



# Injector linac layout (work in progress)

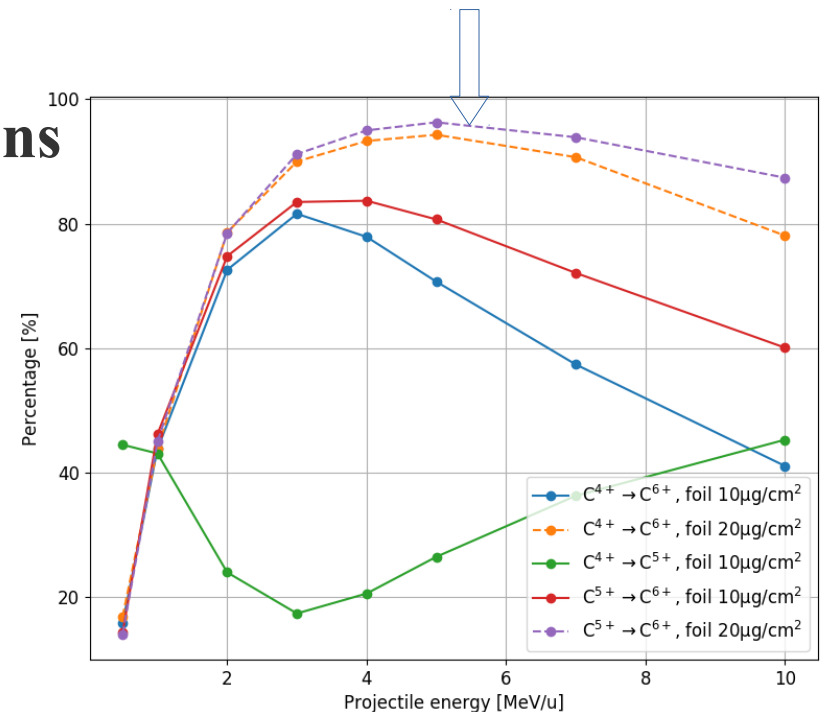
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June 21, 2019

# Outlook

- $C^{5+}$  ion sources
- Development of a script which:
  - Visualizes various linac options
  - Calculates optimal parameters and minimum cost
  - Stores data about various sources, RFQs, linacs
- Some results concerning preferable linac layout

# C<sup>5+</sup> ion sources

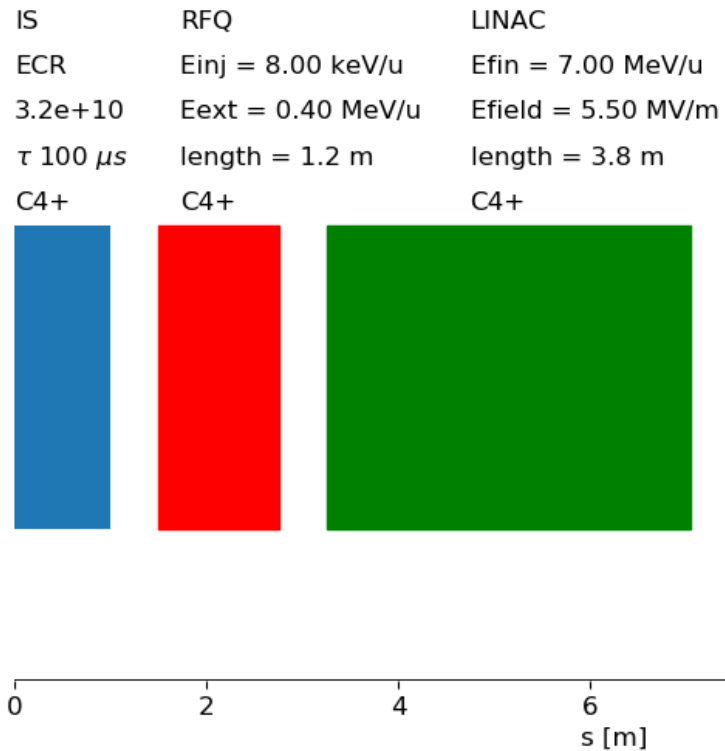
- Injecting C<sup>5+</sup> instead of C<sup>4+</sup> allows to shorten the linac and RFQ keeping the pollution (He<sup>2+</sup>, O<sup>8+</sup> etc...) small.
- HIMAC source: NIRS-HEC,
  - 18 GHz ECR,
  - Constructed in 1996
  - C<sup>5+</sup> current 550 μA ie. 6.2e10 ions
- C<sup>5+</sup> stripping at ~5 MeV/u



# Legacy linac

Cost (all included,  
source, RFQ, linac)  
~10 M€

Legacy200MHzC4+



# 200 MHz linac with C<sup>5+</sup>, cost-optimized

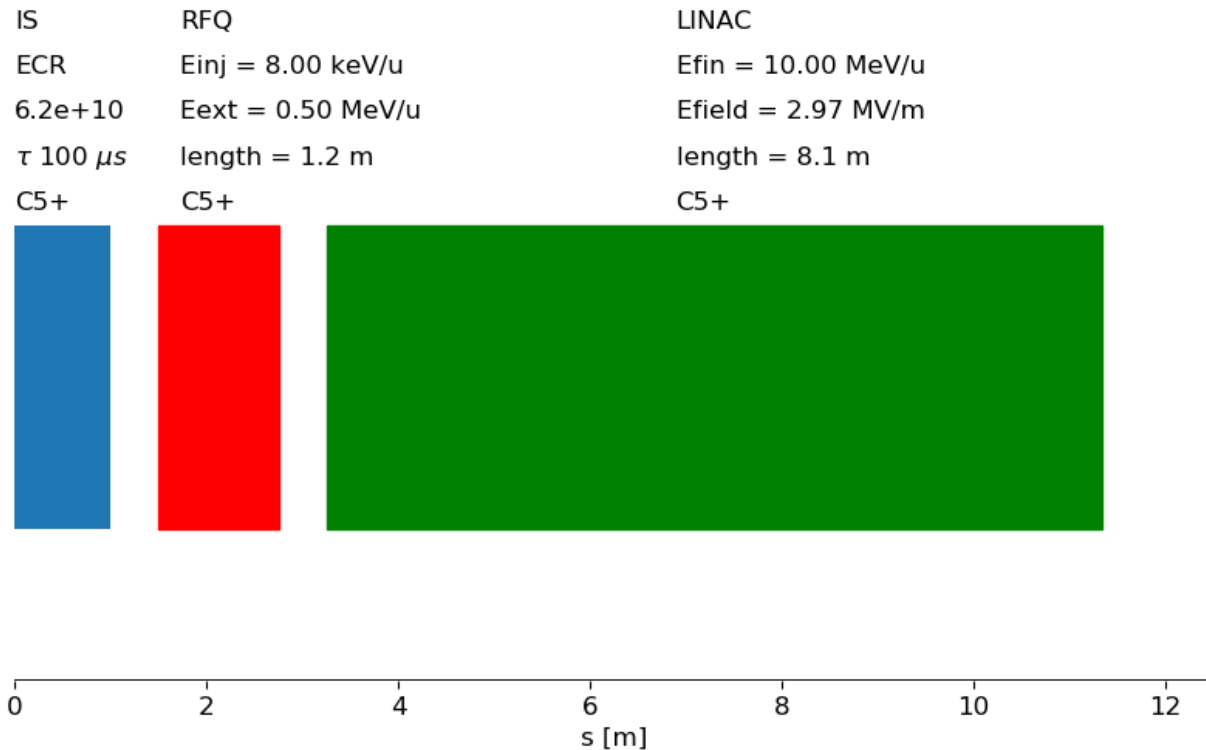
Cost:

2.45 M€ – linac

1.2 M€ – RFQ

Total: 3.65 M€

200MHzC5+



# e.g. 325 MHz linac with C<sup>5+</sup>, cost-optimized

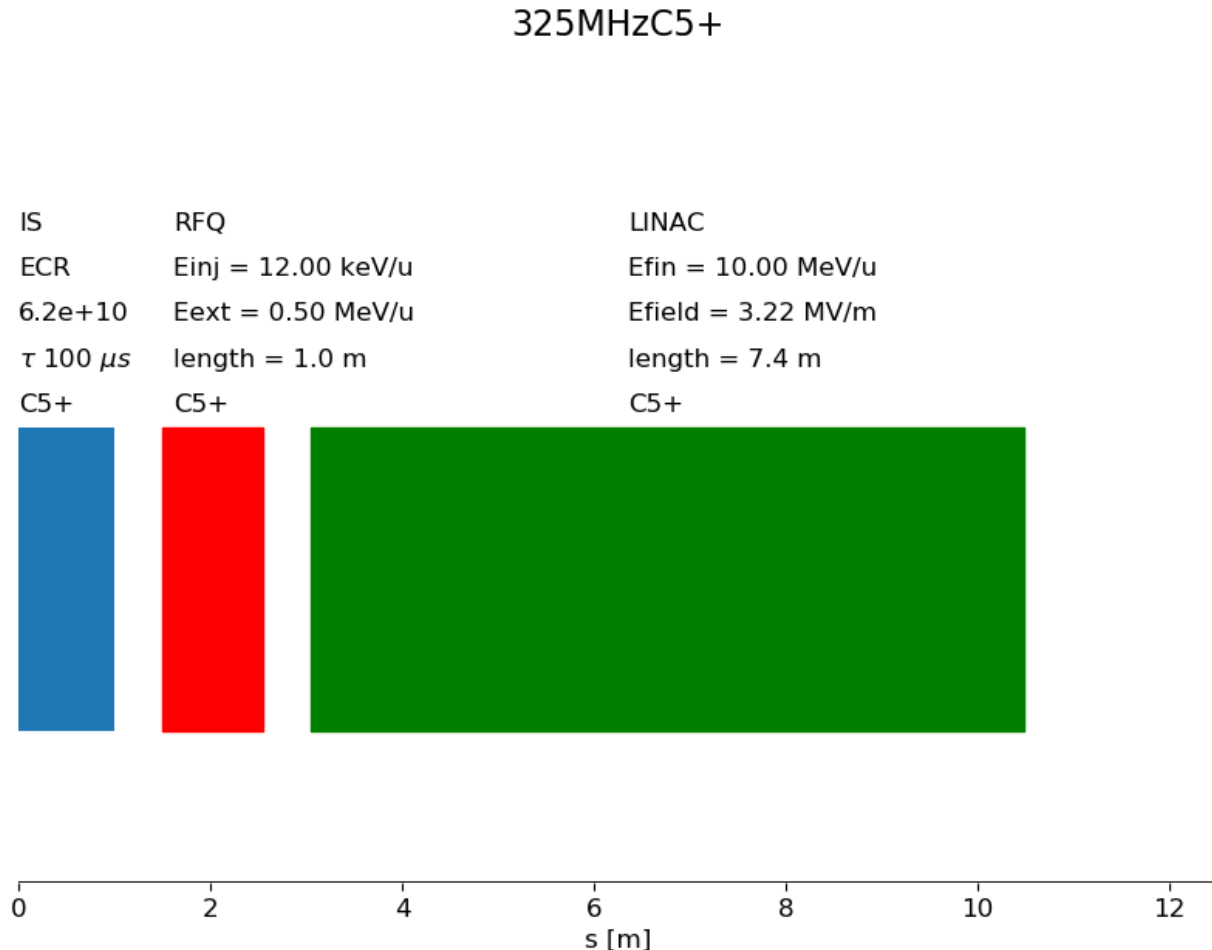
Length of 325 MHz FRQ  
scaled from 200 MHz using  
Kilpatrick's criterion

$$f[\text{MHz}] = 1.64 E^2 e^{-8.5/E}$$

f [MHz]	E[MV/m]	
200	14.7	
325	17.8	gain 1.2
750	25.2	gain 1.7

Cost:  
2.25 M€ - linac  
1.0 M€ - RFQ

Total: 3.25 M€



# 325 MHz linac with $C^{5+}$ , stripping after RFQ, cost-optimized

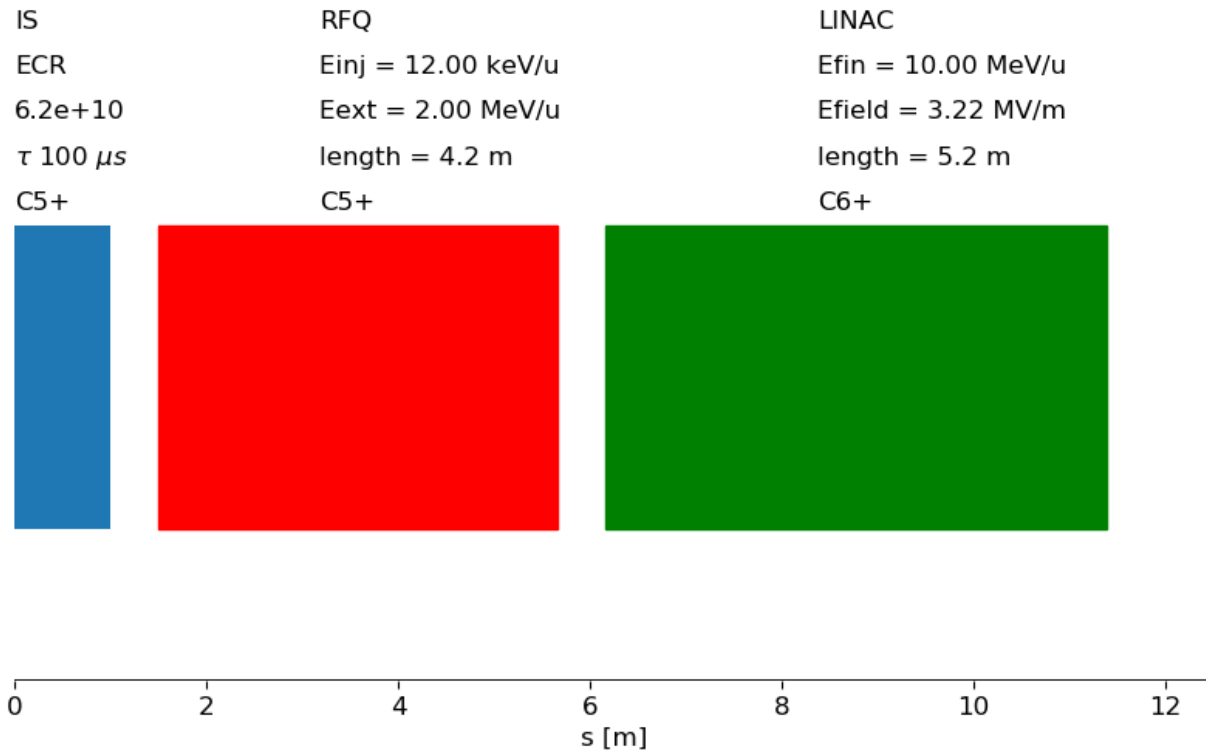
Cost:

1.6 M€ - linac

4.2 M€ - RFQ

Total: 5.8 M€

HERFQC5+325MHzC6+

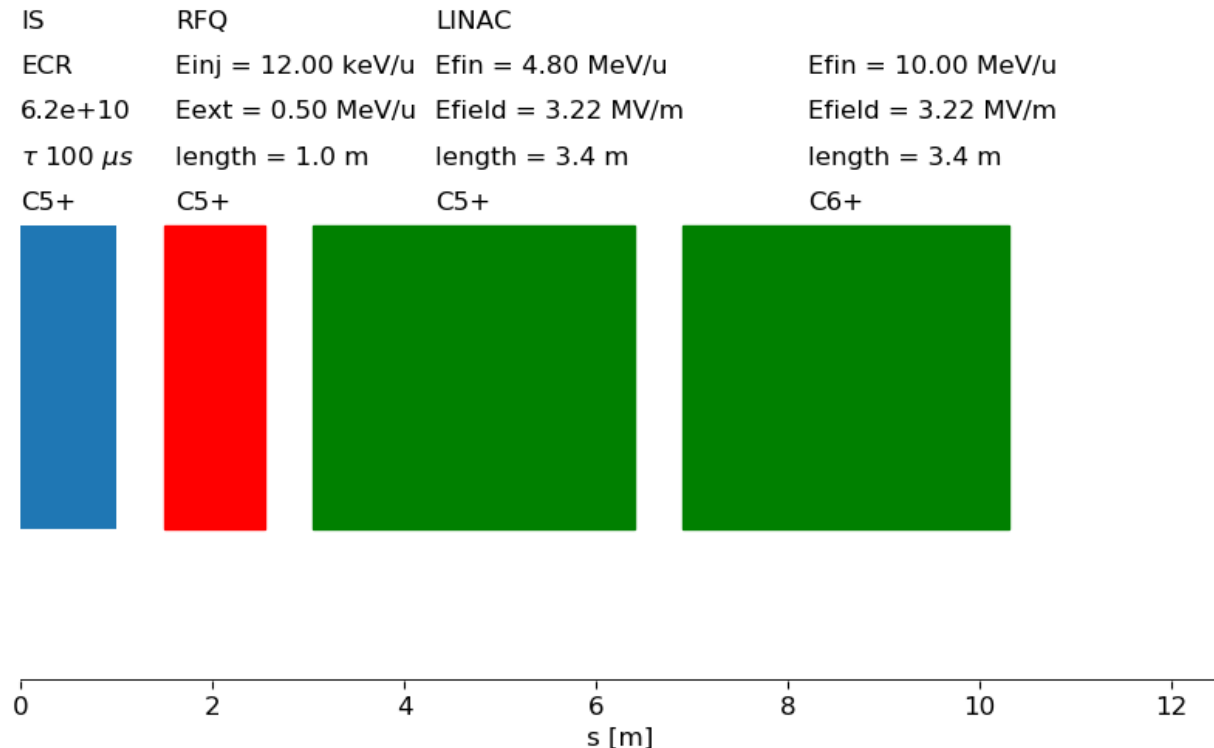


# 325 MHz linac with C<sup>5+</sup>, stripping after first part of IH, cost-optimized

Cost  
 2.0 M€ - linac  
 1.0 M€ - RFQ

RFQC5+D325MHzC6+

Total: 3 M€





# 750 MHz linac with $C^{5+}$ , stripping after RFQ, cost-optimized

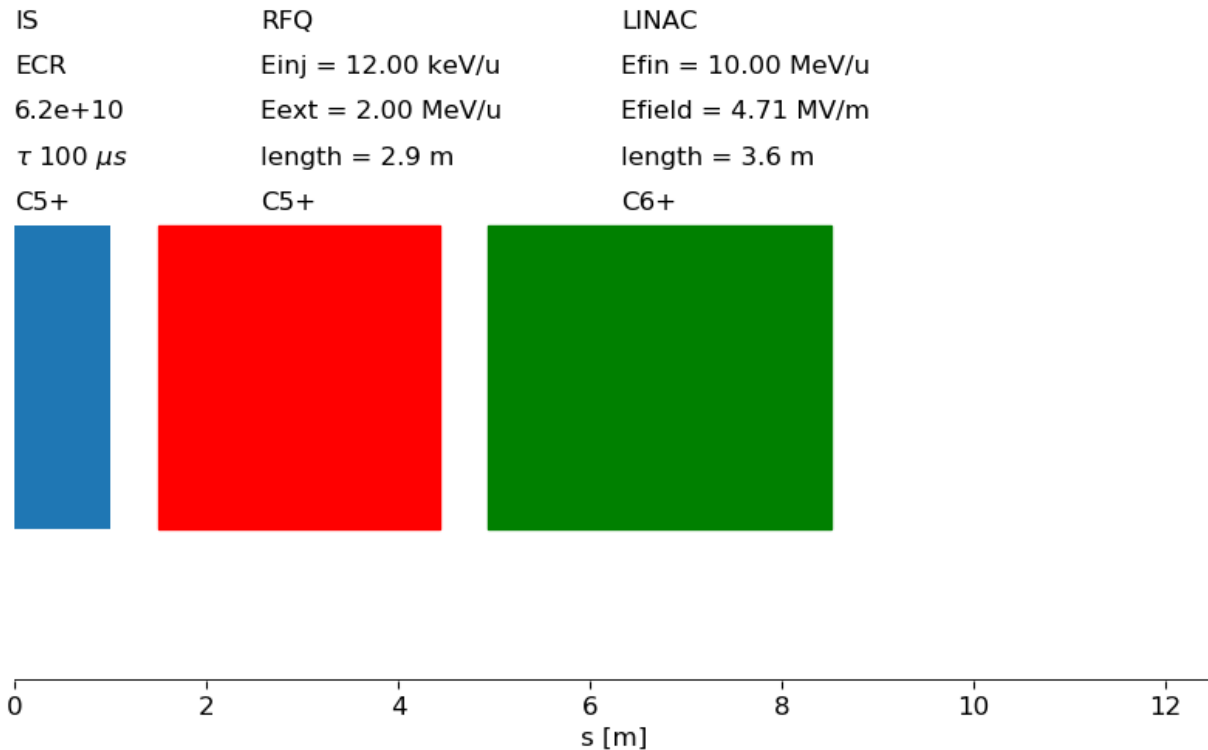
Cost:

1.5 M€ - linac

2.9 M€ - RFQ

Total: 4.4 M€

HERFQC5+750MHzC6+



# 750 MHz linac with $C^{5+}$ , stripping after first part of the linac, cost-optimized

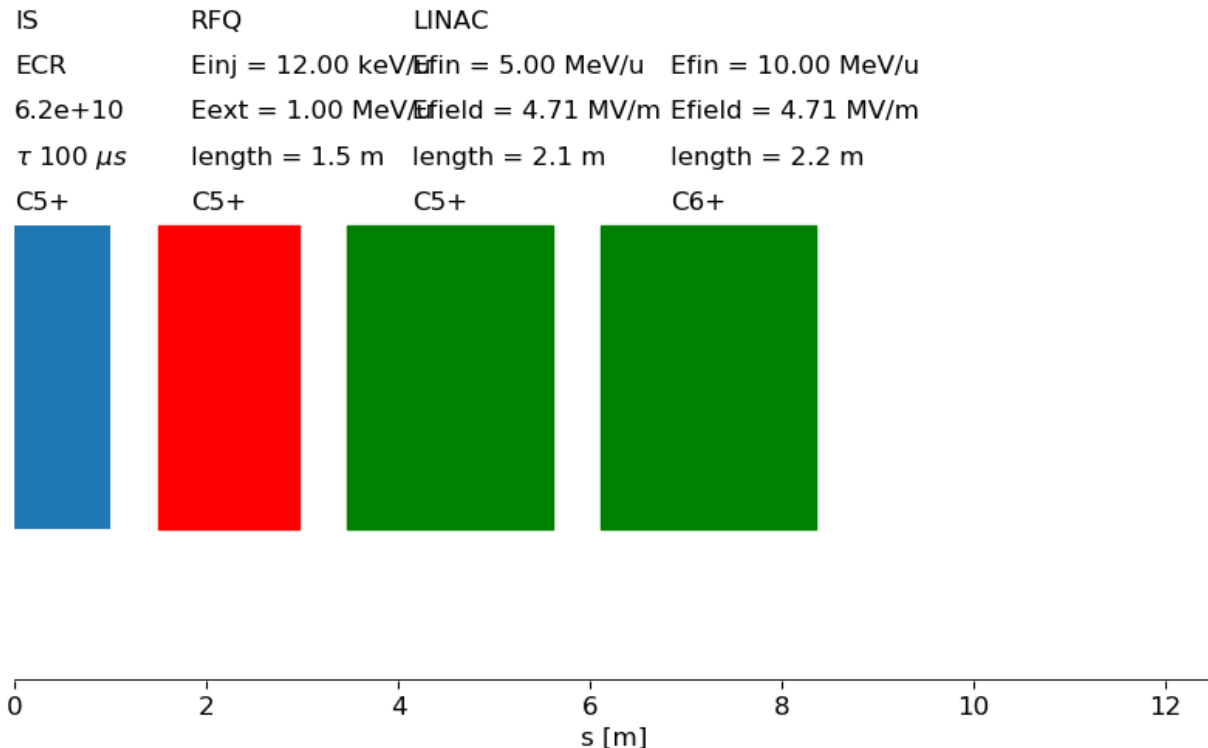
Cost:

1.8 M€ - linac

1.5 M€ - RFQ

Total: 3.3 M€

RFQC5+D750MHzC6+



(but I have arbitrarily prolonged the RFQ)

# Conclusions

- RFQ power is missing the model
- C5+ source seem to be a good option
- Splitting IH is much cheaper than long RFQ
- Optimal linac, also at 325 MHz, is long (10 m)
  - probably a higher gradient at the additional cost is a way to go
- 750 MHz linac is short enough in optimized version, but jump in technology too large?