

Introduction to dump issues

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17th August 2005 at Snowmass '05

This session...

- Introduction to the dump issues (Appleby, 5')
- Summary of dump studies at KEK (Sugahara, 20')
- A water dump for the ILC (Walz, 30')
- Agreement in prewritten summary (Markiewicz, 5')

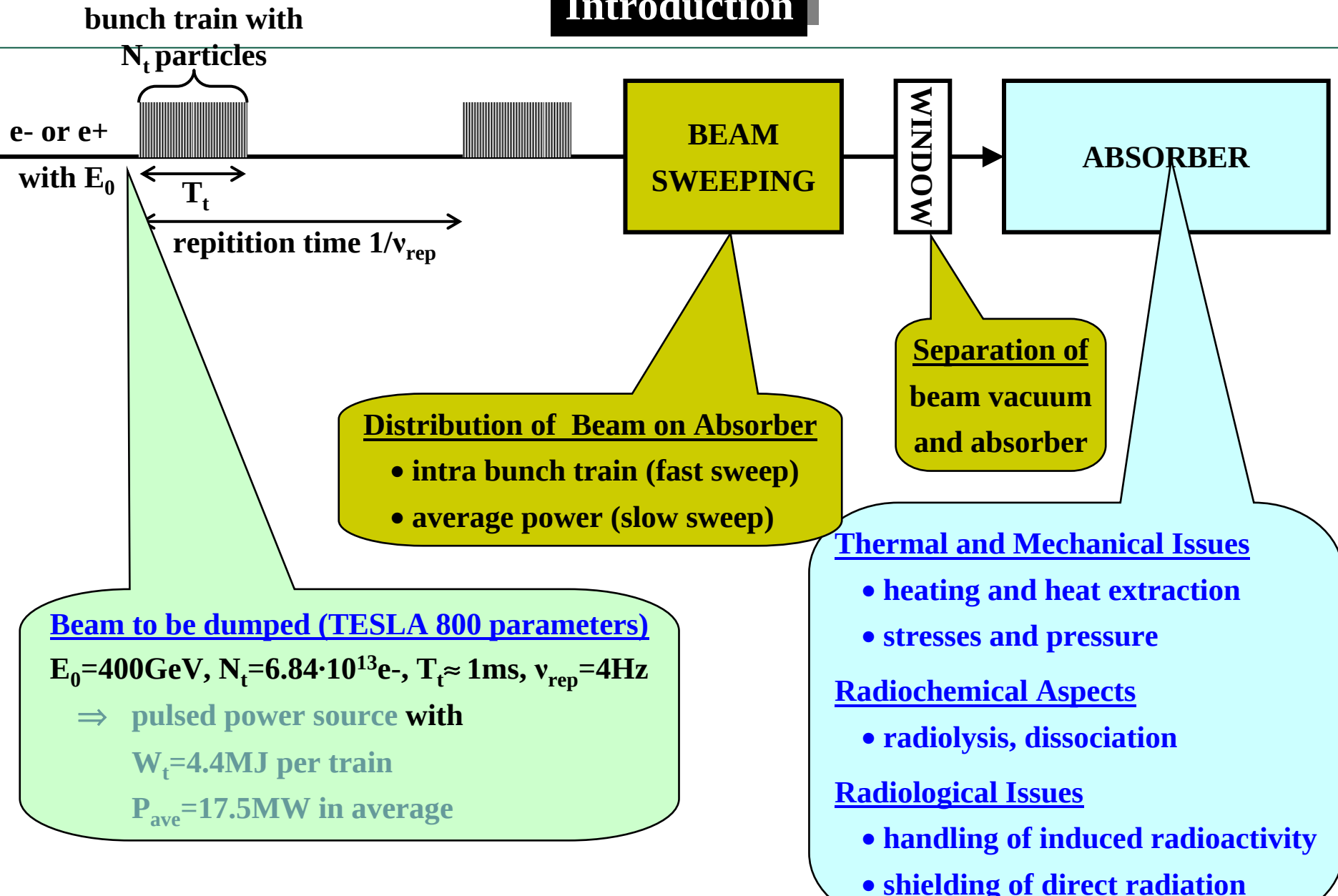
This talk: Issues of dumps and a brief
summary of the talk by Michael Schmitz of
DESY at the BDIR meeting in London in June.

Baseline configuration document

...	...	...
Main beam dumps based on water vortex scheme rated for 18MW beam. Common e+- and g dump for 20mrad, separate g dump for 2mrad. Separate beam dumps rated for full power for all beamlines (total six beam dumps). Undisrupted beam size increased by distance.	Prototype and tests of beam dump window? Gas dump prototype?	Elliptical wide window. Gas beam dump (1km of Ar in Fe). Beam sweeping and/or graphite rod to increase undisrupted beam size.
...	...	...

6 18MW dumps!!!

Introduction



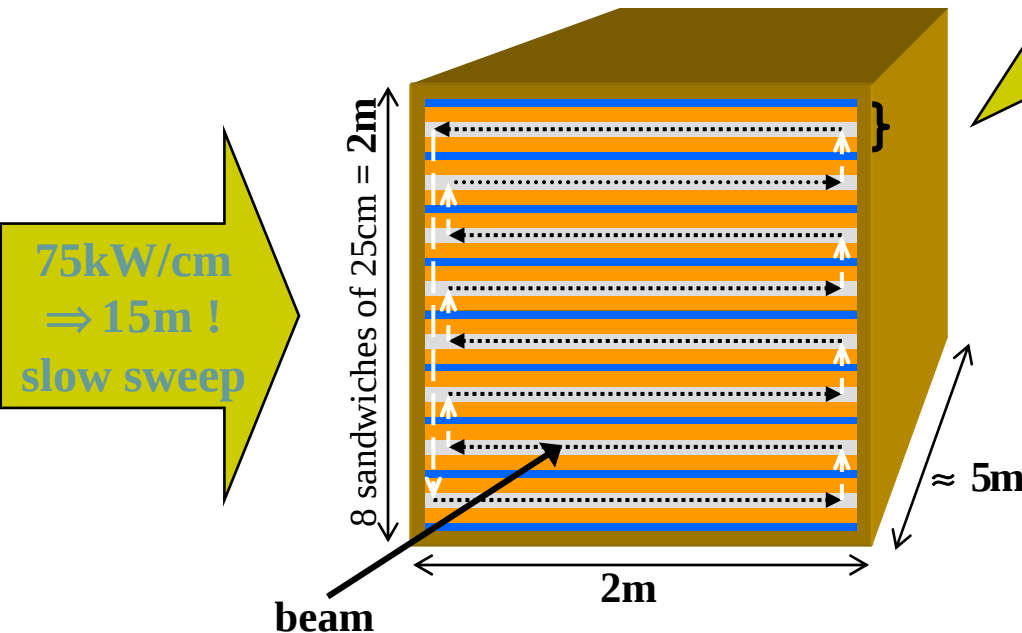
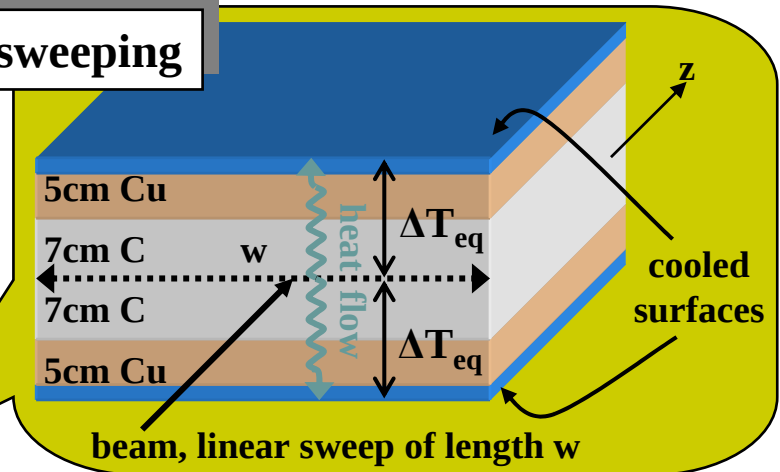
Solid Dump: Heat Extraction

C-based absorber embedded in Cu

- capture 400 GeV shower $\Rightarrow$ longitudinal: $\approx 5\text{m}$, transversal: $1R_m(\text{C})+3R_m(\text{Cu})=7\text{cm}+5\text{cm}$
- $E_0=400\text{GeV}$, $P_{\text{ave}}=17.5\text{MW} \Leftrightarrow I_{\text{ave}}=44\mu\text{A} \Rightarrow (dP/dz)_{\text{max}} \approx 75\text{kW/cm}$! How to get rid of ?

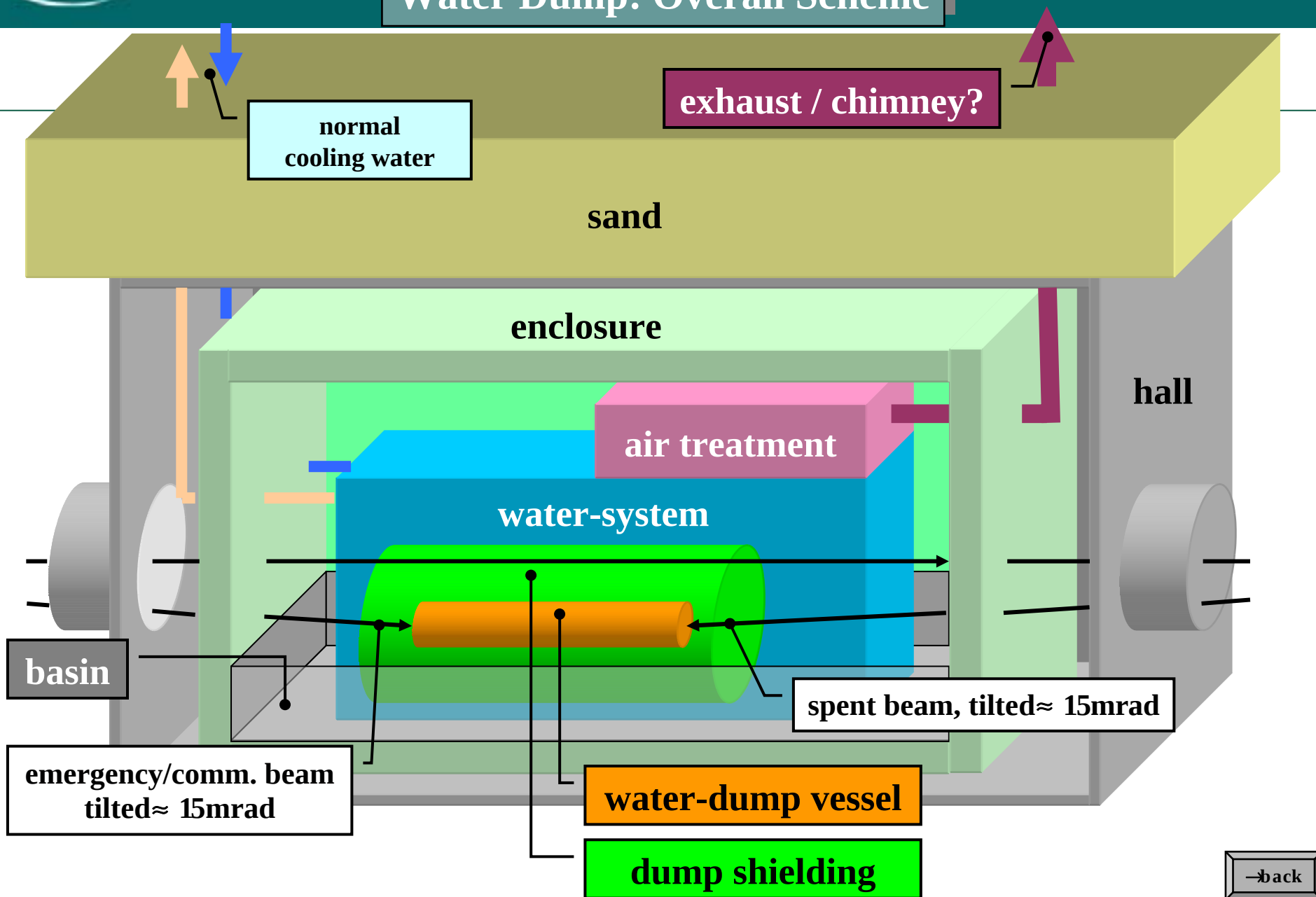
Heat extraction by transverse heat conduction and sweeping

$\alpha_{\text{tot}} \approx 0.12\text{W}/(\text{cm}^2 \cdot \text{K})$ and $(dP/dz)_{\text{max}} = \alpha_{\text{tot}} \cdot w \cdot (\Delta T_{\text{eq}})_{\text{max}}$
 allow $(\Delta T_{\text{eq}})_{\text{max}} \leq 400\text{K}$ (prevent oxidation of C)
 $\Rightarrow w \approx 20\text{cm} / (\text{kW/cm}) \cdot (dP/dz)_{\text{max}}$



Discussion

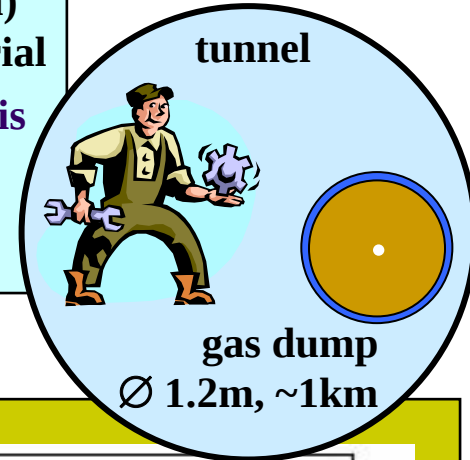
- huge and heavy absorber
- huge vacuum system
- complicated slow beam sweeping
 $\Rightarrow$ C-Cu Approach not suitable
 only reasonable for
 $(dP/dz)_{\text{max}} \approx \text{kW/cm} \Leftrightarrow P_{\text{ave}} \approx 100\text{kW}$



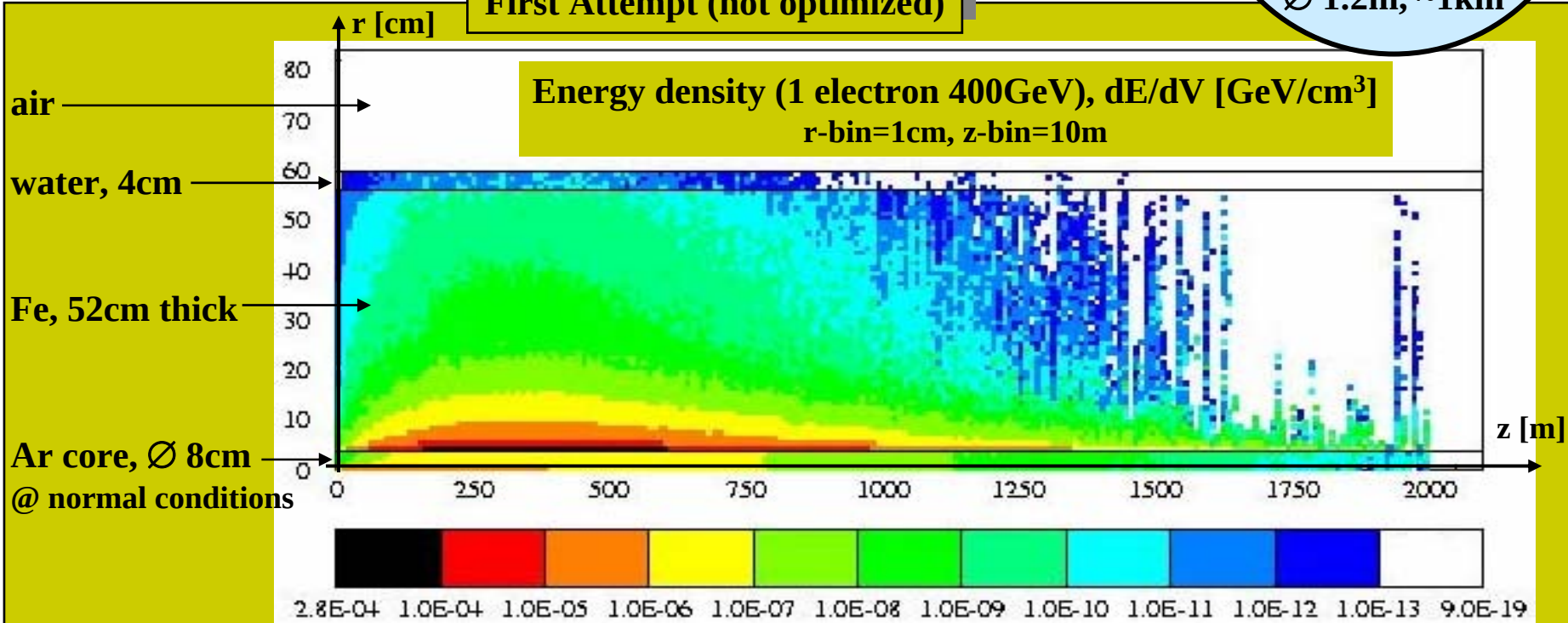
Basic Idea

One atomic noble gas core (Ar, Xe) is surrounded by solid material (Fe)

- gas core acts as scattering target (only small amount of energy deposition) and distributes energy **longitudinally over $\sim 1\text{km}$** into surrounding material
→ **low energy densities, no sweeping, small spot size possible, no radiolysis**
- surrounding material takes main part of energy
 $Z > 20 \rightarrow$ **reduced tritium production**



First Attempt (not optimized)



Graphite-Copper Dump	Water Dump	Noble Gas Dump
2m x 2m, 5m long	Ø1.5m, 10m long	Ø1.2m, 1km long (extra? tunnel)
heat conductivity & immense slow sweep	adequate water flow no slow sweep	heat conductivity no slow sweep
radiation degradation of heat conductivity of graphite ?	explosive radiolysis gases in a highly activated system	no dissociation of one atomic gas
cyclic stress in C tolerable	transient pressure in water	gas buffers transient expansion
window Ø2m unless not put upstream of sweeping	vac./water window Ø20cm challenging design	vacuum/gas window Ø8cm design ~exists
need increased spot size (fast sweep) to limit energy density		applicable for smaller spot sizes and therefore as γ/γ -dump
total tritium inventory= 300TBq ≈ 30% in water, rest in C-Cu		tritium inventory factor 10 less and 98% bound in a solid
maintenance complicated		easier maintenance
high activated components, dismantling costs not negligible		activation of 1km tunnel
Technically not practicable for high power applications	Principally feasible, but inherent risks will make it difficult to „sell“ it as reliable, safe and robust.	Attractive new idea, which should be investigated in more detail