



Status of the compact X-band pulse compressor with flat top

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Outline

- **Backgrounds**
- Features of compact designs
- Cylinder resonant cavity
- New polarizer
- Summary





Backgrounds

□ Pulse compressors in electron-positron collider

➤ Circular electron-positron collider

- LEP (Large Electron-Positron collider): LIPS

- BEPC&BEPC II (Beijing Electron Positron Collider): SLED

➤ Linear electron-positron collider

- VLEPP: BOC

- NLC/GLC: SLED II

- JLC: SLED II



[1] <http://home.cern/about/accelerators/large-electron-positron-collider>

[2] 1992-CERN-Igor-Status VLEPP RF Power Multiplier (VPM)

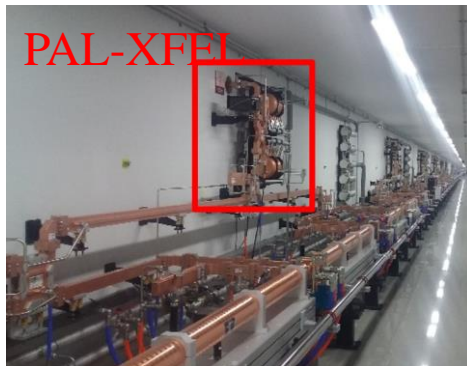
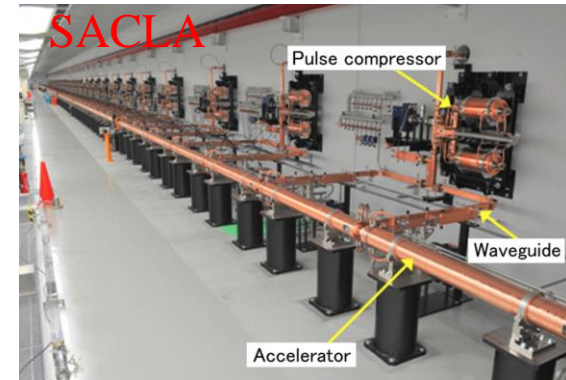
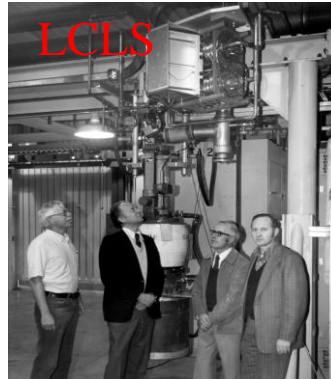




Backgrounds

□ Pulse compressors in FELs

- LCLS
- SACLA XFEL facility
- PAL-XFEL
- SINAP-SXFEL
- SwissFEL



[1] 1974-SLAC-Z. D. Farkas-A METHOD OF DOUBLING SLAC' s ENERGY

[2] Mitsubishi Heavy Industries Technical Review Vol. 49 No. 2 (June 2012)

[3] C-band RF pulse compressor for SwissFEL, IPAC 2013 Conference, Shanghai, China, 2013.

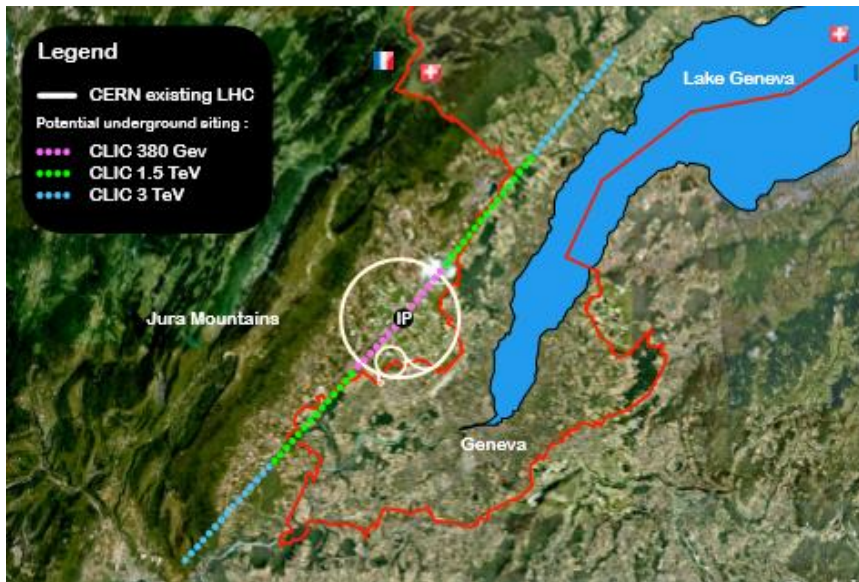
[4] 2016-CLIC_workshop-Progress_in_C-band_and_X-band_technology_at_SINAP_Fang



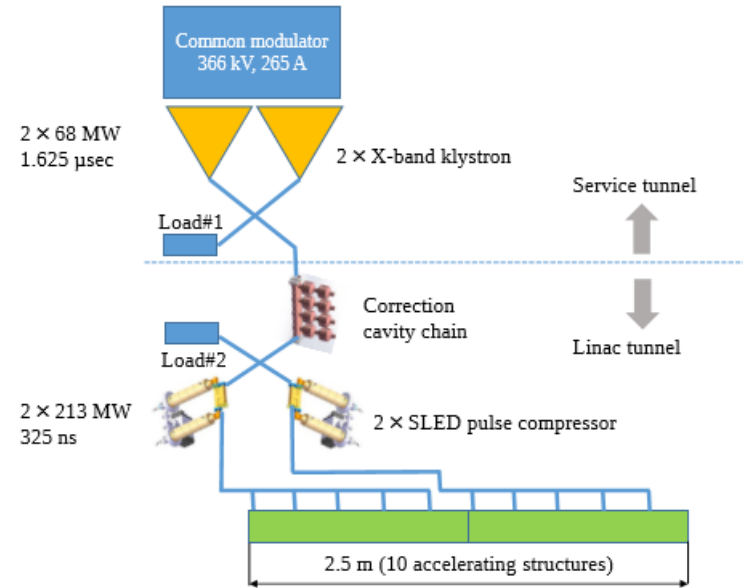


Backgrounds

□ 380GeV stage klystron based CLIC



CLIC footprints near CERN (three stages)



Proposed RF unit

[1] Updated baseline for a staged Compact Linear Collider, edited by P.N. Burrows, P. Lebrun, L. Linssen, D. Schulte, E. Sicking, S. Stapnes, M.A. Thomson, CERN-2016-004 (CERN, Geneva, 2016),





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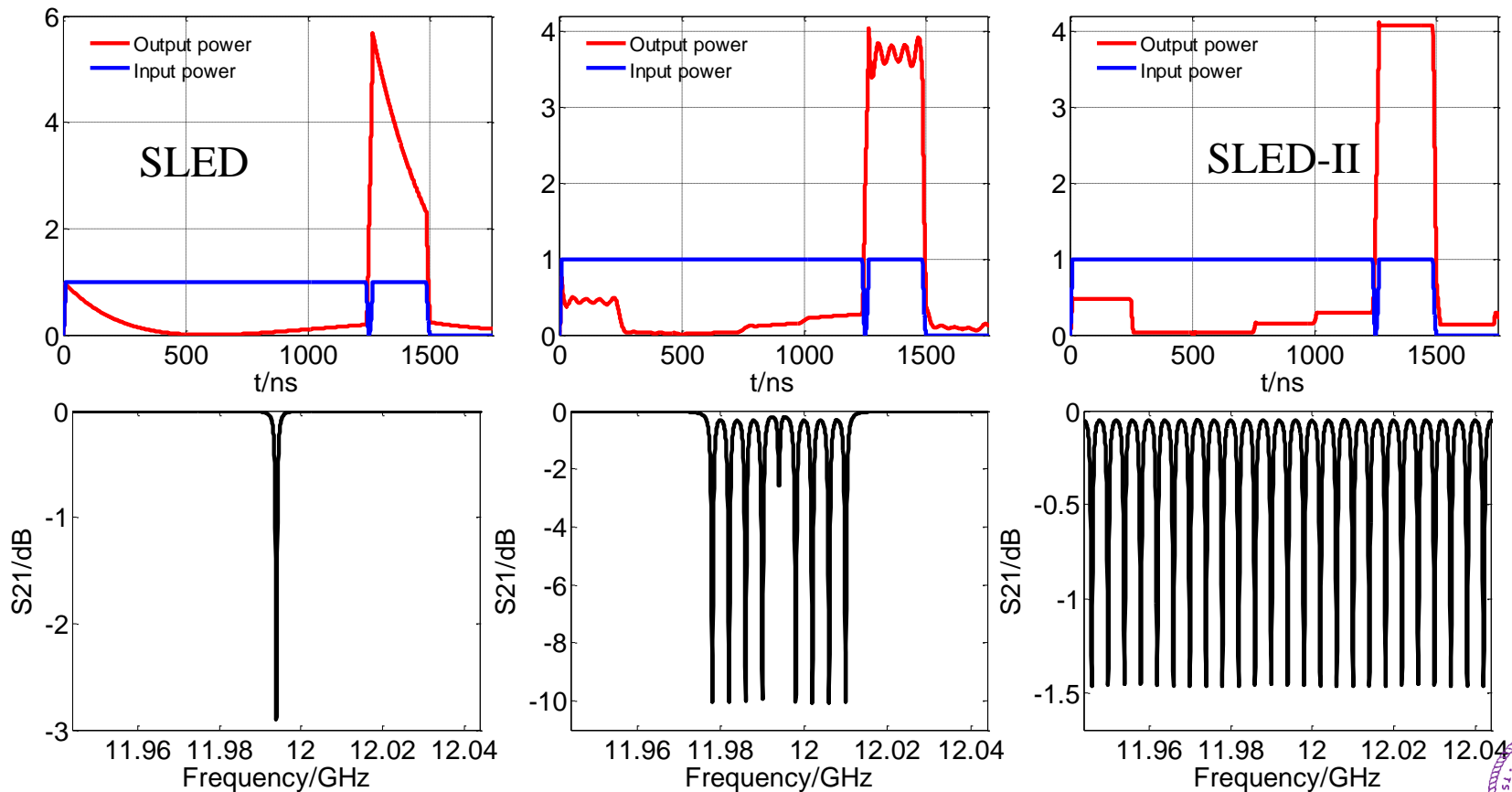




Features of compact designs-I

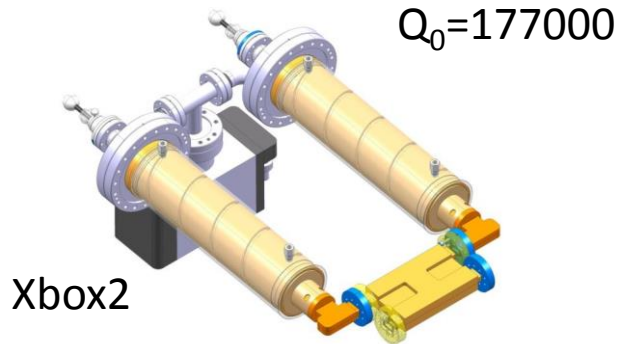
□ Coupled cavities

- Flat top pulse (compared with SLED)
- Very compact (compared with SLED-II)

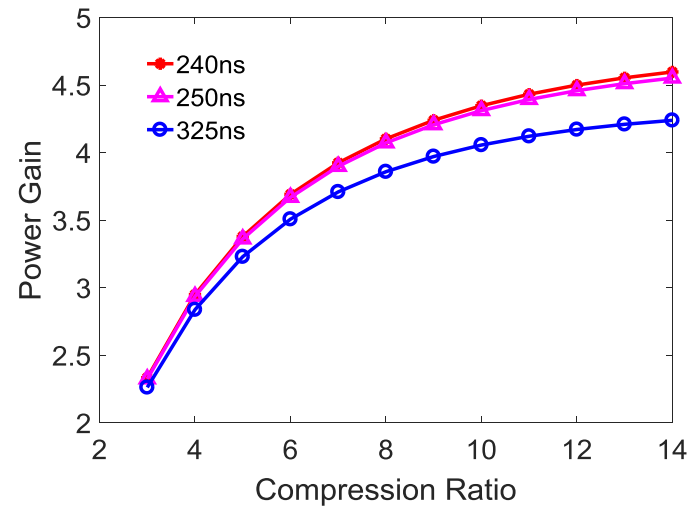
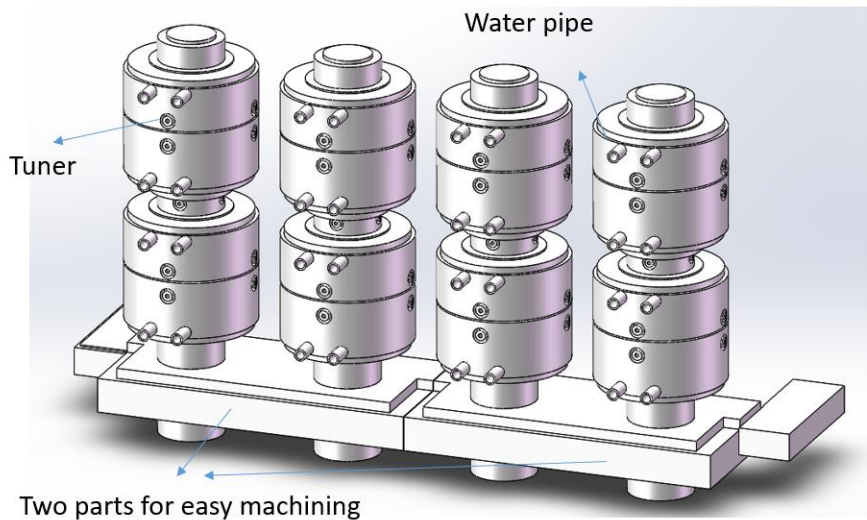
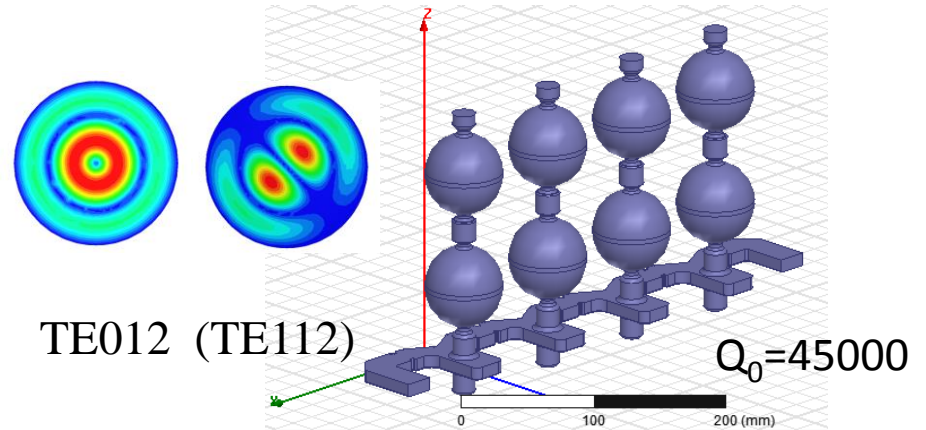


The design at present

Storage Cavity



Correction cavities chain

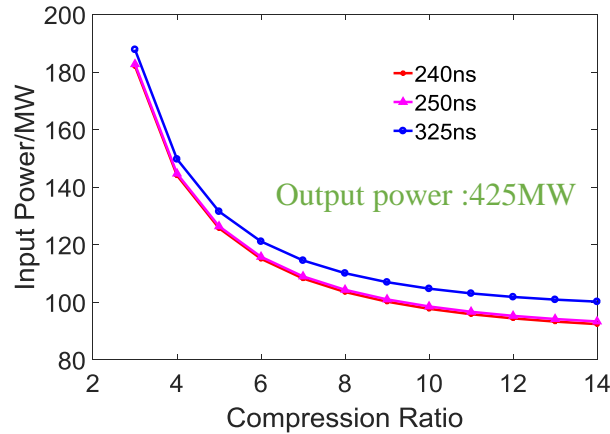


Power gains as function of compression ratio with different output lengths.



The design at present

Input powers as function of compression ratio with different output lengths.

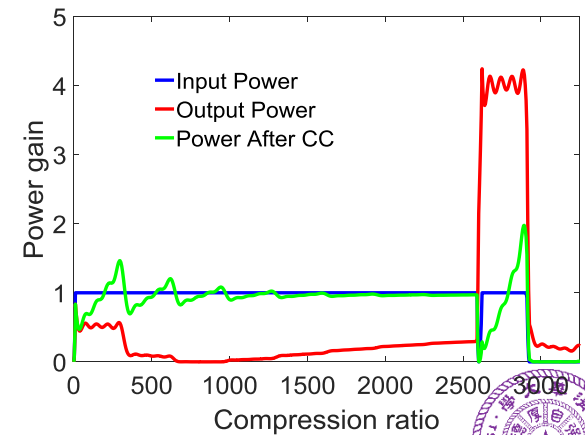
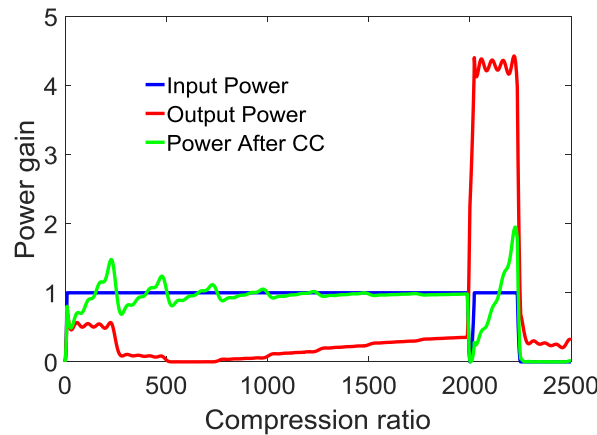
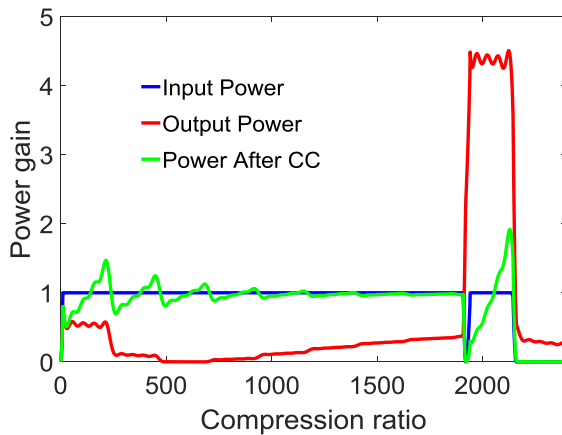


T(ns)	β_s	β_c	Δf (MHz)
240	5.98	1.56	4.24
250	5.8	1.52	4
325	4.48	4.48	3.08

T=240ns, Cr=9

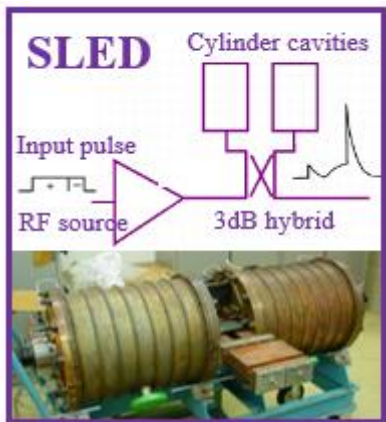
T=250ns, Cr=9

T=325ns, Cr=9



Features of compact designs-II

Single resonant cavity (Rotating feature)

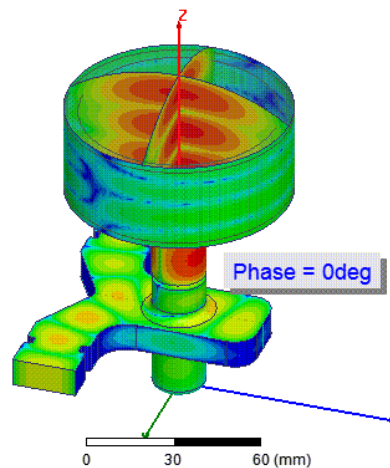
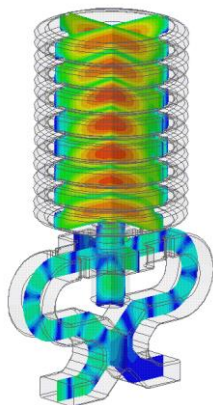
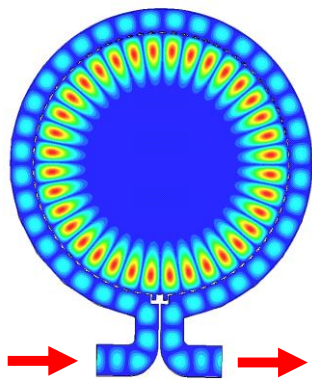
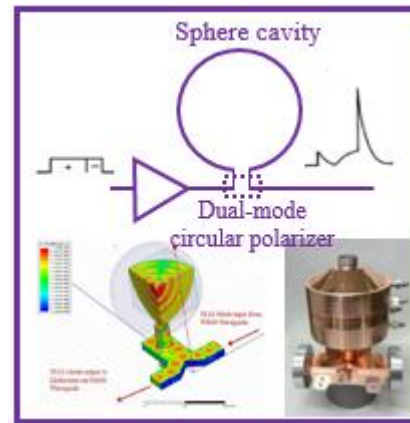


Two resonant cavity

Single resonant cavity

3dB hybrid

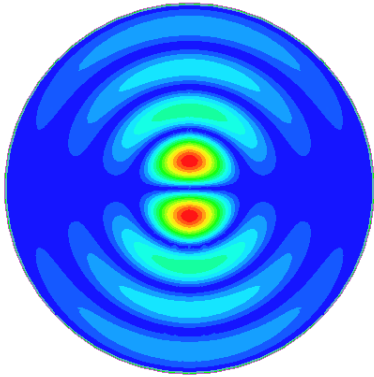
Polarizer



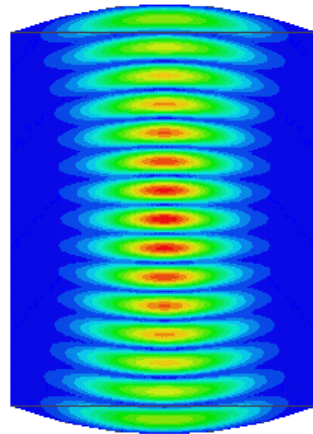


Features of compact designs-II

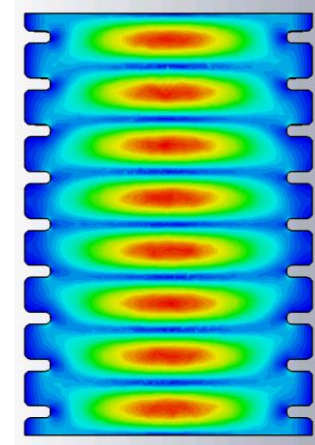
- High Q resonant cavity (**Polarization feature**)



Spherical Cavity



Optical Cavity



Corrugated Wall Cavity

- Similar field patterns
- The operation mode has two polarizations





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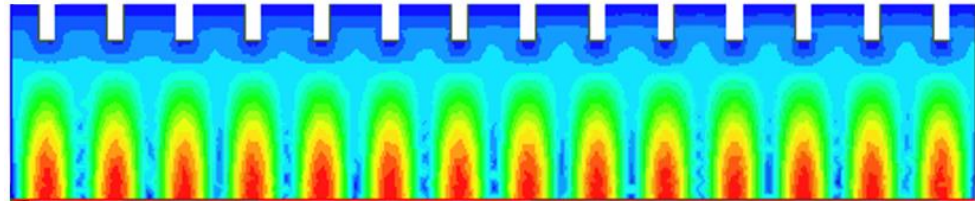




Cylinder Resonant Cavity

HE_{1-1-n}

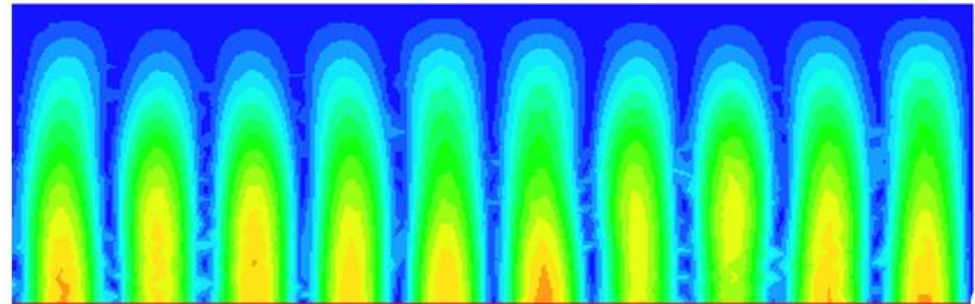
Corrugated Wall Cavity



Similar

TE_{1-1-n}

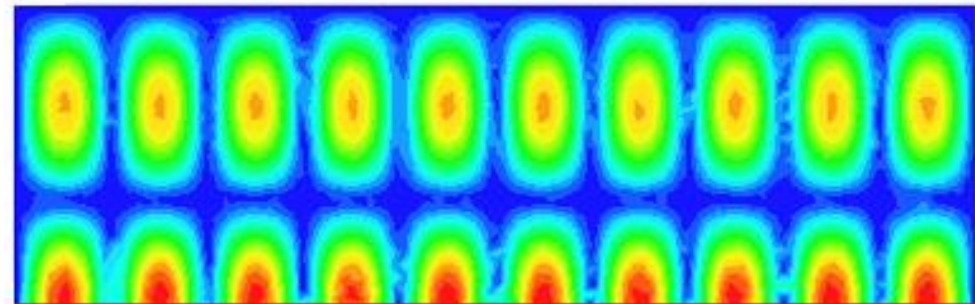
Cylinder Cavity



Reducing field of cylinder flank

TE_{1-2-n}

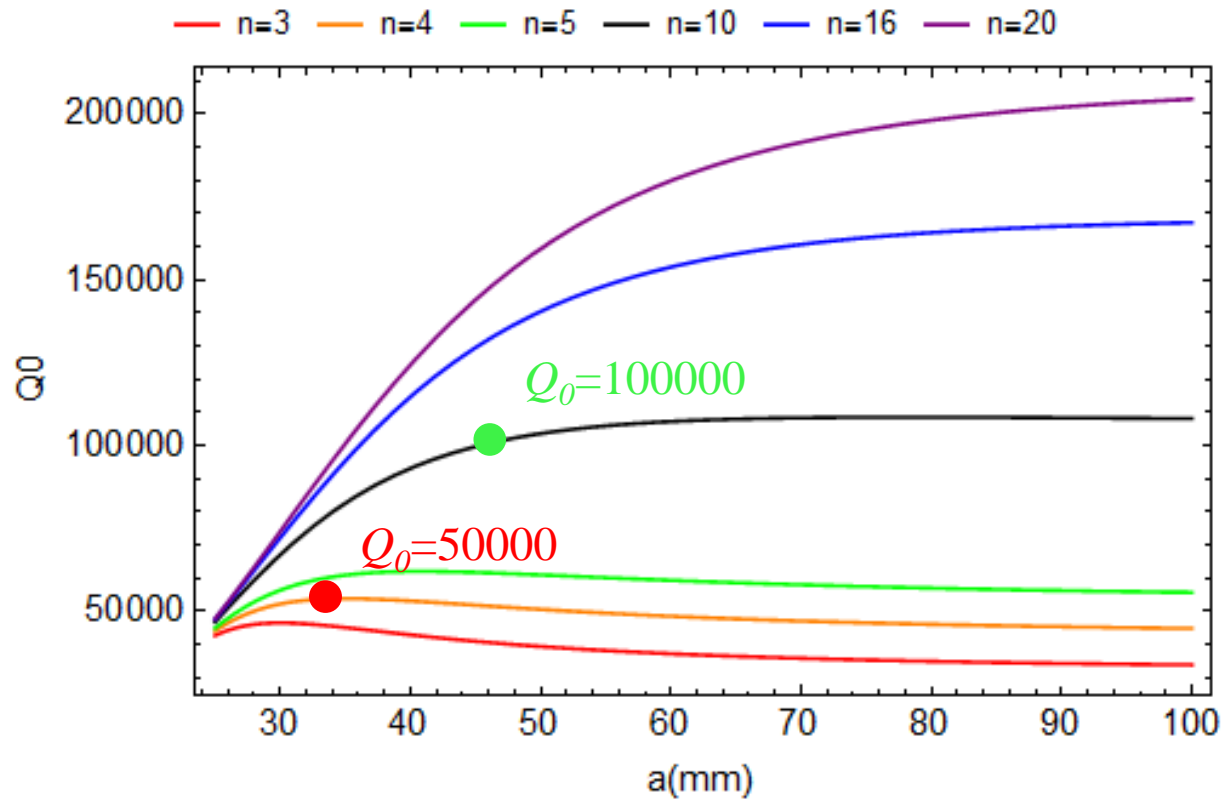
Cylinder Cavity





Cylinder Resonant Cavity

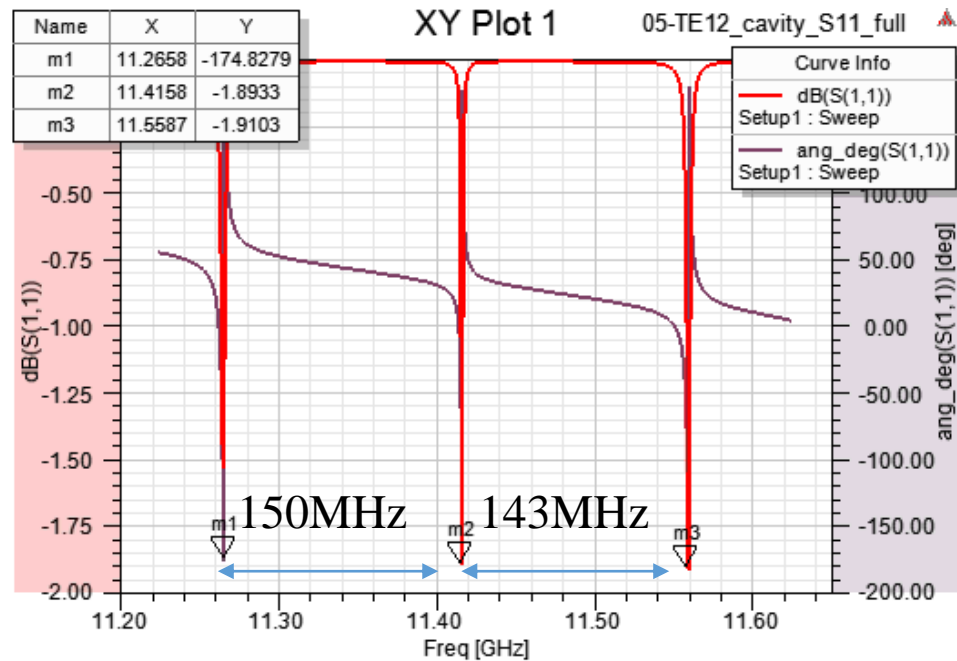
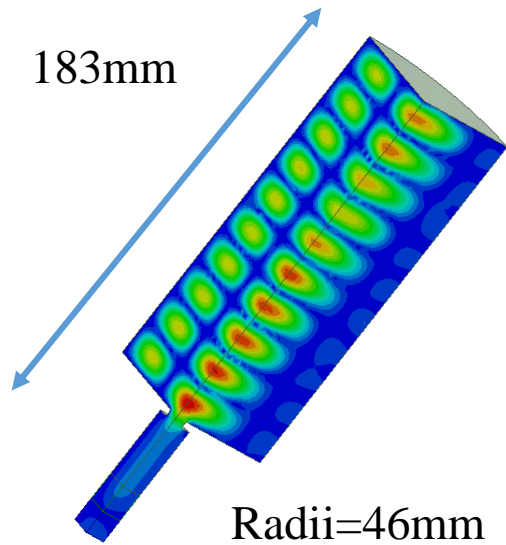
TE_{1-2-n} Cylinder Cavity





Cylinder Resonant Cavity

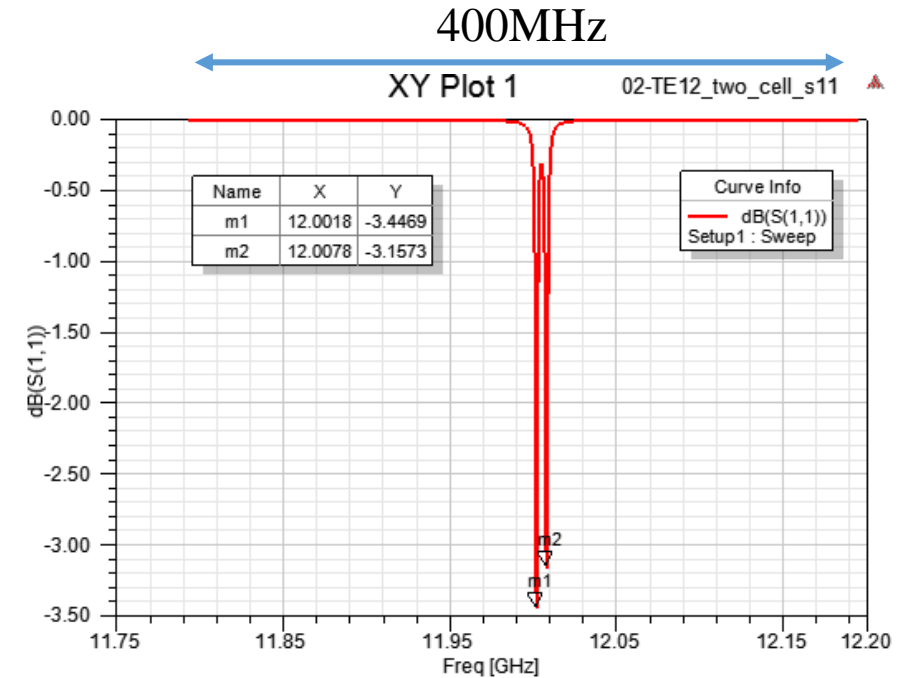
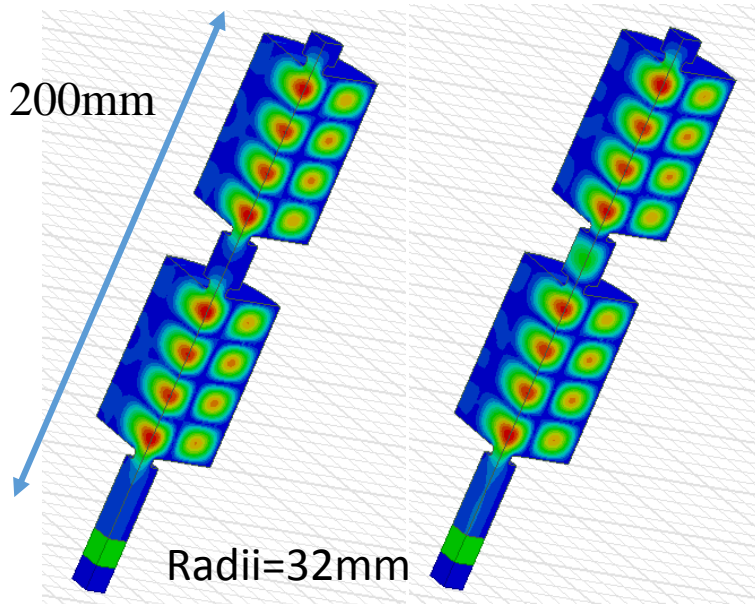
f	Q_0	Q_e
11.416	95094	11725





Cylinder Resonant Cavity

f_1 (GHz)	12.0019	12.0079
Q_0	48966	48126
Q_e	9569	8892





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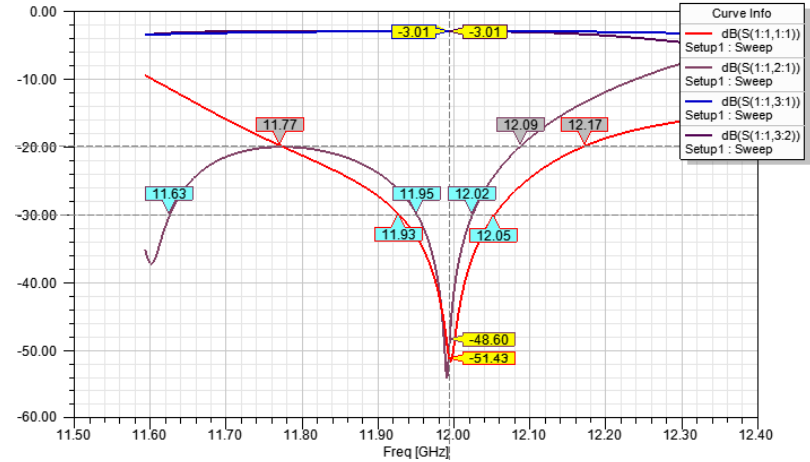
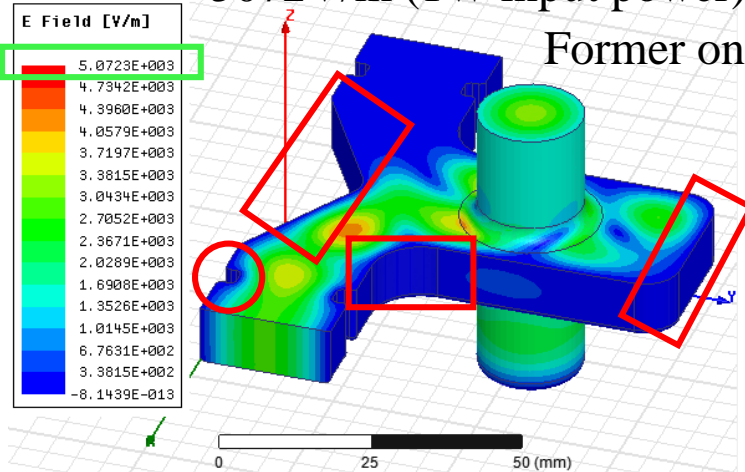




New polarizer

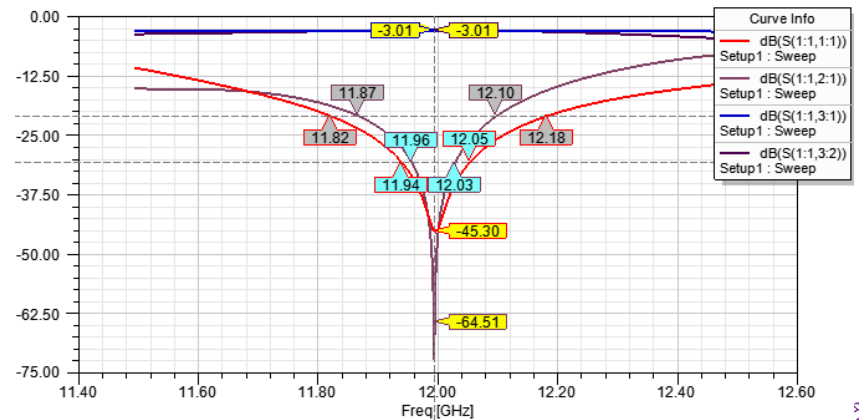
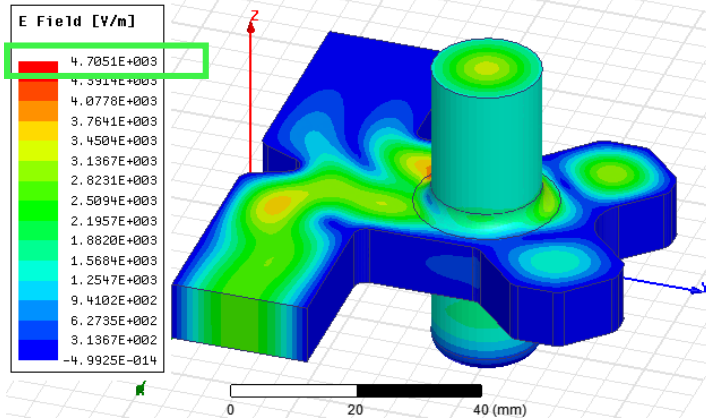
5072V/m (1W input power)

Former one



More compact and lower field on surface

4705V/m (1W input power)





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Summary

- The features of compact design are surmised, including the use of correction cavities to replace the long delay and the design of single resonant cavities.
- New cylinder resonant cavities were designed and can be used as a SLED or the cavity of a correction cavities chain
- A new polarizer with lower surface field was designed





Thanks for your attention !

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