

LHC - Physics

SM

$$m_H \geq 2m_Z \Rightarrow H \rightarrow 2Z \rightarrow 4\mu$$
$$H^0: m_H \leq 2m_Z \Rightarrow H \rightarrow Z Z^* \rightarrow 4\mu$$
$$m_H \in (60, 120) \Rightarrow H \rightarrow 2\mu$$

pp

beyond
SM

$$\text{SUSY: } pp \rightarrow \tilde{q}\tilde{q}^* + X \rightarrow \bar{q}\tilde{r}\tilde{q}\tilde{r} + X, \dots$$
$$E_t + 2, 4 \text{ jets}$$

$W', Z', \text{leptoquarks, compositeness, } \dots$

QCD str. fun. up to $5 \cdot 10^5 \text{ GeV}^2$
clean processes
leptoquarks, e^* , W_R , compositeness

ep

$$L \approx 2.5 \cdot 10^{32} \text{ cm}^{-2} \text{ s}^{-1}$$

1.7 TeV

qg - plasma

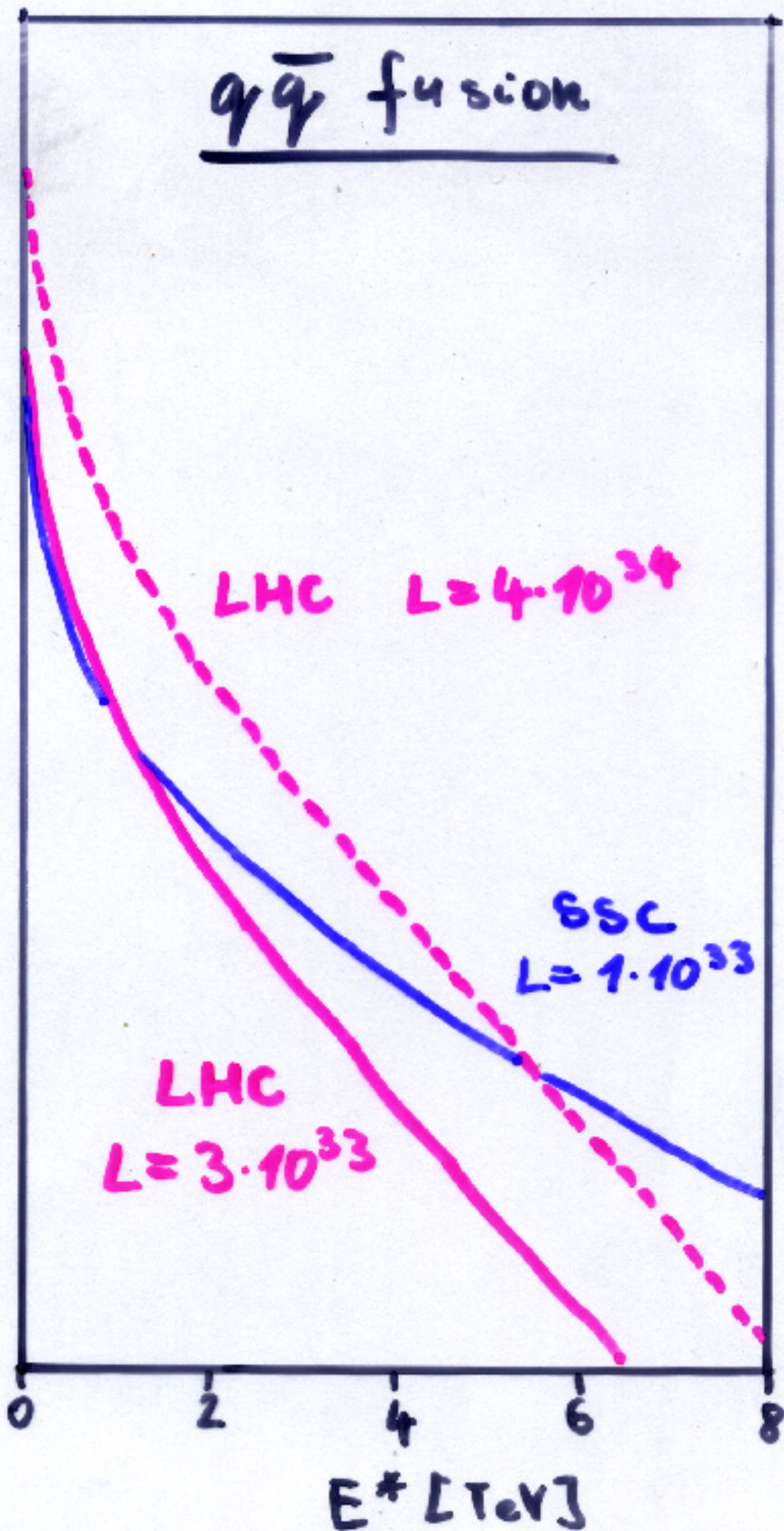
tt

AA

13.12 TeV for Pb

$q\bar{q}$ fusion

$\frac{dL}{dE^*}$



22 → 4 μ

LHC

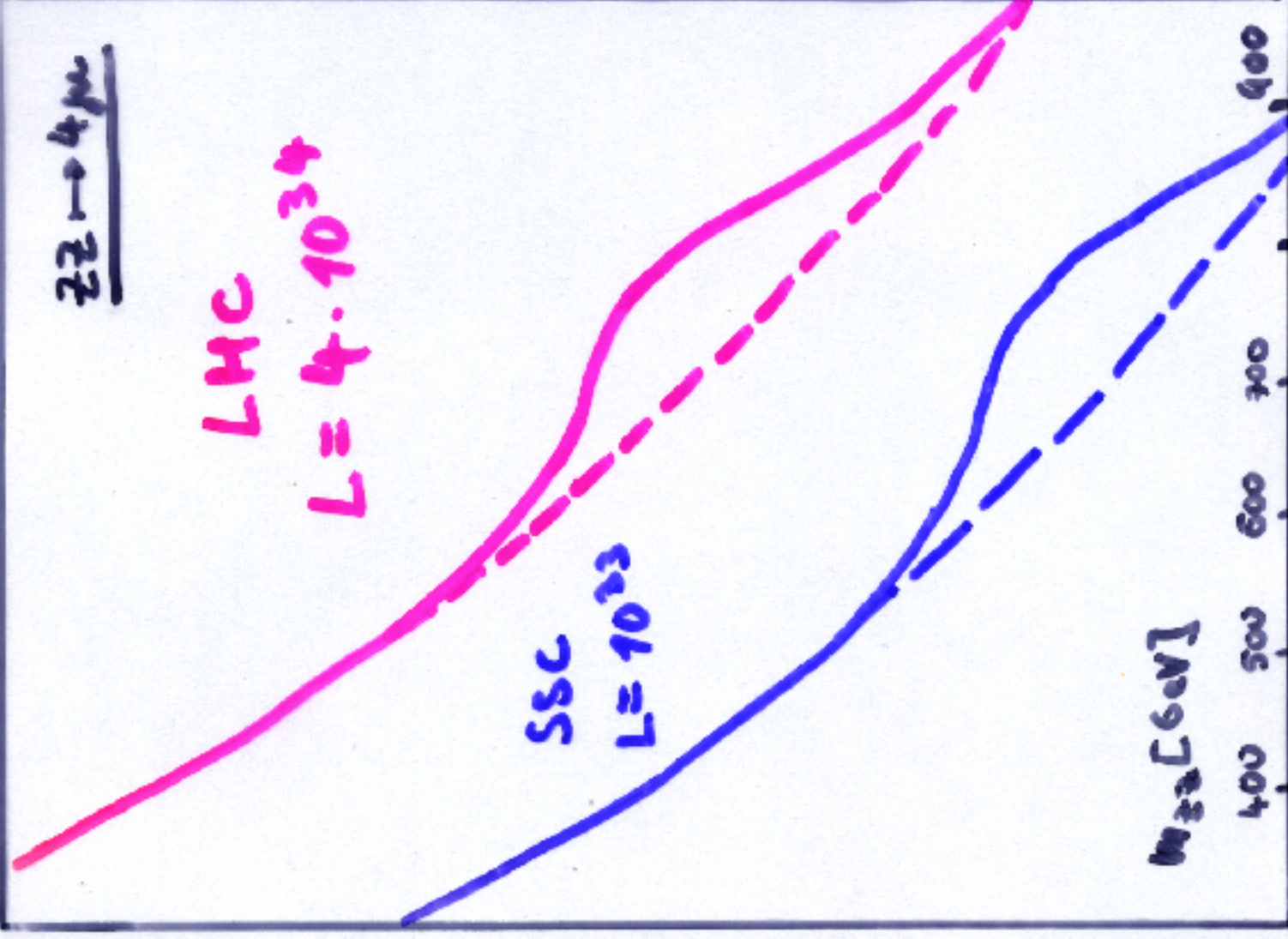
$$L = 4 \cdot 10^{34}$$

SSC

$$L = 10^{33}$$

$M_H [GeV]$

400 500 600 700 800



88 → 22

$$M_H = 250 \text{ GeV}$$

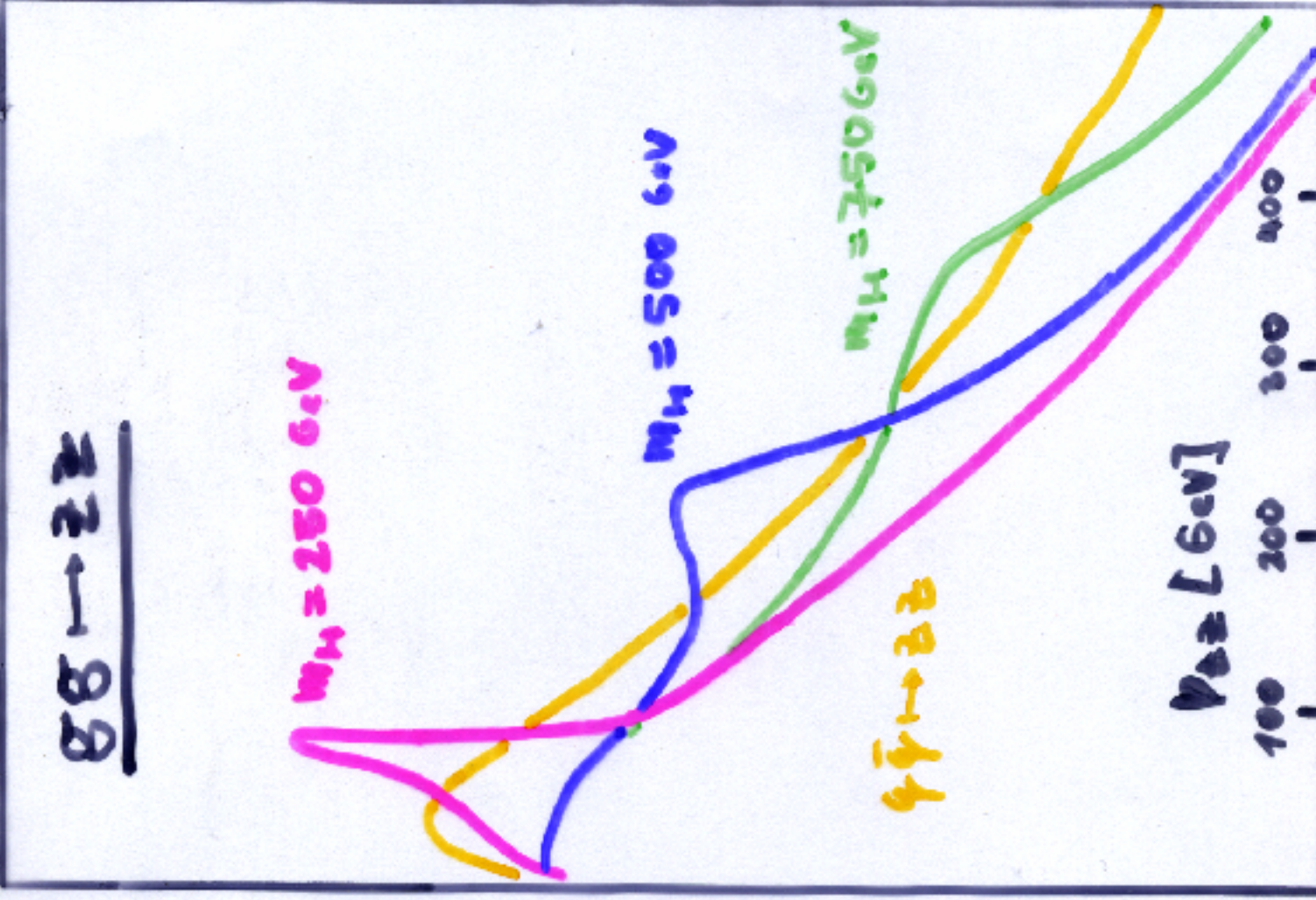
$$M_H = 500 \text{ GeV}$$

$$M_H = 750 \text{ GeV}$$

88 → 22

$M_H [GeV]$

100 200 300 400



LHC

circumference $\approx 2.7 \text{ km}$

revolution time $\approx 89 \mu\text{s}$

revolution freq. $\approx 11 \text{ kHz}$

max. beam energy
(for $B = 10 \text{ TeV}$) 8 TeV

acc. time 20 min

inter bunch spacing 15 ns

p/beam $4.84 \cdot 10^{14}$

p/bunch 10^{11}

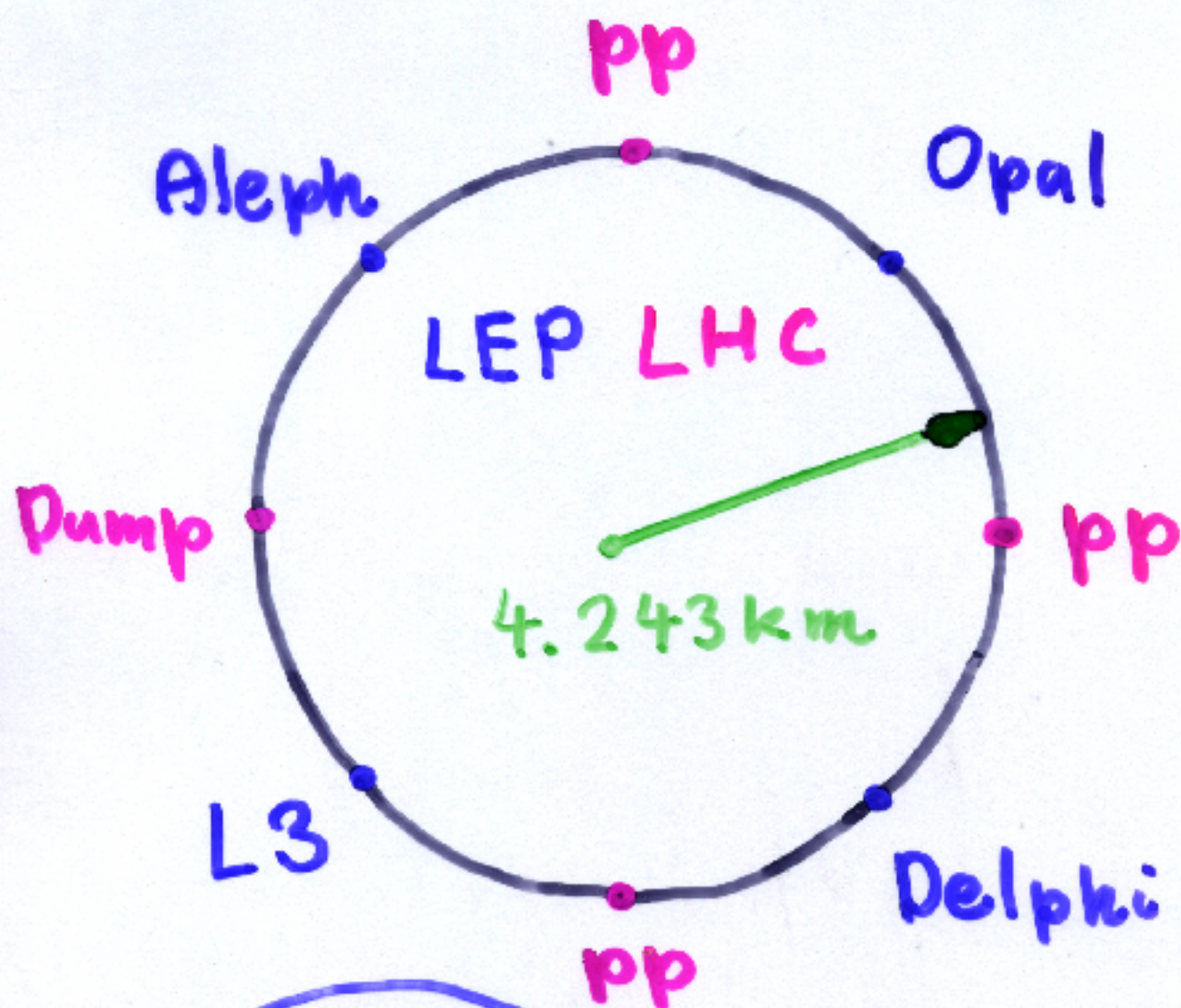
bunch/beam 4840

energy/beam 597 MJ

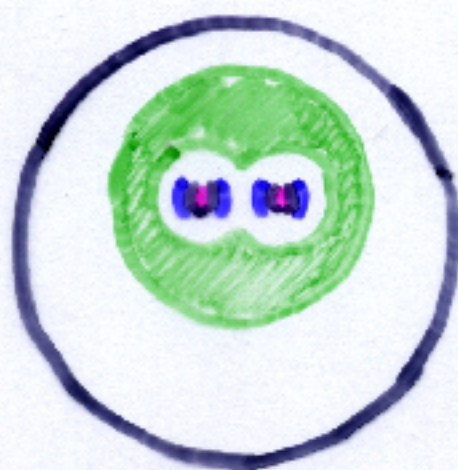
Energy $16, 1.7, 1312 \text{ TeV}$

Luminosity $5 \cdot 10^{34}, 2.5 \cdot 10^{32}, 10^{28} \text{ cm}^{-2} \text{ s}^{-1}$
(pp, ep, AA)

LHC



LHC



shield

iron yoke

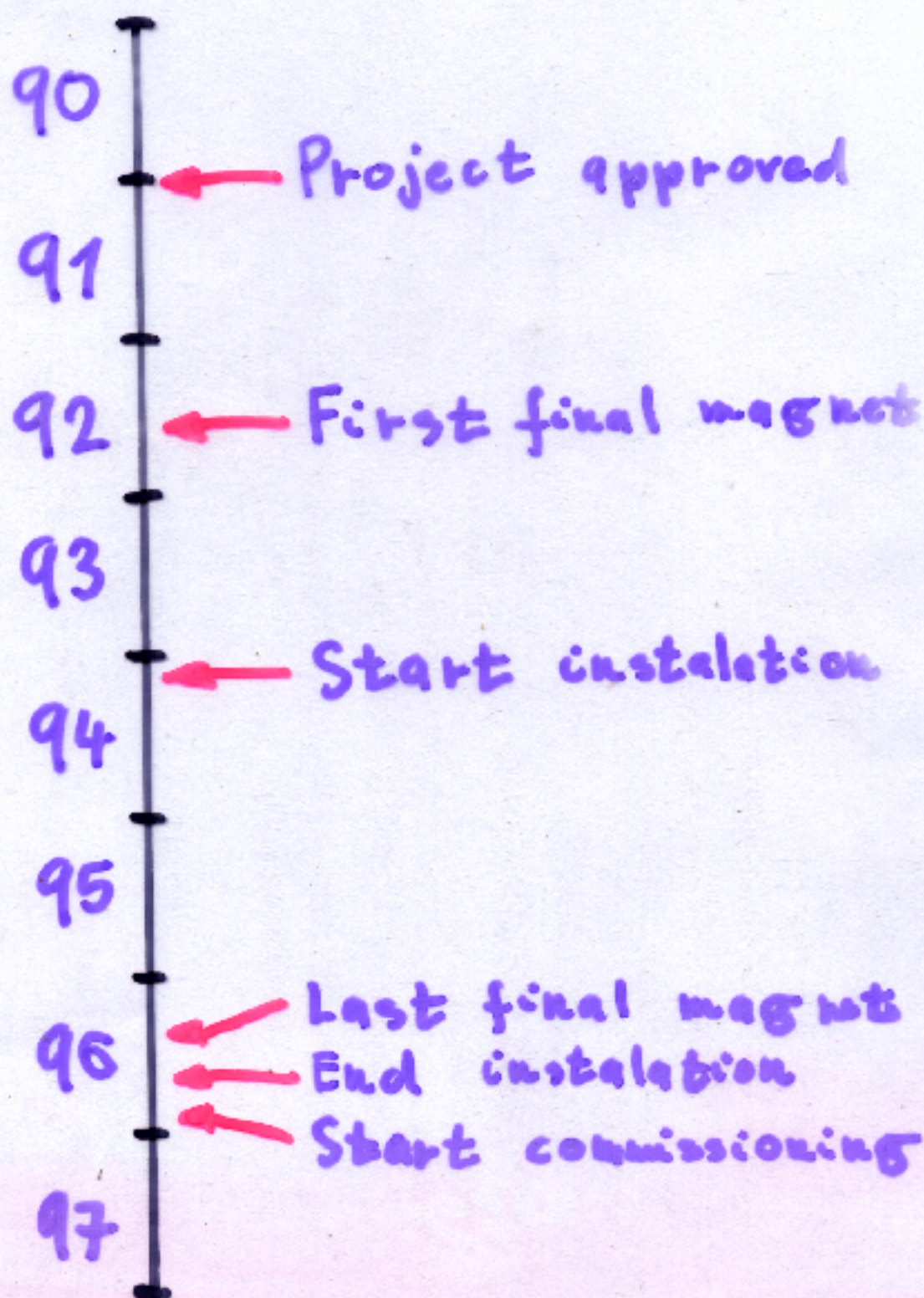
superconducting
coils

beams

magnets: NbTi at 2K (HeII)
or
Nb₃Sn at 4K (He)

exp. areas: a) two caverns
b) compact det.

Time Table



(80%) cost: $\approx 1.4 \cdot 10^9$ SFr

Working Groups

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31/5 ÷ 1/6 CERN

Workshops: 4 ÷ 9/9 Aachen