



X-band pulse compressors at Tsinghua

Yuliang Jiang



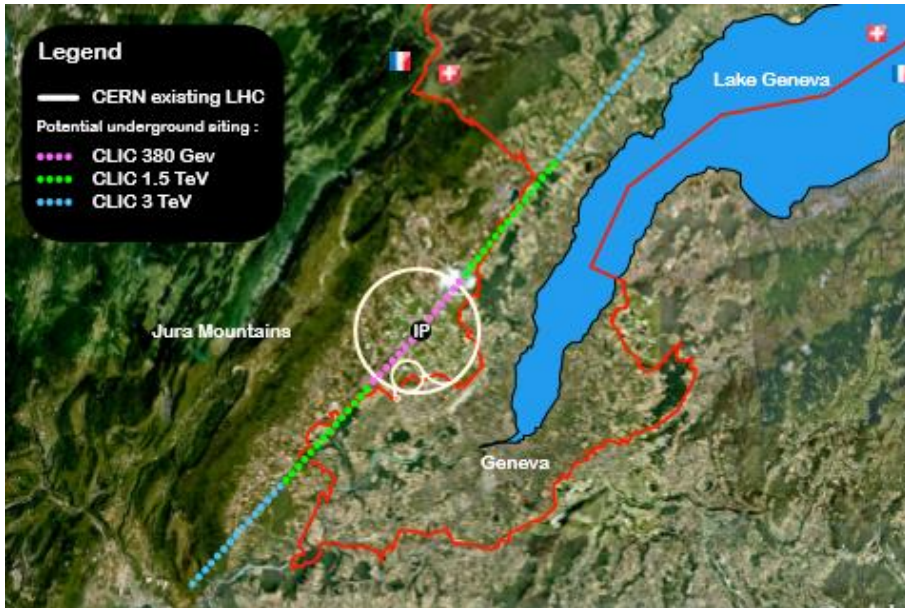
Outline



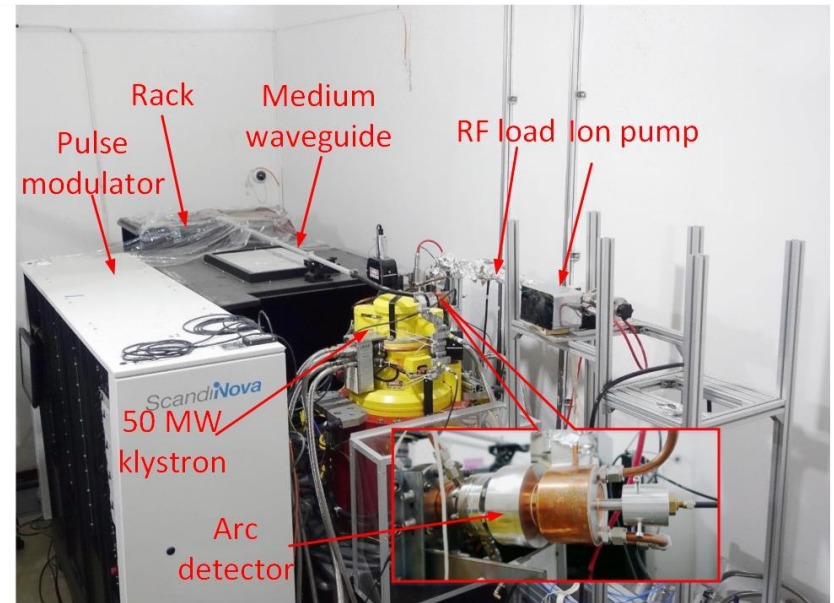
➤ Backgrounds

- Correction cavity chain for CLIC
- X-band pulse compressor for TTX
- Summary

Klystron-based CLIC



X-band High power test facility at Tsinghua



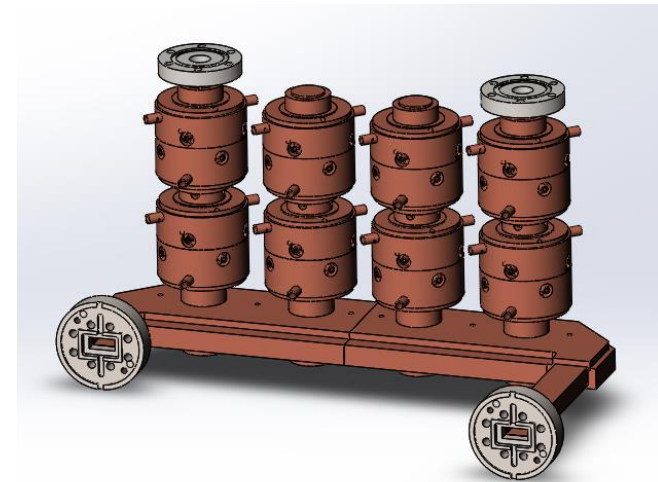
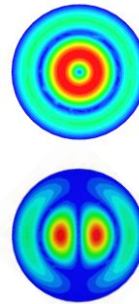
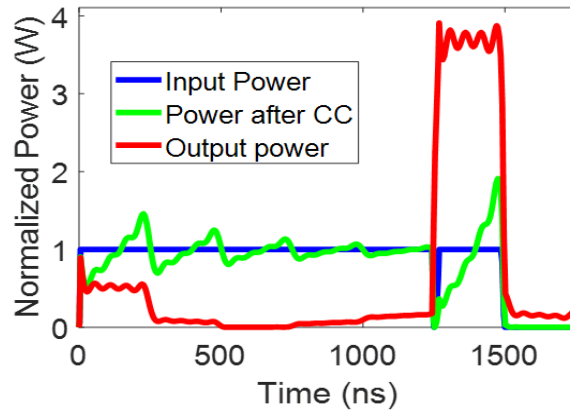
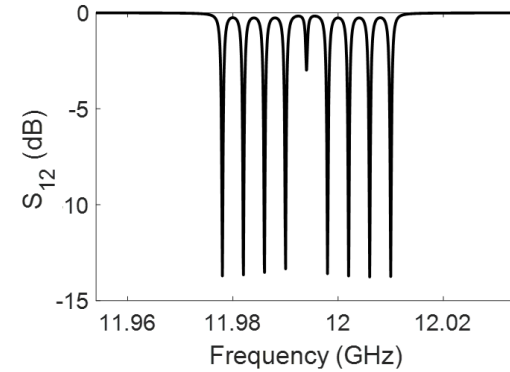
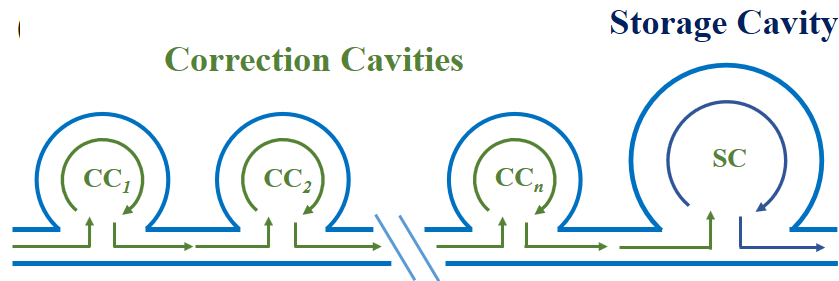


Outline



- Backgrounds
- **Correction cavity chain for CLIC**
- X-band pulse compressor for TTX
- Summary

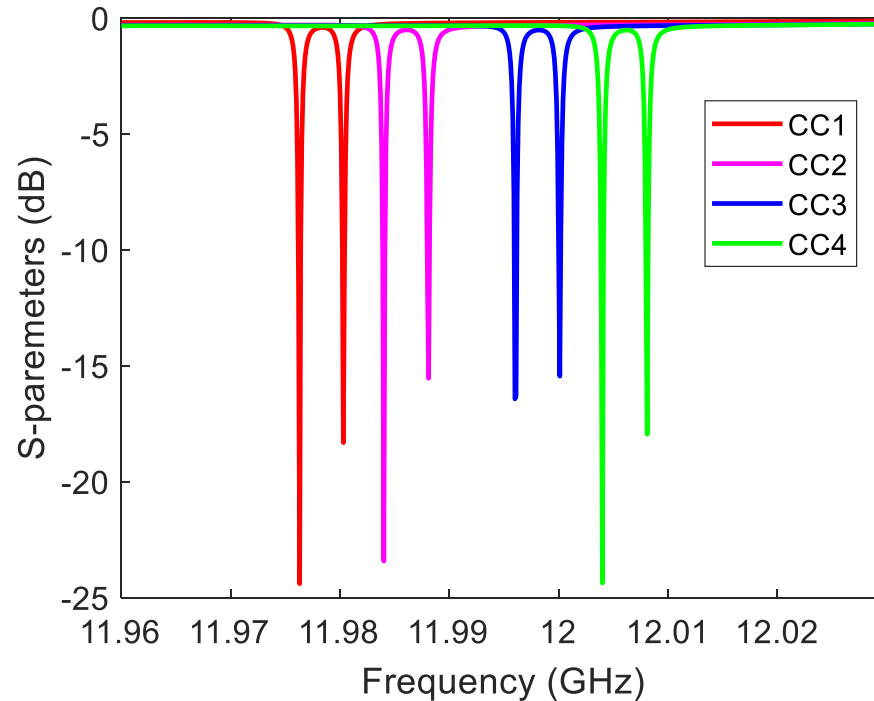
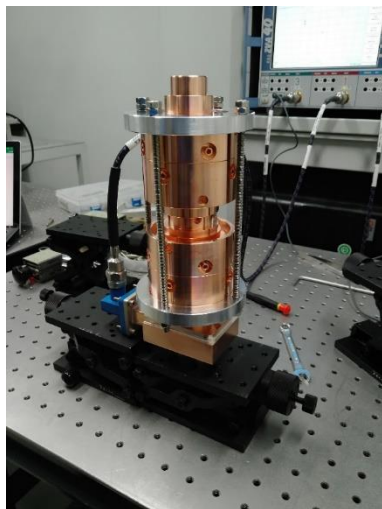
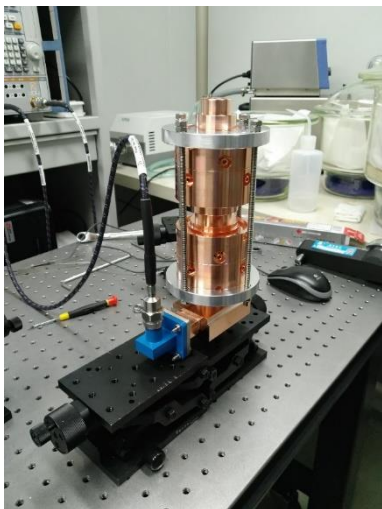
◆ Design of correction cavity chain for CLIC



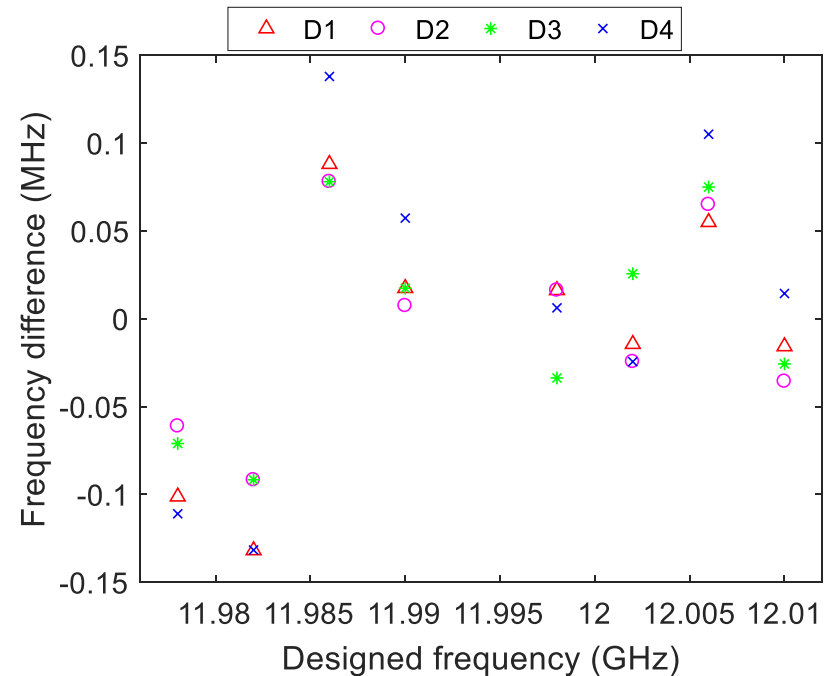
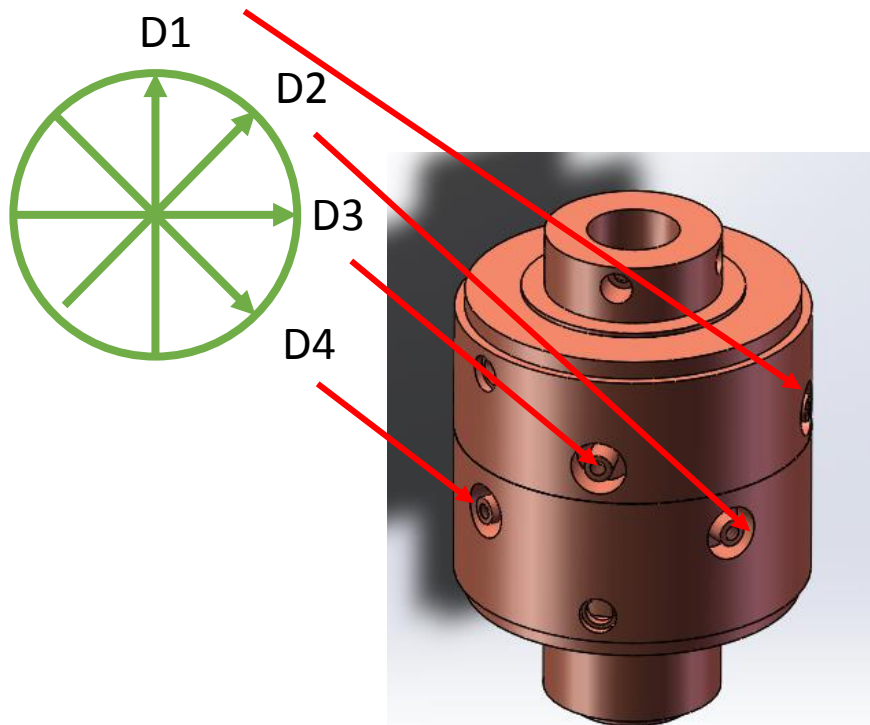
[1] Ping Wang, Hao Zha, Igor Syratcev, Jiuru Shi, and Huaibi Chen, [rf design of a pulse compressor with correction cavity chain for klystron-based compact linear collider](#), Phys. Rev. Accel. Beams 20, 112001 (2017)

◆ Cold measure of CC before brazing

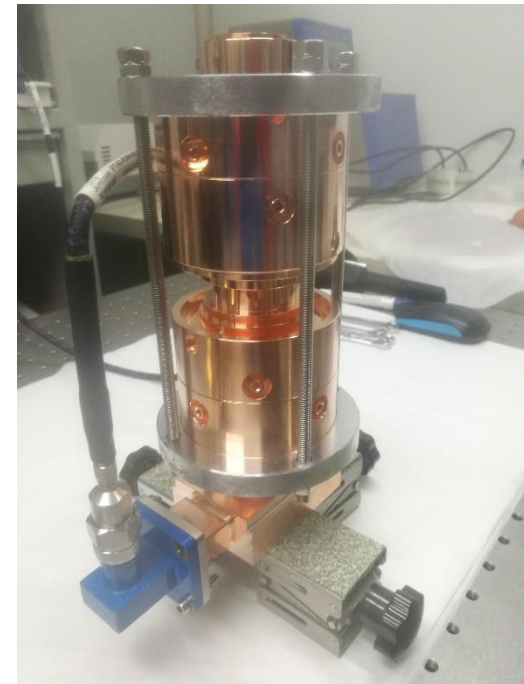
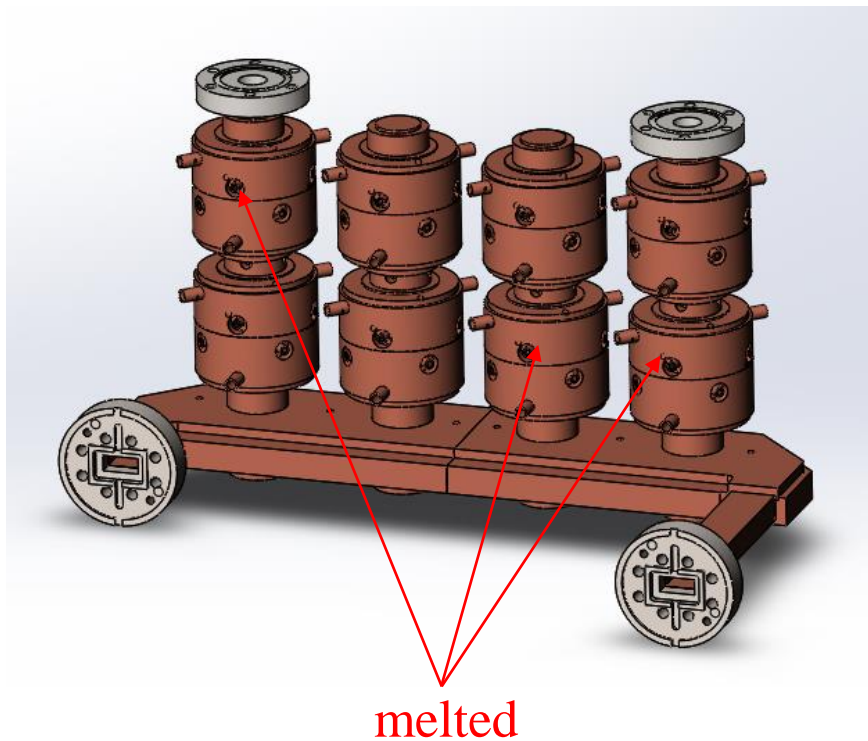
- Before brazing, the unloaded quality factors were less than the designed ones.
- The torque was 1 N·m.



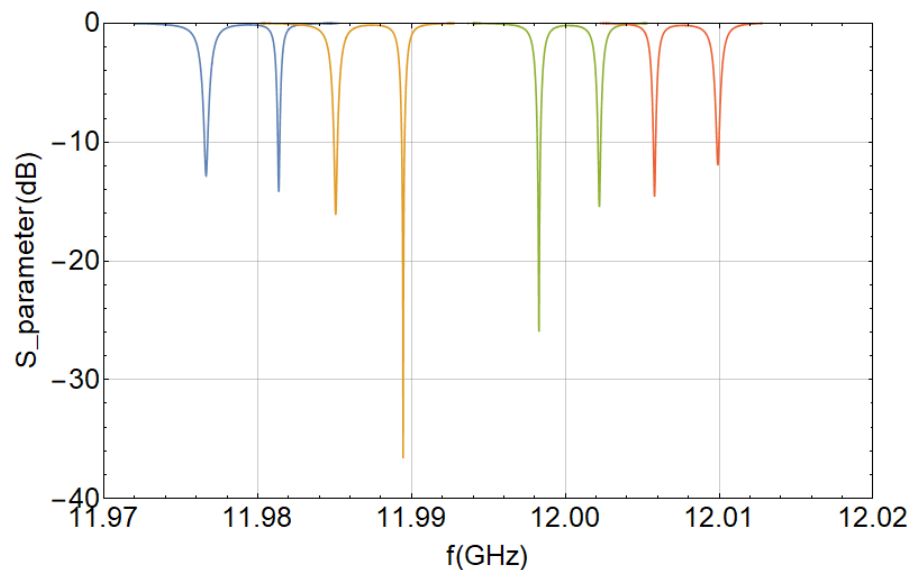
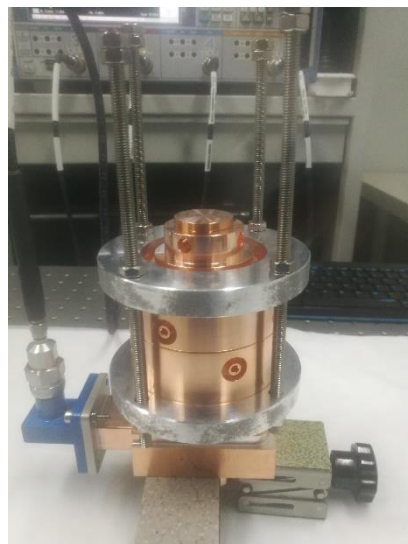
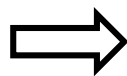
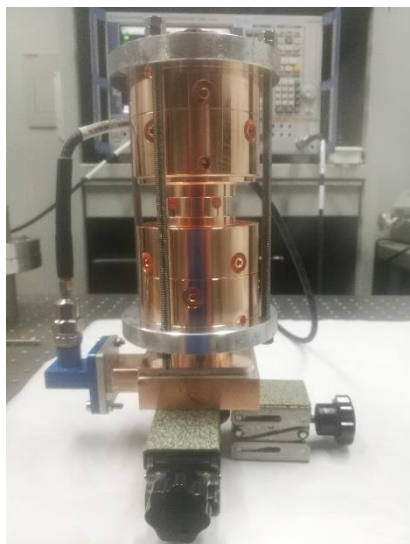
- ◆ Preliminary tuning of CC before brazing
- The frequencies of four directions were tuned by cutting off a little bit of the resonant cavities.
- Working temperature of CC is 30 °C.



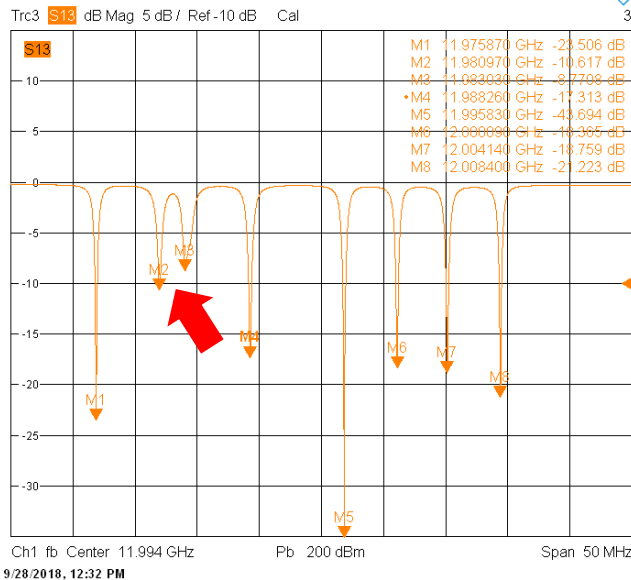
- ◆ Three cavities were melted while brazing
- The three cavities were re-fabricated.
- The frequency shift after the preliminary tuning were not measured this time.



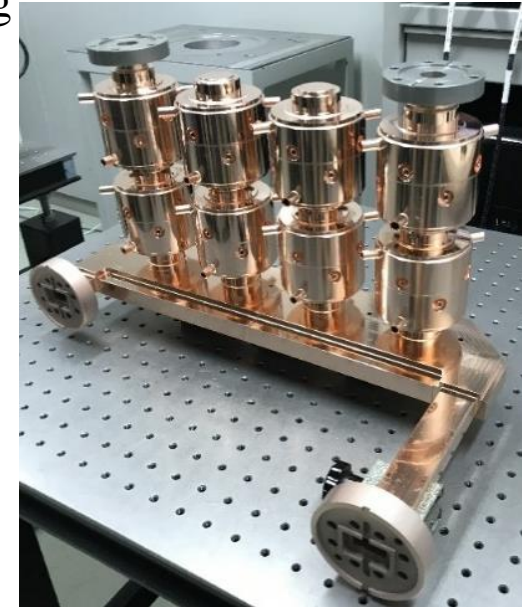
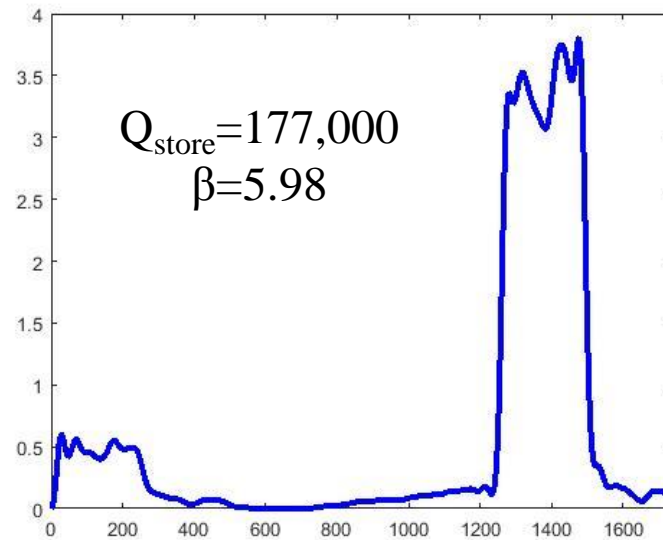
- ◆ Previous measure method after preliminary tuning
 - Each set consisted of a brazed cavity and an unbrazed cavity.
 - The cut-off thickness at the mid-plane of the cavity was ~ 0.02 mm.
 - Under this condition, the unbrazed cavity wasn't compressed tightly as the pressure was almost remained in the brazing surface of the brazed cavity.
- ◆ Optimized measure method
 - Separate measurements
 - Applicable for cavities at the bottom.



- ◆ The cavities were well brazed this time 😊
- ◆ Obvious frequency shifts were observed for two sets of cavities 🤔

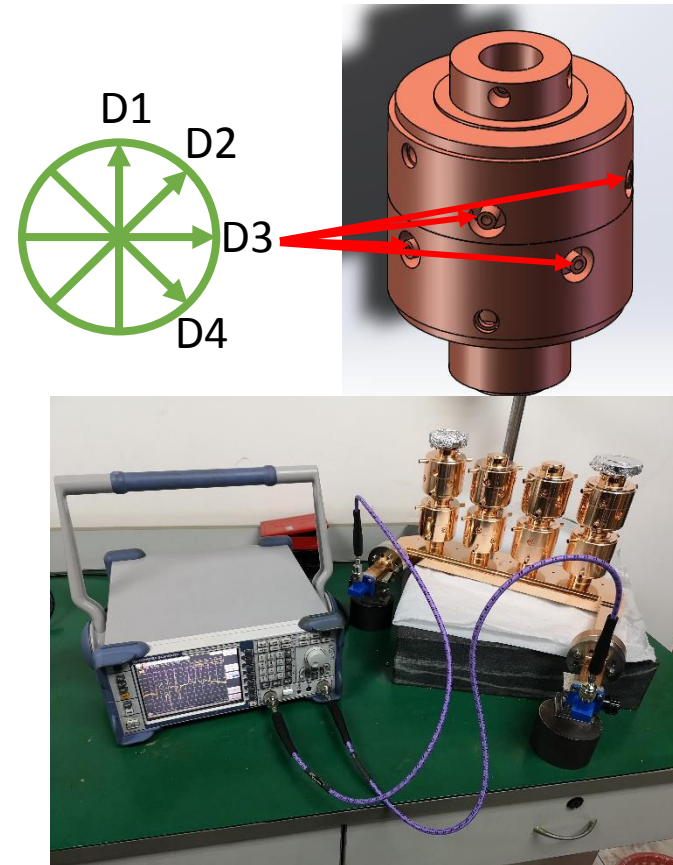


Simulated pulse shape after brazing



- ◆ Tuning of the correction cavity chain
 - The frequency and the polarization of the cavity were tuned by tuning holes on it.
 - The frequency difference between two coupled cavities was tuned by holes in the middle.

Tuning tools



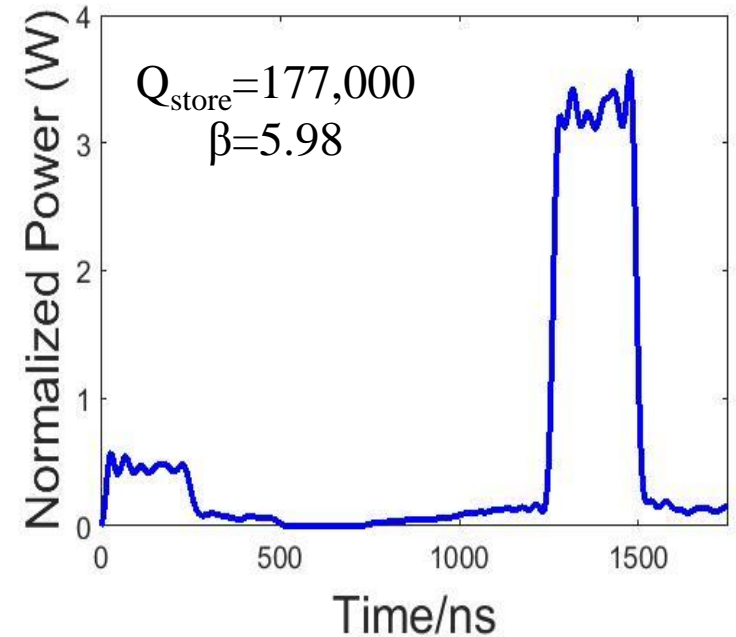
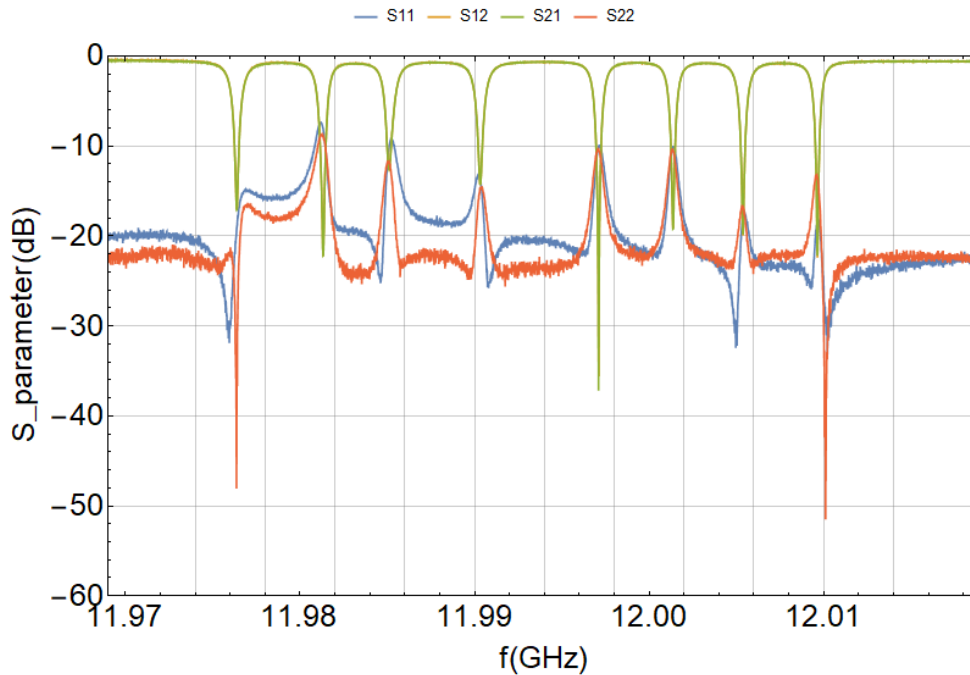


Correction cavity chain for CLIC



◆ Results after tuning

- Only the first two sets were tuned as tuning increased the reflection easily
- The working temperature is set at $\sim 32^\circ\text{C}$





Outline



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- **X-band pulse compressor for TTX**
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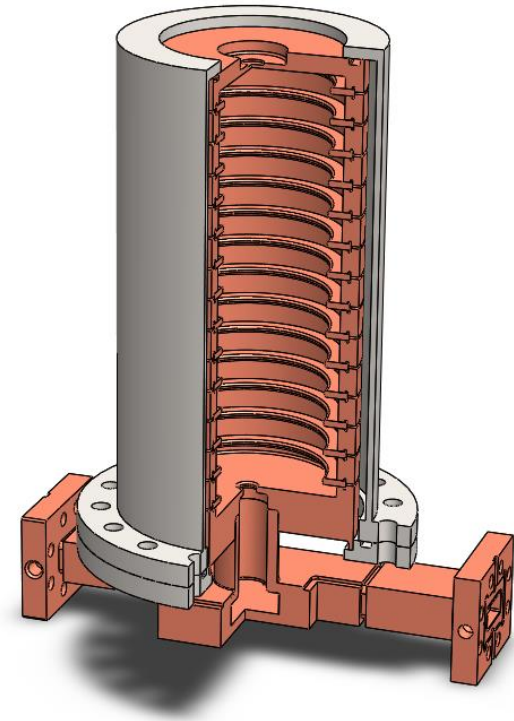
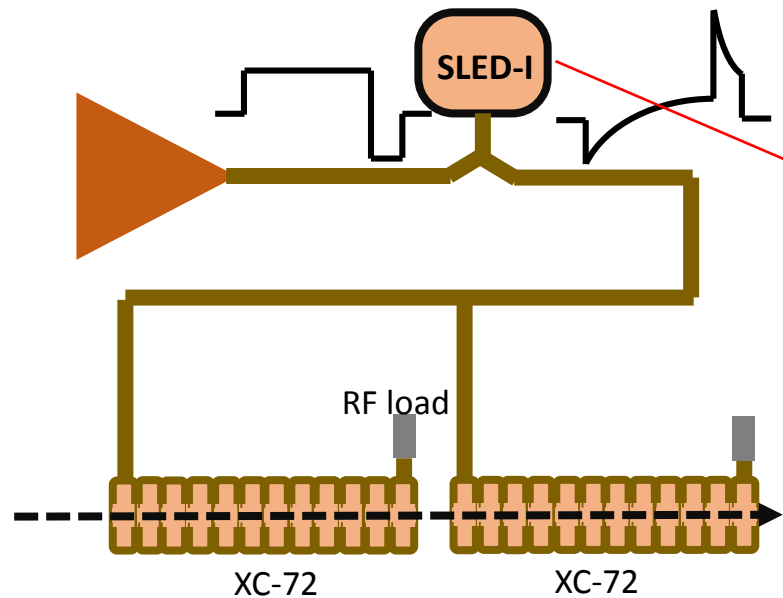
◆ X-band RF system for TTX

➤ X-band Klystron:

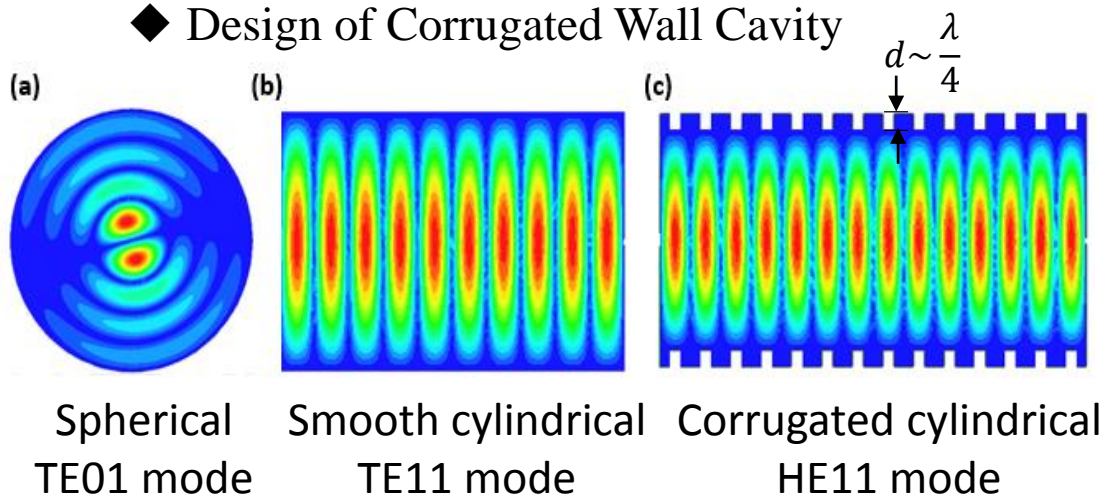
- 11424 MHz,
- 50 MW, 1.5 μ s

➤ Pulse compressor:

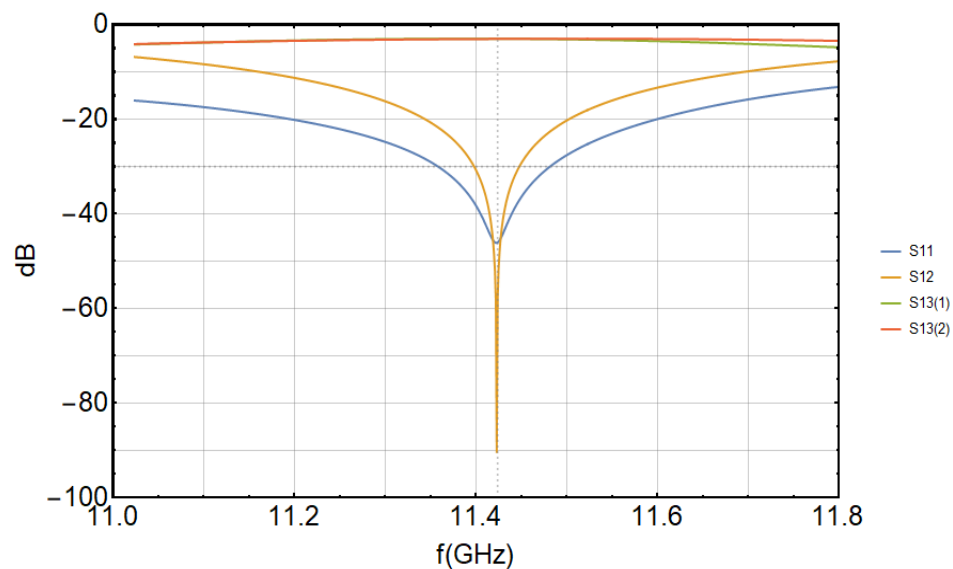
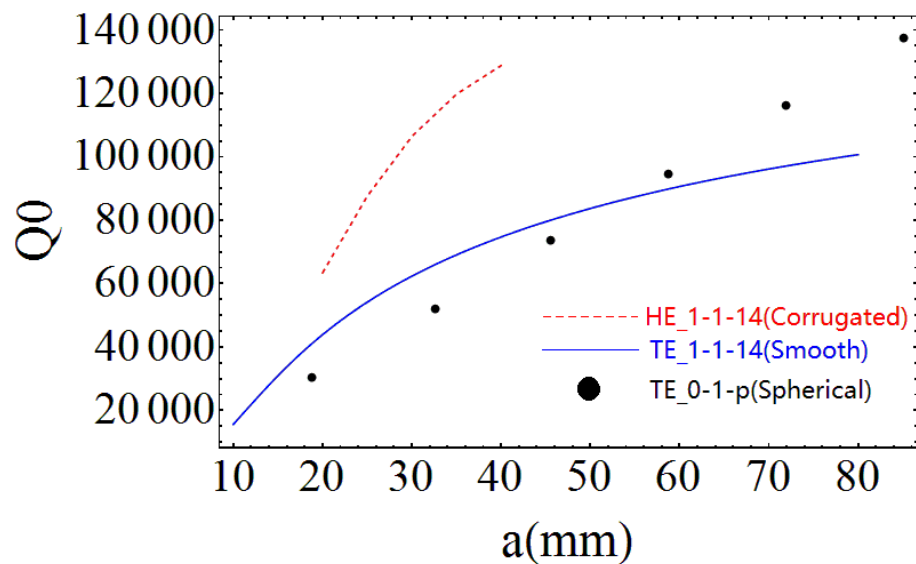
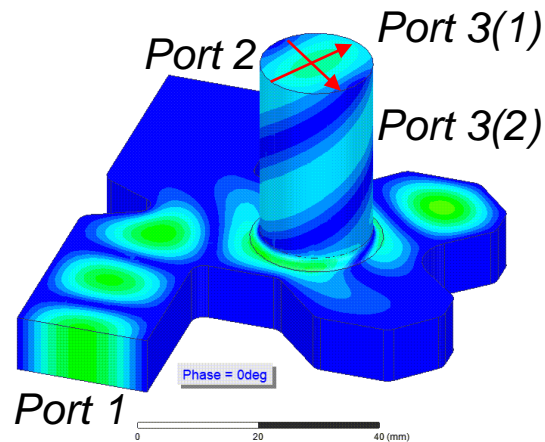
- $Q_0=115,000$
- $\beta = 3.23$



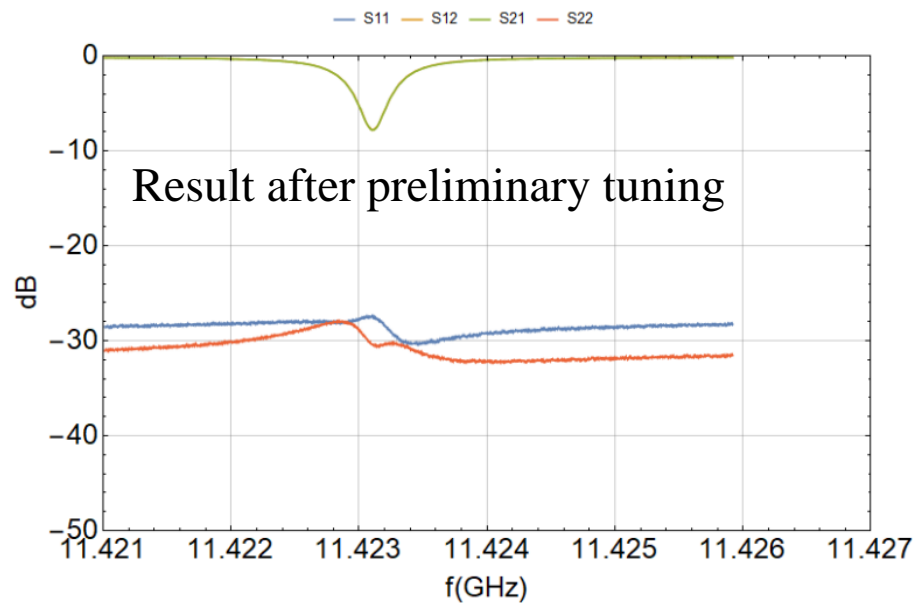
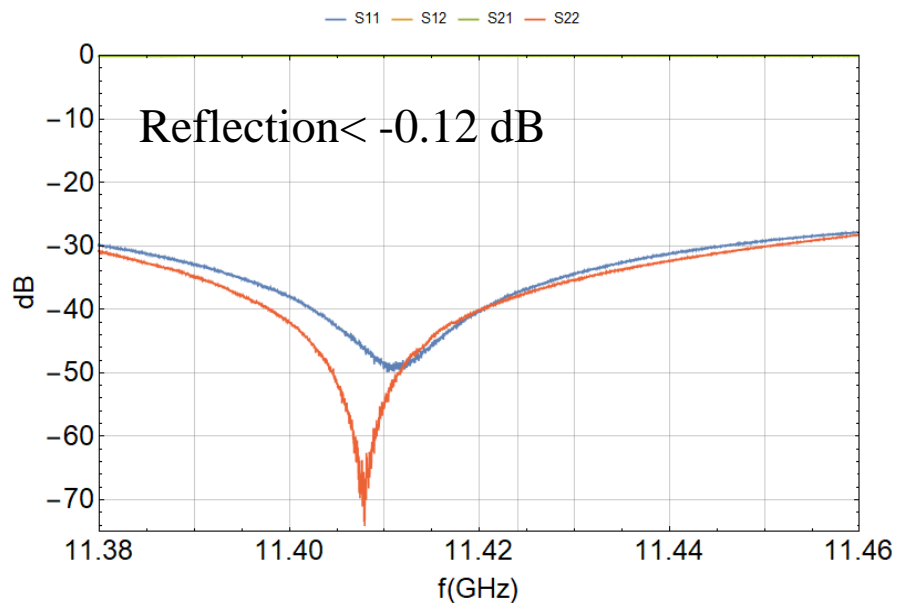
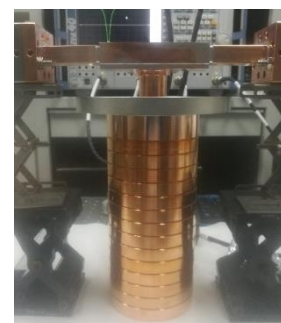
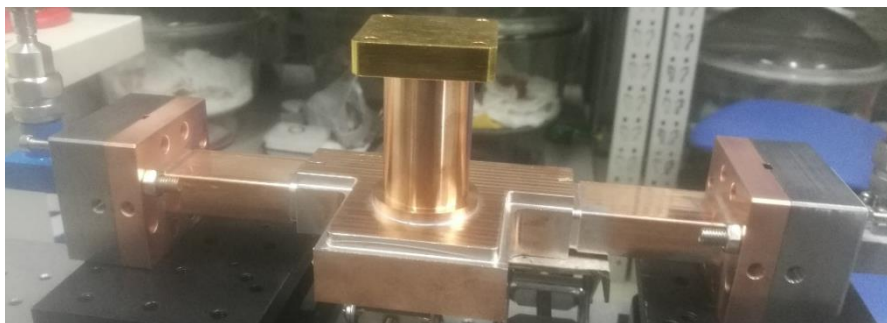
◆ Design of Corrugated Wall Cavity



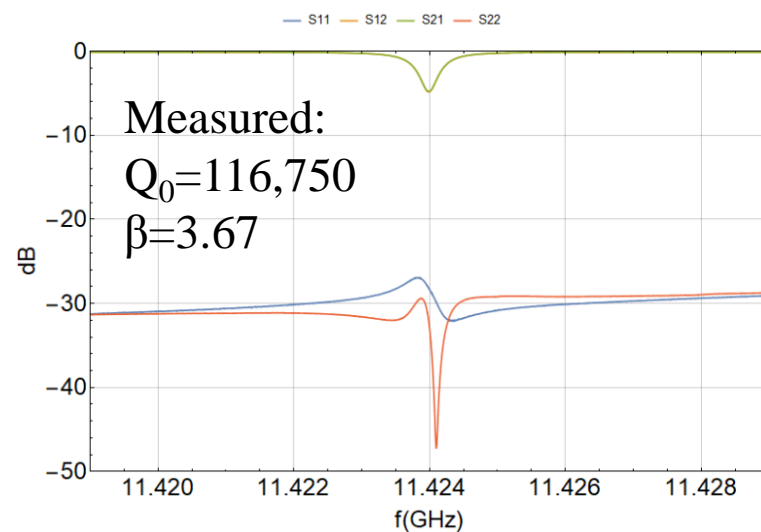
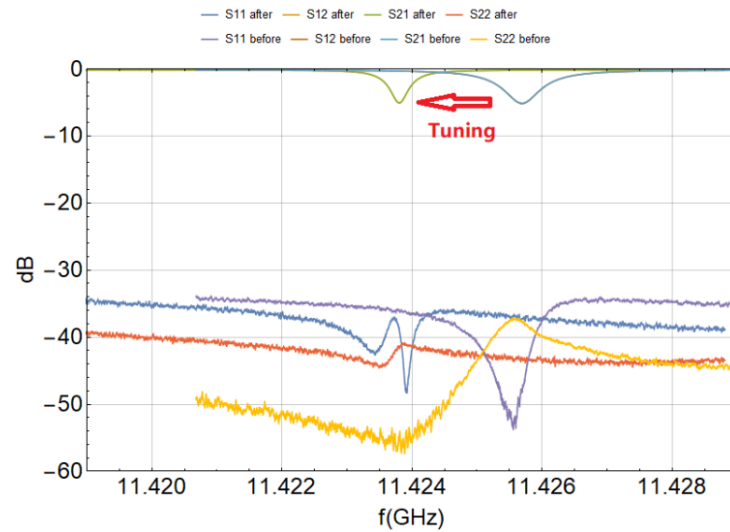
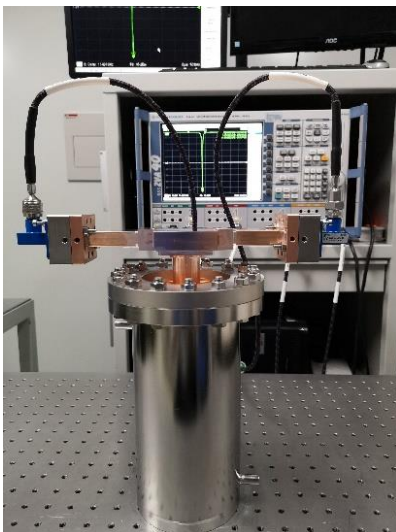
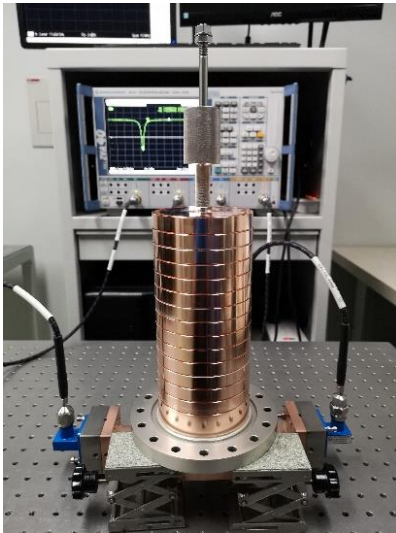
◆ Design of RF polarizer



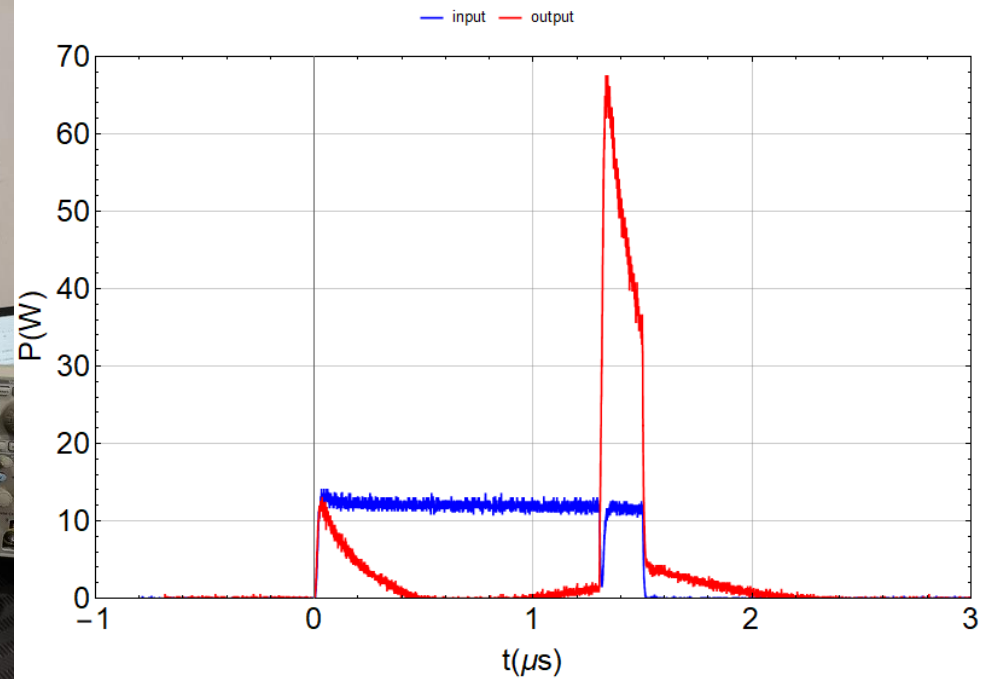
◆ Measurements of RF polarizer and the corrugated cavity



◆ Brazing and tuning



- ◆ Low power test
- Compress the RF pulse from 1.5 μs to 150 ns
- Peak power gain more than 5





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Summary



- The correction cavity chain was tuned and shipped to CERN. It has been installed on XBox2 recently. High power tests will be conducted.
- The pulse compressor based on corrugated wall cavity was low power tested, and the results match the simulation. It will be installed on the X-band high power test facility after the winter vacation.



Thanks for your attention !