SRF Technology for Muon Colliders

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Jlab

1st Muon Community Meeting
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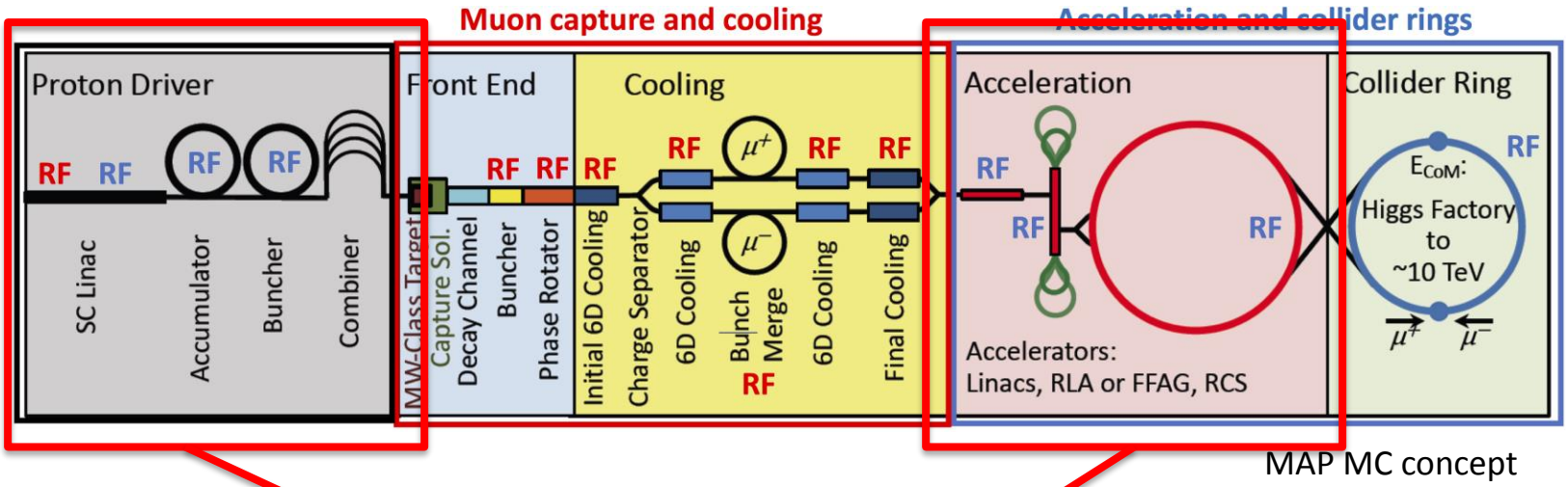
Muon acceleration SRF challenges

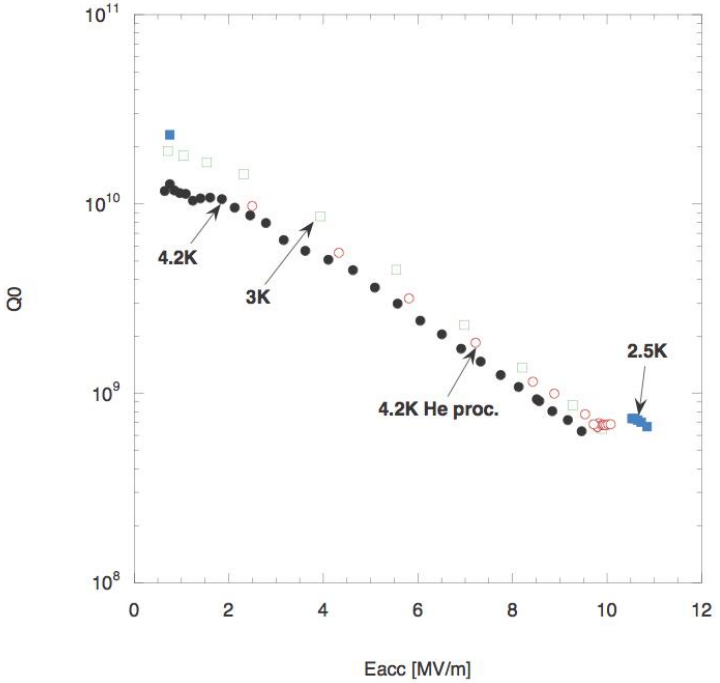


MAP MC concept

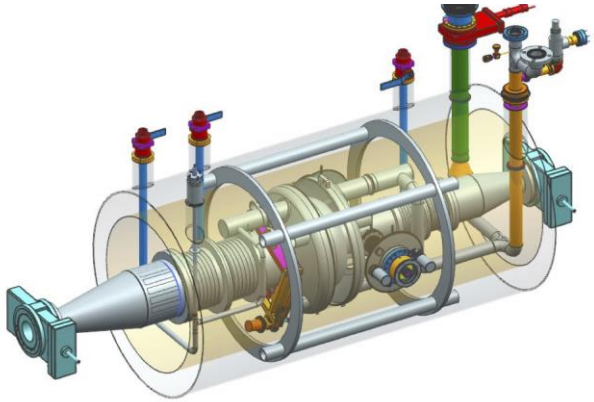
- Proton driver e.g. SNS, ESS, PIP-II
- Fast acceleration - high gradient
- Large transverse beam size - low frequency
  - Depends on 6D cooling
  - 200 MHz >325 MHz, 20 MV/m> 650 MHz 25 MV/m > 975 MHz?
  - Thin film based? > bulk Nb?
- Heavy beam loading in RLA's (few% energy spreadover bunch train?)
- Proximity to high field magnets (solenoids or quads)
- Decay products (~15% muons lost in acceleration)?

Example cavities

Cornell 200 MHz (Nb on Cu)



400 MHz bulk Nb

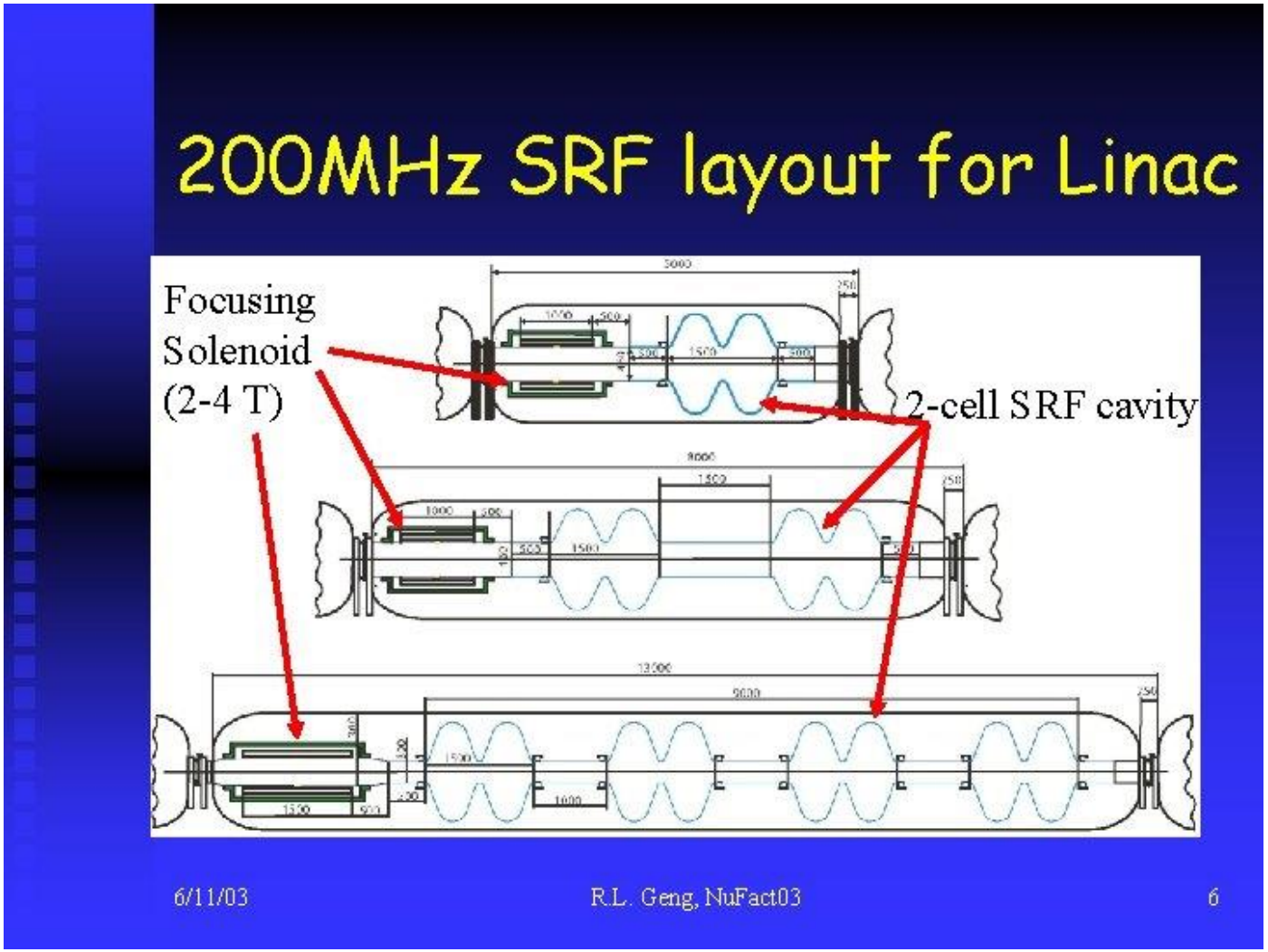


EIC 591 MHz (bulk Nb)

PERLE/FCC 800 MHz (bulk Nb)

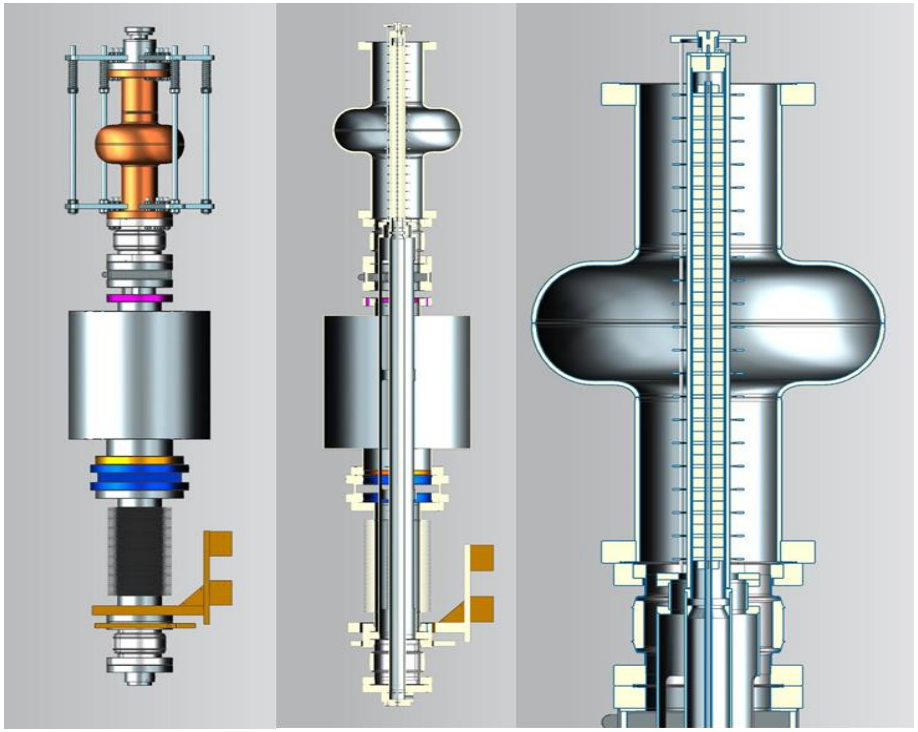
200 MHz cryomdules

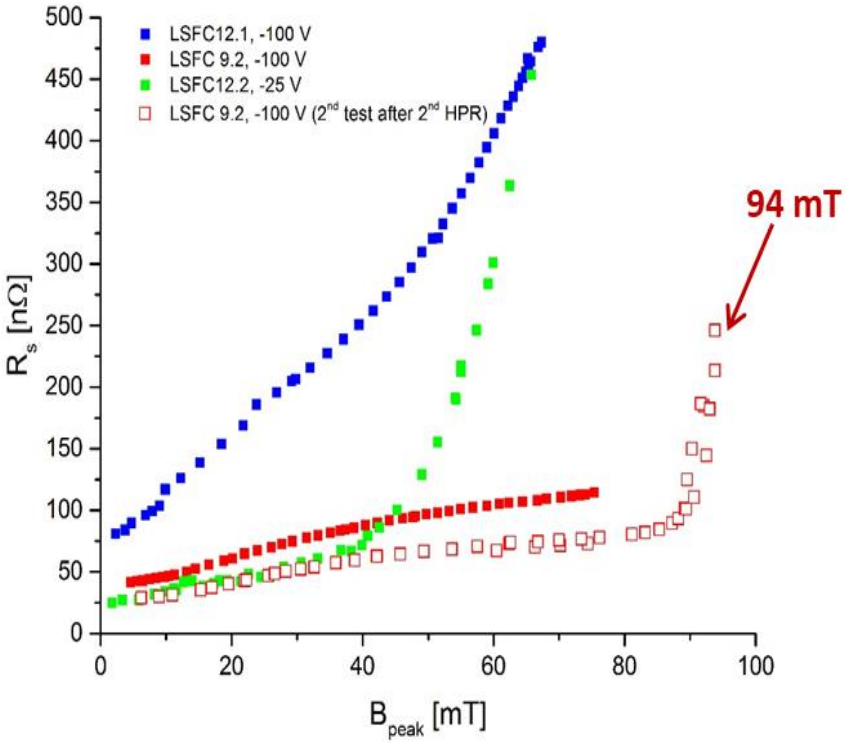
R. Geng



Thin film technology Development

Anne Marie Valente-Feliciano

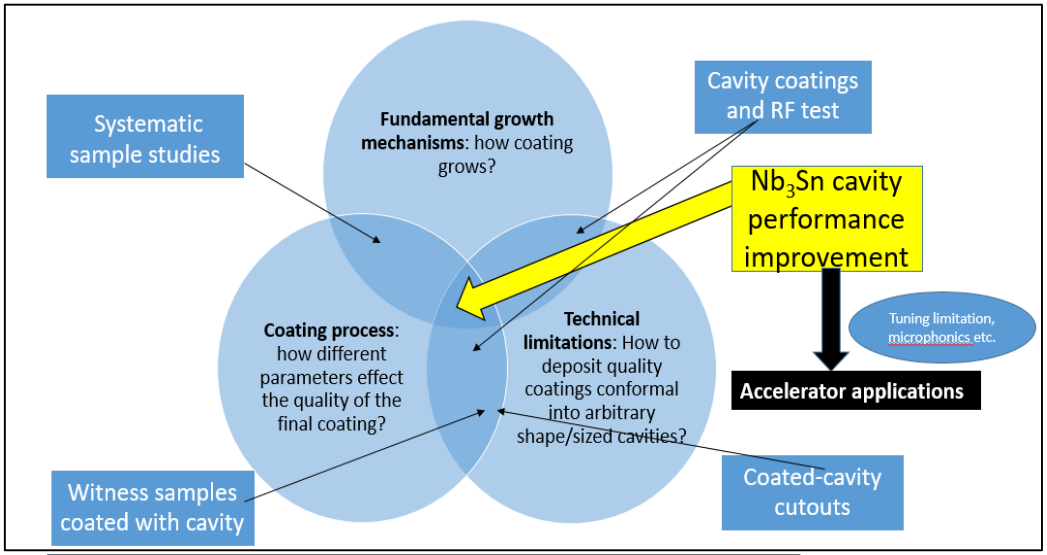


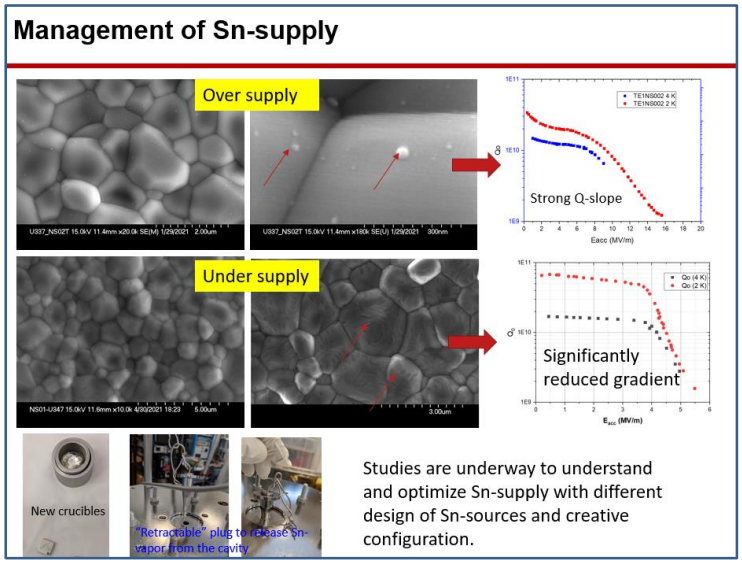


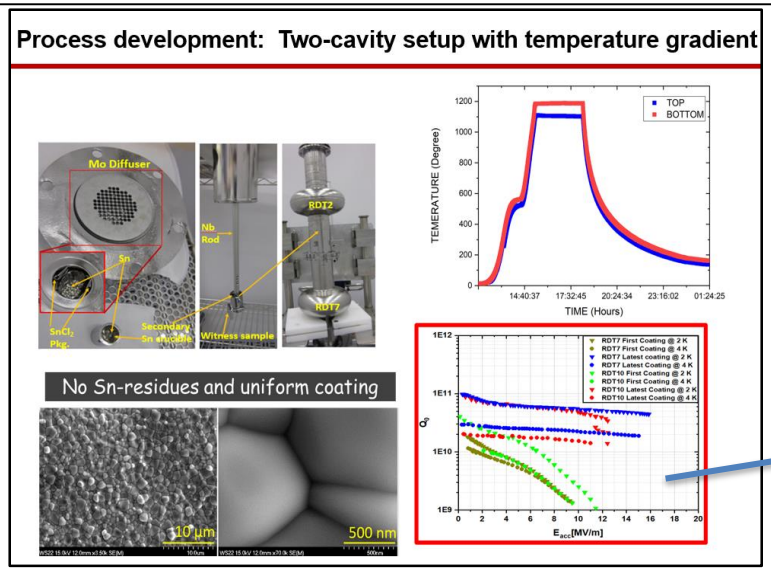
Good progress with Nb on Cu using HIPIMS at Jlab and CERN
Other materials (NbN, Nb3Sn, NbTiN, etc) possible.

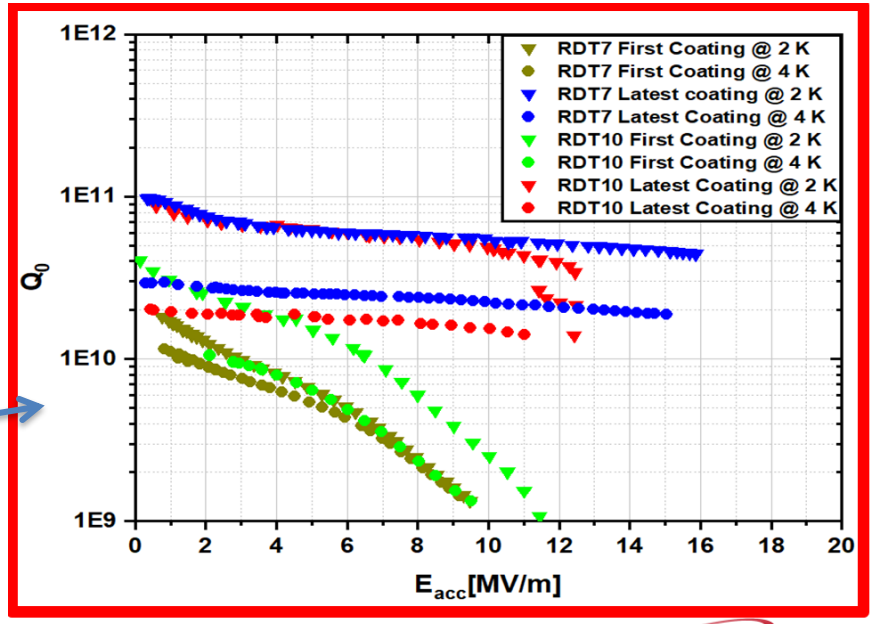
Jlab Nb_3Sn Development

Uttar Pudasaini





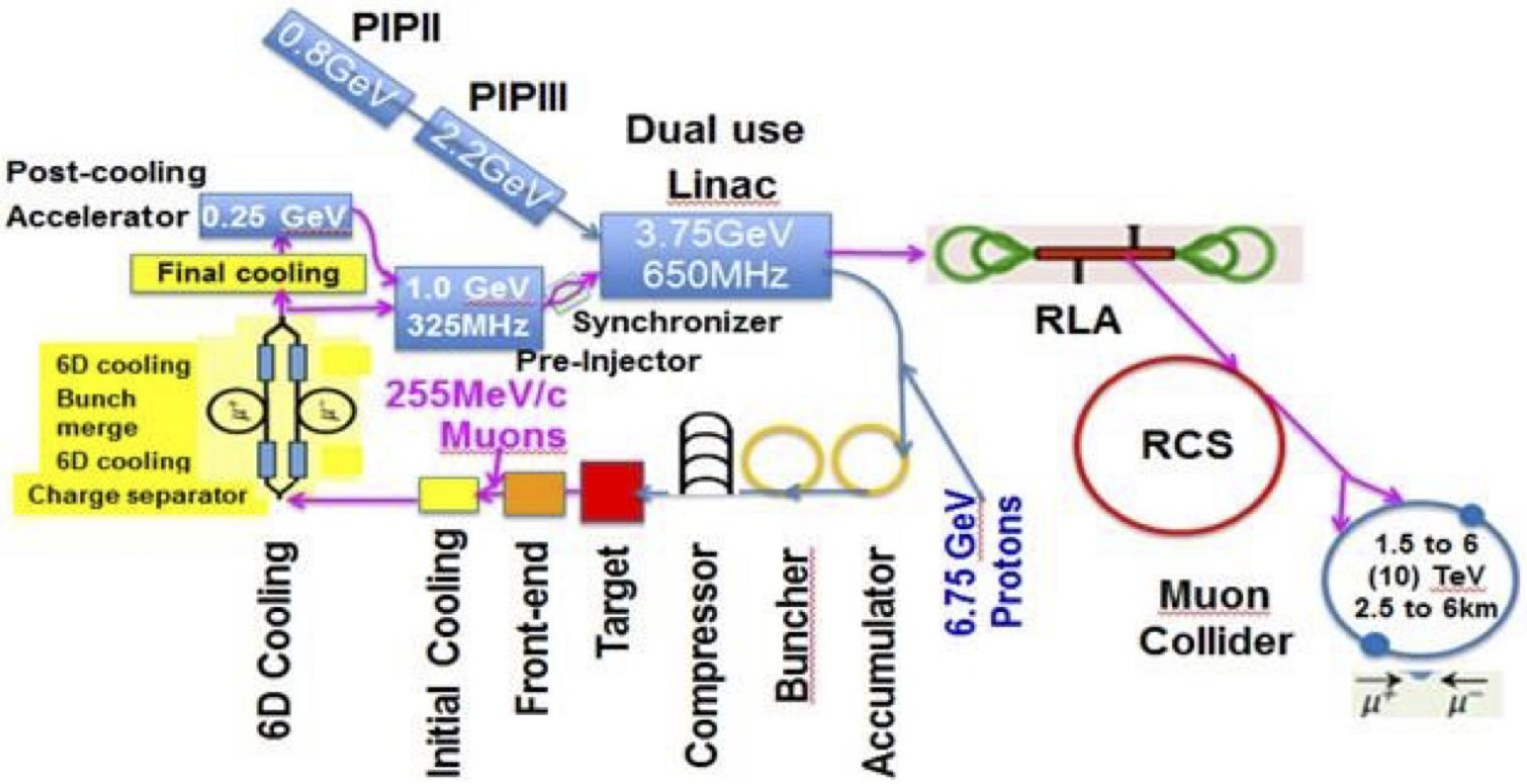




CEBAF five-cell cavities, 952 MHz single-cell cavities, Twin-axis cavity have been coated

Jefferson Lab

Dual use linac?



c) Layout of a multi-TeV Muon Collider

'The NuMAX Long Baseline Neutrino Factory Concept', J-P. Delahaye, C.M. Ankenbrandt, S.A. Bogacz et al, JINST, **13**, T06003 (2018)

More R&D needed

- Proton drivers
- Accelerating structures
  - 325, 650, 975 MHz? 1.3 GHz?
  - LFD, microphonics
  - High stored energy?
- Efficient cryomodules
  - High packing factor (how close can the magnets be to SRF?)
  - HTS magnets?
  - Low cost construction?
- High power RF sources, modulators, components
- New materials
- Beam tests

Conclusions

- Muon acceleration using SRF looks feasible
- Frequency choice strongly depends on 6D cooling
- Bulk Nb, Nb on Cu or other materials viable
- R&D needed (more on cost reduction than viability)
- Test facilities needed

Thank you for your attention!