



Capture and Cooling Working Group Introduction



Science & Technology Facilities Council

ISIS Neutron and Muon Source

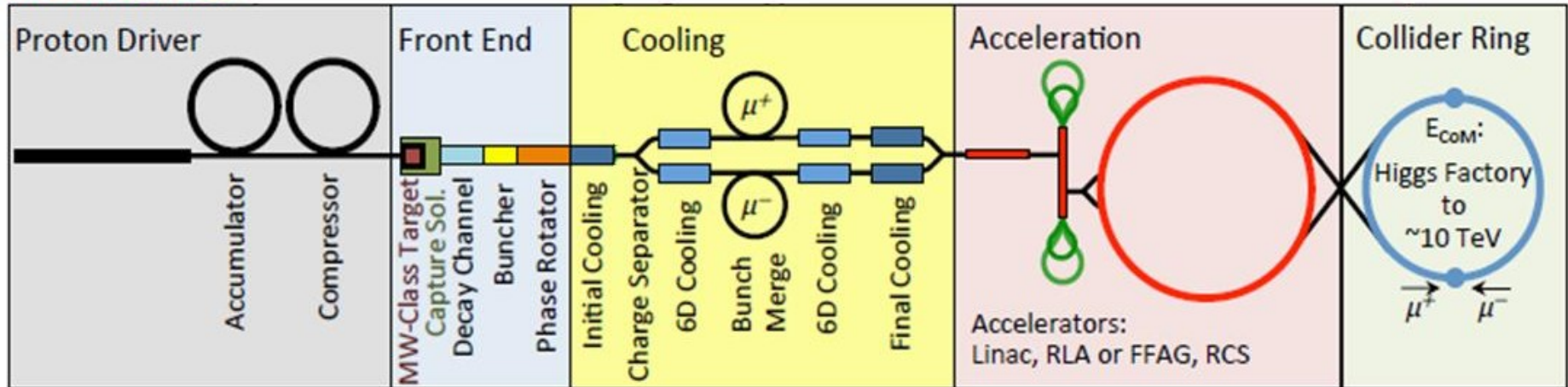
C. T. Rogers

ISIS

Rutherford Appleton Laboratory

Muon Collider Facility

Muon Collider



- Reminder – muon collider facility (proton-based)
 - Protons on target in high-field solenoid → pions, muons et al.
 - **Clean up beam impurities**
 - **Capture muons longitudinally**
 - **Transverse and longitudinal cooling**
 - Acceleration
 - Collider ring
- } Capture and cooling Working group

Job List

- Get hold of lattices
- Check they run and we can reproduce results
- Establish where lattices are missing or incomplete
- Work on improving performance
 - Especially final cooling
- Identify technical issues/risks
- Work on mitigating risk
 - What experimental data/demonstrations do we need?
- Cost optimisation
 - E.g. rings



Lattices, etc

Particle Selection	Scott Berg	Proc. IPAC2014 TUPME022	With Scott
Buncher	Dave Neuffer?	https://map-docdb.fnal.gov/cgi-bin/ShowDocument?docid=4355	?
Phase Rotator	Dave Neuffer?	https://map-docdb.fnal.gov/cgi-bin/ShowDocument?docid=4355	?
Initial Cooling			
HfoFo – gas filled	Yuri Alexahin	https://map-docdb.fnal.gov/cgi-bin/ShowDocument?docid=4377	On docdb
HfoFo – vacuum	Yuri Alexahin	https://map-docdb.fnal.gov/cgi-bin/ShowDocument?docid=4377	?
Charge Separation			
Charge Separation	Cary Yoshikawa	https://www.osti.gov/biblio/1113648	?
6D Cooling			
HfoFo	Diktys Stratakis	https://journals.aps.org/prab/abstract/10.1103/PhysRevSTAB.18.031003	With Rogers
Helical snake	Katsuya Yonehara	https://iopscience.iop.org/article/10.1088/1748-0221/13/09/P09003	With Katsuya
Bunch Merge			
Phase Rotator and tr	Yu Bao	https://journals.aps.org/prab/abstract/10.1103/PhysRevAccelBeams.19.031001	?
6D Cooling			
HfoFo	Diktys Stratakis	https://journals.aps.org/prab/abstract/10.1103/PhysRevSTAB.18.031003	With Rogers
Helical snake	Katsuya Yonehara	https://iopscience.iop.org/article/10.1088/1748-0221/13/09/P09003	With Katsuya
Final Cooling			
Linear Cooling	Dave Neuffer?	https://journals.aps.org/prab/abstract/10.1103/PhysRevSTAB.18.091001	?
PIC	James Maloney?	https://arxiv.org/pdf/1401.8256.pdf	?
Potato slicer	Don Summers?	https://map-docdb.fnal.gov/cgi-bin/ShowDocument?docid=4403	?





Technology challenge - Solenoids

- High field solenoids
 - State of the art solenoids required in many places
 - Transfer of “laboratory-class” solenoid to “accelerator-class” perhaps not so straightforward
- Radiation load
 - Not aware of detailed assessment of effect of muon decays on magnet systems (see above)
- Quench protection
 - Extremely compact magnet schemes throughout the muon source
 - Quench in one magnet likely to induce quench in all magnets
 - Needs care





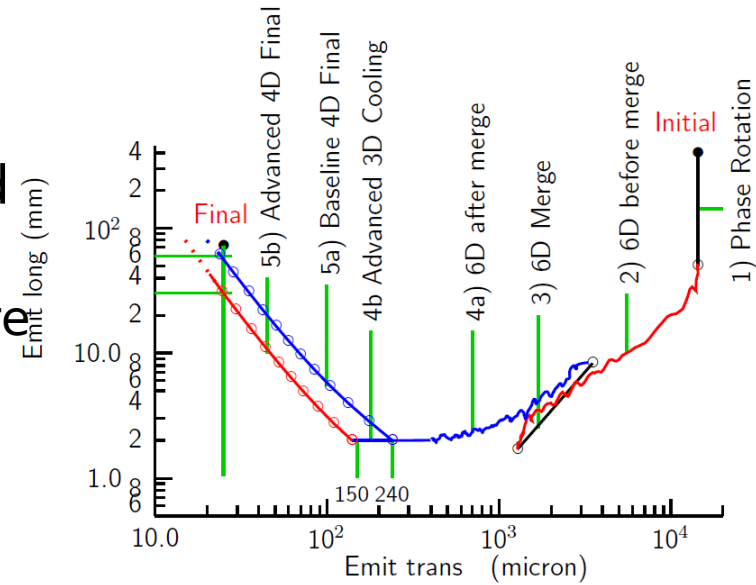
Technology challenge - RF

- RF systems
 - Challenge to operate RF in high field magnet
 - Breakdown → electrons stripped from surface
- Proof-of-principle operation using Beryllium-coated windows
 - Largely seems to suppress breakdown
 - Beryllium is very hard and does not absorb much energy
- Experimental results for high pressure gas filled RF encouraging
 - Demonstrate practicality issues in an accelerator



Technology challenge – Physics

- In addition to general comments above:
- Energy straggling not well constrained by MICE
 - Not clear how good the models are here (literature review perhaps?)
- Intensity dependence issues
- Final cooling just misses requirement
 - Additionally, very high field magnets may be challenging



Organisation

- Mailing Lists
 - <https://e-groups.cern.ch/>
 - muoncollider-facility
 - muoncollider-cooling-complex
 - **Please let me know if there is a problem**
- Working group meetings
 - Propose every 2 weeks
 - Thursday afternoon 16:00 CERN time
 - Alternate with MICE meetings
- Trying to get a wiki/website organised
 - Links to meetings
 - Summary lattice info
 - Links to papers/proceedings
 - Etc



Onwards...

- 16:00** → 16:10 **Introduction** 🕒 10m
Speaker: Chris Rogers (STFC)
- 16:10** → 16:40 **The Muon Accelerator Programme muon capture and cooling design** 🕒 30m
Speaker: David Neuffer
- 16:40** → 17:10 **RF Cavities for muon cooling** 🕒 30m
Speaker: Daniel Bowring (FNAL)
- 17:10** → 17:40 **Analysis of MICE data** 🕒 30m
Speaker: Mr Paul Jurj (Imperial College London)
- 17:40** → 18:00 **Discussion** 🕒 20m

