

ACCELERATOR SESSIONS SUMMARY

Outline

- ❑ Show highlights from the **13 talks** !
- ❑ ... and some comments from us and the discussions

Many thanks to all speakers (especially those from far away 😊)
...and the audience for the full attendance and discussions

DAVE WARK, ILIAS EFTHYMIPOULOS

EuroNu : 2008 – 2012 R&D program

2



Science & Technology
Facilities Council

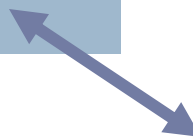


Strategy Group

“.....studies of the scientific case for future neutrino facilities and the R&D into associated technologies are required to be in a position to define the optimal neutrino programme based on the information available in around 2012; Council will play an active role in promoting a coordinated European participation in a global neutrino programme”

- **Crucial R&D for 2nd generation facilities (post T2K)**
 - **Include 3 main areas**
 - **CERN to Fermilab**
 - **Neutrino Facility**
 - **Beta-Beam**
 - **Performance**
 - **Present outcomes**
 - **Done in collaboration, not competition**
- *Flexibility to absorb new ideas?*
 - *Request for manpower increase 6÷10 FTE in 2009-2013*
 - *Difficult to address site-specific issues (eg. CERN) without local contribution*

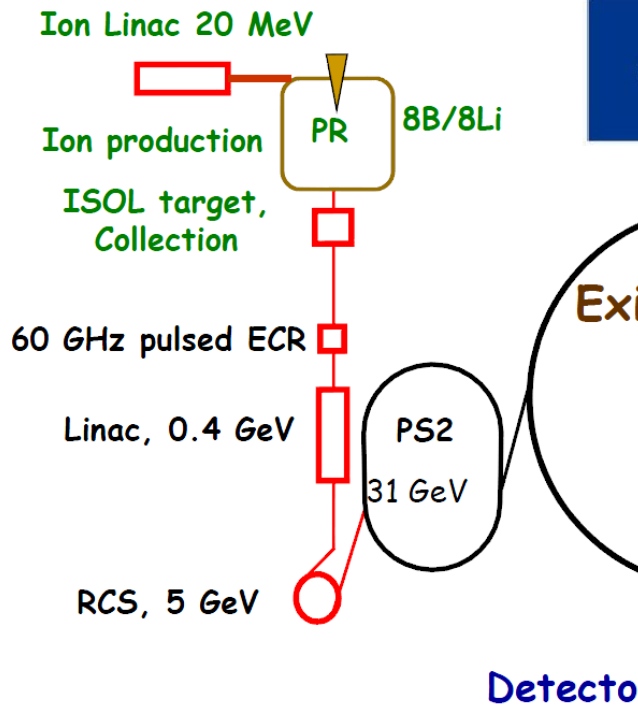
▪ IDS
▪ International
Advisory Panel
(IAP)



Beta beam design study

3

Beta Beam scenario : EURO- β BEAM



- Baseline design for He6/Ne18 studied within EURISOL DS
 - seems feasible (-Ne18 production)
- New production method for Li8/B8 under evaluation
 - major R&D is needed
- Compatibility check with PS2 an urgent issue
- Need to work with experiments to understand the required duty factor
- β Beam design uses existing accelerators (eg. PS2, SPS) to reduce cost, is this the optimal?

02/10/09

European Strategy for F
Elena Wild

Baseline Ion production - β Beam

4



Overview

${}^6\text{He}$ $3e^{13}/\text{s}$ out of the target can be achieved:
simulations done : 1-2 GeV p, 40 MeV d
1-2 GeV 100-200 kW converter : in operation RAL
40 MeV d converter : under development SPIRAL 2, GANIL
isotope production with suitable thick target tested ISOLDE

${}^{18}\text{Ne}$ $2e^{13}/\text{s}$ out of target:
 ${}^3\text{He}$, 30 MeV, 200 mA on oxide target, but MW beam required
1-2 GeV p no
p, 70 MeV, 30 mA on Al_2O_3 target, but 100 kW solid target R&D

60 GHz ECRIS in bunched mode:
characterized for 18 and 28 G
Need to confirm 90 and 30%
Need to confirm gas load and

- *Important technology know-how at CERN that is presently discontinued*
- *System aspects and long-term operation of the ion sources to be addressed as well*

Production of Li8 – B8 ion sources

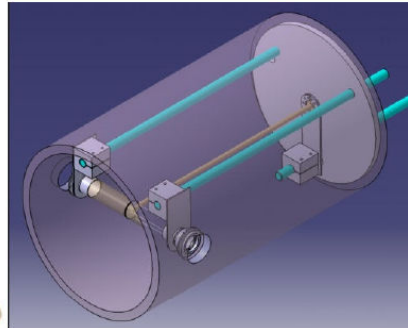
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CRC
Louvain-la-Neuve



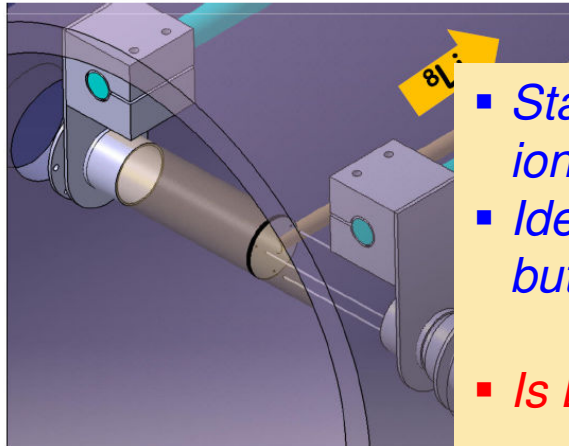
What we have today



Drawings are under construction
At the moment we use solid geometry
for the foils



The main goal is to **extract** Li8



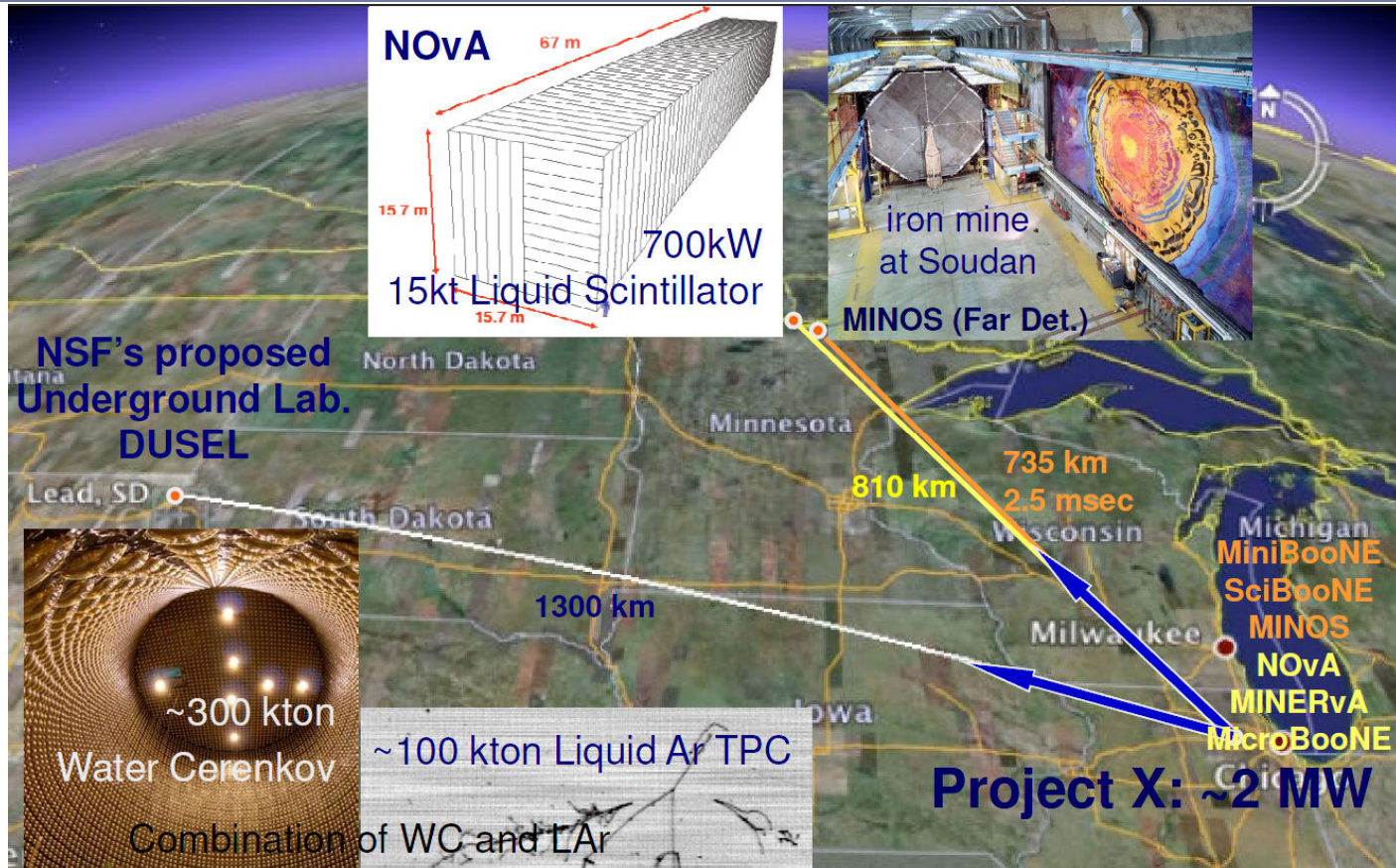
- *Started with Li8 - the less difficult of the two ions*
- *Ideas for B8 production slightly coming up, but remains challenging*
- *Is B8 a potential show stopper?*
 - *Request study including chemists*



CERN Neutrino Workshop, 1-3 October 2009

Plans for ν Physics in US - FermiLab

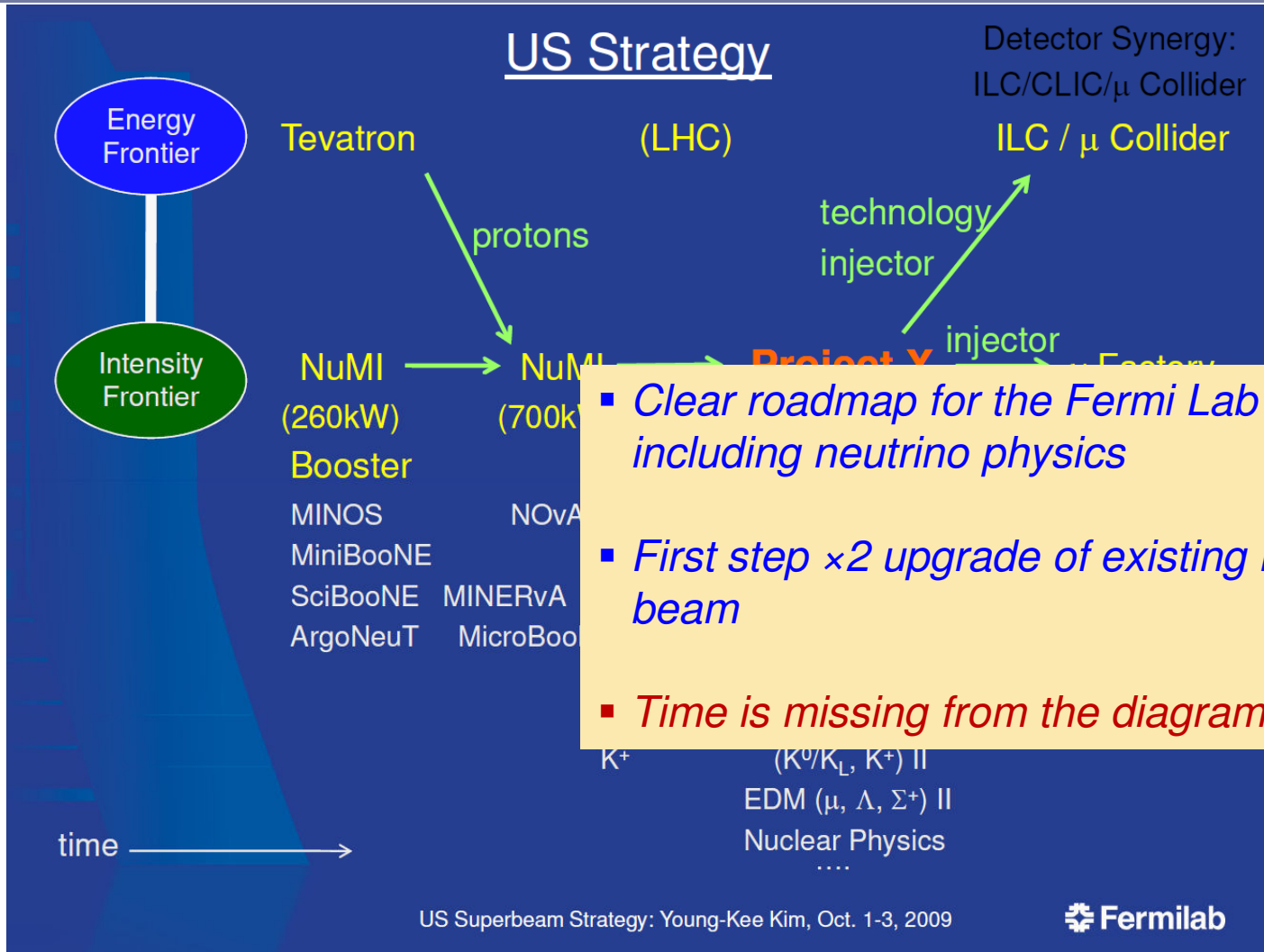
6



Matter – Antimatter Asymmetry with Neutrinos
Proton Decay
Supernovae Neutrinos

Plans for ν Physics in US - FermiLab

7



Plans for ν Physics in Japan

8

Summary Accelerator Based Neutrino Project in Japan

Short Term

- Beam commissioning of J-PARC MR has started May-2008
- Commissioning of J-PARC Neutrino Beam Facility has started in April-2009
- T2K is aiming for the first results in 2010 with $100\text{kw} \times 10^7\text{sec}$ integrated proton power on target to unveil below CHOOZ limit with ν_e appearance

Mid Term

- T2K data critical in physics
 - KEK Report
 - Submit proposal "J-PARC and commissioning" and commissioning
- *Clear roadmap including neutrino physics, with T2K beam starting next year*
 - *Built-in target station for MW operation – staged approach*
 - *Significant European contribution in the experiments*

Long Term

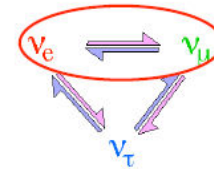
- Discoveries
- *Synergy in detector development and high-power beams/targets, collaboration already underway.*

ν Superbeams in Europe

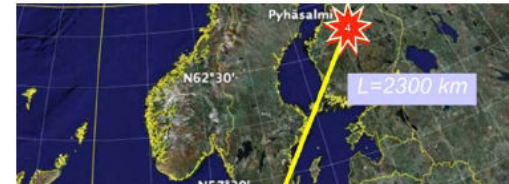
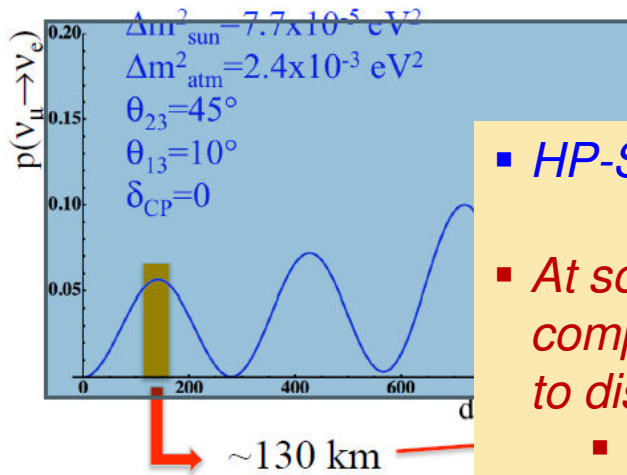
9

Neutrino Super Beam from SPL

SPL proton kinetic energy: ~ 4 GeV



Neutrino energy: ~ 300 MeV



- *HP-SPL is the key element for all scenarios*
- *At some point we should start looking at a complete physics program : beam + detectors to discuss performance and physics reach*
 - *Of course this may lead to plus 😊 and ☹*

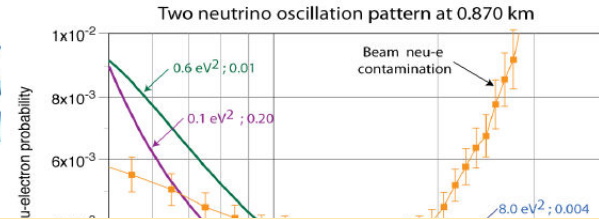
Gargamelle ν Physics with LArgon

10

New features of the CERN proposal

- It appears that the present proposal, unlike LNSD and MiniBooNE, can determine both the mass difference and the value of the mixing angle.
- Very different and characteristic oscillation patterns are possible on the values in the $(\Delta m^2, \theta)$ plane.
- The intrinsic ν -e background and beam contamination is also significantly reduced.
- The magnitude of the oscillatory behaviour, for which the parameters are completely unknown, and the experimental circumstances, well defined backgrounds, also considering the high statistical impact and resolution of the measurement.

C. Rubbia, CERN, Oct09



- *Interesting proposal to use existing machines (PS) and new technologies (LArgon TPC) to repeat an old beam concept for new physics*
- *Beyond the physics question this proposal can have some interesting derivatives:*
 - *neutrino/muon beam for R&D tests (cost?)*
 - *if properly designed possibility for targetry R&D*
 - *Bridge the gap until future mega-projects are approved – BUT should not lead to diversion of resources from the main goal!*
 - *Worth considering ???*

Muon production & capture in NF

11



Key MERIT Results

- Jet surface instabilities reduced by high-magnetic fields
- Hg jet disruption mitigation
 - 20 m/s operation
- 115kJ pulse containment
 - *MERIT was an important milestone experiment done at CERN with strong EU-US collaboration*
 - *The challenge in the targetry area for NF is the system design – focus/resources/expertise is needed*
- Hg ejection velocities
- Pion production remains below design beam impact
 - *CERN /Europe has expertise there is ongoing R&D in the area that could justify continuing as an approved/recognized RDxxx effort*
- 170kHz operations possible at design beam intensities



European Neutrino Physics Oct. 2-3, 2009

Harold G. Kirk

NF downstream systems

12



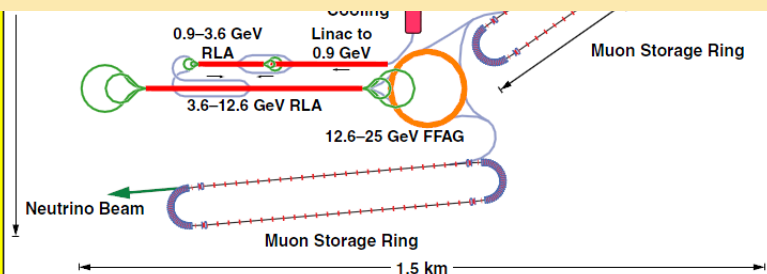
Neutrino Factory Ingredients



- Neutrino Factory comprises these sections

- Proton Driver
 - primary beam on production target
- Target, Capture, and Decay
 - create π ; decay into μ
- Bunching and Phase Rotation
 - reduce ΔE of bunch
- Cooling
 - reduce transverse emittance
 - ⇒ MICE
- Acceleration
 - 130 MeV \rightarrow 25 GeV with RLAs+FFAGs \Rightarrow EMMA
- Decay Ring
 - store for 500 turns; long straight sections

- MICE/EMMA important R&D experiments done in UK with strong EU-US collaboration
- CERN/EU expertise would be beneficial in the studies of several NF components where in the past made significant contributions

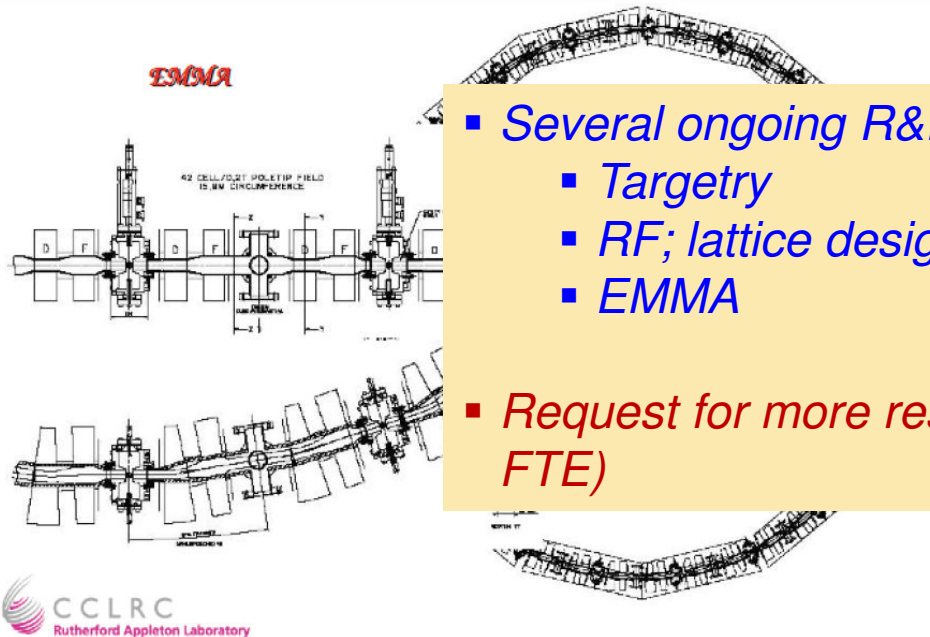
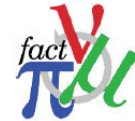


NF R&D in Europe

13



EMMA - first NS FFAG



- *Several ongoing R&D projects within EURONu*
 - *Targetry*
 - *RF; lattice designs, ...*
 - *EMMA*
- *Request for more resources (engineering 6-10 FTE)*

5. Displaced quadrupoles

J. Pozimski European Strategy for Future Neutrino Physics @ CERN 1-3 October 2009

Synergies...

14

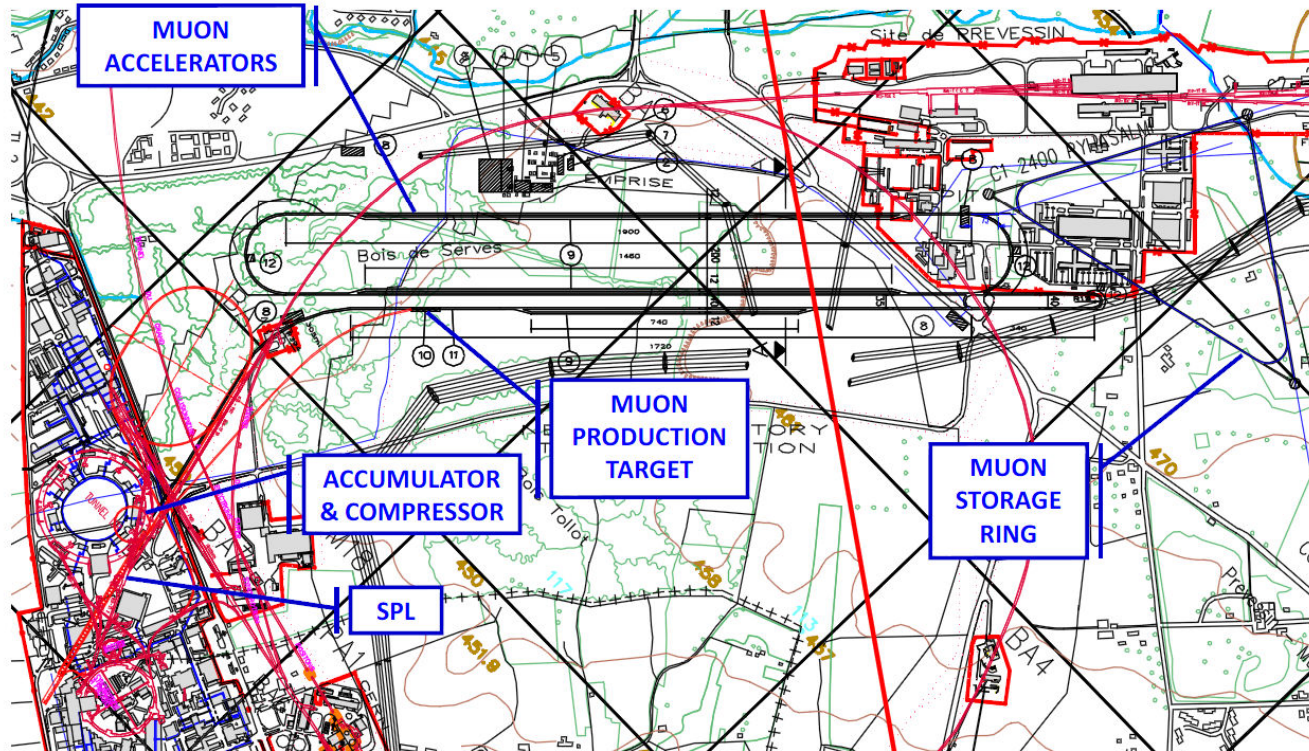


European Strategy for Future Neutrino Physics – October 2009

Neutrino Factory at CERN

“Proof of principle” [obsolete v Factory design]

Neutrinos with the “High power” SPL



R.G.

30

3/10/2009

Synergies...

15



European Strategy for Future Neutrino Physics – October 2009

Goal of the SPL study (2008-2012)

from Note on 31/03/2009 (EDMS Id 993472)

The goal of the SPL study is to submit to the CERN Council in mid-2012 a detailed Conceptual Design Report and a cost estimate.

Plans for future LHC injectors

For that purpose:

- cavities must be built and tested for a reliable assessment of the achievable gradient,
- a full size prototype cryomodule must be designed and assembled,
- the SM18 test place at CERN must be upgraded to allow for exercising multiple cavities in the prototype cryomodule at the nominal RF power,
- Civil Engineering and Integration must be studied, including safety and environment concerns.

Multiple partners are already collaborating or are planning to collaborate:

- Member states institutions [CEA, IN2P3, DESY, Rostock & Frankfurt Universities, STFC-DL, ASTEC-RHUL, Cockcroft Institute, Soltan Institute, ESS (Lund, Bilbao,...), ...] often with the support of the E.U., in the context of its FP7 programme (“sLHC” CNI-PP + “EuCARD” IA)
- Non-member states institutions [TRIUMF, Stony Brook/BNL, FNAL, SNS]

and more are in discussion (USA, China, India, Turkey, Hungary,...)

From NF to MC

16



Muon Collider Motivation - 2



- *Size isn't everything!*
- *MC requires major investments in accelerator R&D to face NEW and CHALLENGING questions to pay off for good physics!!*