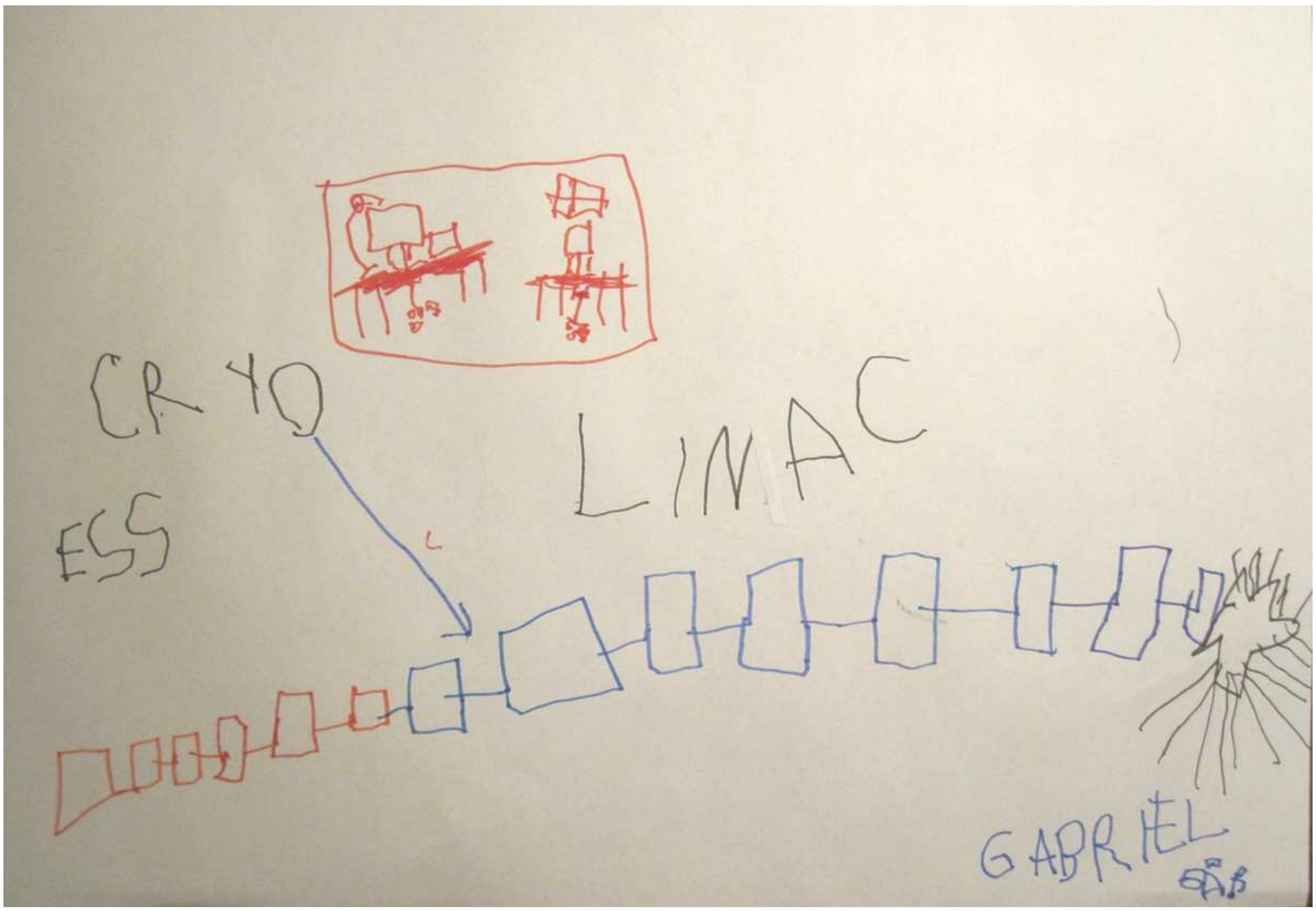
ESS Conceptual Design Report



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PRELIMINARY DRAFT: NOT READY FOR CIRCULATION

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1 Introduction (Carlile)

1.1 Primary parameters

The European Spallation Source is a state-of-the-art .....

Beam Power	[MW]	5.0

Table 1: Primary parameters of the European Spallation Source.

More words here.

1.2 Scientific need and discovery potential

1.3 Schedule

1.4 Site

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4.7.3 Low-Level RF

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4.7.5 Accelerating Structures: 704 MHz

4.7.6 Higher Order Modes

Justification of the decision to install HOM couplers (or not) should be based on:

Beam dynamics Marcel Schuh's studies [**?**] suggest that HOMs are only of concern when they coincide with a peak in the Fourier space of the beam. A comparison is therefore necessary between the Fourier space occupied by the beam, and the R/Q spectrum simulated for the cavity.

It should be remembered that the frequencies of the HOMs observed in the tuned cavities is likely to be significantly different from those determined from simulation, and that it is possible that mode thought to lie far enough from a machine line may shift into a position where it has a negative impact on the beam dynamics.

Operational risk presented by their installation As was demonstrated at SNS [REF?], HOM couplers may increase the risk of failure of each individual accelerating cavity. The mechanism behind this is thought to be that a high-level of field emission & multipacting in the couplers thermally detunes the position of the "notch" filter whose purpose is to ensure that the high power accelerating field is not coupled out of the cavity. This detuning resulted in excessive power being transmitted through the HOM coupler electronics, causing failure of the cavity.

Beam dynamics studies conducted for ESS [REF?], as well as for similar linacs around the world [SNSREF, SPLREF], show that the risk of significant degradation of the longitudinal phase space by HOM power is low for the proposed pulse structure [refer to appropriate section of CDR].

Despite this, the decision has been taken to install suitable couplers on both families of elliptical cavities.

The justification for this is that it has been shown that the Rostock / Brookhaven / Saclay coupler design presents a very low risk of multipacting problems [REF?], and that the increased cost of the cavities and cryomodules [refer to costing section of CDR] is thought to be worth the increased flexibility in the pulse structure achieved by the addition of these dampers.

4.8 Cryogenic systems

4.8.1 Cryomodules

4.9 Vacuum systems

4.10 Beam instrumentation

4.11 Magnet systems

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