WPP-4: Electron Gun

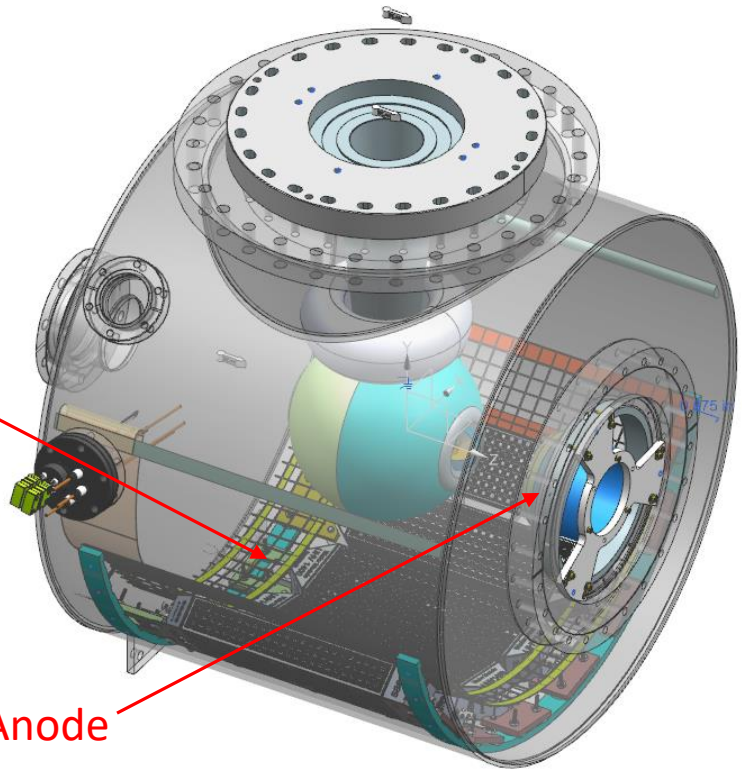
- The electron gun consists of
  - High-voltage photo gun
  - Drive laser system
  - GaAs/GaAsP Photocathode
- High-voltage gun is the most urgent item
  - The gun voltage in TDR is 200 kV. A higher voltage desirable.
  - Meaningful technical progresses since TDR would be reflected in a new design
  - New GaAs gun based on lessons learned from 350 kV CsKSb magnetized dc photogun

350 kV alumina insulator

Triple-junction shield

Cathode electrode

Photocathode



NEG pumps

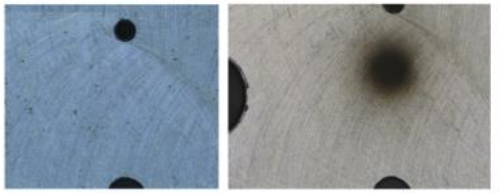
Biased and Tilted Anode

WPP-6: Rotating Target for Undulator Scheme

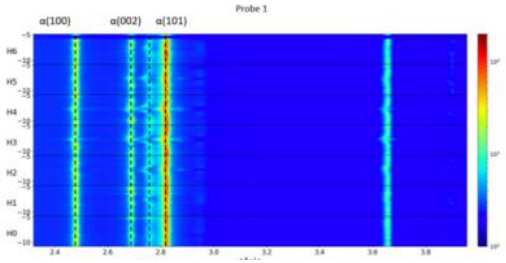
- Target specification
  - Titanium alloy, 7mm thick (0.2 X_0), diameter 1m
  - Rotating at 2000 rpm (100 m/s) in vacuum
  - Photon power ~60 kW, deposited power ~2 kW
  - Radiation cooling
  - Magnetic bearings
- R&D to be done as WP-prime
  - Design finalization, partial laboratory test, mock-up design (in the first 2 years)
  - Magnetic bearings: performance, specification, test (in the remaining years)

Target material test

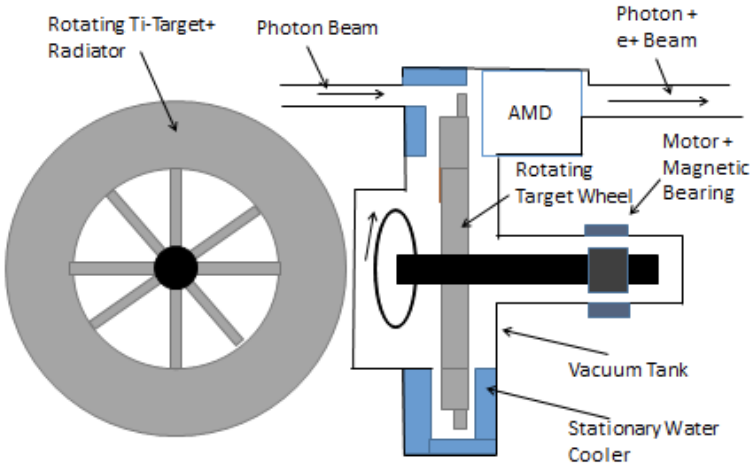
Target before and after radiation:



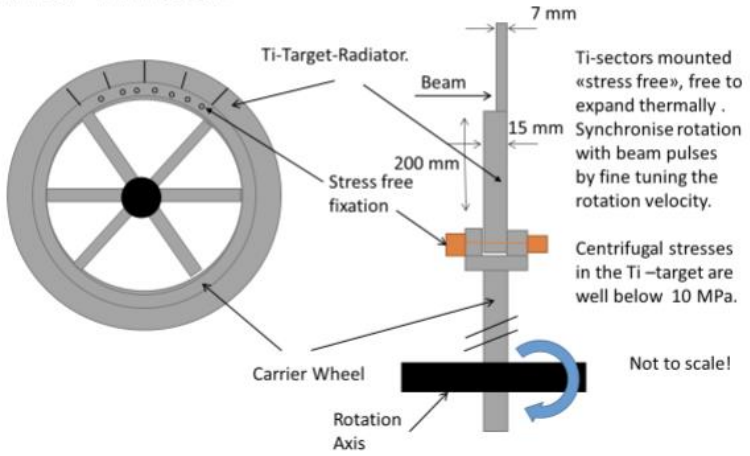
α/β phase transitions in Ti-6Al-4V:



Principal Layout: Ti-Wheel with a Diameter of 1.0 m, rotating at 100 m/s, 2000 rpm.

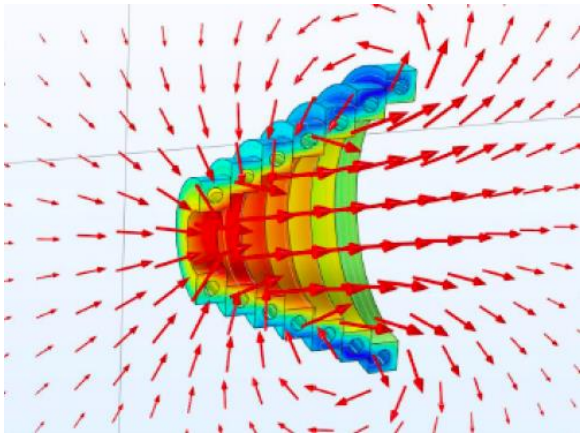


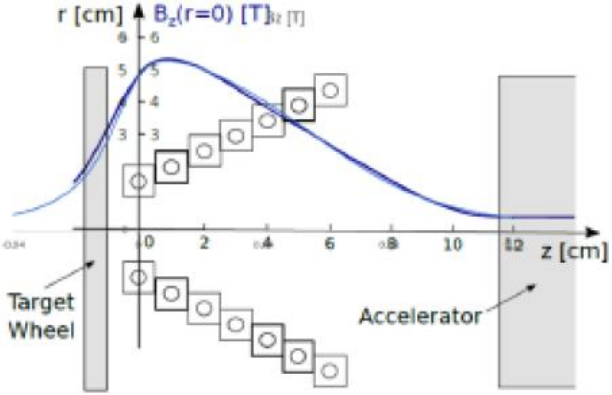
Ti-Target Sector Modules, mounted onto a «Carrier Wheel»



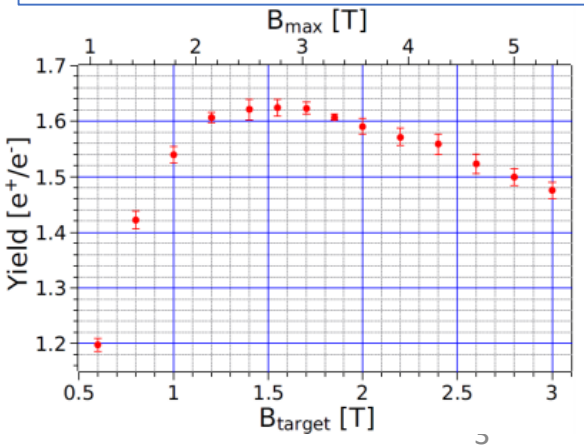
WPP-7: Focusing System for Undulator Scheme

- The critical item for the undulator scheme is the magnetic focusing system right after the target
- Possible candidates are: (a) Pulsed solenoid, (b) Plasma lens
- The strongest candidate is (a) pulsed solenoid.
- R&D items to be done as WP-prime
  - Detailed simulations for (a) (already on-going)
  - Principal design for a prototype pulsed solenoid
  - Field measurements with 1kA (pulsed and DC) and with 50kA both in a single pulse mode and finally in a 5ms pulsed mode
  - Prototype of (b) plasma lens (funded study on-going)





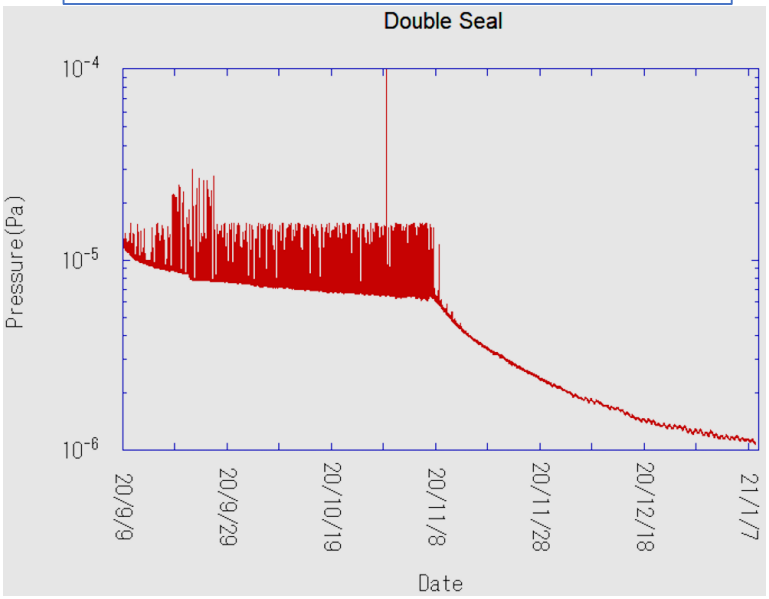
Yield versus field on the target

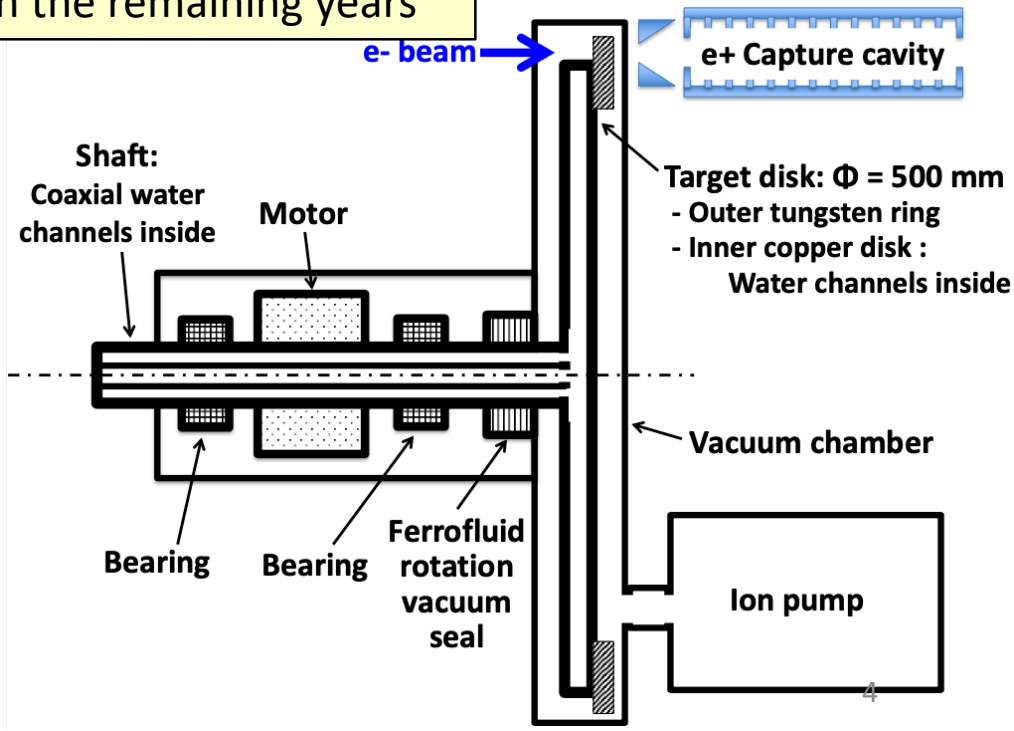


WPP-8: Rotating Target for e-Driven Scheme

- Target specification
  - W or W-Re, 16 mm (5 X_0) thick, diameter 50cm
  - Rotating at 5 m/s in vacuum
  - Water cooled.
  - Vacuum seal by ferromagnetic seal
- R&D items to be done in 2 years
  - Target stress calculation with FEM
  - Vacuum seal
  - Target module design
- Target module prototyping can be done in the remaining years

Vacuum test with double seal

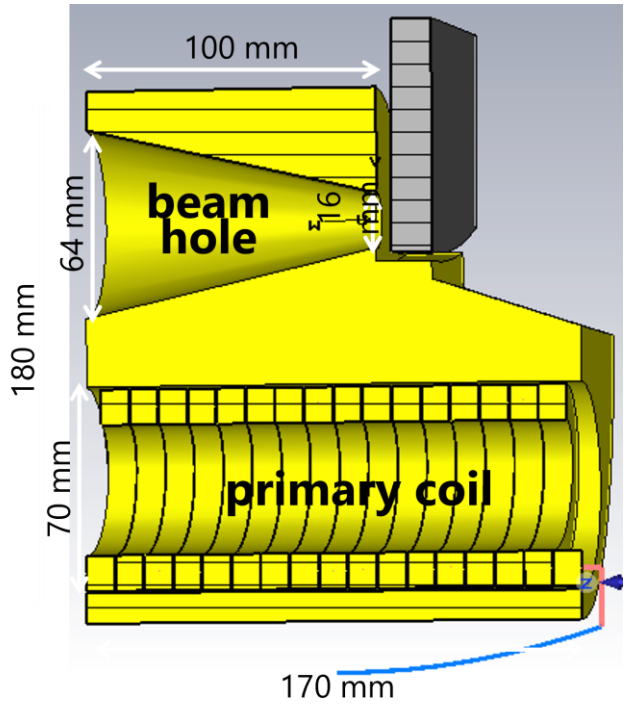


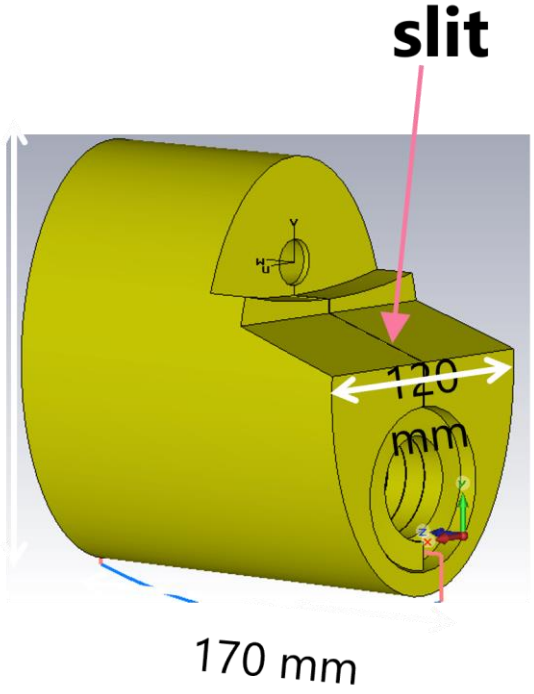


WPP-9: Focusing System for e-Driven Scheme

- Flux Concentrator (FC) is chosen as the focusing device after the target
- The specification parameters such as max field, electric current and the dynamic force are satisfied in existing target, but the pulse energy and the heat load are higher.
- A prototype necessary after detailed design study
- R&D items as WP-prime
  - Flux concentrator conductor design (in first 2 years)
  - Conductor prototyping (in the remaining years)

Parameter	ILC FC	Unit
Max. B field	5	T
Max. surf. current	25	KA
Dynamic force	125	kA.T
Pulse energy	140	J
Average Power	13.7	kW

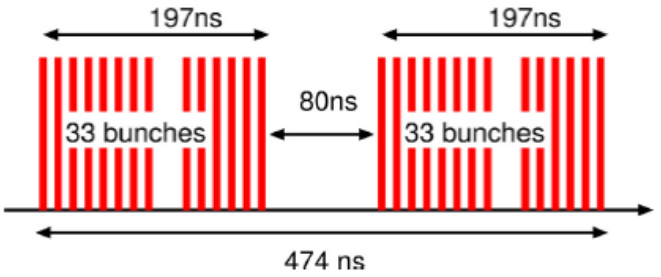




WPP-10: Capture Cavity and Linac for e-Driven Scheme

- The positrons after the magnetic focusing system are accelerated to 5GeV through various linacs (Standing wave, travelling wave, S-band, L-band) and injected into the damping ring.

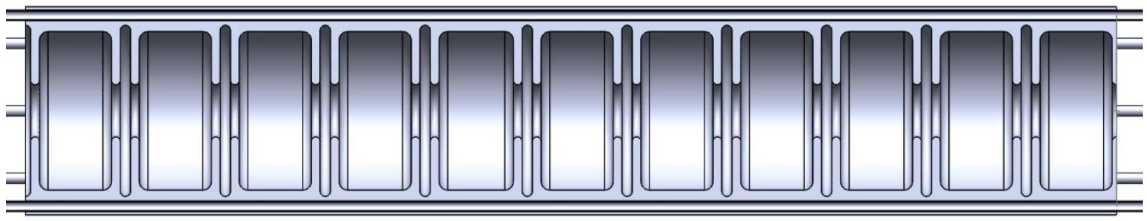
- Technically the most critical element is the L-band, standing-wave structure right after the target and FC.
  - ➢ High beamloading (up to ~1A)
  - ➢ Special bunch pattern →
  - ➢ Changing beam current (mixed electron-positron, capture process in RF buckets)

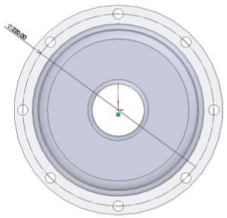


- The technologies of the power unit is known well but it is needed for the test.

- R&D items as WPP-10 for the first 2 years
  - ➢ APS (Alternating Periodic Structure) cavity design and cold model
  - ➢ Beam-loading compensation and tuning method
  - ➢ L-band klystron design
  - ➢ Power unit prototype design
  - ➢ solenoid design
- Prototyping of these components in later years

APS cavity →

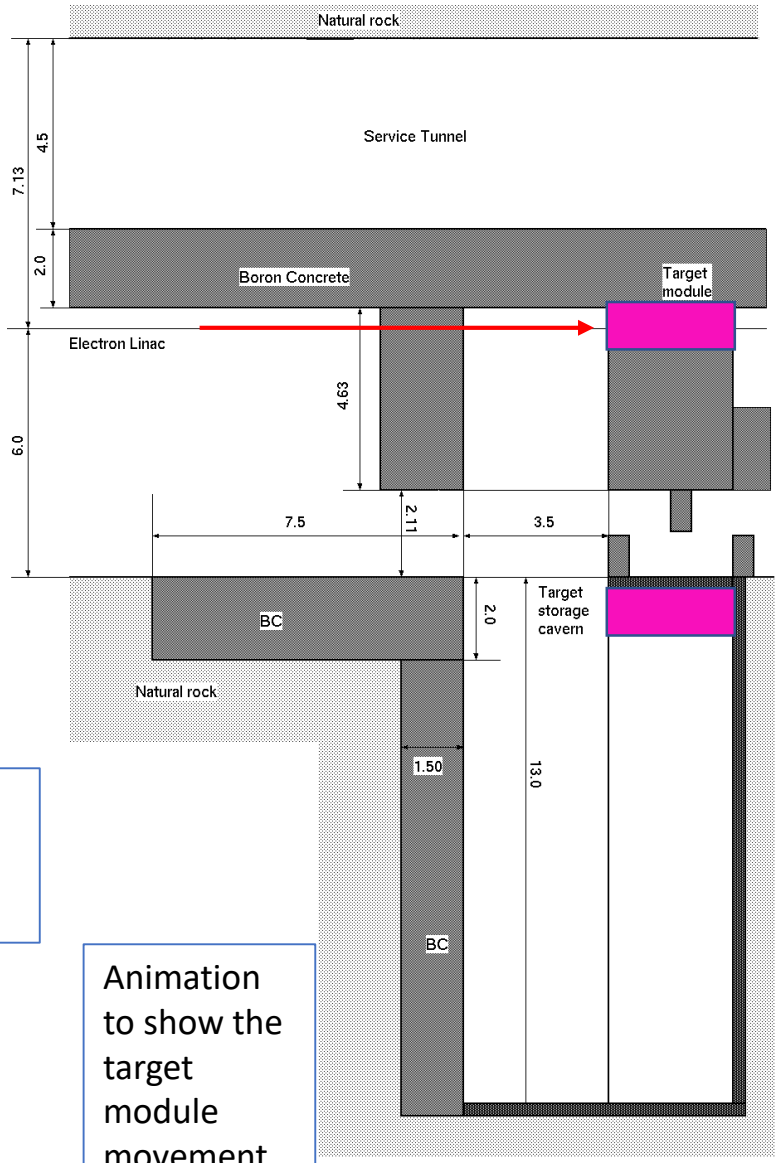


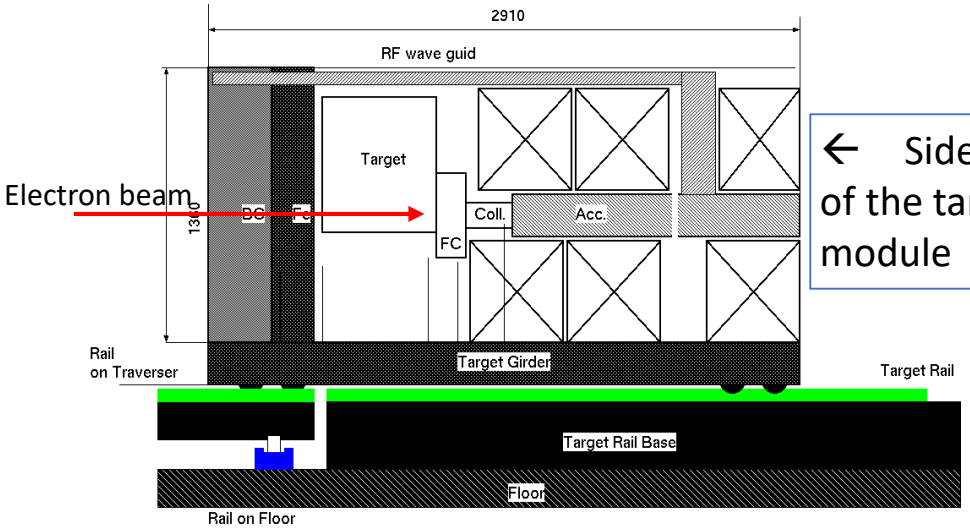


WPP-11:

- Special attention is needed due to the high radiation of the target area. This is a common issue for E-Driven and Undulator positron source.
- Careful design of shielding is required.
- The components near the target (target, flux concentrator, first cavity with solenoid) require replacement in every few years. The work must be done by remotely.
- The works to be done as WP-prime
  - Conceptual design
  - Fabricate Mockup
  - Prototyping of critical components

Floor layout of the target section.





← Side view of the target module

Animation to show the target module movement