

# ALCPG11 – Eugene

## Positron Source

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# Positron Source UK summary

- Presentation covers the following:
  - **Positron Source breakdown**
  - **Positron Source UK summary**
  - **General Over-View of Positron Source CAD model**
  - **Positron Source walk through from end of Main LINAC to Damping Ring**
  - **Each slide shows work done and a brief work to be done outline**
  - **Final Summary**



# Positron Source breakdown

- Positron Source is broken down into the following parts (locally):

- **Undulator Area**

- Undulator Protection
- Undulator Matching
- Fast Abort Dump

- Auxiliary Source

- Target Area

- Capture Area

- 'Positron Source' Dogleg

- Transfer Line (PTRAN 1 and 2)

- 5GeV Booster

- Positron Line Transfer (PLTR)

- Spin Rotation
- Energy Compression

The EDMS Work Breakdown Structure (WBS) is as follows:

- PS Pre-Undulator
- PS Fast Abort Line
- PS Undulator Section
- PS Target Bypass Dogleg
- PS Auxiliary Source
- PS Positron Capture Section
- PS Positron Pre-Acceleration Section
- PS Transfer Lines
  - PS 400MeV Positron Transfer Line
  - PS 5GeV Positron Transfer Line
- PS 5GeV Booster
- Positron Line To Ring
  - PS Spin Rotation
  - PS Energy Compression



# Positron Source UK summary

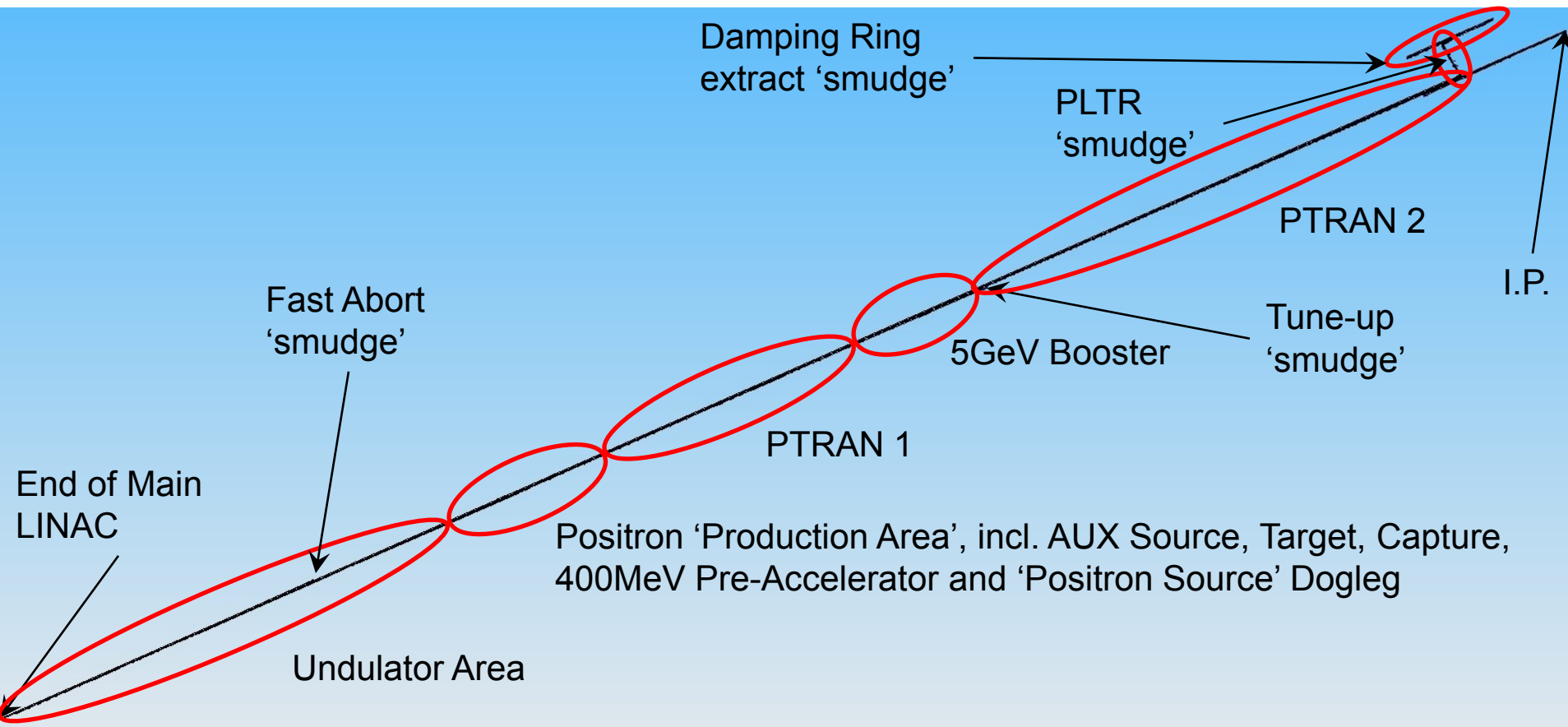
- Each section has a list of:
  - **Work done,**
  - **Improvement suggestion and**
  - **Work to be done**

**There are 2 documents pertinent to this work:**

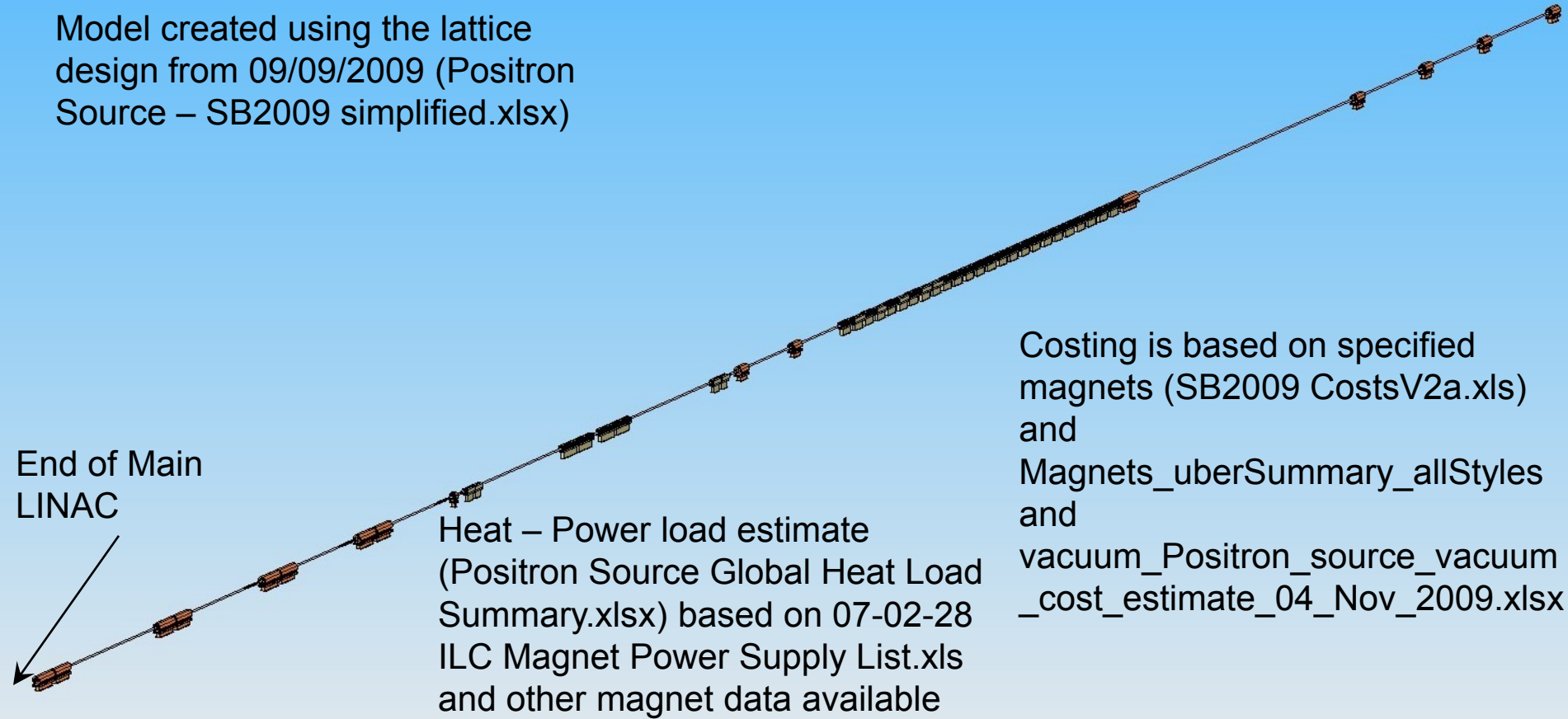
- **Document list – contains the majority of documents used to perform the work**
- **ILC Central Integration Close Out report – provides an overview of the work done for the Central Integration task**
- **Both are available on EDMS**

# Positron Source – General View

Positron Source side of ILC including BDS, RTML, Positron Source and Damping Ring extract



Model created using the lattice design from 09/09/2009 (Positron Source – SB2009 simplified.xlsx)



End of Main LINAC

Heat – Power load estimate (Positron Source Global Heat Load Summary.xlsx) based on 07-02-28 ILC Magnet Power Supply List.xls and other magnet data available

Costing is based on specified magnets (SB2009 CostsV2a.xls) and Magnets\_uberSummary\_allStyles and vacuum\_Positron\_source\_vacuum\_cost\_estimate\_04\_Nov\_2009.xlsx

This area can be optimised according to <http://projects.astec.ac.uk/ilcdecks/> in conjunction with the Fast Abort Dump. These sections have been ‘copied’ from the RDR Tune-Up line and undergone an initial optimisation process.



# PS – Pre-Undulator - Matching

Model created using the lattice design from 09/09/2009 (Positron Source – SB2009 simplified.xlsx)

Heat – Power load estimate (Positron Source Global Heat Load Summary.xlsx) based on 07-02-28 ILC Magnet Power Supply List.xls and other magnet data available

Costing is based on specified magnets (SB2009 CostsV2a.xls) and Magnets\_uberSummary\_allStyles and vacuum\_Positron\_source\_vacuum\_cost\_estimate\_04\_Nov\_2009.xlsx

This area can be considered complete. There may be a change in position (relative to I.P.) due to BDS optimisation.



# PS – Fast Abort Line

Model created using the lattice design from 09/09/2009 (Positron Source – SB2009 simplified.xlsx)

Heat – Power load estimate (Positron Source Global Heat Load Summary.xlsx) based on 07-02-28 ILC Magnet Power Supply List.xls and other magnet data available

Costing is based on specified magnets (SB2009 CostsV2a.xls) and Magnets\_uberSummary\_allStyles and vacuum\_Positron\_source\_vacuum\_cost\_estimate\_04\_Nov\_2009.xlsx

This area must be revised. Some criteria to bear in mind are the shielding requirement and separation from Undulator section.





# PS – Undulator Section

Model created using the lattice design from 09/09/2009 (Positron Source – SB2009 simplified.xlsx)

Heat – Power load estimate (Positron Source Global Heat Load Summary.xlsx) established from information supplied by RAL colleagues

Costing is based on information supplied by RAL colleague and includes Cryo and Power supply

61 Strings consisting of:  
3 Undulators and one  
Quadrupole magnet

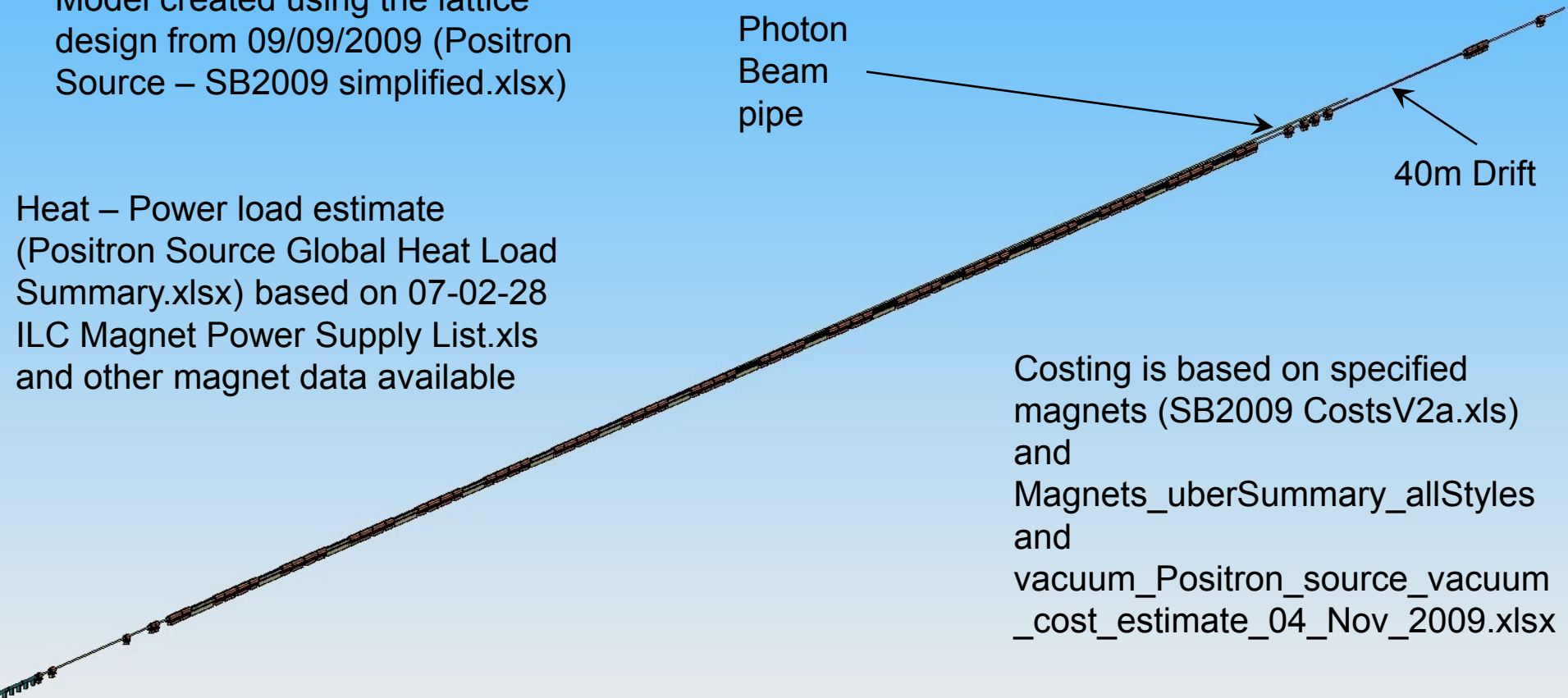
The Undulator area has been extended to an effective 235m (306m physical) and the magnet length (at end of 3 Undulator string) increased. The Undulator prototype is now not far of completion). See: 2010.07.15\_-\_7th\_Positron\_Source\_Meeting\_-\_DESY\_-\_4m\_module\_-\_Owen\_Taylor.ppt

# PS – Target Bypass Dogleg

Model created using the lattice design from 09/09/2009 (Positron Source – SB2009 simplified.xlsx)

Photon Beam pipe

40m Drift

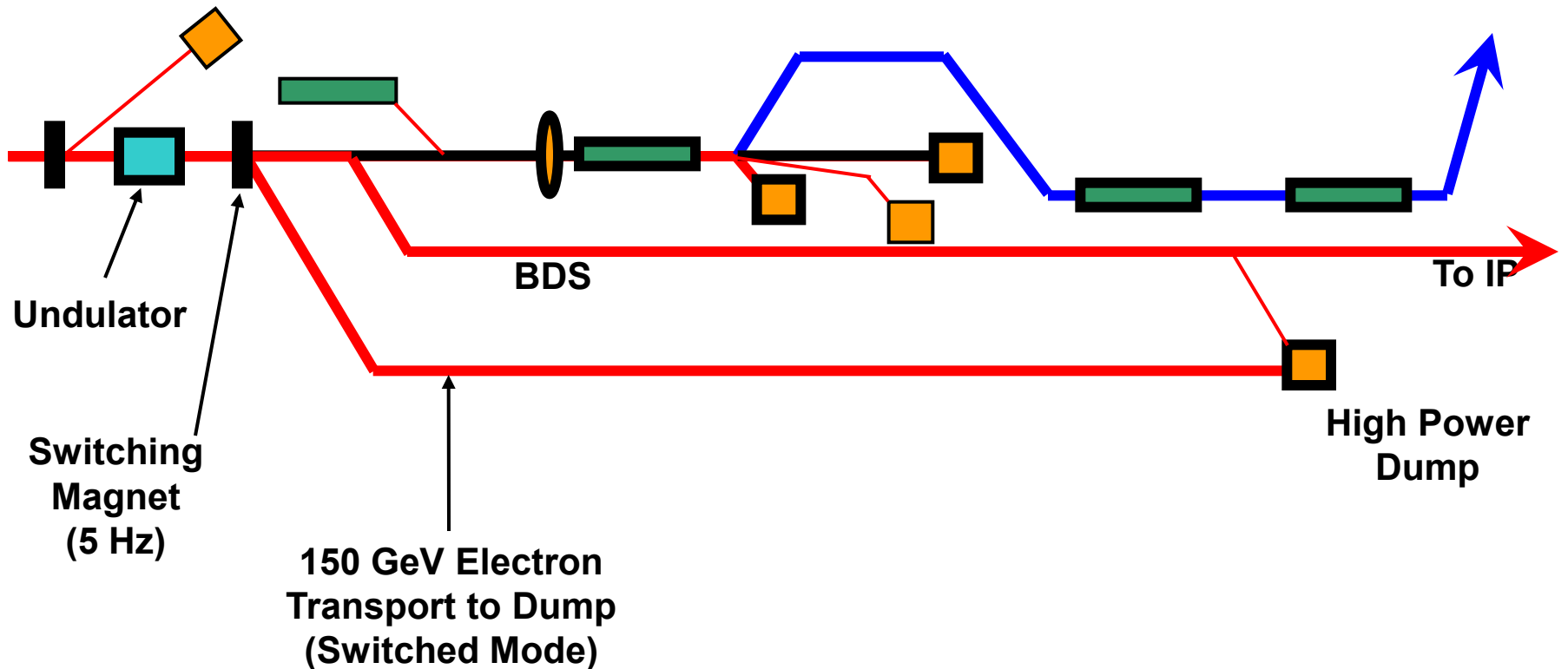


Heat – Power load estimate (Positron Source Global Heat Load Summary.xlsx) based on 07-02-28 ILC Magnet Power Supply List.xls and other magnet data available

Costing is based on specified magnets (SB2009 CostsV2a.xls) and Magnets\_uberSummary\_allStyles and vacuum\_Positron\_source\_vacuum\_cost\_estimate\_04\_Nov\_2009.xlsx

The dogleg provides a 1.5m beam offset. For the 10Hz low energy operation this must be revised. An Additional beam line is required and a 5Hz switching magnet. See 10HZ Low Energy Operation.pptx (J. Clarke)

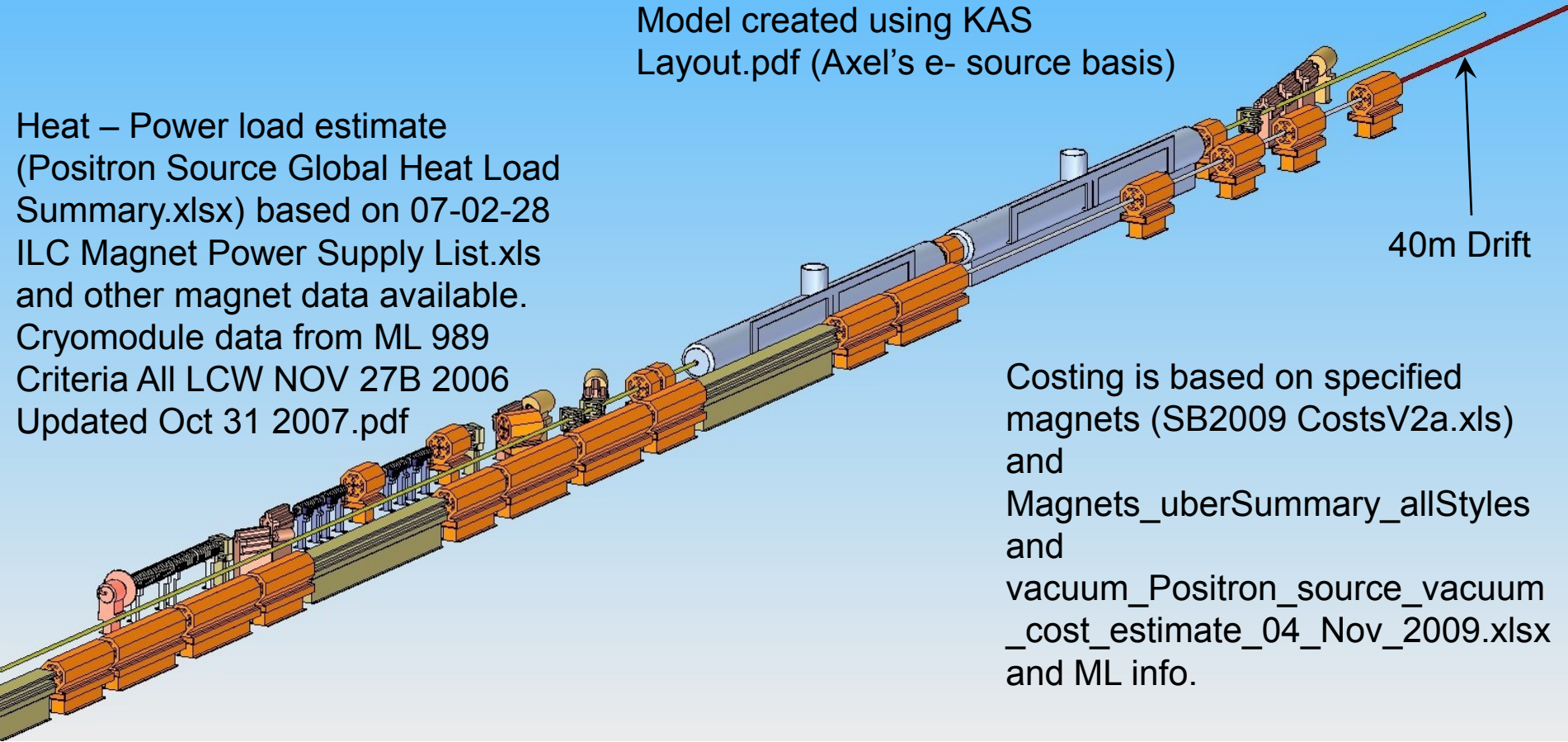
## Jim's 10Hz proposal:



# PS – Auxiliary Source (AUX)

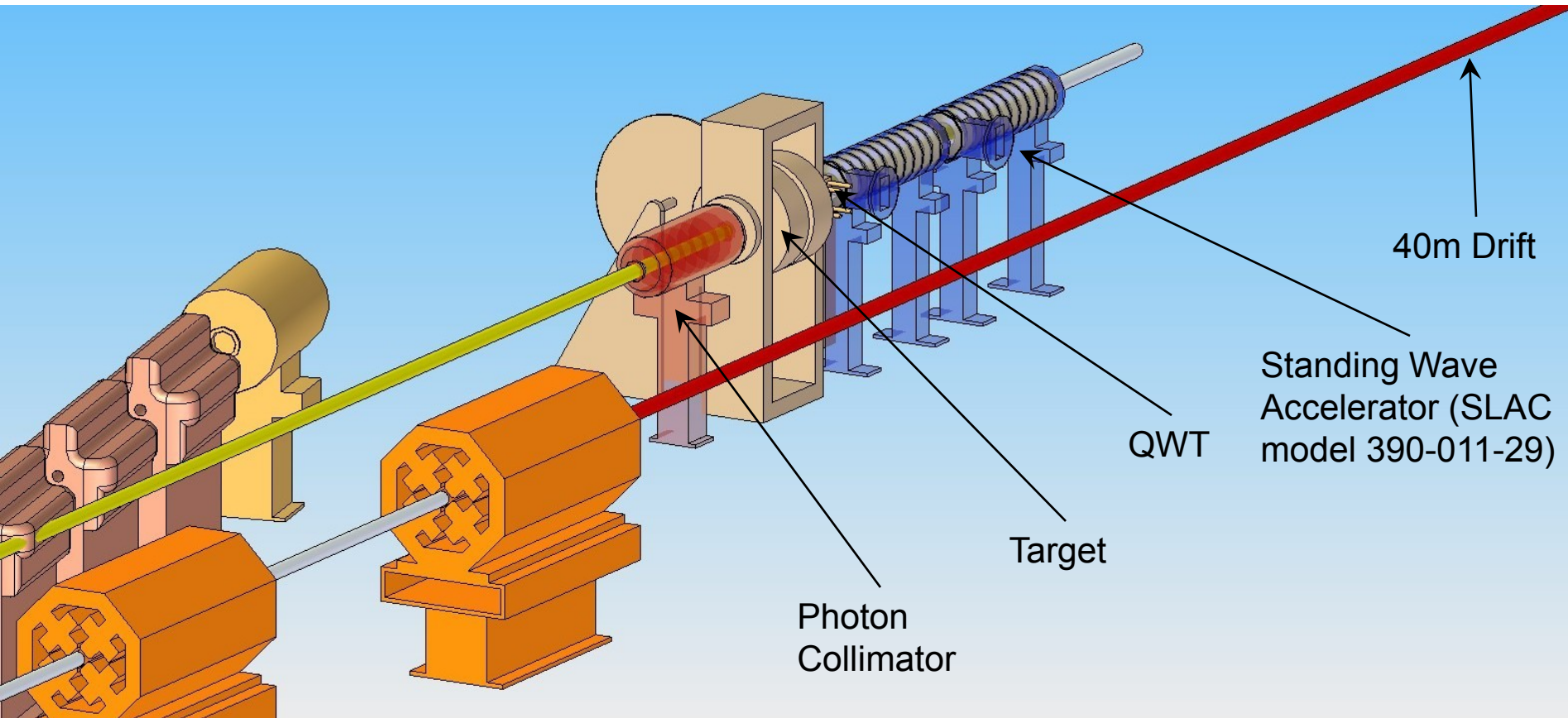
Model created using KAS  
Layout.pdf (Axel's e- source basis)

Heat – Power load estimate  
(Positron Source Global Heat Load  
Summary.xlsx) based on 07-02-28  
ILC Magnet Power Supply List.xls  
and other magnet data available.  
Cryomodule data from ML 989  
Criteria All LCW NOV 27B 2006  
Updated Oct 31 2007.pdf



Costing is based on specified  
magnets (SB2009 CostsV2a.xls)  
and  
Magnets\_uberSummary\_allStyles  
and  
vacuum\_Positron\_source\_vacuum  
\_cost\_estimate\_04\_Nov\_2009.xlsx  
and ML info.

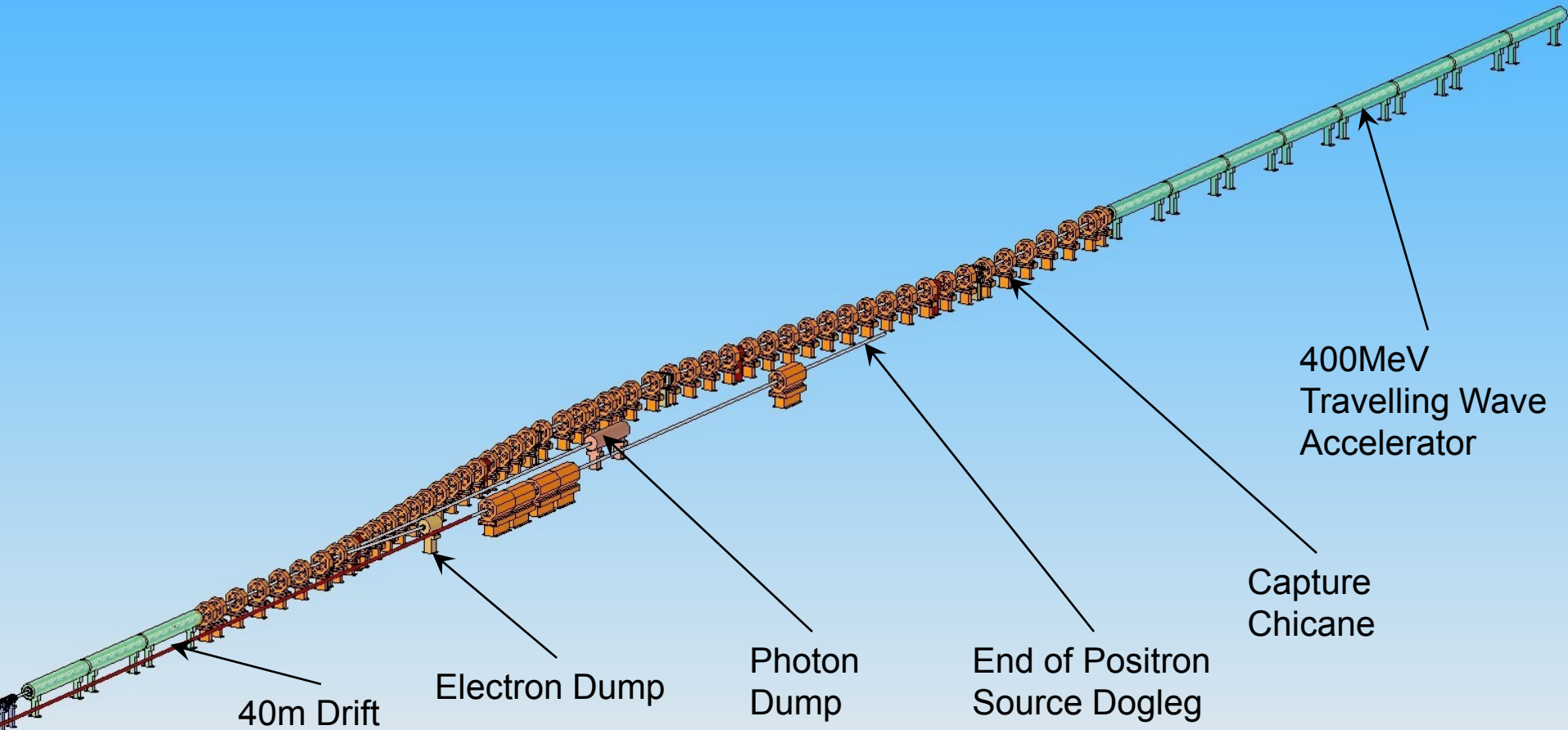
The AUX source is at this moment in time not much more than an artists impression. The lattice needs to be designed. It is feasible to utilise the photon vacuum vessel and the distance to the target needs to be defined.



The Target Area has seen a lot of work during Positron Source workshops. The remote handling enclosure is not shown. The target requires a redesign to cater for the AUX source beam. Latest workshop info: <http://indico.desy.de/conferenceOtherViews.py?view=standard&confId=3061>

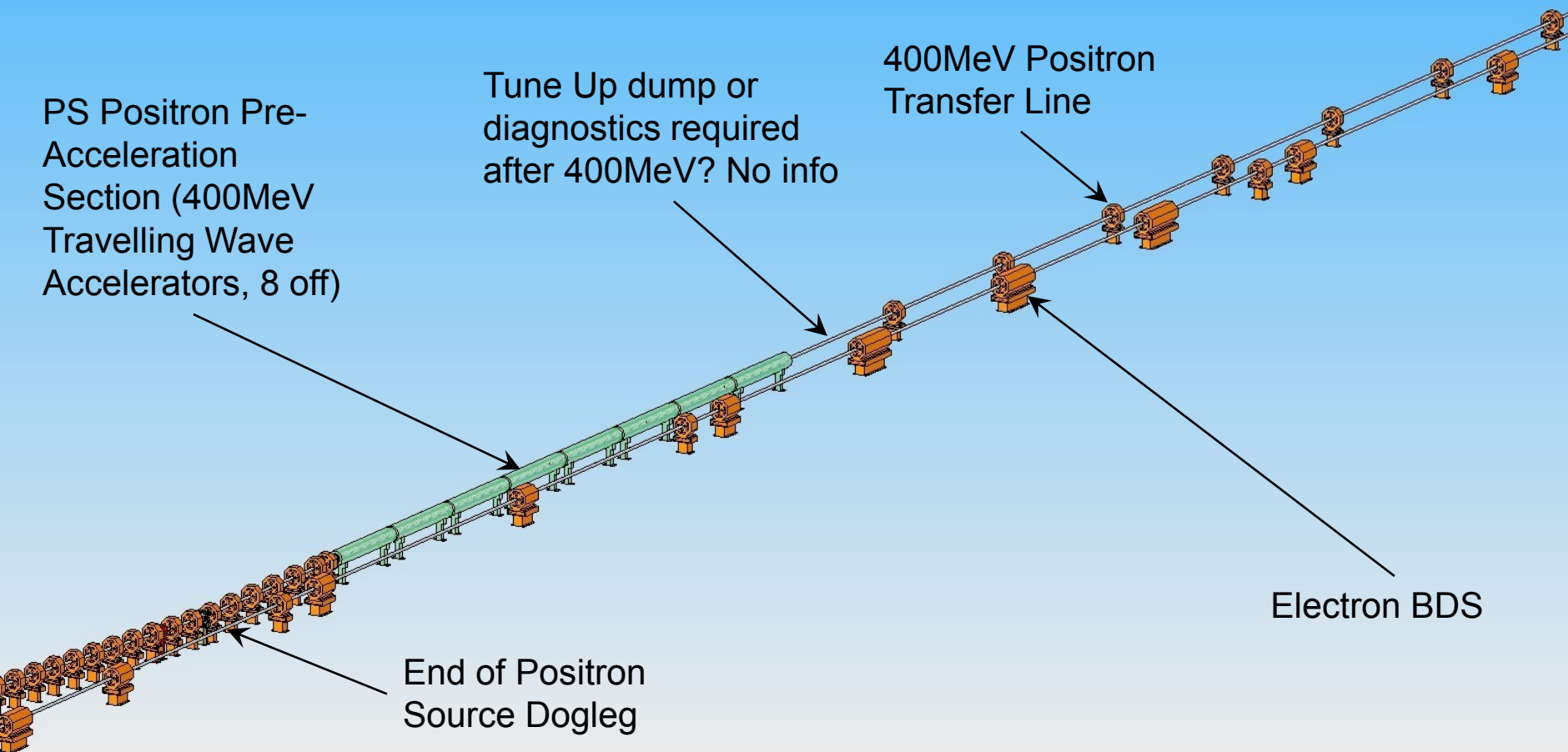


# PS – Positron Capture Section – Capture Area



An additional Electron Dump is required due to the AUX source. The lattice needs to be designed as the illustration is a re-arrangement of the RDR layout (400 MeV in middle of chicane).

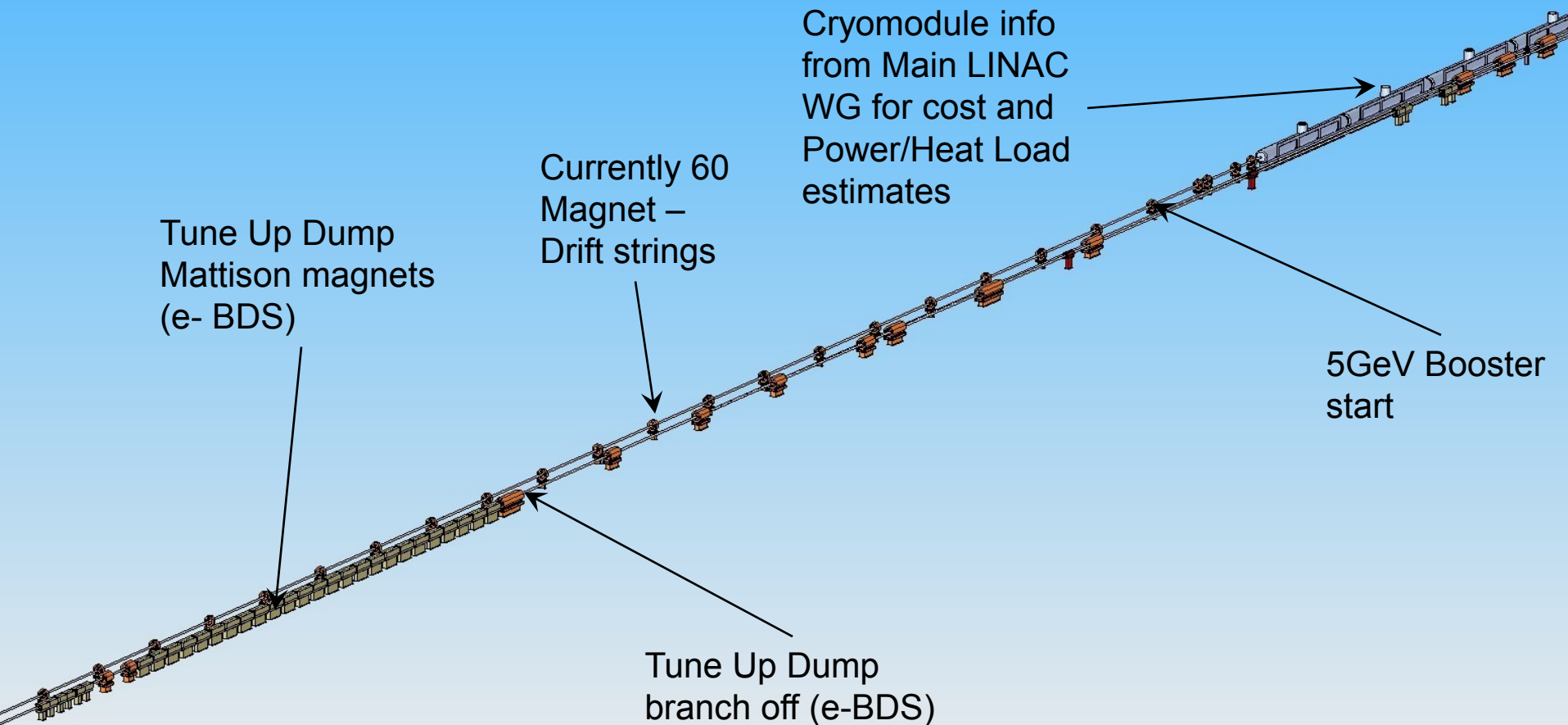
# PS – 400MeV Positron Transfer Line



Again, this area is a best guess as far as CAD is concerned. The 400MeV Positron Transfer Line is the “same” as the RDR where a Quad is followed by a drift. Lattice needs to be designed.

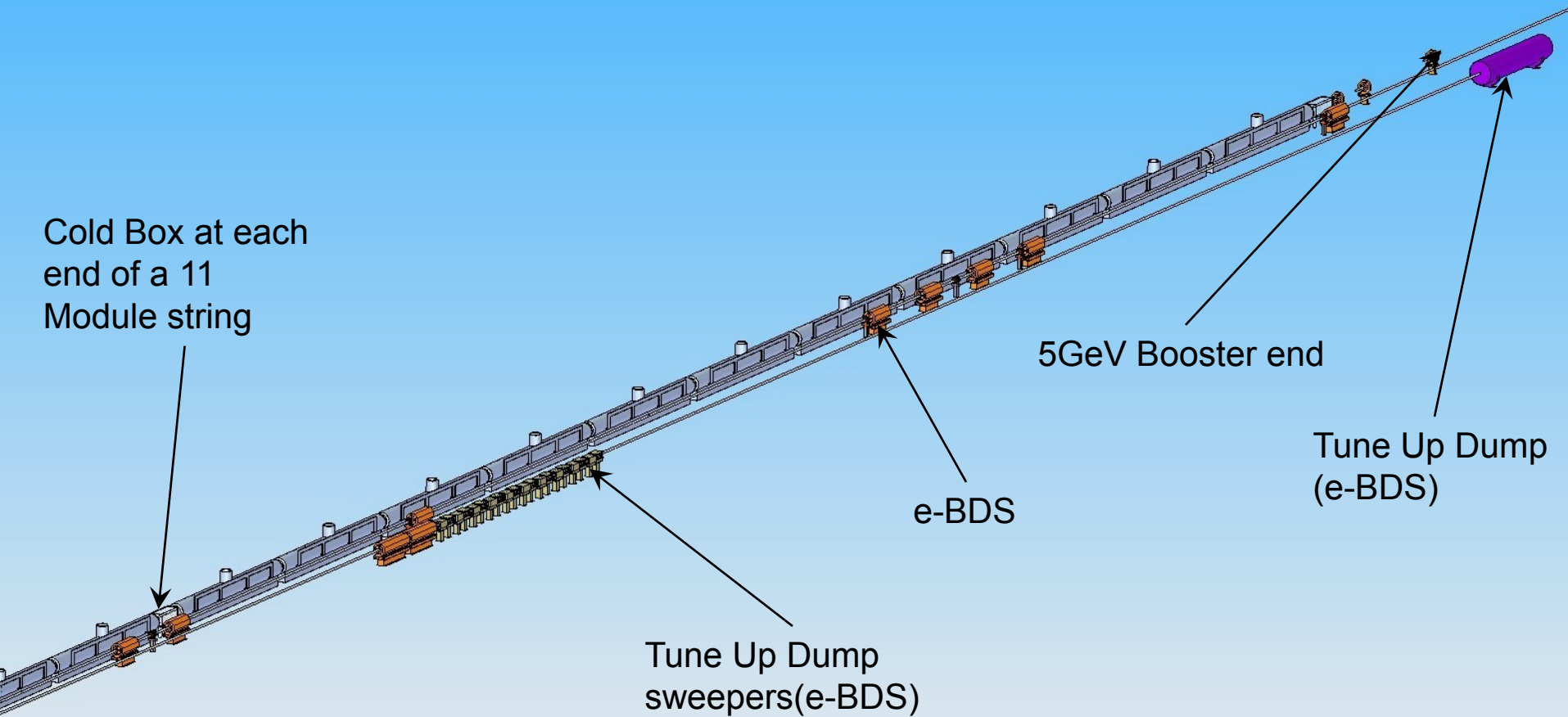


# PS – End 400MeV PTRAN – 5GeV Booster

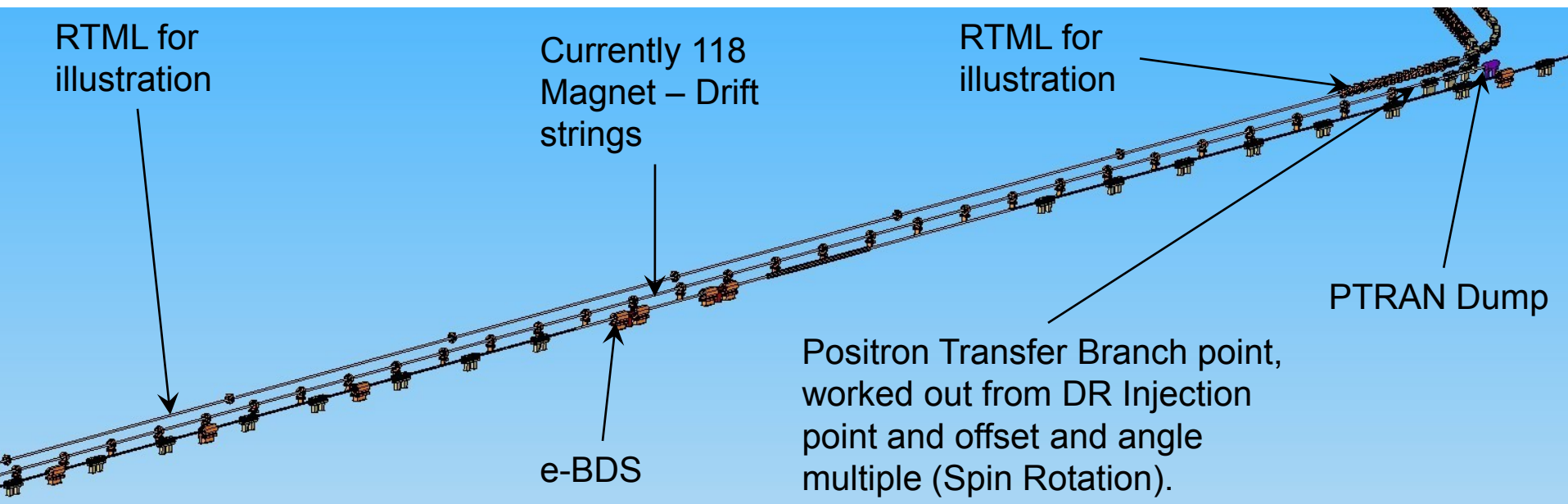


The lattice needs to be designed. The 5GeV Booster section can still move up or down the Positron TRANSfer line (PTRAN).



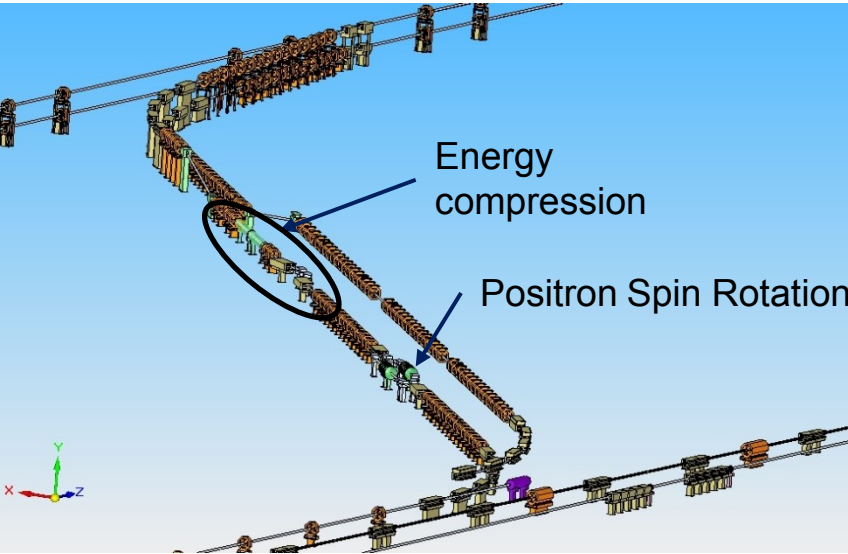


The lattice needs to be designed. The 5GeV Booster section can still move up or down the Positron TRANSfer line (PTRAN). Currently shown just upstream of e-BDS Tune up dump for radiation and CF&S reasons.

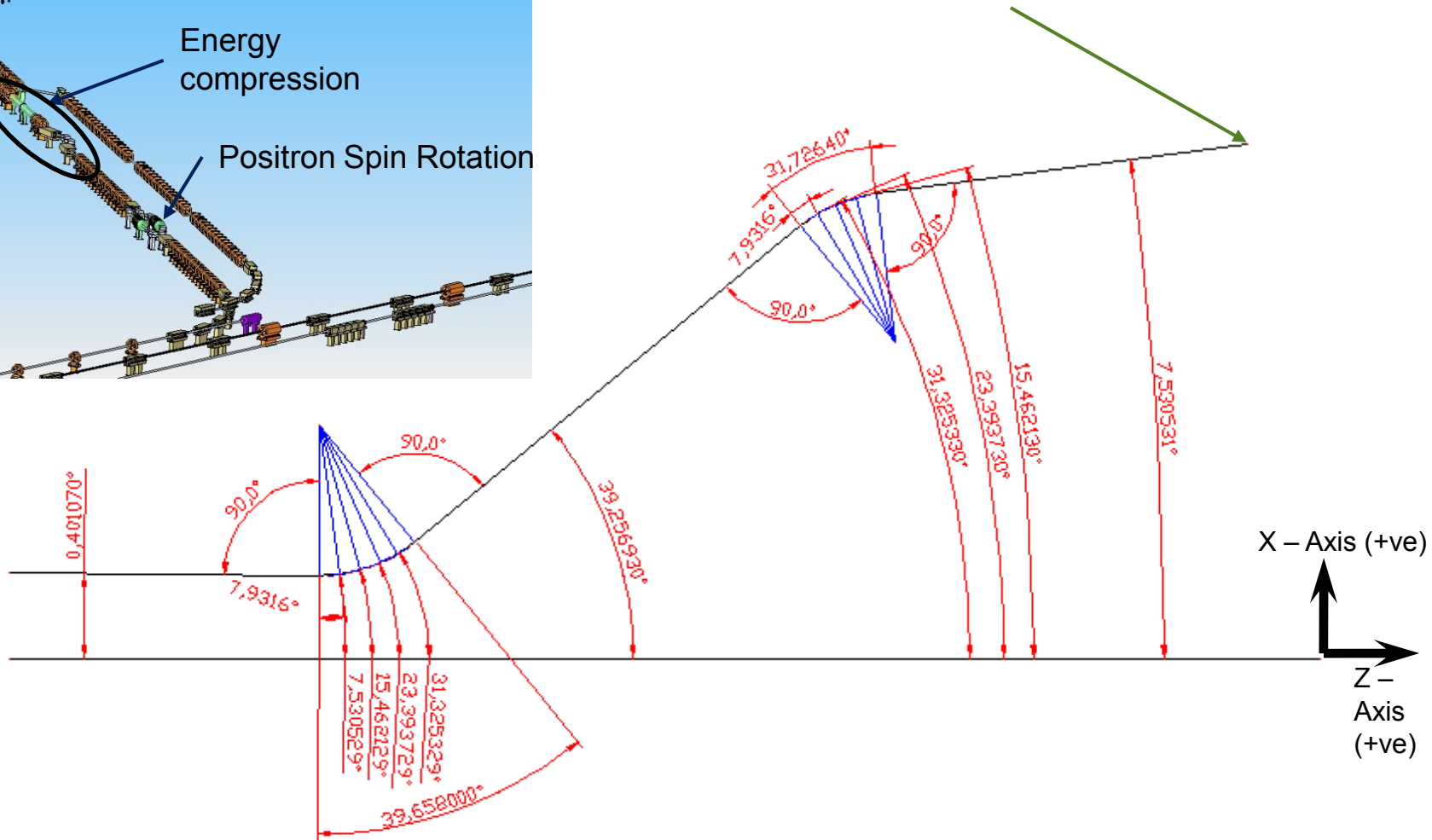


The lattice needs to be designed. Depending on the 5GeV Booster location, it is envisaged to have 118 magnet – drift strings.

# Theoretical PLTR

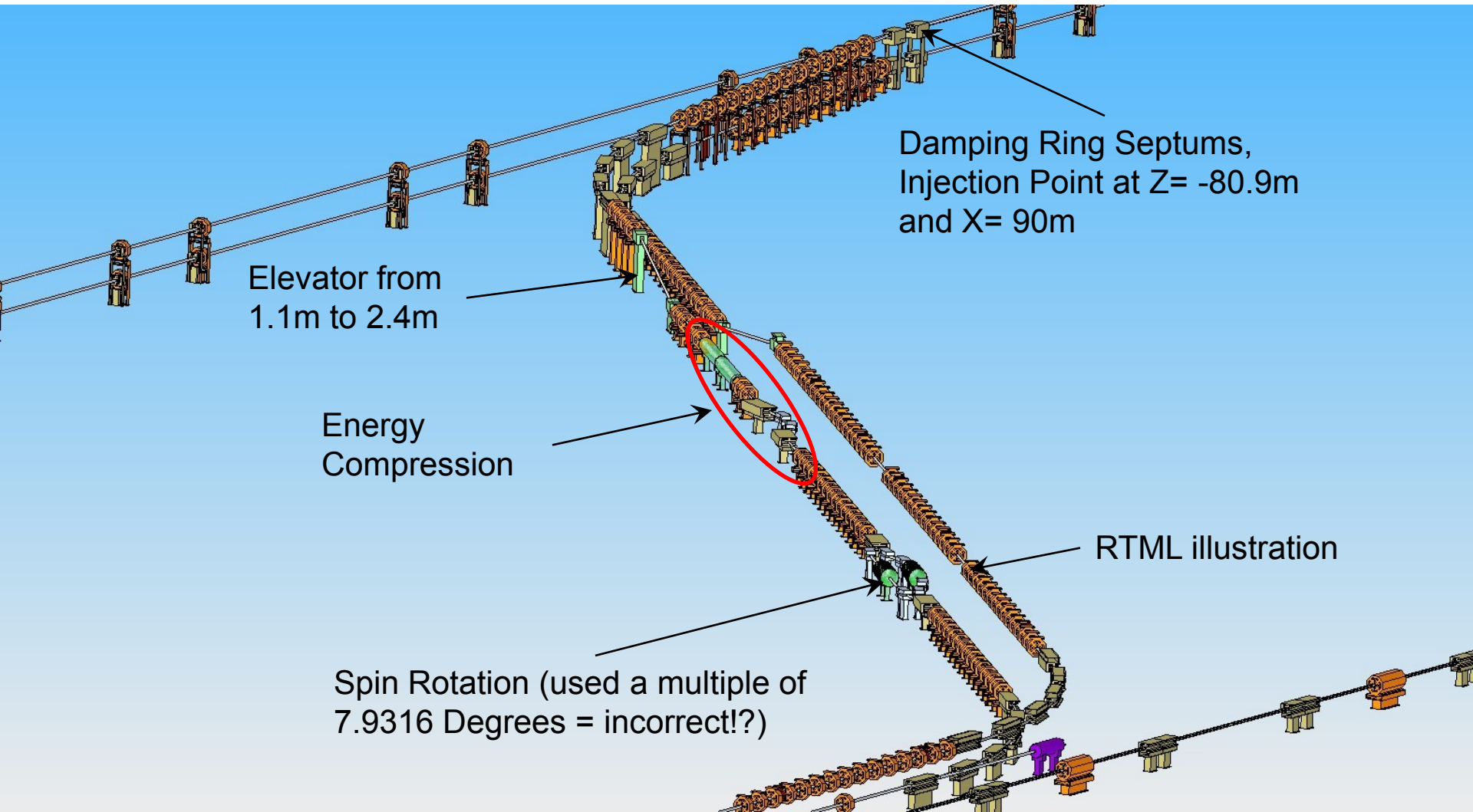


DR Injection point at:  
X= 90 m, Y= 1.3m and  
Z: -80.9m





# PS – Positron Line To Ring (PLTR)



The lattice needs to be designed. This area is a pure guesstimate and place holders have been used for the cost and Power/Heat load estimates.



# Positron Source Final Summary

The Positron Source has been modeled with the AD&I data available. This includes the beam parameters, the lattice information and some artistic interpretation of the RDR information.

It is a feasible design for the “standard” machine. There are some refinements to be carried out (not all applicable to the 10Hz option) in particular to the Fast Abort Dump. All of the Capture Area (including the Target) and onwards does not have a lattice design.

The current Positron Capture Area through to the Ring representation has been created using the RDR data in a “cut – and – paste” method.

This is only one suggestion and CF&S proposals may vary according to machine location. However, spatial, installation, operating and beam considerations have been taken into account during the process.

A meeting during which the work done, the work outstanding and options (i.e. 10 Hz) has been held on the 10<sup>th</sup> February 2011 at Daresbury. It further identified the WBS, the EDMS layout and the documentation required. All uploaded now!

A “blue print” for the other Work Groups.

Many thanks to everyone for their fantastic support and family type attitude.