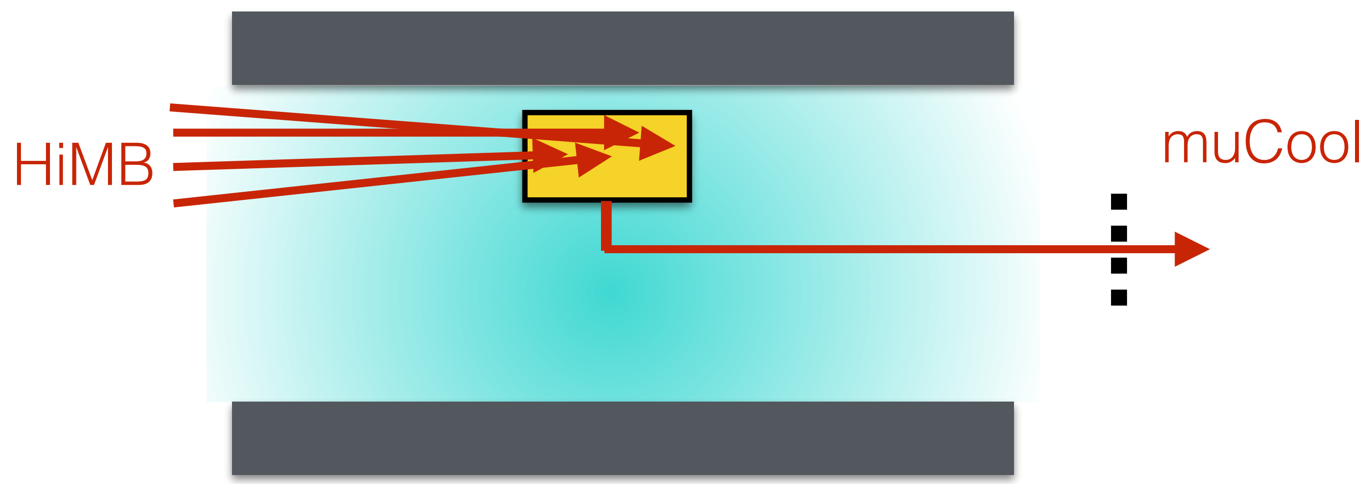
HiMB-Cool summary



- Difficult to make precise predictions as we are facing an unconventional development. We do not have a history…or reference points.
- For sure we have a long way to go….with many risks but also with potentially many interesting applications
- Risks: Electric breakdown, turbolences, vacuum and thermal management

Total estimated efficiency for continous-extraction HIMB output → muCool outside solenoid:

2×10^{-5} — 1×10^{-4}

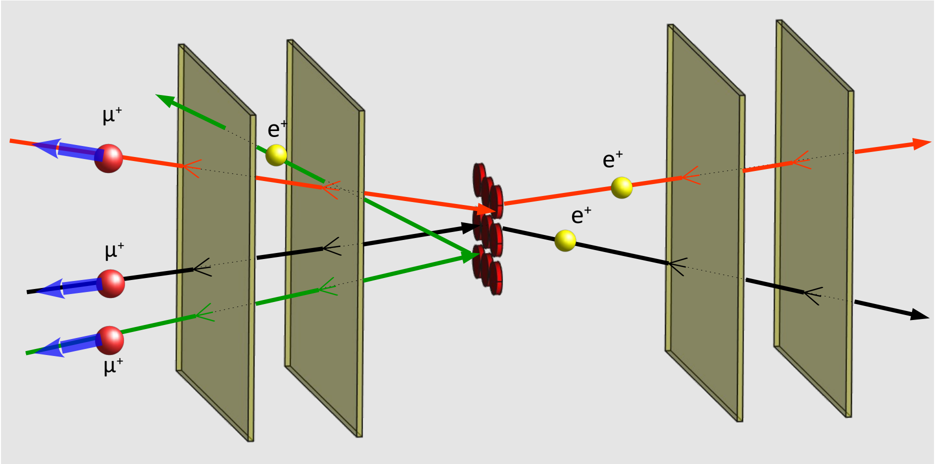
For pulsed extraction there are additional losses

E:	10 keV
ΔE:	100 eV
Diameter:	20 mm
Divergence:	2 mrad

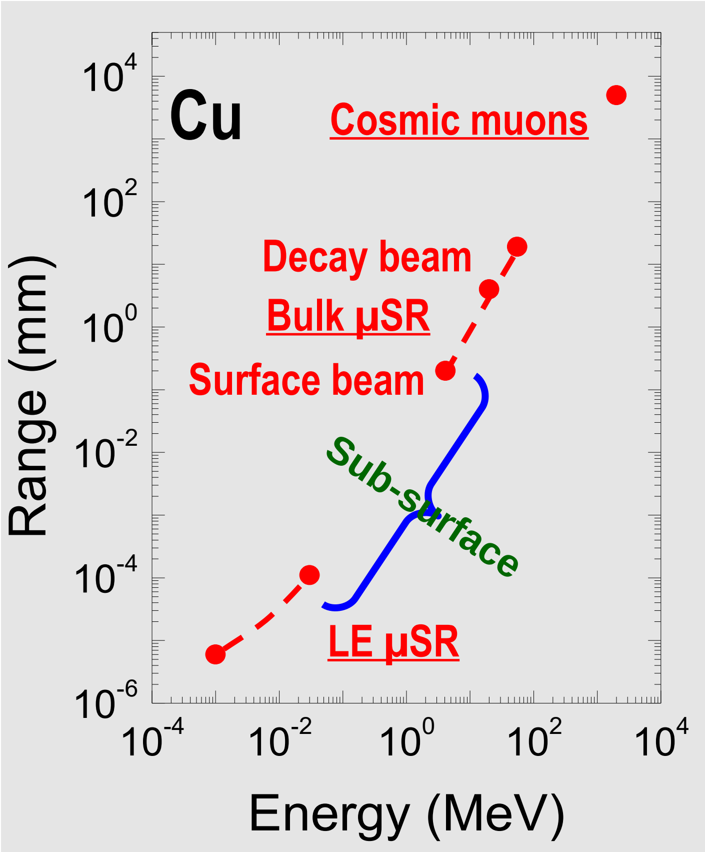
Are larger efficiency possible?
Maybe!

Applications: μSR

- The potential of HiMB for μSR applications is best exploited using a pixel detector (vertexing) to correlate muons and positrons (see Zaher Salman talk)



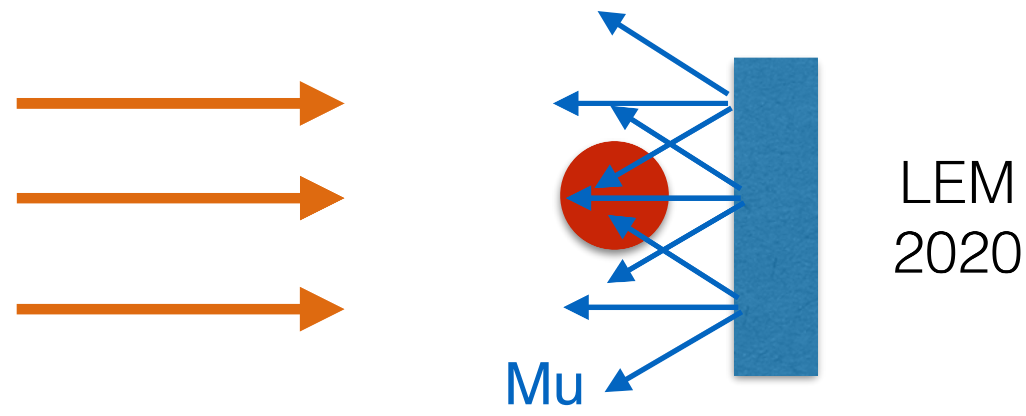
- muCool delivering 5 x 10^5 μ/s with beam size < 1 mm (@ 10 keV) could however find a niche of applications where only tiny samples are available or needed (e.g. for investigating strain effects, see Zurab Guguchia talk)

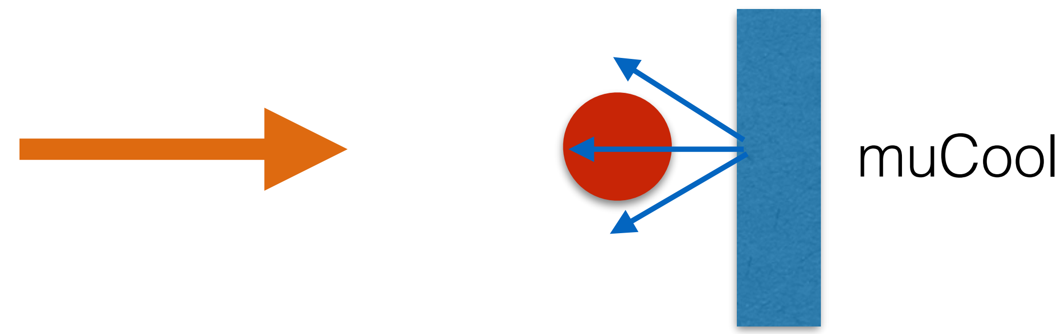


- the muCool beam can be easily split in various spectrometer to avoid pileup effects and is well suited for re-acceleration to hundreds of keV (filling the gap between low-energy to bulk μSR.

Applications: muonium spectroscopy

- The combination of keV-energy and sub-mm beam size and larger rates from the HiMB-cool represent a leap for muonium spectroscopy.
- The low energy yields efficient muon-to-vacuum-muonium conversion
- Small size implies larger excitation rates, better control of systematics, novel techniques.
- Improve (see talk Paolo Crivelli)
  - Lamb shift to 10-20 kHz (present goal at LEM 1 MHz)
  - 1S-2S to 1 kHz (present goal at LEM is 10 kHz)
- Novel transitions
  - 2S-3S, 2S-nS (talk Dylan Yost)
  - in flight spectroscopy (talk Ben Ohayon)

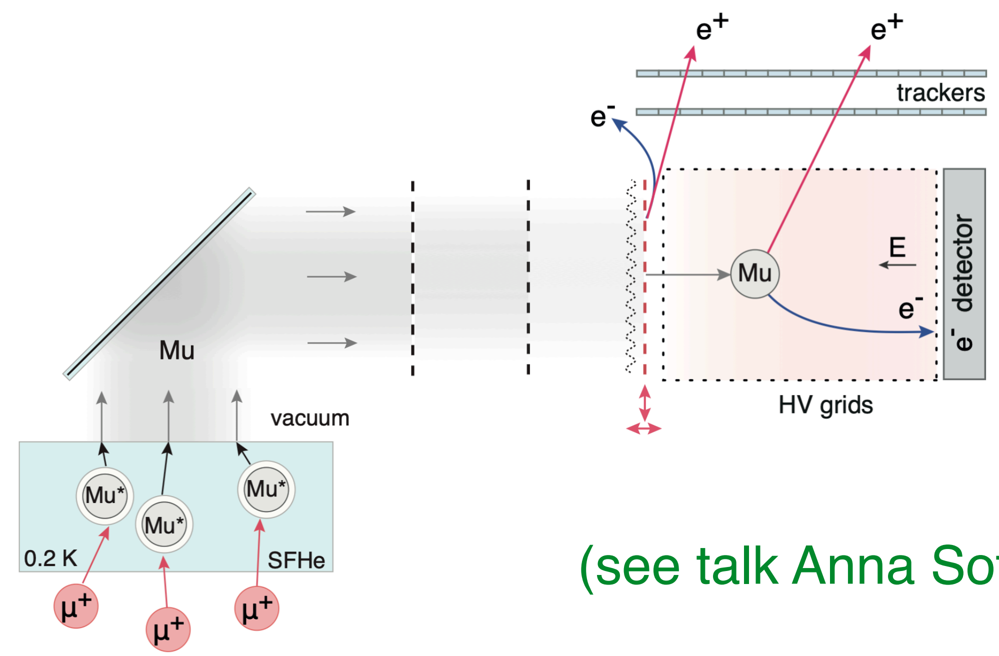




Muonium spectroscopy is fundamental for the muon g-2

Applications: muonium gravity

- Two possibilities are being presently investigated
  - grating interferometry
  - whispering gallery

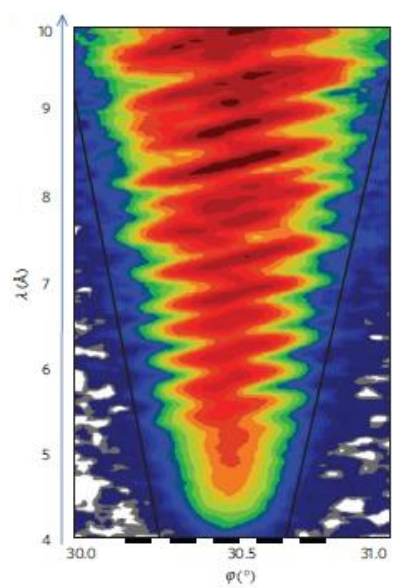


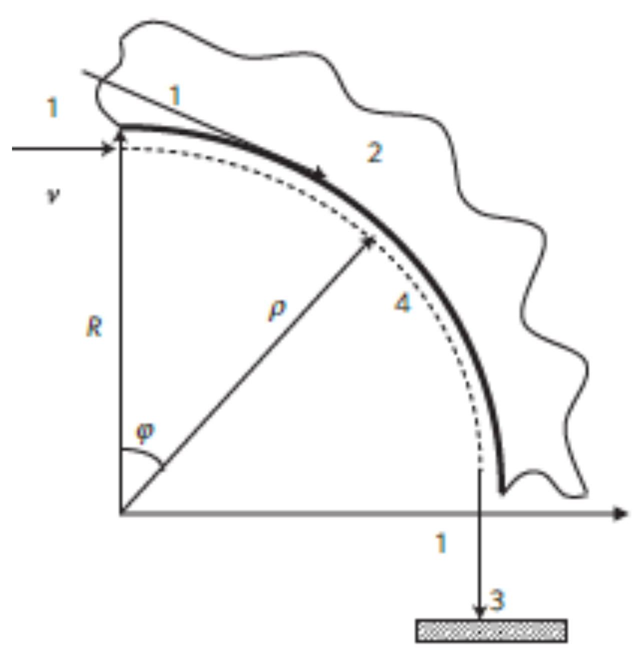
(see talk Anna Soter)

- Is not yet totally clear wether HiMB-cool represents the best solution for muonium gravity with interferometry. It depends very much on the diffusion properties of Mu in SFHe. If Mu diffuses at Landau velocity is probably better (statistically) to go directly with HiMB only.

- HiMB-cool is the beam to be used for the whispering gallery technique

(see talk Valery Nesvizhevsky)

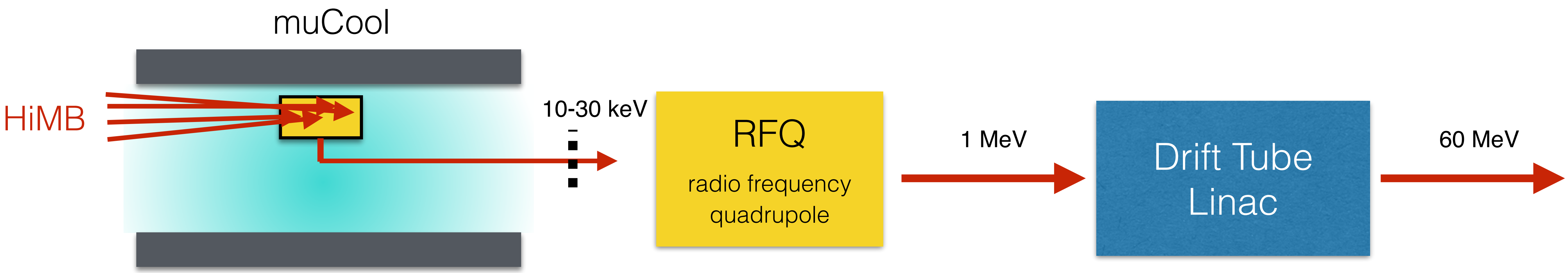




- The sub-mm muCool size has two other advantages:
  - low background
  - easiest grating production and alignment
  - less systematics

Application: Re-acceleration

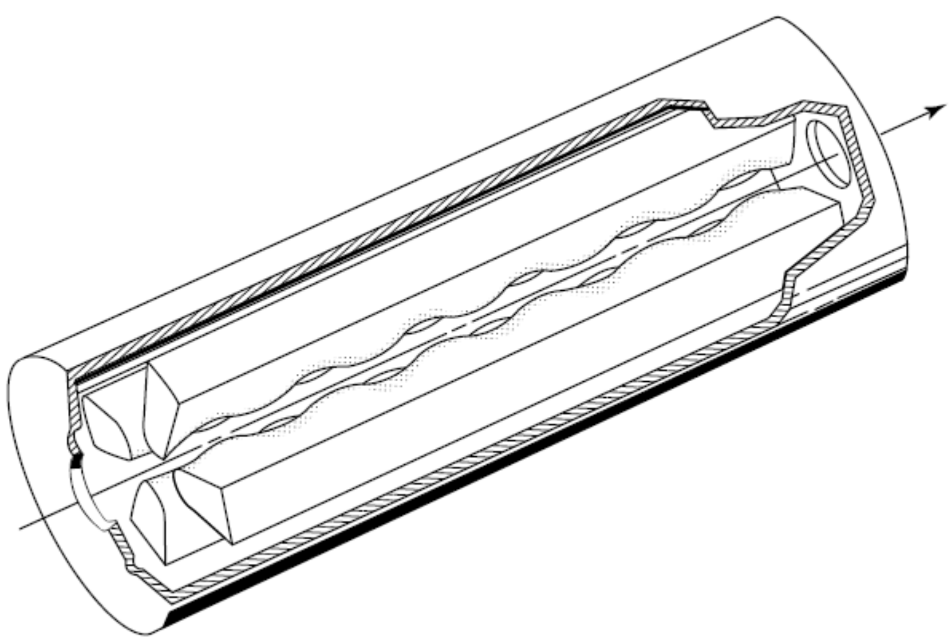
(see talk Masamitsu Aiba)

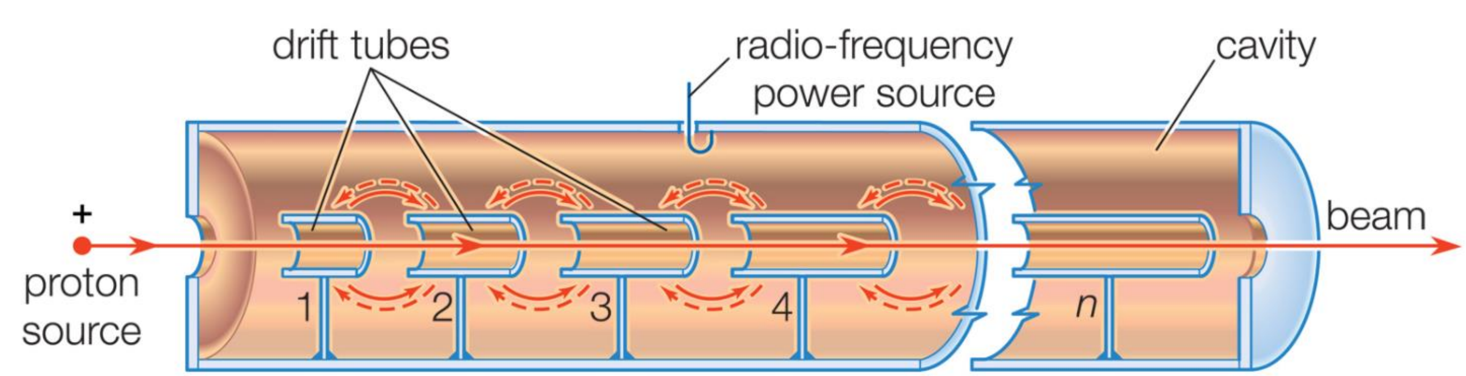


It would be advantageous to have some re-acceleration inside the solenoid

CW operation of RFQ is possible

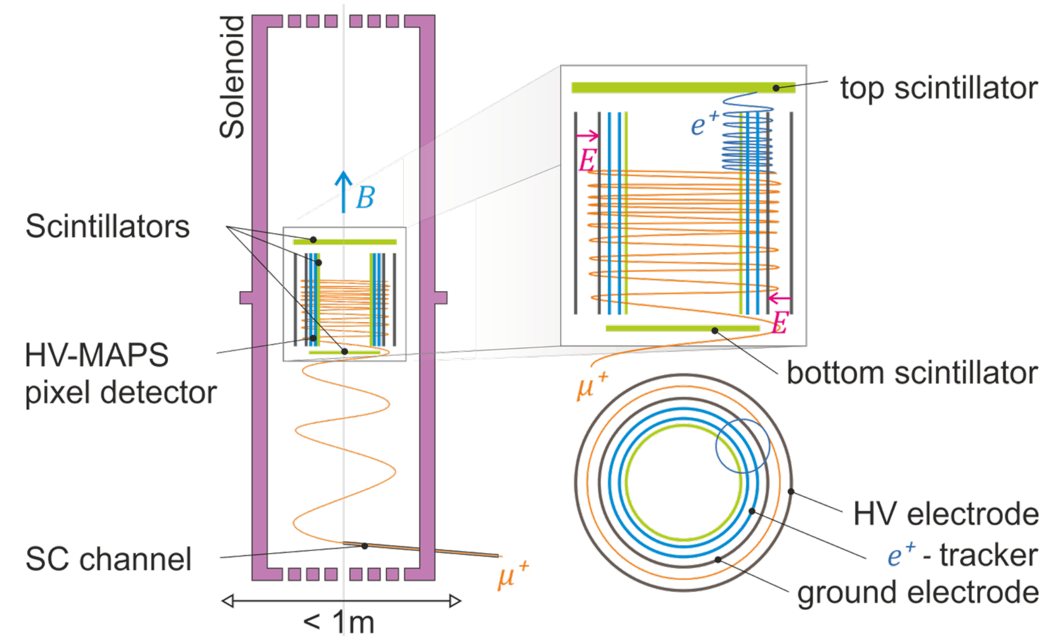
- larger flux (no accumulation losses)
- 300-400 kW power ⇨ superconducting accelerator
- energy spread around 1% (should be ok for experiments)





Application: μEDM and g-2 (see talk Philipp Schmidt-Wellenburg)

- The phase-space of muCool is suited for μEDM and g-2 experiments in small storage rings.
- With the present layout, a rate of 5×10^5 μ/s from HiMB-Cool (after accelerating the beam to 125 MeV/c) in cw-mode allows to improve the μEDM by a factor of 2 only compared to present μE1 beam at 125 MeV/c
  - bunching, muon on demands and more rates is needed to improve the situation. Wether this is possible or not depends very much on the final performance of the muCool setup.



- Alternative designs are being explored.
  Last night considerations of Philipp: using muCool (5×10^5 μ/s @ 100 keV energy), in a 18T solenoid might improve (g-2) by a factor 3 compared to J-PARC.

@ 125 MeV/c