

## Compilation of beams produced with MARS

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The goal of this compilation was to make readily available all information gained over the years for each beam our group developed with the Momentum Achromat Recoil Spectrometer (MARS) line at Texas A & M University [1]. Starting with some of the first beams separated in 1992, all the way to the present, this survey includes all information that was *recorded* in our group's log books or was easily and accurately calculable. As of March 2014 this includes a total of 200 MARS experiments with about 40 different primary beams, each often looking at more than one secondary beam. The categories listed in Table I were filled in to the greatest degree possible, offering valuable information that can be used to plan future experiments.

**Table I.** List of MARS beam parameters recorded in the beam compilation spreadsheet.

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| <ul style="list-style-type: none"> <li>• Experiment Label (ex. RUN1110A)</li> <li>• Log Book Number &amp; Page Number</li> <li>• Experiment Start Date</li> <li>• Group/Organization</li> <li>• General Purpose</li> <li>• D3 Degree of Elevation</li> <li>• Cyclotron Used (K500 or K150)</li> <li>• Primary Beam</li> <li>• Particle, Charge State &amp; Energy (MeV/u)</li> <li>• Primary Target             <ul style="list-style-type: none"> <li>◦ Solid                 <ul style="list-style-type: none"> <li>▪ Material, Thickness &amp; Location</li> </ul> </li> <li>◦ Gas                 <ul style="list-style-type: none"> <li>▪ Type, Temp. (K) &amp; Pressure (atm)</li> </ul> </li> <li>◦ Window Material &amp; Thickness (mil)                 <ul style="list-style-type: none"> <li>▪ Entrance &amp; Exit</li> </ul> </li> </ul> </li> <li>• Degarders             <ul style="list-style-type: none"> <li>◦ Material, Thickness &amp; Location</li> </ul> </li> <li>• Magnet Settings (Amperes &amp; Polarity)             <ul style="list-style-type: none"> <li>◦ K5MB22AY</li> <li>◦ MARSBLD1</li> <li>◦ Q1</li> <li>◦ Q2</li> <li>◦ D1 - D2</li> <li>◦ D1 trim</li> <li>◦ Q3</li> <li>◦ S1</li> <li>◦ ExB Velocity Filter                 <ul style="list-style-type: none"> <li>▪ B-Field</li> <li>▪ E-Field Upper &amp; Lower Dial Settings</li> </ul> </li> <li>◦ D3</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>◦ S2</li> <li>◦ Q4</li> <li>◦ Q5</li> <li>• All Slit Settings (cm)             <ul style="list-style-type: none"> <li>◦ Right After Primary Target</li> <li>◦ Coffin (Controls Momentum Spread)</li> <li>◦ Right After Coffin</li> <li>◦ Very End of Beam Line</li> </ul> </li> <li>• FC Location &amp; Configuration</li> <li>• Si Detectors Used for Production (DE-E)             <ul style="list-style-type: none"> <li>◦ Thickness (micron), Bias (V) &amp; Leakage Current (uA)</li> </ul> </li> <li>• Secondary Targets             <ul style="list-style-type: none"> <li>◦ Material, Thickness &amp; Location</li> </ul> </li> <li>• Secondary Beam Particle             <ul style="list-style-type: none"> <li>◦ Production Mechanism</li> <li>◦ Q-value (MeV)</li> <li>◦ Energy at End of MARS (MeV/u)</li> <li>◦ Calculated Bp Using D1-D2 (T m)</li> </ul> </li> <li>• Final Tuning File Name</li> <li>• Numbers for Production Calculations             <ul style="list-style-type: none"> <li>◦ Number of Secondary Particles</li> <li>◦ Faraday Cup Count (in k)</li> <li>◦ Beam Current in the Coffin (nA)</li> </ul> </li> <li>• Best Production Results             <ul style="list-style-type: none"> <li>◦ Events per nC</li> <li>◦ Particles Per Second</li> </ul> </li> <li>• Secondary Energy Spread (%)</li> <li>• Secondary Momentum Spread (%)</li> <li>• Attenuation of Primary Beam</li> <li>• Purity of Secondary Beam (%)</li> </ul> |
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The information listed for the secondary beam regarding its Q-value and energy at the end of MARS was obtained from the program MARSINATOR [2] and the Bp value was calculated with the current settings for D1-D2 and a spread sheet used by our group for that sole purpose [3]. All equations used are also written out for easy reference. A list of all relevant publications for the beams recorded in this compilation is also included, as well as general comments regarding the individual experiments. It is hoped that this list will be kept current and accessible to everyone wanting to use the MARS beam line. The latest version is currently located on the MARS TAMU-cyclotron website, specifically at <http://cyclotron.tamu.edu/mars.html>.

[1] R.E. Tribble, R.H. Burch and C.A. Gagliardi, Nucl. Instrum. Methods Phys. Res. **A285**, 441 (1989).

[2] A. Azhari, MARSINATOR Program

[3] L. Trache, Excel Spread Sheet