

# Central Region Group Status and Positron Region

K. Yokoya

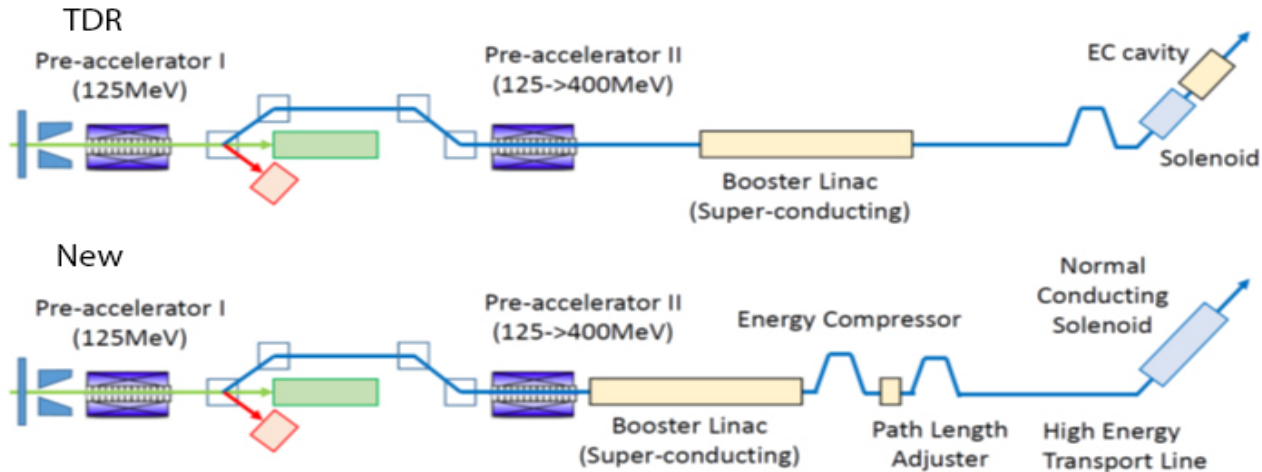
2016.9.14. Posipol2016, LAL

# Issues Discussed in CRWG

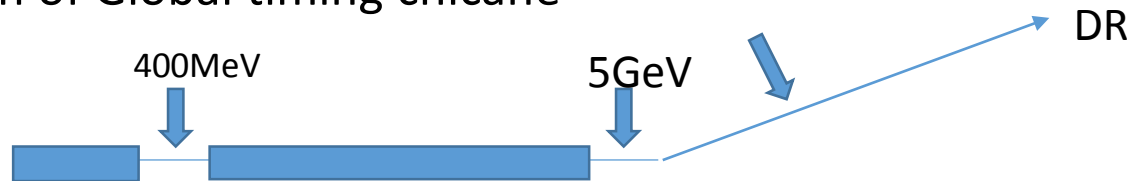
- Positron-related
  - 10Hz operation
  - Auxiliary positron source (APS)
  - Positron target region
- MPS,PPS
- Beam dumps
  - Main dumps
  - Tune-up dumps
- BDS-related
  - Muon wall
- Tunnel of the Central Region

# These are already accepted?

- Relocation of positron booster linac → Yes



- Positron spin rotator
  - 2 parallel line for up and down polarization (strong request from physics and positron groups) → Yes
  - Superconducting or normal-conducting solenoid?
- Location of Global timing chicane



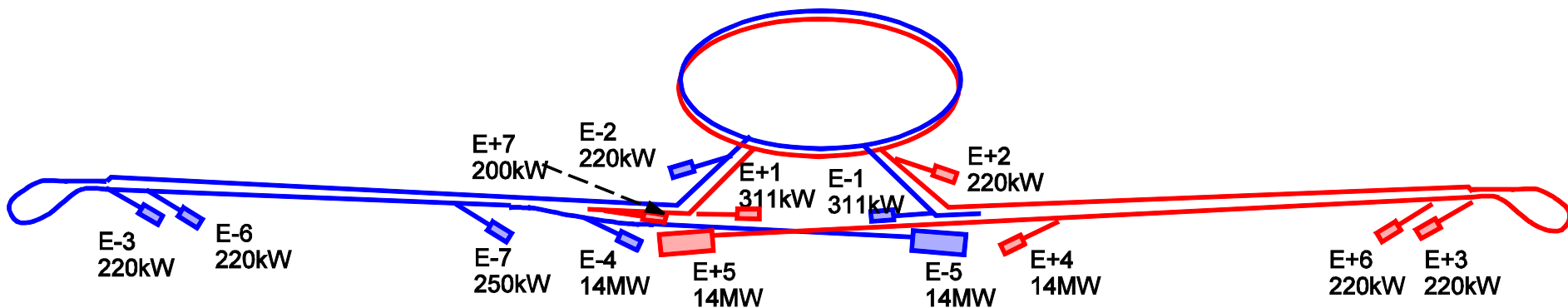
- Location of 1.5km ML tunnel extention → Not yet

# 10Hz Operation

- TDR mentions 10Hz operation for  $E_{CM} < 250\text{GeV}$ 
  - Gives parameter sets for 200 and 230GeV
  - Damping ring with stronger wigglers
  - But detail of linac operation, additional beam line, beam dynamics are not given
- Is 10Hz operation really needed?
  - 200-250GeV: sweep the region above LEP
  - But most important is Z-pole (92GeV) and W-pair (160GeV)
- Conclusion in CRWG
  - Prepare spaces for beamlines that guarantee down to  $E_{CM}=200\text{GeV}$ 
    - Preliminary beamline optics to tune-up dump by Okugi
  - This does not guarantee  $E_{CM} < 200\text{GeV}$ .
    - Beam dynamics complex
    - Will think of 92GeV and 160GeV later, if turn out to be necessary

# Tune-up Dumps

- Change of the commissioning strategy
  - Tuning by weak beam using local tune-up dumps
  - Use main dumps for full current tuning
- Reduced power scale of all the tune-up dumps
  - Maximum  $\sim 400\text{kW}$ 
    - Except main dumps (E-5, E+5) and photon dump E+7
  - Proposal of a new dump E+8 for spent electron after positron generation in 5+5 Hz operation
- Will soon come to a change request



# New specification of Power Levels

- Not final yet

				TDR	New spec
				kW	(margin not added)
MPD	E-1	**	SC tune-up dump	311	60
MPD	E-2		EDRX tune-up dump	220	60
MPD	E-3		RTML tune-up dump	220	60
HPD	E-4		BDS tune-up dump 1)	14000	400
HPD	E-5	*	Primary e- dump	14000	14000
MPD	E-6		RTML tune-up dump	220	60
MPD	E-7		Electron fast abort dump	250	60
	E-8		Spent electron dump for 5+5Hz	none	6300
MPD	E+1	**	SC tune-up dump	311	60
MPD	E+2		PDRX tune-up dump	220	60
MPD	E+3		RTML tune-up dump	220	60
HPD	E+4		BDS tune-up dump	14000	400
HPD	E+5	*	Primary e+ dump	14000	14000
MPD	E+6		RTML tune-up dump	220	60
MPD	E+7	*	Target dump (mostly as photons)	200	300
		**	45kW always on		
		*	non-stop dump (always on)		
		MPD	High power dump		
		HPD	Medium power dump		
		1)	Also as spent electron dump for 5+5Hz in TDR		

# XFEL Dump

- Solid dump being constructed as the main beam dump for XFEL
- Similar pulse structure and total power as ILC BDS tune-up dump and undulator photon dump
- Except (compared with photon dump)
  - Electron dump vs. photon
  - Max energy 25GeV vs. some 100MeV  
(Be careful: lower energy does not mean easier)

XFEL Beam Parameters for the main beam dump

Beam energy	$\leq 25\text{GeV}$	Repetition rate	10Hz
Bunch distance	$\geq 200\text{ns}$	Average power	$\leq 300\text{kW}$
Pulse length	$\leq 800\mu\text{s}$	RMS spot (x,y)	$\geq 2\text{mm}$
Bunch charge	$\leq 1\text{nC}$	Slow sweep	R=5cm
Train charge	$\leq 4000\text{nC}$	Fast (ibtrain) sweep	no
Train energy	$\leq 100\text{kJ}$	Life	20 years

Description of the Beam Dump Systems for the European XFEL  
M. Schmitz, EDMS: D00000004303811 Feb.4.2014

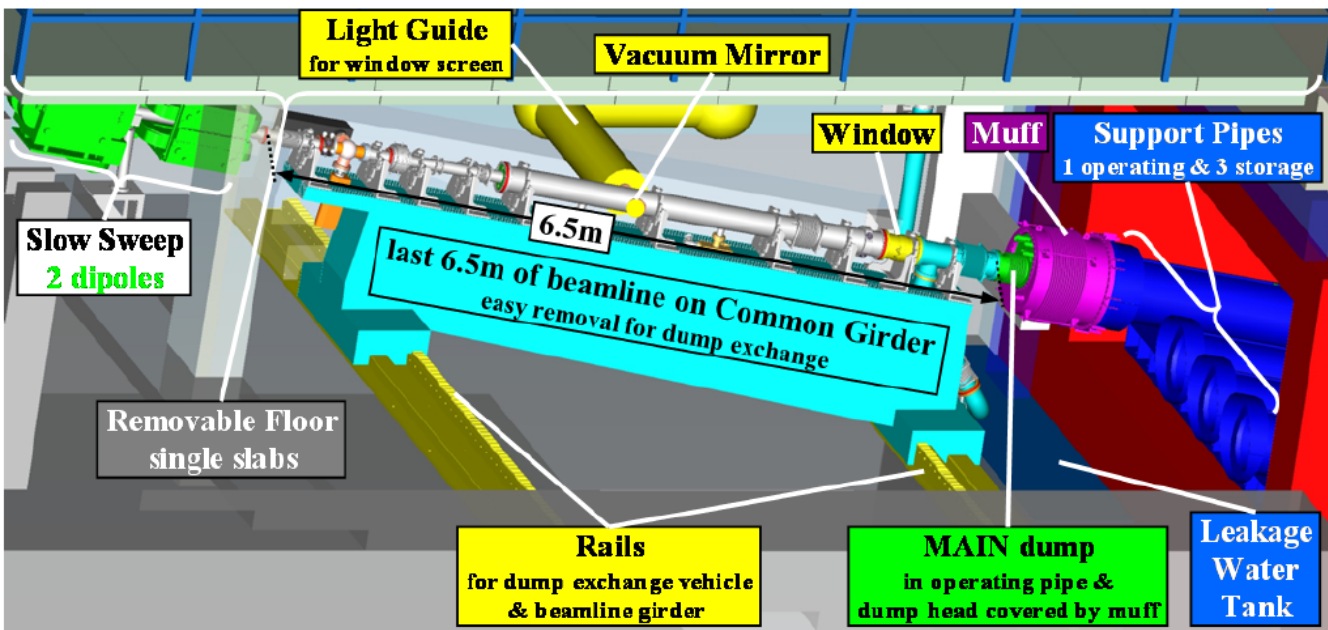
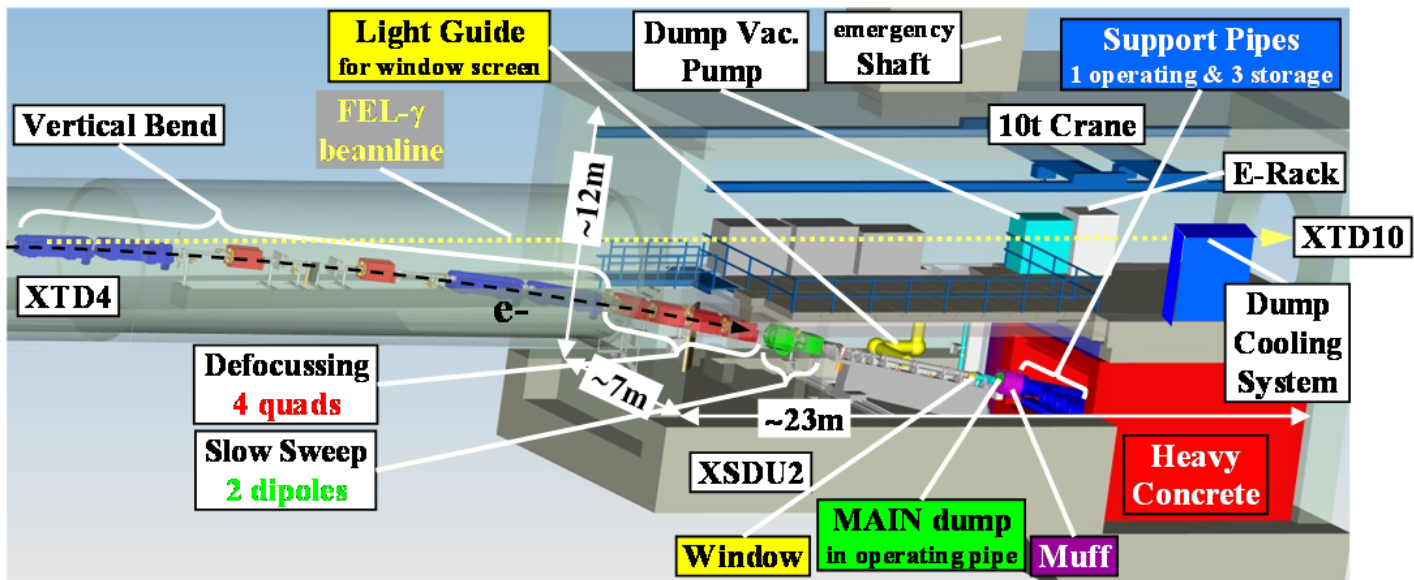
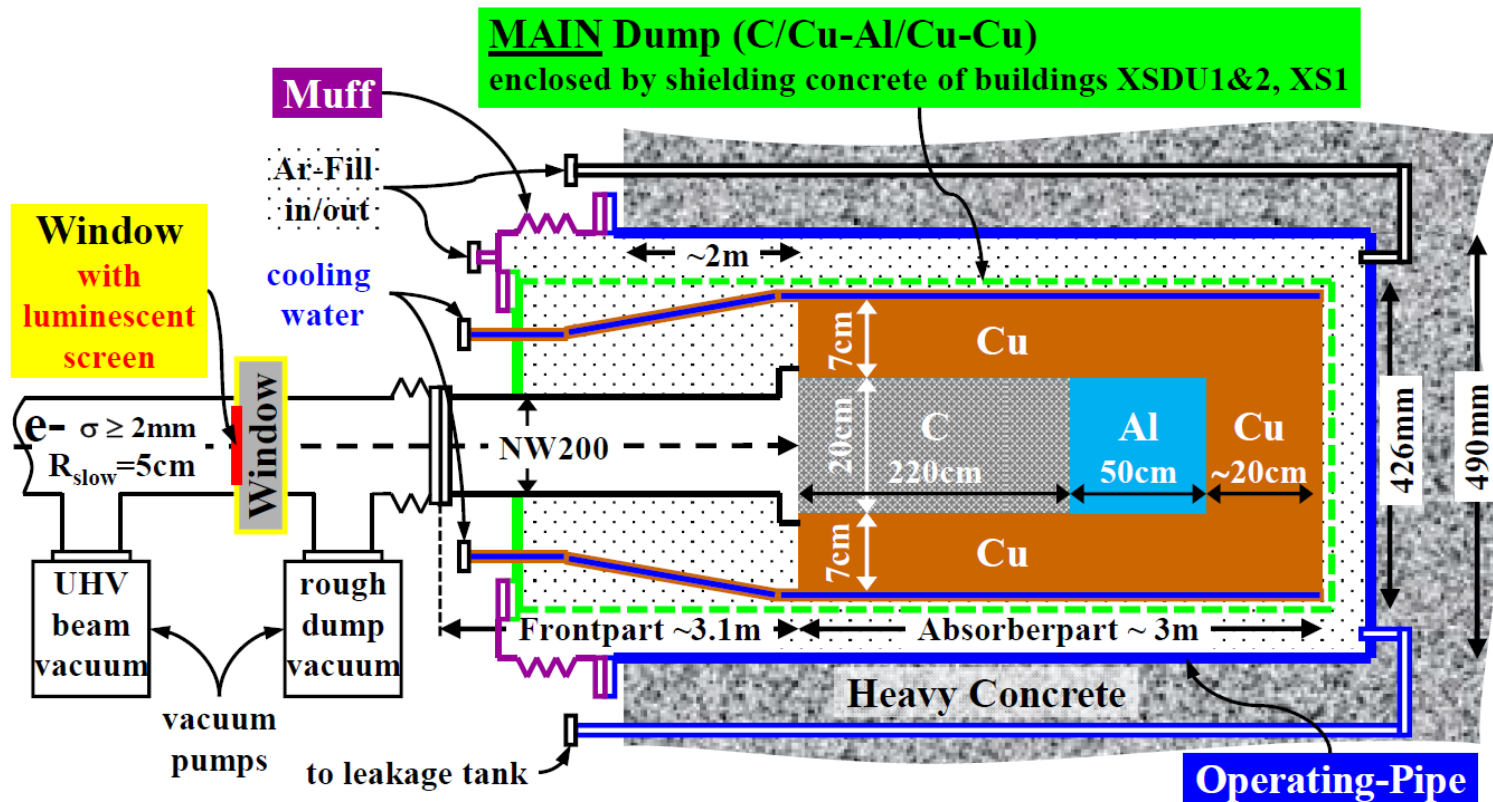
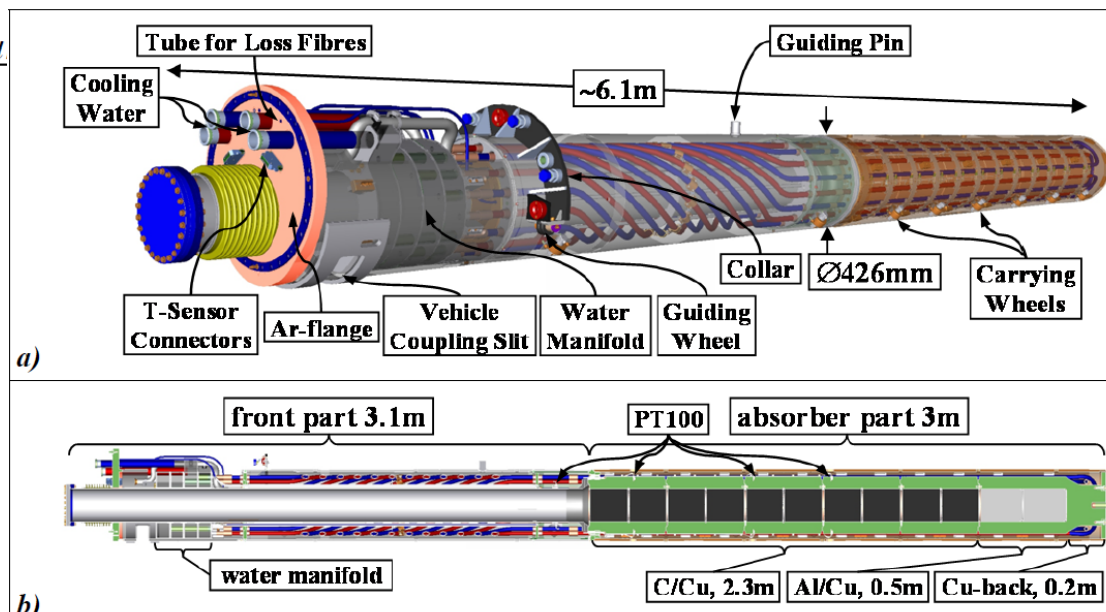


Figure 3: Detailed view into the dump pit area in front of the MAIN-dump in XSDU2.





*Figur*

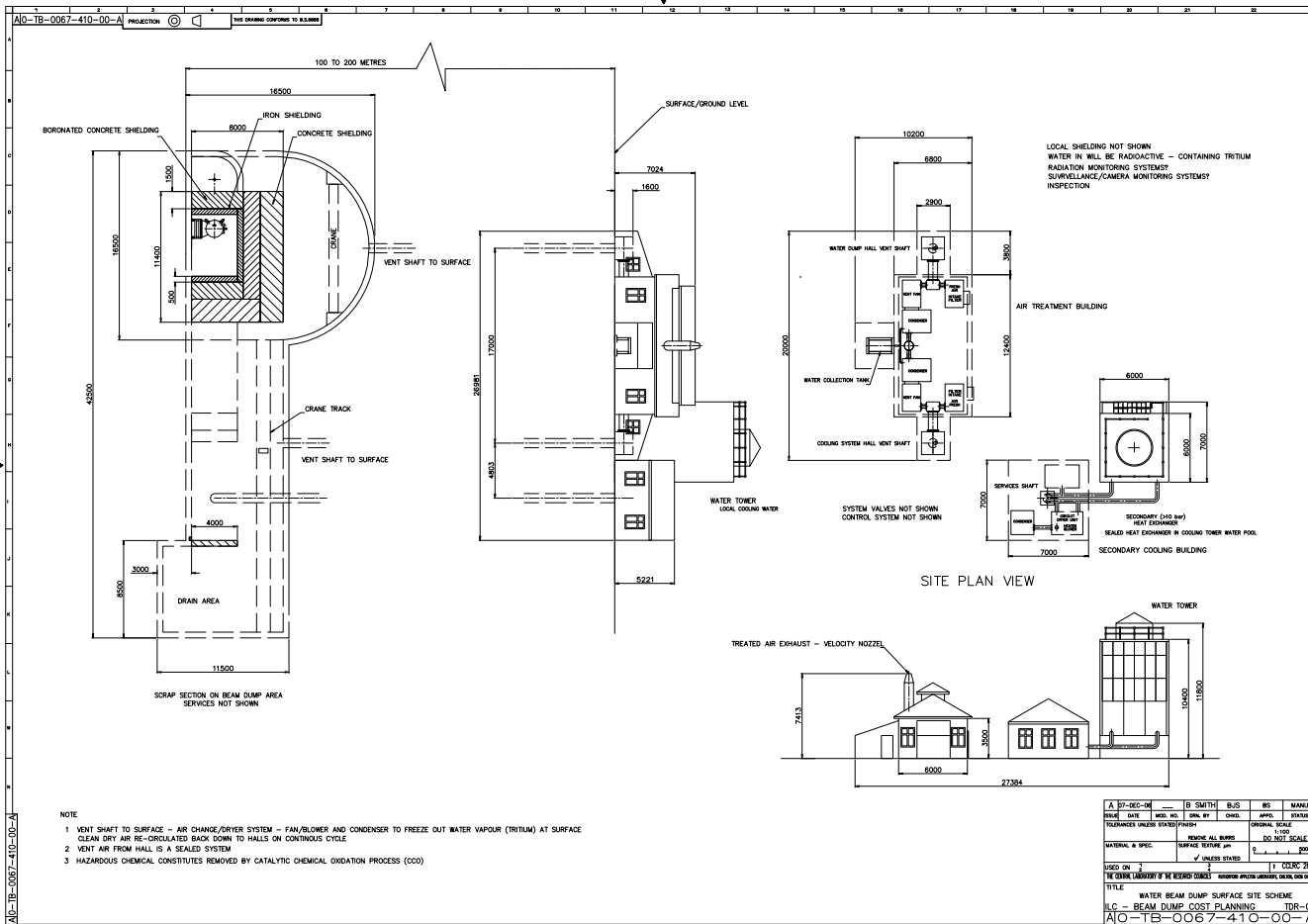


# Main Dumps

- Two 14 MW main dumps (plus 6.3MW spent electron dump)
  - Detailed check of the dump system is not CRWG expertise
- Need specialist team
  - Beam dump specialists
  - CFS
- Issues
  - Robot work
  - Safety in particular window breakdown
  - Required human access



# Water beam dump surface site scheme



B. Smith, CCLRC:  
0-TB-0067-410-00-A

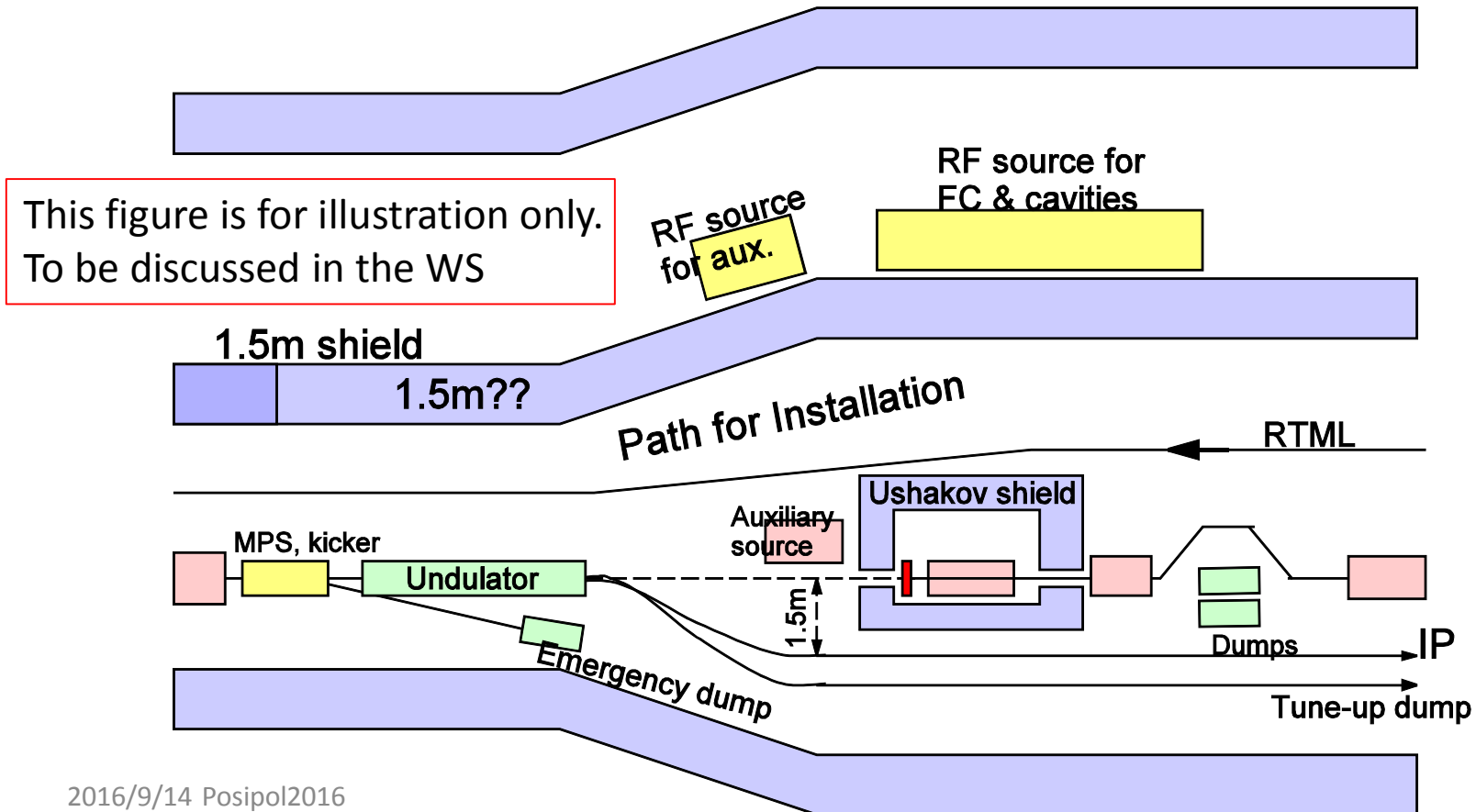
[D0000000945465](https://www.osti.gov/servlets/handle/document/5000000945465)

Shows surface facilities that service the dump, including cooling and exhaust for gases (tritium!)

# Positron (target region)

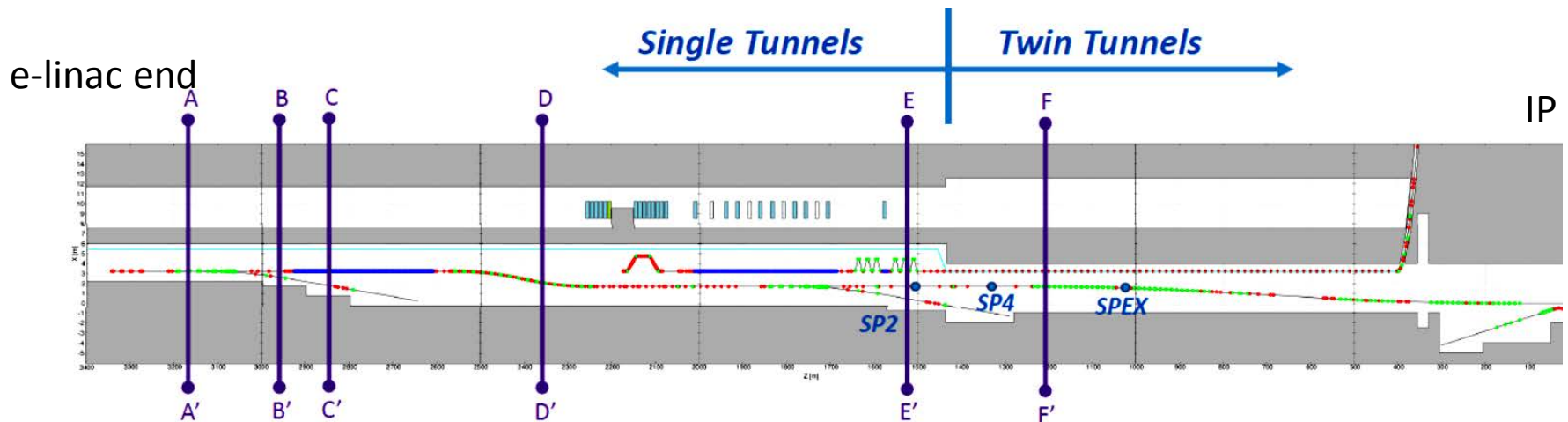
- Main issues needed as inputs to CRWG
  - Design of photon dump
    - A problem (radiation damage of the window by photon beam) of TDR design pointed out at Santander
  - Required shielding of the target region including the thoughts on
    - Target replacement
    - Where/how waste targets to be stored
    - Path to take waste target to the surface
- Will be discussed in POSIPOL@LAL next week
- This would take some more time

- Consensus among ILC positron team
  - No human access to the accelerator and service tunnels needed during high-energy beam on (normal operation and commissioning) as in main linac region
  - Special shield wall needed for target+FC+solenoid+a few cavities
  - Photon/electron dumps must also be shielded



# BDS Tunnel (electron)

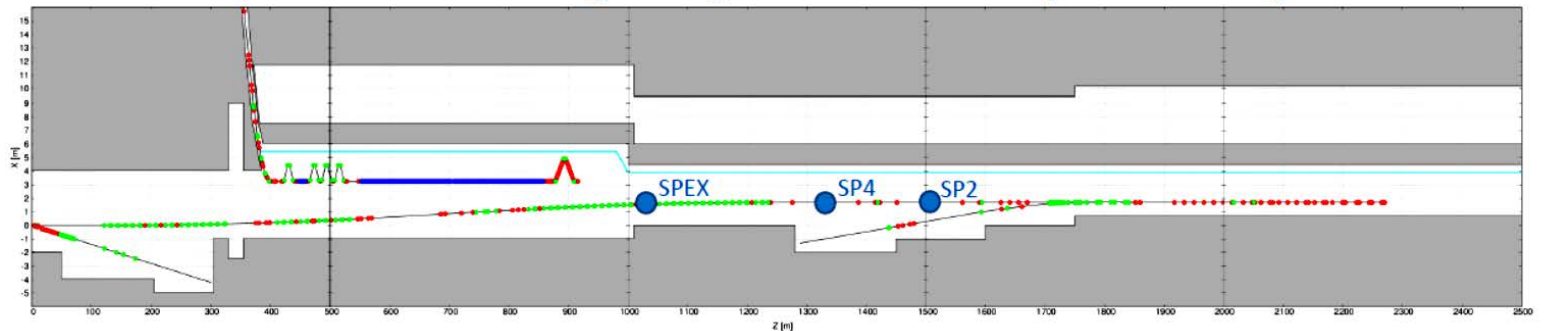
- Okugi's proposal
  - Single (kamaboko) tunnel from ML end to e+ ECS
  - Twin tunnel to muon wall
    - Penetration for cables only (no waveguides)
    - Small tunnel cross-section possible after collimators
- Must come to final conclusion
  - Info from positron team needed



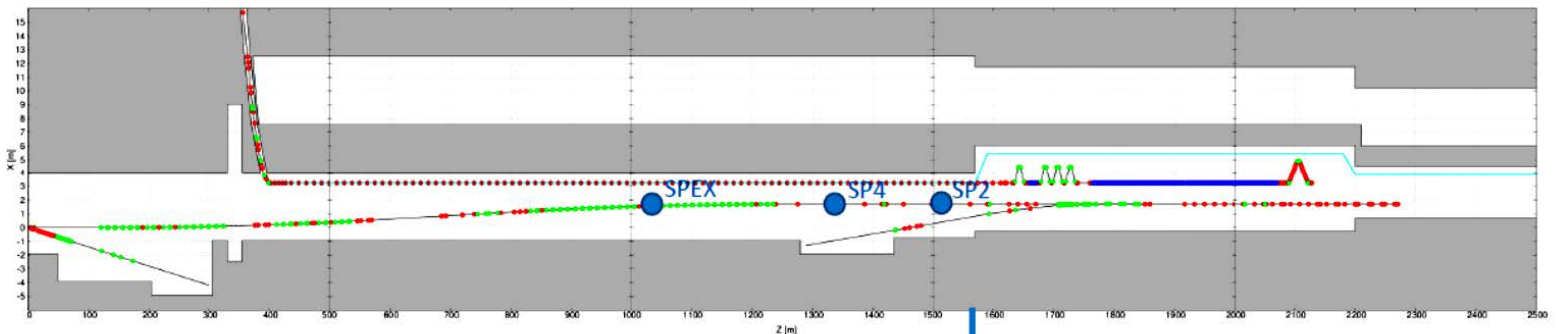
# BDS Tunnel (positron)

- Okugi's proposal
  - Move electron source upstream
- Must come to final conclusion
  - Required size of the components
  - Then, send to CFS team for tunnel layout

TDR



Okugi



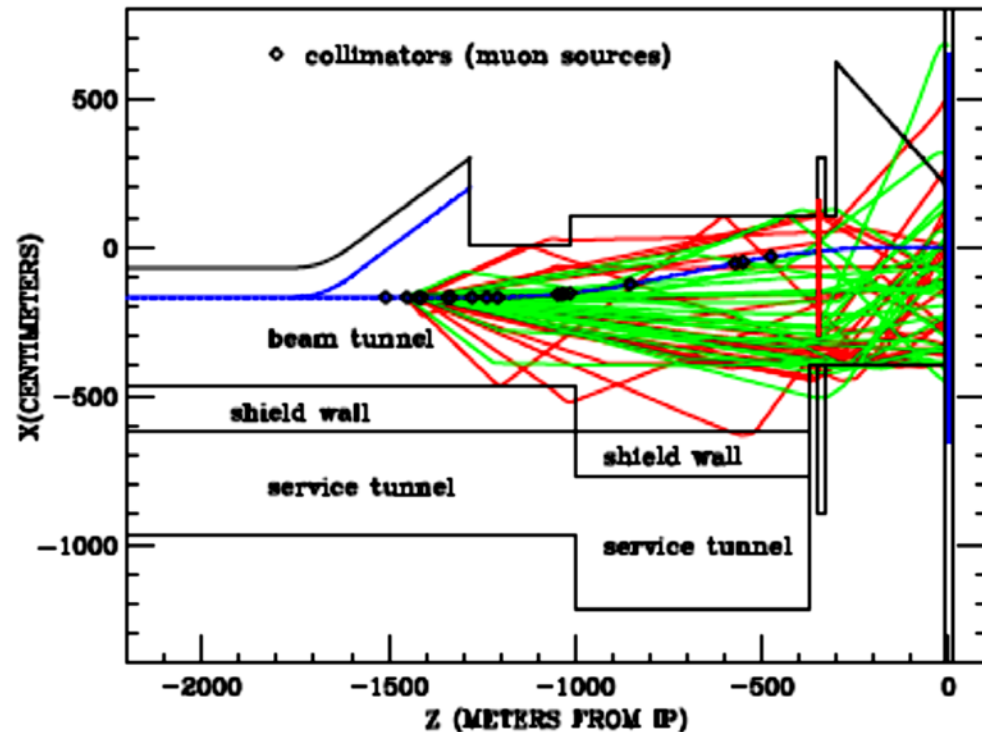


# Muon Wall

- TDR: 5m long magnetized spoiler, filling the tunnel crosssection.
- Background to the detector was re-estimated with different conditions

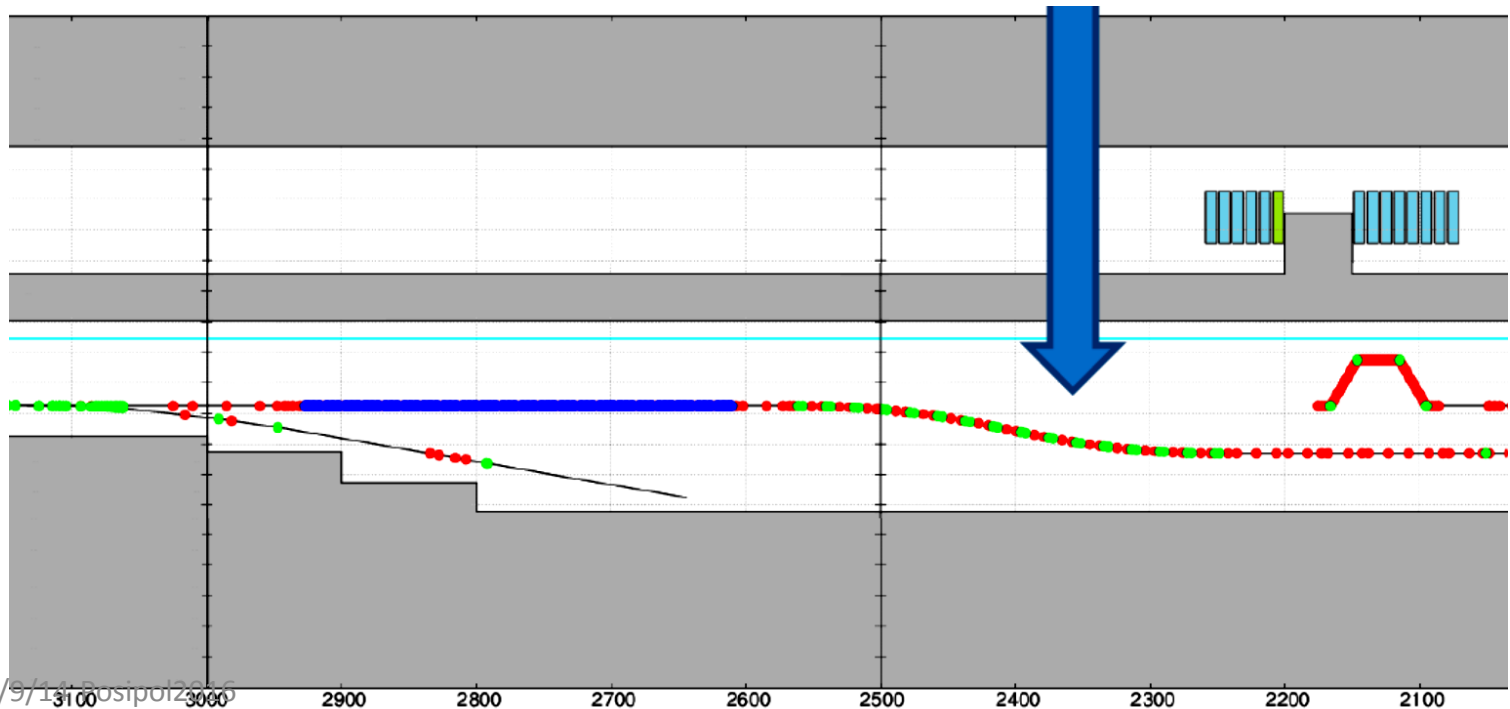
	#/200 bunches R=6.5m detector	#/200 bunches R=2.5m TPC
No spoilers	138	9648
2x 5m mag.spoilers	25	1008
5x 5m toroid	3.3	273
both	0.5	17

- Can we remove 5m magnetized iron?



# Auxiliary Positron Source

- Our conclusion has been to retain it for DR and BDS commissioning
  - Weak intensity but can still be useful for DR emittance tuning if stacking possible
  - Does it require a wider tunnel?
- Now, under new commissioning strategy, is it still useful?



# New Members to CRWG

- Members Since Dec.2015)  
K.Yokoya (KEK,chair), E.Paterson (SLAC), G.White (SLAC), B.List (DESY), T.Okugi (KEK), M.Kuriki (Hiroshima U.), M.Miyahara (KEK), T.Sanuki (Tohoku U.)
- Reorganization of CFS team in Japan
  - Lead by Hayano & Terunuma
- New members (all KEK)
  - Shinichiro Michizono
  - Hitoshi Hayano
  - Nobuhiro Terunuma

# Future Plan

- Expect change of organization in December
- Some items may come to conclusion by that time
  - Positron BDS tunnel
  - Auxiliary positron source
- Some items require more inputs
  - Electron BDS tunnel including positron target region
  - Main dump-related issues
- Whole system must be reviewed
  - Installation
  - Commissioning
  - Accidents
- Problem
  - Expand the expertise?

# Recent Decision by the Technical Board after a meeting with CRWG

- The CRWG will submit a CR to specify the dump layout and power levels. We will try to do this before the Sept 20th CMB meeting.
- Glen White will work with the experimentalists to ascertain whether the muon spoiler is necessary. If not then a CR will be generated.
- The CFS team will create a basic central region concept based on Okugi-san's 2-tunnel scheme. It is recognized that no design exists at present for the high power (multi-MW dumps) so these areas will be shown generically. Likewise the positron target area and photon dump is also not defined and again will be represented generically for the present time.
- We will endeavor to obtain assistance (from CERN) to develop the design of the high power dumps and associated remote handling scheme. The low power dumps will be based on the existing designs such as the solid dump for XFEL and aluminum ball dump of JLAB.
- There will be no action on the positron system until after the upcoming POSIPOL meeting