MSU View of RIA R&D Priorities

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Guiding Principles

- **Highest priority given to those technical issues that if unresolved pose a significant risk to project success as measured by:**
  - **Performance, Schedule, & Cost**
    - Ordered with decreasing weight
- **Priority given to complete R&D efforts already begun assuming:**
  - **Appropriate progress has been made**
  - **Continuation will increase probability of project success**

High Level Issues

- **RIA high beam power poses technical challenges reflected in:**
  - **Stripping, fragmentation, & ISOL targets**
  - **Fragment separator designs & beam dumps**
  - **Radiation field characterization & Radiation resistant magnets**
- **Schedule is an important factor**
  - **Civil construction is early project issue requiring details of e.g, linac tunnel and support building**
  - **Long lead items, e.g. SRF systems, can become critical path**

Summary Priorities

R&D Area	Priority
Linac stripping targets	1
SRF structures	1
ISOL beam production	1
Fragmentation targets	1
Characterization of secondary radiation	1
Radiation resistant magnets	1
Fragment separator designs	1
Helium gas stopping systems	1
High power beam dumps	2
High resolution mass separation & cooling	2
Charge state boosting	2
Beam dynamics	3
ECR development	3
Ion sources for ISOL beam production	3
Experimental equipment	3

Highest

Driver Linac Stripping Targets – *Priority 1*

- *2 Stripping targets required for A>Xe*
  - *Necessary to achieve base uranium and 400 kW long-term goal*
- *For 400 kW beam power*
  - *1st stripper power density about 3 kW/mm^3*
  - *2nd stripper power density about 2 kW/mm^3*

SRF Structures – *Priority 1*

- R&D supported to prototype & verify parameters
- Necessary to:
  - Support detailed system engineering for base design & cost
  - Have adequate details to support civil construction design – early project element
  - Avoid long-lead SRF systems procurement becoming critical path issue

ISOL Beam Production – *Priority 1*

- Full utilization of high beam power necessary to realize full scientific potential
- ISOL stations capable of handling 400 kW beam power necessary
  - ~10x existing
- Detailed infrastructure layouts from results of R&D program
- R&D will take time => needs to start early

Fragmentation Targets – *Priority 1*

- **Full utilization of high beam power necessary to realize full scientific potential**
- **Fragmentation targets capable of handling 400 kW beam power necessary**
  - **~100x existing**
- **Detailed infrastructure layouts from results of R&D program**
- **R&D will take time => needs to start early**

Characterization of Secondary Radiation – *Priority 1*

- Necessary to support facility hazard category rating
- Necessary to determine bulk shielding and civil engineering design requirements
- Necessary to support other target area R&D efforts
  - ISOL targets, Fragment separators, radiation resistant magnets
- Use data where extant & obtain critical data where necessary
- Benchmark newly developed ion production & transport codes

Radiation Resistant Magnets – *Priority 1*

- All magnets in ISOL target areas and initial stages of fragment separator systems in very high radiation environment
- Existing designs – lower performance
- Want high performance & high reliability
- Will drive infrastructure decisions and influence RIA performance

Fragment Separator Designs – *Priority 1*

- RIA fragment separator requirements move design to nearly unexplored regime
- High beam powers of primary and secondary beam pose design problems
- Need suitable RIB production models to support design effort
- Will drive infrastructure decisions and influence RIA performance

Helium Gas Stopping Systems – *Priority 1*

- R&D funded for several years
- Two outstanding questions
  - What is efficiency?
  - What is intensity limitation?
- Information needed to determine design requirements & performance of approach
- Will drive infrastructure decisions

Priority 2 Items

- **High power beam dumps**
  - **High power densities of heavy ions**
  - **Becomes important when e.g. fragment separator design concepts further developed**
- **High resolution mass separation & beam cooling**
  - **Cooling could reduce complexity & cost of mass separation**
  - **Important impact on facility layout but not yet time critical**
- **Charge state boosting for post-acceleration**
  - **ECR effort funded**
  - **EBITs promising alternative**
  - **Important but not yet time critical**

Priority 3 Items

- **Beam dynamics**
  - **R&D begun – needs to continue but not yet time critical**
- **ECR development**
  - **R&D begun – need to take obtain experimental information from hardware developed – not yet time critical**
- **Ion sources for ISOL beam production**
  - **Cheap disposable ECRs desirable – not time critical**
- **Experimental Equipment**
  - **Equipment requirements still in formative stage**
  - **Equipment R&D lower priority at this stage**

Summary

- Historically emphasis on driver linac
- Some driver linac R&D must continue
  - SRF R&D
  - Stripping targets
- Emphasis shift to target area(s) and downstream
  - ISOL beam production systems
  - Fragmentation production systems