A Possible Option for a Flexible and Affordable MUCOOL Facility

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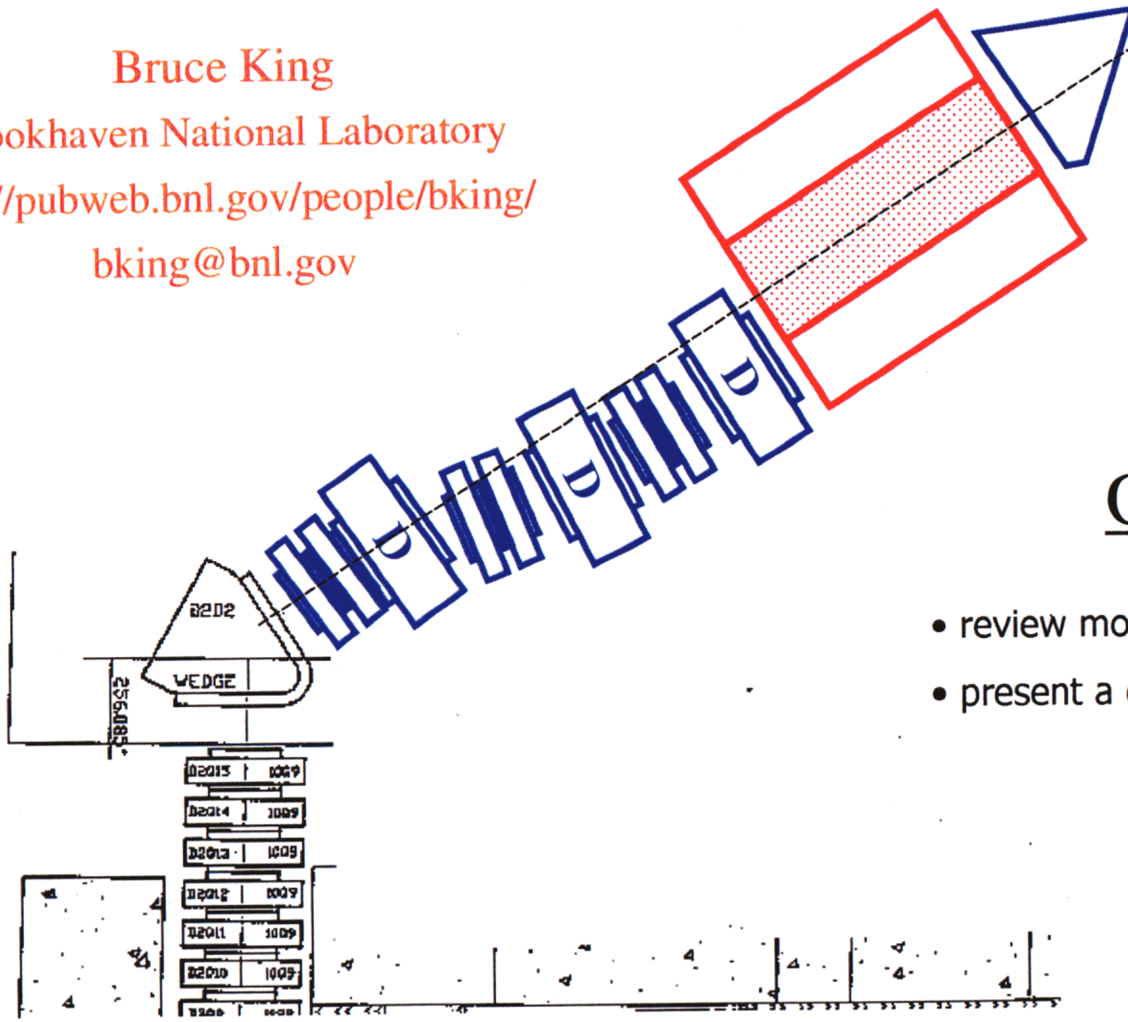


Outline

- review motivation for a MuCOOL facility
- present a conceptual design scenario

Acknowledgments: thanks to Al Pendzick, Charlie Pearson and Steve Peggs for engineering guidance.

A MuCOOL Facility: What and Why ?

Its purpose is to perform ionization cooling experiments and, mainly, to bench-test and measure the performance of cooling apparatus. The useful lifetime of the facility could be as long as a decade.

It consists of 3 parts:

1) a muon test beam

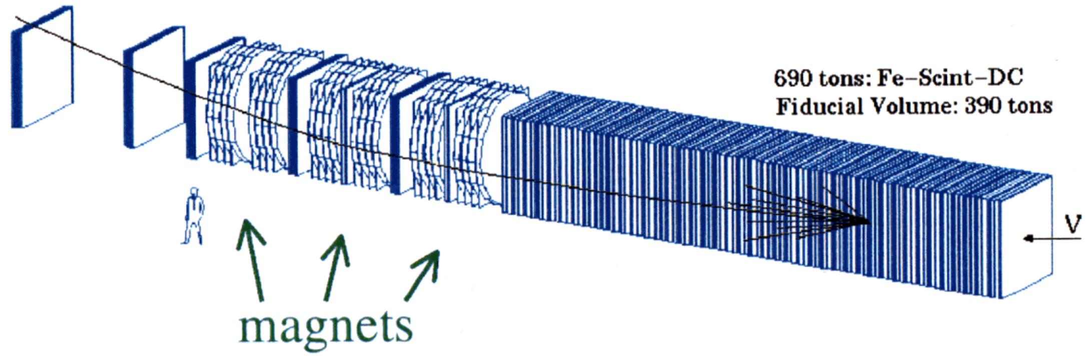
2) a work area for "plugging in" cooling apparatus

3) track-by-track beam instrumentation, upstream & downstream of the cooling apparatus

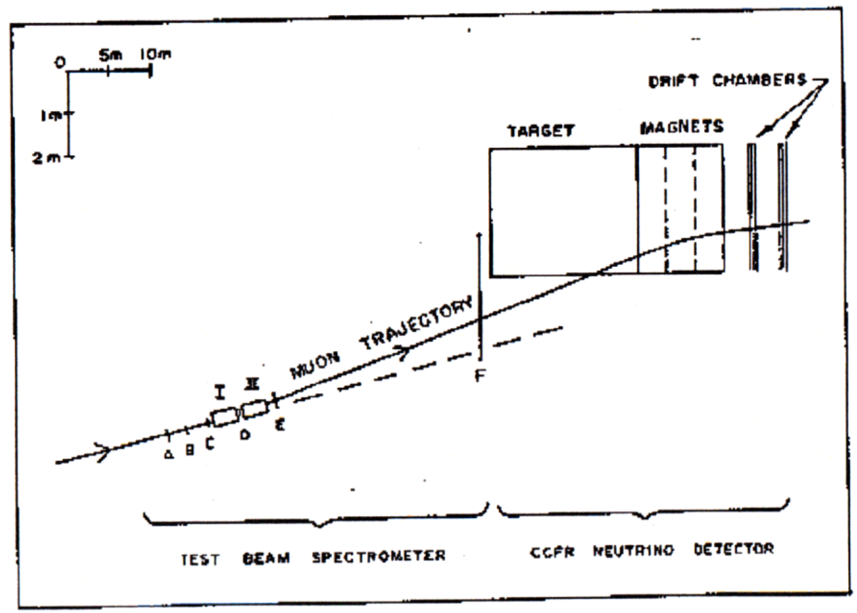
HEP Experiments often calibrate apparatus using test beams ...

An example is the calibration of the muon spectrometer for the CCFR/NuTeV neutrino detector.

LAB-E Detector – Fermilab E815 (NuTeV)



The muon test-beam set-up:

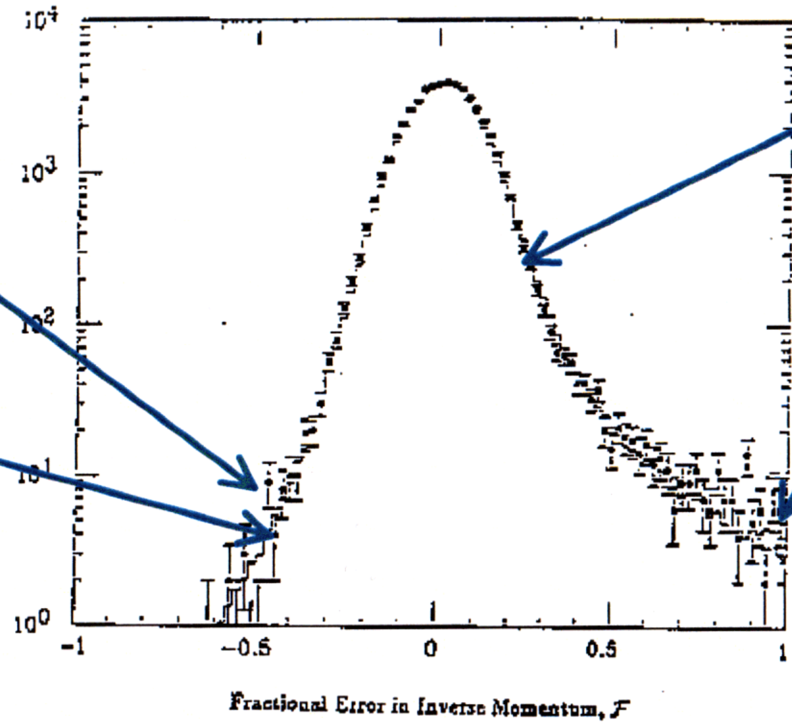


Momentum Resolution Function for CCFR Muon Spectrometer

ref. B.J. King *et al.* (CCFR Collab.), Nucl. Inst. Meth. **A302** (1991), 254-260

error bars are test-beam data

the histogram is a prior prediction from a Monte Carlo computer simulation



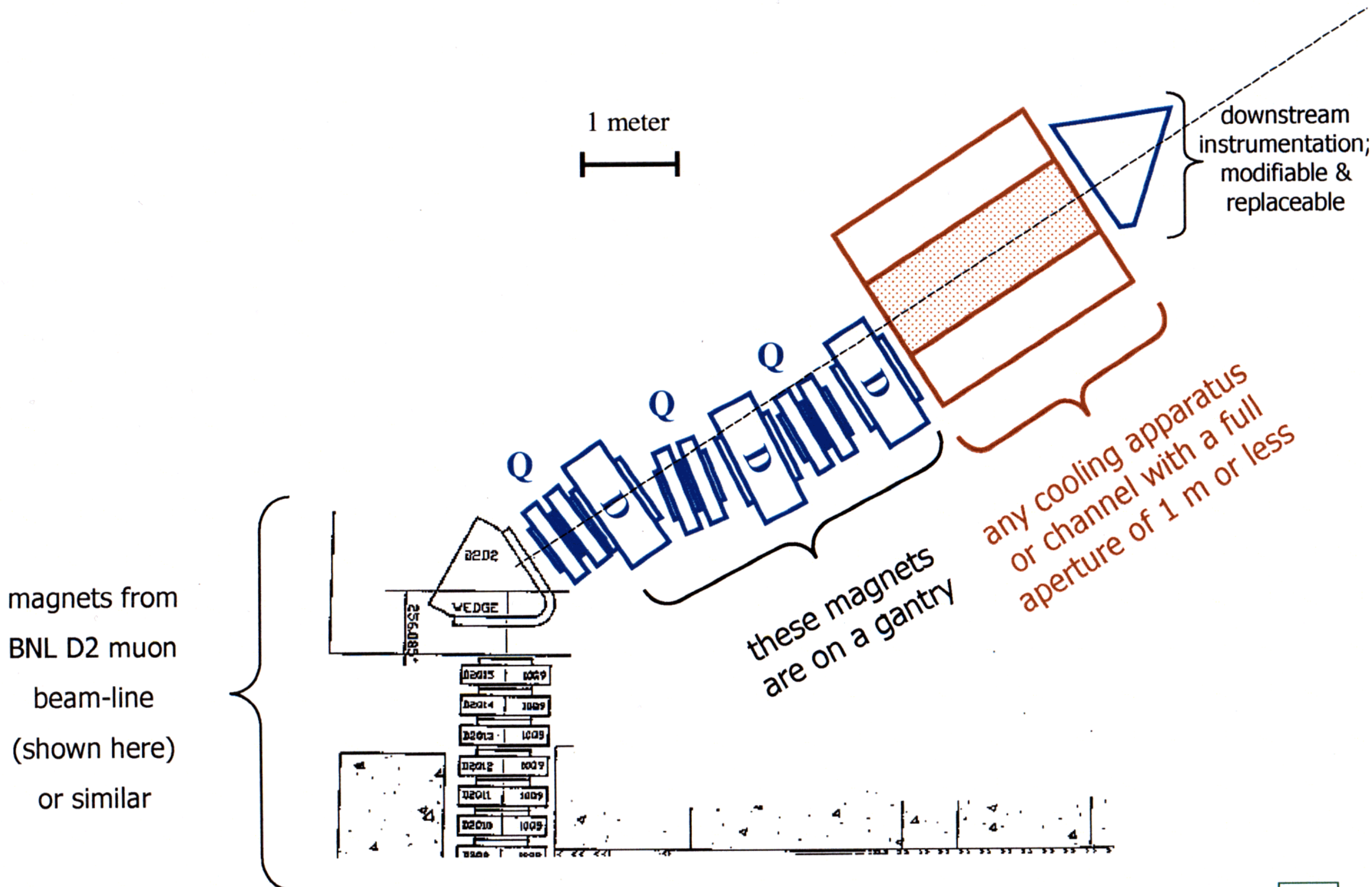
rms resolution checks and calibrates computer code

tails verify physics model and check for hardware problems

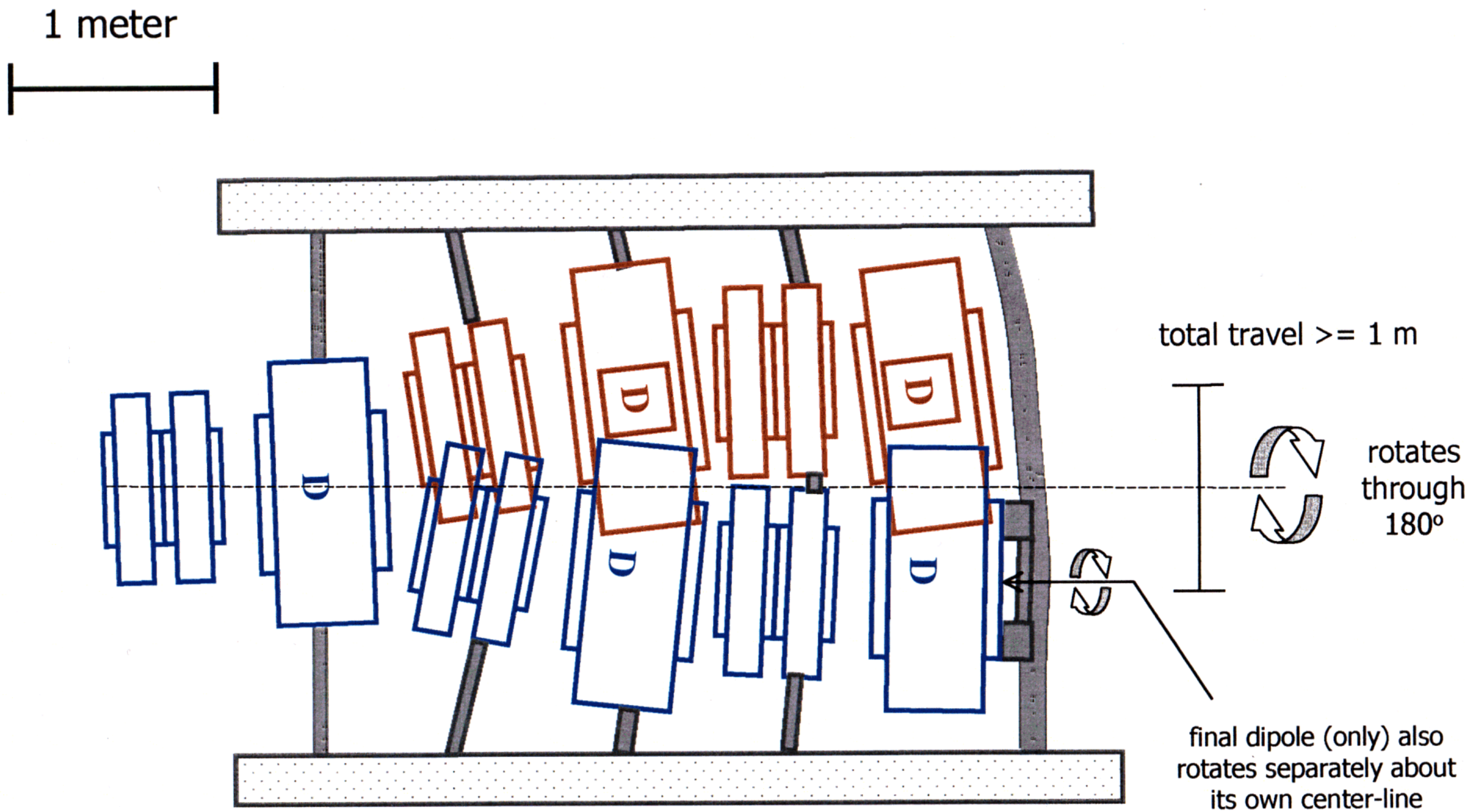
calibrations at a MUCOOL facility would have these same goals

Figure 3.9: The experimental resolution function of the muon spectrometer; measured using 50,385 momentum-analysed test beam muons at a momentum setting of 120 GeV/c. The solid line is an independent Monte Carlo prediction at 120 GeV/c.

Suggested Beam-line



Conceptual Design of the Gantry



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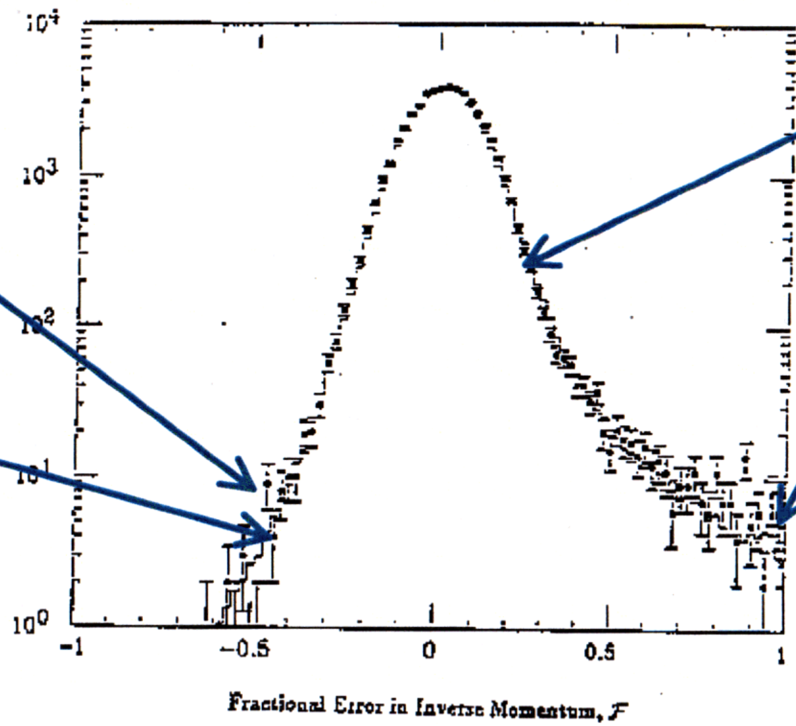

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Summary: A First Assessment of the Concept

BNL engineers Pendzick and Pearson believe the rotating gantry is technically feasible.

They estimate that the gantry and its magnets might cost about half a million dollars. This is considerably less than some cooling apparatus and much less than the cost of setting up the beam-line (e.g. ~ $3M for shielding alone).

The (upstream) instrumentation can be compact and, hence, cheaper and less difficult technically than in designs with larger emittance beams.

The overall scenario needs many details fleshed out before its overall attractiveness can be gauged. In particular, the design and efficiency of the beam-line needs to be simulated and optimized.

BNL D2 Muon Beamline