A Report from PosiPol2015 to AD&I meeting (10 Sep. 2015)

LINEAR COLLIDER COLLABORATION

Designing the world's next great particle accelerator

Masao KURIKI (Hiroshima University)

PosiPol2015

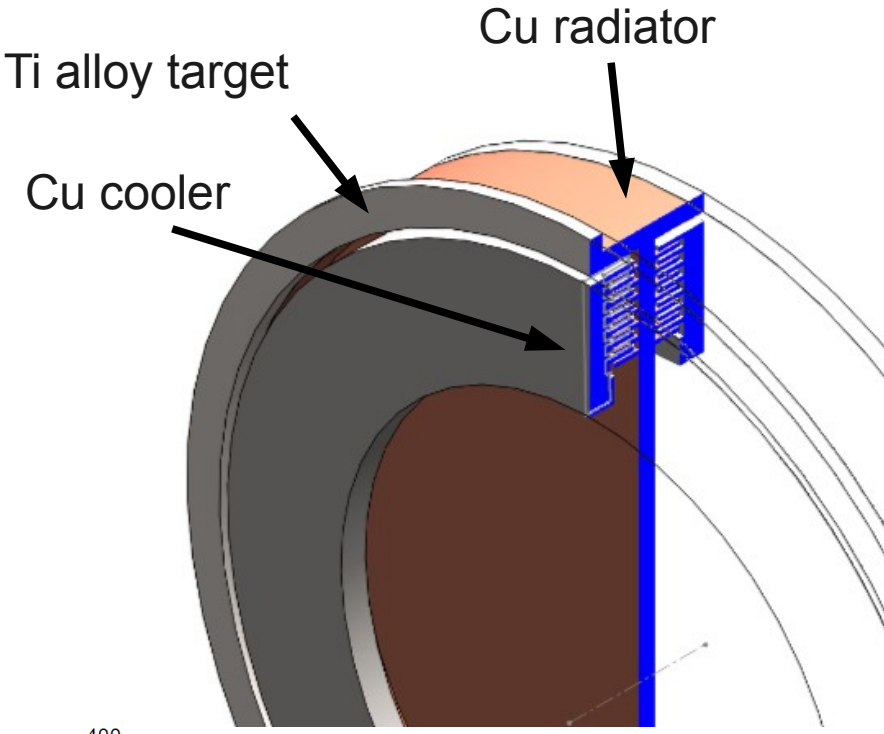
- **That was held on 2-4, Sept. 2015 at Cock-Croft Institute in Daresbury lab. UK.**
- **10^{th} workshop for polarized positron and related issues.**
- **Close connection to LC groups.**
- **20 contributions**
  - **Undulator :7**
  - **E-driven: 8**
  - **Compton: 2**
  - **Other/common :3**

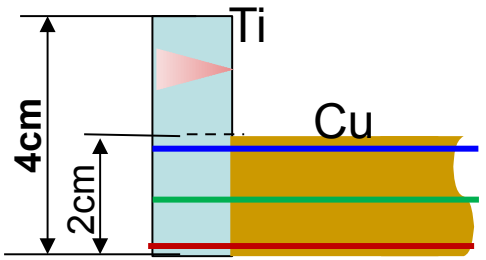
Undulator

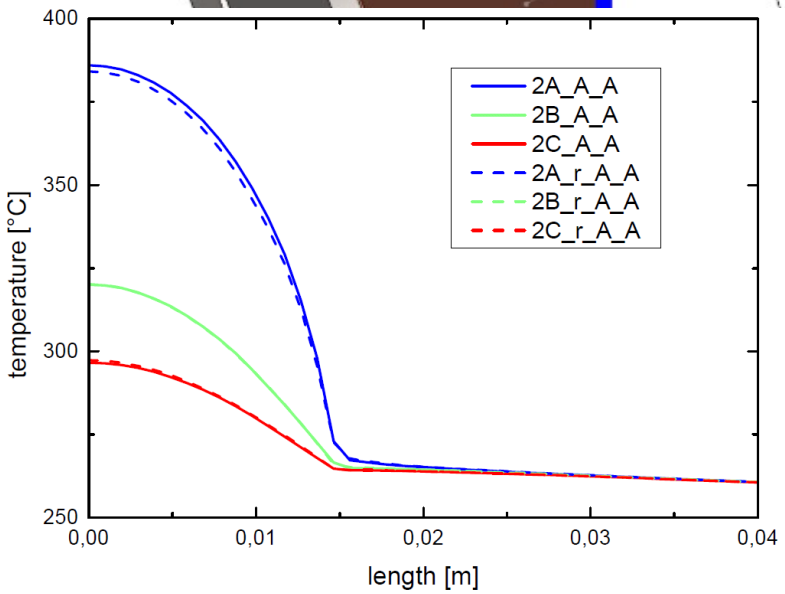
- **The design is matured.**
- **Target is the biggest issue.**
- **Three proposals.**
  - Water-cooled ferro-fluid seal : Most developed, but no progress since the pending.
  - Contact cooling: Rotation test in air was done.
  - Radiation cooling: Conceptual design was done. Simulation study is on-going.
- **Need a guide line to develop the road-map to develop the target design.**

Radiation Cooling Target : S. Riemann, F. Dietrich

- **2-3m² is required to remove 2-4 kW heat.**
- **The heat transfer is easily balanced for increased heat load because P~T⁴.**
- **Heat transfer and mechanical stability between the Ti-alloy and Cu conductor is an issue.**
- **Optimization is ongoing.**

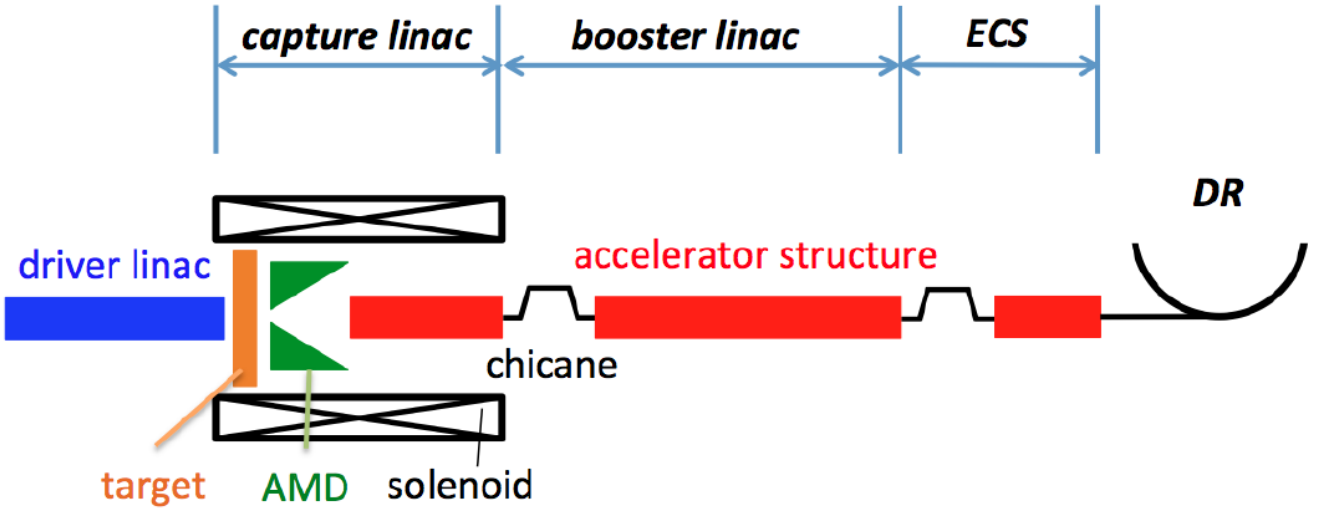


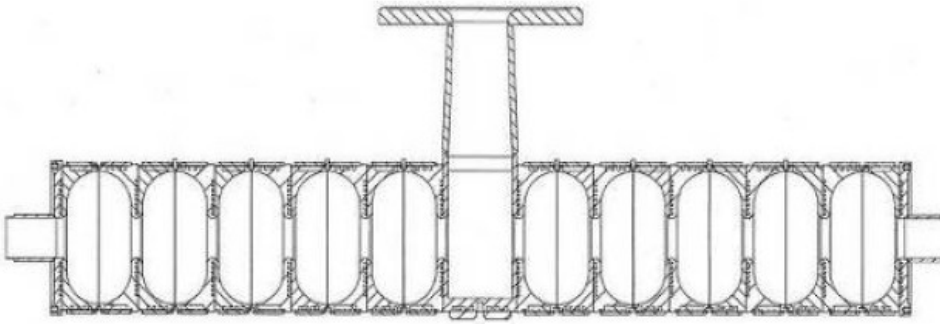


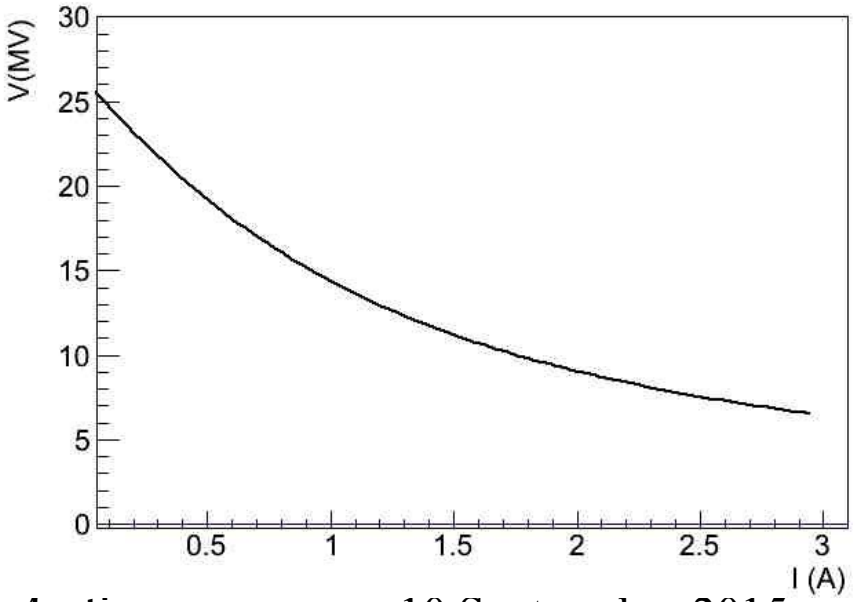


E-driven capture simulation : M. Kuriki

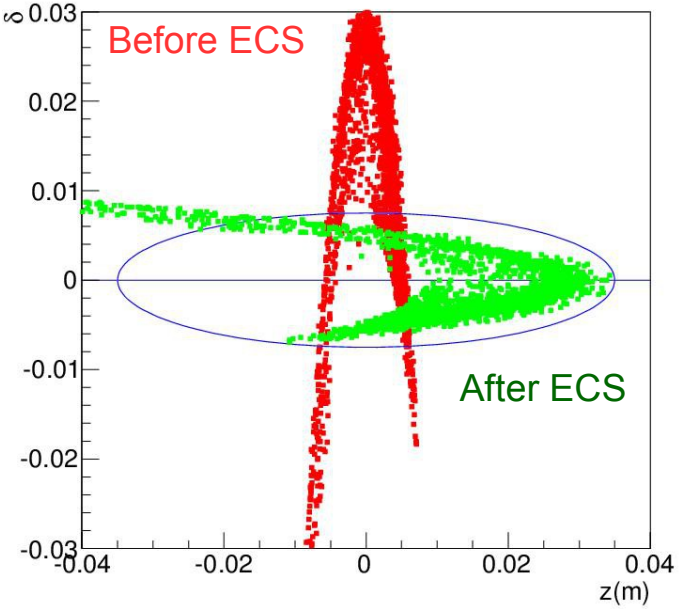
- **By assuming a conservative RF system (45MW L-band SW), the simulation was redone.**
- **Include beam loading, 8MV/m with 2A**

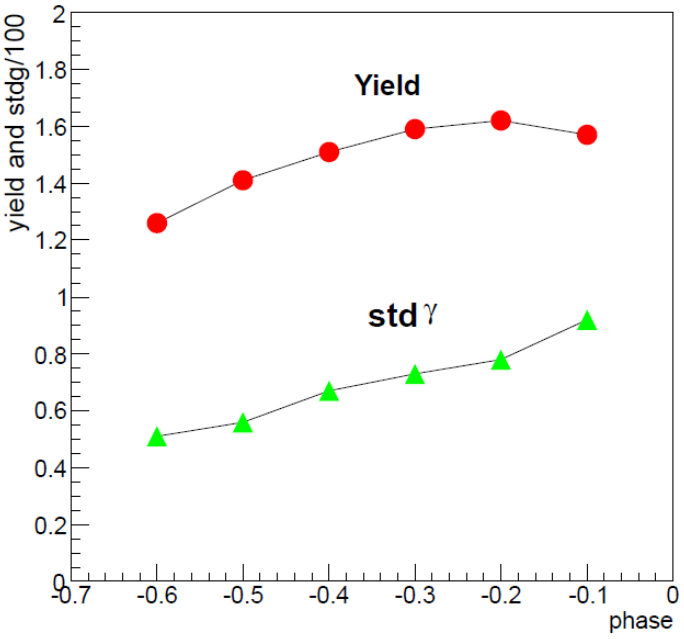






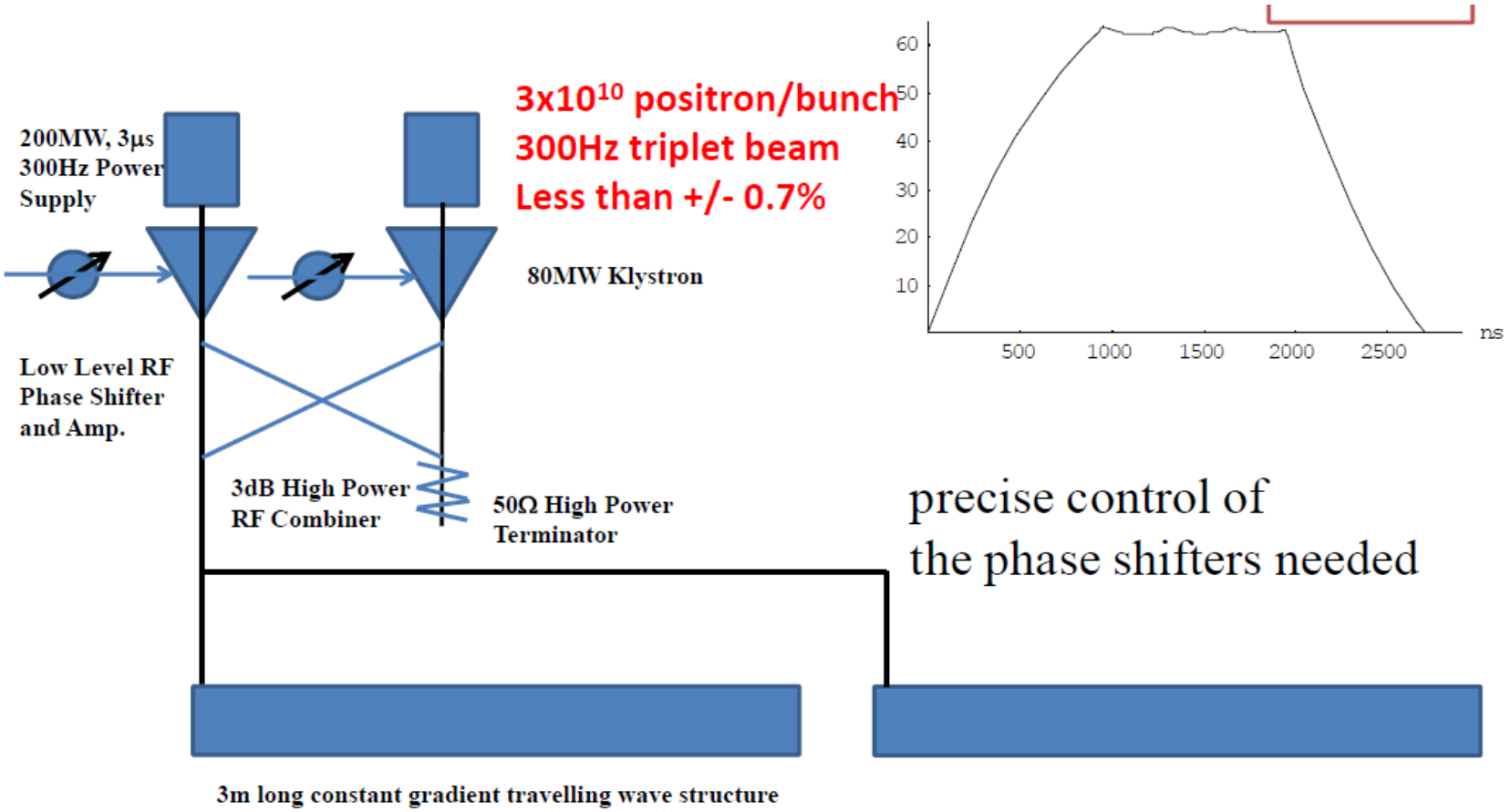
- The yield (Ne+/Ne-) is obtained including all conditions.
- The booster and ECS simulation was simplified (no full tracking).
- The yield was 1.2-1.6 (depending on the initial phase).
- No significant degradation comparing to the last simulation with 25 MV/m.
- The yield depends on rather aperture than gradient of the capture RF.





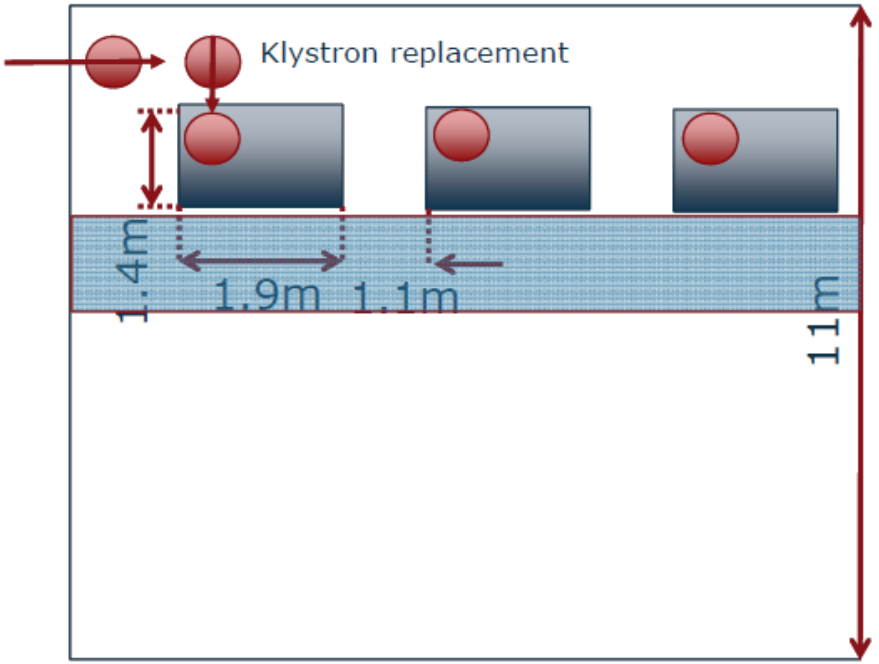
Klystron and Modulator for 300Hz Linac :
S. Fukuda

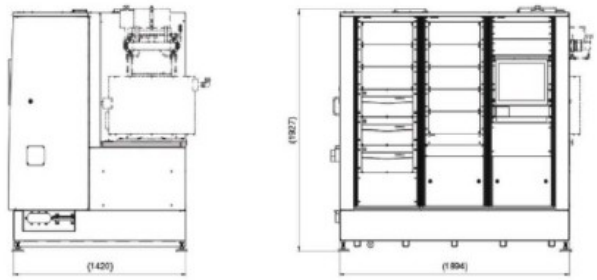
- **A large number of RF sources is required → high density layout of the system.**
- **Minimize R&D as the technical backup.**

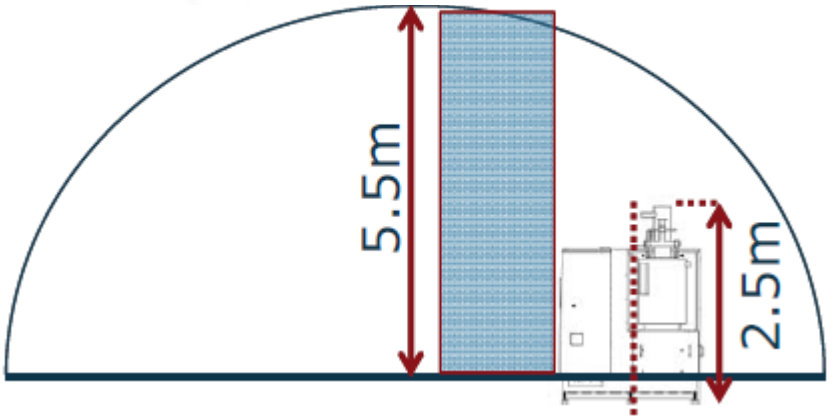


RF system

- L-band: 50 MW tube, since design of this power level is not difficult.
- S-band: 80 MW tube since 2856MHz 80MW klystron is available in market. The scaling to 2.6 GHz is obvious.
- 88 L-band system (50MW klystron, modulator, acc tube)
- 132 S-band system (80MW klystron, modulator, acc tube)
- These system is placed in every 3m in the tunnel.

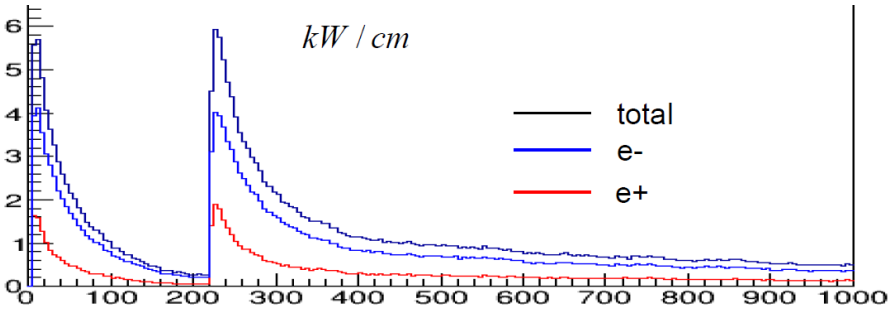


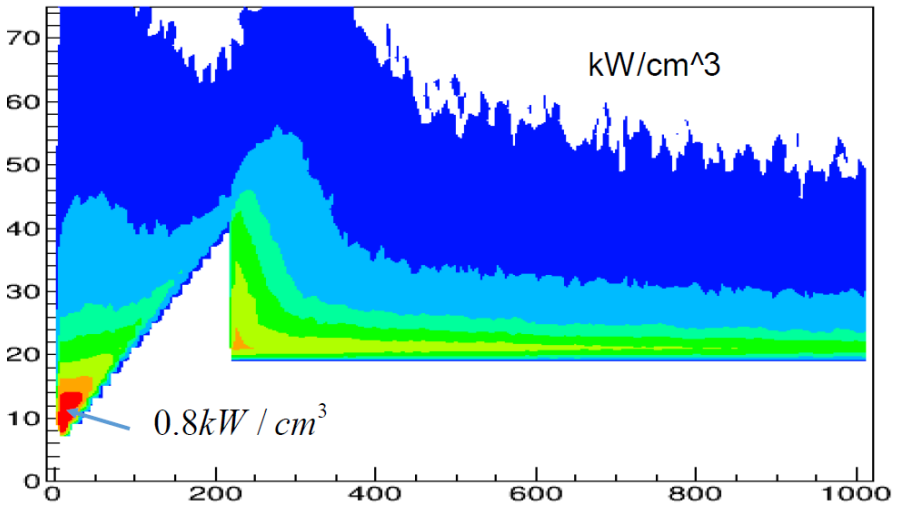




Energy depostion around e+ target for a conventional source (T. Takahashi)

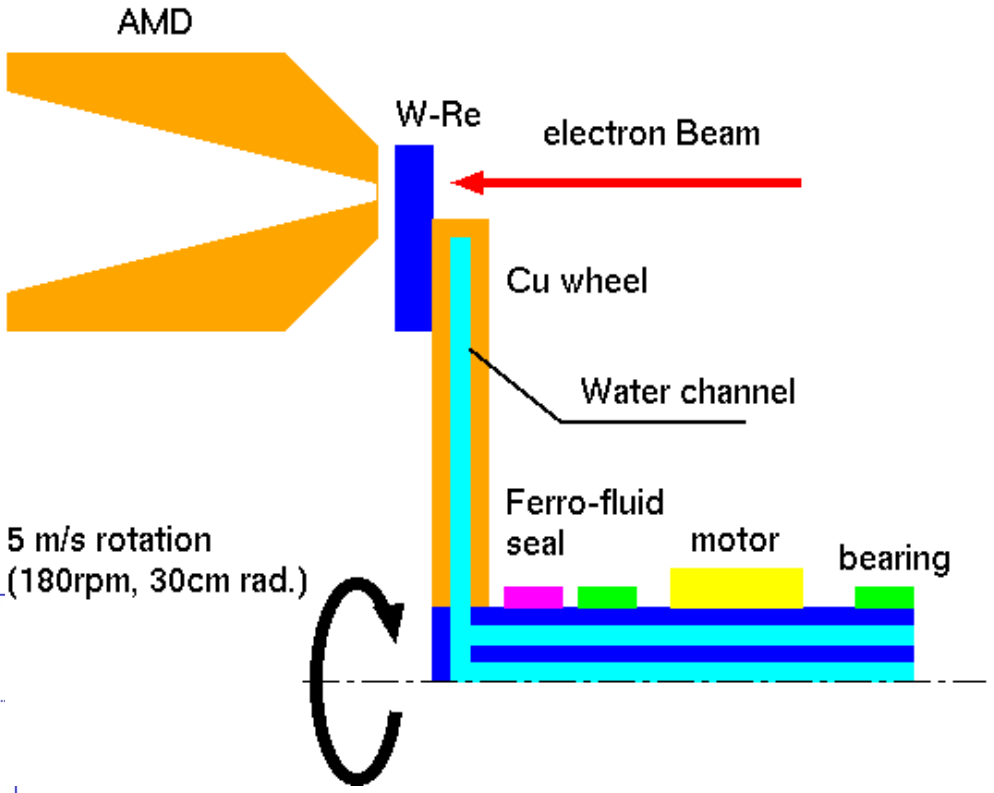
- Energy deposit for e- driven (2640, 5Hz) is estimated.
  - 35kW for the target.
  - 31kW for the AMD.
  - 172kW for RF.
- The highest energy density is observed at the edge of AMD, 0.8 kW/cm^3.
- The heat and radiation protection should be considered.

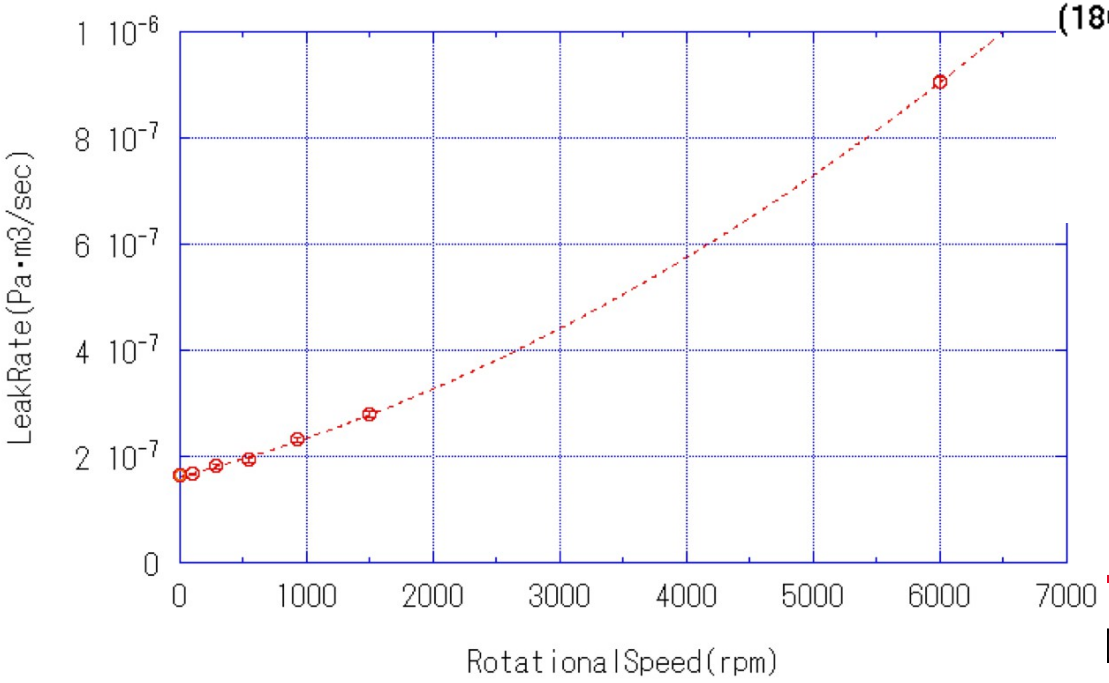




Slow Rotation Target for E-driven (T. Omori)

- Ferro-fluid seal leak rate : acceptable (180 rpm – 2e-7Pa.m^3/s.
- After irradiation (4.7 MGy, ILC 3 years operation), there was no additional leakage.

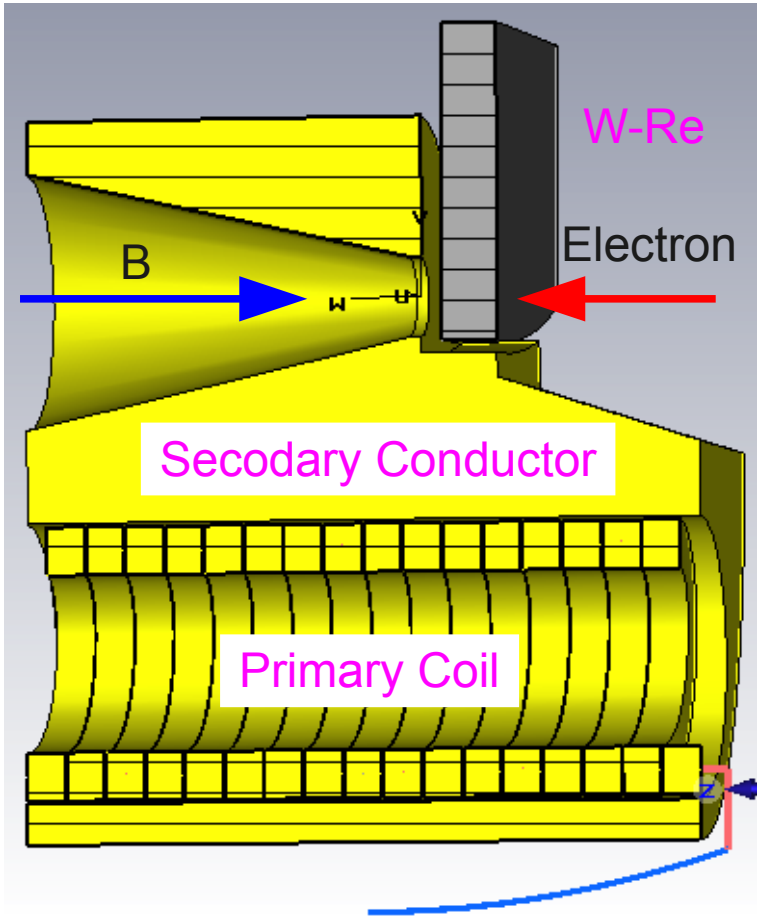




- The seal performance is enough for ILC positron source.

Flux Concentrator

- **Flax Concentrator for ILC E-driven e+ source was designed by P. Martyshkin.**
- **16mm diameter (aperture), 5 T peak, 1T at Target, 41kW ohmic loss.**
- **25kA for driver (25us, half sine pulse).**
- **Heat by eddycurrent on the target is negligible, 2kW.**



Outline of the Plan in Next Two Years

(1) We will make a prototype in two years (FY2015-2016).

(2) The prototype is full-size, d=500 mm.

(3) Full-size means that target wheel has the same radius, the same weight, the same moment as those of the real target. The locations of the vacuum seal and bearing in the prototype are as same as those in the real one.

(4) The prototype is not totally as same as the real one.

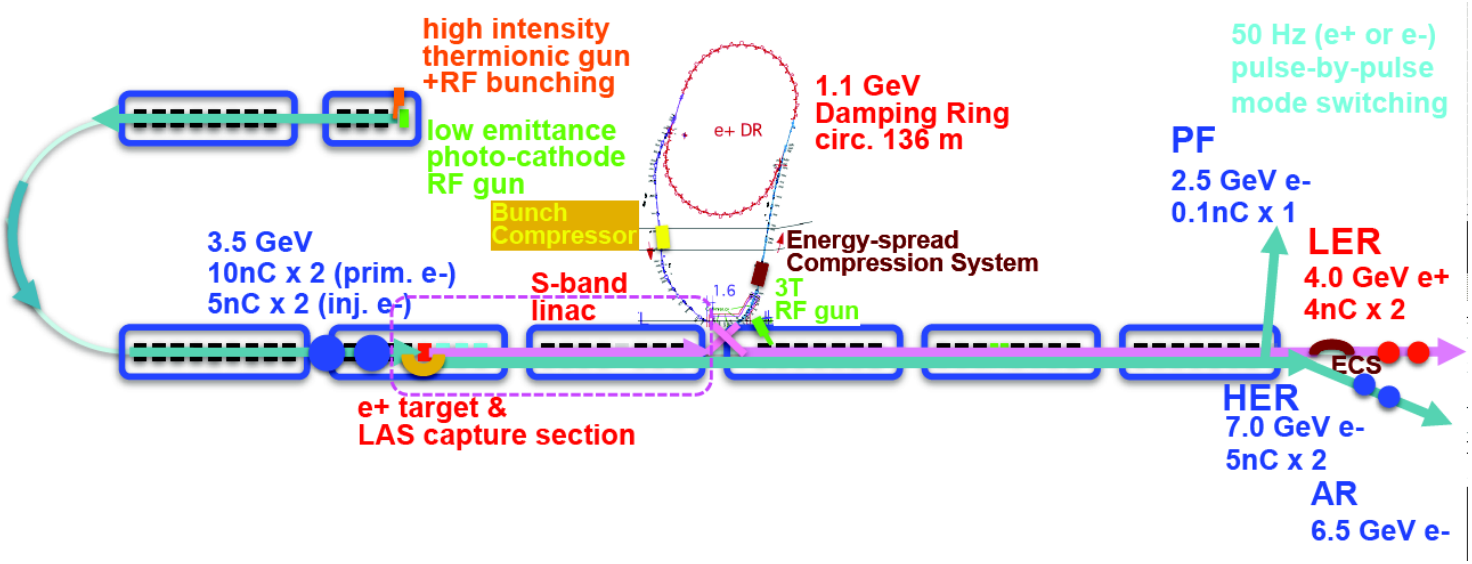
- **The prototype has no water channels in it.**
- **We don't use W for disk.**

(5) We will use irradiated ferromagnetic fluid in the prototype.

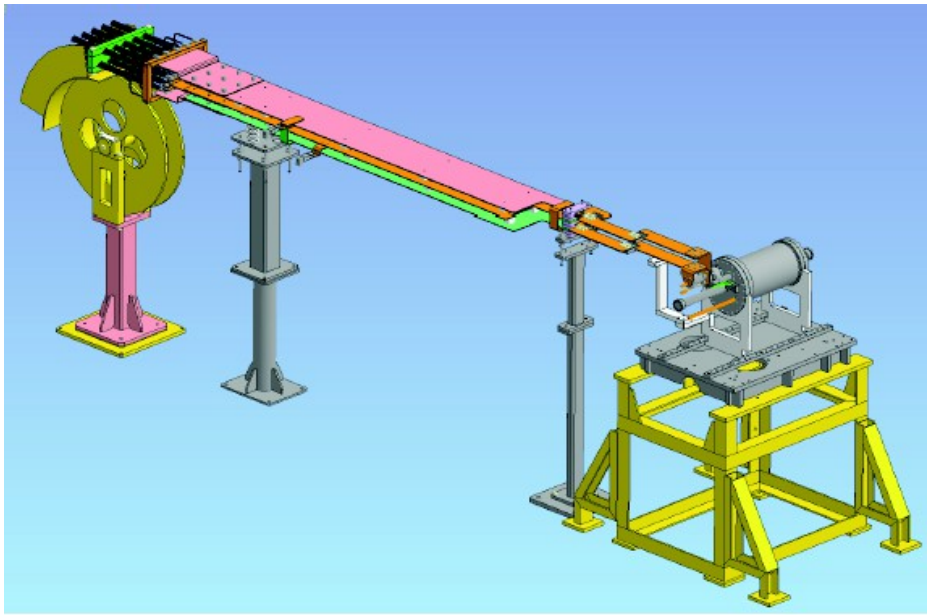
(6) We will make continuous running test (~1 year?) and will prove that vacuum always stay good level.

Super KEKB injector (T. Kamitani)

- **Damping Ring for lower emittance (2000-> 92[h]/7[v] mm.mrad)**
- **Capture section upgrade for high e+ intensity (1-> 4nC)**
  - Flux concentrator
  - LAS (Large Aperture S-band RF)

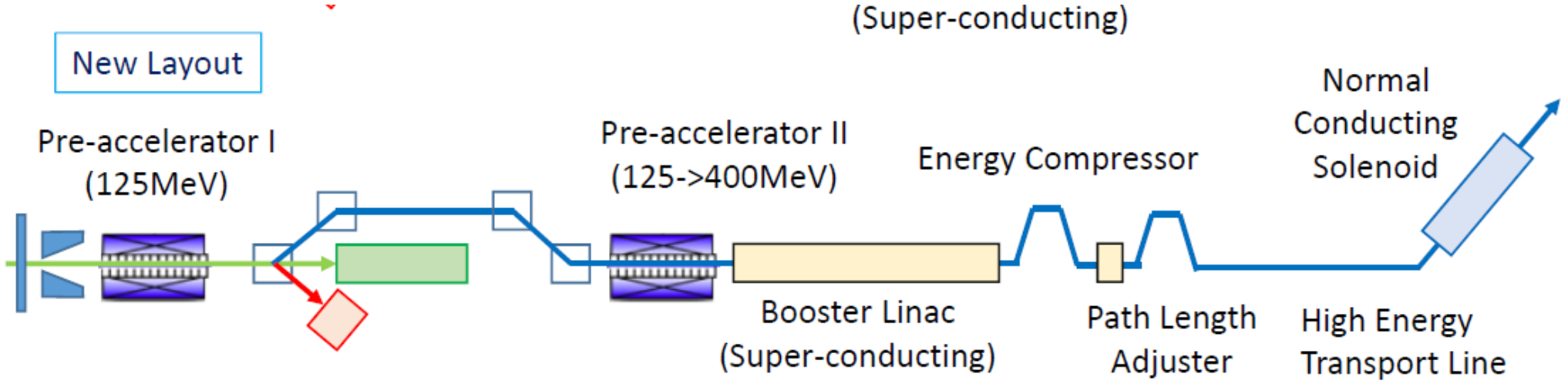


- **Fire accident at the cable terminal between the pulse modulator and FC.**
- **HV was in tolerance of the cable, but it was replaced for larger margin.**
- **To reduce the inductance, tri-plates parallel line is introduced.**
- **Operation test was successful (12kA).**
- **The system installation is ongoing.**



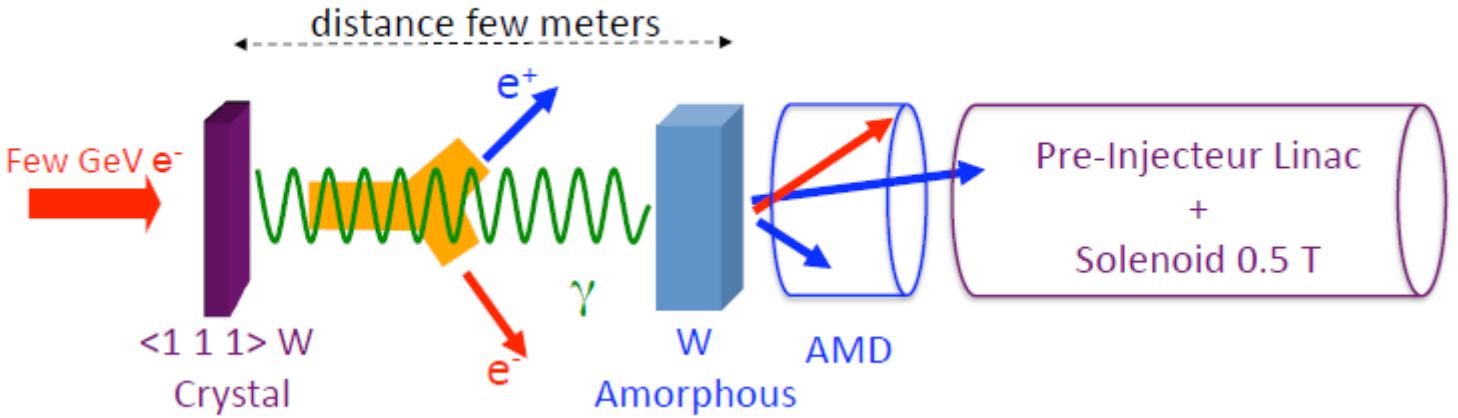
Considerations to arrange the beam sources for ILC BDS tunnel : T. Okugi

- **Many questions making consistencies.**
  - Size, place, configuration, etc.
  - Several proposals for better integration, improve the performance.
- **The source group will answer these questions (hopefully until LCWS2015).**
- **The list includes not only the positron, but also electron.**

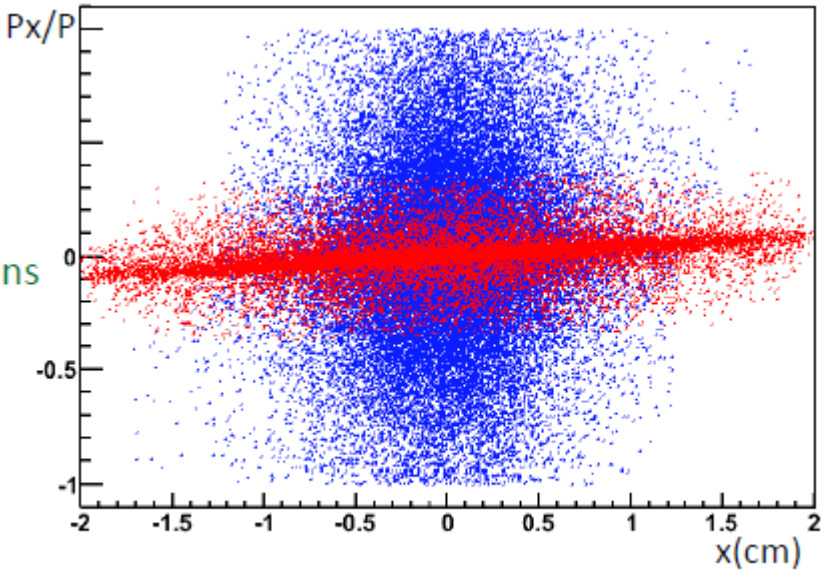


Beam Dynamics Studies of the CLIC Positron Source : C. Bayar

AMD effect on the positron beam



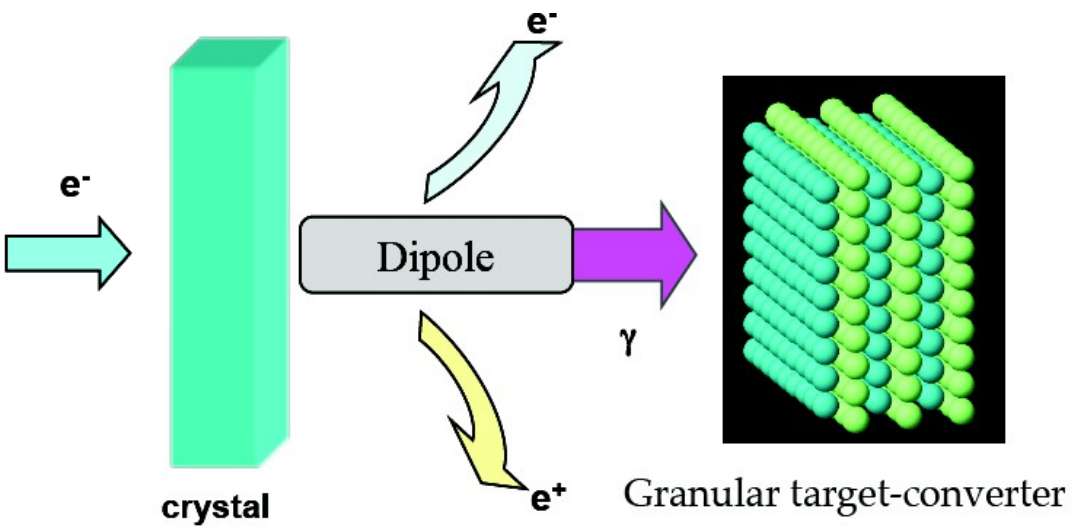
- $B(z)=B_{min}/(1+\alpha z)$
  - B_{max} = 6 T, B_{min} =0.5 T, L=0.2 m
- After the AMD
  - Small angles & large dimensions easier to transport
- e^+ yield (Ne^+/Ne^-) : 1 to 4
- $<E_{e+}>$: 50 to 110 MeV

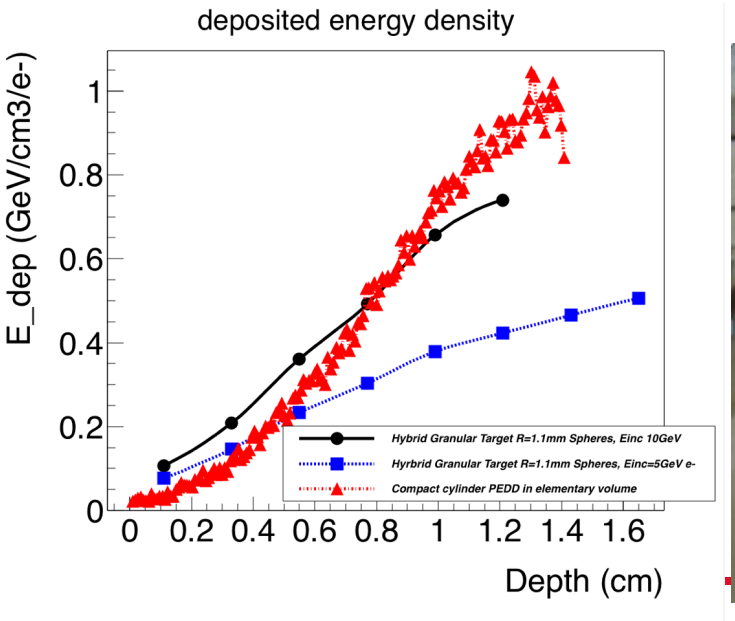


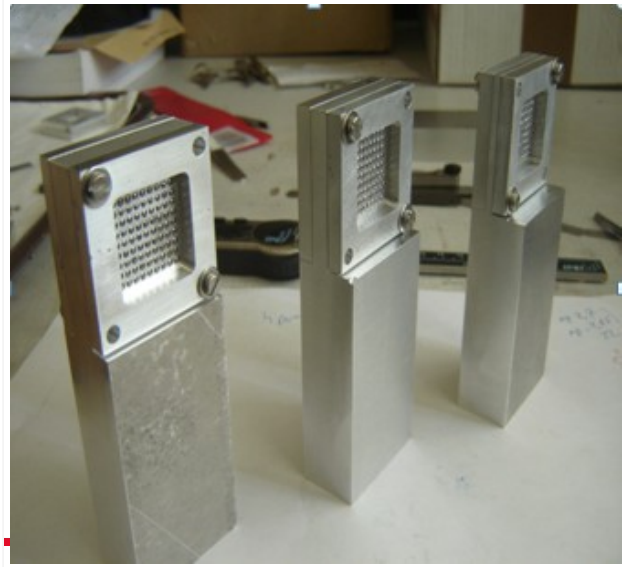
Olivier Dadoun, IPAC2010

Granular Target for hybrid target (E-driven)

- Granular target can provide better heat dissipation associated with the ratio Surface/Volume of the spheres and the better resistance to the shocks.
- Tungsten a few mm R.
- PEDD is 11.6 J/g (amorphous target 22.7 J/g).
- A beam test at KEKB linac will be made in 2015 October.







Change Request

K.Yokoya

- Possible contents of the change request
  - Make the CFS design compatible with both undulator source and e-driven source
  - For the tunnel design a system design of the e-driven source to somewhat detail is necessary
- Deadline
  - There is no rigorous deadline
  - But hopefully before November workshop
  - Tentatively, deadline for detailed design should be the end of September
- We agreed to apply this change request as the source group.

Summary

- Undulator : The technical design is matured, but the technical confidence on the target system is not fully established yet.
  - We need a guide line to establish the technical confidence.
- E-driven: The conceptual design is established, but the technical design is being developed. The target prototyping is ongoing.
- CLIC positron source is being studied.
- Discussion on the system integration is started.
- We agree to apply the change configuration request for positron CFS.