Hardware Commissioning with Beam at the European Spallation Source: Ion Source to DTL1

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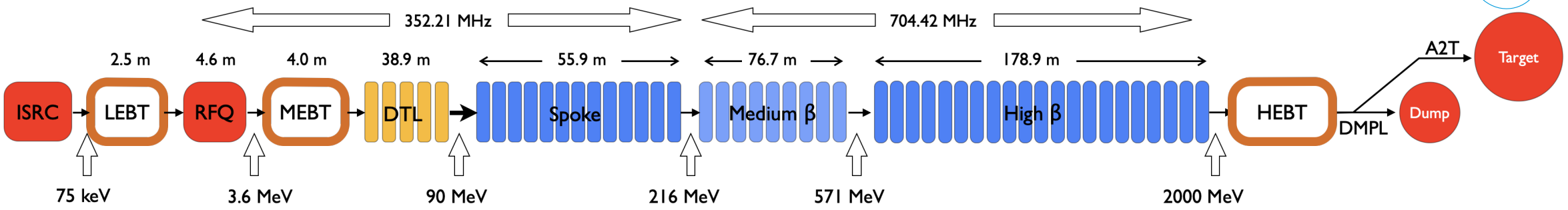
ON BEHALF OF EUROPEAN SPALLATION SOURCE ERIC (ESS)
AND THE ESS ACCELERATOR COLLABORATION

2022-08-30

LINAC2022
LIVERPOOL

Commissioning Phases



Isrc & LEBT

to MEBT Faraday Cup

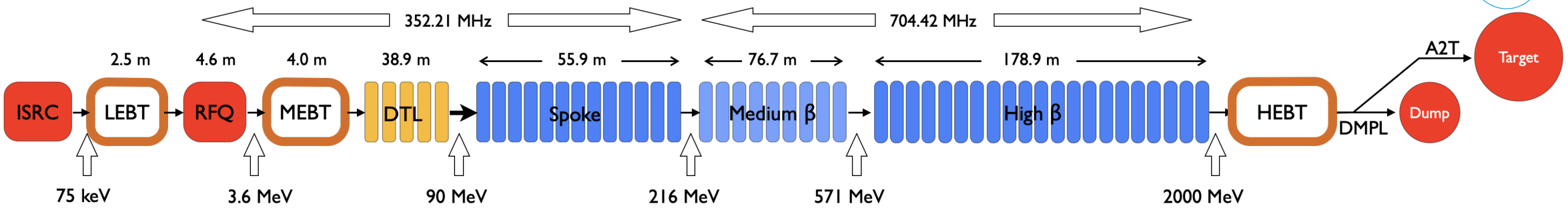
to DTL1 Faraday Cup

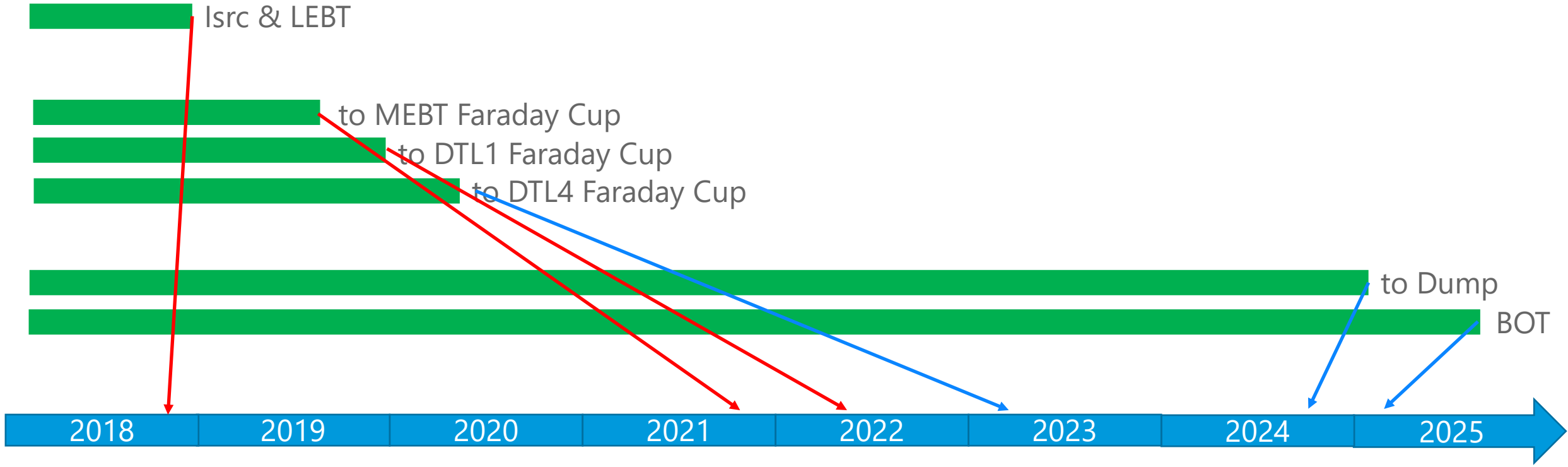
to DTL4 Faraday Cup

to Dump

BOT

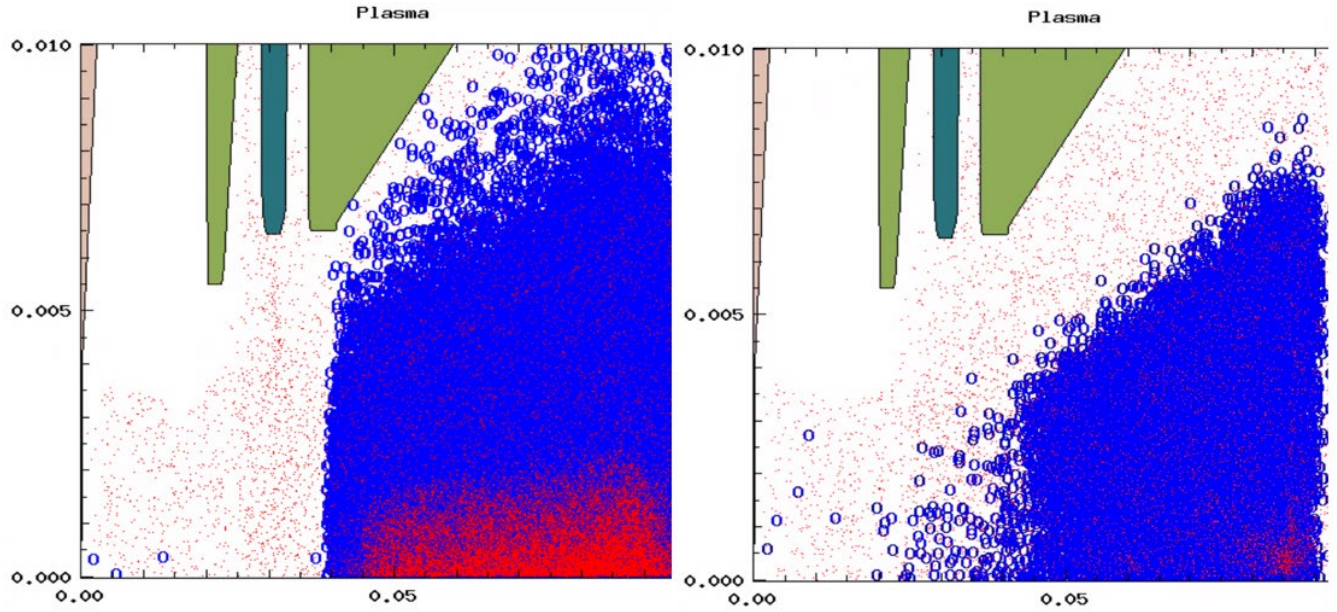
Commissioning Phases

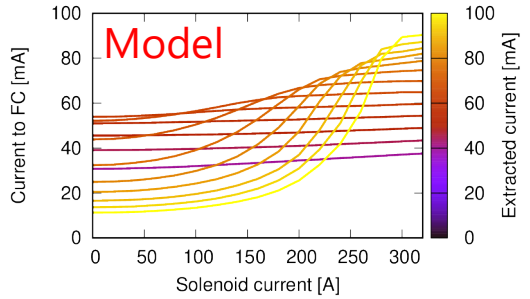


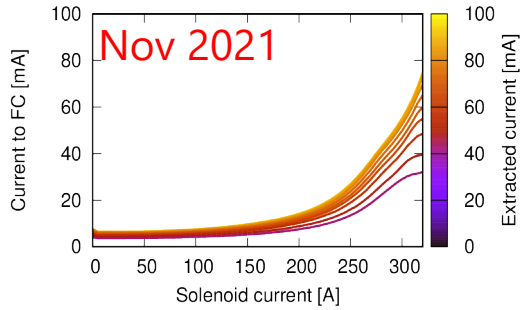


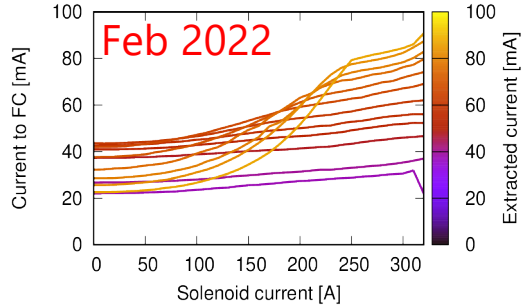
Ion Source & LEBT

- Repeller cable found disconnected
  - Output now matches model well and meets requirements
- Chopper and Iris working well
- High-stability configuration tested
- Construction of test-stand started







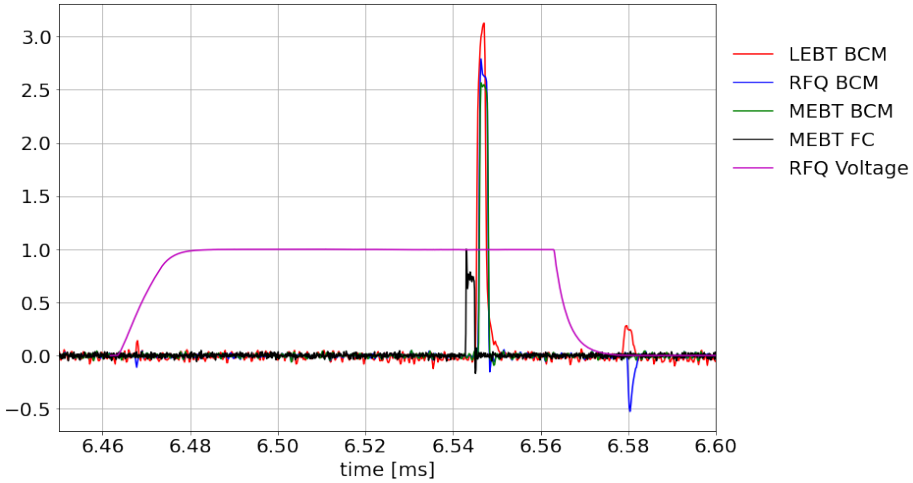


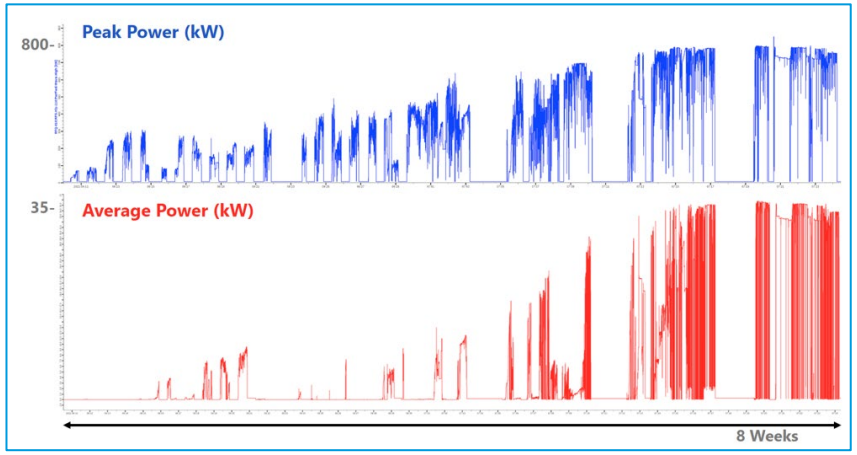
L. Bellan, “Space Charge and Electron Confinement in High Current Low Energy Transport Lines” TUOPA08
L. Neri, “HSMDIS Performance On The ESS Ion Source” THPORI19

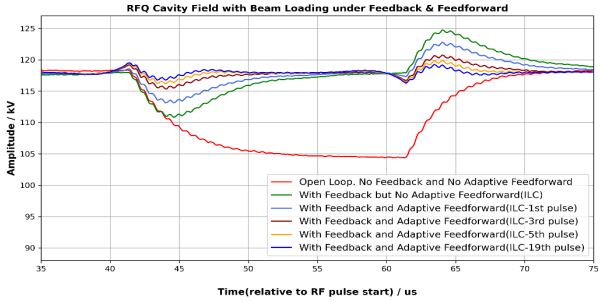
RFQ

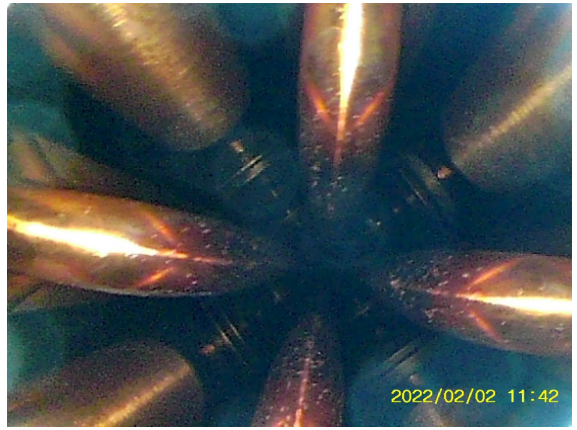
- RF conditioned over 8 weeks in summer 2021
  - 112% nominal field reached
  - 96% availability over 24 hours
  - Stable to ± 1.5 kHz

- First beam on 2nd Dec. 2021
  - 3mA, 5μs probe
  - Nominal 62.5 mA, 20μs achieved
  - LLRF beam compensation development ongoing





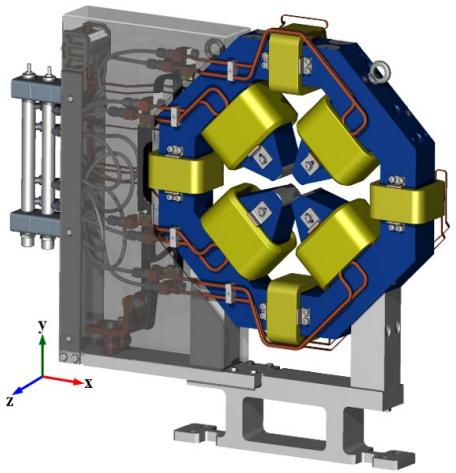


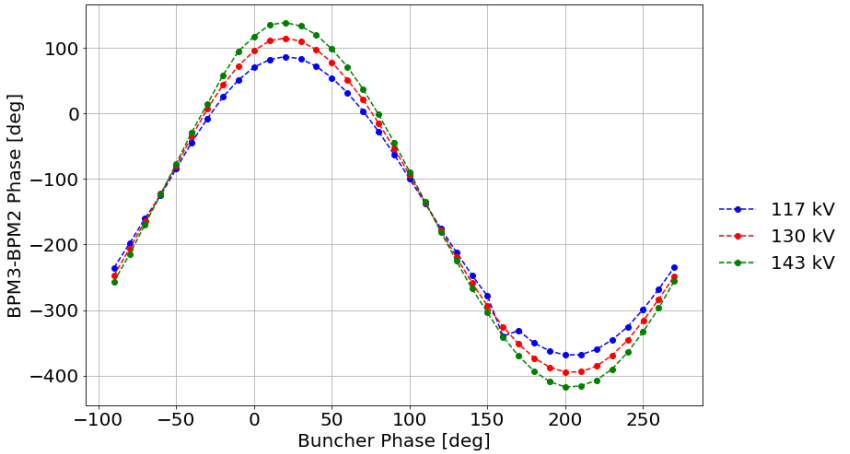


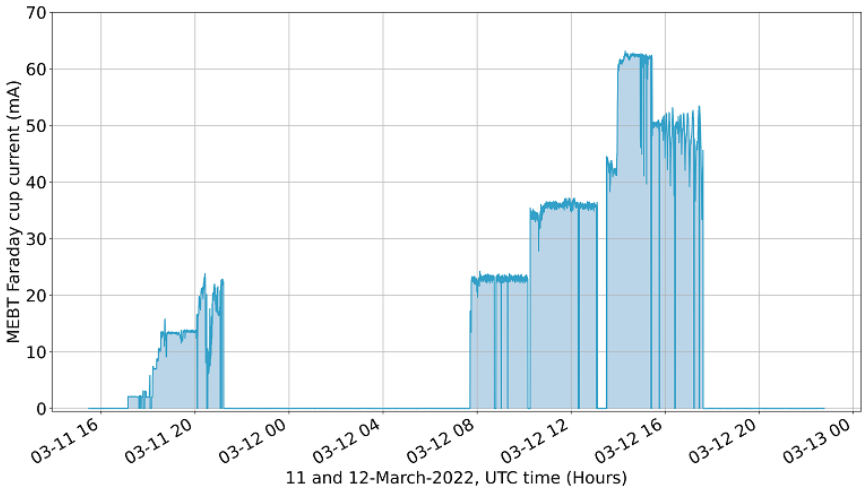
R. Zeng, “RFQ Performance During RF Conditioning and Beam Commissioning at ESS” TUPOPA05
D. Noll, “First Beam Matching and Transmission Studies on the ESS RFQ” TUPOPA04

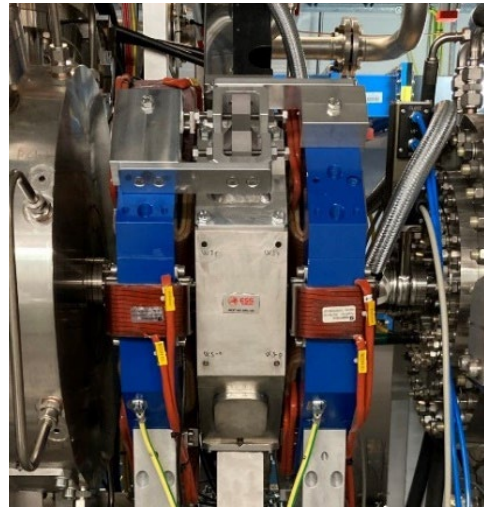
MEBT

- Nominal peak beam current transported
- Quadrupoles and bunchers operate as expected
- Chopper operational
  - Power supply failure being investigated
- Additional alignment brackets added







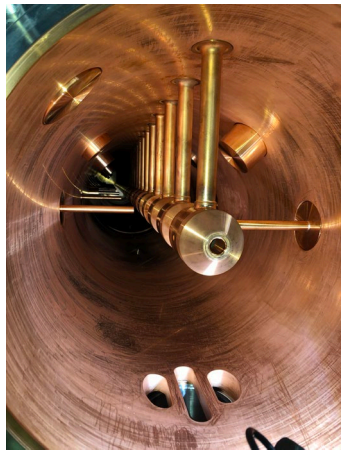


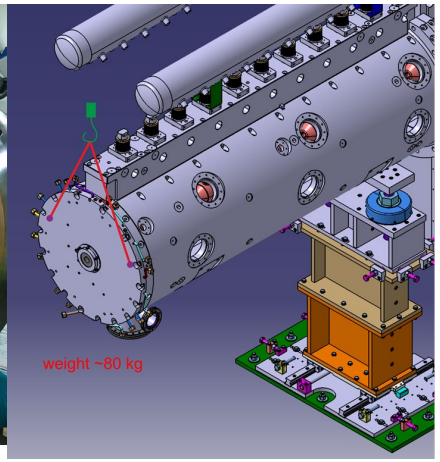
A. Garcia Sosa, “Commissioning of the Medium Energy Beam Transport Line of the ESS Normal Conducting Linac” TUPOJO14

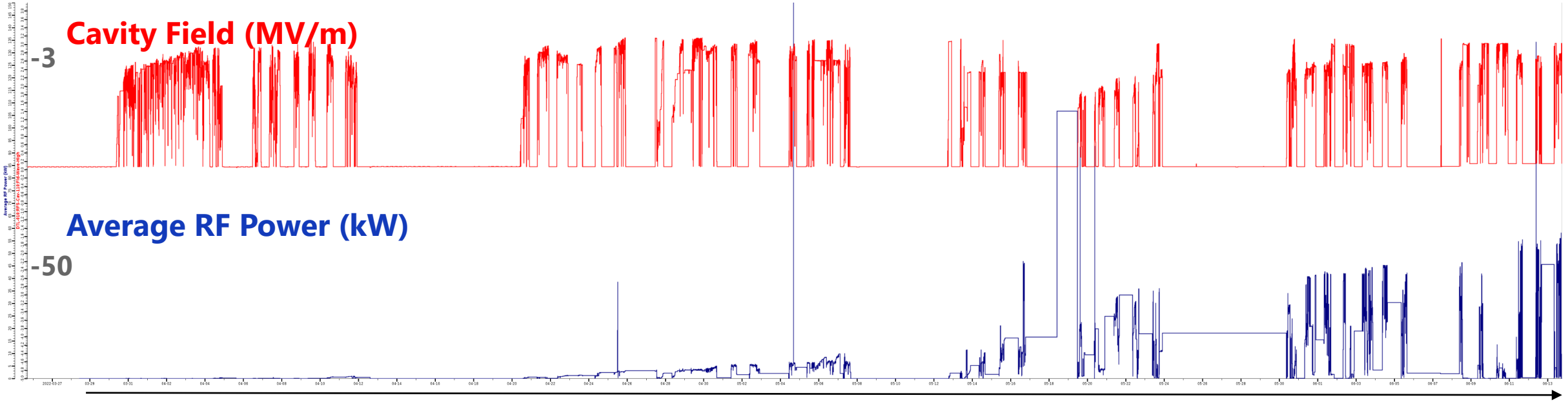
DTL1

RF Conditioning

- Nominal cavity field reached with 10μs pulse in 1 week
- Several weeks of 15hrs/day operation to reach full average power
- Vacuum leak on drift tube with integrated steerer found
  - Tube replaced by removal of end plate before DTL2 installed





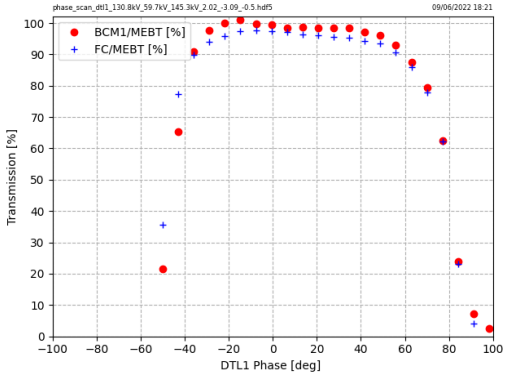


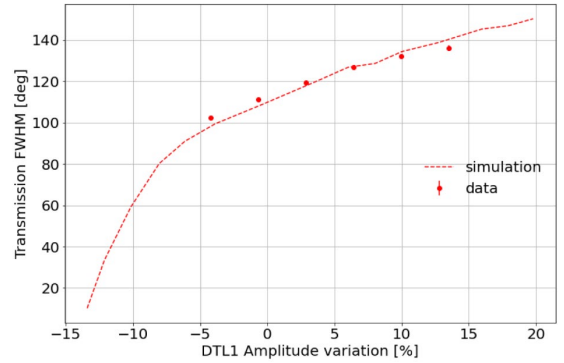
F. Grespan, “High Power RF Conditioning of the ESS DTL1” TUPOJO09

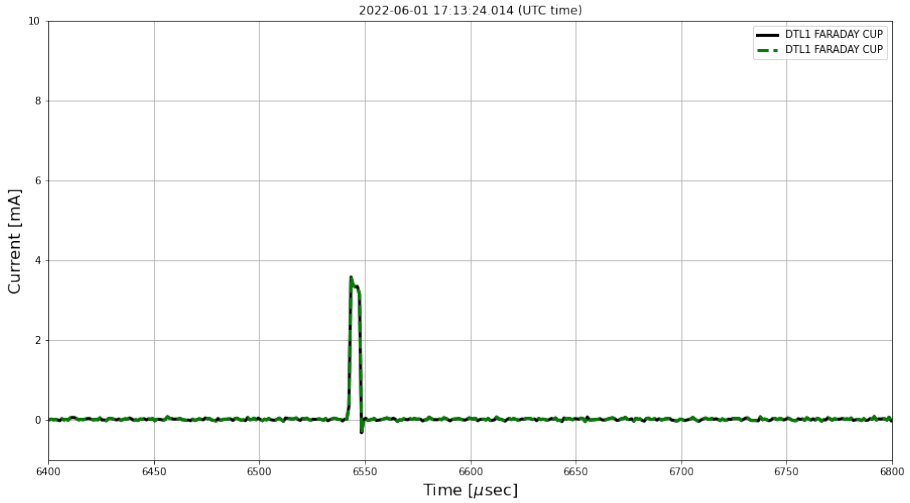
DTL1

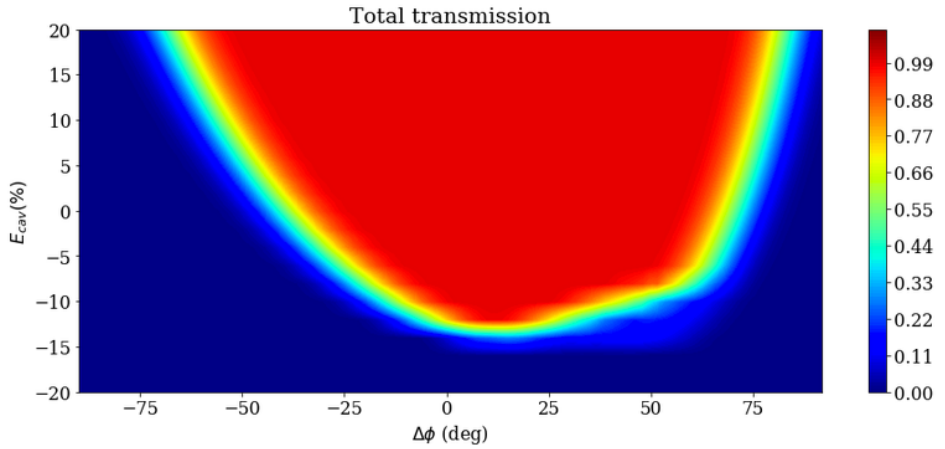
Beam Commissioning

- 62.5 mA, 5µs beam accelerated
- 100% transmission over nominal phase range
- Accelerating field calibration refined with beam
- Polarity of PMQs and Steerers confirmed



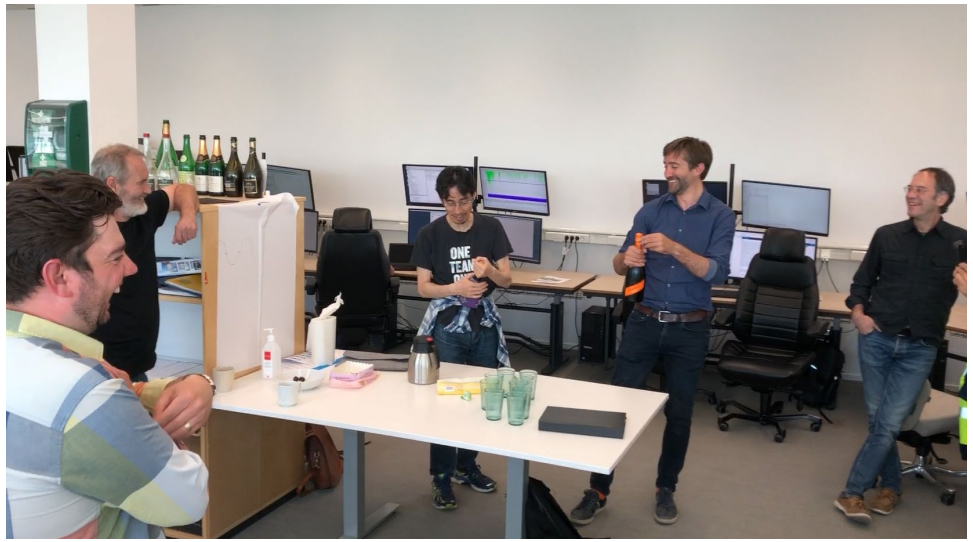






R. Miyamoto, “Beam Commissioning of Normal Conducting Part and Status of ESS Project” MO1PA02

Thank you!



Coming soon…