

Monophase Measurements
on
Prototype PixeT Structures

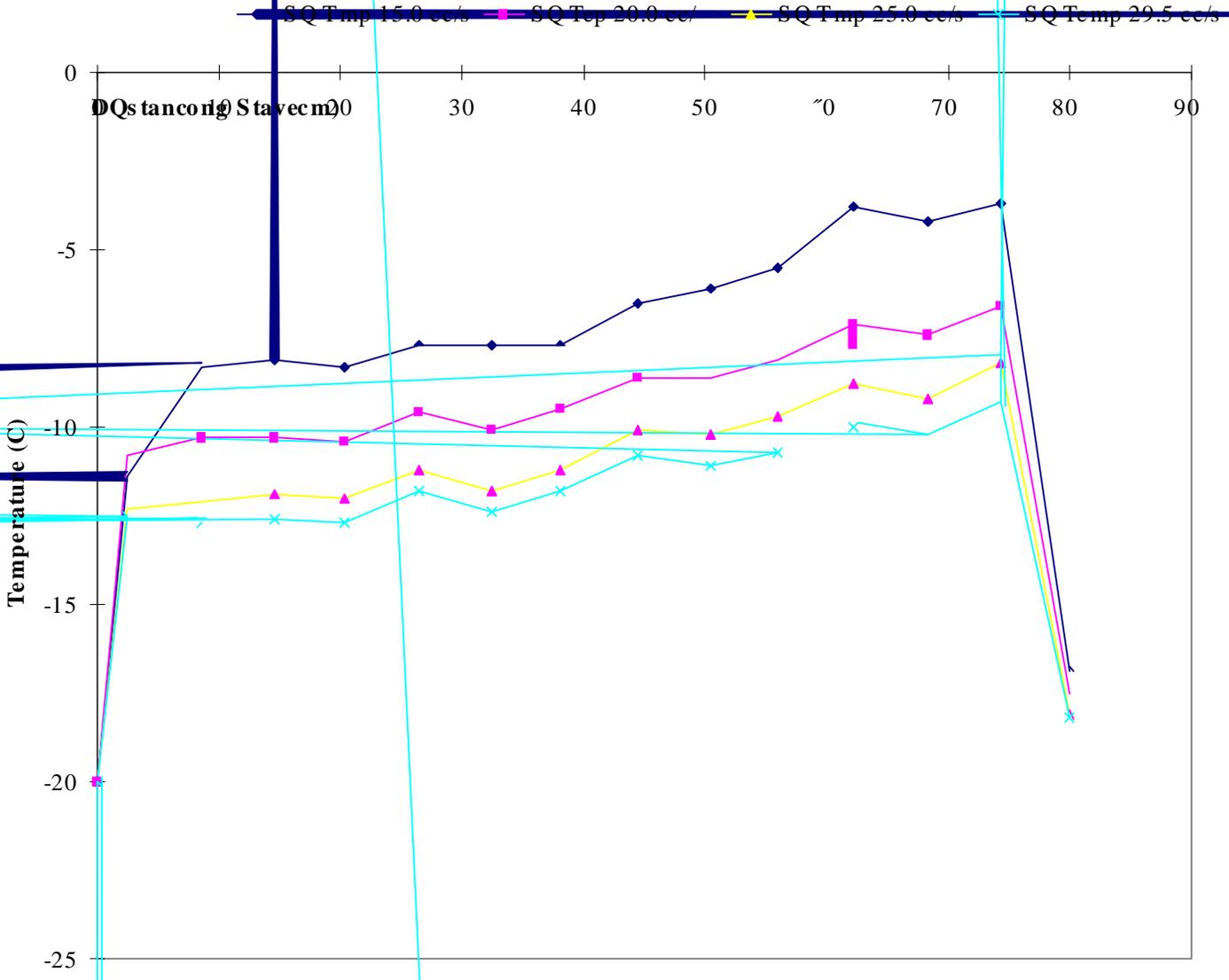
D. Bintinger, M. Gilchriese, J. Taylor and J. Wirth
and contributions from
D. Cragg, E. Perrin and V. Vacek
May 1999

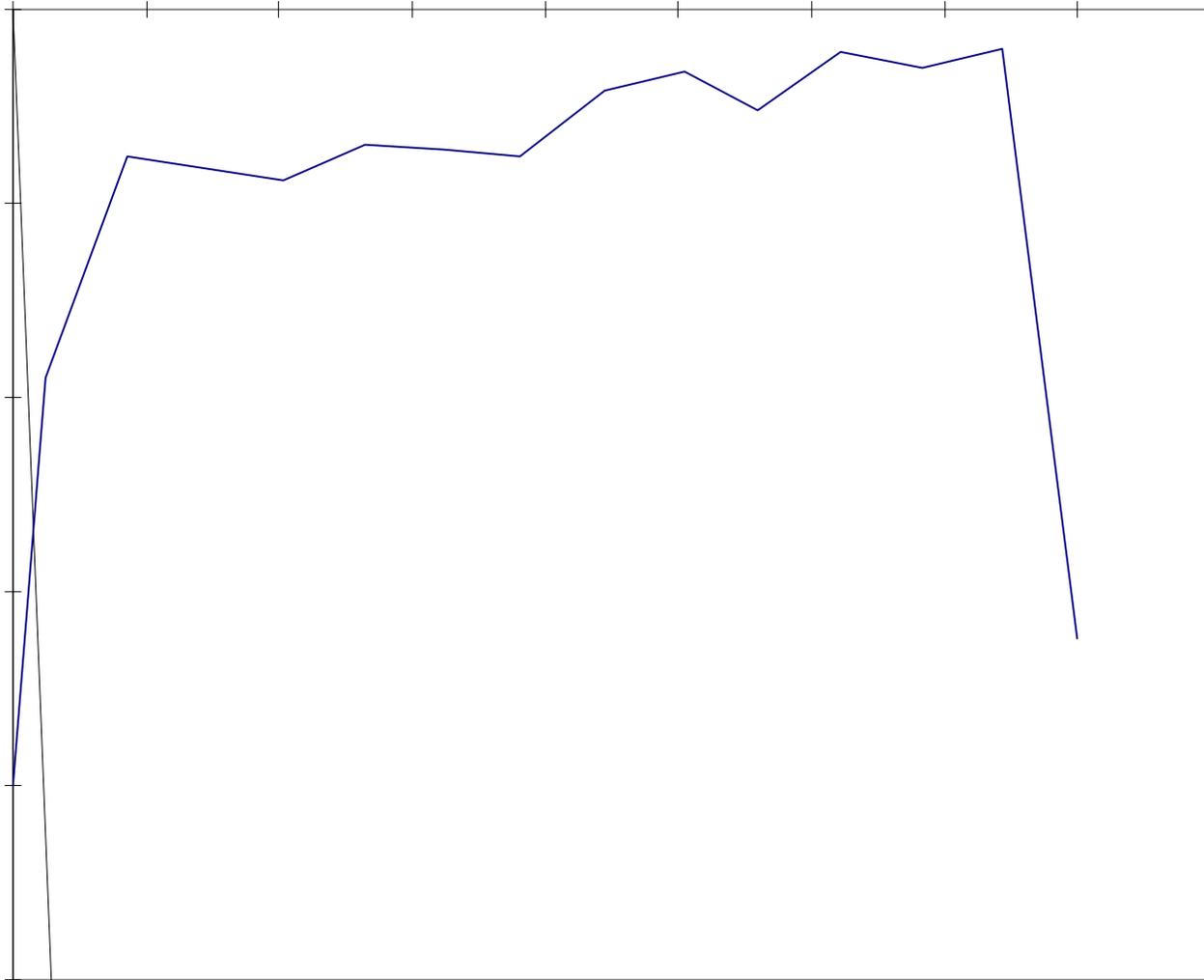
Setup

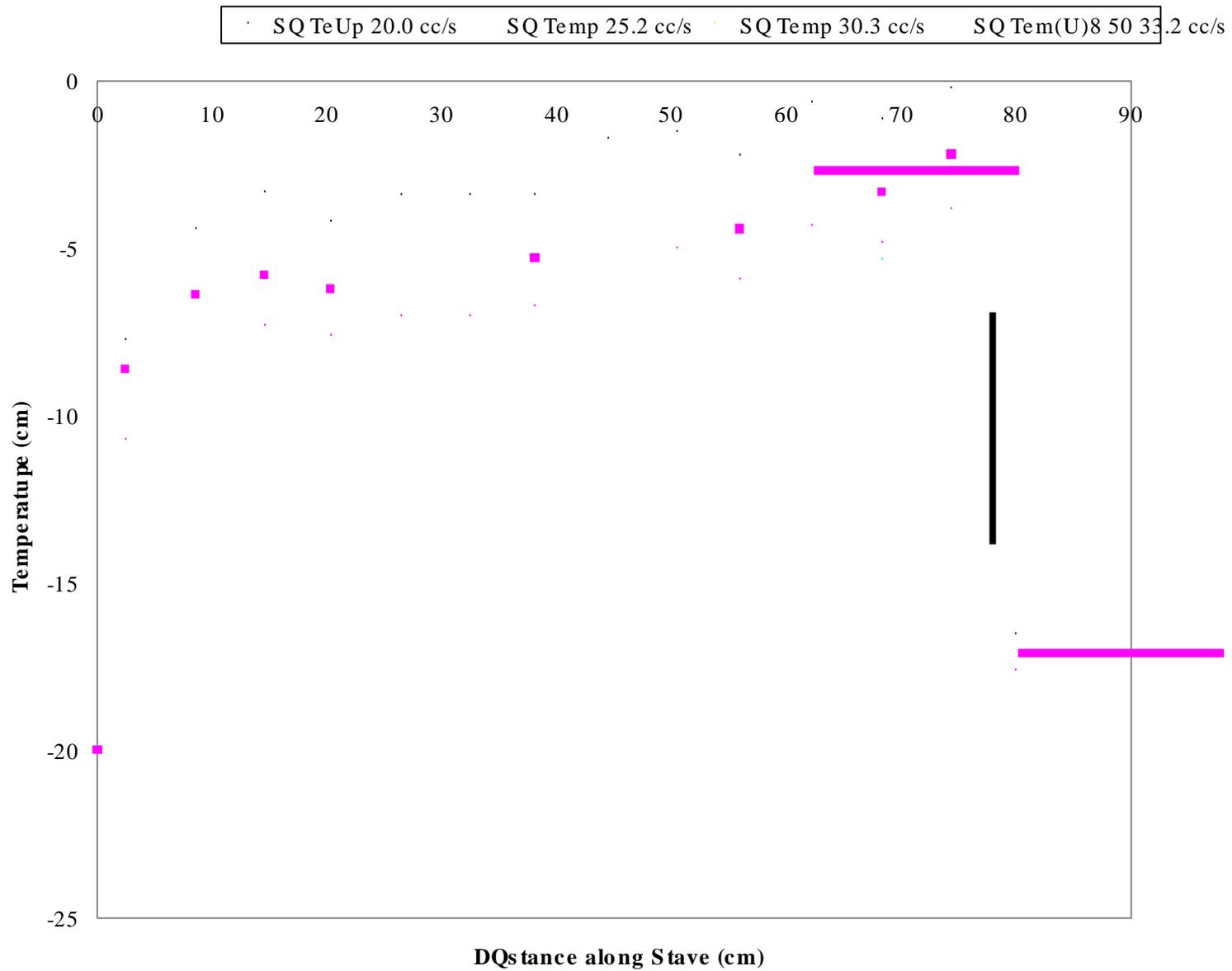
- C_6F_{14} cooled to about -25C or higher and circulated by pump.
- Pressure sensors on inlet and outlet (two)

Prototype Stave

Stave Temperatur vs DQs tanc, 80 Watts, Inlt=-20 C







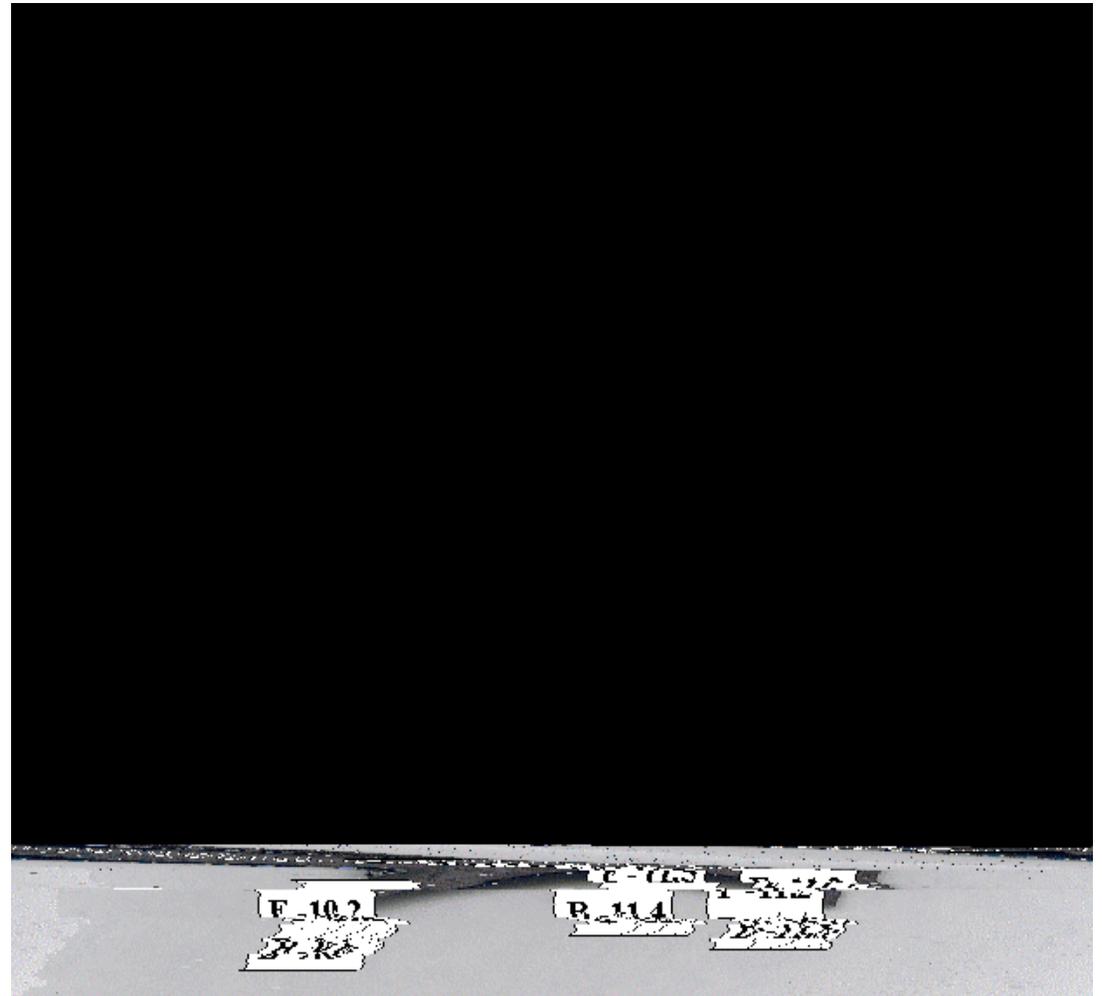


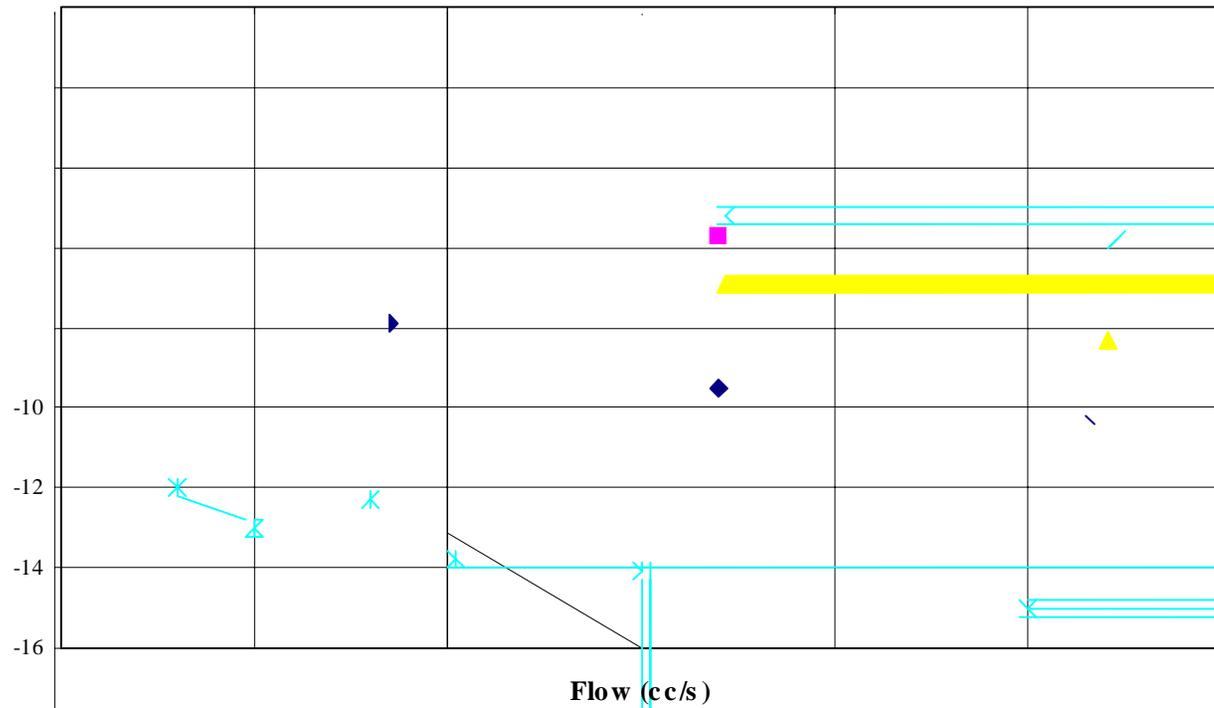
Comparison With Calculations

- Comparison made using C_6F_{14} properties as provided by 3M

Calculated Temperature and Measurements

Pixel Sector Prototype



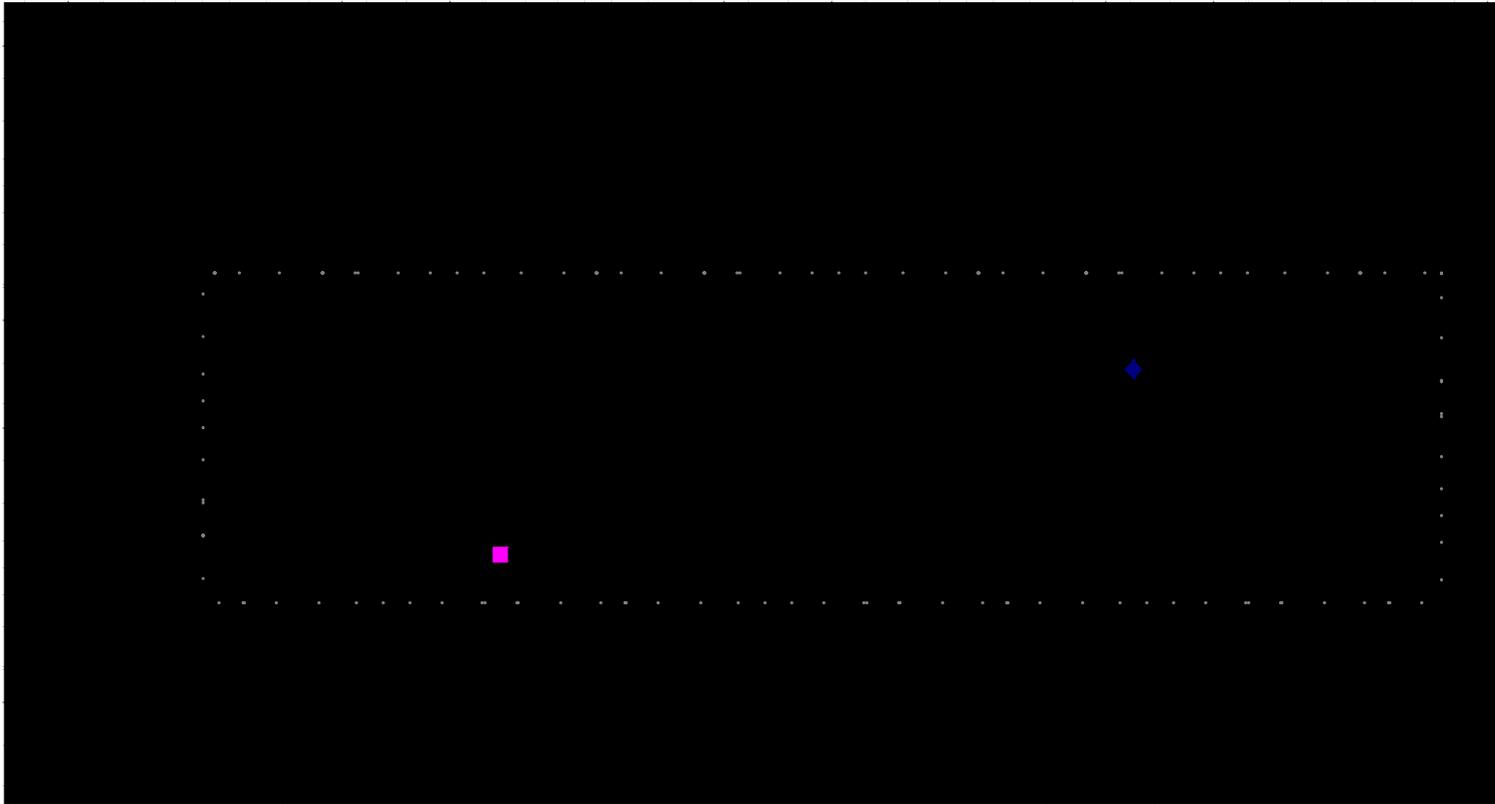


For a power of
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 For a power of

36W and inTet T of
 48W and inTet T of
 60W and inTet T of

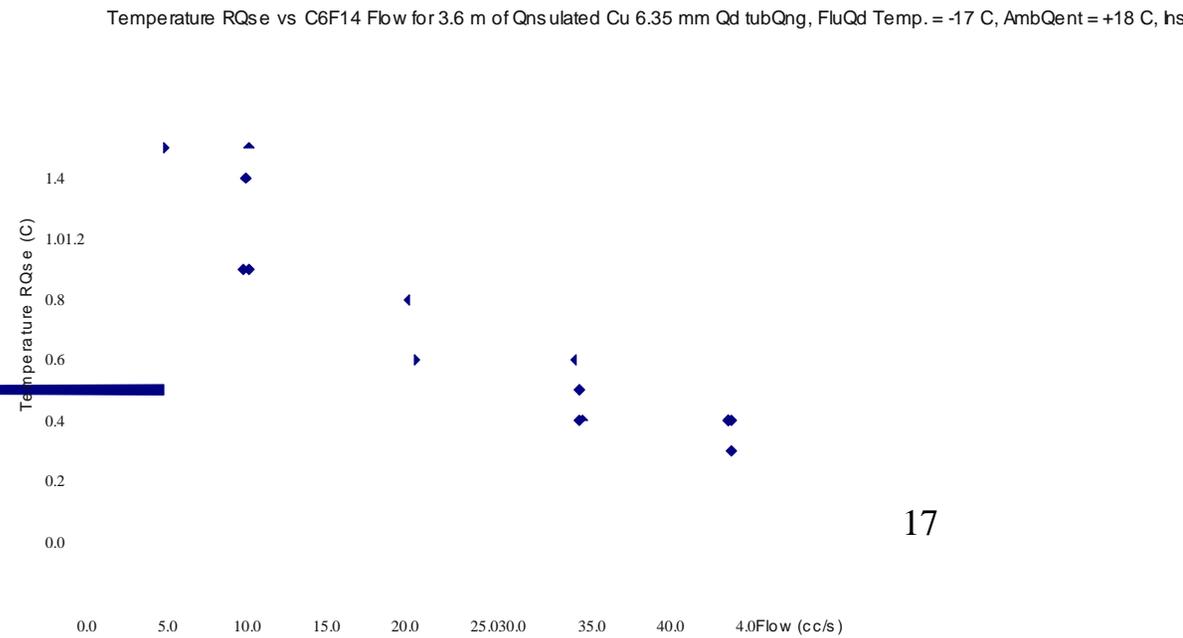
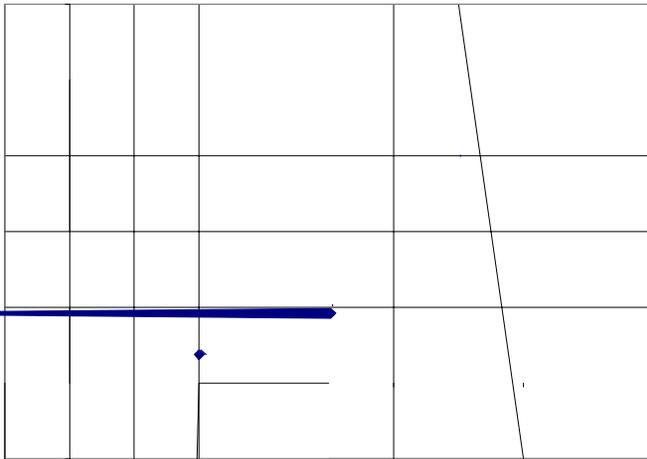
-20C we need flow of >5 cc/s
 -20C we need flow of >13 cc/s
 -25C we need flow of >about 8 cc/s

Pressure Drop in Stave vs FlWw



Calculated Velocity

Pressure Measurements in Lon Tube



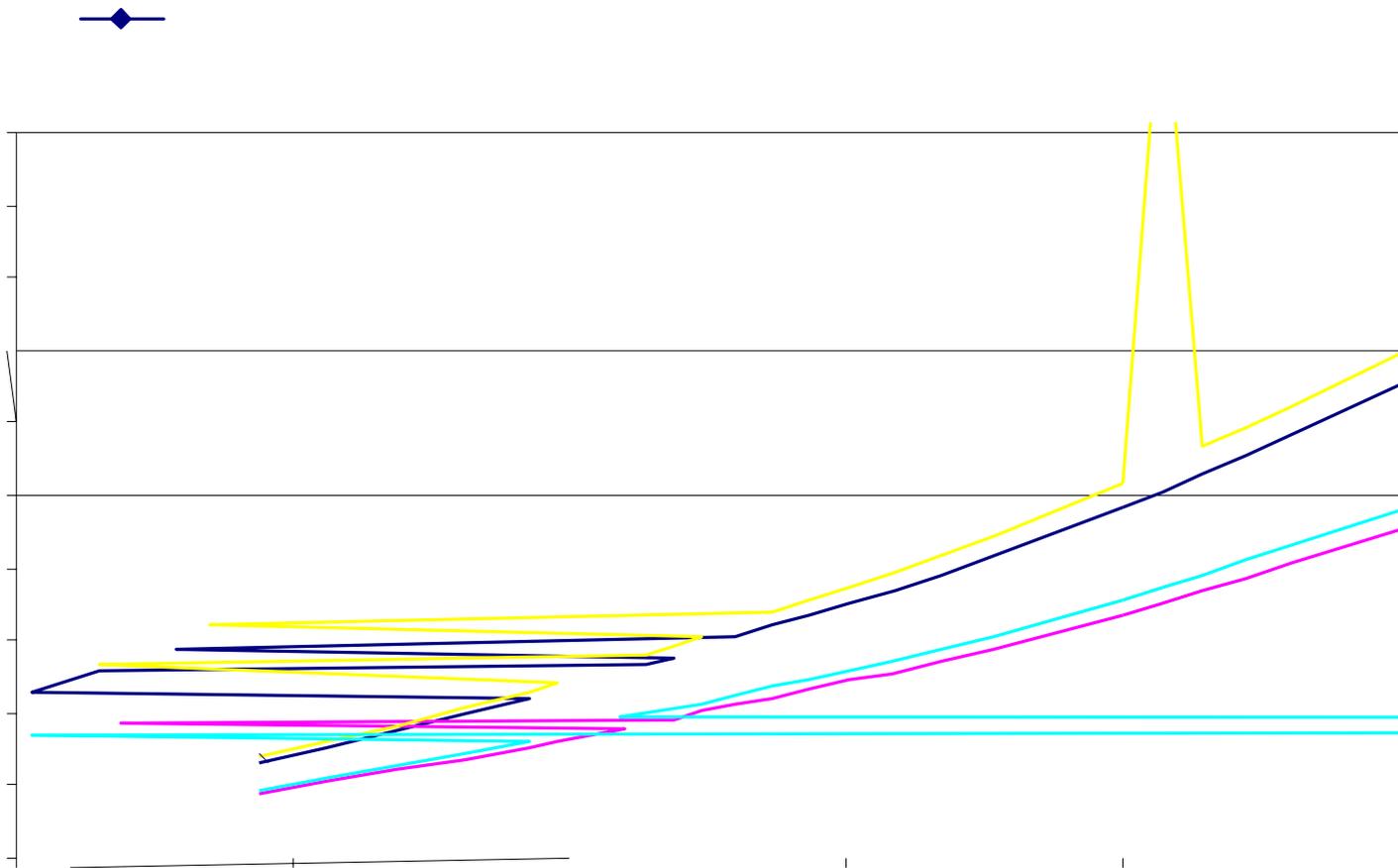
Total Circuit Pressure

- Using the effective hydraulic diameter of 2.9UU for the stave and inlet/outlet tubing sizes and routing (bends), the total circuit pressure from and to PPB3 was calculated.
- Two different piping configurations were compared (IDs shown below)

	<u>Baseline Layout</u>	<u>“Max QmuU” Layout</u>
Pixel->PPB1	5.1UU	6.0mU
PPB1->PPB2	6.9UU	8.0mU
PPB2->PPB3	13UU	13UU

- Two staves per circuit are assumed.
- Little difference in pressure for wider fluid - see plot next page

Pressure(bar)



10

9

8

7

096.76 211.76 177.4

Summary for Stave

- For baseline pipe sizes(5.1, 6.9, 13 UU ID)
 - For -20°C inlet teUperature
 - 80W stave power => 2.2 bar circuit pressure
 - 100 W => 4.0 bar
 - 120 W => bQg number
 - For -25°C int teUperature
 - 80W stave power => <1 bar circuit pressure
 - 100 W => 1.5 bar

Prototype pin-fin tube and sector structures have been successfully cooled with IQquid C

Conclusions

F_{14}

- Calculations using fluid properties are in reasonable agreement with measurements of pressures and temperatures and can be used with some confidence to predict system performance.
 - For a stack power of about 90W, an inlet temperature of 20°C