Accelerator WG Summary part ?/3

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Outline

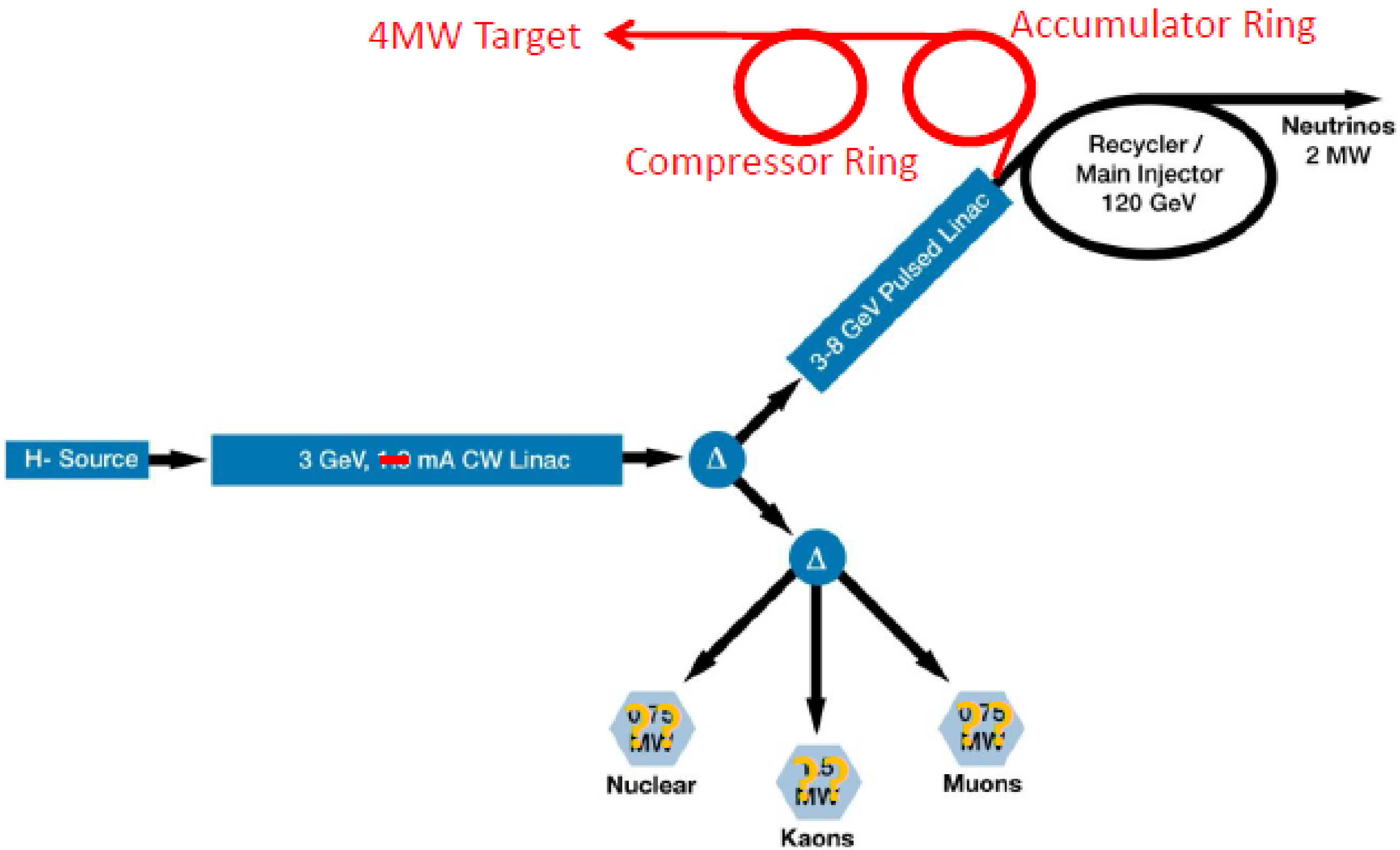
- proton driver
- target
- simulations

Project X Task Force & Upgrade plans

Keith Gollwitzer & Sergei Nagaitsev, Fermilab

- Project X – MAP Task Force was set up to ensure that it's possible
  for Project X to meet MC requirements
- work to date
- designed programmable chopper system to provide appropriate bunch structure
- add accumulator ring after pulsed linac
  consolidate linac beam pulses into bunches
- follow with a compressor ring
  narrow bunch width ~2 ns
- looking at trombone/funnel system to deliver multiple bunches to target
- agreed on PrX upgrade numbers
  increase average beam current to 5 mA during injection
  increase rep rate to 15 Hz
  increase linac beam pulse length to give 10% duty factor

Project X Task Force & Upgrade plans



Project X Task Force & Upgrade plans

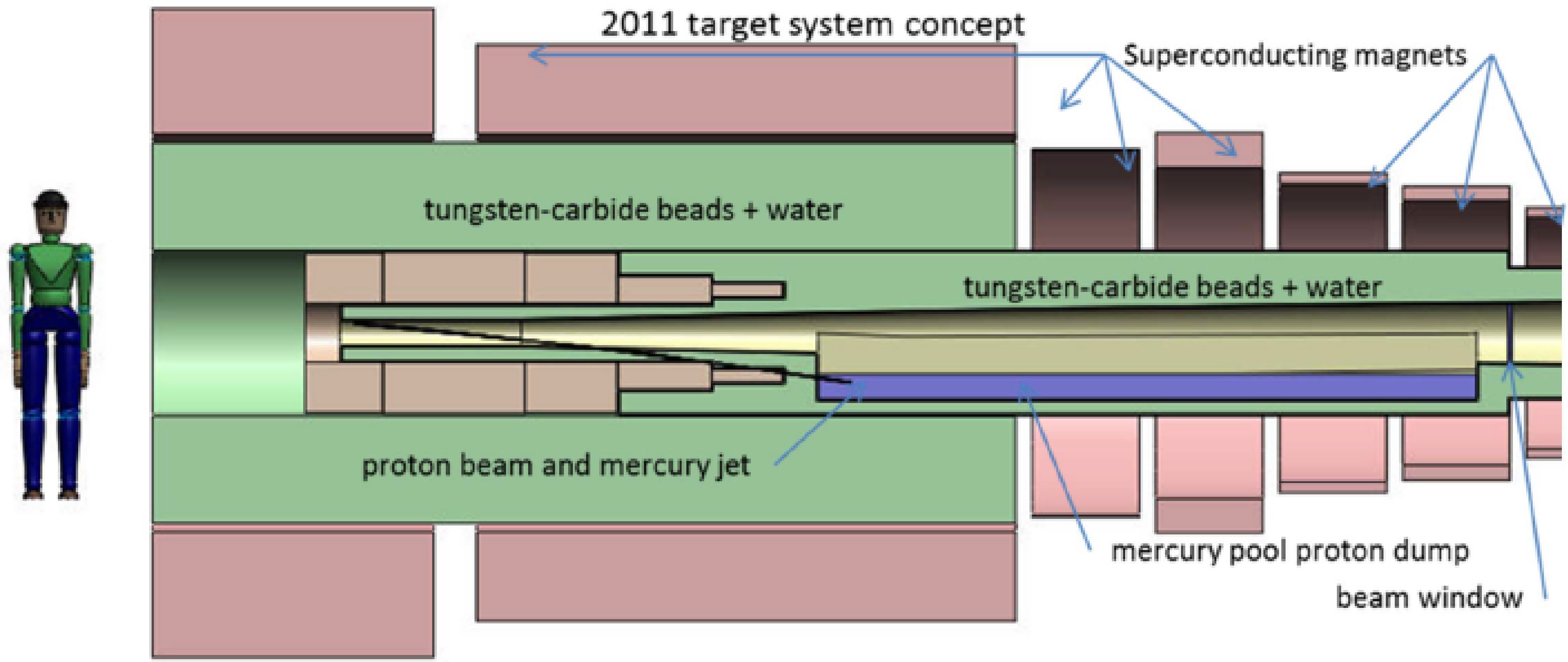
- discussed instability limits for rings
  - determines maximum power per bunch
- MC impact on PrX pulsed linac
  - more RF power needed per cavity
  - upgrade capacity of power couplers
  - add more cryogenic capacity
- MC impact on conventional facilities
  - more water cooling
  - more room for klystrons
- a plausible upgrade path to 4 MW at 8 GeV for Project X exists
- such an upgrade would reuse > 75% of Project X RDR cost

Radiation management for capture solenoid

Harold Kirk, BNL

- bulk of energy deposition in target capture solenoids is due to neutrons
- found that Study 2 capture configuration is unacceptable for present parameters
  - large average energy deposition and large dynamic heat load on cryogenics
  - peak energy depositions which exceeded ITER criteria by a factor of ~35
- considered new designs with larger IR for SC coils
- allowed putting additional shielding in gap
- have new configuration (IDS120) with acceptable average and peak deposition
  - dynamic heat load in the capture solenoids to ~1 kW
  - peak energy deposition to < 0.15 mW/g
- but the capture solenoids stored energy now > 3 GJ

MC Target baseline



MC Target baseline

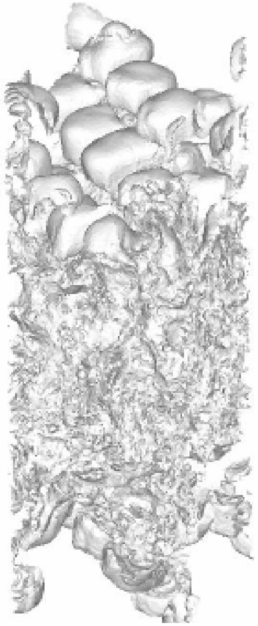
Kirk McDonald, Princeton

- have baseline design for 8 GeV, 4 MW, Hg jet, 20 T
- still many issues need more work to flesh out this design, e.g.
- one proton bunch on target or many?
- design of PD final focus onto target
  - air gap between two systems?
  - may need large-aperture quads
- supporting and cooling required shielding around target
- quench protection for SC magnets with very large stored energy
- Hg containment vessel and associated plumbing

Simulation of high intensity Hg jet

Roman Samulyak, SUNY (KM)

- simulating MHD of Hg jet interactions with proton beam in magnetic field
- developing new code (SPH) that works over larger range of time scales
- looking for explanation of delay in production of surface
  filaments from jets
- examine interaction of spent proton beam with Hg beam dump
- look at jet interactions under MC beam conditions
  instantaneous power deposition >> NF
  maximum pressure in jet ~ x10 for MC
  jet disruption velocity ~ 100 m/s



Megapie target at PSI

Michael Wohlmuther, PSI (KM)

- illustration of extensive infrastructure needed for MW targets
- used lead-bismuth eutectic as target material
- many issues that must be addressed
  - damage on beam windows
  - heat removal
  - handling radioactive gases
  - remote handling
  - hot cells for handling used targets

SNS experience with mercury

Steven Trotter, ORNL

- SNS experience in building high-power Hg target station
- safety analysis and documentation required
- follow requirements of Clean Air Act
  - radioactive emissions
  - obtaining necessary permits
- handle waste management issues
  - accounting for all Hg in system
- consider worst-case accident scenarios
- existence proof that MW class target facilities can be built in US

Existing simulation codes and needs

RCF, BNL

- existing codes are satisfactory for most of our present MC simulations
- we are becoming aware of some issues that could use more computer resources:
    1. Hg jet interactions for MC beam parameters
    2. interaction of intense muon bunches in absorbers?
    3. space charge effects near end of cooling
    4. multi-turn energy loss from μ decays in accelerator
    5. beam-beam interactions in collider ring
    6. reducing backgrounds on physics detectors

Effects in absorbers

Kevin Paul, Tech X

- first examination of possible plasma effects due to intense μ beam
  passing thru cooling channel absorbers
- expected recombination times << beam time scales
- no residual plasma left in material between pulses
- no beam instabilities driven
- RF-driven plasma currents small compared with beam current
  no beam loading expected
- avalanche possible, but may be avoidable
  requires further investigation
- largest uncertainties are in atomic and molecular cross sections
  need to be checked with experiments

Advanced computing for MAP

Rob Ryne, LBNL

- discussed how large-scale parallel accelerator modeling, and other advanced computational methods, can impact MAP
- easy to get access to 10Ks of CPU cores now
- identified areas where MAP could benefit from advanced computing
- e.g. parallel 3D space charge codes (IMPACT, Synergia) available need to determine best way of interfacing to our MC codes
- new 5-year program (SciDAC3) will likely be announced this summer
- discussions between MAP and SciDAC/ComPASS will continue to ensure that future ComPASS activities can address needs of MAP