

## Studies for Future Neutrino Beams in Europe

- The European scene
- CERN: LHC injector upgrade
- UKNF
- Design Study EUROv
- Infrastructure proposals, EUCARD, DEVDET

## The European scene

### High Energy Frontier:

- LHC about to turn on (first beams in June-July)
- Two linear collider projects ILC, CLIC
- Activity on muon collider is limited (RAL MC meeting 2008-01)
- sLHC includes upgrade of injectors
  - approved, opportunities for high intensity programme

### Neutrinos:

#### No European coordination on neutrinos for present program

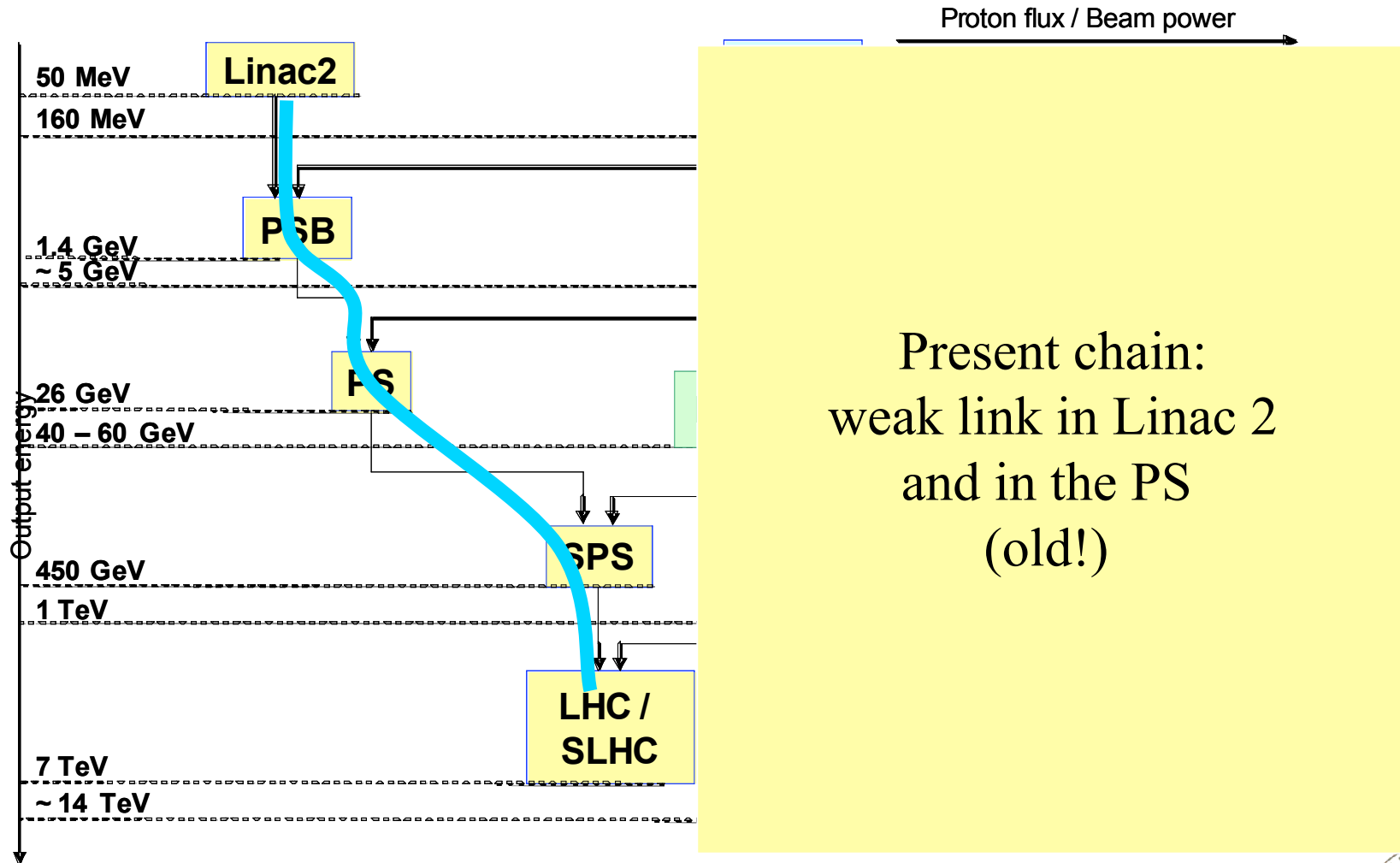
- CNGS program (future?)
- strong EU involvement in T2K, OvBB expts, D-CHOOZ

#### Future (some coordination, BENE)

- UKNF
- EU Design study program EUROv
- EU Infrastructure proposals, EUCARD, DEVDET



# Upgrade of the proton accelerator complex at CERN Protons Accelerators for the Future (PAF) WG

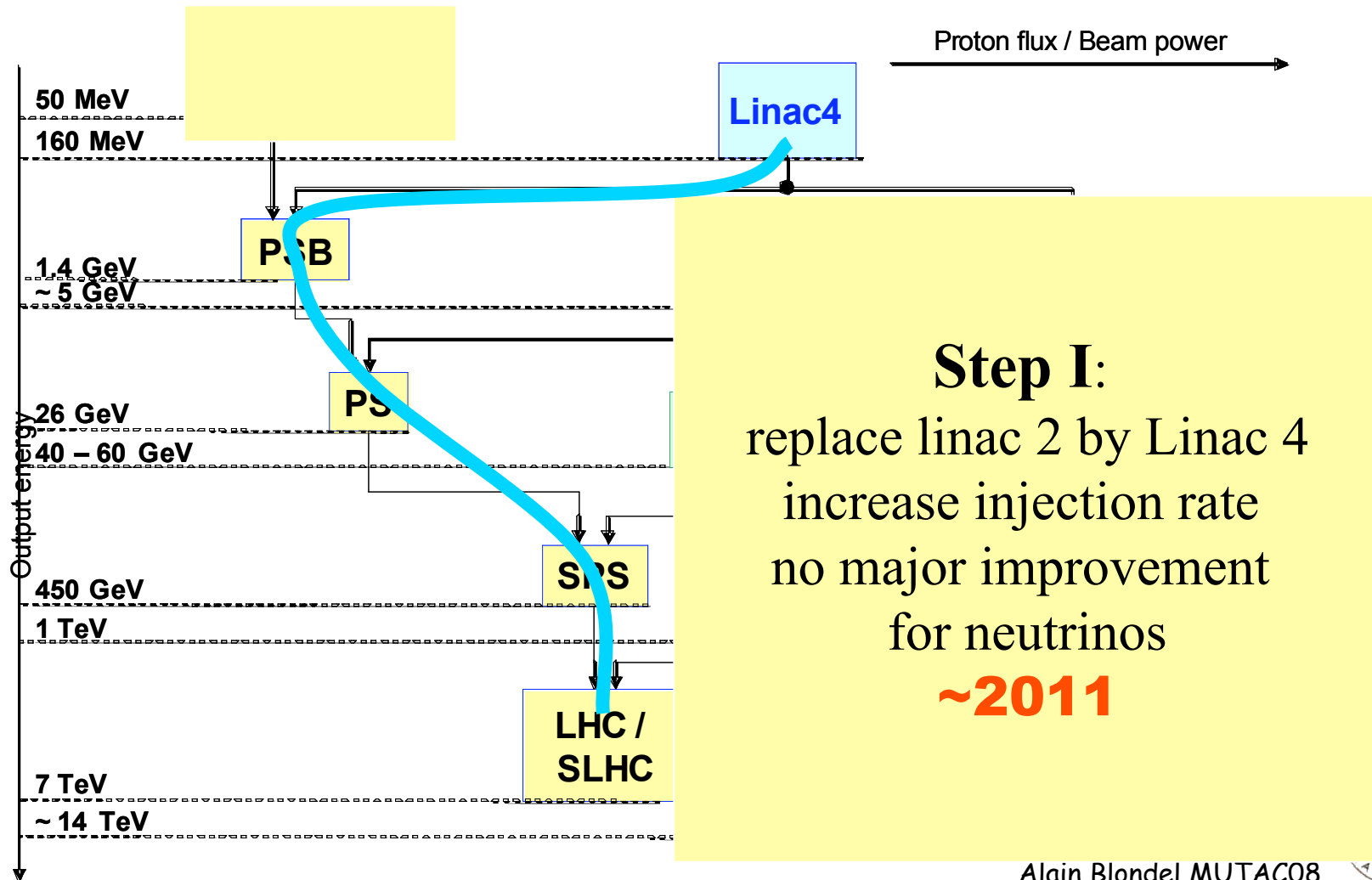


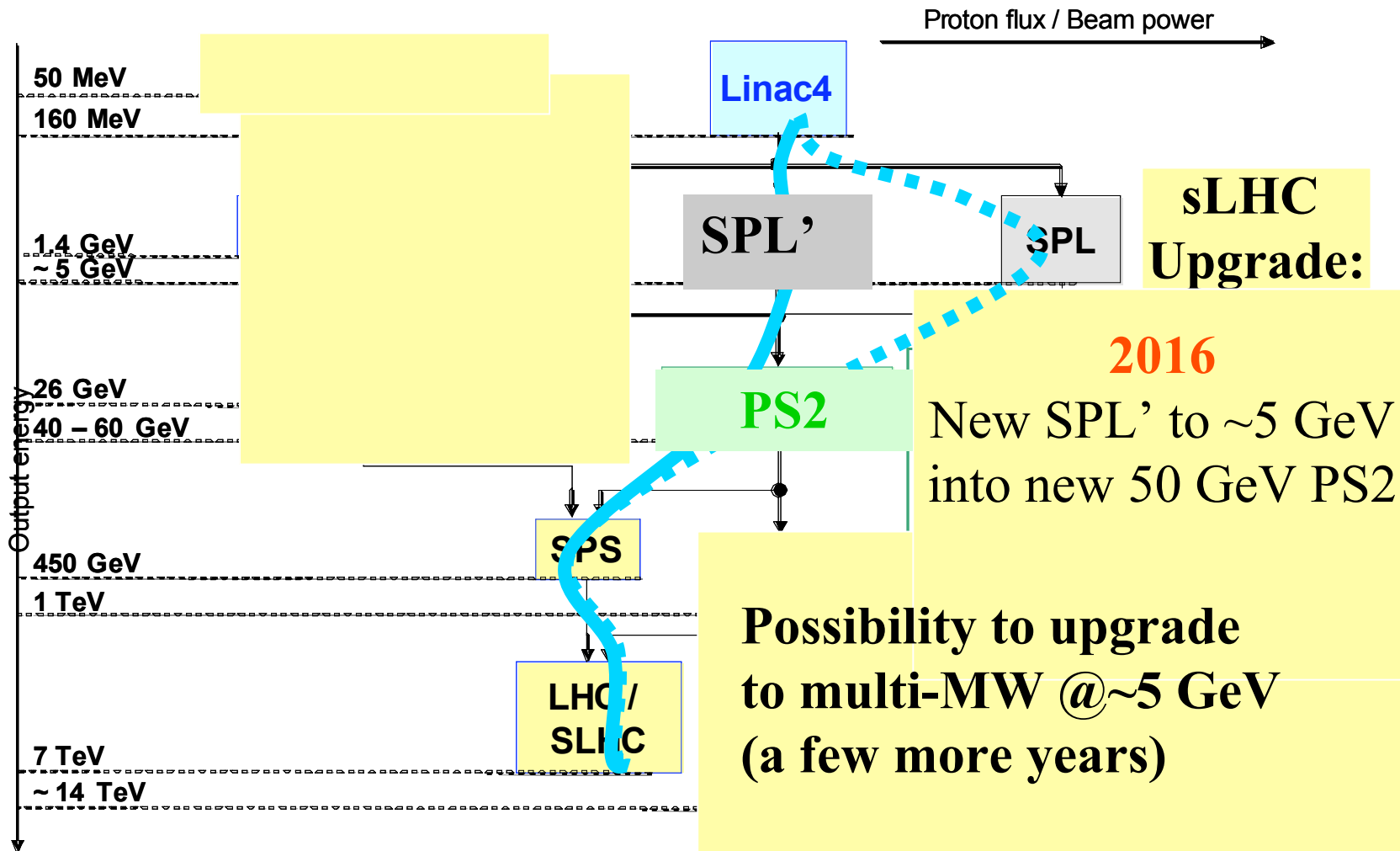
Present chain:  
weak link in Linac 2  
and in the PS  
(old!)

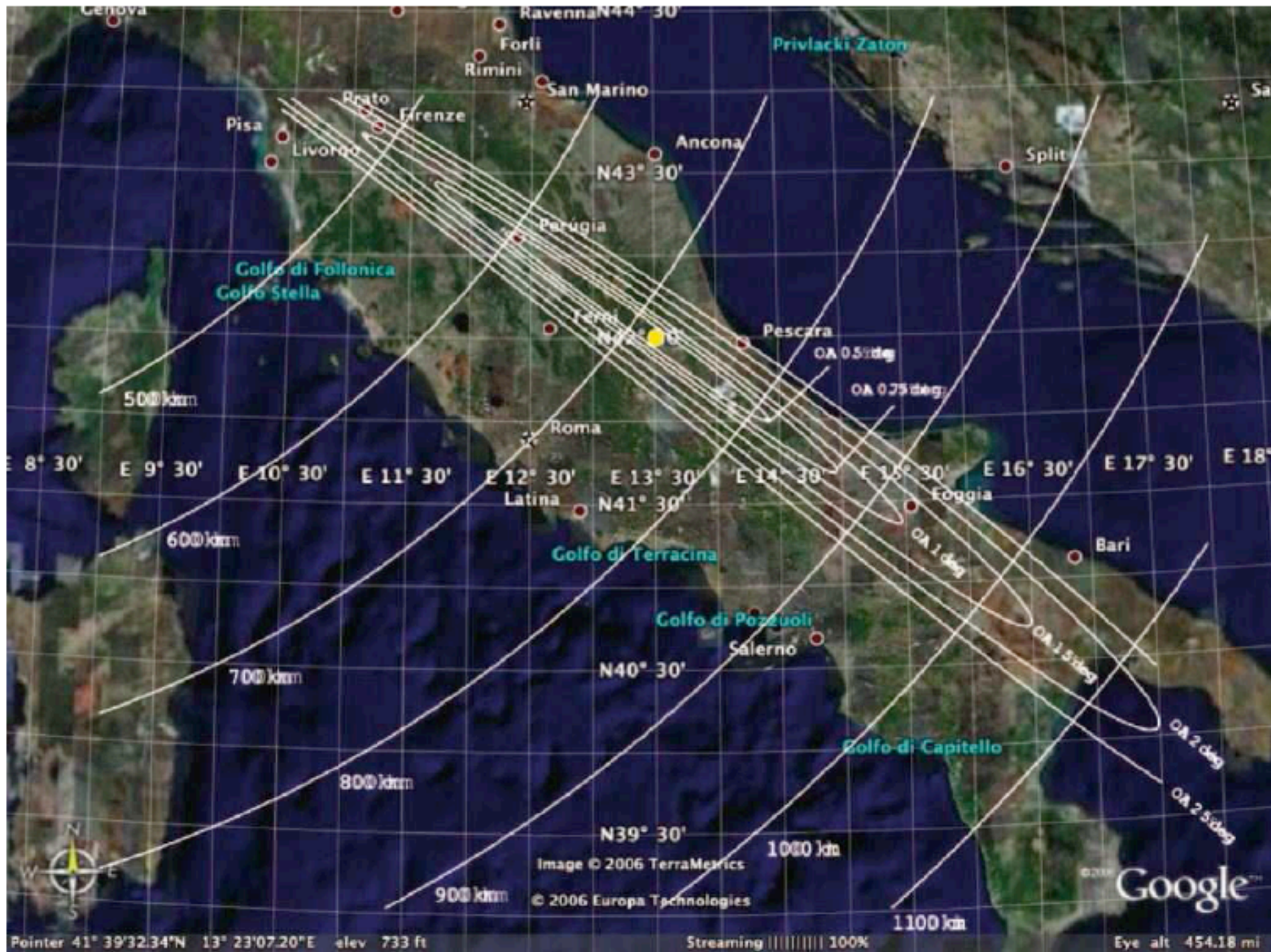


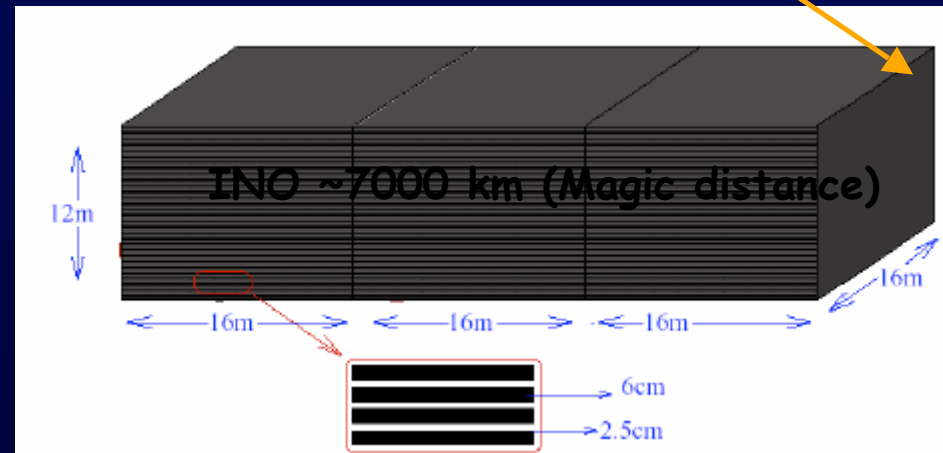
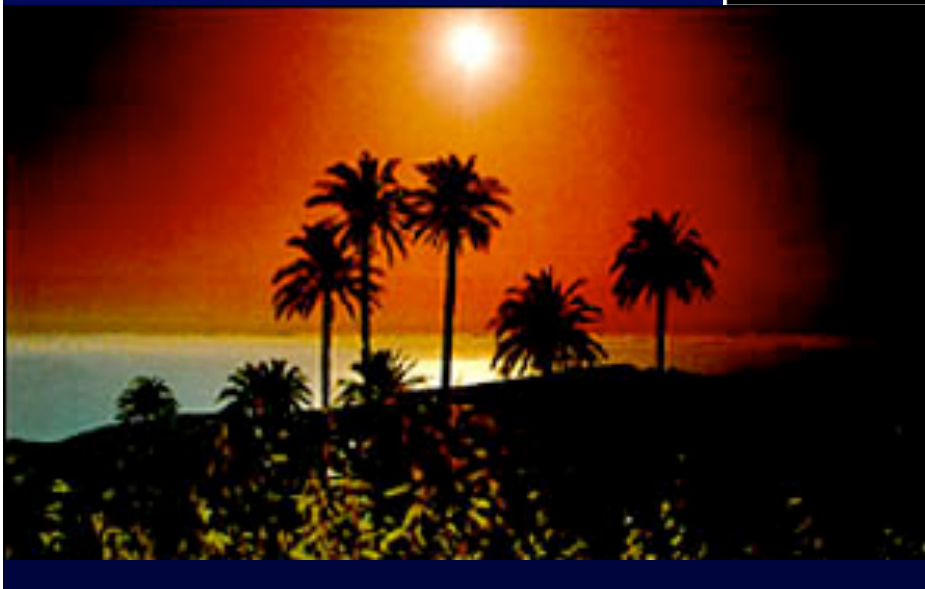
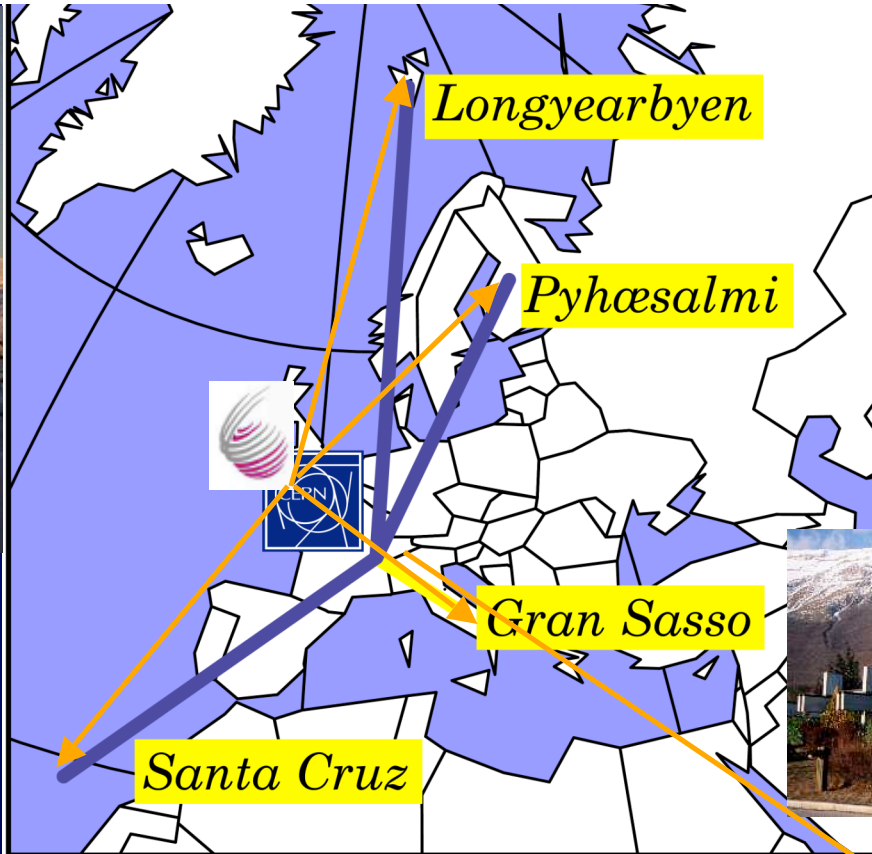


Priority is given to LHC and efforts should be made to incorporate the demands of the High intensity neutrino programme the cheapest way to LHC luminosity consolidation is to -- implement the LINAC 4 and replace the CERN PS







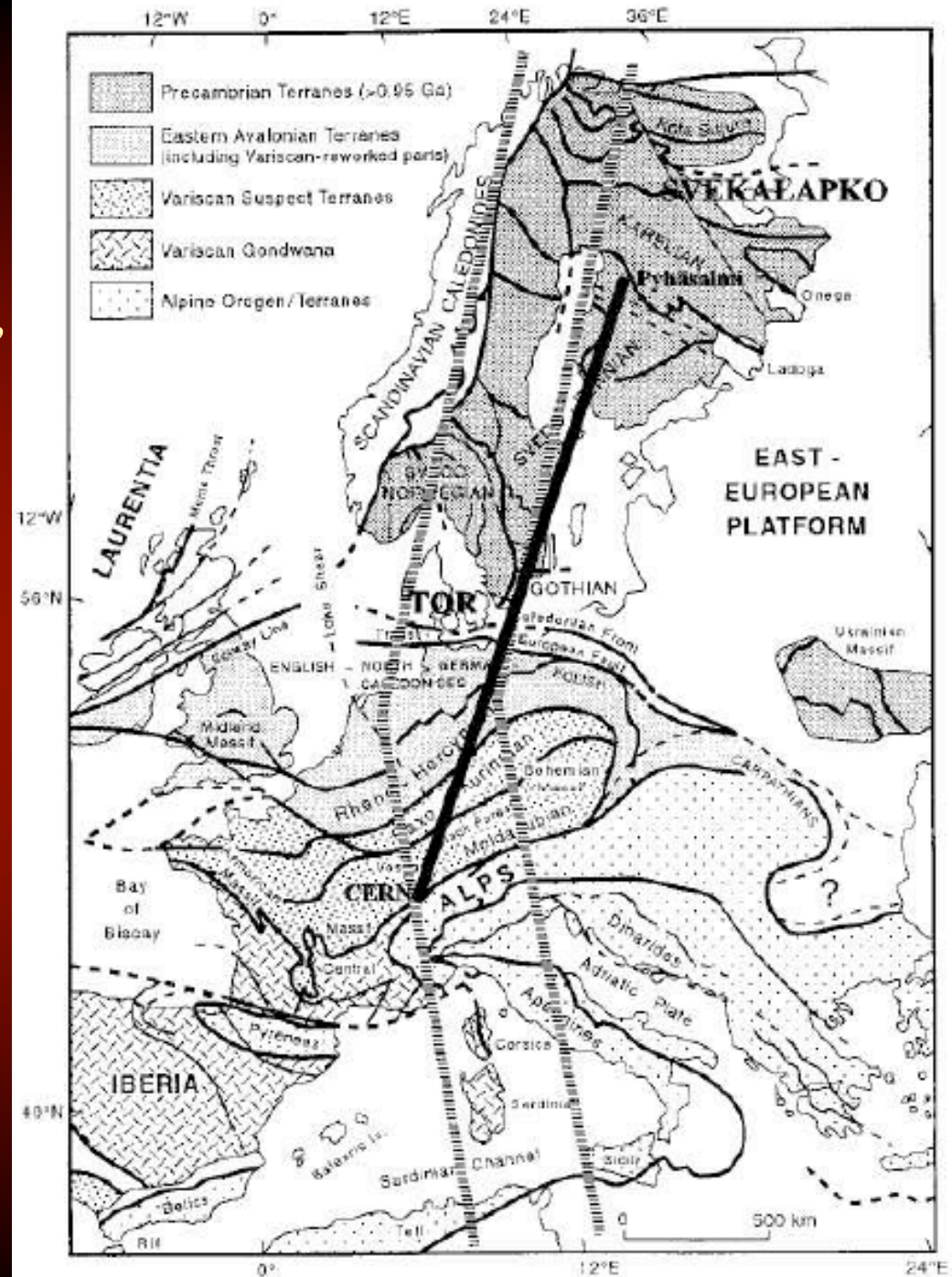


A study was made by

E. Kozlovskaya, J. Peltoniemi, J. Sarkamo,

*The density distribution in the Earth along the CERN-Pyhäsalmi baseline and its effect on neutrino oscillations. CUPP-07/2003*

→the uncertainties on matter effects are at the level of a few%





# UKNF: R&D program

## Conceptual design work:

- Conceived as UK contribution to IDS-NF

## Proton driver:

- Front End Test Stand:
  - Collaboration with CERN through HIPPI
  - Collaboration with University of the Basque Country
  - Contacts with FNAL HINS programme

## Targetry:

- Solid-target shock and design studies
- Powder-jet target investigation (synergy with T2K@4MW)
- Analysis for MERIT

## Manufacturing techniques for high-power RF cavities

- Contributing to MuCOOL button tests

# Front End Test Stand

## Status:

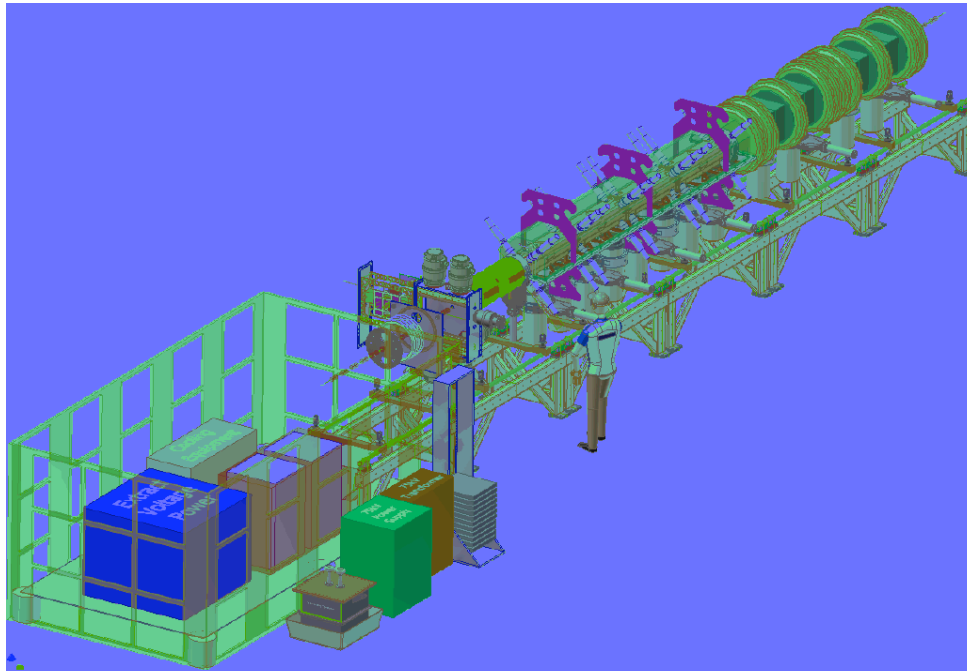
### Ion source:

- Performance demonstrated in test rig
- Installation in R8 started
- Expect to commission in summer 2008

### 324 MHz RF power:

- Klystron from Toshiba already in R8

Rail system for test stand installed in R8



## FETS main components:

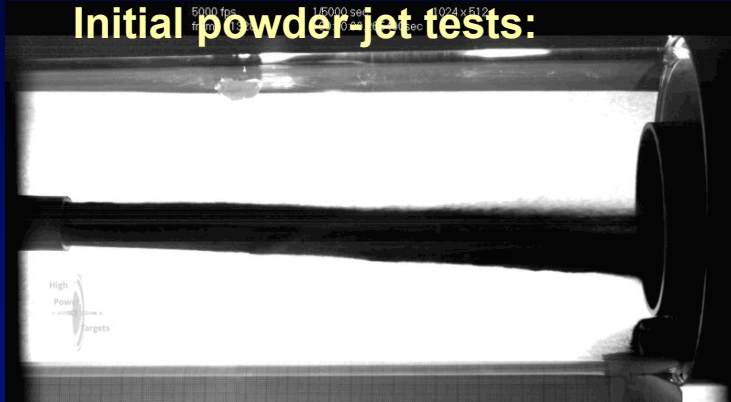
- High brightness H-ion source (RAL)
- Magnetic Low Energy Beam Transport (LEBT) (Warwick, U.Basque, Imperial)
- High current, high duty factor Radio Frequency Quadrupole (Imperial)
- Very high speed beam chopper (RAL)
- Comprehensive diagnostics (Imperial)



# Target studies.

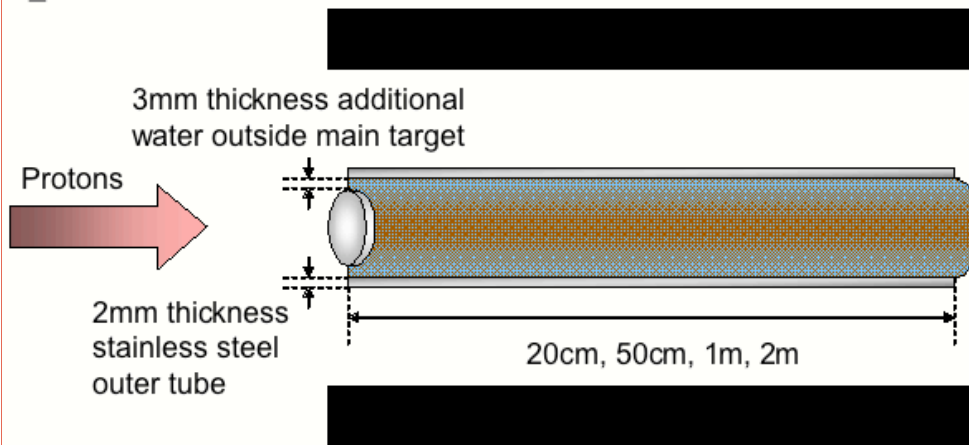
- Powder-jet test rig manufactured
- Goal: systematic study of:
  - Jet production
  - Erosion (reason for long return line)
  - Recycling

Initial powder-jet tests:

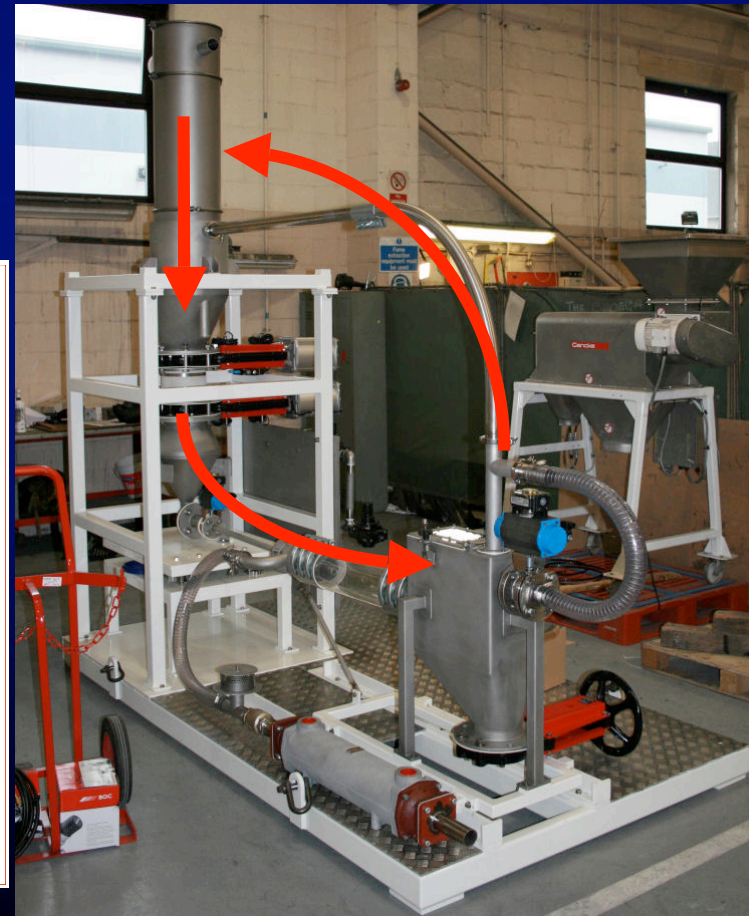


## Tantalum coin target

4\_4 = 16 runs



Tantalum "coin", 2mm thick ∅  100 coins in target for 20cm total Ta thickness



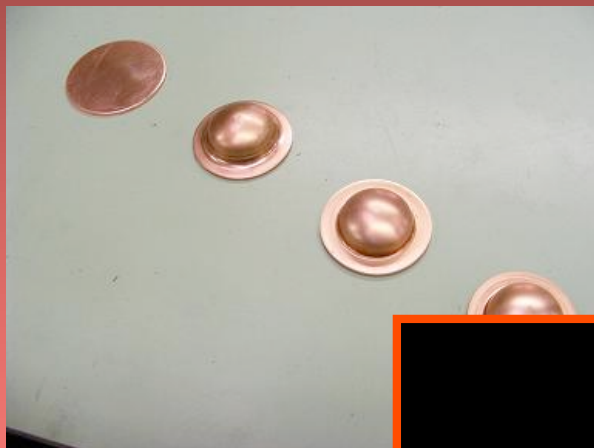
# Manufacturing techniques for RF cavities

Lancaster/Cockroft Inst  
collaboration with MuCOOL

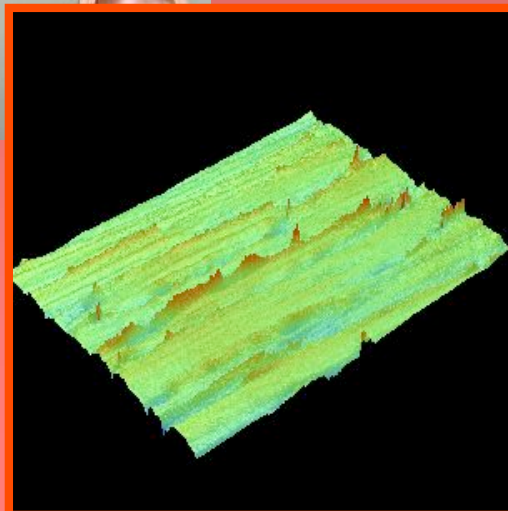
develop controlled manufacturing processes for the  
production of high-gradient RF cavities

surface properties: roughness, topology, purity, inclusions

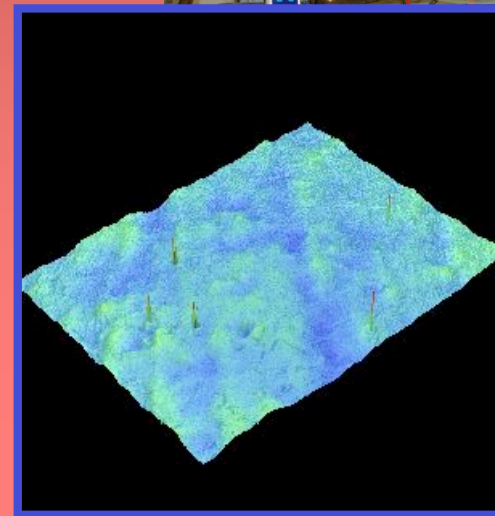
Fabricate a number of buttons for insertion in MuCOOL 805 MHz cavity  
using various manufacturing, surface treatment, monitoring



Before



After





## FP-7 European Neutrino Design Study (Euroν DS)

4 years (2008 -2011) - 4 M Euros from EU (EU best rated proposal!)

Proposal accepted

Delay in contract's signature. Possible new start date on 1<sup>st</sup> May 08? -> 1/05/2012

Coordinator: R. Edgecock (RAL), Deputies: M. Dracos (IN2P3), M. Lindroos (CERN)

- WP on Beta beam (E. Wildner -CERN)

- WP on Neutrino Factory (J. Pozimski, Imperial College,U.K-Deputy: M.Meddahi-CERN)

- 4 other WPs: Super Beams, Detectors, Physics, Management

Goal: Comparison between the 3 facilities (SB, BB, NF) based on their physics reach and cost, taking into account the knowledge of the neutrino oscillation parameters available at that time. Determination of the criteria to be used.



## FP-7 European Neutrino Design Study (Euroν DS)

Work package No	Work package title	Type of activity	Lead participant No	Person-months	Start month	End month
1	Management and Knowledge Dissemination	MGT	1	92	1	48
2	Super-Beam	RTD	2	333	1	48
3	Neutrino Factory	RTD	5	282	1	48
4	Beta Beam	RTD	3	295	1	48
5	Detector Performance	RTD	4	178	1	48
6	Physics Reach	RTD	6	206	1	48
	TOTAL			1386		



## EUROv -- Neutrino Factory Work Package

Overall deliverable: Recommendation of the reference NF design and Performance and cost evaluation of the Facility. End to end simulation.

Participants: Imperial (84 p-m), STFC (78 p-m), CERN (84 p-m), CNRS (7 p.m), Oxford University (6 p-m), Warwick University (28 p-m)

CERN participation to the NF WP:

Co-management of the WP (elaboration of the proposal-budget planning-milestones-deliverables-labs commitments...)

Muon front end studies: review, proposal of reference scheme, performance evaluation of reference scheme and costing

Particle production and collimation (target and solenoid)

Muon acceleration : review, proposal of reference scheme and costing

CERN team formed (1 Fellow, 3 part-time CERN staff (20%), 1 part-time CERN-JP Fellow)





## FP-7 Integrating activity: EuCARD European Coordination for Accelerator Research and Development

Proposal sent 29 Feb. 08.

Neutrino Network: NEU2012 (300 kEuros from EU)

Coordinator: V. Palladino (INFN). CERN actively participates to the network proposal preparation.

Goal: link the neutrino community, Ensure dissemination of information. By 2012, propose a roadmap to the next accelerator neutrino facility, in agreement with Physics need.

**Task1:** Coordination and communication. CERN involved with full time Fellow, shared with Task2 and Task3

**Task 2:** Getting the most out of existing neutrino facilities. scrutinise the performance of operating neutrino facilities. CERN involved with CNGS

**Task3:** Road map to the next accelerator facility: synthesise the EU and worldwide Research performed on possible future new facilities while surveying the coherence with the physics needs. Conclude with a recommendation for the choice of a next generation facility, taking into account the technological risks and synergies with other Programmes.

Also includes a Transnational access for MICE (300k€)



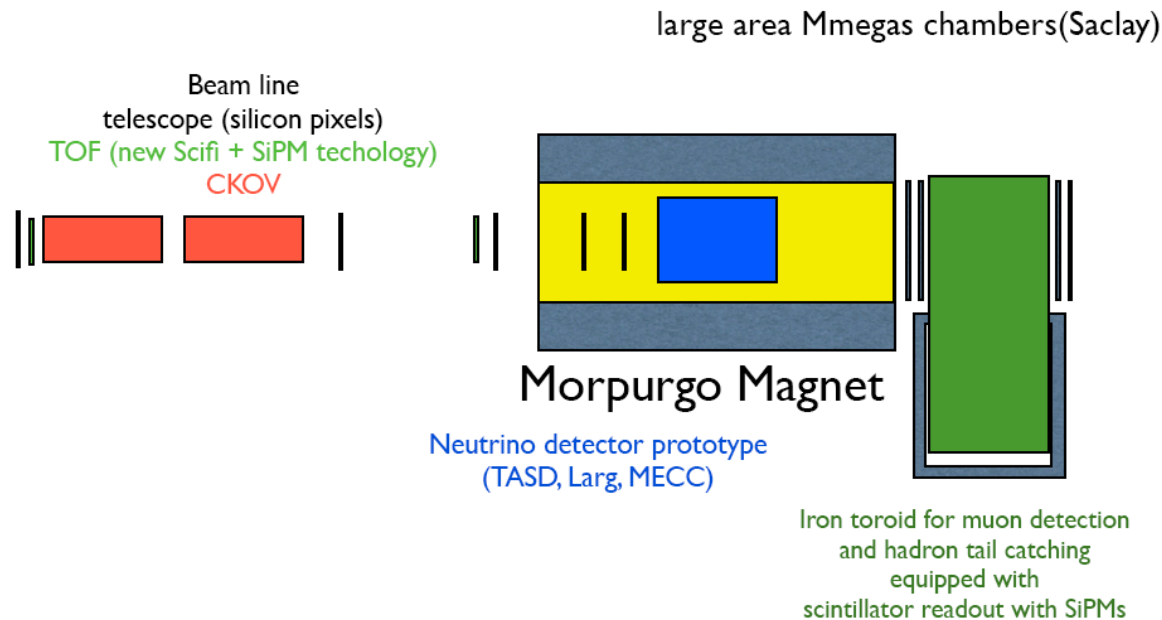


## FP-7 Integrating activity: DEvDET Development of Detectors

Proposal sent 29 Feb. 08. For 11 M€ (about 1M€ for neutrinos)

### Aims for neutrino community:

- Answer key experimental questions on detectors for future neutrino beams
  - ex: . charge confusion for low energy muons in iron-scintillator sandwich.
  - . properties of stopping pions and muons in Liquid Argon and Water
  - . Integration of emulsions/Larg/TASD with magnetized iron spectrometer (Hybrid detector)
- Organize community to decide in 2012 on detectors.



### Neutrino Activities:

- Software (M. Ellis)
- Electronics (A. Weber)
- Test beam (A. Blondel)
- Networking (A. Cervera)

# Conclusions

- 1. Neutrino physics is recognized as an important part of the future of HEPP in Europe**
- 2. R&D on accelerator and detector technologies declared important by European Strategy Document to prepare 2012**
- 3. This has played a favorable role for approval of EUROv**
- 4. Some opportunity has been prepared with LHC injector upgrade at CERN, (SPL) this defines the time scale as post-2016.**
- 5. Other occasions to coordinate/fund will be found in EUCARD and DEvDET -- if approved.**
- 6. World wide coordination is seen as necessary and beneficial!**

