

# Status of the Rebaselining

D. Schulte for the Rebaselining Team

# Model Availability

- Const model exists for most critical parts (based on cost WG, Ph. Lebrun)
  - Drive beam generation complex (R. Corsini, I. Syratchev)
  - Main linac (A. Grudiev)
  - Civil engineering and infrastructure for these (Ph. Lebrun)
  - This review highlighted already some cost savings
- Power model exists but needs to be validated (B. Jeanneret)
- Structure database exists (K. Sjøbæck, A. Grudiev)
  - But waiting for improved data with better RF boundary description
  - RF limits have changed, old CLIC\_G not acceptable any more
- Parameter and beam model exists (input from Y. Papaphilippou, R. Tomas)
  - Some improvement of the BDS has been made recently ( $\beta_x=4\text{mm}$ , Hector Garcia, Rogelio Tomas), if no issue with tolerances is found this will improve beam parameter flexibility
- Optimisation code exists that derives machine parameters and cost for each structure and gradient

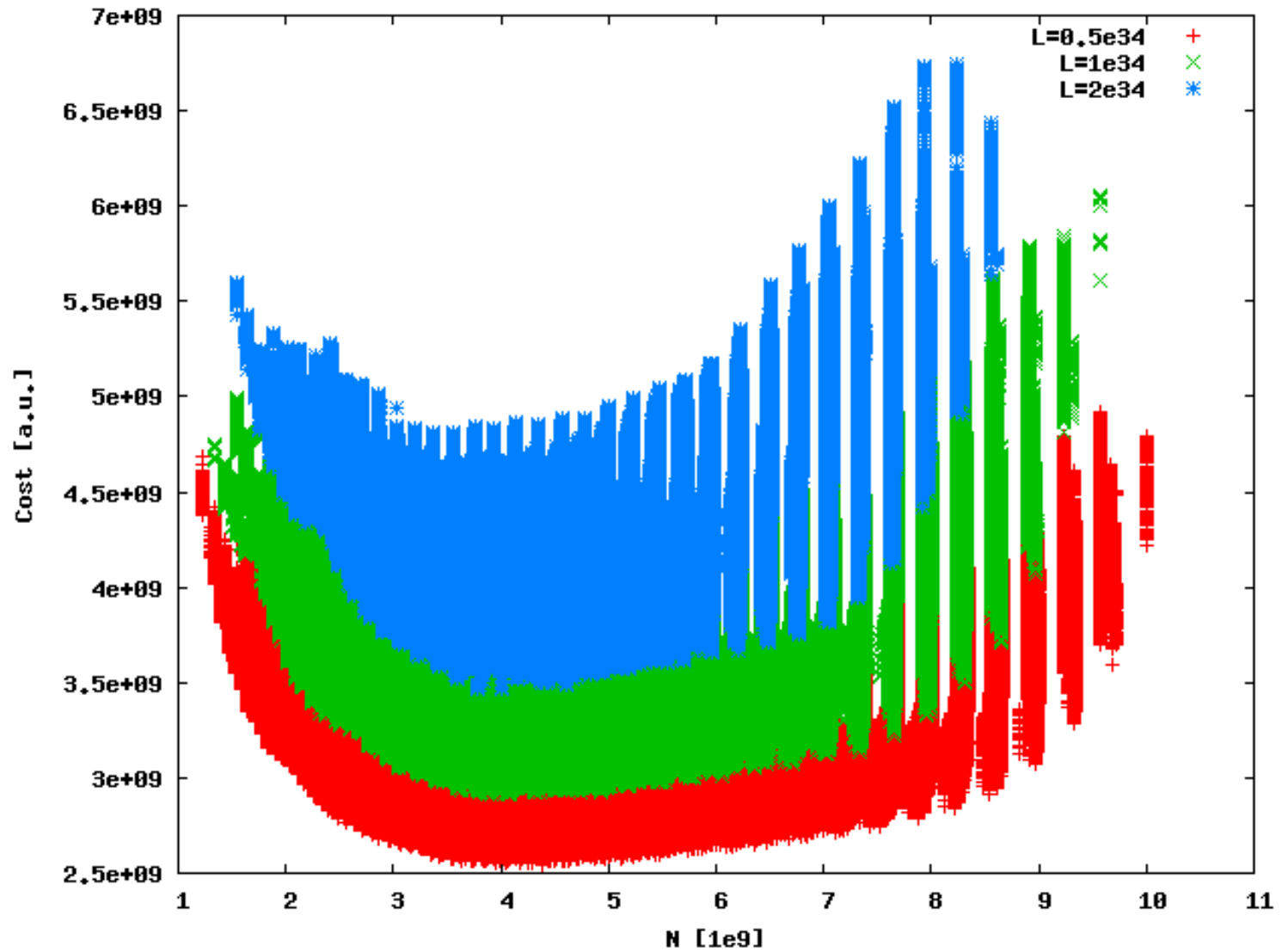
# Choices In Optimisation Code

- Assume 50Hz operation
  - To minimise magnetic stray field effects
  - Only harmonics would be possible, but suffer from pulse-to-pulse variation
- Target for one specific luminosity
  - Use only the pulse length good for this luminosity
- Only consider 350GeV machine
  - Neglect impact of upgrade
  - i.e. gradients below 100MV/m are allowed
  - Charge scaling is for local stability
    - Emittance growth can vary but stays below 3TeV limit
- Beam parameters at IP are
  - $\beta_x \geq 8\text{mm}$ ,  $\beta_y \geq 0.1\text{mm}$ ,  $\epsilon_x \geq 660\text{nm} \wedge \epsilon_x \geq 1200\text{nm} (N/6.8 \cdot 10^9)$ ,  $\epsilon_y = 25\text{nm}$
  - $L_{0.01}/L \geq 0.6$
- RF constraints are from Alexej Grudiev
  - Safety margin added if mentioned

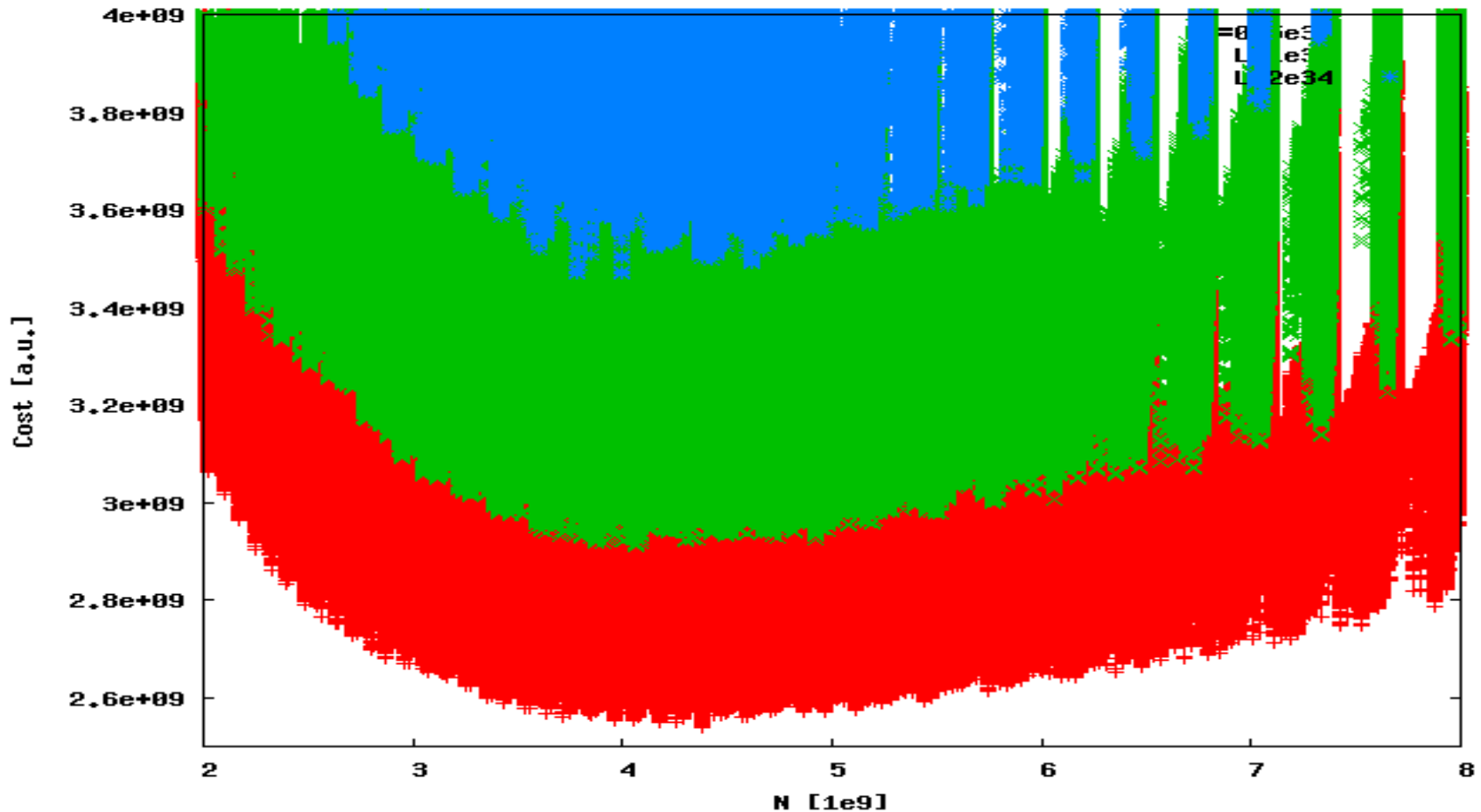
# Algorithm

- Go through different combinations of  $L_{\text{structure}}$ ,  $a_1$ ,  $a_2$ ,  $d_1$ ,  $d_2$  and  $G$
- For each
  - Identify highest bunch charge and use it
  - Determine minimum bunch distance and use it
  - Calculate input power, fill and rise time and maximum available beam time
  - If luminosity is below target got to next structure
  - **Adjust beam pulse time according to luminosity**
  - Determine number of drive beam sectors for  $n_f=24$  and  $f_{\text{DBA}}=1\text{GHz}$
  - Adjust to next larger integer
  - Calculate cost
  - While stretching linac by one decelerator is cheaper, stretch
  - Store parameter set

# Cost vs. Bunch Charge



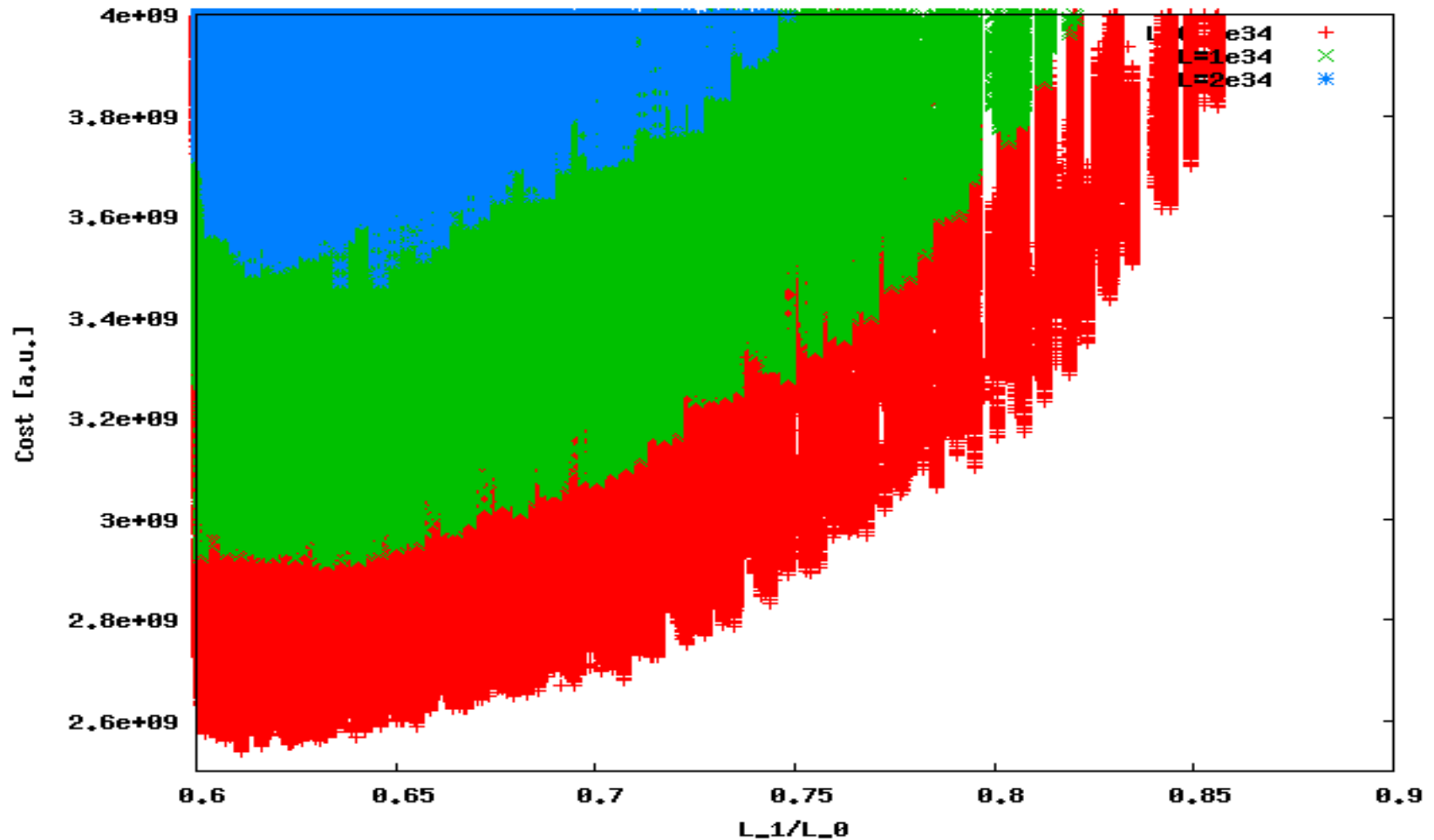
# Cost vs. Bunch Charge



Optimum bunch charges around  $4 \times 10^9$

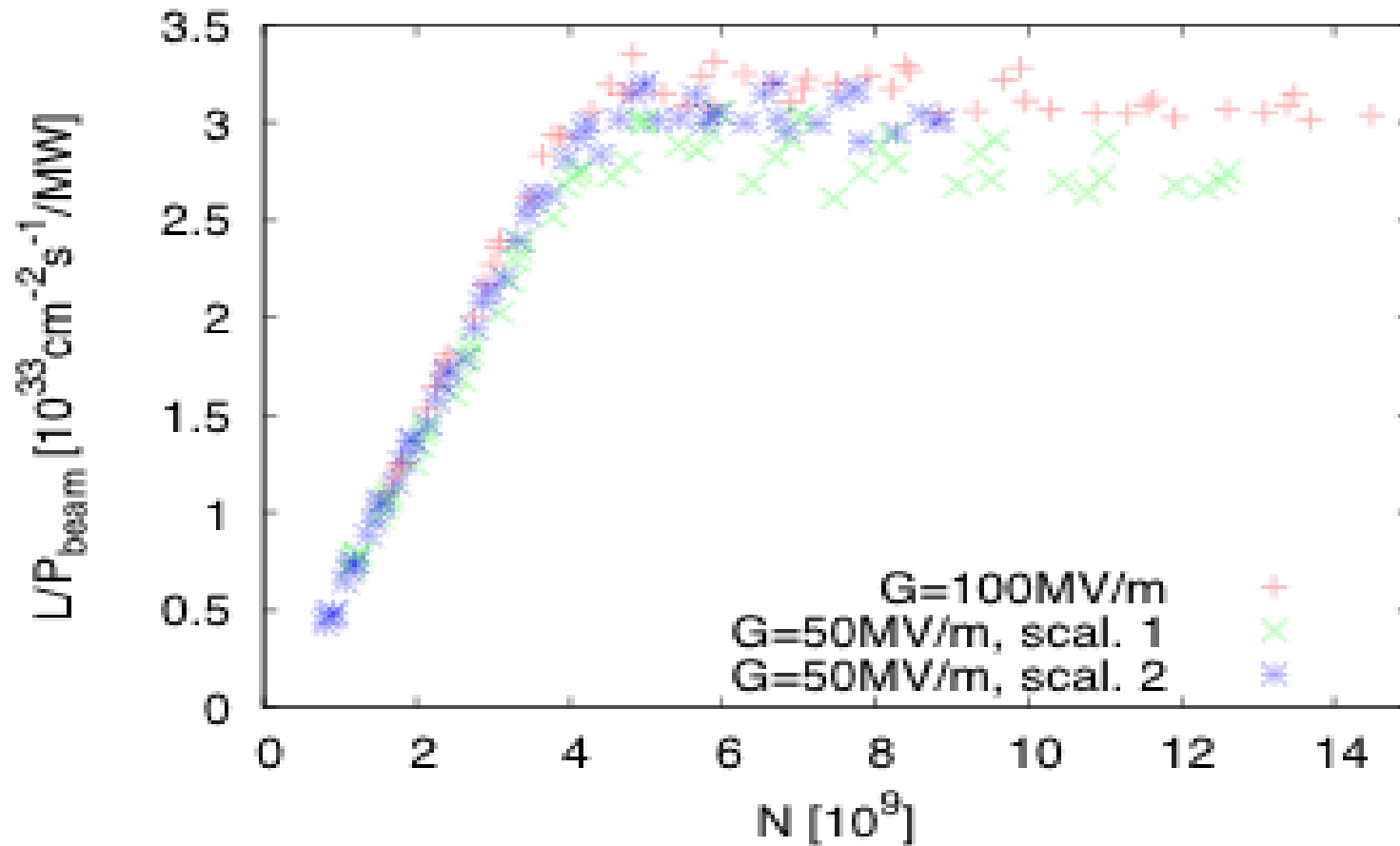
Difference between  $L=0.5 \times 10^{34} \text{cm}^{-2}\text{s}^{-1}$  and  $L=2 \times 10^{34} \text{cm}^{-2}\text{s}^{-1}$  is about 1GCHF  
-> Need to decide what to aim for

# Cost vs. Luminosity Quality



Will go close to the limit for the luminosity spectrum quality

# Luminosity and Bunch Charge

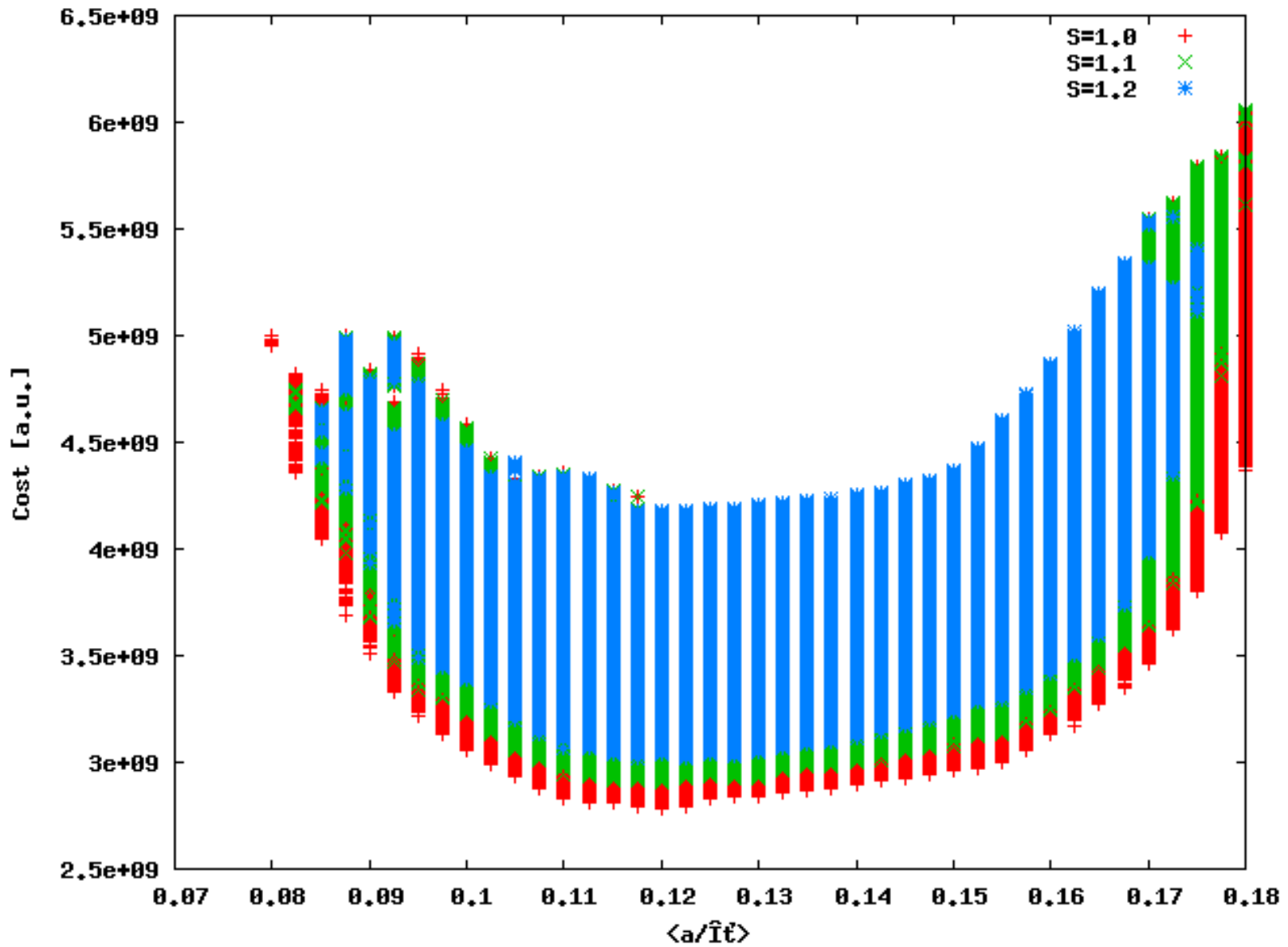


Get full  $L/I_{\text{beam}}$  for  $N > 4 \times 10^9$ , RF pushes the other way

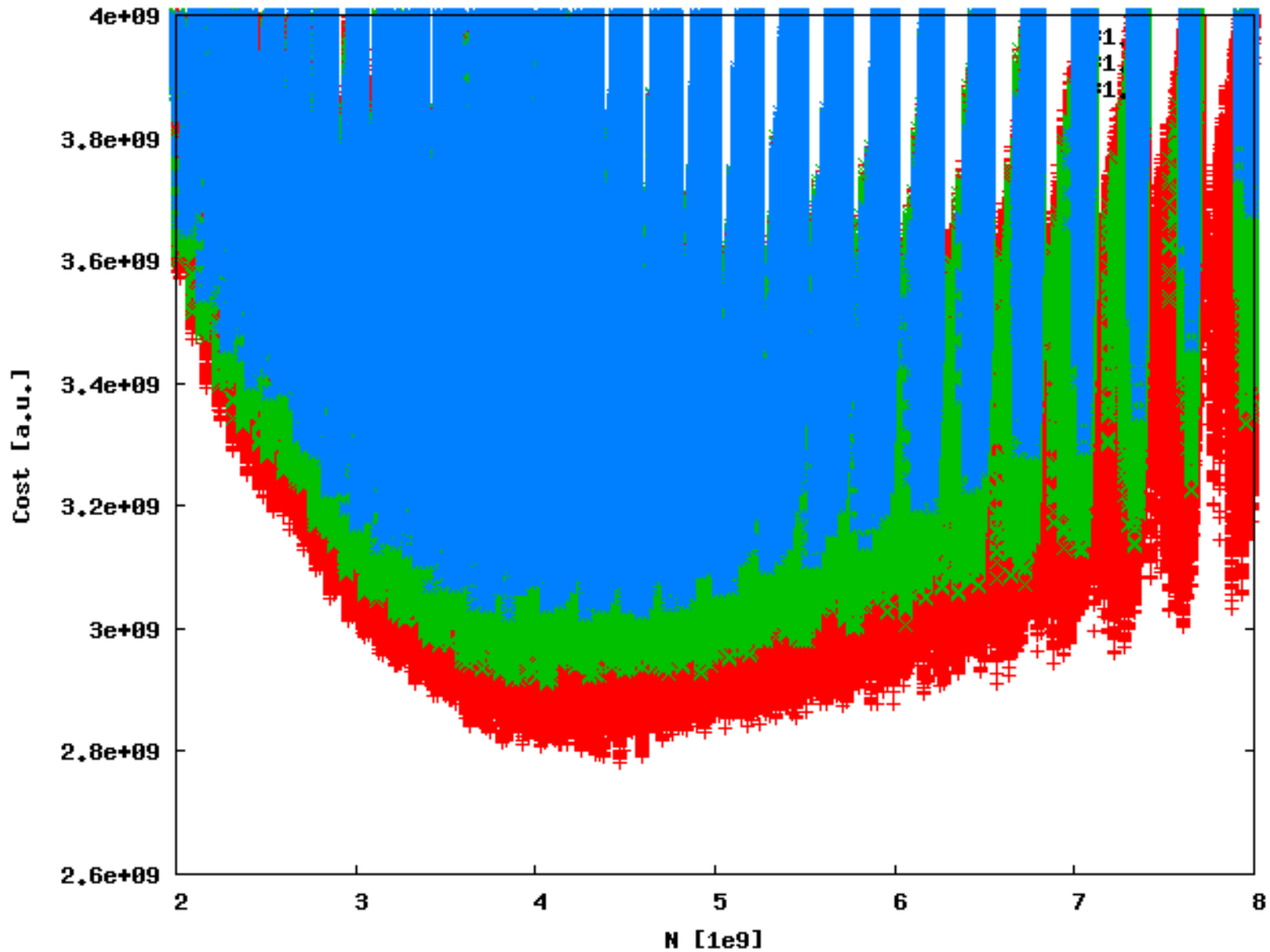
New BDS design can reduce this limit to about  $2.5\text{-}3 \times 10^9$



# Impact of RF Constraints



# Impact of RF Constraints on Beam



# Conclusion

- Tool is mostly ready
  - Final RF database being developed
  - Some consolidation of cost estimate
  - Power model needs to be validated and used
- Decide on how to treat the upgrade
  - Different options can be considered
- Decide on luminosity target
  - Significant cost impact
  - Significant impact on upgrade
- Decide on required structure robustness
  - Which parameters should we be able to vary by how much
  - Which robustness do we need for the beam parameters
- Plan to be ready by next CLIC workshop

# Conclusion II

- Would not expect large impact on physics
  - Given that most effects are a correction to the physics potential
  - They were considered not to bind the optimisation
- Luminosity spectrum should remain similar
  - Single bunch energy spread
  - Beamstrahlung
- Bunch charge could remain similar
  - $4 \times 10^9$
  - But background rates may change somewhat
- Bunch spacing can vary slightly
  - But can only go up
- Luminosity goal is the only real knob