Advanced Ionisation Cooling

C. T. Rogers on behalf of LoI signees
and
Muon Collider Collaboration

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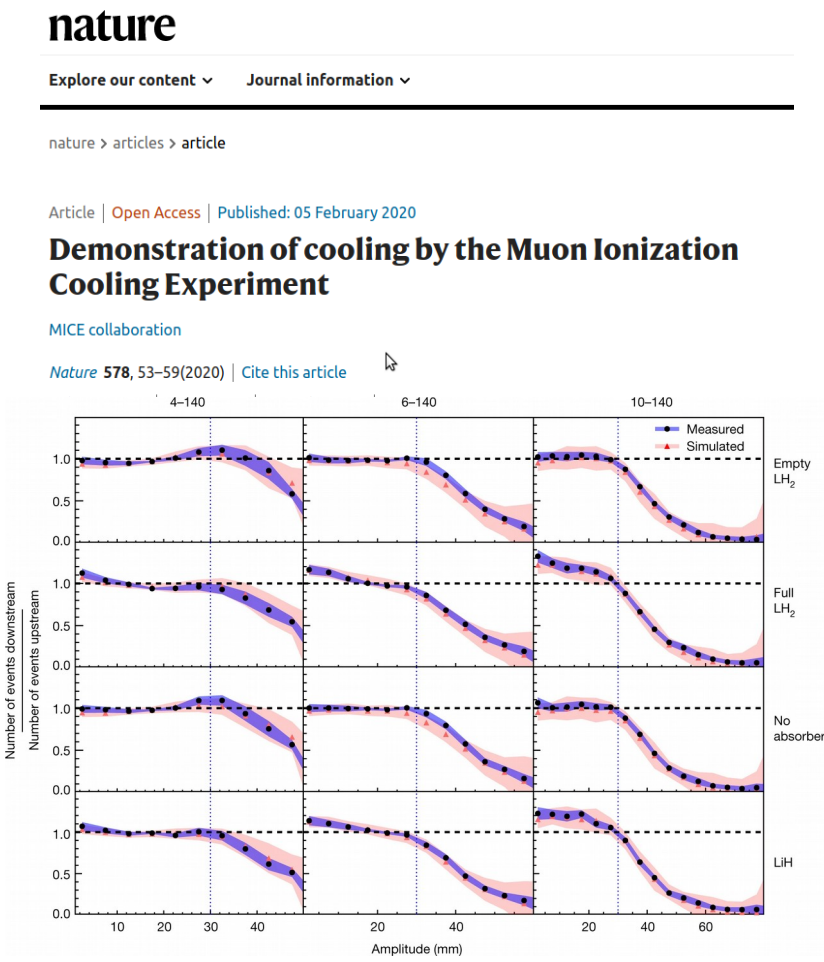
Muon Collider Facility

- **Muon beam physics** highlighted as **high priority initiative** by European strategy update
  - ~10 TeV Muon Collider has **physics reach comparable to FCC-hh**
  - **Footprint** is considerably **smaller**
  - Many technical risks mitigated by previous studies and prototypes
- CERN-led Muon Collider Collaboration formed in June
- Reminder – muon collider facility (proton-based)
  - Protons on target → pions, muons et al.
  - **Transverse and longitudinal cooling**
  - Acceleration
  - Collider ring
- **Ionisation Cooling** is **key technology** to deliver luminosity
  - Needs to work in muon lifetime (2 μs)

Muon Cooling

- **Muon ionisation cooling** has been **demonstrated**
- Now understand potential issues
  - Longitudinal emittance
  - Very high field solenoids
  - “Conventional” intensity effects
  - Absorber heating
  - Plasma loading of cavities
  - Day-to day operation
  - …
- Propose **program** of
  - **Prioritisation** using simulation
  - Hardware **prototyping**
  - **Beam tests** where necessary



Beam Tests

- Single-pass (linac) prototype
  - Measurement of cooling challenging
- Ring prototype
  - Multi-turns → bigger cooling signal
  - May be more expensive
- Muons
  - Difficult to get to high intensities
- Protons
  - High intensities available
  - Energy loss regime is quite different → thin absorbers
  - Nuclear effects may also contribute
- **Phased approach** may be productive
  - Build a ring segment for protons; add more segments for muons
- Aim to **reliably build, and operate**, muon collider source
  - Deliver unprecedented physics reach of the muon collider