Comment on number of passes in RLAs

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- Quadrupole focusing profile for multi-pass linacs
  - triplet vs FODO
  - Multi-pass linac (2 GeV per pass)
  - phase advance for the 1-st pass
  - beam envelopes
  - matching to the Arcs
Racetrack 7-pass RLA

As proposed by Milorad Popovic and Chuck Ankenbrandt

- injection energy 2 GeV
- multi-pass linac (2 GeV per pass)
- Final energy 30 GeV (7-pass)
- 800 MHz SRF
- 5-cell cavity 26 MV/m
- 4 cavities per module
Alex Bogacz, Comment on number of passes in RLAs

**Triplet focusing 90° phase adv/cell**

1-pass, 2-4 GeV

4-pass, 14-16 GeV

hor. phase adv/cell lost
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**Triplet focusing $120^\circ$ phase adv/cell**

1-pass, 2-4 GeV

5-pass, 18-20 GeV

hor. phase adv/cell lost
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FODO focusing 120° phase adv/cell

1-pass , 2-4 GeV

7-pass, 26-28 GeV

uniform phase adv/cell decl
Alex Bogacz, Comment on number of passes in RLAs

FODO focusing 90° phase adv/cell

1-pass , 2-4 GeV

7-pass, 26-28 GeV

uniform phase adv/cell decl
FODO focusing 90° phase adv/cell

1-pass, 2-4 GeV
2-pass, 6-8 GeV
3-pass, 10-12 GeV
4-pass, 14-16 GeV
FODO focusing 90° phase adv/cell

5-pass, 18-20 GeV

6-pass, 22-24 GeV

7-pass, 26-28 GeV

uniform phase adv/cell decl
Summary

- FODO lattice more favorable (compared to the triplet) to accommodate large number of passes
  - uniform phase advance decrease in both planes
  - smaller variation of Twiss function – easier match to the Arcs
  - Allows to maintain $90^\circ$ phase advance per cell for lowest passes

- 7-pass 2-30 GeV RLA (proposed by Milorad and Chuck) has a multi-pass focusing solution:
  - $90^\circ$ FODO lattice – lowest pass linacs
  - tolerable phase ‘slippage’ in the higher pass linacs
  - Feasible beta matching to the Arcs