Work Package 4 – Target and Cooling

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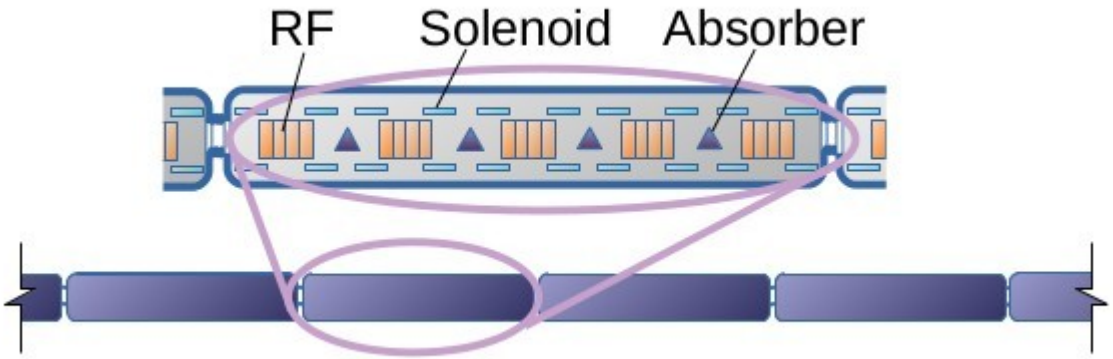
Science & Technology Facilities Council
ISIS

Tasks

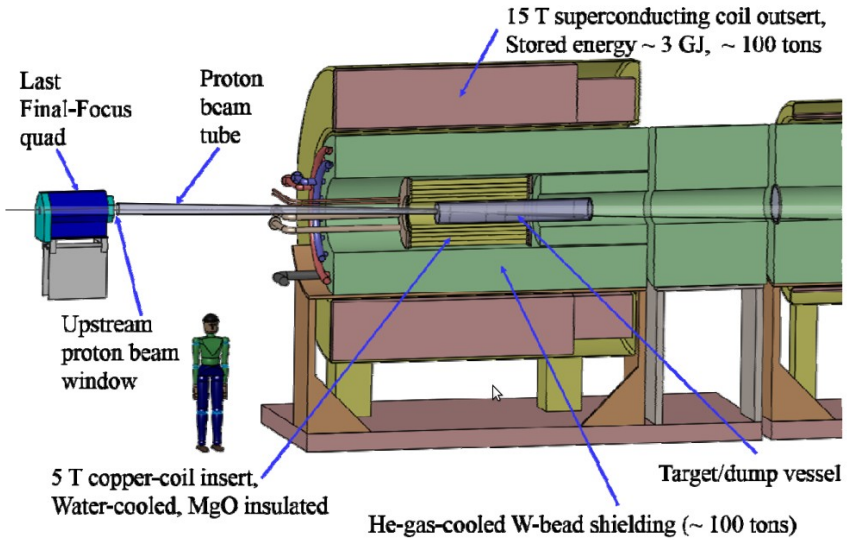
- Task 4.1 Coordination and Communication
- Task 4.2 Cooling system (**RAL**, Imperial)
  - Design and optimisation of the 6D beam cooling system
  - Interface to related accelerator systems
  - Assessment of experimental infrastructure
  - Final cooling system is out-of-scope
- Task 4.3 Target system (**CERN**, RAL, Warwick, ENEA)
  - Design of target concept
    - Including graphite, liquid metal and fluidised Tungsten
  - Studies of target systems, such as heat load and pion yield
  - Assessment of shielding requirements and radiation load on surrounding systems (esp magnets)
  - Liaison with proton driver work package
- Task 4.4 Software development (**Imperial**, RHUL)
  - Support for cooling channel design in BDSIM

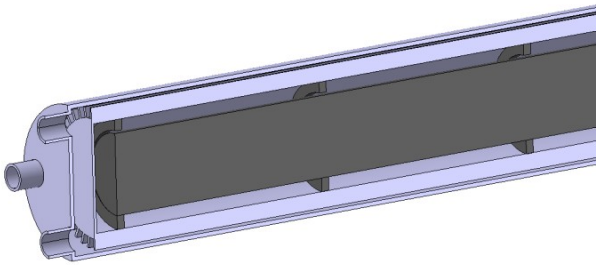
Cooling



- 6D cooling system requires very compact lattice
  - Absorber, solenoid, RF
- Baseline design conservative in some technology choices e.g. solenoid
- Integration issues not fully explored
- Aim is to optimise the design
  - Consider existing and likely technology limitations established in WP6, WP7
  - Consider also constraints from integration in liaison with WP8

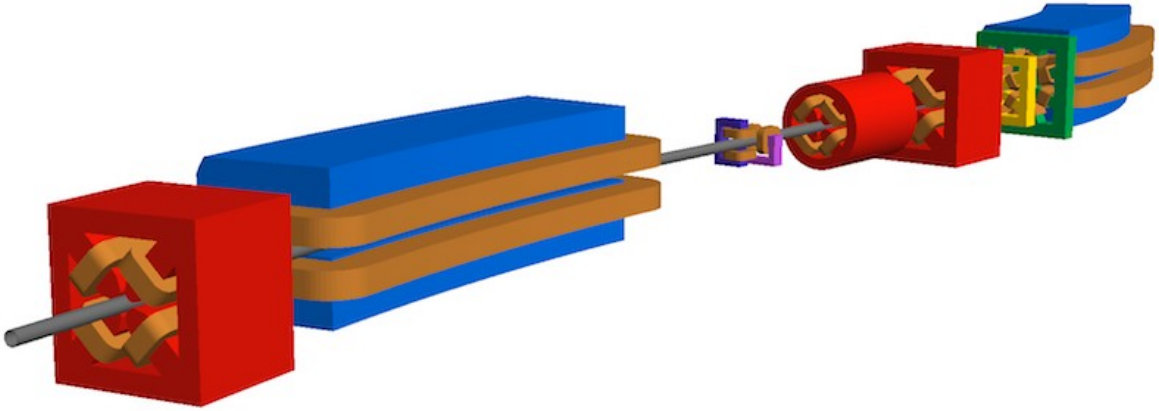
Target





- Target incorporates challenging combination of magnet and materials
  - Stress on target
  - Heat load on target
  - Radiation load on magnet
- Thick shielding required to protect the magnet
  - Tension between magnet forces and radiation load
  - Close collaboration with WP7

BDSIM



- Existing cooling simulations are done with G4Beamline and ICOOL
  - Both developed in US
  - Excellent to develop the capability in Europe
- BDSIM has been used by FCC, CLIC and ILC
  - Incorporates Geant4 physics models
  - Support for simulation of long beamlines and rings
  - Python API

Milestones and Deliverables

- Milestones
  - Baseline muon cooling cell design (12 months)
    - Input to WP8, WP6, WP7
  - Initial assessment of target radiation load on magnet systems (12 months)
    - Input to WP7
- Deliverables
  - Development of BDSIM simulation – 24 months
  - Advisory report on key subsystems – 36 months
    - For input to European Strategy
  - Consolidated report on key subsystems – 48 months

Resources

		Matching							EU DEV				
	Deliverable	Staff		Postdoc		Student		Material	Staff	Postdoc		Student	Cost (Approx)
		FTEy	Name	FTEy	Institute	FTEy	Institute	MEUR	FTEy	FTEy	Name	[FTEy]	[kEUR]
Coordination	Coordination and Communication		0.4 UKRI*										
Ionisation Cooling	6D cooling		1.6 UKRI*										
			0.4 Imperial				3.5 UKRI/Imperial			1	Imperial**		103
	BDSIM		0.4 RHUL							1	Imperial**		103
Target	Heat load and shock on target		1.5 CERN										
	Preliminary target complex design									1.2	UKRI*		87.7
	Radiation calculation and pion yield		0.8 Warwick				1.75 UKRI					1.75 Warwick	50
	Tungsten Powder Jet									1.2	UKRI*		87.7
	Heavy Liquid Metal		CERN/ENEA										
Sum		**4.7**		**0**		**5.25**				**4.4**		**1.75**	**431.4**

*UKRI is UK Research and Innovation (AKA STFC AKA Rutherford Appleton Laboratory)

**1 FTEy of this post-doc is in WP8

Assume start is January 2023

Assume grant period is 4 years