High-Energy Beam Transport for ESS (WP7)

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- Some input for reflection
  - I Previous ESS
  - II SNS
  - III Particle therapy

Work Package 7 Description

- *Design of High Energy Beam Transport system.*
- *Define standards for the normal conducting magnets*
- *Define standards for the corresponding power converters*
- *Beam dumps and collimators for the whole Linac. (dump→target division)*

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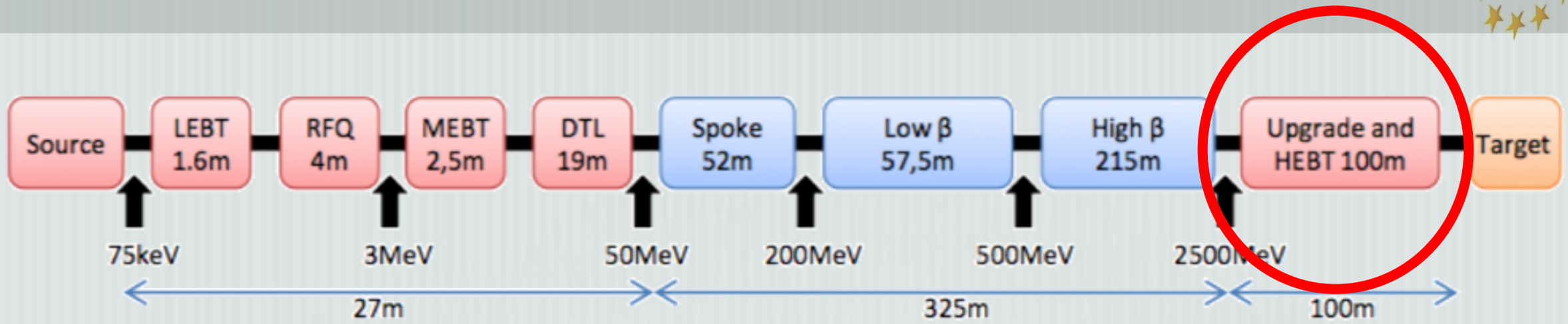
Apologies

- Today, no definite descriptions and designs can be presented
- Only some ideas and some “alike” setups and scenarios can be presented to inspire better ideas.

100 m HEBT



	Length (m)	Input Energy (MeV)	Frequency (MHz)	Geometric β	# of Sections	Temp (K)
RFQ	4	75×10^{-3}	352.2	--	1	≈ 300
DTL	19	3	352.2	--	3	≈ 300
Spoke	52	50	352.2	0.45	14 (3c)	≈ 2
Low Beta	57.5	200	704.4	0.63	10 (4c)	≈ 2
High Beta	215	500	704.4	0.75	19 (8c)	≈ 2
HEBT	100	2500	--	--	--	--

Purpose of HEBT

- Transport beam to main target
- Beam expander/spreader
- Diagnostics of beam from linac
- Halo collimation
- Future upgrades:
  HEBT to second target station
  more rf-modules for power upgrade/reliability/
  ?
- Linac beam dump
  de-coupled from target building?

Linac beam dump

- Limited to < 5 MW due to cost? (SNS 200 kW)
- Decoupled from main target would give time for target installation etc. during initial phases of linac commissioning
- Dump at same/above/below main target level?

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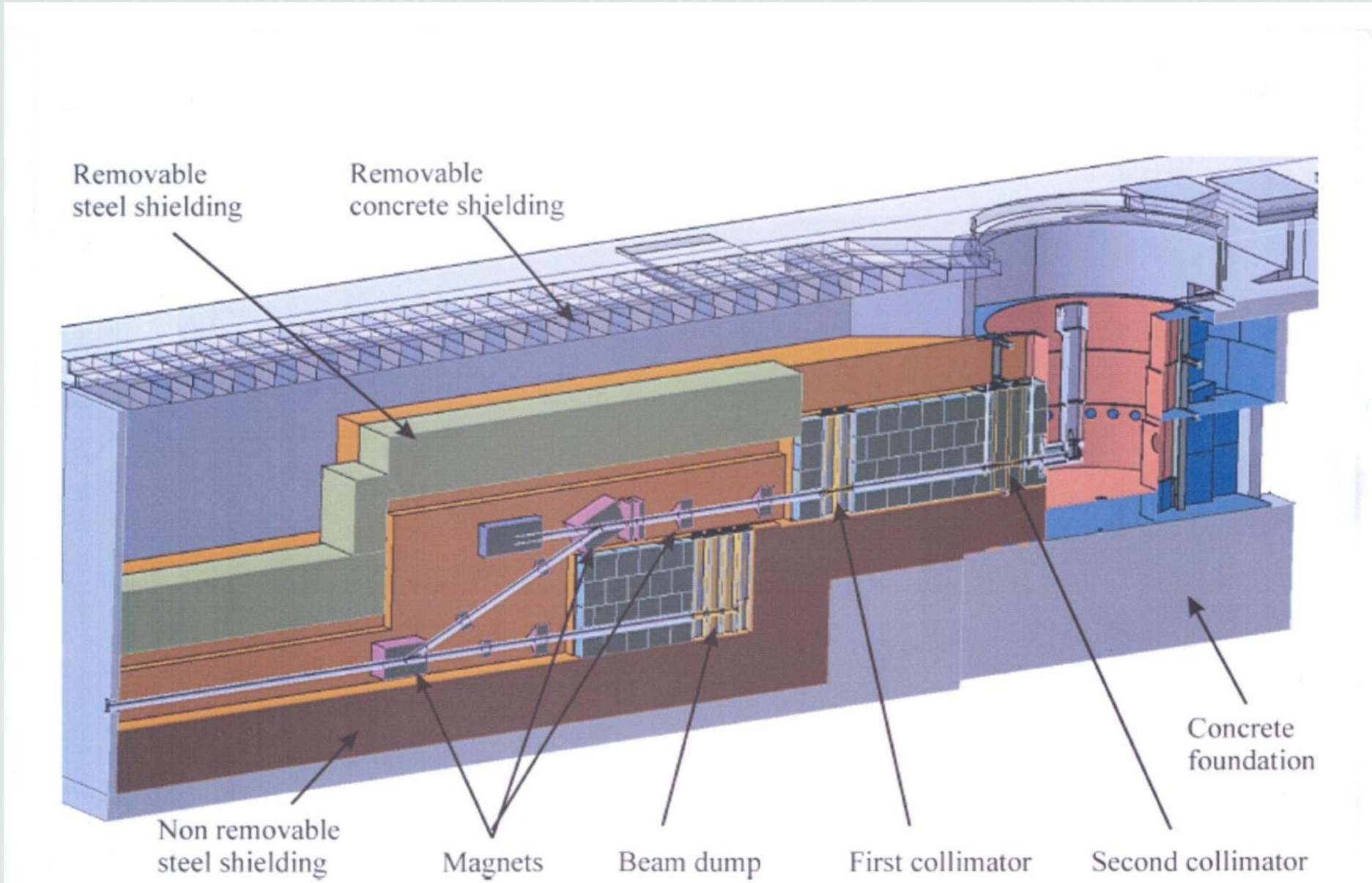
2003 ESS



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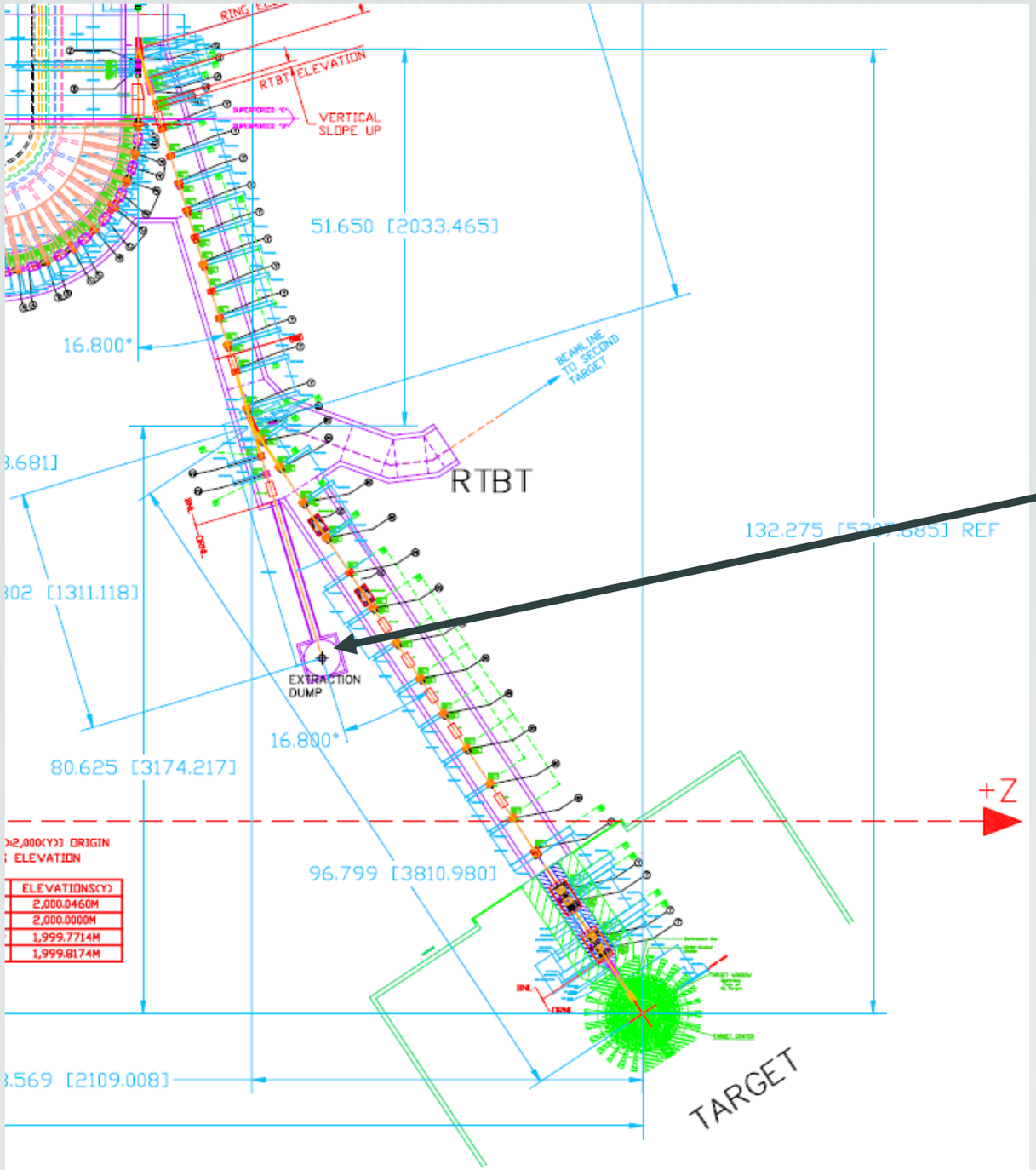
SNS



200 kW linac beam dump

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Main target station

- Horisontal beam to target
- Vertical/semi-vertical/? beam to target
  - beneficial for liquid target (beam window)
  - better azimuthal angular range for beamlines
  - not a small magnet system!
  - SuperConducting?
  - expander/spreader?
  - collimation/backstreaming n etc.

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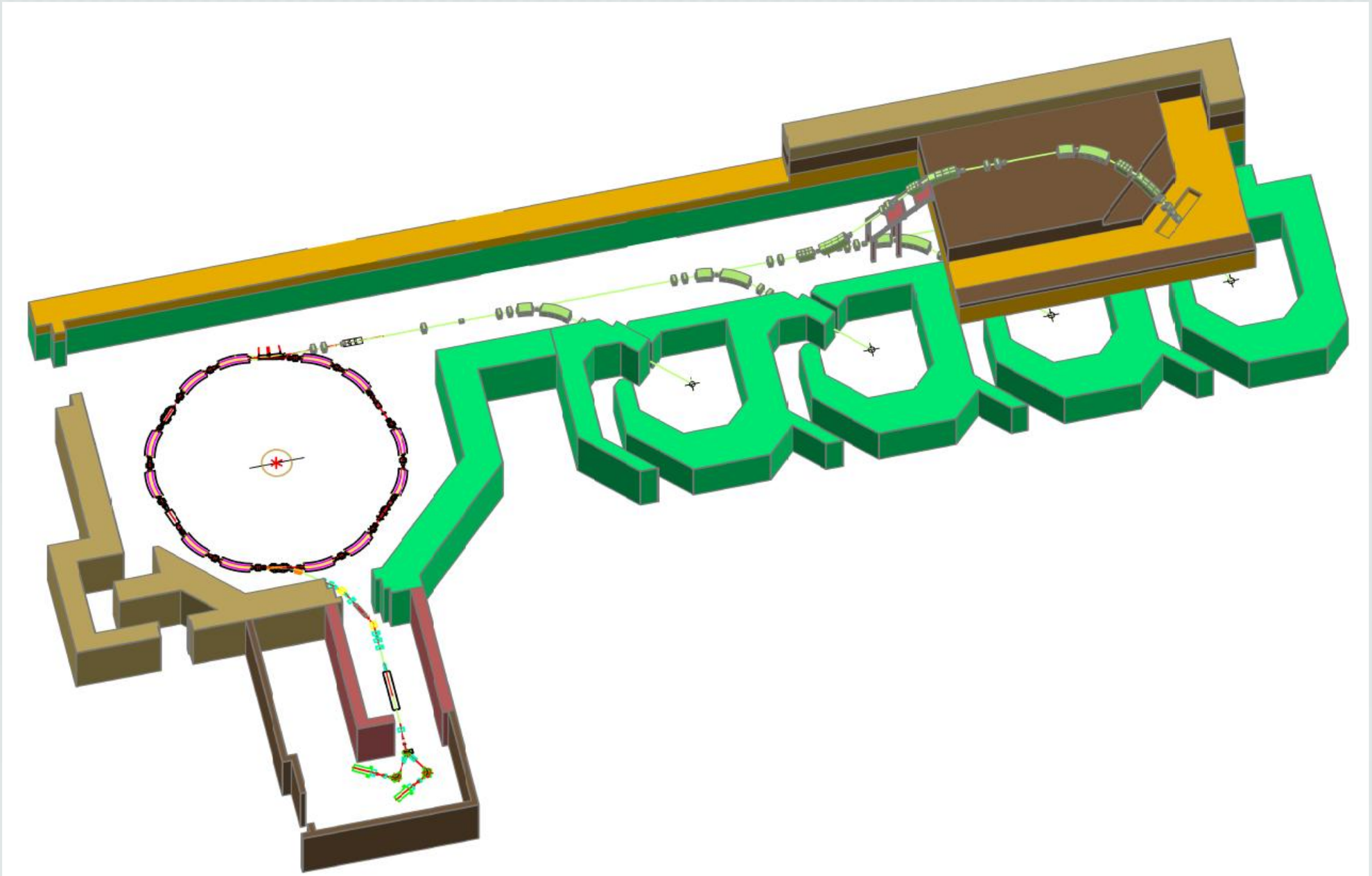
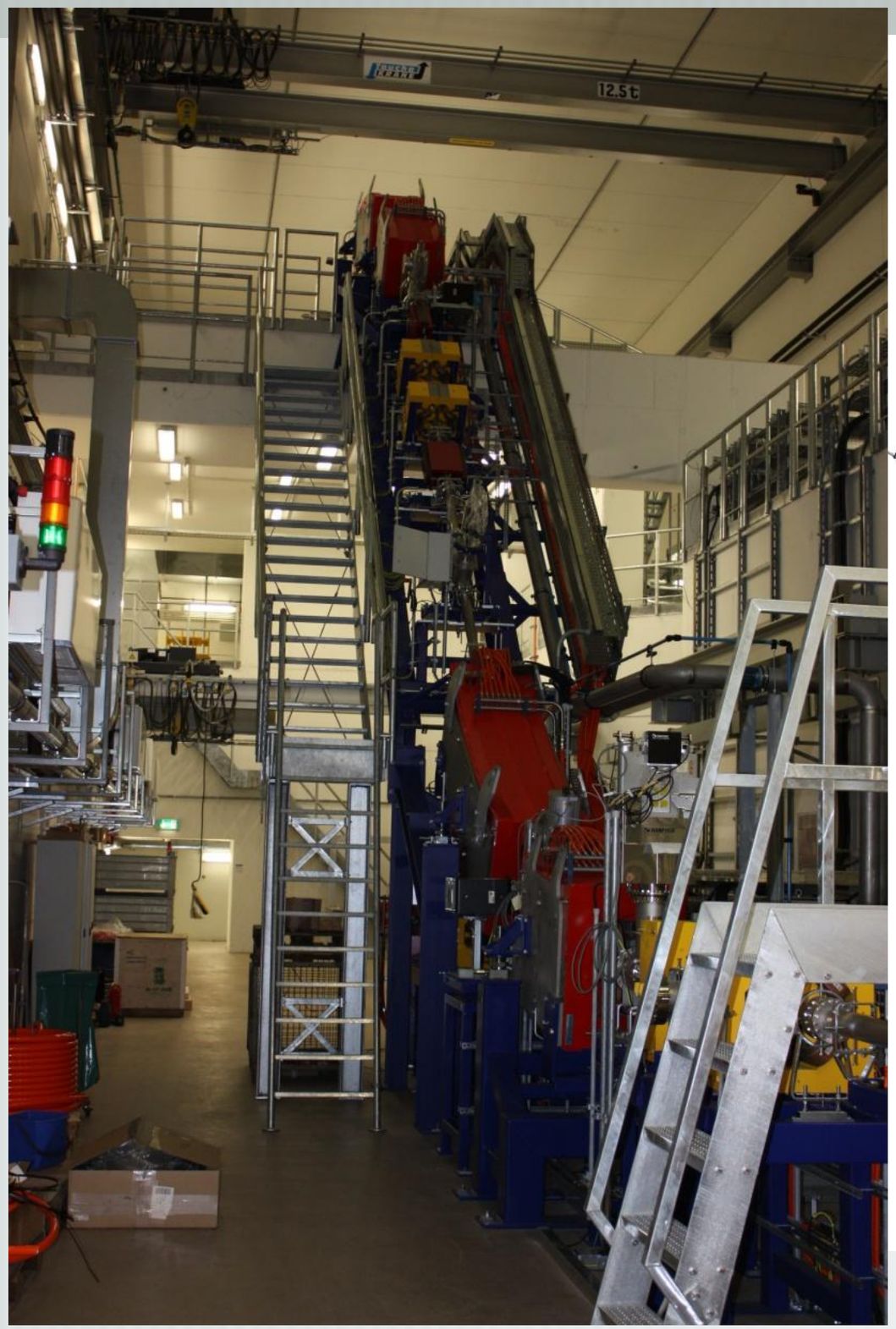
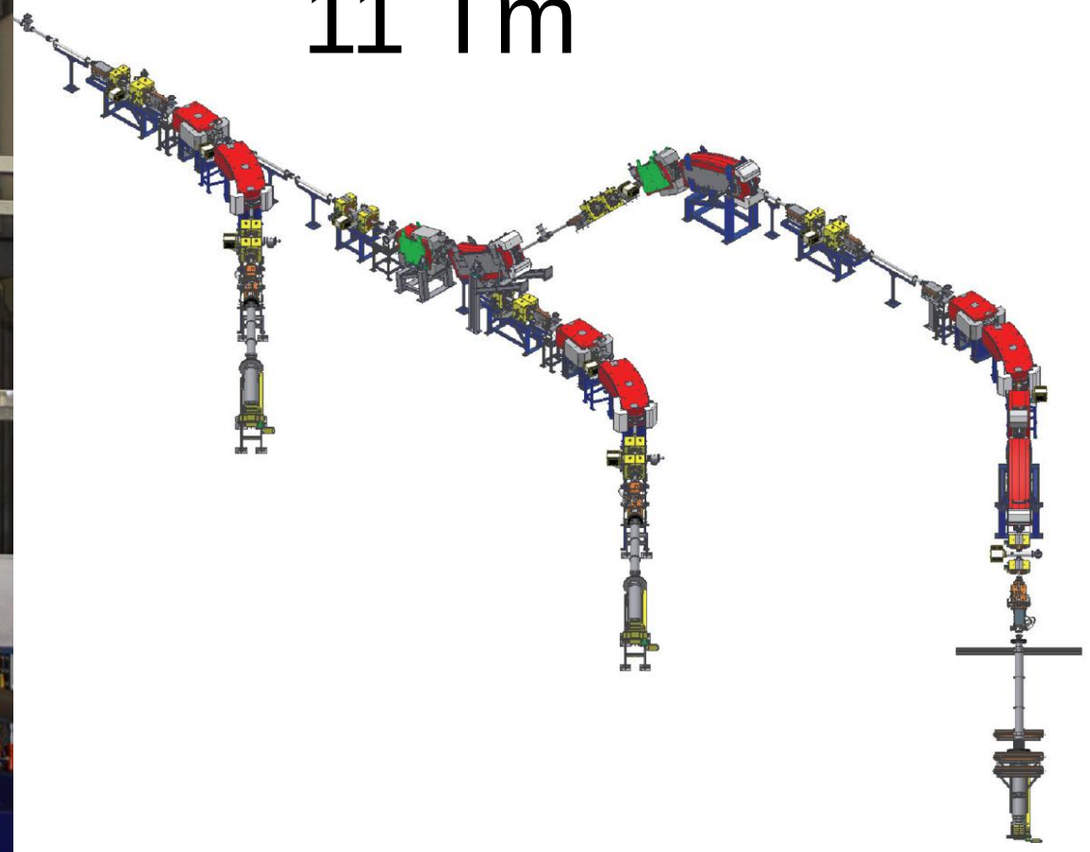
Marburg PT facility



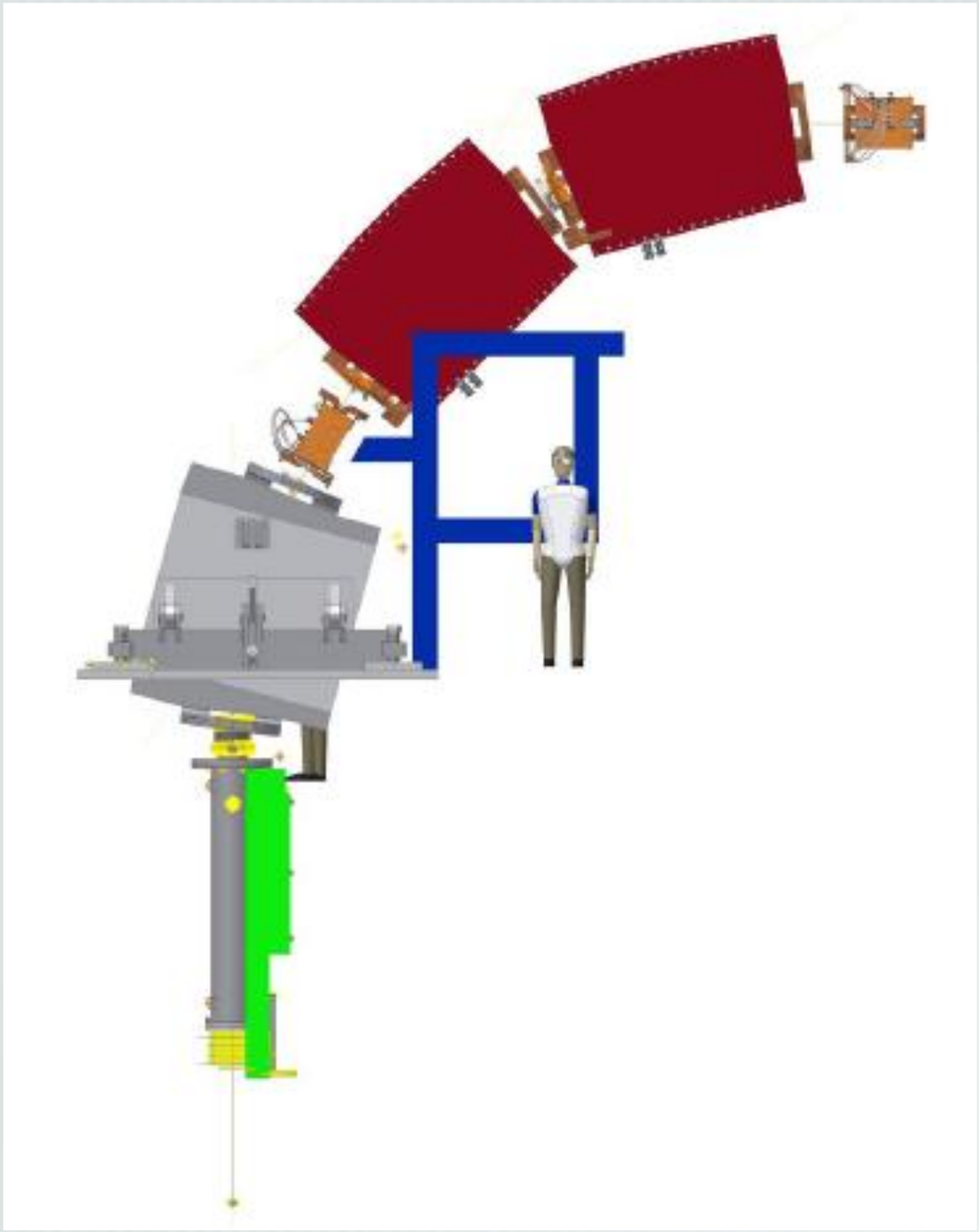
7 Tm PT semi-vertical beamline



Height 8m
7 Tm; we need
11 Tm



Vertical (90°) PT beamline



Height 8m
7 Tm; we need 11 Tm
13+13+24 t

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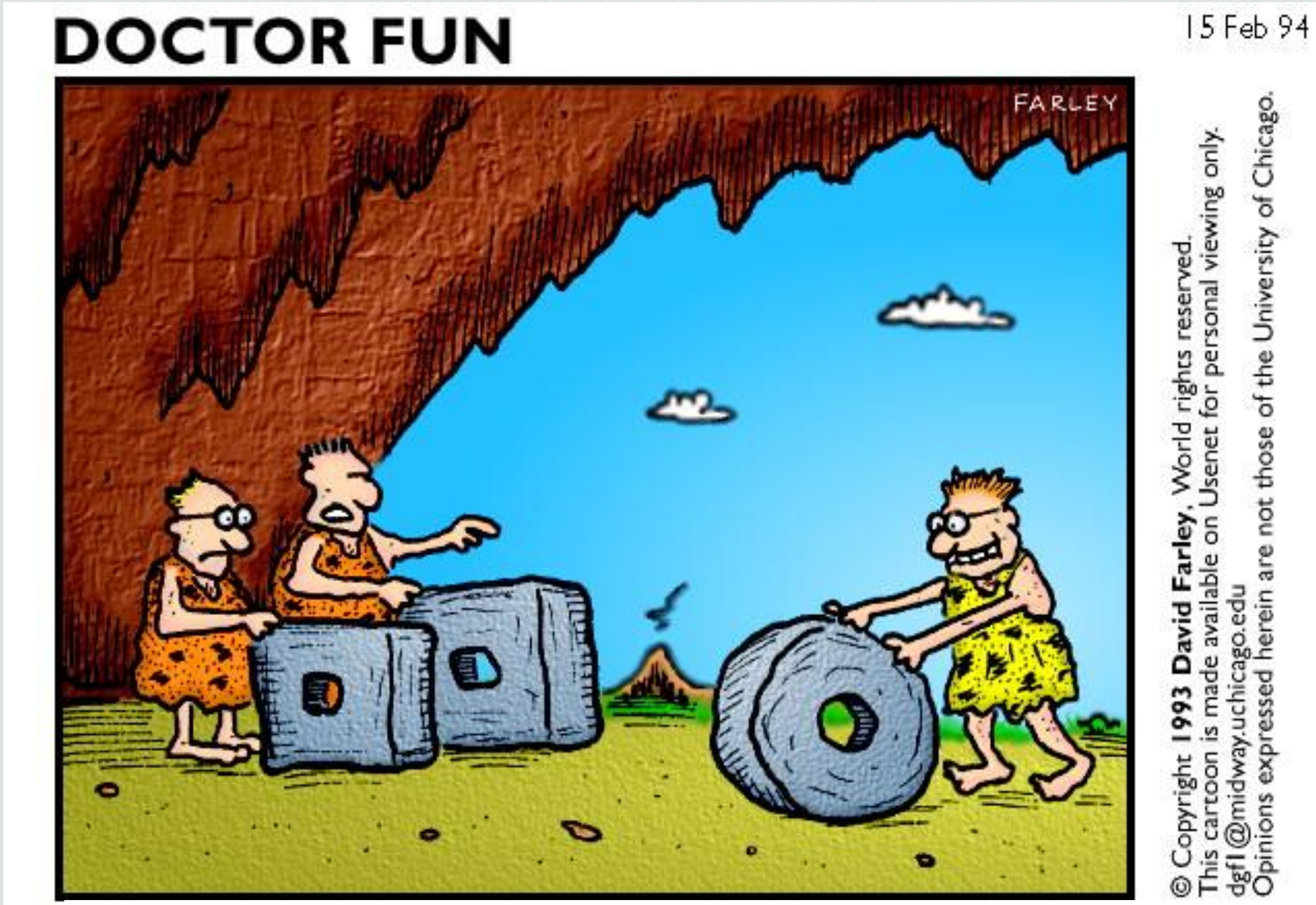
Normal conducting magnets

- Standardisation
- DC/pulsed
- Warm quads/steerers/BD in linac? Warm intermediate sections needed anyway for valves? Heatload from cold-warm transitions small?
- Rad. Hardness, at least near target
- Design for 10 years operational costs in design: Cu/Fe ↔ kWh – Permanent magnets?
- Design for ”hot/warm” cooling water

Power converters

- Standardisation
- Choice of technology
- DC ↔ pulsed?
- Design for 10 years operational costs in design
- Design for ”hot/warm” cooling water

Conclusions?



”Look! Borg get upgrade already!”

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