Technical System Review

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Assignments

Main Linac,

SC Ring to Main Linac: Paolo Michelato

Beam Delivery System

Warm Ring to Main Linac: Yusuke Suetsugu

Damping Rings: Ron Reid, Ross Schlueter and LBL engineers

Transport Lines: John Noonan

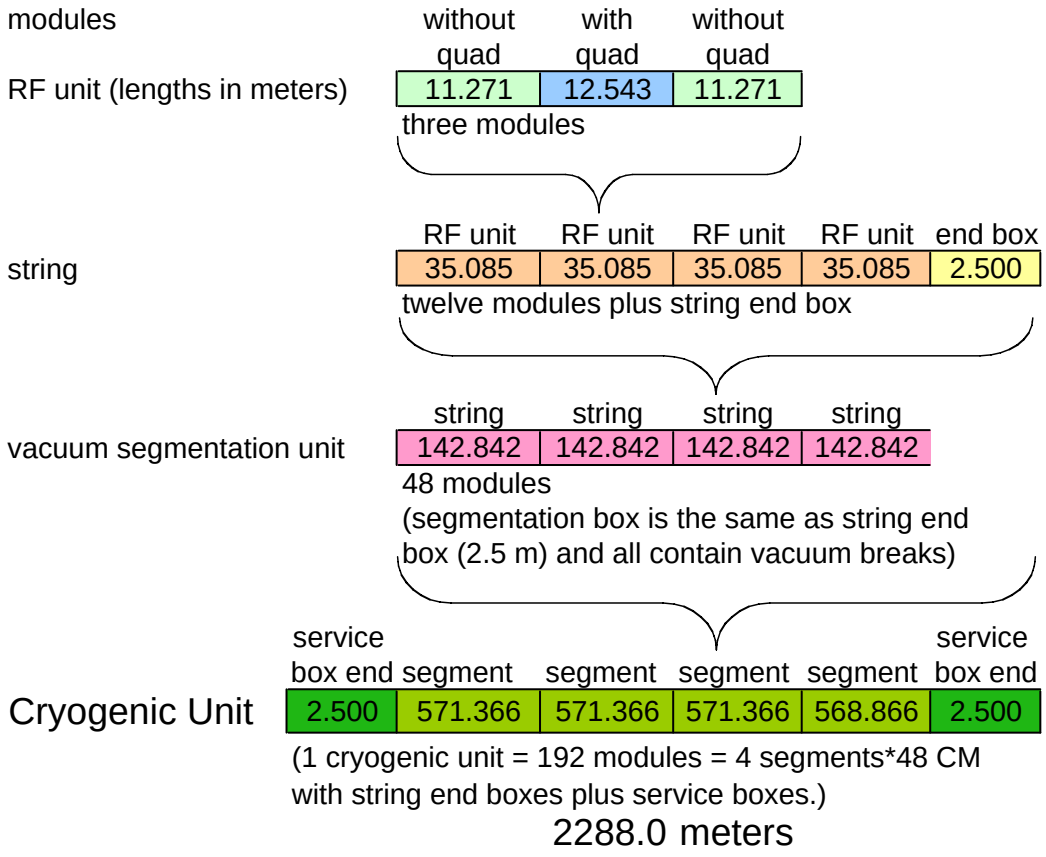
Main Linac Cold Vacuum Systems

Three main vacuum systems in the cold part :

1. Insulating vacuum system
2. Beam line vacuum system
3. Coupler vacuum system

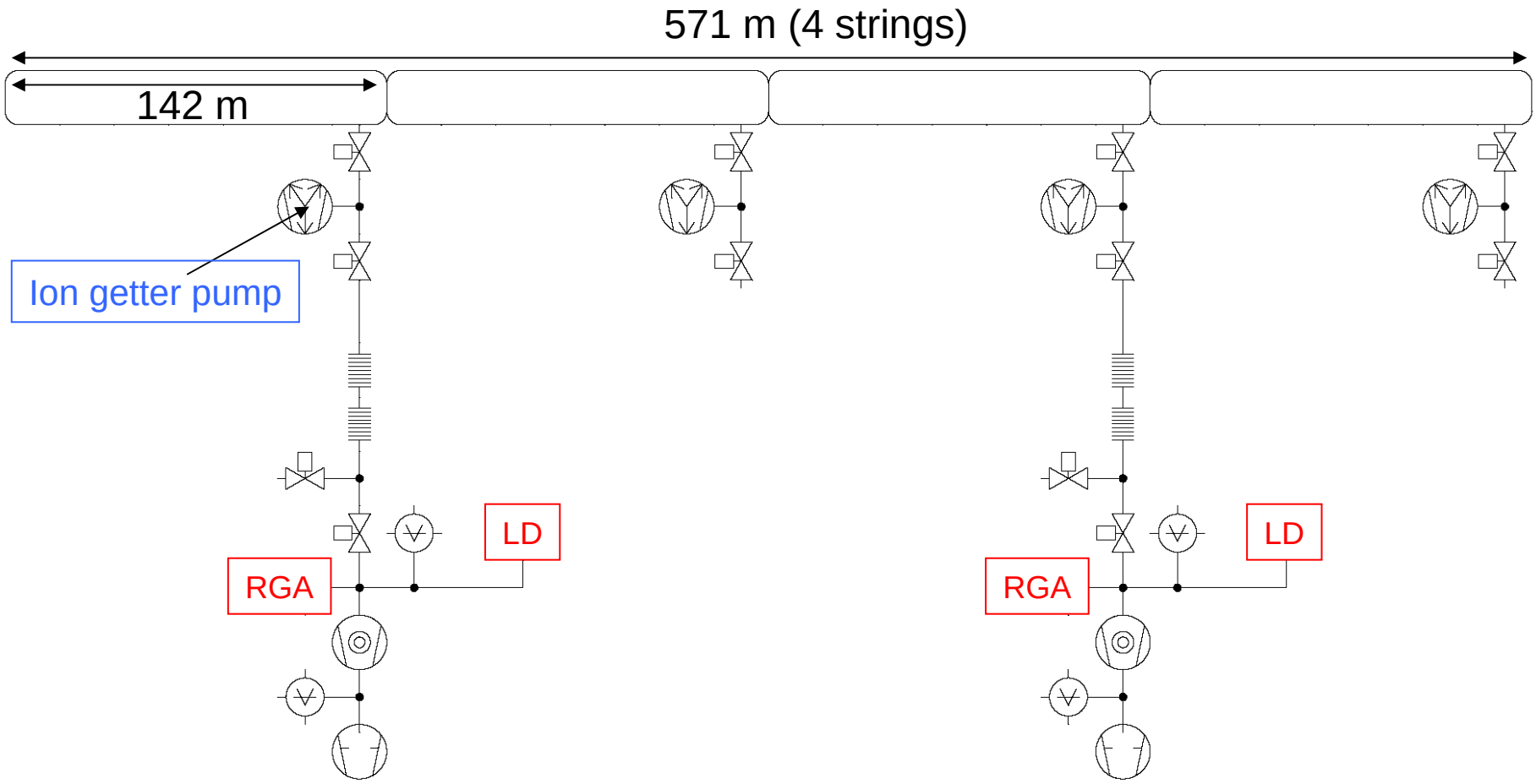
Vacuum system segmentation

- Cold vacuum system segmentation reflects the cryogenic structure of the linac.
- After 6 June videoconference the insulation vacuum breaks **should be** every 140 m?



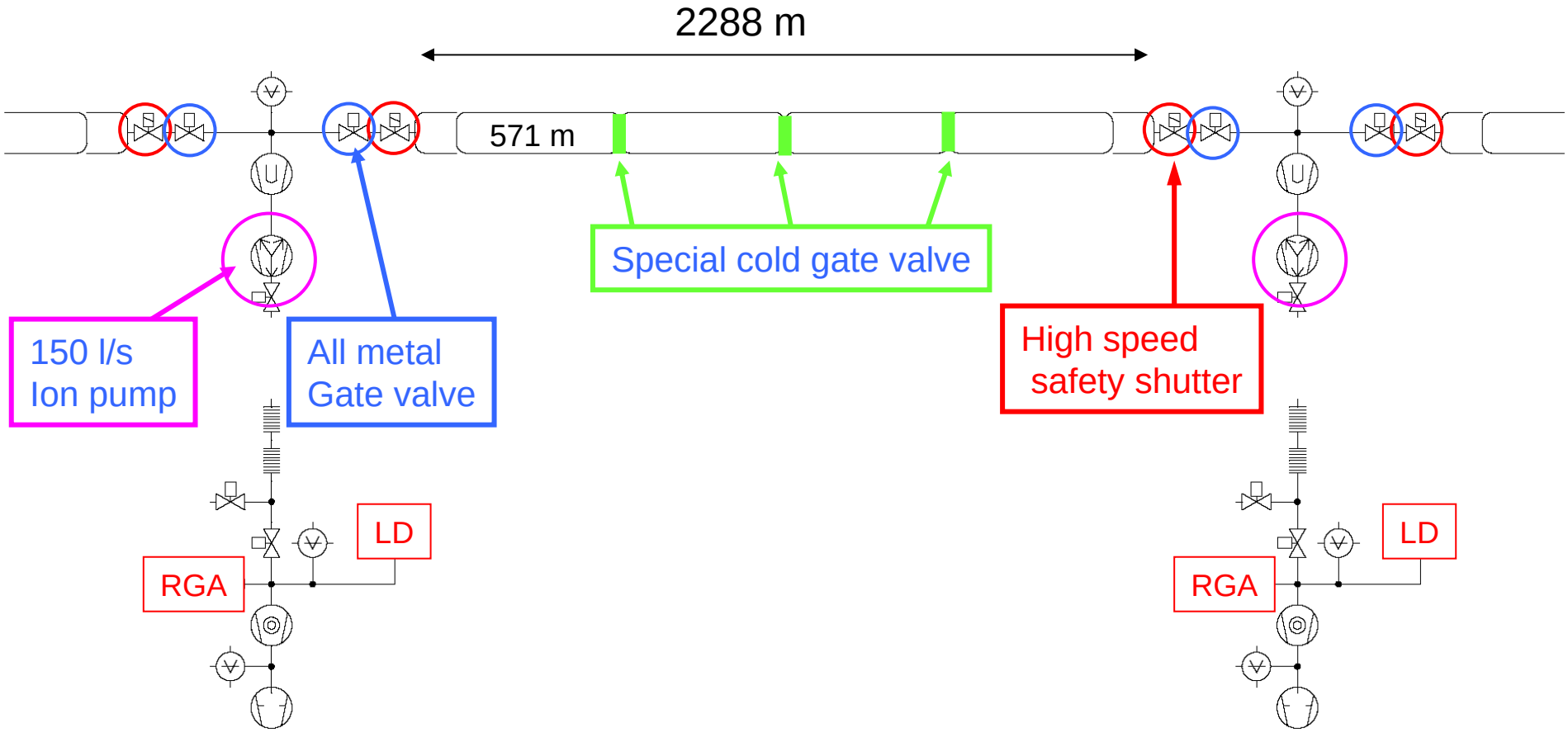
Tom Peterson, 13 June 2006

Beam line vacuum system 1/2



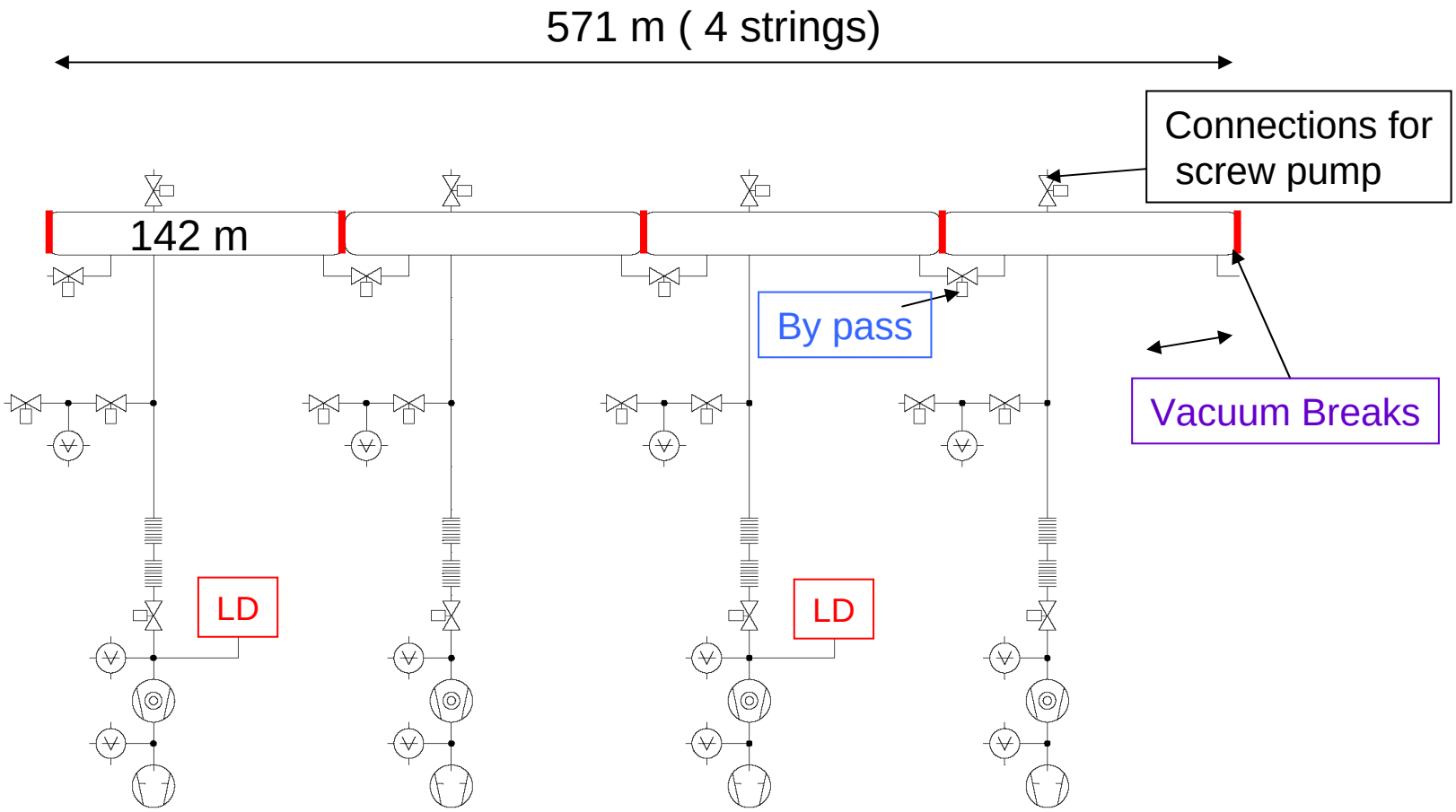
2 TMP pumping units with high sensitivity LD and RGA, safety, clean venting system, slow start pumping etc.

Beam line vacuum system 2/2



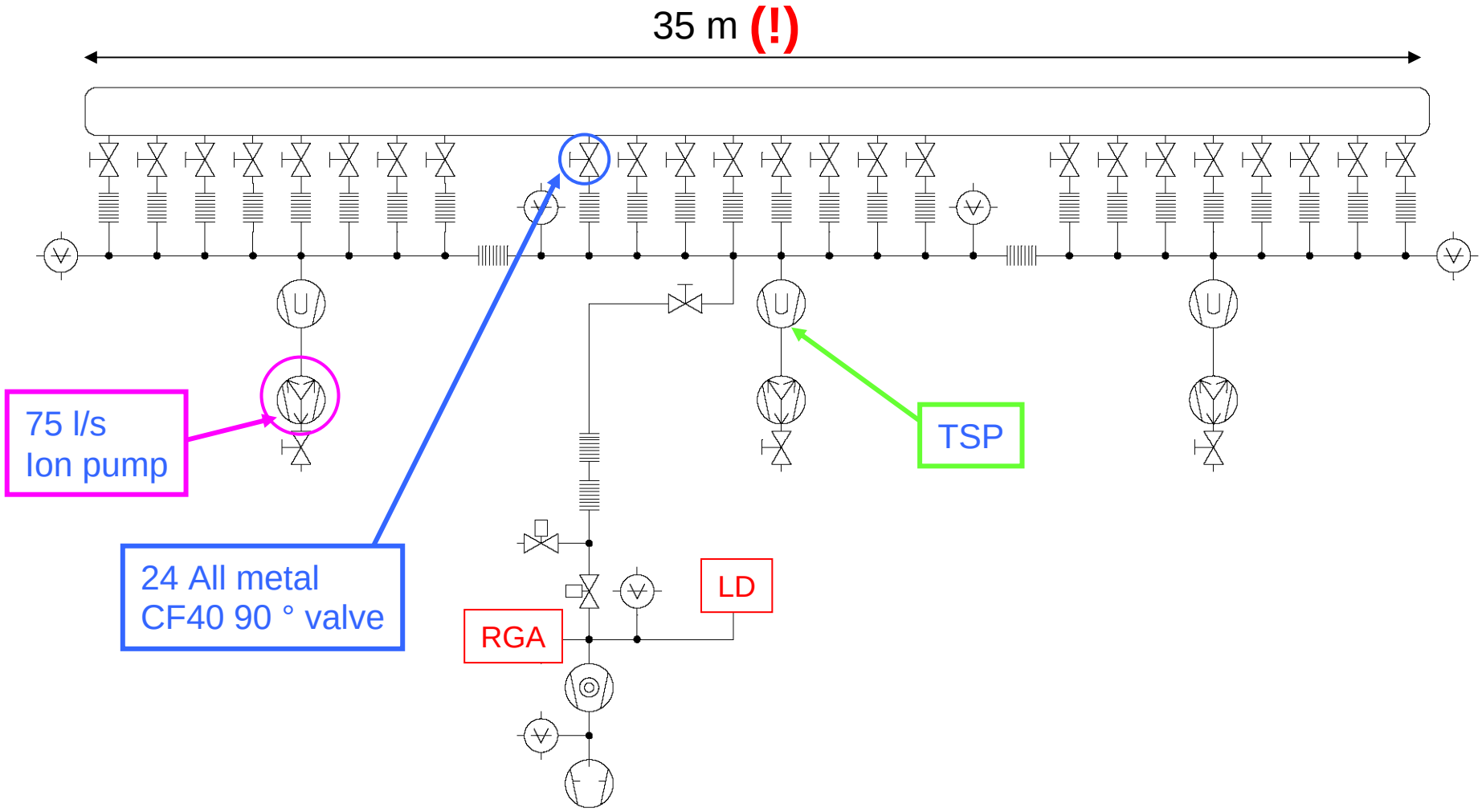
2 TMP pumping units with high sensitivity LD and RGA, safety, clean venting system, slow start pumping etc.

Insulating vacuum system



4 TMP pumping units: 2 with LD (leak detector) +
2 large screw pump for fore pumping

Coupler vacuum system



BDS and warm RTML 1

- The estimated cost is very rough. The accuracy should be ~100 %
  - **For beam pipes, two cases are considered (BDS):**
    - SS version: Use SS (Stainless Steel) for the region where SR power is low, and SS+Cu coating for the region where SR power is low but impedance should be small.
    - Aluminum version: Use aluminum alloy for above regions.
  - **For RTML, only SS version was considered.**
    - Low SR power density

BDS and warm RTML 2

- Baking in situ. is an option.
  - Assumed thermal gas desorption rate was relatively large, because no baking in situ. was basically assumed.
  - In case, baking heaters and thermal insulation were counted in this cost estimation.
  - **Detailed photo-desorption rate was not considered yet (BDS)**
  - **Cost for design work was included.**

BDS and warm RTML 3

- Included terms
  - **Beam pipes (including design cost)**
    - Circular straight pipe with Conflat SS flange, cooling channel
  - **Bellows chambers (with finger-type RF-shielding)**
  - **Pumps (with controllers, Rough pumping unit)**
  - **Vacuum gauges (with controllers)**
  - **Valves (with controllers)**
  - **Manifolds**
  - **Baking heaters and thermal insulators**
  - **Gaskets (in average size and numbers)**
  - **Bolts (with nuts, in average numbers)**
  - **Supports (in average number)**

BDS and warm RTML 4

- Not included terms
  - **Cables between components and controllers**
  - **Preparation before installation, such as assembling, pre-baking of beam pipe, testing, etc.**
  - **Power supply for baking**
  - **Spares**
  - **Installation**
  - **Alignment of beam pipes**
  - **Storage area of vacuum components before installation**

Transport Lines

- Conventional Technology
- Cost estimates based on recent procurements
- Does not include: Absorbers, installation, utilities, diagnostics

Engineering basis

- The maximum pressure in a long tube is:

$$P_{\max} = \frac{QL^2}{8C} + \frac{QL}{S} \qquad @\ x = \frac{L}{2}$$

Or

$$L_{\max} = \frac{-\frac{Q}{S} + \sqrt{\left(\frac{Q}{S}\right)^2 + 4P_{\max}\frac{Q}{8C}}}{2\times\frac{Q}{8C}}$$

Area systems not included

- One of the assumptions is that the vacuum system is so integrated into the area system, that the vacuum is part of the area, e.g. electron source, positron target, superconducting undulator,etc.

- The vacuum technical group can assist, but needs specifications.

Interfaces

- The magnet/chamber interface needs to be defined.
  - **Flanged vs welded beam pipe**
  - **Baked vs unbaked**
  - **Meeting with magnet group on Friday**

- Realized that shielded, o-ring gate valves might be available. This could reduce valve costs by ~20%.

Description of Cost Methodology

- The cost estimates are based on
  - **Industrial quotations**
  - **Prices of recently delivered components**
  - **The estimations are related to the technology, i.e. outgassing, cable lengths, distance between pumps.**

Integration and Standards

- Standardization
  - **Unsure how to normalize between the 3 regions**
  - **Design vanity versus design standards**

- Project Lifecycle Management System
  - **Will need to have version/revision control**
  - **Retrievable data that is assured of being the most current specification**

At Vancouver

- Meet with the Magnet Technical Group to resolve issues of chamber stay clear, temperature requirements
- Clarify remaining vacuum system requirements for area systems,
  - **where the electron source area wants vacuum, etc.**
- Show CCB cost estimates
  - **Seek assistance on standardization**

Valencia

- Complete cost estimates
  - **The most complex vacuum technology is related to the cold systems**
- Draft of vacuum technology report(s)
  - **Meeting with RDR group for instruction on Friday.**