Physics Possibilities of a PS ν beam

Beam Properties and Layout

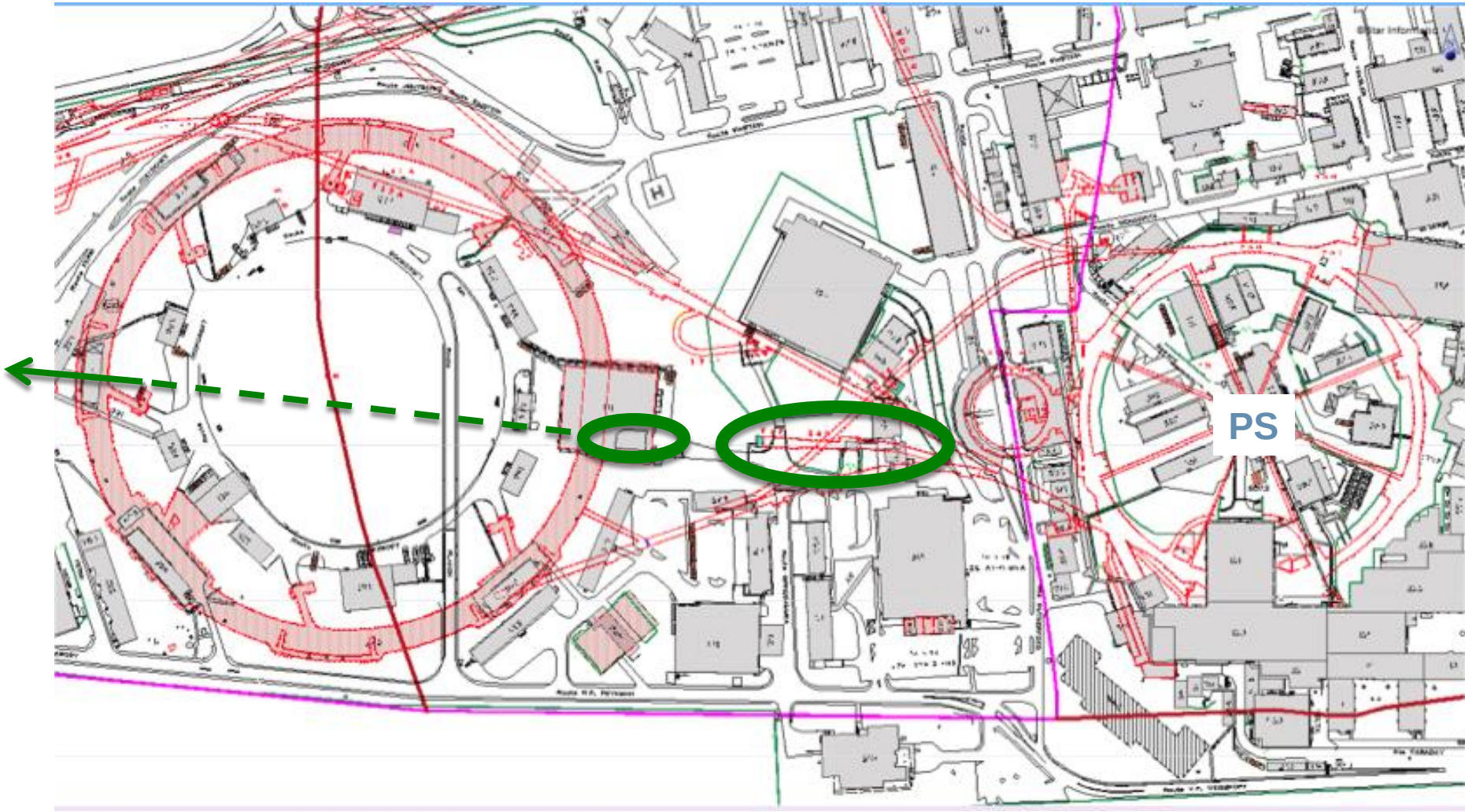
Outline

- The PS ν-beam – layout & beam parameters
- ν-R&D possibilities

R. Steerenberg, I. Efthymiopoulos – CERN

PS Neutrino Beam

2 Layout – old PS neutrino beam to BEBC



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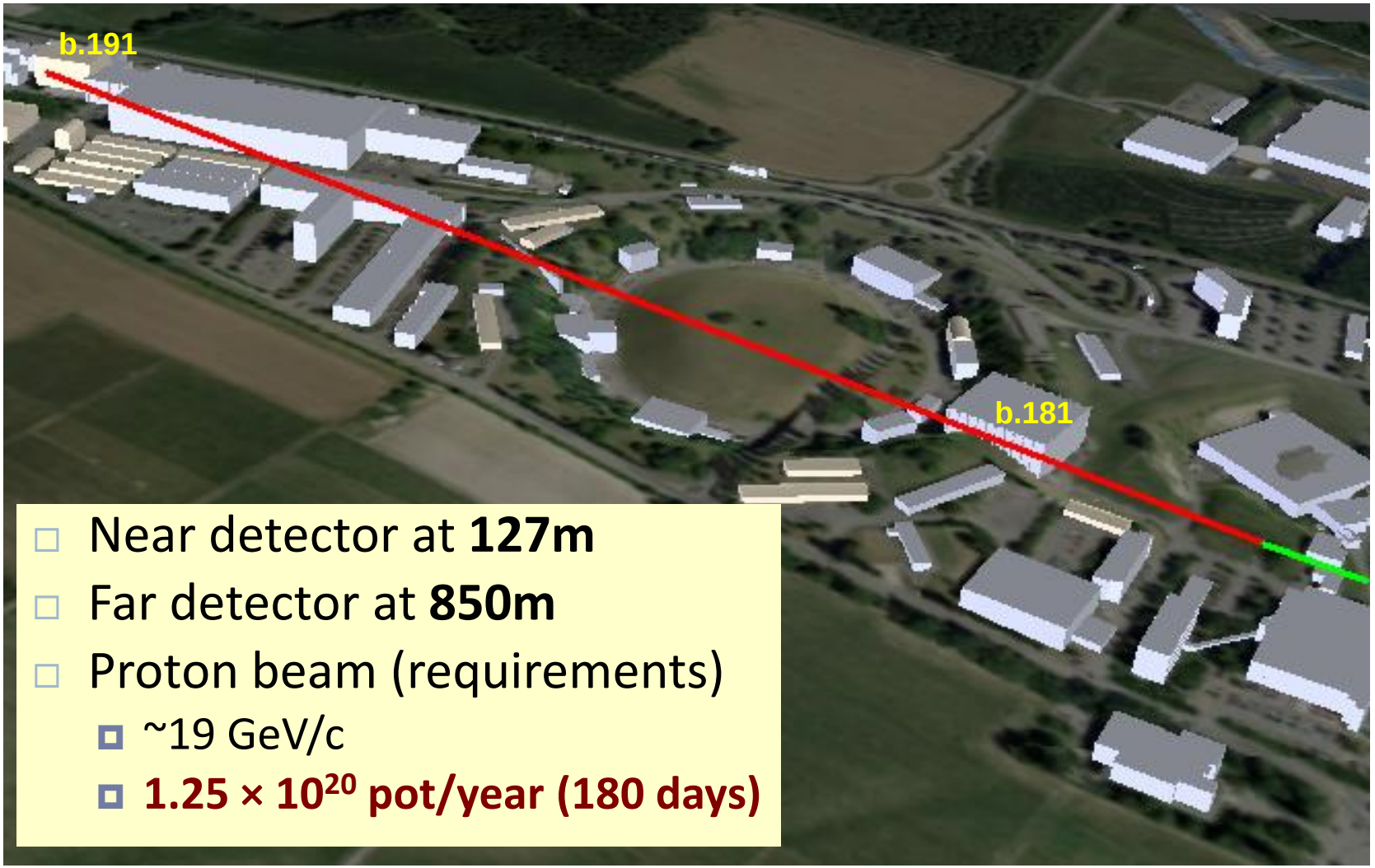
3 Layout – old PS neutrino beam to BEBC



- Near detector at **127m**
- Far detector at **850m**
- Proton beam (requirements)
  - ~19 GeV/c
  - **1.25×10^{20} pot/year (180 days)**

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Proton beam – how can we get the required intensity?

- Not at all trivial ! (a: intensity, b: radiation to PS)
- How to get the required intensity of 1.25×10^{20} pot/year ??

- Assume that the super cycles are similar to the present ones:
  - Daytime (10 hrs): 39 bp, 46.8 seconds (1xFT, 4xCNGS, 1xMD)
  - Night-time (14 hrs): 33 bp, 39.6 seconds (1xFT, 4xCNGS)
  - Possible intensity per cycle: 3×10^{13} protons, 180 days run
- To achieve the required intensity, one would need:
  - **10(12)** cycles of 1bp, or **25(36)%** of the day(night) super cycle

- Clearly not realistic in the present situation…

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Proton beam – possible scenario

- Assume the following:
  - Similar super cycles than at present
  - No EASTB (DIRAC/PS212)
  - Keep ISOLDE duty cycle unchanged
  - Anticipate request for increase of nTOF protons
  - 180 days of physics run per year
  - Machine availability is not taken into account
  - POPS operational

- This would give 7 cycles per super cycles, day and night to be shared between nTOF and TT7, resulting to **6.7×10^{19} pot/yr (53.4% of request)**

- Warning: the lines above require quite some modifications in the PS ring and extraction that need to be carefully studied
  - Double batch extraction, kicker pulsing, switching magnet, etc…

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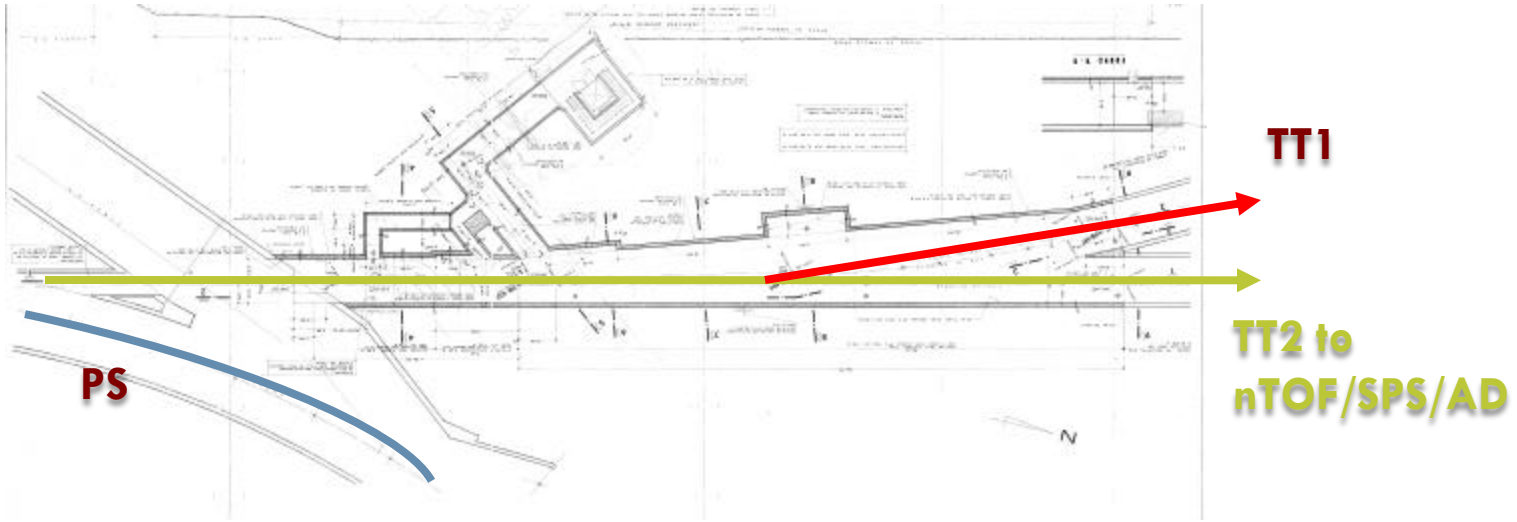
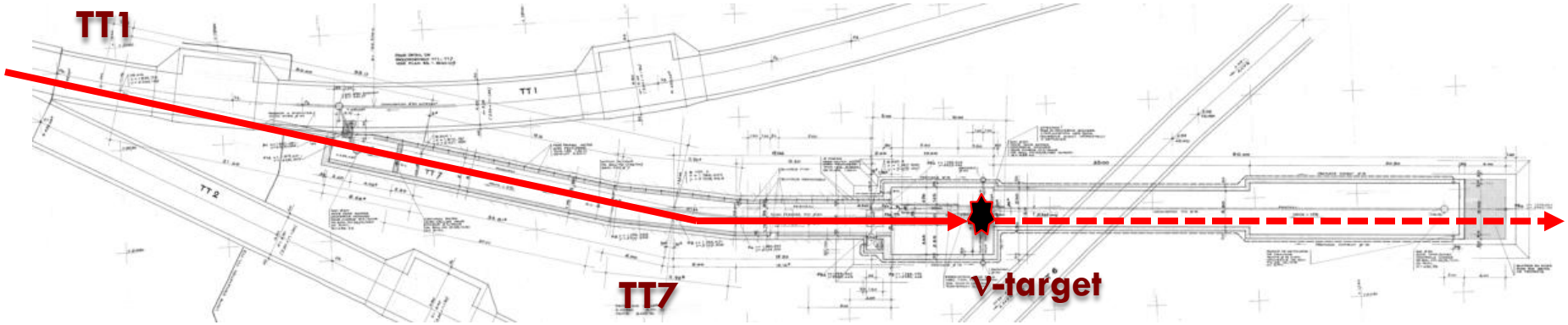
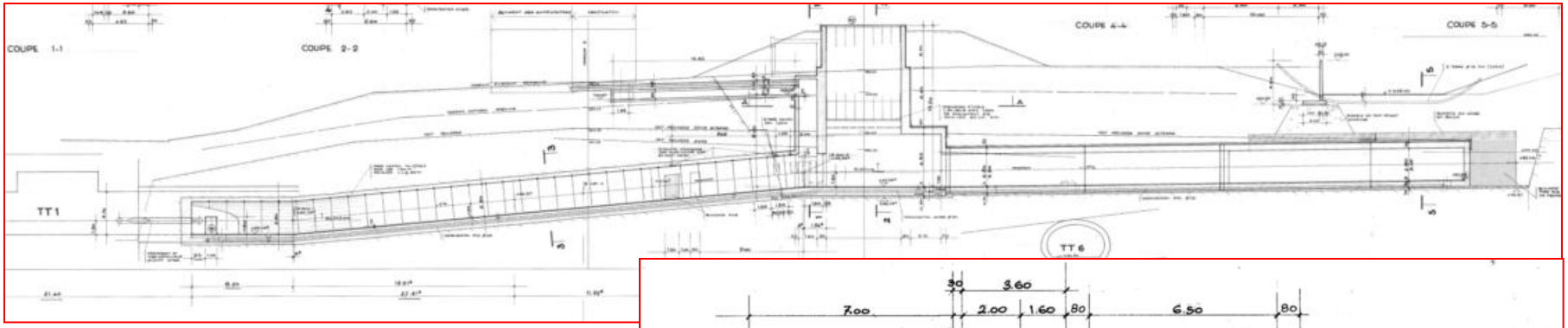
6 Infrastructure - tunnels

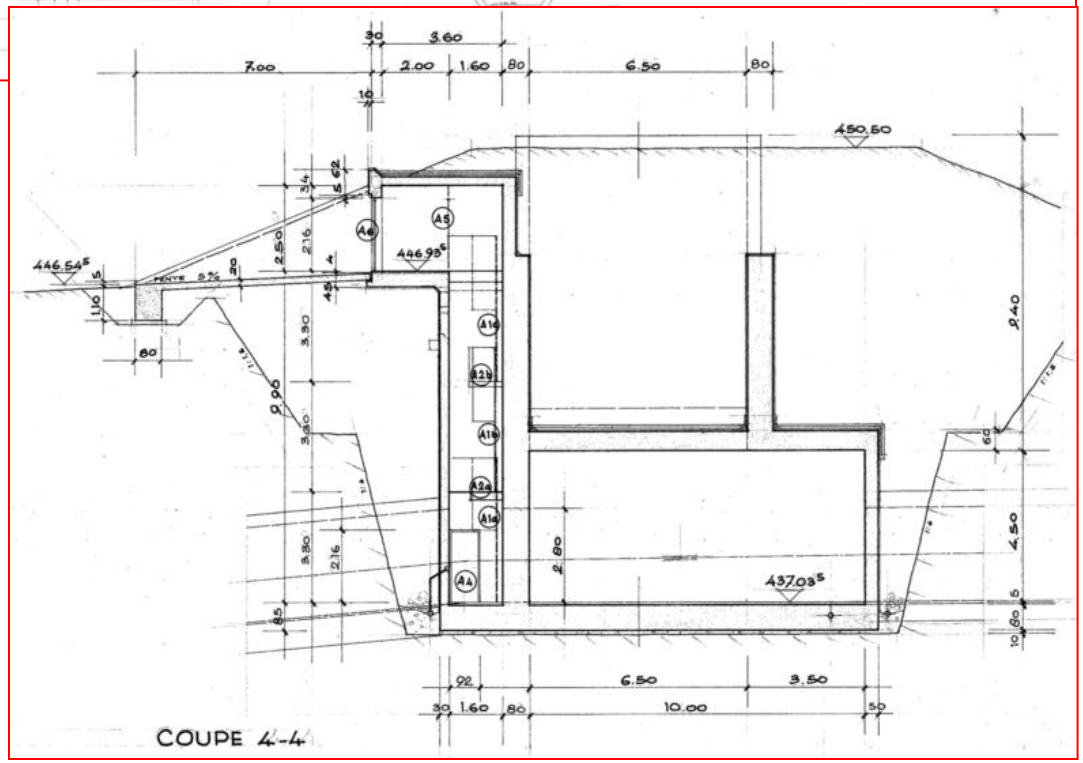




PS Neutrino Beam

Infrastructure - tunnels





- The TT1/TT7 tunnels are presently used as storage areas
- Some CE work is required to convert them back to beam tunnels and HI target areas
- Word of caution: safety requirements have changed since the 80's !!!

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Photo tour – beam tunnels

TT7

TT7 – entrance to target cavern

TT1

TT7 target cavern

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Building 181 – near detector area

CERN NEG Coating Plant

Courtesy of Jose-Miguel Jimenez

CERN LHC Magnet Repair Facility

Courtesy of Paolo Fessia

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Project status

- Feasibility study presented at the A&T sector meetings and workshops
- Presently in the pre-evaluation phase
  - **Rende Steerenberg** (proton beam), **Edda Gschwendtner** (secondary beam), Ilias Efthymiopoulos, et. al.
    - **~10kW** facility, profit from the “fresh” CNGS experience !
  - Collaboration with experimental team – beam simulation & performance
  - Should include the experimental areas (near & far detector) in a common project
- Aim for a better estaimate of work and resources needed to make the beam line, as input to discussions of the experimental proposal(s?) in the scientific committees and CERN management
- Follow CNGS project framework, collaboration with other “neutrino beam builders” via NBI

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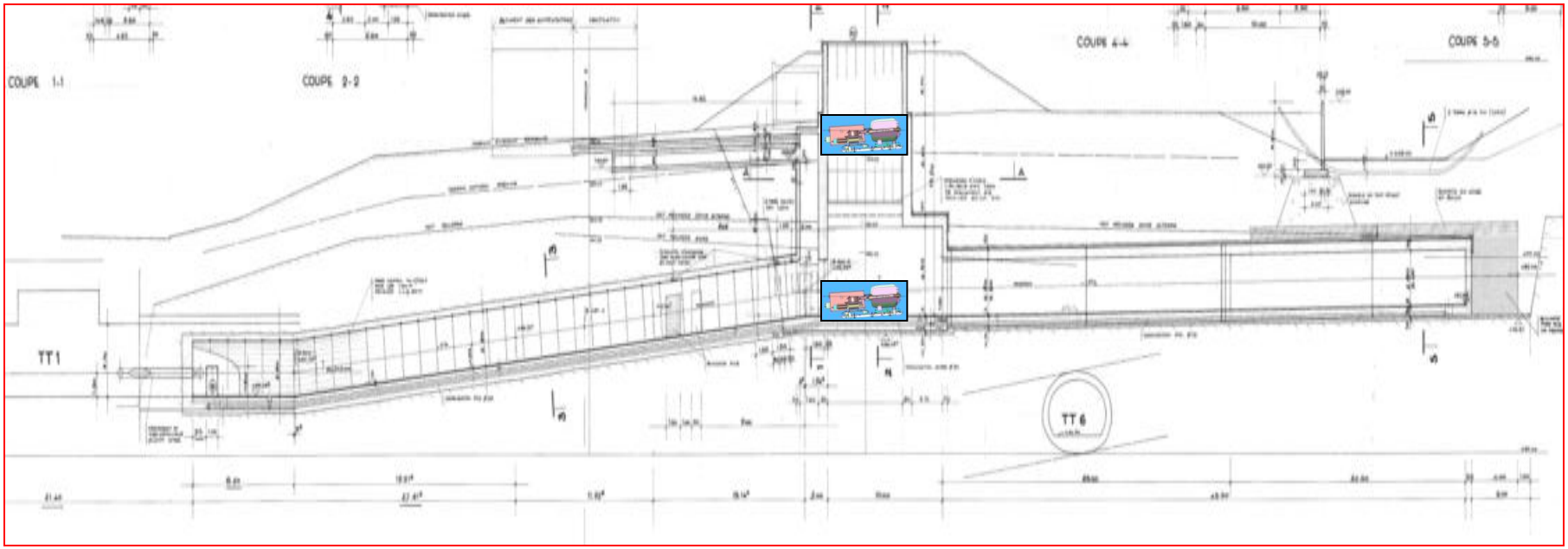
R&D test bed for neutrino beams

- Once the facility is made, besides the physics experiment (sterile neutrinos, x-sections, etc.)
- Could be the ideal place for targetry R&D for future high-power neutrino beams : **MERIT++ experiment**



PS Neutrino Beam

Conclusions

- Reviving the old PS neutrino beam it seems to receive increasing interest in the community, so it may actually happen!
- Preliminary estimates of beam intensity look reasonable and under certain assumptions **6.8×1019 pot/year** can be delivered
- We are presently in the pre-evaluation phase. At some point the project will find its way in the CERN management for approval
- Making the PS ν-beam would be a good short-term project to revive neutrino physics at CERN with several interesting physics and R&D spin-offs.
- At the same time it should not be an excuse to divert or reduce effort on our real goal towards the next generation neutrino experiments at Europe or with strong European participation in a global effort.