Discussion: What synergies exist between experimental programs with high-energy muons?

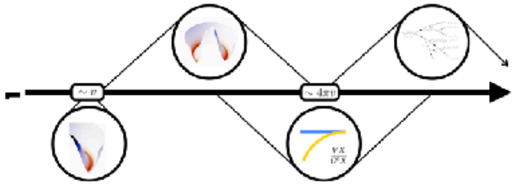
μTRISTAN Physics Possibilities

For the scenario of μ^+ based colliders to make sense,

1. the scaling up of muon cooling technology of g-2/ EDM experiments should be possible within a reasonable time scale such as 5-10 years.
2. For example, for a 3km ring design (2TeV machine), it should be less expensive than ILC/C^3.
3. The facility should support various other muon/ hadron programs.

How realistic?

The Broad Physics Case of a Muon Collider



- Some theory to-do's:
  - Electroweak radiation at high energies.
  - Prospects for electroweak restoration, electroweak radiation measurements.
  - Tests for electroweak symmetry beyond perturbative examples.
  - Neutrino physics potential in high-energy collisions.
  - Fully map connections to low-energy experimental results.
  - ...
- Synergistic theory needs of other experiments?
- Forward muon detector development relevant to other experiments?

Challenges & Synergies of detectors at a high-energy muon collider

Solid-State Detectors (TF3/DRD3, RDC3)
- Radiation-hard silicon detectors with O(10ps) timing resolution
- Integrated or hybrid design

Calorimetry (TF6/DRD6, RDC9)
- High-granularity (transverse and longitudinal); good radiation hardness
- good timing resolution and low integration time (esp. ECAL)
- Scintillator or Silicon-based sampling; Crilin: semi-homogenous w/ SiPMs readout

Gaseous Detectors (TF1/DRD1, RDC6)
- Mostly Muon spectrometer: micromegas, GEM, etc.. focus on good timing resolution, sustainable gas mixtures

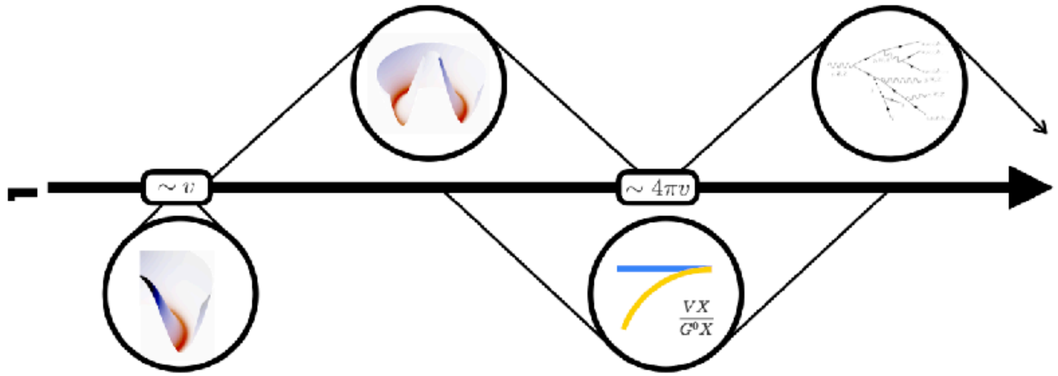
Photon-Detectors and PID (TF4/DRD4, RDC2)
- Less explored so far, but PID can offer additional physics oportunities

Electronics (TF7/DRD7, RDC4)
- Radiation-hard ASIC design (HL-LHC levels)
- Small feature size for more complex on-chip processing (tracker, calo?)

Trigger and DAQ (RDC5)
- Triggerless readout requires large real-time data handling

Detector Mechanics (RDC10)
- Lightweight structures, nozzle support design,

The Broad Physics Case of a Muon Collider



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N. Craig

Materials for discussion

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Challenges & Synergies of detectors at a high-energy muon collider

Muon Collider Detector R&D

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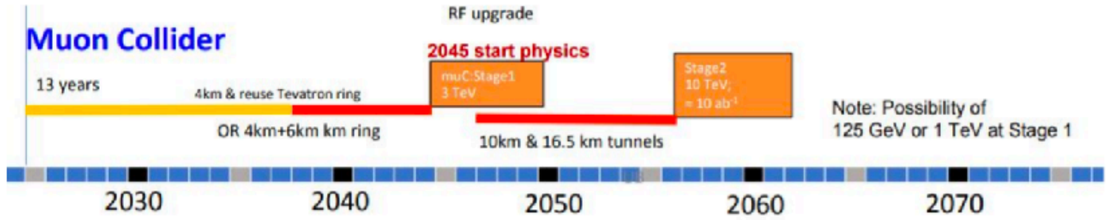
Timelines

A technically-limited timeline would see a high-energy muon collider in 2040s
A full TDR needs to be produced by end of the 2030s.



R&D program and an accelerator-demonstration facility in the shorter term

add r&d and demonstrator timeline

Need to take advantage of synergies among these programs and other areas of HEP and beyond for detector R&D.

S. Pagan Griso