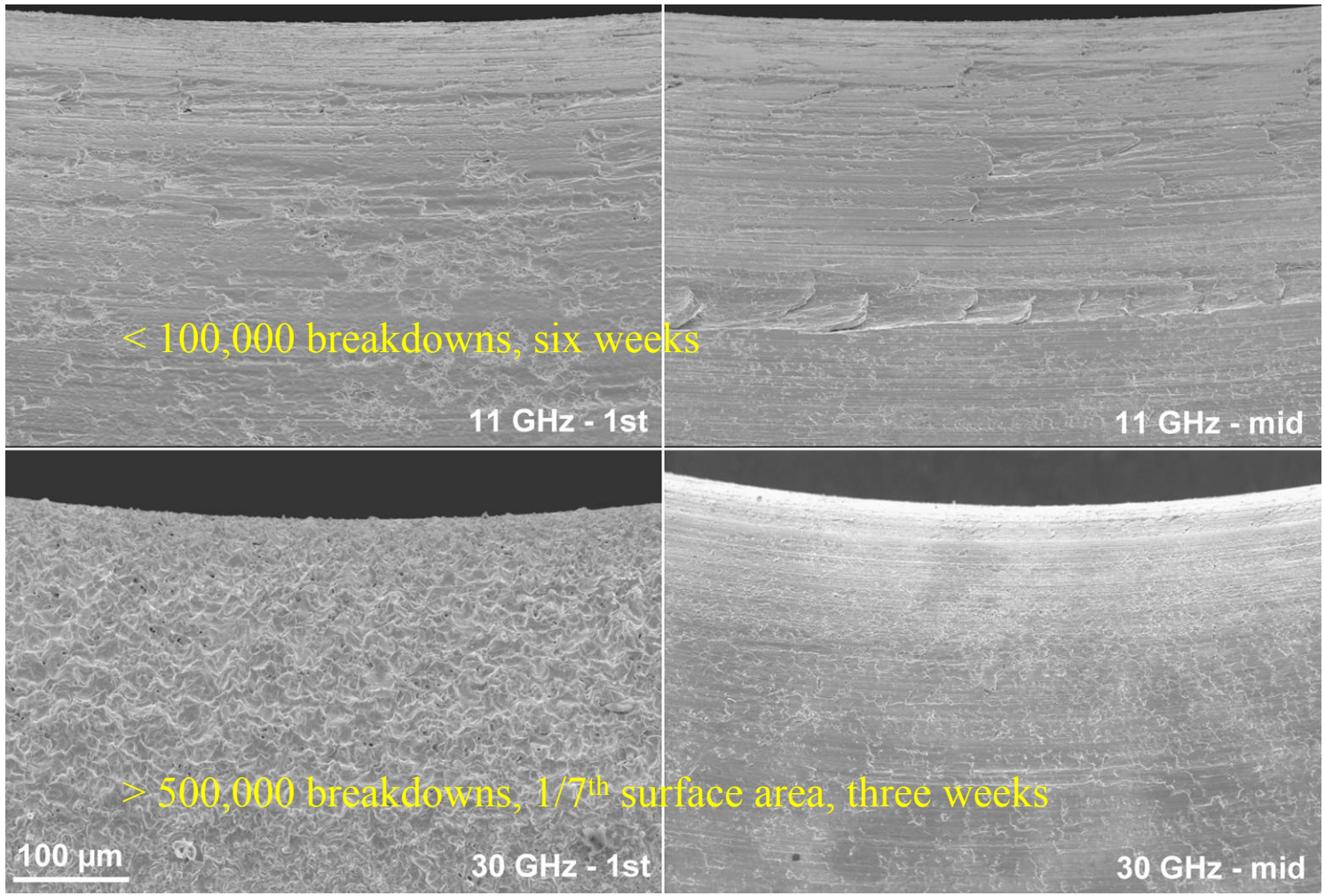
11 GHz, molybdenum, variable pulse length

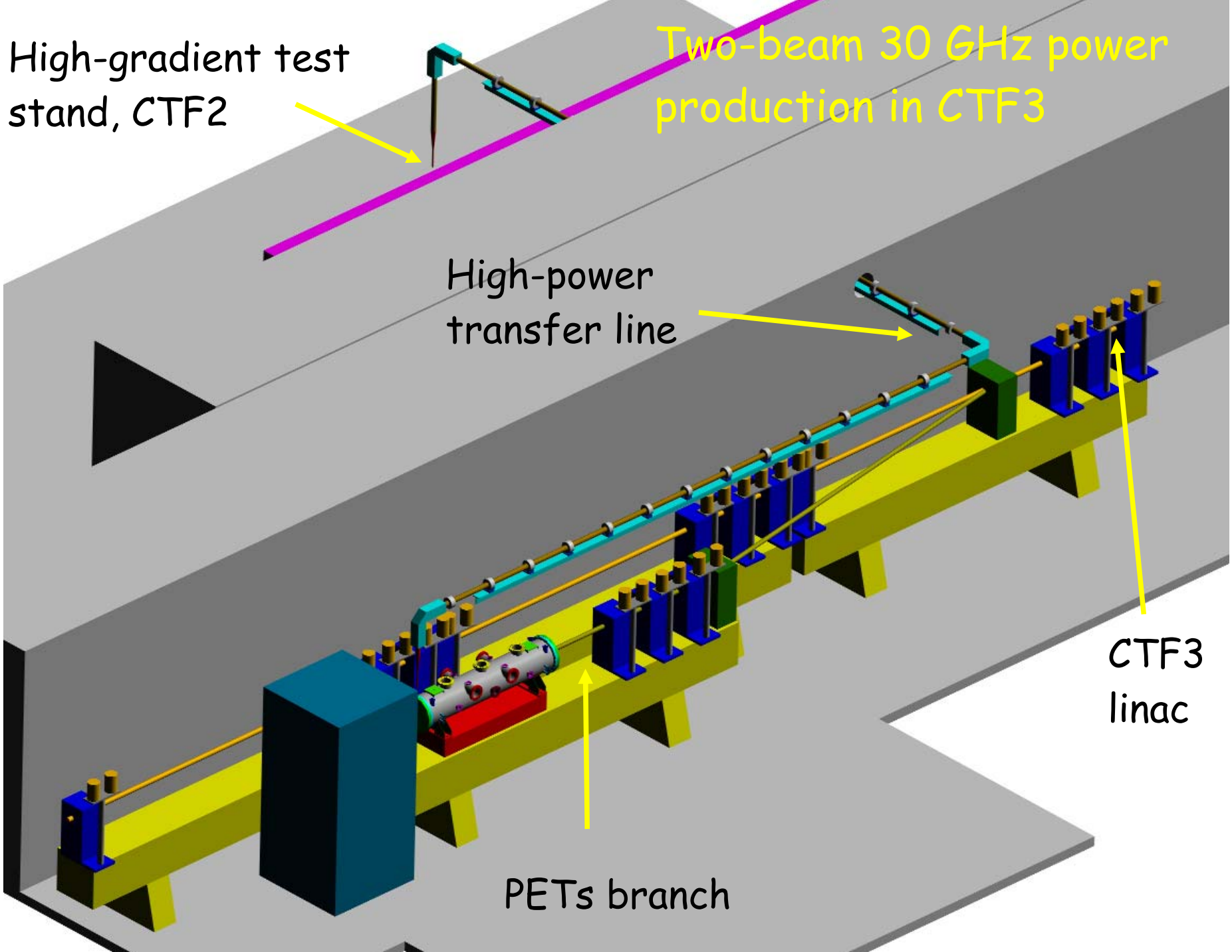


30 GHz, 16 ns pulse length

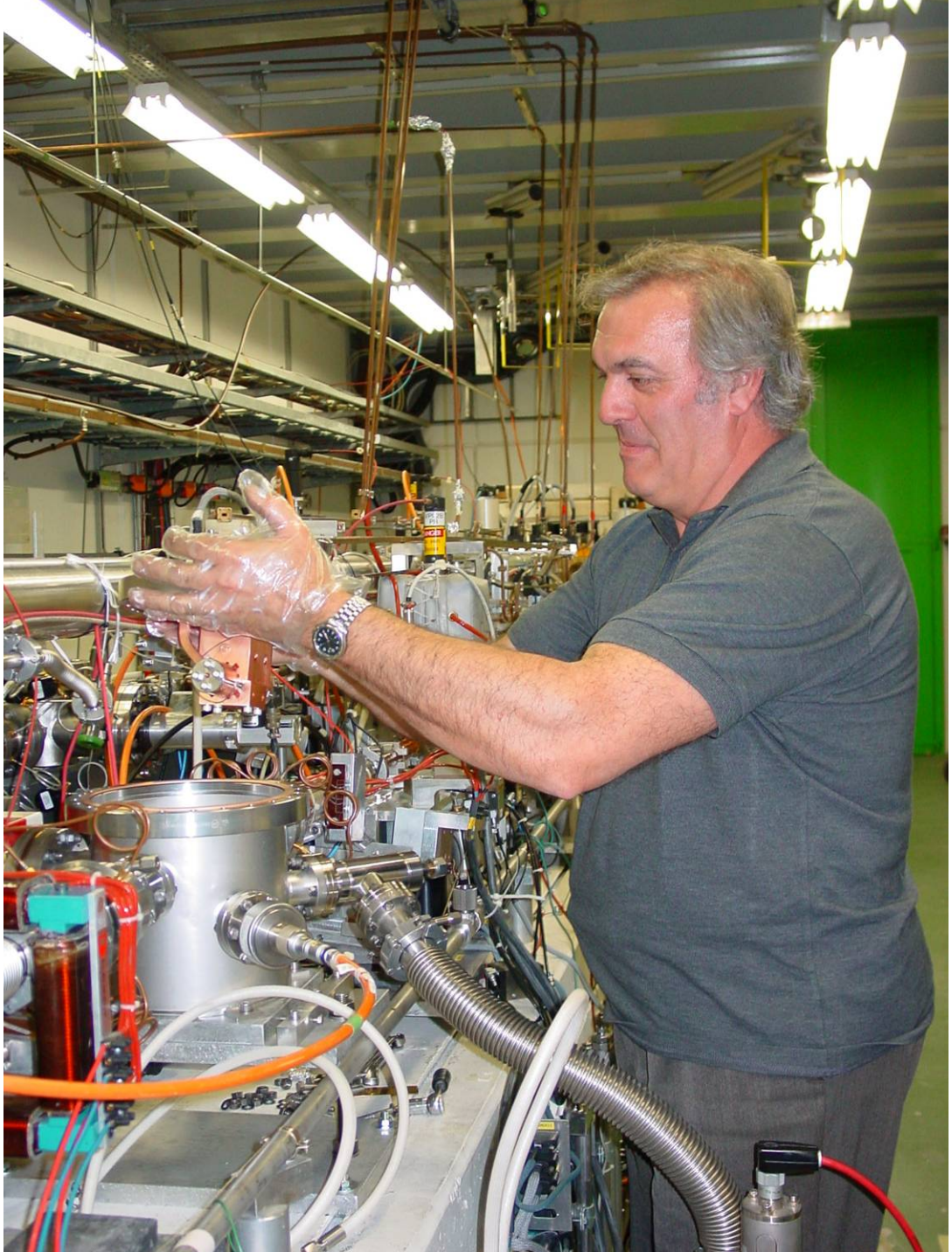
And 153 MV/m, 69 MW, 150 ns, copper, X-band, .11 a/λ

State of inner radius of iris (location of highest surface electric field) surface after conditioning




High-gradient test stand, CTF2
Two-beam 30 GHz power production in CTF3
High-power transfer line
CTF3 linac
PETs branch

30 GHz installation in CTF2

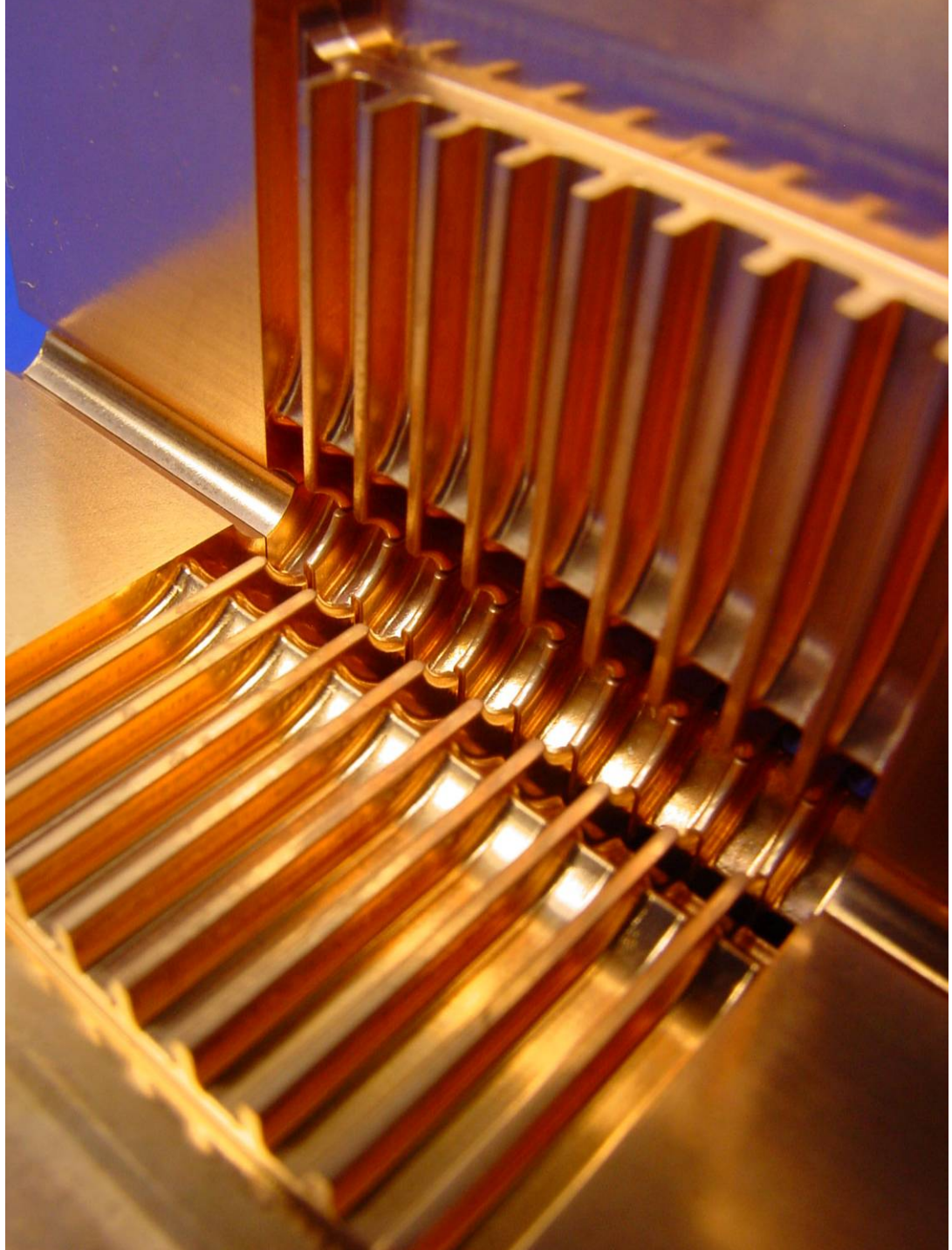


Structures currently in production

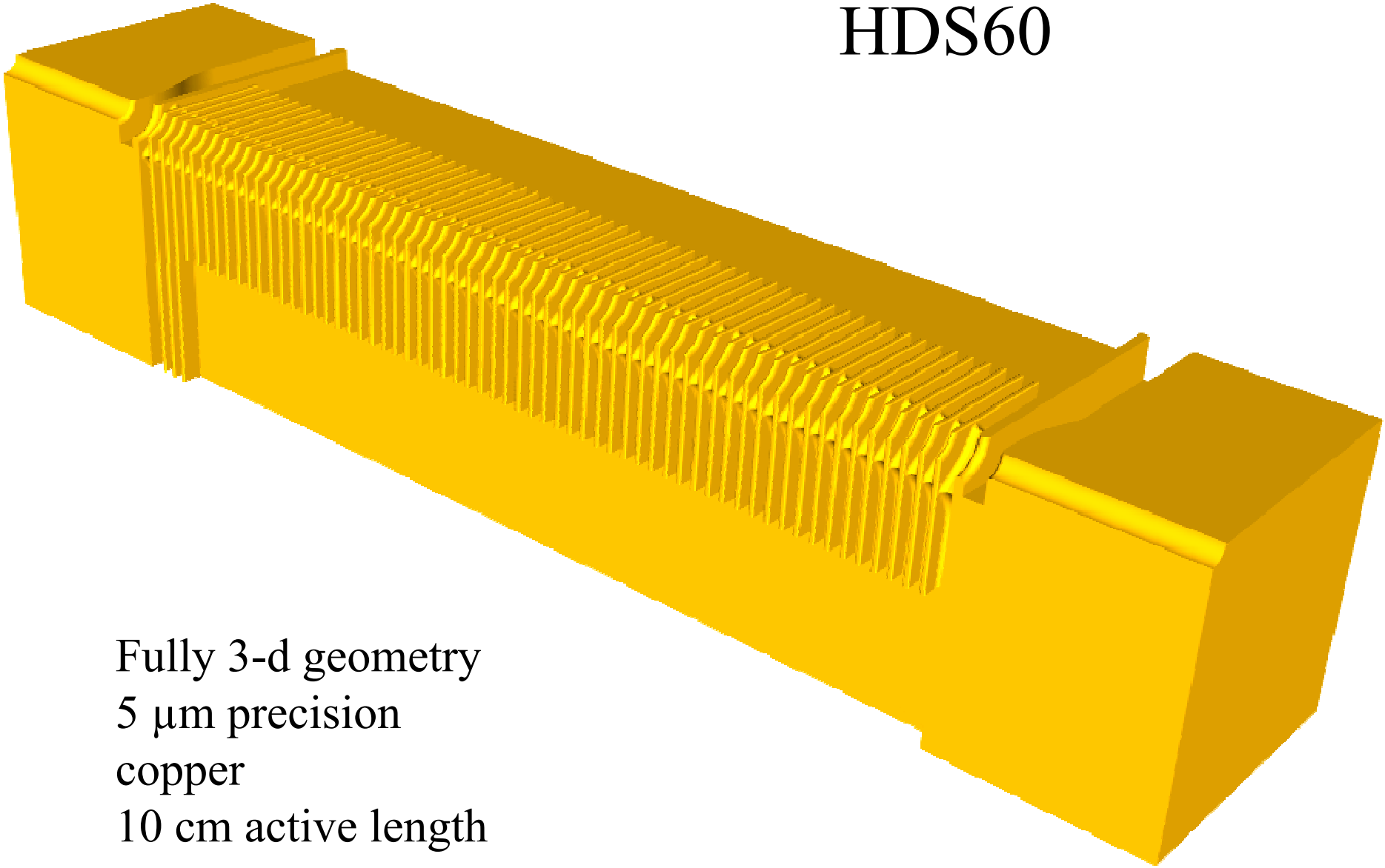
Iris diameter	material	Phase advance	geometry	Power for 150 MV/m (first cell/average)
3.5 mm	copper	$2\pi/3$	circular	56 MW
3.5 mm	Molybdenum/ copper	$2\pi/3$	circular	56 MW
3.5 mm	Tungsten/ copper	$2\pi/3$	circular	56 MW
4.0 mm	copper	$\pi/2$	circular	100 MW
3.8-3.2 mm tapered	copper	$\pi/3$	HDS	100 MW

Mo iris structure tested in CTF2, duplicate under fabrication

HDS machining test



HDS60



Fully 3-d geometry
5 μm precision
copper
10 cm active length

The current plan for the subsequent structures

Iris diameter	material	Phase advance	geometry	Power for 150 MV/m (first cell/average)
To be determined	Molybdenum/ copper	$2\pi/3$	circular	160 MW
To be determined	molybdenum	To be determined	HDS	160 MW
To be determined	Mo/Cu bimetallic	To be determined	HDS	160 MW

Schedule

Test area: Tank, waveguides, directional couplers, loads, vacuum, water cooling are in fabrication. Diagnostics: vacuum thermocouples, faraday cups, X-ray monitors have been requested. rf i/q signal capture planned.

Conditioning control system: 3 GHz system is under development which will be directly carried over to 30 GHz. High speed data acquisition system planned.

Structures: Mo iris structure has been given priority. We plan to test it during run 1 next year – expected duration is 1 month full-time. The 30 GHz part of run 2 is to be dedicated to power production. Further accelerating structure tests will be continued in 2006.