LINAC2026 - 33rd Linear Accelerator Conference

TUPO010

RF design of a spherical-cavity-type pulse compressor for muon linac

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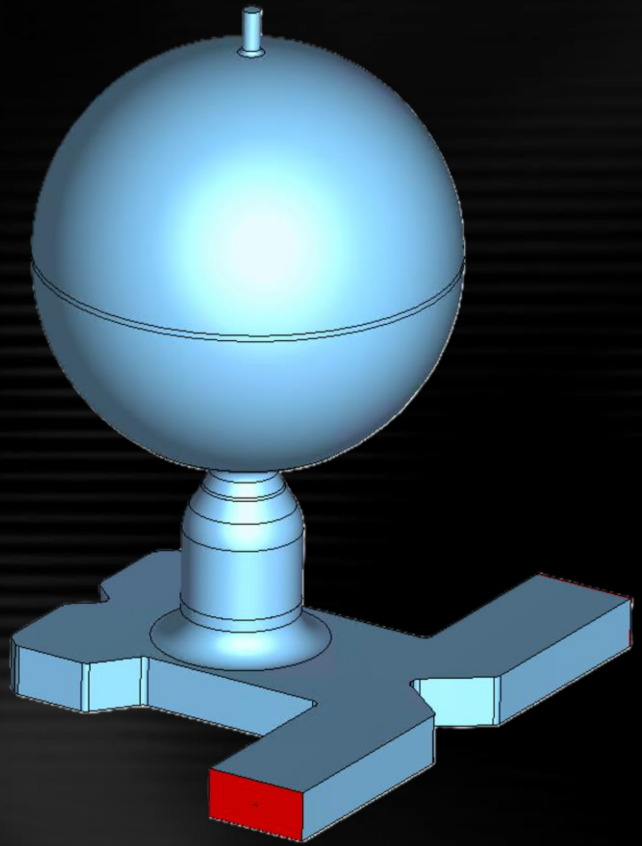

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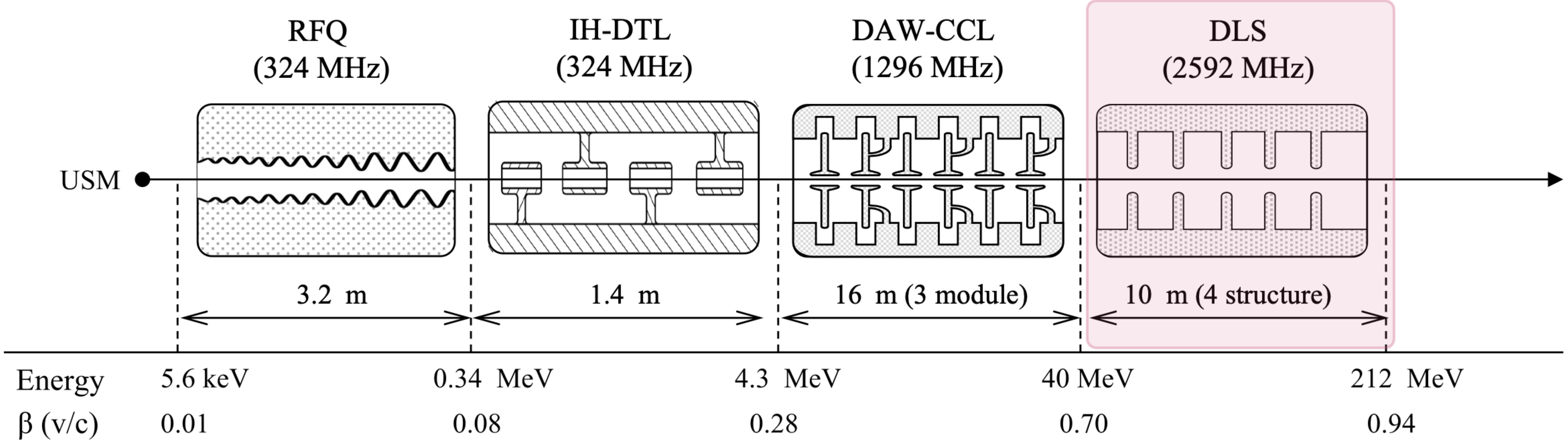
Muon LINAC at J-PARC

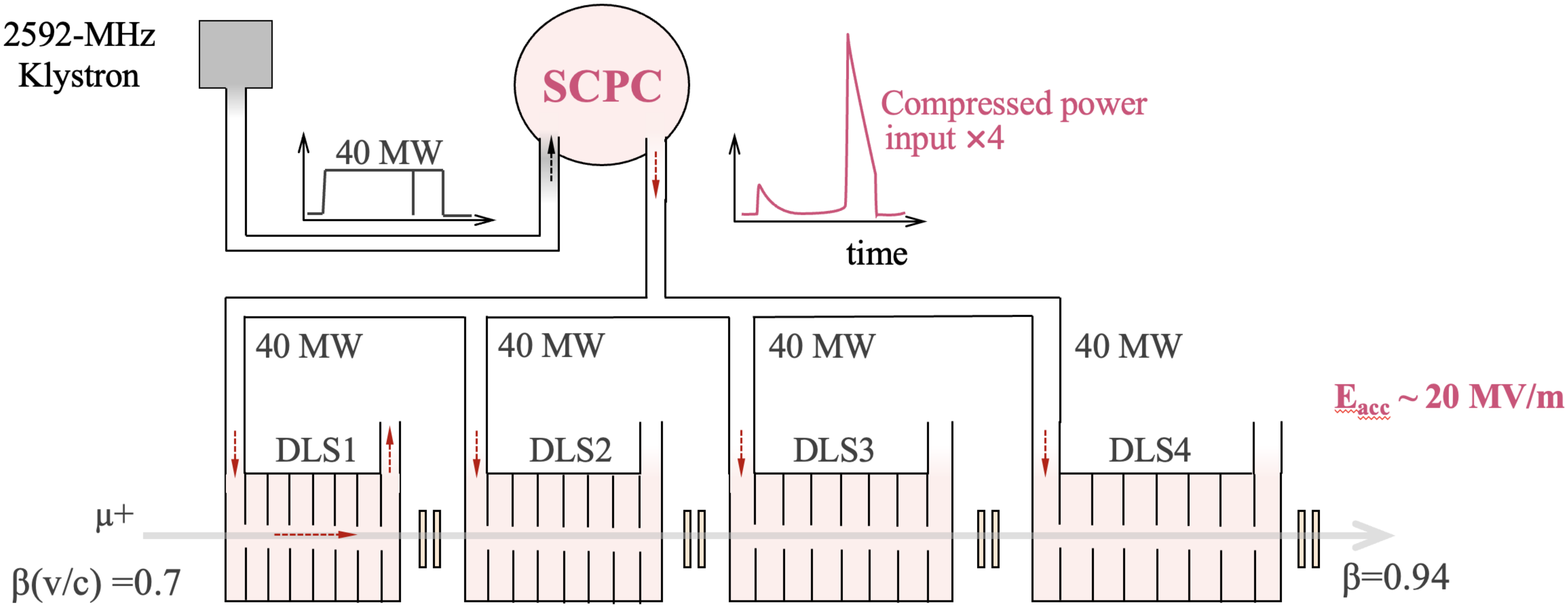
- We are developing a **muon LINAC** in the J-PARC for measurements of the muon anomalous magnetic moment (g−2).
- The four-stage linac will accelerate muons from β = 0.01 ~ 0.94.
- **Disk-Loaded Traveling-Wave structure (DLS)** is used at β=0.70 ~ 0.94.



THIS POSTER'S TOPIC : **How do you drive the four DLS?**

Spherical-cavity-type pulse compressor (SCPC)

- To achieve a higher accelerating gradient at lower cost, we will adopt the SCPC.
- The RF power generated by the klystron is temporarily stored in the **SCPC** and then released as a time-compressed, short-duration, high-power pulse.



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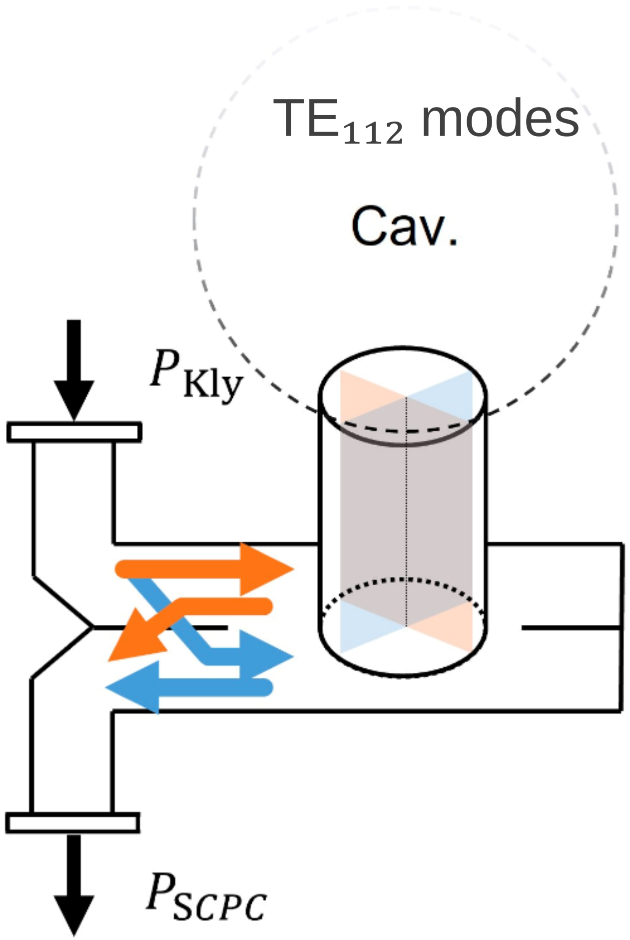
SCPC for muon linac



Y. Bando, Master thesis, 2021

- A single spherical cavity stores RF energy in two TE_{112} modes; the polarizer separates input and output without a circulator.
- The SCPC was pioneered at S-band by Tsinghua University and adopted by KEK for the electron linac.

Parameter	Tsinghua	KEK / SuperKEKB	muon linac
Frequency	2856 MHz	2856 MHz	2592 MHz
Coupling β	8	6.4	6.4
Input pulse width	3.6 μs	4 μs	4 μs
Peak power gain	7 (design)	6 (design)	~6 (ave. ~ 4)
Status	operated	operated	RF design

Objective of this poster: RF design of a 2592 MHz SCPC for the muon DLS

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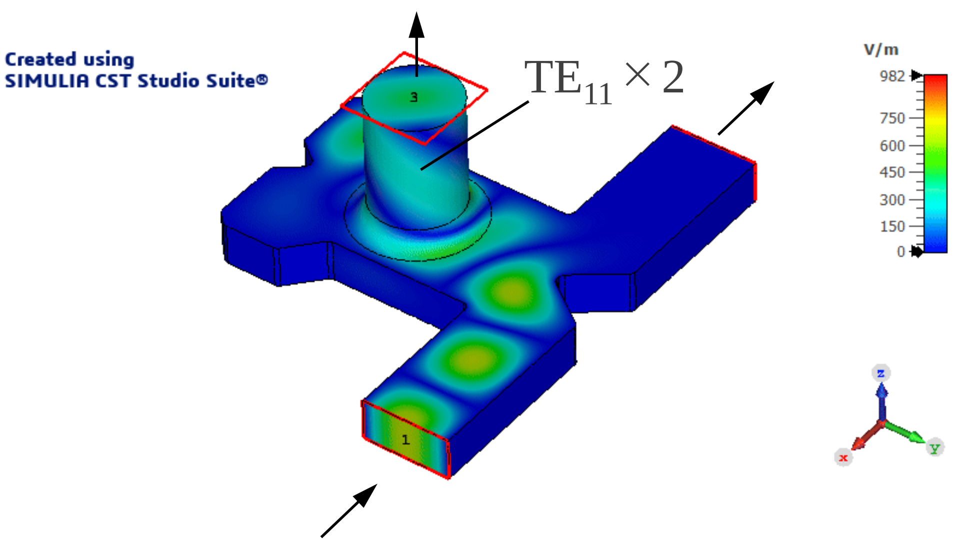
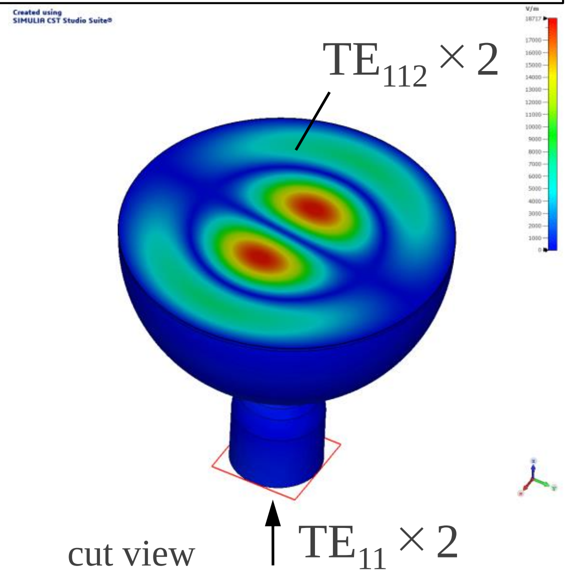
RF design in CST

- The SCPC was designed in CST on a component-by-component basis.
- All dimensions were parametrized, and their impact on the RF performance was investigated, as shown in this poster.
- The coupling β is tuned by the iris radius between the circular waveguide and the cavity.

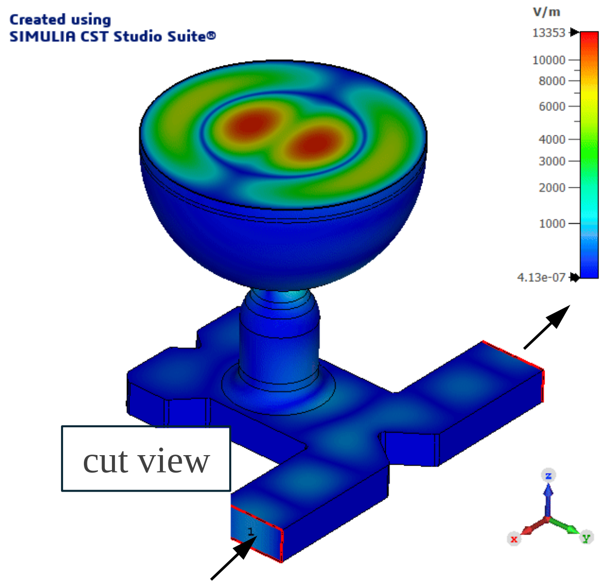
Polarizer



Spherical cavity



Combined



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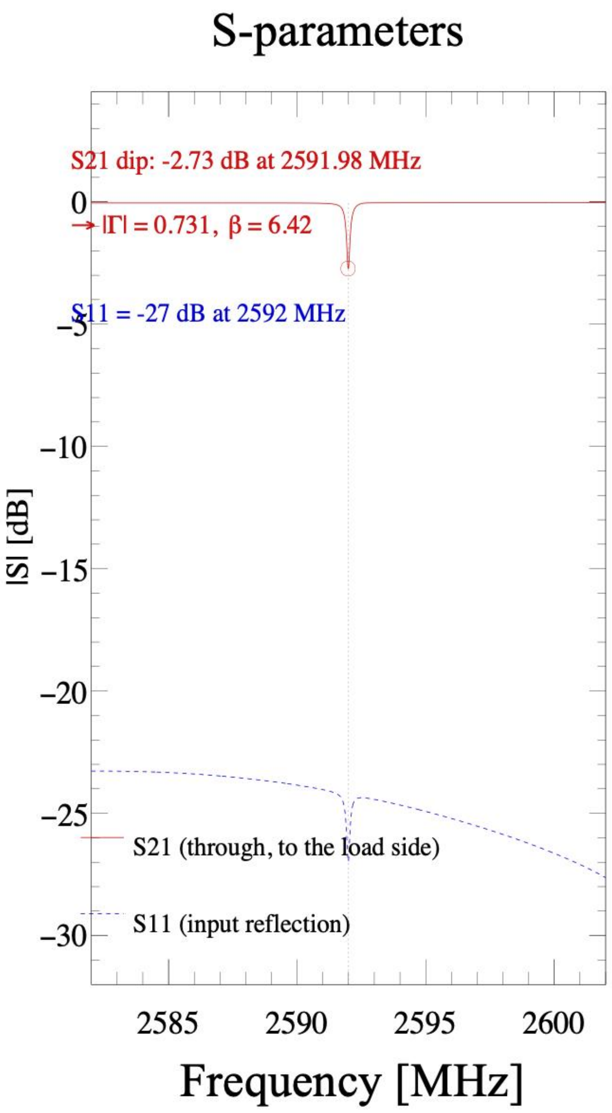
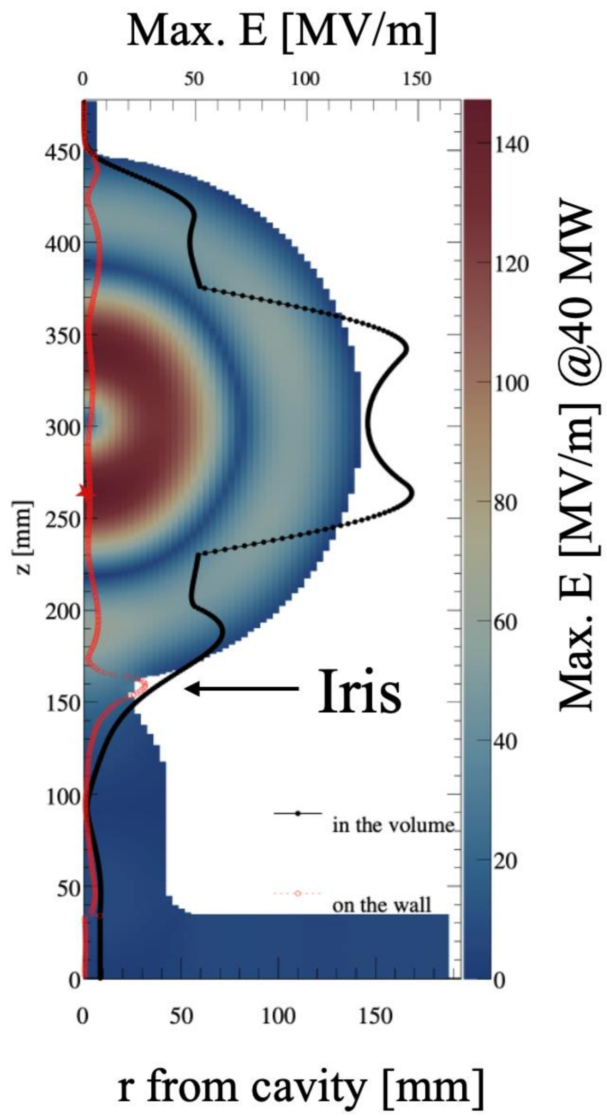
Results





For input RF power of 40 MW

Operating frequency	2592.00 MHz
S21 dip depth	−2.73 dB → β = 6.42
Max surface E (coupling iris)	27.6 MV/m
Max surface H (coupling iris)	202 kA/m
Interior max E / H (on axis)	147 MV/m / 650 kA/m

Design complete — target frequency and β achieved, surface fields below the proven KEK values.

Details in the poster!