Shielded RF Lattice

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**Shielded RF - Reminder**

- Increase cell length to remove RF from solenoid fringe fields
  - Add shielding using iron or bucking coils?
  - Try to keep good acceptance and focusing

- Look at cooling section
  - This is where the RF is most limited
  - This is where optics are most demanding

- How well can we cool in this shielded scenario?
- How well can we optimise the cooling lattice?
- Try to keep RF cavities in < 0.1 – 0.5 T fields
- Liquid Hydrogen absorbers
Capture at Higher P

- Work at higher energy to reduce geometric emittance
- Use existing capture scheme for acceleration
- Keep peak field same
  - Change phasing to bring both reference particles in at higher momentum
  - Still phase with 233 MeV/c particle
  - Needs ~ 4-6 degrees phase to bring to 273 MeV/c
- Cut 273 MeV/c < Pz < 373 MeV/c
- All simulations done in g4bl v2.06
LiH Lattice Schematic

- LiH absorber every cell
  - Much more compact
  - Some compromise in cooling performance
    - LiH makes a bit more scattering
Matching from RF Capture

- Bring into flipping lattice
- Note I do fiddle with magnet currents in the cooling lattice
  - I don't always redo the match!
  - Probably good enough

![Graph: Match](image1)

![Graph: Single ¼ cell beta](image2)
Emittances

- Transverse and longitudinal emittance look good
  - But note mismatch to cooling
  - Worse for 4° case (off-momentum)
- Longitudinal matching is better
Capture Performance

- Transmission inside usual cuts:
  - 30 mm normalised transverse acceptance
  - 150 mm normalised longitudinal acceptance
- Note however momentum cut is
  - 173 < Pz < 373 MeV/c for low field geometry
  - 100 < Pz < 200 MeV/c for baseline
## Components

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>LiH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunnel length</td>
<td>75 m</td>
<td>120 m</td>
</tr>
<tr>
<td>Number of RF</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>RF length</td>
<td>500 mm</td>
<td>500 mm</td>
</tr>
<tr>
<td>RF peak field</td>
<td>16* MV/m</td>
<td>19 MV/m</td>
</tr>
<tr>
<td>Number of coils</td>
<td>100</td>
<td>40</td>
</tr>
<tr>
<td>Coil current</td>
<td>106.66</td>
<td>21</td>
</tr>
<tr>
<td>Inner radius</td>
<td>350 mm</td>
<td>400 mm</td>
</tr>
<tr>
<td>Outer radius</td>
<td>500 mm</td>
<td>500 mm</td>
</tr>
<tr>
<td>Length</td>
<td>150 mm</td>
<td>1000 mm</td>
</tr>
<tr>
<td>Coil peak field</td>
<td>2.8 T</td>
<td>1.25 T</td>
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<tr>
<td>Coil current</td>
<td>106.66 A/mm^2</td>
<td>19 A/mm^2</td>
</tr>
</tbody>
</table>
Conclusion

- Full simulation in G4BL
- Includes reoptimisation of phase rotation to capture at higher energy
- Or we use LiH, fields $<~ 0.3$ T, lose $\sim 20\%$ muon rate
- Cooling channel cost $\sim$ same (New!)
The modified lattice should be fully documented so that a third party could reproduce the lattice.

The modified baselines should be properly integrated with the muon front end and simulated fully. Any simulation should reproduce the front end baseline performance.

There should be two codes with simulations showing similar performance.

There is a fair amount of work involved in changing baseline. The improvement should be shown to be of sufficient magnitude that a rebaseline is worth while, i.e. there is a definable and significant benefit.

The relative increase in hardware should not be too great (i.e. the cost shouldn't increase by too much, relative to the improvement in performance).