Front-end lattice starting after the target area (update I)

Gersende Prior
European Organization for Nuclear Research (CERN)

Idea

- Make a front-end lattice that starts at z > 6 m in order to:
  - be able to load a beam file that has included the pions/muons phase space after interaction in the target surrounding material (including the Be window at z = 6m).
  - be independent on the target area designs changes that may/will occur in the future (taper change, magnet arrangements, shielding)
  - be independent on the taper profile (choose an area where is constant)
- Doing the exercise on the ISS lattice (aka ST2a for test purpose):
  - MARS and ICOOL field profile matches
  - choose z = 50 m as place to hand off the beam file (also where the figure of merit is computed).
  - allow to compare MARS and ICOOL particles yield where we hand off the beam file.

Technicality

- ICOOL:
  - create a shorter lattice which contains only the front-end elements from z = 50 m to end of the lattice (it cuts part of the drift section).

Magnetic field profile matches ISS lattice.

- MARS:
  - translate the MARS beam output at 50 m (fort.82) into an ICOOL file where the z position is shifted by 50 m (z = 0).
  - wo smearing the time of the particles by 1-3 ns.

First attempt

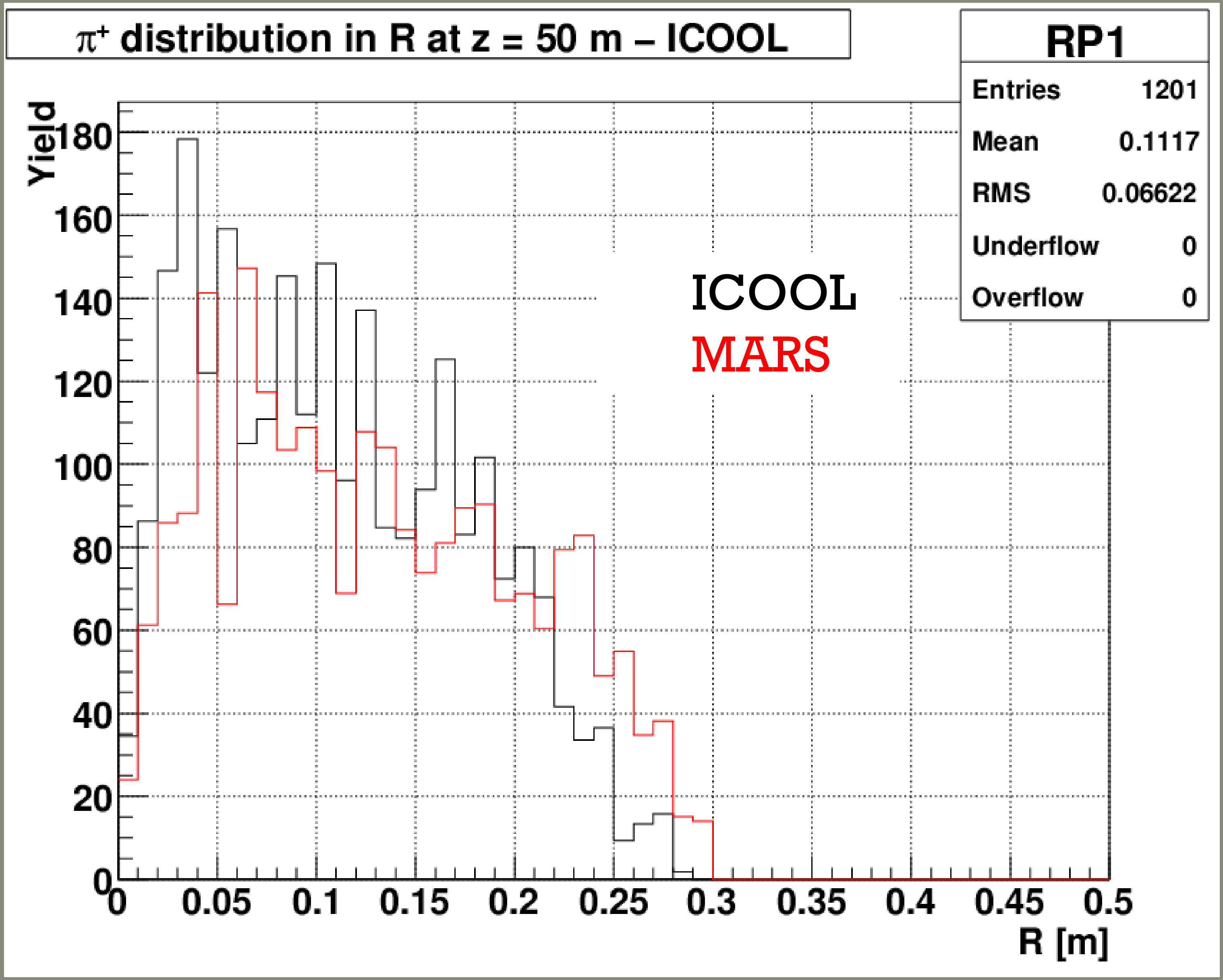
- MARS+ICOOL+ECALC9F:
  - reference particle time was either set to 0 ns or <t> of the beam file.

Only a 1/10 of the particles remaining.

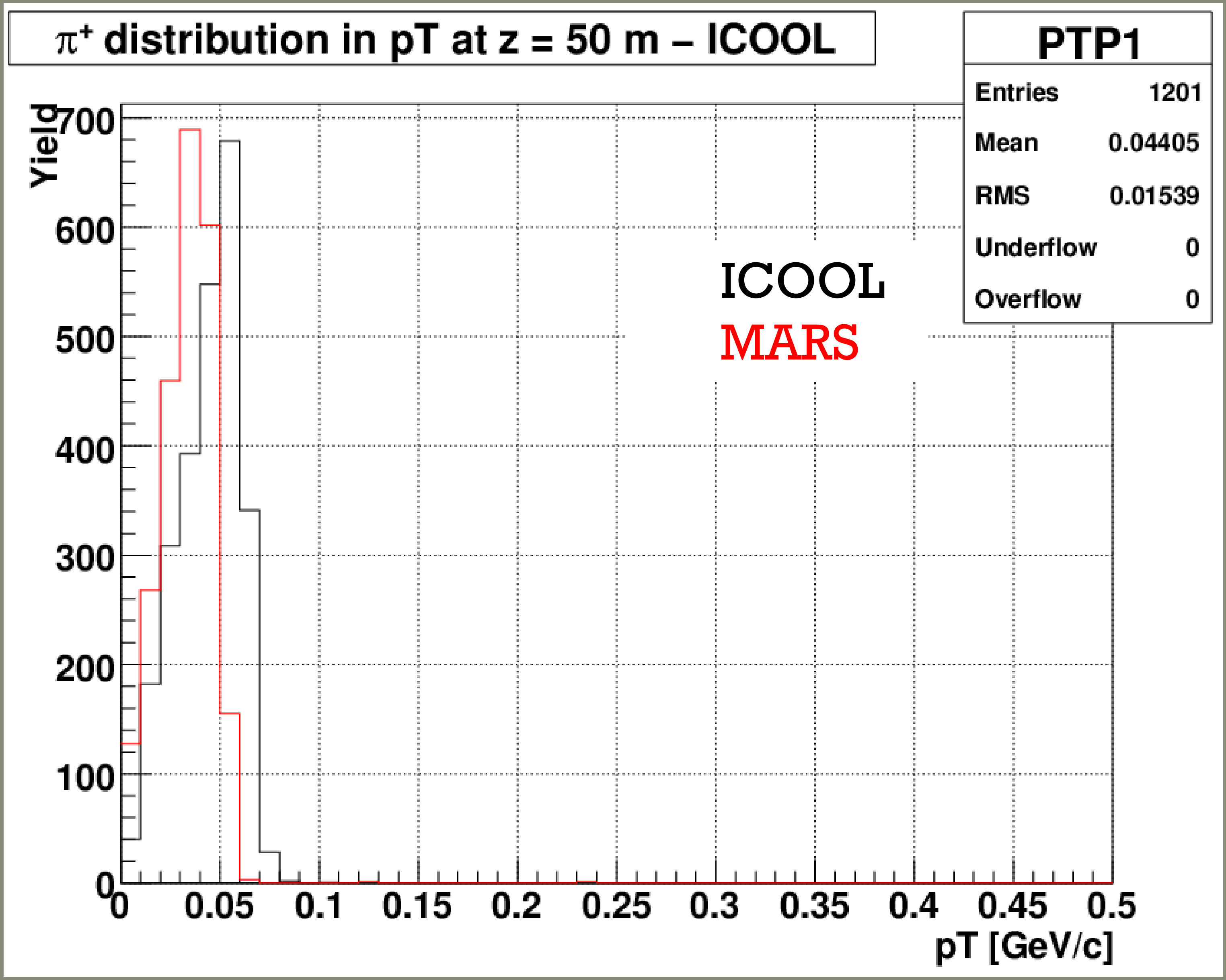
- Where particles are lost (17752 weighted pi/K/mu at start):
  - 716 weighted particles lost with flag -23 (particle radius not defined in r-region).
  - 829 weighted particles lost with flag -43 (pz < PZMINTRK).
  - 419 weighted particles lost with flag -76 (stepping gave results with r > 100 m or pT > 1000 GeV/c.
  - 1448 remaining particles at the end of the front-end with 214 of them passing the acceptance cuts.

Where did all the other particles go ?

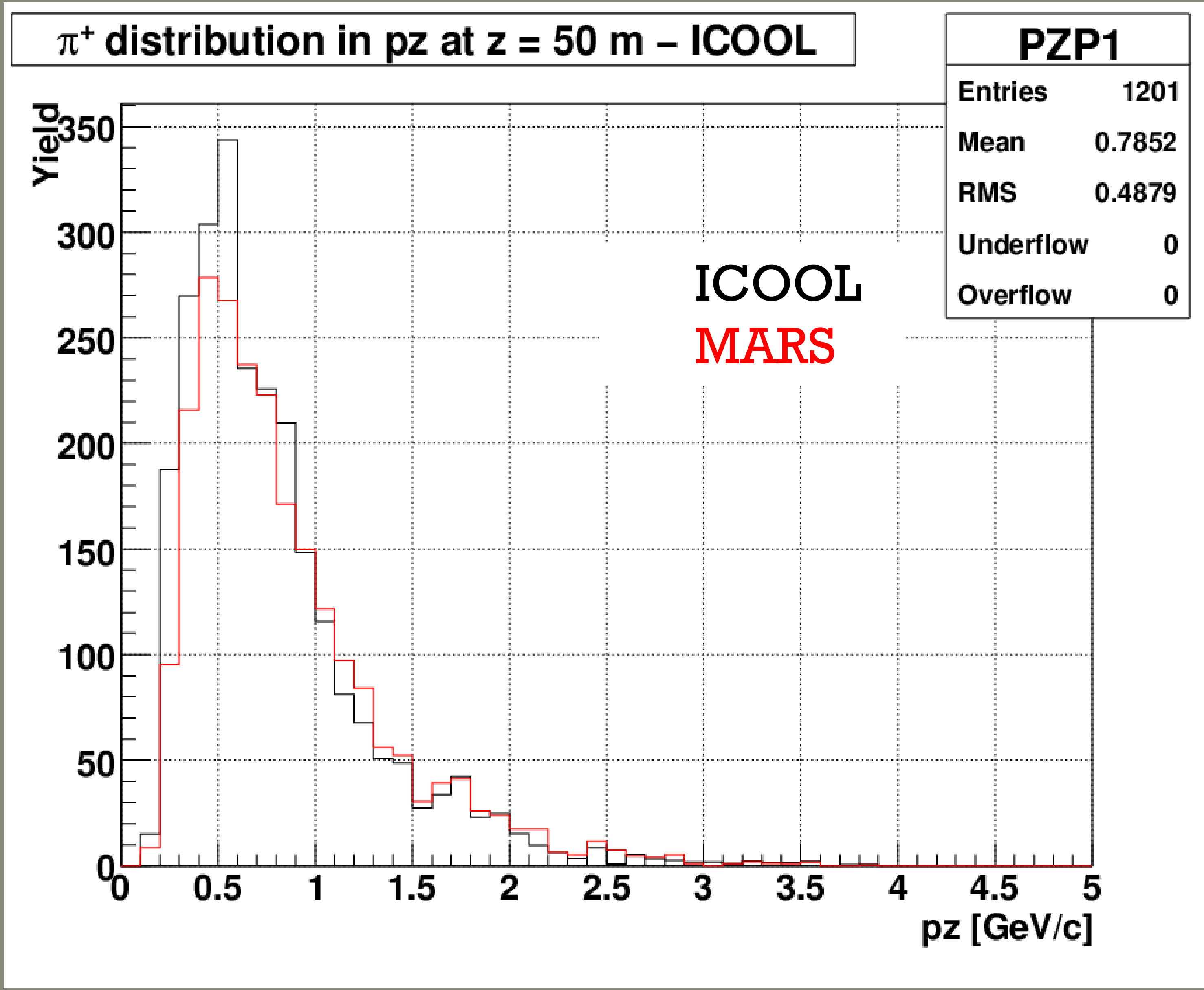
Checking particle phase space (1/)



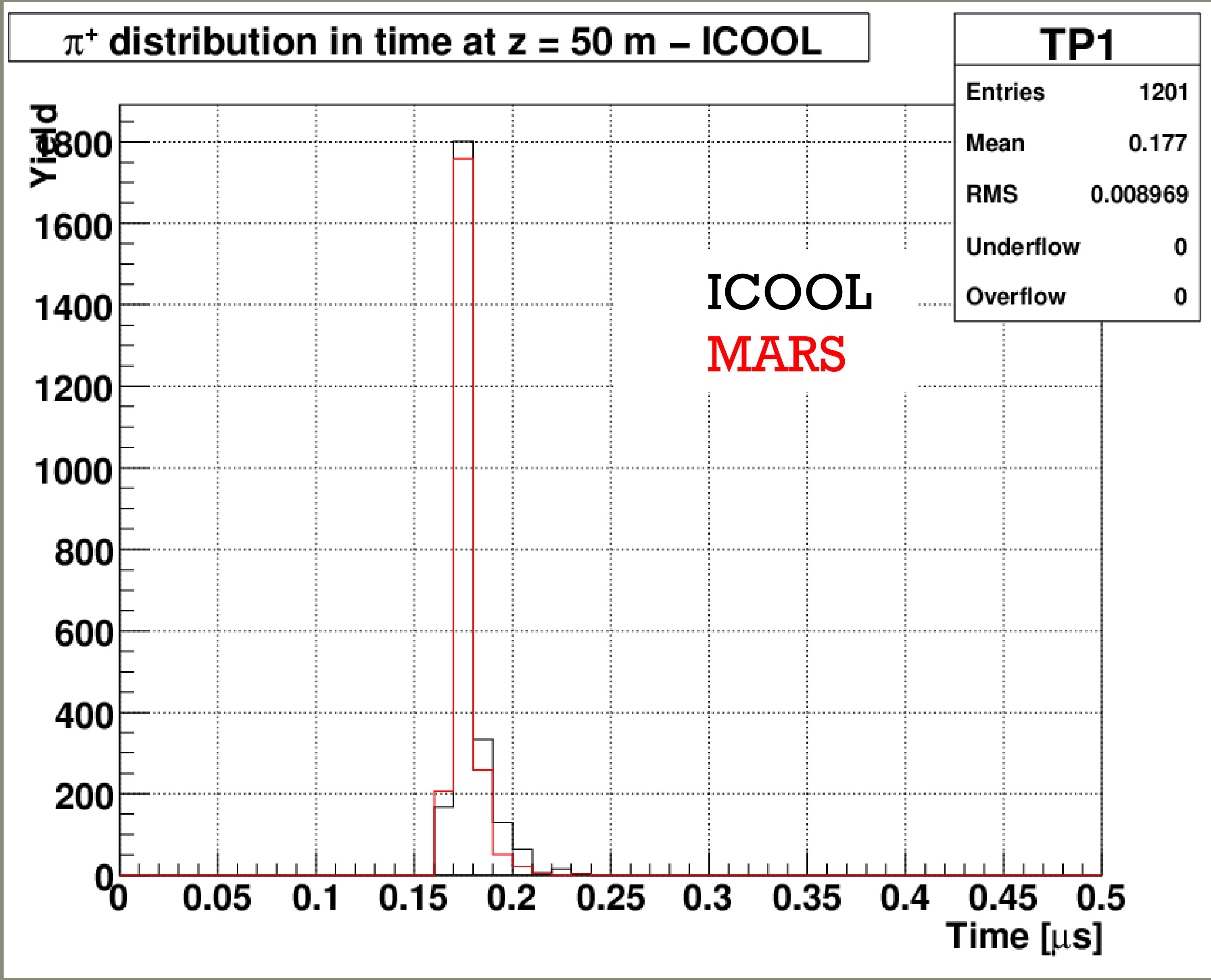
Checking particle phase space (2/)



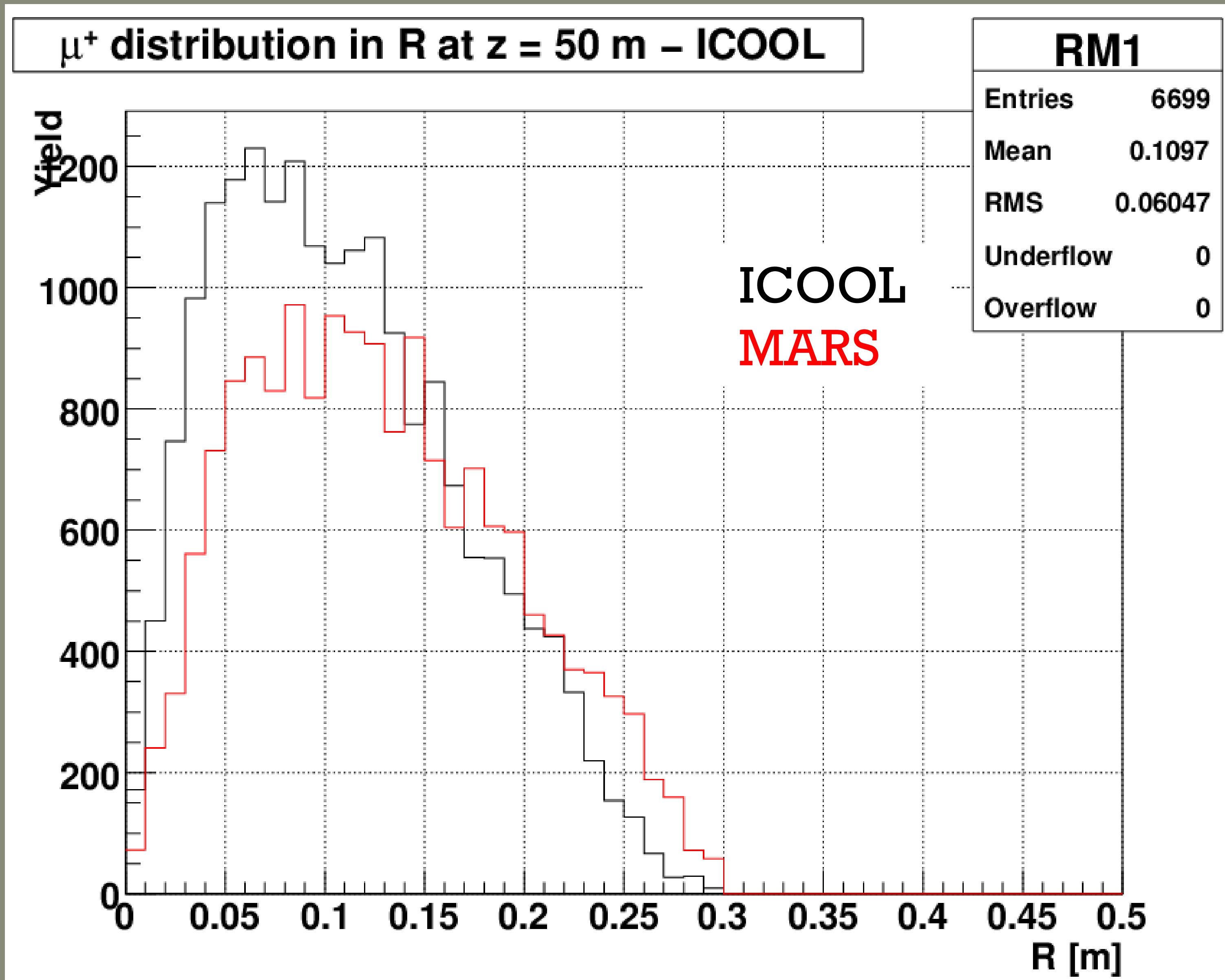
Checking particle phase space (3/)



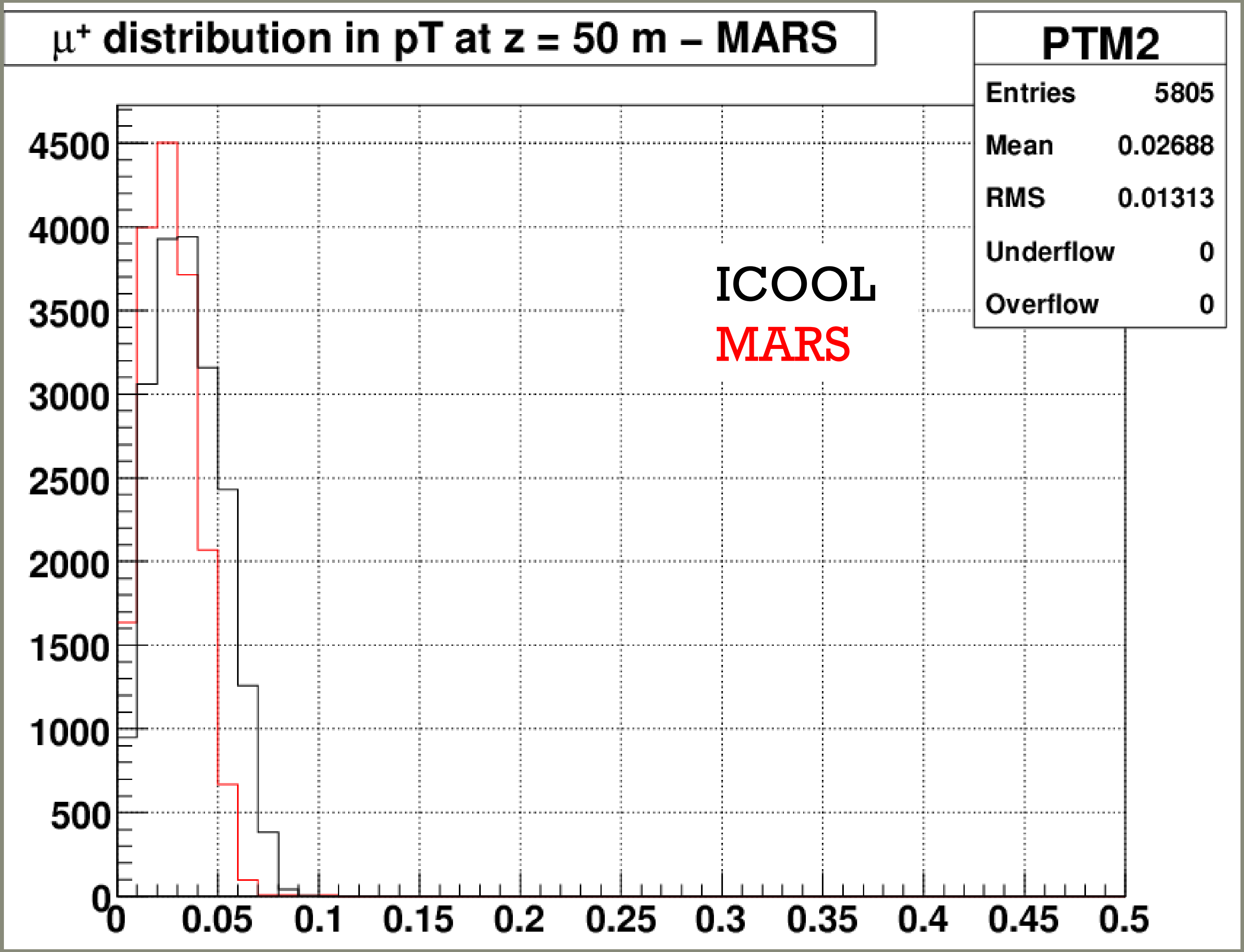
Checking particle phase space (4/)



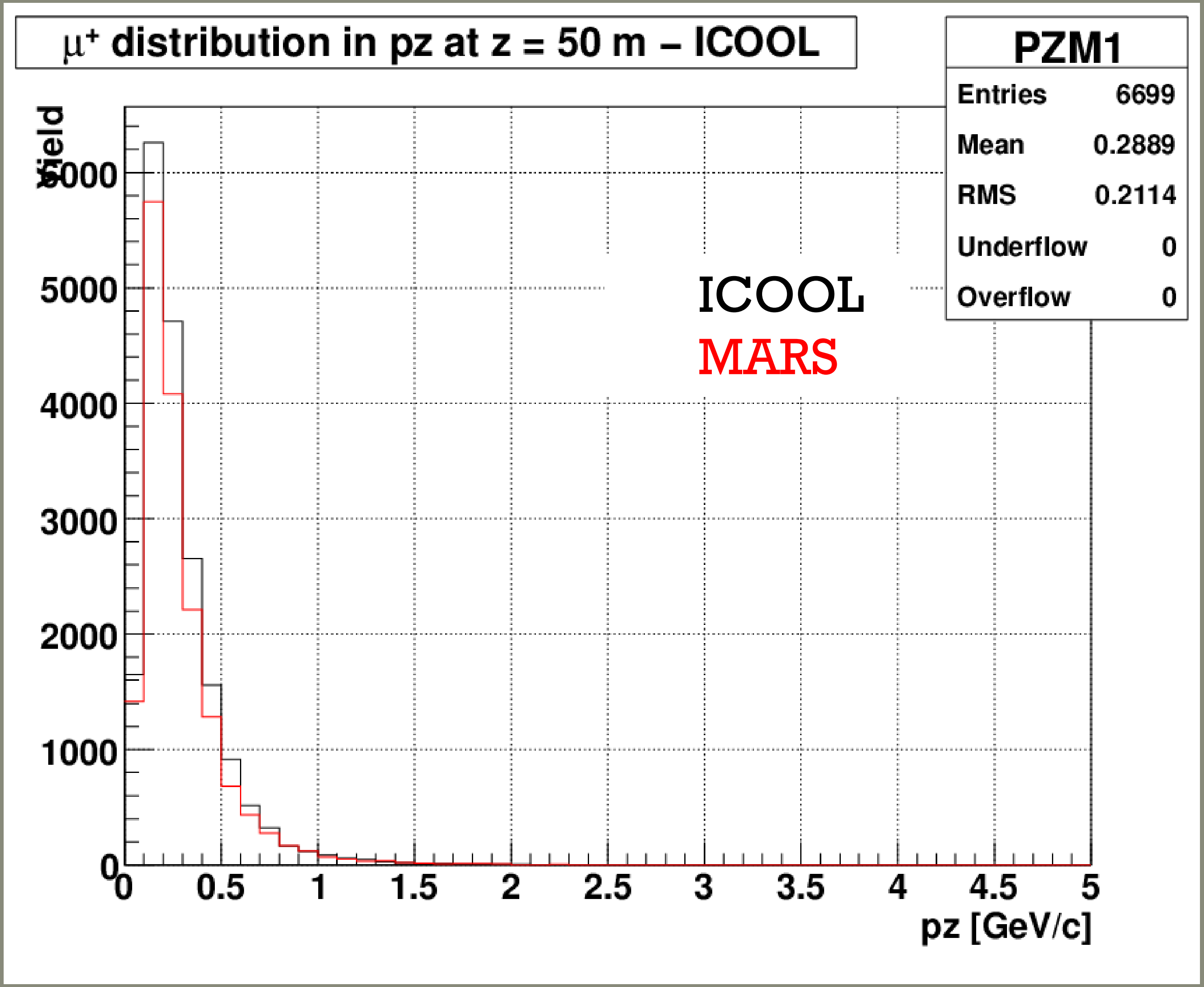
Checking particle phase space (5/)



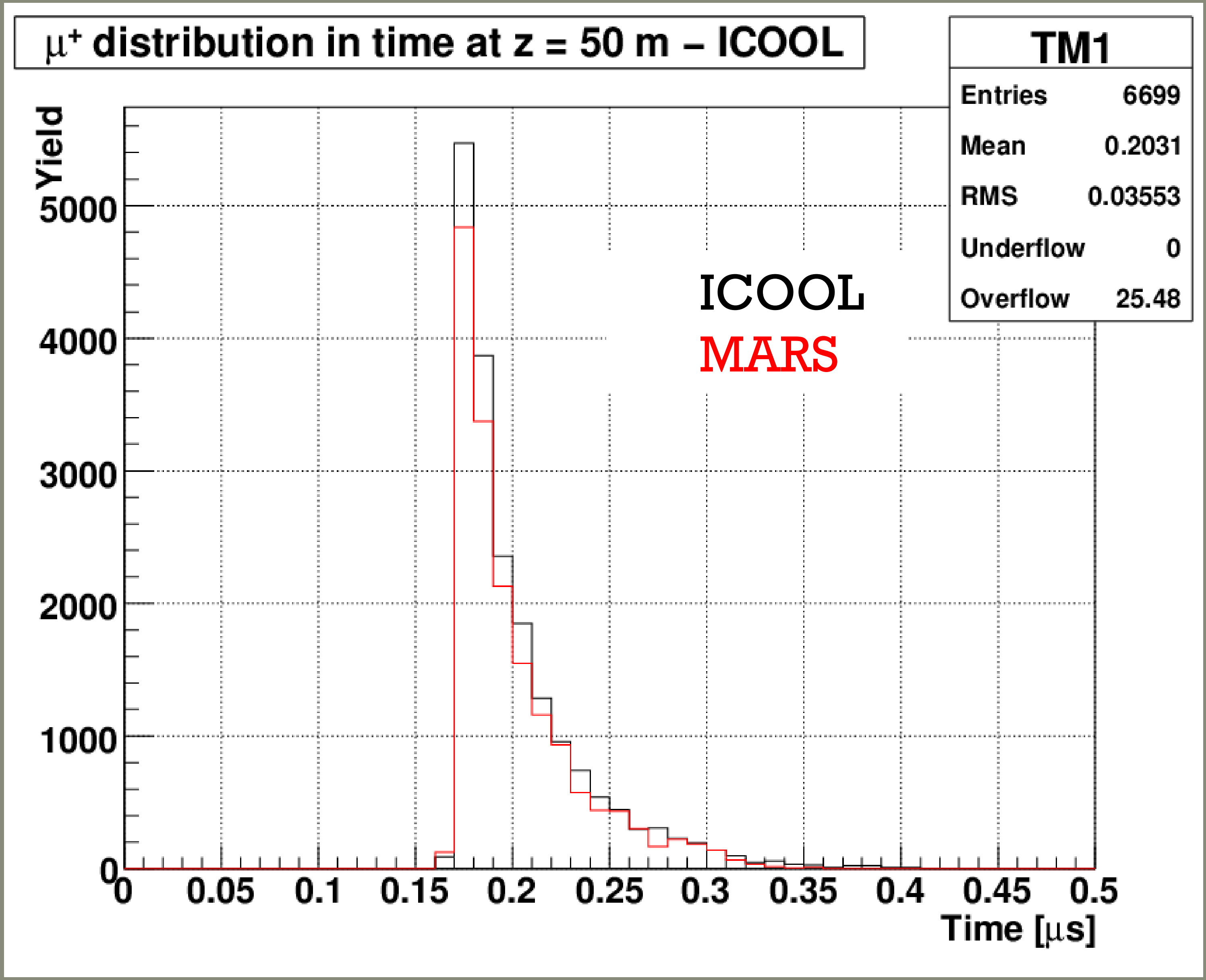
Checking particle phase space (6/)



Checking particle phase space (7/)



Checking particle phase space (8/)



Conclusion & todo

- Effect on target material on particle distribution:
  - beam emittance increase (more particles may be lost)
  - pT shifted to lower value

Important for the FE optimization to hand off the particles beam at a location where the energy loss in material is only driven by the cooling absorbers

- Hunting for the particles lost:
  - Need to debug/understand why particles are lost (may be due to a RF phase problem)

Computing particles tally plane per plane.