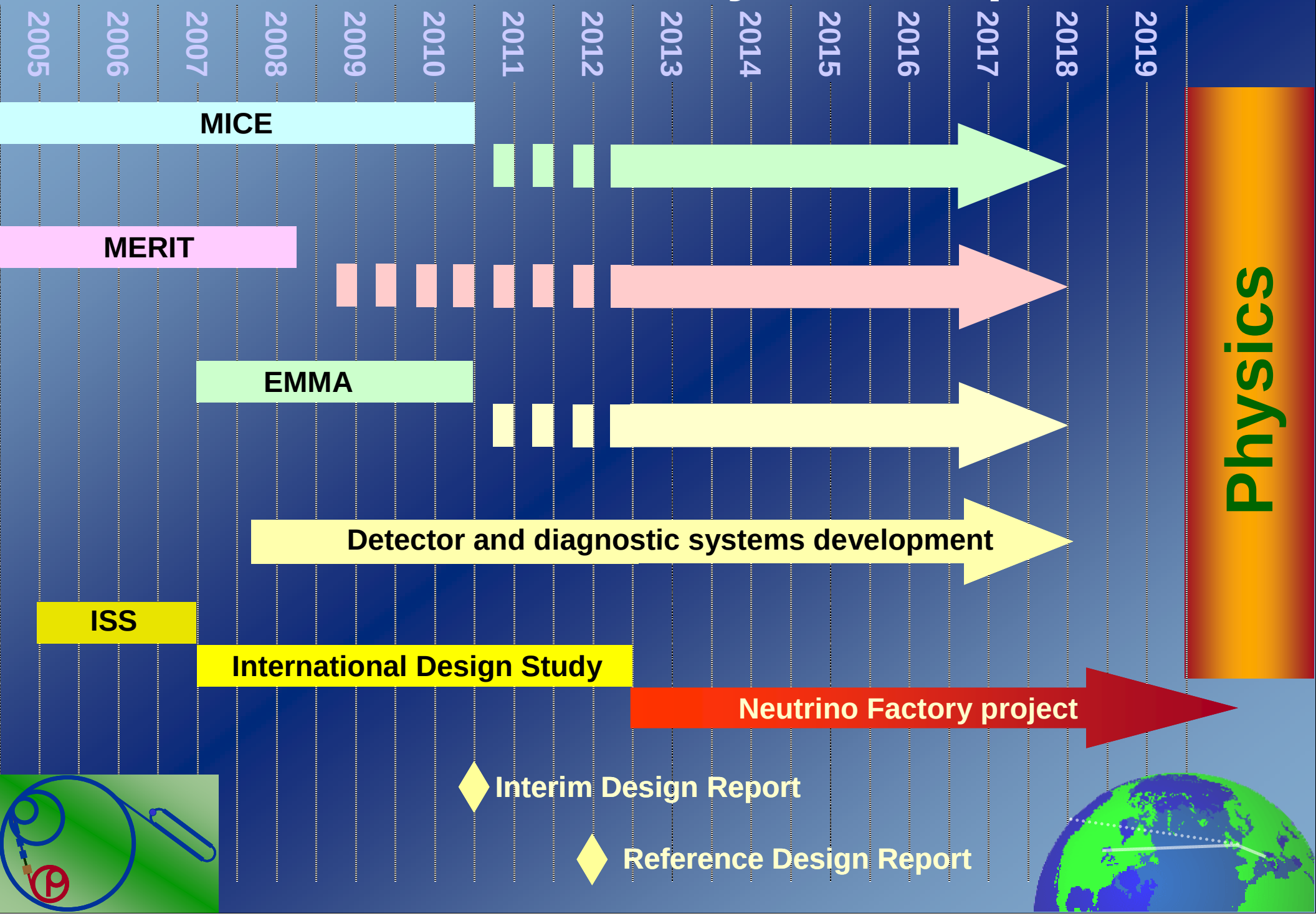
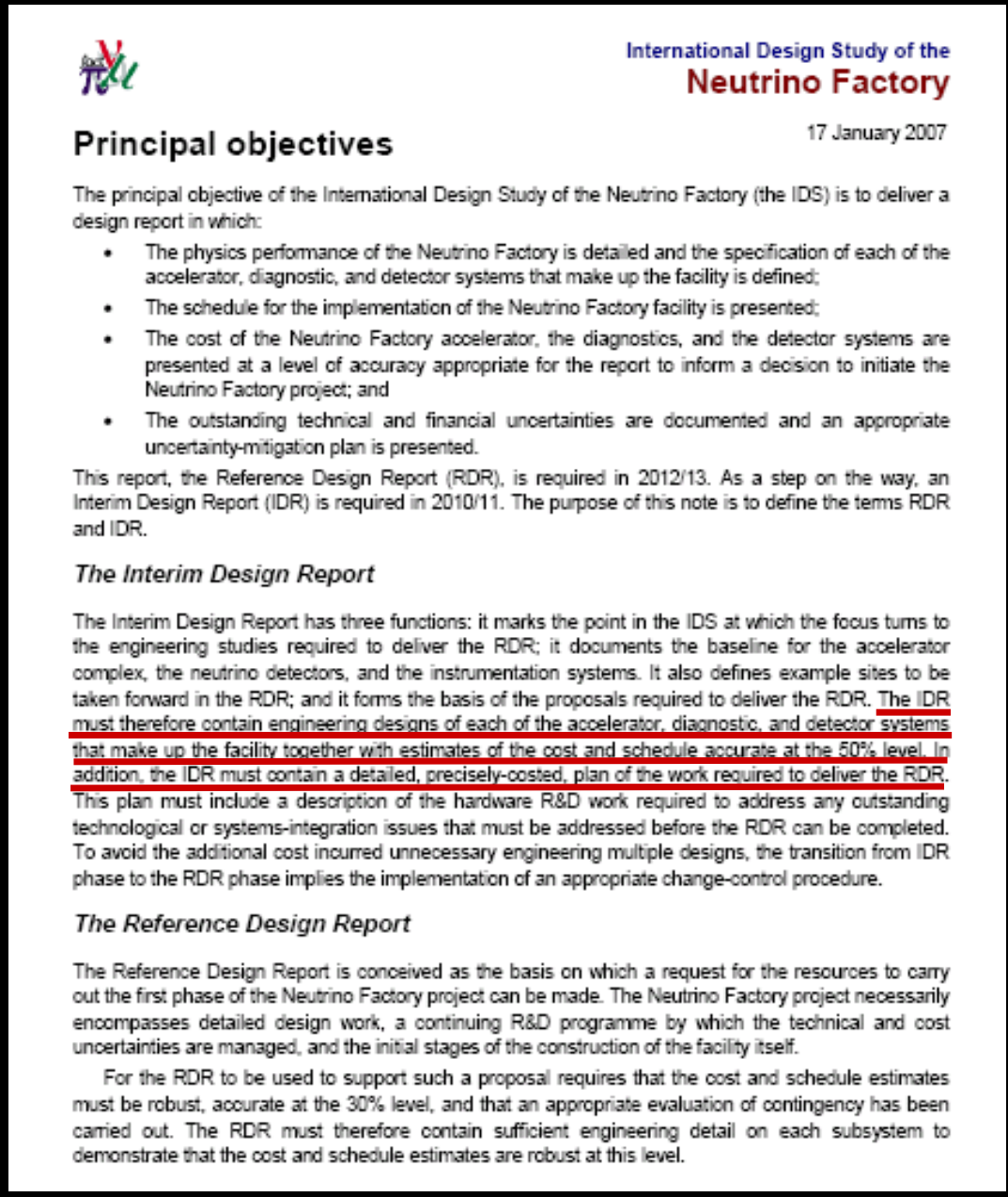
An attempt to generate a discussion …

Neutrino Factory roadmap



- The task we set ourselves:
  - IDR 2010
    - Engineering designs for accelerator and detector systems to allow
    - Costing at the 50% level
    - Work plan and cost estimate for the production of the RDR
  - We have 2 years!



International Design Study of the
Neutrino Factory

17 January 2007

Principal objectives

The principal objective of the International Design Study of the Neutrino Factory (the IDS) is to deliver a design report in which:

- The physics performance of the Neutrino Factory is detailed and the specification of each of the accelerator, diagnostic, and detector systems that make up the facility is defined;
- The schedule for the implementation of the Neutrino Factory facility is presented;
- The cost of the Neutrino Factory accelerator, the diagnostics, and the detector systems are presented at a level of accuracy appropriate for the report to inform a decision to initiate the Neutrino Factory project; and
- The outstanding technical and financial uncertainties are documented and an appropriate uncertainty-mitigation plan is presented.

This report, the Reference Design Report (RDR), is required in 2012/13. As a step on the way, an Interim Design Report (IDR) is required in 2010/11. The purpose of this note is to define the terms RDR and IDR.

The Interim Design Report

The Interim Design Report has three functions: it marks the point in the IDS at which the focus turns to the engineering studies required to deliver the RDR; it documents the baseline for the accelerator complex, the neutrino detectors, and the instrumentation systems. It also defines example sites to be taken forward in the RDR; and it forms the basis of the proposals required to deliver the RDR. The IDR must therefore contain engineering designs of each of the accelerator, diagnostic, and detector systems that make up the facility together with estimates of the cost and schedule accurate at the 50% level. In addition, the IDR must contain a detailed, precisely-costed, plan of the work required to deliver the RDR. This plan must include a description of the hardware R&D work required to address any outstanding technological or systems-integration issues that must be addressed before the RDR can be completed. To avoid the additional cost incurred unnecessary engineering multiple designs, the transition from IDR phase to the RDR phase implies the implementation of an appropriate change-control procedure.

The Reference Design Report

The Reference Design Report is conceived as the basis on which a request for the resources to carry out the first phase of the Neutrino Factory project can be made. The Neutrino Factory project necessarily encompasses detailed design work, a continuing R&D programme by which the technical and cost uncertainties are managed, and the initial stages of the construction of the facility itself.

For the RDR to be used to support such a proposal requires that the cost and schedule estimates must be robust, accurate at the 30% level, and that an appropriate evaluation of contingency has been carried out. The RDR must therefore contain sufficient engineering detail on each subsystem to demonstrate that the cost and schedule estimates are robust at this level.

Organisation:

IDS-NF-004

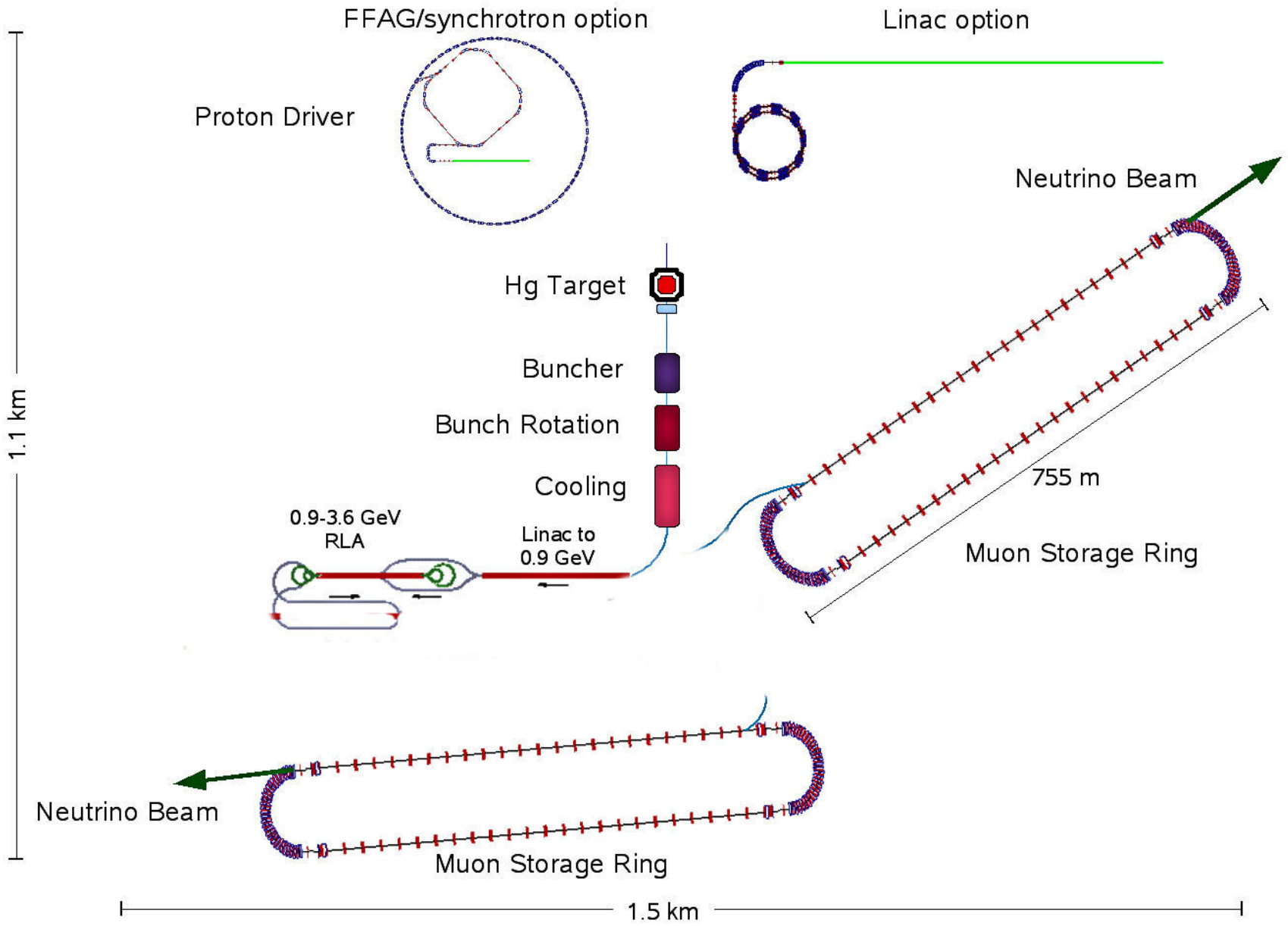
System Sub-system	Task list Performed	 Required	Coordinators	Comments
Target	Optics Tracking 1 Tracking 2	CDR IDR costing	C.Densham (RAL), H.Kirk (BNL)	Particle production must be revisited when HARP results are included in MARS/Geant4
Muon front-end			C.Rogers (ASTeC), D.Neuffer (FNAL)	
Capture	Optics Tracking 1	Tracking 2 CDR IDR costing		
Bunching and phase rotation	Optics → Tracking 1 →	Tracking 2 CDR IDR costing		Risk mitigation: evaluate to what extent minor lattice revisions are required if it is demonstrated that the baseline gradient can not be achieved in the magnetic field.
Cooling	Optics → Tracking 1 →	Tracking 2 CDR IDR costing		Risk mitigation: evaluate to what extent minor lattice revisions are required if it is demonstrated that the baseline gradient can not be achieved in the magnetic field.
Acceleration ***Linear accelerators***	Optics	Tracking 1 Tracking 2 CDR IDR costing	A.Bogacz (JLab), J.Pozimski (ICL)	
FFAG	Optics → Tracking 1 →	Tracking 2 CDR IDR costing	S.Berg (BNL), S.Machida (RAL)	While initial optics and tracking work has been done, the fact that an injection and extraction scheme has not been proposed implies that it is necessary to revisit both the optics analysis and the tracking.
Storage ring		Optics Tracking 1 Tracking 2 CDR IDR costing	C.Prior (ASTeC), ANO	Present lattices store muons of a single charge only. A modification of the optics is required to allow positive and negative muons to be stored simultaneously.

Accelerator tasks and coordinators:

An embarrassment of riches?

- Three Neutrino Factory target concepts:
  - Liquid mercury jet
  - Solid metal bar
  - Powder jet
- Each has strengths and weaknesses
  - Likely, each can be ‘made to work’ …
  - … but what if, one or more can not be?

The IDS-NF baseline (2007/1.00)



So, …

- Is the specification of the baseline correct, or, should the baseline contain *options* for the target technology?
  - If it should, we should update the baseline document (IDS-NF-001)
- For RDR there should be *one* target fully worked through and, perhaps, a backup
  - What is the process by which the choice is made?
    - Face the issue of *process* …
- Proto-plan emerging …

Relevant IDS-NF meetings:

- Target task kick off meeting:
  - ~15Dec08 at CERN (TBC)
- IDS-NF plenary #3:
  - 23rd and 24th March 2009 at CERN
    - Identical to the EUROnu Neutrino Factory work package parallel sessions
- First EUROnu Plenary:
  - Week of 23Mar09 at CERN