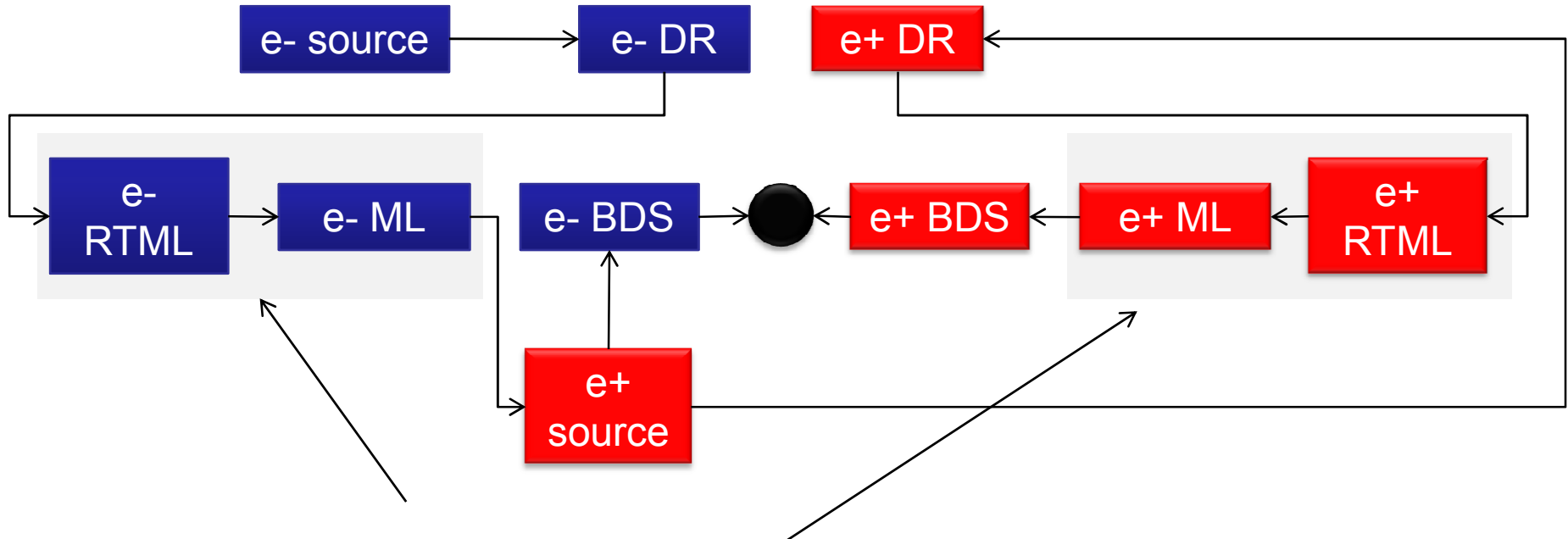




Block Diagram



- Factor availability of single-tunnel housing out of overall availability calculations
- Look for solutions to achieve “**equivalent system availability**” of RTML/ML system as for RDR (dual tunnel) solution
- Avoid complications due to ‘recovery times’ of overall systems – concentrate on what has changed.



What to model?

- What has changed:
 - **Power supplies, electronics now in accelerator housing (no access during operations)**
 - **Two options for HLRF**
 - klystrons and modulators in tunnel (DRFS) – no access
 - klystrons and modulators in surface buildings (KlysClust)
 - water cooling for both solutions
- What has not changed
 - **cryomodule (incl. tuners, magnets etc.)**
 - **cryogenic systems**

} factor out



Focus on changed components

- Assume 'not changed' contribution to overall availability remains unchanged
 - **A valid assumption to first-order?**
- Understand what needs to be done to changed systems to achieve equivalent availability.
 - **First question: what is goal availability of single RTML/ML system?**
 - **Second question: what are the top-five availability drivers that we need to concentrate on?**



KlyCluster and DRFS

- Potentially different from availability standpoint
- May require different 'maintenance and operational models' to achieve equivalent availability
- Obvious difference: tunnel access to exchange klystrons
 - **scheduled or opportunistic maintenance?**
- Historical questions:
 - **what was primary failure mode forcing access to the accelerator tunnel?**
 - **For single and dual tunnel approaches studied to date**



Failure Modes

- Within context of RTML/ML system availability
- Need to understand 'failure tree' of (for example) RF unit
 - **DRFS simple**
 - **KlyCluster will require assumptions**
- Look to characterise sub-system MTBF
 - **MTBF of an 'RF unit' rather than klystron/modulator/LLRF etc.**
- Hot spare units:
 - **Almost certainly needed**
 - **Output of availability studies**
- Failure models:
 - **Constant average failure rate easiest (poisson stats)**
 - **With simple 'system availability' model we can look at other models**
 - But they must be based on some realistic experience
- Note: focus tends to be on HLRF, but AVAILSIM studies certainly identified bigger drivers