ILC Cryogenic Systems
Main Linac Drift Spaces

T. Peterson

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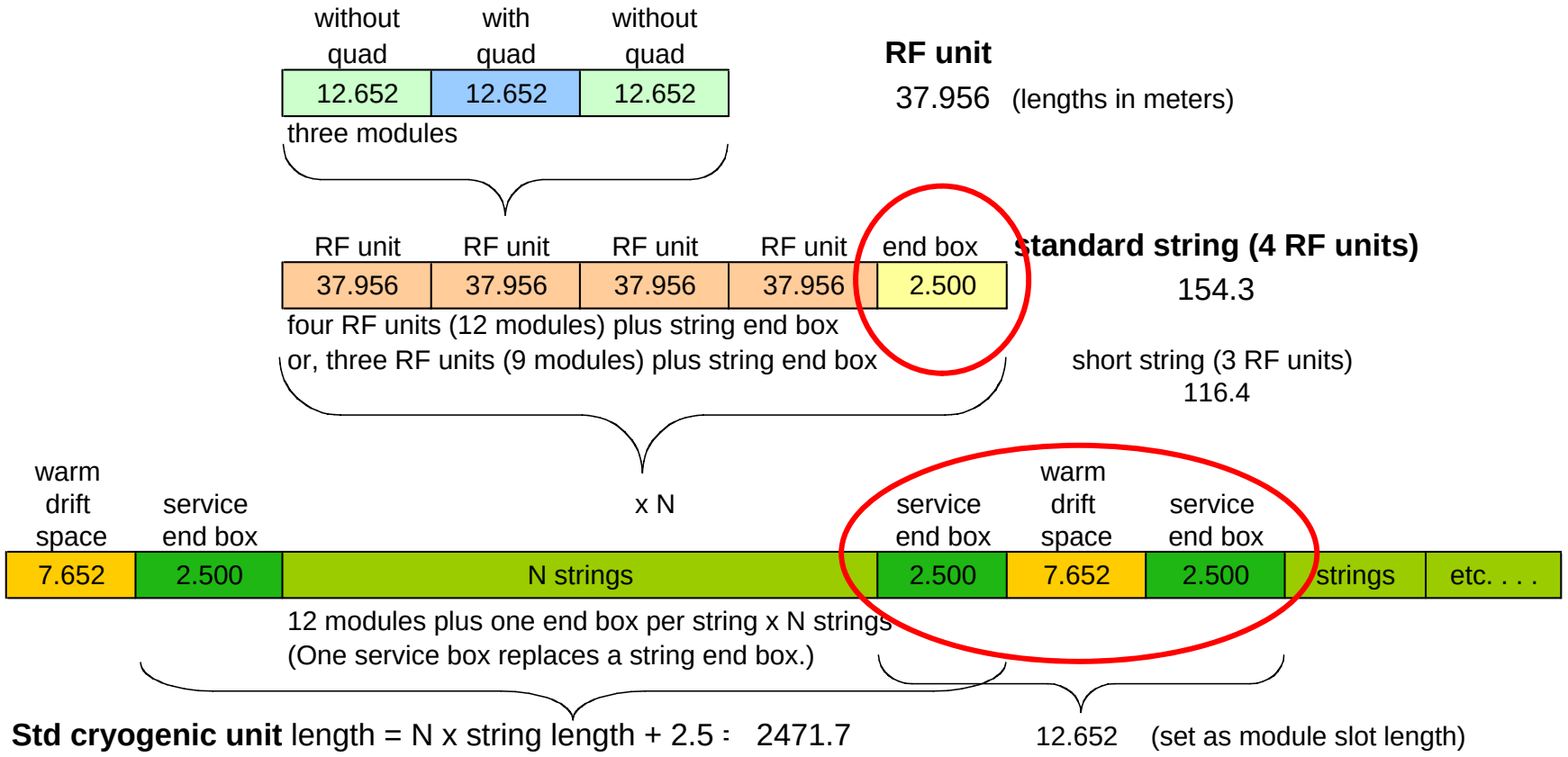
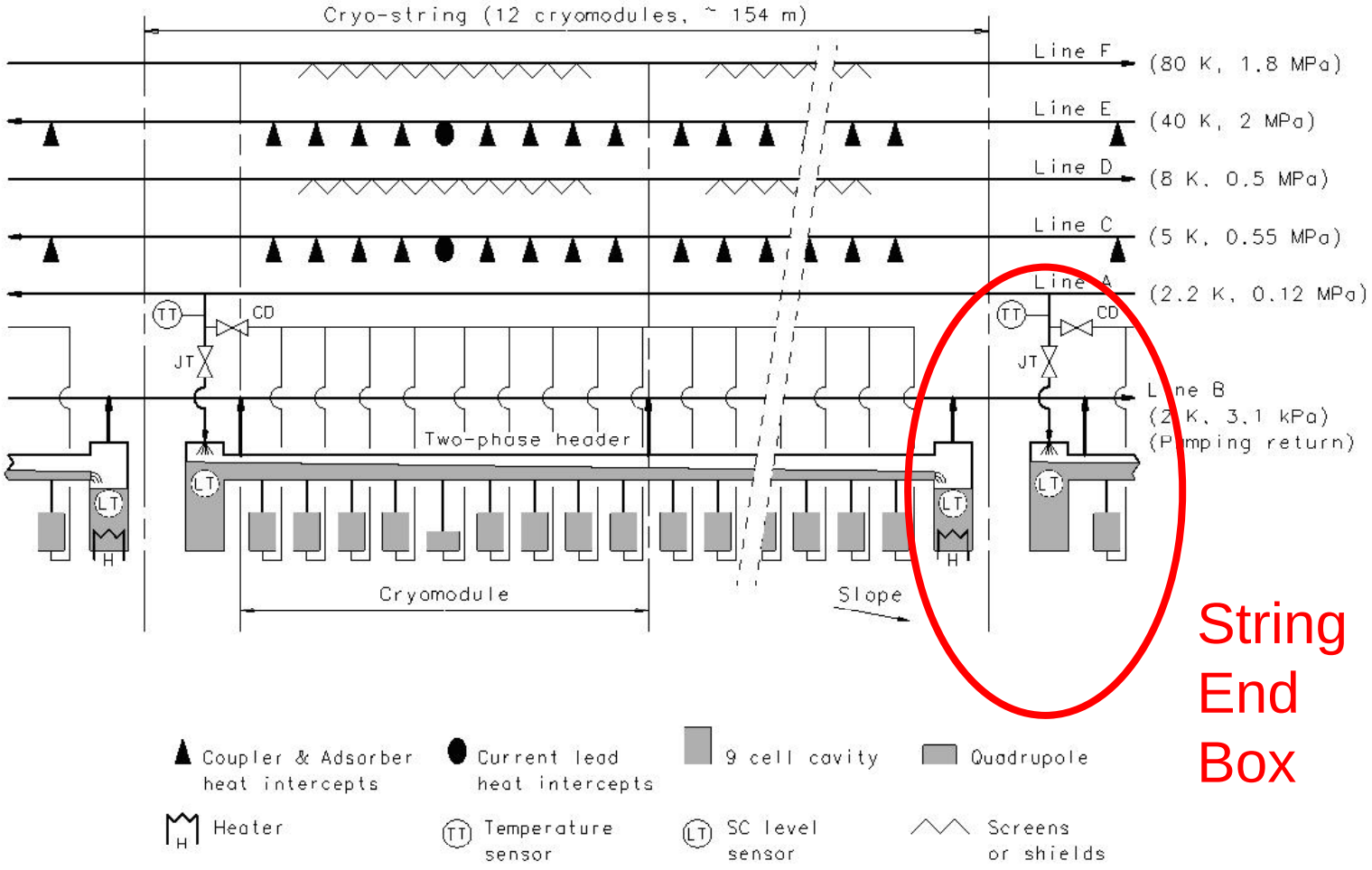
Main Linac Drift Spaces

- String end box
  - **Every string end**
  - **2.5 meter slot length**
  - **Typically every 154.3 meters**
    - Except for short strings -- 116.4 meters
- Cryogenic unit end and service boxes
  - **Ends of cryogenic units**
    - Service box (“feed” box) ties cryogenic unit to cryoplant
    - Unit end box terminates cryogenic unit and may connect to next
  - **12.65 meter slot length (cryomodule length)**
- Other drift spaces
  - **Around undulator**
  - **Main linac ends**
  - **Within RTML**

Main Linac Layout

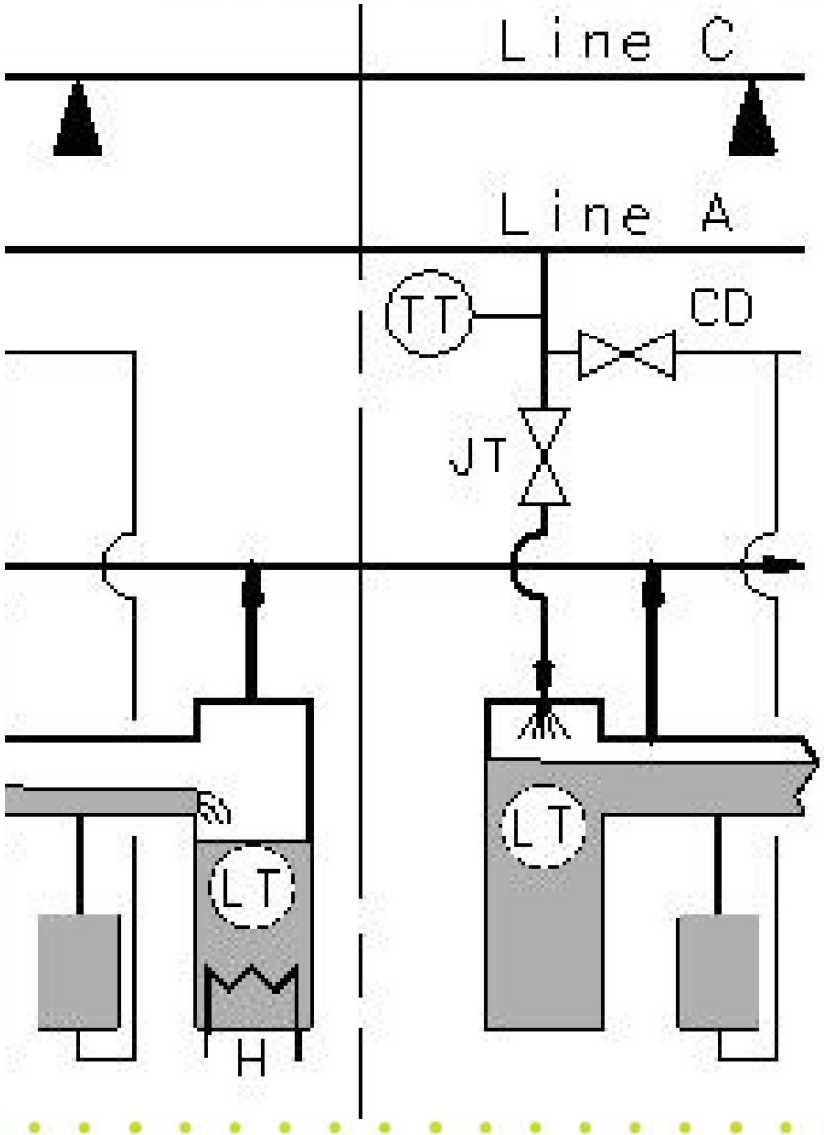


A cryogenic “string”



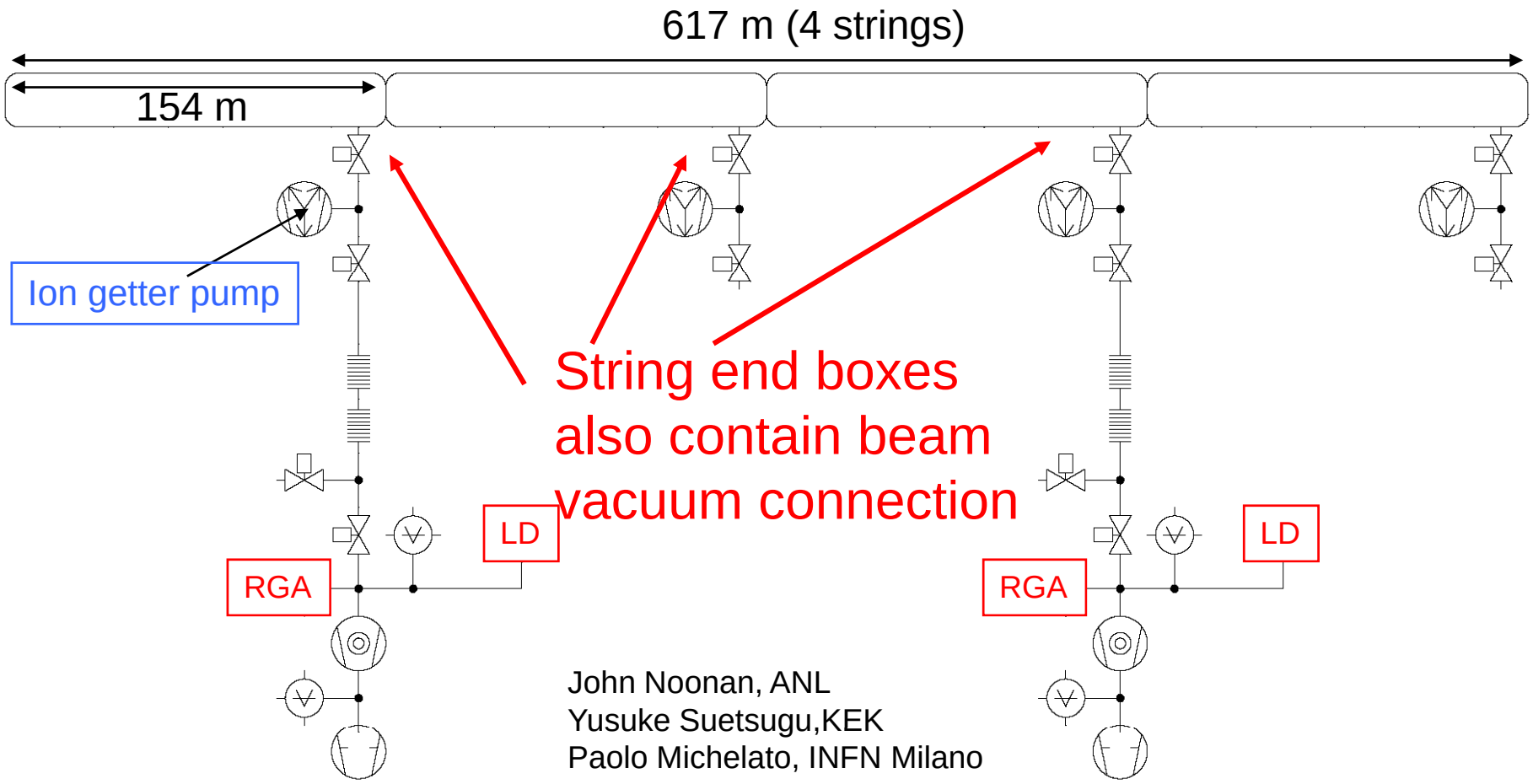
String End Box

String End Box



String end boxes contain cryogenic valves, two Small helium vessels, Instrumentation, and more

Beam line vacuum system 1/2

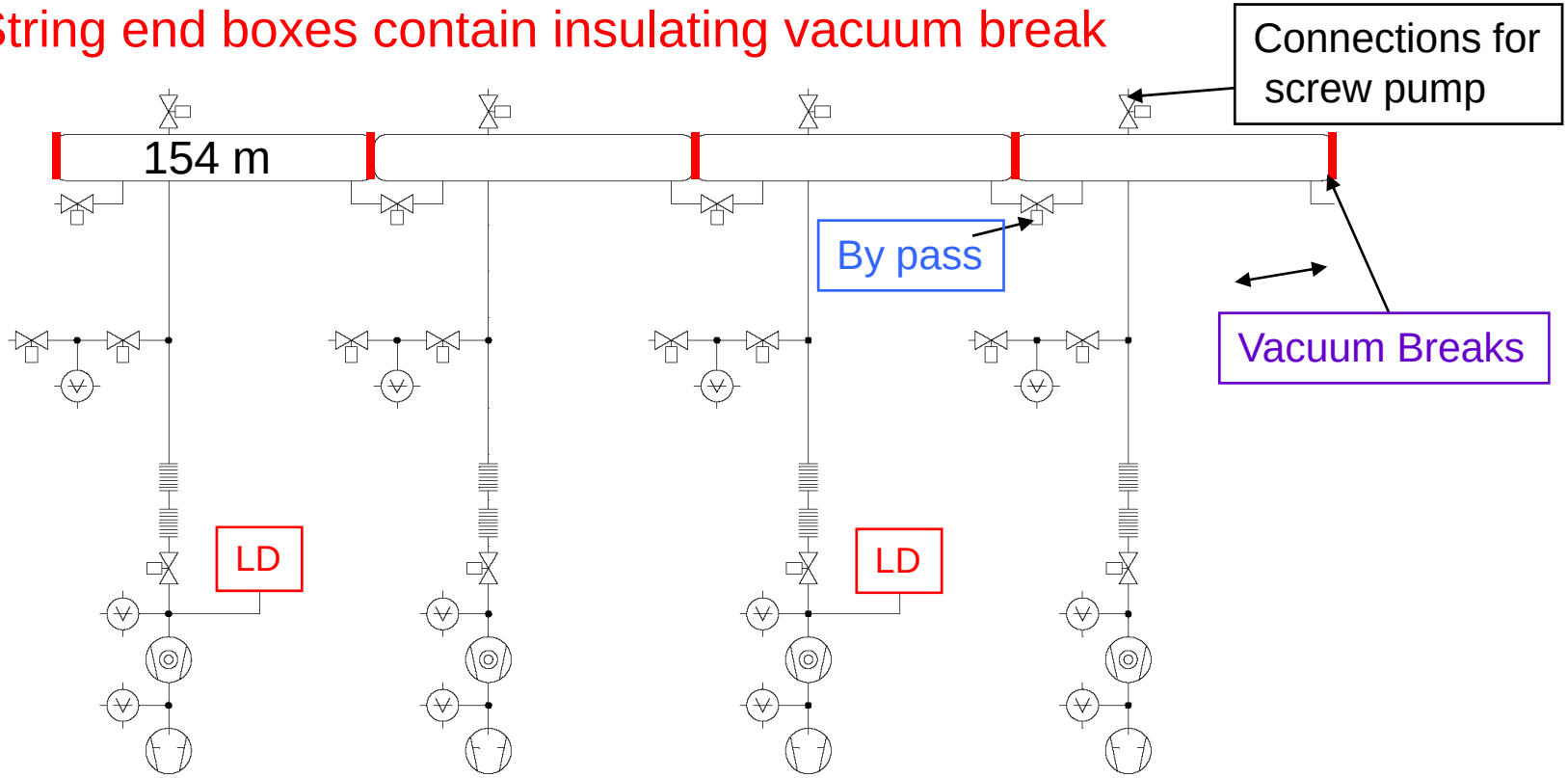


2 TMP pumping units with high sensitivity LD and RGA, safety, clean venting system, slow start pumping etc.

Insulating vacuum system

617 m (4 strings)

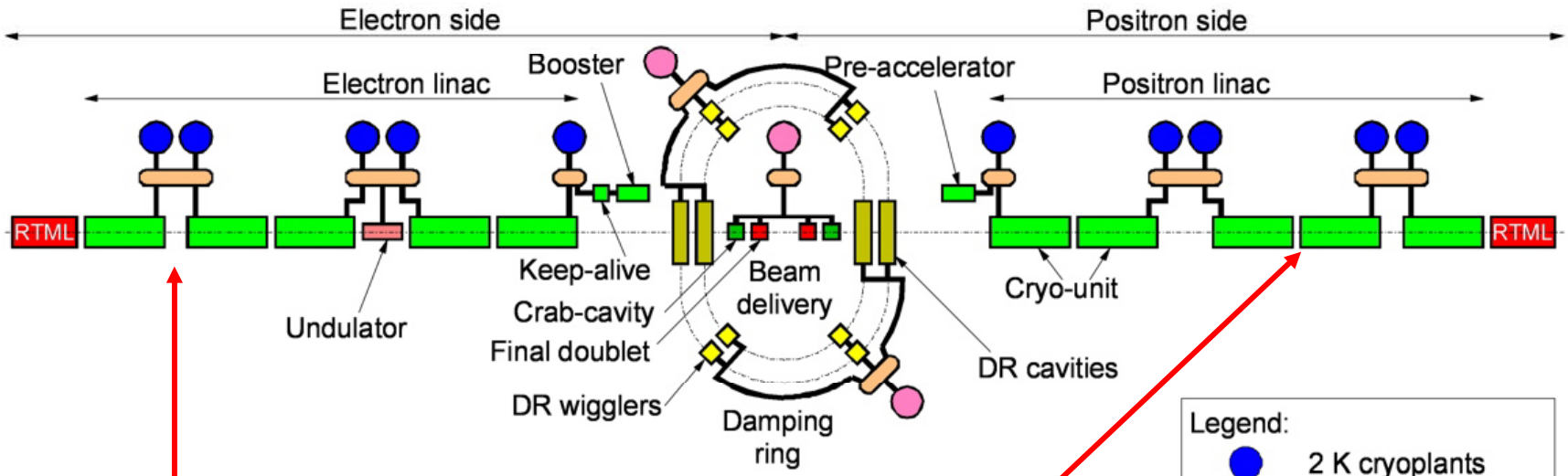
String end boxes contain insulating vacuum break



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

John Noonan, ANL
Yusuke Suetsugu,KEK
Paolo Michelato, INFN Milano

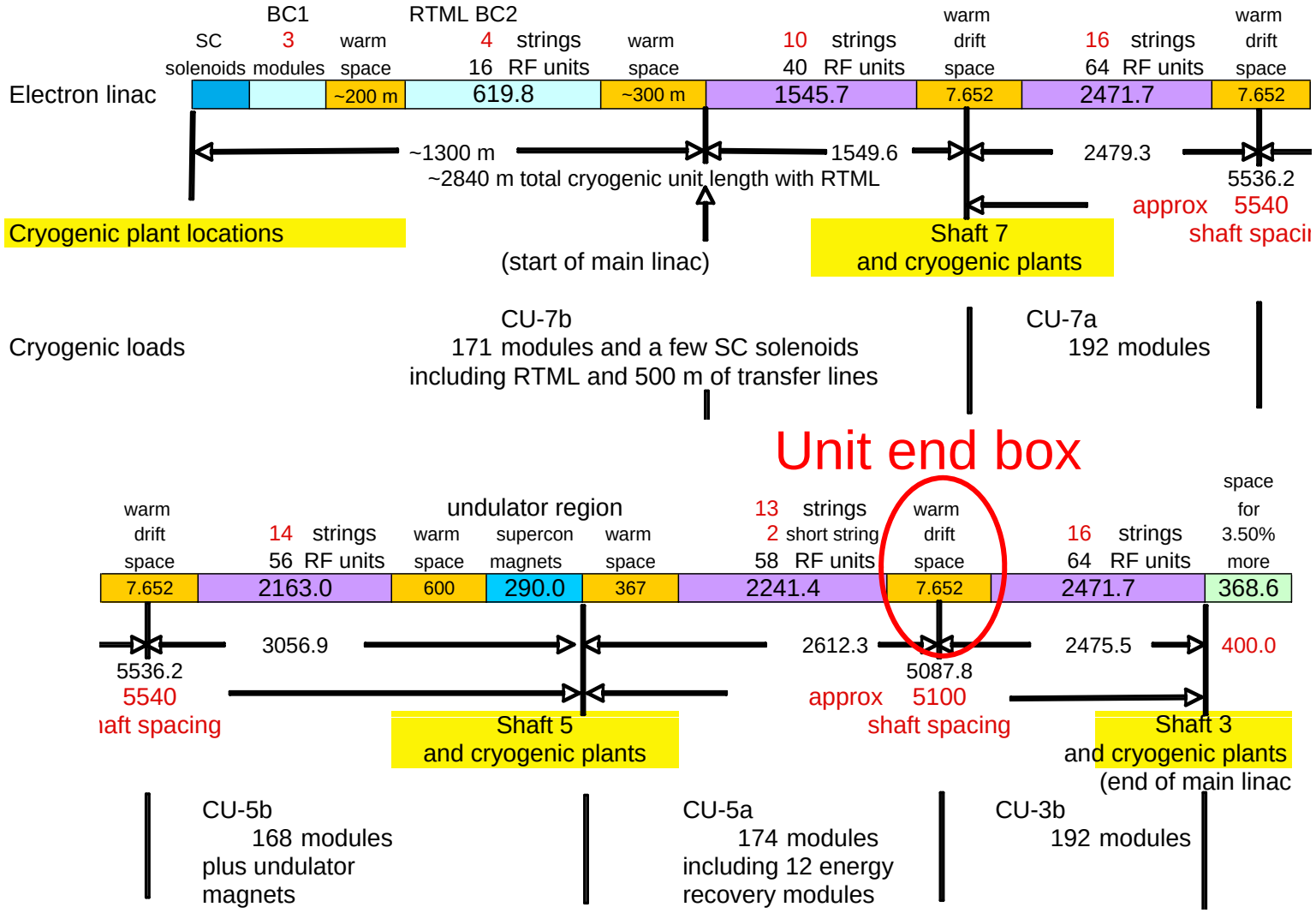
ILC cryoplant layout



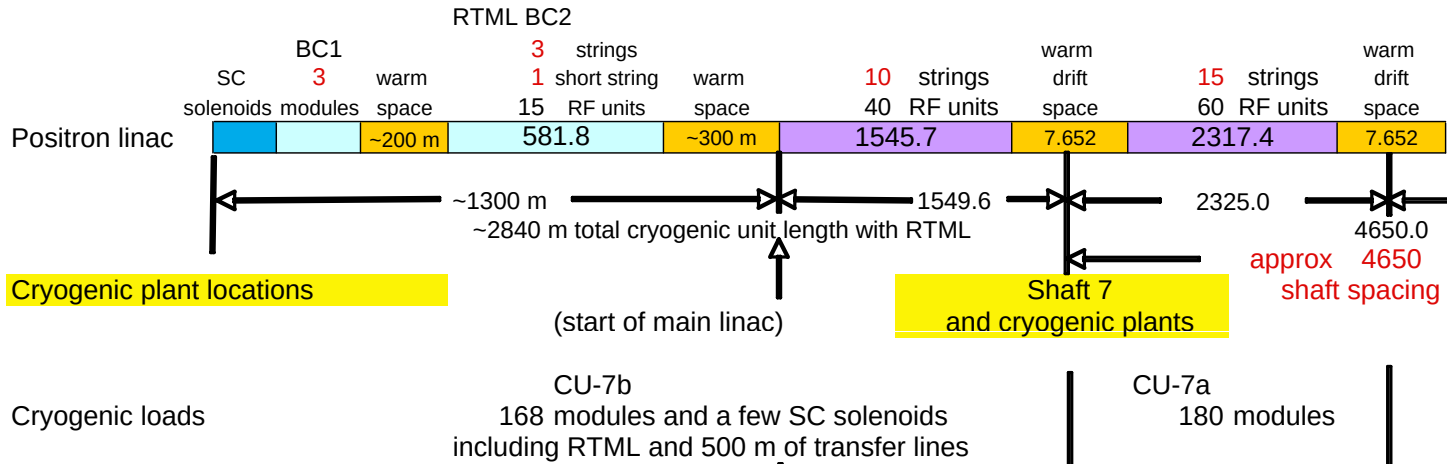
Service box with connection to cryogenic plant

Unit end box with possible cross-connect

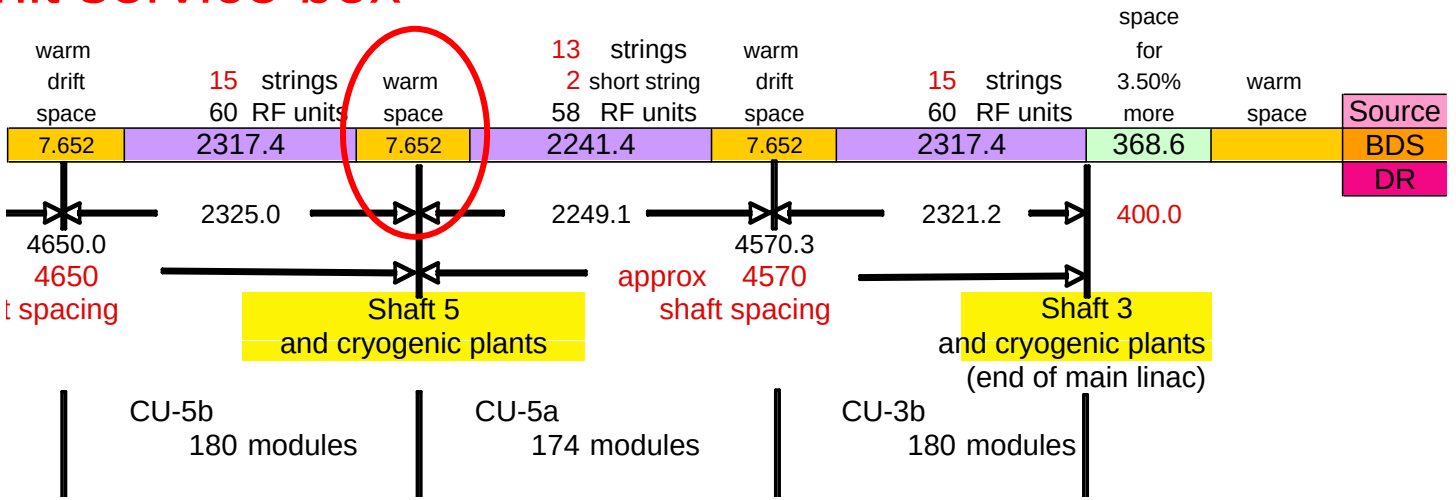
Main Linac Layout e- side



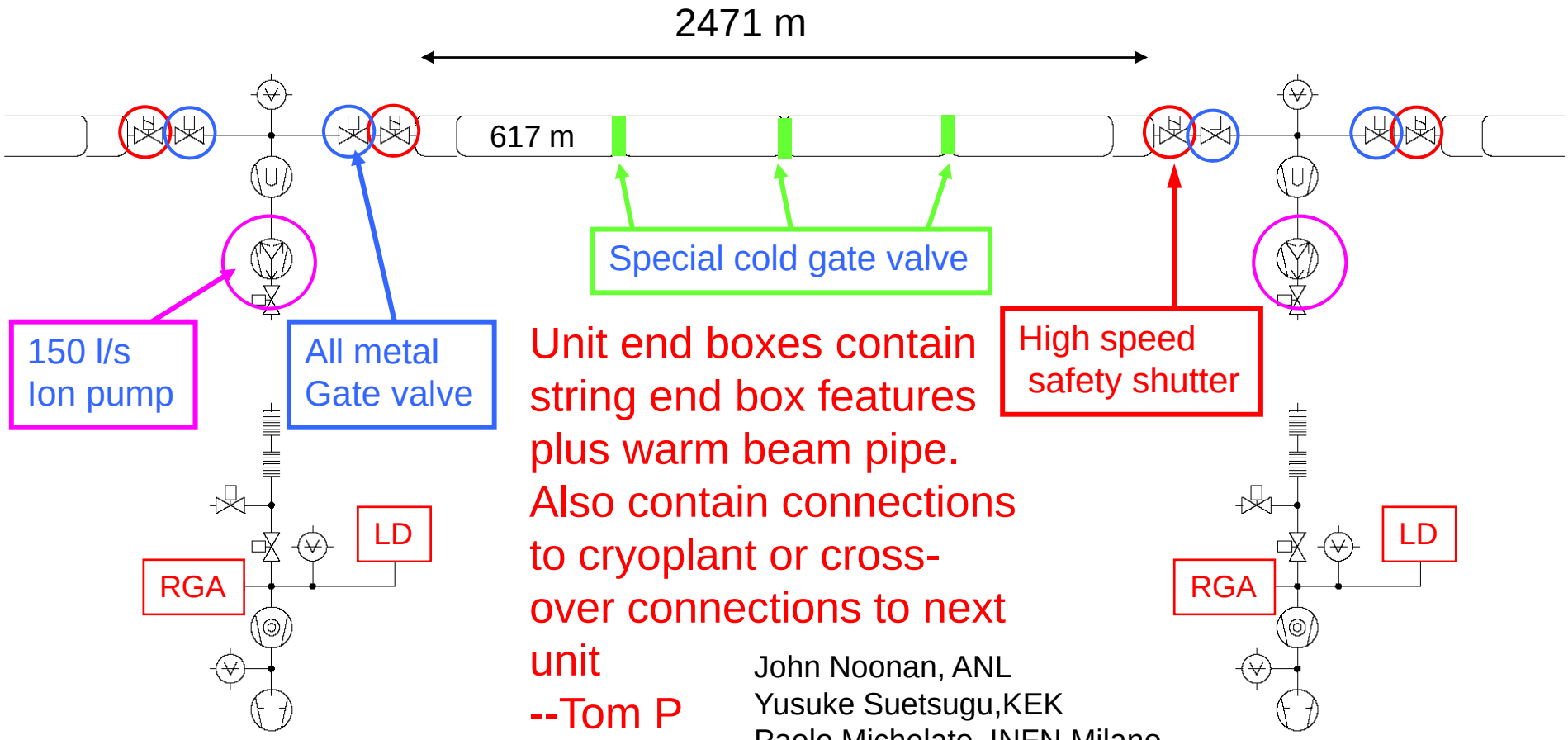
Main Linac Layout e+ side



Unit service box



Beam line vacuum system 2/2



Unit end boxes contain string end box features plus warm beam pipe. Also contain connections to cryoplant or cross-over connections to next unit
--Tom P

John Noonan, ANL
Yusuke Suetsugu,KEK
Paolo Michelato, INFN Milano

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

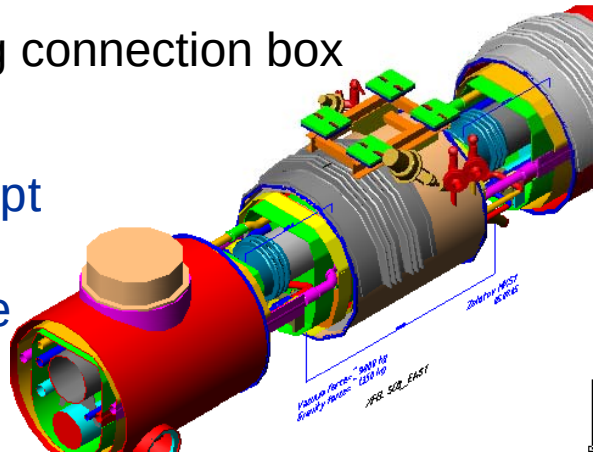
Unit service and end boxes

- Very large boxes
- Contain features of string end box, plus
  - **Warm-cold beam pipe transitions**
  - **Pipes offset to create space for beamline components**
  - **Connections to cryoplants are like cryomodule without RF -- full sized pipes within vacuum**
  - **Large end forces due to vacuum terminations and pipe offsets**
  - **Various features for insulating and beam vacuum**
  - **Instrumentation for cryogenics and vacuum**
- Some concepts for similar XFEL boxes follow

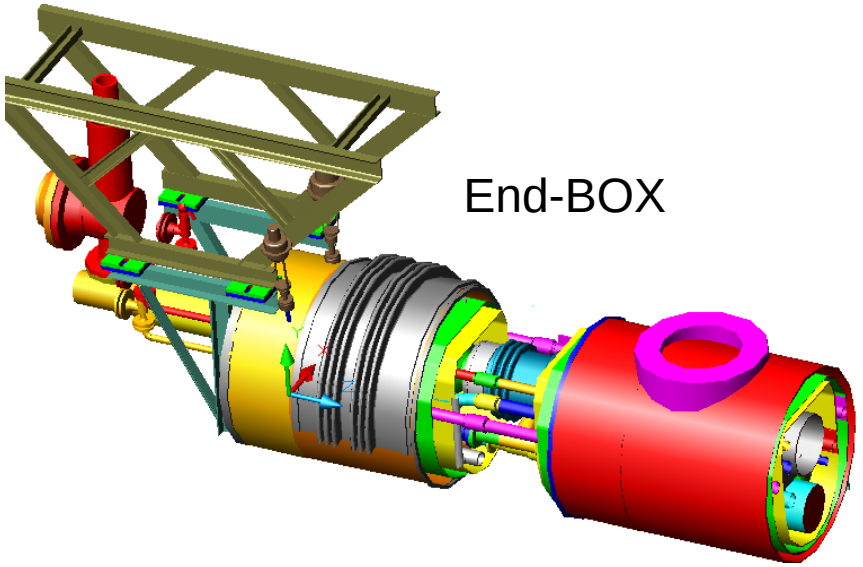
XFEL linac cryogenic components

This slide from XFEL_Cryoplant_120506.ppt by Bernd Petersen

‚regular' string connection box



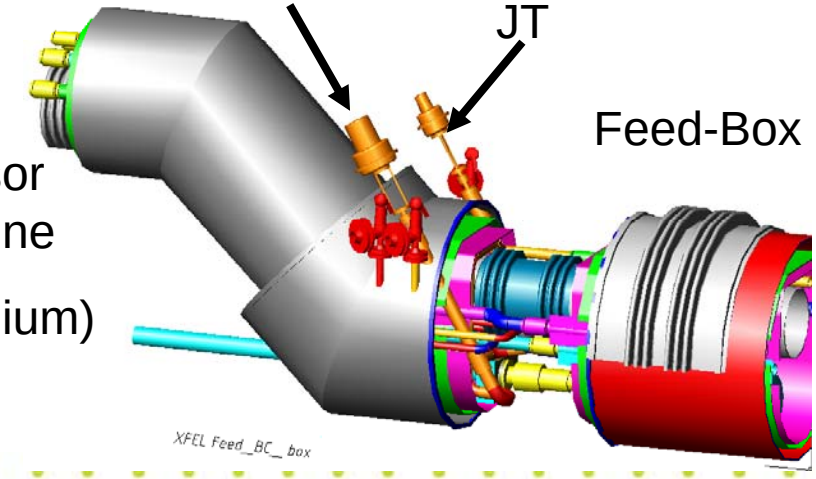
The ILC string end box concept is like this -- a short, separate cryostat



End-BOX

Cool-down/warm-up

JT



Feed-Box

Bunch Compressor Bypass Transferline

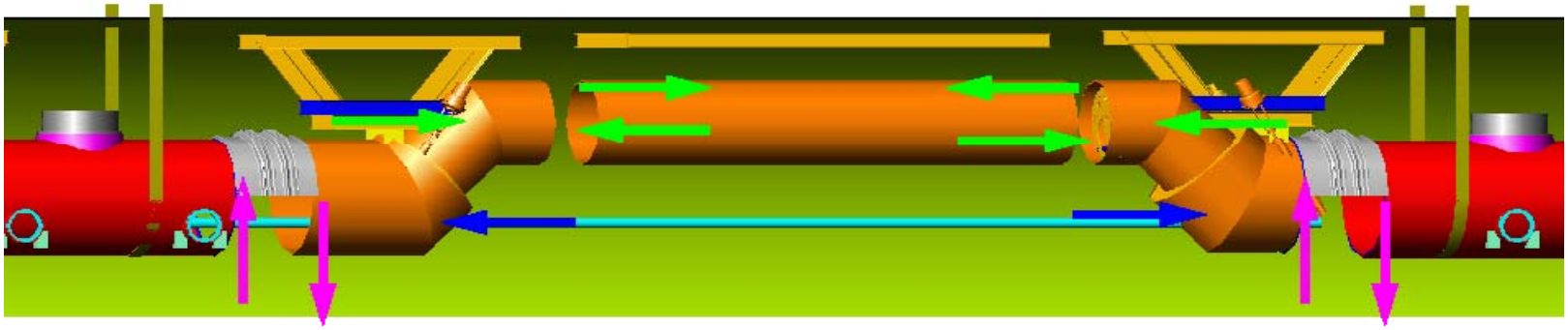
(only 1-phase helium)

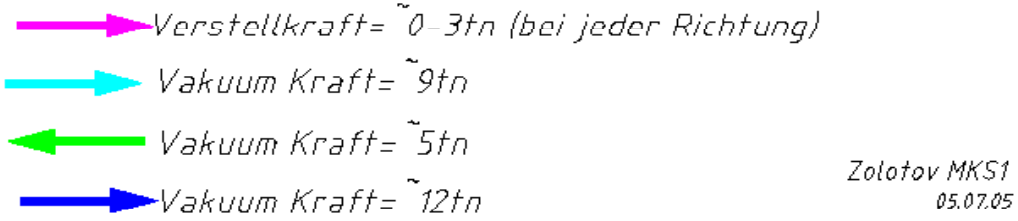
The ILC cryogenic unit service boxes may be offset from the beamline, reducing drift space length, with a concept like this.

XFEL Bunch-Compressor-Transferlines

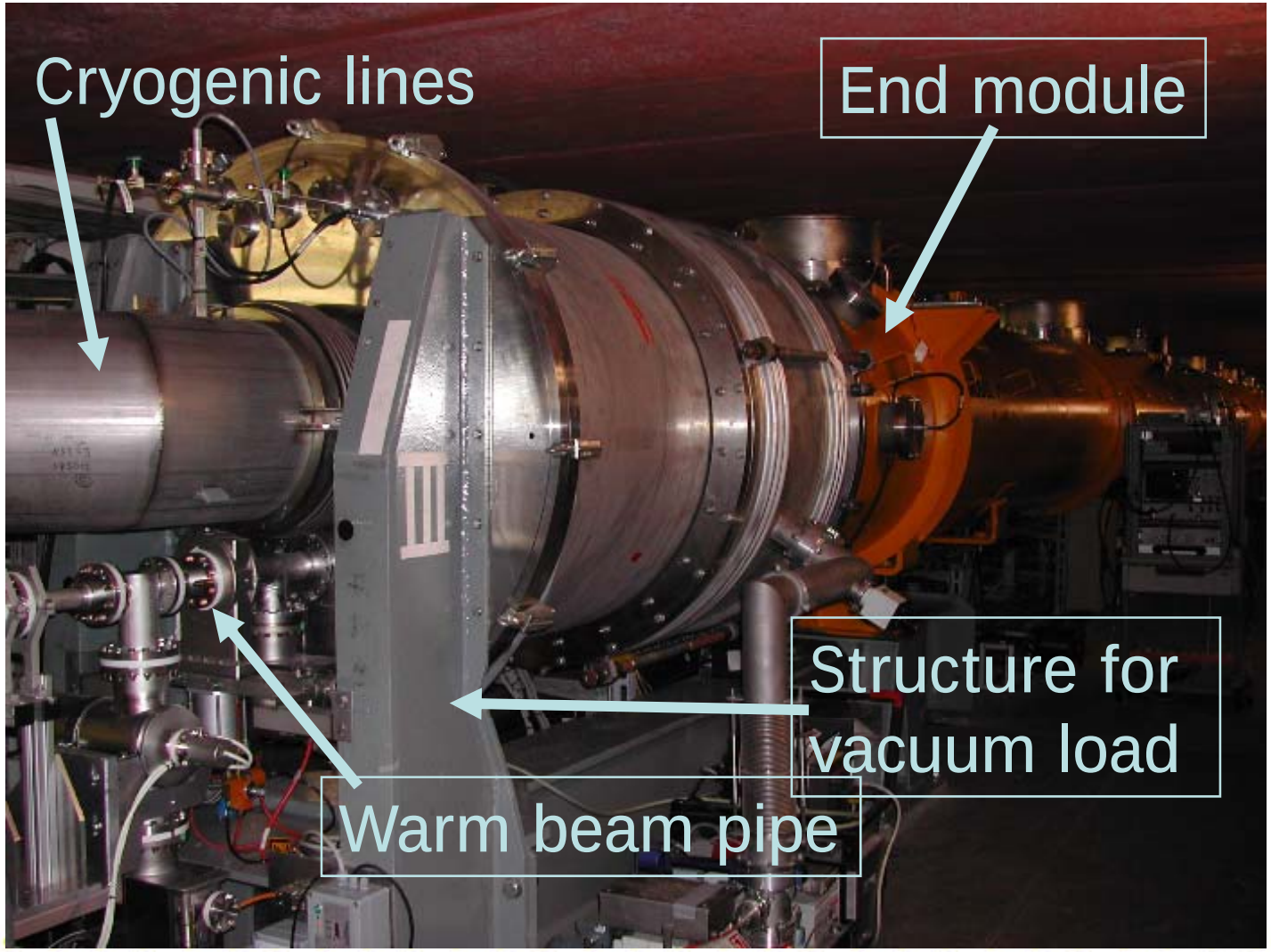
This slide from XFEL_Cryoplant_120506.ppt by Bernd Petersen

- The cryogenic unit service boxes may be offset from the beamline as shown, but they would be larger. Drift space is reduced to about 2.5 meters on each end plus warm drift space.





TTF cold-warm transition ~ 2 m



Concluding remarks

- Cryogenic box designs are only conceptual
- Lengths may change
  - **Drift space length may change slightly both for string ends and for unit ends**
  - **For string end box estimate 2.5 meters slot length +1 m / - 0.5 m range**
  - **For cryogenic unit end box or service (feed) box, selected cryomodule slot length = 12.65 m**
    - Estimate 7.65 m of this is available warm beam tube length
- Locations of short strings may change
  - **Locations with only 116.4 m between string end boxes may change**
- Cryogenic box design is a major task for the EDR
  - **Will not have detailed drawings in 2010**
  - **Aim for good 3-D CAD models and better definition of lengths and interfaces**