

Recycling cavities design discussion

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Power and Signal Recycling Cavities



- cavities between the arm cavities (well defined) and the injection and detection parts of the interferometer
- study focus on ET – HF to mitigate thermal effect at the beamsplitter (“large beam” required)
- aim for PRC and SRC with similar design
- the design will impact on the infrastructure

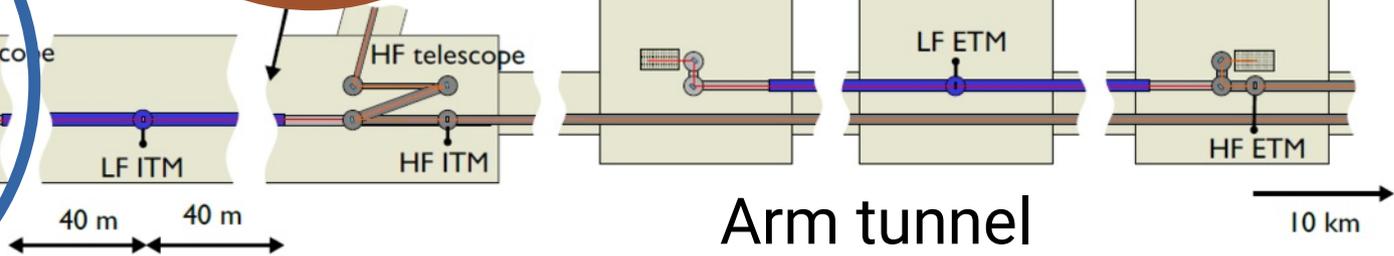
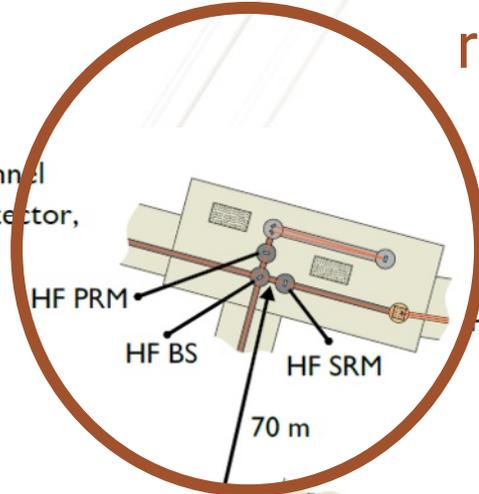
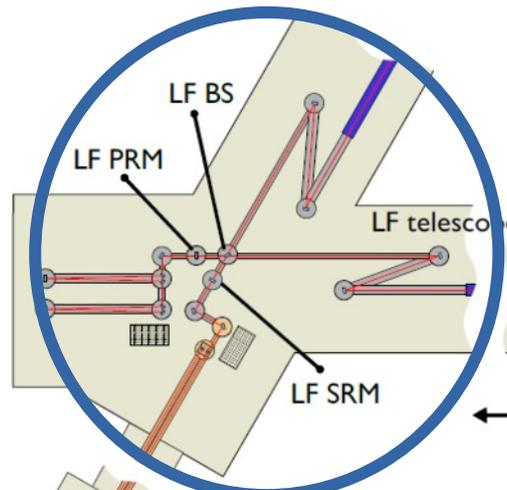


The first proposed design



ET - HF recycling cavern

Top view of left lower corner of one tunnel in the triangle, showing ITMs of one detector, and ETMs of another



- HF vacuum system
- LF vacuum system
- cryo shields
- filter cavity vacuum
- fused silica optics
- silicon optics



<https://doi.org/10.1103/PhysRevD.103.023004>

Similar study for Cosmic Explorer



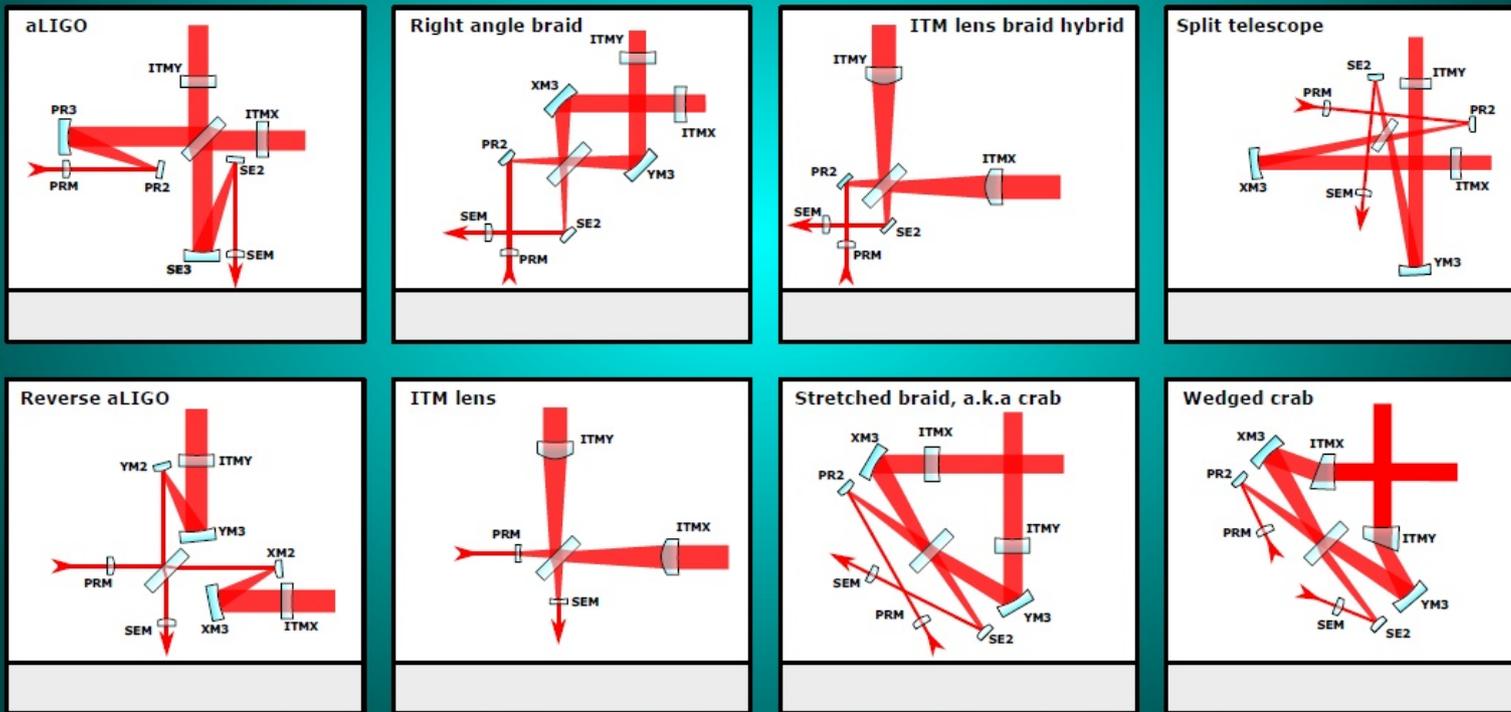
CHOOSING A CORNER LAYOUT FOR



With the design of an entirely new facility comes the opportunity to rethink the layout of the interferometer corner. This poster shows some of the concepts we've considered so far, each with their own advantages and disadvantages. We invite you to stick a pin in your favorite layout, or better yet attach a note with the reasons why!*

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Stick your pins or notes here

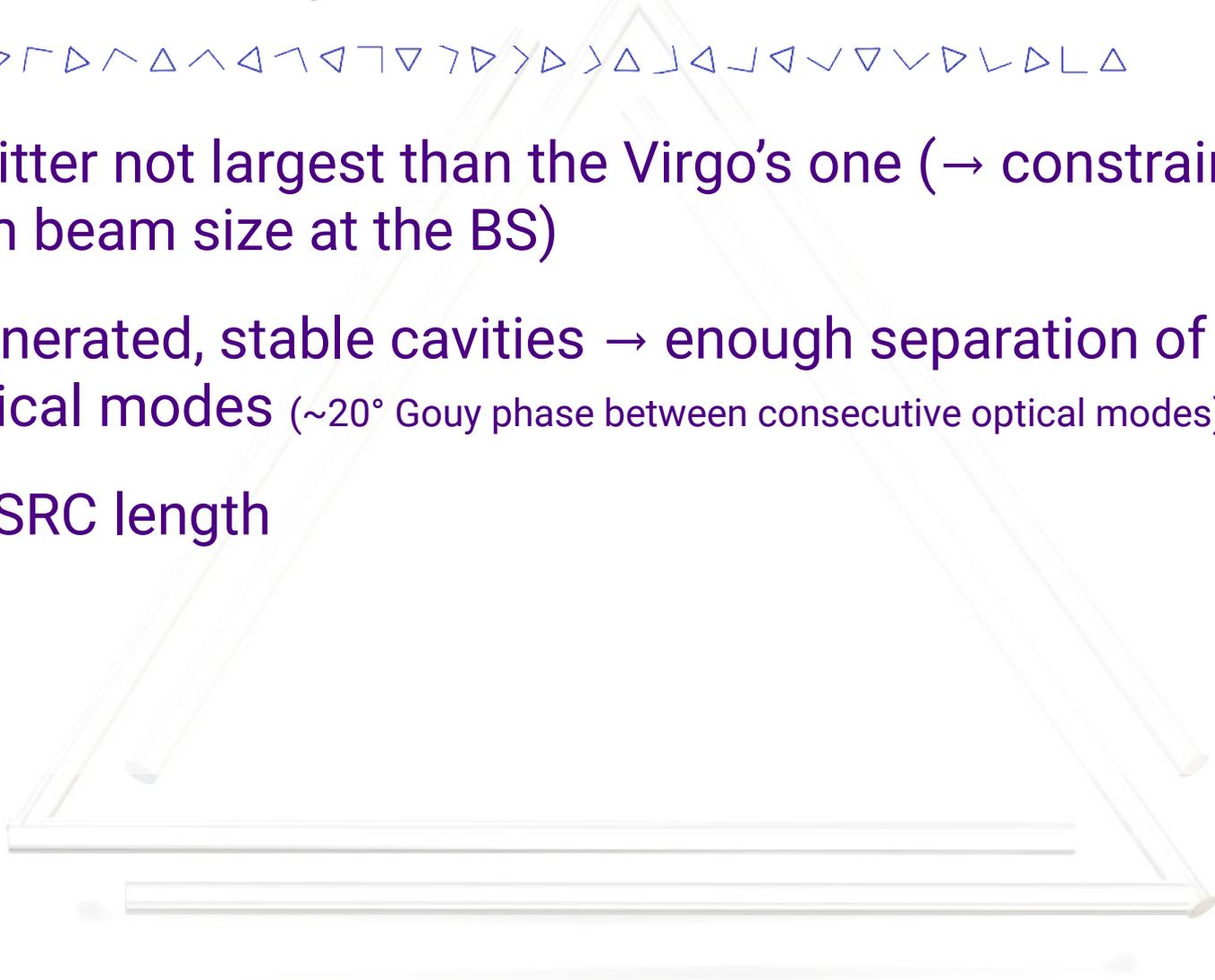


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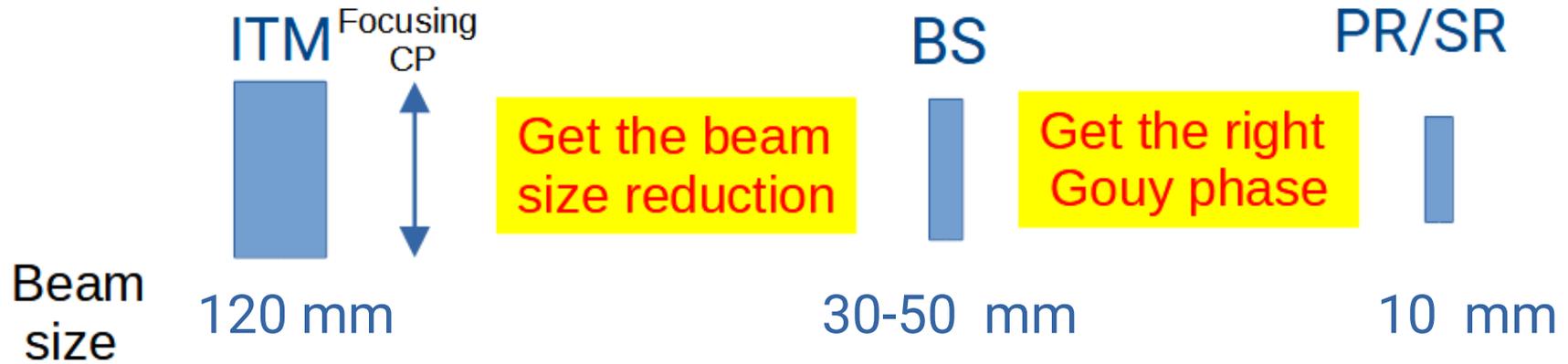
The first driving constraints



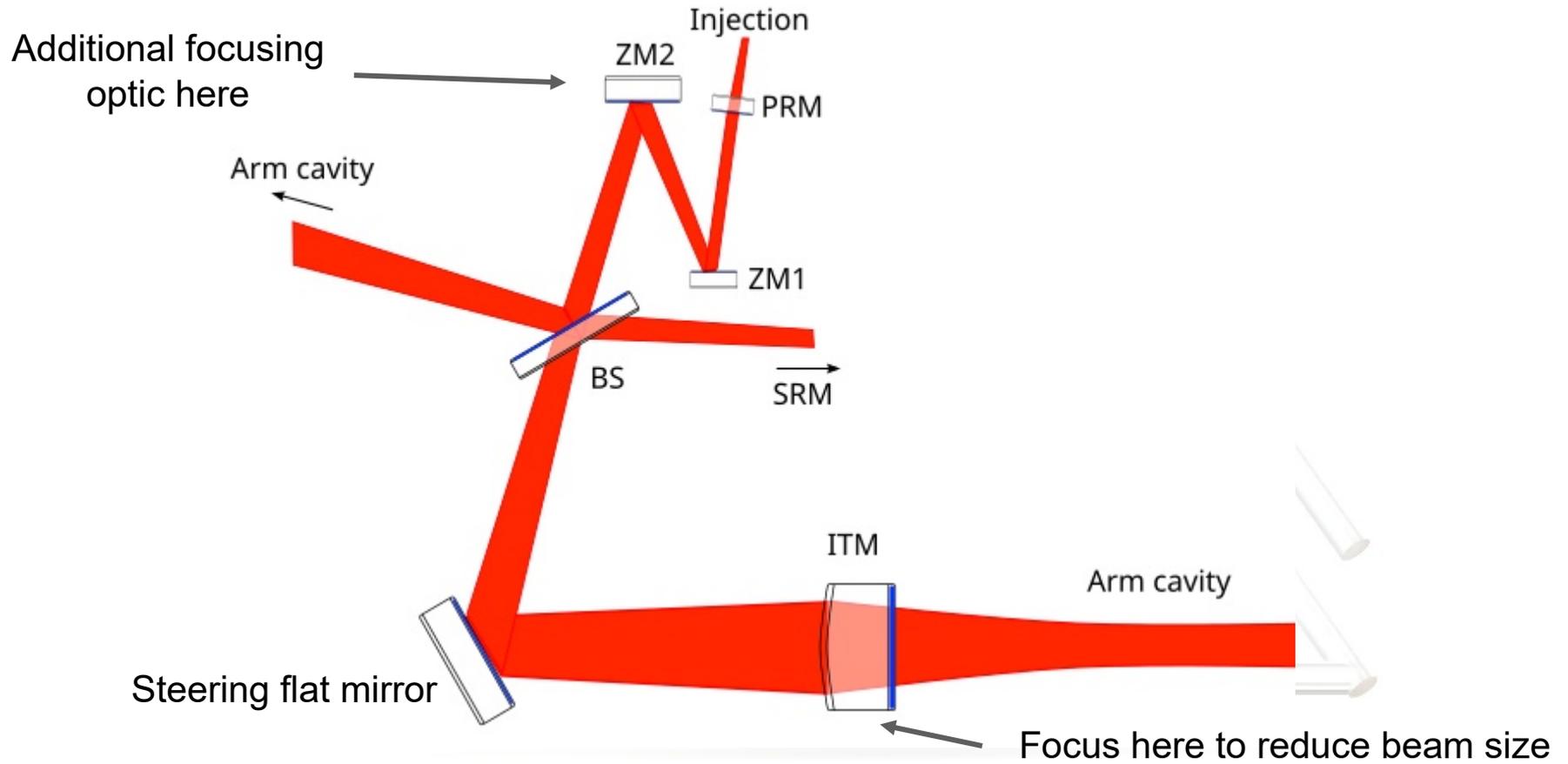
- beam splitter not largest than the Virgo's one (→ constraint on the maximum beam size at the BS)
- non-degenerated, stable cavities → enough separation of higher order optical modes ($\sim 20^\circ$ Gouy phase between consecutive optical modes)
- ~ 100 m SRC length



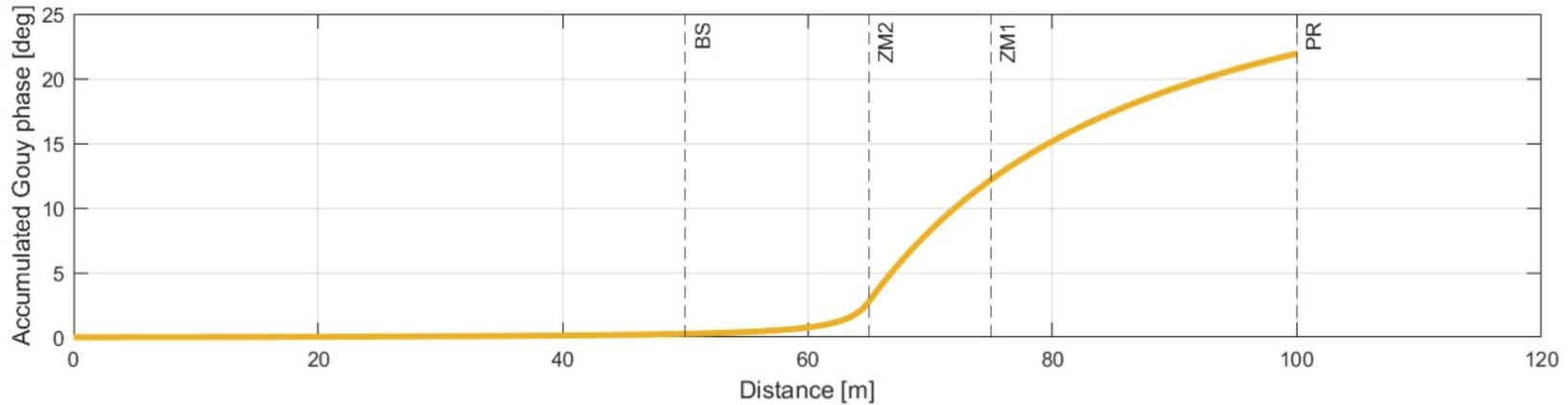
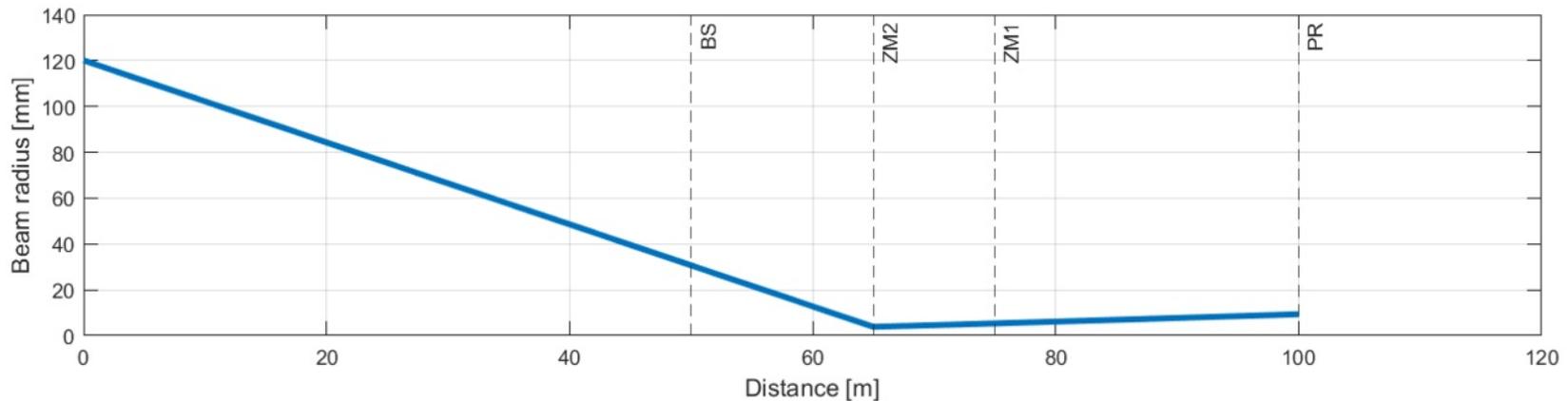
New proposed design



New proposed design



Beam size evolution and Gouy phase



A lot of work remains



- cross-check the proposed design (what about the astigmatism and thermal effect ?)
- how robust it is ? can it guarantee optimal mode matching ?
- slightly different setting for the PRC and SRC ? (to achieve smaller beam size on SRM)
- secondary beam dumping, sidebands frequency, control strategy

Summary/work plan on overleaf document:

<https://www.overleaf.com/read/yvxxmxnsmnbfy>

Recent call to look for volunteers to contribute